T-79-05-20

MOTOROLA

LM833

2

DUAL, LOW NOISE, AUDIO OPERATIONAL AMPLIFIER

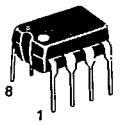
The LM833 is a standard low-cost monolithic dual general-purpose operational amplifier employing Bipolar technology with innovative high-performance concepts for audio systems applications. With high frequency PNP transistors, the LM833 offers low voltage noise (4.5 nV/$\sqrt{Hz}$), 15 MHz gain bandwidth product, 7.0 V/μs slew rate, 0.3 mV input offset voltage with 2.0 μV/°C temperature coefficient of input offset voltage. The LM833 output stage exhibits no deadband crossover distortion, large output voltage swing, excellent phase and gain margins, low open-loop high frequency output impedance and symmetrical source/sink ac frequency response.

The LM833 is specified over the vehicular temperature range and is available in the plastic DIP and SO-8 packages (P and D suffixes). A quad device is available in the MC34079 family.

- Low Voltage Noise: 4.5 nV/$\sqrt{Hz}$
- High Gain Bandwidth Product: 15 MHz
- High Slew Rate: 7.0 V/μs
- Low Input Offset Voltage: 0.3 mV
- Low T.C. of Input Offset Voltage: 2.0 μV/°C
- Low Distortion: 0.002%
- Excellent Frequency Stability
- Dual Supply Operation

DUAL OPERATIONAL AMPLIFIER

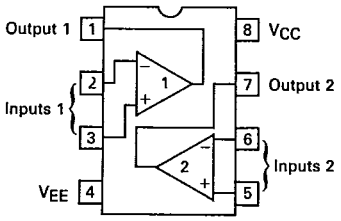
SILICON MONOLITHIC INTEGRATED CIRCUIT



P SUFFIX
PLASTIC PACKAGE
CASE 626-05

D SUFFIX
PLASTIC PACKAGE
CASE 751-02
SO-8

PIN ASSIGNMENTS



Dual, Top View

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage (V_{CC} to V_{EE})	V_S	+36	Volts
Input Differential Voltage Range	V_{IDR}	30 NOTE 1	Volts
Input Voltage Range	V_{IR}	±15 NOTE 1	Volts
Output Short-Circuit Duration (NOTE 2)	t_S	Indefinite	Seconds
Operating Ambient Temperature Range	T_A	−40 to +85	°C
Operating Junction Temperature	T_J	+150	°C
Storage Temperature	T_{stg}	−60 to +150	°C
Maximum Power Dissipation (NOTE 2)	P_D	500 NOTE 3	mW

NOTES:
1. Either or both input voltages must not exceed the magnitude of V_{CC} or V_{EE}.
2. Power dissipation must be considered to ensure maximum junction temperature (T_J) is not exceeded (See power dissipation performance characteristic).
3. Maximum value at $T_A \leq 85°C$.

ORDERING INFORMATION

Device	Temperature Range	Package
LM833P	−40 to +85°C	Plastic DIP
LM833D	−40 to +85°C	SO-8

DC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, T_A = 25°C unless otherwise noted).

Characteristics	Symbol	Min	Typ	Max	Unit
Input Offset Voltage (R_S = 10 Ω, V_O = 0 V)	V_{IO}	—	0.3	5.0	mV
Average Temperature Coefficient of Input Offset Voltage R_S = 10 Ω, V_O = 0 V, T_A = T_{low} to T_{high}	$\Delta V_{IO}/\Delta T$	—	2.0	—	μV/°C
Input Offset Current (V_{CM} = 0 V, V_O = 0 V)	I_{IO}	—	10	200	nA
Input Bias Current (V_{CM} = 0 V, V_O = 0 V)	I_{IB}	—	300	1000	nA
Common Mode Input Voltage Range	V_{ICR}	— −12	+14 −14	+12 —	V
Large Signal Voltage Gain (R_L = 2.0 kΩ, V_O = ±10 V)	A_{VOL}	90	110	—	dB
Output Voltage Swing: R_L = 2.0 kΩ, V_{ID} = 1.0 V R_L = 2.0 kΩ, V_{ID} = 1.0 V R_L = 10 kΩ, V_{ID} = 1.0 V R_L = 10 kΩ, V_{ID} = 1.0 V	V_{O+} V_{O-} V_{O+} V_{O-}	10 — 12 —	13.7 −14.1 13.9 −14.7	— −10 — −12	V V V V
Common Mode Rejection (V_{IN} = ±12 V)	CMR	80	100	—	dB
Power Supply Rejection (V_S = 15 to 5.0 V, −15 to −5.0 V)	PSR	80	115	—	dB
Power Supply Current (V_O = 0 V, Both Amplifiers)	I_D	—	4.0	8.0	mA

AC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = −15 V, T_A = 25°C unless otherwise noted).

Characteristics	Symbol	Min	Typ	Max	Unit
Slew Rate (V_{IN} = −10 V to +10 V, R_L = 2.0 kΩ, A_V = +1.0)	SR	5.0	7.0	—	V/μs
Gain Bandwidth Product (f = 100 kHz)	GBW	10	15	—	MHz
Unity Gain Frequency (Open Loop)	f_U	—	9.0	—	MHz
Unity Gain Phase Margin (Open Loop)	θ_m	—	60	—	Deg
Equivalent Input Noise Voltage (R_S = 100 Ω, f = 1.0 kHz)	e_n	—	4.5	—	nV/√Hz
Equivalent Input Noise Current (f = 1.0 kHz)	i_n	—	0.5	—	pA/√Hz
Power Bandwidth (V_O = 27 V_{p-p}, R_L = 2.0 kΩ, THD ≤ 1.0%)	BWP	—	120	—	kHz
Distortion (R_L = 2.0 kΩ, f = 20 Hz to 20 kHz, V_O = 3.0 V_{rms}, A_V = +1.0)	THD	—	0.002	—	%
Channel Separation (f = 20 Hz to 20 kHz)	—	—	−120	—	dB

FIGURE 1 — MAXIMUM POWER DISSIPATION versus TEMPERATURE

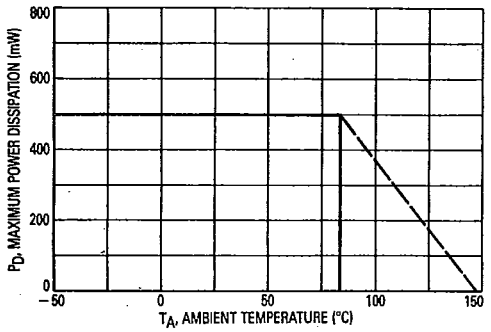


FIGURE 2 — INPUT BIAS CURRENT versus TEMPERATURE

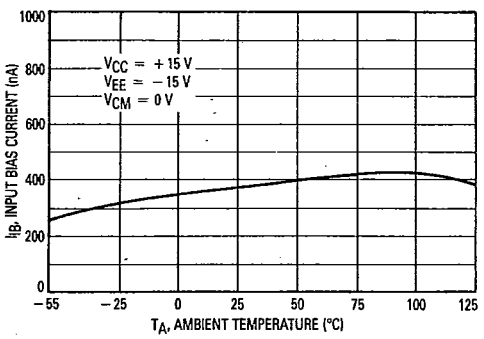


FIGURE 3 — INPUT BIAS CURRENT versus SUPPLY VOLTAGE

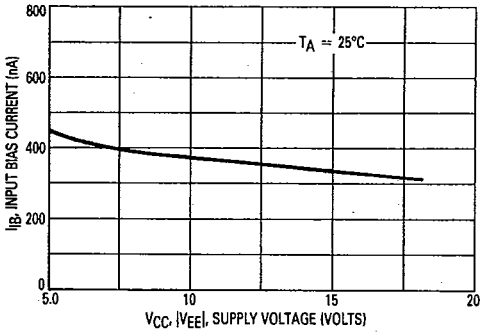


FIGURE 4 — SUPPLY CURRENT versus SUPPLY VOLTAGE

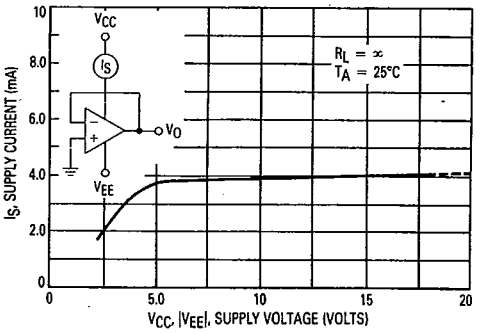


FIGURE 5 — DC VOLTAGE GAIN versus TEMPERATURE

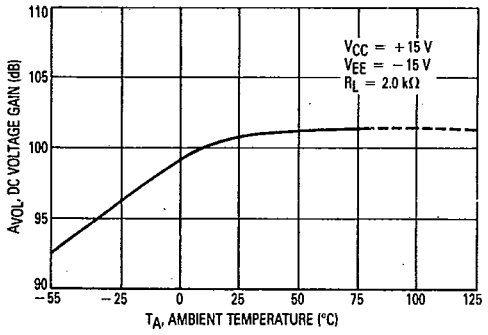


FIGURE 6 — DC VOLTAGE GAIN versus SUPPLY VOLTAGE

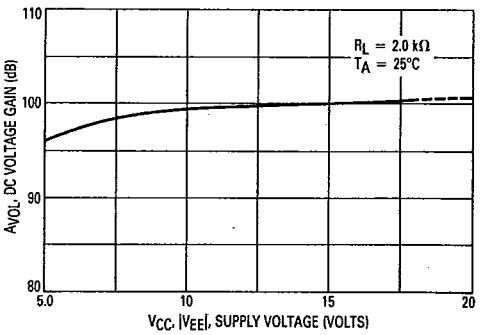


FIGURE 7 — OPEN-LOOP VOLTAGE GAIN AND PHASE versus FREQUENCY

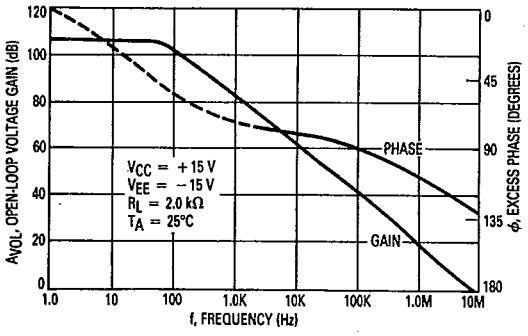


FIGURE 8 — GAIN BANDWIDTH PRODUCT versus TEMPERATURE

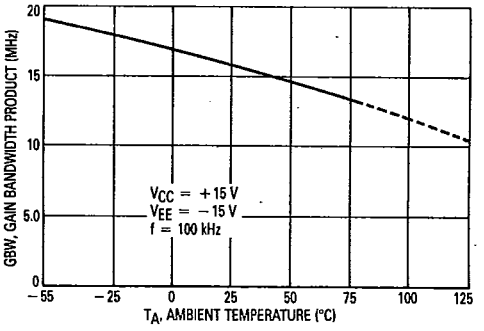


FIGURE 9 — GAIN BANDWIDTH PRODUCT versus SUPPLY VOLTAGE

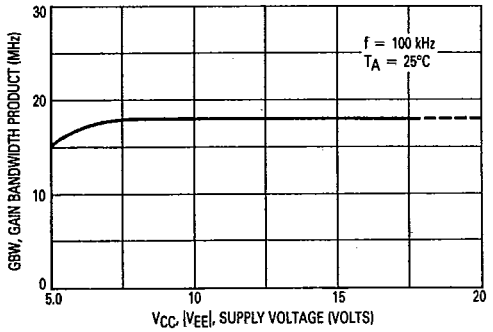


FIGURE 10 — SLEW RATE versus TEMPERATURE

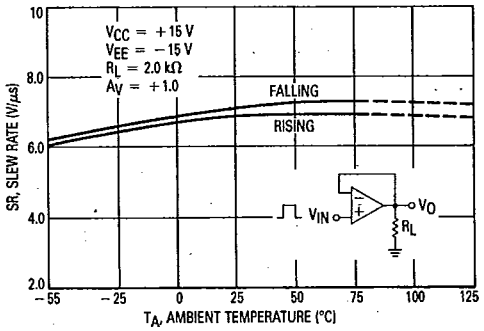


FIGURE 11 — SLEW RATE versus SUPPLY VOLTAGE

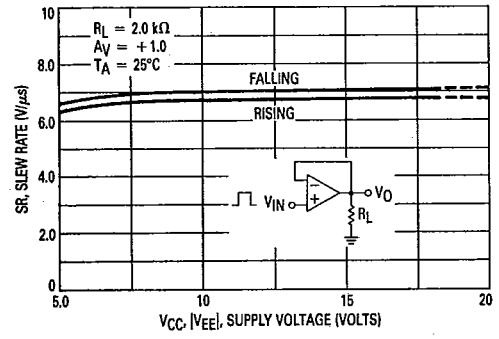


FIGURE 12 — OUTPUT VOLTAGE versus FREQUENCY

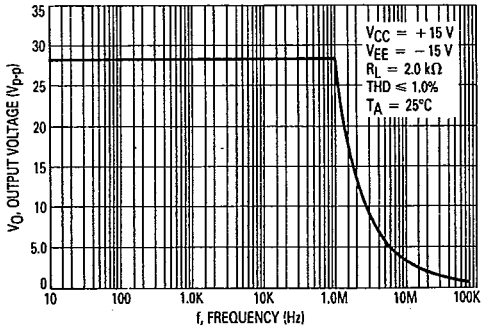


FIGURE 13 — MAXIMUM OUTPUT VOLTAGE versus SUPPLY VOLTAGE

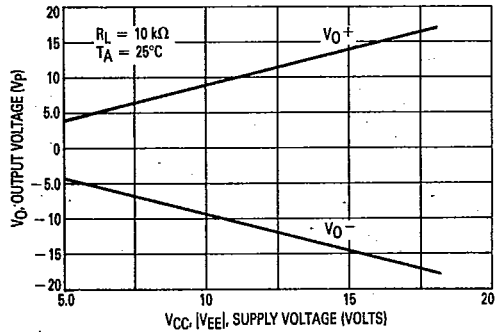


FIGURE 14 — OUTPUT SATURATION VOLTAGE versus TEMPERATURE

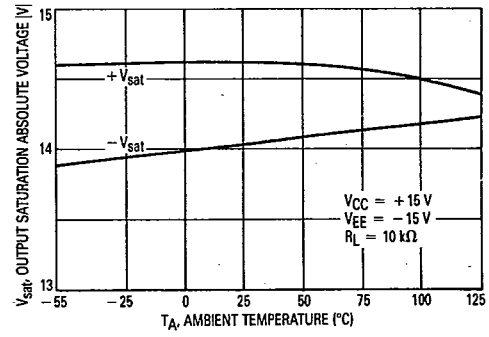


FIGURE 15 — POWER SUPPLY REJECTION versus FREQUENCY

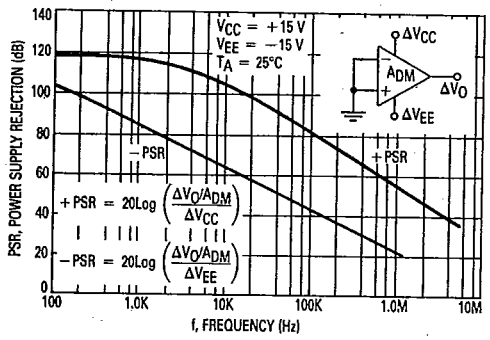


FIGURE 16 — COMMON MODE REJECTION versus FREQUENCY

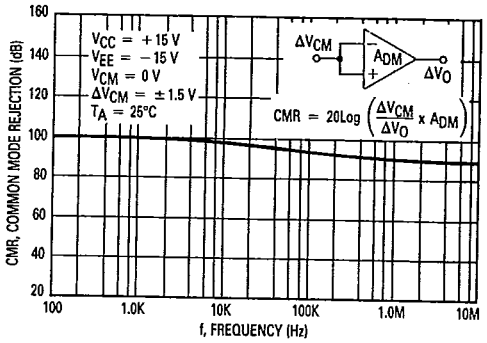


FIGURE 17 — TOTAL HARMONIC DISTORTION versus FREQUENCY

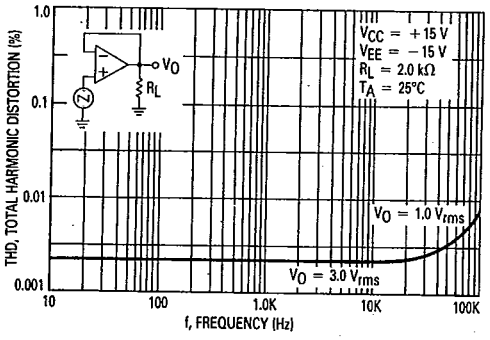


FIGURE 18 — INPUT REFERRED NOISE VOLTAGE versus FREQUENCY

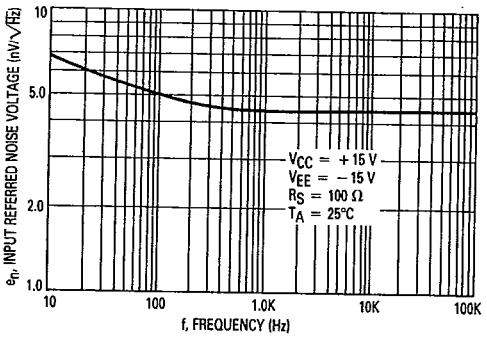


FIGURE 19 — INPUT REFERRED NOISE CURRENT versus FREQUENCY

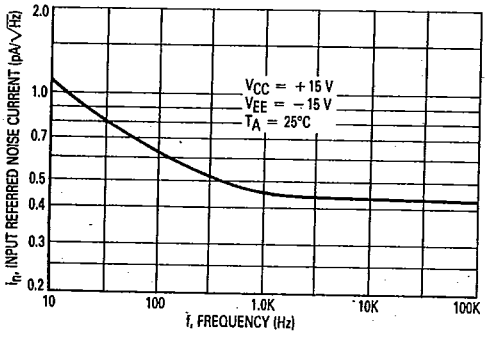


FIGURE 20 — INPUT REFERRED NOISE VOLTAGE versus SOURCE RESISTANCE

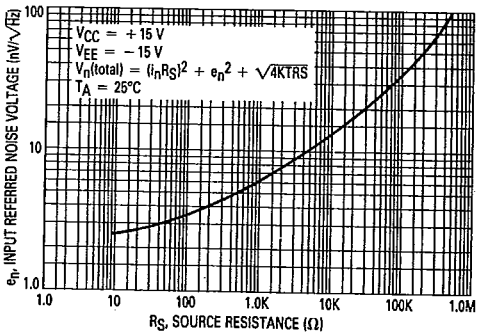


FIGURE 21 — INVERTING AMPLIFIER

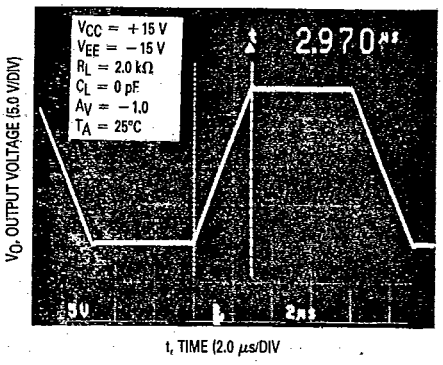


FIGURE 22 — NON-INVERTING AMPLIFIER SLEW RATE

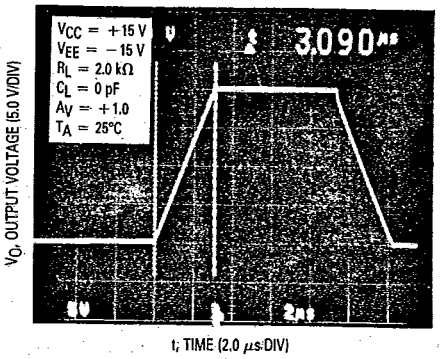


FIGURE 23 — NON-INVERTING AMPLIFIER OVERSHOOT