



## LM358

## LINEAR INTEGRATED CIRCUIT

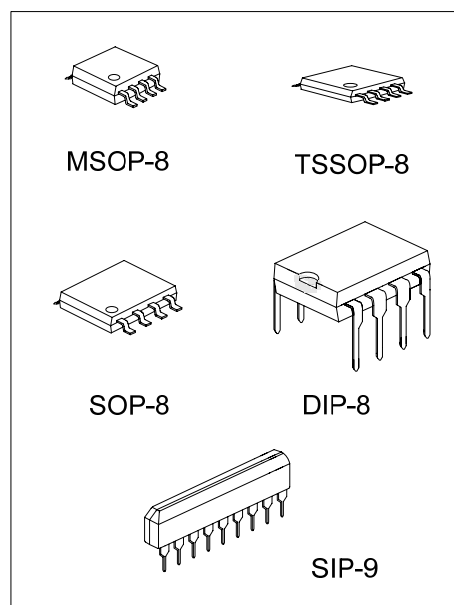
### DUAL OPERATIONAL AMPLIFIER

#### DESCRIPTION

The UTC LM358 consists of two independent high gain, internally frequency compensated operational amplifier. It can be operated from a single power supply and also split power supplies.

#### FEATURES

- \*Internally frequency compensated for unity gain.
- \*Wide power supply range 3V - 32V.
- \*Input common-mode voltage range include ground.
- \*Large DC voltage gain.



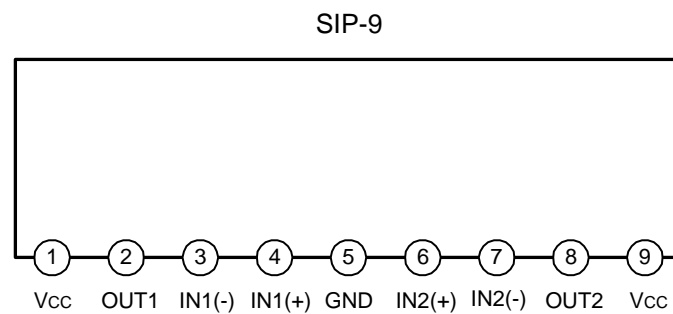
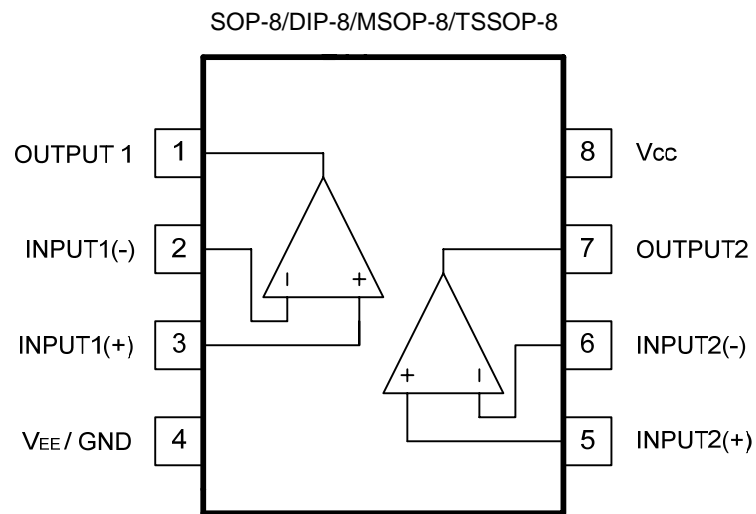
\*Pb-free plating product number: LM358L

#### ORDERING INFORMATION

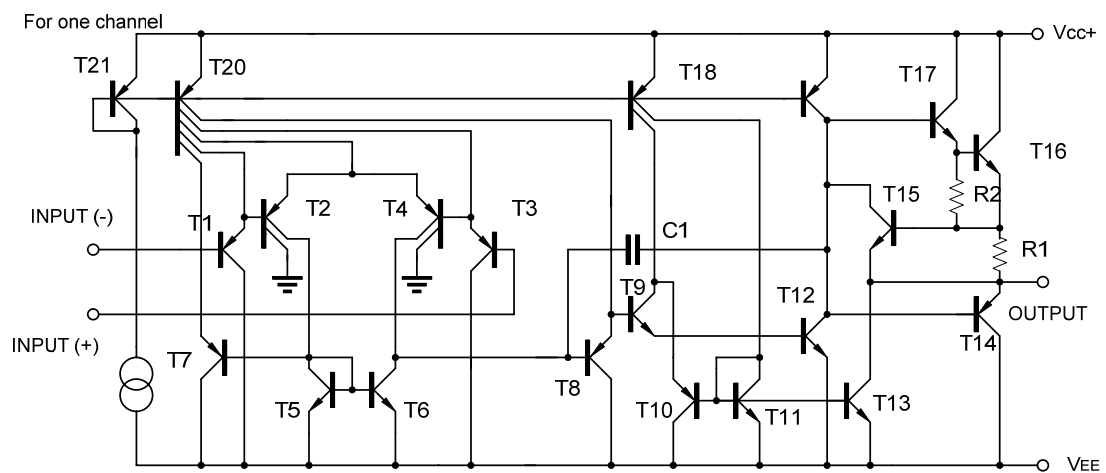
Ordering Number		Package	Packing
Normal	Lead Free Plating		
LM358-D08-T	LM358L-D08-T	DIP-8	Tube
LM358-G09-T	LM358L-G09-T	SIP-9	Tube
LM358-P08-R	LM358L-P08-R	TSSOP-8	Tape Reel
LM358-P08-T	LM358L-P08-T	TSSOP-8	Tube
LM358-S08-R	LM358L-S08-R	SOP-8	Tape Reel
LM358-S08-T	LM358L-S08-T	SOP-8	Tube
LM358-SM1-R	LM358L-SM1-R	MSOP-8	Tape Reel
LM358-SM1-T	LM358L-SM1-T	MSOP-8	Tube

<p>LM358L-D08-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Plating</p>		<p>(1) R: Tape Reel, T: Tube (2) D08: DIP-8, G09: SIP-9, S08: SOP-8, SM1: MSOP-8, P08: TSSOP-8 (3) L: Lead Free Plating, Blank: Pb/Sn</p>
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## ■ PIN DESCRIPTION



## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		$V_{CC}$	$\pm 16$ or 32	V
Differential Input Voltage		$V_{I(DIFF)}$	$\pm 32$	V
Input Voltage		$V_I$	-0.3 ~ +32	V
Output Short to Ground			Continuous	
Power Dissipation	SIP-9	$P_D$	600	mW
	DIP-8		500	
	SOP-8		280	
	TSSOP-8/MSOP-8		200	
Junction Temperature		$T_J$	+125	°C
Operating Temperature		$T_{OPR}$	0 ~ +70	°C
Storage Temperature		$T_{STG}$	-65 ~ +150	°C

Note Absolute maximum ratings are those values 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 otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{I(OFF)}$	$V_{CM}=0V$ to $V_{CC}-1.5V$ $V_{O(P)}=1.4V$ , $R_S=0\Omega$		2.9	7.0	mV
Input Common Mode Voltage	$V_{I(CM)}$	$V_{CC}=30V$	0		$V_{CC}-1.5$	V
Differential Input Voltage	$V_{I(DIFF)}$				$V_{CC}$	V
Output Voltage Swing	$V_{OH}$	$V_{CC}=30V$ , $R_L=2K\Omega$	26			V
		$V_{CC}=30V$ , $R_L=10K\Omega$	27	28		V
	$V_{OL}$	$V_{CC}=5V$ , $R_L \geq 10K\Omega$		5	20	mV
Large Signal Voltage Gain	$G_V$	$V_{CC}=15V$ , $R_L \geq 2K\Omega$ $V_{O(P)}=1V \sim 11V$	25	100		V/mV
Power Supply Current	$I_{CC}$	$R_L=\infty$ , $V_{CC}=30V$		0.8	2.0	mA
		$R_L=\infty$ , Full Temperature Range		0.5	1.2	mA
Input Offset Current	$I_{I(OFF)}$			5	50	nA
Input Bias Current	$I_{I(BIAS)}$			45	250	nA
Short Circuit Current to Ground	$I_{SC}$			40	60	mA
Output Current	$I_{SOURCE}$	$V_I(+)=1V$ , $V_I(-)=0V$ $V_{CC}=15V$ , $V_{O(P)}=2V$	10	30		mA
	$I_{SINK}$	$V_I(+)=0V$ , $V_I(-)=1V$ $V_{CC}=15V$ , $V_{O(P)}=2V$	10	15		mA
		$V_I(+)=0V$ , $V_I(-)=1V$ $V_{CC}=15V$ , $V_{O(P)}=200mV$	12	100		mA
Common Mode Rejection Ratio	CMRR		65	80		dB
Power Supply Rejection Ratio	PSRR		65	100		dB
Channel Separation	CS	$f=1KHZ \sim 20KHZ$		120		dB

## TYPICAL CHARACTERISTICS

Fig.1 Input Voltage Range

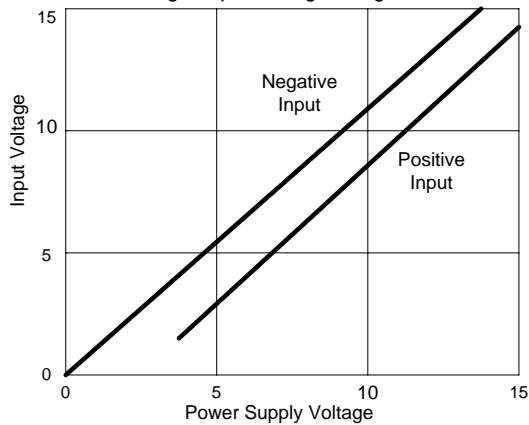


Fig.2 Input Current vs Temperature

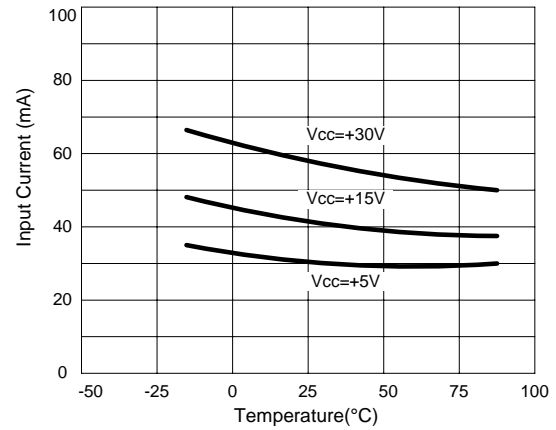


Fig.3 Input Current vs Supply Voltage

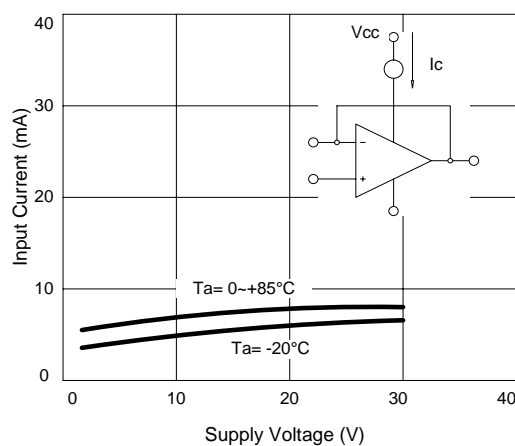


Fig. 4 Voltage Gain vs Supply Voltage

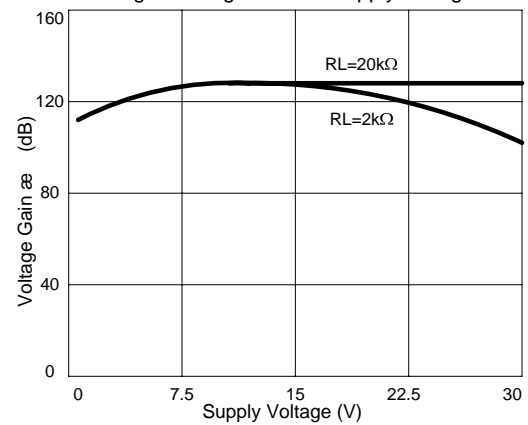


Fig. 5 Open Loop Gain vs Frequency

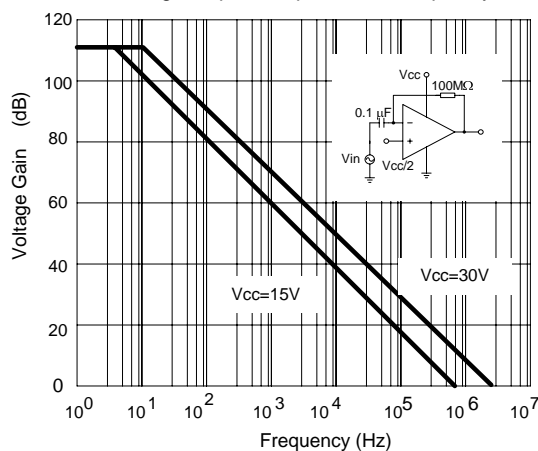
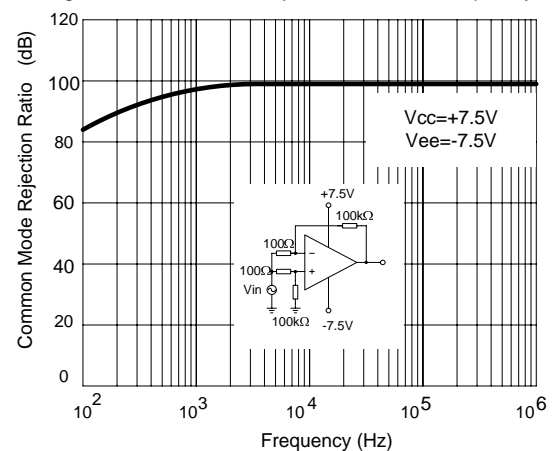


Fig. 6 Common Mode Rejection Ratio vs Frequency



## ■ TYPICAL CHARACTERISTICS(Cont.)

Fig. 7 Voltage Follower Pulse Response

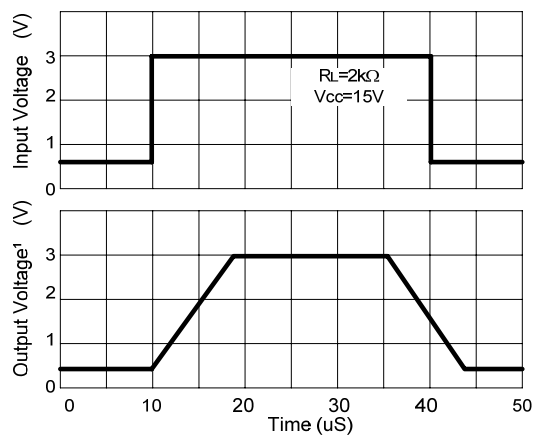


Fig. 8 Voltage Follower Response (Small Signal)

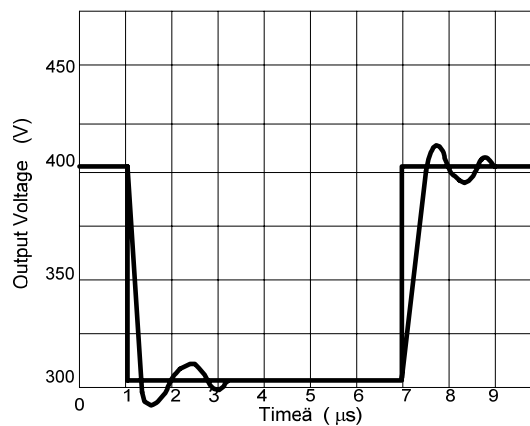


Fig. 9 Gain vs Large Signal Frequency

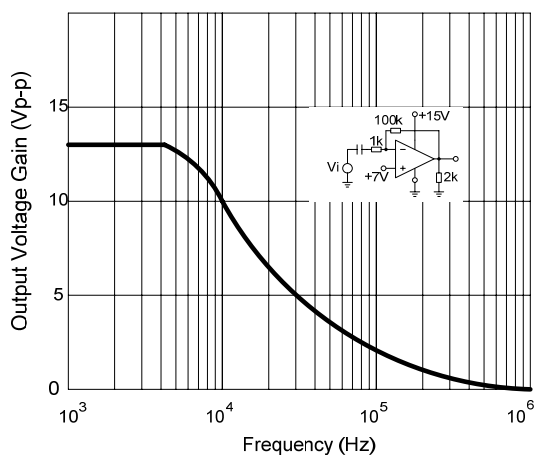


Fig. 10 Output Current Sinking vs Output Voltage

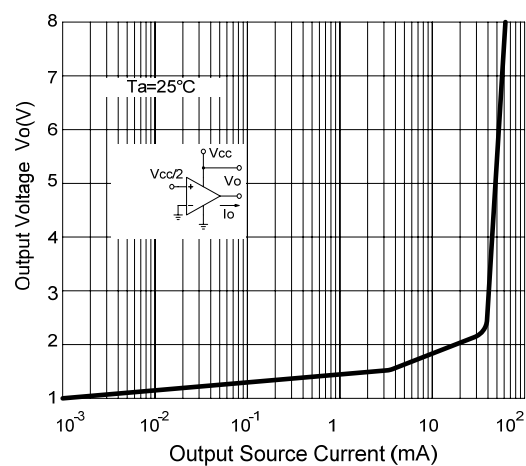


Fig. 11 Output Sink Current vs Output Voltage

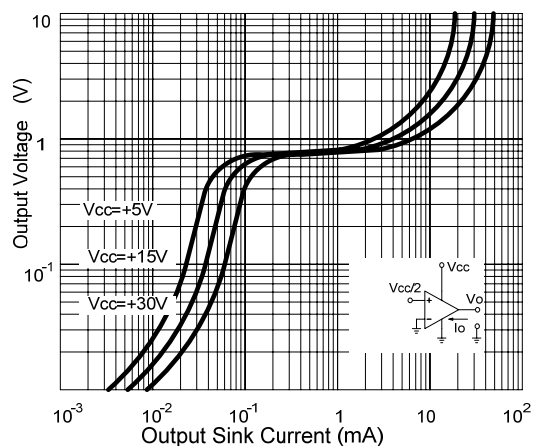
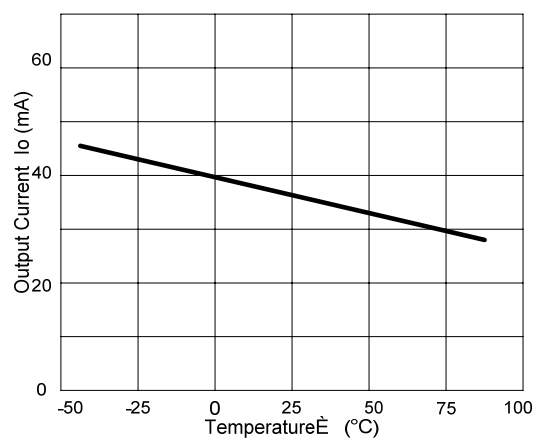


Fig. 12 Current Limiting vs Temperature



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