

Three-terminal 3 A adjustable voltage regulators

Features

- Output current: 3 A
- Internal current and thermal limiting
- Typical output impedance: 0.01 W
- Minimum input voltage: 7.5 V
- Power dissipation: 30 W

Description

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

The 3 A 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, 1 A regulator. An overall worst case specification for the combined effects of input voltage, load current, ambient temperature, and power dissipation ensure that the LM323 will perform satisfactorily as a system element.

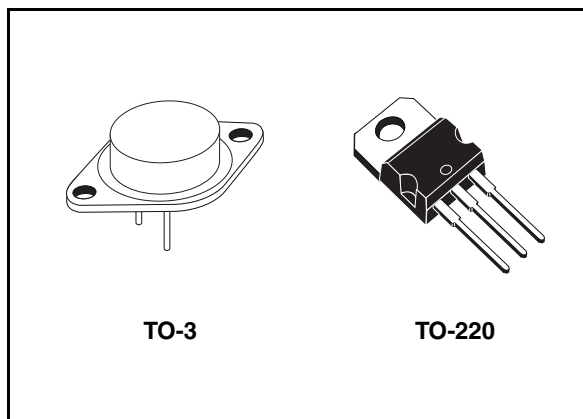


Table 1. Device summary

Order codes		Temperature range
TO-220	TO-3	
LM323T	LM323K	0°C to 125°C

Contents

1 **Diagram 3**

2 **Pin configuration 4**

3 **Maximum ratings 5**

4 **Electrical characteristics 6**

5 **Typical characteristics 7**

6 **Typical application 9**

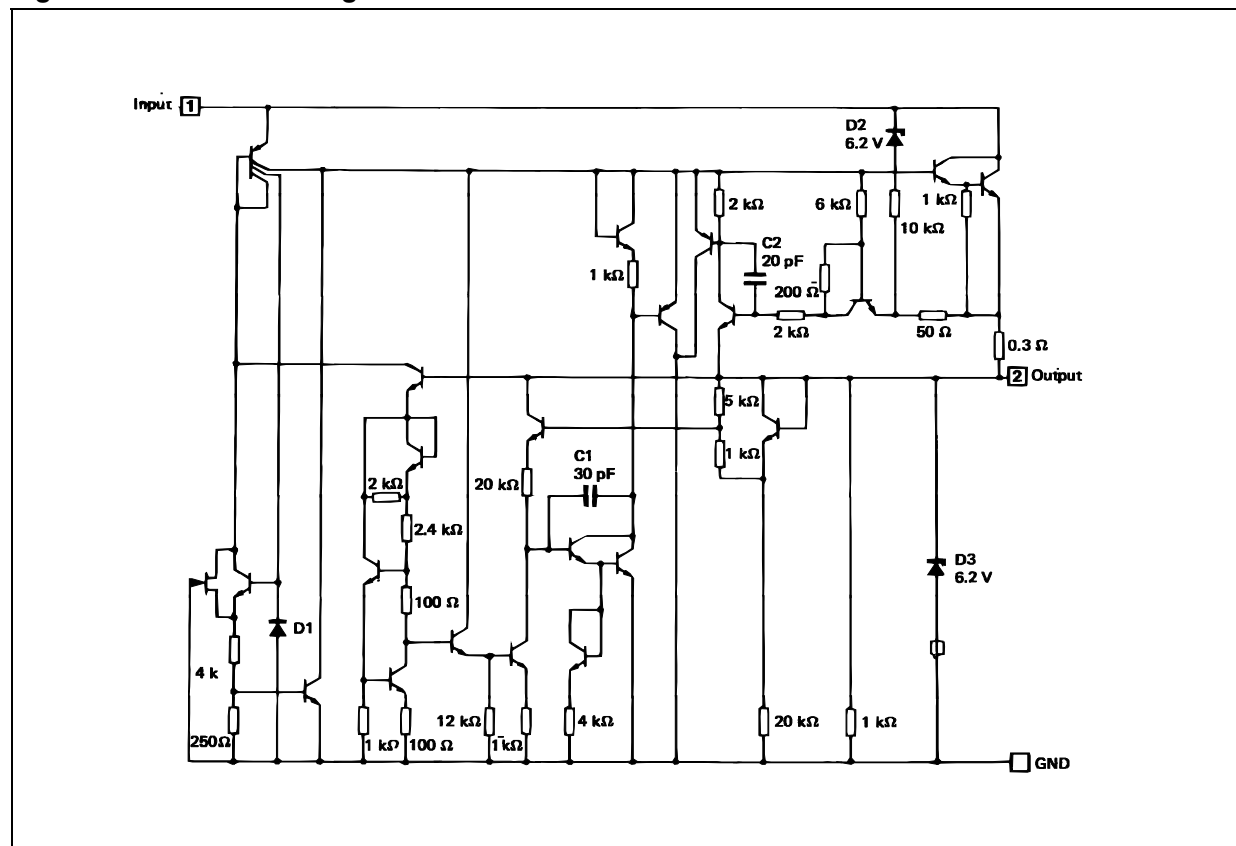
7 **Package mechanical data 11**

8 **Revision history 14**



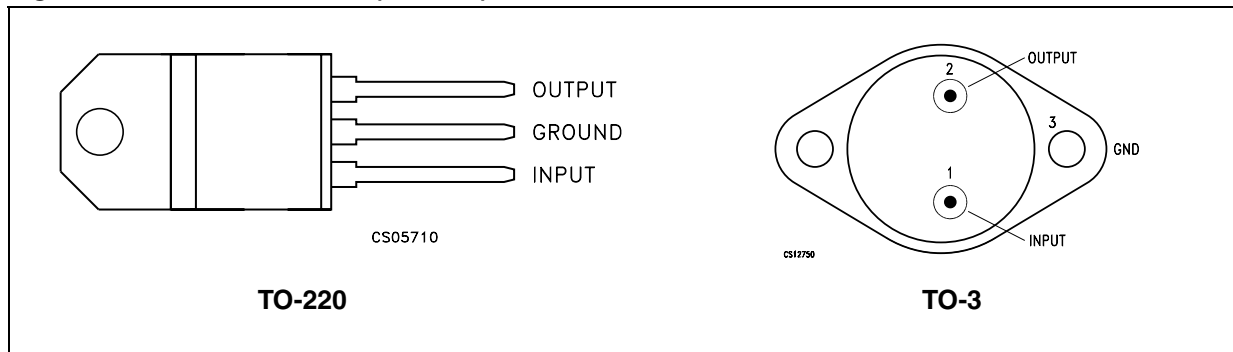
1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

Figure 2. Pin connections (tot view)



3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	Input voltage	20	V
I_O	Output current	Internally limited	
P_D	Power dissipation	Internally limited	
T_{STG}	Storage temperature range	-65 to 150	°C
T_{OP}	Operating junction temperature range	0 to 125	°C

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied

Table 3. Thermal data

Symbol	Parameter	TO-220	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	3	2	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	35	°C/W

4 Electrical characteristics

Table 4. Electrical characteristics ($T_J = 0$ to 150°C , unless otherwise specified ⁽¹⁾)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage rang ⁽²⁾	$T_J = 25^\circ\text{C}$, $V_I = 7.5\text{ V}$, $I_O = 0$	4.8	5	5.2	V
V_O	Output voltage range ⁽²⁾	$T_J = T_{\min}$ to $T_{\max}$, $P \leq P_{\max}$ $V_I = 7.5$ to 15 V , $I_O = 0$ to 3 A	4.75		5.25	V
K_{VI}	Line regulation ⁽³⁾	$V_I = 7.5$ to 15 V , $T_J = 25^\circ\text{C}$		5	25	mV
K_{VO}	Load regulation (Note 3)	$I_O = 0$ to 3 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 V , $I_O = 0$ to 3 A		12	20	mA
V_{NO}	Output noise voltage	$T_J = 25^\circ\text{C}$, $f = 10\text{ Hz}$ to 100 kHz		40		μV_{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

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 $\leq 5\%$.

5 Typical characteristics

Figure 3. Output noise voltage

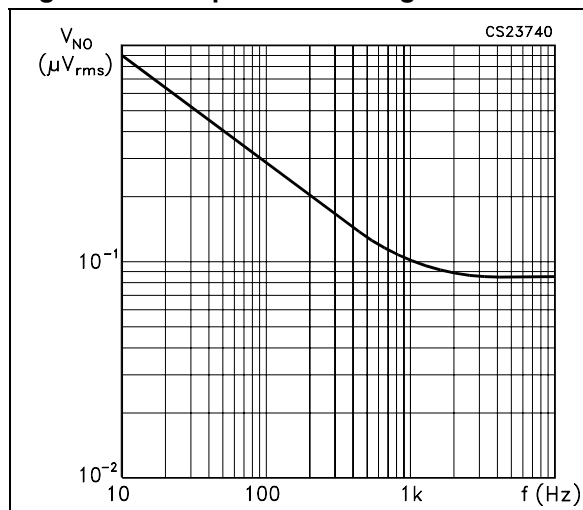


Figure 4. Output impedance

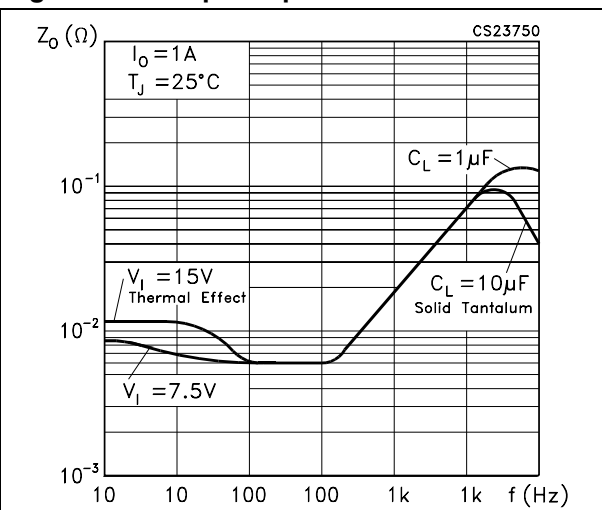


Figure 5. Peak available output current

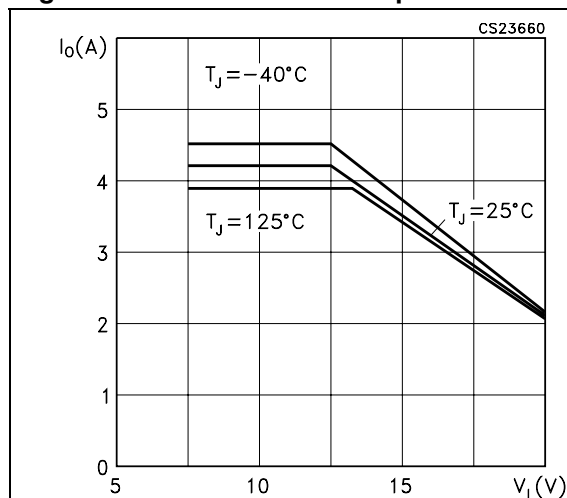


Figure 6. Short circuit current

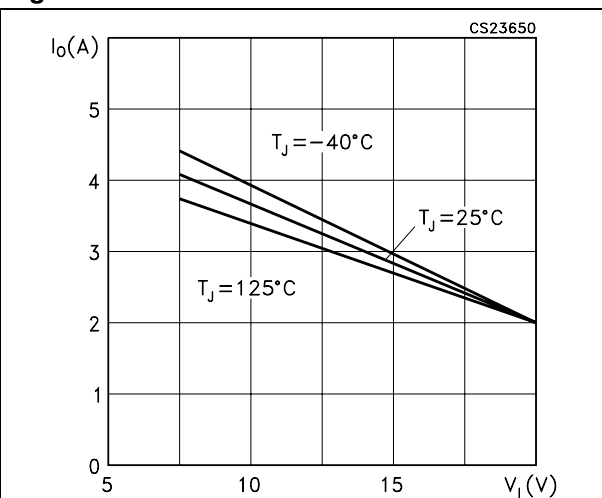


Figure 7. Ripple rejection

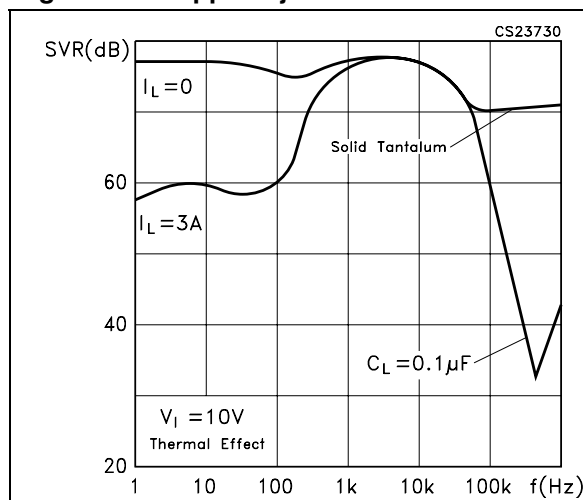


Figure 8. Dropout voltage

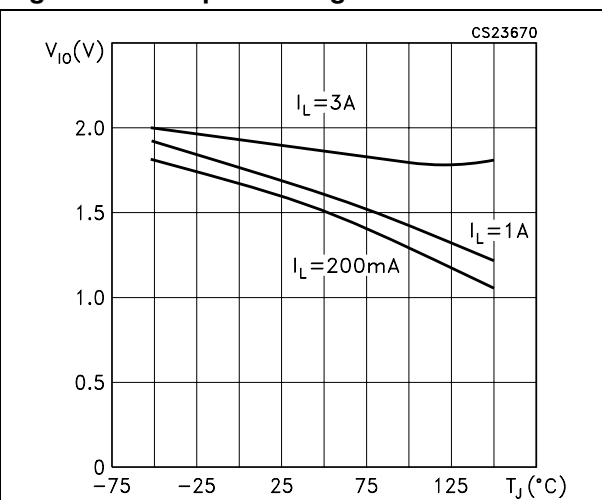


Figure 9. Line transient response

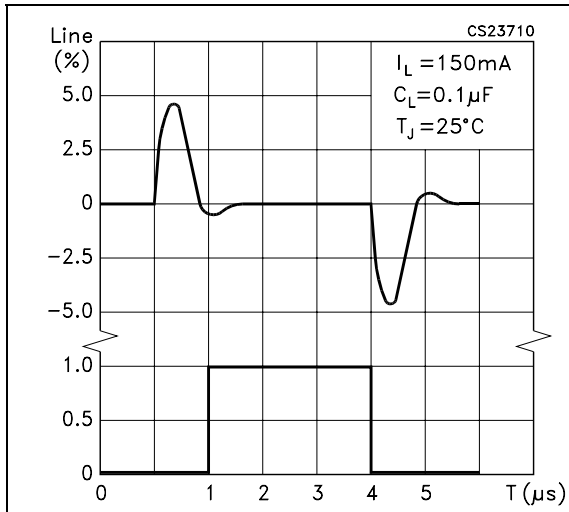


Figure 10. Output voltage

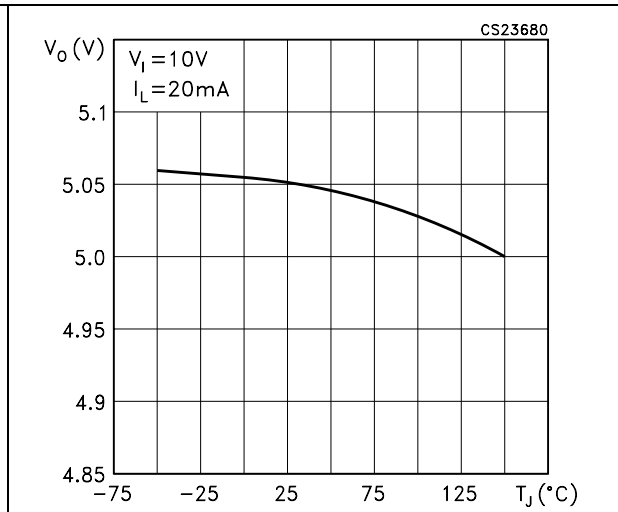


Figure 11. Quiescent current

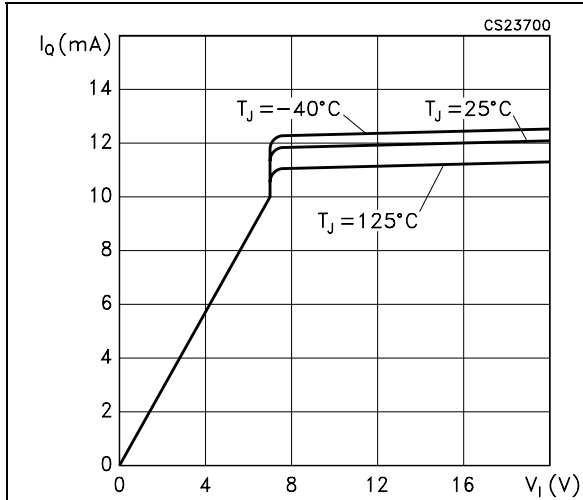
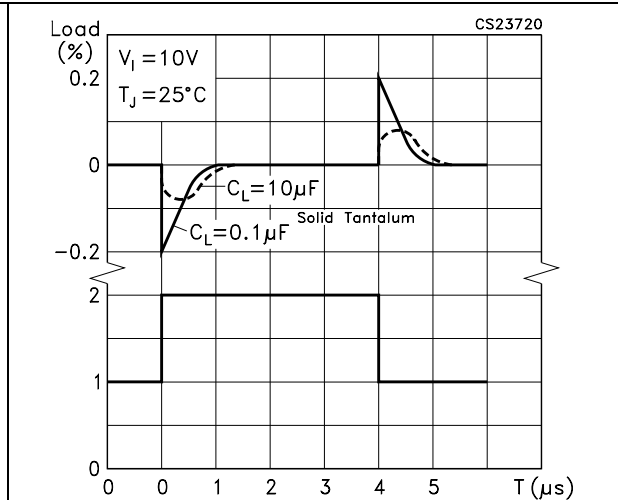
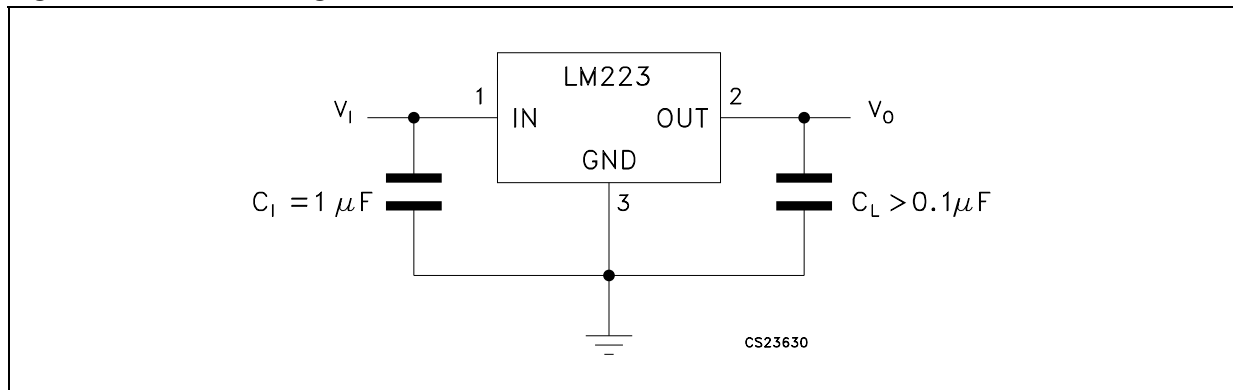


Figure 12. Load transient response



6 Typical application

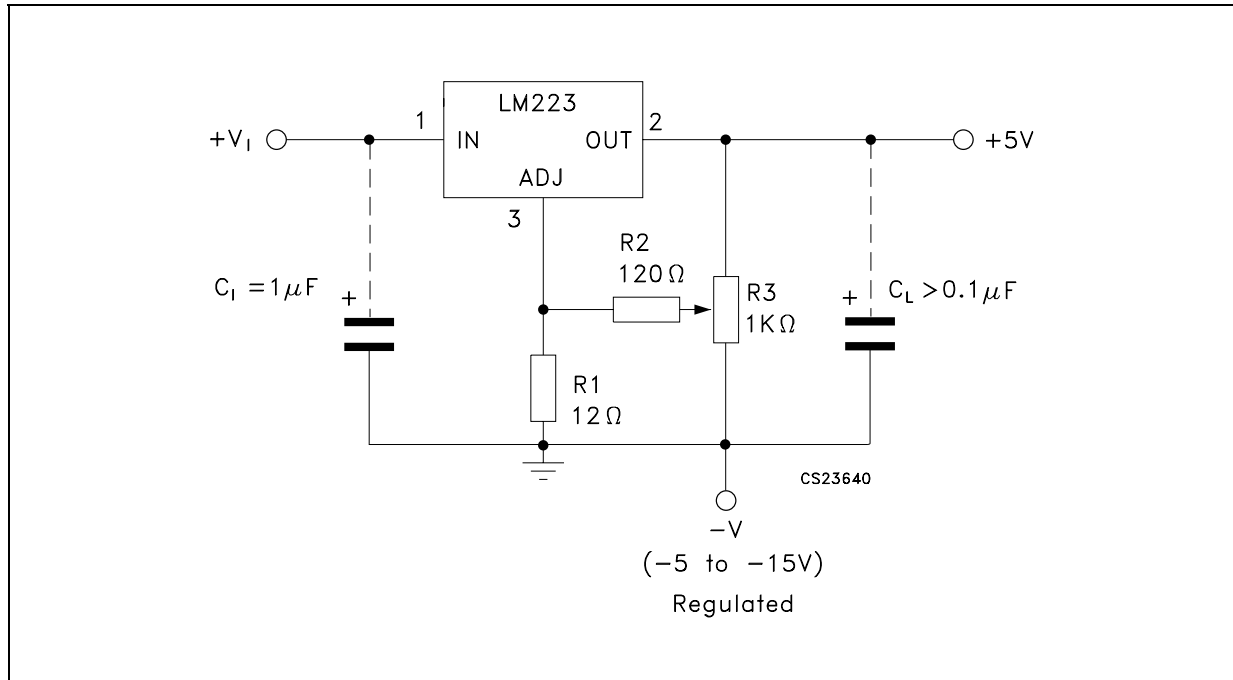
Figure 13. Basic 3 A regulator



C_I = Required if regulator is distant from filter capacitors.

C_L = Regulator is stable with no load capacitor into resistive loads.

Figure 14. Trimming output to 5 V



[illegible]

A = LM101A, LM201A, LM301A.

The circuit diagram shows an LM223 operational amplifier configured as a precision current source. The non-inverting input (+) is connected to ground through resistor R5 (3.3 kΩ). The inverting input (-) is connected to the output through feedback resistor R4 (1 kΩ) and to a reference voltage V₋ through resistor R6*. Resistor R1 (10 kΩ) connects the output to the non-inverting input. A compensation capacitor C1 is connected between the output and the inverting input. The output is also connected to a load capacitor C_L. The supply voltage is +12 V ≤ V_I ≤ +20 V. The input voltage V₋ ranges from -10 V to 20 V and is unregulated.

Component Values:

- R1: 10 kΩ
- R2: 2 kΩ
- R3: 10 kΩ
- R4: 1 kΩ
- R5: 3.3 kΩ
- R6*: $\frac{V_-}{12 \text{ mA}}$
- C1: 30 pF
- C_L: > 0.1 μF

Equations:

- Output Current: $I_{out} = \frac{V_-}{R_6^*}$
- Input Resistance: $R_i = R_5 + R_4 + R_3 + R_2 + R_1$

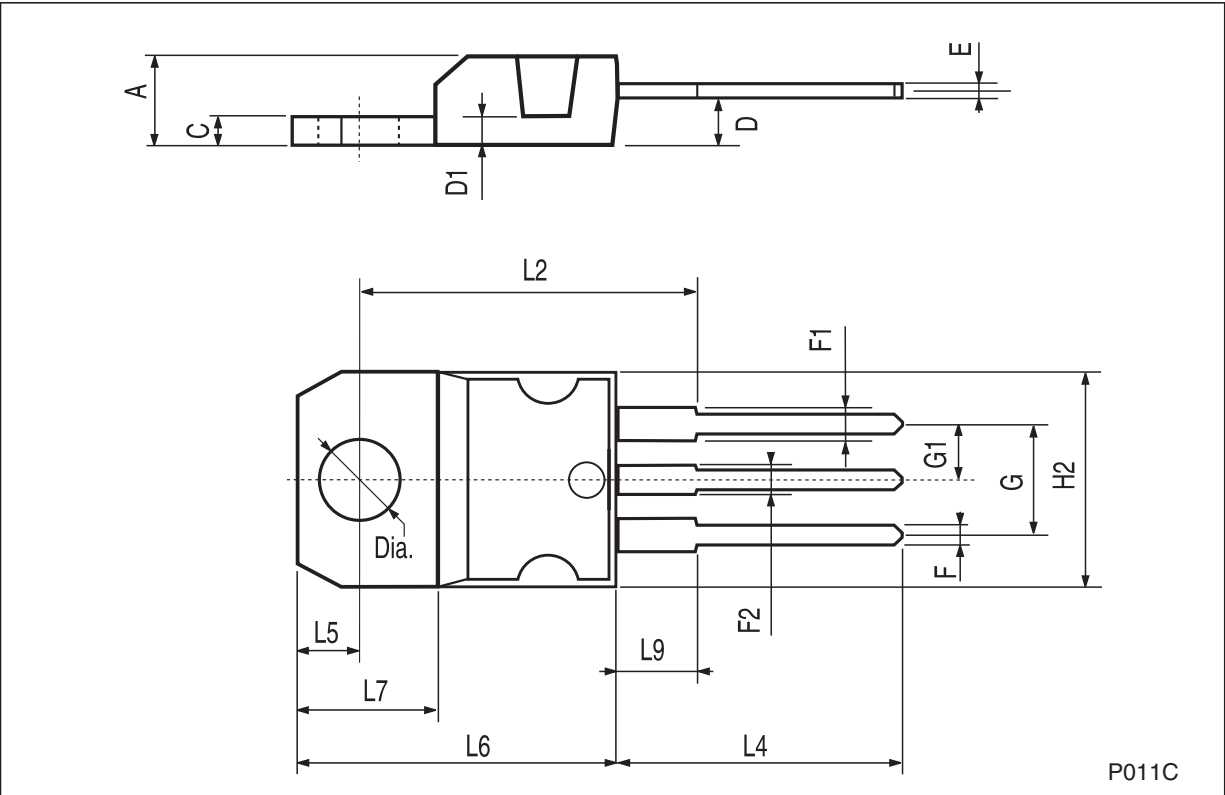
$C_1 = 2 \mu F$ optional - improves ripple rejection, noise and transient response.

7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK[®] packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

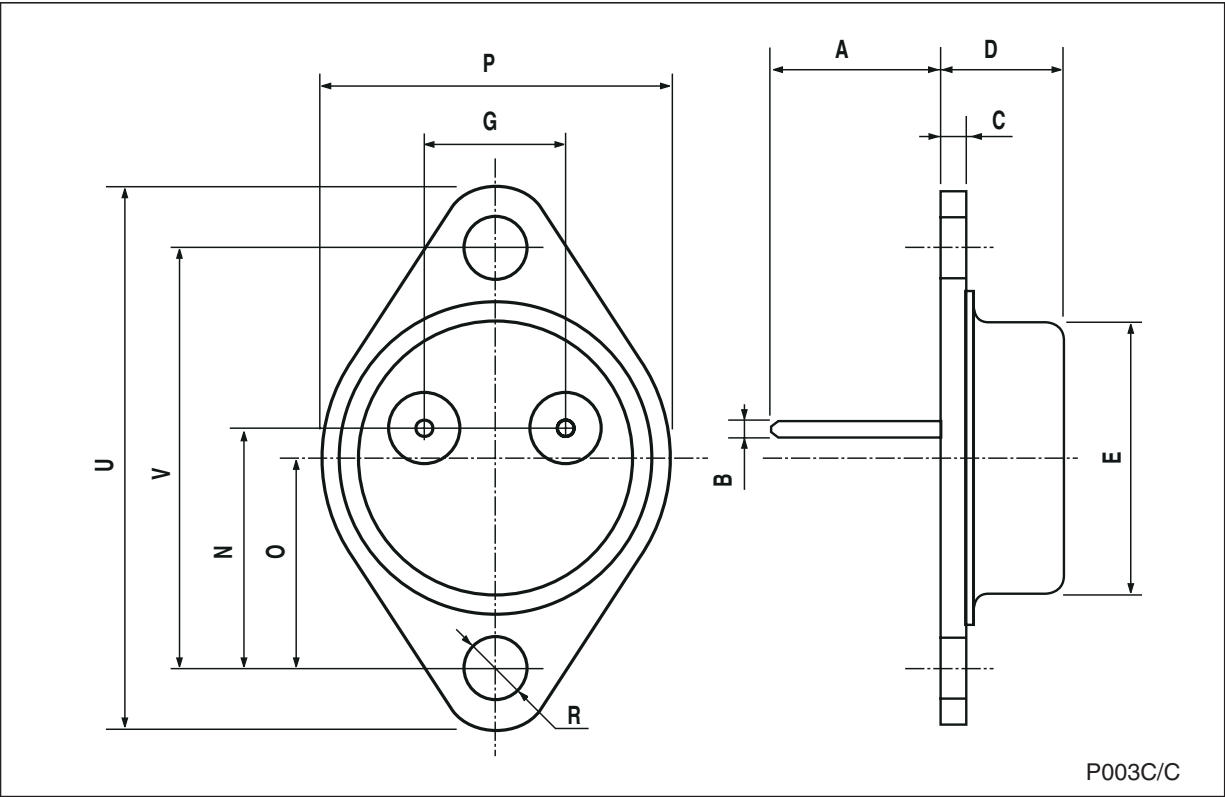
TO-220 mechanical data

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



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	



8 Revision history

Table 5. Document revision history

Date	Revision	Changes
04-Nov-2005	3	Updated curves, no content change.
12-Feb-2008	4	Added: Table 1 on page 1 .

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2008 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com