

High-Speed, Rail-to-Rail I/O, Dual CMOS Operational Amplifier

■ FEATURES

- Operating Voltage: 2.7V to 5.5V
- High speed SR=9V/ μ s. typ(at V_{DD} = 5V)
GBW=5MHz typ
- Rail-to-Rail Input/Output
- Low input bias current I_B =1pA typ
- Unity gain stable
- Enhanced RF noise Immunity
- Package
MSOP8(TVSP8)MEET JEDEC MO-187-DA/ THINTYPE
SOP8 JEDEC 150mil
- CMOS process
- Wide temperature range T_a =-40°C to 125°C

■ APPLICATIONS

- Current sensors / Sensor amplifiers
- Photodiode amplifiers
- ADC front ends
- ASIC input or output amplifiers
- Battery-powered instruments

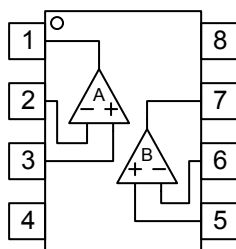
■ GENERAL DESCRIPTION

The NJU7047 is a dual rail to rail input/output operational amplifier featuring high speed, low input bias current and wide temperature range.

High-speed characteristics of slew rate(SR=9V/ μ s) and bandwidth (GBW=5MHz), low input bias current (I_B =1pA typ) and wide temperature range (T_a =-40°C to 125°C) makes NJU7047 especially suitable for sensors and filters application for industrial.

In addition to The NJU7047 featuring rail to rail input/output makes especially suitable for buffers of input and output for ADC, DAC, ASIC and other wide output swing devices.

■ PIN CONFIGURATION



MSOP8(TVSP8), SOP8
(Top View)

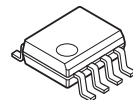
PIN FUNCTION

- 1: A OUTPUT
- 2: A -INPUT
- 3: A +INPUT
- 4: V_{SS}
- 5: B +INPUT
- 6: B -INPUT
- 7: B OUTPUT
- 8: V_{DD}

■ PACKAGE OUTLINE



NJU7047RB1
(MSOP8(TVSP8))



NJU7047E
(SOP8)

■ABSOLUTE MAXIMUM RATINGS(Ta=25°C unless otherwise noted.)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V _{DD}	+7	V
Input Common Mode Voltage	V _{ICM}	V _{SS} -0.3 to V _{DD} +0.3	V
Differential Input Voltage	V _{ID}	±7 (Note1)	V
Power Dissipation	P _D	[MSOP8] 510 (Note2), 670 (Note3)	mW
		[SOP8] 620 (Note2), 870 (Note3)	
Operating Temperature Range	T _{opr}	-40 to +125	°C
Storage Temperature Range	T _{stg}	-55 to +150	°C

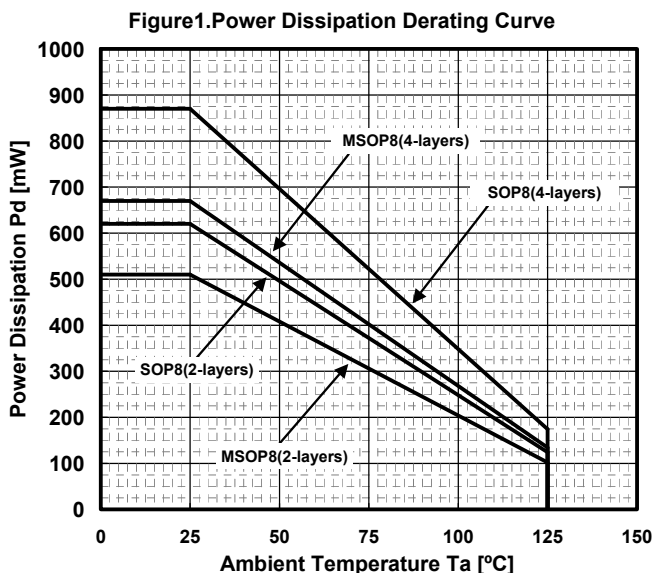
(Note1) For supply voltage less than +7V, the absolute maximum rating is equal to the supply voltage.

(Note2) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting.

(Note3) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting.

(Note4) Do not exceed "Power dissipation: P_D" in which power dissipation in IC is shown by the absolute maximum rating.

See Figure "Power Dissipation Curve" when ambient temperature is over 25°C.



■RECOMMENDED OPERATING CONDITION (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	2.7 to 5.5	V

■ ELECTRICAL CHARACTERISTICS

DC CHARACTER ($V_{DD}=5V$, $V_{SS}=0V$, $T_a=25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC}	No Signal	-	1.4	2.2	mA
Input Offset Voltage	V_{IO}	$V_{ICM}=5V$	-	0.9	5	mV
		$V_{ICM}=2.5V$	-	0.9	5	mV
		$V_{ICM}=0V$	-	0.9	5	mV
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$		-	2	-	$\mu V/^\circ C$
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open Loop Gain	A_V	$V_{out}=1.5V$ to $3.5V$, $R_L=10k\Omega$ to $2.5V$	90	110	-	dB
Common Mode Rejection Ratio	CMR	$V_{ICM}=0V$ to $5V$	60	80	-	dB
Supply Voltage Rejection Ratio	SVR	$V_{DD}=2.7V$ to $5.5V$, $V_{ICM}=0V$	65	90	-	dB
Maximum Output Voltage	V_{OH}	$R_L=10k\Omega$ to $2.5V$	4.95	4.99	-	V
		$R_L=600\Omega$ to $2.5V$	4.88	4.93	-	V
	V_{OL}	$R_L=10k\Omega$ to $2.5V$	-	0.01	0.05	V
		$R_L=600\Omega$ to $2.5V$	-	0.07	0.12	V
Common Mode Input Voltage Range	V_{ICM}	CMR \geq 60dB	0	-	5	V

AC CHARACTER ($V_{DD}=5V$, $V_{SS}=0V$, $V_{ICM}=2.5V$, $T_a=25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	5	-	MHz
Phase Margin	ϕ_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	70	-	deg
Gain Margin	G_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	16	-	dB
Equivalent Input Noise Voltage	V_{NI}	$f=1kHz$	-	20	-	nV/\sqrt{Hz}
Slew Rate	SR	$G_V=0dB$, $R_L=10k\Omega$, $C_L=20pF$, $V_{IN}=2V_{PP}$	5	9	-	$V/\mu s$
Total Harmonic Distortion	THD	$G_V=0dB$, $R_L=10k\Omega$, $f=1kHz$, $V_O=1V_{rms}$	-	0.01	-	%

■ ELECTRICAL CHARACTERISTICS

DC CHARACTER ($V_{DD}=2.7V$, $V_{SS}=0V$, $T_a=25^\circ C$, unless otherwise noted.)

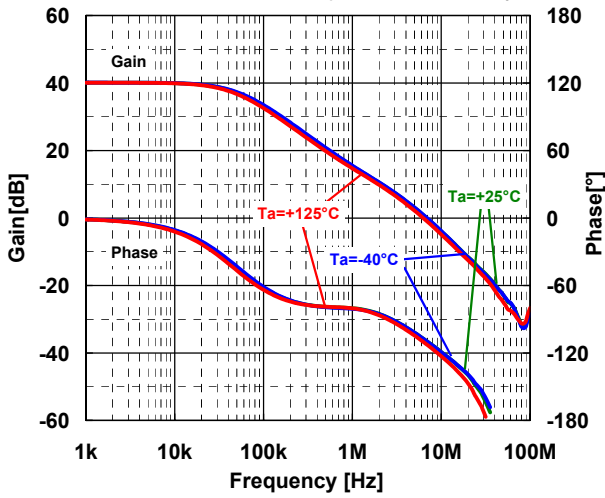
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC}	No Signal	-	1.2	2	mA
Input Offset Voltage	V_{IO}	$V_{ICM}=2.7V$	-	0.9	5	mV
		$V_{ICM}=1.35V$	-	0.9	5	mV
		$V_{ICM}=0V$	-	0.9	5	mV
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$		-	2	-	$\mu V/^\circ C$
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open Loop Gain	A_V	$V_{out}=0.35V$ to $2.35V$, $R_L=10k\Omega$ to $1.35V$	90	110	-	dB
Common Mode Rejection Ratio	CMR	$V_{ICM}=0V$ to $2.7V$	55	75	-	dB
Maximum Output Voltage	V_{OH}	$R_L=10k\Omega$ to $1.35V$	2.65	2.69	-	V
		$R_L=600\Omega$ to $1.35V$	2.6	2.64	-	V
	V_{OL}	$R_L=10k\Omega$ to $1.35V$	-	0.01	0.05	V
		$R_L=600\Omega$ to $1.35V$	-	0.05	0.1	V
Common Mode Input Voltage Range	V_{ICM}	CMR \geq 55dB	0	-	2.7	V

AC CHARACTER ($V_{DD}=5V$, $V_{SS}=0V$, $V_{ICM}=2.5V$, $T_a=25^\circ C$, unless otherwise noted.)

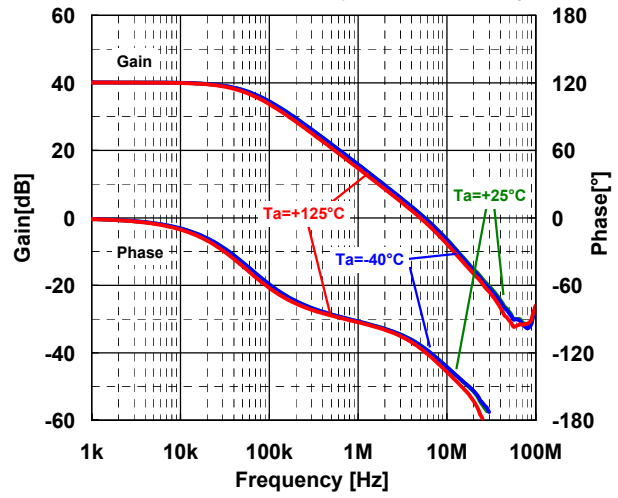
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	5	-	MHz
Phase Margin	ϕ_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	65	-	deg
Gain Margin	G_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	18	-	dB
Equivalent Input Noise Voltage	V_{NI}	$f=1kHz$	-	20	-	nV/\sqrt{Hz}
Slew Rate	SR	$G_V=0dB$, $R_L=10k\Omega$, $C_L=20pF$, $V_{IN}=2V_{PP}$	3.5	7	-	$V/\mu s$
Total Harmonic Distortion	THD	$G_V=0dB$, $R_L=10k\Omega$, $f=1kHz$, $V_O=1V_{rms}$	-	0.02	-	%

TYPICAL CHARACTERISTICS

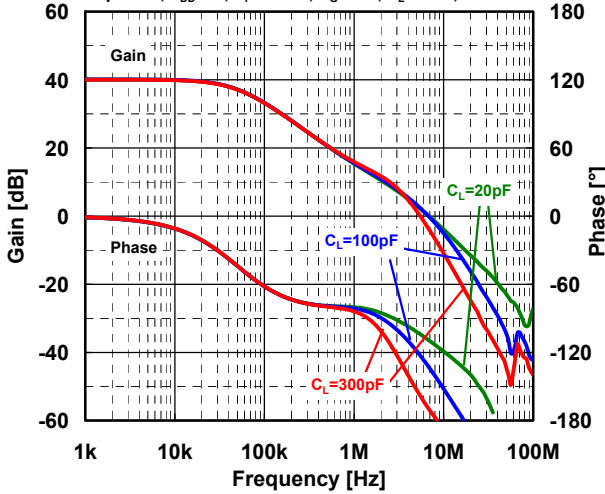
Gain/Phase vs. Frequency (Temperature)
 $G_V=40\text{dB}$, $V_{DD}=5\text{V}$, $R_F=100\text{k}\Omega$, $R_G=1\text{k}\Omega$, $R_L=10\text{k}\Omega$, $C_L=20\text{pF}$



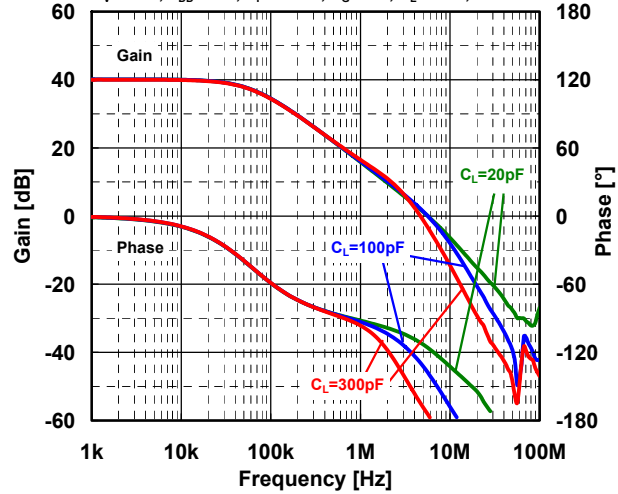
Gain/Phase vs. Frequency (Temperature)
 $G_V=40\text{dB}$, $V_{DD}=2.7\text{V}$, $R_F=100\text{k}\Omega$, $R_G=1\text{k}\Omega$, $R_L=10\text{k}\Omega$, $C_L=20\text{pF}$



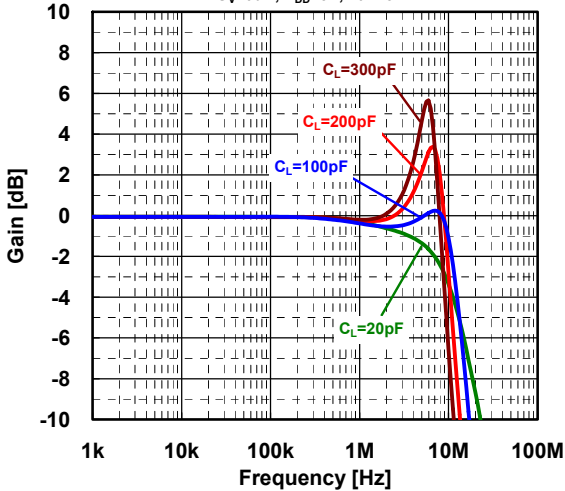
Gain/Phase vs. Frequency (Load Capacitance)
 $G_V=40\text{dB}$, $V_{DD}=5\text{V}$, $R_F=100\text{k}\Omega$, $R_G=1\text{k}\Omega$, $R_L=10\text{k}\Omega$, $T_a=25^\circ\text{C}$



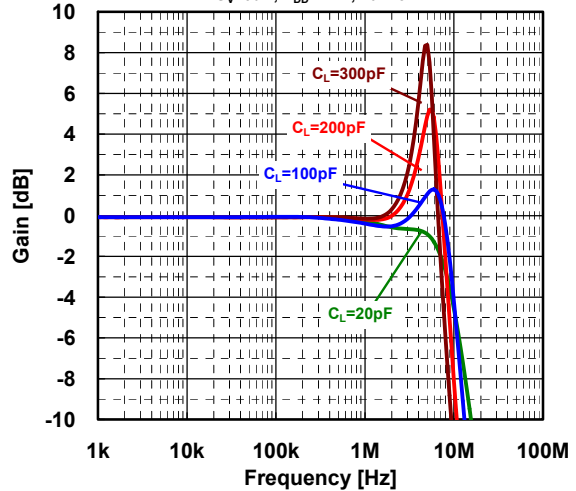
Gain/Phase vs. Frequency (Load Capacitance)
 $G_V=40\text{dB}$, $V_{DD}=2.7\text{V}$, $R_F=100\text{k}\Omega$, $R_G=1\text{k}\Omega$, $R_L=10\text{k}\Omega$, $T_a=25^\circ\text{C}$



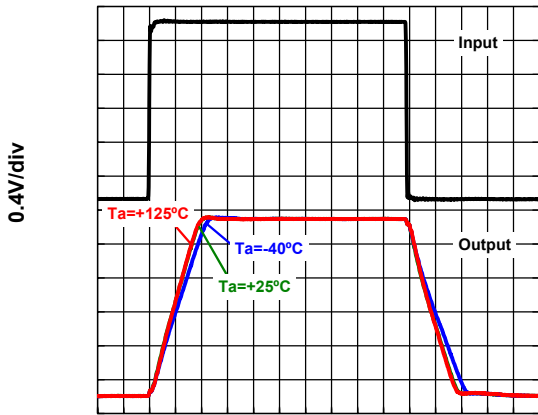
Unity Gain Frequency Response (Load Capacitance)
 $G_V=0\text{dB}$, $V_{DD}=5\text{V}$, $T_a=25^\circ\text{C}$



Unity Gain Frequency Response (Load Capacitance)
 $G_V=0\text{dB}$, $V_{DD}=2.7\text{V}$, $T_a=25^\circ\text{C}$

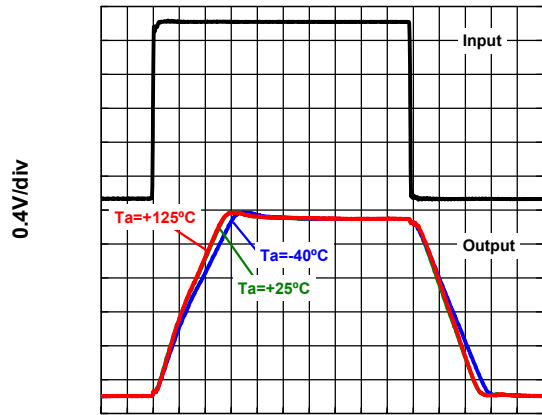


Transient Response (Temperature)
 $V_{DD}=5V$, $V_{IN}=2V_{pp}$, $R_L=10k\Omega$, $C_L=20pF$



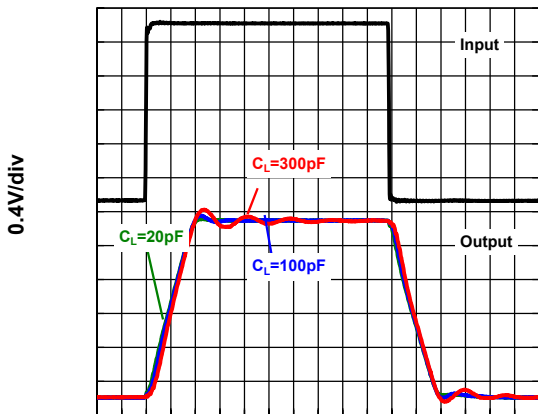
0.1µs/div

Transient Response (Temperature)
 $V_{DD}=2.7V$, $V_{IN}=2V_{pp}$, $R_L=10k\Omega$, $C_L=20pF$



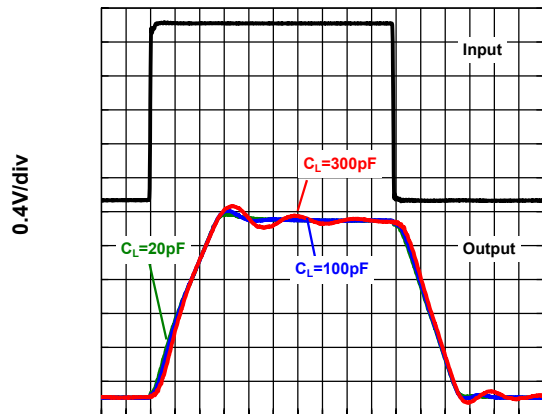
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Transient Response (Load Capacitance)
 $V_{DD}=5V$, $V_{IN}=2V_{pp}$, $R_L=10k\Omega$, $T_a=25^\circ C$



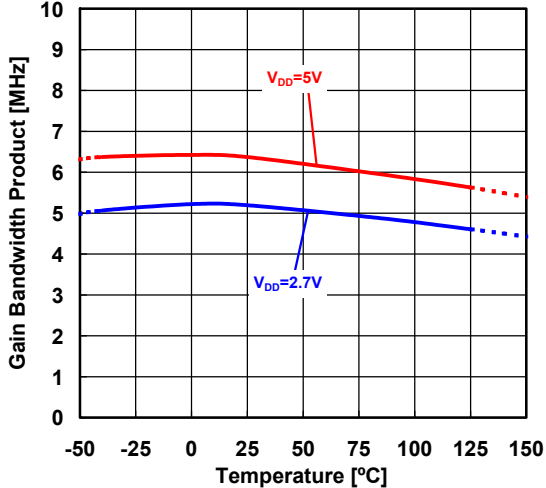
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Transient Response (Load Capacitance)
 $V_{DD}=2.7V$, $V_{IN}=2V_{pp}$, $R_L=10k\Omega$, $T_a=25^\circ C$

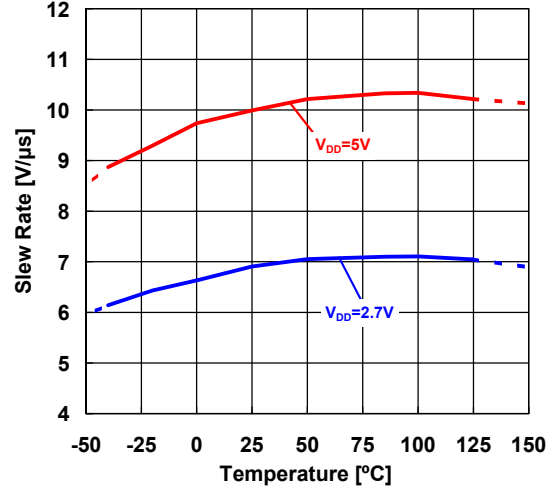


0.1µs/div

Gain Bandwidth Product vs. Temperature
 $G_V=40dB$, $R_L=10k\Omega$, $C_L=20pF$

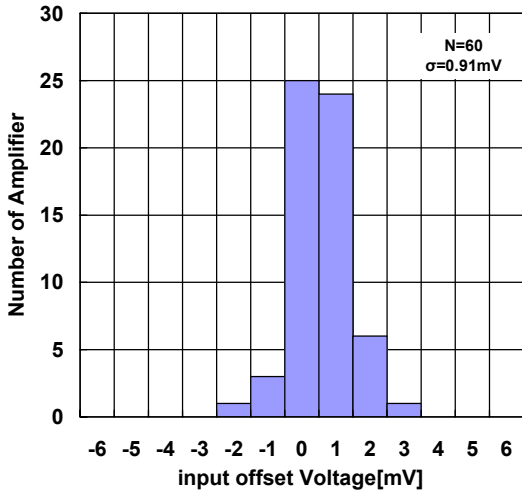


Slew Rate vs. Temperature (Supply Voltage)
 $G_V=0dB$, $V_{IN}=1V_{pp}$, $R_L=10k\Omega$, $C_L=20pF$



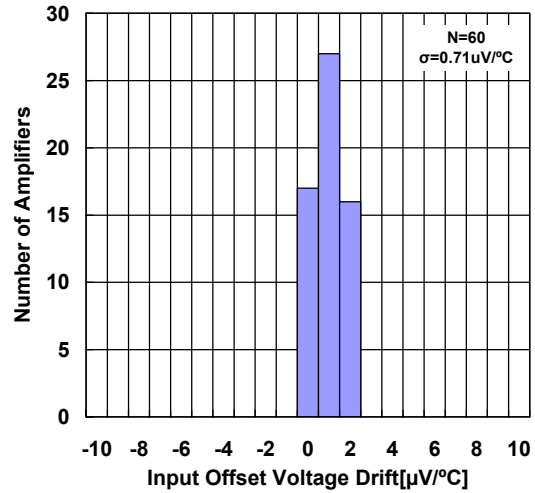
Input Offset Voltage Distribution

$V_{DD}=5V, V_{ICM}=2.5V, T_a=25^\circ C$



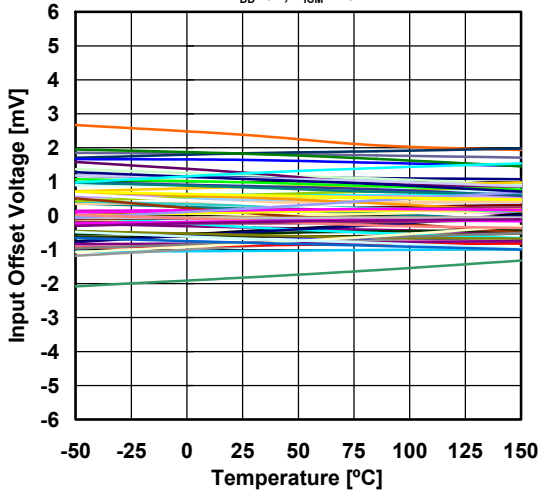
Input Offset Voltage Drift Distribution

$V_{DD}=5V, V_{ICM}=2.5V, T_a=-40^\circ C$ to $125^\circ C$



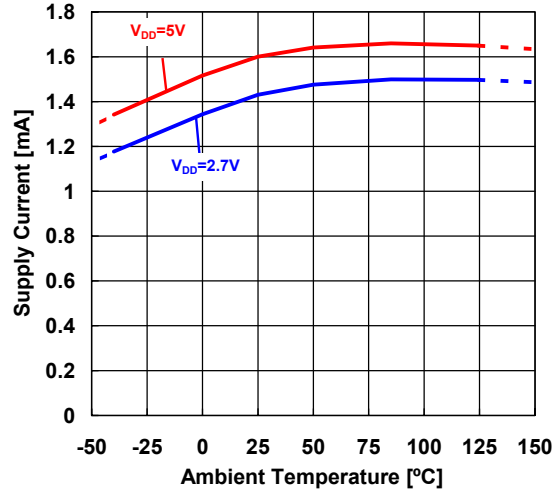
Input Offset Voltage vs. Temperature

$V_{DD}=5V, V_{ICM}=2.5V$



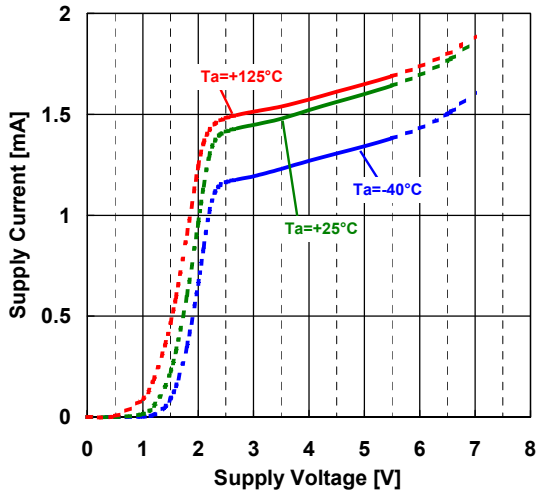
Supply Current vs. Temperature

$V_{ICM}=V_{DD}/2$



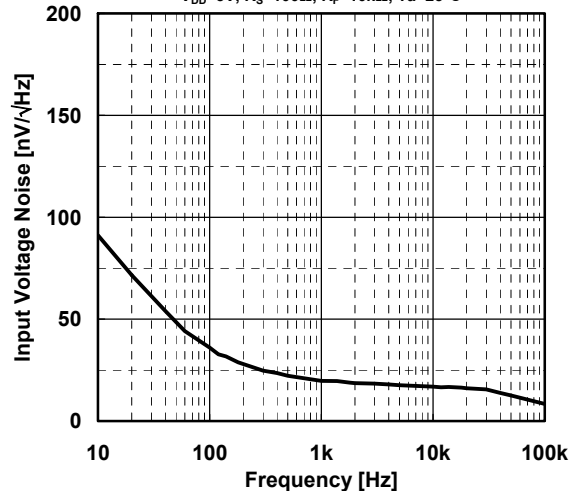
Supply Current vs. Supply Voltage (Temperature)

$V_{ICM}=V_{DD}/2$

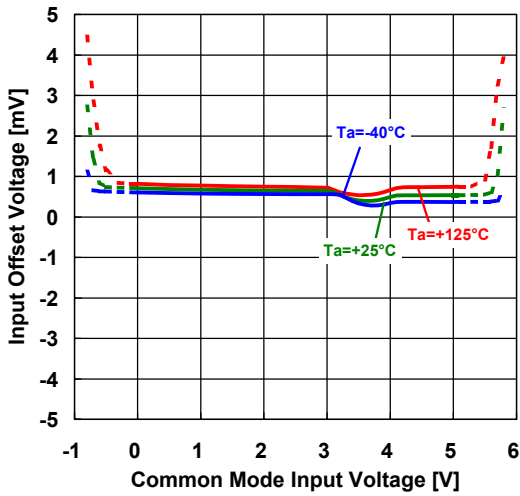


Input Voltage Noise vs. Frequency

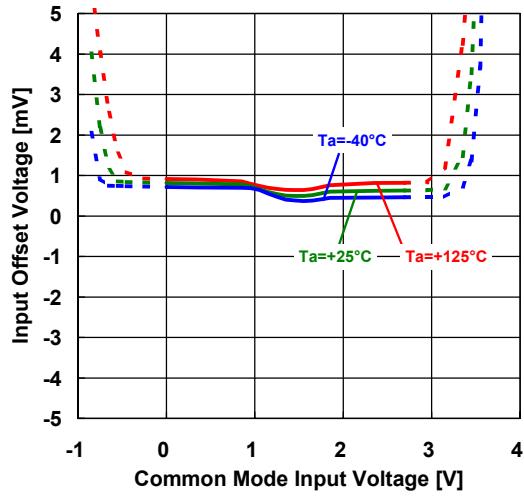
$V_{DD}=5V, R_S=100\Omega, R_F=10k\Omega, T_a=25^\circ C$



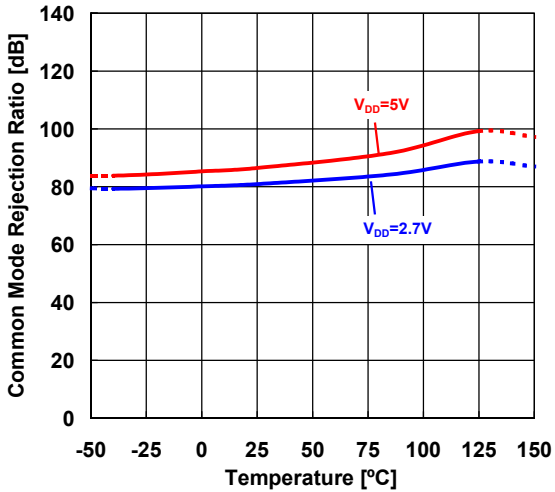
Input Offset Voltage vs. Common Mode Input Voltage (Temperature)
 $V_{DD}=5V, V_{ICM}=V_{DD}/2$



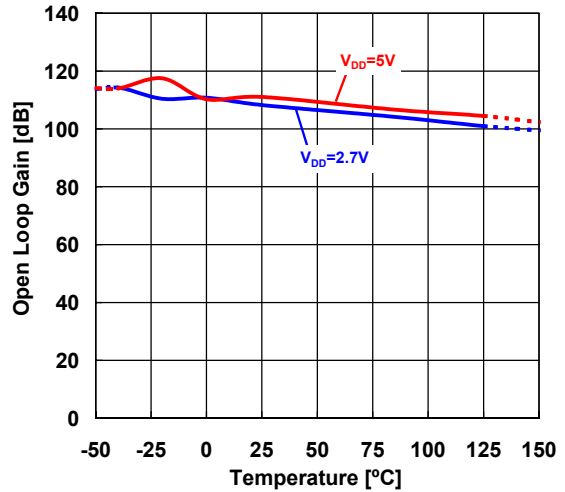
Input Offset Voltage vs. Common Mode Input Voltage (Temperature)
 $V_{DD}=2.7V, V_{ICM}=V_{DD}/2$



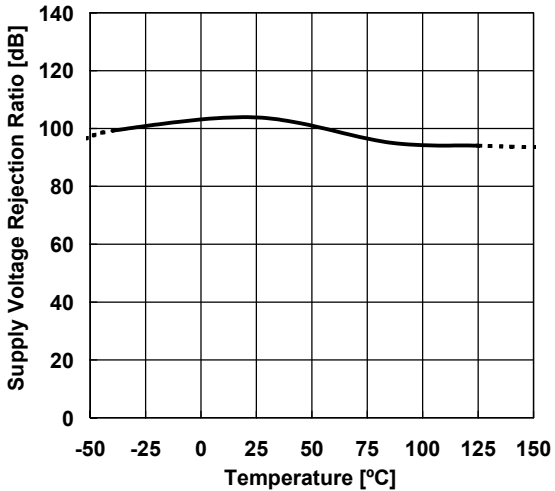
CMR vs. Temperature (Supply Voltage)
 $V_{ICM}=V_{SS} \text{ to } V_{DD}$



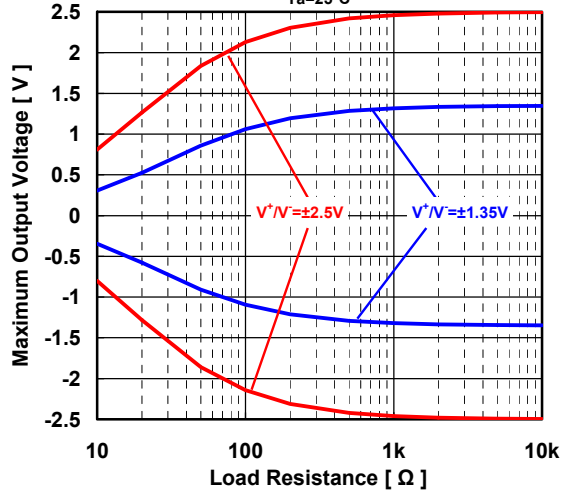
Open Loop Gain vs. Temperature (Supply Voltage)
 $V_O=V_{DD}/2 \pm 1V$

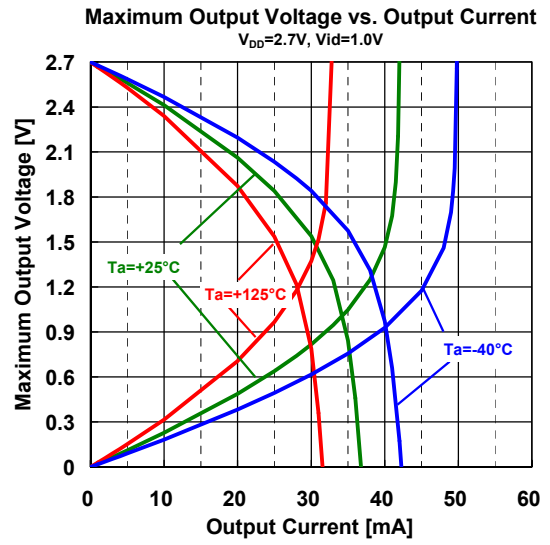
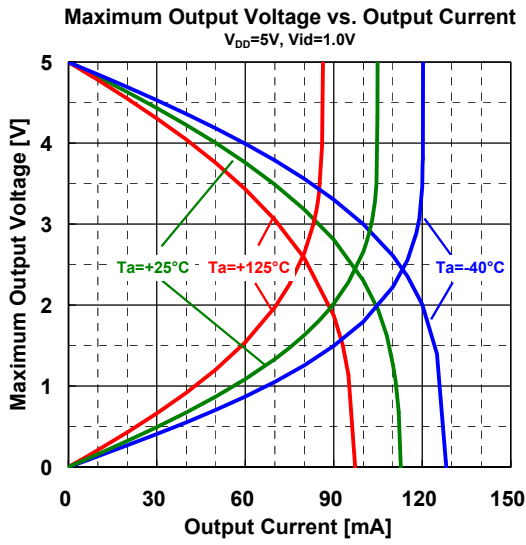


SVR vs. Temperature
 $V_{DD}=2.7V \text{ to } 5.5V$



Maximum Output Voltage vs. Load Resistance
 $T_a=25^\circ C$

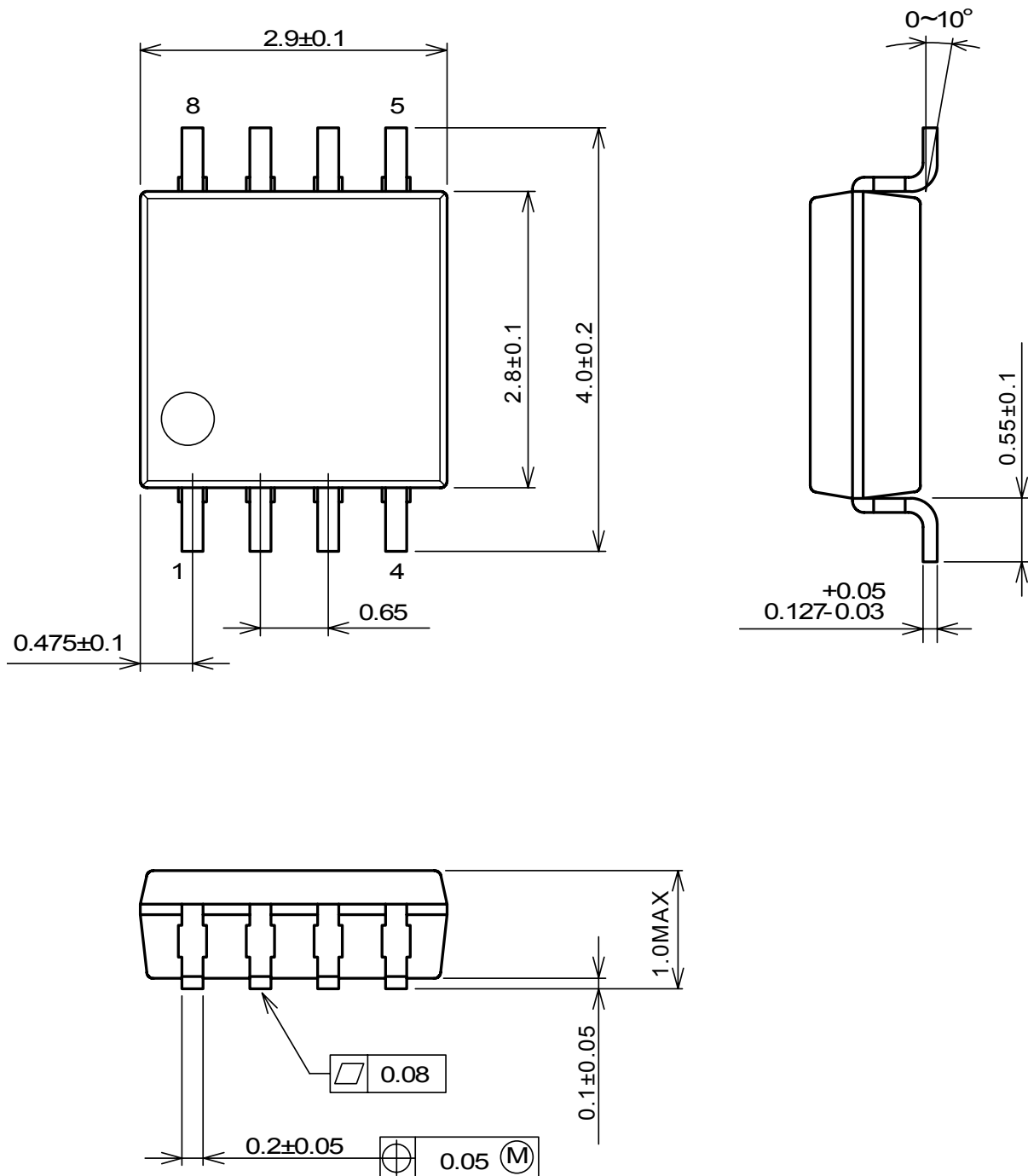




NJU7047

■ PACKAGE DIMENSIONS

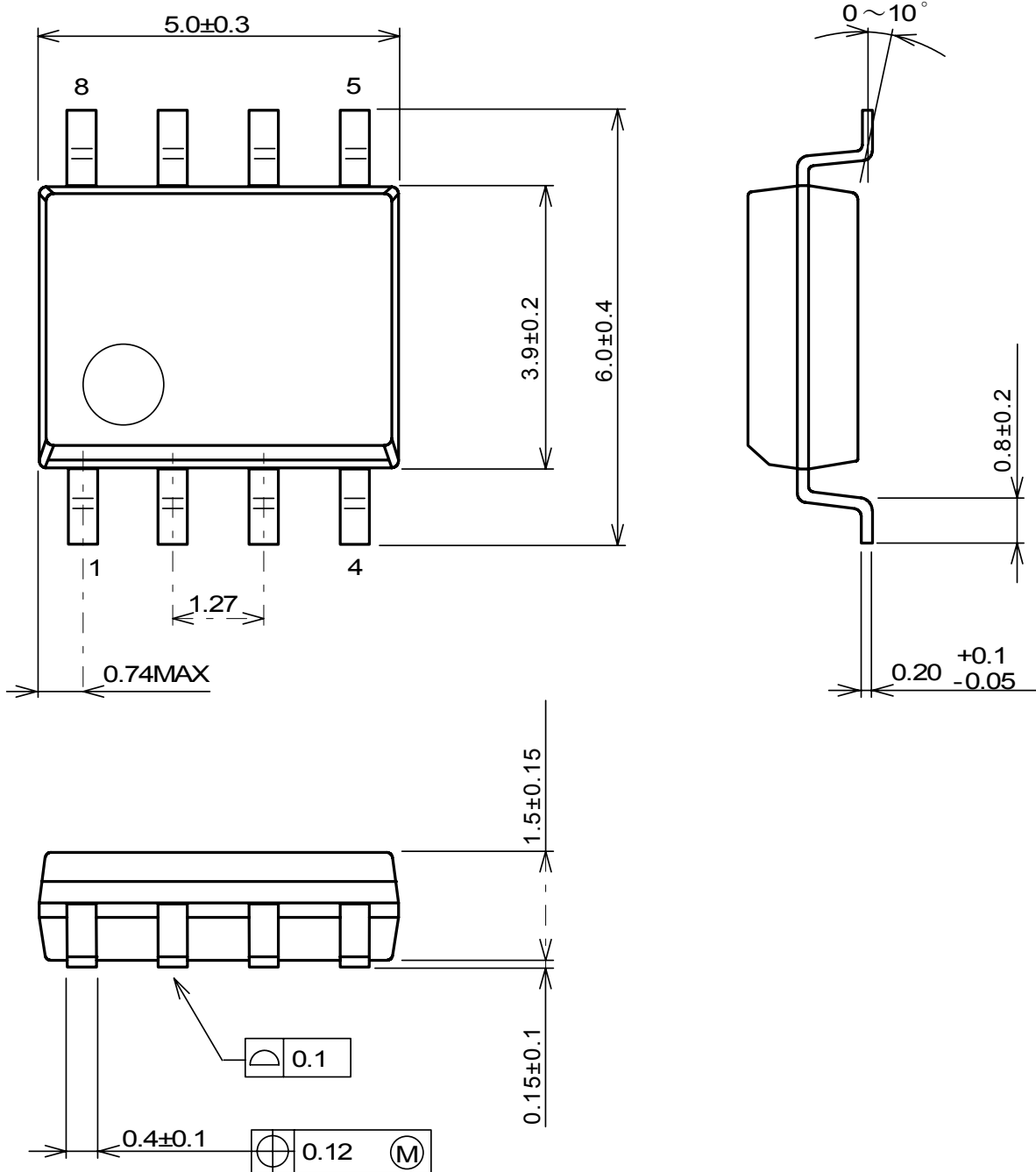
MSOP8(TVSP8)



UNIT: mm

■ PACKAGE DIMENSIONS

SOP8



UNIT: mm

■ MEMO

[CAUTION]

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