

Dual Operational Amplifiers

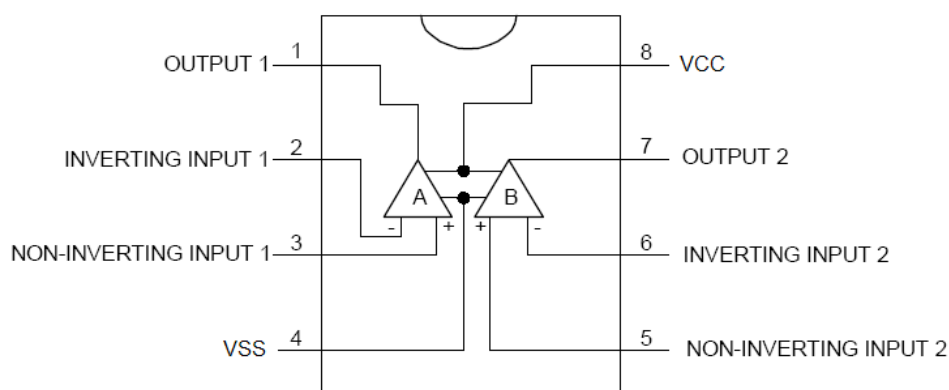
❖ GENERAL DESCRIPTION

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

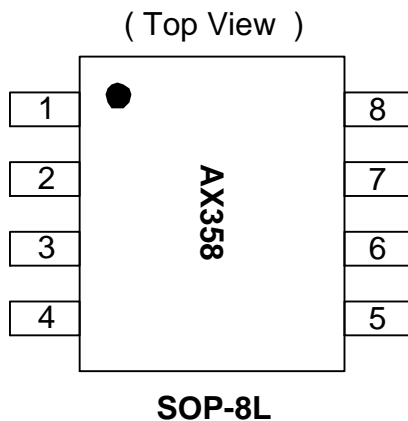
- Two internally compensated OP amps
- Wide power supply range: 3V to 40V
- Large output voltage swing: 0V to $V_{CC}-1.5V$
- Low input bias current
- Low input offset voltage and offset current
- Internally frequency compensated for unity gain
- Short Circuit Protected Outputs
- Input common-mode voltage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

❖ 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
<p>AX 358 X X</p> <p>Package Type: S:SOP-8L</p> <p>Packing: A : Taping</p>	<p>Logo ← AX 3 5 8 → Part number</p> <p>Y Y W W X → ID code:internal</p> <p>WW: 01-52</p> <p>Year: 10=2010 11=2011</p>

❖ **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	-	$\mu V/^\circ C$
Input offset current	I_{IO}	$V_O=1.4V$	25 $^\circ C$	-	2	50	nA
			Full range	-	-	150	
Average temperature coefficient of input offset current	αI_{IO}		Full range	-	10	-	$\mu A/^\circ C$
Input bias current	I_{IB}	I_{IN+} or I_{IN-}	25 $^\circ C$	-	-20	-250	nA
			Full range	-	-	-500	
Common-mode input voltage range	V_{ICR}	$V_{CC}=5V$ to MAX	25 $^\circ C$	0 to $V_{CC}-1.5$	-	-	V
			Full range	0 to $V_{CC}-2$	-	-	V
High-level output voltage	V_{OH}	$V_{CC}=MAX$, $R_L=2K\Omega$	Full range	26	-	-	V
		$V_{CC}=MAX$, $R_L \geq 10K\Omega$	Full range	27	28	-	
Low-level output voltage	V_{OL}	$R_L \geq 10K\Omega$	Full range	-	5	20	mV
Large-signal differential voltage amplification	A_{VD}	$V_{CC}=15V$, $V_O=1V$ to 11V, $R_L \geq 2K\Omega$	25 $^\circ C$	25	100	-	V/mV
			Full range	15	-	-	
Common-mode rejection ratio	CMRR	$V_{CC}=5V$ to MAX, $V_{IC}=V_{ICR}$ min.	25 $^\circ C$	65	80	-	dB
Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$)	K_{SVR}	$V_{CC}=5V$ to MAX	25 $^\circ C$	65	100	-	dB
Crosstalk attenuation	V_{O1}/V_{O2}	F=1KHz to 20KHz	25 $^\circ C$	-	120	-	dB

❖ **ELECTRICAL CHARACTERISTICS (CONTINUE)**

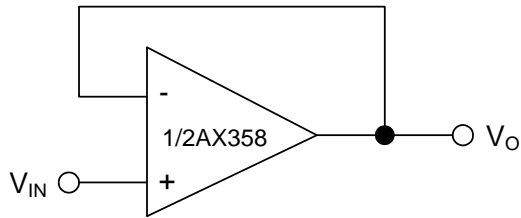
Output current	I _o	V _{CC} =15V, V _{ID} =1V, V _O =0V	25°C	-20	-30	-	mA
			Full range	-10	-	-	
		V _{CC} =15V, V _{ID} = -1V, V _O =2V	25°C	10	20	-	
			Full range	5	-	-	
	V _{ID} = -1V, V _O =200mV	25°C	12	30	-	uA	
Short-circuit output current	I _{os}	V _{CC} =15V, V _O =0V	25°C	-	40	-	mA
Supply current (two amplifiers)	I _{CC}	V _O -2.5V, No Load	Full range	-	0.7	1.2	mA
		V _{CC} =MAX, V _O =0.5V _{CC} , 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.

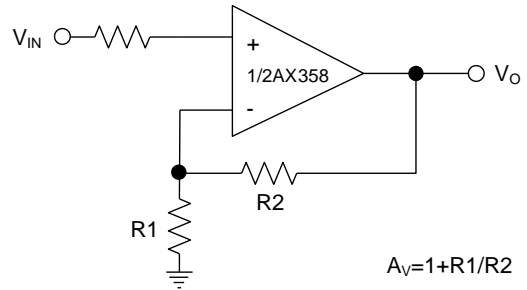
Note2: (VIN+) – (VIN-) > +1mV (min.) for V_O=1.4V.

❖ APPLICATION CIRCUIT

Volgate Follower

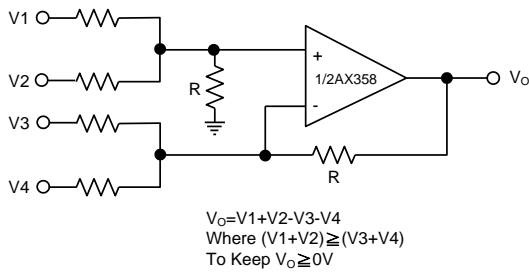


Non Inverting DC Amplifier



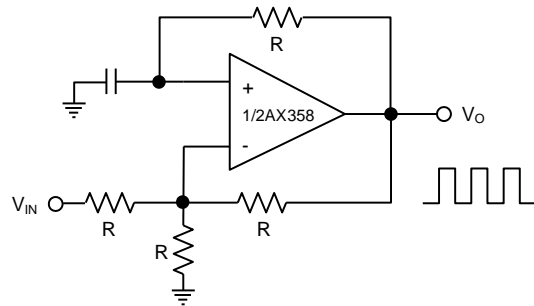
$A_v = 1 + R1/R2$

DC Summing Amplifier

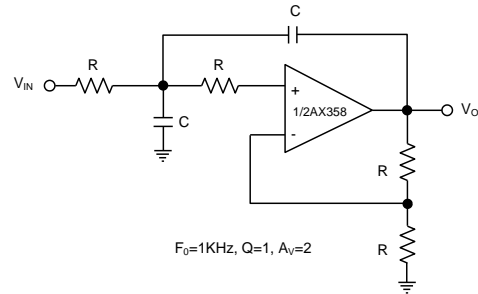


$V_o = V1 + V2 - V3 - V4$
Where $(V1 + V2) \geq (V3 + V4)$
To Keep $V_o \geq 0V$

Square-wave Oscillator

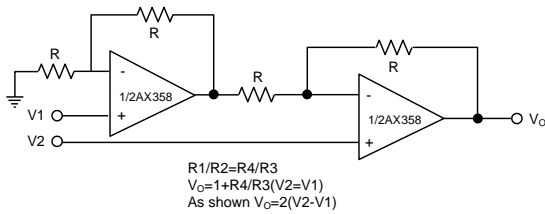


DC Coupled Low-Pass RC Active Filter



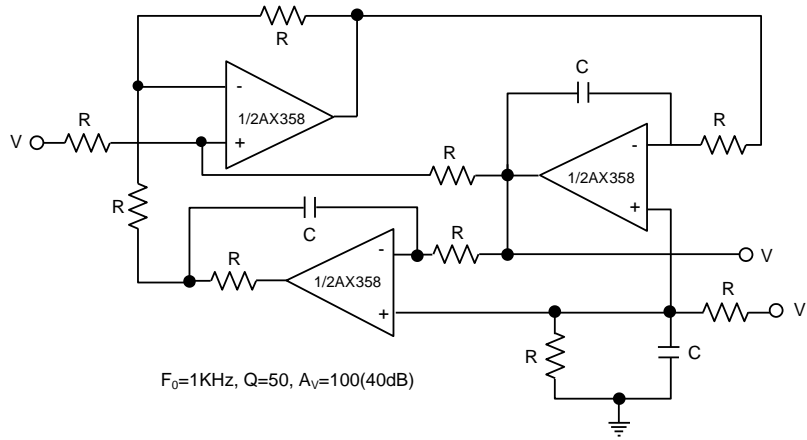
$F_0 = 1KHz, Q=1, A_v=2$

High Input Z, DC differential Amplifier

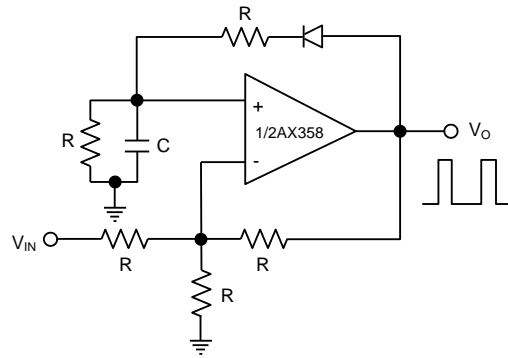


$R1/R2 = R4/R3$
 $V_o = 1 + R4/R3 (V2 - V1)$
As shown $V_o = 2(V2 - V1)$

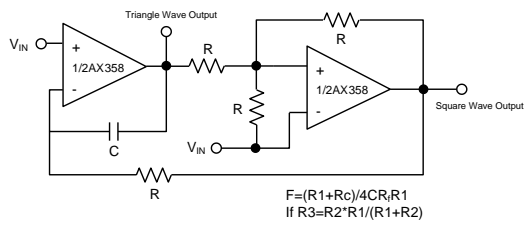
Active Band-Pass Filter



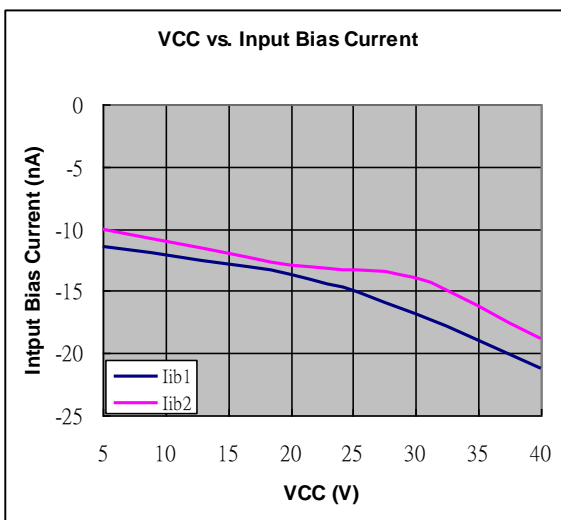
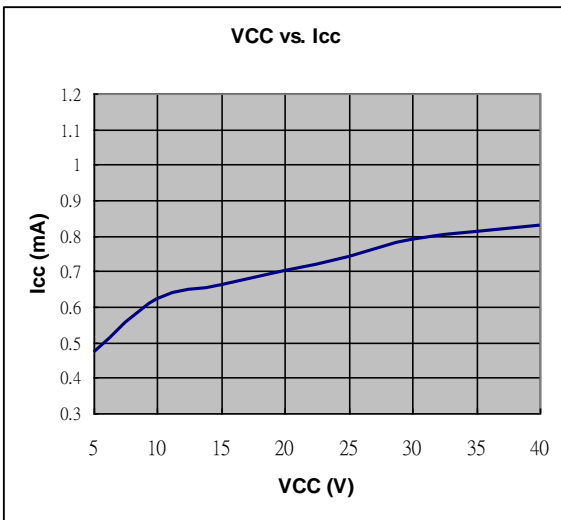
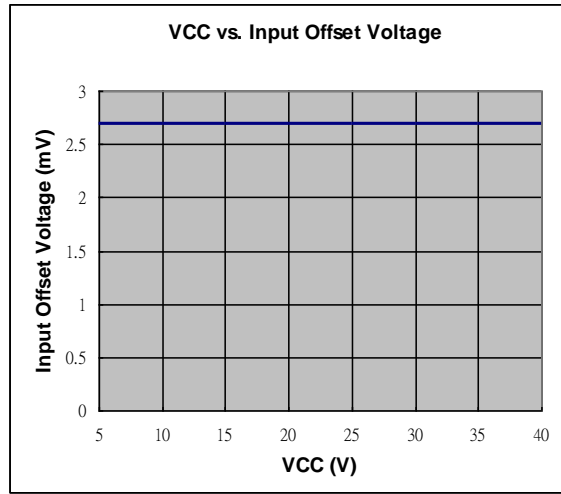
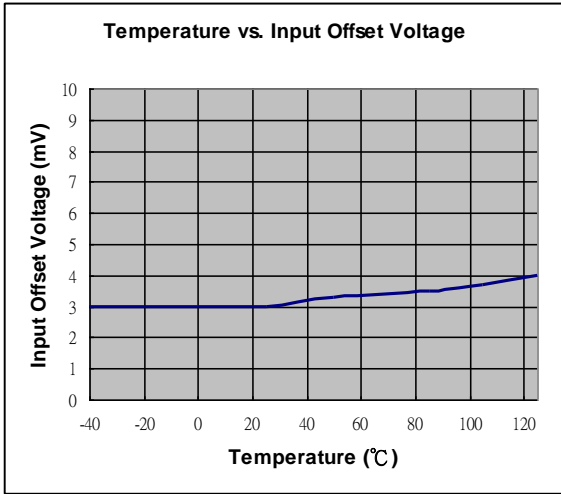
Pulse Generator



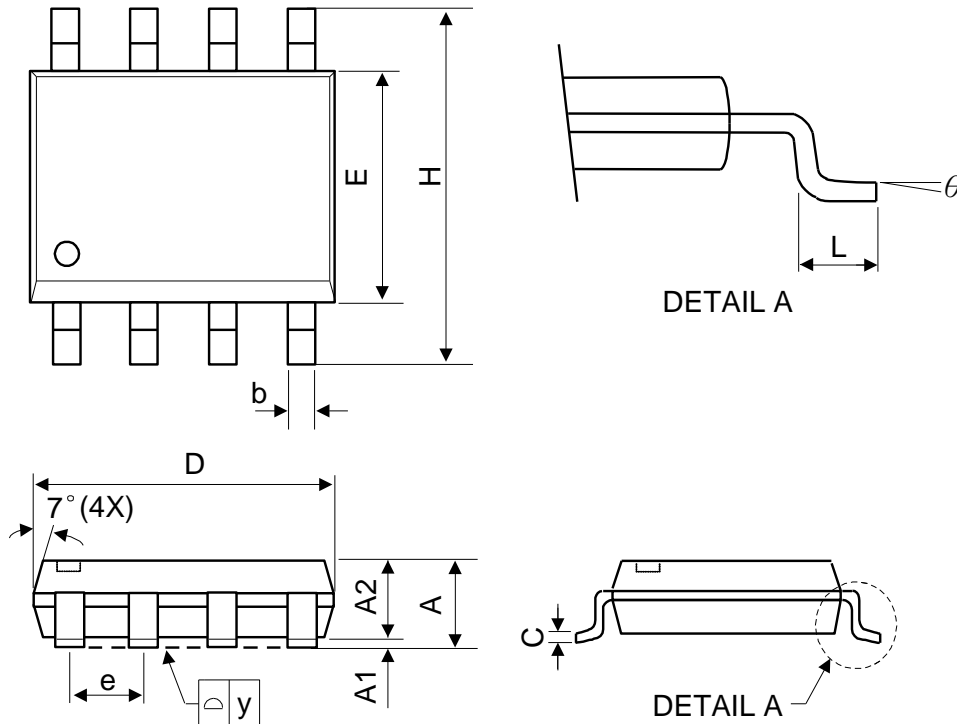
Function Generator



❖ 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