

DUAL OPERATIONAL AMPLIFIER

FEATURES

- Supply Voltage $\pm 4V$ to $\pm 18V$
- Wide Gain Bandwidth Product 10 MHz typ.
- Slew Rate $4V/\mu s$ typ.
- Package Outline SOP8
DMP8
MSOP8 (TVSP8)*
*meet JEDEC MO-187-DA / thin type
SSOP8
- Bipolar Technology
- Internal ESD Protection
Human Body Model (HBM) $\pm 2000V$ typ.
- Wide Temperature Range $-40^{\circ}C$ to $125^{\circ}C$

DESCRIPTION

The NJM8065 integrated circuit is a high-gain, wide bandwidth, dual operational amplifier.

The NJM8065 combines many of the features of the NJM4558 as well as providing the capability of wider bandwidth (10MHz typ.), and higher slew rate ($4V/\mu s$ typ.) make the NJM8065 ideal for active filters, data and telecommunications, and many instrumentation applications.

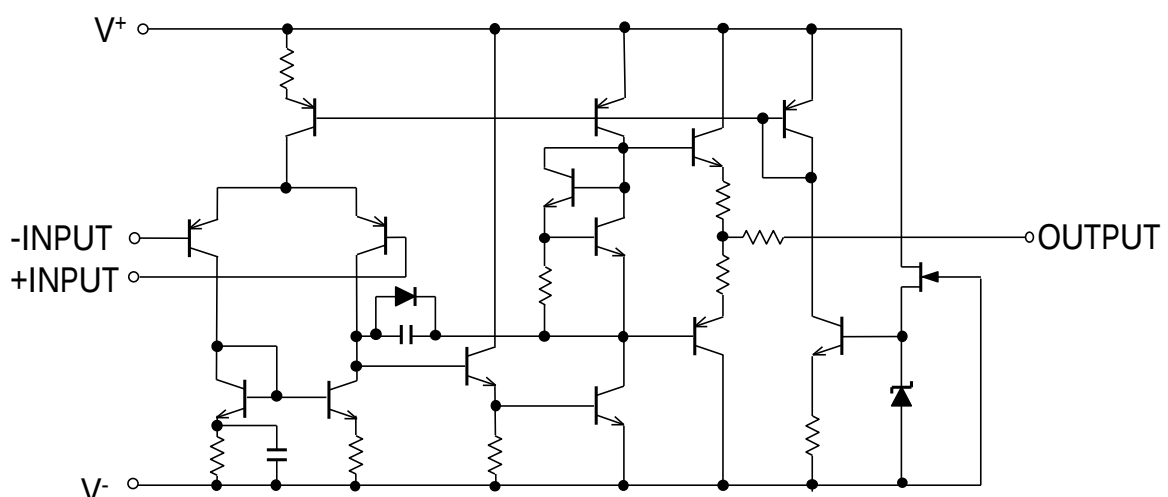
APPLICATIONS

- Audio
- Active Filters
- Servo Control Amplifiers
- Headphone Amplifiers

■ RELATED PRODUCTS

PRODUCT NAME	FEATURES
NJM8068	$3nV/\sqrt{Hz}$, 0.001%, $6.8V/\mu s$, 19MHz (Low noise, low distortion audio Op-Amp)
NJM8080	$5nV/\sqrt{Hz}$, 0.0005%, $5V/\mu s$, 15MHz (Low noise, low distortion audio Op-Amp)

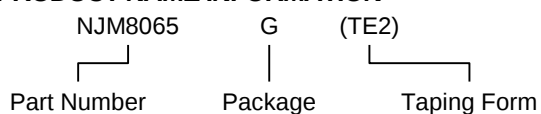
■ EQUIVALENT CIRCUIT



PIN CONFIGURATIONS

PRODUCT NAME	NJM8065G	NJM8065M	NJM8065RB1	NJM8065V
Package	SOP8	DMP8	MSOP8 (TVSP8)	SSOP8
Pin Functions				

PRODUCT NAME INFORMATION



ORDERING INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJM8065G	SOP8	Yes	Yes	Pure Sn	8065	88	2500
NJM8065M	DMP8	Yes	Yes	Sn2Bi	8065	95	2000
NJM8065RB1	MSOP8 (TVSP8)	Yes	Yes	Sn2Bi	8065	18	2000
NJM8065V	SSOP8	Yes	Yes	Sn2Bi	8065	42	2000

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	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⁾	P_D	2-Layer / 4-Layer ⁽⁴⁾ SOP8: 690 / 1000 DMP8: 470 / 600 MSOP8 (TVSP8): 510 / 680 SSOP8: 430 / 540	mW
Maximum Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	-65 to 150	°C

■ THERMAL CHARACTERISTICS

PACKAGE	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance		2-Layer / 4-Layer ⁽⁴⁾	
SOP8	Θ_{ja}	181 / 125	°C/W
DMP8		266 / 208	
MSOP8 (TVSP8)		245 / 184	
SSOP8		291 / 231	
Junction-to-Top of Package Characterization Parameter		2-Layer / 4-Layer ⁽⁴⁾	
SOP8	Ψ_{jt}	49 / 43	°C/W
DMP8		72 / 65	
MSOP8 (TVSP8)		51 / 45	
SSOP8		46 / 45	

(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^+ .

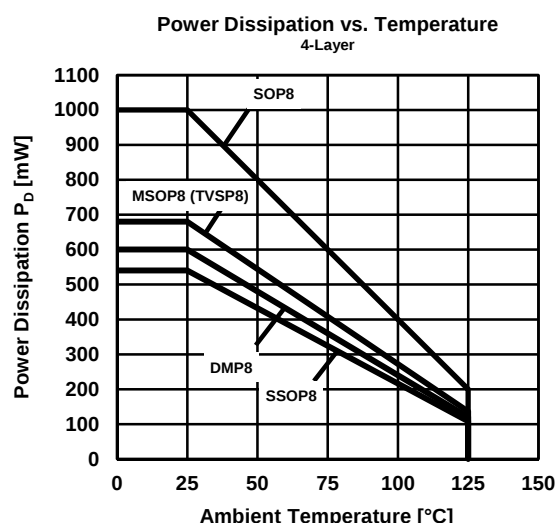
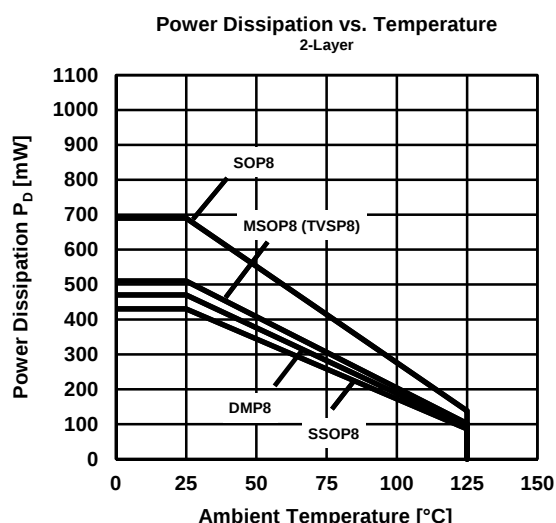
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.

(3) Power dissipation is the power that can be consumed by the IC at $T_a=25^\circ\text{C}$, 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: 74.2×74.2 mm

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



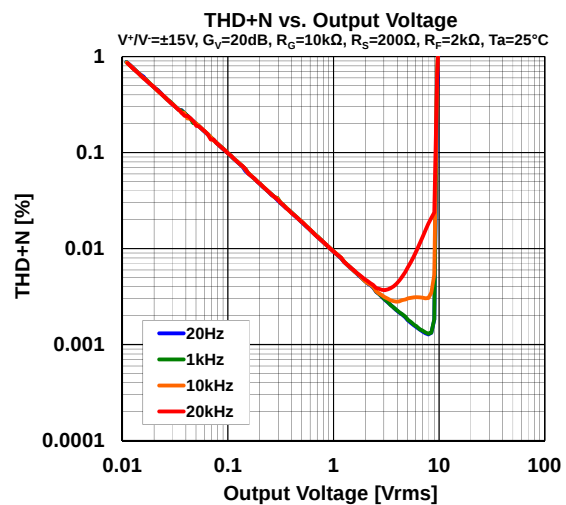
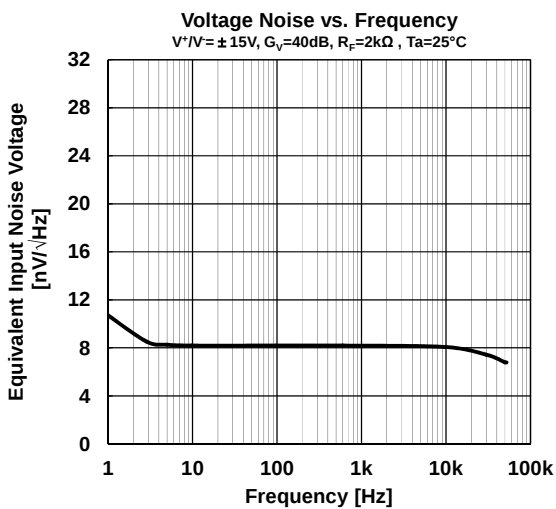
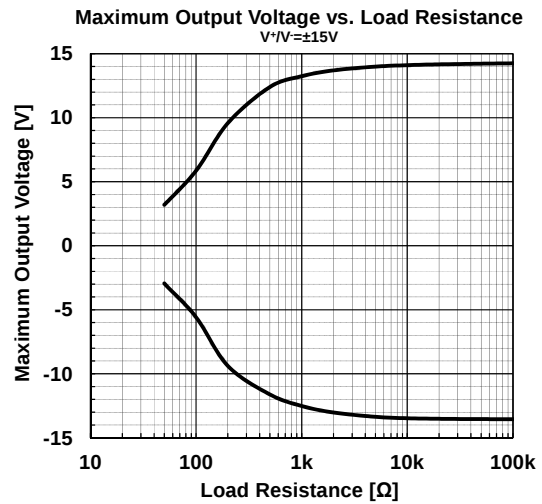
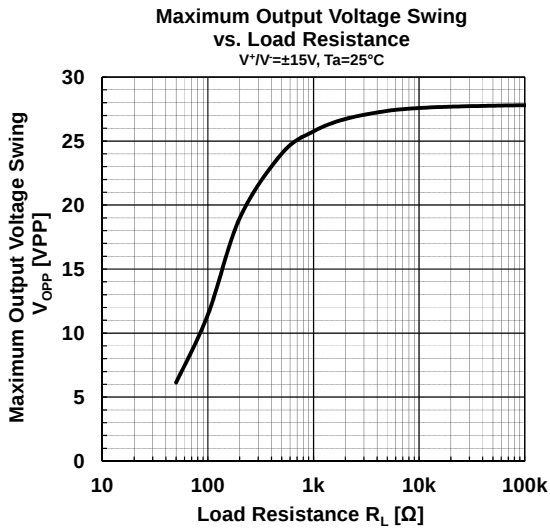
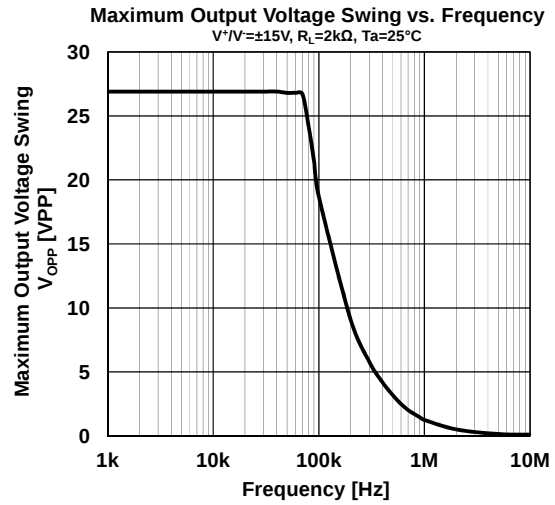
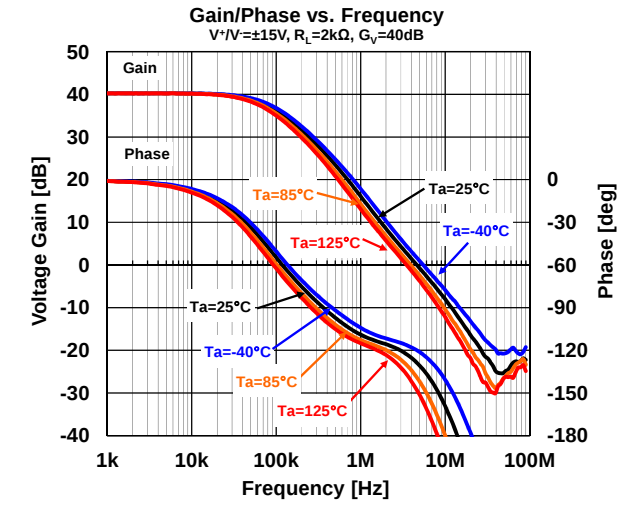
■ RECOMMENDED OPERATING CONDITIONS

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

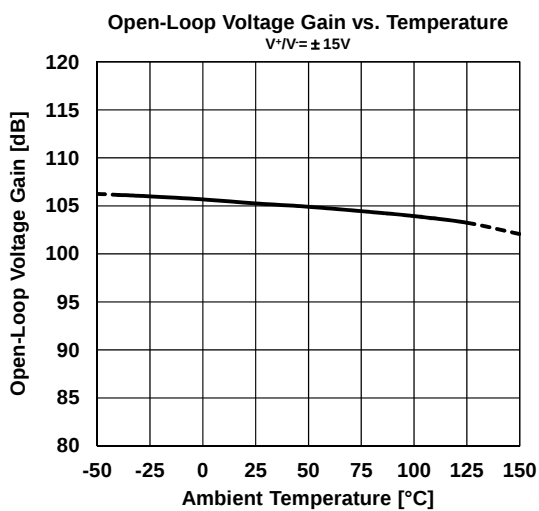
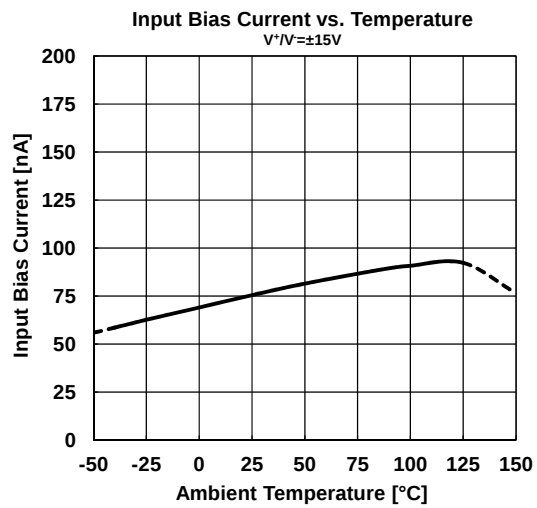
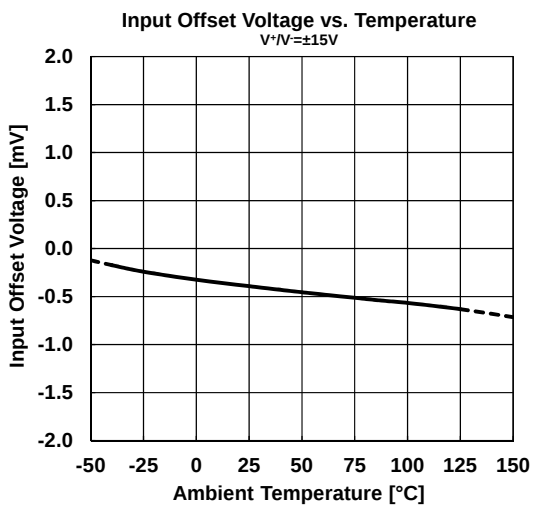
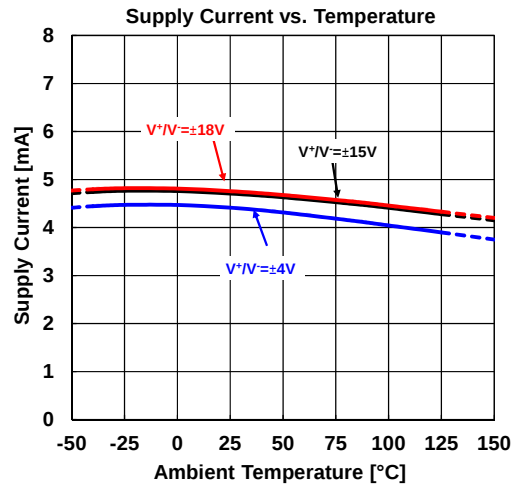
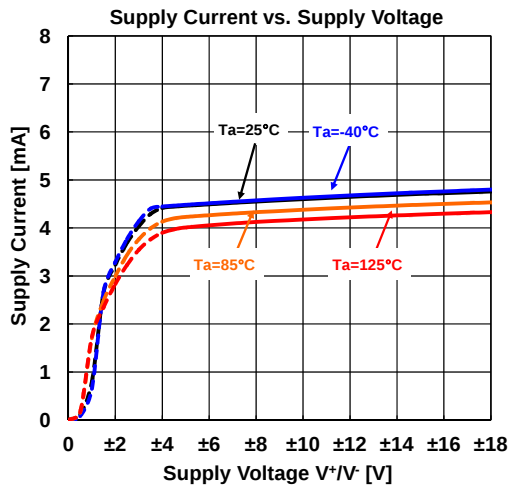
■ ELECTRICAL CHARACTERISTICS ($V^+/V^- = \pm 15$, $T_a = 25^\circ\text{C}$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
INPUT/OUTPUT CHARACTERISTICS						
Input Offset Voltage	V_{IO}	$R_S \leq 10\text{k}\Omega$	-	0.5	3	mV
Input Offset Current	I_{IO}		-	2	50	nA
Input Bias Current	I_B		-	50	200	nA
Input Resistance	R_{IN}		-	1	-	M Ω
Open-Loop Voltage Gain	A_V	$R_L \geq 2\text{k}\Omega$, $V_O = \pm 10\text{V}$	86	100	-	dB
Maximum Output Voltage1	V_{OM1}	$R_L \geq 2\text{k}\Omega$	± 12	± 14	-	V
Maximum Output Voltage2	V_{OM2}	$I_O = 25\text{mA}$	± 10	± 11.5	-	V
Common-Mode Input Voltage Range	V_{ICM}		± 12	± 14	-	V
Common-Mode Rejection Ratio	CMR	$R_S \leq 10\text{k}\Omega$	70	95	-	dB
POWER SUPPLY						
Supply Current	I_{SUPPLY}		-	4.5	7	mA
Supply Voltage Rejection Ratio	SVR	$R_S \leq 10\text{k}\Omega$	76.5	100	-	dB
AC PERFORMANCE						
Slew Rate	SR		-	4	-	V/ μs
Gain Bandwidth Product	GBW	$f = 10\text{kHz}$	-	10	-	MHz
Equivalent Input Noise Voltage	e_n	$f = 1\text{kHz}$	-	8	-	nV/ $\sqrt{\text{Hz}}$

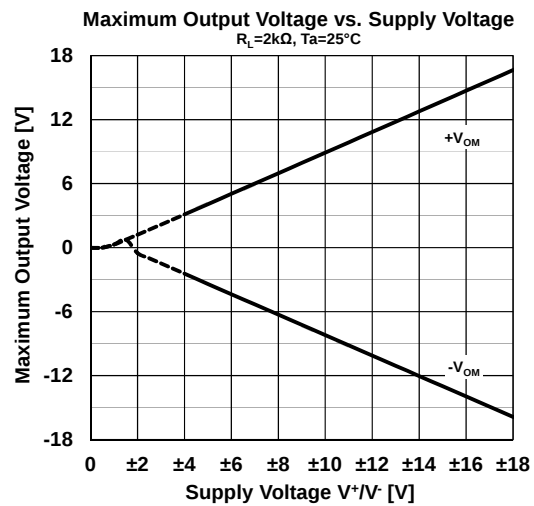
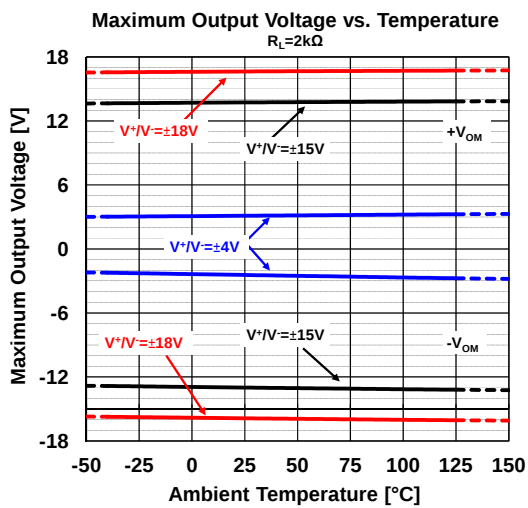
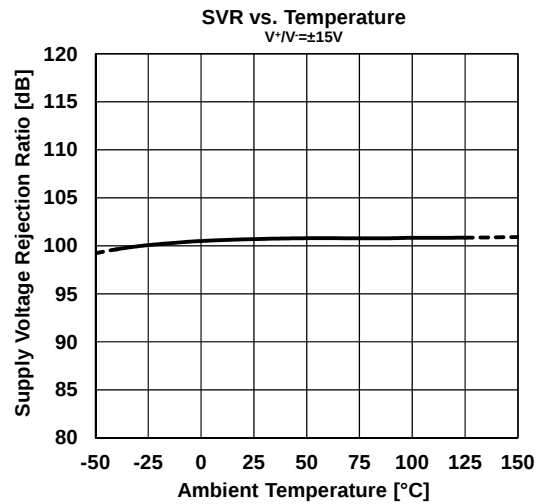
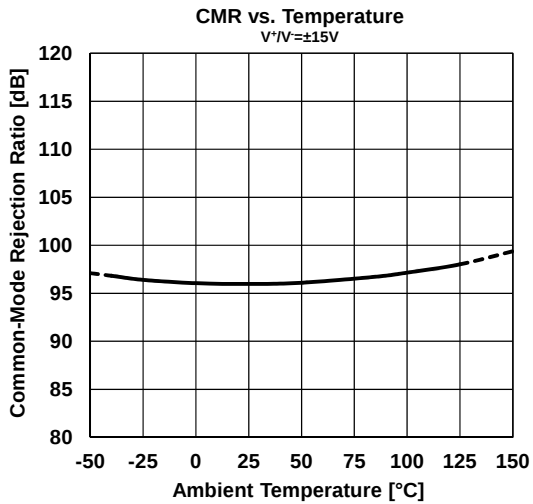
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS

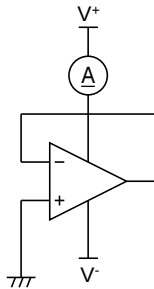


■ TYPICAL CHARACTERISTICS



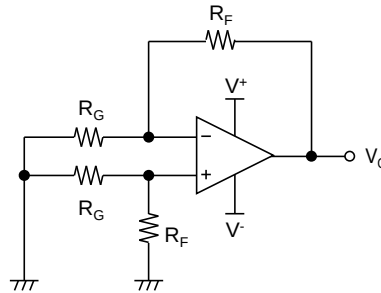
■ TEST CIRCUITS

• I_{SUPPLY}



• V_{IO} , CMR, SVR

$R_G=50\Omega$, $R_F=50k\Omega$



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

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

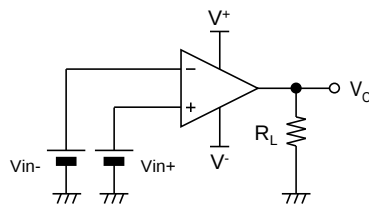
$$SVR = 20 \log \frac{\Delta V_S \left(1 + \frac{R_F}{R_G} \right)}{\Delta V_O}$$

$V_S = V^+ - V^-$

• V_{OM}

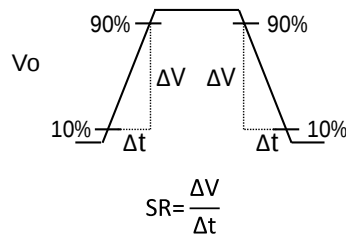
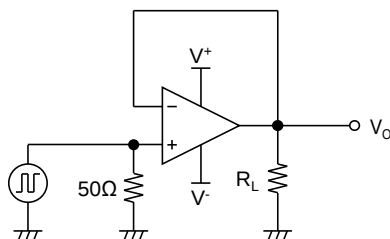
$+V_{OM}$: $V_{in+} = 1V$, $V_{in-} = -1V$

$-V_{OM}$: $V_{in+} = -1V$, $V_{in-} = 1V$

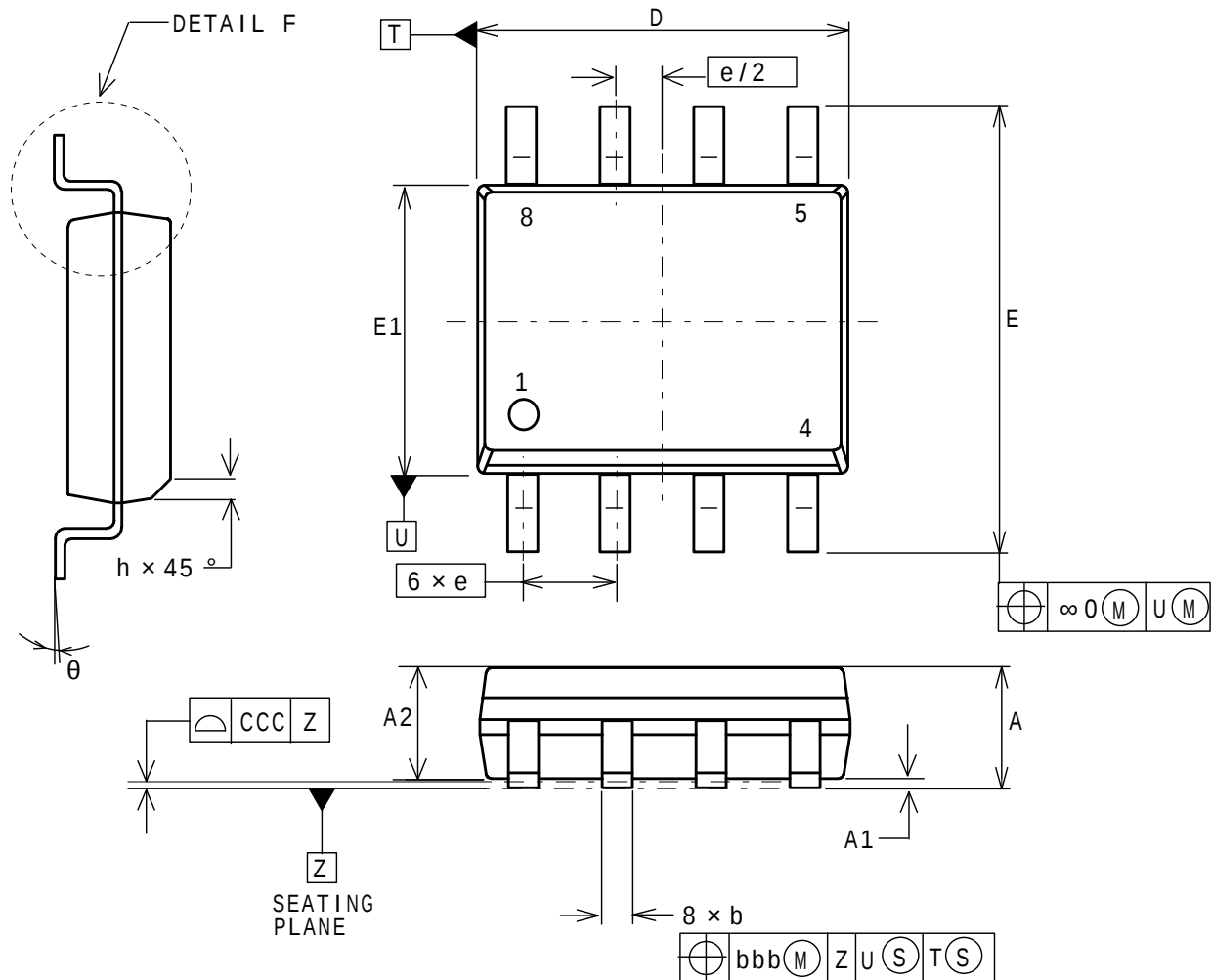


• SR

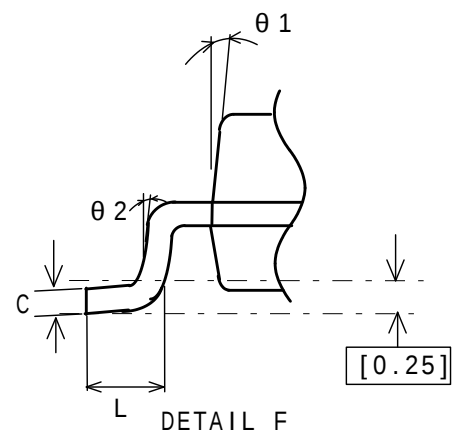
$R_L=2k\Omega$



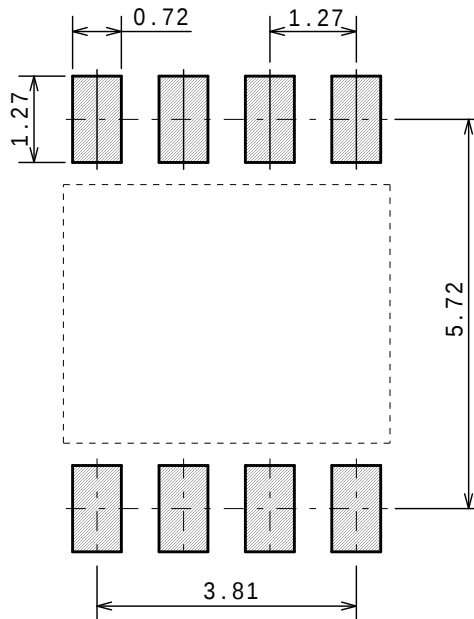
■ PACKAGE DIMENSIONS



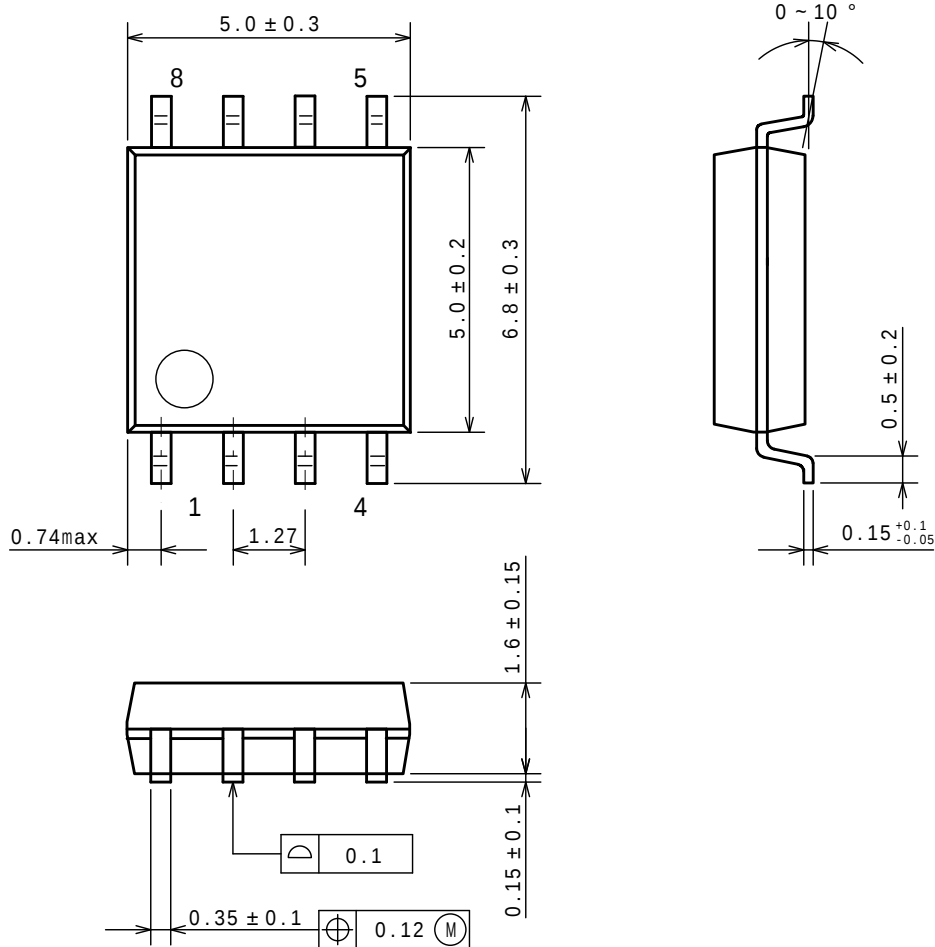
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E1	.150		.157	3.80		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°
	$\theta 1$	5°		15°	5°		15°
	$\theta 2$	2°	7°	12°	2°	7°	12°
LEAD EDGE OFFSET	$\infty 0$	.010			0.25		
LEAD OFFSET	bbb	.010			0.25		
COPLANARITY	CCC	.004			0.10		



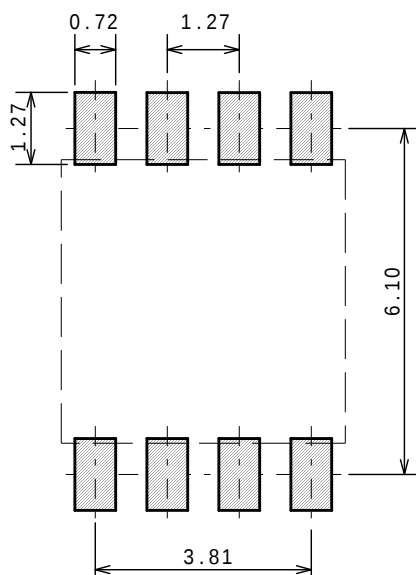
■ EXAMPLE OF SOLDER PADS DIMENSIONS



■ PACKAGE DIMENSIONS



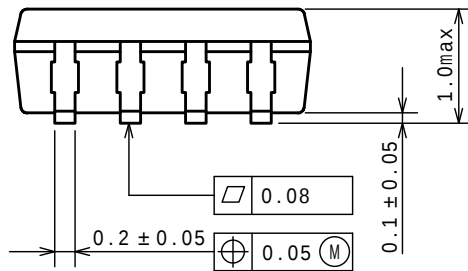
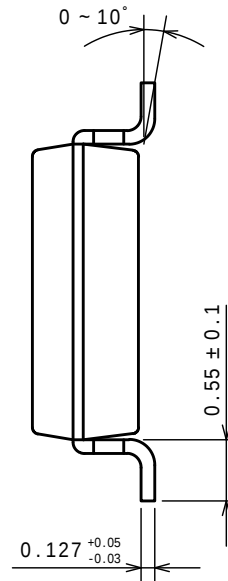
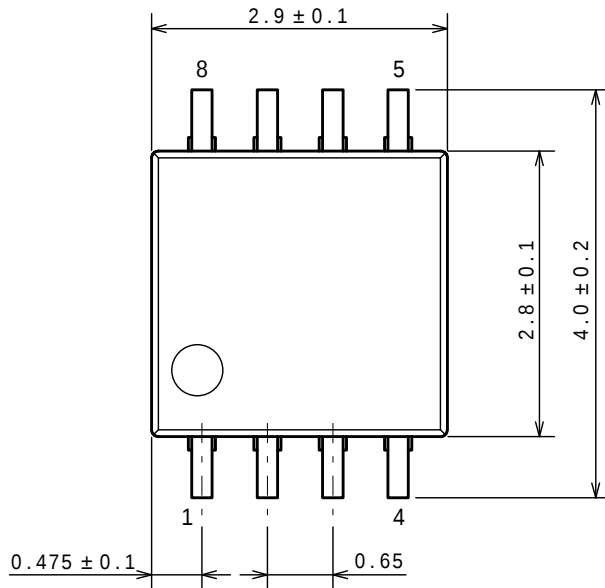
■ EXAMPLE OF SOLDER PADS DIMENSIONS



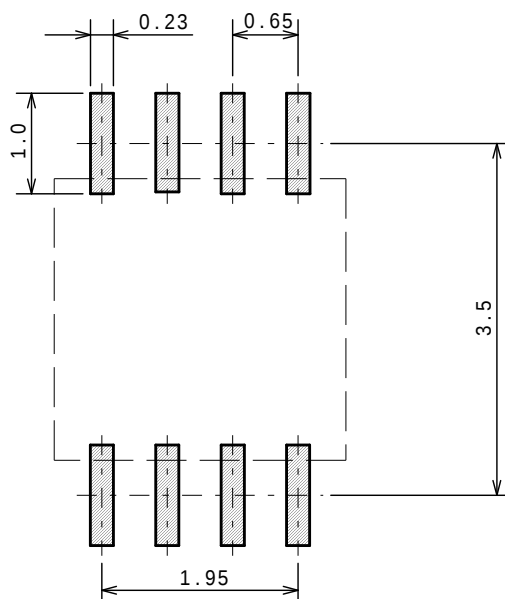
MSOP8 (TVSP8) JEDEC MO-187-DA/THIN TYPE

Unit: mm

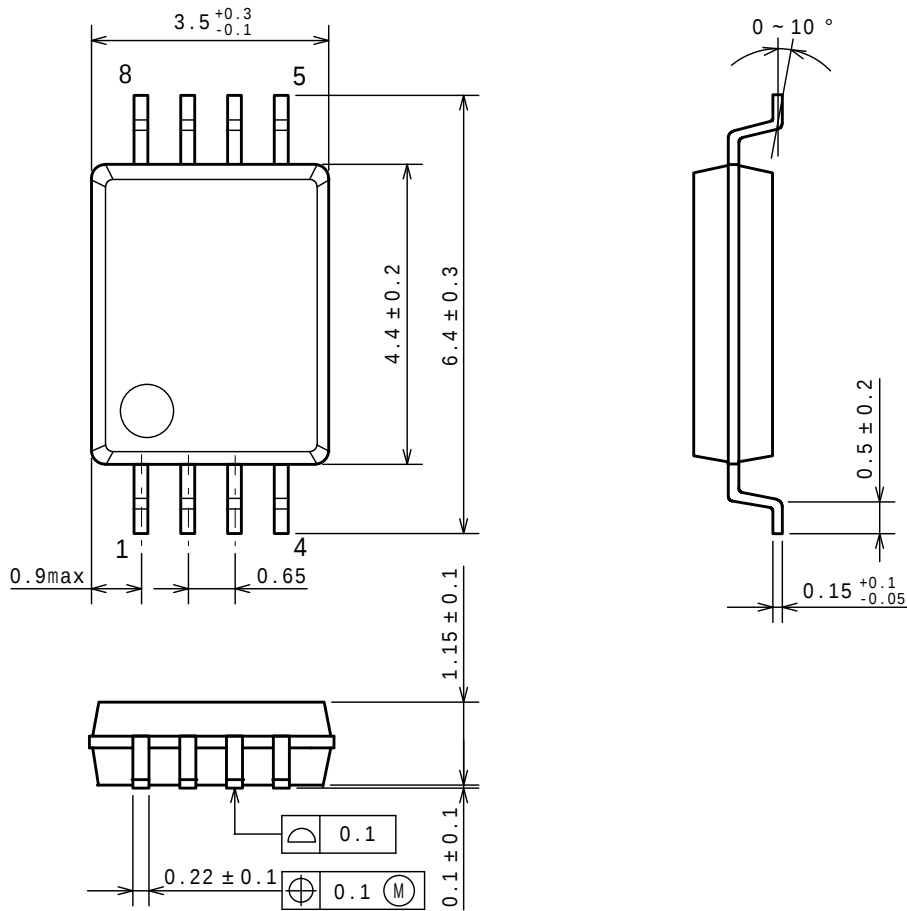
■ PACKAGE DIMENSIONS



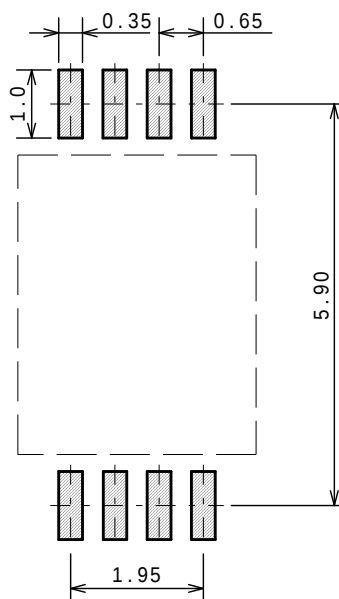
■ EXAMPLE OF SOLDER PADS DIMENSIONS



■ PACKAGE DIMENSIONS

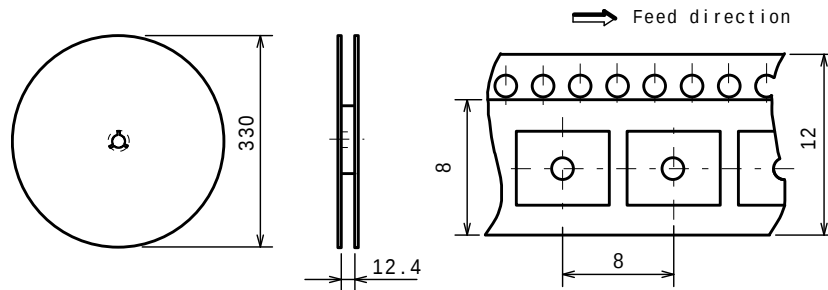


■ EXAMPLE OF SOLDER PADS DIMENSIONS

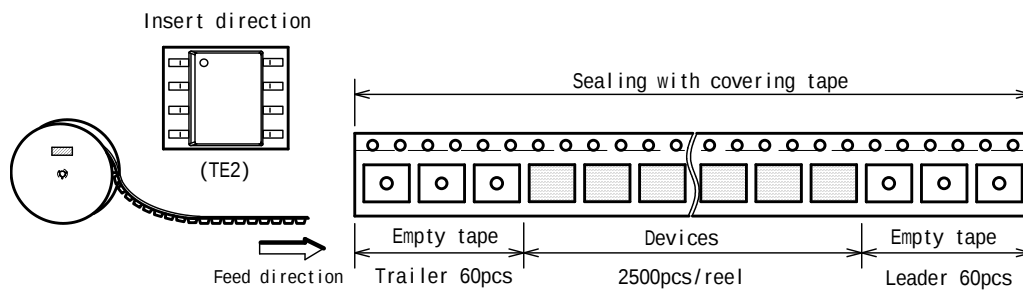


■ PACKING SPEC

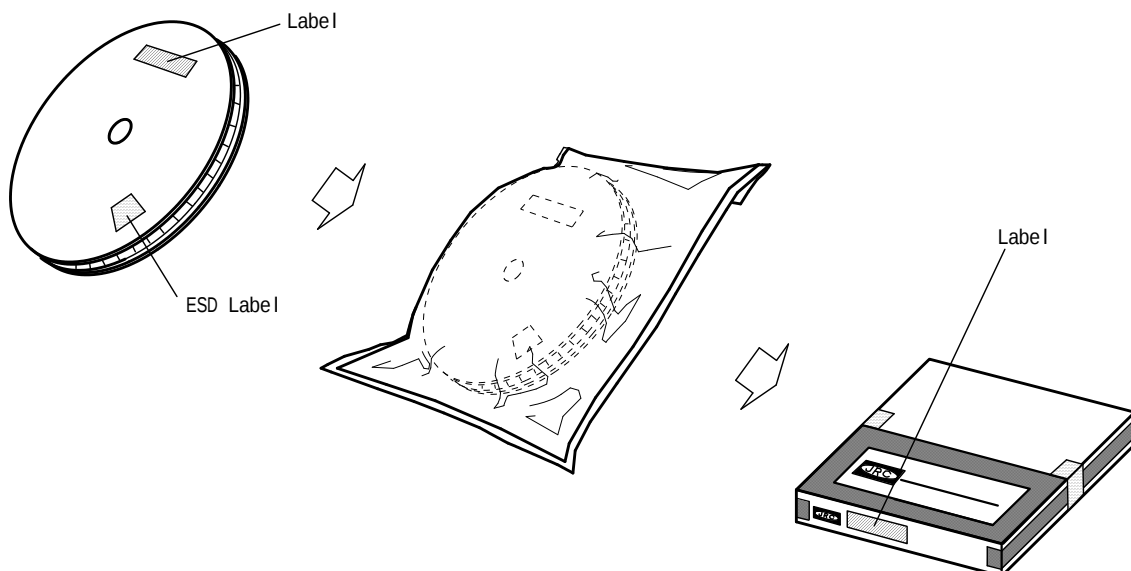
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE

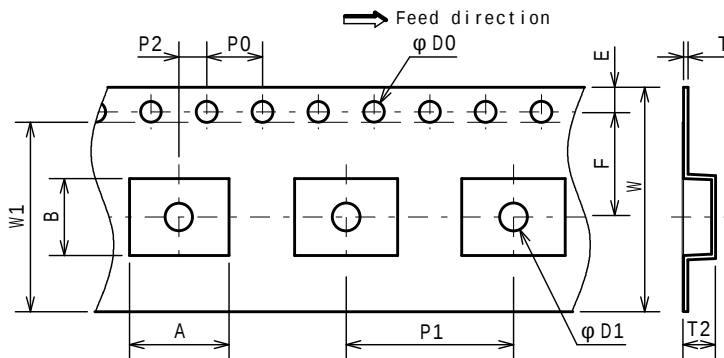


PACKING STATE



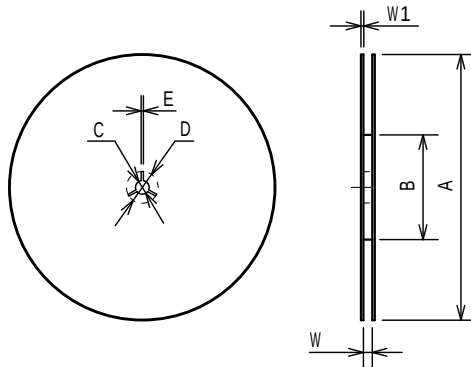
PACKING SPEC

TAPING DIMENSIONS



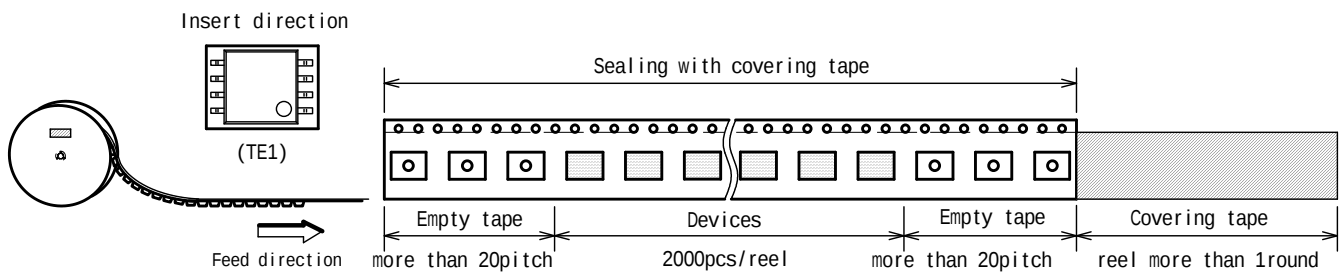
SYMBOL	DIMENSION	REMARKS
A	7.1	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	2.05 ± 0.1	
E	1.75 ± 0.1	
F	7.5 ± 0.1	
P0	4.0 ± 0.1	
P1	12.0 ± 0.1	
P2	2.0 ± 0.1	
T	0.3 ± 0.05	
T2	2.3	
W	16.0 ± 0.3	
W1	13.5	THICKNESS 0.1max

REEL DIMENSIONS

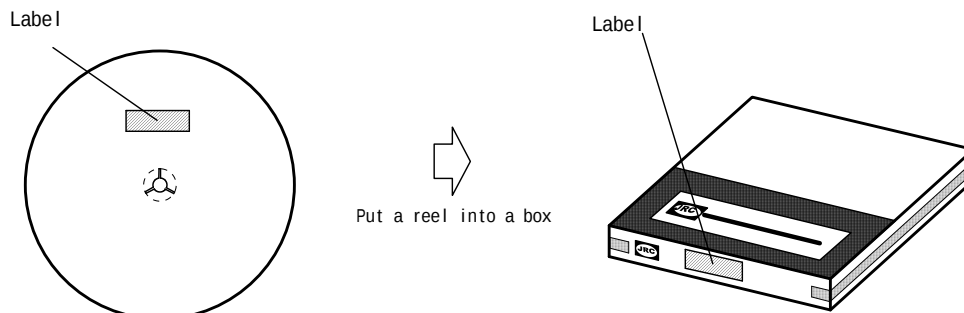


SYMBOL	DIMENSION
A	$\phi 330 \pm 2$
B	$\phi 80 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	17.5 ± 0.5
W1	2 ± 0.2

TAPING STATE



PACKING STATE

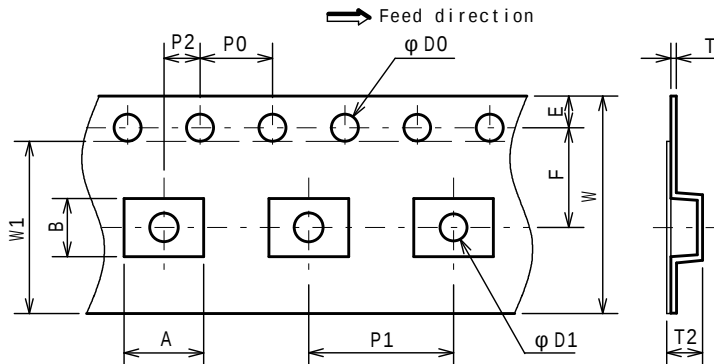


MSOP8 (TVSP8) MEET JEDEC MO-187-DA/THIN TYPE

PACKING SPEC

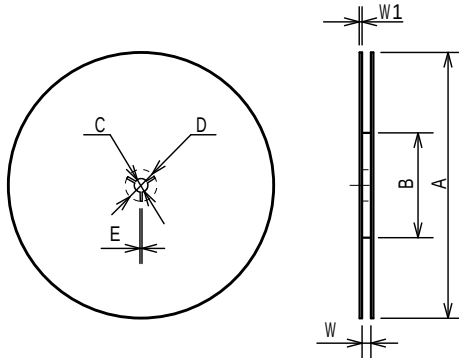
Unit: mm

TAPING DIMENSIONS



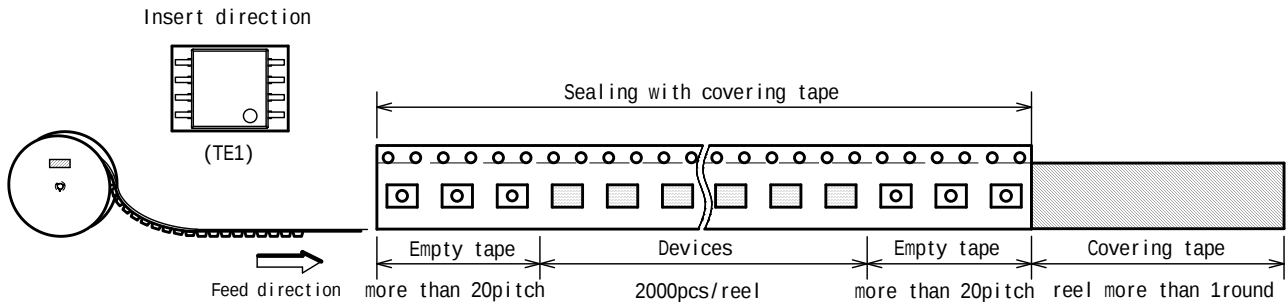
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	$1.5^{+0.1}_0$	
D1	$1.5^{+0.1}_0$	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.30 ± 0.05	
T2	1.75 (MAX.)	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

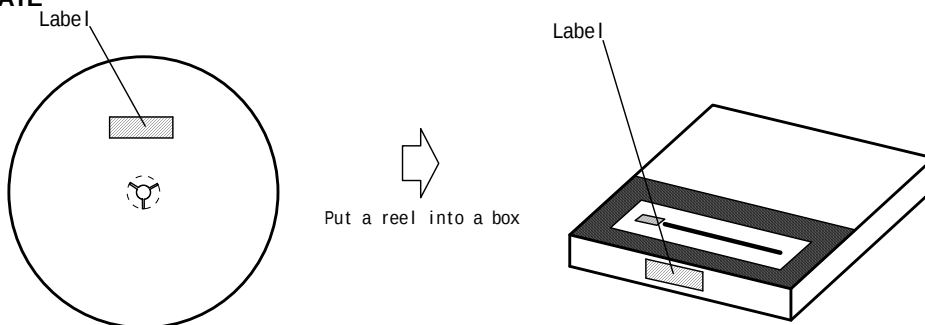


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2.0 ± 0.2

TAPING STATE

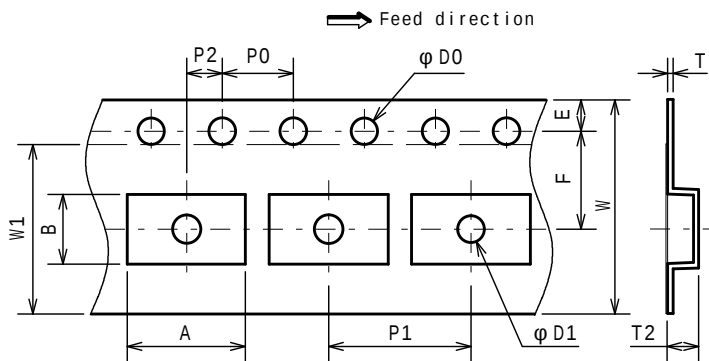


PACKING STATE



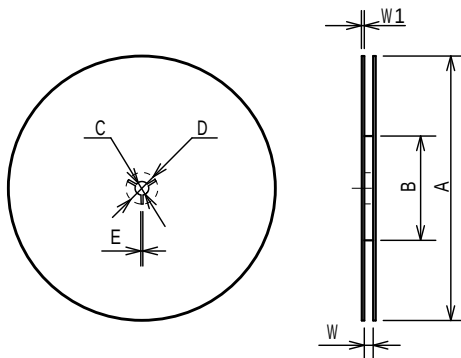
PACKING SPEC

TAPING DIMENSIONS



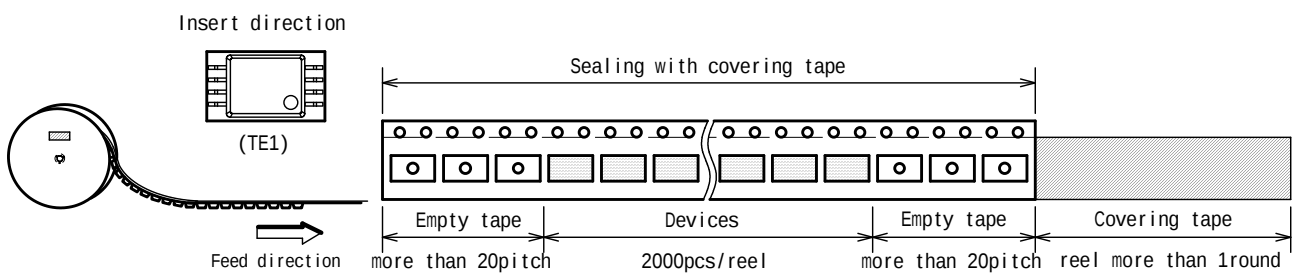
SYMBOL	DIMENSION	REMARKS
A	6.7	BOTTOM DIMENSION
B	3.9	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

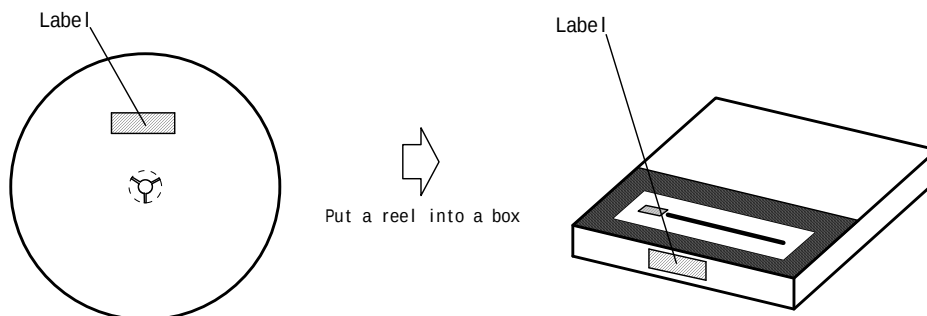


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

TAPING STATE

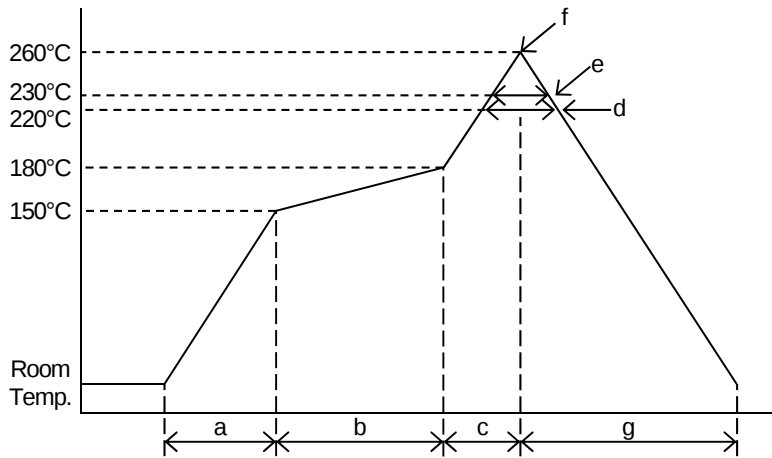


PACKING STATE



■ RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING PROFILE



a	Temperature ramping rate	1 to 4°C/s
b	Pre-heating temperature	150 to 180°C
	Pre-heating time	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]

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