GS393

Low Power Low Offset Voltage Dual Comparators

JAN. 2010

Product Description

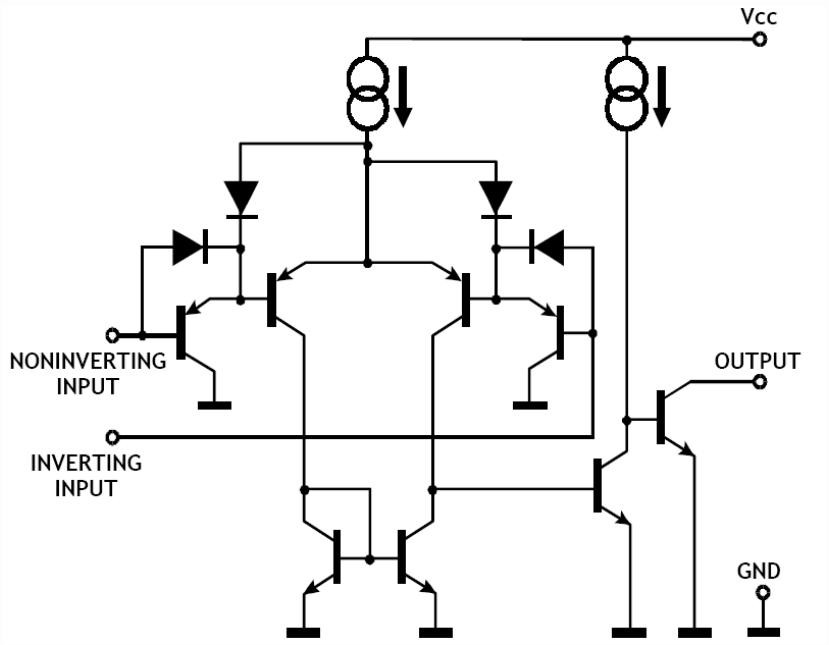
The GS393 consists of two independent precision voltage comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the 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 GS393 was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the GS393 will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

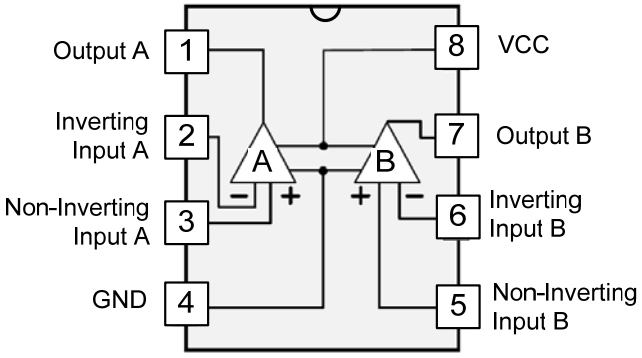
Features

- Wide supply Voltage range: 2.0V to 32V.
- 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: 3 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.

Block Diagram

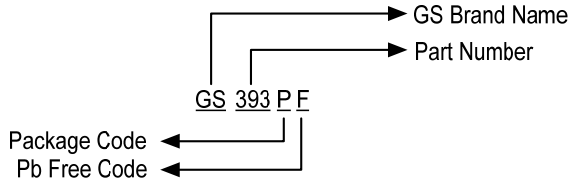


Packages & Pin Assignments

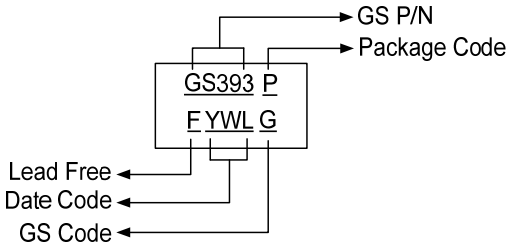


Device	Package
GS393S	SOP-8
GS393P	DIP-8

Ordering & Marking Information



Ordering



Marking

Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage		36	V
V_{IDR}	Differential Input Voltage		36	V
V_{IN}	Input Voltage		-0.3 to +36	V
I_{IN}	Input Current		20	mA
	POWER DISSIPATION (Note 1)			
	Molded DIP		780	mW
	Small Outline Package		510	mW
I_{OS}	Output Short-Circuit to GND		Continuous	
T_A	Operating Temperature Range		0 to 70	°C
T_{STG}	Storage temperature Range		-65 to 150	°C
θ_{JA}	Junction to Ambient Thermal Resistance	DIP-8	110	°C/W
		SOP-8	160	
θ_{JC}	Junction to Case Thermal Resistance	DIP-8	42	°C/W
		SOP-8	22	
ESD	ESD Rating (HBM)		2K	V

Note 1: For operating at high temperatures, the GS393 must be derated based on a 125°C maximum junction temperature and a thermal resistance of 170°C /W which applies for the device soldered in a PCB, operating in a still air ambient. The low bias dissipation and the "ON-OFF" characteristic of the outputs keeps the chip dissipation very small ($P_D \leqq 100mW$), provided the output transistors are allowed to saturate.

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} min, Vo=1.4 V	25 °C		2	5	mV
			Full range			9	
I_{IO}	Input offset current	Vo=1.4 V	25 °C		5	50	nA
			Full range			150	
I_{IB}	Input bias current	Vo=1.4 V	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, Vo=1.4V to 11.4 V, R_L ≥ 15 kΩ toV_{CC}	25 °C	50	200		V/mV
I_{OH}	High-level output current	V_{OH}=5V, 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} = 4mA, 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 = ∞	V_{CC} = 5V, 25 °C		0.8	1	mA
			V_{CC} = 30V, Full range			2.5	

* Full range (MIN to MAX), for the GS393 is 0ºC to 70ºC. 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 °C

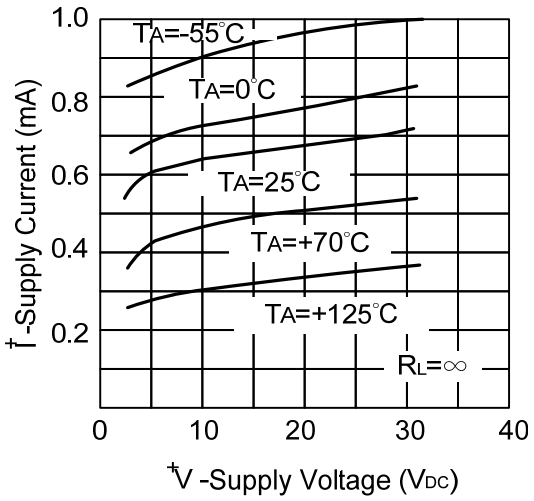
Parameter	Test conditions		Typ	Unit
Response time	R_L connected to 5V through 5.1 kΩ, C_L=15pF* (See Note 1)	100-mV input step with 5-mV overdrive	1.3	µs
		TTL-level input step	0.3	

*C_L includes probe and jig capacitance.

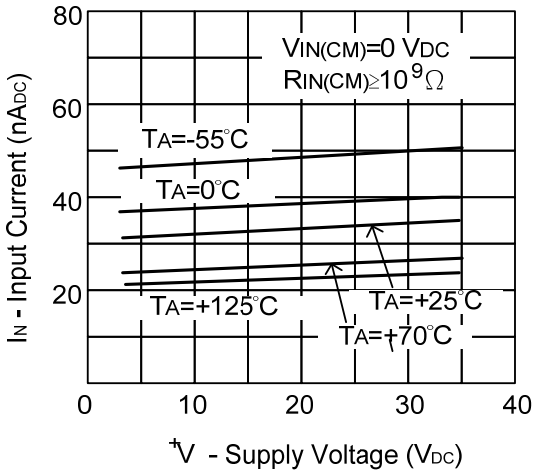
Note 1: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

Typical Performance Characteristics

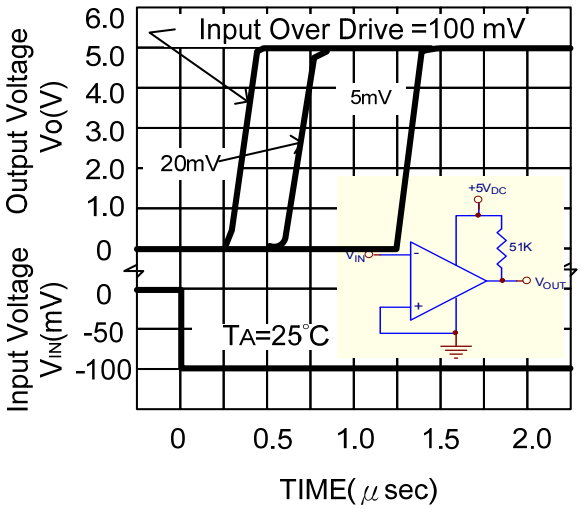
Supply Current



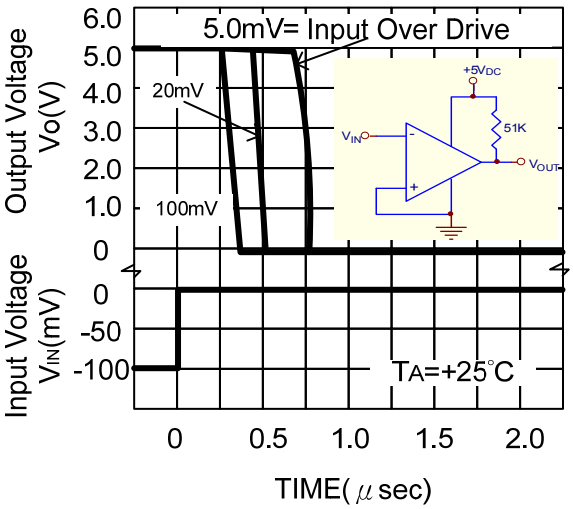
Input Current



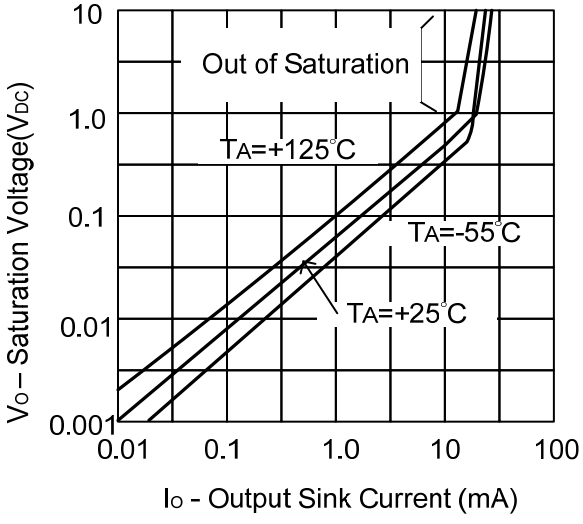
Response Time for Various Input Overdrives–Positive Transition



Response Time for Various Input Overdrives–Negative Transition



Output Saturation Voltage



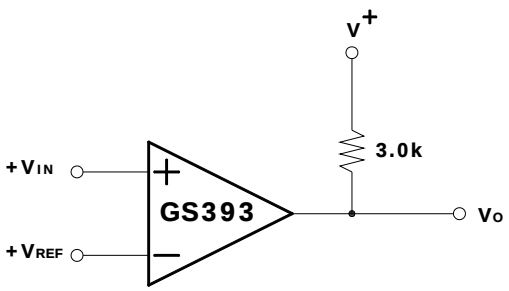
Typical Application (V_{CC}=5V)

The GS393 dual 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＜10kΩ should be used.

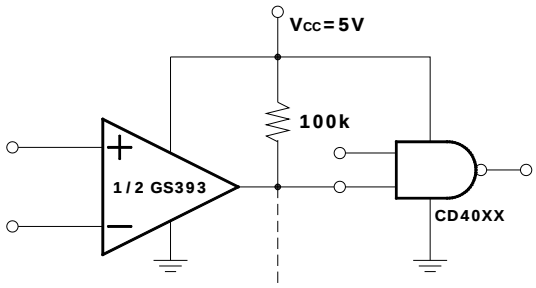
The addition of positive feedback (＜10mV) is also recommended. It is good design practice to ground all unused pins.

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.

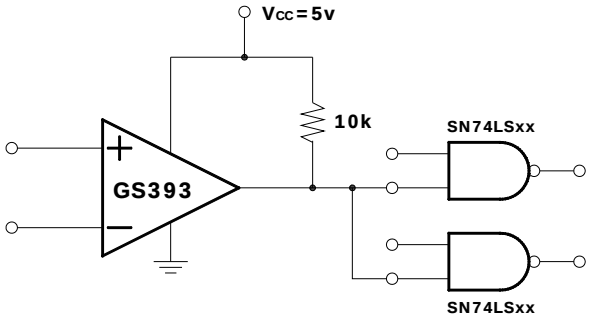
Basic Comparator



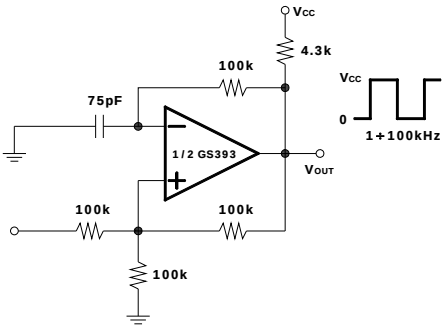
Driving CMOS



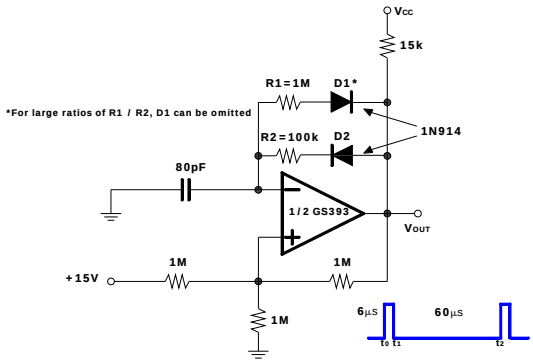
Driving TTL



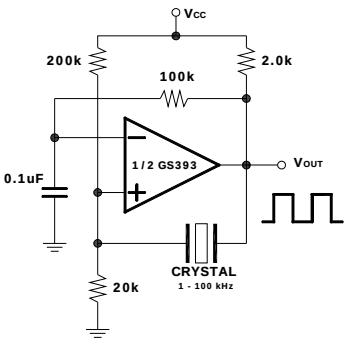
Square-Wave Oscillator



Pulse Generator

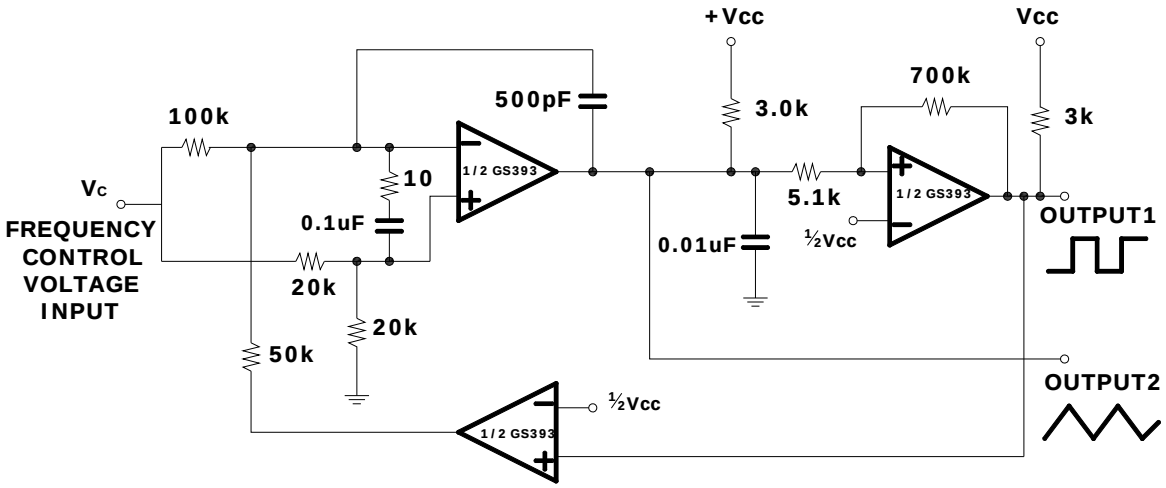


Crystal Controlled Oscillator

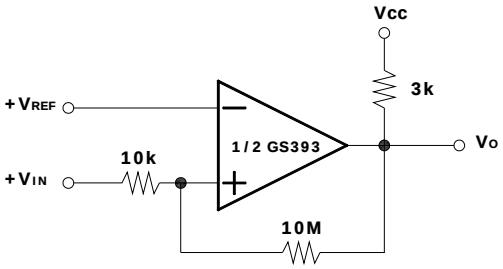


Typical Application (Continue)

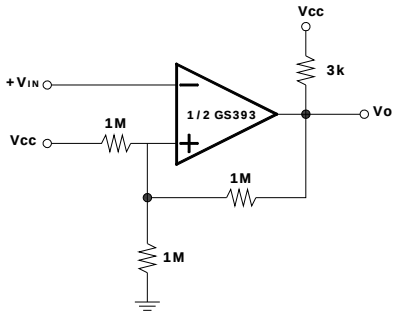
Two-Decade High-Frequency VCO



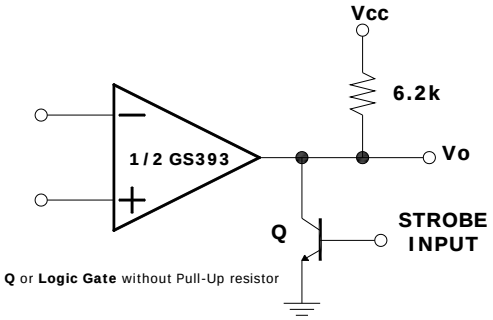
Non-Inverting Comparator with Hysteresis



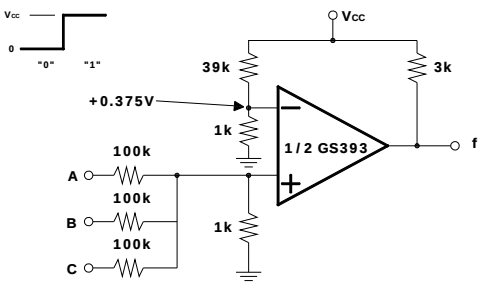
Inverting Comparator with Hysteresis



Output Strobing

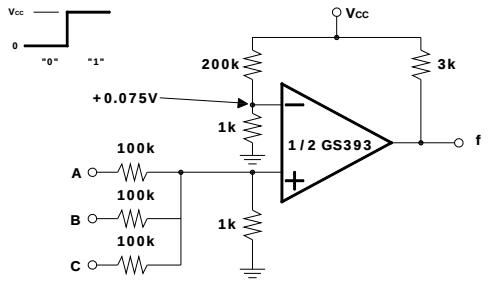


And Gate

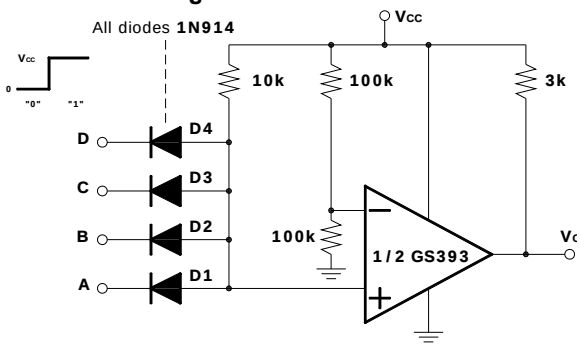


Typical Application (Continue)

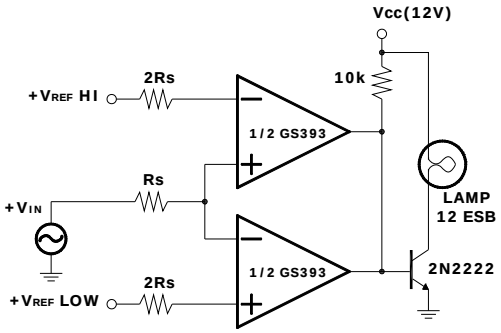
OR Gate



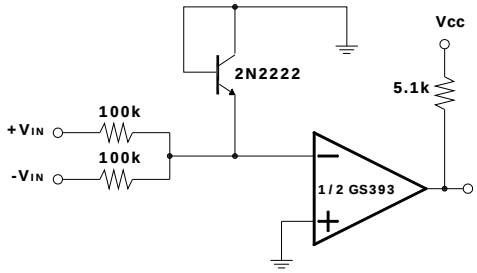
Large Fan-in AND Gate



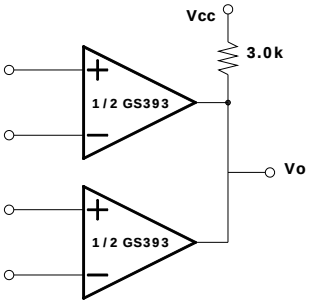
Limit Comparator



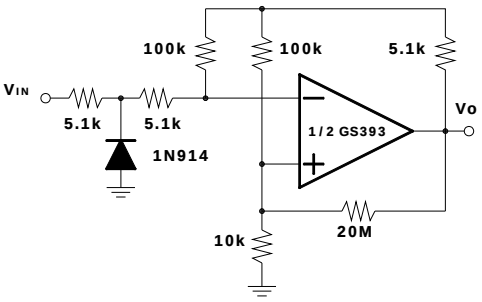
Comparing Input Voltages of Opposite Polarity



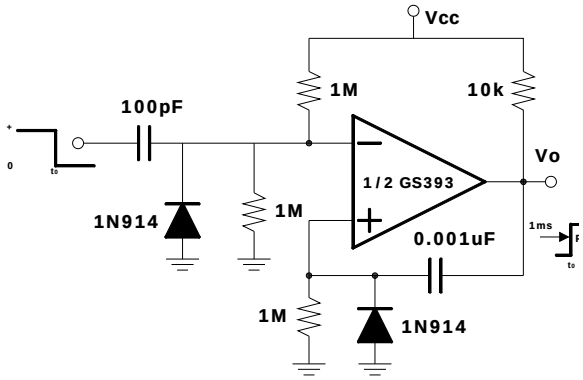
ORing the Outputs



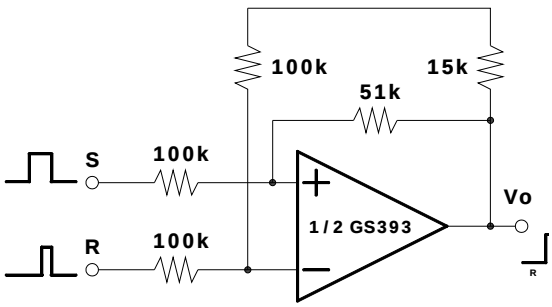
Zero Crossing Detector (Single Power Supply)



One-Shot Multi-vibrator

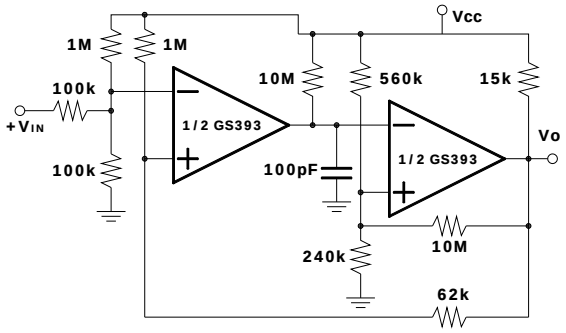


Bi-Stable Multi-vibrator

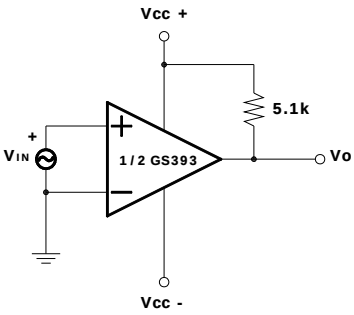


Typical Application (Continue)

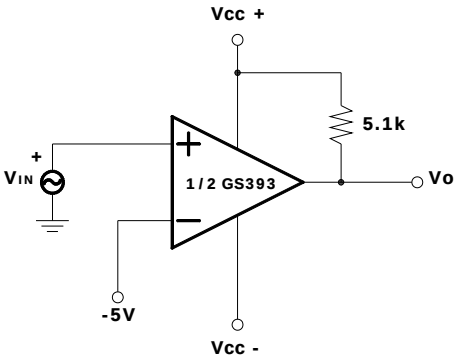
One-Shot Multi-vibrator with Input Lock Out



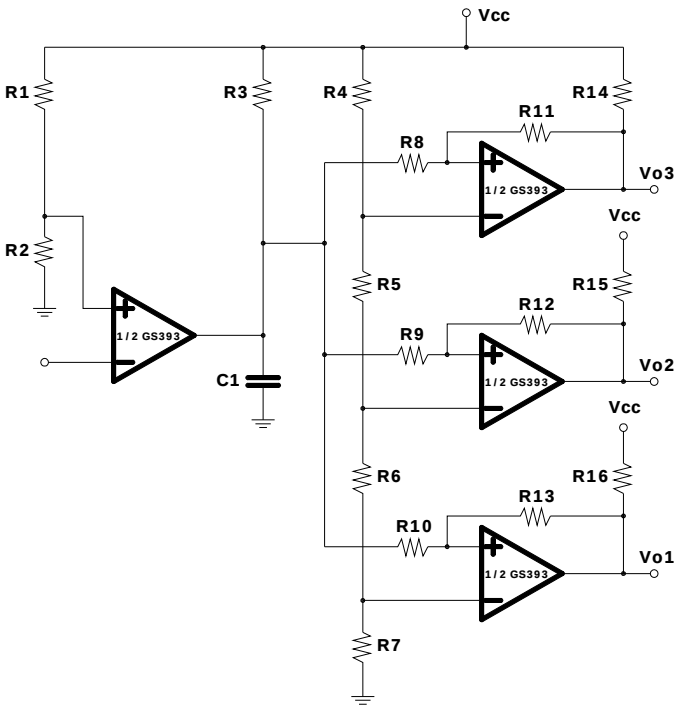
Zero Crossing Detector



Comparator With a Negative Reference



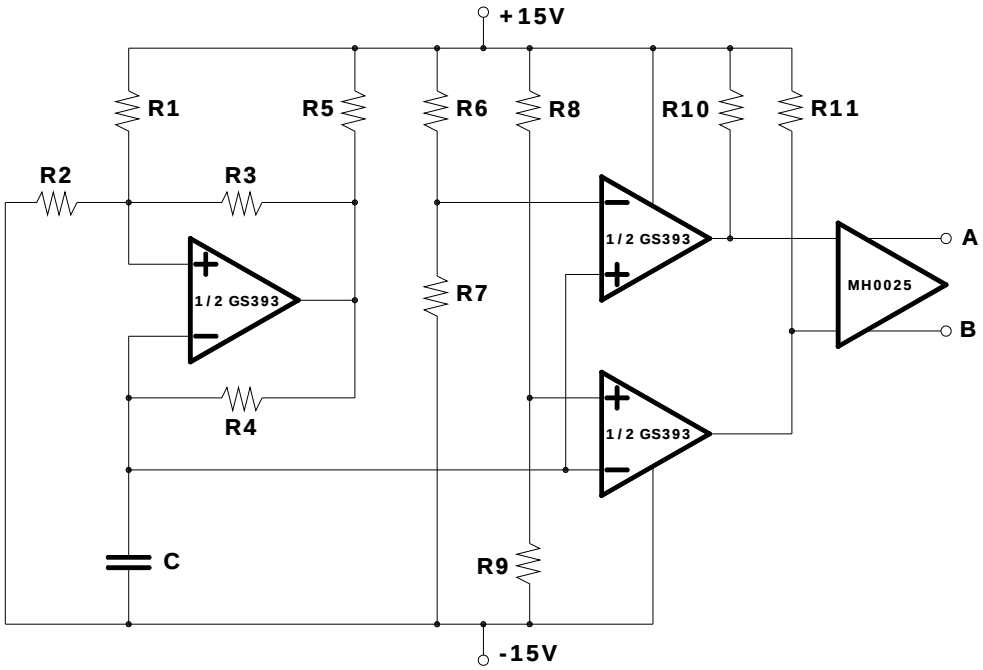
Time Delay Generator



R1=10k，R2=10k，R3=15k，R4=200k，R5=51k，R6=51k，R7=51k，R8=10k，R9=10k
R10=10k，R11=10M，R12=10M，R13=10M，R14=3k，R15=3k，R16=3k，C1=0.001uF

Split-Supply Applications

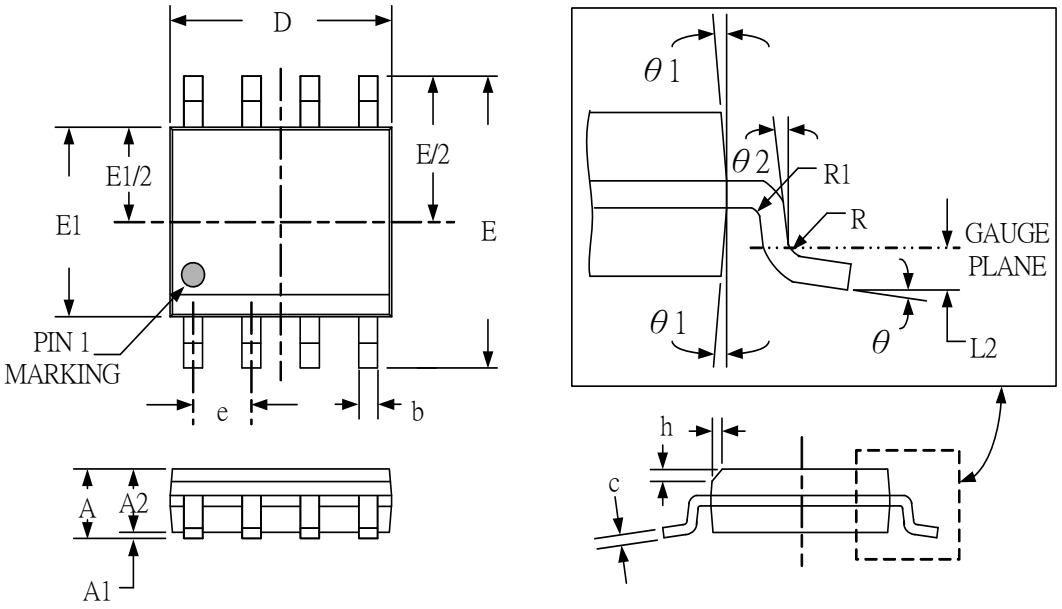
MOS CLOCK DRIVER



R1=51k，R2=51k，R3=10k，R4=5.1k，R5=2k，R6=3.9k
R7=8.2k，R8=2k，R9=6.8k，R10=2.4k，R11=2.4k C=50pF

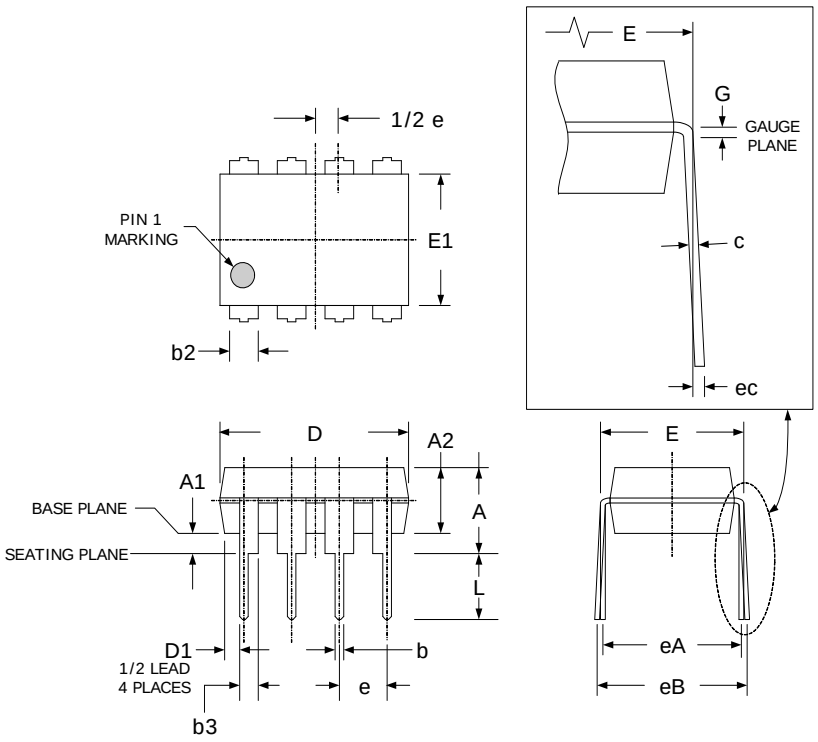
Package Dimension

SOP-8 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	4.90 (TYP)		.193 (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-8 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	9.02	10.16	.355	.400
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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