## Features

- Low power consumption
- Low voltage drop
- Low temperature coefficient
- High input voltage (up to 30V)
- Output voltage accuracy: tolerance ±3%
- TO92, SOT89 and SOT23-5 package

## Applications

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

## General Description

The HT71xx-1 series is a set of three-terminal low power high voltage regulators implemented in CMOS technology. They allow input voltages as high as 30V. They are available with several fixed output voltages ranging from 2.1V to 5.0V. CMOS technology ensures low voltage drop and low quiescent current.

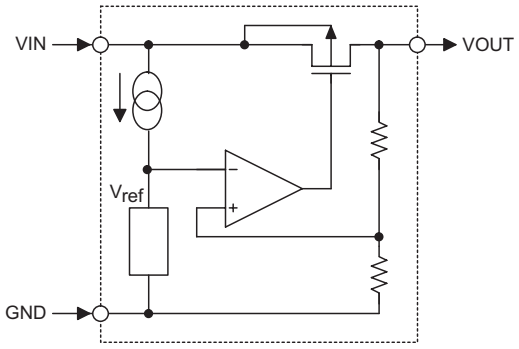
Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain variable voltages and currents.

## Selection Table

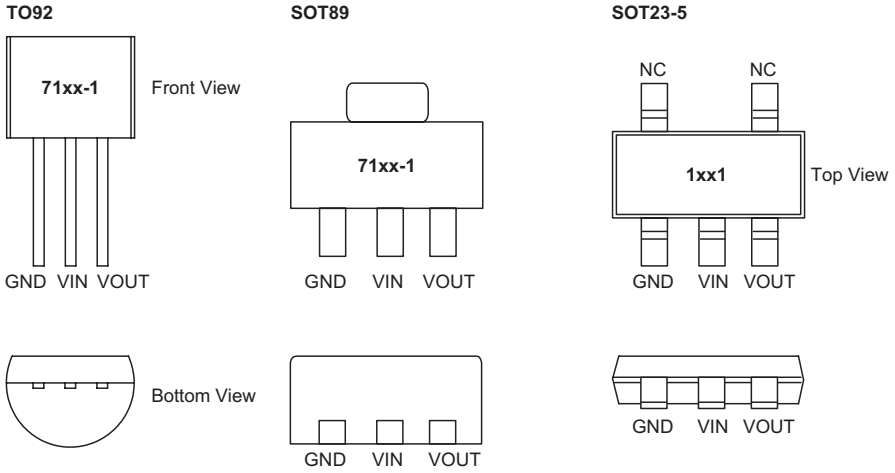
| Part No. | Output Voltage | Package | Marking |
|---|---|---|---|
| HT7121-1 | 2.1V | TO92<br>SOT89<br>SOT23-5 | 71xx-1 (for TO92)<br>71xx-1 (for SOT89)<br>1xx1 (for SOT23-5) |
| HT7123-1 | 2.3V | | |
| HT7125-1 | 2.5V | | |
| HT7127-1 | 2.7V | | |
| HT7130-1 | 3.0V | | |
| HT7133-1 | 3.3V | | |
| HT7136-1 | 3.6V | | |
| HT7144-1 | 4.4V | | |
| HT7150-1 | 5.0V | | |

Note: "xx" stands for output voltages.

## Block Diagram




## Pin Assignment




### Absolute Maximum Ratings

Supply Voltage ..... −0.3V to 33V

Storage Temperature .....−50°C to 125°C

Operating Temperature .....−40°C to 85°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

## Thermal Information

| Symbol | Parameter | Package | Max. | Unit |
|---|---|---|---|---|
| $\theta_{JA}$ | Thermal Resistance (Junction to Ambient) (Assume no ambient airflow, no heat sink) | SOT23-5 | 500 | °C/W |
| | | SOT89 | 200 | °C/W |
| | | TO92 | 200 | °C/W |
| $P_D$ | Power Dissipation | SOT23-5 | 0.20 | W |
| | | SOT89 | 0.50 | W |
| | | TO92 | 0.50 | W |

Note: $P_D$ is measured at Ta = 25°C

## Electrical Characteristics

### HT7121-1, +2.1V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 4.1V | $I_{OUT}$=10mA | 2.037 | 2.100 | 2.163 | V |
| $I_{OUT}$ | Output Current | 4.1V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 4.1V | 1mA≤$I_{OUT}$≤20mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 100 | mV |
| $I_{SS}$ | Quiescent Current | 4.1V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 3.1V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 4.1V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

### HT7123-1, +2.3V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 4.3V | $I_{OUT}$=10mA | 2.231 | 2.300 | 2.369 | V |
| $I_{OUT}$ | Output Current | 4.3V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 4.3V | 1mA≤$I_{OUT}$≤20mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 100 | mV |
| $I_{SS}$ | Quiescent Current | 4.3V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 3.3V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 4.3V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7125-1, +2.5V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 4.5V | $I_{OUT}$=10mA | 2.425 | 2.500 | 2.575 | V |
| $I_{OUT}$ | Output Current | 4.5V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 4.5V | 1mA≤$I_{OUT}$≤20mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 100 | mV |
| $I_{SS}$ | Quiescent Current | 4.5V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 3.5V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 4.5V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7127-1, +2.7V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 4.7V | $I_{OUT}$=10mA | 2.619 | 2.700 | 2.781 | V |
| $I_{OUT}$ | Output Current | 4.7V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 4.7V | 1mA≤$I_{OUT}$≤20mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 100 | mV |
| $I_{SS}$ | Quiescent Current | 4.7V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 3.7V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 4.7V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7130-1, +3.0V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{OUT}$ | Output Voltage | 5V | $I_{OUT}$=10mA | 2.910 | 3.00 | 3.090 | V |
| $I_{OUT}$ | Output Current | 5V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 5V | 1mA≤$I_{OUT}$≤20mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 100 | mV |
| $I_{SS}$ | Quiescent Current | 5V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 5V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7133-1, +3.3V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{OUT}$ | Output Voltage | 5.3V | $I_{OUT}$=10mA | 3.201 | 3.300 | 3.399 | V |
| $I_{OUT}$ | Output Current | 5.3V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 5.3V | 1mA≤$I_{OUT}$≤30mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 55 | mV |
| $I_{SS}$ | Quiescent Current | 5.3V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4.3V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 5.3V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7136-1, +3.6V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 5.6V | $I_{OUT}$=10mA | 3.492 | 3.600 | 3.708 | V |
| $I_{OUT}$ | Output Current | 5.6V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 5.6V | 1mA≤$I_{OUT}$≤30mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 55 | mV |
| $I_{SS}$ | Quiescent Current | 5.6V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4.6V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 5.6V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7144-1, +4.4V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 6.4V | $I_{OUT}$=10mA | 4.268 | 4.400 | 4.532 | V |
| $I_{OUT}$ | Output Current | 6.4V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 6.4V | 1mA≤$I_{OUT}$≤30mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 55 | mV |
| $I_{SS}$ | Quiescent Current | 6.4V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 5.4V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 6.4V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

Note: 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.

## HT7150-1, +5.0V Output Type

Ta=25°C

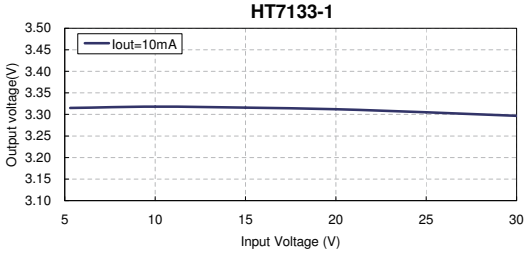
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | Conditions | | | | |
| $V_{IN}$ | Input Voltage | — | — | — | — | 30 | V |
| $V_{OUT}$ | Output Voltage | 7V | $I_{OUT}$=10mA | 4.850 | 5.00 | 5.150 | V |
| $I_{OUT}$ | Output Current | 7V | — | 20 | 30 | — | mA |
| $\Delta V_{OUT}$ | Load Regulation | 7V | 1mA≤$I_{OUT}$≤30mA | — | 15 | 45 | mV |
| $V_{DIF}$ | Dropout Voltage (Note) | — | $I_{OUT}$=1mA, $\Delta V_{OUT}$=2% | — | 35 | 55 | mV |
| $I_{SS}$ | Quiescent Current | 7V | No load | — | 2.5 | 4.0 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 6V≤$V_{IN}$≤30V, $I_{OUT}$=1mA | — | 0.1 | 0.2 | %/V |
| $\frac{\Delta V_{OUT}}{\Delta T_a \times V_{OUT}}$ | Temperature Coefficient | 7V | $I_{OUT}$=10mA, -40°C<Ta<85°C | — | ±100 | — | ppm/°C |

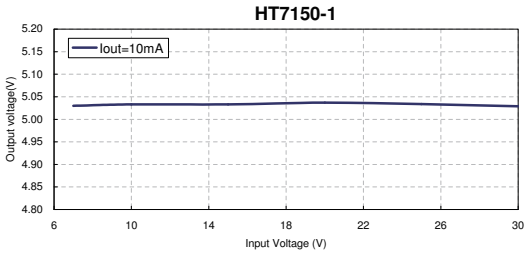
Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at $V_{IN}$ = $V_{OUT}$+2V with a fixed load.

# Typical Performance Characteristic

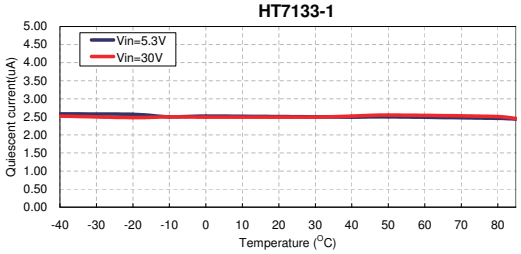
Test Condition: Vin=Vout+2V, Iout=10mA, $T_J$=25ºC, unless otherwise noted

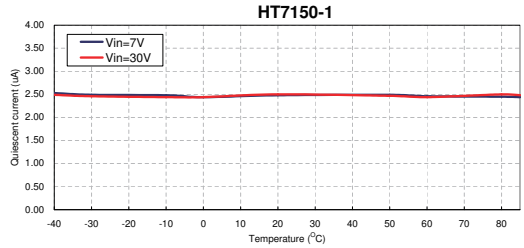
## Output Voltage vs Input Voltage



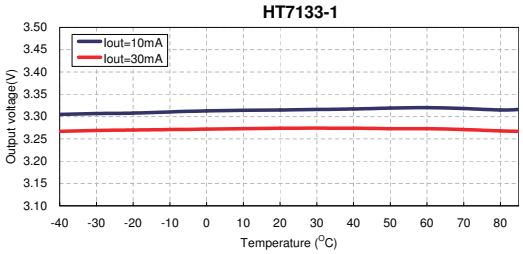



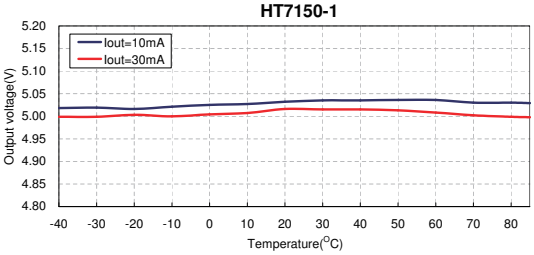

## Quiescent Current (Iout=0mA) vs Temperature



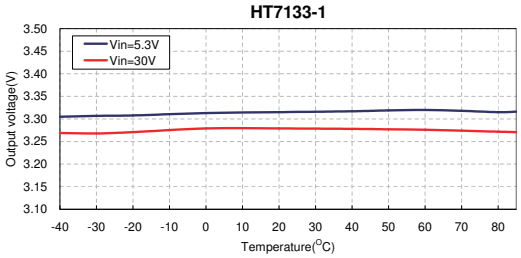



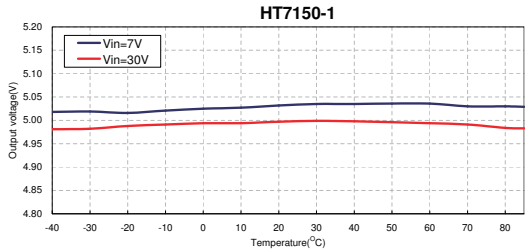

## Output Voltage vs Temperature (Vin=Vout+2V)



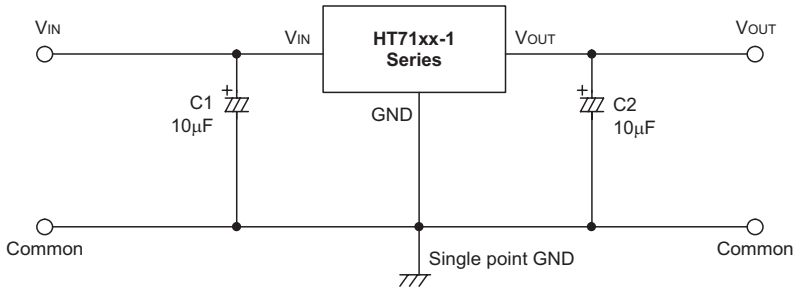

## Output Voltage vs Temperature



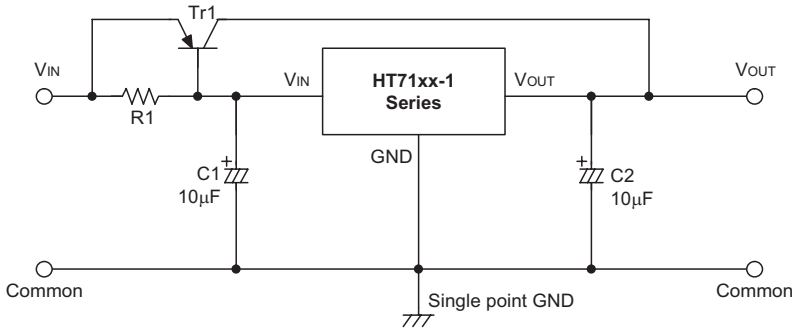



## Application Circuits

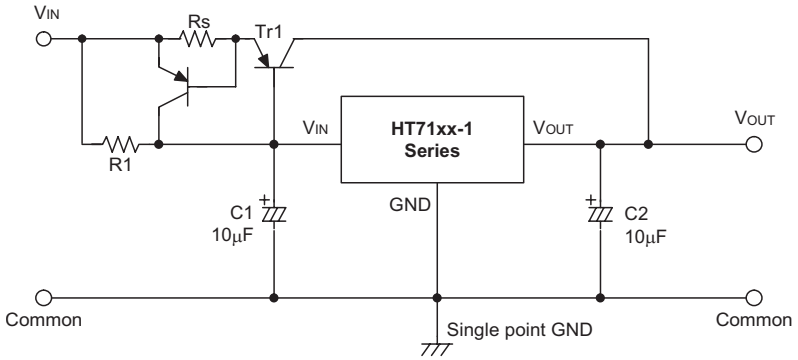
### Basic Circuits



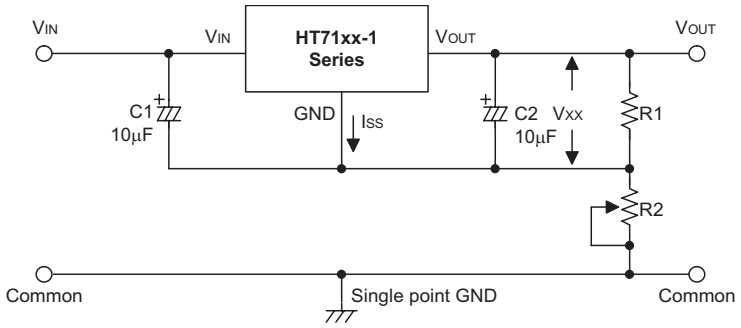

### High Output Current Positive Voltage Regulator




### Short-Circuit Protection by Tr1

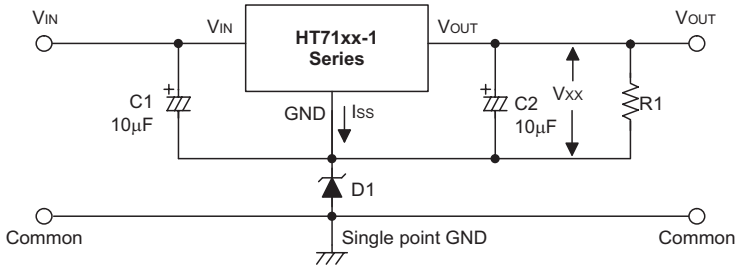


## Circuit for Increasing Output Voltage



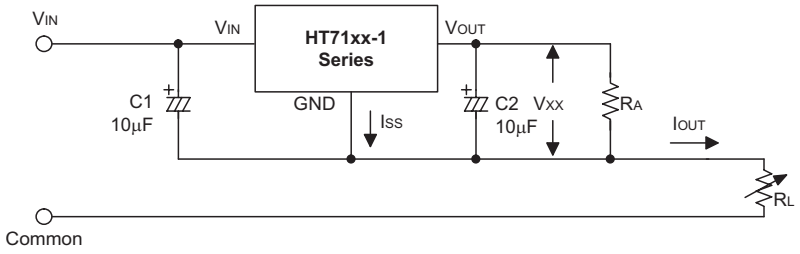

$V_{OUT}=V_{XX}\ (1+R2/R1)+I_{SS}\times R2$

## Circuit for Increasing Output Voltage



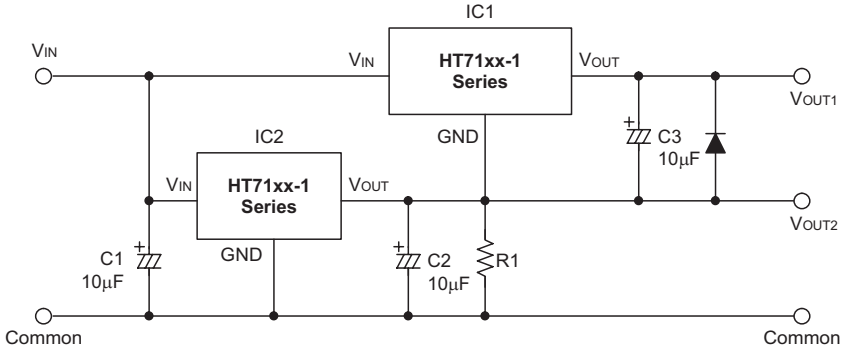

$V_{OUT}=V_{XX}+V_{D1}$

## Constant Current Regulator




$I_{OUT}=V_{XX}/R_A+I_{SS}$

## Dual Supply



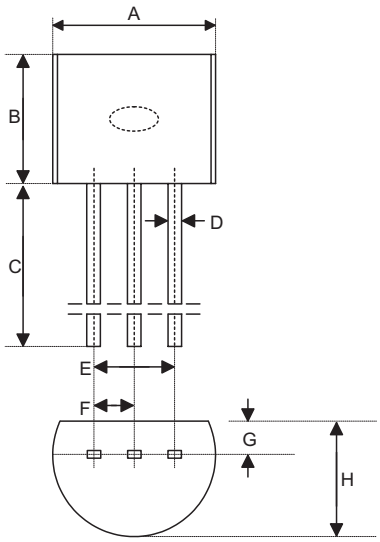
## Package Information

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 information.

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

- Further Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- Packing Meterials Information
- Carton information

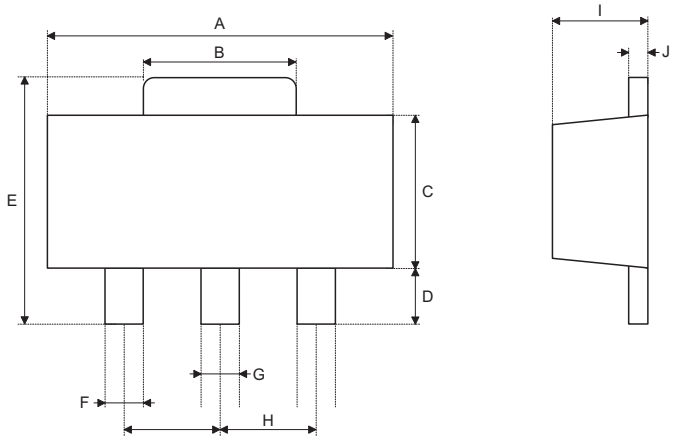
## 3-pin TO92 Outline Dimensions




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 0.173 | 0.180 | 0.205 |
| B | 0.170 | — | 0.210 |
| C | 0.500 | 0.580 | — |
| D | — | 0.015 BSC | — |
| E | — | 0.010 BSC | — |
| F | — | 0.050 BSC | — |
| G | — | 0.035 BSC | — |
| H | 0.125 | 0.142 | 0.165 |

| Symbol | Dimensions in mm | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 4.39 | 4.57 | 5.21 |
| B | 4.32 | — | 5.33 |
| C | 12.70 | 14.73 | — |
| D | — | 0.38 BSC | — |
| E | — | 2.54 BSC | — |
| F | — | 1.27 BSC | — |
| G | — | 0.89 BSC | — |
| H | 3.18 | 3.61 | 4.19 |

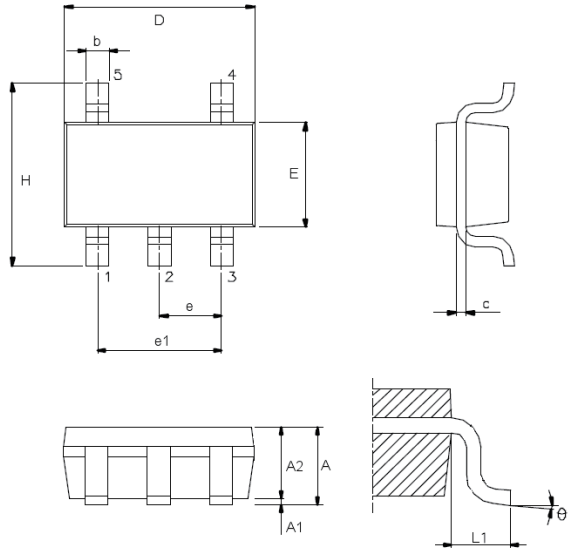
## 3-pin SOT89 Outline Dimensions




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 0.173 | — | 0.181 |
| B | 0.053 | — | 0.072 |
| C | 0.090 | — | 0.102 |
| D | 0.035 | — | 0.047 |
| E | 0.155 | — | 0.167 |
| 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 | — | 4.60 |
| B | 1.35 | — | 1.83 |
| C | 2.29 | — | 2.60 |
| D | 0.89 | — | 1.20 |
| E | 3.94 | — | 4.25 |
| 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 SOT23-5 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° |

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