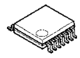
Rail-to-Rail Output
Quad CMOS Operational Amplifier

■ GENERAL DESCRIPTION

The **NJU7058** is a Quad CMOS operational amplifier that feature low noise as V_{NI}=15nV/√Hz (at V_{DD}= 5V, f=1kHz). It is tolerant to RF noise.
The NJU7058 can operate from a single-supply voltage of +1.8V to +5.5V. In addition, this amplifier features Rail-to-Rail output and low input bias current (1pA).

■ PACKAGE OUTLINE



NJU7058V
(SSOP14)

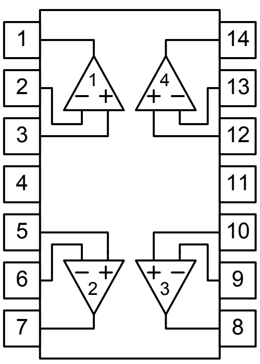
■ FEATURES

- ●Low Operating Voltage 1.8V to 5.5V
- ●Voltage Noise 15nV/√Hz (typ.) (at V_{DD}= 5V, f=1kHz)
- ●Rail-to-Rail Output V_{OH}=4.9V min./ V_{OL}=0.1V max. (at V_{DD}= 5V, R_L=10kΩ)
  V_{OH}=4.8V min./ V_{OL}=0.2V max. (at V_{DD}= 5V, I_O=2mA)
- ●Package SSOP14
- ●Enhanced RF Noise Immunity
- ●CMOS Process

■ APPLICATION

- ●Sensor amplifiers
- ●Photodiode amplifiers
- ●Low noise signal processing applications
- ●Microphone amplifiers
- ●Battery-operated application

■ PIN CONFIGURATION (Top View)



Pin Function

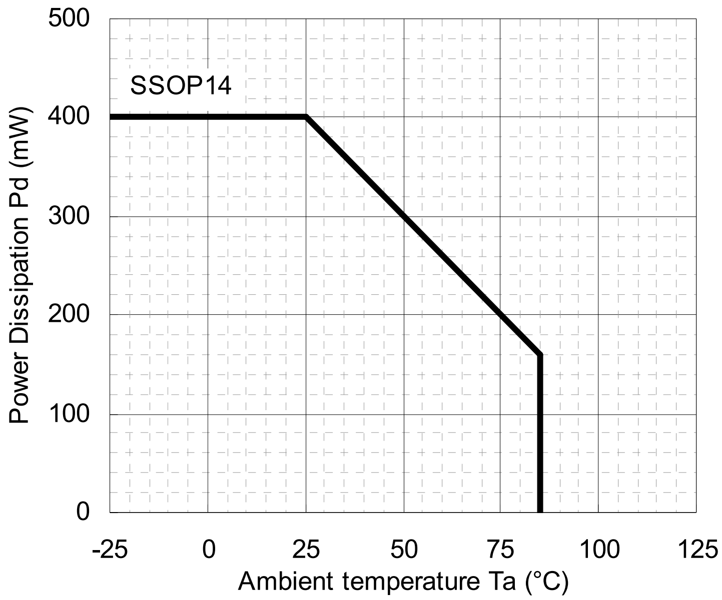
1. OUTPUT 1	8. OUTPUT 3
2. -INPUT 1	9. -INPUT 3
3. +INPUT 1	10. +INPUT 3
4. V_{DD}	11. V_{SS}
5. +INPUT 2	12. +INPUT 4
6. -INPUT 2	13. -INPUT 4
7. OUTPUT 2	14. OUTPUT 4

■ ABSOLUTE MAXIMUM RATINGS

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	400[SSOP14] (Note2)	mW
Operating Temperature Range	T_{opr}	-40 to +85	°C
Storage Temperature Range	T_{stg}	-55 to +125	°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) 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.

Figure. Power Dissipation Curve



■ RECOMMENDED OPERATING CONDITION (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	1.8 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	I_{DD}	No Signal	-	1.1	1.7	mA
Input Offset Voltage	V_{IO}	Vic=0V, R_S=50Ω	-	1	4	mV
Input Offset Voltage drift	ΔVio/ΔT		-	0.7	-	μV/ºC
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open loop gain	A_V	Vo=0.5V to 4.5V, R_L=10kΩ to 2.5V	70	90	-	dB
Common Mode Rejection Ratio	CMR	V_{ICM}=0V to 4.1V	65	80	-	dB
Supply Voltage Rejection Ratio	SVR	V_{DD}=1.8V to 5.5V	70	90	-	dB
Maximum Output Voltage 1	$V_{OH}1$	R_L=10kΩ to 2.5V	4.9	4.95	-	V
	$V_{OL}1$	R_L=10kΩ to 2.5V	-	0.05	0.1	V
Maximum Output Voltage 2	$V_{OH}2$	R_L=10kΩ to 0V	4.9	4.95	-	V
	$V_{OL}2$	R_L=10kΩ to 0V	-	0.02	0.05	V
Maximum Output Voltage 3	$V_{OH}3$	Isource=2mA	4.8	4.85	-	V
	$V_{OL}3$	Isink=2mA	-	0.15	0.2	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥65dB	0	-	4.1	V

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	R_L=10kΩ to 2.5V, C_L=20pF, f=100kHz	-	2.1	-	MHz
Phase Margin	$\square_M$	R_L=10kΩ to 2.5V, C_L=20pF	-	80	-	deg
Gain Margin	G_M	R_L=10kΩ to 2.5V, C_L=20pF	-	10	-	dB
Equivalent Input Noise Voltage	e_n	f=1kHz	-	15	-	nV/√Hz
Slew Rate	SR	G_V=0dB, R_L=10kΩ to 2.5V, C_L=20pF, Vin=3Vpp (1V to 4V) (Note4) (Note5)	-	0.8	-	V/us
Channel Separation	CS	f=1kHz	-	120	-	dB
Total Harmonic Distortion	THD	G_V=6dB, R_F=50kΩ, R_G=50kΩ, C_L=20pF, Vo=4Vpp, f=1kHz (Note6)	-	0.01	-	%

(Note4) Slew rate is defined by the lower value of the rise or fall.

(Note5) See figure2-1 for test circuit.

(Note6) See figure2-3 for test circuit.

■ ELECTRICAL CHARACTERISTICS

DC CHARACTER (V_{DD}=1.8V, V_{SS}=0V, Ta=25˚C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{DD}	No Signal	-	0.9	1.5	mA
Input Offset Voltage	V_{IO}	Vic=0V, R_S=50Ω	-	1	4	mV
Input Offset Voltage drift	ΔVio/ΔT		-	0.8	-	μV/ºC
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Open loop gain	A_V	Vo=0.5V to 1.3V, R_L=10kΩ to 0.9V	65	90	-	dB
Common Mode Rejection Ratio	CMR	V_{ICM}=0V to 0.9V	65	80	-	dB
Supply Voltage Rejection Ratio	SVR	V_{DD}=1.8V to 5.5V	70	90	-	dB
Maximum Output Voltage 1	$V_{OH}1$	R_L=10kΩ to 0.9V	1.7	1.75	-	V
	$V_{OL}1$	R_L=10kΩ to 0.9V	-	0.05	0.1	V
Maximum Output Voltage 2	$V_{OH}2$	R_L=10kΩ to 0V	1.7	1.75	-	V
	$V_{OL}2$	R_L=10kΩ to 0V	-	0.02	0.05	V
Maximum Output Voltage 3	$V_{OH}3$	Isource=1mA	1.5	1.55	-	V
	$V_{OL}3$	Isink=1mA	-	0.25	0.3	V
Common Mode Input Voltage Range	V_{ICM}	CMR≥65dB	0	-	0.9	V

AC CHARACTER (V_{DD}=1.8V, V_{SS}=0V, Ta=25˚C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	R_L=10kΩ to 0.9V, C_L=20pF, f=100kHz	-	1.7	-	MHz
Phase Margin	φ_M	R_L=10kΩ to 0.9V, C_L=20pF	-	80	-	deg
Gain Margin	G_M	R_L=10kΩ to 0.9V, C_L=20pF	-	13	-	dB
Equivalent Input Noise Voltage	e_n	f=1kHz	-	18	-	nV/√Hz
Slew Rate	SR	G_V=0dB, R_L=10kΩ to 1.5V, C_L=20pF, Vin=0.5Vpp (0.3V to 0.8V) (Note4) (Note7)	-	0.6	-	V/us
Channel Separation	CS	f=1kHz	-	110	-	dB
Total Harmonic Distortion	THD	G_V=+6dB, R_F=50kΩ, R_G=50kΩ, C_L=20pF, Vo=1Vpp, f=1kHz (Note8)	-	0.01	-	%

(Note4) Slew rate is defined by the lower value of the rise or fall.

(Note7) See figure2-2 for test circuit.

(Note8) See figure2-4 for test circuit..

■ MEASUREMENT CIRCUITS

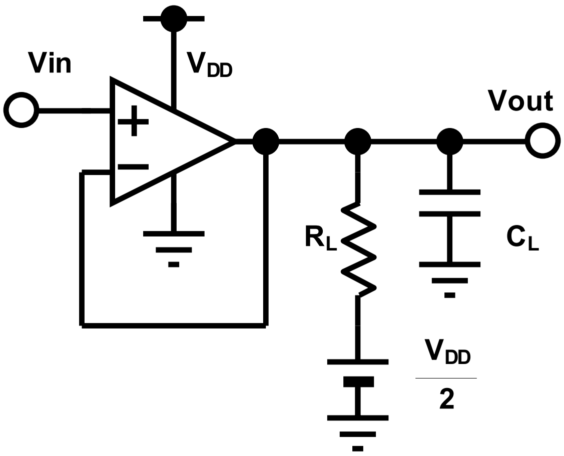


Figure 2-1:Measurement circuit 1

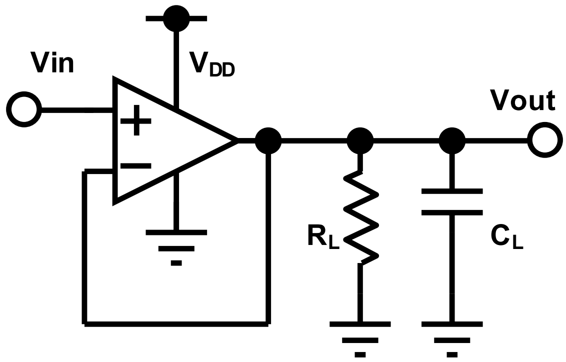


Figure 2-2:Measurement circuit 2

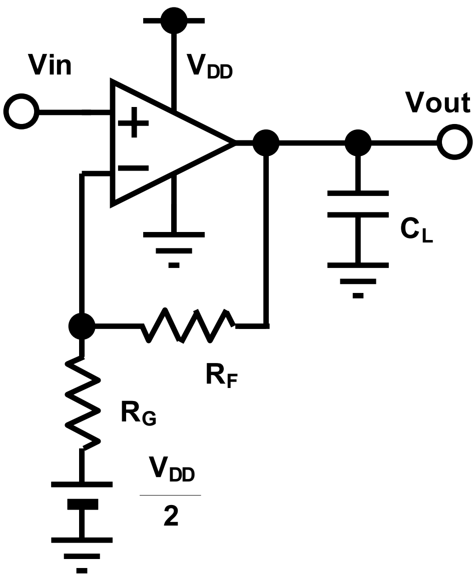


Figure 2-3:Measurement circuit 3

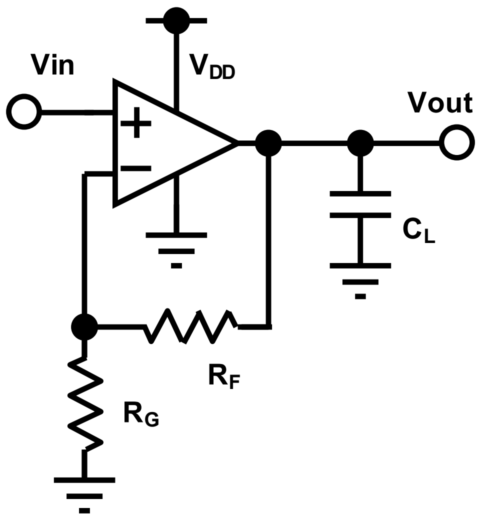
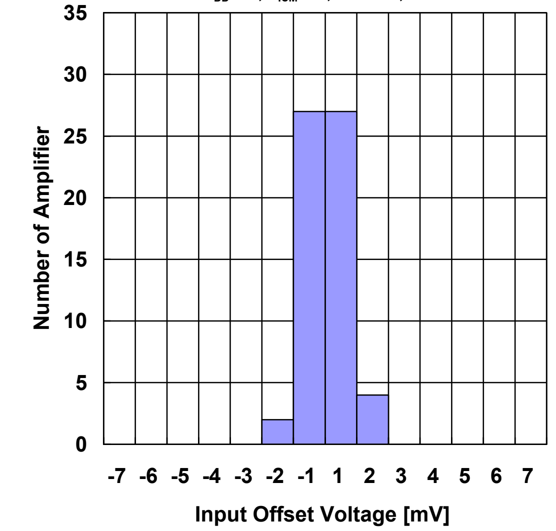


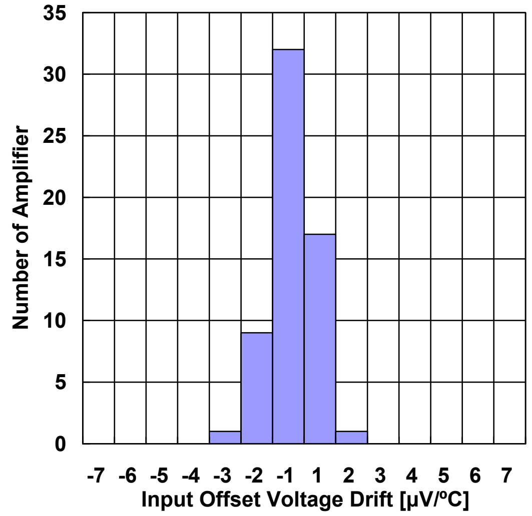
Figure 2-4:Measurement circuit 4

■ ELECTRICAL CHARACTERISTICS

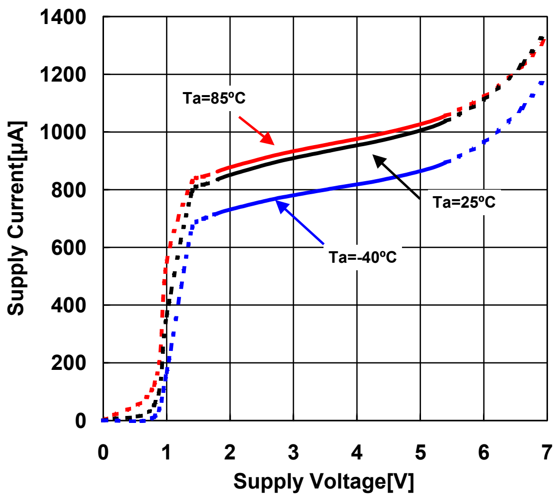
Input Offset Voltage Distribution
V_{DD}=5V, V_{ICM}=0V, Ta=25ºC, N=60



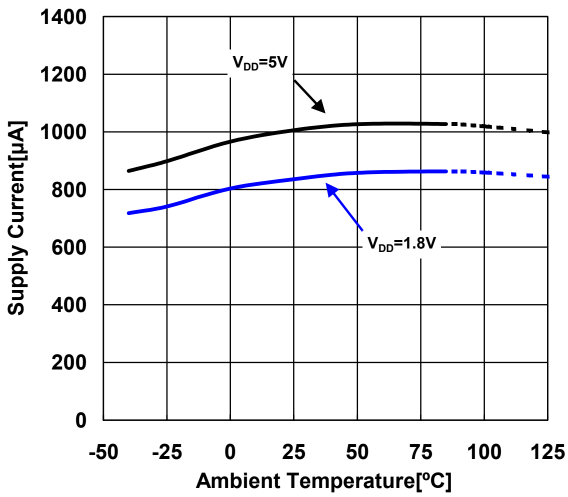
Input Offset Voltage Drift Distribution
V_{DD}=5V, V_{ICM}=0V, Ta=-40ºC→85ºC, N=60



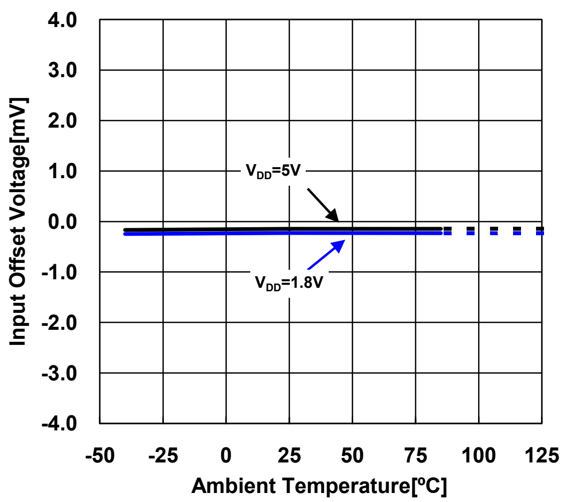
Supply Current vs Supply Voltage
Gv=0dB



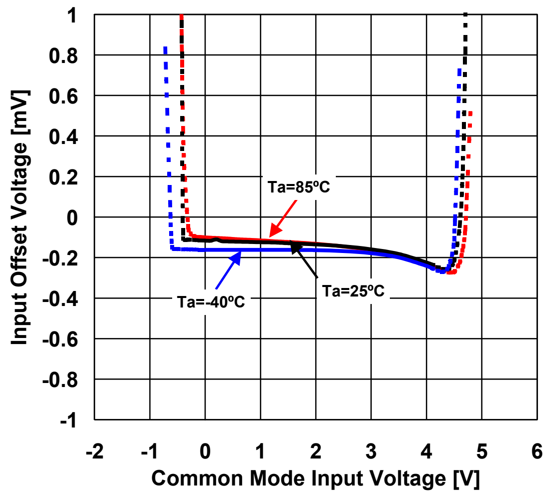
Supply Current vs Temperature
Gv=0dB



Input Offset Voltage vs Temperature
(Supply Voltage)
$V_{ICM}=V_{DD}/2$

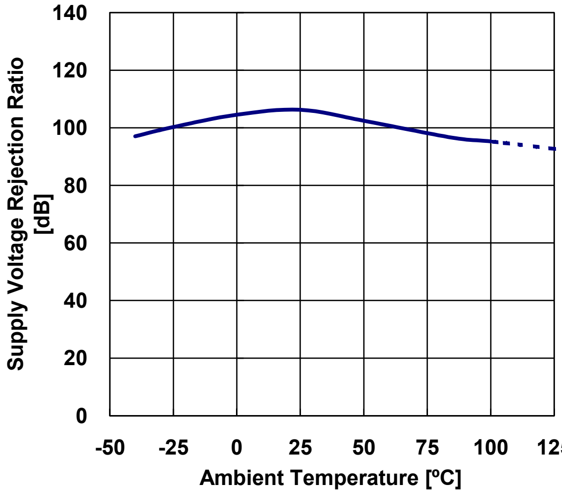


Input Offset Voltage vs Common Mode Input Voltage
(Temperature)
V_{DD}=5V

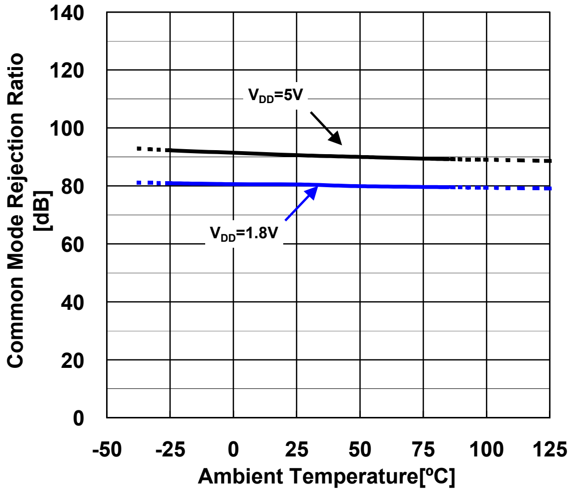


■ ELECTRICAL CHARACTERISTICS

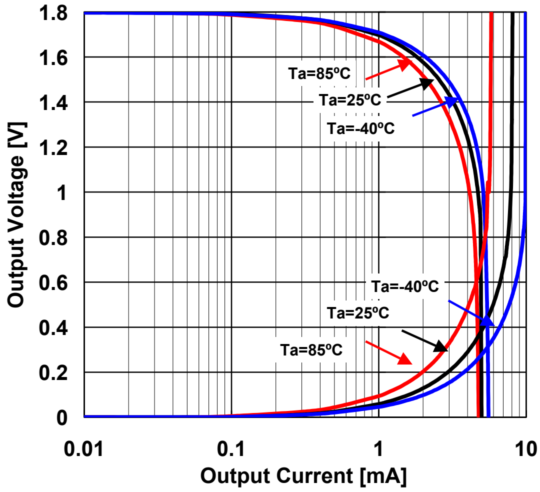
SVR vs Temperature
V_{DD}=1.8V→5.5V



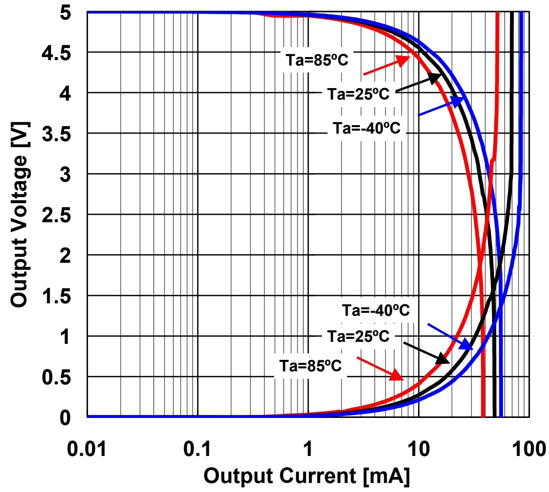
CMR vs Temperature
(Supply Voltage)
V_{ICM}=0V→VDD-0.9V



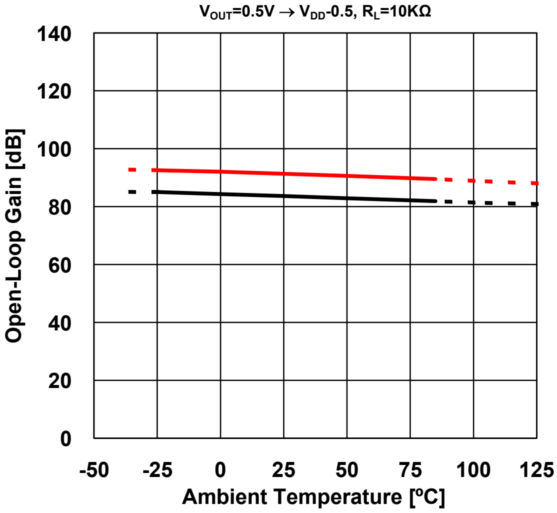
Output Voltage vs Output Current (Temperature)
V_{DD}=1.8V, V_{ICM}=0.9V



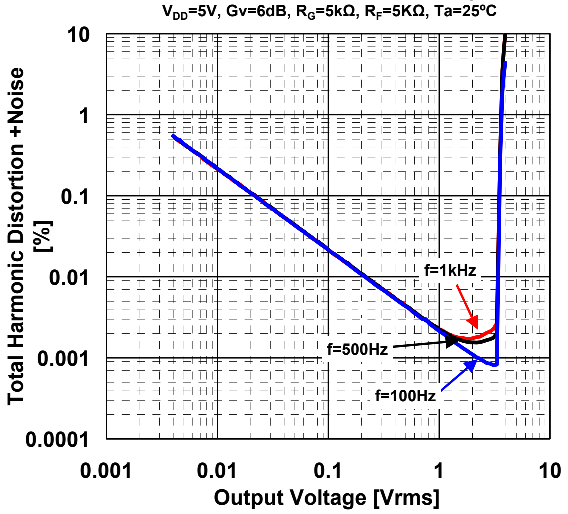
Output Voltage vs Output Current (Temperature)
V_{DD}=5V, V_{ICM}=2.5V



Open-Loop Gain vs Temperature
V_{OUT}=0.5V → V_{DD}-0.5, R_L=10KΩ

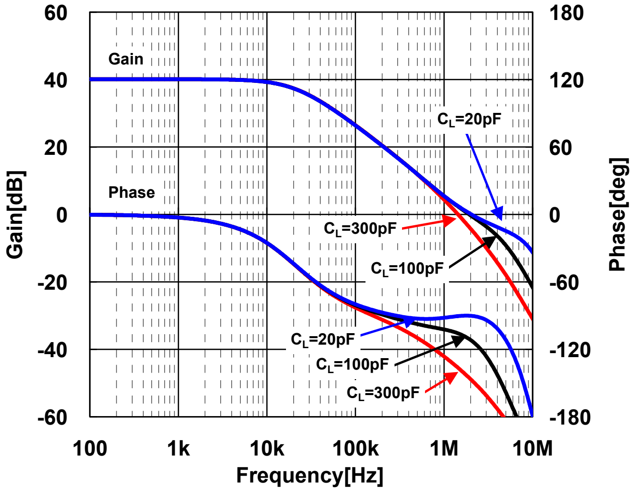


THD + Noise vs. Output Voltage
V_{DD}=5V, Gv=6dB, R_G=5kΩ, R_F=5KΩ, Ta=25ºC

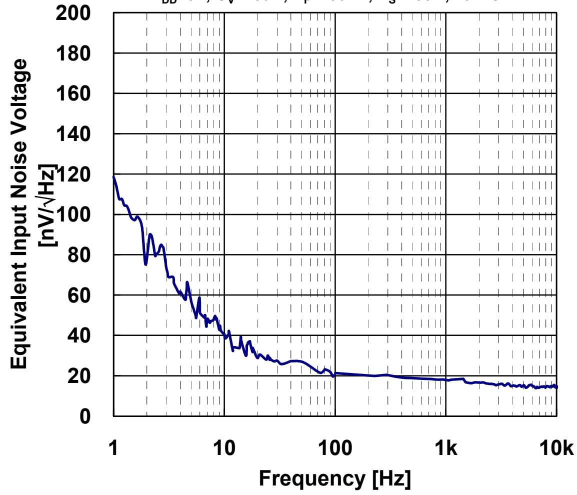


■ ELECTRICAL CHARACTERISTICS

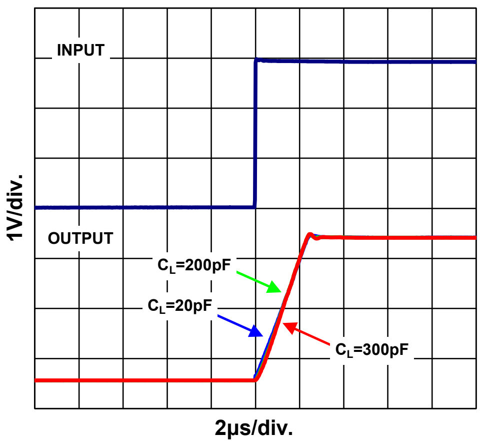
Gain/Phasevs.Frequency (Load Capacitance)
V_{DD}=5V, Gv=40dB, R_F=100kΩ, Ta=25ºC



Equivalent Input Noise Voltage vs Frequency
V_{DD}=5V, G_V=20dB, R_F=100kΩ, R_S=100Ω, Ta=25ºC



pulse Response (Load Capacitance)
V_{DD}=5V, G_V=0dB, R_L=10KΩ, Ta=25ºC



Pulse Response (Load capacitance)
V_{DD}=5V, G_V=0dB, R_L=10KΩ, Ta=25ºC