

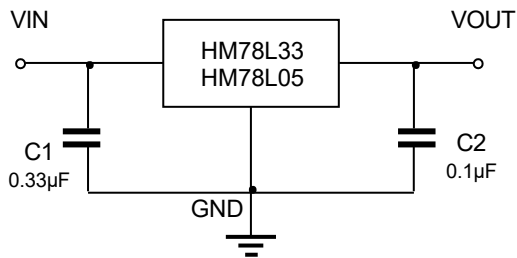
## 30V 100mA Low Dropout Linear Regulator

### ■ Description

The HM78L33/HM78L05 is a fixed voltage (3.3V/5V) three-terminal integrated regulator that can be used in many applications. Its excellent internal current limit and thermal shutdown characteristics make it especially suitable for overload conditions. When used to replace the traditional Zener diode-resistor bank, its output impedance is effectively improved, but the bias current is greatly reduced.

With enough heat dissipation, HM78L33/HM78L05 can provide 100mA output current. A current limit is included to limit the peak output current to a safe value, and a safe area protection for the output transistor to limit internal power dissipation. A thermal shutdown circuit prevents the IC from overheating if the internal power dissipation is too high for the provided heat sink.

### ■ Typical Application Circuit



### ■ Features

- $\pm 4\%$  output voltage tolerance over temperature
- VIN range up to 30V
- Maximum output current 100mA
- Output transistor safe area protection
- Built-in Thermal Protection
- Built-in Overcurrent Protection

### ■ Application

- New energy (photovoltaic inverter, charging pile, etc.)
- Security (walkie-talkies, alarms, etc.)
- Mobile terminals (notebooks, sound cards, etc.)
- Electric vehicles (wipers, windows, etc.)
- LED lighting
- Smart meters

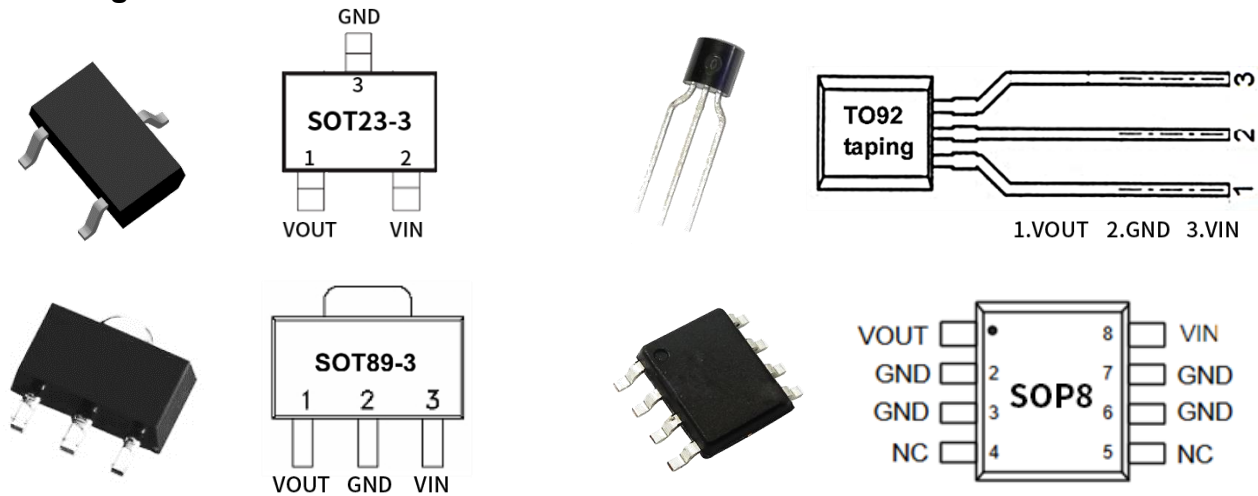
### ■ Package (RoHS Compliant)

- SOT89-3
- SOT23-3
- TO-92
- SOP8

### ■ Ordering Information

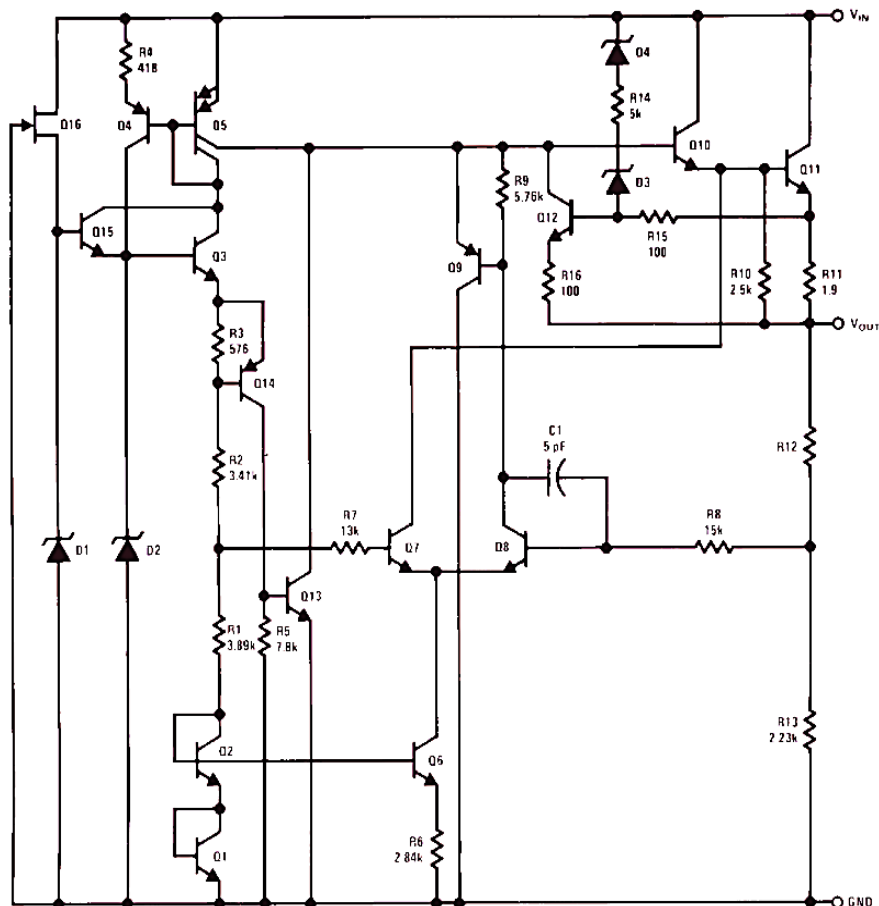
| Part Number        | Input voltage (V) | Output voltage (V) | Maximum output current (mA) | Quiescent Current (uA) | Output precision | PSRR (dB@120Hz) | Dropout (mV) | Enable |
|--------------------|-------------------|--------------------|-----------------------------|------------------------|------------------|-----------------|--------------|--------|
| HM78L33<br>HM78L05 | 7~30              | 3.3<br>5           | 100                         | 300                    | $\pm 4\%$        | 75              | 800@40mA     | —      |

## ■ Pin configuration



| Pin Name | SOT23-3 Pin | TO-92 Pin | SOT89-3 Pin | SOP8 Pin   | Pin Function       |
|----------|-------------|-----------|-------------|------------|--------------------|
| VOUT     | 1           | 1         | 1           | 1          | Output Voltage Pin |
| GND      | 3           | 2         | 2           | 2, 3, 6, 7 | Ground             |
| VIN      | 2           | 3         | 3           | 8          | Input Voltage pin. |
| NC       | —           | —         | —           | 4, 5       | Not connected      |

## ■ Functional block diagram



■ **Absolute Maximum Ratings**

| Project                               | Symbol    | Value      | Units |
|---------------------------------------|-----------|------------|-------|
| Input voltage                         | $V_{IN}$  | -0.3 ~ +35 | V     |
| Lead Temperature (Soldering, 10 sec.) | —         | 300        | °C    |
| Storage Temperature                   | $T_{stg}$ | -65 ~ +150 | °C    |
| Junction Temperature                  | $T_J$     | 125        | °C    |

■ **Recommended Operating Conditions**

| Project              | Symbol   | Value      | Units |
|----------------------|----------|------------|-------|
| Input voltage        | $V_{IN}$ | +7 ~ +30   | V     |
| Junction Temperature | $T_J$    | -40 ~ +125 | °C    |

■ **Electrical Characteristics**

$V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , unless otherwise specified

| Symbol                    | Parameter                   | Test Conditions  | Min   | Typ | Max   | Units         |
|---------------------------|-----------------------------|--|-------|-----|-------|---------------|
| $V_{OUT}$                 | Output Voltage<br>(HM78L33) | $T_J = 25^\circ C$   | 3.168 | 3.3 | 3.432 | V             |
|                           |                             | $V_{IN} = 7 \sim 20V$ ,<br>$I_{OUT} = 1mA \sim 40mA$<br>$T_J = 0^\circ C \sim 125^\circ C$ | 3.135 |     | 3.465 |               |
|                           |                             | $I_{OUT} = 1mA \sim 70mA$<br>$T_J = 0^\circ C \sim 125^\circ C$                            | 3.135 |     | 3.465 |               |
| $V_{OUT}$                 | Output Voltage<br>(HM78L05) | $T_J = 25^\circ C$   | 4.8   | 5   | 5.2   | V             |
|                           |                             | $V_{IN} = 7 \sim 20V$ ,<br>$I_{OUT} = 1mA \sim 40mA$<br>$T_J = 0^\circ C \sim 125^\circ C$ | 4.75  |     | 5.25  |               |
|                           |                             | $I_{OUT} = 1mA \sim 70mA$<br>$T_J = 0^\circ C \sim 125^\circ C$                            | 4.75  |     | 5.25  |               |
| $\Delta V_{LINE}$         | Line Regulation             | $V_{IN} = 7 \sim 20V$  |       | 12  | 30    | mV            |
|                           |                             | $V_{IN} = 8 \sim 20V$  |       | 10  | 25    |               |
| $\Delta V_{LOAD}$         | Load Regulation             | $I_{OUT} = 1mA \sim 100mA$   |       | 20  | 50    | mV            |
|                           |                             | $I_{OUT} = 1mA \sim 40mA$  |       | 10  | 25    |               |
| $I_Q$                     | Quiescent Current           | $T_J = 25^\circ C$   |       | 0.3 |       | mA            |
|                           |                             | $T_J = 125^\circ C$  |       |     | 1     |               |
| $\Delta I_Q$              | Quiescent Current<br>Change | $V_{IN} = 8 \sim 20V$<br>$T_J = 0^\circ C \sim 125^\circ C$                                |       |     | 0.2   | mA            |
|                           |                             | $I_{OUT} = 1mA \sim 40mA$<br>$T_J = 0^\circ C \sim 125^\circ C$                            |       |     | 0.1   |               |
| PSRR                      | Ripple Rejection            | $f = 120Hz$ ,<br>$V_{IN} = 8V \sim 20V$<br>$T_J = 25^\circ C$                              |       | 75  |       | dB            |
| $V_N$                     | Output Noise Voltage        | $f = 10Hz \sim 100KHz$   |       | 32  |       | $\mu V$       |
| $V_{DROP}$                | Dropout Voltage             |  |       | 0.8 |       | V             |
| $\Delta V_{OUT}/\Delta T$ | $V_{OUT}$ Temp. Coefficient | $I_{OUT} = 5mA$  |       | 0.4 |       | $mV/^\circ C$ |
| $I_{PK}$                  | Peak Output Current         |  |       | 170 |       | mA            |

## ■ Typical Characteristics

$V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^{\circ}C$ , unless otherwise specified

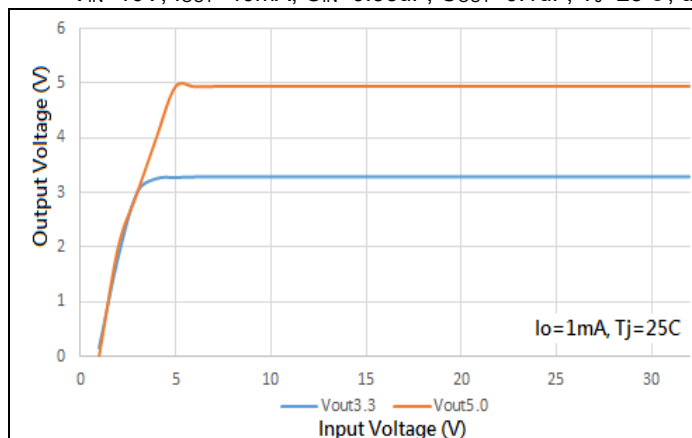


Fig 1. Output Voltage vs Input Voltage

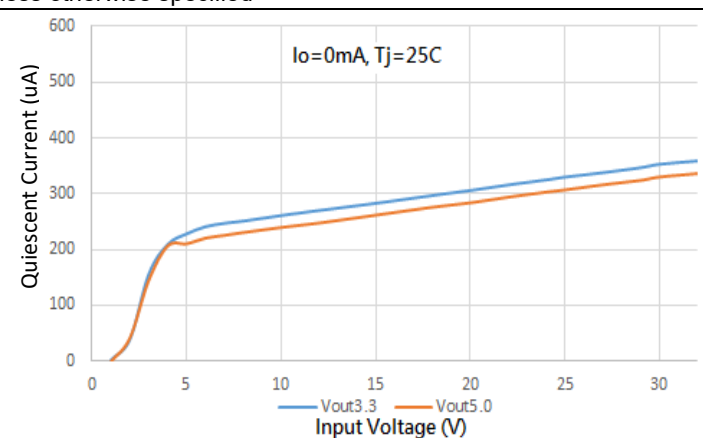


Fig 2. Quiescent Current vs Input Voltage

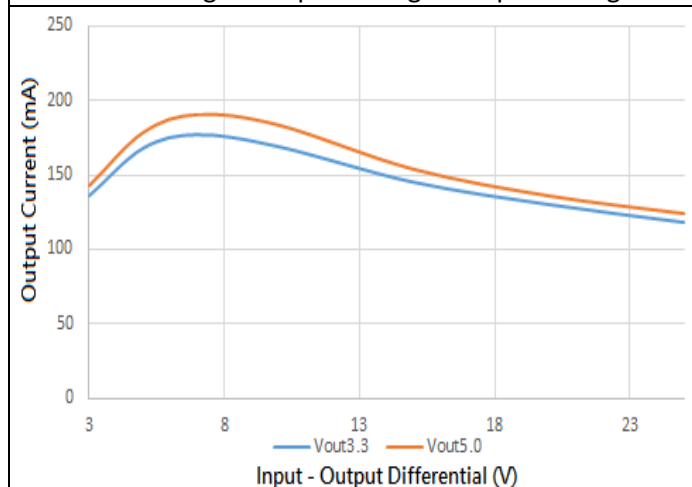


Fig 3. Peak Output Current vs Input-Output Differential

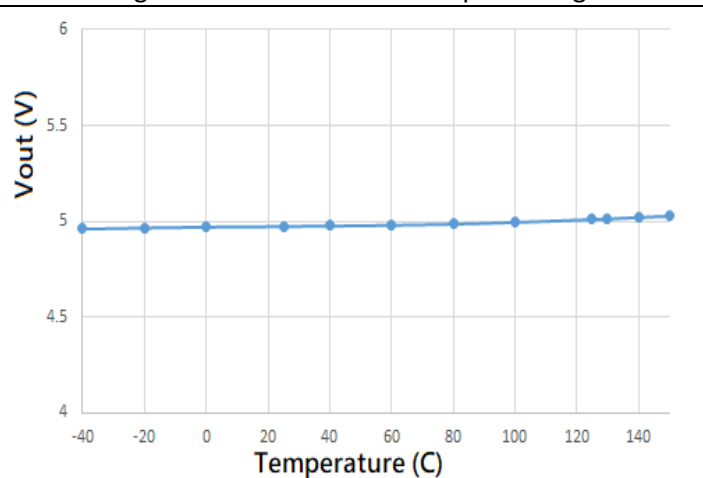


Fig 4.  $V_{OUT}$  vs Temp

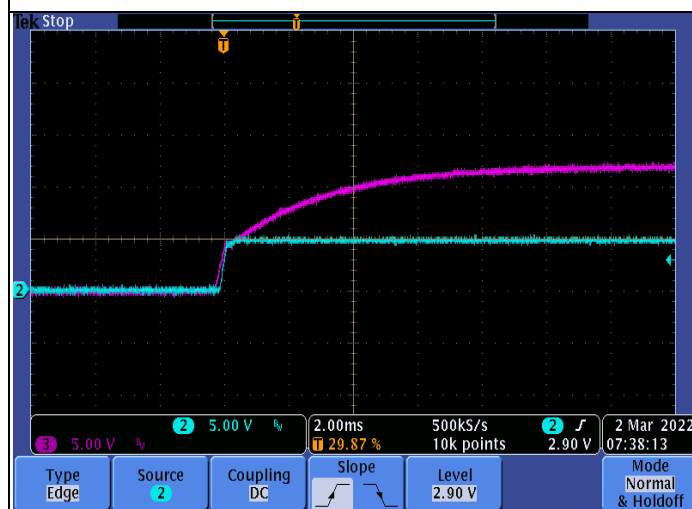


Fig 5.  $V_{IN}$  Start up

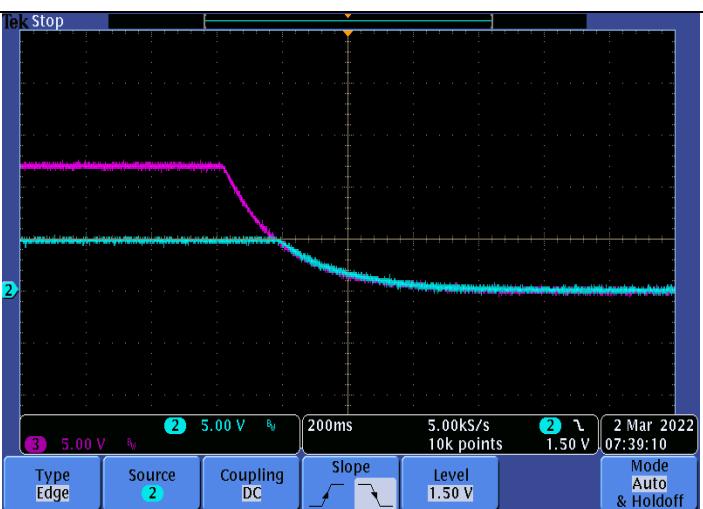


Fig 6.  $V_{IN}$  Power off

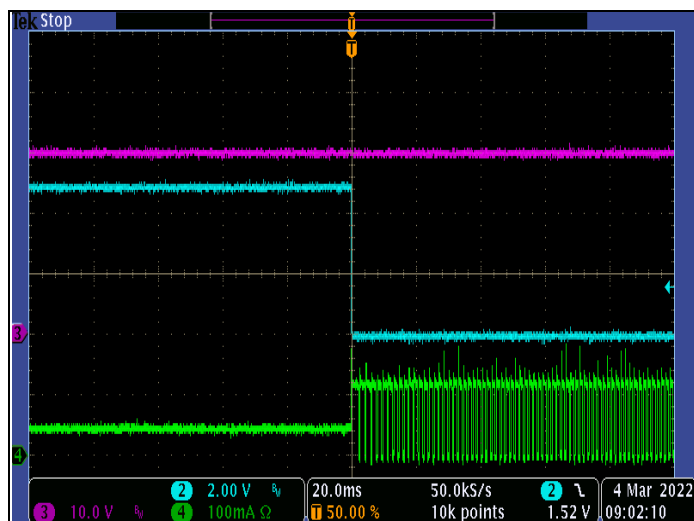


Fig 7.  $V_{OUT}$  Short to GND

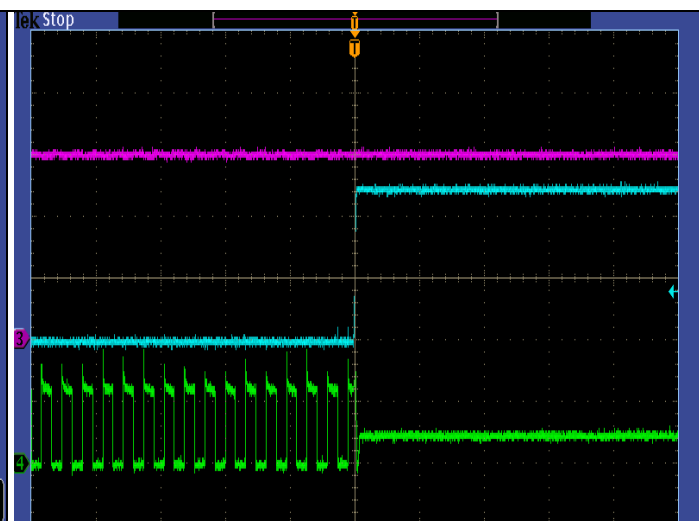


Fig 8.  $V_{OUT}$  Short and Release

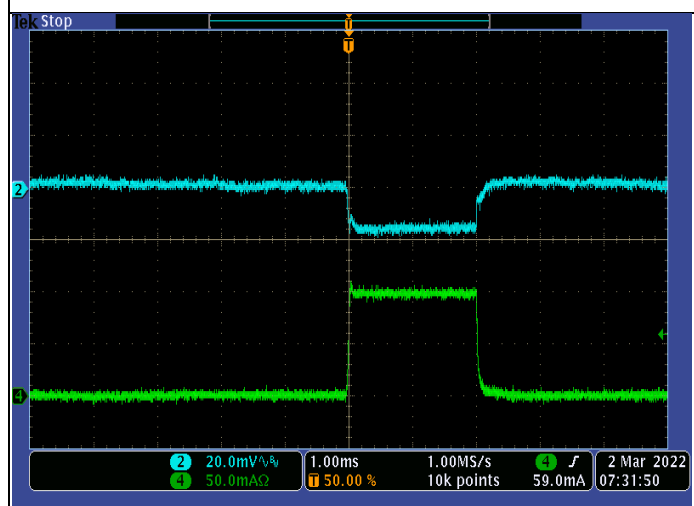


Fig 9. Load Transient

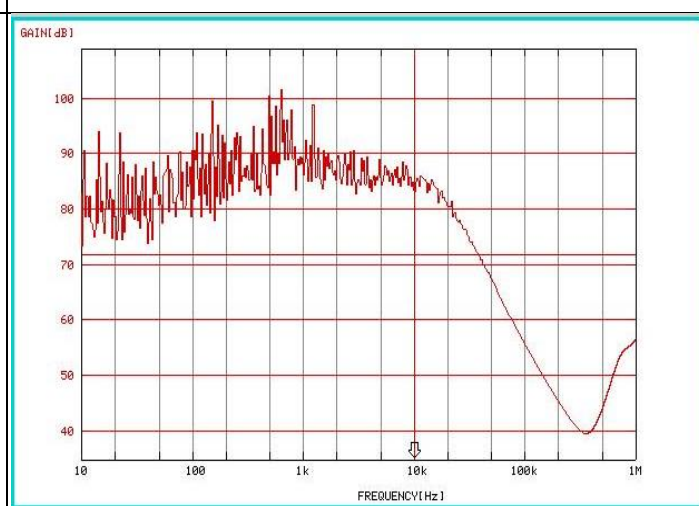
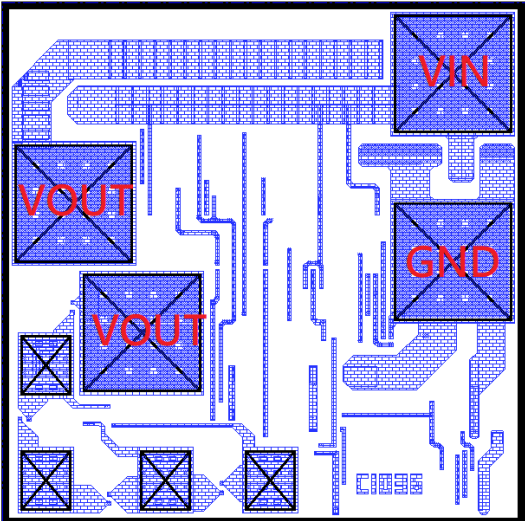


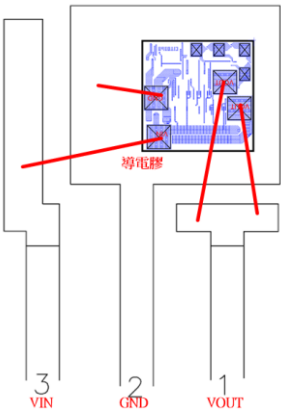
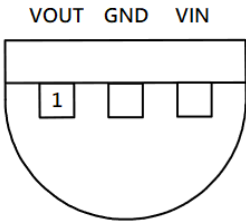
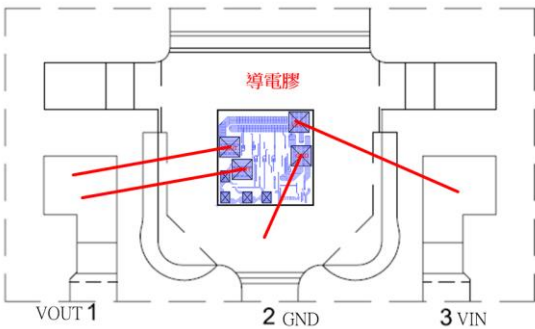
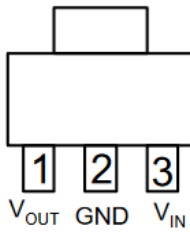
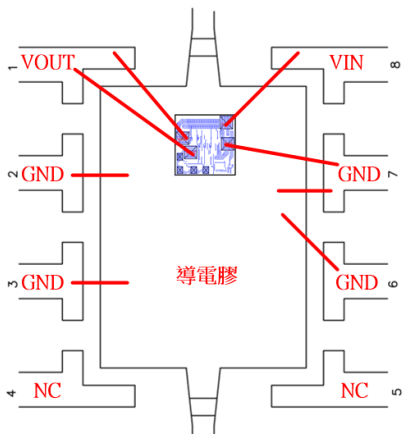
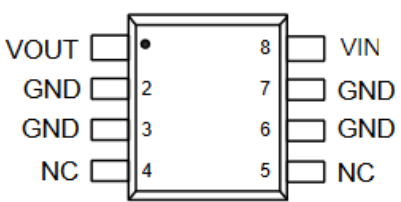
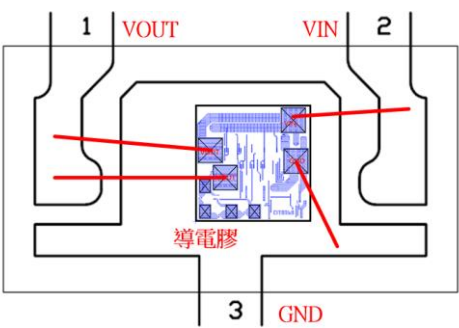
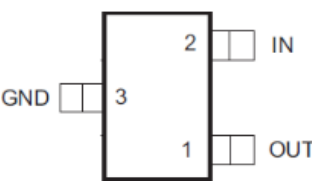
Fig 10. PSRR vs Frequency ( $V_{IN} = 9V$ ,  $V_{OUT} = 5V$ )

■ PAD Location and Coordinates

| PHYSICAL CHARACTERISTICS       |                                      | UNIT            | CHIP DRAWING   |
|--------------------------------|--------------------------------------|-----------------|--|
| Wafer Size                     | 200                                  | mm              |  |
| Die Size (with S/L)            | 0.332 * 0.326                        | mm <sup>2</sup> |  |
| Scribe line width              | 62 (X direction)<br>56 (Y direction) | um              |  |
| TOP Metal thickness            | 3                                    | μm              |  |
| Metal layers                   | 3                                    | layers          |  |
| Top Metallization              | Al-Cu                                |                 |  |
| Wafer Thickness                | 736                                  | μm              |  |
| CUP (circuit under PAD) or not | YES                                  |                 |  |

| PAD NAME | PAD SIZE (μm <sup>2</sup> ) | Coordinate  |
|----------|-----------------------------|-------------|
| GND      | 60*60                       | ( 233,136 ) |
| VIN      | 60*60                       | ( 233,233 ) |
| VOUT     | 60*60                       | (37,166)    |
| VOUT     | 60*60                       | (72,99)     |

## ■ Bonding Diagram Example

|   |  |
|---|--|
|    | <p>( Bottom View )</p>  <p><b>TO92-3L</b></p> |
|   | <p>( Top View )</p>  <p><b>SOT89-3L</b></p>   |
|  |  <p><b>SOP8</b></p>                          |
|  |  <p><b>SOT23-3</b></p>                       |