



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-LM193DT

Low-power, dual-voltage comparators

网址 www.sztdbdt.com 🔍

用芯智造 · 卓越品质

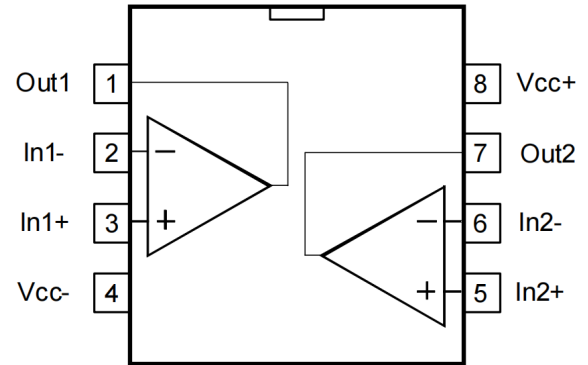
**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



Features

- Wide single-supply voltage range or dual supplies: 2 V to 36 V or ± 1 V to ± 18 V
- Very low supply current (0.45 mA) independent of supply voltage (1mW/ comparator at 5 V)
- Low input bias current: 20 nA typ.
- Low input offset current: ± 3 nA typ.
- Low input offset voltage: ± 1 mV typ.
- Input common-mode voltage range includes ground
- Low output saturation voltage: 80 mV typ. ($I_{\text{sink}} = 4$ mA)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs
- Available in DFN8 2x2, MiniSO8, TSSOP8, and SO8 packages
- LM393W with internal ESD protection: 2 kV HBM



Description

The LM193, LM293, LM393 and LM393W devices consist of two independent low voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible. 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 LM393W offers additional ESD robustness of 2 kV HBM on all pins.



Figure 1. Schematic diagram (LM193, L293, LM393)

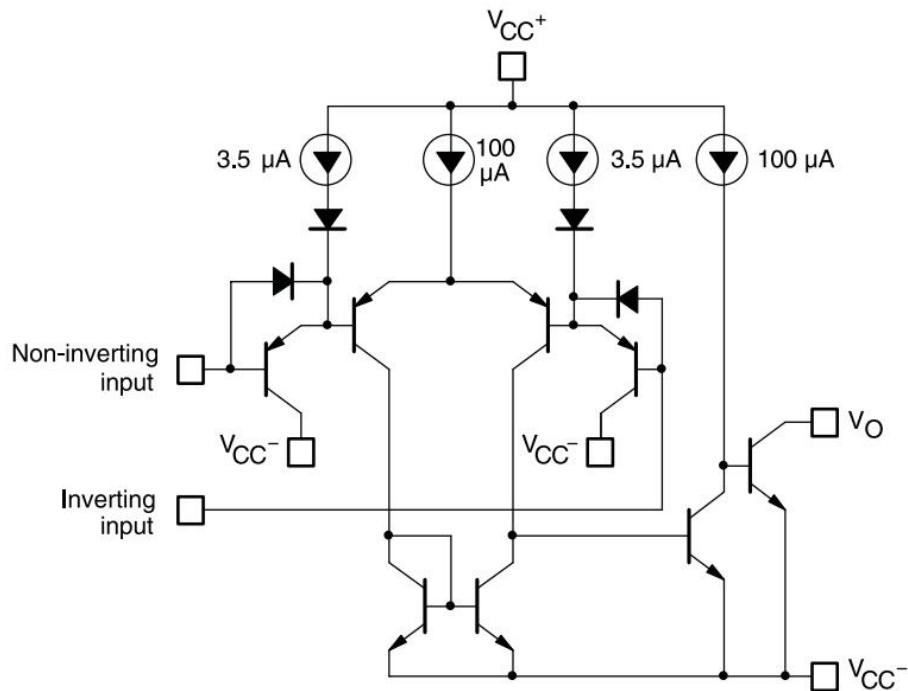
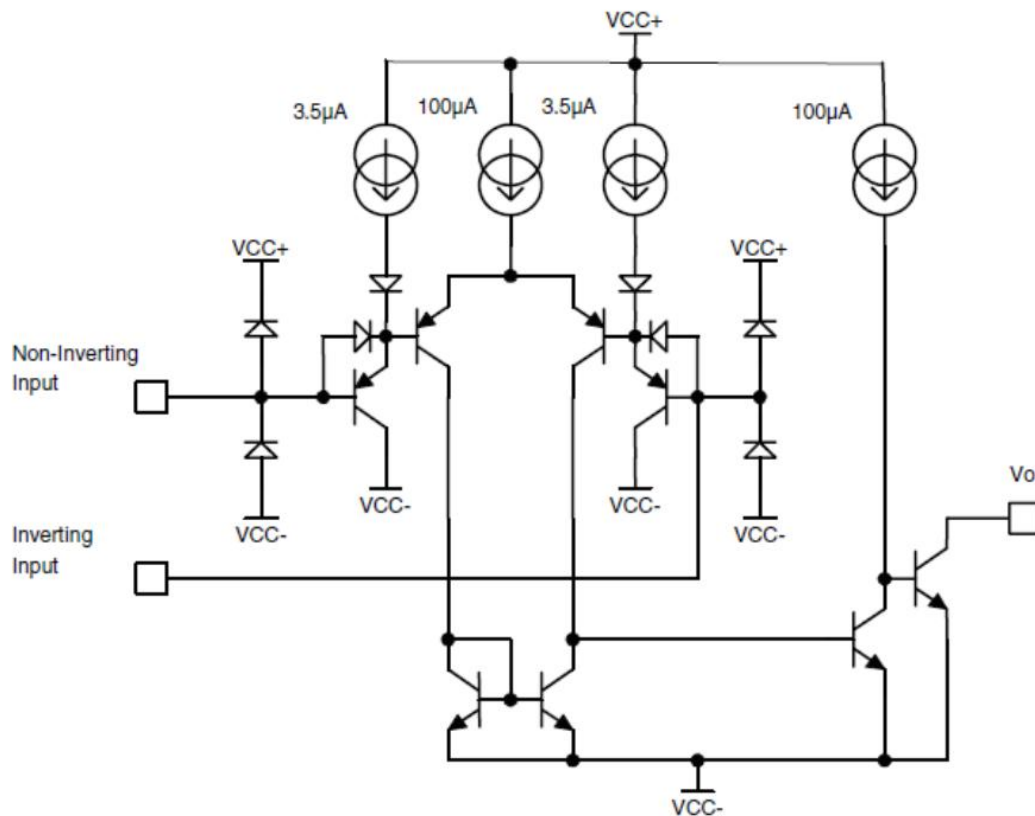


Figure 2. Schematic diagram (LM393W)





3

Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage		± 18 or 36	V
V_{id}	Differential input voltage LM193, LM293, LM393 LM393W		± 36 $V_{CC-} - 0.3$ to $V_{CC+} + 0.3$	
V_{in}	Input voltage LM193, LM293, LM393 LM393W		-0.3 to 36 $V_{CC-} - 0.3$ to $V_{CC+} + 0.3$	
	Output short-circuit to ground ⁽¹⁾		Infinite	
R_{thja}	Thermal resistance junction to ambient ⁽²⁾	DFN8 2x2	57	°C/W
		MiniSO8	190	
		TSSOP8	120	
		SO8	125	
R_{thjc}	Thermal resistance junction to case ⁽²⁾	DFN8 2x2	—	
		MiniSO8	39	
		TSSOP8	37	
		SO8	40	
T_j	Maximum junction temperature		150	°C
T_{stg}	Storage temperature range		-65 to 150	
ESD class ⁽³⁾ LM193, LM293, LM393	HBM: human body model ⁽⁴⁾		H1B	
	MM: machine model ⁽⁵⁾		M2	
	CDM: charged device model ⁽⁶⁾		C5	
ESD class LM393W	HMB: human body model ⁽⁷⁾		2000	V
	MM: machine model		200	
	CDM: charged device mode ⁽⁸⁾		1500	

1. Short-circuits from the output to V_{CC+} can cause excessive heating and potential destruction. The maximum output current is approximately 20 mA independent of the magnitude of V_{CC+} .
2. Short-circuits can cause excessive heating and destructive dissipation. Values are typical.
3. ESD class definition from AEC-Q100:
4. HBM class H1B: ESD voltage level from 500 V to 1000 V
5. MM class M2: ESD voltage level from 100 V to 200 V
6. CDM class C5: ESD voltage level greater than 1500 V.
7. JEDEC JESD22-A114F
8. JEDEC JESD22-101F



Table 2. Operating conditions

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage (V_{CC}^{+}) - (V_{CC}^{-})		2 to 36	V
V_{icm}	Common mode input voltage range ($V_{CC}^{+} = 30\text{ V}$)	$T_{amb} = 25\text{ }^{\circ}\text{C}$	0 to (V_{CC}^{+}) - 1.5	
		$T_{min} \leq T_{amb} \leq T_{max}$	0 to (V_{CC}^{+}) - 2	
T_{oper}	Operating free-air temperature range	LM193	-55 to 125	$^{\circ}\text{C}$
		LM293, LM293A	-40 to 105	
		LM393, LM393A, LM393W	0 to 70	



4 Electrical characteristics

Table 3. $V_{CC+} = 5\text{ V}$, $V_{CC-} = 0\text{ V}$, $T_{amb} = 25\text{ }^{\circ}\text{C}$ (unless otherwise specified)

Symbol	Parameter	Condition	LM293A, LM393A			LM193, LM293, LM393, LM393W			Unit
			Min.	Typ.	Max.	Min	Typ.	Max.	
V_{io}	Input offset voltage ⁽¹⁾			1	2		1	5	mV
		$T_{min} \leq T_{amb} \leq T_{max}$			4			9	
I_{io}	Input offset current			3	25		3	50	nA
		$T_{min} \leq T_{amb} \leq T_{max}$			100			150	
I_{ib}	Input bias current (I^+ or I^-) ⁽²⁾			20	100		20	250	
		$T_{min} \leq T_{amb} \leq T_{max}$			300			400	
A_{vd}	Large signal voltage gain	$V_{CC} = 15\text{ V}$, $R_L = 15\text{ k}\Omega$, $V_o = 1\text{ V}$ to 11 V	50	200		50	200		V/mV
I_{CC}	Supply current (all comparators)	$V_{CC} = 5\text{ V}$, no load		0.45	1		0.45	1	mA
		$V_{CC} = 30\text{ V}$, no load		0.6	2.5		0.6	2.5	
V_{id}	Differential input voltage ⁽³⁾				V_{CC+}			V_{CC+}	
V_{OL}	Low-level output voltage	$V_{id} = -1\text{ V}$, $I_{sink} = 4\text{ mA}$		80	400		80	400	mV
		$T_{min} \leq T_{amb} \leq T_{max}$			700			700	
I_{OH}	High-level output current	$V_{CC} = V_o = 30\text{ V}$, $V_{id} = 1\text{ V}$		0.1			0.1		nA
		$T_{min} \leq T_{amb} \leq T_{max}$			1			1	μA
I_{sink}	Output sink current	$V_{id} = 1\text{ V}$, $V_o = 1.5\text{ V}$	6	18		6	18		mA
t_{re}	Response time ⁽⁴⁾	$R_L = 5.1\text{ k}\Omega$ connected to V_{CC+}		1.3			1.3		μs
t_{rel}	Large signal response time	$R_L = 5.1\text{ k}\Omega$ connected to V_{CC+} , $e_l = \text{TTL}$, $V_{(ref)} = 1.4\text{ V}$		300			300		ns

1. At output switch point, $V_o = 1.4\text{ V}$, $R_s = 0$ with V_{CC+} from 5 V to 30 V , and over the full common-mode range (0 V to $(V_{CC+}) - 1.5\text{ V}$).
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 charge exists on the reference of input lines.
3. 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 (or 0.3 V below the negative power supply, if used).
4. The response time specified is for a 100 mV input step with 5 mV overdrive. For larger overdrive signals, 300 ns can be obtained.



6

Typical applications

Figure 9. Basic comparator

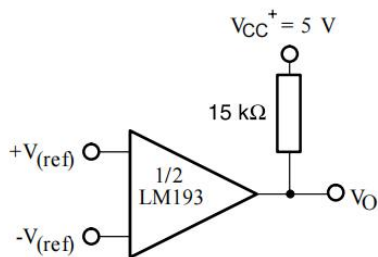


Figure 10. Driving TTL

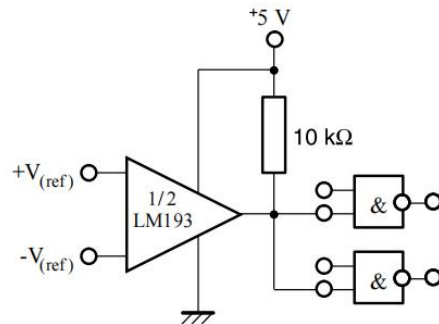


Figure 11. Low-frequency op amp (1)

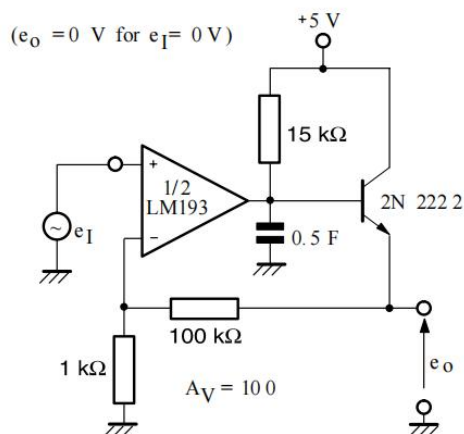


Figure 12. Driving CMOS

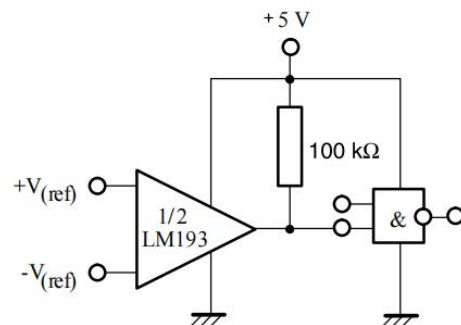


Figure 13. Low-frequency op amp (2)

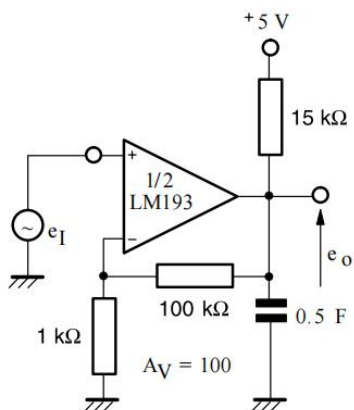


Figure 14. Transducer amplifier

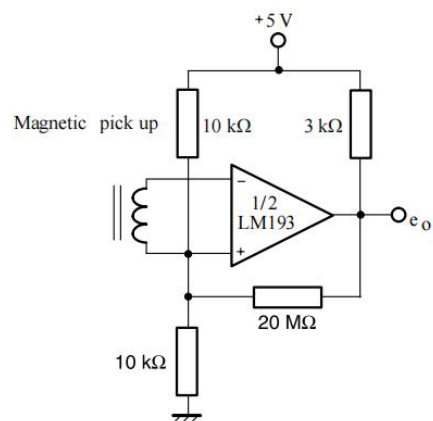




Figure 15. Low-frequency op amp with offset adjust

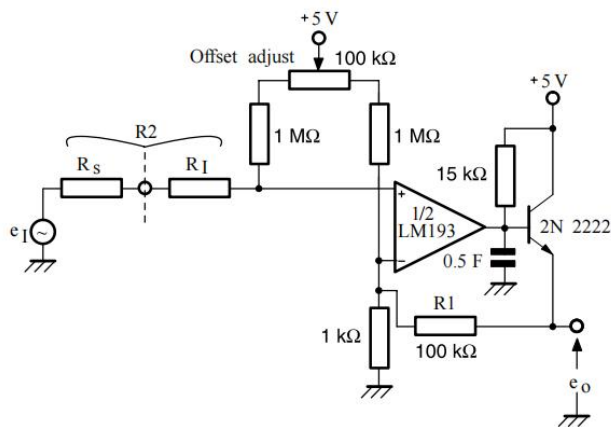


Figure 16. Zero crossing detector (single power supply)

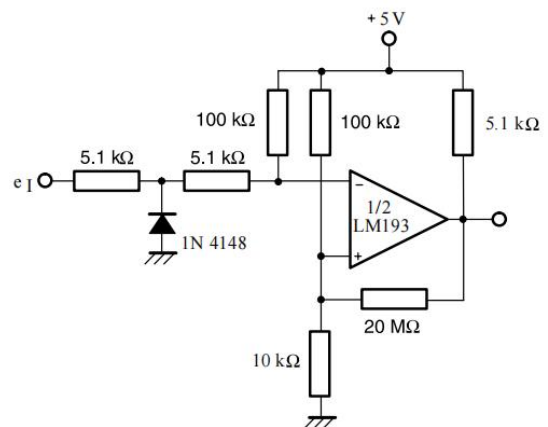


Figure 17. Limit comparator

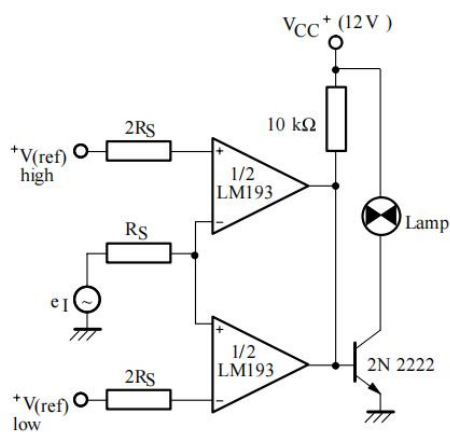


Figure 18. Crystal controlled comparator

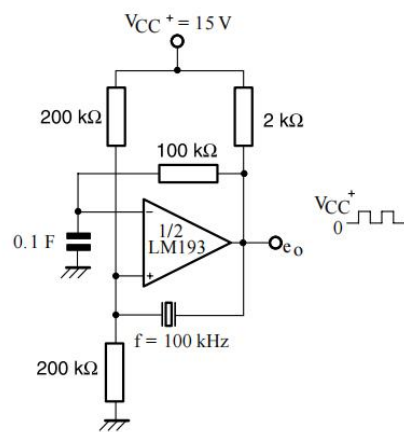


Figure 19. Split supply applications (zero crossing detector)

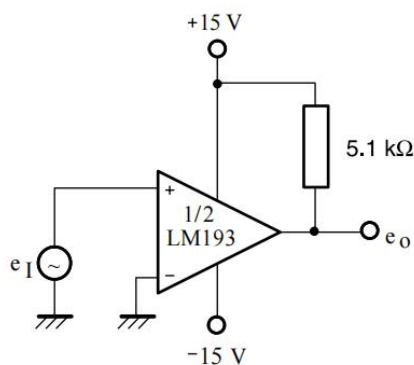


Figure 20. Comparator with a negative reference

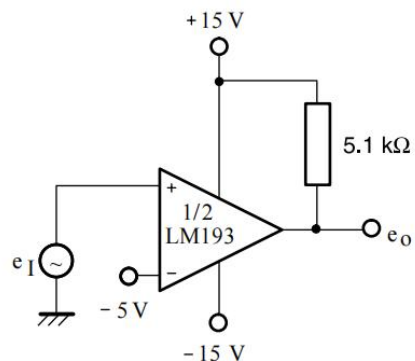
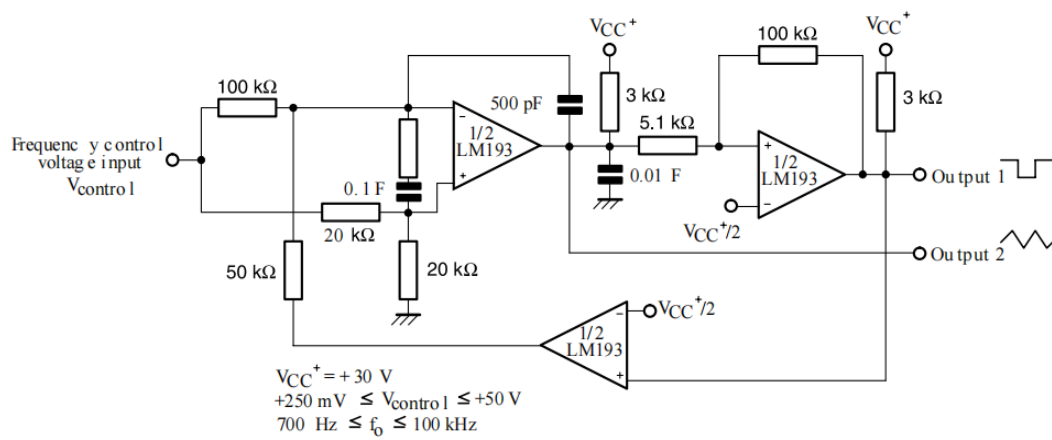




Figure 21. Two-decade, high-frequency VCO



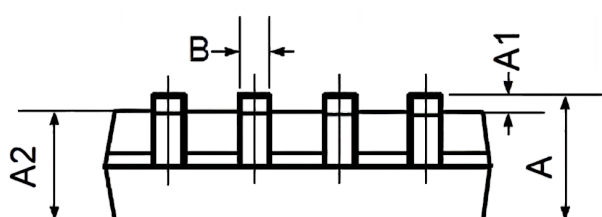
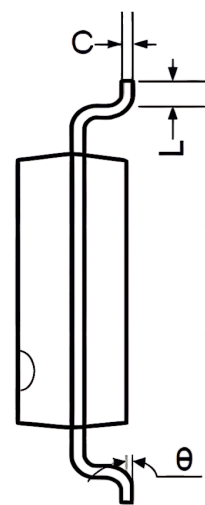
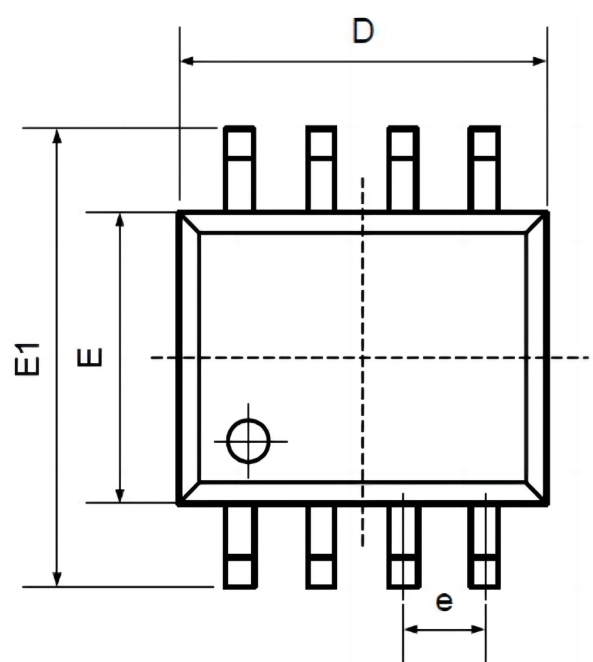


Order information

Order Number	Package	Package Quantity	Marking On The park
LM193DT-TUDI	SOP8	Tape,Reel,2500	LM193DT



Package SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



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