HOLTEK

## 30V, 150mA Low Power LDO with Protections

# HT75Rxx-7

Revision: V1.01 Date: December 03, 2025

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## Features

- Low power consumption
- Low voltage dropout
- Low temperature coefficient
- Maximum input voltage: 30V
- Output voltage accuracy: ±2%
- Low Quiescent Current: 2.5μA (typ.)
- High output current: 150mA
- Soft start function
- Over current protection
- Over temperature protection
- Allow 1μF ceramic type output capacitor
- Package types: 3-pin SOT89, 5-pin SOT23

## Applications

- Battery-powered equipment
- Communication equipment
- Audio/Video equipment

## General Description

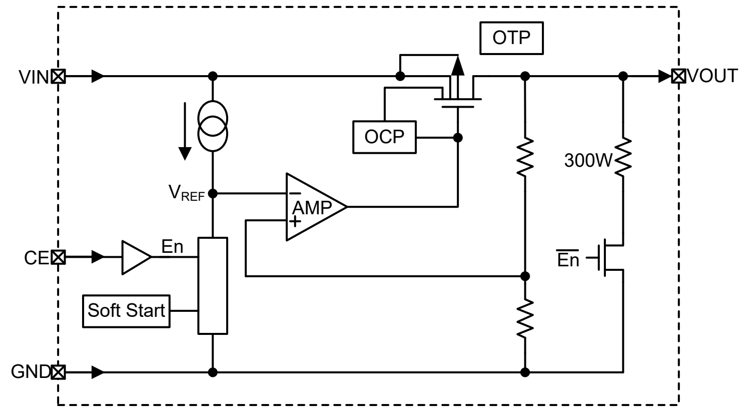
The HT75Rxx-7 series of devices are low-power high-voltage regulators implemented in CMOS technology, which ensures low voltage dropout and low quiescent current. They allow input voltages as high as 30V and are available with several fixed output voltages ranging from 3V to 12V.

The devices include a soft start function, which is used to control the output slew rate to prevent the overshooting phenomenon when power on. The chip enable pin, CE, accepts a CMOS level as logic input. When the CE input is low, a fast discharge path pulls the output voltage low via a 300Ω resistor. An internal over current protection circuit prevents the devices from damage even if the output is shorted to ground. An over temperature protection circuit ensures that the device junction temperature will not exceed a temperature of 150°C. The soft start function inhibits the output overshooting when power on.

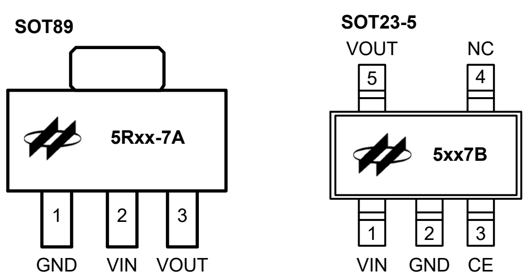
## Selection Table

| Part No. | Output Voltage(V) | Package | Marking |
|---|---|---|---|
| HT75R30-7A | 3.0 | SOT89 | 5R30-7A |
| HT75R33-7A | 3.3 | | 5R33-7A |
| HT75R36-7A | 3.6 | | 5R36-7A |
| HT75R50-7A | 5.0 | | 5R50-7A |
| HT75RC0-7A | 12.0 | | 5RC0-7A |
| HT75R30-7B | 3.0 | SOT23-5 | 5307B |
| HT75R33-7B | 3.3 | | 5337B |
| HT75R36-7B | 3.6 | | 5367B |
| HT75R50-7B | 5.0 | | 5507B |
| HT75RC0-7B | 12.0 | | 5C07B |

## Block Diagram




## Pin Assignment



## Pin Description

| Pin No. | | Pin Name | Pin Description |
|---|---|---|---|
| SOT89 | SOT23-5 | | |
| 1 | 2 | GND | Ground pin |
| 2 | 1 | VIN | Input pin |
| 3 | 5 | VOUT | Output pin |
| — | 3 | CE | Chip enable pin, high enable |
| — | 4 | NC | No connection |

## Absolute Maximum Ratings

| Parameter | | Value | Unit |
|---|---|---|---|
| $V_{IN}$ | | -0.3 to 33 | V |
| $V_{CE}$ | | -0.3 to $V_{IN}$+0.3 | V |
| Operating Temperature Range, Ta | | -40 to 105 | °C |
| Maximum Junction Temperature, $T_{J(MAX)}$ | | 150 | °C |
| Storage Temperature Range | | -60 to 150 | °C |
| ESD Susceptibility | Human Body Model | ±2000 | V |
| | Machine Model | ±200 | V |
| Junction-to-Ambient Thermal Resistance, $\theta_{JA}$ | SOT89 | 200 | °C/W |
| | SOT23-5 | 500 | °C/W |
| Power Dissipation, $P_D$ | SOT89 | 0.5 | W |
| | SOT23-5 | 0.2 | W |

Note: $P_D$ is measured at Ta = 25°C.

## Recommended Operating Range

| Parameter | Value | Unit |
|---|---|---|
| $V_{IN}$ | 3.1 to 30 | V |
| $V_{CE}$ | 0 to $V_{IN}$ | V |

## Electrical Characteristics

Ta=25°C, $V_{IN}$=$V_{OUT}$+2V, $V_{CE}$=$V_{IN}$, $C_{IN}$=$C_{OUT}$=1μF, unless otherwise specified

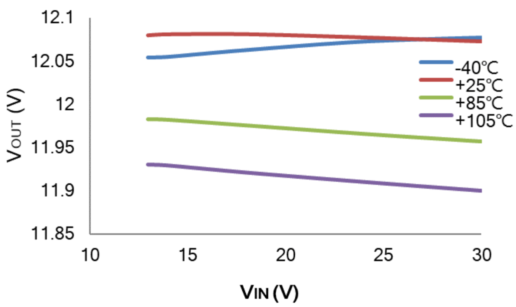
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | — | 3 | — | 12 | V |
| $V_O$ | Output Voltage Accuracy | $I_{OUT}$=10mA | –2 | — | 2 | % |
| $I_{OUT}$ | Output Current | — | 150 | — | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 50mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage | $I_{OUT}$=1mA, $V_{OUT}$ drop=2% (Note) | — | 10 | 30 | mV |
| $I_{SS}$ | Quiescent Current | $I_{OUT}$=0mA | — | 2.5 | 4.0 | μA |
| | | $V_{CE}$=2.0V, $V_{IN}$=30V, $I_{OUT}$=0mA | — | 3.0 | 5.0 | μA |
| $I_{SHD}$ | Shutdown Current | $V_{CE}$=0V | — | 0.1 | 0.5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times \Delta V_{OUT}}$ | Line Regulation | $V_{OUT}$+1V ≤ $V_{IN}$ ≤ 30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times \Delta V_{OUT}}$ | Temperature Coefficient | $I_{OUT}$=10mA, -40°C < Ta < 85°C | — | ±100 | — | ppm/°C |

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SHORT}$ | Output Short Current | $V_{IN}$=12V, force $V_{OUT}$=0V | — | 150 | — | mA |
| $T_{SHD}$ | Shutdown Temperature | — | — | 150 | — | °C |
| $T_{REC}$ | Recovery Temperature | — | — | 125 | — | °C |
| $V_{IH}$ | CE Input High Threshold | $V_{OUT}+1V \le V_{IN} \le 30V$ | 2.0 | — | — | V |
| $V_{IL}$ | CE Input Low Threshold | $V_{OUT}+1V \le V_{IN} \le 30V$ | — | — | 0.6 | V |
| $R_{DIS}$ | Discharge Resistor | $V_{CE}$=0V, measure at $V_{OUT}$ | — | 300 | — | Ω |

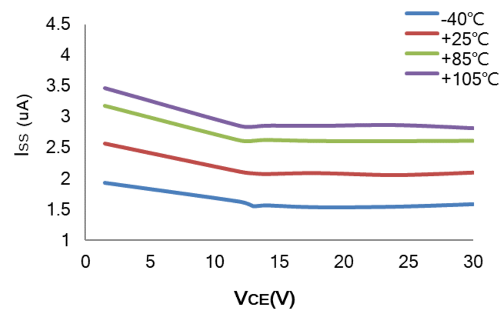
Note: The dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at $V_{IN}=V_{OUT}+2V$ with a fixed load.

## Typical Performance Characteristics

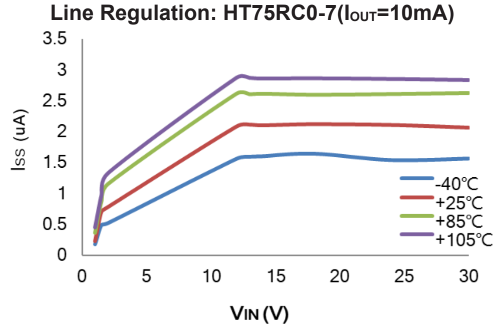
Test Condition: $V_{IN}=V_{OUT}+2V$, $V_{CE}=V_{IN}$, $I_{OUT}$=10mA, $C_{IN}$=1μF, $C_{OUT}$=1μF, Ta=25°C, unless otherwise noted



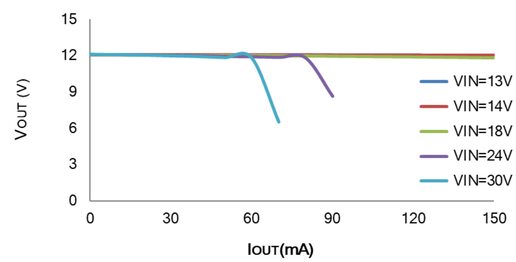

**Line Regulation: HT75RC0-7($I_{OUT}$=10mA)**



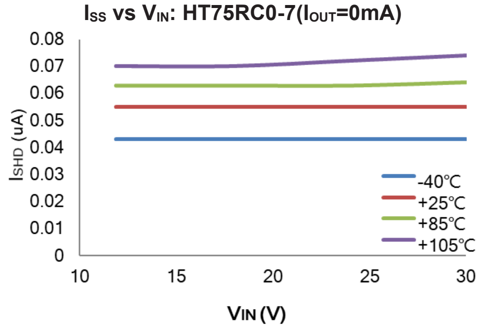

**$I_{SS}$ vs $V_{CE}$: HT75RC0-7($I_{OUT}$=0mA)**



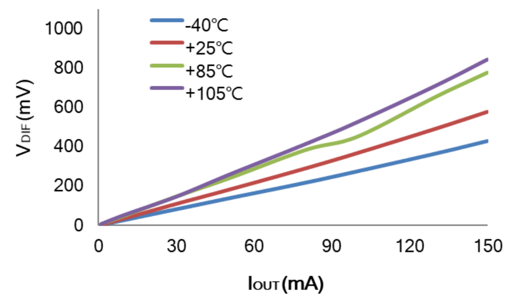

**$I_{SS}$ vs $V_{IN}$: HT75RC0-7($I_{OUT}$=0mA)**




**$V_{OUT}$ vs $I_{OUT}$: HT75RC0-7**

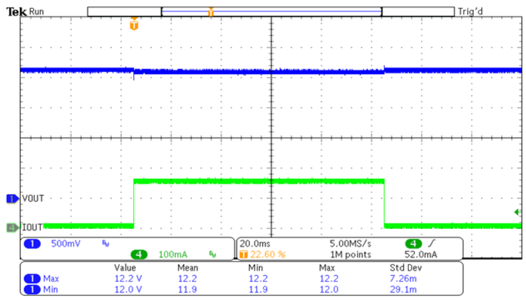



**$I_{SHD}$ vs $V_{IN}$: HT75RC0-7($I_{OUT}$=0mA)**

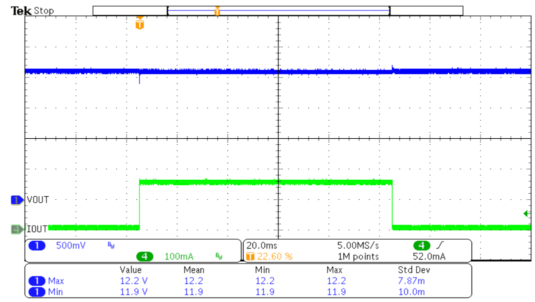



**Dropout Voltage: HT75RC0-7**

## Load Transient Response

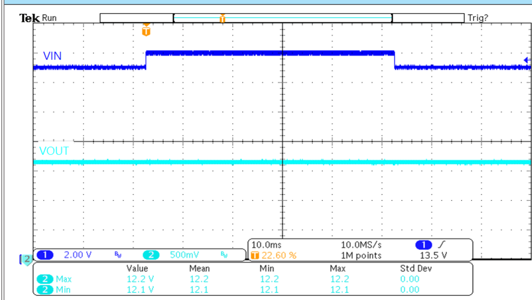



Load Transient Response:
HT75RC0-7 ($V_{IN}$=14V, $I_{OUT}$=1mA to 150mA)

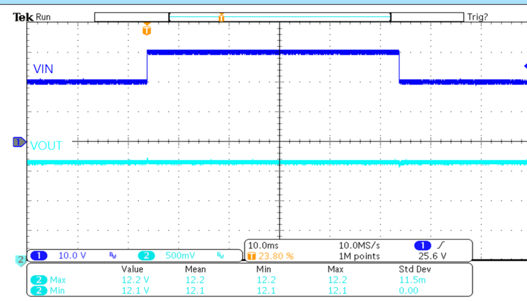



Load Transient Response:
HT75RC0-7 ($V_{IN}$=14V, $I_{OUT}$=0mA to 150mA)

## Line Transient Response

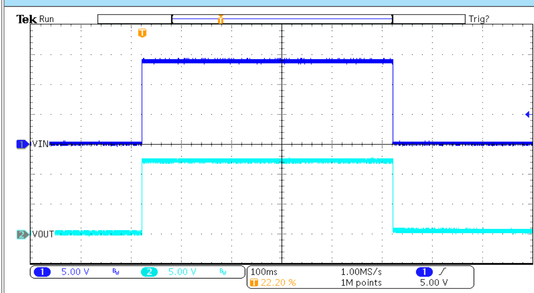



Line Transient Response: HT75RC0-7
($V_{IN}$=13V to 14V, $I_{OUT}$=10mA)

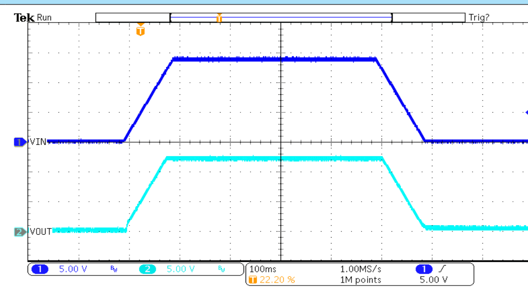



Line Transient Response: HT75RC0-7
($V_{IN}$=20V to 30V, $I_{OUT}$=10mA)

## Power ON/OFF Response ($I_{OUT}$=0mA)

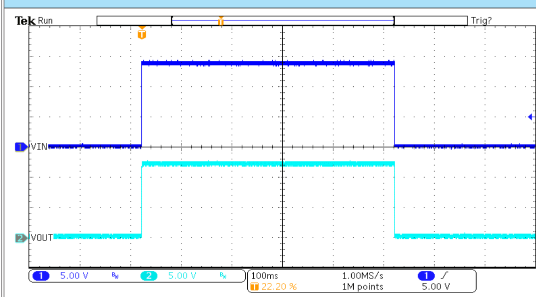



Power On/Off Response: HT75RC0-7
($V_{IN}$=14V, $I_{OUT}$=0mA, $T_{RISE}$=$T_{FALL}$=0.1ms)

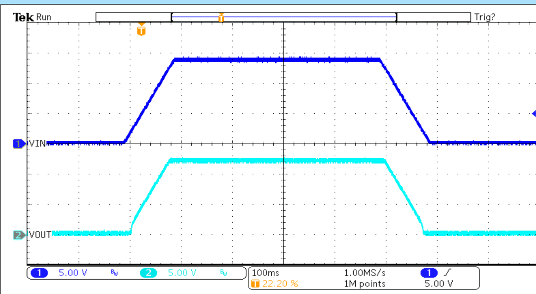



Power On/Off Response: HT75RC0-7
($V_{IN}$=14V, $I_{OUT}$=0mA, $T_{RISE}$=$T_{FALL}$=100ms)

## Power ON/OFF Response ($I_{OUT}$=150mA)




Power On/Off Response: HT75RC0-7
($V_{IN}$=14V, $I_{OUT}$=150mA, $T_{RISE}$=$T_{FALL}$=0.1ms)

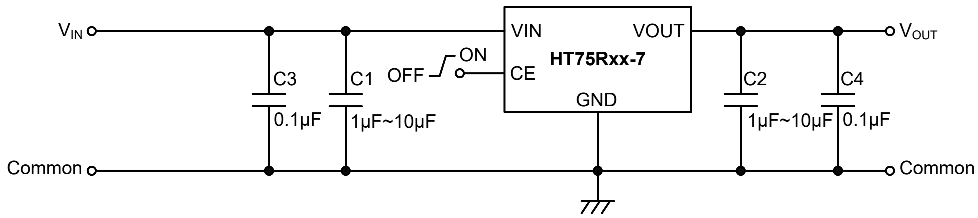



Power On/Off Response: HT75RC0-7
($V_{IN}$=14V, $I_{OUT}$=150mA, $T_{RISE}$=$T_{FALL}$=100ms)

# Application Circuits

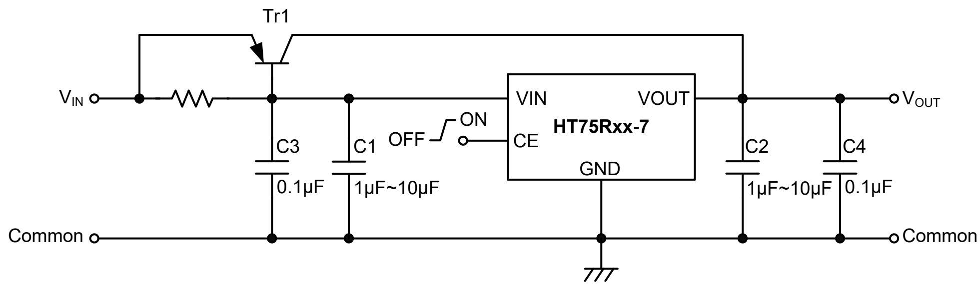
## Basic Circuit

**$C_{IN}$=C1, $C_{OUT}$=C2**



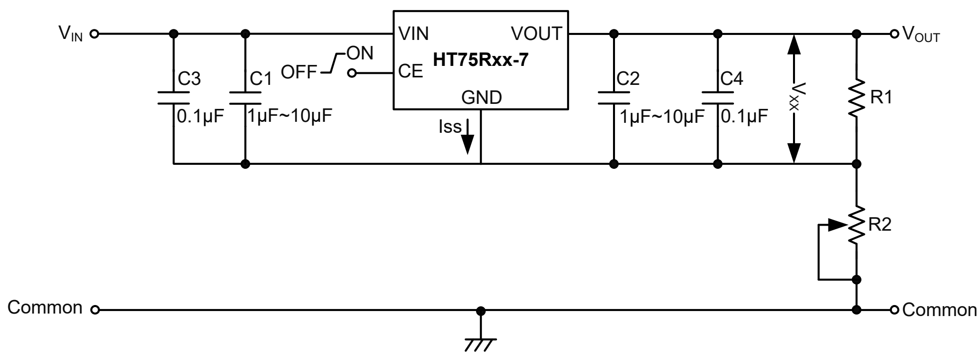

## High Output Current Positive Voltage Regulator

**$C_{IN}$=C1, $C_{OUT}$=C2**

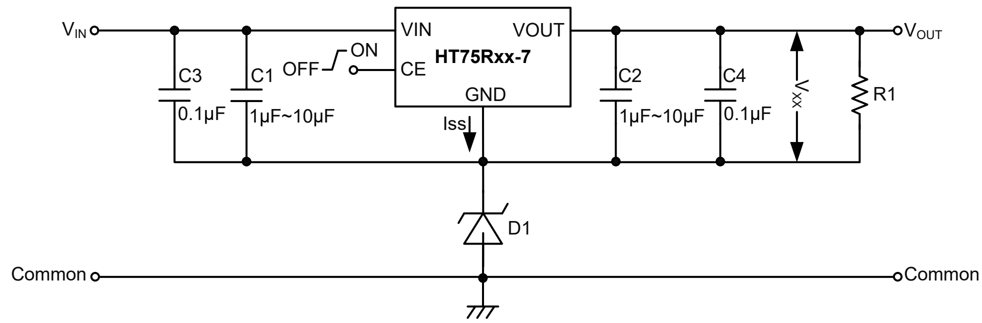



## Circuit for Increasing Output Voltage

**$C_{IN}$=C1, $C_{OUT}$=C2, $V_{OUT}=V_{XX}\times(1+R2/R1)+I_{SS}\times R2$**

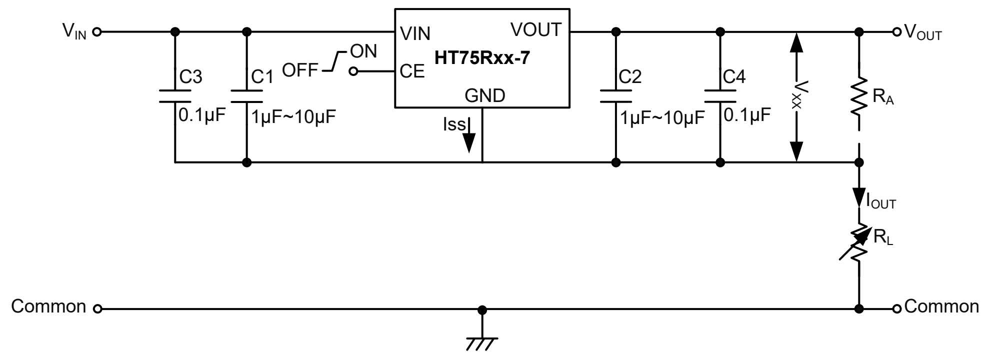


**$C_{IN}$=C1, $C_{OUT}$=C2, $V_{OUT}$=$V_{XX}$+$V_{D1}$**



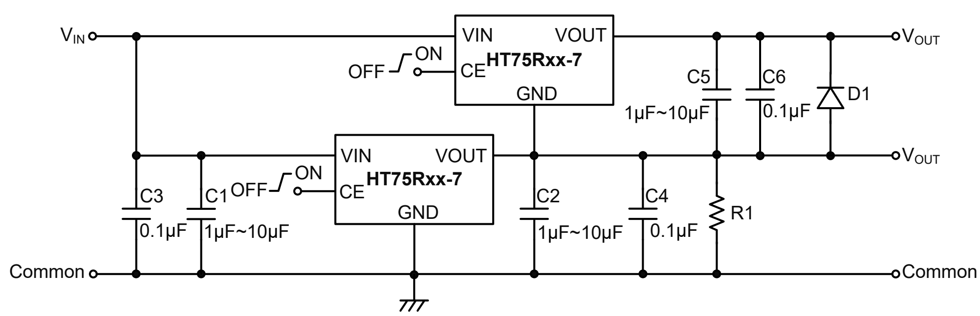

## Constant Current Regulator

**$C_{IN}$=C1, $C_{OUT}$=C2, $I_{OUT}$=$V_{XX}$/$R_A$+$I_{SS}$**




## Dual Supply Circuit

**$C_{IN}$=C1, $C_{OUT}$=C2**



# Application Information

When using this series of regulators, it is important that the following application points are noted if correct operation is to be achieved.

## External Circuit

It is important that external capacitors are connected to both the input and output pins. For the input pin, suitable bypass capacitors as shown in the application circuits should be connected, especially in situations where a battery power source is used which may have a higher impedance. For the output pin, a suitable capacitor should also be connected especially in situations where the load has a transient nature, in which case larger capacitor values should be selected to limit any output transient voltages.

## OCP and OTP Protections

The series of devices implements the over current protection and over junction temperature protection to prevent device damage even if the output is shorted to ground. When the output is shorted to ground, the output current will be clamped to $I_{SHORT}$ and the junction temperature will rise. Once the junction temperature exceeds 150°C, the series of devices will shut down the power element to prevent thermal damage. The protection will be released when the junction temperature falls to 125°C.

## Fast Output Discharging Function

When the CE input is low, the output voltage will be fast discharged to 0V via an internal 300Ω resistor. This discharging path does not appear with protections such as over current protection or over temperature protection.

## Input Capacitor $C_{IN}$ Considerations

It is recommended that the input capacitor is at least 1μF and is ceramic type for better temperature coefficient and lower ESR (Equivalent Series Resistance).

## Output Capacitor $C_{OUT}$ Considerations

The output capacitance plays an important role in keeping the output voltage stable. For the ceramic type capacitor, the capacitance should be at least 1.0μF. For E-cap type capacitor, the capacitance should be at least 2.2μF.

## Thermal Considerations

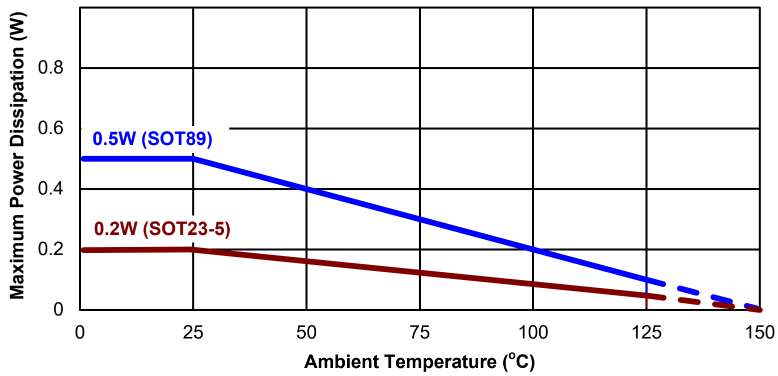
The maximum power dissipation depends on the thermal resistance of the package, the PCB layout, the rate of the surrounding airflow and the difference between the junction and ambient temperature. The maximum power dissipation can be calculated using the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - Ta)/\theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum junction temperature, Ta is the ambient temperature and $\theta_{JA}$ is the junction-to-ambient thermal resistance of the device package in degrees per watt. The following table shows the $\theta_{JA}$ values for various package types.

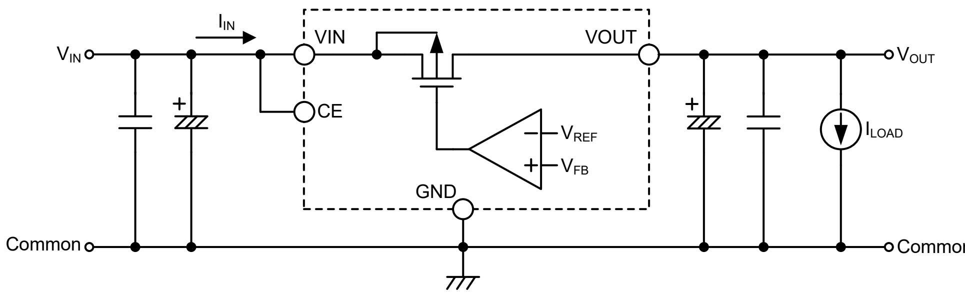
| Package Type | $\theta_{JA}$ (°C/W) |
|---|---|
| SOT89 | 200°C/W |
| SOT23-5 | 500°C/W |

For maximum operating rating conditions, the maximum junction temperature is 150°C. However, it is recommended that the maximum junction temperature does not exceed 125°C during normal operation to maintain an adequate margin for device reliability. The de-rating curves of different packages for maximum power dissipation are as follows:

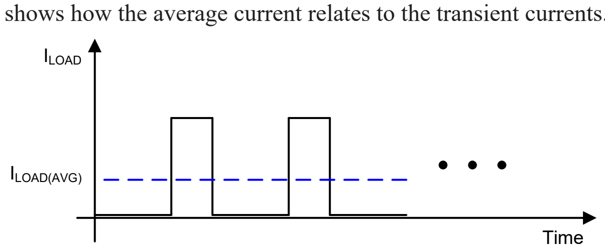



### Power Dissipation Calculation

In order to keep the devices within their operating limits and to maintain a regulated output voltage, the power dissipation of the devices, given by $P_D$, must not exceed the Maximum Power Dissipation, given by $P_{D(MAX)}$. Therefore $P_D \leq P_{D(MAX)}$. From the diagram it can be seen that almost all of this power is generated across the pass transistor which is acting like a variable resistor in series with the load to keep the output voltage constant. This generated power, which will appear as heat, must never allow the devices to exceed their maximum junction temperature.




In practical applications, the regulator may be required to provide both steady state and transient currents due to the transient nature of the load. Although the devices may be working well within their limits with their steady state current, care must be taken with transient loads which may cause the current to rise close to their maximum current value. This will result in device junction temperature rises which however must not exceed the maximum junction temperature. With both steady state and transient currents, the important current to consider is the average or more precisely the RMS current, which is the value of current that will appear as heat generated in the devices. The following diagram shows how the average current relates to the transient currents.




As the quiescent current of the devices is very small, it can generally be ignored and as a result the input current can be assumed to be equal to the output current. Therefore the power dissipation of the devices, $P_D$, can be calculated as the voltage dropout across the input and output multiplied by the current, given by the equation, $P_D = (V_{IN} - V_{OUT}) \times I_{IN.}$ As the input current is also equal to the load current the power dissipation $P_D = (V_{IN} - V_{OUT}) \times I_{LOAD.}$ However, with transient load currents, $P_D = (V_{IN} - V_{OUT}) \times I_{LOAD(AVG)}$ as shown in the figure.

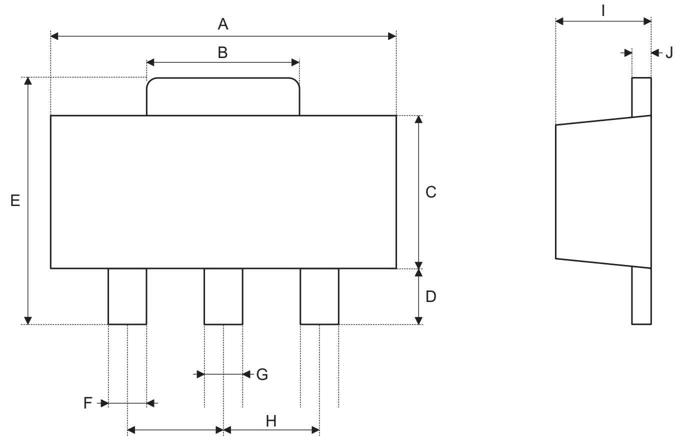
## Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the Package/Carton Information.

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- The Operation Instruction of Packing Materials
- Carton information

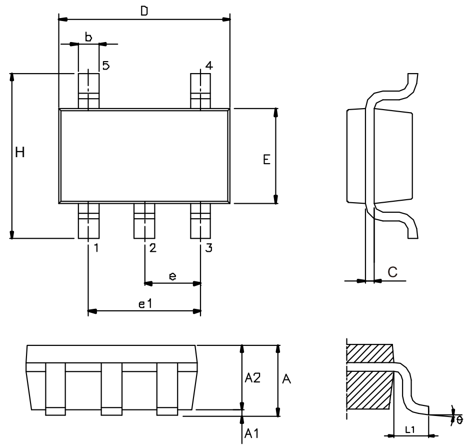
### 3-pin SOT89 Outline Dimensions




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 0.173 | — | 0.185 |
| B | 0.053 | — | 0.072 |
| C | 0.090 | — | 0.106 |
| D | 0.031 | — | 0.047 |
| E | 0.155 | — | 0.173 |
| F | 0.014 | — | 0.019 |
| G | 0.017 | — | 0.022 |
| H | 0.059 BSC | | |
| I | 0.055 | — | 0.063 |
| J | 0.014 | — | 0.017 |

| Symbol | Dimensions in mm | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 4.40 | — | 4.70 |
| B | 1.35 | — | 1.83 |
| C | 2.29 | — | 2.70 |
| D | 0.80 | — | 1.20 |
| E | 3.94 | — | 4.40 |
| F | 0.36 | — | 0.48 |
| G | 0.44 | — | 0.56 |
| H | 1.50 BSC | | |
| I | 1.40 | — | 1.60 |
| J | 0.35 | — | 0.44 |

### 5-pin SOT23 Outline Dimensions




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | — | — | 0.057 |
| A1 | — | — | 0.006 |
| A2 | 0.035 | 0.045 | 0.051 |
| b | 0.012 | — | 0.020 |
| C | 0.003 | — | 0.009 |
| D | 0.114 BSC | | |
| E | 0.063 BSC | | |
| e | 0.037 BSC | | |
| e1 | 0.075 BSC | | |
| H | 0.110 BSC | | |
| L1 | 0.024 BSC | | |
| θ | 0° | — | 8° |

| Symbol | Dimensions in mm | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | — | — | 1.45 |
| A1 | — | — | 0.15 |
| A2 | 0.90 | 1.15 | 1.30 |
| b | 0.30 | — | 0.50 |
| C | 0.08 | — | 0.22 |
| D | 2.90 BSC | | |
| E | 1.60 BSC | | |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| H | 2.80 BSC | | |
| L1 | 0.60 BSC | | |
| θ | 0° | — | 8° |