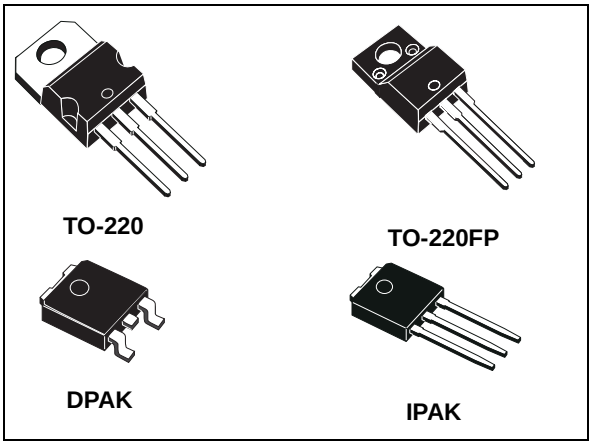
L78M

Precision 500 mA regulators

Datasheet - production data



Features

- Output current to 0.5 A
- Output voltages of 5; 6; 8; 9; 10; 12; 15; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection
- Output voltage tolerance: 2% (AB and AC versions) or 4% (C version)
- Guaranteed in extended temperature range

Description

The L78M series of three-terminal positive regulators is available in TO-220, TO-220FP, DPAK and IPAK 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 shutdown and safe area protection, resulting it essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

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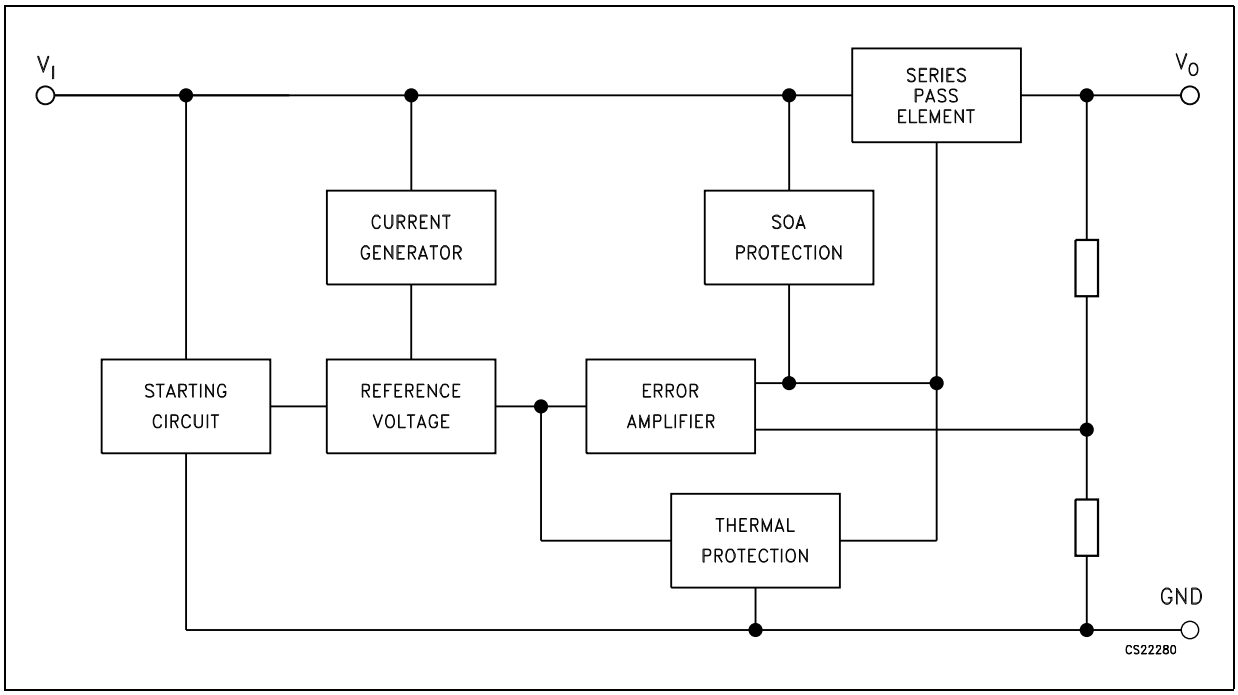
1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)

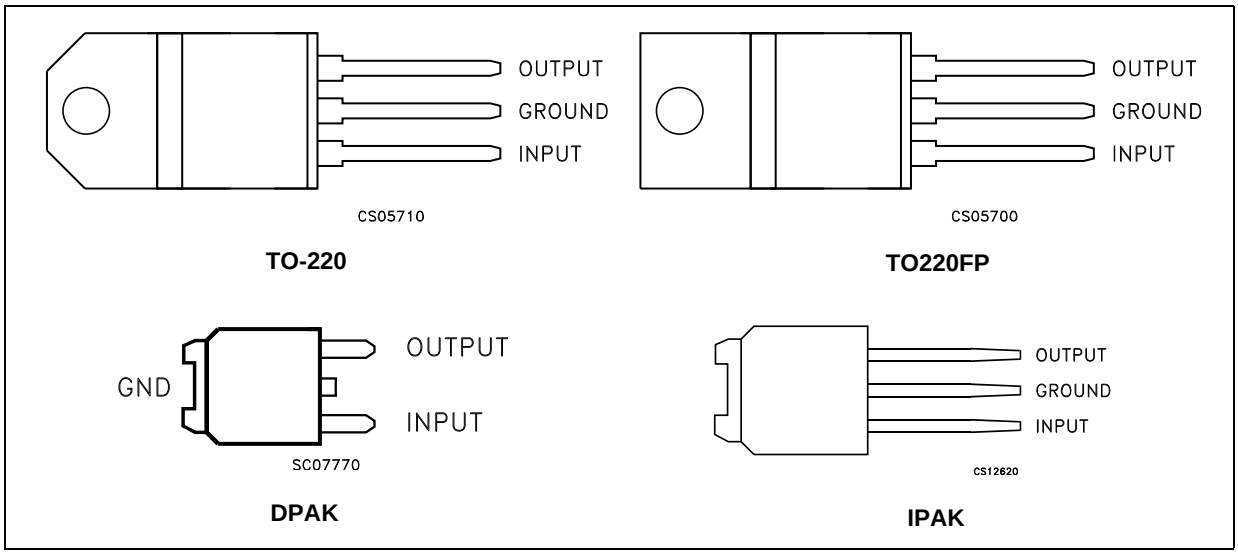
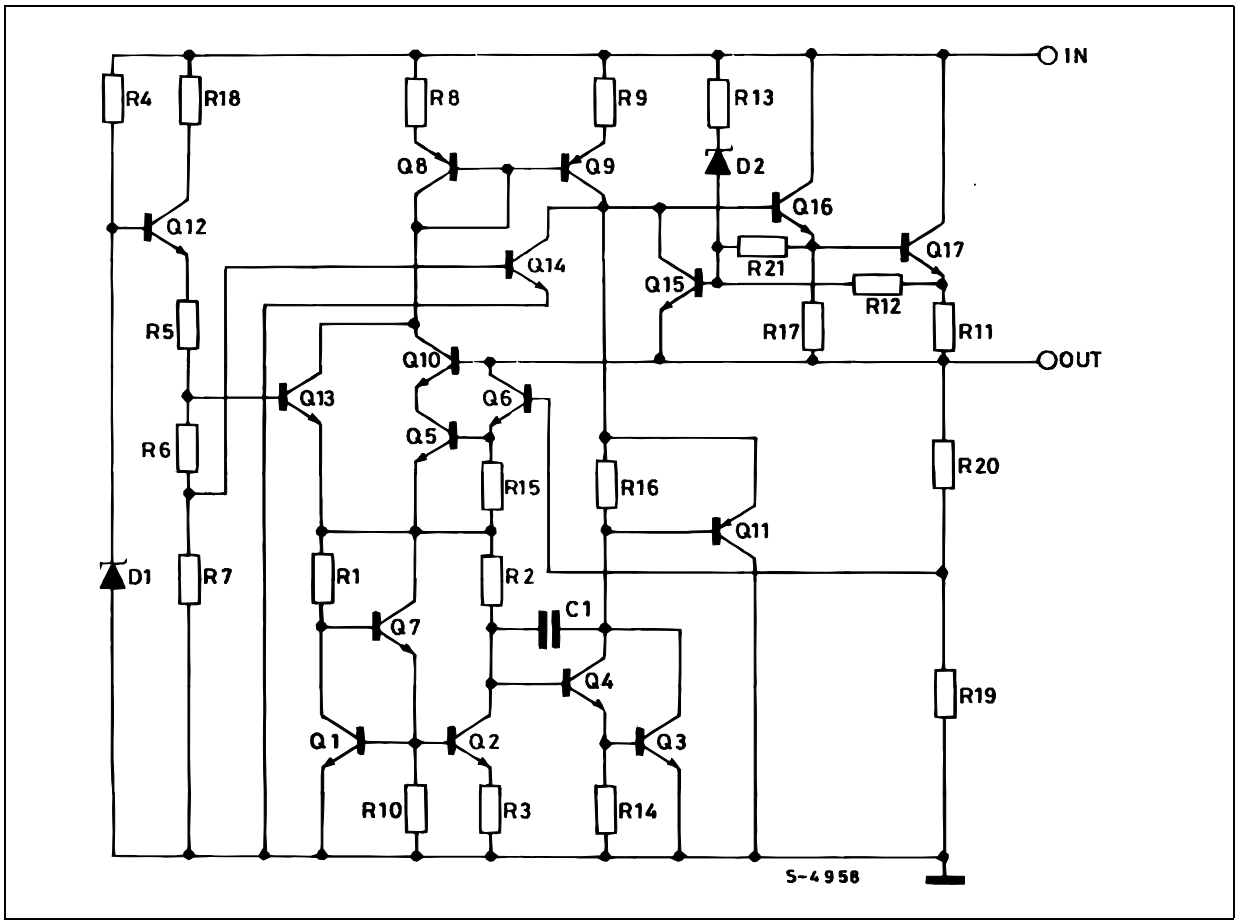


Figure 3. Schematic diagram



3 Maximum ratings

Table 1. Absolute maximum ratings

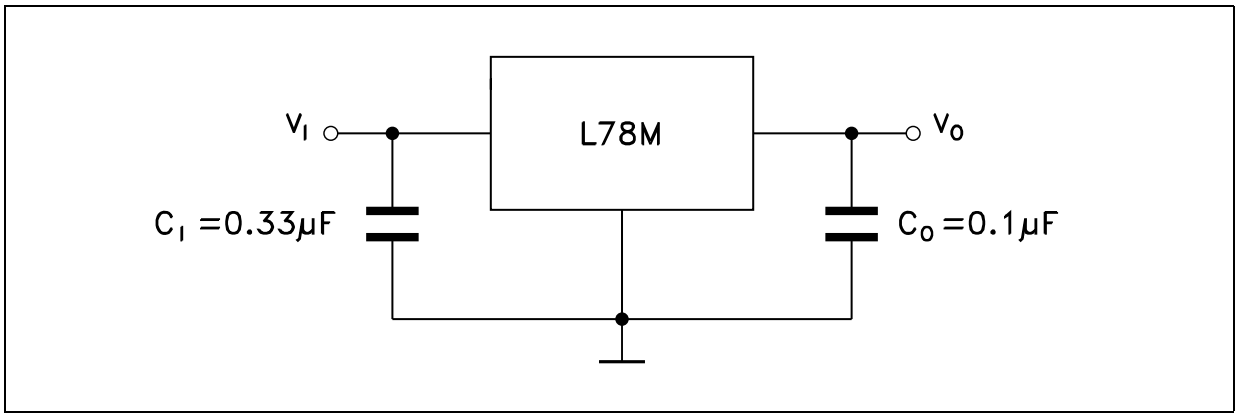
Symbol	Parameter		Value	Unit
V_I	DC input voltage	for V_O = 5 to 18 V	35	V
		for V_O = 20, 24 V	40	
I_O	Output current		Internally limited	mA
P_D	Power dissipation		Internally limited	mW
T_{STG}	Storage temperature range		- 65 to 150	°C
T_{OP}	Operating junction temperature range	for L78MxxAC	0 to 125	°C
		for L78MxxAB	-40 to 125	
		for L78MxxC	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-220FP	DPAK	IPAK	Unit
R_{thJC}	Thermal resistance junction-case	5	5	8	8	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	60	100	100	°C/W

Figure 4. Application circuit



4 Test circuits

Figure 5. DC parameter

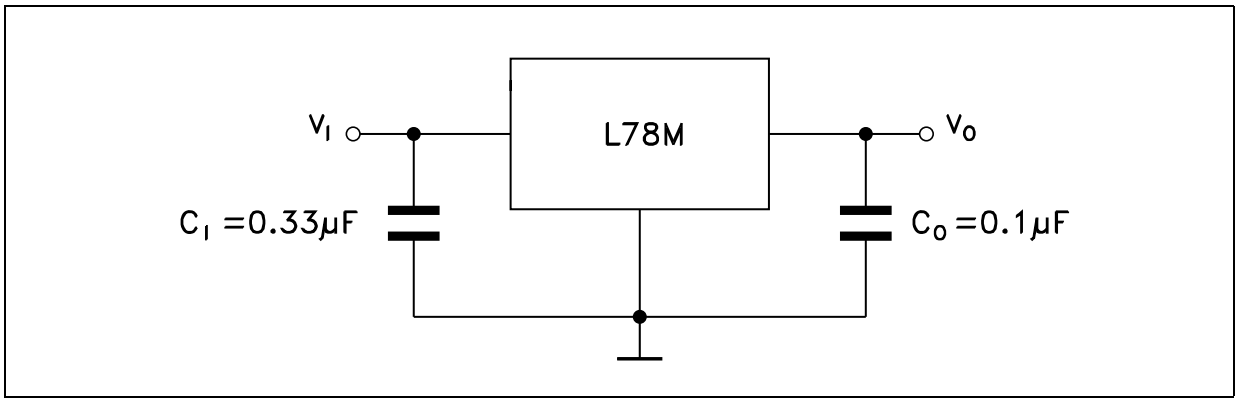


Figure 6. Load regulation

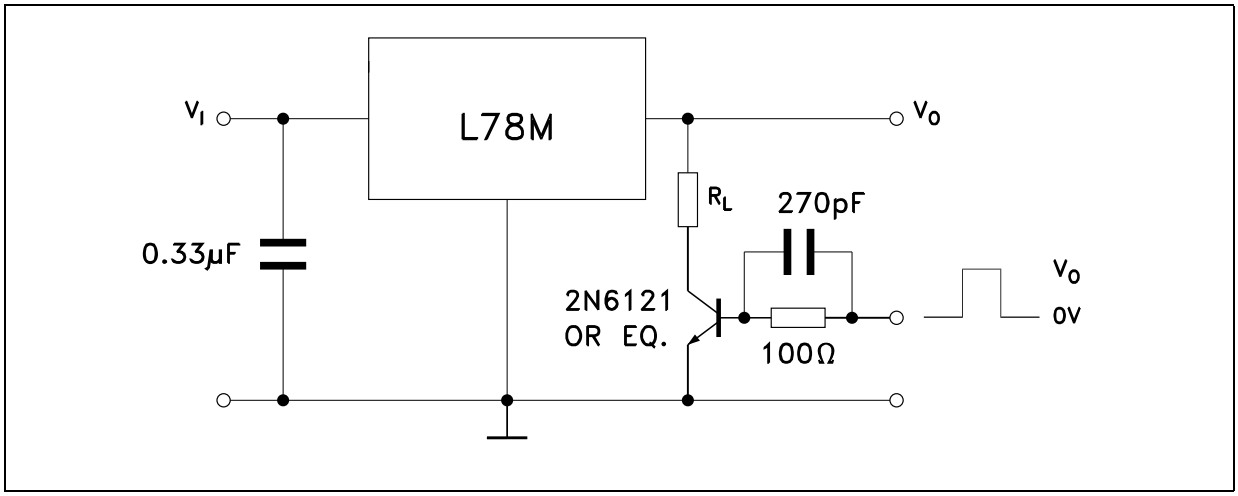
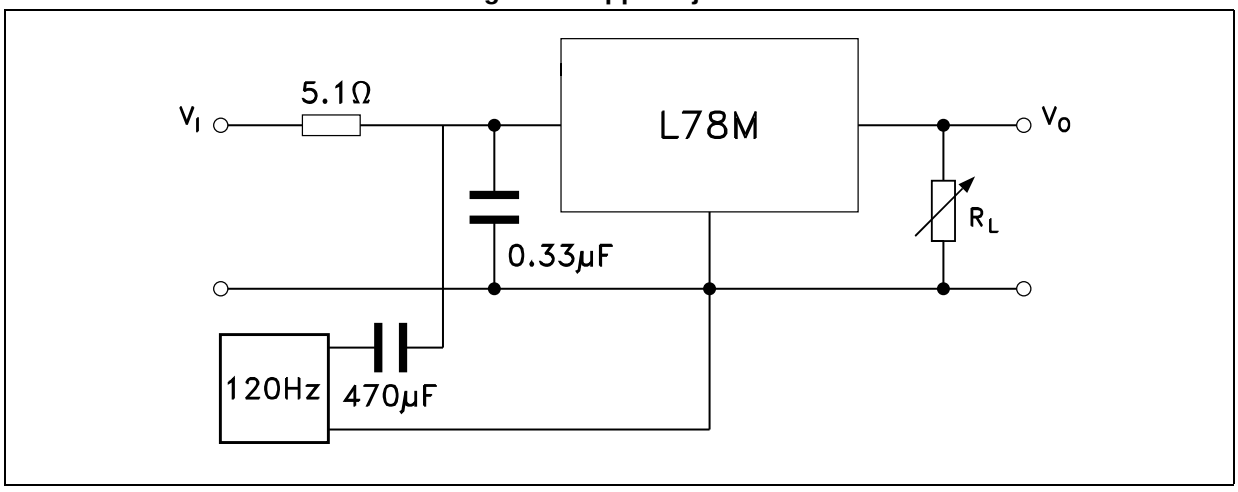


Figure 7. Ripple rejection



5 Electrical characteristics

Refer to the test circuits, T_J = 25 °C, V_I = 10 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 3. Electrical characteristics of L78M05C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		4.8	5	5.2	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 7 to 20 V	4.75	5	5.25	V
ΔV_O	Line regulation	V_I = 7 to 25 V, I_O = 200 mA			100	mV
		V_I = 8 to 25 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			100	mV
		I_O = 5 to 200 mA, T_J = 25 °C			50	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 8 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 8 to 18 V, f = 120 Hz, I_O = 300 mA	62			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		40		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		300		mA

Refer to the test circuits, V_I = 10 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 4. Electrical characteristics of L78M05A

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 to 350 mA, V_I = 7 to 20 V	4.8	5	5.2	V
ΔV_O	Line regulation	V_I = 7 to 25 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 8 to 25 V, I_O = 200 mA, T_J = 25°C			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			100	mV
		I_O = 5 to 200 mA, T_J = 25°C			50	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 8 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 8 to 18 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	62			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		40		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	T_J = 25°C, V_I = 35 V		300		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 11 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 5. Electrical characteristics of L78M06C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		5.75	6	6.25	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 8 to 21 V	5.7	6	6.3	V
ΔV_O	Line regulation	V_I = 8 to 25 V, I_O = 200 mA			100	mV
		V_I = 9 to 25 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			120	mV
		I_O = 5 to 200 mA, T_J = 25 °C			60	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 9 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 9 to 19 V, f = 120 Hz, I_O = 300 mA	59			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		45		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		270		mA

Refer to the test circuits, V_I = 11 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 6. Electrical characteristics of L78M06A

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 to 350 mA, V_I = 8 to 21 V	5.75	6	6.3	V
ΔV_O	Line regulation	V_I = 8 to 25 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 9 to 25 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			120	mV
		I_O = 5 to 200 mA, T_J = 25°C			60	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 9 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 9 to 19 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	59			dB
eN	Output noise voltage	B =10 Hz to 100 kHz		45		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	T_J = 25°C, V_I = 35 V		270		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 14 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 7. Electrical characteristics of L78M08C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		7.7	8	8.3	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 10.5 to 23 V	7.6	8	8.4	V
ΔV_O	Line regulation	V_I = 10.5 to 25 V, I_O = 200 mA			100	mV
		V_I = 11 to 25 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			160	mV
		I_O = 5 to 200 mA, T_J = 25 °C			80	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 10.5 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 11.5 to 21.5 V, f = 120 Hz, I_O = 300 mA	56			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		52		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		250		mA

Refer to the test circuits, V_I = 14 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 8. Electrical characteristics of L78M08A

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 to 350 mA, V_I = 10.5 to 23 V	7.7	8	8.3	V
ΔV_O	Line regulation	V_I = 10.5 to 25 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 11 to 25 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			160	mV
		I_O = 5 to 200 mA, T_J = 25°C			80	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 10.5 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 11.5 to 21.5 V, f = 120 Hz I_O = 300 mA, T_J = 25°C	56			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		52		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	T_J = 25°C, V_I = 35 V		250		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 15 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 9. Electrical characteristics of L78M09C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		8.65	9	9.35	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 11.5 to 24 V	8.55	9	9.45	V
ΔV_O	Line regulation	V_I = 11.5 to 25 V, I_O = 200 mA			100	mV
		V_I = 12 to 25 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			180	mV
		I_O = 5 to 200 mA, T_J = 25 °C			90	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 11.5 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 12.5 to 23 V, f = 120 Hz, I_O = 300 mA	56			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		58		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		250		mA

Refer to the test circuits, V_I = 15 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 10. Electrical characteristics of L78M09A

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 to 350 mA, V_I = 11.5 to 24 V	8.64	9	9.36	V
ΔV_O	Line regulation	V_I = 11.5 to 25 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 12 to 25 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			180	mV
		I_O = 5 to 200 mA, T_J = 25°C			90	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 11.5 to 25 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 12.5 to 23 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	56			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		52		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25°C		250		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, V_I = 16 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 11. Electrical characteristics of L78M10A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	9.8	10	10.2	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 12.5 to 25 V	9.6	10	10.4	V
ΔV_O	Line regulation	V_I = 12.5 to 30 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 13 to 30 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			200	mV
		I_O = 5 to 200 mA, T_J = 25°C			100	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 12.5 to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.5		mV/°C
SVR	Supply voltage rejection	V_I = 13.5 to 24 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	56			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		64		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25°C		245		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 19 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 12. Electrical characteristics of L78M12C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		11.5	12	12.5	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 14.5 to 27 V	11.4	12	12.6	V
ΔV_O	Line regulation	V_I = 14.5 to 30 V, I_O = 200 mA			100	mV
		V_I = 16 to 30 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			240	mV
		I_O = 5 to 200 mA, T_J = 25 °C			120	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 14.5 to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-1		mV/°C
SVR	Supply voltage rejection	V_I = 15 to 25 V, f = 120 Hz, I_O = 300 mA	55			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		75		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		240		mA

Refer to the test circuits, V_I = 19 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 13. Electrical characteristics of L78M12A

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 to 350 mA, V_I = 14.5 to 27 V	11.5	12	12.5	V
ΔV_O	Line regulation	V_I = 14.5 to 30 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 16 to 30 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			240	mV
		I_O = 5 to 200 mA, T_J = 25°C			120	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 14.5 to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1		mV/°C
SVR	Supply voltage rejection	V_I = 15 to 25 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	55			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		75		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25°C		240		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 23 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 14. Electrical characteristics of L78M15C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		14.4	15	15.6	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 17.5 to 30 V	14.25	15	15.75	V
ΔV_O	Line regulation	V_I = 17.5 to 30 V, I_O = 200 mA			100	mV
		V_I = 20 to 30 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			300	mV
		I_O = 5 to 200 mA, T_J = 25 °C			150	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 17.5 to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-1		mV/°C
SVR	Supply voltage rejection	V_I = 18.5 to 28.5 V, f = 120 Hz, I_O = 300 mA	54			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		90		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		240		mA

Refer to the test circuits, V_I = 23 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 15. Electrical characteristics of L78M15A

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 to 350 mA, V_I = 17.5 to 30 V	14.4	15	15.6	V
ΔV_O	Line regulation	V_I = 17.5 to 30 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 20 to 30 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			300	mV
		I_O = 5 to 200 mA, T_J = 25°C			150	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 17.5 to 30 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1		mV/°C
SVR	Supply voltage rejection	V_I = 18.5 to 28.5 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	54			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		90		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25°C		240		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

Refer to the test circuits, T_J = 25 °C, V_I = 33 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified.

Table 16. Electrical characteristics of L78M24C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		23	24	25	V
V_O	Output voltage	I_O = 5 to 350 mA, V_I = 27 to 38 V	22.8	24	25.2	V
ΔV_O	Line regulation	V_I = 27 to 38 V, I_O = 200 mA			100	mV
		V_I = 28 to 38 V, I_O = 200 mA			50	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25 °C			480	mV
		I_O = 5 to 200 mA, T_J = 25 °C			240	
I_d	Quiescent current				6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 27 to 38 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA, T_J = 0 to 125 °C		-1.2		mV/°C
SVR	Supply voltage rejection	V_I = 28 to 38 V, f = 120 Hz, I_O = 300 mA	50			dB
eN	Output noise voltage	B = 10 Hz to 100 kHz		170		µV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	V_I = 35 V		240		mA

Refer to the test circuits, V_I = 33 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

Table 17. Electrical characteristics of L78M24A

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 to 350 mA, V_I = 27 to 38 V	23	24	25	V
ΔV_O	Line regulation	V_I = 27 to 38 V, I_O = 200 mA, T_J = 25°C			100	mV
		V_I = 28 to 38 V, I_O = 200 mA, T_J = 25°C			30	
ΔV_O	Load regulation	I_O = 5 to 500 mA, T_J = 25°C			480	mV
		I_O = 5 to 200 mA, T_J = 25°C			240	
I_d	Quiescent current	T_J = 25°C			6	mA
ΔI_d	Quiescent current change	I_O = 5 to 350 mA			0.5	mA
		I_O = 200 mA, V_I = 27 to 38 V			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1.2		mV/°C
SVR	Supply voltage rejection	V_I = 28 to 38 V, f = 120 Hz, I_O = 300 mA, T_J = 25°C	50			dB
eN	Output noise voltage	B =10 Hz to 100 kHz, T_J = 25°C		170		µV
V_d	Dropout voltage	T_J = 25°C		2		V
I_{sc}	Short circuit current	V_I = 35 V, T_J = 25°C		240		mA
I_{scp}	Short circuit peak current	T_J = 25°C		700		mA

6 Typical performance

Figure 8. Dropout voltage vs. junction temp.

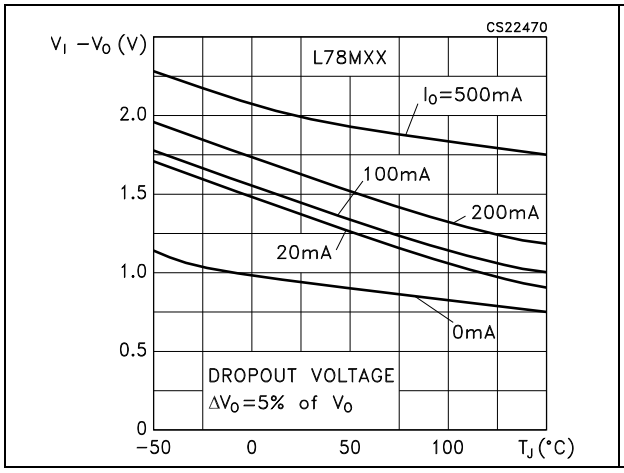


Figure 9. Dropout characteristics

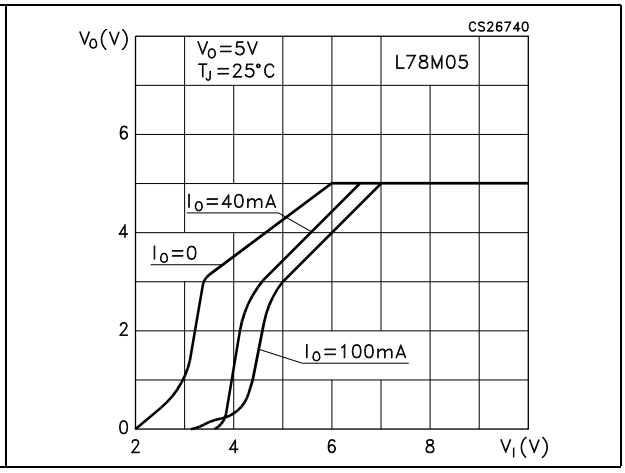


Figure 10. Peak output current vs. input-output differential voltage

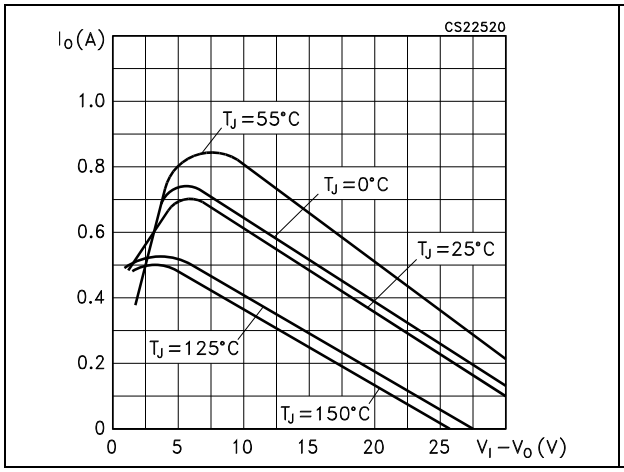


Figure 11. Output voltage vs. junction temperature

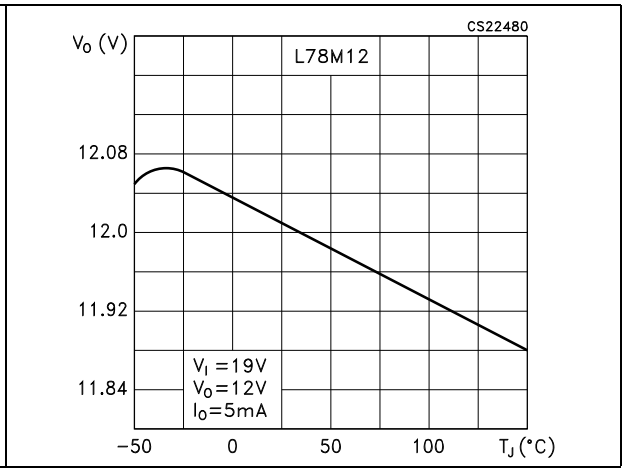


Figure 12. Supply voltage rejection vs. frequency

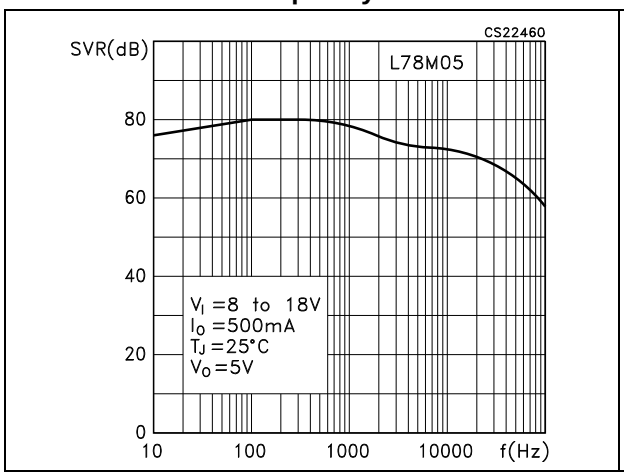


Figure 13. Quiescent current vs. junction temperature

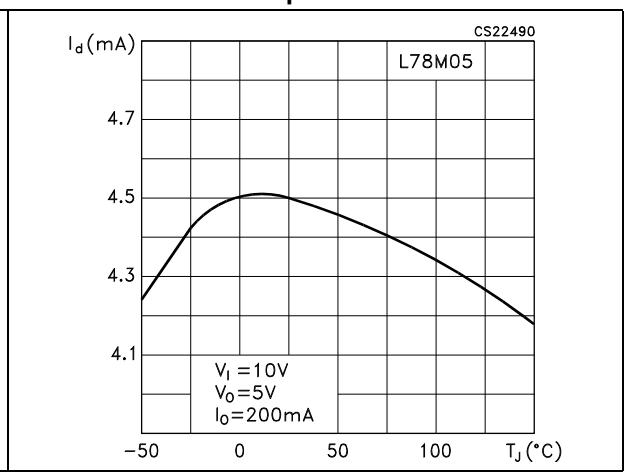


Figure 14. Load transient response

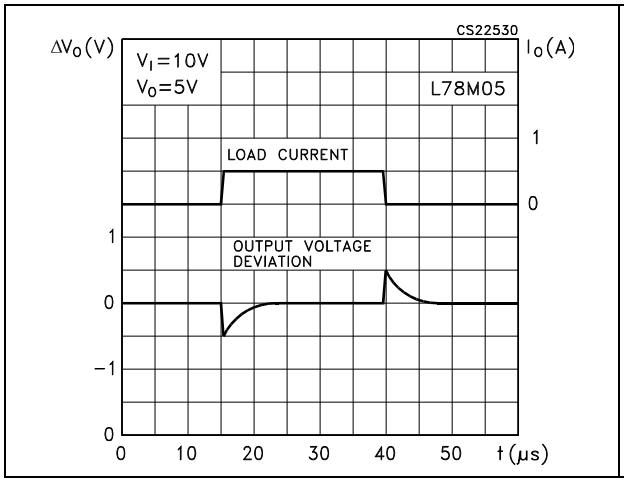


Figure 15. Line transient response

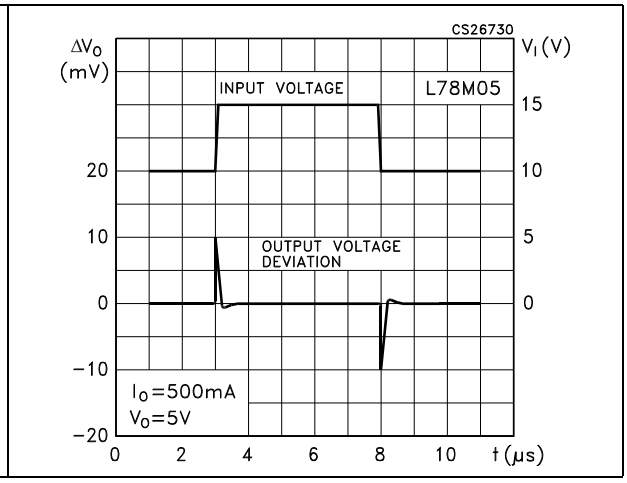
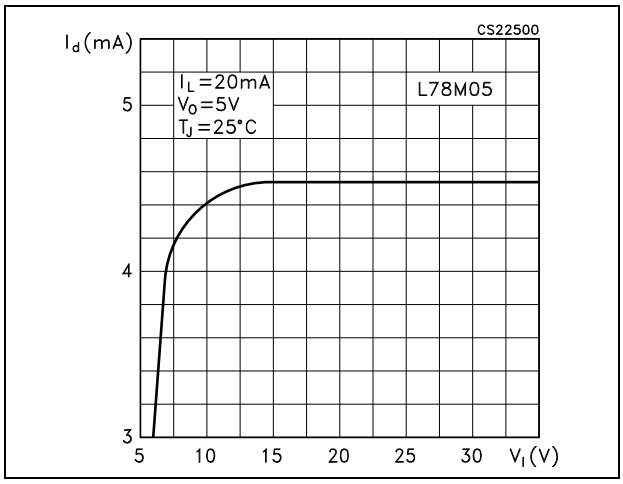


Figure 16. Quiescent current vs. input voltage

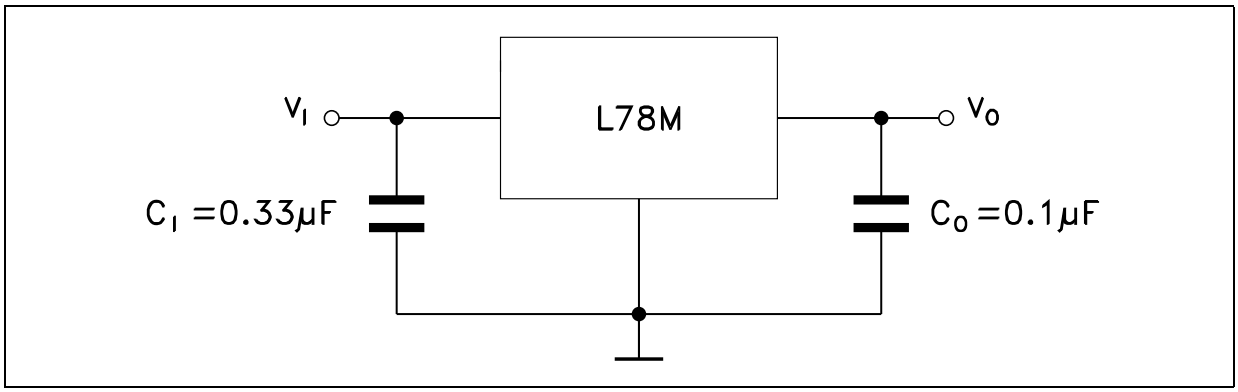


7 Applications information

7.1 Design considerations

The L78M 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 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 a capacitor if the regulator is connected to the power supply filter with long wire 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.

Figure 17. Fixed output regulator



Note: Although no output capacitor is need for stability, C_O improve transient response if present. C_I is required if regulator is located an appreciable distance from power supply filter.

Figure 18. Constant current regulator

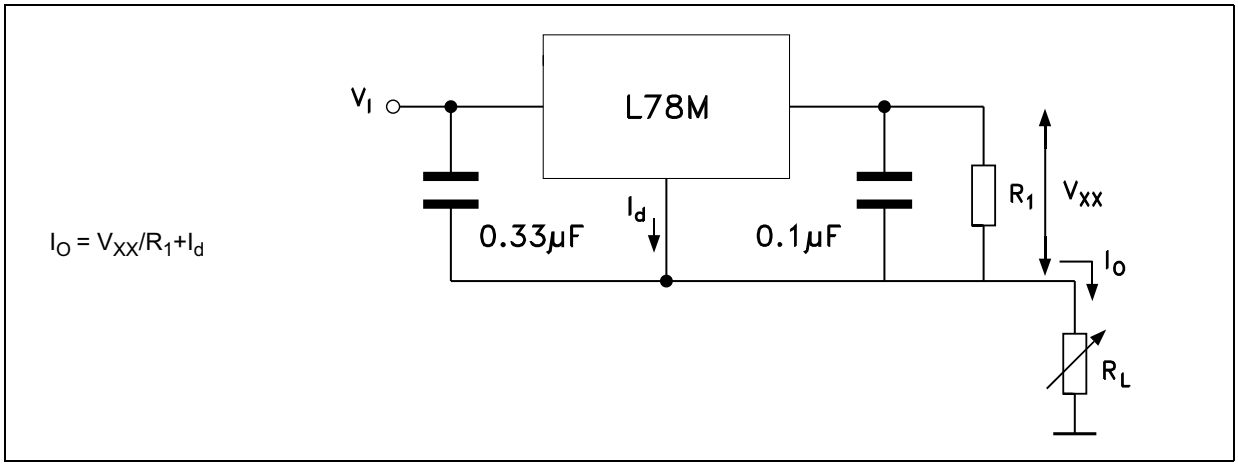


Figure 19. Circuit for increasing output voltage

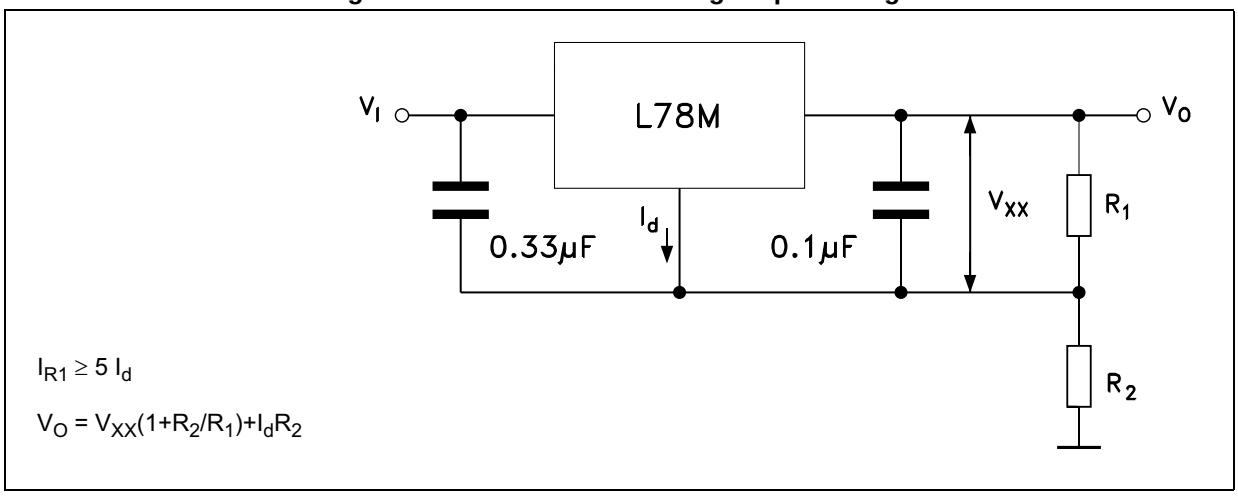


Figure 20. Adjustable output regulator (7 to 30 V)

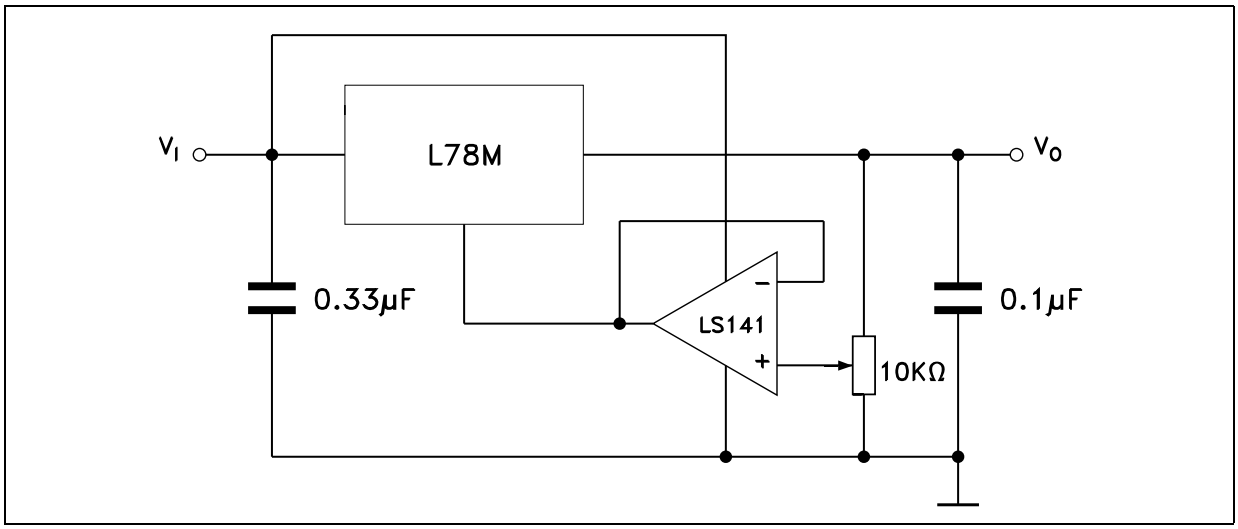


Figure 21. 0.5 to 10 V regulator

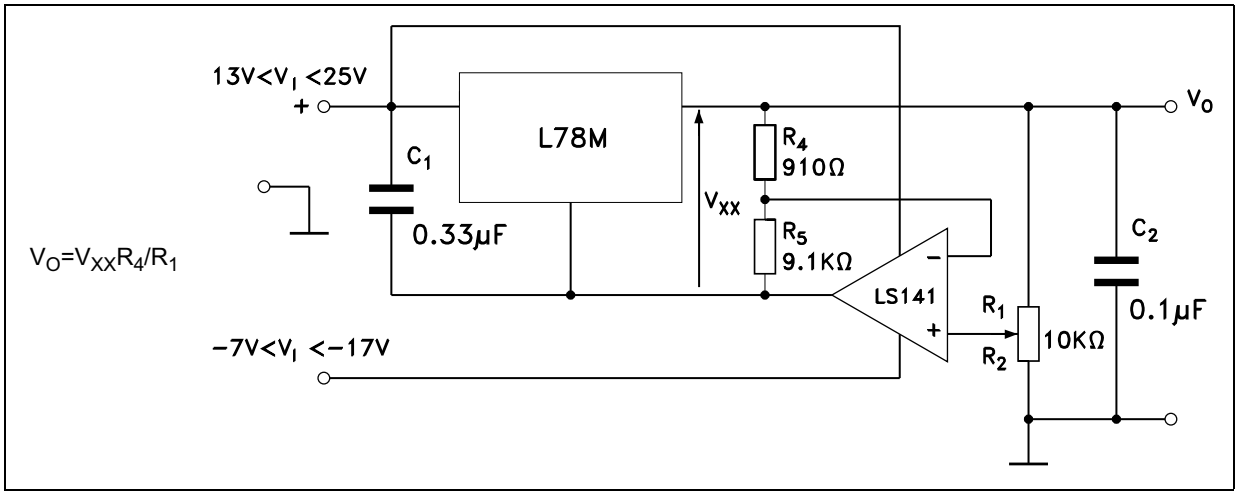


Figure 22. High current voltage regulator

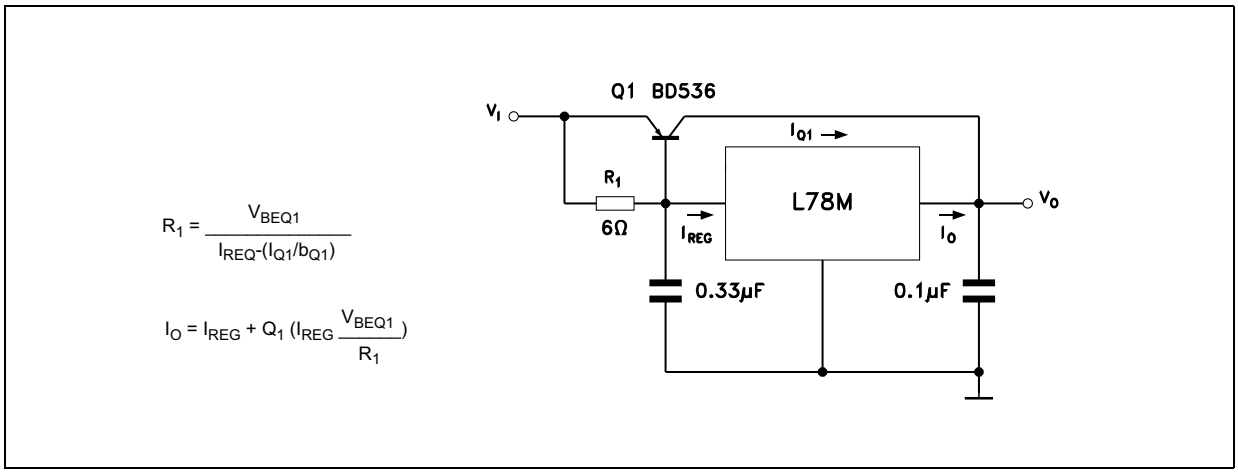


Figure 23. High output current with short circuit protection

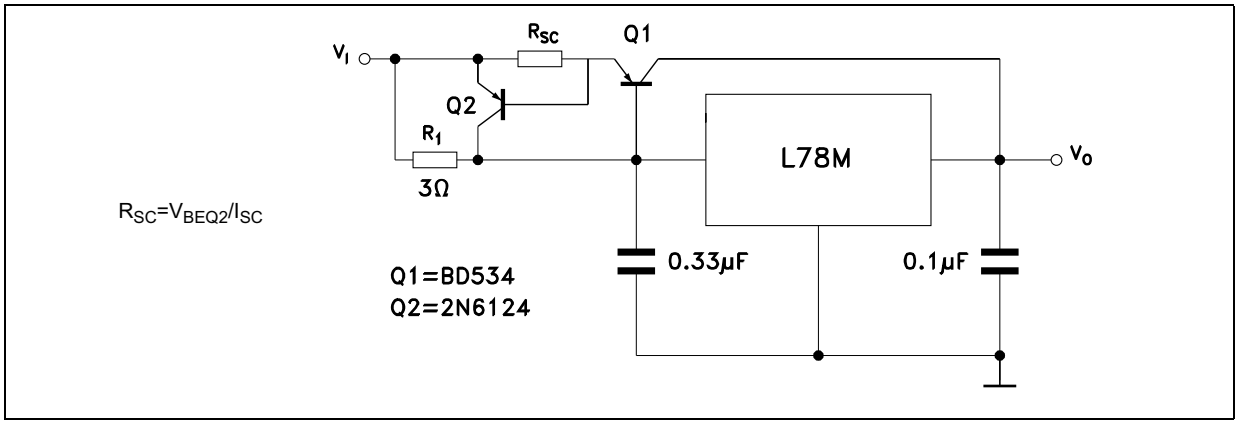


Figure 24. Tracking voltage regulator

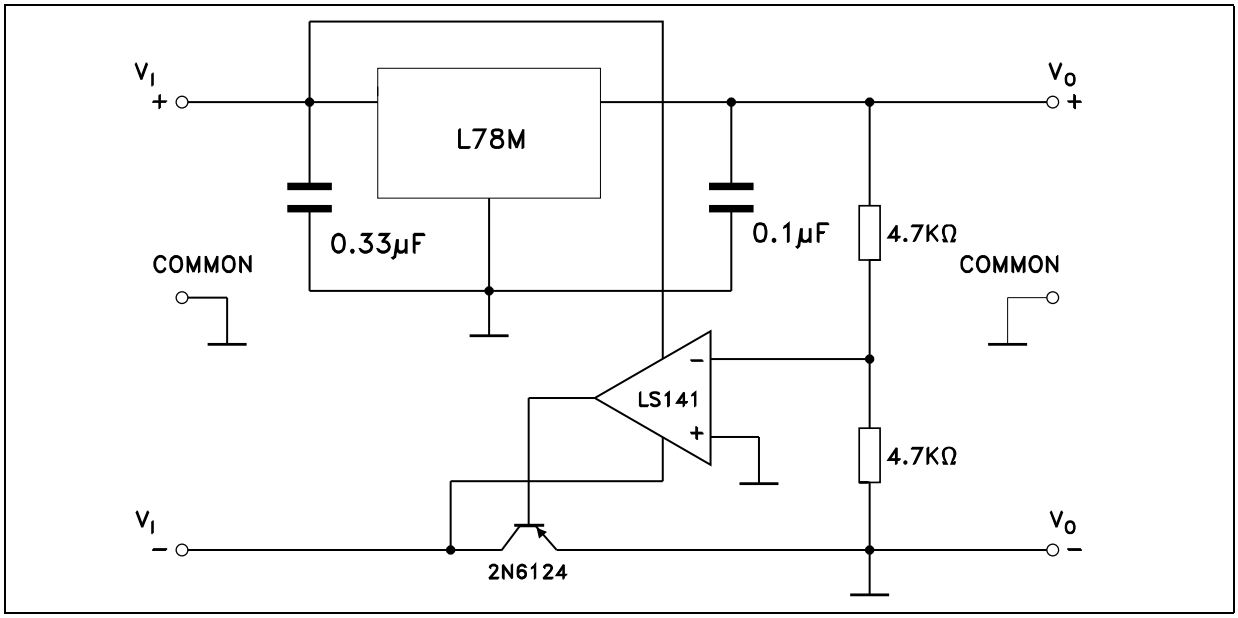


Figure 25. High input voltage circuit

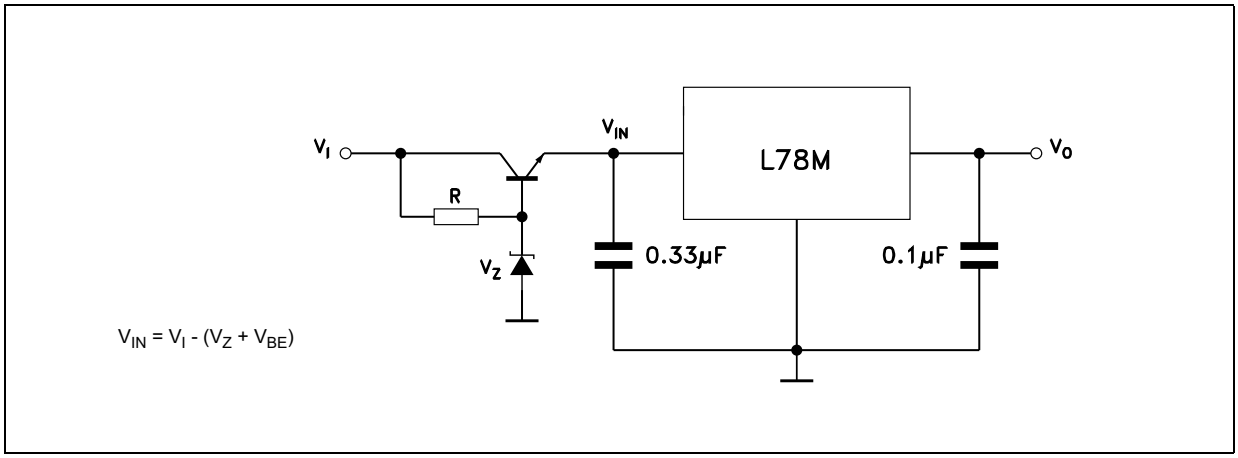


Figure 26. Reducing power dissipation with dropping resistor

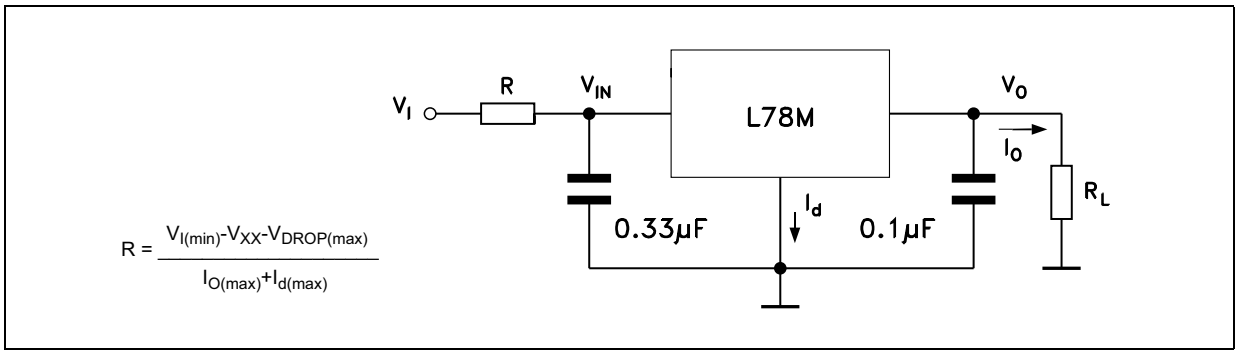
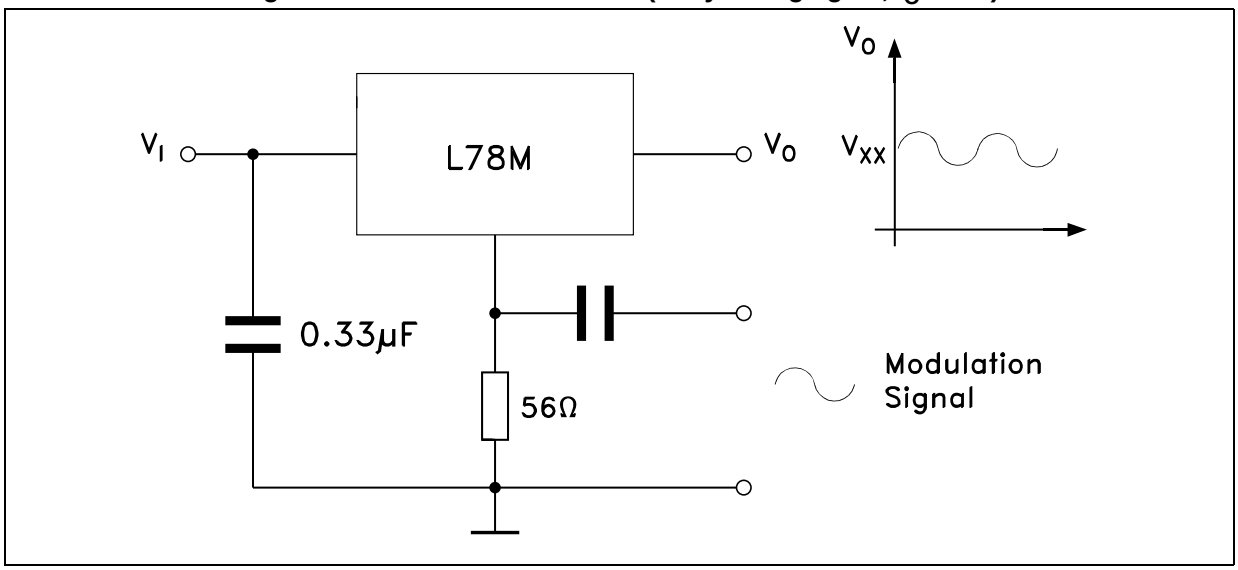
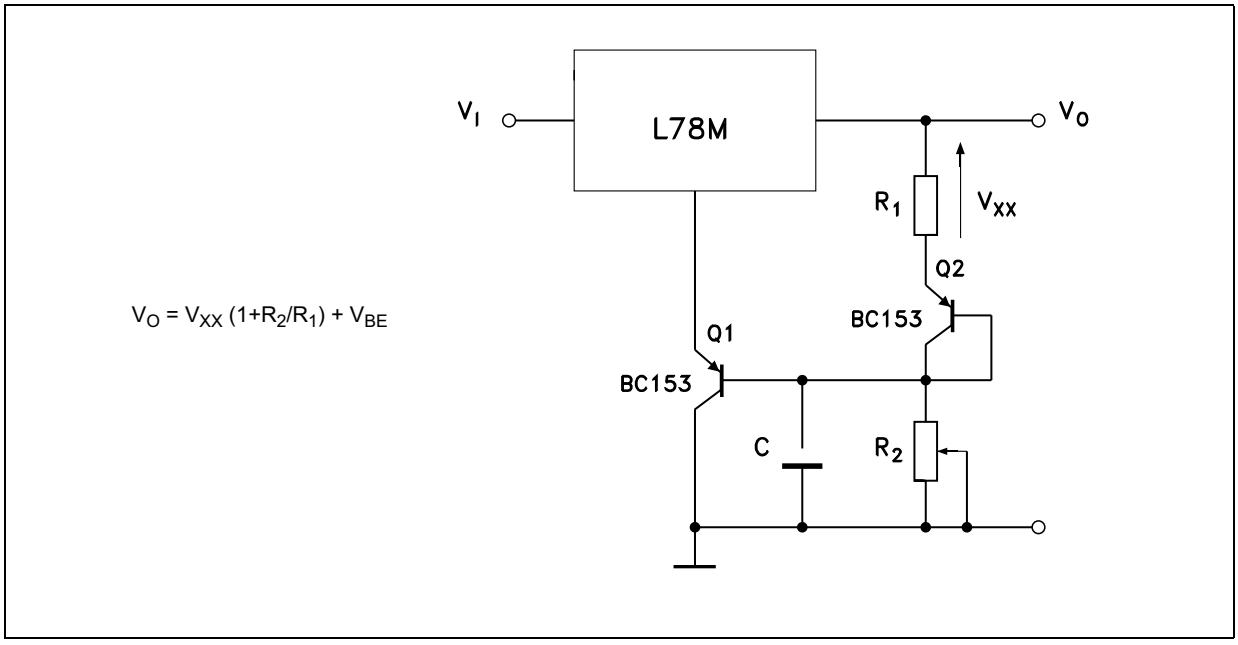


Figure 27. Power AM modulator (unity voltage gain, $I_O \leq 0.5$)



Note: The circuit performs well up to 100 kHz.

Figure 28. 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.

8 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Figure 29. TO-220 (single gauge) drawing

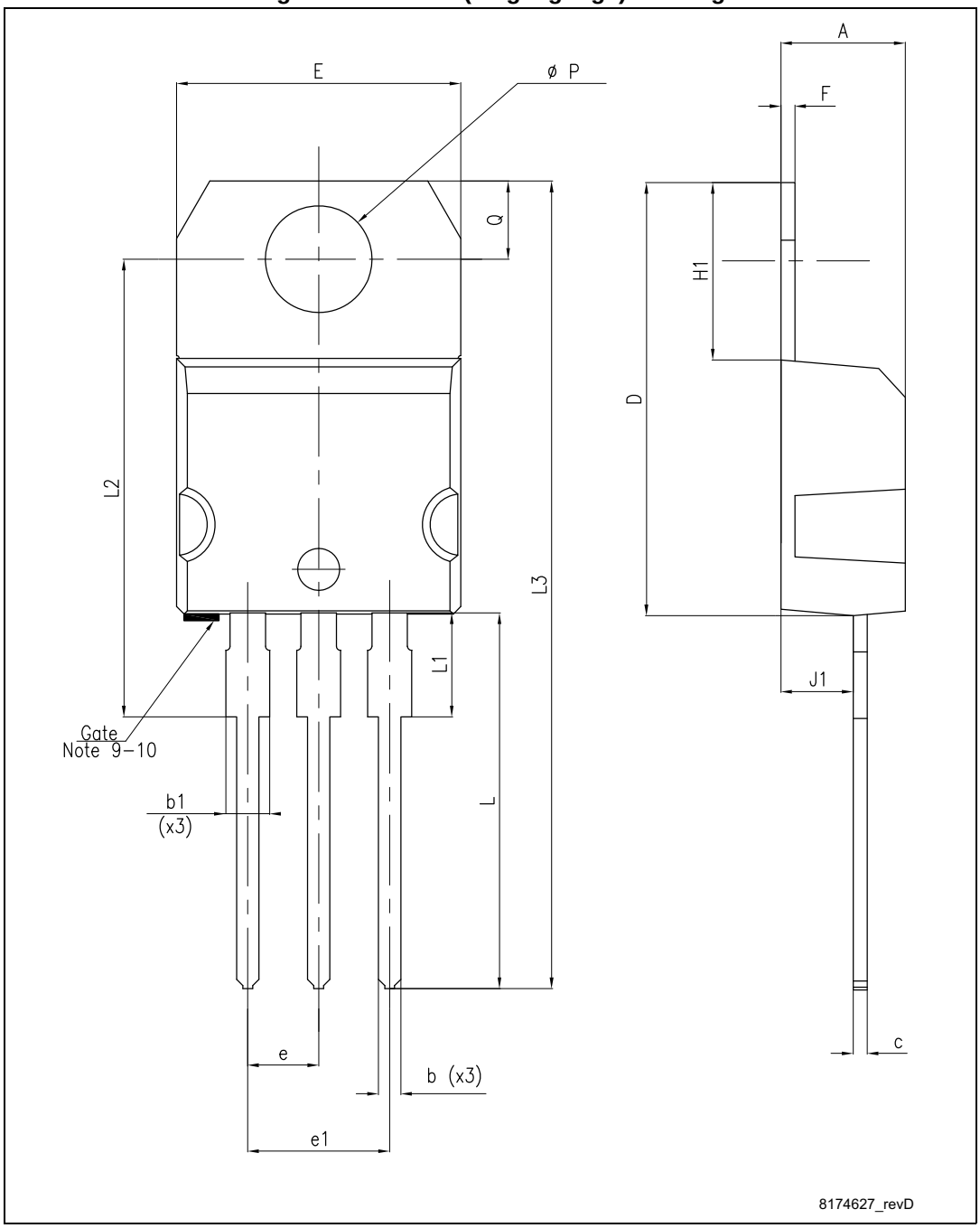


Table 18. TO-220 (single gauge) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	0.51		0.60
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

Figure 30. TO-220 (dual gauge) drawing

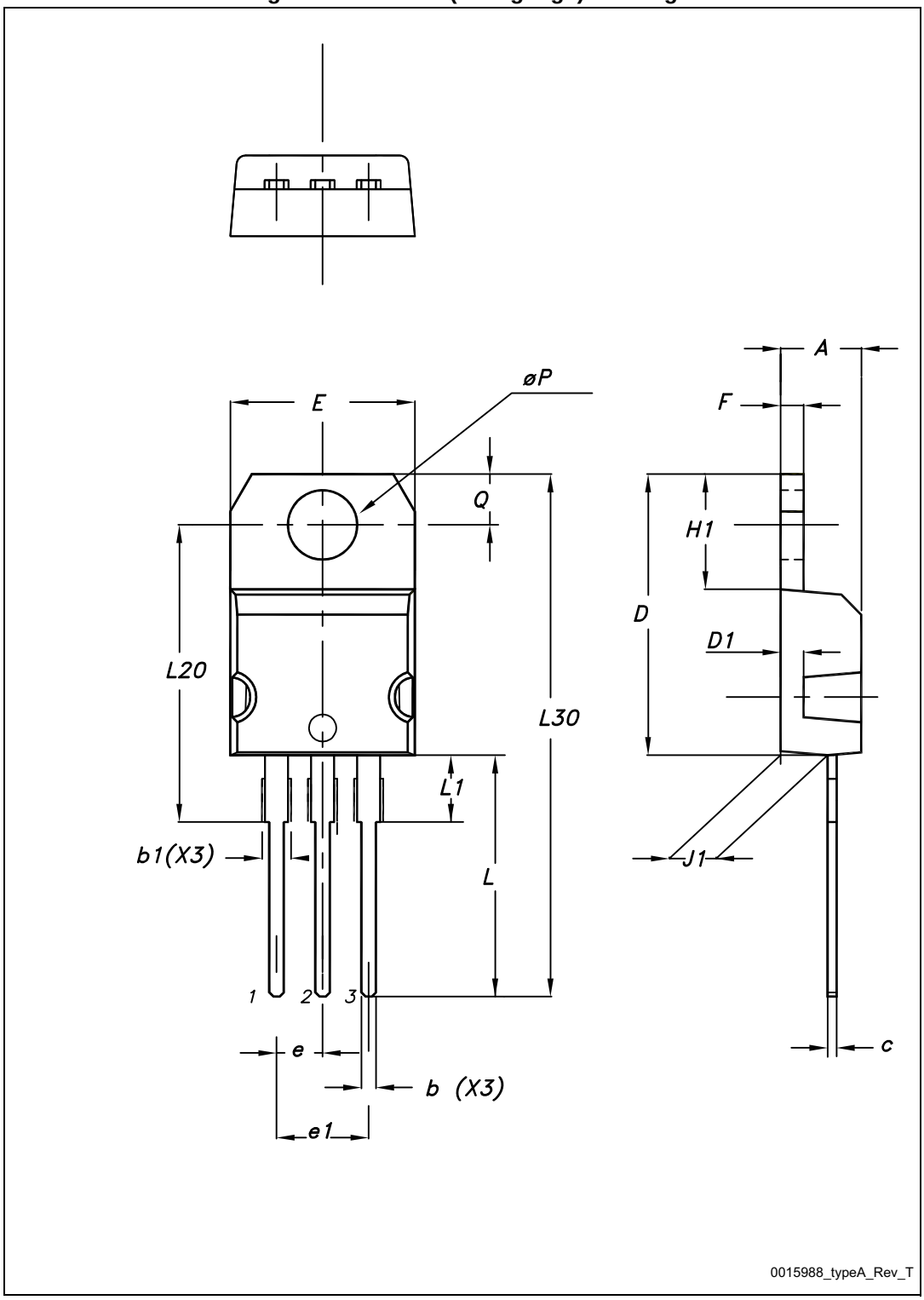


Table 19. TO-220 (dual gauge) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

Figure 31. TO-220FP drawing

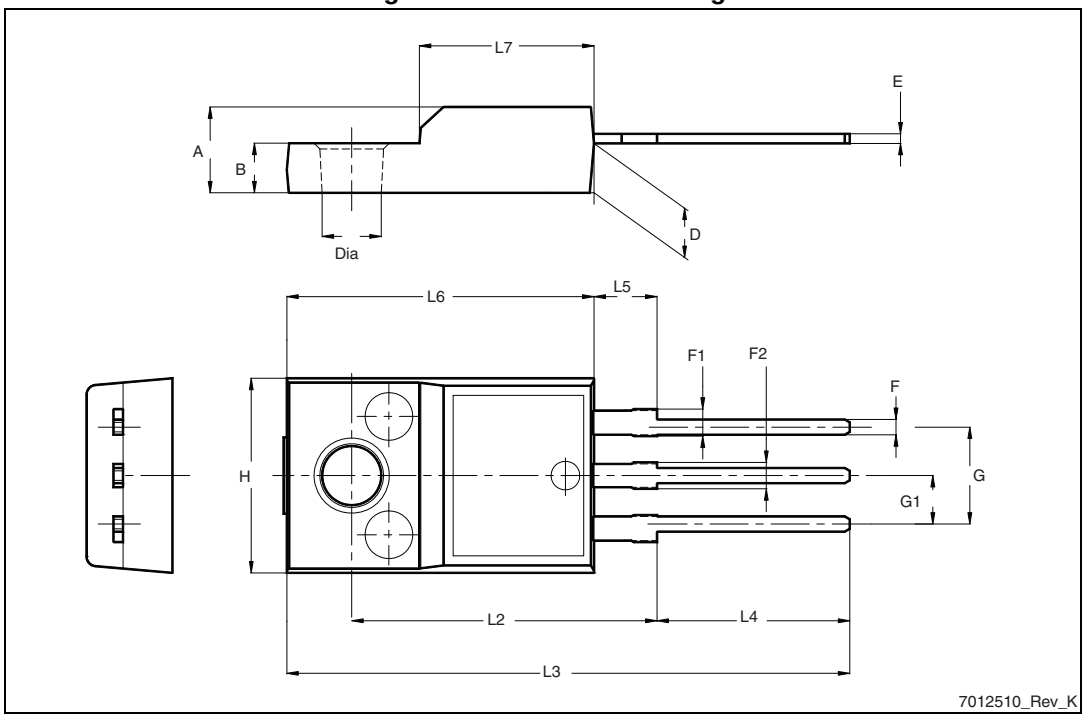


Table 20. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 32. DPAK drawing

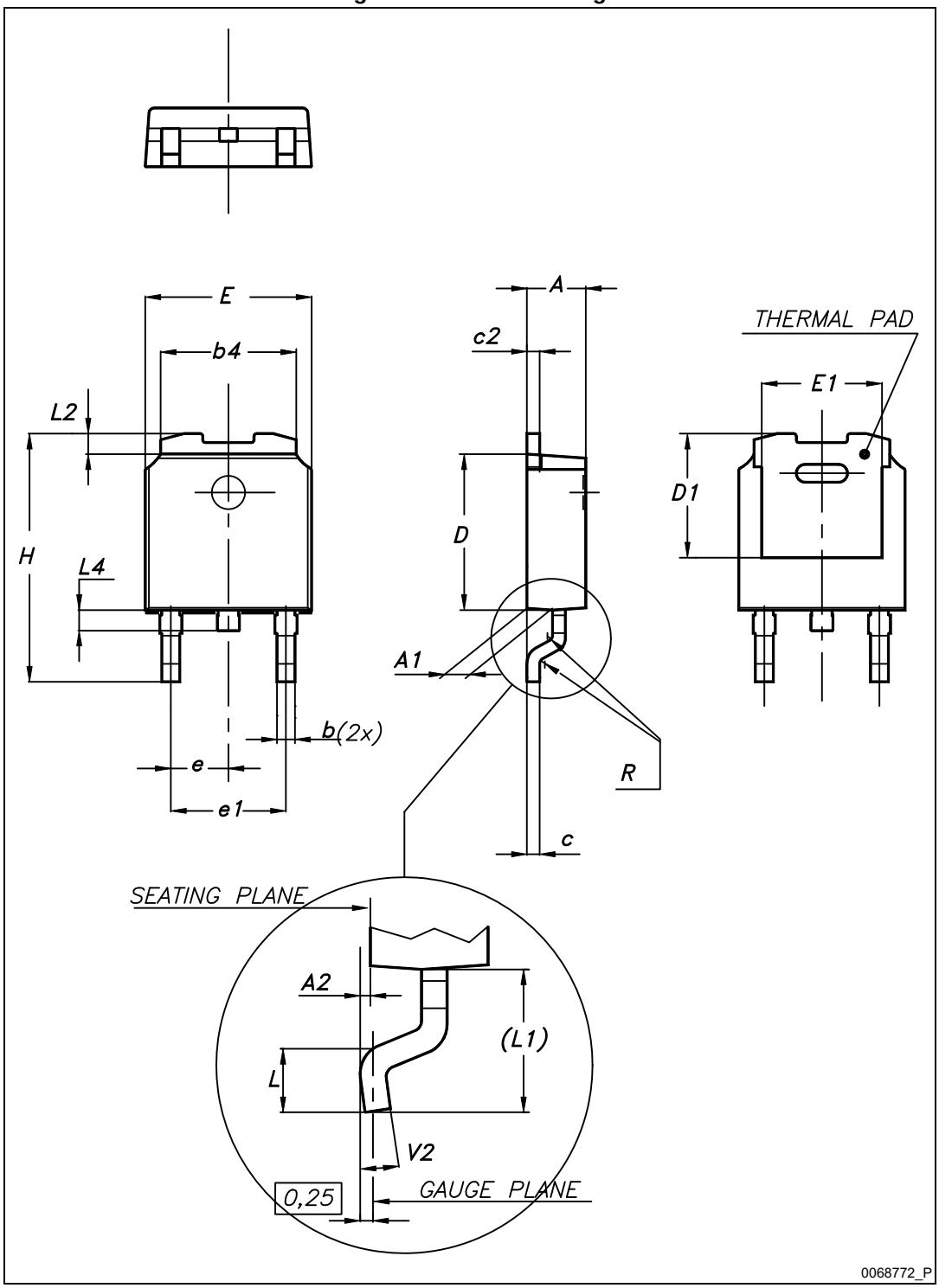
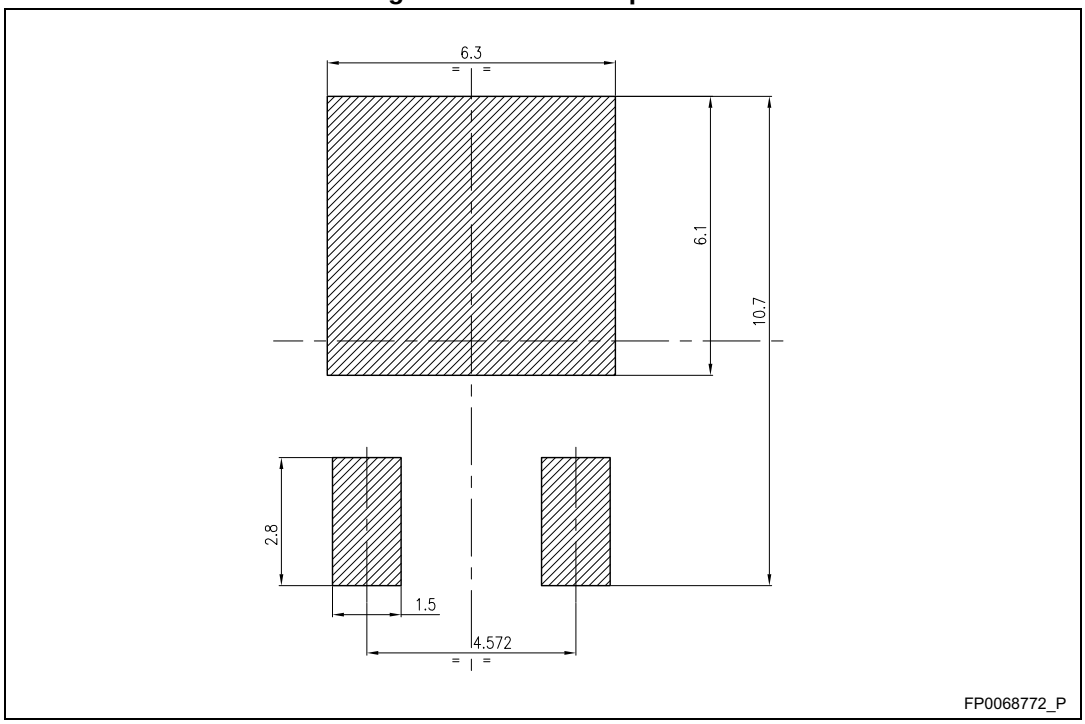


Table 21. DPAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 33. DPAK footprint [(a)]



a. All dimensions are in millimeters

Figure 34. DPAK type F drawing

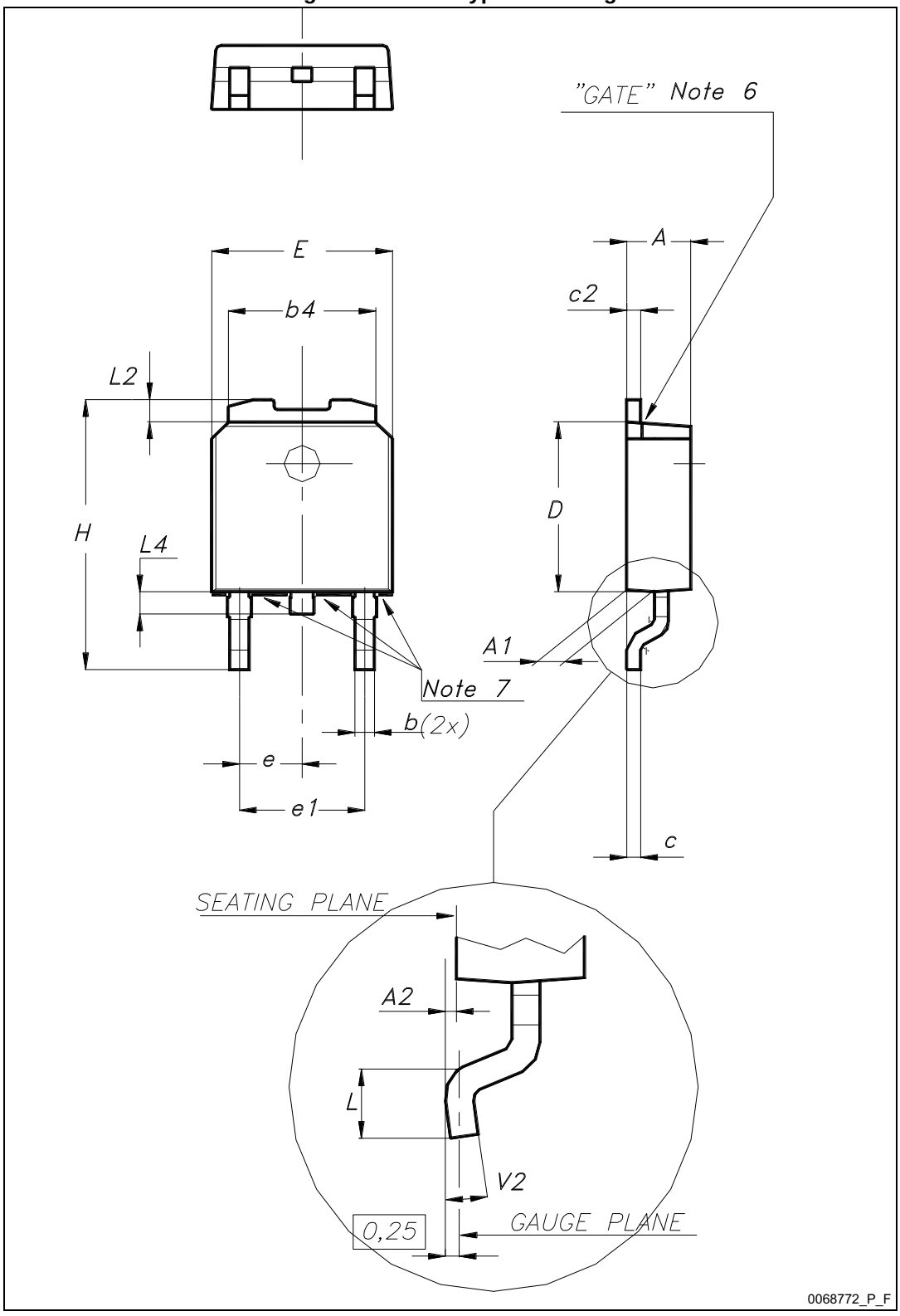


Table 22. DPAK (TO-252) type F mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.18		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	4.95		5.46
c	0.46		0.61
c2	0.46		0.60
D	5.97		6.22
E	6.35		6.73
e1	4.40		4.70
H	9.35		10.34
L	1.00		1.78
L2			1.27
L4	0.60		1.02
V2	0°		8°

Figure 35. IPAK drawing

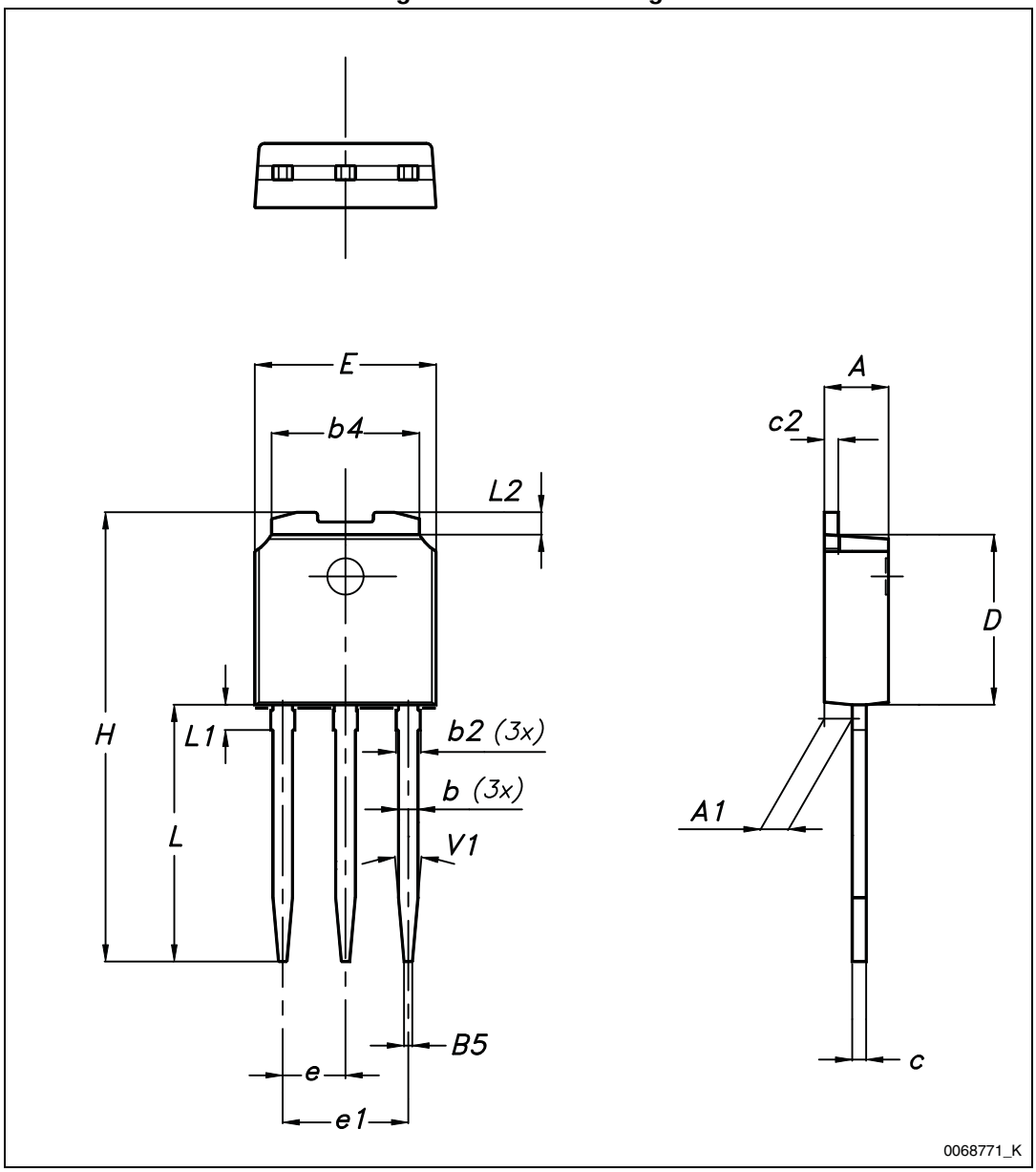


Table 23. IPAK mechanical data

DIM	mm.		
	min.	typ.	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

9 Packaging mechanical data

Figure 36. Tape for DPAK and D^{2}PAK

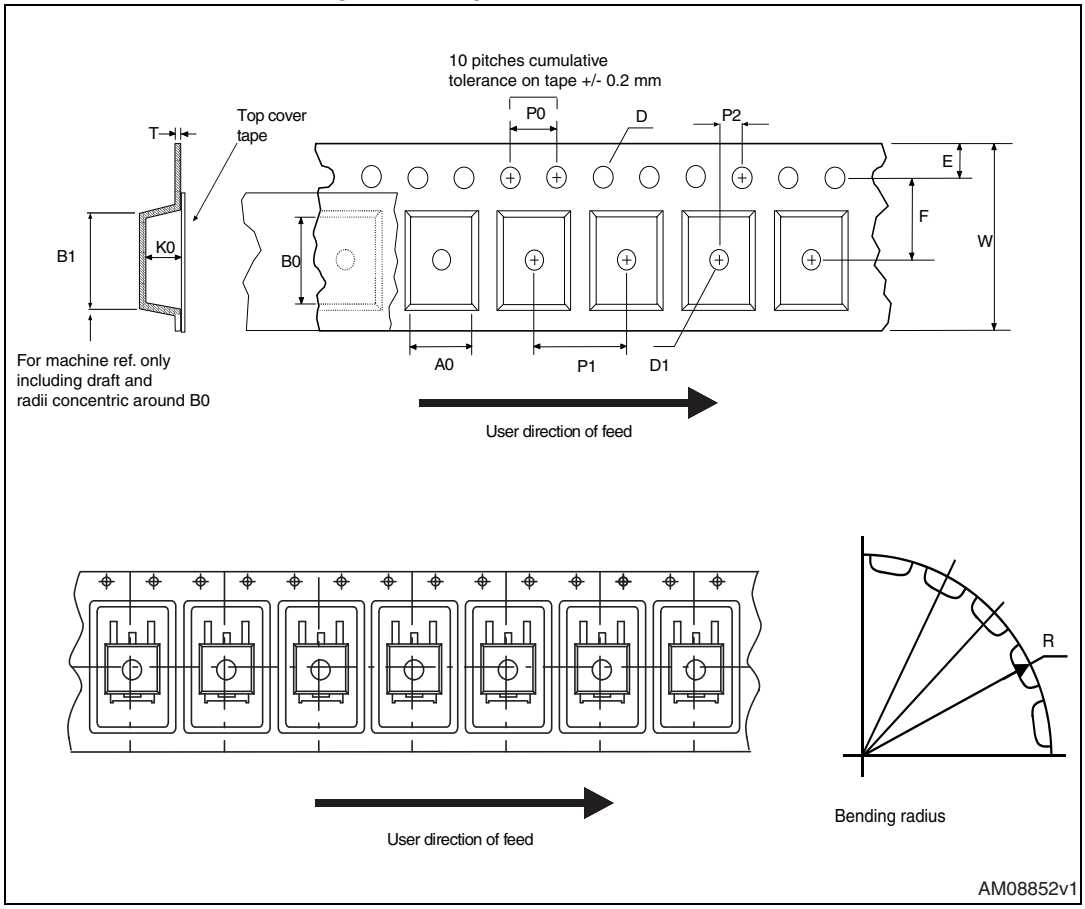


Figure 37. Reel for DPAK and D²PAK

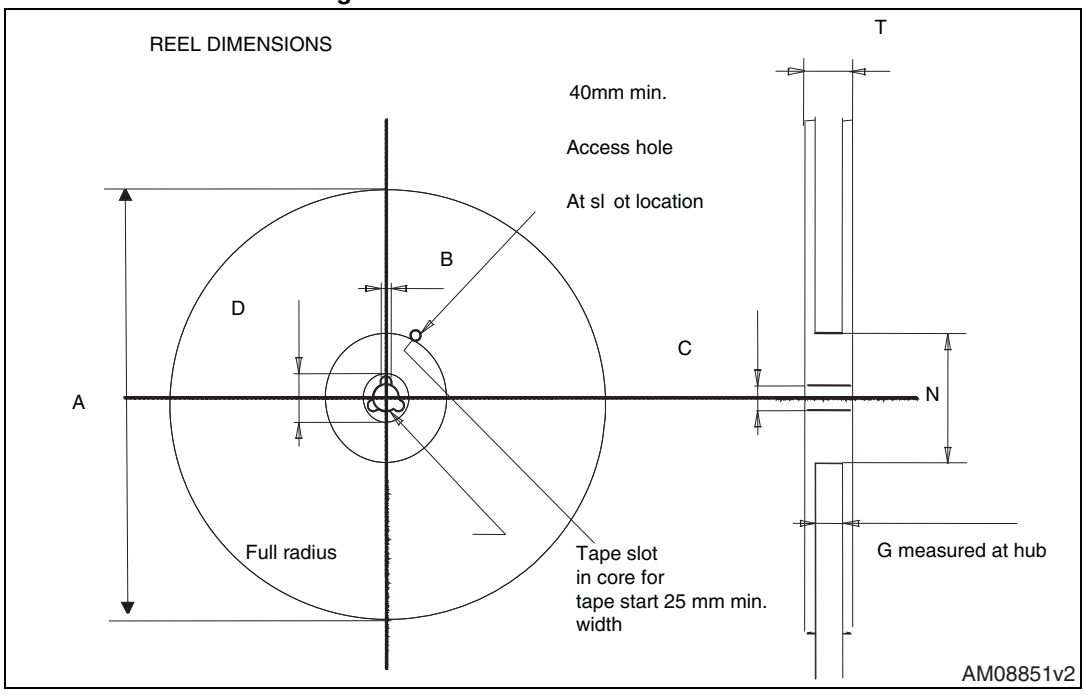


Table 24. DPAK and D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

10 Order codes

Table 25. Order codes

Order codes					Output voltages
TO-220 (single gauge)	TO-220 (dual gauge)	TO-220FP	DPAK	IPAK	
L78M05ABV	L78M05ABV-DG		L78M05ABDT-TR		5 V
			L78M05ACDT-TR		
L78M05CV	L78M05CV-DG	L78M05CP	L78M05CDT-TR	L78M05CDT-1	5 V
			L78M06ABDT-TR		6 V
			L78M06CDT-TR		6 V
			L78M08ABDT-TR		8 V
L78M08CV	L78M08CV-DG		L78M08CDT-TR		8 V
			L78M09ABDT-TR		9 V
L78M09CV	L78M09CV-DG		L78M09CDT-TR		9 V
			L78M10ABDT-TR		10 V
			L78M12ABDT-TR		12 V
			L78M12ACDT-TR		12 V
L78M12CV	L78M12CV-DG		L78M12CDT-TR		12 V
L78M15ABV	L78M15ABV-DG		L78M15ABDT-TR		15 V
L78M15CV	L78M15CV-DG		L78M15CDT-TR		15 V
			L78M24ABDT-TR		24 V
			L78M24ACDT-TR		24 V
L78M24CV	L78M24CV-DG		L78M24CDT-TR		24 V

11 Revision history

Table 26. Document revision history

Date	Revision	Changes
21-Jun-2004	6	Document updating.
30-Aug-2006	7	Order codes updated.
29-Nov-2006	8	DPAK mechanical data updated and add footprint data.
06-Jun-2007	9	Order codes updated.
10-Dec-2007	10	Added *Table 25*.
19-Feb-2008	11	Modified: *Table 25 on page 44*.
15-Jul-2008	12	Modified: *Table 25 on page 44* and *Table 26 on page 45*.
07-Apr-2009	13	Modified: *Figure 9 on page 22* and *Figure 15 on page 23*.
14-Jun-2010	14	Added: *Table 18 on page 26*, *Figure 29 on page 27*, *Figure 30 on page 28*, *Figure 31* and *Figure 32 on page 29*.
11-Nov-2010	15	Modified: R_{thJC} value for TO-220 *Table 2 on page 5*.
08-Feb-2012	16	Added: order codes L78M05CV-DG, L78M12CV-DG and L78M15CV-DG *Table 25 on page 44*.
09-Mar-2012	17	Added: order codes L78M08CV-DG and L78M09CV-DG *Table 25 on page 44*.
15-May-2012	18	Added: order codes L78M24CV-DG *Table 25 on page 44*.
19-Apr-2013	19	Removed: Available on request footnote 2 *Table 25 on page 44*.
04-Jun-2014	20	Part numbers L78MxxAB, L78MxxAC and L78MxxC changed to L78M. Updated the title and the features in cover page. Cancelled Table 1.Device summary. Updated *Section 3: Maximum ratings*, *Section 5: Electrical characteristics*, *Section 6: Typical performance* and *Section 8: Package mechanical data*. Added *Section 7: Applications information* and *Section 9: Packaging mechanical data*. Minor text changes.

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