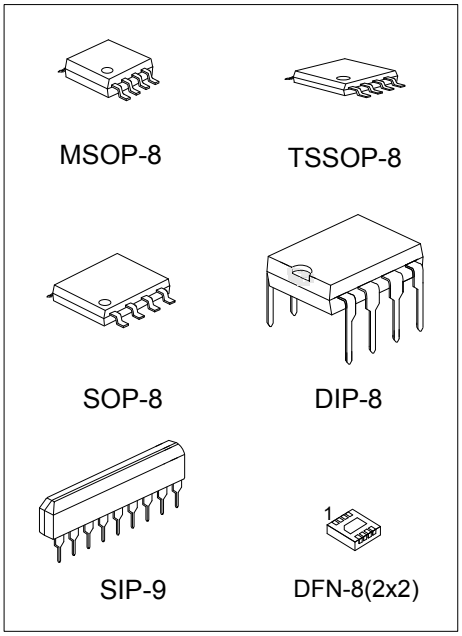
# DUAL OPERATIONAL AMPLIFIER




## ■ 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.

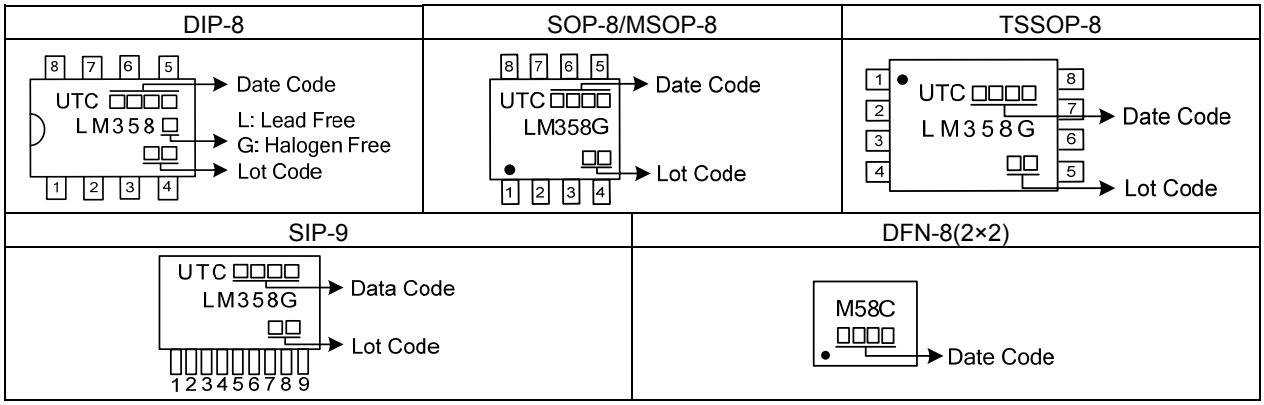
## ■ ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen-Free | | |
| LM358L-D08-T | LM358G-D08-T | DIP-8 | Tube |
| - | LM358G-G09-T | SIP-9 | Tube |
| - | LM358G-P08-R | TSSOP-8 | Tape Reel |
| - | LM358G-S08-R | SOP-8 | Tape Reel |
| - | LM358G-SM1-R | MSOP-8 | Tape Reel |
| - | LM393G-K08-2020-R | DFN-8(2×2) | Tape Reel |

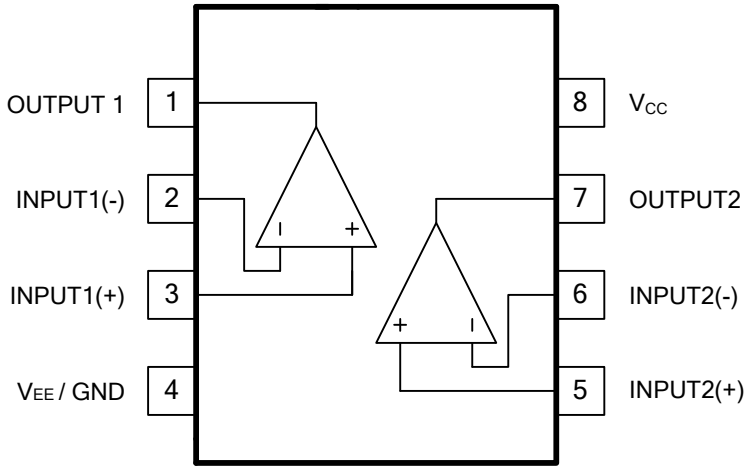
LM358L-D08-T
(1) Packing Type
(2) Package Type
(3) Green Package

(1) T: Tube, R: Tape Reel
(2) D08: DIP-8, G09: SIP-9, S08: SOP-8, P08: TSSOP-8, SM1: MSOP-8, K08-2020: DFN-8(2×2)
(3) L: Lead Free, G: Halogen Free and Lead Free

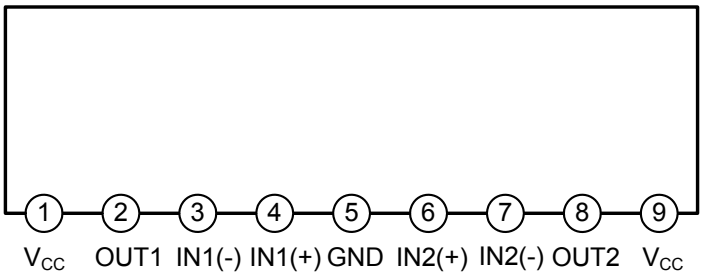
## ■ MARKING



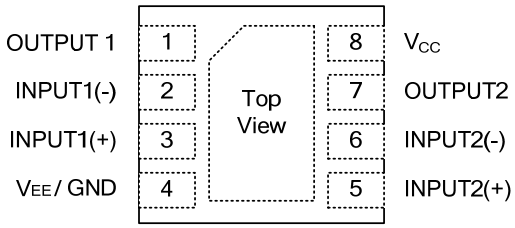
## ■ PIN DESCRIPTION




SOP-8/DIP-8/MSOP-8/TSSOP-8

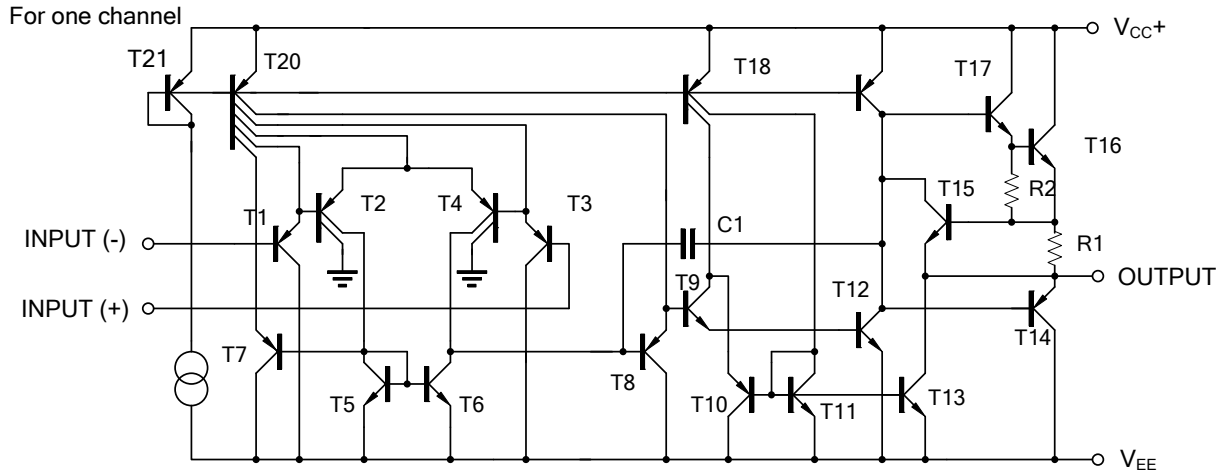



SIP-9




DFN-8(2×2)

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Supply Voltage | | $V_{CC}$ | ±16 or 32 | V |
| Differential Input Voltage | | $V_{I(DIFF)}$ | ±32 | V |
| Input Voltage | | $V_I$ | -0.3 ~ +32 | V |
| Output Short to Ground | | | Continuous | |
| Power Dissipation | SIP-9 | $P_D$ | 750 | mW |
| | DIP-8 | | 625 | |
| | SOP-8 | | 440 | |
| | TSSOP-8 | | 360 | |
| | MSOP-8 | | 300 | |
| | DFN-8(2×2) | | 830 | |
| Junction Temperature | | $T_J$ | +125 | °C |
| Operating Temperature (Note 2) | | $T_{OPR}$ | -40 ~ +105 | °C |
| Storage Temperature | | $T_{STG}$ | -65 ~ +150 | °C |

Notes: 1. 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.
2. It is guarantee by design, not 100% be tested.

## ■ ELECTRICAL CHARACTERISTICS ($V_{CC}$=5.0V, $V_{EE}$=GND, $T_A$=25°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<br>$V_{O(P)}$=1.4V, $R_S$=0Ω | | 2.0 | 5.0 | 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, $R_L$=2KΩ | 26 | | | V |
| | | $V_{CC}$=30V, $R_L$=10KΩ | 27 | 28 | | V |
| | $V_{OL}$ | $V_{CC}$=5V, $R_L$≧10KΩ | | 5 | 20 | mV |
| Large Signal Voltage Gain | $G_V$ | $V_{CC}$=15V, $R_L$≧2KΩ<br>$V_{O(P)}$=1V ~ 11V | 25 | 100 | | V/mV |
| Power Supply Current | $I_{CC}$ | $R_L$=∝, $V_{CC}$=30V | | 0.8 | 2.0 | mA |
| | | $R_L$=∝, 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 | 70 | mA |
| Output Current | $I_{SOURCE}$ | $V_I$(+)=1V, $V_I$(-)=0V<br>$V_{CC}$=15V, $V_{O(P)}$=2V | 10 | 30 | | mA |
| | $I_{SINK}$ | $V_I$(+)=0V, $V_I$(-)=1V<br>$V_{CC}$=15V, $V_{O(P)}$=2V | 10 | 15 | | mA |
| | | $V_I$(+)=0V, $V_I$(-)=1V<br>$V_{CC}$=15V, $V_{O(P)}$=200mV | 12 | 100 | | μA |
| Common Mode Rejection Ratio | CMRR | | 65 | 80 | | dB |
| Power Supply Rejection Ratio | PSRR | | 65 | 100 | | dB |
| Channel Separation | CS | f=1KHZ ~ 20KHZ | | 120 | | dB |

## ■ TYPICAL CHARACTERISTICS

Fig.1 Input Voltage Range

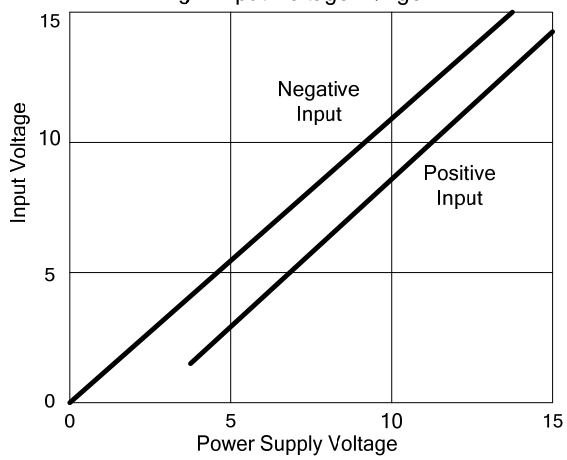



Fig.2 Input Current vs Temperature

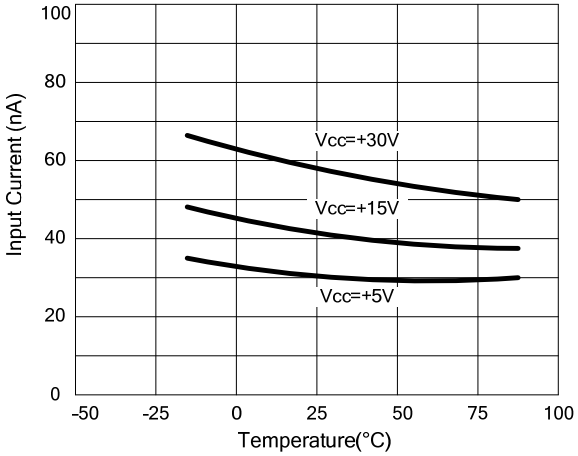



Fig.3 Supply Current vs Supply Voltage

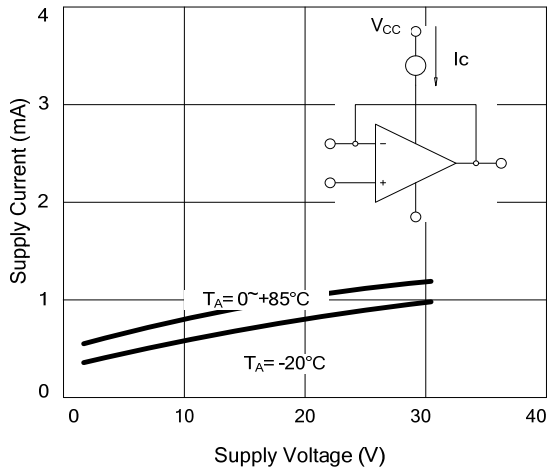



Fig. 4 Voltage Gain vs Supply Voltage

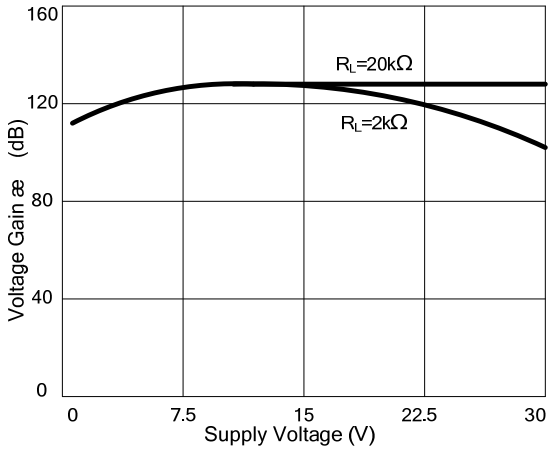



Fig. 5 Open Loop Gain vs Frequency

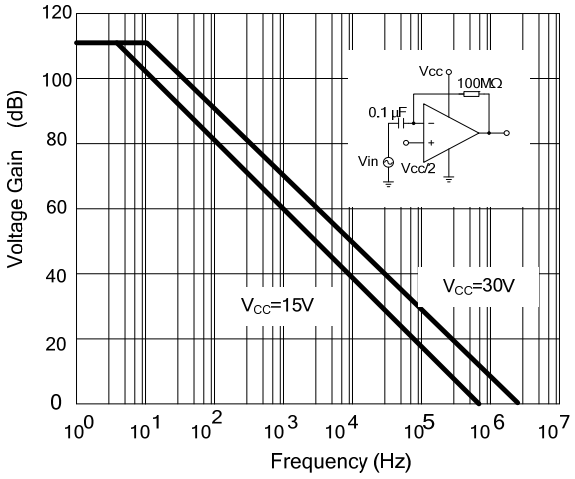
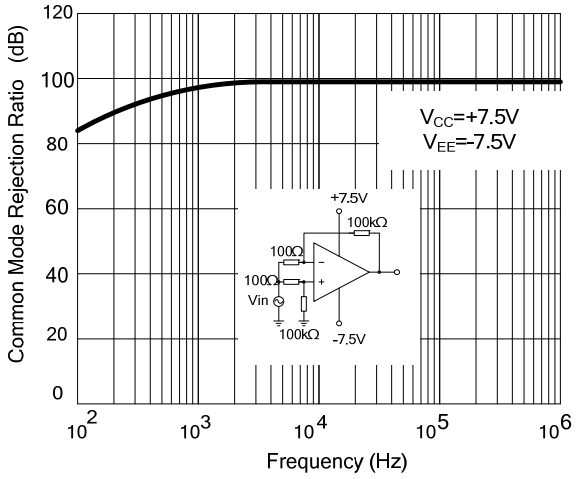



Fig. 6 Common Mode Rejection Ratio vs Frequency



## ■ TYPICAL CHARACTERISTICS(Cont.)

Fig. 7 Voltage Follower Pulse Response

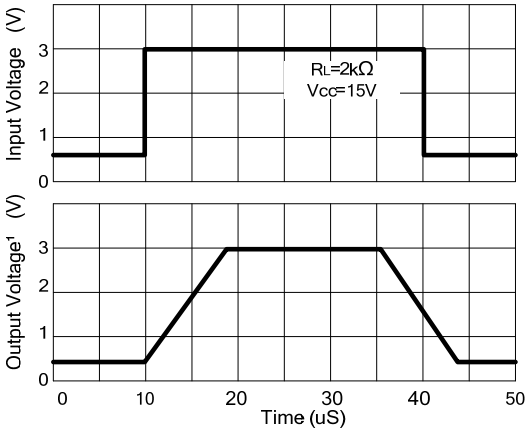



Fig. 8 Voltage Follower Response (Small Signal)

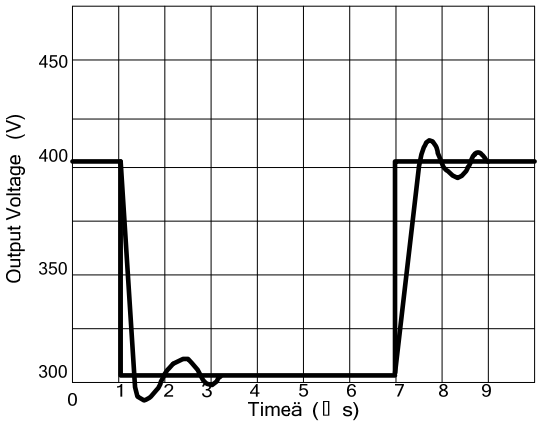



Fig. 9 Gain vs Large Signal Frequency

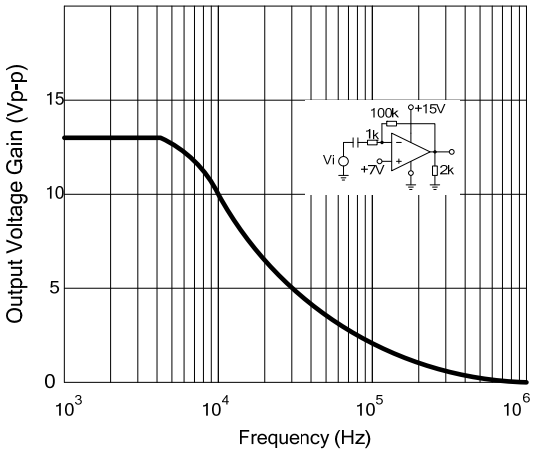



Fig. 10 Output Source Current vs Output Voltage

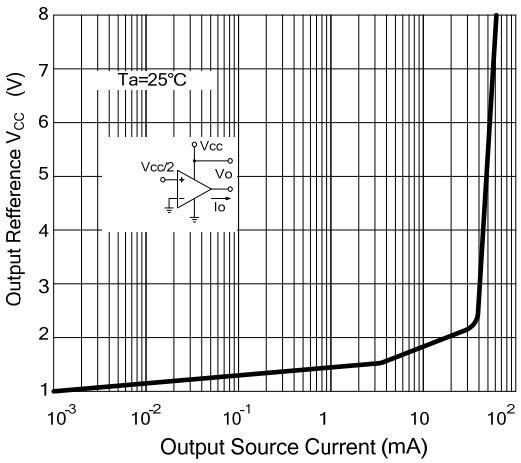



Fig. 11 Output Sink Current vs Output Voltage

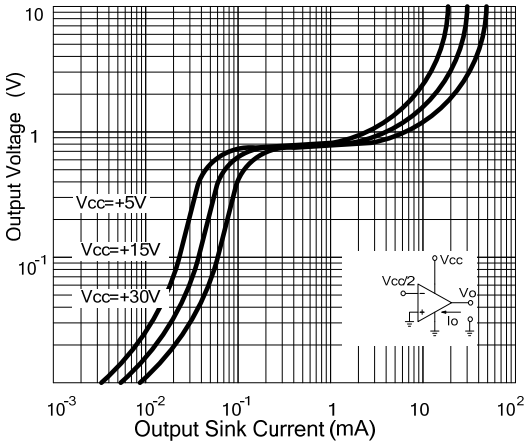
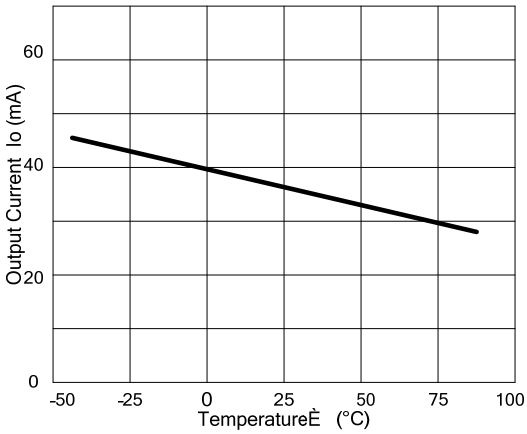



Fig.12 Current Limiting vs Temperature



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