

Features

- Low power consumption
- Low voltage drop
- Low temperature coefficient
- High input voltage (up to 24V)
- Output voltage accuracy: tolerance $\pm 3\%$
- TO-92, SOT-89 and SOT-25 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 24V. They are available with several fixed output voltages ranging from 3.0V 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.

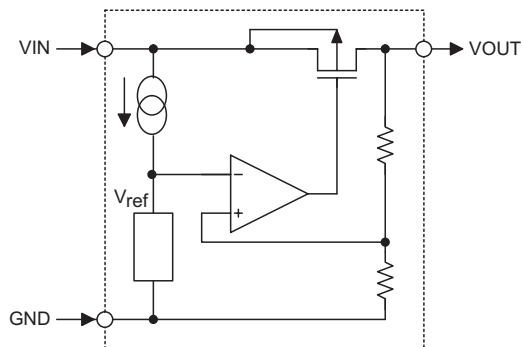
Selection Table

| Part No. | Output Voltage | Package | Marking |
|----------|----------------|---------------------------|---|
| HT7130-1 | 3.0V | TO-92 SOT-89 SOT-25 | 71XXA-1 (for TO-92) 71XX-1 (for SOT-89) 1XX1 (for SOT-25) |
| HT7133-1 | 3.3V | | |
| HT7136-1 | 3.6V | | |
| HT7144-1 | 4.4V | | |
| HT7150-1 | 5.0V | | |

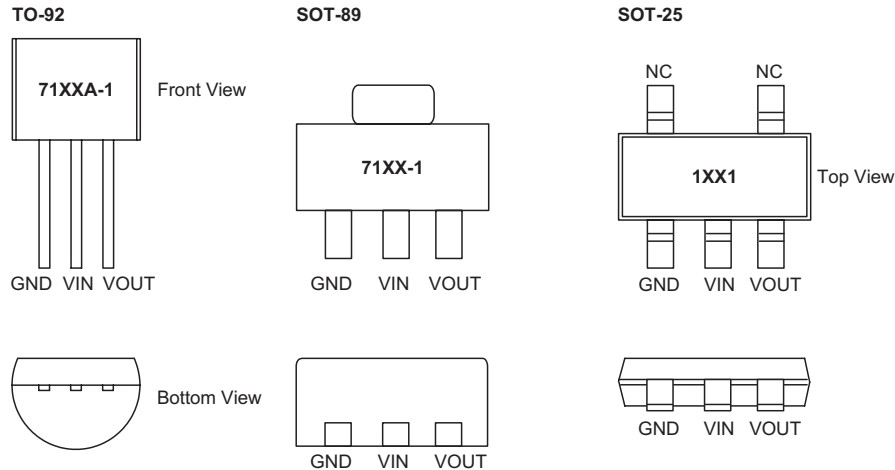
Note: "XX" stands for output voltages.

For lead free devices, TO-92 package will add a "#" mark at the end of the date code, whereas SOT-89 & SOT-25 packages will add a "#" mark at the end of the marking.

Block Diagram



Pin Assignment



Absolute Maximum Ratings

| | | | |
|------------------------------|--------------|-----------------------------|----------------|
| Supply Voltage | -0.3V to 26V | Storage Temperature | -50°C to 125°C |
| Power Consumption (*1) | 200mW | Operating Temperature | -40°C to 85°C |
| Power Consumption (*2) | 150mW | | |

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.

- *1: applied to SOT-89 and TO-92
- *2: applied to SOT-25

Electrical Characteristics

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 | 2.91 | 3 | 3.09 | V |
| I _{OUT} | Output Current | 5V | — | 20 | 30 | — | mA |
| ΔV _{OUT} | Load Regulation | 5V | 1mA ≤ I _{OUT} ≤ 20mA | — | 60 | 100 | mV |
| V _{DIF} | Voltage Drop | — | I _{OUT} =1mA | — | 100 | — | mV |
| I _{SS} | Current Consumption | 5V | No load | — | 2.5 | 5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4V ≤ V _{IN} ≤ 24V I _{OUT} =1mA | — | 0.2 | — | %/V |
| V _{IN} | Input Voltage | — | — | — | — | 24 | V |
| $\frac{\Delta V_{DET}}{\Delta T_a}$ | Temperature Coefficient | 5V | I _{OUT} =10mA 0°C < T _a < 70°C | — | ±0.45 | — | mV/°C |

HT7133-1, +3.3V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|-------------------------|-----------------|---|-------|------|-------|-------|
| | | V _{IN} | Conditions | | | | |
| V _{OUT} | Output Voltage | 5.5V | I _{OUT} =10mA | 3.201 | 3.3 | 3.399 | V |
| I _{OUT} | Output Current | 5.5V | — | 20 | 30 | — | mA |
| ΔV _{OUT} | Load Regulation | 5.5V | 1mA ≤ I _{OUT} ≤ 30mA | — | 60 | 100 | mV |
| V _{DIF} | Voltage Drop | — | I _{OUT} =1mA | — | 100 | — | mV |
| I _{SS} | Current Consumption | 5.5V | No load | — | 2.5 | 5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4.5V ≤ V _{IN} ≤ 24V I _{OUT} =1mA | — | 0.2 | — | %/V |
| V _{IN} | Input Voltage | — | — | — | — | 24 | V |
| $\frac{\Delta V_{DET}}{\Delta T_a}$ | Temperature Coefficient | 5.5V | I _{OUT} =10mA 0°C < Ta < 70°C | — | ±0.5 | — | mV/°C |

HT7136-1, +3.6V Output Type

Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|-------------------------|-----------------|---|-------|------|-------|-------|
| | | V _{IN} | Conditions | | | | |
| V _{OUT} | Output Voltage | 5.6V | I _{OUT} =10mA | 3.492 | 3.6 | 3.708 | V |
| I _{OUT} | Output Current | 5.6V | — | 20 | 30 | — | mA |
| ΔV _{OUT} | Load Regulation | 5.6V | 1mA ≤ I _{OUT} ≤ 30mA | — | 60 | 100 | mV |
| V _{DIF} | Voltage Drop | — | I _{OUT} =1mA | — | 60 | — | mV |
| I _{SS} | Current Consumption | 5.6V | No load | — | 2.5 | 5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 4.6V ≤ V _{IN} ≤ 24V I _{OUT} =1mA | — | 0.2 | — | %/V |
| V _{IN} | Input Voltage | — | — | — | — | 24 | V |
| $\frac{\Delta V_{DET}}{\Delta T_a}$ | Temperature Coefficient | 5.6V | I _{OUT} =10mA 0°C < Ta < 70°C | — | ±0.6 | — | mV/°C |

HT7144-1, +4.4V Output Type

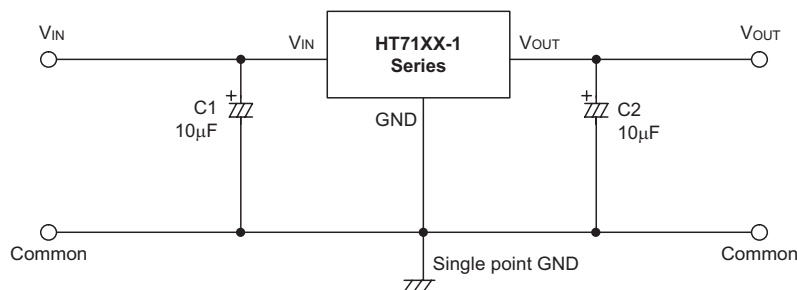
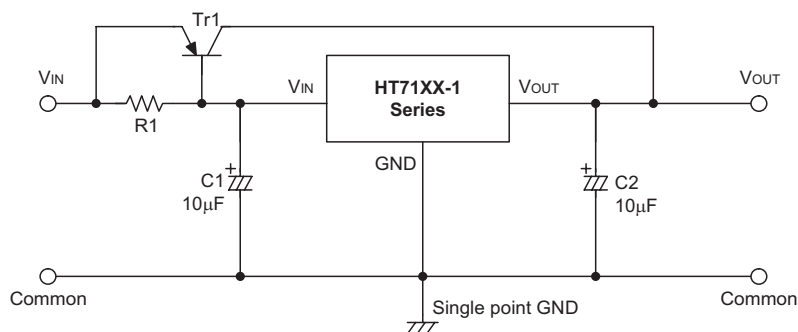
Ta=25°C

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|-------------------------|-----------------|---|-------|------|-------|-------|
| | | V _{IN} | Conditions | | | | |
| V _{OUT} | Output Voltage | 6.4V | I _{OUT} =10mA | 4.268 | 4.4 | 4.532 | V |
| I _{OUT} | Output Current | 6.4V | — | 20 | 30 | — | mA |
| ΔV _{OUT} | Load Regulation | 6.4V | 1mA ≤ I _{OUT} ≤ 30mA | — | 60 | 100 | mV |
| V _{DIF} | Voltage Drop | — | I _{OUT} =1mA | — | 100 | — | mV |
| I _{SS} | Current Consumption | 6.4V | No load | — | 2.5 | 5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 5.4V ≤ V _{IN} ≤ 24V I _{OUT} =1mA | — | 0.2 | — | %/V |
| V _{IN} | Input Voltage | — | — | — | — | 24 | V |
| $\frac{\Delta V_{DET}}{\Delta T_a}$ | Temperature Coefficient | 6.4V | I _{OUT} =10mA 0°C < Ta < 70°C | — | ±0.7 | — | mV/°C |

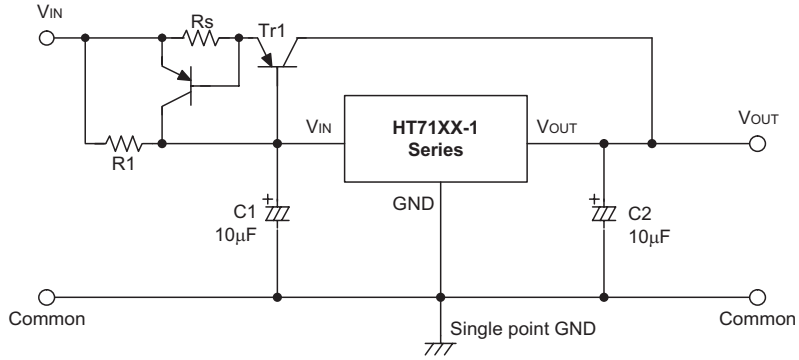
HT7150-1, +5.0V Output Type

Ta=25°C

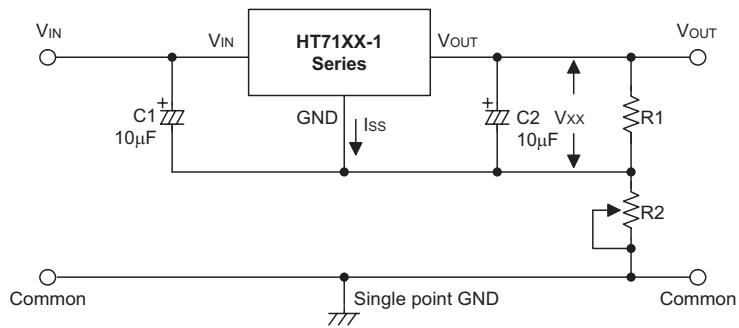
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|-------------------------|-----------------|---|------|-------|------|-------|
| | | V _{IN} | Conditions | | | | |
| V _{OUT} | Output Voltage | 7V | I _{OUT} =10mA | 4.85 | 5 | 5.15 | V |
| I _{OUT} | Output Current | 7V | — | 20 | 30 | — | mA |
| ΔV _{OUT} | Load Regulation | 7V | 1mA ≤ I _{OUT} ≤ 30mA | — | 60 | 100 | mV |
| V _{DIF} | Voltage Drop | — | I _{OUT} =1mA | — | 100 | — | mV |
| I _{SS} | Current Consumption | 7V | No load | — | 2.5 | 5 | μA |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | Line Regulation | — | 6V ≤ V _{IN} ≤ 24V I _{OUT} =1mA | — | 0.2 | — | %/V |
| V _{IN} | Input Voltage | — | — | — | — | 24 | V |
| $\frac{\Delta V_{DET}}{\Delta T_a}$ | Temperature Coefficient | 7V | I _{OUT} =10mA 0°C < T _a < 70°C | — | ±0.75 | — | mV/°C |

Application Circuits
Basic Circuits

High Output Current Positive Voltage Regulator


Short-Circuit Protection by Tr1

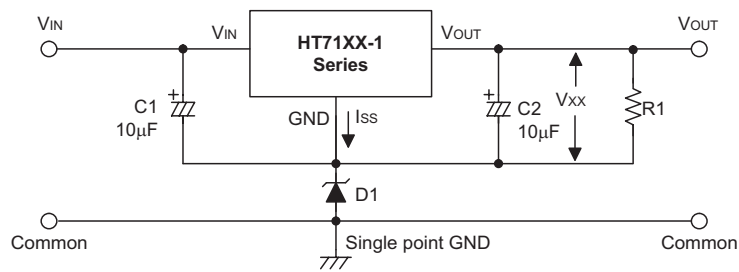


Circuit for Increasing Output Voltage



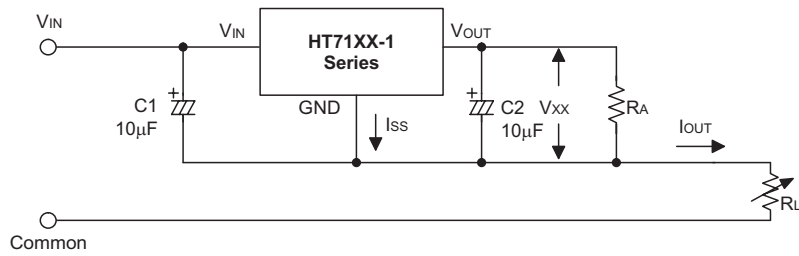
$$V_{OUT} = V_{XX} \left(1 + \frac{R2}{R1}\right) + I_{SS} R2$$

Circuit for Increasing Output Voltage



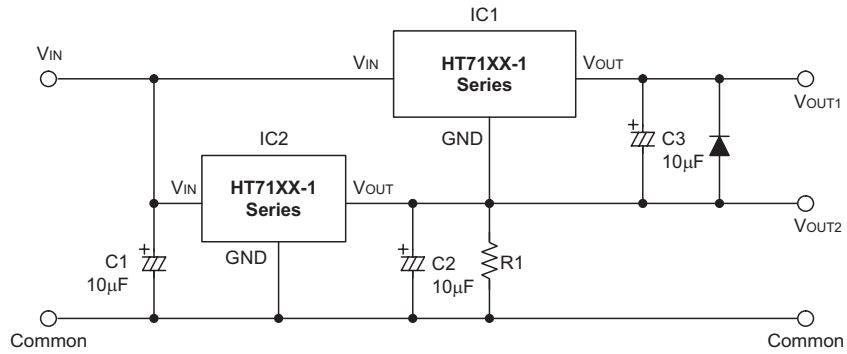
$$V_{OUT} = V_{XX} + V_{D1}$$

Constant Current Regulator



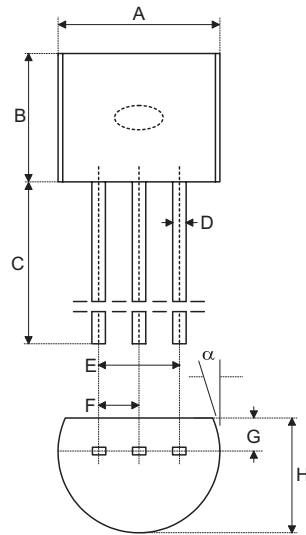
$$I_{OUT} = \frac{V_{xx}}{R_A} + I_{SS}$$

Dual Supply



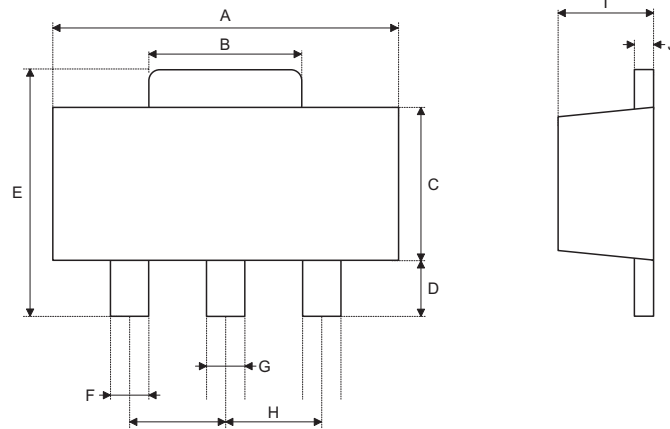
Package Information

3-pin TO-92 Outline Dimensions



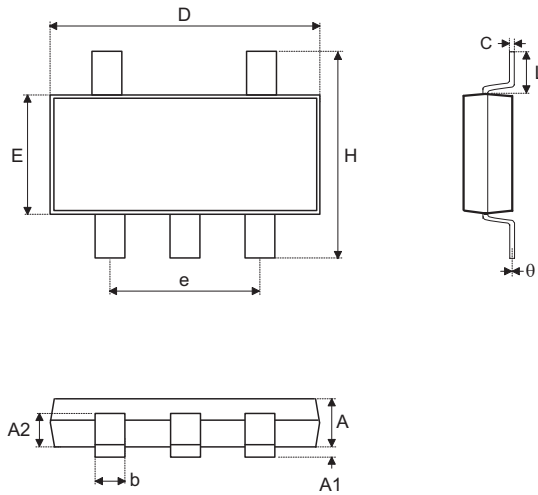
| Symbol | Dimensions in mil | | |
|----------|-------------------|------|------|
| | Min. | Nom. | Max. |
| A | 170 | — | 200 |
| B | 170 | — | 200 |
| C | 500 | — | — |
| D | 11 | — | 20 |
| E | 90 | — | 110 |
| F | 45 | — | 55 |
| G | 45 | — | 65 |
| H | 130 | — | 160 |
| I | 8 | — | 18 |
| α | 4° | — | 6° |

3-pin SOT-89 Outline Dimensions



| Symbol | Dimensions in mil | | |
|--------|-------------------|------|------|
| | Min. | Nom. | Max. |
| A | 173 | — | 181 |
| B | 64 | — | 72 |
| C | 90 | — | 102 |
| D | 35 | — | 47 |
| E | 155 | — | 167 |
| F | 14 | — | 19 |
| G | 17 | — | 22 |
| H | — | 59 | — |
| I | 55 | — | 63 |
| J | 14 | — | 17 |

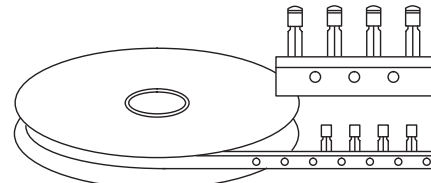
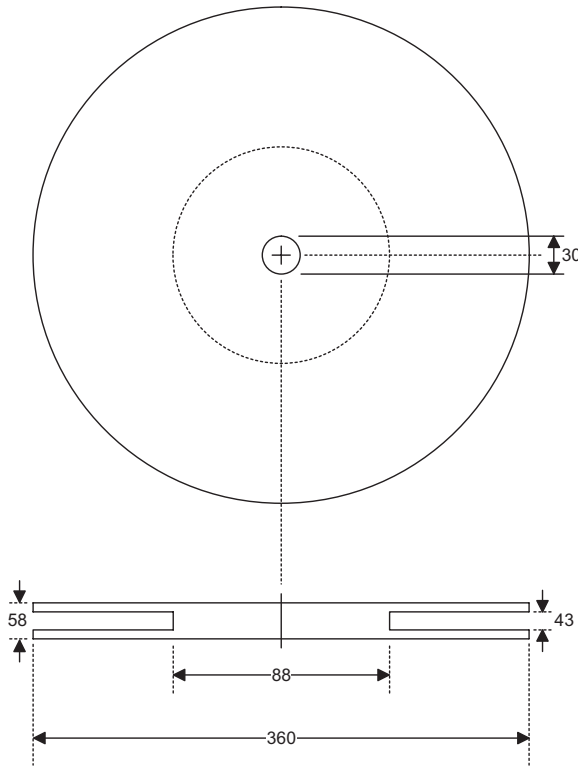
5-pin SOT-25 Outline Dimensions



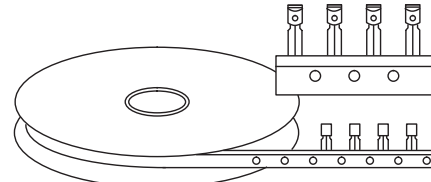
| Symbol | Dimensions in mm | | |
|--------|------------------|------|------|
| | Min. | Nom. | Max. |
| A | 1.00 | — | 1.30 |
| A1 | — | — | 0.10 |
| A2 | 0.70 | — | 0.90 |
| b | 0.35 | — | 0.50 |
| C | 0.10 | — | 0.25 |
| D | 2.70 | — | 3.10 |
| E | 1.40 | — | 1.80 |
| e | — | 1.90 | — |
| H | 2.60 | — | 3 |
| L | 0.37 | — | — |
| theta | 1° | — | 9° |

Product Tape and Reel Specifications

TO-92 Reel Dimensions (Unit: mm)

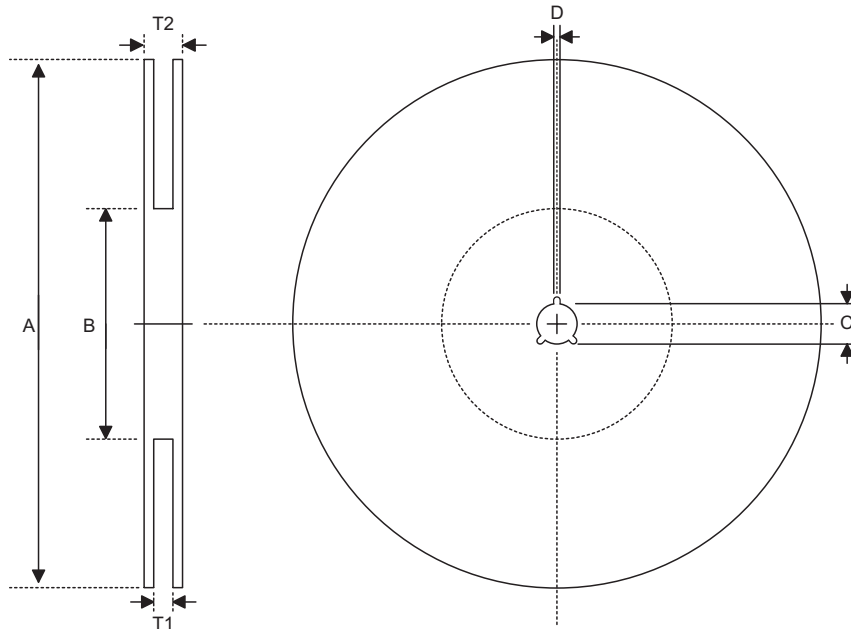


Package Up, Flat Side Up



Package Up, Flat Side Down

SOT-89 & SOT-25 Reel Dimensions



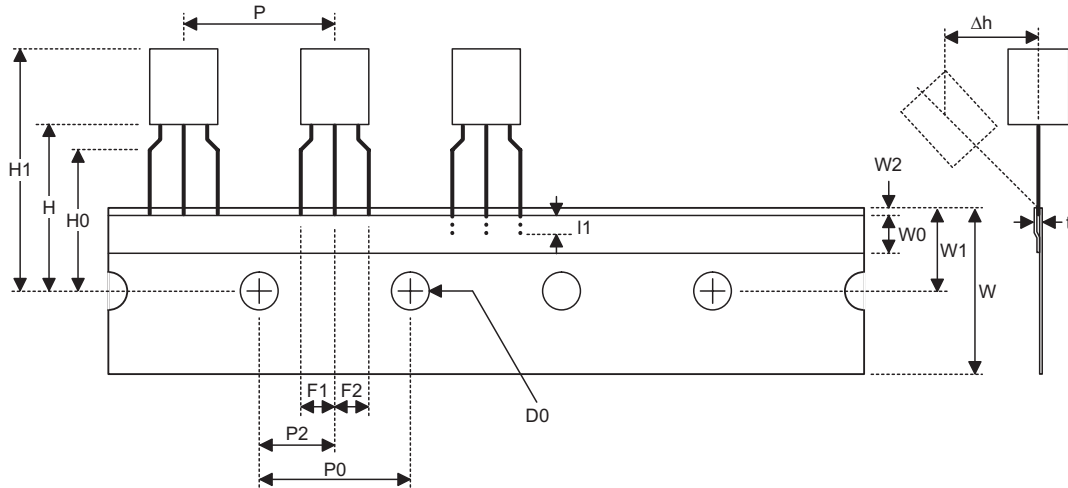
SOT-89

| Symbol | Description | Dimensions in mm |
|--------|-----------------------|------------------|
| A | Reel Outer Diameter | 180±1.0 |
| B | Reel Inner Diameter | 62±1.5 |
| C | Spindle Hole Diameter | 12.75+0.15 |
| D | Key Slit Width | 1.9±0.15 |
| T1 | Space Between Flange | 12.4+0.2 |
| T2 | Reel Thickness | 17-0.4 |

SOT-25

| Symbol | Description | Dimensions in mm |
|--------|-----------------------|------------------|
| A | Reel Outer Diameter | 178±1.0 |
| B | Reel Inner Diameter | 62±1.0 |
| C | Spindle Hole Diameter | 13.0±0.2 |
| D | Key Slit Width | 2.5±0.25 |
| T1 | Space Between Flange | 8.4+1.5 -0.0 |
| T2 | Reel Thickness | 11.4+1.5 |

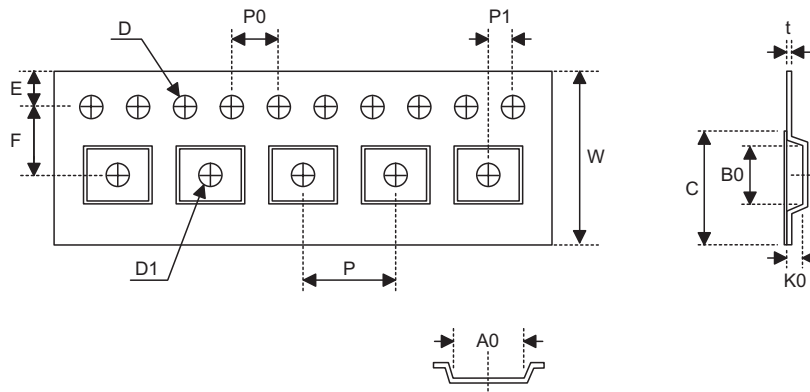
TO-92 Carrier Tape Dimensions



TO-92

| Symbol | Description | Dimensions in mm |
|----------------|---|------------------|
| l1 | Taped Lead Length | (2.5) |
| P | Component Pitch | 12.7±1.0 |
| P ₀ | Perforation Pitch | 12.7±0.3 |
| P ₂ | Component to Perforation (Length Direction) | 6.35±0.4 |
| F ₁ | Lead Spread | 2.5+0.4 -0.1 |
| F ₂ | Lead Spread | 2.5+0.4 -0.1 |
| Δh | Component Alignment | 0±0.1 |
| W | Carrier Tape Width | 18.0+1.0 -0.5 |
| W ₀ | Hold-down Tape Width | 6.0±0.5 |
| W ₁ | Perforation Position | 9.0±0.5 |
| W ₂ | Hold-down Tape Position | (0.5) |
| H ₀ | Lead Clinch Height | 16.0±0.5 |
| H ₁ | Component Height | Less than 24.7 |
| D ₀ | Perforation Diameter | 4.0±0.2 |
| t | Taped Lead Thickness | 0.7±0.2 |
| H | Component Base Height | 19.0±0.5 |

Note: Thickness less than 0.38±0.05mm~0.5mm
 P₀ Accumulated pitch tolerance: ±1mm/20pitches.
 () Bracketed figures are for consultation only

SOT-89 & SOT-25 Carrier Tape Dimensions

SOT-89

| Symbol | Description | Dimensions in mm |
|--------|--|------------------|
| W | Carrier Tape Width | 12.0+0.3 -0.1 |
| P | Cavity Pitch | 8.0±0.1 |
| E | Perforation Position | 1.75±0.1 |
| F | Cavity to Perforation (Width Direction) | 5.5±0.05 |
| D | Perforation Diameter | 1.5+0.1 |
| D1 | Cavity Hole Diameter | 1.5+0.1 |
| P0 | Perforation Pitch | 4.0±0.1 |
| P1 | Cavity to Perforation (Length Direction) | 2.0±0.10 |
| A0 | Cavity Length | 4.8±0.1 |
| B0 | Cavity Width | 4.5±0.1 |
| K0 | Cavity Depth | 1.8±0.1 |
| t | Carrier Tape Thickness | 0.30±0.013 |
| C | Cover Tape Width | 9.3 |

SOT-25

| Symbol | Description | Dimensions in mm |
|--------|--|------------------|
| W | Carrier Tape Width | 8.0+0.3 -0.3 |
| P | Cavity Pitch | 4.0 |
| E | Perforation Position | 1.75 |
| F | Cavity to Perforation (Width Direction) | 3.5±0.05 |
| D | Perforation Diameter | 1.5+0.1 |
| D1 | Cavity Hole Diameter | 1.5+0.1 |
| P0 | Perforation Pitch | 4.0 |
| P1 | Cavity to Perforation (Length Direction) | 2.0 |
| A0 | Cavity Length | 3.15 |
| B0 | Cavity Width | 3.2 |
| K0 | Cavity Depth | 1.4 |
| t | Carrier Tape Thickness | 0.20±0.03 |
| C | Cover Tape Width | 5.3 |

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