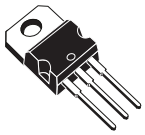
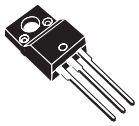
L78M

Datasheet

Precision 500 mA regulators



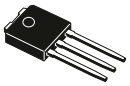
TO-220



TO-220FP



DPAK



IPAK

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

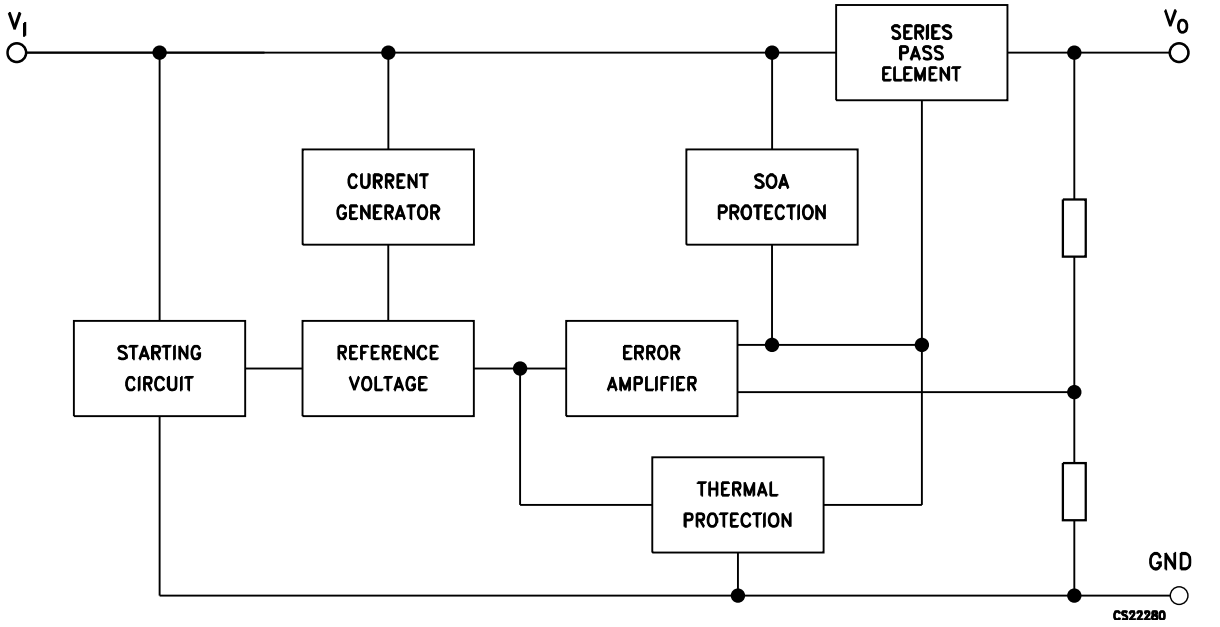
Description

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.

Maturity status link
L78M

1 Diagram

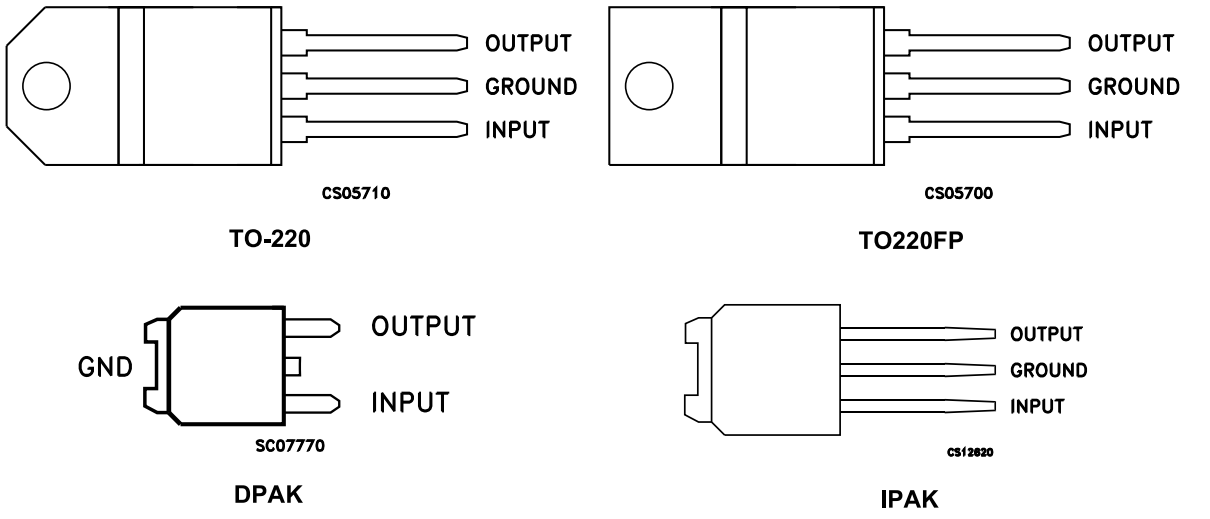
Figure 1. **Block diagram**



AMG080320171800MT

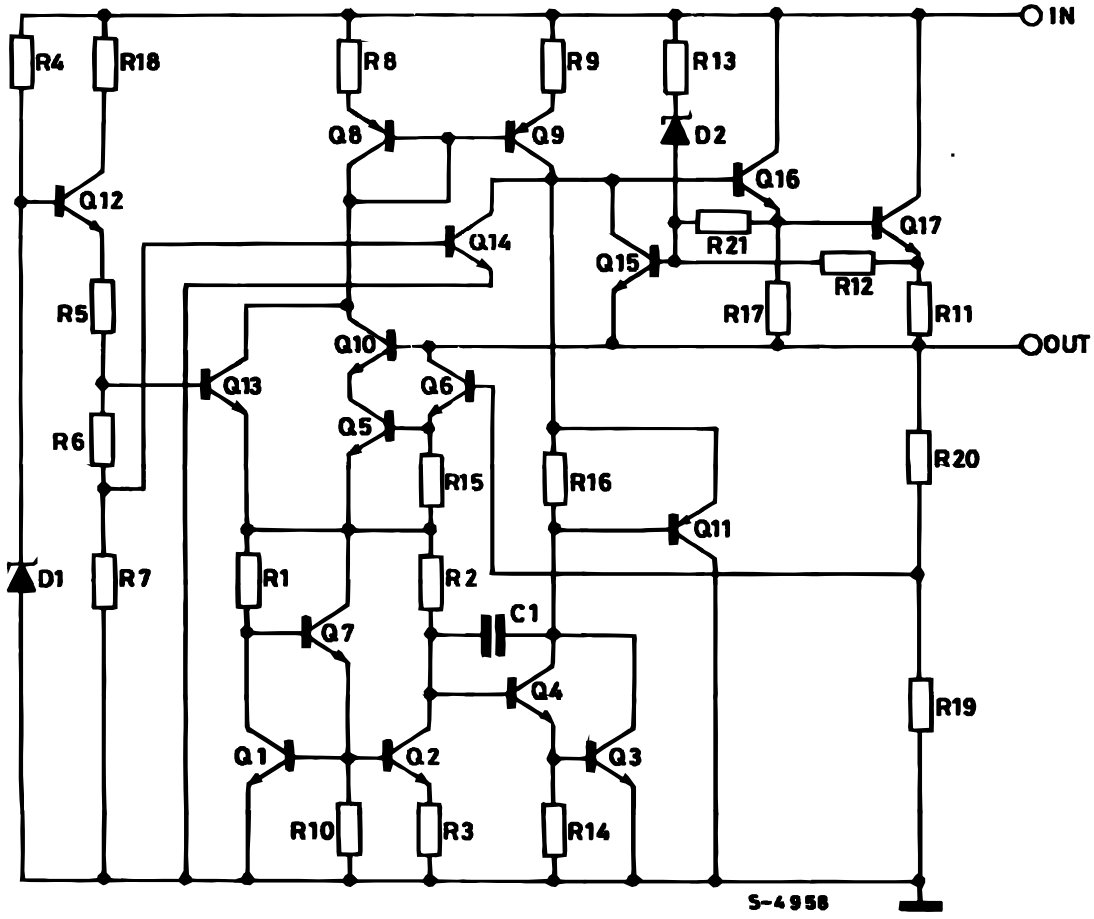
2 Pin configuration

Figure 2. **Pin connections (top view)**



AMG080320171801MT

Figure 3. Schematic diagram



AMG080320171802MT

3 Maximum ratings

Table 1. Absolute maximum ratings

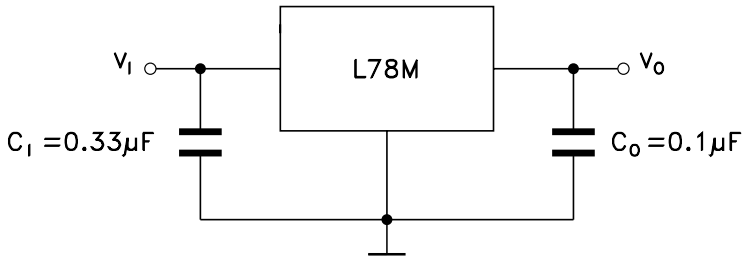
Symbol	Parameter		Value	Unit
V_I	DC input voltage	for V_O = 5 to 18 V	35	V
		for V_O = 20, 24 V	40	
I_O	Output current		Internally limited	mA
P_D	Power dissipation		Internally limited	mW
T_{STG}	Storage temperature range		- 65 to 150	°C
T_{OP}	Operating junction temperature range	for L78MxxAC	0 to 125	°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

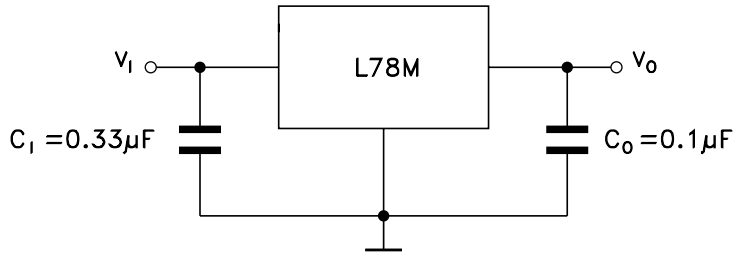
Figure 4. Application circuit



AMG080320171803MT

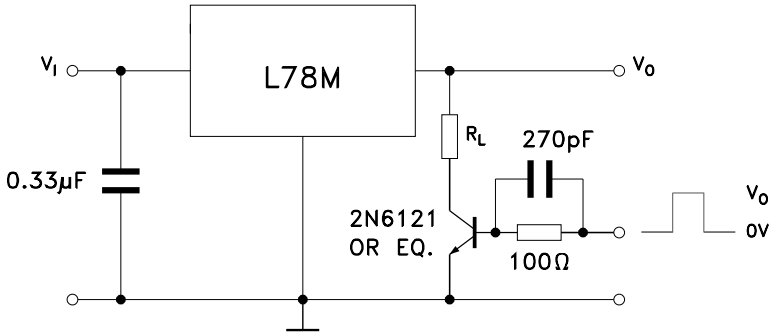
4 Test circuits

Figure 5. **DC parameter**



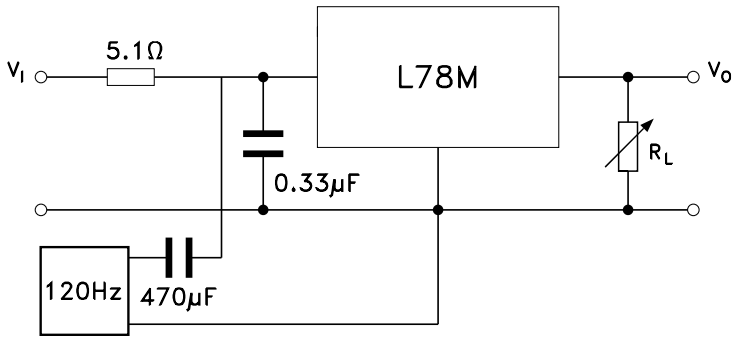
AMG080320171804MT

Figure 6. **Load regulation**



AMG080320171805MT

Figure 7. **Ripple rejection**



AMG080320171806MT

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
DV_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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$\Delta V_O/\Delta T$	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.

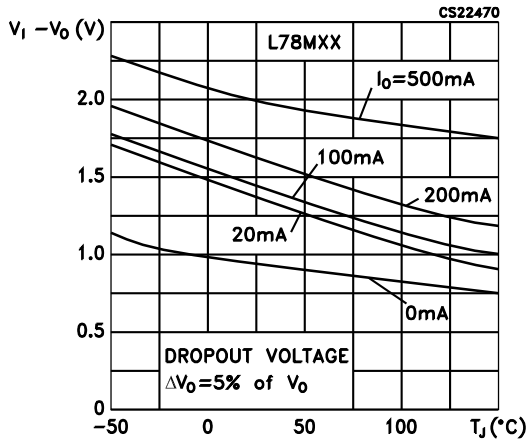
Table 17. Electrical characteristics of L78M24A

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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

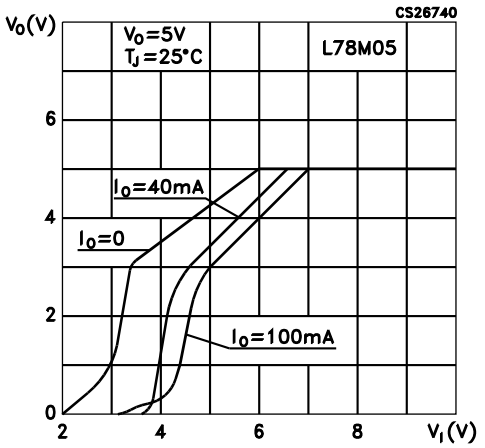
6 Typical performance

Figure 8. Dropout voltage vs junction temp.



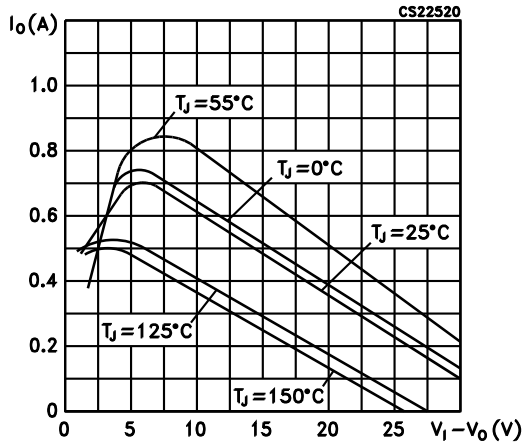
AMG080320171819MT

Figure 9. Dropout characteristics



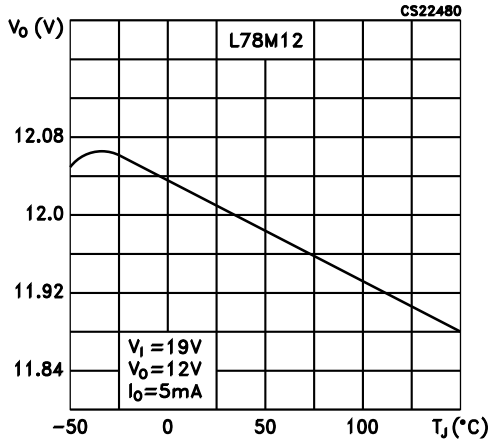
AMG080320171820MT

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



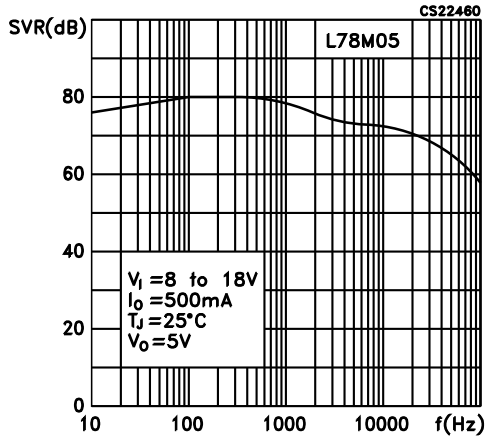
AMG080320171821MT

Figure 11. Output voltage vs junction temperature



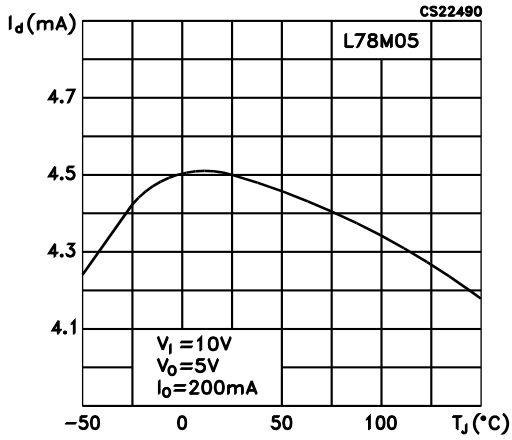
AMG080320171822MT

Figure 12. Supply voltage rejection vs frequency



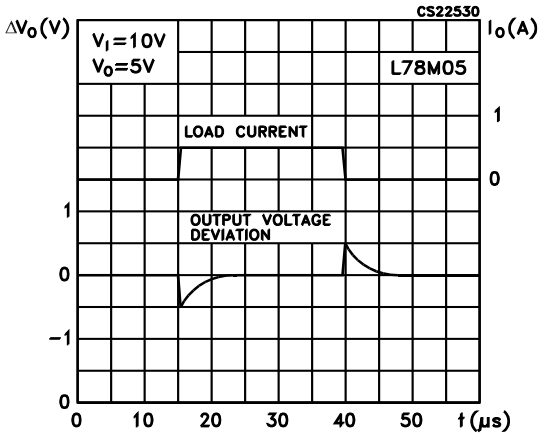
AMG080320171823MT

Figure 13. Quiescent current vs junction temperature



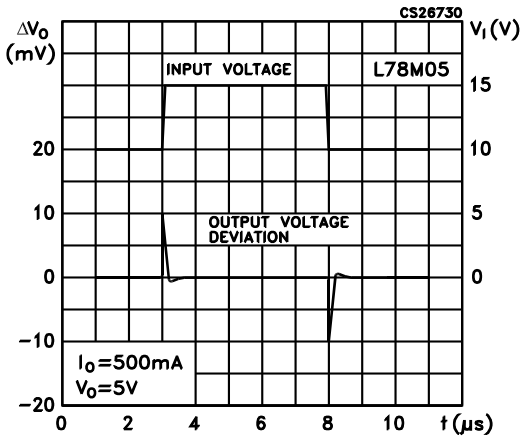
AMG080320171824MT

Figure 14. Load transient response



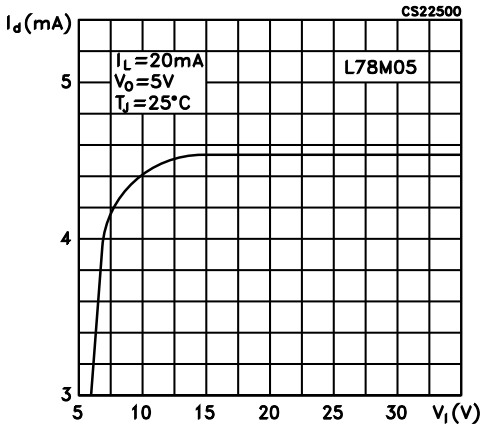
AMG080320171825MT

Figure 15. Line transient response



AMG080320171826MT

Figure 16. Quiescent current vs input voltage



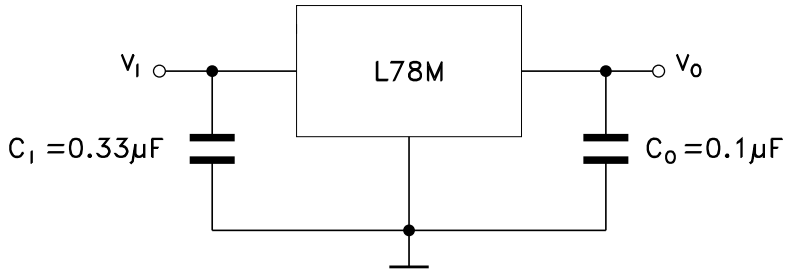
AMG080320171827MT

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.

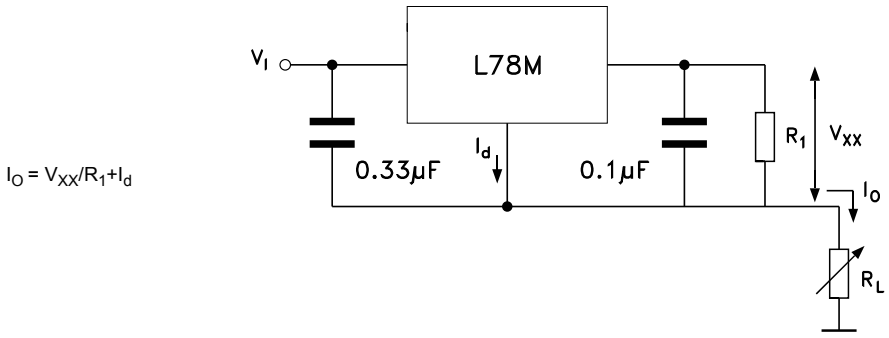
Figure 17. Fixed output regulator



AMG080320171807MT

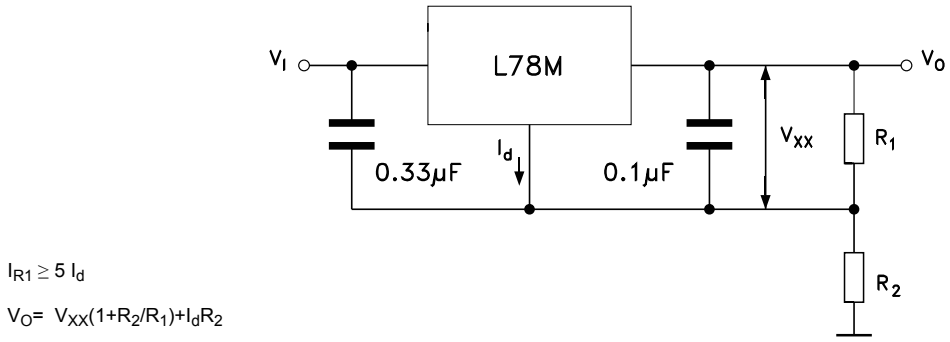
Note: Although no output capacitor is need for stability, C_o improve transient response if present. C_I is required if regulator is located an appreciable distance from power supply filter.

Figure 18. Constant current regulator



AMG080320171808MT

Figure 19. **Circuit for increasing output voltage**

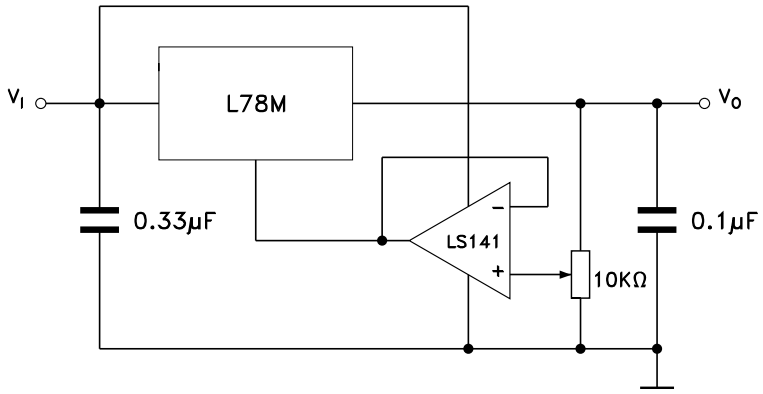


$I_{R1} \geq 5\ I_d$

$V_O = V_{XX}(1+R_2/R_1)+I_dR_2$

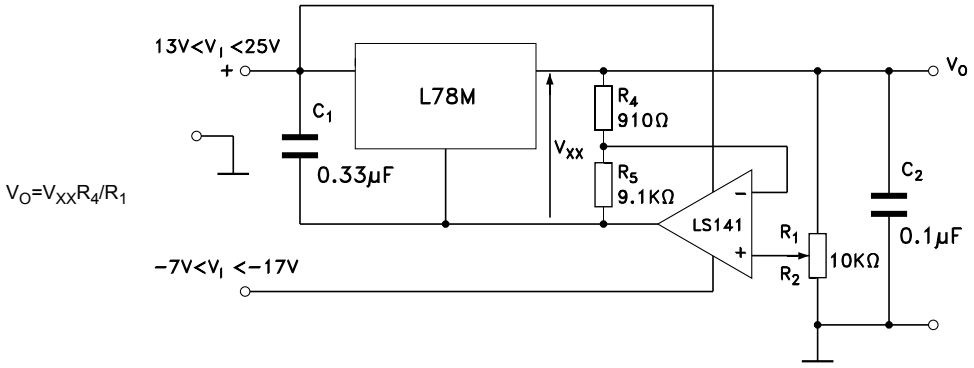
AMG080320171809MT

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



AMG080320171811MT

Figure 21. **0.5 to 10 V regulator**



$V_O = V_{XX}R_4/R_1$

AMG080320171812MT

Figure 22. **High current voltage regulator**

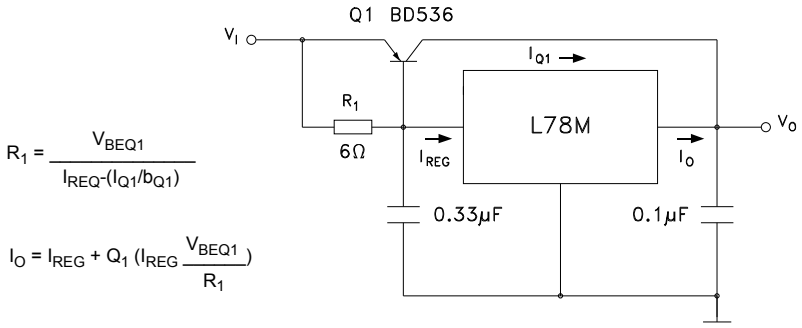
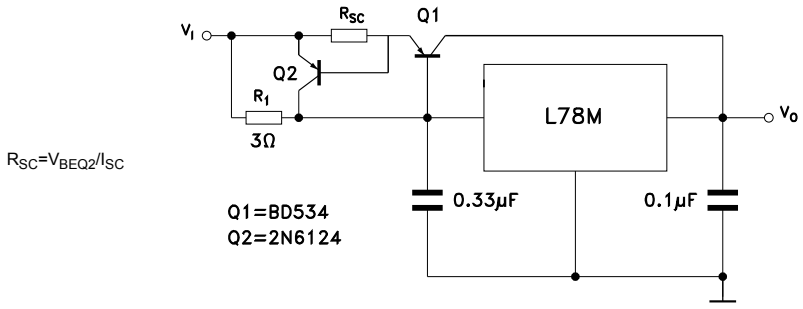
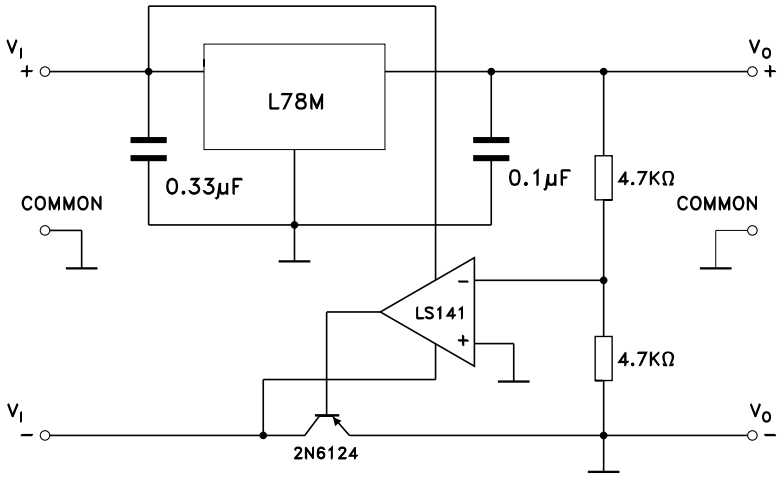


Figure 23. **High output current with short circuit protection**



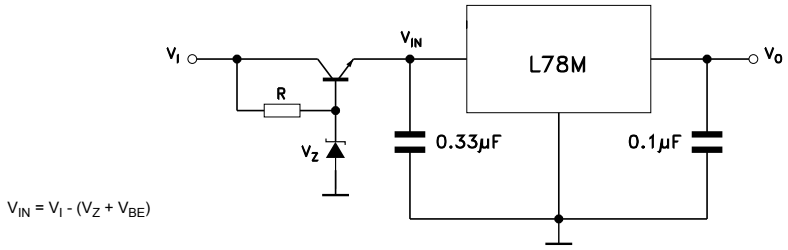
AMG080320171828MT

Figure 24. **Tracking voltage regulator**



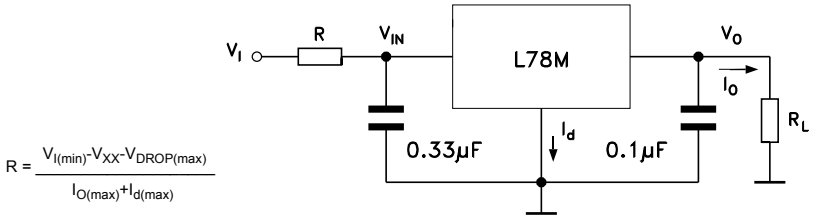
AMG080320171814MT

Figure 25. **High input voltage circuit**



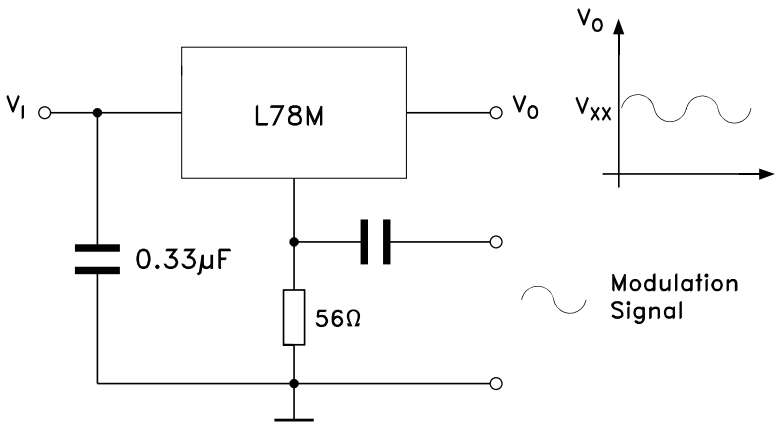
AMG080320171815MT

Figure 26. **Reducing power dissipation with dropping resistor**



AMG080320171816MT

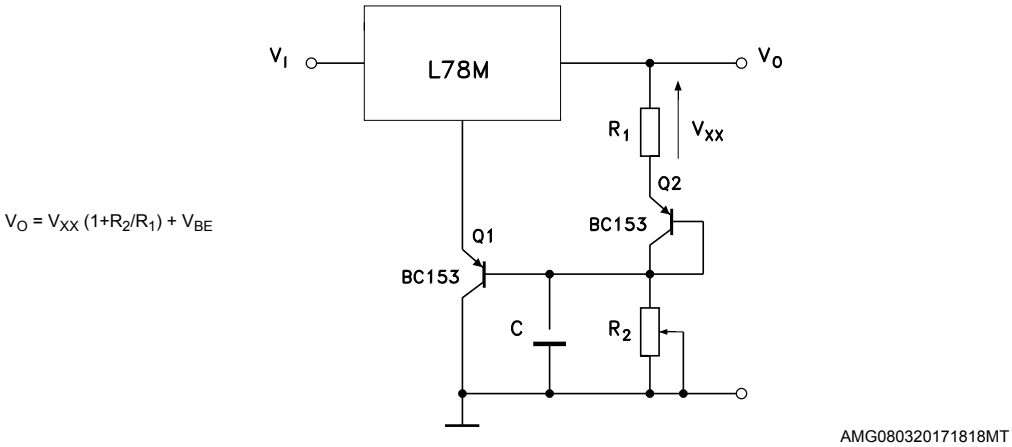
Figure 27. **Power AM modulator (unity voltage gain, $I_O \leq 0.5$)**



AMG080320171817MT

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 information

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.

8.1 TO-220 (single gauge) package information

Figure 29. TO-220 (single gauge) package outline

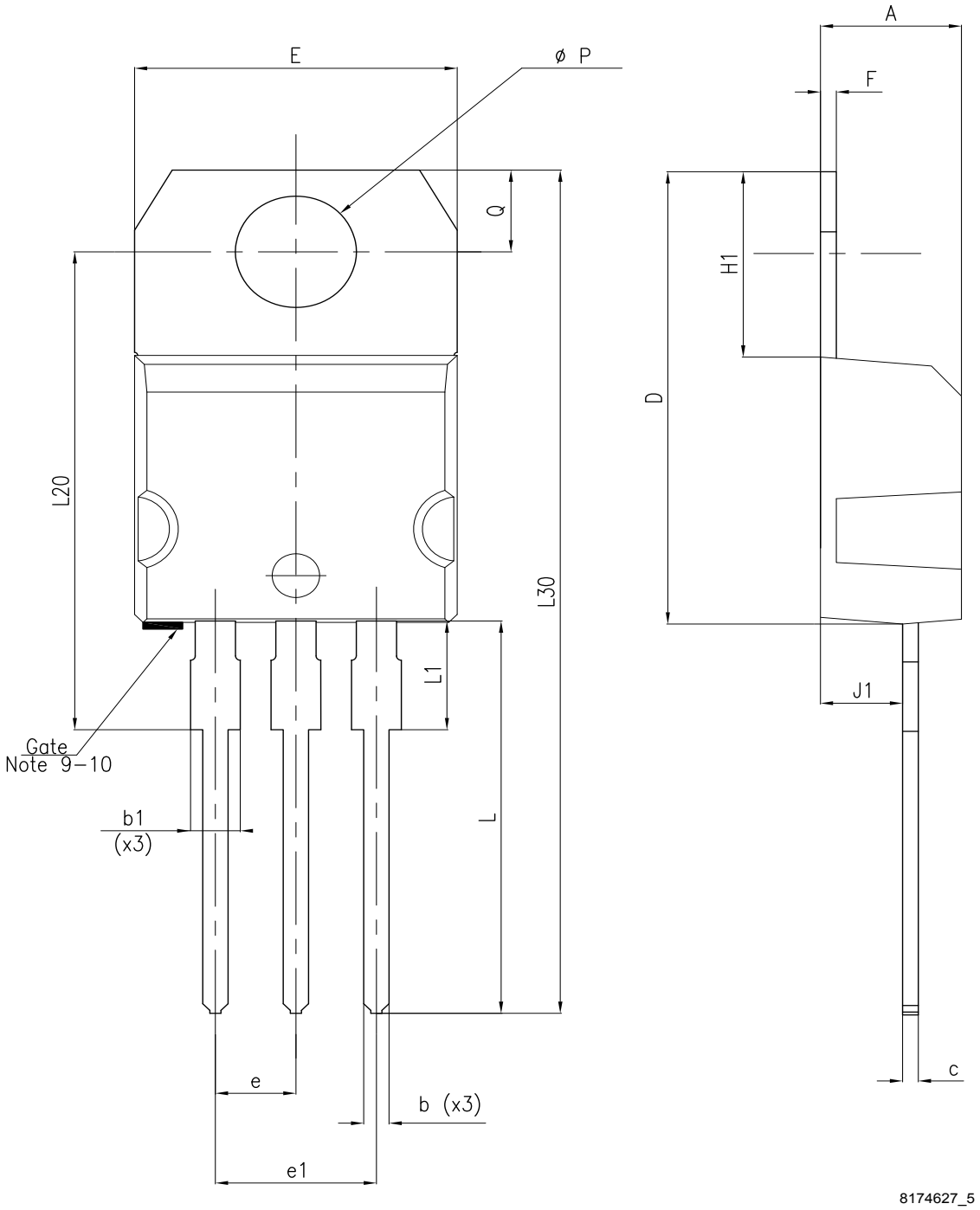
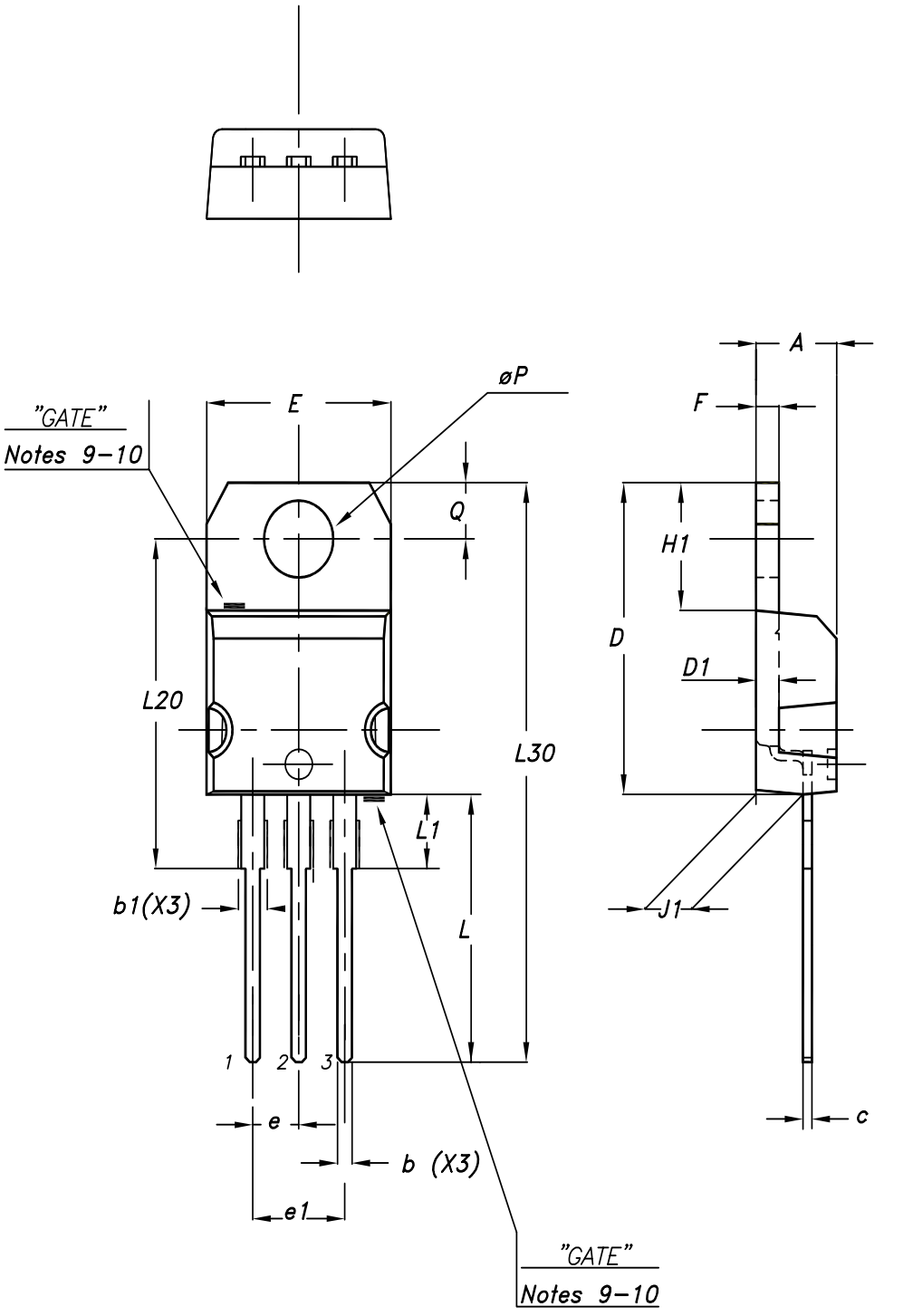


Table 18. **TO-220 (single gauge) mechanical data**

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	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

8.2 TO-220 (dual gauge) package information

Figure 30. **TO-220 (dual gauge) package outline**



0015988_21_Type A

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

8.3 TO-220FP type A package information

Figure 31. **TO-220FP package outline**

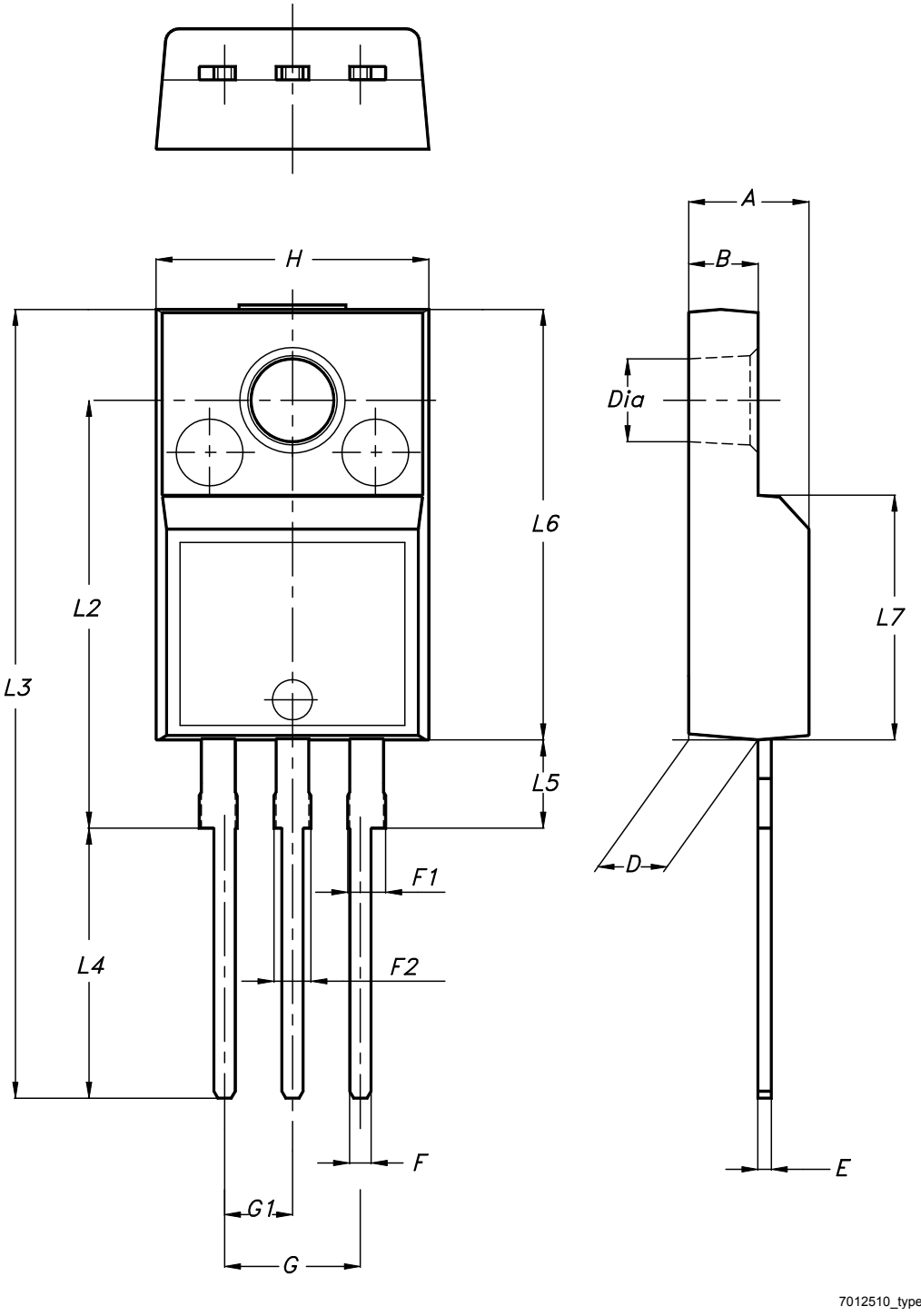


Table 20. **TO-220FP package mechanical data**

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

8.4 DPAK (TO-252) package information

Table 21. **DPAK (TO-252) mechanical data (type A)**

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	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.159	2.286	2.143
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	1.50
L2			3.00
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 32. **DPAK (TO-252) package outline A**

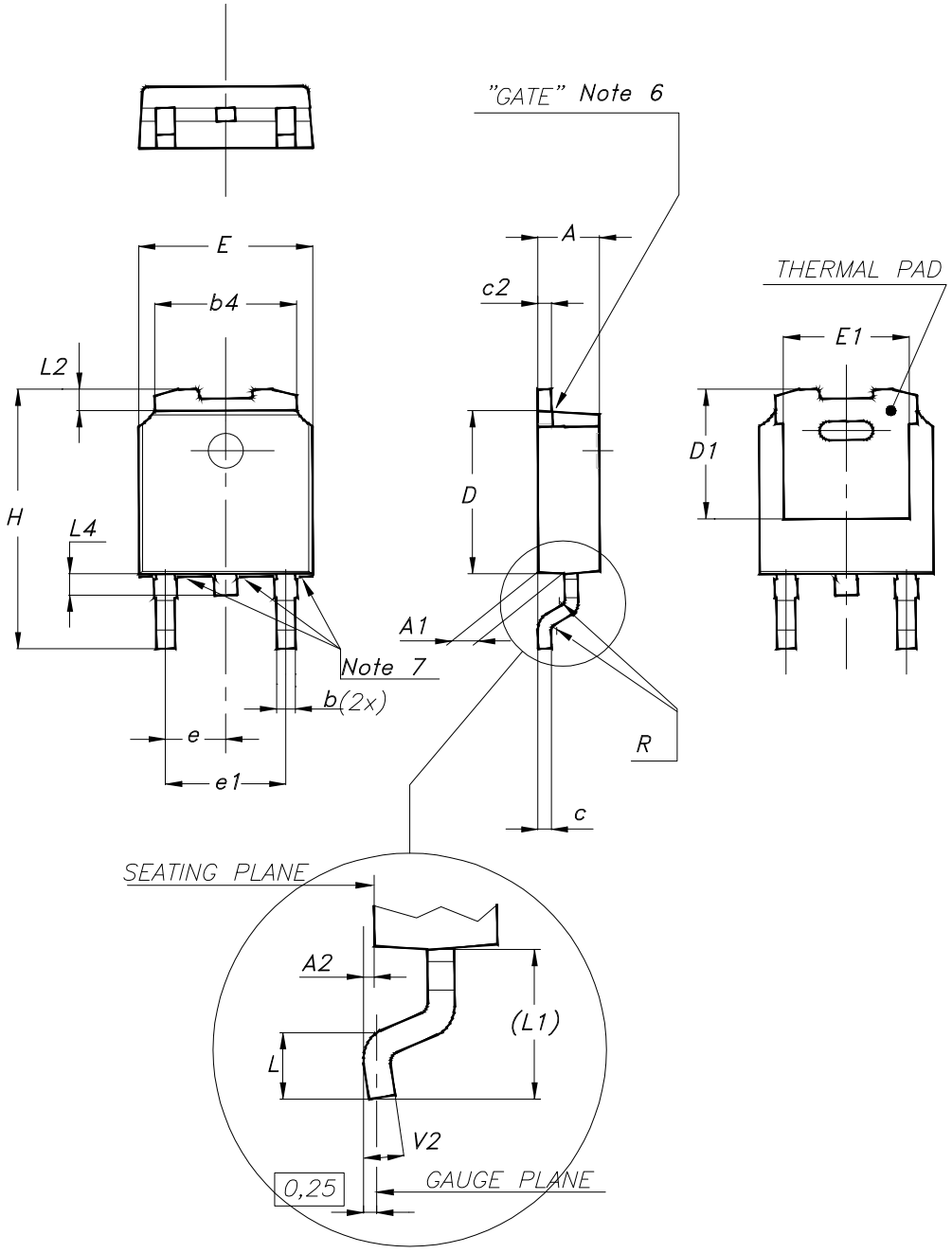


Table 22. **DPAK(TO-252) mechanical data (type E)**

Dim.	mm		
	Min.	Typ.	Max.
A	2.18		2.39
A2			0.13
b	0.65		0.884
b4	4.95		5.46
c	0.46		0.61
c2	0.46		0.60
D	5.97		6.22
D1	5.21		
E	6.35		6.73
E1	4.32		
e		2.286	
e1		4.572	
H	9.94		10.34
L	1.50		1.78
L1		2.74	
L2	0.89		1.27
L4			1.02

Figure 33. **DPAK (TO-252) package outline E**

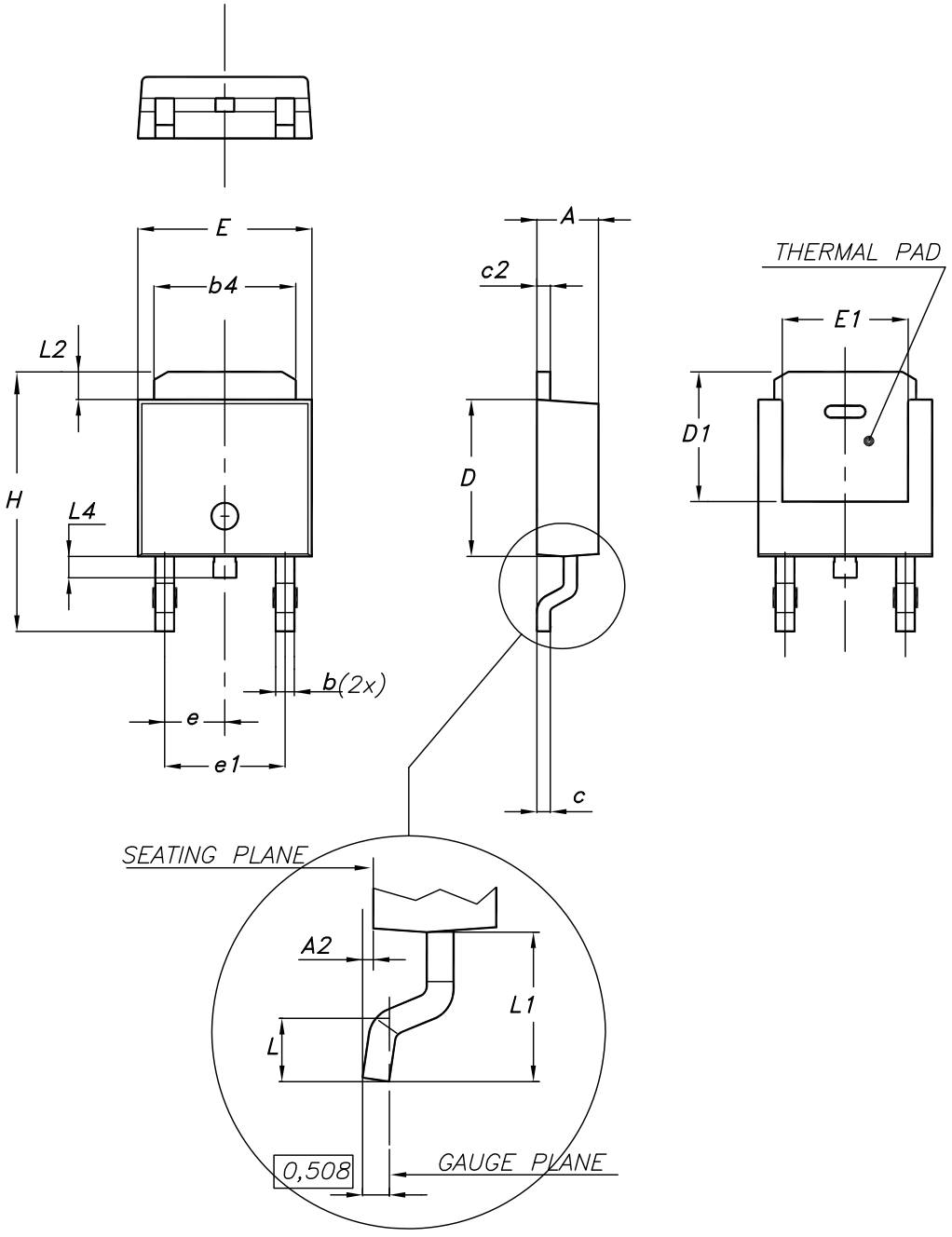


Table 23. **DPAK (TO-252) mechanical data type I**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00	-	0.10
b	0.77	-	0.89
b1	0.76	0.81	0.86
b2	0.77	-	1.10
b3	5.23	5.33	5.43
c	0.47	-	0.60
c1	0.46	0.51	0.56
c2	0.47	-	0.60
D	6.00	6.10	6.20
D1	5.25	5.40	5.60
E	6.50	6.60	6.70
E1	4.70	4.85	5.00
e		2.286 BSC	
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1		2.90 REF	
L2	0.90	-	1.25
L3		0.51 BSC	
L4	0.60	0.80	1.00
L5	0.90	-	1.50
L6		1.80 BSC	
Θ	0°	-	8°
Θ1	3°	5°	7°
Θ2	1°	3°	5°

Figure 34. **DPAK (TO-252) package outline I**

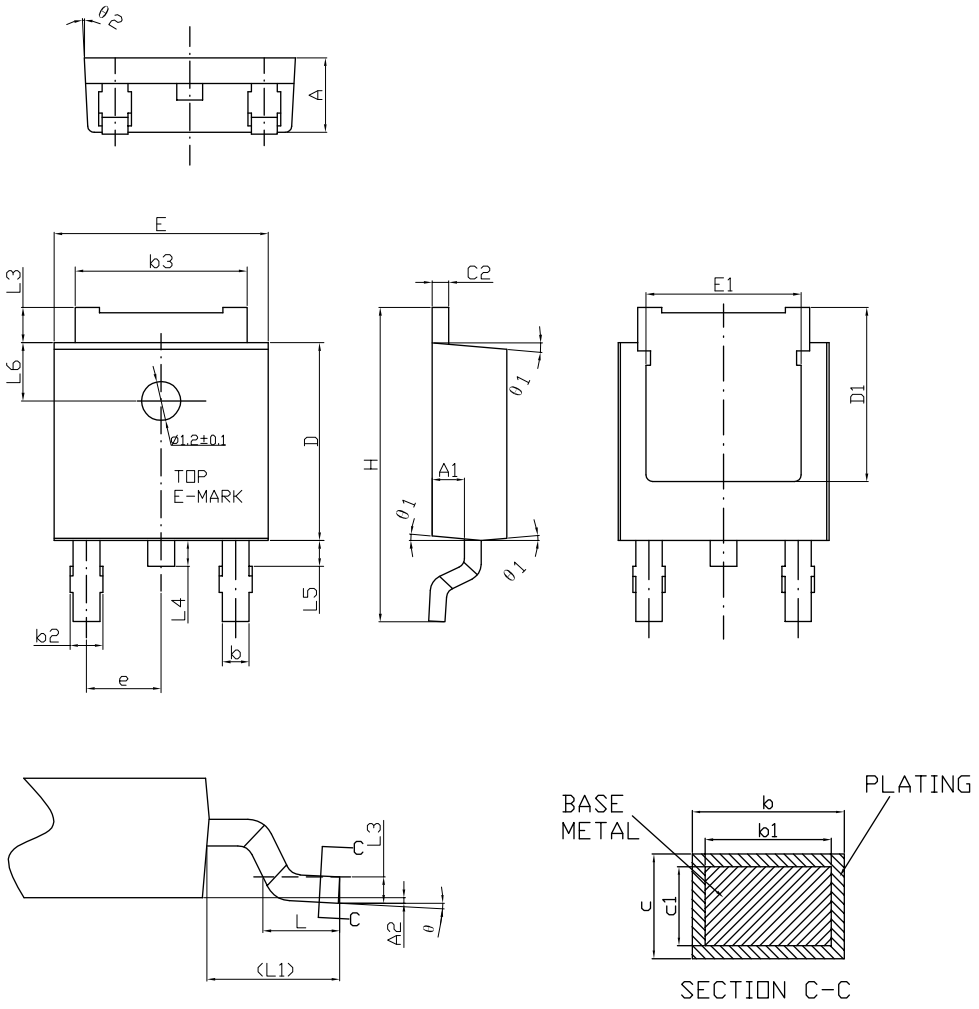
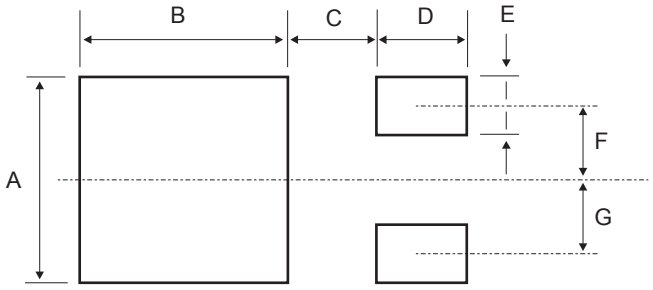


Table 24. **DPAK footprint data**

Values		
	mm.	inch.
A	6.70	0.264
B	6.70	0.64
C	1.80	0.070
D	3.00	0.118
E	1.60	0.063
F	2.30	0.091
G	2.30	0.091

Figure 35. **DPAK footprint recommended data**



8.5 DPAK packing information

Figure 36. **DPAK tape**

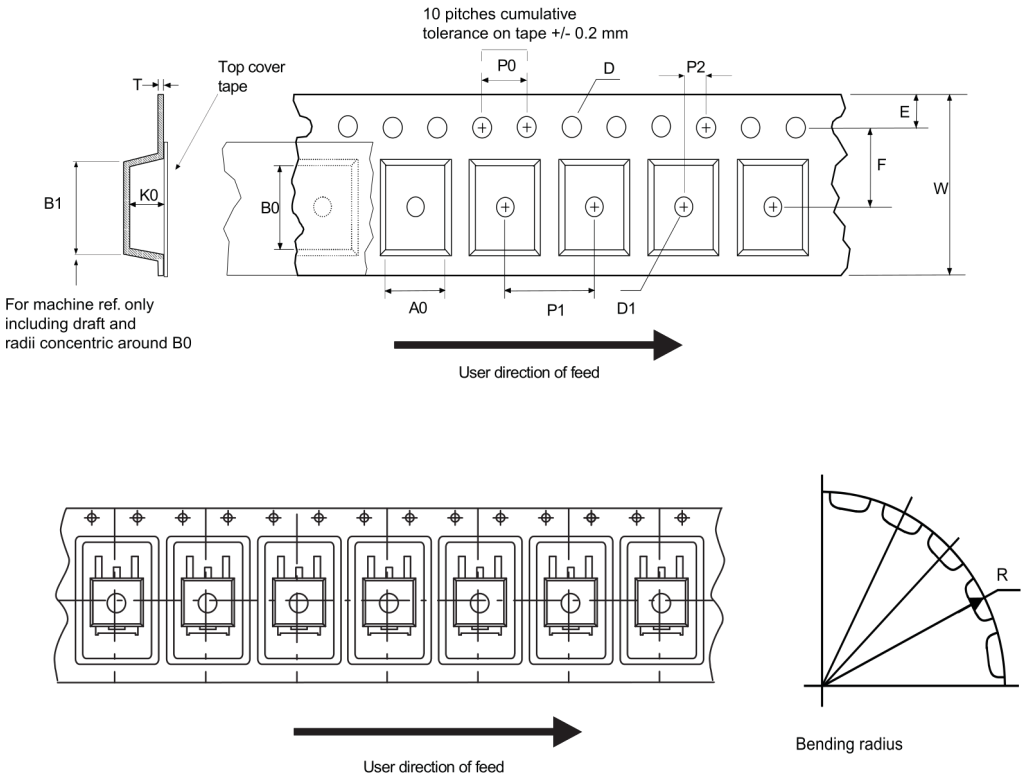


Figure 37. **DPAK reel**

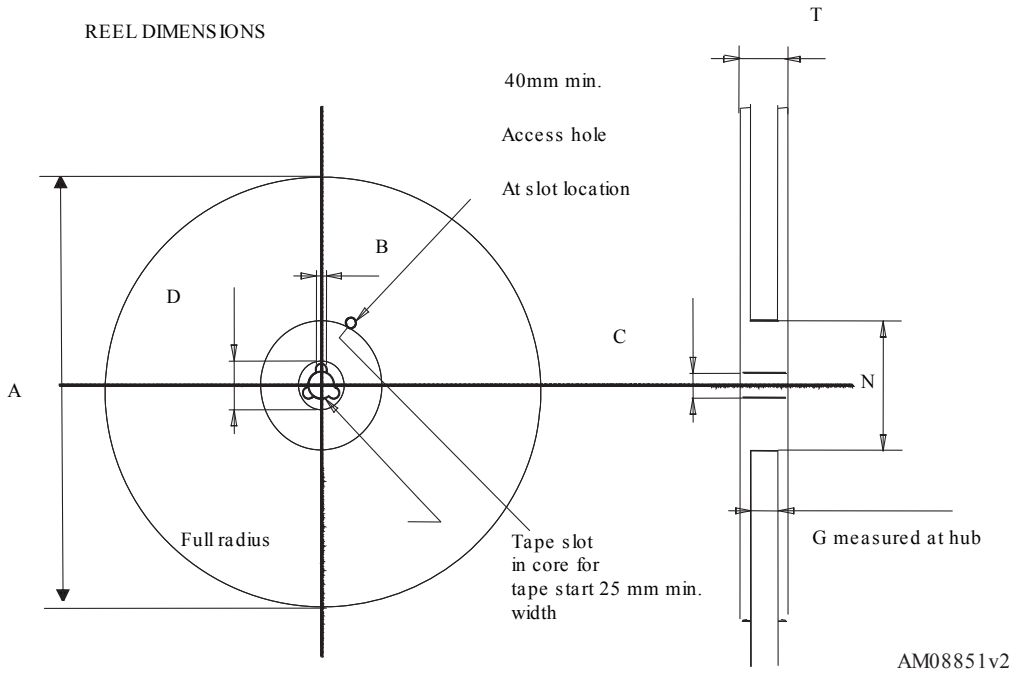


Table 25. **DPAK tape and reel mechanical data**

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			

8.6 IPAK package information

Figure 38. **IPAK package outline**

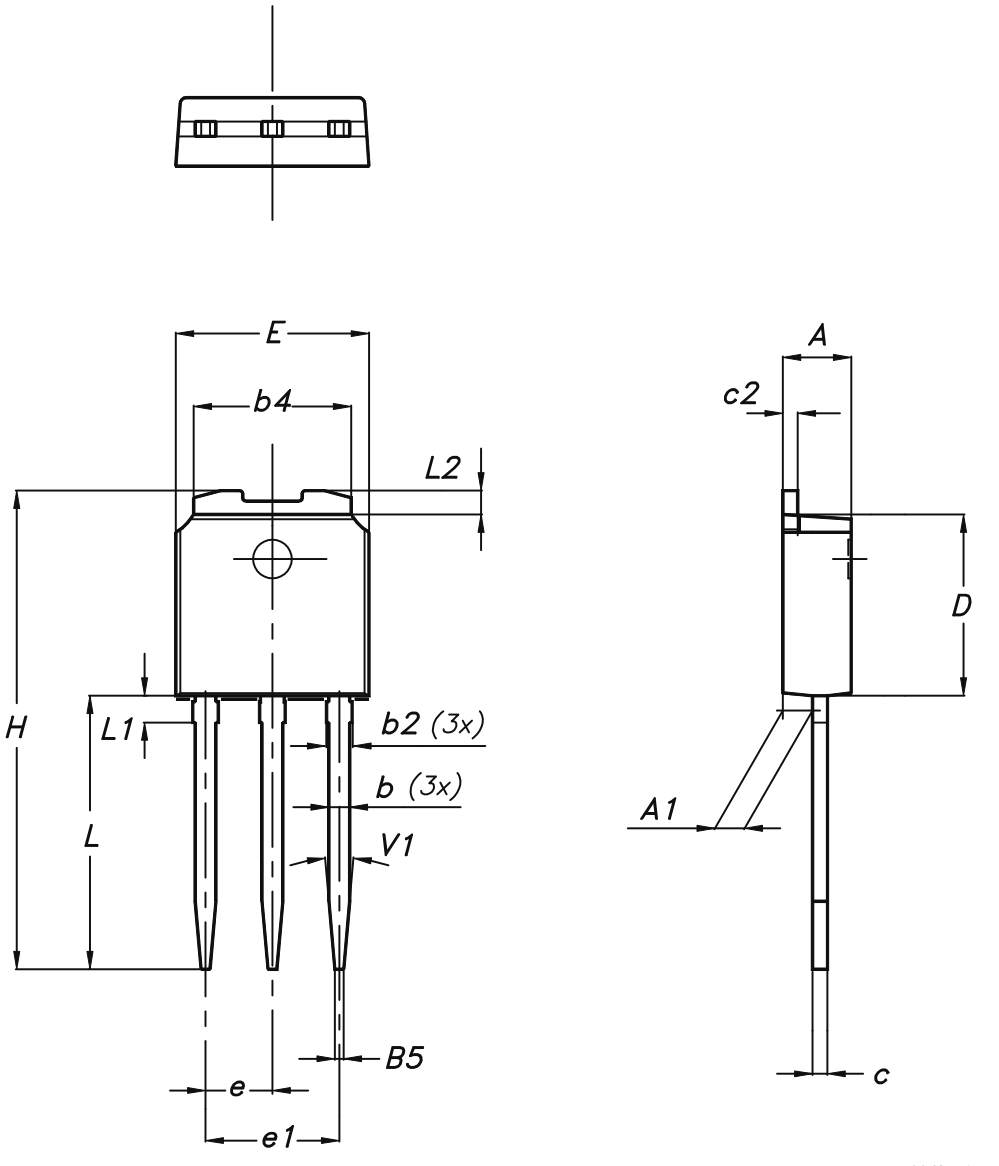


Table 26. **IPAK mechanical data**

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 Ordering information

Table 27. **Order code**

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

Revision history

Table 28. **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. Canceled 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.
21-Mar-2017	21	Updated Section 8: "Package information" (DPAK package information changed from type F to type I). Minor text changes.
12-Jun-2019	22	Updated Section 8.4 DPAK (TO-252) package information.
26-Nov-2019	23	Added Table 21. DPAK (TO-252) mechanical data (type A), Table 22. DPAK(TO-252) mechanical data (type E) and Table 23. DPAK (TO-252) mechanical data type I Updated Figure 34. DPAK (TO-252) package outline I.

Contents

1 Diagram 2
2 Pin configuration 3
3 Maximum ratings 5
4 Test circuits 6
5 Electrical characteristics 7
6 Typical performance 16
7 Applications information 18
7.1 Design considerations 18
8 Package information 23
8.1 TO-220 (single gauge) package information 23
8.2 TO-220 (dual gauge) package information 24
8.3 TO-220FP package information 26
8.4 DPAK (TO-252) package information 29
8.5 DPAK packing information 36
8.6 IPAK package information 37
9 Ordering information 40
Revision history 41
Contents 42
List of tables 43
List of figures 44

List of tables

Table 1. Absolute maximum ratings . . . 5
Table 2. Thermal data . . . 5
Table 3. Electrical characteristics of L78M05C . . . 7
Table 4. Electrical characteristics of L78M05A . . . 8
Table 5. Electrical characteristics of L78M06C . . . 8
Table 6. Electrical characteristics of L78M06A . . . 9
Table 7. Electrical characteristics of L78M08C . . . 9
Table 8. Electrical characteristics of L78M08A . . . 10
Table 9. Electrical characteristics of L78M09C . . . 10
Table 10. Electrical characteristics of L78M09A . . . 11
Table 11. Electrical characteristics of L78M10A . . . 11
Table 12. Electrical characteristics of L78M12C . . . 12
Table 13. Electrical characteristics of L78M12A . . . 12
Table 14. Electrical characteristics of L78M15C . . . 13
Table 15. Electrical characteristics of L78M15A . . . 13
Table 16. Electrical characteristics of L78M24C . . . 14
Table 17. Electrical characteristics of L78M24A . . . 14
Table 18. TO-220 (single gauge) mechanical data . . . 24
Table 19. TO-220 (dual gauge) mechanical data . . . 26
Table 20. TO-220FP package mechanical data . . . 28
Table 21. DPAK (TO-252) mechanical data (type A) . . . 29
Table 22. DPAK(TO-252) mechanical data (type E) . . . 31
Table 23. DPAK (TO-252) mechanical data type I . . . 33
Table 24. DPAK footprint data . . . 34
Table 25. DPAK tape and reel mechanical data . . . 37
Table 26. IPAK mechanical data . . . 39
Table 27. Order code . . . 40
Table 28. Document revision history . . . 41

List of figures

Figure 1. Block diagram . . . 2
Figure 2. Pin connections (top view) . . . 3
Figure 3. Schematic diagram . . . 4
Figure 4. Application circuit . . . 5
Figure 5. DC parameter . . . 6
Figure 6. Load regulation . . . 6
Figure 7. Ripple rejection . . . 6
Figure 8. Dropout voltage vs junction temp . . . 16
Figure 9. Dropout characteristics . . . 16
Figure 10. Peak output current vs input-output differential voltage . . . 16
Figure 11. Output voltage vs junction temperature . . . 16
Figure 12. Supply voltage rejection vs frequency . . . 17
Figure 13. Quiescent current vs junction temperature . . . 17
Figure 14. Load transient response . . . 17
Figure 15. Line transient response . . . 17
Figure 16. Quiescent current vs input voltage . . . 17
Figure 17. Fixed output regulator . . . 18
Figure 18. Constant current regulator . . . 18
Figure 19. Circuit for increasing output voltage . . . 19
Figure 20. Adjustable output regulator (7 to 30 V) . . . 19
Figure 21. 0.5 to 10 V regulator . . . 19
Figure 22. High current voltage regulator . . . 20
Figure 23. High output current with short circuit protection . . . 20
Figure 24. Tracking voltage regulator . . . 20
Figure 25. High input voltage circuit . . . 21
Figure 26. Reducing power dissipation with dropping resistor . . . 21
Figure 27. Power AM modulator (unity voltage gain, $I_O \leq 0.5$) . . . 21
Figure 28. Adjustable output voltage with temperature compensation . . . 22
Figure 29. TO-220 (single gauge) package outline . . . 23
Figure 30. TO-220 (dual gauge) package outline . . . 25
Figure 31. TO-220FP package outline . . . 27
Figure 32. DPAK (TO-252) package outline A . . . 30
Figure 33. DPAK (TO-252) package outline E . . . 32
Figure 34. DPAK (TO-252) package outline I . . . 34
Figure 35. DPAK footprint recommended data . . . 35
Figure 36. DPAK tape . . . 36
Figure 37. DPAK reel . . . 37
Figure 38. IPAK package outline . . . 38

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2019 STMicroelectronics – All rights reserved