Low Noise, High-Speed Dual Operational Amplifier

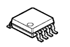
■ GENERAL DESCRIPTION

The NJM2719 is a high speed voltage feedback dual operational amplifier specifically optimized for low voltage noise.

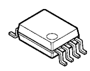
Combining a voltage noise of 2.5nV/√Hz typ. (at f =100kHz) and unity gain of 100MHz, the NJM2719 is ideal for I/Q baseband amplifier, RFID reader application and other wireless communication system designs.

The NJM2719 is available in two 8-lead package options: tiny fine pitch surface mount (SSOP/MSOP).

■PACKAGE OUTLINE



NJM2719RB1 (MSOP8(TVSP8))



NJM2719V (SSOP8)

■ FEATURES

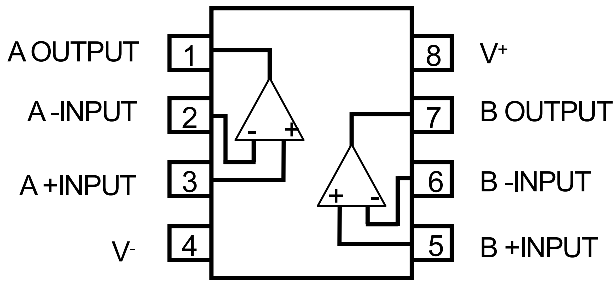
●Low Noise	Vni = 2.5nV/√Hz typ. (at f=100kHz) Vni = 3nV/√Hz typ. (at f=10kHz)
●Unity Gain Bandwidth	fT = 100MHz typ. (at V^+/V^- = ±5V) fT = 90MHz typ. (at V^+/V^- = ±2.5V)
●Phase Margin	Φm = 60deg typ.
●Slew Rate	60V/µs typ. (at V^+/V^- = ±5V) 35V/µs typ. (at V^+/V^- = ±2.5V)
●Output Rail-to-Rail	V_{OH} ≥ +4.7V, V_{OL} ≤ -4.8V (at V^+/V^- = ±5V) V_{OH} ≥ +2.4V, V_{OL} ≤ -2.4V (at V^+/V^- = ±2.5V)
●Operating Voltage	±2.25V ~ ±5V
●Bipolar Technology	
●Package Outline	NJM2719V : SSOP8 NJM2719RB1 : MSOP8 (TVSP8) MEET JEDEC MO-187-DA / THIN TYPE

■ APPLICATION

- ●Wireless Communication Equipment
- ●I/Q Baseband Application
- ●RFID Reader Application
- ●Active Filter
- ●ADC/DAC Buffer
- ●Ultrasound Amplifier

■ PIN CONFIGURATION

(Top View)



SSOP8 [NJM2719V]
MSOP8(TVSP8) [NJM2719RB1]

■ ABSOLUTE MAXIMUM RATINGS (Ta=25˚C)

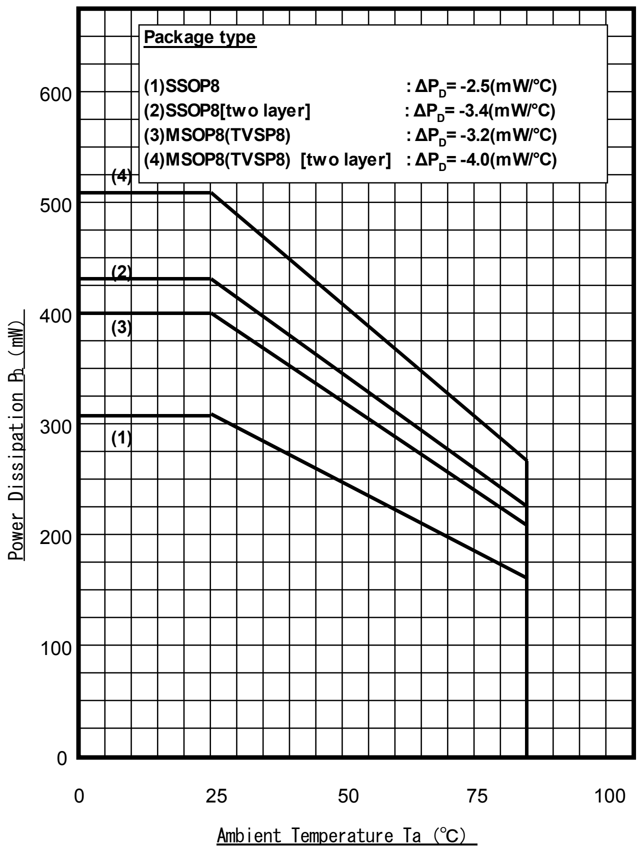
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	±5.5	V
Common Mode Input Voltage Range	V_{ICM}	±5.5 (Note1)	V
Differential Input Voltage Range	V_{ID}	±3	V
Power Dissipation	P_D	310[SSOP8], 400[MSOP8(TVSP8)]	mW
		410[SSOP8](Note2), 510[MSOP8(TVSP8)] (Note2)	mW
Operating Temperature Range	T_{opr}	-40 to +85	˚C
Storage Temperature Range	T_{stg}	-50 to +150	˚C

(Note 1) The output voltage of normal operation will be the Output Voltage Swing of electrical characteristics.

(Note 2) On the PCB " EIA/JEDEC (114.3x76.2x1.57mm, two layers, FR-4) "

(Note 3) Do not exceed "Power dissipation: PD" in which power dissipation in IC is shown by the absolute maximum rating.
Refer to following Figure 1 for a permissible loss when ambient temperature (Ta) is Ta ≥25°C.

Figure1: Power Dissipation – Ambient Temperature



■ OPERATING VOLTAGE (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+/V^-	(Note3)	±2.25	-	±5.5	V

■ ELECTRICAL CHARACTERISTICS

●DC CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	No Signal	-	11	14	mA
Input Offset Voltage	V_{IO}	Rs=50Ω	-	1	9	mV
Input Offset Voltage Drift	ΔVio/ΔT	Rs=50Ω	-	10	-	μV/deg
Input Bias Current	I_B		-	2.9	25	μA
Input Offset Current	I_{IO}		-	0.2	2	μA
Voltage Gain	Av	R_L = 1kΩ to 0V, Vo = ±1V	68	91	-	dB
Common Mode Rejection Ratio	CMR	-2V ≤ V_{CM} ≤ +1.2V	82	92	-	dB
Supply Voltage Rejection Ratio	SVR	±2.25V ≤ V^+/V^- ≤ ±5V	84	97	-	dB
Maximum Output Voltage 1	V_{OH1}	R_L = 1kΩ to 0V	+2.3	+2.4	-	V
	V_{OL1}		-	-2.4	-2.3	
Maximum Output Voltage 2	V_{OH2}	Isource =4mA, +Input =+0.1V, -Input =-0.1V	+2.2	+2.3	-	V
	V_{OL2}	Isink =4mA, +Input =-0.1V, -Input =+0.1V	-	-2.3	-2.2	
Common Mode Input Voltage Range	V_{ICM}+	CMR≥82dB	+1.2	-	-	V
	V_{ICM}-		-	-	-2	

●AC CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain	fT	Av=+40dB, Rf =1.98kΩ, Rg =20Ω, R_L =1kΩ to 0V, C_L =5pF	-	90	-	MHz
Phase Margin	φm		-	60	-	deg
Gain Margin	Gm		-	10	-	dB
Equivalent Input Noise Voltage	V_{NI1}	f =100kHz	-	2.5	-	nV/√Hz
	V_{NI2}	f =10kHz	-	3	-	
Equivalent Input Noise Current	I_{NI}	f =100kHz	-	3	-	pA/√Hz
Channel Separation	CS	f =1MHz, Vin =0.2Vpp, Av =+1, R_L =1kΩ to 0V, C_L =5pF	-	70	-	dB

●TRANSIENT CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate 1	+SR1	Av =0dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp	-	35	-	V/μs
	-SR1		-	35	-	
Slew Rate 2	+SR2	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp	-	30	-	V/μs
	-SR2		-	30	-	
Rise Time	tr	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =0.2Vpp, 10% to 90%	-	8.3	-	ns
Fall Time	tf		-	8.3	-	
Power Band Width	PBW	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp, HD2 ≤-40dB, HD3 ≤-40dB	-	3	-	MHz
Total Harmonic Distortion	THD	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, f =10kHz, Vout =2Vpp	-	0.1	-	%
Second Harmonic	HD2	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, f =1MHz, Vout =2Vpp	-	-50	-	dBc
Third Harmonic	HD3		-	-50	-	
Settling time (1%)	ts1	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp	-	100	-	ns
Settling time (0.1%)	ts2		-	110	-	

●DC CHARACTERISTICS (V^+/V^-=±5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	No Signal	-	14	17	mA
Input Offset Voltage	V_{IO}	Rs=50Ω	-	1	9	mV
Input Offset Voltage Drift	ΔVio/ΔT	Rs=50Ω	-	10	-	μV/deg
Input Bias Current	I_B		-	2.9	25	μA
Input Offset Current	I_{IO}		-	0.2	2	μA
Voltage Gain	Av	R_L = 1kΩ to 0V, Vo = ±1V	70	91	-	dB
Common Mode Rejection Ratio	CMR	-4.5V ≤ V_{CM} ≤ +3.7V	82	92	-	dB
Supply Voltage Rejection Ratio	SVR	±2.25V ≤ V^+/V^- ≤ ±5V	84	97	-	dB
Maximum Output Voltage 1	V_{OH1}	R_L = 1kΩ to 0V	+4.6	+4.7	-	V
	V_{OL1}		-	-4.8	-4.7	
Maximum Output Voltage 2	V_{OH2}	Isource =5mA, +Input =+0.1V, -Input =-0.1V	+4.5	+4.6	-	V
	V_{OL2}	Isink =5mA, +Input =-0.1V, -Input =+0.1V	-	-4.7	-4.6	
Common Mode Input Voltage Range	V_{ICM}+	CMR≥82dB	+3.7	-	-	V
	V_{ICM}-		-	-	-4.5	

●AC CHARACTERISTICS (V^+/V^-=±5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Unity Gain	fT	Av=+40dB, Rf =1.98kΩ, Rg =20Ω, R_L =1kΩ to 0V, C_L =5pF	-	100	-	MHz
Phase Margin	φm		-	60	-	deg
Gain Margin	Gm		-	10	-	dB
Equivalent Input Noise Voltage	V_{NI1}	f =100kHz	-	2.5	-	nV/√Hz
	V_{NI2}	f =10kHz	-	3	-	
Equivalent Input Noise Current	I_{NI}	f =100kHz	-	3	-	pA/√Hz
Channel Separation	CS	f =1MHz, Vin =0.2Vpp, Av =+1, R_L =1kΩ to 0V, C_L =5pF	-	70	-	dB

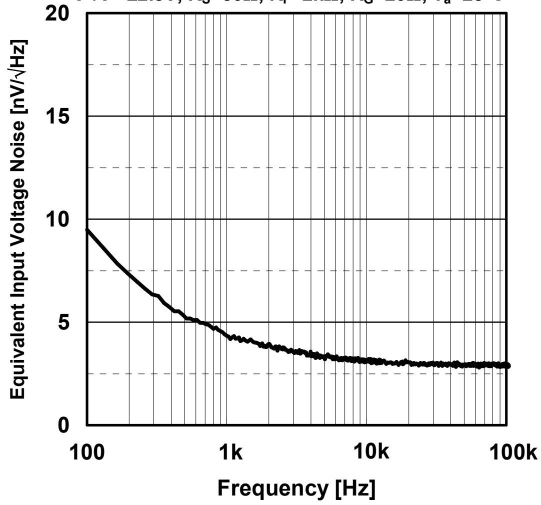
●TRANSIENT CHARACTERISTICS (V^+/V^-=±5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate 1	+SR1	Av =0dB, R_L =1kΩ to 0V, C_L =5pF, Vout =5Vpp	-	60	-	V/μs
	-SR1		-	60	-	
Slew Rate 2	+SR2	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =5Vpp	-	55	-	V/μs
	-SR2		-	55	-	
Rise Time	tr	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =0.2Vpp, 10% to 90%	-	8	-	ns
Fall Time	tf		-	8	-	
Power Band Width	PBW	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp, HD2 ≤-40dB, HD3 ≤-40dB	-	4	-	MHz
Total Harmonic Distortion	THD	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, f =10kHz, Vout =2Vpp	-	0.1	-	%
Second Harmonic	HD2	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, f =1MHz, Vout =2Vpp	-	-50	-	dBc
Third Harmonic	HD3		-	-50	-	
Settling time (1%)	ts1	Av =+6dB, R_L =1kΩ to 0V, C_L =5pF, Vout =2Vpp	-	90	-	ns
Settling time (0.1%)	ts2		-	110	-	

■ TYPICAL CHARACTERISTICS

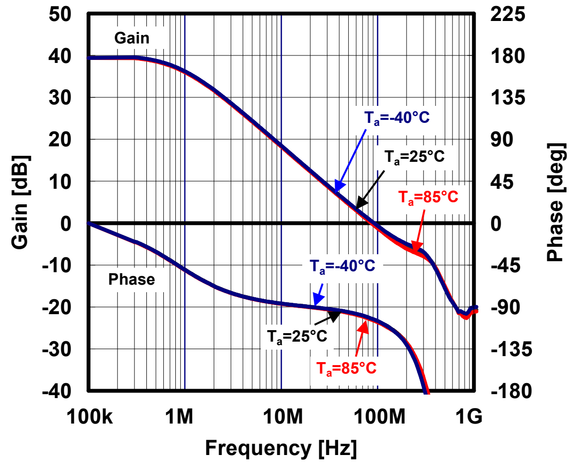
Equivalent Input Voltage Noise vs. Frequency

V^+/V^-=±2.5V, R_S=50Ω, R_F=2kΩ, R_G=20Ω, T_a=25°C



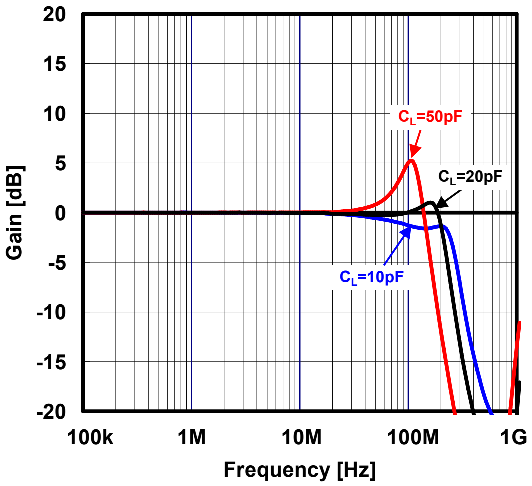
Closed-Loop Gain/Phase vs. Frequency

V^+/V^-=±2.5V, R_S=50Ω, R_F=2kΩ, R_G=20Ω, R_L=1kΩ, C_L=5pF



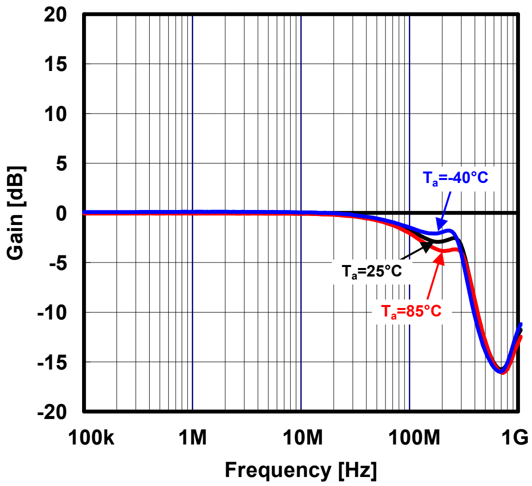
Unity Gain Frequency Response

V^+/V^-=±2.5V, R_S=50Ω, R_L=1kΩ, Ta=25°C



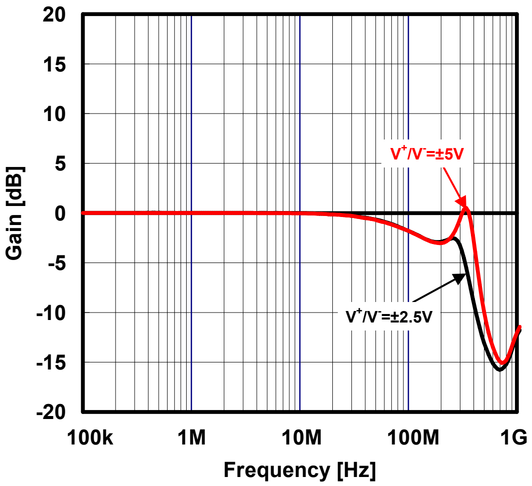
Unity Gain Frequency Response

V^+/V^-=±2.5V, R_S=50Ω, R_L=1kΩ, C_L=5pF



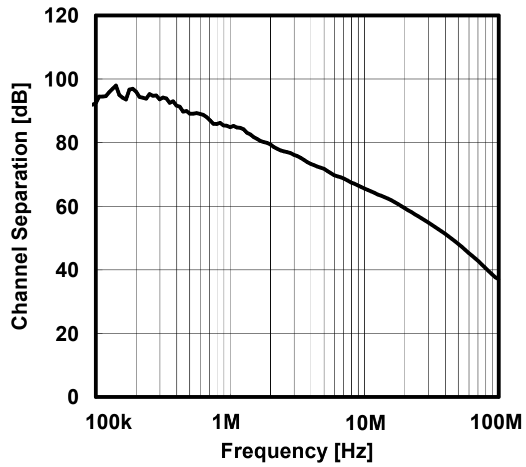
Unity Gain Frequency Response

R_S=50Ω, R_L=1kΩ, C_L=5pF, Ta=25°C

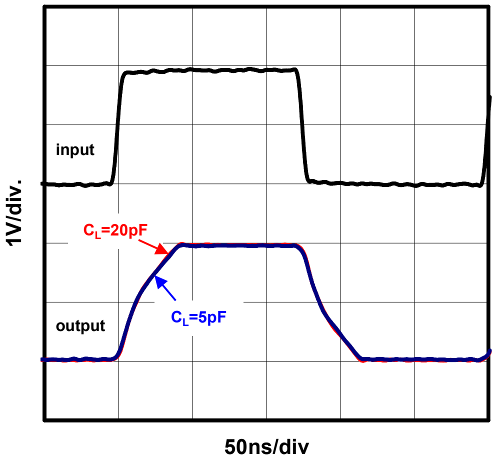


Channel Separation vs. Frequency

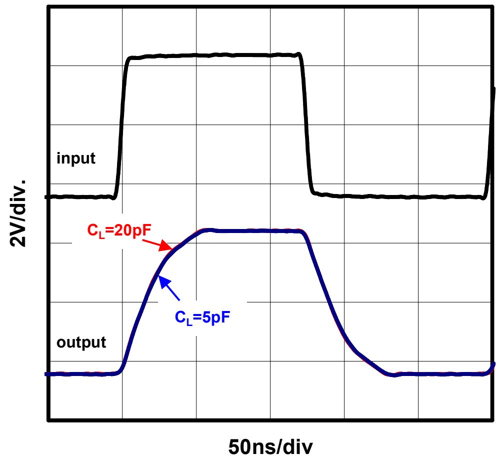
V^+/V^-=±5V, V_O=0.2Vpp, G_V=0dB, R_L=1kΩ, C_L=5pF,



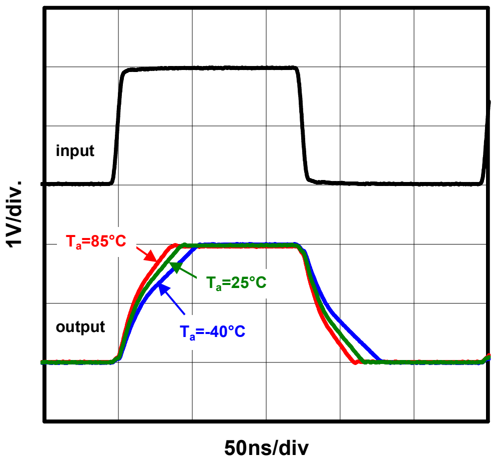
Transinet Response
V^+/V^-=±2.5V,f=4MHz,V_O=2V_{PP},G_V=1,R_T=50Ω,
R_L=1kΩ,T_a=25°C



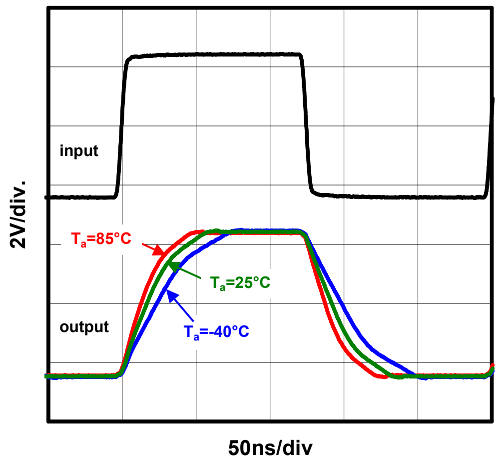
Transient Response
V^+/V^-=±5V,f=4MHz,V_O=5V_{PP},G_V=1,R_T=50Ω,
R_L=1kΩ,T_a=25°C



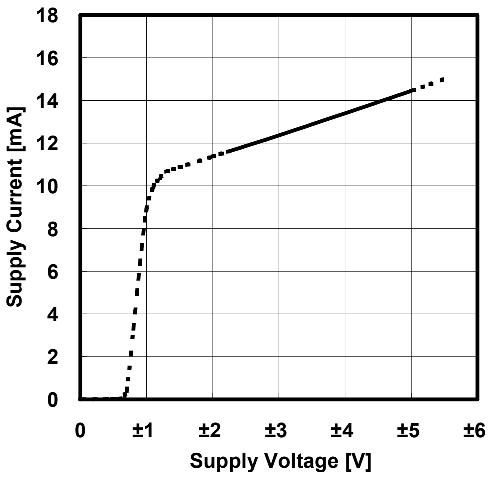
Transeint Response
V^+/V^-=±2.5V,f=4MHz,V_O=2V_{PP},G_V=1,R_T=50Ω,
R_L=1kΩ, C_L=5pF



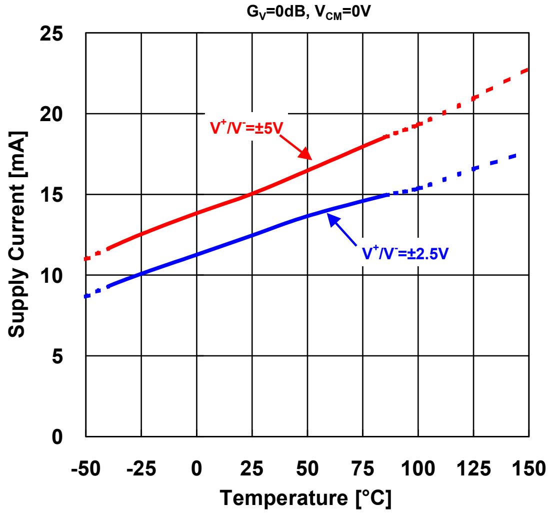
Transient Response
V^+/V^-=±5V,f=4MHz,V_O=5V_{PP},G_V=1,R_T=50Ω,
R_L=1kΩ, C_L=5pF



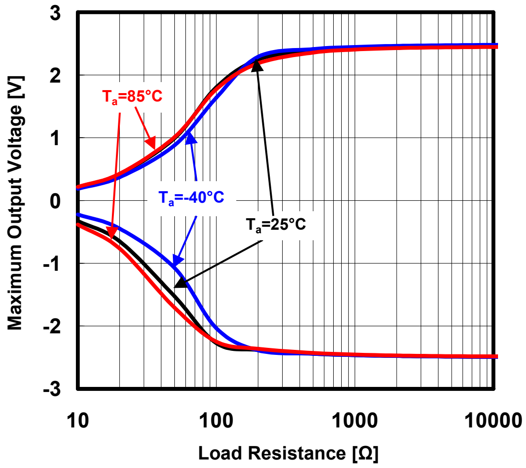
Supply Current vs. Supply Voltage
G_V=0dB, Ta=25°C



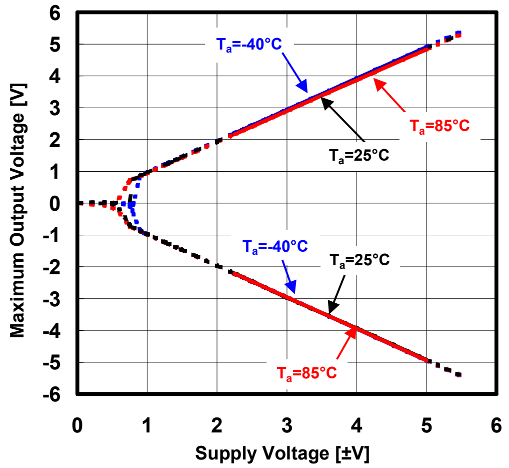
Supply Current vs. Temperature
G_V=0dB, V_{CM}=0V



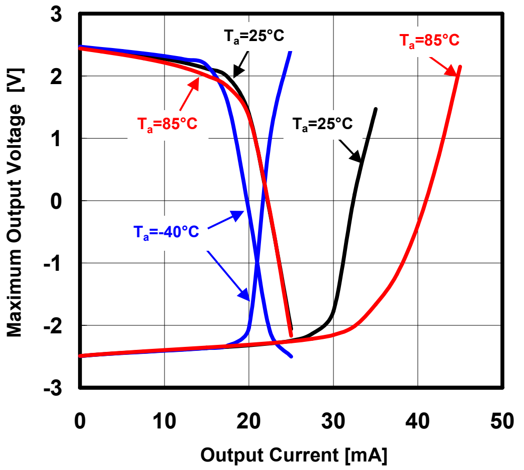
Maximum Output Voltage
vs.Load Resistance
$V^+/V^-=\pm2.5V, V_{IN}=\pm0.2V$



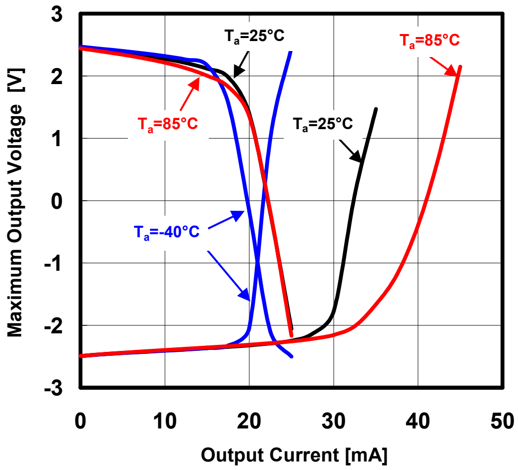
Maximum Output Voltage
vs. Supply Voltage
$V_{IN}=\pm0.2V, R_L=1k\Omega$



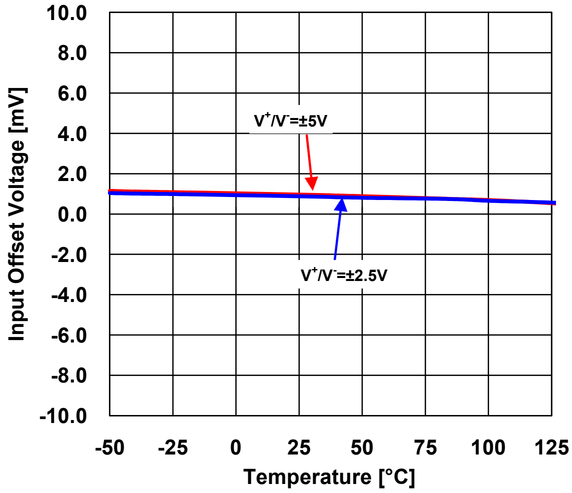
Maximum Output Voltage
vs. Output Current
$V^+/V^-=\pm2.5V, V_{IN}=\pm0.2V$



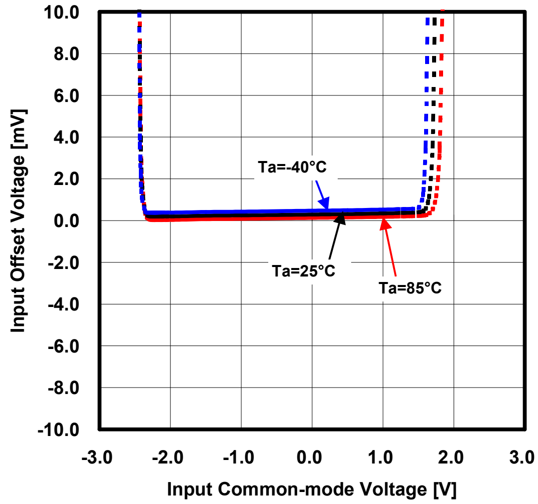
Maximum Output Voltage
vs. Output Current
$V^+/V^-=\pm2.5V, V_{IN}=\pm0.2V$

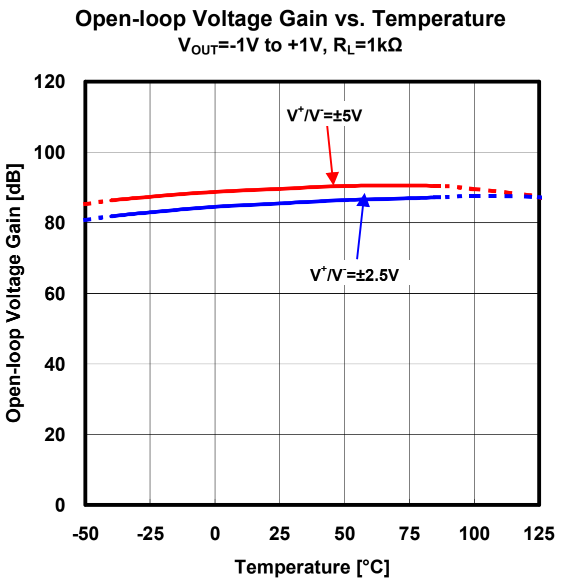


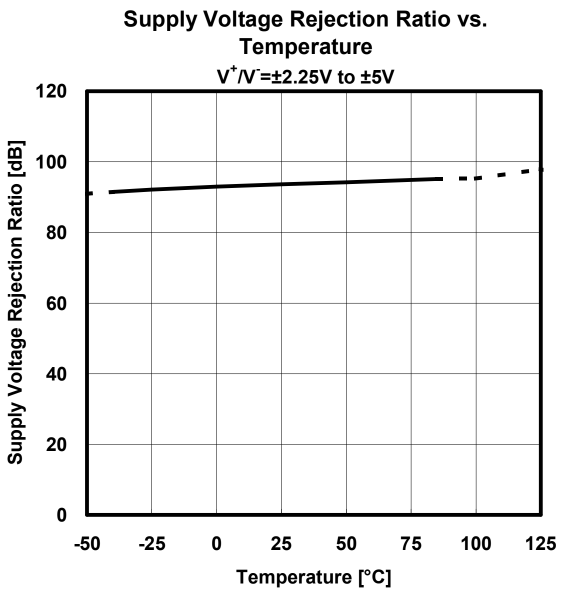
Input Offset Voltage vs. Temperature
$V_{CM}=0V$

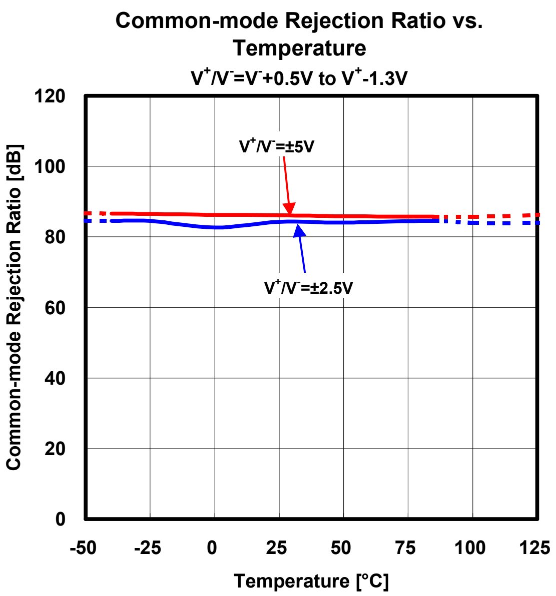


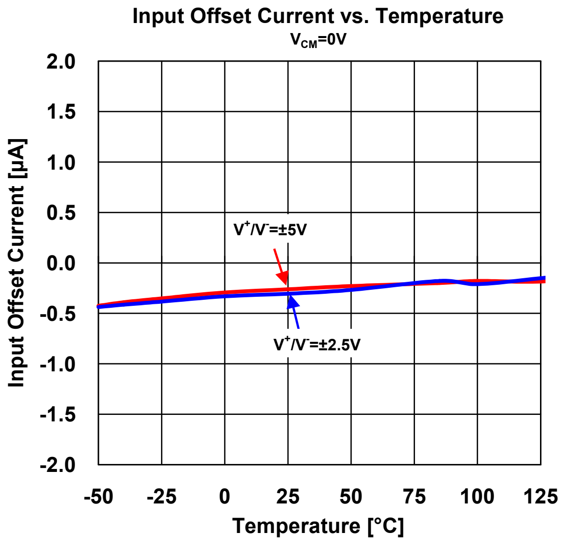
Input Offset Voltage
vs. Input Common-mode Voltage
$V^+/V^-=\pm2.5V$




Open-loop Voltage Gain vs. Temperature
VOUT=-1V to +1V, RL=1kΩ
V+/V-=±5V
V+/V-=±2.5V
Open-loop Voltage Gain [dB]
Temperature [°C]


Supply Voltage Rejection Ratio vs. Temperature
V+/V-=±2.25V to ±5V
Supply Voltage Rejection Ratio [dB]
Temperature [°C]


Common-mode Rejection Ratio vs. Temperature
V+/V-=V-+0.5V to V+-1.3V
V+/V-=±5V
V+/V-=±2.5V
Common-mode Rejection Ratio [dB]
Temperature [°C]


Input Offset Current vs. Temperature
VCM=0V
V+/V-=±5V
V+/V-=±2.5V
Input Offset Current [μA]
Temperature [°C]

■ APPLICATION

●Stability

Generally, when driving a large capacitive load in low closed-loop gain or unity-gain configurations, circuit stability is reduced. In the case of using the NJM2719 for these configurations, it is necessary to care about unwanted oscillation.

An effective way to improve stability and to avoid oscillation is to add an isolation resistor as shown in Figure 1.

Figure 2 shows required resistor values (R_{ISO}) for stability versus load capacitances (C_L) in the unity-gain configuration (Figure 1). To ensure the stability, add a larger isolation resistor in Figure 2. (Resistor values in Figure2 are reference values when parasitic capacitance of an evaluation board is minimized.)

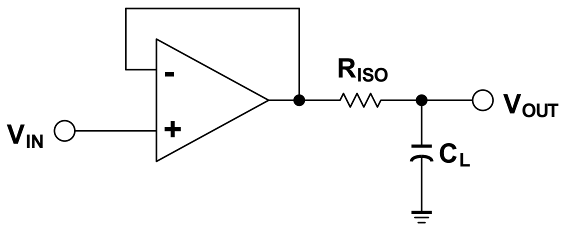


Figure 1.

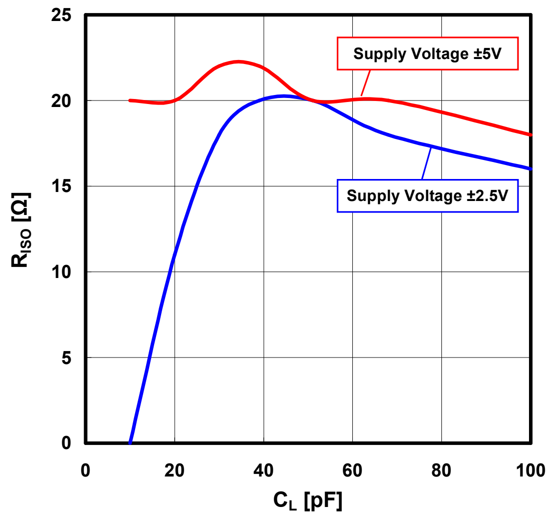


Figure 2. Required Isolation Resistor values for stability, R_{ISO}[Ω], versus Capacitive Loads, C_L[pF]. (G_V=0dB)

■ NOTE