Power Management ICs for Automotive Body Control

LED Indicator Driver

BD8105FV

No.11039ECT01

●Description

The BD8105FV is a serial parallel control LED driver with 35V input voltage rating.
Responding to the 3-line serial data, it turns the 12ch open drain output on/off.
Due to its compact size, it is optimal for small spaces.

●Features

1) Open Drain Output
2) 3-line Serial Control + Enable Signal
3) Internal Temperature Protection Circuit (TSD)
4) Cascade Connection Compatible
5) SSOP-B20W
6) Internal 12 ch Power Transistor

●Applications

These ICs can be used with car and consumer electronic.

●Absolute Maximum Ratings (Ta=25℃)

Parameter	Symbol	Ratings	Unit
Power Supply Voltage	VCC	7	V
Output Voltage(Pin No : 4～9, 11～16)	VDmax	35	V
Input Voltage(Pin No : 1, 2, 3, 17, 18)	VIN	-0.3～VCC	V
Power Dissipation	Pd	1187*	mW
Operating Temperature Range	Topr	-40～+105	℃
Storage Temperature Range	Tstg	-55～+150	℃
Drive Current (DC)	IomaxD	50	mA
Drive Current(Pulse)	IomaxP	150**	mA
Junction Temperature	Tjmax	150	℃

* Pd decreased at 9.50mW/℃ for temperatures above Ta=25℃,mounted on 70×70×1.6mm Glass-epoxy PCB.
** Do not however exceed Pd. Time to impress≦200msec

●Operational Conditions (Ta=-40~105℃)

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Power Supply Voltage	Vcc	4.5	5	5.5	V
Drive Current	Io	-	20	40	mA

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

●Electrical Characteristics (Unless specified, Ta=-40~105℃ Vcc=4.5～5.5V)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
【Output D0～D11】(Pin No : 4～9, 11～16)						
ON Resistor	RON	-	6	12	Ω	I_D=20mA
Output leakage current	IDL	-	0	5	μA	V_D=34V
【Logic input】(Pin No : 1, 2, 3, 17, 18)						
Upper limit threshold voltage	VTH	Vcc ×0.8	-	-	V	
Bottom limit threshold voltage	VTL	-	-	Vcc ×0.2	V	
Serial clock frequency	FCLK	-	-	1	MHz	
Input Current	IIN	20	50	100	μA	VIN=5V
Input leakage Current	IINL	-	0	5	μA	VIN=0V
【WHOLE】						
Circuit Current	ICC	-	0.3	5	mA	Serial Data Input, VCC=5V,CLK=500KHz, SEROUT=OPEN
Static Current	ISTN	-	0	50	μA	RST_B=OPEN, SEROUT=OPEN
【SER OUT】(Pin No. : 20)						
Output Voltage high	VOH	4.6	4.8	-	V	VCC=5V, ISO=-5mA
Output voltage Low	VOL	-	0.2	0.4	V	VCC=5V, ISO=5mA

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

●Electrical Characteristic Diagrams (Unless otherwise specified Ta=25℃)

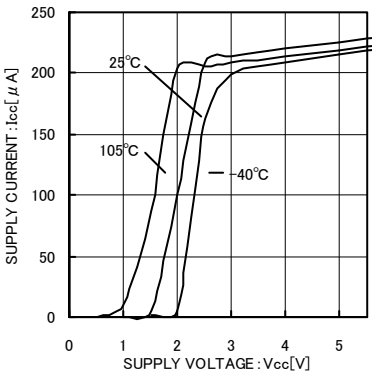


Fig.1 Circuit current 1

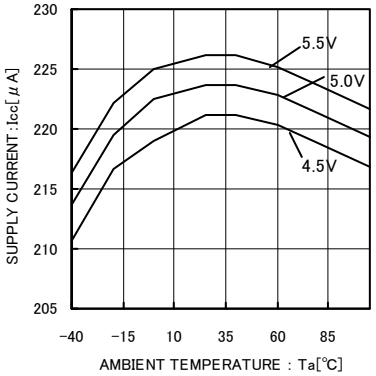


Fig.2 Circuit current 2

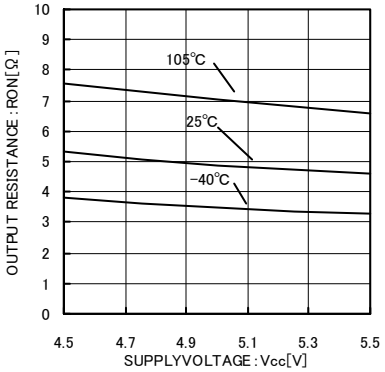


Fig.3 Dxx on resistance 1
(at IDD=20mA)

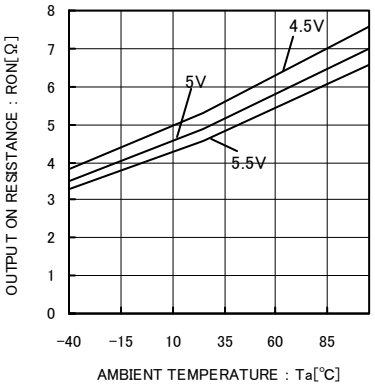


Fig.4 Dxx on resistance 2
(at IDD=20mA)

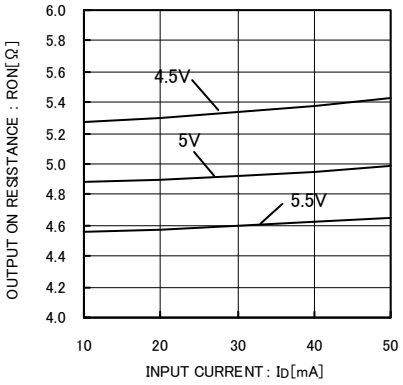


Fig.5 Dxx on resistance

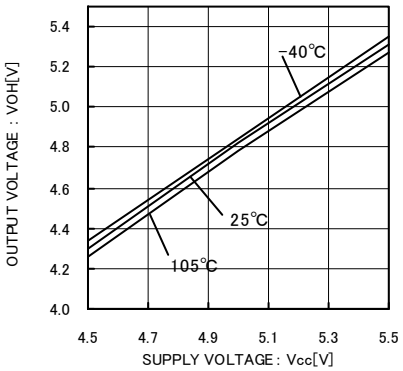


Fig.6 SEROUT high side voltage 1
(at ISO=-5mA)

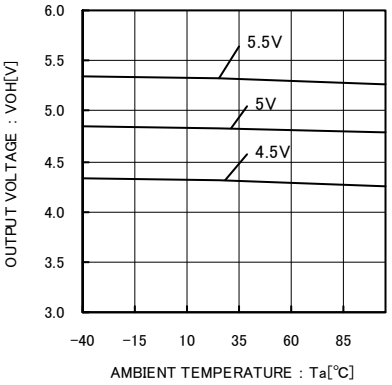


Fig.7 SEROUT high side voltage 2
(at ISO=-5mA)

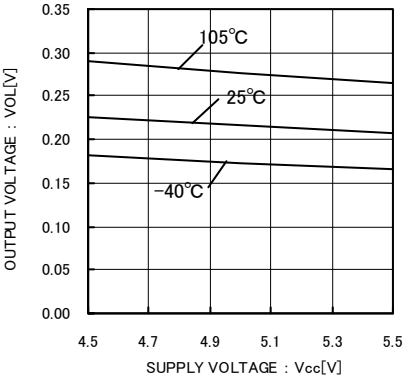


Fig.8 SEROUT low side voltage 1
(at ISO=5mA)

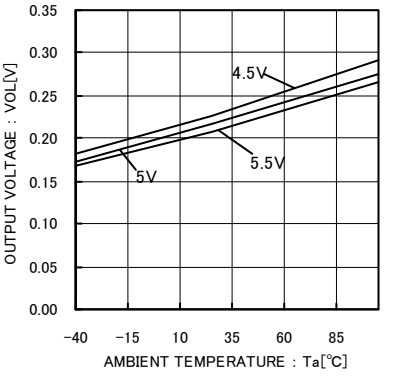


Fig.9 SEROUT low side voltage 2
(at ISO=5mA)

●Block Diagram

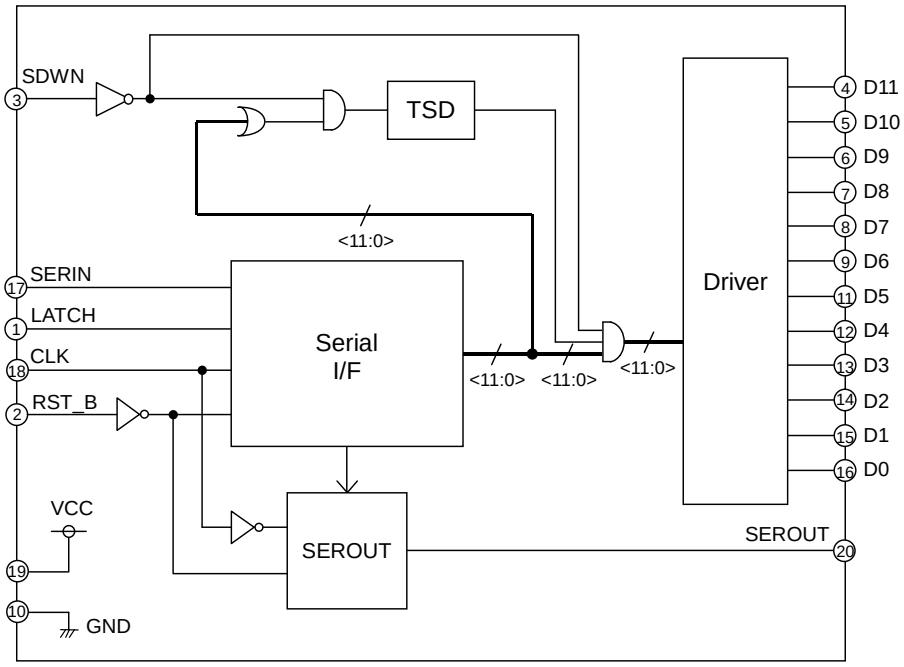


Fig.10

●Pin Setup Diagram

BD8105FV(SSOP-B20W)

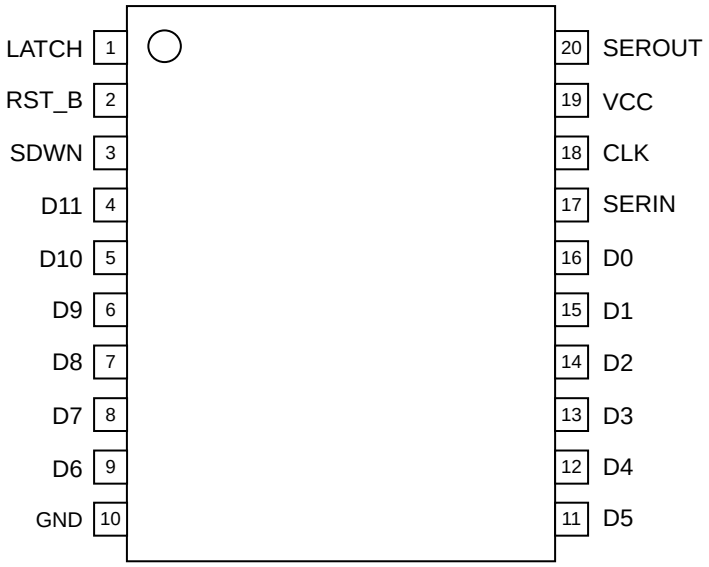


Fig.11

●Terminal Number・Terminal Name

Pin Number	Terminal Name	Function
1	LATCH	Latch Signal Input Terminal (H: Latches Data)
2	RST_B	Reset Reversal Input Terminal (L: FF Data 0)
3	SDWN	Shutdown Input Terminal (H: Output Off)
4	D11	Drain Output Terminal 11
5	D10	Drain Output Terminal 10
6	D9	Drain Output Terminal 9
7	D8	Drain Output Terminal 8
8	D7	Drain Output Terminal 7
9	D6	Drain Output Terminal 6
10	GND	Ground Terminal
11	D5	Drain Output Terminal 5
12	D4	Drain Output Terminal 4
13	D3	Drain Output Terminal 3
14	D2	Drain Output Terminal 2
15	D1	Drain Output Terminal 1
16	D0	Drain Output Terminal 0
17	SERIN	Serial Data Input Terminal
18	CLK	Clock Input Terminal
19	VCC	Supply Voltage Input Terminal
20	SEROUT	Serial Data Output Terminal

●Block Operation

1)Serial I/F

The I/F is a 3-line serial (LATCH, CLK, SERIN) style.
12-bit output ON/OFF can be set-up. This is composed of shift register. + 12-bit register.

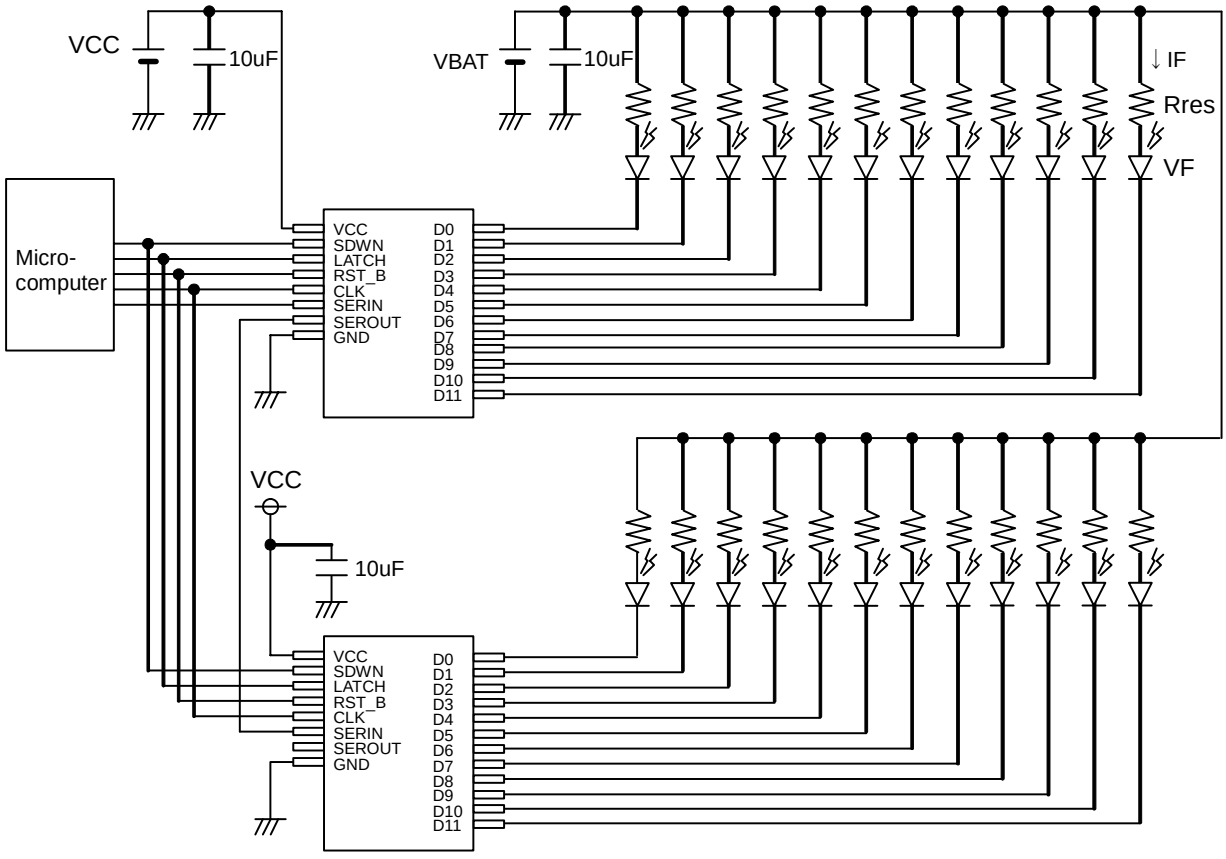
2)Driver

It is a 12-bit open drain output.

3)TSD (Thermal Shut Down)

To prevent heat damage and overheating, when the chip temperature goes over approximately 175℃, the output turns off. When the temperature goes back down, normal operation resumes. However, the intended use of the temperature protection circuit is to protect the IC, so please construct thermal design with the junction temperature Tjmax under 150℃.

●Application Circuit



$$IF = \frac{VBAT - VF}{Rres + RON}$$

Fig.12

●Serial Communication

The serial I/F is composed of a shift register which changes the CLK and SERIN serial signals to parallel signals, and a register to remember those signals with a LATCH signal. The registers are reset by applying a voltage under VCC × 0.2 to the RST_B terminal or opening it, and D11~D0 become open. To prevent erroneous LED lighting, please apply voltage under VCC × 0.2 to RST_B or make it open during start-up.

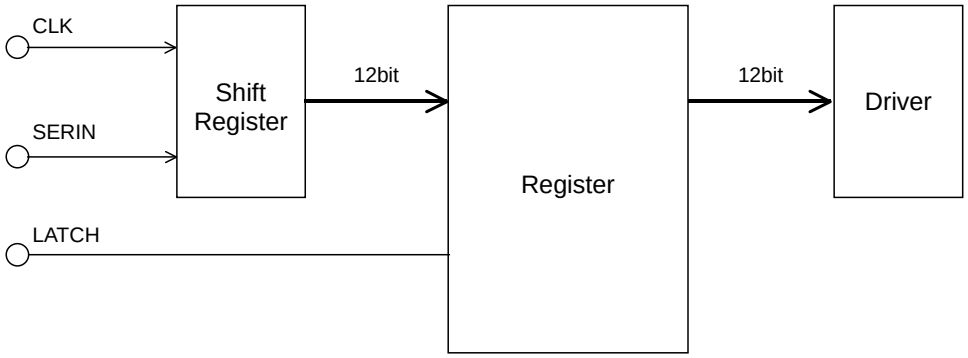


Fig.13

1)Serial Communication Timing

The 12-bit serial data input from SERIN is taken into the shift register by the rise edge of the CLK signal, and is recorded in the register by the rise edge of the LATCH signal. The recorded data is valid until the next rise edge of the LATCH signal.

2)Serial Communication Data

The serial data input configuration of SERIN terminal is shown below:

First →

d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0	→Last
Data												

Terminal Name	Output Status	Data											
		d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0
D11	ON	1	*	*	*	*	*	*	*	*	*	*	*
	OFF	0	*	*	*	*	*	*	*	*	*	*	*
D10	ON	*	1	*	*	*	*	*	*	*	*	*	*
	OFF	*	0	*	*	*	*	*	*	*	*	*	*
D9	ON	*	*	1	*	*	*	*	*	*	*	*	*
	OFF	*	*	0	*	*	*	*	*	*	*	*	*
D8	ON	*	*	*	1	*	*	*	*	*	*	*	*
	OFF	*	*	*	0	*	*	*	*	*	*	*	*
D7	ON	*	*	*	*	1	*	*	*	*	*	*	*
	OFF	*	*	*	*	0	*	*	*	*	*	*	*
D6	ON	*	*	*	*	*	1	*	*	*	*	*	*
	OFF	*	*	*	*	*	0	*	*	*	*	*	*
D5	ON	*	*	*	*	*	*	1	*	*	*	*	*
	OFF	*	*	*	*	*	*	0	*	*	*	*	*
D4	ON	*	*	*	*	*	*	*	1	*	*	*	*
	OFF	*	*	*	*	*	*	*	0	*	*	*	*
D3	ON	*	*	*	*	*	*	*	*	1	*	*	*
	OFF	*	*	*	*	*	*	*	*	0	*	*	*
D2	ON	*	*	*	*	*	*	*	*	*	1	*	*
	OFF	*	*	*	*	*	*	*	*	*	0	*	*
D1	ON	*	*	*	*	*	*	*	*	*	*	1	*
	OFF	*	*	*	*	*	*	*	*	*	*	0	*
D0	ON	*	*	*	*	*	*	*	*	*	*	*	1
	OFF	*	*	*	*	*	*	*	*	*	*	*	0

* represents “Don’t care”.

3)Enable Signal

By applying voltage at least VCC×0.8 or more to the SDWN terminal, D0 (16 pin)~D11 (4 pin) become open forcibly. At this time, the temperature protection circuit (TSD) stops. D11～D0 become PWM operation by inputting PWM to SDWN(3 pin).

4)SEROUT

A cascade connection can be made (connecting at least 2 or more IC's in serial).
Serial signal input from SERIN is transferred into receiver IC by the fall edge of the CLK signal.
Since this functionality gives enough margins for the setup time prior to the rise edge of the CLK signal on the receiver IC (using the exact same CLK signal of sender IC), the application reliability can be improved as cascade connection functionality.

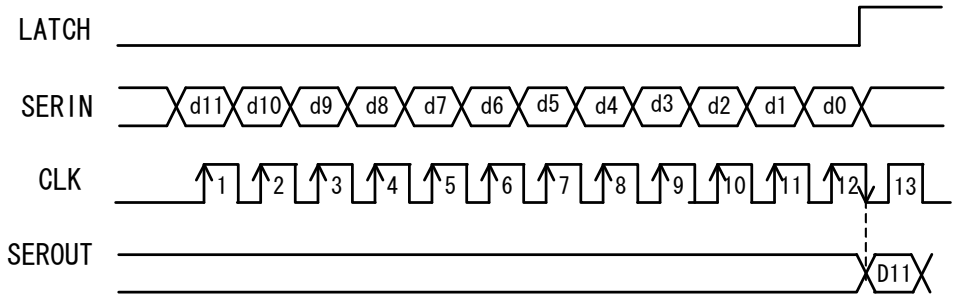


Fig.14

●Cascade Connection

By using (at least) 2 ICs, each IC's D11~D0, at (at least) 24ch, can be controlled by the 24-bit SERIN signal. The serial data input to the sender IC can be transferred to the receiver IC by inputting 12CLK to the CLK terminal.

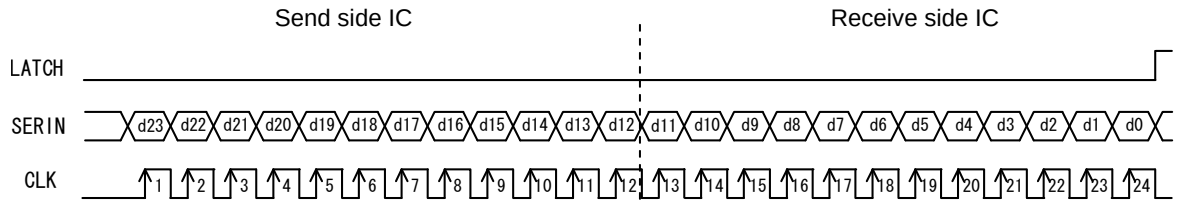


Fig.15

●INPUT SIGNAL'S TIMING CHART

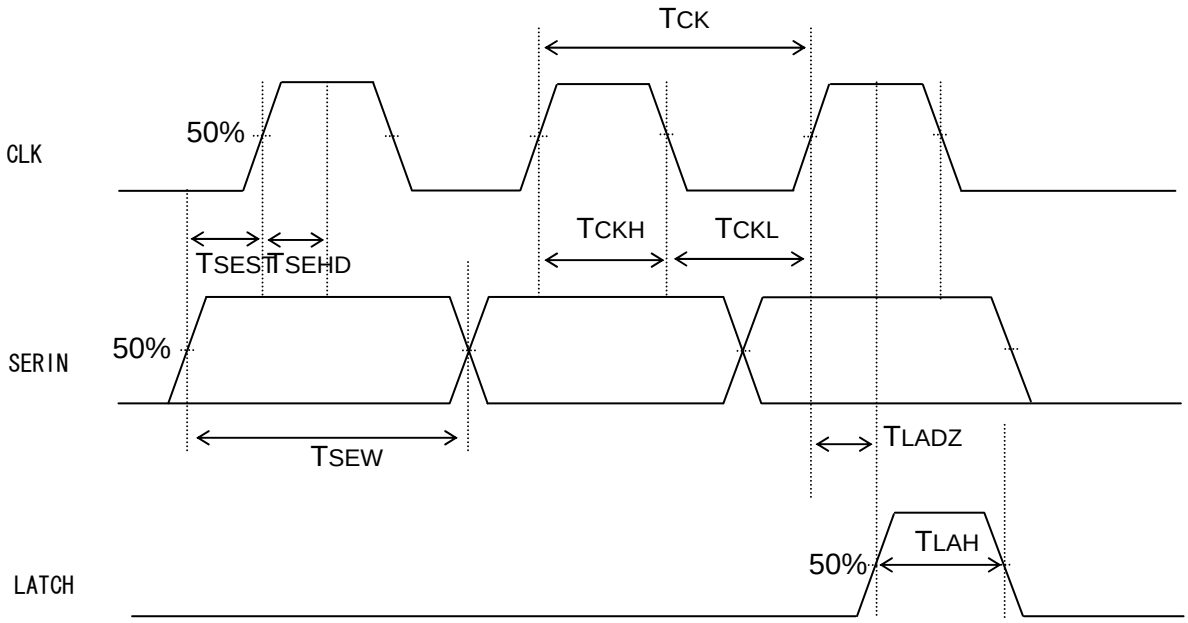


Fig.16

●INPUT SIGNAL'S TIMING RULE(Ta=-40～105℃ Vcc=4.5～5.5V)

Parameter	Symbol	Min	Unit
CLK period	TCK	1000	ns
CLK high pulse width	TCKH	480	ns
CLK low pulse width	TCKL	480	ns
SERIN high and low pulse width	TSEW	980	ns
SERIN setup time prior to CLK rise	TSEST	150	ns
SERIN hold time after CLK fall	TSEHD	150	ns
LATCH high pulse time	TLAH	480	ns
Last CLK rise to LATCH rise	TLADZ	250	ns

●OUTPUT SIGNAL'S DELAY CHART

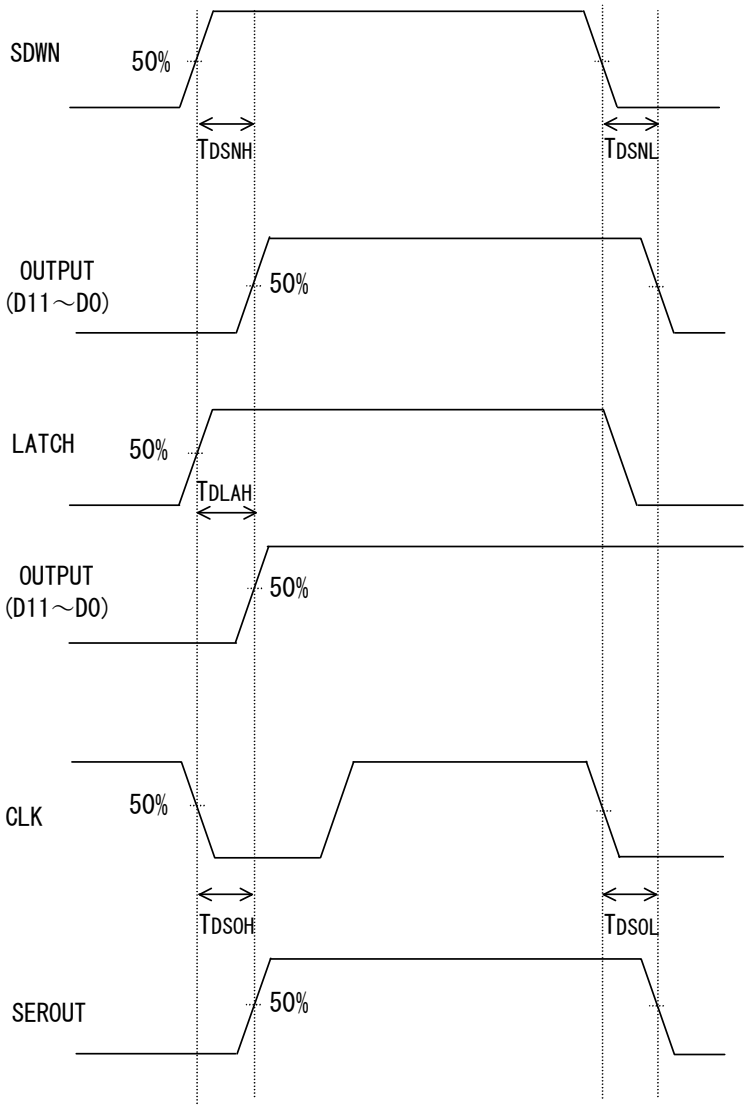


Fig.17

●OUTPUT SIGNAL'S DELAY TIME(Ta=-40～105℃ Vcc=4.5～5.5V)

Parameter	Symbol	Max	Unit
SDWN Switching Time(L→H)	TDSNH	300	ns
SDWN Switching Time(H→L)	TDSNL	300	ns
LATCH Switching Delay Time	TDLAH	300	ns
SEROUT Propagation Delay Time(L→H)	TDSOH	350	ns
SEROUT Propagation Delay Time (H→L)	TDSOL	350	ns

●INPUT/OUTPUT EQUIVALENT CIRCUIT(PIN NAME)

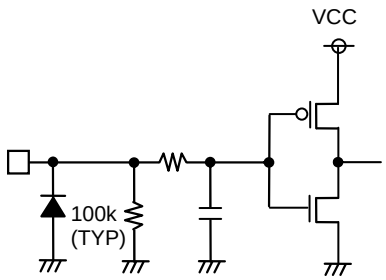
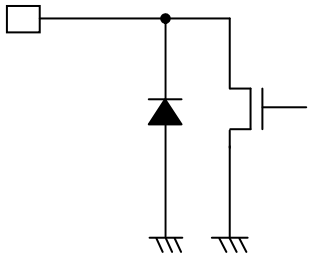
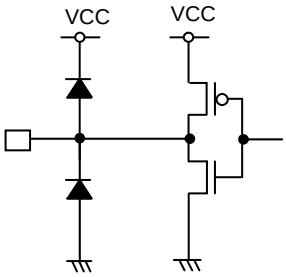
1PIN(LATCH) 2PIN(RST_B) 3PIN(SDWN) 17PIN(SERIN) 18PIN(CLK)	4PIN(D11),5PIN(D10) 6PIN(D9),7PIN(D8) 8PIN(D7),9PIN(D6) 11PIN(D5),12PIN(D4) 13PIN(D3),14PIN(D2) 15PIN(D1),16PIN(D0)	20PIN(SEROUT)
		

Fig.18

●Notes for use

(1) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings such as the applied voltage or operating temperature range 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 use of the IC in a special mode where the absolute maximum ratings may be exceeded is anticipated.

(2) Reverse connection of a power supply connector
If the connector of power is wrong connected, it may result in IC breakage. In order to prevent the breakage from the wrong connection, the diode should be connected between external power and the power terminal of IC as protection solution.

(3) GND potential
Ensure a minimum GND pin potential in all operating conditions.

(4) Setting of heat
Use a setting of heat that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

(5) Pin short and mistake fitting
Use caution when orienting and positioning the IC for mounting on printed circuit boards. Improper mounting may result in damage to the IC. Use of the IC in excess of absolute maximum ratings such as the applied voltage or operating temperature range may result in IC damage.

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

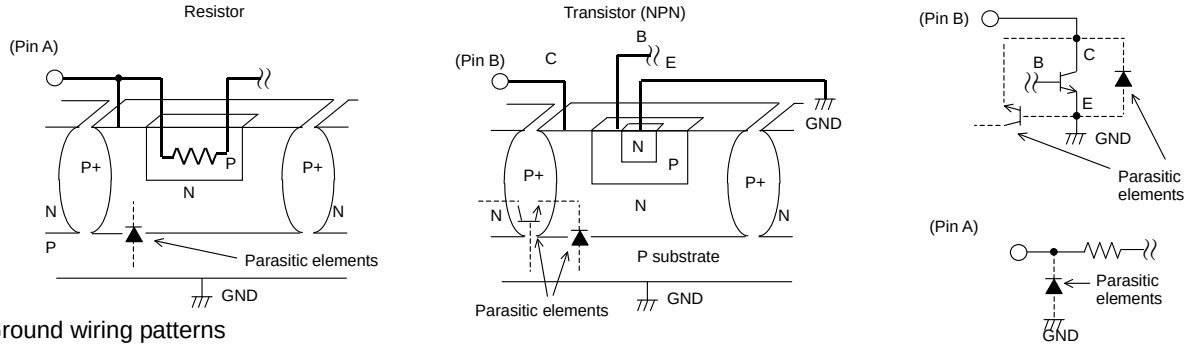
(7) Thermal shutdown circuit(TSD)
This IC built-in a Thermal shutdown circuit (TSD circuit). If Chip temperature becomes 175℃(TYP.), make the output an Open state. Eventually, warmly clearing the circuit is decided by the condition of whether the heat excesses over the assigned limit, resulting the cutoff of the circuit of IC, and not by the purpose of preventing and ensuring the IC. Therefore, the warm switch-off should not be applied in the premise of continuous employing and operation after the circuit is switched on.

(8) Testing on application boards
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. Ground the IC during assembly steps as an antistatic measure, and use similar caution when transporting or storing the IC. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process

(9) IC terminal input
This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P/N junctions are formed at the intersection of these P layers with the N layers of other elements to create a variety of parasitic elements. For example, when a resistor and transistor are connected to pins. (See the chart below.)

- ○the P/N junction functions as a parasitic diode when
  GND > (Pin A) for the resistor or GND > (Pin B) for the transistor (NPN).
- ○Similarly, when GND > (Pin B) for the transistor (NPN), the parasitic diode described above combines with the N layer of other adjacent elements to operate as a parasitic NPN transistor.

The formation of parasitic elements as a result of the relationships of the potentials of different pins is an inevitable result of the IC's architecture. The operation of parasitic elements can cause interference with circuit operation as well as IC malfunction and damage. For these reasons, it is necessary to use caution so that the IC is not used in a way that will trigger the operation of parasitic elements, such as by the application of voltages lower than the GND (PCB) voltage to input pins.



(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 patterns of any external components.

●Ordering part number

B	D	8	1	0	5	F	V	-	E	2

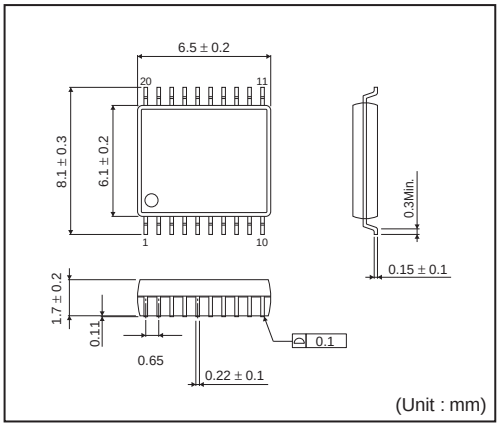
Part No. (BD)

Part No. (8105)

Package
FV: SSOP-B20W

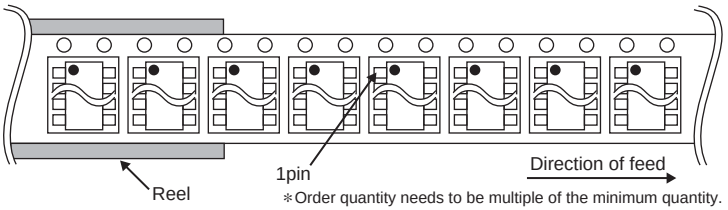
Packaging and forming specification
E2: Embossed tape and reel

SSOP-B20W



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2000pcs
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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   [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.

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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Other Precaution

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