

### Features

- Low power consumption
- High input voltage (up to 24V)
- Low voltage drop
- Output voltage accuracy: tolerance  $\pm 3\%$
- Low temperature coefficient
- 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 24V. 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.

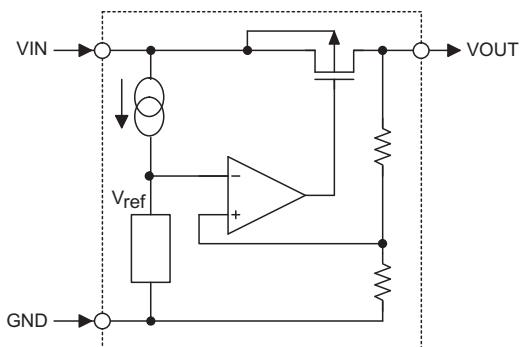
### Selection Table

Part No.	Output Voltage	Package	Marking
HT7121-1	2.1V	TO92 SOT89 SOT23-5	71XXA-1 (for TO92) 71XX-1 (for SOT89) 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		

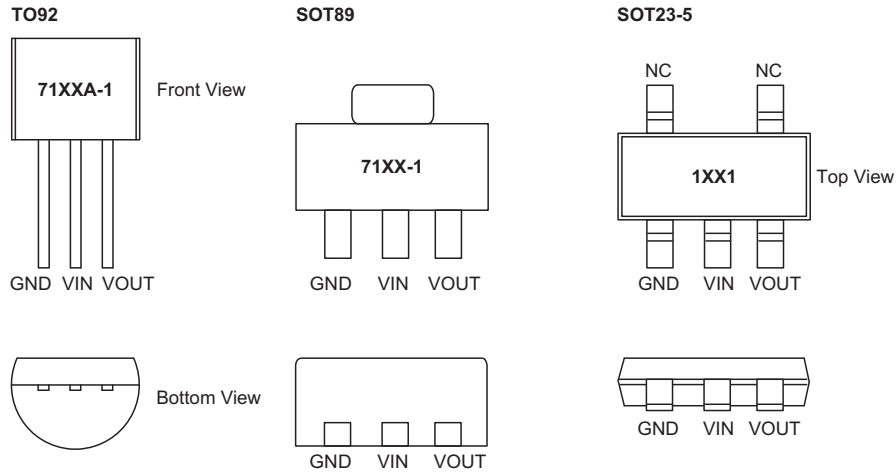
Note: "XX" stands for output voltages.

For lead free devices, TO92 package will add a "#" mark at the end of the date code, whereas SOT89 & SOT23-5 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  
 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  $T_a = 25^\circ\text{C}$

**Electrical Characteristics**
**HT7121-1, +2.1V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	4.1V	I <sub>OUT</sub> =10mA	2.037	2.100	2.163	V
I <sub>OUT</sub>	Output Current	4.1V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	4.1V	1mA ≤ I <sub>OUT</sub> ≤ 20mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	4.1V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	3.1V ≤ V <sub>IN</sub> ≤ 24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	4.1V	I <sub>OUT</sub> =10mA 0°C < T <sub>a</sub> < 70°C	—	±0.37	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

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

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	4.3V	I <sub>OUT</sub> =10mA	2.231	2.300	2.369	V
I <sub>OUT</sub>	Output Current	4.3V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	4.3V	1mA ≤ I <sub>OUT</sub> ≤ 20mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	4.3V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	3.3V ≤ V <sub>IN</sub> ≤ 24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	4.3V	I <sub>OUT</sub> =10mA 0°C < T <sub>a</sub> < 70°C	—	±0.39	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7125-1, +2.5V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	4.5V	I <sub>OUT</sub> =10mA	2.425	2.500	2.575	V
I <sub>OUT</sub>	Output Current	4.5V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	4.5V	1mA≤I <sub>OUT</sub> ≤20mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	4.5V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	3.5V≤V <sub>IN</sub> ≤24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	4.5V	I <sub>OUT</sub> =10mA 0°C<T <sub>a</sub> <70°C	—	±0.41	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7127-1, +2.7V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	4.7V	I <sub>OUT</sub> =10mA	2.619	2.700	2.781	V
I <sub>OUT</sub>	Output Current	4.7V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	4.7V	1mA≤I <sub>OUT</sub> ≤20mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	4.7V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	3.7V≤V <sub>IN</sub> ≤24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	4.7V	I <sub>OUT</sub> =10mA 0°C<T <sub>a</sub> <70°C	—	±0.43	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7130-1, +3.0V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	5V	I <sub>OUT</sub> =10mA	2.91	3.00	3.09	V
I <sub>OUT</sub>	Output Current	5V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	5V	1mA ≤ I <sub>OUT</sub> ≤ 20mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	5V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	4V ≤ V <sub>IN</sub> ≤ 24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5V	I <sub>OUT</sub> =10mA 0°C < T <sub>a</sub> < 70°C	—	±0.45	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7133-1, +3.3V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	5.5V	I <sub>OUT</sub> =10mA	3.201	3.300	3.399	V
I <sub>OUT</sub>	Output Current	5.5V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	5.5V	1mA ≤ I <sub>OUT</sub> ≤ 30mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	5.5V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	4.5V ≤ V <sub>IN</sub> ≤ 24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5.5V	I <sub>OUT</sub> =10mA 0°C < T <sub>a</sub> < 70°C	—	±0.5	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7136-1, +3.6V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	5.6V	I <sub>OUT</sub> =10mA	3.492	3.600	3.708	V
I <sub>OUT</sub>	Output Current	5.6V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	5.6V	1mA≤I <sub>OUT</sub> ≤30mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	60	—	mV
I <sub>SS</sub>	Current Consumption	5.6V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	4.6V≤V <sub>IN</sub> ≤24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5.6V	I <sub>OUT</sub> =10mA 0°C<T <sub>a</sub> <70°C	—	±0.6	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7144-1, +4.4V Output Type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	6.4V	I <sub>OUT</sub> =10mA	4.268	4.400	4.532	V
I <sub>OUT</sub>	Output Current	6.4V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	6.4V	1mA≤I <sub>OUT</sub> ≤30mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	6.4V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	5.4V≤V <sub>IN</sub> ≤24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	6.4V	I <sub>OUT</sub> =10mA 0°C<T <sub>a</sub> <70°C	—	±0.7	—	mV/°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<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**HT7150-1, +5.0V Output Type**

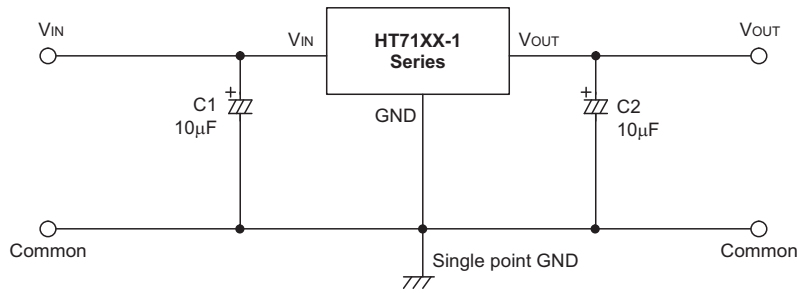
Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	7V	I <sub>OUT</sub> =10mA	4.85	5.00	5.15	V
I <sub>OUT</sub>	Output Current	7V	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	7V	1mA ≤ I <sub>OUT</sub> ≤ 30mA	—	60	100	mV
V <sub>DIF</sub>	Voltage Drop (Note)	—	I <sub>OUT</sub> =1mA, ΔV <sub>OUT</sub> =2%	—	100	—	mV
I <sub>SS</sub>	Current Consumption	7V	No load	—	2.5	5.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	6V ≤ V <sub>IN</sub> ≤ 24V I <sub>OUT</sub> =1mA	—	0.2	—	%/V
V <sub>IN</sub>	Input Voltage	—	—	—	—	24	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	7V	I <sub>OUT</sub> =10mA 0°C < T <sub>a</sub> < 70°C	—	±0.75	—	mV/°C

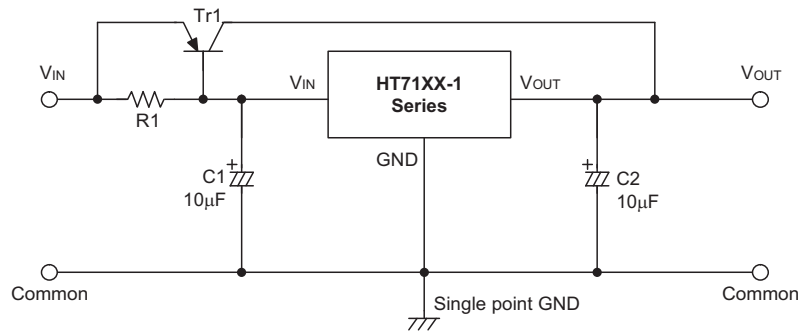
Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V<sub>IN</sub> = V<sub>OUT</sub>+2V with a fixed load.

**Application Circuits**

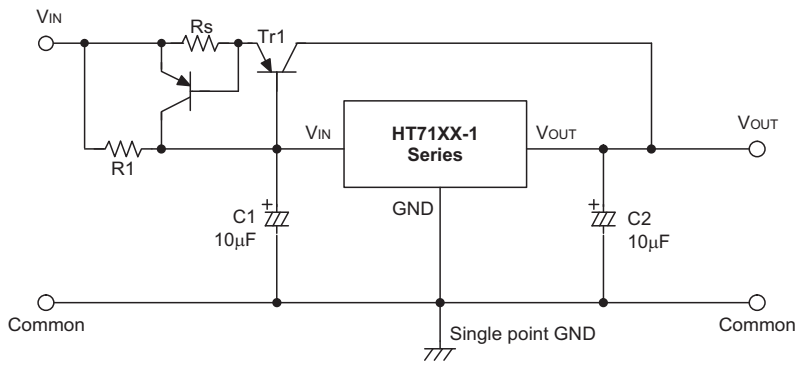
**Basic Circuits**



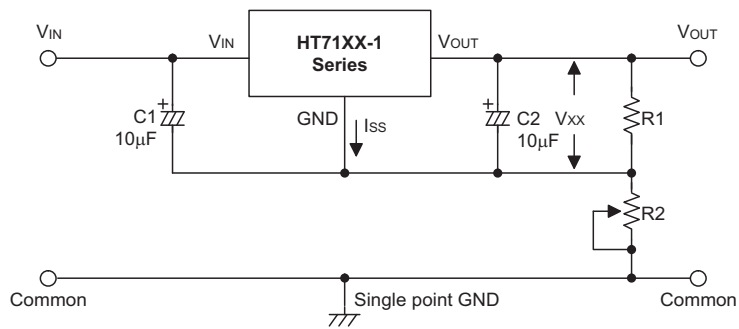
**High Output Current Positive Voltage Regulator**



**Short-Circuit Protection by Tr1**

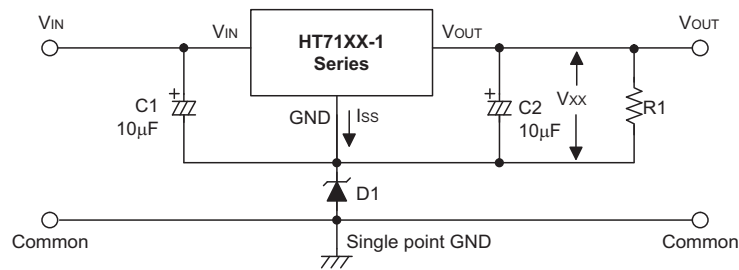


**Circuit for Increasing Output Voltage**



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

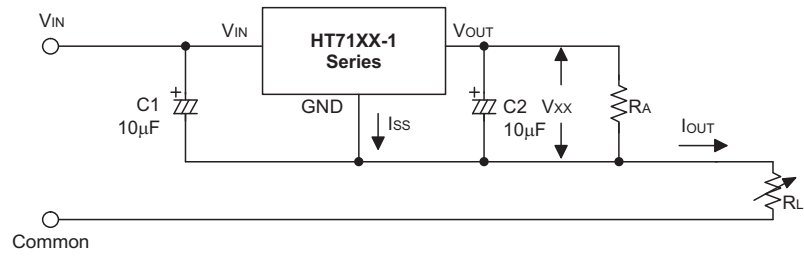
**Circuit for Increasing Output Voltage**



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

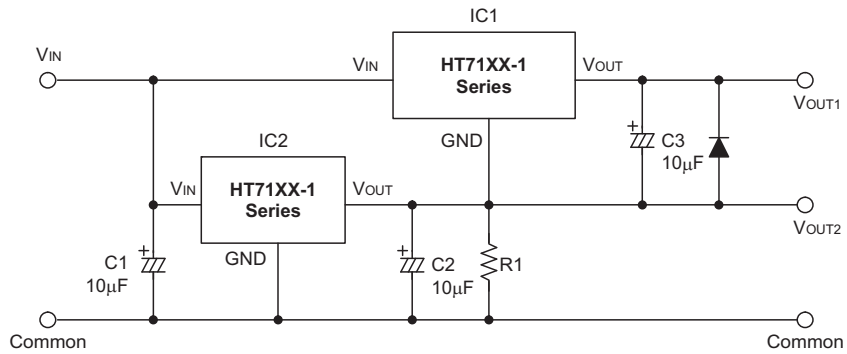


**Constant Current Regulator**



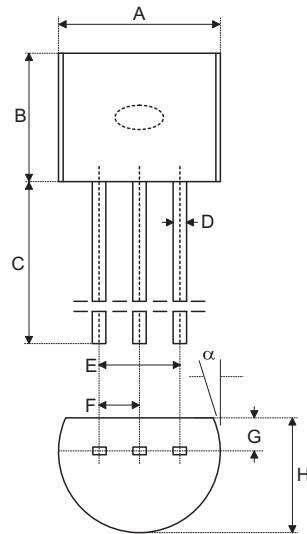
$$I_{OUT} = \frac{V_{XX}}{R_A} + I_{SS}$$

**Dual Supply**



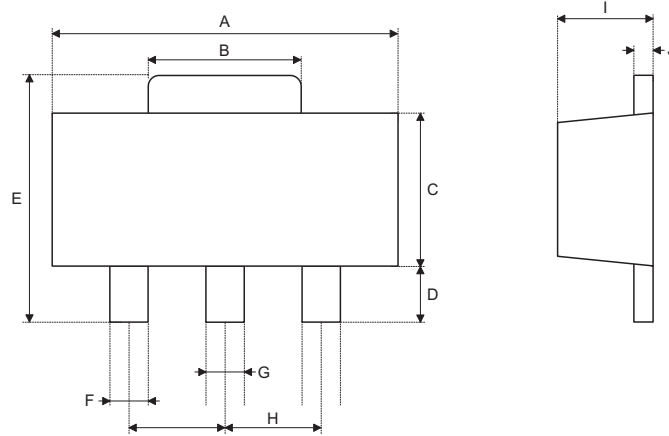
**Package Information**

**3-pin TO92 Outline Dimensions**



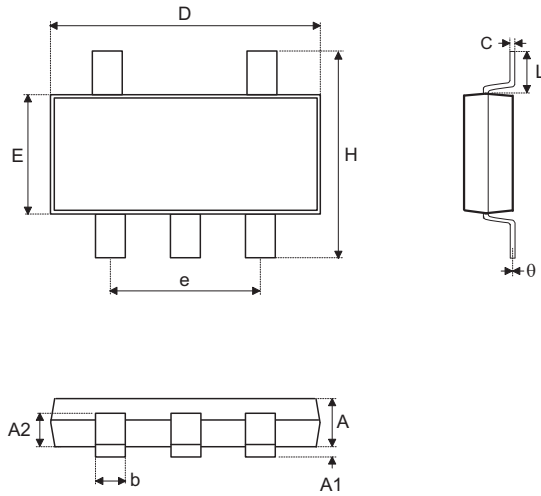
Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	170	—	200
B	170	—	200
C	500	—	—
D	11	—	20
E	90	—	110
F	45	—	55
G	45	—	65
H	130	—	160
I	8	—	18
$\alpha$	4°	—	6°

**3-pin SOT89 Outline Dimensions**



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

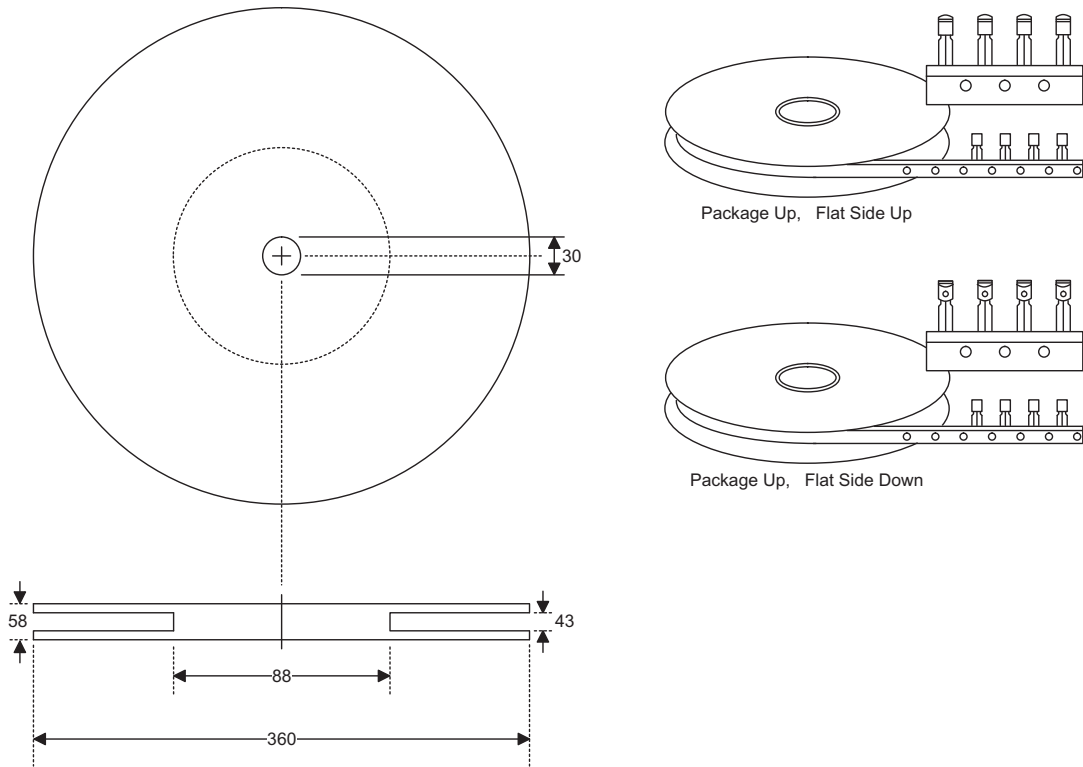
5-pin SOT23-5 Outline Dimensions



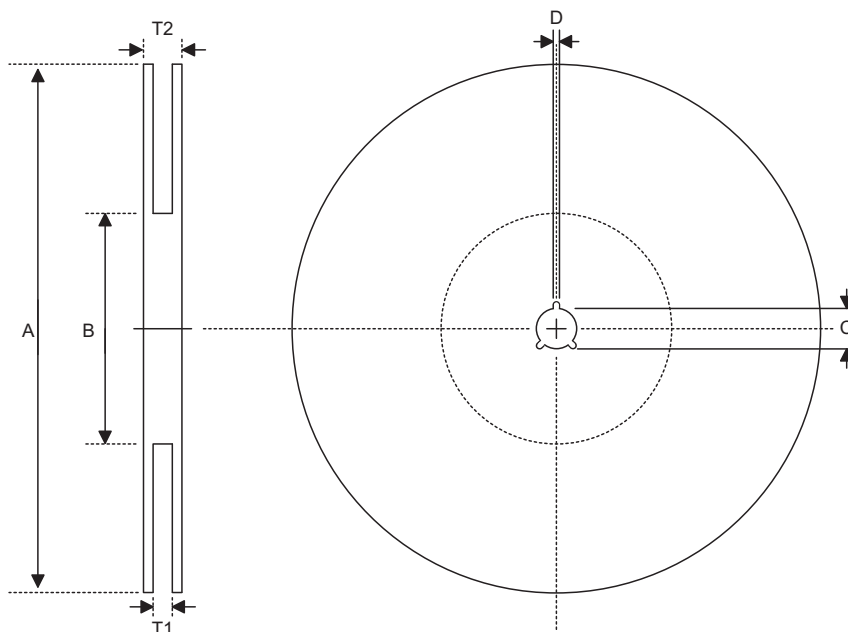
Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	1.00	—	1.30
A1	—	—	0.10
A2	0.70	—	0.90
b	0.35	—	0.50
C	0.10	—	0.25
D	2.70	—	3.10
E	1.40	—	1.80
e	—	1.90	—
H	2.60	—	3.00
L	0.37	—	—
$\theta$	1°	—	9°

**Product Tape and Reel Specifications**

3-pin TO92 Reel Dimensions (Unit: mm)



**Reel Dimensions**

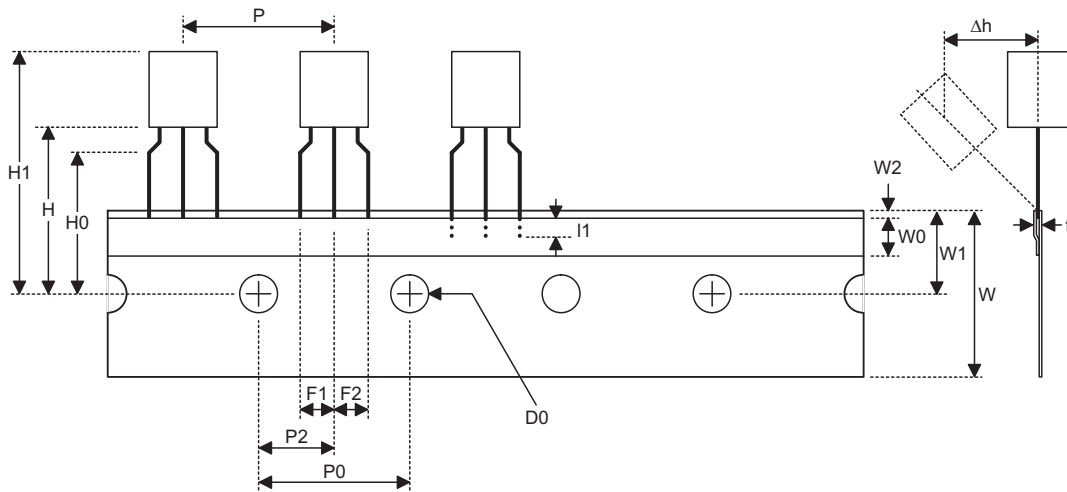


**SOT89**

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 <sup>+0.15/-0.00</sup>
D	Key Slit Width	1.90±0.15
T1	Space Between Flange	12.4 <sup>+0.2/-0.00</sup>
T2	Reel Thickness	17.0 <sup>+0.0/-0.4</sup>

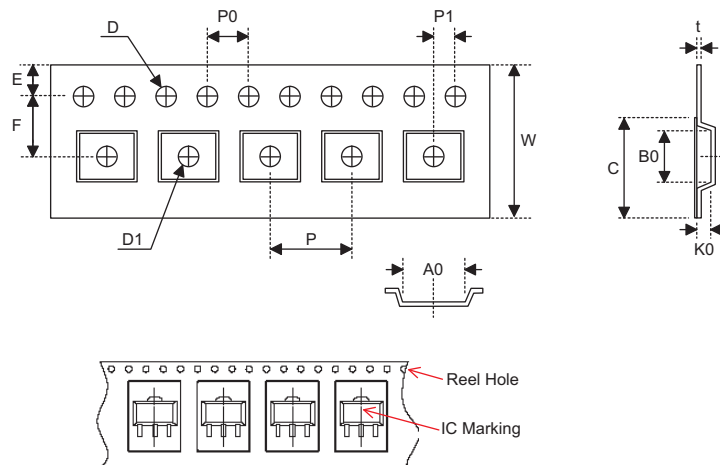
**SOT23-5**

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 <sup>+1.5/-0.0</sup>
T2	Reel Thickness	11.4 <sup>+1.5/-0.0</sup>

**Carrier Tape Dimensions**

**TO92**

Symbol	Description	Dimensions in mm
l1	Taped Lead Length	(2.5)
P	Component Pitch	12.7±1.0
P <sub>0</sub>	Perforation Pitch	12.7±0.3
P <sub>2</sub>	Component to Perforation (Length Direction)	6.35±0.40
F <sub>1</sub>	Lead Spread	2.5 <sup>+0.4/-0.1</sup>
F <sub>2</sub>	Lead Spread	2.5 <sup>+0.4/-0.1</sup>
Δh	Component Alignment	0.0±0.1
W	Carrier Tape Width	18.0 <sup>+1.0/-0.5</sup>
W <sub>0</sub>	Hold-down Tape Width	6.0±0.5
W <sub>1</sub>	Perforation Position	9.0±0.5
W <sub>2</sub>	Hold-down Tape Position	(0.5)
H <sub>0</sub>	Lead Clinch Height	16.0±0.5
H <sub>1</sub>	Component Height	Less than 24.7
D <sub>0</sub>	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

**Carrier Tape Dimensions**

**SOT89**

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	12.0 <sup>+0.3/-0.1</sup>
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 <sup>+0.1/-0.0</sup>
D1	Cavity Hole Diameter	1.5 <sup>+0.1/-0.0</sup>
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

**SOT23-5**

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 <sup>+0.1/-0.0</sup>
D1	Cavity Hole Diameter	1.5 <sup>+0.1/-0.0</sup>
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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