



# *HT72XX*

## *General Purpose Regulator*

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### **Features**

Low power consumption  
Low voltage drop  
Low temperature coefficient

High input voltage (up to 24V)  
High output current : 100mA ( $P_d$  250mW)  
TO-92 package

### **Applications**

Battery-powered equipment  
Communication equipment

Audio/Video equipment

### **General Description**

The HT72XX series is a set of three-terminal high current high voltage regulator implemented in CMOS technology. They can deliver 100mA output current and allow an input voltage as high as 24V. They are available with several fixed output voltages ranging from 2.4V to 15V. CMOS technology ensures low voltage drop and low quiescent current.

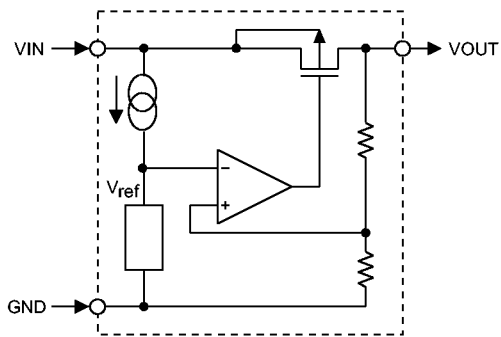
Although designed primarily as fixed voltage regulator, these devices can be used with external components to obtain variable voltages and currents.

**Selection Table**

Part No.	Pin Assignment	Output Voltage	Tolerance
HT7230	B	3.0V	5%
HT7231	A		
HT7233	B	3.3V	5%
HT7234	A		
HT7245	B	4.5V	5%
HT7246	A		
HT7250	B	5.0V	5%
HT7251	A		
HT7260	B	6.0V	5%
HT7261	A		
HT7270	B	7.0V	5%
HT7271	A		
HT7280	B	8.0V	5%
HT7281	A		
HT7290	B	9.0V	5%
HT7291	A		
HT72C0	B	12V	5%
HT72C1	A		

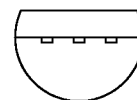
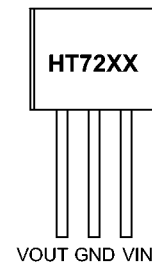
Note: For semi-custom parts, selectable regulated voltage range is from 2.4V to 12V in 0.1V increment.

**Block Diagram**

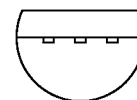
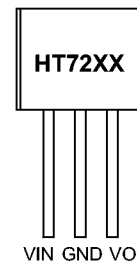


**Pin Assignment**

**A. TO-92**



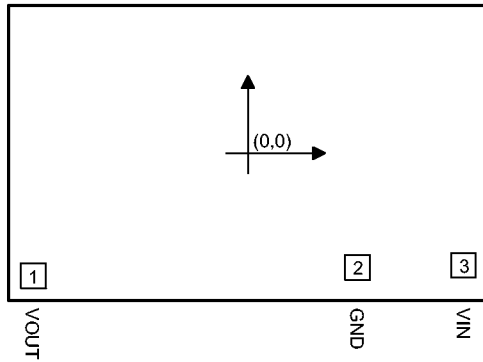
**B. TO-92**



Front View

Bottom View

**Pad Assignment**



**Pad Coordinates**

Unit: m

Pad No.	X	Y
1	838.50	479.00
2	429.00	446.50
3	843.50	439.50

Chip size: 2108 1371 ( m)<sup>2</sup>

\* The IC substrate should be connected to VDD in the PCB layout artwork.

**Absolute Maximum Ratings**

Supply Voltage..... 0.3V to 26V      Storage Temperature..... 50 C to 125 C  
 Power Consumption..... 250mW      Operating Temperature .....0 C to 70 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.

**Electrical Characteristics**

HT72XX series (HT7230, HT7231, +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 Tolerance	5V	I <sub>OUT</sub> =10mA	2.85	3.0	3.15	V
I <sub>OUT</sub>	Output Current	5V		60	100		mA
V <sub>OUT</sub>	Load Regulation	5V	1mA I <sub>OUT</sub> 50mA		60	120	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	5V	No load		200	350	A
$\frac{V_{OUT}}{V_{IN} V_{OUT}}$	Line Regulation		4V V <sub>IN</sub> 12V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	5V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		0.45		mV/ C

**HT72XX series (HT7233, HT7234, +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 Tolerance	5.5V	I <sub>OUT</sub> =10mA	3.14	3.3	3.47	V
I <sub>OUT</sub>	Output Current	5.5V		60	100		mA
V <sub>OUT</sub>	Load Regulation	5.5V	1mA I <sub>OUT</sub> 50mA		60	100	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	5.5V	No load		220	400	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		4.5V V <sub>IN</sub> 12V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	5.5V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		0.5		mV/ C

**HT72XX series (HT7245, HT7246, +4.5V output type)**

Ta=25 C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	6.4V	I <sub>OUT</sub> =10mA	4.27	4.5	4.72	V
I <sub>OUT</sub>	Output Current	6.4V		100	150		mA
V <sub>OUT</sub>	Load Regulation	6.4V	1mA I <sub>OUT</sub> 70mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	6.4V	No load		300	450	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		5.4V V <sub>IN</sub> 12V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	6.4V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		0.7		mV/ C

**HT72XX series (HT7250, HT7251, +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	4.75	5.0	5.25	V
I <sub>OUT</sub>	Output Current	7V		100	150		mA
V <sub>OUT</sub>	Load Regulation	7V	1mA I <sub>OUT</sub> 30mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	7V	No load		330	500	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		6V V <sub>IN</sub> 15V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	7V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		0.75		mV/ C

**HT72XX series (HT7260, HT7261, +6.0V output type)**

Ta=25 C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	8V	I <sub>OUT</sub> =10mA	7.6	8.0	8.4	V
I <sub>OUT</sub>	Output Current	8V		100	150		mA
V <sub>OUT</sub>	Load Regulation	8V	1mA I <sub>OUT</sub> 30mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	8V	No load		390	600	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		6V V <sub>IN</sub> 15V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	8V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		0.9		mV/ C

**HT72XX series (HT7270, HT7271, +7.0V output type)**

Ta=25 C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	9V	I <sub>OUT</sub> =10mA	6.65	7.0	7.35	V
I <sub>OUT</sub>	Output Current	9V		100	150		mA
V <sub>OUT</sub>	Load Regulation	9V	1mA I <sub>OUT</sub> 70mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	9V	No load		450	700	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		8V V <sub>IN</sub> 20V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	9V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		1.05		mV/ C

**HT72XX series (HT7280, HT7281, +8.0V output type)**

Ta=25 C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage Tolerance	10V	I <sub>OUT</sub> =10mA	7.61	8	8.4	V
I <sub>OUT</sub>	Output Current	10V		100	150		mA
V <sub>OUT</sub>	Load Regulation	10V	1mA I <sub>OUT</sub> 70mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	10V	No load		500	800	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		9V V <sub>IN</sub> 20V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	10V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		1.2		mV/ C

**HT72XX series (HT7290, HT7291, +9.0V output type)**

Ta=25 C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage Tolerance	12V	I <sub>OUT</sub> =10mA	8.55	9	9.45	V
I <sub>OUT</sub>	Output Current	12V		100	150		mA
V <sub>OUT</sub>	Load Regulation	12V	1mA I <sub>OUT</sub> 70mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	12V	No load		600	900	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		10V V <sub>IN</sub> 20V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	12V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		1.35		mV/ C

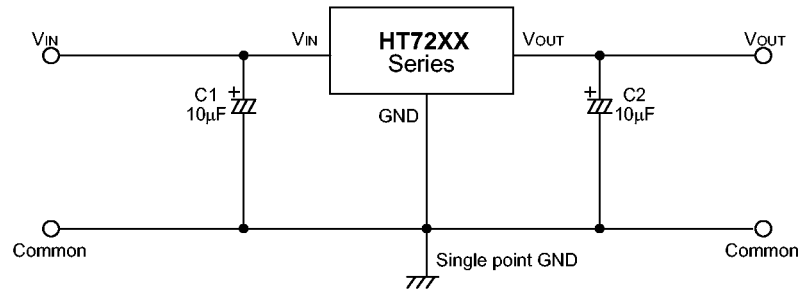
**HT72XX series (HT72C0, HT72C1, +12V output type)**

Ta=25 C

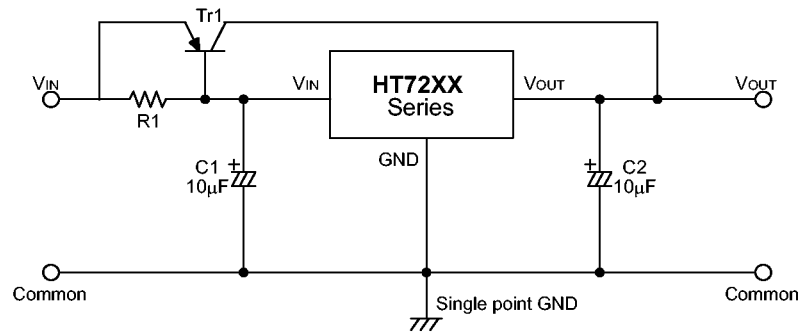
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage Tolerance	15V	I <sub>OUT</sub> =10mA	11.4	12	12.6	V
I <sub>OUT</sub>	Output Current	15V		100	150		mA
V <sub>OUT</sub>	Load Regulation	15V	1mA I <sub>OUT</sub> 70mA		60	150	mV
V <sub>DIF</sub>	Voltage Drop		I <sub>OUT</sub> =1mA		100		mV
I <sub>SS</sub>	Current Consumption	15V	No load		800	1200	A
$\frac{V_{OUT}}{V_{IN}}$	Line Regulation		14V V <sub>IN</sub> 24V I <sub>OUT</sub> =1mA		0.2		%/V
V <sub>IN</sub>	Input Voltage					24	V
$\frac{V_{OUT}}{T_a}$	Temperature Coefficient	15V	I <sub>OUT</sub> =10mA 0 C<Ta<70 C		1.8		mV/ C

## Application Circuits

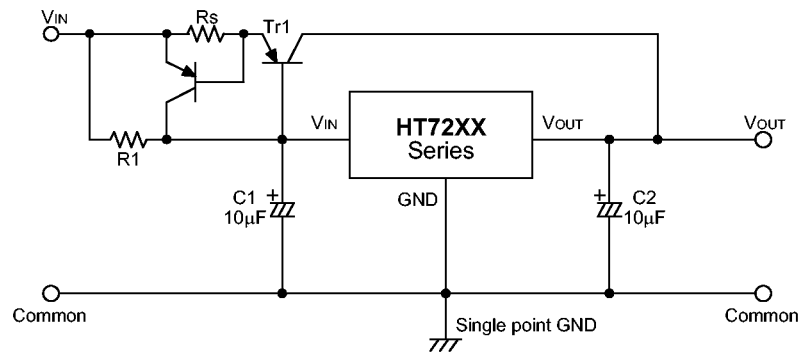
### Basic circuit



### High output current positive voltage regulator

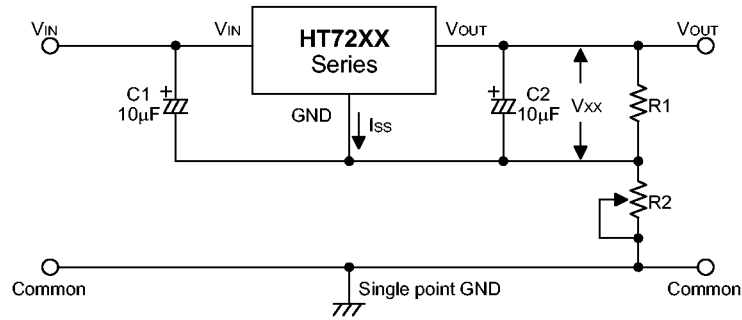


### Short-Circuit protection by $Tr1$



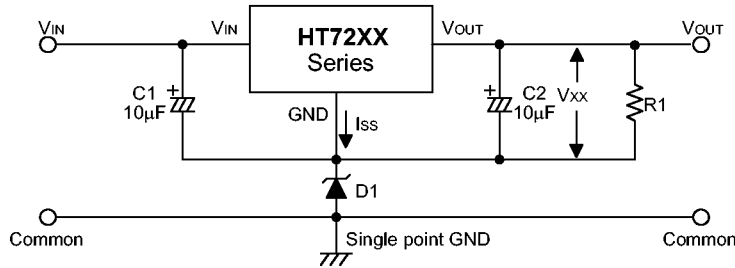


**Circuit for increasing output voltage**



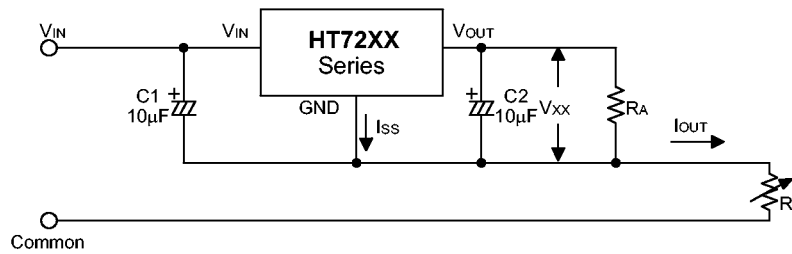
$$V_{OUT} = V_{XX} \left( 1 + \frac{R2}{R1} \right) + I_{SS} R2$$

**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

