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

■ FEATURES

- Operating Voltage: 2.7V to 5.5V
- High speed SR=9V/μs. 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 Ta=−40℃ to 125℃

■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.

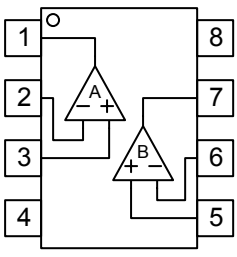
High-speed characteristics of slew rate(SR=9V/us) and bandwidth (GBW=5MHz), low input bias current (I_B=1pA typ) and wide temperature range (Ta=−40℃ to 125℃) makes NJU7047 especially suitable for sensors and filters application for industrial.

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.

■APPLICATIONS

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

■PIN CONFIGURATION



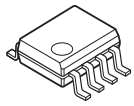
MSOP8(TVSP8), SOP8
(Top View)

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))



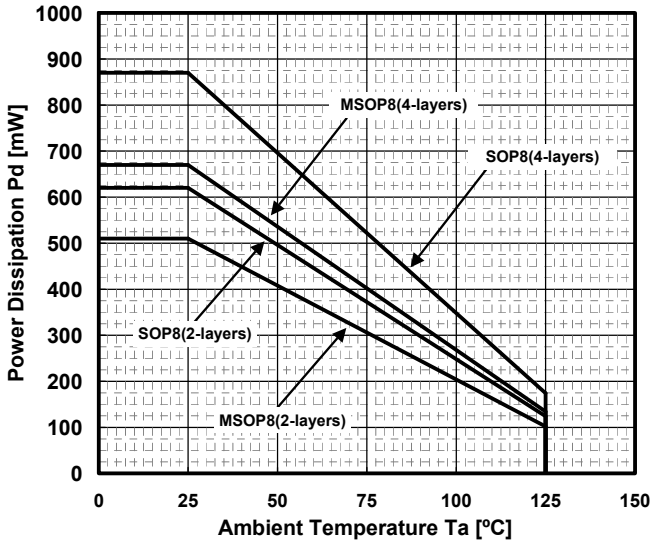
NJU7047E
(SOP8)

■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.

Figure1.Power Dissipation Derating Curve



■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, Ta=25˚C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	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	ΔVio/ΔT		-	2	-	μV/°C
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open Loop Gain	A_V	Vout=1.5V to 3.5V, R_L=10kΩ 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=10kΩ to 2.5V	4.95	4.99	-	V
		R_L=600Ω to 2.5V	4.88	4.93	-	V
	V_{OL}	R_L=10kΩ to 2.5V	-	0.01	0.05	V
		R_L=600Ω to 2.5V	-	0.07	0.12	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥60dB	0	-	5	V

AC CHARACTER (V_{DD}=5V, V_{SS}=0V, V_{ICM}=2.5V, Ta=25˚C, unless otherwise noted.)

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

■ELECTRICAL CHARACTERISTICS

DC CHARACTER (V_{DD}=2.7V, V_{SS}=0V, Ta=25˚C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	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	ΔVio/ΔT		-	2	-	μV/°C
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open Loop Gain	A_V	Vout=0.35V to 2.35V, R_L=10kΩ 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=10kΩ to 1.35V	2.65	2.69	-	V
		R_L=600Ω to 1.35V	2.6	2.64	-	V
	V_{OL}	R_L=10kΩ to 1.35V	-	0.01	0.05	V
		R_L=600Ω to 1.35V	-	0.05	0.1	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥55dB	0	-	2.7	V

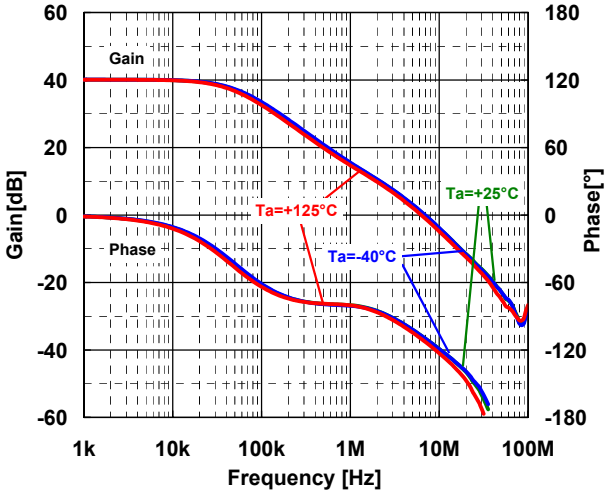
AC CHARACTER (V_{DD}=5V, V_{SS}=0V, V_{ICM}=2.5V, Ta=25˚C, unless otherwise noted.)

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

■TYPICAL CHARACTERISTICS

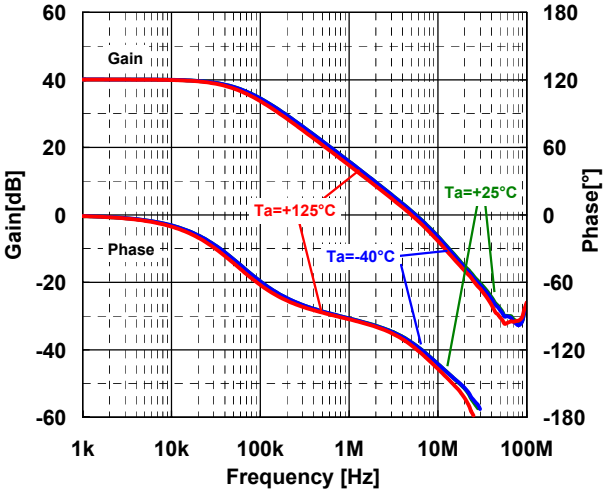
Gain/Phase vs. Frequency (Temperature)

G_V=40dB, V_{DD}=5V, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, C_L=20pF



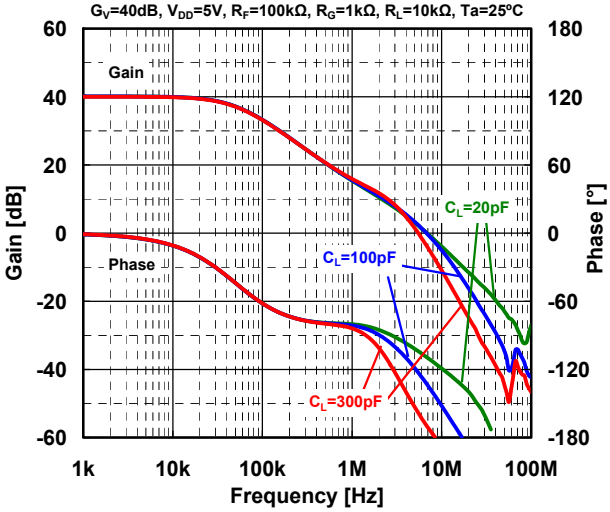
Gain/Phase vs. Frequency (Temperature)

G_V=40dB, V_{DD}=2.7V, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, C_L=20pF



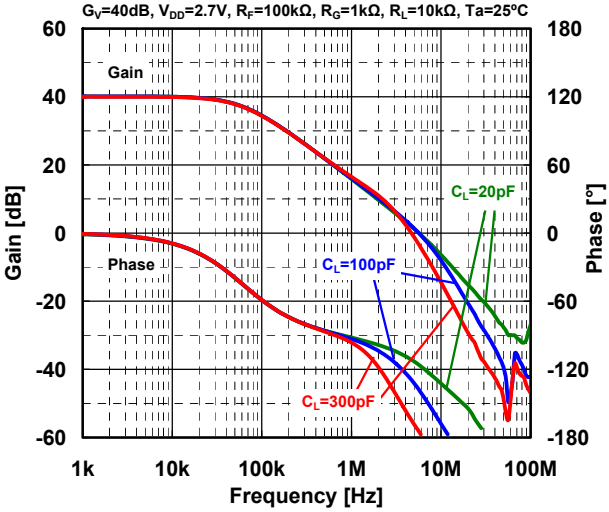
Gain/Phase vs. Frequency (Load Capacitance)

G_V=40dB, V_{DD}=5V, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, Ta=25°C



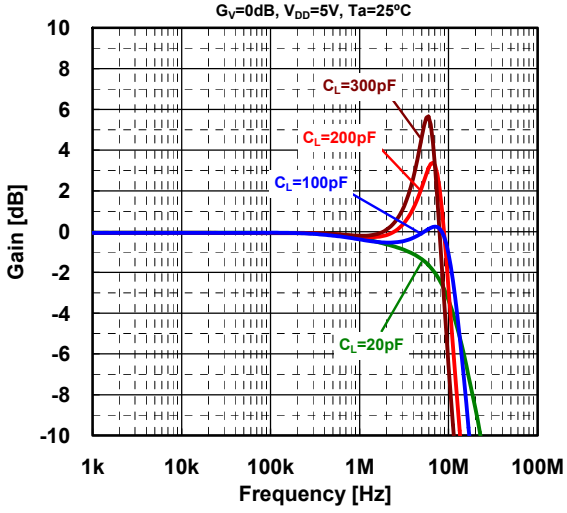
Gain/Phase vs. Frequency (Load Capacitance)

G_V=40dB, V_{DD}=2.7V, R_F=100kΩ, R_G=1kΩ, R_L=10kΩ, Ta=25°C



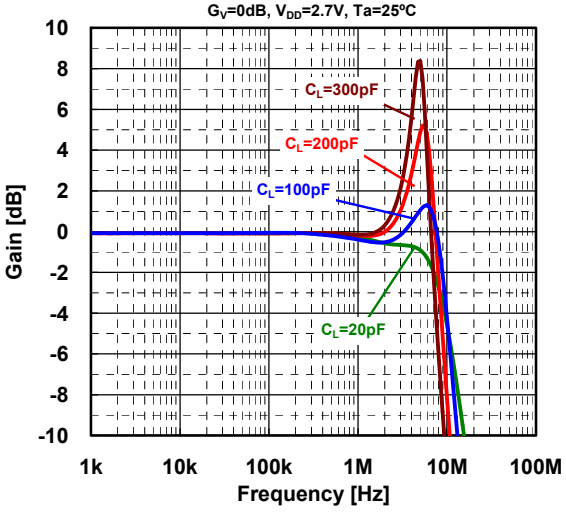
Unity Gain Frequency Response (Load Capacitance)

G_V=0dB, V_{DD}=5V, Ta=25°C

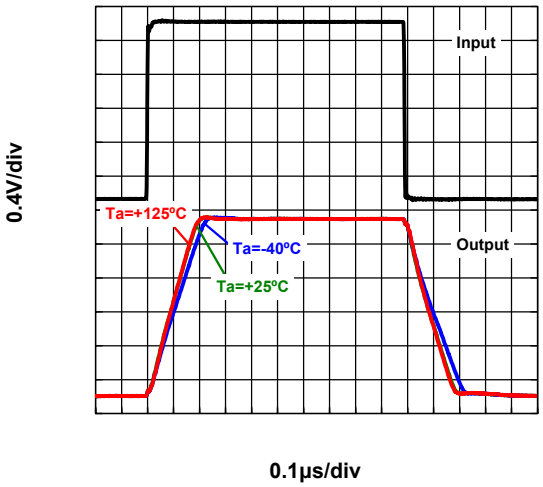


Unity Gain Frequency Response (Load Capacitance)

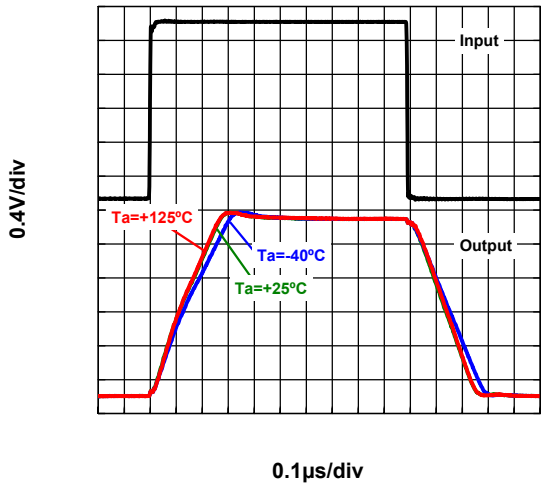
G_V=0dB, V_{DD}=2.7V, Ta=25°C



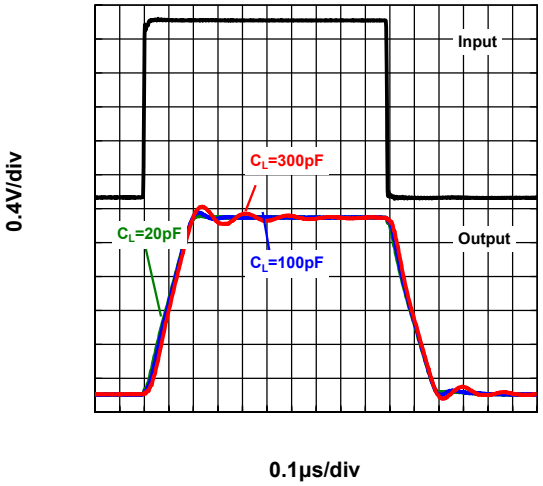
Transient Response (Temperature)
V_{DD}=5V, V_{IN}=2Vpp, R_L=10kΩ, C_L=20pF



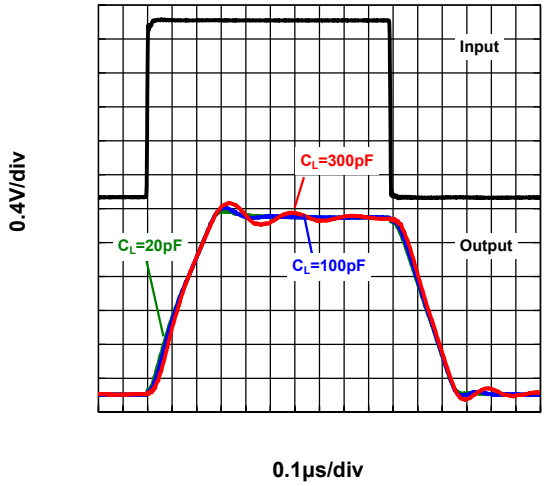
Transient Response (Temperature)
V_{DD}=2.7V, V_{IN}=2Vpp, R_L=10kΩ, C_L=20pF



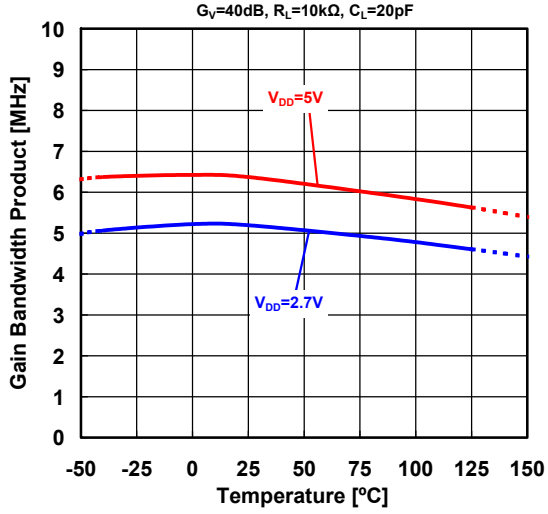
Transient Response (Load Capacitance)
V_{DD}=5V, V_{IN}=2Vpp, R_L=10kΩ, Ta=25°C



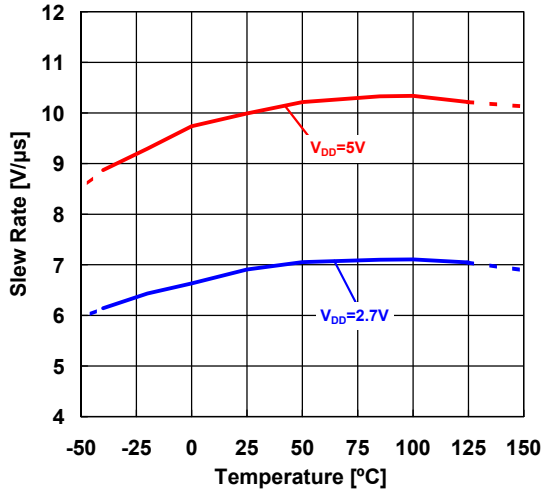
Transient Response (Load Capacitance)
V_{DD}=2.7V, V_{IN}=2Vpp, R_L=10kΩ, Ta=25°C



Gain Bandwidth Product vs. Temperature
G_V=40dB, R_L=10kΩ, C_L=20pF

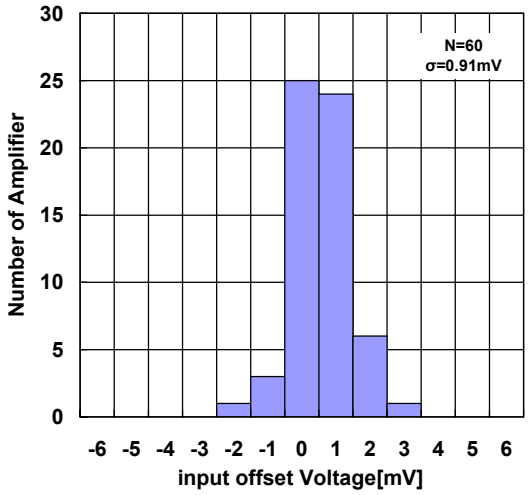


Slew Rate vs. Temperature (Supply Voltage)
G_V=0dB, V_{IN}=1Vpp, R_L=10kΩ, C_L=20pF



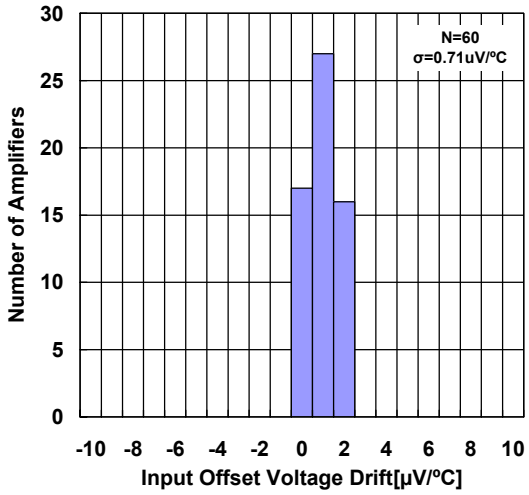
Input Offset Voltage Distribution

V_{DD}=5V, V_{ICM}=2.5V, Ta=25ºC



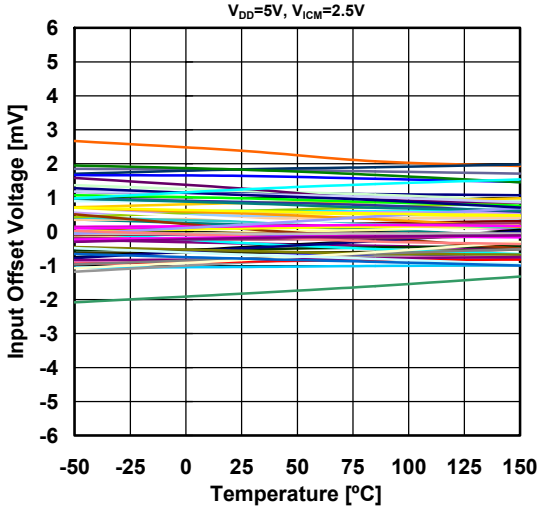
Input Offset Voltage Drift Distribution

V_{DD}=5V, V_{ICM}=2.5V, Ta=-40ºC to 125ºC



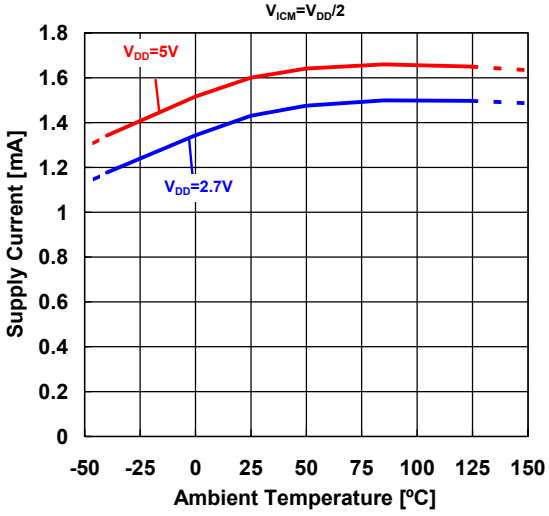
Input Offset Voltage vs. Temperature

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



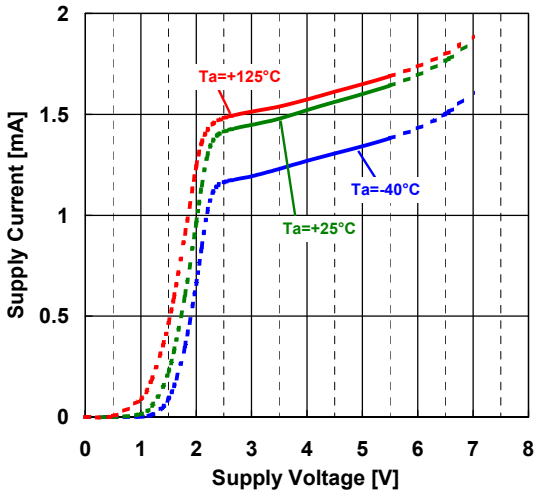
Supply Current vs. Temperature

V_{ICM}=V_{DD}/2



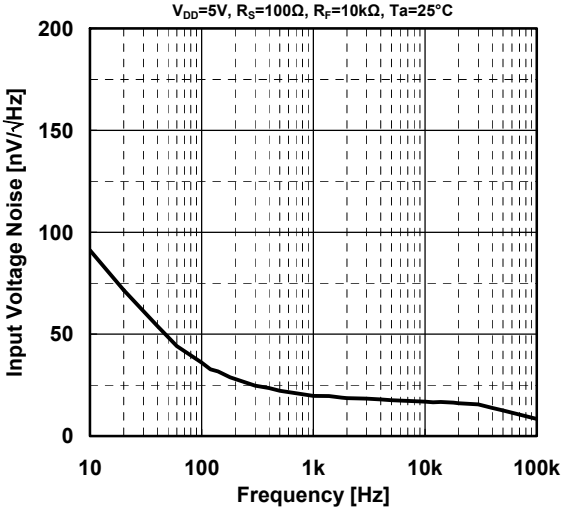
Supply Current vs. Supply Voltage (Temperature)

V_{ICM}=V_{DD}/2

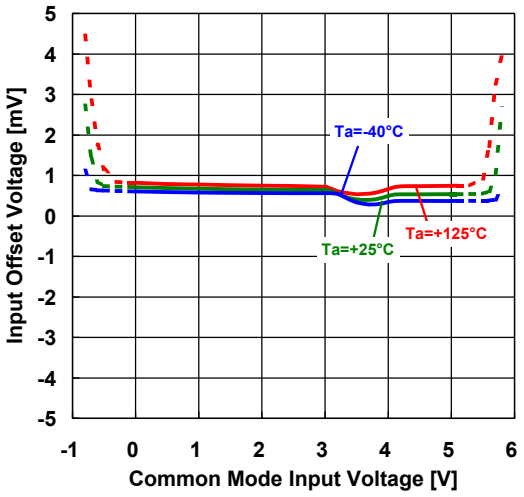


Input Voltage Noise vs. Frequency

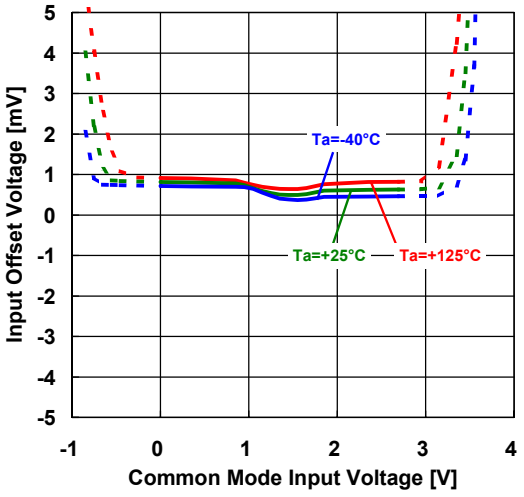
V_{DD}=5V, R_S=100Ω, R_F=10kΩ, Ta=25°C



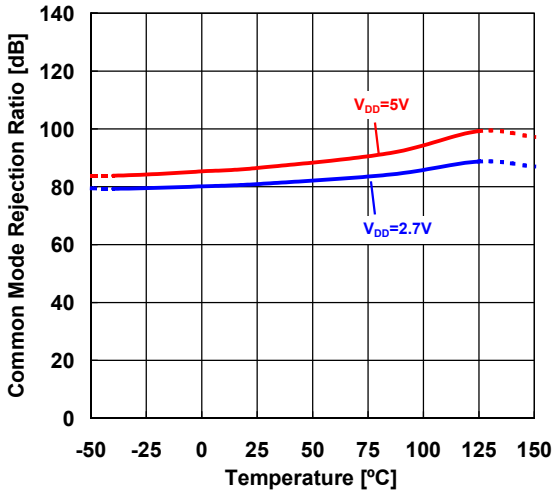
Input Offset Voltage vs. Common Mode Input Voltage (Temperature)
V_{DD}=5V, V_{ICM}=V_{DD}/2



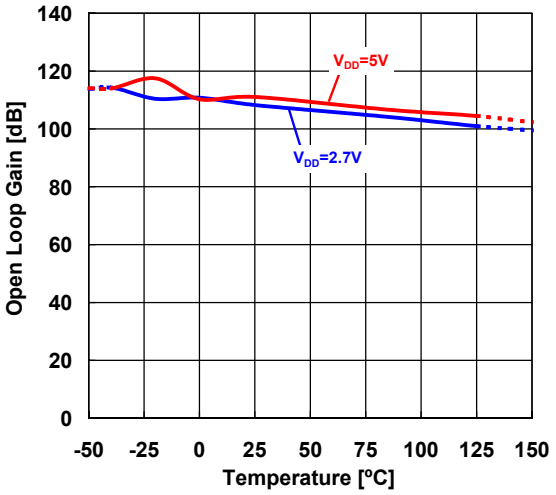
Input Offset Voltage vs. Common Mode Input Voltage (Temperature)
V_{DD}=2.7V, V_{ICM}=V_{DD}/2



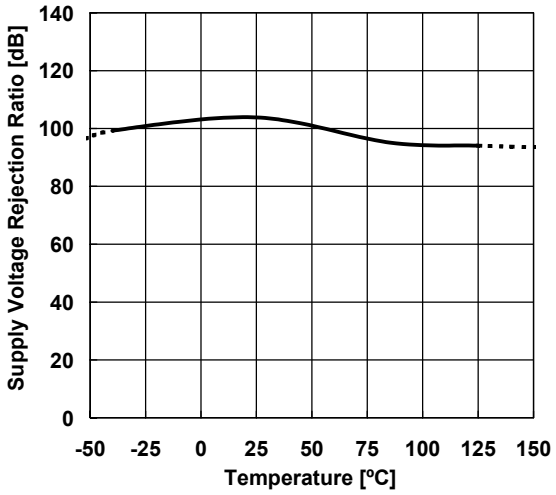
CMR vs. Temperature (Supply Voltage)
V_{ICM}=V_{SS} to V_{DD}



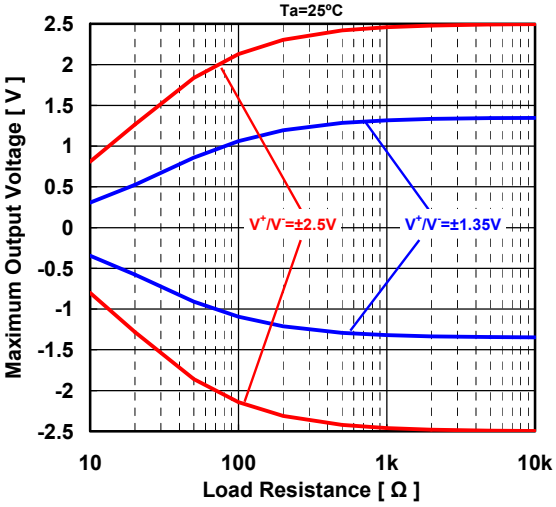
Open Loop Gain vs. Temperature (Supply Voltage)
V_O=V_{DD}/2 ± 1V

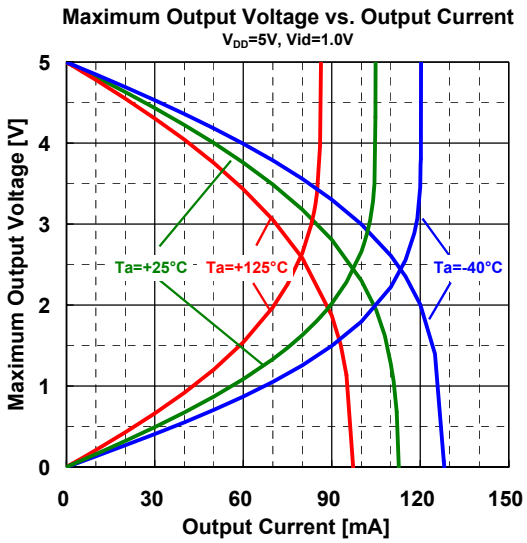


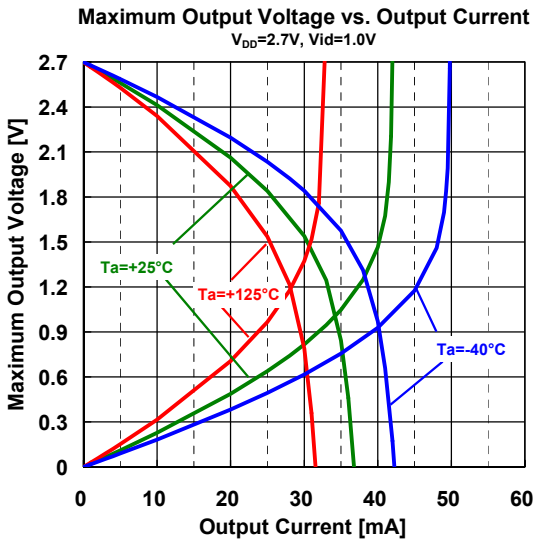
SVR vs. Temperature
V_{DD}=2.7V to 5.5V



Maximum Output Voltage vs. Load Resistance
Ta=25ºC

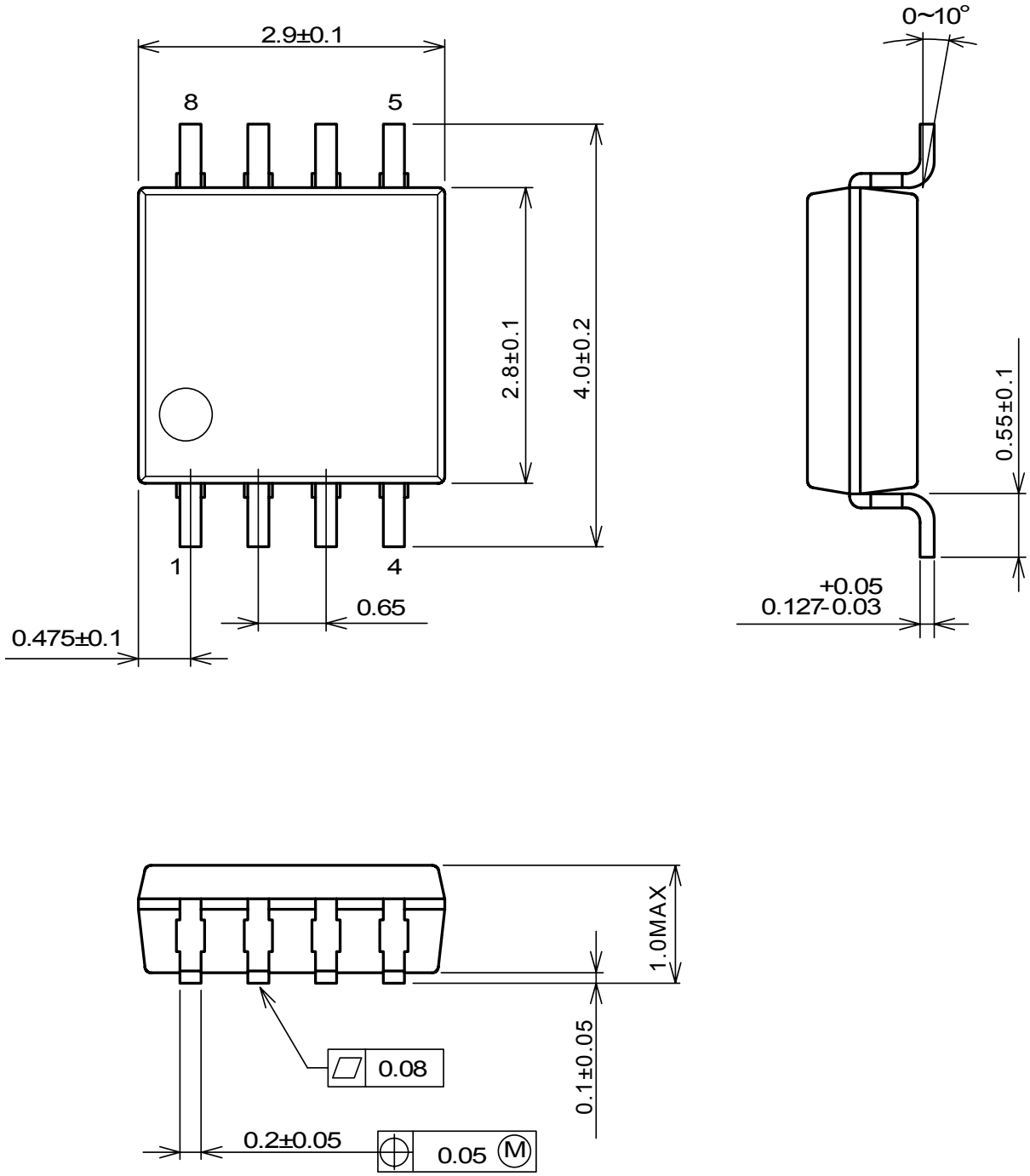



Maximum Output Voltage vs. Output Current
VDD=5V, Vid=1.0V
Maximum Output Voltage [V]
Output Current [mA]
0
1
2
3
4
5
0
30
60
90
120
150
Ta=+25°C
Ta=+125°C
Ta=-40°C


Maximum Output Voltage vs. Output Current
VDD=2.7V, Vid=1.0V
Maximum Output Voltage [V]
Output Current [mA]
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
0
10
20
30
40
50
60
Ta=+25°C
Ta=+125°C
Ta=-40°C

■ **PACKAGE DIMENSIONS**

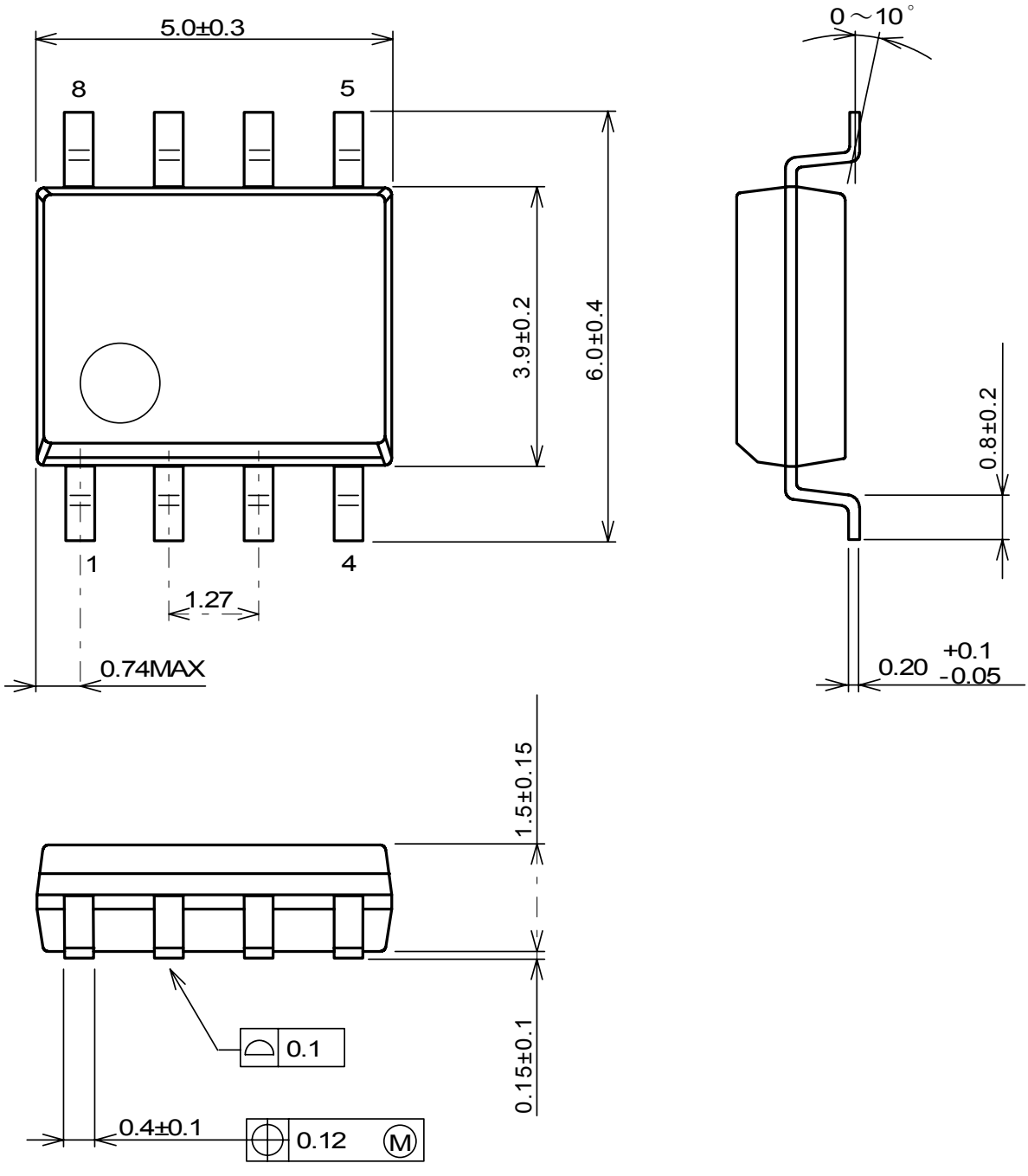
MSOP8(TVSP8)



UNIT: mm

■ **PACKAGE DIMENSIONS**

SOP8



UNIT: mm

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