钛地半导体
Tudi Semiconductor

Product Specification

TUDI-LM258/358W

Low-power dual operational amplifier

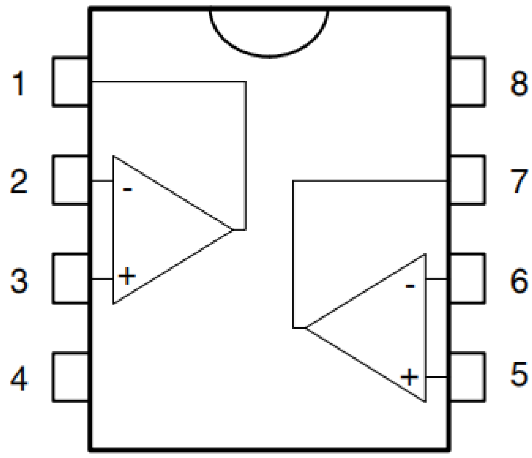
网址 www.sztdbdt.com

用芯智造 · 卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features



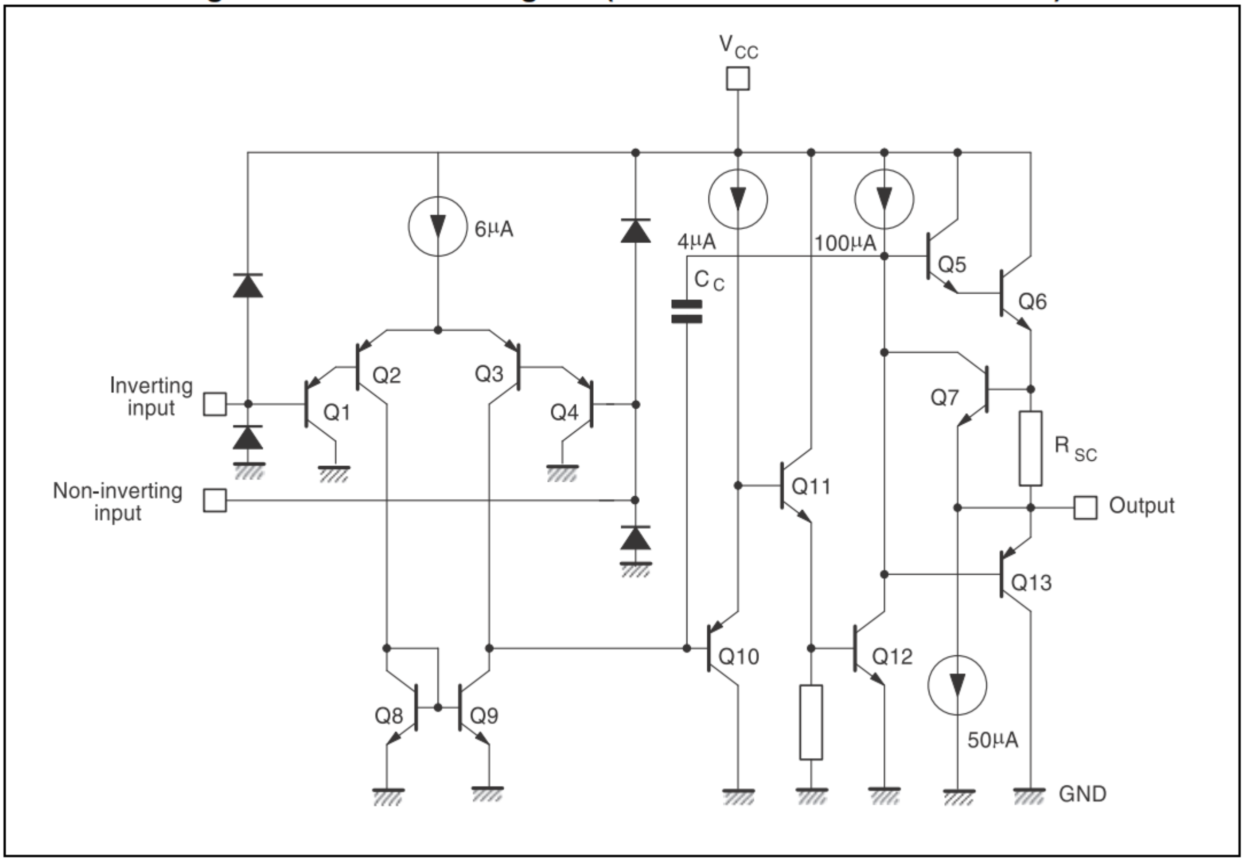
- ESD internal protection: 2 kV
- Internal frequency compensation implemented
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1.1 MHz (temperature compensated)
- Very low supply current per operator - essentially independent of supply voltage
- Low input bias current: 20 nA (temperature compensated)
- Low input offset voltage: 2 mV
- Low input offset current: 2 nA
- Input common mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to (VCC+) - 1.5 V

Description

The LM158W, LM258W, and LM358W circuits consist of two independent, high-gain, operational amplifiers (op-amps), which employ an internal frequency compensation and are specifically designed to operate from a single power supply over a wide range of voltages. The low-power supply drain is independent of the power supply voltage magnitude. Application areas include transducer amplifiers, DC gain blocks, and all the conventional op-amp circuits, which can now be more easily implemented in single power supply systems. For example, these circuits can be directly supplied with the standard +5 V, which is used in logic systems and easily provide the required interface electronics with no additional power supply. In linear mode, the input common mode voltage range includes ground. The output voltage can also swing to ground, even though operated from a single power supply voltage.

1 Schematic diagram

Figure 1. Schematic diagram (1/2 LM158W/LM258W/LM358W)



2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	LM158W/AW	LM258W/AW	LM358W/AW	Unit
V_{CC}^+	Supply voltage	+32			V
V_{in}	Input voltage	-0.3 to V_{CC}^+ +0.3			
V_{id}	Differential input voltage	-0.3 to V_{CC}^+ +0.3			
	Output short-circuit duration(1)	Infinite			
I_{in}	Input current(2)	5 mA in DC or 50 mA in AC (duty cycle=10%, T=1 s)			mA
T_{oper}	Operating free-air temperature range	-55 to +125	-40 to +105	0 to +70	°C
T_{stg}	Storage temperature range	-65 to +150			
T_j	Maximum junction temperature	150			
R_{thja}	Thermal resistance junction-to-ambient(3) SO8 MiniSO8 TSSOP8	 125 190 120			°C/W
R_{thjc}	Thermal resistance junction-to-case(3) SO8 MiniSO8 TSSOP8	 40 39 37			
ESD	HBM: human body model(4)	2			kV
	MM: machine model(5)	200			V
	CDM: charged device model(6)	1.5			kV

1. Short-circuits from the output to V_{CC} can cause excessive heating if V_{CC} > 15 V. The maximum output current is approximately 40 mA independent of the magnitude of V_{CC}. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
2. This input current only exists when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistor becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also NPN parasitic action on the IC chip. This transistor action can cause the output voltages of the op amps to go to the V_{CC} voltage level (or to ground for a large overdrive) for the time during which an input is driven negative. This is not destructive and normal output will be restored for input voltage higher than -0.3 V.
3. Short-circuits can cause excessive heating and destructive dissipation. R_{th} are typical values.
4. Human body model: a 100 pF capacitor is discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
5. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
6. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}^{+}	Supply voltage	3 to 30	V
V_{icm}	Common mode input voltage range(1)	V_{DD} -0.3 to V_{CC} -1.5	V
T_{oper}	Operating free air temperature range LM158W LM258W LM358W	 -55 to +125 -40 to +105 0 to +70	°C

1. When used in comparator, the functionality is guaranteed as long as at least one input remains within the operating common mode voltage range.

3 Electrical characteristics

Table 3. V_{CC}^{+} = +5 V, V_{CC}^{-} = ground, V_o = 1.4 V, T_{amb} = +25 °C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage(1) LM158AW LM258AW, LM358AW LM158W, LM258W LM358W $T_{min} \le T_{amb} \le T_{max}$ LM158AW, LM258AW, LM358AW LM158W, LM258W LM358W		 1 1 2 2	 2 3 5 7 4 7 9	mV
$\Delta V_{io}/\Delta T$	Input offset voltage drift LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W		 7 7	 15 30	µV/°C
I_{io}	Input offset current LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W $T_{min} \le T_{amb} \le T_{max}$ LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W		 2 2	 10 30 30 40	nA
$\Delta I_{io}/\Delta T$	Input offset current drift LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W		 10 10	 200 300	pA/°C
I_{ib}	Input bias current(2) LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W $T_{min} \le T_{amb} \le T_{max}$ LM158AW, LM258AW, LM358AW LM158W, LM258W, LM358W		 20 20	 50 150 100 200	nA
A_{vd}	Large signal voltage gain V_{CC}^{+} = +15 V, R_L = 2 kΩ, V_o = 1.4 V to 11.4 V $T_{min} \le T_{amb} \le T_{max}$	 50 25	 100		V/mV
SVR	Supply voltage rejection ratio $R_s \le$ 10 kΩ, V_{CC}^{+} = 5 V to 30 V $T_{min} \le T_{amb} \le T_{max}$	 65 65	 100		dB
I_{CC}	Supply current, all amp, no load $T_{min} \le T_{amb} \le T_{max}$, V_{CC}^{+} = +5 V $T_{min} \le T_{amb} \le T_{max}$, V_{CC}^{+} = +30 V		 0.7	 1.2 2	mA

Table 3. V_{CC}^+ = +5 V, V_{CC}^- = ground, V_o = 1.4 V, T_{amb} = +25 °C (unless otherwise specified) (continued)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{icm}	Input common mode voltage range V_{CC}^+ = +30 V[3] T_{amb} = +25° C $T_{min} \leq T_{amb} \leq T_{max}$	 0 0		 V_{CC}^+ -1.5 V_{CC}^+ -2	V
CMR	Common mode rejection ratio $R_s \leq 10$ kΩ $T_{min} \leq T_{amb} \leq T_{max}$	 70 60	 85		dB
I_{source}	Output current source V_{CC}^+ = +15 V, V_o = +2 V, V_{id} = +1 V	20	40	60	mA
I_{sink}	Output sink current V_{CC}^+ = +15 V, V_o = +2 V, V_{id} = -1 V V_{CC}^+ = +15 V, V_o = +0.2 V, V_{id} = -1 V	 10 12	 20 50		 mA µA
V_{OH}	High level output voltage R_L = 2 kΩ, V_{CC}^+ = 30 V $T_{min} \leq T_{amb} \leq T_{max}$ R_L = 10 kΩ, V_{CC}^+ = 30 V $T_{min} \leq T_{amb} \leq T_{max}$	 26 26 27 27	 27 28		V
V_{OL}	Low level output voltage R_L = 10 kΩ $T_{min} \leq T_{amb} \leq T_{max}$		 5	 20 20	mV
SR	Slew rate V_{CC}^+ = 15 V, V_i = 0.5 to 3 V, R_L = 2 kΩ, C_L = 100 pF, unity gain	0.3	0.6		V/µs
GBP	Gain bandwidth product V_{CC}^+ = 30 V, f =100 kHz, V_{in} =10 mV, R_L=2 kΩ, C_L = 100 pF	0.7	1.1		MHz
THD	Total harmonic distortion f = 1 kHz, A_v = 20 dB, R_L = 2 kΩ, V_o = 2 V_{pp}, C_L = 100 pF, V_O = 2 V_{pp}		0.02		%
e_n	Equivalent input noise voltage f = 1 kHz, R_s = 100 Ω, V_{CC}^+ = 30 V		55		$\frac{nV}{\sqrt{Hz}}$
V_{o1}/V_{o2}	Channel separation [4] 1 kHz ≤ f ≤ 20 kHz		120		dB

1. V_o = 1.4 V, R_s = 0 Ω, 5 V < V_{CC}^+ < 30 V, 0 < V_{ic} < V_{CC}^+ - 1.5 V.
2. The direction of the input current is out of the IC. This current is essentially constant, independent of the state of the output so there is no change in the load on the input lines.
3. The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is V_{CC}^+ - 1.5 V, but either or both inputs can go to +32 V without damage.
4. Due to the proximity of external components ensure that there is no coupling originating via stray capacitance between these external parts. Typically, this can be detected at higher frequencies because then this type of capacitance increases.

4 Typical applications

Single supply voltage V_{CC} = +5 V_{DC}

Figure 18. AC-coupled inverting amplifier

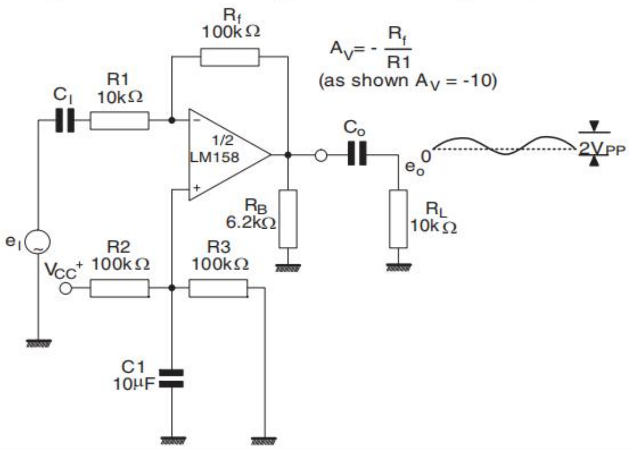


Figure 19. Non-inverting DC amplifier

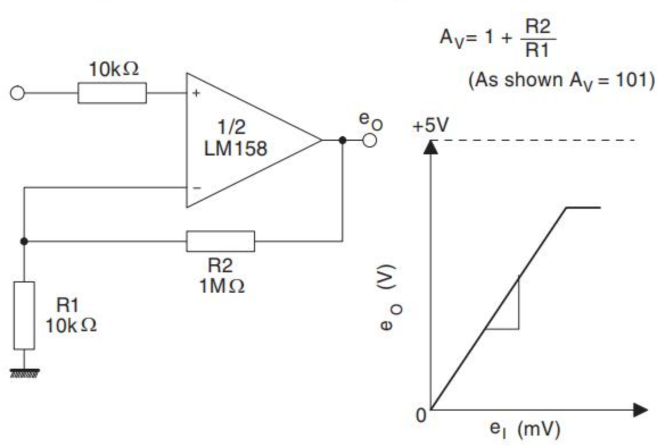


Figure 20. AC-coupled non-inverting amplifier

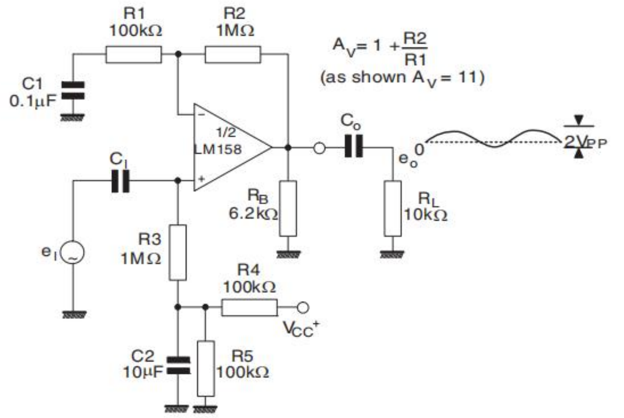


Figure 21. DC summing amplifier

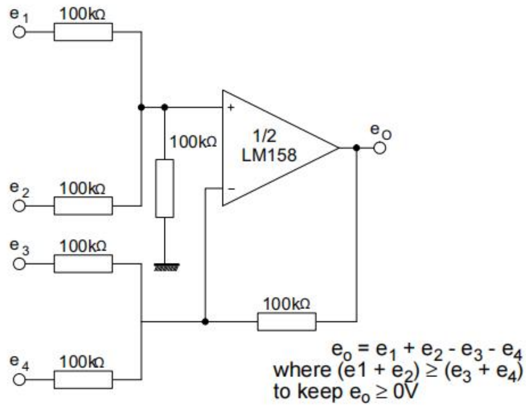
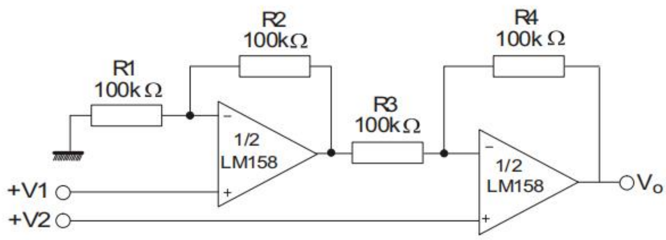


Figure 22. High input Z, DC differential amplifier

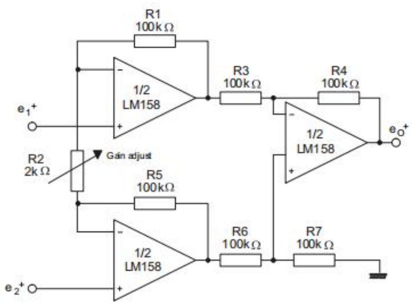


if R1 = R5 and R3 = R4 = R6 = R7

$e_o = [1 + \frac{2R1}{R2}]\ ((e_2 + e_1)$

As shown e_o = 101 $(e_2 + e_1)$

Figure 23. High input Z adjustable gain DC instrumentation amplifier



If R1 = R5 and R3 = R4 = R6 = R7

e_0 = [1 + 2R1/R2] $((e_2 + e_1)$

As shown e_0 = 101 $(e_2 + e_1)$

Figure 24. Using symmetrical amplifiers to reduce input current

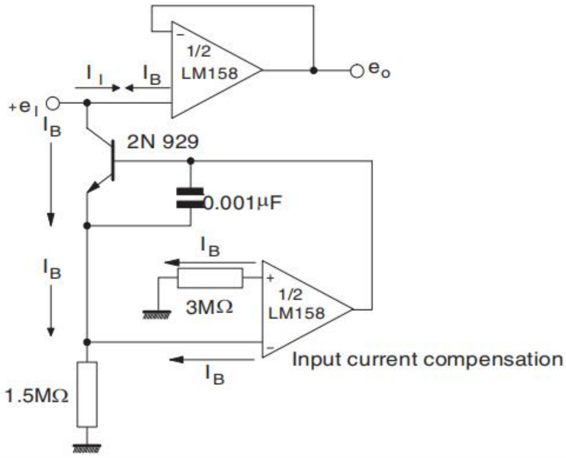


Figure 25. Low drift peak detector

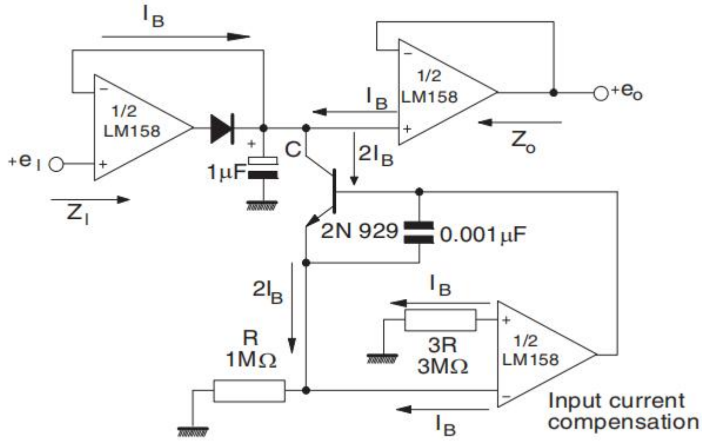
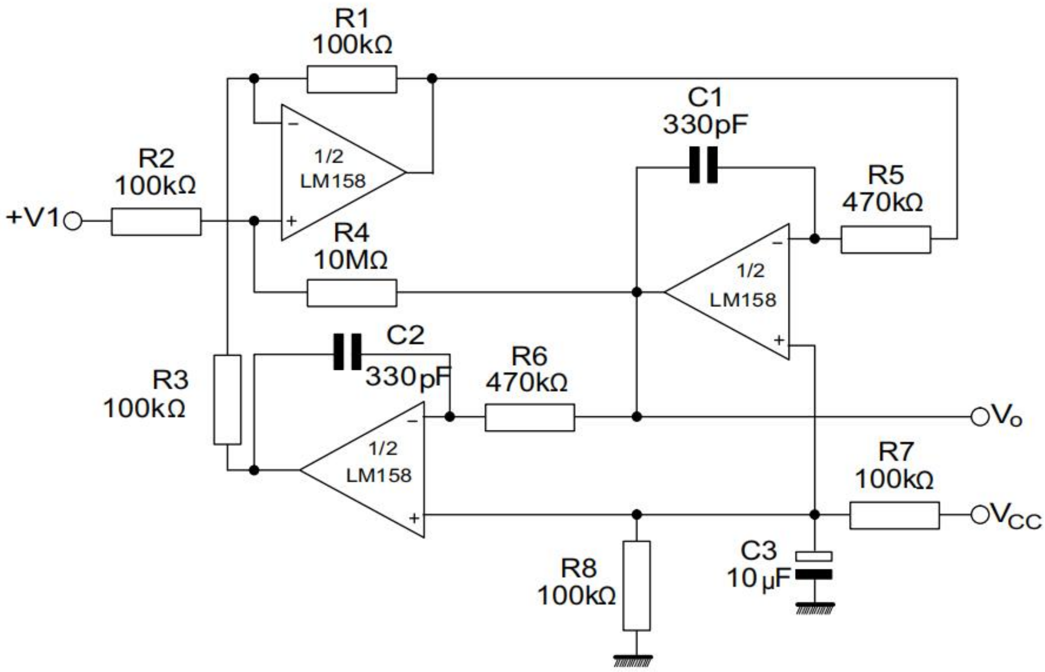


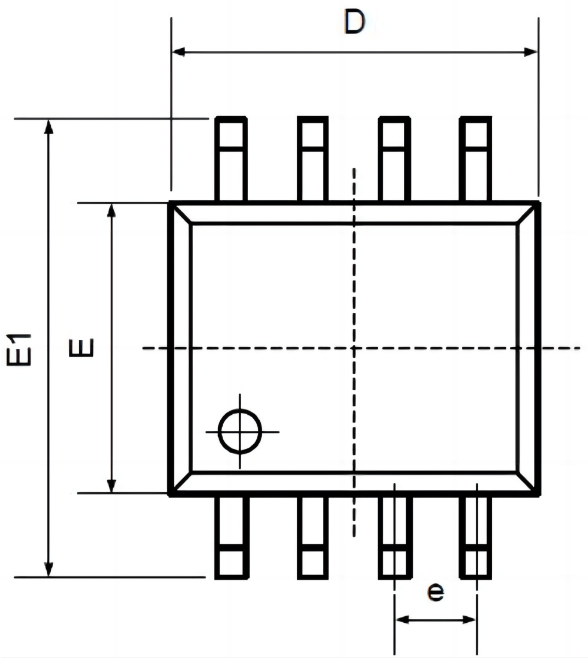
Figure 26. Active band-pass filter

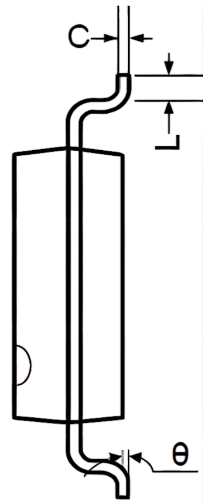


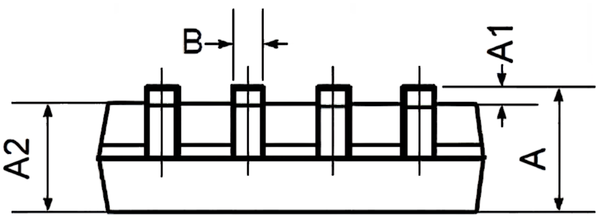
Order information

Order Number	Package	Package Quantity	Marking On The park
LM258AWYPT-TUDI	TSSOP8	Tape,Reel,2500	LM258AWYPT
LM258WDT-TUDI	SOP8	Tape,Reel,2500	LM258WDT
LM258WYDT-TUDI	SOP8	Tape,Reel,2500	LM258WYDT
LM258WYPT-TUDI	TSSOP8	Tape,Reel,2500	LM258WYPT

Package SOP8

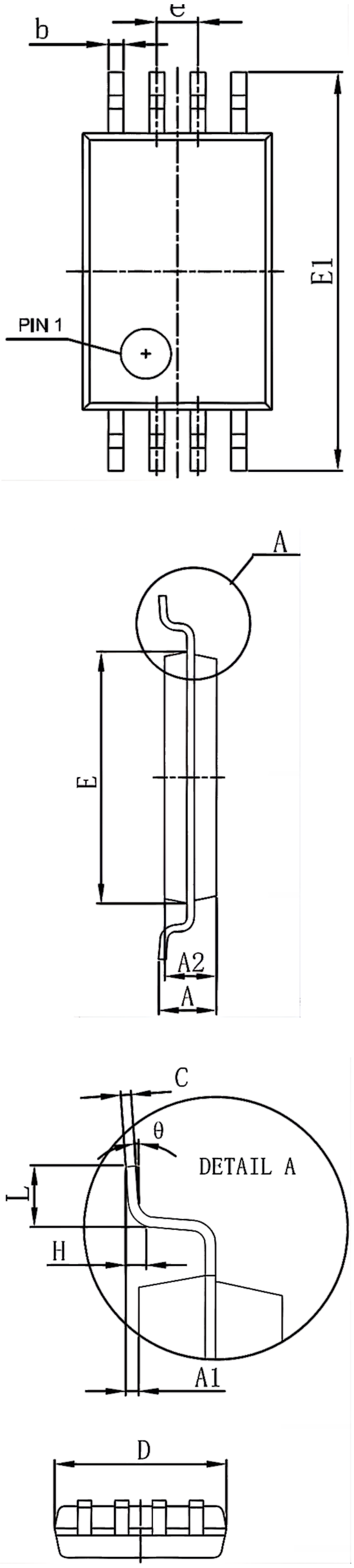






Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

Package TSSOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°		1°	

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