Power Management Switch ICs for PCs and Digital Consumer products

Load Switch ICs for Portable Equipment

BD2200GUL, BD2201GUL

No.11029EAT22

●Description

BD2200GUL ,BD2201GUL are Load switches for portable device. It is Load switch IC with build-in N channel MOSFET. This switch IC achieves On-resistance of 100mΩ (Typ.). It has the function of Soft-Start and build-in discharge circuit.

●Features

1) Single Channel Of Low On-resistance (Typ.=100mΩ) N-channel MOSFET Built in
2) 500mA Output Load Current (BD2200GUL)
   1000mA Output Load Current (BD2201GUL)
3) Soft-Start Function
4) Output Discharge Circuit
5) VCSP50L1 package

●Application

Mobile phone, Digital still camera, PDA, MP3 player, PC, etc.

●Line up matrix

Part Number	On-resistance	Output current	Discharge circuit	Logic control input	Package
BD2200GUL	100mΩ	500mA	○	High	VCSP50L1 1.5×1.0 mm
BD2201GUL	100mΩ	1000mA	○	High	VCSP50L1 1.5×1.0 mm

●Absolute Maximum Ratings (Ta=25℃)

Parameter	Symbol	Ratings	Unit
VIN Supply voltage	V_{IN}	-0.3 ~ 6.0	V
EN input voltage	V_{EN}	-0.3 ~ V_{IN} + 0.3	V
VOUT voltage	V_{OUT}	-0.3 ~ 6.0	V
Storage temperature	T_{STG}	-55 ~ 150	℃
Power dissipation	Pd	575 *1	mW

*1 Mounted on 50mm * 58mm * 1.75mm Glass-epoxy PCB. Derating: 4.6mW / ℃ at Ta > 25℃

* This product is not designed for protection against radioactive rays.

●Operation Conditions

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Switch input voltage	V_{IN}	2.7	3.3	5.5	V
Operation temperature	T_{OPR}	-25	25	85	℃
Output current (BD2200GUL)	I_{LO}	0	-	500	mA
Output current (BD2201GUL)	I_{LO}	0	-	1000	mA

●Electrical Characteristics

○BD2200GUL (unless otherwise specified, V_{IN} = 3.3V, Ta = 25℃)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
[Current consumption]						
Operating current	I_{DD}	-	20	30	μA	V_{EN} = 1.2V, V_{OUT} = open
Standby current	I_{STB}	-	0.01	1	μA	V_{EN} = 0V, V_{OUT} = open
[I/O]						
EN input voltage	V_{ENH}	1.2	-	-	V	High level input
	V_{ENL}	-	-	0.4	V	Low level input
EN input current	I_{EN}	-1	-	1	μA	V_{EN} = 0V or V_{EN} = 1.2V
[Power switch]						
On-resistance	R_{ON}	-	100	200	mΩ	I_{LO} = 500mA
Switch leakage current	I_{LEAK}	-	0.01	1	μA	V_{EN} = 0V, V_{OUT} = 0V
Output rise time	T_{ON1}	-	1.0	2.0	ms	R_L = 10Ω, V_{OUT} :10% → 90%
Output turn-on time	T_{ON2}	-	1.2	2.4	ms	R_L = 10Ω, V_{EN} :50% →V_{OUT} :90%
Output fall time	T_{OFF1}	-	2.5	5.0	μs	R_L = 10Ω, V_{OUT} :90% → 10%
Output turn-off time	T_{OFF2}	-	4.5	9.0	μs	R_L = 10Ω, V_{EN} :50% →V_{OUT} :10%
[Discharge circuit]						
Discharge on-resistance	R_{DISC}	-	70	110	Ω	I_{LO} = -1mA, V_{EN} = 0V
Discharge current	I_{DISC}	-	15	20	mA	V_{OUT} = 3.3V, V_{EN} = 0V

○BD2201GUL (unless otherwise specified, V_{IN} = 3.3V, Ta = 25℃)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
[Current consumption]						
Operating current	I_{DD}	-	20	30	μA	V_{EN} = 1.2V, V_{OUT} = open
Standby current	I_{STB}	-	0.01	1	μA	V_{EN} = 0V, V_{OUT} = open
[I/O]						
EN input voltage	V_{ENH}	1.2	-	-	V	High level input
	V_{ENL}	-	-	0.4	V	Low level input
EN input current	I_{EN}	-1	-	1	μA	V_{EN} = 0V or V_{EN} = 1.2V
[Power switch]						
On-resistance	R_{ON}	-	100	180	mΩ	I_{LO} = 500mA
Switch leakage current	I_{LEAK}	-	0.01	1	μA	V_{EN} = 0V, V_{OUT} = 0V
Output rise time	T_{ON1}	-	1.0	2.0	ms	R_L = 10Ω, V_{OUT} :10% → 90%
Output turn-on time	T_{ON2}	-	1.2	2.4	ms	R_L = 10Ω, V_{EN} :50% →V_{OUT} :90%
Output fall time	T_{OFF1}	-	2.5	5.0	μs	R_L = 10Ω, V_{OUT} :90% → 10%
Output turn-off time	T_{OFF2}	-	4.5	9.0	μs	R_L = 10Ω, V_{EN} :50% →V_{OUT} :10%
[Discharge circuit]						
Discharge on-resistance	R_{DISC}	-	70	110	Ω	I_{LO} = -1mA, V_{EN} = 0V
Discharge current	I_{DISC}	-	15	20	mA	V_{OUT} = 3.3V, V_{EN} = 0V

●Test Circuit

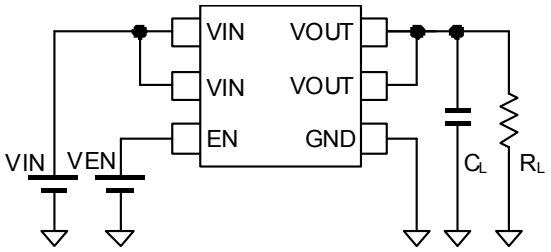


Fig.1 Measurement circuit

●Switch Output Turn ON/OFF Timing

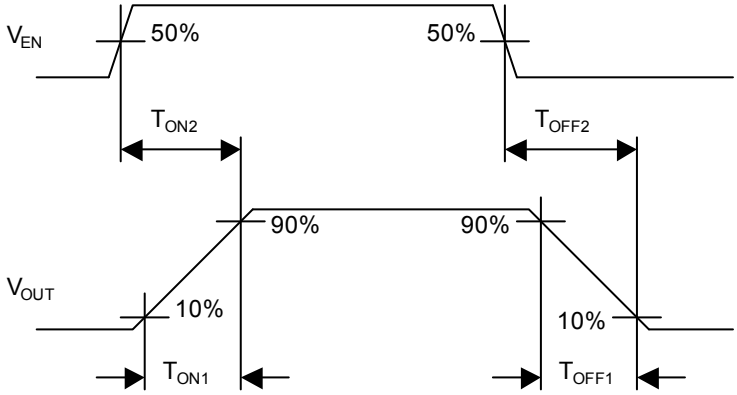


Fig.2 Timing diagrams

●Reference Data

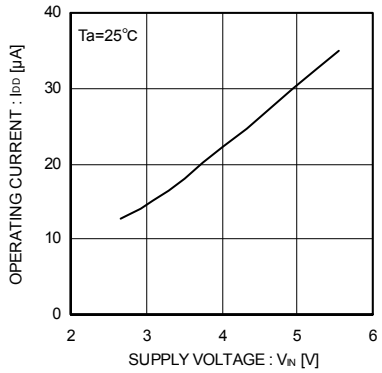


Fig.3 Operating current
EN enable

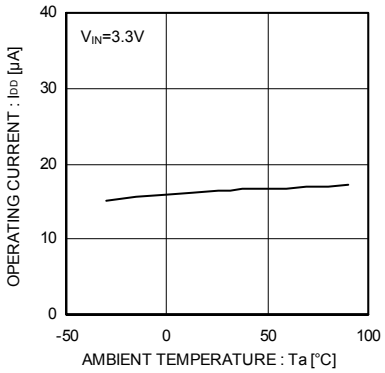


Fig.4 Operating current
EN enable

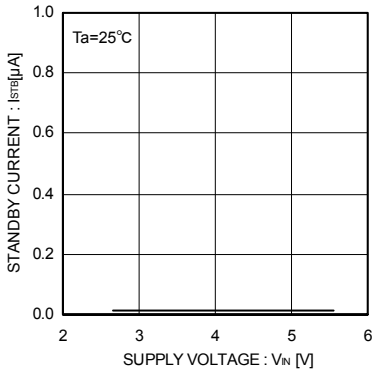


Fig.5 Standby current
EN disable

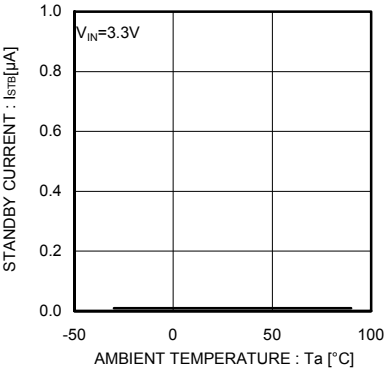


Fig.6 Standby current
EN disable

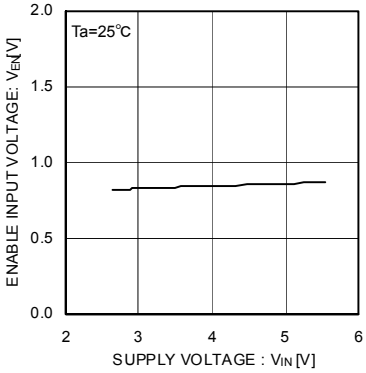


Fig.7 EN input voltage

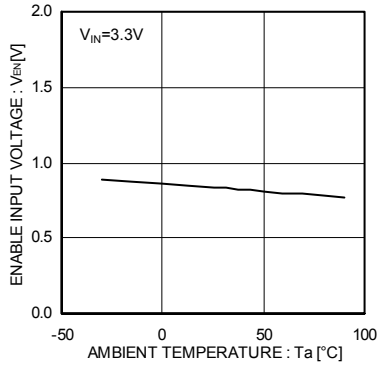


Fig.8 EN input voltage

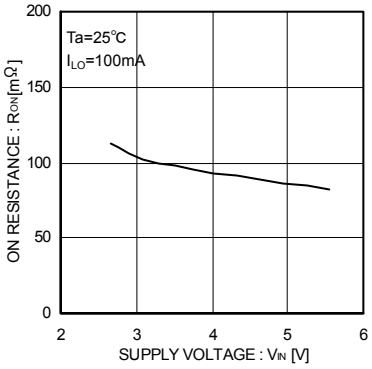


Fig.9 On-resistance vs. V_{IN}

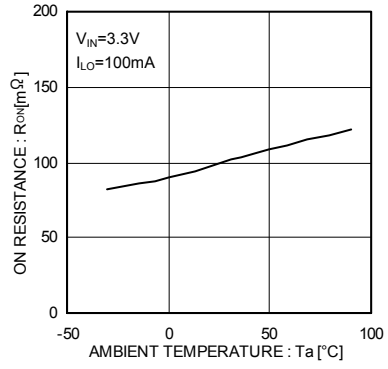


Fig.10 On-resistance vs. temperature

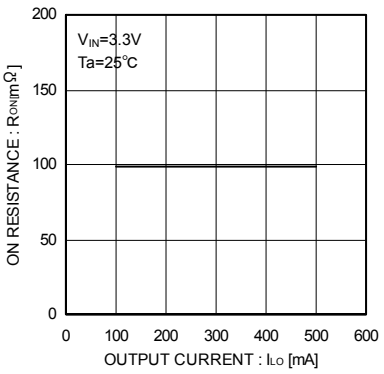


Fig.11 On-resistance vs. I_{LO}

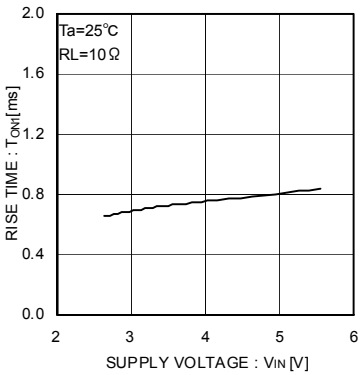


Fig.12 Output rise time

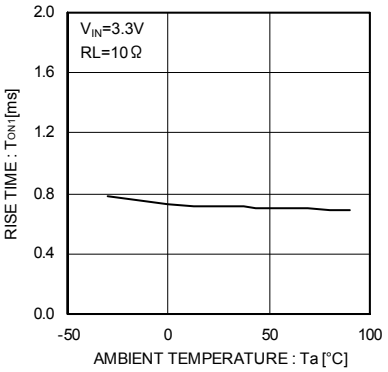


Fig.13 Output rise time

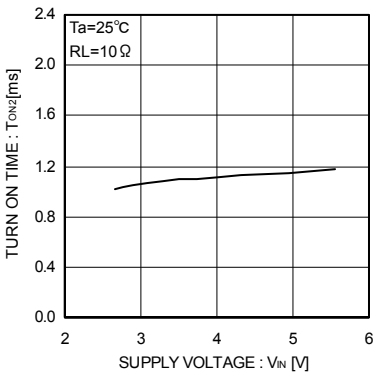


Fig.14 Output turn-on time

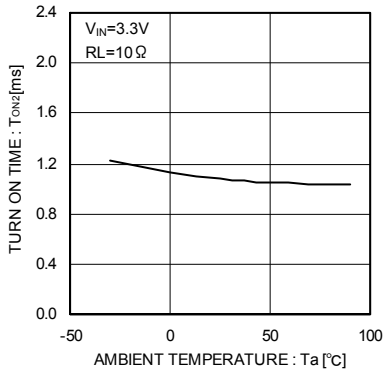


Fig.15 Output turn-on time

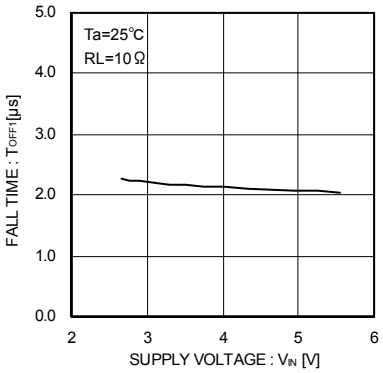


Fig.16 Output fall time

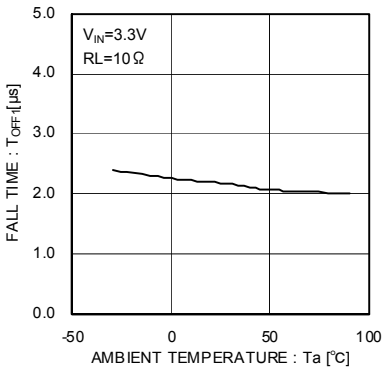


Fig.17 Output fall time

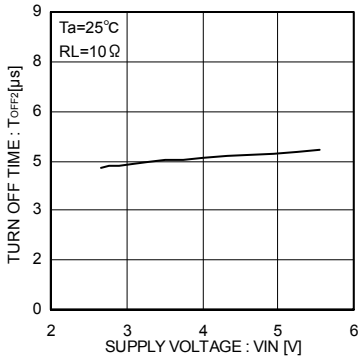


Fig.18 Output turn-off time

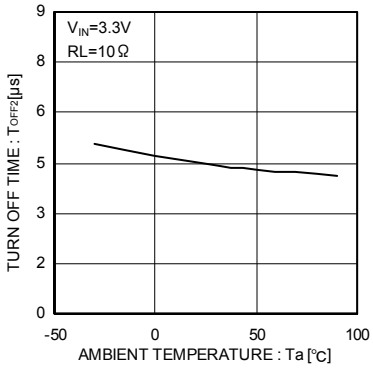


Fig.19 Output turn-off time

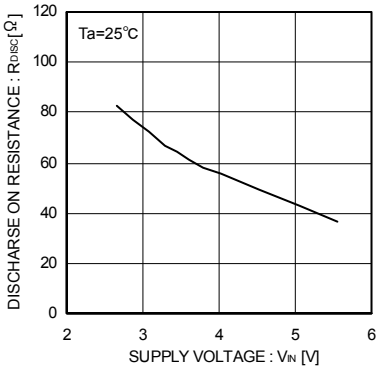


Fig.20 Discharge on-resistance

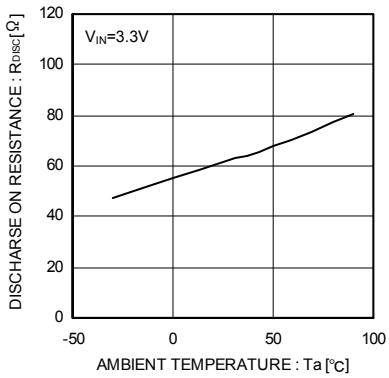


Fig.21 Discharge on-resistance

●Waveform Data (BD2200GUL)

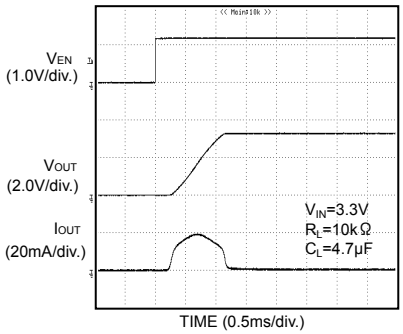


Fig.22 Output turn-on response

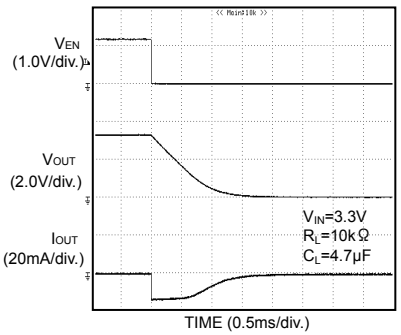


Fig.23 Output turn-off response

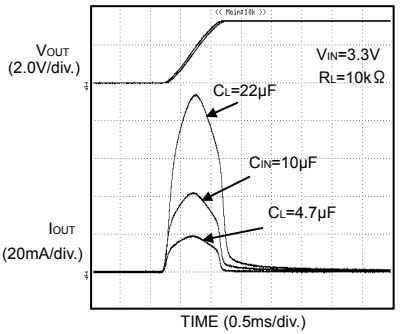


Fig.24 Rush current response

●Block Diagram

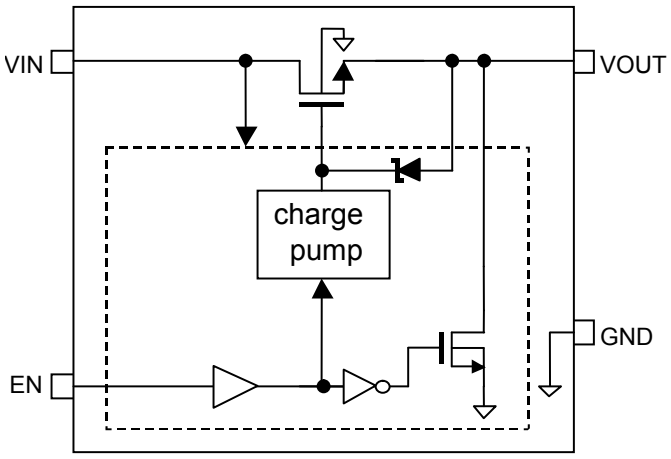


Fig.25 Bock diagram

B	VIN	VOUT	VOUT
A	VIN	EN	GND
	1	2	3

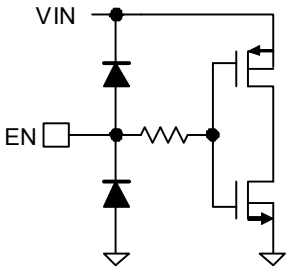
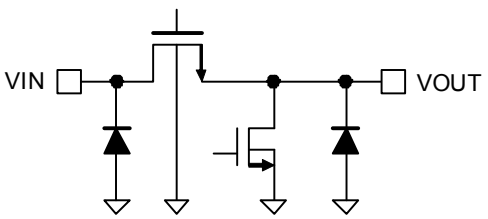
BD2200GUL,BD2201GUL
(Bottom view)

Fig.26 Pin configuration

●Pin Description

Pin number	Pin name	Pin function
A3	GND	Ground
B2, B3	VOUT	Switch output (connect each pin externally)
A1, B1	VIN	Switch input (connect each pin externally)
A2	EN	Enable input (Active-High Switch on input)

●I/O Equivalent Circuit

Pin name	Pin number	Equivalent circuit
EN	A2	
VIN VOUT	A1, B1 B2, B3	

●Operation Description

1. Switch operation
   Each VIN and VOUT pins are connected to MOSFET's drain and source. By setting EN input to High level, the internal charge pump operates and turns on MOSFET.
   When MOSFET is turned on, the switch becomes bidirectional characteristics. Consequently, in case of VIN < VOUT, the current is flowing from VOUT to VIN.

2. Output discharge circuit
   Discharge circuit operates when switch is off. When discharge circuit operates, 70Ω (Typ.) resistor is connected between VOUT pin and GND pin. This discharges the electrical charge quickly.

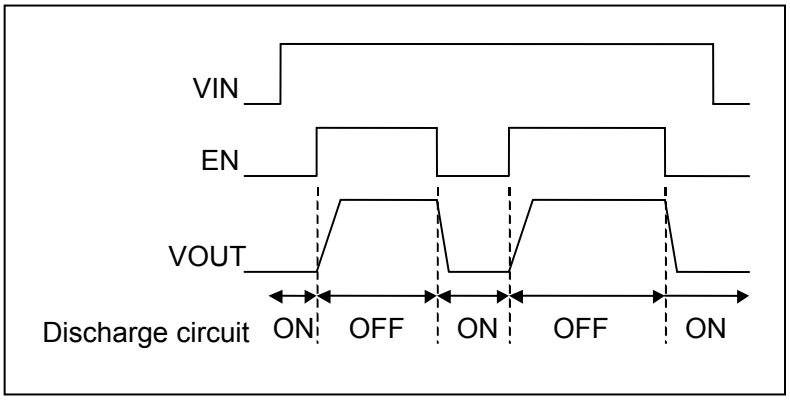


Fig.27 Operation timing

●Application Circuit Example

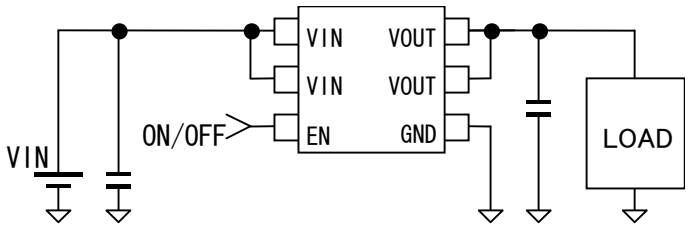


Fig.28 Application circuit example

**This application circuit does not guarantee its operation.
When using the circuit with changes to the external circuit constants, make sure to leave an adequate margin for external components including static and transitional characteristics as well as dispersion of the IC.

●Power Dissipation Characteristics

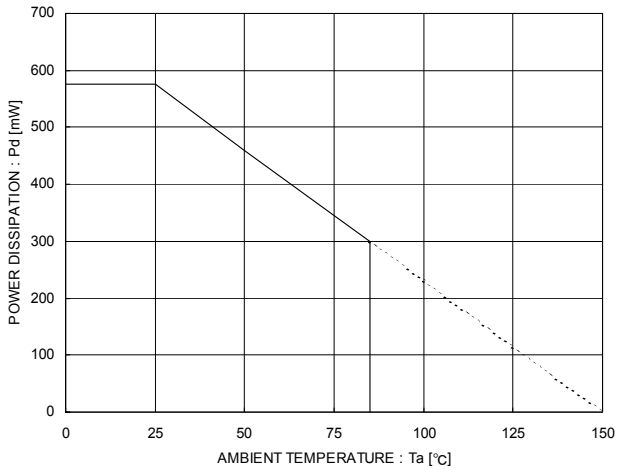


Fig.29 Power dissipation curve (Pd-Ta Curve)
(VCSP50L1 package)

●Notes for use

(1) Absolute Maximum Ratings
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Power supply and GND line
Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines. Pay attention to the interference by common impedance of layout pattern when there are plural power supplies and GND lines. Especially, when there are GND pattern for small signal and GND pattern for large current included the external circuits, separate each GND pattern. Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use a capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the Occurrence of capacity dropout at a low temperature, thus determining the constant.

(3) GND voltage
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

(4) Short circuit between terminals and erroneous mounting
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

(5) Operation in strong electromagnetic field
Be noted that using ICs in the strong electromagnetic field can malfunction them.

(6) Input terminals
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

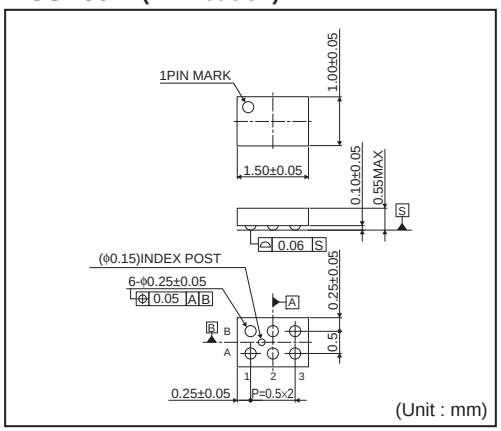
(7) External capacitor
In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

(8) 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 part number

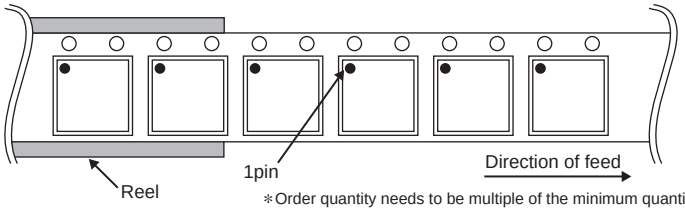
B	D		2	2	0	0		G	U	L	-	E	2
Part No.			Part No. 2200 2201					Package GUL: VCSP50L1				Packaging and forming specification E2: Embossed tape and reel	

VCSP50L1(BD2200GUL)



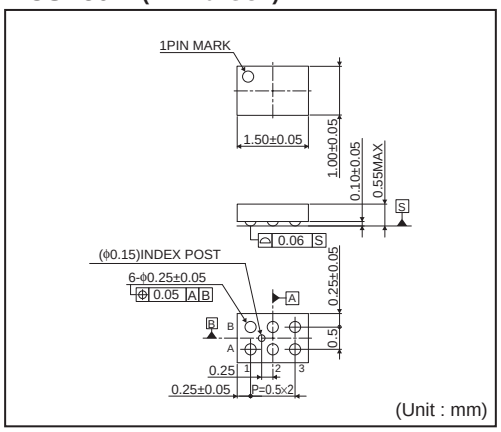
<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	3000pcs
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)



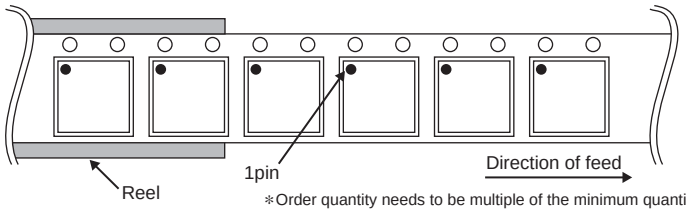
∗Order quantity needs to be multiple of the minimum quantity.

VCSP50L1(BD2201GUL)



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	3000pcs
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.

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Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.

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