

# 1 Channel Compact High Side Switch ICs

# 0.75A Current Limit High Side Switch ICs

**BD2246G BD2247G**

## General Description

BD2246G and BD2247G are low on-resistance N-channel MOSFET high-side power switches, optimized for Universal Serial Bus (USB) applications. BD2246G and BD2247G are equipped with the function of over-current detection, thermal shutdown, under-voltage lockout and soft-start.

## Key Specifications

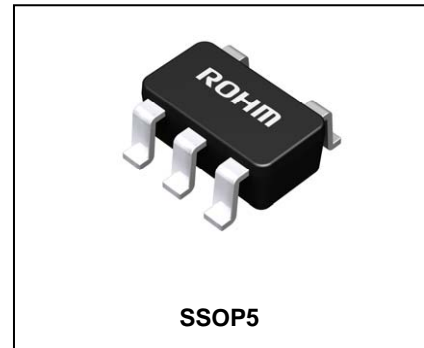
■ Input voltage range:	2.7V to 5.5V
■ ON resistance : (VIN=5V)	110mΩ(Typ.)
■ Over current threshold:	0.63A min., 0.9A max.
■ Standby current:	0.01μA (Typ.)
■ Operating temperature range:	-40°C to +85°C

## Features

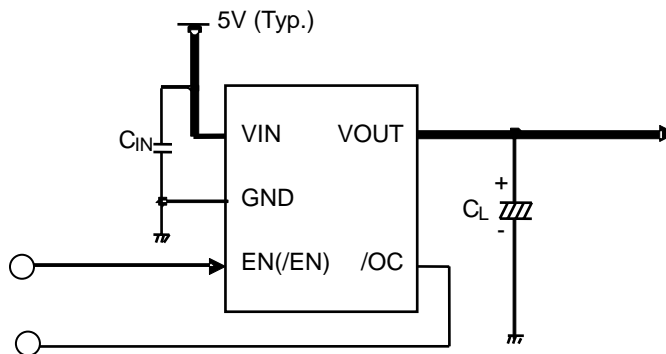
- Low On-Resistance (Typ. 110mΩ) N-channel MOSFET Built-in
- Reverse Current Protection when Power Switch Off
- Output Discharge Function
- Over-Current Detection
- Thermal Shutdown
- Open-Drain Fault Flag Output
- Under-Voltage Lockout
- Soft-Start Circuit
- Control Input Logic
  - Active-High : BD2246G
  - Active-Low : BD2247G

## Package

SSOP5

 W(Typ.) D(Typ.) H (Max.)  
 2.90mm x 2.80mm x 1.25mm


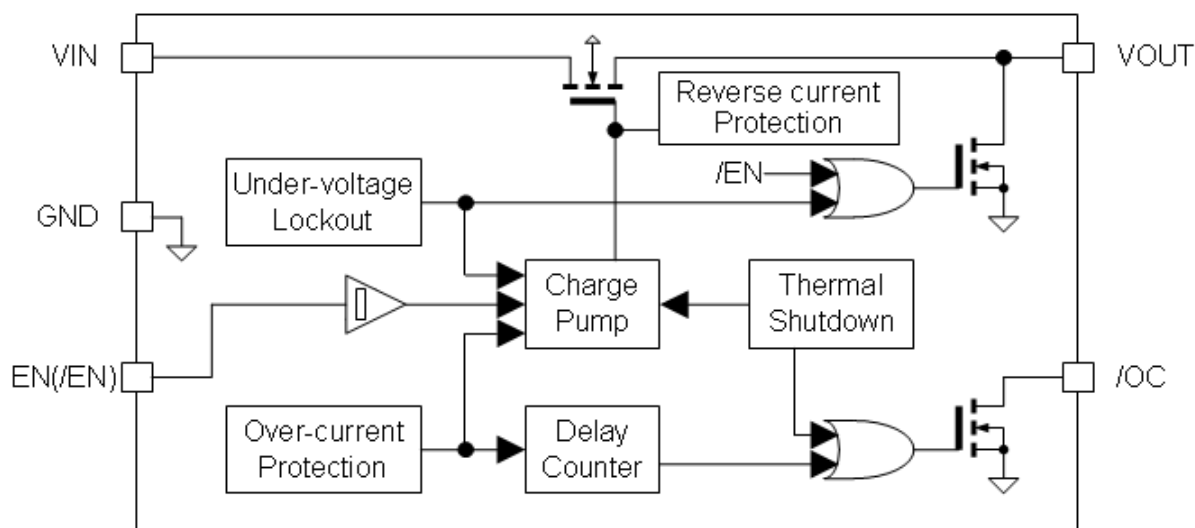
## Typical Application Circuit



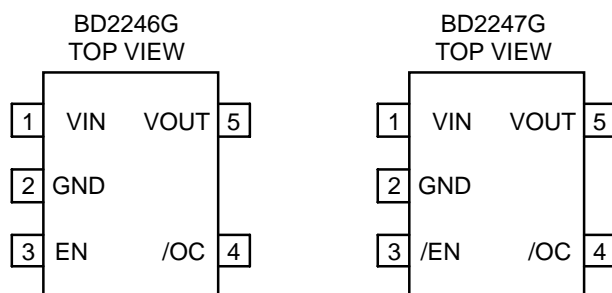
## Lineup

Over current detection(@VIN=5V)			Control input logic	Package		Orderable Part Number
Min.	Typ.	Max.				
0.63A	0.765A	0.9A	High	SSOP5	Reel of 3000	BD2246G – TR
0.63A	0.765A	0.9A	Low	SSOP5	Reel of 3000	BD2247G – TR

### ●Block Diagram



## ●Pin Configurations



### ●Pin Descriptions

## BD2246G

Pin No.	Symbol	I/O	Function
1	VIN	-	Switch input and the supply voltage for the IC.
2	GND	-	Ground.
3	EN	I	Enable input. High level input turns on the switch.
4	/OC	O	Over-current notification terminal. Low level output during over-current or over-temperature condition. Open-drain fault flag output.
5	VOUT	O	Switch output.

## BD2247G

Pin No.	Symbol	I/O	Function
1	VIN	-	Switch input and the supply voltage for the IC.
2	GND	-	Ground.
3	/EN	I	Enable input. Low level input turns on the switch.
4	/OC	O	Over-current notification terminal. Low level output during over-current or over-temperature condition. Open-drain fault flag output.
5	VOUT	O	Switch output.

# ●Absolute Maximum Ratings(Ta=25°C)

Parameter	Symbol	Ratings	Unit
VIN supply voltage	VIN	-0.3 to 6.0	V
EN(/EN) input voltage	VEN(/EN)	-0.3 to 6.0	V
/OC voltage	V/OC	-0.3 to 6.0	V
/OC sink current	I/OC	5	mA
VOUT voltage	VOUT	-0.3 to 6.0	V
Storage temperature	TSTG	-55 to 150	°C
Power dissipation	Pd	675 <sup>*1</sup>	mW

\*1 Mounted on 70mm x 70mm x 1.6mm glass epoxy board. Reduce 5.4mW per 1°C above 25°C

# ●Recommended Operating Ratings

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
VIN operating voltage	VIN	2.7	5.0	5.5	V
Operating temperature	TOPR	-40	-	85	°C

# ●Electrical Characteristics (VIN= 5V, Ta= 25°C, unless otherwise specified.)

BD2246G

## DC Characteristics

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Operating current	IDD	-	110	160	μA	VEN = 5V, VOUT = open, VIN = 5V
		-	75	110		VEN = 3.3V, VOUT = open, VIN = 3.3V
Standby current	ISTB	-	0.01	5	μA	VEN = 0V, VOUT = open, VIN = 5V
EN input voltage	VENH	2.0	-	-	V	High input, VIN = 3.3V to 5V
	VENL	-	-	0.8	V	Low input, VIN = 5V
		-	-	0.6		Low input, VIN = 3.3V
EN input leakage	IEN	-1	0.01	1	μA	VEN = 0V or 5V
On-resistance	RON	-	110	155	mΩ	IOUT = 500mA, VIN = 5V
		-	130	180		IOUT = 500mA, VIN = 3.3V
Reverse leak current	IREV	-	-	1	μA	VOUT = 5V, VIN = 0V
Over-current threshold	ITH	630	765	900	mA	VIN = 5V
		600	740	890		VIN = 3.3V
Short circuit output current	Isc	350	500	650	mA	VOUT = 0V,RMS, VIN = 3.3V to 5V
Output discharge resistance	RDISC	30	60	120	Ω	IDISC = 1mA, VIN = 5V
		50	100	200		IDISC = 1mA, VIN = 3.3V
/OC output low voltage	V/OC	-	-	0.4	V	I/OC = 0.5mA, VIN = 3.3V to 5V
UVLO threshold	VTUVH	2.1	2.3	2.5	V	VIN increasing
	VTUVL	2.0	2.2	2.4	V	VIN decreasing

## AC Characteristics

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Output rise time	TON1	-	1	6	ms	RL = 20Ω, VIN = 3.3V to 5V
Output turn-on time	TON2	-	1.5	10	ms	RL = 20Ω, VIN = 3.3V to 5V
Output fall time	TOFF1	-	1	20	μs	RL = 20Ω, VIN = 3.3V to 5V
Output turn-off time	TOFF2	-	3	40	μs	RL = 20Ω, VIN = 3.3V to 5V
/OC delay time	T/OC	10	15	20	ms	VIN = 5V
		11	16	21		VIN = 3.3V

## ●Electrical Characteristics - continued

BD2247G

DC Characteristics

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Operating current	I <sub>DD</sub>	-	110	160	μA	V <sub>EN</sub> = 0V, V <sub>OUT</sub> = open, V <sub>IN</sub> = 5V
		-	75	110		V <sub>EN</sub> = 0V, V <sub>OUT</sub> = open, V <sub>IN</sub> = 3.3V
Standby current	I <sub>STB</sub>	-	0.01	5	μA	V <sub>EN</sub> = 5V, V <sub>OUT</sub> = open, V <sub>IN</sub> = 5V
/EN input voltage	V <sub>ENH</sub>	2.0	-	-	V	High input, V <sub>IN</sub> = 3.3V to 5V
	V <sub>ENL</sub>	-	-	0.8	V	Low input, V <sub>IN</sub> = 5V
		-	-	0.6		Low input, V <sub>IN</sub> = 3.3V
/EN input leakage	I <sub>EN</sub>	-1	0.01	1	μA	V <sub>EN</sub> = 0V or 5V
On-resistance	R <sub>ON</sub>	-	110	155	mΩ	I <sub>OUT</sub> = 500mA, V <sub>IN</sub> = 5V
		-	130	180		I <sub>OUT</sub> = 500mA, V <sub>IN</sub> = 3.3V
Reverse leak current	I <sub>REV</sub>	-	-	1	μA	V <sub>OUT</sub> = 5V, V <sub>IN</sub> = 0V
Over-current threshold	I <sub>TH</sub>	630	765	900	mA	V <sub>IN</sub> = 5V
		600	740	890		V <sub>IN</sub> = 3.3V
Short circuit output current	I <sub>SC</sub>	350	500	650	mA	V <sub>OUT</sub> = 0V, RMS, V <sub>IN</sub> = 3.3V to 5V
Output discharge resistance	R <sub>DISC</sub>	30	60	120	Ω	I <sub>DISC</sub> = 1mA, V <sub>IN</sub> = 5V
		50	100	200		I <sub>DISC</sub> = 1mA, V <sub>IN</sub> = 3.3V
/OC output low voltage	V <sub>OC</sub>	-	-	0.4	V	I <sub>OC</sub> = 0.5mA, V <sub>IN</sub> = 3.3V to 5V
UVLO threshold	V <sub>TUVH</sub>	2.1	2.3	2.5	V	V <sub>IN</sub> increasing
	V <sub>TUVL</sub>	2.0	2.2	2.4	V	V <sub>IN</sub> decreasing

AC Characteristics

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Output rise time	T <sub>ON1</sub>	-	1	6	ms	R <sub>L</sub> = 20Ω, V <sub>IN</sub> = 3.3V to 5V
Output turn-on time	T <sub>ON2</sub>	-	1.5	10	ms	R <sub>L</sub> = 20Ω, V <sub>IN</sub> = 3.3V to 5V
Output fall time	T <sub>OFF1</sub>	-	1	20	μs	R <sub>L</sub> = 20Ω, V <sub>IN</sub> = 3.3V to 5V
Output turn-off time	T <sub>OFF2</sub>	-	3	40	μs	R <sub>L</sub> = 20Ω, V <sub>IN</sub> = 3.3V to 5V
/OC delay time	T <sub>OC</sub>	10	15	20	ms	V <sub>IN</sub> = 5V
		11	16	21		V <sub>IN</sub> = 3.3V

●Measurement Circuit

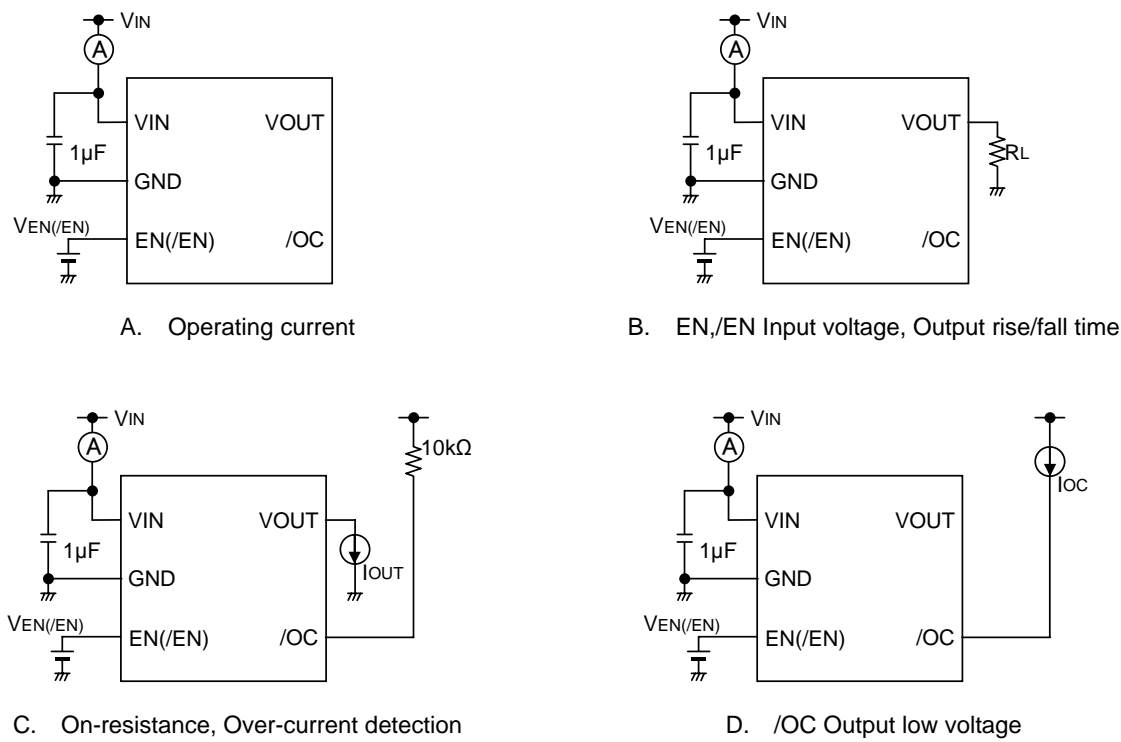
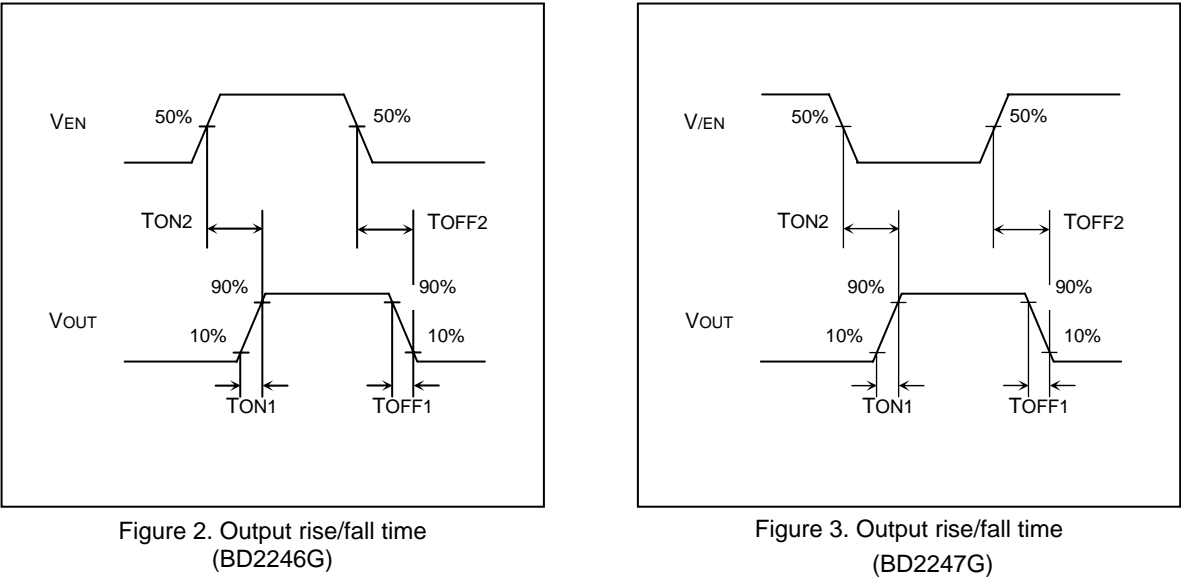


Figure 1. Measurement circuit

●Timing Diagram



●Typical Performance Curves

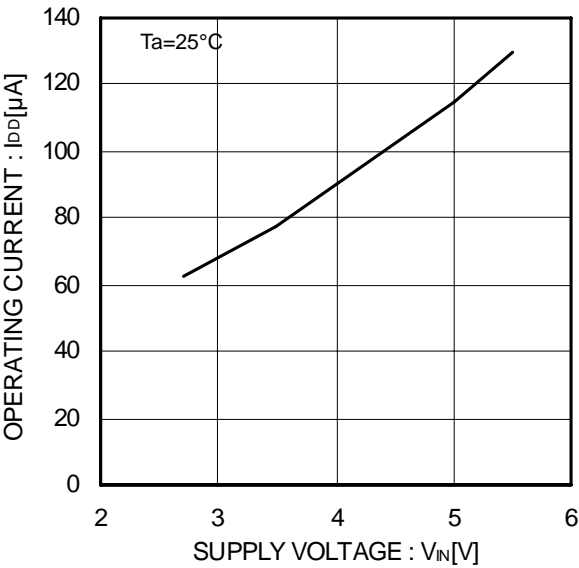


Figure 4. Operating current  
EN,/EN enable

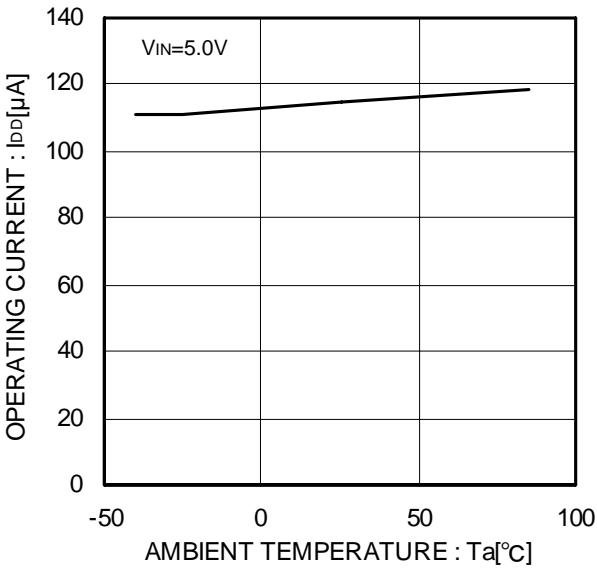


Figure 5. Operating current  
EN,/EN enable

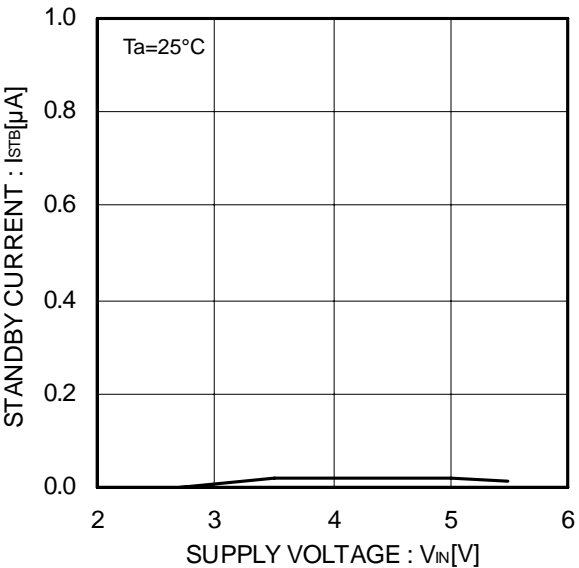


Figure 6. Standby current  
EN,/EN disable

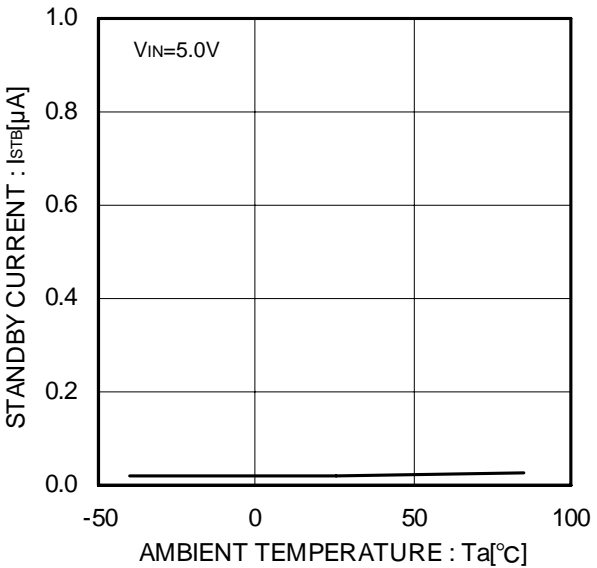


Figure 7. Standby current  
EN,/EN disable

●Typical Performance Curves - continued

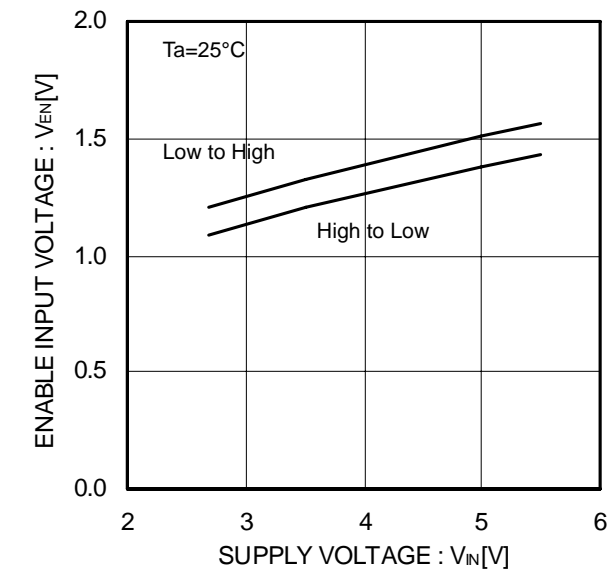


Figure 8. EN, /EN input voltage

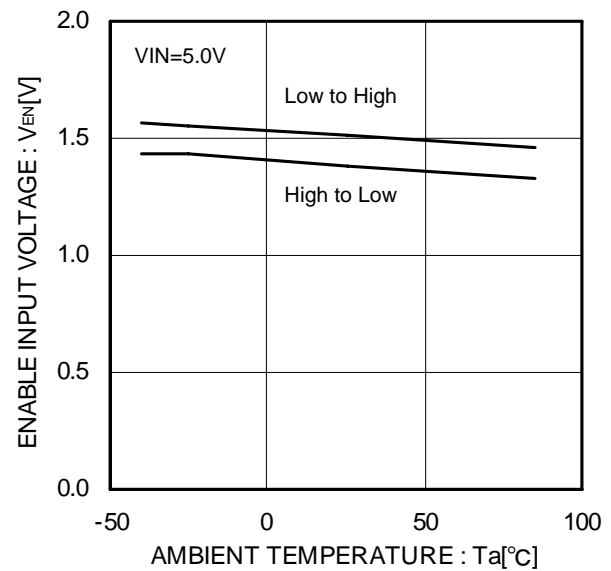


Figure 9. EN, /EN input voltage

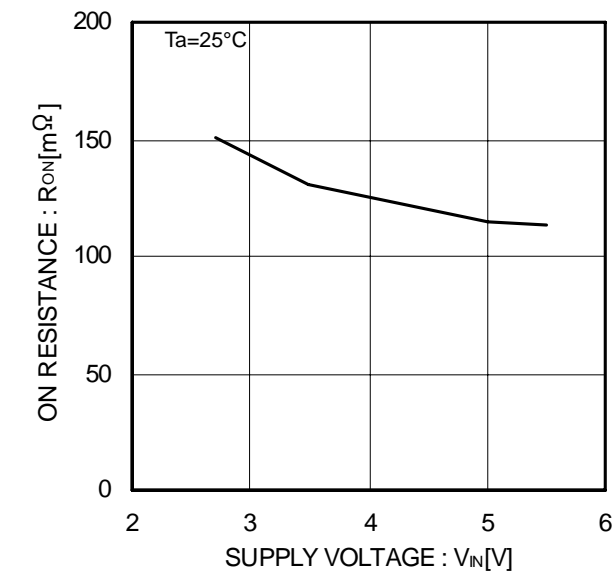


Figure 10. On-resistance

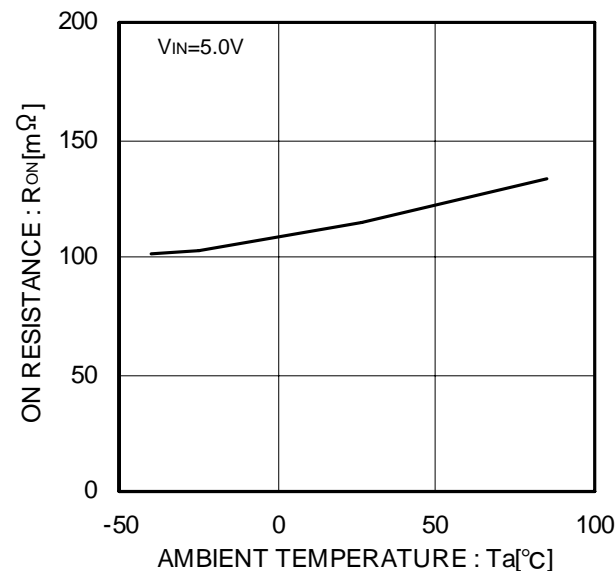


Figure 11. On-resistance

## ● Typical Performance Curves - continued

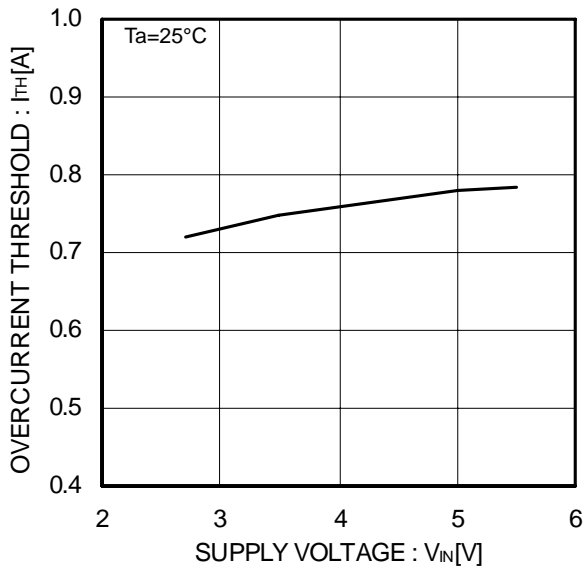


Figure 12. Over-current threshold

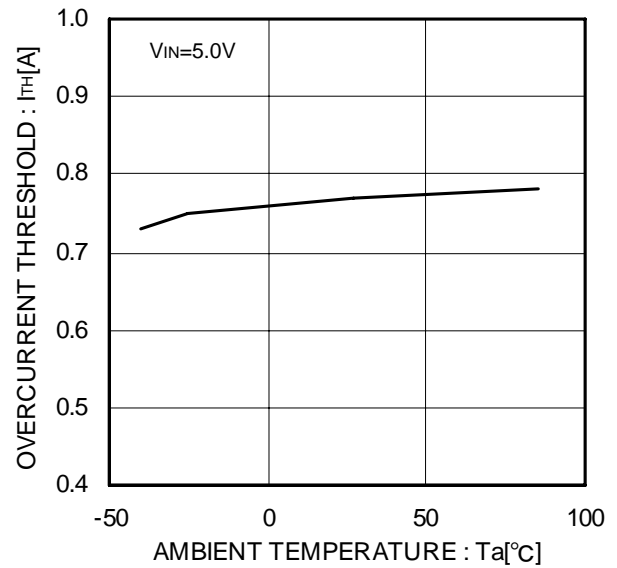


Figure 13. Over-current threshold

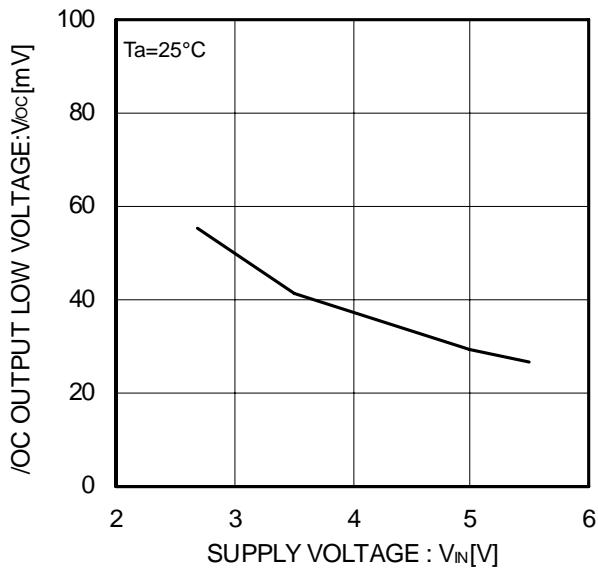


Figure 14. /OC output low voltage

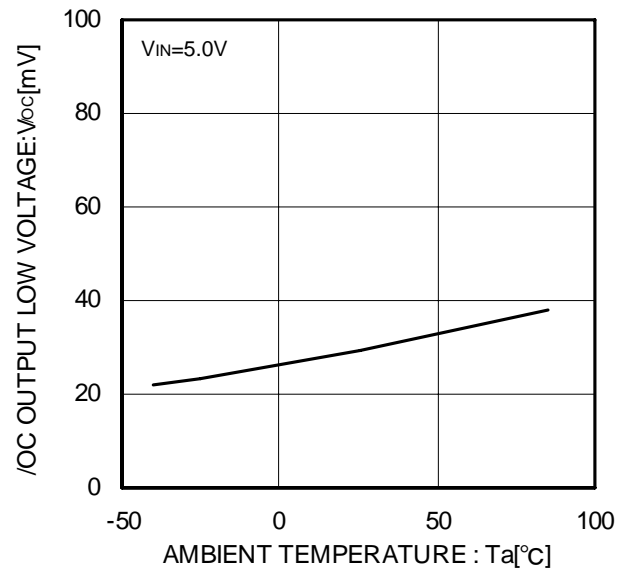


Figure 15. /OC output low voltage

●Typical Performance Curves - continued

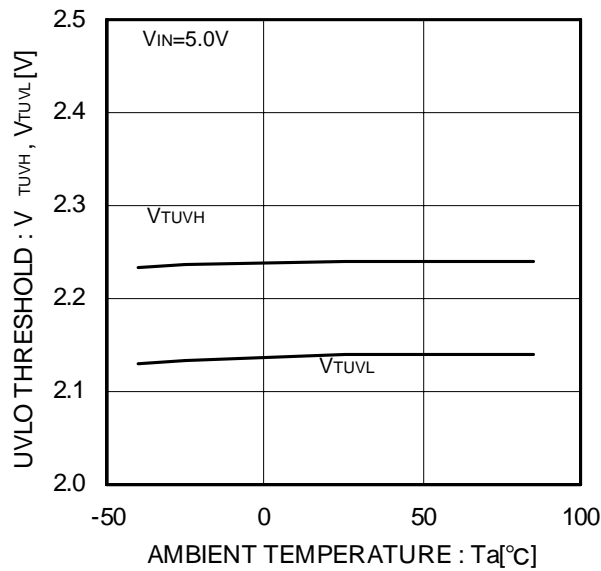


Figure 16. UVLO threshold

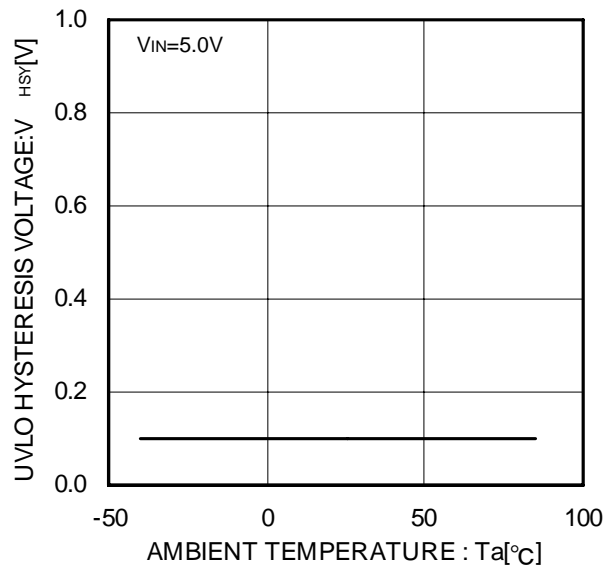


Figure 17. UVLO hysteresis voltage

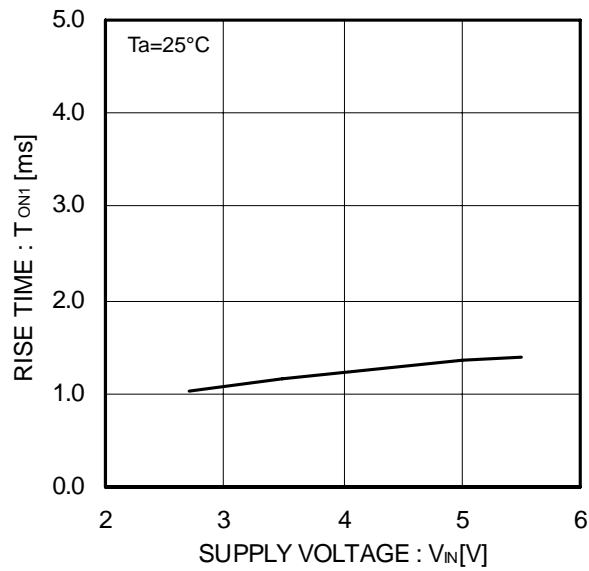


Figure 18. Output rise time

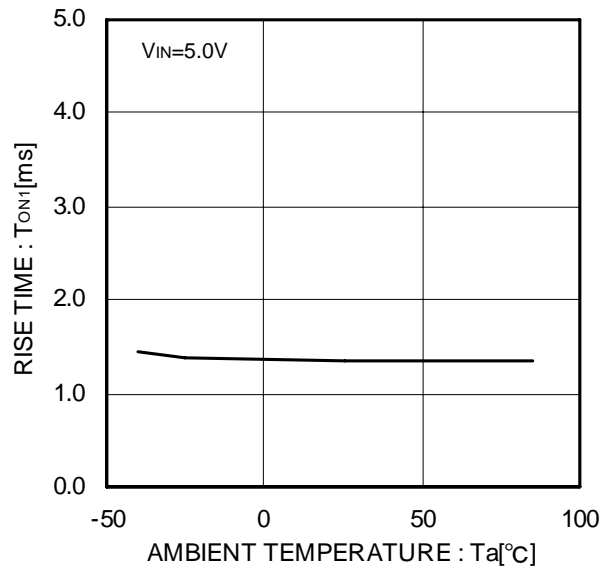


Figure 19. Output rise time

●Typical Performance Curves - continued

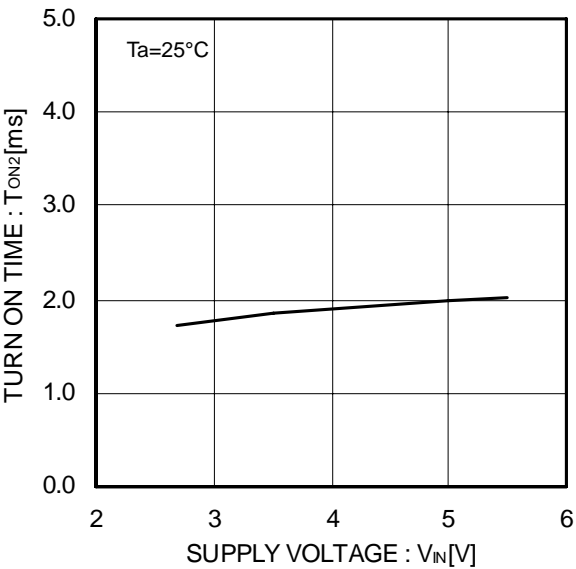


Figure 20. Output turn-on time

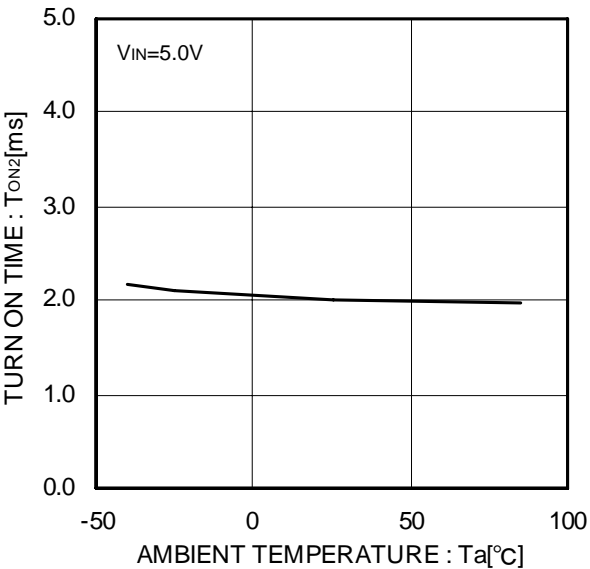


Figure 21. Output turn-on time

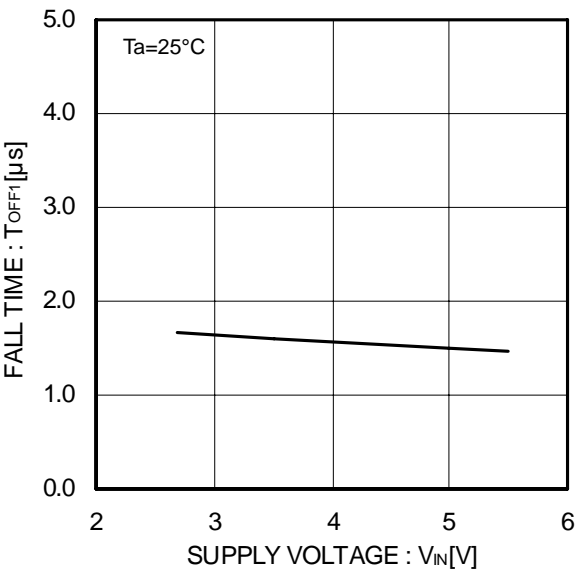


Figure 22. Output fall time

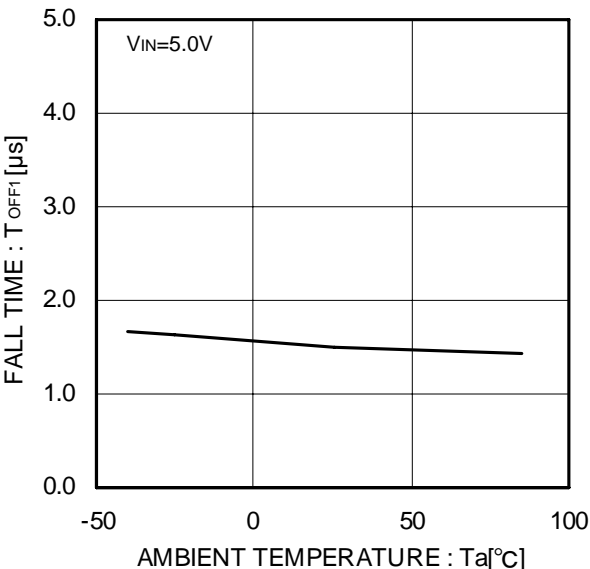


Figure 23. Output fall time

●Typical Performance Curves - continued

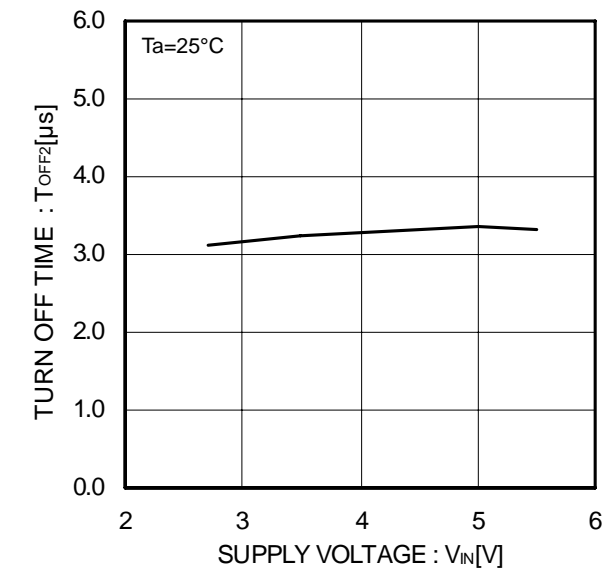


Figure 24. Output turn-off time

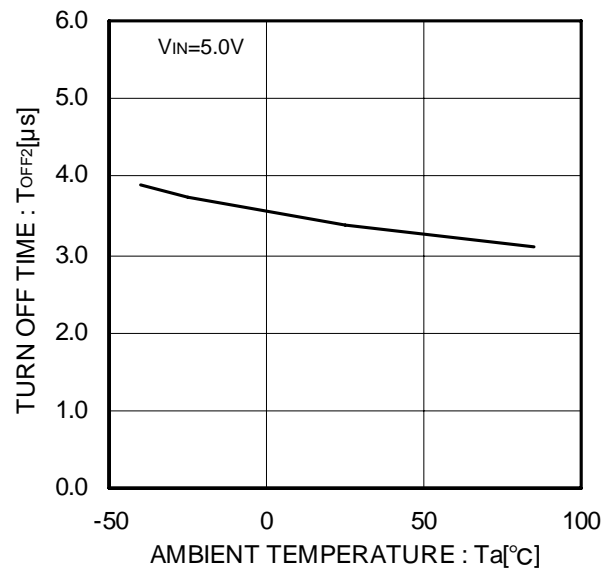


Figure 25. Output turn-off time

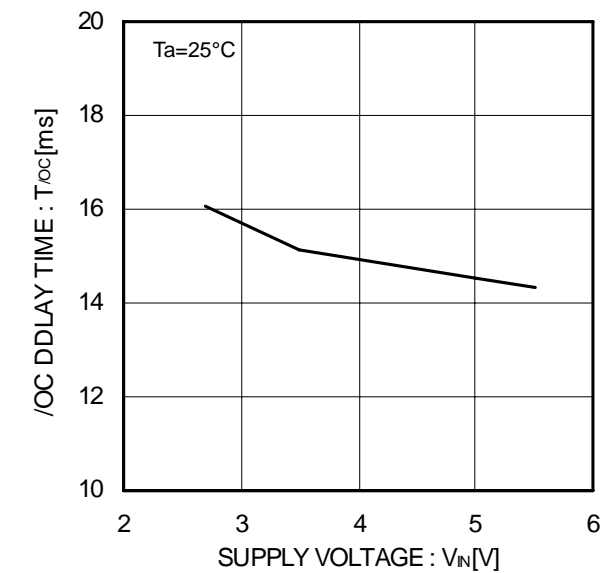


Figure 26. /OC delay time

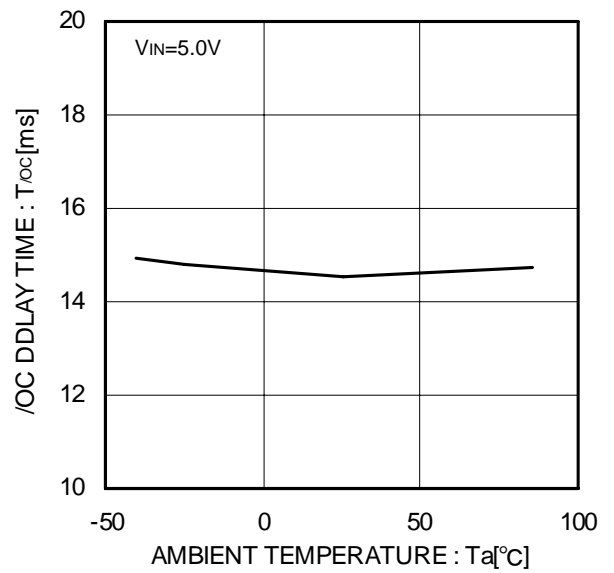


Figure 27. /OC delay time

●Typical Performance Curves - continued

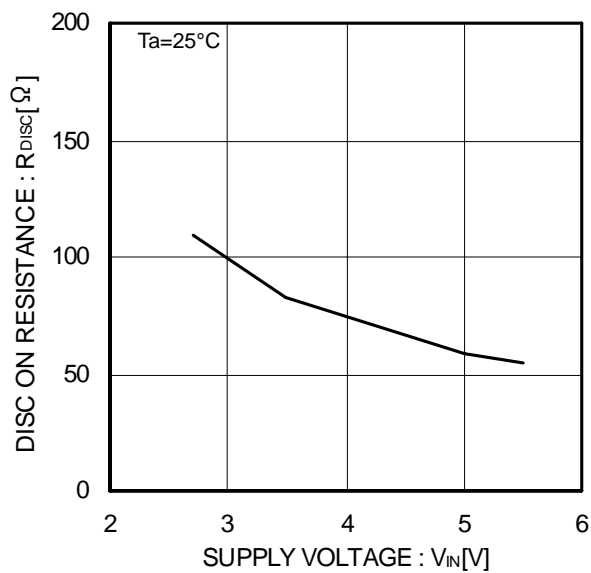


Figure 28. Discharge on resistance

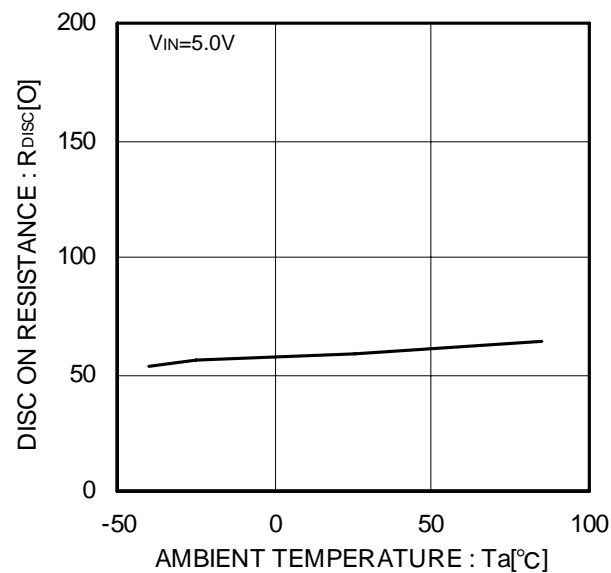


Figure 29. Discharge on resistance

# ●Typical Wave Forms (BD2246G)

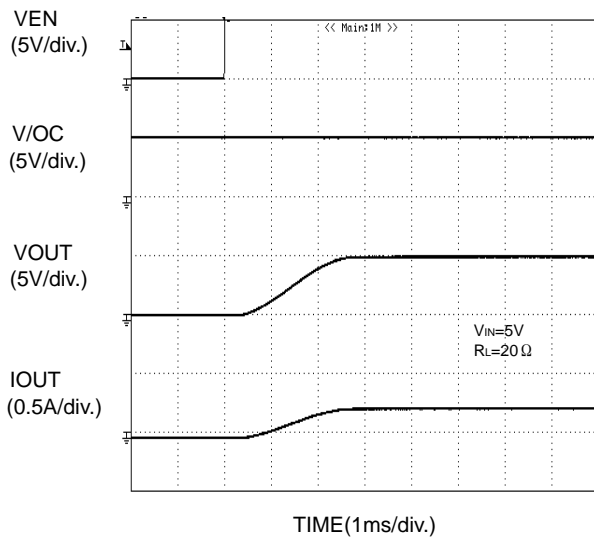


Figure 30. Output rise characteristic

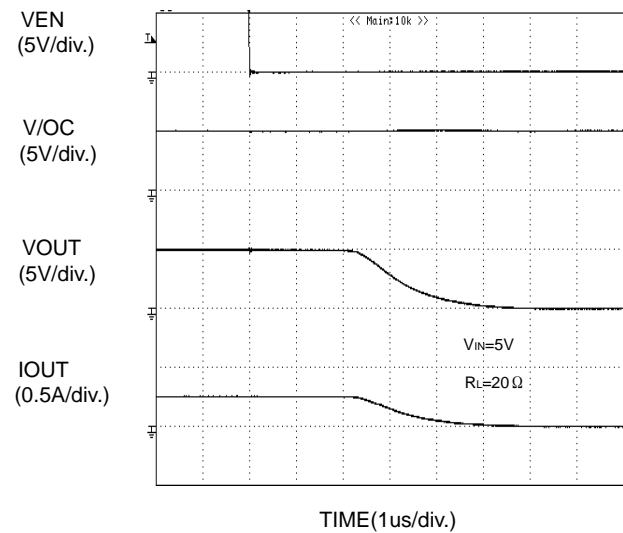


Figure 31. Output fall characteristic

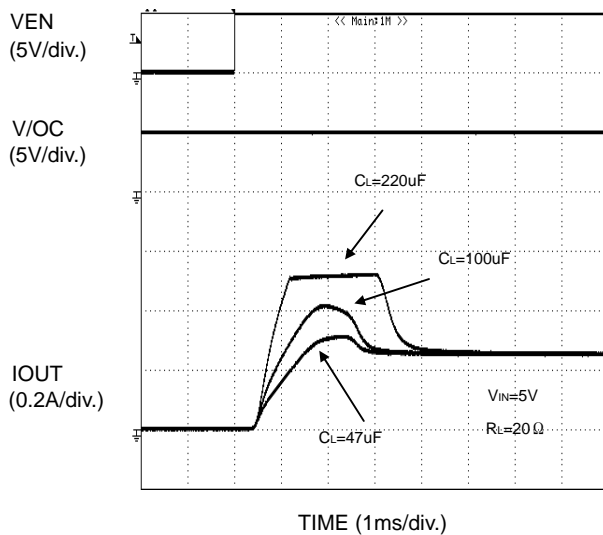
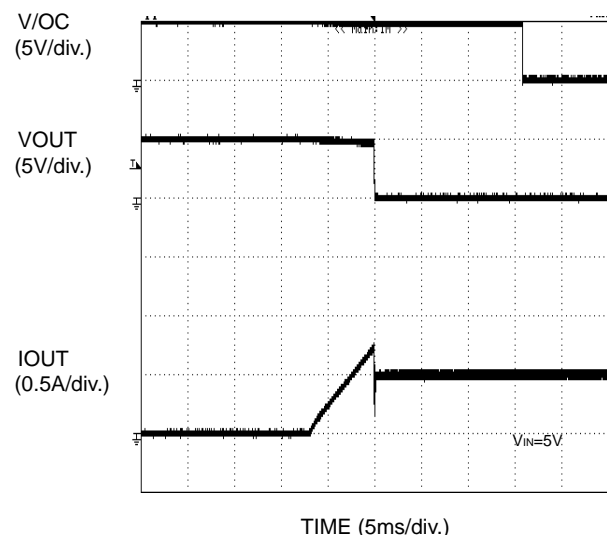


Figure 32. Inrush current response

Figure 33. Over-current response  
ramped load

## ● Typical Wave Forms - continued

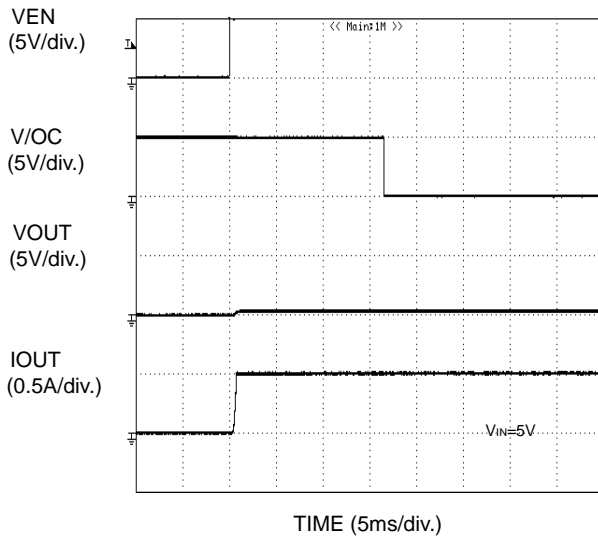


Figure 34. Over-current response enable to shortcircuit

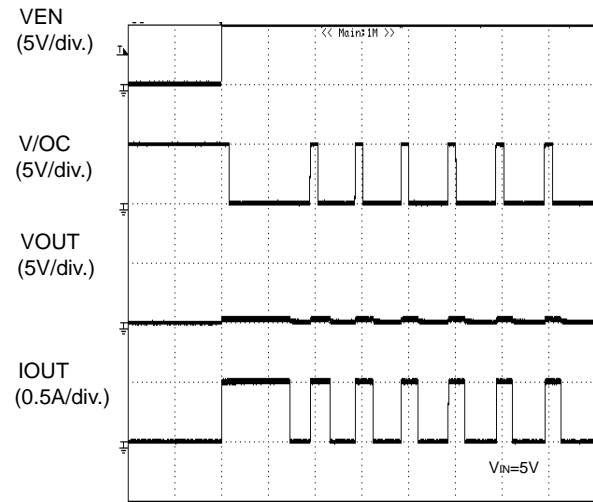


Figure 35. Over-current response enable to shortcircuit

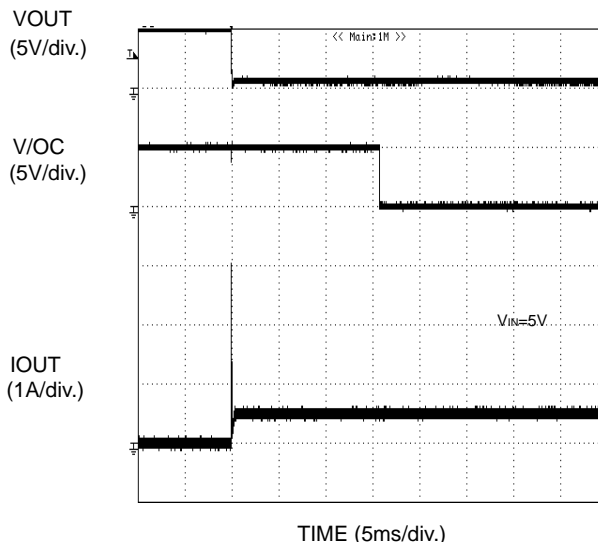


Figure 36. Over-current response 1Ω load to enabled device

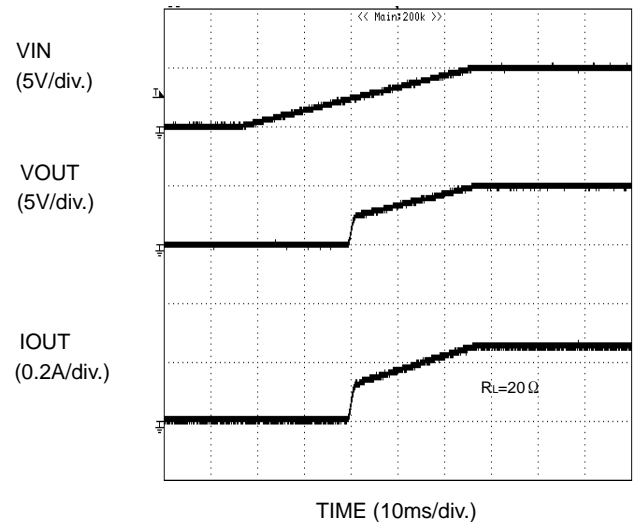


Figure 37. UVLO response increasing VIN

### ●Typical Wave Forms - continued

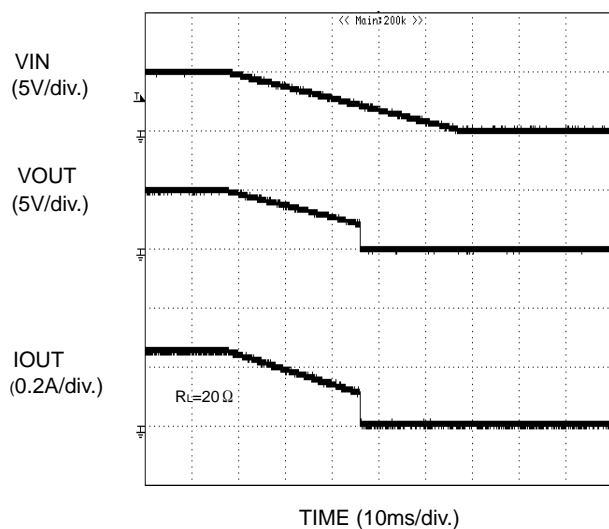
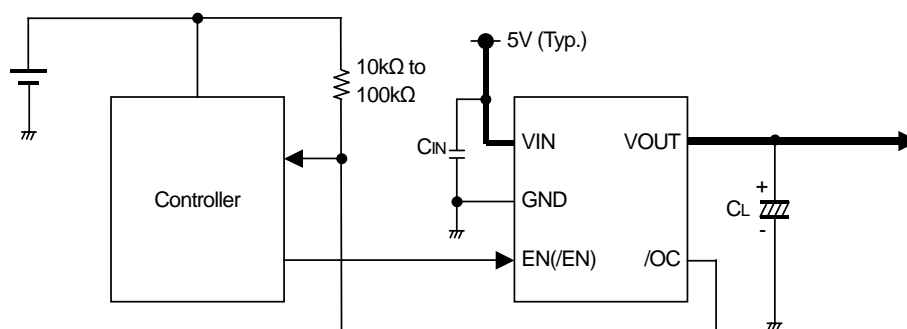


Figure 38. UVLO response decreasing VIN

### ●Typical Application Circuit



### ●Application Information

When excessive current flows owing to output shortcircuit or so, ringing occurs by inductance of power source line to IC, and may cause bad influences upon IC actions. In order to avoid this case, connect a bypass capacitor  $C_{IN}$  by VIN terminal and GND terminal of IC. 1 $\mu$ F or higher is recommended. In order to decrease voltage fluctuations of power source line to IC, connect a low ESR capacitor in parallel with  $C_{IN}$ . 10 $\mu$ F to 100 $\mu$ F or higher is effective.

Pull up /OC output by resistance 10k $\Omega$  to 100k $\Omega$ .

Set up value which satisfies the application as  $C_L$ .

This system connection diagram doesn't guarantee operating as the application.

When using the circuit with changes to the external circuit constants, make sure to leave an adequate margin for external components including static and transitional characteristics as well as dispersion of the IC.

## ●Functional Description

### 1. Switch Operation

VIN terminal and VOUT terminal are connected to the drain and the source of switch MOSFET respectively. And the VIN terminal is used also as power source input to internal control circuit.

When the switch is turned on from EN,/EN control input, VIN terminal and VOUT terminal are connected by a 110mΩ(Typ.) switch. In on status, the switch is bidirectional. Therefore, when the potential of VOUT terminal is higher than that of VIN terminal, current flows from VOUT terminal to VIN terminal.

Since a parasitic diode between the drain and the source of switch MOSFET is canceled, in the off status, it is possible to prevent current from flowing reversely from VOUT to VIN.

### 2. Thermal Shutdown Circuit (TSD)

If over-current would continue, the temperature of the IC would increase drastically. If the junction temperature were beyond 135°C(Typ.) in the condition of over-current detection, thermal shutdown circuit operates and makes power switch turn off and outputs fault flag (/OC). Then, when the junction temperature decreases lower than 115°C(Typ.), power switch is turned on and fault flag (/OC) is cancelled. Unless the fact of the increasing chips temperature is removed or the output of power switch is turned off, this operation repeats.

The thermal shutdown circuit operates when the switch is on (EN,/EN signal is active).

### 3. Over-Current Detection (OCD)

The over-current detection circuit limits current ( $I_{SC}$ ) and outputs fault flag (/OC) when current flowing in each switch MOSFET exceeds a specified value. There are three types of response against over-current. The over-current detection circuit works when the switch is on (EN,/EN signal is active).

#### 3-1. When the switch is turned on while the output is in shortcircuit status

When the switch is turned on while the output is in shortcircuit status or so, the switch gets in current limit status soon.

#### 3-2. When the output shortcircuits while the switch is on

When the output shortcircuits or large capacity is connected while the switch is on, very large current flows until the over-current limit circuit reacts. When the current detection, limit circuit works, current limitation is carried out.

#### 3-3. When the output current increases gradually

When the output current increases gradually, current limitation does not work until the output current exceeds the over-current detection value. When it exceeds the detection value, current limitation is carried out.

### 4. Under-Voltage Lockout (UVLO)

UVLO circuit prevents the switch from turning on until the VIN exceeds 2.3V(Typ.). If the VIN drops below 2.2V(Typ.) while the switch turns on, then UVLO shuts off the power switch. UVLO has hysteresis of a 100mV(Typ.).

Under-voltage lockout circuit works when the switch is on (EN,/EN signal is active).

### 5. Fault Flag (/OC) Output

Fault flag output is N-MOS open drain output. At detection of over-current, thermal shutdown, low level is output.

Over-current detection has delay filter. This delay filter prevents instantaneous current detection such as inrush current at switch on, hot plug from being informed to outside.

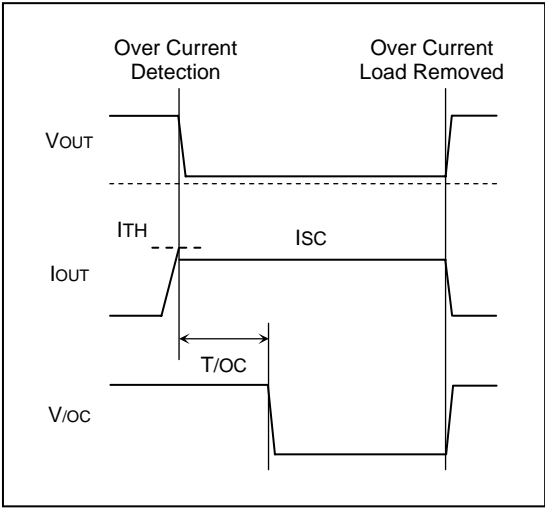


Figure 39. Over-current detection

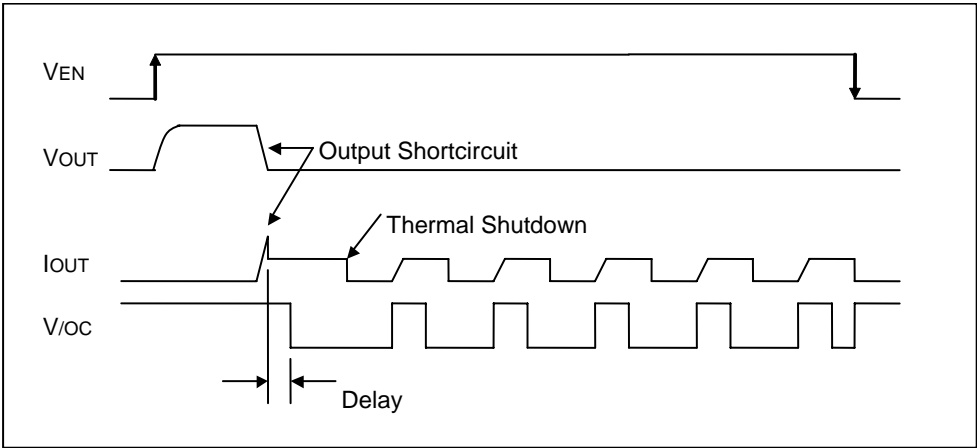


Figure 40. Over-current detection, Thermal shutdown timing (BD2246G)

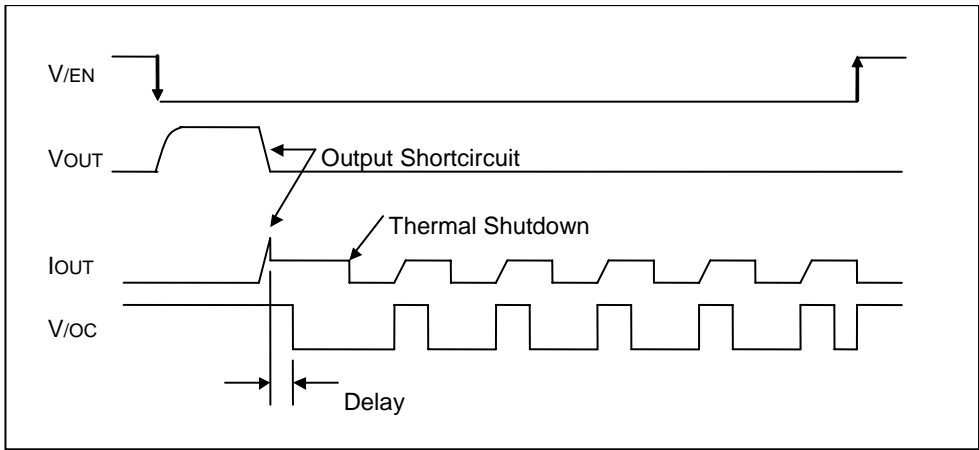
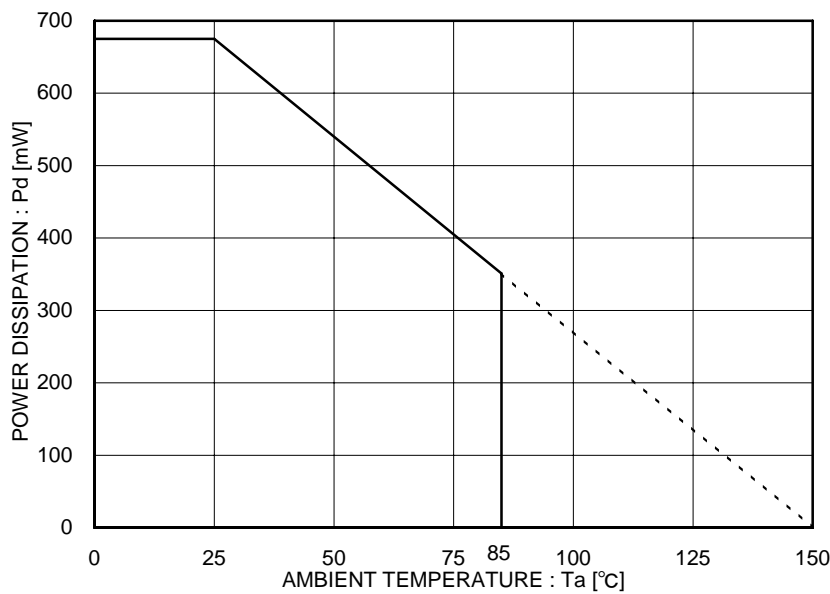


Figure 41. Over-current detection, Thermal shutdown timing (BD2247G)

●Power Dissipation  
(SSOP5 package)



\* 70mm x 70mm x 1.6mm Glass Epoxy Board

Figure 42. Power Dissipation Curve (Pd-Ta Curve)

●I/O Equivalence Circuit

Symbol	Pin No.	Equivalence Circuit
EN (/EN)	3	
VOUT	5	
/OC	4	

**●Operational Notes**

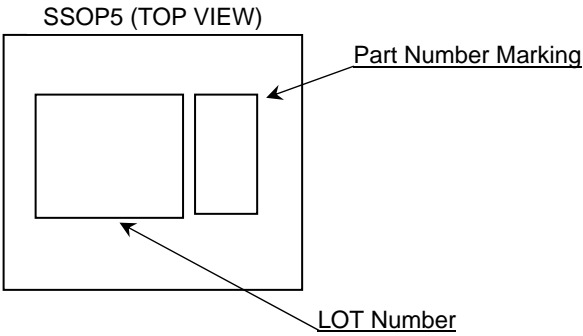
- (1) Absolute maximum ratings  
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.
- (2) Operating conditions  
These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.
- (3) Reverse connection of power supply connector  
The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC's power supply terminal.
- (4) Power supply line  
Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines. In this regard, for the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner. Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.
- (5) GND voltage  
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.
- (6) Short circuit between terminals and erroneous mounting  
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.
- (7) Operation in strong electromagnetic field  
Be noted that using ICs in the strong electromagnetic field can malfunction them.
- (8) Inspection with set PCB  
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.
- (9) Input terminals  
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.
- (10) Ground wiring pattern  
If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.
- (11) External capacitor  
In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.
- (12) Thermal shutdown circuit (TSD)  
When junction temperatures become detected temperatures or higher, the thermal shutdown circuit operates and turns a switch OFF. The thermal shutdown circuit is aimed at isolating the LSI from thermal runaway as much as possible. Do not continuously use the LSI with this circuit operating or use the LSI assuming its operation.
- (13) Thermal design  
Perform thermal design in which there are adequate margins by taking into account the power dissipation (Pd) in actual states of use.

●Ordering Information

B D 2 2 4 6 G							-	T R	
Part Number							Package G: SSOP5	Packaging and forming specification TR: Embossed tape and reel	

B D 2 2 4 7 G							-	T R	
Part Number							Package G: SSOP5	Packaging and forming specification TR: Embossed tape and reel	

●Marking Diagram

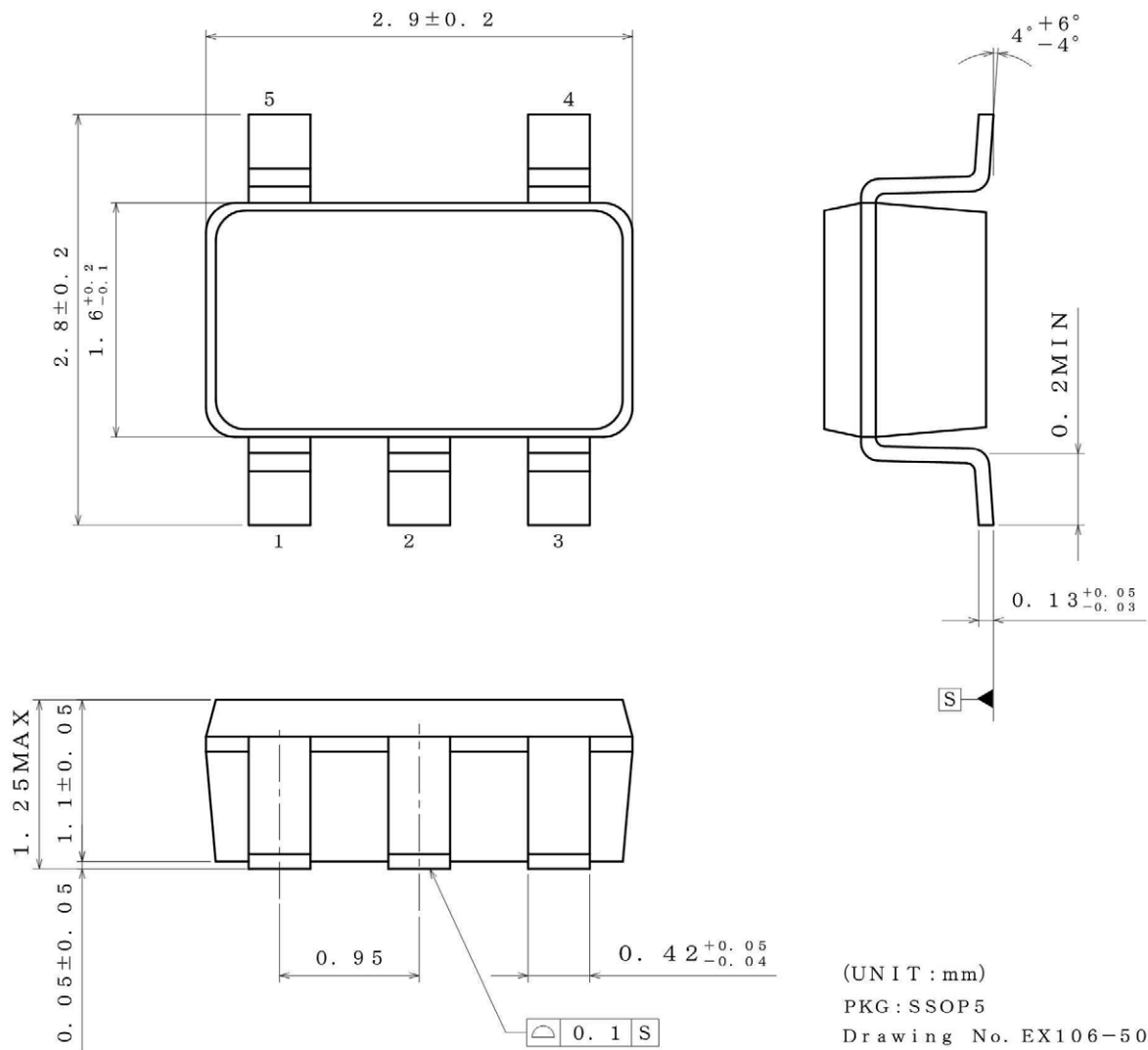


Part Number	Part Number Marking
BD2246G	J5
BD2247G	J6

## ●Physical Dimension Tape and Reel Information

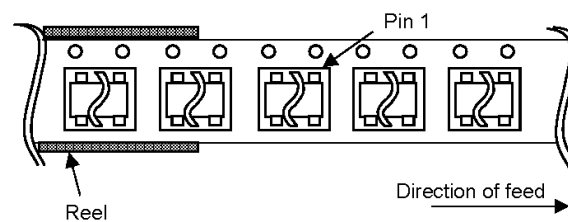
Package Name

SSOP5



## &lt; Tape and Reel Information &gt;

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TR ( The direction is the 1pin of product is at the upper right when you hold ) reel on the left hand and you pull out the tape on the right hand



## ●Revision History

Date	Revision	Changes
11.Mar.2013	001	New Release

# Notice

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  - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
  - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
  - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - [f] Sealing or coating our Products with resin or other coating materials
  - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
  - [h] Use of the Products in places subject to dew condensation
- 4) The Products are not subject to radiation-proof design.
- 5) Please verify and confirm characteristics of the final or mounted products in using the Products.
- 6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- 8) Confirm that operation temperature is within the specified range described in the product specification.
- 9) ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

### ●Precaution for Mounting / Circuit board design

- 1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- 2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

### ●Precautions Regarding Application Examples and External Circuits

- 1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
- 2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

### ●Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

### ●Precaution for Storage / Transportation

- 1) Product performance and soldered connections may deteriorate if the Products are stored in the places where:
  - [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [b] the temperature or humidity exceeds those recommended by ROHM
  - [c] the Products are exposed to direct sunshine or condensation
  - [d] the Products are exposed to high Electrostatic
- 2) Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
- 3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

### ●Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

### ●Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

### ●Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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