National Semiconductor

August 2000

LM837
Low Noise Quad Operational Amplifier

General Description

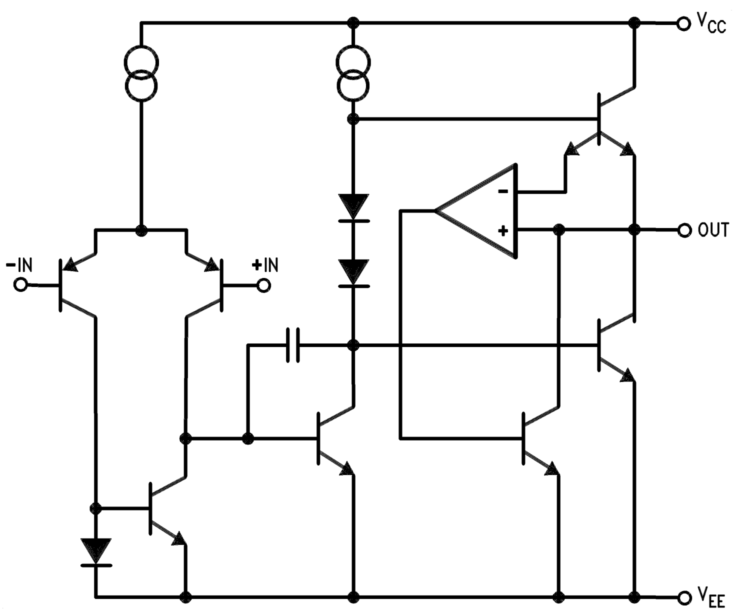
The LM837 is a quad operational amplifier designed for low noise, high speed and wide bandwidth performance. It has a new type of output stage which can drive a 600Ω load, making it ideal for almost all digital audio, graphic equalizer, preamplifiers, and professional audio applications. Its high performance characteristics also make it suitable for instrumentation applications where low noise is the key consideration.

The LM837 is internally compensated for unity gain operation. It is pin compatible with most other standard quad op amps and can therefore be used to upgrade existing systems with little or no change.

Features

- High slew rate 10 V/µs (typ); 8 V/µs (min)
- Wide gain bandwidth product 25 MHz (typ); 15 MHz (min)
- Power bandwidth 200 kHz (typ)
- High output current ±40 mA
- Excellent output drive performance >600Ω
- Low input noise voltage 4.5 nV/$\sqrt{Hz}$
- Low total harmonic distortion 0.0015%
- Low offset voltage 0.3 mV

Schematic and Connection Diagrams



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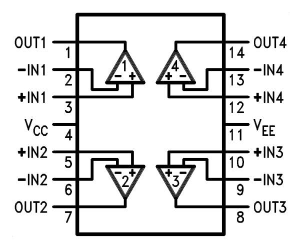
Dual-In-Line Package



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Top View
Order Number LM837M, LM837MX or LM837N
See NS Package Number M14A or N14A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage, V_{CC}/V_{EE}	±18V
Differential Input Voltage, V_{ID} (Note 2)	±30V
Common Mode Input Voltage, V_{IC} (Note 2)	±15V
Power Dissipation, P_D (Note 3)	1.2W (N) 830 mW (M)
Operating Temperature Range, T_{OPR}	−40˚C to +85˚C
Storage Temperature Range, T_{STG}	−60˚C to +150˚C
Soldering Information	
Dual-In-Line Package	
Soldering (10 seconds)	260˚C
Small Outline Package	
Vapor Phase (60 seconds)	215˚C
Infrared (15 seconds)	220˚C

ESD rating to be determined.

See AN-450 “Surface Mounting Methods and Their Effect on Product Reliability” for other methods of soldering surface mount devices.

DC Electrical Characteristics

T_A = 25˚C, V_S = ±15V

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage	R_S = 50Ω		0.3	5	mV
I_{OS}	Input Offset Current			10	200	nA
I_B	Input Bias Current			500	1000	nA
A_V	Large Signal Voltage Gain	R_L = 2 kΩ, V_{OUT} = ±10V	90	110		dB
V_{OM}	Output Voltage Swing	R_L = 2 kΩ	±12	±13.5		V
		R_L = 600Ω	±10	±12.5		V
V_{CM}	Common Mode Input Voltage		±12	±14.0		V
CMRR	Common Mode Rejection Ratio	V_{IN} = ±12V	80	100		dB
PSRR	Power Supply Rejection Ratio	V_S = 15 ~ 5, −15 ~ −5	80	100		dB
I_S	Power Supply Current	R_L = ∞, Four Amps		10	15	mA

AC Electrical Characteristics

T_A = 25˚C, V_S = ±15V

Symbol	Parameter	Condition	Min	Typ	Max	Units
SR	Slew Rate	R_L = 600Ω	8	10		V/µs
GBW	Gain Bandwidth Product	f = 100 kHz, R_L = 600Ω	15	25		MHz

Design Electrical Characteristics

T_A= 25˚C, V_S=±15V (Note 4)

Symbol	Parameter	Condition	Min	Typ	Max	Units
PBW	Power Bandwidth	V_O = 25 V_{P-P}, R_L = 600Ω, THD $<$ 1%		200		kHz
e_{n1}	Equivalent Input Noise Voltage	JIS A, R_S = 100Ω		0.5		µV
e_{n2}	Equivalent Input Noise Voltage	f = 1 kHz		4.5		$nV/\sqrt{Hz}$
i_n	Equivalent Input Noise Current	f = 1 kHz		0.7		$pA/\sqrt{Hz}$
THD	Total Harmonic Distortion	A_V = 1, V_{OUT} = 3 Vrms, f = 20 ~ 20 kHz, R_L = 600Ω		0.0015		%
f_U	Zero Cross Frequency	Open Loop		12		MHz
ϕ_m	Phase Margin	Open Loop		45		deg
	Input-Referred Crosstalk	f = 20 ~ 20 kHz		−120		dB
$\Delta V_{OS}/\Delta T$	Average TC of Input Offset Voltage			2		µV/˚C

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

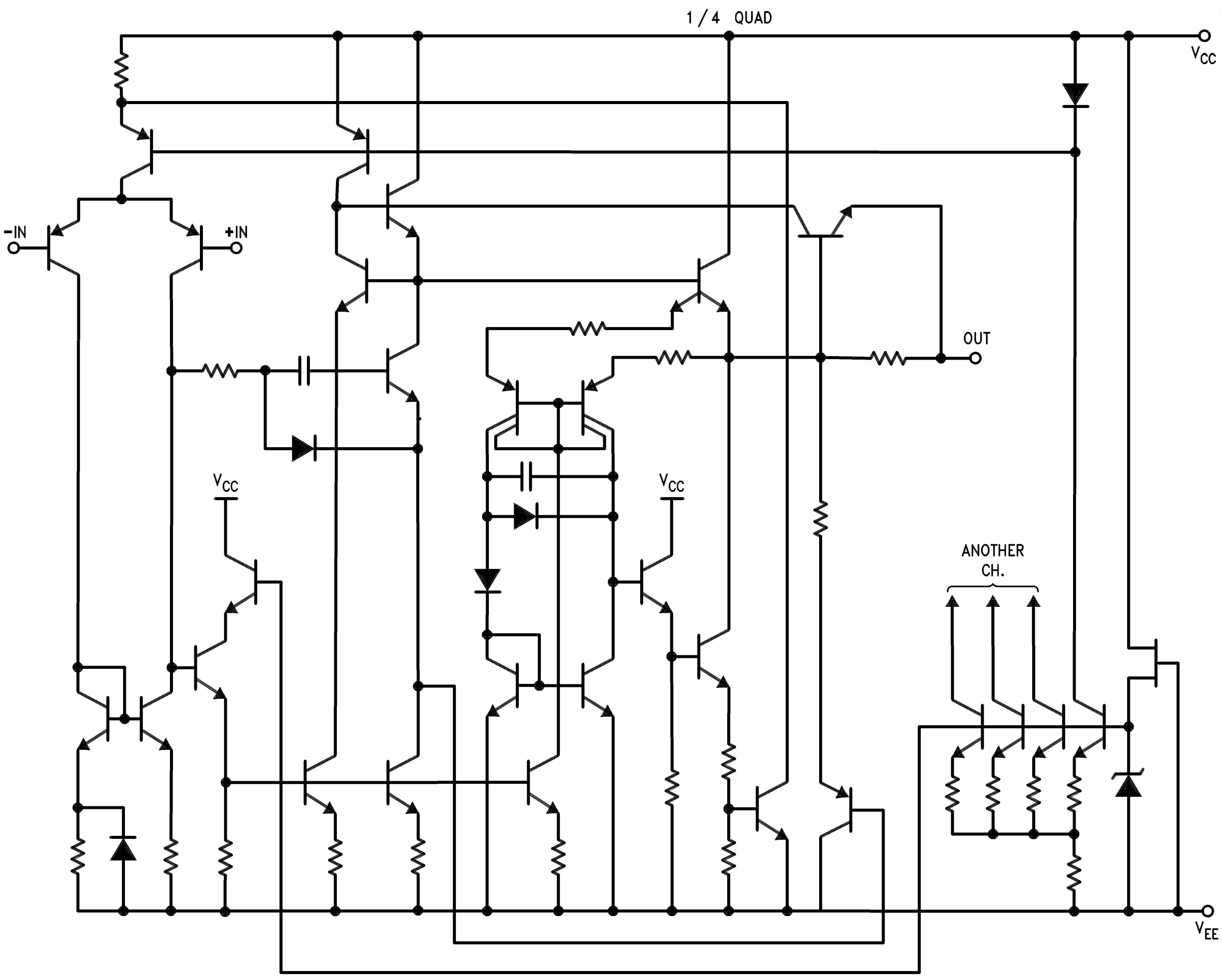
Note 2: Unless otherwise specified the absolute maximum input voltage is equal to the power supply voltage.

Design Electrical Characteristics (Continued)

Note 3: For operation at ambient temperatures above 25˚C, the device must be derated based on a 150˚C maximum junction temperature and a thermal resistance, junction to ambient, as follows: LM837N, 90˚C/W; LM837M, 150˚C/W.

Note 4: The following parameters are not tested or guaranteed.

Detailed Schematic



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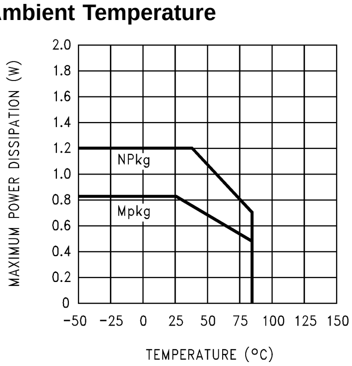
Typical Performance Characteristics

Maximum Power Dissipation vs Ambient Temperature



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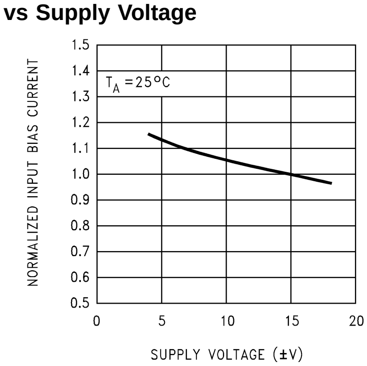
Normalized Input Bias Current vs Supply Voltage



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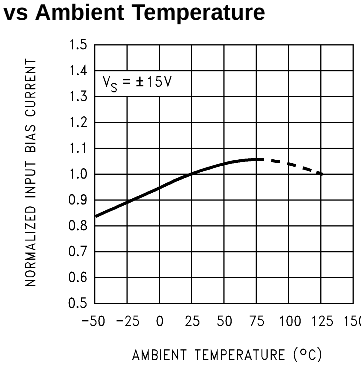
Normalized Input Bias Current vs Ambient Temperature



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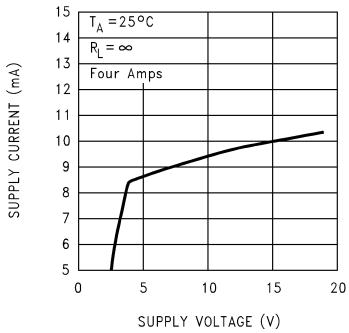
Typical Performance Characteristics (Continued)

Supply Current vs Supply Voltage



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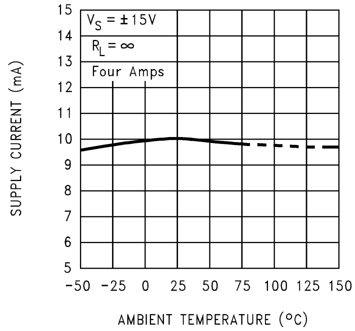
Supply Current vs Ambient Temperature



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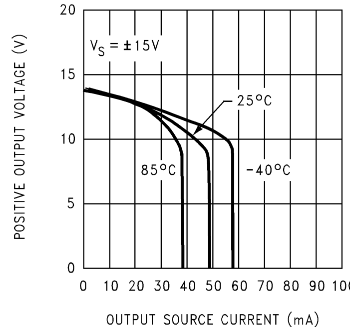
Positive Current Limit



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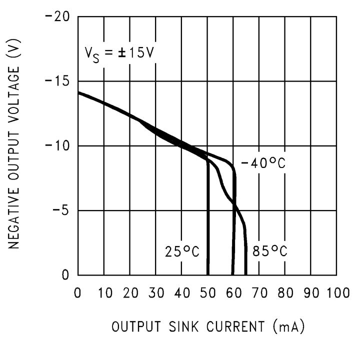
Negative Current Limit



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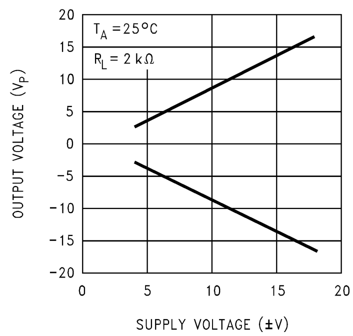
Maximum Output Voltage vs Supply Voltage



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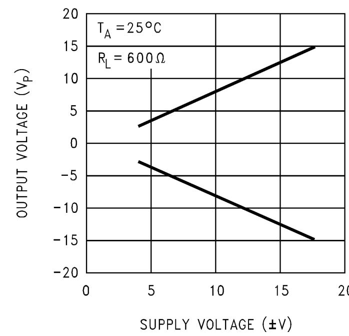
Maximum Output Voltage vs Supply Voltage



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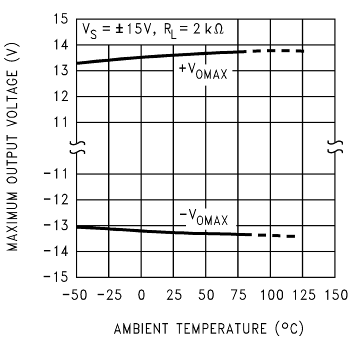
Maximum Output Voltage vs Ambient Temperature



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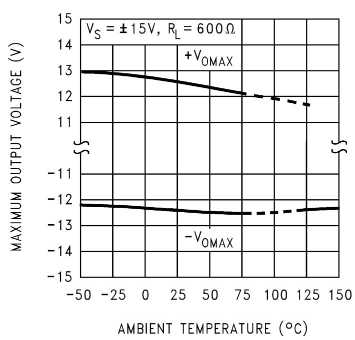
Maximum Output Voltage vs Ambient Temperature



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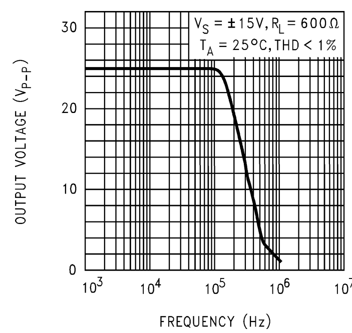
Power Bandwidth



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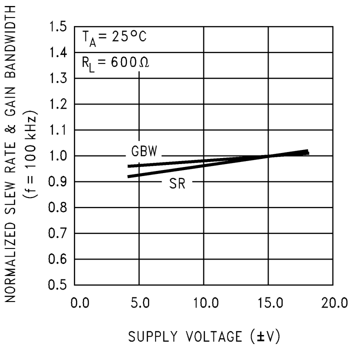
Typical Performance Characteristics (Continued)

Normalized Slew Rate & Gain Bandwidth vs Supply Voltage (f = 100 kHz)



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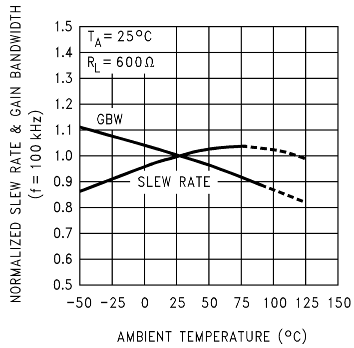
Normalized Slew Rate & Gain Bandwidth (f = 100 kHz) vs Ambient Temperature



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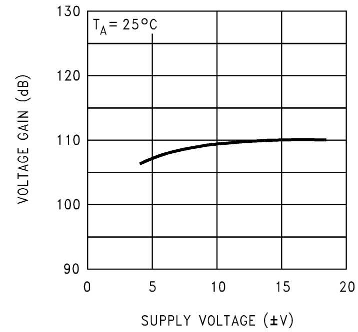
Voltage Gain vs Supply Voltage



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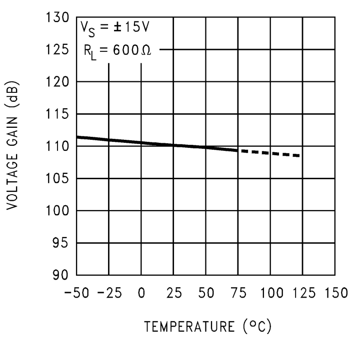
Voltage Gain vs Ambient Temperature



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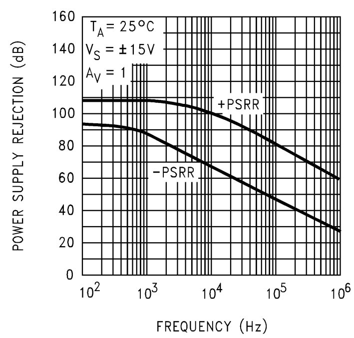
Power Supply Rejection vs Frequency



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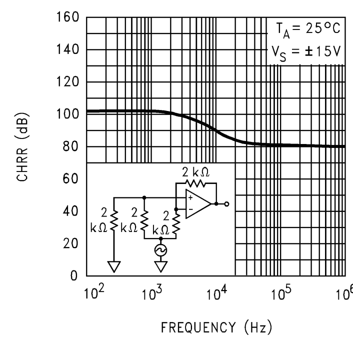
CMRR vs Frequency



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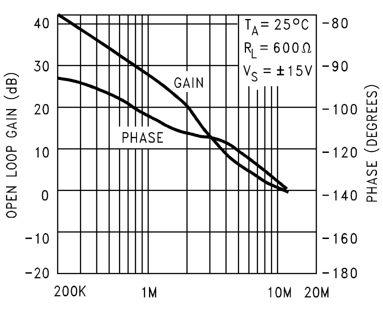
Open Loop Gain & Phase vs Frequency



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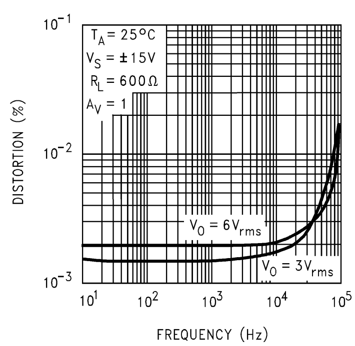
Total Harmonic Distortion vs Frequency



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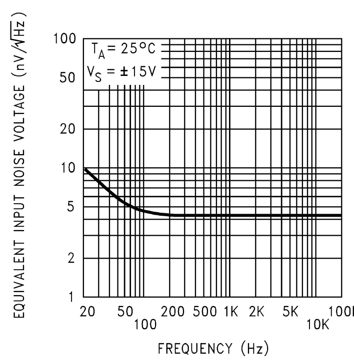
Equivalent Input Noise Voltage vs Frequency



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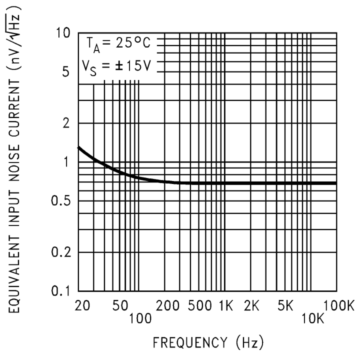
Typical Performance Characteristics (Continued)

Equivalent Input Noise Current vs Frequency



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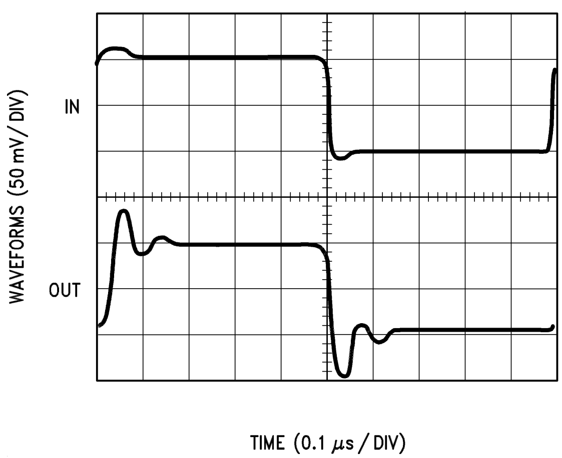
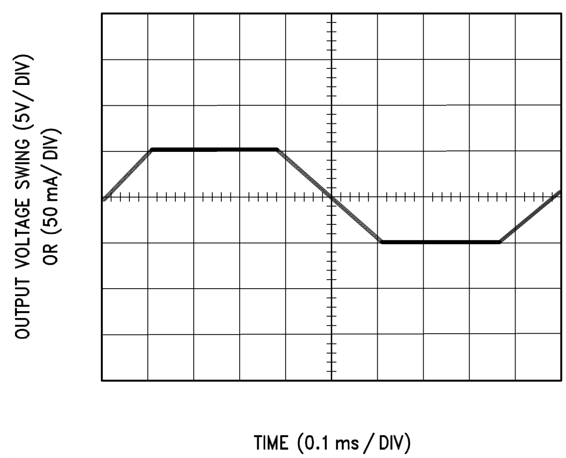
Small Signal, Non-Inverting
T_A = 25˚C, A_V = 1, R_L = 600Ω, V_S = ±15V



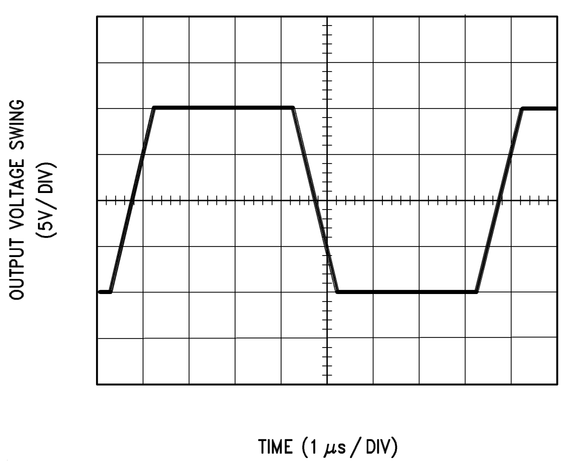
DS009047-6

Current Limit
T_A = 25˚C, V_S = ±15V, R_L = 100Ω, A_V = 1



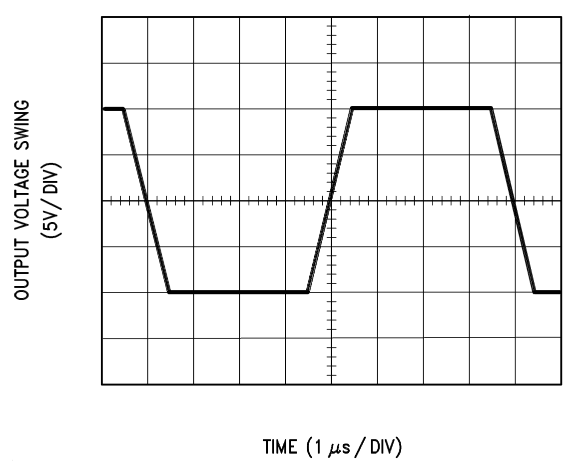
DS009047-7

Large Signal Non-Inverting
T_A = 25˚C, R_L = 600Ω, V_S = ±15V



DS009047-8

Large Signal Inverting
T_A = 25˚C, R_L = 600Ω, V_S = ±15V



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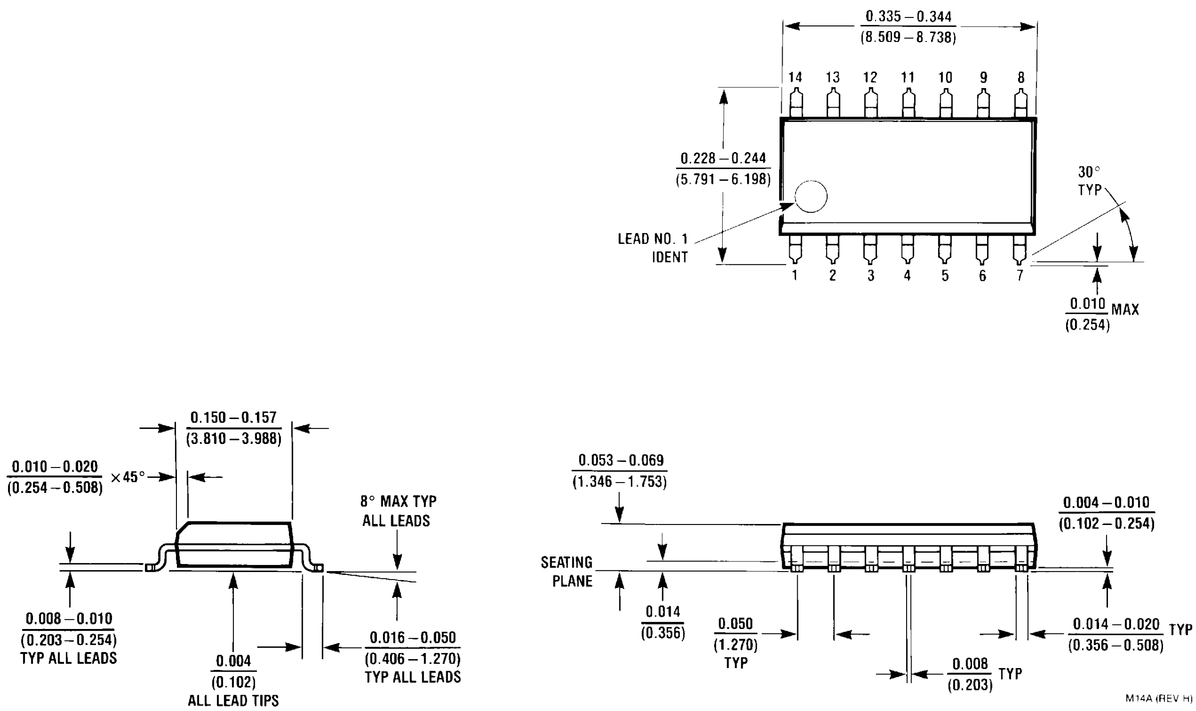
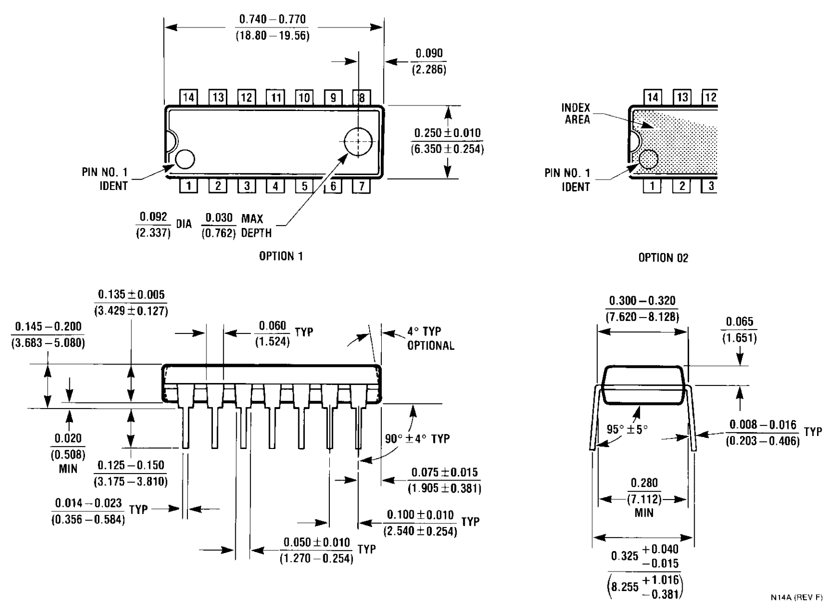
Physical Dimensions inches (millimeters) unless otherwise noted



Molded Package (SO)
Order Number LM837M or LM837MX
NS Package Number M14A



Lit. #107255
Molded Dual-In-Line Package
Order Number LM837N
NS Package Number N14A

Notes

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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