# HIGH-SPEED AND HIGH OPERATING VOLTAGE OPERATIONAL AMPLIFIER

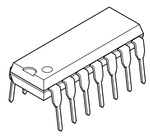
## ■GENERAL DESCRIPTION

The NJM2727 is a high-speed, high operating voltage single operational amplifier.

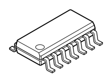
With 300V/µs slew rate, 40MHz unity gain bandwidth and 4mV input offset voltage the NJM2727 offers high performance.

The NJM2727 operates on ±15V power supply for systems requiring large voltage swings, such as industrial equipment.

## ■PACKAGE OUTLINE



**NJM2727D**



**NJM2727E**

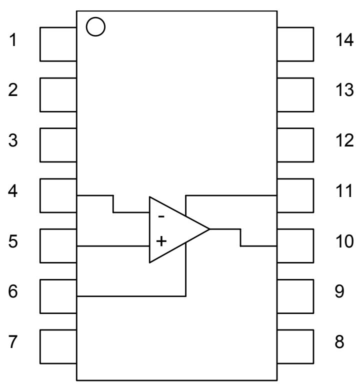
## ■FEATURES

| | |
|---|---|
| •Operating Voltage | ± 4.5V to ± 18V |
| •Input Offset Voltage | $V_{IO}$=4mV max. |
| •Output Voltage | ± 12V typ. (at $R_L$=500Ω $V^+/V^-$=±15V) |
| •Unity Gain Bandwidth | 40MHz typ. |
| •High Slew Rate | 300V/µs typ. (at $R_L$=500Ω $V^+/V^-$=±15V) |
| •Bipolar Technology | |
| •Package Outline | NJM2727D DIP14 |
| | NJM2727E EMP14 |

## ■ Application

- ●Active Filters
- ●ADC/DAC Buffers
- ●Line Drivers, Cable Drivers
- ●Pulse Amplifiers
- ●Ultrasound Amplifiers

## ■ PIN CONFIGURATION




**NJM2727D**
**NJM2727E**

PIN FUNCTION

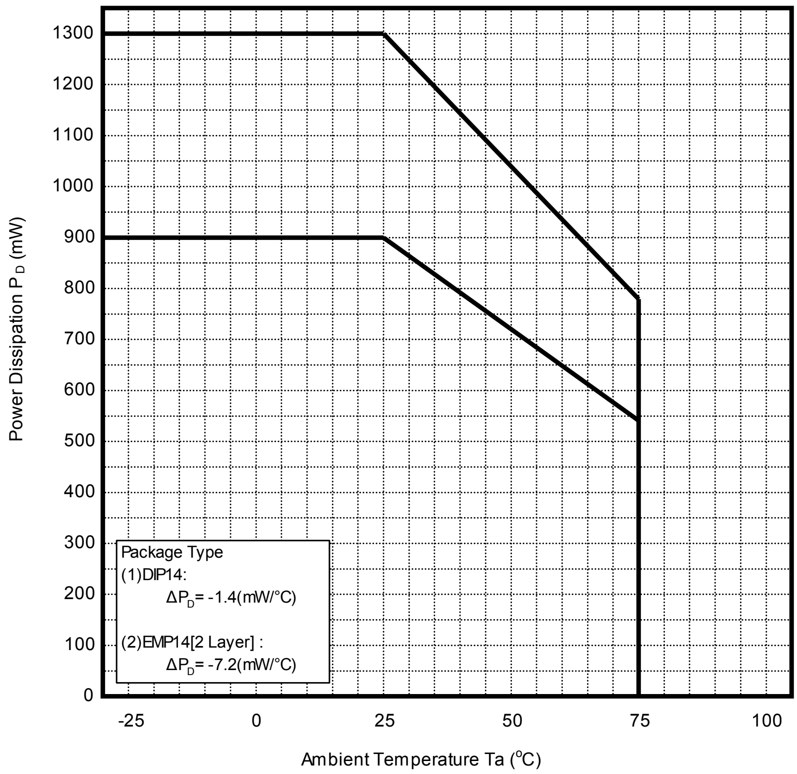
| | |
|---|---|
| 1. NC | 8. NC |
| 2. NC | 9. NC |
| 3. NC | 10. OUTPUT |
| 4. −INPUT | 11. $V^+$ |
| 5. +INPUT | 12. NC |
| 6. V- | 13. NC |
| 7. NC | 14. NC |

## ■ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V^+ / V^-$ | ±20 | V |
| Differential Input Voltage Range | $V_{ID}$ | ±6 | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | ±20 (Note 1) | V |
| Power Dissipation | $P_D$ | 1300 [ DIP8 ]<br>900 [ EMP8 ] (Note 2) | mW |
| Operating Temperature Range | Topr | −40 ~ +75 | °C |
| Storage Temperature Range | Tstg | −50 ~ +150 | °C |

(Note 1) For supply Voltages less than±20V, the maximum input voltage is equal to the Supply Voltage.
(Note 2) On a PCB (76.2×114×31.6mm, two layers, FR-4)
(Note 3) Do not exceed "Power dissipation: $P_D$" 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. Ambient Temperature




## ■RECOMMENDED OPERATING CONDITION (Ta=25°C)

| PARAMETER | SYMBOL | RATING | Min. | Typ. | Max. | UNIT |
|---|---|---|---|---|---|---|
| Operating Voltage | $V^+/V^-$ | | ±4.5 | ±15 | ±18 | V |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## ■ELECTRIC CHARACTERISTICS

•DC CHARACTERISTICS (V+/V−=±15V, Ta= 25˚C)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Supply Current | Icc | No Signal | - | 10 | 13 | mA |
| Input Offset Voltage | $V_{IO}$ | Rs=50Ω, $R_F$=50kΩ | - | 1 | 4 | mV |
| Input Bias Current | $I_B$ | $R_B$=500Ω | - | 10 | 30 | μA |
| Input Offset Current | $I_{IO}$ | $R_B$=500Ω | - | 0.2 | 1.2 | μA |
| Large Signal Voltage Gain | Av | $R_L$=2kΩ, Vo=±5V | 60 | 66 | - | dB |
| Common Mode Rejection Ratio | CMR | −11V≤$V_{ICM}$≤+11V | 80 | 100 | - | dB |
| Supply Voltage Rejection Ratio | SVR | $V^+$ / $V^-$=±4.5V ~ ±18V | 70 | 80 | - | dB |
| Maximum Output Voltage1 | $V_{OM1}$ | $R_L$=500Ω (Note 3) | ±11 | ±12 | - | V |
| Maximum Output Voltage2 | $V_{OM2}$ | $R_L$=150Ω (Note 3) | - | ±3 | - | V |
| Input Common Mode Voltage Range | $V_{ICM}$ | CMR≥80dB | ±11 | ±12 | - | V |

•AC CHARACTERISTICS (V+/V−=±15V, Ta= 25˚C)

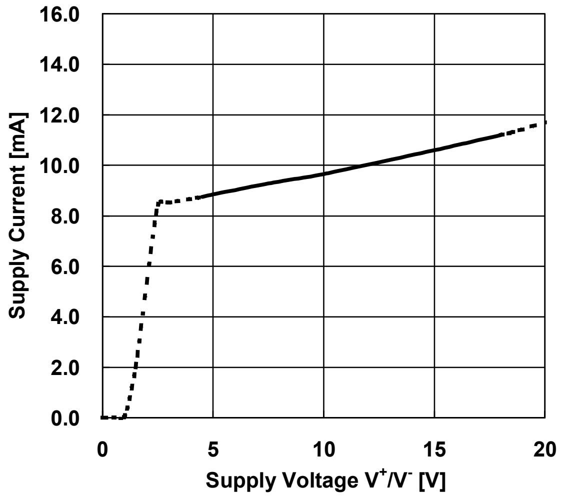
| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Unity Gain Frequency | fT | $A_V$=40dB, $R_F$=1.98kΩ, $R_G$=20Ω<br>$R_L$=∞, $C_L$=5pF | - | 40 | - | MHz |
| Phase Margin | φM | $A_V$=40dB, $R_F$=1.98kΩ, $R_G$=20Ω<br>RL=∞, $C_L$=5pF | - | 60 | - | deg |
| Equivalent Input Noise Voltage | $V_{NI}$ | $A_V$=40dB, $R_F$=1.98kΩ, $R_G$=20Ω<br>$R_L$=∞, $C_L$=5pF, f=100kHz | - | 14 | - | nV/√Hz |

•TRANSIENT CHARACTERISTICS (V+/V−=±15V, Ta= 25˚C)

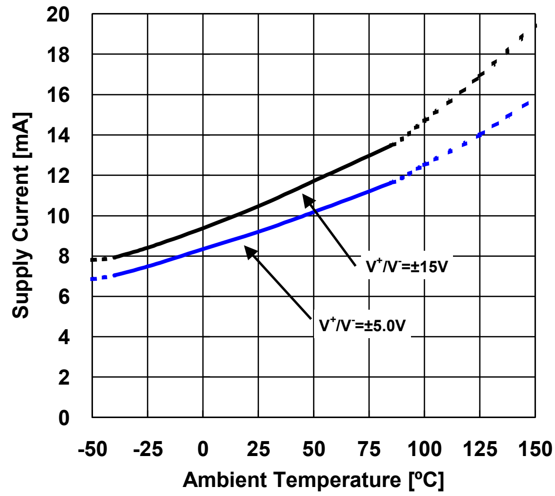
| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Slew Rate1 | $SR1_P$ | Gain= +1, $R_F$=0Ω, $R_G$=∞<br>$R_L$=500Ω, $C_L$=5pF, $V_{IN}$=10Vpp | - | 300 | - | V/μs |
| | $SR1_N$ | Gain= −1, $R_F$=1kΩ, $R_G$=1kΩ<br>$R_L$=∞, $C_L$=5pF, $V_{IN}$=10Vpp | - | 300 | - | V/μs |
| Slew Rate2 | $SR2_P$ | Gain= +1, $R_F$=0Ω, $R_G$=∞<br>$R_L$=500Ω, $C_L$=5pF, $V_{IN}$=1Vpp | - | 100 | - | V/μs |
| | $SR2_N$ | Gain= −1, $R_F$=1kΩ, $R_G$=1kΩ<br>$R_L$=∞, $C_L$=5pF, $V_{IN}$=1Vpp | - | 100 | - | V/μs |
| Differential Gain | DG | $A_V$=6dB, $R_F$=2kΩ, $R_G$=2kΩ,<br>$R_L$=150Ω, $C_L$=5pF,<br>Vin=1Vpp(NTSC) | - | 0.09 | - | % |
| Differential Phase | DP | | - | 0.64 | - | deg |

## ■TYPICAL CHARACTERISTICS

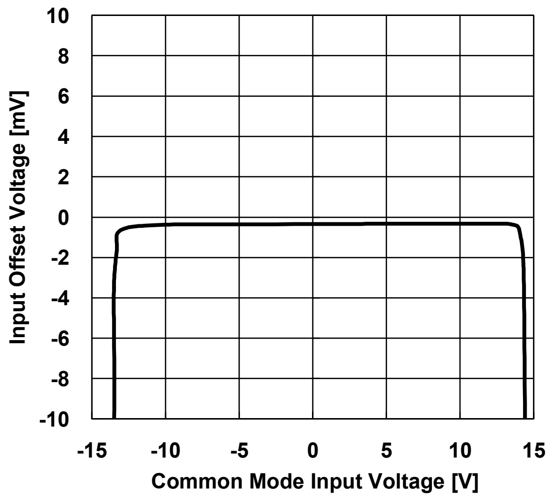
Supply Current vs. Supply Voltage
$V_{IN}$=0V, Ta=25°C



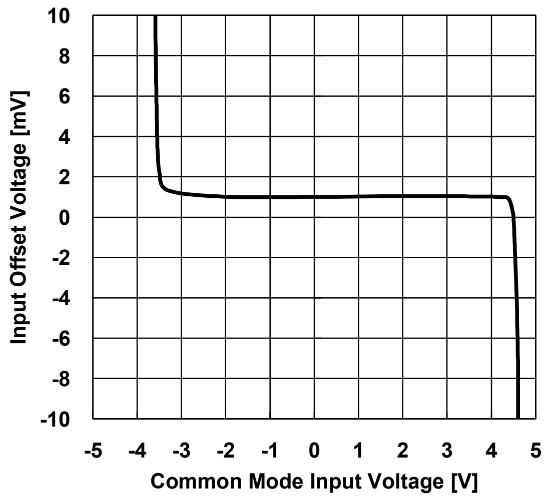

Supply Current vs. Ambient Temperature
$V_{IN}$=0V



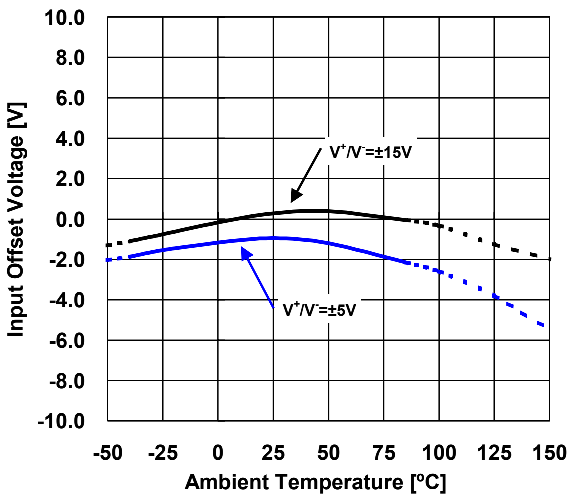

Input Offset Voltage
vs. Common Mode Input Voltage
$V^+/V^-$=±15V, Ta=25°C




Input Offset Voltage
vs. Common Mode Input Voltage
$V^+/V^-$=±5V, Ta=25°C




Input Offset Voltage vs. Ambient Temperature
$V^+/V^-$=±5/±15V





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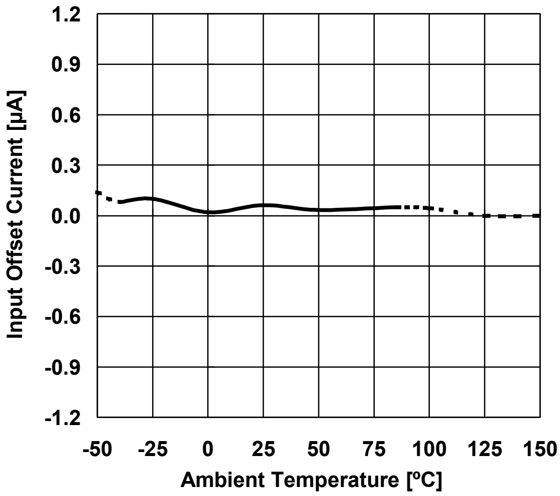
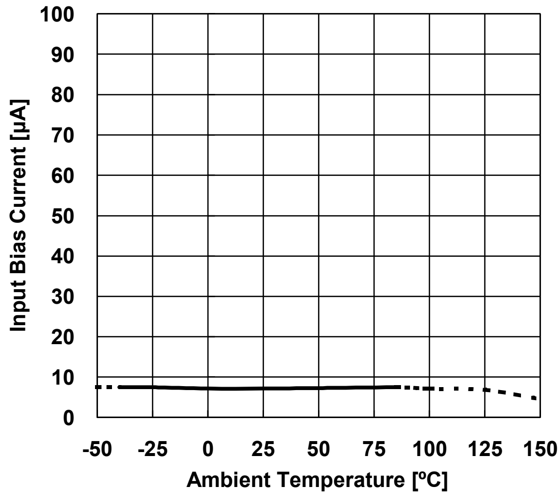
## ■TYPICAL CHARACTERISTICS

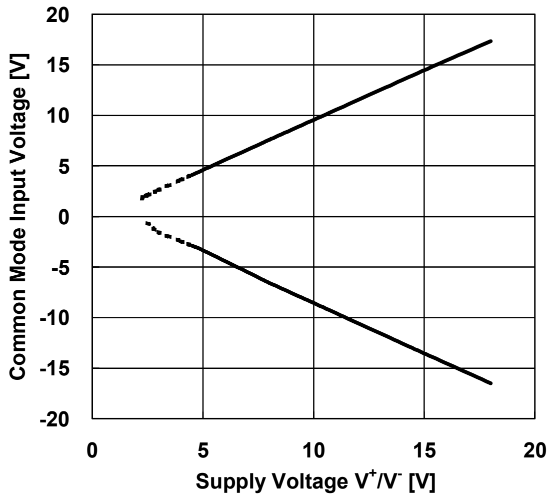
**Input Offset Current vs. Ambient Temperature**
$V^+/V^-=\pm15V$



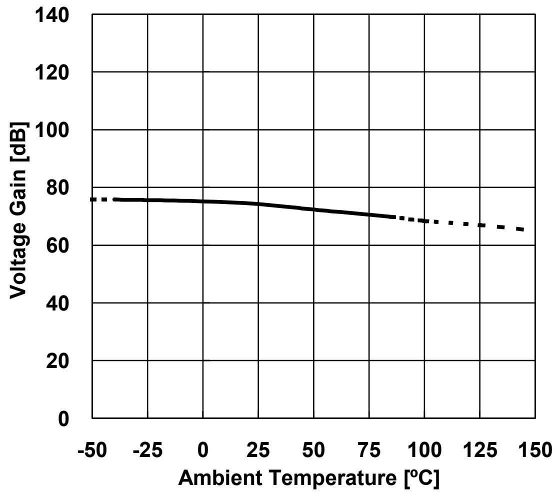

**Input Bias Current vs. Ambient Temperature**
$V^+/V^-=\pm15V$



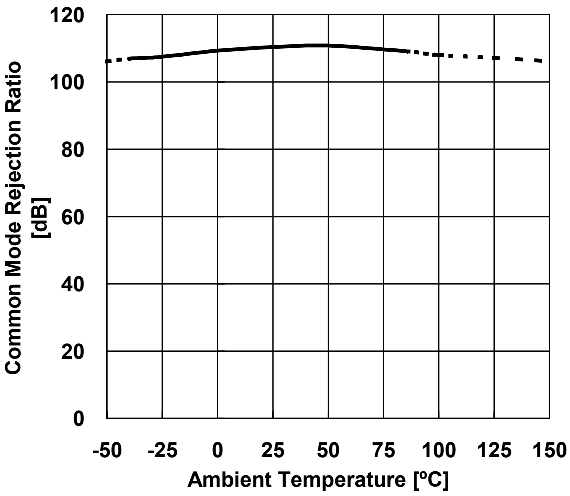

**Common Mode Input Voltage vs. Supply Voltage**
CMR≥80dB, Ta=25ºC



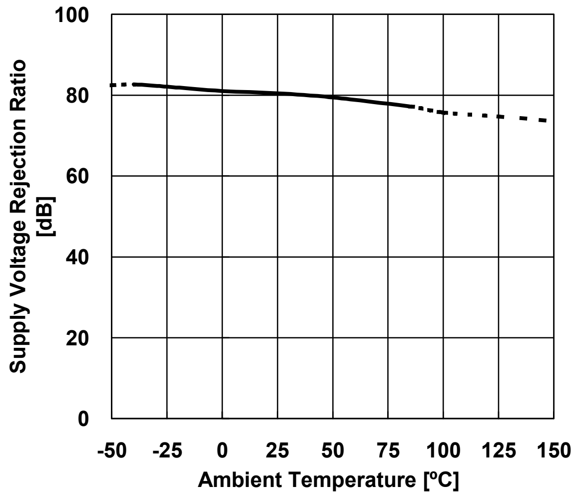

**Voltage Gain vs. Ambient Temperature**
$V^+/V^-=\pm15V$, $R_L=2k\Omega$




**Common Mode Rejection Ratio vs. Ambient Temperature**
$V^+/V^-=\pm15V$, $-15V\leq V_{ICM}\leq+12.5V$

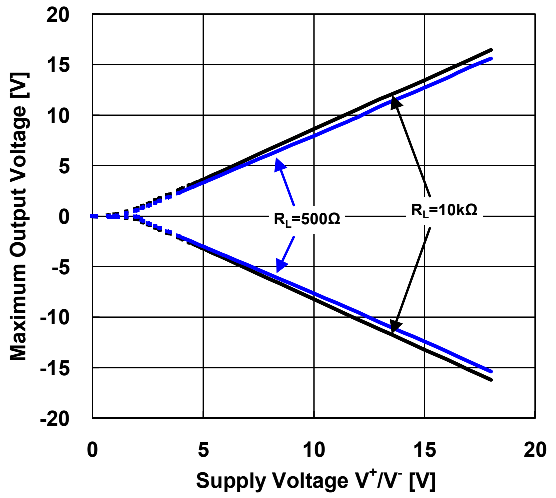



**Supply Voltage Rejection Ratio vs. Ambient Temperature**
$V^+/V^-=\pm2.5V$ to $\pm15V$

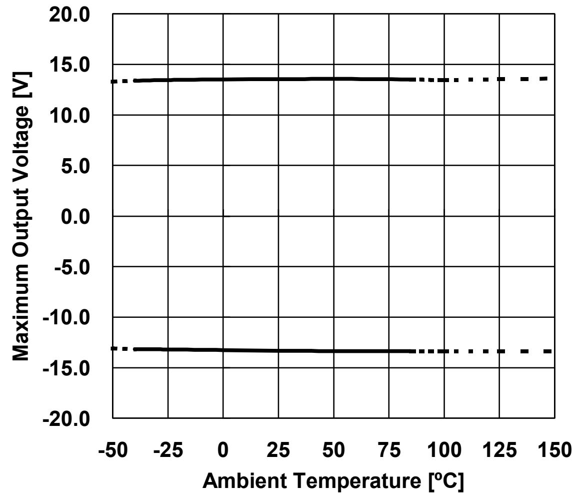


## ■TYPICAL CHARACTERISTICS

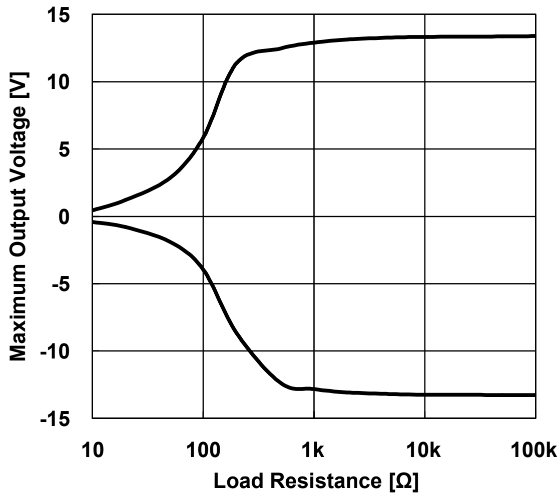
**Maximum Output Voltage vs. Supply Voltage**
Ta=25ºC



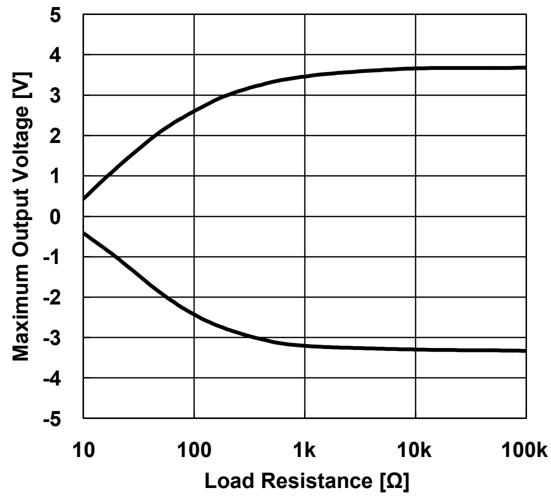

**Maximum Output Voltage vs. Ambient Temperature**
V+/V-=±15V, Gv=open, $V_{IN}$=±1V, $R_L$=10kΩ



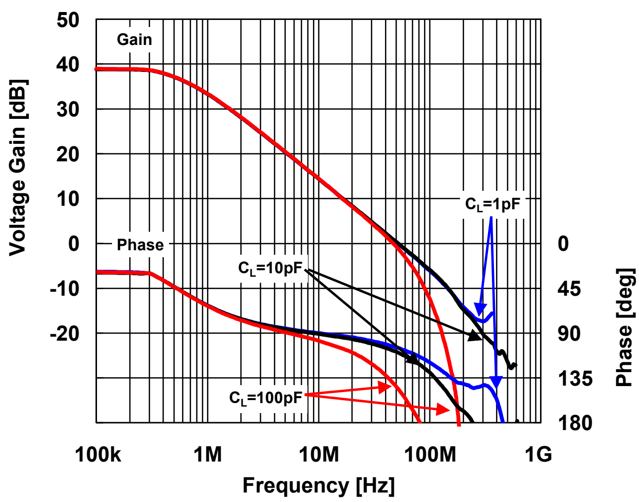

**Maximum Output Voltage vs. Load Resistance**
V+/V-=±15V, Ta=25ºC



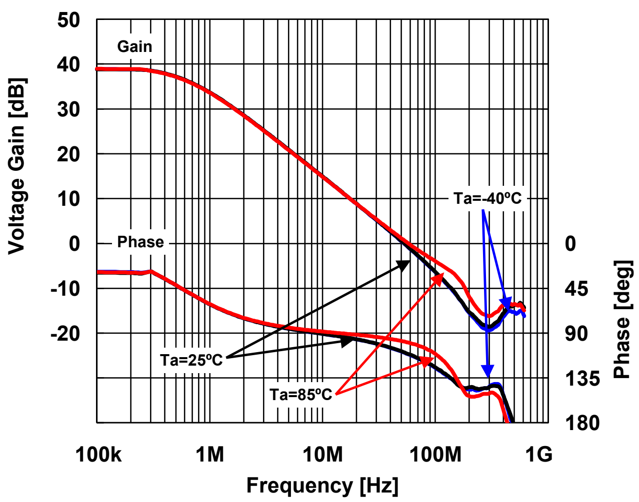

**Maximum Output Voltage vs. Load Resistance**
V+/V-=±5V, Ta=25ºC




**Gain/Phase vs. Frequency** (Load Capacitance)
V+/V-=±15V, $V_{IN}$=0.02$V_{PP}$, $G_V$=40dB, $R_T$=50Ω,
$R_F$=1.98kΩ, $R_G$=20Ω, $C_F$=0F, $R_L$=500Ω, Ta=+25ºC

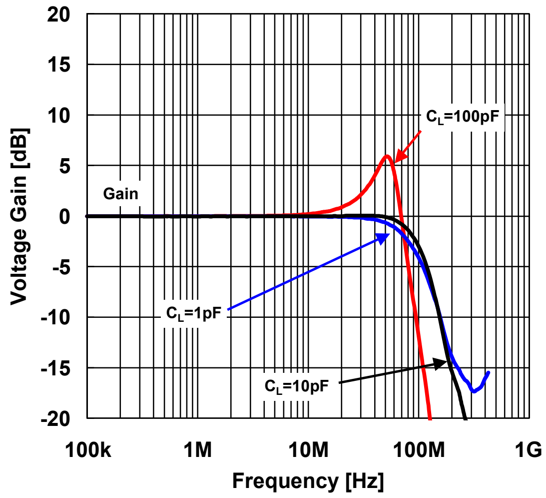



**Gain/Phase vs. Frequency** (Ambient Temperature)
V+/V-=±15V, $V_{IN}$=0.02Vpp, $G_V$=40dB, $R_T$=50Ω,
$R_F$=1.98kΩ, $R_G$=20Ω, $C_F$=0F, $C_L$=10pF, $R_L$=500Ω

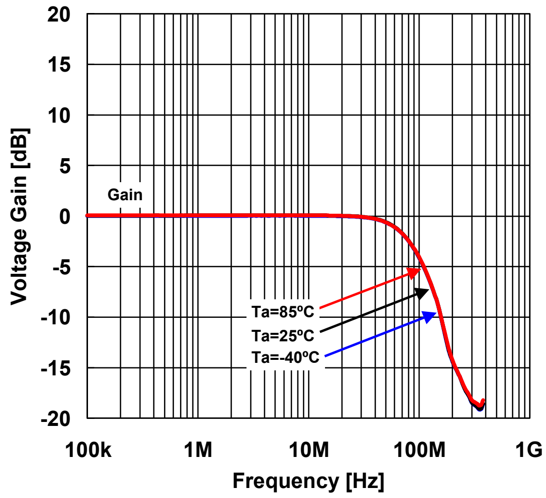


## ■TYPICAL CHARACTERISTICS

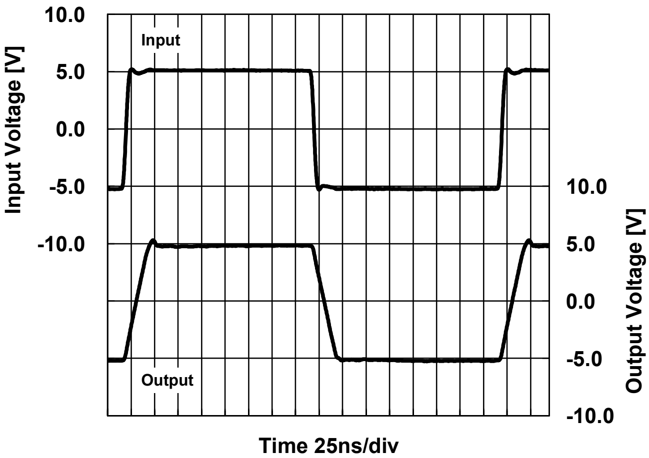
**V.F. Peak vs. Frequency** (Load Capacitance)
$V^+/V^-$=±15V, $V_{IN}$=0.02Vpp, $G_V$=0dB, $R_T$=50Ω,
$R_F$=0Ω, $R_G$=open, $C_F$=0F, $R_L$=500Ω, Ta=+25ºC



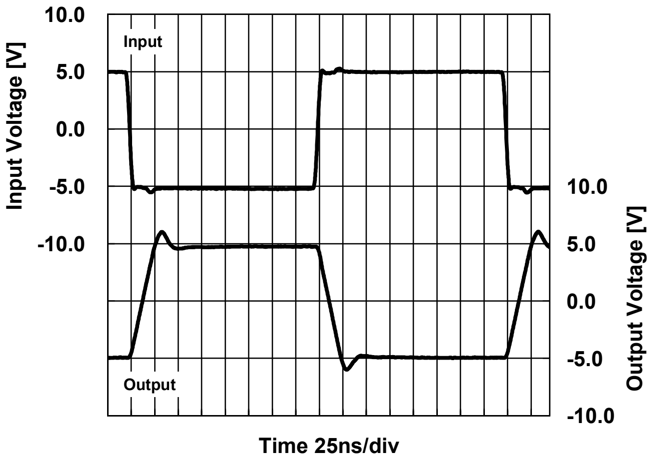

**V.F. Peak vs. Frequency** (Ambient Temperature)
$V^+/V^-$=±15V, $V_{IN}$=0.02Vpp, $G_V$=0dB, $R_T$=50Ω,
$R_F$=0Ω, $R_G$=open, $C_F$=0F, $C_L$=10pF, $R_L$=500Ω



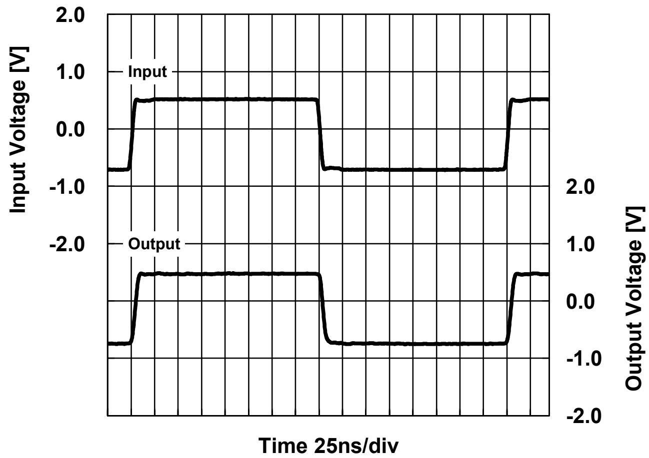

**Pulse Response**
(Non Inverting Configuration, Large Signal)
$V^+/V^-$=±15V, f=2.5MHz, $V_O$=10$V_{PP}$, $G_V$=0dB, $R_T$=50Ω,
$R_F$=0Ω, $R_G$=∞, $R_L$=500Ω, $C_L$=10pF, Ta=+25ºC



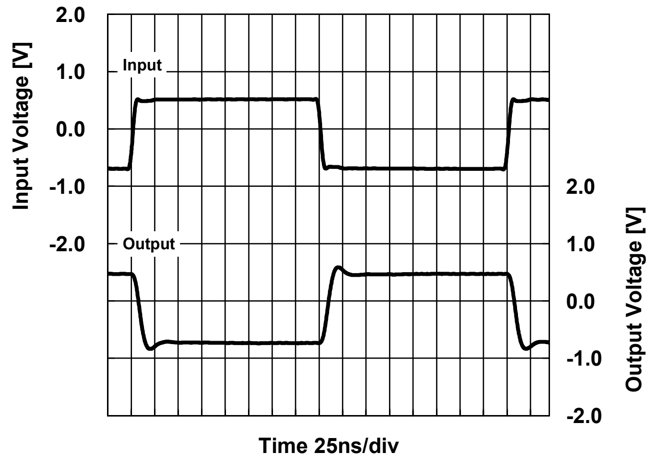

**Pulse Response**
(Inverting Configuration, Large Signal)
$V^+/V^-$=±15V, f=2.5MHz, $V_O$=10$V_{PP}$, $G_V$=0dB, $R_T$=56Ω,
$R_F$=1kΩ, $R_G$=1kΩ, $R_L$=1kΩ, $C_L$=10pF, Ta=+25ºC




**Pulse Response**
(Non Inverting Configuration, Small Signal)
$V^+/V^-$=±15V, f=2.5MHz, $V_O$=1$V_{PP}$, $G_V$=0dB, $R_T$=50Ω,
$R_F$=0Ω, $R_G$=∞, $R_L$=500Ω, $C_L$=10pF, Ta=+25ºC



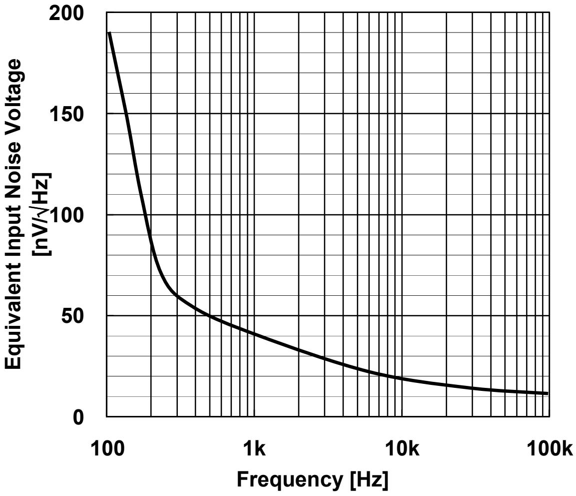

**Pulse Response**
(Inverting Configuration, Small Signal)
$V^+/V^-$=±15V, f=2.5MHz, $V_O$=1$V_{PP}$, $G_V$=0dB, $R_T$=56Ω,
$R_F$=1kΩ, $R_G$=1kΩ, $R_L$=1kΩ, $C_L$=10pF, Ta=+25ºC



## ■TYPICAL CHARACTERISTICS

**Equivalent Input Noise Voltage vs. Frequency**

$V^+/V^-=\pm15V$, $V_{IN}=50\Omega$ to GND, $G_V=40dB$, $R_S=50\Omega$,
$R_F=1.98k$, $R_G=20\Omega$, $R_L=\infty$, $C_L=0pF$, $Ta=25°C$




## ■TEST CIRCUITS

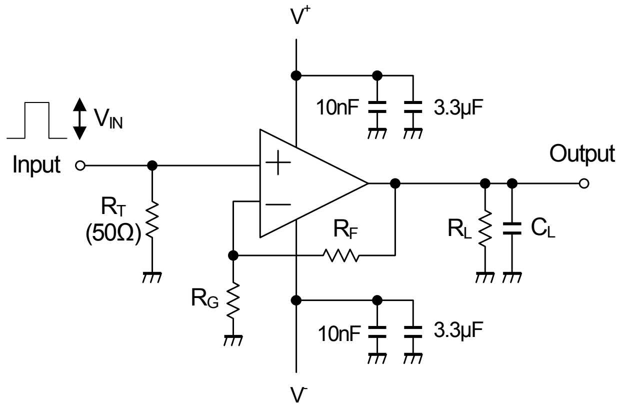



Figure 2 - 1: Slew Rate Test Circuit (Non Inverting)

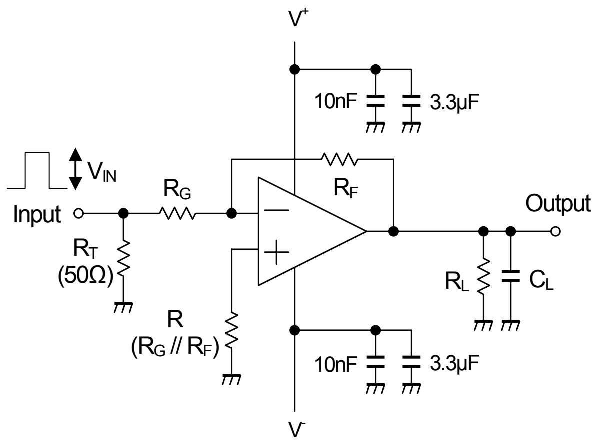



Figure 2 - 2: Slew Rate Test Circuit (Inverting)

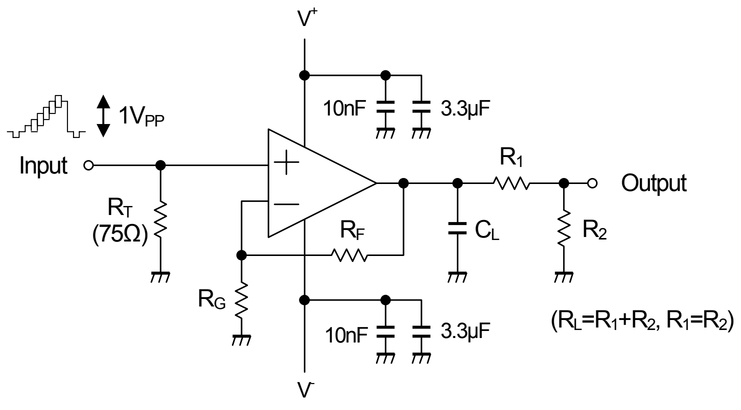



Figure 2 - 3: DG / DP Test Circuit