

Features

- Low start-up voltage: 0.7V (Typ.), 0.9V (Max.)
- High efficiency: 85% (Typ.), $V_{OUT} \geq 2.7V$
- High output voltage accuracy: $\pm 2.5\%$
- Output voltage: 1.8V, 2.2V, 2.7V, 3.0V, 3.3V, 3.7V, 5.0V
- Output current up to 100mA
- Ultra low supply current I_{DD2} : 4 μ A (Typ.)
- Low ripple and low noise
- Low shutdown current: 0.5 μ A (Typ.)
- TO92, SOT89, SOT23 and SOT23-5 package

Applications

- Palmtops/PDAs
- Portable communicators/Smartphones
- Cameras/Camcorders
- Battery-powered equipment

General Description

The HT77XX series is a set of PFM step-up DC/DC converter with high efficiency and low ripple. The series features extremely low start-up voltage and high output voltage accuracy. They require only three external components to provide a fixed output voltage of 1.8V, 2.2V, 2.7V, 3.0V, 3.3V, 3.7V or 5.0V. CMOS technology ensures ultra low supply current and makes them ideal for battery-operated applications powered from one or more cells.

The HT77XX consists of an oscillator, a PFM control circuit, a driver transistor, a reference voltage unit, and a high speed comparator. They employ pulse frequency modulation (PFM) for minimum supply current and ripple at light output loading. These devices are available in space saving TO92, SOT89, SOT23 and SOT23-5 packages. For SOT23-5 package, it also build-in a chip enable function to reduce power consumption during shutdown mode.

Selection Table

| Part No. | Output Voltage | Package | Marking |
|----------|----------------|-----------------------------------|---|
| HT7718 | 1.8V | TO92 SOT89 SOT23 SOT23-5 | HT77XX (for TO92) HT77XX# (for SOT89) HT77XX+ (for SOT89) 77XX# (for SOT23) 77XX+ (for SOT23) 77XX# (for SOT23-5) 77XX+ (for SOT23-5) |
| HT7722 | 2.2V | | |
| HT7727 | 2.7V | | |
| HT7730 | 3.0V | | |
| HT7733 | 3.3V | | |
| HT7737 | 3.7V | | |
| HT7750 | 5.0V | | |

Note: "XX" stands for output voltages.

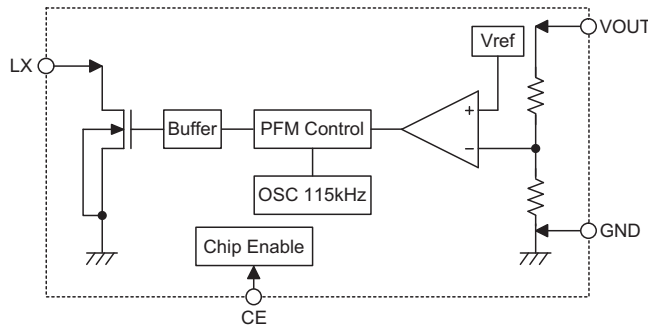
Both lead free and green compound devices are available.

"#" stands for lead free devices. For the TO-92 package, there will be a "#" mark at the end of the date code.

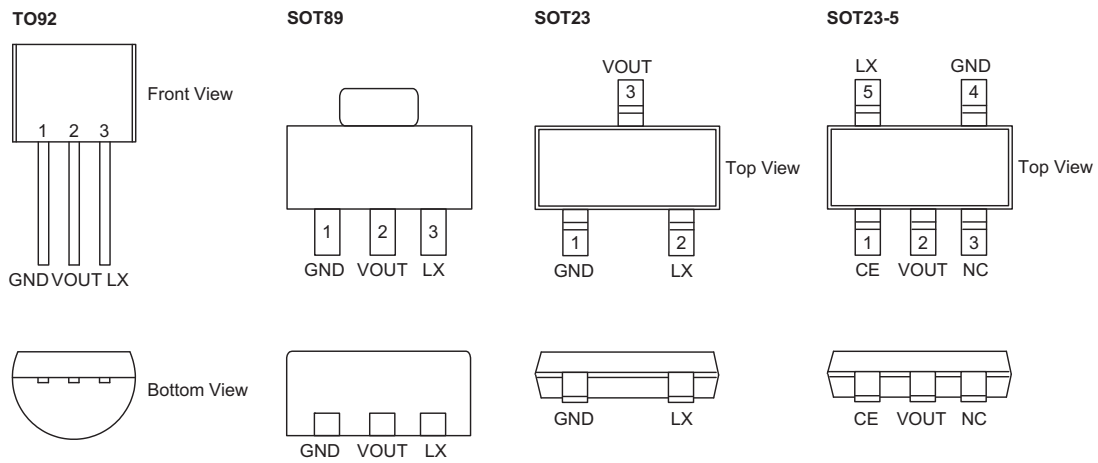
"+" stands for green compound devices, which are Lead-free and Halogen-free.

For the TO-92 package, there will be a "+" mark at the end of the date code.

Block Diagram



Pin Assignment



Pin Description

| Pin No. | | | | Pin Name | Description |
|---------|-------|-------|---------|----------|---------------------------------------|
| TO92 | SOT89 | SOT23 | SOT23-5 | | |
| — | — | — | 1 | CE | Chip enable pin, high active |
| 2 | 2 | 3 | 2 | VOUT | DC/DC converter output monitoring pin |
| — | — | — | 3 | NC | No connection |
| 1 | 1 | 1 | 4 | GND | Ground pin |
| 3 | 3 | 2 | 5 | LX | Switching pin |

Absolute Maximum Ratings

Supply Voltage $V_{SS}-0.3V$ to $V_{SS}+7V$ Storage Temperature $-50^{\circ}C$ to $125^{\circ}C$
 Operating Temperature $-40^{\circ}C$ to $85^{\circ}C$

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 |
|---------------|---|---------|------|------|
| θ_{JA} | Thermal Resistance (Junction to Ambient) (Assume no ambient airflow, no heat sink) | SOT89 | 300 | °C/W |
| | | TO92 | 300 | °C/W |
| | | SOT23 | 330 | °C/W |
| | | SOT23-5 | 320 | °C/W |
| P_D | Power Dissipation | SOT89 | 0.33 | W |
| | | TO92 | 0.33 | W |
| | | SOT23 | 0.3 | W |
| | | SOT23-5 | 0.31 | W |

Note: P_D is measured at $T_a = 25^\circ\text{C}$

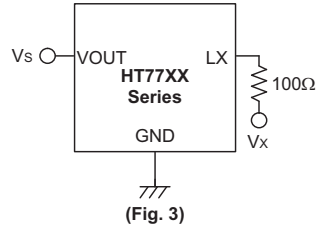
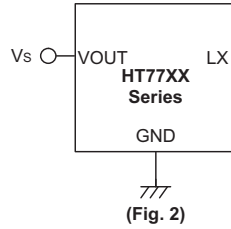
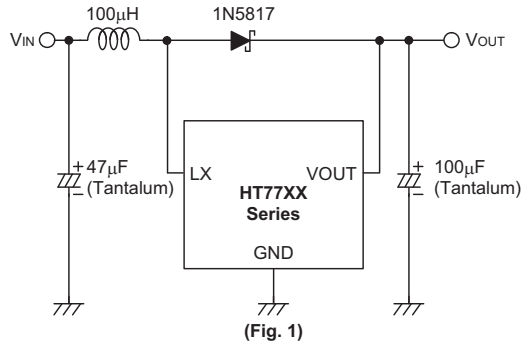
Electrical Characteristics

$V_{IN} = V_{OUT} \times 0.6$; $I_{OUT} = 10\text{mA}$; $T_a = 25^\circ\text{C}$ (Unless otherwise specified)

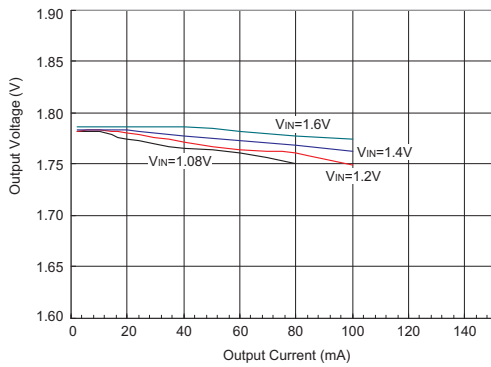
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit | |
|------------------|--|---|-------------------------|------|------|---------------|---------------|
| V_{IN} | Input Voltage | — | — | — | 6 | V | |
| ΔV_{OUT} | Output Voltage Tolerance | — | -2.5 | — | 2.5 | % | |
| V_{START} | Start-up Voltage (Fig. 1) | $V_{IN}: 0 \rightarrow 2\text{V}$; $I_{OUT} = 1\text{mA}$ | — | 0.7 | 0.9 | V | |
| V_{HOLD} | Minimum Hold-on Voltage (Fig. 1) | $V_{IN}: 2 \rightarrow 0\text{V}$; $I_{OUT} = 1\text{mA}$ | — | — | 0.7 | V | |
| I_{IN} | No-load Input Current (Fig. 1) | $I_{OUT} = 0\text{mA}$ | — | 10 | 20 | μA | |
| I_{DD1} | Supply Current 1 (Fig. 2) | $V_S = V_{OUT} \times 0.95$ Measured at V_{OUT} pin | $V_{OUT} = 1.8\text{V}$ | — | 35 | 50 | μA |
| | | | $V_{OUT} = 2.2\text{V}$ | — | 37 | 55 | |
| | | | $V_{OUT} = 2.7\text{V}$ | — | 40 | 60 | |
| | | | $V_{OUT} = 3.0\text{V}$ | — | 45 | 68 | |
| | | | $V_{OUT} = 3.3\text{V}$ | — | 55 | 81 | |
| | | | $V_{OUT} = 3.7\text{V}$ | — | 64 | 85 | |
| | | | $V_{OUT} = 5.0\text{V}$ | — | 85 | 134 | |
| I_{DD2} | Supply Current 2 (Fig. 2) | $V_S = V_{OUT} + 0.5\text{V}$ Measured at V_{OUT} pin | — | 4 | 7 | μA | |
| I_{SHDN} | Shutdown Current | $CE = \text{GND}$ | — | 0.5 | 1 | μA | |
| V_{IH} | CE High Threshold | — | 2 | — | — | V | |
| V_{IL} | CE Low Threshold | — | — | — | 0.4 | V | |
| I_{LEAK} | LX Leakage Current (Fig. 3) | $V_S = V_{OUT} + 0.5\text{V}$, $V_X = 6\text{V}$ Measured at the LX pin | — | — | 0.9 | μA | |
| f_{OSC} | Maximum Oscillator Frequency (Fig. 3) | $V_S = V_{OUT} \times 0.95$ Measured at LX pin | — | 115 | — | kHz | |
| D_{OSC} | Oscillator Duty Cycle (Fig. 3) | $V_S = V_{OUT} \times 0.95$ Measured at LX pin | 65 | 75 | 85 | % | |
| η | Efficiency | $V_{OUT} \leq 2.2\text{V}$ | — | 80 | — | % | |
| | | $V_{OUT} \geq 2.7\text{V}$ | — | 85 | — | | |

Note: Absolute maximum ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. The guaranteed specifications apply only for the test conditions listed.

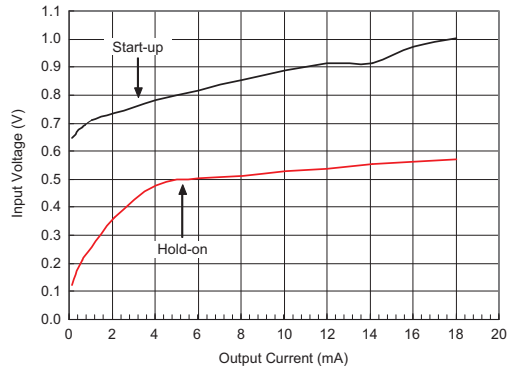
Test Circuit



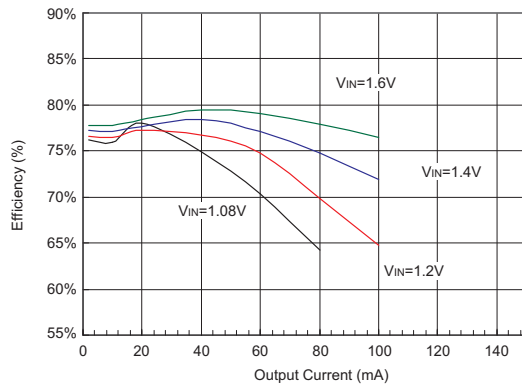
Typical Performance Characteristics



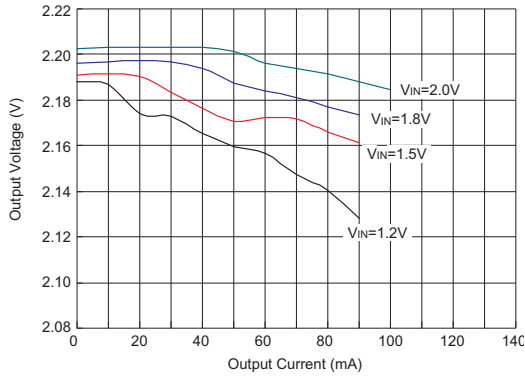
HT7718 Output Voltage v.s Output Current



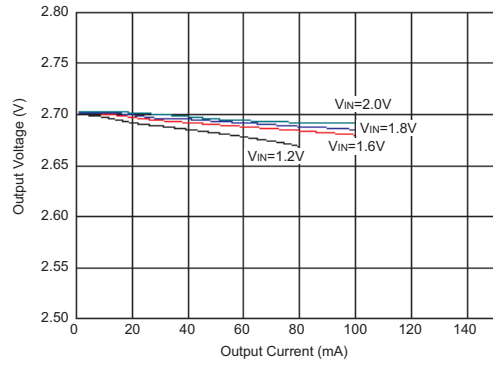
HT7718 Start-Up & Hold-On Voltage



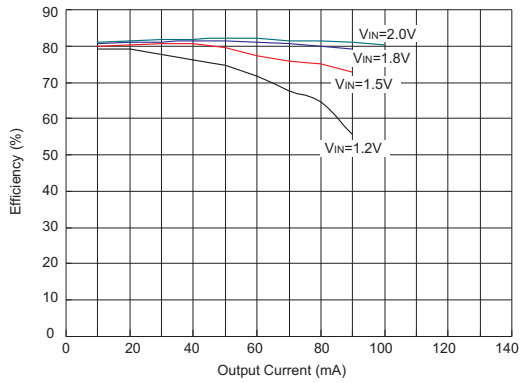
HT7718 Efficiency v.s Output Current



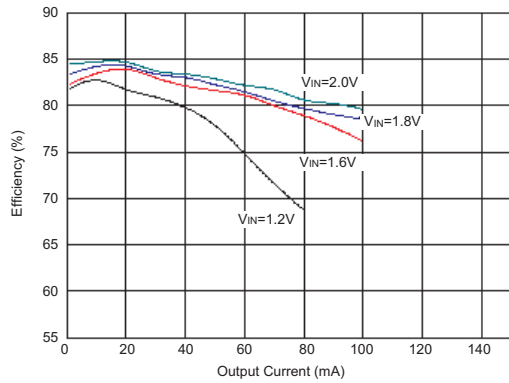
HT7722 Output Voltage v.s Output Current



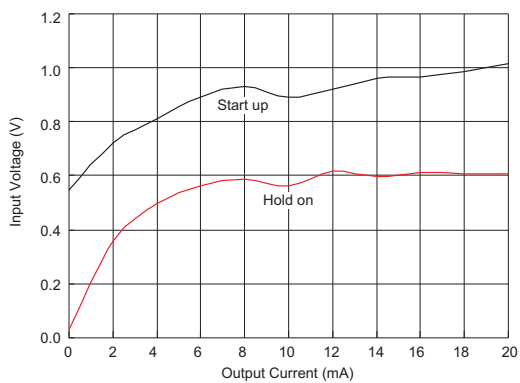
HT7727 Output Voltage v.s Output Current



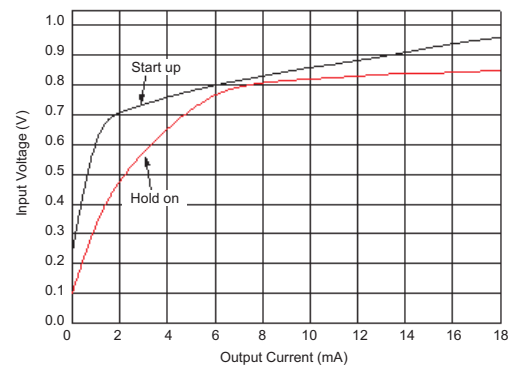
HT7722 Efficiency v.s Output Current



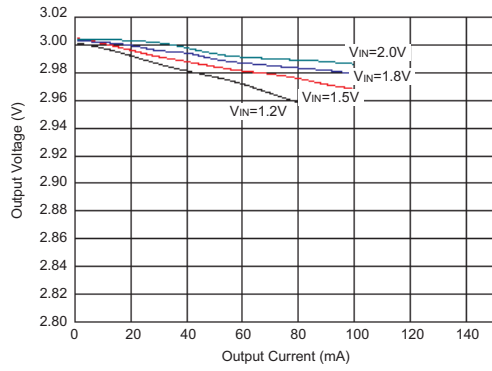
HT7727 Efficiency v.s Output Current



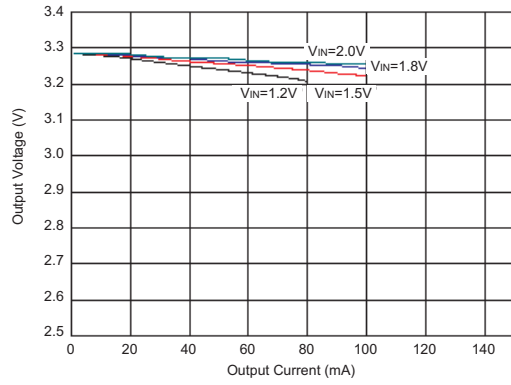
HT7722 Start-Up & Hold-On Voltage



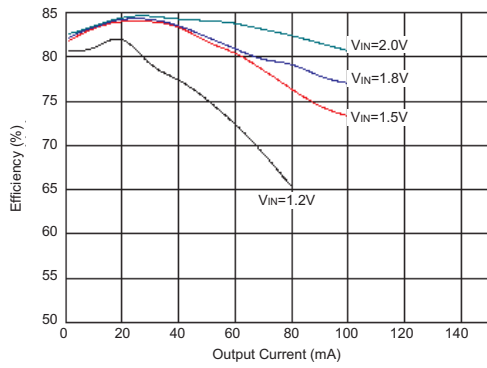
HT7727 Start-Up & Hold-On Voltage



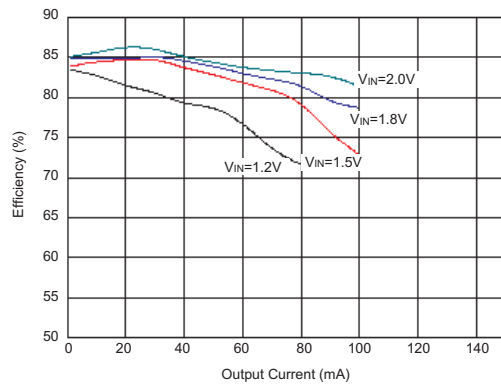
HT7730 Output Voltage v.s Output Current



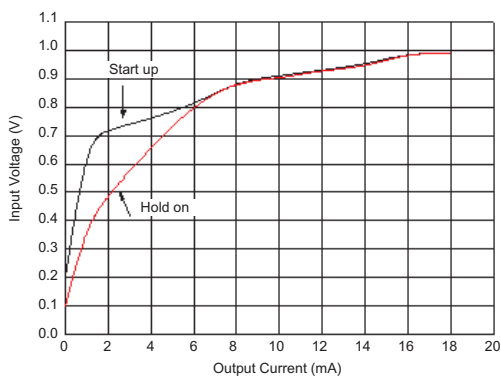
HT7733 Output Voltage v.s Output Current



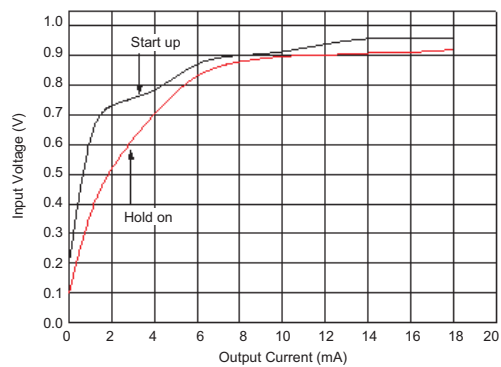
HT7730 Efficiency v.s Output Current



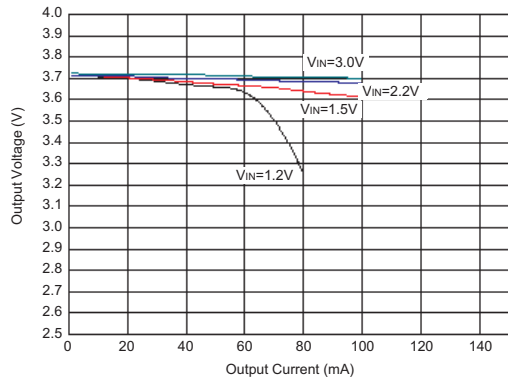
HT7733 Efficiency v.s Output Current



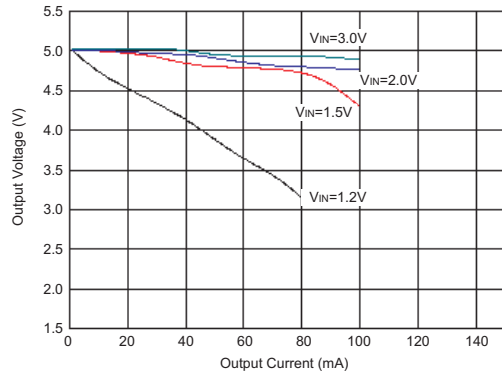
HT7730 Start-Up& Hold-On Voltage



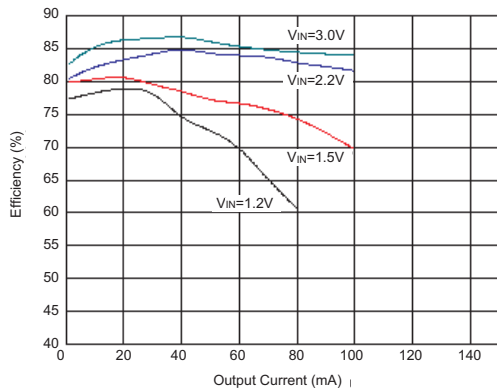
HT7733 Start-Up& Hold-On Voltage



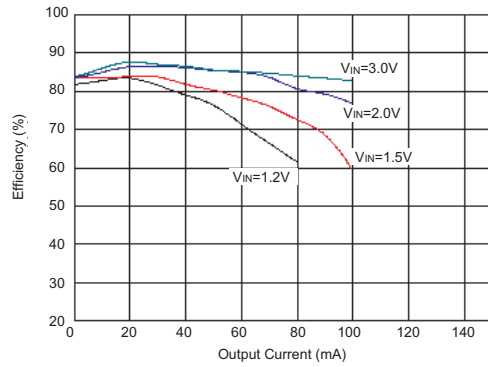
HT7737 Output Voltage v.s Output Current



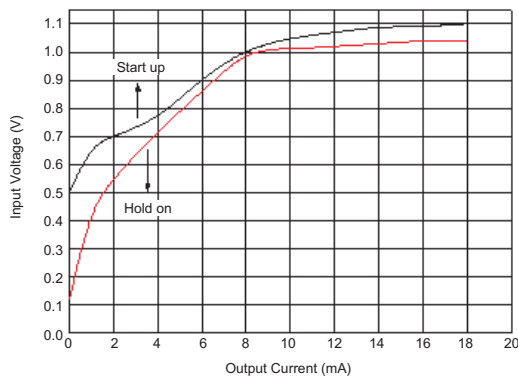
HT7750 Output Voltage v.s Output Current



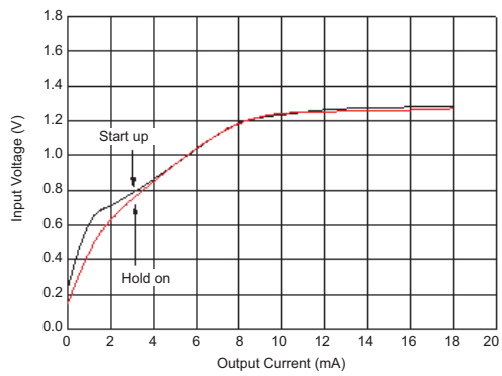
HT7737 Efficiency v.s Output Current



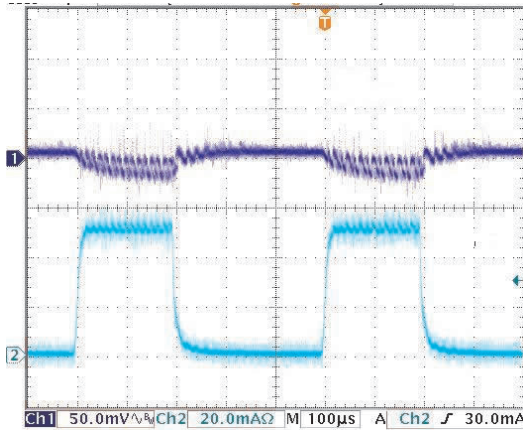
HT7750 Efficiency v.s Output Current



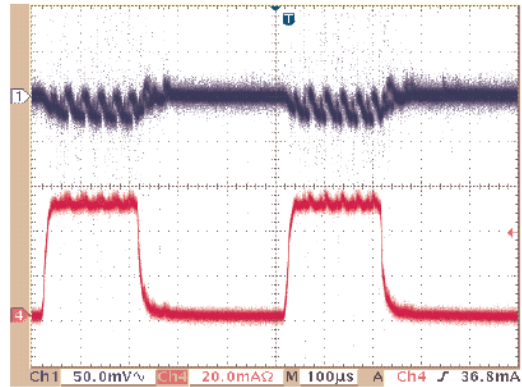
HT7737 Start-Up & Hold-On Voltage



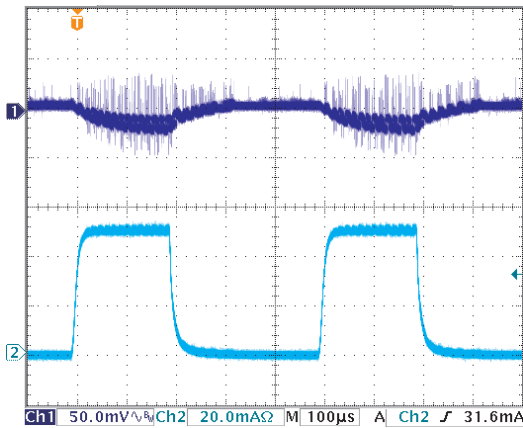
HT7750 Start-Up & Hold-On Voltage



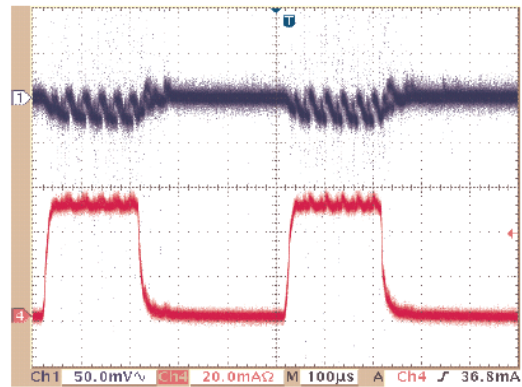
HT7718 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=1.08V)



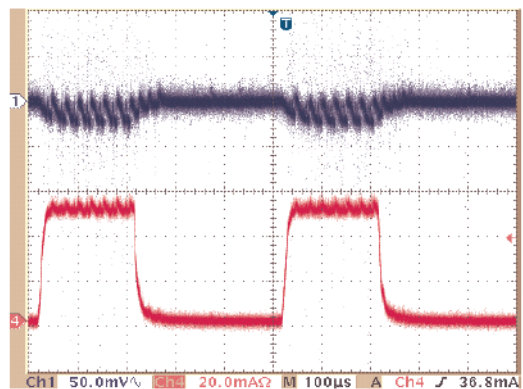
HT7730 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=1.8V)



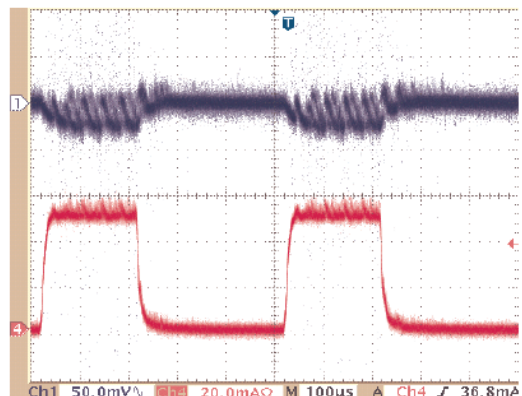
HT7722 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=1.08V)



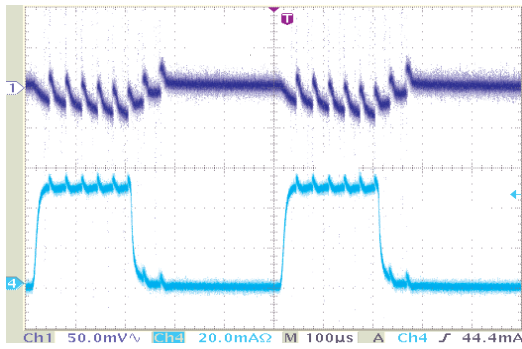
HT7733 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=1.98V)



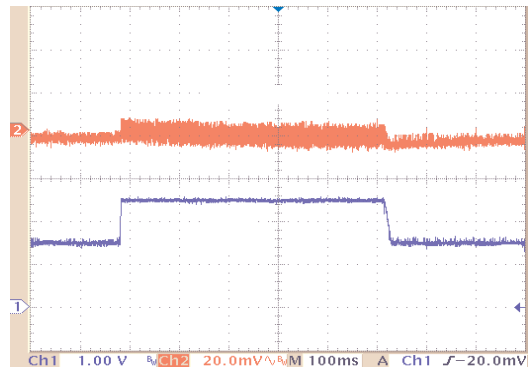
HT7727 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=1.62V)



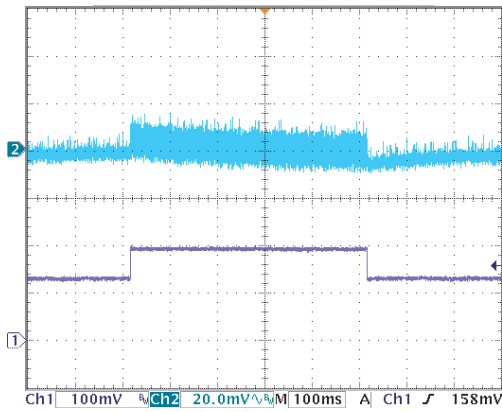
HT7737 Load Transient Response
(L=100μH, C_{OUT}=100μF, V_{IN}=2.22V)



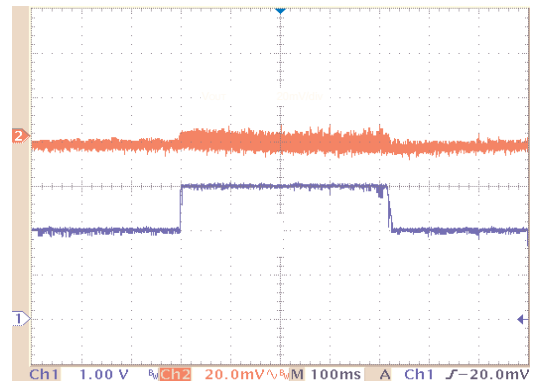
HT7750 Load Transient Response
($L=100\mu\text{H}$, $C_{\text{OUT}}=100\mu\text{F}$, $V_{\text{IN}}=3\text{V}$)



HT7733 Line Transient Response
($L=100\mu\text{H}$, $C_{\text{OUT}}=100\mu\text{F}$)



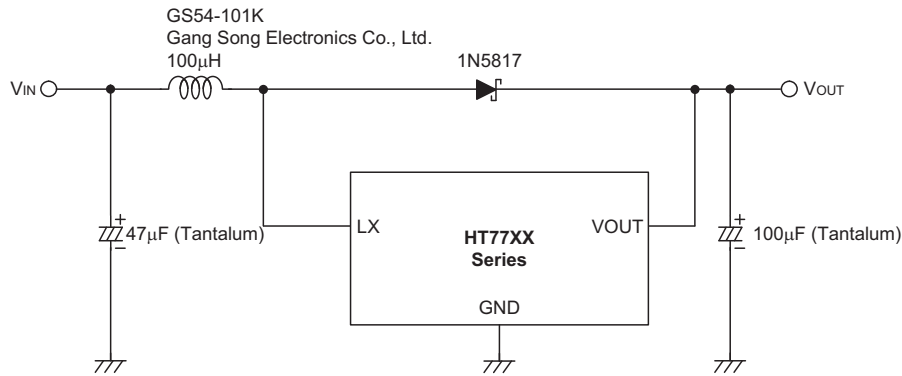
HT7722 Line Transient Response
($L=100\mu\text{H}$, $C_{\text{OUT}}=100\mu\text{F}$)



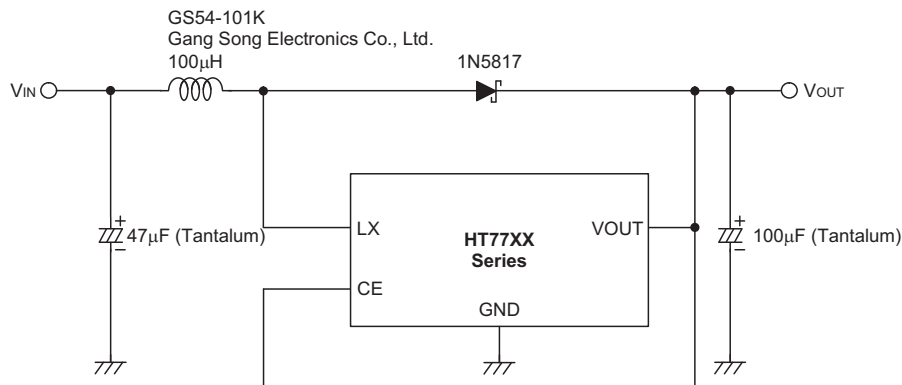
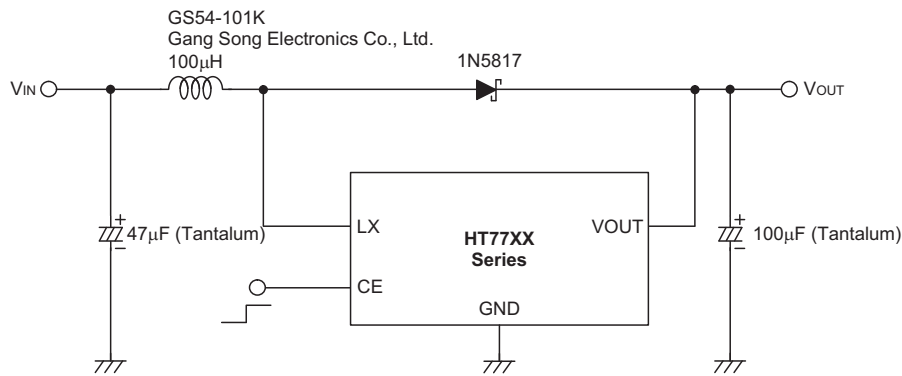
HT7750 Line Transient Response
($L=100\mu\text{H}$, $C_{\text{OUT}}=100\mu\text{F}$)

Application Circuits

Without CE Pin



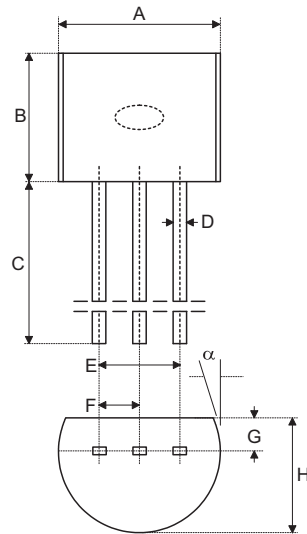
With CE Pin



Note: For the SOT23-5 package, when CE is pulled low, the internal blocks of the device, such as the reference band gap, gain block, and all feedback and control circuitry will be switched off. The boost converter's output, V_{OUT}, will be at a value one Schottky diode voltage drop below the input voltage and the LX pin remains in a high impedance condition. The output capacitor and load at V_{OUT} determine the rate at which V_{OUT} decays.

Package Information

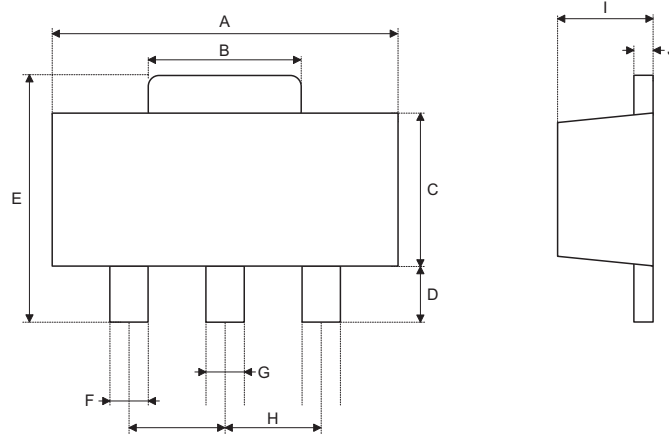
3-pin TO92 Outline Dimensions



| Symbol | Dimensions in inch | | |
|----------|--------------------|------|-------|
| | Min. | Nom. | Max. |
| A | 0.170 | — | 0.200 |
| B | 0.170 | — | 0.200 |
| C | 0.500 | — | — |
| D | 0.011 | — | 0.020 |
| E | 0.090 | — | 0.110 |
| F | 0.045 | — | 0.055 |
| G | 0.045 | — | 0.065 |
| H | 0.130 | — | 0.160 |
| α | 0° | — | 10° |

| Symbol | Dimensions in mm | | |
|----------|------------------|------|------|
| | Min. | Nom. | Max. |
| A | 4.32 | — | 5.08 |
| B | 4.32 | — | 5.08 |
| C | 12.70 | — | — |
| D | 0.28 | — | 0.51 |
| E | 2.29 | — | 2.79 |
| F | 1.14 | — | 1.40 |
| G | 1.14 | — | 1.65 |
| H | 3.30 | — | 4.06 |
| α | 0° | — | 10° |

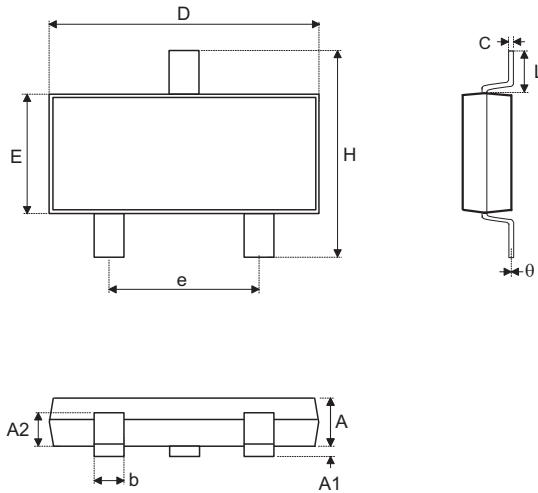
3-pin SOT89 Outline Dimensions



| Symbol | Dimensions in inch | | |
|--------|--------------------|-------|-------|
| | Min. | Nom. | Max. |
| A | 0.173 | — | 0.181 |
| B | 0.059 | — | 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 | — |
| I | 55 | — | 63 |
| J | 14 | — | 17 |

| Symbol | Dimensions in mm | | |
|--------|------------------|------|------|
| | Min. | Nom. | Max. |
| A | 4.39 | — | 4.60 |
| B | 1.50 | — | 1.83 |
| C | 2.29 | — | 2.59 |
| D | 0.89 | — | 1.19 |
| E | 3.94 | — | 4.24 |
| F | 0.36 | — | 0.48 |
| G | 0.43 | — | 0.56 |
| H | — | 1.50 | — |
| I | 1.40 | — | 1.60 |
| J | 0.36 | — | 0.43 |

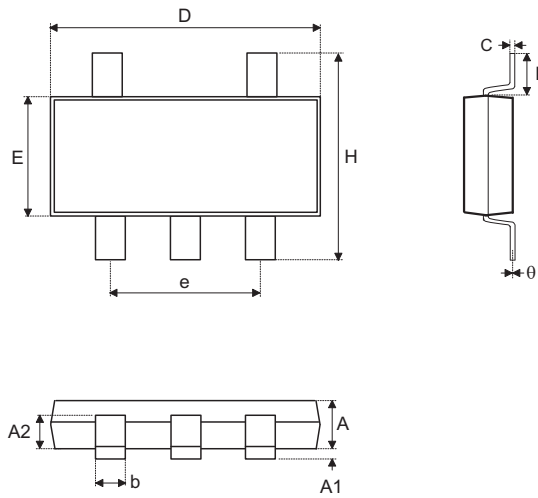
3-pin SOT23 Outline Dimensions



| Symbol | Dimensions in inch | | |
|----------|--------------------|-------|-------|
| | Min. | Nom. | Max. |
| A | 0.039 | — | 0.051 |
| A1 | — | — | 0.004 |
| A2 | 0.028 | — | 0.035 |
| b | 0.014 | — | 0.020 |
| C | 0.004 | — | 0.010 |
| D | 0.106 | — | 0.122 |
| E | 0.055 | — | 0.071 |
| e | — | 0.075 | — |
| H | 0.102 | — | 0.118 |
| L | 0.015 | — | — |
| θ | 0° | — | 9° |

| 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 | — | 3.00 |
| L | 0.37 | — | — |
| θ | 0° | — | 9° |

5-pin SOT23-5 Outline Dimensions

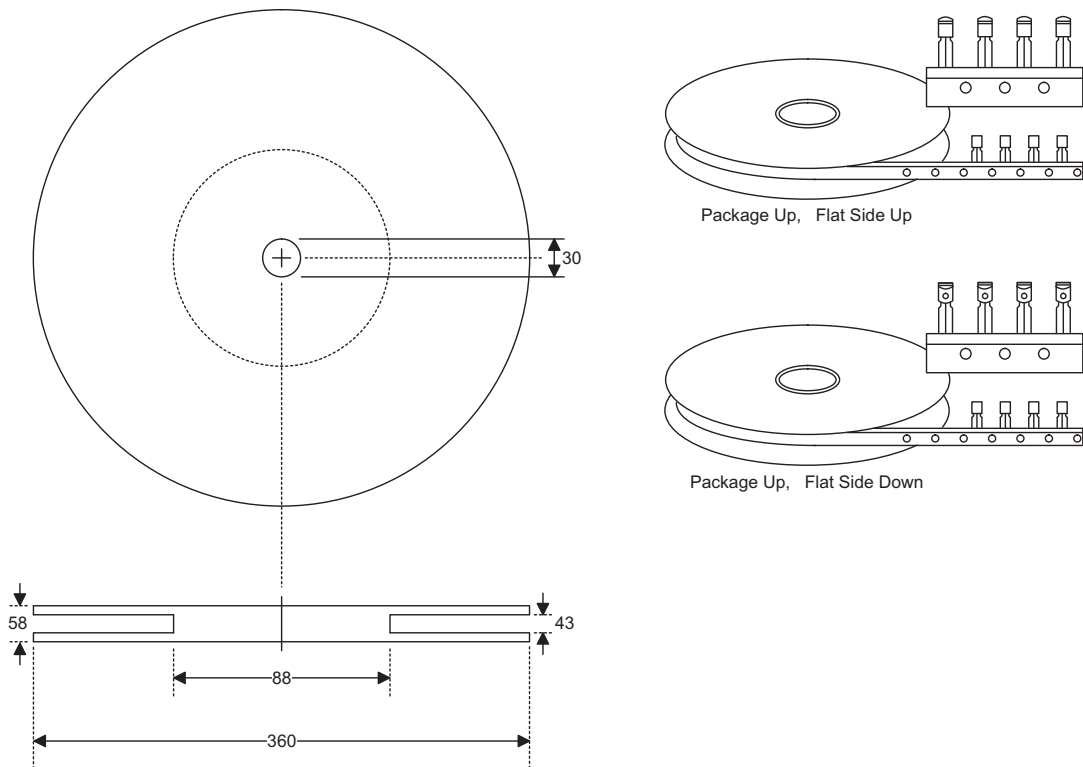


| Symbol | Dimensions in inch | | |
|----------|--------------------|-------|-------|
| | Min. | Nom. | Max. |
| A | 0.039 | — | 0.051 |
| A1 | — | — | 0.004 |
| A2 | 0.028 | — | 0.035 |
| b | 0.014 | — | 0.020 |
| C | 0.004 | — | 0.010 |
| D | 0.106 | — | 0.122 |
| E | 0.055 | — | 0.071 |
| e | — | 0.075 | — |
| H | 0.102 | — | 0.118 |
| L | 0.015 | — | — |
| θ | 0° | — | 9° |

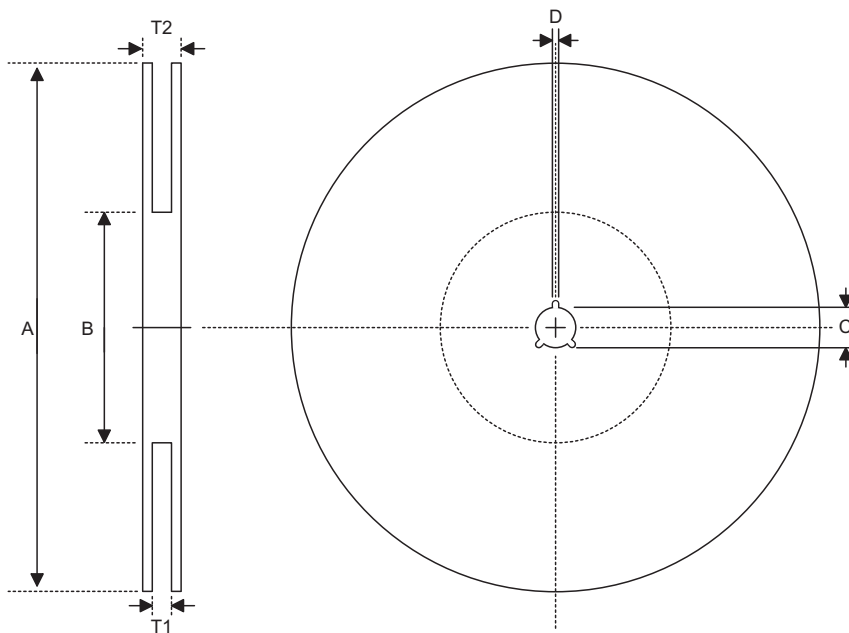
| Symbol | Dimensions in mm | | |
|----------|------------------|------|------|
| | Min. | Nom. | Max. |
| A | 1.00 | — | 1.30 |
| A1 | — | — | 0.10 |
| A2 | 0.70 | — | 0.90 |
| b | 0.35 | — | 0.50 |
| C | 0.10 | — | 0.25 |
| D | 2.70 | — | 3.10 |
| E | 1.40 | — | 1.80 |
| e | — | 1.90 | — |
| H | 2.60 | — | 3.00 |
| L | 0.37 | — | — |
| θ | 0° | — | 9° |

Product Tape and Reel Specifications

TO92 Reel Dimensions (Unit: mm)



Reel Dimensions

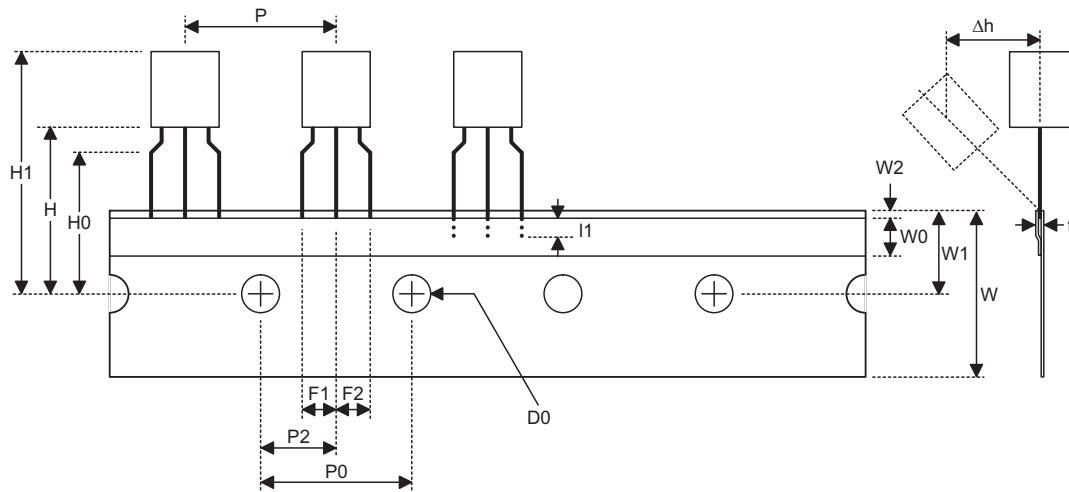


SOT89-3

| Symbol | Description | Dimensions in mm |
|--------|-----------------------|------------------------------|
| A | Reel Outer Diameter | 180.0±1.0 |
| B | Reel Inner Diameter | 62.0±1.5 |
| C | Spindle Hole Diameter | 12.75 ^{+0.15/-0.00} |
| D | Key Slit Width | 1.9±0.15 |
| T1 | Space Between Flange | 12.4 ^{+0.2/-0.0} |
| T2 | Reel Thickness | 17.0 ^{+0.0/-0.4} |

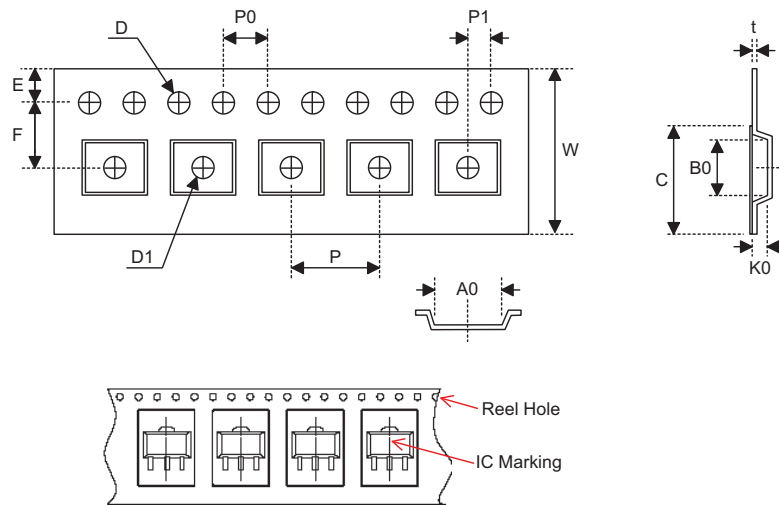
SOT23-3, SOT23-5

| Symbol | Description | Dimensions in mm |
|--------|-----------------------|---------------------------|
| A | Reel Outer Diameter | 178.0±1.0 |
| B | Reel Inner Diameter | 62.0±1.0 |
| C | Spindle Hole Diameter | 13.0±0.2 |
| D | Key Slit Width | 2.50±0.25 |
| T1 | Space Between Flange | 8.4 ^{+1.5/-0.0} |
| T2 | Reel Thickness | 11.4 ^{+1.5/-0.0} |

Carrier Tape Dimensions

TO92

| 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±0.40 |
| 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±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 reference only.

Carrier Tape Dimensions

SOT89-3

| 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±0.10 |
| F | Cavity to Perforation (Width Direction) | 5.50±0.05 |
| D | Perforation Diameter | 1.5 ^{+0.1/-0.0} |
| D1 | Cavity Hole Diameter | 1.5 ^{+0.1/-0.0} |
| P0 | Perforation Pitch | 4.0±0.1 |
| P1 | Cavity to Perforation (Length Direction) | 2.0±0.1 |
| 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 | 0.300±0.013 |
| C | Cover Tape Width | 9.3±0.1 |

SOT23-3, SOT23-5

| Symbol | Description | Dimensions in mm |
|--------|--|--------------------------|
| W | Carrier Tape Width | 8.0±0.3 |
| P | Cavity Pitch | 4.0±0.1 |
| E | Perforation Position | 1.75±0.10 |
| F | Cavity to Perforation (Width Direction) | 3.50±0.05 |
| D | Perforation Diameter | 1.5 ^{+0.1/-0.0} |
| D1 | Cavity Hole Diameter | 1.5 ^{+0.1/-0.0} |
| P0 | Perforation Pitch | 4.0±0.1 |
| P1 | Cavity to Perforation (Length Direction) | 2.00±0.05 |
| A0 | Cavity Length | 3.15±0.10 |
| B0 | Cavity Width | 3.2±0.1 |
| K0 | Cavity Depth | 1.4±0.1 |
| t | Carrier Tape Thickness | 0.20±0.03 |
| C | Cover Tape Width | 5.3±0.1 |

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