LM139/LM239/LM339/LM2901/LM3302 Low Power Low Offset Voltage Quad Comparators

Check for Samples: LM139-N, LM239-N, LM2901-N, LM3302-N, LM339-N

FEATURES

- **Wide Supply Voltage Range**
- **LM139/139A Series 2 to 36 V_{DC} or ±1 to ±18 V_{DC}**
- **LM2901: 2 to 36 V_{DC} or ±1 to ±18 V_{DC}**
- **LM3302: 2 to 28 V_{DC} or ±1 to ±14 V_{DC}**
- **Very Low Supply Current Drain (0.8 mA) — Independent of Supply Voltage**
- **Low Input Biasing Current: 25 nA**
- **Low Input Offset Current: ±5 nA**
- **Offset Voltage: ±3 mV**
- **Input Common-Mode Voltage Range Includes GND**
- **Differential Input Voltage Range Equal to the Power Supply Voltage**
- **Low Output Saturation Voltage: 250 mV at 4 mA**
- **Output Voltage Compatible with TTL, DTL, ECL, MOS and CMOS Logic Systems**

ADVANTAGES

- **High Precision Comparators**
- **Reduced V_{OS} Drift Over Temperature**
- **Eliminates Need for Dual Supplies**
- **Allows Sensing Near GND**
- **Compatible with all Forms of Logic**
- **Power Drain Suitable for Battery Operation**

APPLICATIONS

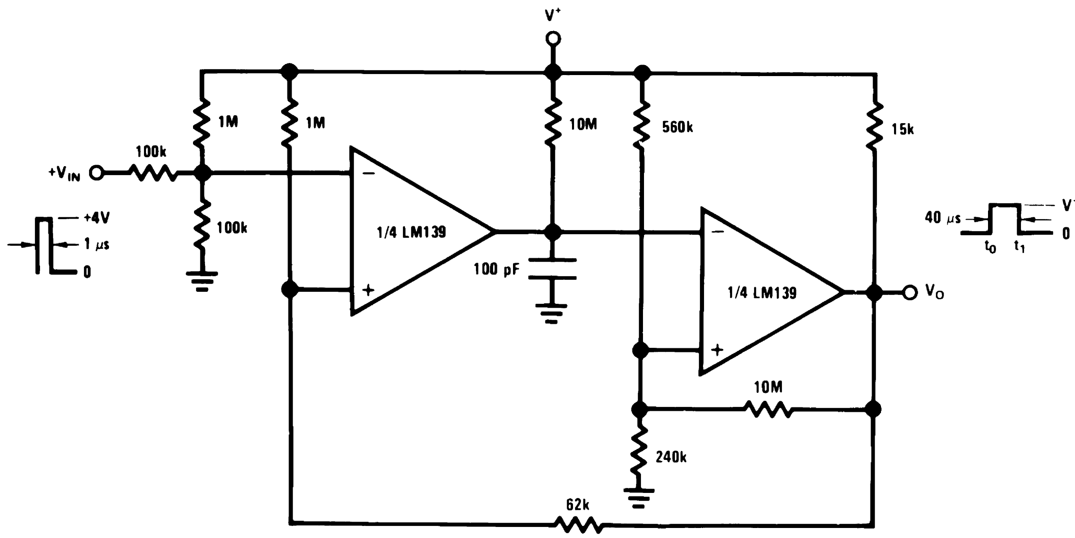
- **Limit Comparators**
- **Simple Analog-to-Digital Converters**
- **Pulse, Squarewave and Time Delay Generators**
- **Wide Range VCO; MOS Clock Timers**
- **Multivibrators and High Voltage Digital Logic Gates**

DESCRIPTION

The LM139 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2 mV max for all four comparators. These were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, they will directly interface with MOS logic— where the low power drain of the LM339 is a distinct advantage over standard comparators.

One-Shot Multivibrator with Input Lock Out



Connection Diagrams

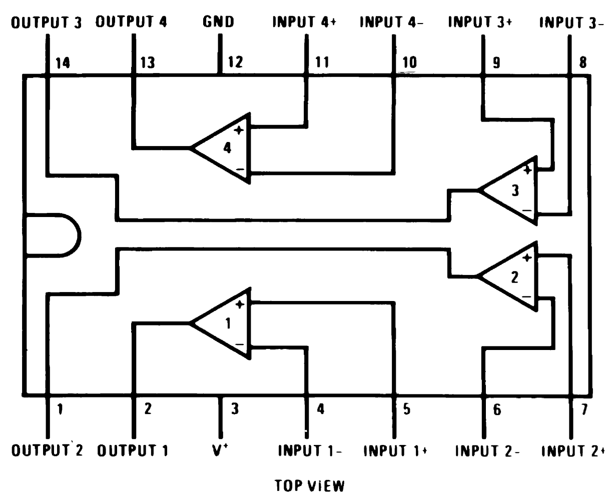


Figure 1. CDIP, SOIC, PDIP Packages – Top View
See Package Numbers J0014A, D0014A, NFF0014A

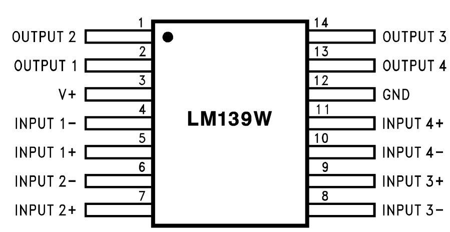


Figure 2. CLGA Package
See Package Numbers NAD0014B, NAC0014A

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings(1)

	LM139/LM239/LM339 LM139A/LM239A/LM339A LM2901	LM3302
Supply Voltage, V^+	36 V_{DC} or ±18 V_{DC}	28 V_{DC} or ±14 V_{DC}
Differential Input Voltage(2)	36 V_{DC}	28 V_{DC}
Input Voltage	−0.3 V_{DC} to +36 V_{DC}	−0.3 V_{DC} to +28 V_{DC}
Input Current (V_{IN}<−0.3 V_{DC})(3)	50 mA	50 mA
Power Dissipation(4)		
PDIP	1050 mW	1050 mW
Cavity DIP	1190 mW	
SOIC Package	760 mW	
Output Short-Circuit to GND(5)	Continuous	Continuous
Storage Temperature Range	−65°C to +150°C	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	260°C	260°C
Operating Temperature Range		−40°C to +85°C
LM339/LM339A	0°C to +70°C	
LM239/LM239A	−25°C to +85°C	
LM2901	−40°C to +85°C	
LM139/LM139A	−55°C to +125°C	
Soldering Information		
PDIP Package Soldering (10 seconds)	260°C	260°C
SOIC Package		
Vapor Phase (60 seconds)	215°C	215°C
Infrared (15 seconds)	220°C	220°C
ESD rating (1.5 kΩ in series with 100 pF)	600V	600V

(1) Refer to RETS139AX for LM139A military specifications and to RETS139X for LM139 military specifications.
(2) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3 V_{DC} (or 0.3 V_{DC}below the magnitude of the negative power supply, if used) (at 25°C).
(3) This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V^+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than −0.3 V_{DC} (at 25°C).
(4) For operating at high temperatures, the LM339/LM339A, LM2901, LM3302 must be derated based on a 125°C maximum junction temperature and a thermal resistance of 95°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The LM239 and LM139 must be derated based on a 150°C maximum junction temperature. The low bias dissipation and the “ON-OFF” characteristic of the outputs keeps the chip dissipation very small (P_D≤100 mW), provided the output transistors are allowed to saturate.
(5) Short circuits from the output to V^+ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 20 mA independent of the magnitude of V^+.

Electrical Characteristics

(V^+=5 V_{DC}, T_A = 25°C, unless otherwise stated)

Parameter	Test Conditions	LM139A			LM239A, LM339A			LM139			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	See [1]		1.0	2.0		1.0	2.0		2.0	5.0	mV_{DC}
Input Bias Current	$I_{IN(+)}$ or $I_{IN(-)}$ with Output in		25	100		25	250		25	100	nA_{DC}
	Linear Range [2], V_{CM}=0V										
Input Offset Current	$I_{IN(+)}-I_{IN(-)}$, V_{CM}=0V		3.0	25		5.0	50		3.0	25	nA_{DC}
Input Common-Mode Voltage Range	V^+=30 V_{DC} (LM3302, V^+ = 28 V_{DC}) [3]	0		$V^+-1.5$	0		$V^+-1.5$	0		$V^+-1.5$	V_{DC}
Supply Current	$R_L = \infty$ on all Comparators, $R_L = \infty$, V^+ = 36V, (LM3302, V^+ = 28 V_{DC})		0.8	2.0		0.8 1.0	2.0 2.5		0.8 1.0	2.0 2.5	mA_{DC} mA_{DC}
Voltage Gain	R_L≥15 kΩ, V^+ = 15 V_{DC} V_O = 1 V_{DC} to 11 V_{DC}	50	200		50	200		50	200		V/mV
Large Signal Response Time	V_{IN} = TTL Logic Swing, V_{REF} = 1.4 V_{DC}, V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ		300			300			300		ns
Response Time	V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ [4]		1.3			1.3			1.3		μs
Output Sink Current	$V_{IN(-)}$ = 1 V_{DC}, $V_{IN(+)}$ = 0, V_O ≤ 1.5 V_{DC}	6.0	16		6.0	16		6.0	16		mA_{DC}
Saturation Voltage	$V_{IN(-)}$ = 1 V_{DC}, $V_{IN(+)}$ = 0, I_{SINK} ≤ 4 mA		250	400		250	400		250	400	mV_{DC}
Output Leakage Current	$V_{IN(+)}$ = 1 V_{DC}, $V_{IN(-)}$ = 0, V_O = 5 V_{DC}		0.1			0.1			0.1		nA_{DC}

(1) At output switch point, V_O≃1.4 V_{DC}, R_S = 0Ω with V^+ from 5 V_{DC} to 30 V_{DC}; and over the full input common-mode range (0 V_{DC} to V^+ −1.5 V_{DC}), at 25°C. For LM3302, V^+ from 5 V_{DC} to 28 V_{DC}.
(2) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(3) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+ −1.5V at 25°C, but either or both inputs can go to +30 V_{DC} without damage (25V for LM3302), independent of the magnitude of V^+.
(4) The response time specified is a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained, see typical performance characteristics section.

Electrical Characteristics

(V^+ = 5 V_{DC}, T_A = 25°C, unless otherwise stated)

Parameter	Test Conditions	LM239, LM339			LM2901			LM3302			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	See (1)		2.0	5.0		2.0	7.0		3	20	mV_{DC}
Input Bias Current	$I_{IN(+)}$ or $I_{IN(-)}$ with Output in Linear Range (2), V_{CM}=0V		25	250		25	250		25	500	nA_{DC}
Input Offset Current	$I_{IN(+)}-I_{IN(-)}$, V_{CM} = 0V		5.0	50		5	50		3	100	nA_{DC}
Input Common-Mode Voltage Range	V^+ = 30 V_{DC} (LM3302, V^+ = 28 V_{DC}) (3)	0		V^+−1.5	0		V^+−1.5	0		V^+−1.5	V_{DC}
Supply Current	R_L = ∞ on all Comparators, R_L = ∞, V^+ = 36V, (LM3302, V^+ = 28 V_{DC})		0.8 1.0	2.0 2.5		0.8 1.0	2.0 2.5		0.8 1.0	2.0 2.5	mA_{DC} mA_{DC}
Voltage Gain	R_L ≥ 15 kΩ, V^+ = 15 V_{DC} V_O = 1 V_{DC} to 11 V_{DC}	50	200		25	100		2	30		V/mV
Large Signal Response Time	V_{IN} = TTL Logic Swing, V_{REF} = 1.4 V_{DC}, V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ,		300			300			300		ns
Response Time	V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ (4)		1.3			1.3			1.3		μs
Output Sink Current	$V_{IN(-)}$= 1 V_{DC}, $V_{IN(+)}$ = 0, V_O ≤ 1.5 V_{DC}	6.0	16		6.0	16		6.0	16		mA_{DC}
Saturation Voltage	$V_{IN(-)}$ = 1 V_{DC}, $V_{IN(+)}$ = 0, I_{SINK} ≤ 4 mA		250	400		250	400		250	500	mV_{DC}
Output Leakage Current	$V_{IN(+)}$ = 1 V_{DC},$V_{IN(-)}$ = 0, V_O = 5 V_{DC}		0.1			0.1			0.1		nA_{DC}

(1) At output switch point, V_O≃1.4 V_{DC}, R_S = 0Ω with V^+ from 5 V_{DC} to 30 V_{DC}; and over the full input common-mode range (0 V_{DC} to V^+ −1.5 V_{DC}), at 25°C. For LM3302, V^+ from 5 V_{DC} to 28 V_{DC}.
(2) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(3) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+ −1.5V at 25°C, but either or both inputs can go to +30 V_{DC} without damage (25V for LM3302), independent of the magnitude of V^+.
(4) The response time specified is a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained, see typical performance characteristics section.

Electrical Characteristics

(V^+ = 5.0 V_{DC} (1))

Parameter	Test Conditions	LM139A			LM239A, LM339A			LM139			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	See (2)			4.0			4.0			9.0	mV_{DC}
Input Offset Current	$I_{IN(+)}−I_{IN(−)}$, V_{CM} = 0V			100			150			100	nA_{DC}
Input Bias Current	$I_{IN(+)}$ or $I_{IN(−)}$ with Output in			300			400			300	nA_{DC}
	Linear Range, V_{CM} = 0V (3)										
Input Common-Mode	V^+=30 V_{DC} (LM3302,	0		V^+−2.0	0		V^+−2.0	0		V^+−2.0	V_{DC}
Voltage Range	V^+ = 28 V_{DC}) (4)										
Saturation Voltage	$V_{IN(−)}$=1 V_{DC}, $V_{IN(+)}$ = 0, I_{SINK} ≤ 4 mA			700			700			700	mV_{DC}
Output Leakage Current	$V_{IN(+)}$ = 1 V_{DC}, $V_{IN(−)}$ = 0, V_O = 30 V_{DC}, (LM3302, V_O = 28 V_{DC})			1.0			1.0			1.0	$μA_{DC}$
Differential Input Voltage	Keep all V_{IN}'s ≥ 0 V_{DC} (or $V^−$, if used) (5)			36			36			36	V_{DC}

(1) These specifications are limited to −55°C ≤ T_A ≤ +125°C, for the LM139/LM139A. With the LM239/LM239A, all temperature specifications are limited to −25°C ≤ T_A ≤ +85°C, the LM339/LM339A temperature specifications are limited to 0°C ≤ T_A ≤ +70°C, and the LM2901, LM3302 temperature range is −40°C ≤ T_A ≤ +85°C.

(2) At output switch point, V_O≃1.4 V_{DC}, R_S = 0Ω with V^+ from 5 V_{DC} to 30 V_{DC}; and over the full input common-mode range (0 V_{DC} to V^+ −1.5 V_{DC}), at 25°C. For LM3302, V^+ from 5 V_{DC} to 28 V_{DC}.

(3) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.

(4) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+ −1.5V at 25°C, but either or both inputs can go to +30 V_{DC} without damage (25V for LM3302), independent of the magnitude of V^+.

(5) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3 V_{DC} (or 0.3 V_{DC}below the magnitude of the negative power supply, if used) (at 25°C).

Electrical Characteristics

($V^+ = 5.0\ V_{DC}$ [1])

Parameter	Test Conditions	LM239, LM339			LM2901			LM3302			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	See [2]			9.0		9	15			40	mV_{DC}
Input Offset Current	$I_{IN(+)}-I_{IN(-)}$, V_{CM} = 0V			150		50	200			300	nA_{DC}
Input Bias Current	$I_{IN(+)}$ or $I_{IN(-)}$ with Output in			400		200	500			1000	nA_{DC}
	Linear Range, V_{CM} = 0V [3]										
Input Common-Mode	$V^+ = 30\ V_{DC}$ (LM3302, $V^+ = 28\ V_{DC}$)			$V^+-2.0$	0		$V^+-2.0$	0		$V^+-2.0$	V_{DC}
Voltage Range	See [4]										
Saturation Voltage	$V_{IN(-)} = 1\ V_{DC}$, $V_{IN(+)} = 0$, $I_{SINK} \leq 4$ mA			700		400	700			700	mV_{DC}
Output Leakage Current	$V_{IN(+)} = 1\ V_{DC}$, $V_{IN(-)} = 0$, $V_O = 30\ V_{DC}$, (LM3302, $V_O = 28\ V_{DC}$)			1.0			1.0			1.0	μA_{DC}
Differential Input Voltage	Keep all V_{IN}'s ≥ 0 V_{DC} (or V^-, if used) [5]			36			36			28	V_{DC}

(1) These specifications are limited to −55°C ≤ T_A ≤ +125°C, for the LM139/LM139A. With the LM239/LM239A, all temperature specifications are limited to −25°C ≤ T_A ≤ +85°C, the LM339/LM339A temperature specifications are limited to 0°C ≤ T_A ≤ +70°C, and the LM2901, LM3302 temperature range is −40°C ≤ T_A ≤ +85°C.
(2) At output switch point, V_O≃1.4 V_{DC}, R_S = 0Ω with V^+ from 5 V_{DC} to 30 V_{DC}; and over the full input common-mode range (0 V_{DC} to V^+ −1.5 V_{DC}), at 25°C. For LM3302, V^+ from 5 V_{DC} to 28 V_{DC}.
(3) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(4) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+ −1.5V at 25°C, but either or both inputs can go to +30 V_{DC} without damage (25V for LM3302), independent of the magnitude of V^+.
(5) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3 V_{DC} (or 0.3 V_{DC}below the magnitude of the negative power supply, if used) (at 25°C).

Typical Performance Characteristics

LM139/LM239/LM339, LM139A/LM239A/LM339A, LM3302

Supply Current

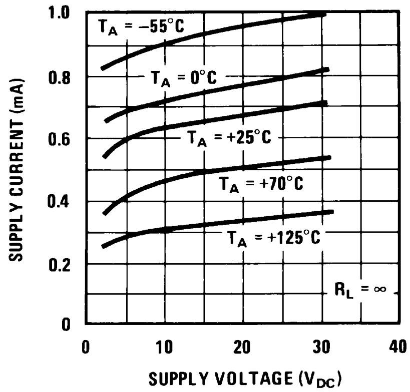


Figure 3.

Input Current

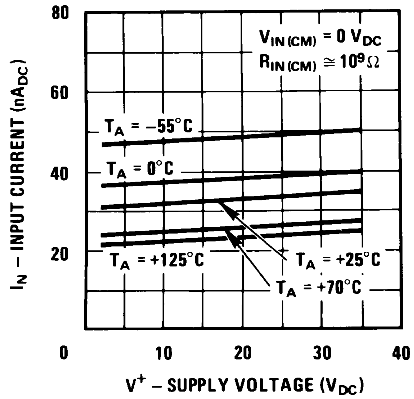


Figure 4.

Output Saturation Voltage

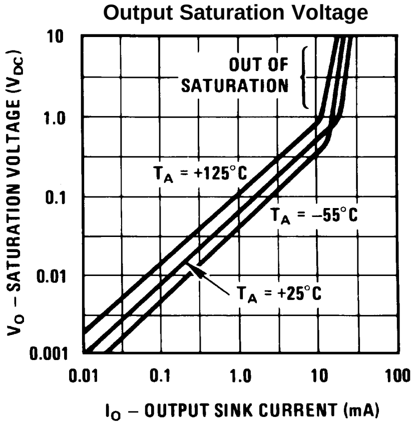


Figure 5.

Response Time for Various Input Overdrives – Negative Transition

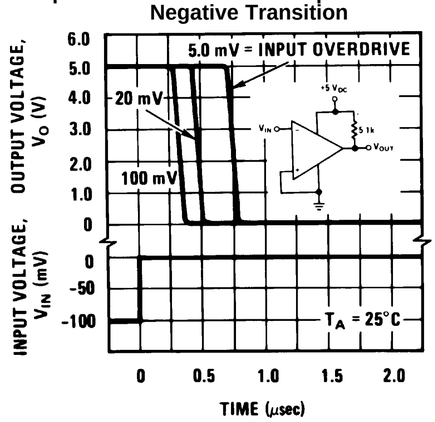


Figure 6.

Response Time for Various Input Overdrives – Positive Transition

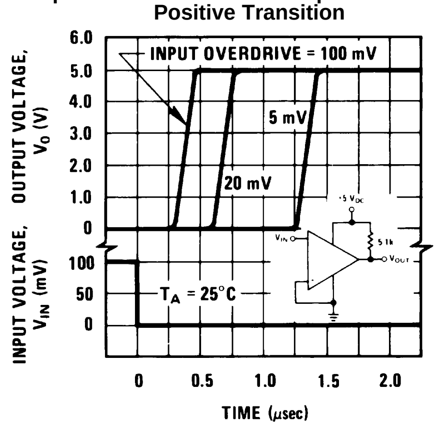


Figure 7.

Typical Performance Characteristics

LM2901

Supply Current

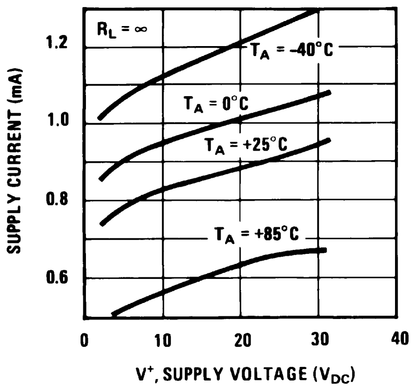


Figure 8.

Input Current

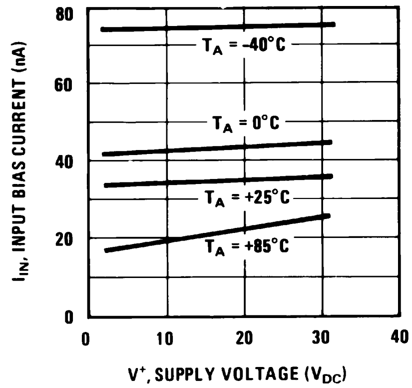


Figure 9.

Output Saturation Voltage

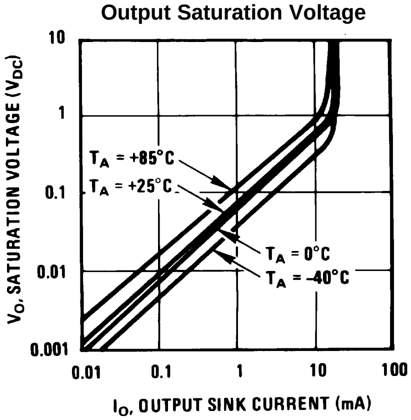


Figure 10.

Response Time for Various Input Overdrives – Negative Transition

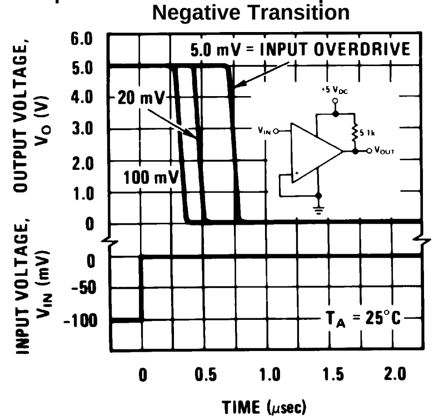


Figure 11.

Response Time for Various Input Overdrives – Positive Transition

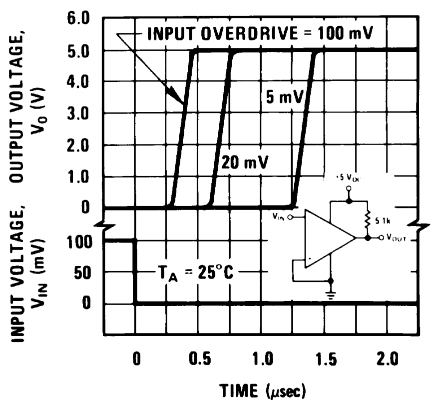


Figure 12.

Application Hints

The LM139 series are high gain, wide bandwidth devices which, like most comparators, can easily oscillate if the output lead is inadvertently allowed to capacitively couple to the inputs via stray capacitance. This shows up only during the output voltage transition intervals as the comparator changes states. Power supply bypassing is not required to solve this problem. Standard PC board layout is helpful as it reduces stray input-output coupling. Reducing this input resistors to < 10 kΩ reduces the feedback signal levels and finally, adding even a small amount (1 to 10 mV) of positive feedback (hysteresis) causes such a rapid transition that oscillations due to stray feedback are not possible. Simply socketing the IC and attaching resistors to the pins will cause input-output oscillations during the small transition intervals unless hysteresis is used. If the input signal is a pulse waveform, with relatively fast rise and fall times, hysteresis is not required.

All pins of any unused comparators should be tied to the negative supply.

The bias network of the LM139 series establishes a drain current which is independent of the magnitude of the power supply voltage over the range of from 2 V_{DC} to 30 V_{DC}.

It is usually unnecessary to use a bypass capacitor across the power supply line.

The differential input voltage may be larger than V^+ without damaging the device. Protection should be provided to prevent the input voltages from going negative more than −0.3 V_{DC} (at 25°C). An input clamp diode can be used as shown in the applications section.

The output of the LM139 series is the uncommitted collector of a grounded-emitter NPN output transistor. Many collectors can be tied together to provide an output OR'ing function. An output pull-up resistor can be connected to any available power supply voltage within the permitted supply voltage range and there is no restriction on this voltage due to the magnitude of the voltage which is applied to the V^+ terminal of the LM139A package. The output can also be used as a simple SPST switch to ground (when a pull-up resistor is not used). The amount of current which the output device can sink is limited by the drive available (which is independent of V^+) and the β of this device. When the maximum current limit is reached (approximately 16 mA), the output transistor will come out of saturation and the output voltage will rise very rapidly. The output saturation voltage is limited by the approximately 60Ω R_{SAT} of the output transistor. The low offset voltage of the output transistor (1 mV) allows the output to clamp essentially to ground level for small load currents.

Typical Applications

($V^+ = 5.0\ V_{DC}$)

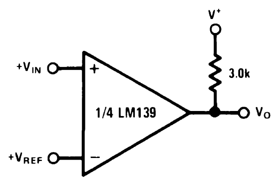


Figure 13. Basic Comparator

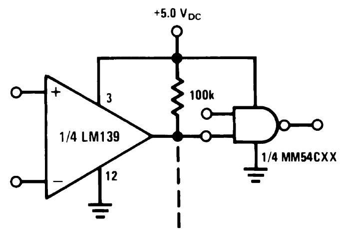


Figure 14. Driving CMOS

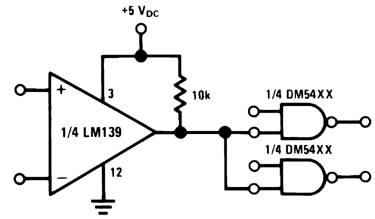


Figure 15. Driving TTL

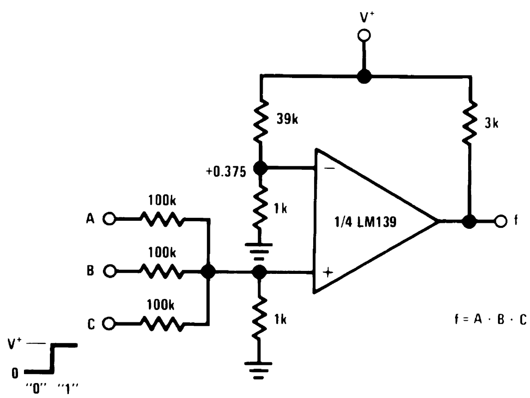


Figure 16. AND Gate

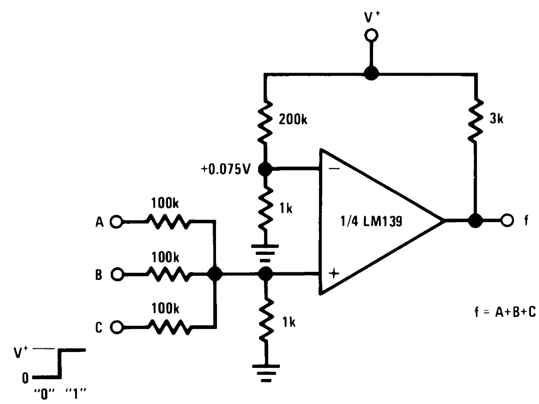


Figure 17. OR Gate

Typical Applications

(V^{+}= 15 V_{DC})

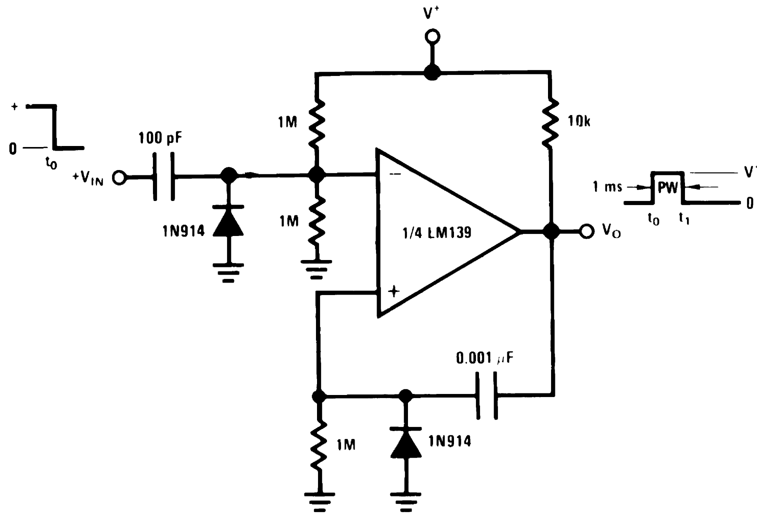


Figure 18. One-Shot Multivibrator

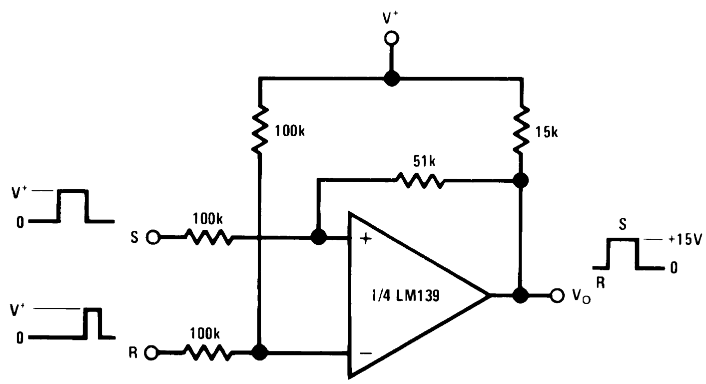


Figure 19. Bi-Stable Multivibrator

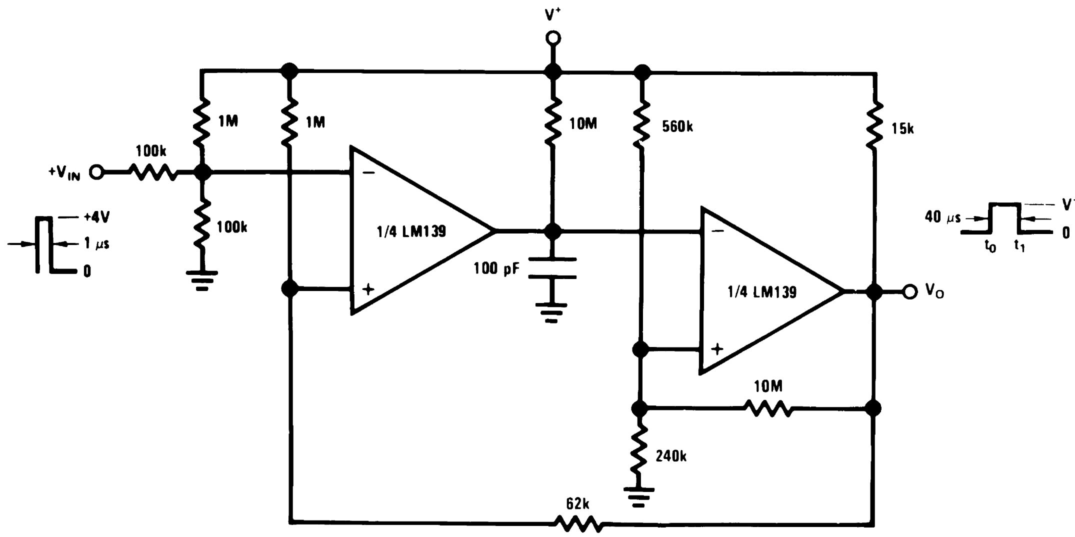


Figure 20. One-Shot Multivibrator with Input Lock Out

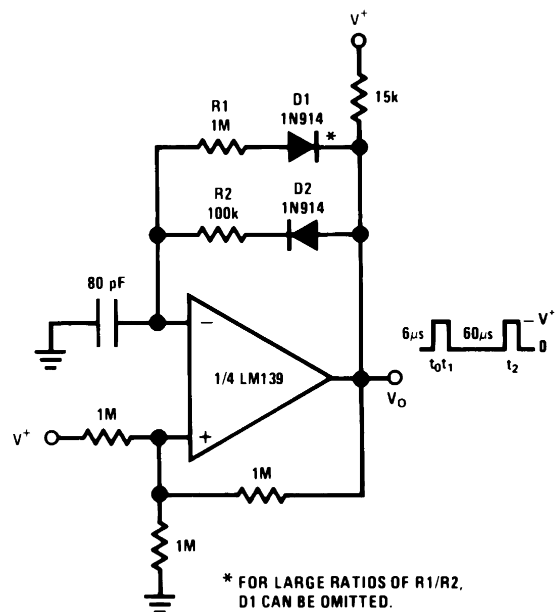


Figure 21. Pulse Generator

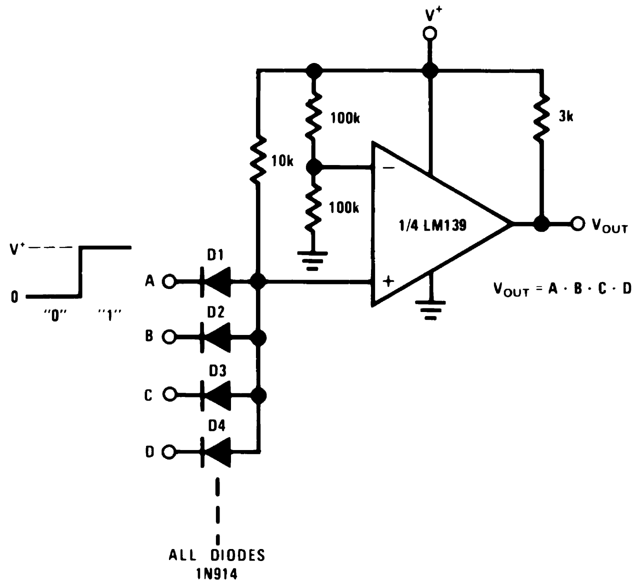


Figure 22. Large Fan-In AND Gate

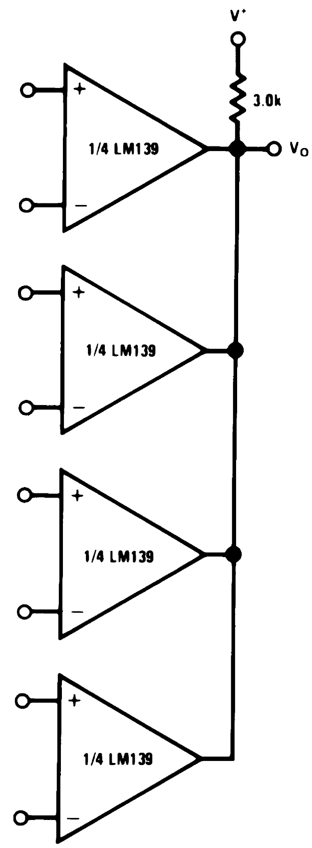


Figure 23. ORing the Outputs

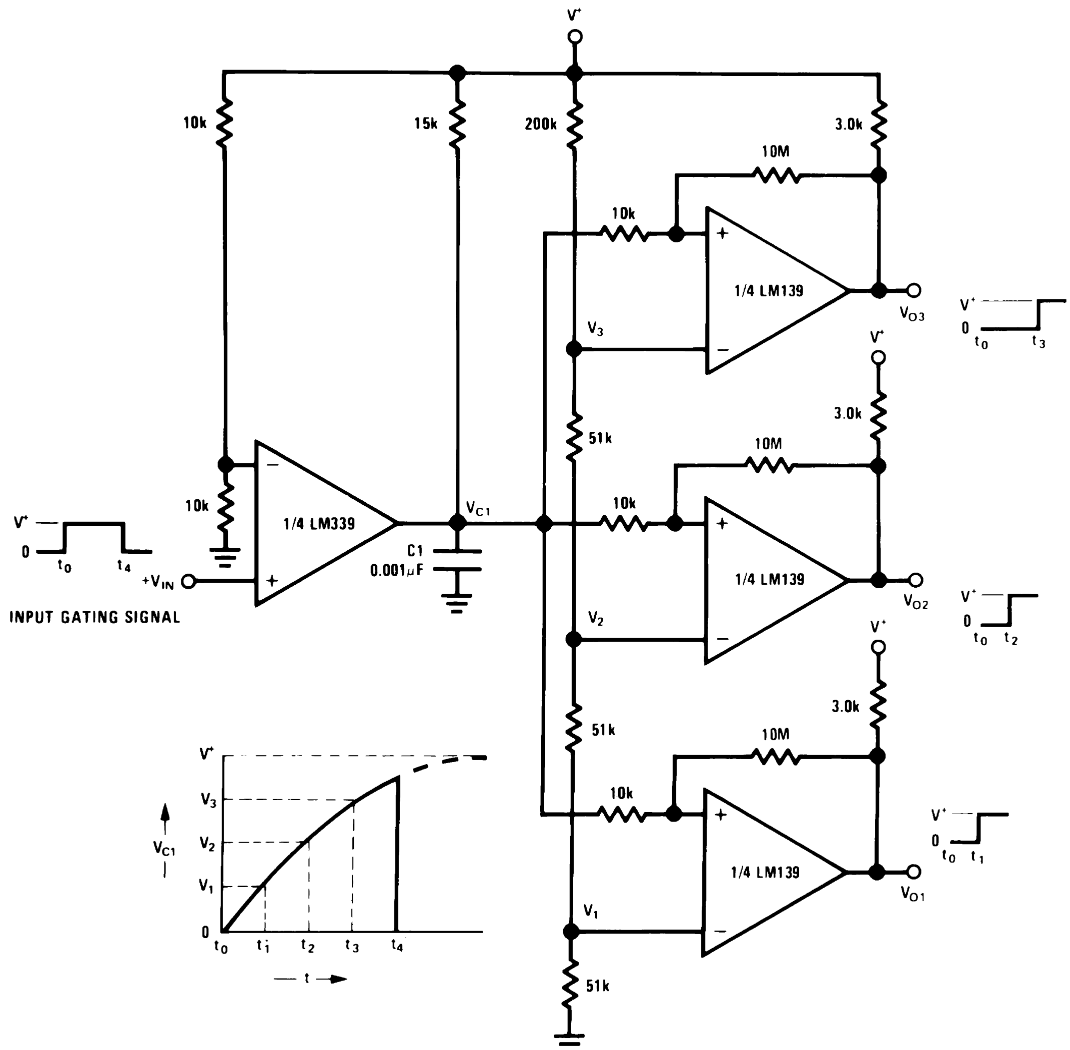


Figure 24. Time Delay Generator

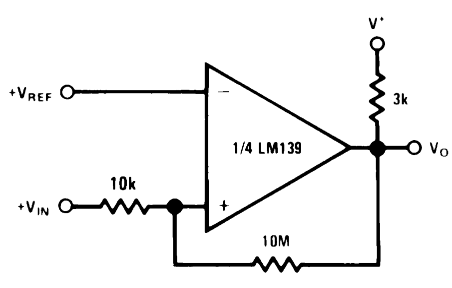


Figure 25. Non-Inverting Comparator with Hysteresis

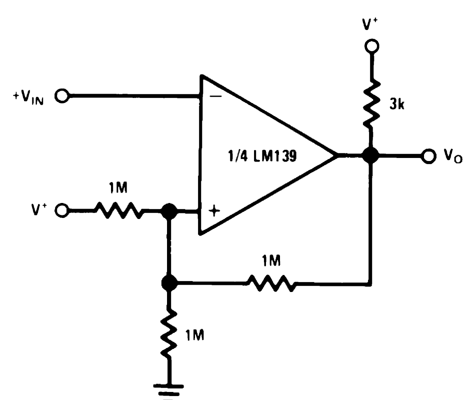


Figure 26. Inverting Comparator with Hysteresis

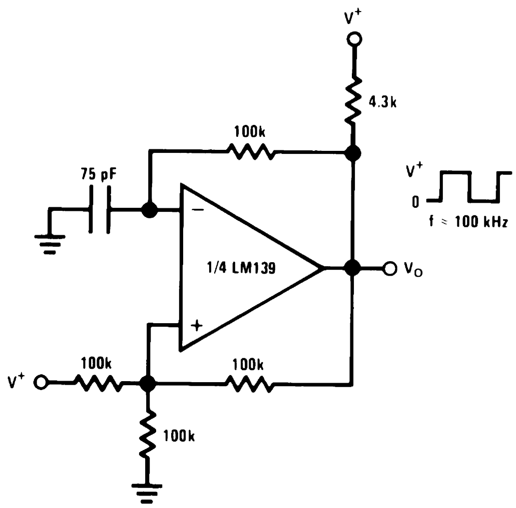


Figure 27. Squarewave Oscillator

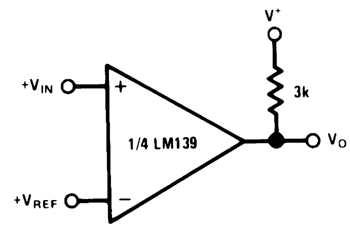


Figure 28. Basic Comparator

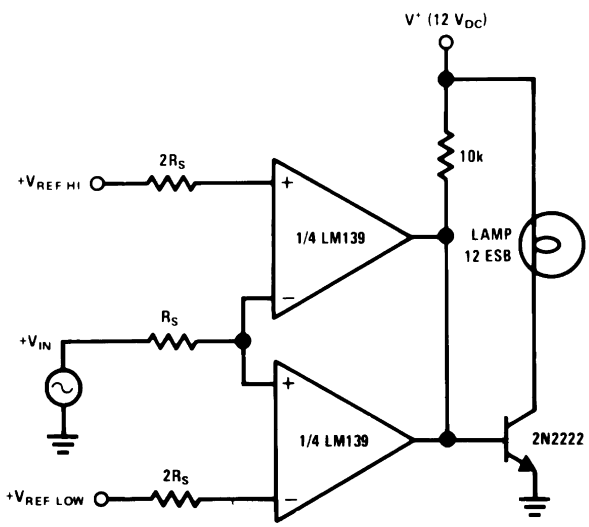


Figure 29. Limit Comparator

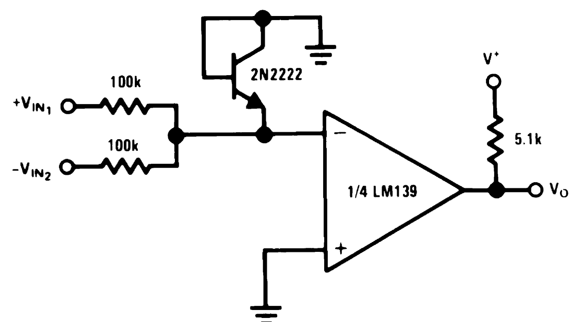
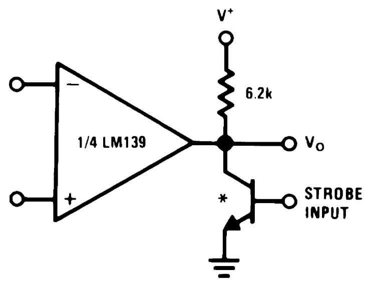


Figure 30. Comparing Input Voltages of Opposite Polarity



* Or open-collector logic gate without pull-up resistor

Figure 31. Output Strobing

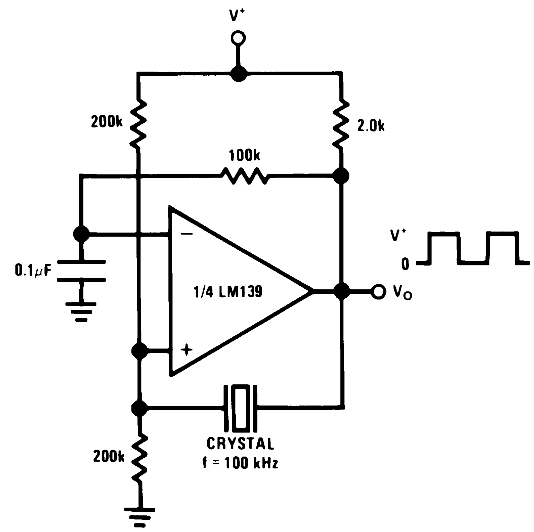
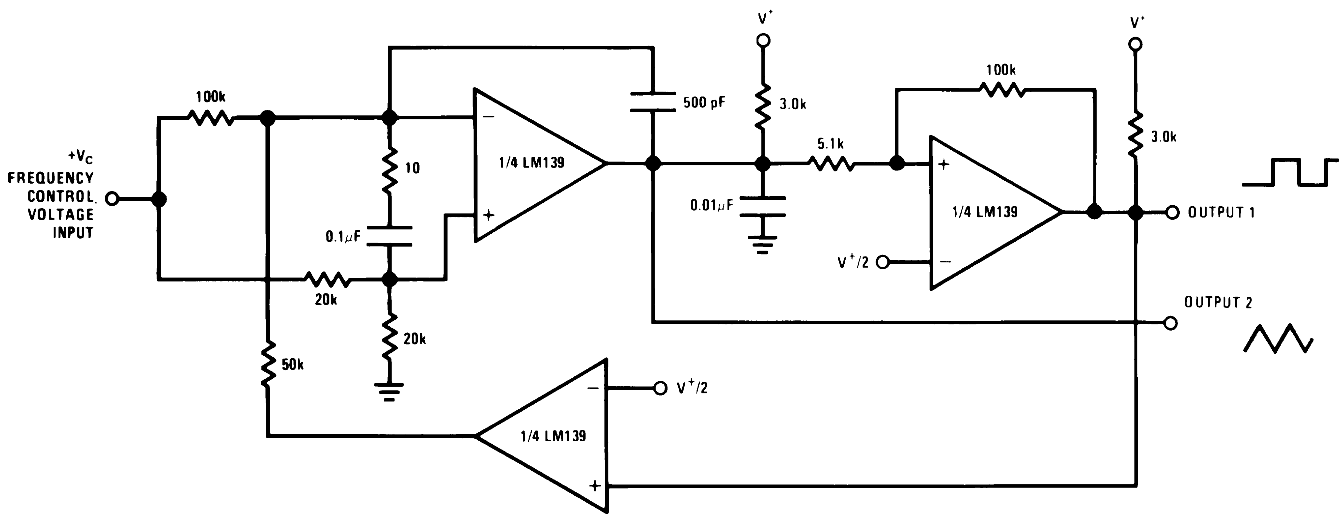


Figure 32. Crystal Controlled Oscillator



$V^+ = +30\ V_{DC}$
$250\ mV_{DC} \leq V_C \leq +50\ V_{DC}$
$700\ Hz \leq f_O \leq 100\ kHz$

Figure 33. Two-Decade High-Frequency VCO

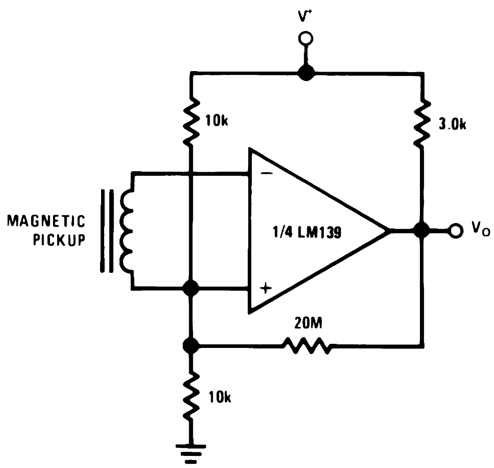


Figure 34. Transducer Amplifier

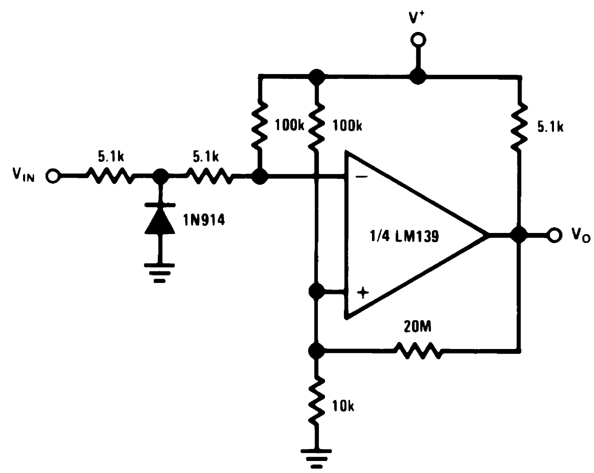


Figure 35. Zero Crossing Detector (Single Power Supply)

Split-Supply Applications

($V^+ = +15\ V_{DC}$ and $V^- = -15\ V_{DC}$)

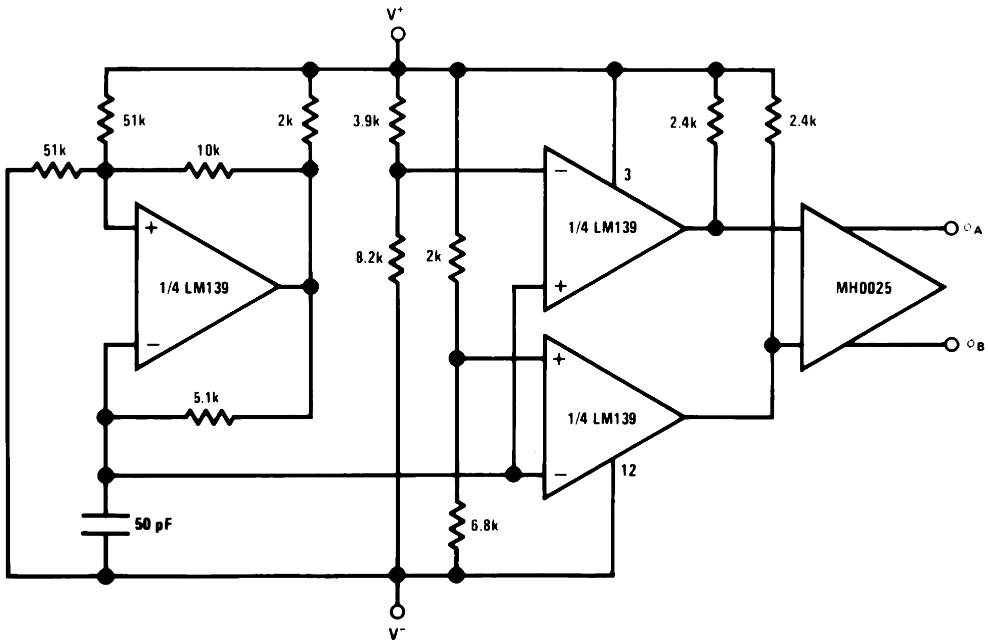


Figure 36. MOS Clock Driver

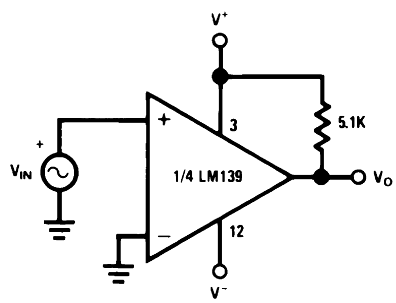


Figure 37. Zero Crossing Detector

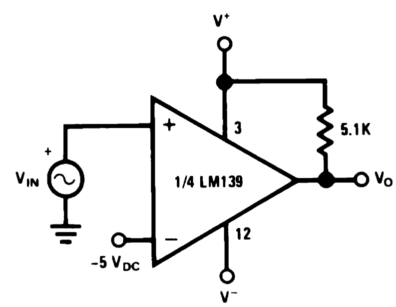
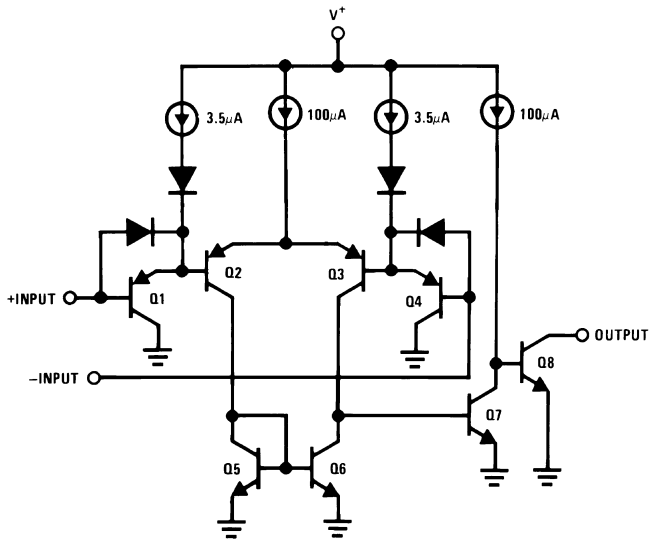


Figure 38. Comparator With a Negative Reference

Schematic Diagram



REVISION HISTORY

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM139AJ/PB	ACTIVE	CDIP	J	14	25	TBD	Call TI	Call TI	-55 to 125	LM139AJ	Samples
LM139J/PB	ACTIVE	CDIP	J	14	25	TBD	Call TI	Call TI	-55 to 125	LM139J	Samples
LM239J	ACTIVE	CDIP	J	14	25	TBD	Call TI	Call TI	-25 to 85	LM239J	Samples
LM2901M	ACTIVE	SOIC	D	14	55	TBD	Call TI	Call TI	-40 to 85	LM2901M	Samples
LM2901M/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM2901M	Samples
LM2901MX	ACTIVE	SOIC	D	14	2500	TBD	Call TI	Call TI	-40 to 85	LM2901M	Samples
LM2901MX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM2901M	Samples
LM2901N/NOPB	ACTIVE	PDIP	NFF	14	25	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	-40 to 85	LM2901N	Samples
LM2901N/PB	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Call TI		LM2901N	Samples
LM339AM	ACTIVE	SOIC	D	14	55	TBD	Call TI	Call TI	-25 to 85	LM339AM	Samples
LM339AM/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-25 to 85	LM339AM	Samples
LM339AMX	ACTIVE	SOIC	D	14	2500	TBD	Call TI	Call TI	-25 to 85	LM339AM	Samples
LM339AMX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-25 to 85	LM339AM	Samples
LM339AN/NOPB	ACTIVE	PDIP	NFF	14	25	Green (RoHS & no Sb/Br)	SN	Level-1-NA-UNLIM	-25 to 85	LM339AN	Samples
LM339AN/PB	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Call TI		LM339AN	Samples
LM339J	ACTIVE	CDIP	J	14	25	TBD	Call TI	Call TI	-25 to 85	LM339J	Samples
LM339M	ACTIVE	SOIC	D	14	55	TBD	Call TI	Call TI	-25 to 85	LM339M	Samples
LM339M/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-25 to 85	LM339M	Samples
LM339MX	ACTIVE	SOIC	D	14	2500	TBD	Call TI	Call TI	-25 to 85	LM339M	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM339MX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-25 to 85	LM339M	Samples
LM339N/NOPB	ACTIVE	PDIP	NFF	14	25	Green (RoHS & no Sb/Br)	SN	Level-1-NA-UNLIM	-25 to 85	LM339N	Samples
LM339N/PB	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Call TI		LM339N	Samples
MLM339P	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Call TI		LM339N	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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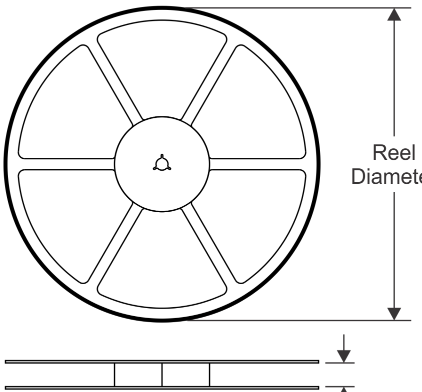
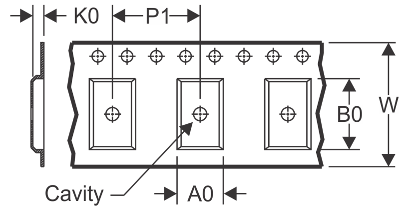
TAPE AND REEL INFORMATION

REEL DIMENSIONS

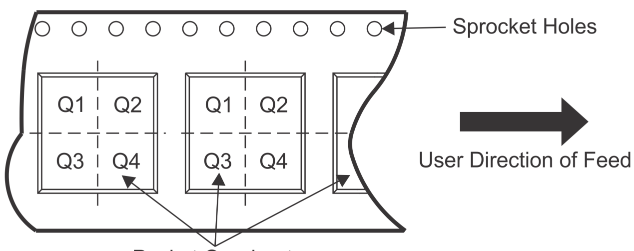


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

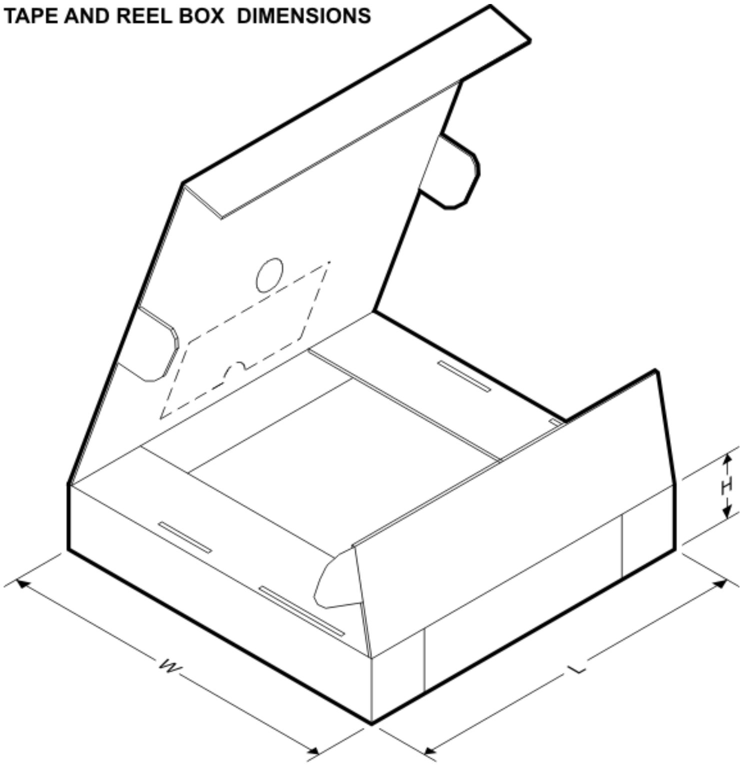
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM2901MX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM2901MX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM339AMX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM339AMX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM339MX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM339MX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

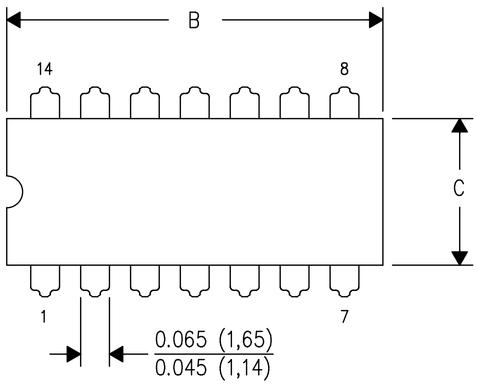


*All dimensions are nominal

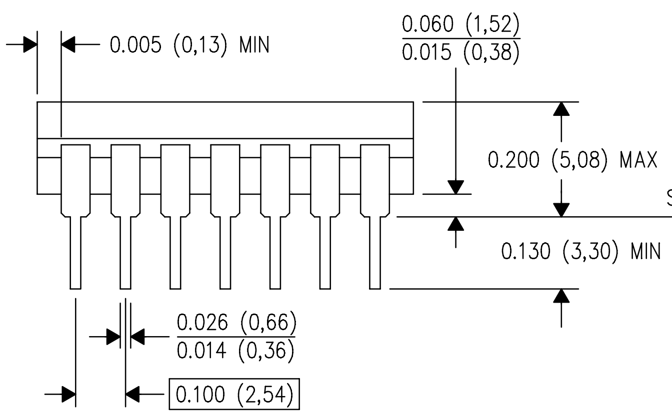
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM2901MX	SOIC	D	14	2500	367.0	367.0	35.0
LM2901MX/NOPB	SOIC	D	14	2500	367.0	367.0	35.0
LM339AMX	SOIC	D	14	2500	367.0	367.0	35.0
LM339AMX/NOPB	SOIC	D	14	2500	367.0	367.0	35.0
LM339MX	SOIC	D	14	2500	367.0	367.0	35.0
LM339MX/NOPB	SOIC	D	14	2500	367.0	367.0	35.0

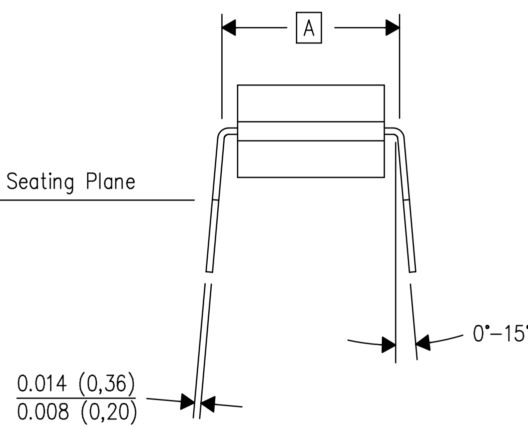
J (R–GDIP–T**)　　CERAMIC DUAL IN–LINE PACKAGE

14 LEADS SHOWN



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	——	——	——	——
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

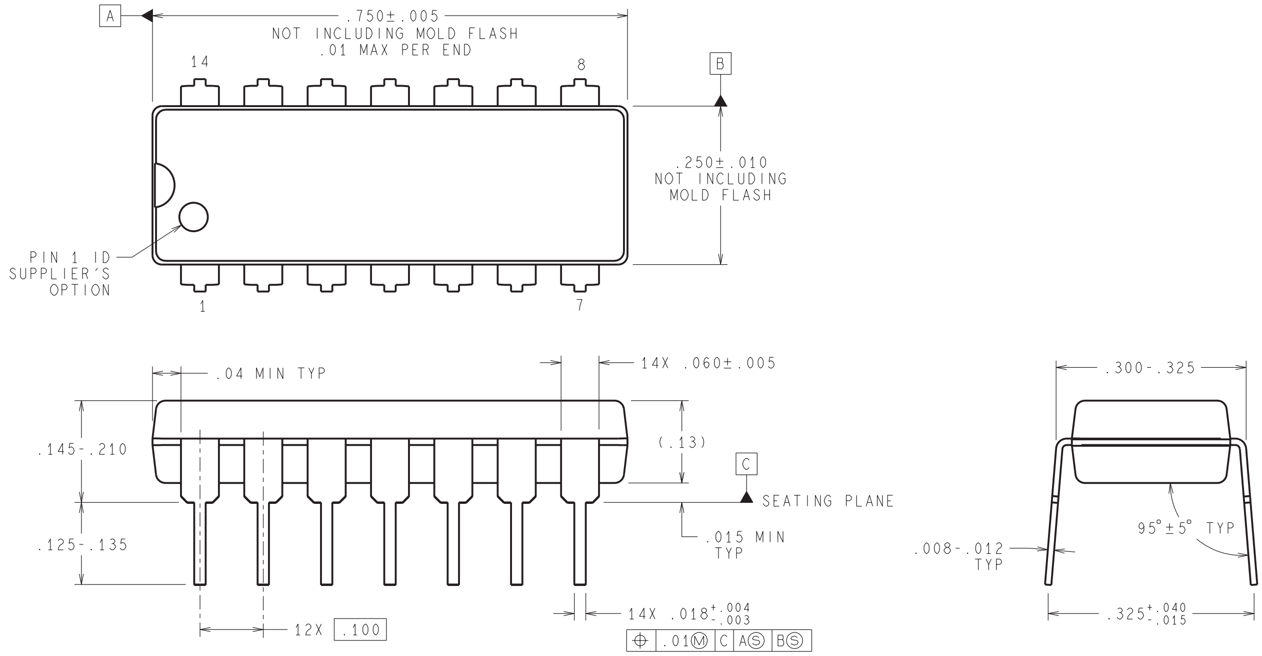




4040083/F 03/03

NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

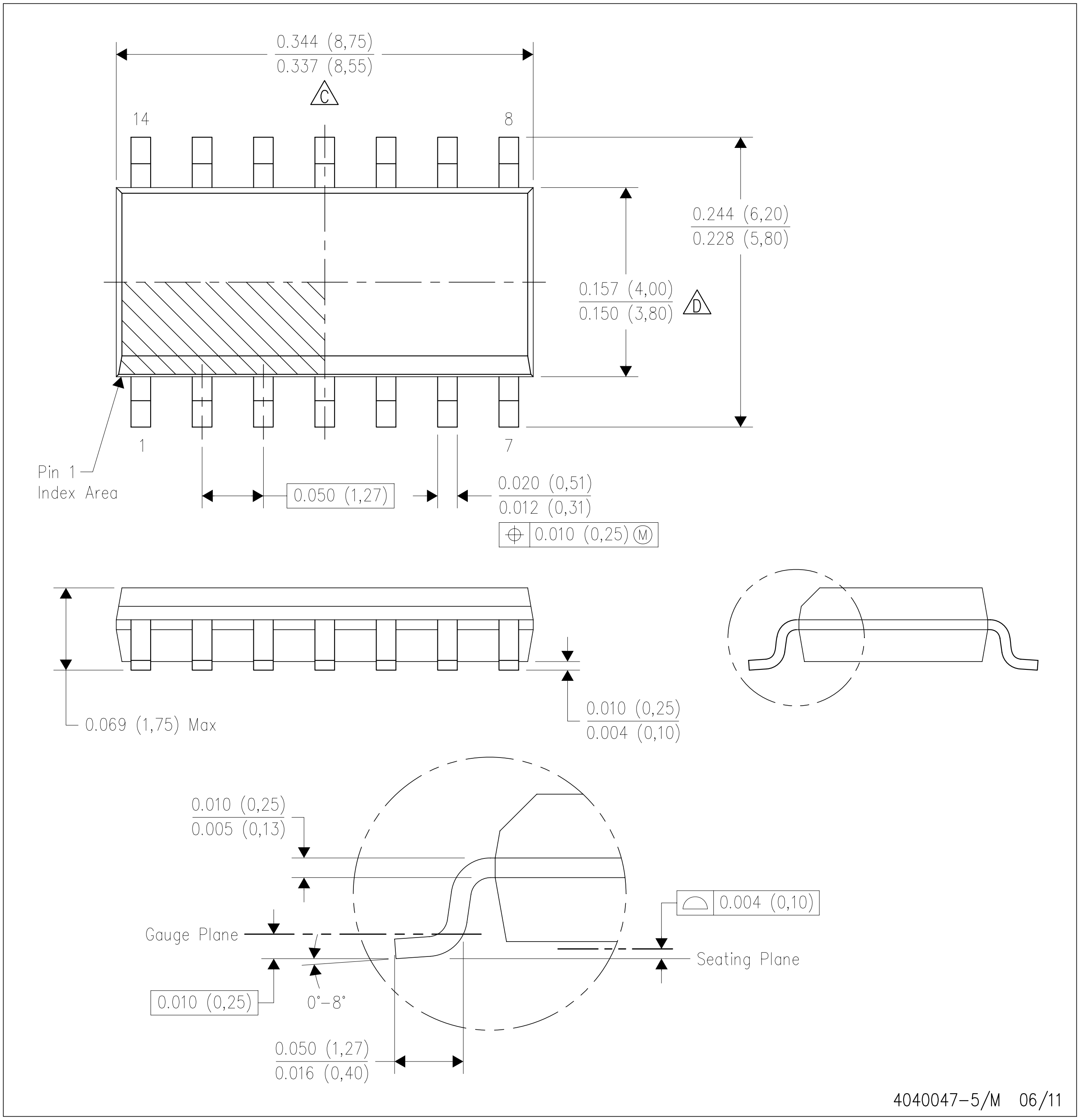
NFF0014A



DIMENSIONS ARE IN INCHES
DIMENSIONS IN ( ) FOR REFERENCE ONLY

N14A (Rev G)

D (R–PDSO–G14) PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AB.

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