

## Single Supply, Rail-to-Rail Output Dual Operational Amplifier

### ■ GENERAL DESCRIPTION

The NJM2746 is a Rail-to-Rail Output single supply dual operational amplifier with a low noise of  $10\text{nV}/\sqrt{\text{Hz}}$ .

It has an output voltage swing closer to the rails, which can offer a wide dynamic range of output voltage easier compared with conventionally single supply operational amplifiers.

And Input voltage range extended from ground level makes it suited for single supply operation. The NJM2746 is suitable for various amplifiers and filters using in sound processing, signal detection and other applications. The NJM2746 is available in a wide variety of packages, SOP8 (DMP8), SOP8 JEDEC 150 mil, SSOP8, MSOP8 (TVSP8) and a small lead-less 2020 size package of ESON8 which allows high-density mounting.

### ■ FEATURES

- Operating Voltage 2.5V to 14V
- Rail-to-Rail Output  $V_{OH} \geq 4.9\text{V Typ.}$  (at  $V^+ = 5\text{V}, R_L = 5\text{k}\Omega$ )  
 $V_{OL} \leq 0.1\text{V Typ.}$  (at  $V^+ = 5\text{V}, R_L = 5\text{k}\Omega$ )
- Offset Voltage 1mV Typ.
- Slew Rate 3.5V/ $\mu\text{s}$  Typ.
- Low Distortion 0.001% Typ. (at  $V^+ = 5\text{V}, f = 1\text{kHz}$ )
- Low Input Voltage Noise 10nV/ $\sqrt{\text{Hz}}$  Typ. (at  $f = 1\text{kHz}$ )
- Bipolar Technology
- Package Outline DMP8,  
SSOP8,  
MSOP8 (TVSP8) MEET JEDEC MO-187-DA/ THIN TYPE  
SOP8 JEDEC 150mil,  
ESON8 (2020)

### ■ PACKAGE INFORMATION



NJM2746KU1  
(ESON8)



NJM2746M  
(DMP8)



NJM2746E  
(SOP8)

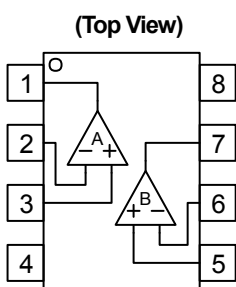


NJM2746V  
(SSOP8)



NJM2746RB1  
(MSOP8 (TVSP8))

### ■ PIN CONFIGURATION

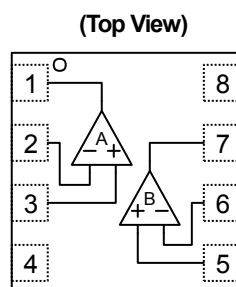


NJM2746M

NJM2746E

NJM2746V

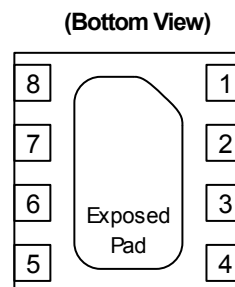
NJM2746RB1



NJM2746KU1

About Exposed Pad

Connect the Exposed Pad on the GND.



### PIN FUNCTION

1. A OUTPUT
2. A - INPUT
3. A +INPUT
4. GND(V)
5. B +INPUT
6. B - INPUT
7. B OUTPUT
8. V<sup>+</sup>

# NJM2746

## ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+$	15	V
Common Mode Input Voltage Range	$V_{ICM}$	0~15(Note1)	V
Differential Input Voltage Range	$V_{ID}$	$\pm 15$ (Note1)	V
Power Dissipation	$P_D$	(DMP8) 300 (SOP8) 300 (SSOP8) 250 (MSOP8(TVSP8)) 320 (ESON8) 360(Note2) (ESON8) 940(Note3)	mW
Operating Temperature Range	$T_{opr}$	-40~+85	°C
Storage Temperature Range	$T_{stg}$	-50~+125	°C

(Note1) For supply voltage less than 15V, the absolute maximum input voltage is equal to the supply voltage.

(Note2) Mounted on the EIA/JEDEC standard board (76.2×114.3×1.6mm, 2 layer, FR-4).

(Note3) Mounted on the EIA/JEDEC standard board (76.2×114.3×1.6mm, 4 layer, FR-4).

## ■ OPERATING VOLTAGE

( $T_a=25^\circ\text{C}$ )

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V^+$	2.5~14	V

## ■ ELECTRICAL CHARACTERISTICS

### ●DC CHARACTERISTICS ( $V^+=5\text{V}, T_a=25^\circ\text{C}$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	$I_{CC}$	$R_L=\infty, V_{IN}=2.5\text{V}$ , No signal	-	4	5.5	mA
Input Offset Voltage	$V_{IO}$	$R_S \leq 10\text{k}\Omega$	-	1	6	mV
Input Bias Current	$I_B$		-	100	350	nA
Input Offset Current	$I_{IO}$		-	5	100	nA
Voltage Gain	$A_v$	$R_L \geq 10\text{k}\Omega$ to 2.5V, $V_o=0.5\text{V}\sim 4.5\text{V}$	65	85	-	dB
Common Mode Rejection Ratio	CMR	$0\text{V} \leq V_{CM} \leq 4\text{V}$	60	75	-	dB
Supply Voltage Rejection Ratio	SVR	$V^+=2.5\text{V}\sim 14\text{V}$	60	80	-	dB
Maximum Output Voltage	$V_{OH}$	$R_L \geq 5\text{k}\Omega$ to 2.5V	4.75	4.9	-	V
	$V_{OL}$	$R_L \geq 5\text{k}\Omega$ to 2.5V	-	0.1	0.25	V
Common Mode Input Voltage Range	$V_{ICM}$	CMR $\geq 60\text{dB}$	0	-	4	V

### ●AC CHARACTERISTICS ( $V^+=5\text{V}, T_a=25^\circ\text{C}$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GB	$f=1\text{MHz}$	-	10	-	MHz
Phase Margin	$\Phi_M$	$R_L=10\text{k}\Omega, C_L=10\text{pF}$	-	75	-	deg
Equivalent Input Noise Voltage	$V_{NI}$	$f=1\text{kHz}, V_{CM}=2.5\text{V}$	-	10	-	nV/ $\sqrt{\text{Hz}}$
Total Harmonic Distortion	THD	$f=1\text{kHz}, A_v=+2,$ $R_L=10\text{k}\Omega$ to 2.5V, $V_o=1.5\text{Vrms}$	-	0.001	-	%
Channel Separation	CS	$f=1\text{kHz}, R_L=10\text{k}\Omega$ to 2.5V, $V_o=1.5\text{Vrms}$	-	120	-	dB

### ●AC CHARACTERISTICS ( $V^+=5\text{V}, T_a=25^\circ\text{C}$ )

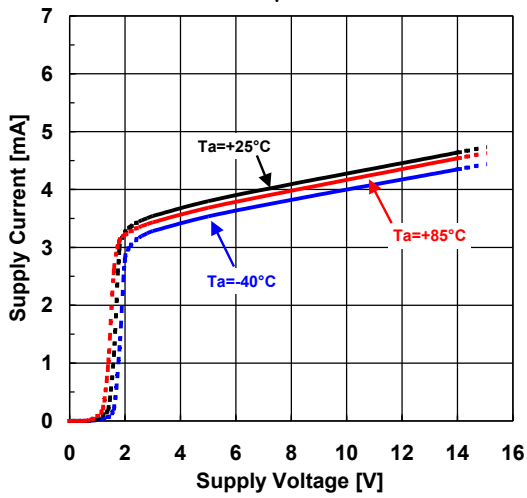
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Slew Rate(Note4)	SR	$A_v=1, V_{IN}=2\text{Vpp}$ $R_L=10\text{k}\Omega$ to 2.5V, $C_L=10\text{pF}$ to 2.5V	-	3.5	-	V/ $\mu\text{s}$

(Note4) Number specified is the slower of the positive and negative slew rates.

## ■ TYPICAL CHARACTERISTICS

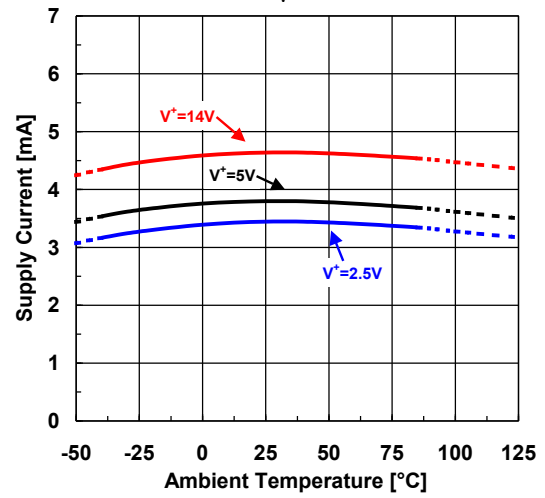
Supply Current vs. Supply Voltage

$G_V=0\text{dB}$



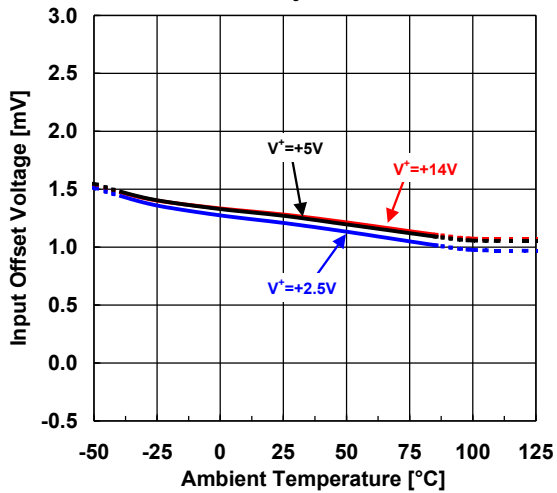
Supply Current vs. Temperature

$G_V=0\text{dB}$



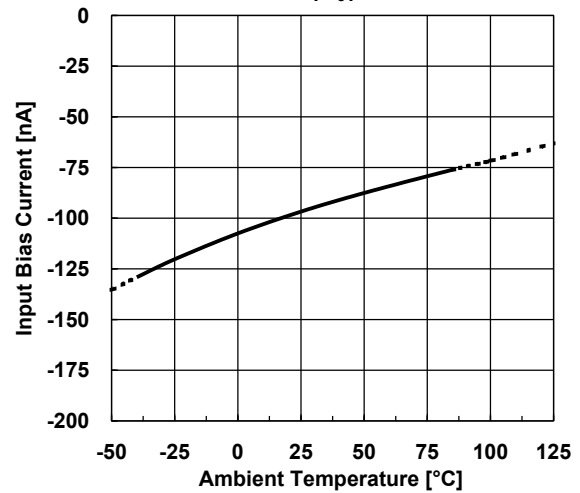
Input Offset Voltage vs. Temperature

$R_S=10\text{k}\Omega$



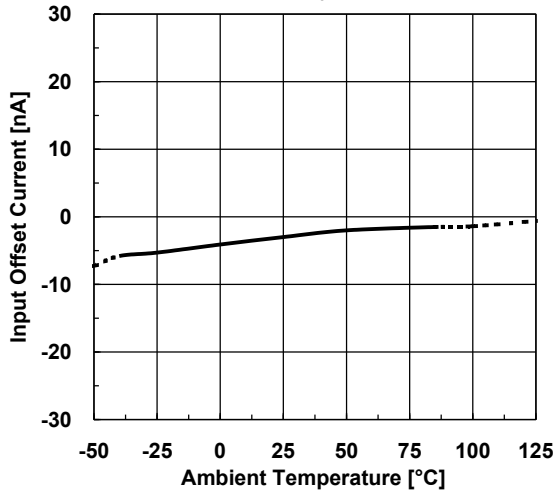
Input Bias Current vs. Temperature

$V_I=5\text{V}$



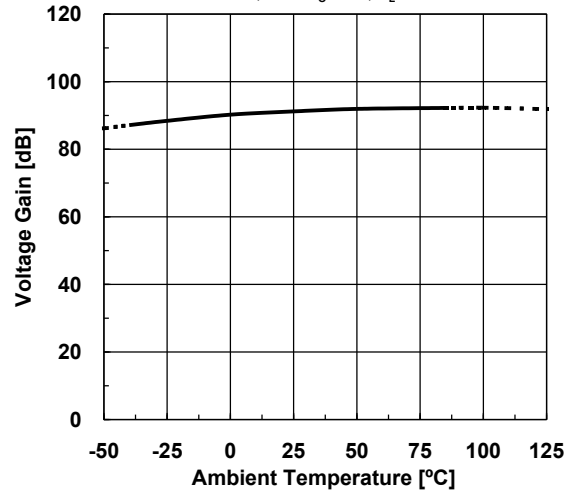
Input Offset Current vs. Temperature

$V_I=5\text{V}$

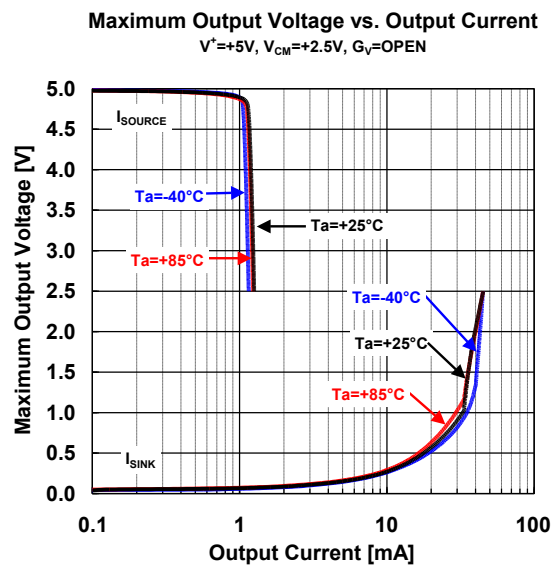
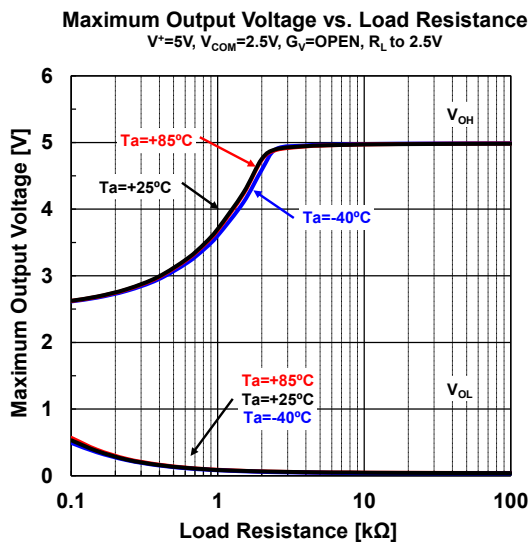
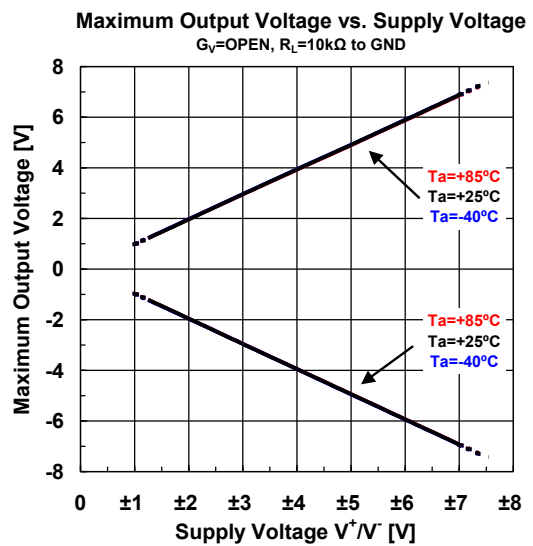
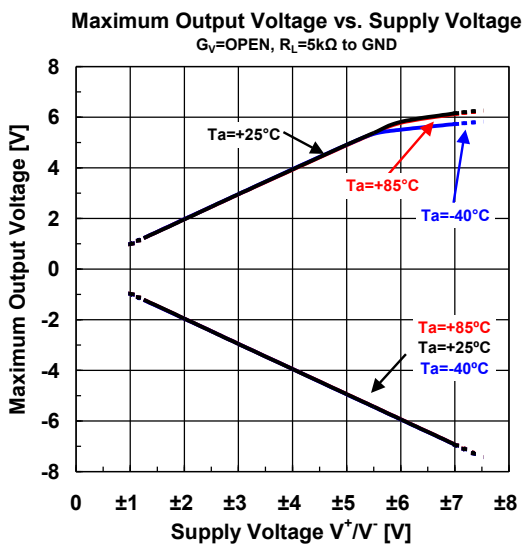
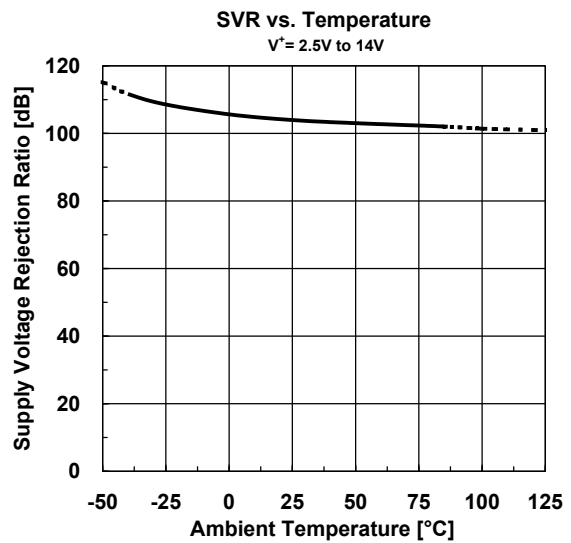
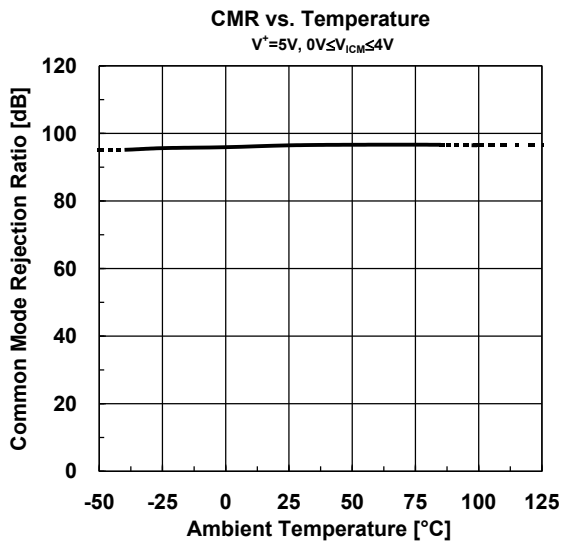


Large Signal Voltage Gain vs. Temperature

$V_I=5\text{V}, 0.5\text{V} \leq V_O \leq 4.5\text{V}, R_L=10\text{k}\Omega$



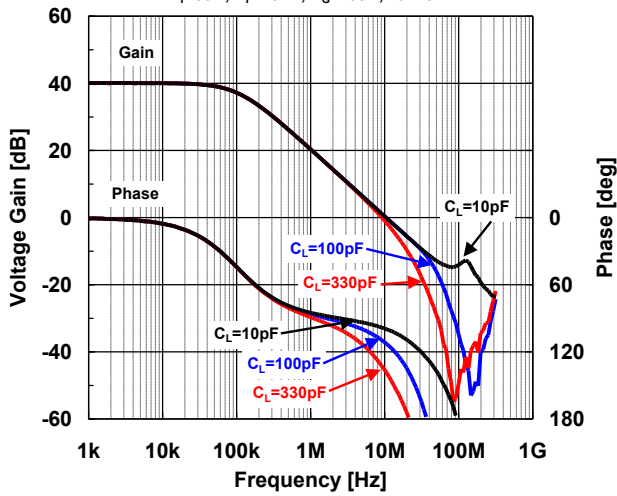
## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS

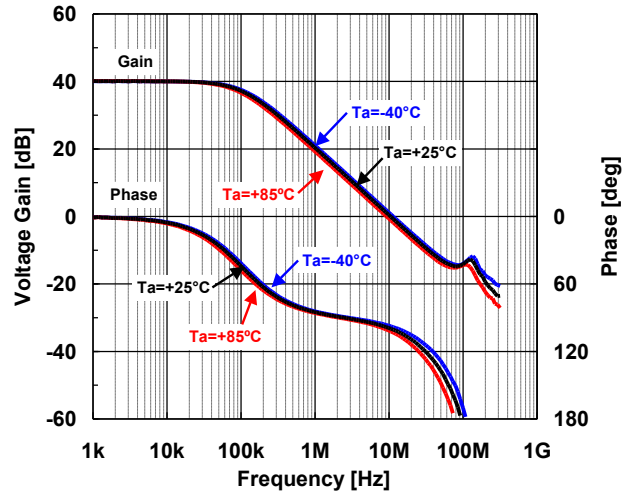
**Gain/Phase vs. Frequency**

$V^+=5V, V_{IN}=0.02V_{pp}, G_V=40dB,$   
 $R_T=50\Omega, R_F=10k\Omega, R_G=100\Omega, T_a=25^\circ C$



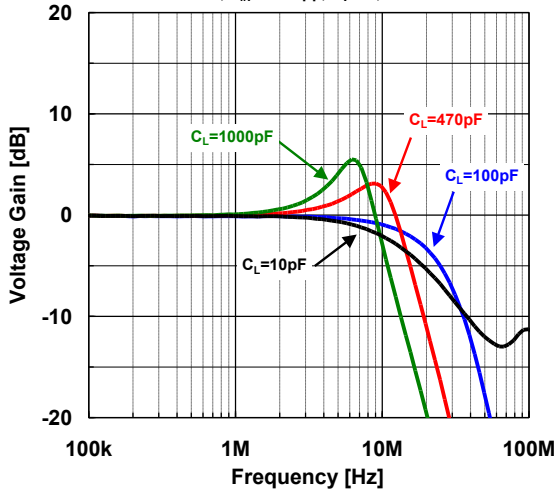
**Gain/Phase vs. Frequency**

$V^+=5V, V_{IN}=0.02V_{pp}, G_V=40dB$   
 $R_T=50\Omega, R_F=10k\Omega, R_G=100\Omega, C_L=10pF$



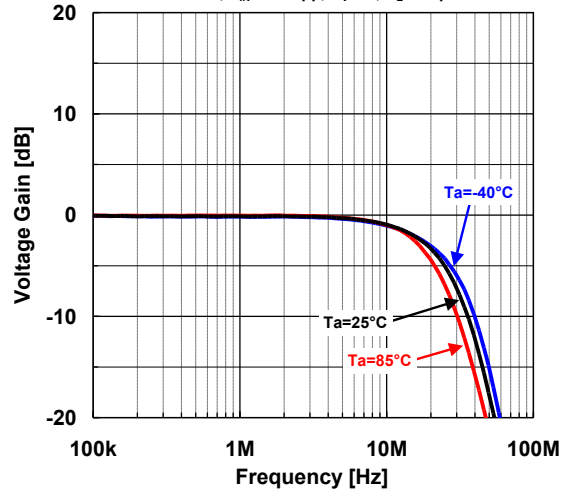
**Gain vs. Frequency**

$V^+=5V, V_{IN}=0.02V_{pp}, A_V=+1, T_a=25^\circ C$



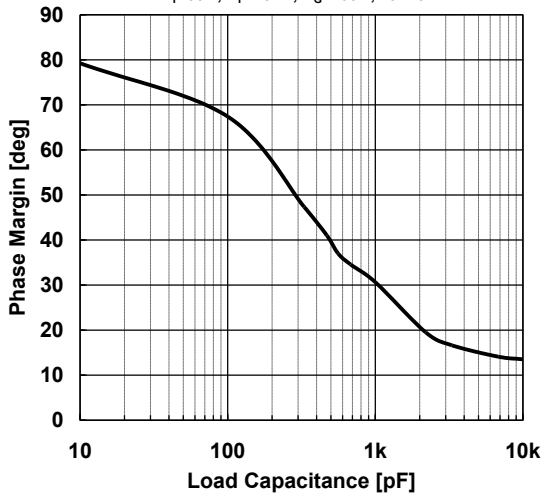
**Gain vs. Frequency**

$V^+=5V, V_{IN}=0.02V_{pp}, A_V=+1, C_L=100pF$



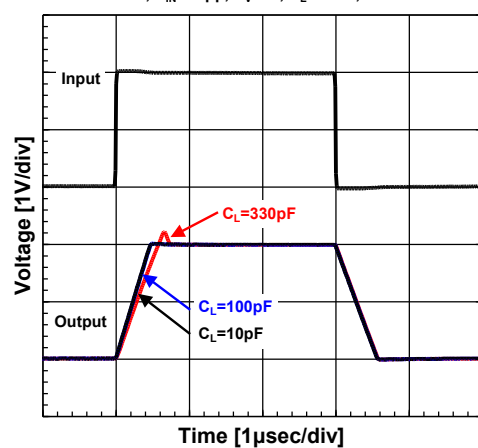
**Phase Margin vs. Load Capacitance**

$V^+=5V, V_{IN}=0.02V_{pp}, V_O=V^+/2, G_V=40dB,$   
 $R_T=50\Omega, R_F=10k\Omega, R_G=100\Omega, T_a=25^\circ C$

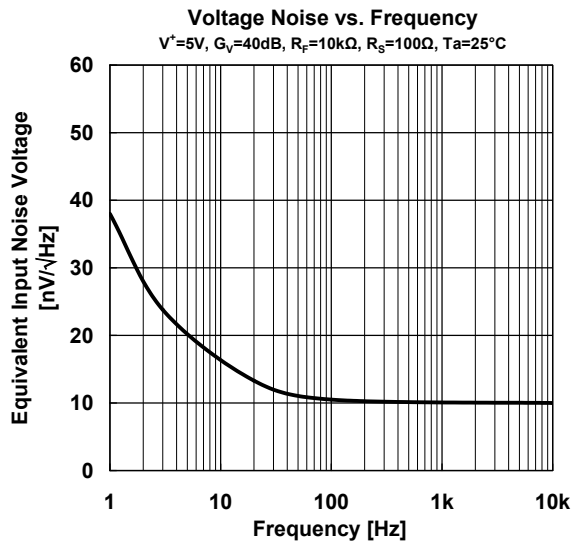
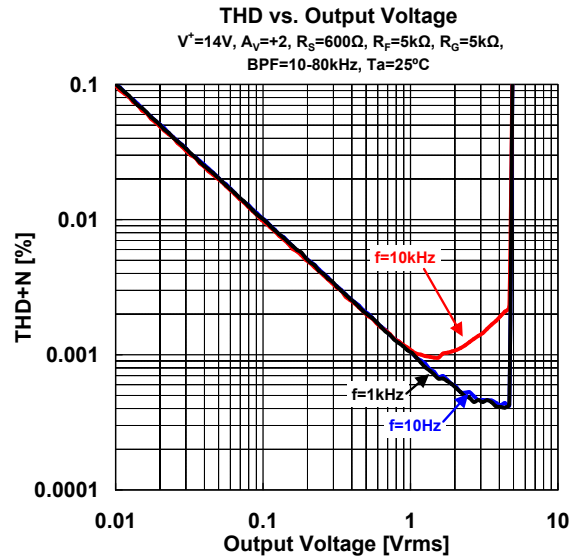
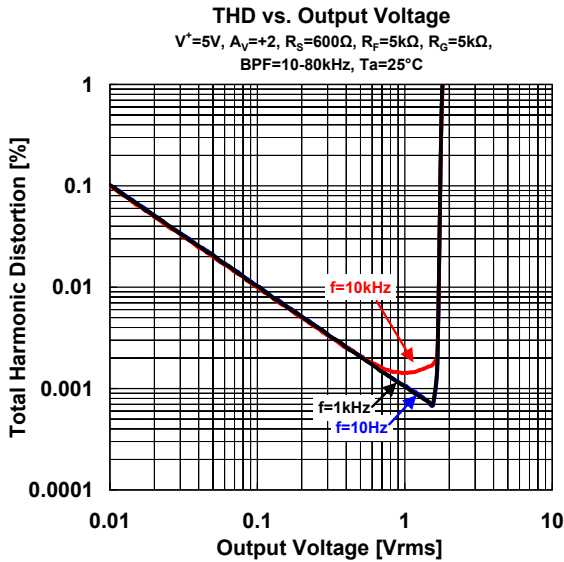
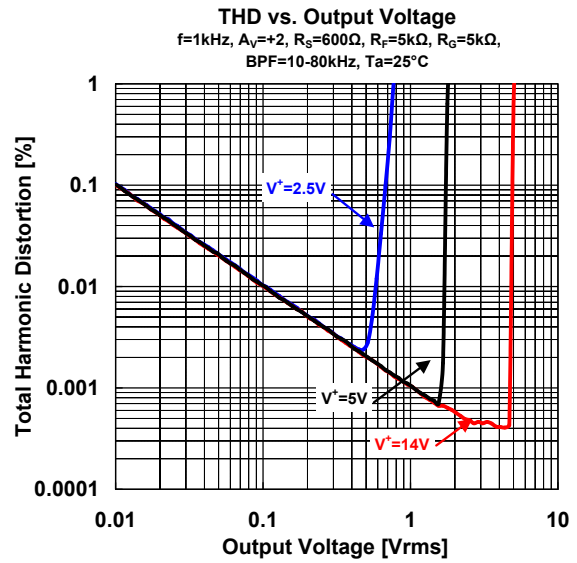
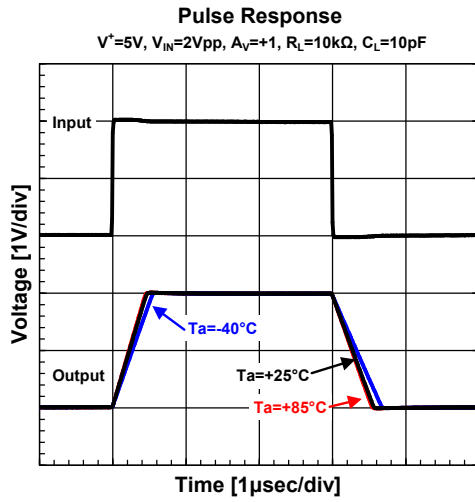


**Pulse Response**

$V^+=5V, V_{IN}=2V_{pp}, A_V=+1, R_L=10k\Omega, T_a=25^\circ C$



## ■ TYPICAL CHARACTERISTICS



**[CAUTION]**

The specifications on this data book are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this data book are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.