

5uA Low Iq, 40V 150mA LDO

Product Features

- Low Power Consumption:5.0uA (Typ.)
- Maximum Output Current:150mA
- Small Dropout Voltage
- 740mV@100mA (VOUT=3.3V)
- 1300mV@150mA (VOUT=3.3V)
- Input Voltage Range:3V~40V
- Output Voltage
Range:3.0V,3.3V,3.6V,5.0V,9.0V,12V
- Highly Accuracy: $\pm 2\%$
- Current Limit and Short Protection
- Over Temperature Protection

Product Overview

FS75XX series is a group of positive voltage output 3-terminal linear regulator, capable of delivering 150mA current and working under 40V input voltage. It also features extremely low standby current which is only 5uA, while still keeps very fast load transient response capability. With the extremely low 5uA standby current, FS75XX can greatly improve natural life of batteries.

FS75XX includes high accuracy voltage reference, error amplifier, and current limit circuit and output driver module. FS75XX has well load transient response and good temperature characteristic. And it uses trimming technique to guarantee output voltage accuracy within $\pm 2\%$. FS75XX can provide 3.0V,3.3V,3.6V,5.0V,9.0V, 12V output value. It also can be customized on command.

FS75XX is housed in 2 different types of packages, which are SOT23 and SOT89-3.

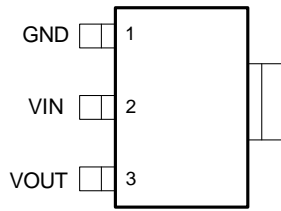
Application field

- Wearables
- Toys
- Smart Home Application
- Battery Powered equipment

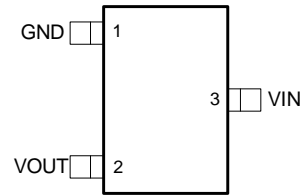
V0.1(202310)



Chip packaging and pin definition



SOT89-3



SOT23

FS75XX Pin function description

| SOT89-3 | SOT23 | Name of the pin | Description |
|---------|-------|-----------------|-------------------------|
| 1 | 1 | GND | Ground |
| 3 | 2 | OUT | Output of the regulator |
| 2 | 3 | VIN | Power Supply Input |

Marking Information

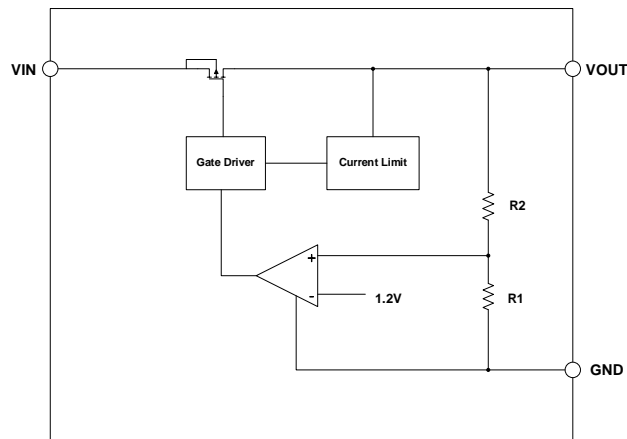
| Top Marking (SOT23) | Top Marking (SOT89-3) |
|---|--|
| <p><u>03</u> <u>XX</u> <u>Y</u> <u>W</u></p> <p>↓ FS75XX</p> <p>Week 01~26(A~Z) 27~52(a~z)</p> <p>Year 1=2021 2=2022 ... 9=2029</p> <p>Output Voltage 3.0V=30 3.3V=33 5.0V=50 9.0V=90 12.0V=120</p> | <p><u>01</u> <u>XX</u></p> <p>Output Voltage 3.0V=30 3.3V=33 5.0V=50 9.0V=90 12.0V=120</p> <p>Product Code:FS75XX</p> <p><u>LL</u> <u>F</u> <u>Y</u> <u>W</u></p> <p>Week 01~26(A~Z) 27~52(a~z)</p> <p>Year 1=2021 2=2022 ... 9=2029</p> <p>FAB ID</p> <p>LOT NO</p> |



Order information

| Part No | Package | Voltage option | Marking | Tape & Reel |
|--------------|---------|----------------|---------------|-------------|
| FS7530-30R3A | SOT23 | 3.0V | 7530YW | 3K/Reel |
| FS7533-33R3A | SOT23 | 3.3V | 7533YW | 3K/Reel |
| FS7550-50R3A | SOT23 | 5.0V | 7550 YW | 3K/Reel |
| FS7530-30FA | SOT89-3 | 3.0V | 0130 LLFYW | 1K/Reel |
| FS7533-33FA | SOT89-3 | 3.3V | 0133 LLFYW | 1K/Reel |
| FS7550-50FA | SOT89-3 | 5.0V | 0150 LLFYW | 1K/Reel |

Block Diagram



FS75XX Block diagram

Absolute Maximum Ratings

Maximum working range

| Parameter | value |
|------------------------------------|---------------|
| $V_{IN}^{(1)}$ | 42V |
| Out Voltage | -0.3V ~ +20V |
| Operating Junction Temperature(Tj) | 125°C |
| Operating Temperature Range | -40°C ~ 85°C |
| Storage Temperature Range | -55°C ~ 125°C |



| | |
|-------------------------|-----------|
| ESD Human body mode | 2KV |
| Lead Temperature & Time | 260°C,10S |

Notes:

(1) Exceeding these ratings may damage the device.

Electrical Characteristics

All typical values are at Tj=25°C (unless otherwise noted)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------|--------------------------|-----|------|------|-------|
| Input Voltage range | | 3 | | 40 | V |
| Output Voltage range | | 3 | | 12 | V |
| Output Accuracy | | -2 | | 2 | % |
| Ground supply current | No load | | 5 | 10 | μA |
| Max output current | Vin-Vout=2V | 150 | | | mA |
| Line regulation | Iload=1mA | | 0.01 | 0.1 | % |
| Load regulation | Iload=1-100mA | | 2 | 4 | % |
| Dropout Voltage | Iload=100mA, Vout>3V | | 740 | 1000 | mV |
| Current Limit | | | 200 | | mA |
| Short current | | | 200 | | mA |
| PSRR @ 100Hz | Vin=Vout+0.5V, Iload=1mA | | 65 | | dB |
| Startup time | | | 500 | | uS |
| OTP | | | 165 | | °C |
| OTP hysteresis | | | 30 | | °C |

Note1: All tests are conducted under ambient temperature 25°C and within a short period of time 20ms

Function Descriptions

A minimum of 1uF capacitor must be connected from Vout to ground to insure stability. Input capacitor of 1uF is recommended to ensure the input voltage does not sag below the minimum dropout voltage during load transient event. Vin pin must always be dropout voltage higher than Vout in order for the device to regulate properly.



Application Information

Like any low-dropout regulators, FS75XX requires input and output decoupling capacitors. These capacitors must be correctly selected for good performance. Both input and output capacitors are recommended to be placed as close to chip pin as possible.

Capacitor Selection

Normally, use a 1uF capacitor on the input and a 1uF capacitor on the output of the FS75XX. Larger input capacitor values and lower ESR (X5R, X7R) provide better supply noise rejection and transient response..

Input-Output (Dropout) Voltage

A regulator's minimum input-to-output voltage differential (dropout voltage) determines the lowest usable supply voltage. In battery-powered systems, this determines the useful end-of-life battery voltage. Because the device uses a PMOS, its dropout voltage is a function of drain to source on resistance, RDS (on), multiplied by the load current:

$$V_{\text{dropout}} = V_{\text{in}} - V_{\text{out}} = R_{\text{DS (on)}} \times I_{\text{out}}$$

Current Limit and Thermal Shutdown Protection

In order to prevent overloading or thermal condition from damaging the device, FS75XX has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

Thermal Considerations

The FS75XX series can deliver a current of up to 150mA over the full operating junction temperature range. However, the maximum output current must be controlled at higher ambient temperature to ensure the junction temperature does not exceed 150°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

$$P_d = (V_{\text{in}} - V_{\text{out}}) \times I_{\text{out}}$$

The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

$$P_d (\text{max}) = (T_j (\text{max}) - T_a) / \theta_{ja}$$

Where $T_j (\text{max})$ is the maximum junction temperature of the die (150°C) and T_a is the maximum ambient temperature.

When junction temperature exceeds 150°C, over temperature protection may be triggered to prevent device from over heat

PCB Layout

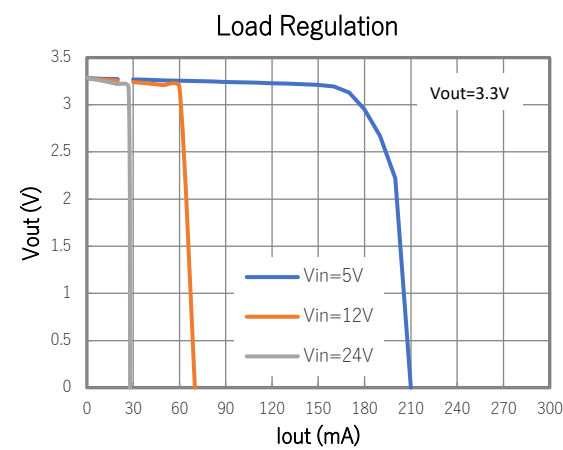
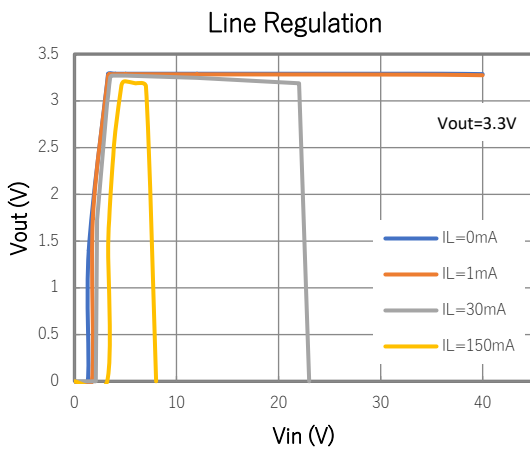
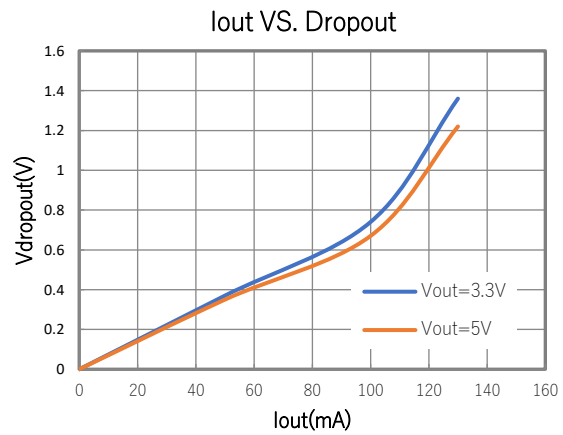
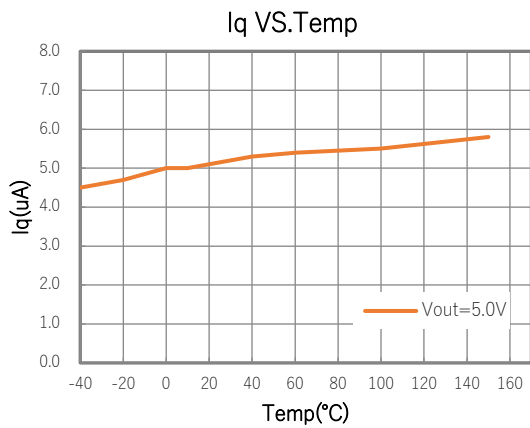
An input capacitance of 1uF is required between the FS75XX input pin and ground (the amount of the capacitance may be increased without limit), this capacitor must be located a distance of not more than 1cm from the input and return to a clean analog ground. Input capacitor can filter out the input voltage spikes caused by the surge current due to the inductive effect of the package pin and the printed circuit board's



routing wire. Otherwise, the actual voltage at the Vin pin may exceed the absolute maximum rating. The output capacitor also must be located a distance of not more than 1cm from output to a clean analog ground. Because it can filter out the output spike caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire.

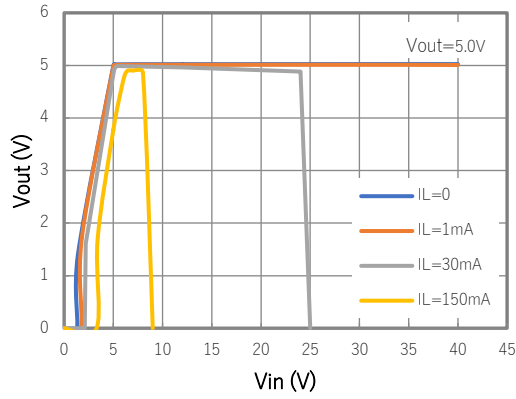
Typical Characteristics

$C_{IN}=C_{OUT}=1\mu F$, $T_A = 25^\circ C$, unless otherwise specified

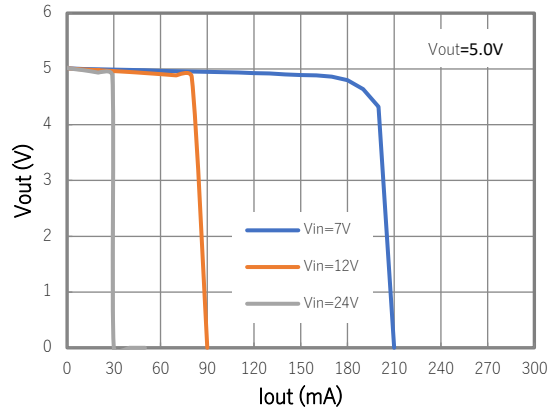




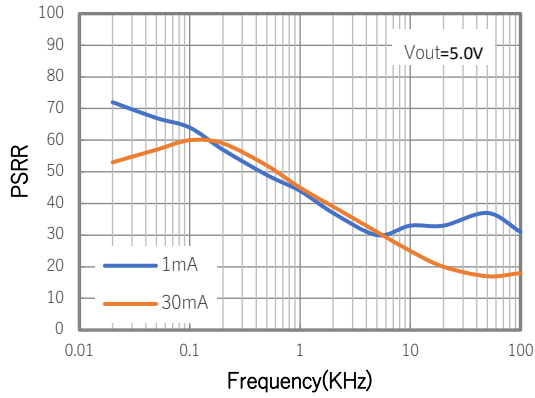
Line Regulation



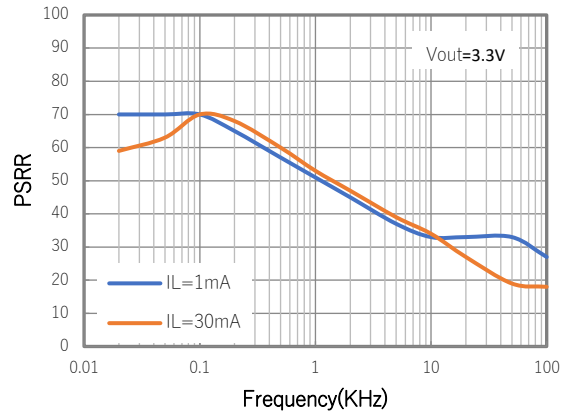
Load Regulation



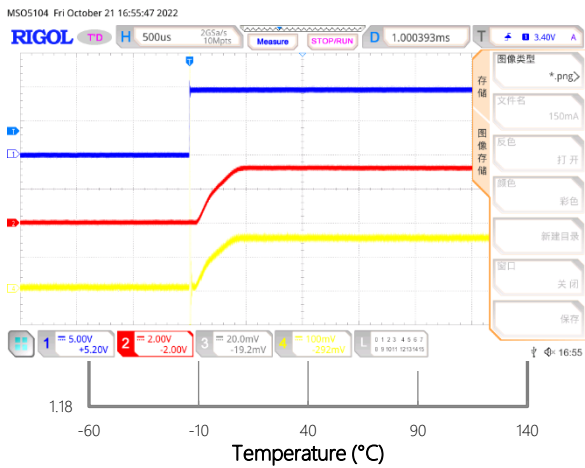
PSRR



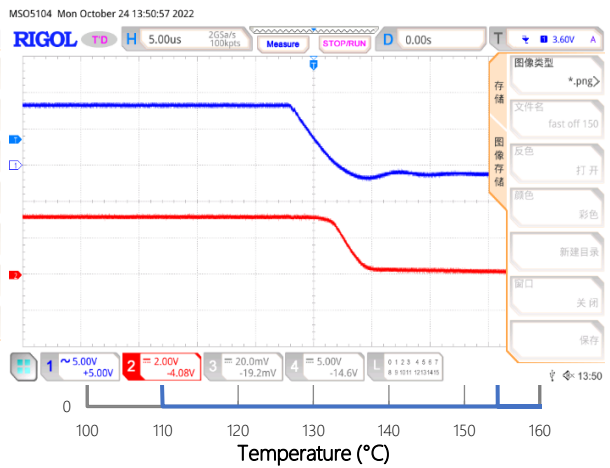
PSRR



Vin fast on 150mA, Vout=3.3V



Vin fast off 150mA, Vout=3.3V





Vin fast on 150mA, Vout=5.0V

Vin fast off 150mA, Vout=5.0V



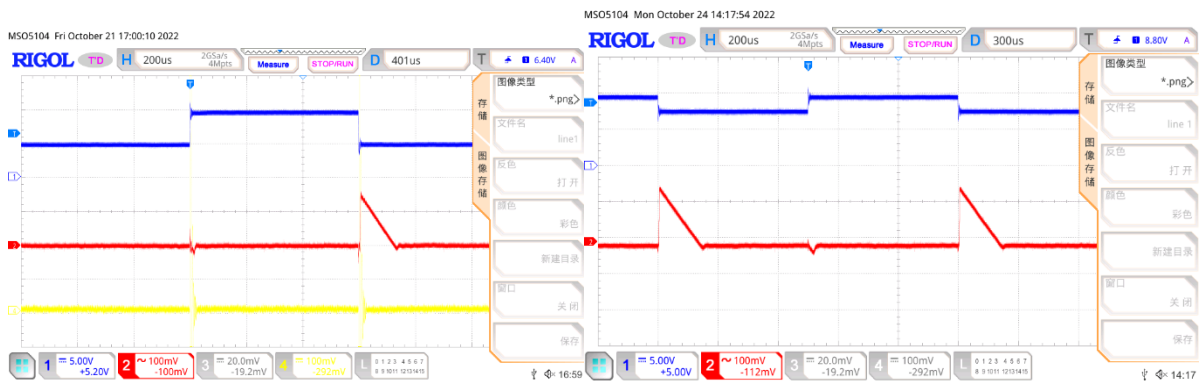
Vin slow on/off 150mA, Vout=3.3V

Vin slow on/off 150mA, Vout=5.0V



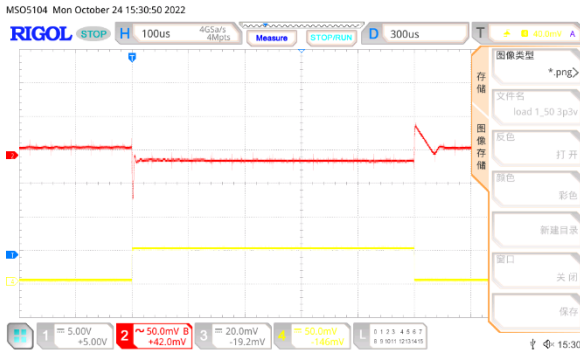
Line transient Vout=3.3V, Iout=1mA

Line transient Vout=5.0V, Iout=1mA

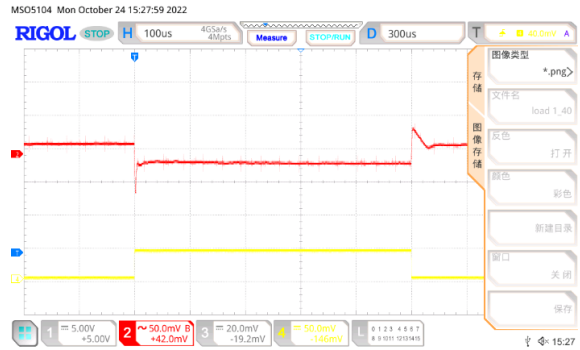




Load transient Vout=3.3V, Iout=1mA-50mA



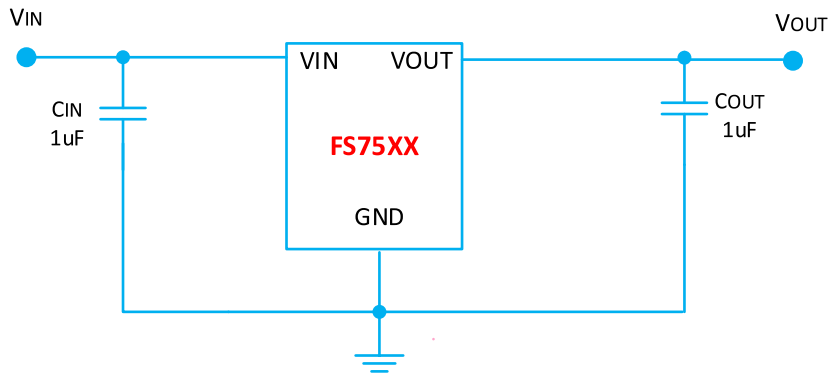
Load transient Vout=5.0V, Iout=1mA-40mA



Application example

Note:

Input capacitor (C_{IN}=1uF) and Output capacitor (C_{OUT}≥1uF) are recommended in all application circuit.



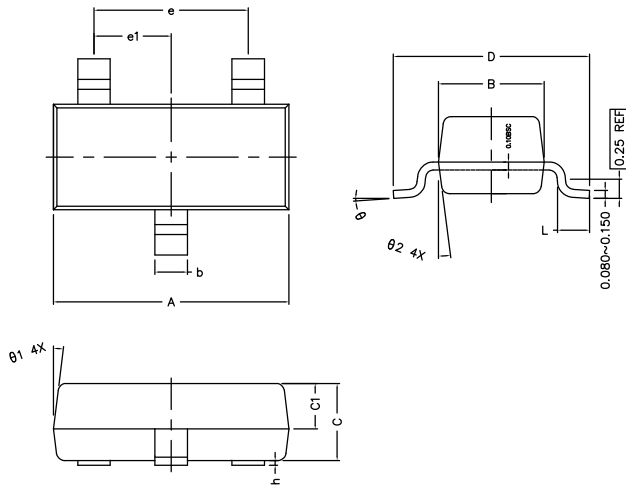


Package outline drawing

Package SOT23

Devices per reel 3000 pcs

Package dimension (mm):

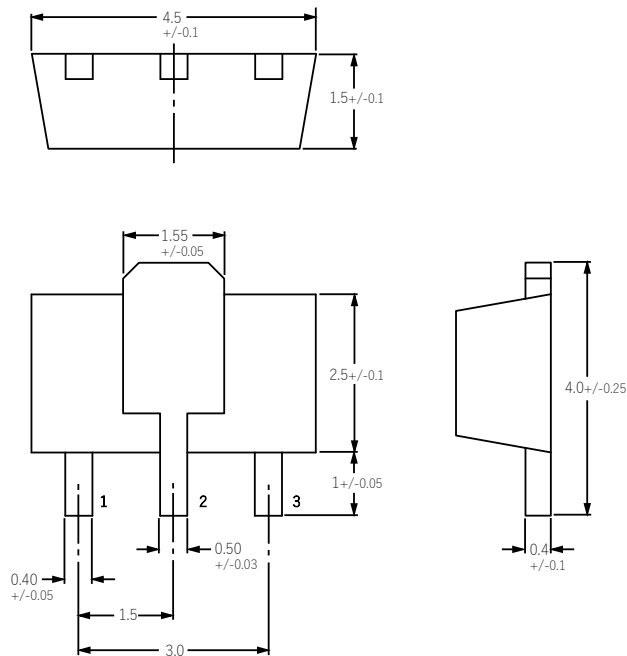


| Symbol | MIN | NORM | MAX |
|--------|----------|-------|-------|
| A | 2.800 | 2.900 | 3.000 |
| B | 1.200 | 1.300 | 1.400 |
| C | 0.900 | 1.000 | 1.100 |
| C1 | 0.500 | 0.550 | 0.600 |
| D | 2.250 | 2.400 | 2.550 |
| L | 0.300 | 0.400 | 0.500 |
| h | 0.010 | 0.050 | 0.100 |
| b | 0.300 | 0.400 | 0.500 |
| e | 1.90 TYP | | |
| e1 | 0.95 TYP | | |
| θ1 | 7° TYP | | |
| θ2 | 7° TYP | | |
| θ | 0°~7° | | |

Package SOT89-3

Devices per reel 1000 pcs

Package dimension (mm):





Company information and statement

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