



# HT71XX

## High Voltage Regulator

### Features

- Low power consumption
- Low voltage drop
- Low temperature coefficient
- High input voltage (up to 24V)
- TO-92 and SOT-89 packages

### Applications

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

### General Description

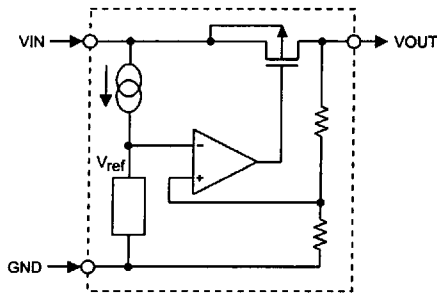
The HT71XX series is a set of three-terminal low power high voltage regulators implemented in CMOS technology. They allow input voltages as high as 24V. They are available with several fixed output voltages ranging from 1.5V to 15V. CMOS technology ensures low voltage drop and low quiescent current.

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

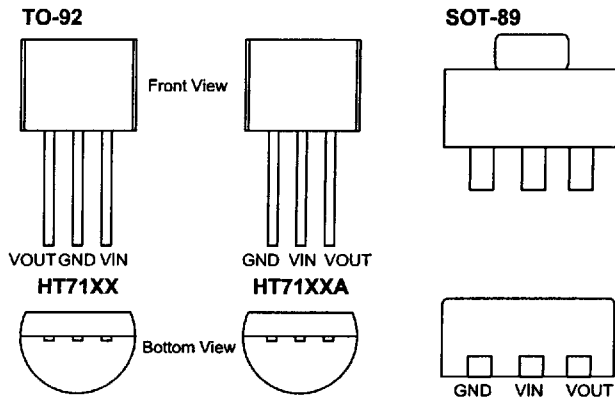
### Selection Table

Part No.	Output Voltage	Tolerance
HT7130	3.0V	±5%
HT7133	3.3V	±5%
HT7136	3.6V	±5%
HT7144	4.4V	±5%
HT7150	5.0V	±5%
HT7170	7.0V	±5%
HT7190	9.0V	±5%
HT71C0	12V	±5%

**Block Diagram**

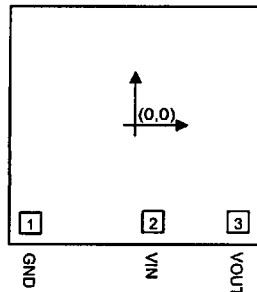


**Pin Assignment**



Note: To distinguish the new TO-92 package pin-out (GND VIN VOUT) from the older version (VOUT GND VIN), an HT71XXA mark will be printed on the package while the older version will retain its HT71XX mark.  
The older pin-out package will be obsolete after June 1, 2000.

**Pad Assignment**



Chip size: 1374×1294 (μm)<sup>2</sup>

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

**Pad Coordinates**

Unit: μm

Pad No.	X	Y
1	-480.00	-451.50
2	87.50	-444.50
3	482.00	-444.50

**Absolute Maximum Ratings**

Supply Voltage .....-0.3V to 28V      Storage Temperature .....-50°C to 125°C  
 Power Consumption ..... 200mW      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**
**HT7130, +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	2.85	3.0	3.15	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	—	I <sub>OUT</sub> =1mA	—	100	—	mV
I <sub>SS</sub>	Current Consumption	5V	No load	—	4	6.0	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<Ta<70°C	—	±0.45	—	mV/°C

**HT7133, +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	3.135	3.3	3.465	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	—	I <sub>OUT</sub> =1mA	—	100	—	mV
I <sub>SS</sub>	Current Consumption	5.5V	No load	—	4	6	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<Ta<70°C	—	±0.5	—	mV/°C

**HT7136, +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	3.42	3.6	3.78	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	—	I <sub>OUT</sub> =1mA	—	60	—	mV
I <sub>SS</sub>	Current Consumption	5.6V	No load	—	3.0	7.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	4.6V ≤ V <sub>IN</sub> ≤ 12V 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 < Ta < 70°C	—	±0.6	—	mV/°C

**HT7144, +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	4.18	4.4	4.62	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	—	I <sub>OUT</sub> =1mA	—	100	—	mV
I <sub>SS</sub>	Current Consumption	6.4V	No load	—	4	7.5	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 < Ta < 70°C	—	±0.7	—	mV/°C

**HT7150, +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	—	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	—	I <sub>OUT</sub> =1mA	—	100	—	mV
I <sub>SS</sub>	Current Consumption	7V	No load	—	5	9	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 < Ta < 70°C	—	±0.75	—	mV/°C

**HT7170, +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	—	20	30	—	mA
ΔV <sub>OUT</sub>	Load Regulation	9V	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	9V	No load	—	7	12.5	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	8V ≤ 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	9V	I <sub>OUT</sub> =10mA 0°C < Ta < 70°C	—	±1.05	—	mV/°C

**HT7190, +9V output type**

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	12V	I <sub>OUT</sub> =10mA	8.55	9	9.45	V
I <sub>OUT</sub>	Output Current	12V	—	30	40	—	mA
ΔV <sub>OUT</sub>	Load Regulation	12V	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	12V	No load	—	9	14	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	10V ≤ 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	12V	I <sub>OUT</sub> =10mA 0°C < Ta < 70°C	—	±1.35	—	mV/°C

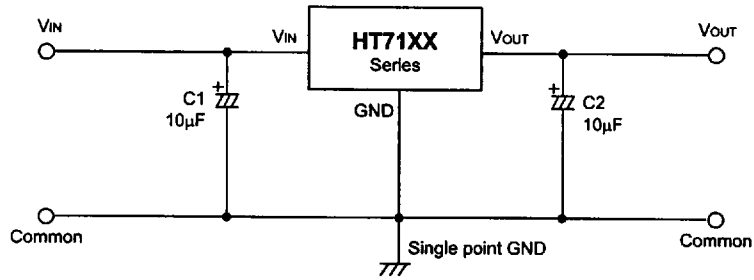
**HT71C0, +12V output type**

Ta=25°C

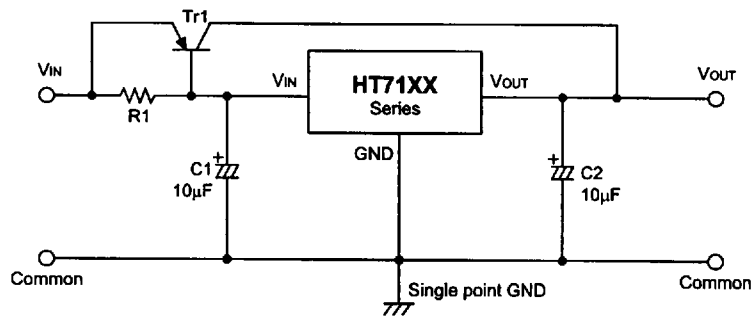
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>IN</sub>	Conditions				
V <sub>OUT</sub>	Output Voltage	15V	I <sub>OUT</sub> =10mA	11.4	12	12.6	V
I <sub>OUT</sub>	Output Current	15V	—	30	40	—	mA
ΔV <sub>OUT</sub>	Load Regulation	15V	1mA ≤ I <sub>OUT</sub> ≤ 30mA	—	60	150	mV
V <sub>DIF</sub>	Voltage Drop	—	I <sub>OUT</sub> =1mA	—	100	—	mV
I <sub>SS</sub>	Current Consumption	15V	No load	—	11	15	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	—	13V ≤ 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	15V	I <sub>OUT</sub> =10mA 0°C < Ta < 70°C	—	±1.8	—	mV/°C

Application Circuits

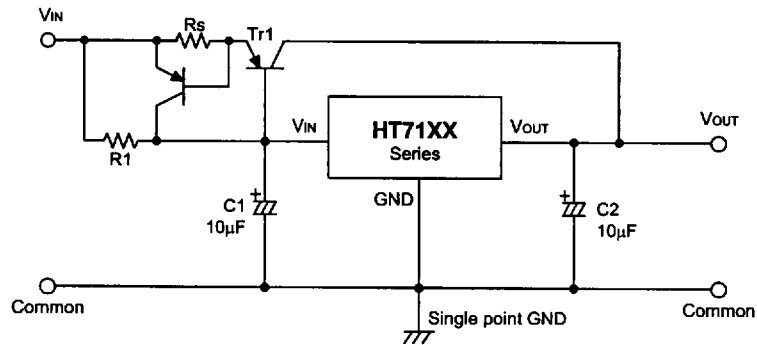
Basic circuits



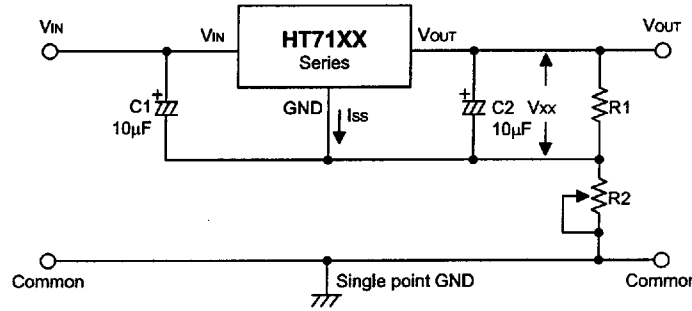
High output current positive voltage regulator



Short-Circuit protection by  $Tr1$

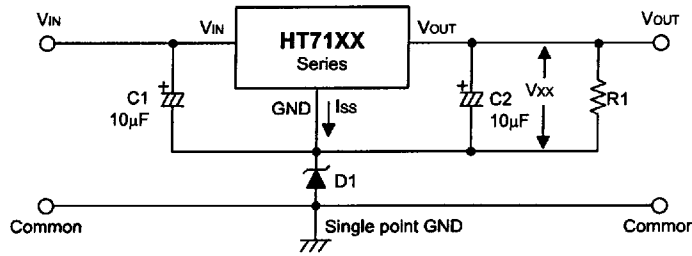


**Circuit for increasing output voltage**



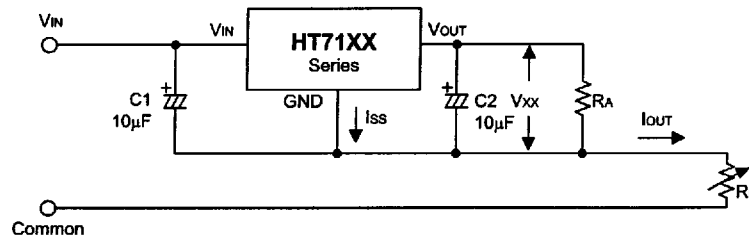
$$V_{OUT} = V_{XX} \left(1 + \frac{R_2}{R_1}\right) + I_{SS} R_2$$

**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

