GS393

Low Power Low Offset Voltage Dual Comparators

Product Description

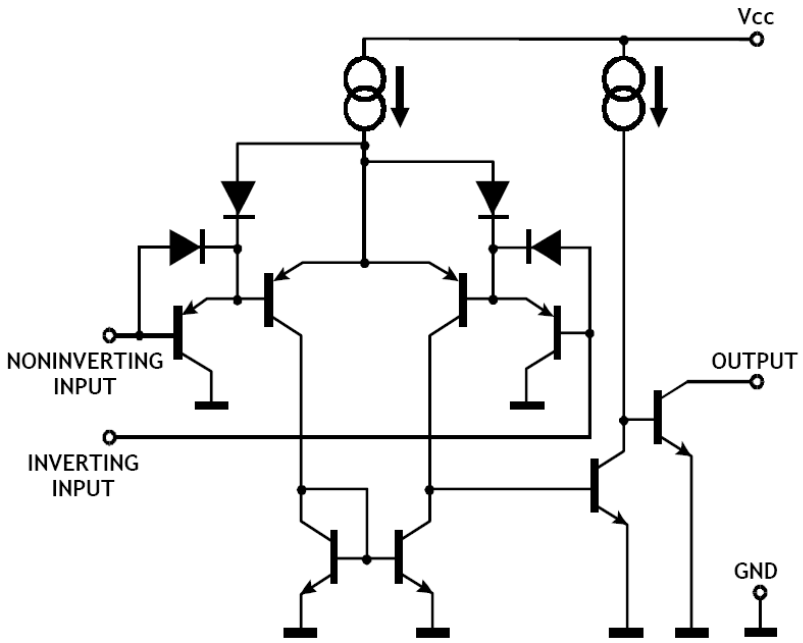
The GS393 consists of two independent precision voltage comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the 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.

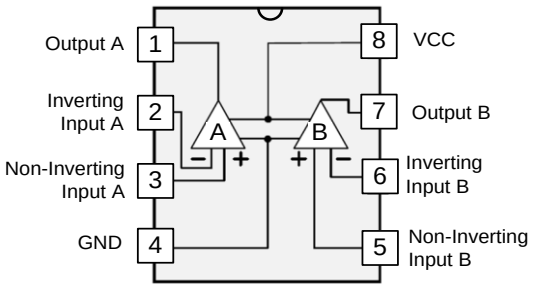
Features

- Wide supply Voltage range: 2.0V to 36V.
- 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.

Block Diagram

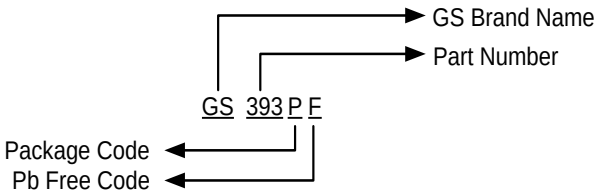


Packages & Pin Assignments

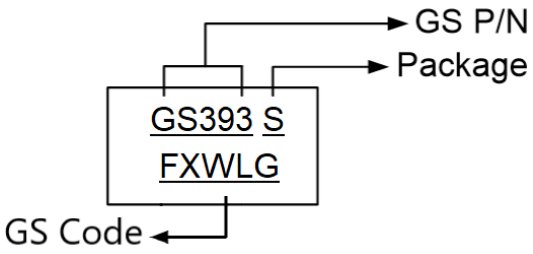


Device	Package	Quantity Reel
GS393SF	SOP-8	4000 PCS
GS393MSF	MSOP-8	4000 PCS
GS393TSSF	TSSOP-8	3000 PCS

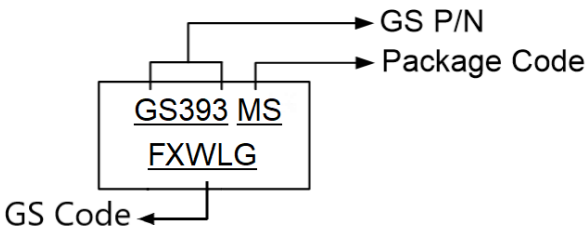
Ordering Information



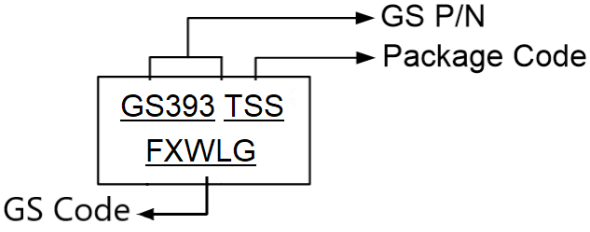
Marking Information



SOP-8 (S Type)



MSOP-8 (MS Type)



TSSOP-8 (TSS Type)

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		-40 to 85	ºC
T_{STG}	Storage temperature Range		-65 to 150	ºC
θ_{JA}	Junction to Ambient Thermal Resistance	SOP-8	160	ºC/W
		MSOP-8	200	
θ_{JC}	Junction to Case Thermal Resistance	SOP-8	22	ºC/W
ESD	ESD Rating (HBM)		2K	V

Note 1: For operating at high temperatures, the GS393 must be derated based on a 125ºC maximum junction temperature and a thermal resistance of 170ºC /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	T_A = 25ºC		2	5	mV
		0 ºC ≤ T_A ≤ 70ºC			9	
I_{IO}	Input offset current	T_A = 25ºC		5	50	nA
		0 ºC ≤ T_A ≤ 70ºC			150	
I_{IB}	Input bias current	T_A = 25ºC		-25	-250	nA
		0 ºC ≤ T_A ≤ 70ºC			-400	
V_{ICR}	Common-mode input voltage range	T_A = 25ºC	0		V_{CC} - 1.5	V
		0 ºC ≤ T_A ≤ 70ºC	0		V_{CC} - 2.0	
G_V	Large-signal differential voltage amplification	V_{CC} = 15 V, R_L ≥ 15 kΩ to V_{CC}	50	200		V/mV
I_{OH}	High-level output current	$V_{IN(+)}$ ≥1.0V , $V_{IN(-)}$= 0V , V_O = 5.0V		0.1	50	nA
		$V_{IN(+)}$ ≥ 1.0V , $V_{IN(-)}$ = 0V , V_O = 30V			1	µA
V_{OL}	Low-level output voltage	$V_{IN(-)}$ ≥ 1.0V, $V_{IN(+)}$ = 0V , I_{SINK} ≤ 4.0mA		130	400	mV
		$V_{IN(-)}$ ≥ 1.0V, $V_{IN(+)}$ = 0V , I_{SINK} ≤ 4.0mA , 0 ºC ≤ T_A ≤ 70ºC			700	
I_{SINK}	Low-level output current	V_{OL}= 1.5V, V_{ID}=1V	6	16		mA
I_{CC}	Supply current	R_L = ∞		0.4	1	mA
		V_{CC} = 30V			2.5	
V_{id}	Differential Input Voltage				V_{CC}^+	V

Switching Characteristics V_{CC}=5V, T_A=25 °C

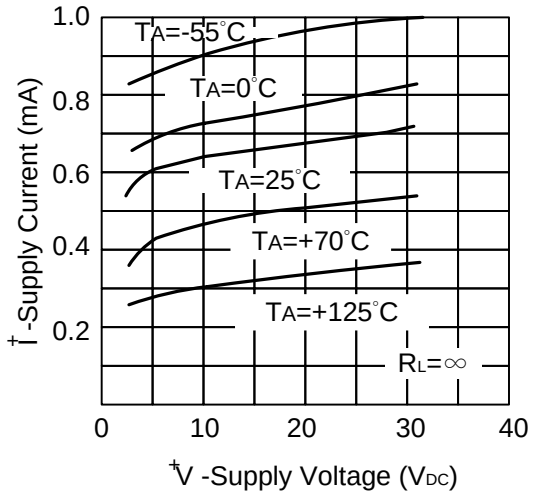
Symbol	Parameter	Typ	Unit
tre	Response time V_{RL} = 5.0V , R_L = 5.1kΩ	1.3	μs
trel	Large Signal Response Time V_{IN} = TTL,V_{REF} = 1.4V	0.3	

*C_L includes probe and jig capacitance.

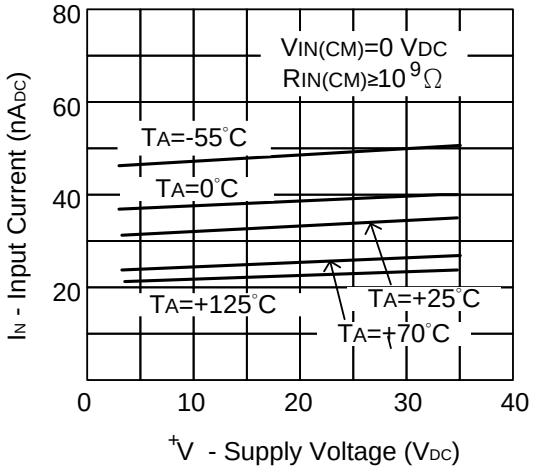
Note 1: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

Typical Performance Characteristics

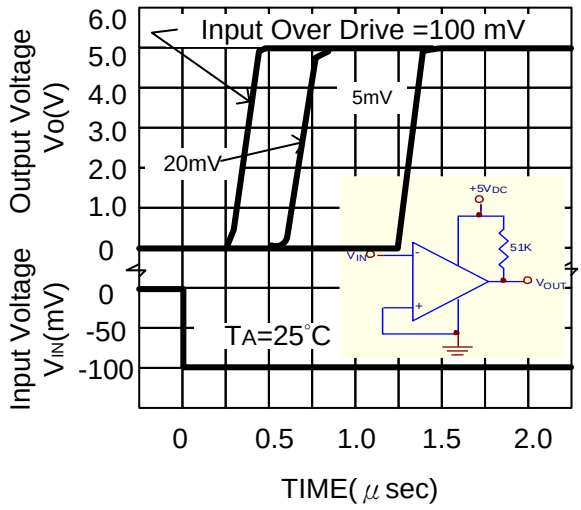
Supply Current



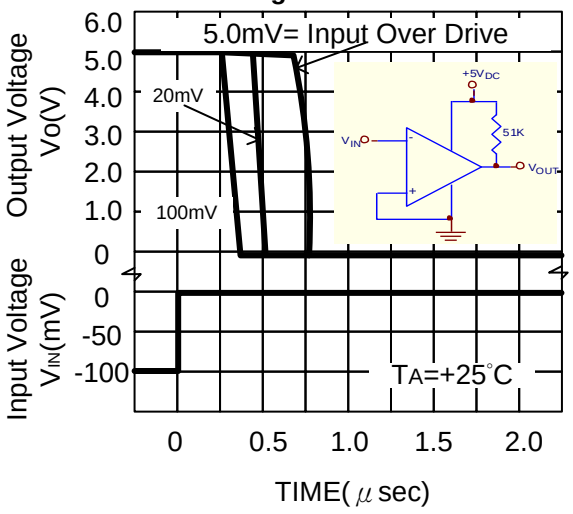
Input Current



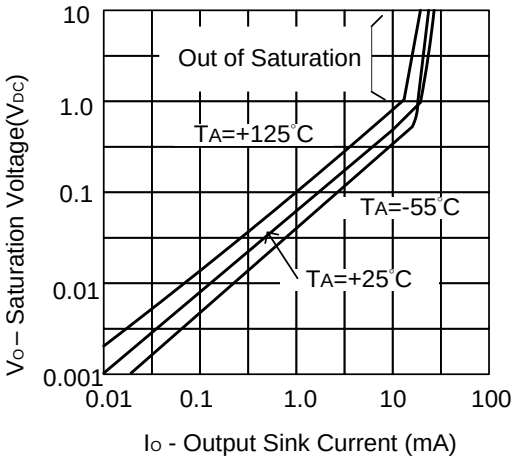
Response Time for Various Input Overdrives–Positive Transition



Response Time for Various Input Overdrives–Negative Transition



Output Saturation Voltage



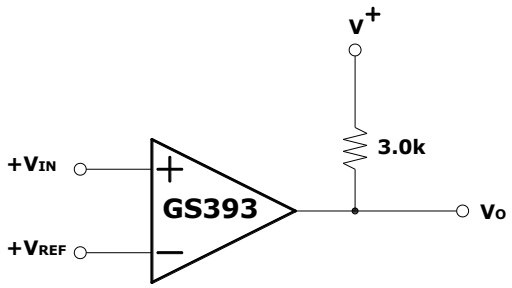
Typical Application (V_{CC}=5V)

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.

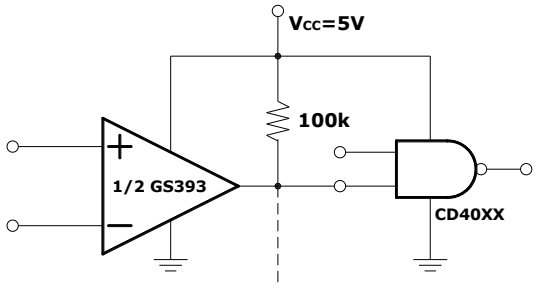
The addition of positive feedback (＜10mV) is also recommended. It is good design practice to ground all unused pins.

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.

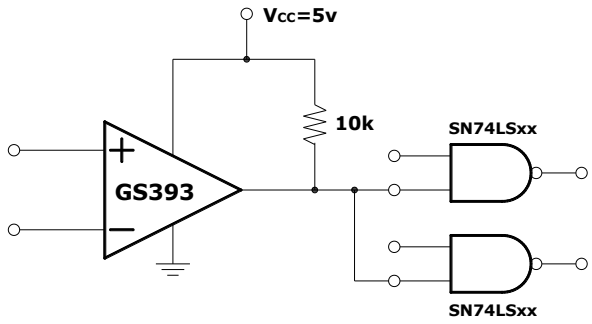
Basic Comparator



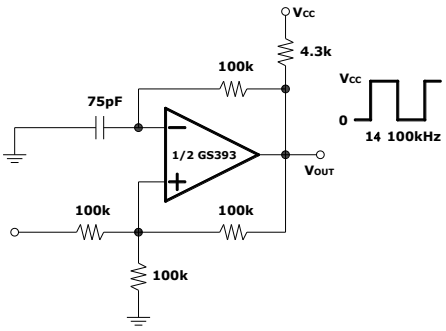
Driving CMOS



Driving TTL

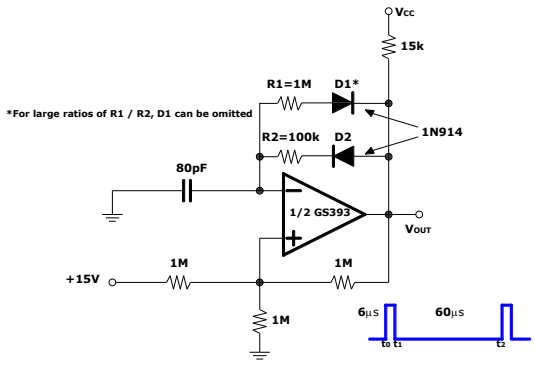


Square-Wave Oscillator

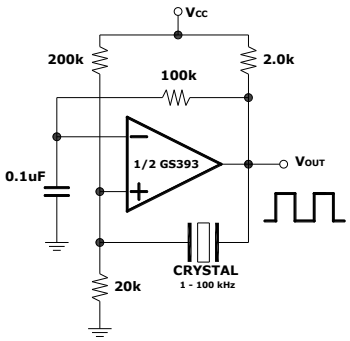


Typical Application (Continue)

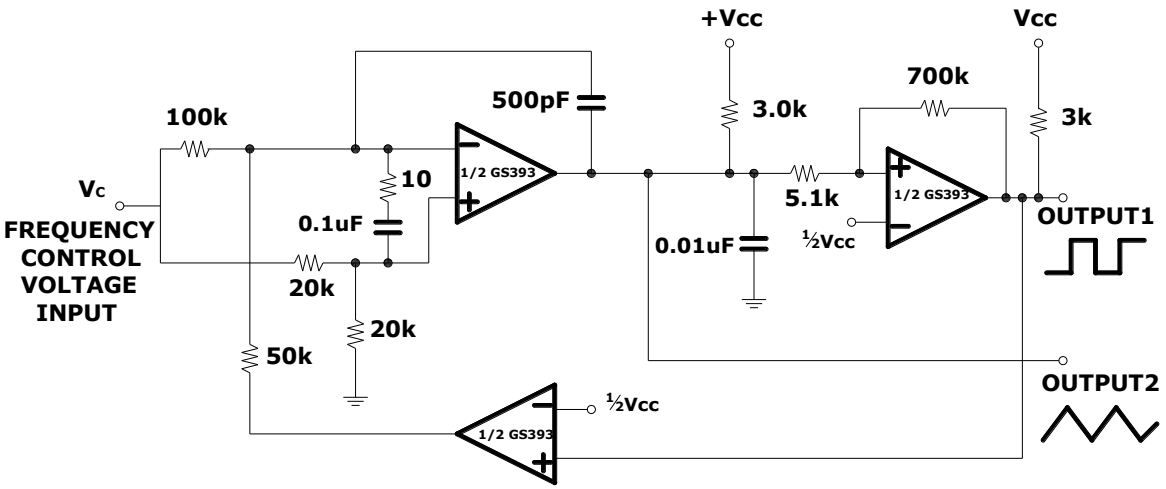
Pulse Generator



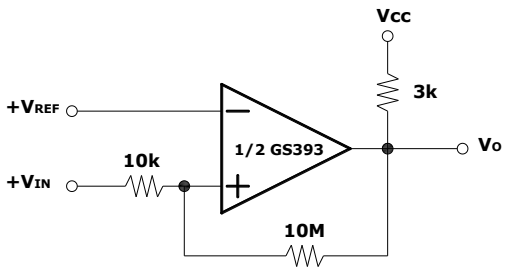
Crystal Controlled Oscillator



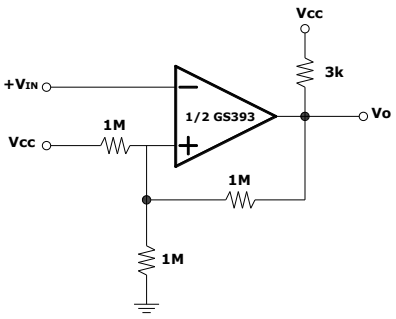
Two-Decade High-Frequency VCO



Non-Inverting Comparator with Hysteresis



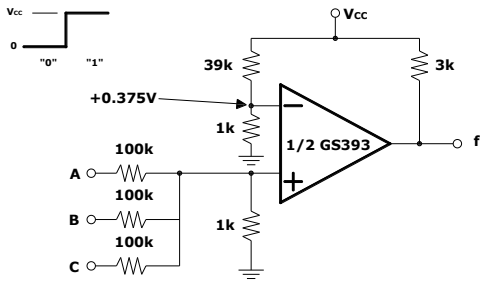
Inverting Comparator with Hysteresis



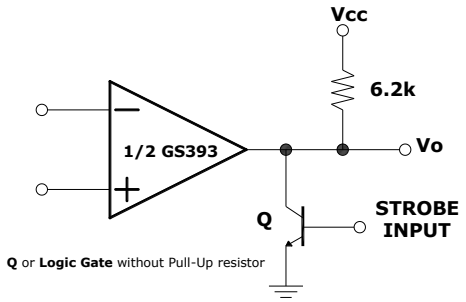
Output Strobing

And Gate

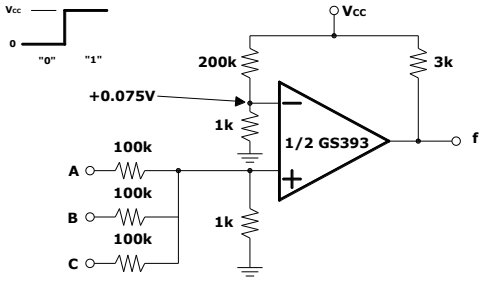
Typical Application (Continue)



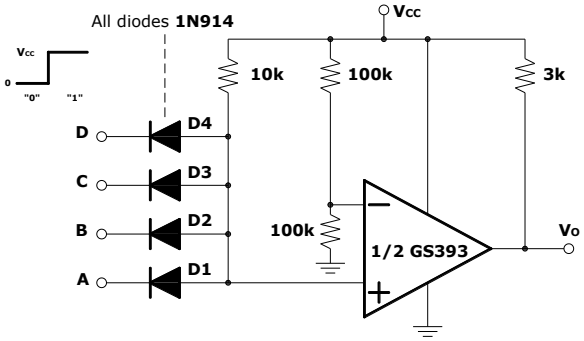
OR Gate



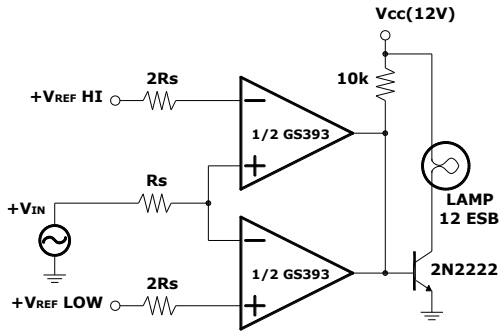
Large Fan-in AND Gate



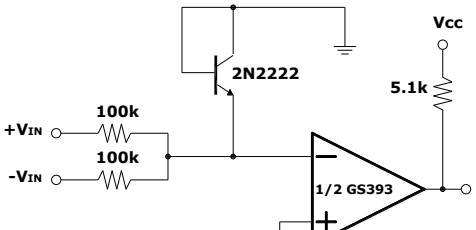
Limit Comparator



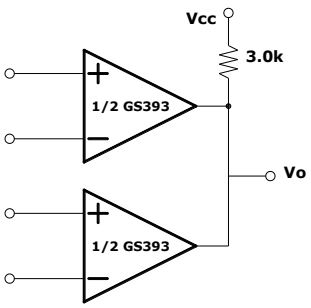
Comparing Input Voltages of Opposite Polarity



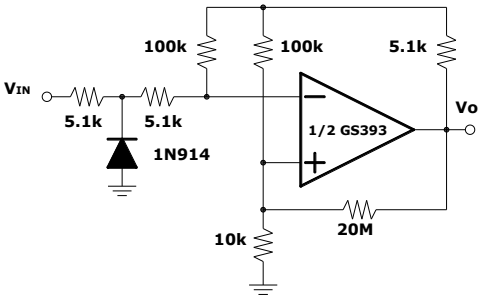
ORing the Outputs



Zero Crossing Detector (Single Power Supply)

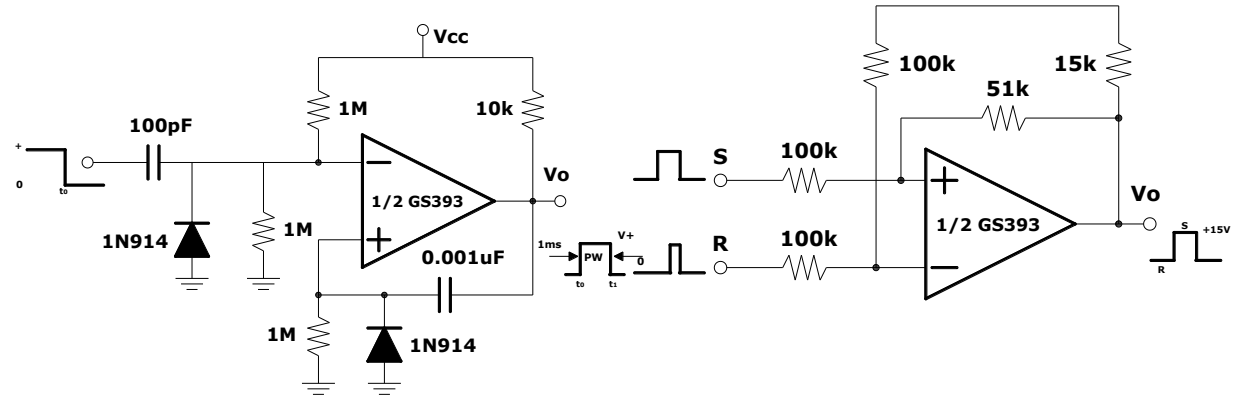


One-Shot Multi-vibrator

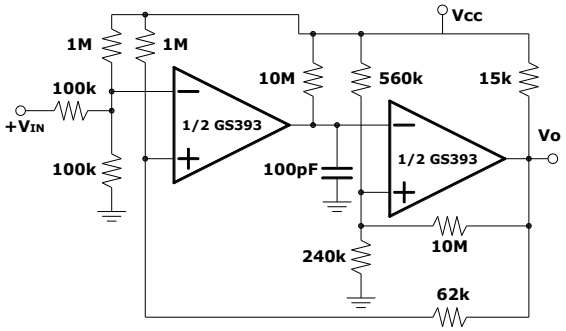


Bi-Stable Multi-vibrator

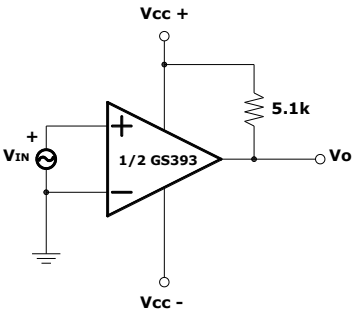
Typical Application (Continue)



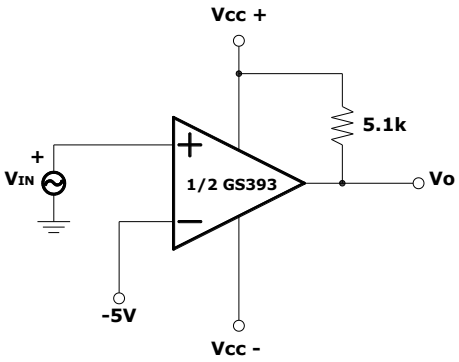
One-Shot Multi-vibrator with Input Lock Out



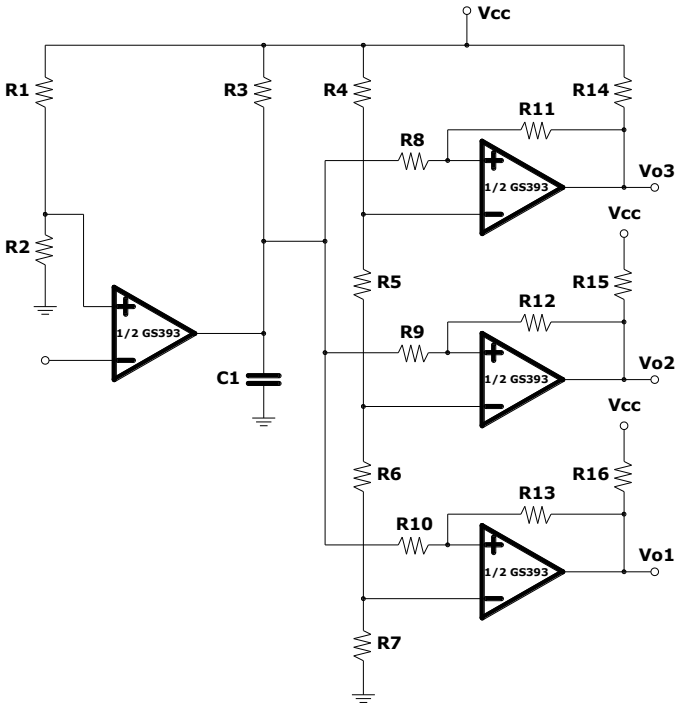
Zero Crossing Detector



Comparator With a Negative Reference



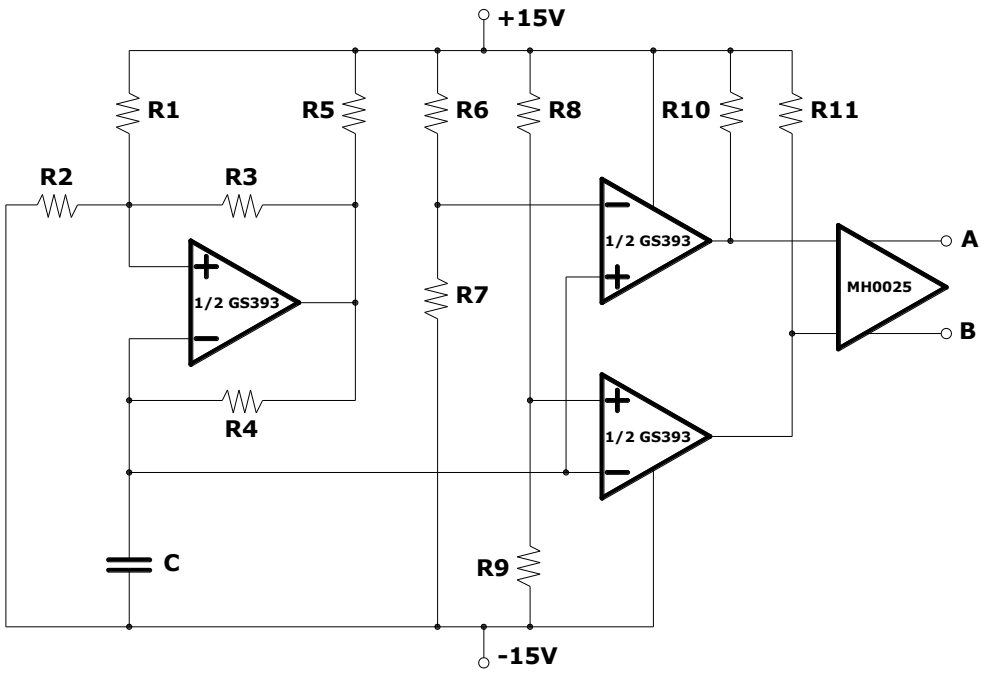
Time Delay Generator



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

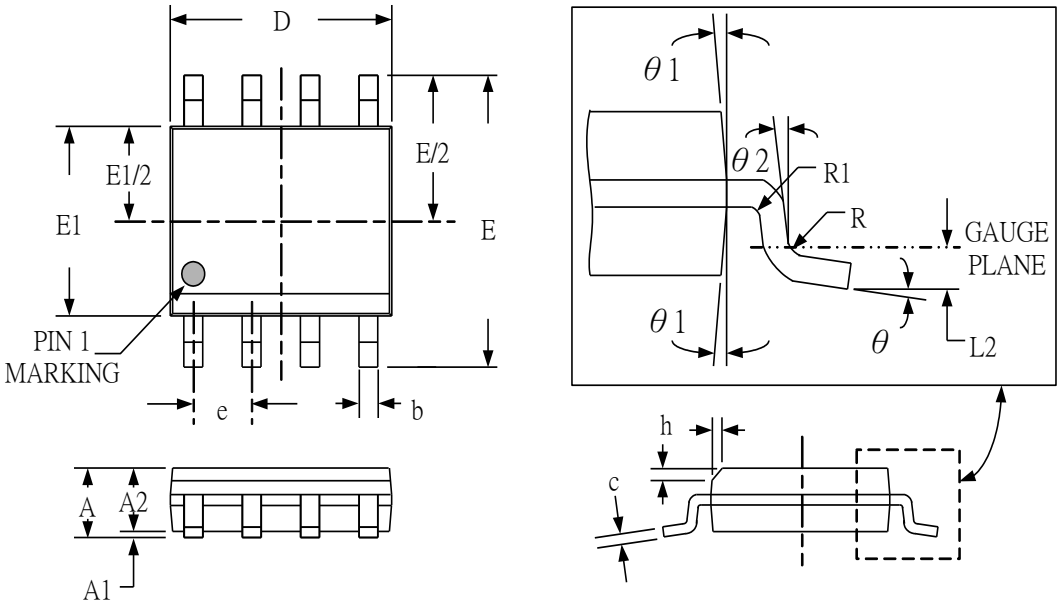
MOS CLOCK DRIVER



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

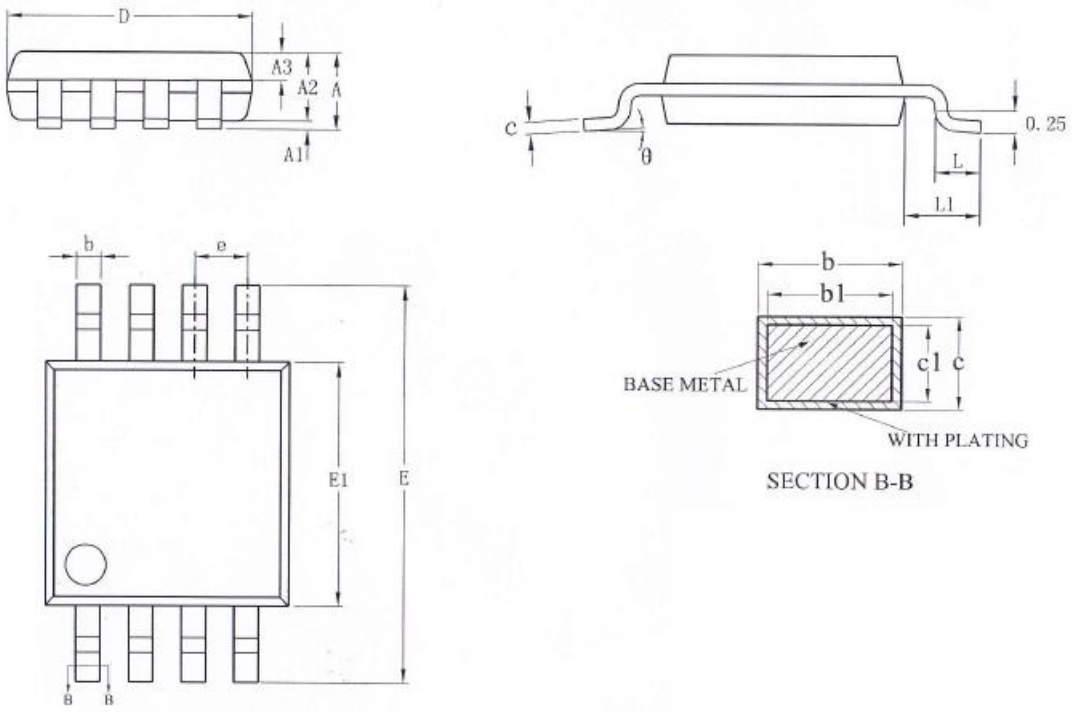
SOP-8



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°	-

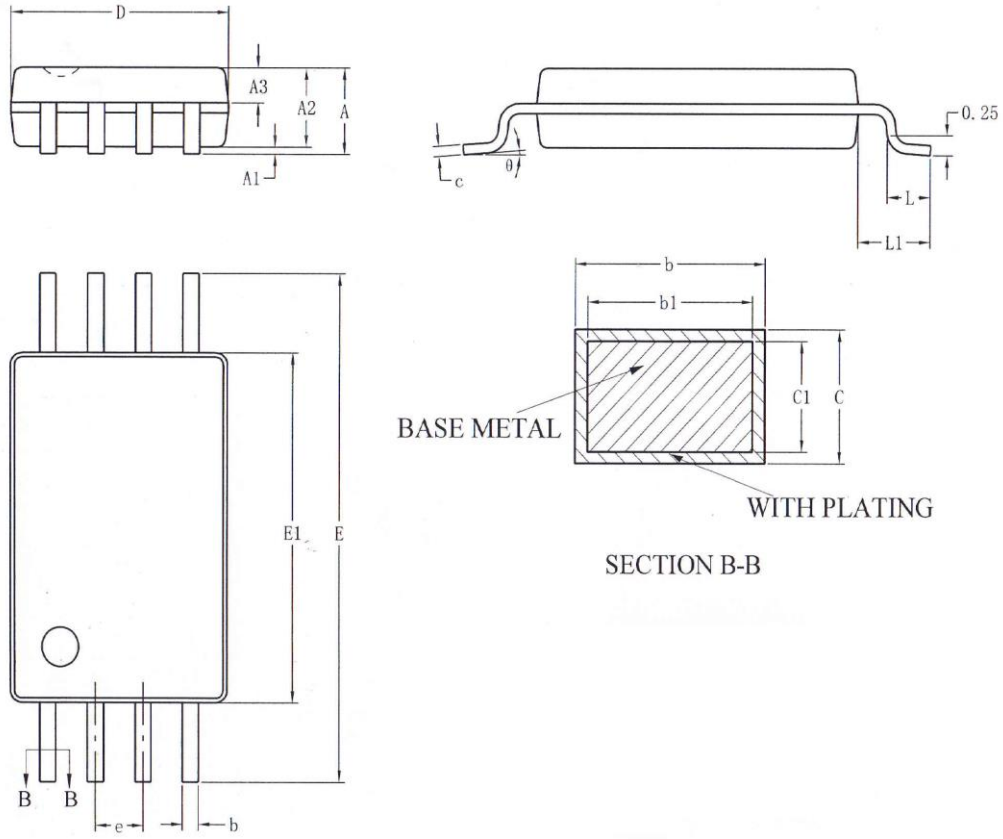
Package Dimension

MSOP-8



Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	-	1.100	-	0.043
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.030	0.037
A3	0.300	0.400	0.012	0.016
b	0.280	0.360	0.011	0.014
b1	0.270	0.330	0.011	0.013
c	0.150	0.190	0.006	0.007
c1	0.140	0.160	0.005	0.006
D	2.900	3.100	0.114	0.122
E	4.700	5.100	0.185	0.201
E1	2.900	3.100	0.114	0.122
e	0.650 (TYP)		0.026 (TYP)	
L	0.40	0.70	0.016	0.028
L1	0.950 (TYP)		0.037 (TYP)	
θ	0°	8°	0°	8°

TSSOP-8



Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	-	1.200	-	0.047
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.035	0.041
A3	0.390	0.490	0.015	0.020
b	0.200	0.280	0.008	0.011
b1	0.190	0.250	0.007	0.010
c	0.130	0.170	0.005	0.007
c1	0.120	0.140	0.005	0.006
D	2.900	3.100	0.114	0.122
E	6.200	6.600	0.244	0.260
E1	4.300	4.500	0.170	0.177
e	0.650 (TYP)		0.026 (TYP)	
L	0.45	0.75	0.018	0.030
L1	1.000 (TYP)		0.039 (TYP)	
θ	0°	8°	0°	8°

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