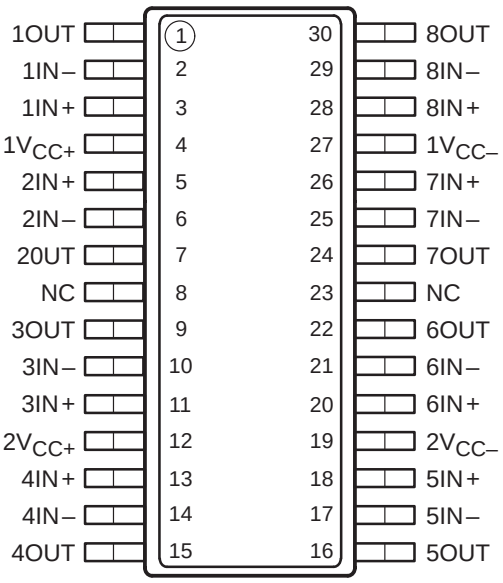
- **Low Power Consumption**
- **Wide Common-Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Output Short-Circuit Protection**
- **Low Total Harmonic Distortion . . . 0.003% Typ**
- **High Input Impedance . . . JFET-Input Stage**
- **Latch-Up-Free Operation**
- **High Slew Rate . . . 13 V/μs Typ**
- **Common-Mode Input Voltage Range Includes V_{CC+}**

DB PACKAGE
(TOP VIEW)



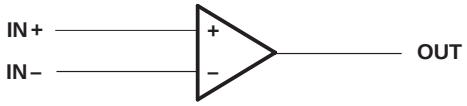
NC – No internal connection

description

The TL084x2 JFET-input operational amplifier incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The device features high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.

The TL084x2 is characterized for operation from 0°C to 70°C.

symbol (each amplifier)

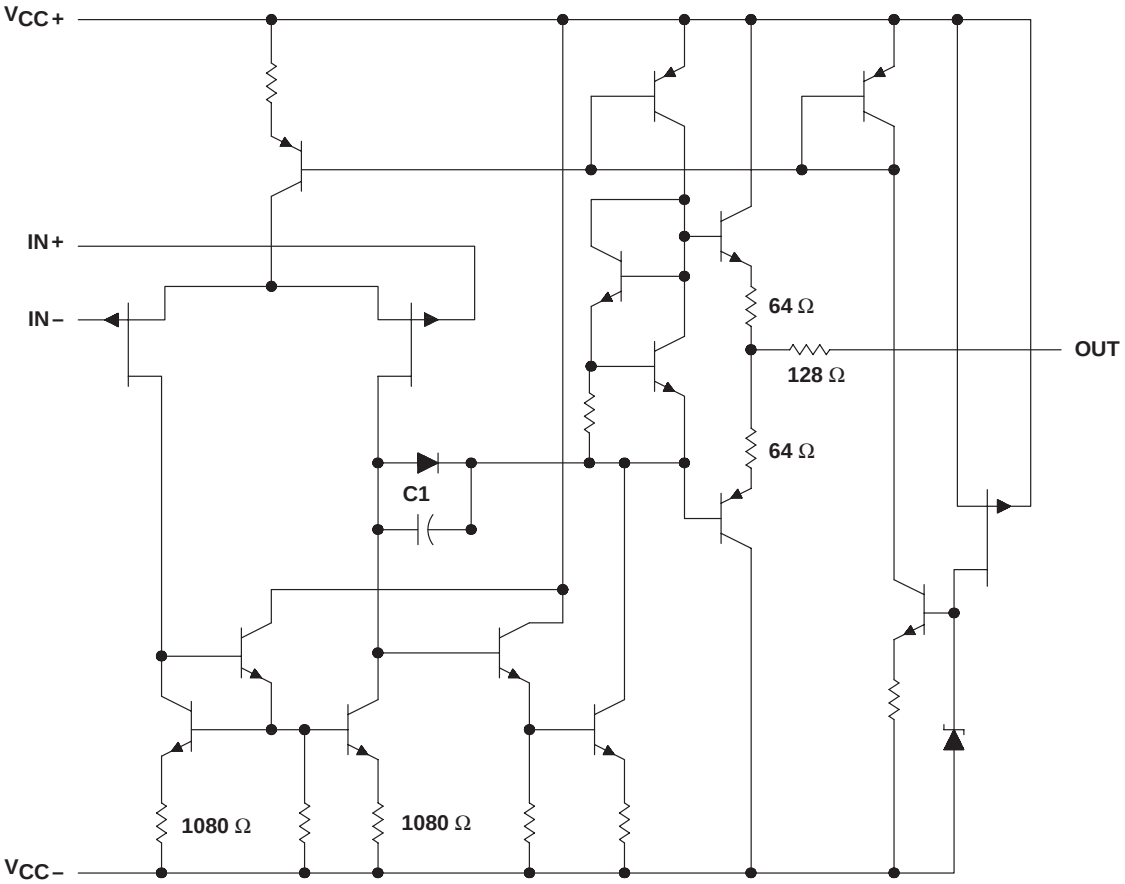


AVAILABLE OPTION

T_A	V_{IO}max AT 25°C	PACKAGE
		SMALL OUTLINE (DB)†
0°C to 70°C	15 mV	TL084x2DBLE

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

schematic (each amplifier)



All component values shown are nominal.

COMPONENT COUNT	
Resistors	76
Transistors	120
JFET	20
Diodes	12
Capacitors	8

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	$T_A \leq 25°C$ 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		5	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	±10	±11		V
V_{OM}	Maximum peak output voltage swing	R_L = 10 kΩ		25°C	±12	±13.5		V
		R_L ≥ 10 kΩ		Full range	±12			
		R_L ≥ 2 kΩ			±10	±12		
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V,	R_L ≥ 2 kΩ	25°C	25	200		V/mV
		V_O = ±10 V,	R_L ≥ 2 kΩ	Full range	15			
B_1	Unity-gain bandwidth			25°C		3		MHz
r_i	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	76		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	V_{CC} = ±15 V to ± 9 V, R_S = 50 Ω	V_O = 0,	25°C	70	76		dB
I_{CC}	Supply current (per amplifier)	V_O = 0,	No load	25°C		1.4	2.8	mA
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 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 14. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

operating characteristics, $V_{CC\pm}$ = ±15 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	V_I = 10 V,	R_L = 2 kΩ,	C_L = 100 pF,	See Figure 1		13		V/μs
t_r	Rise time	V_I = 20 mV,	R_L = 2 kΩ,	C_L = 100 pF,	See Figure 1		0.05		μs
	Overshoot factor						20%		
V_n	Equivalent input noise voltage	R_S = 20 Ω,	f = 1 kHz				18		nV/√Hz

PARAMETER MEASUREMENT INFORMATION

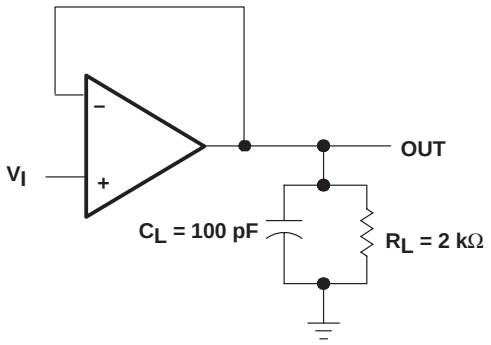


Figure 1. Unity-Gain Amplifier

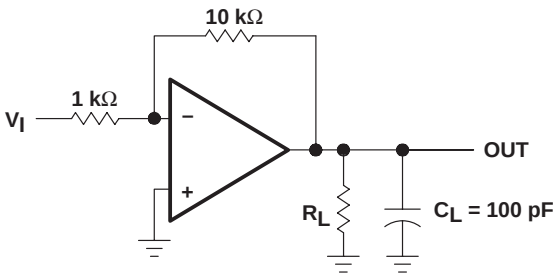


Figure 2. Gain-of-10 Inverting Amplifier

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{OM}	Maximum peak output voltage	vs Frequency vs Free-air temperature vs Load resistance vs Supply voltage	3, 4, 5 6 7 8
A_{VD}	Large-signal differential voltage amplification	vs Free-air temperature vs Frequency	9 10
P_D	Total power dissipation	vs Free-air temperature	11
I_{CC}	Supply current	vs Free-air temperature vs Supply voltage	12 13
I_{IB}	Input bias current	vs Free-air temperature	14
	Pulse response	Large signal	15
V_O	Output voltage	vs Elasped time	16
CMRR	Common-mode rejection ratio	vs Free-air temperature	17
V_n	Equivalent input noise voltage	vs Frequency	18
THD	Total harmonic distortion	vs Frequency	19
	Phase shift	vs Free-air temperature	10

TYPICAL CHARACTERISTICS

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

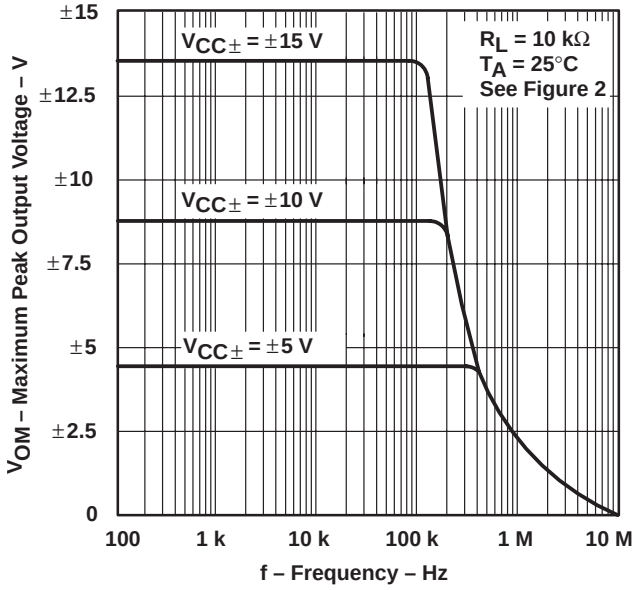


Figure 3

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

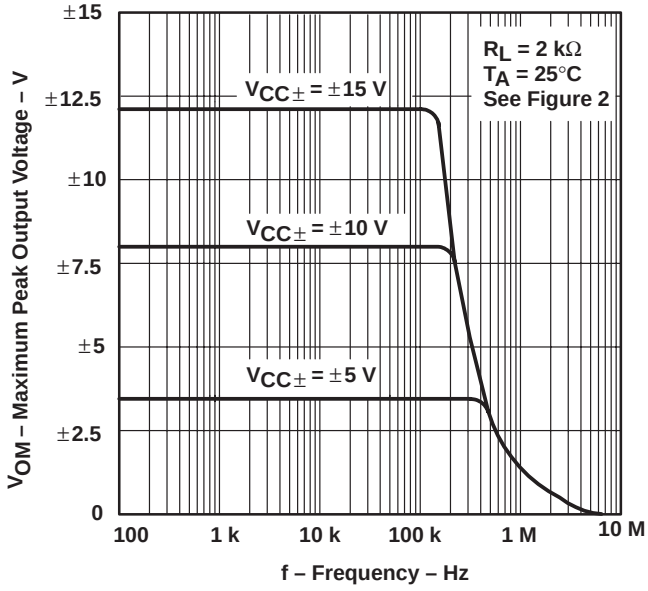


Figure 4

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

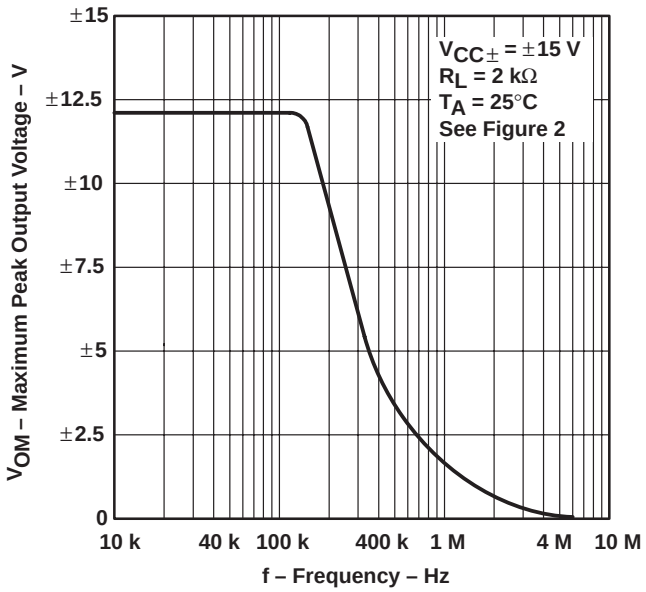


Figure 5

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

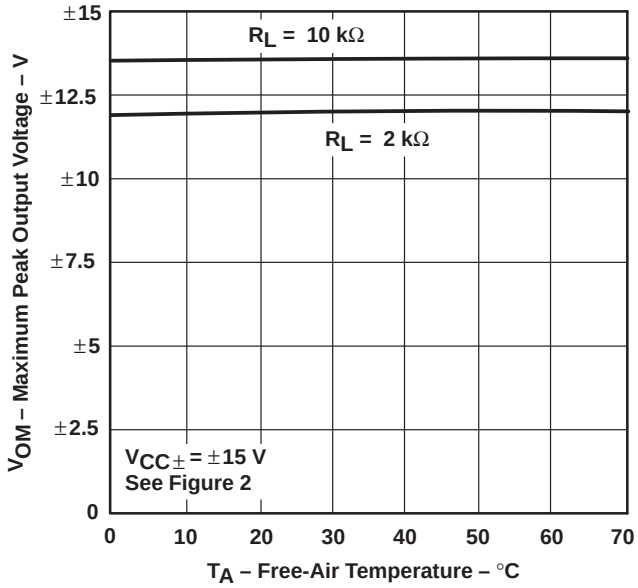


Figure 6

TYPICAL CHARACTERISTICS

MAXIMUM PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

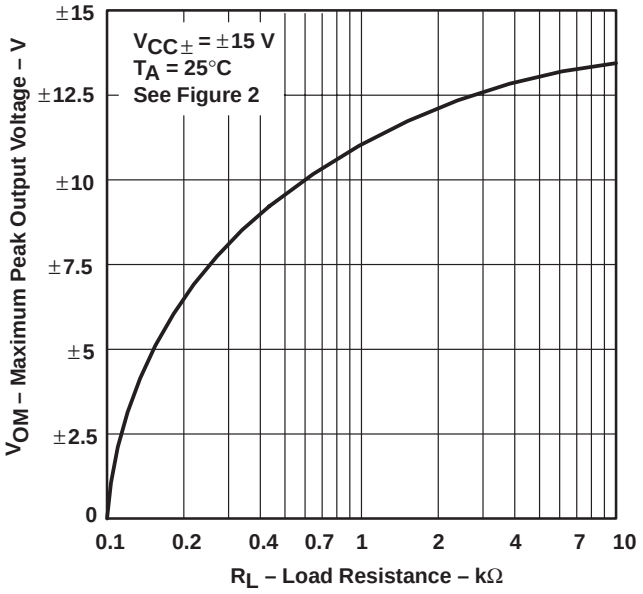


Figure 7

MAXIMUM PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

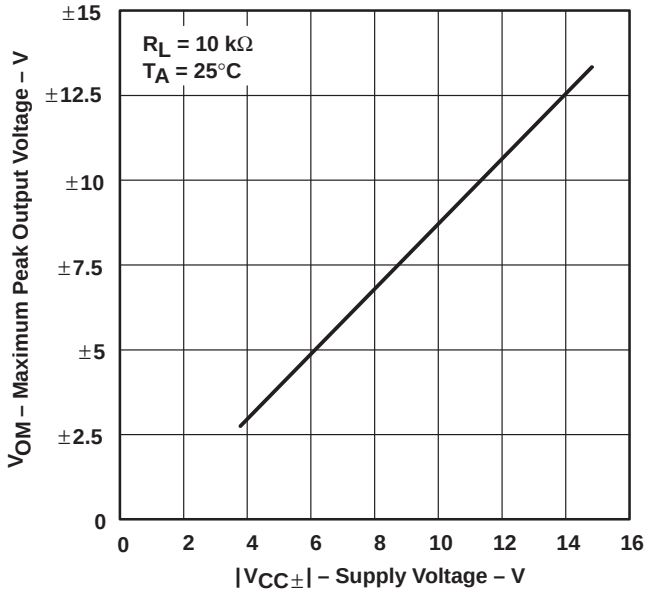


Figure 8

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

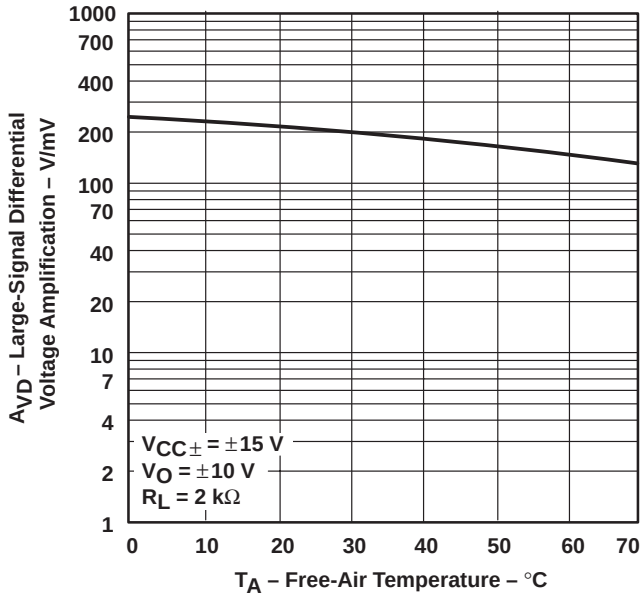


Figure 9

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREQUENCY

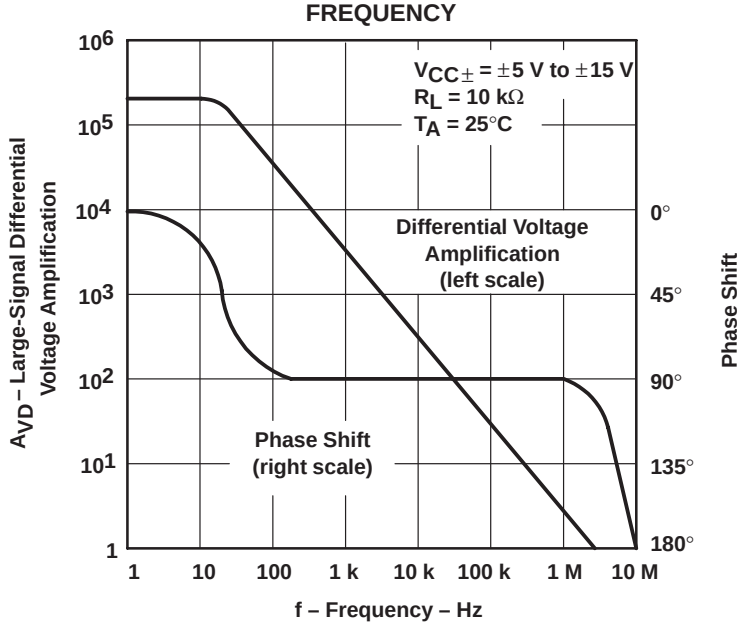


Figure 10

TOTAL POWER DISSIPATION vs FREE-AIR TEMPERATURE

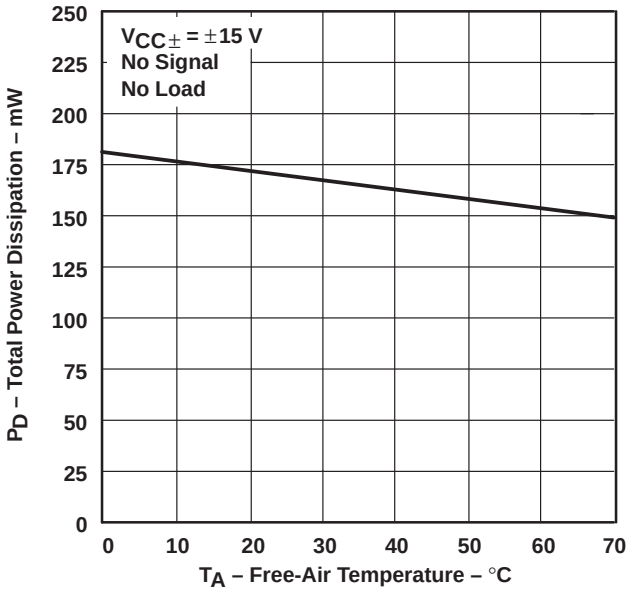


Figure 11

SUPPLY CURRENT (PER AMPLIFIER) vs FREE-AIR TEMPERATURE

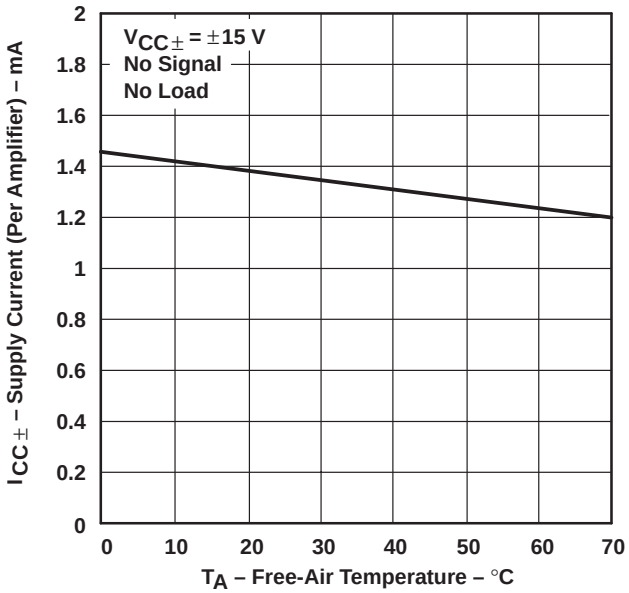


Figure 12

TYPICAL CHARACTERISTICS

SUPPLY CURRENT vs SUPPLY VOLTAGE

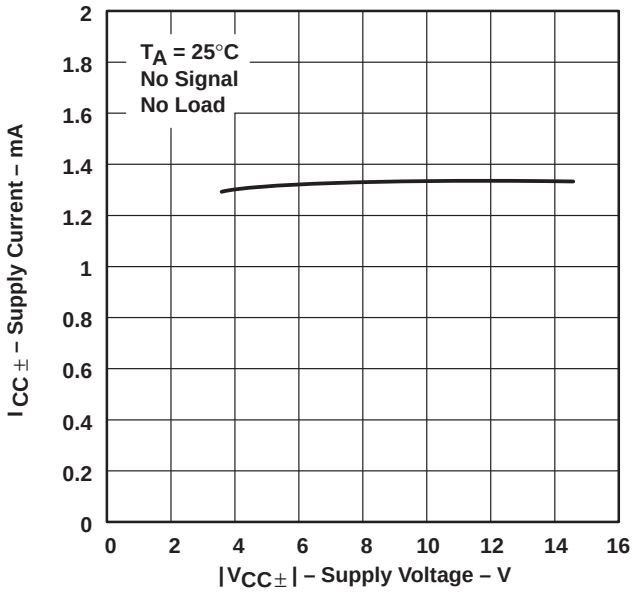


Figure 13

INPUT BIAS CURRENT vs FREE-AIR TEMPERATURE

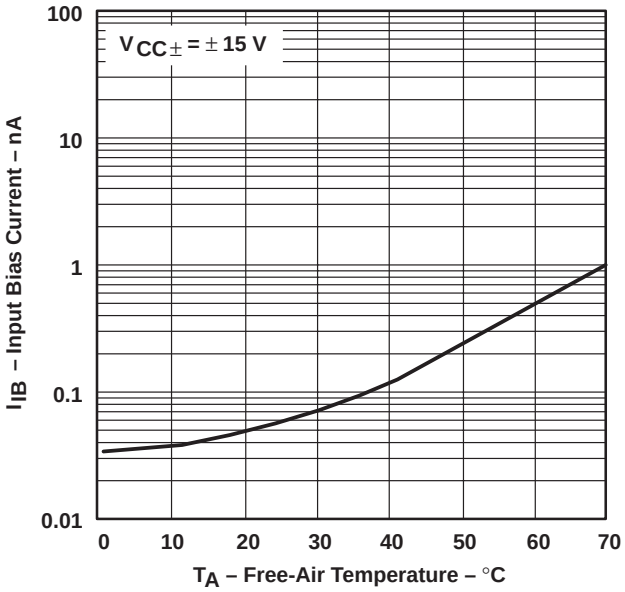


Figure 14

VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE

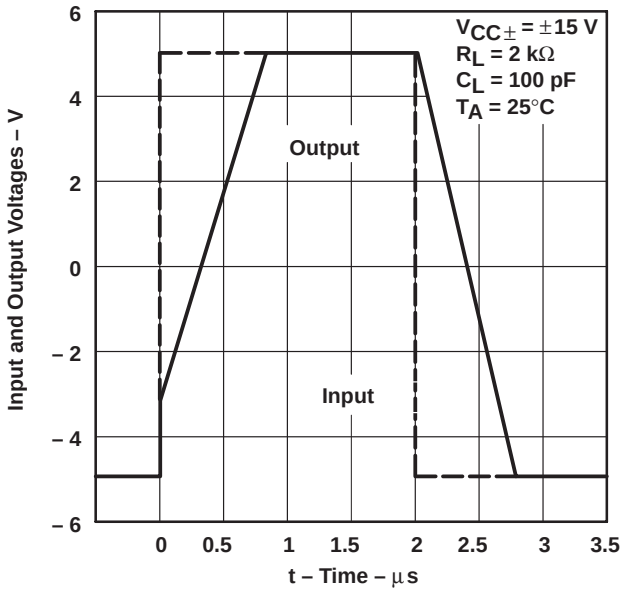


Figure 15

OUTPUT VOLTAGE vs ELAPSED TIME

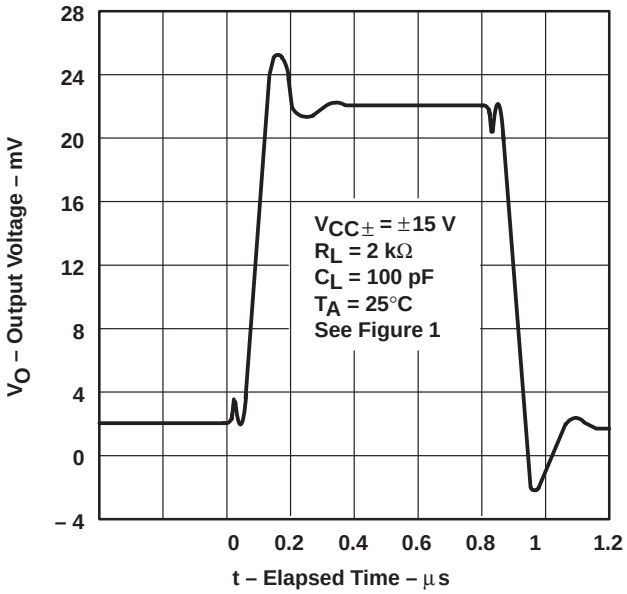


Figure 16

TYPICAL CHARACTERISTICS

COMMON-MODE REJECTION RATIO vs FREE-AIR TEMPERATURE

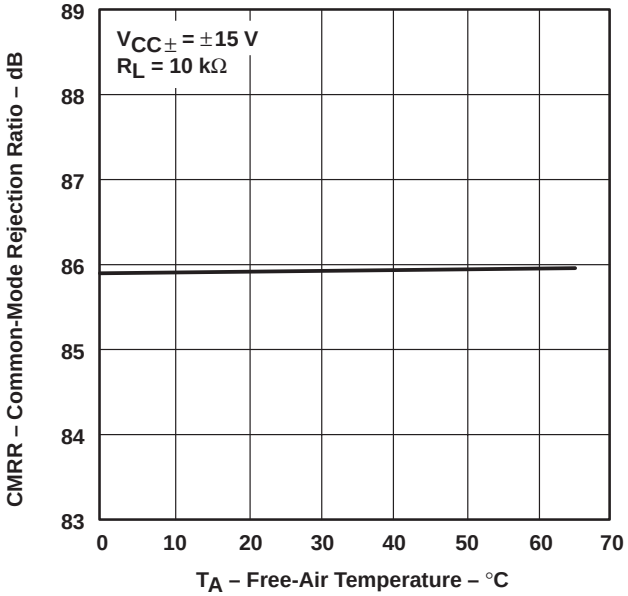


Figure 17

EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

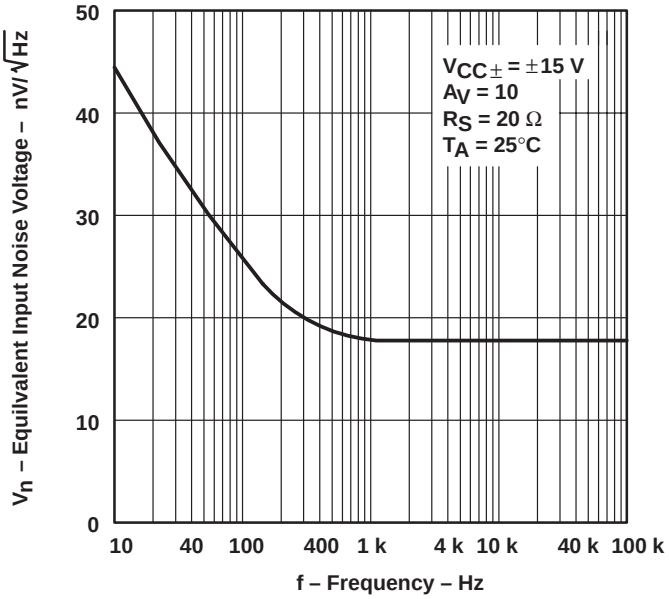


Figure 18

TOTAL HARMONIC DISTORTION vs FREQUENCY

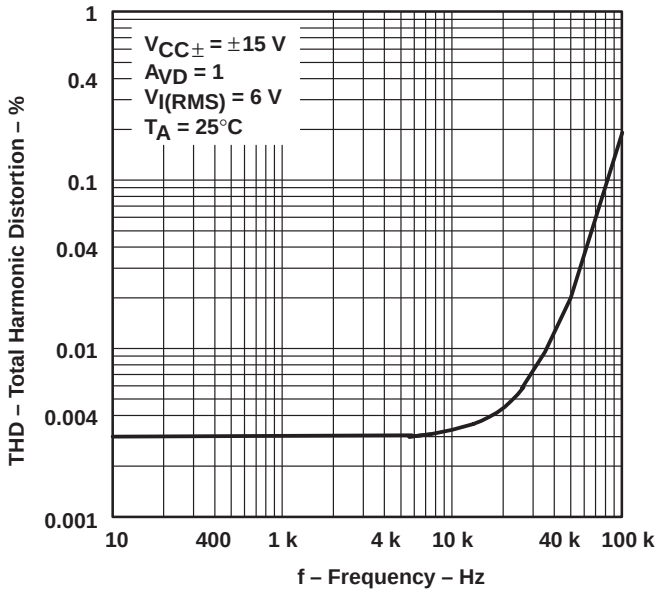


Figure 19

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