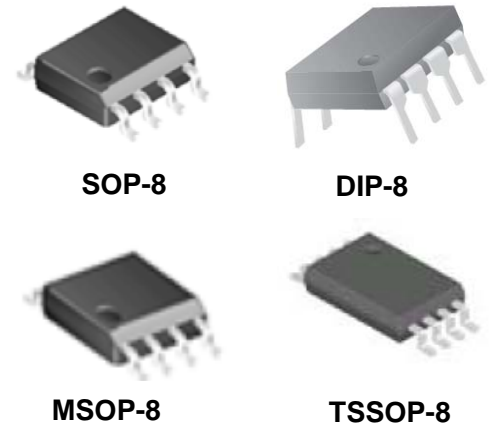


Dual Operational Amplifier

General Description

- The LM358 series consists of two independent high gain, internally frequency compensated operational amplifiers. It can be operated from a single power supply and also split power supplies.
- The LM358 is available in SOP-8, DIP-8, TSSOP-8 and MSOP-8 packages



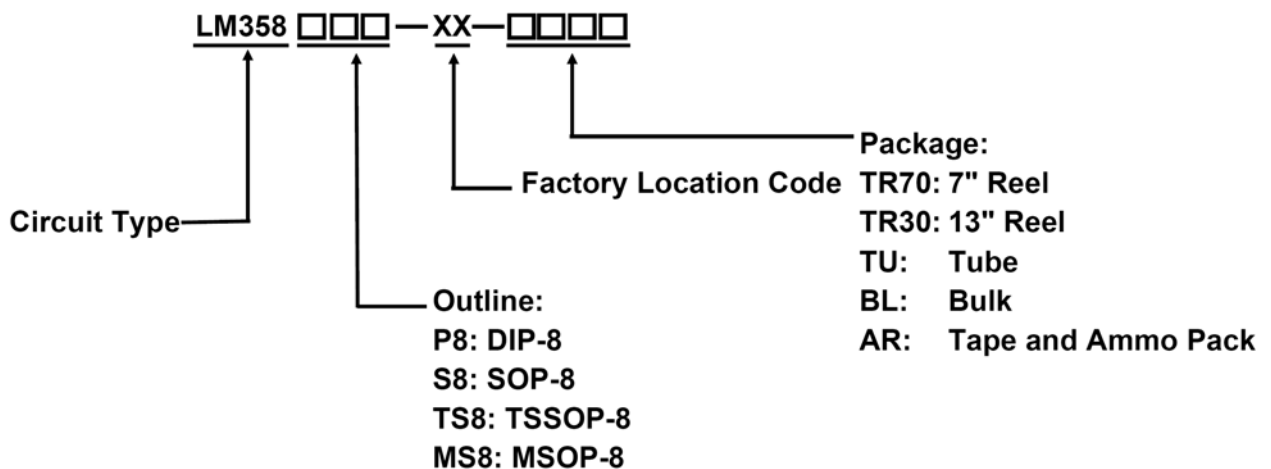
Features

- Internally frequency compensated for unity gain
- Wide power supply range 3V - 32 V
- Input common-mode voltage range include ground
- Large DC voltage gain: 100dB Typical
- RoHS Compliance

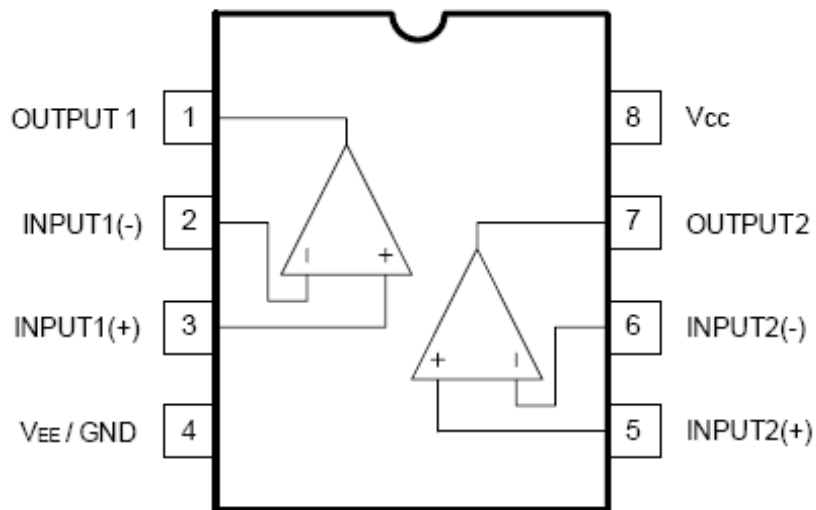
Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

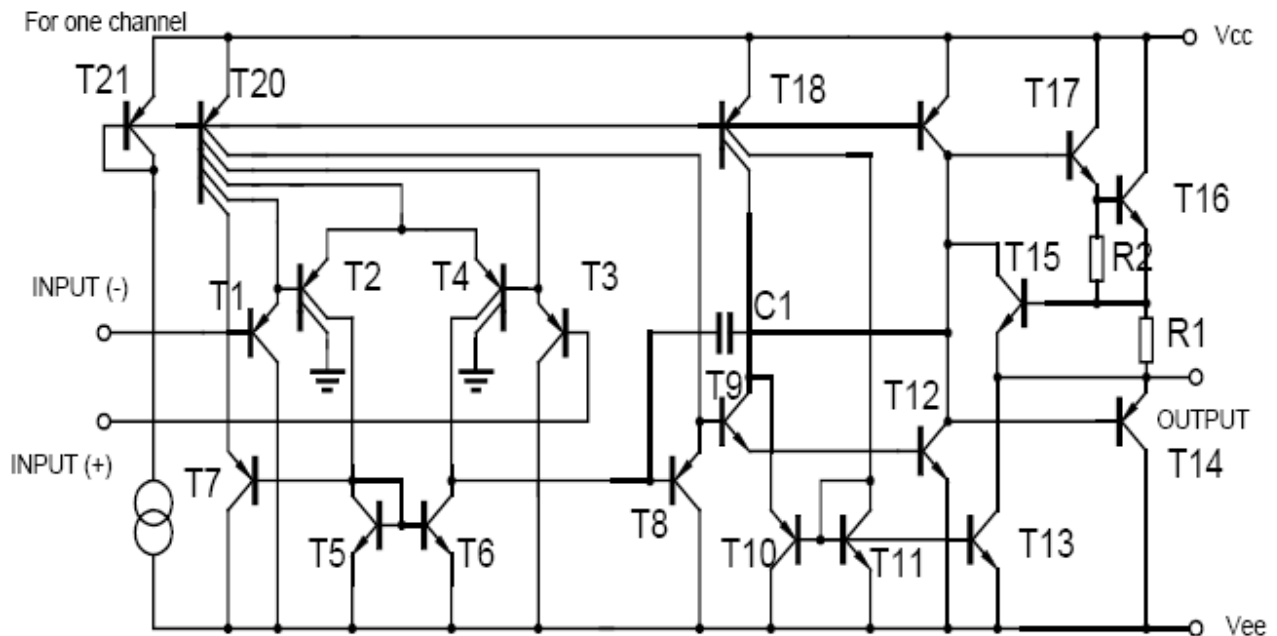
Ordering Information



Internal Block Diagram



Schematic Diagram



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit	
V _{CC}	Supply Voltage	±16	V	
V _{I(DIFF)}	Differential Input Voltage	±32	V	
V _I	Input Voltage	-0.3 ~ +32	V	
-	Output Short to Ground	Continuous	-	
P _D	Power Dissipation	TSSOP-8	200	mW
		MSSOP-8	200	
		SOP-8	280	
		Dip-8	500	
T _J	Junction Temperature	125	°C	
T _{OPR}	Operating Temperature Range	0 ~ +70	°C	
T _{STG}	Storage Temperature Range	-65~ +150	°C	

Note: Absolute maximum ratings are those beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics ($V_{CC}=5.0V$, $V_{EE}=GND$, $T_A=25^\circ C$ unless noted otherwise)

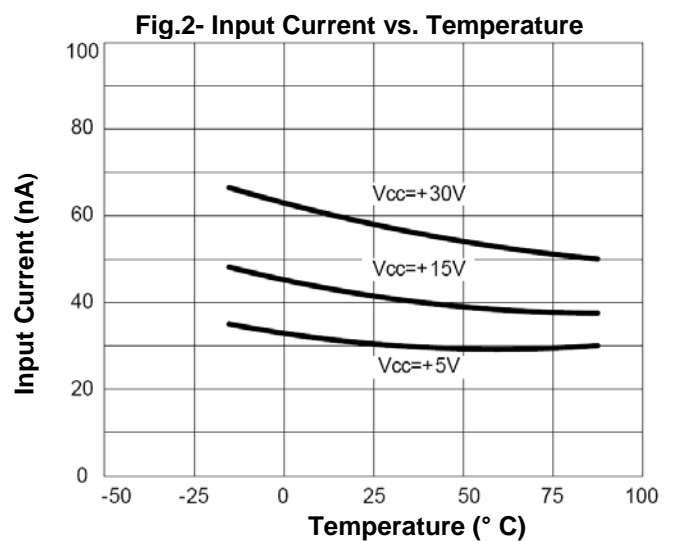
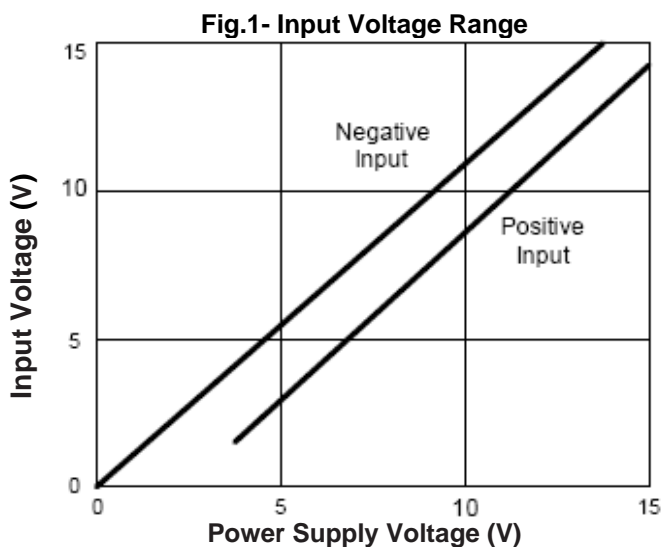
Symbol	Description	LM358			Unit	Conditions
		Min.	Typ.	Max.		
V _{I(OFF)}	Input Offset Voltage	-	2.9	7	mV	V _{CM} =0V to V _{CC} -1.5V V _{O(P)} =1.4V, R _S =0Ω
V _{I(CM)}	Input Common Mode Voltage	0	-	V _{CC} -1.5	V	V _{CC} =30V
V _{I(DIFF)}	Differential Input Voltage	-	-	V _{CC}	V	-
V _{O(H)}	Output Voltage Swing	26	-	-	V	V _{CC} =30V, R _L =2KΩ
		27	28	-		V _{CC} =30V, R _L =10KΩ
V _{O(L)}		-	5	20	mV	V _{CC} =5V, R _L ≥10KΩ
G _V	Large Signal Voltage Gain	25	100	-	V/mV	V _{CC} =15V, R _L ≥2KΩ V _{O(P)} =1V ~11V

Dual Operational Amplifier

LM358

Symbol	Description	LM358			Unit	Conditions
		Min.	Typ.	Max.		
I _{CC}	Power Supply Current	-	0.8	2.0	mA	R _L =∞, V _{CC} =30V
		-	0.5	1.2		R _L =∞, Full Temperature Range
I _{I(OFF)}	Input Offset Current	-	5	50	nA	-
I _{BIAS}	Input Bias Current	-	45	250	nA	-
I _{SC}	Short Circuit Current to Ground	-	40	60	mA	-
I _{SOURCE}	Output Current	10	30	-	mA	V _{I(+)} =1V, V _{I(-)} =0V V _{CC} =15V, V _{O(P)} =2V
I _{SINK}		10	15	-	mA	V _{I(+)} =0V, V _{I(-)} =1V V _{CC} =15V, V _{O(P)} =2V
		12	100	-	μA	V _{I(+)} =0V, V _{I(-)} =1V V _{CC} =15V, V _{O(P)} =200mV
CMRR	Common Mode Rejection Ratio	65	80	-	dB	-
PSRR	Power Supply Rejection Ratio	65	100	-	dB	-
CS	Channel Separation	-	120	-	dB	f=1KHZ ~ 20KHZ

Typical Characteristics Curves



Dual Operational Amplifier

LM358

Fig.3- Input Current vs Supply Voltage

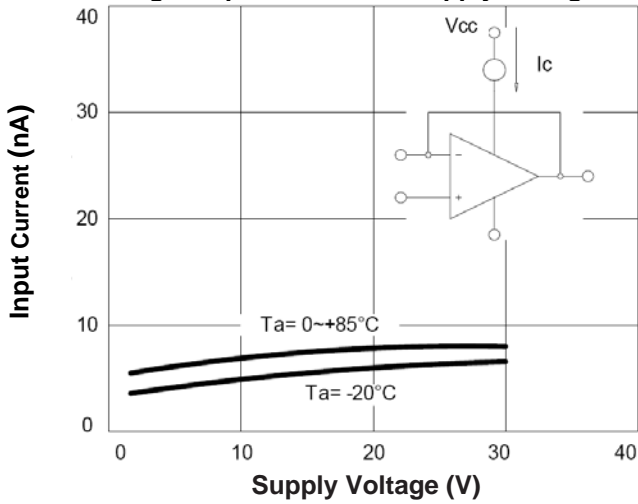


Fig.4- Voltage Gain vs Supply Voltage

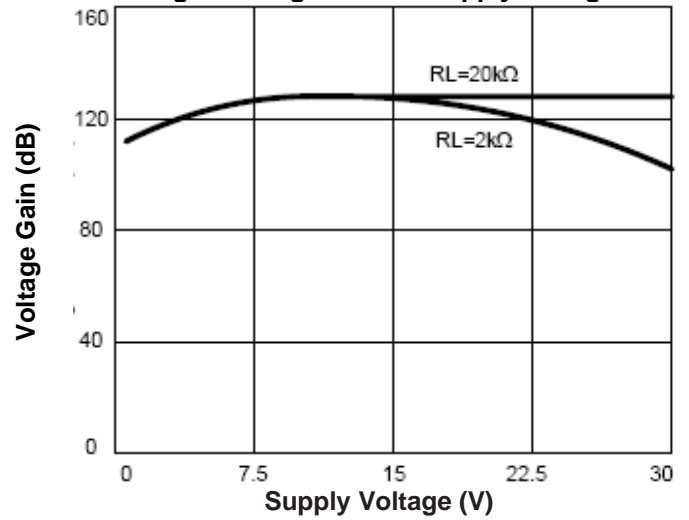


Fig.5- Open Loop Frequency Response

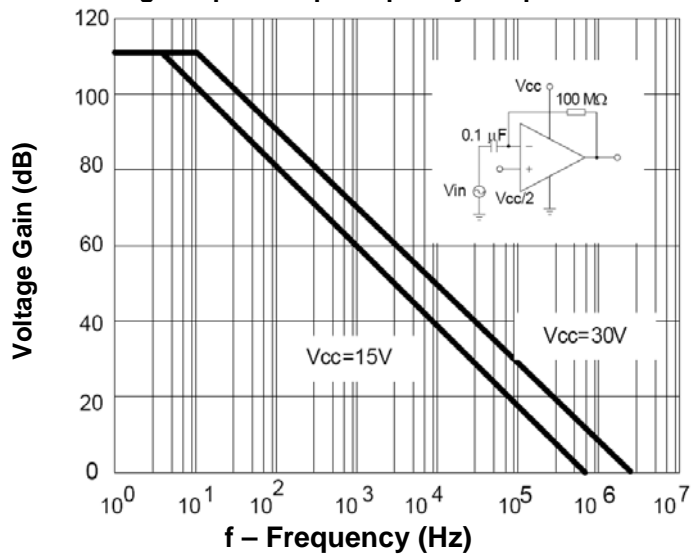


Fig.6- Common Mode Rejection Ratio

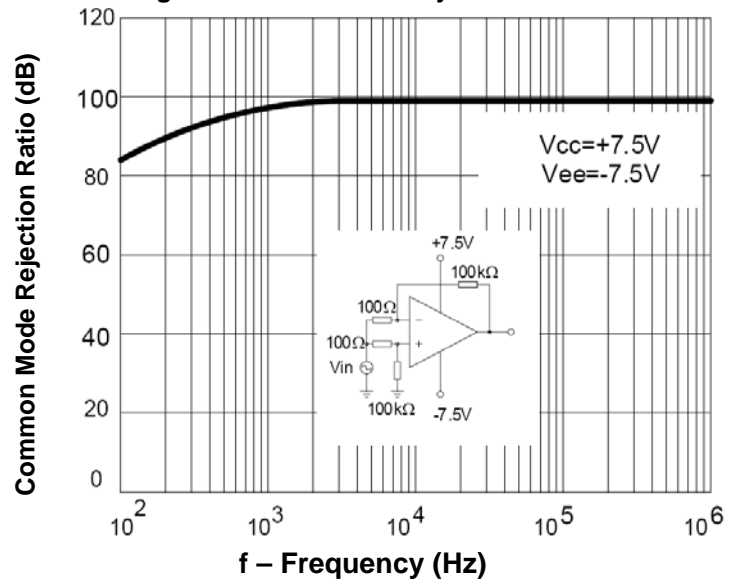


Fig.7- Voltage Follower Pulse Response

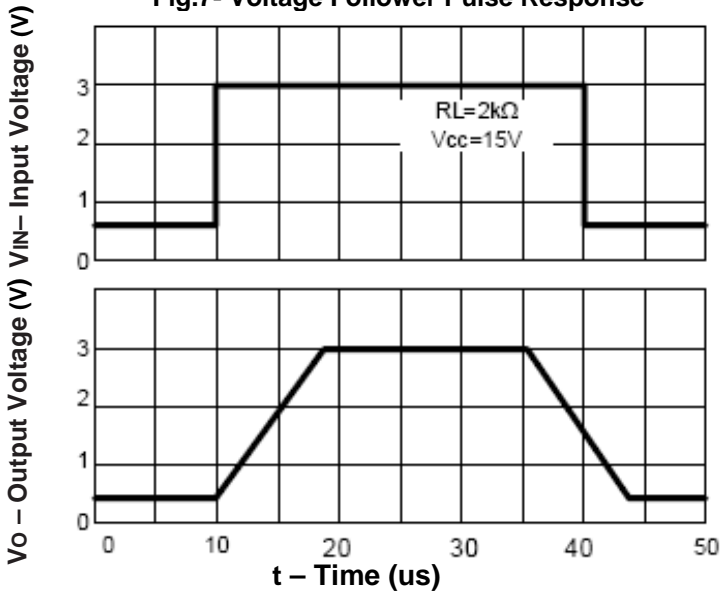


Fig.8- Voltage Follower Pulse Response (Small Signal)

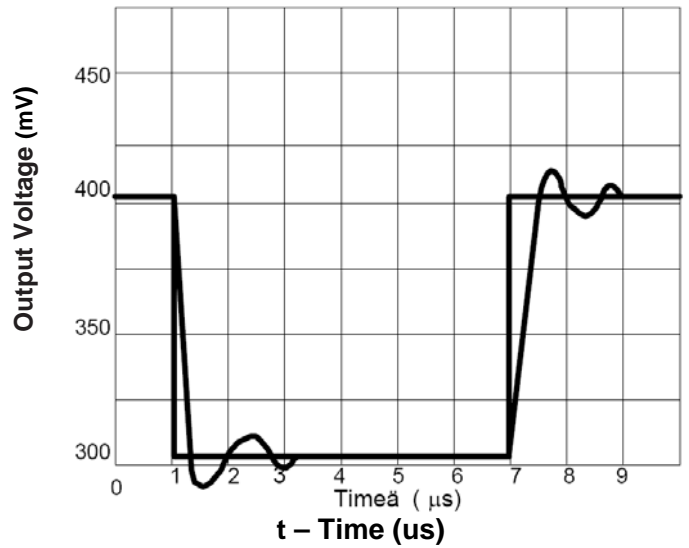


Fig.9- Gain vs Large Signal Frequency

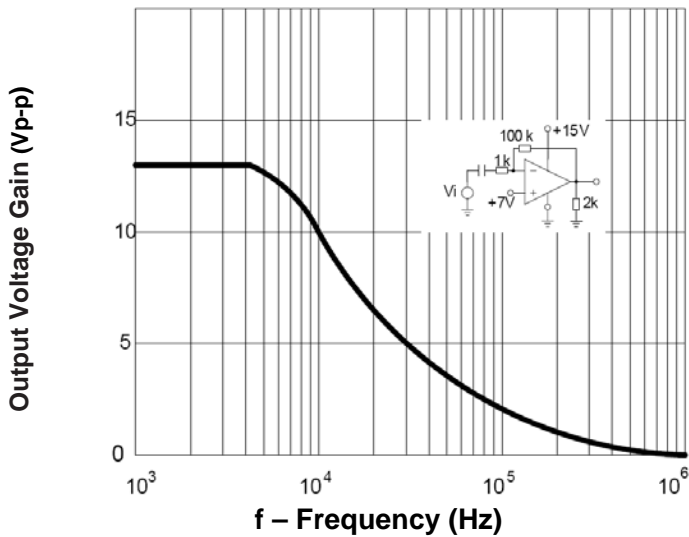
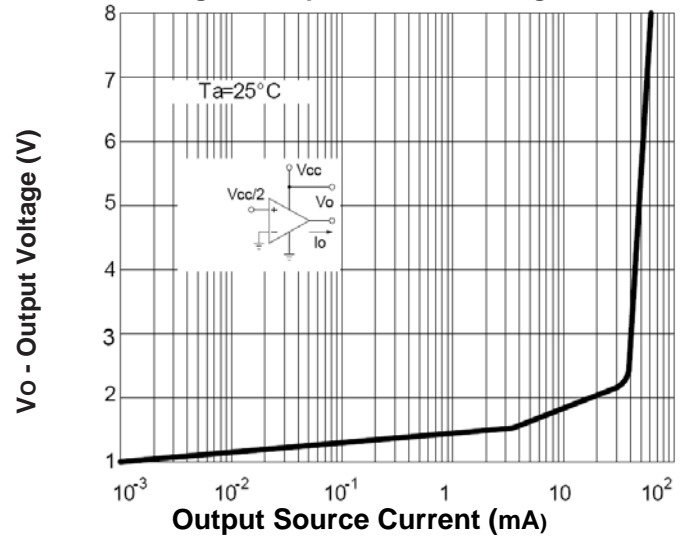


Fig.10- Output Current Sinking



Dual Operational Amplifier

LM358

Fig.11- Output Sink Current

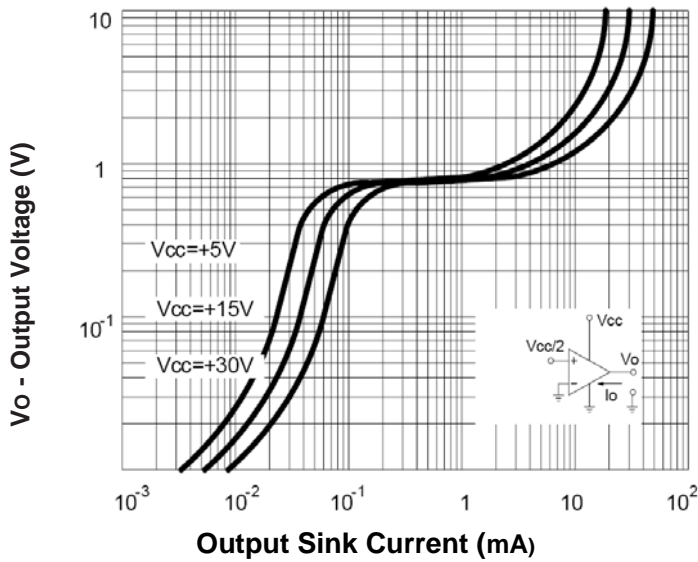
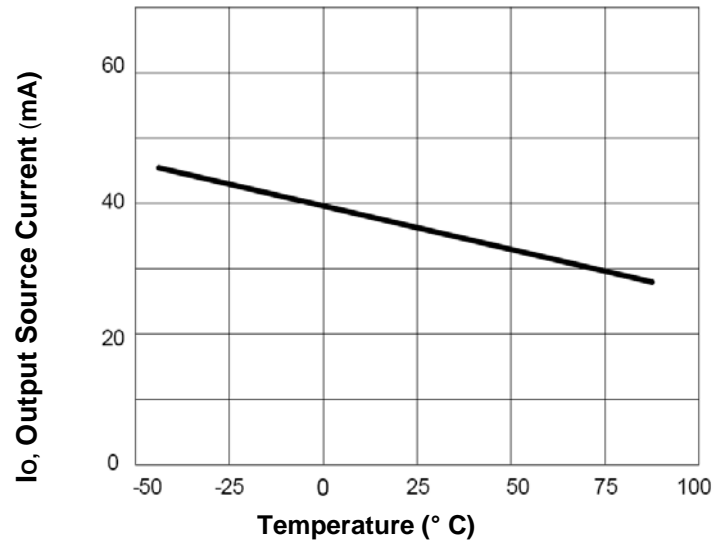


Fig.12- Current Limiting vs Temperature



Typical Application

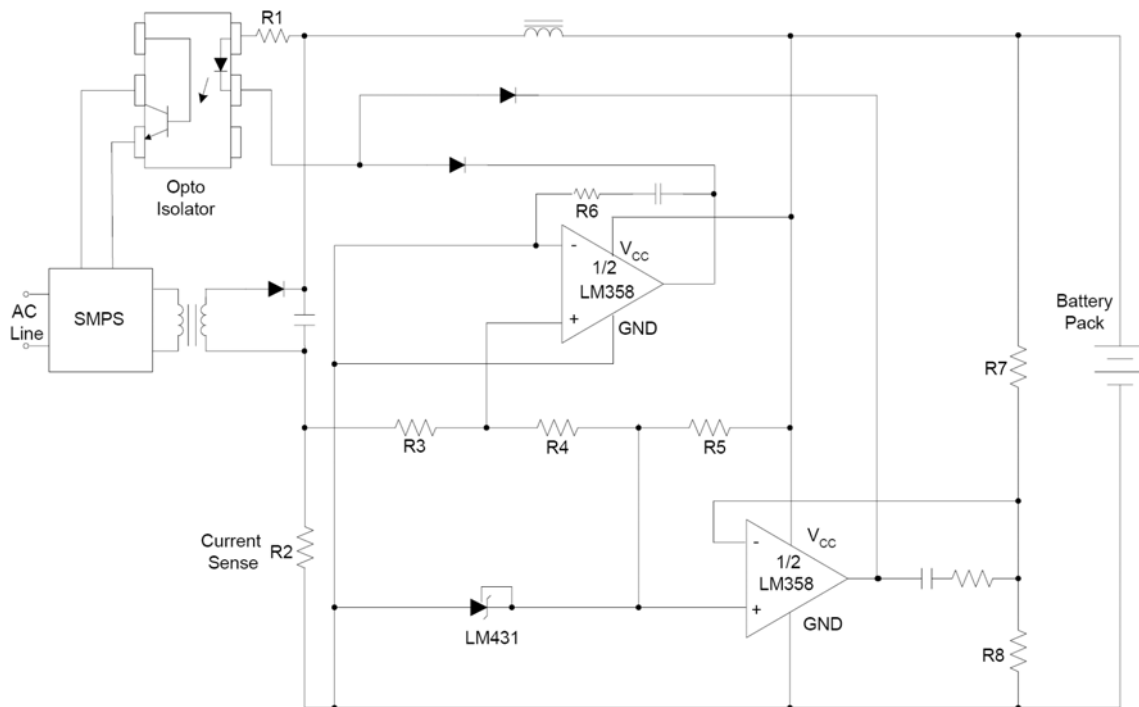


Fig.13- Battery Charger

Typical Application (Continued)

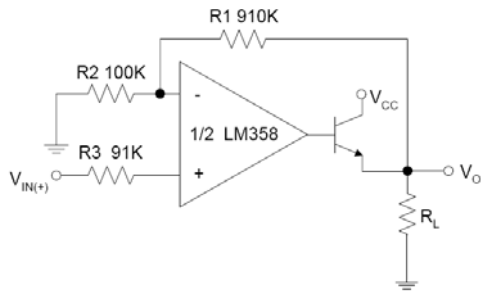


Fig.14- Power Amplifier

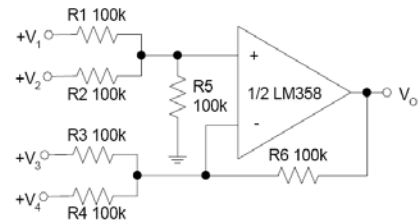


Fig.15- DC Summing Amplifier

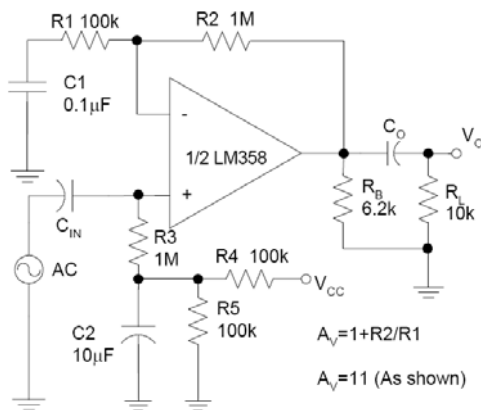


Fig.16- AC Coupled Non-Inverting Amplifier

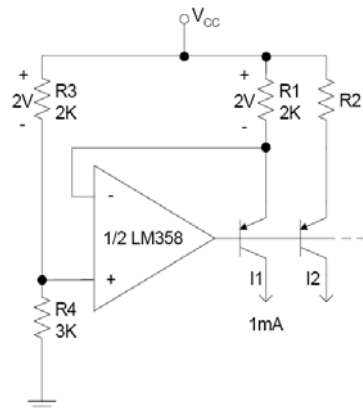


Fig.17- Fixed Current Sources

Typical Application (Continued)

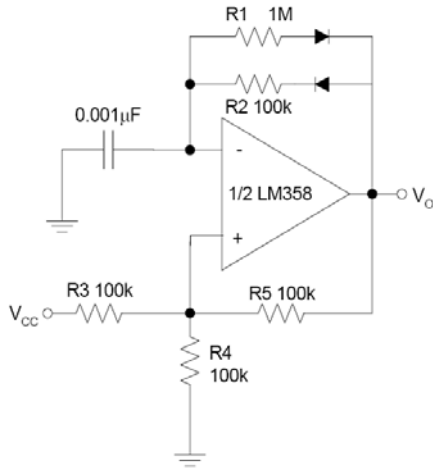


Fig.18- Pulse Generator

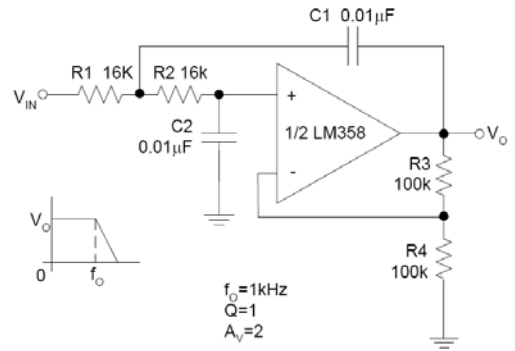
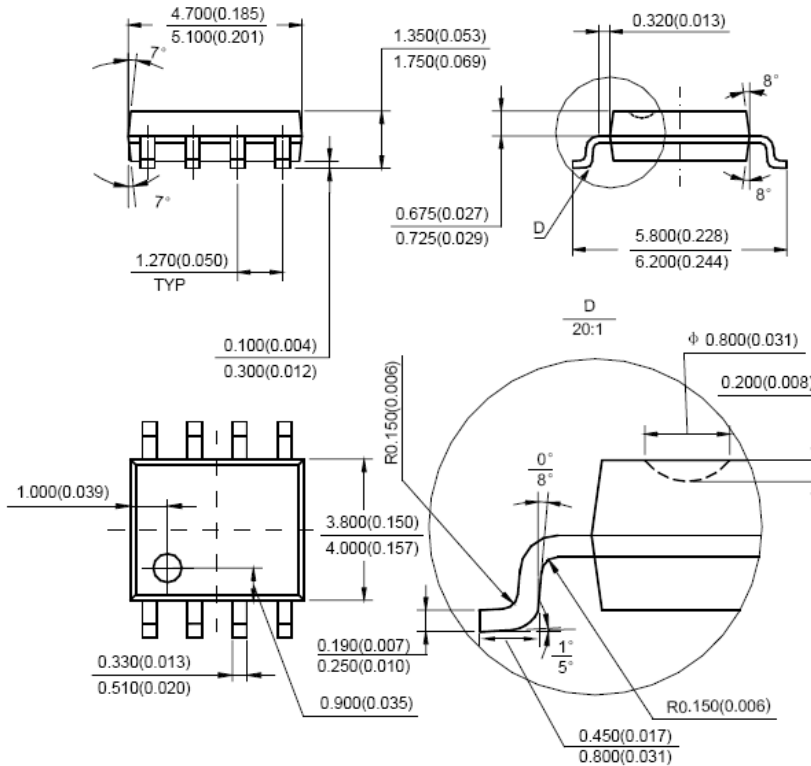


Fig.19- DC Coupled Low-Pass Active Filter

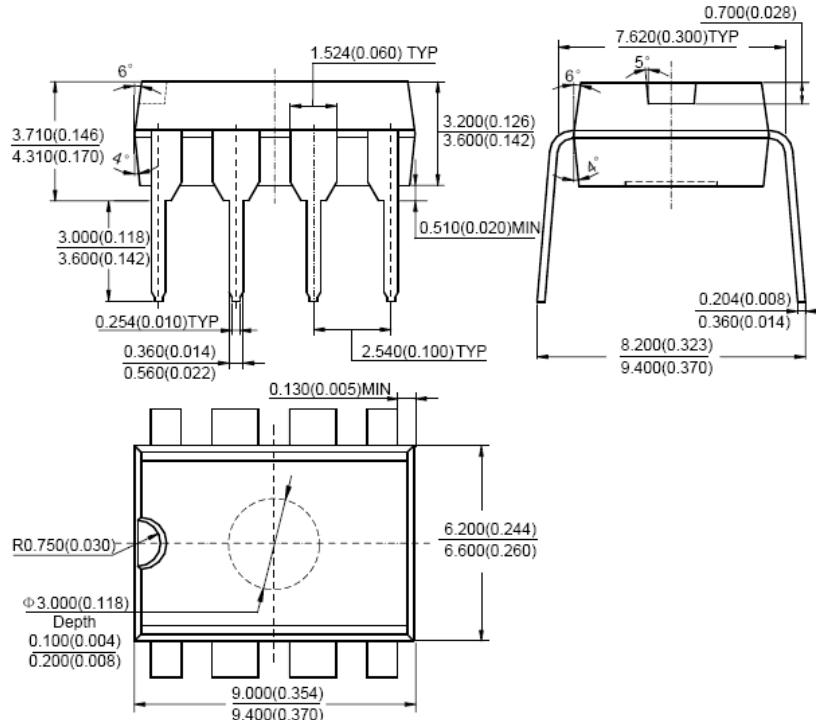
Dimensions in inches (mm)



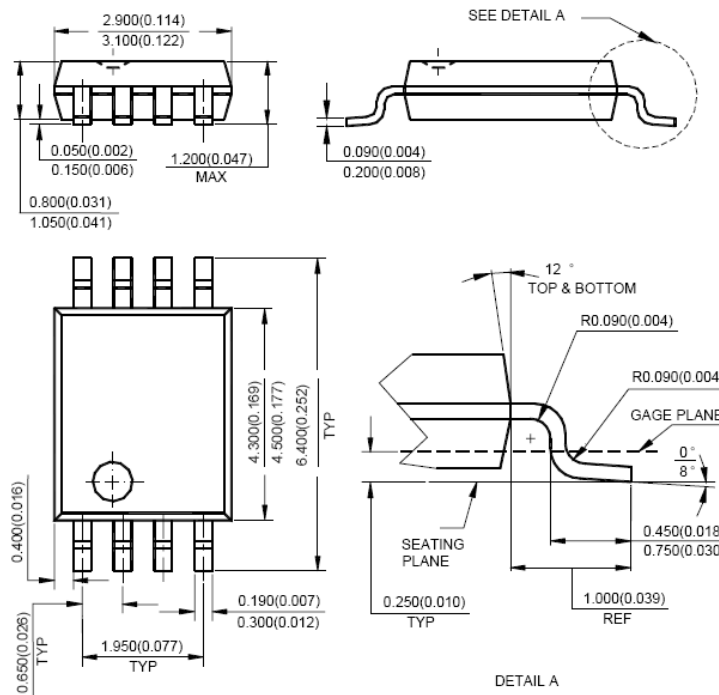
SOP-8

Dual Operational Amplifier

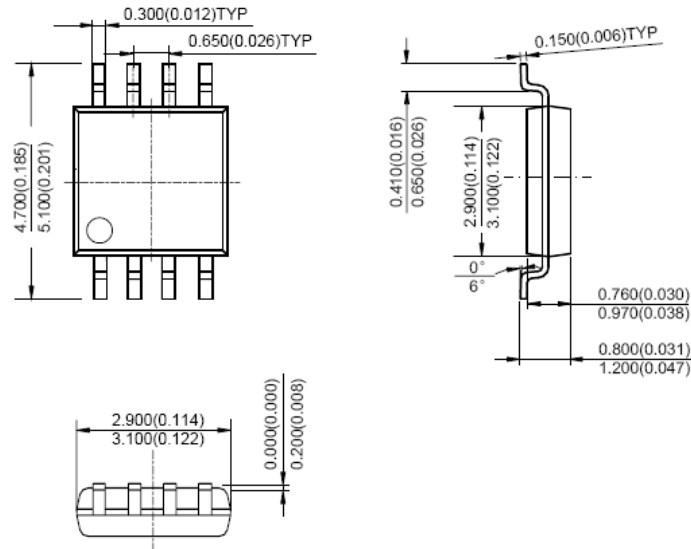
LM358



DIP-8



TSSOP-8



MSOP-8

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