

## LOW-POWER J-FET INPUT OPERATIONAL AMPLIFIERS

### FEATURES

- Wide Power Supply Range  $\pm 2$  to  $\pm 18V$
- High Input Resistance  $10^{12}\Omega$  typ.
- Wide Temperature Range  $-40^{\circ}C$  to  $125^{\circ}C$
- Bipolar Technology
- Low Operating Current  $200\mu A/amp$  typ.
- Slew Rate  $3.5V/\mu s$  typ.
- Internal ESD Protection  
Human Body Model (HBM)  $\pm 2000V$  typ.
- Package
  - NJM062C/062CA SOP8
  - NJM064C/064CA SSOP8
  - SOP14
  - SSOP14(U.D)

### DESCRIPTION

The NJM062C/064C are J-FET input operational amplifiers designed as low-power versions of the NJM072C/074C. It features high input impedance, high slew rate and low input offset and bias current.

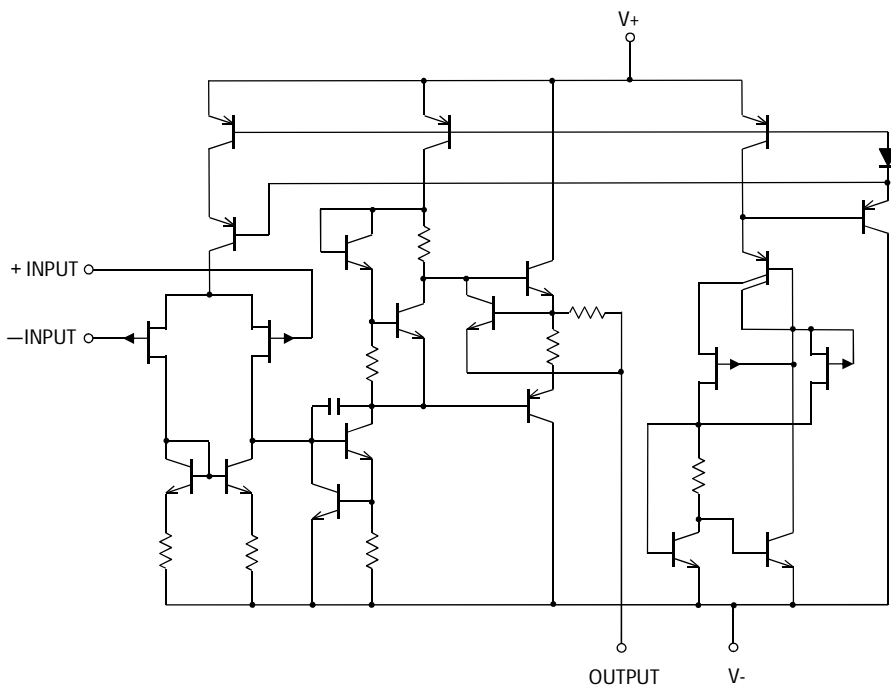
The NJM062C/064C are suitable for audio amplifier applications and measurement applications. In addition, the realization of a wide operating temperature reaches by a new design.

Product Name	Dual	NJM062CG/CV	NJM062CAG/CAV
	Quad	NJM064CG/CV	NJM064CAG/CAV
Input Offset Voltage		15mV max.	6mV max.

### APPLICATIONS

- Battery Powered Measuring Instruments
- Active Filters
- Sensor Amplifiers
- Audio Amplifiers / Filters
- Photodiode Amplifiers

### ■ EQUIVALENT CIRCUIT



## ■ PIN CONFIGURATIONS

PRODUCT NAME	NJM062CG/CAG	NJM062CV/CAV	NJM064CG/CAG	NJM064CV/CAV(U.D)
Package	SOP8	SSOP8	SOP14	SSOP14
Pin Functions	<p>(Top View)</p> <p>1 A OUTPUT, 2 A -INPUT, 3 A +INPUT, 4 V-, 5 B +INPUT, 6 B -INPUT, 7 B OUTPUT, 8 V+</p>		<p>(Top View)</p> <p>1 A OUTPUT, 2 A -INPUT, 3 A +INPUT, 4 V-, 5 B +INPUT, 6 B -INPUT, 7 B OUTPUT, 8 C OUTPUT, 9 C -INPUT, 10 C +INPUT, 11 V-, 12 D +INPUT, 13 D -INPUT, 14 D OUTPUT</p>	

## ■ PRODUCT NAME INFORMATION



## ■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJM062CG	SOP8	Yes	Yes	Pure Sn	062	88	2500
NJM062CAG	SOP8	Yes	Yes	Pure Sn	062A	88	2500
NJM062CV	SSOP8	Yes	Yes	Sn2Bi	062	42	2000
NJM062CAV	SSOP8	Yes	Yes	Sn2Bi	062A	42	2000
NJM064CG	SOP14	Yes	Yes	Pure Sn	064	150	2500
NJM064CAG	SOP14	Yes	Yes	Pure Sn	064A	150	2500
NJM064CV	SSOP14	Yes	Yes	Sn2Bi	064	65	2000
NJM064CAV	SSOP14	Yes	Yes	Sn2Bi	064A	65	2000

## ■ ABSOLUTE MAXIMUM RATINGS

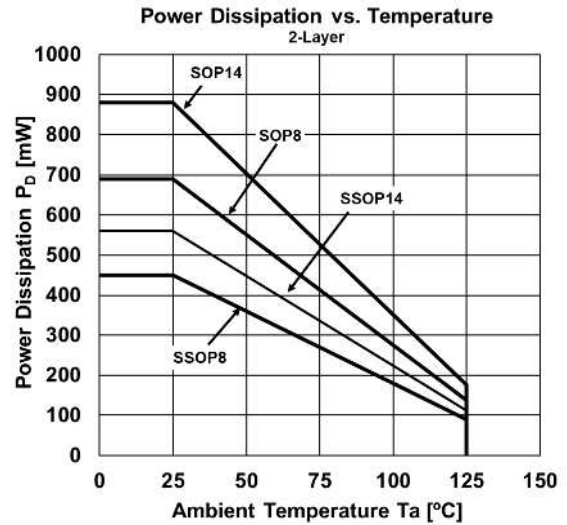
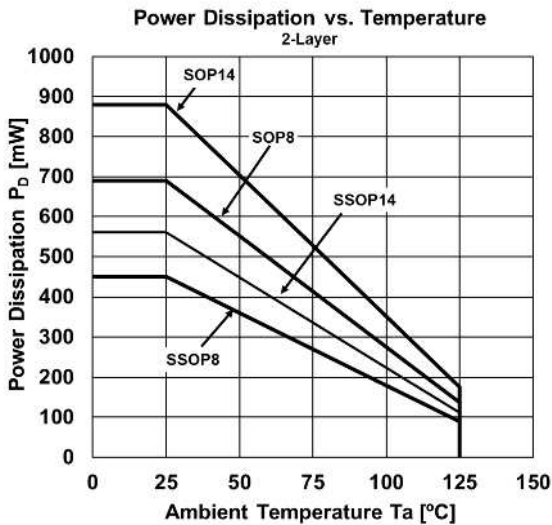
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+ / V^-$	$\pm 18$	V
Differential Input Voltage <sup>(1)</sup>	$V_{ID}$	$\pm 36$	V
Input Voltage <sup>(2)</sup>	$V_{IN}$	$V^- - 0.3$ to $V^+ + 36$	V
Output Terminal Input Voltage	$V_O$	$V^- - 0.3$ to $V^+ + 0.3$	V
Power Dissipation <sup>(3)</sup>	$P_D$	2-Layer / 4-Layer <sup>(4)</sup>	
SOP8		690 / 1000	mW
SSOP8		450 / 570	
SOP14		880 / 1200	
SSOP14	560 / 700		
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	$\Theta_{ja}$	2-Layer / 4-Layer <sup>(4)</sup>	°C/W
SOP8		181 / 125	
SSOP8		278 / 221	
SOP14		142 / 104	
SSOP14		225 / 179	
Junction-to-Top of Package Characterization Parameter	$\Psi_{jt}$	2-Layer / 4-Layer <sup>(4)</sup>	°C/W
SOP8		49 / 43	
SSOP8		41 / 40	
SOP14		39 / 34	
SSOP14		40 / 36	

- (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. (76.2x114.3x1.6 mm: based on EIA/JDEC standard, 2-layer FR-4)  
4-Layer: Mounted on glass epoxy board. (76.2x114.3x1.6 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

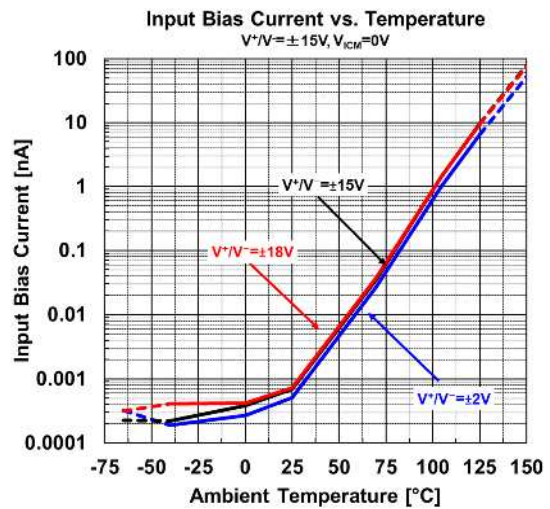
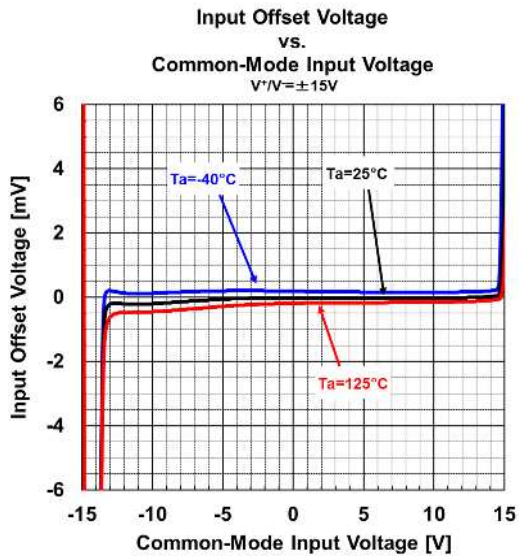
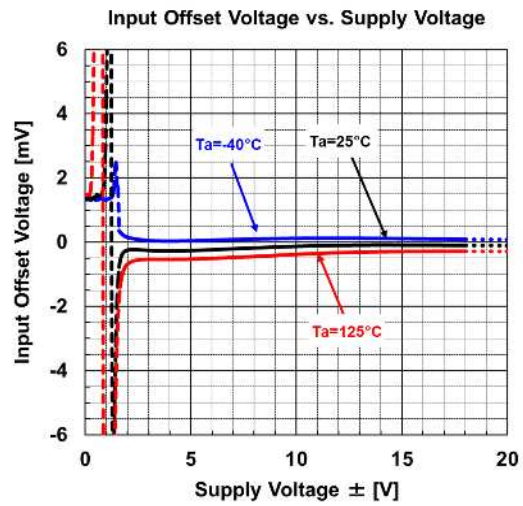
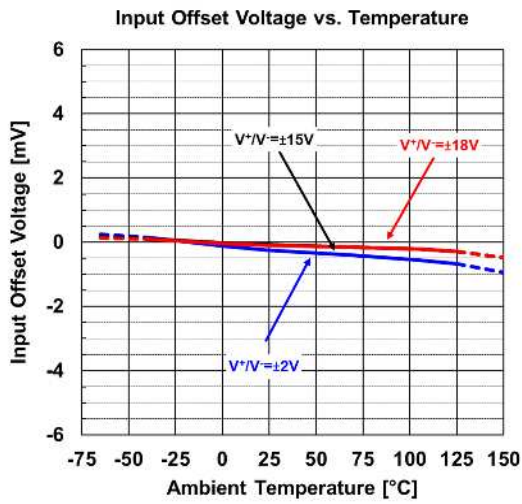
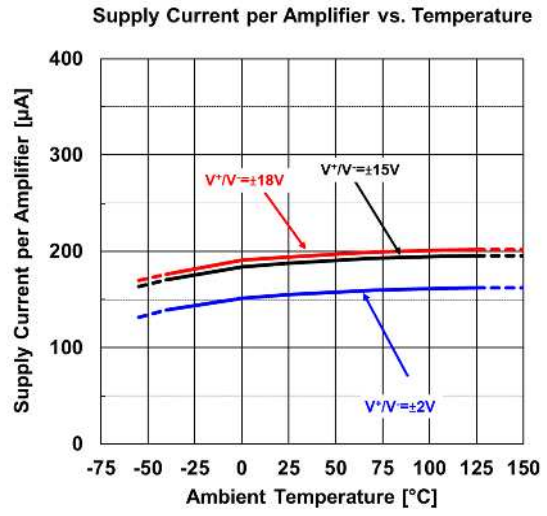
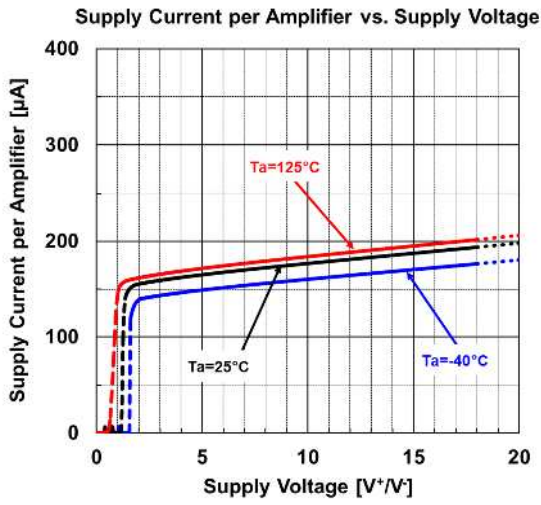
PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Supply Voltage	$V^+ / V^-$	$T_a=25^\circ\text{C}$	$\pm 2$ to $\pm 18$	V
Operating Temperature Range	$T_{opr}$		-40 to 125	°C

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

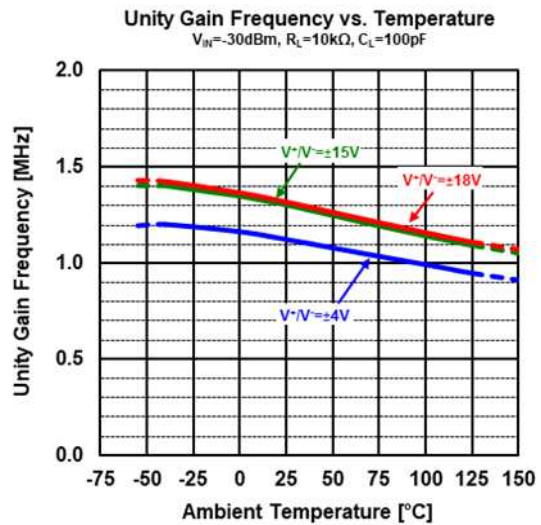
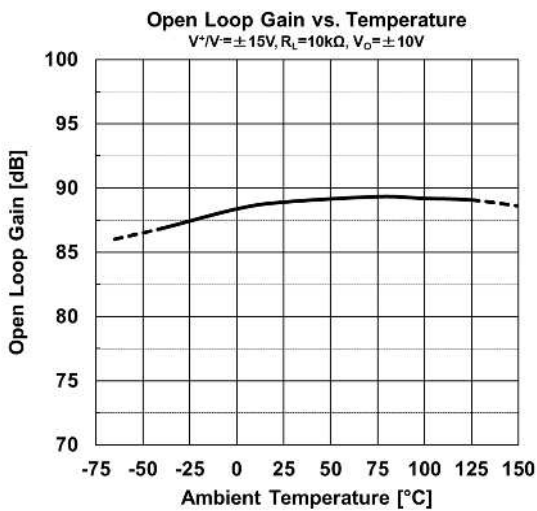
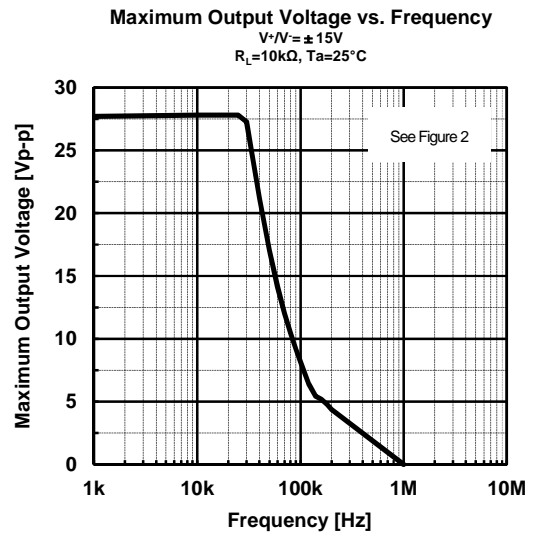
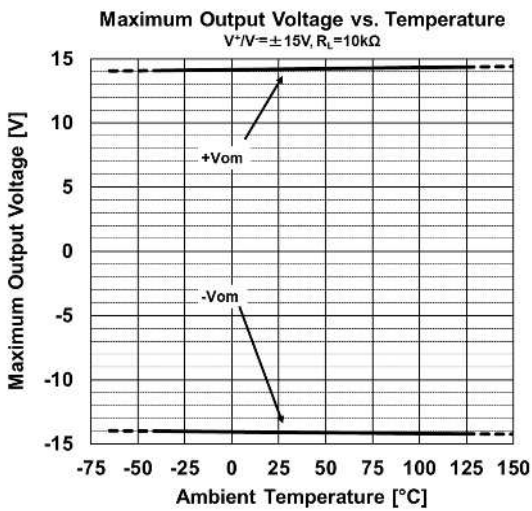
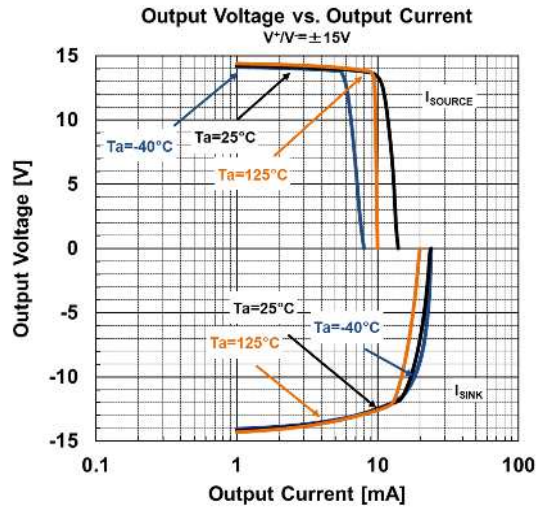
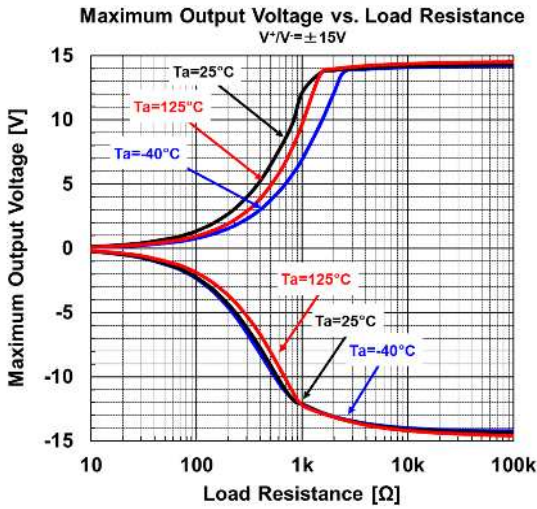
PARAMETER	SYMBOL	TEST CONDITIONS	NJM062C / NJM064C			NJM062CA / NJM064CA			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
<b>INPUT CHARACTERISTICS</b>									
Input Offset Voltage	$V_{IO}$	$R_S = 50\Omega$ , $T_a = 25^\circ C$ $R_S = 50\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	-	3	15	-	3	6	mV
Input Offset Voltage Drift	$\Delta V_{IO} / \Delta T$	$R_S = 50\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	-	10	-	←	←	←	$\mu V / ^\circ C$
Input Offset Current	$I_{IO}$	$T_a = 25^\circ C$ $0^\circ C < T_a < 70^\circ C^{(5)}$	-	5	200	-	5	100	pA
			-	-	5	-	-	3	nA
Input Bias Current	$I_B$	$T_a = 25^\circ C$ $0^\circ C < T_a < 70^\circ C^{(5)}$	-	30	400	-	30	200	pA
			-	-	10	-	-	7	nA
Input Resistance	$R_{IN}$		-	$10^{12}$	-	←	←	←	$\Omega$
Open-Loop Voltage Gain	$A_V$	$R_L \geq 10k\Omega$ , $V_O = \pm 10V$ , $T_a = 25^\circ C$ $R_L \geq 10k\Omega$ , $V_O = \pm 10V$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	3	20	-	8	20	-	V/mV
			3	-	-	8	-	-	
Common-Mode Rejection Ratio	CMR	$V_{IC} = V_{ICM \min}$ , $R_S \leq 10k\Omega$	70	90	-	72	90	-	dB
Common-Mode Input Voltage Range	$V_{ICM}$	$\geq$ CMR MIN	$\pm 13$	-13.5 to 15	-	←	←	←	V
<b>OUTPUT CHARACTERISTICS</b>									
Maximum Output Voltage	$V_{OM}$	$R_L = 10k\Omega$ , $T_a = 25^\circ C$ $R_L = 10k\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	$\pm 10$	$\pm 13.5$	-	←	←	←	V
			$\pm 10$	-	-	←	←	←	
<b>POWER SUPPLY</b>									
Supply Current per Amplifier	$I_{SUPPLY}$	No Signal	-	200	250	←	←	←	$\mu A$
Supply Voltage Rejection Ratio	SVR	$V^+ / V^- = \pm 9V$ to $\pm 15V$ , $R_S \leq 50k\Omega$	70	100	-	80	100	-	dB
<b>AC CHARACTERISTICS</b>									
Slew Rate	SR	$V_{IN} = 10V_{pp}$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , See Figure 1	1.5	3.5	-	←	←	←	V/ $\mu s$
Unity Gain Frequency	$f_T$	$R_L = 10k\Omega$	-	1	-	←	←	←	MHz
Rise Time	$t_r$	$V_{IN} = 20mV_{pp}$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , See Figure 1	-	0.2	-	←	←	←	$\mu s$
Overshoot	$K_{OV}$	$V_{IN} = 20mV_{pp}$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , See Figure 1	-	10	-	←	←	←	%
Equivalent Input Noise Voltage	$e_n$	$R_S = 20\Omega$ , $f = 1kHz$	-	35	-	←	←	←	nV/ $\sqrt{Hz}$
Channel Separation	CS	$G_V = 40dB$	-	120	-	←	←	←	dB

(5) This parameter is not 100% test.

## ■ TYPICAL CHARACTERISTICS



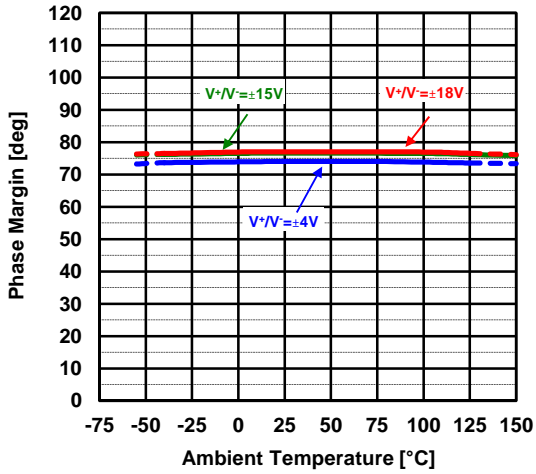
## ■ TYPICAL CHARACTERISTICS



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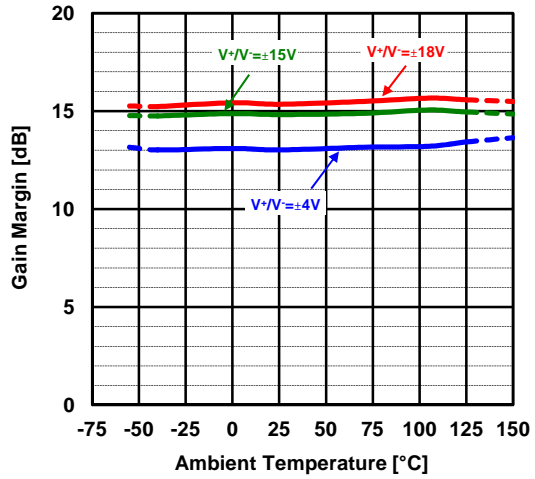
**Phase Margin vs. Temperature**

$V_{IN} = -30\text{dBm}$ ,  $R_L = 10\text{k}\Omega$ ,  $C_L = 100\text{pF}$



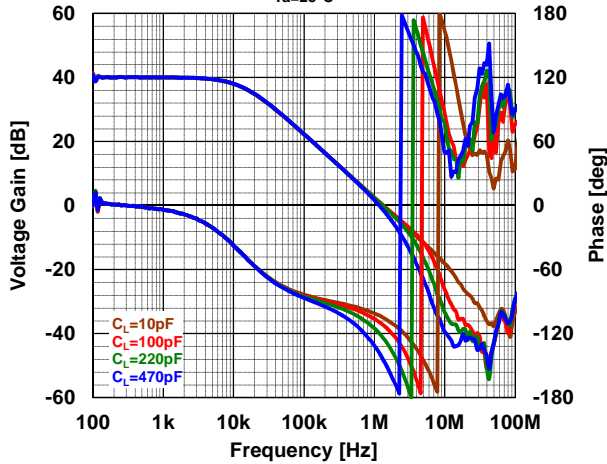
**Gain Margin vs. Temperature**

$V_{IN} = -30\text{dBm}$ ,  $R_L = 10\text{k}\Omega$ ,  $C_L = 100\text{pF}$



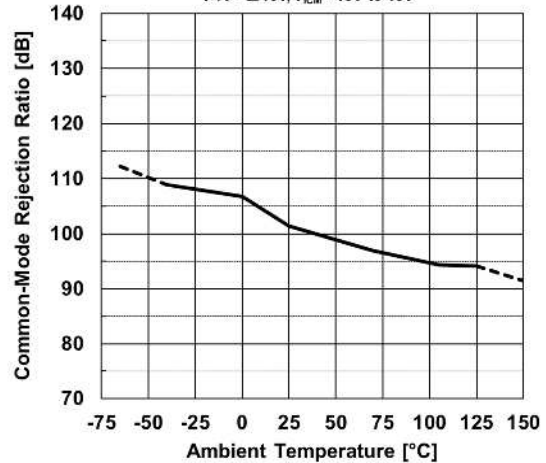
**Closed Loop Gain / Phase vs. Frequency**

$V^+/V^- = \pm 15\text{V}$ ,  $V_{IN} = -30\text{dBm}$ ,  $R_I = 100\Omega$ ,  $R_F = 10\text{k}\Omega$ ,  $G_V = 40\text{dB}$ ,  $T_a = 25^\circ\text{C}$



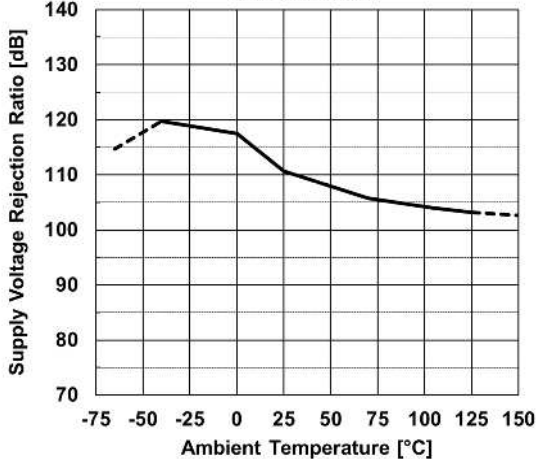
**CMR vs. Temperature**

$V^+/V^- = \pm 15\text{V}$ ,  $V_{ICM} = -13\text{V}$  to  $13\text{V}$



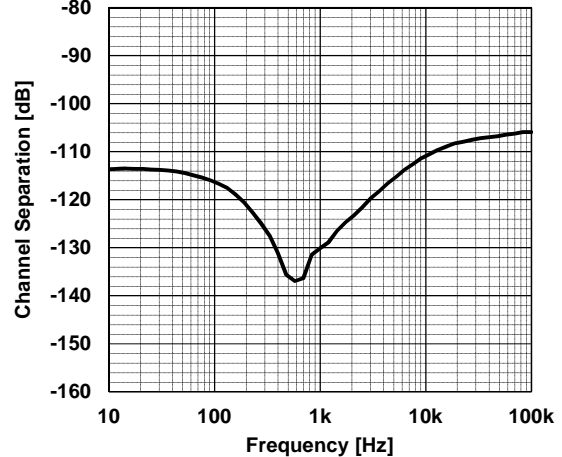
**SVR vs. Temperature**

$V^+/V^- = \pm 9\text{V}$  to  $\pm 18\text{V}$

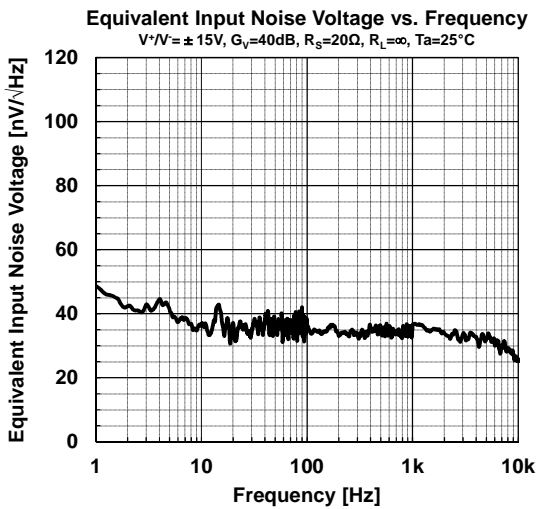
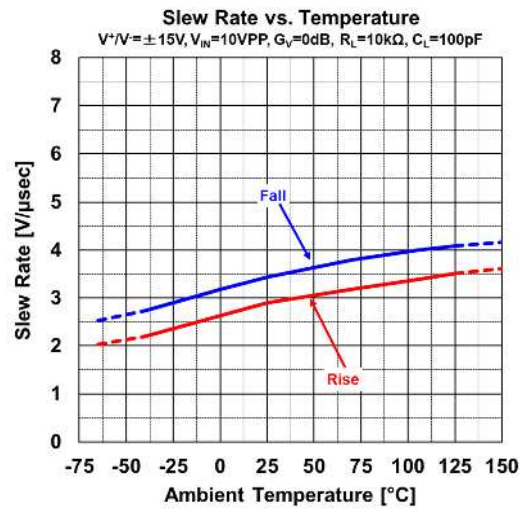
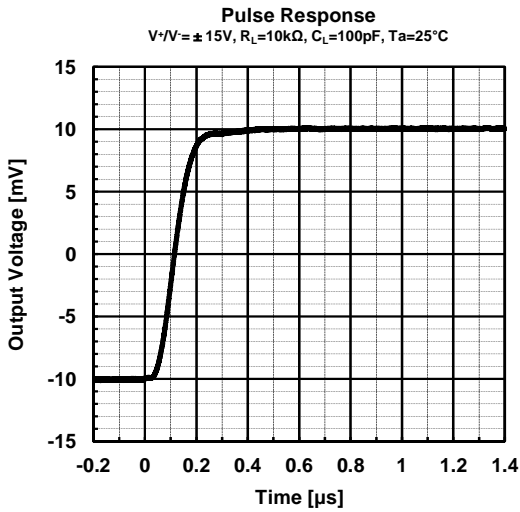
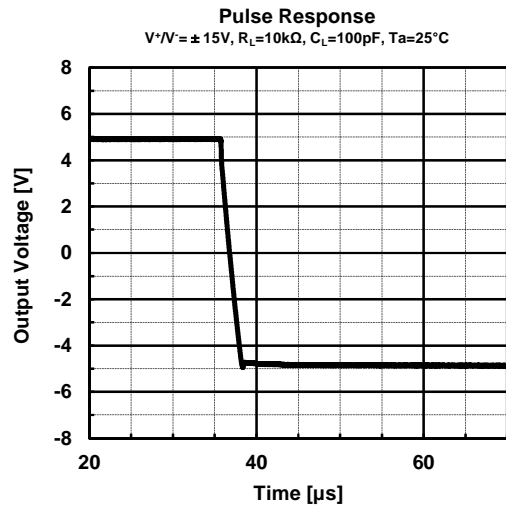
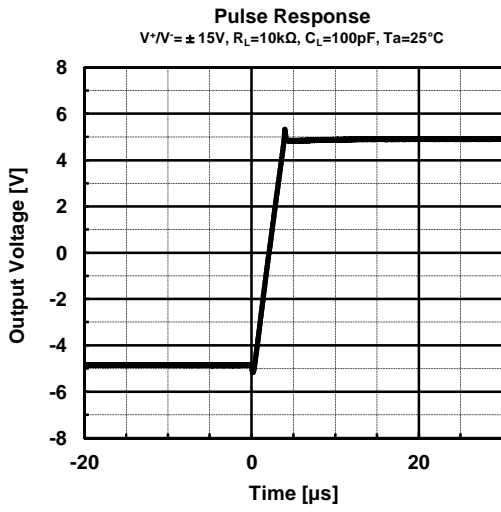


**Channel Separation vs. Frequency**

$V^+/V^- = \pm 15\text{V}$ ,  $G_V = 40\text{dB}$ ,  $V_O = 5\text{Vrms}$ ,  $R_L = 2\text{k}\Omega$ ,  $T_a = 25^\circ\text{C}$



## ■ TYPICAL CHARACTERISTICS





## ■ TEST CIRCUITS

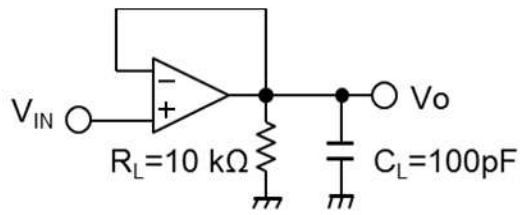


Figure1. Voltage Follower

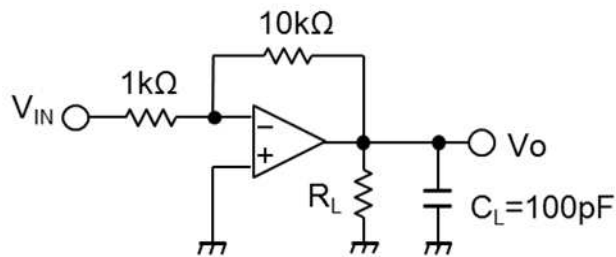


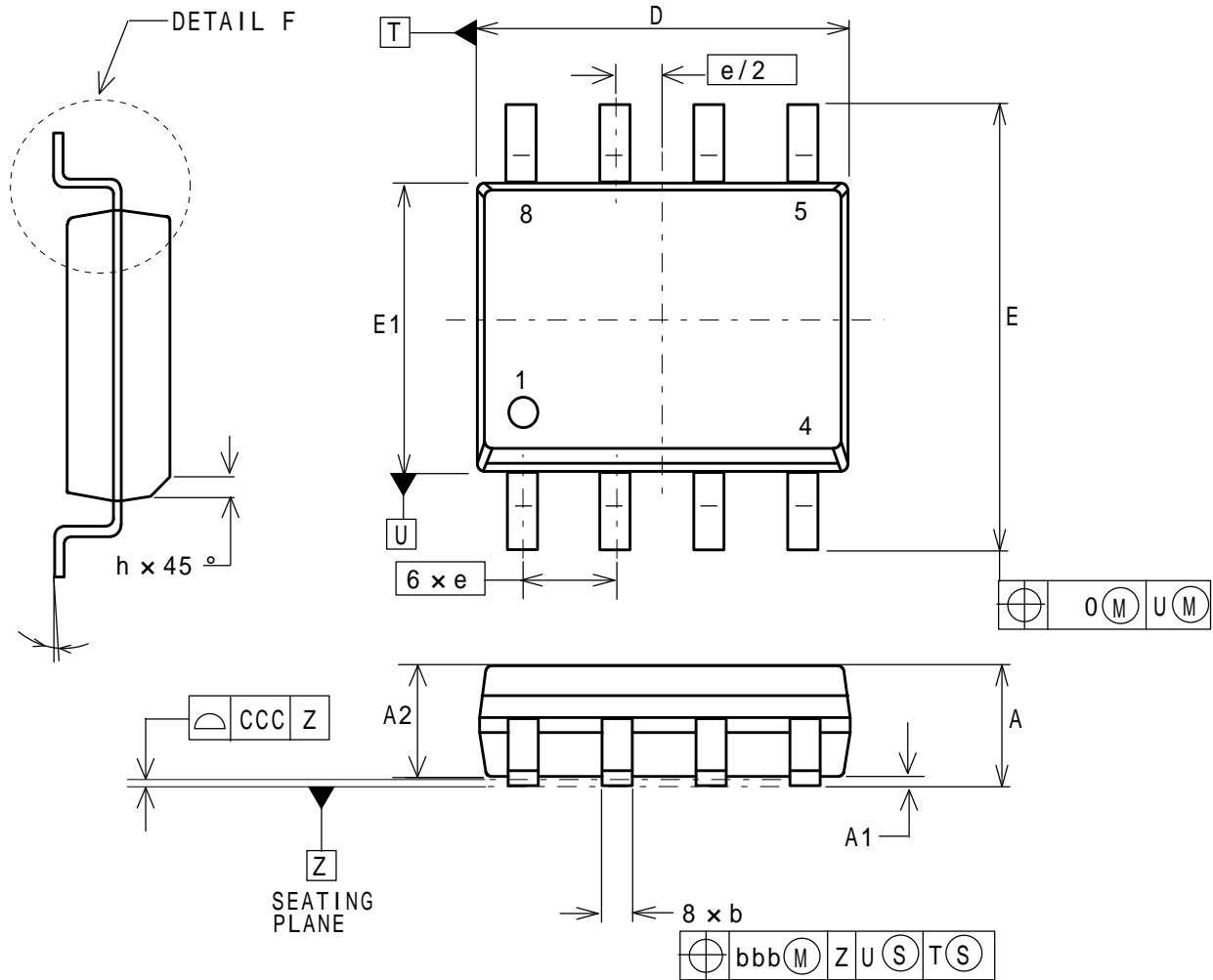
Figure2. 20dB Inverting Amplifier (\*)

(\*) 20dB Inverting Amplifier uses a Maximum Output Voltage vs. Frequency on page 6.

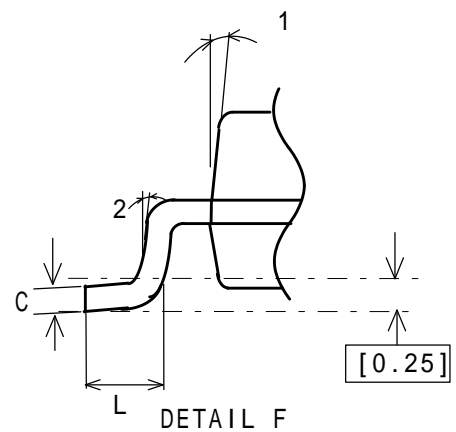
## SOP8

Unit: mm

### PACKAGE DIMENSIONS



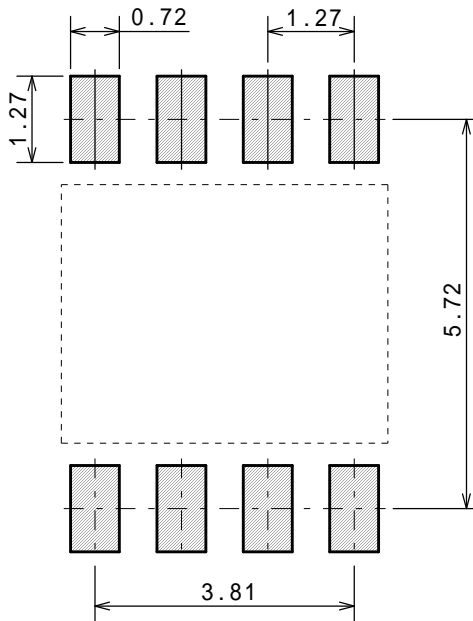
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E1	.150		.157	3.80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

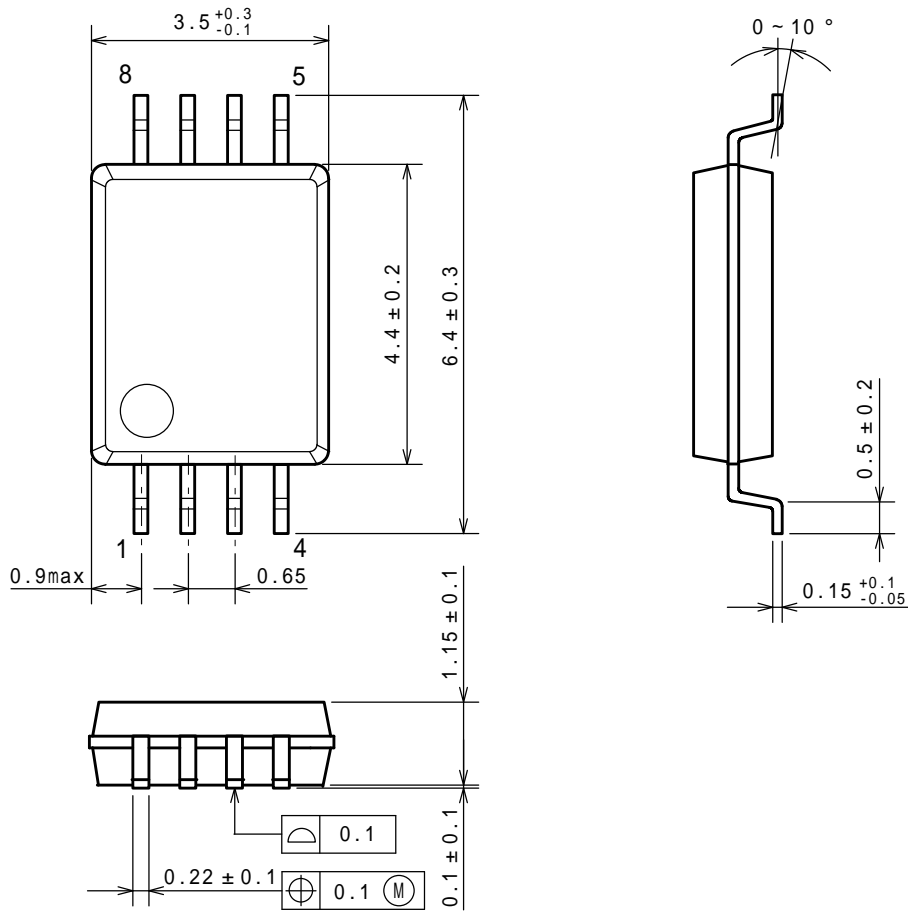
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



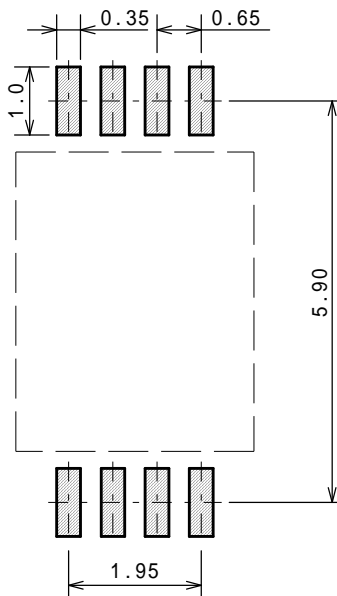
## SSOP8

Unit: mm

### ■ PACKAGE DIMENSIONS



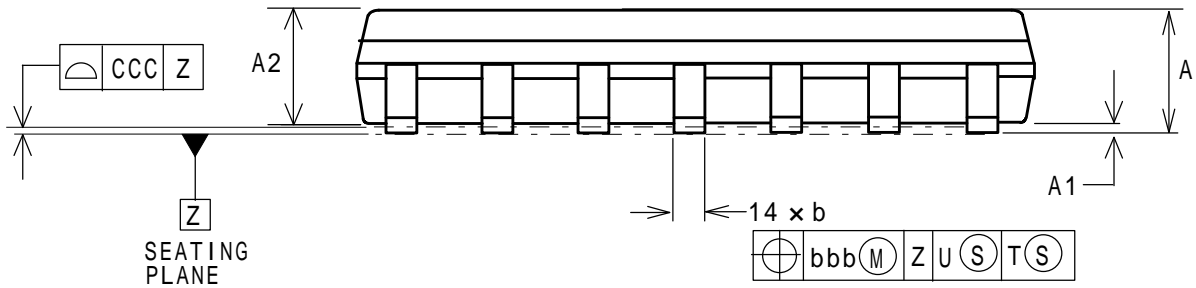
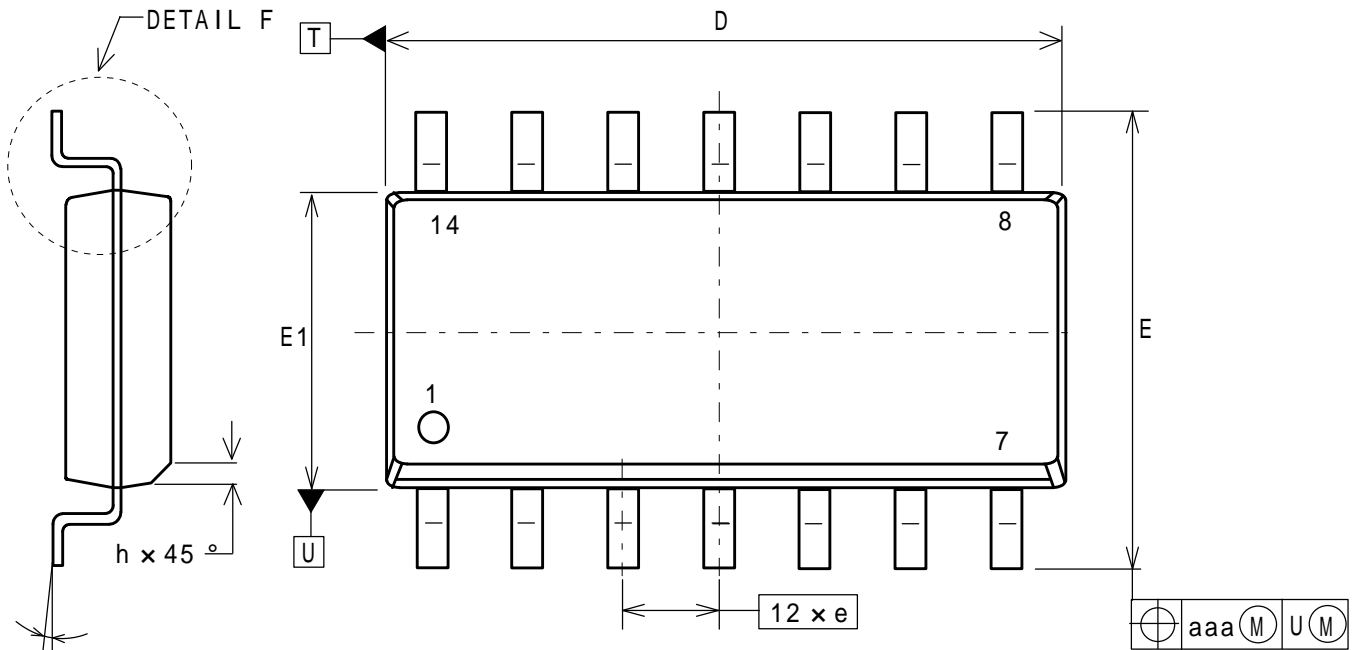
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



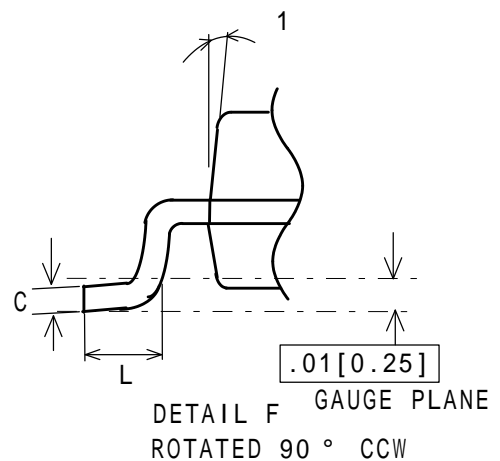
## SOP14

Unit: mm

### PACKAGE DIMENSIONS



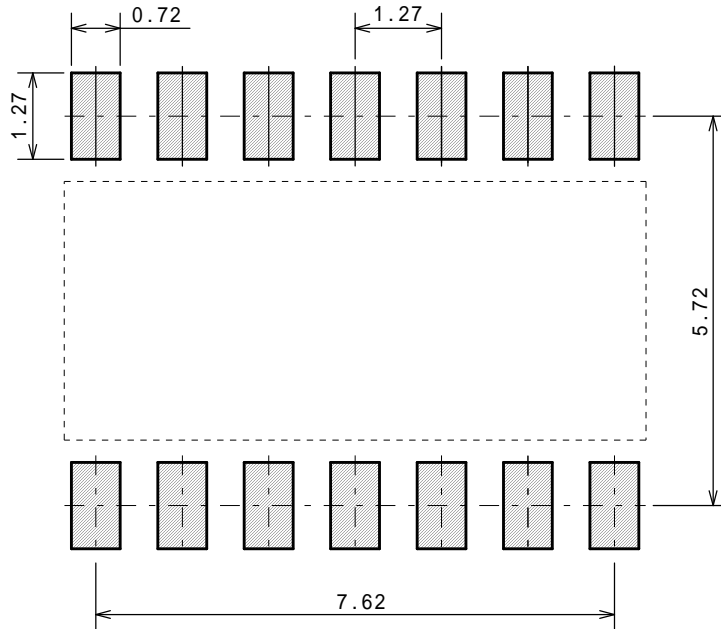
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.013		.020	0.33		0.51
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.337		.344	8.55		8.75
	E1	.150		.157	3.80		4.00
LEAD PITCH	E	.228		.244	5.80		6.20
	e	.050 BSC			1.27 BSC		
	L	.016		.050	0.40		1.27
	h	.010		.020	0.25		0.50
	1	0°		8°	0°		8°
		5°		15°	5°		15°
LEAD EDGE OFFSET	aaa			.010			0.25
LEAD OFFSET	bbb			.010			0.25
COPLANARITY	CCC			.004			0.10



## SOP14

Unit: mm

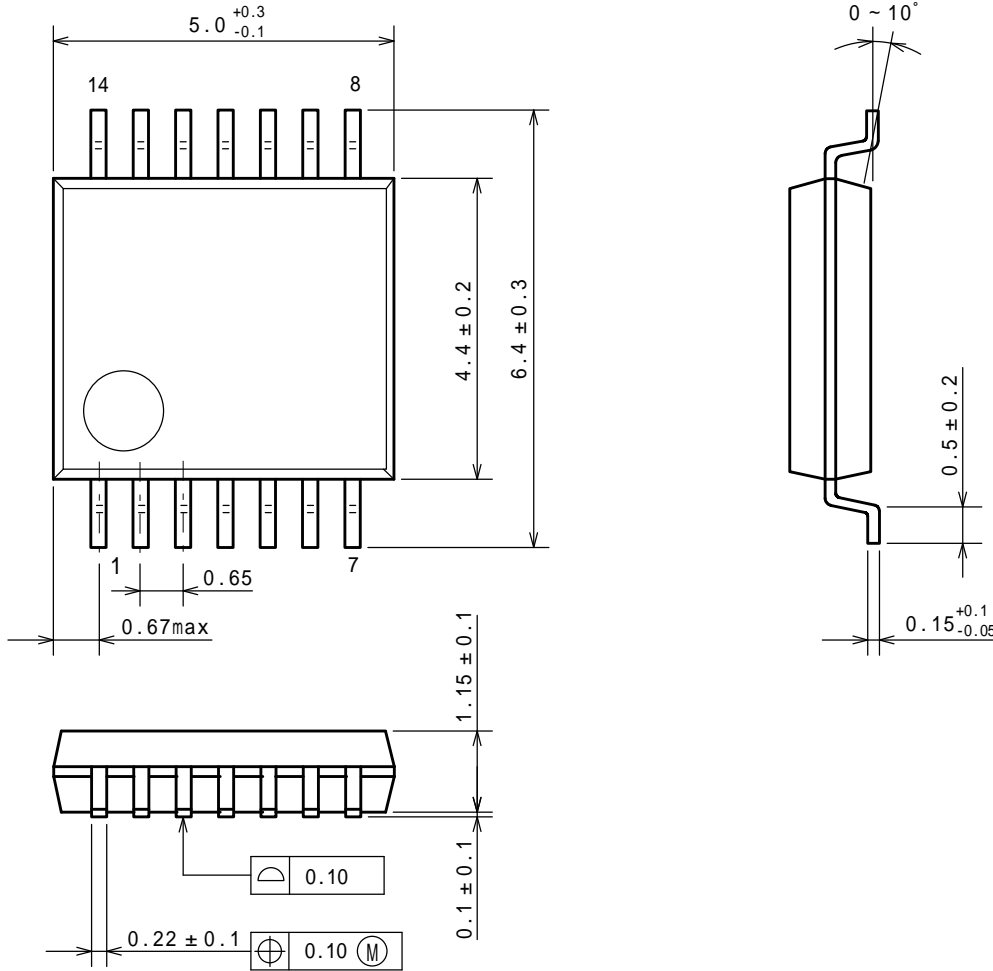
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



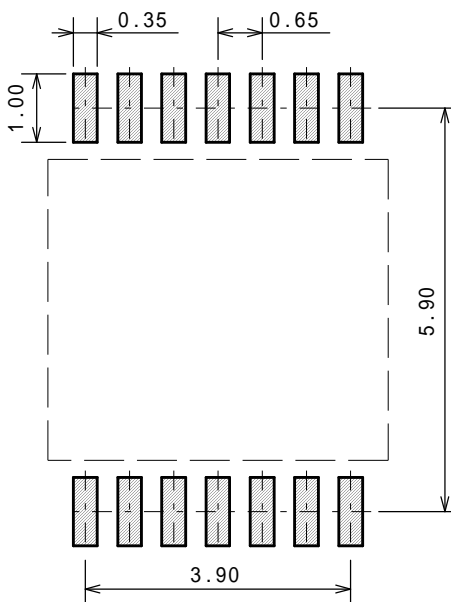
## SSOP14

Unit: mm

### ■ PACKAGE DIMENSIONS



### ■ EXAMPLE OF SOLDER PADS DIMENSIONS

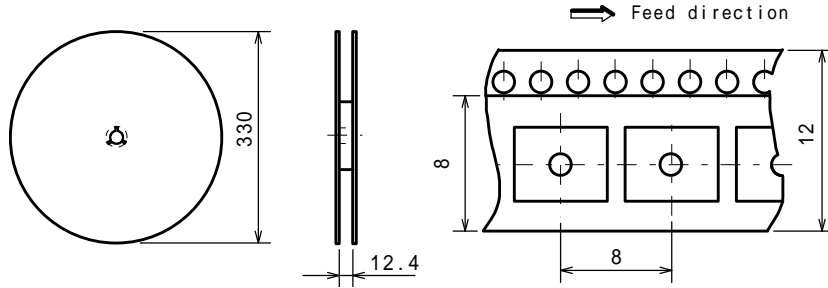


## SOP8

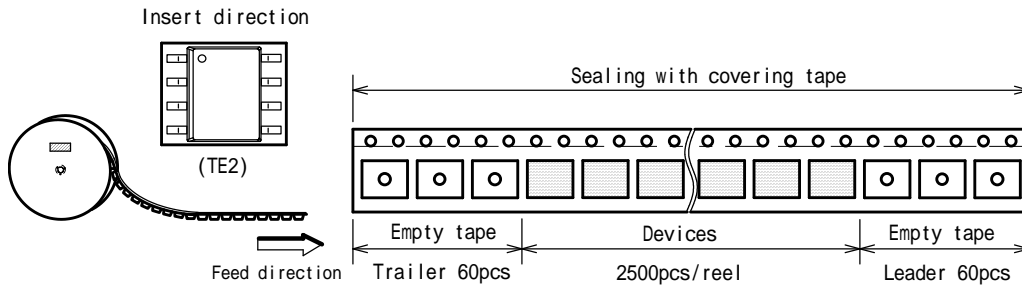
### PACKING SPEC

Unit: mm

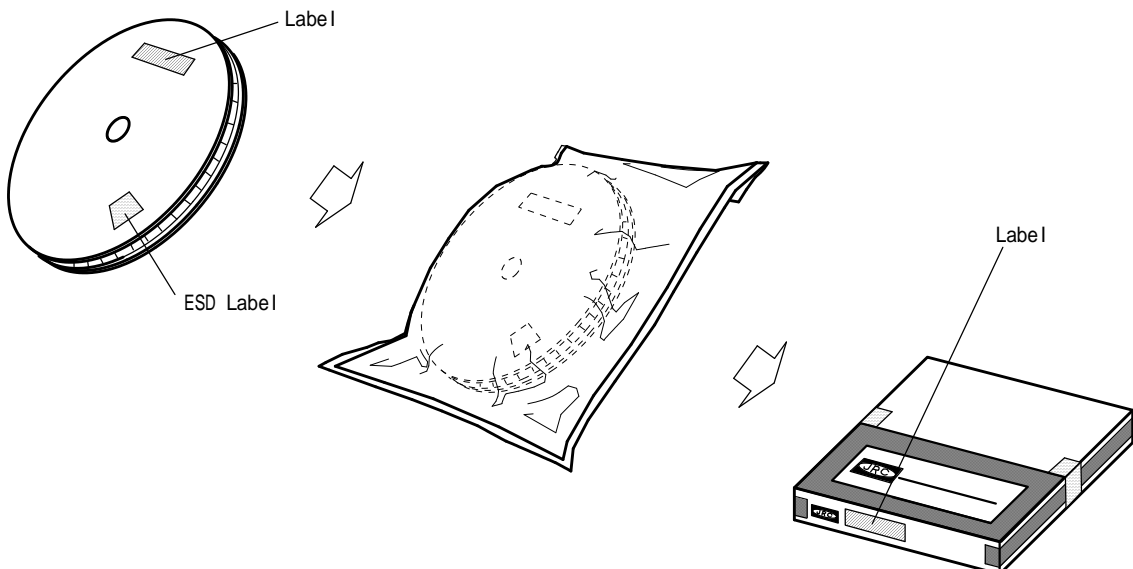
#### REEL DIMENSIONS / TAPING DIMENSIONS



#### TAPING STATE



#### PACKING STATE



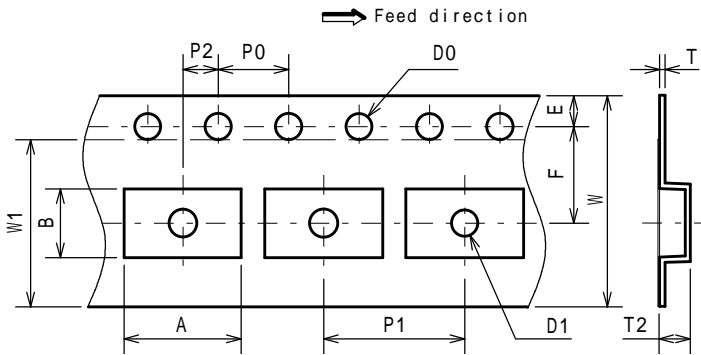


## SSOP8

### PACKING SPEC

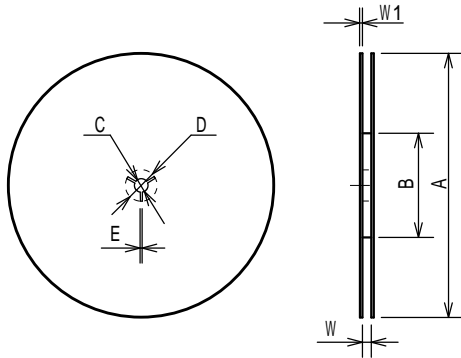
Unit: mm

#### TAPING DIMENSIONS



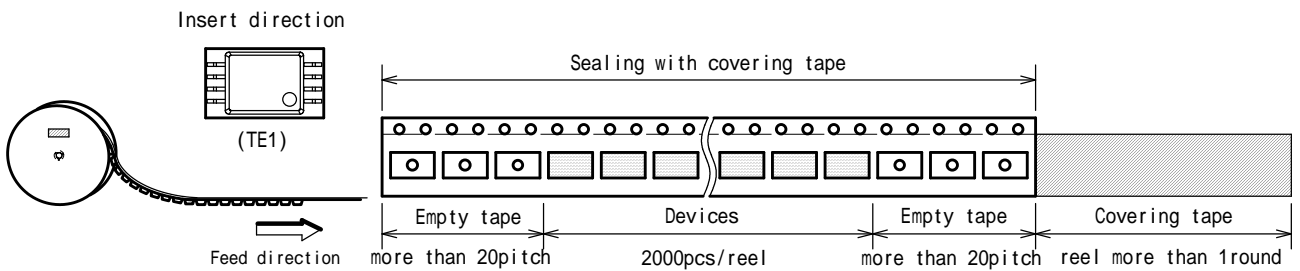
SYMBOL	DIMENSION	REMARKS
A	6.7	BOTTOM DIMENSION
B	3.9	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

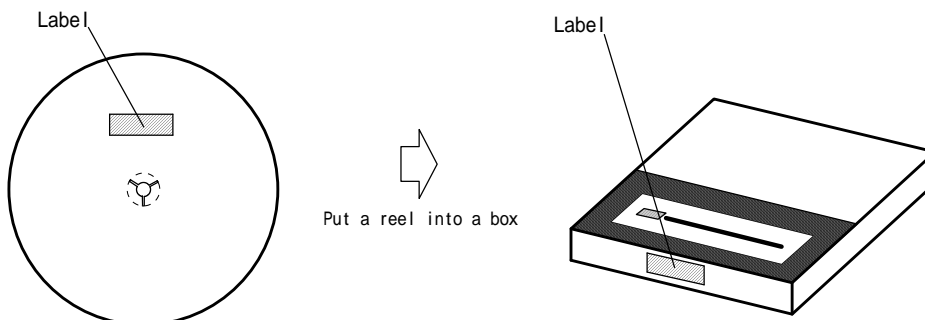


SYMBOL	DIMENSION
A	254 ± 2
B	100 ± 1
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

#### TAPING STATE



#### PACKING STATE

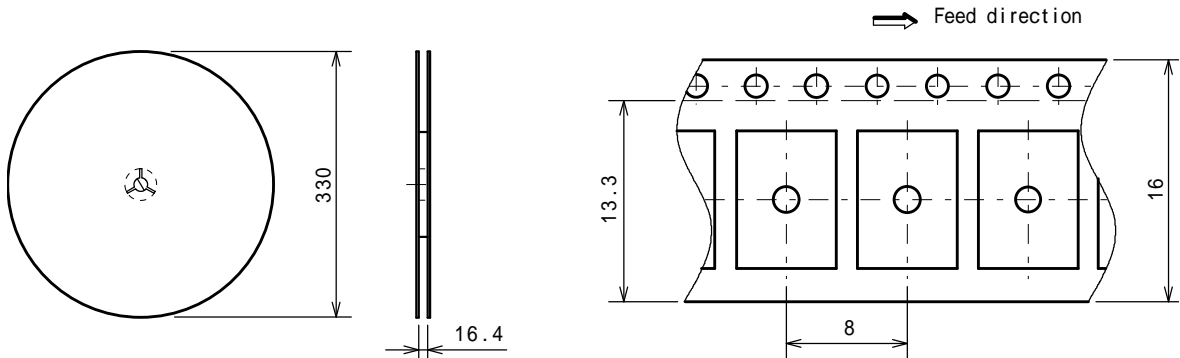


## SOP14

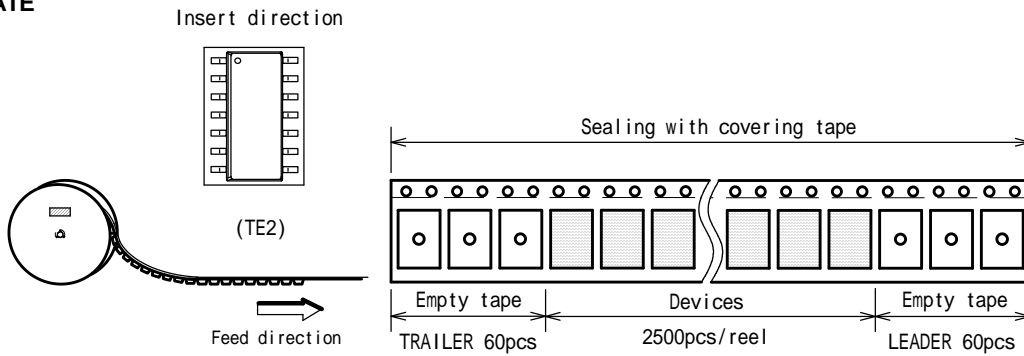
### PACKING SPEC

Unit: mm

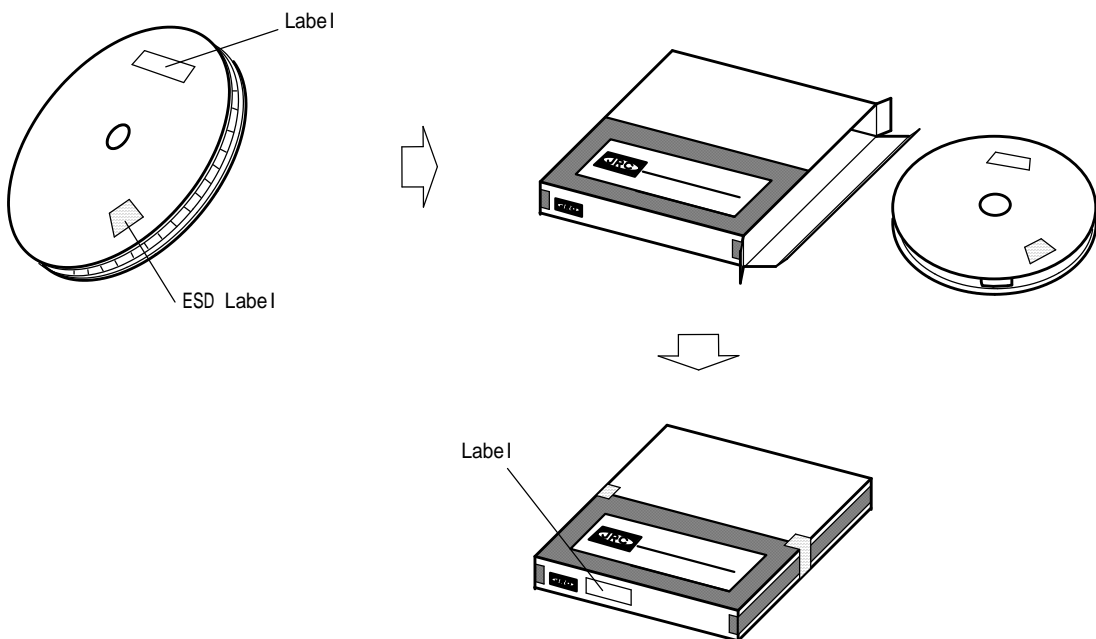
#### REEL DIMENSIONS / TAPING DIMENSIONS



#### TAPING STATE



#### PACKING STATE

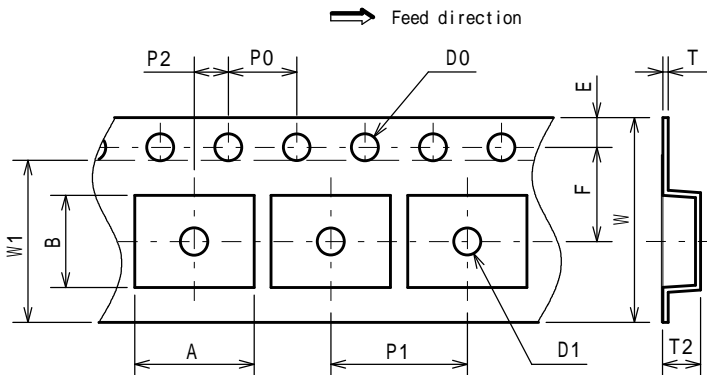


## SSOP14

### PACKING SPEC

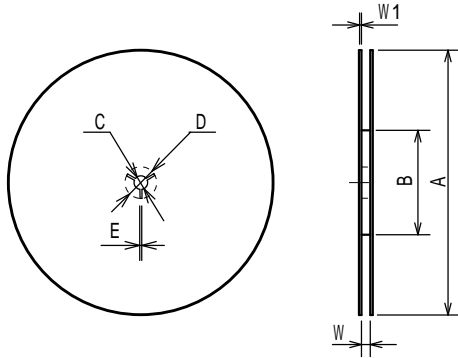
Unit: mm

#### TAPING DIMENSIONS



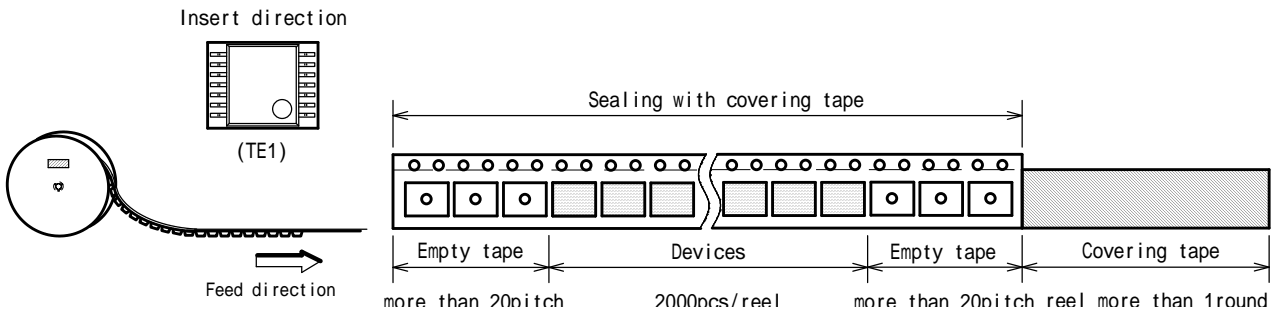
SYMBOL	DIMENSION	REMARKS
A	6.95	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

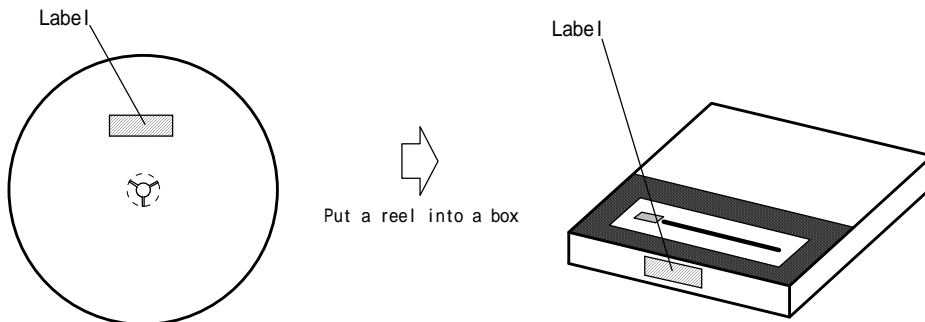


SYMBOL	DIMENSION
A	254 ± 2
B	100 ± 1
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

#### TAPING STATE

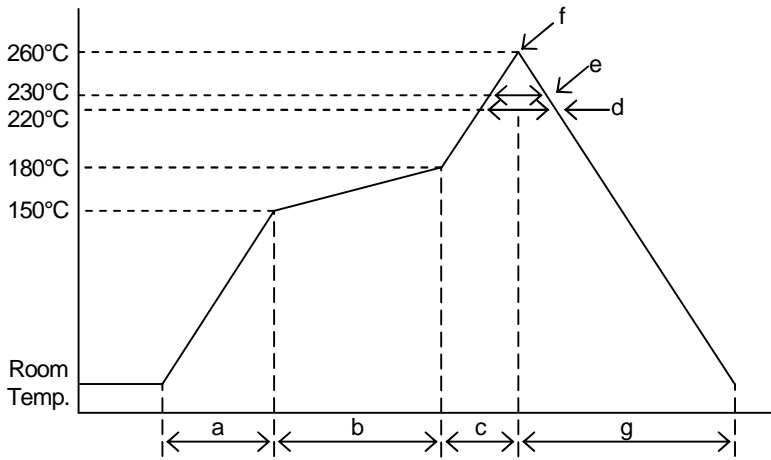


#### PACKING STATE



## ■ 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.

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