Datasheet

Small Signal IGBT/MOSFET Gate Driver Series

Three-Channel Small Signal IGBT/MOSFET Gate Drivers

BD6563FV-LB

●General Description

BD6563FV-LB is 3-ch gate driver to drive gate of IGBT/MOSFET from 5V input signals.

Output signals consist of each high side and low side drive signals in order to make ON/OFF timing control easy. 1 input signal generates 2 output signals which are high side output and low side output signal for 1 channel drive. High side output signal outputs "H" level and high impedance and low side output signal outputs "L" signal and high impedance.

●Key Specifications

- Output-side supply voltage(max.): 30V
- Input-side supply voltage: 3.0V to 5.5V
- Output peak current(≦1us): ±0.6A
- Input-Output delay time (at VDD=3.3V):380ns(Max.)
- Input-Output delay time (at VDD=5.0V):345ns(Max.)
- Operating temperature range: -25℃ to +125℃

●Features

- Three-Channel Gate Drivers
- Separated Turn ON and Turn OFF Output

●Package

W(Typ.) x D(Typ.) x H(Max.)

SSOP-B16 5.00mm x 6.40mm x 1.35mm

SSOP-B16

●Applications

- Low-side IGBT/MOSFET Gate Drive for DCDC Converter
- Low-side IGBT/MOSFET Gate Drive for Inverter

●Typical Application Circuit

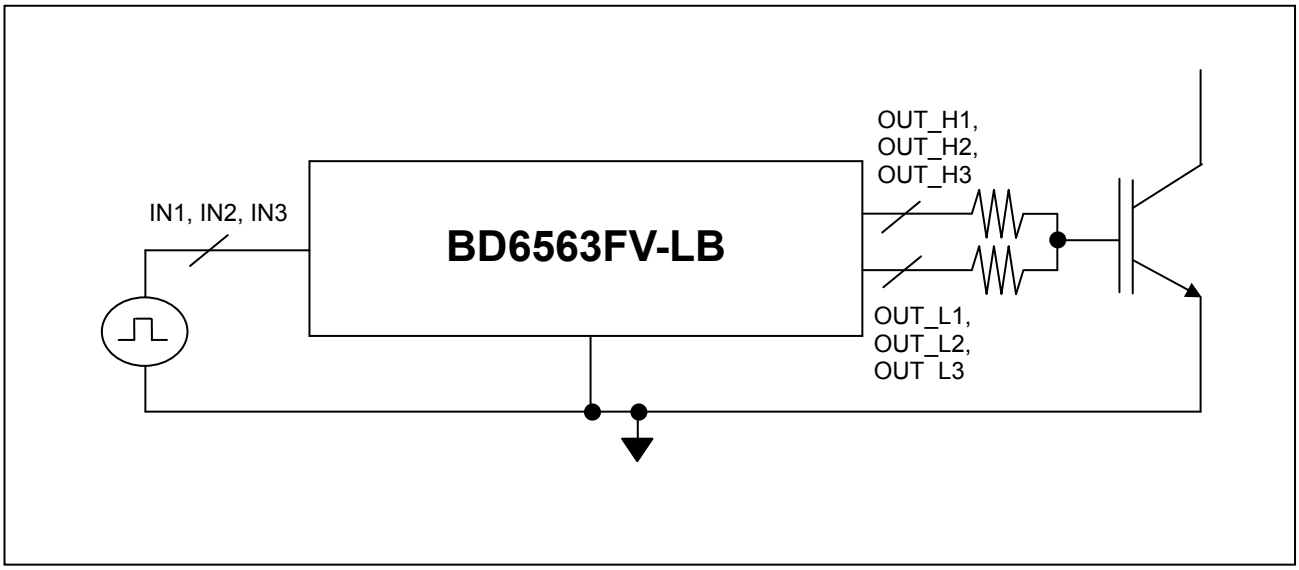


Figure 1. Typical Application Circuit

●Pin Configuration

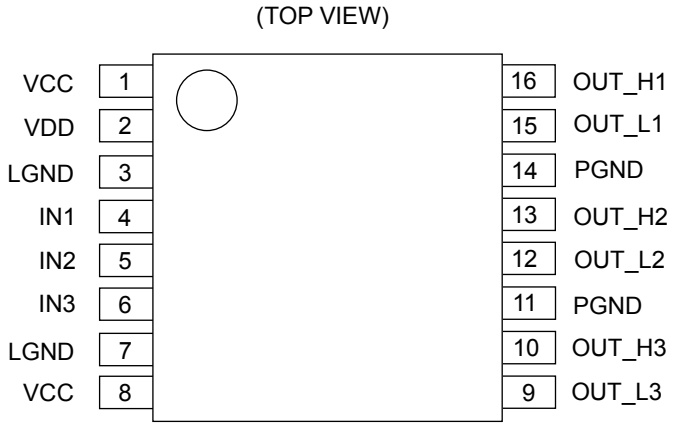


Figure 2. Pin configuration

●Pin Description

Pin No.	Pin Name	Function
1	VCC	Output-side power supply pin
2	VDD	Input-side power supply pin
3	LGND	Input-side ground pin
4	IN1	Control input 1 pin
5	IN2	Control input 2 pin
6	IN3	Control input 3 pin
7	LGND	Input-side ground pin
8	VCC	Output-side power supply pin
9	OUT_L3	Low-side output 3 pin
10	OUT_H3	High-side output 3 pin
11	PGND	Output-side ground pin
12	OUT_L2	Low-side output 2 pin
13	OUT_H2	High-side output 2 pin
14	PGND	Output-side ground pin
15	OUT_L1	Low-side output 1 pin
16	OUT_H1	High-side output 1 pin

●Block Diagram

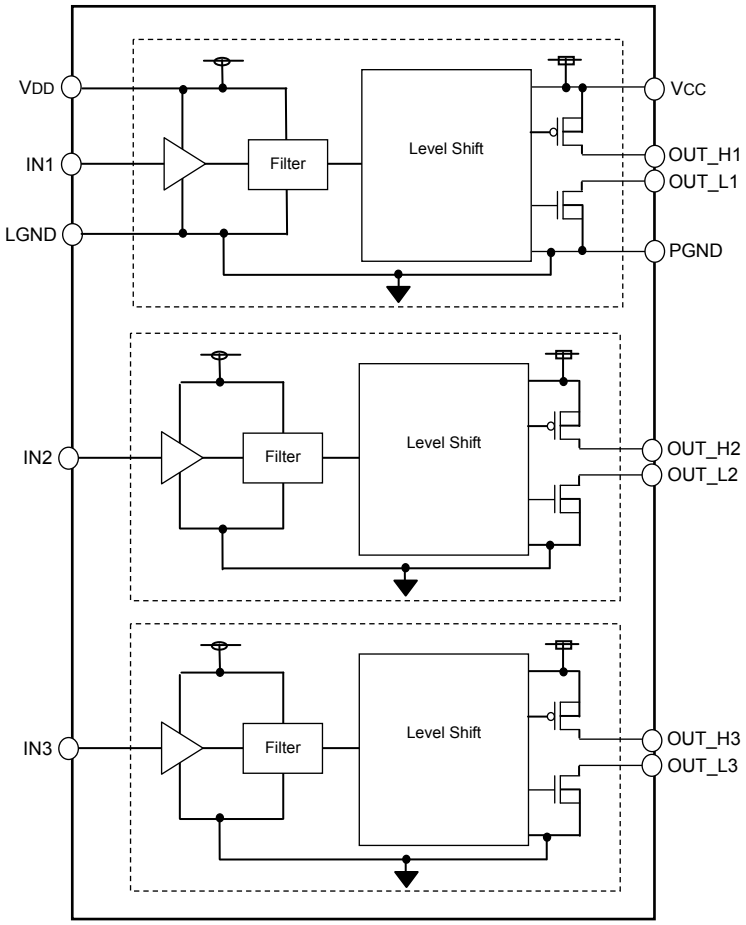


Figure 3. Block Diagram

●**Absolute Maximum Ratings**

Parameter	Symbol	Limits	Units
Output-side supply voltage	V_{CCMAX}	30	V
Input-side supply voltage	V_{DDMAX}	7	V
INX *1 pin input voltage	V_{INXMAX}	-0.3 to VDD+0.3	V
OUT_HX / OUT_LX *1 pin output voltage	$V_{OUTHXMAX}$ $V_{OUTLXMAX}$	-0.3 to VCC+0.3	V
OUT_HX *1 pin output current (Peak 1us)	$I_{OUTHXMAX}$	-0.6*2	A
OUT_LX *1 pin output current (Peak 1us)	$I_{OUTLXMAX}$	+0.6*2	A
Power dissipation	P_d	0.87*3	W
Operating temperature range	T_{OPR}	-25 to +125	℃
Storage temperature range	T_{stg}	-55 to +150	℃
Junction temperature	T_{jmax}	+150	℃

*1 X=1,2,3
*2 Should not exceed Pd and Tj=150°C.
*3 Derate above Ta=25°C at a rate of 7.0mW/°C. Mounted on a glass epoxy of 70 mm × 70 mm × 1.6 mm.

●**Recommended Operating Ratings**

Parameter	Symbol	Min.	Max.	Units
Output-side supply voltage	V_{CC}	10	25	V
Input-side supply voltage	V_{DD}	3.0	5.5	V
INX *1 high level input voltage	V_{DD}	V_{DD}×0.7	-	V
INX *1 low level input voltage	V_{DD}	-	V_{DD}×0.3	V

*1 X=1,2,3

●**Electrical Characteristics**

（Unless otherwise specified Ta=-25℃ to 125℃, V_{DD}=3.0V to 5.5V, V_{CC}=10V to 25V）

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
INX *1 pull-down resistance	R_{INX}	25	50	100	kΩ	
Output-side circuit current 1	I_{CC1}	-	0.32	1	mA	IN1=IN2=IN3=0V
Output-side circuit current 2	I_{CC2}	-	0.43	1	mA	IN1=IN2=IN3=25kHz, Duty=50%
Input-side circuit current 1	I_{DD1}	-	0	10	uA	IN1=IN2=IN3=0V
Input-side circuit current 2	I_{DD2}	-	25	100	uA	IN1=IN2=IN3=25kHz, Duty=50%
High level output voltage	V_{OUTHX}	VCC-2.0	VCC-1.0	VCC-0.4	V	I_{OUTHX}=-100mA
Low level output voltage	V_{OUTLX}	0.15	0.4	1.0	V	I_{OUTLX}=100mA
Output delay time H 1	t_{PLHX1}	170	250	330	ns	V_{DD} =5.0V
Output delay time L 1	t_{PHLX1}	185	265	345	ns	V_{DD} =5.0V
Delay matching 1, OUT_HX and OUT_LX $t_{PLHX1} – t_{PHLX1}$ *1	$\Delta t_{PLHX1-PHLX1}$	-30	-15	0	ns	V_{DD} =5.0V
Output delay time H 2	t_{PLHX2}	170	250	330	ns	V_{DD} =3.3V
Output delay time L 2	t_{PHLX2}	220	300	380	ns	V_{DD} =3.3V
Delay matching 2, OUT_HX and OUT_LX $t_{PLHX2} – t_{PHLX2}$ *1	$\Delta t_{PLHX2-PHLX2}$	-80	-50	0	ns	V_{DD} =3.3V
Delay matching, OUT_H1,OUT_H2,OUT_H3 $t_{PLHX} – t_{PLHY}$ *1	Δt_{PLH}	-20	0	20	ns	
Delay matching, OUT_L1,OUT_L2,OUT_L3 $t_{PHLX} – t_{PHLY}$ *1	Δt_{PHL}	-20	0	20	ns	

*1 X=1,2,3, Y=1,2,3

●**Typical Performance Curves**

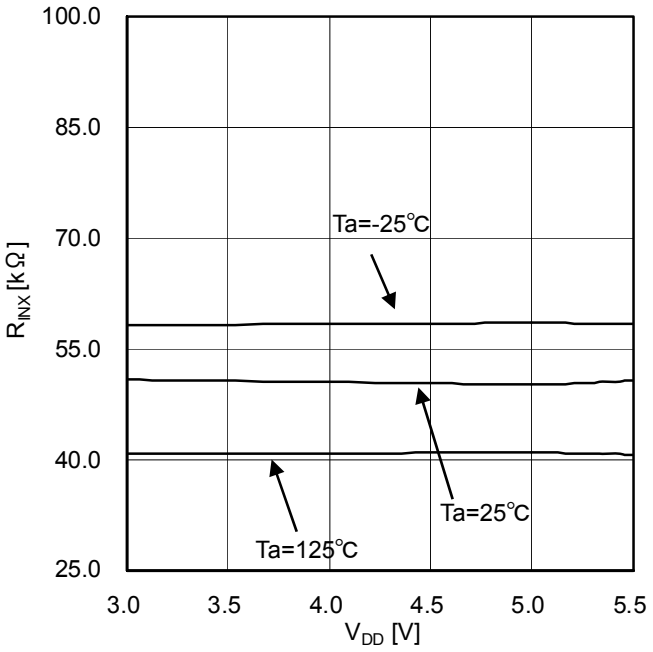


Figure 4. INX pull-down resistance

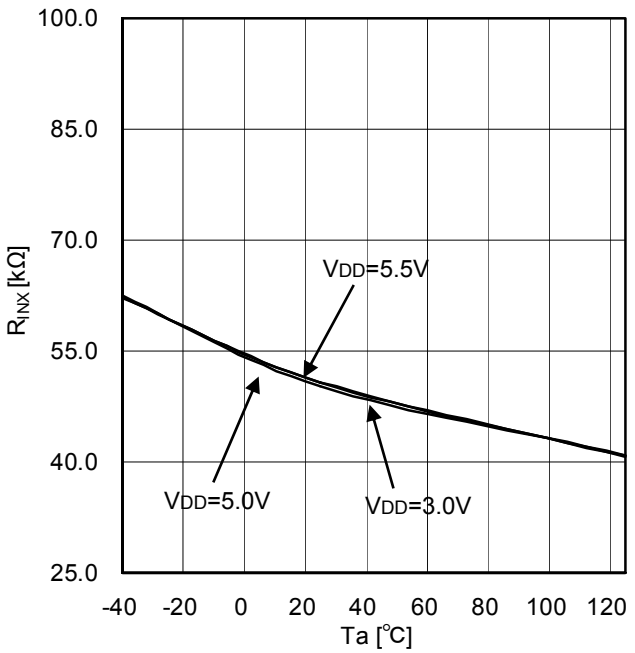


Figure 5. INX pull-down resistance

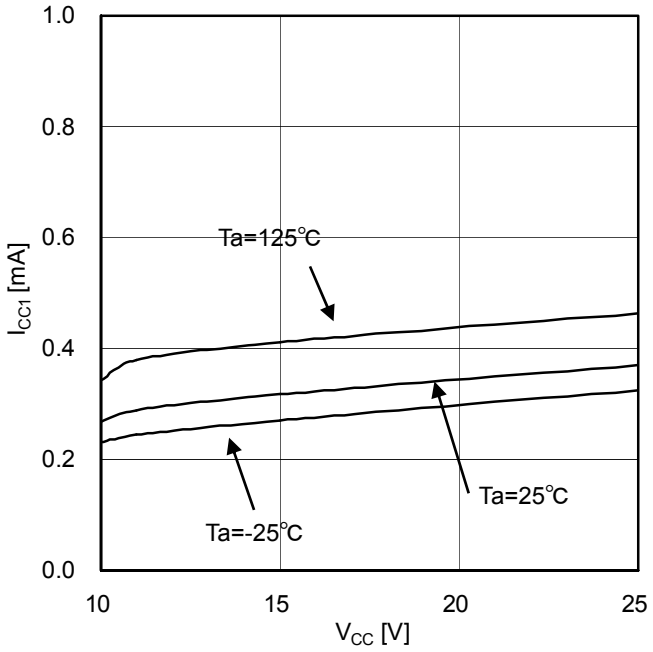


Figure 6. Output-side circuit current
（at IN1=IN2=IN3=L）

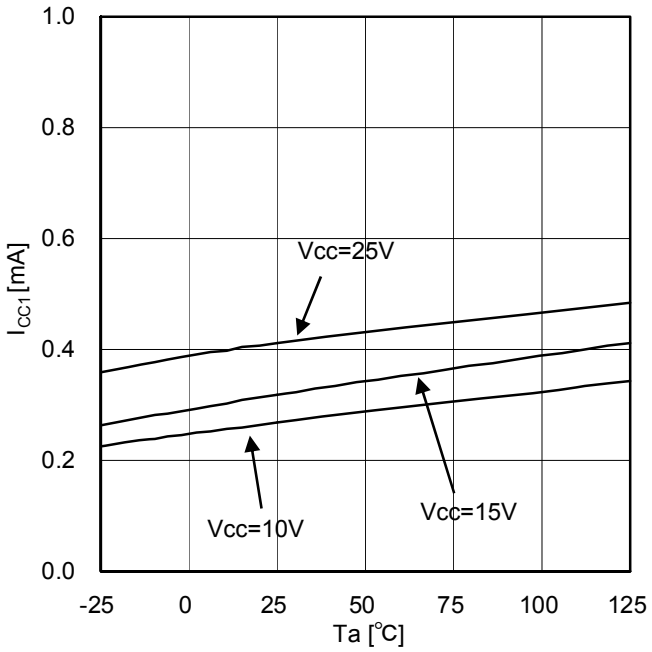


Figure 7. Output-side circuit current
（at IN1=IN2=IN3=L）

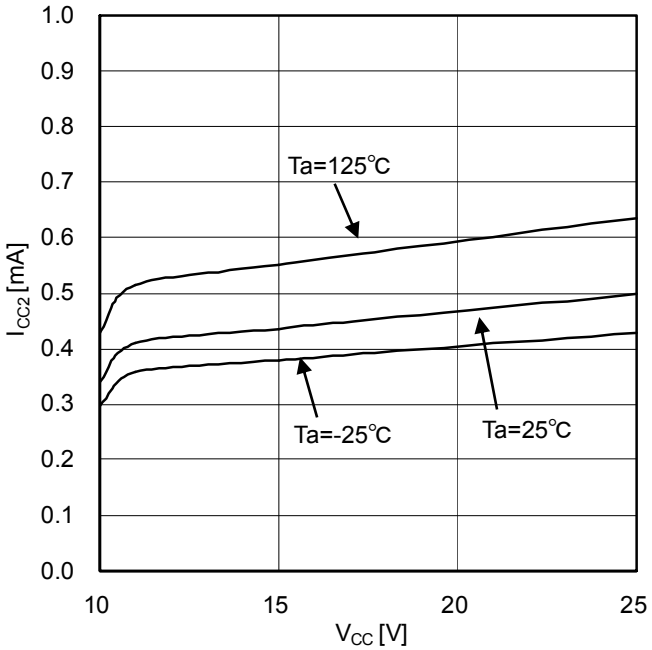


Figure 8. Output-side circuit current
（at IN1=IN2=IN3=25kHz and Duty=50%）

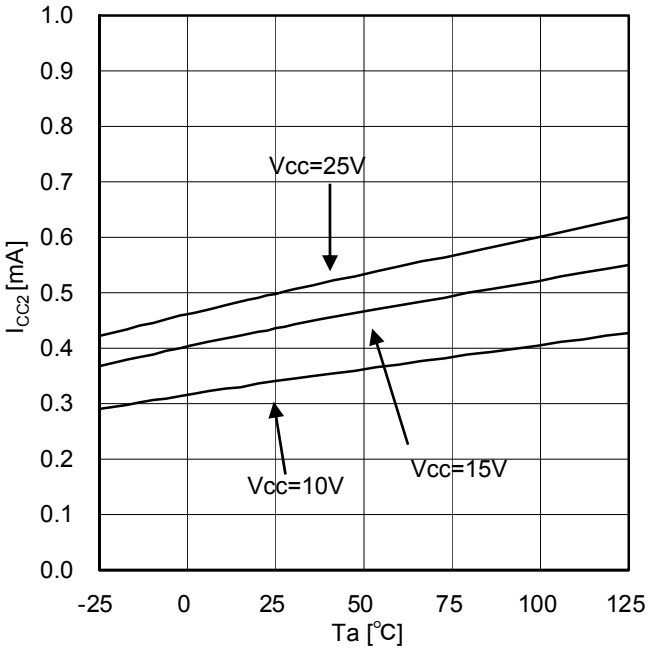


Figure 9. Output-side circuit current
（at IN1=IN2=IN3=25kHz and Duty=50%）

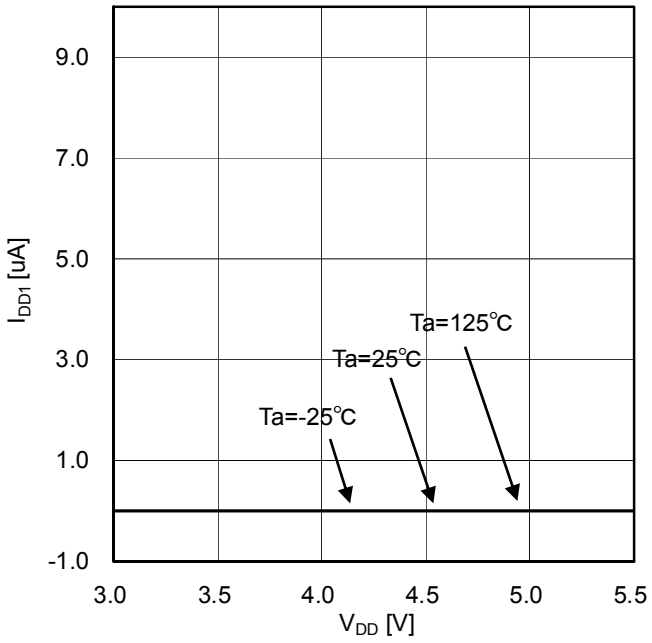


Figure 10. Input-side circuit current
（at IN1=IN2=IN3=L）

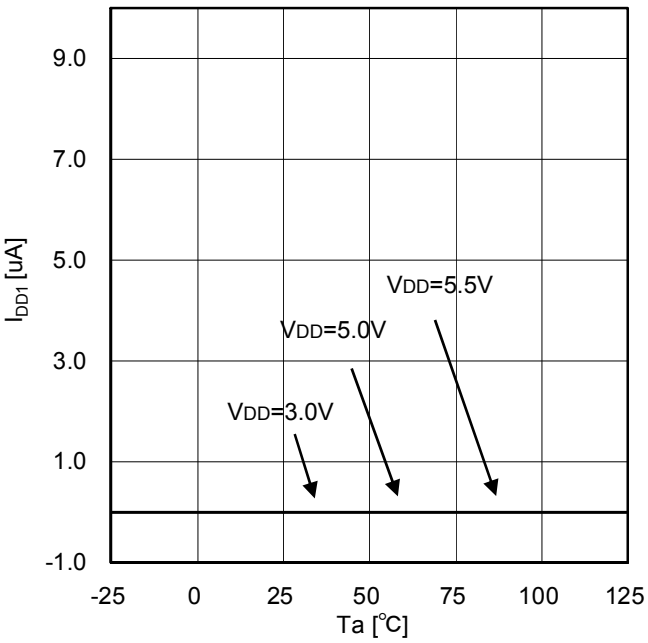


Figure 11. Input-side circuit current
（at IN1=IN2=IN3=L）

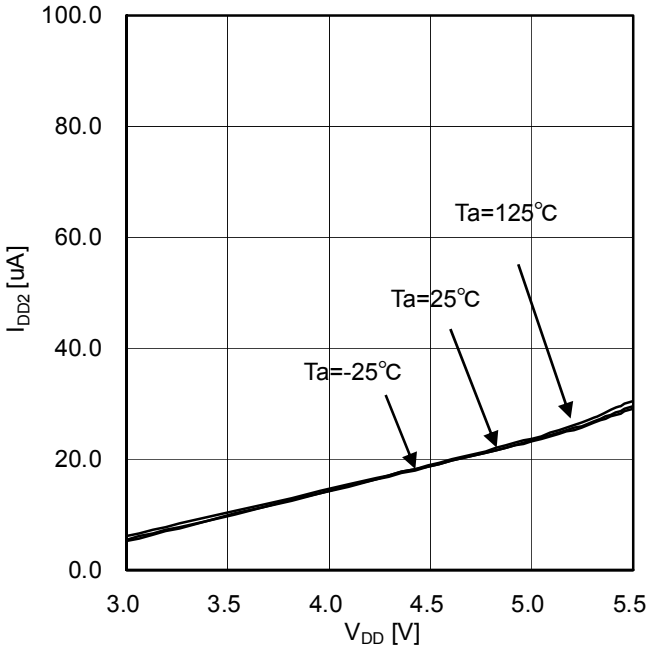


Figure 12. Input-side circuit current
（at IN1=IN2=IN3=25kHz and Duty=50%）

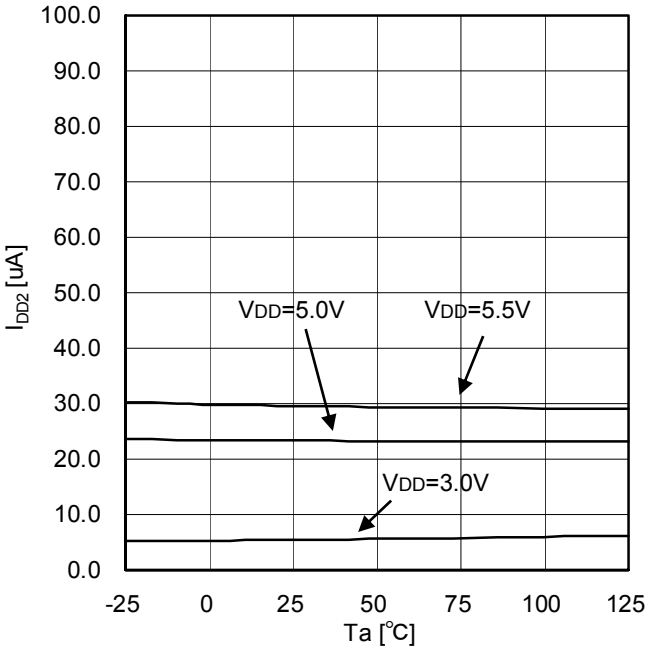


Figure 13. Input-side circuit current
（at IN1=IN2=IN3=25kHz and Duty=50%）

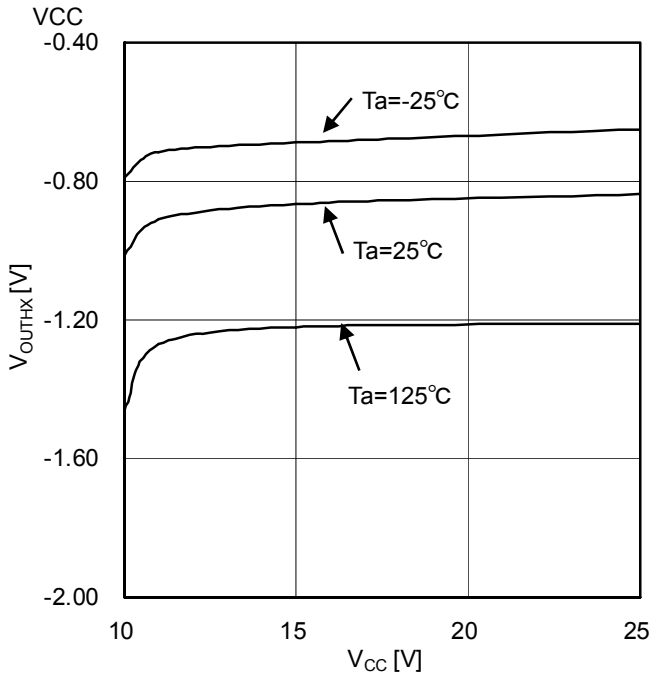


Figure 14. High level output voltage

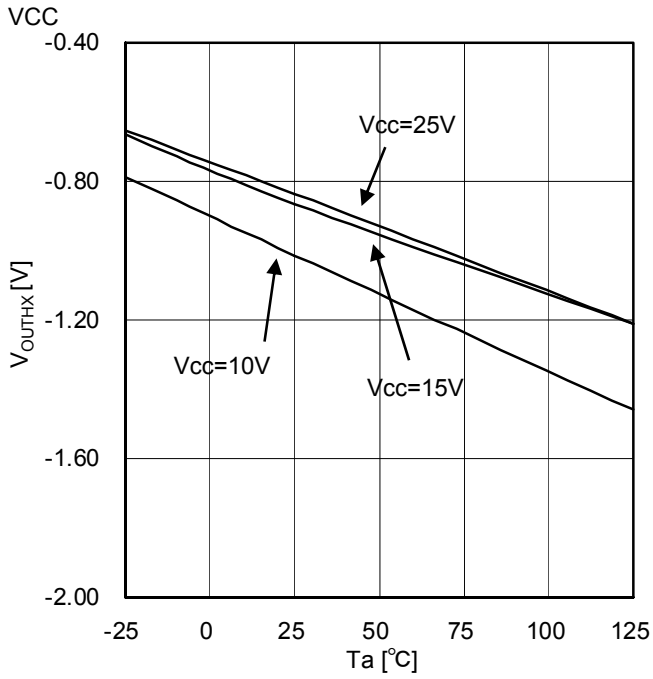


Figure 15. High level output voltage

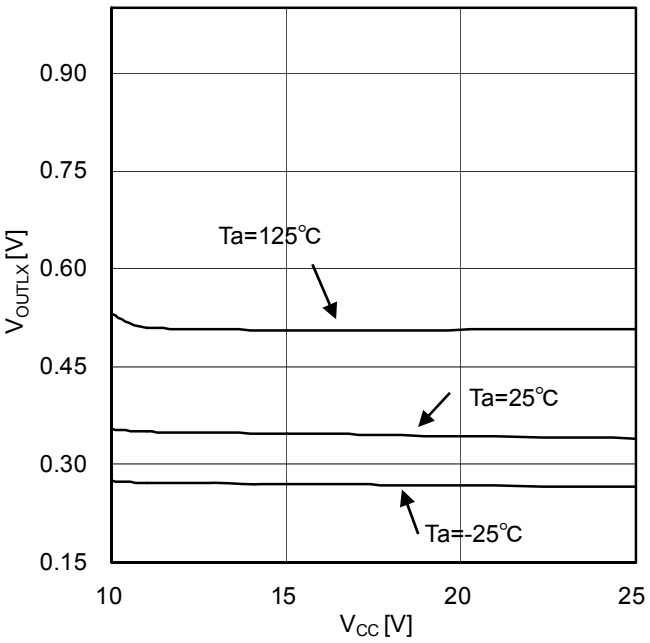


Figure 16. Low level output voltage

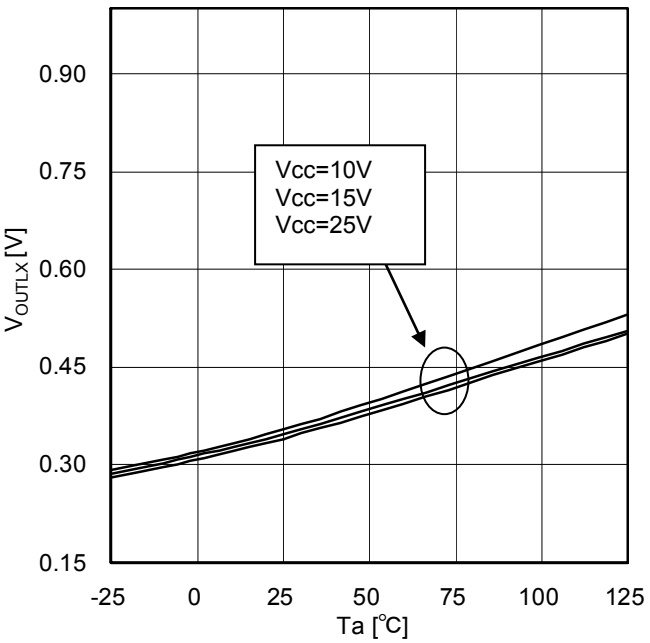


Figure 17. Low level output voltage

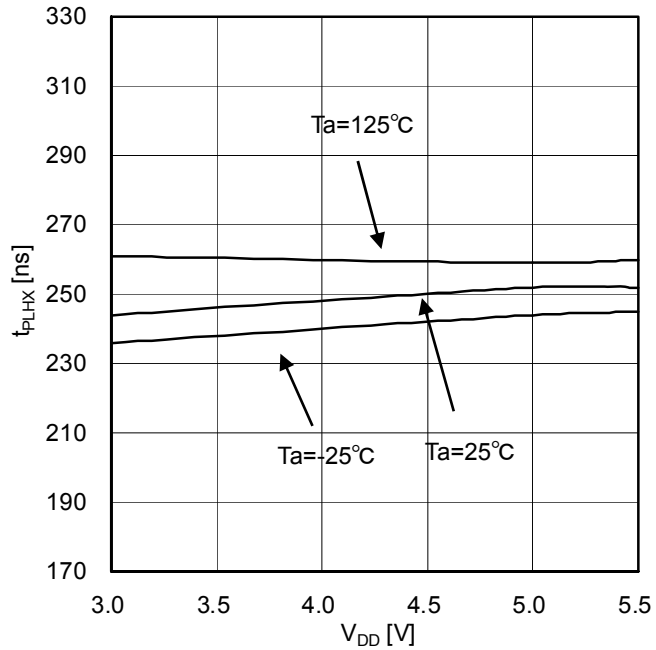


Figure 18. Output delay time H

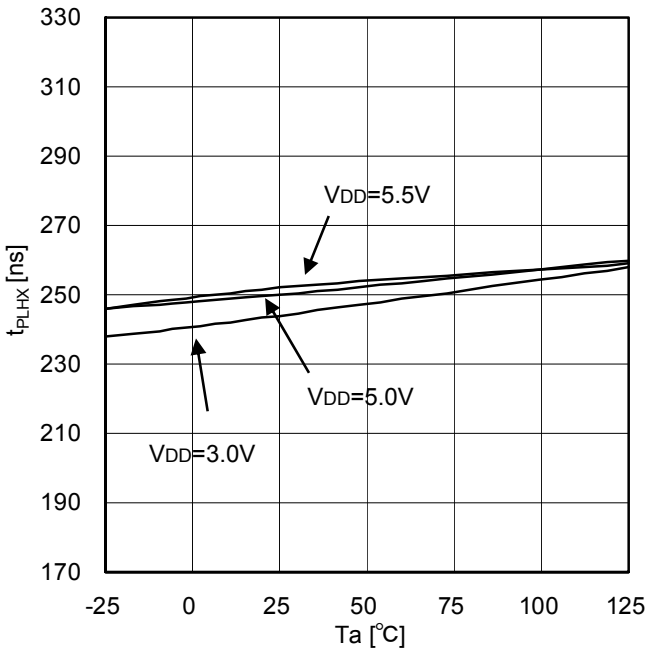


Figure 19. Output delay time H

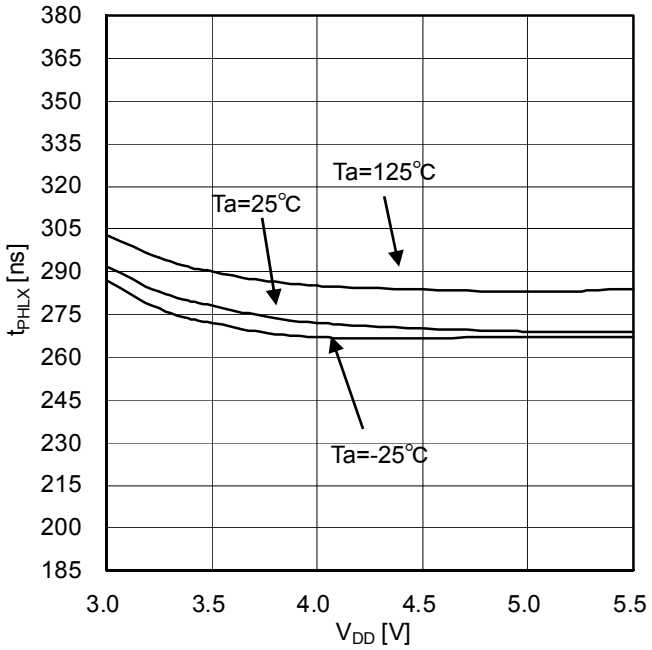


Figure 20. Output delay time L

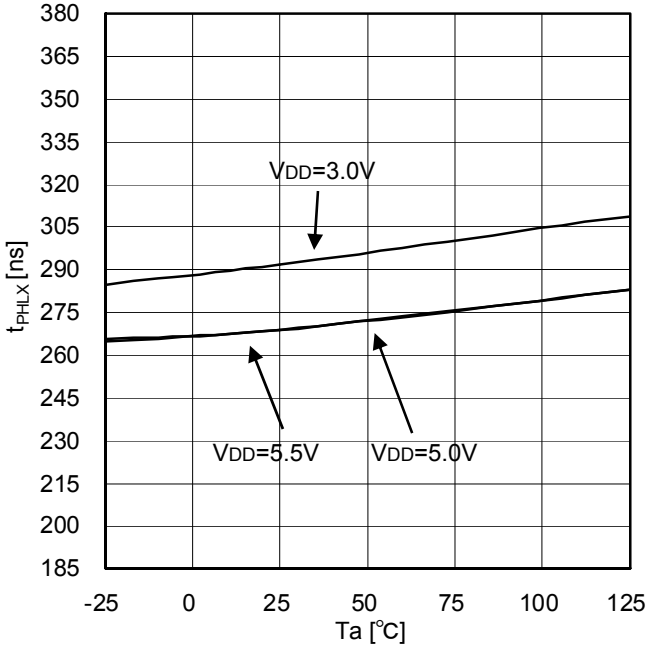


Figure 21. Output delay time L

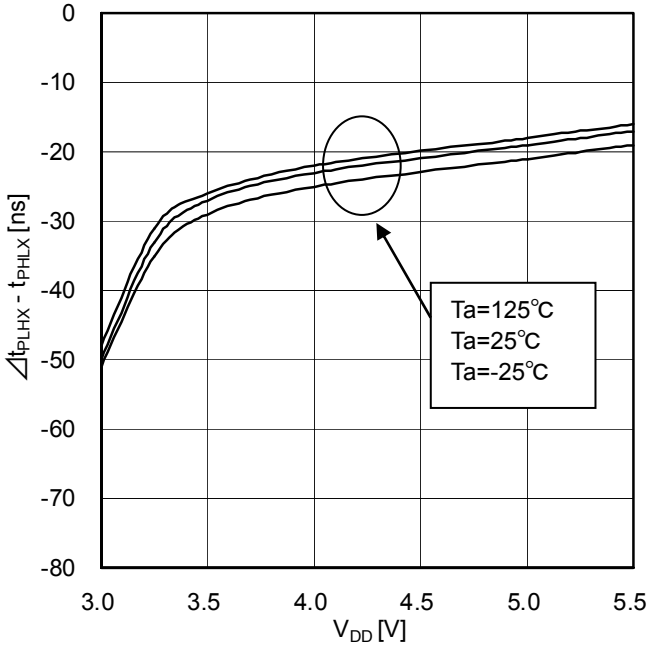


Figure 22. Delay matching, OUT_HX and OUT_LX

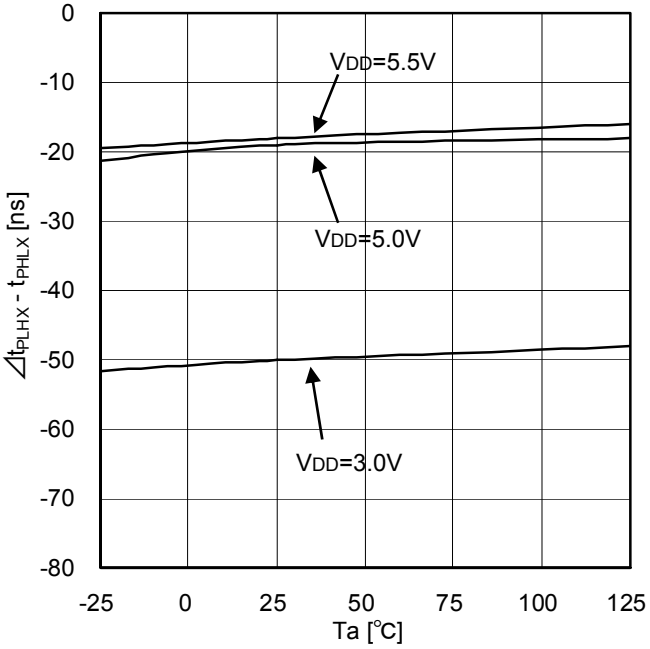


Figure 23. Delay matching, OUT_HX and OUT_LX

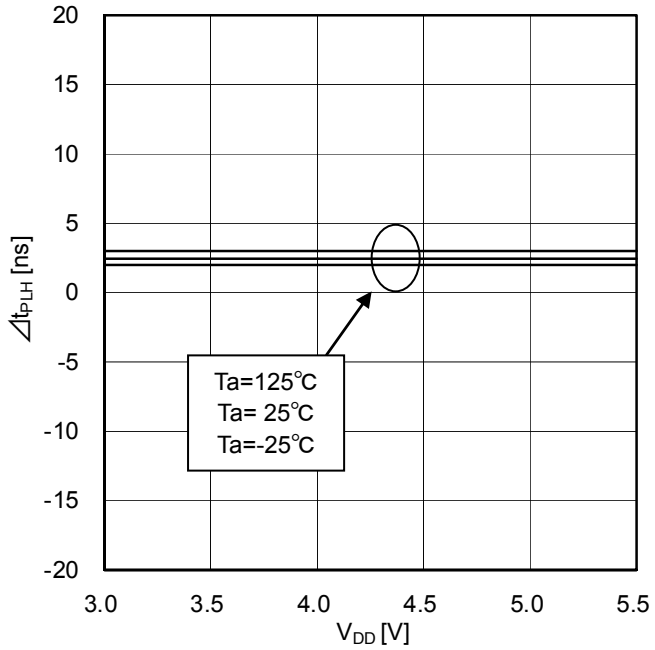


Figure 24. Delay matching, OUT_H1, OUT_H2, OUT_H3

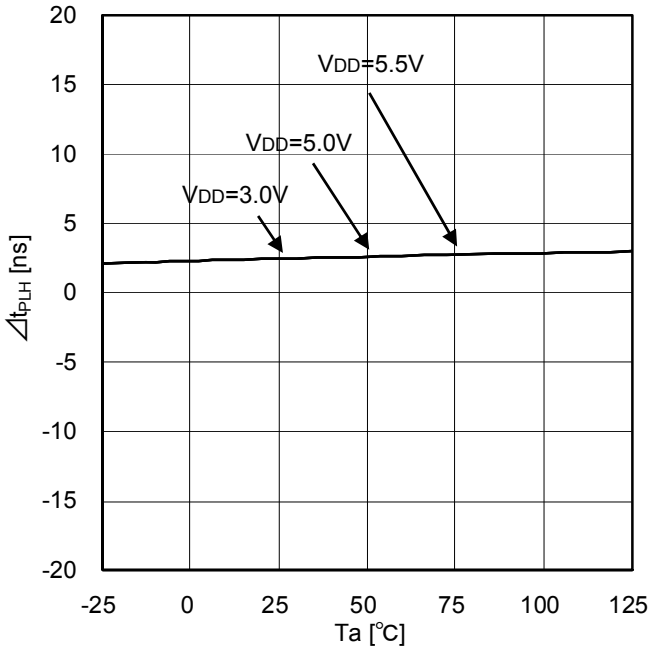


Figure 25. Delay matching, OUT_H1, OUT_H2, OUT_H3

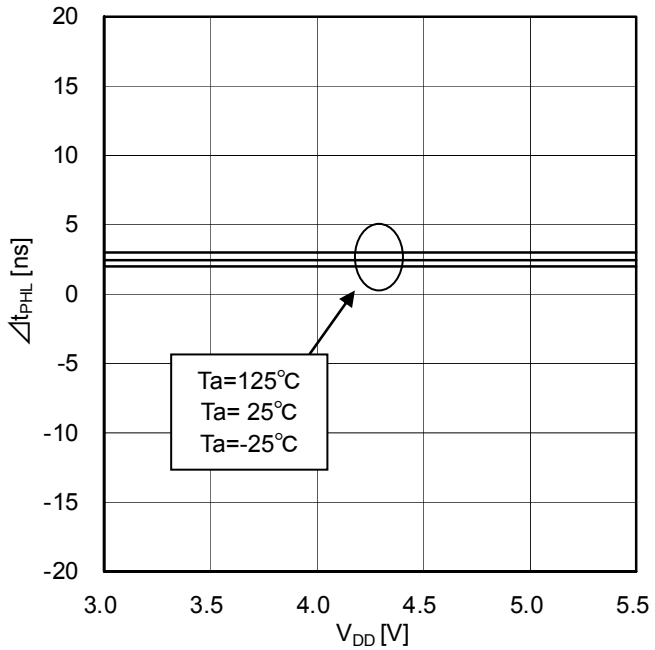


Figure 26. Delay matching, OUT_L1, OUT_L2, OUT_L3

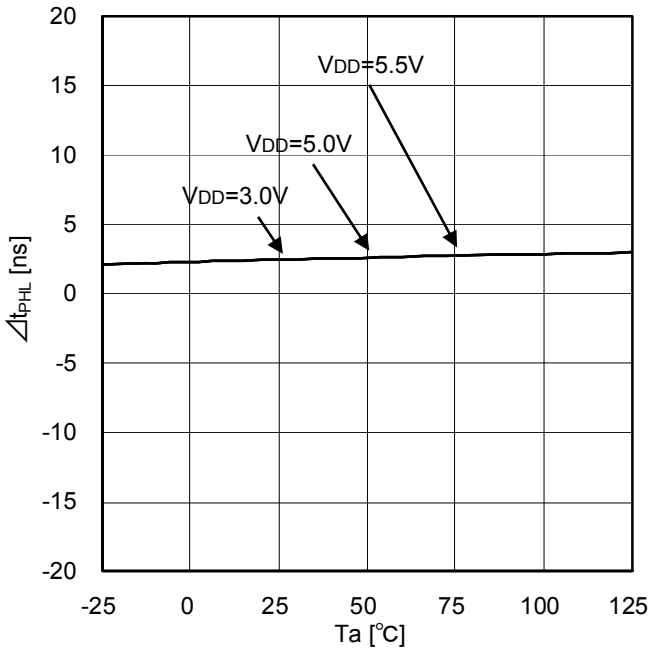
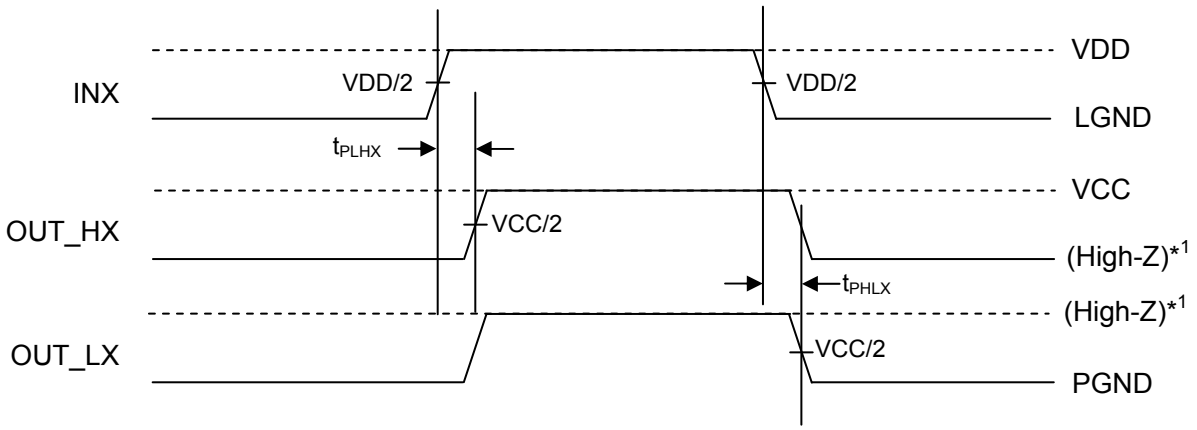


Figure 27. Delay matching, OUT_L1, OUT_L2, OUT_L3

●**Timing Chart**



*1 Under condition that OUT_HX and OUT_LX are shorted.

Figure 28. Timing Chart

●**Power Dissipation**

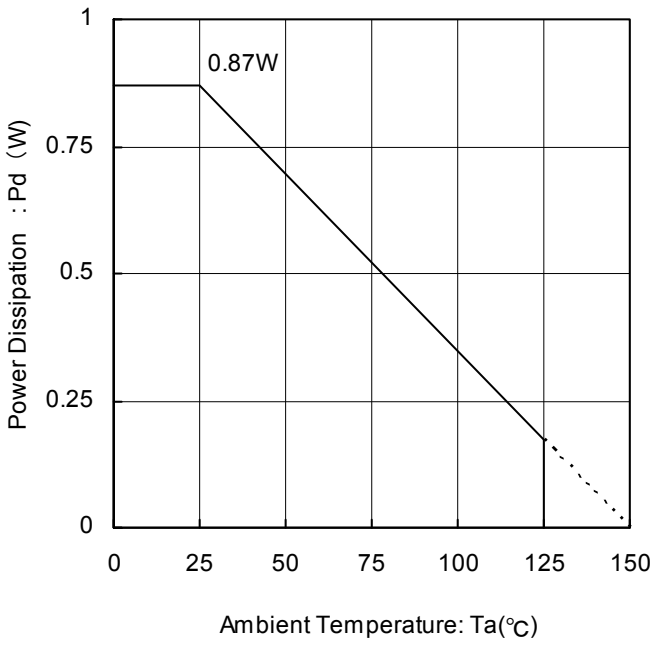
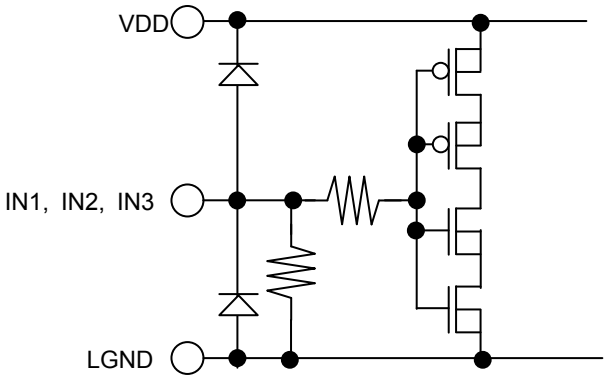
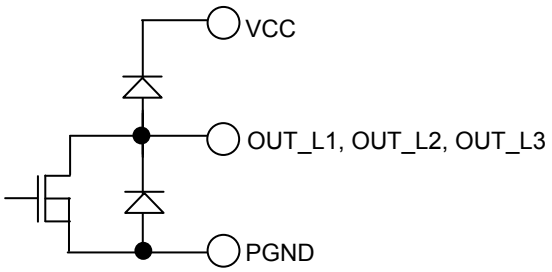
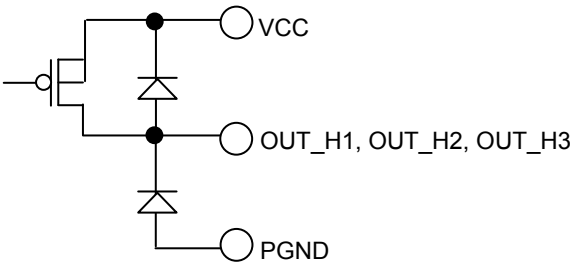


Figure 29. SSOP-B16 Derating Curve

Please confirm that the IC's chip temperature Tj is not over 150℃, while considering the IC's power consumption (W), package power (Pd) and ambient temperature (Ta). When Tj=150℃ is exceeded the functions as a semiconductor do not operate and some problems (ex. Abnormal operation of various parasitic elements and increasing of leak current) occur. Constant use under these circumstances leads to deterioration and eventually IC may destruct. Tjmax=150℃ must be strictly obeyed under all circumstances.

●I/O equivalence circuits

Pin No.	Name / Function	I/O equivalence circuits
4, 5, 6	IN1, IN2, IN3	
	Control input X pin	
9, 12, 15	OUT_L1, OUT_L2, OUT_L3	
	Low-side output X pin	
10, 13, 16	OUT_H1, OUT_H2, OUT_H3	
	High-side output X pin	

●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 the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

(2) Connecting the power supply connector backward

Connecting of the power supply in reverse polarity can damage IC. Take precautions when connecting the power supply lines. An external direction diode can be added.

(3) Power supply Lines

Design PCB layout pattern to provide low impedance GND and supply lines. To obtain a low noise ground and supply line, separate the ground section and supply lines of the digital and analog blocks. Furthermore, for all power supply terminals to ICs, connect a capacitor between the power supply and the GND terminal. When applying electrolytic capacitors in the circuit, not that capacitance characteristic values are reduced at low temperatures.

(4) GND Potential

The potential of LGND pin and PGND pin must be minimum potential in all operating conditions.

(5) Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

(6) Inter-pin shorts and mounting errors

When attaching to a printed circuit board, pay close attention to the direction of the IC and displacement. Improper attachment may lead to destruction of the IC. There is also possibility of destruction from short circuits which can be caused by foreign matter entering between outputs or an output and the power supply or GND.

(7) Operation in a strong electric field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

(8) Inspection of the application board

During inspection of the application board, if a capacitor is connected to a pin with low impedance there is a possibility that it could cause stress to the IC, therefore an electrical discharge should be performed after each process. Also, as a measure again electrostatic discharge, it should be earthed during the assembly process and special care should be taken during transport or storage. Furthermore, when connecting to the jig during the inspection process, the power supply should first be turned off and then removed before the inspection.

(9) Input terminal of IC

Between each element there is a P+ isolation for element partition and a P substrate. This P layer and each element's N layer make up the P-N junction, and various parasitic elements are made up.

For example, when the resistance and transistor are connected to the terminal as shown in figure 65,

- ○When GND＞(Terminal A) at the resistance and GND＞(Terminal B) at the transistor (NPN), the P-N junction operates as a parasitic diode.
- ○Also, when GND＞(Terminal B) at the transistor (NPN), The parasitic NPN transistor operates with the N layers of other elements close to the aforementioned parasitic diode.

Because of the IC's structure, the creation of parasitic elements is inevitable from the electrical potential relationship. The operation of parasitic elements causes interference in circuit operation, and can lead to malfunction and destruction. Therefore, be careful not to use it in a way which causes the parasitic elements to operate, such as by applying voltage that is lower than the GND (P substrate) to the input terminal.

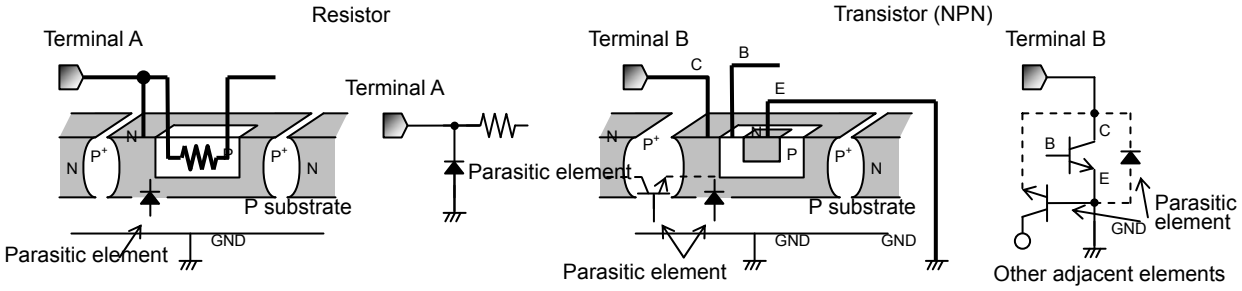


Figure 30. Pattern Diagram of Parasitic Element

(10) Ground Wiring Patterns

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the application's reference point so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern potential of any external components, either.

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.

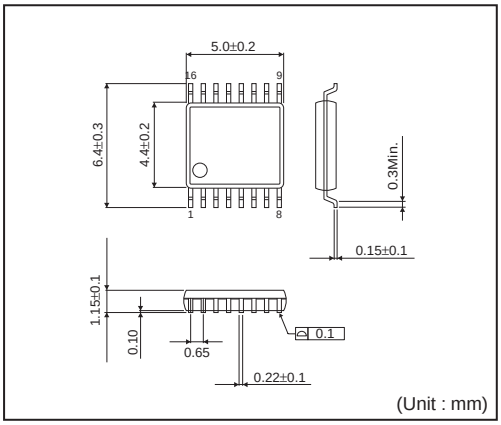
If there are any differences in translation version of this document formal version takes priority

●Ordering Information

B D 6 5 6 3 F V	-	LBE2
Part Number		Packaging and forming specification E2: Embossed tape and reel
	Package FV : SSOP-B16	

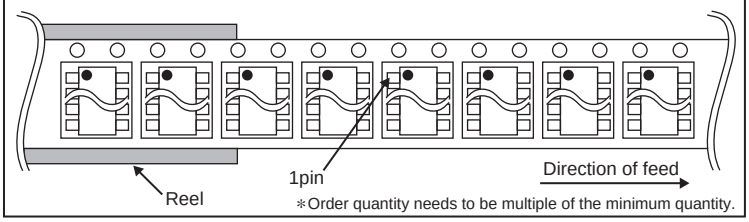
●Physical Dimension Tape and Reel Information

SSOP-B16



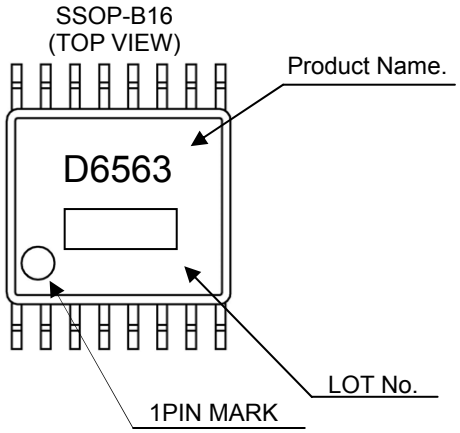
<Tape and Reel information>

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 Diagram



●**Revision History**

Date	Revision	Changes
05.JUL.2012	001	New Release
13.JUL.2012	002	Page 1 : Change Key Specifications 'Output peak current' Page 4 : Change Absolute Maximum Ratings 'OUT_HX pin output current' Page 4 : Change Absolute Maximum Ratings 'OUT_LX pin output current'

Notice

●General Precaution

1) Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2) All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

●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, 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.

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

3) Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [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.

●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.

●Precaution Regarding Intellectual Property Rights

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