Parallel Input 8-channel Sink Driver

■FEATURES

- ●8-channel Parallel Input Parallel Output
- ●Inverter Input
- ●Supply Voltage V_{DD}=3.0 to 5.5V
- ●Output Voltage V_{DS}=up to 40V (45V Rating)
- ●Output Current 300mA(Peak) / ch.
- ●Built-in Noise Filter (CLRb Pin)
- ●Protection Circuit OCP, TSD
- ●Output Slew Rate Control
- ●FLT Output
- ●Operating Temperature Topr=-40 to 125°C
- ●Package Outline HTSSOP24-P1

■GENERAL DESCRIPTION

The NJW4828-B is 8-channel sink driver with 300mA output.

The input block is inverter type, and the output block is always driven with inverted logic according to the input signal.

The CLRb input has built-in filter for noise immunity.

Supply voltage and input voltage correspond to 5V logic, maximum rating of output voltage is 45V.

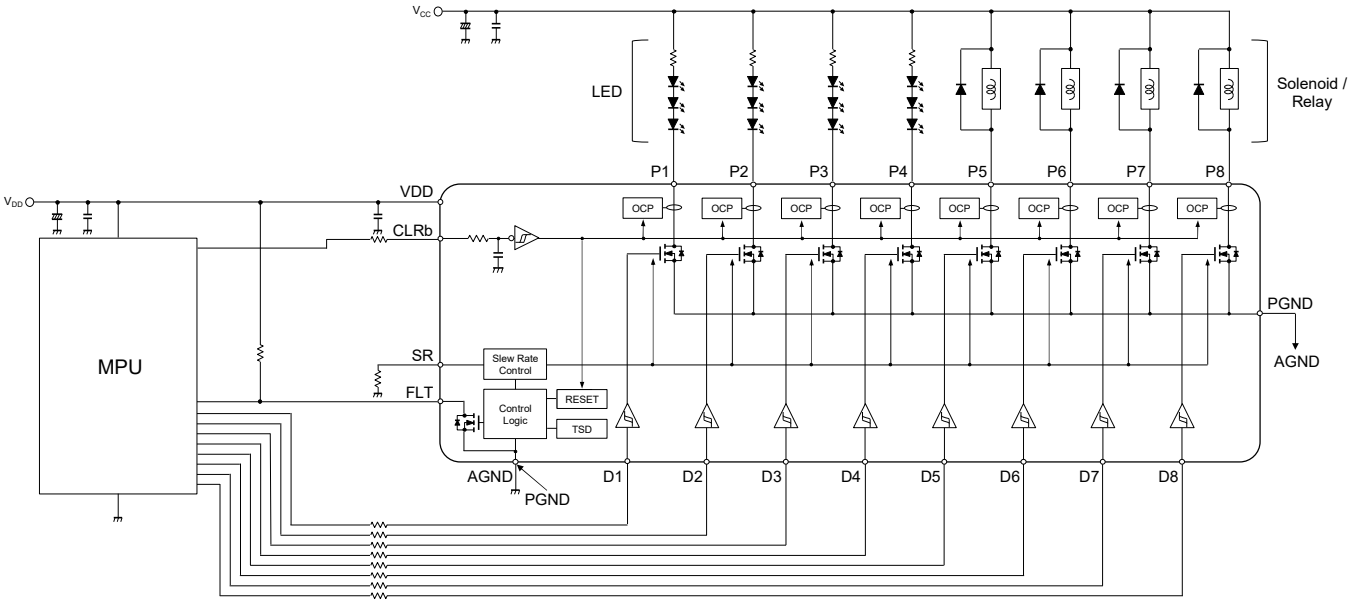
The protection circuits have over current protection (OCP) and thermal shutdown (TSD).

Moreover, because it has built-in output slew rate adjustment function, it can be applied as EMI countermeasure.

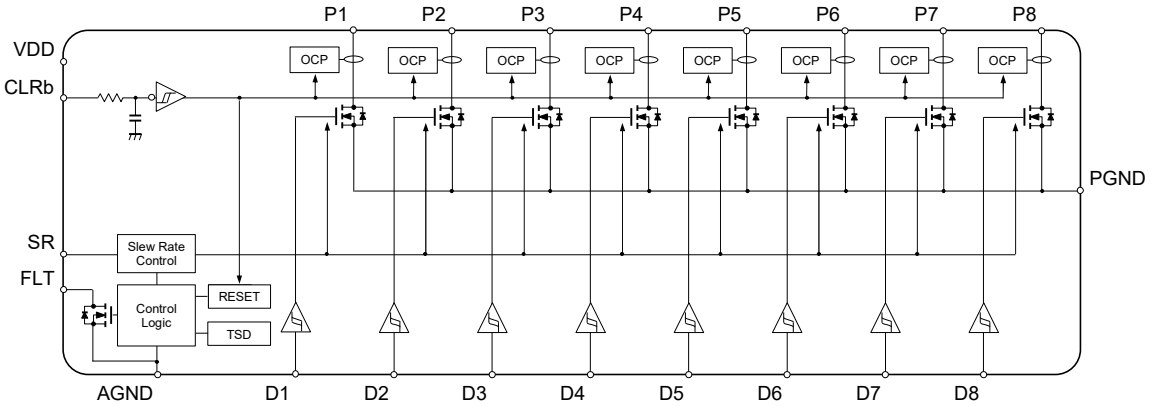
■APPLICATION

LED, Relay, solenoid and unipolar stepping motor applications for industrial equipment and white goods

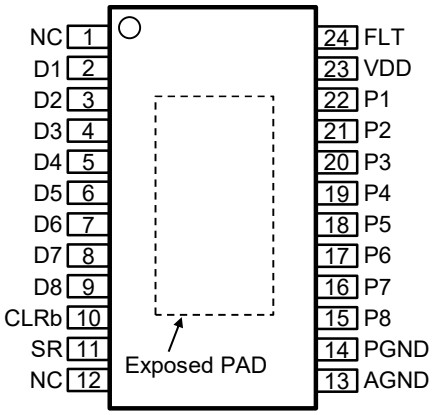
■TYPICAL APPLICATION



■BLOCK DIAGRAM

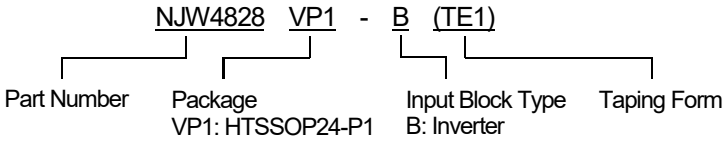


■PIN CONFIGURATION



PIN NO.	SYMBOL	I/O	DESCRIPTION
1	NC	-	Not Internally Connected
2	D1	I	Parallel Data Input Pin
3	D2	I	
4	D3	I	
5	D4	I	
6	D5	I	
7	D6	I	
8	D7	I	
9	D8	I	
10	CLRb	I	Clear Signal Input Pin
11	SR	-	Output Slew Rate Setting Pin
12	NC	-	Not Internally Connected
13	AGND	-	Control Block Ground Pin
14	PGND	-	Output Block Ground Pin
15	P8	O	Parallel Output Pin
16	P7	O	
17	P6	O	
18	P5	O	
19	P4	O	
20	P3	O	
21	P2	O	
22	P1	O	
23	VDD	-	Power Supply Pin
24	FLT	O	Error Signal Output Pin
-	Exposed PAD	-	Back Side Thermal PAD It must be set to open or connected to AGND

■PRODUCT NAME INFORMATION



■ORDERING INFORMATION

PRODUCT NAME	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ(pcs)
NJW4828VP1-B(TE1)	HTSSOP24-P1	yes	yes	Ni/Pd/Au	4828B	83	2500

■ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT	NOTE
Supply Voltage	V_{DD}	-0.3 to +7	V	VDD Pin
Output Pin Voltage 1	V_{DS}	-0.3 to +45	V	P1 to P8 Pin
Output Pin Voltage 2	V_O	-0.3 to V_{DD}	V	FLT Pin
Input Pin Voltage	V_{IN}	-0.3 to V_{DD}	V	D1 to D8, CLRb Pin
Output Current	I_{DS}	300	mA	P1 to P8 Pin
Power Dissipation (Ta=25°C) HTSSOP24-P1	P_D	1.2(1)	W	
		1.6(2)		
		3.2(3)		
Junction Temperature Range	Tj	-40 to +150	°C	
Operating Temperature Range	Topr	-40 to +125	°C	
Storage Temperature Range	Tstg	-50 to +150	°C	

(1): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 2Layers FR-4, with Exposed Pad)

(2): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4)

(3): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4, with Exposed Pad)
(For 4Layers: Applying 99.5×99.5mm inner Cu area and thermal via holes to a board based on JEDEC standard JESD51-5)

■RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{DD}	3.0 to 5.5	V
Output Pin Voltage	V_{DS}	0 to 40	V
Output Current(4)	I_{DS}	0 to 300	mA

(4): Caution that the total power consumption of P1 to P8 does not exceed the power dissipation of rating.

■**ELECTRICAL CHARACTERISTICS (DC Parameter)** (Unless otherwise noted, V_{DD}=5V, R_{SR}=500kΩ, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current 1	I_{Q1}	All outputs OFF	-	1.4	2.8	mA
Quiescent Current 2	I_{Q2}	All outputs ON	-	1.6	3.2	mA
H level Input Voltage 1	V_{IH1}	CLRb, D1 to D8 Pin	0.7V_{DD}	-	V_{DD}	V
H level Input Voltage 2	V_{IH2}	V_{DD}=3V, CLRb, D1 to D8 Pin	0.7V_{DD}	-	V_{DD}	V
L level Input Voltage 1	V_{IL1}	CLRb, D1 to D8 Pin	0	-	0.3V_{DD}	V
L level Input Voltage 2	V_{IL2}	V_{DD}=3V, CLRb, D1 to D8 Pin	0	-	0.3V_{DD}	V
H level Input Current	I_{IH}	V_{DD}=5.5V, V_{IN}=5.5V, CLRb, D1 to D8 Pin	-	-	1	μA
L level Input Current	I_{IL}	V_{DD}=5.5V, V_{IN}=0V, CLRb, D1 to D8 Pin	-	-	1	μA
Output ON Resistance 1	R_{ON1_P}	V_{SR}=0V, I_{DS}=100mA, P1 to P8 Pin	-	0.9	2.7	Ω
Output ON Resistance 2	R_{ON2_P}	V_{DD}=3V, V_{SR}=0V, I_{DS}=100mA, P1 to P8 Pin	-	1	3	Ω
Maximum Output Current	I_{DMAX_P}	V_{SR}=0V, P1 to P8 Pin	300	-	-	mA
Output Leak Current	I_{LEAK_P}	V_{DS}=40V, P1 to P8 Pin	-	-	1	μA
Thermal Shutdown Operating Temperature	T_{TSD_DET}		-	170	-	°C
Thermal Shutdown Recovery Temperature	T_{TSD_REV}		-	150	-	°C
FLT Pin "L" Output Voltage	V_{OL_FLT}	I_{FLT}=4mA	-	0.2	0.4	V
FLT Pin Leak Current	I_{LEAK_FLT}	V_{DD}=5.5V, V_{FLT}=5.5V	-	-	1	μA

■**ELECTRICAL CHARACTERISTICS (Switching Parameter)**

(Unless otherwise noted, V_{DD}=5V, V_{CC}=24V, CL=30pF(P-PGND), R_L=240Ω(P-V_{CC}), Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output "H-L" Transition Time	t_{THL}	R_{SR}=500kΩ	-	2.5	-	μs
Output "L-H" Transition Time	t_{TLH}	R_{SR}=500kΩ	-	1.8	-	μs
Output "H-L" Propagation Delay Time (D-P)	t_{pdHL_D}	V_{SR}=0V	-	0.2	-	μs
Output "L-H" Propagation Delay Time (D-P)	t_{pdLH_D}	V_{SR}=0V	-	0.9	-	μs
CLRb "L" Pulse Width	t_{W_CLRb}		5	-	-	μs

■**THERMAL CHARACTERISTICS**

PARAMETER	SYMBOL	VALUE	UNIT
Junction to ambient thermal resistance	θja	103(5) 78(6) 39(7)	°C/W
Junction to top of package characterization parameter	ψjt	13(5) 13(6) 6(7)	°C/W

(5): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 2Layers FR-4, with Exposed Pad)

(6): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4)

(7): Mounted on glass epoxy board. (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4, with Exposed Pad)
(For 4Layers: Applying 99.5×99.5mm inner Cu area and thermal via holes to a board based on JEDEC standard JESD51-5)

■APPLICATION NOTE / GLOSSARY

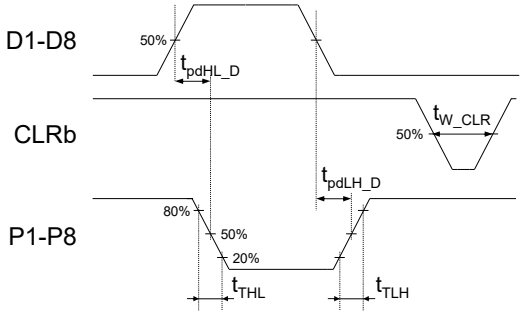
●Truth Table

INPUT		P OUTPUT (with pull-up resistor)	OPERATION
CLRb	D		
L	X	All OFF (H)	Reset all data of the protection circuit
H	L	OFF (H)	-
	H	ON (L)	-

H : High Level X : Don't Care

L : Low Level

●Timing Chart / Timing Definition



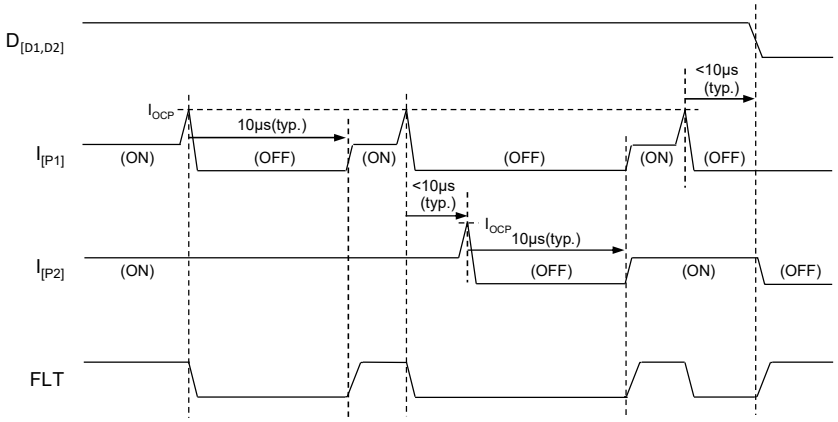
●Over Current Protection Circuit (OCP)

Overcurrent detection operates for each P1 - P8 output.

When overcurrent is detected, the corresponding P output is turned OFF and FLT pin becomes L level.

After overcurrent is detected, when data is reset or passage of internal recovery time(10µs typ.), it returns to normal operation.

In the condition of the P output is already overcurrent detected and turned off, if another P output is detected continuously, all the recovery timing of the corresponding P outputs will be all taken over.



●Thermal Shutdown Circuit (TSD)

When the junction temperature inside the IC exceeds T_{TSD_DET}, all P outputs are turned OFF and FLT pin becomes L level.

When the internal junction temperature drops to T_{TSD_REV} or less, it returns to normal operation state.

Input signals other than CLRb are not accepted while the thermal shutdown circuit is operating.

●FLT Output Function

The FLT Pin becomes L level as an error signal when the OCP or TSD is operated.

During the protection circuit is operating, when the CLRb signal is input, reset all protection circuit status and turn off the FLT pin becomes off state.

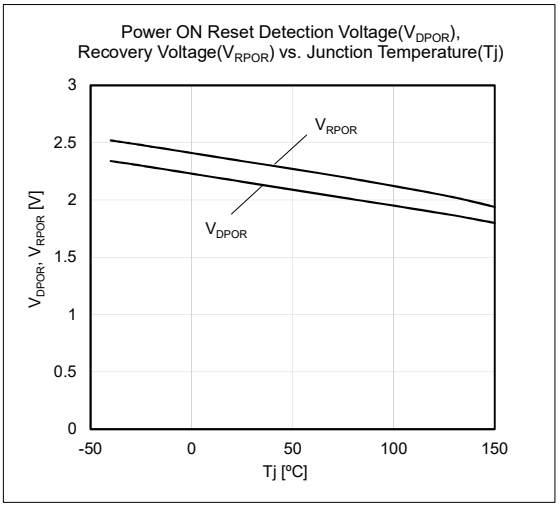
When FLT function is used, connect external pull-up resistor.

When FLT function is not used, connect the FLT pin to AGND or open.

●Power ON Reset Function

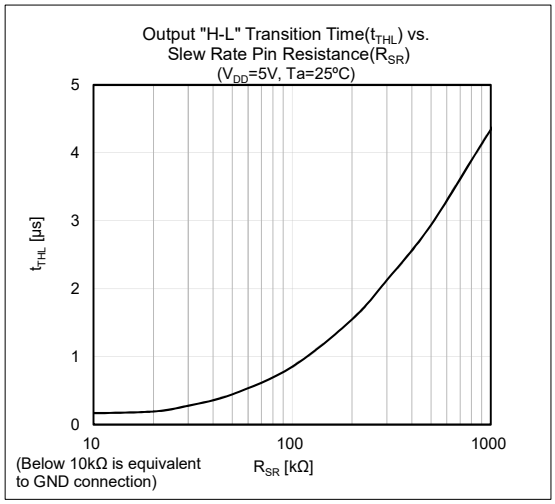
The power supply pin has built-in power on reset function.
When the V_{DD} voltage below V_{DPOR} (typ.), all outputs are turned off and all internal states are initialized.

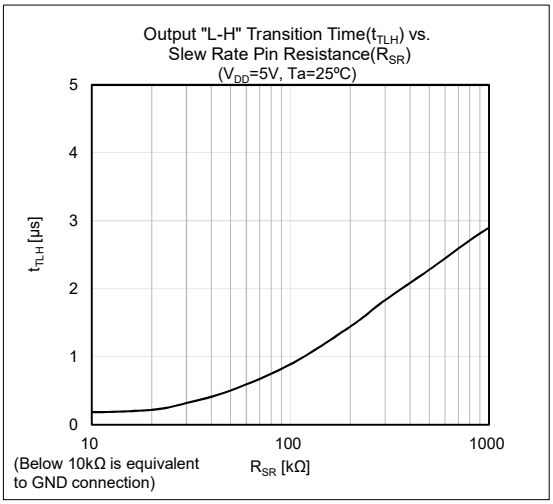
When the V_{DD} voltage exceeds V_{RPOR} (typ.), it operates normally, but the V_{DD} voltage should be used within the recommended operating voltage range (V_{DD}=3.0V to 5.5V)



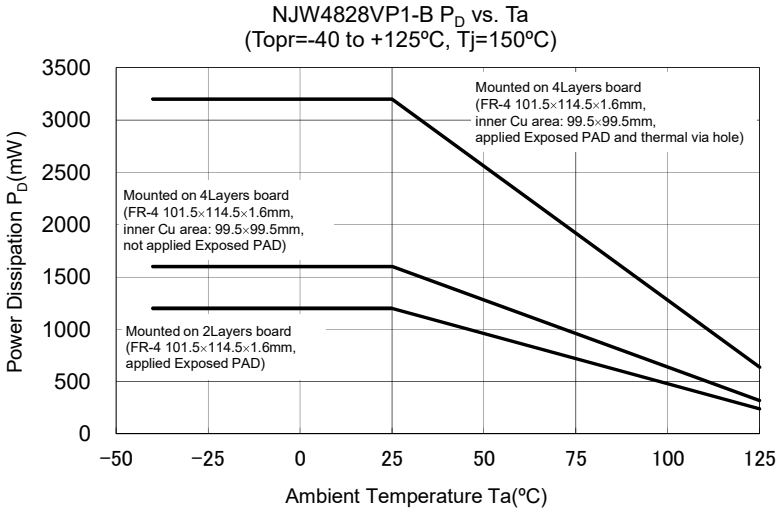
●Output Slew Rate Setting Function (SR Pin)

The SR function can set the rise time and fall time of the gate voltage of the output FETs by connecting a pull-down resistor to the SR pin.
The pull-down resistance can be set from 0 Ω (connected to AGND) to 1M Ω. It should not be open.
When this function is not used, connect the SR pin to AGND.

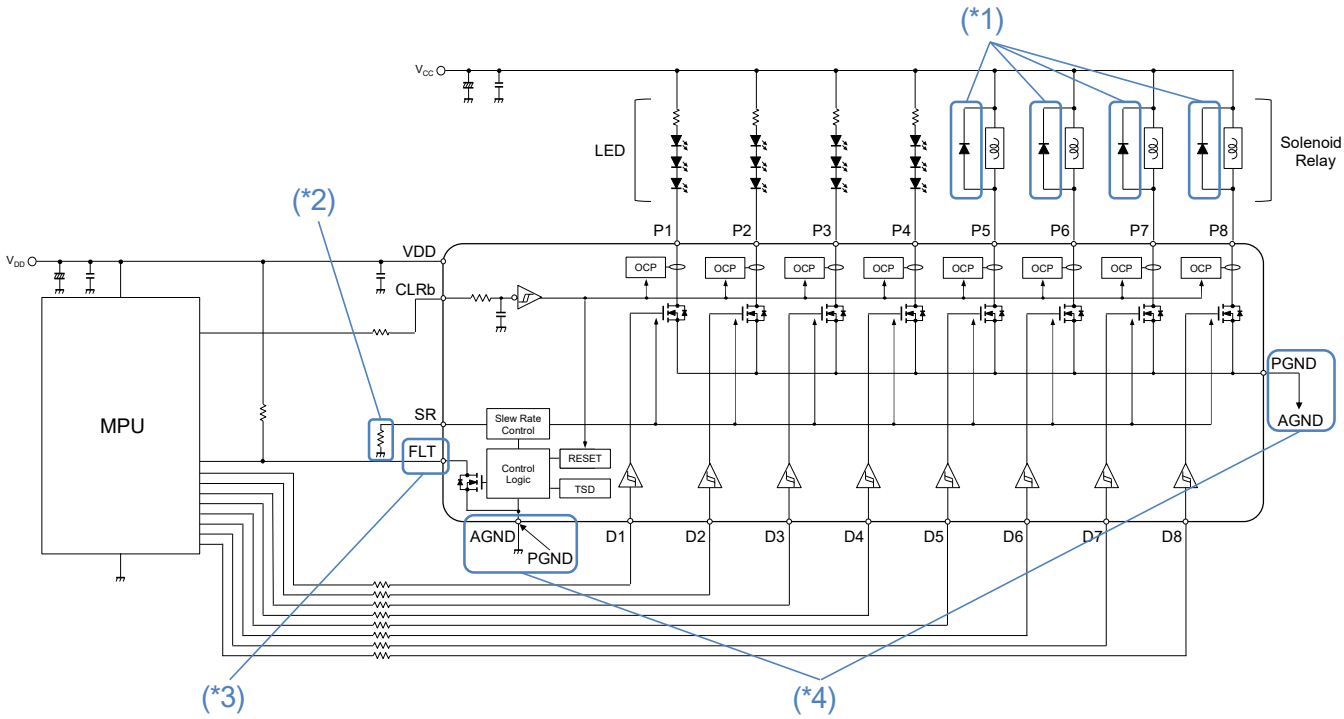




●Power Dissipation vs. Ambient Temperature



■TYPICAL APPLICATION 1



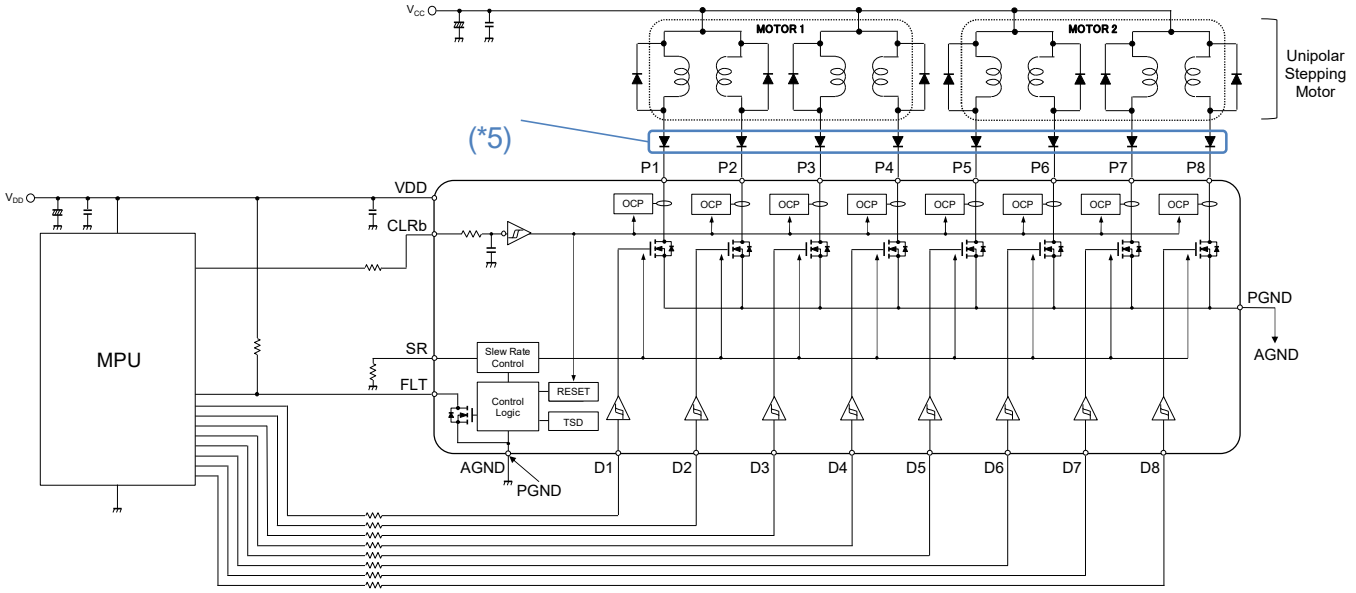
(*1): The output pins don't have clamp circuits.
Therefore, when driving inductive loads such as solenoids and relays, connect a diode to the outside and secure path of recirculation current at turn-off.

(*2): When SR function is not used, connect the SR pin to AGND and it should not be open.

(*3): When FLT function is not used, connect the FLT pin to AGND or open.

(*4): It should be wired the board so that there is no potential difference between AGND and PGND.

■TYPICAL APPLICATION 2 (Driving unipolar stepping motor)



< About the turn-off circuit >

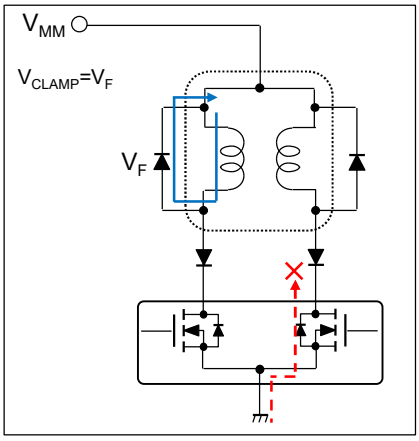
There are various turn-off circuit methods for the purpose of extracting the speed performance of the motor.
The turn-off time of motor current depends on the clamp voltage of the turn-off circuit.
Therefore, it is necessary to select an appropriate turn-off method according to the motor speed.
However, the larger the clamp voltage of the turn-off circuit, the negative voltage is generated by electromagnetic induction to the other winding.

Method	Diode Turn-off	Resistor + Diode Turn-off	Zener Diode + Diode Turn-off
External parts scale	Small	Medium	Large
Motor Speed	Low	High	
Negative voltage value	Low	Middle to High	

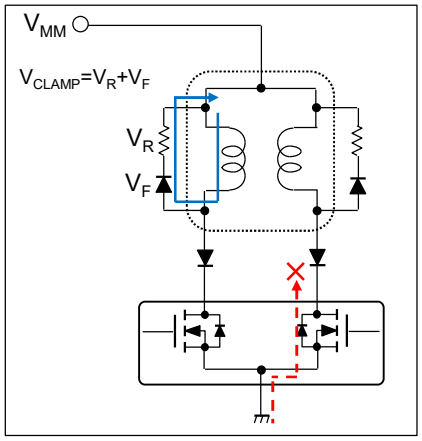
(*5): Prevention of Malfunction for Negative Voltage

In unipolar motor drive, when switching the winding current electromagnetically coupled, the output pin may become below the GND potential due to long wiring of the motor, routing of the GND wiring of the mounting board, turn-off circuit type, and so on.
Due to the nature of the monolithically structured IC, when a large negative voltage is applied to the output pin, the inside of the IC may cause unexpected operation, which may cause circuit malfunction (miss step).
Therefore, in order to reliably prevent circuit malfunction due to negative voltage, it is recommended to insert a diode in series at the output pin and take countermeasures.

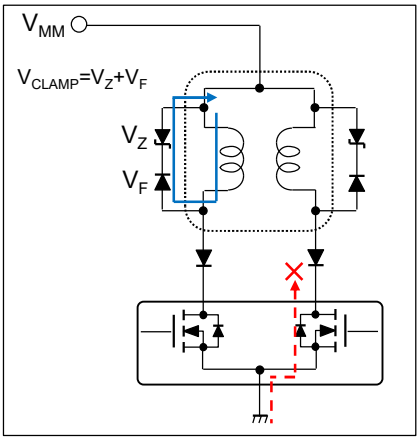
Diode Turn-off Circuit



Resistor + Diode Turn-off Circuit

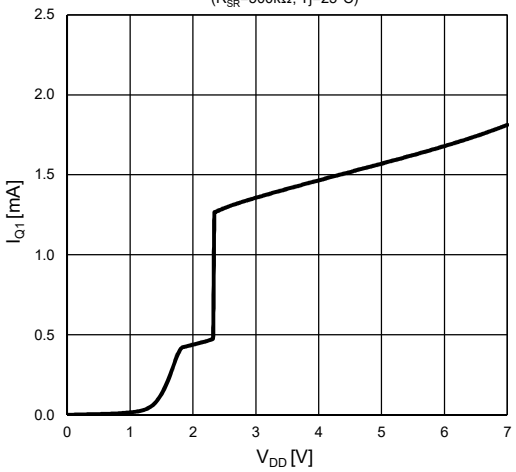


Zener Diode + Diode Turn-off Circuit

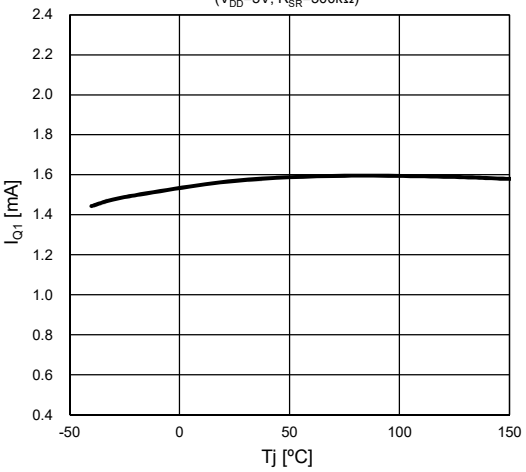


■TYPICAL CHARACTERISTICS

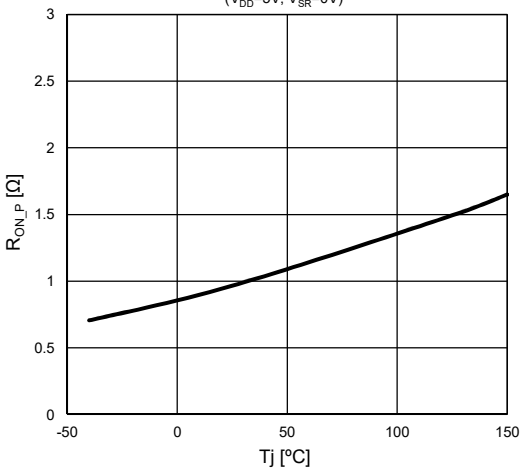
I_{Q1} vs. V_{DD}
(R_{SR}=500kΩ, Tj=25ºC)



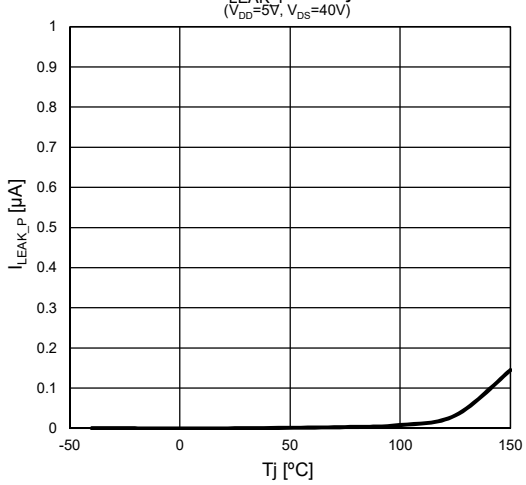
I_{Q1} vs. Tj
(V_{DD}=5V, R_{SR}=500kΩ)



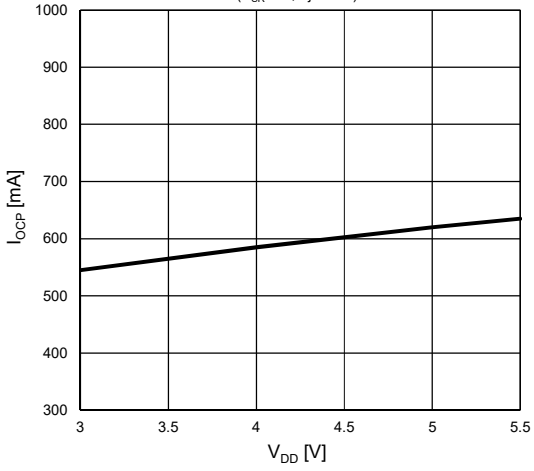
R_{ON_P} vs. Tj
(V_{DD}=5V, V_{SR}=0V)



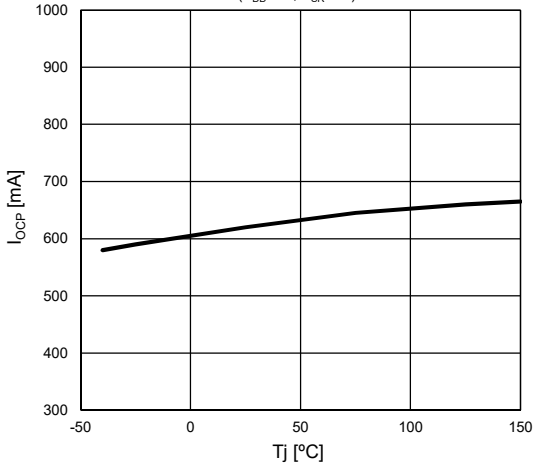
I_{LEAK_P} vs. Tj
(V_{DD}=5V, V_{DS}=40V)



I_{OCP} vs. V_{DD}
(V_{SR}=0V, Tj=25ºC)



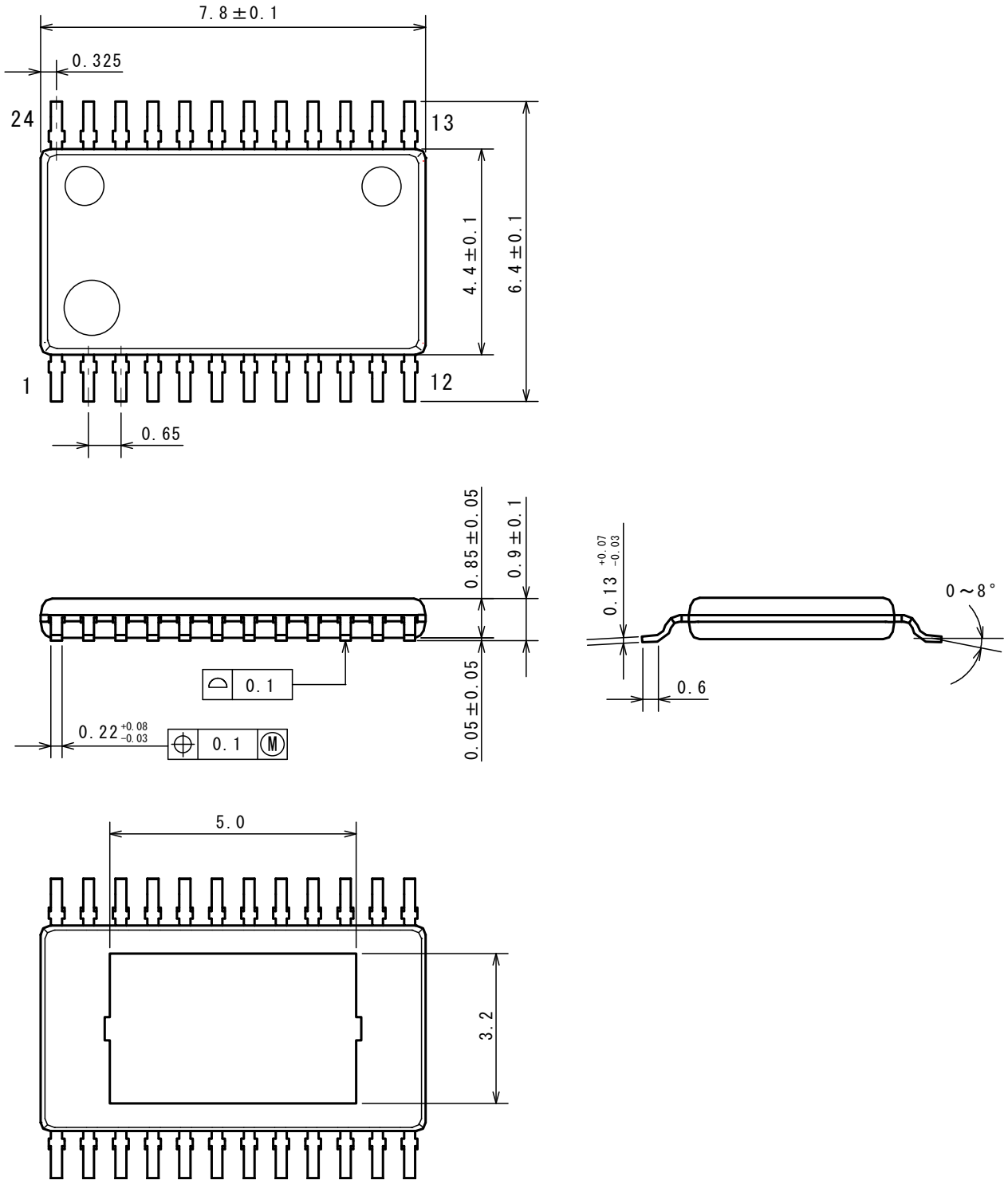
I_{OCP} vs. Tj
(V_{DD}=5V, V_{SR}=0V)



HTSSOP24-P1

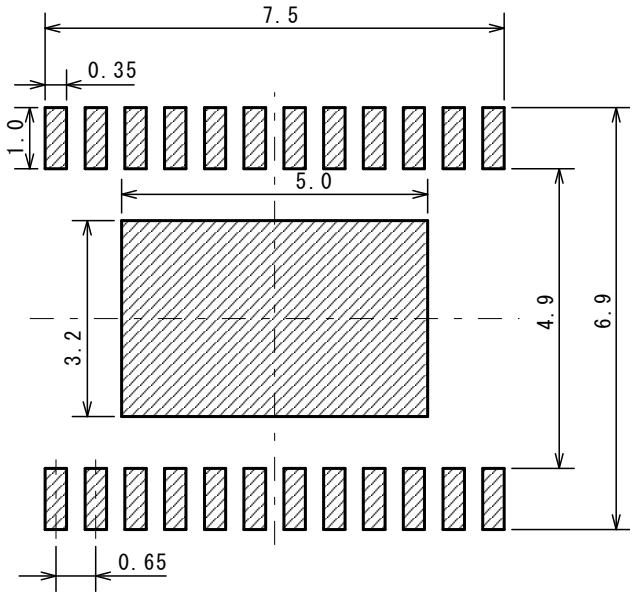
Unit: mm

■PACKAGE DIMENSIONS

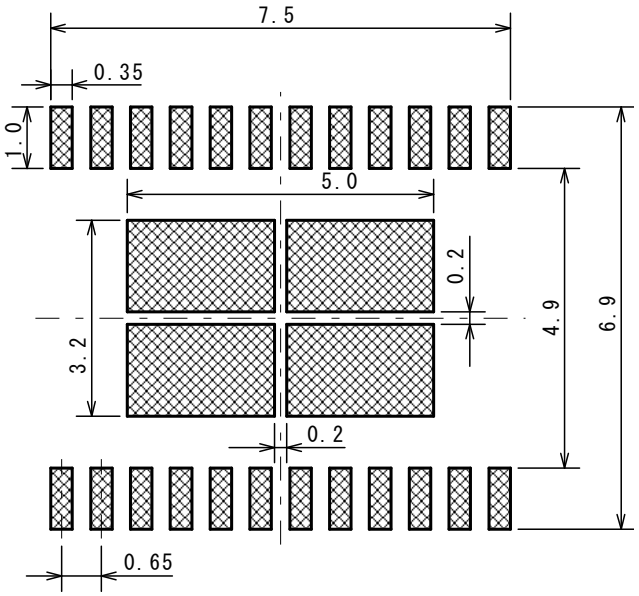


Unit: mm

■EXAMPLE OF SOLDER PADS DIMENSIONS



<Solder pattern>



<Metal mask>

＜Instructions for mounting＞

Please note the following points when you mount HTSSOP24-P1 package IC because there is a backside electrode.

(1) Temperature profile of lead and backside electrode.

It is necessary that both re-flow temperature profile of lead and backside electrode are higher than preset temperature.

When solder wet temperature is lower than lead/backside electrode temperature, there is possibility of defect mounting.

(2) Design of foot pattern / metal mask

Metal mask thickness of solder pattern print is more than 0.13mm.

(3) Solder paste

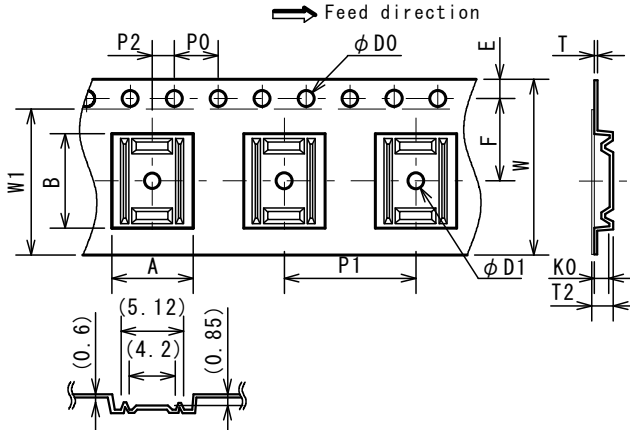
The mounting was evaluated with following solder paste, foot pattern and metal mask. Because mounting might be greatly different according to the manufacturer and the product number even if the solder composition is the same. We will strongly recommend to evaluate mounting previously with using foot pattern, metal mask and solder paste.

Solder paste composition	Sn3Ag0.5Cu (Senju Metal Industry Co., Ltd : M705-GRN350-32-11)

■PACKING SPEC

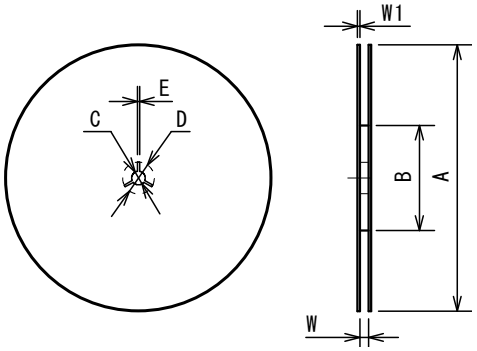
Unit: mm

TAPING DIMENSIONS



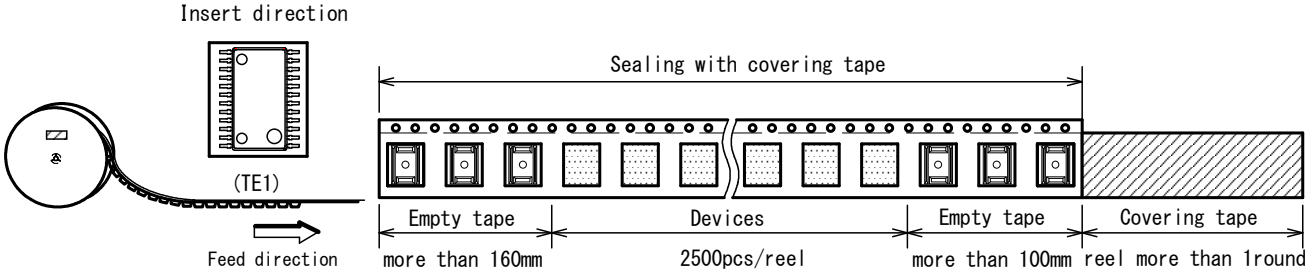
SYMBOL	DIMENSION	REMARKS
A	7.45±0.2	
B	8.60±0.1	
D0	$1.5^{+0.1}_{0}$	
D1	$1.5^{+0.1}_{0}$	
E	1.75±0.1	
F	7.5±0.1	
P0	4.0±0.1	
P1	12.0±0.1	
P2	2.0±0.1	
T	0.3±0.05	
T2	1.85	
K0	1.45±0.3	
W	16.0±0.3	
W1	13.3	THICKNESS 0.1max

REEL DIMENSIONS

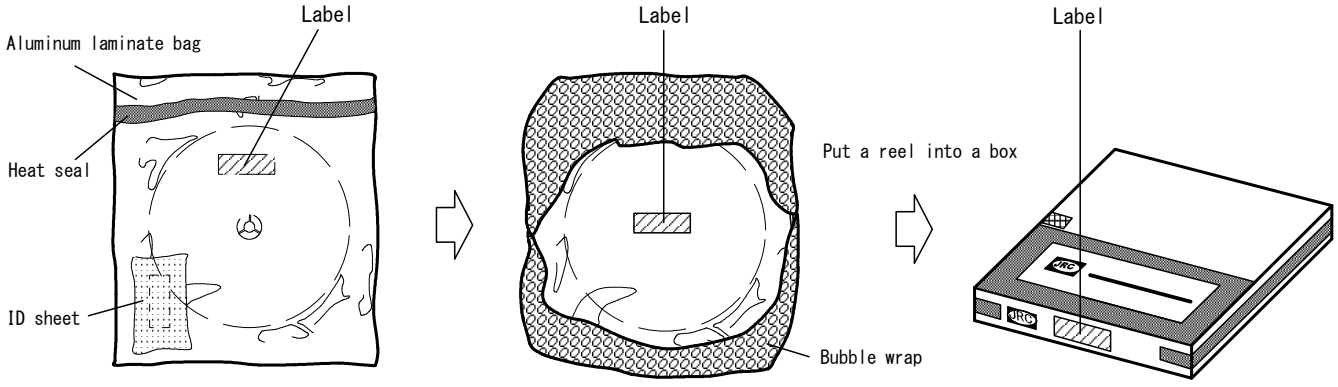


SYMBOL	DIMENSION
A	φ330±2
B	φ100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	17.4±1
W1	2

TAPING STATE



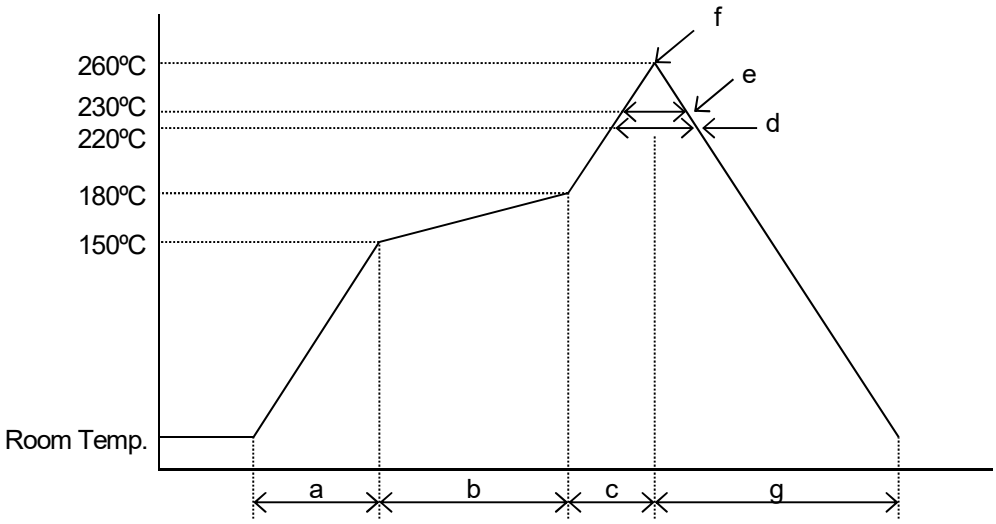
PACKING STATE



■RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING METHOD

*Recommended reflow soldering procedure



a:	Temperature ramping rate	: 1 to 4ºC/s
b:	Pre-heating temperature	: 150 to 180ºC
	Pre-heating time	: 60 to 120s
c:	Temperature ramp rate	: 1 to 4ºC /s
d:	220ºC or higher time	: Shorter than 60s
e:	230ºC or higher time	: Shorter than 40s
f:	Peak temperature	: Lower than 260ºC
g:	Temperature ramping rate	: 1 to 6ºC /s

The temperature indicates at the surface of mold package.

■REVISION HISTORY

Date	Revision	Changes
21.Jun.2018	Ver.1.0	New Release

[CAUTION]

1. New JRC strives to produce reliable and high quality semiconductors. New JRC's semiconductors are intended for specific applications and require proper maintenance and handling. To enhance the performance and service of New JRC's semiconductors, the devices, machinery or equipment into which they are integrated should undergo preventative maintenance and inspection at regularly scheduled intervals. Failure to properly maintain equipment and machinery incorporating these products can result in catastrophic system failures

2. The specifications on this datasheet are only given for information without any guarantee as regards either mistakes or omissions. The application circuits in this datasheet are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.
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3. To ensure the highest levels of reliability, New JRC products must always be properly handled.
The introduction of external contaminants (e.g. dust, oil or cosmetics) can result in failures of semiconductor products.

4. New JRC offers a variety of semiconductor products intended for particular applications. It is important that you select the proper component for your intended application. You may contact New JRC's Sale's Office if you are uncertain about the products listed in this catalog.

5. Special care is required in designing devices, machinery or equipment which demand high levels of reliability. This is particularly important when designing critical components or systems whose failure can foreseeably result in situations that could adversely affect health or safety. In designing such critical devices, equipment or machinery, careful consideration should be given to amongst other things, their safety design, fail-safe design, back-up and redundancy systems, and diffusion design.

6. The products listed in the catalog may not be appropriate for use in certain equipment where reliability is critical or where the products may be subjected to extreme conditions. You should consult our sales office before using the products in any of the following types of equipment.

   Aerospace Equipment
   Equipment Used in the Deep sea
   Power Generator Control Equipment (Nuclear, Steam, Hydraulic)
   Life Maintenance Medical Equipment
   Fire Alarm/Intruder Detector
   Vehicle Control Equipment (airplane, railroad, ship, etc.)
   Various Safety devices

7. New JRC's products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this catalog. Failure to employ New JRC products in the proper applications can lead to deterioration, destruction or failure of the products. New JRC shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of its products. Products are sold without warranty of any kind, either express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose.

8. Warning for handling Gallium and Arsenic(GaAs) Products (Applying to GaAs MMIC, Photo Reflector). This Products uses Gallium(Ga) and Arsenic(As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed, please follow the related regulation and do not mix this with general industrial waste or household waste.

9. The product specifications and descriptions listed in this catalog are subject to change at any time, without notice.