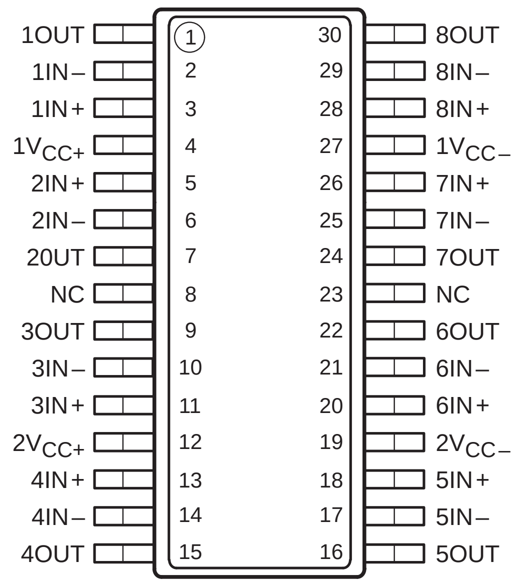
- **Very Low Power Consumption**
- **Typical Supply Current . . . 200 μA (Per Amplifier)**
- **Wide Common-Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Common-Mode Input Voltage Range Includes V_{CC+}**
- **Output Short-Circuit Protection**
- **High Input Impedance . . . JFET-Input Stage**
- **Internal Frequency Compensation**
- **Latch-Up-Free Operation**
- **High Slew Rate . . . 3.5 V/μs Typ**

DB PACKAGE
(TOP VIEW)



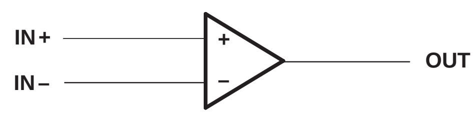
NC – No internal connection

description

The TL064x2 JFET-input operational amplifier is designed as a low-power version of the TL084x2 amplifier. It features high input impedance, wide bandwidth, high slew rate, and low input offset and bias currents. The TL064x2 features the same terminal assignments as the TL074x2 and TL084x2. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit.

The TL064x2 is characterized for operation from 0°C to 70°C.

symbol (each amplifier)

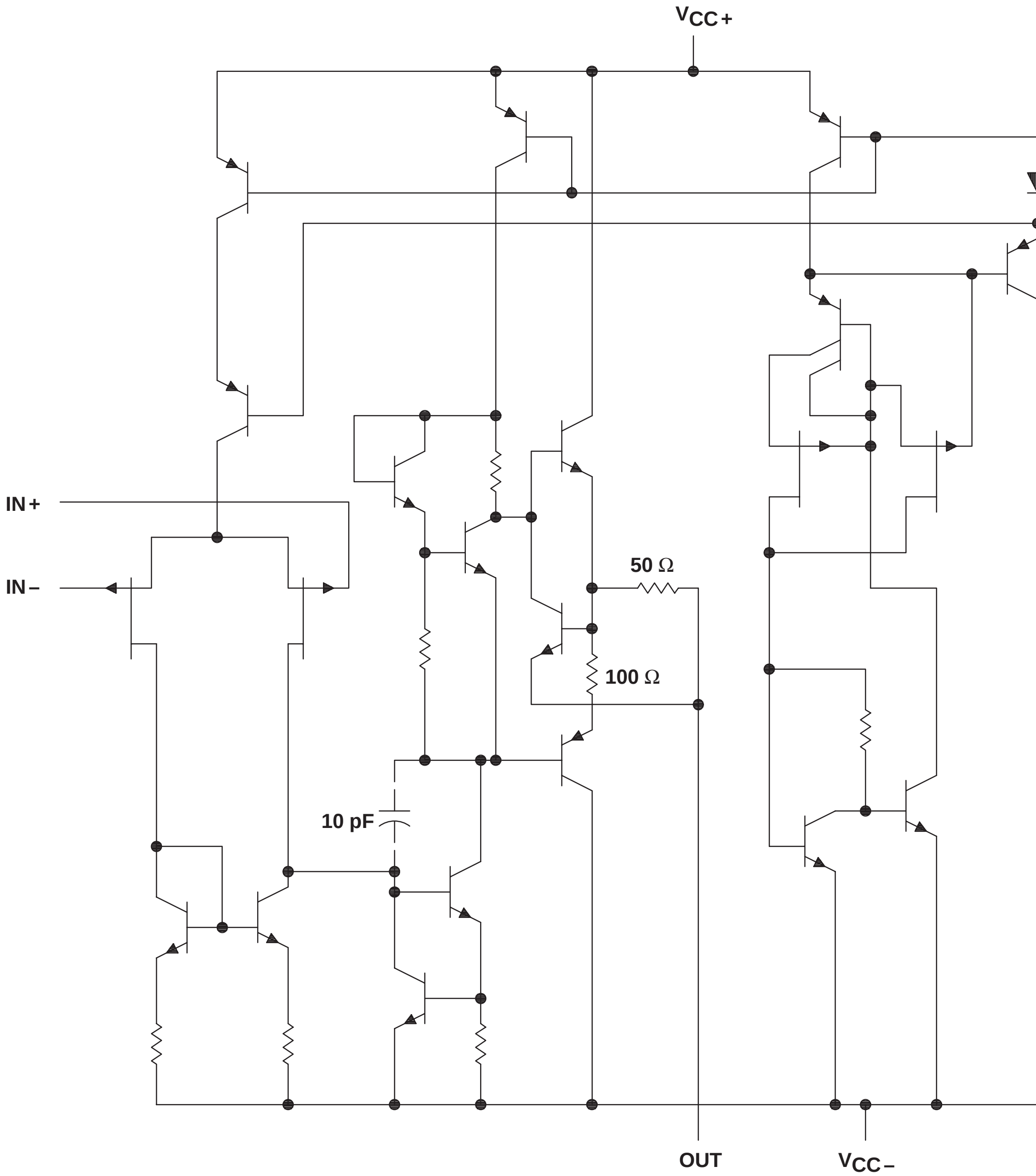


AVAILABLE OPTION

T_A	V_{IO}max AT 25°C	PACKAGE SMALL OUTLINE (DB)†
0°C to 70°C	7 mV	TL064x2DBLE

† The DB package is only available left-end taped and reeled.

schematic (each amplifier)



All component values shown are nominal.

ACTUAL DEVICE COMPONENT COUNT	
Transistors	116
Resistors	60
JFET	24
Capacitors	8
Diodes	4

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC+} (see Note 1) . . . . 18 V
Supply voltage, V_{CC-} (see Note 1) . . . . –18 V
Differential input voltage, V_{ID} (see Note 2) . . . . ±30 V
Input voltage, V_I (any input) (see Notes 1 and 3) . . . . ±15 V
Duration of output short circuit to ground (see Note 4) . . . . unlimited
Continuous total dissipation . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . 0°C to 70°C
Storage temperature range . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values, except differential voltages and V_{CC} specified for the measurement of I_{OS}, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. Differential voltages are at IN + with respect to IN –.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
4. The output can be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
DB	1024 mW	8.2 mW/°C	655 mW

electrical characteristics, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		T_A‡	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 0,	R_S = 50 Ω	25°C		3	15	mV
				Full range			20	
α_{VIO}	Temperature coefficient of input offset voltage	V_O = 0,	R_S = 50 Ω	Full range		10		μV/°C
I_{IO}	Input offset current	V_O = 0		25°C		5	200	pA
				Full range			5	nA
I_{IB}	Input bias current§	V_O = 0		25°C		30	400	pA
				Full range			10	nA
V_{ICR}	Common-mode input voltage range			25°C	±11	–12 to 15		V
V_{OM}	Maximum peak output voltage swing	R_L = 10 kΩ		25°C	±10	±13.5		V
		R_L ≥ 10 kΩ		Full range	±10			
A_{VD}	Large-signal differential voltage amplification	V_O = ± 10 V,	R_L ≥ 10 kΩ	25°C	3	6		V/mV
				Full range	3			
B_1	Unity-gain bandwidth	R_L = 10 kΩ,		25°C		1		MHz
r_1	Input resistance			25°C		10^{12}		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}$min, R_S = 50 Ω	V_O = 0,	25°C	70	86		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	V_{CC} = ± 9 V to ± 15 V, R_S = 50 Ω	V_O = 0,	25°C	70	95		dB
P_D	Total power dissipation (each amplifier)	V_O = 0,	No load	25°C		6	7.5	mW
I_{CC}	Supply current (each amplifier)	V_O = 0,	No load	25°C		200	250	μA
V_{O1}/V_{O2}	Crosstalk attenuation	A_{VD} = 100		25°C		120		dB

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.
‡ Full range is 0°C to 70°C.
§ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 13. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

operating characteristics, $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	V_I = 10 mV, C_L = 100 pF,	R_L = 10 kΩ, See Figure 1	1.5	3.5		V/μs
t_r	Rise time	V_I = 20 V, C_L = 100 pF,	R_L = 10 kΩ, See Figure 1		0.2		μs
	Overshoot factor				10%		
V_n	Equivalent input noise voltage	R_S = 20 Ω,	f = 1 kHz		42		nV/$\sqrt{Hz}$

PARAMETER MEASUREMENT INFORMATION

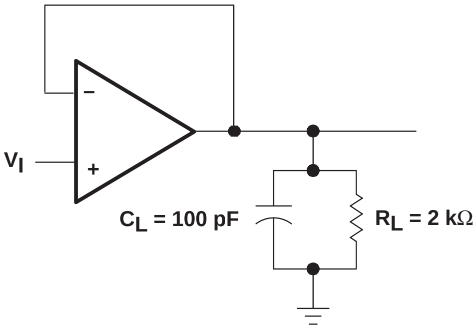


Figure 1. Unity-Gain Amplifier

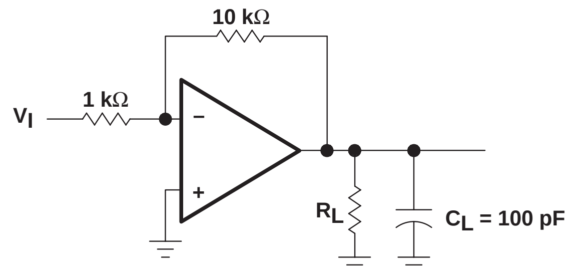


Figure 2. Gain-of-10 Inverting Amplifier

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{OM}	Maximum peak output voltage	vs Supply voltage vs Free-air temperature vs Load resistance vs Frequency	3 4 5 6
A_{VD}	Differential voltage amplification	vs Free-air temperature	7
A_{VD}	Large-signal differential voltage amplification	vs Frequency	8
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature	9 10
P_D	Total power dissipation	vs Free-air temperature	11
	Normalized unity-gain bandwidth	vs Free-air temperature	12
	Normalized slew rate	vs Free-air temperature	12
I_{IB}	Input bias current	vs Free-air temperature	13
	Pulse response	Large signal	14
V_O	Output voltage	vs Time	15
V_n	Equivalent input noise voltage	vs Frequency	16
	Normalized phase shift	vs Free-air temperature	12

TYPICAL CHARACTERISTICS

MAXIMUM PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

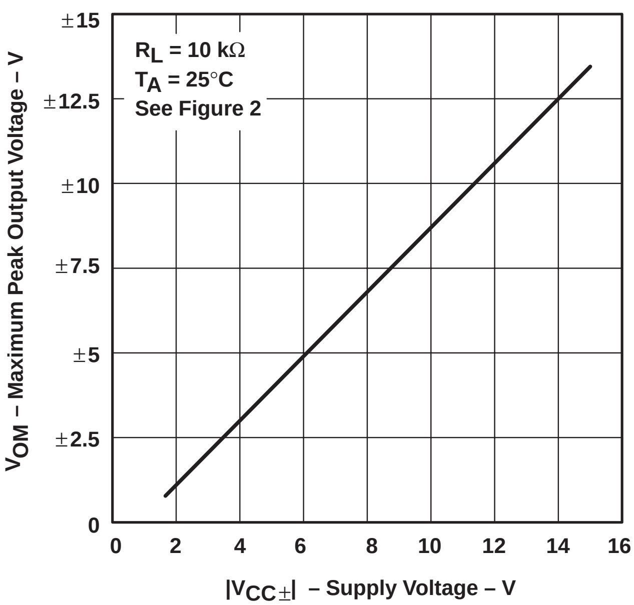


Figure 3

MAXIMUM PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

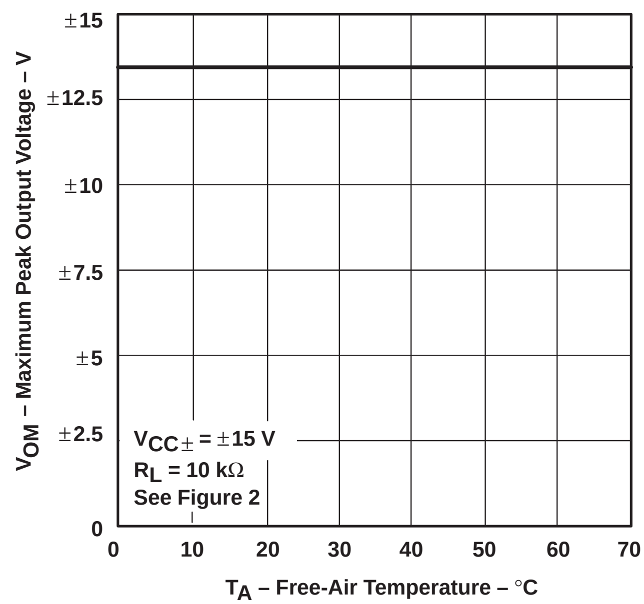


Figure 4

MAXIMUM PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

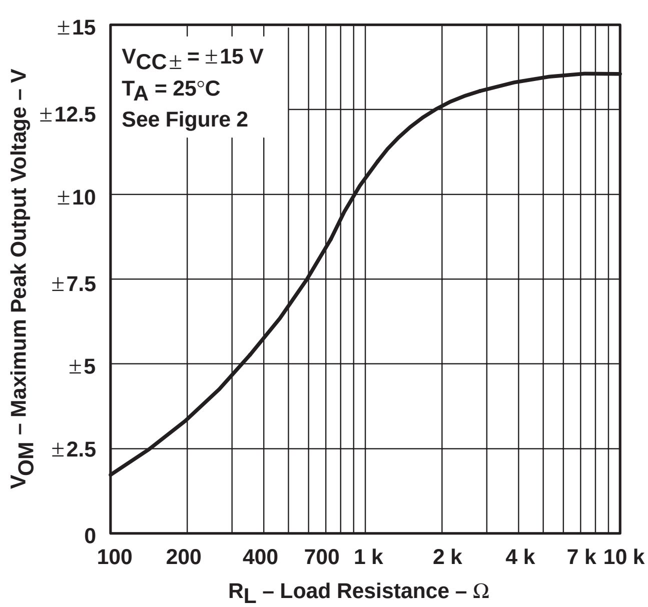


Figure 5

MAXIMUM PEAK OUTPUT VOLTAGE vs FREQUENCY

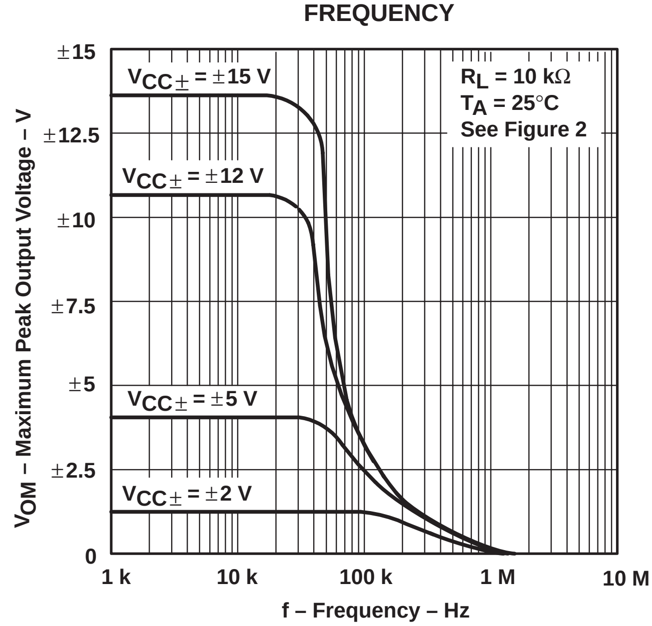


Figure 6

TYPICAL CHARACTERISTICS

**DIFFERENTIAL VOLTAGE AMPLIFICATION
vs
FREE-AIR TEMPERATURE**

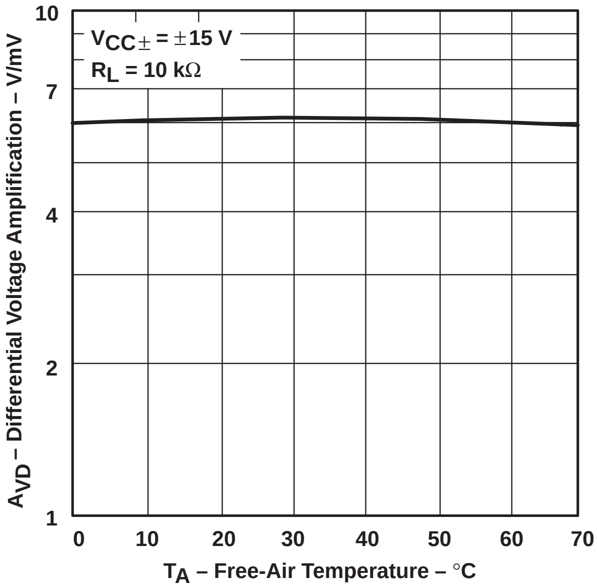


Figure 7

**LARGE-SIGNAL
DIFFERENTIAL VOLTAGE
AMPLIFICATION AND PHASE SHIFT
vs
FREQUENCY**

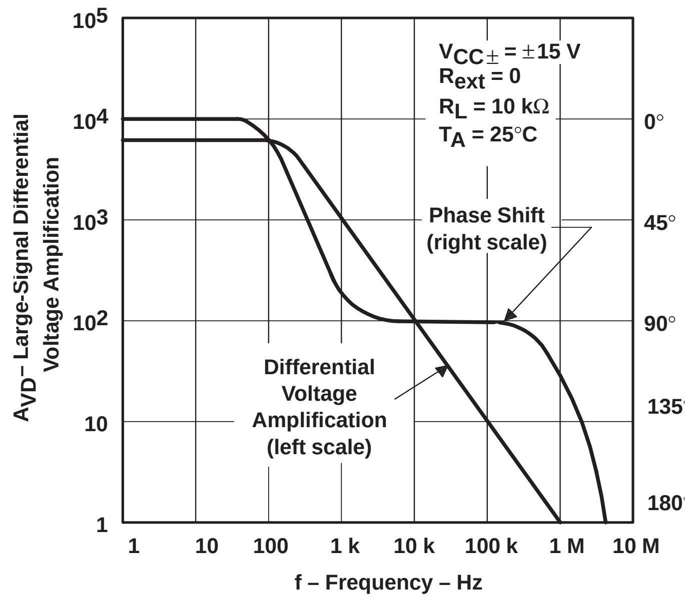


Figure 8

**SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

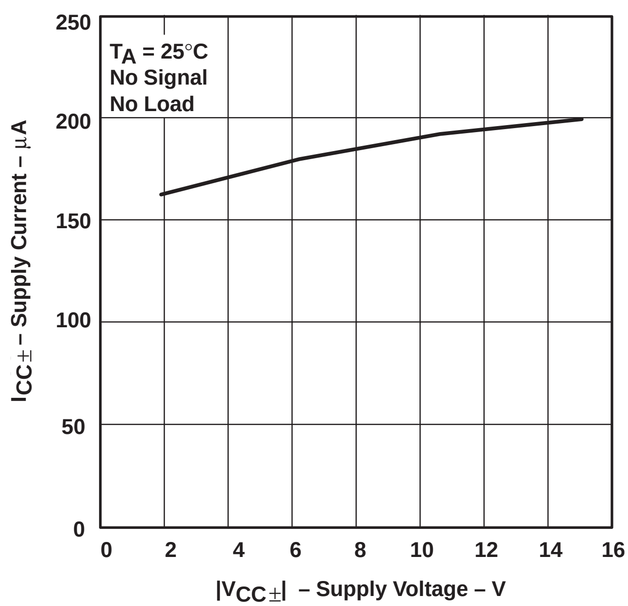


Figure 9

**SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE**

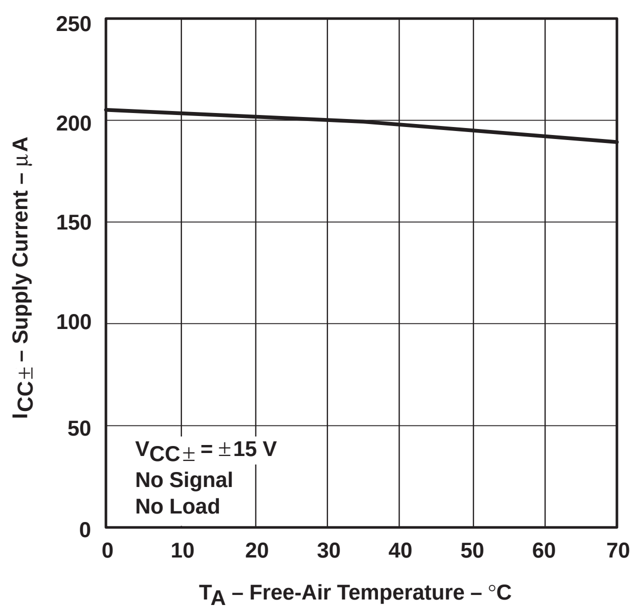


Figure 10

TYPICAL CHARACTERISTICS

TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE

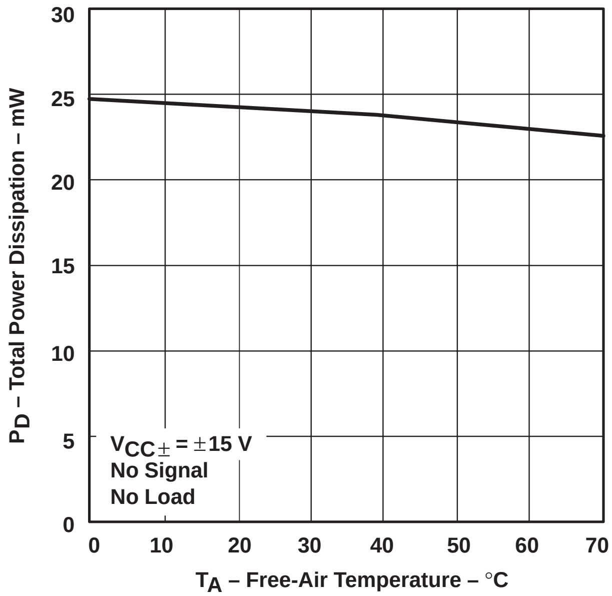


Figure 11

NORMALIZED UNITY-GAIN BANDWIDTH,
NORMALIZED SLEW RATE, AND
NORMALIZED PHASE SHIFT
vs
FREE-AIR TEMPERATURE

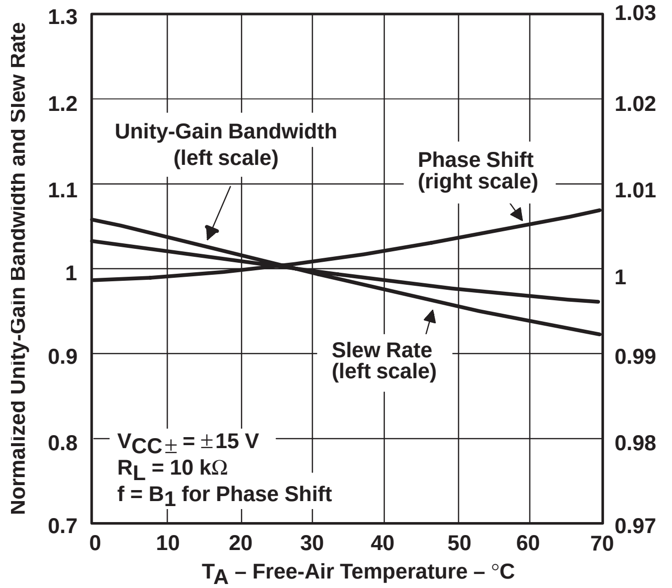


Figure 12

INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

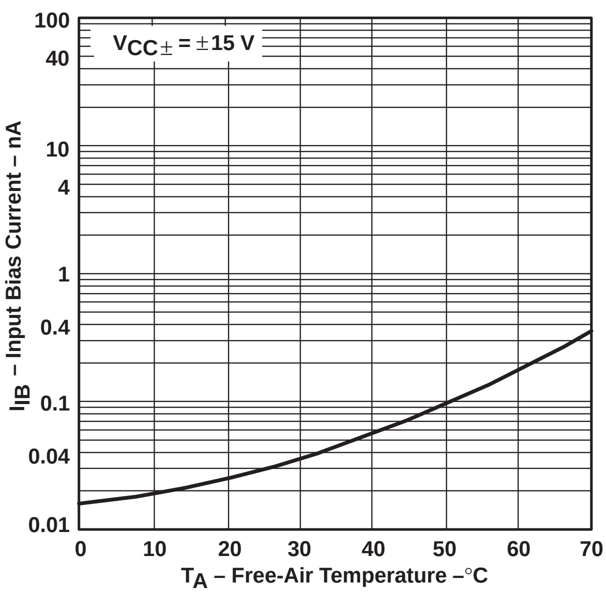


Figure 13

VOLTAGE FOLLOWER
LARGE SIGNAL PULSE RESPONSE

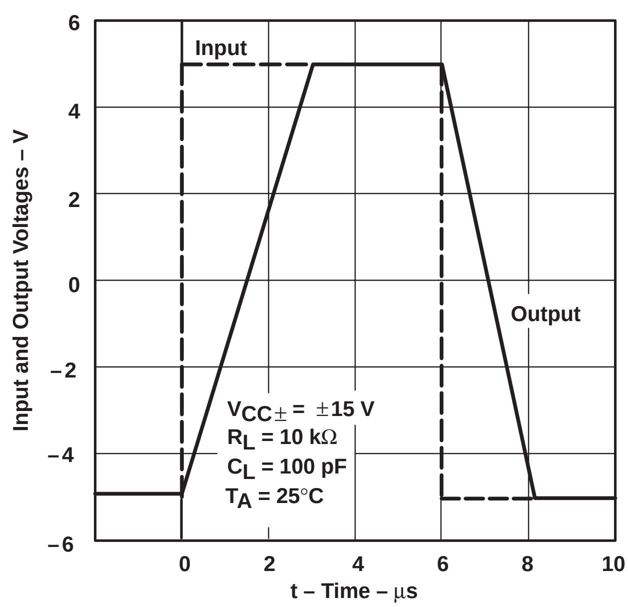


Figure 14

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE
vs
TIME

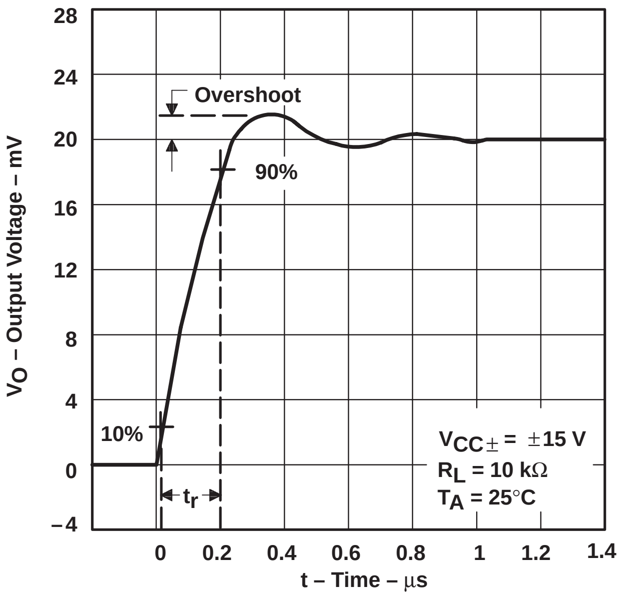


Figure 15

EQUIVALENT INPUT NOISE VOLTAGE
vs
FREQUENCY

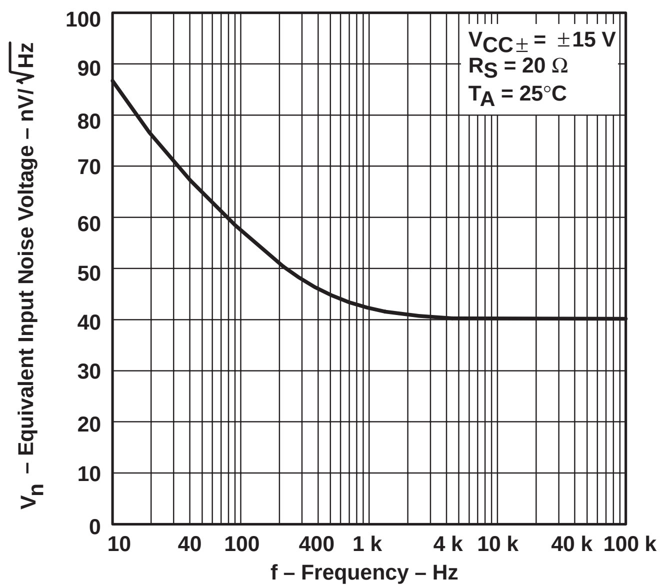


Figure 16

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