

GS339

Single Supply Quad Comparator

Product Description

The GS339 consists of four independent precision voltage 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.

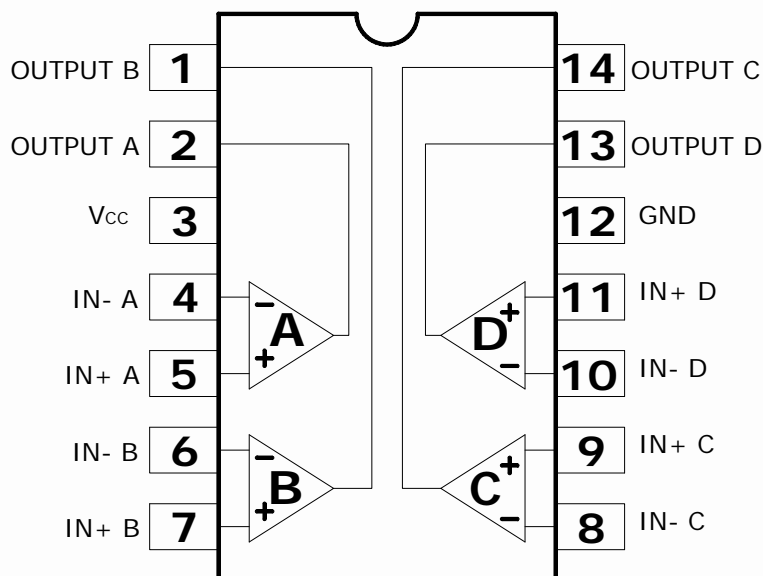
Features

- Wide supply Voltage range: 2.0V to 40V.
- Low supply current drain independent of supply voltage.
- Low input biasing current: 25 nA typ.
- Low input offset current: 5 nA typ.
- Low input offset voltage: 2 mV typ.
- Input common-mode voltage range includes GND.
- Differential input voltage range equal to the power supply voltage
- Low output saturation voltage.
- Output voltage compatible with TTL, MOS and CMOS logic.

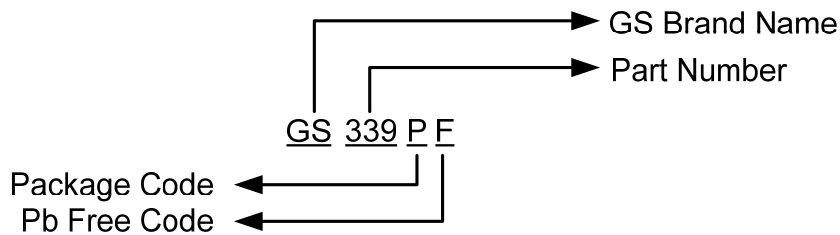
Applications

Application areas include limit comparators, simple analog to digital converters; pulse, square wave and time delay generators; wide range VCO; multivibrators and high voltage digital logic gates.

Packages & Pin Assignments

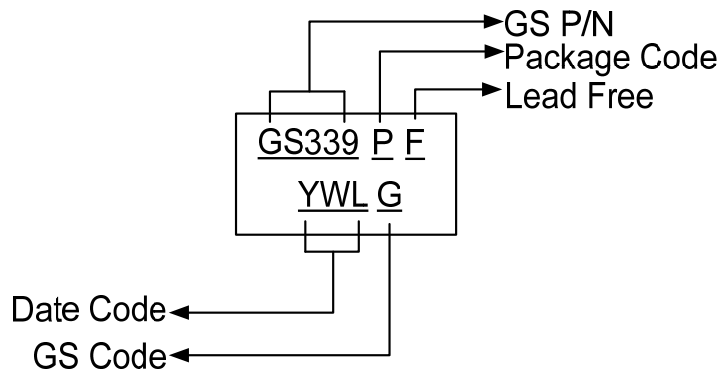


Ordering Information



Device	Package
GS339SF	SOP-14
GS339PF	DIP-14

Marking Information



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	± 20 or 40	V
V_{DI}	Differential Input Voltage	± 40	V
V_{IN}	Input Voltage	40	V
	Output Short-circuit to Ground (Note1)	Infinite	
P_D	Power Dissipation	DIP-14	1.5
		SOP-14	0.83
T_A	Operating Temperature Range	-40 to 85	$^{\circ}C$
T_{STG}	Storage temperature Range	-65 to 150	$^{\circ}C$
θ_{JA}	Junction to Ambient Thermal Resistance	DIP-14	80
		SOP-14	150
θ_{JC}	Junction to Case Thermal Resistance	DIP-14	41
		SOP-14	23
ESD	ESD Rating (HBM)	2K	V

Note 1: Short-circuit from the output to V_{CC+} can cause excessive heating and eventual destruction. The maximum output current is approximately 20mA independent of the magnitude of V_{CC+} .

Electrical Characteristics

at specified free-air temperature, $V_{CC}=5V$ (unless otherwise noted)

Symbol	Parameter	Test conditions*		Min	Typ	Max	Unit	
V_{IO}	Input offset voltage	$V_{CC} = 5 V$ to $30V$, $V_{IC} = V_{ICR \text{ min}}$, $V_O=1.4 V$	25 °C		2	5	mV	
			Full range			9		
I_{IO}	Input offset current	$V_O = 1.4V$	25 °C		5	50	nA	
			Full range			150		
I_{IB}	Input bias current	$V_O = 1.4V$	25 °C		25	250	nA	
			Full range			400		
V_{ICR}	Common-mode input voltage range**		25 °C	0 to $V_{CC} - 1.5$			V	
			Full range		0 to $V_{CC} - 2.0$			
A_{VD}	Large-signal differential voltage amplification	$V_{CC} = 15 V$, $V_O=1.4V$ to $11.4V$, $R_L \geq 15 k\Omega$ to V_{CC}	25 °C	50	200		V/mV	
I_{OH}	High-level output current	$V_{OH} = 5 V$, $V_{ID}=1V$,	25 °C		0.1	50	nA	
		$V_{OH} = 30V$, $V_{ID}=1V$	Full range			1	μA	
V_{OL}	Low-level output voltage	$I_{OL} = 4 \text{ mA}$, $V_{ID}=-1V$	25 °C		150	400	mV	
			Full range			700		
I_{OL}	Low-level output current	$V_{OL} = 1.5V$, $V_{ID}=-1V$	25 °C	6			mA	
I_{CC}	Supply current	$R_L = \infty$	$V_{CC}=5V$	25 °C		0.8	2	mA
			$V_{CC}=30V$	Full range			2.5	

* Full range (MIN to MAX), for the GS339 is $-40^{\circ}C$ to $85^{\circ}C$. All characteristics are measured with zero common-mode input voltage unless otherwise specified.

* The voltage at either input or common-mode should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC} - 1.5V$, but either or both inputs can go to 30V without damage.

Switching Characteristics

$V_{CC}=5V$, $T_A=25^{\circ}C$

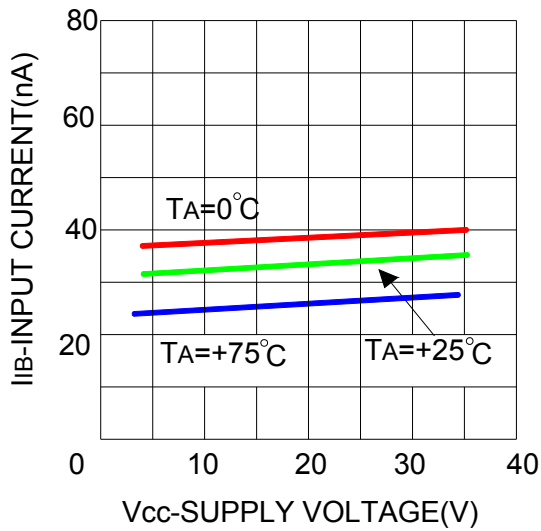
Parameter	Test conditions		Typ	Unit
Response time	R_L connected to 5V through 5.1 k Ω , $C_L=15pF$ (Note 1)	100-mV input step with 5-mV overdrive	1.3	μs
		TTL-level input step	0.3	

Note 1: C_L includes probe and jig capacitance.

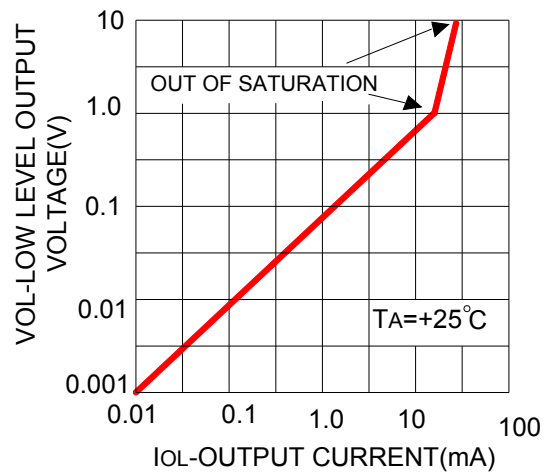
Note 2: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

Typical Performance Characteristics

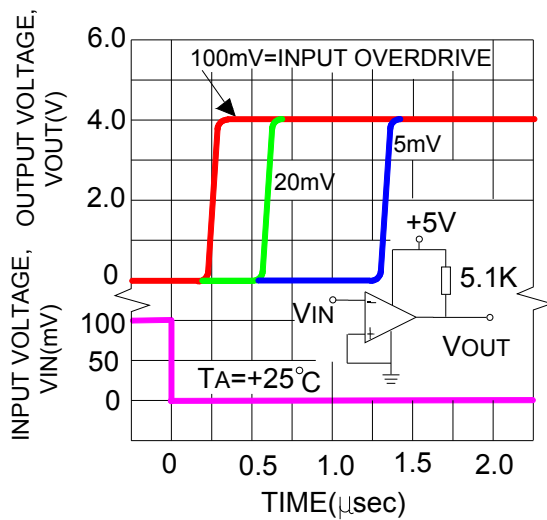
Input Current



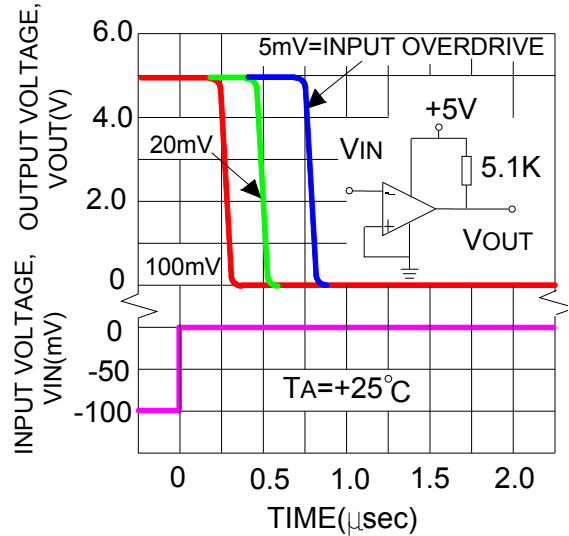
Low Level Output Voltage



Response Time For Various Input Overdrives – Positive Transition



Response Time For Various Input Overdrives – Negative Transition



Typical Applications ($V_{CC}=5V$)

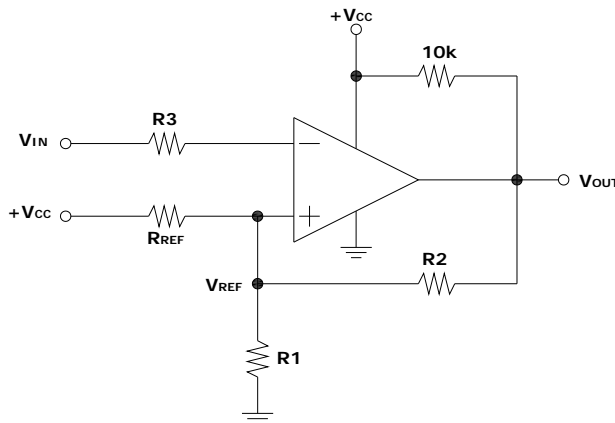
These quad comparators feature high gain, wide bandwidth characteristic. This gives the device oscillation tendencies if the outputs are capacitively coupled to the inputs via stray capacitance.

This oscillation manifests itself during output transitions (V_{OL} to V_{OH}). To alleviate this situation, input resistors $< 10k\Omega$ should be used.

The addition of positive feedback ($< 10mV$) is also recommended. It is good design practice to ground all unused pins.

Differential input voltages may be larger than supply voltage without damaging the comparator's input. Voltage is more negative than $-0.3V$ should not be used.

Inverting Comparator With Hysteresis



$$R2 \gg R_{REF} \parallel R1$$

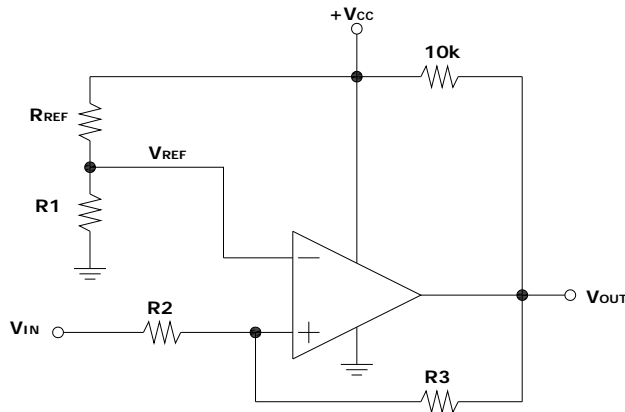
$$R3 \cong R1 \parallel R_{REF} \parallel R2$$

$$V_{REF} \cong V_{CC} \times R1 / (R_{REF} + R1)$$

Amount of Hysteresis

$$V_H = (R1 \parallel R_{REF} / R1 \parallel R_{REF} + R2) \times [V_{OUT(MAX)} - V_{OUT(MIN)}]$$

Non-Inverting Comparator With Hysteresis



$$R2 \cong R_{REF} \parallel R1$$

$$R3 \cong R1 \parallel R_{REF} \parallel R2$$

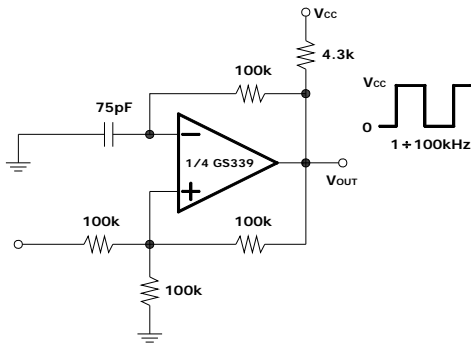
$$V_{REF} \cong V_{CC} \times R1 / (R_{REF} + R1)$$

Amount of Hysteresis

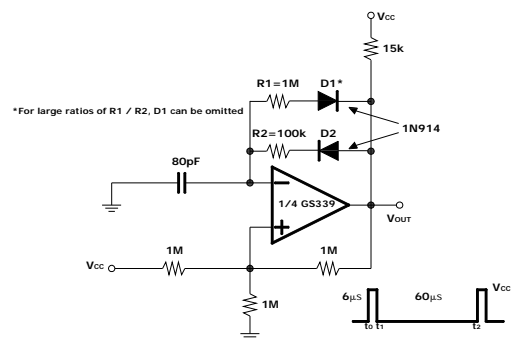
$$V_H = [R2 / (R2 + R3)] \times [V_{OUT(MAX)} - V_{OUT(MIN)}]$$

Typical Application (Continue)

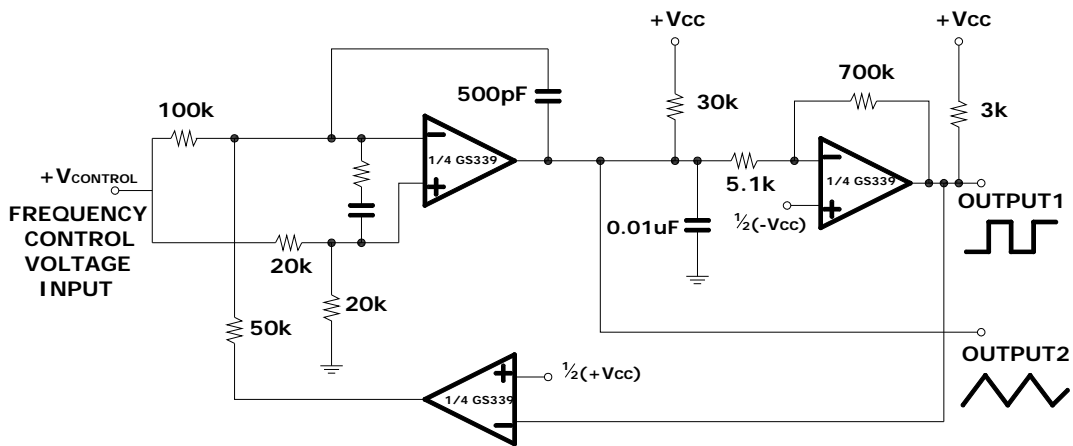
Square-Wave Oscillator



Pulse Generator

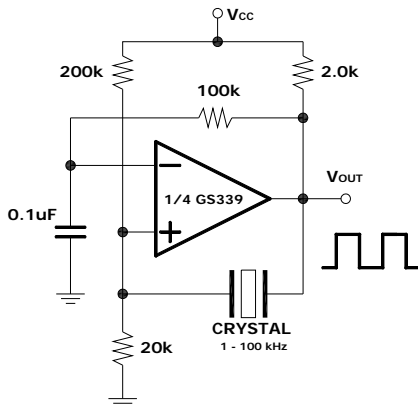


Two-Decade High Frequency Voltage Controlled Oscillator (Vco)

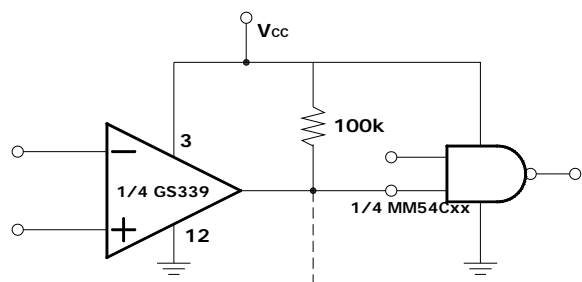


$$+250\text{mV} \leq V_c \leq +50\text{V} ; 700\text{Hz} \leq f_o \leq 100\text{kHz}$$

Crystal Controlled Oscillator

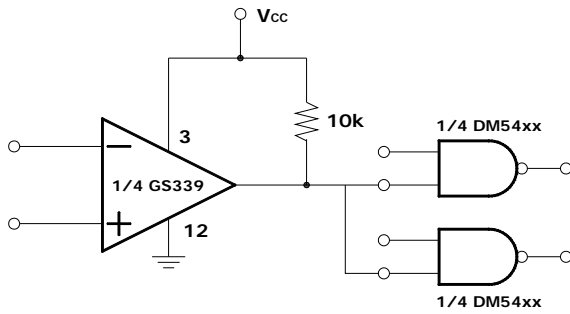


Driving CMOS

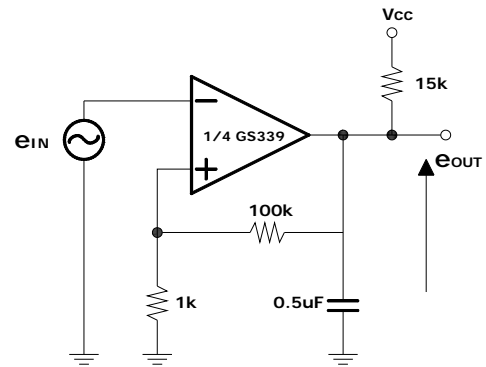


Typical Application (Continue)

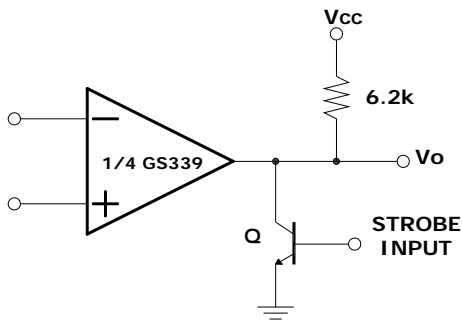
Driving TTL



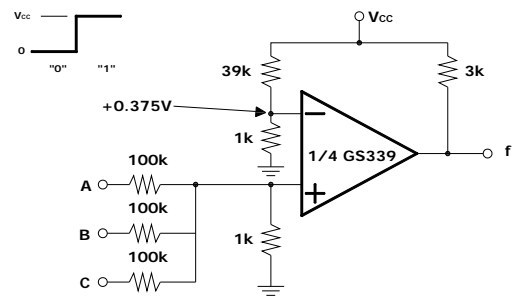
Low Frequency Op Amplifier



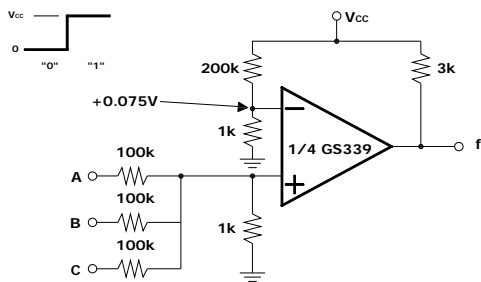
Output Strobing



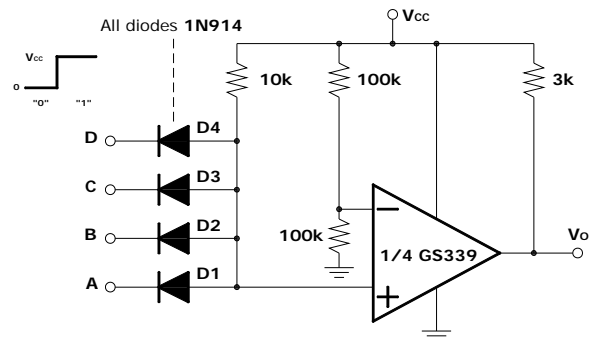
<And> Gate



<Or> Gate

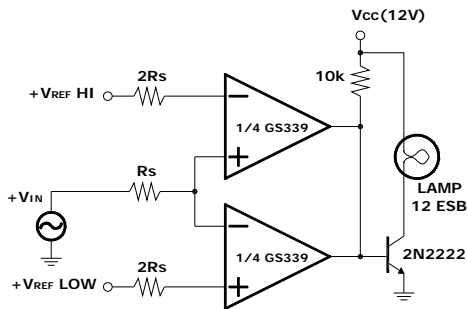


Large Fan-In <And> Gate

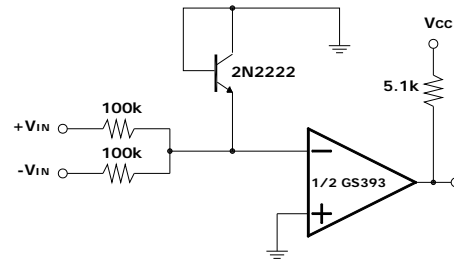


Typical Application(Continue)

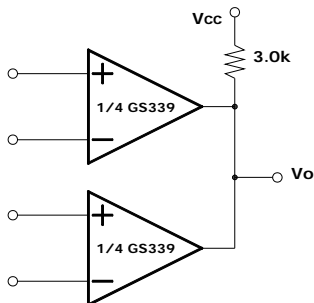
Limit Comparator



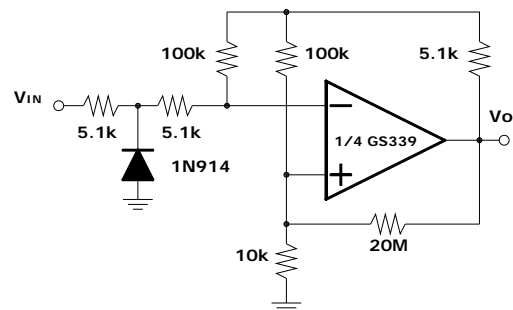
Comparing Input Voltages Of Opposite Polarity



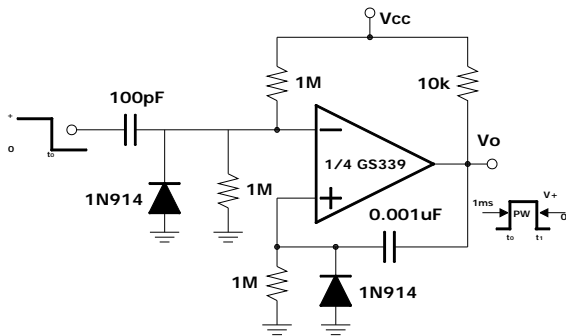
Oring The Outputs



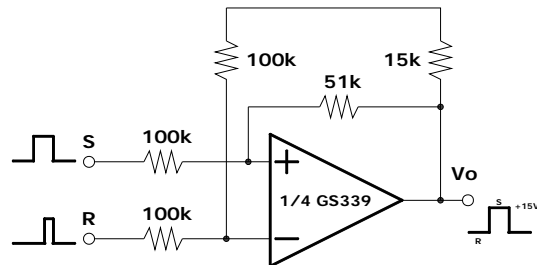
Zero Crossing Detector (Single Power Supply)



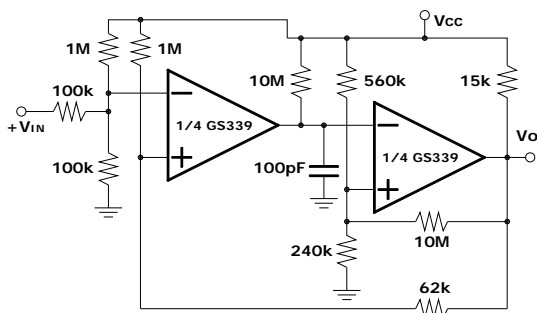
One-Shot Multivibrator



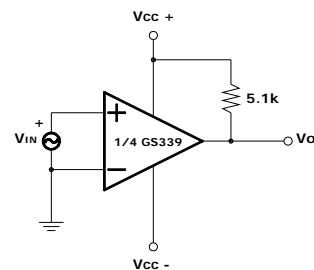
Bi-Stable Multivibrator



One-Shot Multivibrator With Input Lock Out

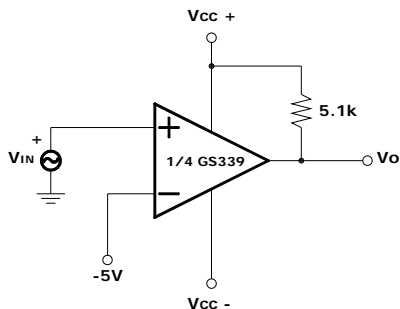


Zero Crossing Detector

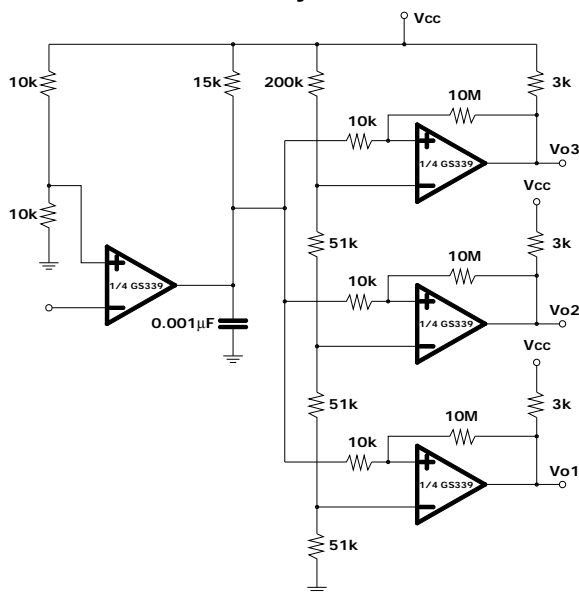


Typical Application (Continue)

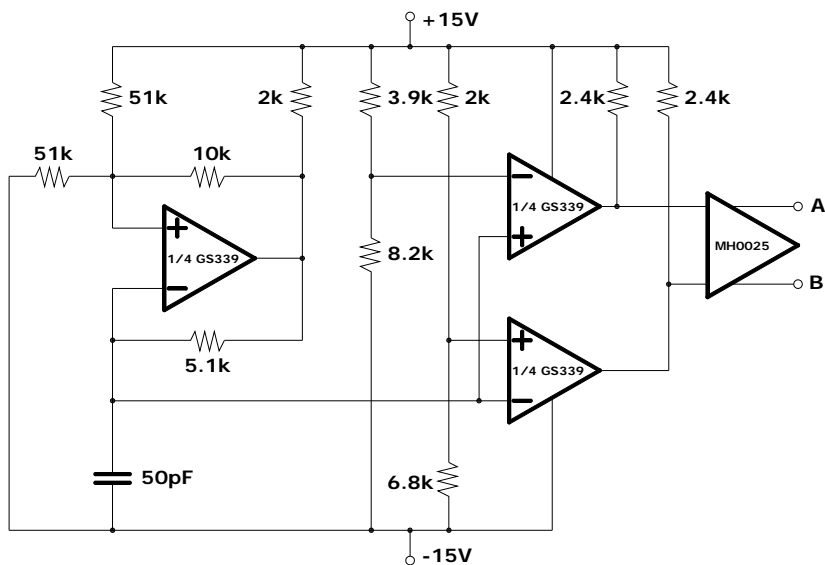
Comparator With A Negative Reference



Time Delay Generator

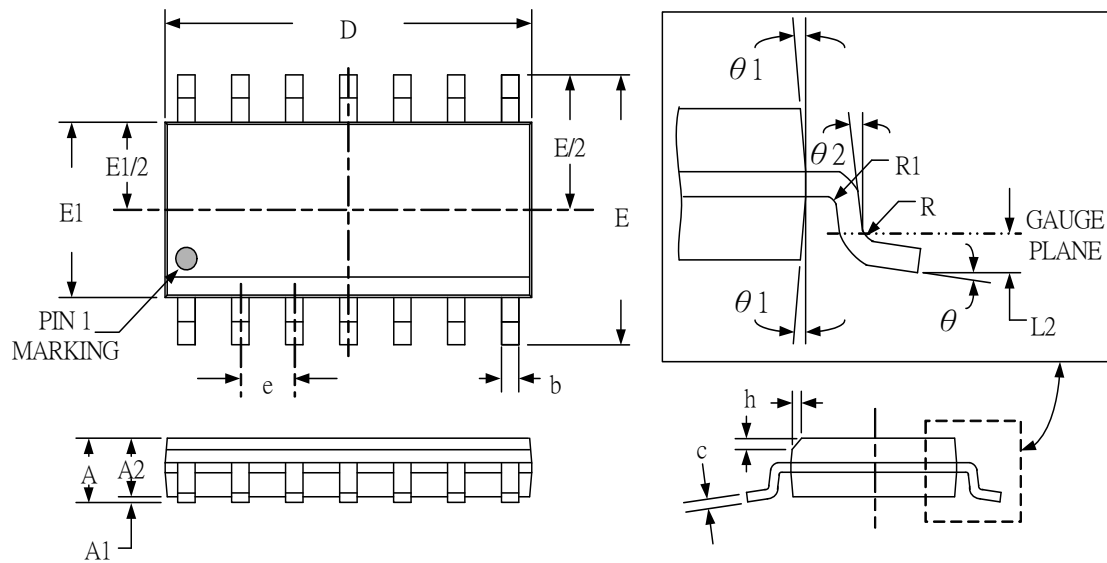


Split-Supply Applications MOS Clock Driver



Package Dimension

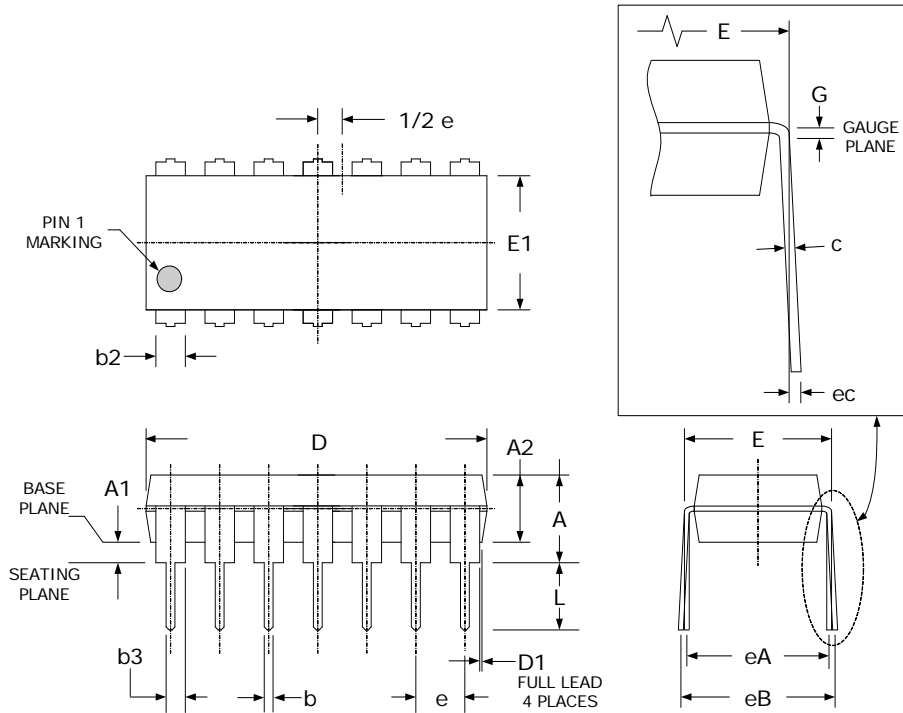
SOP-14 PLASTIC PACKAGE



Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	.053	.069
A1	0.10	0.25	.004	.010
A2	1.25	1.65	.049	.065
b	0.31	0.51	.012	.020
b1	0.28	0.48	.011	.019
c	0.17	0.25	.007	.010
D	8.65 (TYP)		.341 (TYP)	
E	6.00 (TYP)		.236 (TYP)	
E1	3.90 (TYP)		.154 (TYP)	
e	1.27 (TYP)		.050 (TYP)	
L	0.40	1.27	.016	.050
L1	1.04 (TYP)		.041 (TYP)	
L2	0.25 (TYP)		.010 (TYP)	
R	0.07	-	.003	-
R1	0.07	-	.003	-
h	0.25	0.50	.010	.020
θ	0°	8°	0°	8°
θ1	5°	15°	5°	15°
θ2	0°	-	0°	-

DIP-14 PLASTIC PACKAGE







Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	-	5.33	-	.210
A1	0.38	-	.015	-
A2	2.92	4.95	.115	.195
b	0.36	0.56	.014	.022
b2	1.14	1.78	.045	.070
b3	0.76	1.14	.030	.045
c	0.20	0.36	.008	.014
D	18.67	19.69	.735	.775
D1	0.13	-	.005	-
E	7.62	8.26	.300	.325
E1	6.10	7.11	.240	.280
e	2.54 (TYP)		.100 (TYP)	
eA	7.62 (TYP)		.300 (TYP)	
eB	-	10.92	-	.430
eC	0.00	1.52	.000	.060
L	2.92	3.81	.115	.150
G	0.38 (TYP)		.015 (TYP)	



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