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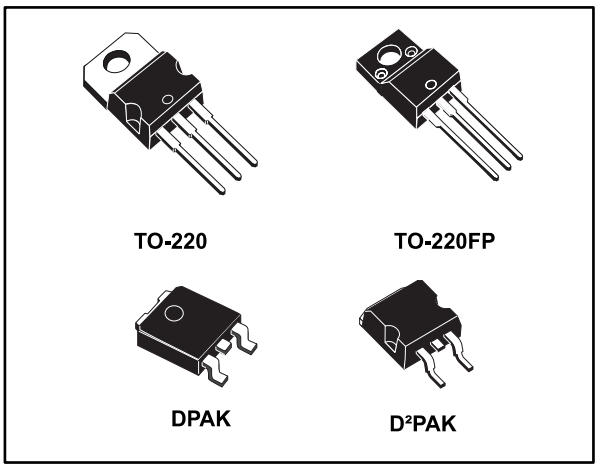
L78

Positive voltage regulator ICs

Datasheet - production data



Features

- Output current up to 1.5 A
- Output voltages of 5; 6; 8; 8.5; 9; 12; 15; 18; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection
- 2 % output voltage tolerance (A version)
- Guaranteed in extended temperature range (A version)

Description

The L78 series of three-terminal positive regulators is available in TO-220, TO-220FP, D²PAK and DPAK 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 embeds 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.

This is information on a product in full production.

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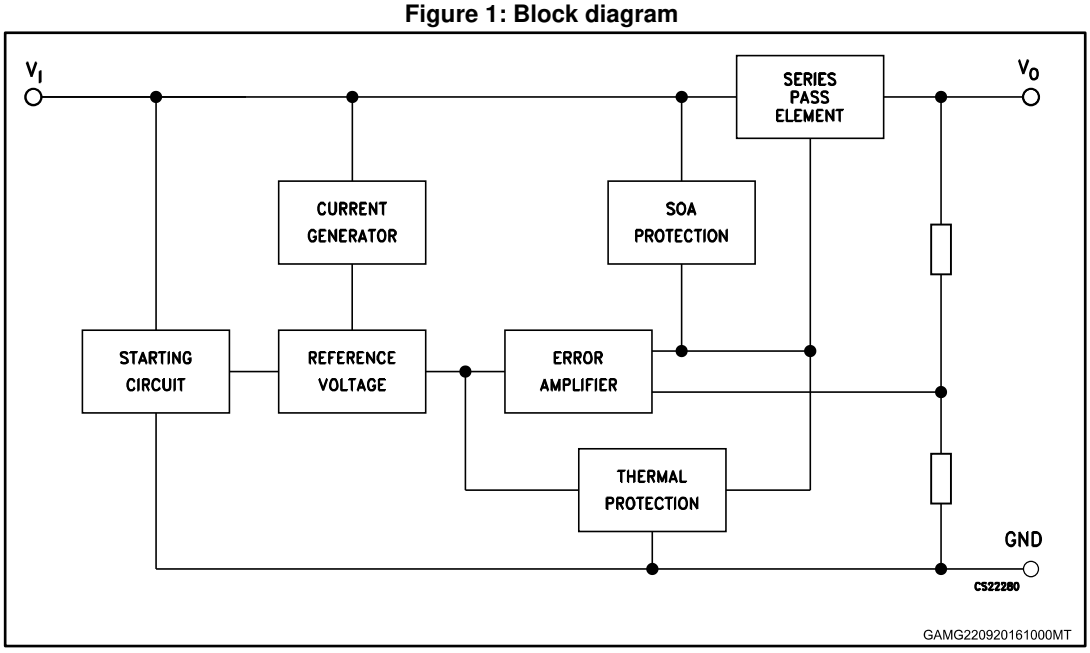
Contents

1 Diagram

Figure 1: Block diagram



2 Pin configuration

Figure 2: Pin connections (top view)

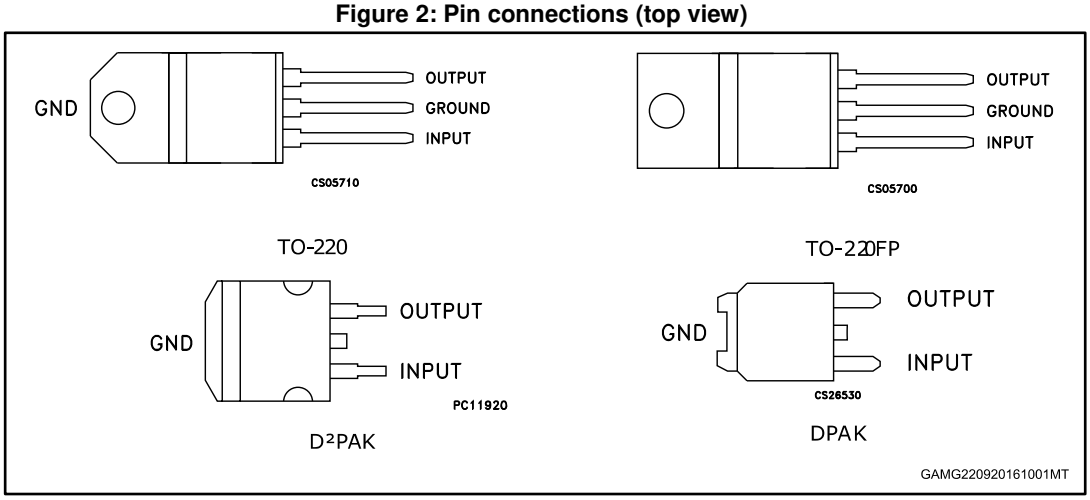
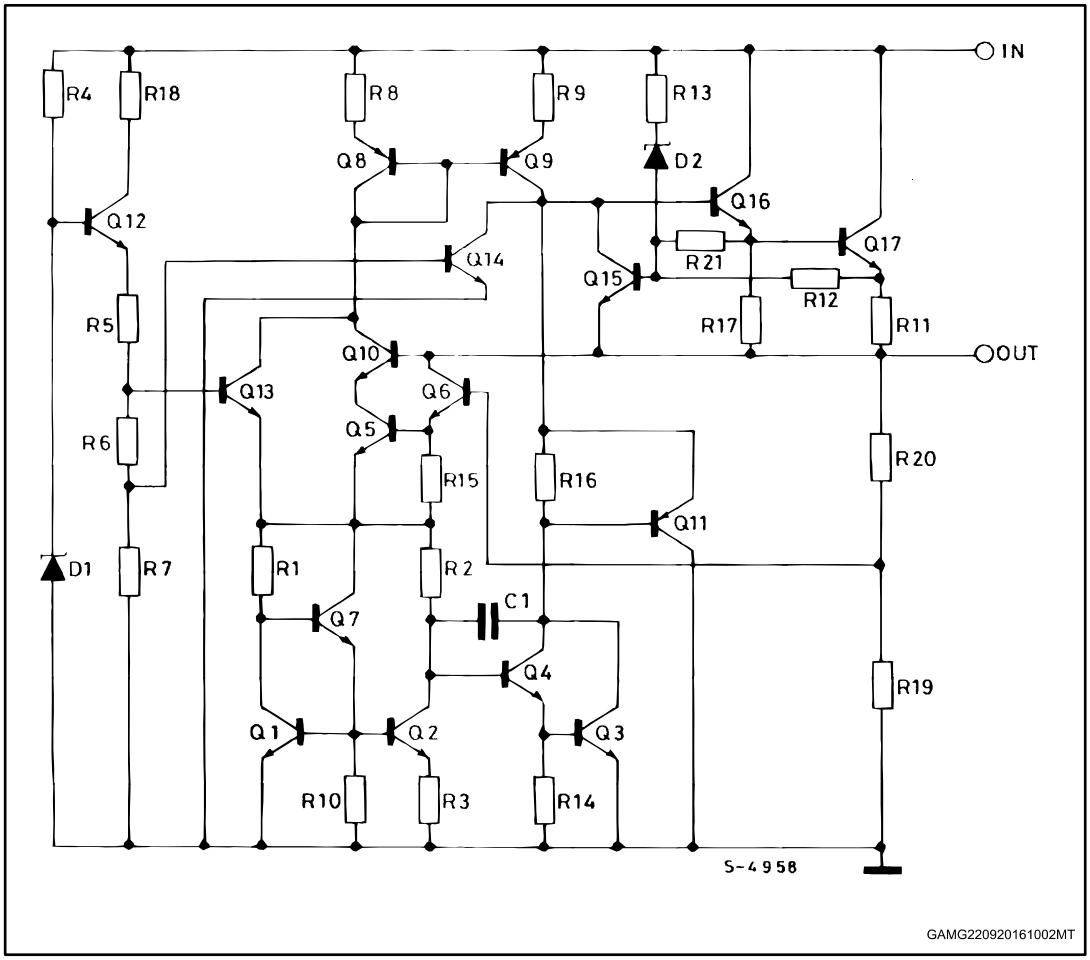


Figure 3: Schematic diagram



3 Maximum ratings

Table 1: Absolute maximum ratings

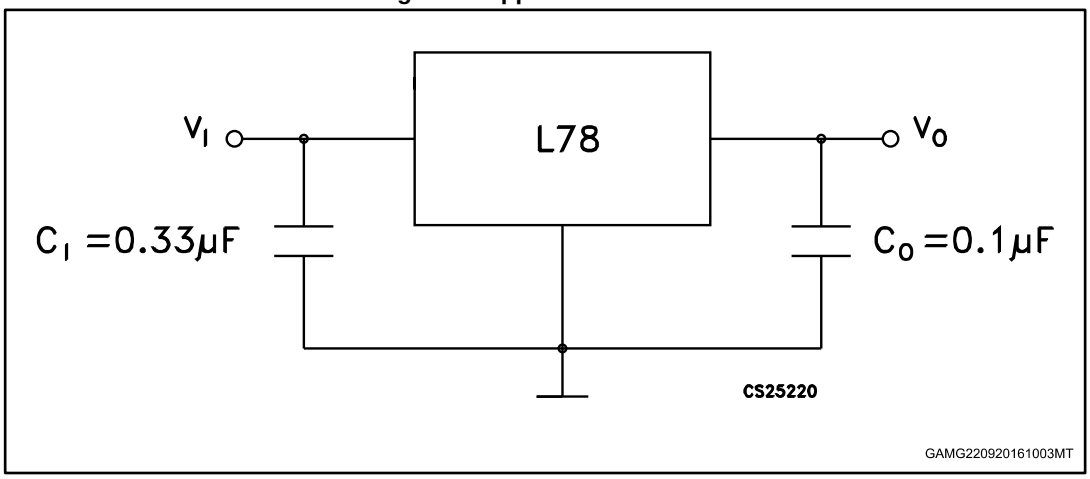
Symbol	Parameter		Value	Unit
V_I	DC input voltage	for V_O= 5 to 18 V	35	V
		for V_O= 20, 24 V	40	
I_O	Output current		Internally limited	
P_D	Power dissipation		Internally limited	
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range	for L78xxC, L78xxAC	0 to 125	°C
		for L78xxAB	-40 to 125	

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

Table 2: Thermal data

Symbol	Parameter	D²PAK	DPAK	TO-220	TO-220FP	Unit
R_{thJC}	Thermal resistance junction-case	3	8	5	5	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	100	50	60	°C/W

Figure 4: Application circuits



4 Test circuits

Figure 5: DC parameter

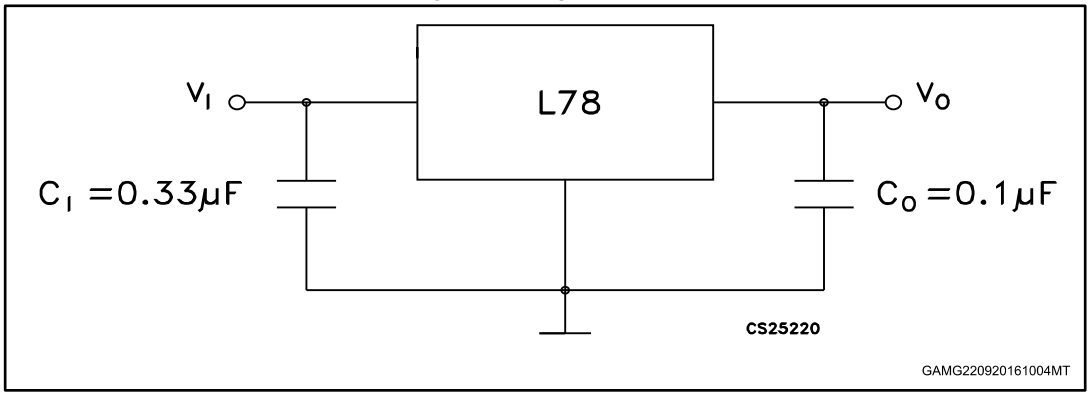


Figure 6: Load regulation

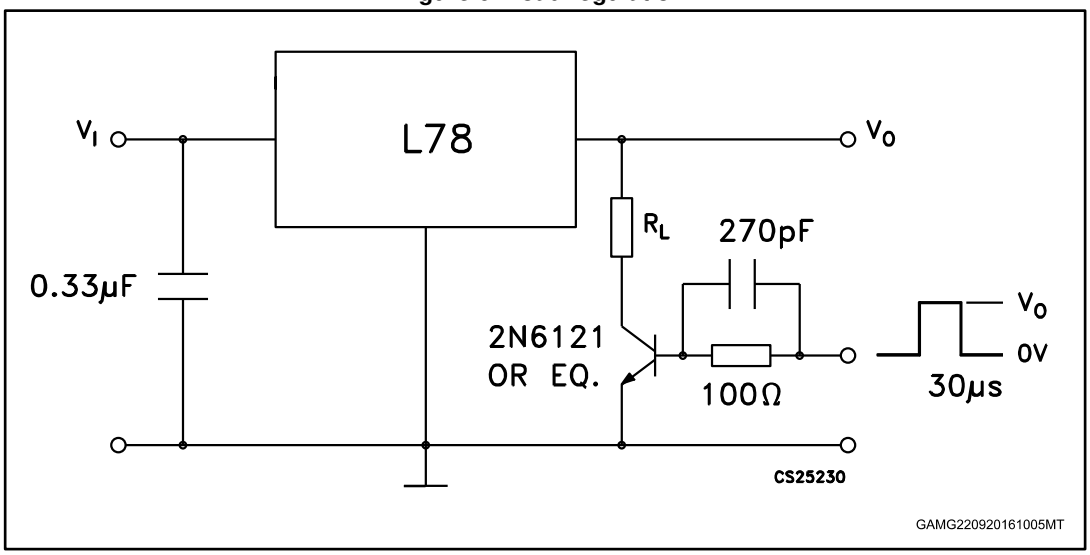
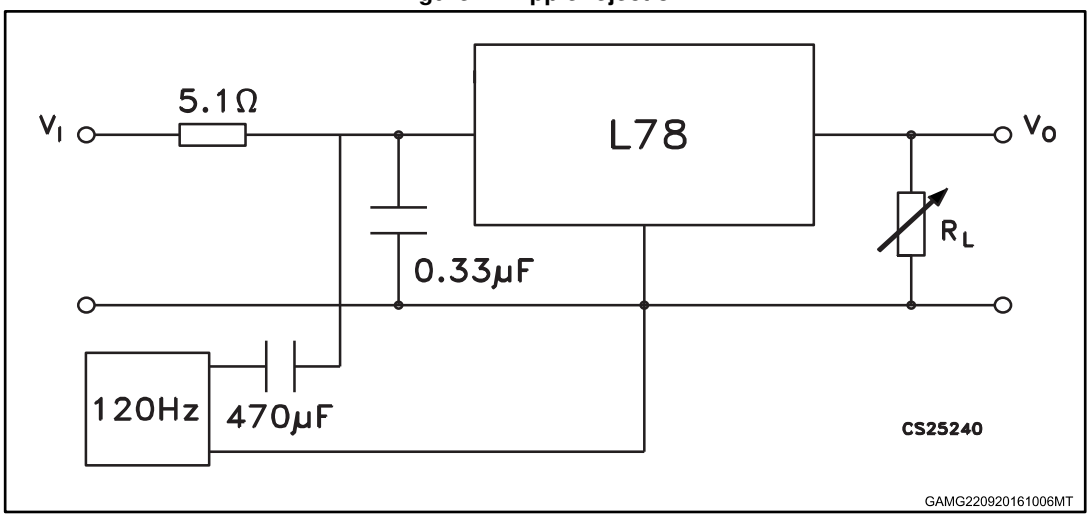


Figure 7: Ripple rejection



5 Electrical characteristics

V_I = 10 V, I_O = 1 A, T_J = 0 to 125 °C (L7805AC), T_J = -40 to 125 °C (L7805AB), unless otherwise specified[a]

Table 3: Electrical characteristics of L7805A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	4.9	5	5.1	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 7.5 to 18 V	4.8	5	5.2	V
V_O	Output voltage	I_O = 1 A, V_I = 18 to 20 V, T_J = 25 °C	4.8	5	5.2	V
ΔV_O (1)	Line regulation	V_I = 7.5 to 25 V, I_O = 500 mA, T_J = 25 °C		7	50	mV
		V_I = 8 to 12 V		10	50	mV
		V_I = 8 to 12 V, T_J = 25 °C		2	25	mV
		V_I = 7.3 to 20 V, T_J = 25 °C		7	50	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		8	50	
I_q	Quiescent current	T_J = 25 °C		4.3	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 8 to 23 V, I_O = 500 mA			0.8	mA
		V_I = 7.5 to 20 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 8 to 18 V, f = 120 Hz, I_O = 500 mA		68		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B =10 Hz to 100 kHz		10		µV/V_O
R_O	Output resistance	f = 1 kHz		17		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-1.1		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 11 V, I_O = 1 A, T_J = 0 to 125 °C (L7806AC), T_J = -40 to 125 °C (L7806AB), unless otherwise specified[a]

Table 4: Electrical characteristics of L7806A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	5.88	6	6.12	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 8.6 to 19 V	5.76	6	6.24	V
V_O	Output voltage	I_O = 1 A, V_I = 19 to 21 V, T_J = 25 °C	5.76	6	6.24	V
ΔV_O (1)	Line regulation	V_I = 8.6 to 25 V, I_O = 500 mA, T_J = 25 °C		9	60	mV
		V_I = 9 to 13 V		11	60	mV
		V_I = 9 to 13 V, T_J = 25 °C		3	30	mV
		V_I = 8.3 to 21 V, T_J = 25 °C		9	60	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25° C		4.3	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 9 to 24 V, I_O = 500 mA			0.8	mA
		V_I = 8.6 to 21 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 9 to 19 V, f = 120 Hz, I_O = 500 mA		65		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B =10 Hz to 100 kHz		10		µV/V_O
R_O	Output resistance	f = 1 kHz		17		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-0.8		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 14 V, I_O = 1 A, T_J = 0 to 125 °C (L7808AC), T_J = -40 to 125 °C (L7808AB), unless otherwise specified[a]

Table 5: Electrical characteristics of L7808A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	7.84	8	8.16	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 10.6 to 21 V	7.7	8	8.3	V
V_O	Output voltage	I_O = 1 A, V_I = 21 to 23 V, T_J = 25 °C	7.7	8	8.3	V
ΔV_O (1)	Line regulation	V_I = 10.6 to 25 V, I_O = 500 mA, T_J = 25 °C		12	80	mV
		V_I = 11 to 17 V		15	80	mV
		V_I = 11 to 17 V, T_J = 25 °C		5	40	mV
		V_I = 10.4 to 23 V, T_J = 25 °C		12	80	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25 °C		4.3	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 11 to 23 V, I_O = 500 mA			0.8	mA
		V_I = 10.6 to 23 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 11.5 to 21.5 V, f = 120 Hz, I_O = 500 mA		62		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B =10 Hz to 100 kHz		10		µV/V_O
R_O	Output resistance	f = 1 kHz		18		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-0.8		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 15 V, I_O = 1 A, T_J = 0 to 125 °C (L7809AC), T_J = -40 to 125 °C (L7809AB), unless otherwise specified[a]

Table 6: Electrical characteristics of L7809A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	8.82	9	9.18	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 10.6 to 22 V	8.65	9	9.35	V
V_O	Output voltage	I_O = 1 A, V_I = 22 to 24 V, T_J = 25 °C	8.65	9	9.35	V
ΔV_O (1)	Line regulation	V_I = 10.6 to 25 V, I_O = 500 mA, T_J = 25 °C		12	90	mV
		V_I = 11 to 17 V		15	90	mV
		V_I = 11 to 17 V, T_J = 25 °C		5	45	mV
		V_I = 11.4 to 23 V, T_J = 25 °C		12	90	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25 °C		4.3	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 11 to 25 V, I_O = 500 mA			0.8	mA
		V_I = 10.6 to 23 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 11.5 to 21.5 V, f = 120 Hz, I_O = 500 mA		61		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B =10 Hz to 100 kHz		10		$\mu V/V_O$
R_O	Output resistance	f = 1 kHz		18		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-0.8		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 19 V, I_O = 1 A, T_J = 0 to 125 °C (L7812AC), T_J = -40 to 125 °C (L7812AB), unless otherwise specified[a]

Table 7: Electrical characteristics of L7812A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	11.75	12	12.25	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 14.8 to 25 V	11.5	12	12.5	V
V_O	Output voltage	I_O = 1 A, V_I = 25 to 27 V, T_J = 25 °C	11.5	12	12.5	V
ΔV_O (1)	Line regulation	V_I = 14.8 to 30 V, I_O = 500 mA, T_J = 25 °C		13	120	mV
		V_I = 16 to 12 V		16	120	mV
		V_I = 16 to 12 V, T_J = 25 °C		6	60	mV
		V_I = 14.5 to 27 V, T_J = 25 °C		13	120	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25 °C		4.4	6	mA
					6	mA
DI_q	Quiescent current change	V_I = 15 to 30 V, I_O = 500 mA			0.8	mA
		V_I = 14.8 to 27 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 15 to 25 V, f = 120 Hz, I_O = 500 mA		60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B = 10 Hz to 100 kHz		10		$\mu V/V_O$
R_O	Output resistance	f = 1 kHz		18		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-1		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 23 V, I_O = 1 A, T_J = 0 to 125 °C (L7815AC), T_J = -40 to 125 °C (L7815AB), unless otherwise specified[a]

Table 8: Electrical characteristics of L7815A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	14.7	15	15.3	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 17.9 to 28 V	14.4	15	15.6	V
V_O	Output voltage	I_O = 1 A, V_I = 28 to 30 V, T_J = 25 °C	14.4	15	15.6	V
ΔV_O (1)	Line regulation	V_I = 17.9 to 30 V, I_O = 500 mA, T_J = 25 °C		13	150	mV
		V_I = 20 to 26 V		16	150	mV
		V_I = 20 to 26 V, T_J = 25 °C		6	75	mV
		V_I = 17.5 to 30 V, T_J = 25 °C		13	150	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25 °C		4.4	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 17.5 to 30 V, I_O = 500 mA			0.8	mA
		V_I = 17.5 to 30 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 18.5 to 28.5 V, f = 120 Hz, I_O = 500 mA		58		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B = 10Hz to 100 kHz		10		µV/V_O
R_O	Output resistance	f = 1 kHz		19		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-1		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

V_I = 33 V, I_O = 1 A, T_J = 0 to 125 °C (L7824AC), T_J = -40 to 125 °C (L7824AB), unless otherwise specified[a]

Table 9: Electrical characteristics of L7824A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	23.5	24	24.5	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 27.3 to 37 V	23	24	25	V
V_O	Output voltage	I_O = 1 A, V_I = 37 to 38 V, T_J = 25 °C	23	24	25	V
ΔV_O (1)	Line regulation	V_I = 27 to 38 V, I_O = 500 mA, T_J = 25 °C		31	240	mV
		V_I = 30 to 36 V		35	200	mV
		V_I = 30 to 36 V, T_J = 25 °C		14	120	mV
		V_I = 26.7 to 38 V, T_J = 25 °C		31	240	mV
ΔV_O (1)	Load regulation	I_O = 5 mA to 1 A		25	100	mV
		I_O = 5 mA to 1.5 A, T_J = 25 °C		30	100	
		I_O = 250 to 750 mA		10	50	
I_q	Quiescent current	T_J = 25 °C		4.6	6	mA
					6	mA
ΔI_q	Quiescent current change	V_I = 27.3 to 38 V, I_O = 500 mA			0.8	mA
		V_I = 27.3 to 38 V, T_J = 25 °C			0.8	mA
		I_O = 5 mA to 1 A			0.5	mA
SVR	Supply voltage rejection	V_I = 28 to 38 V, f = 120 Hz, I_O = 500 mA		54		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
eN	Output noise voltage	T_A = 25 °C, B = 10 Hz to 100 kHz		10		µV/V_O
R_O	Output resistance	f = 1 kHz		20		m
I_{sc}	Short circuit current	V_I = 35 V, T_A = 25 °C		0.2		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A
$\Delta V_O/\Delta T$	Output voltage drift			-1.5		mV/°C

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 10 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 10: Electrical characteristics of L7805C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	4.8	5	5.2	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 7 to 18 V	4.75	5	5.25	V
V_O	Output voltage	I_O = 1 A, V_I = 18 to 20V, T_J = 25 °C	4.75	5	5.25	V
ΔV_O(1)	Line regulation	V_I = 7 to 25 V, T_J = 25 °C		3	100	mV
		V_I = 8 to 12 V, T_J = 25 °C		1	50	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			100	mV
		I_O = 250 to 750 mA, T_J = 25 °C			50	
I_d	Quiescent current	T_J = 25° C			8	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 7 to 23 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1.1		mV/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		40		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		17		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.75		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 11 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 11: Electrical characteristics of L7806C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	5.75	6	6.25	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 8 to 19 V	5.7	6	6.3	V
V_O	Output voltage	I_O = 1 A, V_I = 19 to 21 V, T_J = 25 °C	5.7	6	6.3	V
ΔV_O(1)	Line regulation	V_I = 8 to 25 V, T_J = 25 °C			120	mV
		V_I = 9 to 13 V, T_J = 25 °C			60	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			120	mV
		I_O = 250 to 750 mA, T_J = 25 °C			60	
I_d	Quiescent current	T_J = 25 °C			8	mA
DI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 8 to 24 V			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.8		mV/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		45		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		19		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.55		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 14 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 12: Electrical characteristics of L7808C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	7.7	8	8.3	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 10.5 to 21 V	7.6	8	8.4	V
V_O	Output voltage	I_O = 1 A, V_I = 21 to 25 V, T_J = 25 °C	7.6	8	8.4	V
ΔV_O(1)	Line regulation	V_I = 10.5 to 25 V, T_J = 25 °C			160	mV
		V_I = 11 to 17 V, T_J = 25 °C			80	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			160	mV
		I_O = 250 to 750 mA, T_J = 25 °C			80	
I_d	Quiescent current	T_J = 25 °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/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		52		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		16		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.45		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 14.5 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 13: Electrical characteristics of L7885C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	8.2	8.5	8.8	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 11 to 21.5 V	8.1	8.5	8.9	V
V_O	Output voltage	I_O = 1 A, V_I = 21.5 to 26 V, T_J = 25 °C	8.1	8.5	8.9	V
ΔV_O(1)	Line regulation	V_I = 11 to 27 V, T_J = 25 °C			160	mV
		V_I = 11.5 to 17.5 V, T_J = 25 °C			80	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			160	mV
		I_O = 250 to 750 mA, T_J = 25 °C			80	
I_d	Quiescent current	T_J = 25 °C			8	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 11 to 26 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.8		mV/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		55		µV/V_O
SVR	Supply voltage rejection	V_I = 12 to 22 V, f = 120 Hz	56			dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25 °C		2		V
R_O	Output resistance	f = 1 kHz		16		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.45		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 15 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 14: Electrical characteristics of L7809C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	8.64	9	9.36	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 11.5 to 22 V	8.55	9	9.45	V
V_O	Output voltage	I_O = 1 A, V_I = 22 to 26 V, T_J = 25 °C	8.55	9	9.45	V
ΔV_O(1)	Line regulation	V_I = 11.5 to 26 V, T_J = 25 °C			180	mV
		V_I = 12 to 18 V, T_J = 25 °C			90	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			180	mV
		I_O = 250 to 750 mA, T_J = 25 °C			90	
I_d	Quiescent current	T_J = 25 °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/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		70		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		17		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.40		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 19 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 15: Electrical characteristics of L7812C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	11.5	12	12.5	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 14.5 to 25 V	11.4	12	12.6	V
V_O	Output voltage	I_O = 1 A, V_I = 25 to 27 V, T_J = 25 °C	11.4	12	12.6	V
ΔV_O(1)	Line regulation	V_I = 14.5 to 30 V, T_J = 25 °C			240	mV
		V_I = 16 to 22 V, T_J = 25 °C			120	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			240	mV
		I_O = 250 to 750 mA, T_J = 25 °C			120	
I_d	Quiescent current	T_J = 25 °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/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		75		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		18		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.35		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 23 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 16: Electrical characteristics of L7815C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	14.4	15	15.6	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 17.5 to 28 V	14.25	15	15.75	V
V_O	Output voltage	I_O = 1 A, V_I = 28 to 30 V, T_J = 25 °C	14.25	15	15.75	V
ΔV_O(1)	Line regulation	V_I = 17.5 to 30 V, T_J = 25 °C			300	mV
		V_I = 20 to 26 V, T_J = 25 °C			150	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			300	mV
		I_O = 250 to 750 mA, T_J = 25 °C			150	
I_d	Quiescent current	T_J = 25 °C			8	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1A			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/°C
eN	Output noise voltage	B = 10 Hz to 100kHz, T_J = 25 °C		90		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		19		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.23		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.2		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 26 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 17: Electrical characteristics of L7818C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	17.3	18	18.7	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 21 to 31 V	17.1	18	18.9	V
V_O	Output voltage	I_O = 1 A, V_I = 31 to 33 V, T_J = 25 °C	17.1	18	18.9	V
ΔV_O(1)	Line regulation	V_I = 21 to 33 V, T_J = 25 °C			360	mV
		V_I = 24 to 30 V, T_J = 25 °C			180	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			360	mV
		I_O = 250 to 750 mA, T_J = 25 °C			180	
I_d	Quiescent current	T_J = 25 °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/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		110		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		22		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25 °C		0.20		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.1		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

Refer to the test circuits, T_J = 0 to 125 °C, V_I = 33 V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified[a]

Table 18: Electrical characteristics of L7824C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25 °C	23	24	25	V
V_O	Output voltage	I_O = 5 mA to 1 A, V_I = 27 to 37 V	22.8	24	25.2	V
V_O	Output voltage	I_O = 1 A, V_I = 37 to 38 V, T_J = 25 °C	22.8	24	25.2	V
ΔV_O(1)	Line regulation	V_I = 27 to 38 V, T_J = 25 °C			480	mV
		V_I = 30 to 36 V, T_J = 25 °C			240	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25 °C			480	mV
		I_O = 250 to 750 mA, T_J = 25 °C			240	
I_d	Quiescent current	T_J = 25 °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/°C
eN	Output noise voltage	B = 10 Hz to 100 kHz, T_J = 25 °C		170		µV/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 °C		2		V
R_O	Output resistance	f = 1 kHz		28		mΩ
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25° C		0.15		A
I_{scp}	Short circuit peak current	T_J = 25 °C		2.1		A

Notes:

(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.

[a] Minimum load current for regulation is 5 mA.

6 Application information

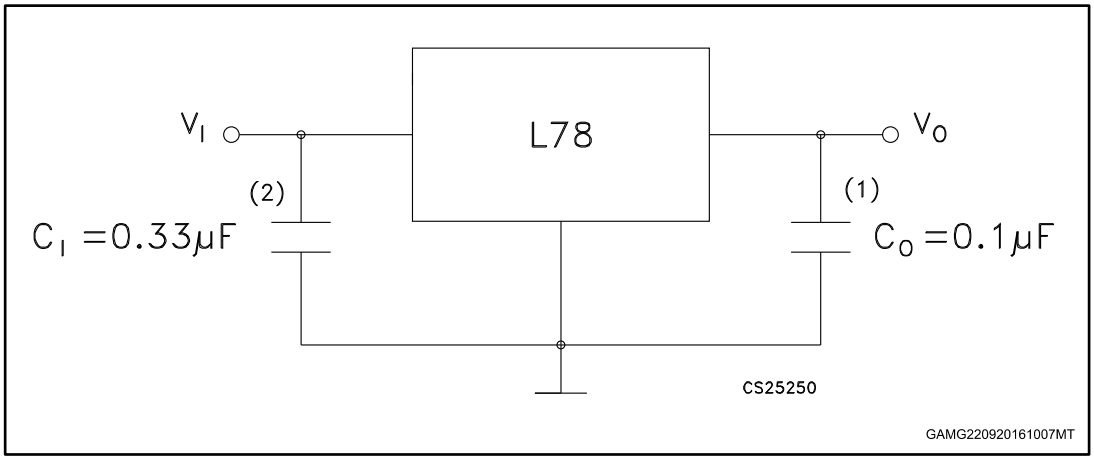
6.1 Design consideration

The L78 Series of fixed voltage regulators are designed with thermal overload protection that shuts down the circuit when subjected to an excessive power overload condition, internal short-circuit protection that limits the maximum current the circuit will pass, and output transistor safe-area compensation that reduces the output short-circuit current as the voltage across the pass transistor is increased. In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with capacitor if the regulator is connected to the power supply filter with long lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high frequency characteristics to insure stable operation under all load conditions. A 0.33 µF or larger tantalum, mylar or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead.

The addition of an operational amplifier allows adjustment to higher or intermediate values while retaining regulation characteristics. The minimum voltage obtained with the arrangement is 2 V greater than the regulator voltage.

The circuit of *Figure 13: "High current voltage regulator"* can be modified to provide supply protection against short circuit by adding a short circuit sense resistor, RSC, and an additional PNP transistor. The current sensing PNP must be able to handle the short circuit current of the three terminal regulator Therefore a four ampere plastic power transistor is specified.

Figure 8: Fixed output regulator



1. Although no output capacitor is need for stability, it does improve transient response.
2. Required if regulator is located an appreciable distance from power supply filter.

Figure 9: Current regulator

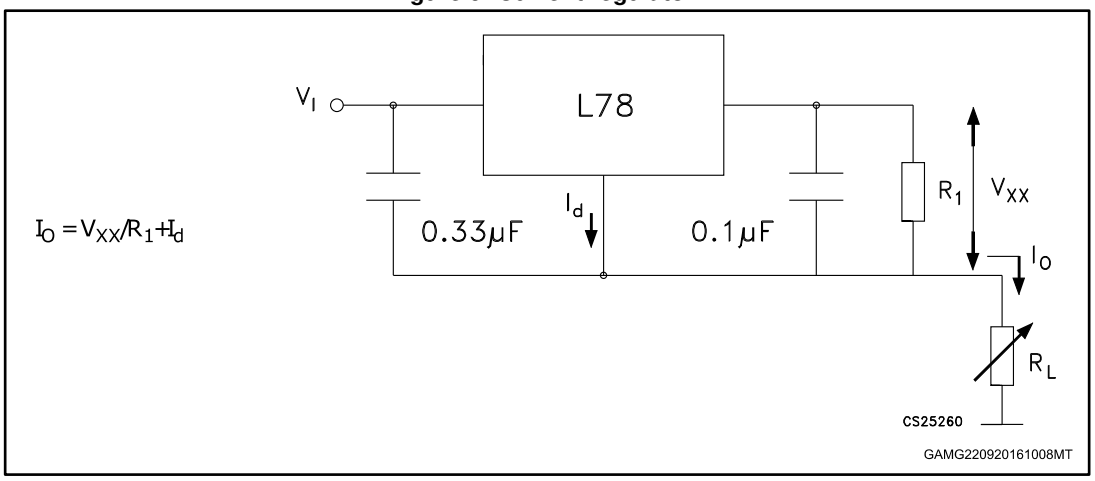


Figure 10: Circuit for increasing output voltage

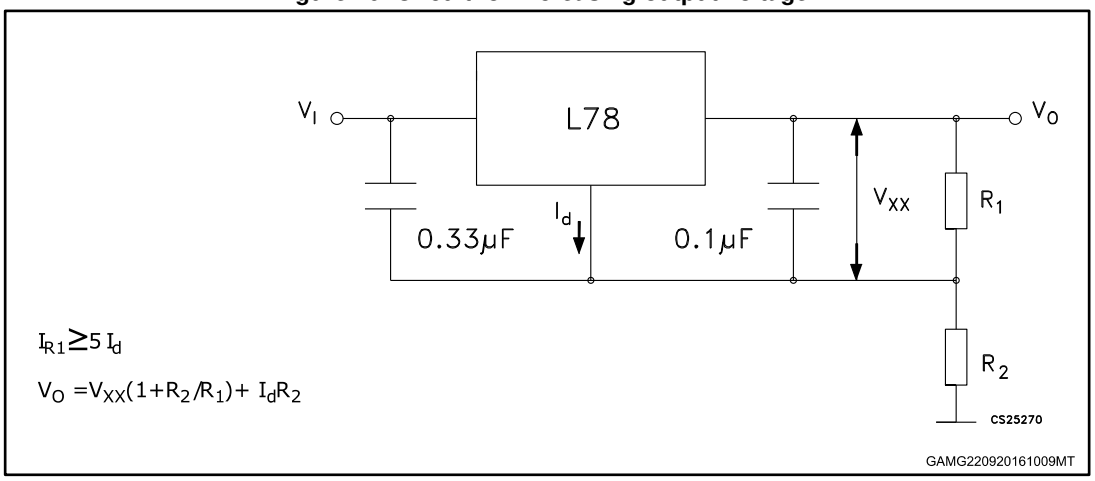


Figure 11: Adjustable output regulator (7 to 30 V)

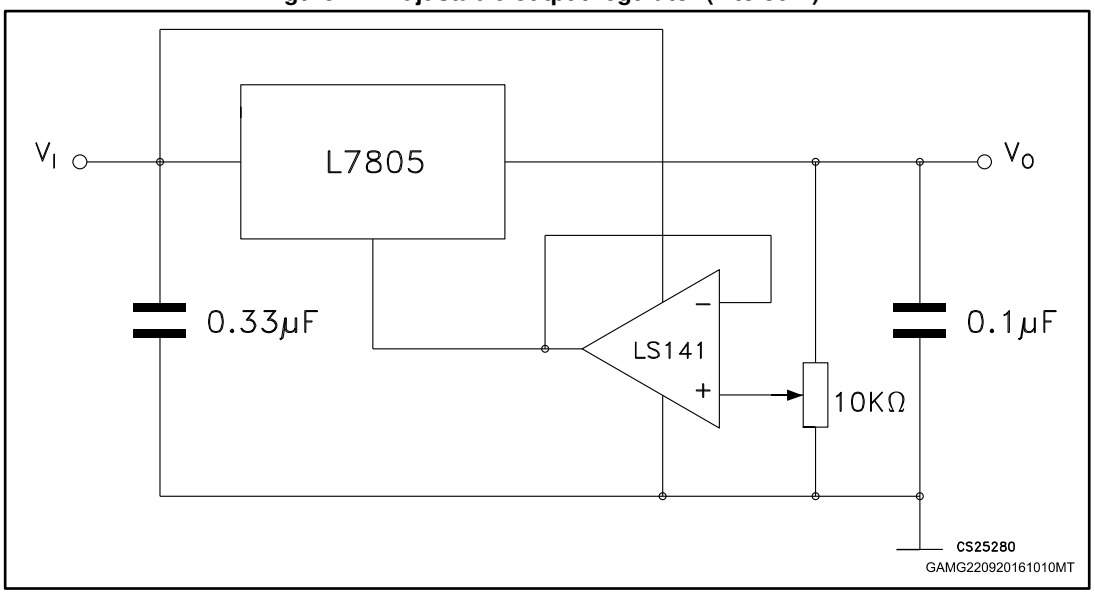


Figure 12: 0.5 to 10 V regulator

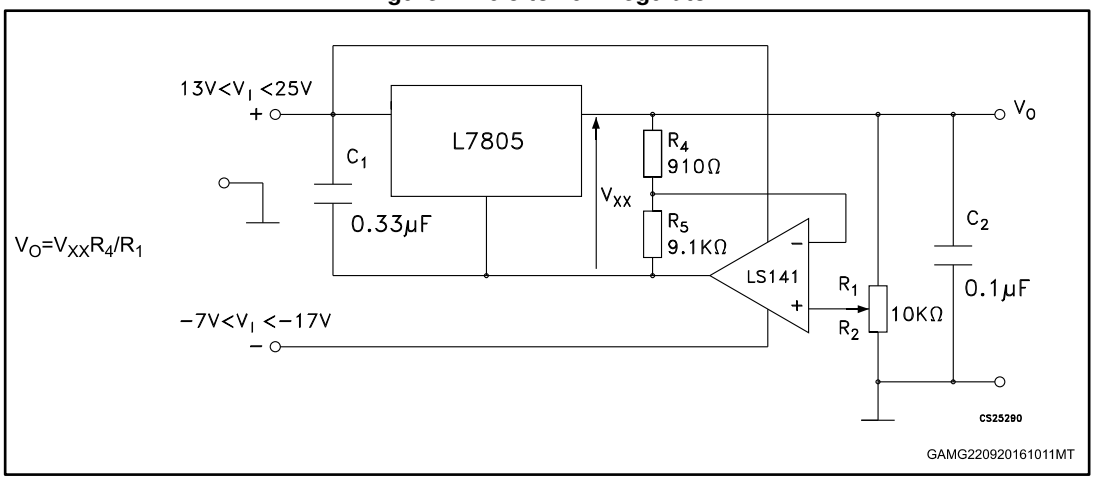
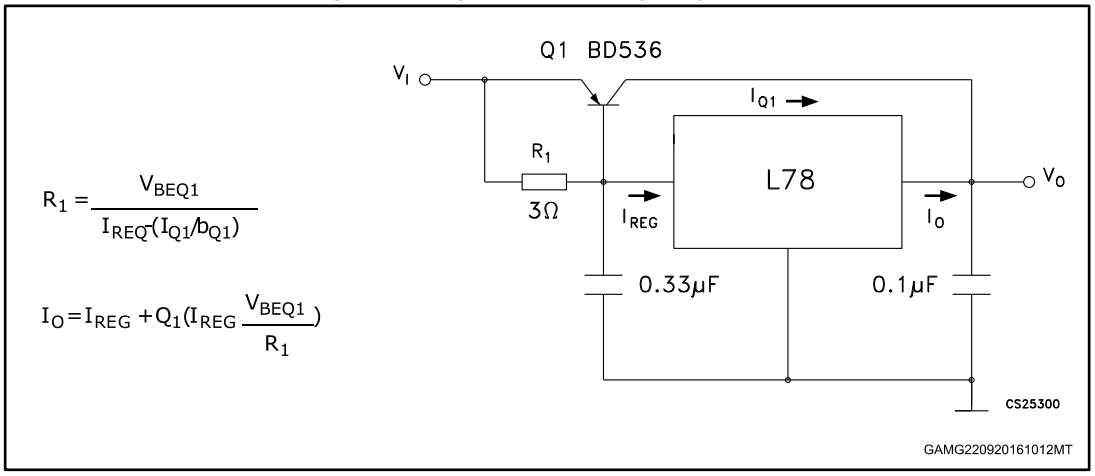


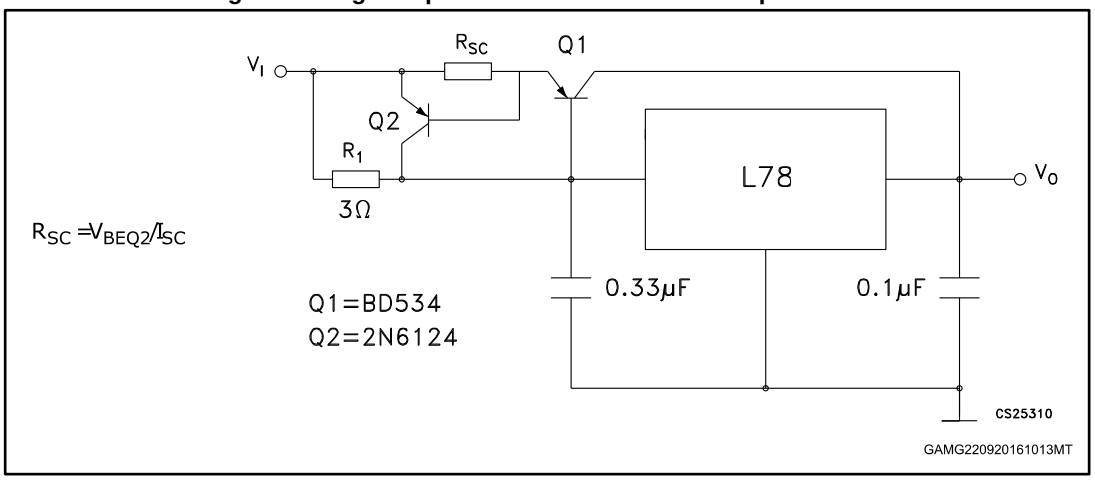
Figure 13: High current voltage regulator



$$R_1 = \frac{V_{BEQ1}}{I_{REQ}-(I_{Q1}/b_{Q1})}$$

$$I_O = I_{REG} + Q_1\left(I_{REG}\frac{V_{BEQ1}}{R_1}\right)$$

Figure 14: High output current with short circuit protection



$R_{SC} = V_{BEQ2}/I_{SC}$