LOW NOISE, BIPOLAR INPUT DUAL AUDIO OPERATIONAL AMPLIFIER

FEATURES

- Designed for High-Quality Sound
- Low Noise 3.5 nV/√Hz at 1kHz
- Low Distortion 0.001%
- Slew Rate 6.8V/µs
- Gain Bandwidth Product 19 MHz
- Open-Loop Voltage Gain 120dB
- Unity-Gain Stable .
- Bipolar Input
- Supply Voltage ±4V to ±18V
- Operating Temperature -40°C to 125°C
- Supply Current (All Amplifiers) 5 mA typ.
- Package SOP8
  MSOP8 (TVSP8)*

* meet JEDEC MO-187-DA / thin type

APPLICATIONS

- Professional Audio Sets
- Audio Pre / Microphone Amplifiers
- Analog / Digital Mixers
- AV Receivers
- Car Audio
- Industrial Measurement Instruments

DESCRIPTION

NJM8068 is a low noise bipolar input dual audio operational amplifier has 3.5 nV/√Hz at 1kHz.

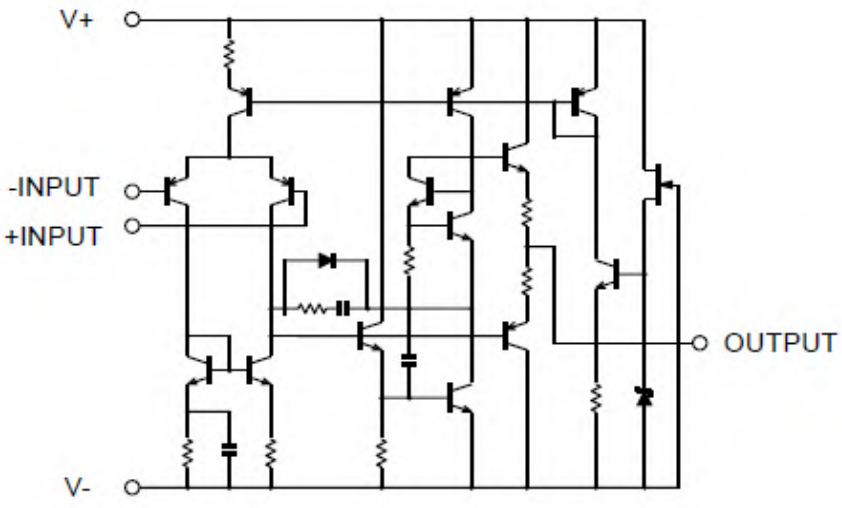
The NJM8068 features Low distortion, high slew rate, wide bandwidth and high open-loop gain. In addition, unity-gain stable allows voltage-follower operation. These features make NJM8068 ideal for audio pre amplifier, microphone amplifier, line amplifier and other audio applications. NJM8068 operate over a wide temperature range of -40°C to 125°C, making this IC ideal for use in industrial measurement instruments

The NJM8068 is available in 8-pin SOP and MSOP (TVSP) packages.

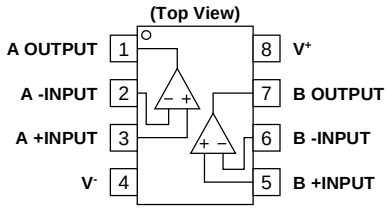
■ RELATED PRODUCT

PRODUCT NAME	FEATURES
NJM8080	**5nV/√Hz, 0.0005%, 5V/µs, 15MHz** (Low noise, low distortion audio Op-Amp)

■ EQUIVALENT CIRCUIT



■ PIN CONFIGURATIONS

PRODUCT NAME	NJM8068G	NJM8068B1
Package	SOP8	MSOP8 (TVSP8)
Pin Functions		

■ PRODUCT NAME INFORMATION

NJM8068 RB1 (TE1)

Part Number — Package — Taping Form

■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJM8068G	SOP8	Yes	Yes	Pure Sn	8068	88	2500
NJM8068RB1	MSOP8 (TVSP8)	Yes	Yes	Sn2Bi	8068	18	2000

■ ABSOLUTE MAXIMUM RATINGS

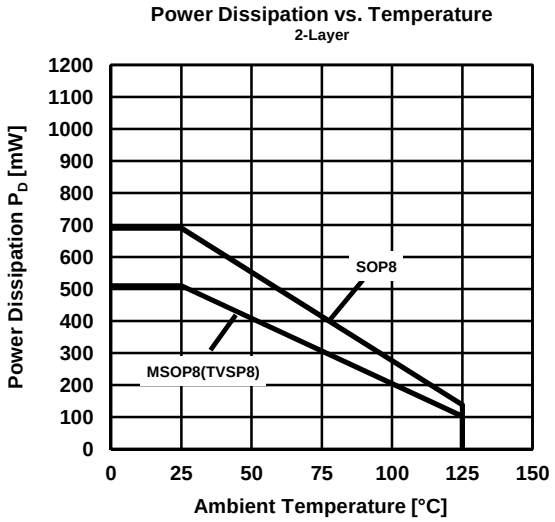
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+/V^-	±18	V
Differential Input Voltage(1)	V_{ID}	±36	V
Input Voltage(2)	V_{IN}	V^--0.3 to V^-+36	V
Output Terminal Input Voltage	V_O	V^--0.3 to V^++0.3	V
Power Dissipation(3) SOP8 MSOP8 (TVSP8)	P_D	2-Layer / 4-Layer(4) 690 / 1000 510 / 680	mW
Storage Temperature Range	T_{stg}	-65 to 150	°C
Maximum Junction Temperature	T_{jmax}	150	°C

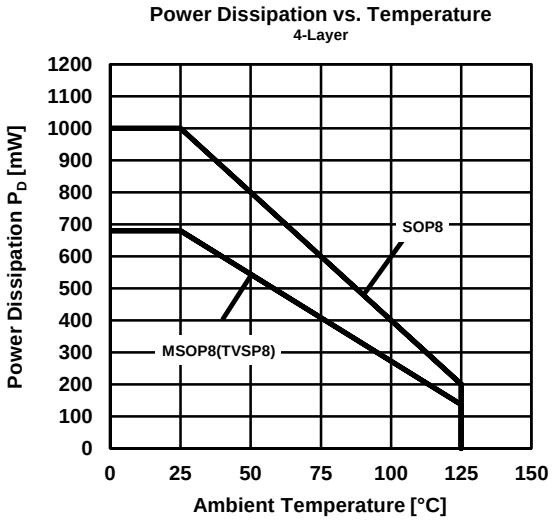
■ THERMAL CHARACTERISTICS

PACKAGE	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance SOP8 MSOP8 (TVSP8)	Θja	2-Layer / 4-Layer(4) 181 / 125 245 / 184	°C/W
Junction-to-Top of Package Characterization Parameter SOP8 MSOP8 (TVSP8)	Ψjt	2-Layer / 4-Layer(4) 49 / 43 51 / 45	°C/W

(1) Differential voltage is the voltage difference between +INPUT and -INPUT.
(2) Input voltage is the voltage should be allowed to apply to the input terminal independent of the magnitude of V^+.
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.
(3) Power dissipation is the power that can be consumed by the IC at Ta=25°C, and is the typical measured value based on JEDEC condition.
(4) 2-Layer: Mounted on glass epoxy board. (76.2×114.3×1.6 mm: based on EIA/JDEC standard, 2-layer FR-4)
4-Layer: Mounted on glass epoxy board. (76.2×114.3×1.6 mm: based on EIA/JDEC standard, 4-layer FR-4), internal Cu area: 74.2 x 74.2 mm

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE





■ RECOMMENDED OPERATING CONDITIONS

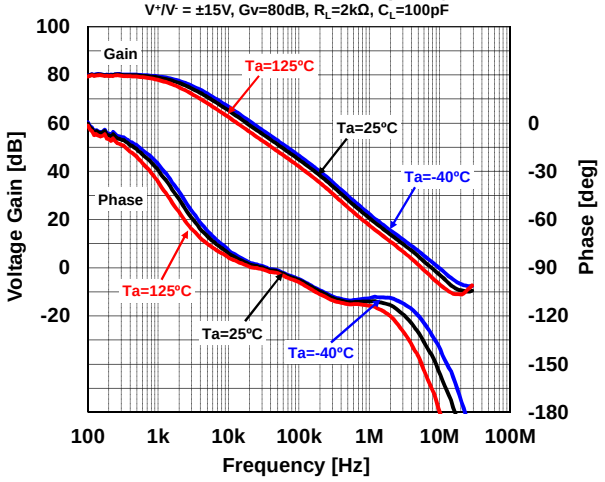
PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Supply Voltage	V^+/V^-	Ta=25°C	±4 to ±18	V
Operating Temperature Range	T_{opr}		-40 to 125	°C

■ ELECTRICAL CHARACTERISTICS (V^+/V^-=±15V, Ta=25°C, unless otherwise noted.)

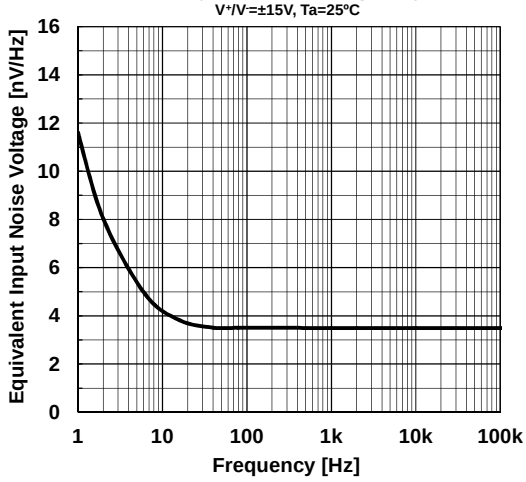
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
INPUT/OUTPUT CHARACTERISTICS						
Input Offset Voltage	V_{IO}	R_S≤10kΩ	-	0.3	3	mV
Input Bias Current	I_B		-	260	1000	nA
Input Offset Current	I_{IO}		-	5	200	nA
Open-Loop Voltage Gain	A_V	R_L=2kΩ, V_O=±10V	90	120	-	dB
Common-Mode Rejection Ratio	CMR		80	110	-	dB
Input Resistance	R_{IN}		50	300	-	kΩ
Common-Mode Input Voltage Range	V_{ICM}		±12	±13.5	-	V
Maximum Output Voltage	V_{OM}	R_L≥2kΩ	±12	±13.5	-	V
POWER SUPPLY						
Supply Current (All Amplifiers)	I_{SUPPLY}		-	5	8	mA
Supply Voltage Rejection Ratio	SVR		80	120	-	dB
AC CHARACTERISTICS						
Gain Bandwidth Product	GBW	f=100kHz	-	19	-	MHz
Unity Gain Frequency	f_T	G_V=0dB	-	7.5	-	MHz
Slew Rate	SR	R_L≥2kΩ	-	6.8	-	V/μs
Noise, Distortion						
Equivalent Input Noise Voltage	e_n	f=1kHz	-	3.5	-	nV/√Hz
		FLAT, f=20Hz to 20kHz	-	0.5	0.7	μVrms
Total Harmonic Distortion + Noise	THD+N		-	0.001	-	%
Channel Separation	CS		-	120	-	dB

■ TYPICAL CHARACTERISTICS

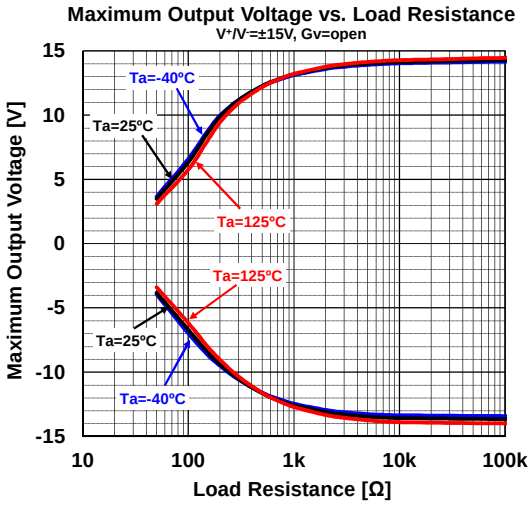
80dB Gain/Phase vs. Frequency



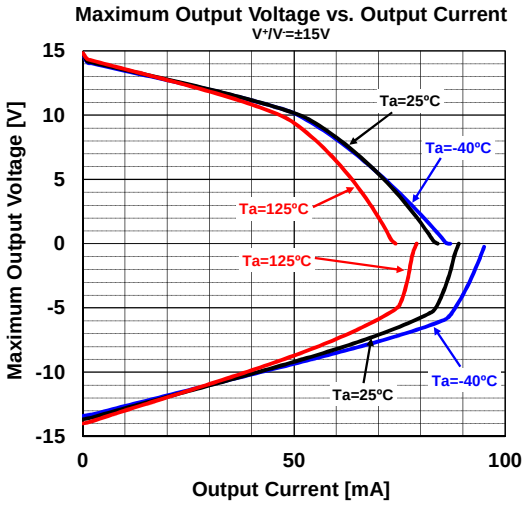
Voltage Noise vs. Frequency



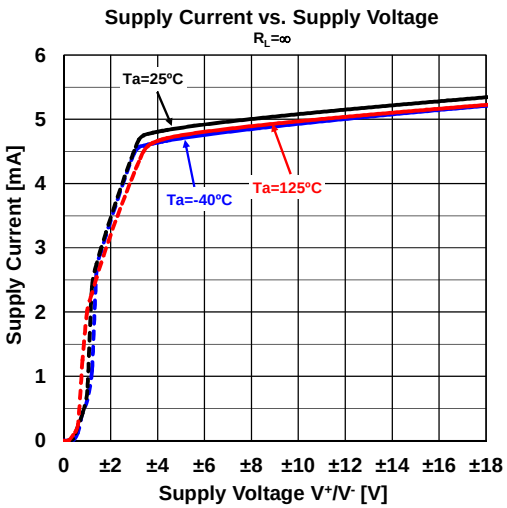
Maximum Output Voltage vs. Load Resistance



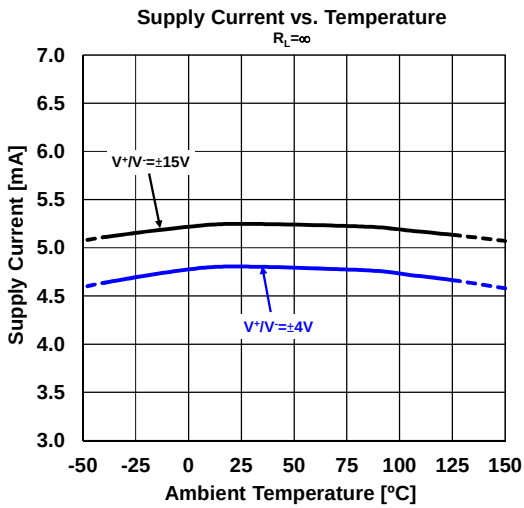
Maximum Output Voltage vs. Output Current



Supply Current vs. Supply Voltage

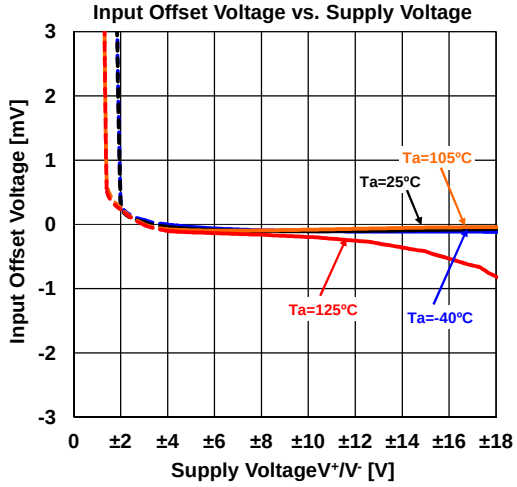


Supply Current vs. Temperature

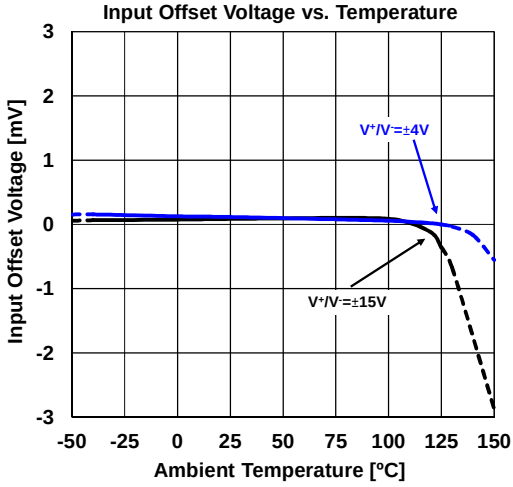


■ TYPICAL CHARACTERISTICS

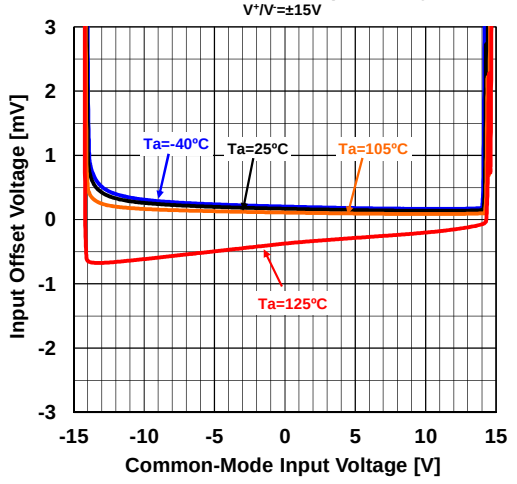
Input Offset Voltage vs. Supply Voltage



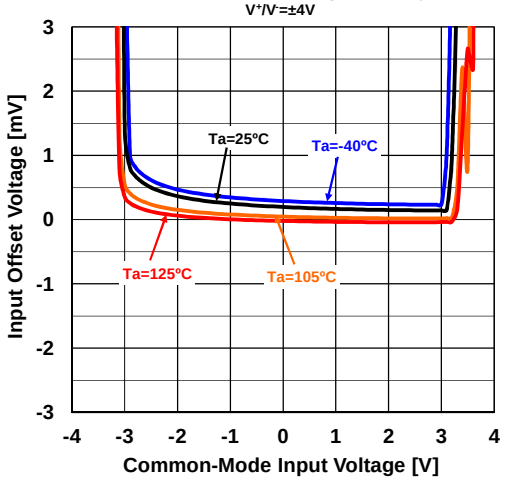
Input Offset Voltage vs. Temperature



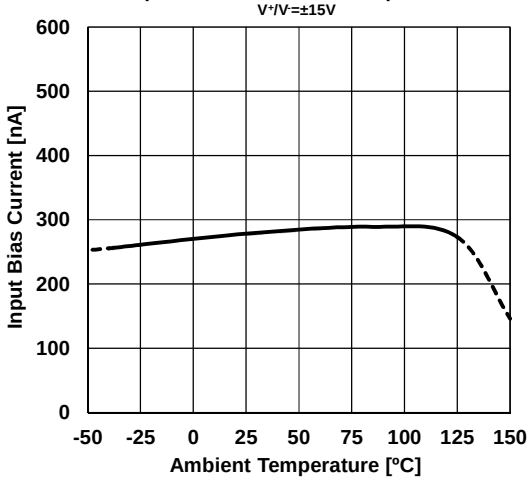
Input Offset Voltage
vs. Common-Mode Input Voltage
V+/V-=±15V



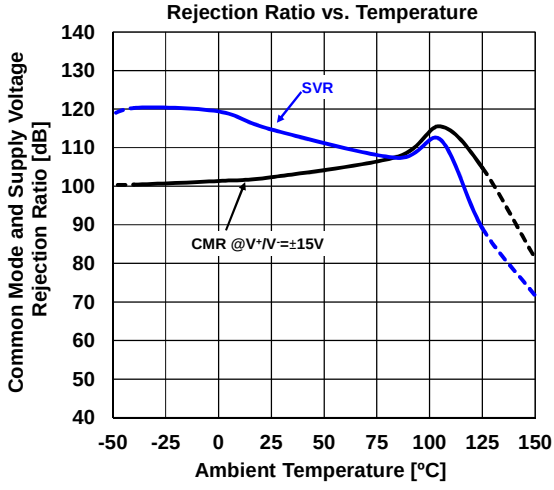
Input Offset Voltage
vs. Common-Mode Input Voltage
V+/V-=±4V



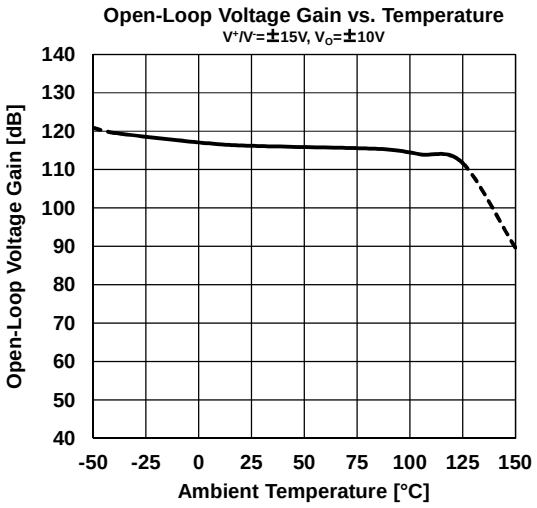
Input Bias Current vs. Temperature
V+/V-=±15V

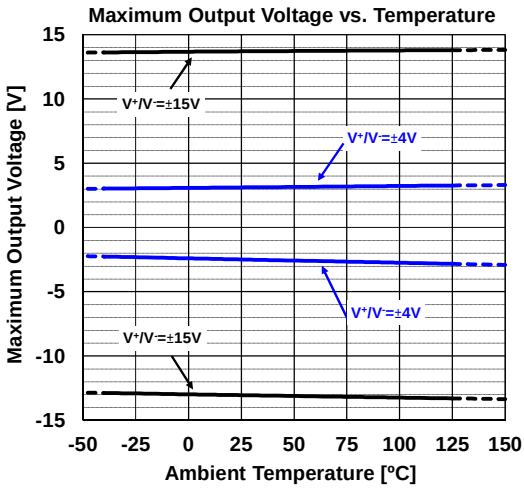


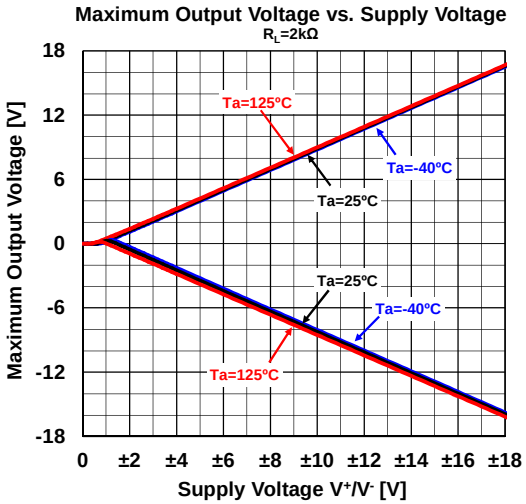
Common Mode and Supply Voltage
Rejection Ratio vs. Temperature

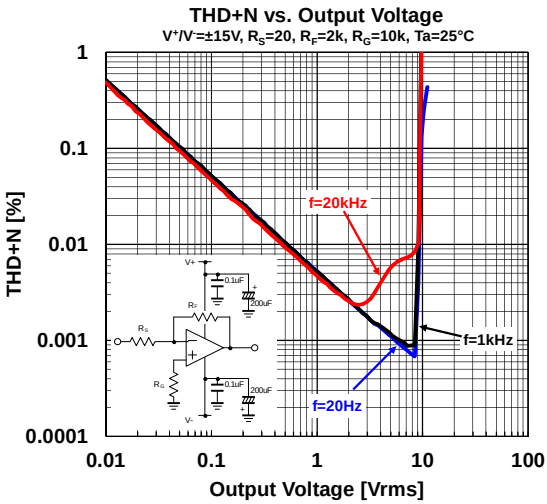


■ TYPICAL CHARACTERISTICS



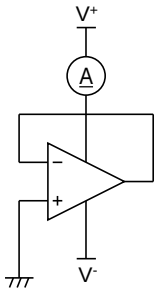






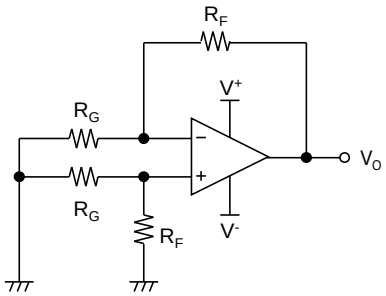
■ TEST CIRCUITS

● I_{SUPPLY}



● V_{IO}, CMR, SVR

R_G=50Ω, R_F=50kΩ



$$V_{IO}=\frac{R_G}{(R_G+R_F)}\times V_O$$

$$CMR=20\log\frac{\Delta V_{COM}\left(1+\frac{R_F}{R_G}\right)}{\Delta V_O}$$

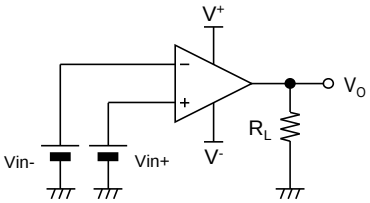
$$SVR=20\log\frac{\Delta V_S\left(1+\frac{R_F}{R_G}\right)}{\Delta V_O}$$

$V_S=V^+-V^-$

● V_{OH}, V_{OL}

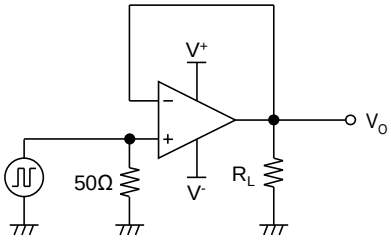
V_{OH}; Vin+ = 1V, Vin- = -1V

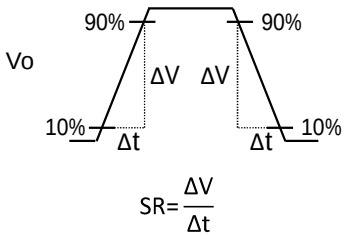
V_{OL}; Vin+ = -1V, Vin- = 1V



● SR

R_L=2kΩ



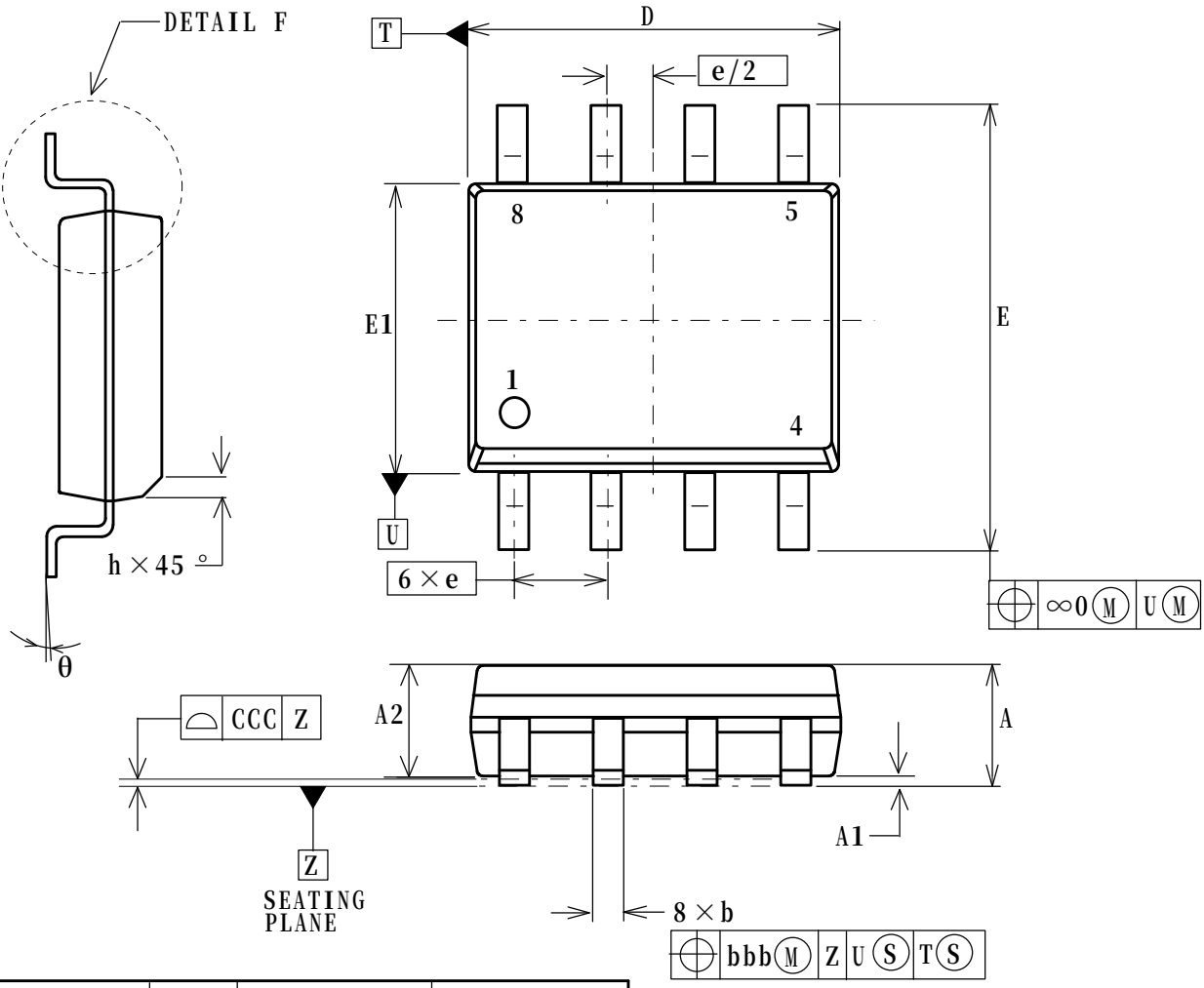


$$SR=\frac{\Delta V}{\Delta t}$$

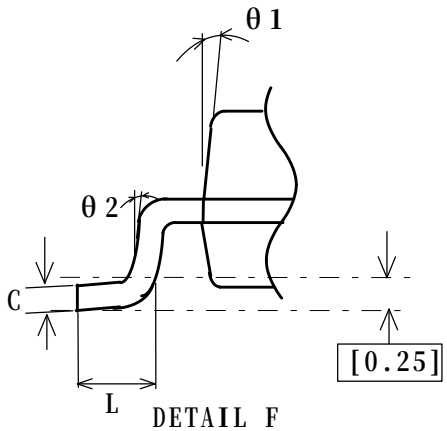
SOP8

Unit: mm

■ PACKAGE DIMENSIONS



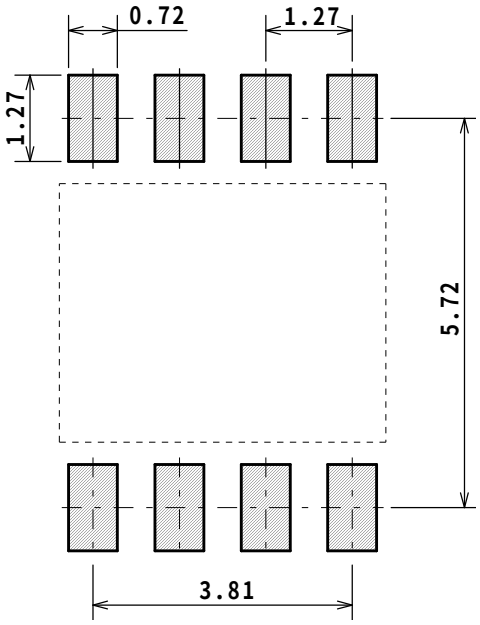
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NOM	MAX	MIN	NOM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E1	.150		.157	3.80		4.00
	E	.228		.244	5.80		6.20
LEAD PITCH	e	.050 BSC			1.27 BSC		
	L	.015		.049	0.40		1.25
	h	.010		.020	0.25		0.50
	θ	0 °		7 °	0 °		7 °
	θ1	5 °		15 °	5 °		15 °
	θ2	2 °	7 °	12 °	2 °	7 °	12 °
LEAD EDGE OFFSET	∞0	.010			0.25		
LEAD OFFSET	bbb	.010			0.25		
COPLANARITY	CCC	.004			0.10		



SOP8

Unit: mm

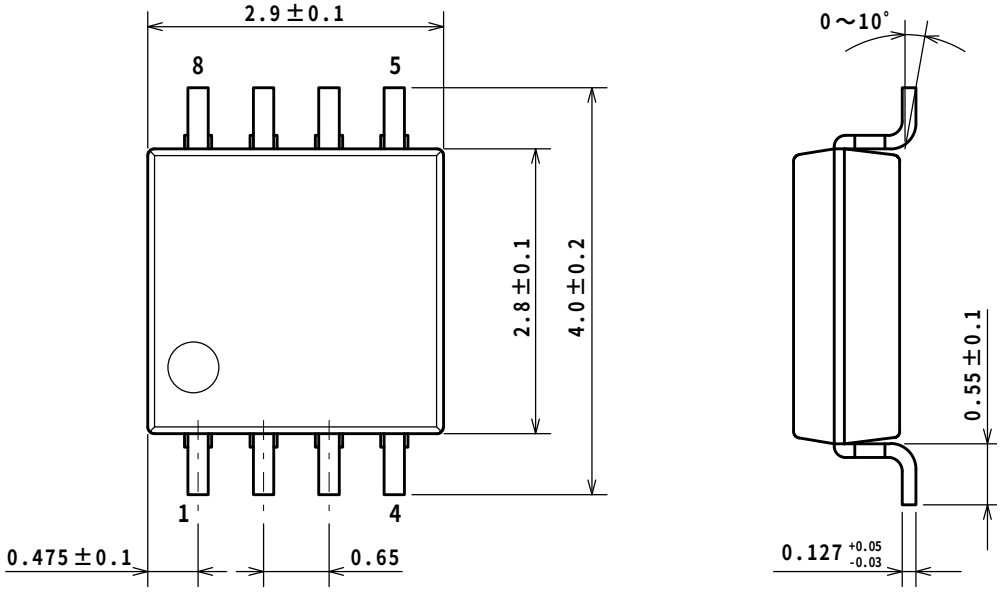
■ EXAMPLE OF SOLDER PADS DIMENSIONS

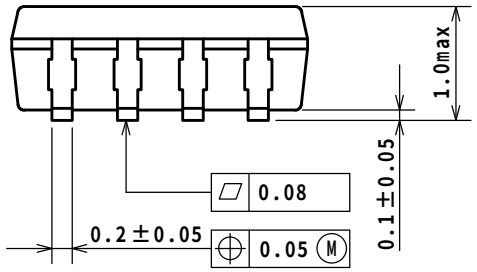


MSOP8 (TVSP8) JEDEC MO-187-DA/THIN TYPE

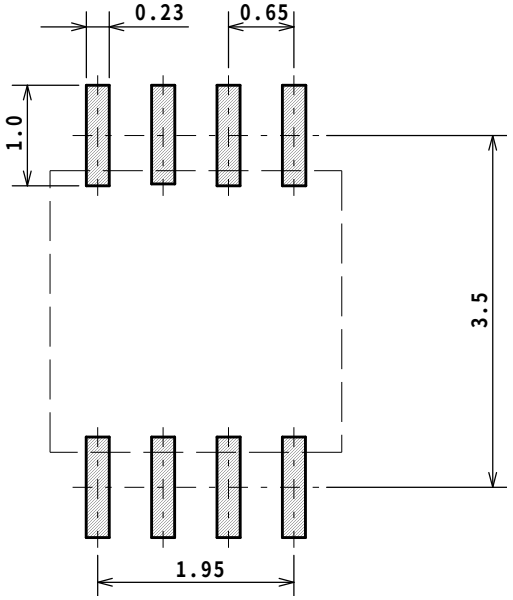
Unit: mm

■ PACKAGE DIMENSIONS





■ EXAMPLE OF SOLDER PADS DIMENSIONS

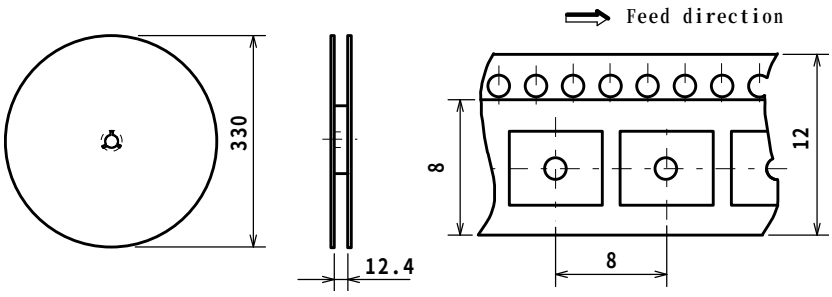


SOP8

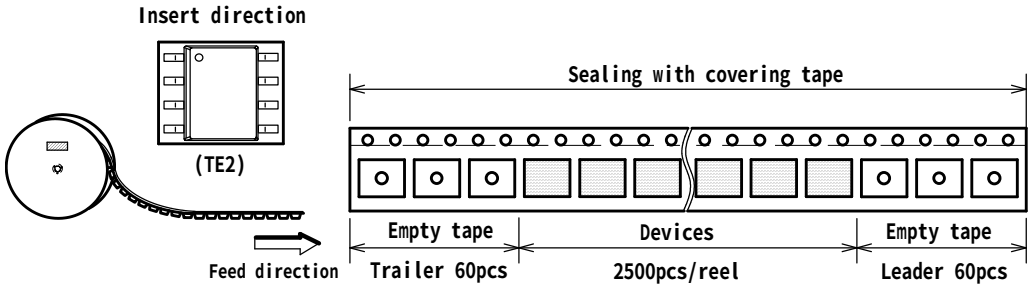
■ PACKING SPEC

Unit: mm

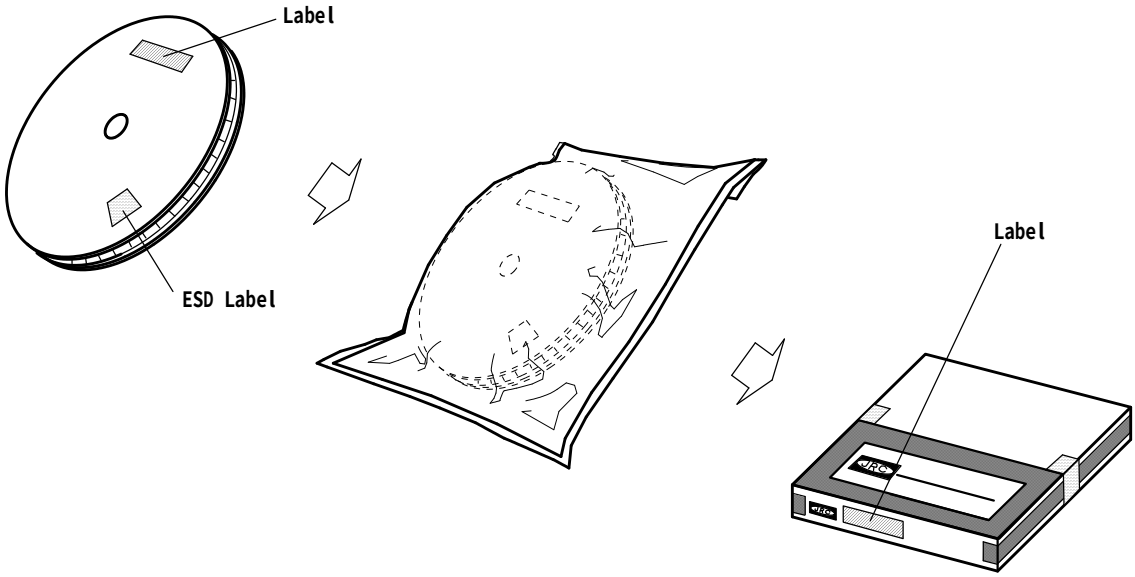
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

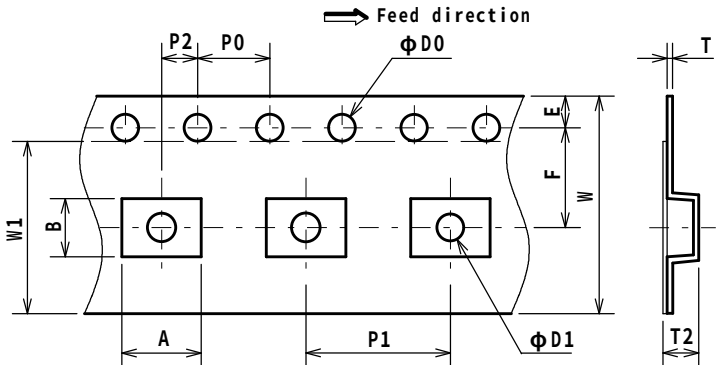


MSOP8 (TVSP8) MEET JEDEC MO-187-DA/THIN TYPE

Unit: mm

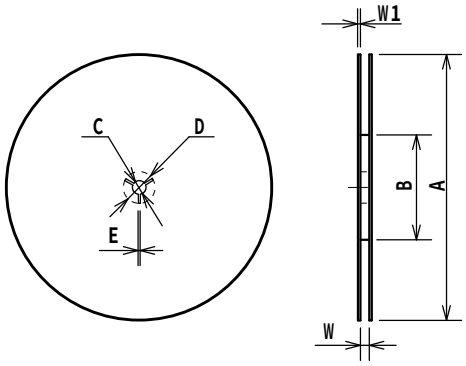
■ PACKING SPEC

TAPING DIMENSIONS



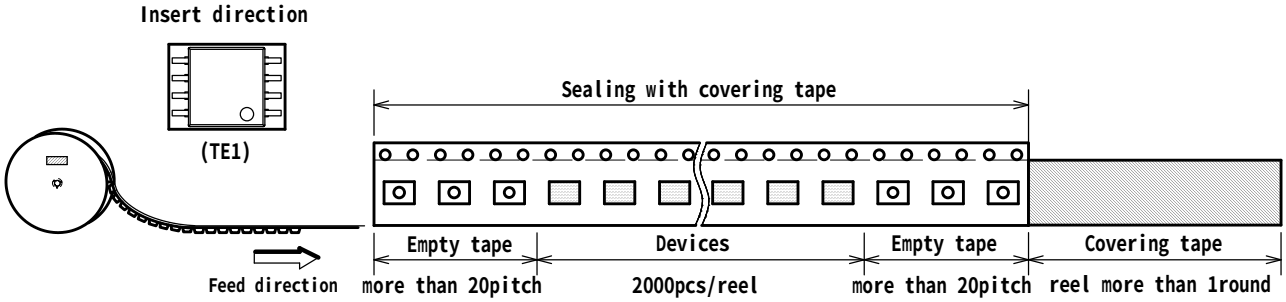
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	$1.5^{+0.1}_{0}$	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	1.75 (MAX.)	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

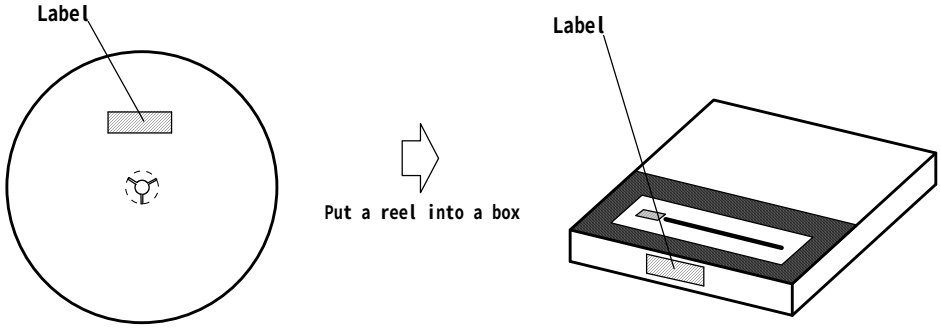


SYMBOL	DIMENSION
A	φ254±2
B	φ100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE

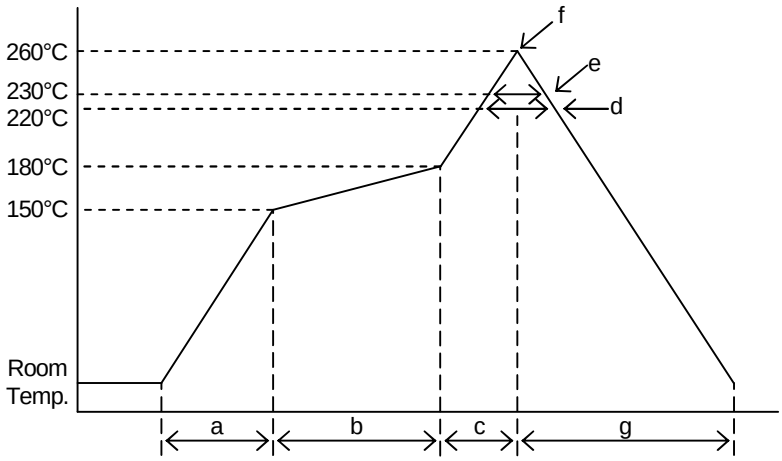


PACKING STATE



■ RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING PROFILE



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

The temperature indicates at the surface of mold package.

[CAUTION]

1. NJR strives to produce reliable and high quality semiconductors. NJR's semiconductors are intended for specific applications and require proper maintenance and handling. To enhance the performance and service of NJR'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 property rights.
   All other trademarks mentioned herein are the property of their respective companies.

3. To ensure the highest levels of reliability, NJR 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. NJR 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 NJR's Sale's Office if you are uncertain about the products listed in this datasheet.

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 this datasheet 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, etc.)
   - Life Maintenance Medical Equipment
   - Fire Alarms / Intruder Detectors
   - Vehicle Control Equipment (Airplane, railroad, ship, etc.)
   - Various Safety Devices

7. NJR'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 datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. NJR shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products. The 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). These products use 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 of, 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 datasheet are subject to change at any time, without notice.