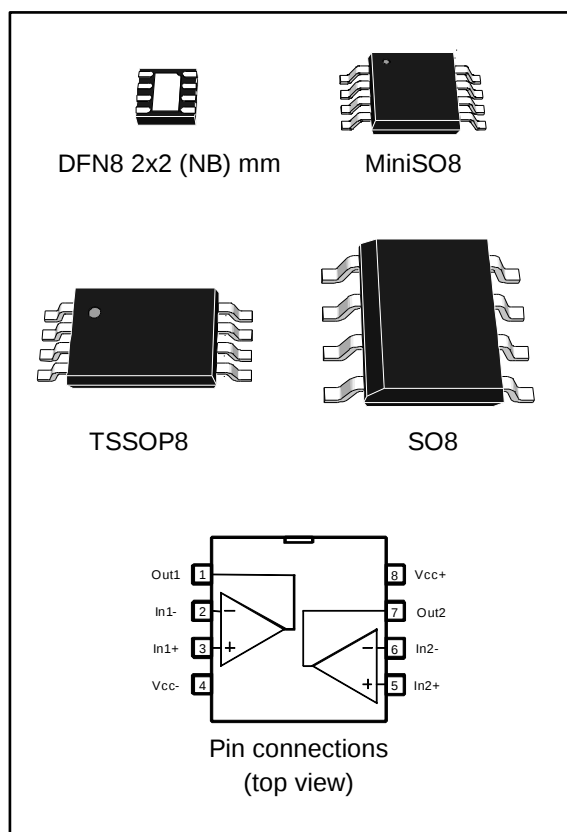


## Low-power dual operational amplifiers

Datasheet - production data



- Low input offset voltage: 2 mV
- Low input offset current: 2 nA
- Input common-mode voltage range includes negative rails
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to ( $V_{CC}^+ - 1.5\text{ V}$ )

### Related products

- See LM158W for enhanced ESD ratings

### Description

These circuits consist of two independent, high-gain, internally frequency-compensated op-amps, specifically designed to operate from a single power supply over a wide range of voltages. The low-power supply drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op-amp circuits, which can now be more easily implemented in single power supply systems. For example, these circuits can be directly supplied with the standard +5 V, which is used in logic systems and will easily provide the required interface electronics with no additional power supply.

In linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.

### Features

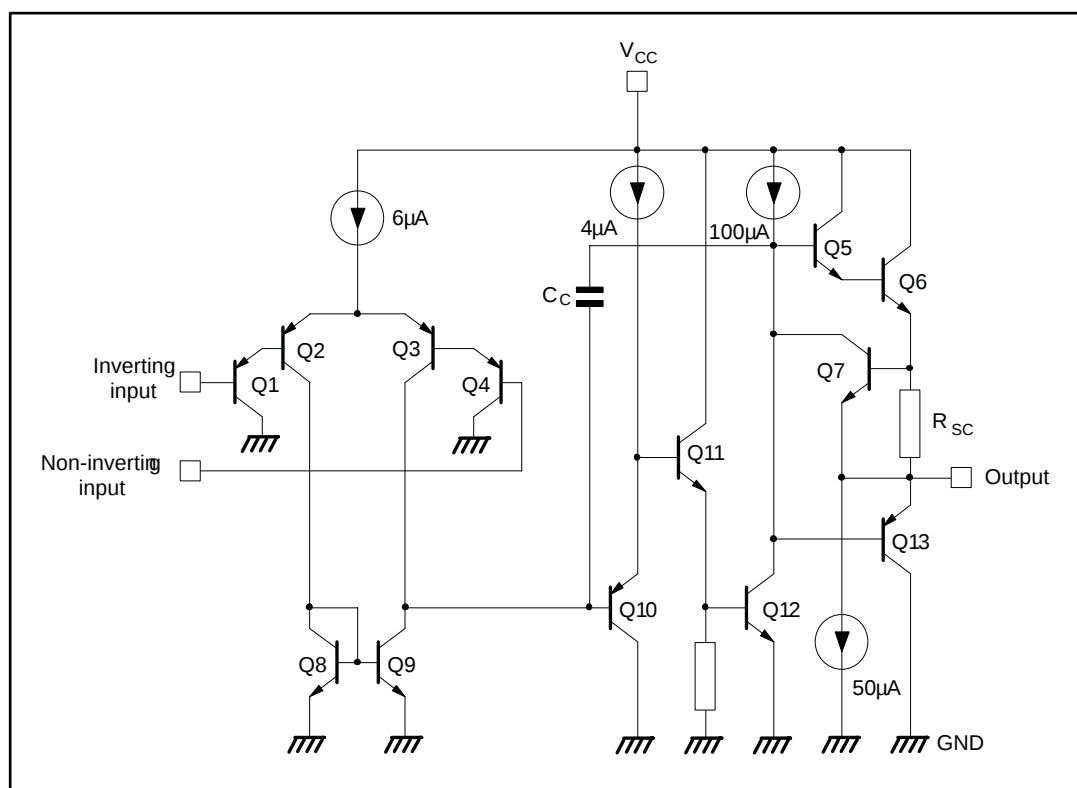
- Internally frequency-compensated
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1.1 MHz (temperature compensated)
- Very low supply current per channel essentially independent of supply voltage
- Low input bias current: 20 nA (temperature compensated)

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## 1 Schematic diagram

**Figure 1: Schematic diagram (1/2 LM158)**



## 2 Absolute maximum ratings

Table 1: Absolute maximum ratings

| Symbol            | Parameter                                             |               | LM158,A                                                   | LM258,A    | LM358,A | Unit |
|-------------------|-------------------------------------------------------|---------------|-----------------------------------------------------------|------------|---------|------|
| V <sub>CC</sub>   | Supply voltage                                        |               | ±16 or 32                                                 |            |         | V    |
| V <sub>i</sub>    | Input voltage                                         |               | 32                                                        |            |         |      |
| V <sub>id</sub>   | Differential input voltage                            |               | 32                                                        |            |         |      |
|                   | Output short-circuit duration <sup>(1)</sup>          |               | Infinite                                                  |            |         |      |
| I <sub>in</sub>   | Input current <sup>(2)</sup>                          |               | 5 mA in DC or 50 mA in AC<br>(duty cycle = 10 %, T = 1 s) |            |         | mA   |
| T <sub>oper</sub> | Operating free-air temperature range                  |               | -55 to 125                                                | -40 to 105 | 0 to 70 | °C   |
| T <sub>stg</sub>  | Storage temperature range                             |               | -65 to 150                                                |            |         |      |
| T <sub>j</sub>    | Maximum junction temperature                          |               | 150                                                       |            |         |      |
| R <sub>thja</sub> | Thermal resistance junction to ambient <sup>(3)</sup> | SO8           | 125                                                       |            |         | °C/W |
|                   |                                                       | MiniSO8       | 190                                                       |            |         |      |
|                   |                                                       | DFN8 2x2 (NB) | 57                                                        |            |         |      |
|                   |                                                       | TSSOP8        | 120                                                       |            |         |      |
| R <sub>thjc</sub> | Thermal resistance junction to case <sup>(3)</sup>    | SO8           | 40                                                        |            |         |      |
|                   |                                                       | MiniSO8       | 39                                                        |            |         |      |
|                   |                                                       | TSSOP8        | 37                                                        |            |         |      |
| ESD               | HBM: human body model <sup>(4)</sup>                  |               | 300                                                       |            |         |      |
|                   | MM: machine model <sup>(5)</sup>                      |               | 200                                                       |            |         |      |
|                   | CDM: charged device model <sup>(6)</sup>              |               | 1.5                                                       |            |         | kV   |

### Notes:

<sup>(1)</sup> Short-circuits from the output to  $V_{CC}$  can cause excessive heating if  $V_{CC} > 15$  V. The maximum output current is approximately 40 mA independent of the magnitude of  $V_{CC}$ . Destructive dissipation can result from simultaneous short circuits on all amplifiers.

<sup>(2)</sup> This input current only exists when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistor becoming forward-biased and thereby acting as input diode clamp. In addition to this diode action, there is NPN parasitic action on the IC chip. This transistor action can cause the output voltages of the Op-amps to go to the  $V_{CC}$  voltage level (or to ground for a large overdrive) for the time during which an input is driven negative. This is not destructive and normal output is restored for input voltages above -0.3 V.

<sup>(3)</sup> Short-circuits can cause excessive heating and destructive dissipation.  $R_{th}$  are typical values.

<sup>(4)</sup> Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 k $\Omega$  resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.

<sup>(5)</sup> Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5  $\Omega$ ). This is done for all couples of connected pin combinations while the other pins are floating.

<sup>(6)</sup> Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.

### 3 Operating conditions

Table 2: Operating conditions

| Symbol     | Parameter                                      |       | Value                                    | Unit |
|------------|------------------------------------------------|-------|------------------------------------------|------|
| $V_{CC}$   | Supply voltage                                 |       | 3 to 30                                  | V    |
| $V_{ICM}$  | Common mode input voltage range <sup>(1)</sup> |       | $V_{CC}^{-} - 0.3$ to $V_{CC}^{+} - 1.5$ |      |
| $T_{oper}$ | Operating free air temperature range           | LM158 | -55 to +125                              | °C   |
|            |                                                | LM258 | -40 to +105                              |      |
|            |                                                | LM358 | 0 to +70                                 |      |

**Notes:**

<sup>(1)</sup>When used in comparator, the functionality is guaranteed as long as at least one input remains within the operating common mode voltage range.

## 4 Electrical characteristics

**Table 3: Electrical characteristics for  $V_{CC+} = +5\text{ V}$ ,  $V_{CC-} = \text{Ground}$ ,  $V_o = 1.4\text{ V}$ ,  $T_{\text{amb}} = +25\text{ }^{\circ}\text{C}$  (unless otherwise specified)**

| Symbol                   | Parameter                                    |                                                                                                 | Min. | Typ. | Max.            | Unit                           |
|--------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------|------|------|-----------------|--------------------------------|
| $V_{io}$                 | Input offset voltage <sup>(1)</sup>          | LM158A                                                                                          |      |      | 2               | mV                             |
|                          |                                              | LM258A, LM358A                                                                                  |      | 1    | 3               |                                |
|                          |                                              | LM158, LM258                                                                                    |      |      | 5               |                                |
|                          |                                              | LM358                                                                                           |      | 2    | 7               |                                |
|                          | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$ | LM158A, LM258A, LM358A                                                                          |      |      | 4               |                                |
|                          |                                              | LM158, LM258                                                                                    |      |      | 7               |                                |
|                          |                                              | LM358                                                                                           |      |      | 9               |                                |
| $\Delta V_{io}/\Delta T$ | Input offset voltage drift                   | LM158A, LM258A, LM358A                                                                          |      | 7    | 15              | $\mu\text{V}/^{\circ}\text{C}$ |
|                          |                                              | LM158, LM258, LM358                                                                             |      | 7    | 30              |                                |
| $I_{io}$                 | Input offset current                         | LM158A, LM258A, LM358A                                                                          |      | 2    | 10              | nA                             |
|                          |                                              | LM158, LM258, LM358                                                                             |      | 2    | 30              |                                |
|                          | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$ | LM158A, LM258A, LM358A                                                                          |      |      | 30              |                                |
|                          |                                              | LM158, LM258, LM358                                                                             |      |      | 40              |                                |
| $\Delta I_{io}/\Delta T$ | Input offset current drift                   | LM158A, LM258A, LM358A                                                                          |      | 10   | 200             | $\text{pA}/^{\circ}\text{C}$   |
|                          |                                              | LM158, LM258, LM358                                                                             |      | 10   | 300             |                                |
| $I_{ib}$                 | Input bias current <sup>(2)</sup>            | LM158A, LM258A, LM358A                                                                          |      | 20   | 50              | nA                             |
|                          |                                              | LM158, LM258, LM358                                                                             |      | 20   | 150             |                                |
|                          | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$ | LM158A, LM258A, LM358A                                                                          |      |      | 100             |                                |
|                          |                                              | LM158, LM258, LM358                                                                             |      |      | 200             |                                |
| $A_{vd}$                 | Large signal voltage gain                    | $V_{CC+} = +15\text{ V}$ , $R_L = 2\text{ k}\Omega$ ,<br>$V_o = 1.4\text{ V to } 11.4\text{ V}$ | 50   | 100  |                 | V/mV                           |
|                          |                                              | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$                                                    | 25   |      |                 |                                |
| SVR                      | Supply voltage rejection ratio               | $V_{CC+} = 5\text{ V to } 30\text{ V}$ , $R_s \leq 10\text{ k}\Omega$                           | 65   | 100  |                 | dB                             |
|                          |                                              | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$                                                    | 65   |      |                 |                                |
| $I_{CC}$                 | Supply current, all amp, no load             | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$ $V_{CC+} = +5\text{ V}$                            |      | 0.7  | 1.2             | mA                             |
|                          |                                              | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$ $V_{CC+} = +30\text{ V}$                           |      |      | 2               |                                |
| $V_{icm}$                | Input common mode voltage range              | $V_{CC+} = +30\text{ V}$ <sup>(3)</sup>                                                         | 0    |      | $V_{CC+} - 1.5$ | V                              |
|                          |                                              | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$                                                    | 0    |      | $V_{CC+} - 2$   |                                |
| CMR                      | Common mode rejection ratio                  | $R_s \leq 10\text{ k}\Omega$                                                                    | 70   | 85   |                 | dB                             |
|                          |                                              | $T_{\min} \leq T_{\text{amb}} \leq T_{\max}$                                                    | 60   |      |                 |                                |
| $I_{\text{source}}$      | Output current source                        | $V_{CC+} = +15\text{ V}$ , $V_o = +2\text{ V}$ , $V_{id} = +1\text{ V}$                         | 20   | 40   | 60              | mA                             |

| Symbol            | Parameter                         |                                                                                                                                         | Min. | Typ. | Max. | Unit                                 |
|-------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|------|------|--------------------------------------|
| $I_{\text{sink}}$ | Output sink current               | $V_{\text{CC}}^{+} = +15 \text{ V}, V_o = +2 \text{ V}, V_{\text{id}} = -1 \text{ V}$                                                   | 10   | 20   |      | mA                                   |
|                   |                                   | $V_{\text{CC}}^{+} = +15 \text{ V}, V_o = +0.2 \text{ V}, V_{\text{id}} = -1 \text{ V}$                                                 | 12   | 50   |      | $\mu\text{A}$                        |
| $V_{\text{OH}}$   | High level output voltage         | $R_L = 2 \text{ k}\Omega, V_{\text{CC}}^{+} = 30 \text{ V}$                                                                             | 26   | 27   |      | V                                    |
|                   |                                   | $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$                                                                                | 26   |      |      |                                      |
|                   |                                   | $R_L = 10 \text{ k}\Omega, V_{\text{CC}}^{+} = 30 \text{ V}$                                                                            | 27   | 28   |      |                                      |
|                   |                                   | $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$                                                                                | 27   |      |      |                                      |
| $V_{\text{OL}}$   | Low level output voltage          | $R_L = 10 \text{ k}\Omega$                                                                                                              |      | 5    | 20   | mV                                   |
|                   |                                   | $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$                                                                                |      |      | 20   |                                      |
| SR                | Slew rate                         | $V_{\text{CC}}^{+} = 15 \text{ V}, V_i = 0.5 \text{ to } 3 \text{ V}, R_L = 2 \text{ k}\Omega, C_L = 100 \text{ pF}, \text{unity gain}$ | 0.3  | 0.6  |      | V/ $\mu\text{s}$                     |
| GBP               | Gain bandwidth product            | $V_{\text{CC}}^{+} = 30 \text{ V}, f = 100 \text{ kHz}, V_{\text{in}} = 10 \text{ mV}, R_L = 2 \text{ k}\Omega, C_L = 100 \text{ pF}$   | 0.7  | 1.1  |      | MHz                                  |
| THD               | Total harmonic distortion         | $f = 1 \text{ kHz}, A_v = 20 \text{ dB}, R_L = 2 \text{ k}\Omega, V_o = 2 V_{\text{pp}}, C_L = 100 \text{ pF}, V_o = 2 V_{\text{pp}}$   |      | 0.02 |      | %                                    |
| $e_n$             | Equivalent input noise voltage    | $f = 1 \text{ kHz}, R_s = 100 \Omega, V_{\text{CC}}^{+} = 30 \text{ V}$                                                                 |      | 55   |      | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |
| $V_{o1}/V_{o2}$   | Channel separation <sup>(4)</sup> | $1 \text{ kHz} \leq f \leq 20 \text{ kHz}$                                                                                              |      | 120  |      | dB                                   |

**Notes:**

<sup>(1)</sup>  $V_o = 1.4 \text{ V}, R_s = 0 \Omega, 5 \text{ V} < V_{\text{CC}}^{+} < 30 \text{ V}, 0 < V_{\text{ic}} < V_{\text{CC}}^{+} - 1.5 \text{ V}$

<sup>(2)</sup> The direction of the input current is out of the IC. This current is essentially constant, independent of the state of the output so there is no change in the load on the input lines.

<sup>(3)</sup> The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V_{\text{CC}}^{+} - 1.5 \text{ V}$ , but either or both inputs can go to +32 V without damage.

<sup>(4)</sup> Due to the proximity of external components, ensure that stray capacitance between these external parts does not cause coupling. Typically, this can be detected because this type of capacitance increases at higher frequencies.

Figure 2: Open-loop frequency response

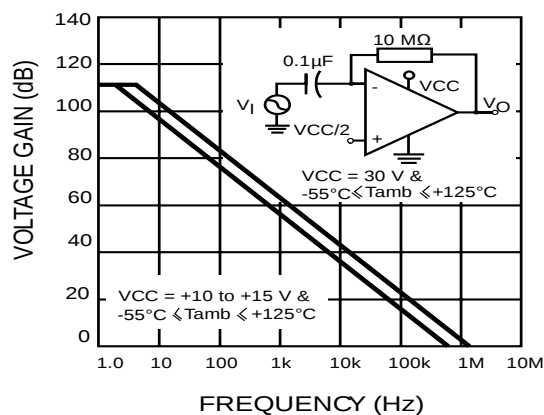


Figure 3: Large signal frequency response

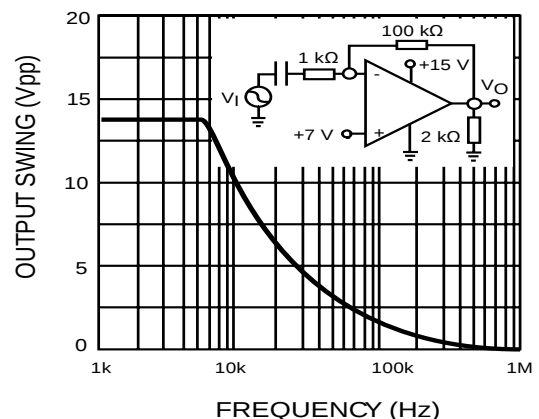


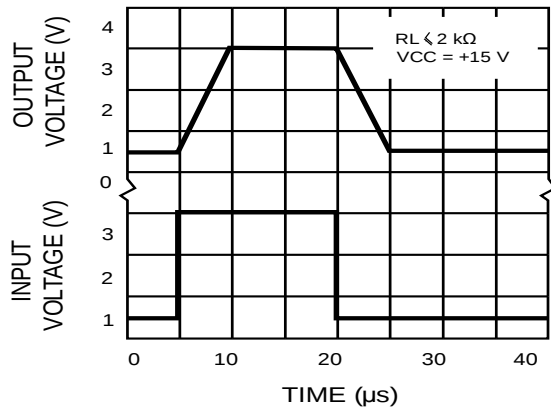
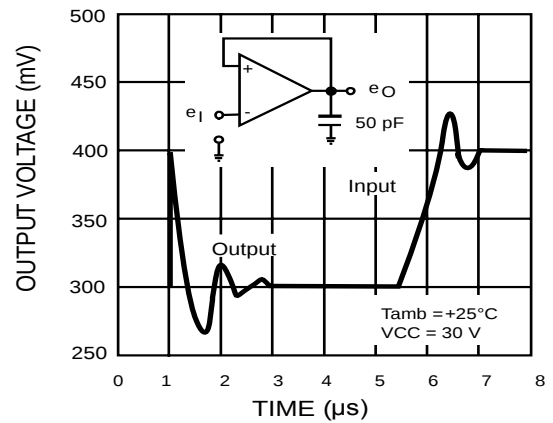
Figure 4: Voltage follower pulse response with  $V_{CC} = 15\text{ V}$ Figure 5: Voltage follower pulse response with  $V_{CC} = 30\text{ V}$ 

Figure 6: Input current

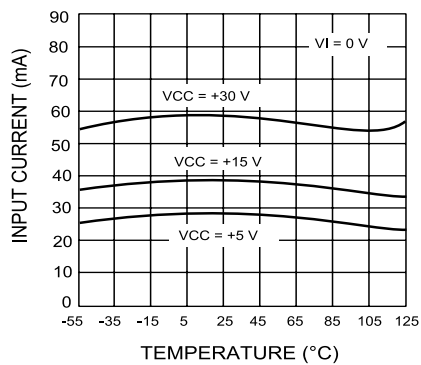


Figure 7: Output voltage vs sink current

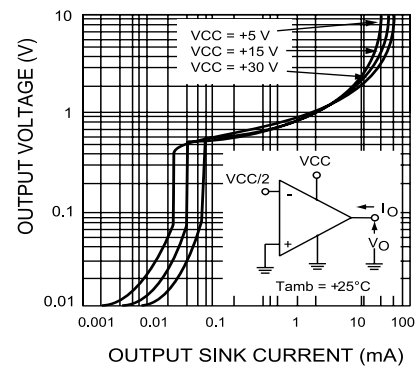


Figure 8: Output voltage vs source current

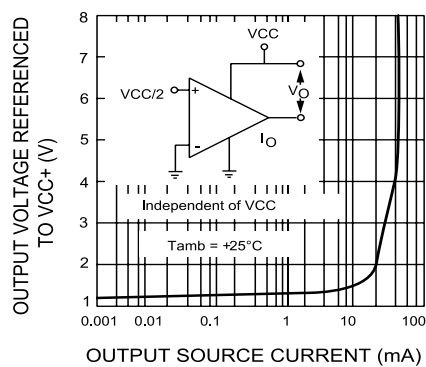


Figure 9: Current limiting

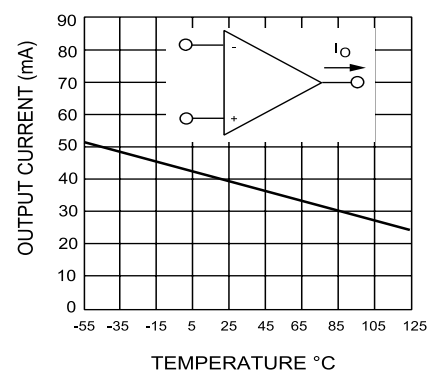


Figure 10: Input voltage range

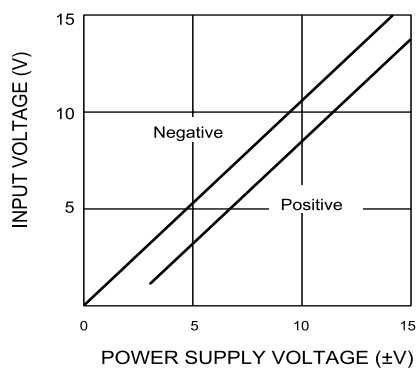


Figure 11: Open-loop gain

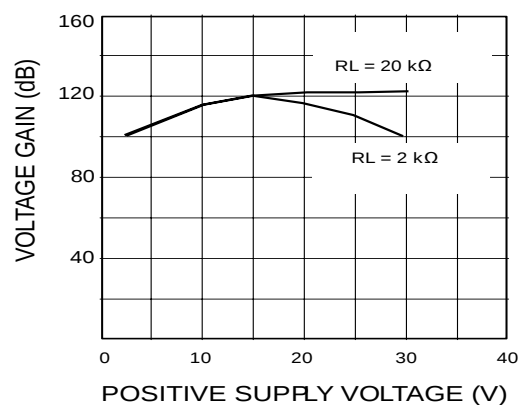


Figure 12: Supply current

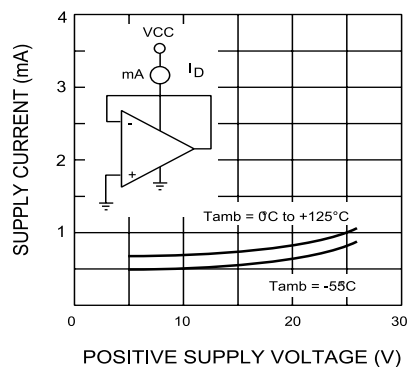


Figure 13: Input current

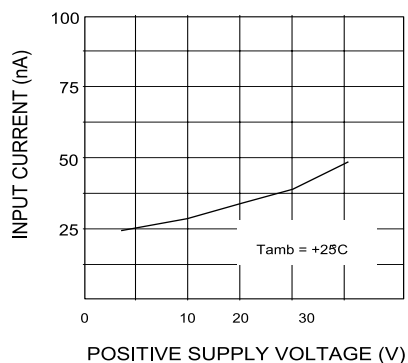


Figure 14: Gain bandwidth product

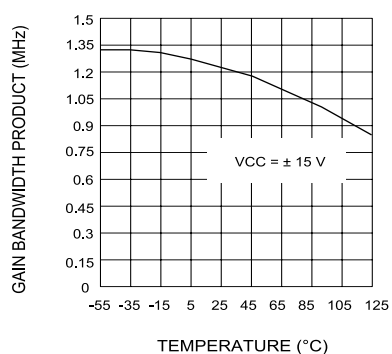


Figure 15: Power supply rejection ratio

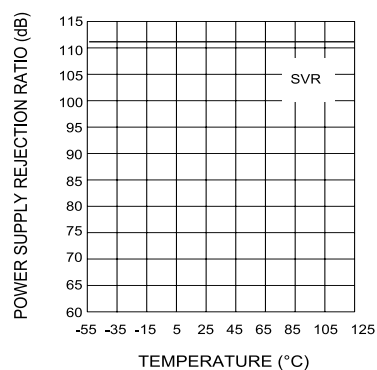


Figure 16: Common-mode rejection ratio

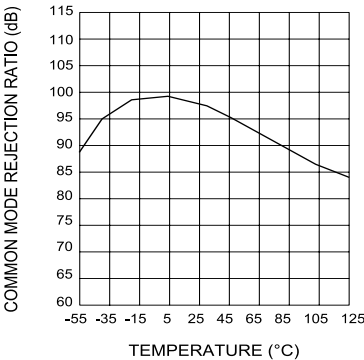
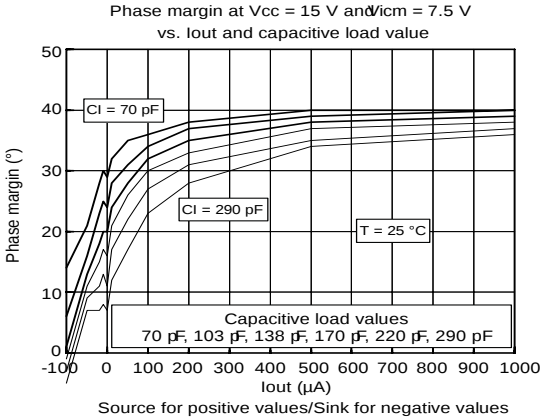


Figure 17: Phase margin vs. capacitive load



## 5 Typical applications

Single supply voltage  $V_{CC} = +5 V_{DC}$ .

Figure 18: AC-coupled inverting amplifier

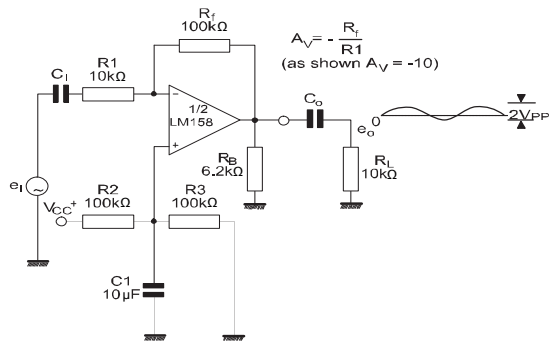


Figure 19: Non-inverting DC amplifier

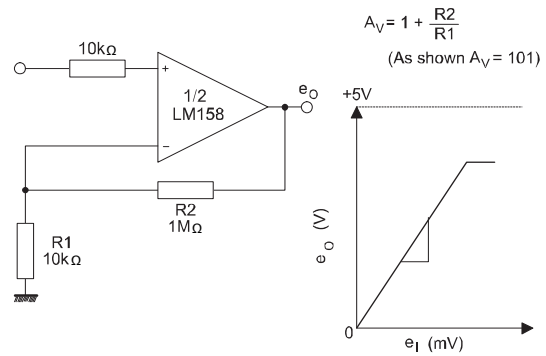


Figure 20: AC-coupled non-inverting amplifier

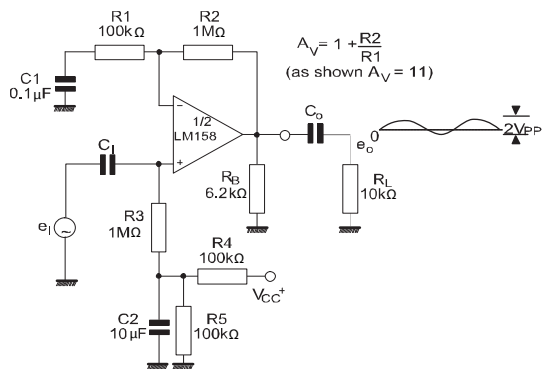


Figure 21: DC summing amplifier

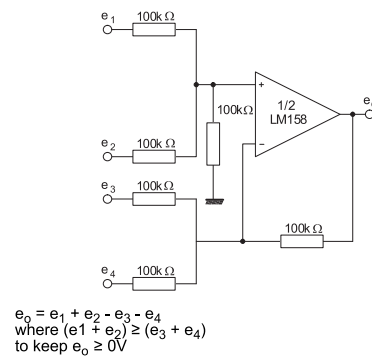


Figure 22: High input Z, DC differential amplifier

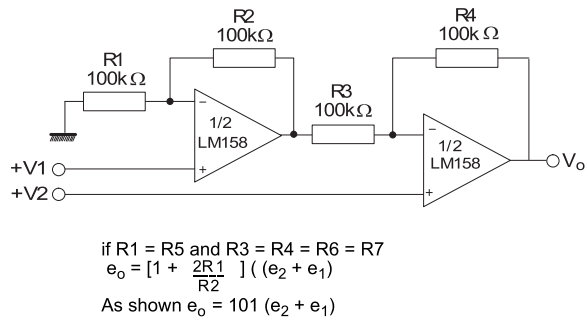


Figure 23: High input Z adjustable gain DC instrumentation amplifier

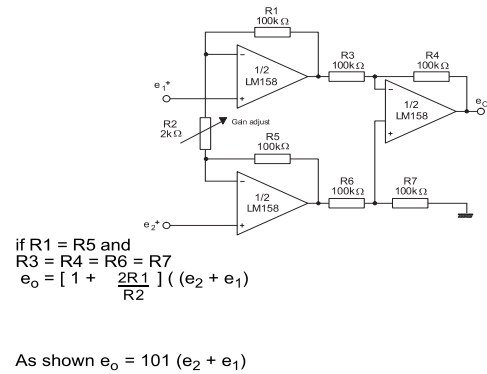


Figure 24: Using symmetrical amplifiers to reduce input current

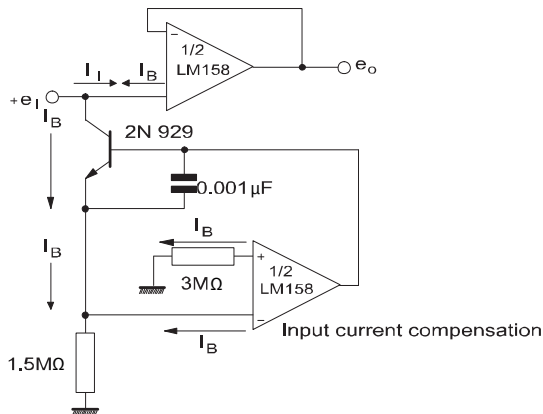


Figure 25: Low drift peak detector

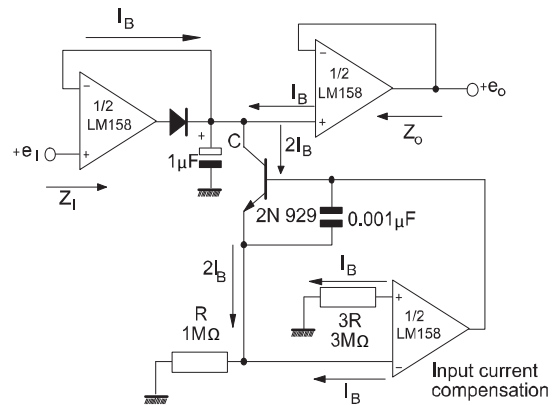
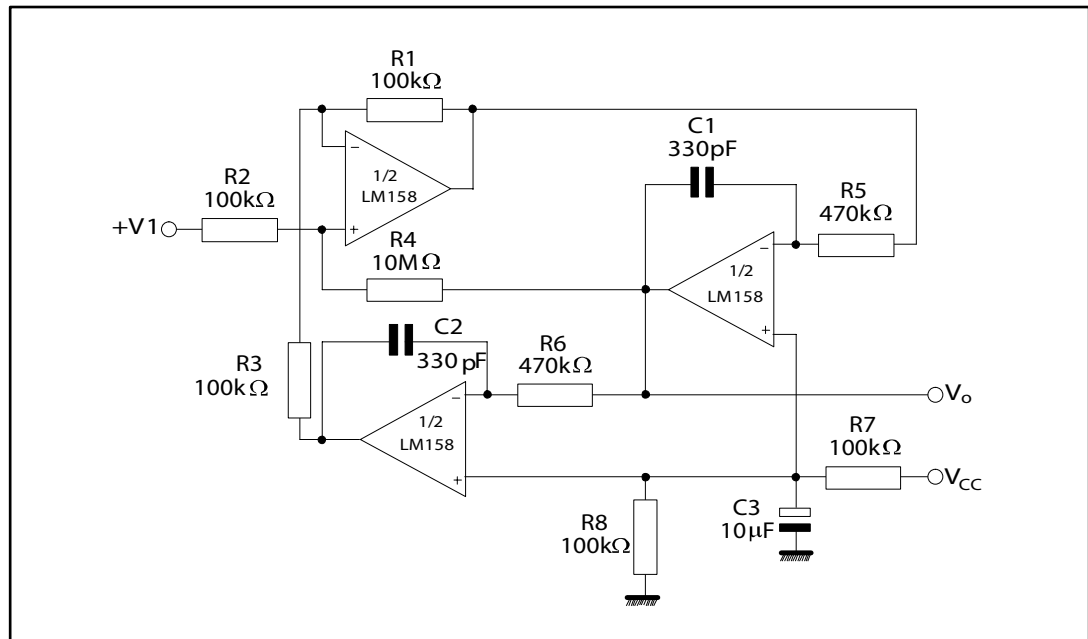


Figure 26: Active band-pass filter



## 6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

## 6.1 SO8 package information

Figure 27: SO8 package mechanical drawing

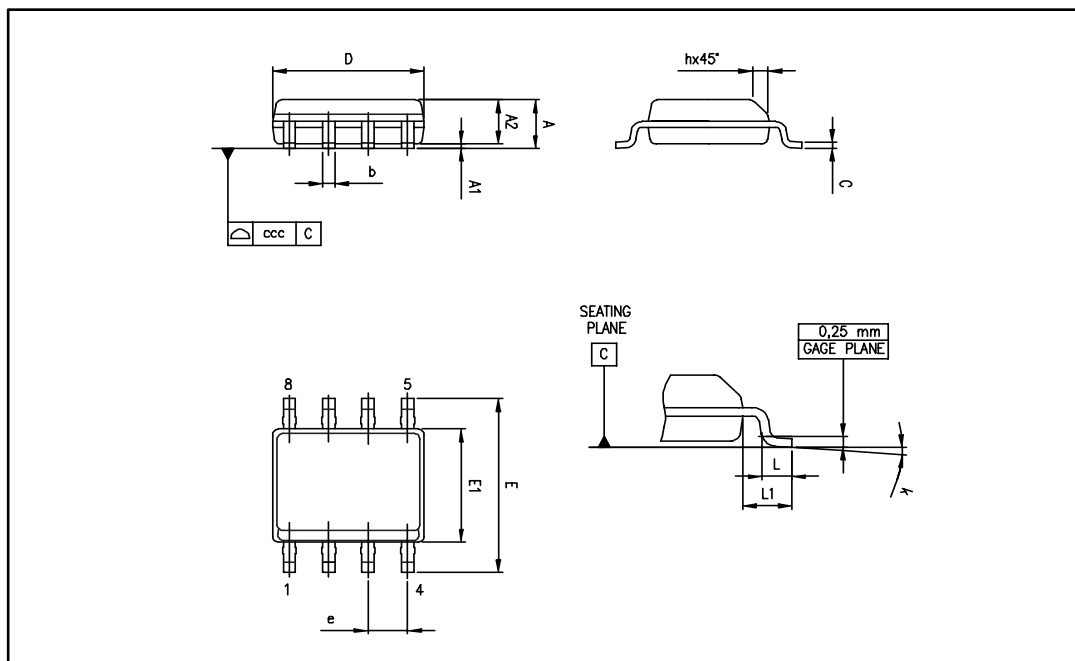


Table 4: SO8 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.75 |        |       | 0.069 |
| A1   | 0.10        |      | 0.25 | 0.004  |       | 0.010 |
| A2   | 1.25        |      |      | 0.049  |       |       |
| b    | 0.28        |      | 0.48 | 0.011  |       | 0.019 |
| c    | 0.17        |      | 0.23 | 0.007  |       | 0.010 |
| D    | 4.80        | 4.90 | 5.00 | 0.189  | 0.193 | 0.197 |
| E    | 5.80        | 6.00 | 6.20 | 0.228  | 0.236 | 0.244 |
| E1   | 3.80        | 3.90 | 4.00 | 0.150  | 0.154 | 0.157 |
| e    |             | 1.27 |      |        | 0.050 |       |
| h    | 0.25        |      | 0.50 | 0.010  |       | 0.020 |
| L    | 0.40        |      | 1.27 | 0.016  |       | 0.050 |
| L1   |             | 1.04 |      |        | 0.040 |       |
| k    | 1°          |      | 8°   | 1°     |       | 8°    |
| ccc  |             |      | 0.10 |        |       | 0.004 |

## 6.2 MiniSO8 package information

Figure 28: MiniSO8 package mechanical drawing

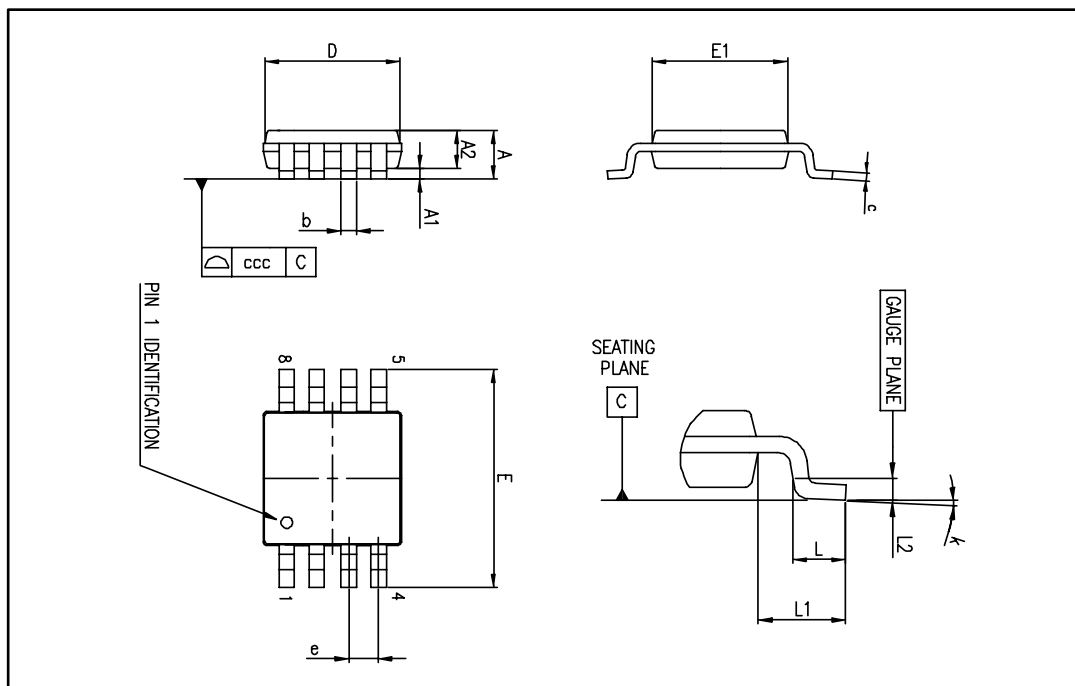


Table 5: MiniSO8 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.1  |        |       | 0.043 |
| A1   | 0           |      | 0.15 | 0      |       | 0.006 |
| A2   | 0.75        | 0.85 | 0.95 | 0.030  | 0.033 | 0.037 |
| b    | 0.22        |      | 0.40 | 0.009  |       | 0.016 |
| c    | 0.08        |      | 0.23 | 0.003  |       | 0.009 |
| D    | 2.80        | 3.00 | 3.20 | 0.11   | 0.118 | 0.126 |
| E    | 4.65        | 4.90 | 5.15 | 0.183  | 0.193 | 0.203 |
| E1   | 2.80        | 3.00 | 3.10 | 0.11   | 0.118 | 0.122 |
| e    |             | 0.65 |      |        | 0.026 |       |
| L    | 0.40        | 0.60 | 0.80 | 0.016  | 0.024 | 0.031 |
| L1   |             | 0.95 |      |        | 0.037 |       |
| L2   |             | 0.25 |      |        | 0.010 |       |
| k    | 0°          |      | 8°   | 0°     |       | 8°    |
| ccc  |             |      | 0.10 |        |       | 0.004 |

### 6.3 DFN8 2 x 2 (NB) package information

Figure 29: DFN8 2 x 2 (NB) package mechanical drawing

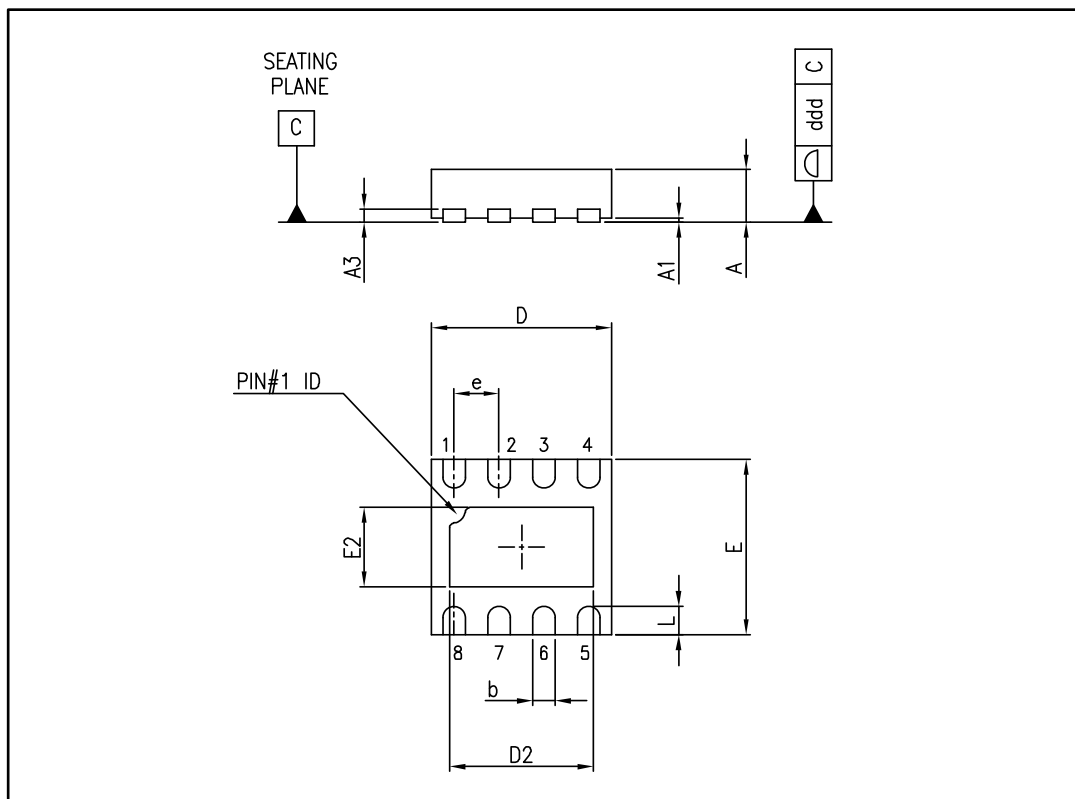
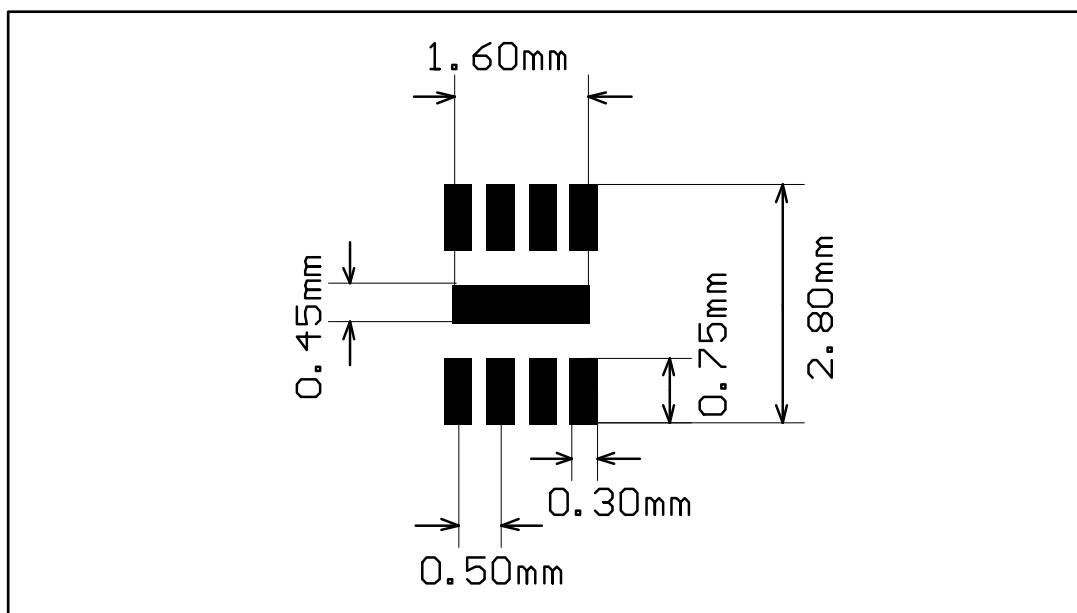


Table 6: DFN8 2 x 2 x 0.6 (NB) mm package mechanical data (pitch 0.5 mm)

| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 0.51        | 0.55 | 0.60  | 0.020  | 0.022 | 0.024 |
| A1   |             |      | 0.05  |        |       | 0.002 |
| A3   |             | 0.15 |       |        | 0.006 |       |
| b    | 0.18        | 0.25 | 0.30  | 0.007  | 0.010 | 0.012 |
| D    | 1.85        | 2.00 | 2.15  | 0.073  | 0.079 | 0.085 |
| D2   | 1.45        | 1.60 | 1.70  | 0.057  | 0.063 | 0.067 |
| E    | 1.85        | 2.00 | 2.15  | 0.073  | 0.079 | 0.085 |
| E2   | 0.75        | 0.90 | 1.00  | 0.030  | 0.035 | 0.039 |
| e    |             | 0.50 |       |        | 0.020 |       |
| L    |             |      | 0.425 |        |       | 0.017 |
| ddd  |             |      | 0.08  |        |       | 0.003 |

Figure 30: DFN8 2 x 2 (NB) footprint recommendation



## 6.4 TSSOP8 package information

Figure 31: TSSOP8 package mechanical drawing

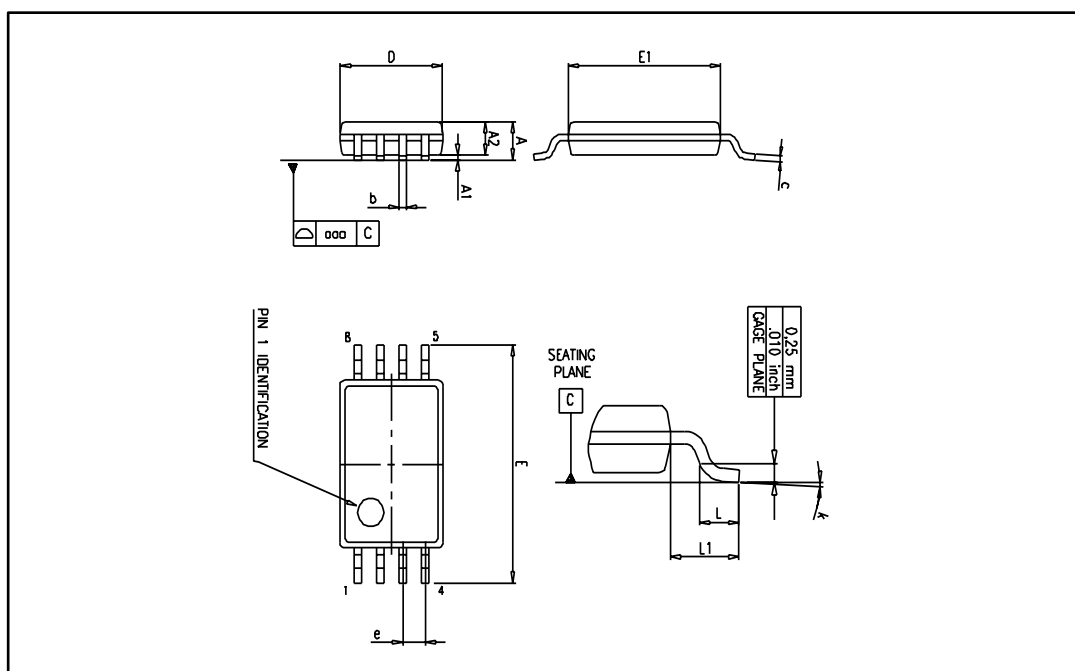


Table 7: TSSOP8 package mechanical data

| Ref. | Dimensions  |      |      |        |        |       |
|------|-------------|------|------|--------|--------|-------|
|      | Millimeters |      |      | Inches |        |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.   | Max.  |
| A    |             |      | 1.2  |        |        | 0.047 |
| A1   | 0.05        |      | 0.15 | 0.002  |        | 0.006 |
| A2   | 0.80        | 1.00 | 1.05 | 0.031  | 0.039  | 0.041 |
| b    | 0.19        |      | 0.30 | 0.007  |        | 0.012 |
| c    | 0.09        |      | 0.20 | 0.004  |        | 0.008 |
| D    | 2.90        | 3.00 | 3.10 | 0.114  | 0.118  | 0.122 |
| E    | 6.20        | 6.40 | 6.60 | 0.244  | 0.252  | 0.260 |
| E1   | 4.30        | 4.40 | 4.50 | 0.169  | 0.173  | 0.177 |
| e    |             | 0.65 |      |        | 0.0256 |       |
| k    | 0°          |      | 8°   | 0°     |        | 8°    |
| L    | 0.45        | 0.60 | 0.75 | 0.018  | 0.024  | 0.030 |
| L1   |             | 1    |      |        | 0.039  |       |
| aaa  |             | 0.1  |      |        | 0.004  |       |

## 7 Ordering information

Table 8: Order codes

| Order code               | Temperature range          | Package                 | Packaging     | Marking |
|--------------------------|----------------------------|-------------------------|---------------|---------|
| LM158QT                  | -55 °C, +125 °C            | DFN8 2x2 (NB)           | Tape and reel | K4A     |
| LM158DT                  |                            | SO8                     |               | 158     |
| LM258ADT                 | -40 °C, +105 °C            | SO8                     |               | 258A    |
| LM258AYDT <sup>(1)</sup> |                            | SO8<br>Automotive grade |               | 258AY   |
| LM258DT                  |                            | SO8                     |               | 258     |
| LM258APT                 |                            | TSSOP8                  |               | 258A    |
| LM258AST                 |                            | MiniSO8                 |               | K408    |
| LM258ST                  |                            |                         |               | K416    |
| LM258QT                  |                            | DFN8 2x2 (NB)           |               | K4C     |
| LM358DT                  |                            | 0 °C, +70 °C            |               | SO8     |
| LM358YDT <sup>(1)</sup>  | SO8<br>Automotive grade    |                         |               | 358Y    |
| LM358ADT                 | SO8                        |                         |               | 358A    |
| LM358PT                  | TSSOP8                     |                         |               | 358     |
| LM358APT                 |                            |                         |               | 358A    |
| LM358YPT <sup>(2)</sup>  | TSSOP8<br>Automotive grade |                         |               | 358Y    |
| LM358AYPT <sup>(2)</sup> |                            |                         |               | 358AY   |
| LM358ST                  | MiniSO8                    |                         |               | K405    |
| LM358AST                 |                            |                         |               | K404    |
| LM358QT                  | DFN8 2x2 (NB)              | K4E                     |               |         |

**Notes:**

<sup>(1)</sup> Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.

<sup>(2)</sup> Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent are on-going.

## 8 Revision history

Table 9: Document revision history

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01-Jul-2003 | 1        | First release.                                                                                                                                                                                                                                                                                                                                                                  |
| 02-Jan-2005 | 2        | $R_{thja}$ and $T_j$ parameters added in AMR <a href="#">Table 1: "Absolute maximum ratings"</a> .                                                                                                                                                                                                                                                                              |
| 01-Jul-2005 | 3        | ESD protection inserted in <a href="#">Table 1: "Absolute maximum ratings"</a> .                                                                                                                                                                                                                                                                                                |
| 05-Oct-2006 | 4        | Added Figure 17: Phase margin vs. capacitive load.                                                                                                                                                                                                                                                                                                                              |
| 30-Nov-2006 | 5        | Added missing ordering information.                                                                                                                                                                                                                                                                                                                                             |
| 25-Apr-2007 | 6        | Removed LM158A, LM258A and LM358A from document title.<br>Corrected error in MiniSO-8 package data. L1 is 0.004 inch.<br>Added automotive grade order codes in <a href="#">Section 7: "Ordering information"</a> .                                                                                                                                                              |
| 12-Feb-2008 | 7        | Corrected $V_{CC}$ max (30 V instead of 32 V) in operating conditions.<br>Changed presentation of electrical characteristics table.<br>Deleted $V_{opp}$ parameter in electrical characteristics table.<br>Corrected miniSO-8 package information.<br>Corrected temperature range for automotive grade order codes.<br>Updated automotive grade footnotes in order codes table. |
| 26-Aug-2008 | 8        | Added limitations on input current in <a href="#">Table 1: "Absolute maximum ratings"</a> .<br>Corrected title for <a href="#">Figure 11</a> .<br>Added E and L1 parameters in <a href="#">Table 4: "SO8 package mechanical data"</a> .<br>Changed <a href="#">Figure 31: "TSSOP8 package mechanical drawing"</a> .                                                             |
| 02-Sep-2011 | 9        | In <a href="#">Section 6: "Package information"</a> , added: <ul style="list-style-type: none"> <li>• DFN8 2 x 2 mm package mechanical drawing</li> <li>• DFN8 2 x 2 mm recommended footprint</li> <li>• DFN8 2 x 2 mm order codes.</li> </ul>                                                                                                                                  |
| 06-Apr-2012 | 10       | Removed order codes LM158YD, LM258AYD, LM258YD and LM358YD from <a href="#">Table 8: "Order codes"</a> .                                                                                                                                                                                                                                                                        |
| 11-Jun-2013 | 11       | <a href="#">Table 8: "Order codes"</a> : removed order codes LM158D, LM158YDT, LM258YDT, and LM258AD; added automotive grade qualification to order codes LM258ATDT and LM358YDT; updated marking for order codes LM158DT and LM258D/LM258DT; updated temperature range, packages, and packaging for several order codes.                                                       |

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20-Jun-2014 | 12       | Removed DIP8 package<br>Corrected typos (W replaced with $\Omega$ , £ replaced with $\leq$ )<br>Updated <a href="#">Features</a><br>Added <a href="#">Related products</a><br><a href="#">Table 3</a> : replaced $DV_{io}$ with $\Delta V_{io}/\Delta T$ and $DI_{io}$ with $\Delta I_{io}/\Delta T$ .<br>Updated <a href="#">Table 7</a> for exposed pad dimensions<br><a href="#">Table 8: "Order codes"</a> : removed order codes LM258YPT and LM258AYPT; removed all order codes for devices with tube packing; added package code (NB) to DFN8 2x2 package. |

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