

Dual Operational Amplifiers

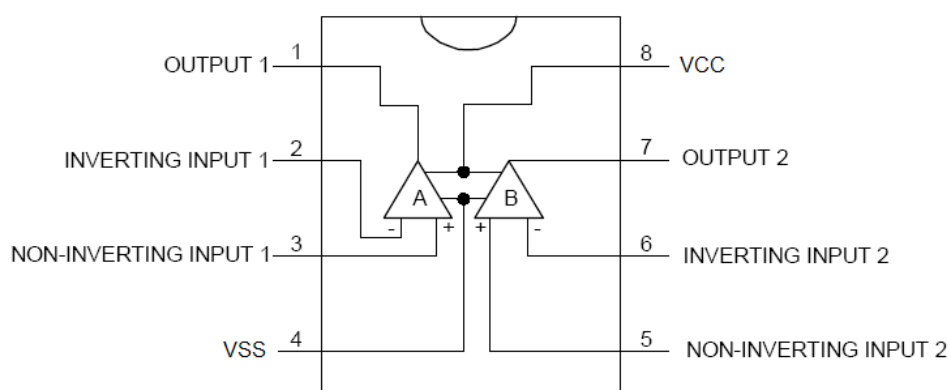
❖ **GENERAL DESCRIPTION**

These devices consist of two independent, high gain, internally frequency-compensated operational amplifiers designed operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3V to 40V, and V_{CC} is at least 1.5V more positive than the input common-mode voltage, the low supply-current drain is independent of the magnitude of the power supply voltage.

❖ **FEATURES**

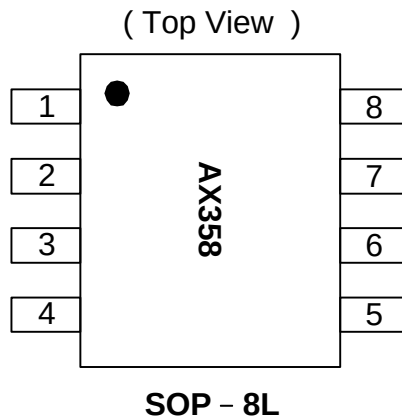
- Two internally compensated OP amps
- Wide power supply range: 3V to 40V
- Large output voltage swing: 0V to $V_{CC}-1.5V$
- Low input bias current
- Low input offset voltage and offset current
- Internally frequency compensated for unity gain
- Short Circuit Protected Outputs
- Input common-mode voltage range includes ground
- SOP-8 Pb-Free package
- RoHS and Halogen free compliance

❖ **BLOCK DIAGRAM**



❖ PIN ASSIGNMET

The package of AX358 is SOP-8L; the pin assignment is given by:



Pin	Description
1	Output 1 (V _{O1})
2	Inverting input 1 (IN1-)
3	Non inverting input 1 (IN1+)
4	VSS
5	Non inverting input 2 (IN2+)
6	Inverting input 2 (IN2-)
7	Output 2 (V _{O2})
8	VCC

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
AX 358 X X Package Type Packing S:SOP-8L A : Taping	Logo ← AX 3 5 8 → Part number YYWWX → ID code:internal WW: 01~52 Year: 18=2018 19=2019 20=2020 21=2021 22=2022 ⋮ 45=2045

❖ ABSOLUTE MAXIMUM RATINGS (at T_A=25°C)

Characteristics	Symbol	Rating	Unit
Power Supply Voltage (Single Supply)	V _{CC}	40	V
Power Supply Voltage (Split Supplies)	V _{CC} , V _{SS}	±20	V
Input Differential Voltage Range	V _{IDR}	±20	V
Input Common Mode Voltage Range	V _{ICR}	-0.3 to V _{CC}	V
Output Short Circuit Duration	T _{SC}	Continuous	
Power Dissipation	PD	500	mW
Storage Temperature Range	T _{ST}	-55 to +165	°C
Operating Junction Temperature	T _{OPJ}	-40 to +125	°C
Junction Temperature Range	T _J	150	°C
Thermal Resistance from Junction to case	θ _{JC}	40	°C/W
Thermal Resistance from Junction to ambient	θ _{JA}	90	°C/W

❖ ELECTRICAL CHARACTERISTICS ($V_{CC} = 5V$, $T_A = 25^\circ C$, unless otherwise specified)

Characteristics	Symbol	Conditions (Note1)		Min	Typ	Max	Units
Input offset voltage(Note2)	V _{IO}	V _{CC} =5V to MAX, V _{IC} =V _{ICR} min, V _O =1.4V	Full ange	1	5	11	mV
Average temperature coefficient of input offset voltage	αV _{IO}		Full range	-	7	-	uV/°C
Input offset current	I _{IO}	V _O =1.4V	25°C	-	2	50	nA
			Full range	-	-	150	
Average temperature coefficient of input offset current	αI _{IO}		Full range	-	10	-	pA/°C
Input bias current	I _{IB}	I _{IN+} or I _{IN-}	25°C	-	-20	-250	nA
			Full range	-	-	-500	
Common-mode input voltage range	V _{ICR}	V _{CC} =5V to MAX	25°C	0 to V _{CC} -1.5	-	-	V
			Full range	0 to V _{CC} -2	-	-	V
High-level output voltage	V _{OH}	V _{CC} =MAX, R _L =2KΩ	Full range	26	-	-	V
		V _{CC} =MAX, R _L ≥ 10KΩ	Full range	27	28	-	
Low-level output voltage	V _{OL}	R _L ≥ 10KΩ	Full range	-	5	20	mV
Large-signal differential voltage amplification	A _{VD}	V _{CC} =15V, V _O =1V to 11V, R _L ≥ 2KΩ	25°C	25	100	-	V/mV
			Full range	15	-	-	
Common-mode rejection ratio	CMRR	V _{CC} =5V to MAX, V _{IC} =V _{ICR} min.	25°C	65	80	-	dB
Supply voltage rejection ratio (ΔV _{CC} /ΔV _{IO})	K _{SVR}	V _{CC} =5V to MAX	25°C	65	100	-	dB
Crosstalk attenuation	V _{O1} /V _{O2}	F=1KHz to 20KHz	25°C	-	120	-	dB
Output current	I _O	V _{CC} =15V, V _{ID} =1V, V _O =0V	25°C	-20	-30	-	mA
			Full range	-10	-	-	
		V _{CC} =15V, V _{ID} = -1V, V _O =2V	25°C	10	20	-	
			Full	5	-	-	

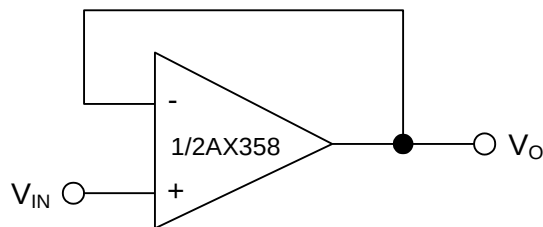
			range				
		$V_{ID} = -1V, V_O = 200mV$	25°C	12	30	-	μA
Short-circuit output current	I_{OS}	$V_{CC} = 15V, V_O = 0V$	25°C	-	40	-	mA
Supply current (two amplifiers)	I_{CC}	$V_O = 2.5V, \text{No Load}$	Full range	-	0.7	1.2	mA
		$V_{CC} = \text{MAX}, V_O = 0.5V_{CC}, \text{No Load}$	Full range	-	1	2	

Note1: All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. "MAX" VCC for testing purposes is 36 V. Full range is 0 °C to 70 °C.

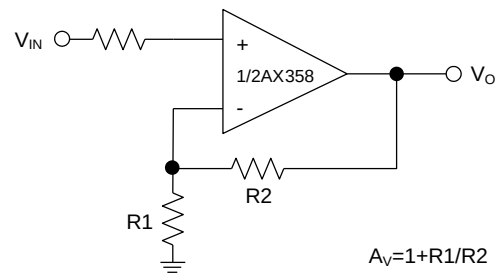
Note2: $(V_{IN+}) - (V_{IN-}) > +1mV$ (min.) for $V_O = 1.4V$.

❖ APPLICATION CIRCUIT

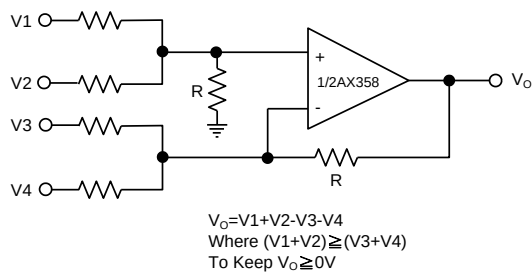
Voltage Follower



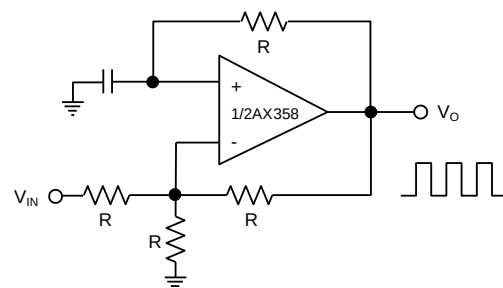
Non Inverting DC Amplifier



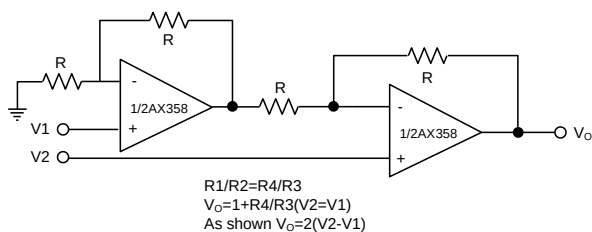
DC Summing Amplifier



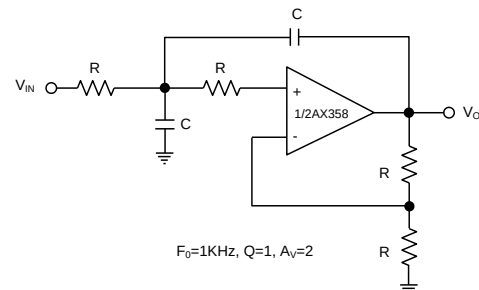
Square-wave Oscillator



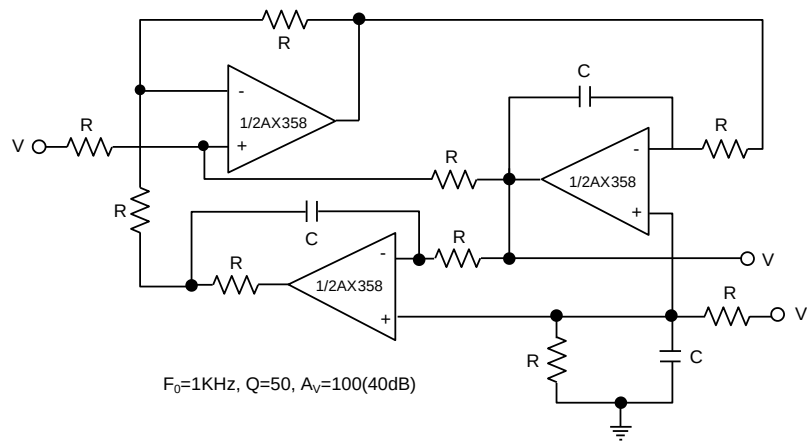
High Input Z, DC differential Amplifier



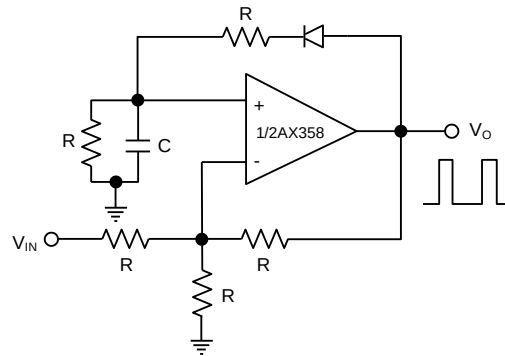
DC Coupled Low-Pass RC Active Filter



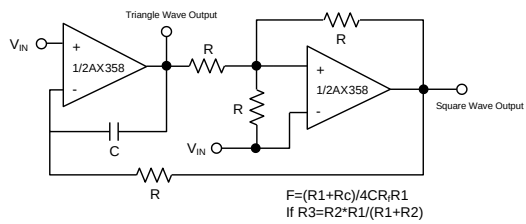
Active Band-Pass Filter



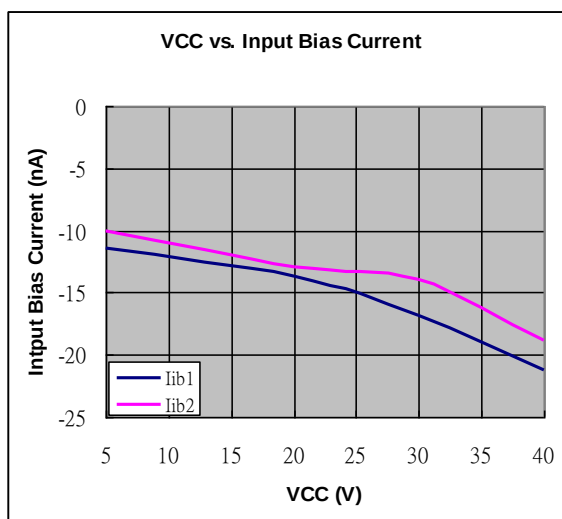
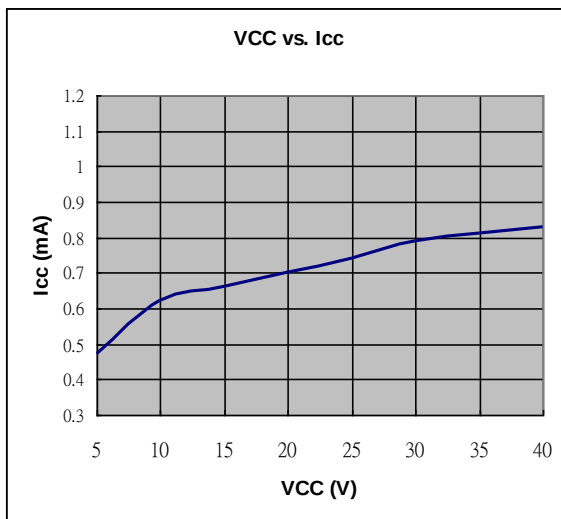
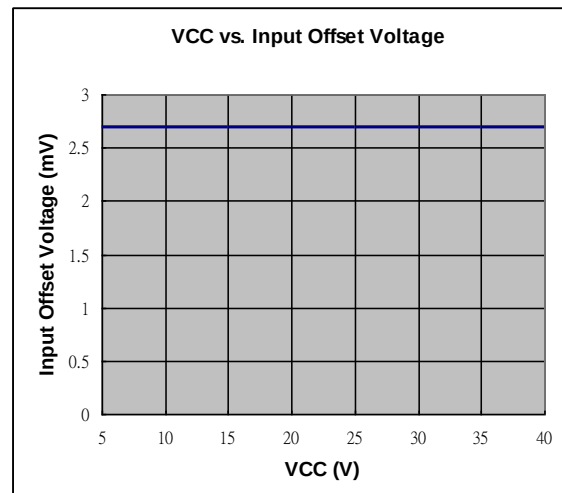
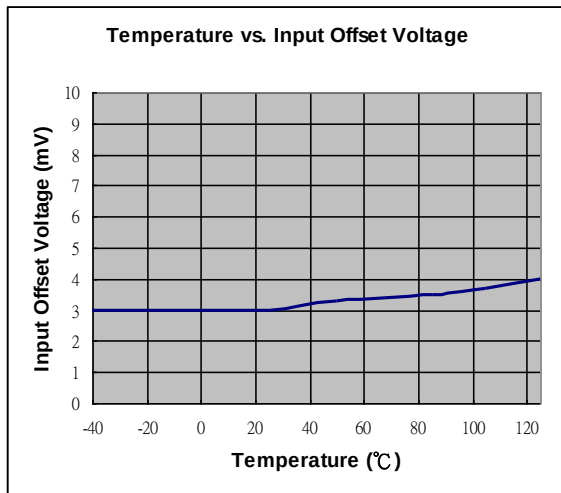
Pulse Generator



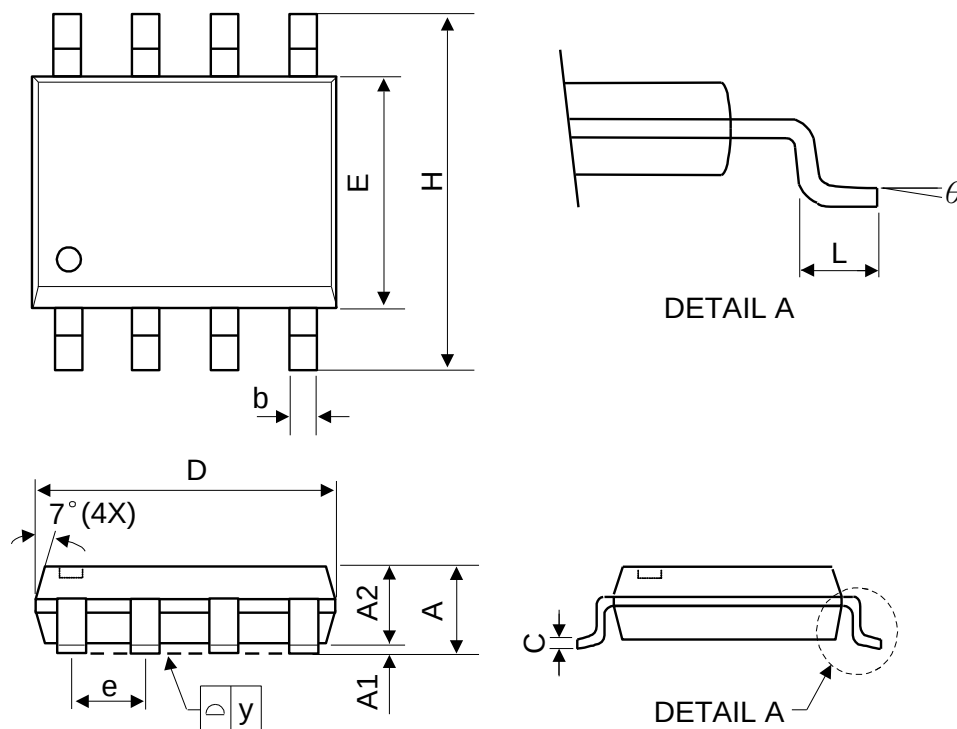
Function Generator



❖ TYPICAL CHARACTERISTICS



❖ **PACKAGE OUTLINES**



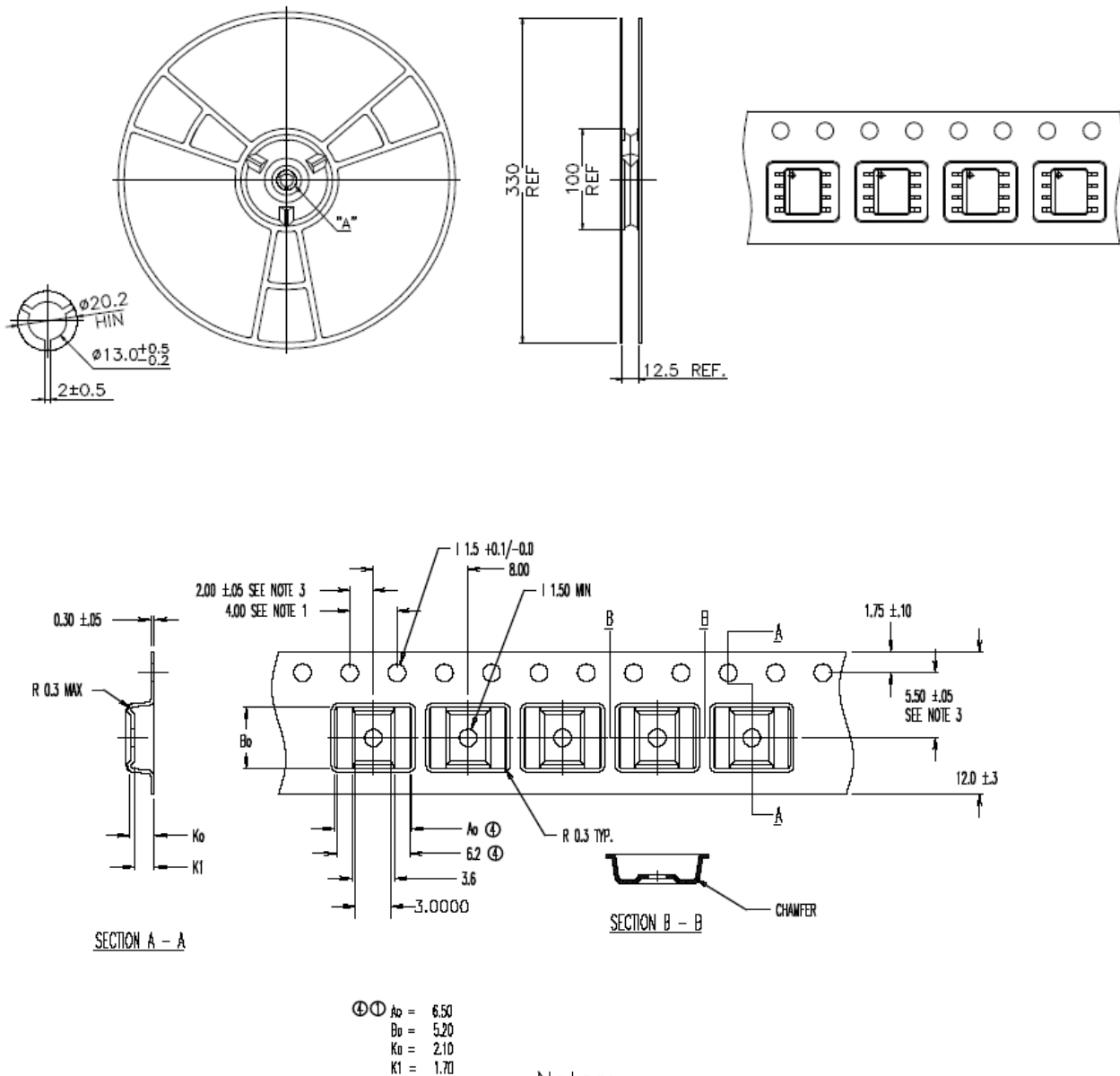
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side

JEDEC outline: MS-012 AA

❖ Carrier tape dimension

SOP8L



Notes:

1. 10 sprocket hole pitch cumulative tolerance $\pm 0.2\text{mm}$
2. Camber not to exceed 1mm in 100mm.
3. Material: Anti-Static Black Advantek Polystyrene.
4. A_0 and B_0 measured on a plane 0.3mm above the bottom of the pocket.
5. K_0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.