National Semiconductor

September 1990

LM592 Differential Video Amplifier

General Description

The LM592 is a two stage differential input, differential output, wideband video amplifier. The use of internal series-shunt feedback gives wide bandwidth with low phase distortion and high gain stability. Emitter follower outputs provide low output impedances necessary to drive capacitive loads. The 14-lead version of this device offers fixed gains of 100 and 400, selected without the addition of external components, while the 8-lead part offers a fixed gain of 400. Both the 14- and 8-lead parts allow the gain to be adjusted from 0 to 400 with the addition of a single resistor. This gain-adjustment capability also allows the device to be configured as a high pass, low pass, or band pass filter.

The LM592 is ideal for use in magnetic memory systems. The device is also very useful as a video and pulse amplifier in video recorders and other communications systems.

Features

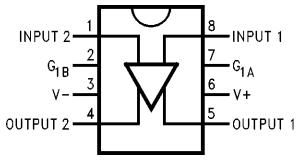
- 120 MHz bandwidth
- Adjustable gains from 0 to 400
- Adjustable pass band
- No frequency compensation required

Applications

- Disc file memories
- Magnetic tape systems
- Thin film or plated wire memories
- Wide band video amplifiers

Connection Diagram

8-Lead Dual-In-Line and Small Outline Package



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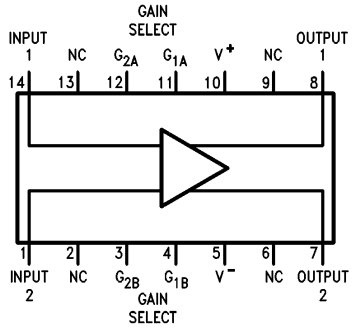
Top View

14-Lead Dual-In-Line and Small Outline Package



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Top View

Package	Part Number	NSC Package Drawing
8-Pin Molded DIP	LM592N-8	N08E
14-Pin Molded DIP	LM592N	N14A
8-Pin Small Outline	LM592M-8	M08A
14-Pin Small Outline	LM592M	M14A
14-Pin Ceramic DIP	LM592J	J14A

RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings

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

Differential Input Voltage	±5V
Common Mode Input Voltage	±6V
V_{supply}	±8V
Output Current	10 mA
Power Dissipation (Note 1)	500 mW
Junction Temperature	+150°C
Storage Temperature Range	−65°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

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

Operating Ratings

Temperature Range	0°C to 70°C
Supply Voltage Range	±3V to ±8V

Electrical Characteristics $T_A = 25°C$, unless otherwise specified, see test circuits, $V_S = \pm 6.0V$ (Note 5)

Characteristics	Test Circuit	Test Conditions	LM592 Typ	LM592 Tested Limit (Note 6)	LM592 Design Limit (Note 7)	Units (Limit)
Differential Voltage Gain						
Gain 1 (Note 2)	1	$R_L = 2 k\Omega$, $V_{OUT} = 3 V_{PP}$	400	250 600	**210** **620**	(Min) (Max)
Gain 2 (Note 3)			100	80 120	**75** **120**	(Min) (Max)
Bandwidth						
Gain 1			40			MHz
Gain 2	2		90			MHz
Rise Time						
Gain 1		$V_{OUT} = 1 V_{PP}$	10.5			ns
Gain 2	2		4.5		12	ns (Max)
Propagation Delay						
Gain 1		$V_{OUT} = 1 V_{PP}$	7.5			ns
Gain 2	2		6		10	ns (Max)
Input Resistance						
Gain 1			4			kΩ
Gain 2			23		10	kΩ (Min)
Input Capacitance		Gain 2 (Note 3)	2			pF
Input Offset Current			0.4	5	**6**	μA (Max)
Input Bias Current			9	26	**31**	μA (Max)
Input Noise Voltage		BW = 1 kHz to 10 MHz	12			μV rms
Input Voltage Range	1			±1	±**1**	V (Min)
Common Mode Rejection Ratio						
Gain 2	1	$V_{CM} = \pm 1V$	86	60	**50**	dB (Min)
Gain 2		$V_{CM} = \pm 1V$, f = 5 MHz	60			dB
Power Supply Rejection Ratio						
Gain 2	1	$\Delta V_S = \pm 0.5V$	70	50	**50**	dB (Min)
Output Offset Voltage						
Gain 1	1	$R_L = \infty$		1.5	**1.5**	V (Max)
Gain 2			0.35	0.75	**0.75**	
Output Common Mode Voltage	1	$R_L = \infty$	2.9	2.4	**2.4**	V (Min)
(Note 4)				3.4	**3.4**	V (Max)
Output Voltage Swing	1	$R_L = 2k$	4	3	**3**	V (Min)
Output Sink Current			3.6	2.5	**2.3**	mA (Min)
Output Resistance			20			Ω
Power Supply Current	1	$R_L = \infty$	18	24	**24**	mA (Max)

Note 1: For operation at elevated temperatures, these devices must be derated based on the thermal resistance θ_{jA} and $T_j$max = 150°C. For those devices in an 8-pin package, θ_{JA} = 117°C/W for the ''N'' package and 182°C/W for the ''M'' package. For those devices in a 14-pin package, θ_{JA} = 90°C/W for the ''N'' package, 135°C/W for the ''M'' package, and 78°C/W for the ''J'' package.

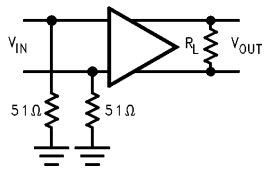
Note 2: This gain applies to both the 8-pin and 14-pin device. To obtain this gain when using the 14-pin device, connect pins G1A and G1B together.

Electrical Characteristics $T_A = 25°C$, unless otherwise specified, see test circuits, $V_S = \pm 6.0V$ (Note 5) (Continued)

Note 3: This gain applies only to the 14-pin device. To obtain this gain, connect pins G2A and G2B together.
Note 4: Gain select pins open. Output Common Mode Voltage $= (V_{01} + V_{02})/2$.
Note 5: Boldface numbers apply at temperature extremes.
Note 6: Guaranteed and 100% production tested.
Note 7: Guaranteed (but not 100% production tested) over the operating temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels.

Test Circuits

Test Circuit 1



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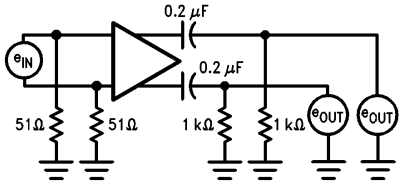
Test Circuit 2



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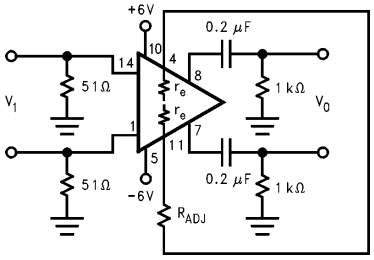
Auxiliary Circuits

Voltage Gain Adjust Circuit



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$$\frac{V_O(S)}{V_1(S)} = \frac{1.4 \times 10^4}{R_{ADJ} + 2r_e} = \frac{1.4 \times 10^4}{R_{ADJ} + 32}$$

Filter Networks

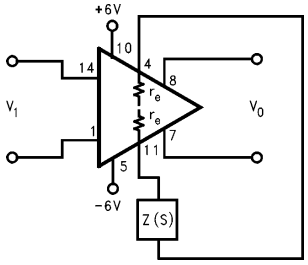

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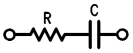
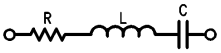
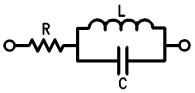
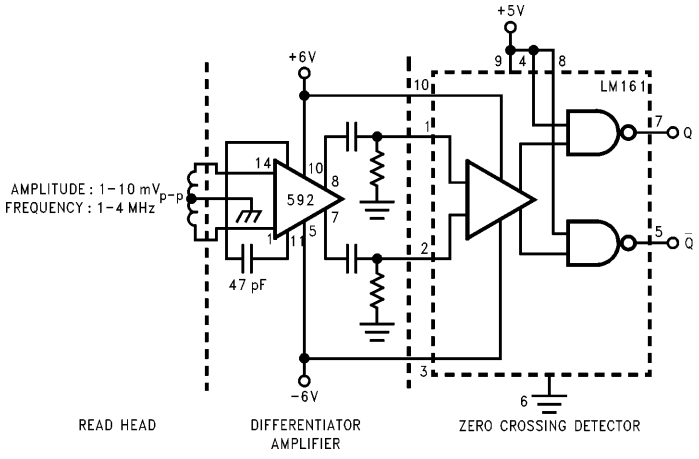
Table for Filter Networks

Impedance Network	Desired Filter	$\frac{V_0(S)}{V_1(S)} = \frac{1.4 \times 10^4}{Z(S) + 2r_e}$
 TL/H/6701–10	Low Pass	$\frac{1.4 \times 10^4}{L}\left[\frac{1}{s + R/L}\right]$
 TL/H/6701–11	High Pass	$\frac{1.4 \times 10^4}{R}\left[\frac{1}{s + 1/RC}\right]$
 TL/H/6701–12	Band Pass	$\frac{1.4 \times 10^4}{L}\left[\frac{s}{s^2 + R/Ls + 1/LC}\right]$
 TL/H/6701–13	Band Reject	$\frac{1.4 \times 10^4}{R}\left[\frac{s^2 + 1/LC}{s^2 + 1/LC + s/RC}\right]$

Note: In the networks above, the R value used is assumed to include $2r_e$, or approximately 32Ω

Typical Application

Disc Tape Phase Modulated Readback Systems



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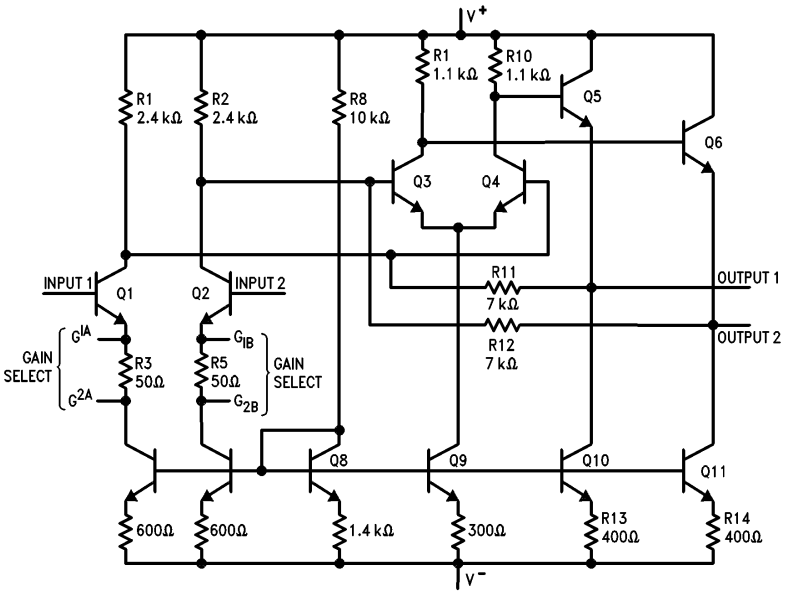
Schematic Diagram



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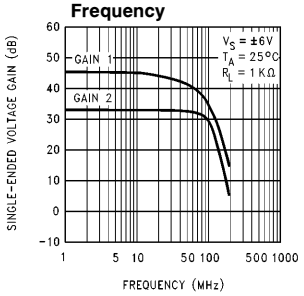
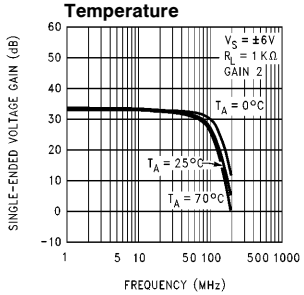
Typical Performance Characteristics

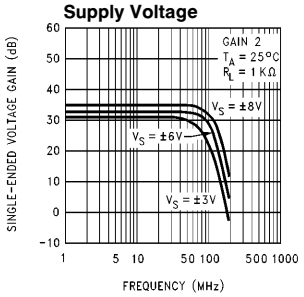
Voltage Gain vs Frequency



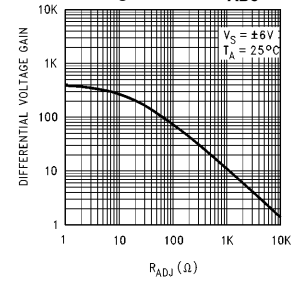
Gain vs Frequency Temperature



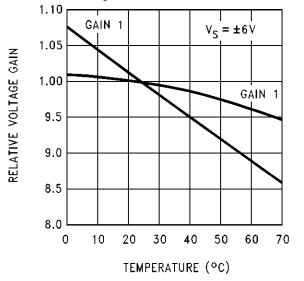
Gain vs Frequency vs Supply Voltage



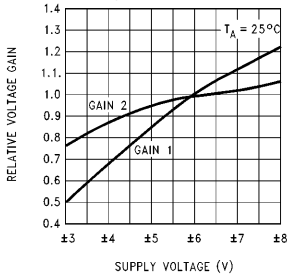
Voltage Gain vs R_{ADJ}



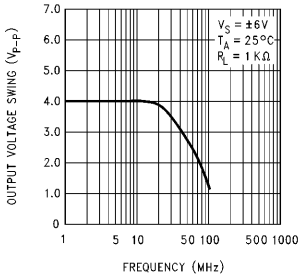
Voltage Gain vs Temperature



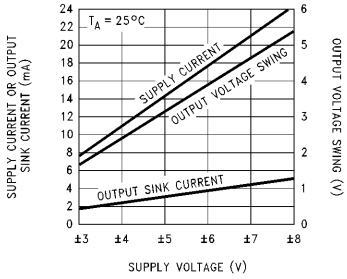
Voltage Gain vs Supply Voltage



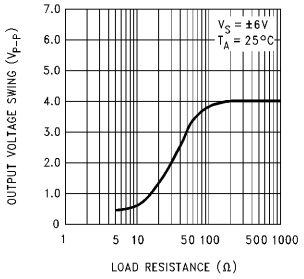
Output Voltage Swing vs Frequency



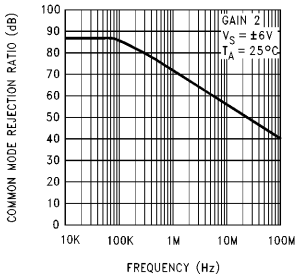
Supply Current, Output Voltage and Current Swing vs Supply Voltage



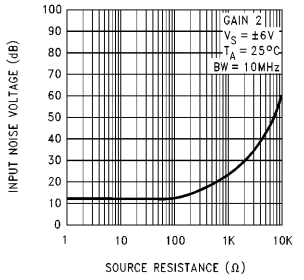
Output Voltage Swing vs Load Resistance



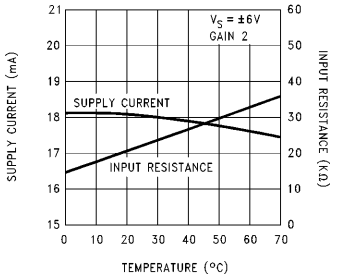
Common Mode Rejection Ratio vs Frequency



Input Noise Voltage vs Source Resistance



Supply Current and Input Resistance vs Temperature



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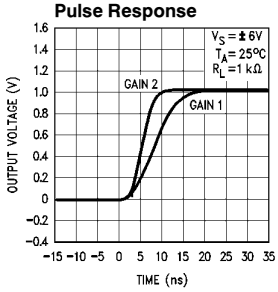
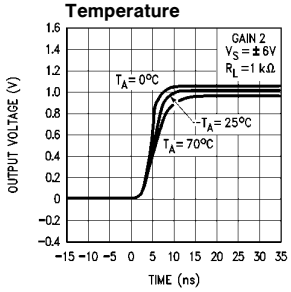
Typical Performance Characteristics (Continued)

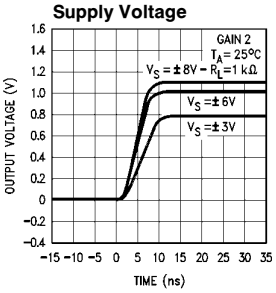
Pulse Response



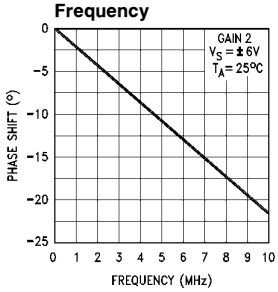
Pulse Response vs Temperature



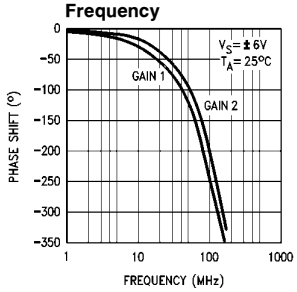
Pulse Response vs Supply Voltage



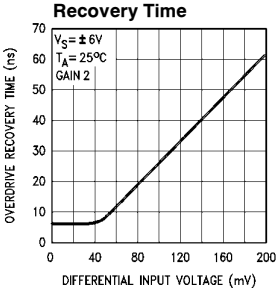
Phase Shift vs Frequency



Phase Shift vs Frequency



Differential Overdrive Recovery Time



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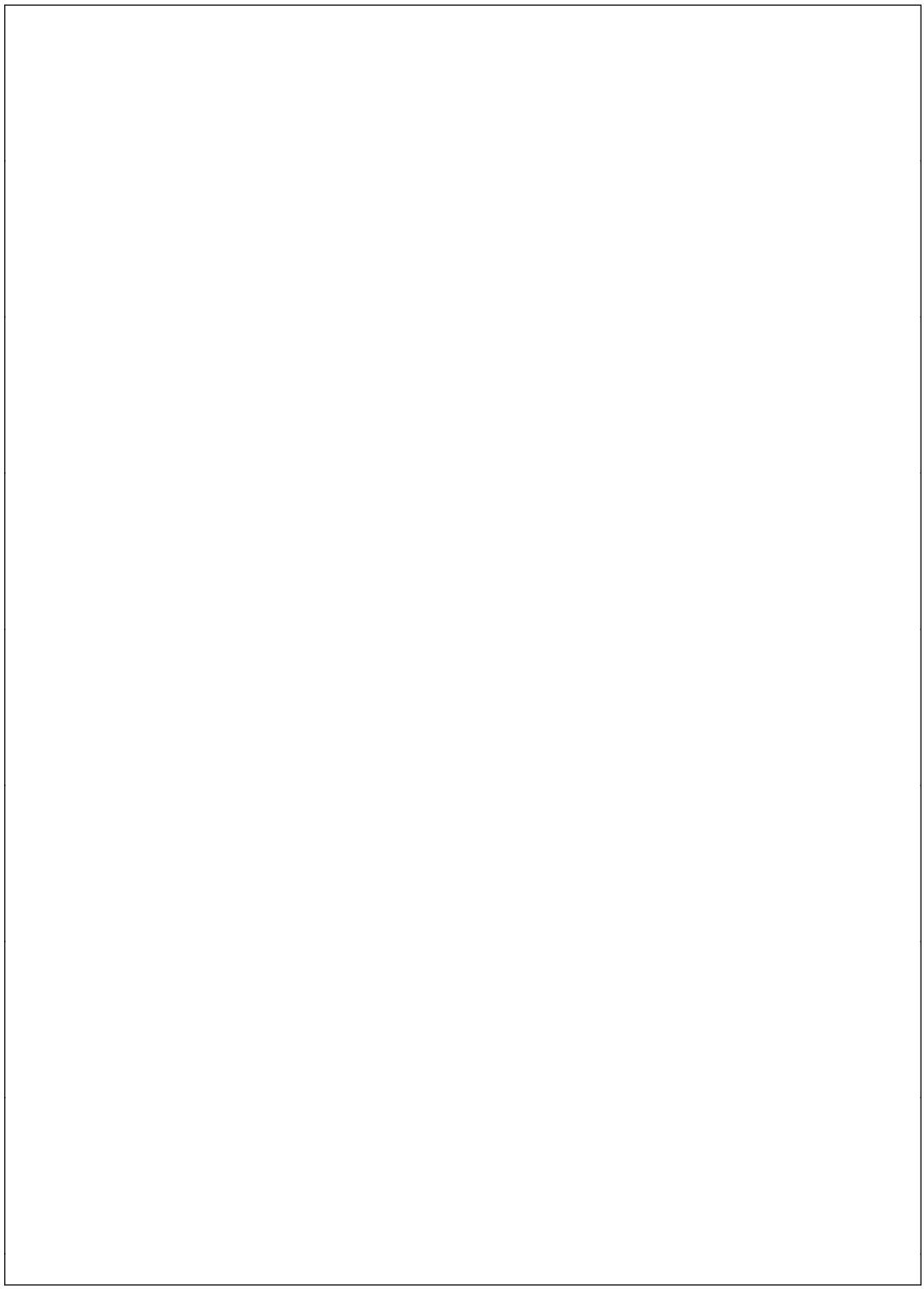
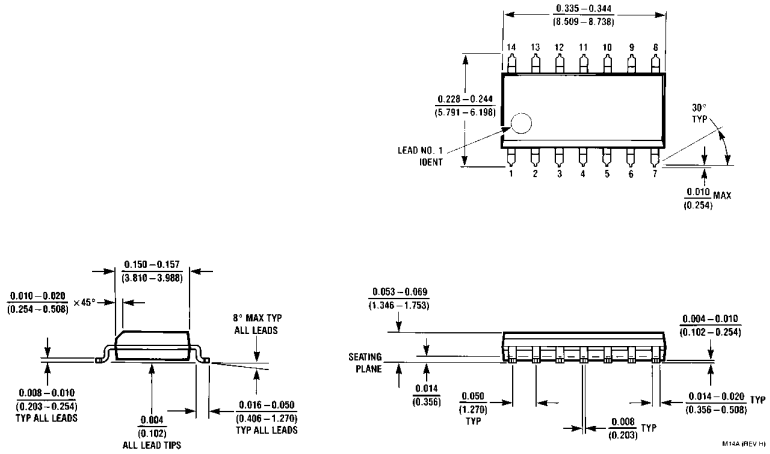
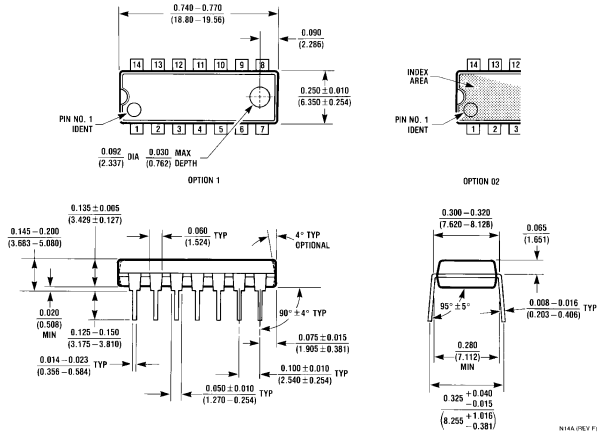


Physical Dimensions inches (millimeters)



Molded Small Outline Package (M)
Order Number LM592M
NS Package Number M14A



Molded Dual-In-Line Package (N)
Order Number LM592N
NS Package Number N14A

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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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