

System Lens Driver Series for Mobile Phone Cameras

Parallel Interface Type Lens Drivers for Stepping Motor BD6360GUL



●Description

The BD6360GUL motor driver provides 2 Full-ON Drive H-bridge channel.

It is offered in an ultra small functional lens system for use in an auto focus or zoom system using a stepping motor.

And It integrates a power supply and wave-shaping circuit for the photo-interrupter necessary in order to determine the location of the motor.

●Features

BD6360GUL

- 1) Ultra-small chip size package : 2.1mm × 2.1mm × 0.55mm
- 2) Low ON-Resistance Power CMOS output : on high and low sides in total typ. 1.00Ω
- 3) ESD resistance (Human Body Model) : 8kV
- 4) Built-in voltage-regulator circuit for photo-interrupter and comparator circuits with hysteresis for photo-interrupter output waveform
- 5) Input mode selection function (1.8V can be put into each control input terminal)
- 6) Built-in UVLO (Under Voltage Lockout Protection) function
- 7) Built-in TSD (Thermal Shut Down) circuit
- 8) Standby current consumption: 0μA Typ.

●Absolute Maximum Ratings (Ta=+25°C)

Parameter	Symbol	Limit	Unit
Power supply voltage	VCC	-0.3~+6.5	V
Control input voltage	VIN	-0.3~VCC+0.3	V
Power dissipation	Pd	730 ^{*1}	mW
Operating temperature range	Topr	-25~+85	°C
Junction temperature	Tjmax	+150	°C
Storage temperature	Tstg	-55~+150	°C
H-bridge output current	Iout	-500~+500 ^{*2}	mA/ch

^{*1} Reduced by 5.84mW/°C over 25°C, when mounted on a glass epoxy board (50mm × 58mm × 1.75mm; 8 layers)

^{*2} Must not exceed Pd, ASO, or Tjmax of 150°C.

●Operating Conditions

Parameter	Symbol	Limit	Unit
Power supply voltage	VCC	+2.3~+5.5	V
Control input voltage	VIN	0~VCC	V
H-bridge output current	Iout	-400~+400 ^{*3}	mA/ch

^{*3} Must not exceed Pd or ASO.

●Electrical Characteristics

BD6360GUL Electrical Characteristics (Unless otherwise specified Ta=25°C, VCC=3.0V)

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Overall						
Circuit current during standby operation	ICCST	-	0	5	μA	PS=0V
Circuit current	ICC	-	1.1	1.8	mA	PS=3V with no signal, and no load
Control input (VIN=IN1A, IN1B, IN2A, IN2B, SEL, PS)						
High level input voltage	VINH	1.5	-	VCC	V	
Low level input voltage	VINL	0	-	0.5	V	
High level input current	IINH	15	30	60	μA	VINH=3V, pull down resistance typ.100kΩ
Low level input current	IINL	-1	0	-	μA	VINL=0V
UVLO						
UVLO voltage	VUVLO	1.6	-	2.2	V	
Photo-interrupter (PI) comparator						
Input bias current	IBIPI	-3	0	3	μA	
Output low level voltage	VLOPI	0	-	0.5	V	Io=+1mA
Output igh level voltage	VHIPI	VCC-0.5	-	VCC	V	Io=-1mA
Threshold voltage	VTHPI	1.2	1.3	1.4	V	Lo→Hi threshold voltage
Hysteresis voltage	VHYSPI	200	300	400	mV	Hi→Lo threshold voltage VTHPI-VHYSPI
Photo-interrupter (PI) regulator						
ON-Resistance	RONSW	-	-	10	Ω	Io=-30mA
OFF current	ILSW	-1.0	0	-	μA	BIAS=0V
Full-ON Drive block (ch1 and ch2)						
Output ON-Resistance	RON	-	1.00	1.25	Ω	Io=+400mA on high and low sides in total
Output AC characteristic						
Turn-on time	-	-	-	2.0	μs	Io=±400mA
Turn-off time	toff	-	0.08	0.5	μs	Io=±400mA
Rise time	tr	0.1	0.15	1.0	μs	Io=±400mA
Fall time	tf	-	0.03	0.2	μs	Io=±400mA

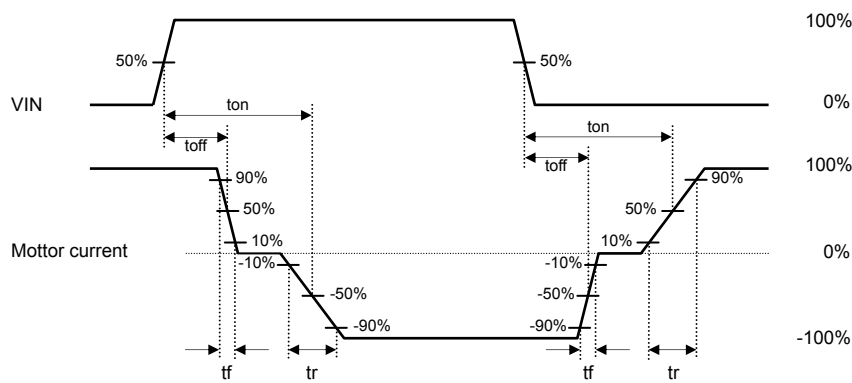


Fig.1 BD6360GUL I/O Switching Waveform

● Power Dissipation Reduction

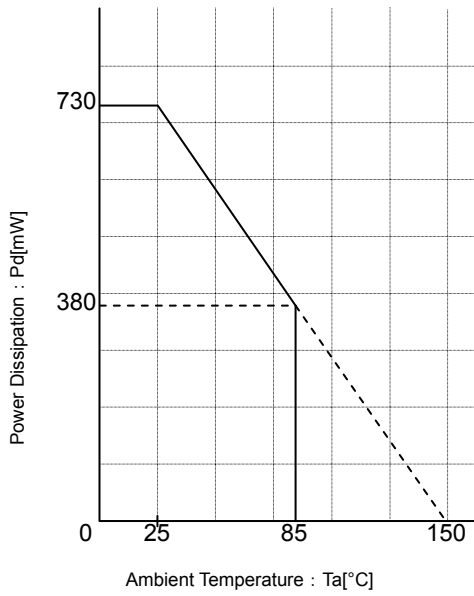


Fig.2 BD6360GUL Power Dissipation Reduction

● Electrical Characteristic Diagrams

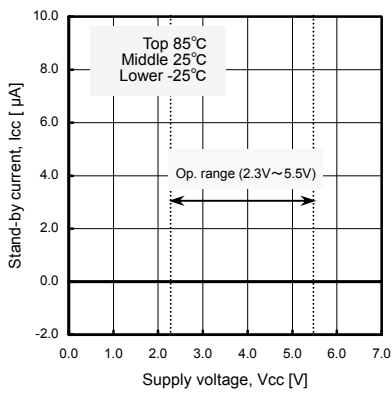


Fig.3 Standby Current

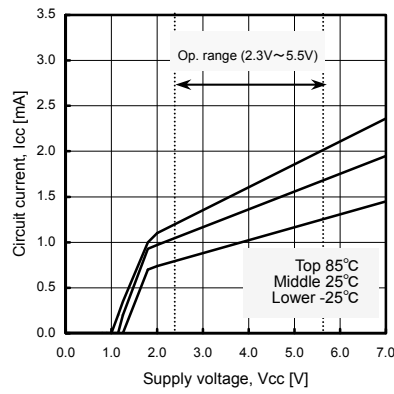


Fig.4 Circuit Current

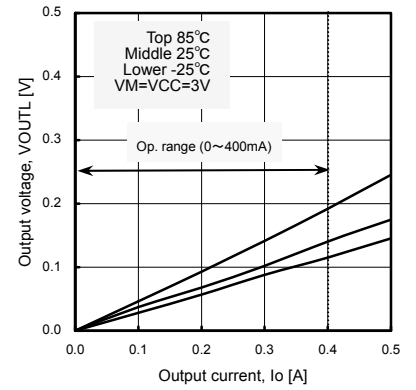


Fig.5 NMOS Output Voltage

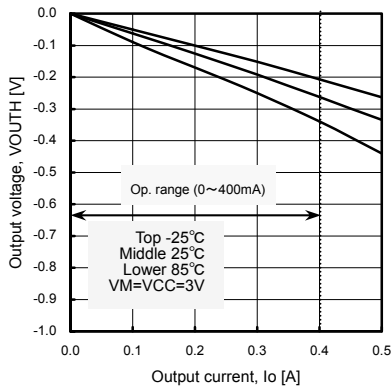


Fig.6 PMOS Output Voltage

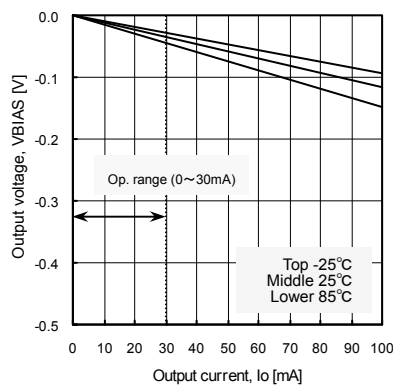


Fig.7 BIAS Output Voltage

●Block Diagram, Application Circuit Diagram, Pin Arrangement and Pin Function Table

1)BD6360GUL Block Diagram, Application Circuit Diagram, Pin Arrangement and Pin Function Table

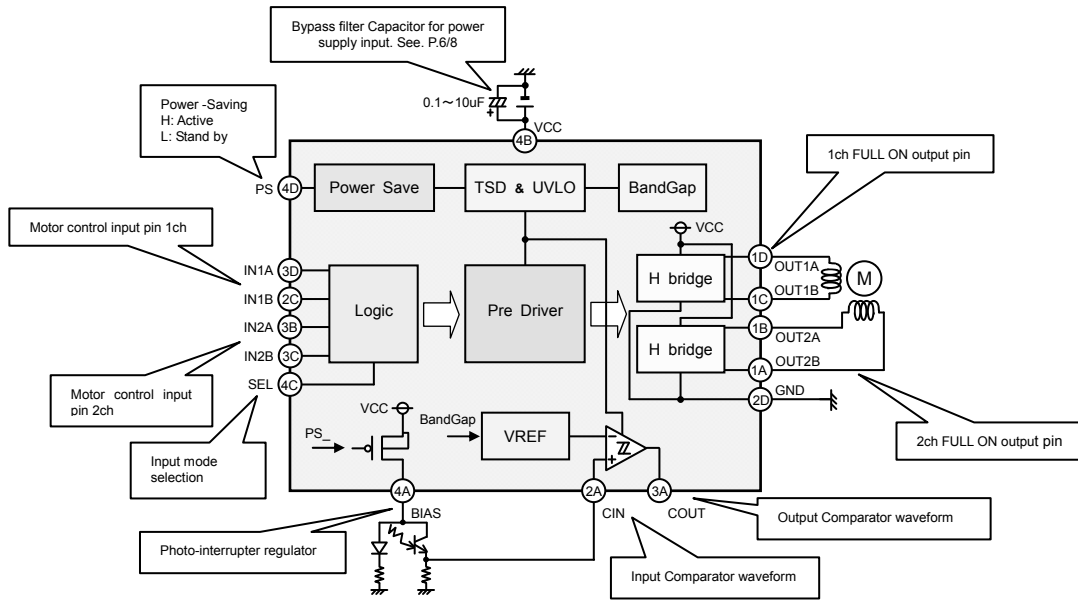


Fig.8 BD6360GUL Application Circuit Diagram

BD6360GUL Pin Function Table

	1	2	3	4
A	OUT2B	CIN	COUT	BIAS
B	OUT2A	INDEX POST	IN2A	VCC
C	OUT1B	IN1B	IN2B	SEL
D	OUT1A	GND	IN1A	PS

No.	Pin name	Function
1A	OUT2B	H-bridge output pin ch2 B
2A	CIN	Comparator circuits with output waveform input pin
3A	COUT	Comparator circuits with output waveform output pin
4A	BIAS	Voltage-regulator for photo-interrupter
1B	OUT2A	H-bridge output pin ch2 A
2B		
3B	IN2A	Control input pin ch2 A
4B	VCC	Power supply pin
1C	OUT1B	H-bridge output pin ch1 B
2C	IN1B	Control input pin ch1 B
3C	IN2B	Control input pin ch2 B
4C	SEL	Input mode selection pin ch1
1D	OUT1A	H-bridge output pin ch1 A
2D	GND	Ground pin
3D	IN1A	Control input pin ch1 A
4D	PS	Power-saving pin

Fig.9 BD6360GUL Pin Arrangement (Top View)

● I/O Truth Table

BD6360GUL I/O Truth Table (x=1or2)

mode	INPUT				OUTPUT		Output mode	
	PS	SEL	INxA	INxB	OUTxA	OUTxB		
EN/IN	H	L	L	X	Z	Z	Standby	
			H	L	H	L	Forward rotation	
			H	H	L	H	Reverse rotation	
IN/IN		H	H	L	L	Z	Z	Standby
				L	H	L	H	Reverse rotation
				H	L	H	L	Forward rotation
	H			H	L	L	Brake	
-	L	X	X	X	Z	Z	Standby	

At forward rotation, current flows from OUTxA to OUTxB. At reverse rotation, current flows form OUTxB to OUTxA.
 L: Low, H: High, X: Don't care, Z: Hi impedance

● Function Explanation

- 1) Power save function
 When the L voltage is applied the PS pin, the IC's inside circuit stop, and when 0V applied, the circuit current became 0μA(Typ.), especially.
 When the IC drive, Serial input while the PS pin applied H voltage. (See the electrical characteristics; P.2/8)
- 2) Control Input Pin
 IN1A, IN1B, IN2A, IN2B, SEL pins
 The IN1A, IN1B, IN2A, IN2B are used to program and control the motor drive modes.
 And, when the L voltage is applied to the SEL pin, the I/O logic can be set to EN(Enable)/IN mode, when the H voltage is applied to the one, the I/O logic can be set to IN/IN mode. (See the electrical characteristics; P.2/8, and the I/O Truth Table; P.5/8)
- 3) H-bridge on the output stage
 Specify maximum current applied to the H-bridge within the operating range, in consideration of power dissipation.
 (See the Operating Conditions; P.1/8)
- 4) Photo-interrupter regulator
 Pay attention to the ON resistance with regard to the power source of the Photo interrupter.
 (See the electrical characteristics; P.2/8)
- 5) The wave-shaping circuit convert
 The wave-shaping circuit convert the distorted output signals from the photo-interrupter into clean rectangular waves, then outputs them to the DSP.
 A hysteresis function is included that blocks output signal chatter caused by input signal noise.

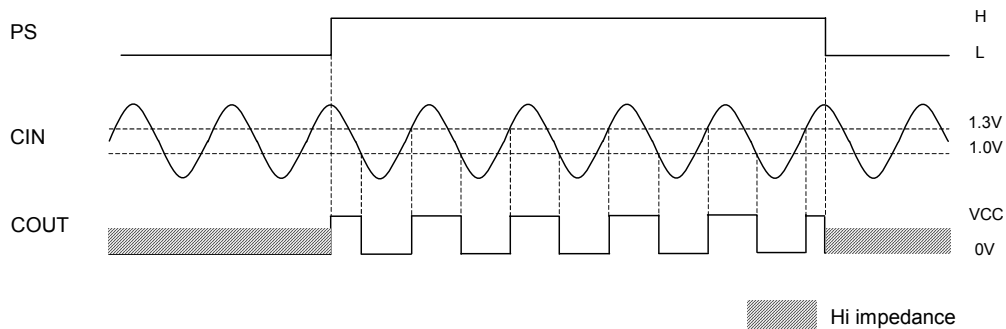


Fig.10 BD6360GUL Photo-interrupter I/O Timing Chart

● I/O Circuit Diagram

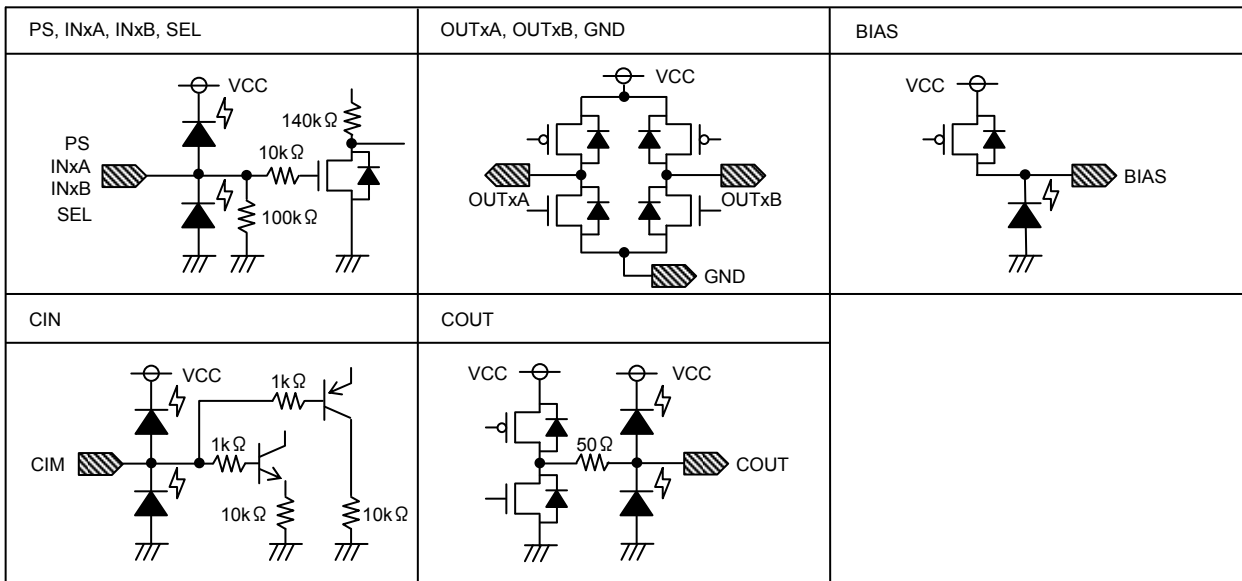


Fig.11 BD6360GUL I/O Circuit Diagram (Resistance values are typical ones)

● Operation Notes

- 1) Absolute maximum ratings

Use of the IC in excess of absolute maximum ratings, such as the applied voltage (VCC) or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.
- 2) Storage temperature range (Tstg)

As long as the IC is kept within this range, there should be no problems in the IC's performance. Conversely, extreme temperature changes may result in poor IC performance, even if the changes are within the above range.
- 3) Power supply and wiring

Be sure to connect the power terminals outside the IC. Do not leave them open. Because a return current is generated by a counter electromotive force of the motor, take necessary measures such as putting a Capacitor between the power source and the ground as a passageway for the regenerative current. Be sure to connect a Capacitor of proper capacitance (0.1μF to 10μF) between the power source and the ground at the foot of the IC, and ensure that there is no problem in properties of electrolytic Capacitors such as decrease in capacitance at low temperatures. When the connected power source does not have enough current absorbing capability, there is a possibility that the voltage of the power source line increases by the regenerative current and exceeds the absolute maximum rating of this product and the peripheral circuits.

Therefore, be sure to take physical safety measures such as putting a zener diode for a voltage clamp between the power source and the ground.

For this IC with a part consists of the CMOS block, it is possible that rush current may flow instantaneously due to the unstable internal logic. Therefore, give special consideration to power coupling capacitance, width of power and ground wirings, and routing of wiring.
- 4) Ground terminal and wiring

The potential at GND terminals should be made the lowest under any operating conditions. Ensure that there are no terminals where the potentials are below the potential at GND terminals, including the transient phenomena. Use short and thick power source and ground wirings to ensure low impedance.
- 5) Thermal design

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

- 6) Pin short and wrong direction assembly of the device.
Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if positive and ground power supply terminals are reversed. The IC may also be damaged if pins are shorted together or are shorted to other circuit's power lines.
- 7) Avoiding strong magnetic field
Malfunction may occur if the IC is used around a strong magnetic field.
- 8) ASO
Ensure that the output transistors of the motor driver are not driven under excess conditions of the absolute maximum ratings and ASO.
- 9) TSD (Thermal Shut Down) circuit
If the junction temperature (T_{jmax}) reaches 175°C , the TSD circuit will operate, and the coil output circuit of the motor will open. There is a temperature hysteresis of approximately 25°C . The TSD circuit is designed only to shut off the IC in order to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. The performance of the IC's characteristics is not guaranteed and it is recommended that the device is replaced after the TSD is activated.
- 10) Testing an application board
When testing the IC on an application board, connecting a Capacitor to a pin with low impedance subjects the IC to stress. Always discharge Capacitors after each process or step. Always turn the IC's power supply off before connecting it to, or removing it from a jig or fixture, during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting and storing the IC.
- 11) Regarding the input pin of the IC
This monolithic IC contains P^+ isolation and P substrate layers between adjacent elements to keep them isolated. P-N junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:
When $\text{GND} > \text{Pin A}$, the P-N junction operates as a parasitic diode.
When $\text{GND} > \text{Pin B}$, the P-N junction operates as a parasitic diode and transistor.
Parasitic elements can occur inevitably in the structure of the IC. The operation of parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic elements operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

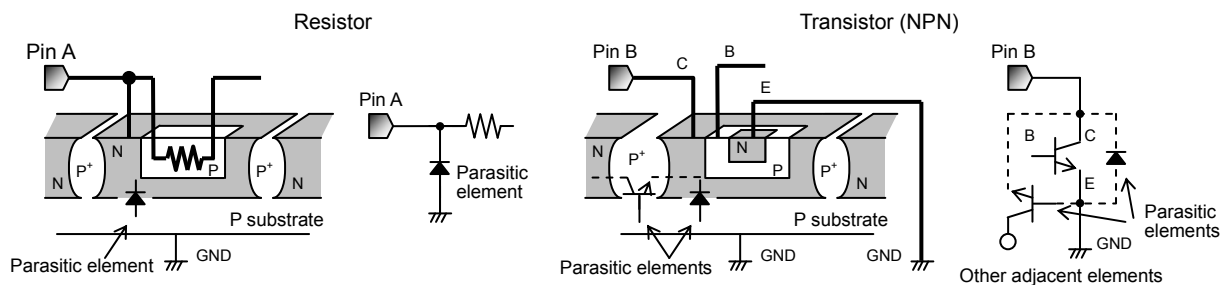
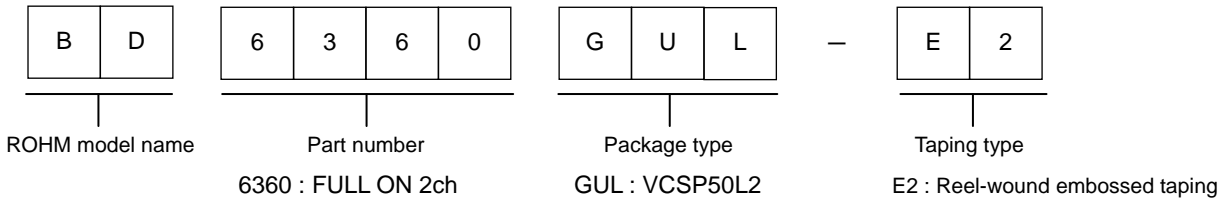


Fig.12 Example of Simple IC Architecture

●Selecting a Model Name when Ordering



VCSP50L2

< Dimension >

(Unit:mm)

< Tape and Reel information >

Tape	Embossed carrier tape (with dry pack)
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.)

※When you order , please order in times the amount of package quantity.

- The contents described herein are correct as of September, 2008
- The contents described herein are subject to change without notice. For updates of the latest information, please contact and confirm with ROHM CO.,LTD.
- Any part of this application note must not be duplicated or copied without our permission.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams and information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by ROHM CO., LTD. is granted to any such buyer.
- The products described herein utilize silicon as the main material.
- The products described herein are not designed to be X ray proof.

The products listed in this catalog are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys). Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

Contact us for further information about the products.

<p>San Diego TEL: +1-858-625-3630 FAX: +1-858-625-3670</p> <p>Atlanta TEL: +1-770-754-5972 FAX: +1-770-754-0691</p> <p>Boston TEL: +1-978-371-0382 FAX: +1-928-438-7164</p> <p>Chicago TEL: +1-847-368-1006 FAX: +1-847-368-1008</p> <p>Dallas TEL: +1-469-287-5366 FAX: +1-469-362-7973</p> <p>Denver TEL: +1-303-708-0908 FAX: +1-303-708-0858</p> <p>Detroit TEL: +1-248-348-9920 FAX: +1-248-348-9942</p> <p>Nashville TEL: +1-615-620-6700 FAX: +1-615-620-6702</p> <p>Mexico TEL: +52-33-3123-2001 FAX: +52-33-3123-2002</p> <p>Düsseldorf TEL: +49-2154-9210 FAX: +49-2154-921400</p> <p>Munich TEL: +49-8999-216168 FAX: +49-8999-216176</p> <p>Stuttgart TEL: +49-711-7272-370 FAX: +49-711-7272-3720</p> <p>France TEL: +33-1-5697-3060 FAX: +33-1-5697-3080</p> <p>United Kingdom TEL: +44-1-908-306700 FAX: +44-1-908-235788</p> <p>Denmark TEL: +45-3694-4739 FAX: +45-3694-4789</p> <p>Esposo TEL: +358-9725-54491 FAX: +358-9-7255-4499</p> <p>Salo TEL: +358-2-7332234 FAX: +358-2-7332237</p> <p>Oulu TEL: +358-9-5372930 FAX: +358-8-5372931</p> <p>Barcelona TEL: +34-9375-24320 FAX: +34-9375-24410</p> <p>Hungary TEL: +36-1-4719338 FAX: +36-1-4719339</p> <p>Poland TEL: +48-22-5757213 FAX: +48-22-5757001</p> <p>Russia TEL: +7-495-739-41-74 FAX: +7-495-739-41-74</p> <p>Seoul TEL: +82-2-8182-700 FAX: +82-2-8182-715</p> <p>Masan TEL: +82-55-240-6234 FAX: +82-55-240-6236</p> <p>Dalian TEL: +86-411-8230-8549 FAX: +86-411-8230-8537</p> <p>Beijing TEL: +86-10-8525-2483 FAX: +86-10-8525-2489</p>	<p>Tianjin TEL: +86-22-23029181 FAX: +86-22-23029183</p> <p>Shanghai TEL: +86-21-6279-2727 FAX: +86-21-6247-2066</p> <p>Hangzhou TEL: +86-571-87658072 FAX: +86-571-87658071</p> <p>Nanjing TEL: +86-25-8689-0015 FAX: +86-25-8689-0393</p> <p>Ningbo TEL: +86-574-87654201 FAX: +86-574-87654208</p> <p>Qingdao TEL: +86-532-5779-312 FAX: +86-532-5779-653</p> <p>Suzhou TEL: +86-512-6807-1300 FAX: +86-512-6807-2300</p> <p>Wuxi TEL: +86-510-82702693 FAX: +86-510-82702992</p> <p>Shenzhen TEL: +86-755-8307-3008 FAX: +86-755-8307-3003</p> <p>Dongguan TEL: +86-769-8393-3320 FAX: +86-769-8398-4140</p> <p>Fuzhou TEL: +86-591-8801-8698 FAX: +86-591-8801-8690</p> <p>Guangzhou TEL: +86-20-3878-8100 FAX: +86-20-3825-5965</p> <p>Huizhou TEL: +86-752-205-1054 FAX: +86-752-205-1059</p> <p>Xiamen TEL: +86-592-238-5705 FAX: +86-592-239-8380</p> <p>Zhuhai TEL: +86-756-3232-480 FAX: +86-756-3232-460</p> <p>Hong Kong TEL: +852-2-740-6262 FAX: +852-2-375-8971</p> <p>Taipei TEL: +886-2-2500-6956 FAX: +886-2-2503-2869</p> <p>Kaohsiung TEL: +886-7-237-0881 FAX: +886-7-238-7332</p> <p>Singapore TEL: +65-6332-2322 FAX: +65-6332-5662</p> <p>Philippines TEL: +63-2-807-6872 FAX: +63-2-809-1422</p> <p>Thailand TEL: +66-2-254-4890 FAX: +66-2-256-6334</p> <p>Kuala Lumpur TEL: +60-3-7958-8355 FAX: +60-3-7958-8377</p> <p>Penang TEL: +60-4-2286453 FAX: +60-4-2286452</p> <p>Kyoto TEL: +81-75-365-1218 FAX: +81-75-365-1228</p> <p>Yokohama TEL: +81-45-476-2290 FAX: +81-45-476-2295</p>
---	--

Excellence in Electronics



ROHM CO., LTD.

21 Saiin Mizosaki-cho, Ukyo-ku, Kyoto
615-8585, Japan
TEL: +81-75-311-2121 FAX: +81-75-315-0172
URL: <http://www.rohm.com>

Published by
KTC LSI Development Headquarters
LSI Business Promotion Group