

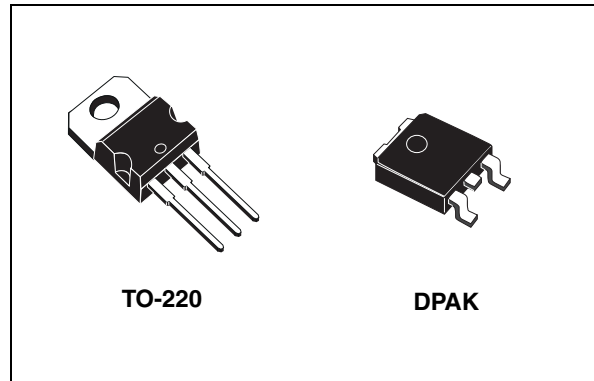
## Precision 500 mA regulators

### 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
- $\pm 2\%$  Output voltage tolerance
- Guaranteed in extended temperature range

### Description

The L78MxxA series of three-terminal positive regulators is available in TO-220 and DPAK 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, making 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.

**Table 1. Device summary**

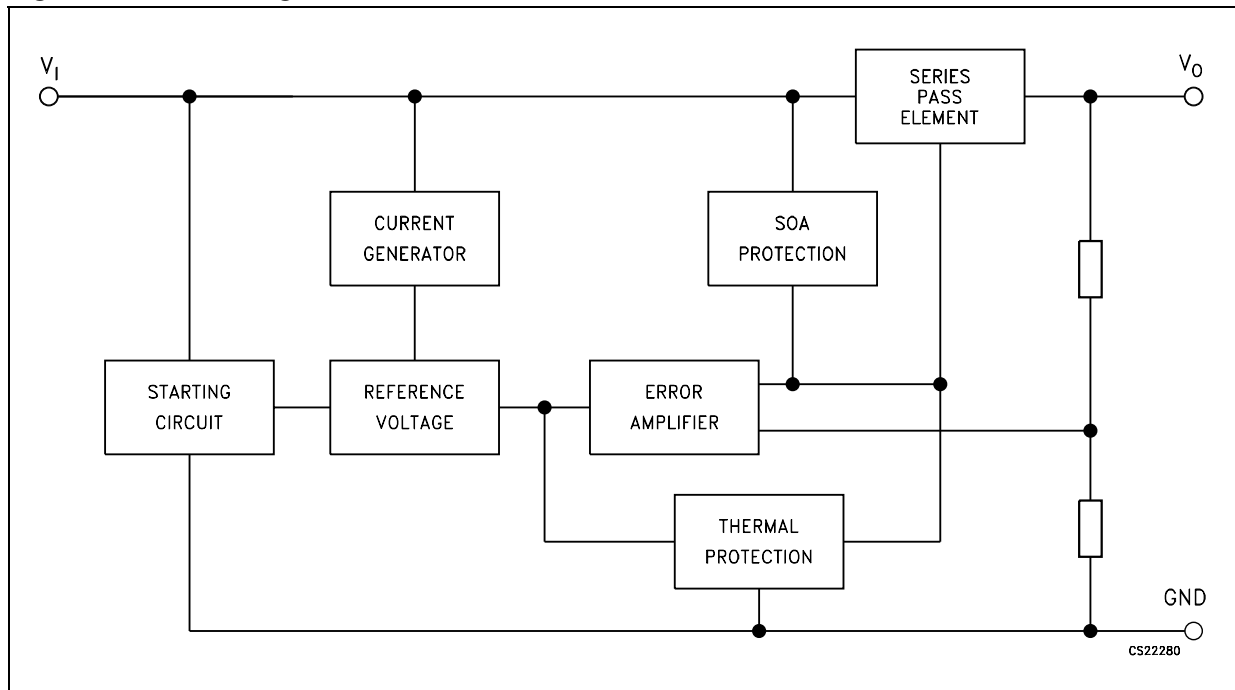
Part numbers	
L78M05AB	L78M12AB
L78M05AC	L78M12AC
L78M06AB	L78M15AB
L78M08AB	L78M24AB
L78M09AB	L78M24AC
L78M10AB	

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# 1 Diagram

Figure 1. Block diagram



## 2 Pin configuration

Figure 2. Pin connections (top view)

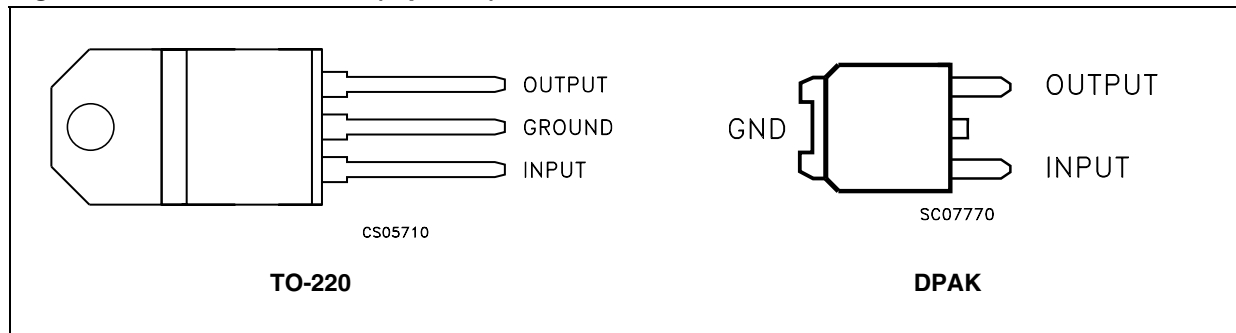
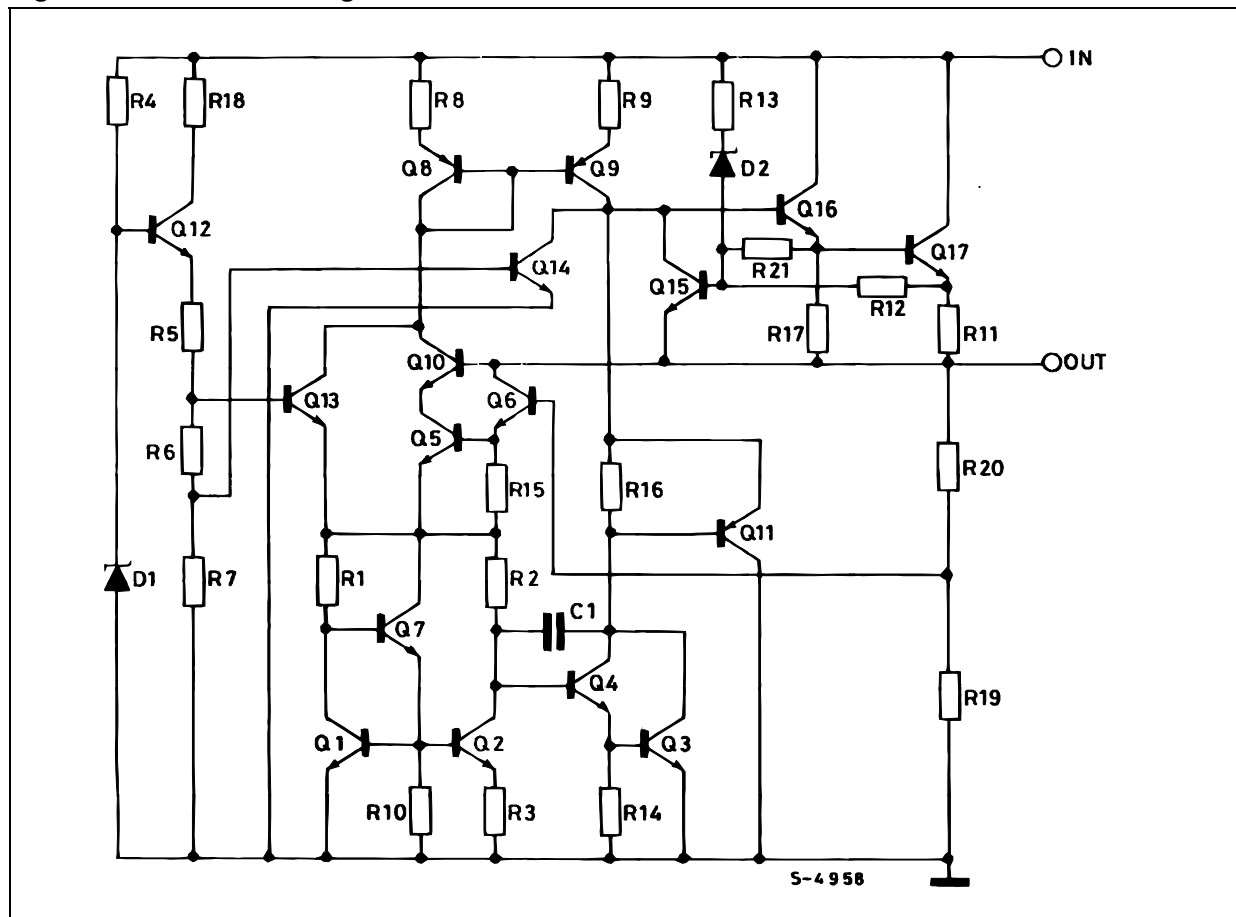


Figure 3. Schematic diagram



### 3 Maximum ratings

**Table 2. Absolute maximum ratings**

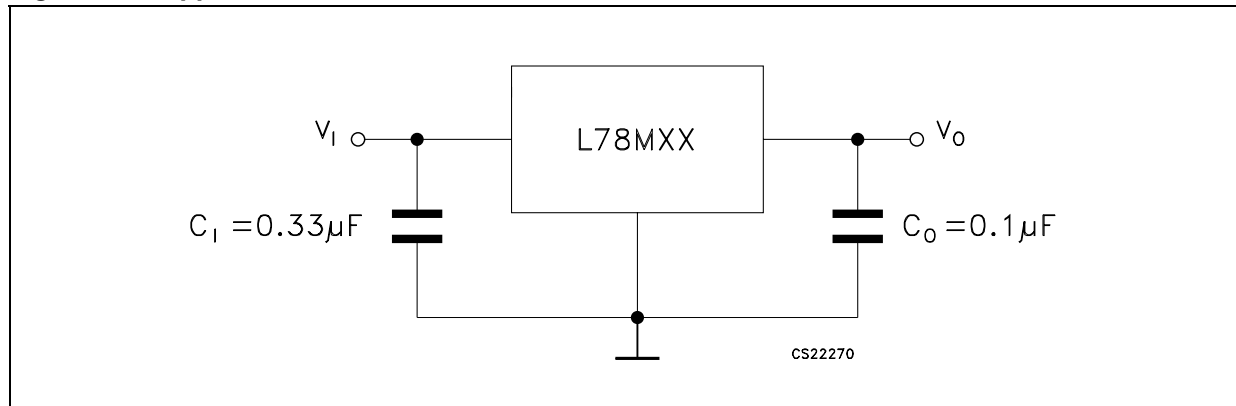
Symbol	Parameter		Value	Unit
$V_I$	DC input voltage	for $V_O = 5$ to $18$ V	35	V
		for $V_O = 20, 24$ V	40	
$I_O$	Output current		Internally limited	mA
$P_D$	Power dissipation		Internally limited	mW
$T_{STG}$	Storage temperature range		-65 to 150	°C
$T_{OP}$	Operating junction temperature range	for L78M00AC	0 to 125	°C
		for L78M00AB	-40 to 125	

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

**Table 3. Thermal data**

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

**Figure 4. Application circuit**



## 4 Test circuits

Figure 5. DC parameter

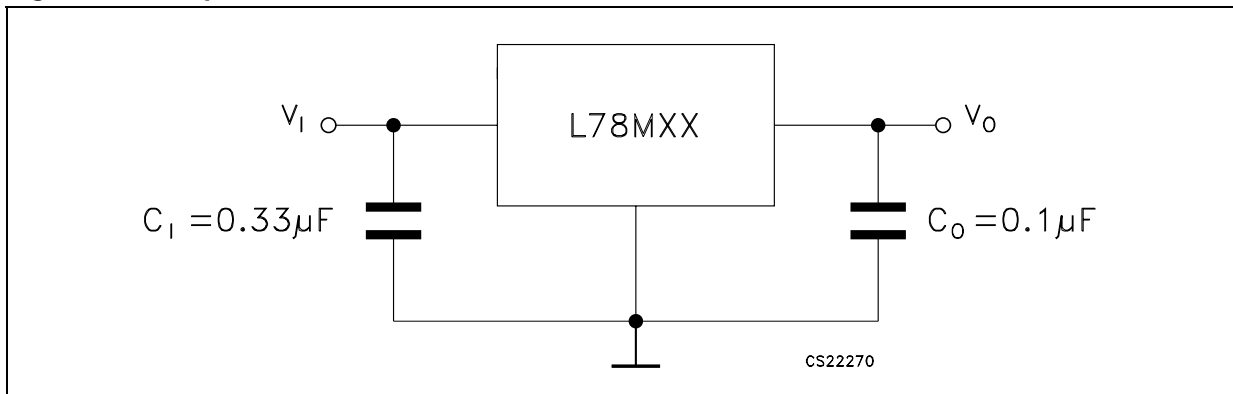


Figure 6. Load regulation

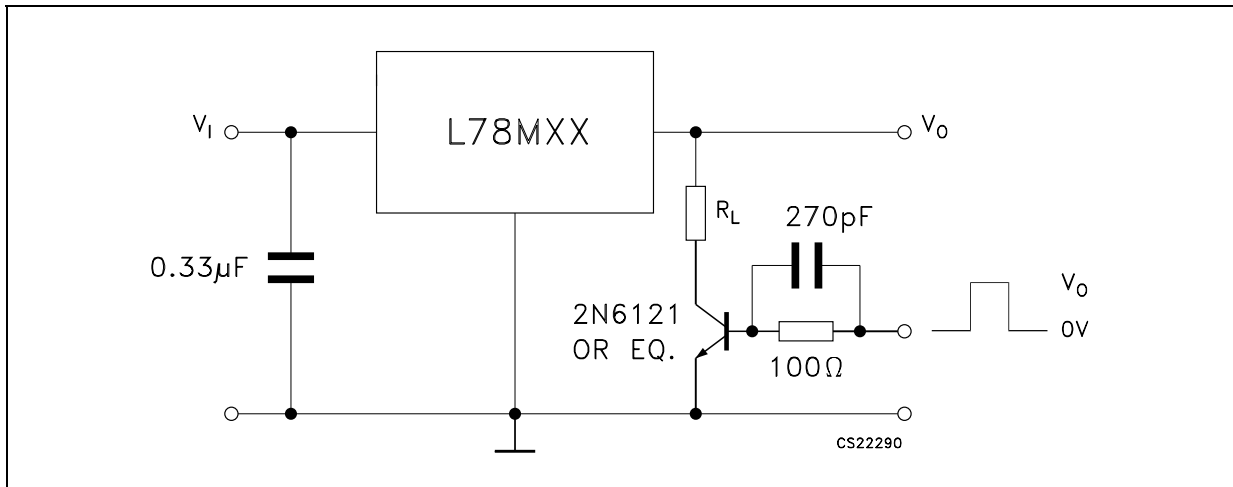
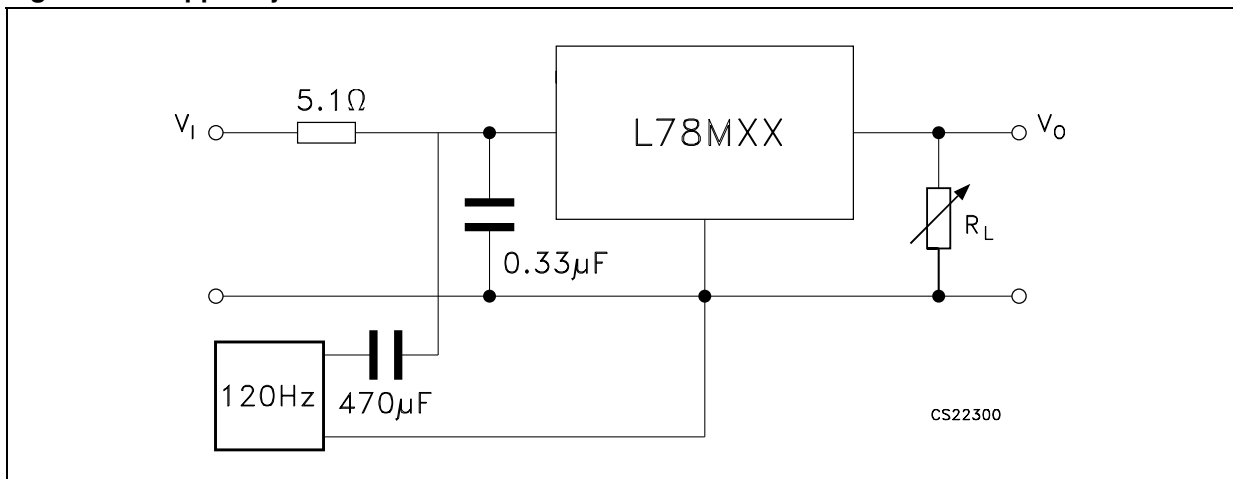


Figure 7. Ripple rejection



## 5 Electrical characteristics

Refer to the test circuits,  $V_I = 10\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 4. Electrical characteristics of L78M05XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	4.9	5	5.1	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 7\text{ to }20\text{ V}$	4.8	5	5.2	V
$\Delta V_O$	Line regulation	$V_I = 7\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 8\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			50	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			50	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 8\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 8\text{ to }18\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	62			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		40		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$T_J = 25^\circ\text{C}$ , $V_I = 35\text{ V}$		300		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Refer to the test circuits,  $V_I = 11\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  
 $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 5. Electrical characteristics of L78M06XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	5.88	6	6.12	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 8\text{ to }21\text{ V}$	5.75	6	6.3	V
$\Delta V_O$	Line regulation	$V_I = 8\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 9\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			120	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			60	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 9\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 9\text{ to }19\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	59			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$		45		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$T_J = 25^\circ\text{C}$ , $V_I = 35\text{ V}$		270		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA



Refer to the test circuits,  $V_I = 14\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified).

**Table 6. Electrical characteristics of L78M08XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	7.84	8	8.16	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 10.5\text{ to }23\text{ V}$	7.7	8	8.3	V
$\Delta V_O$	Line regulation	$V_I = 10.5\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 11\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			80	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 10.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 11.5\text{ to }21.5\text{ V}$ , $f = 120\text{ Hz}$ $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		52		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$T_J = 25^\circ\text{C}$ , $V_I = 35\text{ V}$		250		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Refer to the test circuits,  $V_I = 15\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  
 $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified).

**Table 7. Electrical characteristics of L78M09XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	8.82	9	9.18	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 11.5\text{ to }24\text{ V}$	8.64	9	9.36	V
$\Delta V_O$	Line regulation	$V_I = 11.5\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 12\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			90	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 11.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 12.5\text{ to }23\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		52		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$ , $T_J = 25^\circ\text{C}$		250		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Refer to the test circuits,  $V_I = 16\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  
 $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 8. Electrical characteristics of L78M10XX**

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

Refer to the test circuits,  $V_I = 19\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  
 $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 9. Electrical characteristics of L78M12XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	11.75	12	12.25	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 14.5\text{ to }27\text{ V}$	11.5	12	12.5	V
$\Delta V_O$	Line regulation	$V_I = 14.5\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 16\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			120	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 14.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1		mV/°C
SVR	Supply voltage rejection	$V_I = 15\text{ to }25\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	55			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		75		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$ , $T_J = 25^\circ\text{C}$		240		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Refer to the test circuits,  $V_I = 23\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  
 $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 10. Electrical characteristics of L78M15XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	14.7	15	15.3	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 17.5\text{ to }30\text{ V}$	14.4	15	15.6	V
$\Delta V_O$	Line regulation	$V_I = 17.5\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 20\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			300	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			150	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 17.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 18.5\text{ to }28.5\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	54			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		90		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$ , $T_J = 25^\circ\text{C}$		240		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Refer to the test circuits,  $V_I = 33\text{ V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $T_J = -40\text{ to }125\text{ }^\circ\text{C}$  (AB),  $T_J = 0\text{ to }125\text{ }^\circ\text{C}$  (AC) unless otherwise specified.

**Table 11. Electrical characteristics of L78M24XX**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$T_J = 25^\circ\text{C}$	23.5	24	24.5	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 27\text{ to }38\text{ V}$	23	24	25	V
$\Delta V_O$	Line regulation	$V_I = 27\text{ to }38\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 28\text{ to }38\text{ V}$ , $I_O = 200\text{ mA}$ , $T_J = 25^\circ\text{C}$			30	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			480	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			240	
$I_d$	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 27\text{ to }38\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1.2		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 28\text{ to }38\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$ , $T_J = 25^\circ\text{C}$	50			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$ , $T_J = 25^\circ\text{C}$		170		$\mu\text{V}$
$V_d$	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$ , $T_J = 25^\circ\text{C}$		240		mA
$I_{scp}$	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

# 6 Typical performance

Figure 8. Dropout voltage vs. junction temp.

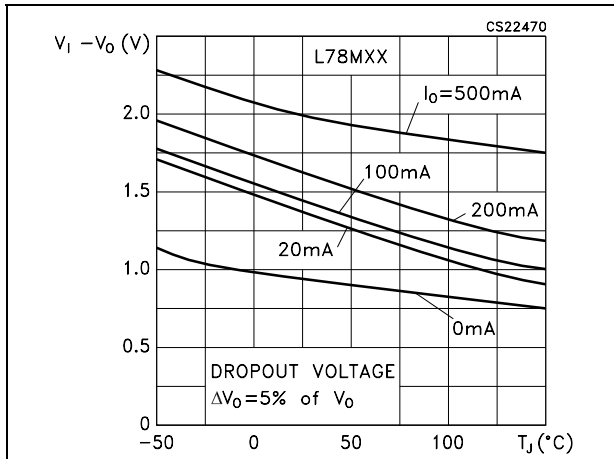


Figure 9. Dropout characteristics

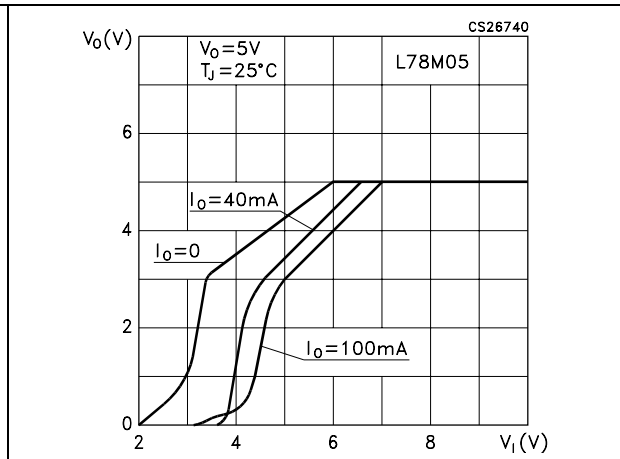


Figure 10. Peak output current vs. input-output differential voltage

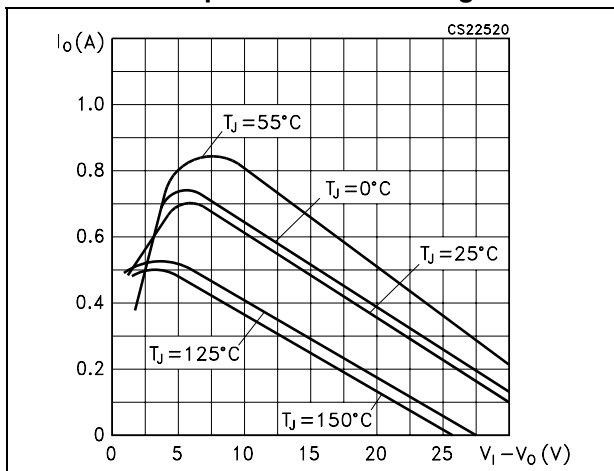


Figure 11. Output voltage vs. junction temperature

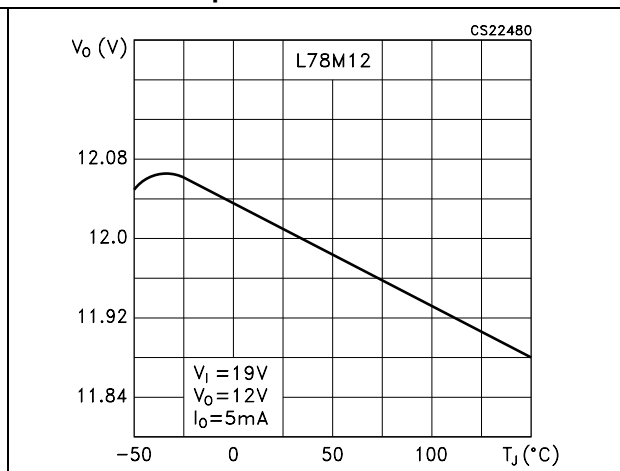


Figure 12. Supply voltage rejection vs. freq.

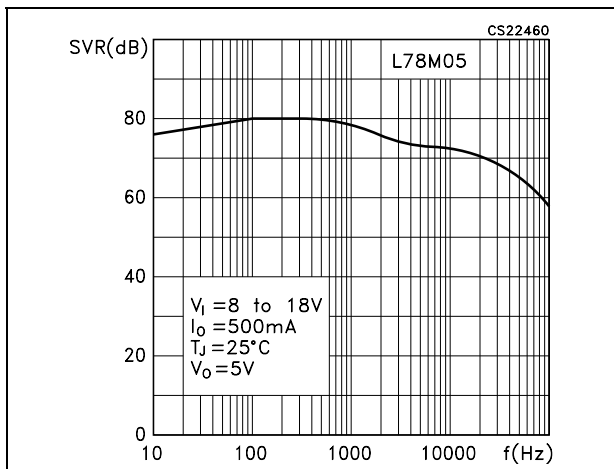


Figure 13. Quiescent current vs. junction temp.

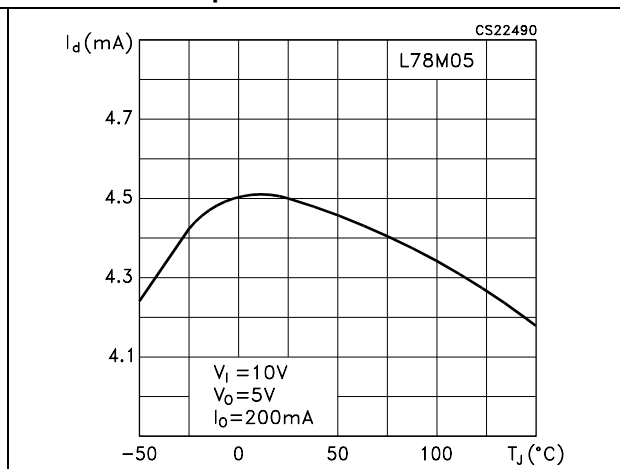


Figure 14. Load transient response

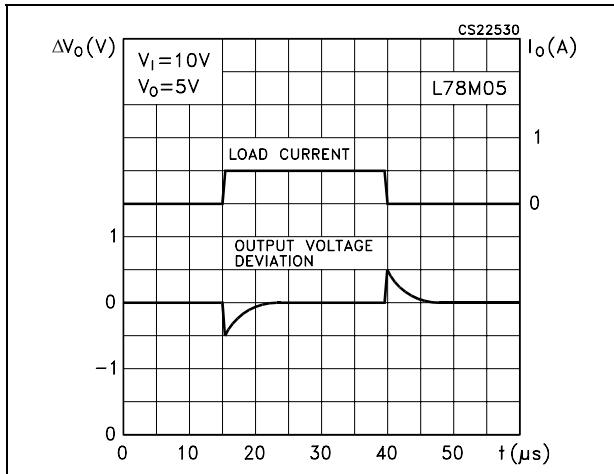


Figure 15. Line transient response

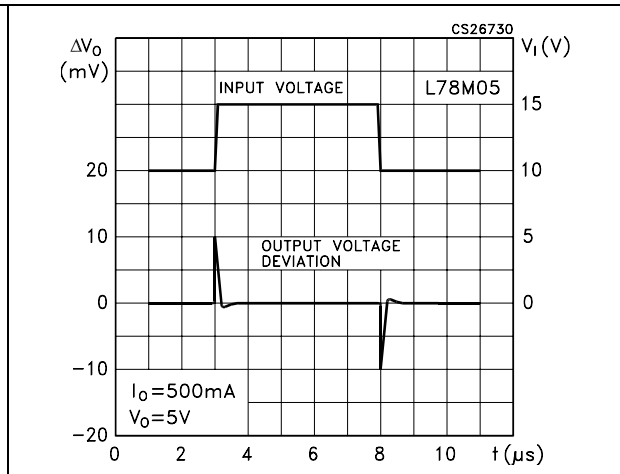
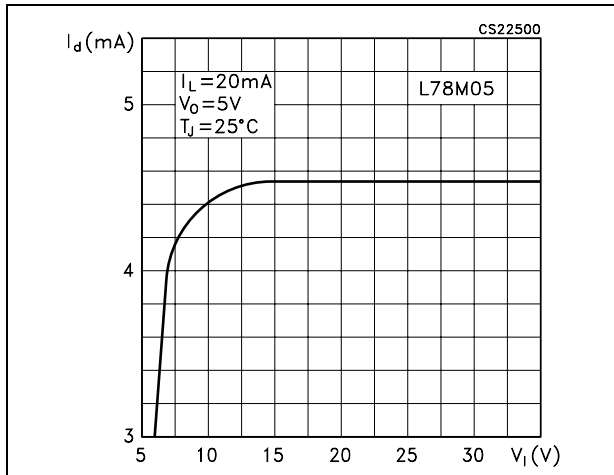


Figure 16. Quiescent current vs. input voltage





## 7 Applications information

### 7.1 Design considerations

The L78MxxA 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  $\mu\text{F}$  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. Current regulator

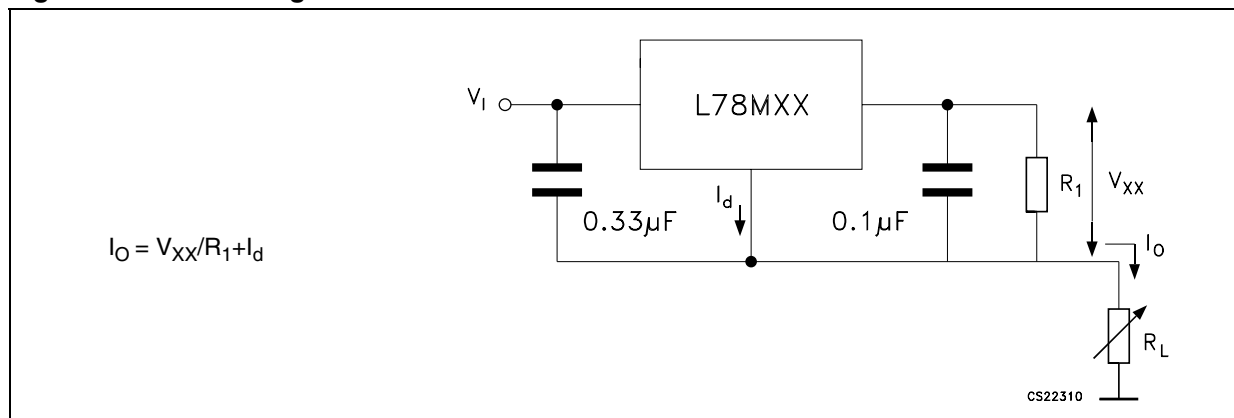


Figure 18. Adjustable output regulator

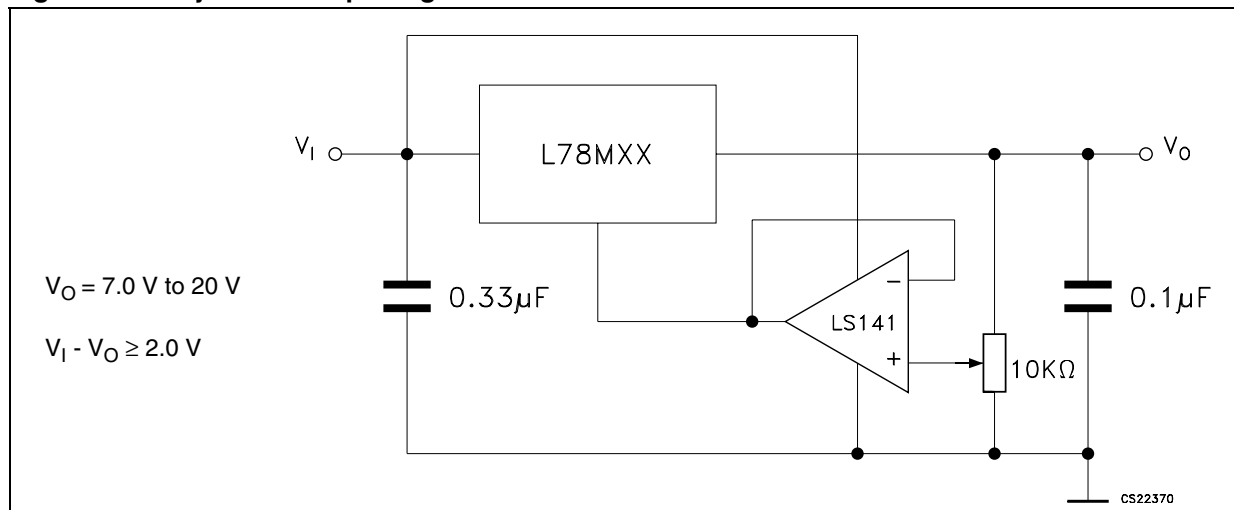


Figure 19. Current boost regulator

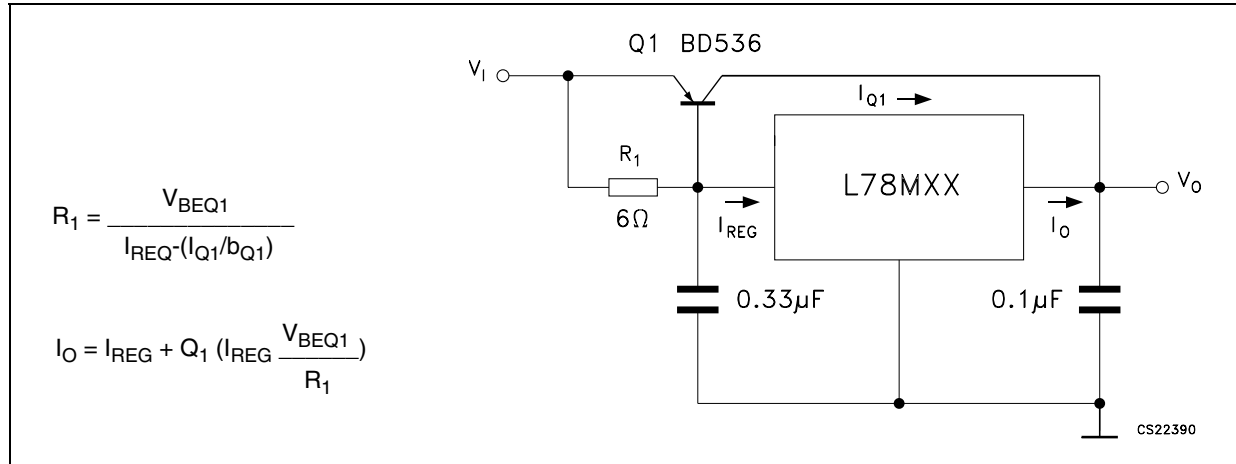
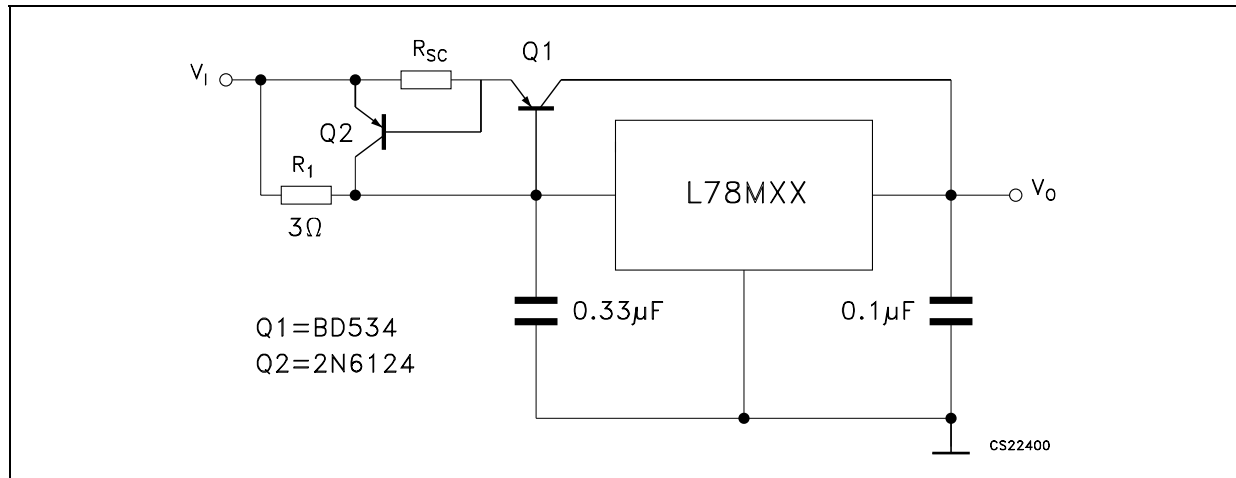


Figure 20. Short-circuit protection



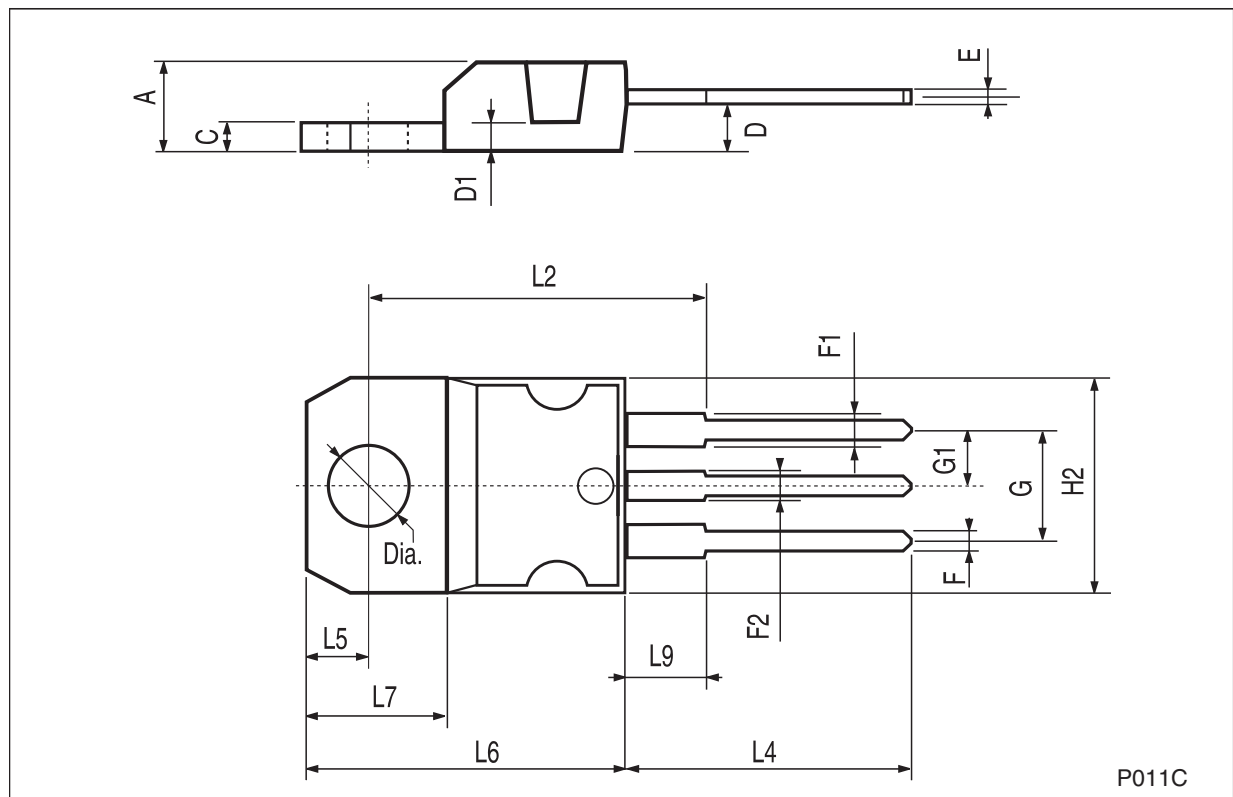
Note: The circuit of [Figure 19](#) can be modified to provide supply protection against short-circuits by adding a short-circuit sense resistor,  $R_{sc}$ , and an additional PNP transistor. The current sensing PNP must be able to handle the short-circuit current of the three-terminal regulator. Therefore, a four ampere plastic power transistor is specified.

## 8 Package mechanical data

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

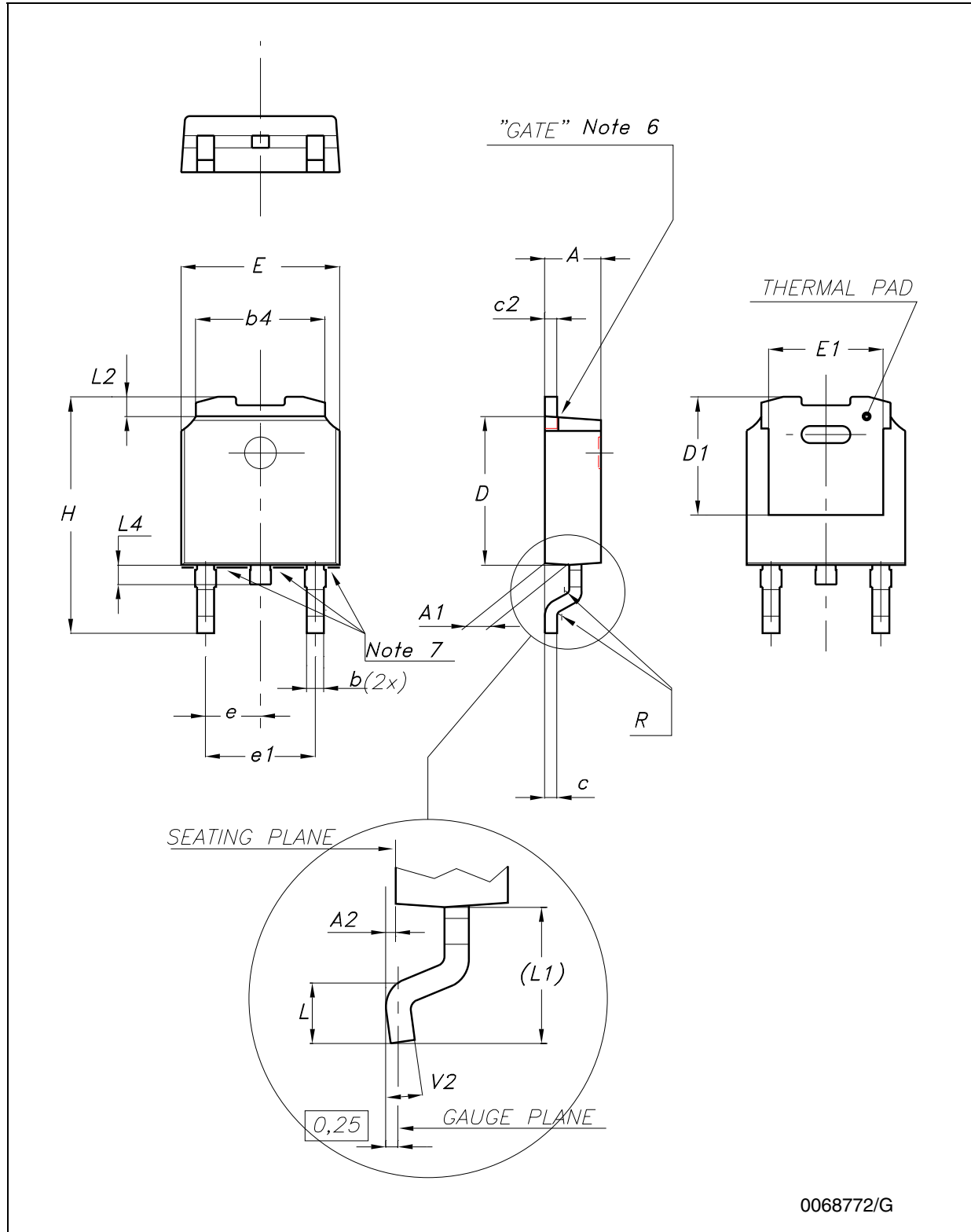
**TO-220 mechanical data**

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



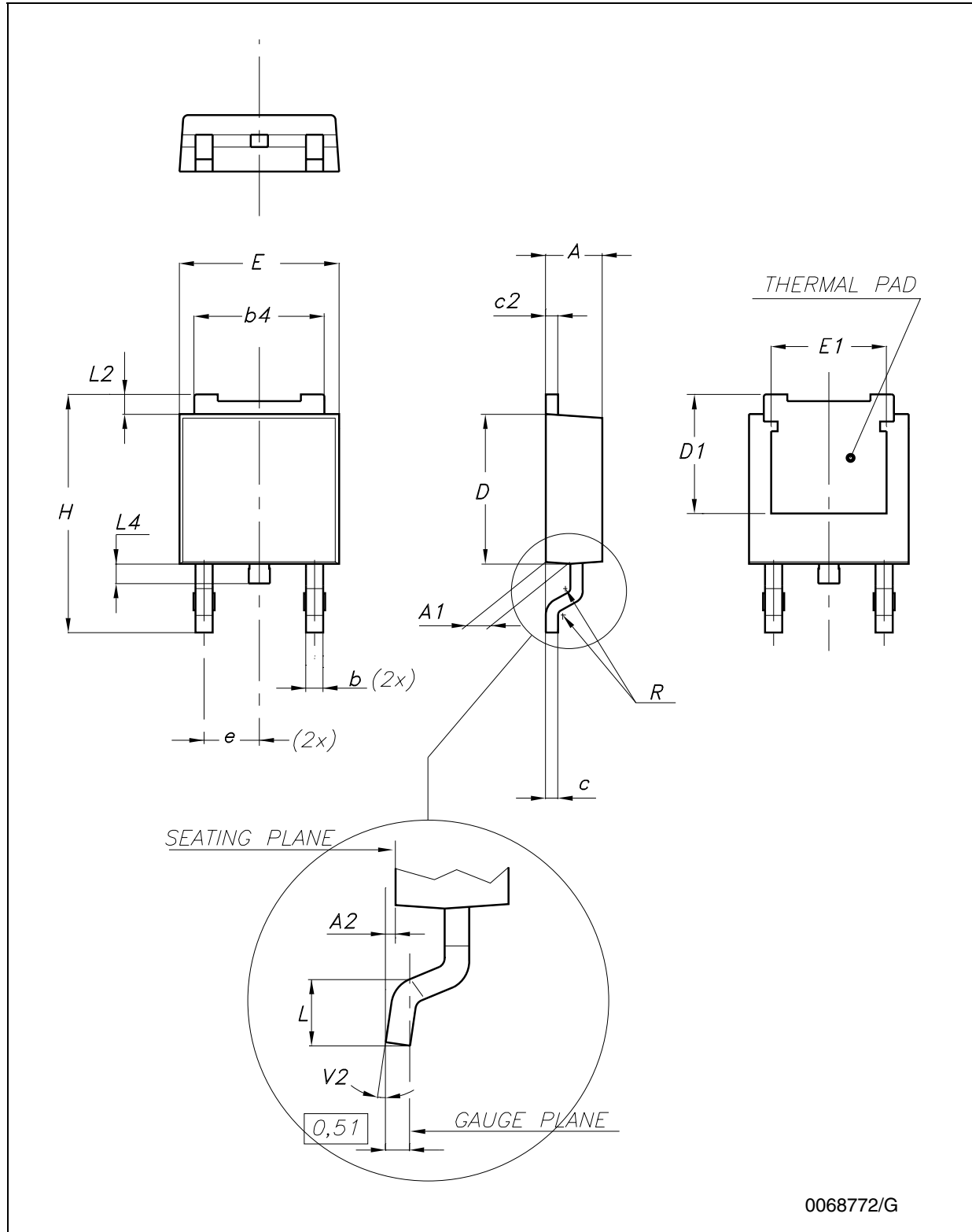
P011C

Figure 21. Drawing dimension DPAK type STD-ST



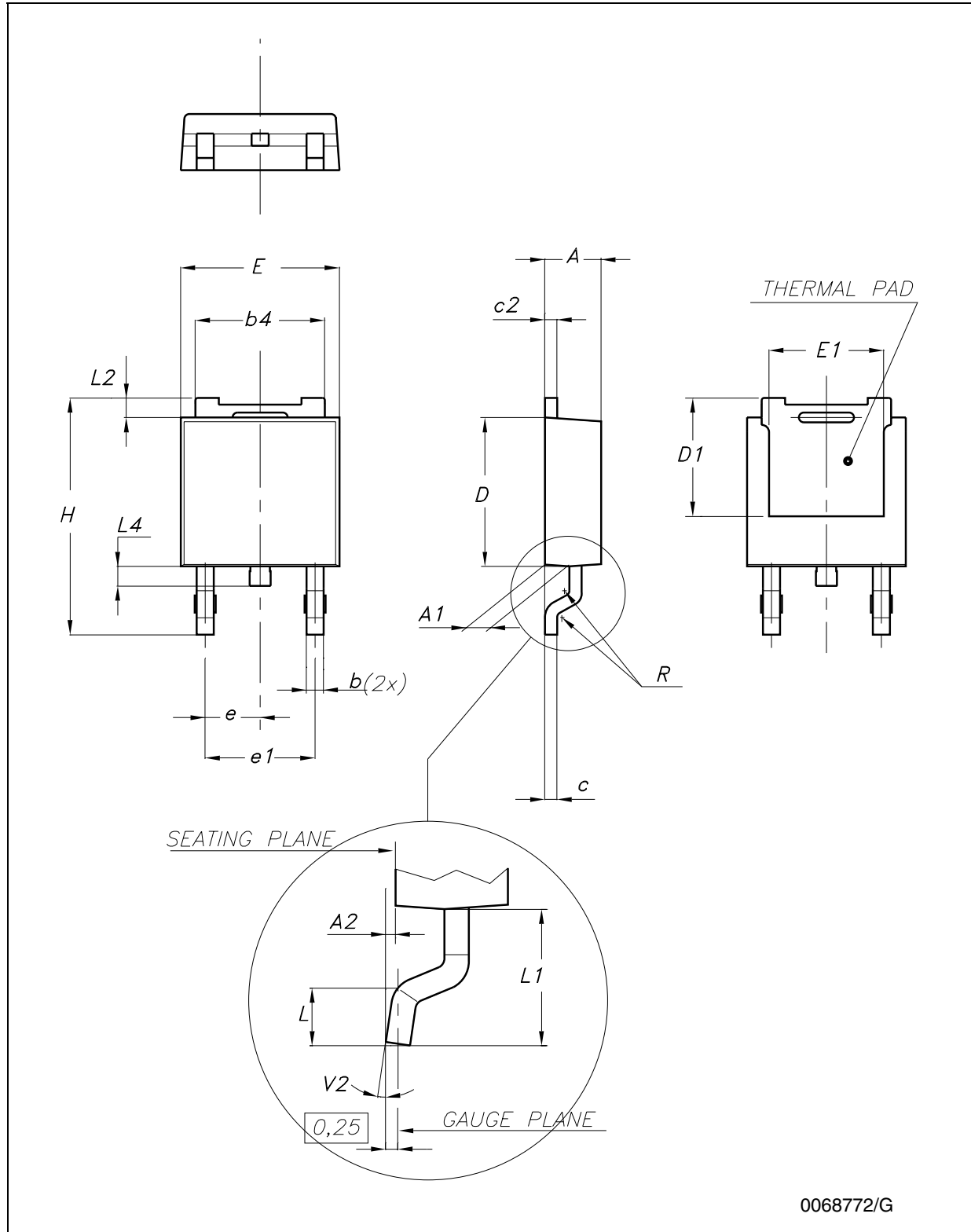
0068772/G

Figure 22. Drawing dimension DPAK type FUJITSU-subcon.



0068772/G

Figure 23. Drawing dimension DPAK type IDS-subcon.



0068772/G

**Table 12. DPAK mechanical data**

Dim.	Type STD-ST			Type Fujitsu-subcon.			Type IDS-subcon.		
	mm.			mm.			mm.		
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	2.25	2.30	2.35	2.19		2.38
A1	0.90		1.10	0.96		1.06	0.89		1.14
A2	0.03		0.23	0		0.10	0.03		0.23
b	0.64		0.90	0.76		0.86	0.64		0.88
b4	5.20		5.40	5.28		5.38	5.21		5.46
c	0.45		0.60	0.46		0.56	0.46		0.58
c2	0.48		0.60	0.46		0.56	0.46		0.58
D	6.00		6.20	6.05		6.15	5.97		6.22
D1		5.10		5.27		5.47		5.20	
E	6.40		6.60	6.55	6.60	6.65	6.35		6.73
E1		4.70			4.77			4.70	
e		2.28		2.23	2.28	2.33		2.28	
e1	4.40		4.60				4.51		4.61
H	9.35		10.10	9.90		10.30	9.40		10.42
L	1.00			1.40		1.60	0.90		
L1		2.80					2.50		2.65
L2		0.80		1.03		1.13	0.89		1.27
L4	0.60		1.00	0.70		0.90	0.64		1.02
R		0.20			0.40			0.20	
V2	0°		8°	0°		8°	0°		8°

*Note: The DPAK package coming from the two subcontractors (Fujitsu and IDS) are fully compatible with the ST's package suggested footprint.*



Figure 24. DPAK footprint recommended data

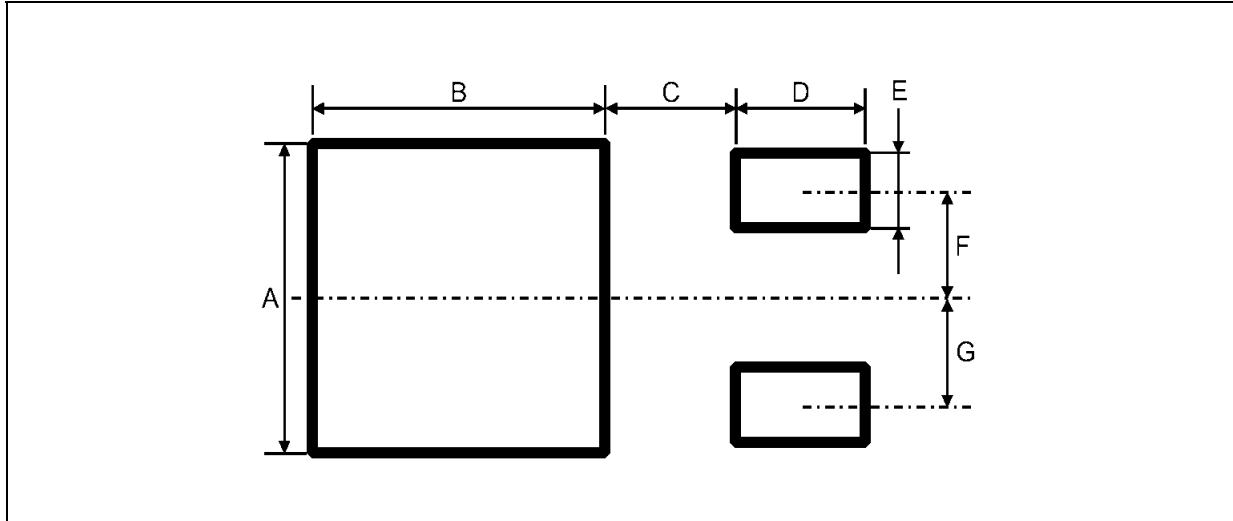
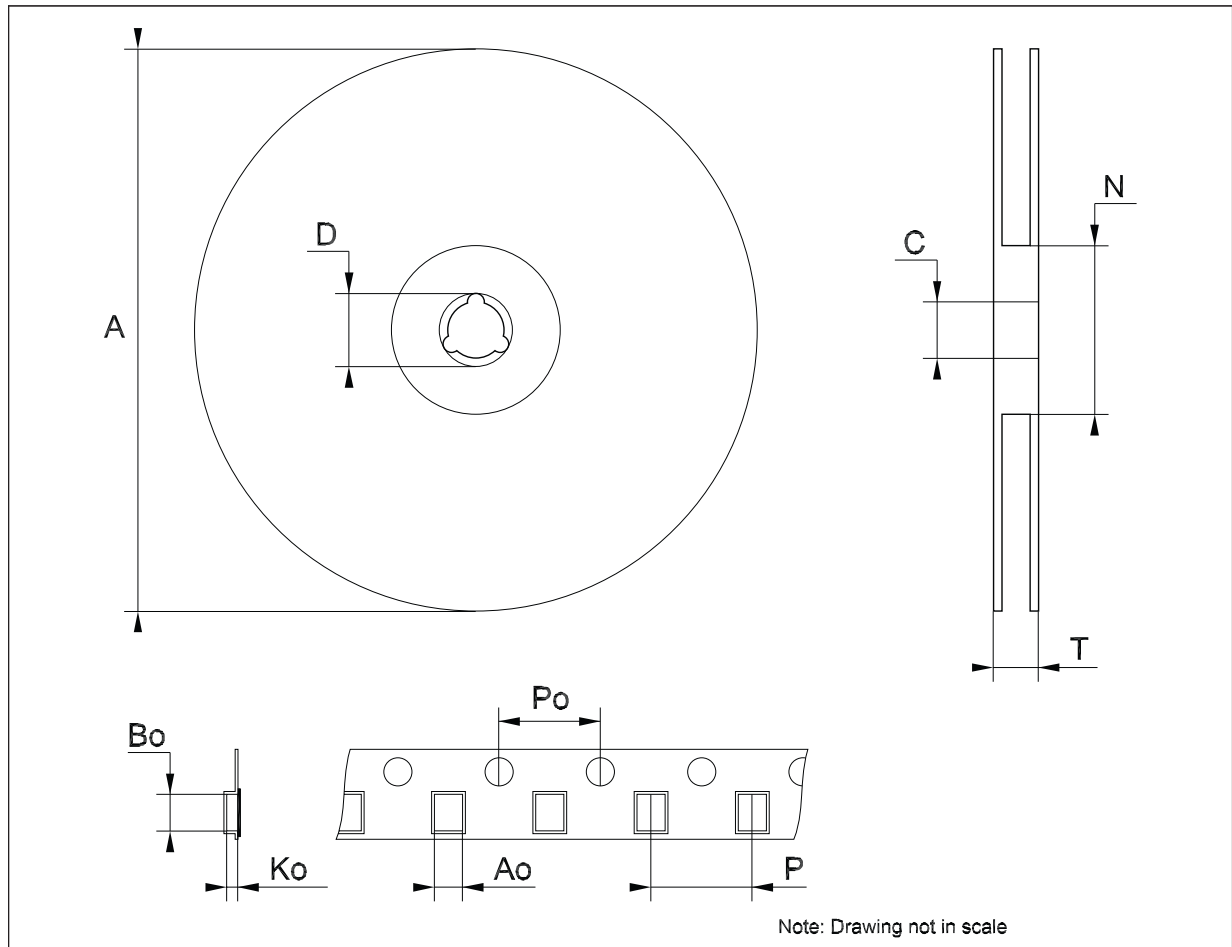


Table 13. Footprint data

Dim.	Values	
	mm.	inch.
A	6.70	0.264
B	6.70	0.64
C	1.8	0.070
D	3.0	0.118
E	1.60	0.063
F	2.30	0.091
G	2.30	0.091

**Tape & reel DPAK-PPAK mechanical data**

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.80	6.90	7.00	0.268	0.272	0.276
Bo	10.40	10.50	10.60	0.409	0.413	0.417
Ko	2.55	2.65	2.75	0.100	0.104	0.105
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



## 9 Order codes

Table 14. Order codes

Part numbers	Packaging		
	TO-220	DPAK	Output voltages
L78M05AB	L78M05ABV	L78M05ABDT-TR	5 V
L78M05AC		L78M05ACDT-TR	5 V
L78M06AB		L78M06ABDT-TR	6 V
L78M08AB		L78M08ABDT-TR	8 V
L78M09AB		L78M09ABDT-TR	9 V
L78M10AB		L78M10ABDT-TR	10 V
L78M12AB	L78M12ABV	L78M12ABDT-TR	12 V
L78M12AC		L78M12ACDT-TR	12 V
L78M15AB	L78M15ABV	L78M15ABDT-TR	15 V
L78M24AB		L78M24ABDT-TR	24 V
L78M24AC		L78M24ACDT-TR	24 V

## 10 Revision history

**Table 15. Document revision history**

Date	Revision	Changes
30-Aug-2006	3	Order codes updated.
05-Oct-2006	4	DPAK mechanical data updated and add footprint data.
10-Dec-2007	5	Modified: <a href="#">Table 14</a> .
20-Feb-2008	6	Modified: <a href="#">Table 14 on page 27</a> .
15-Jul-2008	7	Modified: <a href="#">Table 14 on page 27</a> .
15-Apr-2009	8	Modified: <a href="#">Figure 9 on page 15</a> and <a href="#">Figure 15 on page 16</a> .
28-Jul-2009	9	Modified: <a href="#">Table 14 on page 27</a> .

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