

Positive voltage regulators

Features

- Output current to 1.5 A
- Output voltages of 5; 5.2; 6; 8; 8.5; 9; 10; 12; 15; 18; 20; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection

Description

The L78xx series of three-terminal positive regulators is available in TO-220, TO-220FP, TO-3 and D²PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

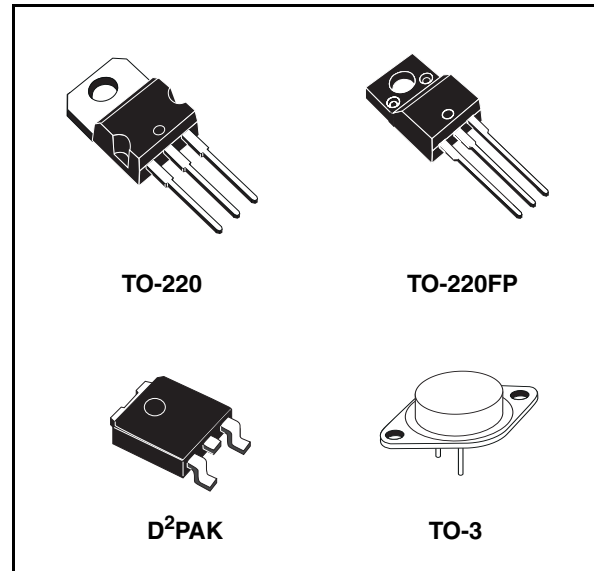


Table 1. Device summary

Order codes	
L7805	L7810C
L7805C	L7812C
L7852C	L7815C
L7806C	L7818C
L7808C	L7820C
L7885C	L7824C
L7809C	

Contents

1	Diagram	5
2	Pin configuration	6
3	Maximum ratings	7
4	Test circuits	9
5	Electrical characteristics	11
6	Typical performance	31
7	Package mechanical data	41
8	Order code	50
9	Revision history	51

List of figures

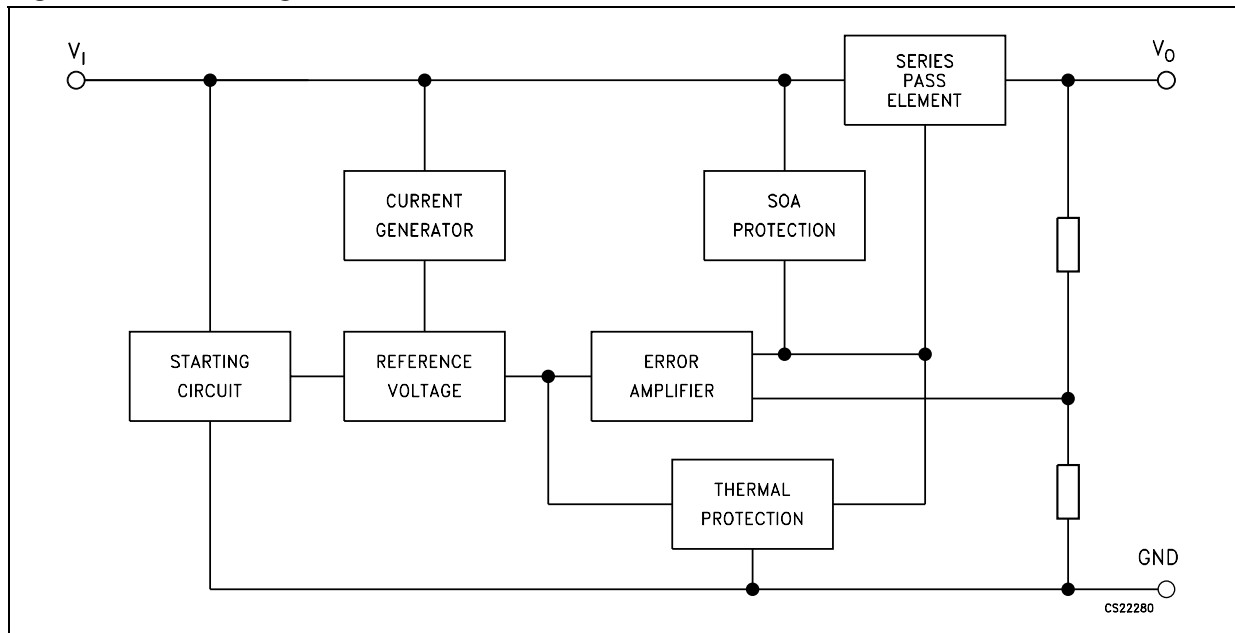
Figure 1.	Block diagram	5
Figure 2.	Pin connections (top view)	6
Figure 3.	Schematic diagram	6
Figure 4.	Application circuits	8
Figure 5.	DC Parameter	9
Figure 6.	Load regulation	9
Figure 7.	Ripple rejection	10
Figure 8.	Dropout voltage vs junction temperature	31
Figure 9.	Peak output current vs input/output differential voltage	31
Figure 10.	Supply voltage rejection vs frequency	31
Figure 11.	Output voltage vs junction temperature	31
Figure 12.	Output impedance vs frequency	31
Figure 13.	Quiescent current vs junction temp.	31
Figure 14.	Load transient response	32
Figure 15.	Line transient response	32
Figure 16.	Quiescent current vs input voltage	32
Figure 17.	Fixed output regulator	32
Figure 18.	Current regulator	33
Figure 19.	Circuit for increasing output voltage	33
Figure 20.	Adjustable output regulator (7 to 30 V)	33
Figure 21.	0.5 to 10 V Regulator	34
Figure 22.	High current voltage regulator	34
Figure 23.	High output current with short circuit protection	34
Figure 24.	Tracking voltage regulator	35
Figure 25.	Split power supply ($\pm 15\text{ V} - 1\text{ A}$)	35
Figure 26.	Negative output voltage circuit	36
Figure 27.	Switching regulator	36
Figure 28.	High input voltage circuit.	36
Figure 29.	High input voltage circuit.	37
Figure 30.	High output voltage regulator	37
Figure 31.	High input and output voltage	37
Figure 32.	Reducing power dissipation with dropping resistor	38
Figure 33.	Remote shutdown	38
Figure 34.	Power AM modulator (unity voltage gain, $I_O \leq 0.5$)	38
Figure 35.	Adjustable output voltage with temperature compensation	39
Figure 36.	Light controllers ($V_{Omin} = V_{XX} + V_{BE}$)	39
Figure 37.	Protection against input short-circuit with high capacitance loads	40
Figure 38.	Drawing dimension D ² PAK (type STD-ST)	45
Figure 39.	Drawing dimension D ² PAK (type WOOSEOK-SUBCON.)	46
Figure 40.	D ² PAK footprint recommended data	48

List of tables

Table 1.	Device summary	1
Table 2.	Absolute maximum ratings	7
Table 3.	Thermal data	7
Table 4.	Electrical characteristics of L7805 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 10\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	11
Table 5.	Electrical characteristics of L7806 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 11\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	12
Table 6.	Electrical characteristics of L7808 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 14\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	13
Table 7.	Electrical characteristics of L7812 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 19\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	14
Table 8.	Electrical characteristics of L7815 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 23\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	15
Table 9.	Electrical characteristics of L7818 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 26\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	16
Table 10.	Electrical characteristics of L7820 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 28\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	17
Table 11.	Electrical characteristics of L7824 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 33\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	18
Table 12.	Electrical characteristics of L7805C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 10\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	19
Table 13.	Electrical characteristics of L7852C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 10\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	20
Table 14.	Electrical characteristics of L7806C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 11\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	21
Table 15.	Electrical characteristics of L7808C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 14\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	22
Table 16.	Electrical characteristics of L7885C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 14.5\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	23
Table 17.	Electrical characteristics of L7809C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 15\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	24
Table 18.	Electrical characteristics of L7810C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 15\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	25
Table 19.	Electrical characteristics of L7812C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 19\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	26
Table 20.	Electrical characteristics of L7815C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 23\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	27
Table 21.	Electrical characteristics of L7818C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 26\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	28
Table 22.	Electrical characteristics of L7820C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 28\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	29
Table 23.	Electrical characteristics of L7824C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 33\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$ unless otherwise specified)	30
Table 24.	D ² PAK mechanical data	47
Table 25.	Footprint data	48
Table 26.	Order code	50
Table 27.	Revision history	51

1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)

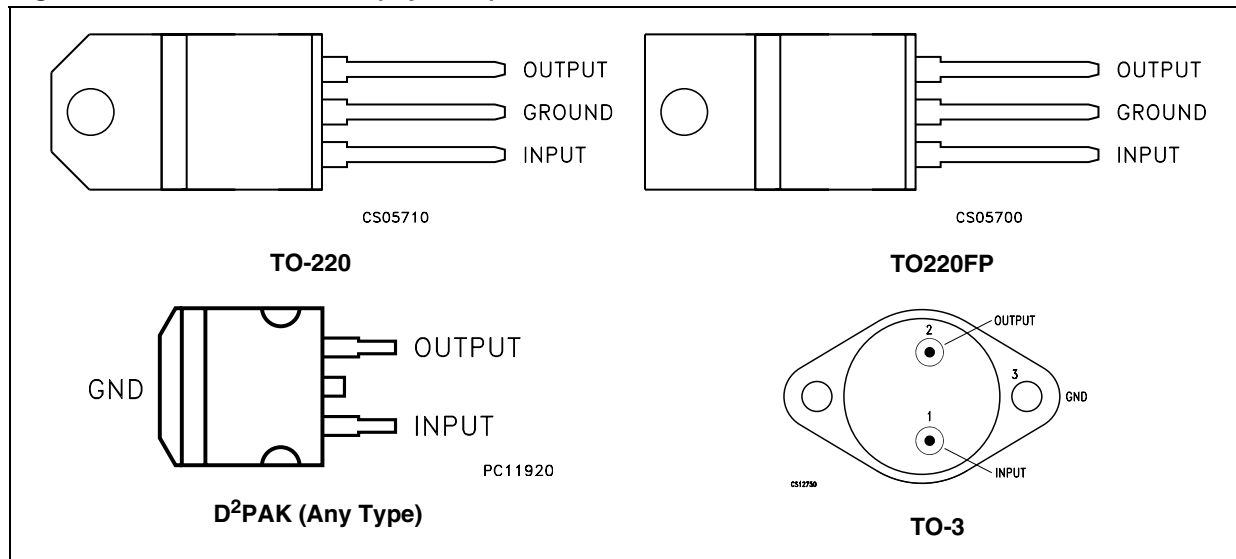
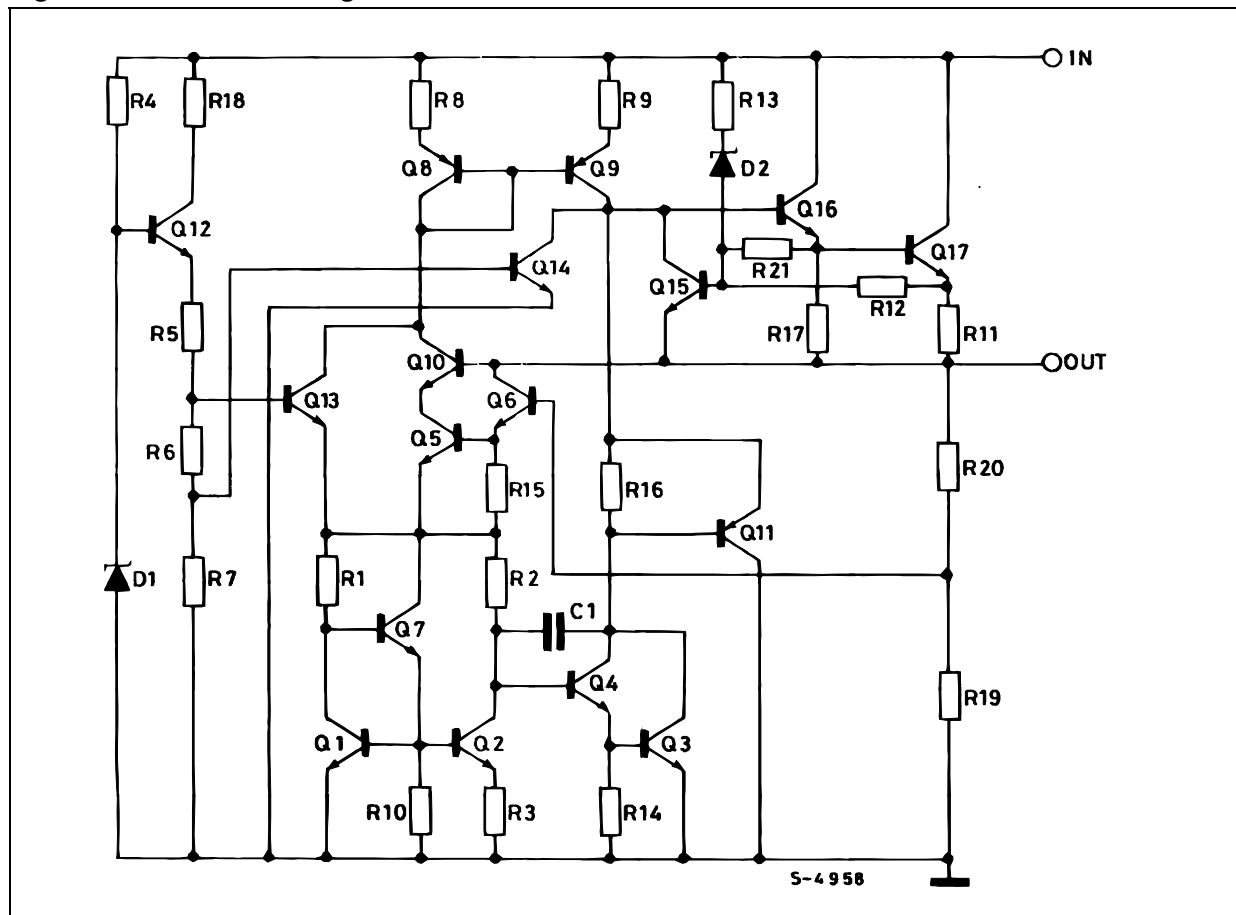


Figure 3. Schematic diagram



3 Maximum ratings

Table 2. Absolute maximum ratings

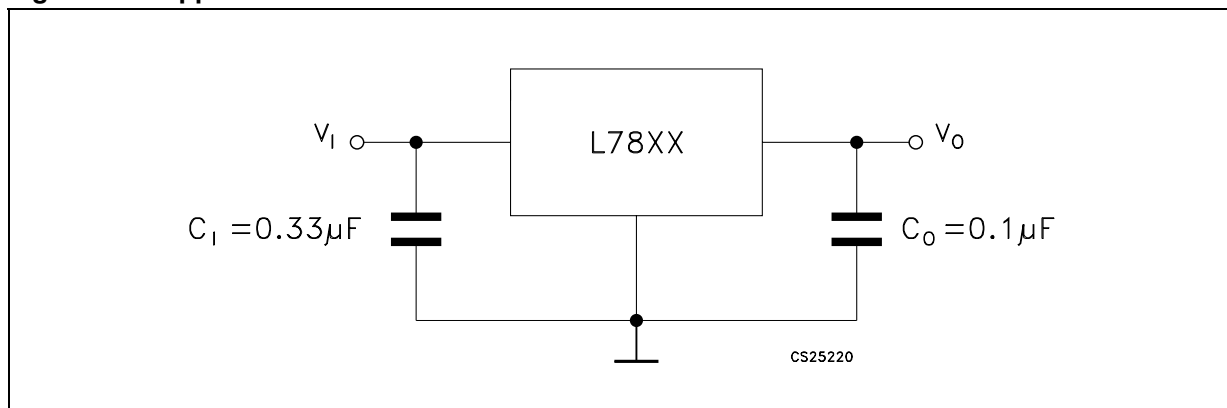
Symbol	Parameter		Value	Unit
V_I	DC Input voltage	for $V_O = 5$ to 18 V	35	V
		for $V_O = 20, 24$ V	40	
I_O	Output current		Internally Limited	
P_D	Power dissipation		Internally Limited	
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range	for L7800	-55 to 150	°C
		for L7800C	0 to 150	

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	D ² PAK	TO-220	TO-220FP	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	3	5	5	4	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	50	60	35	°C/W

Figure 4. Application circuits



4 Test circuits

Figure 5. DC Parameter

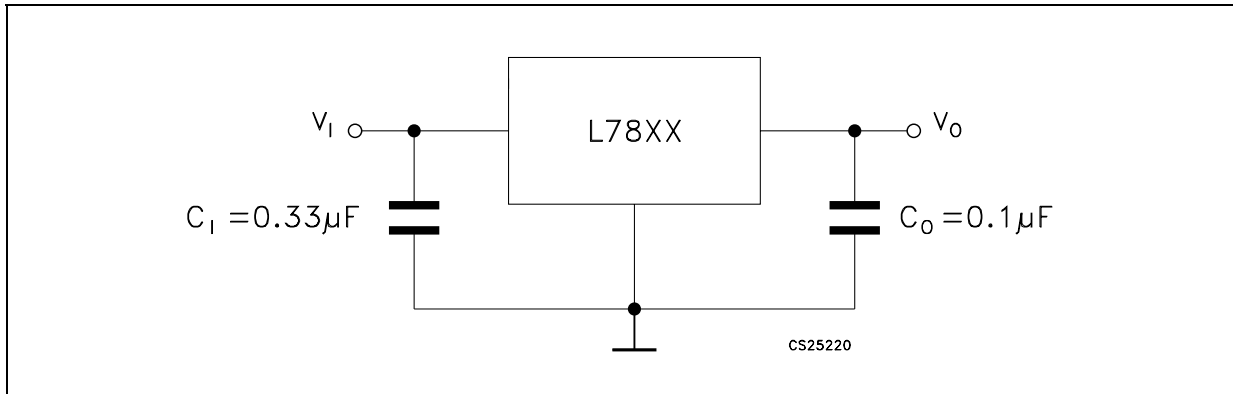


Figure 6. Load regulation

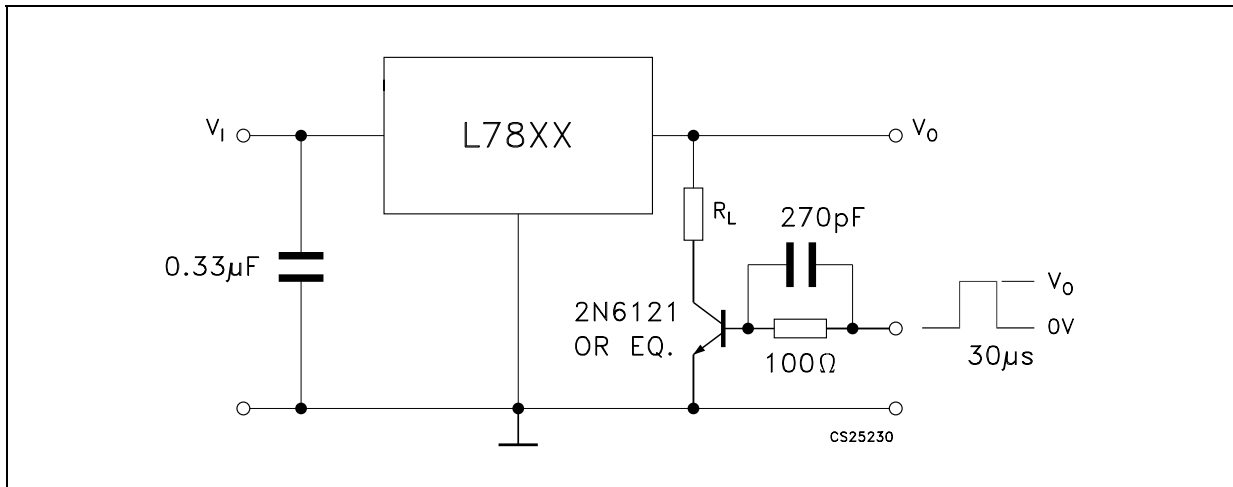
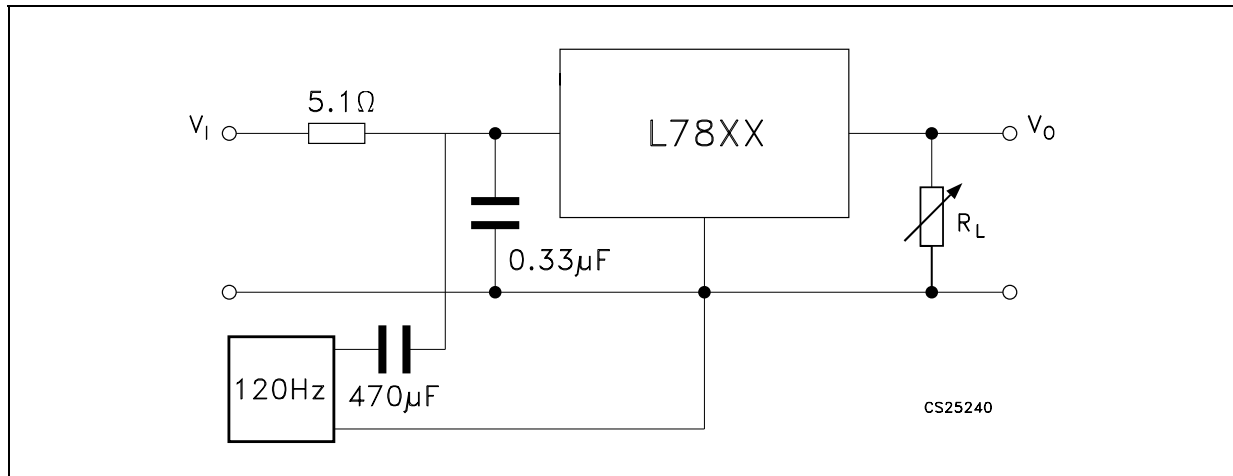


Figure 7. Ripple rejection



5 Electrical characteristics

Table 4. Electrical characteristics of L7805 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 10$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	4.8	5	5.2	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 8$ to 20 V	4.65	5	5.35	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 7$ to 25 V, $T_J = 25^\circ\text{C}$		3	50	mV
		$V_I = 8$ to 12 V, $T_J = 25^\circ\text{C}$		1	25	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			25	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 8$ to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		0.6		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 8$ to 18 V, $f = 120$ Hz	68			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 5. Electrical characteristics of L7806 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 11$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	5.75	6	6.25	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 9$ to 21 V	5.65	6	6.35	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 8$ to 25 V, $T_J = 25^\circ\text{C}$			60	mV
		$V_I = 9$ to 13 V, $T_J = 25^\circ\text{C}$			30	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			30	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 9$ to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		0.7		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 9$ to 19 V, $f = 120$ Hz	65			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		19		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 6. Electrical characteristics of L7808 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	7.7	8	8.3	V
V_O	Output voltage	$I_O = 5\text{ mA to }1\text{ A}$, $P_O \leq 15\text{ W}$ $V_I = 11.5\text{ to }23\text{ V}$	7.6	8	8.4	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 10.5\text{ to }25\text{ V}$, $T_J = 25^\circ\text{C}$			80	mV
		$V_I = 11\text{ to }17\text{ V}$, $T_J = 25^\circ\text{C}$			40	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5\text{ mA to }1.5\text{ A}$, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250\text{ to }750\text{ mA}$, $T_J = 25^\circ\text{C}$			40	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 11.5\text{ to }21.5\text{ V}$, $f = 120\text{ Hz}$	62			dB
V_d	Dropout voltage	$I_O = 1\text{ A}$, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 7. Electrical characteristics of L7812 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 19$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	11.5	12	12.5	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 15.5$ to 27 V	11.4	12	12.6	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 14.5$ to 30 V, $T_J = 25^\circ\text{C}$			120	mV
		$V_I = 16$ to 22 V, $T_J = 25^\circ\text{C}$			60	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			60	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 15$ to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		1.5		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 15$ to 25 V, $f = 120$ Hz	61			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		18		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 8. Electrical characteristics of L7815 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 23$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	14.4	15	15.6	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 18.5$ to 30 V	14.25	15	15.75	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 17.5$ to 30 V, $T_J = 25^\circ\text{C}$			150	mV
		$V_I = 20$ to 26 V, $T_J = 25^\circ\text{C}$			75	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			150	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			75	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 18.5$ to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		1.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 18.5$ to 28.5 V, $f = 120$ Hz	60			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		19		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 9. Electrical characteristics of L7818 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 26$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	17.3	18	18.7	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 22$ to 33 V	17.1	18	18.9	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 21$ to 33 V, $T_J = 25^\circ\text{C}$			180	mV
		$V_I = 24$ to 30 V, $T_J = 25^\circ\text{C}$			90	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			90	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 22$ to 33 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		2.3		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 22$ to 32 V, $f = 120$ Hz	59			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		22		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 10. Electrical characteristics of L7820 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 28$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	19.2	20	20.8	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 24$ to 35 V	19	20	21	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 22.5$ to 35 V, $T_J = 25^\circ\text{C}$			200	mV
		$V_I = 26$ to 32 V, $T_J = 25^\circ\text{C}$			100	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			200	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			100	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 24$ to 35 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		2.5		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 24$ to 35 V, $f = 120$ Hz	58			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		24		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 11. Electrical characteristics of L7824 (refer to the test circuits, $T_J = -55$ to 150°C , $V_I = 33$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	23	24	25	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 28$ to 38 V	22.8	24	25.2	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 27$ to 38 V, $T_J = 25^\circ\text{C}$			240	mV
		$V_I = 30$ to 36 V, $T_J = 25^\circ\text{C}$			120	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			120	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 28$ to 38 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		3		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$			40	$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 28$ to 38 V, $f = 120$ Hz	56			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2	2.5	V
R_O	Output resistance	$f = 1$ KHz		28		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75	1.2	A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$	1.3	2.2	3.3	A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 12. Electrical characteristics of L7805C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 10$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	4.8	5	5.2	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 7$ to 20 V	4.75	5	5.25	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 7$ to 25 V, $T_J = 25^\circ\text{C}$		3	100	mV
		$V_I = 8$ to 12 V, $T_J = 25^\circ\text{C}$		1	50	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			50	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 7$ to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1.1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		40		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 8$ to 18 V, $f = 120$ Hz	62			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 13. Electrical characteristics of L7852C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 10$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	5.0	5.2	5.4	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 8$ to 20 V	4.95	5.2	5.45	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 7$ to 25 V, $T_J = 25^\circ\text{C}$		3	105	mV
		$V_I = 8$ to 12 V, $T_J = 25^\circ\text{C}$		1	52	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			105	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			52	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 7$ to 25 V			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		42		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 8$ to 18 V, $f = 120$ Hz	61			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.75		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 14. Electrical characteristics of L7806C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 11$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	5.75	6	6.25	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 8$ to 21 V	5.7	6	6.3	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 8$ to 25 V, $T_J = 25^\circ\text{C}$			120	mV
		$V_I = 9$ to 13 V, $T_J = 25^\circ\text{C}$			60	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			120	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			60	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 8$ to 25 V			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-0.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		45		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 9$ to 19 V, $f = 120$ Hz	59			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		19		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.55		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 15. Electrical characteristics of L7808C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 14$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	7.7	8	8.3	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 10.5$ to 25 V	7.6	8	8.4	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 10.5$ to 25 V, $T_J = 25^\circ\text{C}$			160	mV
		$V_I = 11$ to 17 V, $T_J = 25^\circ\text{C}$			80	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			80	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 10.5$ to 25 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-0.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		52		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 11.5$ to 21.5 V, $f = 120$ Hz	56			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		16		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.45		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 16. Electrical characteristics of L7885C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 14.5\text{ V}$, $I_O = 500\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	8.2	8.5	8.8	V
V_O	Output voltage	$I_O = 5\text{ mA to }1\text{ A}$, $P_O \leq 15\text{ W}$ $V_I = 11\text{ to }26\text{ V}$	8.1	8.5	8.9	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 11\text{ to }27\text{ V}$, $T_J = 25^\circ\text{C}$			160	mV
		$V_I = 11.5\text{ to }17.5\text{ V}$, $T_J = 25^\circ\text{C}$			80	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5\text{ mA to }1.5\text{ A}$, $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 250\text{ to }750\text{ mA}$, $T_J = 25^\circ\text{C}$			80	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11\text{ to }27\text{ V}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$, $T_J = 25^\circ\text{C}$		55		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 12\text{ to }22\text{ V}$, $f = 120\text{ Hz}$	56			dB
V_d	Dropout voltage	$I_O = 1\text{ A}$, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		0.45		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 17. Electrical characteristics of L7809C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 15$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	8.64	9	9.36	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 11.5$ to 26 V	8.55	9	9.45	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 11.5$ to 26 V, $T_J = 25^\circ\text{C}$			180	mV
		$V_I = 12$ to 18 V, $T_J = 25^\circ\text{C}$			90	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			90	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 11.5$ to 26 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		70		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 12$ to 23 V, $f = 120$ Hz	55			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.40		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 18. Electrical characteristics of L7810C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 15$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	9.6	10	10.4	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 12.5$ to 26 V	9.5	10	10.5	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 12.5$ to 26 V, $T_J = 25^\circ\text{C}$			200	mV
		$V_I = 13.5$ to 19 V, $T_J = 25^\circ\text{C}$			100	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			200	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			100	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 12.5$ to 26 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10$ Hz to 100 KHz, $T_J = 25^\circ\text{C}$		70		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 13$ to 23 V, $f = 120$ Hz	55			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.40		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 19. Electrical characteristics of L7812C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 19$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	11.5	12	12.5	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 14.5$ to 27 V	11.4	12	12.6	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 14.5$ to 30 V, $T_J = 25^\circ\text{C}$			240	mV
		$V_I = 16$ to 22 V, $T_J = 25^\circ\text{C}$			120	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			120	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 14.5$ to 30 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		75		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 15$ to 25 V, $f = 120$ Hz	55			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		18		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.35		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 20. Electrical characteristics of L7815C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 23$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	14.5	15	15.6	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 17.5$ to 30 V	14.25	15	15.75	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 17.5$ to 30 V, $T_J = 25^\circ\text{C}$			300	mV
		$V_I = 20$ to 26 V, $T_J = 25^\circ\text{C}$			150	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			300	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			150	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 17.5$ to 30 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		90		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 18.5$ to 28.5 V, $f = 120$ Hz	54			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		19		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.23		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 21. Electrical characteristics of L7818C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 26$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	17.3	18	18.7	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 21$ to 33 V	17.1	18	18.9	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 21$ to 33 V, $T_J = 25^\circ\text{C}$			360	mV
		$V_I = 24$ to 30 V, $T_J = 25^\circ\text{C}$			180	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			360	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			180	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 21$ to 33 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10$ Hz to 100 KHz, $T_J = 25^\circ\text{C}$		110		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 22$ to 32 V, $f = 120$ Hz	53			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		22		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.20		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 22. Electrical characteristics of L7820C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 28$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	19.2	20	20.8	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 23$ to 35 V	19	20	21	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 22.5$ to 35 V, $T_J = 25^\circ\text{C}$			400	mV
		$V_I = 26$ to 32 V, $T_J = 25^\circ\text{C}$			200	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			400	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			200	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 23$ to 35 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10 Hz to 100 KHz, $T_J = 25^\circ\text{C}$		150		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 24$ to 35 V, $f = 120$ Hz	52			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		24		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.18		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 23. Electrical characteristics of L7824C (refer to the test circuits, $T_J = 0$ to 150°C , $V_I = 33$ V, $I_O = 500$ mA, $C_I = 0.33$ μF , $C_O = 0.1$ μF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	23	24	25	V
V_O	Output voltage	$I_O = 5$ mA to 1 A, $P_O \leq 15$ W $V_I = 27$ to 38 V	22.8	24	25.2	V
$\Delta V_O^{(1)}$	Line regulation	$V_I = 27$ to 38 V, $T_J = 25^\circ\text{C}$			480	mV
		$V_I = 30$ to 36 V, $T_J = 25^\circ\text{C}$			240	
$\Delta V_O^{(1)}$	Load regulation	$I_O = 5$ mA to 1.5 A, $T_J = 25^\circ\text{C}$			480	mV
		$I_O = 250$ to 750 mA, $T_J = 25^\circ\text{C}$			240	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			8	mA
ΔI_d	Quiescent current change	$I_O = 5$ mA to 1 A			0.5	mA
		$V_I = 27$ to 38 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5$ mA		-1.5		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10$ Hz to 100 KHz, $T_J = 25^\circ\text{C}$		170		$\mu\text{V}/V_O$
SVR	Supply voltage rejection	$V_I = 28$ to 38 V, $f = 120$ Hz	50			dB
V_d	Dropout voltage	$I_O = 1$ A, $T_J = 25^\circ\text{C}$		2		V
R_O	Output resistance	$f = 1$ KHz		28		m Ω
I_{sc}	Short circuit current	$V_I = 35$ V, $T_J = 25^\circ\text{C}$		0.15		A
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		2.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

6 Typical performance

Figure 8. Dropout voltage vs junction temperature

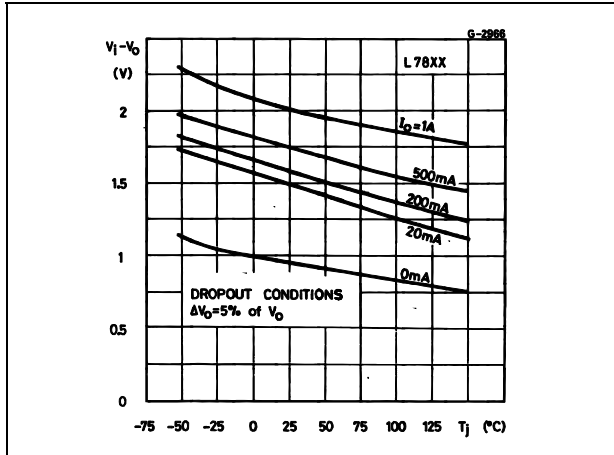


Figure 9. Peak output current vs input/output differential voltage

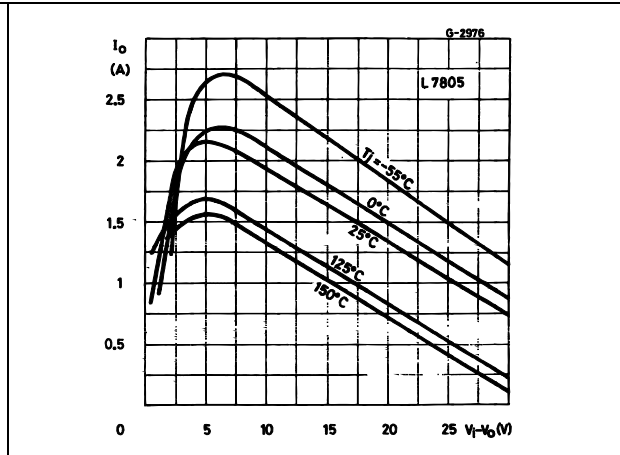


Figure 10. Supply voltage rejection vs frequency

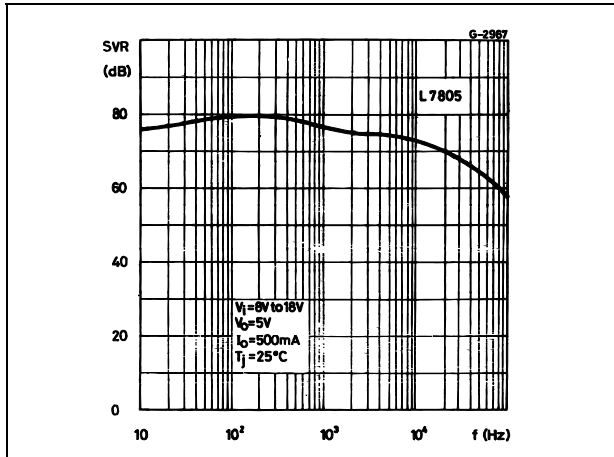


Figure 11. Output voltage vs junction temperature

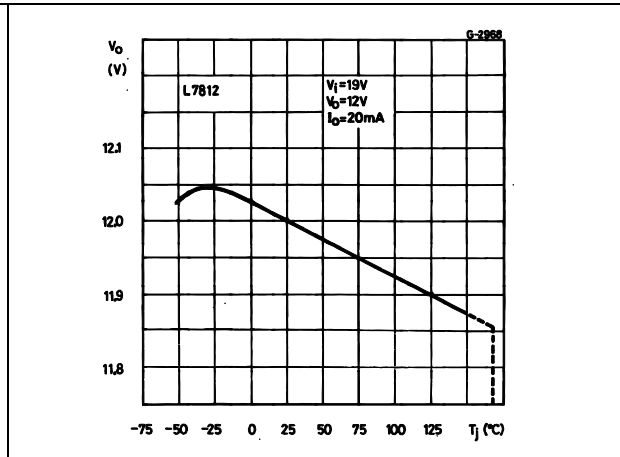


Figure 12. Output impedance vs frequency

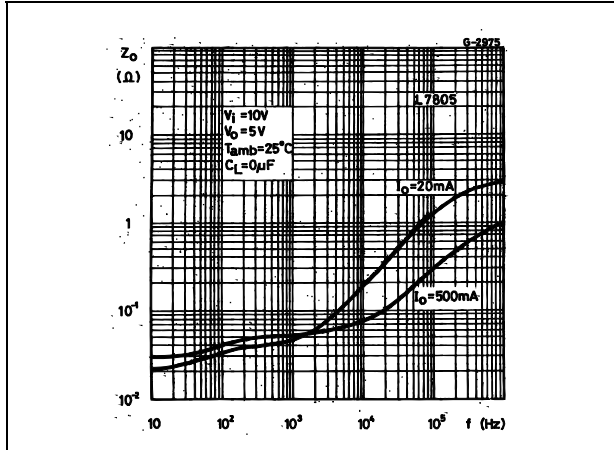


Figure 13. Quiescent current vs junction temp.

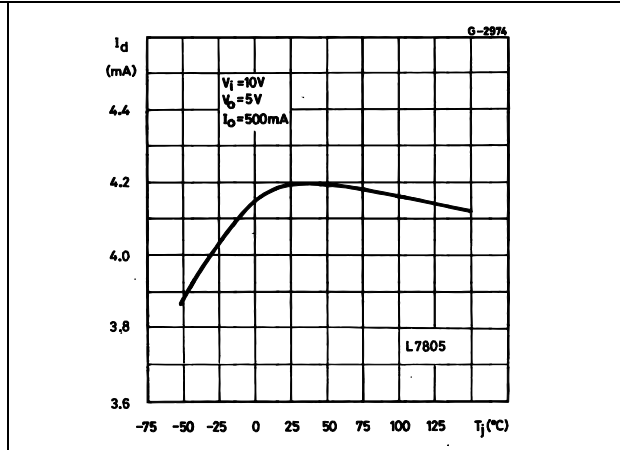


Figure 14. Load transient response

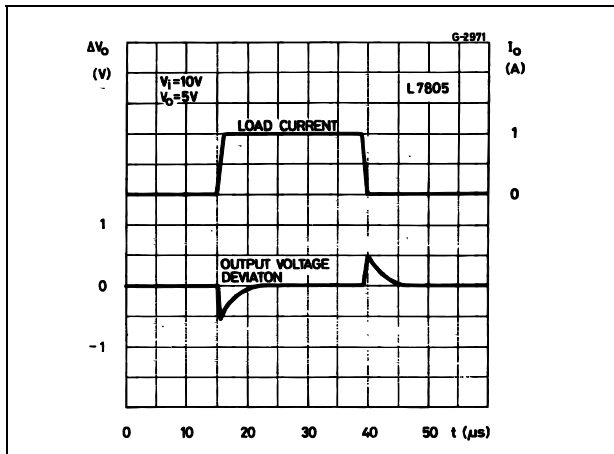


Figure 15. Line transient response

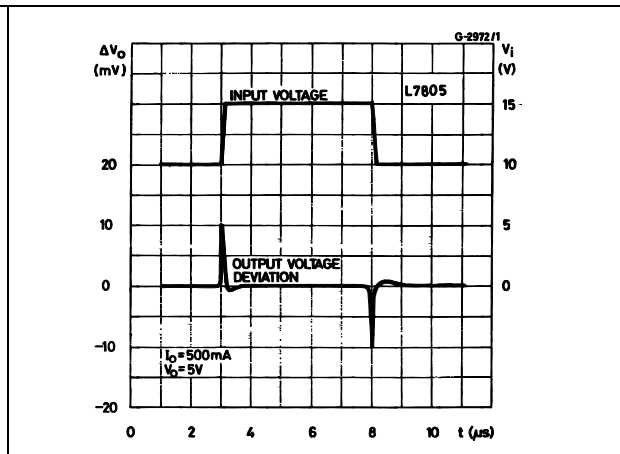


Figure 16. Quiescent current vs input voltage

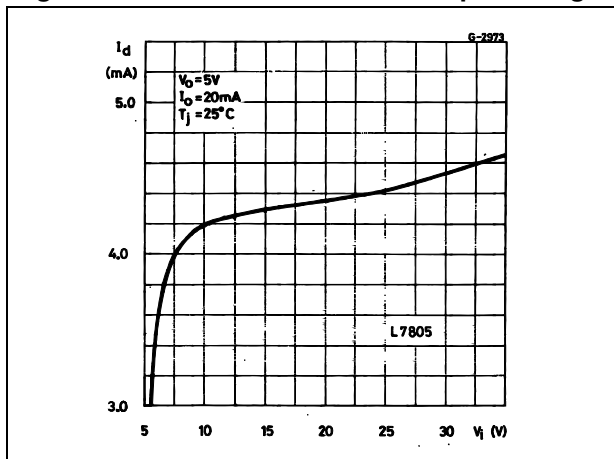
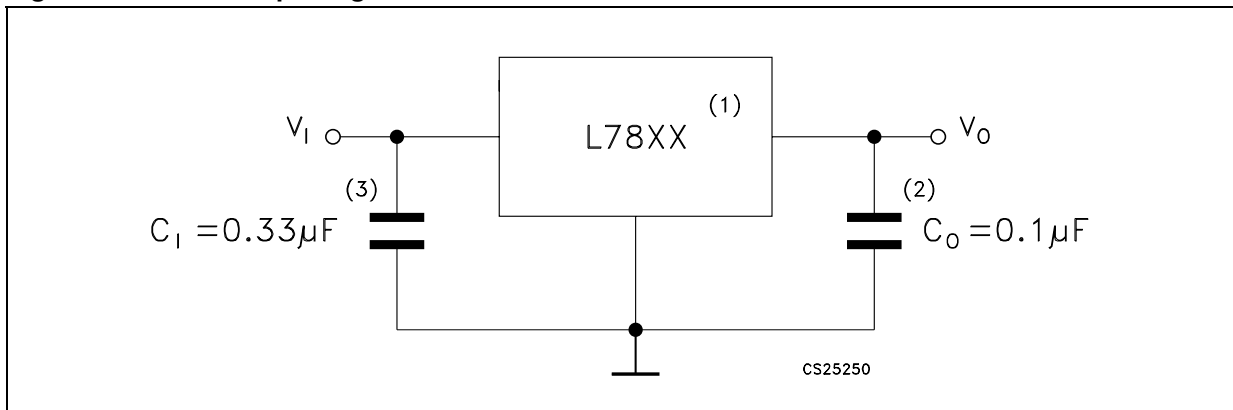


Figure 17. Fixed output regulator



1. To specify an output voltage, substitute voltage value for "XX".
2. Although no output capacitor is need for stability, it does improve transient response.
3. Required if regulator is locate an appreciable distance from power supply filter.

Figure 18. Current regulator

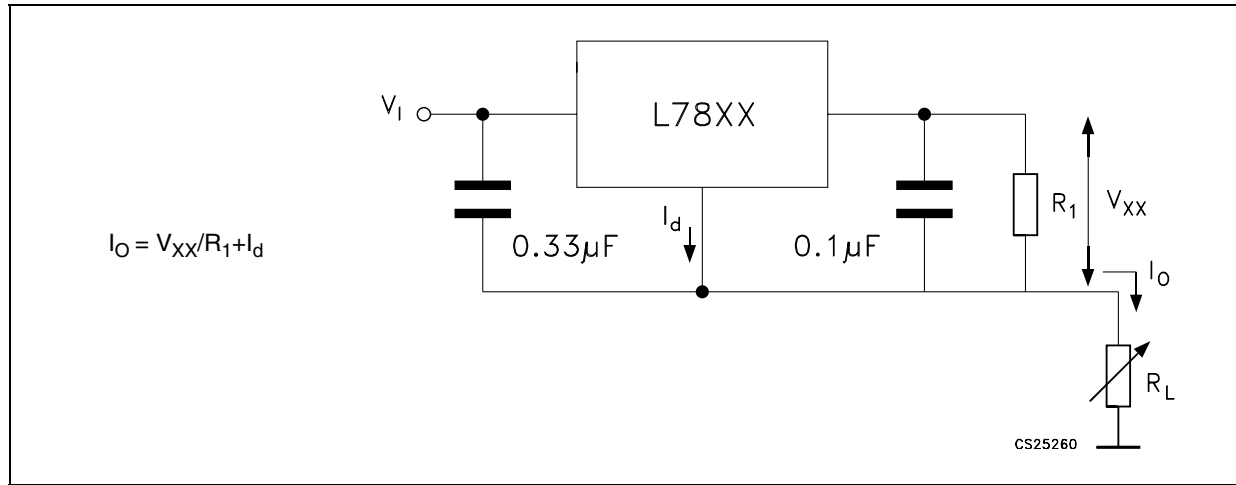


Figure 19. Circuit for increasing output voltage

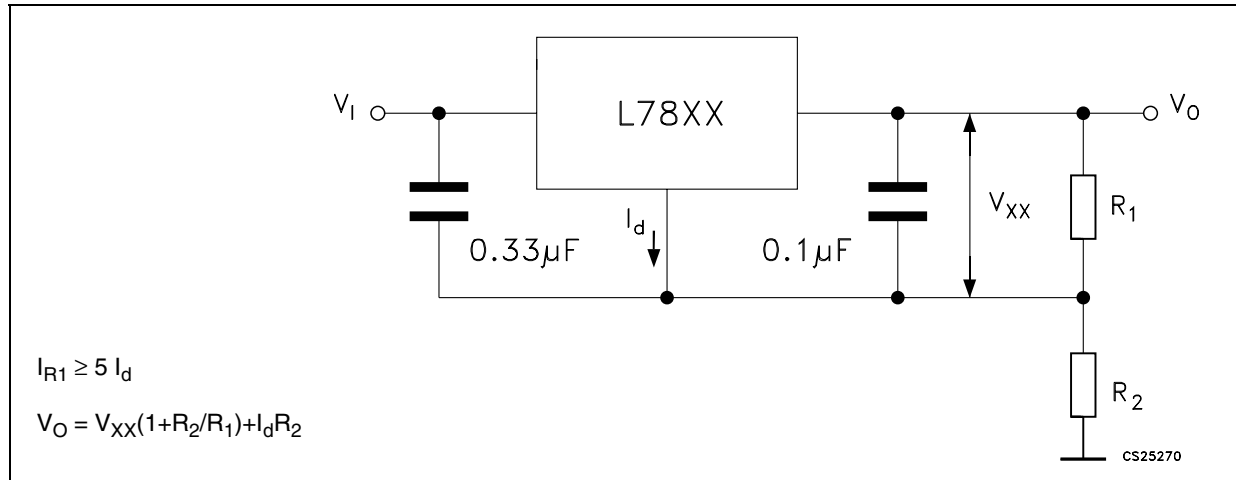


Figure 20. Adjustable output regulator (7 to 30V)

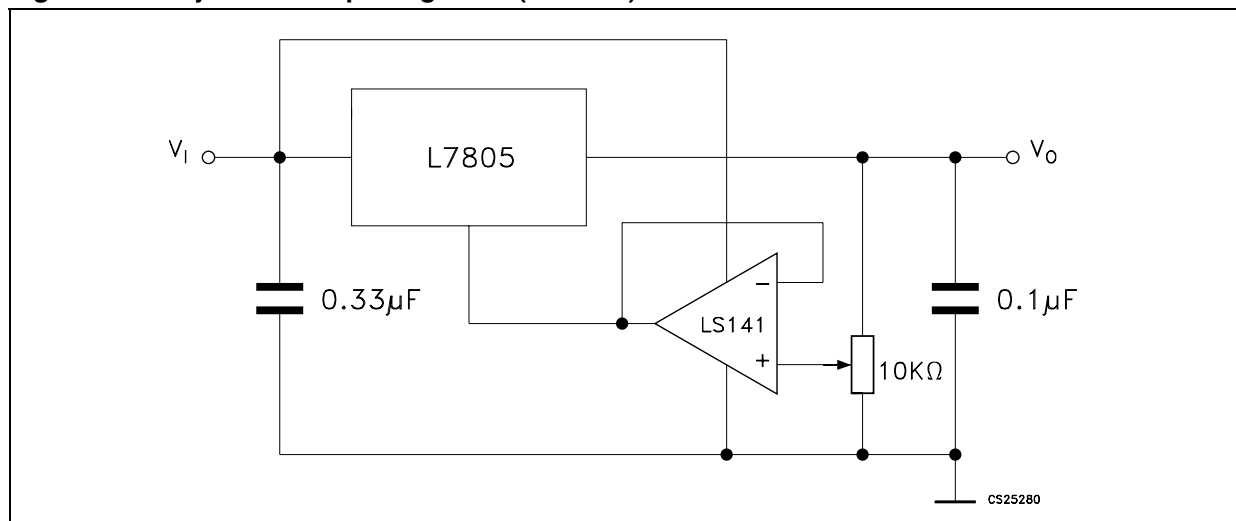


Figure 21. 0.5 to 10V Regulator

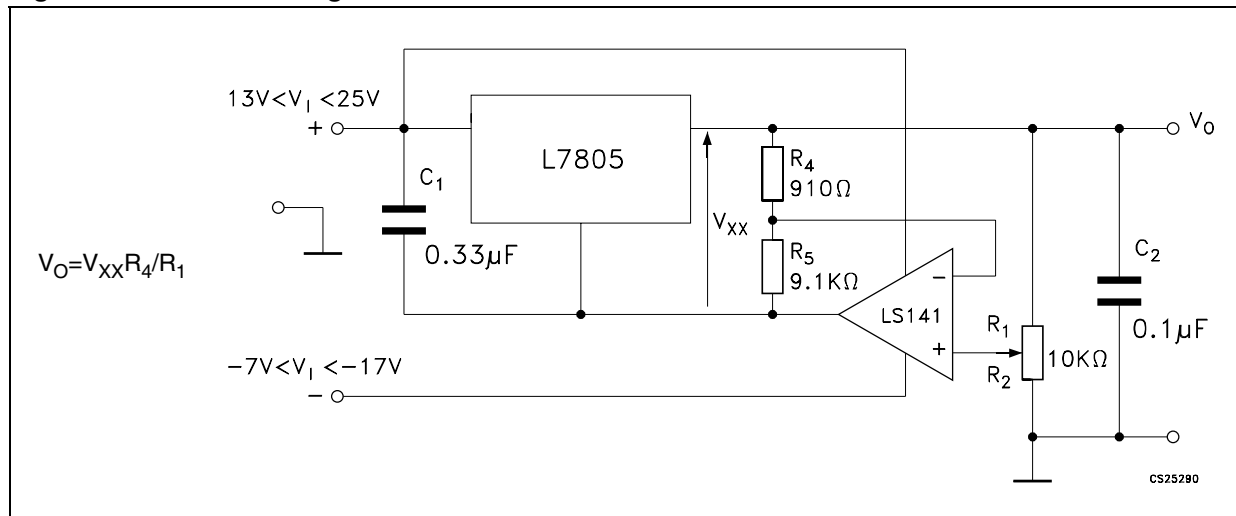


Figure 22. High current voltage regulator

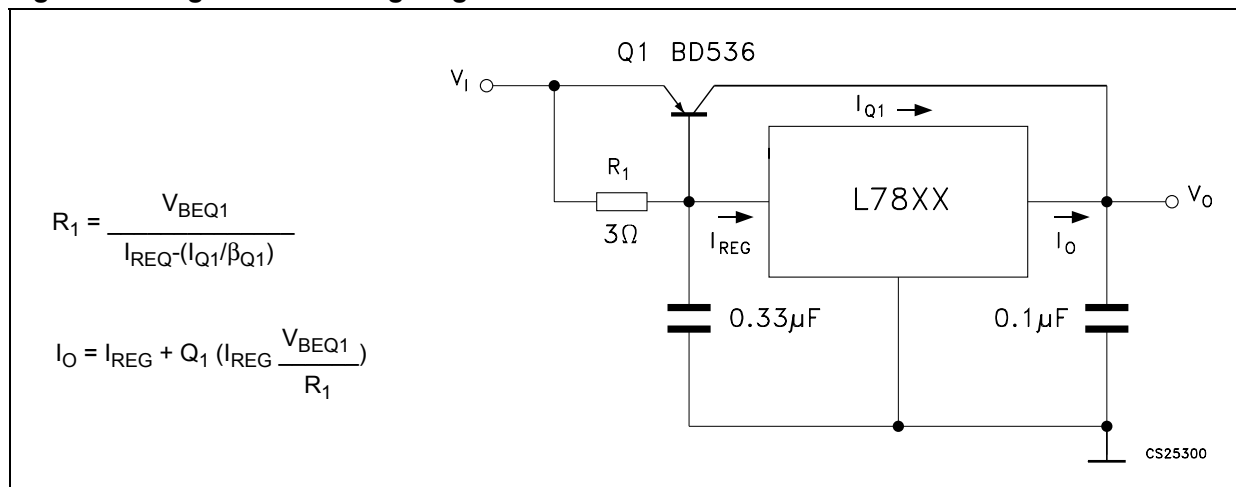


Figure 23. High output current with short circuit protection

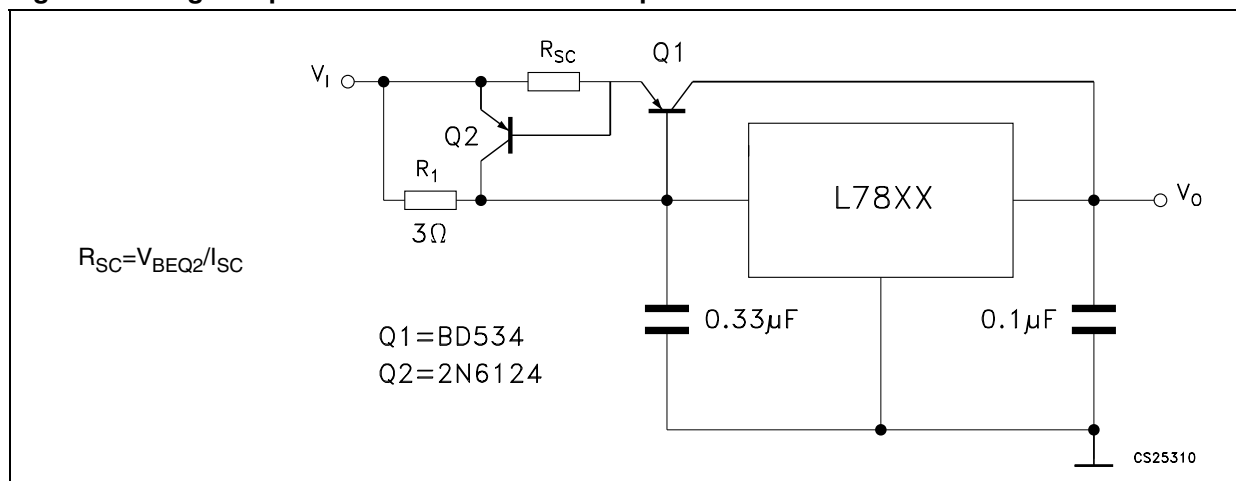


Figure 24. Tracking voltage regulator

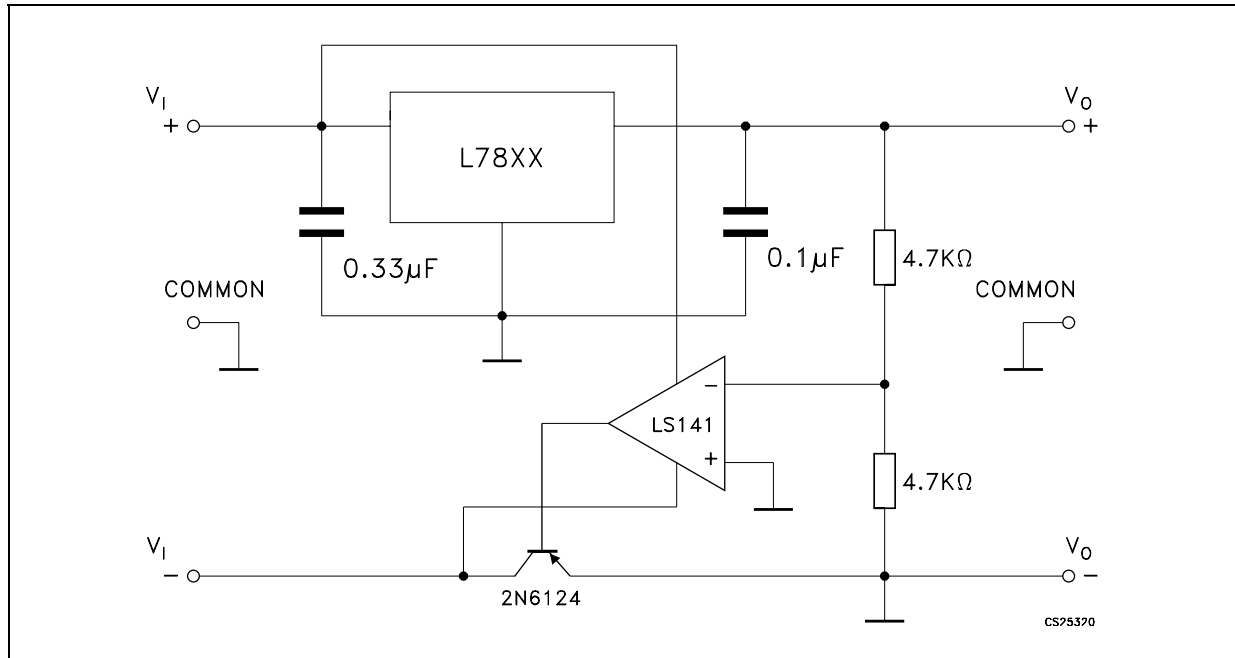
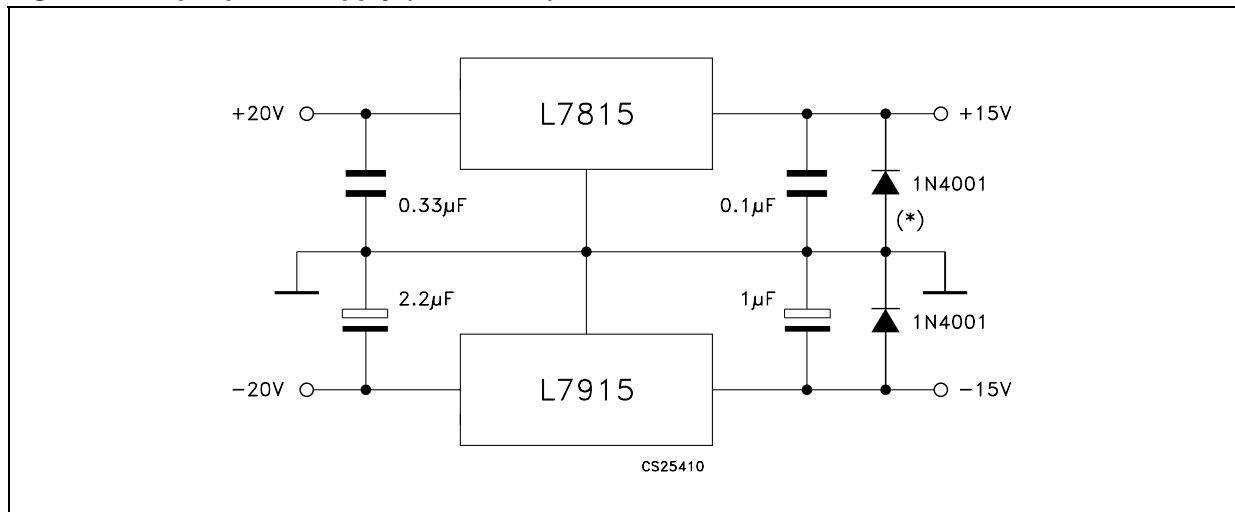


Figure 25. Split power supply ($\pm 15\text{V} - 1\text{A}$)



* Against potential latch-up problems.

Figure 26. Negative output voltage circuit

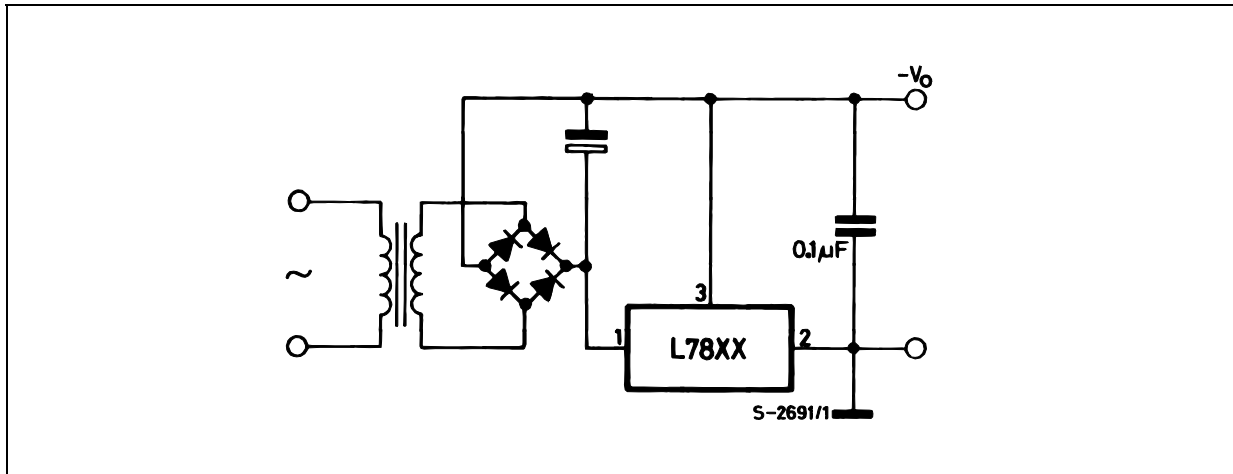


Figure 27. Switching regulator

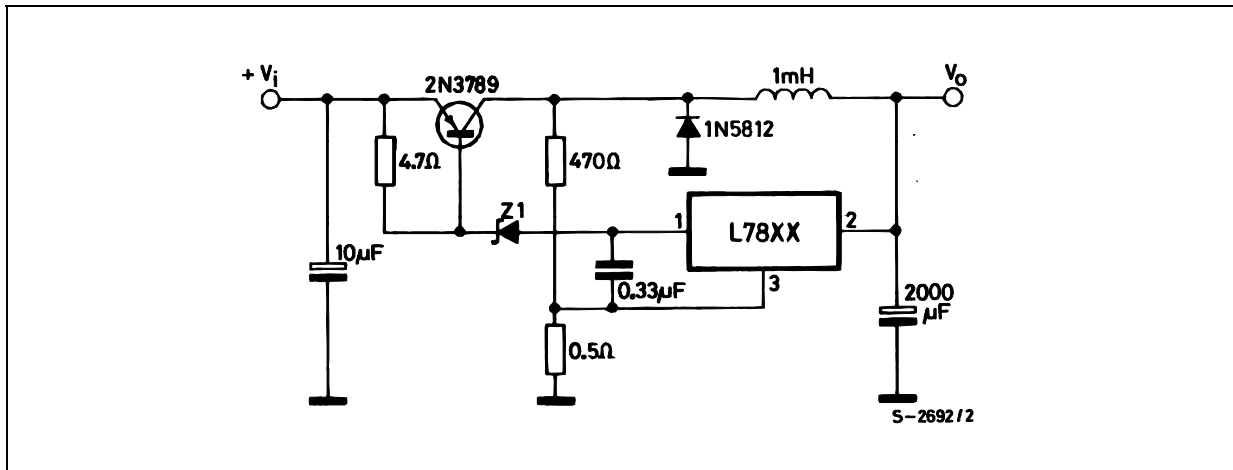


Figure 28. High input voltage circuit

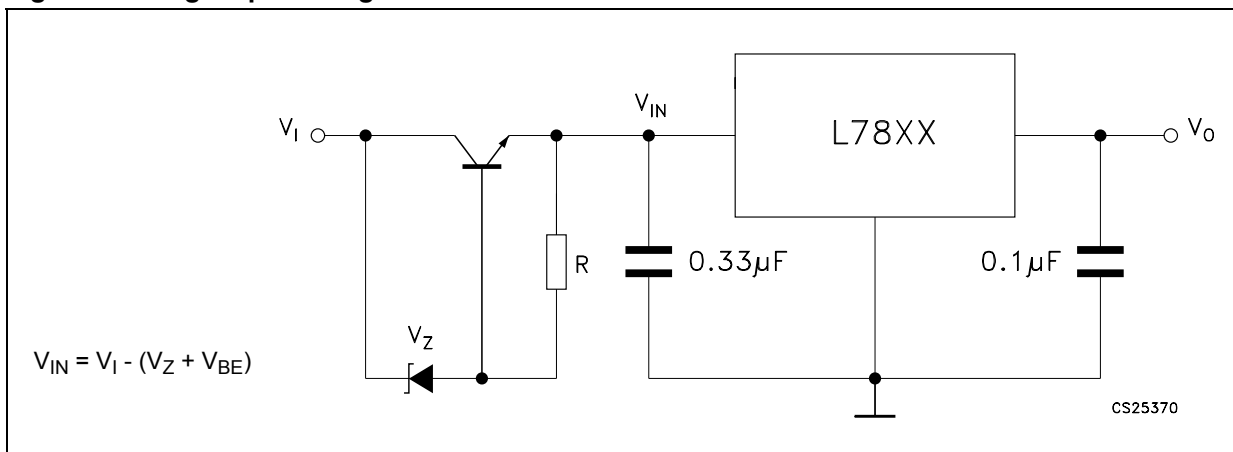


Figure 29. High input voltage circuit

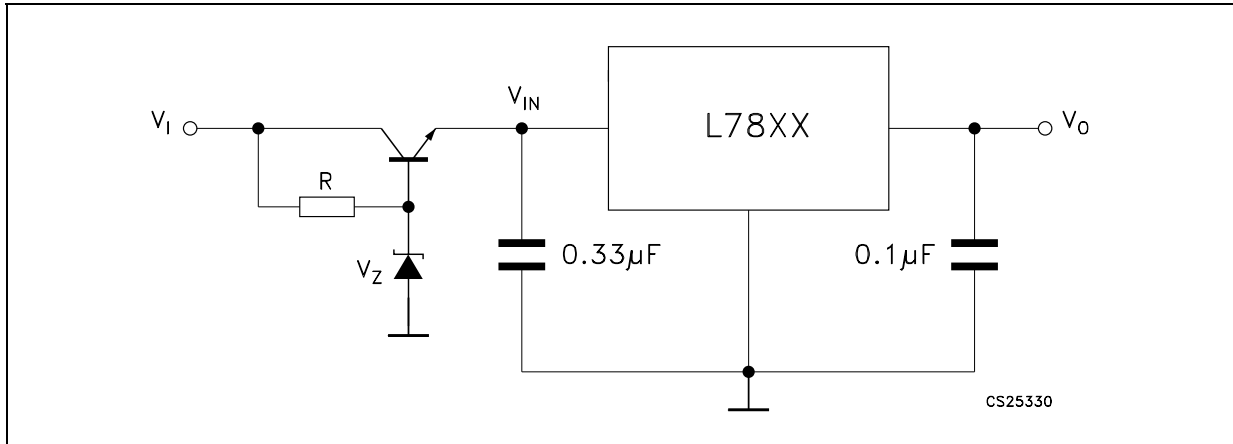


Figure 30. High output voltage regulator

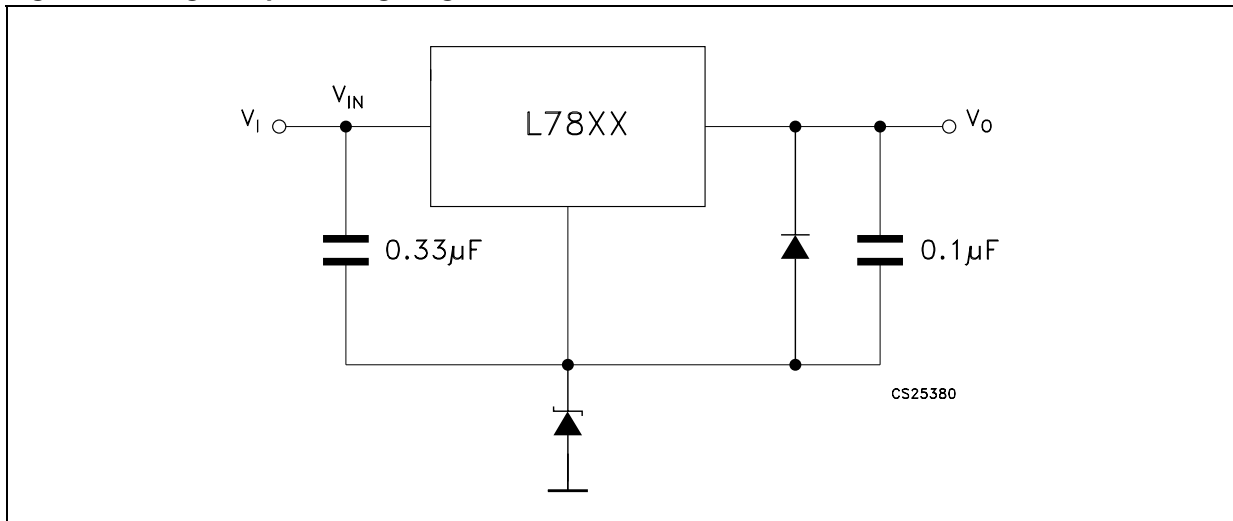


Figure 31. High input and output voltage

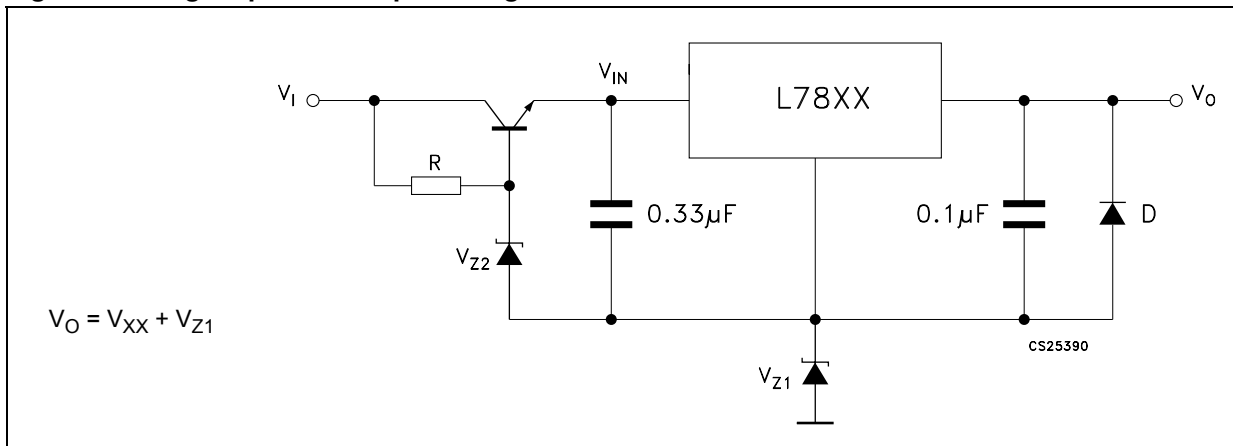


Figure 32. Reducing power dissipation with dropping resistor

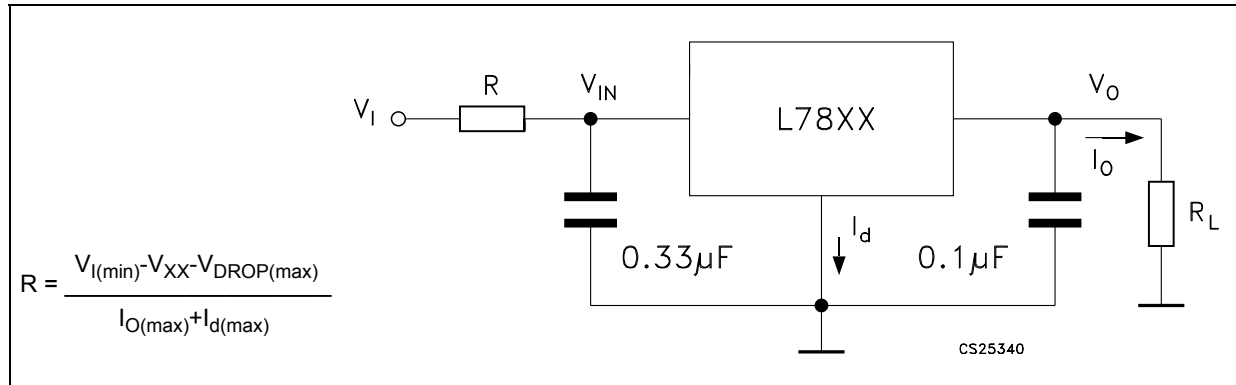


Figure 33. Remote shutdown

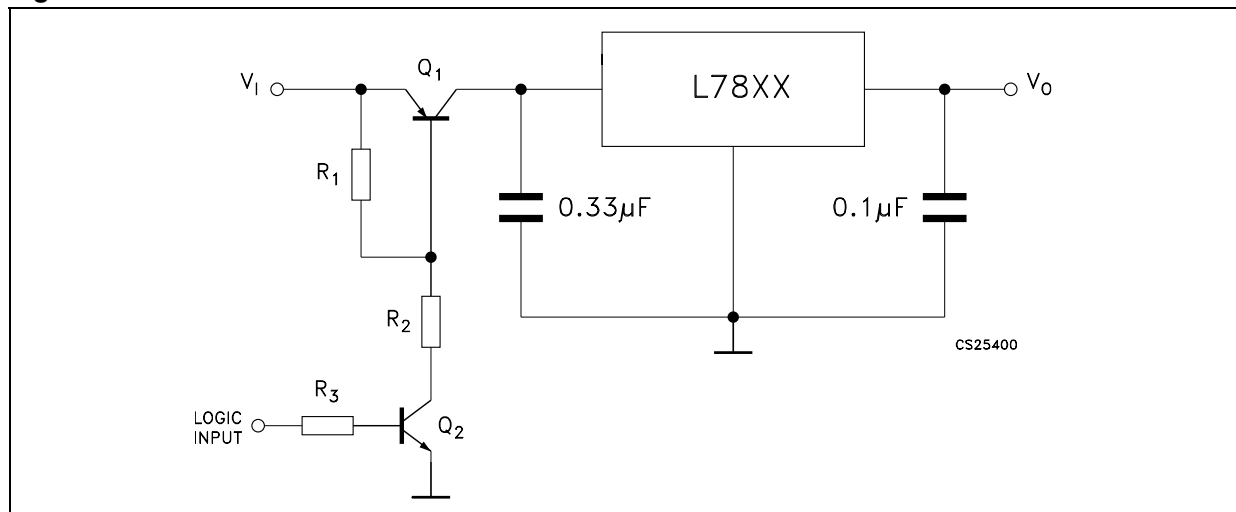
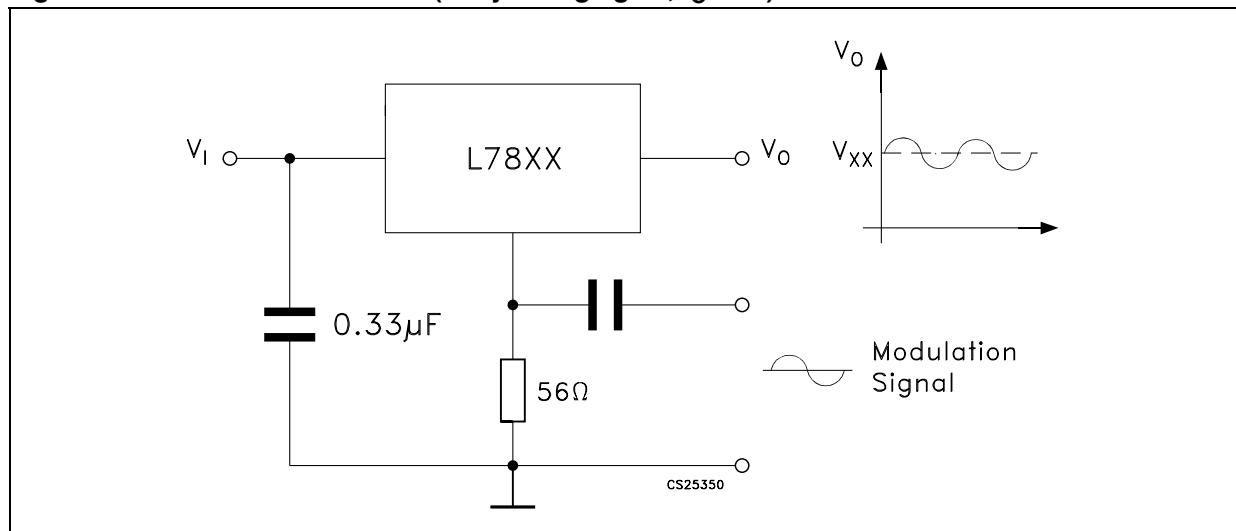
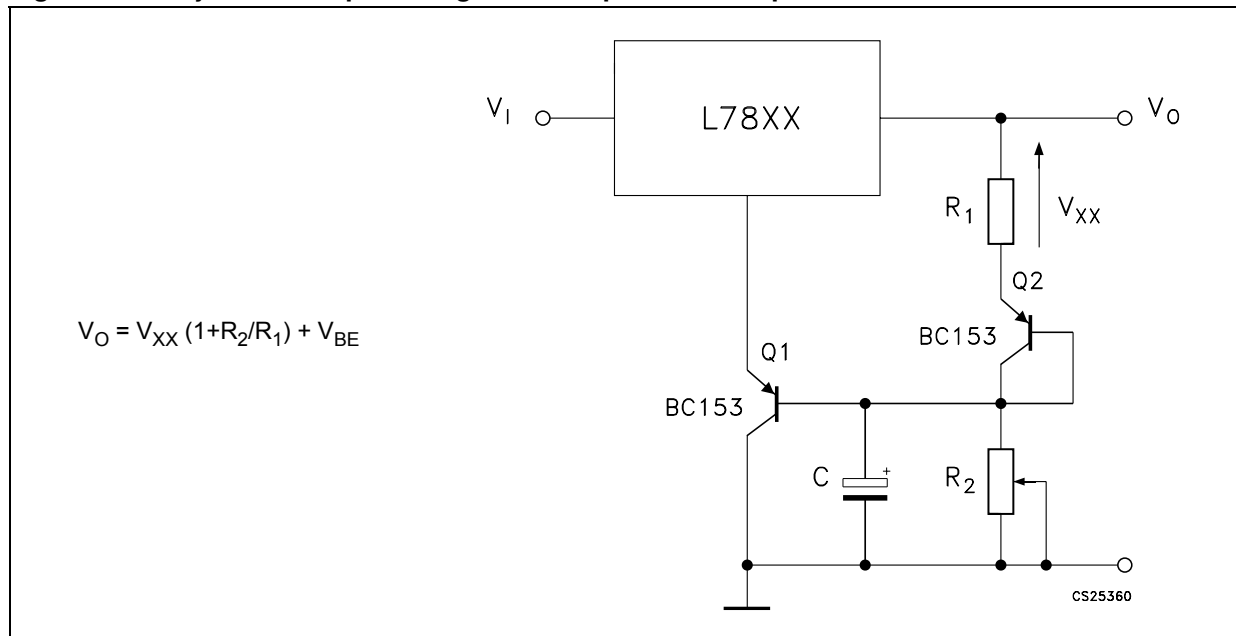


Figure 34. Power AM modulator (unity voltage gain, $I_O \leq 0.5$)



Note: The circuit performs well up to 100 KHz.

Figure 35. Adjustable output voltage with temperature compensation



Note: Q_2 is connected as a diode in order to compensate the variation of the $Q_1 V_{BE}$ with the temperature. C allows a slow rise time of the V_O .

Figure 36. Light controllers ($V_{Omin} = V_{XX} + V_{BE}$)

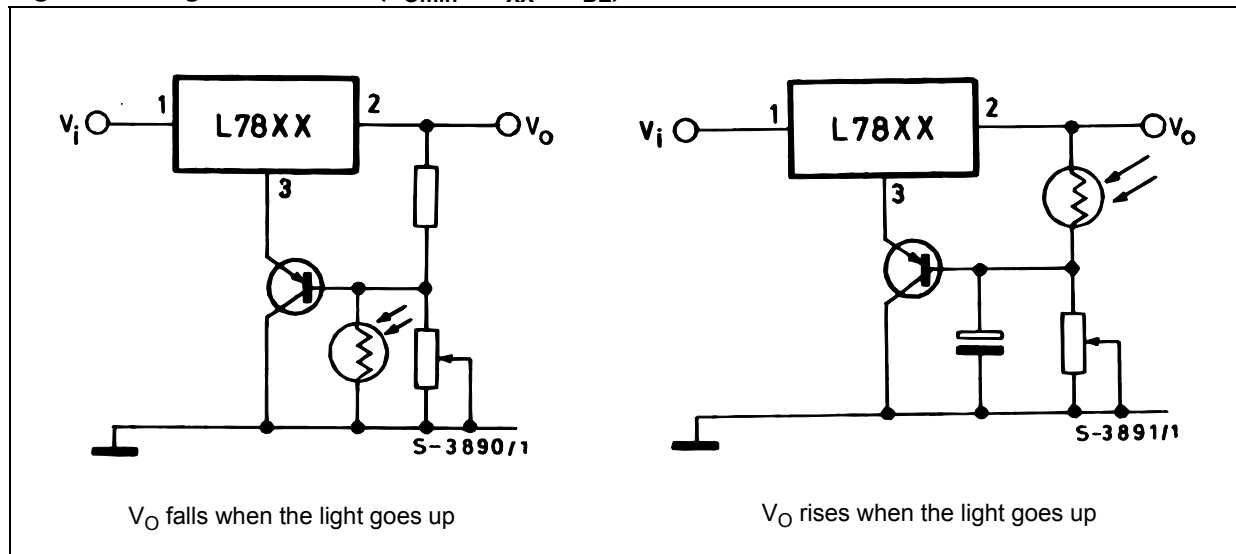
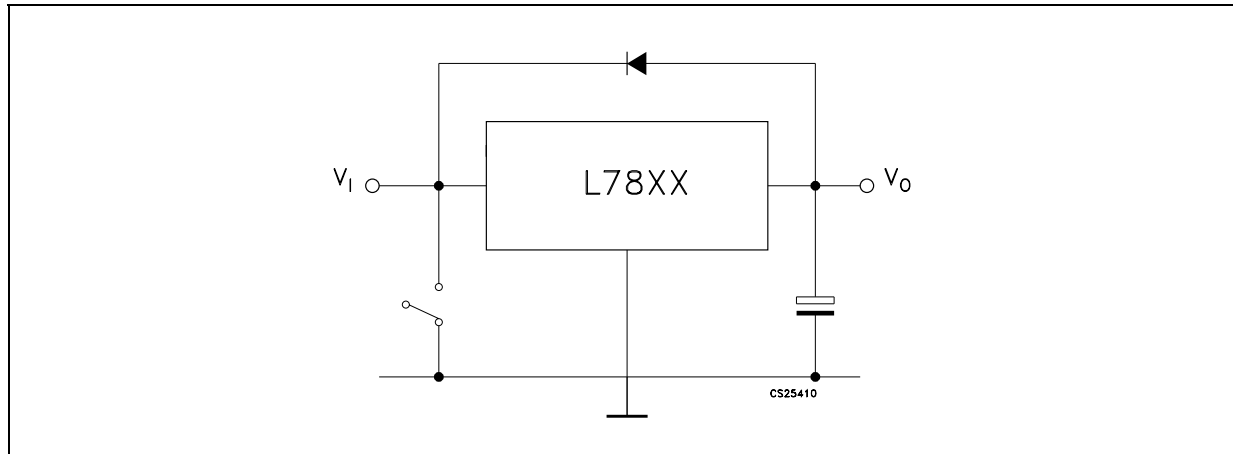


Figure 37. Protection against input short-circuit with high capacitance loads

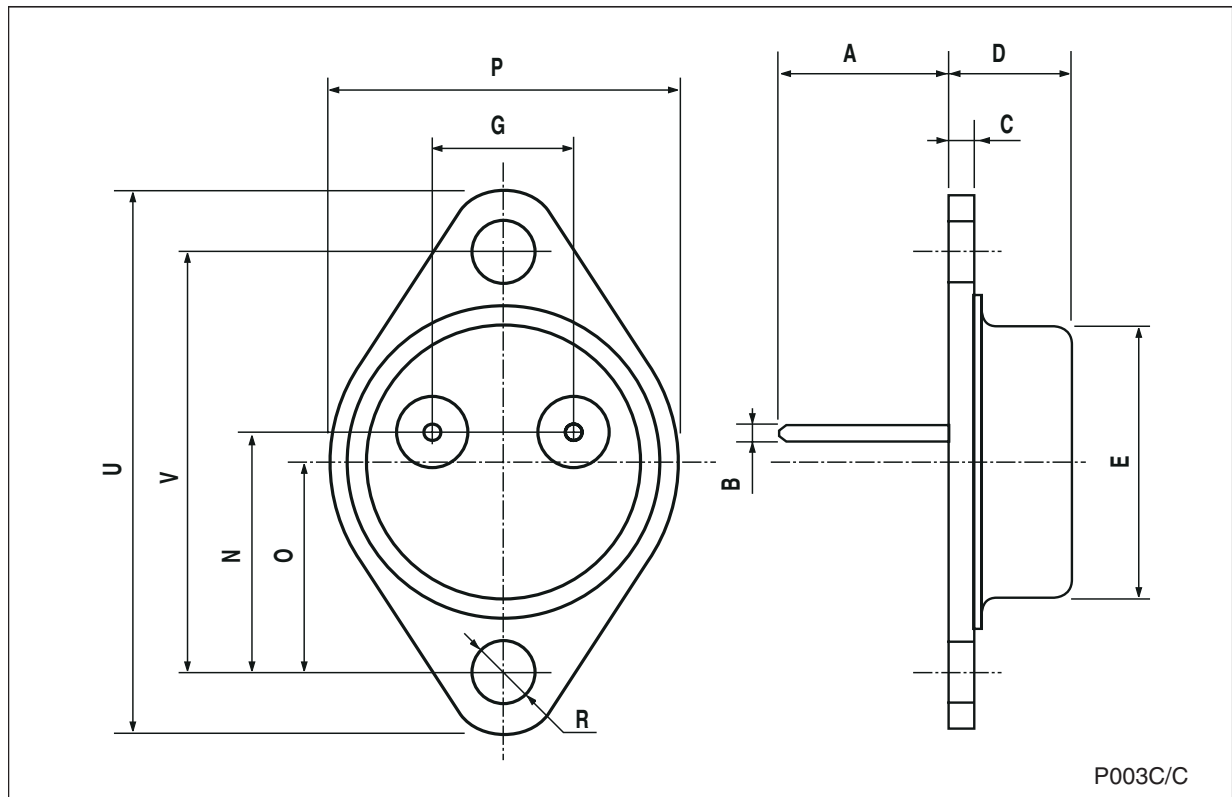
1. Application with high capacitance loads and an output voltage greater than 6 volts need an external diode (see fig. 32) to protect the device against input short circuit. In this case the input voltage falls rapidly while the output voltage decrease slowly. The capacitance discharges by means of the Base-Emitter junction of the series pass transistor in the regulator. If the energy is sufficiently high, the transistor may be destroyed. The external diode by-passes the current from the IC to ground.

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-3 mechanical data

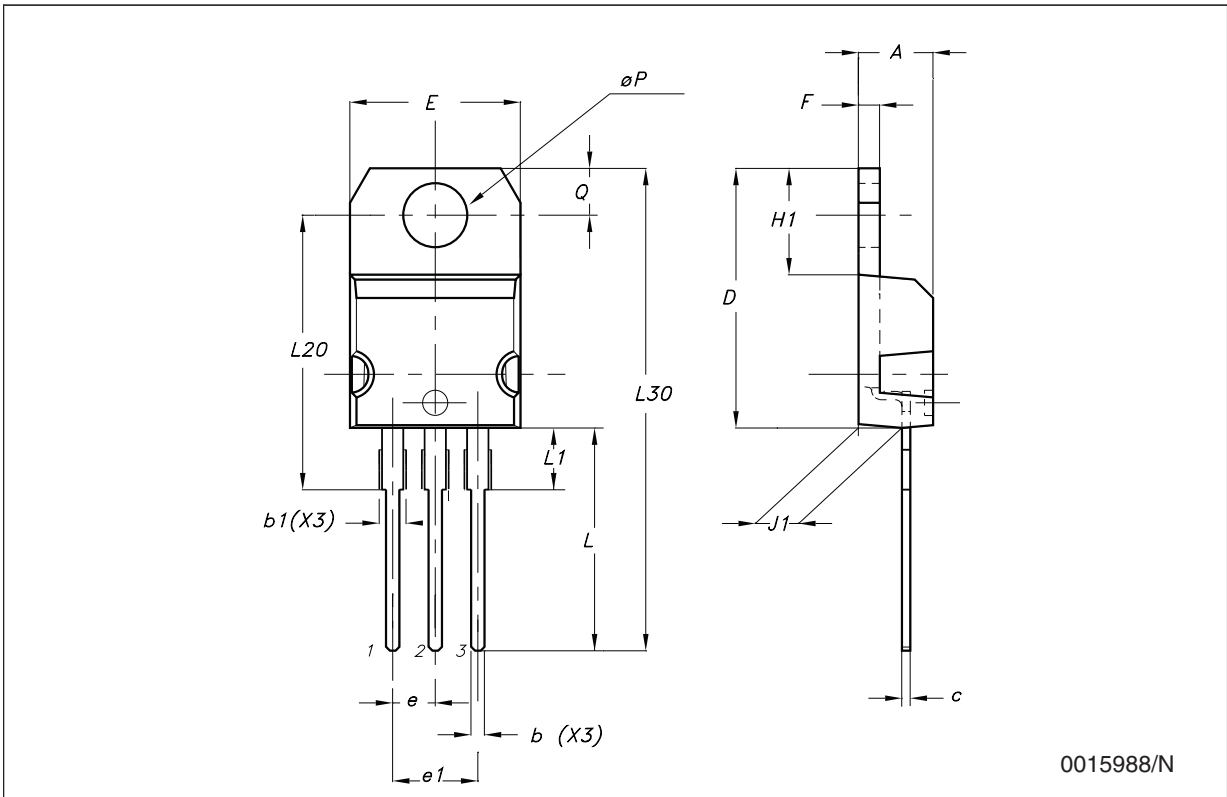
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		11.85			0.466	
B	0.96	1.05	1.10	0.037	0.041	0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.5			1.555
V		30.10			1.185	



P003C/C

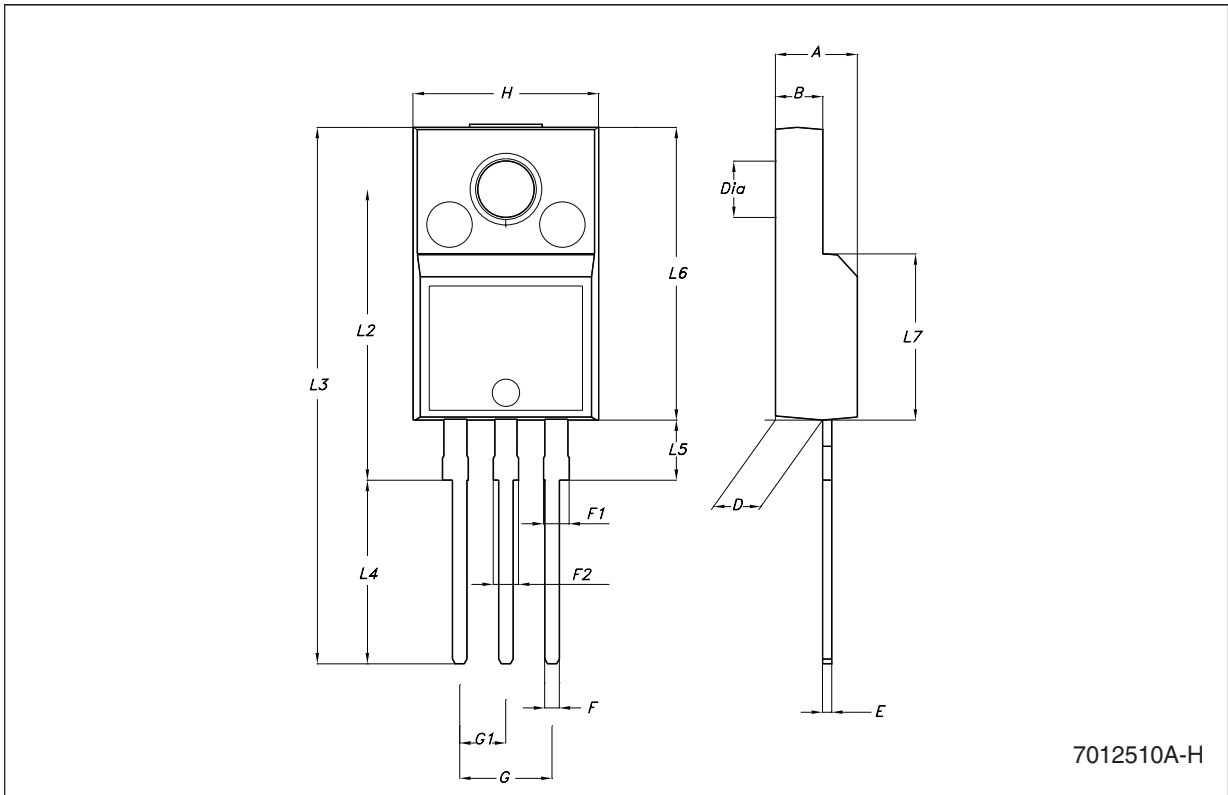
TO-220 (A type) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.035
b1	1.15		1.70	0.045		0.067
c	0.49		0.70	0.019		0.028
D	15.25		15.75	0.600		0.620
E	10.0		10.40	0.394		0.409
e	2.4		2.7	0.094		0.106
e1	4.95		5.15	0.195		0.203
F	1.23		1.32	0.048		0.052
H1	6.2		6.6	0.244		0.260
J1	2.40		2.72	0.094		0.107
L	13.0		14.0	0.512		0.551
L1	3.5		3.93	0.138		0.155
L20		16.4			0.646	
L30		28.9			1.138	
φP	3.75		3.85	0.148		0.152
Q	2.65		2.95	0.104		0.116



TO-220FP mechanical data

Dim.	mm.			inch.		
	Min.	Typ	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.50	0.045		0.059
F2	1.15		1.50	0.045		0.059
G	4.95		5.2	0.194		0.204
G1	2.4		2.7	0.094		0.106
H	10.0		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L5	2.9		3.6	0.114		0.142
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
DIA.	3		3.2	0.118		0.126



7012510A-H

Figure 38. Drawing dimension D²PAK (type STD-ST)

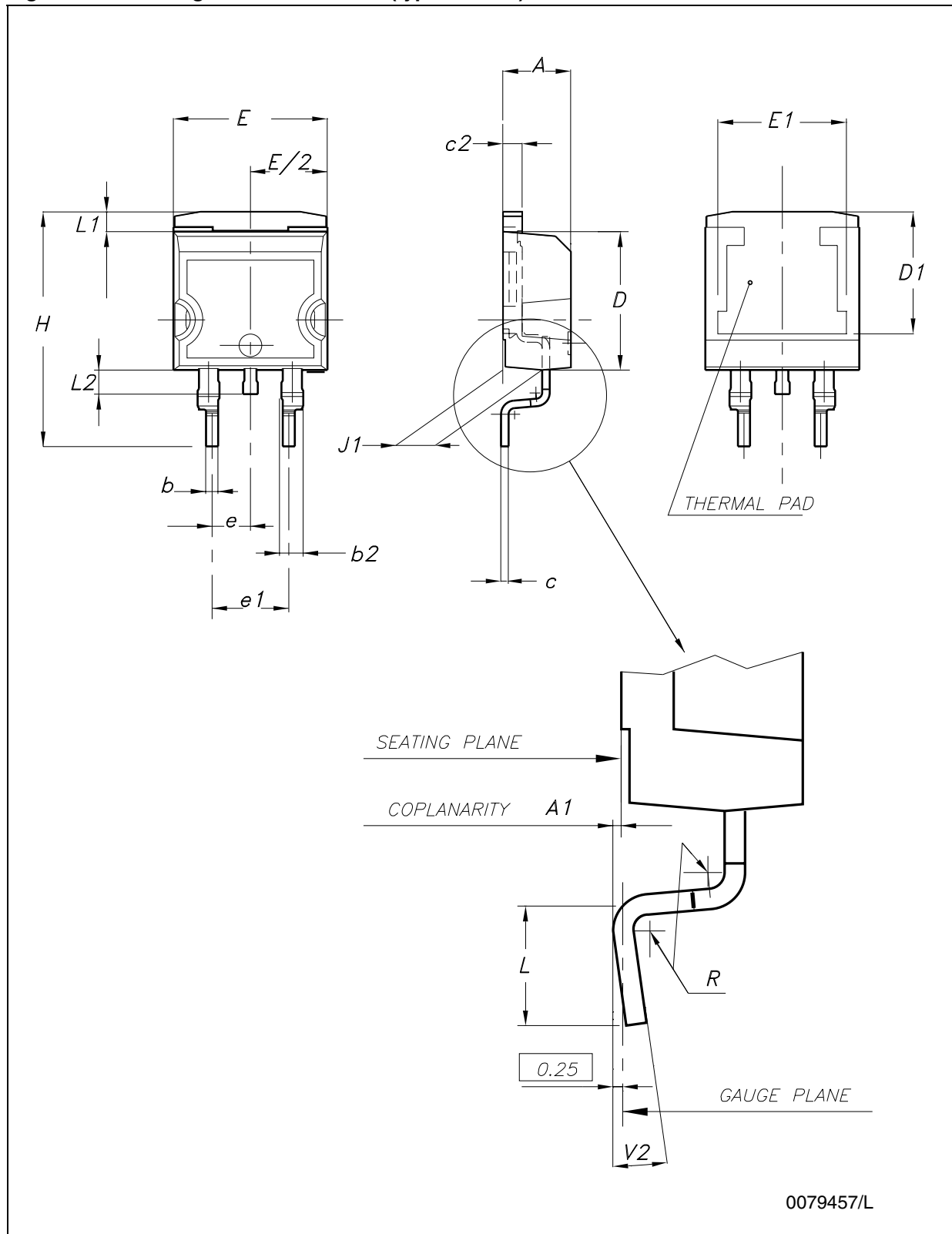


Figure 39. Drawing dimension D²PAK (type WOOSEOK-SUBCON.)

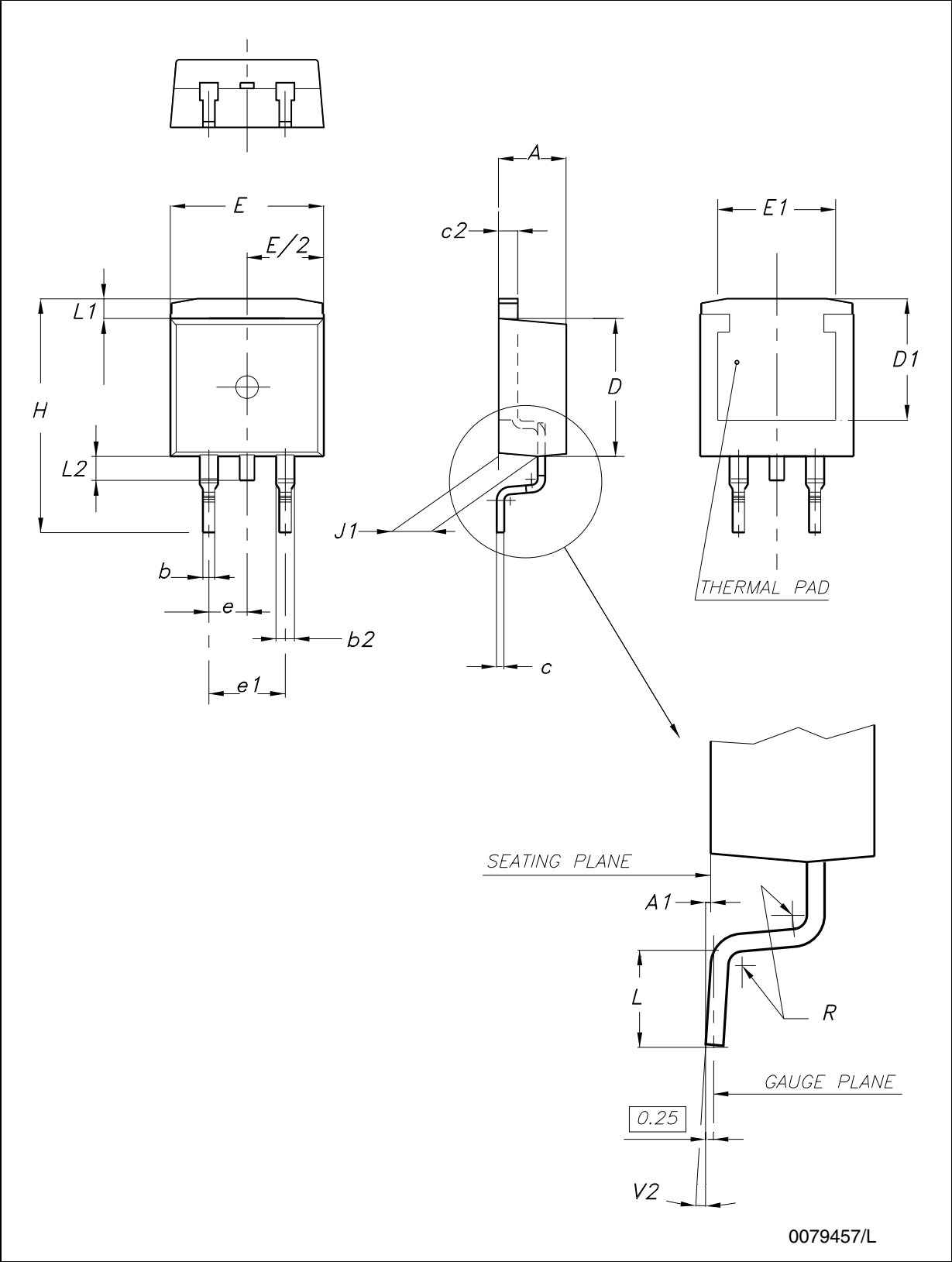


Table 24. D²PAK mechanical data

DIM.	TYPE STD-ST			TYPE WOOSEOK-SUBCON.		
	mm.			mm.		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	4.30		4.70
A1	0.03		0.23	0		0.20
b	0.70		0.93	0.70		0.90
b2	1.14		1.70	1.17		1.37
c	0.45		0.60	0.45	0.50	0.60
c2	1.23		1.36	1.25	1.30	1.40
D	8.95		9.35	9	9.20	9.40
D1	7.50			7.50		
E	10		10.40	9.80		10.20
E1	8.50			7.50		
e		2.54			2.54	
e1	4.88		5.28		5.08	
H	15		15.85	15	15.30	15.60
J1	2.49		2.69	2.20		2.60
L	2.29		2.79	1.79		2.79
L1	1.27		1.40	1		1.40
L2	1.30		1.75	1.20		1.60
R		0.4			0.30	
V2	0°		8°	0°		3°

Note: The D²PAK package coming from the subcontractor Wooseok is fully compatible with the ST's package suggested footprint.

Figure 40. D²PAK footprint recommended data

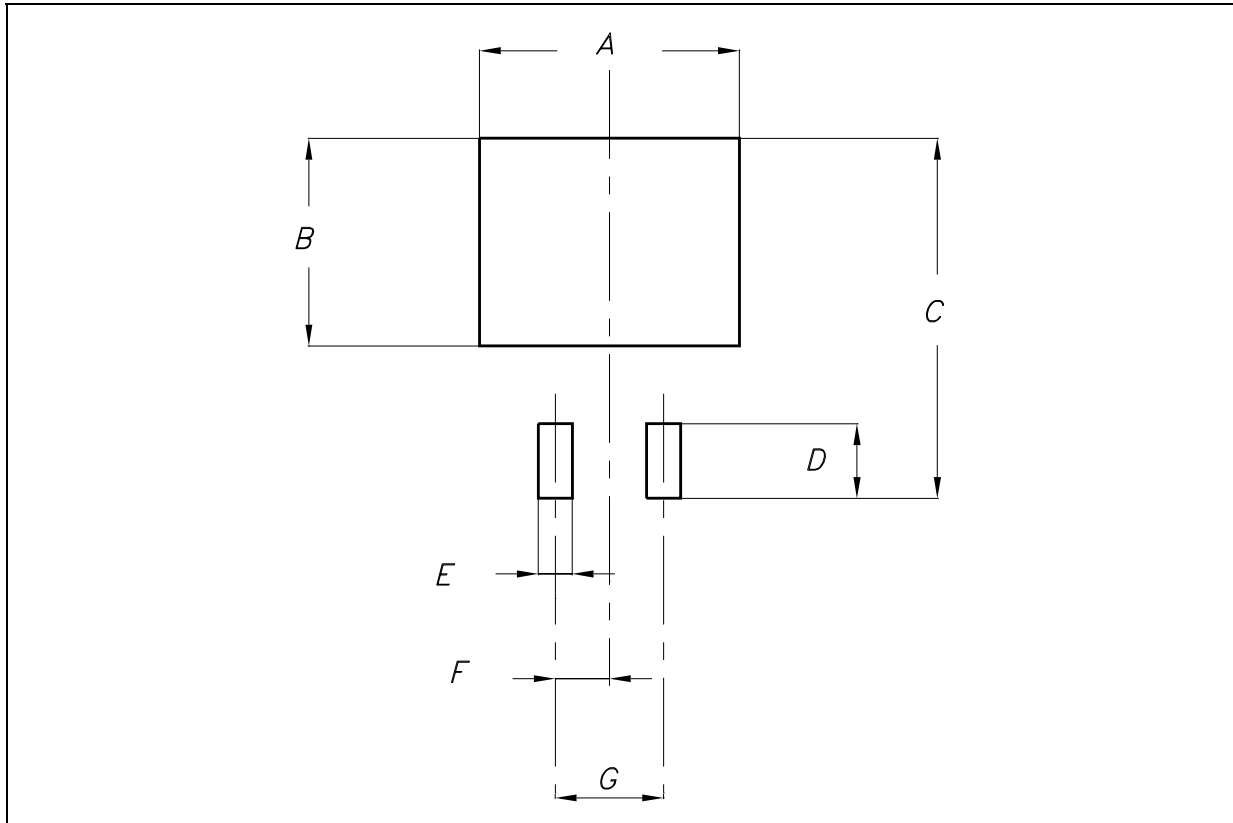
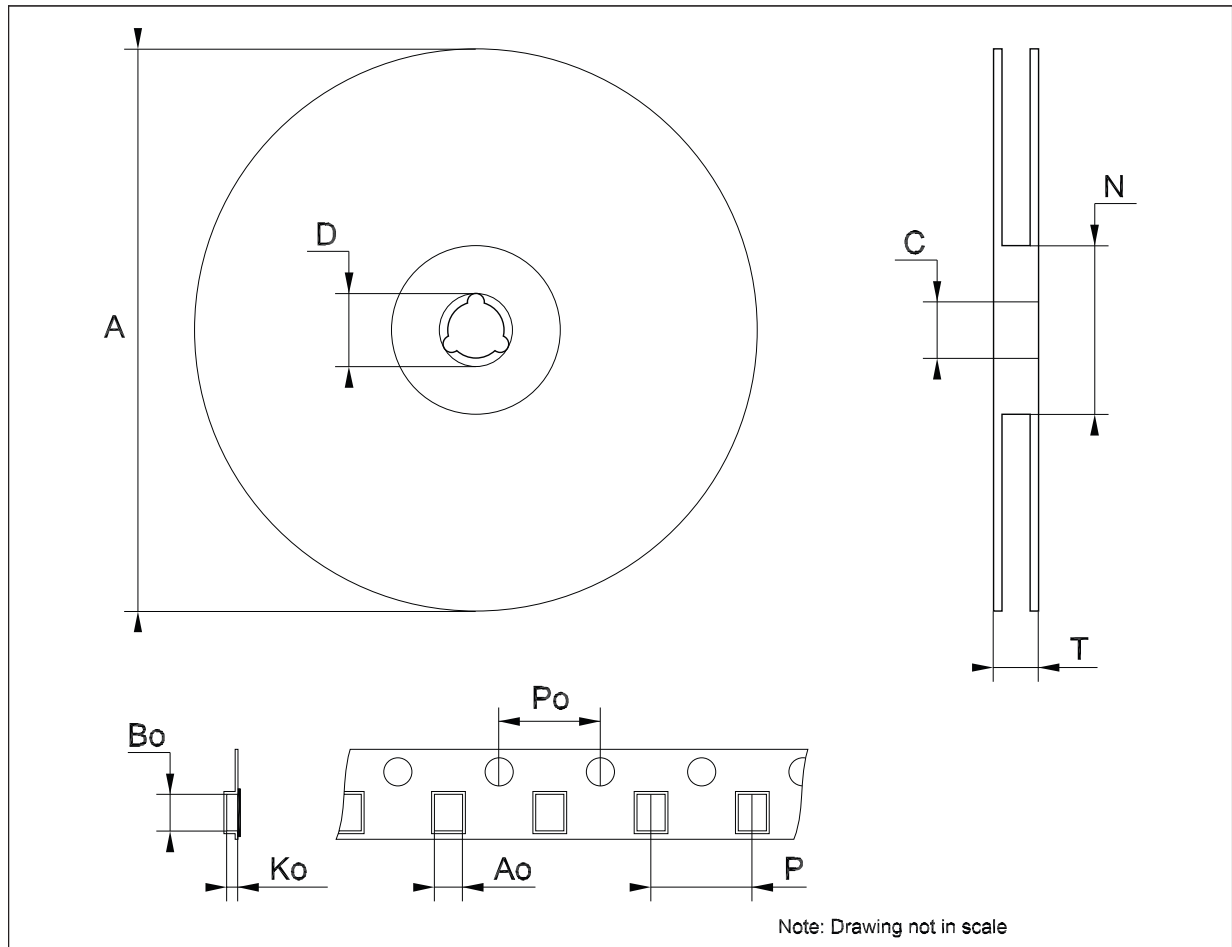


Table 25. Footprint data

VALUES		
	mm.	inch.
A	12.20	0.480
B	9.75	0.384
C	16.90	0.665
D	3.50	0.138
E	1.60	0.063
F	2.54	0.100
G	5.08	0.200

Tape & reel D²PAK-P²PAK-D²PAK/A-P²PAK/A mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	10.50	10.6	10.70	0.413	0.417	0.421
Bo	15.70	15.80	15.90	0.618	0.622	0.626
Ko	4.80	4.90	5.00	0.189	0.193	0.197
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	11.9	12.0	12.1	0.468	0.472	0.476



8 Order code

Table 26. Order code

Part numbers	Packaging			
	TO-220 (A Type)	D ² PAK	TO-220FP	TO-3
L7805				L7805T
L7805C	L7805CV	L7805CD2T-TR	L7805CP	L7805CT
L7852C	L7852CV	L7852CD2T-TR ⁽¹⁾	L7852CP ⁽¹⁾	L7852CT ⁽¹⁾
L7806C	L7806CV	L7806CD2T-TR		L7806CT
L7808C	L7808CV	L7808CD2T-TR	L7808CP	L7808CT
L7885C	L7885CV	L7885CD2T-TR ⁽¹⁾	L7885CP ⁽¹⁾	L7885CT ⁽¹⁾
L7809C	L7809CV	L7809CD2T-TR	L7809CP	L7809CT
L7810C	L7810CV	L7810CD2T-TR ⁽¹⁾		
L7812C	L7812CV	L7812CD2T-TR	L7812CP	L7812CT
L7815C	L7815CV	L7815CD2T-TR	L7815CP	L7815CT
L7818C	L7818CV	L7818CD2T-TR ⁽¹⁾		L7818CT
L7820C	L7820CV	L7820CD2T-TR ⁽¹⁾	L7820CP ⁽¹⁾	L7820CT ⁽¹⁾
L7824C	L7824CV	L7824CD2T-TR	L7824CP	L7824CT

1. Available on request.

9 Revision history

Table 27. Revision history

Date	Revision	Changes
21-Jun-2004	12	Document updating.
03-Aug-2006	13	Order codes has been updated and new template.
19-Jan-2007	14	D ² PAK mechanical data has been updated and add footprint data.
31-May-2007	15	Order codes has been updated.
29-Aug-2007	16	Added Table 1 . in cover page.

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.

© 2007 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