ABLIC
MinebeaMitsumi Group

Product Catalog

Lithium-ion Battery Protection ICs

2023

ABLIC Inc.

S-8240A Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3 500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detec ion voltage	2.000 V to 3.400 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0.015 V to 0 200 V (5 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	0.065 V to 0.500 V (25 mV step)*3	Accuracy ±40 mV
Charge overcurrent detection voltage	–0.200 V to –0.015 V (5 mV step)	Accuracy ±5 mV

- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Release voltage of discharge overcurrent status: V_{RIOV}, V_{DIOV}
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	1.5 µA typ., 3.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

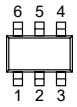
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected from a range of 0 V to 0.7 V in 100 mV step.)

***3.** Load short-circuiting detection voltage = Discharge overcurrent detection voltage + 0.025 × n
(n can be selected from any integer value greater or equal to 2)

SOT-23-6



1 DO
2 VM
3 CO
4 NC
5 VDD
6 VSS

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

HSNT-6(1212)

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-8240B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.5 V to 4.6 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.1 V to 4.6 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.0 V to 3.4 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.0 V to 3.4 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0.015 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circui ing detection voltage	0.065 V to 0.500 V (25 mV step)*3	Accuracy ±40 mV
Charge overcurrent detection voltage	–0.100 V to –0.015 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- Release condition of discharge overcurrent status is selectable: Load disconnection, charger connection
- Release voltage of discharge overcurrent status is selectable: V_{RIOV}, V_{DIOV}
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	1.5 µA typ., 3.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected from a range of 0 V to 0.7 V in 100 mV step.)

***3.** Load short-circuiting detection voltage = Discharge overcurrent detection voltage + 0.025 × n
(n can be selected from any integer value greater or equal to 2)

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

HSNT-6(1212)

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-82L1A Series

BATTERY PROTECTION IC WITH ALARM FUNTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

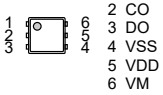
Overcharge detection voltage	4.200 V to 4.600 V (5 mV step)	Accuracy ±12 mV
Overcharge release voltage	4.000 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Alarm status detection voltage	4.200 V to 4.600 V (5 mV step)	Accuracy ±12 mV
Discharge overcurrent detection voltage	0.003 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.010 V to 0.100 V (5 mV step)	Accuracy ±7 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Alarm function
  - AO pin output logic: Active "L"
  - AO pin output form: CMOS output, Nch open-drain output
  - Connection when AO pin = "L": VSS pin, VM pin
- High-withstand voltage: VM pin, CO pin and AO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 800 nA typ., 1500 nA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 500 nA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A



S-82T1A Series

BATTERY PROTECTION IC WITH ALARM FUNTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

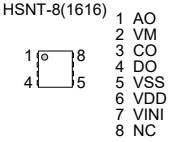
Overcharge detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Overcharge release voltage	3.100 V to 4.800 V*1	Accuracy ±50 mV
Alarm detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Alarm hysteresis voltage	0 V, 0.010 V, 0.020 V	Accuracy ±5 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detection voltage	3 mV to 100 mV (0.5 mV step)	Accuracy ±1 5 mV
Discharge overcurrent 2 detection voltage	10 mV to 100 mV (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–100 mV to –3 mV (0 5 mV step)	Accuracy ±1 5 mV

- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Alarm function
  - AO pin output logic: Active "H", active "L"
  - AO pin output form: CMOS output, Nch open-drain output
  - Connection when AO pin = "L": VSS pin, VM pin
  - Charge control function: Available, unavailable
- High-withstand voltage: VM pin, CO pin and AO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.5 µA typ., 5.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step)

HSNT-8(1616)



S-82U1A Series

BATTERY PROTECTION IC WITH ALARM FUNTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

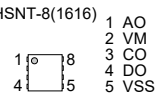
Overcharge detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Overcharge release voltage	3.100 V to 4.800 V*1	Accuracy ±50 mV
Alarm detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Alarm hysteresis voltage	0 V, 0.010 V, 0.020 V	Accuracy ±5 mV
Overdischarge detec ion voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detection voltage	3 mV to 100 mV (0.5 mV step)	Accuracy ±1 mV
Discharge overcurrent 2 detection voltage	10 mV to 100 mV (1 mV step)	Accuracy ±2 mV
Load short-circuiting detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±4.5 mV
Charge overcurrent detection voltage	–100 mV to –3 mV (0.5 mV step)	Accuracy ±1 mV

- Detec ion delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Alarm function
  - AO pin output logic: Active "H", ac ive "L"
  - AO pin output form: CMOS output, Nch open-drain output
  - Connection when AO pin = "L": VSS pin, VM pin
  - Charge control function: Available, unavailable
- High-withstand voltage: VM pin, CO pin and AO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.5 µA typ., 5 0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)



1 AO
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 V NI
8 NC

S-82V1A Series

BATTERY PROTECTION IC WITH ALARM FUNTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

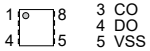
Overcharge detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Overcharge release voltage	3.100 V to 4.800 V*1	Accuracy ±50 mV
Alarm detec ion voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±12 mV
Alarm hysteresis voltage	0 V, 0.010 V, 0.020 V	Accuracy ±5 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detec ion voltage	3 mV to 100 mV (0.25 mV step)	Accuracy ±0.75 mV
Discharge overcurrent 2 detec ion voltage	6 mV to 100 mV (0.5 mV step)	Accuracy ±1.5 mV
Load short-circuiting detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±4 mV
Charge overcurrent detection voltage	–100 mV to –3 mV (0 25 mV step)	Accuracy ±0.75 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Alarm function
  - AO pin output logic: Ac ive "H", active "L"
  - AO pin output form: CMOS output, Nch open-drain output
  - Connection when AO pin = "L": VSS pin, VM pin
  - Charge control function: Available, unavailable
- High-withstand voltage: VM pin, CO pin and AO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.5 µA typ., 5.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)



1 AO
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82R1A Series

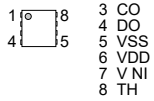
BATTERY PROTECTION IC
WITH BATTERY VOLTAGE MONITORING PIN FOR 1-CELL PACK

Features

- With battery voltage monitoring pin
- High-accuracy overheat protection circuit by an external NTC hermistor
  - Overheat detection temperature: +45°C to +85°C (1°C step) — Accuracy ±3°C*1
- High-accuracy voltage detection circuit
  - Overcharge detection voltage: 3 500 V to 4 800 V (5 mV step) — Accuracy ±15 mV
  - Overcharge release voltage: 3.100 V to 4.800 V*2 — Accuracy ±50 mV
  - Overdischarge detec ion voltage: 2 000 V to 3 000 V (10 mV step) — Accuracy ±50 mV
  - Overdischarge release voltage: 2 000 V to 3.400 V*3 — Accuracy ±75 mV
  - Discharge overcurrent 1 detection voltage: 3 mV to 100 mV (0.5 mV step) — Accuracy ±1 5 mV
  - Discharge overcurrent 2 detection voltage: 10 mV to 100 mV (0.5 mV step) — Accuracy ±3 mV
  - Load short-circuiting detection voltage: 20 mV to 100 mV (1 mV step) — Accuracy ±5 mV
  - Charge overcurrent detection voltage: –100 mV to –3 mV (0.5 mV step) — Accuracy ±1 5 mV
- Detec ion delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condi ion of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 4.5 µA typ., 6.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Temperature detection accuracy varies with NTC thermistor specifications.
When an NTC thermistor listed in **Table 5** is connected, the detection temperature and accuracy can be achieved.
***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***3.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)



1 BS
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 V NI
8 TH

S-82S1A Series

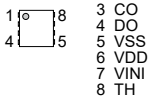
BATTERY PROTECTION IC
WITH BATTERY VOLTAGE MONITORING PIN FOR 1-CELL PACK

Features

- With battery voltage monitoring pin
- High-accuracy overheat protection circuit by an external NTC thermistor
  - Overheat detection temperature: +45°C to +85°C (1°C step) — Accuracy ±3°C*1
- High-accuracy voltage detection circuit
  - Overcharge detection voltage: 3.500 V to 4.800 V (5 mV step) — Accuracy ±15 mV
  - Overcharge release voltage: 3.100 V to 4.800 V*2 — Accuracy ±50 mV
  - Overdischarge detection voltage: 2.000 V to 3.000 V (10 mV step) — Accuracy ±50 mV
  - Overdischarge release voltage: 2.000 V to 3.400 V*3 — Accuracy ±75 mV
  - Discharge overcurrent 1 detection voltage: 3 mV to 100 mV (0.5 mV step) — Accuracy ±1 mV
  - Discharge overcurrent 2 detection voltage: 6 mV to 100 mV (0.5 mV step) — Accuracy ±2 mV
  - Load short-circuiting detec ion voltage: 20 mV to 100 mV (1 mV step) — Accuracy ±5 mV
  - Charge overcurrent detection voltage: –100 mV to –3 mV (0.5 mV step) — Accuracy ±1 mV
- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide opera ion temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 4 5 µA typ., 6.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0 5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Temperature detection accuracy varies with NTC thermistor specifications.
When an NTC thermistor listed in **Table 5** is connected, the detection temperature and accuracy can be achieved.
***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***3.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)



1 BS
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 TH

S-82B1A Series

BATTERY PROTECTION IC
WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage 1	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Discharge overcurrent detection voltage 2	0.030 V to 0.200 V (1 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	0.050 V to 0.500 V (5 mV step)	Accuracy ±20 mV
Charge overcurrent detection voltage	–0.100 V to –0 010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function

CTL pin control logic:	Active "H", active "L"
CTL pin internal resistance:	Pull-up, pull-down
CTL pin internal resistance value:	1.0 MΩ, 2.0 MΩ, 3.0 MΩ, 4.0 MΩ, 5.0 MΩ

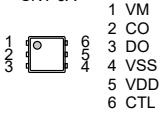
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Release voltage of discharge overcurrent status:
  Discharge overcurrent detection voltage 1 (V_{DIOV1}),
  Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A



S-82B1B Series

BATTERY PROTECTION IC
WITH POWER-SAVING FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3 500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2 000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detec ion voltage 1	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Discharge overcurrent detec ion voltage 2	0.030 V to 0.200 V (1 mV step)	Accuracy ±5 mV
Load short-circuiting detec ion voltage	0.050 V to 0 500 V (5 mV step)	Accuracy ±20 mV
Charge overcurrent detection voltage	–0.100 V to –0.010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Power-saving function

PS pin control logic is selectable:	Active "H", active "L"
PS pin internal resistance connec ion is selectable:	Pull-up, pull-down
PS pin internal resistance value is selectable:	1.0 MΩ, 2.0 MΩ, 3.0 MΩ, 4.0 MΩ, 5.0 MΩ

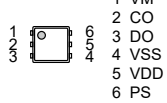
- 0 V battery charge function is selectable: Available, unavailable
- Power-down function
- Release condition of discharge overcurrent status is selectable: Load disconnection, charger connection
- Release voltage of discharge overcurrent status is selectable:
  Discharge overcurrent detection voltage 1 (V_{DIOV1}),
  Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During power-saving:	50 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A



S-82N1A Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3 500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2 000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0.003 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.010 V to 0.200 V (1 mV step)	Accuracy ±7 mV
Charge overcurrent detec ion voltage	–0.100 V to –0.003 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function

CTL pin control logic:	Active "H", active "L"
CTL pin internal resistance connection:	Pull-up, pull-down
CTL pin internal resistance value:	1.0 MΩ, 2.0 MΩ, 3.0 MΩ, 4.0 MΩ, 5.0 MΩ

- Discharge overcurrent control function

Release condition of discharge overcurrent status:	Load disconnection, charger connection
Release voltage of discharge overcurrent status:	Discharge overcurrent detec ion voltage (V_{DIOV}), Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)

- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin, CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	600 nA typ., 990 nA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A

S-82N1B Series

BATTERY PROTECTION IC WITH POWER-SAVING FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detec ion voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2 000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detec ion voltage	0 003 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0 010 V to 0.200 V (1 mV step)	Accuracy ±7 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (1 mV step)	Accuracy ±3 mV

- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
- Power-saving function

PS pin control logic:	Active "H", active "L"
PS pin internal resistance connection:	Pull-up, pull-down
PS pin internal resistance value:	1 0 MΩ, 2.0 MΩ, 3.0 MΩ, 4.0 MΩ, 5.0 MΩ

- Discharge overcurrent control function

Release condition of discharge overcurrent status:	Load disconnection, charger connection
Release voltage of discharge overcurrent status:	Discharge overcurrent detection voltage (V_{DIOV}), Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)

- 0 V battery charge: Enabled, inhibited
- Power-down function
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During opera ion:	600 nA typ., 990 nA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During power-saving:	50 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A

S-82M1A Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0.003 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.010 V to 0.200 V (1 mV step)	Accuracy ±7 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

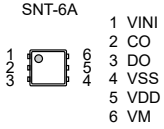
During operation:	600 nA typ., 990 nA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A



S-82A1A Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.5 V to 4.6 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.1 V to 4.6 V*1	Accuracy ±50 mV
Overdischarge detec ion voltage	2.0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.0 V to 3.4 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage 1	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Discharge overcurrent detection voltage 2	0.030 V to 0.200 V (1 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	0.050 V to 0.500 V (5 mV step)	Accuracy ±20 mV
Charge overcurrent detection voltage	–0.100 V to –0.010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Release voltage of discharge overcurrent status: Discharge overcurrent detection voltage 1 (V_{DIOV1}), discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	500 nA max. (Ta = +25°C)

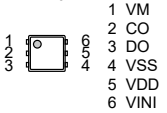
- Lead-free, Sn 100%, halogen-free*3

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

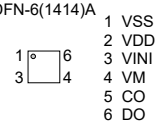
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

***3.** Refer to "■ **Product Name Structure**" for details.

SNT-6A



DFN-6(1414)A



S-82C1F Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

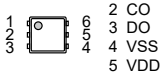
- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage 1	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Discharge overcurrent detection voltage 2	0.030 V to 0.200 V (1 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	0.050 V to 0.500 V (5 mV step)	Accuracy ±20 mV
Charge overcurrent detec ion voltage	–0.100 V to –0 010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Release voltage of discharge overcurrent status: Discharge overcurrent detection voltage 1 (V_{DIOV1}), discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 1.0 µA max. (Ta = +25°C)
- Lead-free, Sn 100%, halogen-free*3

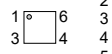
*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)
*3. Refer to "■ **Product Name Structure**" for details.

SNT-6A



1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VINI

DFN-6(1414)A



1 VSS
2 VDD
3 V NI
4 VM
5 CO
6 DO

S-82C1E Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3 000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage 1	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Discharge overcurrent detection voltage 2	0.030 V to 0 200 V (1 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	0.050 V to 0 500 V (5 mV step)	Accuracy ±20 mV
Charge overcurrent detection voltage	–0.100 V to –0.010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function

CTL pin control logic:	Active "H", active "L"
CTL pin internal resistance connection:	Pull-up, pull-down
CTL pin internal resistance value:	1.0 MΩ to 10 MΩ (1 MΩ step)
CTL pin voltage "H":	V_{SS} + 0.7 V, V_{DD} – 0.9 V
CTL pin voltage "L":	V_{SS} + 0.7 V, V_{DD} – 0.9 V

- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Release voltage of discharge overcurrent status: Discharge overcurrent detection voltage 1 (V_{DIOV1}), discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- Discharge overcurrent status reset function by CTL pin: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 1.0 µA max. (Ta = +25°C)
- Lead-free, halogen-free*3

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)
*3. Refer to "■ **Product Name Structure**" for details.

DFN-8(1616)A

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82F1B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1.5 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0 003 V (0.5 mV step)	Accuracy ±1.5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.80$ typ.
- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2 0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-82F1A Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3 000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1 5 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (0.5 mV step)	Accuracy ±1 5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function
  - CTL pin control logic: Active "H", active "L"
  - CTL pin internal resistance connection: Pull-up, pull-down
  - CTL pin internal resistance value: 1 MΩ to 10 MΩ (1 MΩ step)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82H1B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detec ion voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1.5 mV
Discharge overcurrent detec ion voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detec ion voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (0.5 mV step)	Accuracy ±1.5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VINI

S-82H1A Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detec ion voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1.5 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circui ing detec ion voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (0.5 mV step)	Accuracy ±1.5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function
  - CTL pin control logic is selectable: Active "H", active "L"
  - CTL pin internal resistance connection is selectable: Pull-up, pull-down
  - CTL pin internal resistance value is selectable: 1 MΩ to 10 MΩ (1 MΩ step)
- Discharge overcurrent control function
  - Release condi ion of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.8$
- Discharge overcurrent status reset function by CTL pin is selectable: Available, unavailable
- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2 0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82K1B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

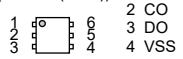
Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1.0 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (0.5 mV step)	Accuracy ±1.0 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

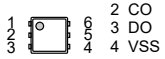
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-6D
(HSNT-6(1618))



1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VINI

SNT-6A



1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-82K1A Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detec ion voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1 0 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.003 V (0.5 mV step)	Accuracy ±1 0 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function
  - CTL pin control logic: Active "H", active "L"
  - CTL pin internal resistance: Pull-up, pull-down
  - CTL pin internal resistance value: 1 MΩ to 10 MΩ (1 MΩ step)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: $V_{RIOV} = V_{DD} \times 0.8$ (typ.)
- Discharge overcurrent status reset function by CTL pin: Available, unavailable
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-wi hstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82P1B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

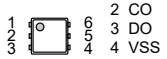
Overcharge detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4 800 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detec ion voltage 1	3 mV to 100 mV (0 25 mV step)	Accuracy ±0.75 mV
Discharge overcurrent detec ion voltage 2	6 mV to 100 mV (0 5 mV step)	Accuracy ±2 mV
Load short-circuiting detec ion voltage	20 mV to 100 mV (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–100 mV to –3 mV (0.25 mV step)	Accuracy ±0.75 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detec ion voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A



1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-82P1A Series

BATTERY PROTECTION IC WITH CHARGE-DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.800 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.800 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detec ion voltage 1	3 mV to 100 mV (0.25 mV step)	Accuracy ±0.75 mV
Discharge overcurrent detec ion voltage 2	6 mV to 100 mV (0.5 mV step)	Accuracy ±2 mV
Load short-circuiting detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±5 mV
Charge overcurrent detec ion voltage	–100 mV to –3 mV (0.25 mV step)	Accuracy ±0.75 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function
  - CTL pin control logic: Active "H", active "L"
  - CTL pin internal resistance connection: Pull-up, pull-down
  - CTL pin internal resistance value: 1 MΩ to 6 MΩ (1 MΩ step)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- Discharge overcurrent status reset function by CTL pin: Available, unavailable
- 0 V battery charge: Enabled, inhibited
- Power-down func ion: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2.0 µA typ., 4 0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82G1B Series

CHARGE-DISCHARGE CURRENT PATH SEPARATION CIRCUIT COMPATIBLE BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3 000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detection voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1.5 mV
Discharge overcurrent detection voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–0.100 V to –0.010 V (1 mV step)	Accuracy ±3 mV

- Detec ion delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function

Load short-circuiting detection 2 func ion is selectable:	Available, unavailable
Release condition of discharge overcurrent status:	Load disconnection
Release voltage of discharge overcurrent status:	$V_{RIOV} = V_{DD} \times 0.8$

- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- High-withstand voltage: VMC pin, VMD pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	0.5 µA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 VMD
2 VMC
3 CO
4 DO
5 VSS
6 VDD
7 V NI
8 NC

S-82Y1B Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4 800 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4 800 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detection voltage	3 mV to 50 mV (0.25 mV step)	Accuracy ±0.5 mV
Discharge overcurrent 2 detection voltage	6 mV to 100 mV (0.5 mV step)	Accuracy ±1.5 mV
Load short-circuiting detection voltage	15 mV to 100 mV (1 mV step)	Accuracy ±3.0 mV
Charge overcurrent detection voltage	–50 mV to –3 mV (0 25 mV step)	Accuracy ±0.5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Discharge overcurrent control function

Release condition of discharge overcurrent status:	Load disconnec ion
Release voltage of discharge overcurrent status:	Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)

- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum ra ing 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	0.5 µA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detec ion voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-6D
(HSNT-6(1618))

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VINI

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-82G1A Series

CHARGE-DISCHARGE CURRENT PATH SEPARATION CIRCUIT COMPATIBLE BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detec ion voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detec ion voltage 1	0.003 V to 0.100 V (0.5 mV step)	Accuracy ±1 5 mV
Discharge overcurrent detec ion voltage 2	0.010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circui ing detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detec ion voltage	–0.100 V to –0.010 V (1 mV step)	Accuracy ±3 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function

CTL pin control logic is selectable:	Active "H", active "L"
CTL pin internal resistance connec ion is selectable:	Pull-up, pull-down
CTL pin internal resistance value is selectable:	1 MΩ to 10 MΩ (1 MΩ step)
Charge-discharge inhibi ion status release func ion by VMD pin is selectable:	Available, unavailable
Transition from charge-discharge inhibition status to discharge overcurrent status is selectable:	Available, unavailable

- Discharge overcurrent control function

Load short-circuiting detection 2 function is selectable:	Available, unavailable
Release condition of discharge overcurrent status:	Load disconnec ion
Release voltage of discharge overcurrent status:	$V_{RIOV} = V_{DD} \times 0.8$

- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- High-withstand voltage: VMC pin, VMD pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	0.5 µA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 VMD
2 VMC
3 CO
4 DO
5 VSS
6 VDD
7 V NI
8 CTL

S-82F1C Series

BATTERY PROTECTION IC FOR 1 CELL PACK WITH LOAD MONITORING PIN

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3 500 V to 4.600 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2 000 V to 3 000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent detec ion voltage 1	0 003 V to 0.100 V (1 mV step)	Accuracy ±1.5 mV
Discharge overcurrent detec ion voltage 2	0 010 V to 0.100 V (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	0.020 V to 0.100 V (1 mV step)	Accuracy ±5 mV
Charge overcurrent detec ion voltage	–0.100 V to –0.003 V (1 mV step)	Accuracy ±1.5 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary)
- Discharge overcurrent control function

Release condi ion of discharge overcurrent status:	Load disconnection
Release voltage of discharge overcurrent status:	$V_{RIOV} = V_{DD} \times 0.8$ (typ.)

- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM1 pin, VM2 pin, and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During operation:	2.0 µA typ., 4.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	0.5 µA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 VM2
2 VM1
3 CO
4 DO
5 VSS
6 VDD
7 VINI
8 NC

S-82D1A Series

BATTERY PROTECTION IC WITH TEMPERATURE PROTECTION FUNCTION FOR 1-CELL PACK

Features

- High-accuracy temperature protection circuit by an external NTC thermistor
  - High temperature charge-discharge inhibition temperature: +40°C to +85°C (1°C step) Accuracy ±3°C*1
  - High temperature charge inhibi ion temperature: +40°C to +85°C (1°C step) Accuracy ±3°C*1
  - Low temperature charge inhibition temperature: –40°C to +10°C (1°C step) Accuracy ±3°C*1
  - Low temperature charge-discharge inhibition temperature: –40°C to +10°C (1°C step) Accuracy ±3°C*1
- High-accuracy voltage detection circuit
  - Overcharge detection voltage: 3.500 V to 4.600 V (5 mV step) Accuracy ±15 mV
  - Overcharge release voltage: 3.100 V to 4.600 V*2 Accuracy ±50 mV
  - Overdischarge detection voltage: 2.000 V to 3.000 V (10 mV step) Accuracy ±50 mV
  - Overdischarge release voltage: 2.000 V to 3.400 V*3 Accuracy ±75 mV
  - Discharge overcurrent detection voltage 1: 0.003 V to 0.100 V (0.5 mV step) Accuracy ±1.5 mV
  - Discharge overcurrent detection voltage 2: 0.010 V to 0.100 V (1 mV step) Accuracy ±3 mV
  - Load short-circuiting detec ion voltage: 0.020 V to 0.100 V (1 mV step) Accuracy ±5 mV
  - Charge overcurrent detection voltage: –0.100 V to –0 003 V (0.5 mV step) Accuracy ±1.5 mV
- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control func ion
  - CTL pin control logic: Active "H", active "L"
  - CTL pin internal resistance: Pull-up, pull-down
  - CTL pin internal resistance value: 1 MΩ to 5 MΩ (1 MΩ step)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}) = $V_{DD} \times 0.8$ (typ.)
- Discharge overcurrent status reset function by CTL pin: Available, unavailable
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28.0 V
- Wide opera ion temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 2 5 µA typ., 5.0 µA max. (Ta = +25°C)
  - During power-down: 100 nA max. (Ta = +25°C)
  - During overdischarge: 0.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Temperature detection accuracy varies with NTC thermistor specifications.
When an NTC thermistor listed in **Table 6** is connected, the detection temperature and accuracy can be achieved.

***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***3.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

HSNT-8(1616)

1 CTL
2 VM
3 CO
4 DO
5 VSS
6 VDD
7 V NI
8 TH

S-8206A Series

BATTERY PROTECTION IC FOR 1-CELL PACK (SECONDARY PROTECTION)

Features

- High-accuracy voltage detection circuit
  - Overcharge detec ion voltage: 3.500 V to 5.000 V (5 mV step) Accuracy ±20 mV
  - Overcharge release voltage: 3.100 V to 4.950 V*1 Accuracy ±50 mV
- Detection delay time is generated only by an internal circuit (external capacitors are unnecessary).
- Output logic: Active "H", ac ive "L"
- Output form: CMOS output, Nch open-drain output
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 1.5 µA typ., 3.0 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0.05 V to 0.4 V in 50 mV step.)

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

HSNT-6(1212)

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-8216A Series

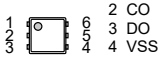
BATTERY PROTECTION IC FOR 1-CELL PACK (SECONDARY PROTECTION)

Features

- High-accuracy voltage detection circuit
  - Overcharge detection voltage: 4.000 V to 5.000 V (5 mV step) — Accuracy ±15 mV
  - Overcharge release voltage: 3.600 V to 4.950 V*1 — Accuracy ±50 mV
  - Discharge overcurrent detection voltage: 0.003 V to 0.100 V (0.5 mV step) — Accuracy ±1.5 mV
- Detection delay time is generated only by an internal circuit (external capacitors are unnecessary).
- Output logic is selectable: Active "H", active "L"
- Output form: CMOS output
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During opera ion: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0.05 V to 0.4 V in 50 mV step.)

SNT-6A



1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-8200A Series

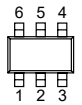
BATTERY PROTECTION IC FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit
  - Overcharge detection voltage: 3.5 V to 4.5 V (5 mV step) — Accuracy ±20 mV (Ta = +25°C), Accuracy ±25 mV (Ta = −10°C to +60°C)
  - Overcharge release voltage: 3.1 V to 4.5 V*1 — Accuracy ±30 mV
  - Overdischarge detection voltage: 2.0 V to 3.4 V (10 mV step) — Accuracy ±35 mV
  - Overdischarge release voltage: 2.0 V to 3.4 V*2 — Accuracy ±50 mV
  - Discharge overcurrent detection voltage: 0.05 V to 0.20 V (10 mV step) — Accuracy ±10 mV
  - Charge overcurrent detection voltage: −0.20 V to −0.05 V (25 mV step) — Accuracy ±15 mV
- Detec ion delay times are generated only by an internal circuit (external capacitors are unnecessary). Accuracy ±20%
- High-withstand voltage (VM pin and CO pin: Absolute maximum rating = 28 V)
- 0 V battery charge function "available" / "unavailable" is selectable.
- Power-down function "available" / "unavailable" is selectable.
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During operation: 2.8 µA typ., 5.0 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SOT-23-6



1 DO
2 VM
3 CO
4 NC
5 VDD
6 VSS

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-8211C Series

BATTERY PROTECTION IC
FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detec ion voltage	3.9 V to 4.5 V (5 mV step)	Accuracy ±25 mV (Ta = +25°C)
		Accuracy ±30 mV (Ta = −5°C to +55°C)
Overcharge release voltage	3.8 V to 4.43 V*1	Accuracy ±50 mV
Overdischarge detec ion voltage	2.0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.0 V to 3.4 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0.05 V to 0.30 V (10 mV step)	Accuracy ±15 mV
Load short-circui ing detection voltage	0.5 V (fixed)	Accuracy ±200 mV
Charge overcurrent detection voltage	−0.1 V (fixed)	Accuracy ±30 mV

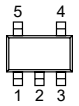
- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
  Accuracy ±20%
- High-withstand voltage (VM pin and CO pin: Absolute maximum ra ing = 28 V)
- 0 V battery charge function "available" / "unavailable" is selectable.
- Power-down function "available" / "unavailable" is selectable.
- Wide operation temperature range Ta = −40°C to +85°C
- Low current consumption

During operation	3 0 µA typ., 5.5 µA max. (Ta = +25°C)
During power-down	0 2 µA max. (Ta = +25°C)

- Lead-free, Sn 100%, halogen-free*3

*1. Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detec ion voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)
*3. Refer to "■ **Product Name Structure**" for details.

SOT-23-5



1 VM
2 VDD
3 VSS
4 DO
5 CO

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-8211D Series

BATTERY PROTECTION IC
FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.6 V to 4.5 V (5 mV step)	Accuracy ±25 mV (Ta = +25 C)
		Accuracy ±30 mV (Ta = −5 C to +55 C)
Overcharge release voltage	3.5 V to 4.4 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.0 V to 3.4 V*2	Accuracy ±100 mV
Discharge overcurrent detec ion voltage	0.05 V to 0.30 V (10 mV step)	Accuracy ±15 mV
Load short-circuiting detection voltage	0.5 V (fixed)	Accuracy ±200 mV

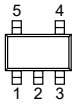
- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
  Accuracy ±20%
- High-withstand voltage (VM pin and CO pin: Absolute maximum rating = 28 V)
- 0 V battery charge function "available" / "unavailable" is selectable.
- Power-down function "available" / "unavailable" is selectable.
- Wide opera ion temperature range Ta = −40 C to +85 C
- Low current consumption

During operation	3.0 µA typ., 5.5 µA max. (Ta = +25 C)
During power-down	0.2 µA max. (Ta = +25 C)

- Lead-free, Sn 100%, halogen-free*3

*1. Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)
*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)
*3. Refer to "■ **Product Name Structure**" for details.

SOT-23-5



1 VM
2 VDD
3 VSS
4 DO
5 CO

SNT-6A

1 NC
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-8261 Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

(1) Internal high accuracy voltage detection circuit
- Overcharge detection voltage 3.900 V to 4.500 V (applicable in 5 mV step) Accuracy: ±25 mV (+25 C) and ±30 mV (–5 C to +55 C)
- Overcharge hysteresis voltage 0.1 V to 0.4 V*1 Accuracy: ±25 mV
  The overcharge hysteresis voltage can be selected from the range 0.1 V to 0.4 V in 50 mV step.
- Overdischarge detection voltage 2.000 V to 3.000 V (applicable in 10 mV step) Accuracy: ±50 mV
- Overdischarge hysteresis voltage 0.0 V to 0.7 V*2 Accuracy: ±50 mV
  The overdischarge hysteresis voltage can be selected from the range 0.0 V to 0.7 V in 100 mV step.
- Overcurrent 1 detection voltage 0 050 V to 0.300 V (applicable in 10 mV step) Accuracy: ±15 mV
- Overcurrent 2 detection voltage 0.500 V (fixed) Accuracy: ±100 mV

(2) High-withstand voltage (VM pin and CO pin: Absolute maximum ra ing = 28 V)

(3) Delay times (overcharge: t_{CU}, overdischarge: t_{DL}, overcurrent 1: t_{IOV1}, overcurrent 2: t_{IOV2}) are generated by an internal circuit. No external capacitor is necessary. Accuracy: ±20%

(4) Three-step overcurrent detec ion circuit is included (overcurrent 1, overcurrent 2 and load short-circuiting).

(5) 0 V battery charge function “Available” / “Unavailable” is selectable.

(6) Power-down function “Yes” / “No” is selectable.

(7) Charger detection function and abnormal charge current detection function
- The overdischarge hysteresis is released by detecting negative voltage at the VM pin (–0.7 V typ.) (Charger detection func ion).
- When the output voltage of the DO pin is high and the voltage at the VM pin is equal to or lower than the charger detection voltage (–0.7 V typ), he output voltage of the CO pin goes low (Abnormal charge current detection function).

(8) Low current consumption
- Operation mode 3.5 μA typ., 7 0 μA max.
- Power-down mode 0.1 μA max.

(9) Wide operating temperature range –40 C to +85 C

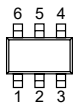
(10) Lead-free, Sn 100%, halogen-free*3

***1.** Overcharge release voltage = Overcharge detec ion voltage – Overcharge hysteresis voltage (where overcharge release voltage < 3.8 V is prohibited.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage (where overdischarge release voltage > 3.4 V is prohibited.)

***3.** Refer to “■ **Product Name Structure**” for details.

SOT-23-6



1 DO
2 VM
3 CO
4 DP
5 VDD
6 VSS

S-8230A/B Series

BATTERY PROTECTION IC WITH DISCHARGE CONTROL FUNCTION FOR 1-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage	3.5 V to 4.5 V (5 mV step)	Accuracy ±20 mV (Ta = +25°C)
		Accuracy ±25 mV (Ta = –10°C to +60°C)
Overcharge release voltage	3.1 V to 4.5 V*1	Accuracy ±30 mV
Overdischarge detection voltage	2.0 V to 3.4 V (10 mV step)	Accuracy ±35 mV
Overdischarge release voltage	2.0 V to 3.4 V*2	Accuracy ±50 mV
Discharge overcurrent detection voltage	0.05 V to 0.20 V (10 mV step)	Accuracy ±10 mV
Load short-circuiting detection voltage	0.5 V (fixed)	Accuracy ±100 mV
Charge overcurrent detection voltage	–0.20 V to –0.05 V (25 mV step)	Accuracy ±15 mV
	–0.16 V to –0.08 V (40 mV step)	

- Detec ion delay times are generated only by an internal circuit (External capacitors are unnecessary). Accuracy ±20%
- Discharge control function

CTL pin control logic is selectable:	Active "H", active "L"
CTL pin internal resistance connection is selectable:	Pull-up, pull-down
CTL pin internal resistance value is selectable:	1.0 MΩ, 2.5 MΩ, 5.0 MΩ
Discharge inhibition status latch func ion is selectable:	Available, unavailable

- 0 V battery charge function is selectable: Available, unavailable
- Power-down func ion is selectable: Available, unavailable
- Release condition of discharge overcurrent status is selectable: Load disconnection, charger connection
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During opera ion:	2.8 μA typ., 5.5 μA max. (Ta = +25°C)
During power-down:	0.1 μA max. (Ta = +25°C)

- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detec ion voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

SNT-6A

1 CTL
2 CO
3 DO
4 VSS
5 VDD
6 VM

S-82A2A/B/C Series

BATTERY PROTECTION IC FOR 2-SERIAL-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage n	3 500 V to 4.800 V (5 mV step)	Accuracy ±15 mV
Overcharge release voltage n	3.100 V to 4.800 V*1	Accuracy ±50 mV
Overdischarge detection voltage n	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage n	2 000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detec ion voltage	3 mV to 100 mV (0.5 mV step)	Accuracy ±1.0 mV
Discharge overcurrent 2 detec ion voltage	10 mV to 100 mV (1 mV step)	Accuracy ±3 mV
Load short-circuiting detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±5 mV
Charge overcurrent detection voltage	–100 mV to –3 mV (0 5 mV step)	Accuracy ±1.0 mV

- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control function (S-82A2A/C Series)

CTL pin control logic:	Ac ive "H", active "L"
CTL pin internal resistance connection:	Pull-up, pull-down
CTL pin internal resistance value:	1 MΩ to 10 MΩ (1 MΩ step)

- Power-saving func ion (S-82A2B Series)

PS pin control logic:	Ac ive "H", active "L"
PS pin internal resistance value:	1 MΩ to 10 MΩ (1 MΩ step)

- 0 V battery charge: Enabled, inhibited
- Power-down func ion: S-82A2A/C Series: Available, unavailable; S-82A2B Series: Available
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide opera ion temperature range: Ta = –40°C to +85°C
- Low current consump ion

During operation:	3 0 µA typ., 6.0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	1 0 µA max. (Ta = +25°C)
During power-saving (S-82A2B Series):	50 nA max. (Ta = +25°C)

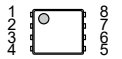
- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

Remark n = 1, 2

SNT-8A



	S-82A2A	S-82A2B	S-82A2C
1	CTL	PS	CTL
2	VM	VM	VM
3	CO	CO	CO
4	DO	DO	DO
5	VINI	VINI	VSS
6	VSS	VSS	VINI
7	VC	VC	VC
8	VDD	VDD	VDD

HSNT-8(1616)

	S-82A2A	S-82A2B	S-82A2C
1	CTL	PS	CTL
2	VM	VM	VM
3	CO	CO	CO
4	DO	DO	DO
5	VINI	VINI	VSS
6	VSS	VSS	VINI
7	VC	VC	VC
8	VDD	VDD	VDD

S-82B2A/B Series

BATTERY PROTECTION IC FOR 2-SERIAL-CELL PACK

Features

- High-accuracy voltage detec ion circuit

Overcharge detec ion voltage n	3.500 V to 4.800 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage n	3.100 V to 4.800 V*1	Accuracy ±50 mV
Overdischarge detection voltage n	2.000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage n	2.000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detection voltage	3 mV to 100 mV (0.5 mV step)	Accuracy ±3.0 mV
Discharge overcurrent 2 detection voltage	10 mV to 100 mV (1 mV step)	Accuracy ±5 mV
Load short-circui ing detection voltage	20 mV to 100 mV (1 mV step)	Accuracy ±10 mV
Charge overcurrent detec ion voltage	–100 mV to –3 mV (0.5 mV step)	Accuracy ±3.0 mV

- Detec ion delay times are generated only by an internal circuit (external capacitors are unnecessary).
- Charge-discharge control func ion (S-82B2A Series)

CTL pin control logic:	Active "H", ac ive "L"
CTL pin internal resistance connection:	Pull-up, pull-down
CTL pin internal resistance value:	1 MΩ to 10 MΩ (1 MΩ step)

- Power-saving function (S-82B2B Series)

PS pin control logic:	Active "H", ac ive "L"
PS pin internal resistance value:	1 MΩ to 10 MΩ (1 MΩ step)

- 0 V battery charge: Enabled, inhibited
- Power-down function: S-82B2A Series: Available, unavailable; S-82B2B Series: Available
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption

During opera ion:	3.0 µA typ., 6 0 µA max. (Ta = +25°C)
During power-down:	50 nA max. (Ta = +25°C)
During overdischarge:	1.0 µA max. (Ta = +25°C)
During power-saving (S-82B2B Series):	50 nA max. (Ta = +25°C)

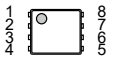
- Lead-free (Sn 100%), halogen-free

*1. Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

*2. Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

Remark n = 1, 2

SNT-8A



	S-82B2A	S-82B2B
1	CTL	PS
2	VM	VM
3	CO	CO
4	DO	DO
5	VINI	V NI
6	VSS	VSS
7	VC	VC
8	VDD	VDD

HSNT-8(1616)

	S-82B2A	S-82B2B
1	CTL	PS
2	VM	VM
3	CO	CO
4	DO	DO
5	VINI	V NI
6	VSS	VSS
7	VC	VC
8	VDD	VDD

S-82C2A Series

BATTERY PROTECTION IC FOR 2-SERIAL-CELL PACK

Features

- High-accuracy voltage detection circuit

Overcharge detection voltage n	3 500 V to 4.800 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage n	3.100 V to 4.800 V*1	Accuracy ±50 mV
Overdischarge detection voltage n	2 000 V to 3.000 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage n	2 000 V to 3.400 V*2	Accuracy ±75 mV
Discharge overcurrent 1 detec ion voltage	3 mV to 400 mV (1 mV step)	Accuracy ±3 mV
Discharge overcurrent 2 detec ion voltage	10 mV to 400 mV (1 mV step)	Accuracy ±5 mV
Load short-circuiting detection voltage	20 mV to 800 mV (5 mV step)	Accuracy ±10 mV
Charge overcurrent detection voltage	–400 mV to –3 mV (1 mV step)	Accuracy ±3 mV

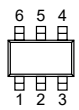
- Detection delay imes are generated only by an internal circuit (external capacitors are unnecessary).
- 0 V battery charge: Enabled, inhibited
- Power-down func ion: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connec ion
- Release voltage of discharge overcurrent status: Discharge overcurrent release voltage (V_{RIOV}), discharge overcurrent 1 detection voltage (V_{DIOV1})
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Wide opera ion temperature range: Ta = –40°C to +85°C
- Low current consump ion
  - During operation: 3 0 µA typ., 6.0 µA max. (Ta = +25°C)
  - During power-down: 50 nA max. (Ta = +25°C)
  - During overdischarge: 2 0 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

Remark n = 1, 2

SOT-23-6



1 DO
2 CO
3 VM
4 VC
5 VDD
6 VSS

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VC

S-8252 Series

BATTERY PROTECTION IC FOR 2-SERIAL-CELL PACK

Features

- High-accuracy voltage detection function for each cell

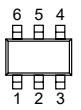
Overcharge detection voltage n (n = 1, 2)	3 550 V to 4.600 V (5 mV steps)	Accuracy ±20 mV (Ta = +25°C) Accuracy ±25 mV (Ta = –10°C to +60°C)
Overcharge release voltage n (n = 1, 2)	3.150 V to 4.600 V*1	Accuracy ±30 mV
Overdischarge detection voltage n (n = 1, 2)	2 000 V to 3.000 V (10 mV steps)	Accuracy ±50 mV
Overdischarge release voltage n (n = 1, 2)	2 000 V to 3.400 V*2	Accuracy ±100 mV
Discharge overcurrent detection voltage	0 050 V to 0.400 V (10 mV steps)	Accuracy ±10 mV
Load short-circuiting detection voltage	0 500 V to 0.900 V (50 mV steps)	Accuracy ±100 mV
Charge overcurrent detection voltage	–0.400 V to –0.050 V (25 mV steps)	Accuracy ±20 mV

- Charge overcurrent detection function: Available, unavailable
- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary). Accuracy ±20%
- High-withstand voltage (VM pin and CO pin: Absolute maximum rating = 28 V)
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 8.0 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1, 2) can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV steps.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1, 2) can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV steps.)

SOT-23-6



1 DO
2 CO
3 VM
4 VC
5 VDD
6 VSS

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 VC

S-8253C/D Series

BATTERY PROTECTION IC FOR 2-SERIES OR 3-SERIES-CELL PACK

Features

(1) High-accuracy voltage detec ion for each cell
- Overcharge detection voltage n (n = 1 to 3) 3.900 V to 4.400 V (50 mV step) Accuracy ±25 mV
- Overcharge release voltage n (n = 1 to 3) 3.800 V to 4.400 V *1 Accuracy ±50 mV
- Overdischarge detection voltage n (n = 1 to 3) 2.000 V to 3.000 V (100 mV step) Accuracy ±80 mV
- Overdischarge release voltage n (n = 1 to 3) 2.000 V to 3.400 V *2 Accuracy ±100 mV

(2) Three-level overcurrent detection (Including load short circuiting detection)
- Overcurrent detection voltage 1 0.050 V to 0.300 V (50 mV step) Accuracy ±25 mV
- Overcurrent detection voltage 2 0.500 V (Fixed)
- Overcurrent detection voltage 3 1.200 V (Fixed)

(3) Delay time (Overcharge, overdischarge, overcurrent) is available by only using an internal circuit. (External capacitors are unnecessary).

(4) Charge / discharge operation can be inhibited by the control pin.

(5) 0 V battery charge function available / unavailable is selectable.

(6) High-withstand voltage Absolute maximum rating 26 V

(7) Wide range of operating voltage 2 V to 24 V

(8) Wide range of operating temperature –40°C to +85°C

(9) Low current consump ion
- During operation 28 µA max. (+25°C)
- During power-down 0.1 µA max. (+25°C)

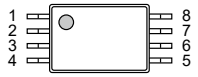
(10) Lead-free, Sn100%, halogen-free*3

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1 to 3) can be selected in 0 V, or in 0.1 V to 0.4 V in 50 mV step.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1 to 3) can be selected in 0 V, or in 0.2 V to 0.7 V in 100 mV step.)

***3.** Refer to "**Product Name Structure**" for details.

8-Pin TSSOP



1 DOP
2 COP
3 VMP
4 CTL
5 VSS
6 VC2
7 VC1
8 VDD

S-8203A Series

BATTERY PROTECTION IC FOR 3-SERIES CELL PACK

Features

- High-accuracy voltage detection function for each cell
  - Overcharge detection voltage n (n = 1 to 3) 3.55 V to 4.50 V*1 (50 mV step) Accuracy ±25 mV
  - Overcharge release voltage n (n = 1 to 3) 3.30 V to 4.50 V*2 Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 3) 2.0 V to 3.2 V*1 (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 3) 2.0 V to 3.4 V*3 Accuracy ±100 mV
- Discharge overcurrent detection in 2-step
  - Discharge overcurrent detection voltage 0.05 V to 0.30 V*4 (50 mV step) Accuracy ±15 mV
  - Short-circuiting detection voltage 0.50 V to 1.0 V*4 (100 mV step) Accuracy ±100 mV
- Charge overcurrent detection function
  - Charge overcurrent detection voltage –0.30 V to –0.05 V (50 mV step) Accuracy ±30 mV
- Settable by external capacitor; overcharge detection delay ime, overdischarge detection delay ime, discharge overcurrent detection delay time, charge overcurrent detection delay time
  (Load short-circuiting detection delay time is internally fixed.)
- Independent charge and discharge control by the control pins
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 2 V to 24 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 40 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

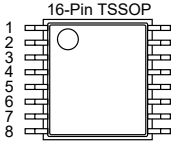
***1.** The overcharge detection voltage n (n = 1 to 3) and overdischarge detec ion voltage (n = 1 to 3) cannot be selected if the voltage difference between them is 0.6 V or lower.

***2.** Overcharge hysteresis voltage n (n = 1 to 3) can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detec ion voltage – Overcharge release voltage)

***3.** Overdischarge hysteresis voltage n (n = 1 to 3) can be selected as 0 V or from a range of 0.2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage – Overdischarge detection voltage)

***4.** The discharge overcurrent detection voltage and load short-circuiting detection voltage cannot be selected if he voltage difference between them is 0.3 V or lower.

16-Pin TSSOP



1 VM
2 CO
3 DO
4 V NI
5 CTLC
6 CTLD
7 CCT
8 CDT
9 CIT
10 VSS
11 NPI
12 VC4
13 VC3
14 VC2
15 VC1
16 VDD

S-8254A Series

BATTERY PROTECTION IC FOR 3-SERIAL- OR 4-SERIAL-CELL PACK

Features

(1) High-accuracy voltage detection for each cell

• Overcharge detection voltage n (n = 1 to 4)	3.90 V to 4.45 V (50 mV step)	Accuracy ±25 mV
• Overcharge release voltage n (n = 1 to 4)	3.80 V to 4.45 V*1	Accuracy ±50 mV
• Overdischarge detection voltage n (n = 1 to 4)	2.0 V to 3.0 V (100 mV step)	Accuracy ±80 mV
• Overdischarge release voltage n (n = 1 to 4)	2.0 V to 3.4 V*2	Accuracy ±100 mV

(2) Three-level overcurrent protection

• Overcurrent detection voltage 1	0.05 V to 0.30 V (50 mV step)	Accuracy ±25 mV
• Overcurrent detection voltage 2	0.5 V	Accuracy ±100 mV
• Overcurrent detection voltage 3	V_{VC1} – 1.2 V	Accuracy ±300 mV

(3) Delay times for overcharge detection, overdischarge detection and overcurrent detection 1 can be set by external capacitors (delay times for overcurrent detection 2 and 3 are fixed internally).

(4) Switchable between a 3-serial cell and 4-serial cell using the SEL pin

(5) Charge/discharge operation can be controlled via the control pins.

(6) 0 V battery charge — Enabled, inh bited

(7) Power-down function — Available

(8) High-withstand voltage — Absolute maximum rating : 26 V

(9) Wide operating voltage range — 2 V to 24 V

(10) Wide operating temperature range — –40°C to + 85°C

(11) Low current consumption

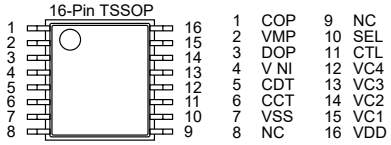
- During operation — 30 µA max. (+25°C)
- During power-down — 0.1 µA max. (+25°C)

(12) Lead-free, Sn100%, halogen-free*3

***1.** Overcharge hysteresis voltage n (n = 1 to 4) can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV steps.
(Overcharge hysteresis voltage = Overcharge detection voltage – Overcharge release voltage)

***2.** Overdischarge hysteresis voltage n (n = 1 to 4) can be selected as 0 V or from a range of 0.2 V to 0.7 V in 100 mV steps.
(Overdischarge hysteresis voltage = Overdischarge release voltage – Overdischarge detection voltage)

***3.** Refer to "■ **Product Name Structure**" for details.



S-8204A Series

BATTERY PROTECTION IC FOR 3-SERIES OR 4-SERIES CELL PACK

Features

- High-accuracy voltage detection function for each cell

Overcharge detection voltage n (n = 1 to 4)	3.8 V to 4.6 V (50 mV step)	Accuracy ±25 mV
Overcharge release voltage n (n = 1 to 4)	3.6 V to 4.6 V*1	Accuracy ±50 mV
Overdischarge detection voltage n (n = 1 to 4)	2.0 V to 3.0 V (100 mV step)	Accuracy ±80 mV
Overdischarge release voltage n (n = 1 to 4)	2.0 V to 3.4 V*2	Accuracy ±100 mV

- Discharge overcurrent detection function in 3-step

Discharge overcurrent detection voltage 1	0.05 V to 0.30 V (50 mV step)	Accuracy ±15 mV
Discharge overcurrent detection voltage 2	0.5 V (fixed)	Accuracy ±100 mV
Load short-circuit detection voltage	1.0 V (fixed)	Accuracy ±300 mV

- Charge overcurrent detection function

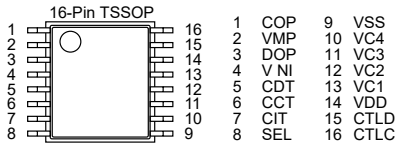
Charge overcurrent detection voltage	–0.25 V to –0.05 V (50 mV step)	Accuracy ±30 mV

- Settable by external capacitor; overcharge detection delay time, overdischarge detection delay time, discharge overcurrent detection delay time 1, discharge overcurrent detection delay time 2, charge overcurrent detection delay time
  (Load short-circuit detection delay time is internally fixed.)
- Switchable between 3-series and 4-series cell by using the SEL pin
- Independent charge and discharge control by the control pins
- High-withstand voltage — Absolute maximum rating: 24 V
- Wide operation voltage range — 2 V to 22 V
- Wide operation temperature range — Ta = –40 C to +85 C
- Low current consumption
  - During operation — 33 µA max. (Ta = +25 C)
  - During power-down — 0.1 µA max. (Ta = +25 C)
- Lead-free, Sn 100%, halogen-free*3

***1.** Overcharge hysteresis voltage n (n = 1 to 4) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage – Overcharge release voltage)

***2.** Overdischarge hysteresis voltage n (n = 1 to 4) is selectable in 0 V, or in 0.2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage – Overdischarge detection voltage)

***3.** Refer to "■ **Product Name Structure**" for details.



S-8204B Series

BATTERY PROTECTION IC FOR 3-SERIES OR 4-SERIES CELL PACK

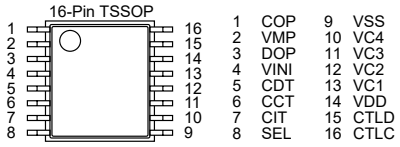
Features

- High-accuracy voltage detec ion function for each cell
  - Overcharge detec ion voltage n (n = 1 to 4): 3.65 V to 4.6 V (50 mV step), Accuracy ±25 mV
  - Overcharge release voltage n (n = 1 to 4): 3.5 V to 4.6 V*1, Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 4): 2.0 V to 3.0 V (100 mV step), Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 4): 2.0 V to 3.4 V*2, Accuracy ±100 mV
- Discharge overcurrent detection in 3-step
  - Discharge overcurrent detection voltage 1: 0.05 V to 0.30 V (50 mV step), Accuracy ±15 mV
  - Discharge overcurrent detection voltage 2: 0.5 V (fixed), Accuracy ±100 mV
  - Load short-circuit detection voltage: 1.0 V (fixed), Accuracy ±300 mV
- Settable by external capacitor; overcharge detection delay time, overdischarge detection delay time, discharge overcurrent detection delay time 1, discharge overcurrent detection delay time 2 (Load short-circuit detection delay time is internally fixed.)
- Switchable between 3-series and 4-series cell by using the SEL pin
- Independent charge and discharge control by the control pins
- Power-down function "available" / "unavailable" is selectable
- High-withstand voltage: Absolute maximum rating: 24 V
- Wide operation voltage range: 2 V to 22 V
- Wide operation temperature range: Ta = –40 C to +85 C
- Low current consumption
  - During operation: 33 µA max. (Ta = +25 C)
  - During power-down: 0.1 µA max. (Ta = +25 C)
- Lead-free, Sn 100%, halogen-free*3

***1.** Overcharge hysteresis voltage n (n = 1 to 4) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage – Overcharge release voltage)

***2.** Overdischarge hysteresis voltage n (n = 1 to 4) is selectable in 0 V, or in 0.2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage – Overdischarge detection voltage)

***3.** Refer to "■ **Product Name Structure**" for details.



S-82B4A/5A Series

BATTERY PROTECTION IC FOR 4-SERIES OR 5-SERIES CELL PACK

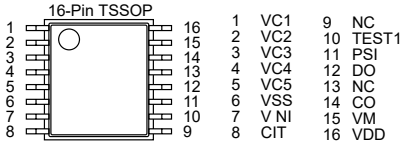
Features

- High-accuracy voltage detection for each cell
  - Overcharge detection voltage n: 3.900 V to 4.500 V (25 mV step), Accuracy ±20 mV
  - Overcharge release voltage n: 3.500 V to 4.500 V*1, Accuracy ±50 mV
  - Overdischarge detection voltage n: 2.000 V to 3.200 V (100 mV step), Accuracy ±50 mV
  - Overdischarge release voltage n: 2.000 V to 3.400 V*2, Accuracy ±100 mV
- Three-level discharge overcurrent detection
  - Discharge overcurrent 1 detec ion voltage: 10 mV to 200 mV (5 mV step), Accuracy ±5 mV
  - Discharge overcurrent 2 detec ion voltage: 20 mV to 300 mV (5 mV step), Accuracy ±10 mV
  - Load short-circuiting detec ion voltage: 50 mV to 400 mV (10 mV step), Accuracy ±20 mV
- Charge overcurrent detection
  - Charge overcurrent detection voltage: –200 mV to –10 mV (5 mV step), Accuracy ±5 mV
- Discharge overcurrent 1 detection delay time is settable by an external capacitor (The other delay time are internally fixed)
- Power saving control by a control pin
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnection, charger connection
- Output voltage of CO and DO pin is limited to VC2 pin voltage. (S-82B5A Series)
- High-withstand voltage: Absolute maximum rating 28.0 V
- Wide operating voltage range: 5.0 V to 24 0 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 4.0 µA typ., 8.0 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
  - During power-saving: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage n can be selected from a range of 0 V to 0.4 V in 50 mV steps.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n can be selected from a range of 0 V to 0.7 V in 100 mV steps.)

Remark n = 1, 2, 3, 4, 5



S-82C4A/5A Series

BATTERY PROTECTION IC FOR 4-SERIES OR 5-SERIES CELL PACK

Features

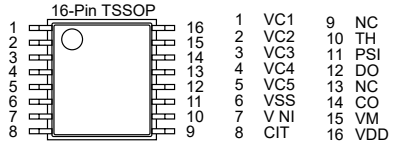
- High-accuracy voltage detection for each cell
  - Overcharge detection voltage n: 3 900 V to 4.500 V (25 mV step) Accuracy ±20 mV
  - Overcharge release voltage n: 3.500 V to 4.500 V*1 Accuracy ±50 mV
  - Overdischarge detec ion voltage n: 2.000 V to 3.200 V (100 mV step) Accuracy ±50 mV
  - Overdischarge release voltage n: 2.000 V to 3.400 V*2 Accuracy ±100 mV
- Three-level discharge overcurrent detection
  - Discharge overcurrent 1 detection voltage: 10 mV to 200 mV (5 mV step) Accuracy ±5 mV
  - Discharge overcurrent 2 detection voltage: 20 mV to 300 mV (5 mV step) Accuracy ±10 mV
  - Load short-circuiting detection voltage: 50 mV to 400 mV (10 mV step) Accuracy ±20 mV
- Charge overcurrent detection
  - Charge overcurrent detec ion voltage: –200 mV to –10 mV (5 mV step) Accuracy ±5 mV
- Discharge overcurrent 1 detection delay ime is settable by an external capacitor (The other delay time are internally fixed)
- Power saving control by a control pin
- 0 V battery charge: Enabled, inhibited
- Power-down func ion: Available, unavailable
- Release condition of discharge overcurrent status: Load disconnec ion, charger connec ion
- Output voltage of CO and DO pin is limited to VC2 pin voltage. (S-82C5A Series)
- Detec ing temperature is possible with connec ing an NTC thermistor at four different points of high-and-low temperatures during charging and of high-and-low temperatures during charge-discharge.
  - High temperature charge-discharge inhibition temperature: +40°C to +85°C (1°C step) Accuracy ±3°C*3
  - High temperature charge inhibition temperature: +40°C to +85°C (1°C step) Accuracy ±3°C*3
  - Low temperature charge inhibition temperature: −40°C to +10°C (1°C step) Accuracy ±3°C*3
  - Low temperature charge-discharge inhibition temperature: −40°C to +10°C (1°C step) Accuracy ±3°C*3
- High-wi hstand voltage: Absolute maximum rating 28.0 V
- Wide operating voltage range: 5.0 V to 24.0 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 5.0 µA typ., 10 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
  - During power-saving: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage n can be selected from a range of 0 V to 0.4 V in 50 mV steps.)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n can be selected from a range of 0 V to 0.7 V in 100 mV steps.)

***3.** Temperature detection accuracy varies with NTC thermistor specifications.
When an NTC thermistor listed in **Table 2** is connected, the detection temperature and accuracy can be achieved.

Remark n = 1, 2, 3, 4, 5



S-8205A/B Series

BATTERY PROTECTION IC FOR 4-SERIES OR 5-SERIES CELL PACK

Features

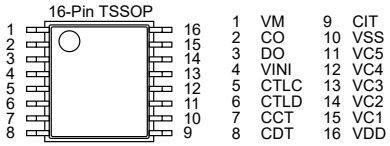
- High-accuracy voltage detection function for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.550 V to 4.500 V*1 (50 mV step) Accuracy ±25 mV
  - Overcharge release voltage n (n = 1 to 5): 3.300 V to 4.500 V*2 Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 5): 2.000 V to 3.200 V*1 (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.000 V to 3.400 V*3 Accuracy ±100 mV
- Discharge overcurrent detection in 2-step
  - Discharge overcurrent detec ion voltage: 0.050 V to 0.300 V*4 (50 mV step) Accuracy ±15 mV
  - Short circuit detection voltage: 0.500 V to 1.000 V*4 (100 mV step) Accuracy ±100 mV
- Charge overcurrent detection
  - Charge overcurrent detection voltage: –0.300 V to –0.050 V (50 mV step) Accuracy ±30 mV
- Settable by external capacitor; Overcharge detection delay time, Overdischarge detection delay time, Discharge overcurrent detection delay time, Charge overcurrent detection delay time
  (Load short circuit detec ion delay time is internally fixed.)
- S-8205A Series: used for 4-series cell, S-8205B Series: used for 5-series cell
- Independent charging and discharge control by the control pins
- 0 V battery charge: Enabled, inhibited
- Power-down function: Available, unavailable
- High-withstand voltage: Absolute maximum rating : 28 V
- Wide range of operation voltage: 2 V to 24 V
- Wide range of operation temperature: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 40 µA max. (Ta = +25°C)
  - During power-down: 0.1 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** The overcharge detection voltage n (n = 1 to 5) and overdischarge detection voltage (n = 1 to 5) are not selectable if he voltage difference between them is 0.6 V or less.

***2.** Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage – Overcharge release voltage)

***3.** Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V, or in 0.2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage – Overdischarge detection voltage)

***4.** The discharge overcurrent detection voltage and load short circuit detection voltage are not selectable if the voltage difference between them is 0.3 V or less.



S-8245A/C Series

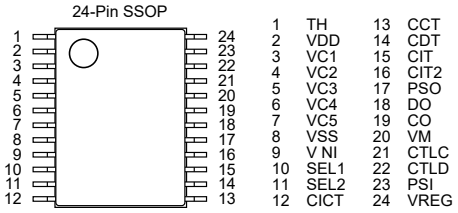
BATTERY PROTECTION IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

Features

- High-accuracy voltage detection for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.550 V to 4.600 V (50 mV step) Accuracy ±20 mV
  - Overcharge release voltage n (n = 1 to 5): 3.150 V to 4.600 V*1 Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 5): 2.000 V to 3.200 V (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.000 V to 3.400 V*2 Accuracy ±100 mV
- Three-level discharge overcurrent detec ion:
  - Discharge overcurrent 1 detection voltage: 0.020 V to 0.300 V (10 mV step) Accuracy ±10 mV
  - Discharge overcurrent 2 detection voltage: 0.040 V to 0.500 V (20 mV step) Accuracy ±15 mV
  - Load short-circui ing detec ion voltage: 0.100 V to 1.000 V (25 mV step) Accuracy ±50 mV
- Charge overcurrent detection:
  - Charge overcurrent detection voltage: −0.300 V to −0.020 V (10 mV step) Accuracy ±10 mV
- Each delay time is settable by an external capacitor
  (Load short-circuiting detection delay time and temperature detection delay time are internally fixed)
- Independent control of charge inhibition, discharge inhibition, and power-saving by each control pin
- 0 V battery charge function is selectable: Available, unavailable
- Power-down func ion is selectable: Available, unavailable
- CIT pin internal resistance value is selectable: 831 kΩ typ., 8.31 MΩ typ.
- CO and DO pin output voltage is limited to 15 V max. respectively
- Switching control for 3-serial to 5-serial cell is possible by inputting voltage to the SEL1 pin and the SEL2 pin
- Protection of 6-serial or more cells is possible by cascade connection
- Temperature detection is possible at four different points by connec ing an NTC
  - High temperature detection ratio during charging / discharging: 0.600 to 0.900 (0.005 step) Accuracy ±0.005
  - Low temperature detection ra io during charging / discharging: 0.030 to 0.400 (0.005 step) Accuracy ±0.005
- High-withstand voltage: Absolute maximum rating 28 V
- Wide opera ion voltage range: 5 V to 24 V
- Wide opera ion temperature range: Ta = −40 C to +85 C
- Low current consumption
  - During operation: 20 μA max. (Ta = +25 C)
  - During power-down: 0.5 μA max. (Ta = +25 C)
  - During power-saving: 0.1 μA max. (Ta = +25 C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.4 V in 50 mV step)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.7 V in 100 mV step)



S-8245B/D Series

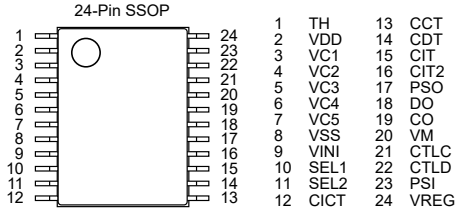
BATTERY PROTECTION IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

Features

- High-accuracy voltage detection for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.550 V to 4.600 V (50 mV step) Accuracy ±20 mV
  - Overcharge release voltage n (n = 1 to 5): 3.150 V to 4.600 V*1 Accuracy ±50 mV
  - Overdischarge detec ion voltage n (n = 1 to 5): 2.000 V to 3 200 V (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.000 V to 3.400 V*2 Accuracy ±100 mV
- Three-level discharge overcurrent detection:
  - Discharge overcurrent 1 detection voltage: 0.020 V to 0 300 V (10 mV step) Accuracy ±10 mV
  - Discharge overcurrent 2 detection voltage: 0.040 V to 0 500 V (20 mV step) Accuracy ±15 mV
  - Load short-circuiting detection voltage: 0.100 V to 1.000 V (25 mV step) Accuracy ±50 mV
- Charge overcurrent detection:
  - Charge overcurrent detection voltage: −0.300 V to −0.020 V (10 mV step) Accuracy ±10 mV
- Each delay ime is settable by an external capacitor
  (Load short-circuiting detection delay time and temperature detection delay time are internally fixed)
- Independent control of charge inhibi ion, discharge inhibition, and power-saving by each control pin
- 0 V battery charge function is selectable: Available, unavailable
- Power-down function is selectable: Available, unavailable
- CIT pin internal resistance value is selectable: 831 kΩ typ., 8.31 MΩ typ.
- CO and DO pin output voltage is limited to 15 V max. respectively
- Switching control for 3-serial to 5-serial cell is possible by inputting voltage to he SEL1 pin and the SEL2 pin
- Temperature detection is possible at four different points by connecting an NTC
  - High temperature detection ratio during charging / discharging: 0.600 to 0.900 (0.005 step) Accuracy ±0.005
  - Low temperature detec ion ratio during charging / discharging: 0.030 to 0.400 (0.005 step) Accuracy ±0.005
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 5 V to 24 V
- Wide operation temperature range: Ta = −40 C to +85 C
- Low current consump ion
  - During operation: 20 μA max. (Ta = +25 C)
  - During power-down: 0.5 μA max. (Ta = +25 C)
  - During power-saving: 0.1 μA max. (Ta = +25 C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.4 V in 50 mV step)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.7 V in 100 mV step)



S-8223A/B/C/D Series

BATTERY PROTECTION IC FOR 2-SERIAL / 3-SERIAL CELL PACK (SECONDARY PROTECTION)

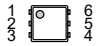
Features

- High-accuracy voltage detection circuit for each cell
  - Overcharge detec ion voltage n (n = 1 to 3)
    - 3.600 V to 4.700 V (50 mV step) — Accuracy ±20 mV (Ta = +25°C); Accuracy ±25 mV (Ta = −10°C to +60°C)
  - Overcharge hysteresis voltage n (n = 1 to 3)*1
    - 0.0 mV to −550 mV (50 mV step)
    - −300 mV to −550 mV — Accuracy ±20%
    - −100 mV to −250 mV — Accuracy ±50 mV
    - −50 mV — Accuracy ±25 mV
    - 0.0 mV — Accuracy −25 mV to +20 mV
- Delay times for overcharge detection are generated only by an internal circuit (external capacitors are unnecessary)
  - Overcharge detection delay time is selectable: 1 s, 2 s, 4 s, 6 s, 8 s
  - Overcharge release delay time is selectable: 2 ms, 64 ms
- Built-in timer reset delay circuit
- Output form is selectable (S-8223A/C Series): CMOS output, Nch open-drain output
- Output logic is selectable (S-8223A/C Series): Active "H", active "L"
- CO pin output voltage is limited to 11.5 V max. (S-8223B/D Series)*2
- High-withstand voltage: Absolute maximum rating 28 V
- Wide opera ion voltage range: 3.6 V to 28 V
- Wide opera ion temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During operation (V_{CU} − 1 0 V for each cell): 0.25 µA typ., 0.5 µA max. (Ta = +25°C)
  - During overdischarge (V_{CU} × 0.5 V for each cell): 0.3 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Select the overcharge hysteresis voltage calculated as the following formula.
(Overcharge detection voltage n) + (Overcharge hysteresis voltage n) ≥ 3.4 V

***2.** Only output logic active "H" is available.

SNT-6A



	S-8223A/B	S-8223C/D
1	VC1	CO
2	VC2	VDD
3	VSS	VC1
4	VC3	VC2
5	VDD	VC3
6	CO	VSS

S-8244 Series

BATTERY PROTECTION IC FOR 1-SERIAL TO 4-SERIAL-CELL PACK (SECONDARY PROTECTION)

Features

(1) Internal high-precision voltage detector circuit
- Overcharge detection voltage range: 3.700 V to 4.550 V: Accuracy of ± 25 mV (at +25°C)
  (at a 5 mV/step) Accuracy of ± 50 mV (at −40°C to +85°C)
- Hysteresis: 5 types
  0.38 ± 0.1 V, 0.25 ± 0 07 V, 0.13 ± 0 04 V, 0.045 ± 0.02 V, None

(2) High-withstand voltage: Absolute maximum rating: 26 V

(3) Wide operating voltage range: 3.6 V to 24 V (refers to he range in which he delay circuit can operate normally after overvoltage is detected)

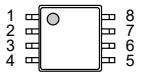
(4) Delay time during detection: Can be set by an external capacitor.

(5) Low current consumption: At 3.5 V for each cell: 3.0 µA max. (+25°C)
At 2.3 V for each cell: 2.4 µA max. (+25°C)

(6) Output logic and form: 5 types
CMOS output active “H”
CMOS output active “L”
Pch open drain output active “L”
Nch open drain output active “H”
Nch open drain output active “L”
(CMOS / Nch open drain output for 0.045 V hysteresis models)

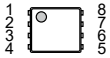
(7) Lead-free (Sn 100%), halogen-free

TMSOP-8



1	VCC
2	SENSE
3	VC1
4	VC2
5	VC3
6	VSS
7	ICT
8	CO

SNT-8A



1	CO
2	ICT
3	VSS
4	VC3
5	VC2
6	VC1
7	SENSE
8	VCC

S-8264A/B/C Series

BATTERY PROTECTION IC FOR 2-SERIAL TO 4-SERIAL-CELL PACK (SECONDARY PROTECTION)

Features

(1) High-accuracy voltage detection circuit for each cell
- Overcharge detection voltage n (n = 1 to 4)
  4.200 V to 4 800 V (in 50 mV steps) Accuracy : ±25 mV (+25°C), Accuracy : ±30 mV (–5°C to +55°C)
- Overcharge hysteresis voltage n (n = 1 to 4)
  –0.520 ±0.210 V, –0.390 ±0.160 V, –0.260 ±0.110 V, –0.130 ±0.06 V, None

(2) Delay times for overcharge detection can be set by an internal circuit only (external capacitors are unnecessary)

(3) Output control function via CTL pin (CTL pin is pulled down internally) (S-8264A Series)
Output control function via CTL pin (CTL pin is pulled up internally) (S-8264C Series)

(4) Output latch function after overcharge detection (S-8264B Series)

(5) Output form and logic CMOS output active “H”

(6) High withstand voltage Absolute maximum rating 26 V

(7) Wide operation voltage range 3.6 V to 24 V

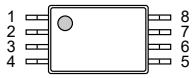
(8) Wide operation temperature range –40°C to +85°C

(9) Low current consump ion
- At 3.5 V for each cell 5.0 µA max. (+25°C)
- At 2.3 V for each cell 4.0 µA max. (+25°C)

(10) Lead-free, Sn 100%, halogen-free*1

***1.** Refer to “■ **Product Name Structure**” for details.

8-Pin TSSOP



1 VDD
2 SENSE
3 VC1
4 VC2
5 VC3
6 VSS
7 CTL
8 CO

SNT-8A

1 VDD
2 SENSE
3 VC1
4 VC2
5 VC3
6 VSS
7 CTL
8 CO

S-8224A/B Series

BATTERY PROTECTION IC FOR 2-SERIAL TO 4-SERIAL CELL PACK (SECONDARY PROTECTION)

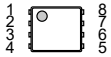
Features

- High-accuracy voltage detection circuit for each cell
  Overcharge detection voltage n (n = 1 to 4)
  3.600 V to 4.700 V (50 mV step) Accuracy ±20 mV (Ta = +25°C)
  Accuracy ±25 mV (Ta = –10°C to +60°C)
  Overcharge hysteresis voltage n (n = 1 to 4)*1
  0.0 mV to –550 mV (50 mV step)
  –300 mV to –550 mV Accuracy ±20%
  –100 mV to –250 mV Accuracy ±50 mV
  –50 mV Accuracy ±25 mV
  0.0 mV Accuracy –25 mV to +20 mV
- Delay times for overcharge detection are generated only by an internal circuit (external capacitors are unnecessary)
  Overcharge detection delay time is selectable: 1 s, 2 s, 4 s, 6 s, 8 s
  Overcharge release delay time is selectable: 2 ms, 64 ms
- Built-in timer reset delay circuit
- Output control function via CTL pin
- Output form is selectable (S-8224A Series): CMOS output, Nch open-drain output
- Output logic is selectable (S-8224A Series): Active "H", active "L"
- CO pin output voltage is limited to 11.5 V max. (S-8224B Series)*2
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 3.6 V to 28 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  During operation (V_{CU} – 1.0 V for each cell): 0.25 µA typ., 0.6 µA max. (Ta = +25°C)
  During overdischarge (V_{CU} × 0 5 V for each cell): 0.3 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Select the overcharge hysteresis voltage calculated as the following formula.
(Overcharge detection voltage n) + (Overcharge hysteresis voltage n) ≥ 3.4 V

***2.** Only output logic active "H" is available.

SNT-8A



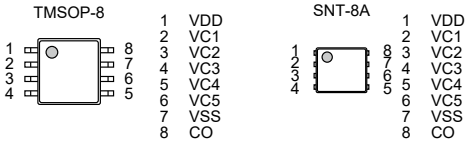
1 VDD
2 VC1
3 VC2
4 VC3
5 VC4
6 VSS
7 CTL
8 CO

S-8215A Series

BATTERY PROTECTION IC FOR 3-SERIAL TO 5-SERIAL CELL PACK (SECONDARY PROTECTION)

Features

- High-accuracy voltage detection circuit for each cell
  - Overcharge detection voltage n (n = 1 to 5)
    - 3.600 V to 4.700 V (50 mV step)
    - Accuracy ±25 mV (Ta = +25°C)
    - Accuracy ±30 mV (Ta = –5°C to +55°C)
  - Overcharge hysteresis voltage n (n = 1 to 5)
    - 0.0 mV to –550 mV (50 mV step)
    - –300 mV to –550 mV: Accuracy ±20%
    - –100 mV to –250 mV: Accuracy ±50 mV
    - 0.0 mV to –50 mV: Accuracy ±25 mV
- Delay times for overcharge detection can be set by an internal circuit only (External capacitors are unnecessary).
- Output form is selectable: CMOS output, Nch open-drain output, Pch open-drain output
- Output logic is selectable: Active "H", active "L"
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 3.6 V to 26 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - At V_{CUn} – 1.0 V for each cell: 3.0 µA max. (Ta = +25°C)
  - At 2.3 V for each cell: 1.7 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free



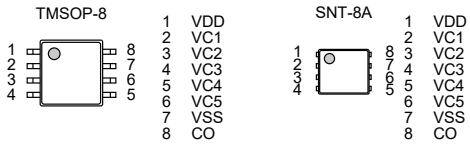
S-8215C Series

BATTERY PROTECTION IC FOR 3-SERIAL TO 5-SERIAL CELL PACK (SECONDARY PROTECTION)

Features

- High-accuracy voltage detection circuit for each cell
  - Overcharge detection voltage n (n = 1 to 5):
    - 2.700 V to 4.700 V (5 mV step): Accuracy ±20 mV (Ta = +25°C), Accuracy ±25 mV (Ta = –10°C to +60°C)
  - Overcharge release voltage n (n = 1 to 5)*1:
    - 2.700 V to 4.700 V: Accuracy ±50 mV (Ta = +25°C)
- Overcharge detection delay times are generated only by an internal circuit (external capacitors are unnecessary)
  - Overcharge detection delay time: 0.5 s, 1 s, 2 s, 4 s, 6 s, 8 s
- Output form: CMOS output, Nch open-drain output
- Output logic: Active "H", active "L"
- Built-in test mode function to check overcharge detection voltage with shortened delay time
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 3.6 V to 26 V
- Wide operation temperature range: Ta = –40°C to +85°C
- Low current consumption
  - During operation: 0.3 µA typ., 0.7 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage + Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0 mV to –400 mV in 50 mV step.)



S-8265C Series

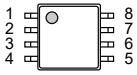
BATTERY PROTECTION IC WITH CELL BALANCING FUNCTION FOR 3-SERIAL TO 5-SERIAL CELL PACK (SECONDARY PROTECTION)

Features

- High-accuracy voltage detection circuit for each cell
  - Cell balancing detection voltage n (n = 1 to 5):
    - 2.700 V to 4.650 V (5 mV step) — Accuracy ±20 mV (Ta = +25°C); Accuracy ±25 mV (Ta = −10°C to +60°C)
  - Cell balancing release voltage n (n = 1 to 5)*1:
    - 2.700 V to 4.650 V — Accuracy ±50 mV (Ta = +25°C)
  - Overcharge detection voltage n (n = 1 to 5)*2:
    - 2.750 V to 4.700 V (5 mV step) — Accuracy ±20 mV (Ta = +25°C); Accuracy ±25 mV (Ta = −10°C to +60°C)
  - Overcharge release voltage n (n = 1 to 5)*3, *4:
    - 2.750 V to 4.700 V — Accuracy ±50 mV (Ta = +25°C)
- Built-in cell balancing discharging FET for each cell
- Output form: CMOS output, Nch open-drain output
- Output logic: Active "H", active "L"
- Built-in test mode function to check cell balancing detection voltage and overcharge detection voltage with shortened delay time
- High-withstand voltage: Absolute maximum ra ing 28 V
- Wide operation voltage range: 3.6 V to 26 V
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During operation: 0.3 µA typ., 0.7 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

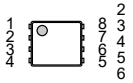
***1.** Cell balancing release voltage = Cell balancing detection voltage + Cell balancing hysteresis voltage
(Cell balancing hysteresis voltage can be selected from a range of 0 mV to −400 mV in 50 mV step.)
***2.** Satisfy Overcharge detection voltage ≥ Cell balancing detection voltage + 50 mV when selecting them.
***3.** Overcharge release voltage = Overcharge detection voltage + Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0 mV to −400 mV in 50 mV step.)
***4.** Satisfy Overcharge release voltage ≥ Cell balancing release voltage + 50 mV when selecting hem.

TMSOP-8



1	VDD
2	VC1
3	VC2
4	VC3
5	VC4
6	VC5
7	VSS
8	CO

SNT-8A



1	VDD
2	VC1
3	VC2
4	VC3
5	VC4
6	VC5
7	VSS
8	CO

S-8259A Series

BATTERY MONITORING IC FOR 1-CELL PACK

Features

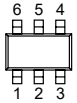
- High-accuracy voltage detection circuit

Overcharge detection voltage	3.500 V to 4.600 V (5 mV step)	Accuracy ±20 mV
Overcharge release voltage	3.100 V to 4.600 V*1	Accuracy ±50 mV
Overdischarge detection voltage	2.000 V to 3.400 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.000 V to 3.400 V*2	Accuracy ±100 mV

- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary).
- CO pin output logic: Active "H", active "L"
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During opera ion: 1 5 µA typ., 3.0 µA max. (Ta = +25°C)
  - During overdischarge: 2 0 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected from a range of 0 V to 0.4 V in 50 mV step.)
***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected from a range of 0.1 V to 0.7 V in 100 mV step.)

SOT-23-6



1	DO
2	VM
3	CO
4	NC
5	VDD
6	VSS

S-8211E Series

BATTERY PROTECTION IC FOR 1-CELL PACK

Features

(1) High-accuracy voltage detection circuit

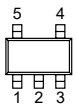
• Overcharge detec ion voltage	3.6 V to 4.5 V (5 mV step)	Accuracy ±25 mV (+25 C) Accuracy ±30 mV (–5 C to +55 C)
• Overcharge release voltage	3 5 V to 4.4 V*1	Accuracy ±50 mV
• Overdischarge detection voltage	2 0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
• Overdischarge release voltage	2 0 V to 3.4 V*2	Accuracy ±100 mV
(2) Detection delay times are generated by an internal circuit (external capacitors are unnecessary)		Accuracy ±20%
(3) Wide operating temperature range	–40 C to +85 C	
(4) Low current consumption		
• During operation	3.0 µA typ., 5.5 µA max. (+25 C)	
• During overdischarge	2.0 µA typ., 3.5 µA max. (+25 C)	
(5) Output logic of CO pin is selectable.	Active “H”, Active “L”	
(6) Lead-free, Sn 100%, halogen-free*3		

***1.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.4 V in 50 mV step)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 100 mV step.)

***3.** Refer to “■ **Product Name Structure**” for details.

SOT-23-5



1	VM
2	VDD
3	VSS
4	DO
5	CO

SNT-6A

1	NC
2	CO
3	DO
4	VSS
5	VDD
6	VM

S-8209A Series

BATTERY PROTECTION IC WITH CELL-BALANCE FUNCTION

Features

• High-accuracy voltage detec ion circuit		
Overcharge detection voltage*1	3 55 V to 4.40 V (5 mV step)	Accuracy ±25 mV
Overcharge release voltage*1	3 50 V to 4.40 V*2	Accuracy ±50 mV
Cell-balance detection voltage*1	3 55 V to 4.40 V (5 mV step)*3	Accuracy ±25 mV
Cell-balance release voltage*1	3 50 V to 4.40 V*4	Accuracy ±50 mV
Overdischarge detection voltage	2 0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2 0 V to 3.4 V*5	Accuracy ±100 mV
• Settable delay time by external capacitor for output pin		
• Control charging, discharging, cell-balance by CTLC pin and CTLD pin		
• Two types of cell-balance function; charge / discharge*6		
• Wide range of operation temperature	Ta = –40°C to +85°C	
• Low current consumption	7 0 µA max.	
• Lead-free, Sn 100%, halogen-free*7		

***1.** Regarding selection of overcharge detection voltage, overcharge release voltage, cell-balance detec ion voltage and cell-balance release voltage, refer to **Remark 3** in "**3. Product name list**" of "■ **Product Name Structure**"

***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage is selectable in 0 V to 0.4 V, in 50 mV step.)

***3.** Select as to overcharge detection voltage > cell-balance detection voltage.

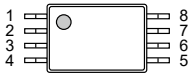
***4.** Cell-balance release voltage = Cell-balance detection voltage – Cell-balance hysteresis voltage
(Cell-balance hysteresis voltage is selectable in 0 V to 0.4 V, in 50 mV step.)

***5.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage is selectable in 0 V to 0.7 V, in 100 mV step.)

***6.** Also available the product without discharge cell-balance function

***7.** Refer to "■ **Product Name Structure**" for details.

8-Pin TSSOP



1	CTLC
2	CTLD
3	VDD
4	CDT
5	VSS
6	DO
7	CO
8	CB

SNT-8A

1	CTLC
2	CTLD
3	VDD
4	CDT
5	VSS
6	DO
7	CO
8	CB

S-8209B Series

BATTERY PROTECTION IC WITH CELL-BALANCE FUNCTION

Features

- High-accuracy voltage detection circuit

Overcharge detec ion voltage*1	3.55 V to 4.40 V (5 mV step)	Accuracy ±25 mV
Overcharge release voltage*1	3.50 V to 4.40 V*2	Accuracy ±50 mV
Cell-balance detection voltage*1	3.55 V to 4.40 V (5 mV step)*3	Accuracy ±25 mV
Cell-balance release voltage*1	3.50 V to 4.40 V*4	Accuracy ±50 mV
Overdischarge detection voltage	2.0 V to 3.0 V (10 mV step)	Accuracy ±50 mV
Overdischarge release voltage	2.0 V to 3.4 V*5	Accuracy ±100 mV

- Settable delay time by external capacitor for output pin
- Control charging, discharging, cell-balance by CTLC pin, CTLD pin
- Two types of cell-balance function; charge / discharge*6
- Wide range of opera ion temperature Ta = –40°C to +85°C
- Low current consumption 7.0 µA max.
- Lead-free, Sn 100%, halogen-free*7

***1.** Regarding selection of overcharge detection voltage, overcharge release voltage, cell-balance detection voltage and cell-balance release voltage, refer to **Remark 3** in "**3. Product name list**" of "■ **Product Name Structure**".

***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage is selectable in 0 V to 0.4 V in 50 mV step.)

***3.** Select as to overcharge detection voltage > cell-balance detection voltage.

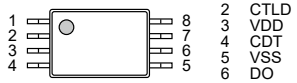
***4.** Cell-balance release voltage = Cell-balance detection voltage – Cell-balance hysteresis voltage
(Cell-balance hysteresis voltage is selectable in 0 V to 0.4 V in 50 mV step.)

***5.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage is selectable in 0 V to 0.7 V in 100 mV step.)

***6.** Also available the product without discharge cell-balance function

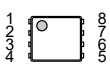
***7.** Refer to "■ **Product Name Structure**" for details.

8-Pin TSSOP



1 CTLC
2 CTLD
3 VDD
4 CDT
5 VSS
6 DO
7 CO
8 CB

SNT-8A



1 CTLC
2 CTLD
3 VDD
4 CDT
5 VSS
6 DO
7 CO
8 CB

S-8249 Series

VOLTAGE MONITORING IC WITH CELL BALANCING FUNCTION

Features

- High-accuracy voltage detection circuit

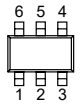
Cell balancing detection voltage:	2.0 V to 4.6 V (5 mV step)	Accuracy ±12 mV (2.0 V ≤ V_{BU} < 2.4 V)
		Accuracy ±0.5% (2.4 V ≤ V_{BU} ≤ 4.6 V)
Cell balancing release voltage:	2.0 V to 4.6 V*1	Accuracy ±24 mV (2.0 V ≤ V_{BL} < 2.4 V)
		Accuracy ±1.0% (2.4 V ≤ V_{BL} ≤ 4.6 V)
Overcharge detection voltage:	2.0 V to 4.6 V (5 mV step)	Accuracy ±12 mV (2.0 V ≤ V_{CU} < 2.4 V)
		Accuracy ±0.5% (2.4 V ≤ V_{CU} ≤ 4.6 V)
Overcharge release voltage:	2.0 V to 4.6 V*2	Accuracy ±24 mV (2.0 V ≤ V_{CL} < 2.4 V)
		Accuracy ±1.0% (2.4 V ≤ V_{CL} ≤ 4.6 V)

- Built-in Nch transistor with ON resistance of 5 Ω typ. between the CB pin and the VSS pin
- Current consumption: 2.0 µA max. (Ta = +25°C)
- Delay times are generated only by an internal circuit (External capacitors are unnecessary).
- CO pin output form and output logic are selectable: CMOS output Active "H", active "L"
  Nch open-drain output Active "H", active "L"
- Switchable to power-saving mode by using the $\overline{CE}$ pin
- Operation temperature range: Ta = –40°C to +85°C
- Lead-free (Sn 100%), halogen-free

***1.** Cell balancing release voltage = Cell balancing detection voltage – Cell balancing hysteresis voltage
(Cell balancing hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 50 mV step.)

***2.** Overcharge release voltage = Overcharge detection voltage – Overcharge hysteresis voltage
(Overcharge hysteresis voltage can be selected as 0 V or from a range of 0.1 V to 0.7 V in 50 mV step.)

SOT-23-6



1 CO
2 VSS
3 DP
4 $\overline{CE}$
5 VDD
6 CB

S-8225A Series

BATTERY MONITORING IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

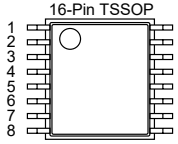
Features

- High-accuracy voltage detection function for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.500 V to 4.400 V (50 mV step), Accuracy ±20 mV (Ta = +25°C), ±30 mV (Ta = 0°C to +60°C)
  - Overcharge release voltage n (n = 1 to 5): 3.300 V to 4.400 V*1, Accuracy ±50 mV
  - Overdischarge detec ion voltage n (n = 1 to 5): 2.000 V to 3 200 V (100 mV step), Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.100 V to 3.400 V*2, Accuracy ±100 mV
- Overcharge detection delay time and overdischarge detection delay time can be set by external capacitor.
- Switchable between 3-serial to 5-serial cell by using he SEL1 pin and the SEL2 pin
- Cascade connection is available.
- The CO pin and the DO pin are controlled by the CTLC pin and the CTLD pin, respectively.
- Output voltage of the CO pin and the DO pin is limited to 12 V max.
- High-withstand voltage: Absolute maximum rating: 28 V
- Wide operation voltage range: 4 V to 26 V
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During operation (V1 = V2 = V3 = V4 = V5 = 3.4 V): 22 µA max. (Ta = +25°C)
  - During power-down (V1 = V2 = V3 = V4 = V5 = 1.6 V): 4.5 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage − Overcharge release voltage)

***2.** Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage − Overdischarge detection voltage)

16-Pin TSSOP



1	CTLD	9	VSS		
2	CTLC	10	VC6		
3	CO	11	VC5		
4	DO	12	VC4		
5	SEL1	13	VC3		
6	SEL2	14	VC2		
7	CDT	15	VC1		
8	CCT	16	VDD		

S-8225B Series

BATTERY MONITORING IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

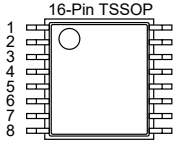
Features

- High-accuracy voltage detection function for each cell
  - Overcharge detec ion voltage n (n = 1 to 5): 3.5 V to 4.4 V (50 mV step), Accuracy ±20 mV (Ta = +25°C), ±30 mV (Ta = 0°C to +60°C)
  - Overcharge release voltage n (n = 1 to 5): 3.3 V to 4.4 V*1, Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 5): 2.2 V to 3.2 V (100 mV step), Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.2 V to 3.4 V*2, Accuracy ±100 mV
- Overcharge detection delay time and overdischarge detec ion delay time can be set by external capacitor.
- Switchable between 3-serial to 5-serial cell by using the SEL1 pin and the SEL2 pin
- The CO pin and the DO pin are controlled by the CTLC pin and the CTLD pin, respectively.
- Output voltage of the CO pin and the DO pin is limited to 12 V max.
- Output logic is selectable.: Active "H", active "L"
- High-wi hstand voltage: Absolute maximum rating: 28 V
- Wide operation voltage range: 4 V to 26 V
- Wide operation temperature range: Ta = −40°C to +85°C
- Low current consumption
  - During operation (V1 = V2 = V3 = V4 = V5 = 3.4 V): 20 µA max. (Ta = +25°C)
  - During power-down (V1 = V2 = V3 = V4 = V5 = 1.6 V): 3.0 µA max. (Ta = +25°C)
- Lead-free (Sn 100%), halogen-free

***1.** Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V, or in 0.1 V to 0.4 V in 50 mV step.
(Overcharge hysteresis voltage = Overcharge detection voltage − Overcharge release voltage)

***2.** Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V, or in 0 2 V to 0.7 V in 100 mV step.
(Overdischarge hysteresis voltage = Overdischarge release voltage − Overdischarge detection voltage)

16-Pin TSSOP



1	CTLD	9	VSS		
2	CTLC	10	VC6		
3	CO	11	VC5		
4	DO	12	VC4		
5	SEL1	13	VC3		
6	SEL2	14	VC2		
7	CDT	15	VC1		
8	CCT	16	VDD		

S-8255A Series

BATTERY MONITORING IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

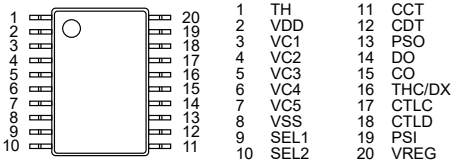
Features

- High-accuracy voltage detec ion function for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.550 V to 4.600 V (50 mV step) Accuracy ±20 mV
  - Overcharge release voltage n (n = 1 to 5): 3.150 V to 4.600 V*1 Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 5): 2.000 V to 3.200 V (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.000 V to 3.400 V*2 Accuracy ±100 mV
- Each delay time is settable by external capacitor (Temperature detection delay time is internally fixed)
- Independent control of charge inhibition, discharge inhibition, and power-saving by each control pin
- 0 V battery detection function is selectable: Available, unavailable
- CO and DO pin output voltage is limited to 8 V max. respec ively
- Switching control for 3-serial to 5-serial cell is possible by inputting voltage to the SEL1 pin and the SEL2 pin
- Monitoring of 6-serial or more cells is possible by cascade connection
- Temperature detection is possible at four different points by connec ing an NTC
  - High temperature detection ratio during charging / discharging: 0.600 to 0.900 (0.005 step) Accuracy ±0.005
  - Low temperature detection ra io during charging / discharging: 0.030 to 0.400 (0.005 step) Accuracy ±0.005
- High-withstand voltage: Absolute maximum rating 28 V
- Wide opera ion voltage range: 5 V to 24 V
- Wide opera ion temperature range: Ta = −40 C to +85 C
- Low current consumption
  - During operation: 19 μA max. (Ta = +25 C)
  - During power-saving: 0.1 μA max. (Ta = +25 C)
- Lead-free, halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.4 V in 50 mV step)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.7 V in 100 mV step)

20-Pin TSSOP



1	TH	11	CCT
2	VDD	12	CDT
3	VC1	13	PSO
4	VC2	14	DO
5	VC3	15	CO
6	VC4	16	THC/DX
7	VC5	17	CTLC
8	VSS	18	CTLD
9	SEL1	19	PSI
10	SEL2	20	VREG

S-8255B Series

BATTERY MONITORING IC FOR 3-SERIAL TO 5-SERIAL CELL PACK

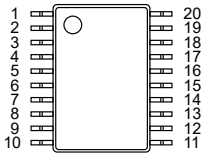
Features

- High-accuracy voltage detection function for each cell
  - Overcharge detection voltage n (n = 1 to 5): 3.550 V to 4.600 V (50 mV step) Accuracy ±20 mV
  - Overcharge release voltage n (n = 1 to 5): 3.150 V to 4.600 V*1 Accuracy ±50 mV
  - Overdischarge detection voltage n (n = 1 to 5): 2.000 V to 3.200 V (100 mV step) Accuracy ±80 mV
  - Overdischarge release voltage n (n = 1 to 5): 2.000 V to 3.400 V*2 Accuracy ±100 mV
- Each delay time is settable by external capacitor (Temperature detection delay time is internally fixed)
- Independent control of charge inhibition, discharge inhibition, and power-saving by each control pin
- 0 V battery detection func ion is selectable: Available, unavailable
- CO and DO pin output voltage is limited to 8 V max. respectively
- Switching control for 3-serial to 5-serial cell is possible by inputting voltage to the SEL1 pin and the SEL2 pin
- Temperature detec ion is possible at four different points by connecting an NTC
  - High temperature detection ratio during charging / discharging: 0.600 to 0.900 (0.005 step) Accuracy ±0.005
  - Low temperature detection ratio during charging / discharging: 0.030 to 0.400 (0.005 step) Accuracy ±0.005
- High-withstand voltage: Absolute maximum rating 28 V
- Wide operation voltage range: 5 V to 24 V
- Wide operation temperature range: Ta = −40 C to +85 C
- Low current consumption
  - During operation: 19 μA max. (Ta = +25 C)
  - During power-saving: 0.1 μA max. (Ta = +25 C)
- Lead-free, halogen-free

***1.** Overcharge release voltage = Overcharge detection voltage − Overcharge hysteresis voltage
(Overcharge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.4 V in 50 mV step)

***2.** Overdischarge release voltage = Overdischarge detection voltage + Overdischarge hysteresis voltage
(Overdischarge hysteresis voltage n (n = 1 to 5) is selectable in 0 V to 0.7 V in 100 mV step)

20-Pin TSSOP



1	TH	11	CCT
2	VDD	12	CDT
3	VC1	13	PSO
4	VC2	14	DO
5	VC3	15	CO
6	VC4	16	THC/DX
7	VC5	17	CTLC
8	VSS	18	CTLD
9	SEL1	19	PSI
10	SEL2	20	VREG

S-8239A Series

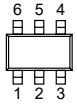
OVERCURRENT MONITORING IC FOR MULTI-SERIAL-CELL PACK

Features

- Built-in high-accuracy voltage detection circuit
  - Overcurrent 1 detection voltage*1 — 0.04 V to 0.30 V (10 mV step) — Accuracy ±15 mV
  - Overcurrent 2 detection voltage — 0.1 V to 0.7 V (100 mV step) — Accuracy ±100 mV
  - Overcurrent 3 detection voltage — 1.2 V (Fixed) — Accuracy ±300 mV
- Built-in three-step overcurrent detection circuit: Overcurrent 1, overcurrent 2, overcurrent 3
- Overcurrent 3 detection func ion: Available, unavailable
- UVLO (under voltage lock out) function
  - UVLO detection voltage — 2 0 V (Fixed) — Accuracy ±100 mV
- High-withstand voltage: VM pin, DO pin: Absolute maximum ra ing 28 V
- Delay times are generated only by an internal circuit (External capacitors are unnecessary).
- Low current consumption
  - During normal opera ion: 7.0 µA max.
  - During UVLO operation: 6.0 µA max.
- Output logic: Active "L", Active "H"
- Wide operation temperature range: Ta = –40°C to +85°C
- Lead-free (Sn 100%), halogen-free

***1.** Overcurrent 1 detection voltage ≤ 0.06 V should be satisfied in he case of overcurrent 2 detec ion voltage = 0.1 V. Overcurrent 1 detection voltage ≤ 0.85 × overcurrent 2 detection voltage – 0.05 V should be satisfied in the case of overcurrent 2 detection voltage ≥ 0.2 V.

SOT-23-6



1 VINI
2 VM
3 DO
4 DP
5 VDD
6 VSS

S-8239B Series

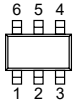
OVERCURRENT MONITORING IC FOR MULTI-SERIAL-CELL PACK

Features

- Built-in high-accuracy voltage detec ion circuit
  - Overcurrent 1 detection voltage*1 — 0.04 V to 0.30 V (10 mV step) — Accuracy ±15 mV
  - Overcurrent 2 detection voltage — 0.1 V to 0.7 V (100 mV step) — Accuracy ±100 mV
  - Overcurrent 3 detection voltage — 1.2 V (Fixed) — Accuracy ±300 mV
- Built-in three-step overcurrent detection circuit: Overcurrent 1, overcurrent 2, overcurrent 3
- Overcurrent 3 detection func ion: Available, unavailable
- UVLO (under voltage lock out) function
  - UVLO detection voltage — 2.0 V (Fixed) — Accuracy ±100 mV
- High-withstand voltage: VM pin, DO pin: Absolute maximum rating 28 V
- Delay times are generated only by an internal circuit (External capacitors are unnecessary).
- Low current consumption
  - During normal opera ion: 7.0 µA max.
  - During power-down: 0.1 µA max.
- Output logic: Active "L"
- Wide operation temperature range: Ta = –40°C to +85°C
- Lead-free (Sn 100%), halogen-free

***1.** Overcurrent 1 detection voltage ≤ 0.06 V should be satisfied in the case of overcurrent 2 detec ion voltage = 0.1 V. Overcurrent 1 detection voltage ≤ 0.85 × overcurrent 2 detection voltage – 0.05 V should be satisfied in the case of overcurrent 2 detection voltage ≥ 0.2 V.

SOT-23-6



1 VINI
2 VM
3 DO
4 DP
5 VDD
6 VSS

S-8269B Series

OVERCURRENT MONITORING IC FOR MULTI-SERIAL-CELL PACK

Features

- High-accuracy voltage detection circuit
  - Discharge overcurrent detection voltage 1: 0.0030 V to 0.1000 V (0.5 mV step) Accuracy ±1.5 mV
  - Discharge overcurrent detection voltage 2: 0.010 V to 0.100 V (1 mV step) Accuracy ±3 mV
  - Load short-circuiting detection voltage: 0.020 V to 0.100 V (1 mV step) Accuracy ±5 mV
  - Charge overcurrent detection voltage: –0.1000 V to –0.0030 V (0 5 mV step) Accuracy ±1.5 mV
- Detection delay times are generated only by an internal circuit (external capacitors are unnecessary)
- Discharge overcurrent control function
  - Release condition of discharge overcurrent status: Load disconnection
  - Release voltage of discharge overcurrent status: V_{DIOV1}, $V_{RIOV} = V_{DD} \times 0.8$ (typ.)
- High-withstand voltage: VM pin and CO pin: Absolute maximum rating 28 V
- Low current consumption
  - During operation: 2.0 µA typ., 4.0 µA max. (Ta = +25°C)
- Wide operation temperature range: Ta = –40°C to +85°C
- Lead-free (Sn 100%), halogen-free

SNT-6A

1 VM
2 CO
3 DO
4 VSS
5 VDD
6 V NI

S-8229A Series

BATTERY MONITORING IC

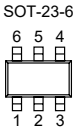
Features

- Detection voltage accuracy: ±1.0%
- Hysteresis characteristics: V_{HYS1} to V_{HYS3} = 0 mV, 50 mV, 300 mV, 400 mV, 500 mV
- Current consumption: During operation: I_{DD1} = 9.0 µA max. ($-V_{DETtotal}$*1 ≥ 42 V)
  I_{DD1} = 11.0 µA max. ($-V_{DETtotal}$*1 < 42 V)
  During power-off: I_{DD2} = 0.1 µA max.
- Operation voltage range: V_{DD} = 3.6 V to 24 V
- Detection voltage: $-V_{DET1(S)}$ to $-V_{DET2(S)}$ = 10.5 V to 21.5 V (0.1 V step)
  $-V_{DET3(S)}$ = 7.5 V to 21.5 V (0.1 V step)
- Output form: Nch open-drain output
- Output logic*2: Full charge all on, full charge all off
- Operation temperature range: Ta = –40°C to +85°C
- Lead-free (Sn 100%), halogen-free

*1. $-V_{DETtotal}$: Total detection voltage
$-V_{DETtotal} = -V_{DET1(S)} + -V_{DET2(S)} + -V_{DET3(S)}$

*2. Full charge all on: When the input voltage is equal to or higher than each of the three detection voltage values, $V_{OUT1} = V_{OUT2} = V_{OUT3} = V_{SS}$.
Full charge all off: When the input voltage is equal to or higher than each of the three detection voltage values, $V_{OUT1} = V_{OUT2} = V_{OUT3}$ = "High-Z".

SOT-23-6



1 OUT1
2 OUT2
3 OUT3
4 VSS
5 VDD
6 ON/OFF

SNT-6A

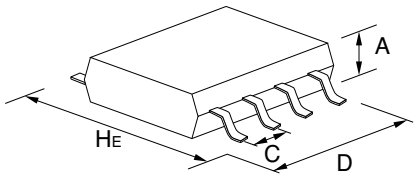
1 OUT3
2 OUT2
3 OUT1
4 ON/OFF
5 VDD
6 VSS

Package List

Package Type	Pin Count	Package Name	Package Size (mm)			Pitch (mm)
			HE	D	A (max.)	C
Lead insertion type	3	TO-92	7.0	5.2	4.2	2.5/1.27
	3	TO-92S	4.95	4.1	1.62	2.5/1.27
Flat-lead type	3	SOT-89-3	4.0	4.5	1.6	1.5
	5	SOT-89-5	4.5	4.5	1.6	1.5
Gull-wing type	4	SC-82AB	2.1	2.0	1.1	1.3
	5	SC-88A	2.1	2.0	1.1	0.65
	3	SOT-23-3	2.8	2.9	1.3	1.9
	3	SOT-23-3S	2.8	2.9	1.2	1.9
	3	TSOT-23-3S	2.85	2.9	0.8	1.9
	5	SOT-23-5	2.8	2.9	1.3	0.95
	6	SOT-23-6	2.8	2.9	1.35	0.95
	6	SOT-23-6W	2.8	2.9	1.3	0.95
	8	8-Pin SOP (JEDEC)	6.0	5.02	1.75	1.27
	8	8-Pin TSSOP	6.4	3.0	1.1	0.65
	8	8-Pin TSSOP	6.4	3.0	1.1	0.65
	16	16-Pin TSSOP	6.4	5.1	1.1	0.65
	20	20-Pin TSSOP	6.4	6.5	1.2	0.65
	24	24-Pin SSOP	7.6	7.9	1.4	0.65
	8	TMSOP-8	4.0	2.9	0.8	0.65
	8	HTMSOP-8	4.0	2.9	0.8	0.65
	16	HTSSOP-16	6.4	5.12	1.1	0.65
	6	HSOP-6	6.0	5.02	1.75	1.91
	8	HSOP-8A	6.0	5.02	1.68	1.27
	8	HSOP-8A	6.0	5.02	1.65	1.27
	8	HSOP-8Q	6.0	5.02	1.68	1.27
	5	TO-252-5S(A)	6.5	6.5	1.4	1.27
	9	TO-252-9S	6.5	6.5	1.4	0.65

Package Type	Pin Count	Package Name	Package Size (mm)			Pitch (mm)
			HE	D	A (max.)	C
Non-lead type	6	6-Pin HSON(A)	3.0	2.9	0.9	0.95
	6	SON-6C	2.55	1.56	0.65	0.5
	4	SNT-4A	1.6	1.2	0.5	0.65
	6	SNT-6A SNT-6A(H)	1.8	1.57	0.5	0.5
	8	SNT-8A	2.46	1.97	0.5	0.5
	4	HSNT-4(0808)	0.8	0.8	0.4	0.4
	4	HSNT-4(0808)B	0.8	0.8	0.41	0.4
	4	HSNT-4(1010)	1.0	1.0	0.4	0.65
	4	HSNT-4(1010)B	1.0	1.0	0.41	0.65
	6	HSNT-6A	2.46	1.96	0.5	0.5
	6	HSNT-6(1212)	1.2	1.2	0.4	0.4
	6	HSNT-6D (HSNT-6(1618))	1.8	1.6	0.4	0.5
	6	HSNT-6(2025)	2.46	1.96	0.5	0.5
	8	HSNT-8(1616)	1.6	1.6	0.4	0.4
	8	HSNT-8(2030)	3.0	2.0	0.5	0.5
	6	DFN-6(1414)A	1.4	1.4	0.6	0.5
	6	DFN-6(1518)A	1.8	1.5	0.33	0.5
	8	DFN-8(1616)A	1.6	1.6	0.6	0.4
	8	DFN-8(2030)	3.0	2.0	0.5	0.5
	8	DFN-8(2030)A	3.0	2.0	0.6	0.5
	8	DFN-8(2030)B	3.0	2.0	0.8	0.5

Remark Please contact our sales representatives regarding WLP package products.



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