

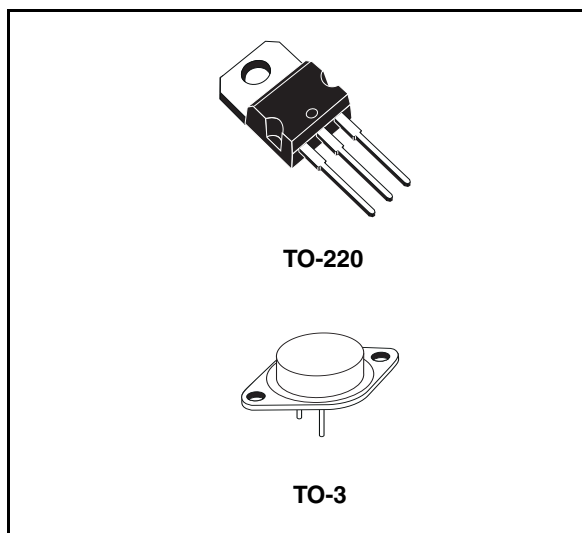
2A Positive voltage regulators

Feature summary

- Output current to 2A
- Output voltages of 5; 7.5; 9; 10; 12; 15; 18; 24V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection

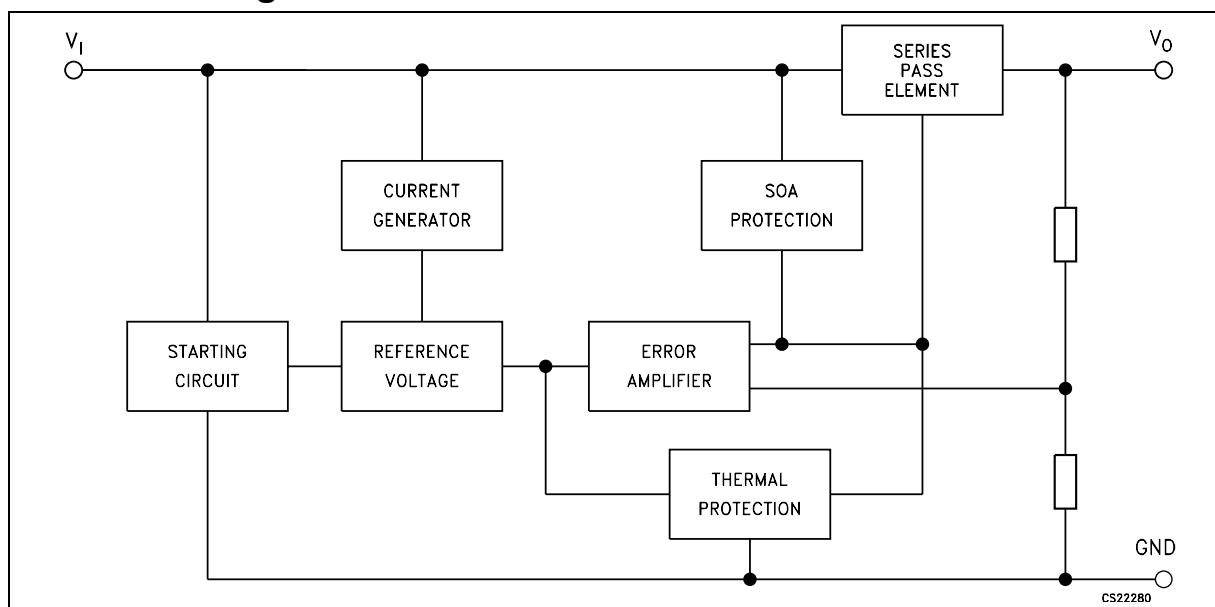
Description

The L78S00 series of three-terminal positive regulators is available in TO-220 and TO-3 packages and with 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 2A output



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

Schematic diagram



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1 Pin configuration

Figure 1. Pin connections (top view)

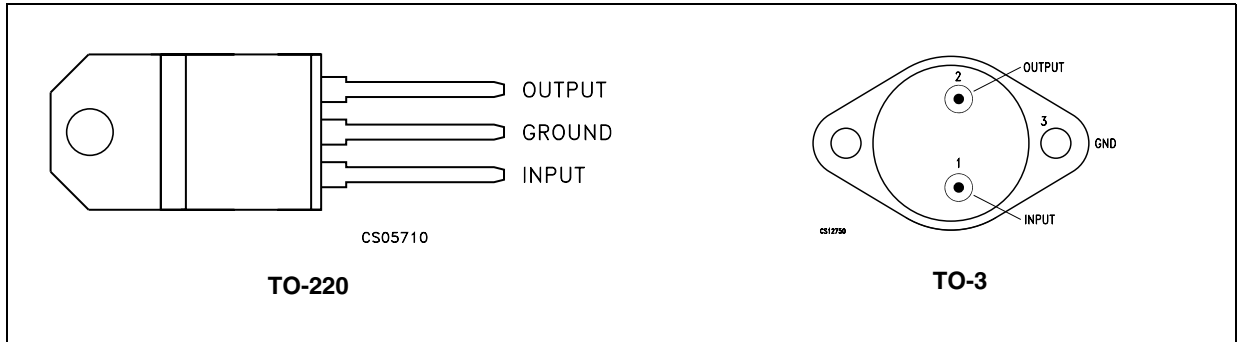
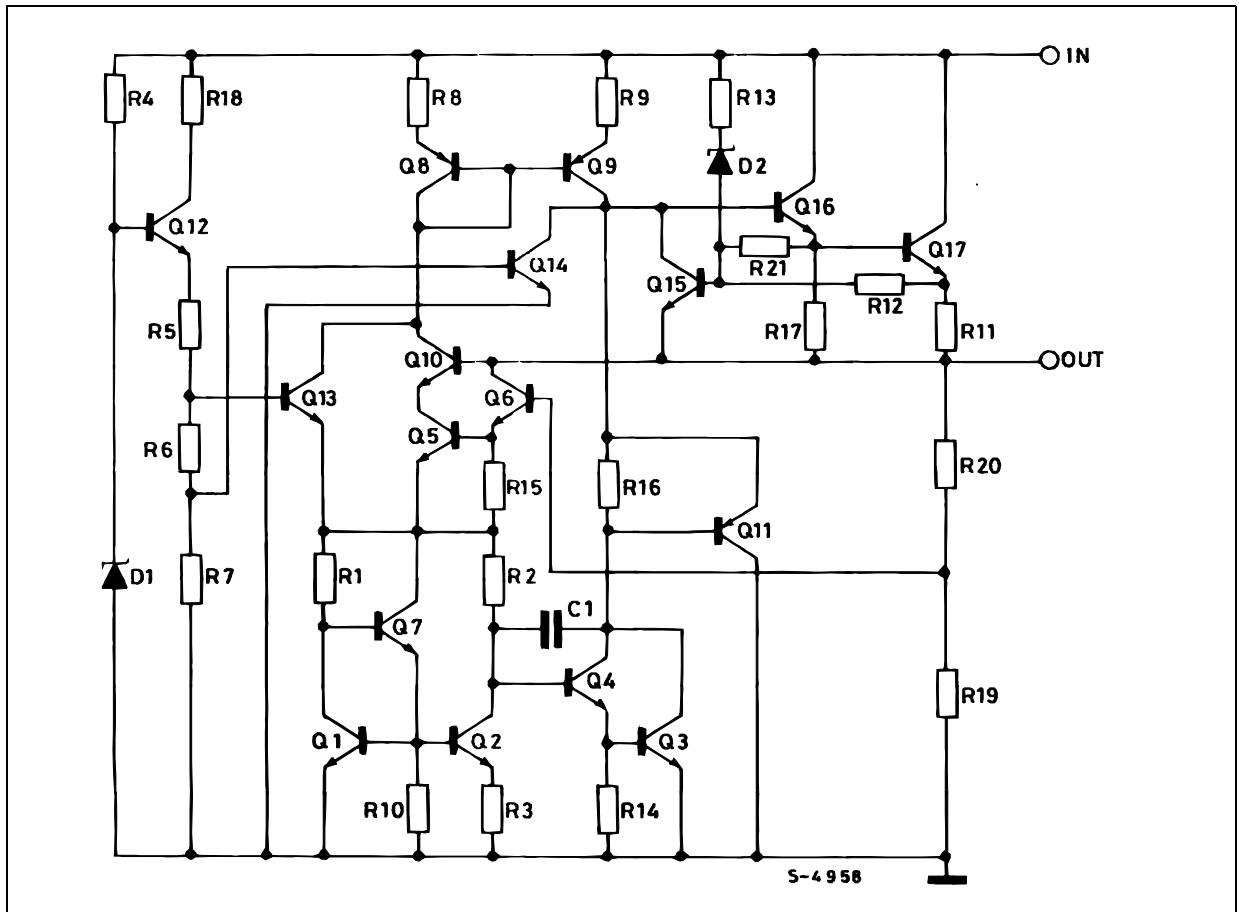


Figure 2. Schematic diagram



2 Maximum ratings

Table 1. Absolute maximum ratings

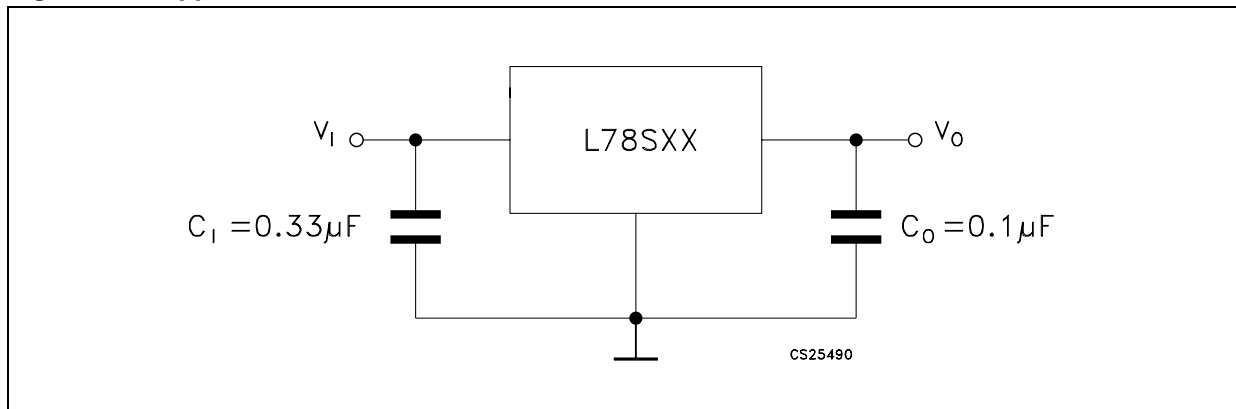
Symbol	Parameter		Value	Unit
V_I	DC Input voltage	for $V_O = 5$ to $18V$	35	V
		for $V_O = 24V$	40	
I_O	Output current		Internally Limited	
P_D	Power dissipation		Internally Limited	
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range	for L78S00	-55 to 150	°C
		for L78S00C	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 2. Thermal Data

Symbol	Parameter	TO-220	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	5	4	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	35	°C/W

Figure 3. Application circuits



3 Test circuits

Figure 4. DC Parameter

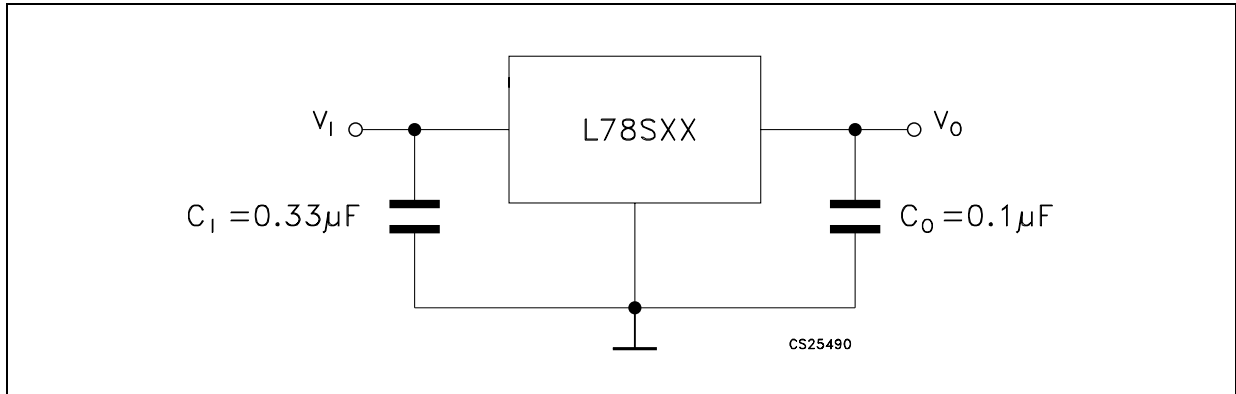


Figure 5. Load regulation

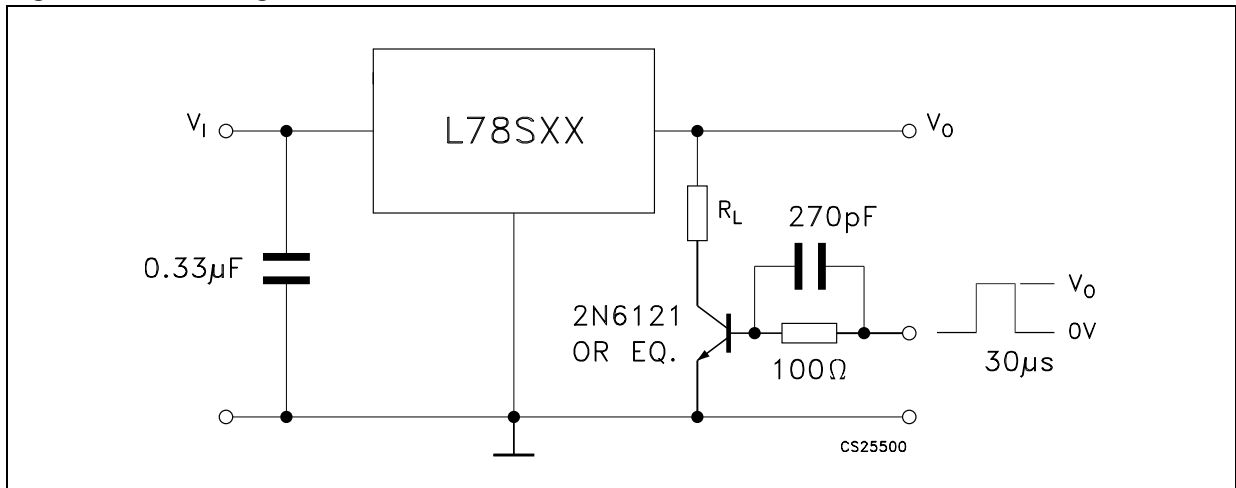
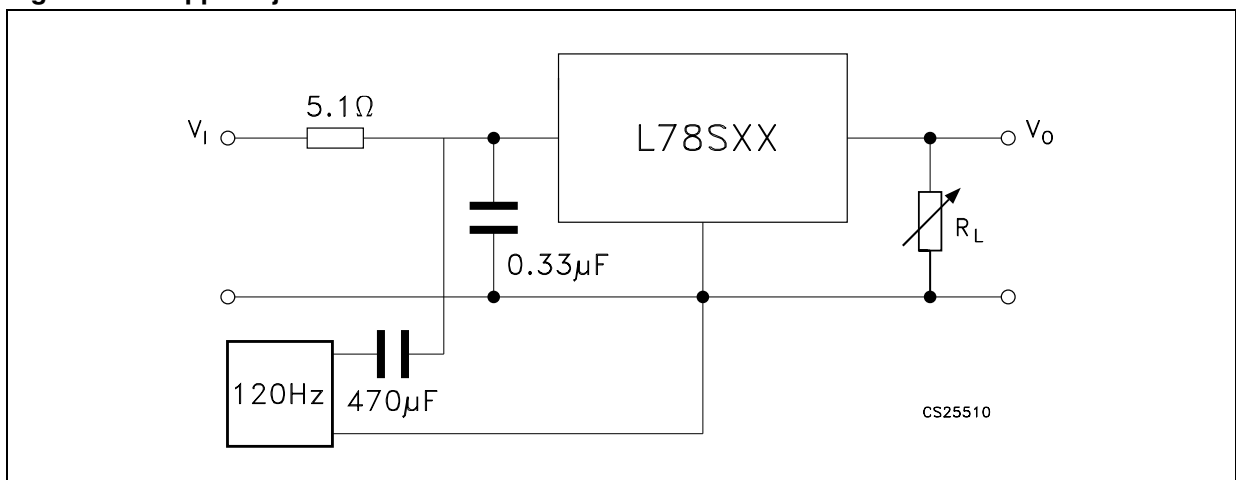


Figure 6. Ripple rejection



4 Electrical characteristics

Table 3. Electrical characteristics of L78S05 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 10\text{V}$, $I_O = 500\text{mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		4.8	5	5.2	V
V_O	Output voltage	$I_O = 1\text{A}$, $V_I = 7\text{V}$	4.75	5	5.25	V
ΔV_O	Line regulation	$V_I = 7$ to 25V			100	mV
		$V_I = 8$ to 25V			50	
ΔV_O	Load regulation	$I_O = 20\text{mA}$ to 2A			100	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA}$ to 1A			0.5	mA
		$V_I = 7$ to 25V , $I_O = 20\text{mA}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = -55^\circ\text{C}$ to 150°C		-1.1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{Hz}$ to 100kHz		40		μV
SVR	Supply voltage rejection	$f = 120\text{Hz}$	60			dB
V_d	Dropout voltage	$I_O \leq 1\text{A}$	8			V
R_O	Output resistance	$f = 1\text{kHz}$		17		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 4. Electrical characteristics of L78S75 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 12.5\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		7.15	7.5	7.9	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 9.5\text{V}$	7.1	7.5	7.95	V
ΔV_O	Line regulation	$V_I = 9.5\text{ to }25\text{V}$			120	mV
		$V_I = 10.5\text{ to }20\text{V}$			60	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }2\text{A}$			120	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$I_O = 20\text{mA}$, $V_I = 9.5\text{ to }25\text{V}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = -55^\circ\text{C to }150^\circ\text{C}$		-0.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10Hz to 100KHz		52		μV
SVR	Supply voltage rejection	f = 120Hz	54			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{A}$	10.5			V
R_O	Output resistance	f = 1 KHz		16		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 5. Electrical characteristics of L78S09 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		8.65	9	9.35	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 11\text{V}$	8.6	9	9.4	V
ΔV_O	Line regulation	$V_I = 11\text{ to }25\text{V}$			130	mV
		$V_I = 11\text{ to }20\text{V}$			65	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }2\text{A}$			130	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 11\text{ to }25\text{ V}$, $I_O = 20\text{mA}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = -55^\circ\text{C to }150^\circ\text{C}$		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10Hz to 100KHz		60		μV
SVR	Supply voltage rejection	f = 120Hz	53			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{A}$	12			V
R_O	Output resistance	f = 1 KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 6. Electrical characteristics of L78S10 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 15\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		9.5	10	10.5	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 12.5\text{ V}$	9.4	10	10.6	V
ΔV_O	Line regulation	$V_I = 12.5\text{ to }30\text{ V}$			200	mV
		$V_I = 14\text{ to }22\text{ V}$			100	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }2\text{ A}$			150	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 12.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = -55^\circ\text{C to }150^\circ\text{C}$		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz		65		µV
SVR	Supply voltage rejection	f = 120Hz	53			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{ A}$	13			V
R_O	Output resistance	f = 1 KHz		17		mΩ
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 7. Electrical characteristics of L78S12 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 19\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		11.5	12	12.5	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 14.5\text{ V}$	11.4	12	12.6	V
ΔV_O	Line regulation	$V_I = 14.5\text{ to }30\text{ V}$			240	mV
		$V_I = 16\text{ to }22\text{ V}$			120	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }2\text{ A}$			160	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 14.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = -55^\circ\text{C to }150^\circ\text{C}$		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz		75		µV
SVR	Supply voltage rejection	f = 120Hz	53			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{ A}$	15			V
R_O	Output resistance	f = 1 KHz		18		mΩ
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 8. Electrical characteristics of L78S15 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 23\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		14.4	15	15.6	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 17.5\text{ V}$	14.25	15	15.75	V
ΔV_O	Line regulation	$V_I = 17.5$ to 30 V			300	mV
		$V_I = 20$ to 26 V			150	
ΔV_O	Load regulation	$I_O = 20\text{ mA}$ to 2 A			180	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA}$ to 1 A			0.5	mA
		$V_I = 17.5$ to 30 V , $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = -55^\circ\text{C}$ to 150°C		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{ Hz}$ to 100 KHz		90		μV
SVR	Supply voltage rejection	$f = 120\text{ Hz}$	52			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{ A}$	18			V
R_O	Output resistance	$f = 1\text{ KHz}$		19		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 9. Electrical characteristics of L78S18 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 26\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		17.1	18	18.9	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 20.5\text{ V}$	17	18	19	V
ΔV_O	Line regulation	$V_I = 20.5$ to 30 V			360	mV
		$V_I = 22$ to 28 V			180	
ΔV_O	Load regulation	$I_O = 20\text{ mA}$ to 2 A			200	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA}$ to 1 A			0.5	mA
		$V_I = 20.5$ to 30 V , $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = -55^\circ\text{C}$ to 150°C		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{ Hz}$ to 100 KHz		110		μV
SVR	Supply voltage rejection	$f = 120\text{ Hz}$	49			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{ A}$	21			V
R_O	Output resistance	$f = 1\text{ KHz}$		22		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 10. Electrical characteristics of L78S24 (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 33\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		23	24	25	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 27\text{V}$	22.8	24	25.2	V
ΔV_O	Line regulation	$V_I = 27\text{ to }38\text{V}$			480	mV
		$V_I = 30\text{ to }36\text{V}$			240	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }2\text{A}$			250	mV
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 27\text{ to }38\text{ V}$, $I_O = 20\text{mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = -55^\circ\text{C to }150^\circ\text{C}$		-1.5		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		170		μV
SVR	Supply voltage rejection	$f = 120\text{Hz}$	48			dB
V_d	Dropout voltage	$I_O \leq 1.5\text{A}$	27			V
R_O	Output resistance	$f = 1\text{ KHz}$		23		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 11. Electrical characteristics of L78S05C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 10\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		4.8	5	5.2	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 7\text{ V}$	4.75	5	5.25	V
ΔV_O	Line regulation	$V_I = 7\text{ to }25\text{ V}$			100	mV
		$V_I = 8\text{ to }25\text{ V}$			50	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{ A}$			100	mV
		$I_O = 2\text{ A}$		80		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 7\text{ to }25\text{ V}$, $I_O = 20\text{ mA}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1.1		mV/°C
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		40		μV
SVR	Supply voltage rejection	$f = 120\text{ Hz}$	54			dB
V_d	Dropout voltage	$I_O \leq 1\text{ A}$	8			V
R_O	Output resistance	$f = 1\text{ KHz}$		17		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 12. Electrical characteristics of L78S75C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 12.5\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		7.15	7.5	7.9	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 9.5\text{V}$	7.1	7.5	7.95	V
ΔV_O	Line regulation	$V_I = 9.5\text{ to }25\text{V}$			120	mV
		$V_I = 10.5\text{ to }20\text{V}$			60	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{A}$			140	mV
		$I_O = 2\text{A}$		100		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 9.5\text{ to }25\text{ V}$, $I_O = 20\text{mA}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-0.8		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		52		μV
SVR	Supply voltage rejection	$f = 120\text{Hz}$	48			dB
V_d	Dropout voltage	$I_O \leq 1\text{A}$	10.5			V
R_O	Output resistance	$f = 1\text{ KHz}$		16		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 13. Electrical characteristics of L78S09C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		8.65	9	9.35	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 11\text{ V}$	8.6	9	9.4	V
ΔV_O	Line regulation	$V_I = 11\text{ to }25\text{ V}$			130	mV
		$V_I = 11\text{ to }20\text{ V}$			65	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{ A}$			170	mV
		$I_O = 2\text{ A}$		100		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 11\text{ to }25\text{ V}$, $I_O = 20\text{ mA}$			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz		60		μV
SVR	Supply voltage rejection	f = 120Hz	47			dB
V_d	Dropout voltage	$I_O \leq 1\text{ A}$	12			V
R_O	Output resistance	f = 1 KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 14. Electrical characteristics of L78S10C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 15\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		9.5	10	10.5	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 12.5\text{V}$	9.4	10	10.6	V
ΔV_O	Line regulation	$V_I = 12.5\text{ to }30\text{V}$			200	mV
		$V_I = 14\text{ to }22\text{V}$			100	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{A}$			240	mV
		$I_O = 2\text{A}$		150		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 12.5\text{ to }30\text{ V}$, $I_O = 20\text{mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10Hz to 100KHz		65		μV
SVR	Supply voltage rejection	f = 120Hz	47			dB
V_d	Dropout voltage	$I_O \leq 1\text{A}$	13			V
R_O	Output resistance	f = 1 KHz		17		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 15. Electrical characteristics of L78S12C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 19\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		11.5	12	12.5	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 14.5\text{ V}$	11.4	12	12.6	V
ΔV_O	Line regulation	$V_I = 14.5\text{ to }30\text{ V}$			240	mV
		$V_I = 16\text{ to }22\text{ V}$			120	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{ A}$			240	mV
		$I_O = 2\text{ A}$		150		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 14.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz		75		μV
SVR	Supply voltage rejection	f = 120Hz	47			dB
V_d	Dropout voltage	$I_O \leq 1\text{ A}$	15			V
R_O	Output resistance	f = 1 KHz		18		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 16. Electrical characteristics of L78S15C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 23\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		14.4	15	15.6	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 17.5\text{V}$	14.25	15	15.75	V
ΔV_O	Line regulation	$V_I = 17.5\text{ to }30\text{V}$			300	mV
		$V_I = 20\text{ to }26\text{V}$			150	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{A}$			300	mV
		$I_O = 2\text{A}$		150		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 17.5\text{ to }30\text{ V}$, $I_O = 20\text{mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1		mV/ $^\circ\text{C}$
eN	Output noise voltage	B = 10Hz to 100KHz		90		μV
SVR	Supply voltage rejection	f = 120Hz	46			dB
V_d	Dropout voltage	$I_O \leq 1\text{A}$	18			V
R_O	Output resistance	f = 1 KHz		19		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 17. Electrical characteristics of L78S18C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 26\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		17.1	18	18.9	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 20.5\text{ V}$	17	18	19	V
ΔV_O	Line regulation	$V_I = 20.5\text{ to }30\text{ V}$			360	mV
		$V_I = 22\text{ to }28\text{ V}$			180	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{ A}$			360	mV
		$I_O = 2\text{ A}$		200		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{ mA to }1\text{ A}$			0.5	mA
		$V_I = 20.5\text{ to }30\text{ V}$, $I_O = 20\text{ mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1		mV/°C
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		110		μV
SVR	Supply voltage rejection	$f = 120\text{ Hz}$	43			dB
V_d	Dropout voltage	$I_O \leq 1\text{ A}$	21			V
R_O	Output resistance	$f = 1\text{ KHz}$		22		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{ V}$		500		mA
I_{scp}	Short circuit peak current			3		A

Table 18. Electrical characteristics of L78S24C (refer to the test circuits, $T_J = 25^\circ\text{C}$, $V_I = 33\text{V}$, $I_O = 500\text{ mA}$, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		23	24	25	V
V_O	Output voltage	$I_O = 1\text{ A}$, $V_I = 27\text{V}$	22.8	24	25.2	V
ΔV_O	Line regulation	$V_I = 27\text{ to }38\text{V}$			480	mV
		$V_I = 30\text{ to }36\text{V}$			240	
ΔV_O	Load regulation	$I_O = 20\text{ mA to }1.5\text{A}$			480	mV
		$I_O = 2\text{A}$		300		
I_d	Quiescent current				8	mA
ΔI_d	Quiescent current change	$I_O = 20\text{mA to }1\text{A}$			0.5	mA
		$V_I = 27\text{ to }38\text{ V}$, $I_O = 20\text{mA}$			1	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{mA}$, $T_J = 0^\circ\text{C to }70^\circ\text{C}$		-1.5		mV/ $^\circ\text{C}$
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		170		μV
SVR	Supply voltage rejection	$f = 120\text{Hz}$	42			dB
V_d	Dropout voltage	$I_O \leq 1\text{A}$	27			V
R_O	Output resistance	$f = 1\text{ KHz}$		28		m Ω
I_{sc}	Short circuit current	$V_I = 27\text{V}$		500		mA
I_{scp}	Short circuit peak current			3		A

5 Typical performance

Figure 7. Dropout voltage vs junction temperature

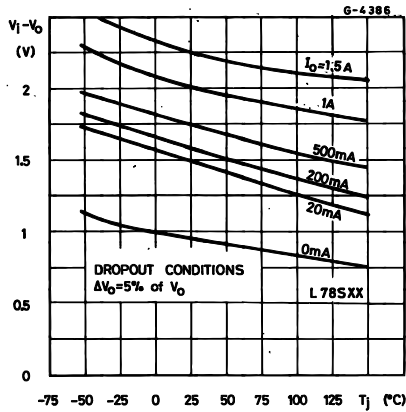


Figure 8. Peak output current vs input/output differential voltage

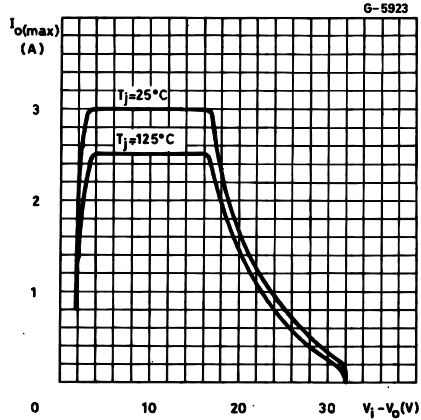


Figure 9. Output impedance vs frequency

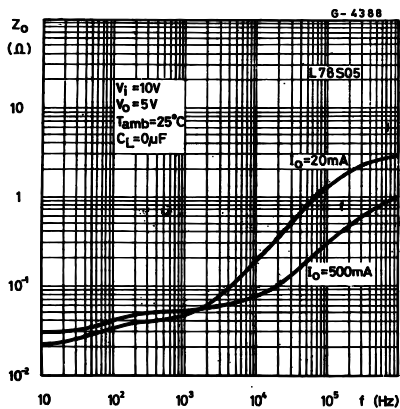


Figure 10. Output voltage vs junction temperature

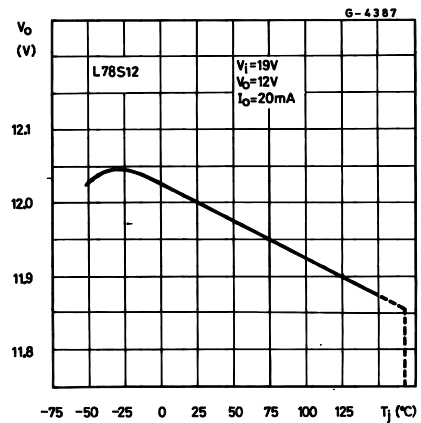


Figure 11. Supply voltage rejection vs frequency

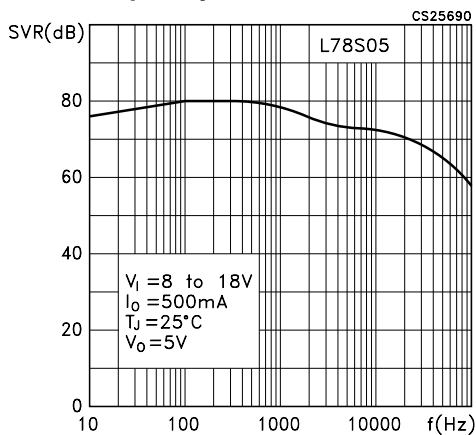


Figure 12. Quiescent current vs junction temperature

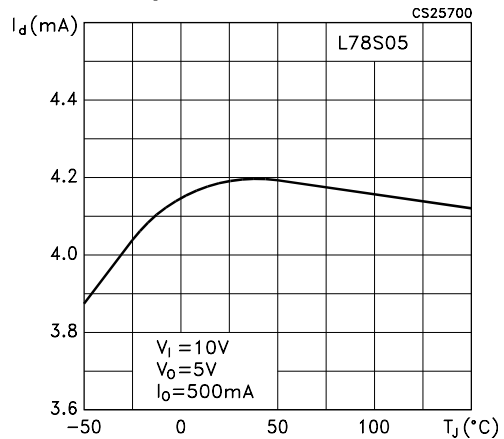


Figure 13. Load transient response

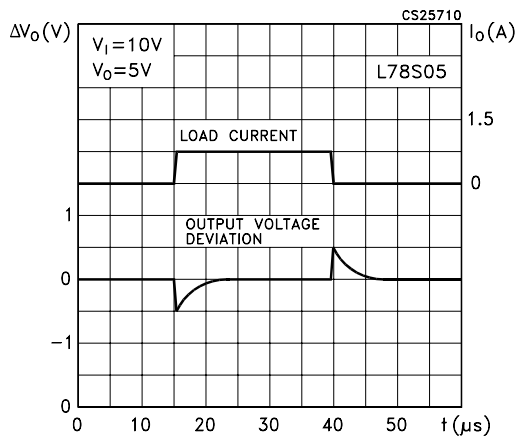


Figure 14. Line transient response

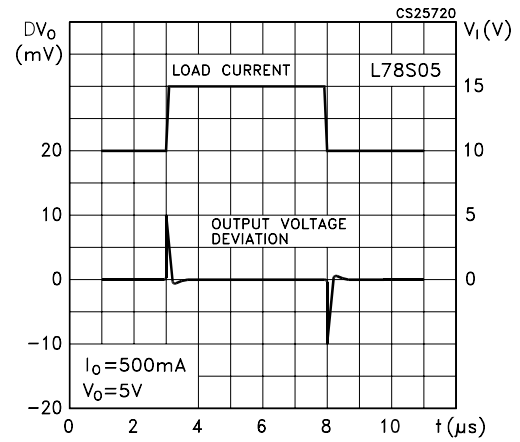


Figure 15. Quiescent current vs input voltage

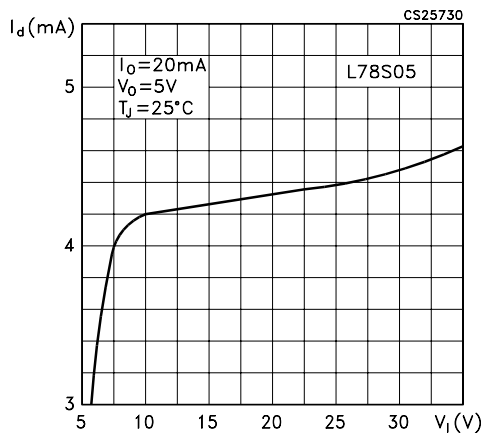
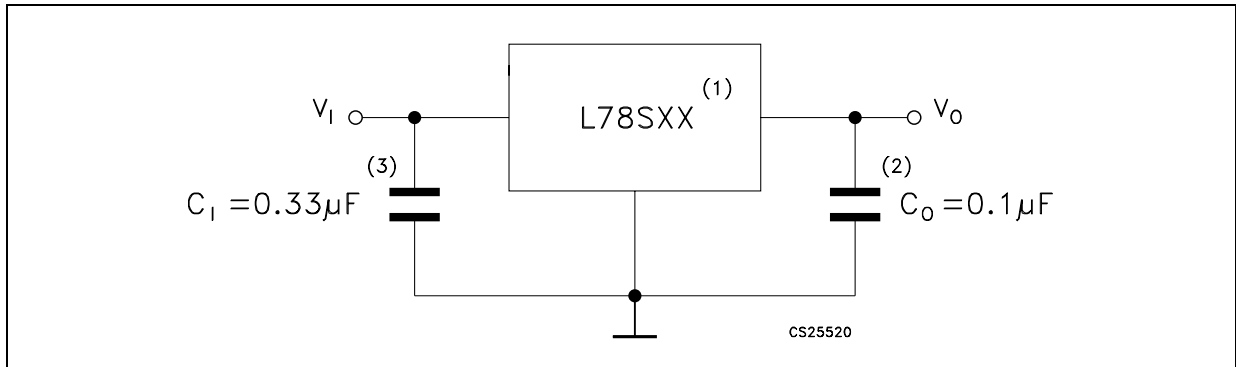
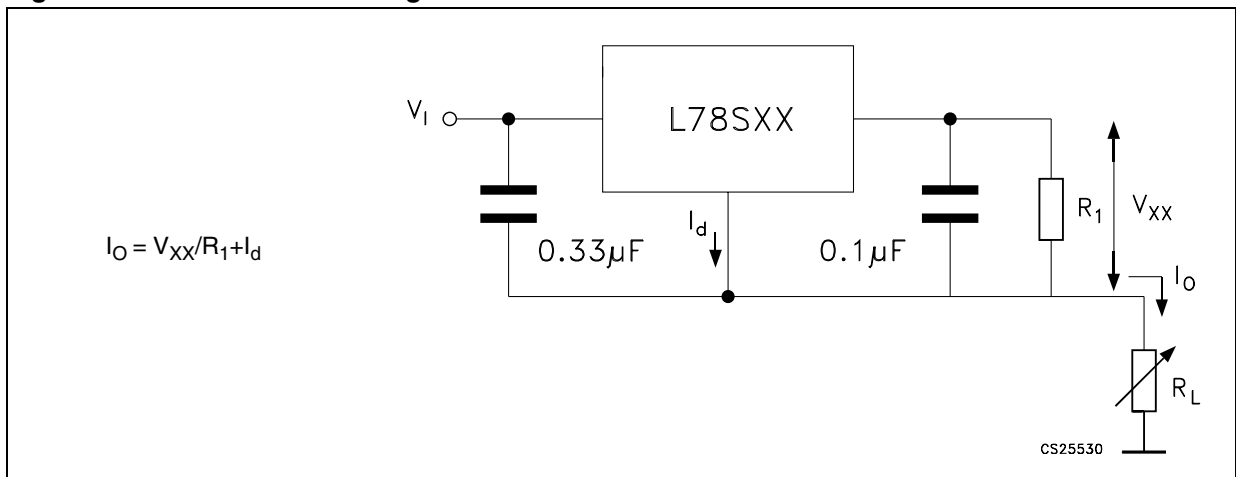


Figure 16. Fixed output regulator



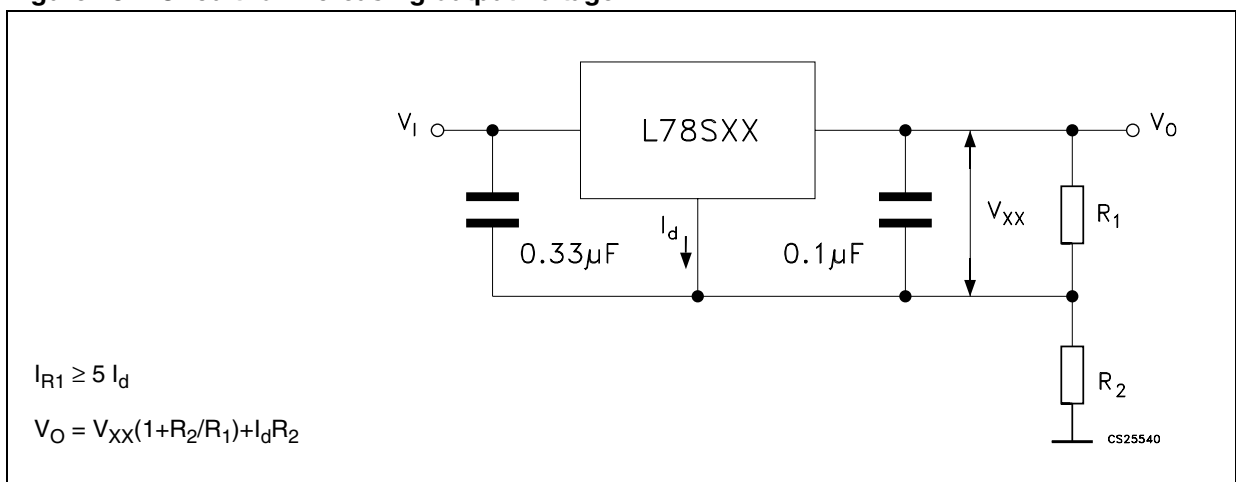
1. To specify an output voltage, substitute voltage value for "XX".
2. Although no output capacitor is need for stability, it does improve transient response.
3. Required if regulator is locate an appreciable distance from power supply filter.

Figure 17. Constant current regulator



$$I_o = V_{XX}/R_1 + I_d$$

Figure 18. Circuit for increasing output voltage



$$I_{R1} \geq 5 I_d$$

$$V_o = V_{XX}(1 + R_2/R_1) + I_d R_2$$

Figure 21. High current voltage regulator

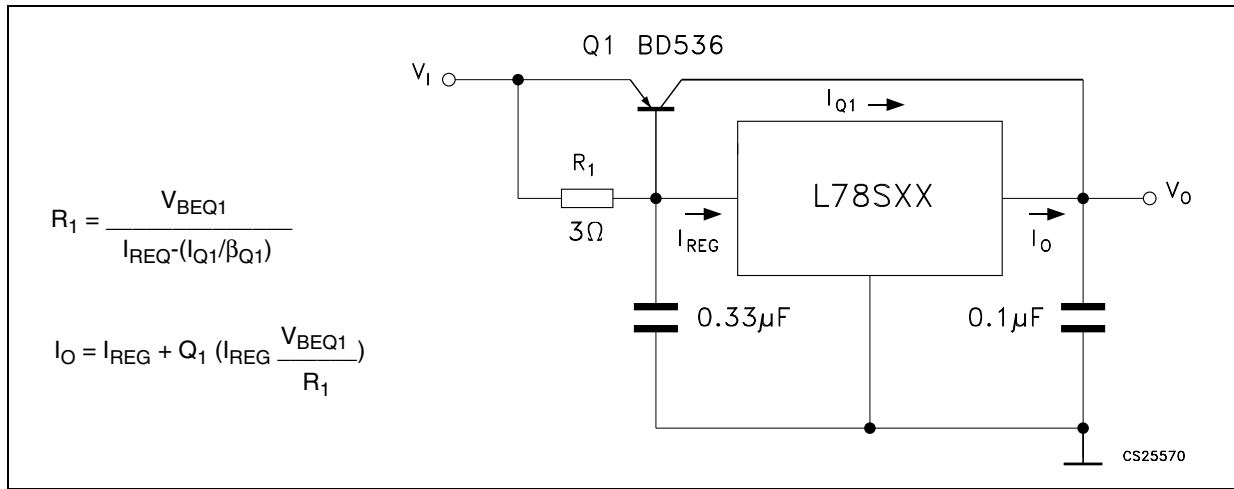


Figure 22. High output current with short circuit protection

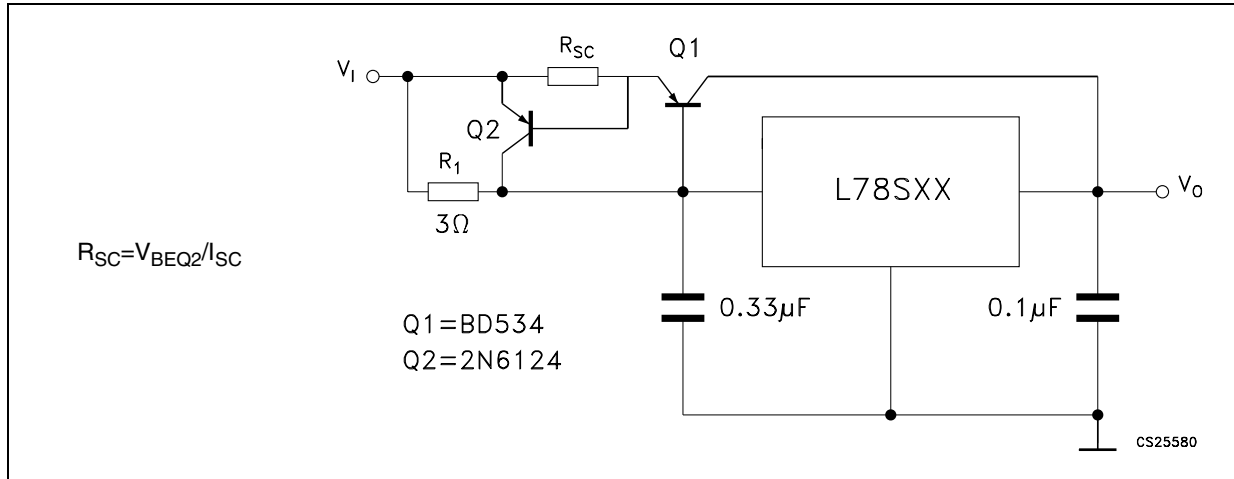


Figure 23. Tracking voltage regulator

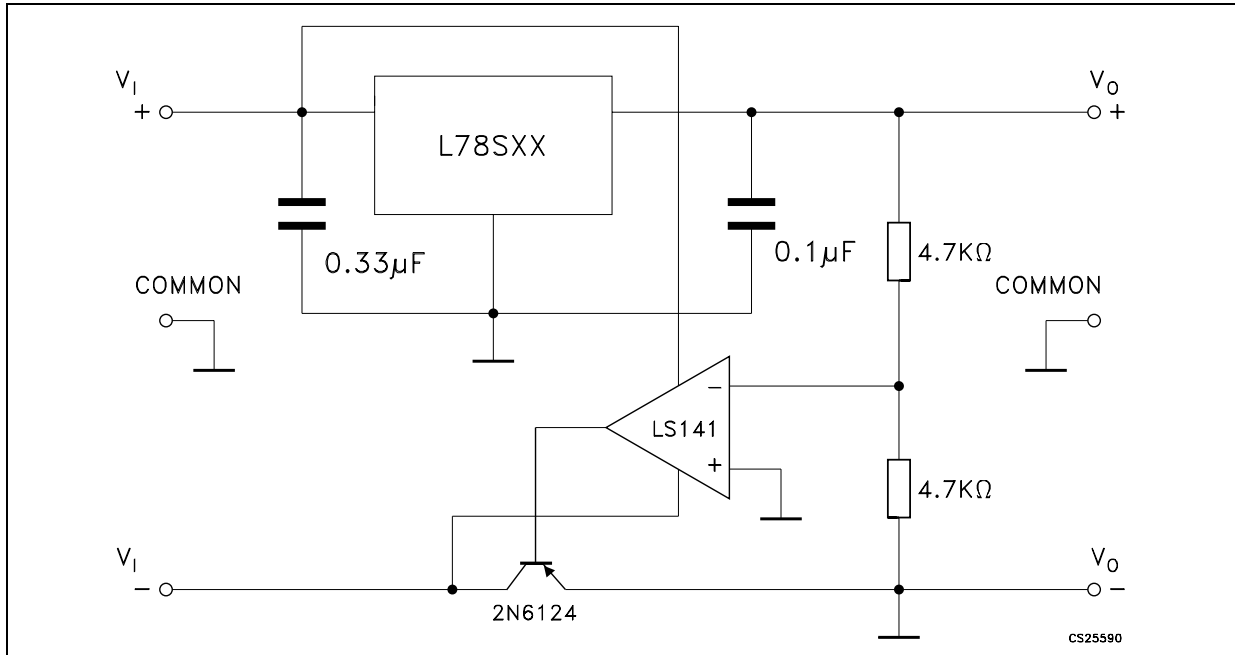


Figure 24. Positive and negative regulator

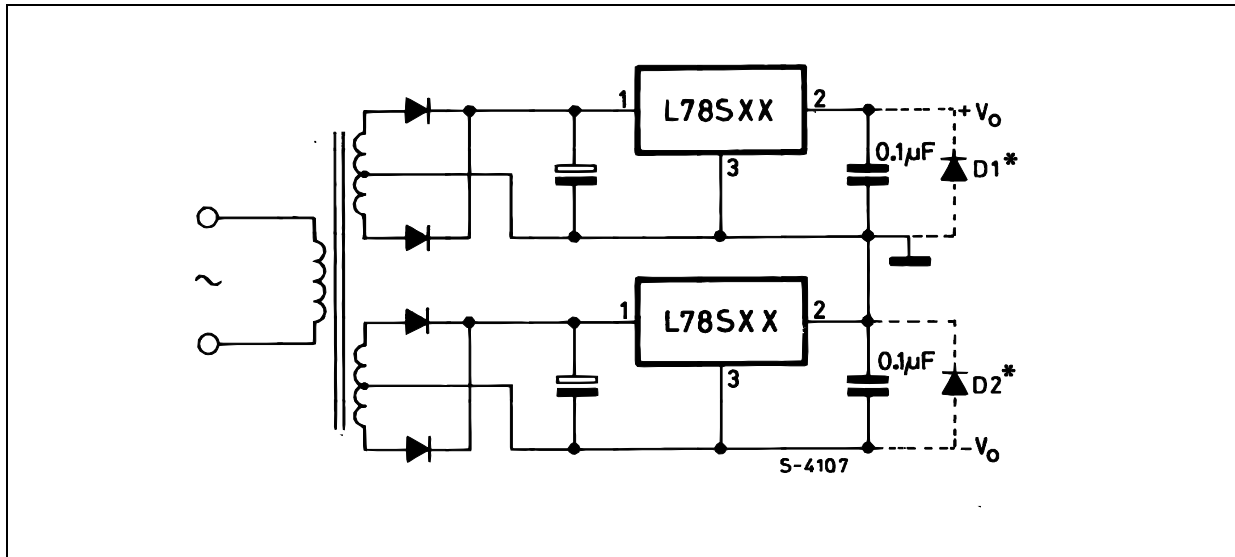


Figure 25. Negative output voltage circuit

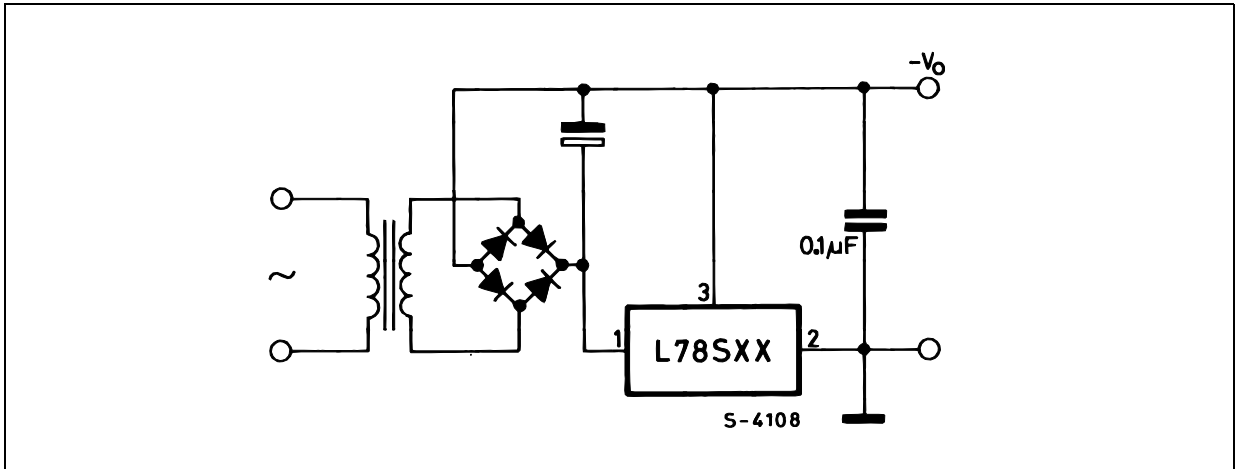


Figure 26. Switching regulator

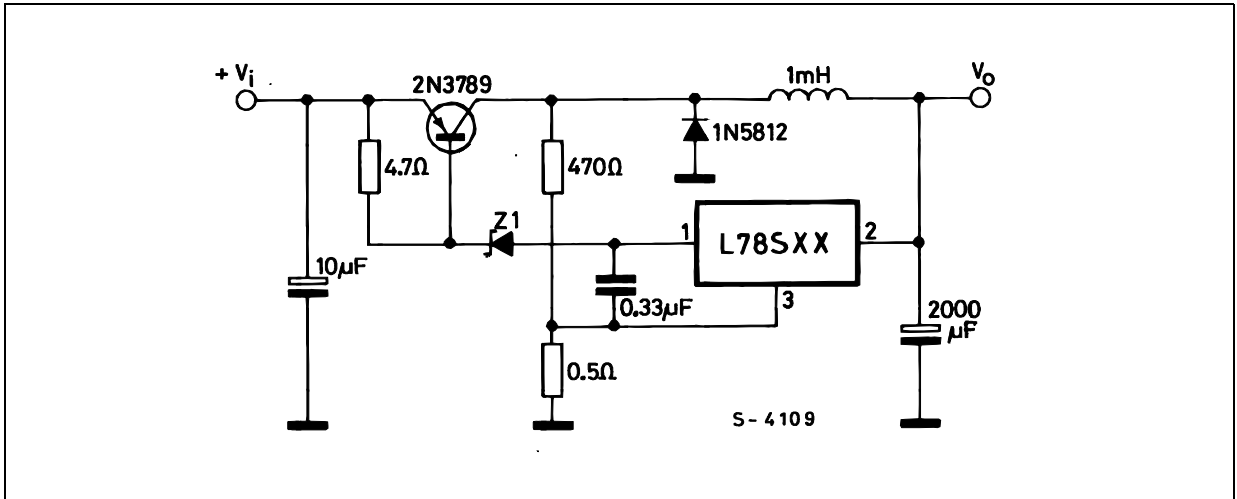


Figure 27. High input voltage circuit

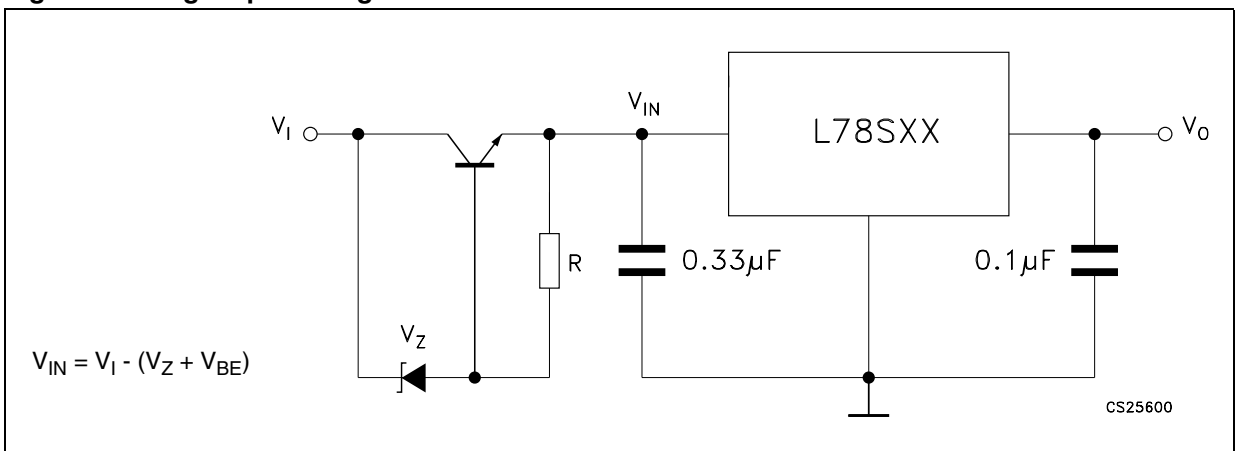


Figure 28. High input voltage circuit

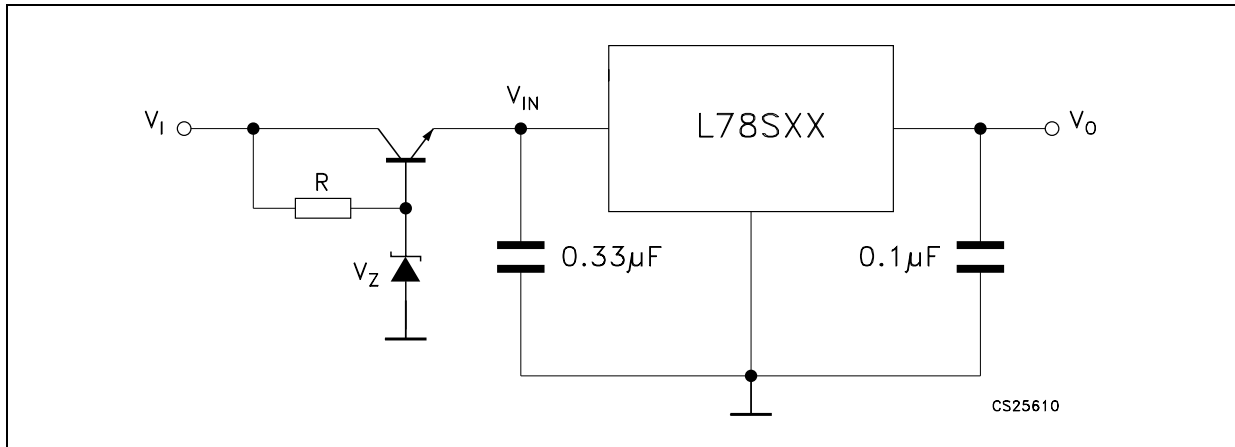


Figure 29. High output voltage regulator

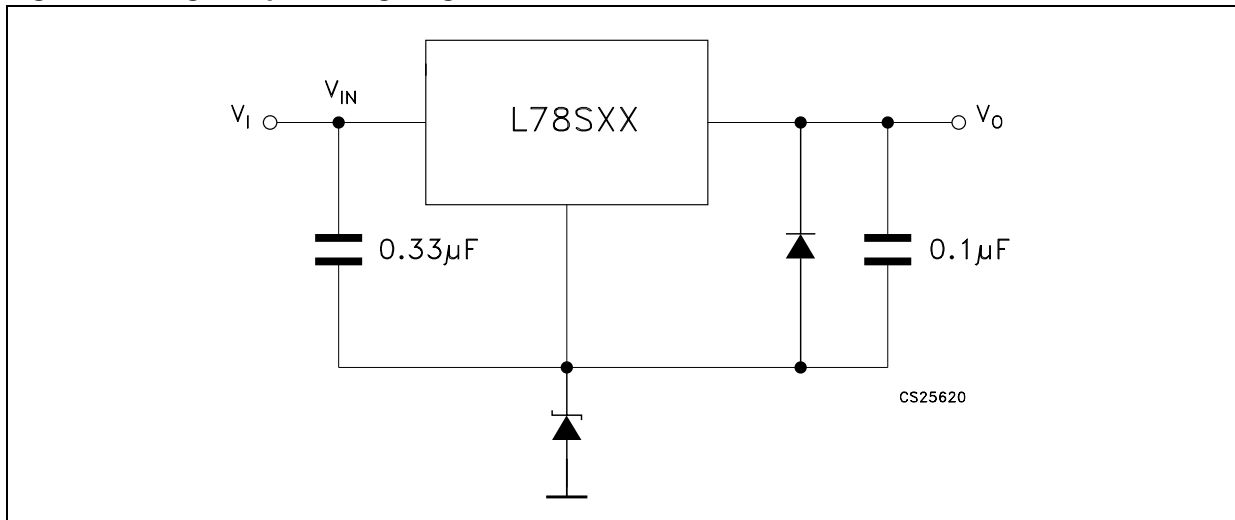


Figure 30. High input and output voltage

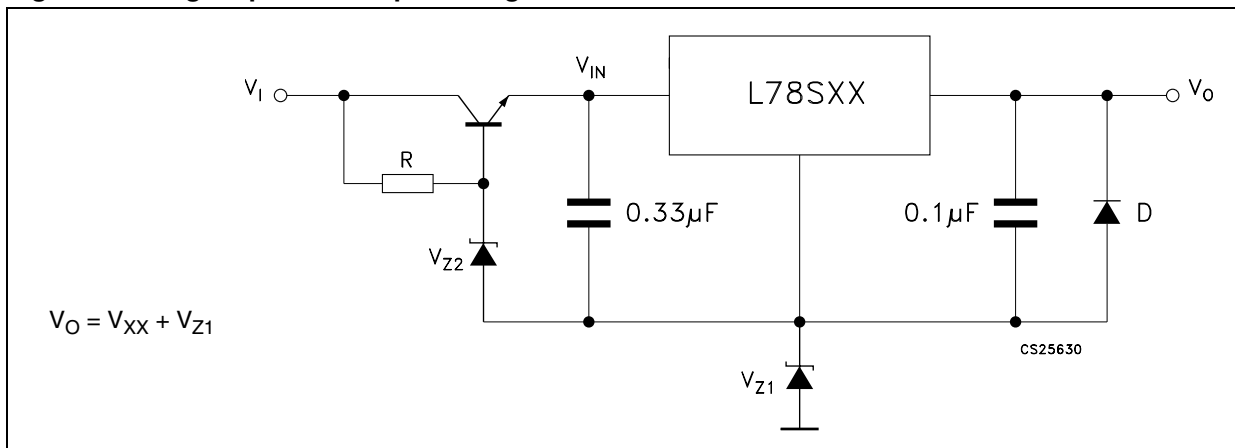


Figure 31. Reducing power dissipation with dropping resistor

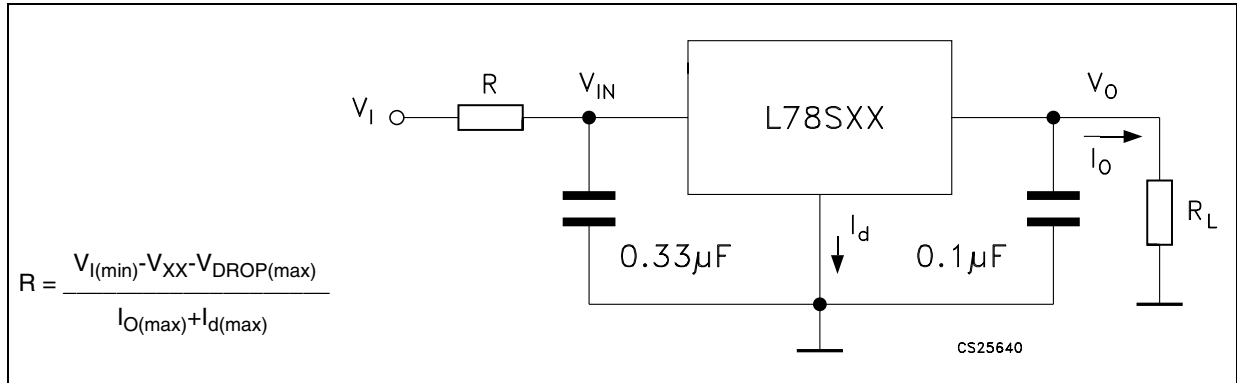


Figure 32. Remote shutdown

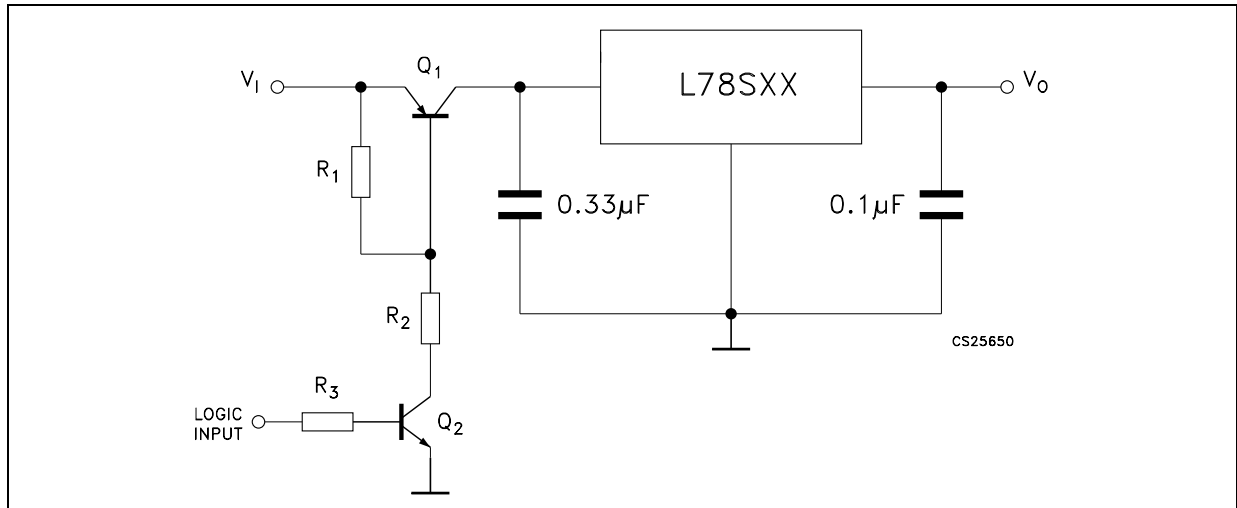
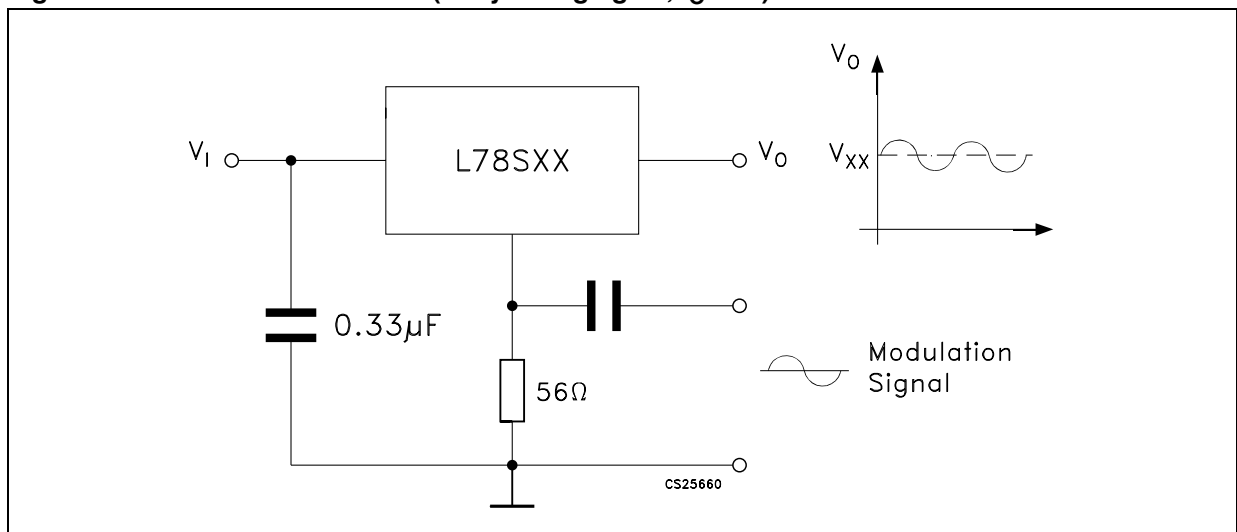
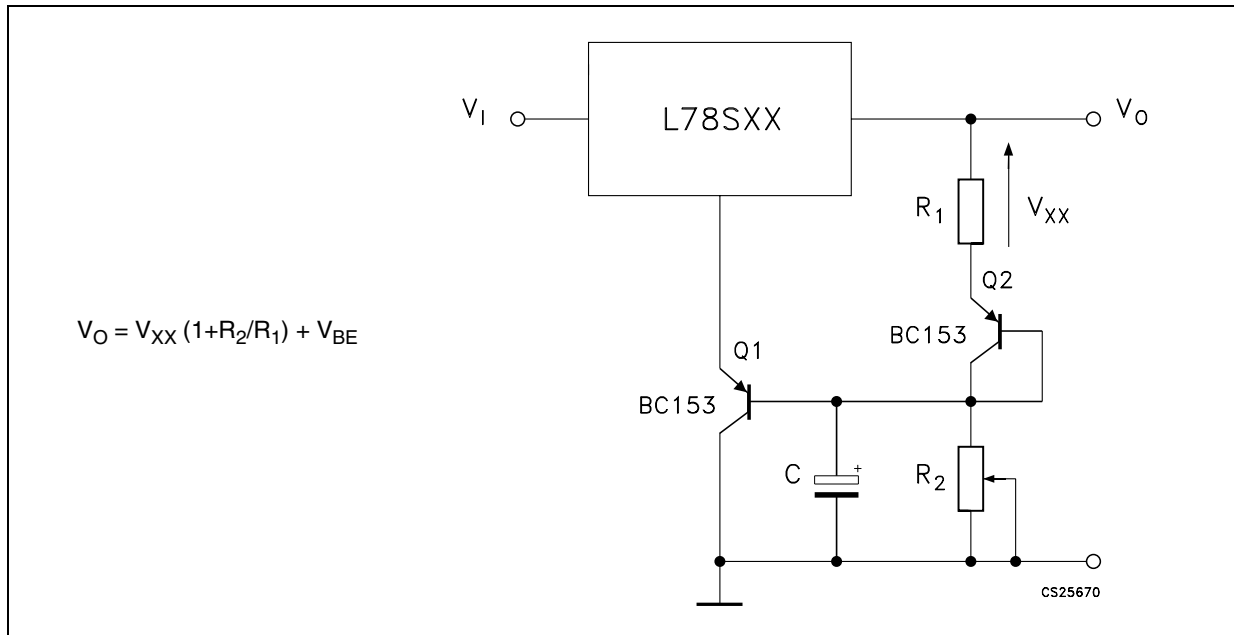


Figure 33. Power AM modulator (unity voltage gain, $I_O \leq 1A$)



Note: The circuit performs well up to 100 KHz.

Figure 34. 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 35. Light controllers ($V_{Omin} = V_{XX} + V_{BE}$)

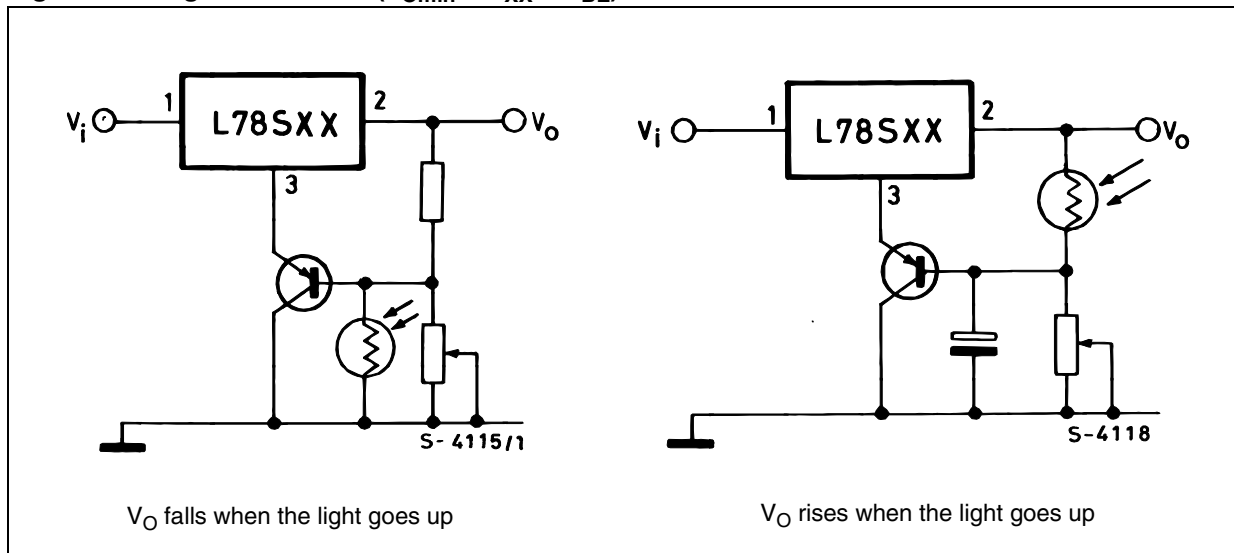
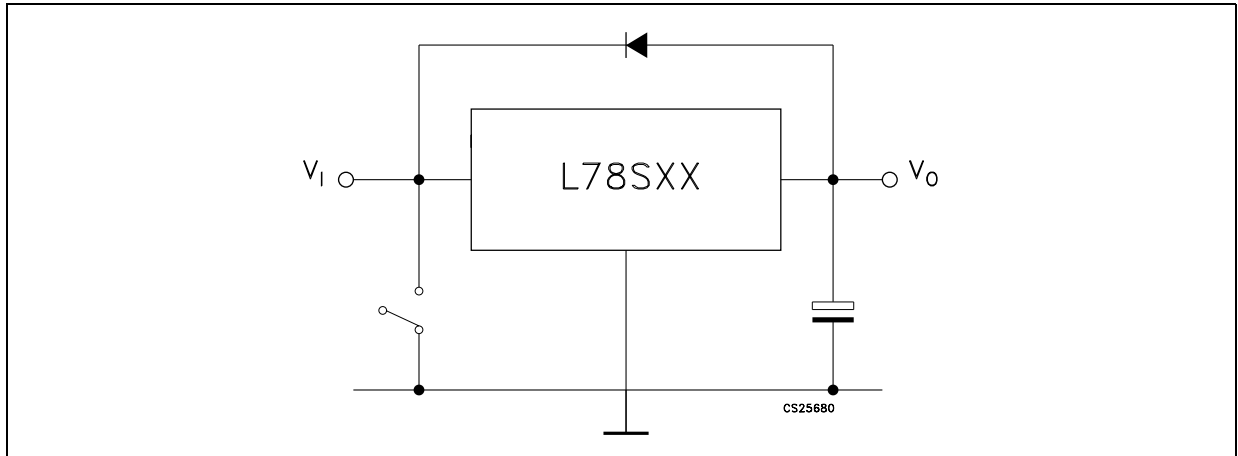


Figure 36. Protection against input short-circuit with high capacitance loads

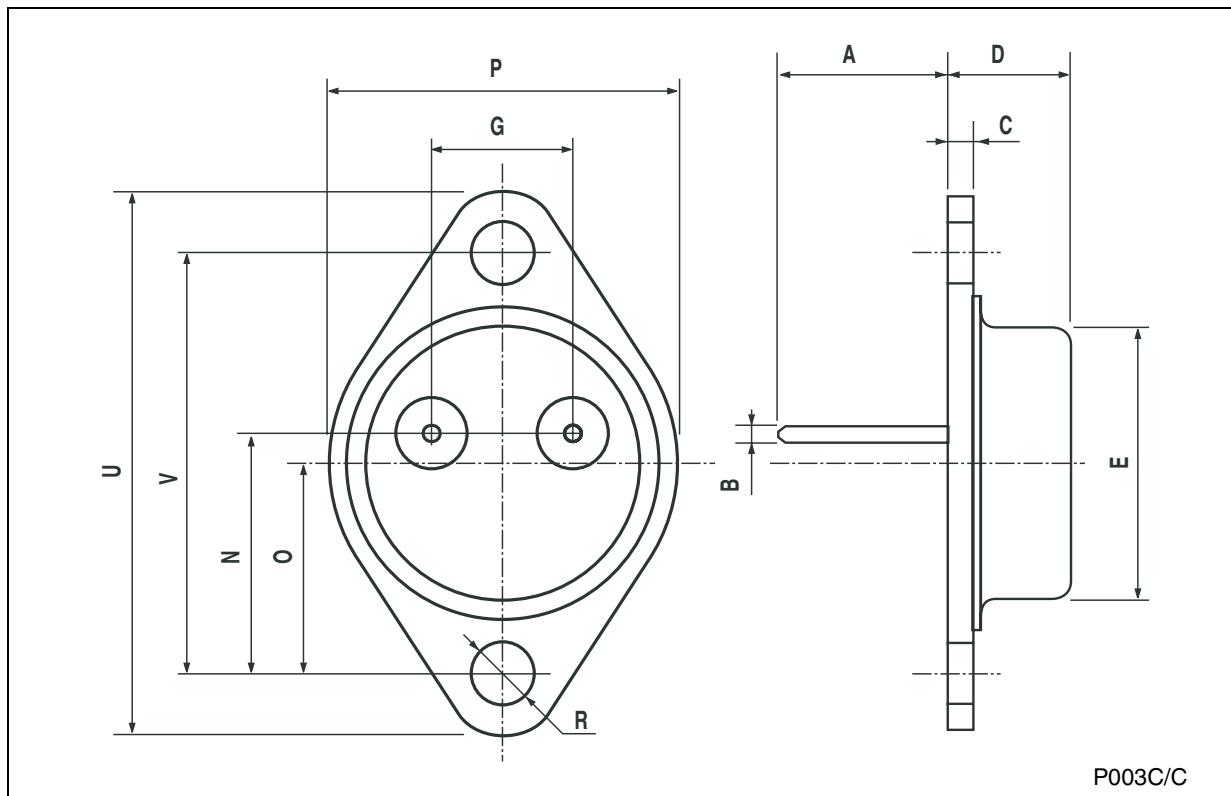
1. Application with high capacitance loads and an output voltage greater than 6 volts need an external diode (see fig. 32) to protect the device against input short circuit. In this case the input voltage falls rapidly while the output voltage decrease slowly. The capacitance discharges by means of the 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.

6 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.

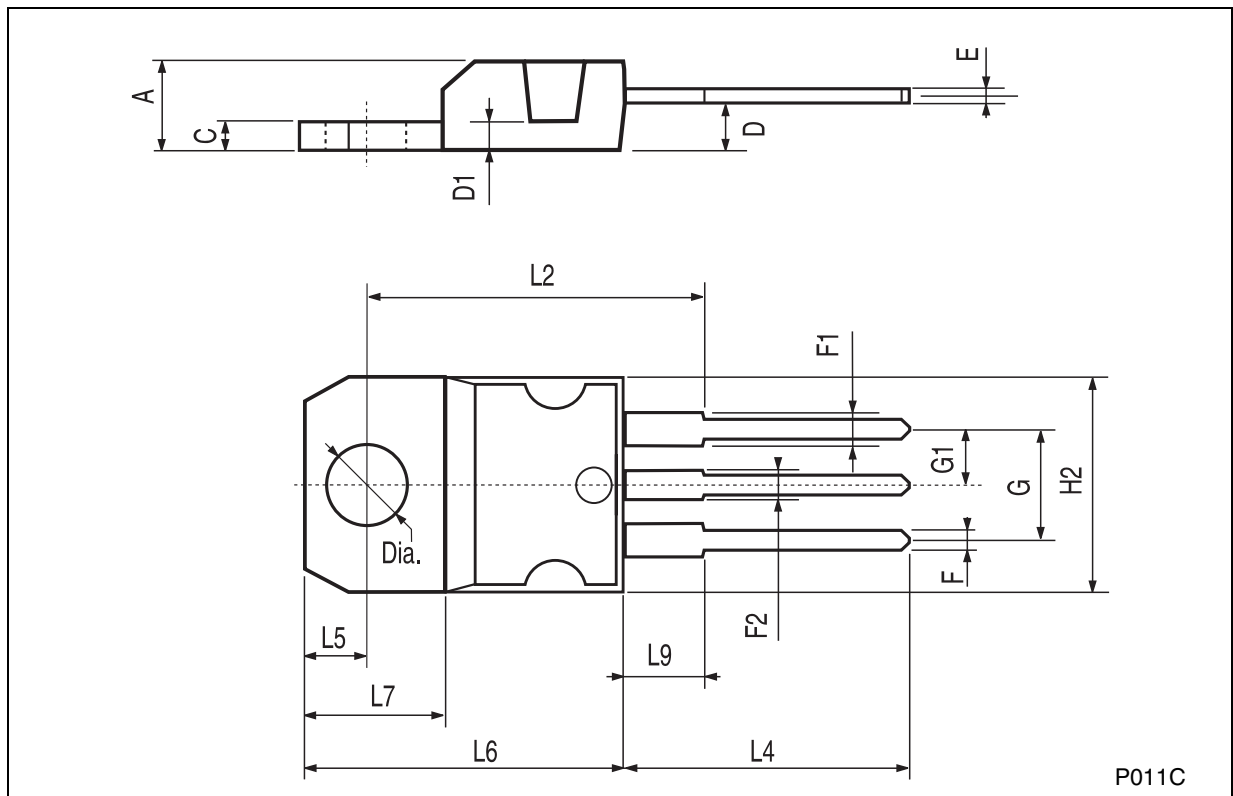
TO-3 MECHANICAL DATA

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	



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



P011C

7 Order code

Table 19. Order code

Part numbers	Packaging		
	TO-220	T0-3	Output voltage
L78S05		L78S05T ⁽¹⁾	5 V
L78S05C	L78S05CV	L78S05CT ⁽¹⁾	5 V
L78S75		L78S75T ⁽¹⁾	7.5 V
L78S75C	L78S75CV	L78S75CT ⁽¹⁾	7.5 V
L78S09		L78S09T ⁽¹⁾	9 V
L78S09C	L78S09CV		9 V
L78S10		L78S10T ⁽¹⁾	10 V
L78S10C	L78S10CV	L78S10CT ⁽¹⁾	10 V
L78S12		L78S12T ⁽¹⁾	12 V
L78S12C	L78S12CV	L78S12CT	12 V
L78S15		L78S15T ⁽¹⁾	15 V
L78S15C	L78S15CV	L78S15CT	15 V
L78S18		L78S18T ⁽¹⁾	18 V
L78S18C	L78S18CV		18 V
L78S24		L78S24T ⁽¹⁾	24 V
L78S24C	L78S24CV	L78S24CT ⁽¹⁾	24 V

1. Available on request.

8 Revision history

Table 20. Revision history

Date	Revision	Changes
07-Sep-2006	2	Order Codes has been updated and new template.

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