1ch High Side Switch ICs

1.0A Current Limit High Side Switch ICs

BD2041AFJ　BD2051AFJ

General Description

BD2041AFJ and BD2051AFJ are single channel high side switch ICs with over-current protection for Universal Serial Bus (USB) power supply line. These ICs have low ON-Resistance N-Channel power MOSFETs with low supply current, built-in over-current protection circuit, thermal shutdown circuit, under voltage lockout and soft-start circuit.

Key Specifications

- Input Voltage Range: 2.7V to 5.5V
- ON-Resistance: 80mΩ(Typ)
- Continuous Current Load: 0.5A
- Over-Current Threshold: 0.7A (Min), 1.6A (Max)
- Standby Current: 0.01µA (Typ)
- Output Rise Time: 1.2ms(Typ)
- Operating Temperature Range: -40°C to +85°C

Features

- Built-In Low ON-Resistance Nch MOSFET (Typ=80mΩ)
- Control Input Logic
  - Active-Low: BD2041AFJ
  - Active-High: BD2051AFJ
- Soft-Start Circuit
- Over-Current Protection
- Thermal Shutdown
- Under Voltage Lockout Function
- Open Drain Error Flag Output
- Reverse-Current Protection when Switch Off
- Flag Output Delay

Package

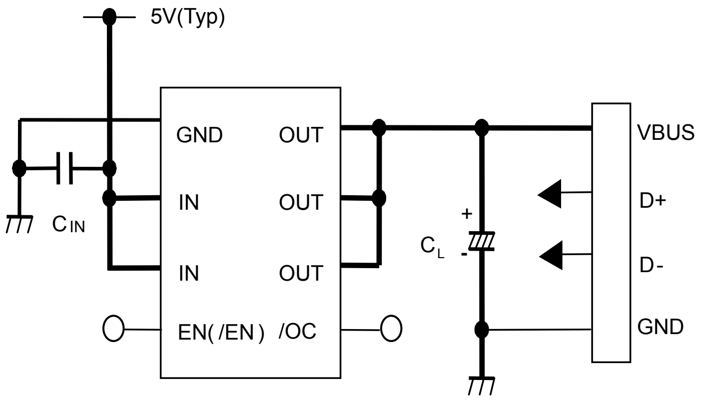
W(Typ)　D(Typ)　H (Max)

SOP-J8
4.90mm x 6.00mm x 1.65mm

Applications

USB Hub in Consumer Appliances, PC, PC Peripheral Equipment, and so forth

Typical Application Circuit

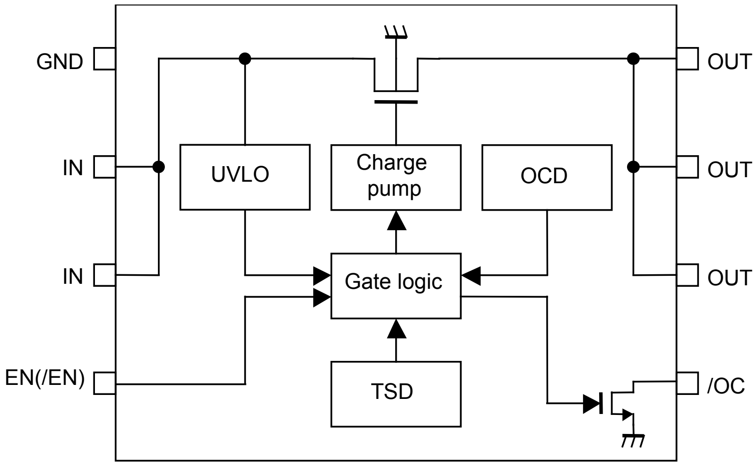


Lineup

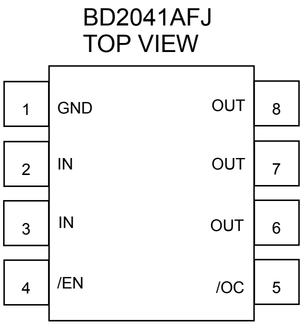
Over-Current Threshold			Control Input Logic	Package		Orderable Part Number
Min	Typ	Max				
0.7A	1.0A	1.6A	Low	SOP-J8	Reel of 2500	BD2041AFJ-E2
0.7A	1.0A	1.6A	High	SOP-J8	Reel of 2500	BD2051AFJ-E2

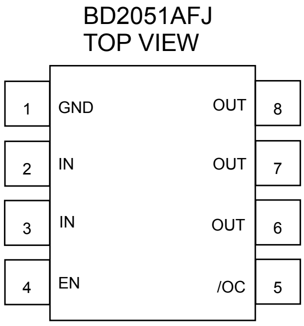
○Product structure : Silicon monolithic integrated circuit　○This product has not designed protection against radioactive rays

Block Diagram



Pin Configurations





Pin Description

Pin No.	Symbol	I / O	Pin Function
1	GND	I	Ground.
2, 3	IN	I	Power supply input. Input terminal to the power switch and power supply input terminal of the internal circuit. When used, connect each pin outside.
4	EN, /EN	I	Enable input. /EN: Power switch on at low level. (BD2041AFJ) EN: Power switch on at high level. (BD2051AFJ) High level input > 2.0V, low level input < 0.8V.
5	/OC	O	Error flag output. Low at over current, thermal shutdown. Open drain output.
6, 7, 8	OUT	O	Power switch output. When used, connect each pin outside.

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{IN}	-0.3 to +6.0	V
Enable Voltage	V_{EN}, $V_{/EN}$	-0.3 to +6.0	V
/OC Voltage	$V_{/OC}$	-0.3 to +6.0	V
/OC Current	$I_{/OC}$	10	mA
OUT Voltage	V_{OUT}	-0.3 to +6.0	V
Storage Temperature	Tstg	-55 to +150	°C
Power Dissipation	Pd	0.67 (Note 1)	W

(Note 1) Derating in done 5.4 mW/°C for operating above Ta≧25°C (Mount on 1-layer 70.0mm x 70.0mm x 1.6mm board)
Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Recommended Operating Conditions

Parameter	Symbol	Rating			Unit
		Min	Typ	Max	
Operating Voltage	V_{IN}	2.7	-	5.5	V
Operating Temperature	Topr	-40	-	+85	°C
Continuous Output Current	I_{LO}	0	-	500	mA

Electrical Characteristics

BD2041AFJ (Unless otherwise specified, V_{IN} = 5.0V, Ta = 25°C)

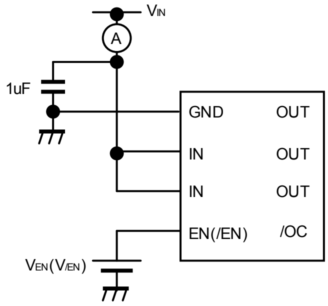
Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Operating Current	I_{DD}	-	90	120	μA	$V_{/EN}$ = 0V, OUT = OPEN
Standby Current	I_{STB}	-	0.01	1	μA	$V_{/EN}$ = 5V, OUT = OPEN
/EN Input Voltage	$V_{/ENH}$	2.0	-	-	V	High Input
	$V_{/ENL}$	-	-	0.8	V	Low Input
		-	-	0.4	V	Low Input 2.7V≤ V_{IN} ≤4.5V
/EN Input Current	$I_{/EN}$	-1.0	+0.01	+1.0	μA	$V_{/EN}$ = 0V or $V_{/EN}$ = 5V
/OC Output Low Voltage	$V_{/OC}$	-	-	0.5	V	$I_{/OC}$ = 5mA
/OC Output Leak Current	$I_{L/OC}$	-	0.01	1	μA	$V_{/OC}$ = 5V
/OC Delay Time	$t_{/OC}$	-	2.5	8	ms	
ON-Resistance	R_{ON}	-	80	100	mΩ	I_{OUT} = 500mA
Over-Current Threshold	I_{TH}	0.7	1.0	1.6	A	
Output Current at Short	I_{SC}	0.7	1.0	1.3	A	V_{IN} = 5V, V_{OUT} = 0V, C_L = 100μF (RMS)
Output Rise Time	t_{ON1}	-	1.2	10	ms	R_L = 10Ω, C_L = OPEN
Output Turn ON Time	t_{ON2}	-	1.5	20	ms	
Output Fall Time	t_{OFF1}	-	1	20	μs	
Output Turn OFF Time	t_{OFF2}	-	3	40	μs	
UVLO Threshold	V_{TUVH}	2.1	2.3	2.5	V	Increasing V_{IN}
	V_{TUVL}	2.0	2.2	2.4	V	Decreasing V_{IN}

Electrical Characteristics - continued

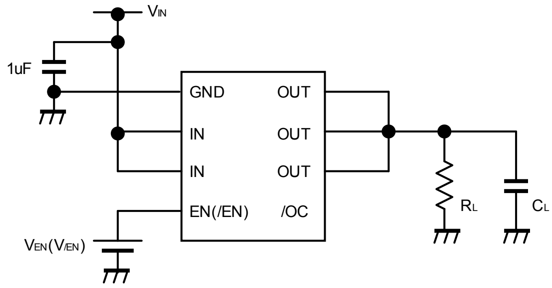
BD2051AFJ (Unless otherwise specified, V_{IN} = 5.0V, Ta = 25°C)

Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Operating Current	I_{DD}	-	90	120	μA	V_{EN} = 5V, OUT = OPEN
Standby Current	I_{STB}	-	0.01	1	μA	V_{EN} = 0V, OUT = OPEN
EN Input Voltage	V_{ENH}	2.0	-	-	V	High Input
	V_{ENL}	-	-	0.8	V	Low Input
		-	-	0.4	V	Low Input 2.7V≤ V_{IN} ≤4.5V
EN Input Current	I_{EN}	-1.0	+0.01	+1.0	μA	V_{EN} = 0V or V_{EN} = 5V
/OC Output Low Voltage	$V_{/OC}$	-	-	0.5	V	$I_{/OC}$ = 5mA
/OC Output Leak Current	$I_{L/OC}$	-	0.01	1	μA	$V_{/OC}$ = 5V
/OC Delay Time	$t_{/OC}$	-	2.5	8	ms	
ON-Resistance	R_{ON}	-	80	100	mΩ	I_{OUT} = 500mA
Over-Current Threshold	I_{TH}	0.7	1.0	1.6	A	
Output Current at Short	I_{SC}	0.7	1.0	1.3	A	V_{IN} = 5V, V_{OUT} = 0V, C_L = 100μF (RMS)
Output Rise Time	t_{ON1}	-	1.2	10	ms	R_L = 10Ω, C_L = OPEN
Output Turn ON Time	t_{ON2}	-	1.5	20	ms	
Output Fall Time	t_{OFF1}	-	1	20	μs	
Output Turn OFF Time	t_{OFF2}	-	3	40	μs	
UVLO Threshold	V_{TUVH}	2.1	2.3	2.5	V	Increasing V_{IN}
	V_{TUVL}	2.0	2.2	2.4	V	Decreasing V_{IN}

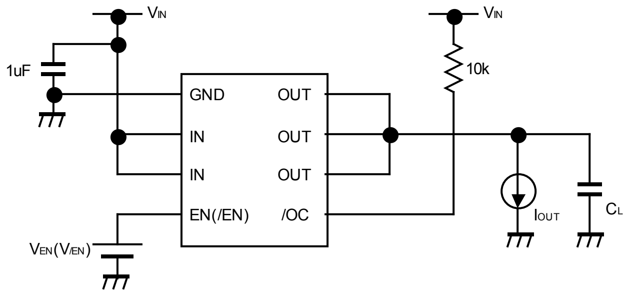
Measurement Circuit



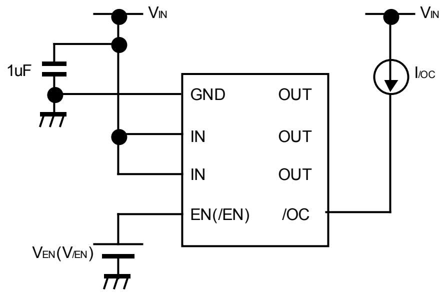
A. Operating Current



B. EN, /EN Input Voltage, Output Rise / Fall Time



C. ON-Resistance, Over Current Detection



D. /OC Output Low Voltage

Figure 1. Measurement Circuit

Timing Diagram

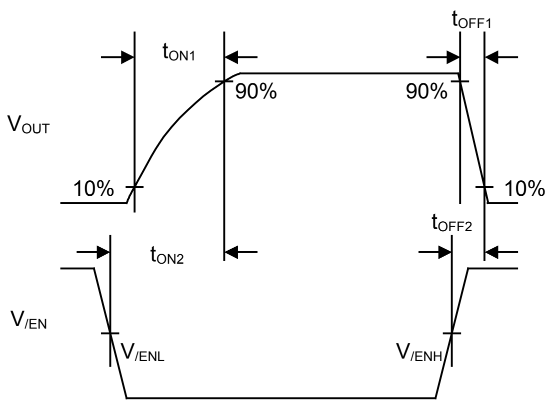


Figure 2. Timing Diagram(BD2041AFJ)

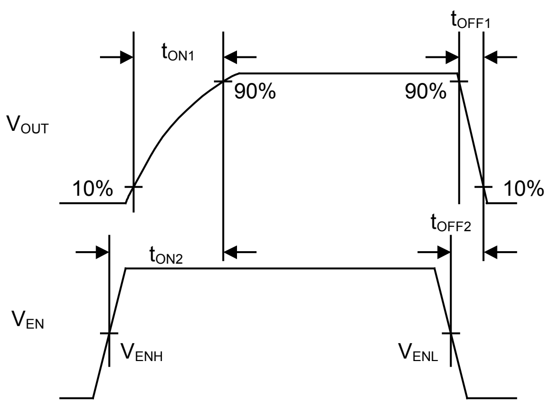


Figure 3. Timing Diagram (BD2051AFJ)

Typical Performance Curves

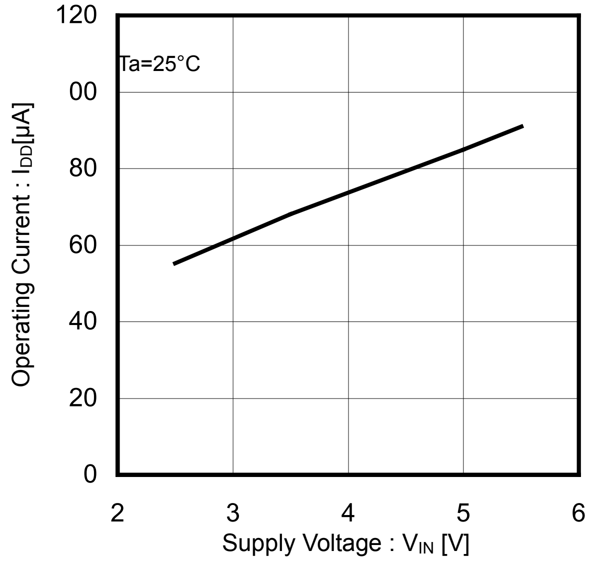


Figure 4. Operating Current vs Supply Voltage (EN, /EN Enable)

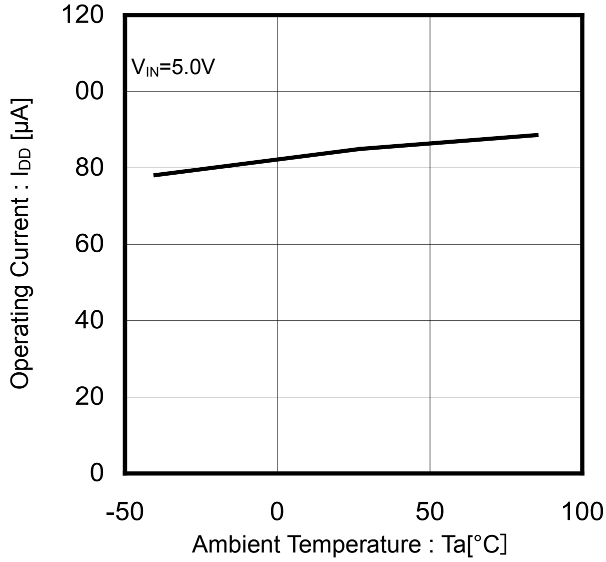


Figure 5. Operating Current vs Ambient Temperature (EN, /EN Enable)

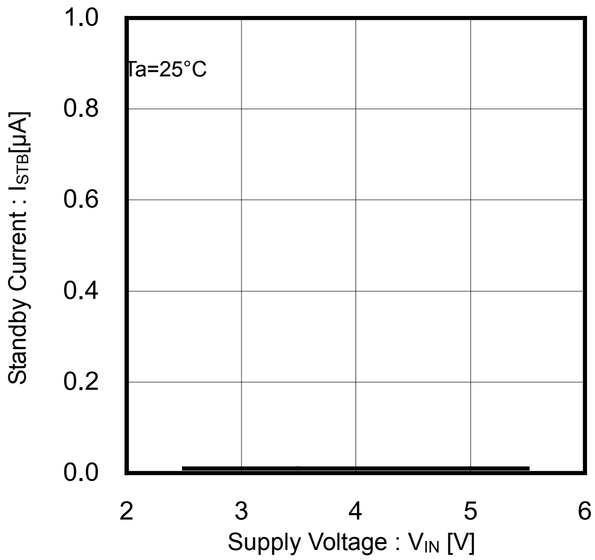


Figure 6. Standby Current vs Supply Voltage (EN, /EN Disable)

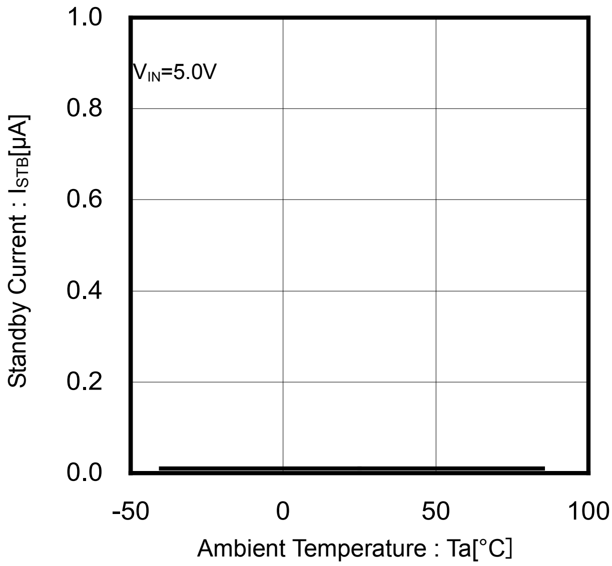


Figure 7. Standby Current vs Ambient Temperature (EN, /EN Disable)

Typical Performance Curves – continued

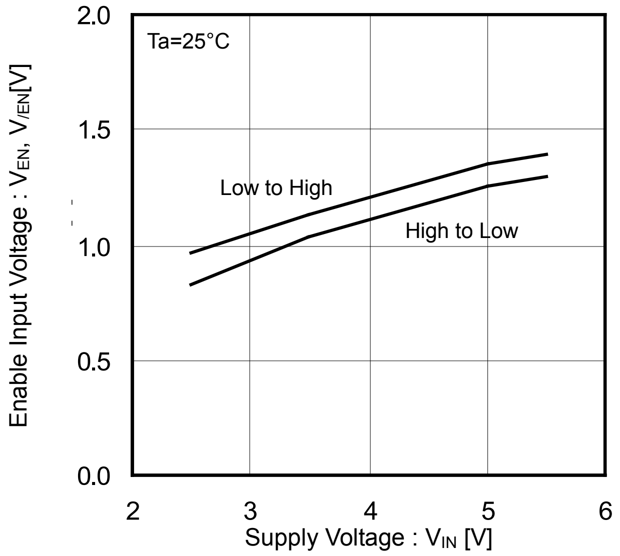


Figure 8. EN, /EN Input Voltage vs Supply Voltage

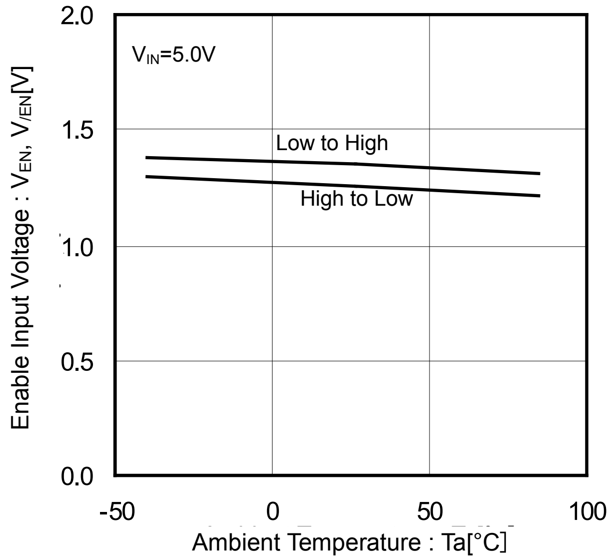


Figure 9. EN, /EN Input Voltage vs Ambient Temperature

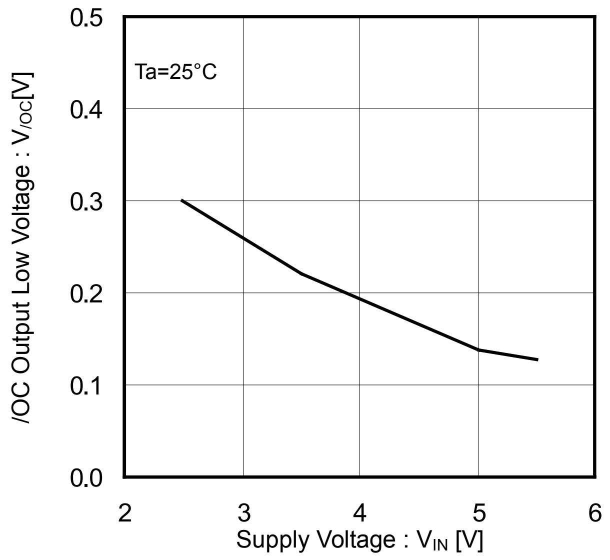


Figure 10. /OC Output Low Voltage vs Supply Voltage

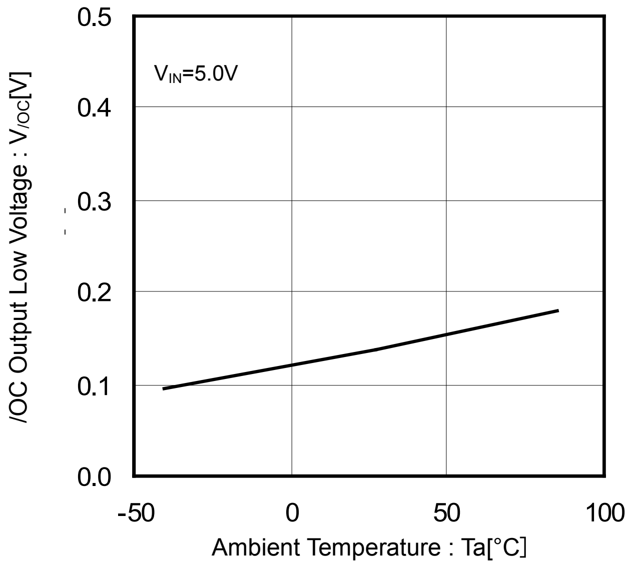


Figure 11. /OC Output Low Voltage vs Ambient Temperature

Typical Performance Curves – continued

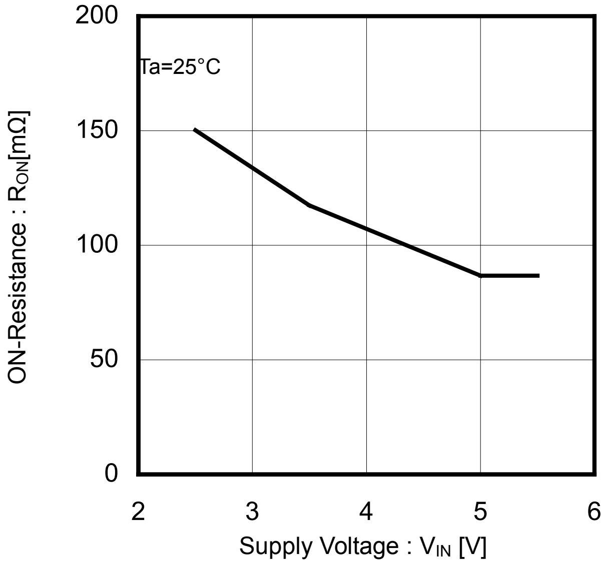


Figure 12. ON-Resistance vs Supply Voltage

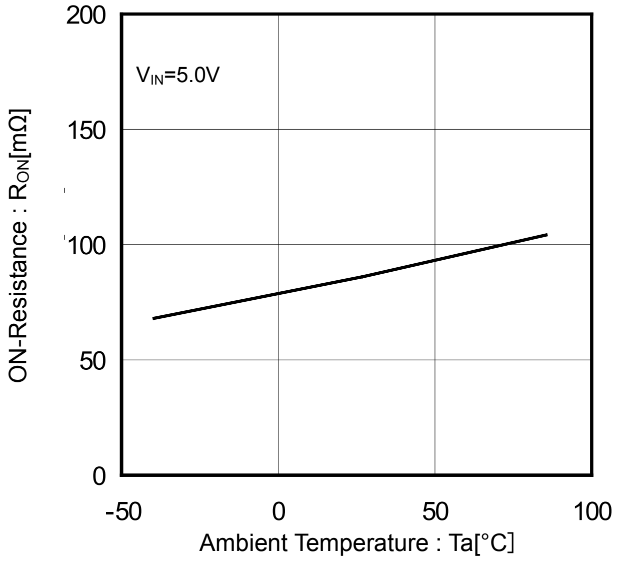


Figure 13. ON-Resistance vs Ambient Temperature

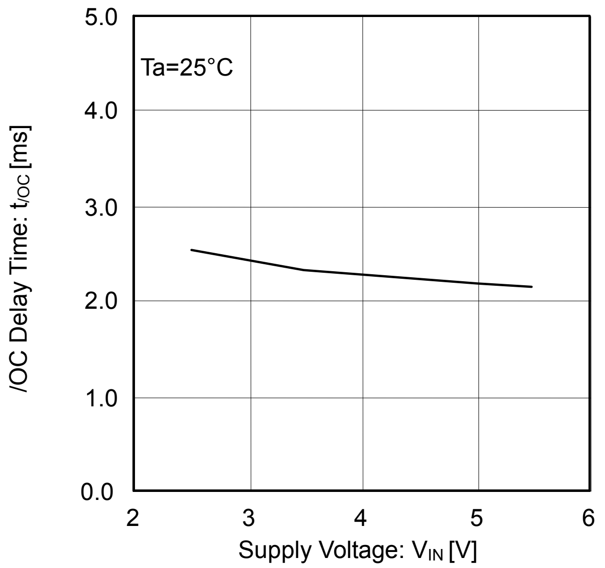


Figure 14. /OC Delay Time vs Supply Voltage

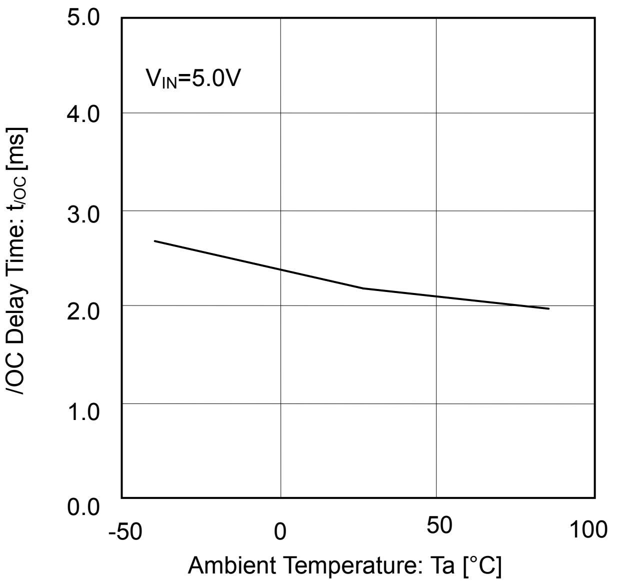


Figure 15. /OC Delay Time vs Ambient Temperature

Typical Performance Curves – continued

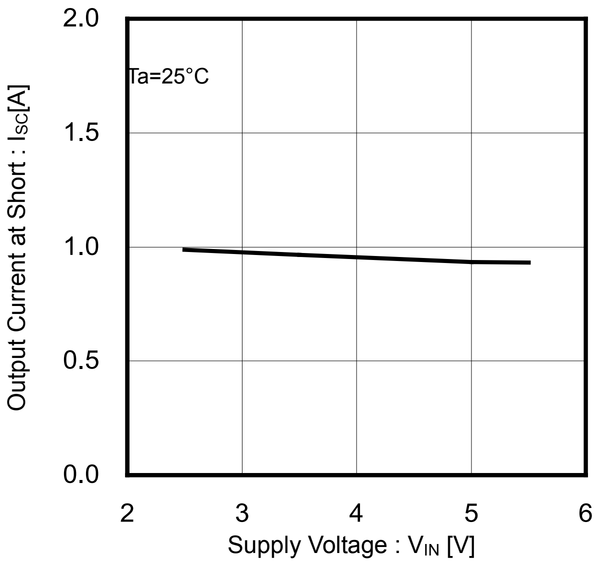


Figure 16. Output Current at Short vs Supply Voltage

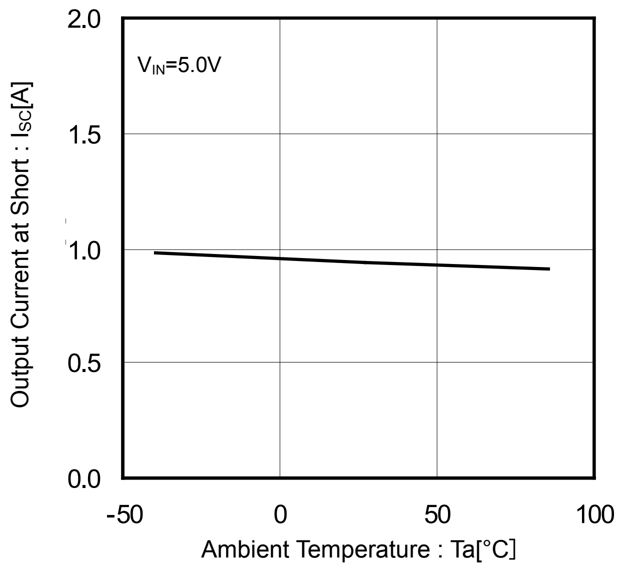


Figure 17. Output Current at Short vs Ambient Temperature

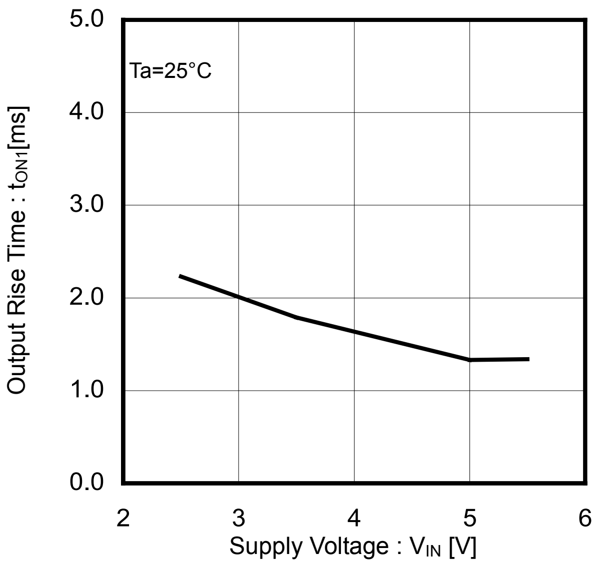


Figure 18. Output Rise Time vs Supply Voltage

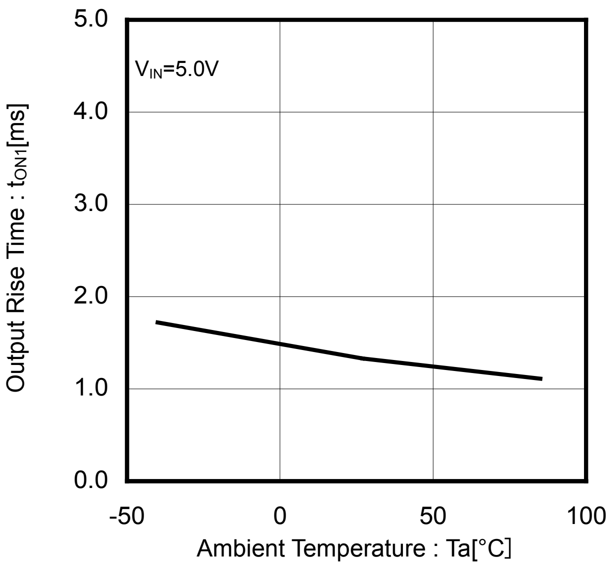


Figure 19. Output Rise Time vs Ambient Temperature

Typical Performance Curves – continued

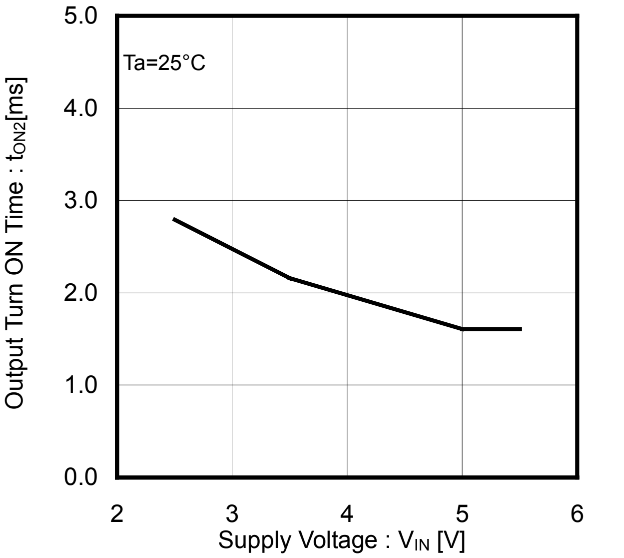


Figure 20. Output Turn ON Time vs Supply Voltage

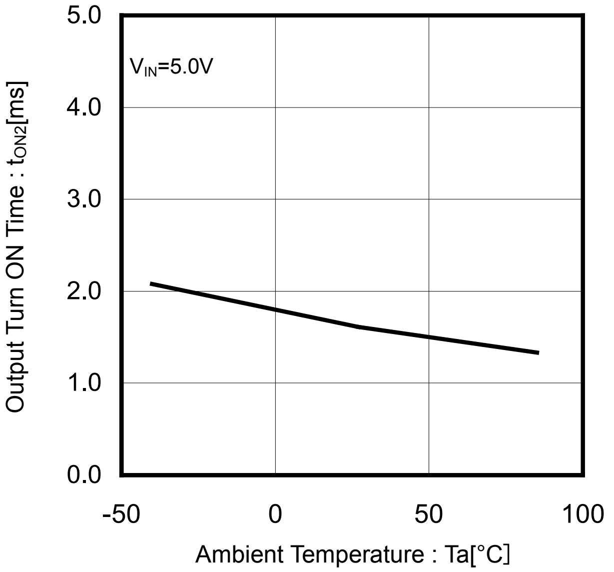


Figure 21. Output Turn ON Time vs Ambient Temperature

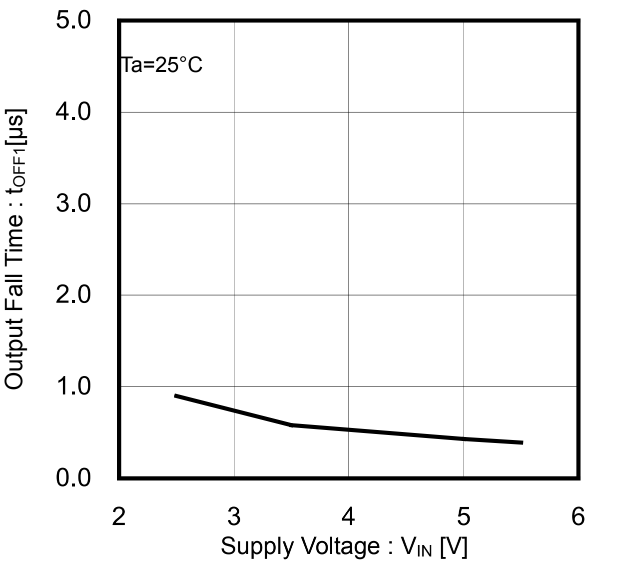


Figure 22. Output Fall Time vs Supply Voltage

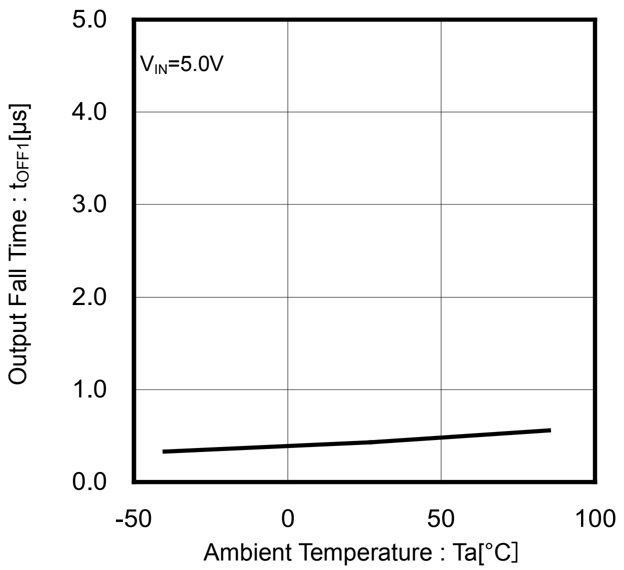


Figure 23. Output Fall Time vs Ambient Temperature

Typical Performance Curves – continued

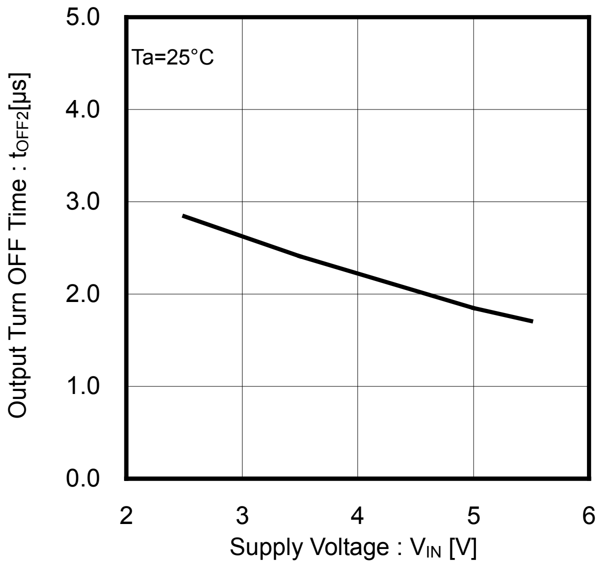


Figure 24. Output Turn OFF Time vs Supply Voltage

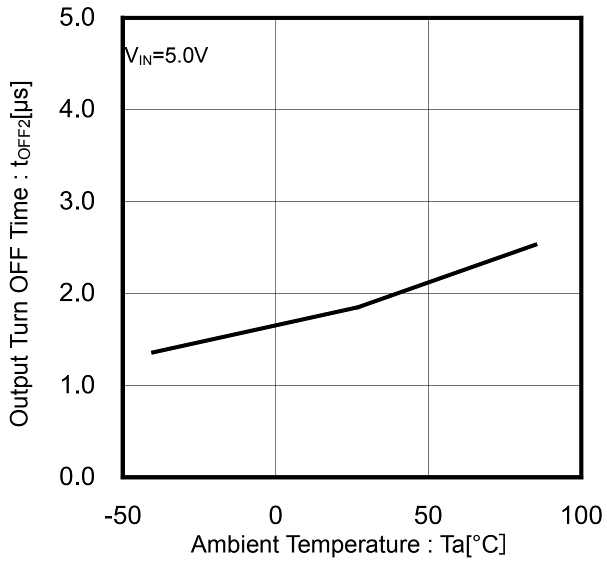


Figure 25. Output Turn OFF Time vs Ambient Temperature

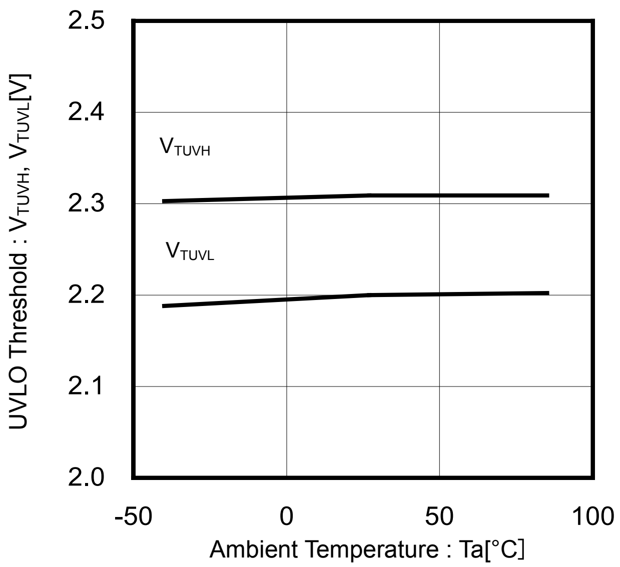


Figure 26. UVLO Threshold Voltage vs Ambient Temperature

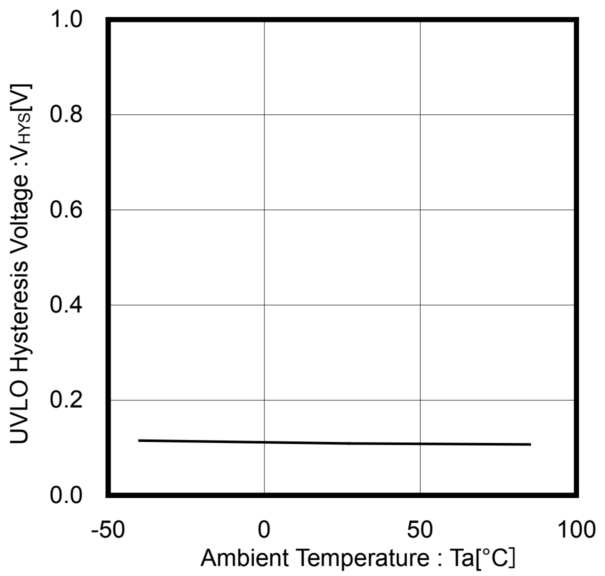


Figure 27. UVLO Hysteresis Voltage vs Ambient Temperature

Typical Wave Forms

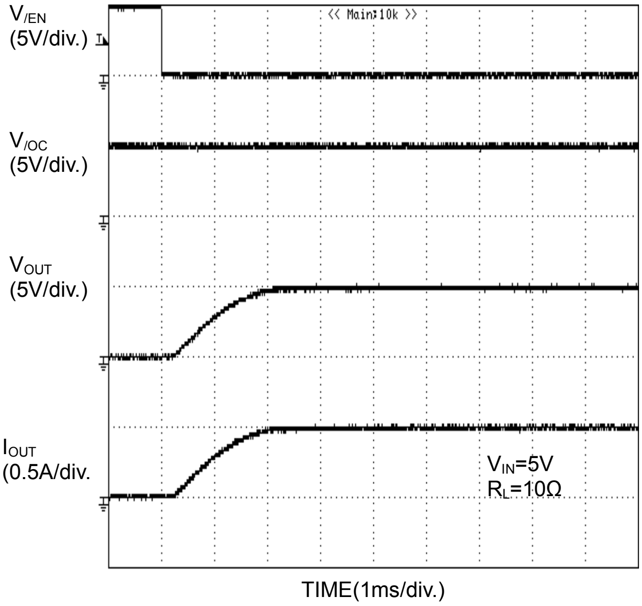


Figure 28. Output Rise Characteristic
(BD2041AFJ)

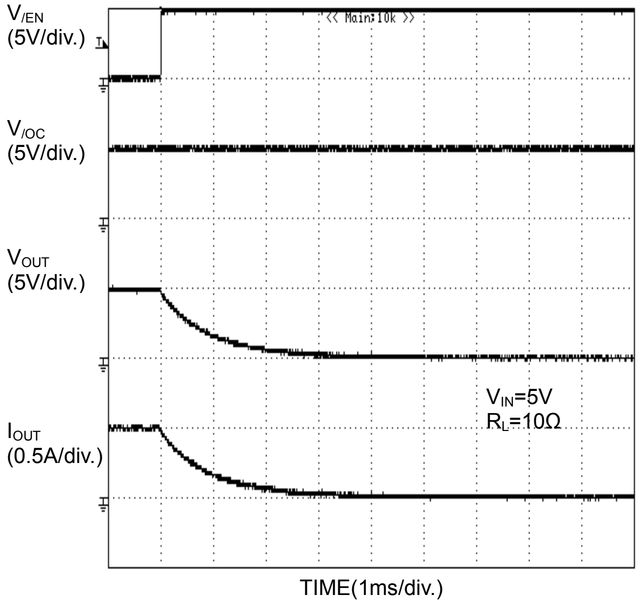


Figure 29. Output Fall Characteristic
(BD2041AFJ)

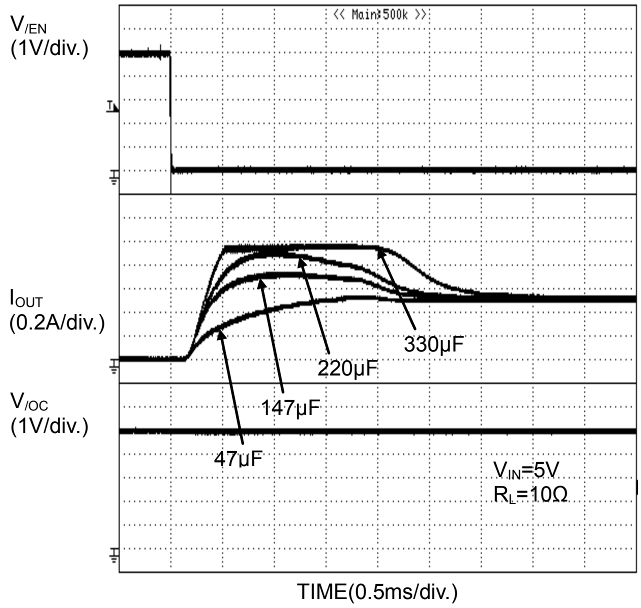


Figure 30. Inrush Current
(BD2041AFJ)

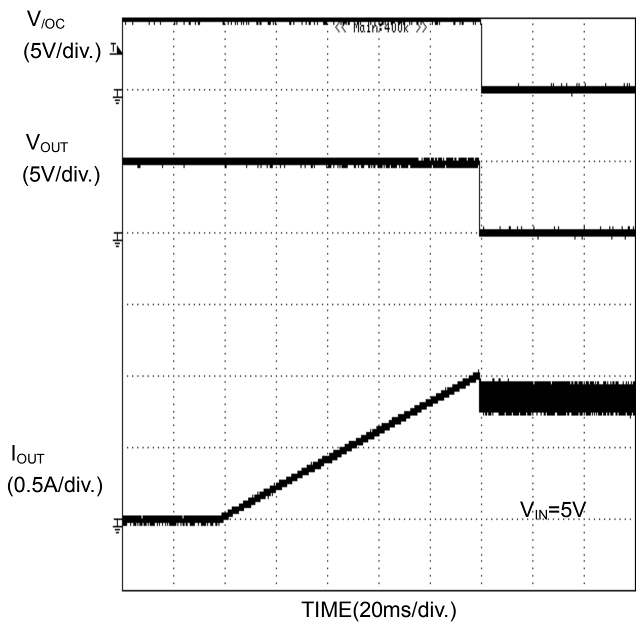


Figure 31. Over-Current Response
Ramped Load
(BD2041AFJ)

Typical Wave Forms - continued

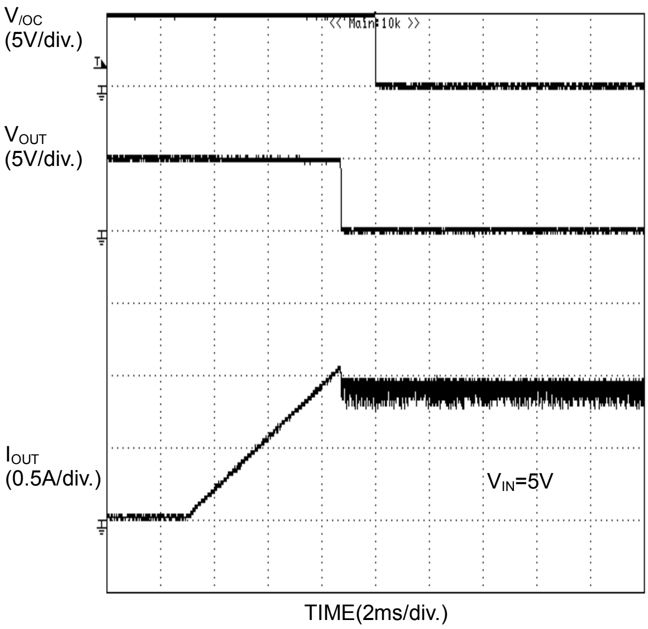


Figure 32. Over-Current Response
Ramped Load
(BD2041AFJ)

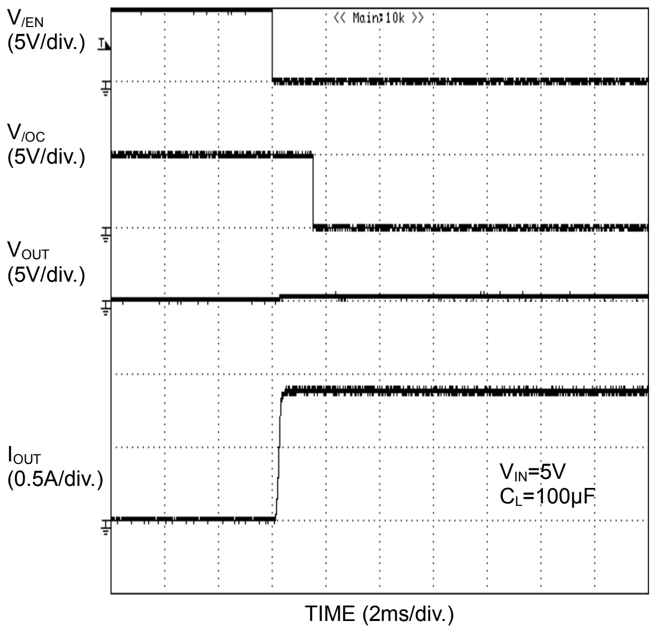


Figure 33. Over-Current Response
Enable to Shortcircuit
(BD2041AFJ)

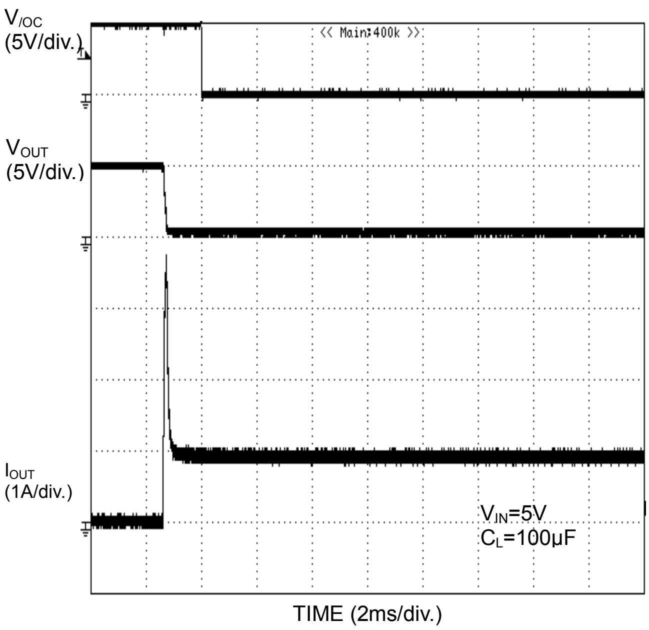


Figure 34. Over-Current Response
Output 1Ω short at Enable
(BD2041AFJ)

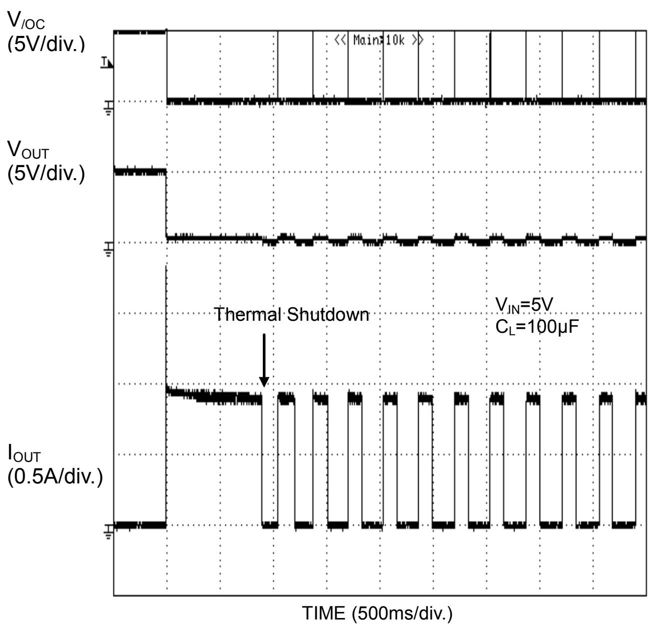


Figure 35. Over-Current Response
Output 1Ω short at Enable
(BD2041AFJ)

Typical Wave Forms – continued

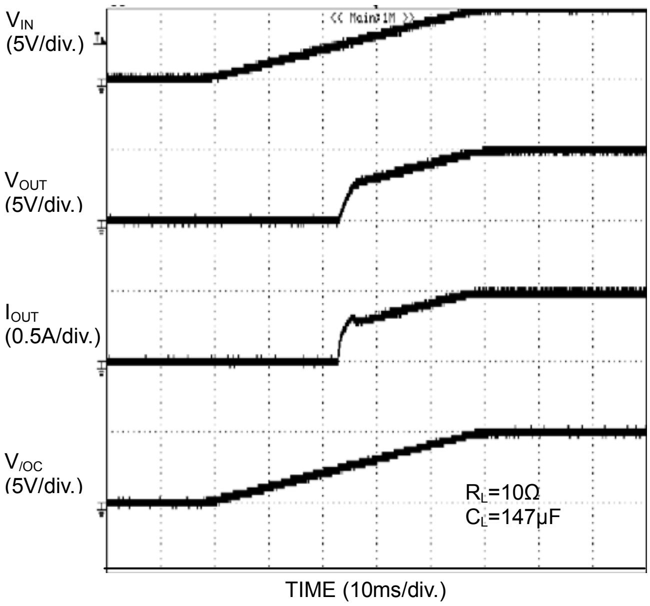


Figure 36. UVLO
V_{IN} Increasing
(BD2041AFJ)

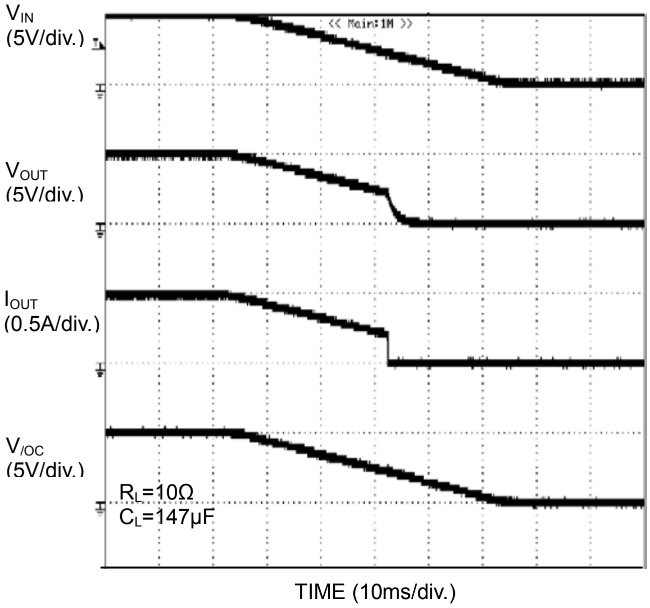
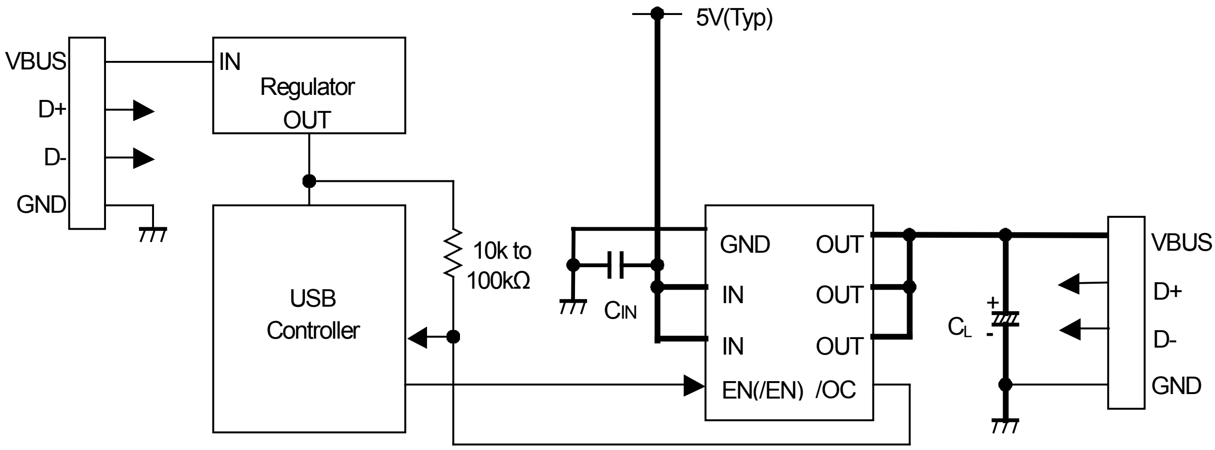


Figure 37. UVLO
V_{IN} Decreasing
(BD2041AFJ)

For the output rise/fall and over-current detection characteristics of BD2051AFJ, please refer to the characteristic of BD2041AFJ.

Typical Application Circuit



Application Information

When excessive current flows due to output short circuit or so, ringing occurs by inductance of power source line and IC. This may cause bad effects on IC operations. In order to avoid this case, a bypass capacitor should be connected across the IN terminal and GND terminal of IC. A 1μF or higher value is recommended.

Pull-up /OC output by resistance 10kΩ to 100kΩ.

Set-up values for C_L which satisfies the application.

This application circuit does not guarantee its operation. When using the circuit with changes to the external circuit constants, it is better to have an adequate margin for the external components such as static and transient characteristics as well as dispersion of the IC.

Functional Description

1. Switch Operation
   IN terminal and OUT terminal are connected to the drain and the source of switch MOSFET respectively. The IN terminal is also used as power source input to internal control circuit.

   When the switch is turned ON by EN(/EN) control input, both the IN and OUT terminals are connected by a 80mΩ bidirectional switch. Therefore, current flows from OUT terminal to IN terminal since the flow of current is from higher to lower potentials.

   On the other hand, when the switch is turned OFF, it is possible to prevent current from flowing reversely from OUT to IN since a parasitic diode between the drain and the source of switch MOSFET is not present.

2. Thermal Shutdown Circuit (TSD)
   If over-current would continue, the temperature of the IC would increase drastically. If the junction temperature goes beyond 140°C (Typ) during the condition of over-current detection, thermal shutdown circuit operates and turns the power switch OFF, causing the IC to output an error flag (/OC). Then, when the junction temperature drops lower than 120°C (Typ), the power switch is turned ON and error flag (/OC) is cancelled. This operation repeats unless the cause of the increase of chip's temperature is removed or the output of power switch is turned OFF.

   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 error flag (/OC) when current flowing in each switch MOSFET exceeds a specified value. The over-current detection circuit works when the switch is ON (EN(/EN) signal is active). There are three types of response against over-current:

(1) When the switch is turned on while the output is in short circuit status, the switch goes into current limit status immediately.
(2) When the output short circuits or high-current load is connected while the switch is ON, very large current flows until the over-current limit circuit reacts. When it exceeds the detection value, current limitation is carried out.
(3) When the output current increases gradually, current limit circuit would not operate unless the output current exceeds the over-current detection value. But when the output current increases gradually and it exceeds the detection value, current limitation is carried out.

4. Under Voltage Lockout (UVLO)
UVLO circuit prevents the switch from turning on until V_{IN} exceeds 2.3V(Typ). If V_{IN} drops below 2.2V(Typ) while the switch is 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. Error Flag (/OC) Output
Error flag output is N-MOS open drain output. During detection of over-current and/or thermal shutdown, the output level is low.

Over-current detection has delay filter. This delay filter prevents current detection flags from being sent during instantaneous events such as inrush current at switch on or during hot plug. If fault flag output is unused, /OC pin should be connected to open or ground line.

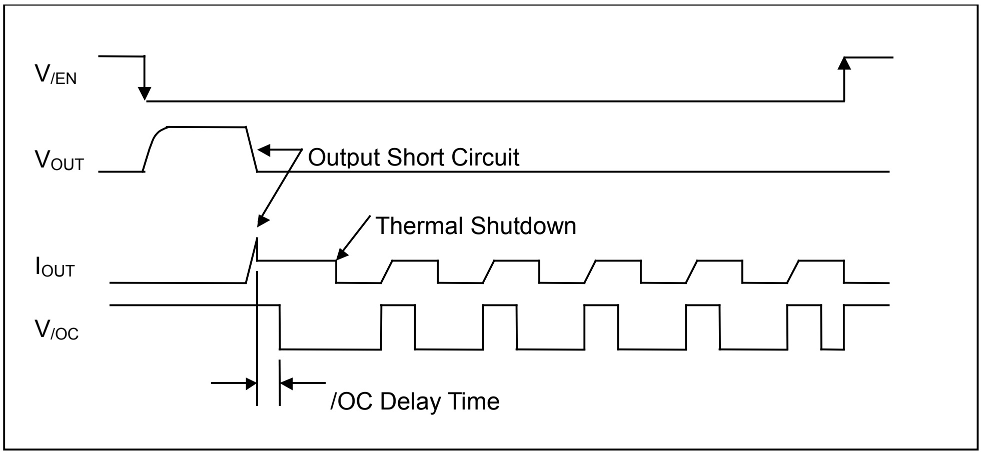


Figure 38. Over-Current Detection, Thermal Shutdown Timing Diagram
(BD2041AFJ)

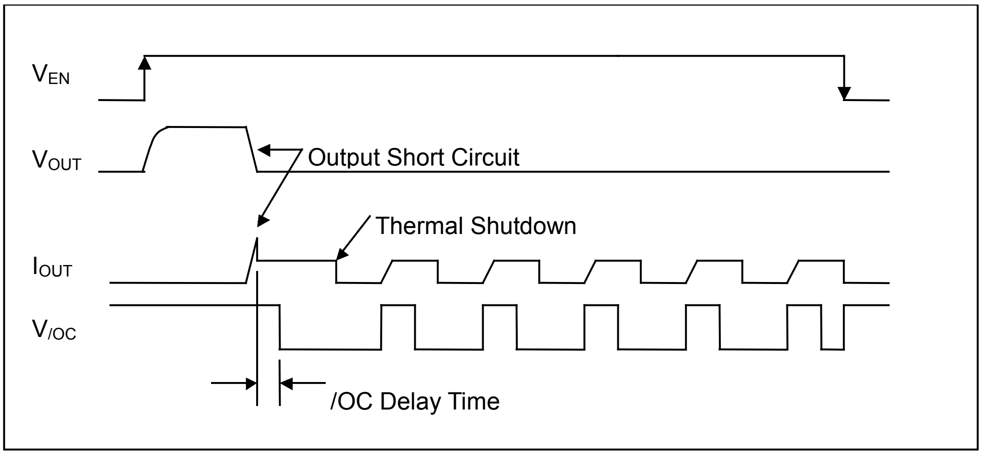
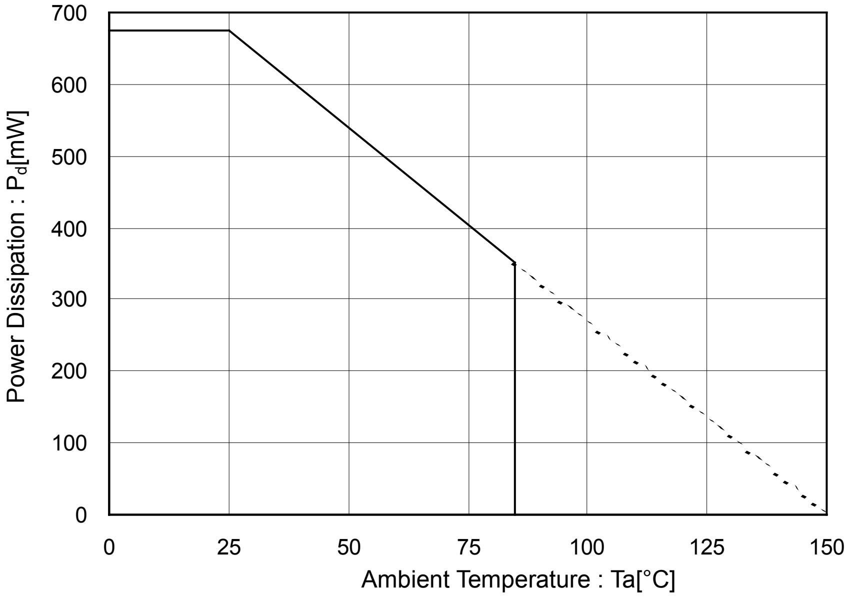


Figure 39. Over-Current Detection, Thermal Shutdown Timing Diagram
(BD2051AFJ)

Power Dissipation

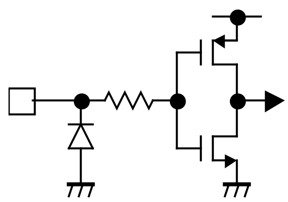
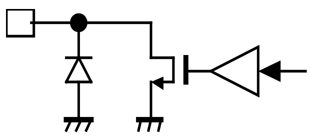
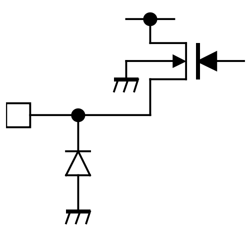
(SOP-J8)



70mm x 70mm x 1.6mm Glass Epoxy Board

Figure 40. Power Dissipation Curve (Pd-Ta Curve)

I/O Equivalence Circuit

Symbol	Pin No	Equivalence Circuit
EN(/EN)	4	
/OC	5	
OUT	6,7,8	

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. The absolute maximum rating of the Pd stated in this specification is when the IC is mounted on a 70mm x 70mm x 1.6mm glass epoxy board. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **In rush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

10. **Inter-pin Short and Mounting Errors**
    Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

Operational Notes - continued

11. Unused Input Pins

Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

12. Regarding the Input Pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.
When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

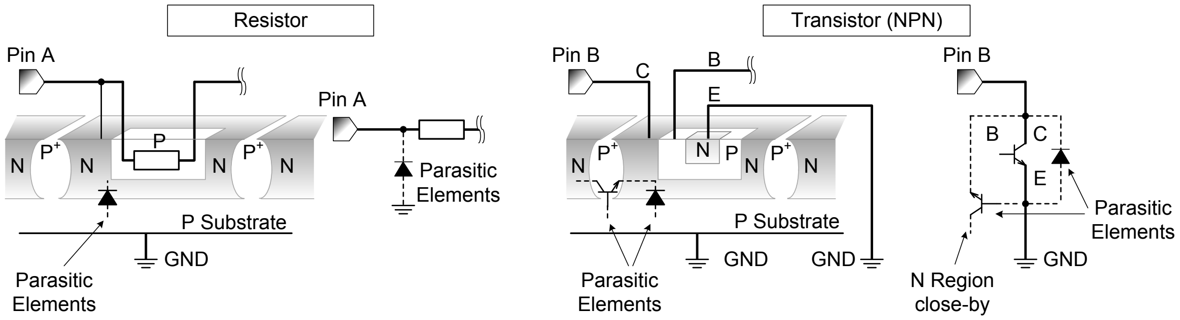


Figure 41. Example of monolithic IC structure

13. Ceramic Capacitor

When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

14. Thermal Shutdown Circuit(TSD)

This IC has a built-in thermal shutdown circuit that prevents heat damage to the IC. Normal operation should always be within the IC’s power dissipation rating. If however the rating is exceeded for a continued period, the junction temperature (Tj) will rise which will activate the TSD circuit that will turn OFF all output pins. When the Tj falls below the TSD threshold, the circuits are automatically restored to normal operation.
Note that the TSD circuit operates in a situation that exceeds the absolute maximum ratings and therefore, under no circumstances, should the TSD circuit be used in a set design or for any purpose other than protecting the IC from heat damage.

15. 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	0	4	1	A	F	J	-	E 2

Part Number

Package
FJ: SOP-J8

Packaging and forming specification
E2: Embossed tape and reel

B	D	2	0	5	1	A	F	J	-	E 2

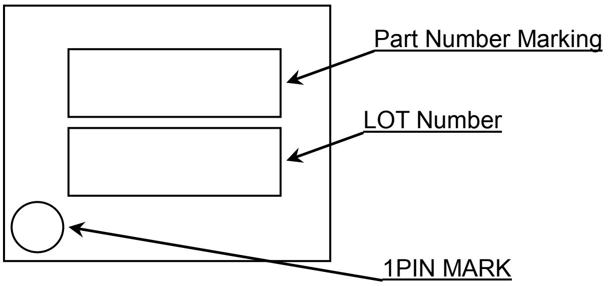
Part Number

Package
FJ: SOP-J8

Packaging and forming specification
E2: Embossed tape and reel

Marking Diagram

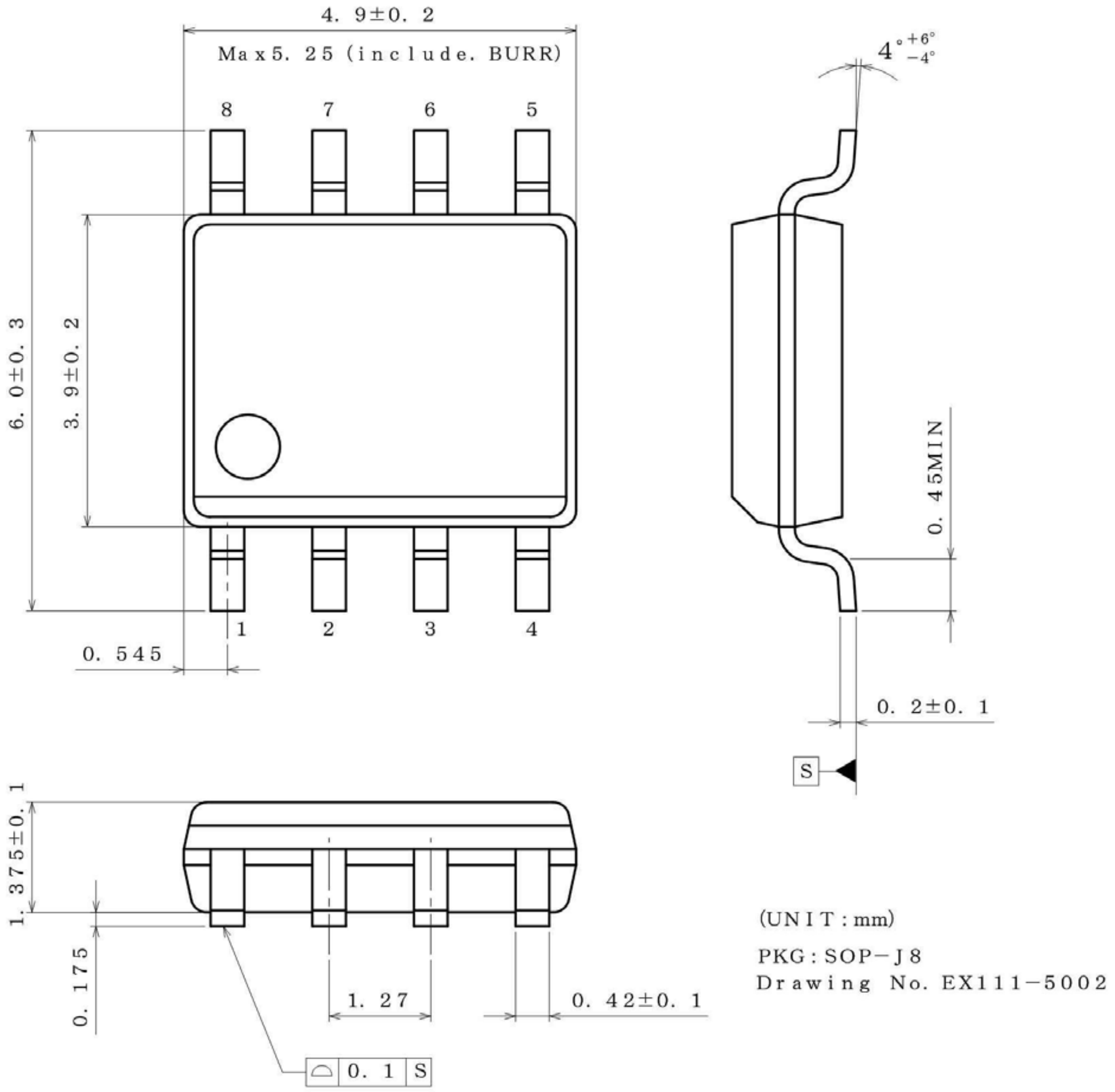
SOP-J8 (TOP VIEW)



Part Number	Part Number Marking
BD2041AFJ	D041A
BD2051AFJ	D051A

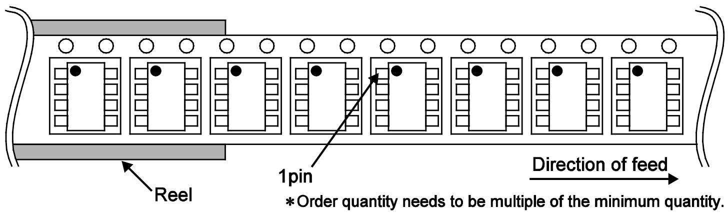
Physical Dimension, Tape and Reel Information

Package Name	SOP-J8



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

Revision History

Date	Revision	Changes
08.Mar.2013	001	New Release
21.Aug.2014	002	Applied the ROHM Standard Style and improved understandability.

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1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, 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 any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [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_2, H_2S, NH_3, SO_2, and NO_2
   [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

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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.

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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).

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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 Cl2, H2S, NH3, SO2, and NO2
   [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.

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