钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM258

Low-power dual operational amplifiers

网址 www.sztdbdt.com

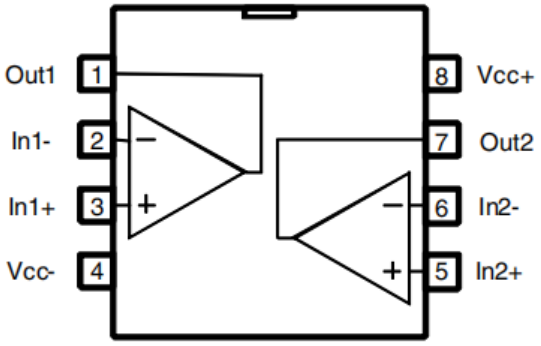
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- Internally frequency-compensated
- 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 negative rails
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to (VCC+ -1.5 V)

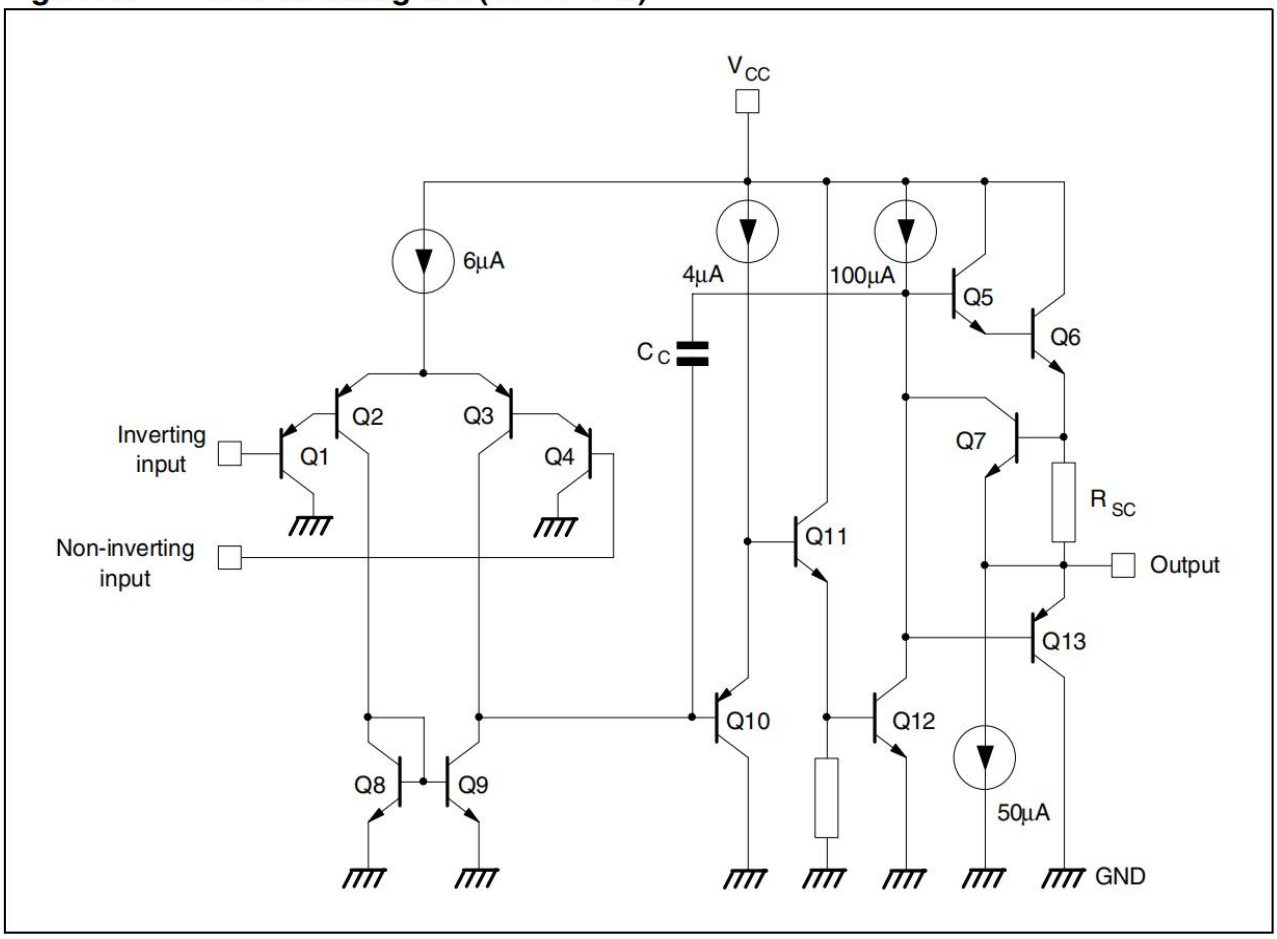


Description

These circuits consist of two independent, high-gain, internally frequency-compensated op-amps, specifically designed to operate from a single power supply over a wide range of voltages. The low-power supply drain is independent of the magnitude of the power supply voltage.
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 will easily provide the required interface electronics with no additional power supply.
In linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.

1 Schematic diagram

Figure 1. Schematic diagram (1/2 LM158)



2 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	LM158,A	LM258,A	LM358,A	Unit
V_{CC}	Supply voltage	+/-16 or 32			V
V_i	Input voltage	32			V
V_{id}	Differential input voltage	32			V
	Output short-circuit duration (1)	Infinite			
I_{in}	Input current (2)	5 mA in DC or 50 mA in AC (duty cycle = 10%, T=1s)			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			°C
T_j	Maximum junction temperature	150			°C
R_{thja}	Thermal resistance junction to ambient(3) SO-8 MiniSO-8 TSSOP8 DIP8 DFN8 2x2	 125 190 120 85 57			°C/W
R_{thjc}	Thermal resistance junction to case (3) SO-8 MiniSO-8 TSSOP8 DIP8	 40 39 37 41			°C/W
ESD	HBM: human body model(4)	300			V
	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 clamp. In addition to this diode action, there is 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 is restored for input voltages above -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 charged to the specified voltage, then discharged through a 1.5 kΩ resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are 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). This is done for all couples of connected pin combinations while the other pins are floating.
6. Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.

3 Operating conditions

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_{CC}^- -0.3 to V_{CC}^+ -1.5	V
T_{oper}	Operating free air temperature range LM158 LM258 LM358	 -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.

4 Electrical characteristics

Table 3. Electrical characteristics for 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) LM158A LM258A, LM358A LM158, LM258 LM358		 1 2	 2 3 5 7	mV
	$T_{min} \le T_{amb} \le T_{max}$ LM158A, LM258A, LM358A LM158, LM258 LM358			 4 7 9	
DV_{io}	Input offset voltage drift LM158A, LM258A, LM358A LM158, LM258, LM358		 7 7	 15 30	µV/°C
I_{io}	Input offset current LM158A, LM258A, LM358A LM158, LM258, LM358 $T_{min} \le T_{amb} \le T_{max}$ LM158A, LM258A, LM358A LM158, LM258, LM358		 2 2 	 10 30 30 40	nA
DI_{io}	Input offset current drift LM158A, LM258A, LM358A LM158, LM258, LM358		 10 10	 200 300	pA/°C
I_{ib}	Input bias current (2) LM158A, LM258A, LM358A LM158, LM258, LM358 $T_{min} \le T_{amb} \le T_{max}$ LM158A, LM258A, LM358A LM158, LM258, LM358		 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 V_{CC}^+ = 5 V to 30 V, $R_s \le 10$ kΩ $T_{min} \le T_{amb} \le T_{max}$	 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
V_{icm}	Input common mode voltage range V_{CC}^+= +30 V (3) $T_{min} \le T_{amb} \le T_{max}$	 0 0	 	 V_{CC}^+ -1.5 V_{CC}^+ -2	V

Table 3. Electrical characteristics for 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
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 stray capacitance between these external parts does not cause coupling. Typically, this can be detected because this type of capacitance increases at higher frequencies.

5 Typical applications

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

Figure 18. AC-coupled inverting amplifier

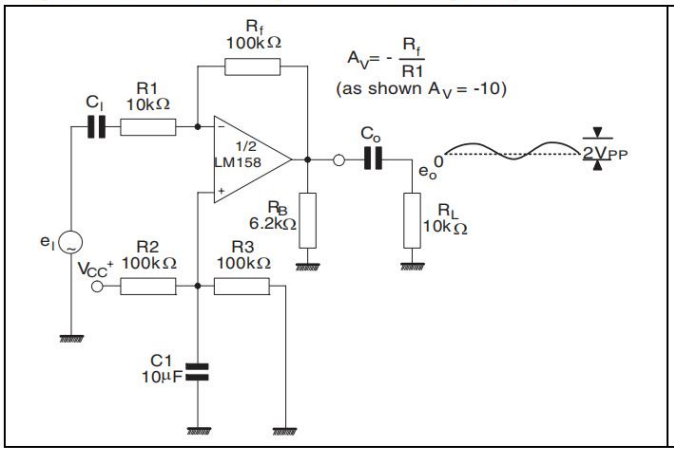


Figure 19. Non-inverting DC amplifier

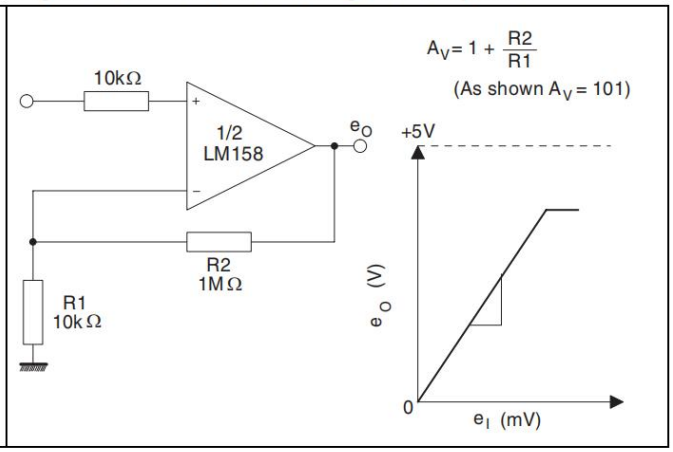


Figure 20. AC-coupled non-inverting amplifier

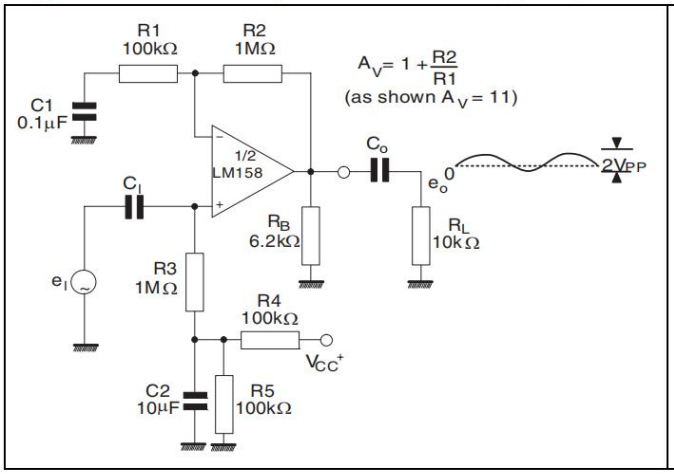
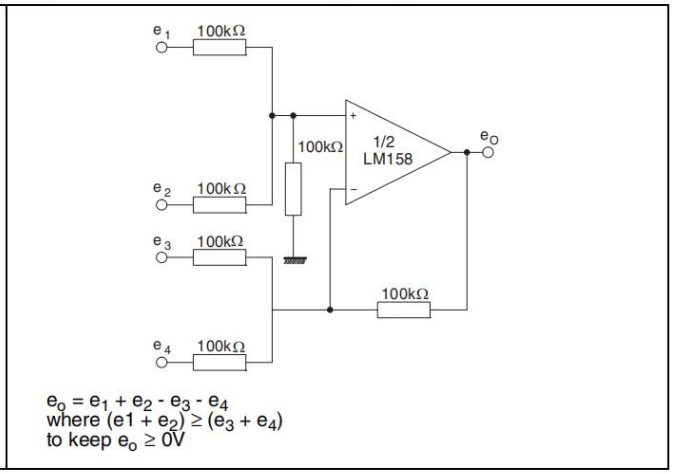
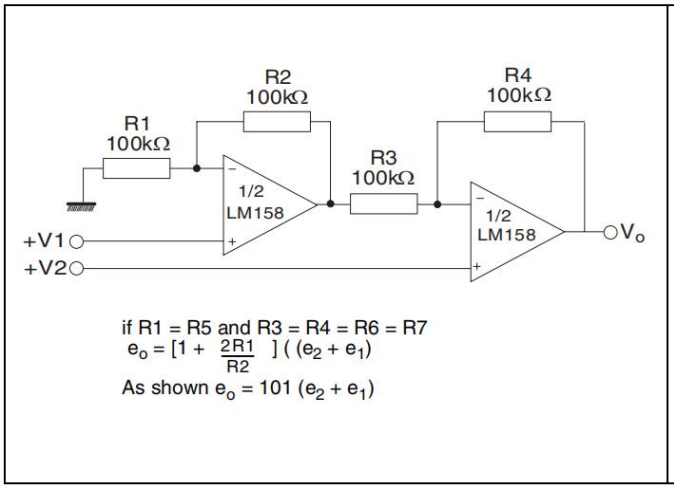


Figure 21. DC summing amplifier



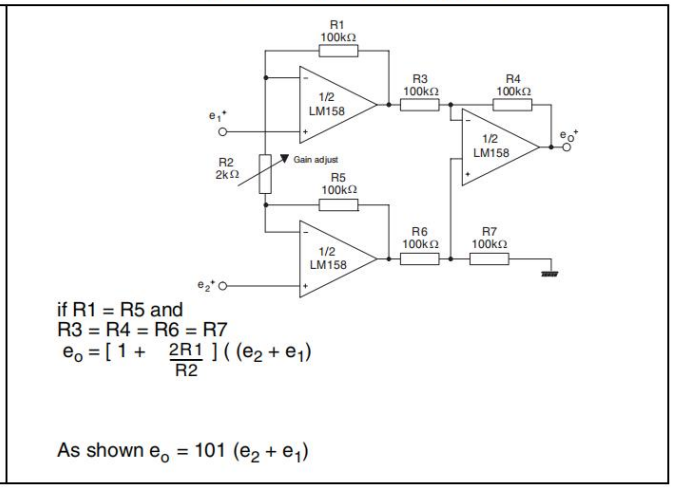
$e_o = e_1 + e_2 - e_3 - e_4$
where $(e1 + e_2) \geq (e_3 + e_4)$
to keep $e_o \geq 0V$

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

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

Figure 24. Using symmetrical amplifiers to reduce input current

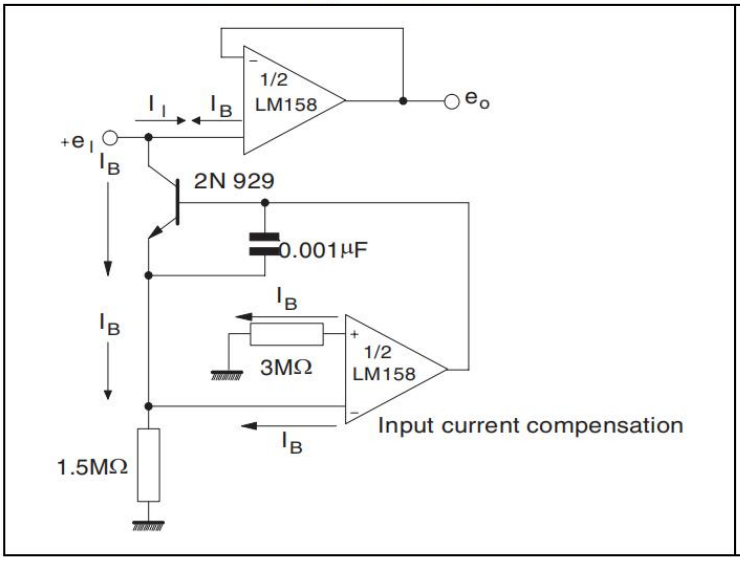


Figure 25. Low drift peak detector

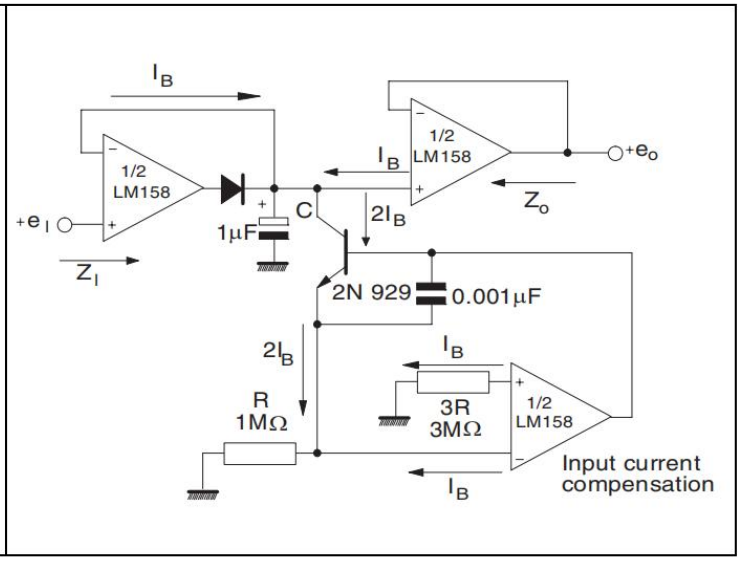
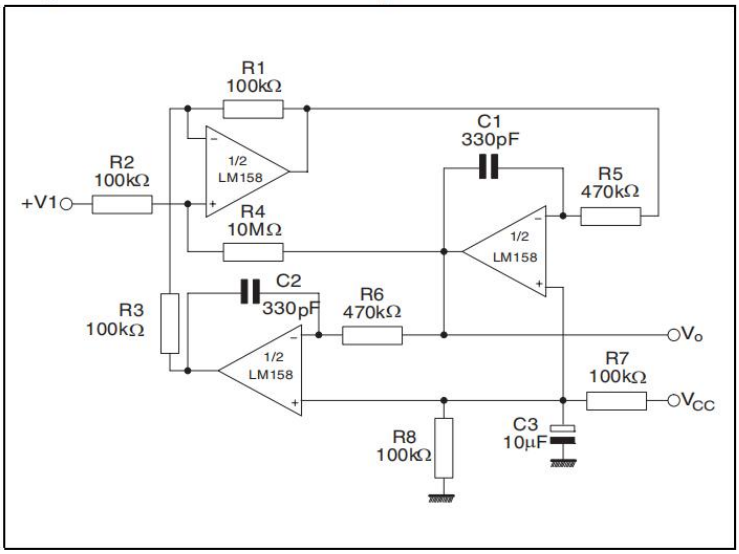


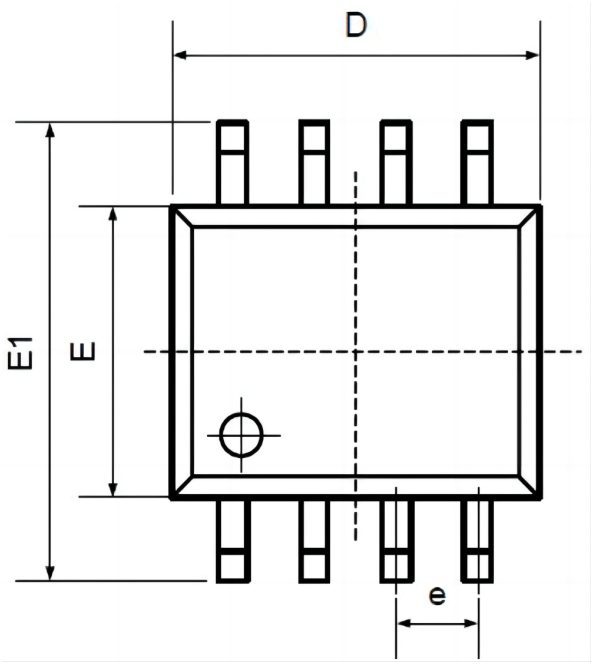
Figure 26. Active band-pass filter

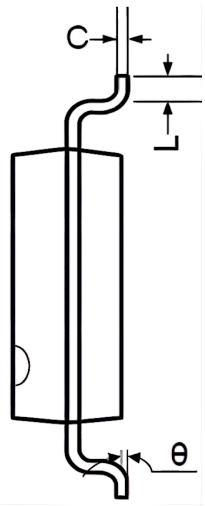


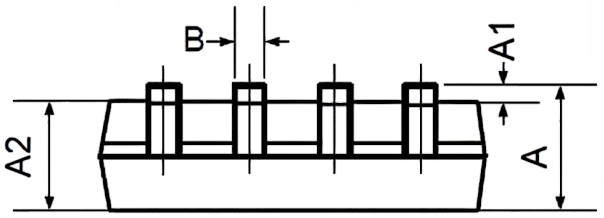
Order information

Order Number	Package	Package Quantity	Marking On The park
LM258ADT-TUDI	SOP8	Tape,Reel,2500	LM258ADT
LM258APT-TUDI	TSSOP8	Tape,Reel,2500	LM258APT
LM258AST-TUDI	MSOP8	Tape,Reel,2500	LM258AST
LM258AYDT-TUDI	SOP8	Tape,Reel,2500	LM258AYDT
LM258AYPT-TUDI	TSSOP8	Tape,Reel,2500	LM258AYPT
LM258N-TUDI	DIP8	Tape,Reel,2500	LM258N
LM258ST-TUDI	MSOP8	Tape,Reel,2500	LM258ST
LM258YPT-TUDI	TSSOP8	Tape,Reel,2500	LM258YPT

Package SOP8

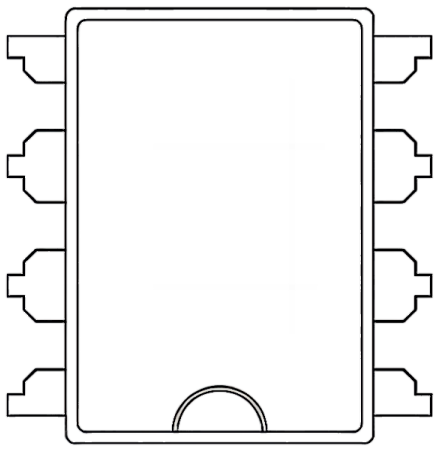


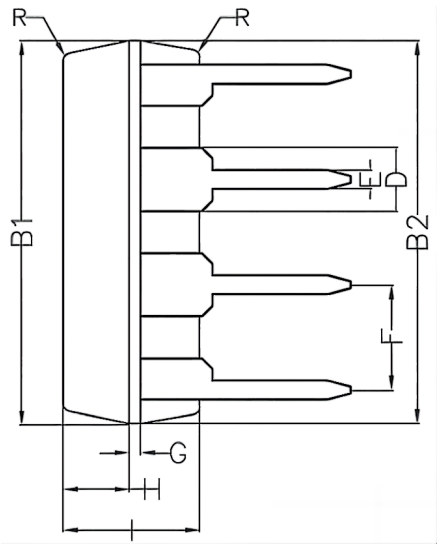


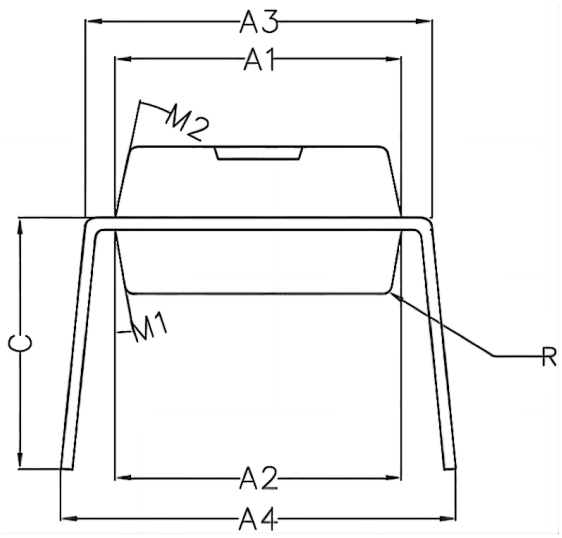


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

Package DIP8

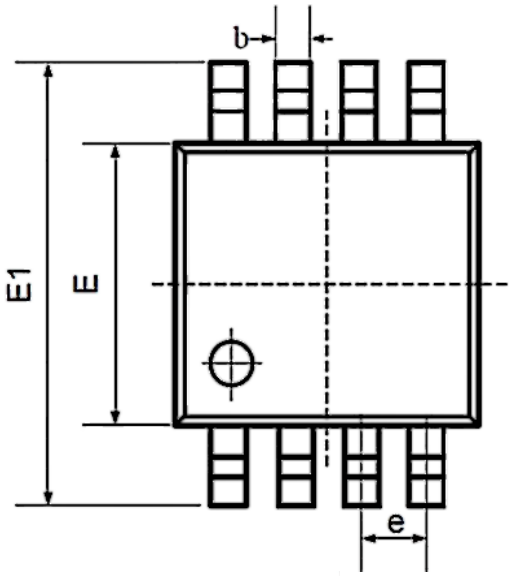


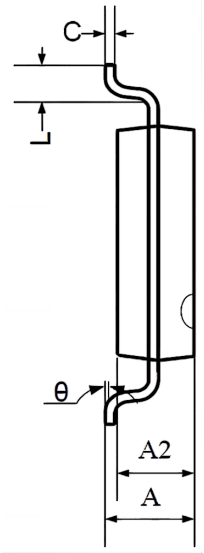


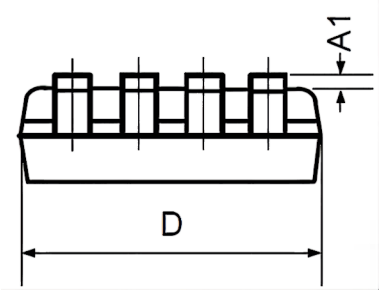


Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
工	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

Package MSOP8

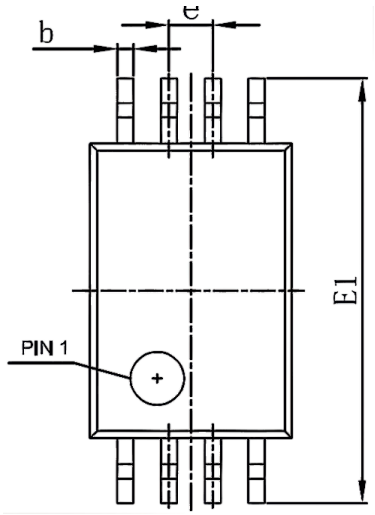


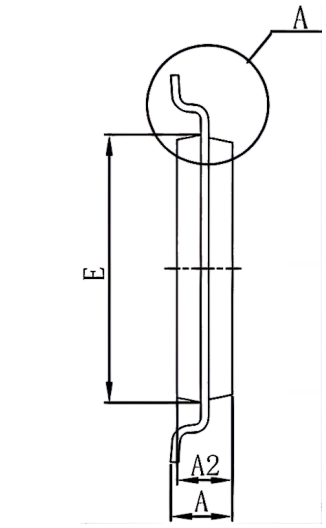


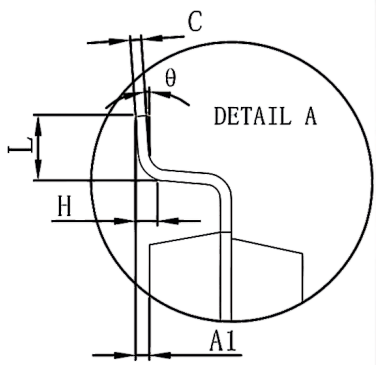


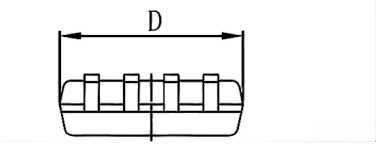
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

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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