

## THREE-TERMINAL 3A-5V POSITIVE VOLTAGE REGULATORS

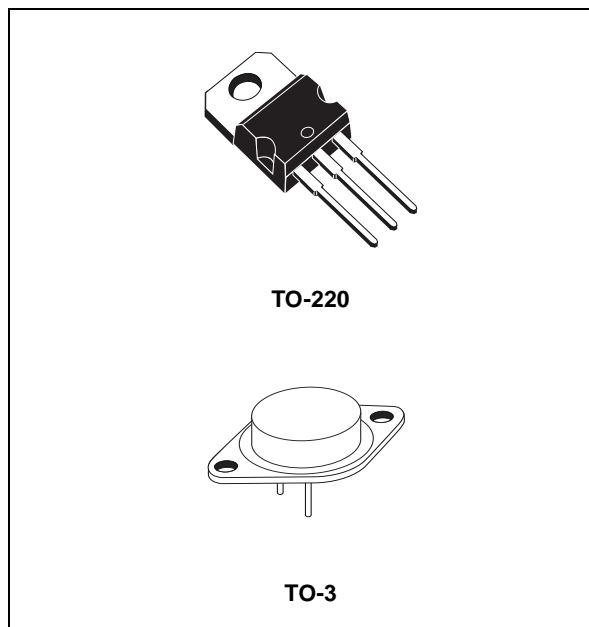
- OUTPUT CURRENT: 3A
- INTERNAL CURRENT AND THERMAL LIMITING
- TYPICAL OUTPUT IMPEDANCE: 0.01 $\Omega$
- MINIMUM INPUT VOLTAGE: 7.5V
- POWER DISSIPATION: 30W

### DESCRIPTION

The LM123, LM223, LM323 are three-terminal positive voltage regulators with a preset 5V output and a load driving capability of 3A. New circuit design and processing techniques are used to provide the high output current without sacrificing the regulation characteristics of lower current devices.

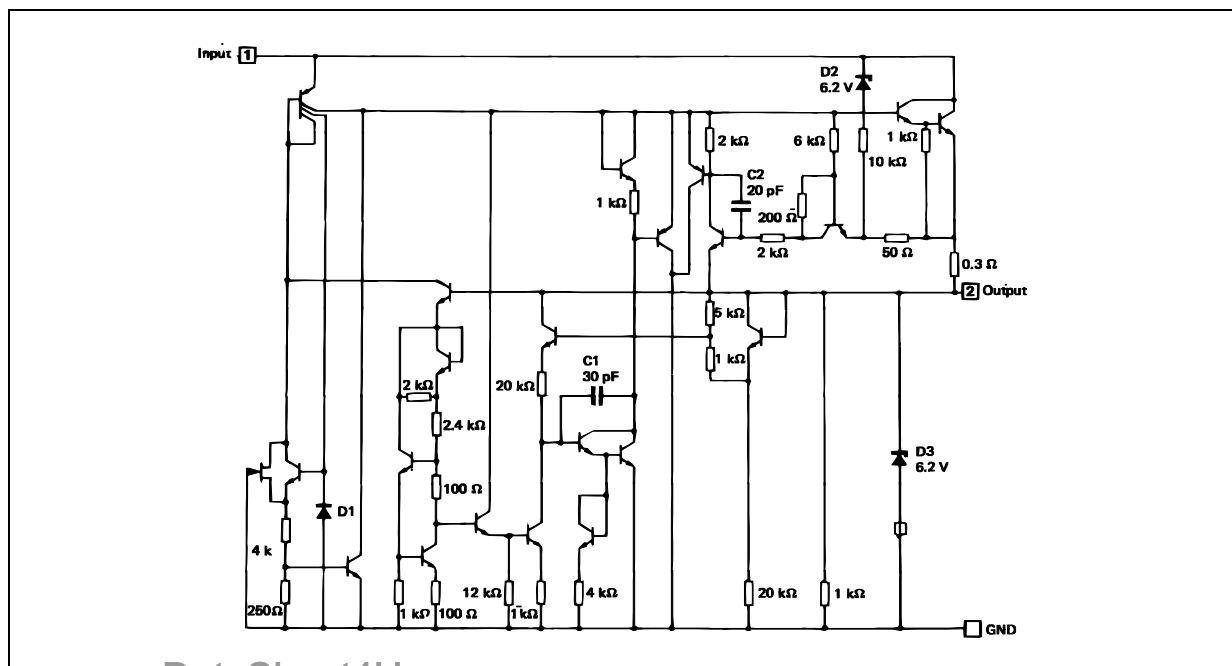
The 3A regulator is virtually blowout proof.

Current limiting, power limiting and thermal shut-down provide the same high level of reliability obtained with these techniques in the LM209, 1A regulator. An overall worst case specification for the combined effects of input voltage, load current, ambient temperature, and power



dissipation ensure that the LM123, LM223, LM323 will perform satisfactorily as a system element.

### SCHEMATIC DIAGRAM



**Table 1: Absolute Maximum Ratings**

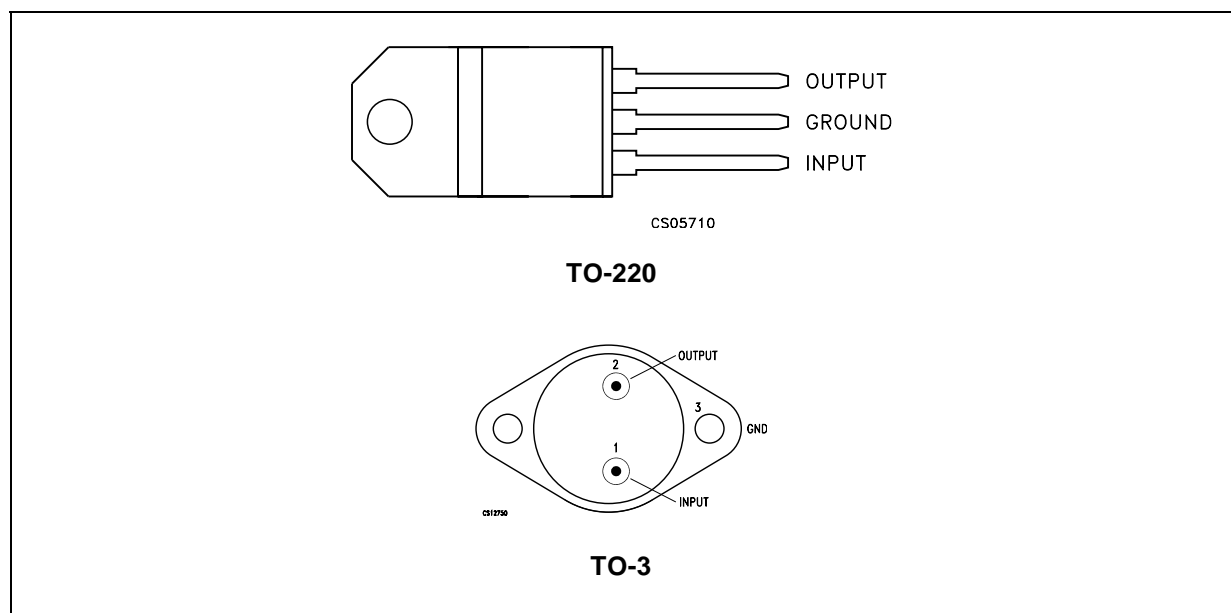
Symbol	Parameter		Value	Unit
$V_I$	Input Voltage		20	V
$I_O$	Output Current		Internally Limited	
$P_{tot}$	Power Dissipation		Internally Limited	
$T_{stg}$	Storage Temperature Range		-65 to 150	°C
$T_{oper}$	Operating Junction Temperature Range	LM123	-55 to 150	°C
		LM223	-25 to 125	
		LM323	0 to 125	

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

**Table 2: Thermal Data**

Symbol	Parameter	TO-220	TO-3	Unit
$R_{thj-case}$	Thermal Resistance Junction-case Max	3	2	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	50	35	°C/W

**Figure 1: Connection Diagram (top view)**



**Table 3: Order Codes**

TYPE	TO-220	TO-3	TEMPERATURE RANGE
LM123		LM123K	-55°C to 150°C
LM223		LM223K	-25°C to 150°C
LM323	LM323T	LM323K	0°C to 125°C

**Table 4: Electrical Characteristics Of LM123/LM223** ( $T_J = -55$  to  $150^\circ\text{C}$  for LM123,  $T_J = -25$  to  $150^\circ\text{C}$  for LM223 unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_O$	Output Voltage Range (Note 2)	$T_a = 25^\circ\text{C}$ , $V_I = 7.5\text{ V}$ , $I_O = 0$	4.7	5	5.3	V
$V_O$	Output Voltage Range (Note 2)	$T_J = T_{\min}$ to $T_{\max}$ $P \leq P_{\max}$ $V_I = 7.5$ to $15\text{ V}$ $I_O = 0$ to $3\text{ A}$	4.6		5.4	V
$K_{VI}$	Line Regulation (Note 3)	$V_I = 7.5$ to $15\text{ V}$ $T_J = 25^\circ\text{C}$		5	25	mV
$K_{VO}$	Load Regulation (Note 3)	$I_O = 0$ to $3\text{ A}$ $V_I = 7.5\text{ V}$ $T_J = 25^\circ\text{C}$		25	100	mV
$I_{IB}$	Quiescent Current	$V_I = 7.5$ to $15\text{ V}$ $I_O = 0$ to $3\text{ A}$		12	20	mA
$V_{NO}$	Output Noise Voltage	$T_a = 25^\circ\text{C}$ $f = 10\text{ Hz}$ to $100\text{ KHz}$		40		$\mu\text{V}_{\text{rms}}$
$I_{OS}$	Short Circuit Current Limit	$V_I = 15\text{ V}$ $T_J = 25^\circ\text{C}$		3	4.5	A
		$V_I = 7.5\text{ V}$ $T_J = 25^\circ\text{C}$		4	5	
$K_{VH}$	Long Term Stability				35	mV

- Notes: 1. Although power dissipation is internally limited, specifications apply only for  $P \leq 30\text{W}$ .  
 2. Selected devices with tightened tolerance output voltage available.  
 3. Load and line regulation are specified at constant junction temperature. Pulse testing is required with a pulse width  $\leq 1\text{ms}$  and duty cycle  $\leq 5\%$ .

**Table 5: Electrical Characteristics Of LM323** ( $T_J = 0$  to  $150^\circ\text{C}$ , unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_O$	Output Voltage Range (Note 2)	$T_a = 25^\circ\text{C}$ , $V_I = 7.5\text{ V}$ , $I_O = 0$	4.8	5	5.2	V
$V_O$	Output Voltage Range (Note 2)	$T_J = T_{\min}$ to $T_{\max}$ $P \leq P_{\max}$ $V_I = 7.5$ to $15\text{ V}$ $I_O = 0$ to $3\text{ A}$	4.75		5.25	V
$K_{VI}$	Line Regulation (Note 3)	$V_I = 7.5$ to $15\text{ V}$ $T_J = 25^\circ\text{C}$		5	25	mV
$K_{VO}$	Load Regulation (Note 3)	$I_O = 0$ to $3\text{ A}$ $V_I = 7.5\text{ V}$ $T_J = 25^\circ\text{C}$		25	100	mV
$I_{IB}$	Quiescent Current	$V_I = 7.5$ to $15\text{ V}$ $I_O = 0$ to $3\text{ A}$		12	20	mA
$V_{NO}$	Output Noise Voltage	$T_a = 25^\circ\text{C}$ $f = 10\text{ Hz}$ to $100\text{ KHz}$		40		$\mu\text{V}_{\text{rms}}$
$I_{OS}$	Short Circuit Current Limit	$V_I = 15\text{ V}$ $T_J = 25^\circ\text{C}$		3	4.5	A
		$V_I = 7.5\text{ V}$ $T_J = 25^\circ\text{C}$		4	5	
$K_{VH}$	Long Term Stability				35	mV

- Notes: 1. Although power dissipation is internally limited, specifications apply only for  $P \leq 30\text{W}$ .  
 2. Selected devices with tightened tolerance output voltage available.  
 3. Load and line regulation are specified at constant junction temperature. Pulse testing is required with a pulse width  $\leq 1\text{ms}$  and duty cycle  $\leq 5\%$ .

Figure 2: Output Noise Voltage

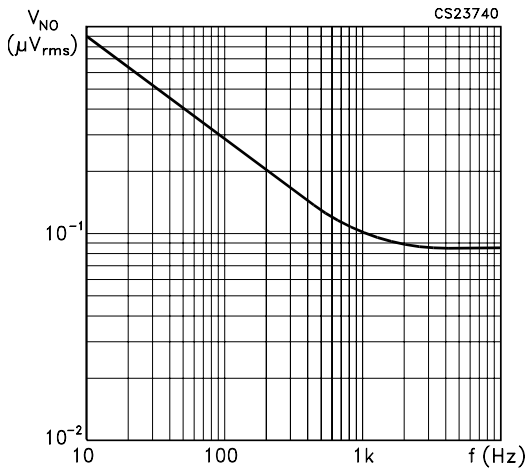


Figure 5: Short Circuit Current

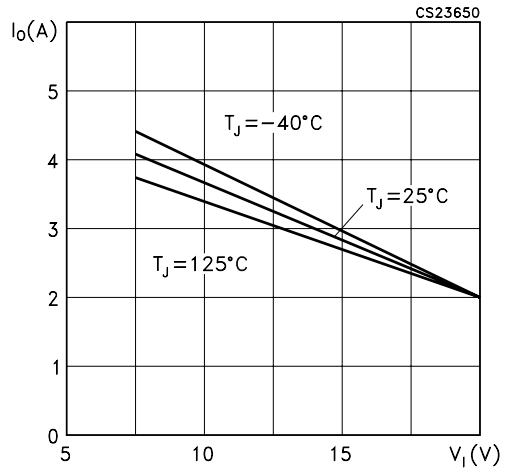


Figure 3: Output Impedance

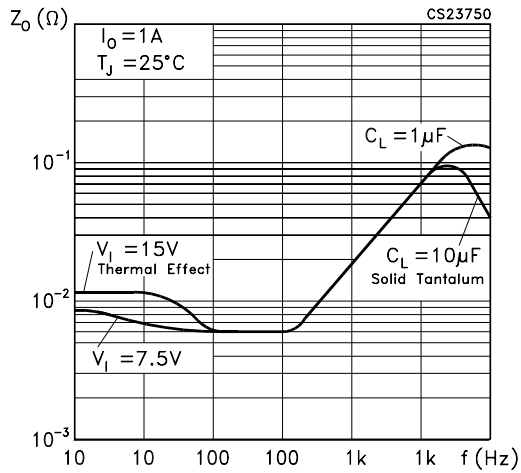


Figure 6: Ripple Rejection

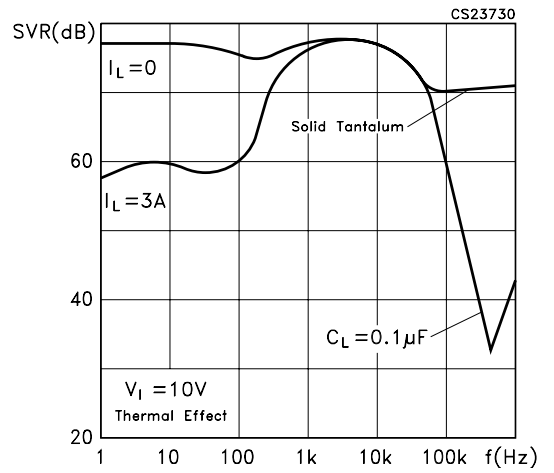


Figure 4: Peak Available Output Current

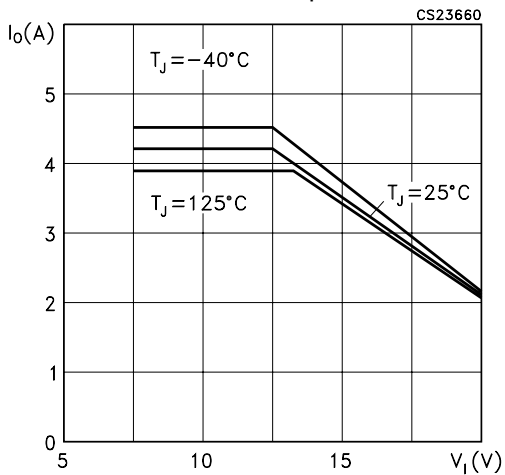
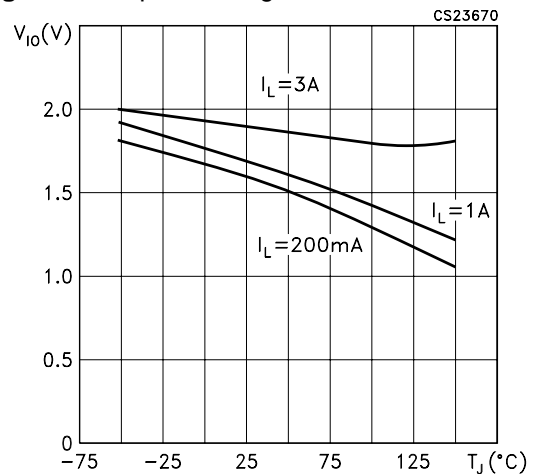
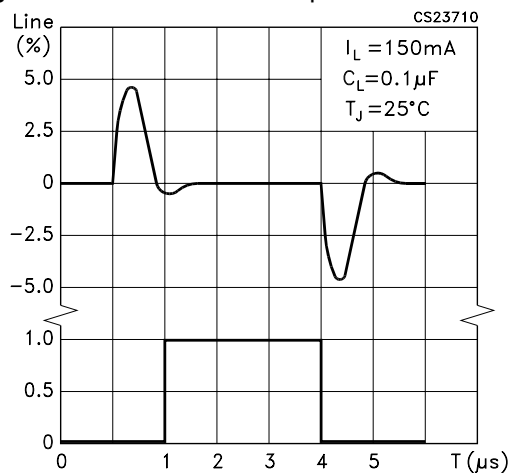


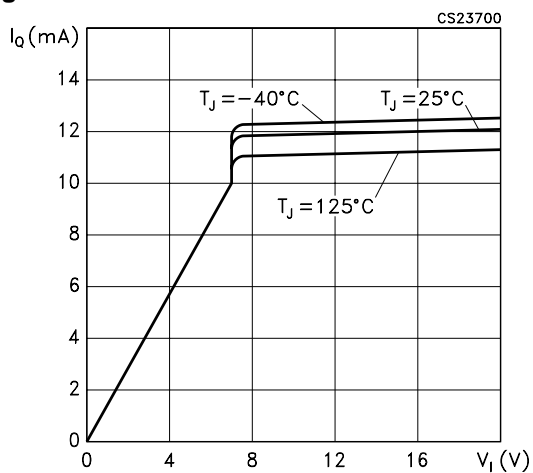
Figure 7: Dropout Voltage



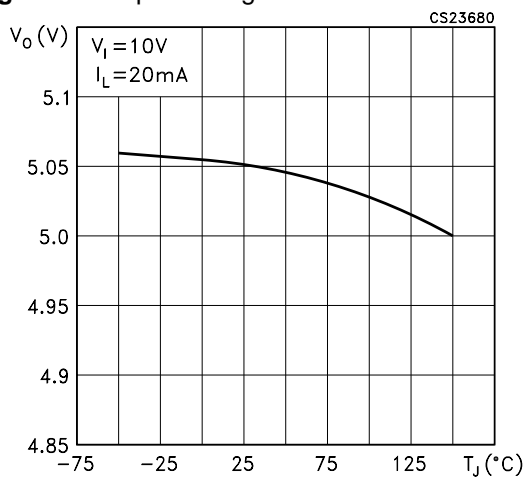
**Figure 8: Line Transient Response**



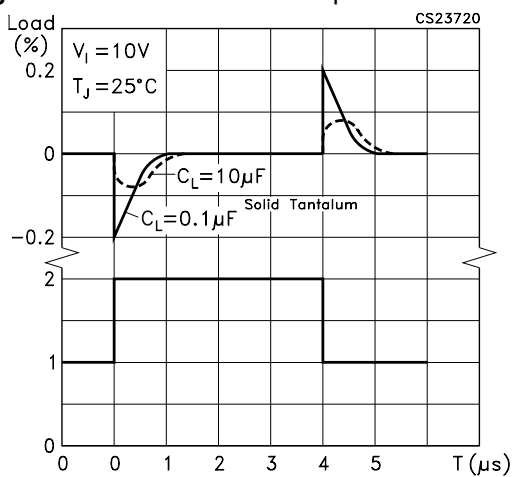
**Figure 10: Quiescent Current**



**Figure 9: Output Voltage**

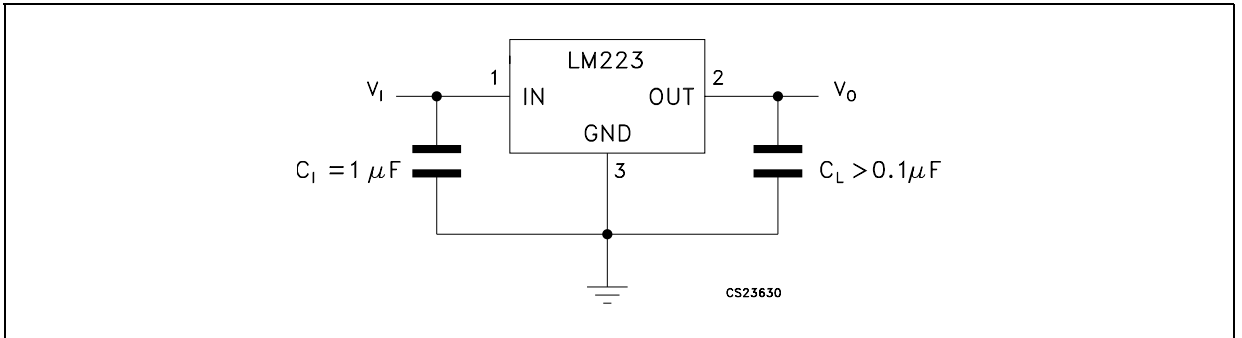


**Figure 11: Load Transient Response**



TYPICAL APPLICATION

Figure 12: Basic 3A Regulator



$C_1$  = Required if regulator is distant from filter capacitors.  
 $C_L$  = Regulator is stable with no load capacitor into resistive loads.

Figure 13: Trimming Output To 5V

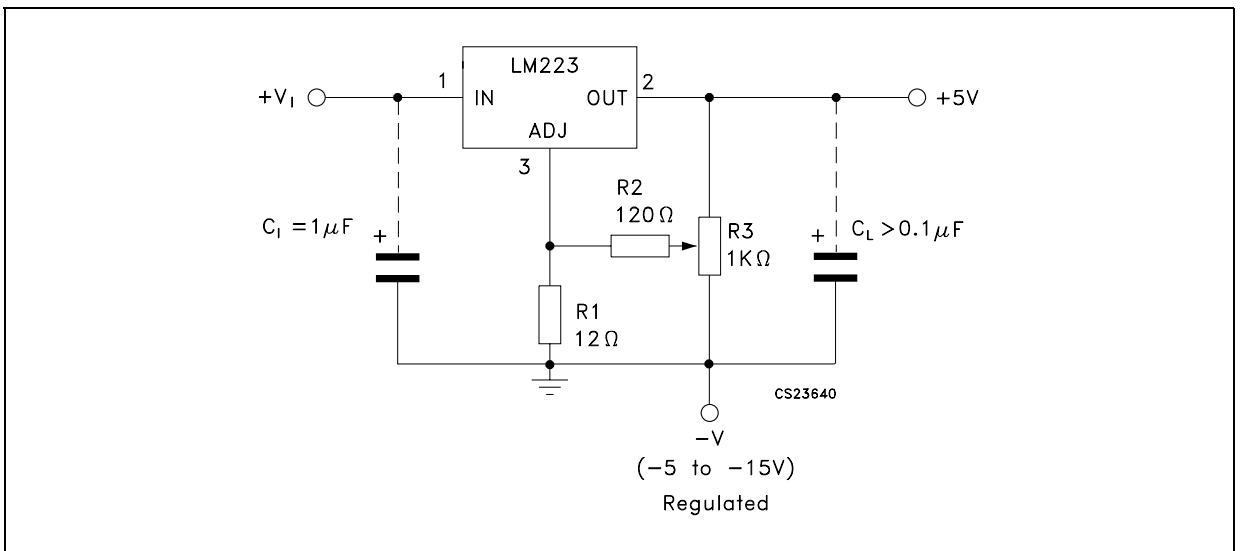
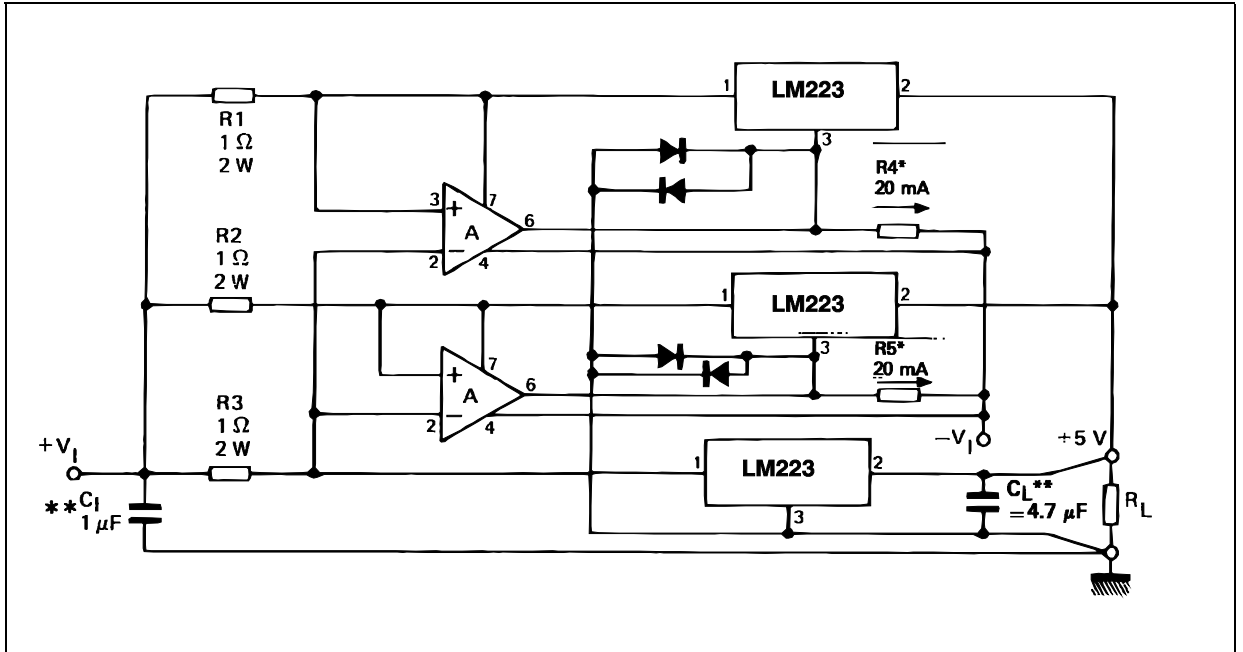
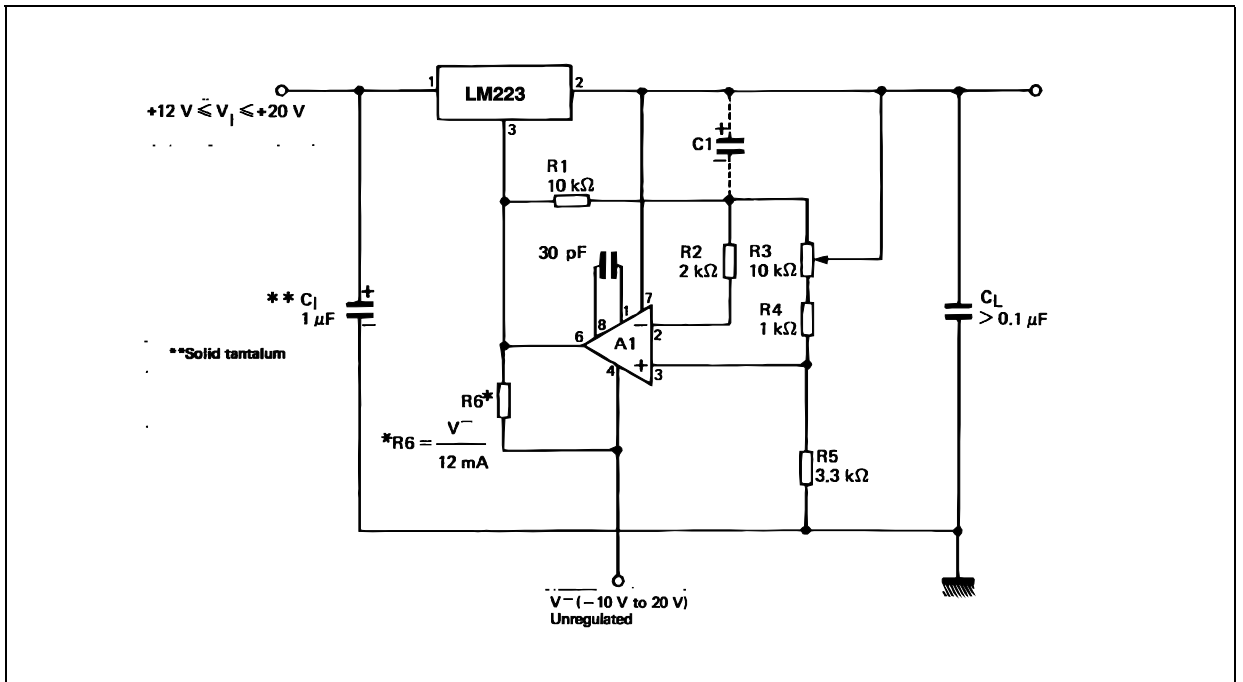


Figure 14: 10A Regulator With Complete Overload Protection



\* Selected for 20 mA current from unregulated negative supply.  
 \*\* Solid tantalum.  
 A = LM101A, LM201A, LM301A.

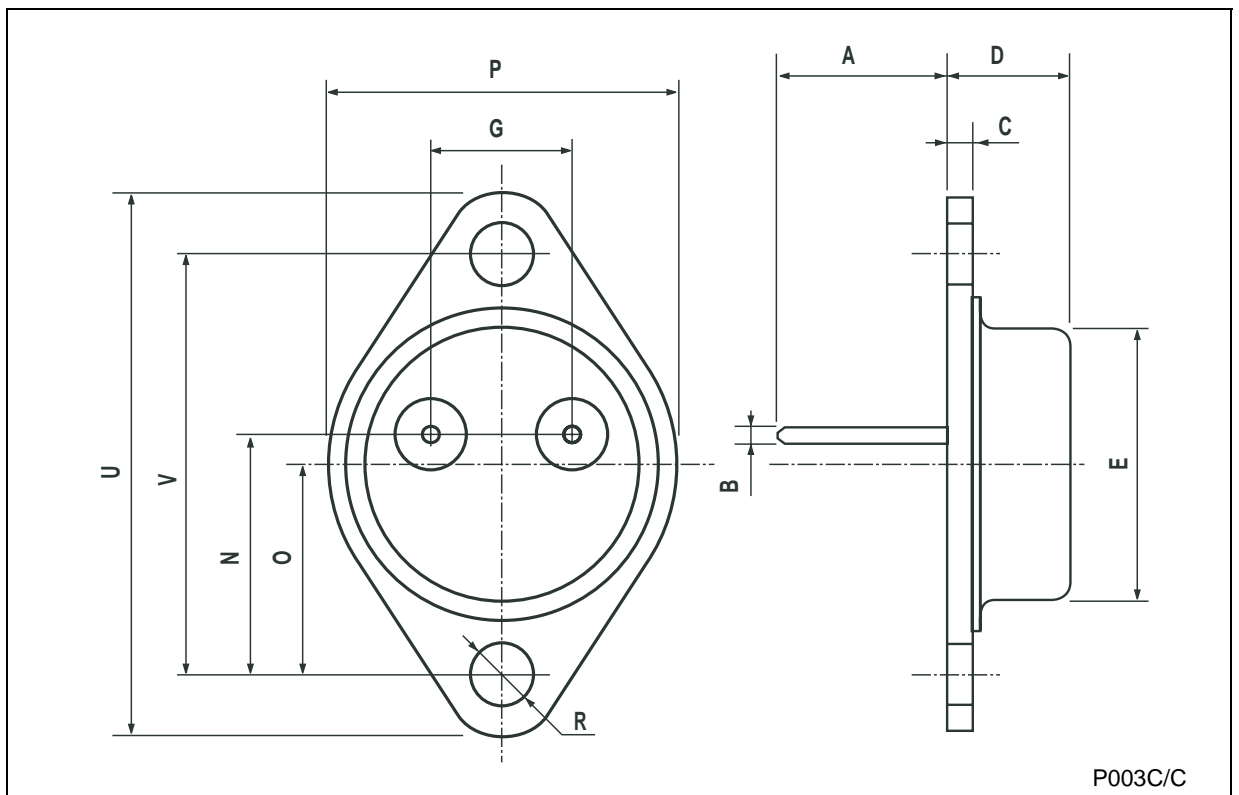
Figure 15: Adjustable Regulator 0 - 10V/3A



A1 = LM101A, LM201A, LM301A.  
 C1 = 2μF optional - improves ripple rejection, noise and transient response.

## TO-3 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		11.85			0.466	
B	0.96	1.05	1.10	0.037	0.041	0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.5			1.555
V		30.10			1.185	

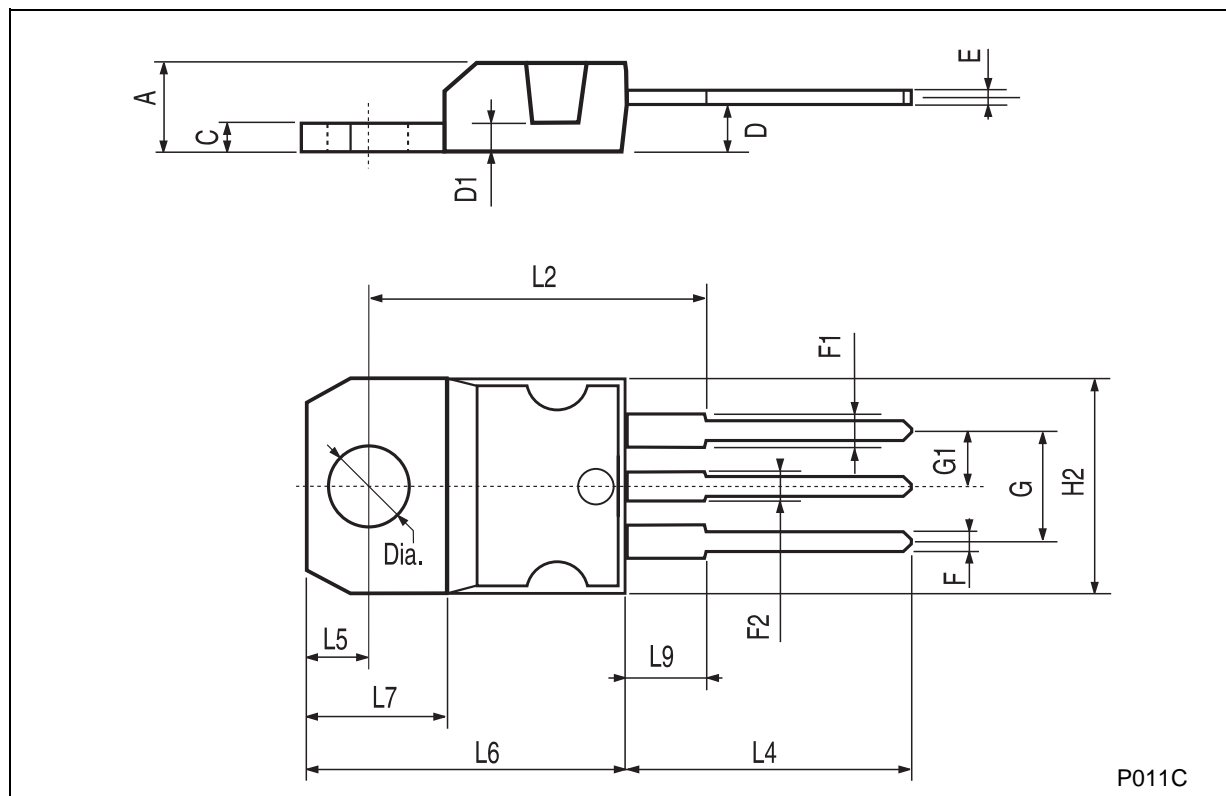


P003C/C



## TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



**Table 6: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
04-Nov-2005	3	Updated curves, no content change.

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