

## High Output Current, Rail-to-Rail Input/Output Dual CMOS Operational Amplifier

### ■GENERAL DESCRIPTION

The NJU7043 is a Rail-to-Rail Input/Output dual CMOS operational amplifier with a low operating voltage from 1.8V to 5.5V and high output current of 40mA which is higher than our conventional CMOS operational amplifiers.

It also offers a rail-to-rail input/output between both rails, low operating current of 300µA per amplifier, low input bias current of 1pA and ground sensing, which is suitable for various applications. The NJU7043 is available in 8-lead package of DIP8, 8-lead small surface mount packages of DMP8, SOP8 JEDEC 150mil, SSOP8, MSOP8 (TVSP8) and PCSP20-CC.

### ■FEATURES

- Operating Voltage
- Rail-to-Rail Input/Output
- High Output Current
- Input Offset Voltage
- Wide Input Common Mode Voltage Range
- Operating Current
- High Input Impedance
- Low Input Bias Current
- Ground Sensing
- Package

$V_{DD}=1.8$  to  $5.5V$

40mA typ. (at  $V_o=0V$ )

$V_{IO}=10mV$  max.

$V_{SS}$  to  $V_{DD}$

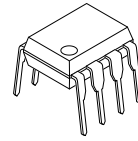
$I_{DD}=300\mu A$  typ. (per Amplifier)

$1T\Omega$  typ.

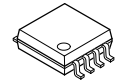
$I_B=1pA$  typ.

DIP8,DMP8,SOP8 JEDEC 150mil , SSOP8  
MSOP8 (TVSP8)MEET JEDEC MO-187-DA/ THIN TYPE,  
PCSP20-CC

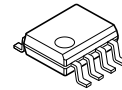
### ■PACKAGE OUTLINE



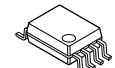
**NJU7043D  
(DIP8)**



**NJU7043M  
(DMP8)**



**NJU7043E  
(SOP8)**



**NJU7043V  
(SSOP8)**



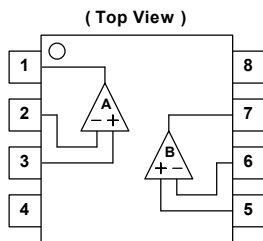
**NJU7043RB1  
(MSOP8(TVSP8))**



**NJU7043SCC  
(PCSP20-CC)**

### ■PIN CONFIGURATION

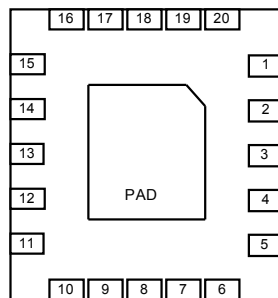
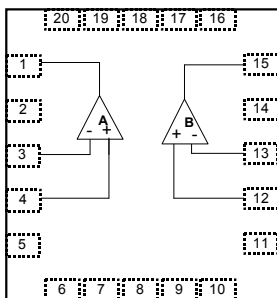
ONJU7043D,M,E,V,RB1



#### PIN FUNCTION

1. OUTPUT A
2. -INPUT A
3. +INPUT A
4.  $V_{SS}(V^-)$
5. +INPUT B
6. -INPUT B
7. OUTPUT B
8.  $V_{DD}(V^+)$

ONJU7043SCC



#### PIN FUNCTION

- |                  |                   |
|------------------|-------------------|
| 1. OUTPUT A      | 11. NC            |
| 2. NC            | 12. +INPUT B      |
| 3. -INPUT A      | 13. -INPUT B      |
| 4. +INPUT A      | 14. NC            |
| 5. NC            | 15. OUTPUT B      |
| 6. NC            | 16. NC            |
| 7. NC            | 17. NC            |
| 8. $V_{SS}(V^-)$ | 18. $V_{DD}(V^+)$ |
| 9. NC            | 19. NC            |
| 10. NC           | 20. NC            |

(Note 1) The NC pin and the PAD should connect with a VSS terminal.

(Note 2) The NC pin is electrically not connected to the die in a package.

(Note 3) The PAD is electrically not connected to the backside of the die. The PAD cannot be used as VSS pin.

## ■ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>DD</sub>	7	V
Common Mode Input Voltage Range	V <sub>ICM</sub>	0 to 7 (Note4)	V
Differential Input Voltage Range	V <sub>ID</sub>	±7	V
Power Dissipation	P <sub>D</sub>	500 (DIP8) 300 (DMP8) 300 (SOP8) 250 (SSOP8) 320 (MSOP8 (TVSP8)) 400 (PCSP20-CC)(note 6)	mW
Operating Temperature Range	Topr	-40 ~ +85	°C
Storage Temperature Range	Tstg	-55 ~ +125	°C

(Note 4) When supply voltage is less than 7V, the absolute maximum input voltage is equal to the voltage.

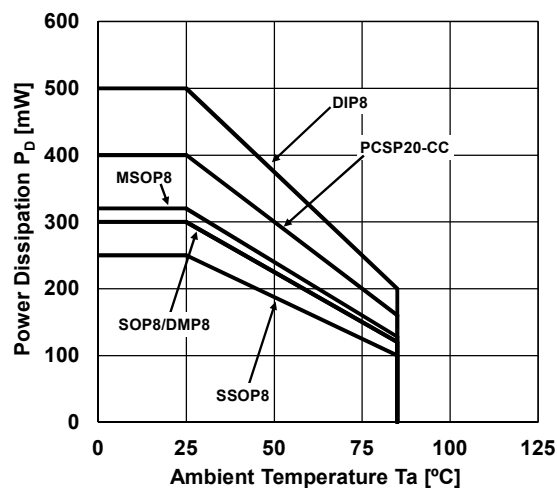
(Note 5) Decoupling capacitor should be connected between V<sub>DD</sub> and V<sub>SS</sub> due to the stabilized operation for the circuit.

(Note 6) On the PCB " EIA/JEDEC (76.2x114.3x1.6mm, two layers, FR-4) ".

(Note 7) Do not exceed "Power dissipation: P<sub>D</sub>" 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 vs. Temperature



## ■RECOMMENDED OPERATION CONDITION

(Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>DD</sub>	1.8 ~ 5.5	V

## ■ ELECTRICAL CHARACTERISTICS

### ● DC CHARACTERISTICS

( $V_{DD}=3.0V, T_a=25^{\circ}C$ )

PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
Operating Current	$I_{DD}$	No Signal, Dual Circuits	-	600	1,000	$\mu A$
Input Offset Voltage	$V_{IO}$		-	-	10	mV
Input Bias Current	$I_B$		-	1	-	$\mu A$
Input Offset Current	$I_{IO}$		-	1	-	$\mu A$
Voltage Gain	$A_v$	$R_L=10k\Omega$	70	90	-	dB
Common Mode Rejection Ratio	CMR	$0 \leq V_{CM} \leq 1.5V,$ $1.5 \leq V_{CM} \leq 3.0V$ (note7)	42	60	-	dB
Supply Voltage Rejection Ratio	SVR	$2.0V \leq V_{DD} \leq 5.0V, V_{CM} = V_{DD}/2$	61	80	-	dB
H Level Output Voltage 1	$V_{OH1}$	$R_L=10k\Omega$	2.95	-	-	V
L Level Output Voltage 1	$V_{OL1}$	$R_L=10k\Omega$	-	-	0.05	V
H Level Output Voltage 2	$V_{OH2}$	$R_L=600\Omega$	2.90	-	-	V
L Level Output Voltage 2	$V_{OL2}$	$R_L=600\Omega$	-	-	0.10	V
Input Common Mode Voltage Range	$V_{ICM}$	CMR $\geq$ 45dB	0	-	3	V

(Note 8) CMR is represented by either CMR+ or CMR- which has lower value.  
CMR+ is measured with  $1.5V \leq V_{CM} \leq 3V$  and CMR- is measured with  $0V \leq V_{CM} \leq 1.5V$ .

### ● AC CHARACTERISTICS

( $V_{DD}=3.0V, T_a=25^{\circ}C$ )

PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
Unity Gain Bandwidth	GB	$R_L=10k\Omega$	-	0.8	-	MHz
Total Harmonic Distortion	THD	$f=1kHz, V_{in}=1V_{pp}, A_v=0dB$	-	0.05	-	%
Equivalent Input Noise Voltage	$e_n$	$f=1kHz$	-	40	-	$nV/\sqrt{Hz}$

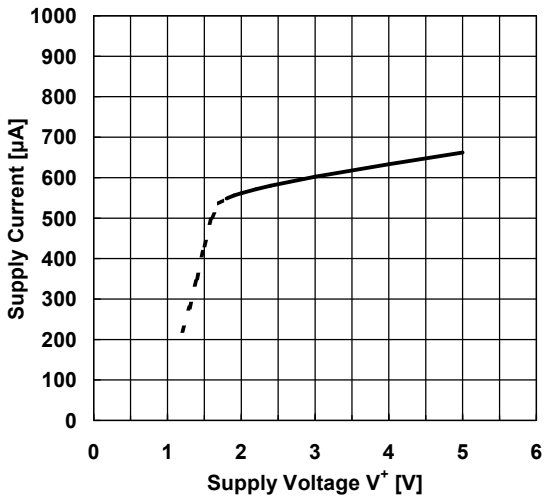
### ● TRANSIENT CHARACTERISTICS

( $V_{DD}=3.0V, T_a=25^{\circ}C$ )

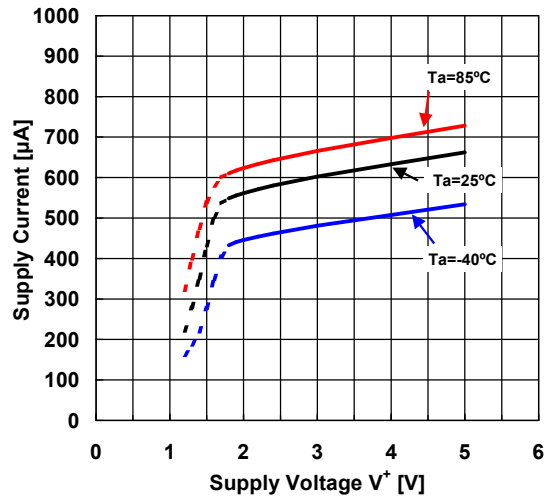
PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
Slew Rate	SR	$R_L=10k\Omega$	-	0.7	-	$V/\mu s$

## ■ TYPICAL CHARACTERISTICS

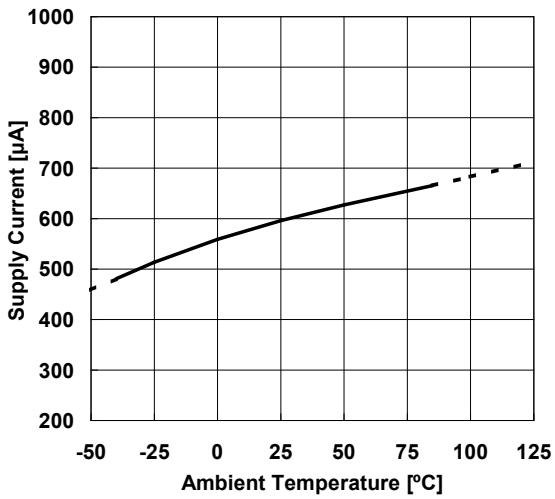
Supply Current vs. Supply Voltage  
Gv = 0dB, Ta=25°C



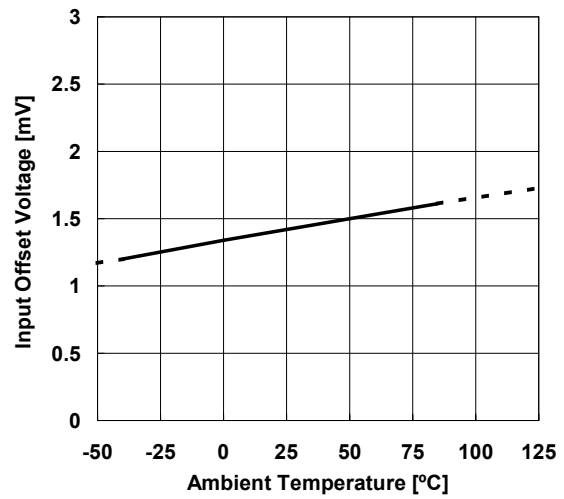
Supply Current vs. Supply Voltage  
(Ambient Temperature)  
Gv = 0dB



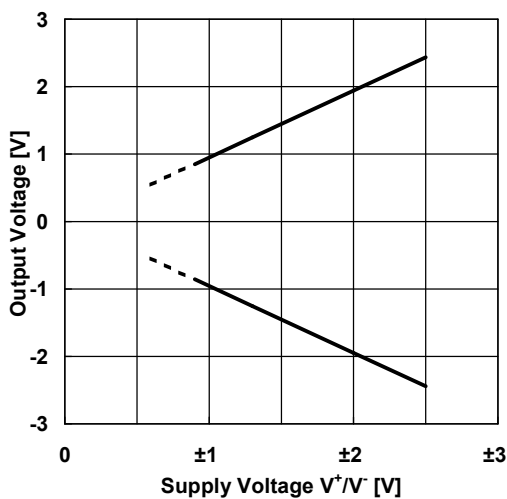
Supply Current vs. Ambient Temperature  
V+/V=±1.5V Gv = 0dB



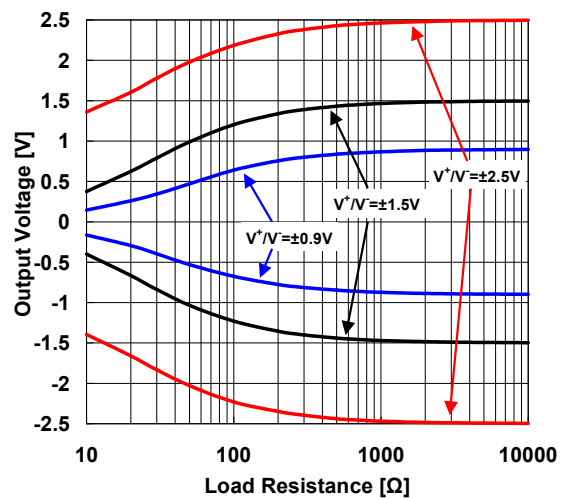
Input Offset Voltage vs. Ambient Temperature  
V+/V=±1.5V



Output Voltage vs. Supply Voltage  
Gv = OPEN R<sub>L</sub>=600Ω Ta=25°C

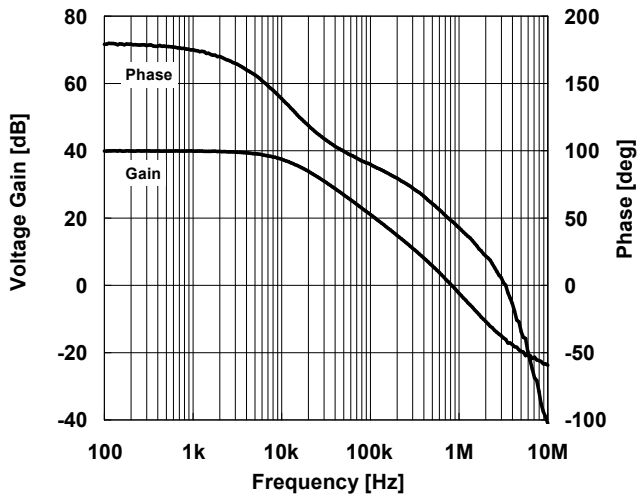


Output Voltage vs. Load Resistance (Supply Voltage)  
Gv = OPEN Ta=25°C

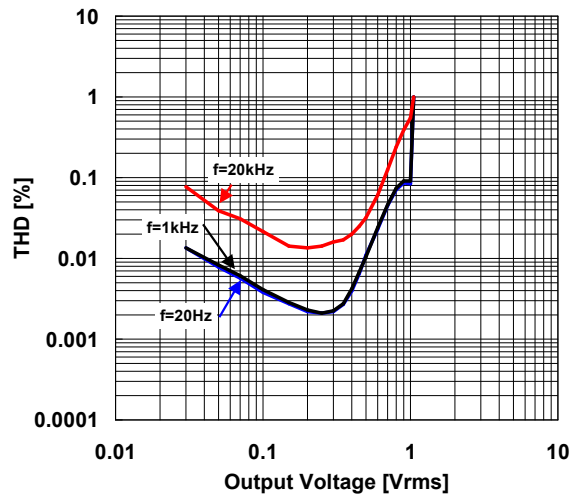


## ■ TYPICAL CHARACTERISTICS

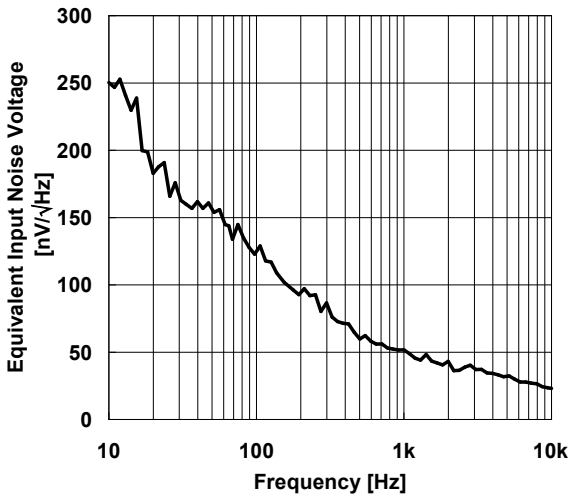
**Gain/Phase vs. Frequency**  
 $V^+/V^- = \pm 1.5V$ ,  $G_v = 40dB$ ,  $R_s = 100k$ ,  $R_g = 1k$ ,  $C_L = 0$



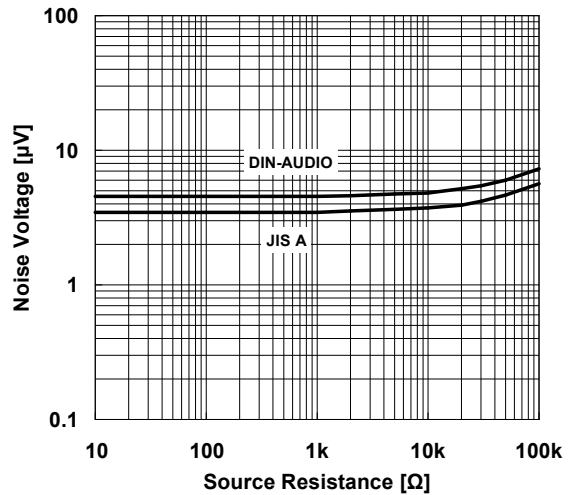
**THD vs. Output Voltage**  
 $V^+/V^- = \pm 1.5V$ ,  $G_v = 0dB$ ,  $R_L = 10k$ ,  $T_a = 25^\circ C$



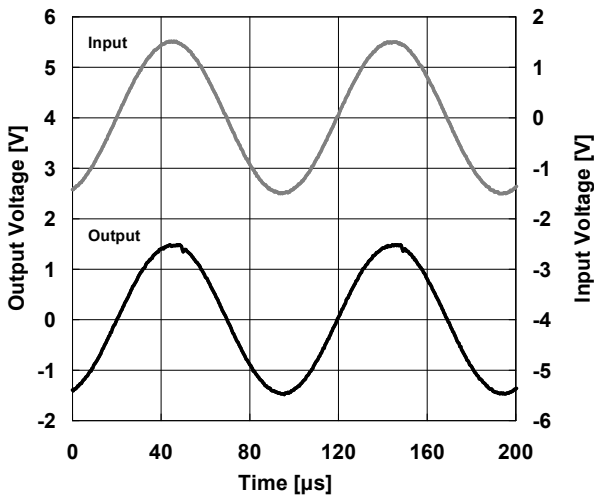
**Equivalent Input Noise Voltage vs. Frequency**  
 $V^+/V^- = \pm 1.5V$ ,  $G_v = 40dB$ ,  $R_s = 600$ ,  $R_G = 100$ ,  $R_f = 10k$ ,  $T_a = 25^\circ C$



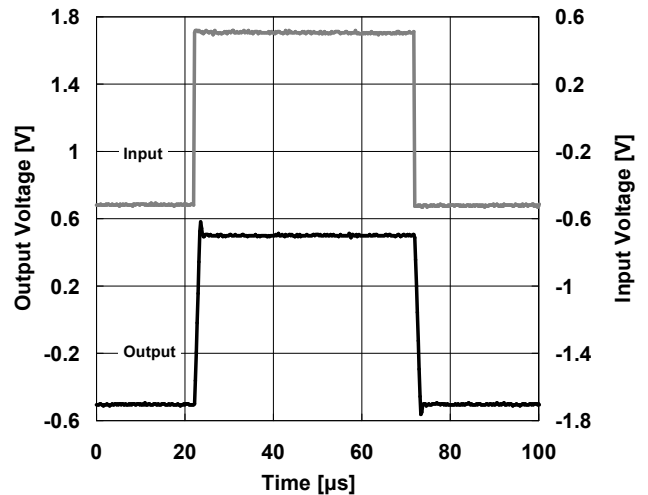
**Noise Voltage vs. Source Resistance**  
 $V^+/V^- = \pm 1.5V$ ,  $G_v = 40dB$ ,  $R_G = 100$ ,  $R_f = 1k$ ,  $T_a = 25^\circ C$



**Pulse Response**  
 $V^+/V^- = \pm 1.5V$ ,  $V_{IN} = 3Vp-p$ ,  $f = 10kHz$   
 $G_v = 0dB$ ,  $R_s = 50$ ,  $R_L = 10k$ ,  $C_L = 0F$ ,  $T_a = 25^\circ C$



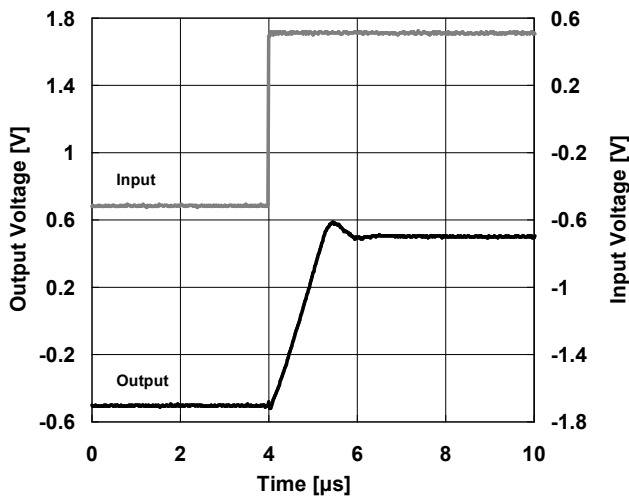
**Pulse Response**  
 $V^+/V^- = \pm 1.5V$ ,  $V_{IN} = 1Vp-p$ ,  $f = 10kHz$   
 $G_v = 0dB$ ,  $R_s = 50$ ,  $R_L = 10k$ ,  $C_L = 0F$ ,  $T_a = 25^\circ C$



## TYPICAL CHARACTERISTICS

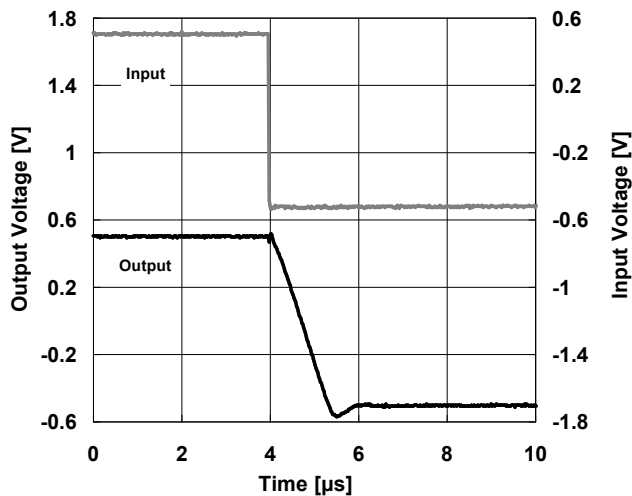
**Pulse Response (Rise)**

$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=1V_{p-p}$ ,  $f=10kHz$   
 $G_v=0dB$ ,  $R_s=50$ ,  $R_L=10k$ ,  $C_L=0F$ ,  $T_a=25^\circ C$



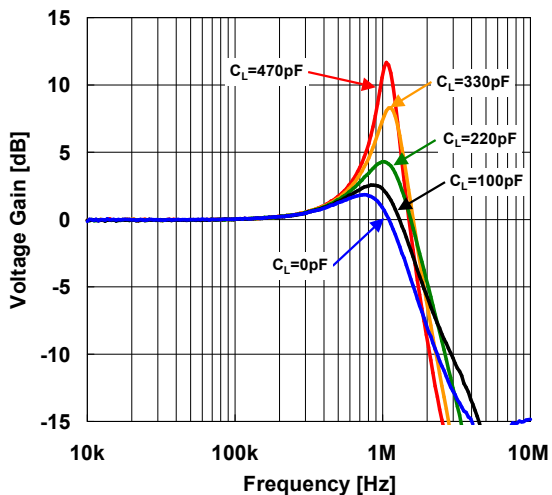
**Pulse Response (Fall)**

$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=1V_{p-p}$ ,  $f=10kHz$   
 $G_v=0dB$ ,  $R_s=50$ ,  $R_L=10k$ ,  $C_L=0F$ ,  $T_a=25^\circ C$



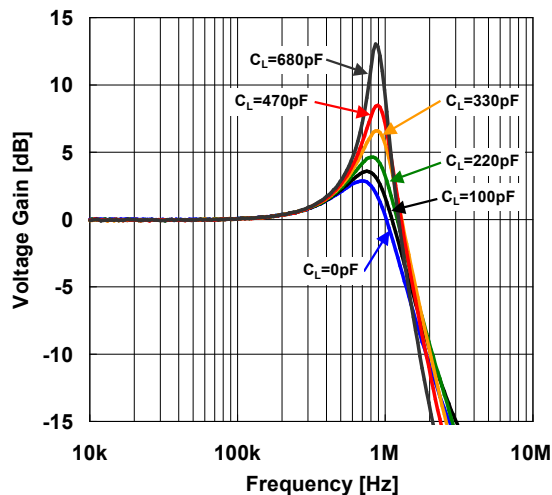
**V.F.Peak vs. Frequency (Load Capacitance)**

$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=-20dBm$ ,  $G_v=0dB$ ,  $R_L=10k$ ,  $T_a=25^\circ C$



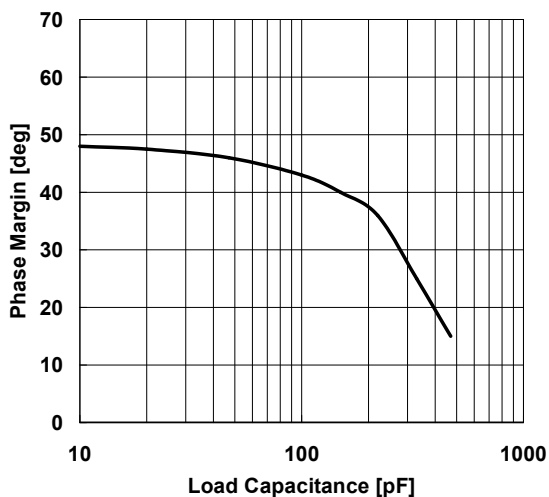
**V.F.Peak vs. Frequency (Load Capacitance)**

$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=-20dBm$ ,  $G_v=0dB$ ,  $R_L=600$ ,  $T_a=25^\circ C$



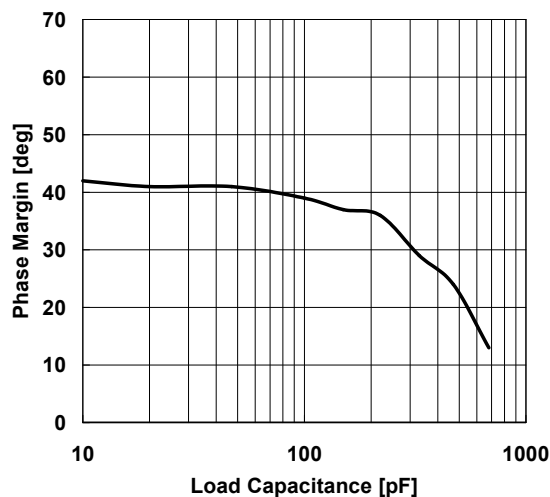
**Phase Margin vs. Load Capacitance**

$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=-30dBm$ ,  $G_v=40dB$ ,  
 $R_L=10k$ ,  $R_s=50$ ,  $R_g=1k$ ,  $R_f=100k$ ,  $T_a=25^\circ C$



**Phase Margin vs. Load Capacitance**

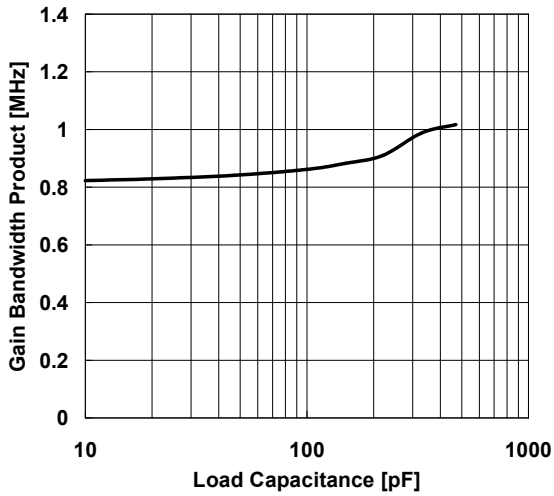
$V^+/V^-=\pm 1.5V$ ,  $V_{IN}=-30dBm$ ,  $G_v=40dB$ ,  
 $R_L=600$ ,  $R_s=50$ ,  $R_g=1k$ ,  $R_f=100k$ ,  $T_a=25^\circ C$



## ■ TYPICAL CHARACTERISTICS

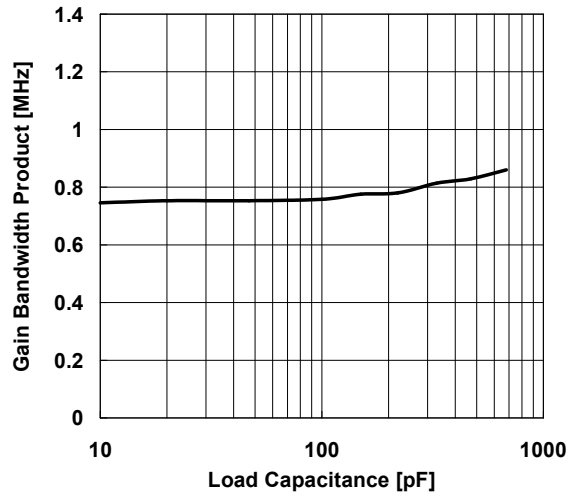
**Gain Bandwidth Product vs. Load Capacitance**

$V^+ / V^- = \pm 1.5V$ ,  $V_{IN} = -30dBm$ ,  $G_v = 40dB$ ,  
 $R_L = 10k$ ,  $R_s = 50$ ,  $R_g = 1k$ ,  $R_f = 100k$ ,  $T_a = 25^\circ C$



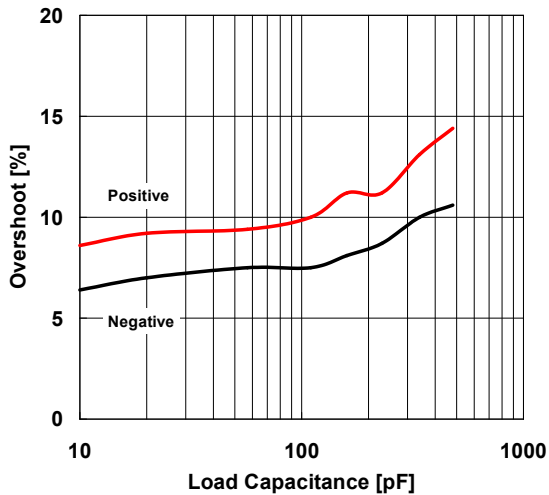
**Gain Bandwidth Product vs. Load Capacitance**

$V^+ / V^- = \pm 1.5V$ ,  $V_{IN} = -30dBm$ ,  $G_v = 40dB$ ,  
 $R_L = 600$ ,  $R_s = 50$ ,  $R_g = 1k$ ,  $R_f = 100k$ ,  $T_a = 25^\circ C$



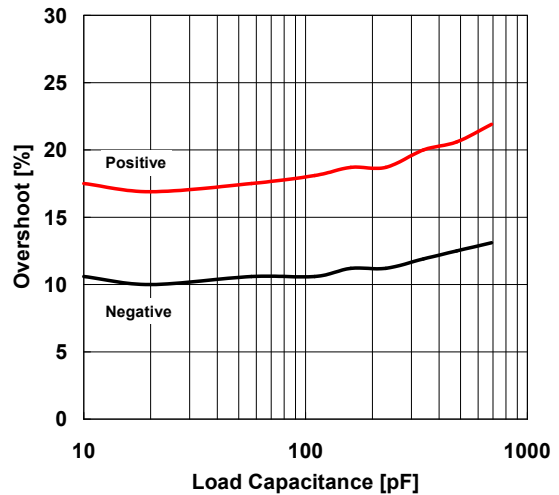
**Overshoot vs. Load Capacitance**

$V^+ / V^- = \pm 1.5V$ ,  $V_{IN} = 1Vp-p$ ,  $f = 10kHz$ ,  
 $G_v = 0dB$ ,  $R_L = 10k$ ,  $R_s = 50$ ,  $T_a = 25^\circ C$



**Overshoot vs. Load Capacitance**

$V^+ / V^- = \pm 1.5V$ ,  $V_{IN} = 1Vp-p$ ,  $f = 10kHz$ ,  
 $G_v = 0dB$ ,  $R_L = 600$ ,  $R_s = 50$ ,  $T_a = 25^\circ C$



**[CAUTION]**

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