

LOW-POWER J-FET INPUT OPERATIONAL AMPLIFIERS

FEATURES

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

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.

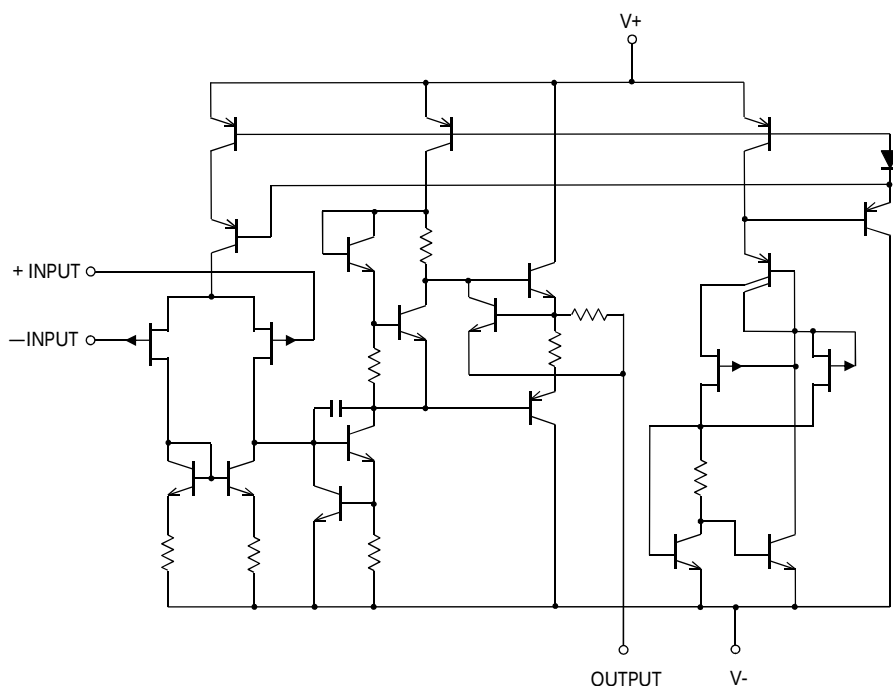
The NJM062C/064C are suitable for audio amplifier applications and measurement applications. In addition, the realization of a wide operating temperature reaches by a new design.

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

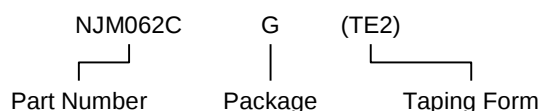
■ EQUIVALENT CIRCUIT



■ PIN CONFIGURATIONS

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

■ 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

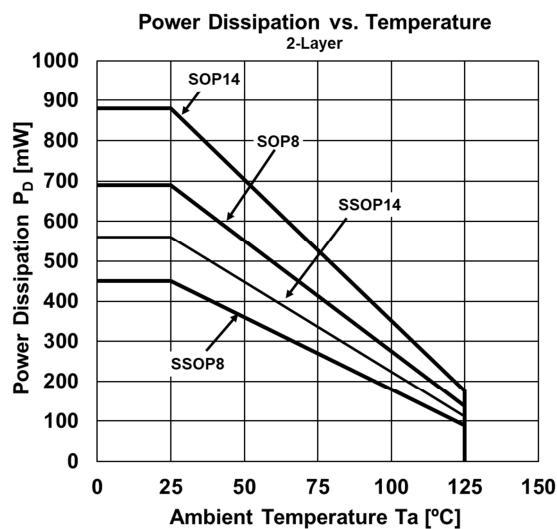
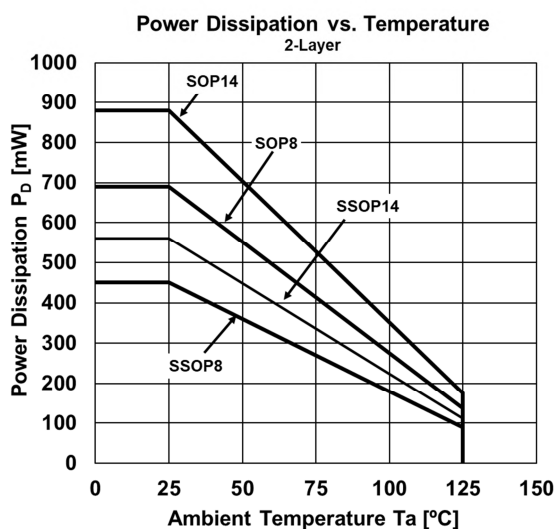
PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+ / V^-	±18	V
Differential Input Voltage ⁽¹⁾	V_{ID}	±36	V
Input Voltage ⁽²⁾	V_{IN}	$V^- - 0.3$ to $V^+ + 36$	V
Output Terminal Input Voltage	V_O	$V^- - 0.3$ to $V^+ + 0.3$	V
Power Dissipation ⁽³⁾	P_D	2-Layer / 4-Layer ⁽⁴⁾	mW
SOP8		690 / 1000	
SSOP8		450 / 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		2-Layer / 4-Layer ⁽⁴⁾	
SOP8	Θ_{ja}	181 / 125	°C/W
SSOP8		278 / 221	
SOP14		142 / 104	
SSOP14		225 / 179	
Junction-to-Top of Package Characterization Parameter		2-Layer / 4-Layer ⁽⁴⁾	
SOP8	Ψ_{jt}	49 / 43	°C/W
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. (76.2×114.3×1.6 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^-	$T_a=25^\circ\text{C}$	± 2 to ± 18	V
Operating Temperature Range	T_{opr}		-40 to 125	°C

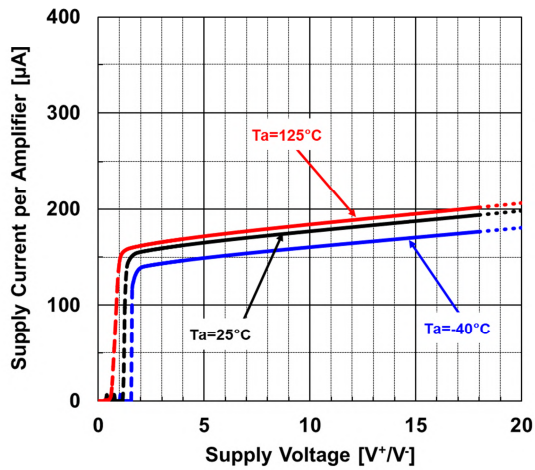
■ ELECTRICAL CHARACTERISTICS ($V^+V^- = \pm 15V$, $T_a = 25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS	NJM062C / NJM064C			NJM062CA / NJM064CA			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
INPUT CHARACTERISTICS									
Input Offset Voltage	V _{IO}	R _S =50Ω, T _a =25°C R _S =50Ω, 0°C< T _a < 70°C ⁽⁵⁾	- -	3 -	15 20	- -	3 -	6 7.5	mV
Input Offset Voltage Drift	ΔV _{IO} /ΔT	R _S =50Ω, 0°C< T _a < 70°C ⁽⁵⁾	-	10	-	←	←	←	μV/°C
Input Offset Current	I _{IO}	T _a =25°C 0°C< T _a < 70°C ⁽⁵⁾	- -	5 -	200 5	- -	5 -	100 3	pA nA
Input Bias Current	I _B	T _a =25°C 0°C< T _a < 70°C ⁽⁵⁾	- -	30 -	400 10	- -	30 -	200 7	pA nA
Input Resistance	R _{IN}		-	10 ¹²	-	←	←	←	Ω
Open-Loop Voltage Gain	A _V	R _L ≥10kΩ, V _O =± 10V, T _a =25°C	3	20	-	8	20	-	V/mV
		R _L ≥10kΩ, V _O =± 10V, 0°C< T _a < 70°C ⁽⁵⁾	3	-	-	8	-	-	
Common-Mode Rejection Ratio	CMR	V _{IC} =V _{ICM} min, R _S ≤10kΩ	70	90	-	72	90	-	dB
Common-Mode Input Voltage Range	V _{ICM}	≥CMR MIN	±13	-13.5 to 15	-	←	←	←	V
OUTPUT CHARACTERISTICS									
Maximum Output Voltage	V _{OM}	R _L =10kΩ, T _a =25°C R _L =10kΩ, 0°C< T _a < 70°C ⁽⁵⁾	±10 ±10	±13.5 -	- -	← ←	← ←	← ←	V
POWER SUPPLY									
Supply Current per Amplifier	I _{SUPPLY}	No Signal	-	200	250	←	←	←	μA
Supply Voltage Rejection Ratio	SVR	V ⁺ /V ⁻ =±9V to ±15V, R _S ≤50kΩ	70	100	-	80	100	-	dB
AC CHARACTERISTICS									
Slew Rate	SR	V _{IN} =10Vpp, R _L =10kΩ, C _L =100pF, See Figure1	1.5	3.5	-	←	←	←	V/μs
Unity Gain Frequency	f _T	R _L =10kΩ	-	1	-	←	←	←	MHz
Rise Time	t _r	V _{IN} =20mVpp, R _L =10kΩ, C _L =100pF, See Figure1	-	0.2	-	←	←	←	μs
Overshoot	K _{OV}	V _{IN} =20mVpp, R _L =10kΩ, C _L =100pF, See Figure1	-	10	-	←	←	←	%
Equivalent Input Noise Voltage	e _n	R _S =20Ω, f=1kHz	-	35	-	←	←	←	nV/√Hz
Channel Separation	CS	G _V =40dB	-	120	-	←	←	←	dB

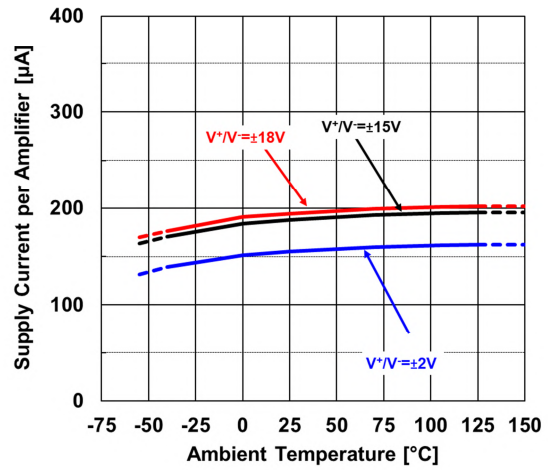
(5) This parameter is not 100% test.

■ TYPICAL CHARACTERISTICS

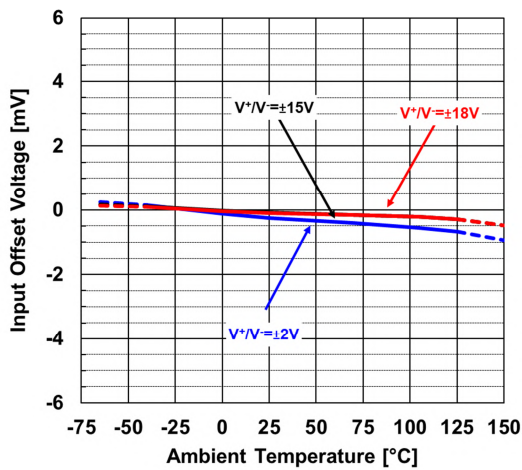
Supply Current per Amplifier vs. Supply Voltage



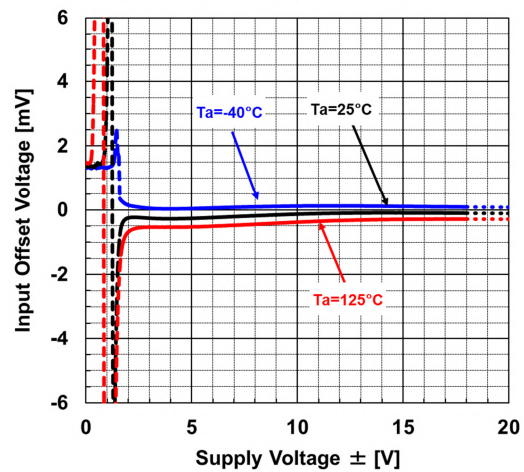
Supply Current per Amplifier vs. Temperature



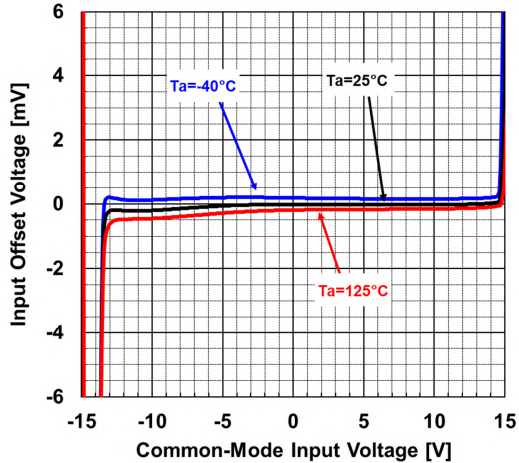
Input Offset Voltage vs. Temperature



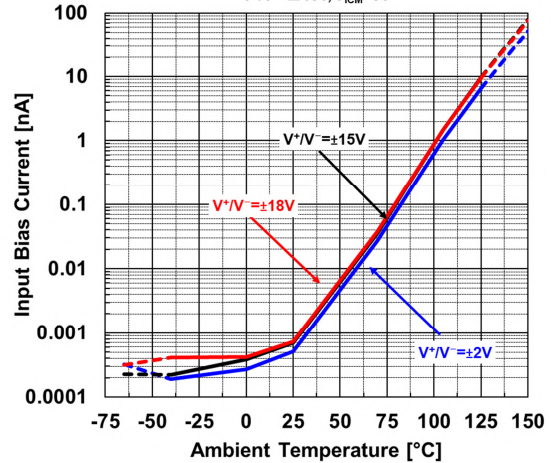
Input Offset Voltage vs. Supply Voltage



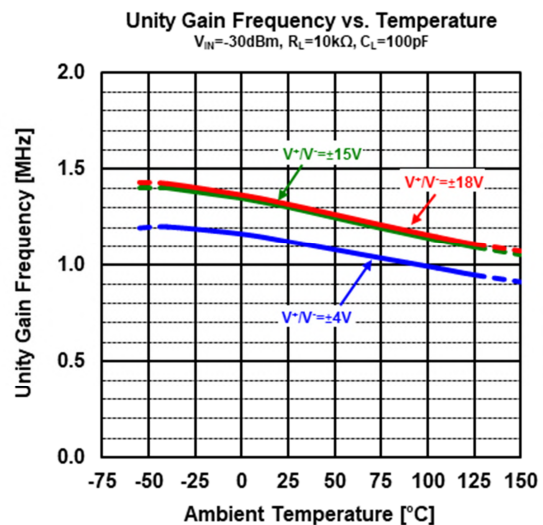
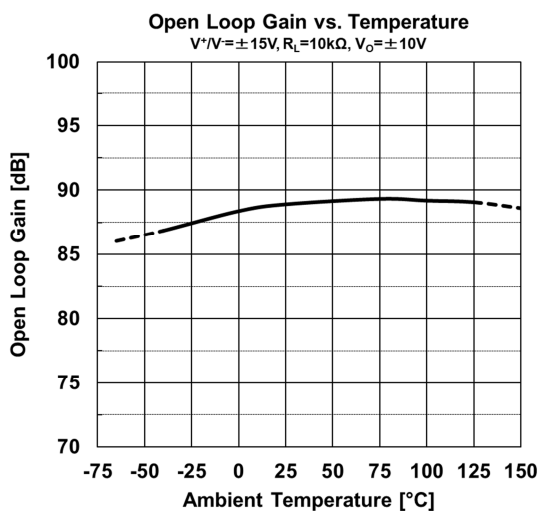
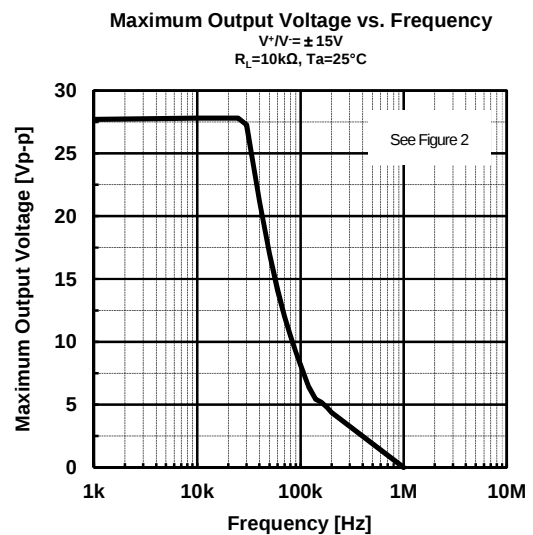
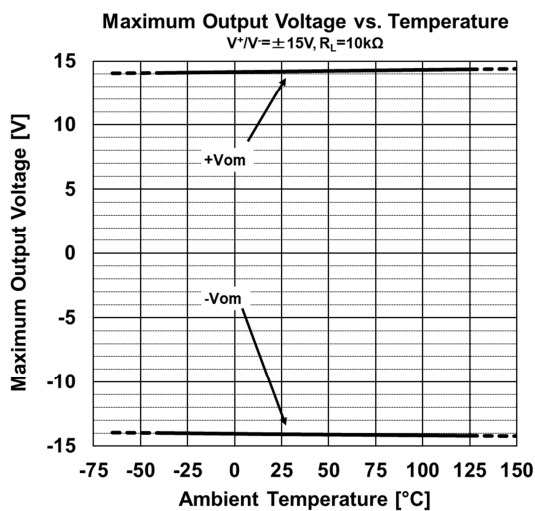
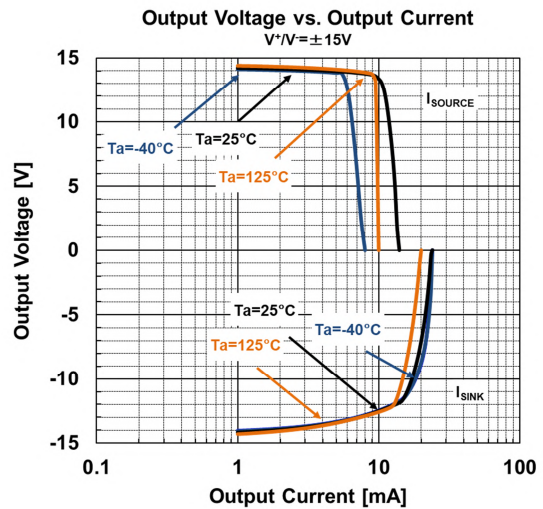
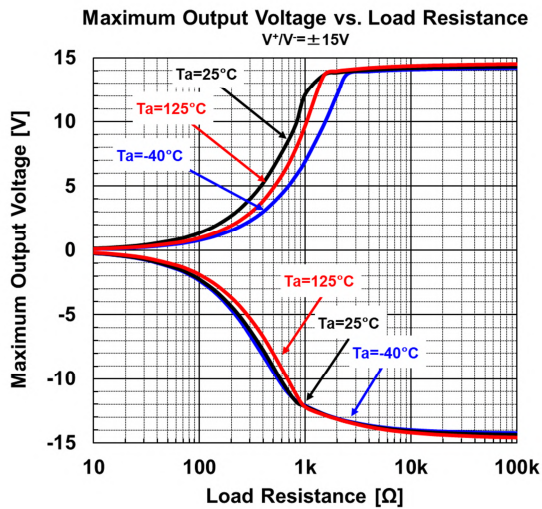
Input Offset Voltage
vs.
Common-Mode Input Voltage
 $V^+/V^- = \pm 15V$



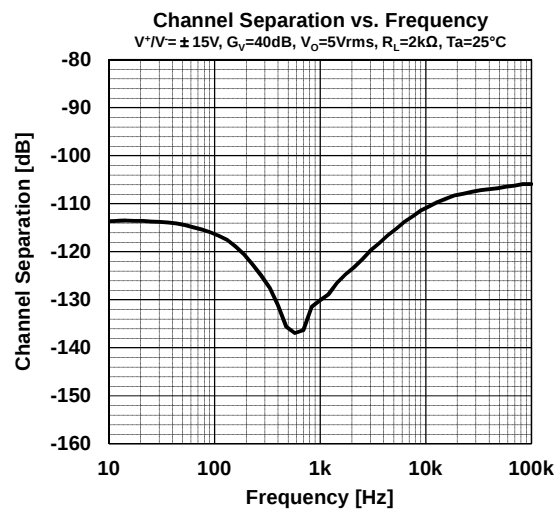
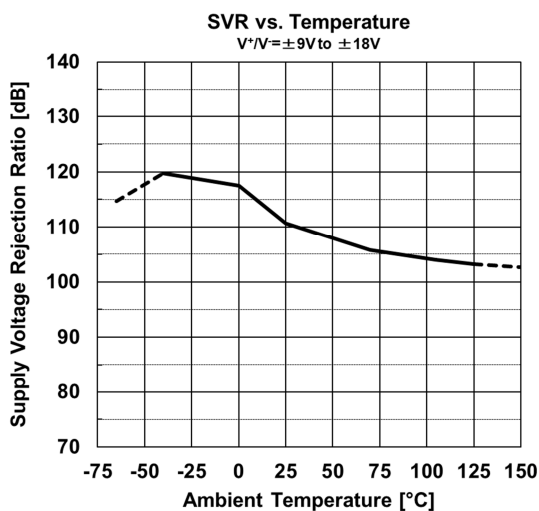
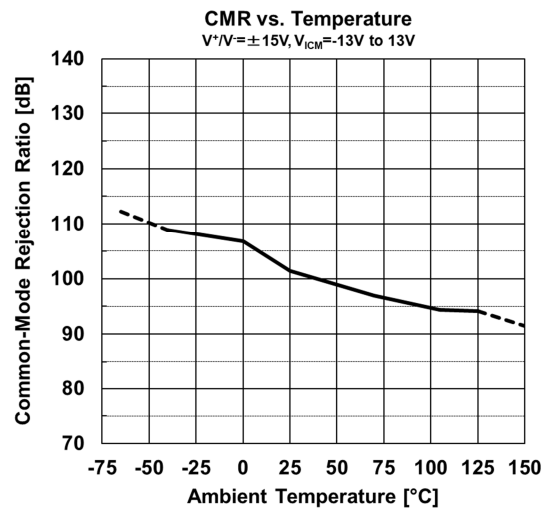
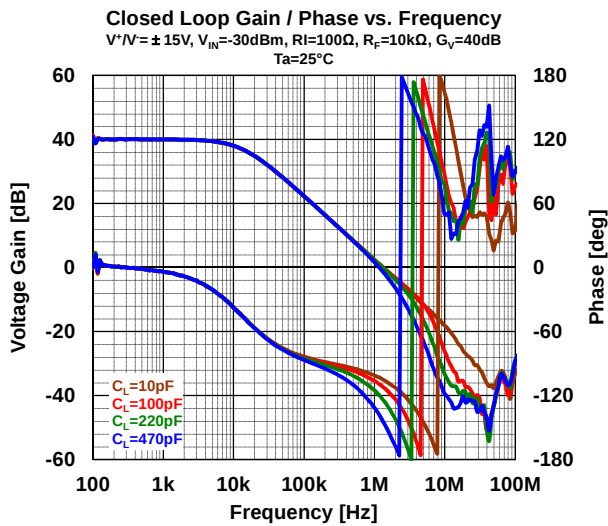
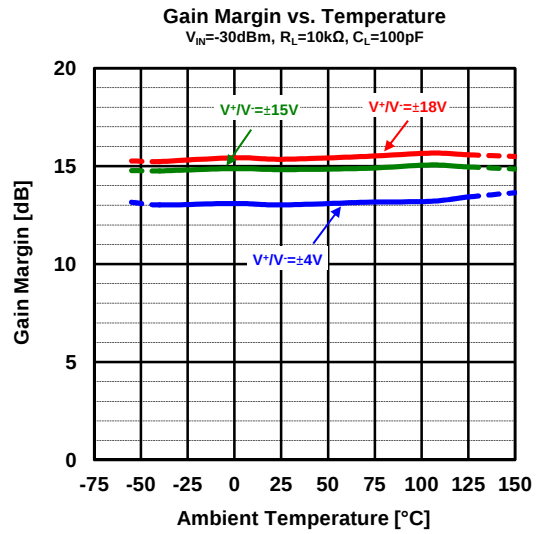
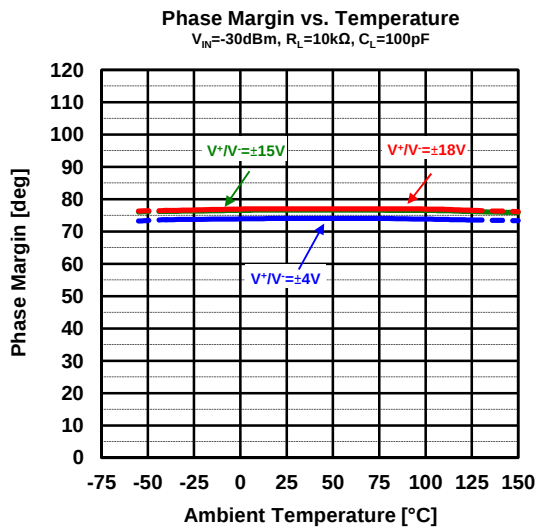
Input Bias Current vs. Temperature
 $V^+/V^- = \pm 15V, V_{CM} = 0V$



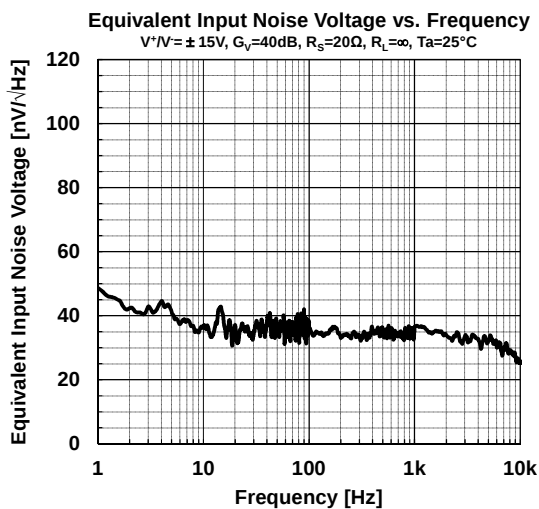
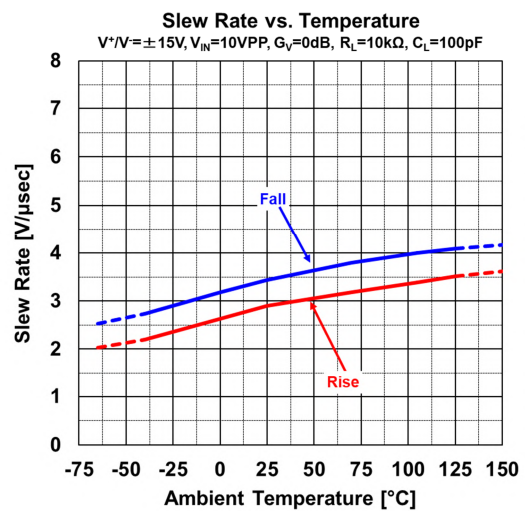
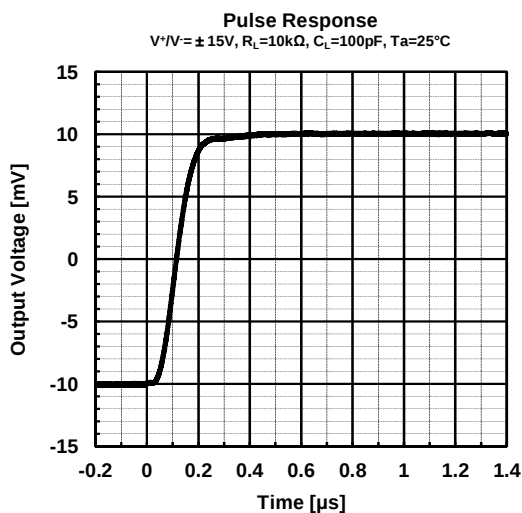
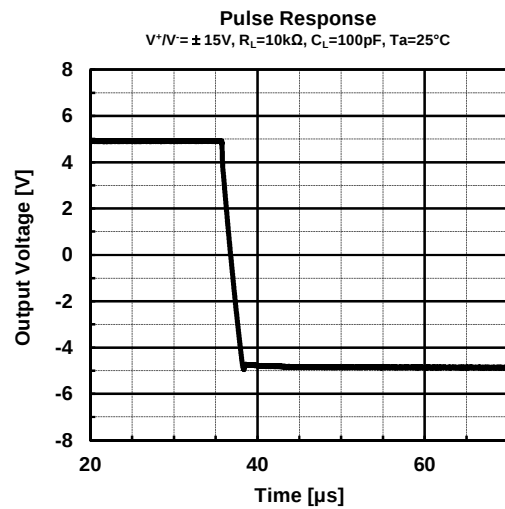
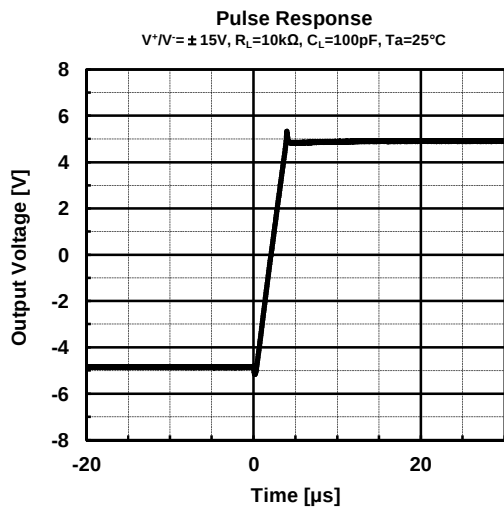
■ TYPICAL CHARACTERISTICS



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■ TYPICAL CHARACTERISTICS



■ TEST CIRCUITS

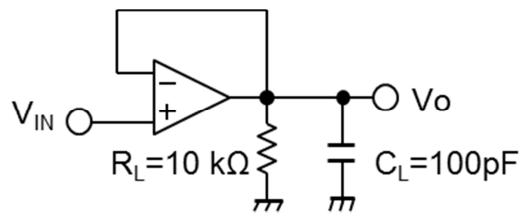


Figure1. Voltage Follower

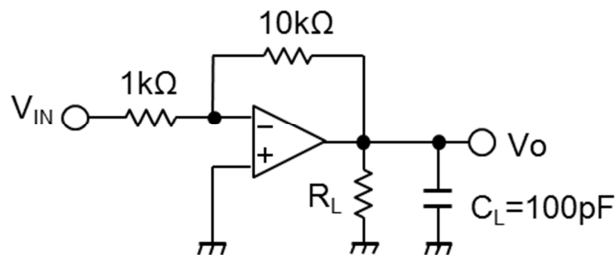


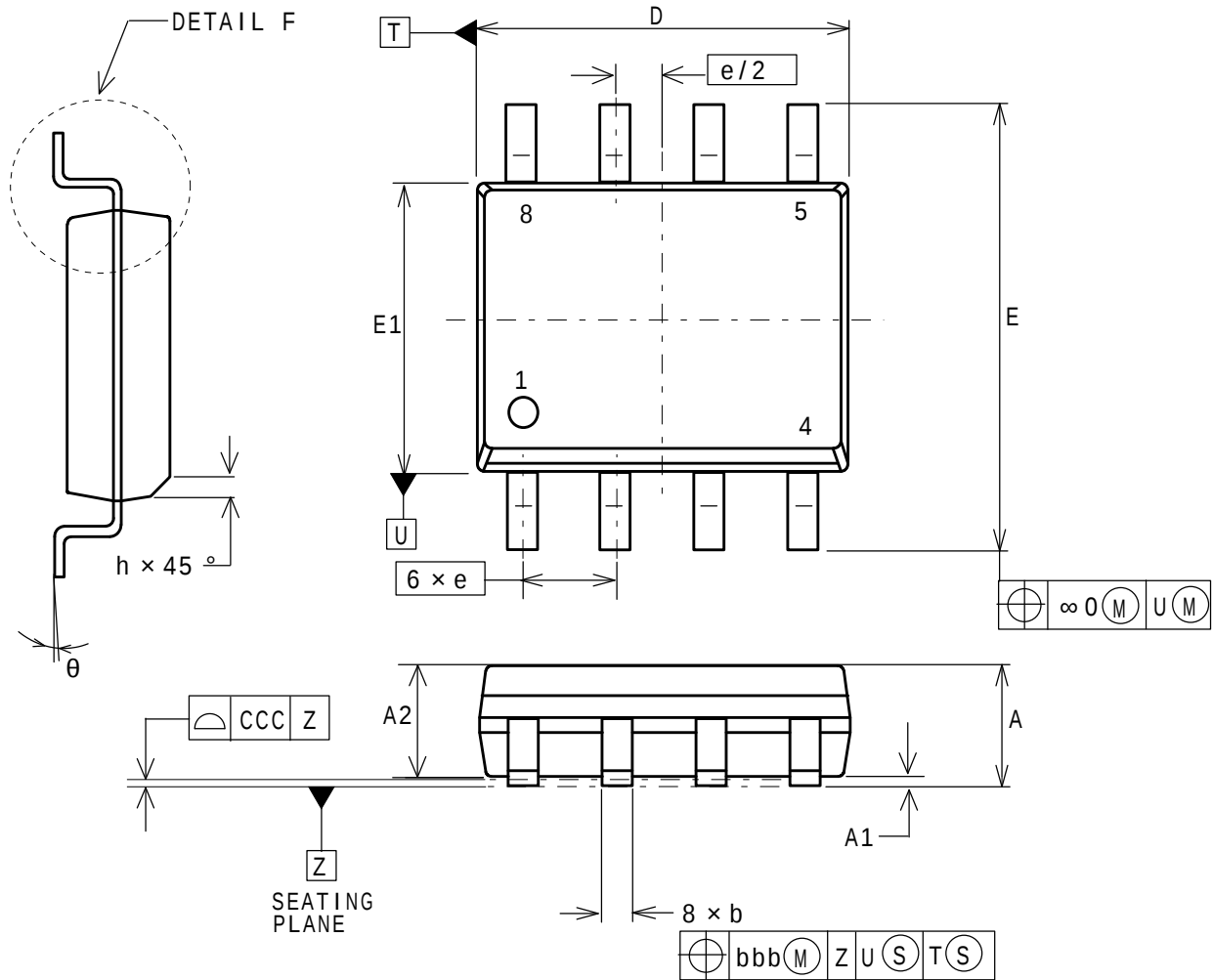
Figure2. 20dB Inverting Amplifier (*)

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

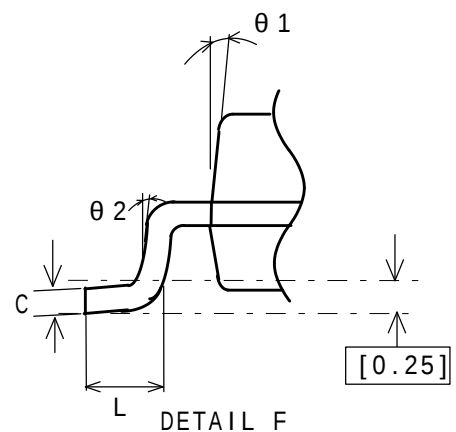
SOP8

Unit: mm

■ PACKAGE DIMENSIONS



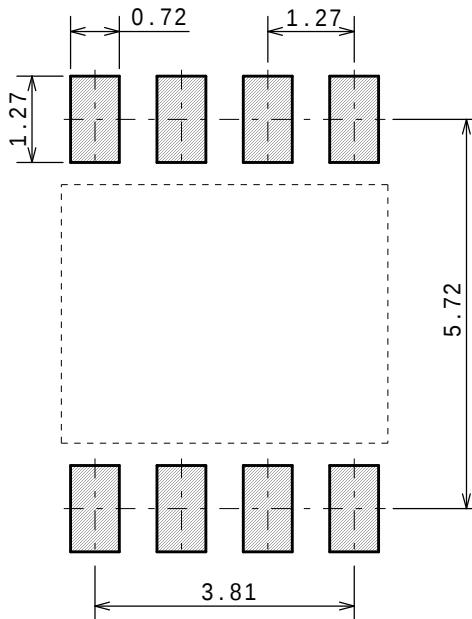
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.014		.019	0.35		0.49
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.189		.197	4.80		5.00
	E1	.150		.157	3.80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



SOP8

Unit: mm

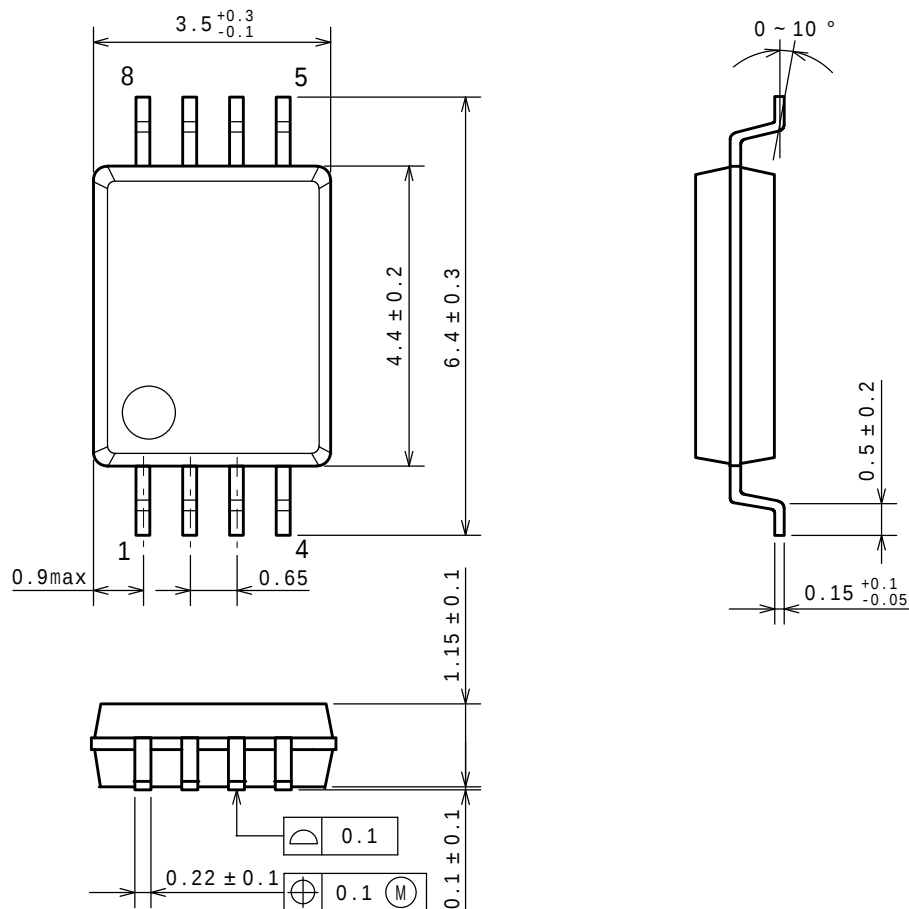
■ EXAMPLE OF SOLDER PADS DIMENSIONS



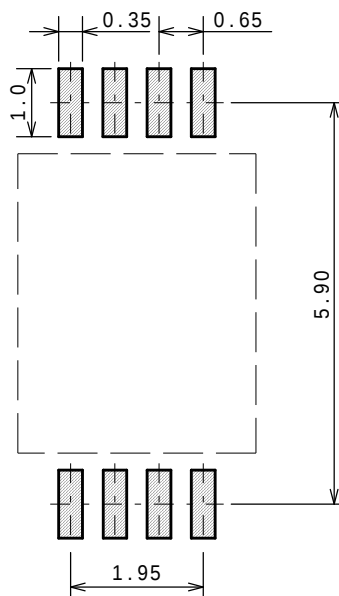
SSOP8

Unit: mm

■ PACKAGE DIMENSIONS



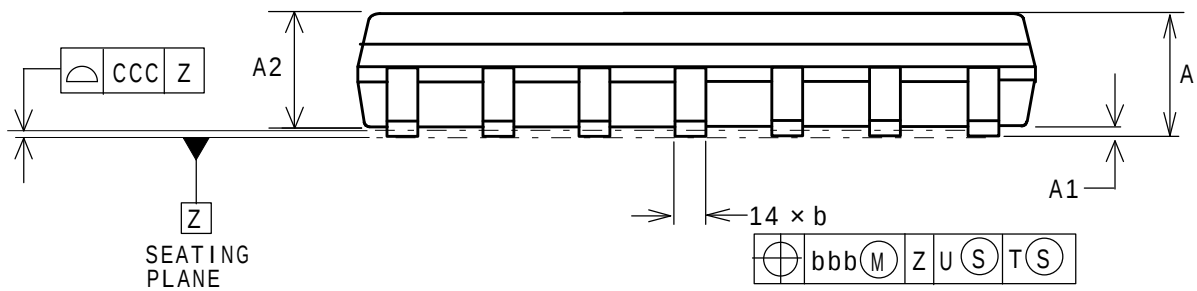
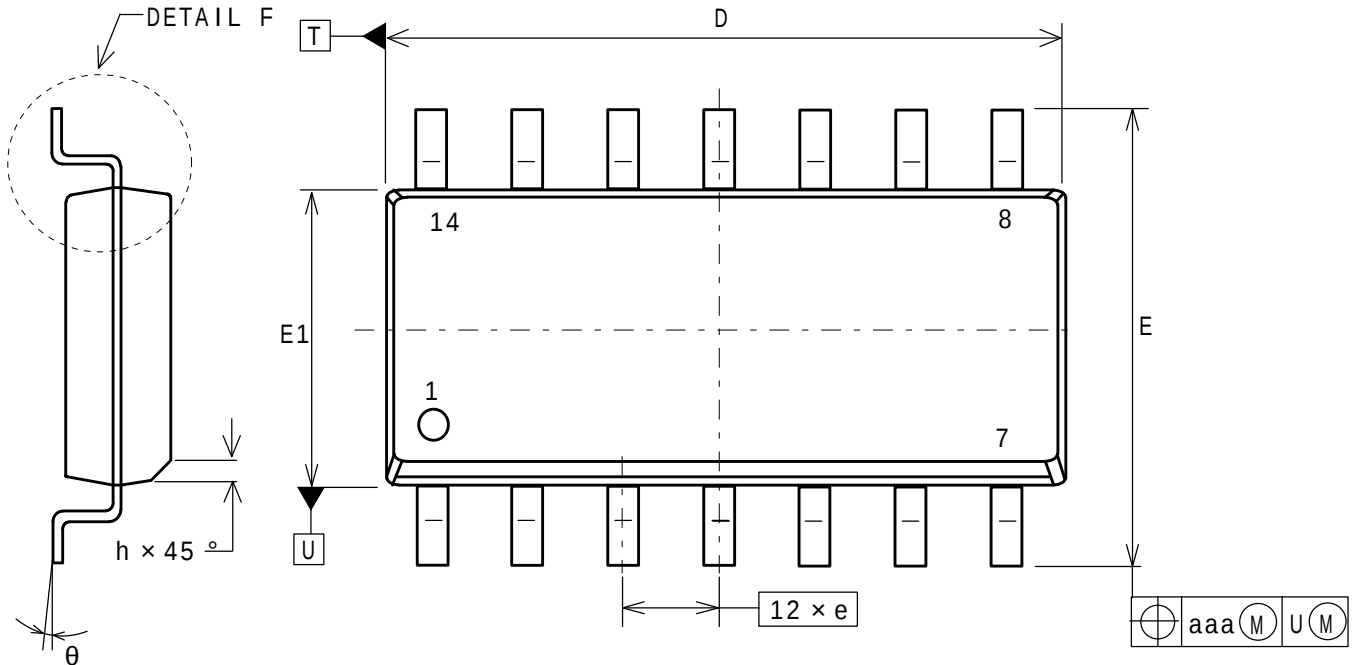
■ EXAMPLE OF SOLDER PADS DIMENSIONS



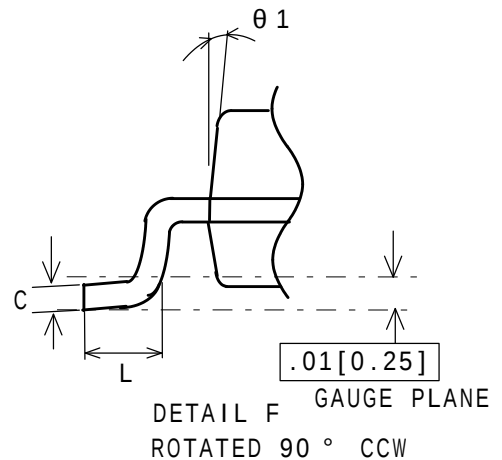
SOP14

Unit: mm

■ PACKAGE DIMENSIONS



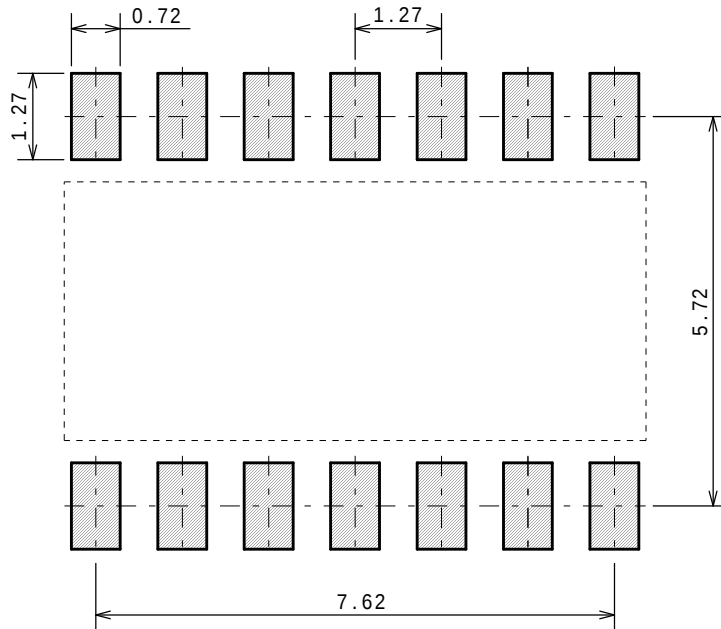
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.013		.020	0.33		0.51
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.337		.344	8.55		8.75
	E1	.150		.157	3.80		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
	θ	0 °		8 °	0 °		8 °
	θ 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

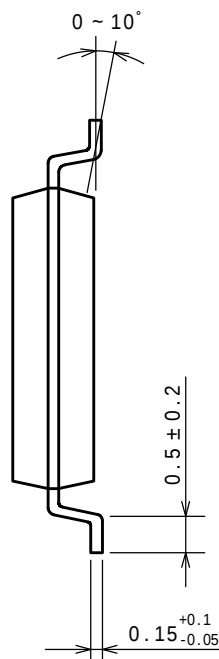
■EXAMPLE OF SOLDER PADS DIMENSIONS



Unit: mm

Technical drawing of a rectangular component with dimensions and tolerances:

- Overall width: $5.0^{+0.3}_{-0.1}$
- Overall height: 6.4 ± 0.3
- Top edge features: 14 pins on the left, 8 pins on the right.
- Bottom edge features: 1 pin on the left, 7 pins on the right.
- Internal dimensions: 4.4 ± 0.2 (height of the central rectangular area), 0.67 max (width of the central rectangular area), 0.65 (width of the central rectangular area).
- Side view dimensions: 1.15 ± 0.1 (height of the component), 0.1 ± 0.1 (thickness of the component).
- Surface texture symbols: 0.10 (surface texture symbol) and 0.10 (M) (surface texture symbol).

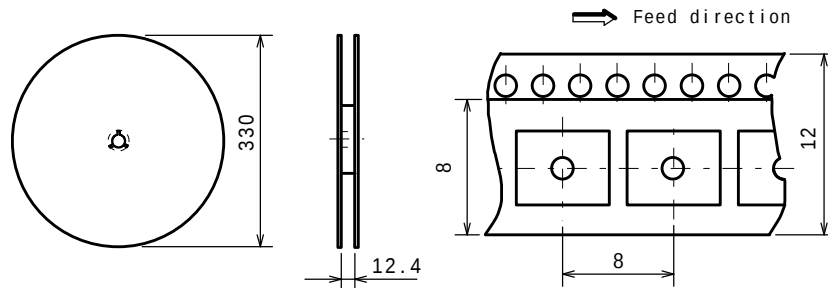


SOP8

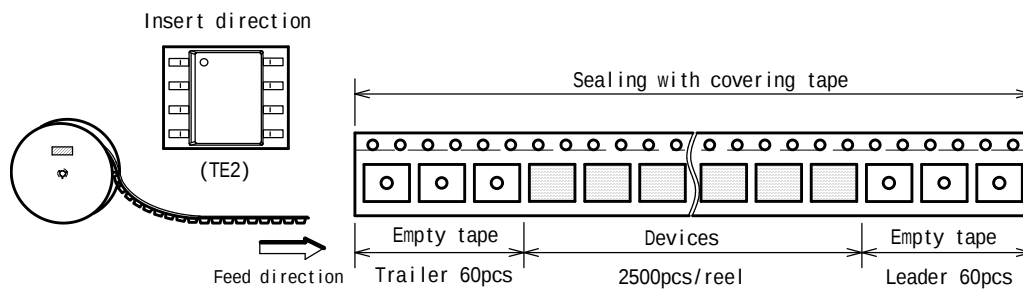
■ PACKING SPEC

Unit: mm

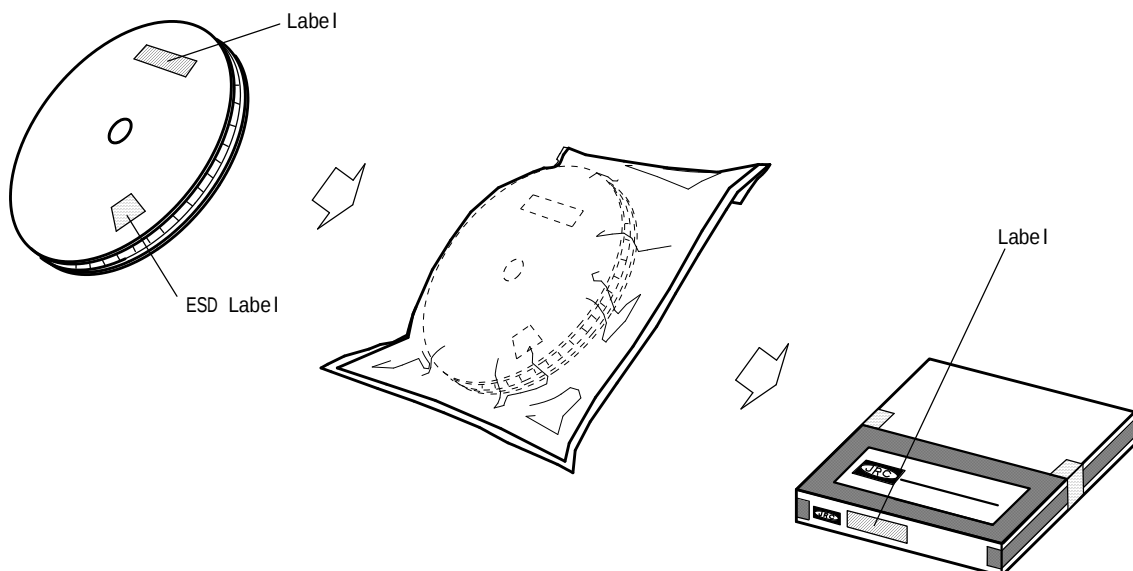
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

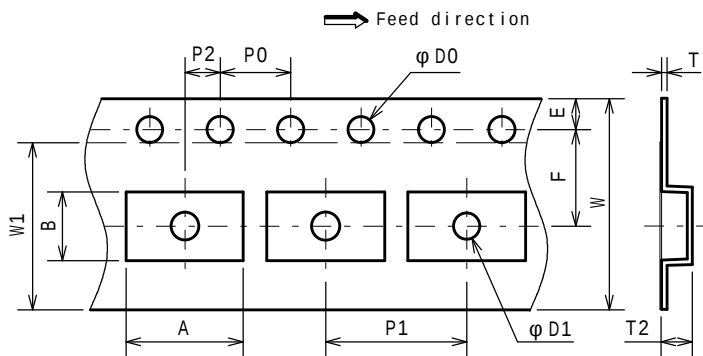


SSOP8

PACKING SPEC

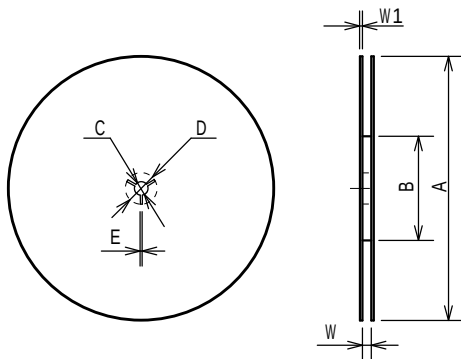
Unit: mm

TAPING DIMENSIONS



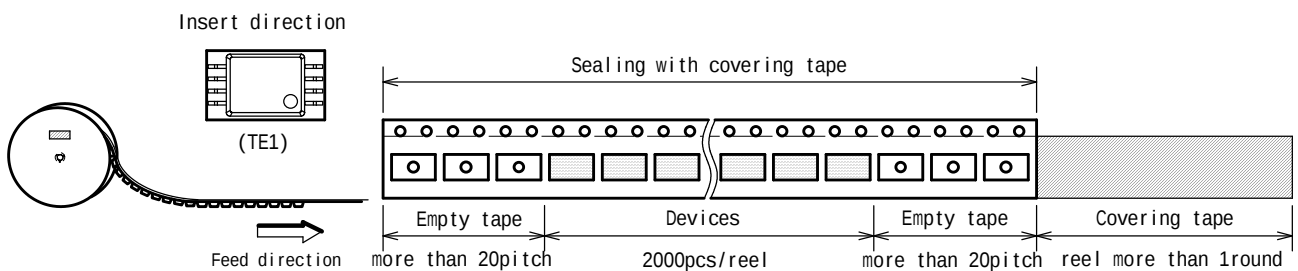
SYMBOL	DIMENSION	REMARKS
A	6.7	BOTTOM DIMENSION
B	3.9	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

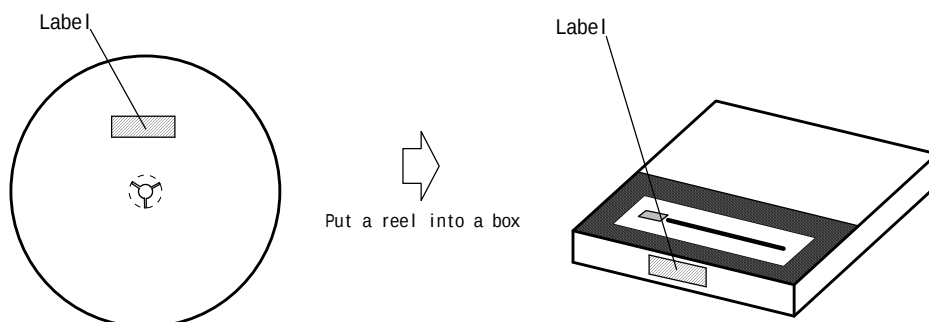


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

TAPING STATE



PACKING STATE

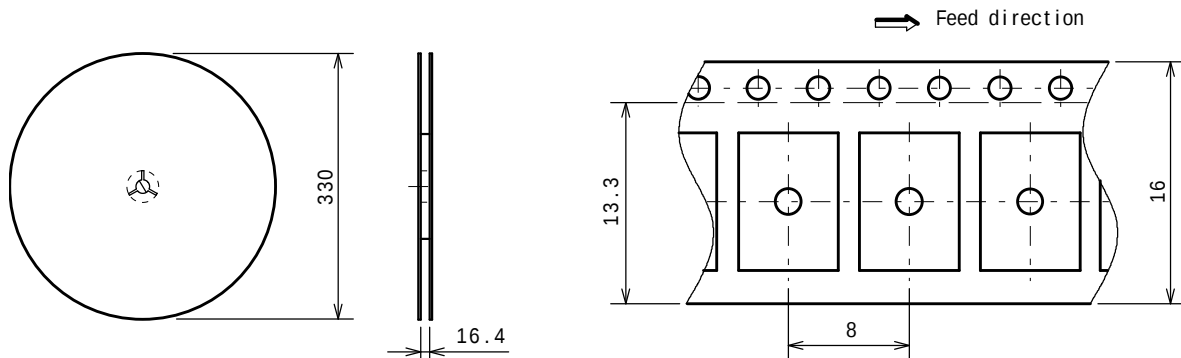


SOP14

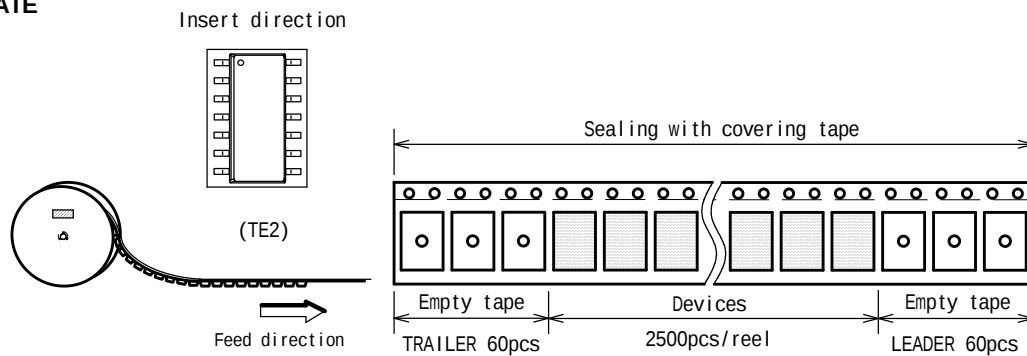
■ PACKING SPEC

Unit: mm

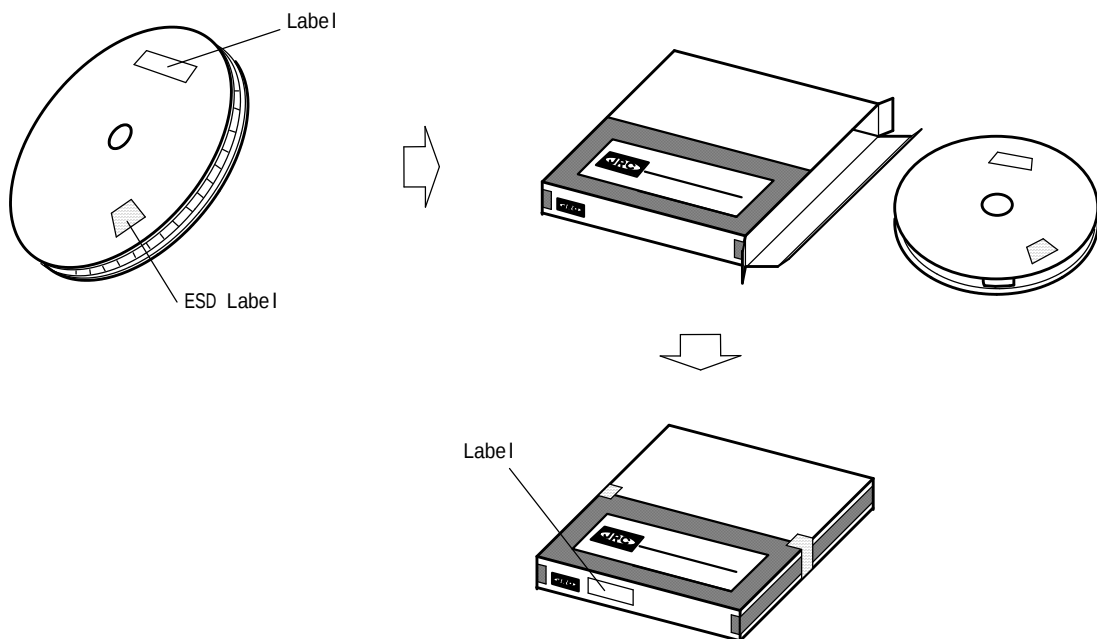
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

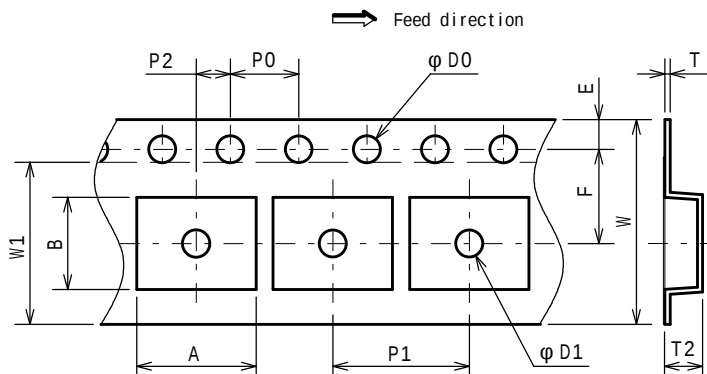


SSOP14

PACKING SPEC

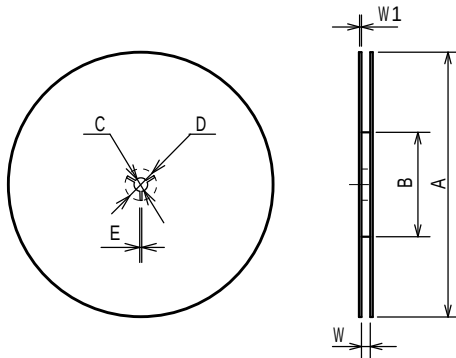
Unit: mm

TAPING DIMENSIONS



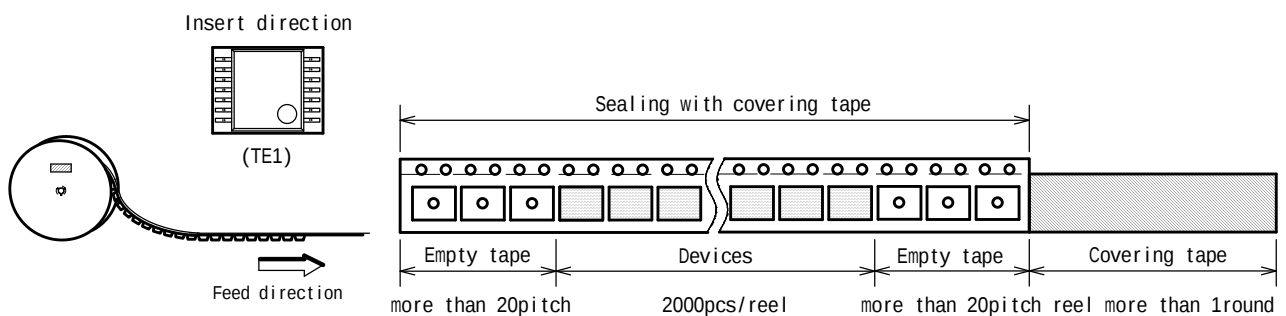
SYMBOL	DIMENSION	REMARKS
A	6.95	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

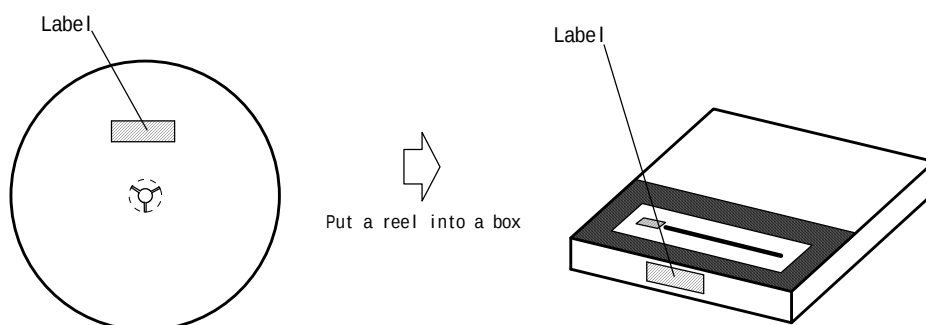


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

TAPING STATE

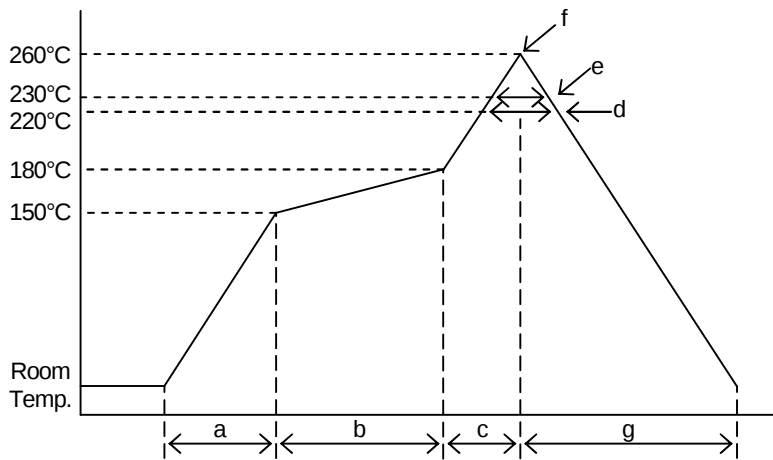


PACKING STATE



■ 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.

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 - Equipment Used in the Deep Sea
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 - Life Maintenance Medical Equipment
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 - Vehicle Control Equipment (Airplane, railroad, ship, etc.)
 - Various Safety Devices
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