

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## MSLM2902DR

Product specification

## GENERAL DESCRIPTION

The MSLM2902DR consist of four independent, high gain and internally frequency compensated operational amplifiers. They are specifically designed to operate from a single power supply. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Typical applications include transducer amplifiers, DC gain blocks and most conventional operational amplifier circuits.

The MSLM2902DR is available in SOP-14 packages.

## FEATURES

- Internally Frequency Compensated for Unity Gain
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.5mA (Typical)
- Wide Power Supply Voltage Range:
  - Single Supply: 3V to 36V
  - Dual Supplies:  $\pm 1.5V$  to  $\pm 18V$
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing: 0V to  $V_{CC} - 1.5V$
- Power Drain Suitable for Battery Operation
- Lead-Free Packages: SOP-14

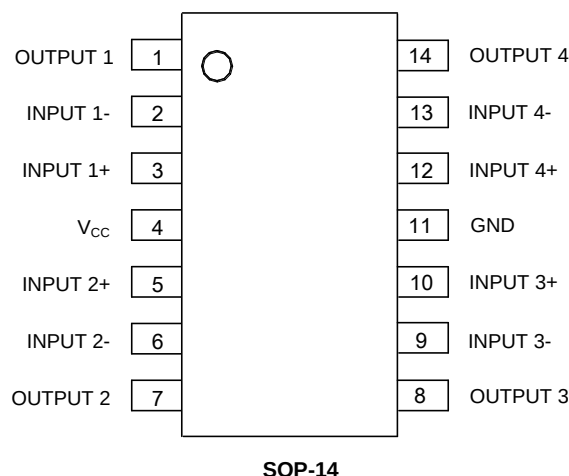
## Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

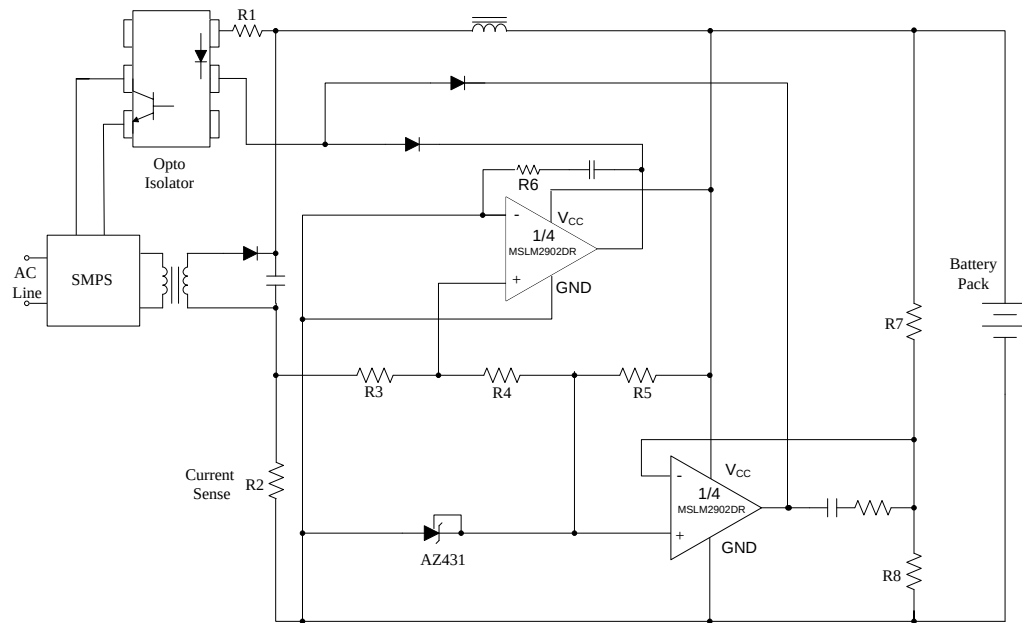
## Reference News

| Type No    | SOP-14                                                                              | MARKING                                                                               |
|------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| MSLM2902DR |  |  |

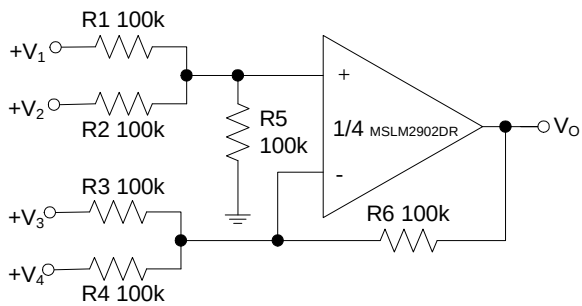
## Pin Assignments



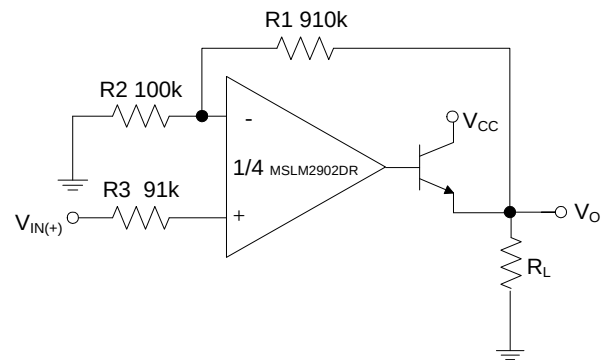
## Typical Applications Circuit



Battery Charger

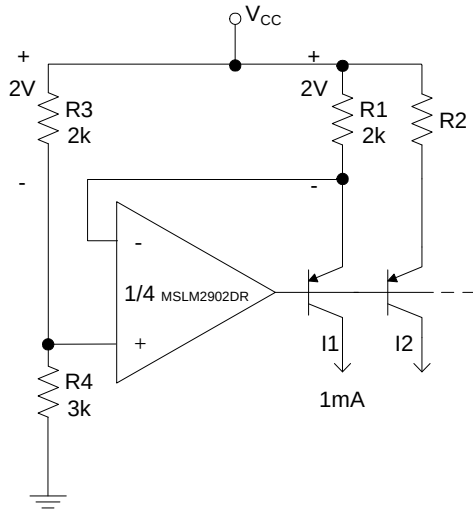


DC Summing Amplifier

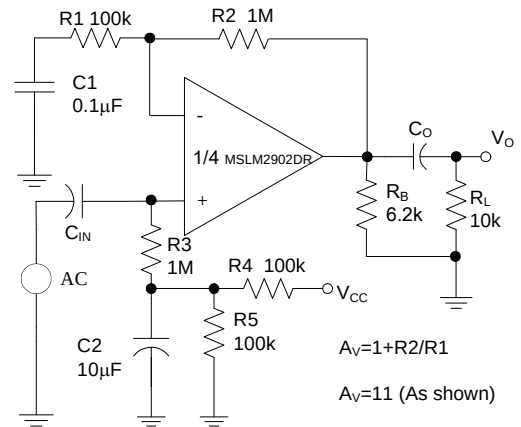


Power Amplifier

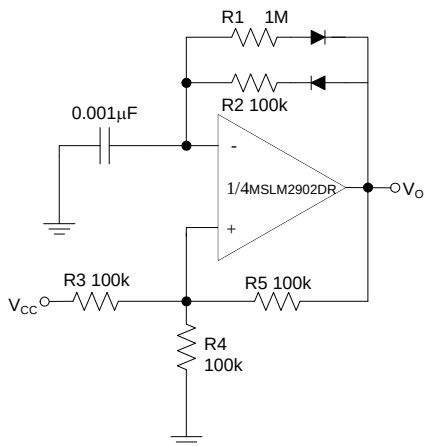
**Typical Applications Circuit** (continued)



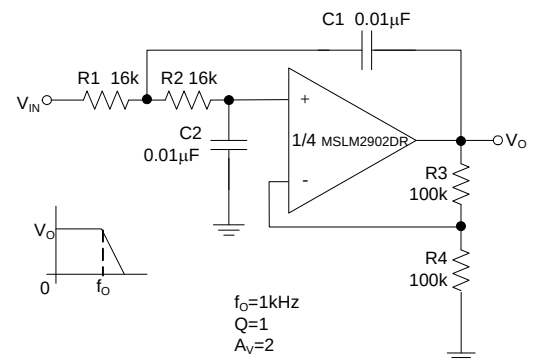
Fixed Current Sources



AC Coupled Non-Inverting Amplifier

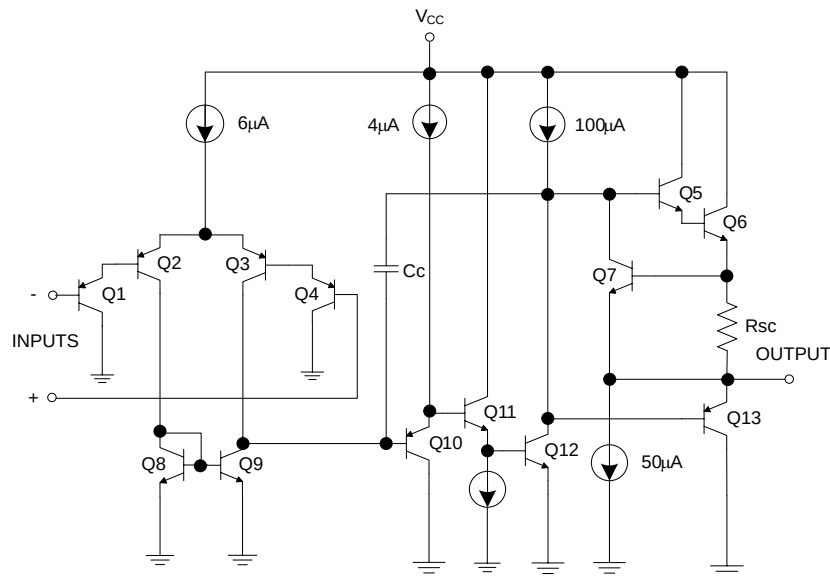


Pulse Generator



DC Coupled Low-Pass RC Active Filter

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

| Symbol            | Parameter                                        | Rating      | Unit |
|-------------------|--------------------------------------------------|-------------|------|
| V <sub>CC</sub>   | Supply Voltage                                   | 40          | V    |
| V <sub>ID</sub>   | Differential Input Voltage                       | 40          | V    |
| V <sub>IN</sub>   | Input Voltage                                    | -0.3 to 40  | V    |
| P <sub>D</sub>    | Total Power Dissipation (T <sub>A</sub> = +25°C) | 800         | mW   |
| T <sub>J</sub>    | Operating Junction Temperature                   | +150        | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                        | -65 to +150 | °C   |
| T <sub>LEAD</sub> | Lead Temperature (Soldering, 10 Seconds)         | +260        | °C   |

Note 4: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

| Symbol          | Parameter                           | Min | Max | Unit |
|-----------------|-------------------------------------|-----|-----|------|
| V <sub>CC</sub> | Supply Voltage                      | 3   | 36  | V    |
| T <sub>A</sub>  | Ambient Operating Temperature Range | -40 | +85 | °C   |

**Electrical Characteristics** (Limits in standard typeface are for  $T_A = +25^{\circ}\text{C}$ , **bold** typeface applies over  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  (Note 5),  $V_{CC} = 5\text{V}$ ,  $\text{GND} = 0\text{V}$ , unless otherwise specified.)

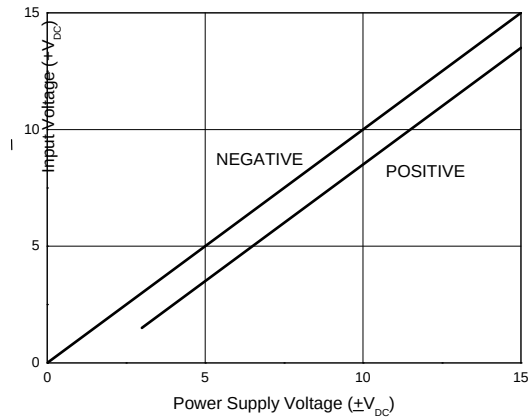
| Symbol                   | Parameter                                               |        | Conditions                                                                                  | Min       | Typ  | Max            | Unit                           |
|--------------------------|---------------------------------------------------------|--------|---------------------------------------------------------------------------------------------|-----------|------|----------------|--------------------------------|
| $V_{IO}$                 | Input Offset Voltage                                    |        | $V_O = 1.4\text{V}$ , $R_S = 0\Omega$ , $V_{CC} = 5\text{V}$ to $30\text{V}$                | —         | 2    | 5              | mV                             |
|                          |                                                         |        |                                                                                             | —         | —    | <b>7</b>       |                                |
| $\Delta V_{IO}/\Delta T$ | Average Temperature Coefficient of Input Offset Voltage |        | $T_A = -40$ to $+85^{\circ}\text{C}$                                                        | —         | 7    | —              | $\mu\text{V}/^{\circ}\text{C}$ |
| $I_{IO}$                 | Input Offset Current                                    |        | $I_{IN+} - I_{IN-}$ , $V_{CM} = 0\text{V}$                                                  | —         | 5    | 30             | nA                             |
|                          |                                                         |        |                                                                                             | —         | —    | <b>100</b>     |                                |
| $I_{BIAS}$               | Input Bias Current                                      |        | $I_{IN+}$ or $I_{IN-}$ , $V_{CM} = 0\text{V}$                                               | —         | 20   | 100            | nA                             |
|                          |                                                         |        |                                                                                             | —         | —    | <b>200</b>     |                                |
| $V_{IR}$                 | Input Common Mode Voltage Range (Note 6)                |        | $V_{CC} = 30\text{V}$                                                                       | 0         | —    | $V_{CC} - 1.5$ | V                              |
| $I_{CC}$                 | Supply Current                                          |        | $T_A = -40$ to $+85^{\circ}\text{C}$ ,<br>$R_L = \infty$                                    |           |      |                | mA                             |
|                          |                                                         |        | $V_{CC} = 30\text{V}$                                                                       | —         | 1.0  | 3              |                                |
|                          |                                                         |        | $V_{CC} = 5\text{V}$                                                                        | —         | 0.7  | 1.2            |                                |
| $G_v$                    | Large Signal Voltage Gain                               |        | $V_{CC} = 15\text{V}$ , $R_L \geq 2\text{k}\Omega$ , $V_O = 1\text{V}$ to $11\text{V}$      | 85        | 100  | —              | dB                             |
|                          |                                                         |        |                                                                                             | <b>80</b> | —    | —              |                                |
| $\text{CMRR}$            | Common Mode Rejection Ratio                             |        | DC, $V_{CM} = 0$ to $(V_{CC} - 1.5)\text{V}$                                                | 60        | 70   | —              | dB                             |
|                          |                                                         |        |                                                                                             | <b>60</b> | —    | —              |                                |
| $\text{PSRR}$            | Power Supply Rejection Ratio                            |        | $V_{CC} = 5$ to $30\text{V}$                                                                | 70        | 100  | —              | dB                             |
|                          |                                                         |        |                                                                                             | <b>60</b> | —    | —              |                                |
| $\text{CS}$              | Channel Separation                                      |        | $f = 1\text{kHz}$ to $20\text{kHz}$                                                         | —         | -120 | —              | dB                             |
| $I_{SOURCE}$             | Output Current                                          | Source | $V_{IN+} = 1\text{V}$ , $V_{IN-} = 0\text{V}$ , $V_{CC} = 15\text{V}$ , $V_O = 2\text{V}$   | 20        | 40   | —              | mA                             |
|                          |                                                         |        |                                                                                             | <b>20</b> | —    | —              |                                |
| $I_{SINK}$               |                                                         | Sink   | $V_{IN+} = 0\text{V}$ , $V_{IN-} = 1\text{V}$ , $V_{CC} = 15\text{V}$ , $V_O = 2\text{V}$   | 10        | 15   | —              | mA                             |
|                          |                                                         |        |                                                                                             | <b>5</b>  | —    | —              |                                |
|                          |                                                         |        | $V_{IN+} = 0\text{V}$ , $V_{IN-} = 1\text{V}$ , $V_{CC} = 15\text{V}$ , $V_O = 0.2\text{V}$ | 12        | 50   | —              | $\mu\text{A}$                  |
| $I_{SC}$                 | Output Short Circuit Current to Ground                  |        | $V_{CC} = 15\text{V}$                                                                       | —         | 40   | 60             | mA                             |
| $V_{OH}$                 | Output Voltage Swing                                    |        | $V_{CC} = 30\text{V}$ , $R_L = 2\text{k}\Omega$                                             | 26        | —    | —              | V                              |
|                          |                                                         |        |                                                                                             | <b>26</b> | —    | —              |                                |
|                          |                                                         |        | $V_{CC} = 30\text{V}$ , $R_L = 10\text{k}\Omega$                                            | 27        | 28   | —              |                                |
|                          |                                                         |        |                                                                                             | <b>27</b> | —    | —              |                                |
| $V_{OL}$                 |                                                         |        | $V_{CC} = 5\text{V}$ , $R_L = 10\text{k}\Omega$                                             | —         | 5    | 20             | mV                             |
|                          |                                                         |        |                                                                                             | —         | —    | <b>30</b>      |                                |
| $\theta_{JC}$            | Thermal Resistance (Junction to Case)                   |        | SOP-14                                                                                      | —         | 18   | —              | $^{\circ}\text{C}/\text{W}$    |
| $\theta_{JA}$            | Thermal Resistance (Junction to Ambient)                |        | SOP-14                                                                                      | —         | 91   | —              | $^{\circ}\text{C}/\text{W}$    |

Notes: 1. Limits over the full temperature are guaranteed by design, but not tested in production.

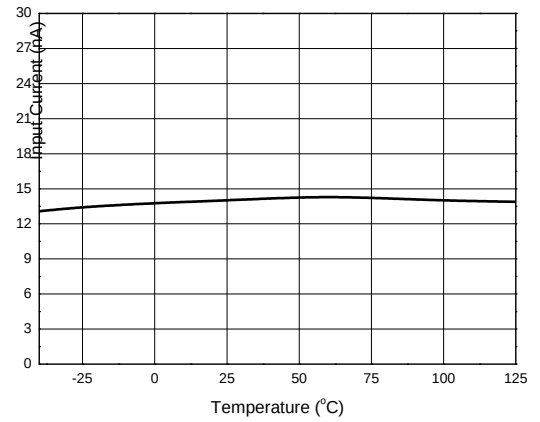
2. The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at  $+25^{\circ}\text{C}$ ). The upper end of the common-mode voltage range is  $V_{CC} - 1.5\text{V}$  (at  $+25^{\circ}\text{C}$ ), but either or both inputs can go to  $+36\text{V}$  without damages, independent of the magnitude of the  $V_{CC}$ .

## Performance Characteristics

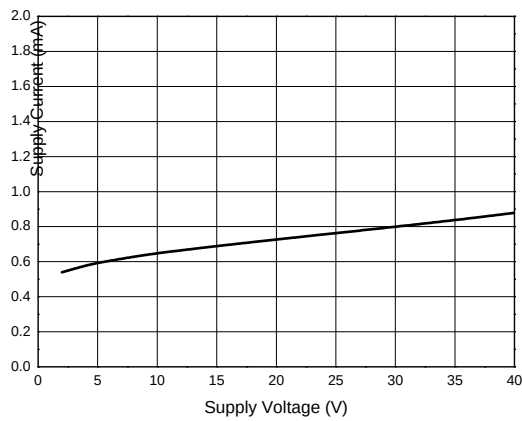
Input Voltage Range



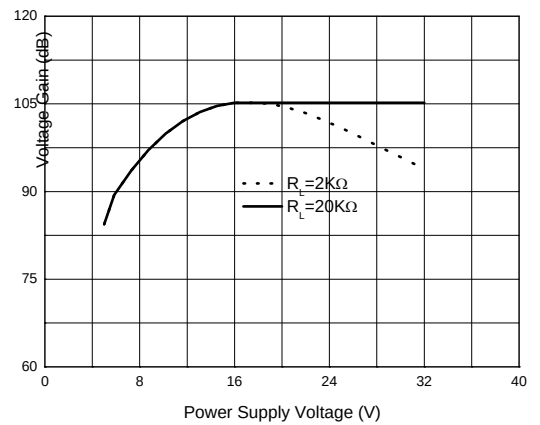
Input Current



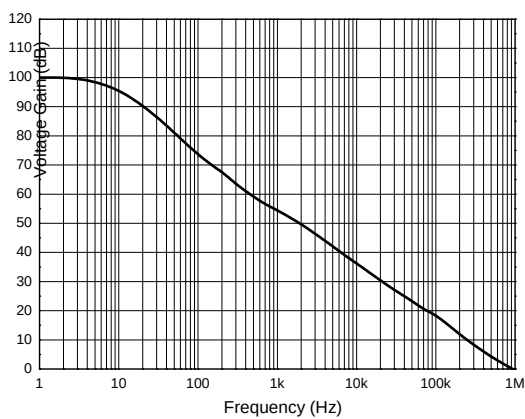
Supply Current



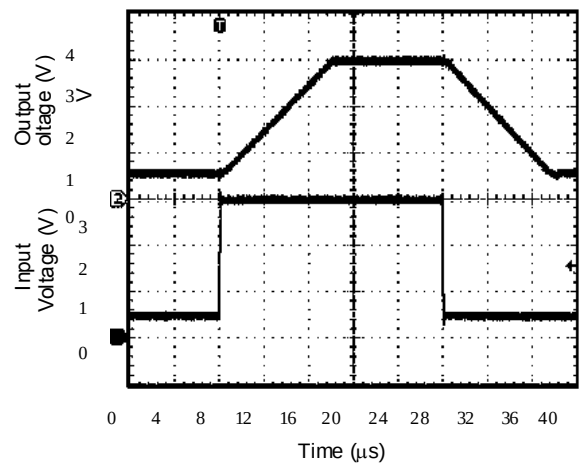
Voltage Gain



Open Loop Frequency Response

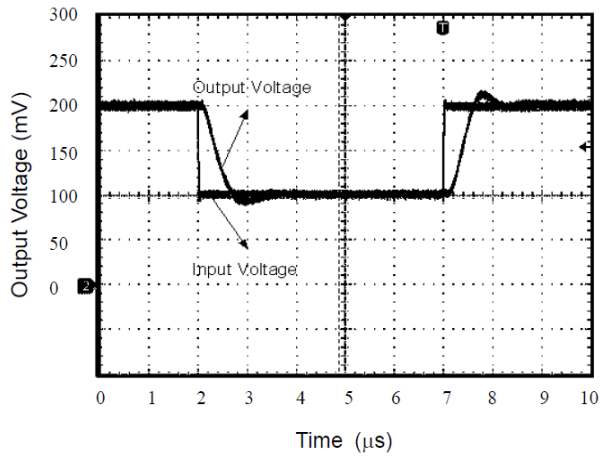


Voltage Follower Pulse Response

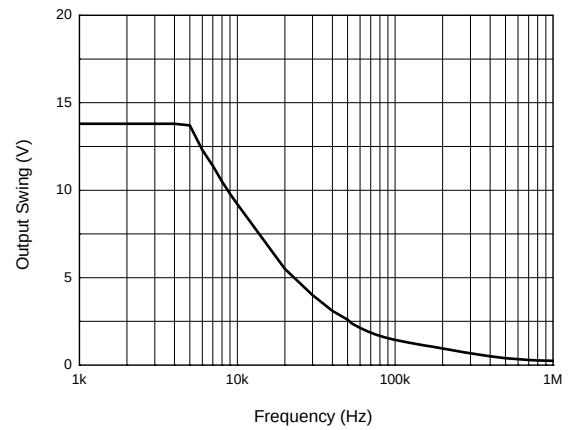


## Performance Characteristics (continued)

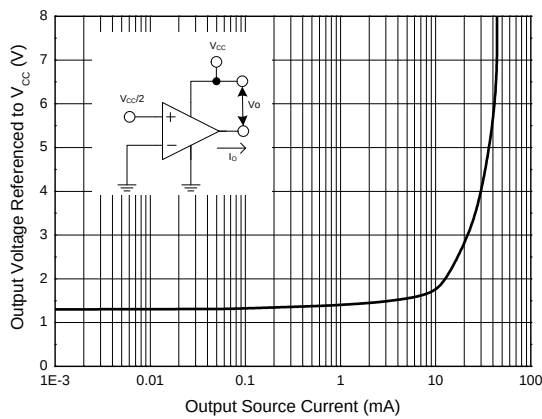
**Voltage Follower Pulse Response (Small Signal)**



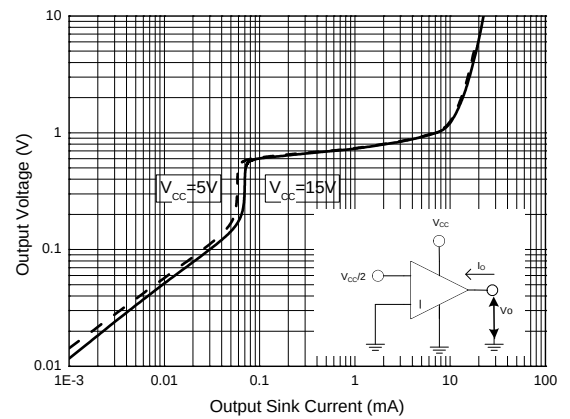
**Large Signal Frequency Response**



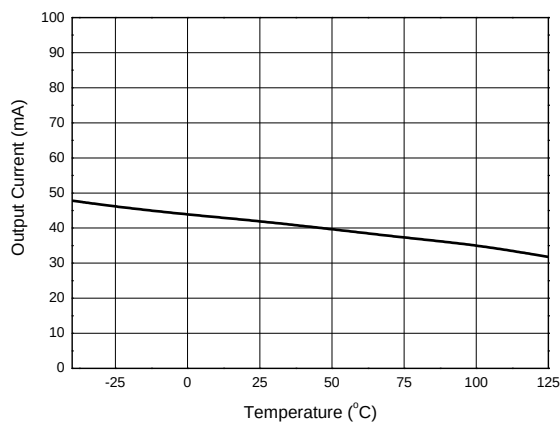
**Output Characteristics: Current Sourcing**



**Output Characteristics: Current Sinking**



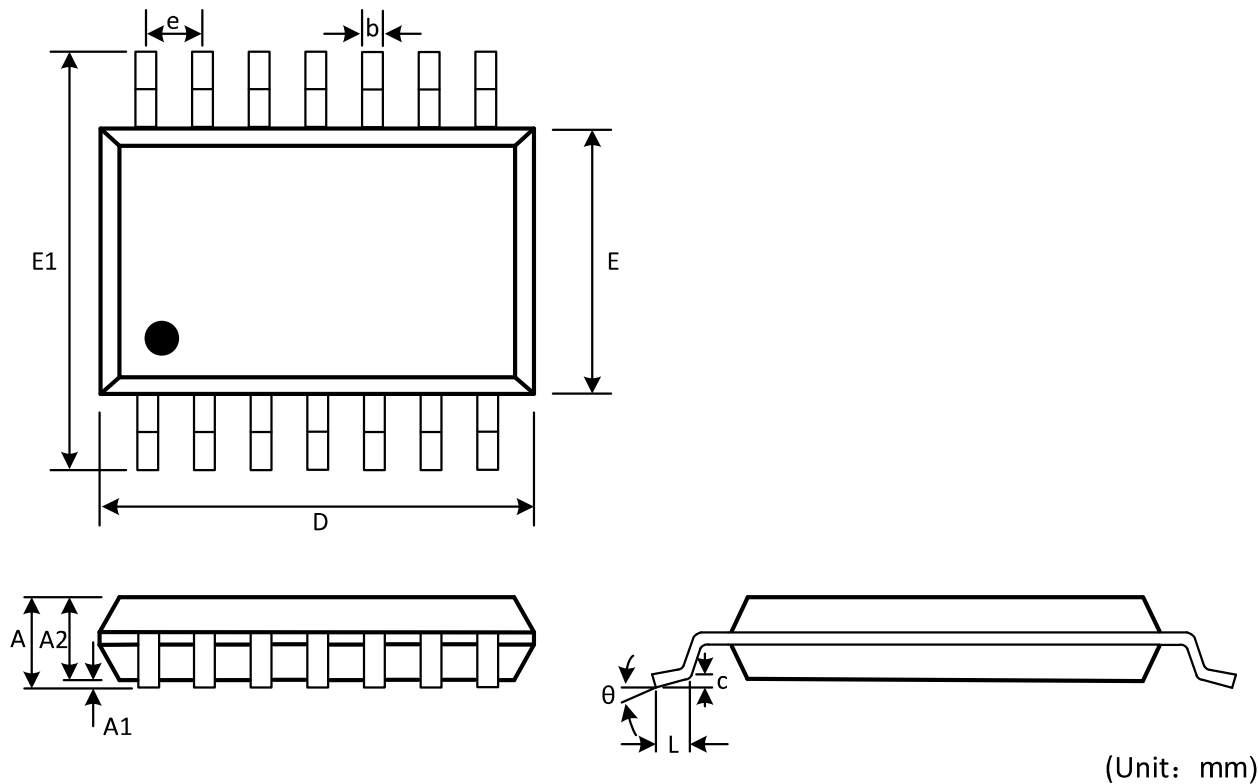
**Current Limiting**





PACKAGE DESCRIPTION

SOP-14



| Symbol | Min        | Max   |
|--------|------------|-------|
| A      | 1.350      | 1.750 |
| A1     | 0.100      | 0.250 |
| A2     | 1.350      | 1.550 |
| b      | 0.310      | 0.510 |
| c      | 0.100      | 0.250 |
| D      | 8.450      | 8.850 |
| e      | 1.270(BSC) |       |
| E      | 5.800      | 6.200 |
| E1     | 3.800      | 4.000 |
| L      | 0.400      | 1.270 |
| θ      | 0°         | 8°    |

REEL SPECIFICATION

| P/N         | PKG    | QTY  |
|-------------|--------|------|
| MSLM2902DR) | SOP-14 | 2500 |

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