

LOW NOISE, J-FET INPUT OPERATIONAL AMPLIFIERS

FEATURES

- Wide Power Supply Range ± 4 to ± 18 V
- Internal ESD Protection
Human Body Model (HBM) ± 2000 V typ.
- High Input Resistance $10^{12}\Omega$ typ.
- Wide Temperature Range -40°C to 105°C
- Bipolar Technology
- High Slew Rate $13 \text{ V}/\mu\text{s}$ typ.
- Wide Unity Gain Bandwidth 3 MHz typ.
- Package
NJM072C/072CA/082C/082CA SOP8
SSOP8 (U.D.)
NJM074C/074CA/084C/084CA SOP14
SSOP14 (U.D.)

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.

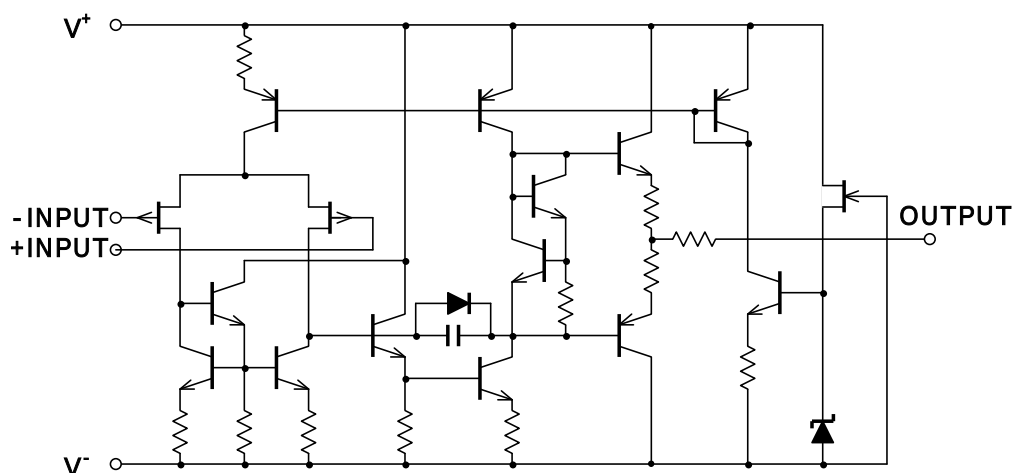
In addition, the realization of a wide operating temperature reaches by a new design.

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

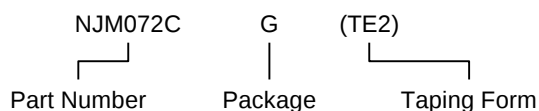
■ EQUIVALENT CIRCUIT



■ PIN CONFIGURATIONS

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

■ PRODUCT NAME INFORMATION



■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJM072CG	SOP8	Yes	Yes	Pure Sn	072	88	2500
NJM072CAG	SOP8	Yes	Yes	Pure Sn	072A	88	2500
NJM082CG	SOP8	Yes	Yes	Pure Sn	082	88	2500
NJM082CAG	SOP8	Yes	Yes	Pure Sn	082A	88	2500
NJM072CV	SSOP8	Yes	Yes	Sn2Bi	TBD	42	2000
NJM072CAV	SSOP8	Yes	Yes	Sn2Bi	TBD	42	2000
NJM082CV	SSOP8	Yes	Yes	Sn2Bi	TBD	42	2000
NJM082CAV	SSOP8	Yes	Yes	Sn2Bi	TBD	42	2000
NJM074CG	SOP14	Yes	Yes	Pure Sn	074	150	2500
NJM074CAG	SOP14	Yes	Yes	Pure Sn	074A	150	2500
NJM084CG	SOP14	Yes	Yes	Pure Sn	084	150	2500
NJM084CAG	SOP14	Yes	Yes	Pure Sn	084A	150	2500
NJM074CV	SSOP14	Yes	Yes	Sn2Bi	TBD	65	2000
NJM074CAV	SSOP14	Yes	Yes	Sn2Bi	TBD	65	2000
NJM084CV	SSOP14	Yes	Yes	Sn2Bi	TBD	65	2000
NJM084CAV	SSOP14	Yes	Yes	Sn2Bi	TBD	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		TBD / TBD	
SOP14		880 / 1200	
SSOP14		TBD / TBD	
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	Θ_{ja}	2-Layer / 4-Layer ⁽⁴⁾	°C/W
SOP8		181 / 125	
SSOP8		TBD / TBD	
SOP14		142 / 104	
SSOP14		TBD / TBD	
Junction-to-Top of Package Characterization Parameter	Ψ_{jt}	2-Layer / 4-Layer ⁽⁴⁾	°C/W
SOP8		49 / 43	
SSOP8		TBD / TBD	
SOP14		39 / 34	
SSOP14		TBD / TBD	

(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^+ .

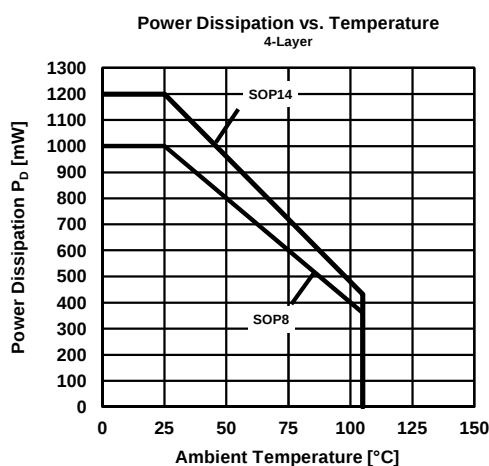
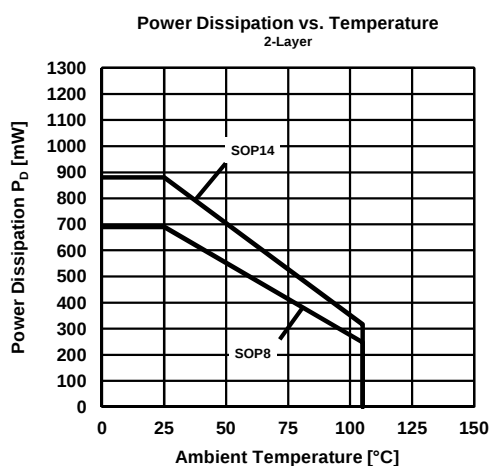
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.

(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	$T_a=25^\circ\text{C}$	± 4 to ± 18	V
Operating Temperature Range	T_{opr}		-40 to 105	°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 NJM082 and NJM084

PARAMETER	SYMBOL	TEST CONDITIONS	NJM072C / NJM082C NJM074C / NJM084C			NJM072CA / NJM082CA NJM074CA / NJM084CA			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	

INPUT CHARACTERISTICS

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) 13(15)	-	3	6(6) 7(7.5)	mV
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) 7	-	30	200 7	pA nA
Input Offset Current	I_{IO}	$T_a = 25^\circ C$ $0^\circ C < T_a < 70^\circ C^{(5)}$	-	5	50(200) 10	-	5	50(100) 2	pA nA
Input Resistance	R_{IN}		-	10^{12}	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	Ω
Open-Loop Voltage Gain	A_V	$R_L \geq 2k\Omega$, $V_O = \pm 10V$, $T_a = 25^\circ C$	25	200	-	50	200	-	V/mV
		$R_L \geq 2k\Omega$, $V_O = \pm 10V$, $0^\circ C < T_a < 70^\circ C^{(5)}$	15	-	-	25	-	-	
Common-Mode Rejection Ratio	CMR	$V_{IC} = V_{ICMmin}$, $R_S \leq 10k\Omega$	70	100	-	75	100	-	dB
Common-Mode Input Voltage Range	V_{ICM}	$\geq CMR \text{ MIN}$	± 11	-12 to 15	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	V

OUTPUT CHARACTERISTICS

Maximum Output Voltage	V_{OM}	$R_L = 10k\Omega$	± 12	± 13.5	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	V
		$R_L = 10k\Omega$, $0^\circ C < T_a < 70^\circ C^{(5)}$	± 12	-	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	
		$R_L = 2k\Omega$, $0^\circ C < T_a < 70^\circ C^{(5)}$	± 10	-	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	

POWER SUPPLY

Supply Current per Amplifier	I_{SUPPLY}	No Signal	-	1.4	2.5(2.8)	$\leftarrow$	$\leftarrow$	$\leftarrow$	mA
Supply Voltage Rejection Ratio	SVR	$V^+/V^- = \pm 9V$ to $\pm 15V$, $R_S \leq 10k\Omega$	70	100	-	80	100	-	dB

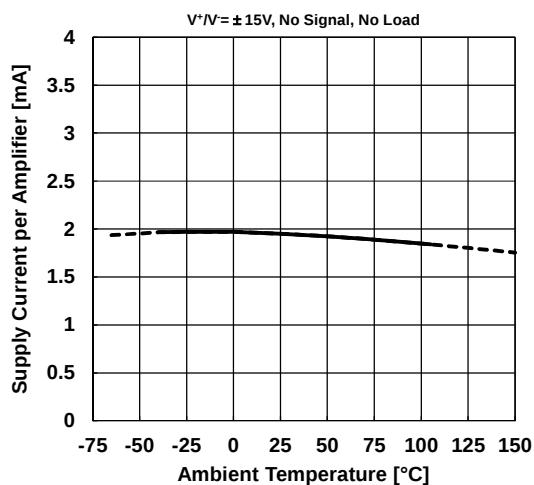
AC CHARACTERISTICS

Slew Rate	SR	$V_{IN} = 10V_{pp}$, $R_L = 2k\Omega$, $C_L = 100pF$, See Figure1	8	13	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	V/ μs
Unity Gain Frequency	f_T		-	3	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	MHz
Rise Time	t_r	$V_{IN} = 20mV_{pp}$, $R_L = 2k\Omega$, $C_L = 100pF$, See Figure1	-	0.1	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	μs
Overshoot	K_{OV}	$V_{IN} = 20mV_{pp}$, $R_L = 2k\Omega$, $C_L = 100pF$, See Figure1	-	20	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	%
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	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	%
Equivalent Input Noise Voltage	V_{NI}	$R_S = 20\Omega$, $f = 10Hz$ to $10kHz$	-	4	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	μV_{rms}
	e_n	$R_S = 20\Omega$, $f = 1kHz$	-	18	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	nV/ $\sqrt{Hz}$
Equivalent Input Noise Current	i_n	$R_S = 20\Omega$, $f = 1kHz$	-	0.01	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	pA/ $\sqrt{Hz}$
Channel Separation	CS	$G_V = 40dB$	-	120	-	$\leftarrow$	$\leftarrow$	$\leftarrow$	dB

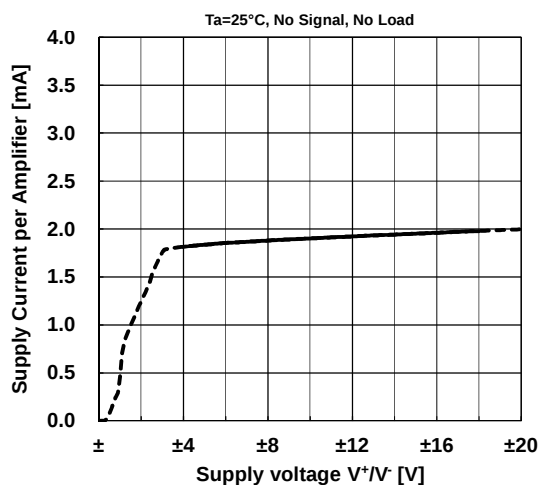
(5) This parameter is not 100% test.

■ TYPICAL CHARACTERISTICS

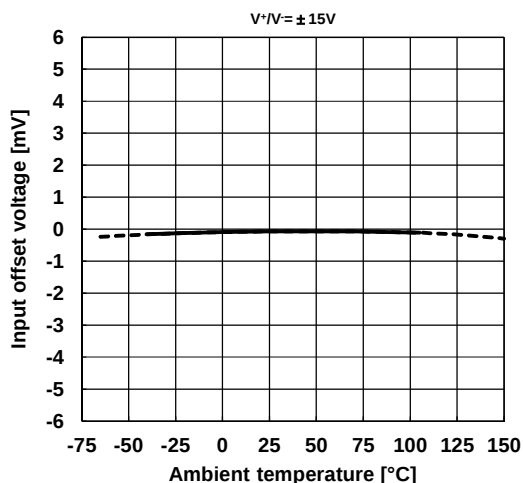
Supply current per amplifier versus ambient temperature



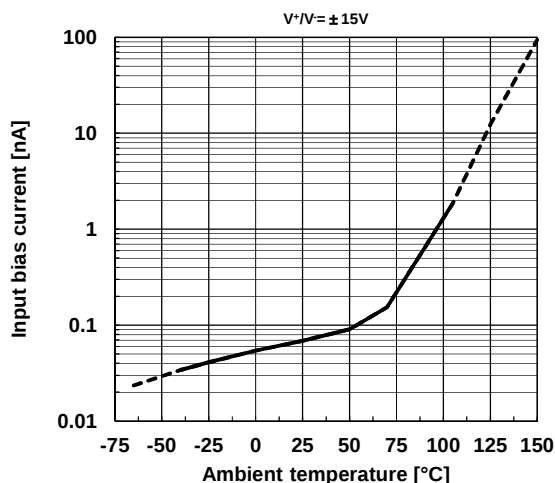
Supply current per amplifier versus Supply voltage



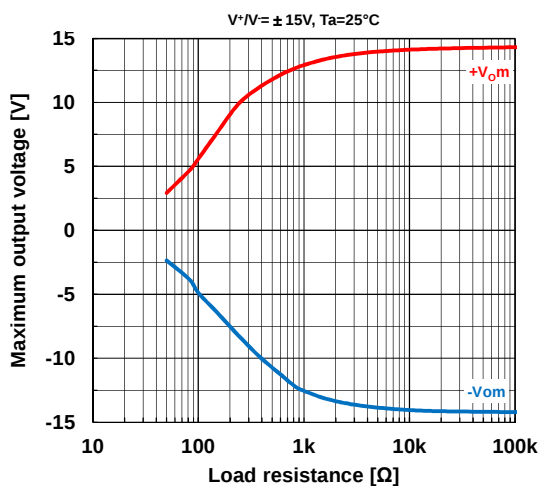
Input offset voltage versus ambient temperature



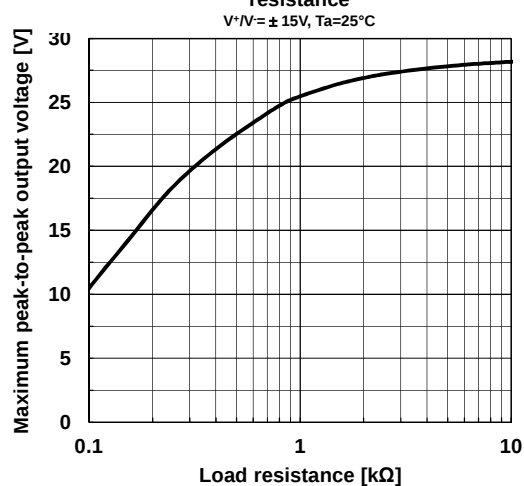
Input bias current versus ambient temperature



Maximum output voltage versus load resistance

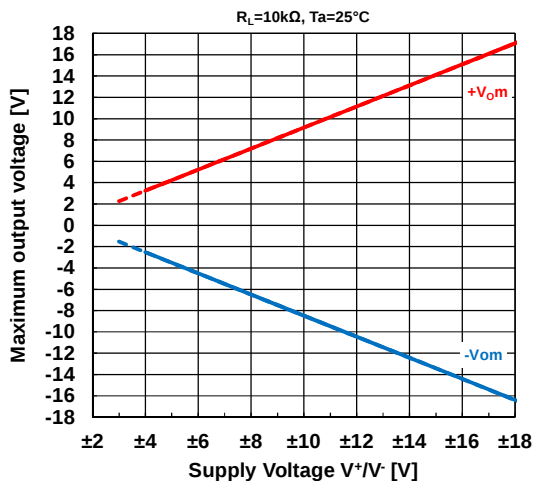


Maximum peak-to-peak output voltage versus load resistance

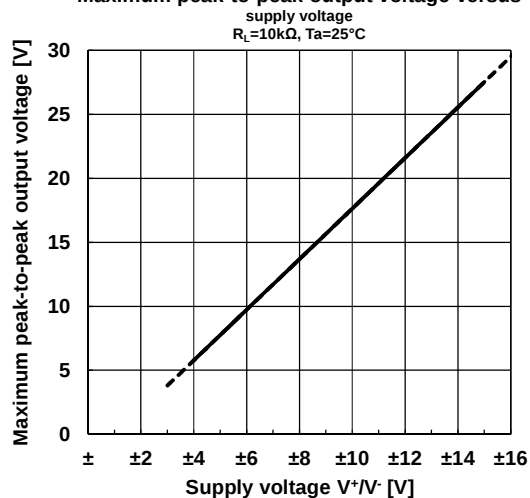


■ TYPICAL CHARACTERISTICS

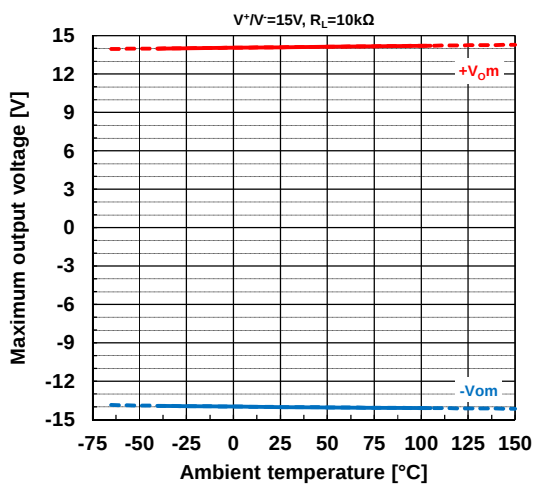
Maximum output voltage versus supply voltage



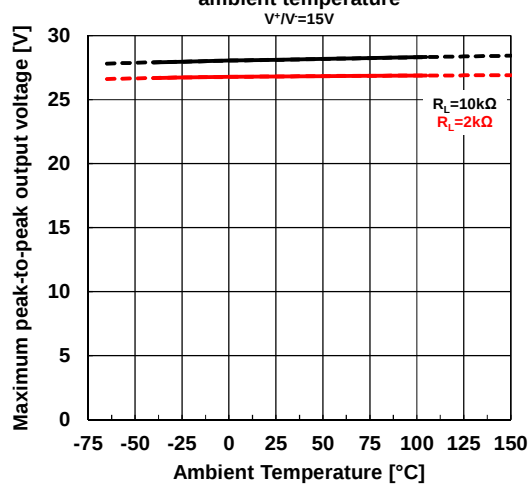
Maximum peak-to-peak output voltage versus supply voltage



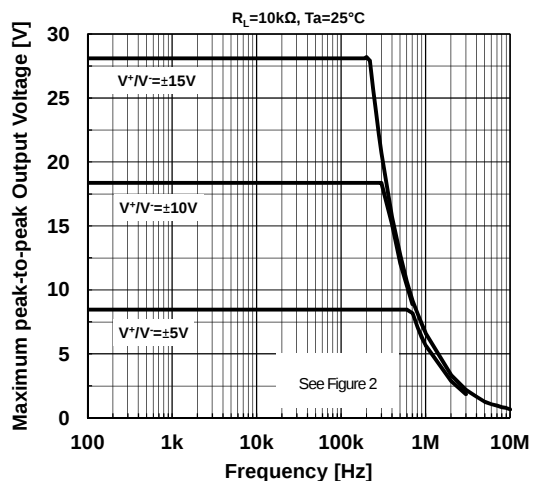
Maximum output voltage versus ambient temperature



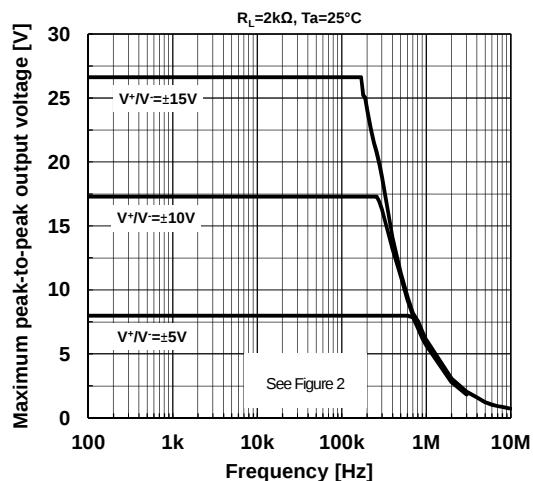
Maximum peak-to-peak output voltage versus ambient temperature



Maximum peak-to-peak output voltage versus frequency

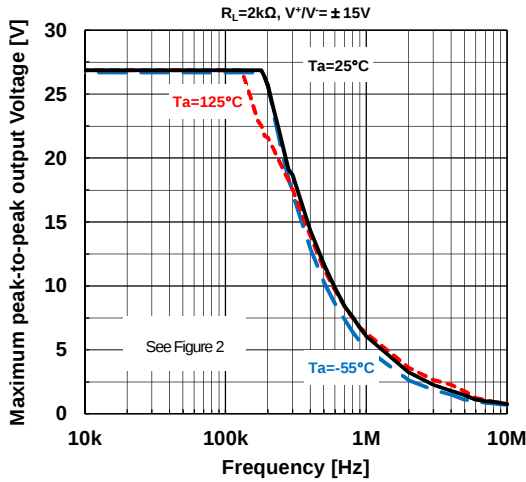


Maximum peak-to-peak output voltage versus frequency

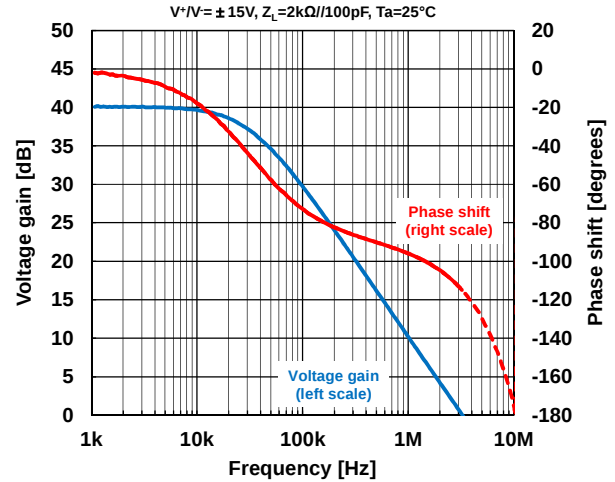


■ TYPICAL CHARACTERISTICS

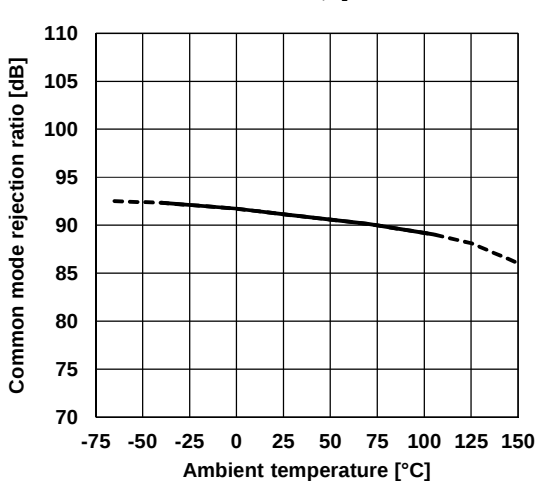
Maximum peak-to-peak output voltage versus frequency



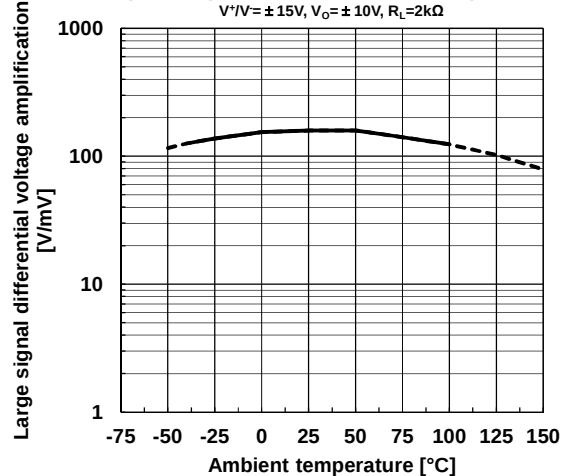
Voltage gain and phase shift versus frequency



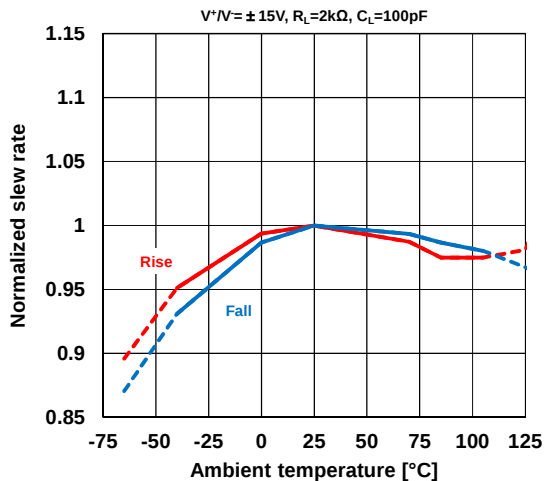
Common mode rejection ratio versus ambient temperature



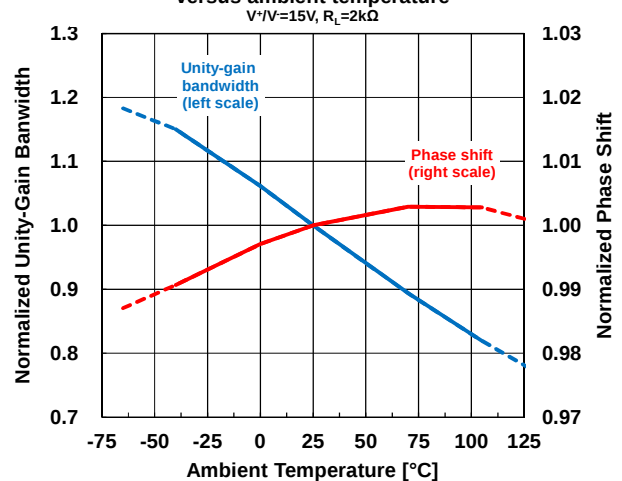
Open Loop Gain versus ambient temperature



Normalized slew rate versus ambient temperature

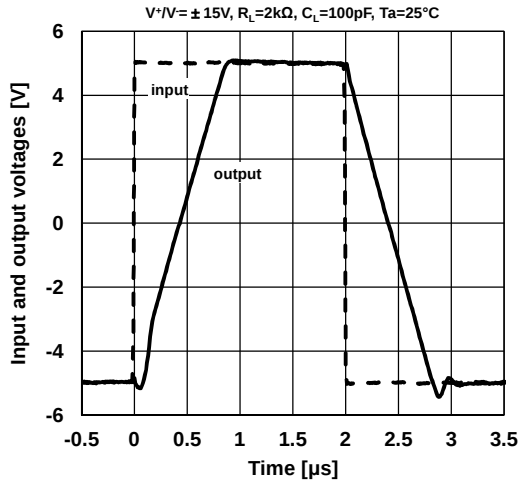


Normalized unity-gain bandwidth and phase shift versus ambient temperature

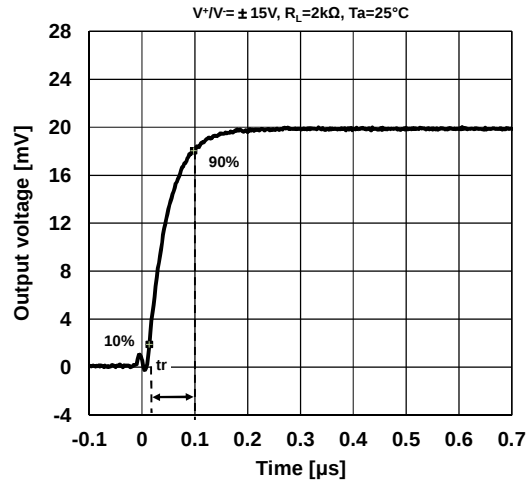


■ TYPICAL CHARACTERISTICS

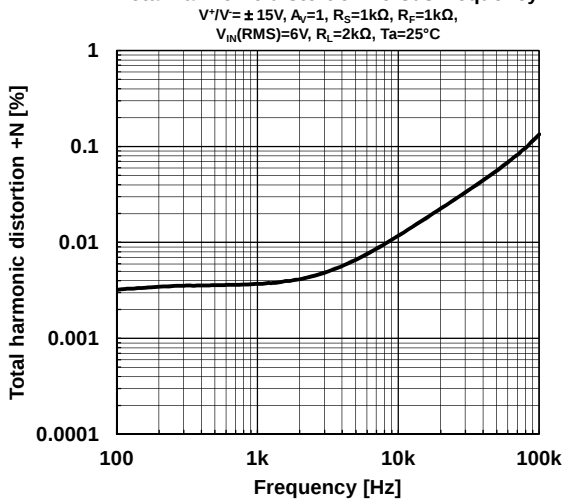
Voltage follower large signal pulse response



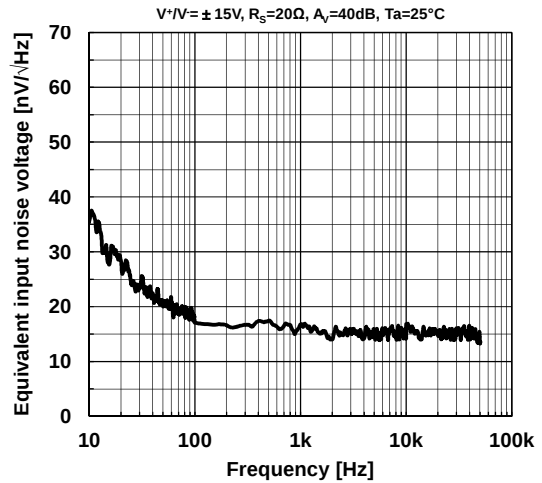
Output voltage versus elapsed time



Total harmonic distortion versus frequency



Equivalent input noise voltage versus frequency



■ TEST CIRCUITS

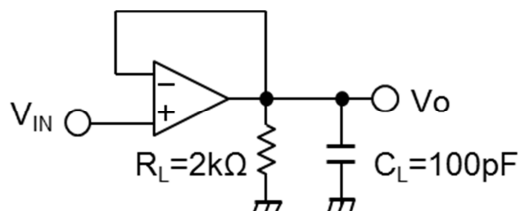


Figure1. Voltage Follower

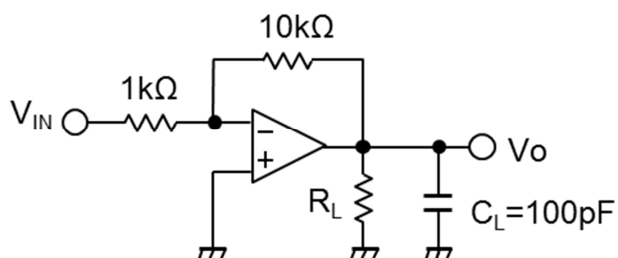


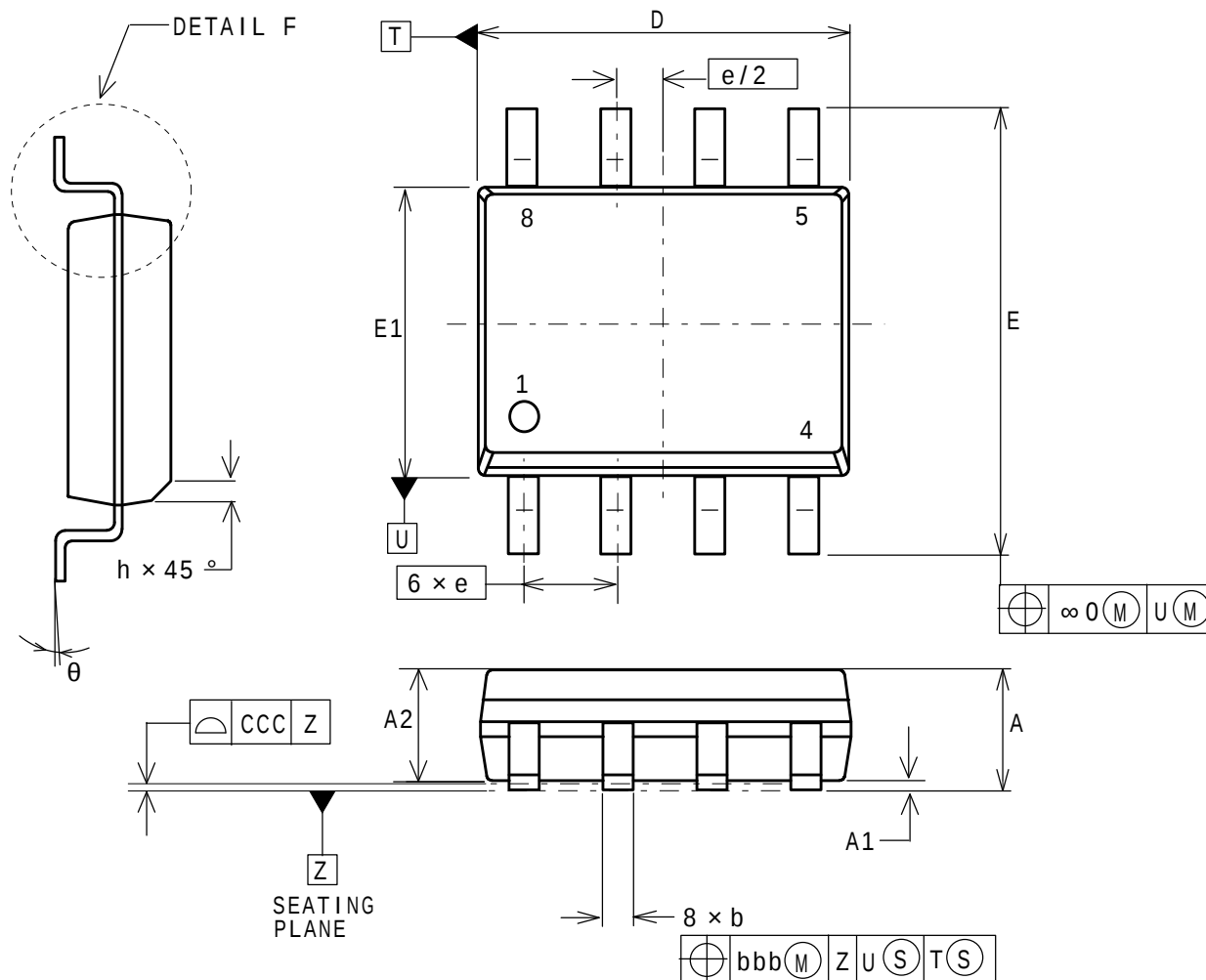
Figure2. 20dB Inverting Amplifier (*)

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

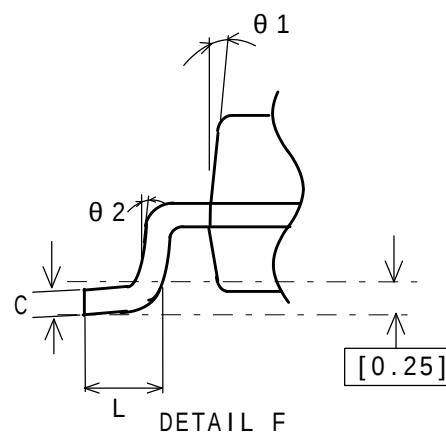
SOP8

■ 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
	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		

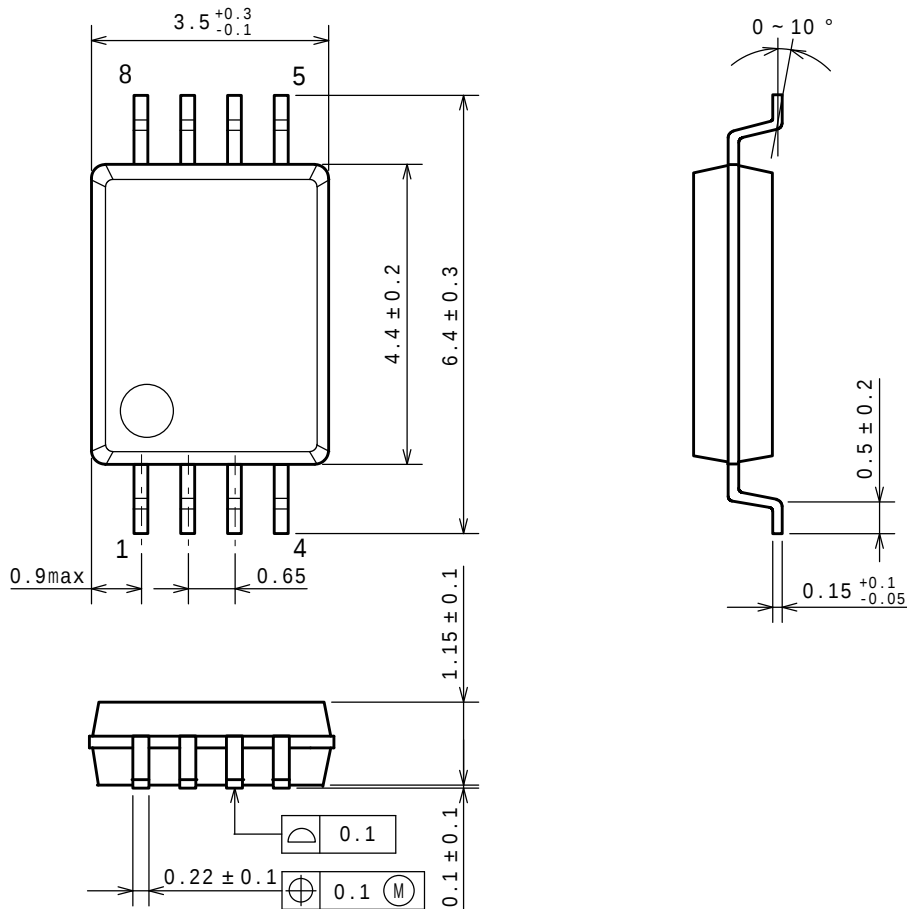


Unit: mm

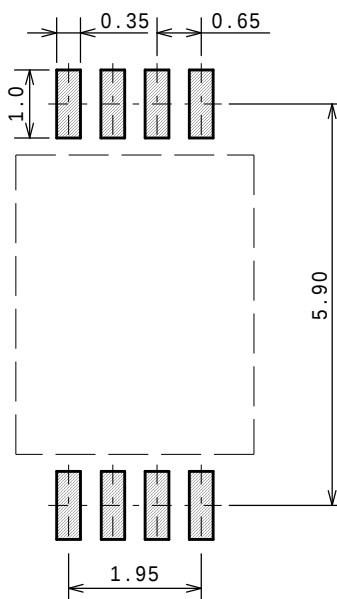
SSOP8

Unit: mm

■ PACKAGE DIMENSIONS



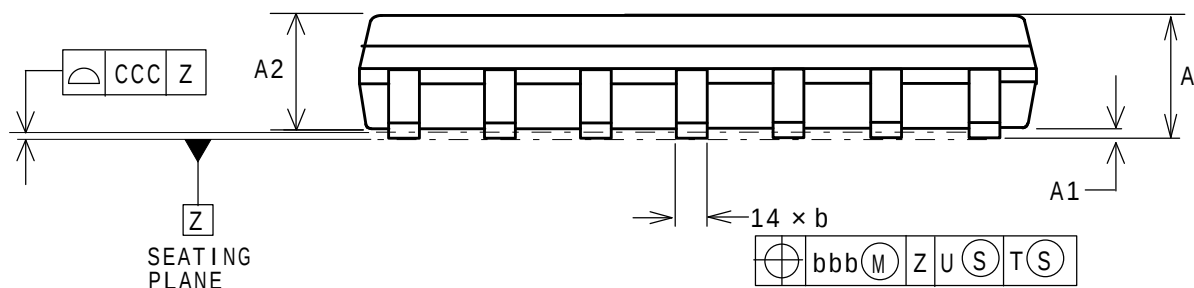
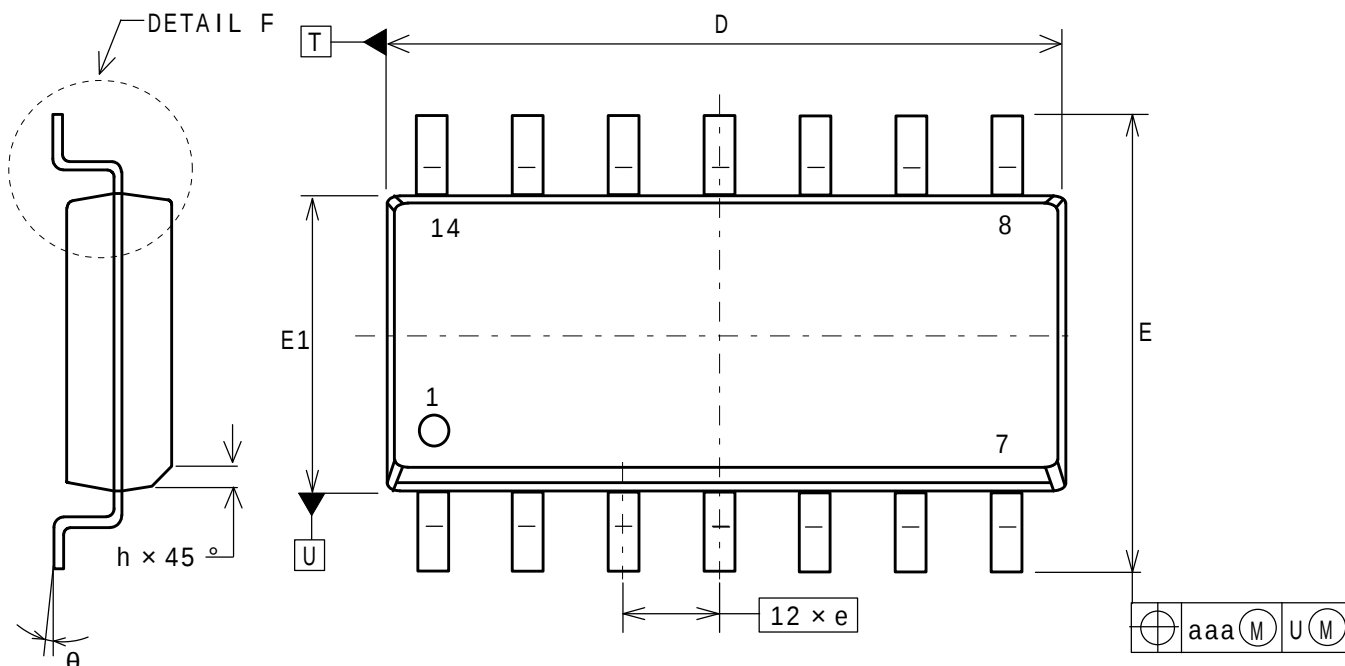
■ EXAMPLE OF SOLDER PADS DIMENSIONS



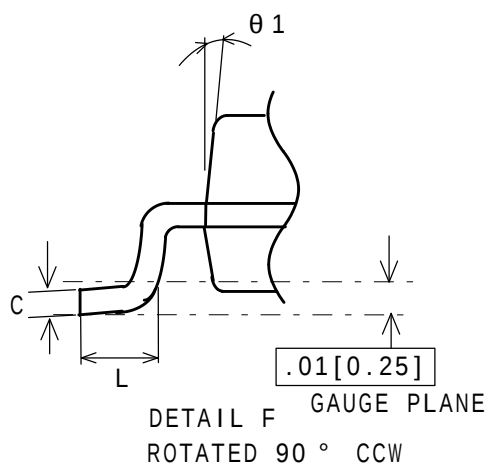
SOP14

Unit: mm

■ PACKAGE DIMENSIONS



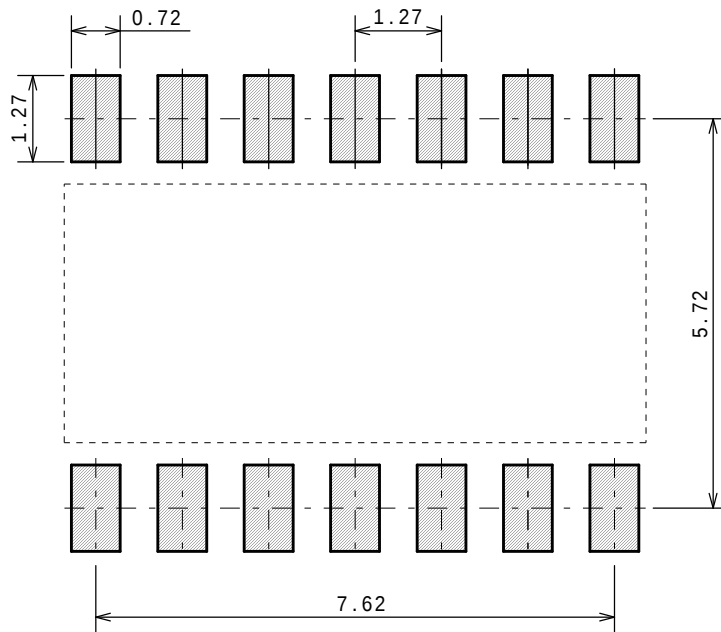
DESCRIPTION	SYMBOL	INCH			MILLIMETER		
		MIN	NCM	MAX	MIN	NCM	MAX
TOTAL THICKNESS	A	.053		.069	1.35		1.75
STAND OFF	A1	.004		.010	0.10		0.25
MOLD THICKNESS	A2	.049		-	1.25		-
LEAD WIDTH	b	.013		.020	0.33		0.51
L/F THICKNESS	C	.007		.010	0.19		0.25
BODY SIZE	D	.337		.344	8.55		8.75
	E1	.150		.157	3.80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

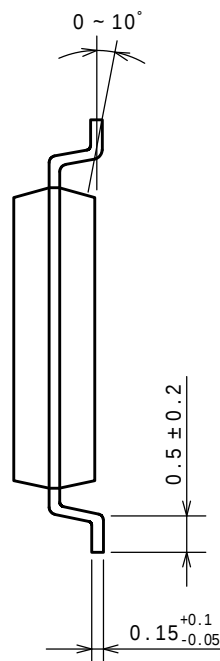
■ EXAMPLE OF SOLDER PADS DIMENSIONS



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 (Ra) and 0.10 (M) (Rz).

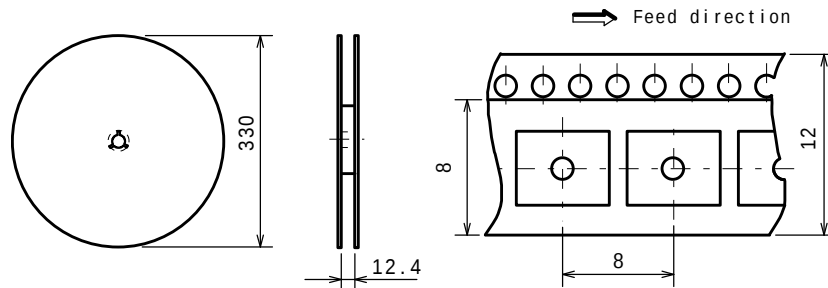


SOP8

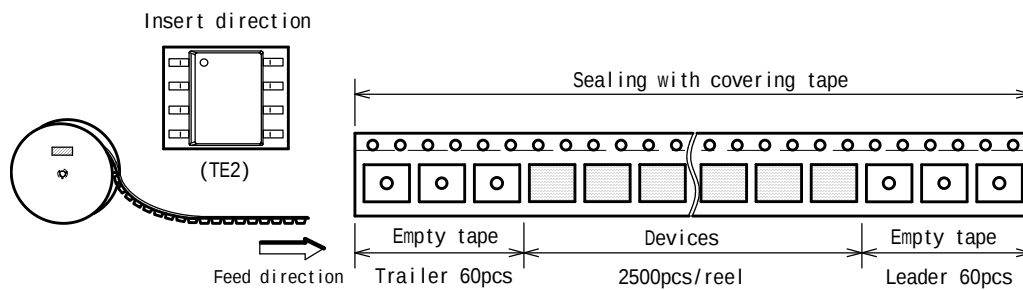
■ PACKING SPEC

Unit: mm

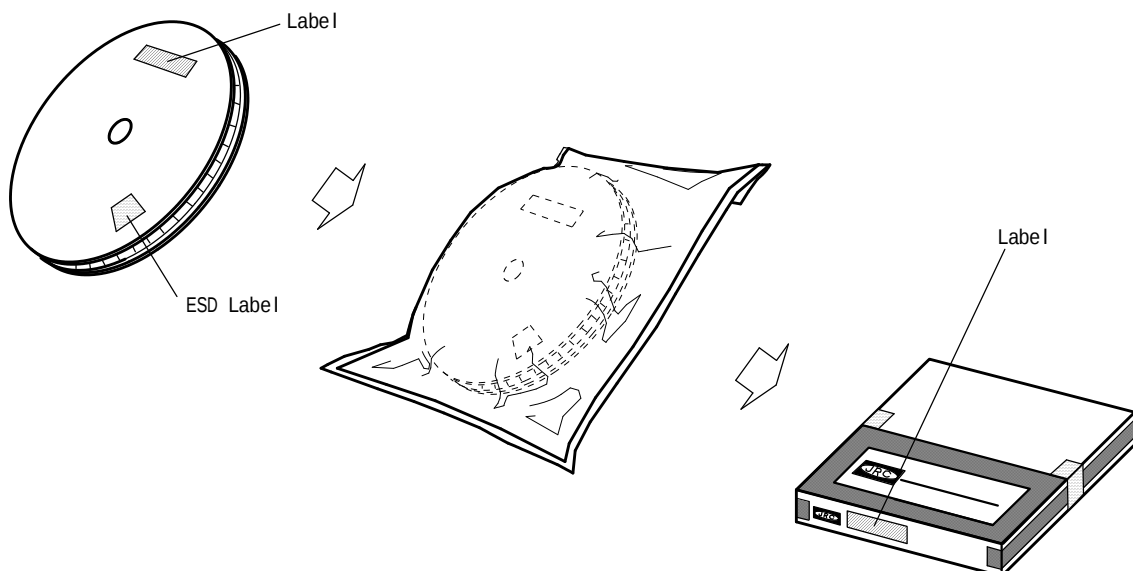
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

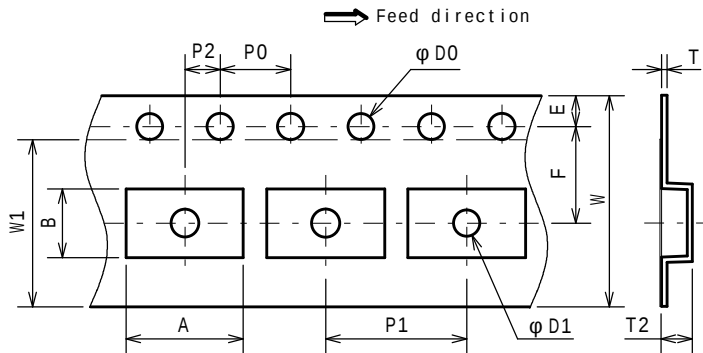


SSOP8

PACKING SPEC

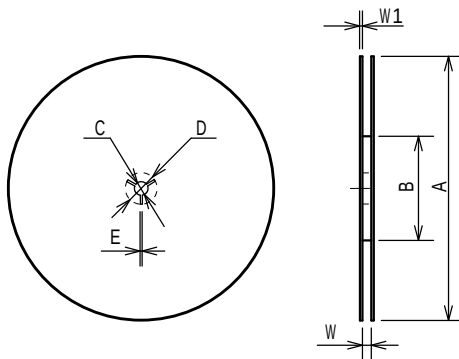
Unit: mm

TAPING DIMENSIONS



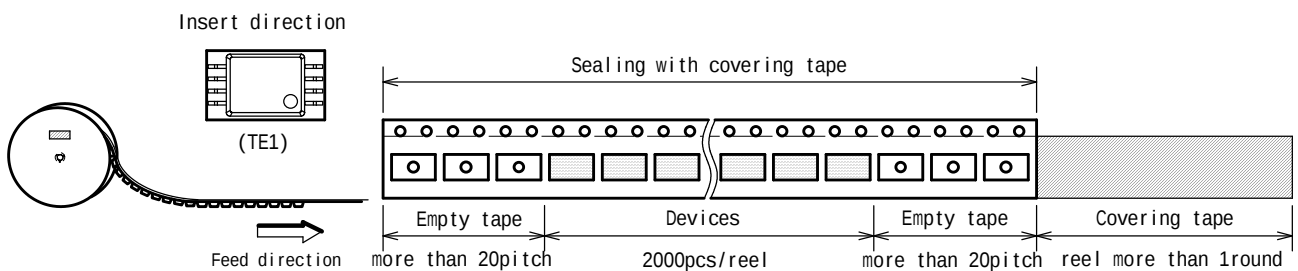
SYMBOL	DIMENSION	REMARKS
A	6.7	BOTTOM DIMENSION
B	3.9	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

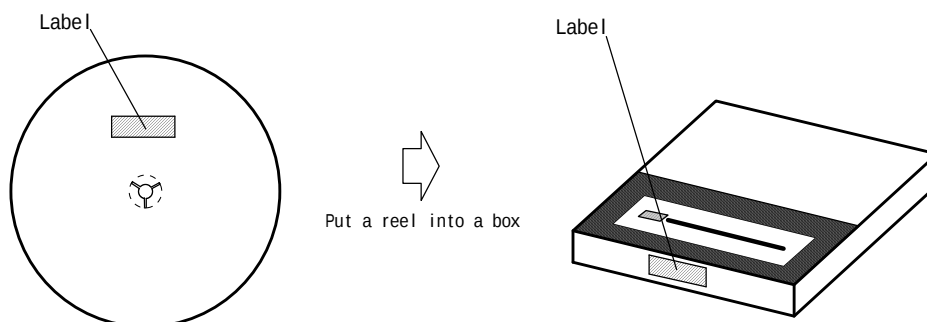


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

TAPING STATE



PACKING STATE

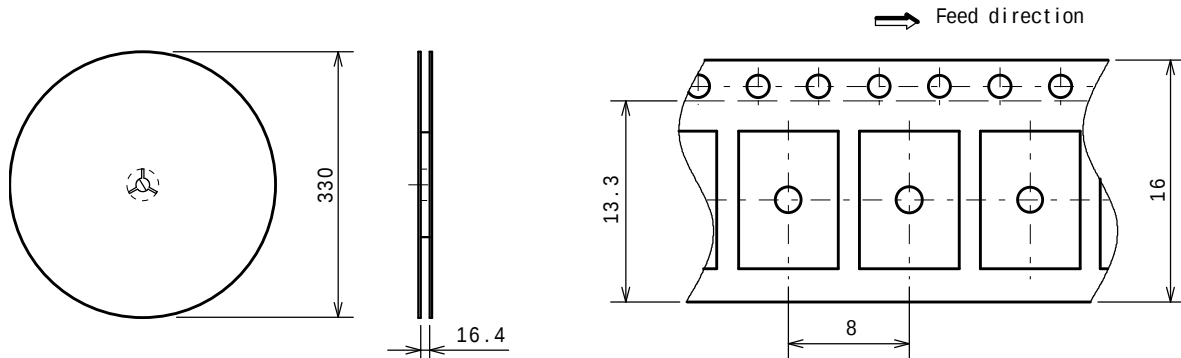


SOP14

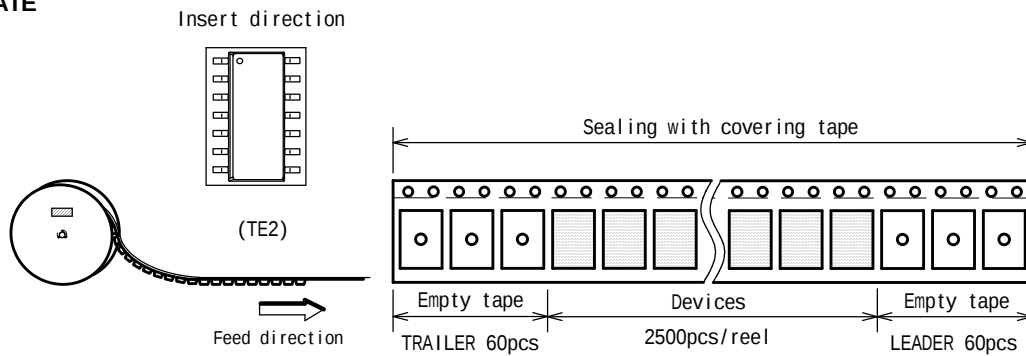
■ PACKING SPEC

Unit: mm

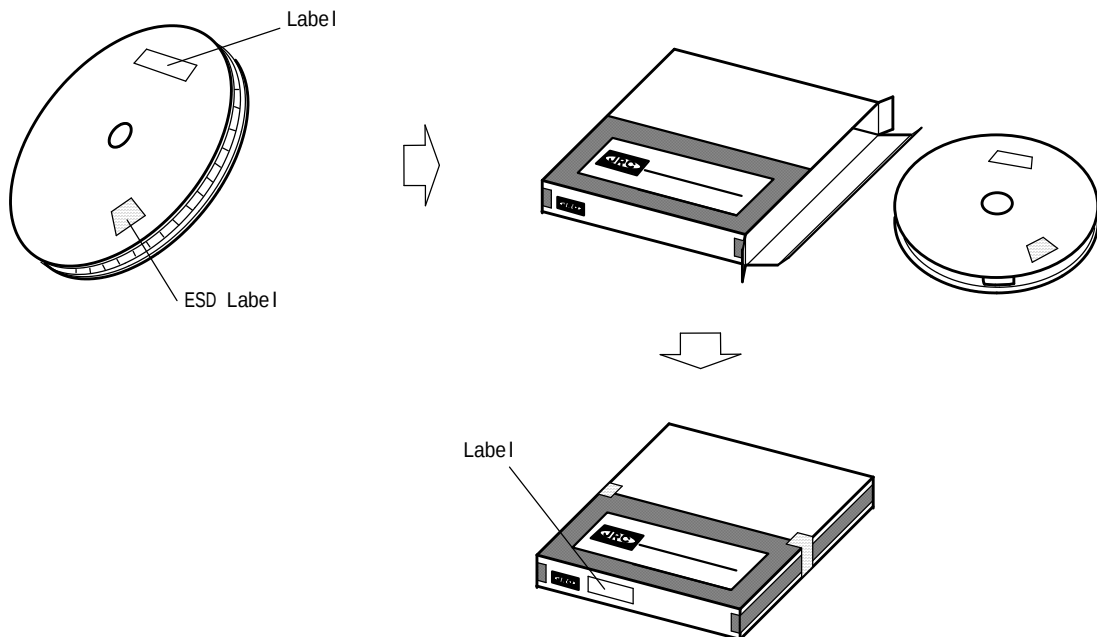
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

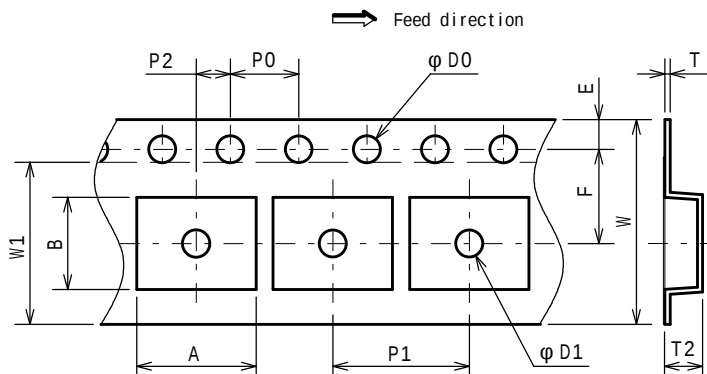


SSOP14

PACKING SPEC

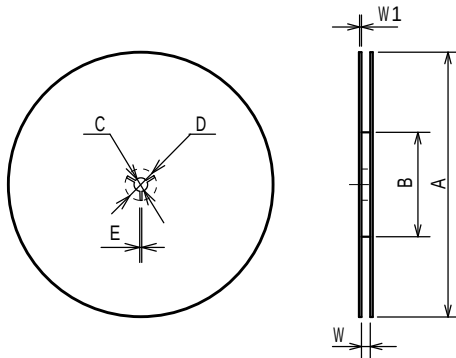
Unit: mm

TAPING DIMENSIONS



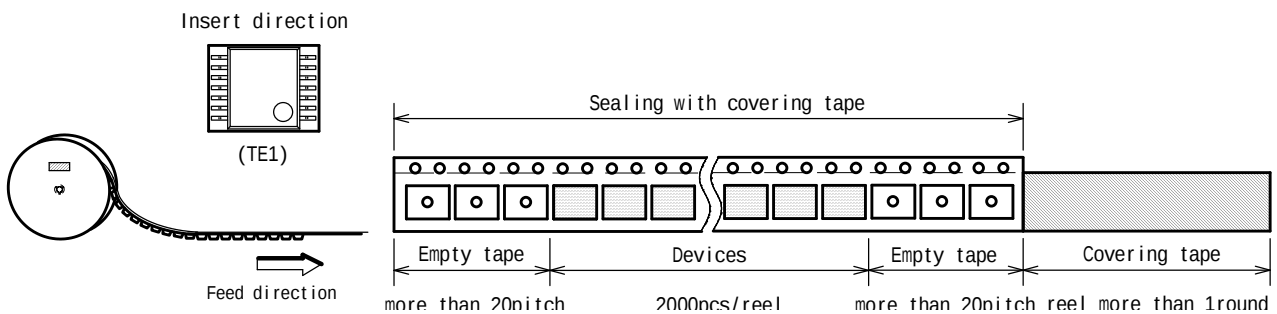
SYMBOL	DIMENSION	REMARKS
A	6.95	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55 ± 0.05	
D1	1.55 ± 0.1	
E	1.75 ± 0.1	
F	5.5 ± 0.05	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.2	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

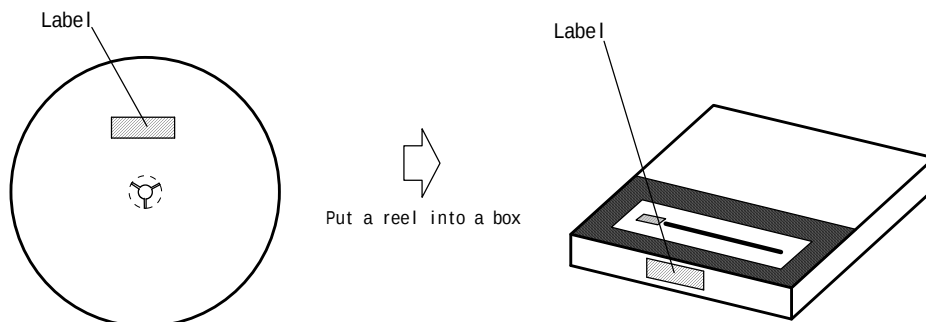


SYMBOL	DIMENSION
A	$\phi 254 \pm 2$
B	$\phi 100 \pm 1$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	13.5 ± 0.5
W1	2 ± 0.2

TAPING STATE

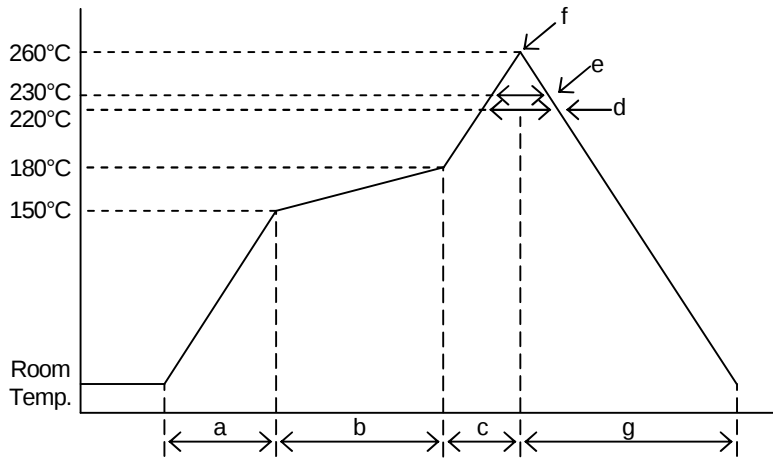


PACKING STATE



■ 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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