1. DESCRIPTION

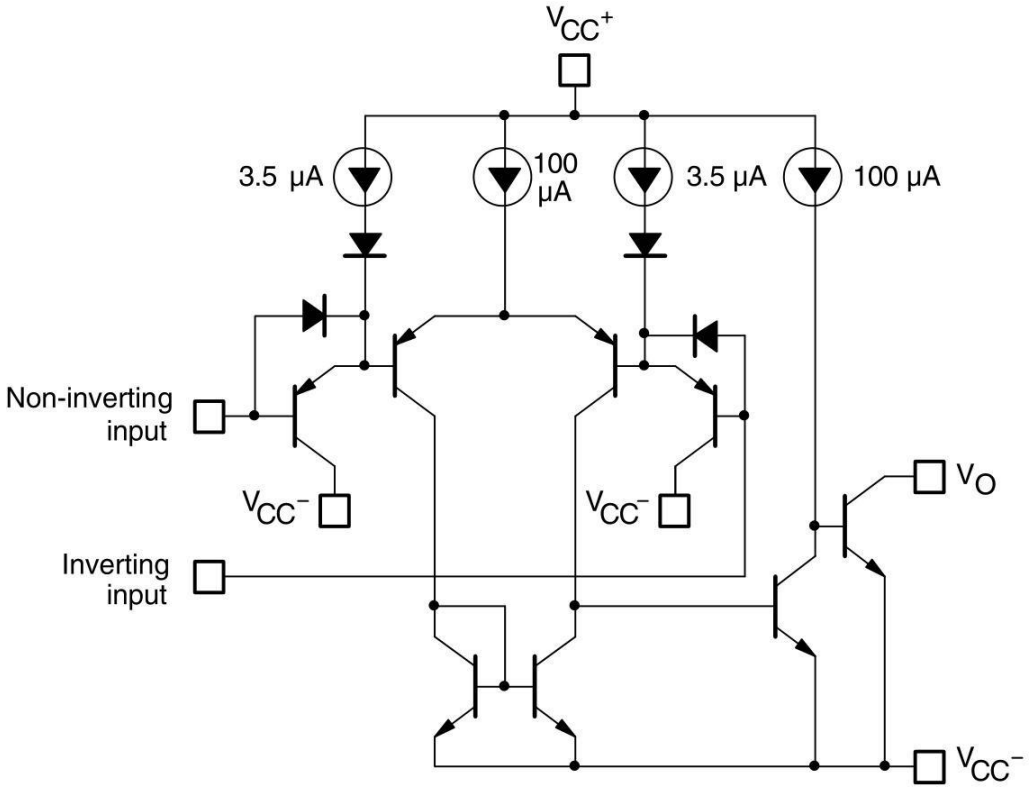
The XL193 devices consist of two independent low voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

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.

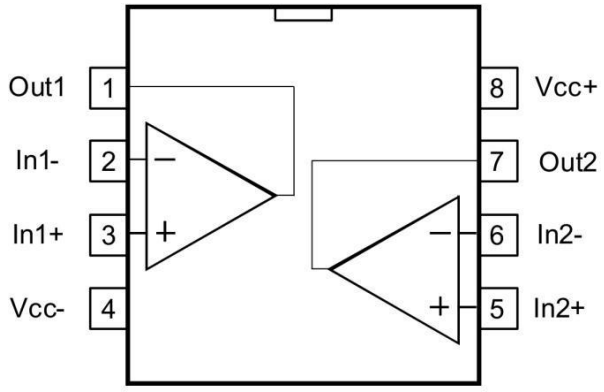
2. FEATURES

- 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 (1 mW/ 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. (Isink = 4 mA)
- Differential input voltage range equal to the supply voltage

3. SCHEMATIC DIAGRAM



4. PACKAGE PIN CONNECTIONS



(Top View)

5. 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 XL193		±36 V_{CC}- -0.3 to V_{CC}+ +0.3	
V_{in}	Input voltage XL193		-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)	SOP8	125	°C/W
R_{thjc}	Thermal resistance junction to case (2)	SOP8	40	
T_j	Maximum junction temperature		150	°C
T_{stg}	Storage temperature range		-65 to 150	
ESD class (3) XL193	HBM: human body model (4)		H1B	
	MM: machine model (5)		M2	
	CDM: charged device model (6)		C5	

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. *HBM class H1B: ESD voltage level from 500 V to 1000 V*
4. *MM class M2: ESD voltage level from 100 V to 200 V*
5. *CDM class C5: ESD voltage level greater than 1500 V.*

6. 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 V)	T_{amb} = 25 °C	0 to (V_{CC}^+) - 1.5	
		$T_{min} \le T_{amb} \le T_{max}$	0 to (V_{CC}^+) - 2	
T_{oper}	Operating free-air temperature range	XL193	-40 to 105	°C

7. ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	XL193			Unit
			Min	Typ.	Max.	
V_{io}	Input offset voltage [1]			1	5	mV
		$T_{min} \leq T_{amb} \leq T_{max}$			9	
I_{io}	Input offset current			3	50	nA
		$T_{min} \leq T_{amb} \leq T_{max}$			150	
I_{ib}	Input bias current (I^+ or I^-) [2]			20	250	
		$T_{min} \leq T_{amb} \leq T_{max}$			400	
A_{vd}	Large signal voltage gain	V_{CC} = 15 V, R_L = 15 kΩ, V_o = 1 V to 11 V	50	200		V/mV
I_{CC}	Supply current (all comparators)	V_{CC} = 5 V, no load		0.45	1	mA
		V_{CC} = 30 V, no load		0.6	2.5	
V_{id}	Differential input voltage [3]				V_{CC}^+	
V_{OL}	Low-level output voltage	V_{id} = -1 V, I_{sink} = 4 mA		80	400	mV
		$T_{min} \leq T_{amb} \leq T_{max}$			700	
I_{OH}	High-level output current	V_{CC} = V_o = 30 V, V_{id} = 1 V		0.1		nA
		$T_{min} \leq T_{amb} \leq T_{max}$			1	µA
I_{sink}	Output sink current	V_{id} = 1 V, V_o = 1.5 V	6	18		mA
t_{re}	Response time [4]	R_L = 5.1 kΩ connected to V_{CC}^+		1.3		µs
t_{rel}	Large signal response time	R_L = 5.1 kΩ connected to V_{CC}^+, e_I = TTL, $V_{(ref)}$ = 1.4 V		300		ns

[1] *At output switch point, V_o = 1.4 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 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.*

8. ELECTRICAL CHARACTERISTICS CURVES

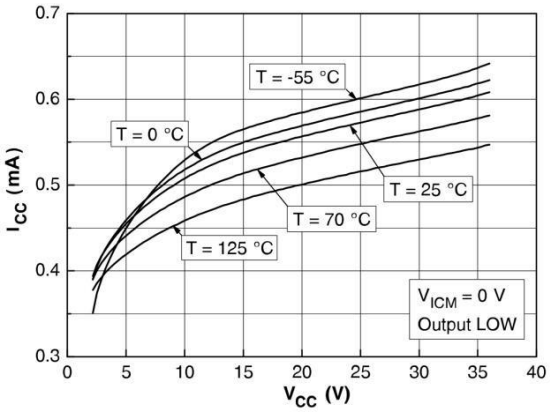


Figure 1. Supply current vs. supply voltage

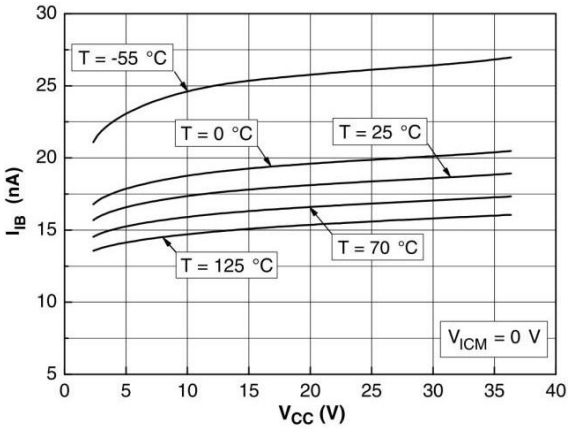


Figure 2. Input current vs. supply voltage

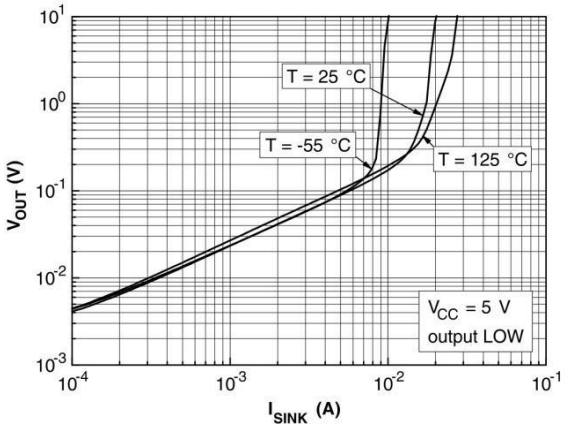


Figure 3. Output saturation voltage vs. output current

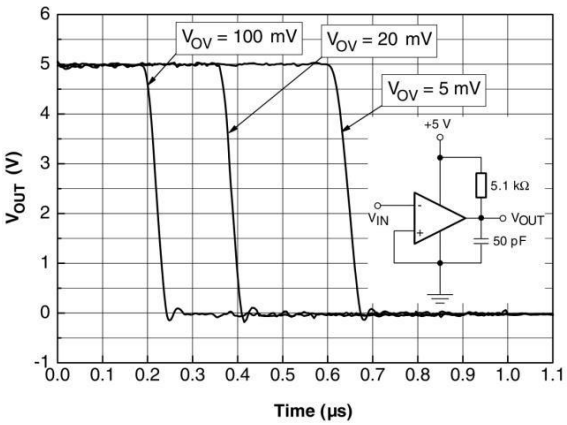


Figure 4. Response time for various input overdrives - negative transition

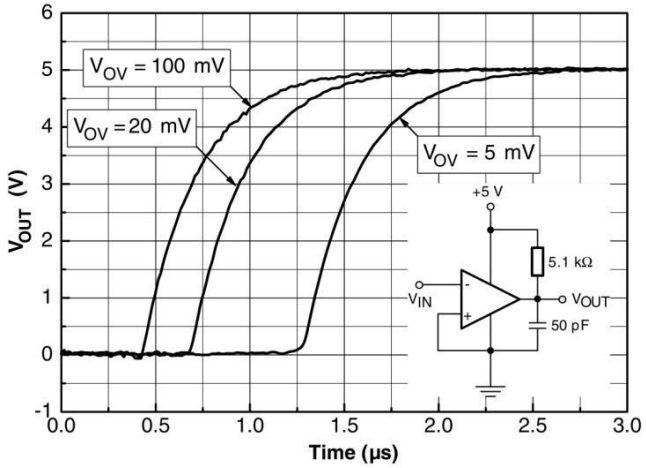


Figure 5. Response time for various input overdrives - positive transition

9. TYPICAL APPLICATIONS

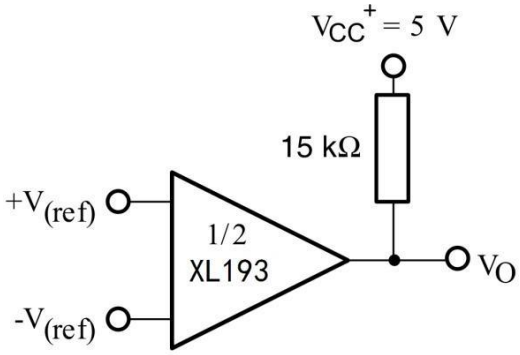


Figure 6. Basic comparator

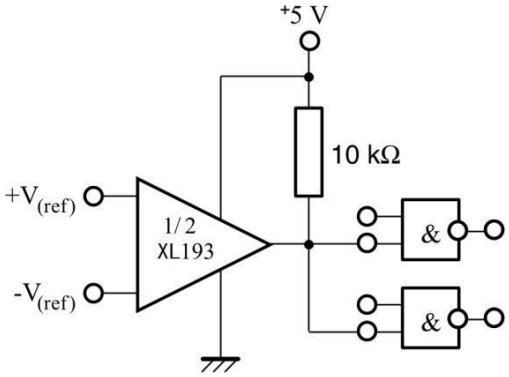


Figure 7. Driving TTL

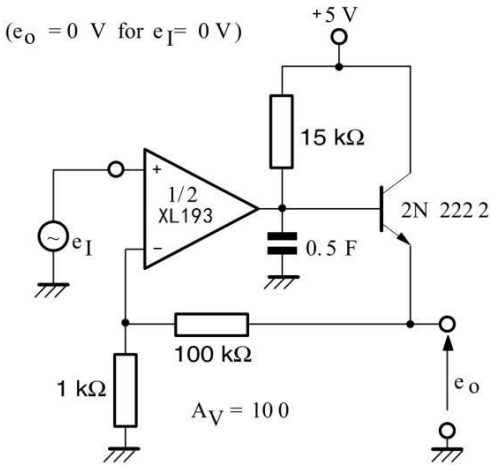


Figure 8. Supply current vs. supply voltage

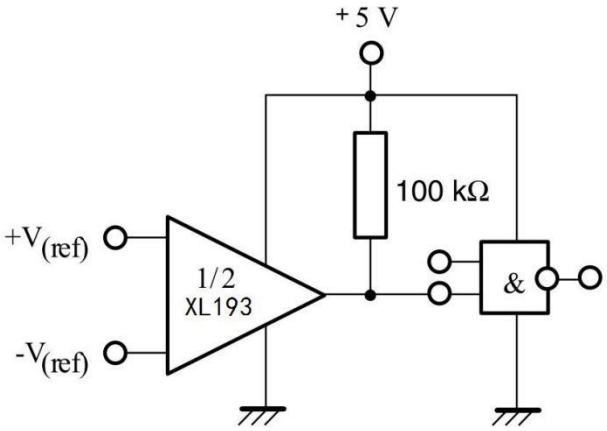


Figure 9. Supply current vs. supply voltage

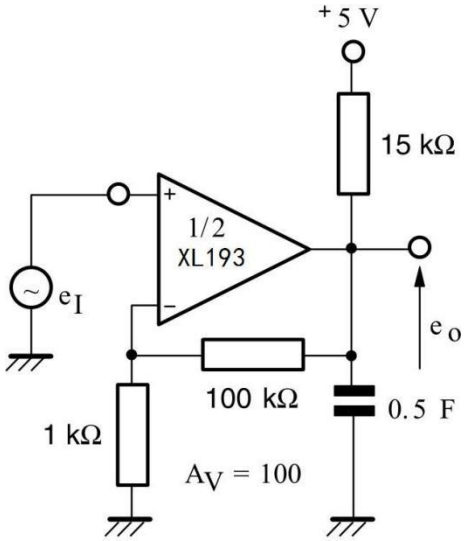


Figure 10. Supply current vs. supply voltage

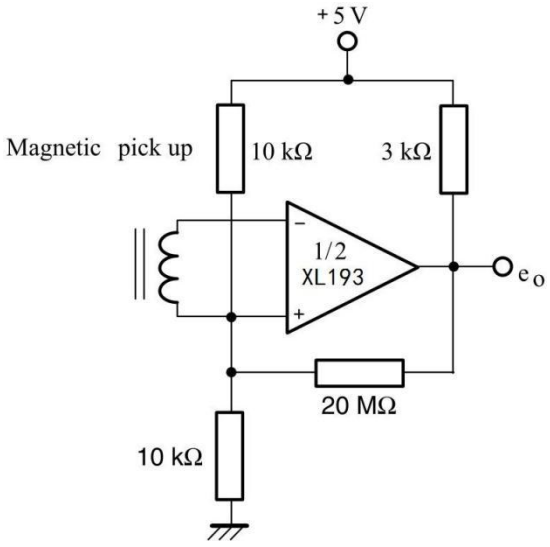


Figure 11. Supply current vs. supply voltage

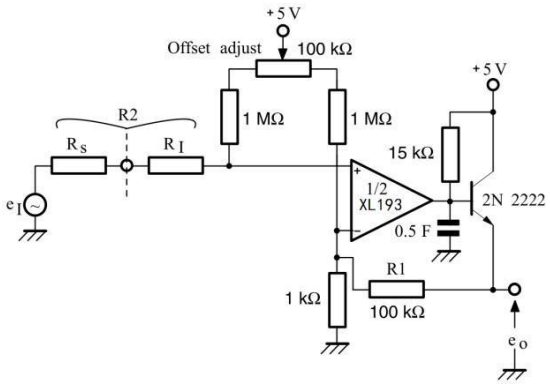


Figure 12. Low-frequency op amp with offset adjust

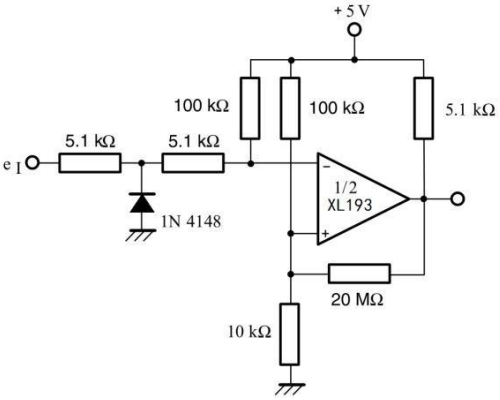


Figure 13. Zero crossing detector (single supply)

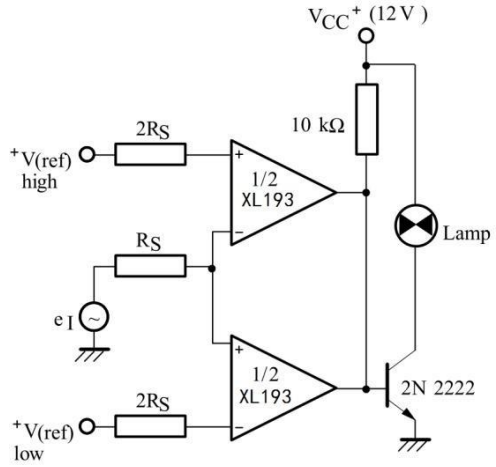


Figure 14. Limit comparator

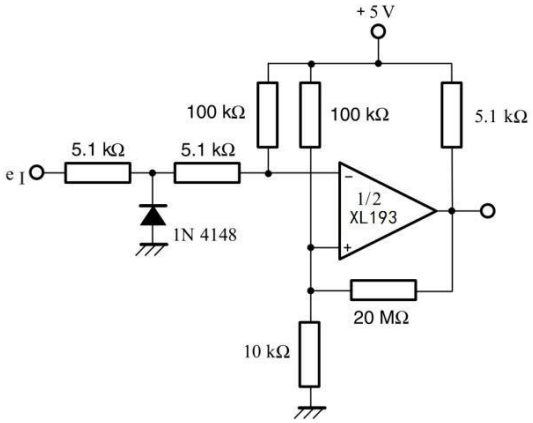


Figure 15. Crystal controlled comparator

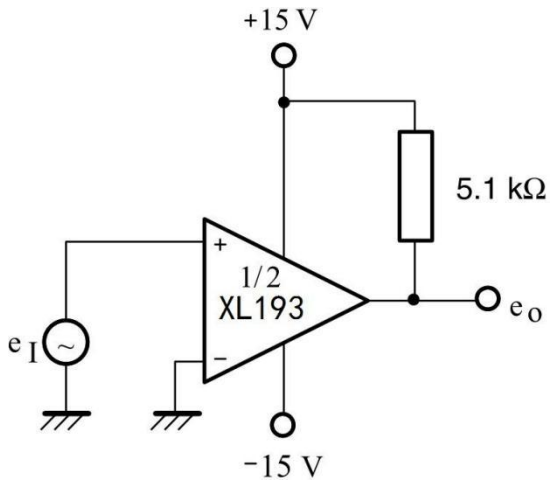


Figure 16. Split supply applications (zero crossing detector)

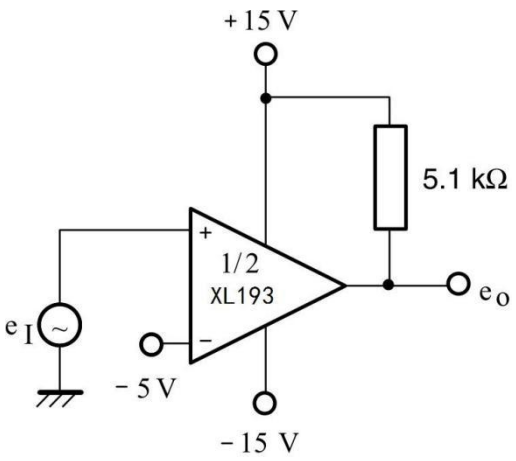


Figure 17. Comparator with a negative reference

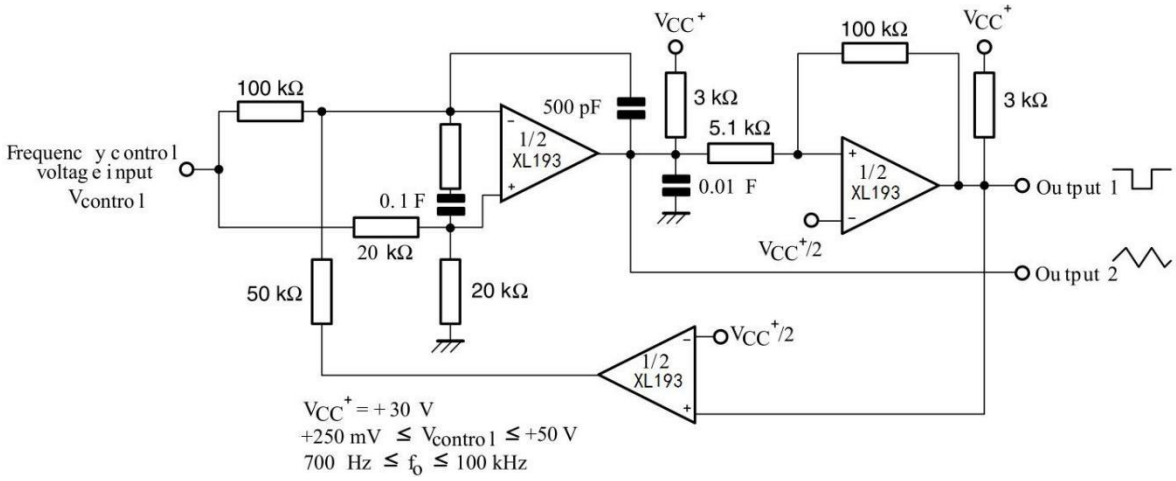


Figure 18. Two-decade, high-frequency VCO reference

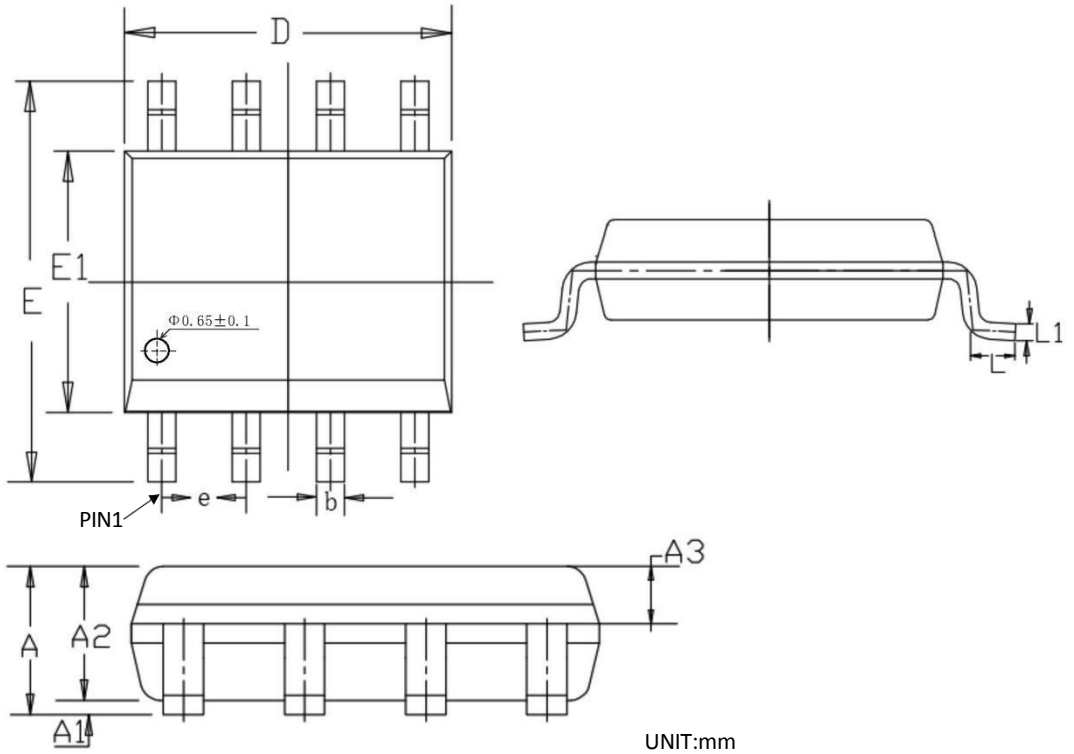
10. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XL193	XL193	SOP8	4.90 * 3.90	- 40 to 105	MSL3	T&R	2500

11. DIMENSIONAL DRAWINGS

SOP8



UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380	–	0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1	–	0.25BSC	–

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