Measures to Prevent Battery Consumption during Storage

Rev.1.0_00

The S-8473 Series and the S-8474 Series are wireless power ICs.
The S-8473 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-8473 Series and S-8474 Series.
Refer to the S-8473 Series and S-8474 Series datasheets for additional details.

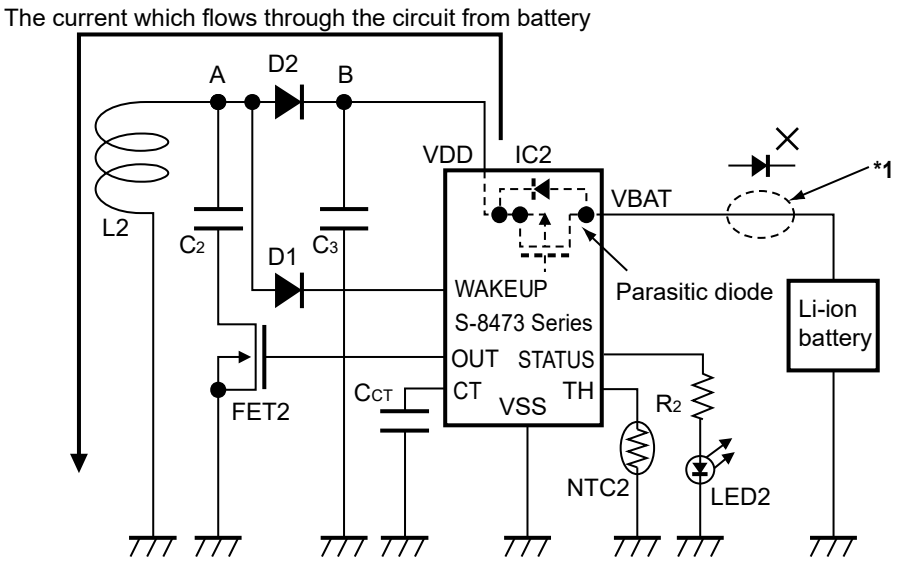
Caution 1. Wireless power transfer devices which use the S-8473 Series and S-8474 Series are optimized to operate at LC resonant frequencies of approximately 88kHz to 106kHz. Within the 88kHz to 106kHz LC resonant frequency range, the circuit for detecting the receiver control IC operates, and the transmitter 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-8473 Series and S-8474 Series. Combine receiver coils and transmitter coils according to the details in this application note.

6. Measures to Prevent Battery Consumption during Storage

6. 1 When a battery is connected

The S-8473 Series has a built-in Pch FET between the VDD pin and VBAT pin. Since a parasitic diode is on the Pch FET, battery voltage connected to the VBAT pin is applied to VDD. This V_{DD} then flows to GND through the receiver coil via the diode D2 leakage current. The current consumption is 1.0μA typ. when the S-8473 Series stops operation; however, the diode D2 leakage current may cause small capacity batteries to be drained. In order to reduce battery consumption during storage, select a diode with low leakage current.



***1.** If a diode is connected for the purpose of reducing reverse current, battery voltage cannot be monitored correctly, and it will affect charge control. For this reason, do not connect a diode here.

Figure 37 Leakage Current Route of Diode D2

6. 2 When using a lithium-ion rechargeable battery protection IC

Figure 38 shows a circuit example using S-8230BAB-I6T1U for storage.
S-8230BAB-I6T1U controls FET4 and FET5 to intercept the discharge from the battery by applying voltage to the CTL pin. Connect the test pin, TP1, provided on the board to the S-8473 Series VSS in the last step of shipping inspection, and then open TP1 again so that S-8230BAB-I6T1U maintains discharge inhibition status. This can reduce battery consumption even in long-term storage by preventing battery current from flowing to the customer circuit and S-8473 Series circuit. Since there is no need to consider D2 diode leakage current in this method, it allows for a wider range of options.
When the S-8473 Series outputs charge voltage from the VBAT pin, S-8230BAB-I6T1U detects the voltage and releases discharge inhibition status.

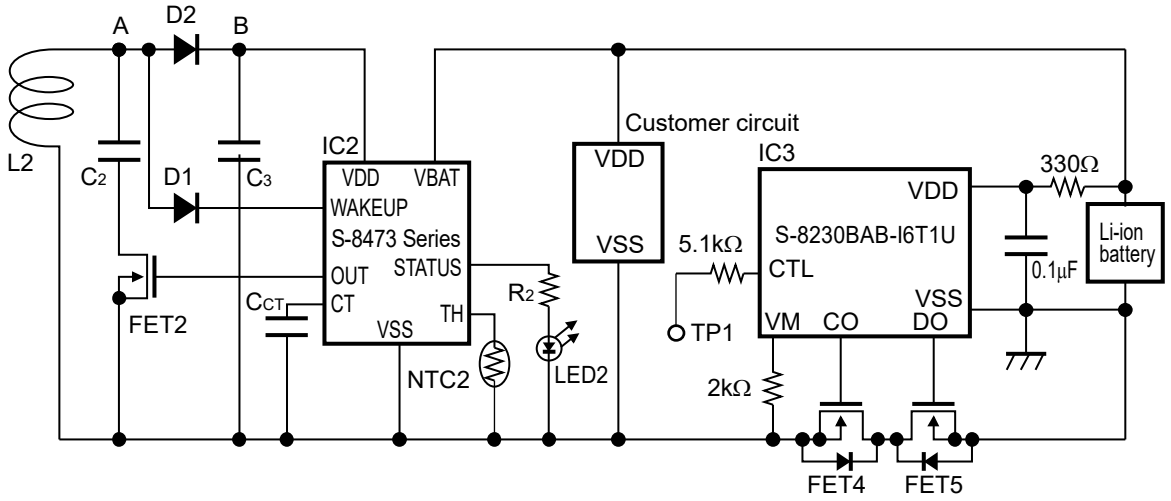


Figure 38 Circuit Example Using S-8230BAB-I6T1U

Figure 39 shows a circuit example of storage using the S-8240A Series.
Connect the test pin, TP1, provided on the board to the S-8240A Series VSS in the last step of shipping inspection, and then open TP1 again so that the S-8240A Series enters power-down mode, reduces current consumption to 50nA or less, and maintains the discharge inhibition status. This can reduce battery consumption even in long-term storage by preventing battery current from flowing to the customer circuit and S-8240A Series circuit.
When the S-8473 Series outputs charge voltage from the VBAT pin, the S-8240A Series detects the voltage and releases power-down mode and discharge inhibition status.

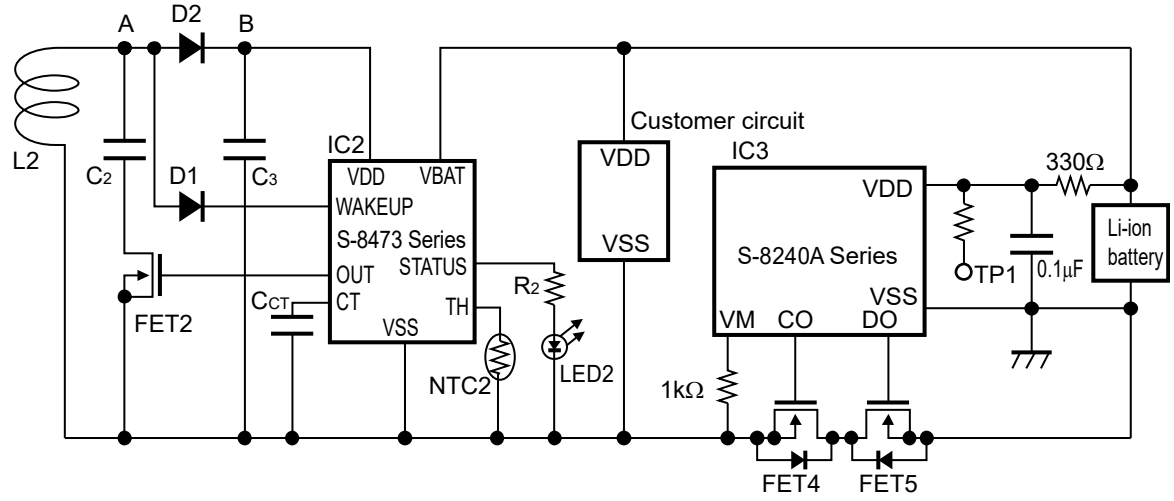


Figure 39 Circuit Example Using S-8240A Series

Remark The customer circuit is the load in the above example.

6. 3 When providing a power supply switch

Figure 40 shows a circuit example when a power supply switch (SW) is provided separate from the customer circuit.
Using a low current consumption CMOS gate to press the SW allows for power supply ON and OFF control with toggle operation, and reduces the battery consumption.
D type flip-flop (TC7W74FU) is used to maintain power supply ON and OFF status, and a Schmitt trigger (TC7S14FU) is used to eliminate SW chatter.

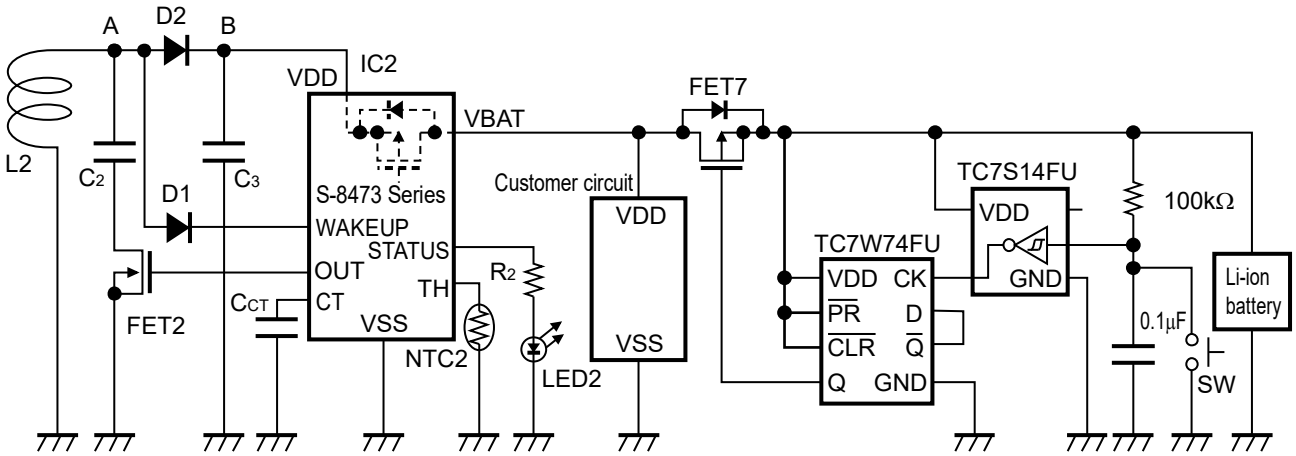


Figure 40 External Power Supply Switch Usage Example 1

Figure 41 shows a circuit example for power supply interception using a customer circuit signal.
When the customer circuit outputs "H" level, the power supply interception signal reverses the output of RS type flip-flop (TC7W02FU), FET7 is turned OFF, and the battery and the customer circuit are intercepted. This allows for a reduction in battery consumption. FET7 is turned ON by pressing the SW.

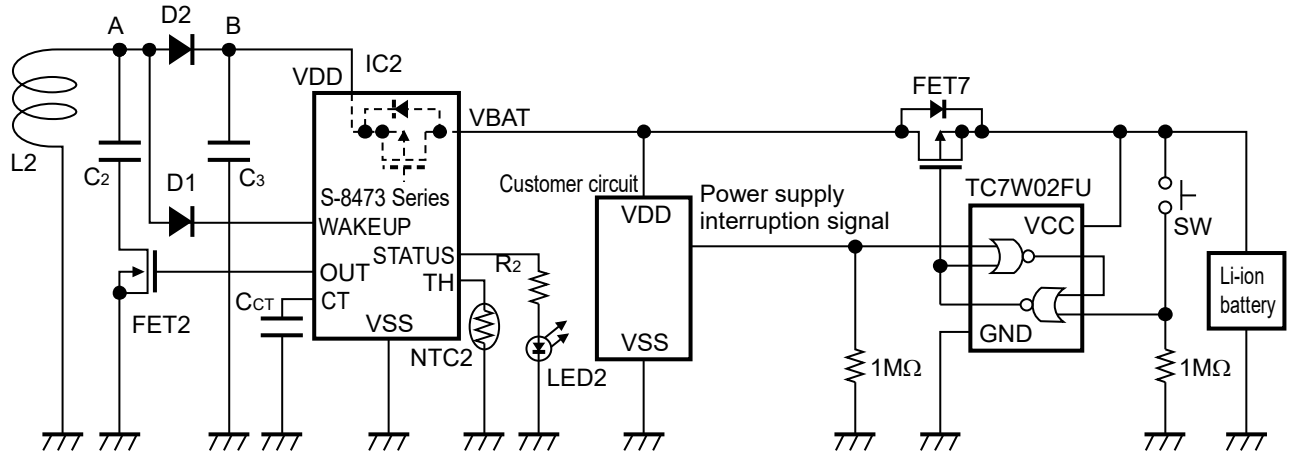


Figure 41 External Power Supply Switch Usage Example 2

Remark The customer circuit is the load in the above example.

9. Board Design Considerations

- When wiring a board, make a single GND as described in the S-8473 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 47**, 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 47,** do not use a power supply which might cause frequency component amplitude to prevent from malfunction.
- When designing the board in **Figure 47**, 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.

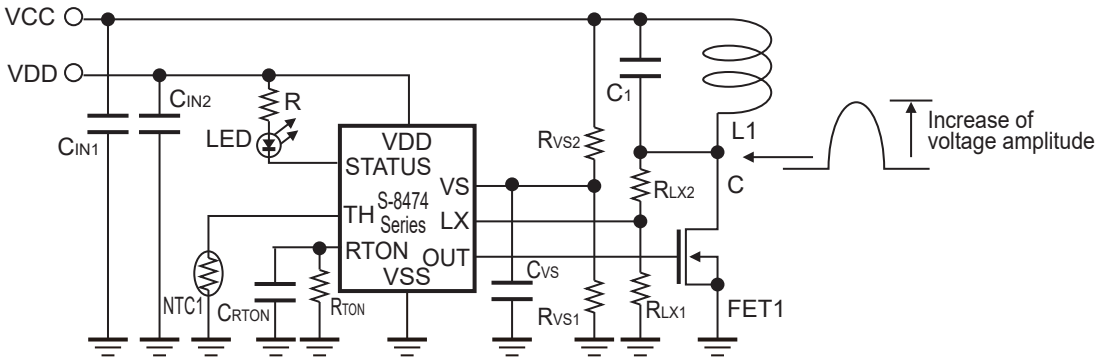


Figure 47

10. 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.

11. Related Sources

Refer to the following datasheets for details of the S-8473 Series and the S-8474 Series.

S-8473 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.