

## LOW NOISE, J-FET INPUT OPERATIONAL AMPLIFIERS

### FEATURES

- Wide Power Supply Range ±4 to ±18V
- Internal ESD Protection  
Human Body Model (HBM) ±2000V typ.
- High Input Resistance 10<sup>12</sup>Ω typ.
- Wide Temperature Range -40°C to 125°C
- Bipolar Technology
- High Slew Rate 13V/μs typ.
- Wide Unity Gain Bandwidth 3MHz typ.
- Package
  - NJM072C/072CA/082C/082CA SOP8
  - NJM072C/072CA/082C/082CA SSOP8
  - NJM074C/074CA/084C/084CA SOP14
  - NJM074C/074CA/084C/084CA SSOP14

### DESCRIPTION

The NJM072C/082C/NJM074C/084C are JFET input operational amplifiers. They feature low input bias and offset currents, high input impedance and fast slew rate.

The low harmonic distortion and low noise make them ideally suit for amplifiers with high fidelity and audio amplifier applications.

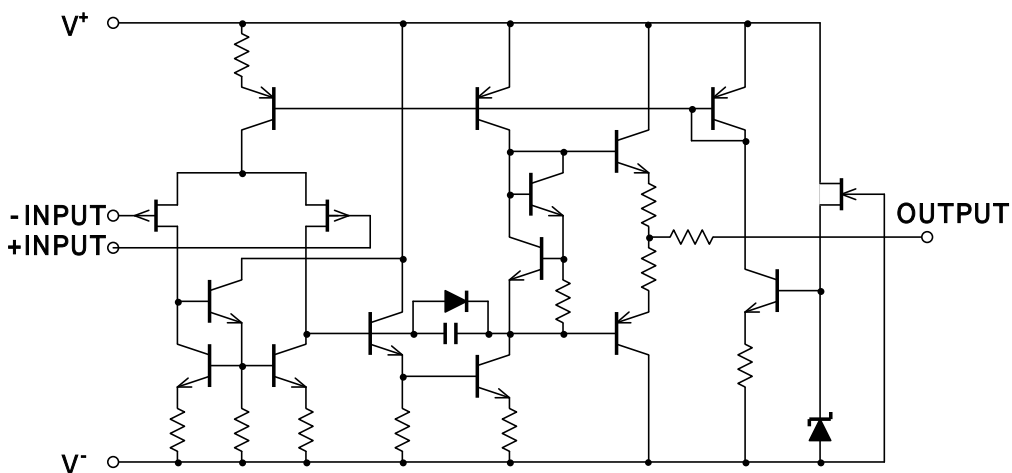
In addition, the realization of a wide operating temperature reaches by a new design.

Product	Dual	NJM072CG/CV	NJM082CG/CV	NJM072CAG/CAV	NJM082CAG/CAV
Name	Quad	NJM074CG/CV	NJM084CG/CV	NJM074CAG/CAV	NJM084CAG/CAV
Input Offset Voltage		10mV max.	15mV max.	6mV max.	

### APPLICATIONS

- Industrial Measuring Instruments
- Active Filters
- Sensor Amplifiers
- Audio Amplifiers / Filters
- Photodiode Amplifiers

### ■ EQUIVALENT CIRCUIT



## ■ PIN CONFIGURATIONS

PRODUCT NAME	NJM072CG/CAG	NJM082CG/CAG	NJM072CV/CAV	NJM082CV/CAV
Package	SOP8		SSOP8	
Pin Functions				
PRODUCT NAME	NJM074CG/CAG	NJM084CG/CAG	NJM074CV/CAV	NJM084CV/CAV
Package	SOP14		SSOP14	
Pin Functions				

## ■ PRODUCT NAME INFORMATION



## ■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJM072CG (TE2)	SOP8	Yes	Yes	Pure Sn	072	88	2500
NJM072CAG (TE2)	SOP8	Yes	Yes	Pure Sn	072A	88	2500
NJM082CG (TE2)	SOP8	Yes	Yes	Pure Sn	082	88	2500
NJM082CAG (TE2)	SOP8	Yes	Yes	Pure Sn	082A	88	2500
NJM072CV (TE1)	SSOP8	Yes	Yes	Sn2Bi	072	42	2000
NJM072CAV (TE1)	SSOP8	Yes	Yes	Sn2Bi	072A	42	2000
NJM082CV (TE1)	SSOP8	Yes	Yes	Sn2Bi	082	42	2000
NJM082CAV (TE1)	SSOP8	Yes	Yes	Sn2Bi	082A	42	2000
NJM074CG (TE2)	SOP14	Yes	Yes	Pure Sn	074	150	2500
NJM074CAG (TE2)	SOP14	Yes	Yes	Pure Sn	074A	150	2500
NJM084CG (TE2)	SOP14	Yes	Yes	Pure Sn	084	150	2500
NJM084CAG (TE2)	SOP14	Yes	Yes	Pure Sn	084A	150	2500
NJM074CV (TE1)	SSOP14	Yes	Yes	Sn2Bi	074	65	2000
NJM074CAV (TE1)	SSOP14	Yes	Yes	Sn2Bi	074A	65	2000
NJM084CV (TE1)	SSOP14	Yes	Yes	Sn2Bi	084	65	2000
NJM084CAV (TE1)	SSOP14	Yes	Yes	Sn2Bi	084A	65	2000

## ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sup>+</sup> /V <sup>-</sup>	±18	V
Differential Input Voltage <sup>(1)</sup>	V <sub>ID</sub>	±36	V
Input Voltage <sup>(2)</sup>	V <sub>IN</sub>	V-0.3 to V+36	V
Output Terminal Input Voltage	V <sub>O</sub>	V-0.3 to V <sup>+</sup> +0.3	V
Power Dissipation (T <sub>a</sub> = 25°C) <sup>(3)</sup>	P <sub>D</sub>	2-Layer / 4-Layer <sup>(4)</sup>	mW
SOP8		720 / 1100	
SSOP8		460 / 570	
SOP14		1000 / 1500	
SSOP14		560 / 700	
Storage Temperature	T <sub>stg</sub>	-65 to 150	°C
Junction Temperature	T <sub>j</sub>	150	°C

## ■ THERMAL CHARACTERISTICS

PACKAGE	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance	θ <sub>ja</sub>	2-Layer / 4-Layer <sup>(4)</sup>	°C/W
SOP8		175 / 118	
SSOP8		274 / 218	
SOP14		121 / 81	
SSOP14		224 / 178	
Junction-to-Top of Package Characterization Parameter	ψ <sub>jt</sub>	2-Layer / 4-Layer <sup>(4)</sup>	°C/W
SOP8		42 / 37	
SSOP8		39 / 38	
SOP14		23 / 18	
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<sup>+</sup>.

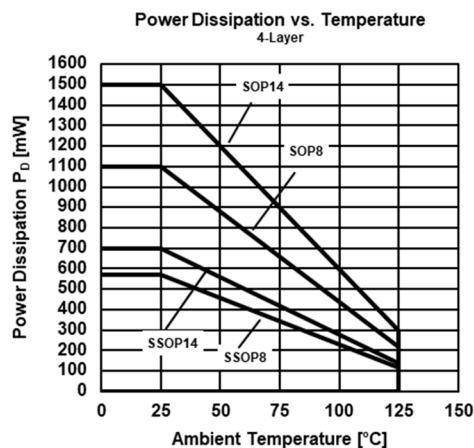
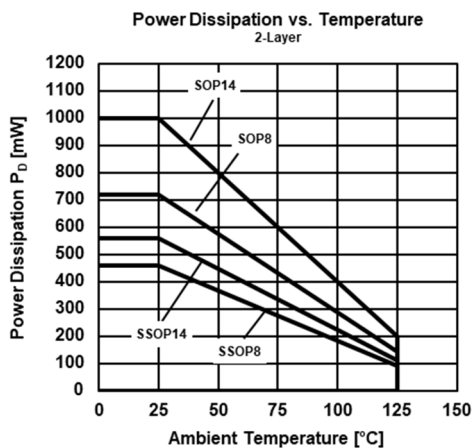
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.

(3) Power dissipation is the power that can be consumed by the IC at T<sub>a</sub>=25°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 <sup>+</sup> /V <sup>-</sup>	T <sub>a</sub> = 25°C	±4 to ±18	V
Operating Temperature	T <sub>opr</sub>		-40 to 125	°C



# NJM072C/074C NJM072CA/074CA NJM082C/084C NJM082CA/084CA

## ■ ELECTRICAL CHARACTERISTICS

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

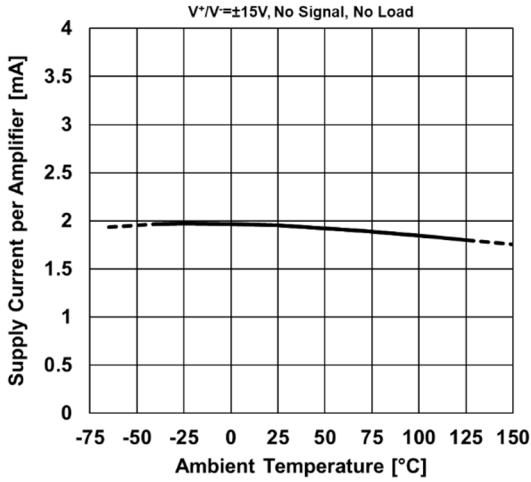
( ) Applies to NJM082C and NJM084C

PARAMETER	SYMBOL	TEST CONDITIONS	NJM072C / NJM082C NJM074C / NJM084C			NJM072CA / NJM082CA NJM074CA / NJM084CA			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	10(15)	-	3	6(6)	mV
			-	-	13(15)	-	-	7(7.5)	
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$	$R_S = 50\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	-	18	-	-	18	-	$\mu V/^\circ C$
Input Bias Current	$I_B$	$T_a = 25^\circ C$ $0^\circ C < T_a < 70^\circ C^{(5)}$	-	30	200(400)	-	30	200	pA
			-	-	7	-	-	7	
Input Offset Current	$I_{IO}$	$T_a = 25^\circ C$ $0^\circ C < T_a < 70^\circ C^{(5)}$	-	5	50(200)	-	5	50(100)	pA
			-	-	10	-	-	2	
Input Resistance	$R_{IN}$		-	$10^{12}$	-	←	←	←	$\Omega$
Open-Loop Voltage Gain	$A_v$	$R_L \geq 2k\Omega$ , $V_O = \pm 10V$ , $T_a = 25^\circ C$ $R_L \geq 2k\Omega$ , $V_O = \pm 10V$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	25	200	-	50	200	-	V/mV
			15	-	-	25	-	-	
Common-Mode Rejection Ratio	CMR	$V_{IC} = V_{ICMIN}$ , $R_S \leq 10k\Omega$	70	100	-	75	100	-	dB
Common-Mode Input Voltage Range	$V_{ICM}$	$\geq$ CMR MIN	$\pm 11$	-12 to 15	-	←	←	←	V
<b>OUTPUT CHARACTERISTICS</b>									
Maximum Output Voltage	$V_{OM}$	$R_L = 10k\Omega$ $R_L = 10k\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$ $R_L = 2k\Omega$ , $0^\circ C < T_a < 70^\circ C^{(5)}$	$\pm 12$	$\pm 13.5$	-	←	←	←	V
			$\pm 12$	-	-	←	←	←	
			$\pm 10$	-	-	←	←	←	
<b>POWER SUPPLY</b>									
Supply Current per Amplifier	$I_{SUPPLY}$	No Signal	-	1.4	2.5(2.8)	←	←	←	mA
Supply Voltage Rejection Ratio	SVR	$V^+/V^- = \pm 9V$ to $\pm 15V$ , $R_S \leq 10k\Omega$	70	100	-	80	100	-	dB
<b>AC CHARACTERISTICS</b>									
Slew Rate	SR	$V_{IN} = 10V_{pp}$ , $R_L = 2k\Omega$ , $C_L = 00pF$ , See Figure1	8	13	-	←	←	←	V/ $\mu s$
Unity Gain Frequency	$f_T$		-	3	-	←	←	←	MHz
Rise Time	$t_r$	$V_{IN} = 20mV_{pp}$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , See Figure1	-	0.1	-	←	←	←	$\mu s$
Overshoot	$K_{OV}$	$V_{IN} = 20mV_{pp}$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , See Figure1	-	20	-	←	←	←	%
Total Harmonic Distortion + Noise	THD+N	$V_{IN} = 6V_{rms}$ , $G_V = 0dB$ $R_L = 2k\Omega$ , $R_S = 1k\Omega$ , $f = 1kHz$	-	0.003	-	←	←	←	%
Equivalent Input Noise Voltage	$V_{NI}$	$R_S = 20\Omega$ , $f = 10Hz$ to $10kHz$	-	4	-	←	←	←	$\mu V_{rms}$
	$e_n$	$R_S = 20\Omega$ , $f = 1kHz$	-	18	-	←	←	←	nV/ $\sqrt{Hz}$
Equivalent Input Noise Current	$i_n$	$R_S = 20\Omega$ , $f = 1kHz$	-	0.01	-	←	←	←	pA/ $\sqrt{Hz}$
Channel Separation	CS	$G_V = 40dB$	-	120	-	←	←	←	dB

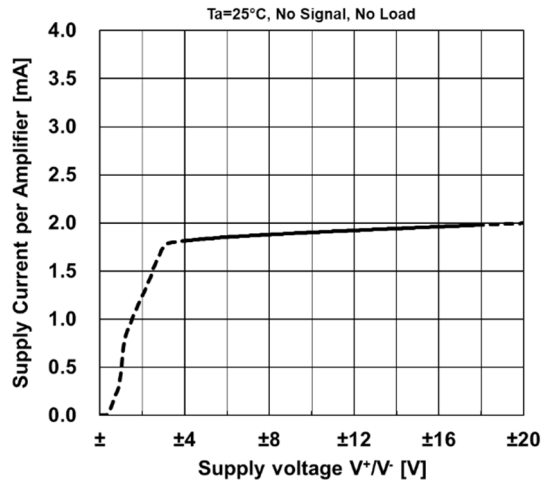
(5) This parameter is not 100% test.

## ■ TYPICAL CHARACTERIS

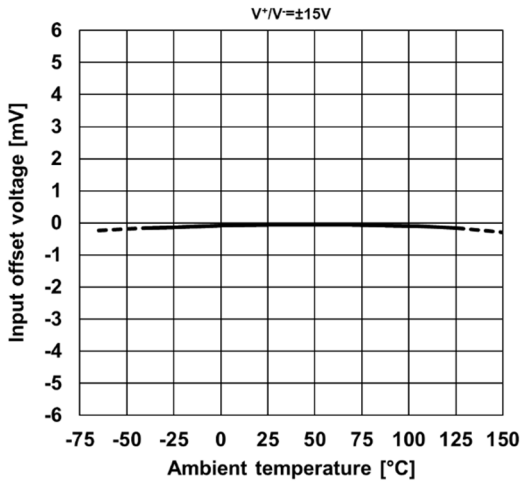
Supply current per amplifier versus ambient temperature



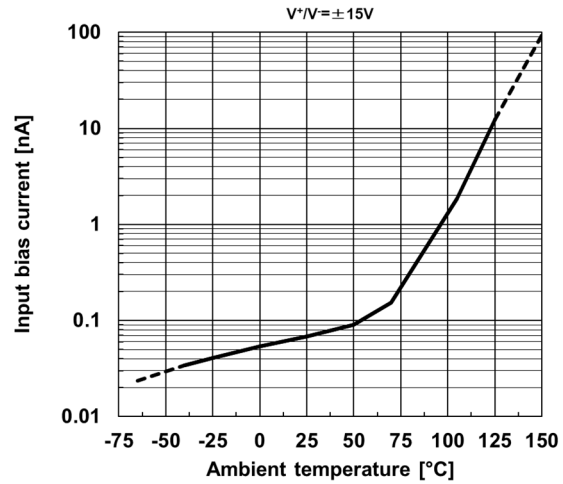
Supply current per amplifier versus Supply voltage



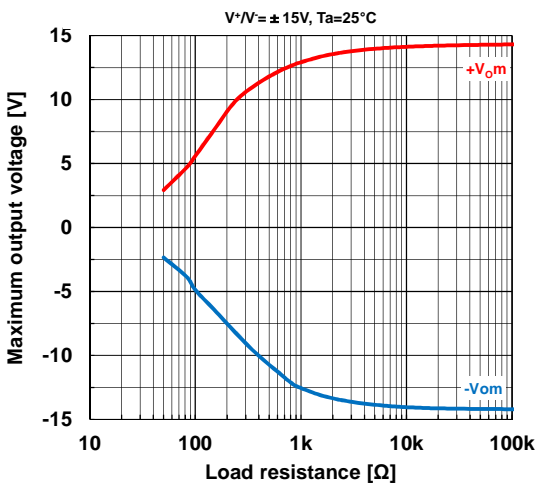
Input offset voltage versus ambient temperature



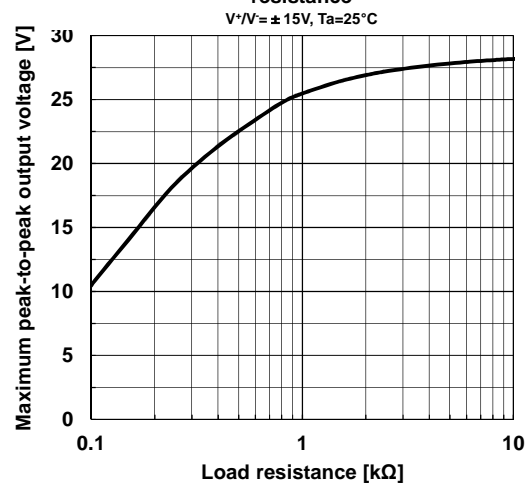
Input bias current versus ambient temperature



Maximum output voltage versus load resistance

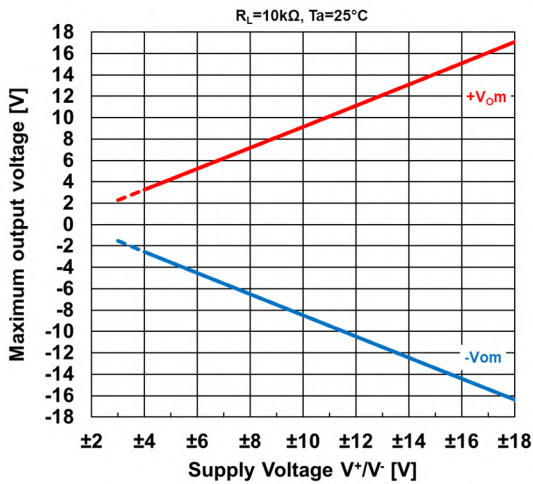


Maximum peak-to-peak output voltage versus load resistance

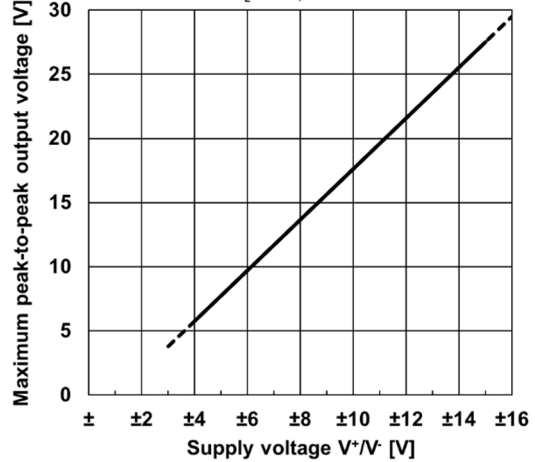


## ■ TYPICAL CHARACTERISTICS

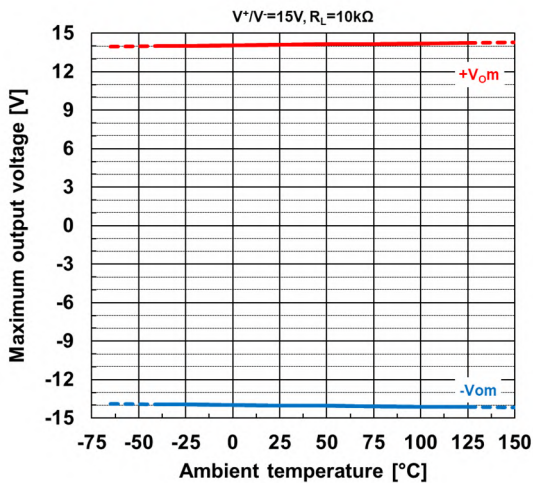
Maximum output voltage versus supply voltage



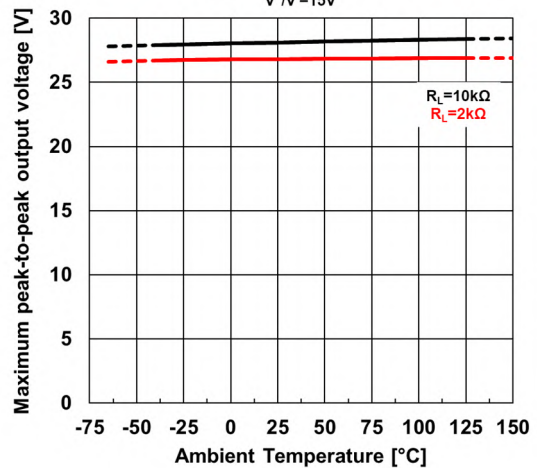
Maximum peak-to-peak output voltage versus supply voltage



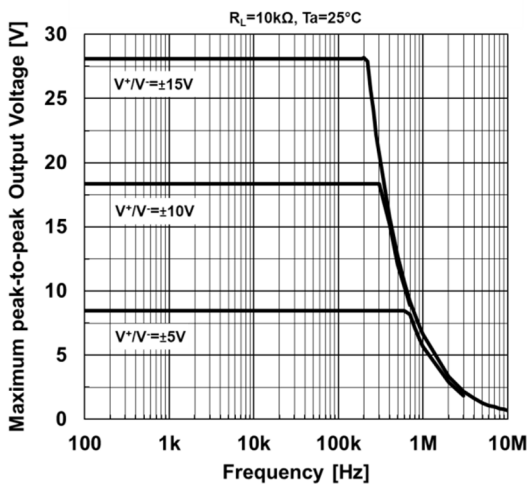
Maximum output voltage versus ambient temperature



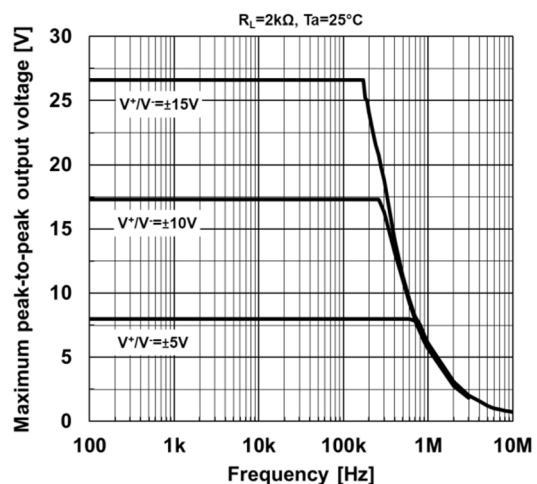
Maximum peak-to-peak output voltage versus ambient temperature



Maximum peak-to-peak output voltage versus frequency

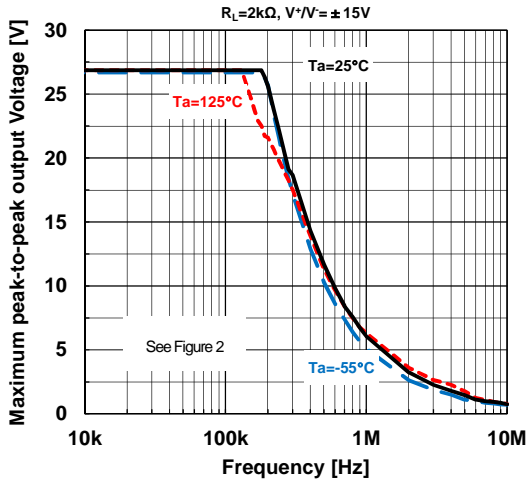


Maximum peak-to-peak output voltage versus frequency

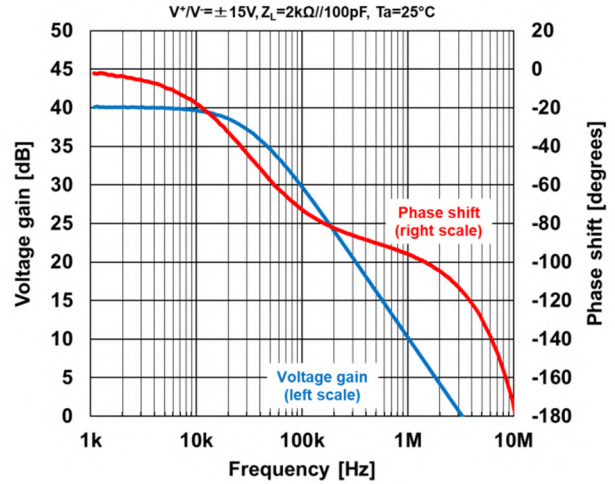


## ■ TYPICAL CHARACTERISTICS

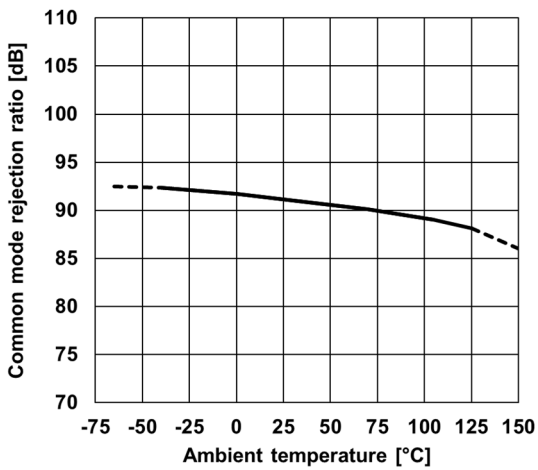
Maximum peak-to-peak output voltage versus frequency



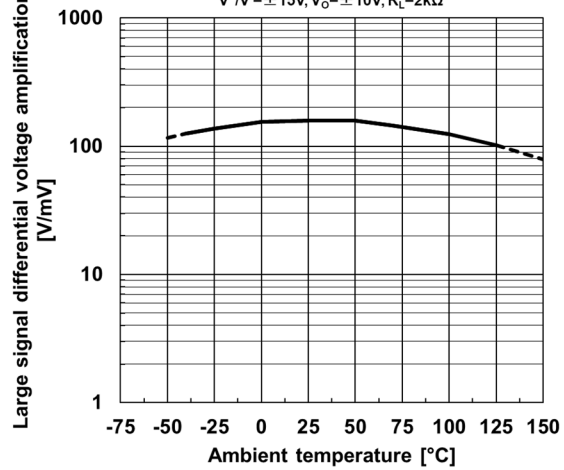
Voltage gain and phase shift versus frequency



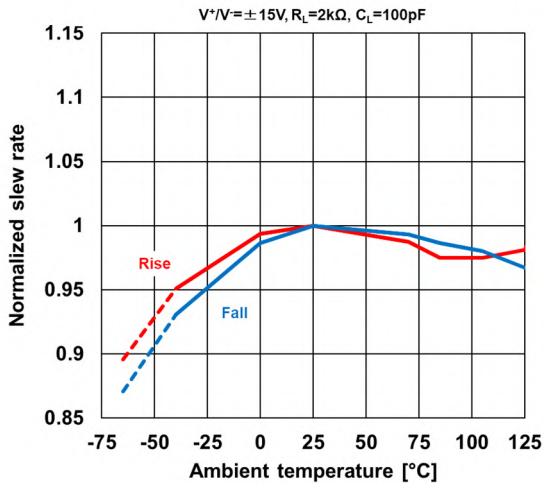
Common mode rejection ratio versus ambient temperature



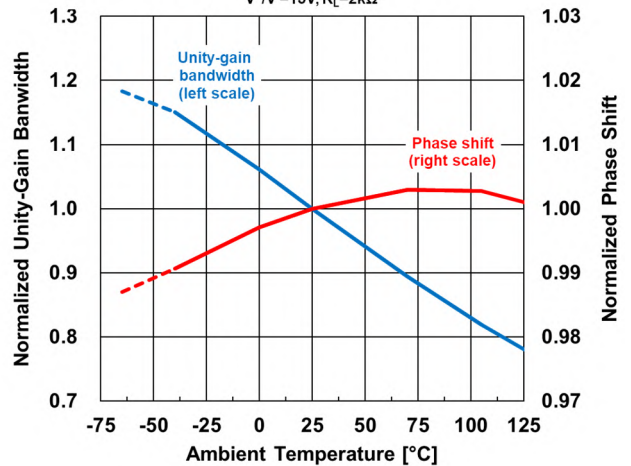
Open Loop Gain versus ambient temperature



Normalized slew rate versus ambient temperature

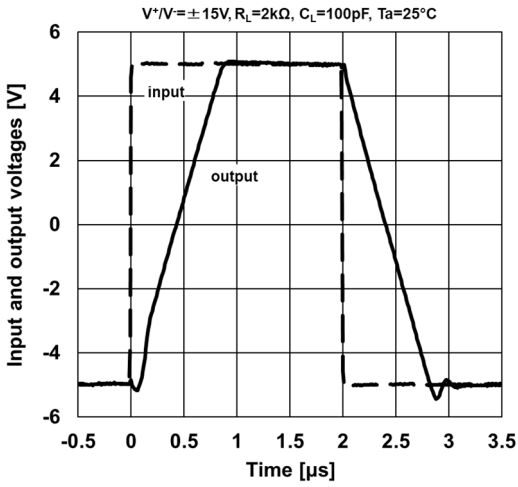


Normalized unity-gain bandwidth and phase shift versus ambient temperature

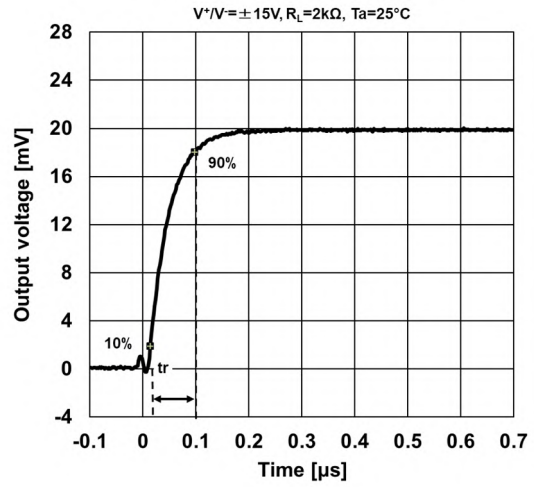


## ■ TYPICAL CHARACTERISTICS

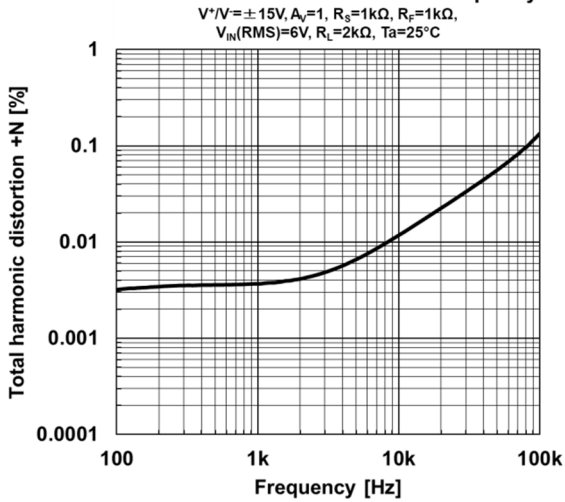
Voltage follower large signal pulse response



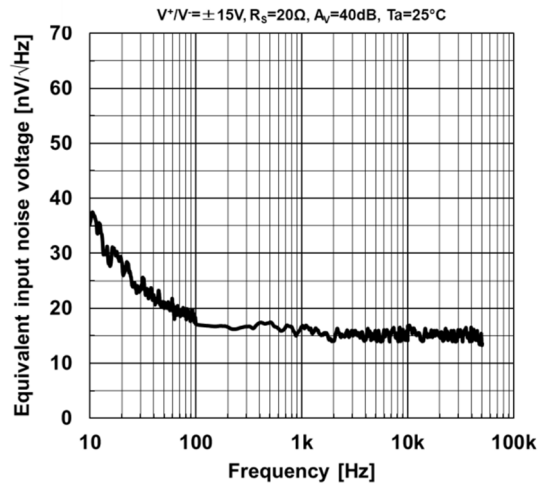
Output voltage versus elapsed time



Total harmonic distortion versus frequency



Equivalent input noise voltage versus frequency





■ TEST CIRCUITS

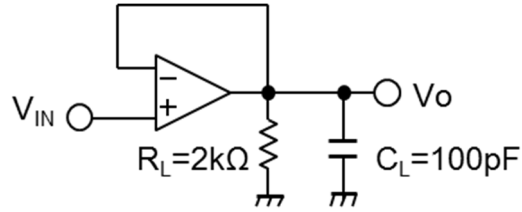


Figure1. Voltage Follower

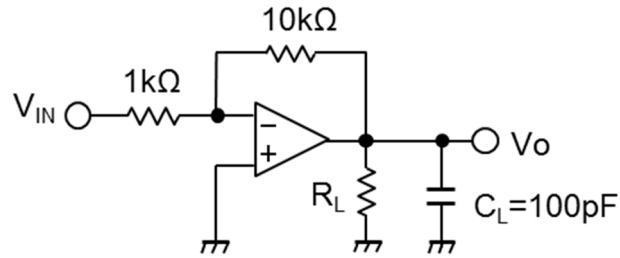


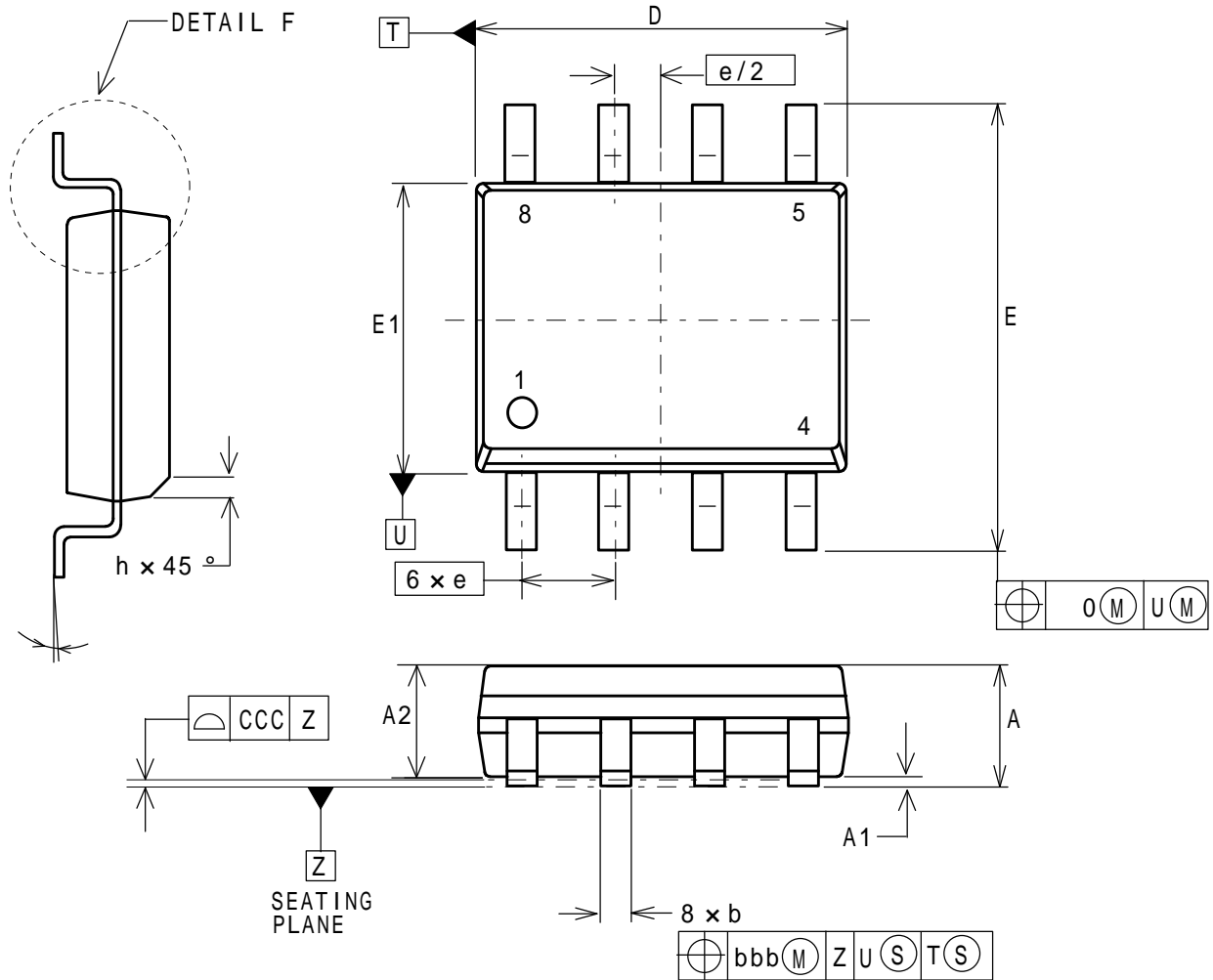
Figure2. 20dB Inverting Amplifier (\*)

(\*) 20dB Inverting Amplifier uses a Maximum Output Voltage vs. Frequency on page 6 and 7.

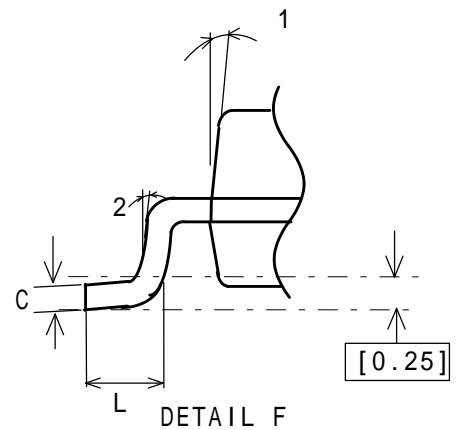
## SOP8

### ■ PACKAGE DIMENSIONS

Unit: mm



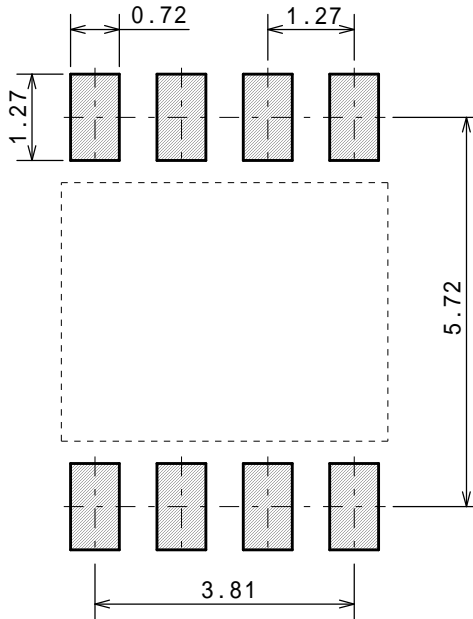
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E1	.150		.157	3.80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

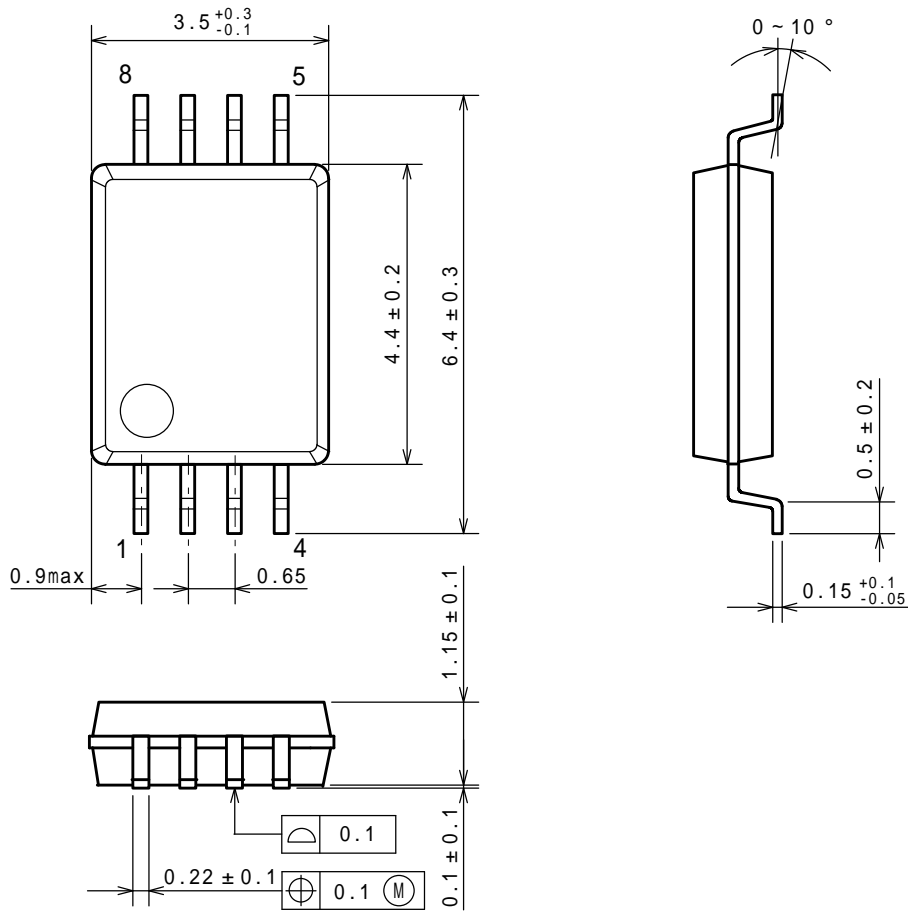
EXAMPLE OF SOLDER PADS DIMENSIONS



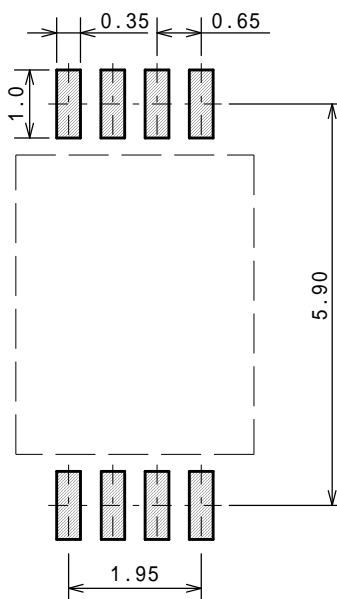
## SSOP8

Unit: mm

### ■ PACKAGE DIMENSIONS



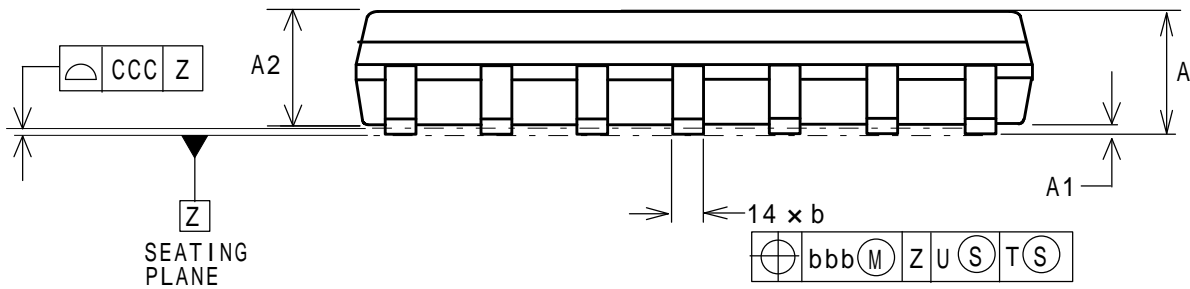
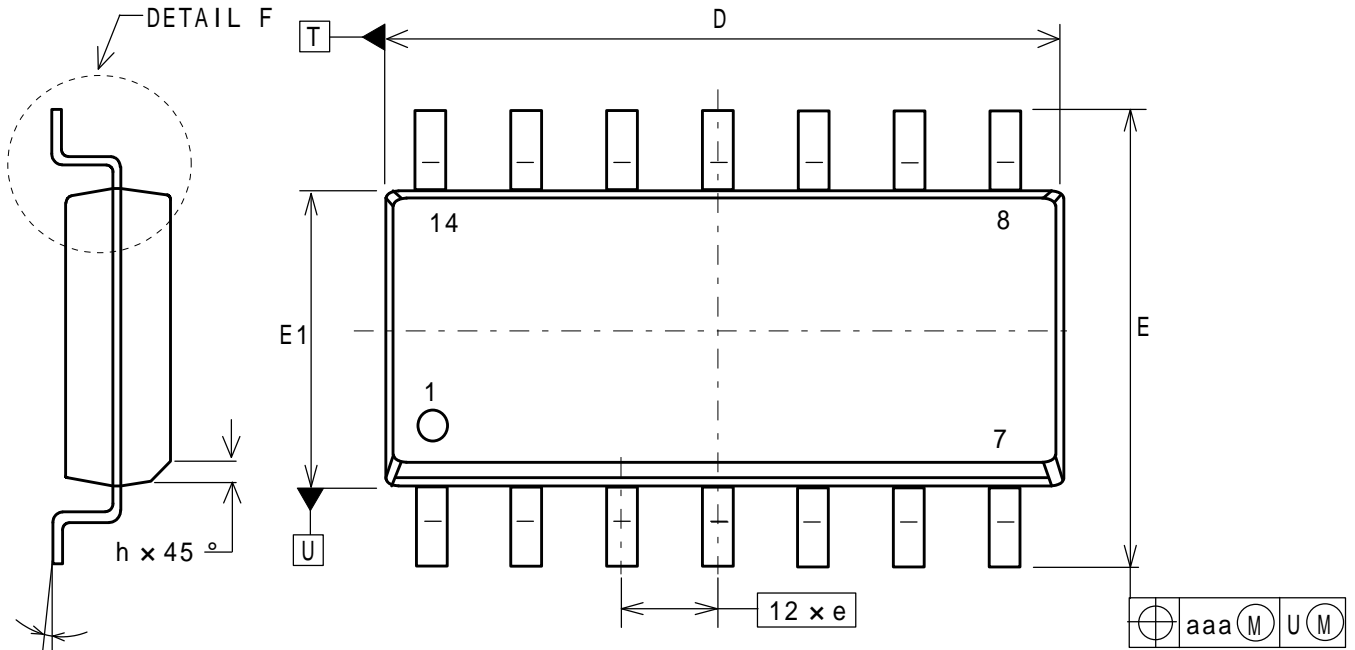
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



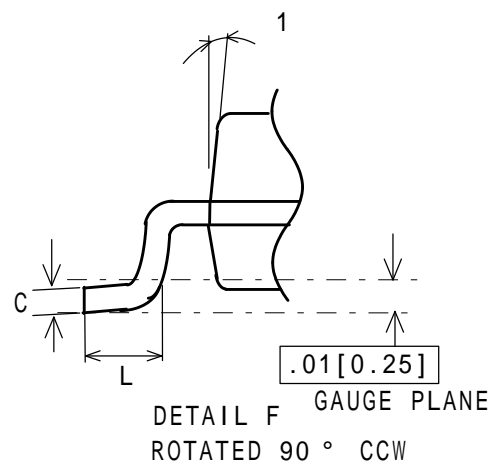
## SOP14

Unit: mm

### ■ PACKAGE DIMENSIONS



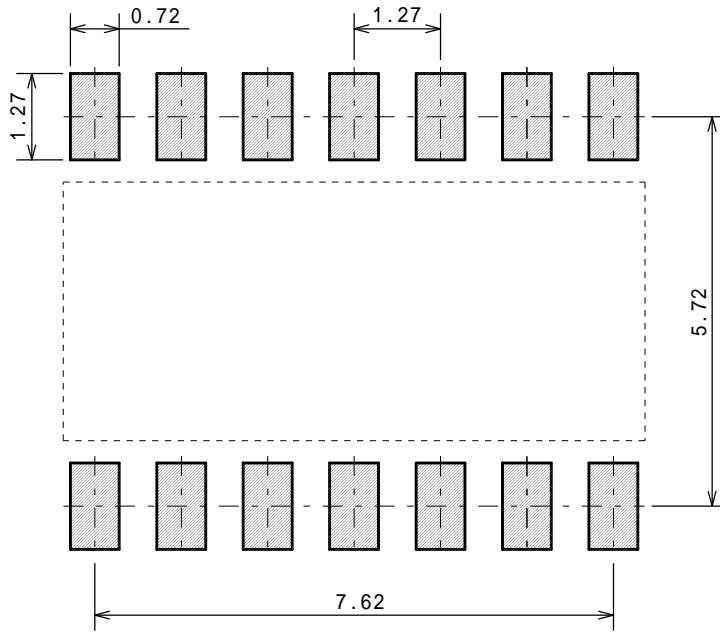
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.013		.020	0.33		0.51
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.337		.344	8.55		8.75
	E1	.150		.157	3.80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

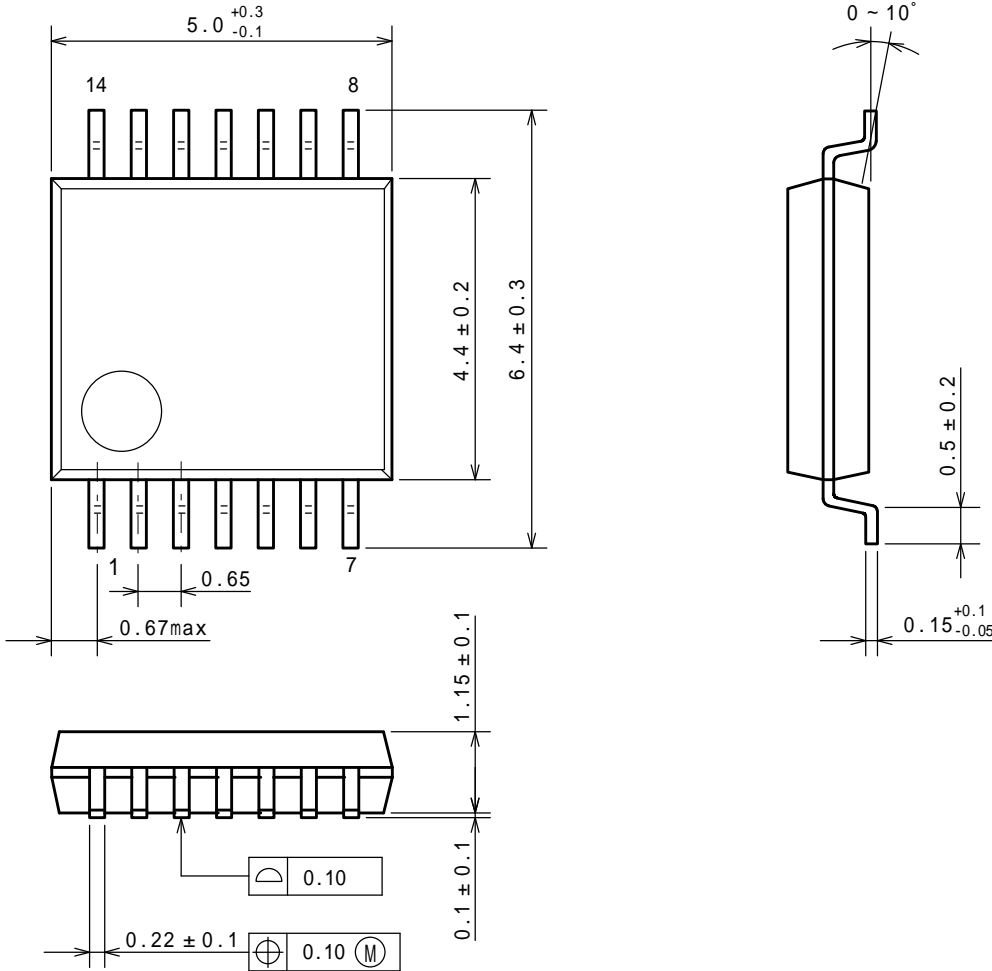
## EXAMPLE OF SOLDER PADS DIMENSIONS



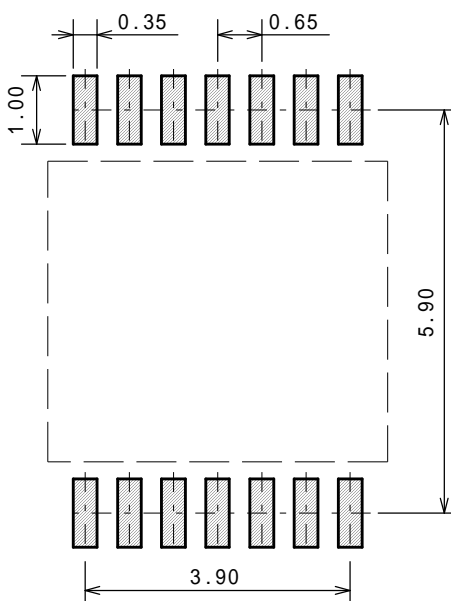
## SSOP14

Unit: mm

### ■ PACKAGE DIMENSIONS



### ■ EXAMPLE OF SOLDER PADS DIMENSIONS

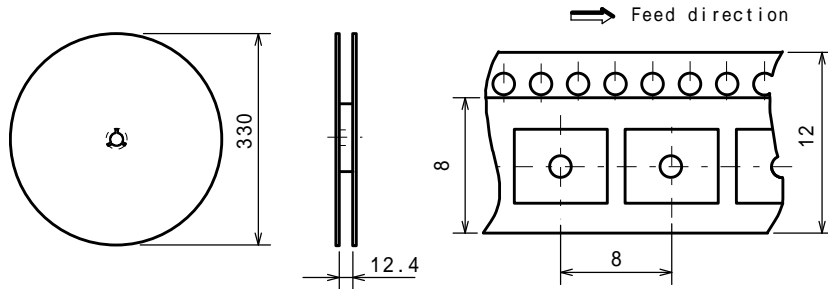


## SOP8

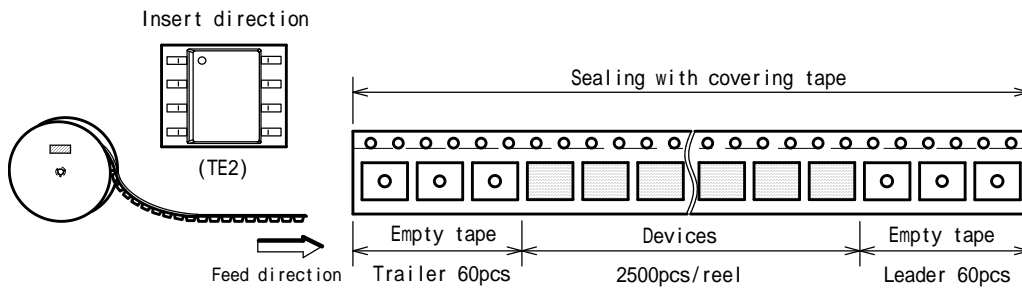
### PACKING SPEC

Unit: mm

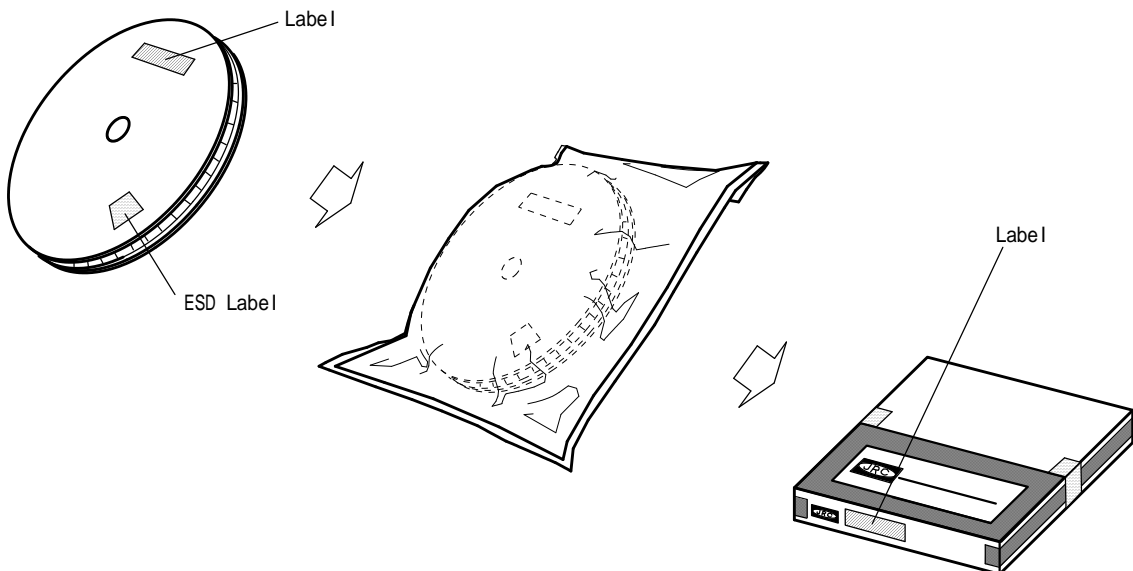
#### REEL DIMENSIONS / TAPING DIMENSIONS



#### TAPING STATE



#### PACKING STATE



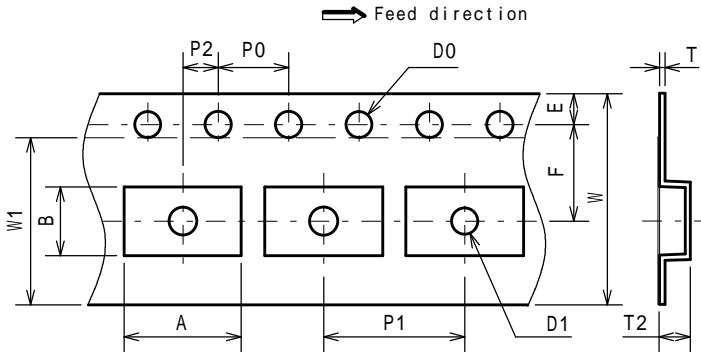


## SSOP8

### PACKING SPEC

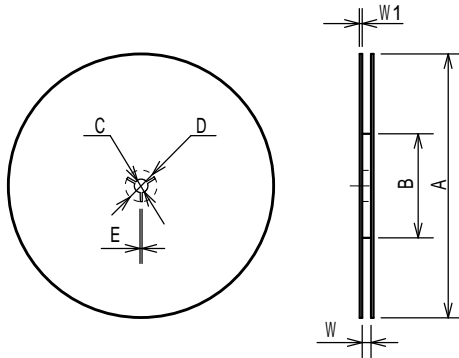
Unit: mm

#### TAPING DIMENSIONS



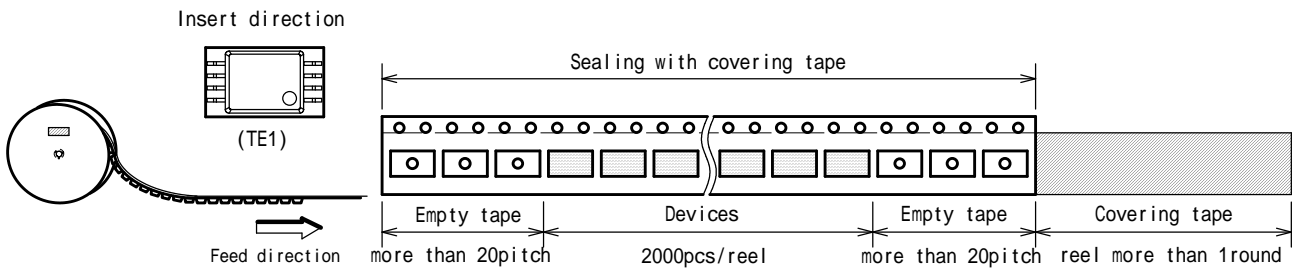
SYMBOL	DIMENSION	REMARKS
A	6.7	BOTTOM DIMENSION
B	3.9	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

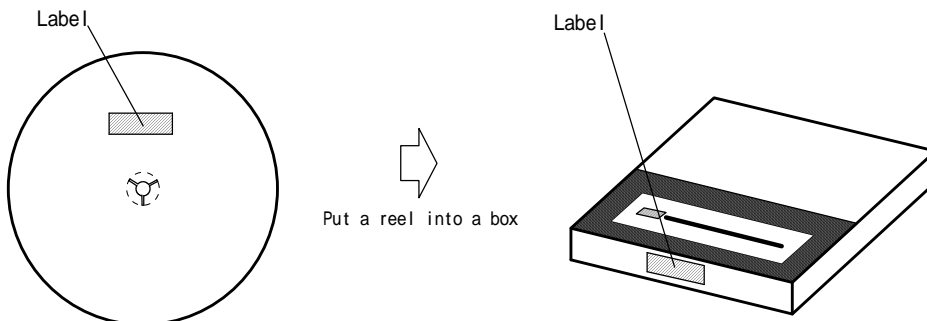


SYMBOL	DIMENSION
A	254 ± 2
B	100 ± 1
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

#### TAPING STATE



#### PACKING STATE

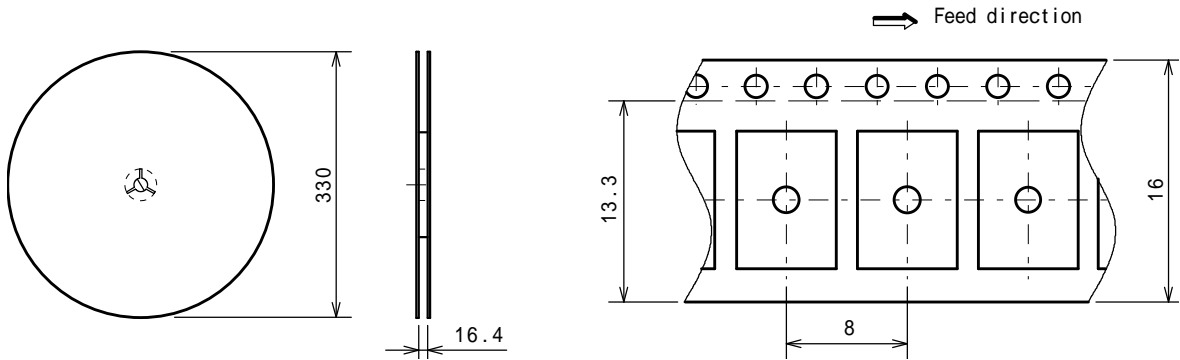


## SOP14

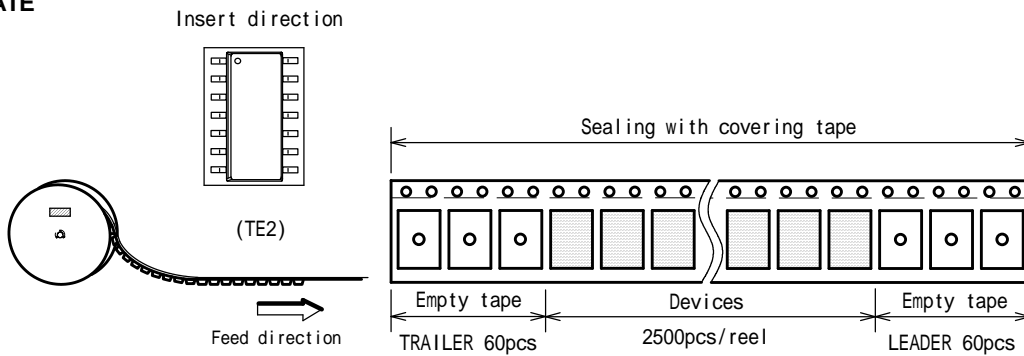
### PACKING SPEC

Unit: mm

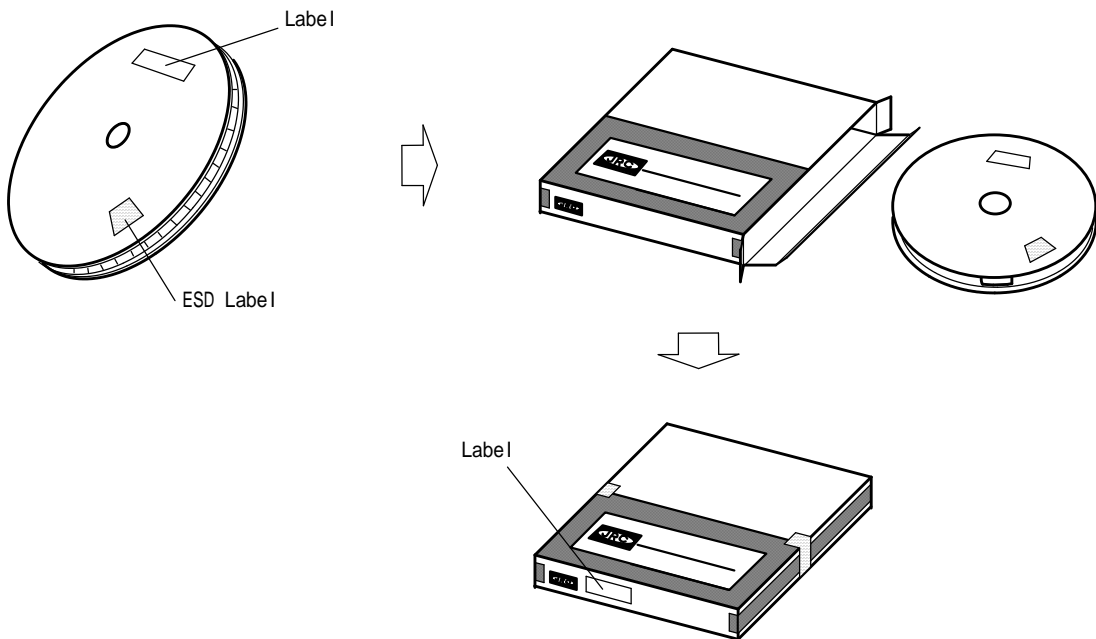
#### REEL DIMENSIONS / TAPING DIMENSIONS



#### TAPING STATE



#### PACKING STATE

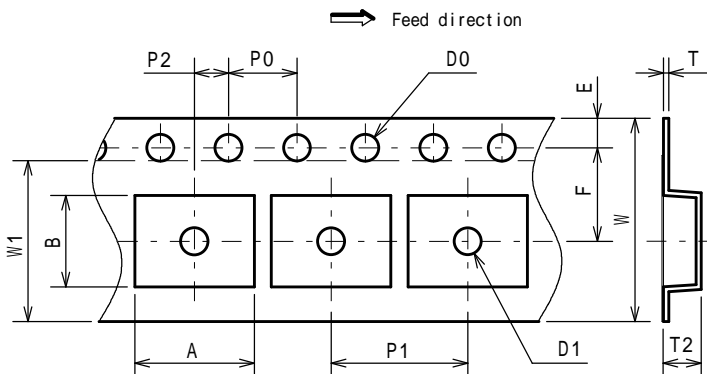


## SSOP14

### PACKING SPEC

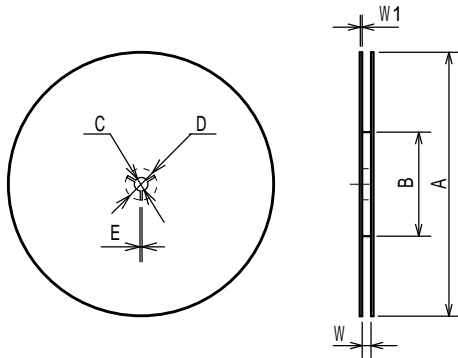
Unit: mm

#### TAPING DIMENSIONS



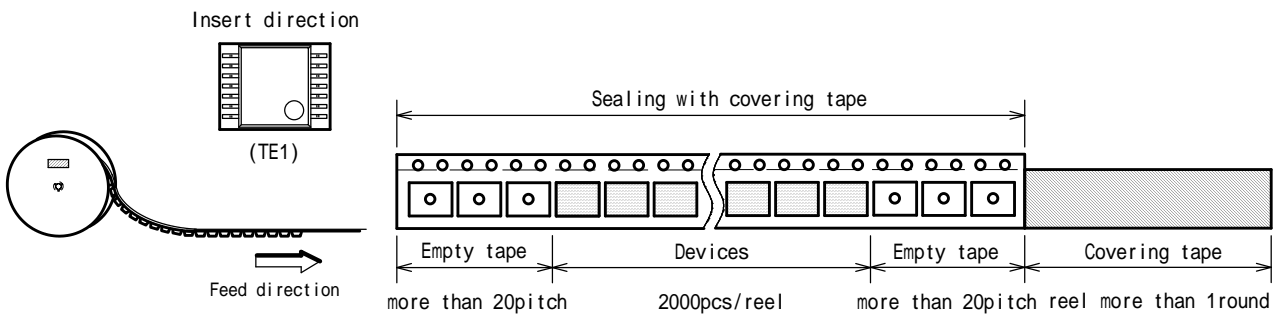
SYMBOL	DIMENSION	REMARKS
A	6.95	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

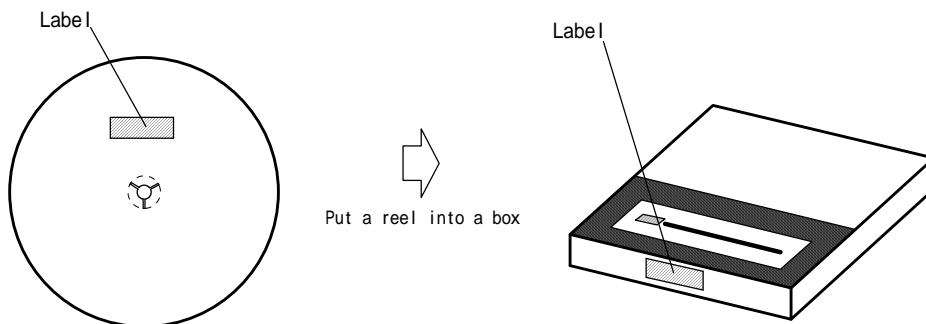


SYMBOL	DIMENSION
A	254 ± 2
B	100 ± 1
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

#### TAPING STATE

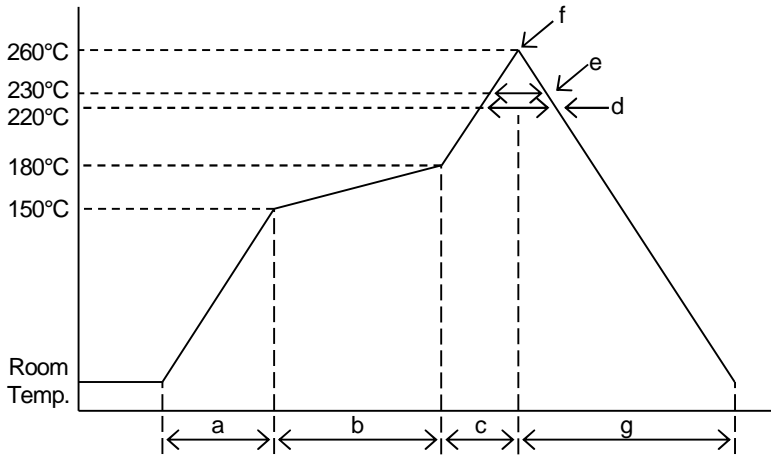


#### PACKING STATE



## ■ 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.

## ■ REVISION HISTORY

DATE	REVISION	CHANGES
Feb.25, 2019	Ver.3.0	Data sheet format revision
Jun.6, 2019	Ver.3.1	Equivalent circuit revision
Nov.13, 2019	Ver.4.0	Extended operating temperature range
Mar.16, 2020	Ver.4.1	Added SSOP package.
Jul.16, 2020	Ver.5.0	NJM074CAV/084CV/084CAV Development completed

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