Characteristics

Rev.1.0_00

The S-8471 Series and the S-8474 Series are wireless power ICs.
The S-8471 Series is a receiver control IC (Receiver), and the S-8474 Series is a transmitter control IC (Transmitter).
This application note serves as technical documentation that describes the combined operation and characteristics of the S-8471 Series and S-8474 Series.
Refer to the S-8471 Series and S-8474 Series datasheets for additional details.

Caution 1. Wireless power transfer devices which use the S-8471 Series and S-8474 Series are optimized to operate at LC resonant frequencies of approximately 88kHz to 106kHz. Within the 88kHz to 106kHz LC resonant frequency range, the circuit for detecting the receiver control IC operates, and the transmitter control IC also operates correctly. If the constants of the used coil (L) and capacitor (C) are changed, the LC resonant frequency also will change, so make sure to maintain the LC resonant frequency within the 88kHz to 106kHz range.

2. There is polarity to the receiver coil and transmitter coil in wireless power transfer devices which use the S-8471 Series and S-8474 Series. Combine receiver coils and transmitter coils according to the details in this application note.

3. Characteristics

3. 1 Evaluation measurement circuit

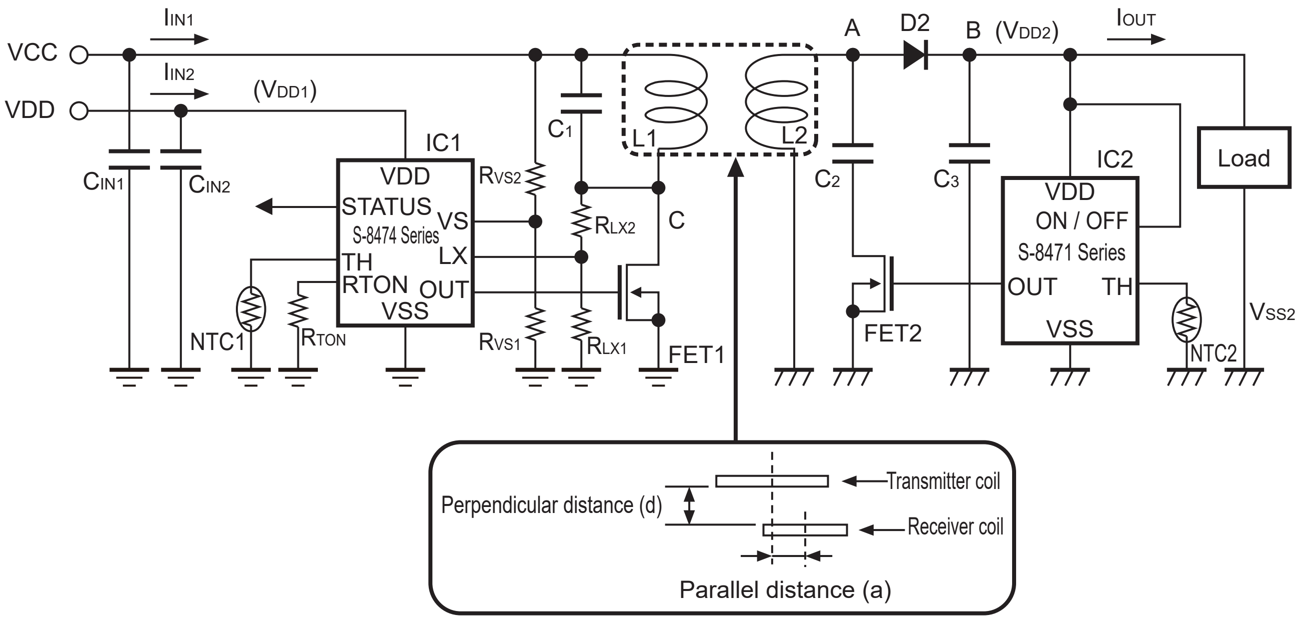


Figure 27 Evaluation Measurement Circuit Diagram

3. 2 External components list

Table 2

Components	Symbol	Components Name	Maker	Remark
Capacitor	C_{IN1}, C_3	GRM31CB31C226ME15L	Murata Manufacturing Co., Ltd.	22μF, 16V
	C_{IN2}	GRM31CB31E106KA75L	Murata Manufacturing Co., Ltd.	10μF, 25V
	C_1	GRM31C2C1H104JA01L	Murata Manufacturing Co., Ltd.	50V, 0.10μF±5%, CH(JIS)
	C_2	GRM188B31H104KA92D	Murata Manufacturing Co., Ltd.	0.1μF, 50V, Ceramic capacitor
Diode	D2	RB551VM-30	ROHM Co., Ltd.	SBD
Inductor	L1	T6-0221-120L	GOTO DENSHI CO., LTD.	21μH, transmitter coil
	L2	R4-0326-117L	GOTO DENSHI CO., LTD.	26μH, receiver coil
Thermistor	NTC1, NTC2	NCP18WF104J03RB	Murata Manufacturing Co., Ltd.	100kΩ, B constant = 4250K
Transistor	FET1	CPH6445	ON Semiconductor	Nch MOSFET, V_{DSS} = 60V, $R_{DS(ON)}$ 0.092Ω @ V_{GS} = 10V
	FET2	MCH3474	ON Semiconductor	Nch MOSFET, V_{DSS} = 30V
Resistor	R_{TON}	MCR03	ROHM Co., Ltd.	1.1MΩ
	R_{VS1}, R_{LX1}	MCR03	ROHM Co., Ltd.	12kΩ
	R_{VS2}, R_{LX2}	MCR03	ROHM Co., Ltd.	82kΩ
IC	IC1	S-8474 Series	ABLIC Inc.	Wireless Power Transmitter Control IC
	IC2	S-8471 Series	ABLIC Inc.	Wireless Power Receiver Control IC

3. 3 Efficiency definition

When power is transferred to the receiver, loss occurs in the transmission circuit and the reception circuit, respectively. Loss is also caused by coil L1 or coil L2. Efficiency, including these losses, is expressed as power conversion efficiency.
Transmission efficiency is calculated with the following expression.

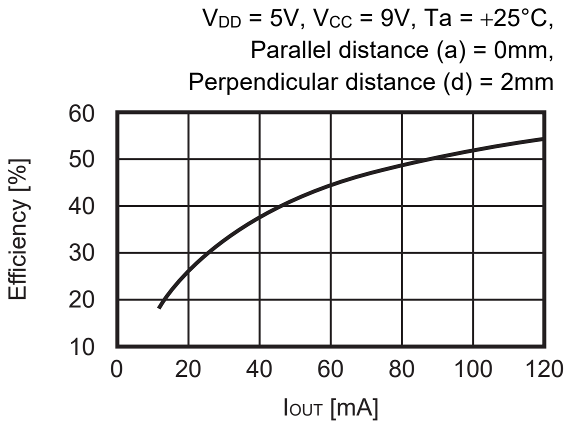
$$\text{Transmission efficiency [\%]} = \frac{V_{DD2} \times I_{OUT}}{(V_{CC} \times I_{IN1} + V_{DD1} \times I_{IN2})} \times 100$$

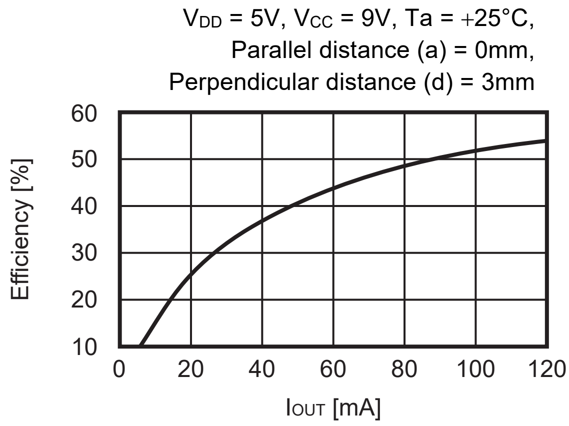
As shown in "**Figure 39 Example of Single Power Supply Input Transmission Circuit with Internal Step-up Circuit**", using a step-up circuit to VCC generation adds loss to the step-up circuit. For this reason, transmission circuit loss increases, and transmission efficiency is reduced.

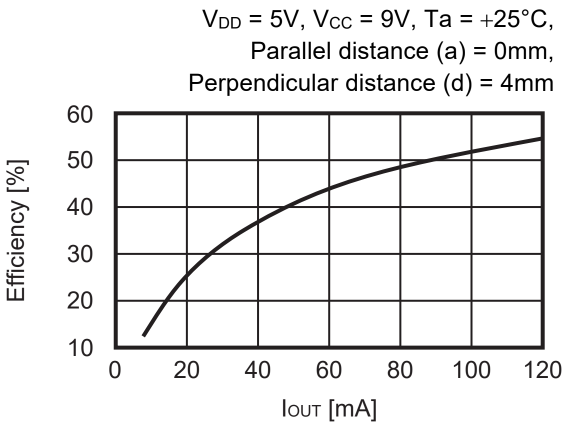
3. 4 Precautions regarding measurement of load characteristics

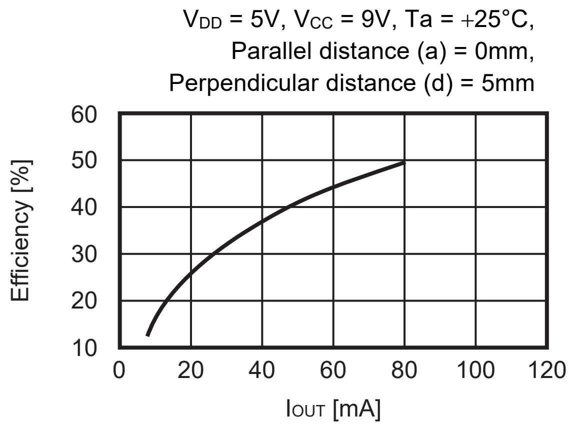
Note that when a constant current electronic load is connected and sufficient power is not transferred, V_{DD2} voltage shown in "**Figure 27 Evaluation Measurement Circuit Diagram**" will fall below V_{SS2}, resulting in possible component damage. Use a resistive load instead of a constant current electronic load.

3. 5 Efficiency per perpendicular distance between coils





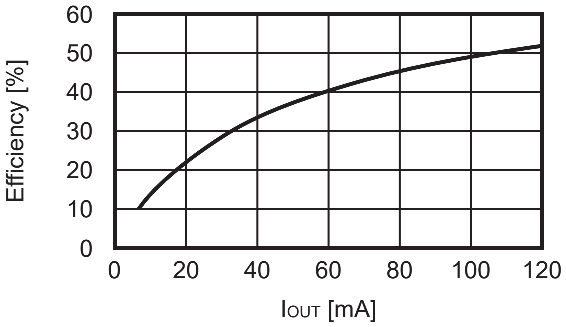




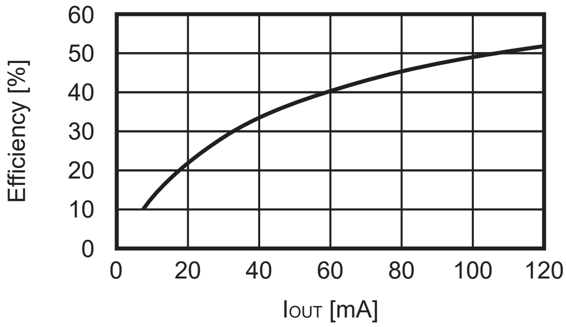
Remark Refer to "**Figure 27 Evaluation Measurement Circuit Diagram**" for perpendicular and parallel distances.

3. 6 Efficiency per parallel distance between coils

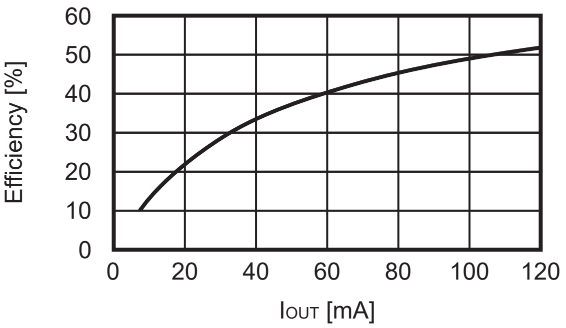
V_{DD} = 5V, V_{CC} = 9V, Ta = +25°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 0mm



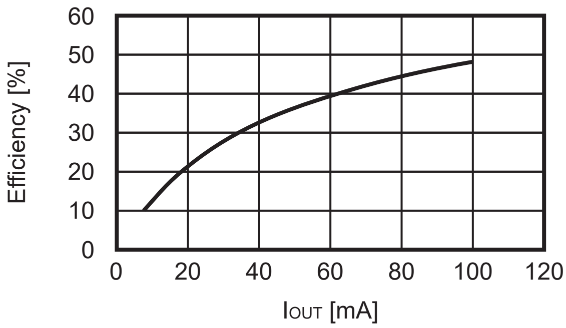
V_{DD} = 5V, V_{CC} = 9V, Ta = +25°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 1mm



V_{DD} = 5V, V_{CC} = 9V, Ta = +25°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 2mm



V_{DD} = 5V, V_{CC} = 9V, Ta = +25°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 3mm

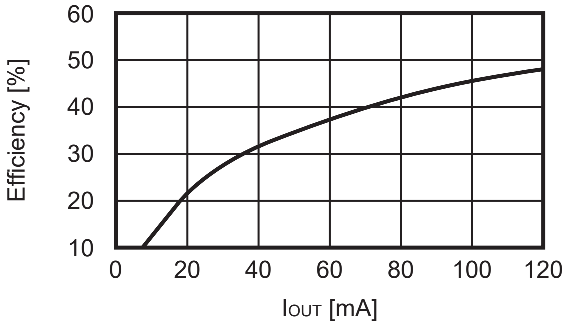


Remark Refer to "**Figure 27 Evaluation Measurement Circuit Diagram**" for perpendicular and parallel distances.

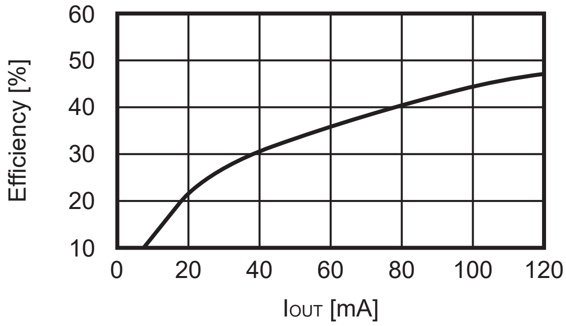
3. 7 Efficiency and output voltage at different temperatures

3. 7. 1 Efficiency at different temperatures

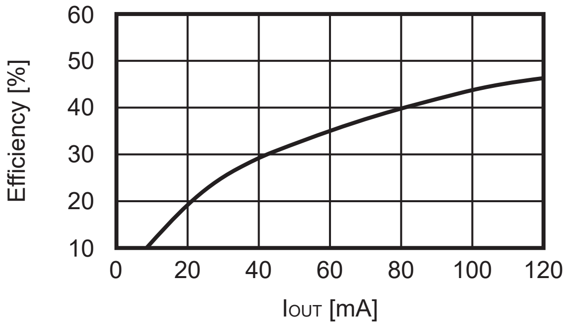
V_{DD} = 5V, V_{CC} = 9V, Ta = +25°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 0mm



V_{DD} = 5V, V_{CC} = 9V, Ta = −40°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 0mm

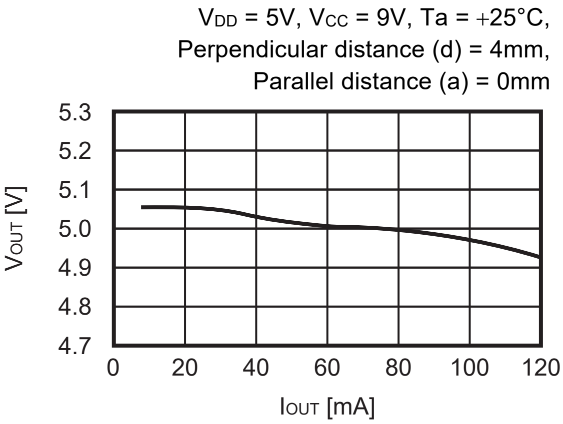


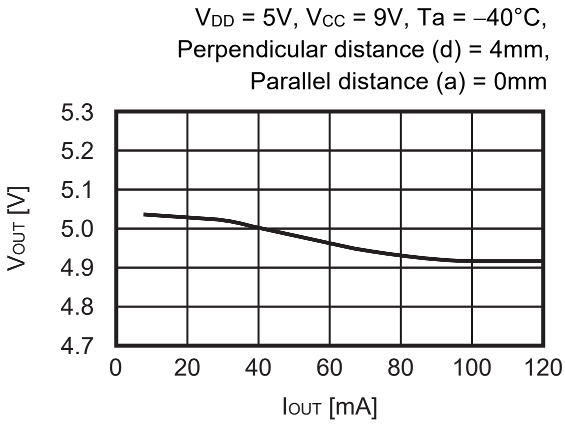
V_{DD} = 5V, V_{CC} = 9V, Ta = +85°C,
Perpendicular distance (d) = 4mm,
Parallel distance (a) = 0mm

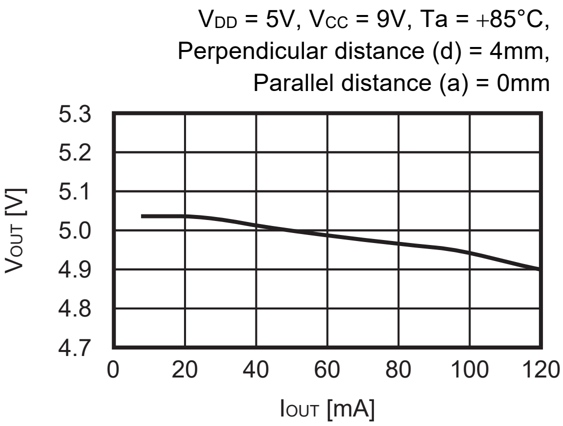


Remark Refer to "**Figure 27 Evaluation Measurement Circuit Diagram**" for perpendicular and parallel distances.

3. 7. 2 Output voltage at different temperatures







Remark Refer to "**Figure 27 Evaluation Measurement Circuit Diagram**" for perpendicular and parallel distances.

6. Board Design Considerations

- When wiring a board, make a single GND as described in the S-8471 Series and the S-8474 Series datasheets.
- To protect from overheat, be sure to connect an NTC thermistor to the TH pin for its use.
- For VCC in **Figure 49**, do not use a power supply which might cause frequency component amplitude of 1kHz to 110kHz (LC resonant frequency). It may result in a malfunction.
- For VDD in **Figure 49,** do not use a power supply which might cause frequency component amplitude to prevent from malfunction.
- When designing the board in **Figure 49**, for the following reasons, do not place a wiring near the RTON pin, the VS pin, and the TH pin. Layout so that resistor R_{TON} is as close to the RTON pin as possible.
  (1) Due to coil L1 and resonant capacitor (C_1), large voltage fluctuation is generated at point C.
  (2) Since impedance in the RTON pin, the VS pin, and the TH pin is high, they are easily affected by an extraneous signal.
  By connecting C_{RTON} (approximately 100pF to 1000pF) between the RTON pin and GND, C_{VS} (approximately 100pF to 1000pF) between the VS pin and GND and C_{NTC} (approximately 100pF to 1000pF) between the TH pin and GND, the influence of extraneous signal can be reduced.
  When detecting the coil temperature using an NTC thermistor in particular, the detection temperature may shift to the high temperature side as a result of the effect of the coil signal. It is recommended that C_{NTC} be connected between the TH pin and GND.

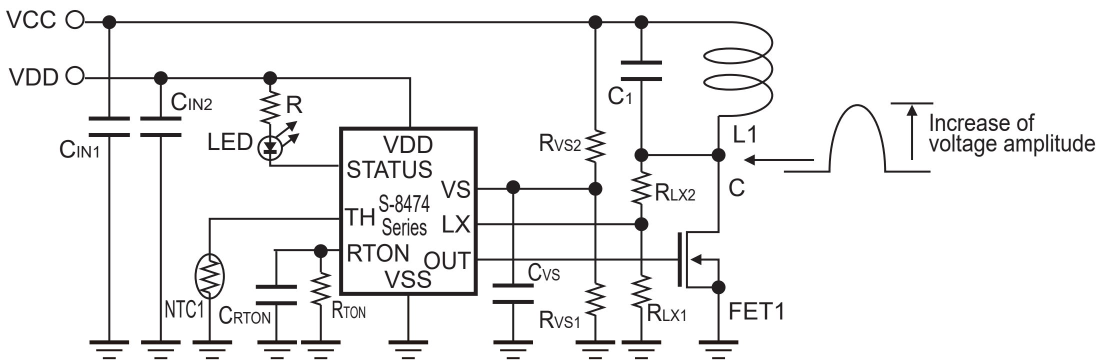


Figure 49

7. Precautions

- The usages described in this application note are typical examples using ABLIC Inc. ICs. Perform thorough evaluation before use.
- When designing for mass production using an application circuit described herein, the product deviation and temperature characteristics of the external components should be taken into consideration. ABLIC Inc. bears no responsibility for any patent infringements related to products using the circuits described herein.
- ABLIC Inc. claims no responsibility for any and all disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

8. Related Sources

Refer to the following datasheets for details of the S-8471 Series and the S-8474 Series.

S-8471 Series Datasheet
S-8474 Series Datasheet

The information described herein is subject to change without notice.
Please contact our sales representatives for information regarding the latest product version / revision.