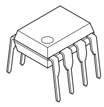
High Speed Current Feedback Operational Amplifier

■ General Description

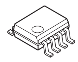
The NJM2723 is a high speed, wide bandwidth and high output current feedback operational amplifier. Driving 150Ω load can expand the versatility of several multimedia applications. Current feedback technology has wide bandwidth and Low supply current.

With a 75MHz at G=+2, 24MHzat G=+10, high slew rate of 2000V/µs, second harmonic distortion -65dB and settling time of 50ns(0.1%) The NJM2723 makes it ideal for high frequency amplifier, active filter and pulse amplifier applications.

■ Package Outline



NJM2723D



NJM2723E

ORDER INFORMATION

Parts	Package
NJM2723D	DIP8
NJM2723E	EMP8

■ Features

High Speed

- ●Bandwidth 75MHz (−3dB, G=+2)
- ●Bandwidth 24MHz (−3dB, G=+10)
- ●Slew Rate 2000V/µs

For Video Applications (V^+/V^-=±5V)

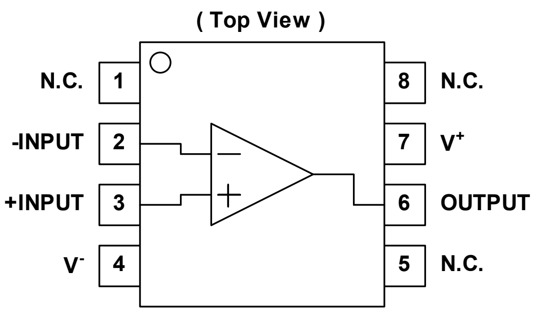
- ●Bandwidth 52MHz (−3dB, G=+2)
- ●Bandwidth 8MHz (0.1dB, G=+2)
- ●Differential Gain 0.05%
- ●Differential Phase 0.25deg
- ●Settling Time 50ns (0.1%, G=+2)

Low Noise

- ●Voltage Noise 6nV/√Hz (@1kHz)
- ●Current Noise 13pA/√Hz (@1kHz)
- ●THD −60dBc (@10MHz)

- ●Specified for ±5V and ±15V operation
- ●150Ω Drive Capability
- ●Output Voltage ±3.5V min. (R_L=150Ω, V^+/V^-=±15V)
  ±2.4V min. (R_L=150Ω, V^+/V^-=±5V)
- ●Supply Range ±3.5V~±17.5V
- ●Supply Current 5mA max.

■ Pin Configuration



■ Applications

- ●High frequency amplifier
- ●Active Filter
- ●150Ωcable driver
- ●Video amplifier

150ΩDrive High Slew Rate OP−AMP Lineup (Single)

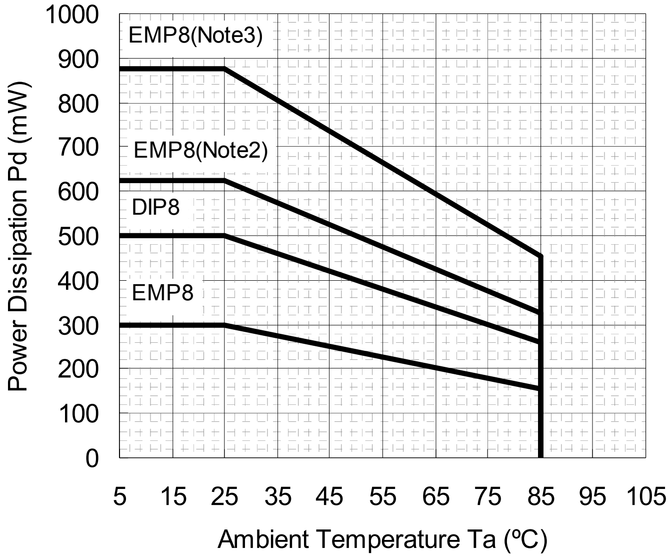
	SR=250V/µs	SR=500V/µs	SR=2000V/µs
Voltage Feedback	NJM2720	NJM2721	
Current Feedback			NJM2723

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

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	±18	V
Common Mode Input Voltage Range	V_{ICM}	±18(Note1)	V
Differential Input Voltage Range	V_{ID}	±3(Note1)	V
Power Dissipation (Note4)	P_D	DIP8: 500 EMP8: 375 / 625 (Note2) / 875 (Note3)	mW
Operating Temperature Range	Topr	-40~+85	°C
Storage Temperature Range	Tstg	-50~+150	°C

(Note1) For supply voltage less than ±18V, the absolute maximum rating is equal to the supply voltage.
(Note2) On the PCB "EIA/JEDEC (114.3×76.2×1.6mm, 2 layers, FR-4)"
(Note3) On the PCB "EIA/JEDEC (114.3×76.2×1.6mm, 4 layers, FR-4)"
(Note4) See Figure "Power Dissipation Derating Curve" when ambient temperature is over 25ºC.

Power Dissipation Derating Curve



Package	ΔPd (mW/°C)
DIP8	-4.0
EMP8	-3.0
EMP8(Note2)	-5.0
EMP8(Note3)	-7.0

■RECOMMENDED OPERATING VOLTAGE (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+/V^-		±3.5	-	±17.5	V

■ **ELECTRICAL CARACTERISTICS** (Measurement is to be conducted as pulse testing.)

● **DC CHARACTERISTICS** (V^+/V^-=±15V, Ta=25°C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	No Signal	-	2.9	5	mA
Input Offset Voltage	V_{IO}		-	4	20	mV
Input Bias Current	I_{B+}		-	2	20	uA
	I_{B-}		-	2	20	uA
Transimpedance	Z_T	R_L=1kΩ, Vo=±10V	1.0	2.5	-	MΩ
Common Mode Input Voltage Range	V_{ICM}	CMR≥56dB	±11	±12	-	V
Common Mode Rejection Ratio	CMR	-11V≤V_{ICM}≤+11V	56	66	-	dB
Supply Voltage Rejection Ratio	SVR	±3.5V≤V^+/V^-≤±17.5V	66	76	-	dB
Maximum Output Voltage	V_{OM}	R_L=1kΩ	±11.5	±13	-	V
Maximum Output Voltage	V_{OM}	R_L=150Ω	±3.5	±4.5	-	V

● **AC CHARACTERISTICS** (V^+/V^-=±15V, Ta=25°C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Bandwidth	BW_{-3dB}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, C_L=1pF	-	75	-	MHz
		G_V=20dB, R_F=680Ω, R_G=75Ω, R_L=1kΩ, C_L=1pF	-	24	-	MHz
0.1dB Flatness	$BW_{0.1dB}$	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, C_L=1pF	-	12	-	MHz
Slew Rate	SR	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, C_L=1pF, Vo=10Vpp, measured20% to 80%	-	1500	-	V/us
Slew Rate	SR	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, C_L=1pF, Vo=20Vpp, measured20% to 80%	-	2000	-	V/us
Settling Time 0.1%	ts	G_V=-1, R_F=620Ω, R_G=620Ω, R_L=1kΩ, C_L=1pF, Vo=10Vpp	-	50	-	ns
Equivalent Input Noise Voltage	Vni	f=100kHz	-	6	-	nV/√Hz
Equivalent Input Noise Current	Ini+	f=100kHz	-	13	-	pA/√Hz
Total Harmonic Distortion	THD	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, Vo=2Vpp, f=10MHz	-	-60	-	dBc
2nd Harmonic Distortion	HD_{2nd}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, Vo=2Vpp, f=10MHz	-	-65	-	dB
3rd Harmonic Distortion	HD_{3nd}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=1kΩ, Vo=2Vpp, f=10MHz	-	-70	-	dB

■ **ELECTRICAL CARACTERISTICS** (Measurement is to be conducted as pulse testing.)

● **DC CHARACTERISTICS** (V^+/V^-=±5V, Ta=25°C, unless otherwise noted.)

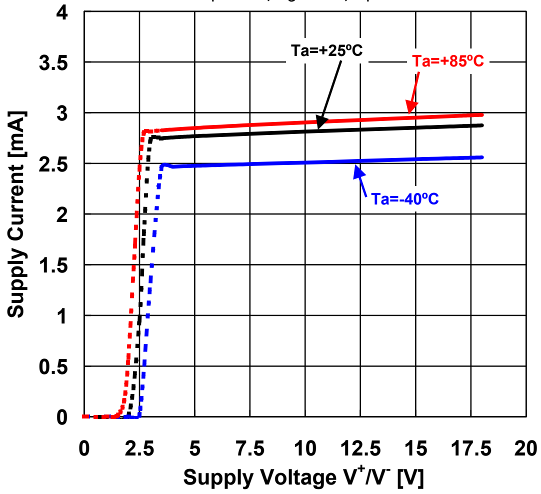
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	Icc	No Signal	-	2.8	4.5	mA
Input Offset Voltage	V_{IO}		-	4	20	mV
Input Bias Current	I_{B+}		-	2	20	uA
	I_{B-}		-	2	20	uA
Transimpedance	Z_T	R_L=150Ω, Vo=±2V	0.25	0.85	-	MΩ
Common Mode Input Voltage Range	V_{ICM}	CMR≥50	±2	±2.25	-	V
Common Mode Rejection Ratio	CMR	$-2 \leq V_{ICM} \leq +2$	50	60	-	dB
Supply Voltage Rejection Ratio	SVR	$\pm3.5 \leq V^+/V^- \leq \pm17.5$	66	76	-	dB
Maximum Output Voltage	V_{OM}	R_L=1kΩ	±2.8	±3.3	-	V
Maximum Output Voltage	V_{OM}	R_L=150Ω	±2.4	±2.8	-	V

● **AC CHARACTERISTICS** (V^+/V^-=±5V, Ta=25°C, unless otherwise noted.)

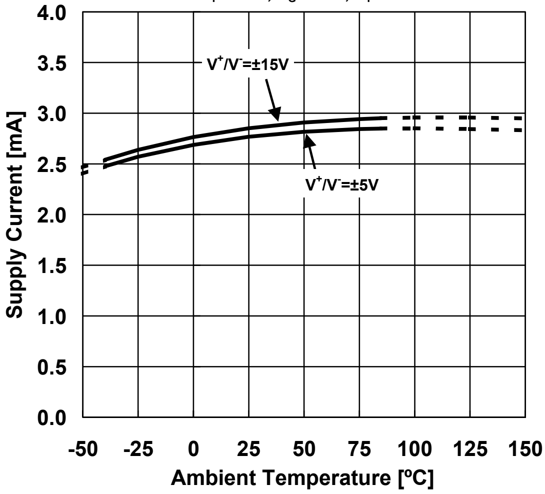
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Bandwidth	BW_{-3dB}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, C_L=1pF	-	52	-	MHz
		G_V=20dB, R_F=680Ω, R_G=75Ω, R_L=150Ω, C_L=1pF	-	16	-	MHz
0.1dB Flatness	$BW_{0.1dB}$	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, C_L=1pF	-	8	-	MHz
Slew Rate	SR	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, C_L=1pF, Vo=2Vpp	-	180	-	V/us
Settling Time 0.1%	ts	G_V=-1, R_F=620Ω, R_G=620Ω, R_L=150Ω, C_L=1pF, Vo=2Vpp	-	50	-	ns
Equivalent Input Noise Voltage	Vni	f=100kHz	-	5	-	nV/√Hz
Equivalent Input Noise Current	Ini+	f=100kHz	-	13	-	pA/√Hz
Total Harmonic Distortion	THD	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, Vo=2Vpp, f=10MHz	-	-50	-	dBc
2nd Harmonic Distortion	HD_{2nd}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, Vo=2Vpp, f=10MHz	-	-60	-	dB
3rd Harmonic Distortion	HD_{3nd}	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, Vo=2Vpp, f=10MHz	-	-50	-	dB
Differential Gain	DG	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, C_L=1pF, V_{INDC}=1/0, V_{IN}=0.286V	-	0.05	-	%
Differential Phase	DP	G_V=6dB, R_F=680Ω, R_G=680Ω, R_L=150Ω, C_L=1pF, V_{INDC}=1/0, V_{IN}=0.286V	-	0.25	-	deg

■ TYPICAL CHARACTERISTICS

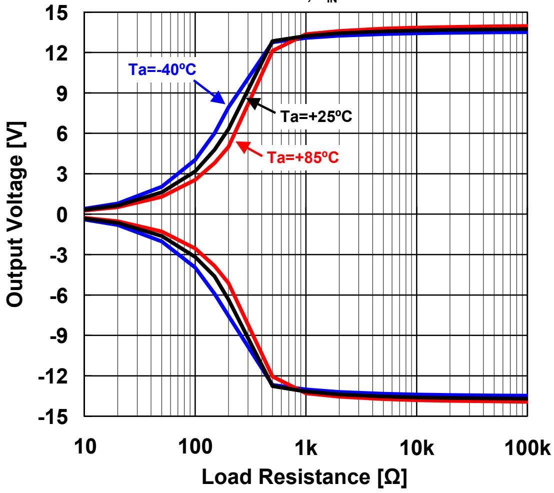
Supply Current vs. Supply Voltage
R_F=680Ω, R_G=680Ω, R_T=50Ω



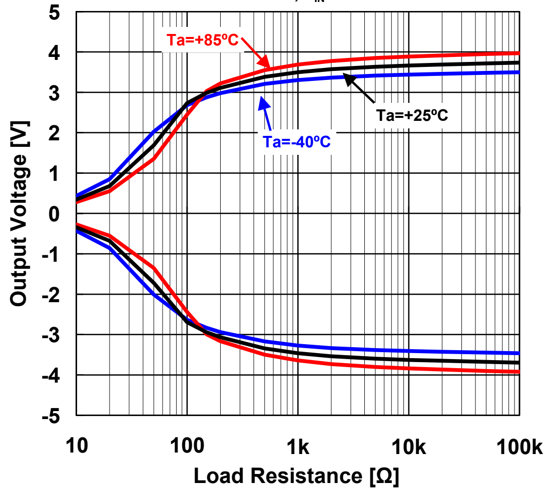
Supply Current vs. Temperature
R_F=680Ω, R_G=680Ω, R_T=50Ω



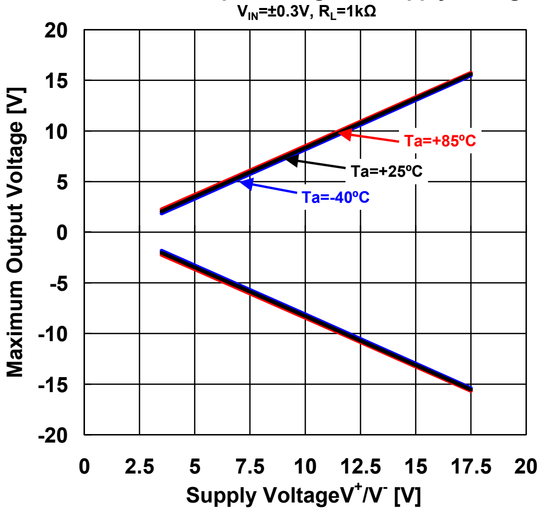
Maximum Output Voltage vs. Load Resistance
V^+/V^-=±15V, V_{IN}=±0.3V



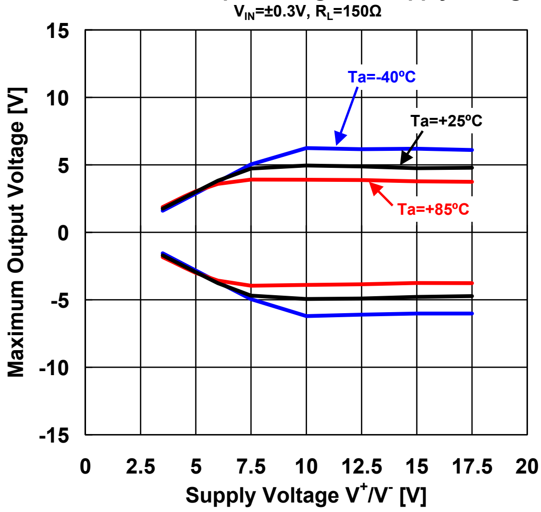
Maximum Output Voltage vs. Load Resistance
V^+/V^-=±5V, V_{IN}=±0.3V



Maximum Output Voltage vs. Supply Voltage
V_{IN}=±0.3V, R_L=1kΩ



Maximum Output Voltage vs. Supply Voltage
V_{IN}=±0.3V, R_L=150Ω



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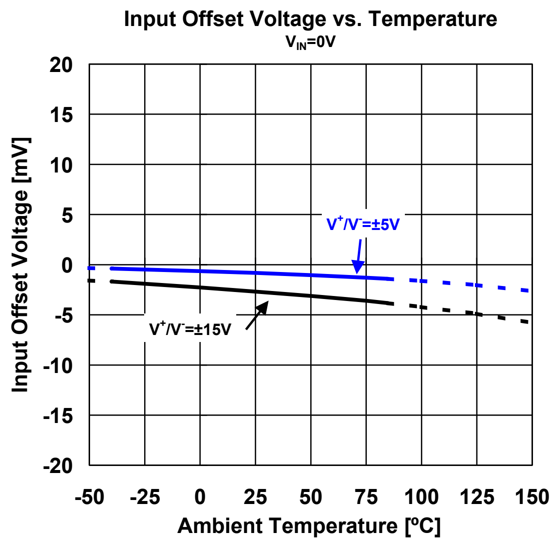

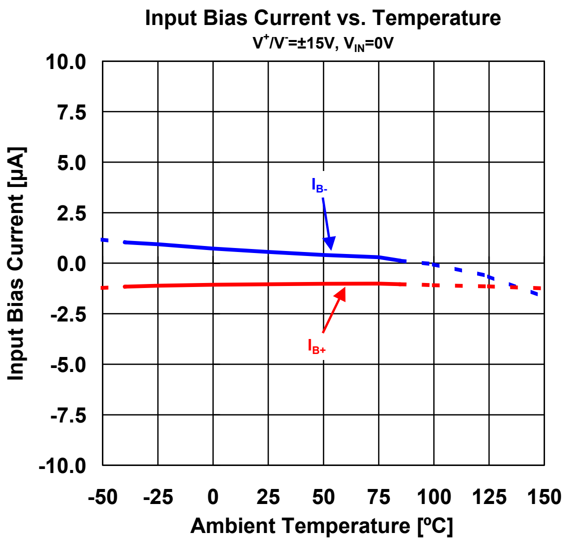

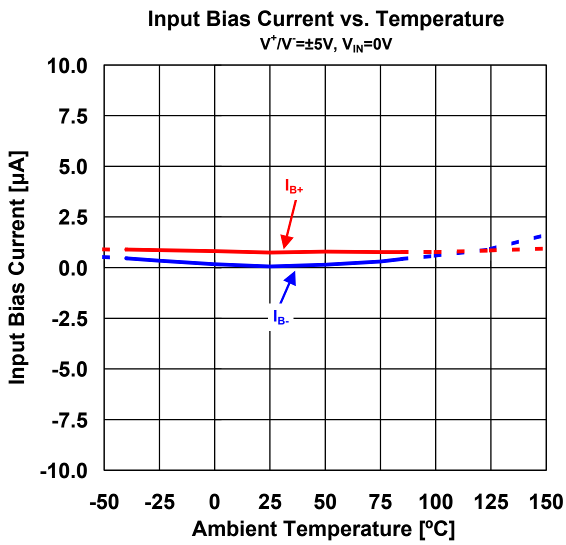

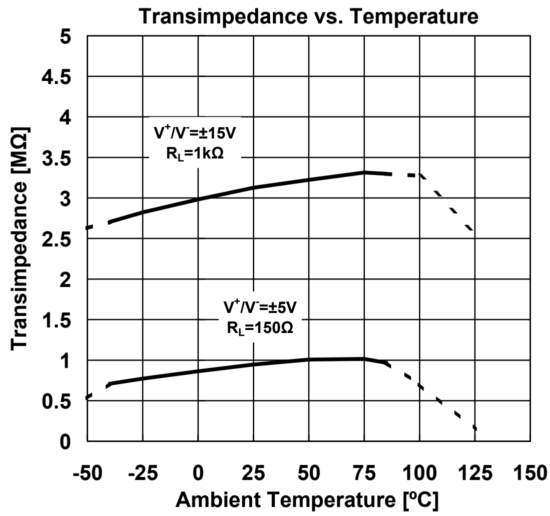

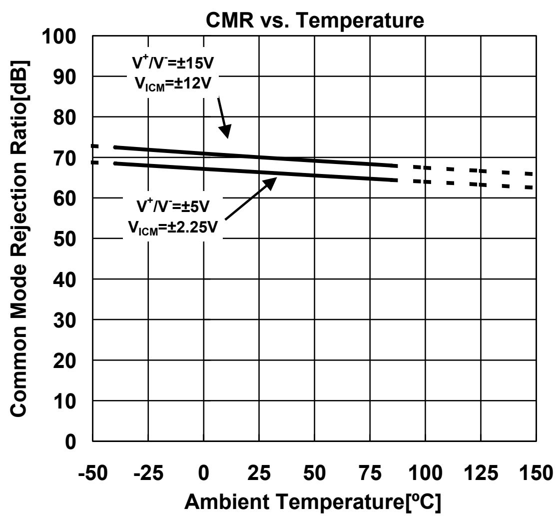

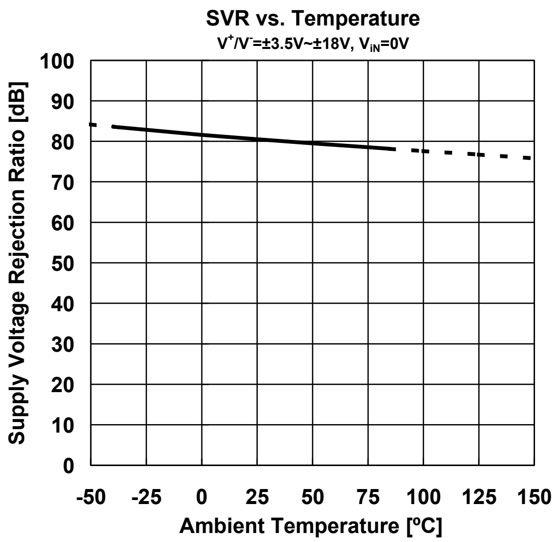

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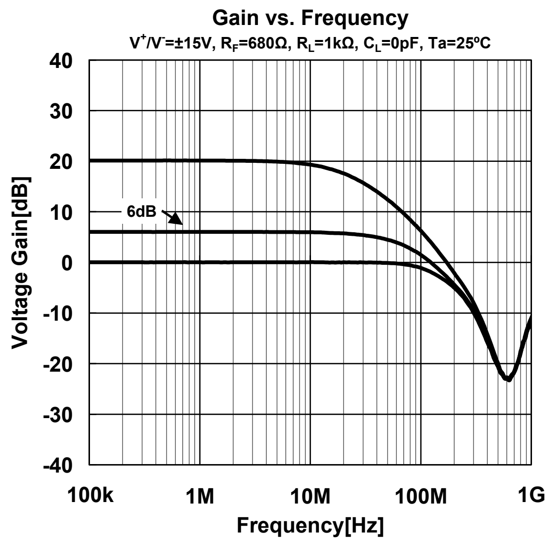
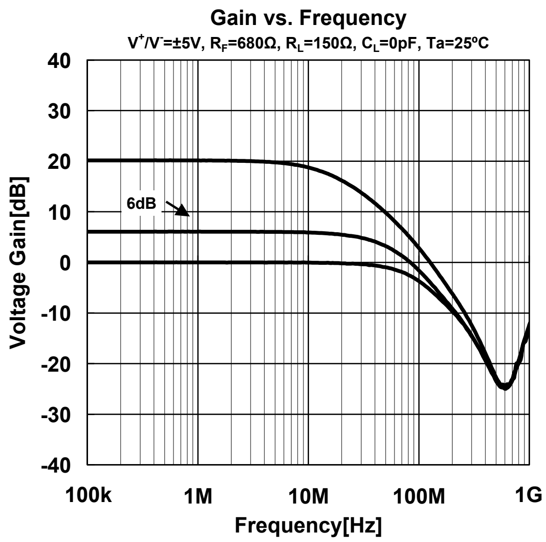
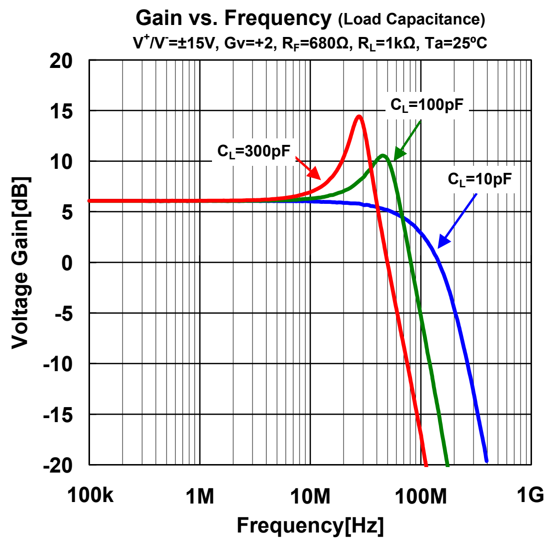
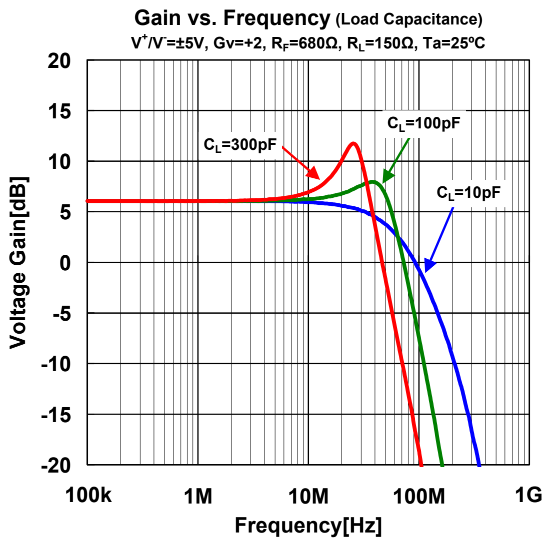
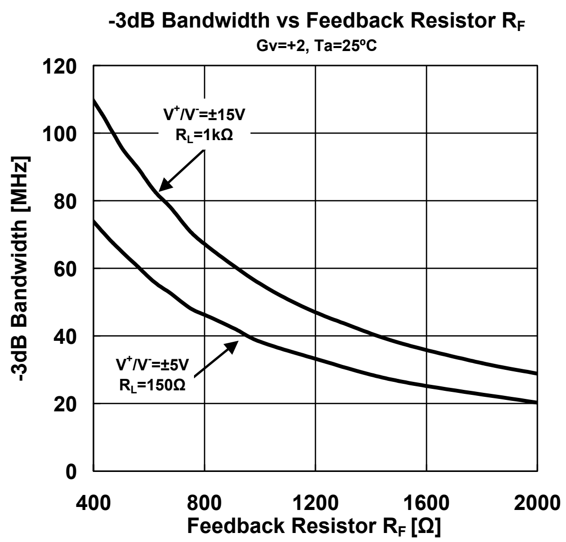




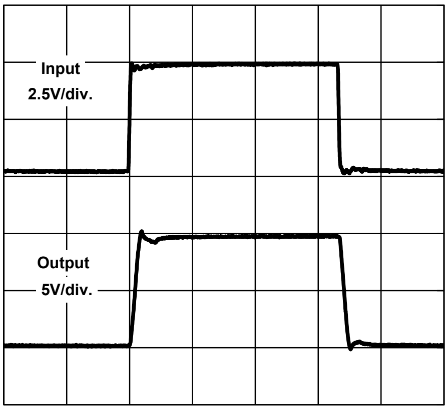






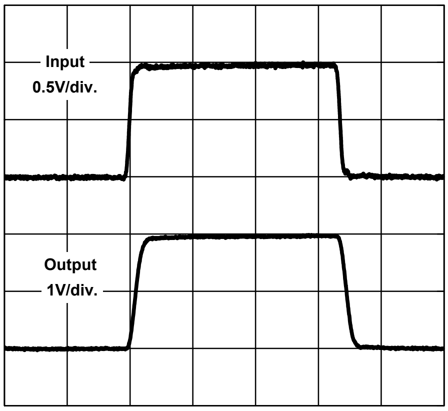
■ TYPICAL CHARACTERISTICS

Pulse Response
V^+/V^-=±15V, Gv=+2, R_F=680Ω, R_L=1kΩ, C_L=0pF, V_O=10Vpp



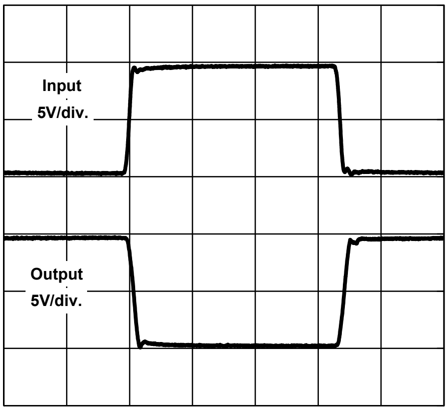
50ns/div.

Pulse Response
V^+/V^-=±5V, Gv=2, R_F=680Ω, R_L=150Ω, C_L=0pF, V_O=2Vpp, Ta=25ºC



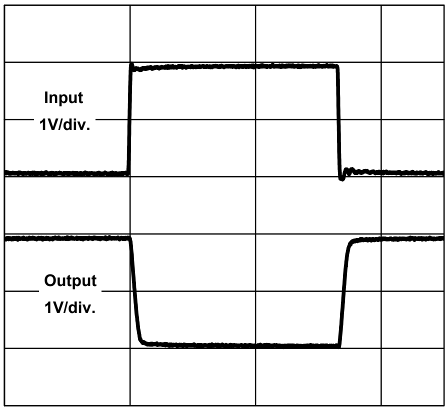
50ns/div.

Pulse Response
V^+/V^-=±15V, Gv=-1, R_F=680Ω, R_L=1kΩ, C_L=0pF, V_O=10Vpp



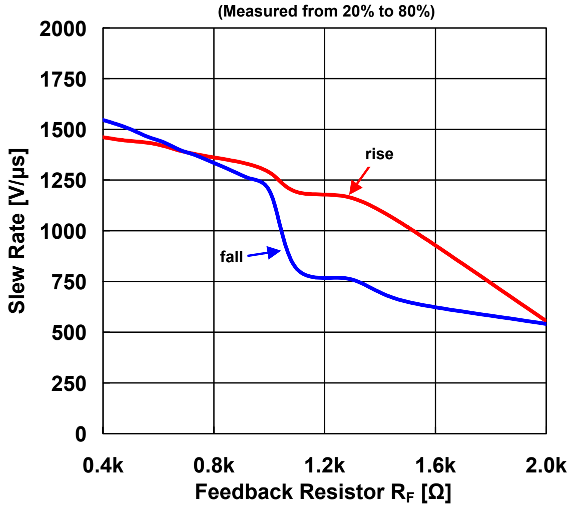
50ns/div.

Pulse Response
V^+/V^-=±5V, Gv=-1, R_F=680Ω, R_L=150Ω, C_L=0pF, V_O=2Vpp, Ta=25ºC

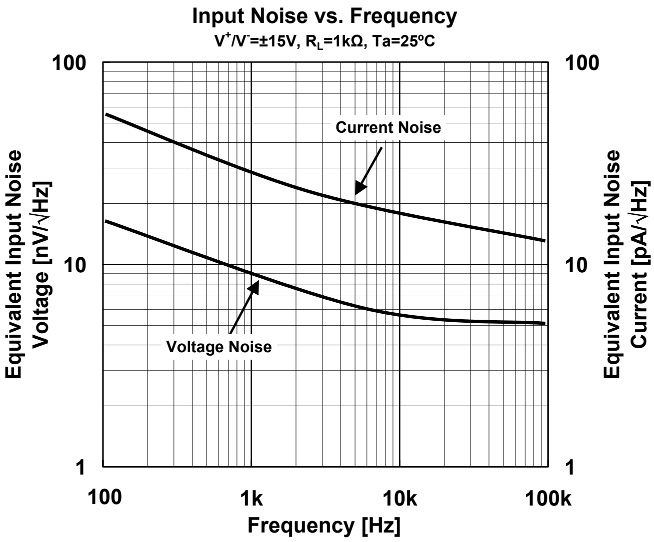


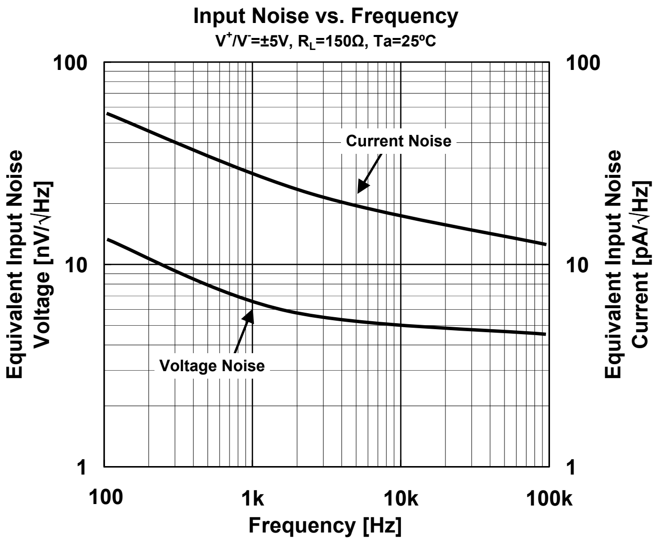
50ns/div.

Slew Rate vs. Feedback Resistor R_F
V^+/V^-=±15V, Gv=+2, Ta=25ºC
(Measured from 20% to 80%)



■ TYPICAL CHARACTERISTICS



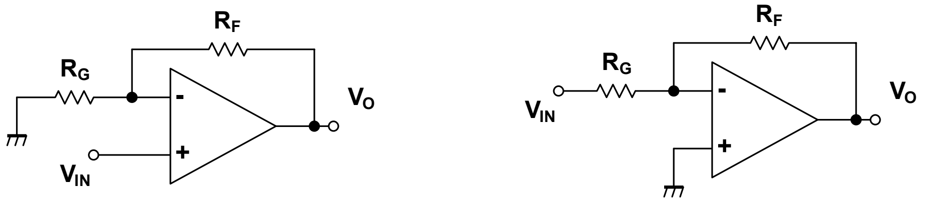


■ Application Note

● Choice of feedback resistor and gain resistor for current feedback operational Amplifier

The NJM2723 is a current feedback operational amplifier. Closed-loop bandwidth depends on the feedback resistor value. Table1 shows recommended resistor values for a variety of useful closed-loop gains and supply voltages.

Figure1. Formula of non−inverting / inverting amplifier



$Gv=1+R_F/R_G$ $Gv=-R_F/R_G$

Table1. -3dB Bandwidth vs. Closed−loop Gain and Resistance Value

$V^+/V^-=\pm 15V$

Closed-Loop Gain	$R_F[\Omega]$	$R_G[\Omega]$	-3dB BW[MHz]
+1	750	-	120
+2	680	680	76
+10	680	75	20
-1	680	680	65
-10	680	68	25

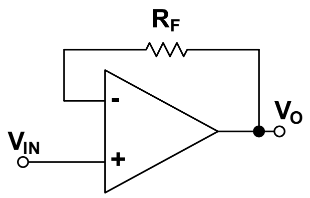
$V^+/V^-=\pm 5V$

Closed-Loop Gain	$R_F[\Omega]$	$R_G[\Omega]$	-3dB BW[MHz]
+1	680	-	85
+2	680	680	52
+10	620	68	15
-1	680	680	50
-10	680	68	20

● In case of using Voltage follower

The feedback resistance must be inserted when using a current feedback amplifier as the voltage follower.
A current feedback amplifier cannot be used by connecting output pin and inverting input pin directly. (Figure2)

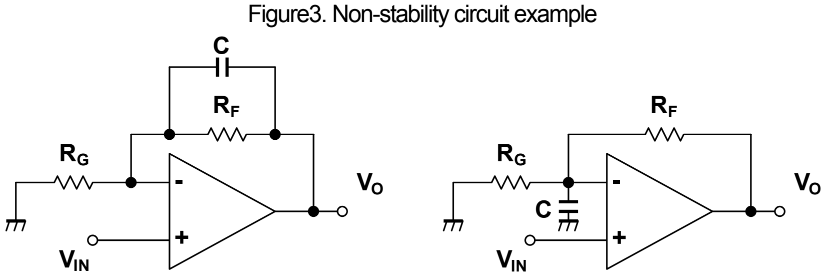
Figure2. Voltage follower circuit



● In case of using capacitive Feedback

For a current feedback amplifier stability operation, do not use a compensation capacitor in parallel with feedback resistance. The dynamic impedance of capacitor in the feedback loop reduces the amplifier's stability.

Figure3. Non-stability circuit example



(a). C connects in paraliel with R_F (b). C connects to input pin

■ **MEMO**

[CAUTION]
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