

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, 24MHz at 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.

■ Features

High Speed

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

For Video Applications ($V^+/V^-=\pm 5V$)

- 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. ($R_L=150\Omega, V^+/V^-=\pm 15V$)
±2.4V min. ($R_L=150\Omega, V^+/V^-=\pm 5V$)
- Supply Range ±3.5V~±17.5V
- Supply Current 5mA max.

■ Applications

- High frequency amplifier
- Active Filter
- 150Ω cable driver
- Video amplifier

150Ω Drive High Slew Rate OP-AMP Lineup (Single)

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

■ Package Outline



NJM2723D

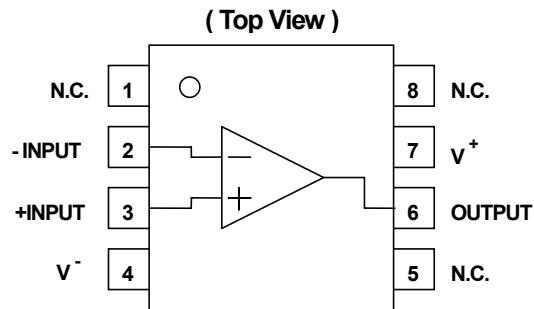


NJM2723E

ORDER INFORMATION

Parts	Package
NJM2723D	DIP8
NJM2723E	SOP8 JEDEC 150mil

■ Pin Configuration



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 SOP8: 375 / 625 (Note2) / 875 (Note3)	mW
Operating Temperature Range	T _{opr}	-40~+85	°C
Storage Temperature Range	T _{stg}	-50~+150	°C

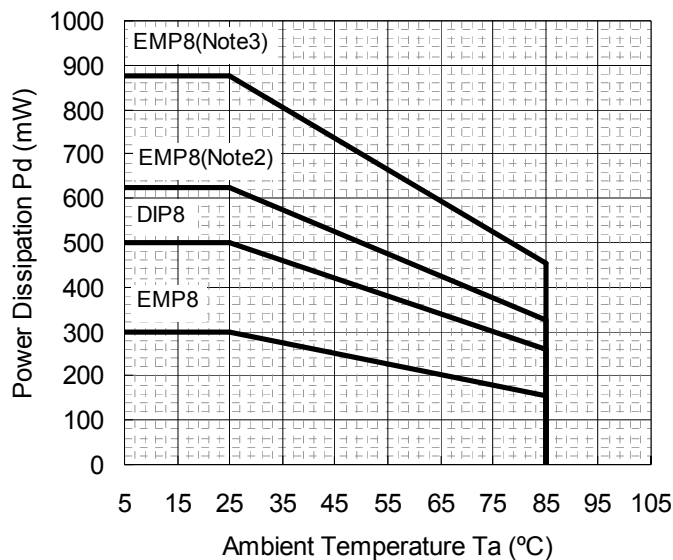
(Note1) For supply voltage less than ±18V, the absolute maximum rating is equal to the supply voltage.

(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 25°C.

Power Dissipation Derating Curve



Package	ΔPd (mW/°C)
DIP8	-4.0
SOP8	-3.0
SOP8(Note2)	-5.0
SOP8(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 CHARACTERISTICS** (Measurement is to be conducted as pulse testing.)

● **DC CHARACTERISTICS**

($V^+ / V^- = \pm 15V$, $T_a = 25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I _{CC}	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, V _o =±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**

($V^+ / V^- = \pm 15V$, $T_a = 25^\circ C$, 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, V _o =10Vpp, measured 20% to 80%	-	1500	-	V/us
Slew Rate	SR	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =1kΩ, C _L =1pF, V _o =20Vpp, measured 20% to 80%	-	2000	-	V/us
Settling Time 0.1%	t _s	G _V =-1, R _F =620Ω, R _G =620Ω, R _L =1kΩ, C _L =1pF, V _o =10Vpp	-	50	-	ns
Equivalent Input Noise Voltage	V _{ni}	f=100kHz	-	6	-	nV/√Hz
Equivalent Input Noise Current	I _{ni+}	f=100kHz	-	13	-	pA/√Hz
Total Harmonic Distortion	THD	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =1kΩ, V _o =2Vpp, f=10MHz	-	-60	-	dBc
2nd Harmonic Distortion	HD _{2nd}	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =1kΩ, V _o =2Vpp, f=10MHz	-	-65	-	dB
3rd Harmonic Distortion	HD _{3rd}	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =1kΩ, V _o =2Vpp, f=10MHz	-	-70	-	dB

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

● DC CHARACTERISTICS

($V^+ / V^- = \pm 5V$, $T_a = 25^\circ C$, unless otherwise noted.)

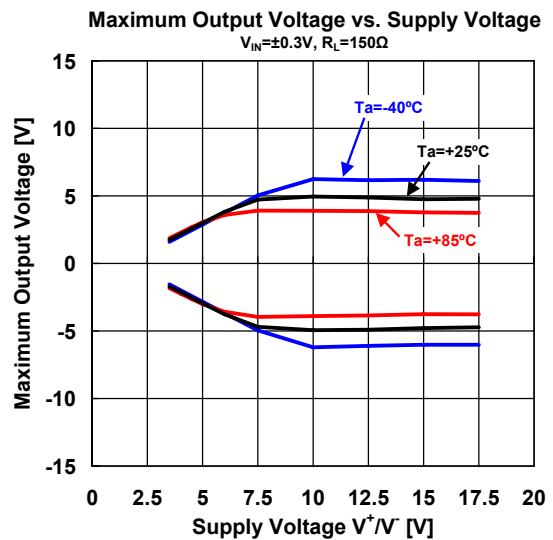
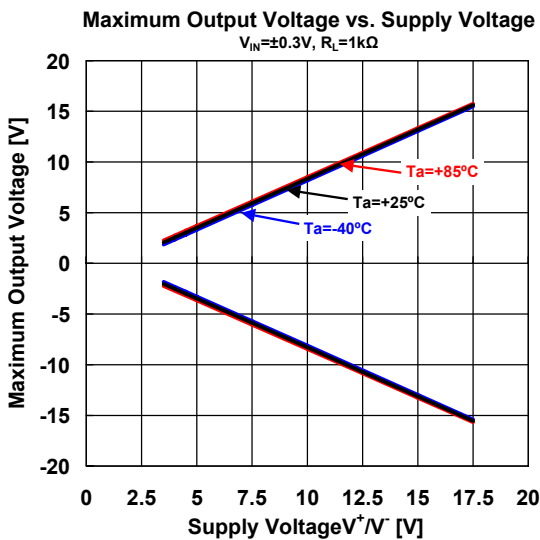
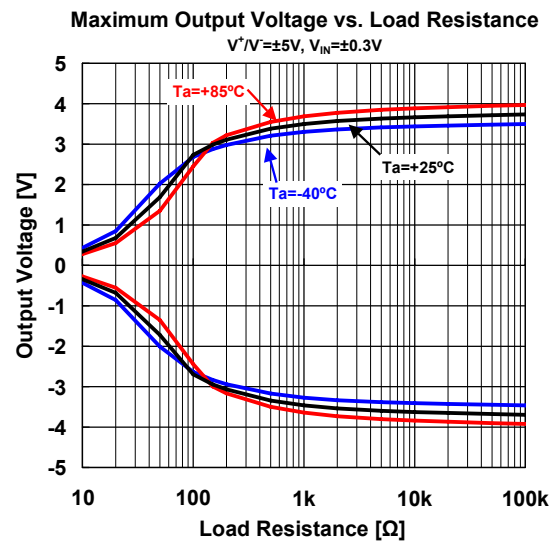
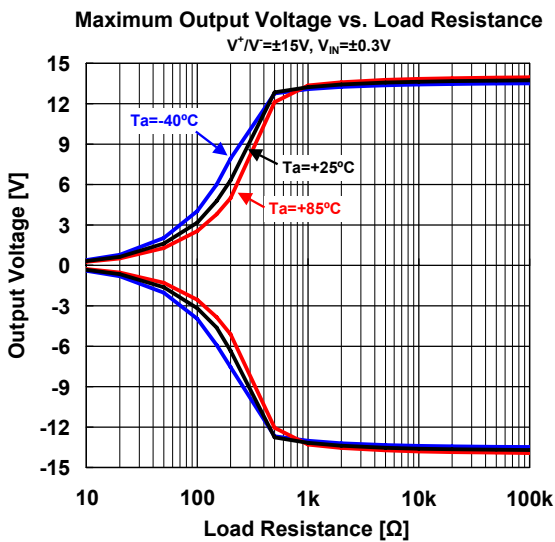
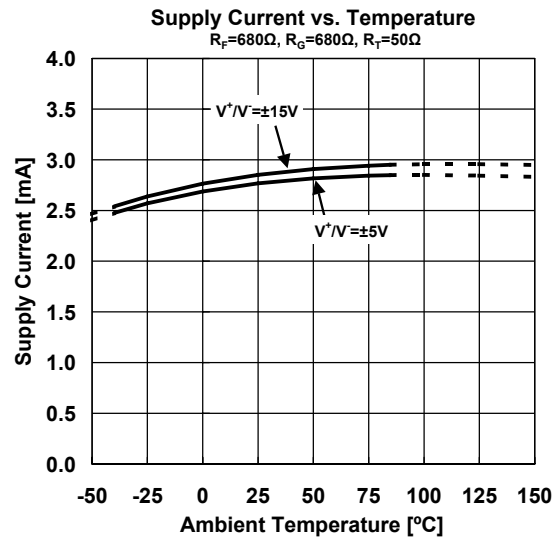
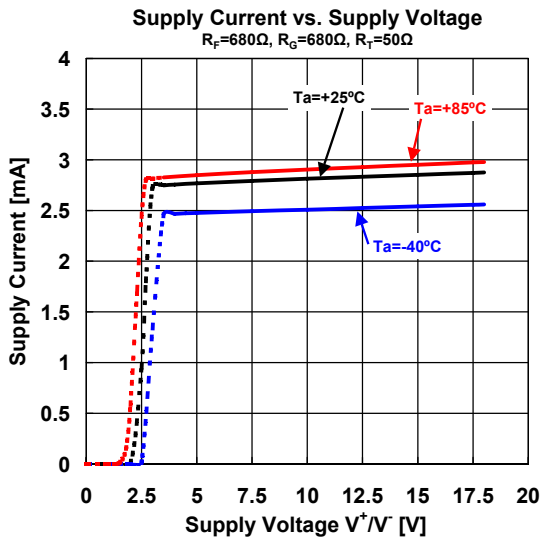
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I _{CC}	No Signal	-	2.8	4.5	mA
Input Offset Voltage	V _{IO}		-	4	20	mV
Input Bias Current	I _{B+}		-	2	20	uA
	I _{B-}		-	2	20	uA
Transimpedance	Z _T	R _L =150Ω, V _o =±2V	0.25	0.85	-	MΩ
Common Mode Input Voltage Range	V _{ICM}	CMR≥50	±2	±2.25	-	V
Common Mode Rejection Ratio	CMR	-2≤V _{ICM} ≤+2	50	60	-	dB
Supply Voltage Rejection Ratio	SVR	±3.5≤V ⁺ /V ⁻ ≤±17.5	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

($V^+ / V^- = \pm 5V$, $T_a = 25^\circ C$, 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, V _o =2Vpp	-	180	-	V/us
Settling Time 0.1%	t _s	G _V =-1, R _F =620Ω, R _G =620Ω, R _L =150Ω, C _L =1pF, V _o =2Vpp	-	50	-	ns
Equivalent Input Noise Voltage	V _{ni}	f=100kHz	-	5	-	nV/√Hz
Equivalent Input Noise Current	I _{ni+}	f=100kHz	-	13	-	pA/√Hz
Total Harmonic Distortion	THD	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =150Ω, V _o =2Vpp, f=10MHz	-	-50	-	dBc
2nd Harmonic Distortion	HD _{2nd}	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =150Ω, V _o =2Vpp, f=10MHz	-	-60	-	dB
3rd Harmonic Distortion	HD _{3rd}	G _V =6dB, R _F =680Ω, R _G =680Ω, R _L =150Ω, V _o =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

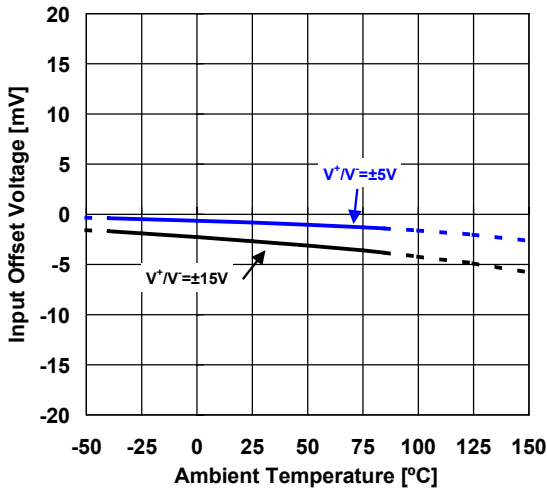
■ TYPICAL CHARACTERISTICS



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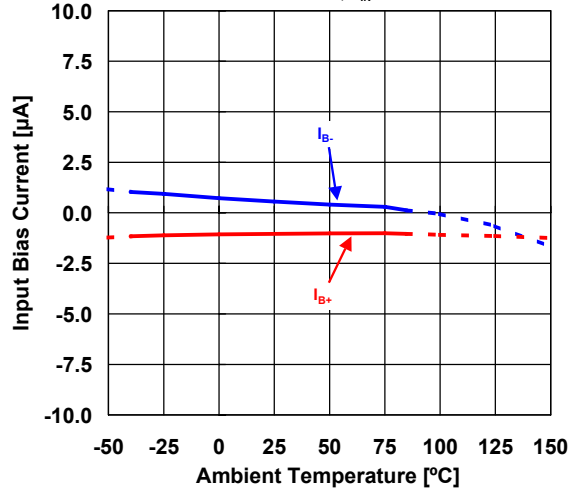
Input Offset Voltage vs. Temperature

$V_{IN}=0V$



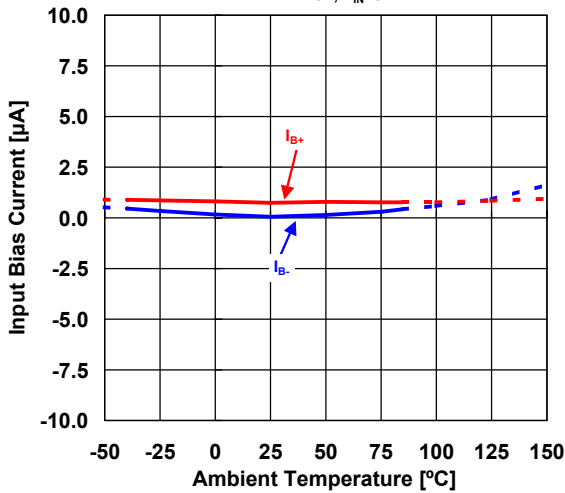
Input Bias Current vs. Temperature

$V^+/V^-=\pm 15V, V_{IN}=0V$

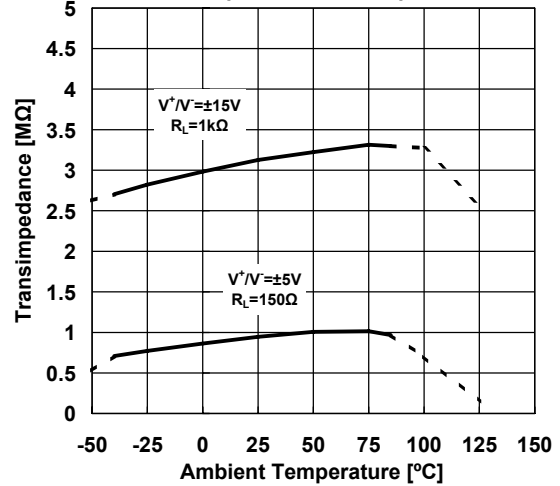


Input Bias Current vs. Temperature

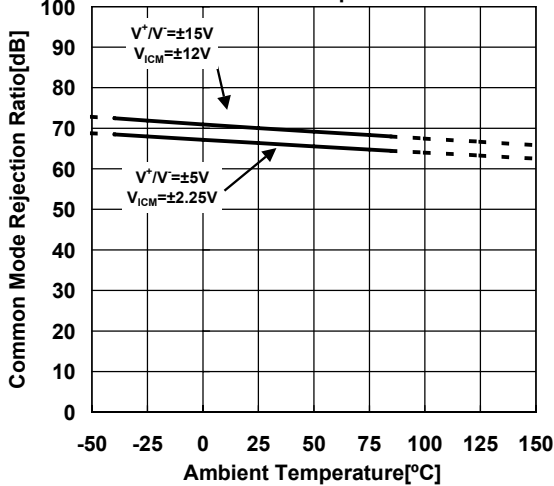
$V^+/V^-=\pm 5V, V_{IN}=0V$



Transimpedance vs. Temperature

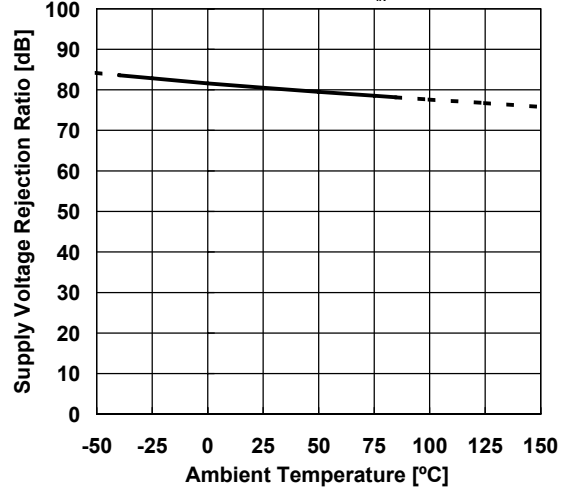


CMR vs. Temperature

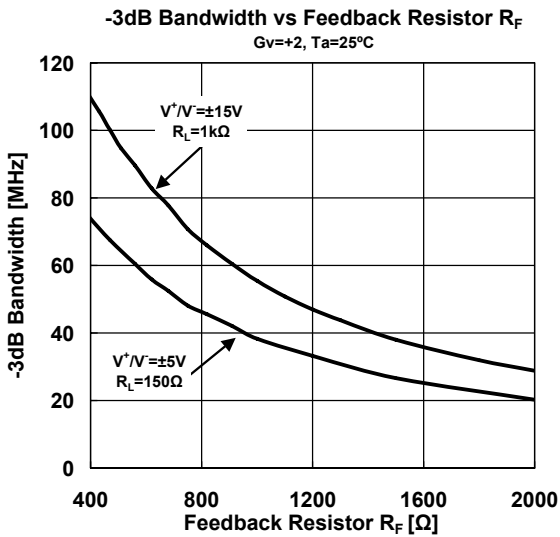
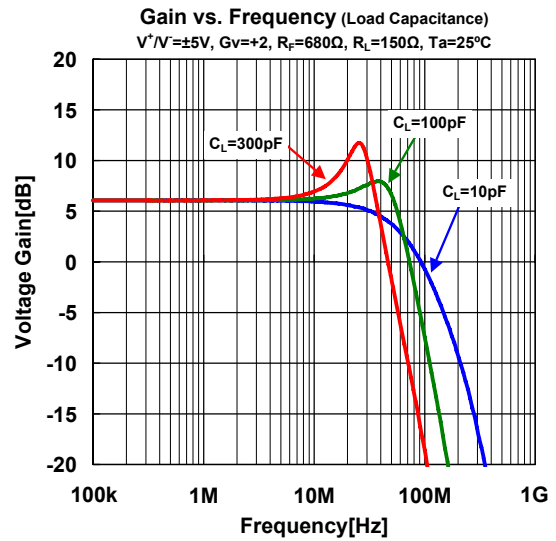
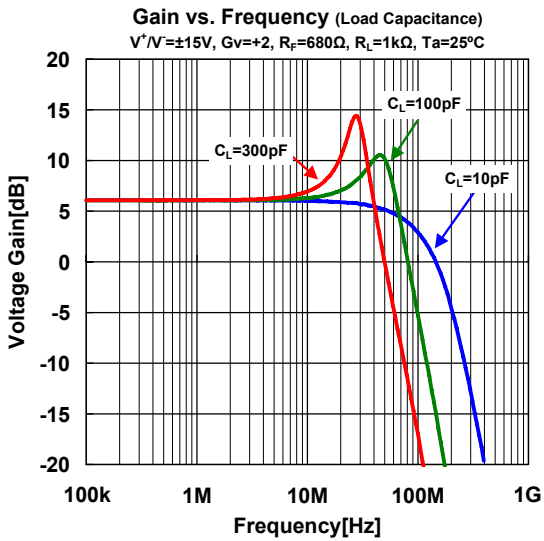
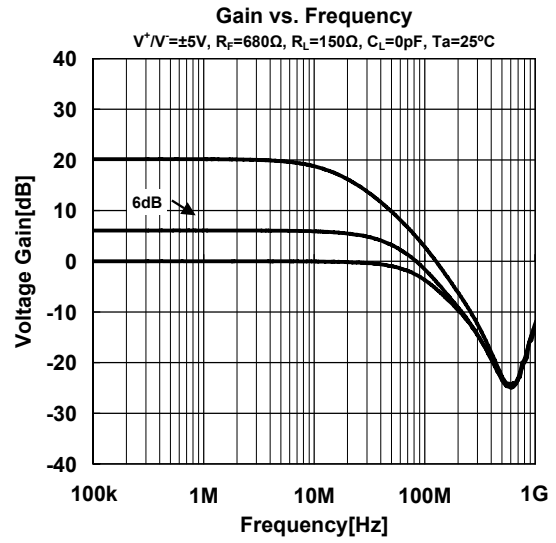
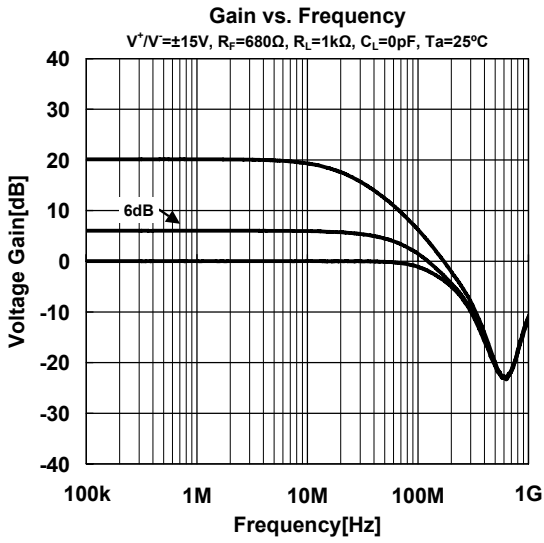


SVR vs. Temperature

$V^+/V^-=\pm 3.5V\sim\pm 18V, V_{IN}=0V$



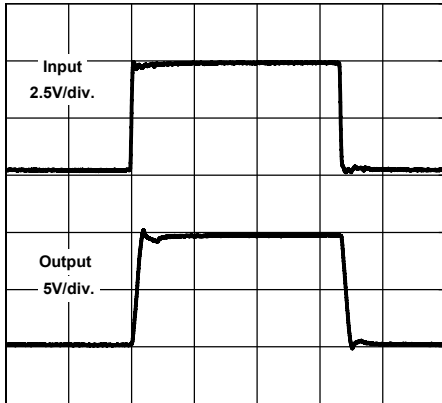
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS

Pulse Response

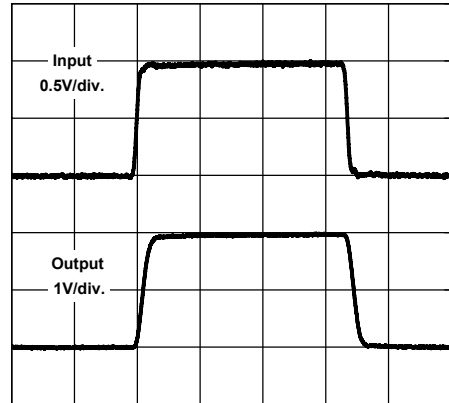
$V^+/V^- = \pm 15V$, $G_v = +2$, $R_F = 680\Omega$, $R_L = 1k\Omega$, $C_L = 0pF$, $V_O = 10V_{pp}$



50ns/div.

Pulse Response

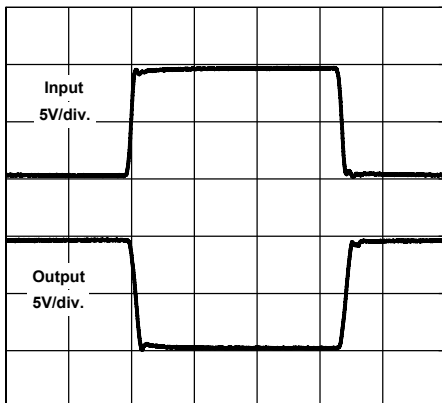
$V^+/V^- = \pm 5V$, $G_v = 2$, $R_F = 680\Omega$, $R_L = 150\Omega$, $C_L = 0pF$, $V_O = 2V_{pp}$, $T_a = 25^\circ C$



50ns/div.

Pulse Response

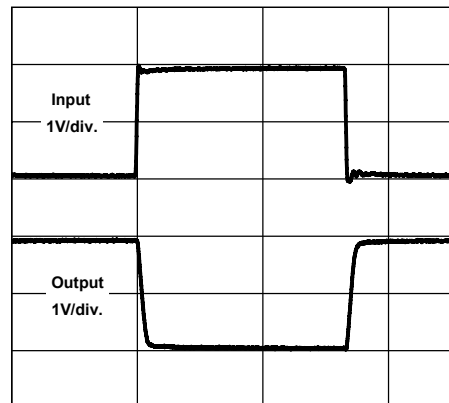
$V^+/V^- = \pm 15V$, $G_v = -1$, $R_F = 680\Omega$, $R_L = 1k\Omega$, $C_L = 0pF$, $V_O = 10V_{pp}$



50ns/div.

Pulse Response

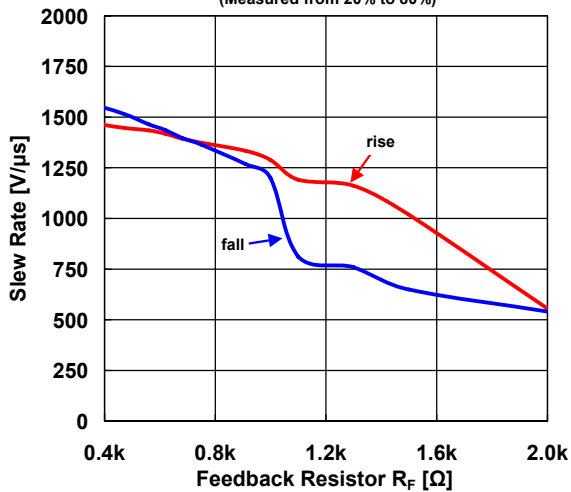
$V^+/V^- = \pm 5V$, $G_v = -1$, $R_F = 680\Omega$, $R_L = 150\Omega$, $C_L = 0pF$, $V_O = 2V_{pp}$, $T_a = 25^\circ C$



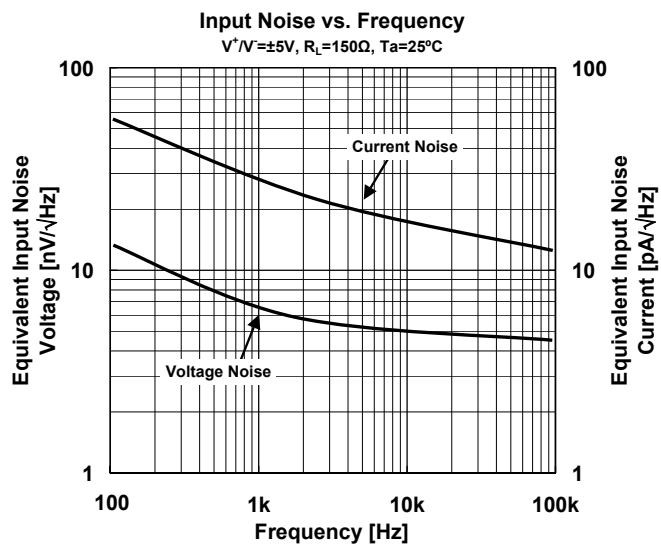
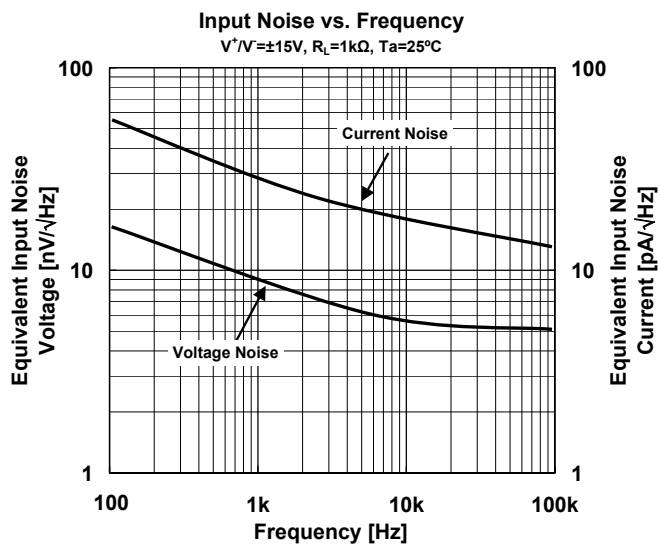
50ns/div.

Slew Rate vs. Feedback Resistor R_F

$V^+/V^- = \pm 15V$, $G_v = +2$, $T_a = 25^\circ C$
(Measured from 20% to 80%)



■ TYPICAL CHARACTERISTICS



NJM2723

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

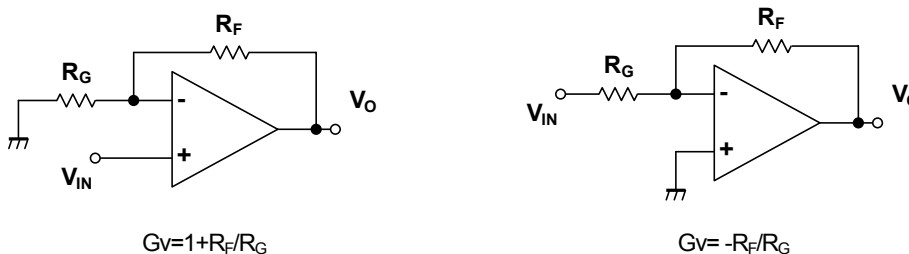


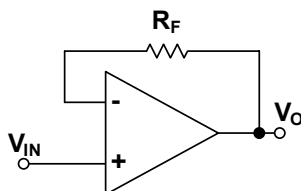
Table1. -3dB Bandwidth vs. Closed-loop Gain and Resistance Value

$V^+/V^- = \pm 15V$				$V^+/V^- = \pm 5V$			
Closed-Loop Gain	$R_F[\Omega]$	$R_G[\Omega]$	-3dB BW[MHz]	Closed-Loop Gain	$R_F[\Omega]$	$R_G[\Omega]$	-3dB BW[MHz]
+1	750	-	120	+1	680	-	85
+2	680	680	76	+2	680	680	52
+10	680	75	20	+10	620	68	15
-1	680	680	65	-1	680	680	50
-10	680	68	25	-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)

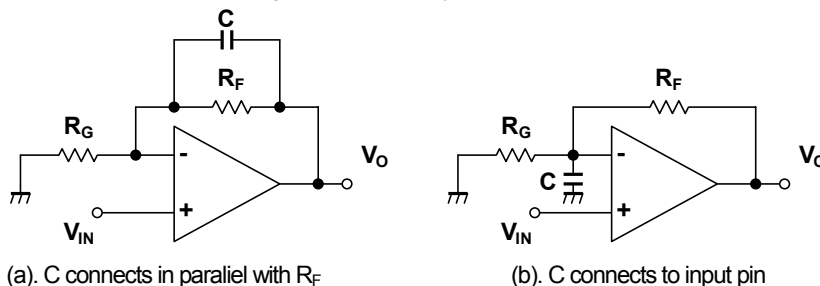
Figure2. Voltage follower circuit



- 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



■ MEMO

[CAUTION]

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