

## Single-Supply High-Operating voltage Dual Operational Amplifier

### ■ GENERAL DESCRIPTION

The NJM2718 is a single-supply high-operating voltage dual operational amplifier. It is suitable for high supply voltage applications.

Large-capacitance drive capability is better or equal than competing products.

### ■ PACKAGE OUTLINE



NJM2718E  
(SOP8)



NJM2718V  
(SSOP8)

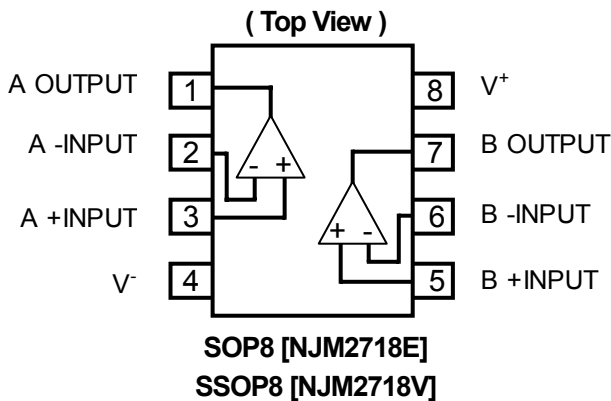
### ■ FEATURES

- Single Supply
- Operating Voltage 3V~36V
- Input Offset Voltage 4mV max.
- Large Capacitance Drive Capability 1000pF typ.
- Output Voltage  $V_{OH} \geq +13.5V$ ,  $V_{OL} \leq -14.0V$  ( at  $V^+ / V^- = \pm 15V$ ,  $R_L = 2k\Omega$  )  
 $V_{OH} \geq +3.7V$ ,  $V_{OL} \leq 0.3V$  ( at  $V^+ = +5V$ ,  $R_L = 2k\Omega$  )
- Slew Rate 3.5V/ $\mu s$  typ. ( at  $V_{in} = 1V_{pp}$ ,  $R_L = 2k\Omega$  )  
9V/ $\mu s$  typ. ( at  $V_{in} = 20V_{pp}$ ,  $R_L = 2k\Omega$  )
- Bipolar Technology
- Package Outline SOP8 JEDEC 150mil , SSOP8

### ■ APPLICATION

- Low-Side Current Sense
- PWM Motor Control System
- Power Supply Module
- Line Driver, ADC/DAC Buffer

### ■ PIN CONFIGURATION



# NJM2718

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	+40	V
Common Mode Input Voltage Range	V <sub>ICM</sub>	V <sup>-</sup> -0.3V to V <sup>+</sup> +0.3V	V
Differential Input Voltage Range	V <sub>ID</sub>	±40	V
Output Voltage	V <sub>O</sub>	V <sup>-</sup> -0.3V to V <sup>+</sup> +0.3V (Note1)	V
Output Sink/Source Current for Each one Output Terminal	I <sub>OPORT</sub>	±80 (Note3)	mA
Flow in Current for V <sup>+</sup> terminal	I <sub>V+</sub>	90 (Note3)	mA
Flow out Current for V <sup>-</sup> terminal	I <sub>Ov-</sub>	90 (Note3)	mA
Power Dissipation	P <sub>D</sub>	300 [SOP8], 250[SSOP8]	mW
		500[SOP8] (Note2)	mW
		350[SSOP8] (Note2)	mW
Operating Temperature Range	T <sub>opr</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-50 to +125	°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 (76.2x114.3x1.6mm, 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.

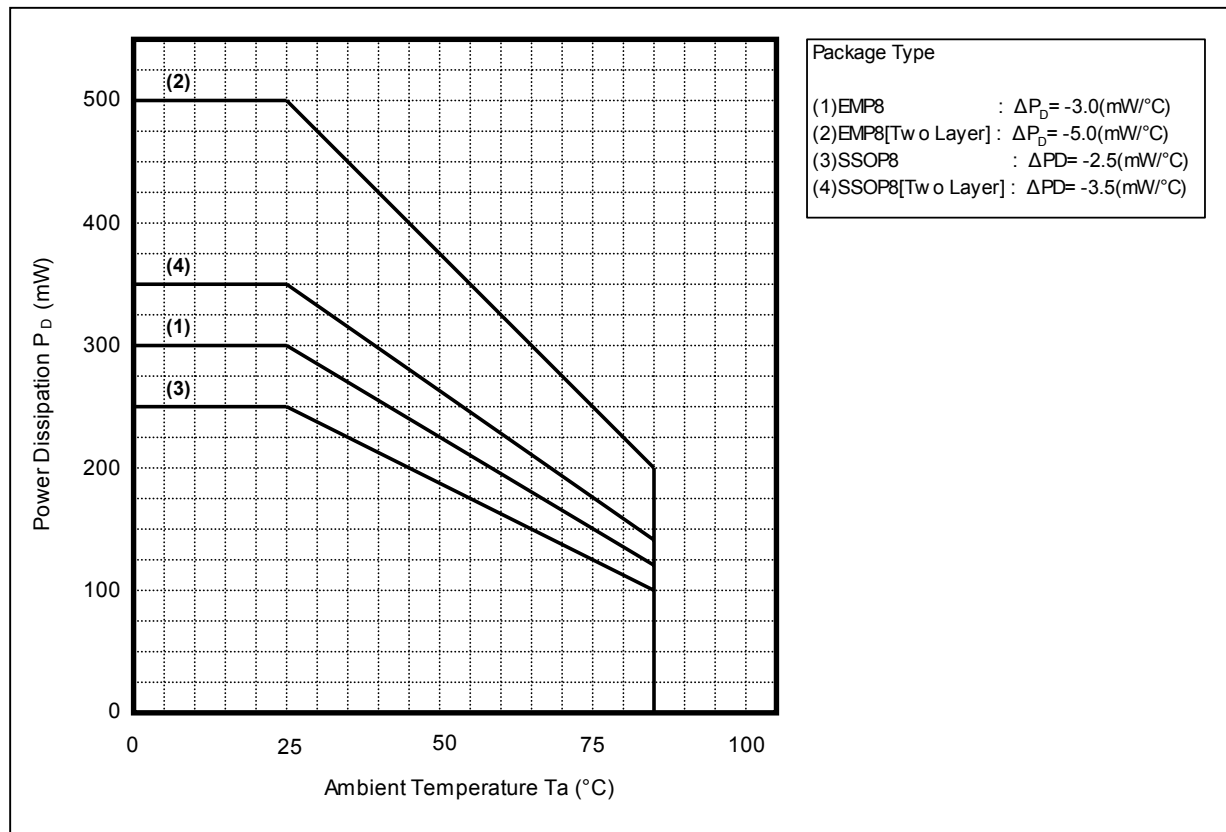


Figure1: Power Dissipation – Ambient Temperature

## ■ OPERATING VOLTAGE

(Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V <sup>+</sup>	(Note3)	+3	-	+36	V

## ■ ELECTRICAL CHARACTERISTICS

### ●DC CHARACTERISTICS ( $V^+V^- = \pm 15V$ , $T_a = 25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	$I_{CC}$	No Signal	-	3.7	5.3	mA
Input Offset Voltage	$V_{IO}$	$R_s = 50\Omega$	-	1	4	mV
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$	$R_s = 50\Omega$	-	10	-	$\mu V/deg$
Input Bias Current	$I_B$	$R_s = 50\Omega$	-	1.2	4	$\mu A$
Input Offset Current	$I_{IO}$	$R_s = 50\Omega$	-	0.1	1.8	$\mu A$
Voltage Gain	$A_v$	$R_L \geq 2k\Omega$ , $V_o = \pm 10V$ , $R_s = 50\Omega$	88	100	-	dB
Common Mode Rejection Ratio	CMR	$-15V \leq V_{ICM} \leq +13V$ , $R_s = 50\Omega$	70	83	-	dB
Supply Voltage Rejection Ratio	SVR	$\pm 1.5V \leq V^+V^- \leq \pm 18V$ , $R_s = 50\Omega$	70	100	-	dB
Maximum Output Voltage 1	$V_{OH1}$	$R_L = 10k\Omega$ to 0V	+13.7	+14	-	V
	$V_{OL1}$	$R_L = 10k\Omega$ to 0V	-	-14.6	-14.2	V
Maximum Output Voltage 2	$V_{OH2}$	$R_L = 2k\Omega$ to 0V	+13.5	+14.0	-	V
	$V_{OL2}$	$R_L = 2k\Omega$ to 0V	-	-13.9	-13.5	V
Output Source Current	$I_{source}$	$V_{in+} = +1V$ , $V_{in-} = 0V$ , $V_o = 0V$	10	30	-	mA
Output Sink Current	$I_{sink}$	$V_{in+} = 0V$ , $V_{in-} = +1V$ , $V_o = 0V$	20	30	-	mA
Common Mode Input Voltage	$V_{ICM}$	CMR $\geq 70$ dB	-15	-	+13	V

### ●AC CHARACTERISTICS ( $V^+V^- = \pm 15V$ , $T_a = 25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$f = 100kHz$	-	1.8	-	MHz
Power Band1	PBW1	$G_v = +1$ , $R_L = 2k\Omega$ to 0V, $V_o = 20V_{pp}$ , THD=1%	-	80	-	kHz
Power Band2	PBW2	$G_v = +1$ , $R_L = 2k\Omega$ to 0V, $V_o = 2V_{pp}$ , THD=1%	-	800	-	kHz
Phase Margin	$\phi_{M1}$	$R_L = 2k\Omega$ to 0V, $C_L = 0pF$	-	85	-	deg
	$\phi_{M2}$	$R_L = 2k\Omega$ to 0V, $C_L = 300pF$	-	75	-	deg
Gain Margin	AM1	$R_L = 2k\Omega$ to 0V, $C_L = 0pF$	-	18	-	dB
	AM2	$R_L = 2k\Omega$ to 0V, $C_L = 300pF$	-	11	-	dB
Equivalent Input Noise Voltage	$V_{NI}$	$R_s = 50\Omega$ , $f = 1kHz$	-	24	-	$nV/\sqrt{Hz}$
Total Harmonic Distortion	THD	$G_v = +10$ , $R_L = 2k\Omega$ to 0V $V_o = 20V_{pp}$ , $f = 10kHz$	-	0.03	-	%
Input Capacitance	$c_i$	$V_{ICM} = 0V$ , $f = 1MHz$ , $V_{inpower} = 0dBm$	-	4.5	-	pF
Channel Separation	CT	$f = 20 \sim 20kHz$ , $R_L = 2k\Omega$	-	120	-	dB

### ●TRANSIENT CHARACTERISTICS ( $V^+V^- = \pm 15V$ , $T_a = 25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate 1	SR1P	$V_{in} = 1V_{pp}$ (-0.5V to +0.5V), $G_v = +1$ , $R_L = 2k\Omega$ to 0V, $C_L = 500pF$	-	3.5	-	$V/\mu s$
	SR1N	$V_{in} = 1V_{pp}$ (-0.5V to +0.5V), $G_v = -1$ , $R_L = 2k\Omega$ to 0V, $C_L = 500pF$	-	3.5	-	$V/\mu s$
Slew Rate 2	SR2P	$V_{in} = 20V_{pp}$ (-10V to +10V), $G_v = +1$ , $R_L = 2k\Omega$ to 0V, $C_L = 500pF$	-	9	-	$V/\mu s$
	SR2N	$V_{in} = 20V_{pp}$ (-10V to +10V), $G_v = -1$ , $R_L = 2k\Omega$ to 0V, $C_L = 500pF$	-	9	-	$V/\mu s$
Settling time(0.1%)	$ts1$	$V_{in} = 10V_{pp}$ , $G_v = -1$ , $R_{in} = 1k\Omega$ , $R_f = 1k\Omega$ , $R_g = 5k\Omega$ , $C_L = 470pF$	-	0.9	-	$\mu s$
Settling time(0.01%)	$ts2$	$V_{in} = 10V_{pp}$ , $G_v = -1$ , $R_{in} = 1k\Omega$ , $R_f = 1k\Omega$ , $R_g = 5k\Omega$ , $C_L = 470pF$	-	1.9	-	$\mu s$

# NJM2718

## ■ ELECTRICAL CHARACTERISTICS

### ●DC CHARACTERISTICS ( $V^+=+5V$ , $V^-=0V$ , $T_a=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	$I_{CC}$	No Signal	-	2.8	3.5	mA
Input Offset Voltage	$V_{IO}$	$R_s=50\Omega$	-	1	4	mV
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$	$R_s=50\Omega$	-	10	-	$\mu V/deg$
Input Bias Current	$I_B$	$R_s=50\Omega$	-	1	4	$\mu A$
Input Offset Current	$I_{IO}$	$R_s=50\Omega$	-	0.1	1.8	$\mu A$
Voltage Gain	$A_v$	$R_L \geq 2k\Omega$ , $V_o=1.5V$ to $3.5V$ , $R_s=50\Omega$	80	100	-	dB
Common Mode Rejection Ratio	CMR	$0V \leq V_{ICM} \leq 3V$ , $R_s=50\Omega$	65	80	-	dB
Supply Voltage Rejection Ratio	SVR	$\pm 1.5V \leq V^+ / V^- \leq \pm 2.5V$ , $R_s=50\Omega$	70	85	-	dB
Maximum Output Voltage 1	$V_{OH1}$	$R_L=2k\Omega$ to $0V$	3.7	4	-	V
	$V_{OL1}$	$R_L=2k\Omega$ to $0V$	-	0.1	0.2	V
Output Source Current	$I_{source}$	$V_{in}=+1V$ , $V_{in}=0V$ , $V_o=+2.5V$	10	20	-	mA
Output Sink Current	$I_{sink}$	$V_{in}=0V$ , $V_{in}=+1V$ , $V_o=+2.5V$	20	30	-	mA
Common Mode Input Voltage	$V_{ICM}$	CMR $\geq 65$ dB	0	-	3	V

### ●AC CHARACTERISTICS ( $V^+=+5V$ , $V^-=0V$ , $T_a=25^\circ C$ )

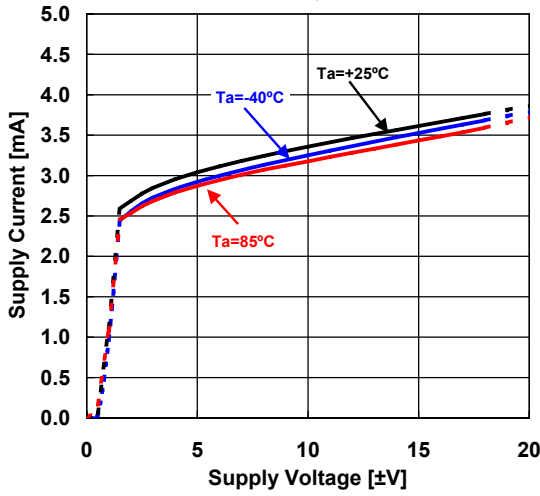
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$f=100kHz$	-	1.7	-	MHz
Power Band1	PBW1	$G_v=+1$ , $R_L=2k\Omega$ to $2.5V$ , $V_o=2V_{pp}$ , THD=1%	-	600	-	kHz
Phase Margin	$\phi M1$	$R_L=2k\Omega$ to $2.5V$ , $C_L=0pF$	-	75	-	deg
	$\phi M2$	$R_L=2k\Omega$ to $2.5V$ , $C_L=300pF$	-	70	-	deg
Gain Margin	AM1	$R_L=2k\Omega$ to $2.5V$ , $C_L=0pF$	-	17	-	dB
	AM2	$R_L=2k\Omega$ to $2.5V$ , $C_L=300pF$	-	11	-	dB
Equivalent Input Noise Voltage	$V_{NI}$	$R_s=50\Omega$ , $f=1kHz$	-	24	-	$nV/\sqrt{Hz}$
Total Harmonic Distortion	THD	$G_v=+10$ , $R_L=2k\Omega$ to $2.5V$ , $V_o=3V_{pp}$ , $f=10kHz$	-	0.05	-	%
Input Capacitance	$c_i$	$V_{cm}=0V$ , $f=1MHz$ , $V_{inpower}=0dBm$	-	5	-	pF
Channel Separation	CT	$f=10kHz$	-	110	-	dB

### ●TRANSIENT CHARACTERISTICS ( $V^+=+5V$ , $V^-=0V$ , $T_a=25^\circ C$ )

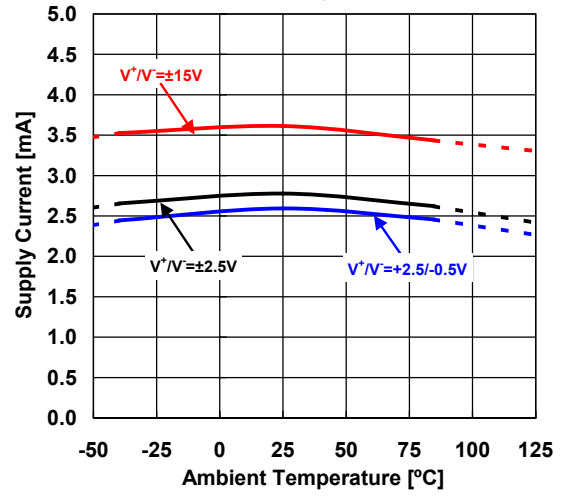
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate 1	$SR1_P$	$V_{in}=1V_{pp}$ (+2V to +3V), $G_v=+1$ , $R_L=2k\Omega$ to $0V$ , $C_L=500pF$	-	3	-	$V/\mu s$
	$SR1_N$	$V_{in}=1V_{pp}$ (+2V to +3V), $G_v=-1$ , $R_L=2k\Omega$ to $0V$ , $C_L=500pF$	-	2.5	-	$V/\mu s$
Settling time(0.1%)	$ts1$	$V_{in}=1V_{pp}$ , $G_v=-1$ , $R_{in}=1k\Omega$ , $R_f=1k\Omega$ , $R_g=5k\Omega$ , $C_L=470pF$	-	1.5	-	$\mu s$
Settling time(0.01%)	$ts2$	$V_{in}=1V_{pp}$ , $G_v=-1$ , $R_{in}=1k\Omega$ , $R_f=1k\Omega$ , $R_g=5k\Omega$ , $C_L=470pF$	-	3	-	$\mu s$

## ■ TYPICAL CHARACTERISTICS

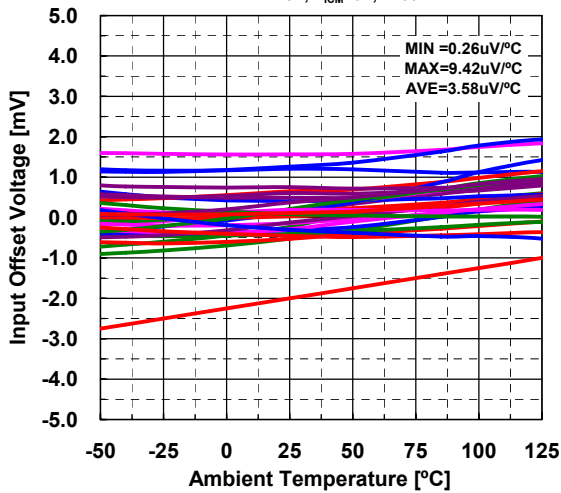
Supply Current vs. Supply Voltage (Temperature)  
 $V_{IN}=0, R_S=50\Omega$



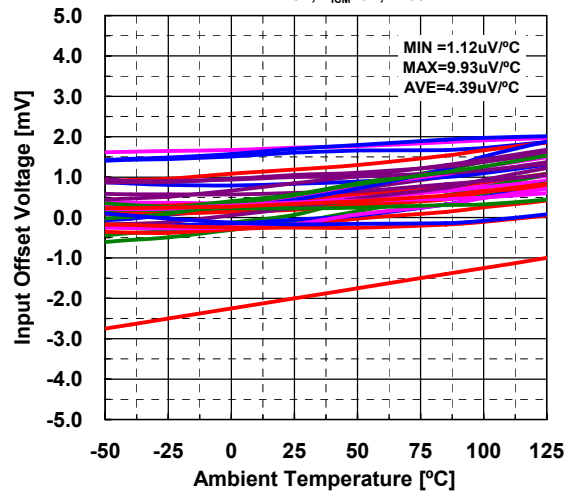
Supply Current vs. Temperature (supply Voltage)  
 $V_{IN}=0, R_S=50\Omega$



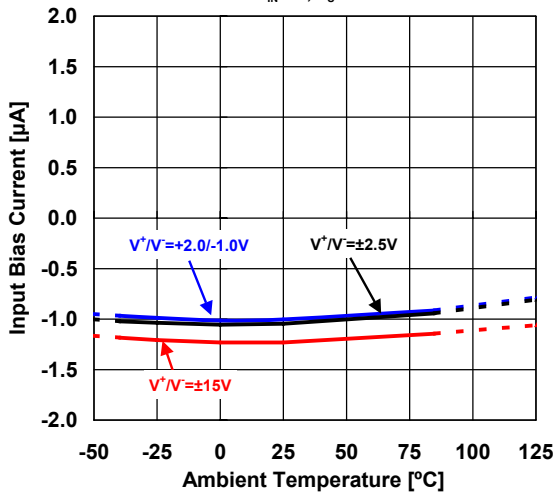
Input Offset Voltage vs. Temperature  
 $V^*/V = \pm 15\text{V}, V_{ICM}=0\text{V}, n=30$



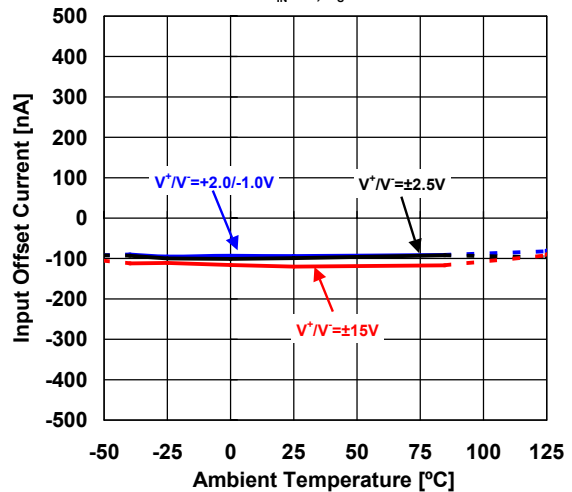
Input Offset Voltage vs. Temperature  
 $V^*/V = \pm 2.5\text{V}, V_{ICM}=0\text{V}, n=30$



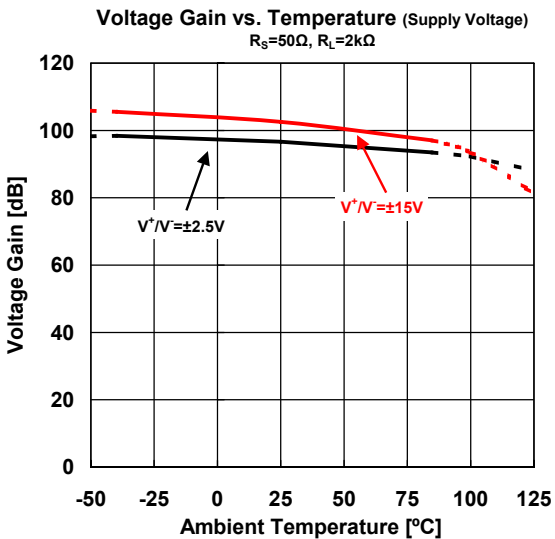
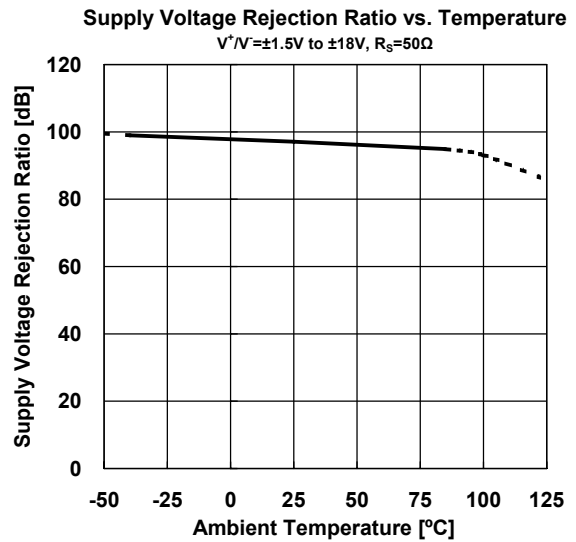
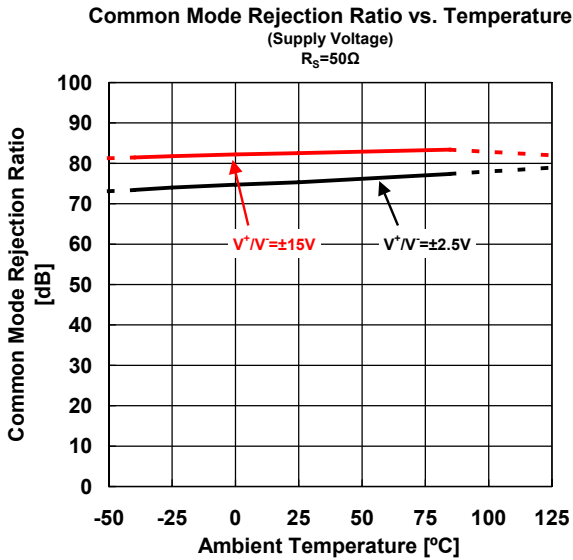
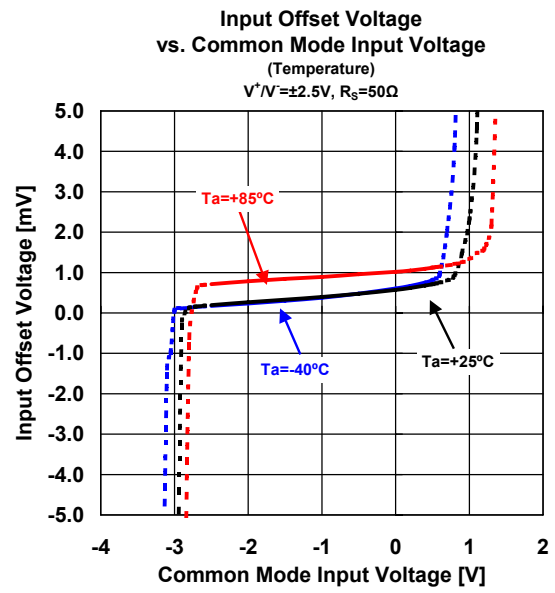
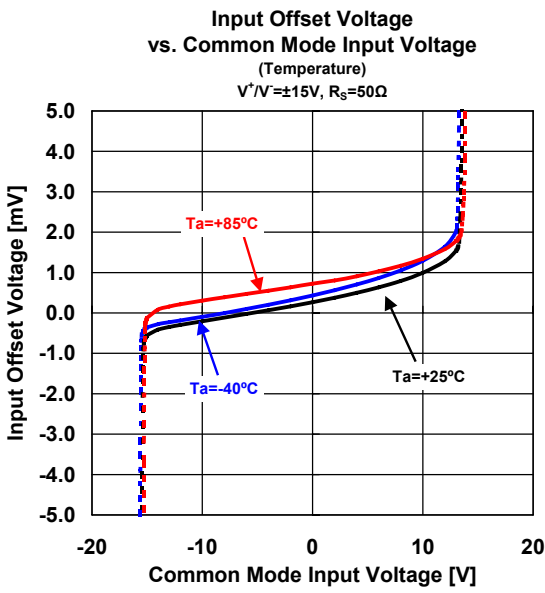
Input Bias Current vs. Temperature (Supply Voltage)  
 $V_{IN}=0\text{V}, R_S=50\Omega$



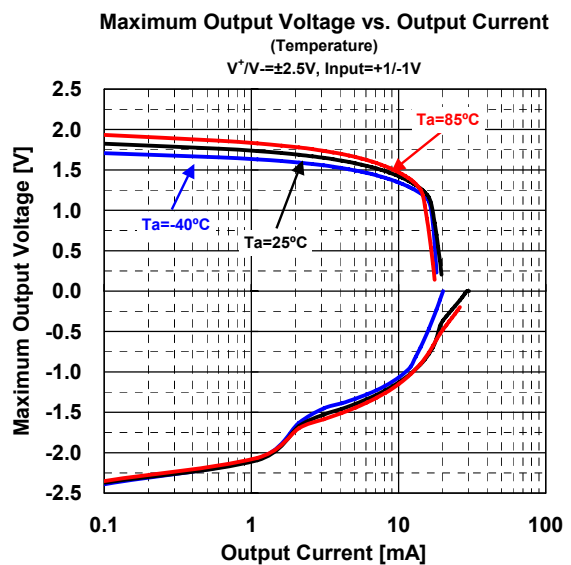
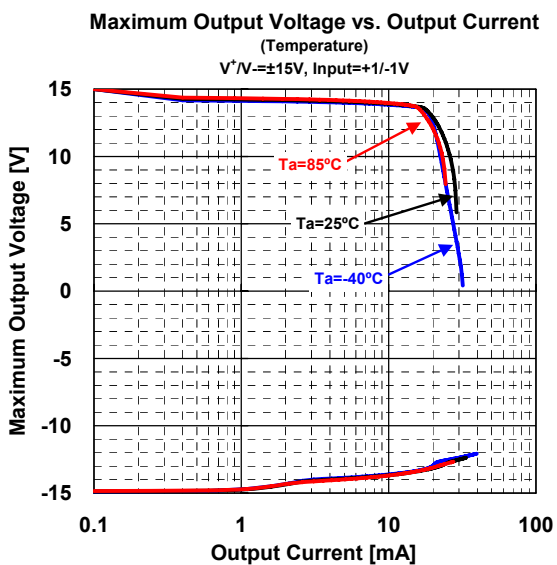
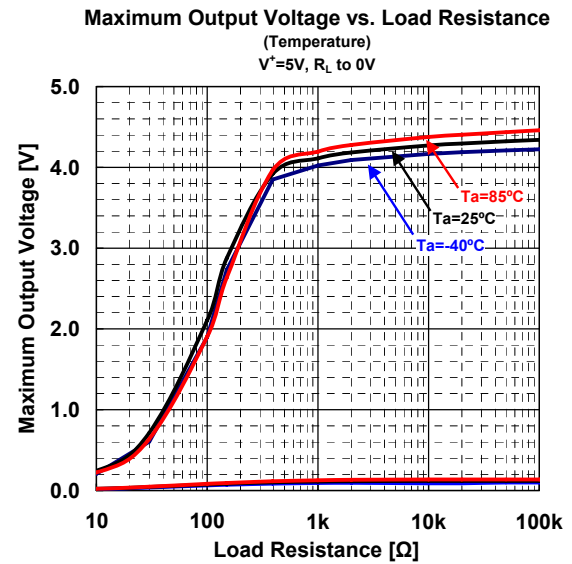
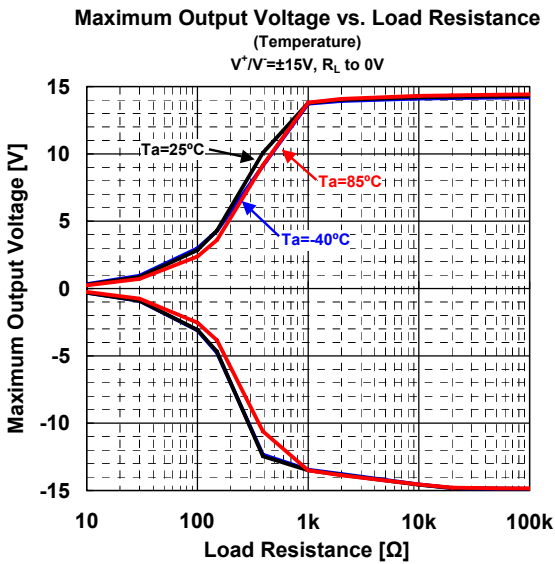
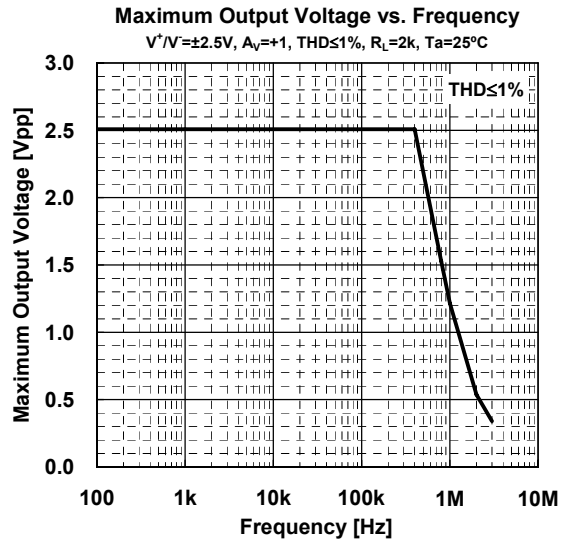
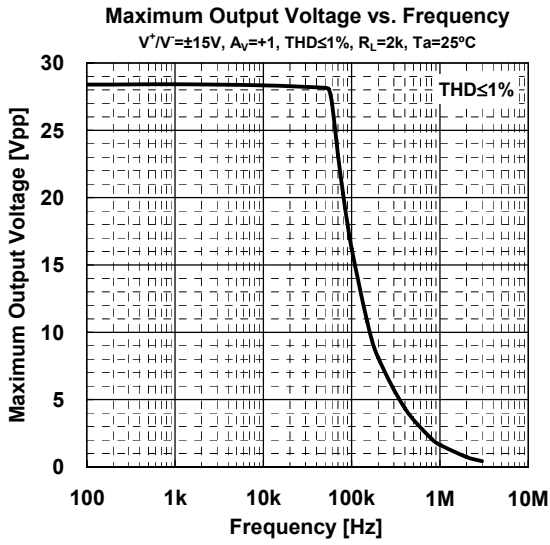
Input Offset Current vs. Temperature (Supply Voltage)  
 $V_{IN}=0\text{V}, R_S=50\Omega$



## ■ TYPICAL CHARACTERISTICS



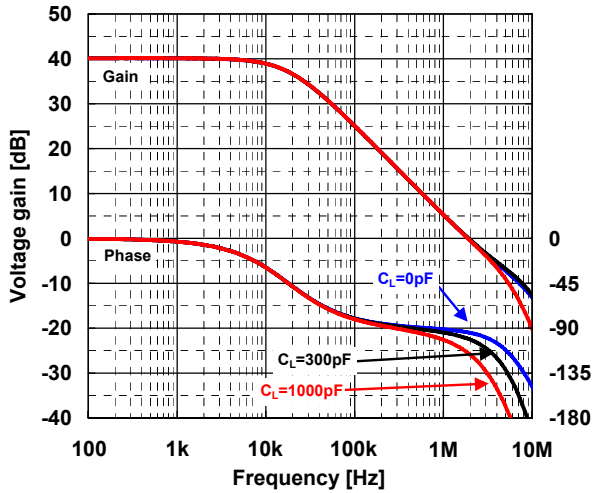
## ■ TYPICAL CHARACTERISTICS



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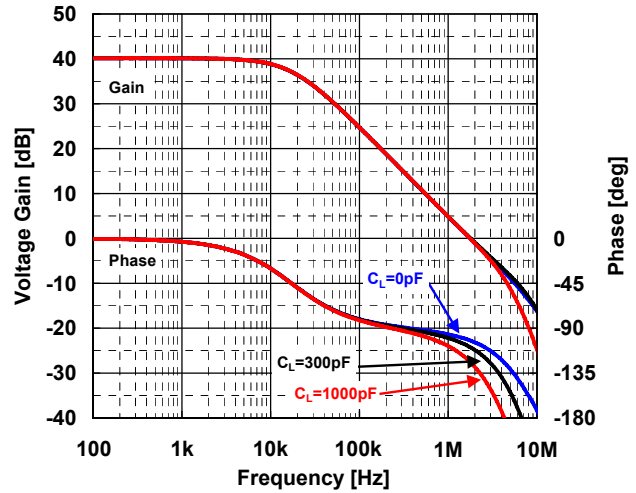
40dB Gain/Phase vs. Frequency (Load Capacitance)

$V^+/V^- = \pm 15V$ ,  $V_{IN} = -20dBm$ ,  $R_G = 20\Omega$ ,  
 $R_F = 2k\Omega$ ,  $R_L = 2k\Omega$  to 0V,  $T_a = 25^\circ C$



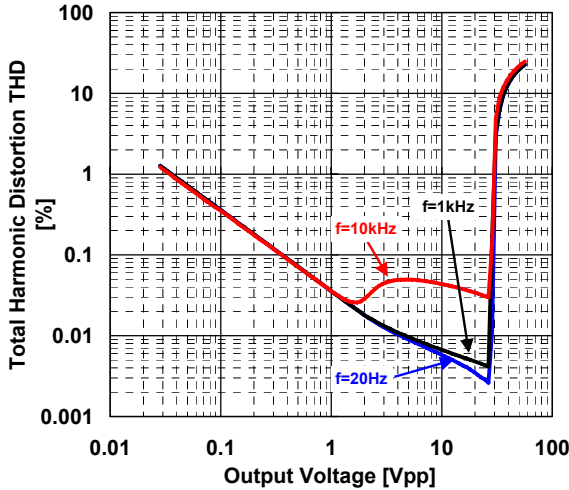
40dB gain/Phase vs. Frequency (Load Capacitance)

$V^+/V^- = \pm 2.5V$ ,  $V_{IN} = -20dBm$ ,  $R_G = 20\Omega$ ,  
 $R_F = 2k\Omega$ ,  $R_L = 2k\Omega$  to 0V,  $T_a = 25^\circ C$



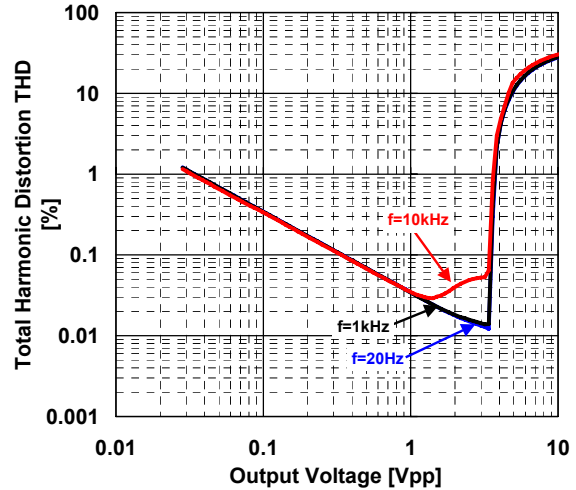
THD vs. Output Voltage (Frequency)

$V^+/V^- = \pm 15V$ ,  $V_{IN} = 2Vpp$ ,  $A_V = 20dB$ ,  $V_O = 20Vpp$ ,  
 $R_1 = 1k\Omega$ ,  $R_2 = 9k\Omega$ ,  $R_G = 1k\Omega$ ,  $R_L = 2k\Omega$ ,  
 $BW = 10\sim 500kHz$ ,  $T_a = 25^\circ C$



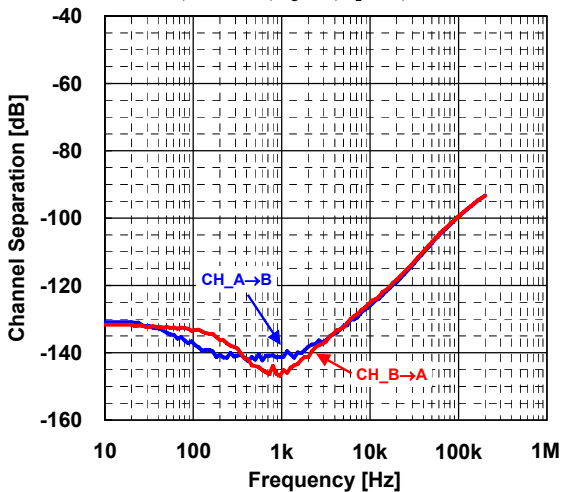
THD vs. Output Voltage (Frequency)

$V^+/V^- = \pm 2.5V$ ,  $Z_{IN} = 40\Omega$ ,  $A_V = 20dB$ ,  $V_O = 3Vpp$ ,  
 $R_1 = 1k\Omega$ ,  $R_2 = 9k\Omega$ ,  $R_G = 10k\Omega$ ,  $R_L = 2k\Omega$ ,  
 $BW = 10\sim 500kHz$ ,  $T_a = 25^\circ C$



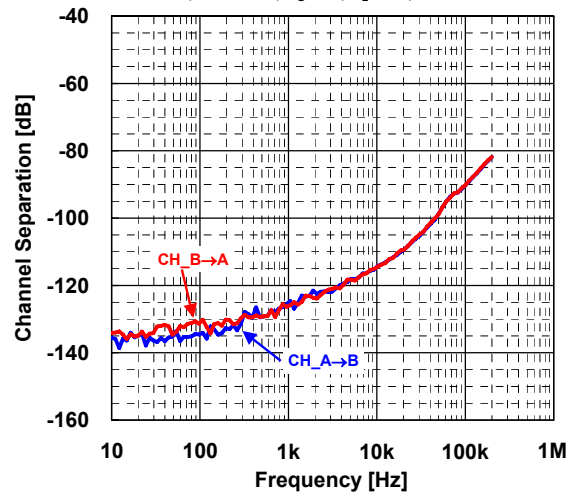
Channel Separation vs. Frequency

$V^+/V^- = \pm 15V$ ,  $V_{IN} = 200mVpp$ ,  $Z_{IN} = 20\Omega$ ,  $A_V = 40dB$ ,  $V_O = 20Vpp$ ,  
 $R_1 = 1k\Omega$ ,  $R_2 = 100k\Omega$ ,  $R_G = 10k\Omega$ ,  $R_L = 2k\Omega$ ,  $BW = 10\sim 500kHz$



Channel Separation vs. Frequency

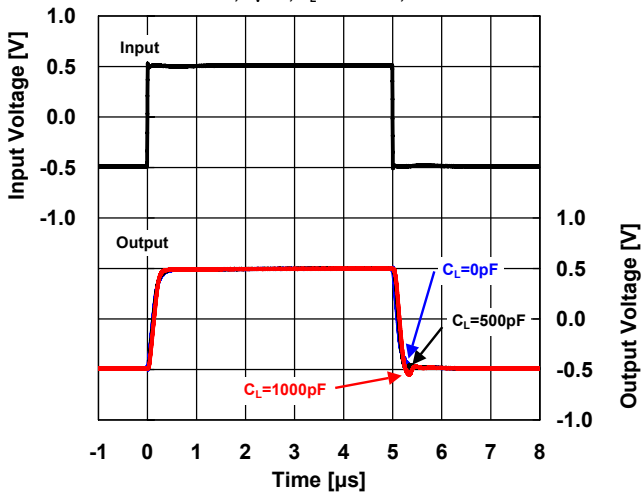
$V^+/V^- = \pm 2.5V$ ,  $V_{IN} = 20mVpp$ ,  $Z_{IN} = 20\Omega$ ,  $A_V = 40dB$ ,  $V_O = 2Vpp$ ,  
 $R_1 = 1k\Omega$ ,  $R_2 = 100k\Omega$ ,  $R_G = 10k\Omega$ ,  $R_L = 2k\Omega$ ,  $BW = 10\sim 500kHz$



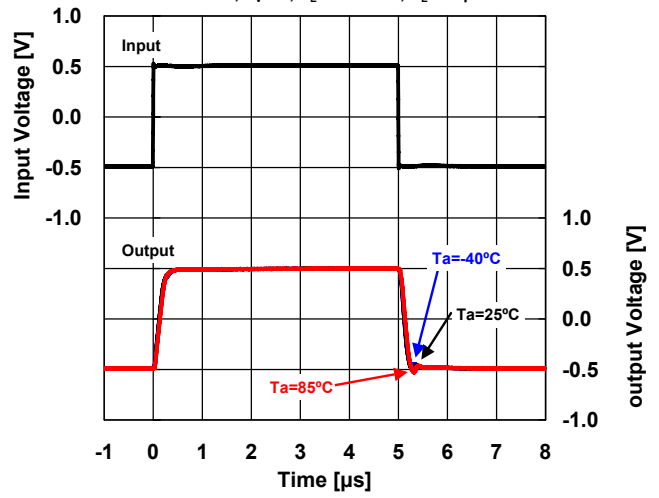


## ■ TYPICAL CHARACTERISTICS

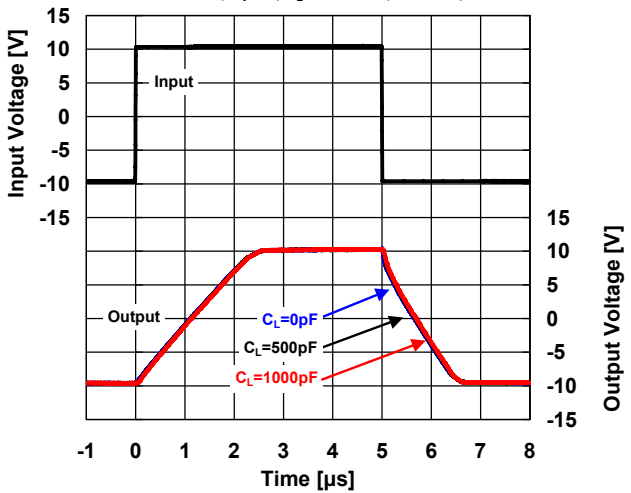
**Frequency Response ( $V_{IN}=1V_{pp}$ , Load Capacitance)**  
 $V^+/V^-=\pm 15V$ ,  $V_{IN}=1V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $T_a=25^\circ C$



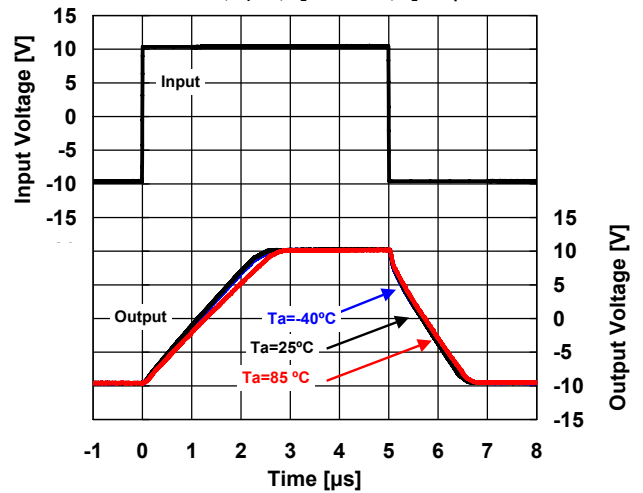
**Frequency Response ( $V_{IN}=1V_{pp}$ , Temperature)**  
 $V^+/V^-=\pm 15V$ ,  $V_{IN}=1V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $C_L=500pF$



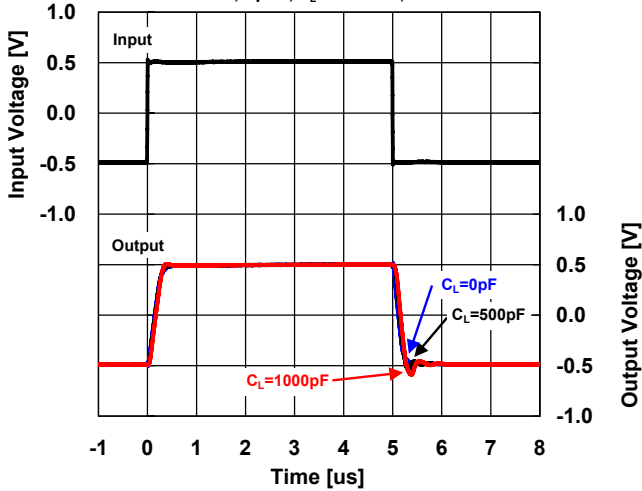
**Frequency Response ( $V_{IN}=20V_{pp}$ , Load Capacitance)**  
 $V^+/V^-=\pm 15V$ ,  $V_{IN}=20V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $T_a=25^\circ C$ ,



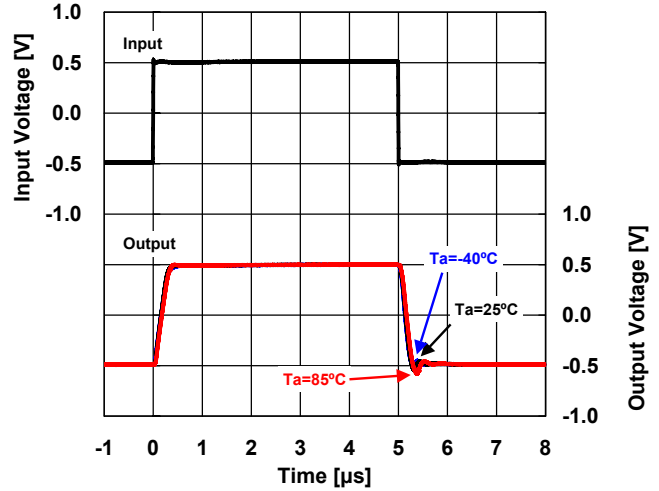
**Frequency Response ( $V_{IN}=20V_{pp}$ , Temperature)**  
 $V^+/V^-=\pm 15V$ ,  $V_{IN}=20V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $C_L=500pF$



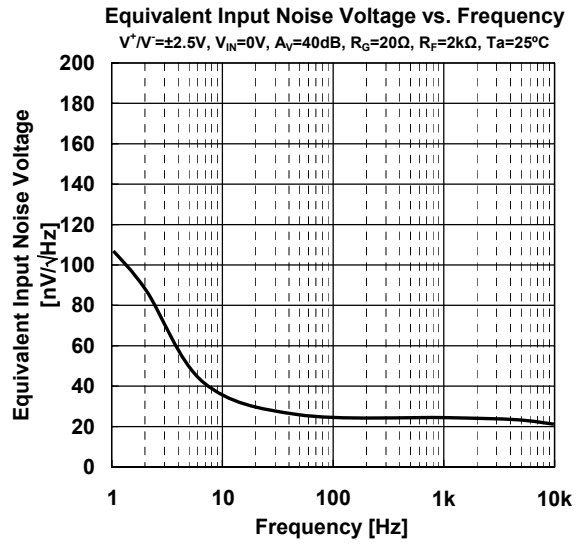
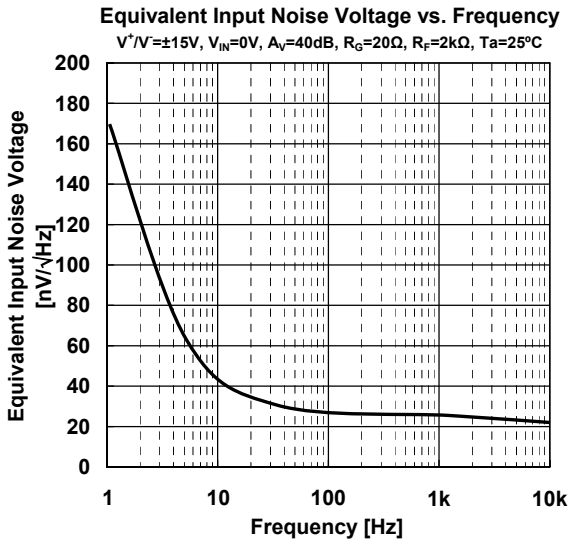
**Frequency Response ( $V_{IN}=1V_{pp}$ , Load Capacitance)**  
 $V^+/V^-=\pm 2.5V$ ,  $V_{IN}=1V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $T_a=25^\circ C$



**Frequency Response ( $V_{IN}=1V_{pp}$ , Temperature)**  
 $V^+/V^-=\pm 2.5V$ ,  $V_{IN}=1V_{pp}$ ,  
 $f=100kHz$ ,  $A_V=+1$ ,  $R_L=2k\Omega$  to  $0V$ ,  $C_L=500pF$



## ■ TYPICAL CHARACTERISTICS



## ■ TEST CIRCUIT

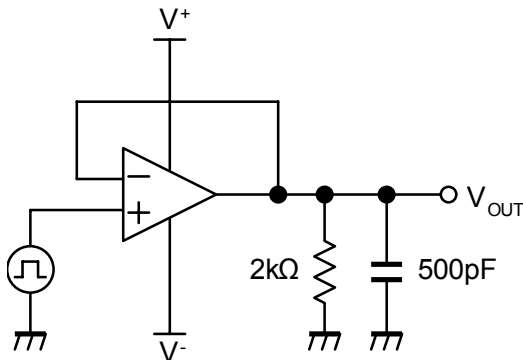


Fig.2.1 Slew Rate (Non Inverting)

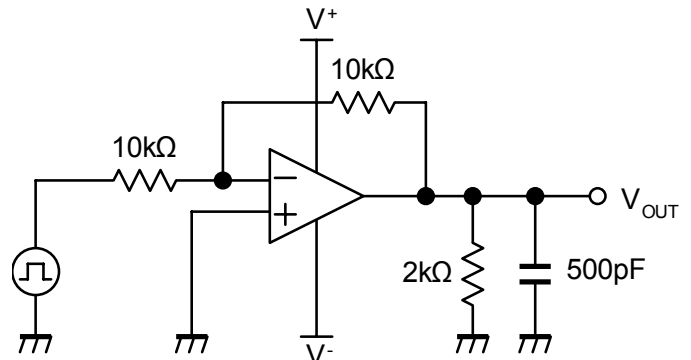


Fig.2.2 Slew Rate (Inverting)

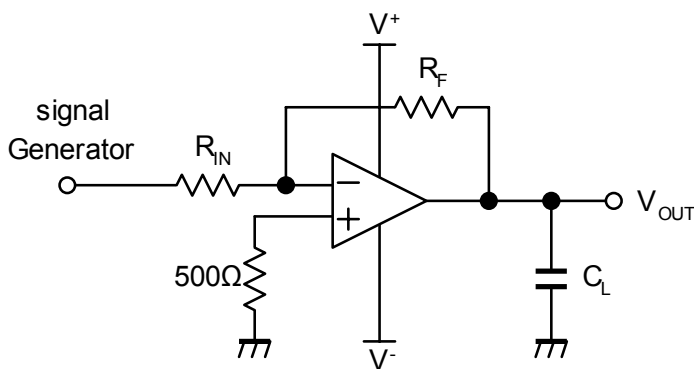


Fig.2.3 Settling Time

[CAUTION]  
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