Datasheet

CMOS LDO Regulator Series for Portable Equipments

Versatile Package FULL CMOS LDO Regulator

BUxxTD3WG series

●General Description
BUxxTD3WG series is high-performance FULL CMOS regulator with 200-mA output, which is mounted on versatile package SSOP5 (2.9 mm × 2.8 mm × 1.25 mm). It has excellent noise characteristics and load responsiveness characteristics despite its low circuit current consumption of 35μA. It is most appropriate for various applications such as power supplies for logic IC, RF, and camera modules.ROHM's.

●Key Specifications
- Output voltage: 1.0V to 3.4V
- Accuracy output voltage: ±1.0% (±25mV)
- Low current consumption: 35μA
- Operating temperature range: -40°C to +85°C

●Applications
Battery-powered portable equipment, etc.

●Package
SSOP5: 2.90mm x 2.80mm x 1.25mm

●Features
- High accuracy detection
- low current consumption
- Compatible with small ceramic capacitor(Cin=Co=0.47uF)
- With built-in output discharge circuit
- High ripple rejection
- ON/OFF control of output voltage
- With built-in over current protection circuit and thermal shutdown circuit
- Package SSOP5 is similar to SOT-23-5 (JEDEC)
- Low dropout voltage

●Typical Application Circuit

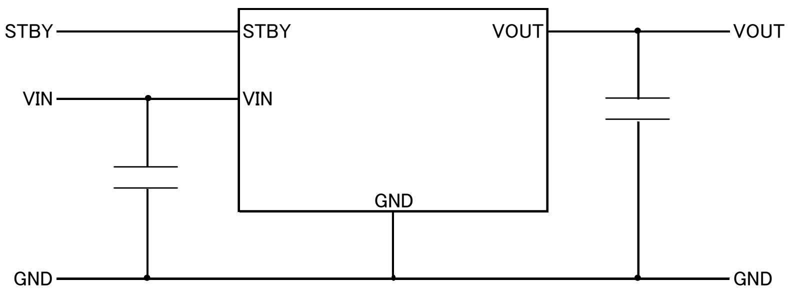
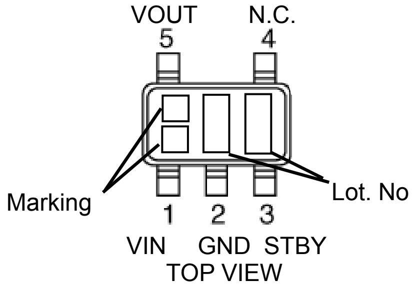


Fig.1 Application Circuit

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

●Connection Diagram

SSOP5



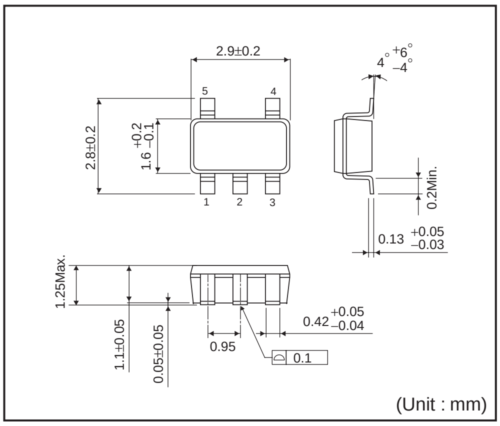
●Pin Descriptions

SSOP5		
PIN No.	Symbol	Function
1	VIN	Power Supply Voltage
2	GND	Grouding
3	STBY	ON/OFF control of output voltage (High: ON, Low: OFF)
4	N.C.	Unconnected Terminal
5	VOUT	Output Voltage

●Ordering Information

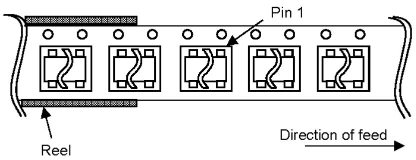
B U	x x	T D 3	W	G	−	x	T R
Part Number	Output Voltage 10 : 1.0V ⇩ 34 : 3.4V	Series Maximum Output Current 200mA	with output discharge	Package G : SSOP5		Halogen Free G : compatible Blank : incompatible	Packageing and forming specification Embossed tape and reel TR : The pin number 1 is the upper right

SSOP5



< Tape and Reel Information >

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)



●**Lineup**

Marking	F0	L6	F1	M0	L5	F2	F3	F4	F5
Output Voltage	1.0V	1.1V	1.2V	1.25V	1.3V	1.5V	1.8V	1.85V	1.9V
Part Number	BU10	BU11	BU12	BU1C	BU13	BU15	BU18	BU1J	BU19

F6	F7	F8	F9	G0	G1	G2	G3	G4
2.0V	2.1V	2.5V	2.6V	2.7V	2.8V	2.85V	2.9V	3.0V
BU20	BU21	BU25	BU26	BU27	BU28	BU2J	BU29	BU30

G5	G6	G7	G8
3.1V	3.2V	3.3V	3.4V
BU31	BU32	BU33	BU34

●**Absolute Maximum Ratings (Ta=25°C)**

PARAMETER	Symbol	Limit	Unit
Power Supply Voltage	VMAX	-0.3 ～ +6.5	V
Power Dissipation	Pd	540(*1)	mW
Maximum junction temperature	TjMAX	+125	℃
Operating Temperature Range	Topr	-40 ～ +85	℃
Storage Temperature Range	Tstg	-55 ～ +125	℃

(*1)Pd deleted at 5.4mW/℃ at temperatures above Ta=25℃, mounted on 70×70×1.6 mm glass-epoxy PCB.

● **RECOMMENDED OPERATING RANGE (not to exceed Pd)**

PARAMETER	Symbol	Limit	Unit
Power Supply Voltage	VIN	1.7～6.0	V
Maximum Output Current	IMAX	200	mA

●OPERATING CONDITIONS

PARAMETER	Symbol	MIN.	TYP.	MAX.	Unit	CONDITION
Input Capacitor	Cin	0.22(*2)	0.47	-	μF	Ceramic capacitor recommended
Output Capacitor	Co	0.22(*2)	0.47	-	μF	

(*2)Make sure that the output capacitor value is not kept lower than this specified level across a variety of temperature, DC bias, changing as time progresses characteristic.

●Electrical Characteristics

(Ta=25℃, VIN=VOUT+1.0V (*3), STBY=VIN, Cin=0.47μF, Co=0.47μF, unless otherwise noted.)

PARAMETER		Symbol	Limit MIN.	Limit TYP.	Limit MAX.	Unit	Conditions
Overall Device							
Output Voltage		VOUT	VOUT×0.99	VOUT	VOUT×1.01	V	IOUT=10μA, VOUT≧2.5V
			VOUT-25mV		VOUT+25mV		IOUT=10μA, VOUT＜2.5V
Operating Current		IIN	–	35	60	μA	IOUT=0mA
Operating Current (STBY)		ISTBY	–	–	1.0	μA	STBY=0V
Ripple Rejection Ratio		RR	45	70	–	dB	VRR=-20dBv, fRR=1kHz, IOUT=10mA
Dropout Voltage		VSAT	–	280	540	mV	2.5V≦VOUT≦2.6V (VIN=0.98*VOUT, IOUT=200mA)
			–	260	500	mV	2.7V≦VOUT≦2.85V (VIN=0.98*VOUT, IOUT=200mA)
			–	240	460	mV	2.9V≦VOUT≦3.1V (VIN=0.98*VOUT, IOUT=200mA)
			–	220	420	mV	3.2V≦VOUT≦3.4V (VIN=0.98*VOUT, IOUT=200mA)
Line Regulation		VDL	–	2	20	mV	VIN=VOUT+1.0V to 5.5V (*4), IOUT=10μA
Load Regulation		VDLO	–	10	80	mV	IOUT=0.01mA to 100mA
Over Current Protection (OCP)							
Limit Current		ILMAX	220	400	700	mA	Vo=VOUT*0.95
Short Current		ISHORT	20	70	150	mA	Vo=0V
Standby Block							
Discharge Resistor		RDSC	20	50	80	Ω	VIN=4.0V, STBY=0V, VOUT=4.0V
STBY Pin Pull-down Current		ISTB	0.1	0.6	2.0	μA	STBY=1.5V
STBY Control Voltage	ON	VSTBH	1.2	–	6.0	V	
	OFF	VSTBL	-0.3	–	0.3	V	

This product is not designed for protection against radioactive rays.
(*3) VIN=2.5V for VOUT≦1.5V
(*4) VIN=2.5V to 3.6V for VOUT≦1.5V

●ELECTRICAL CHARACTERISTICS of each Output Voltage

(Ta=25℃, STBY=VIN, Cin=0.47μF, Co=0.47μF, unless otherwise noted.)

Output Voltage	PARAMETER	MIN.	TYP.	MAX.	Unit	Conditions
1.0V, 1.1V, 1.2V, 1.25V, 1.3V	Maximum output current	80	160	–	mA	VIN=1.7V
		200	–	–		VIN=2.1V
1.5V		60	120	–		VIN=1.8V
		200	–	–		VIN=2.2V
1.8V, 1.85V, 1.9V, 2.0V, 2.1V		200	–	–		VIN=VOUT+0.6V

●Block Diagrams

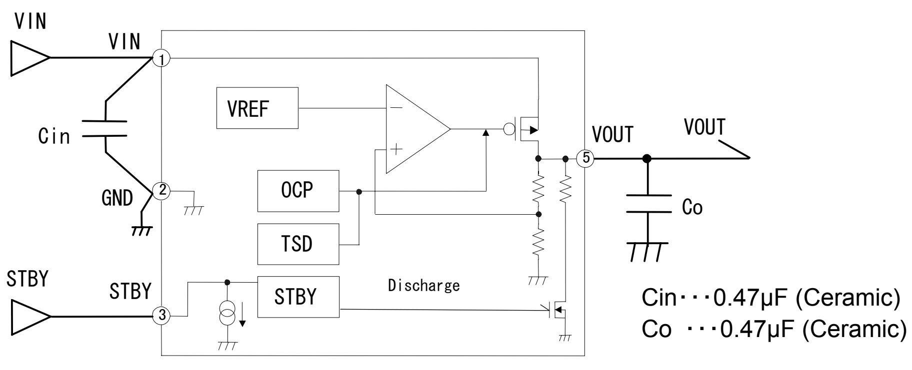


Fig. 2 Block Diagrams

●Reference data **BU18TD3WG** (Ta=25°C unless otherwise specified.)

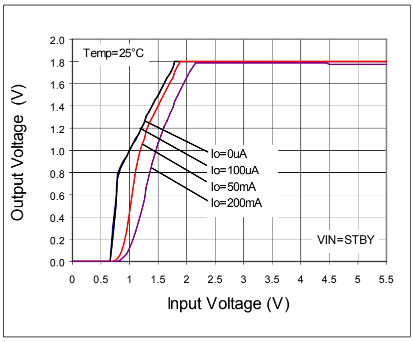


Fig 3. Output Voltage

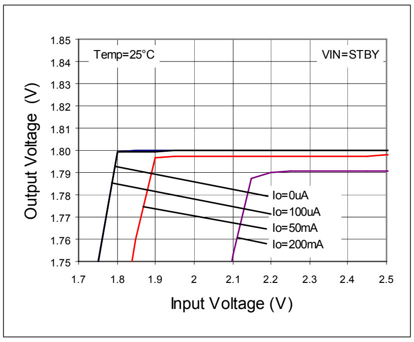


Fig 4. Line Regulation

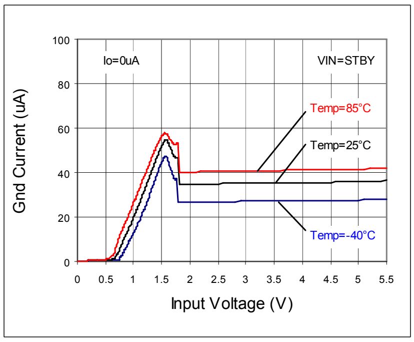


Fig 5. Circuit Current IGND

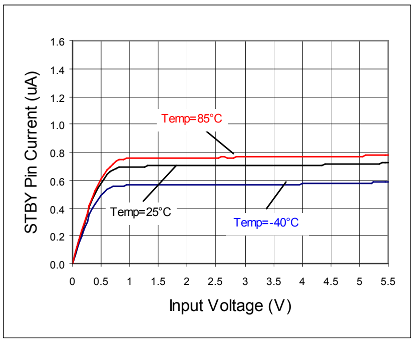


Fig 6. VSTBY - ISTBY

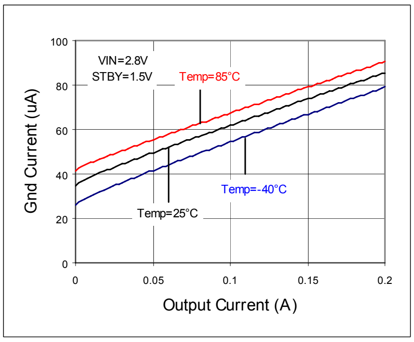


Fig 7. IOUT - IGND

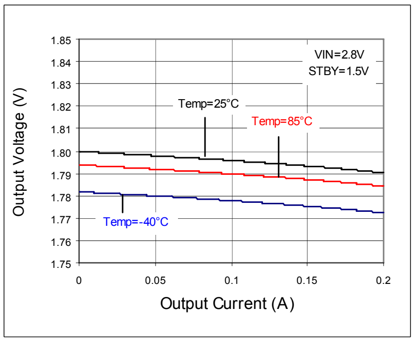


Fig 8. Load Regulation

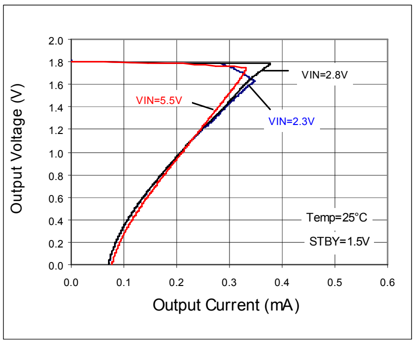


Fig 9. OCP Threshold

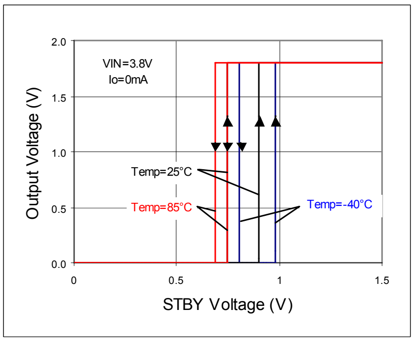


Fig 10. STBY Threshold

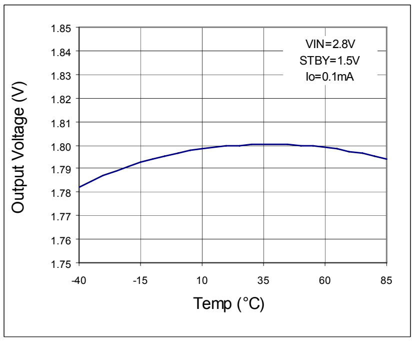


Fig 11. VOUT - Temp

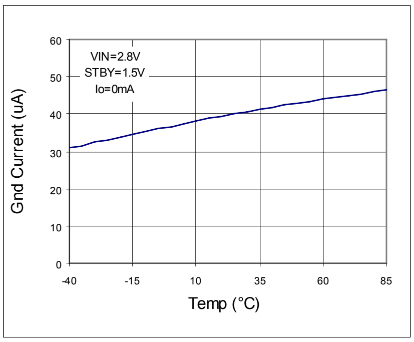


Fig 12. IGND - Temp

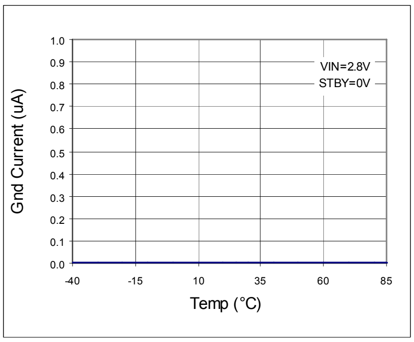


Fig 13. IGND - Temp (STBY)

●Reference data BU18TD3WG (Ta=25ºC unless otherwise specified.)

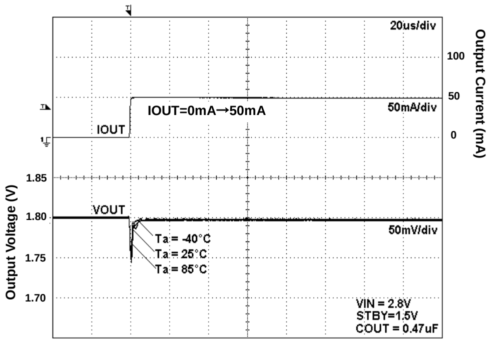


Fig 14. Load Response

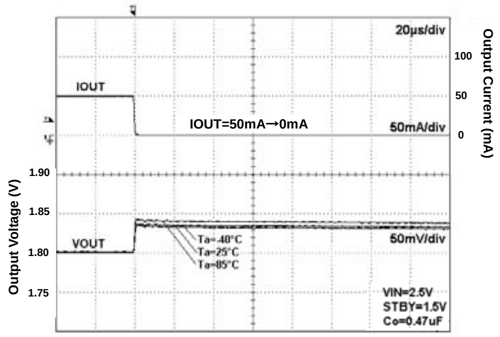


Fig 15. Load Response

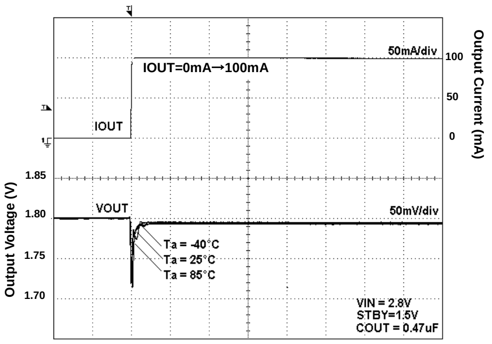


Fig 16. Load Response

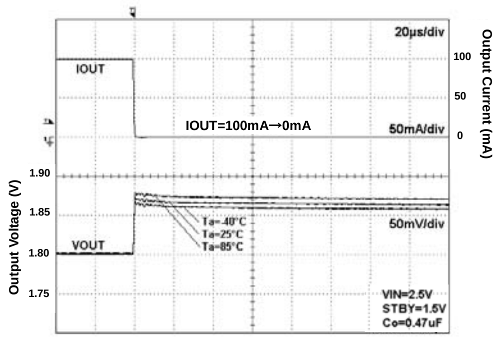


Fig 17. Load Response

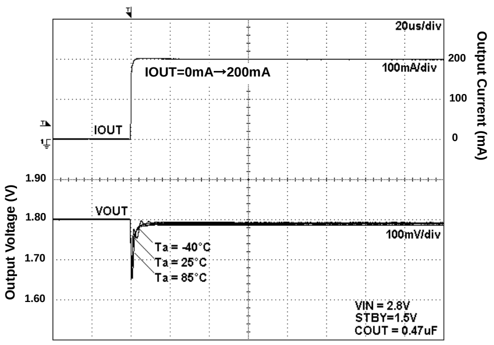


Fig 18. Load Response

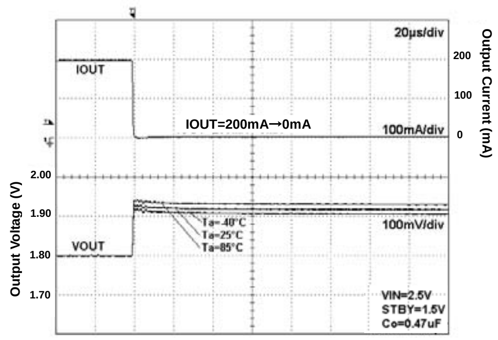


Fig 19. Load Response

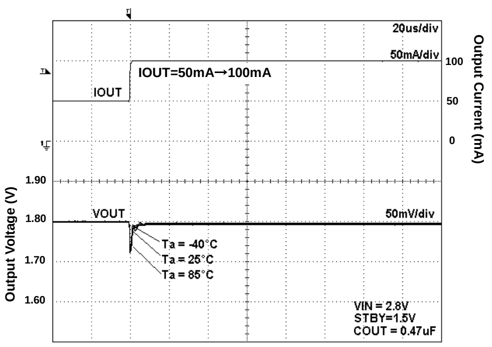


Fig 20. Load Response

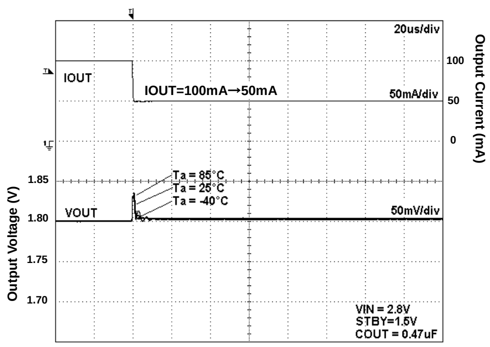


Fig 21. Load Response

●Reference data BU18TD3WG (Ta=25ºC unless otherwise specified.)

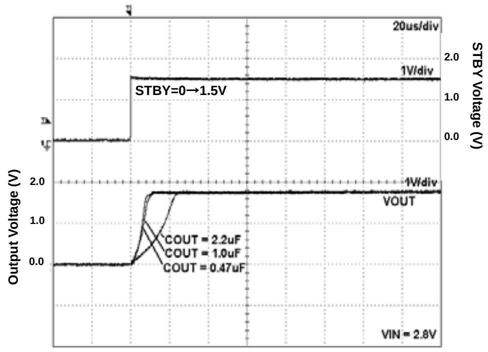


Fig 22. Start Up Time
Iout=0mA

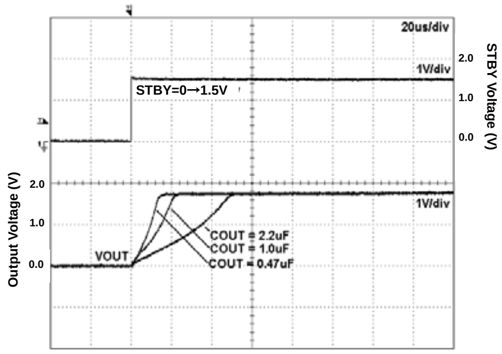


Fig 23. Start Up Time
Iout=200mA

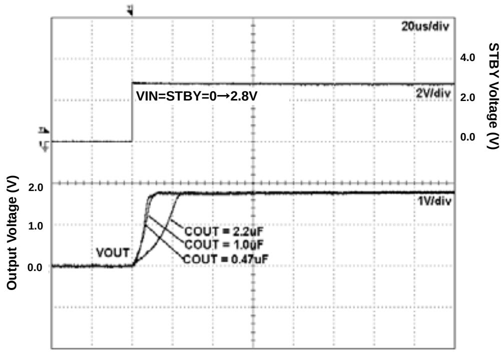


Fig 24. Start Up Time
(VIN=STBY) Iout=0mA
Iout=0mA

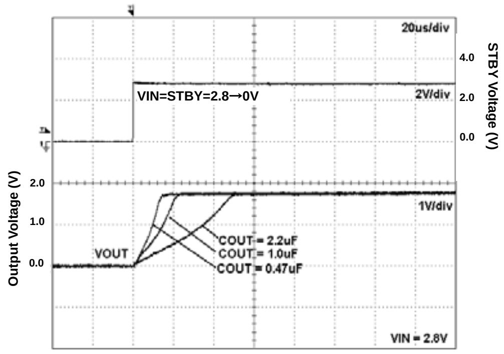


Fig 25. Start Up Time
(VIN=STBY) Iout=200mA

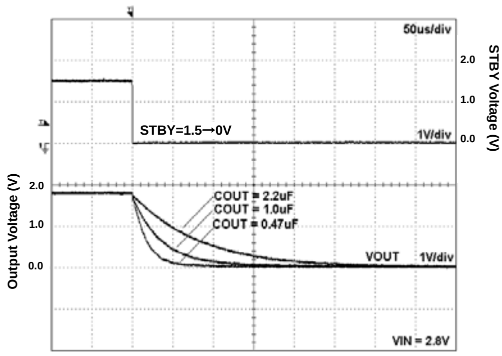


Fig 26. Discharge Time

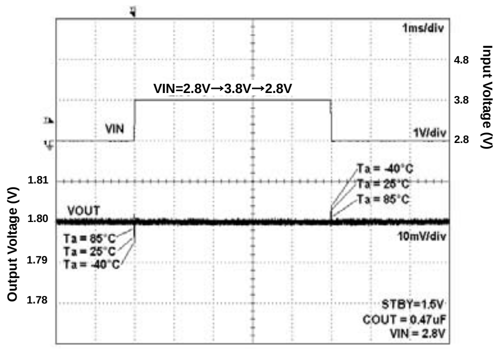


Fig 27. VIN Response

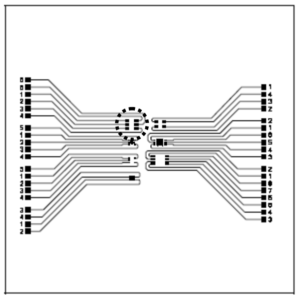
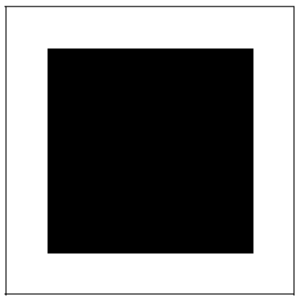
● About power dissipation (Pd)

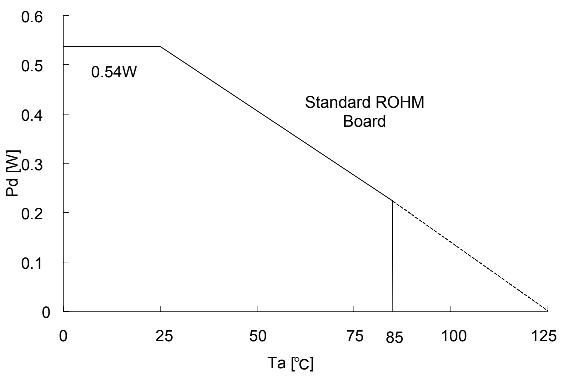
As for power dissipation, an approximate estimate of the heat reduction characteristics and internal power consumption of IC are shown, so please use these for reference. Since power dissipation changes substantially depending on the implementation conditions (board size, board thickness, metal wiring rate, number of layers and through holes, etc.), it is recommended to measure Pd on a set board. Exceeding the power dissipation of IC may lead to deterioration of the original IC performance, such as causing operation of the thermal shutdown circuit or reduction in current capability. Therefore, be sure to prepare sufficient margin within power dissipation for usage.

Calculation of the maximum internal power consumption of IC (PMAX)

PMAX=(VIN-VOUT)×IOUT(MAX.) (VIN: Input voltage VOUT: Output voltage IOUT(MAX): Maximum output current)

○ Measurement conditions

		Standard ROHM Board
Layout of Board for Measurement IC Implementation Position		 Top Layer (Top View)  Bottom Layer (Top View)
Measurement State		With board implemented (Wind speed 0 m/s)
Board Material		Glass epoxy resin (Double-side board)
Board Size		70 mm x 70 mm x 1.6 mm
Wiring Rate	Top layer	Metal (GND) wiring rate: Approx. 0%
	Bottom layer	Metal (GND) wiring rate: Approx. 50%
Through Hole		Diameter 0.5mm x 6 holes
Power Dissipation		0.54W
Thermal Resistance		θja=185.2°C/W



* Please design the margin so that PMAX becomes is than Pd (PMAX<Pd) within the usage temperature range

Fig. 28 SSOP5 Power dissipation heat reduction characteristics (Reference)

●Operation Notes

1.) <u>Absolute maximum ratings</u>
Use of the IC in excess of absolute maximum ratings (such as the input voltage or operating temperature range) may result in damage to the IC. Assumptions should not be made regarding the state of the IC (e.g., short mode or open mode) when such damage is suffered. If operational values are expected to exceed the maximum ratings for the device, consider adding protective circuitry (such as fuses) to eliminate the risk of damaging the IC.

2.) GND potential
The potential of the GND pin must be the minimum potential in the system in all operating conditions.
Never connect a potential lower than GND to any pin, even if only transiently.

3.) Thermal design
Use a thermal design that allows for a sufficient margin for that package power dissipation rating (Pd) under actual operating conditions.

4.) Inter-pin shorts and mounting errors
Use caution when orienting and positioning the IC for mounting on printed circuit boards. Improper mounting or shorts between pins may result in damage to the IC.

5.) Operation in strong electromagnetic fields
Strong electromagnetic fields may cause the IC to malfunction. Caution should be exercised in applications where strong electromagnetic fields may be present.

6.) Common impedance
Wiring traces should be as short and wide as possible to minimize common impedance. Bypass capacitors should be use to keep ripple to a minimum.

7.) Voltage of STBY pin
To enable standby mode for all channels, set the STBY pin to 0.3 V or less, and for normal operation, to 1.2 V or more. Setting STBY to a voltage between 0.3 and 1.2 V may cause malfunction and should be avoided. Keep transition time between high and low (or vice versa) to a minimum.
Additionally, if STBY is shorted to VIN, the IC will switch to standby mode and disable the output discharge circuit, causing a temporary voltage to remain on the output pin. If the IC is switched on again while this voltage is present, overshoot may occur on the output. Therefore, in applications where these pins are shorted, the output should always be completely discharged before turning the IC on.

8.) Over-current protection circuit (OCP)
This IC features an integrated over-current and short-protection circuitry on the output to prevent destruction of the IC when the output is shorted. The OCP circuitry is designed only to protect the IC from irregular conditions (such as motor output shorts) and is not designed to be used as an active security device for the application. Therefore, applications should not be designed under the assumption that this circuitry will engage.

9.) Thermal shutdown circuit (TSD)
This IC also features a thermal shutdown circuit that is designed to turn the output off when the junction temperature of the IC exceeds about 150℃. This feature is intended to protect the IC only in the event of thermal overload and is not designed to guarantee operation or act as an active security device for the application. Therefore, applications should not be designed under the assumption that this circuitry will engage.

10.) Input/output capacitor
Capacitors must be connected between the input/output pins and GND for stable operation, and should be physically mounted as close to the IC pins as possible. The input capacitor helps to counteract increases in power supply impedance, and increases stability in applications with long or winding power supply traces. The output capacitance value is directly related to the overall stability and transient response of the regulator, and should be set to the largest Unstable region or the application to increase these characteristics. During design, keep in mind that in general, ceramic capacitors have a wide range of tolerances, temperature coefficients and DC bias characteristics, and that their capacitance values tend to decrease over time. Confirm these details before choosing appropriate capacitors for your application.(Please refer the technical note, regarding ceramic capacitor of recommendation)

11.) About the equivalent series resistance (ESR) of a ceramic capacitor
Capacitors generally have ESR (equivalent series resistance) and it operates stably in the ESR-IOUT area shown on the right. Since ceramic capacitors, tantalum capacitors, electrolytic capacitors, etc. generally have different ESR, please check the ESR of the capacitor to be used and use it within the stability area range shown in the right graph for evaluation of the actual application.

Cout=0.47μF, Cin=0.47μF, Temp=+25℃

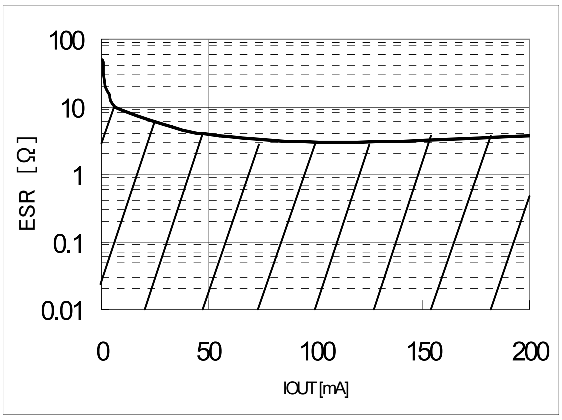


Fig. 29 Stable region (example)

●Revision History

Date	Revision	Changes
7.Feb.2013	001	New Release
30.Jul.2013	002	Adding a Revision History. VSBYH is changed.