EARTH LEAKAGE CURRENT DETECTOR

EARTH LEAKAGE CURRENT DETECTOR IC

BD9584F

●General Description

BD9584F integrates leakage detector and amplifier. Especially, it is suitable for high sensitivity and a high-speed operation use, and since the operating temperature range is wide, it can be used for various uses.

●Key Specifications

- Operating supply voltage range : 8V to 20V
- Operating temperature range : −20°C to +90°C
- Supply current : 250μA(typ.)
- Trip voltage : 6.4mV to 12.0mV
- Output current ability(Ta=−20℃) : 250μA(min.)

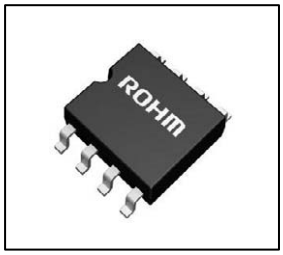
●Features

- Small temperature fluctuation and high input sensitivity
- Wide operating temperature range

●Packages

SOP8

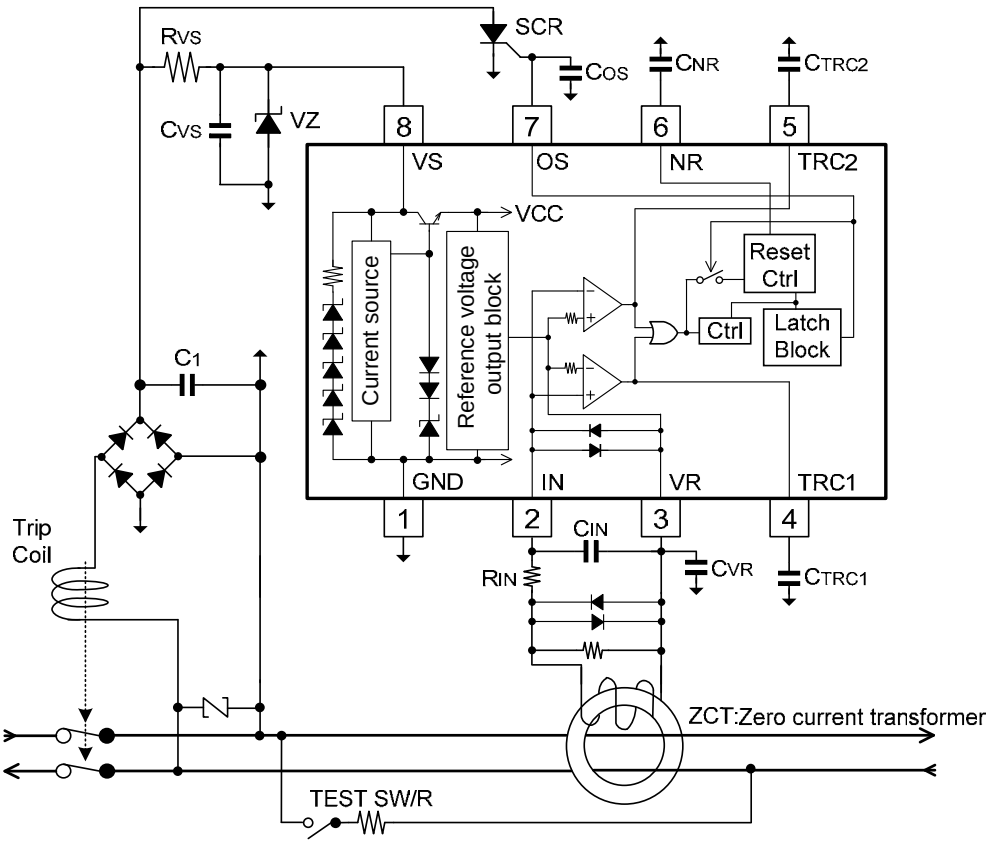
W(Typ.) x D(Typ.) x H(Max.)
5.00mm x 6.20mm x 1.71mm



●Applications

- Earth leakage circuit breaker
- Earth leakage circuit relay

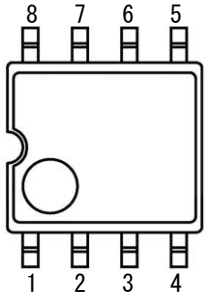
●Typical Application Circuit Example



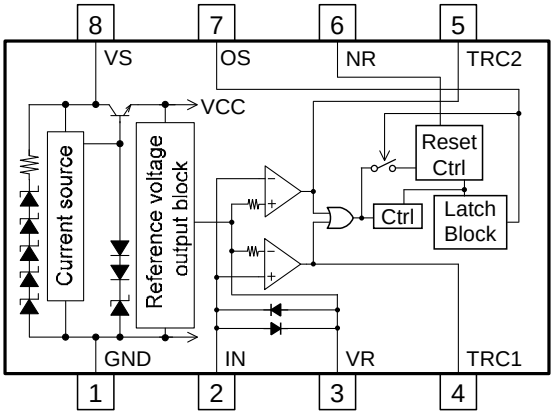
○Product structure : Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays.

●Pin Configurations

SOP8
(TOP VIEW)



●Block Diagrams



●Pin Descriptions

Pin No.	Symbol	Function
1	GND	Ground
2	IN	Input
3	VR	Reference voltage
4	TRC1	Capacitor connection for negative side detection
5	TRC2	Capacitor connection for positive side detection
6	NR	Capacitor connection for false signal detection
7	OS	Output
8	VS	Power supply

●Absolute Maximum Ratings

(Ta=25℃)

Parameter	Symbol	Rating	Unit
Supply current *1	IS	12.5	mA
Supply voltage	VS	36	V
Input terminal voltage	$V_{VR/IN}$	25	V
TRC1/TRC2/NR/OS terminal voltage	$V_{TRC1/TRC2/NR/OS}$	8	V
Power dissipation	Pd	680 *2	mW
Storage temperature	T_{stg}	−55 to +150	℃

*1 The power-supply voltage is limited by the internal clamping circuit.
*2 To use at temperature above Ta=25℃ reduce 5.5mW/℃. Mounted on a glass epoxy PCB (70mm×70mm×1.6mm)

●Recommended Operating Ratings

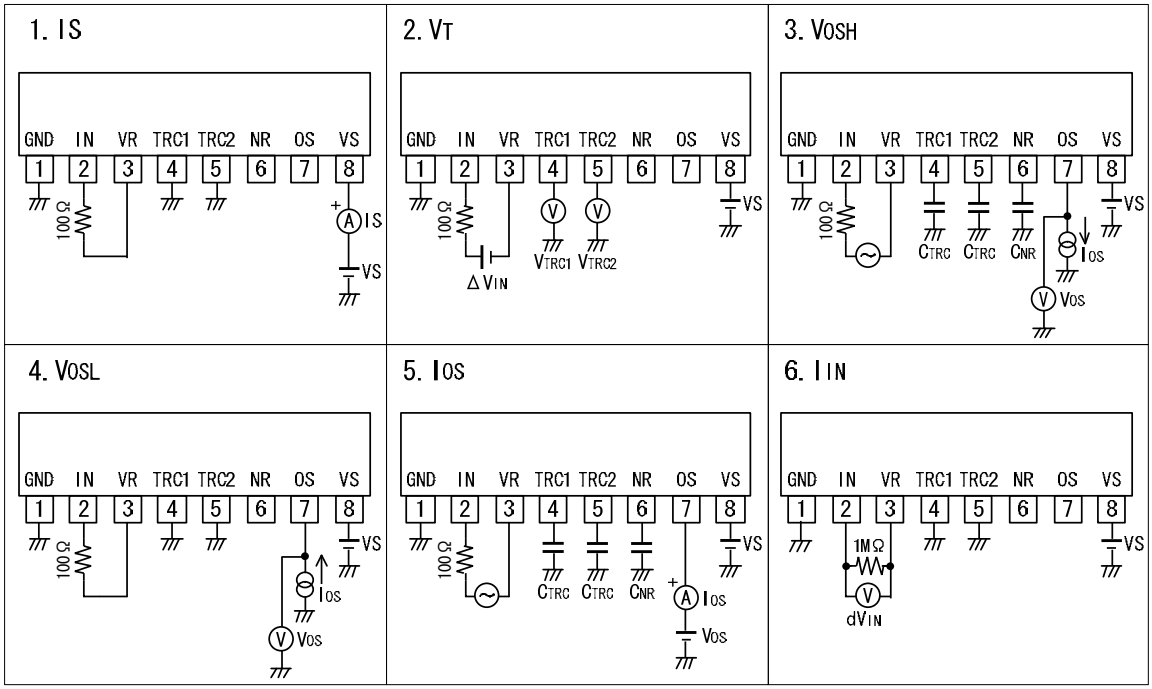
Parameter	Symbol	Limits	Unit
Supply voltage	VS	8 to 20	V
Operating temperature	T_{opr}	−20 to +90	℃

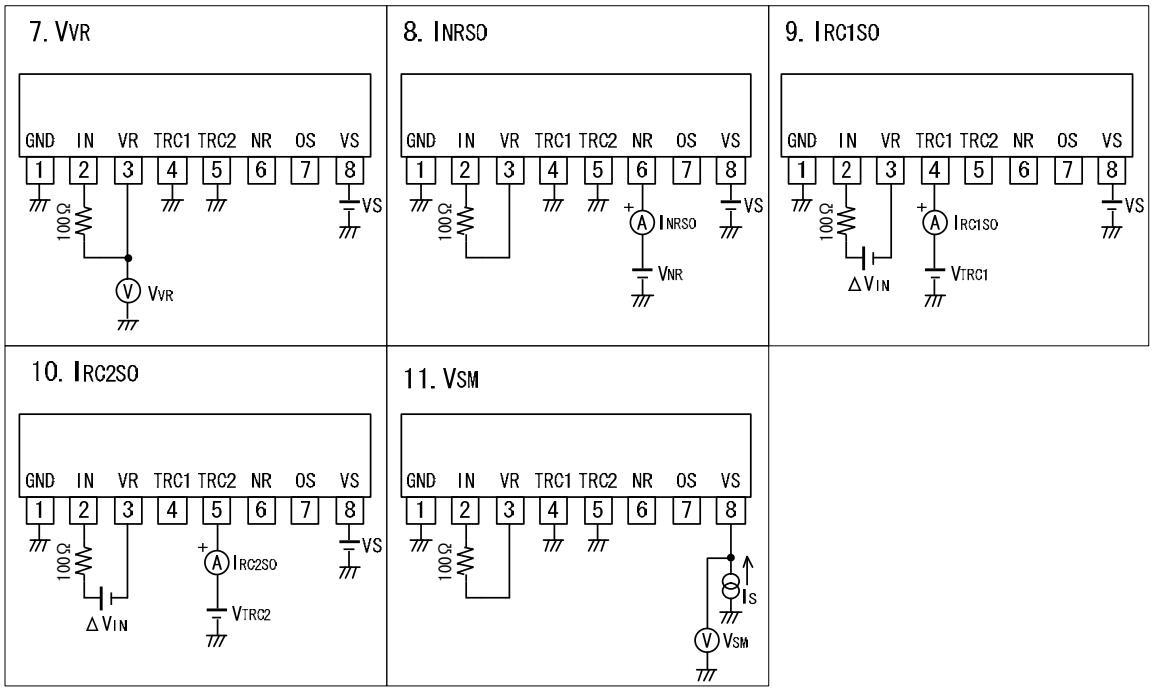
●Electrical Characteristics

(Unless otherwise specified, VS=12V, GND=0V, Ta=25℃)

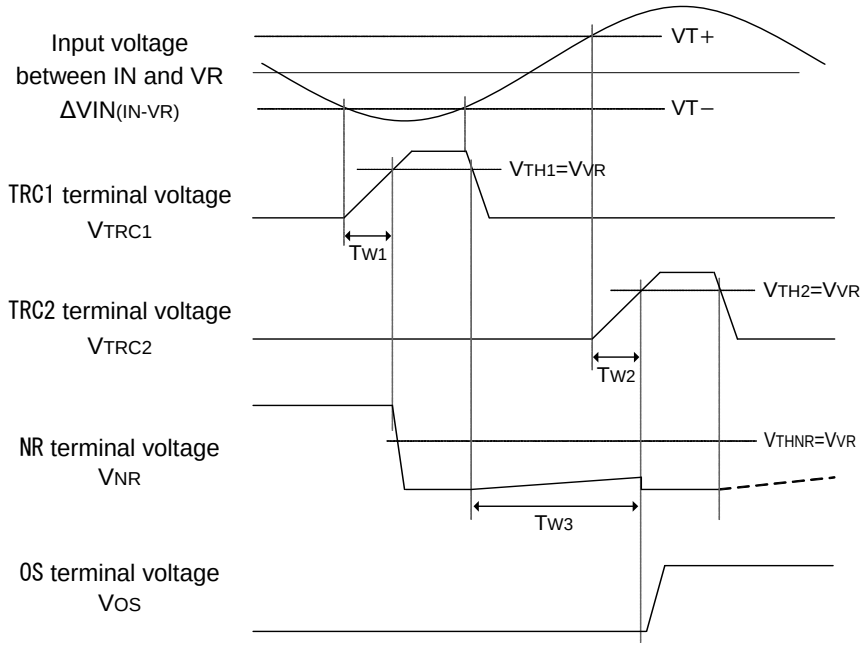
Parameter	Symbol	Temperature Range	Limits			Unit	Conditions
			Min.	Typ.	Max.		
Supply Current(Standby)	IS	25℃	-	250	340	μA	
Trip Voltage	VT	−20℃ to +90℃	6.4	9.2	12.0	mV	CTRC=0.047μF
OS HIGH Voltage	VOSH	25℃	3	-	-	V	IOS=250μF, VS=8V to 20V
OS LOW Voltage	VOSL	25℃	-	-	200	mV	IOS=−100μF, VS=8V to 20V
OS Source Current	IOS	25℃	250	-	-	μA	VOS=0.8V
IN Input Bias Current	IIN	25℃	-	100	-	nA	VVR=VIN
VR Voltage	VVR	25℃	2.1	2.4	2.7	V	VS=8V to 20V
NR Source Current	INRSO	25℃	6.9	9.9	12.9	μA	VNR=2.7V, VVR=VIN
NR Threshold Voltage	VTHNR	25℃	2.1	2.4	2.7	V	
TW3 Pulse Width	TW3	25℃	53.7	80.0	129.1	ms	CNR=0.33μF
TRC1 Source Current	IRC1SO	25℃	35.9	51.3	66.7	μA	VTRC1=2.0V, ΔVIN=VIN−VVR=−0.3V
TRC1 Threshold Voltage	VTH1	25℃	2.1	2.4	2.7	V	
TW1 Pulse Width	TW1	25℃	1.48	2.20	3.53	ms	CTRC=0.047μF
TRC2 Source Current	IRC2SO	25℃	35.9	51.3	66.7	μA	VTRC2=2.0V, ΔVIN=VIN−VVR=+0.3V
TRC2 Threshold Voltage	VTH2	25℃	2.1	2.4	2.7	V	
TW2 Pulse Width	TW2	25℃	1.48	2.20	3.53	ms	CTRC=0.047μF
VS Clamp Voltage	VSM	25℃	27.8	29.4	31.0	V	IS=10.5mA

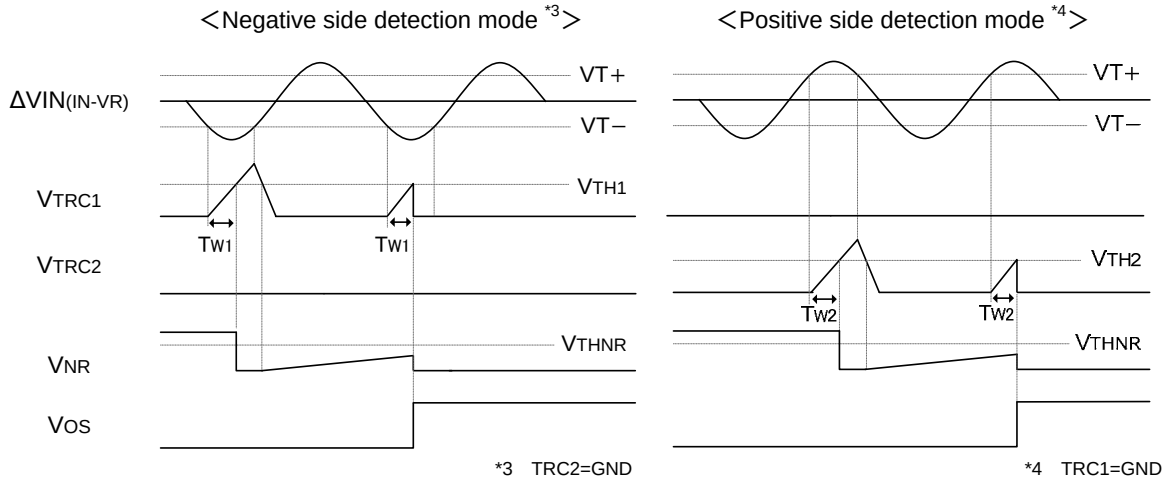
●Test circuits





●Timing Chart





*3 TRC2=GND

*4 TRC1=GND

●**Typical Performance Curves(reference data)**

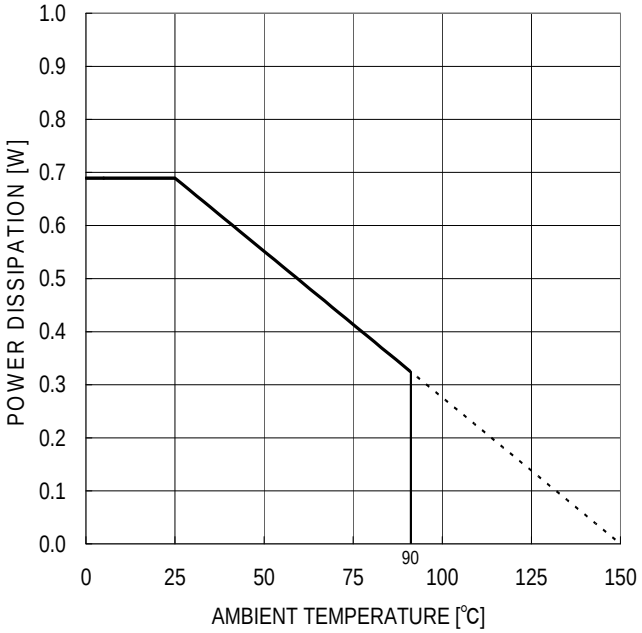


Figure 1
Derating curve

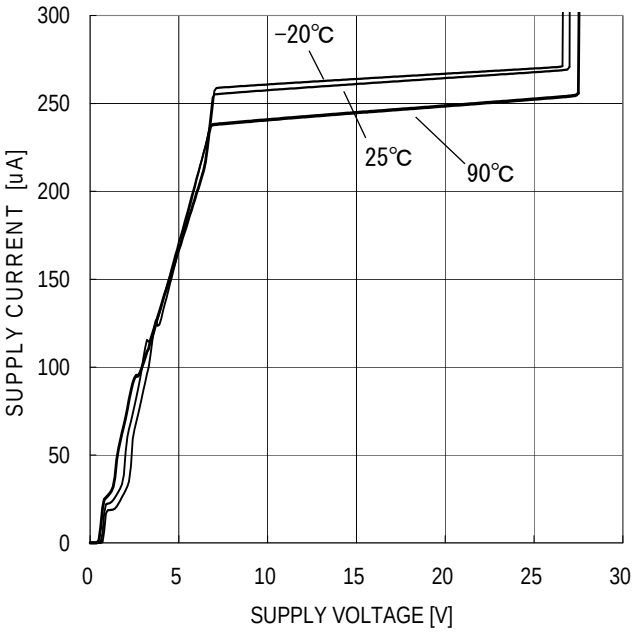


Figure 2
Supply current - Supply voltage

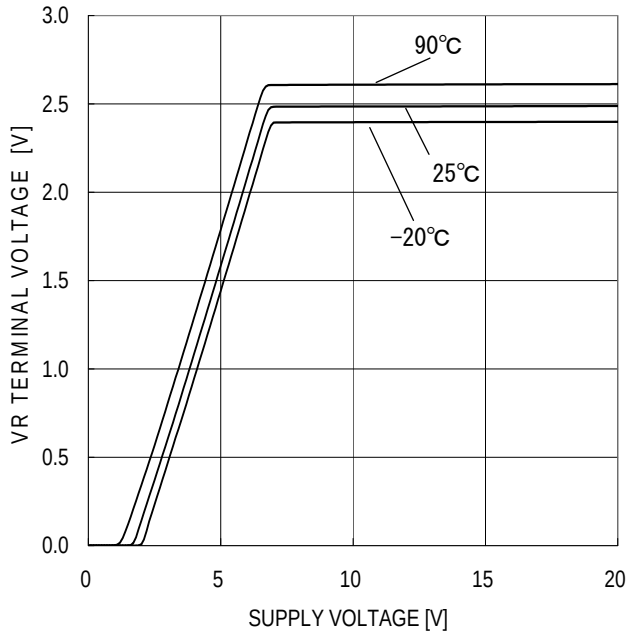


Figure 3
VR terminal voltage
- Supply voltage

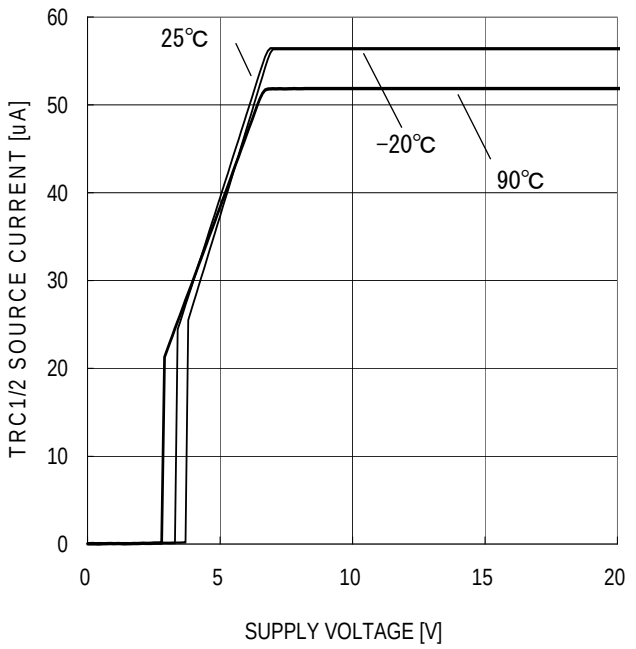


Figure 4
TRC1/2 terminal source current
- Supply voltage

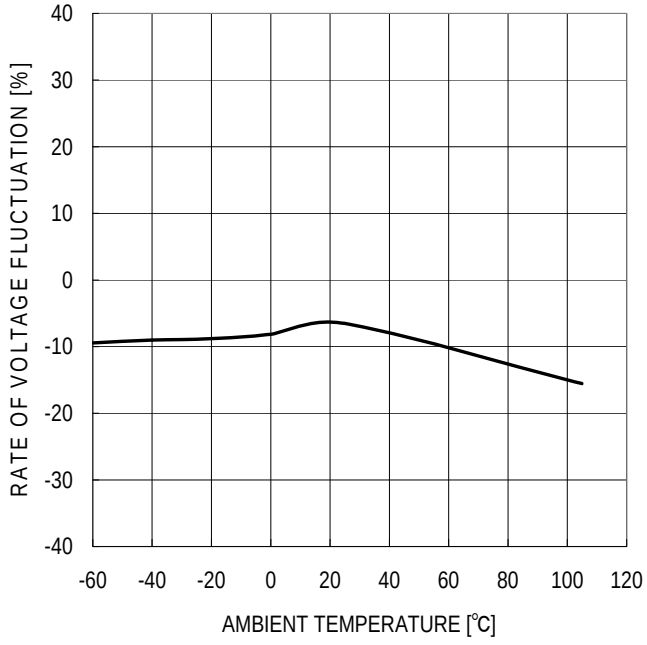


Figure 5
Trip voltage fluctuation rate
- Ambient temperature

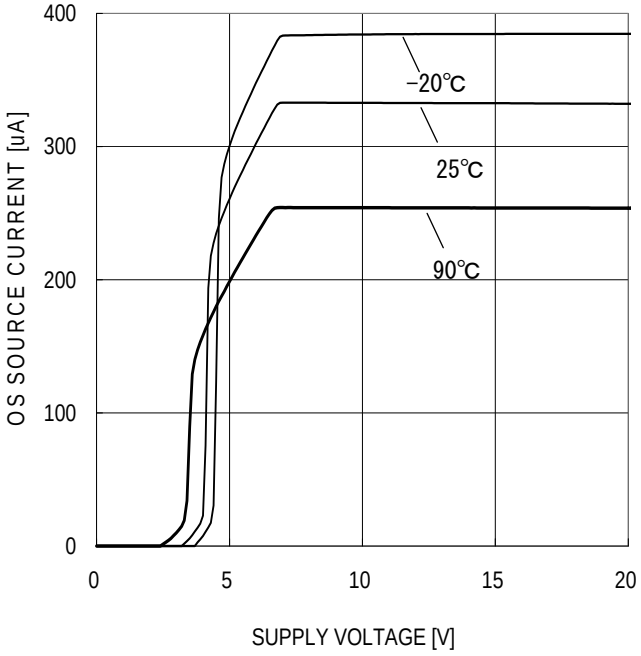


Figure 6
OS terminal source current - Supply voltage

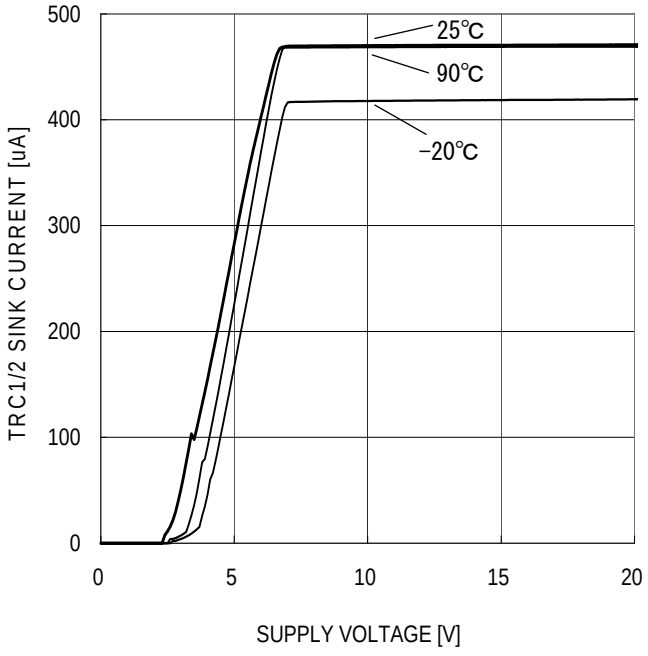


Figure 7
TRC1/2 terminal source current - Supply voltage

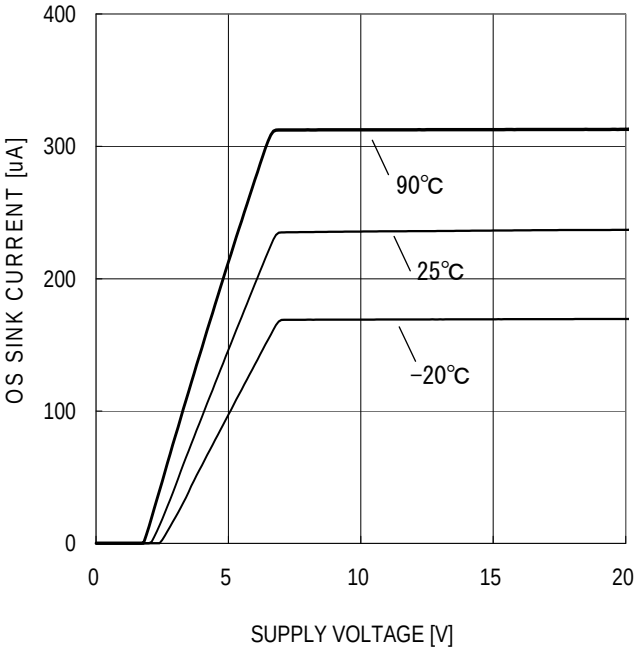


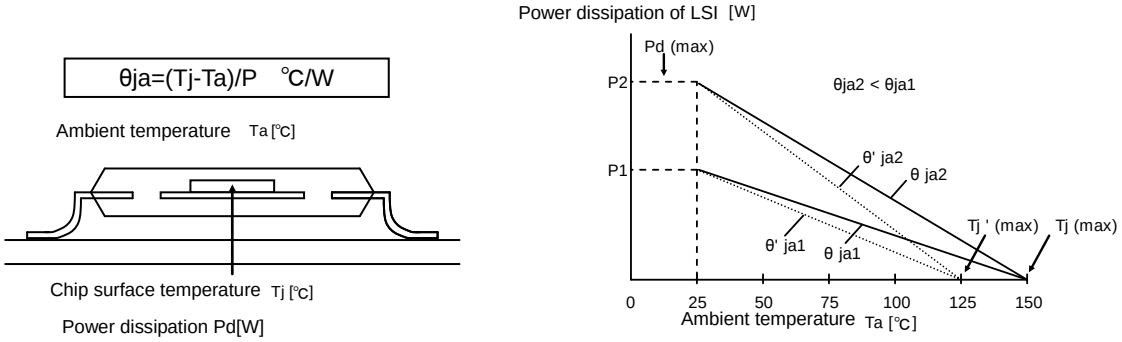
Figure 8
OS terminal sink current - Supply voltage

●Power Dissipation

Power dissipation(total loss) indicates the power that can be consumed by IC at Ta=25℃(normal temperature). IC is heated when it consumed power, and the temperature of IC chip becomes higher than ambient temperature. The temperature that can be accepted by IC chip depends on circuit configuration, manufacturing process, and consumable power is limited. Power dissipation is determined by the temperature allowed in IC chip (maximum junction temperature) and thermal resistance of package (heat dissipation capability). The maximum junction temperature is typically equal to the maximum value in the storage temperature range. Heat generated by consumed power of IC radiates from the mold resin or lead frame of the package. The parameter which indicates this heat dissipation capability(hardness of heat release)is called thermal resistance, represented by the symbol θja℃/W. The temperature of IC inside the package can be estimated by this thermal resistance. Fig.9(a) shows the model of thermal resistance of the package. Thermal resistance θja, ambient temperature Ta, junction temperature Tj, and power dissipation Pd can be calculated by the equation below

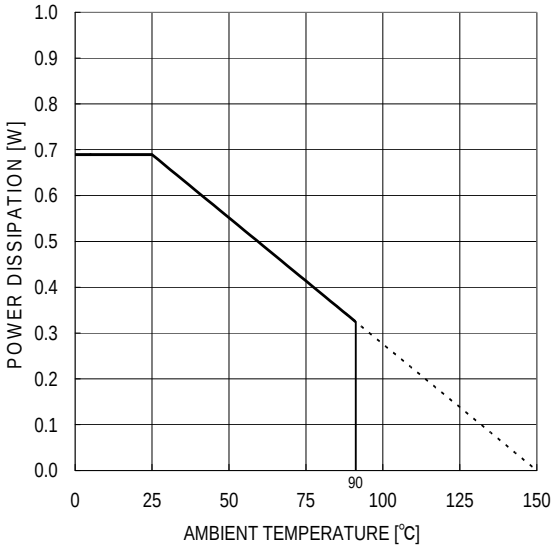
$$\theta ja = (Tj - Ta) / Pd \quad ℃/W \qquad \cdots\cdots (I)$$

Derating curve in Fig.9(b) indicates power that can be consumed by IC with reference to ambient temperature. Power that can be consumed by IC begins to attenuate at certain ambient temperature. This gradient is determined by thermal resistance θja. Thermal resistance θja depends on chip size, power consumption, package, ambient temperature, package condition, wind velocity, etc even when the same of package is used. Thermal reduction curve indicates a reference value measured at a specified condition. Fig.10(a) shows a derating curve for an example of BD9584F.



(a) Thermal resistance (b) Derating curve

Figure 9. Thermal resistance and derating



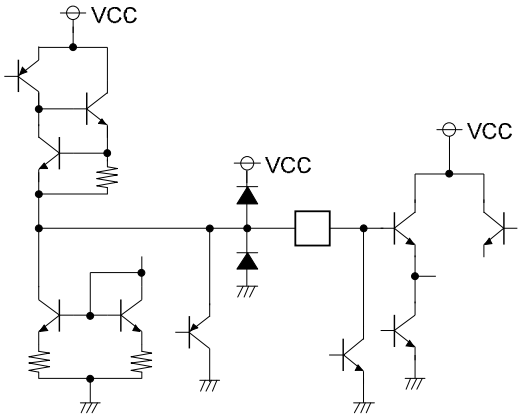
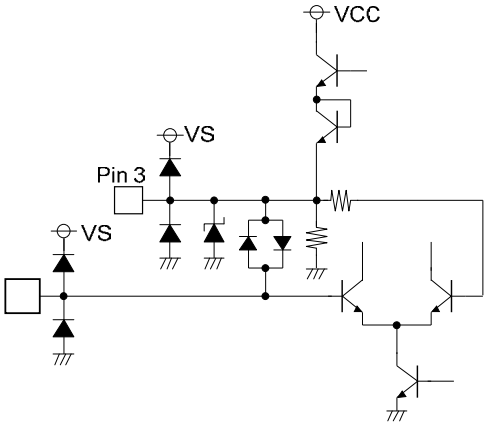
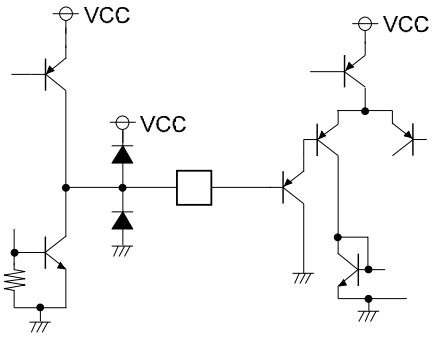
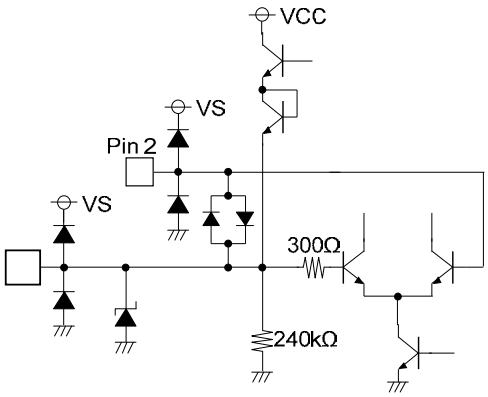
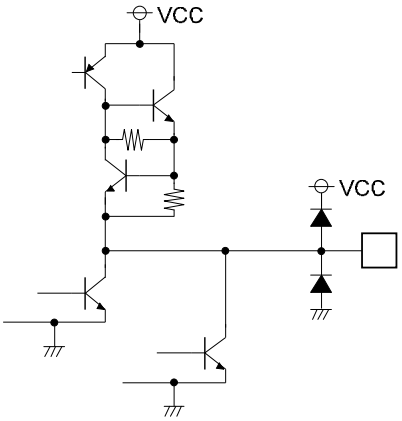
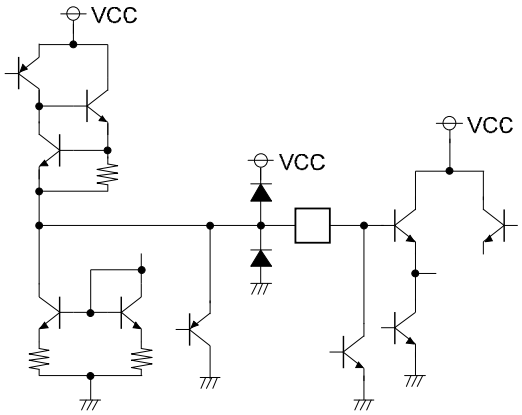
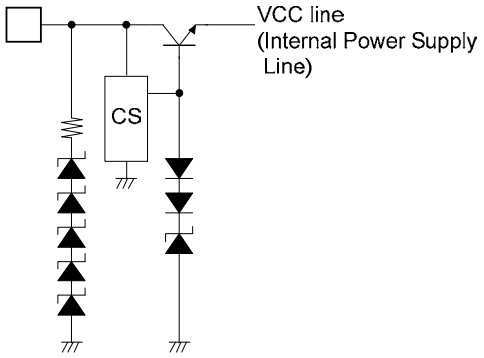
(a) BD9584F

	Derating curve slope	UNIT
BD9584F	5.5	mW/℃

When using the unit above Ta=25℃, subtract the value above per degree℃
Permissible dissipation is a value when FR4 glass epoxy board 70mm×70mm×1.6mm (cooper foil area below 3%) is mounted.

Figure 10. Derating curve

●I/O equivalence circuit

Pin 1 [GND]		Pin 5 [TRC2]	
Pin 2 [IN]		Pin 6 [NR]	
Pin 3 [VR]		Pin 7 [OS]	
Pin 4 [TRC1]		Pin 8 [VS]	

●Operational Notes

1) Absolute maximum ratings
Absolute maximum ratings are the values which indicate the limits, within which the given voltage range can be safely charged to the terminal. However, it does not guarantee the circuit operation.

2) Power dissipation Pd
Using the unit in excess of the rated power dissipation may cause deterioration in electrical characteristics due to a rise in chip temperature, including reduced current capability. Therefore, please take into consideration the power dissipation (Pd) under actual operating conditions and apply a sufficient margin in thermal design. Refer to the thermal derating curves for more information.

3) Terminal short-circuits
When the output and power supply terminals are shorted, excessive output current may flow, resulting in undue heat generation and, subsequently, destruction.

4) Ground terminal voltage
All time, Ground terminal voltage should keep lowest voltage.
In addition, please confirm whether there is not really a terminal becoming the voltage that is lower than GND including a transitional phenomenon.

5) Operation in a strong electromagnetic field
Operation in a strong electromagnetic field may cause malfunctions.

6) Short-circuit between pins and erroneous mounting
Incorrect mounting may damage the IC. In addition, the presence of foreign particles between the outputs, the output and the power supply, or the output and GND may result in IC destruction.

7) IC handing
Applying mechanical stress to the IC by deflecting or bending the board may cause fluctuations in the electrical characteristics due to piezo resistance effects.

8) Board inspection
Connecting a capacitor to a pin with low impedance may stress the IC. Therefore, discharging the capacitor after every process is recommended. In addition, when attaching and detaching the jig during the inspection phase, ensure that the power is turned off before inspection and removal. Furthermore, please take measures against ESD in the assembly process as well as during transportation and storage.

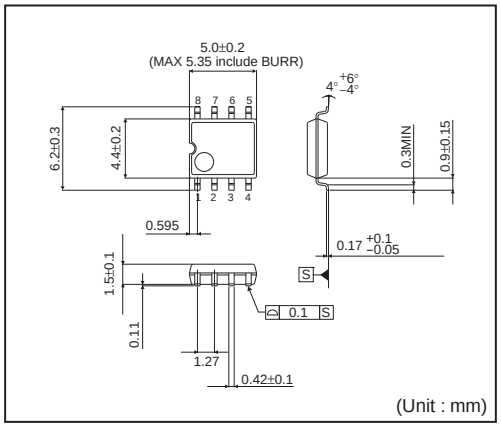
Status of this document
The Japanese version of this document is formal specification. A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document formal version takes priority.

●Ordering Information

B D 9 5 8 4 F	E 2
Part Number	Package F: SOP8
	Packaging and forming specification E2: Embossed tape and reel (SOP8)

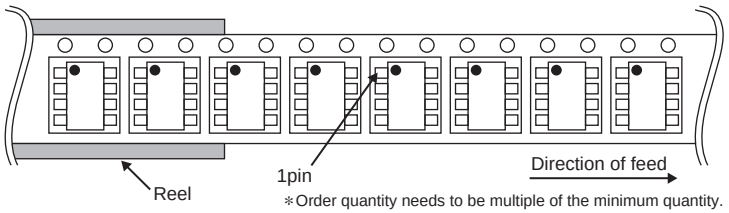
●Physical Dimension Tape and Reel Information

SOP8



<Tape and Reel information>

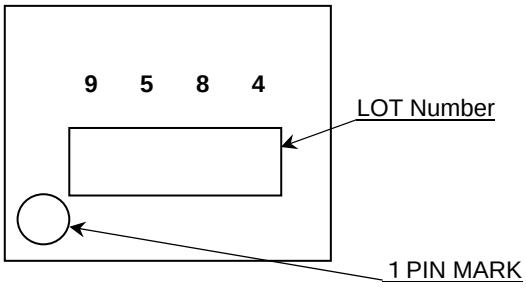
Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



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

●Marking Diagrams

SOP8
(TOP VIEW)



●**Revision History**

Date	Revision	Changes
2012.10.30	001	New Release

Notice

Precaution on using ROHM Products

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	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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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_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

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 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.

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.

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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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