



# L78M00 series

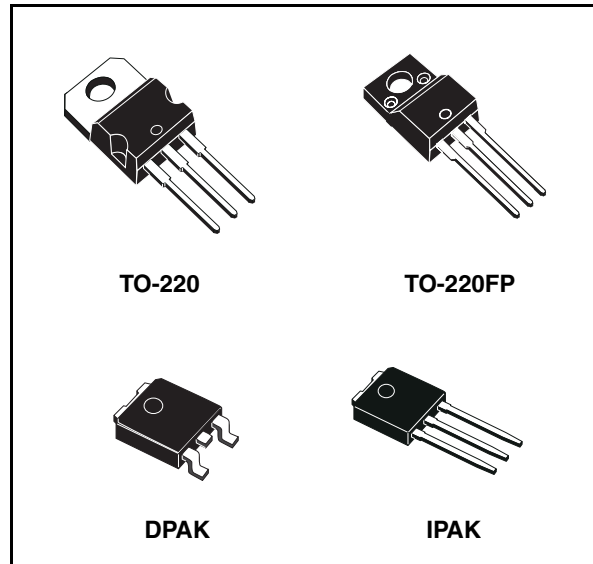
## Positive voltage regulators

### Feature summary

- Output current to 0.5A
- Output voltages of 5; 6; 8; 9; 10; 12; 15; 18; 20; 24V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection

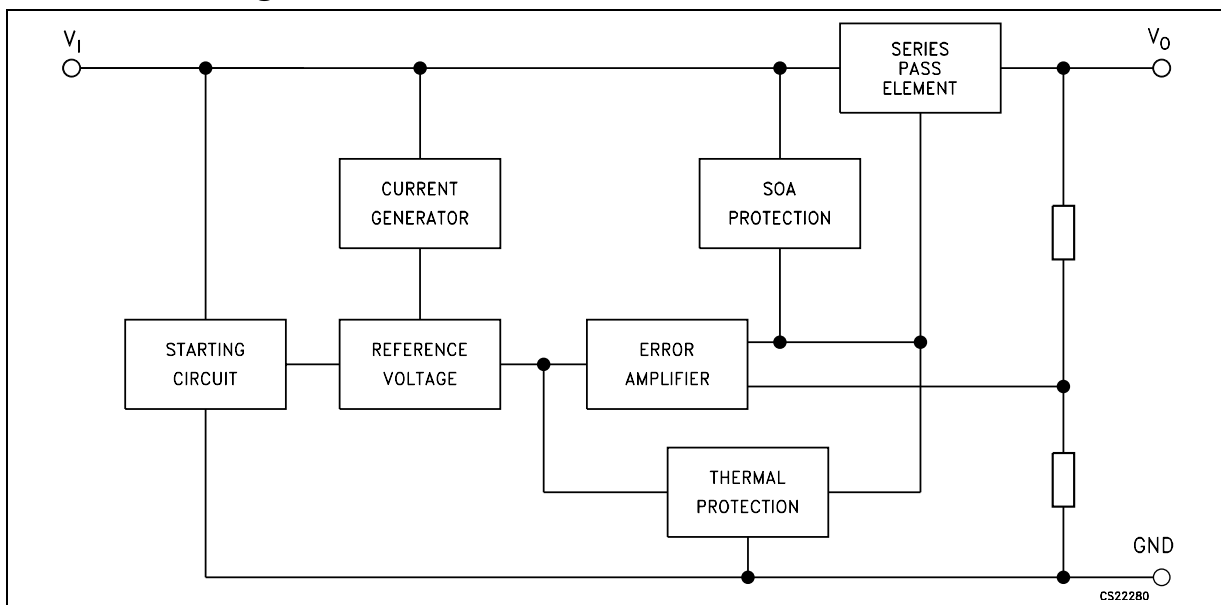
### Description

The L78M00 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 shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can



deliver over 0.5A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

### Schematic diagram



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# 1 Pin configuration

Figure 1. Pin connections (top view)

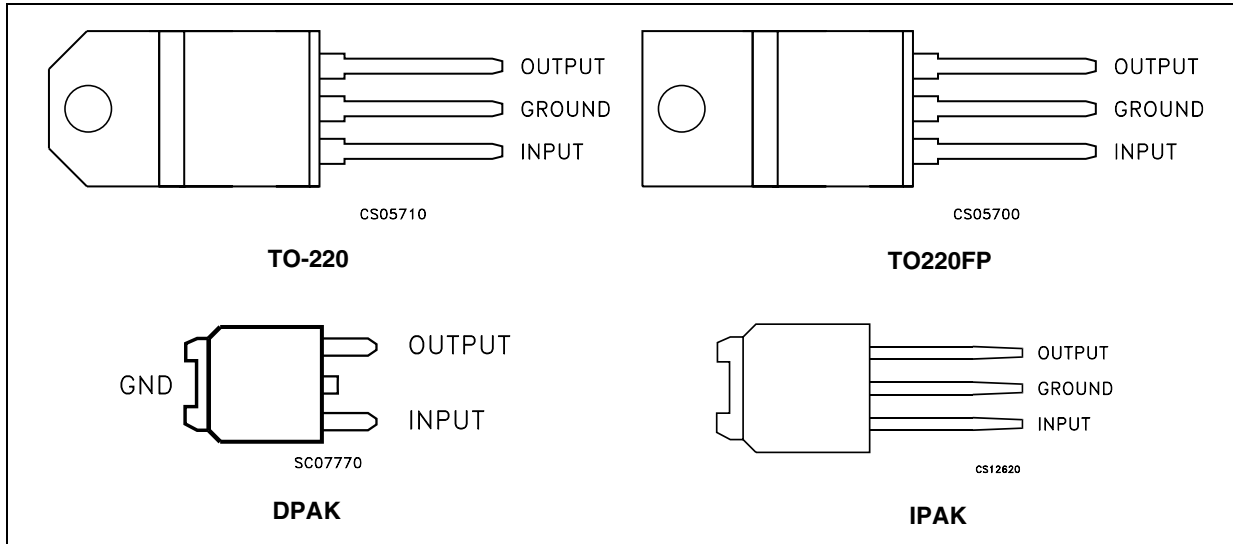
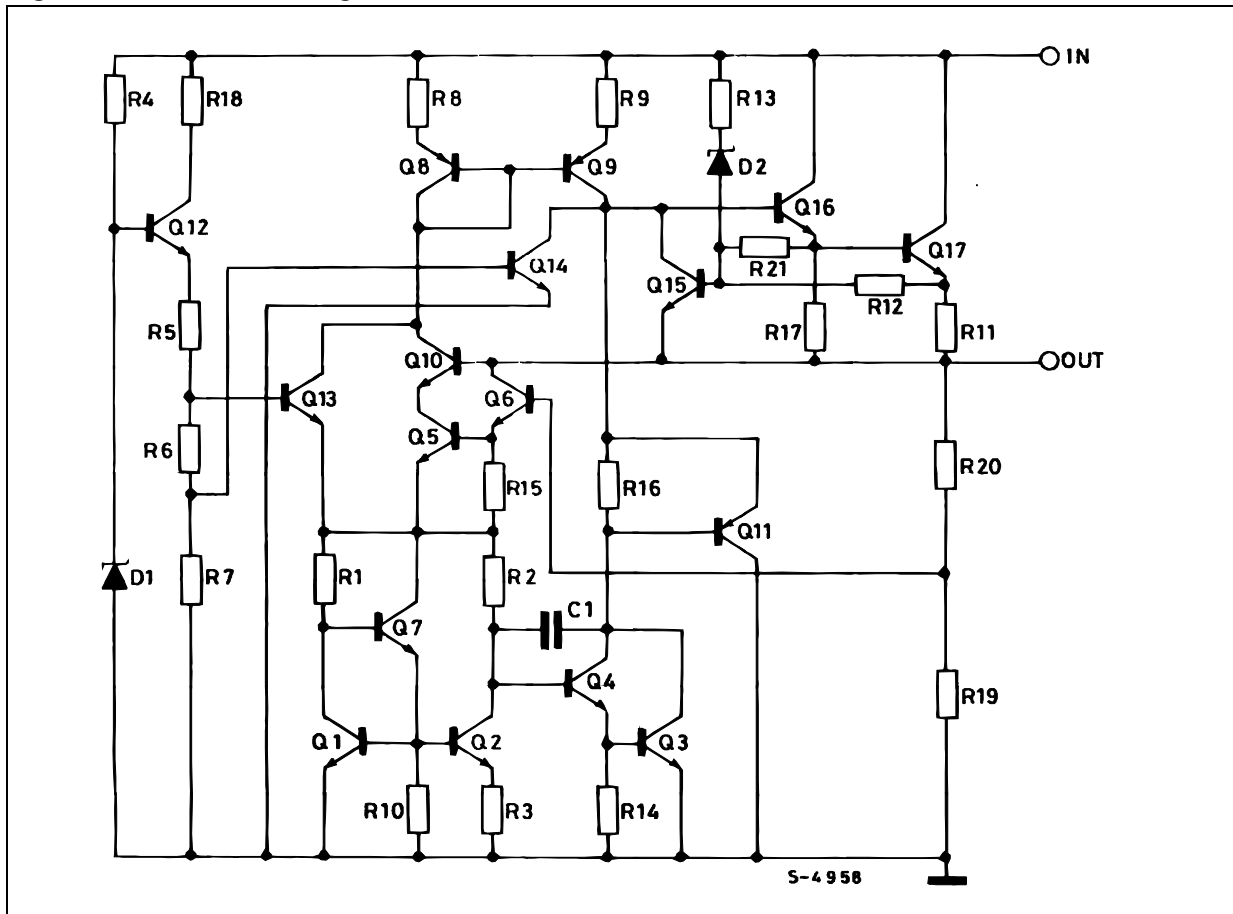


Figure 2. Schematic diagram



## 2 Maximum ratings

**Table 1. Absolute maximum ratings**

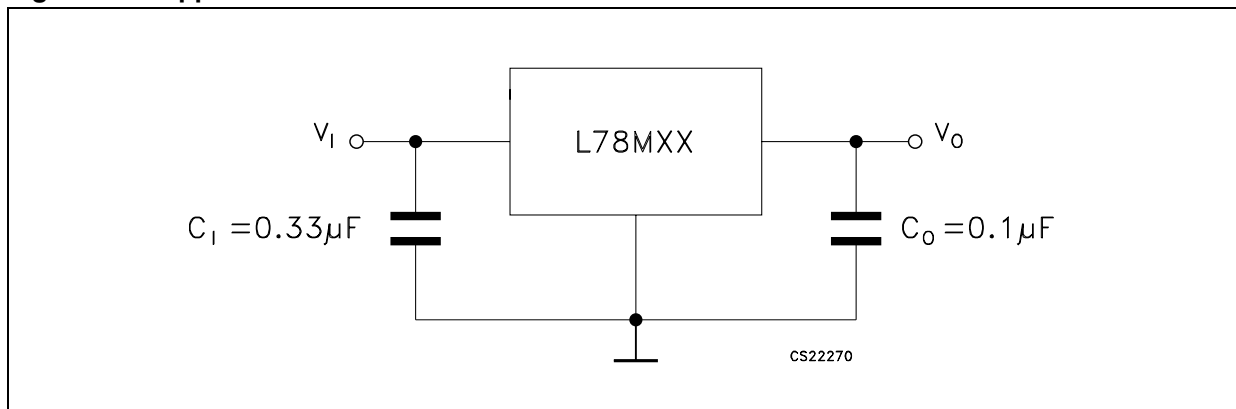
Symbol	Parameter		Value	Unit
$V_I$	DC Input voltage	for $V_O = 5$ to $18V$	35	V
		for $V_O = 20, 24V$	40	
$I_O$	Output current		Internally Limited	mA
$P_D$	Power dissipation		Internally Limited	mW
$T_{STG}$	Storage temperature range		-65 to 150	°C
$T_{OP}$	Operating junction temperature range		0 to 150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

*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	3	5	8		°C/W
$R_{thJA}$	Thermal resistance junction-ambient	50	60	100		°C/W

**Figure 3. Application circuits**



### 3 Test circuits

Figure 4. DC Parameter

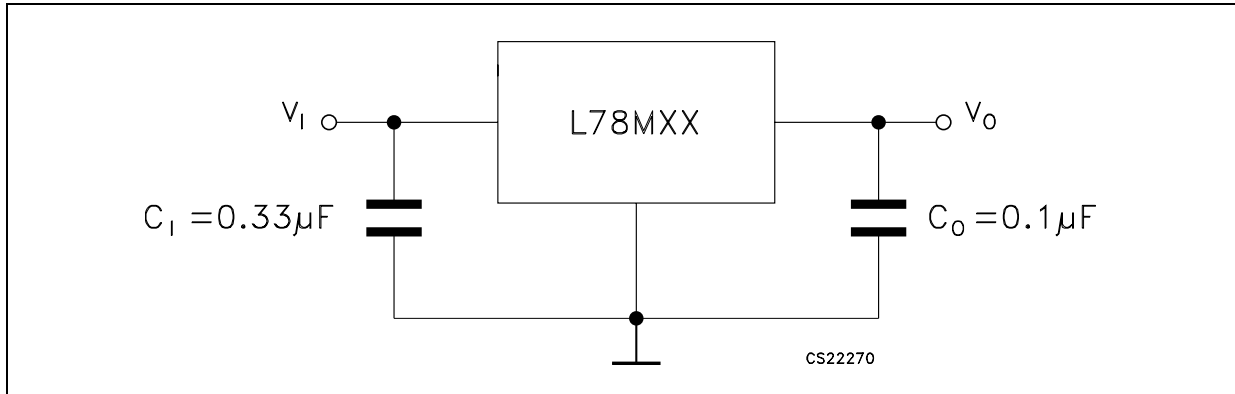


Figure 5. Load regulation

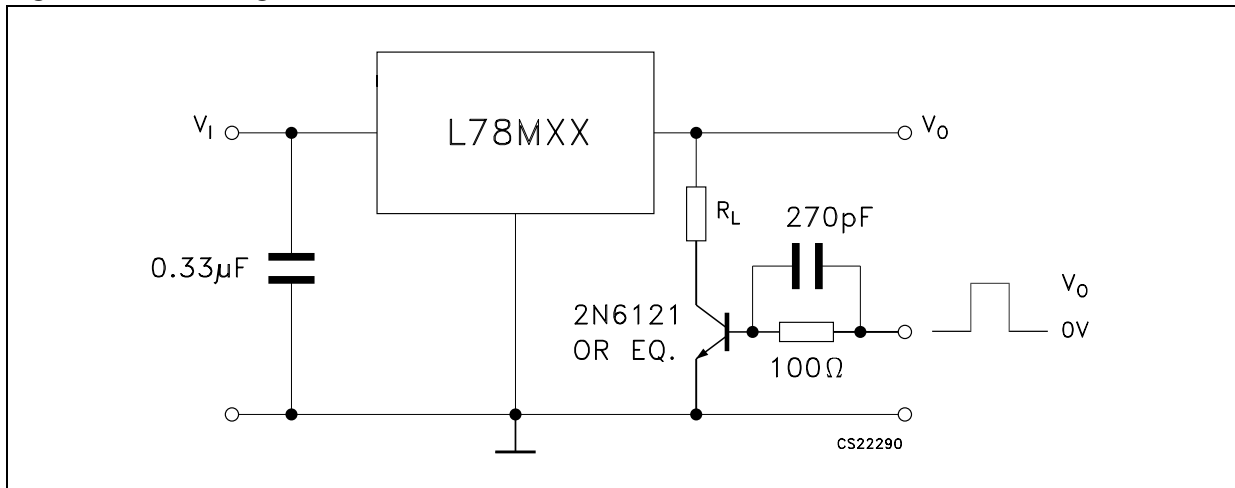
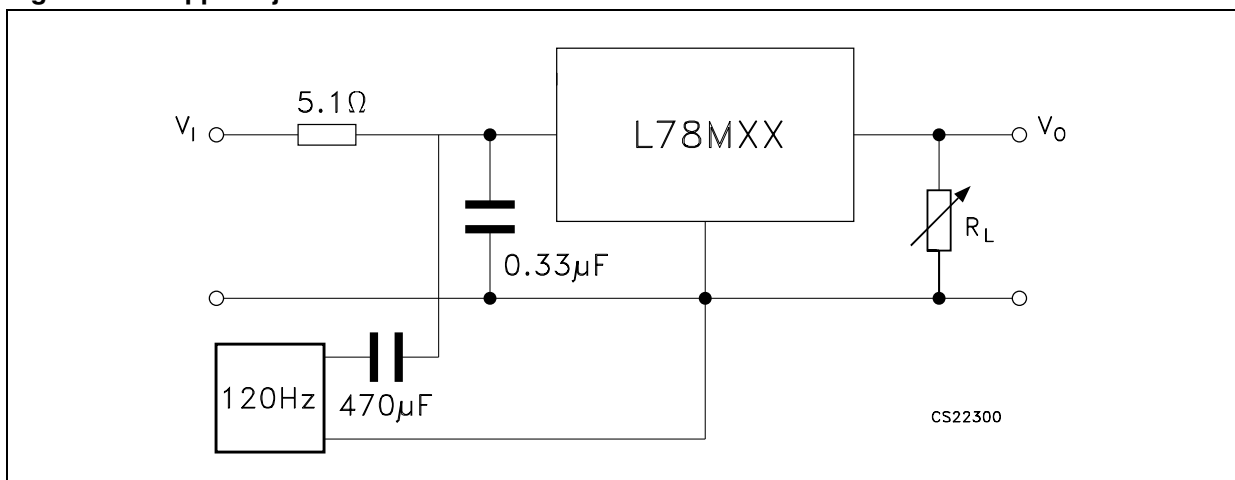


Figure 6. Ripple rejection



## 4 Electrical characteristics

**Table 3. Electrical characteristics of L78M05C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 10\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		4.8	5	5.2	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 7\text{ to }20\text{ V}$	4.75	5	5.25	V
$\Delta V_O$	Line regulation	$V_I = 7\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 8\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-0.5		mV/°C
SVR	Supply voltage rejection	$V_I = 8\text{ to }18\text{ V}$ , $f = 120\text{Hz}$ , $I_O = 300\text{mA}$	62			dB
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		40		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		300		mA

**Table 4. Electrical characteristics of L78M06C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 11\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

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

**Table 5. Electrical characteristics of L78M08C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 14\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		7.7	8	8.3	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 10.5\text{ to }23\text{ V}$	7.6	8	8.4	V
$\Delta V_O$	Line regulation	$V_I = 10.5\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 11\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 11.5\text{ to }21.5\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		52		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		250		mA

**Table 6. Electrical characteristics of L78M09C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 15\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		8.65	9	9.35	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 11.5\text{ to }24\text{ V}$	8.55	9	9.45	V
$\Delta V_O$	Line regulation	$V_I = 11.5\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 12\text{ to }25\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 12.5\text{ to }23\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		58		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		250		mA

**Table 7. Electrical characteristics of L78M10C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 16\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		9.6	10	10.4	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 12.5\text{ to }25\text{ V}$	9.5	10	10.5	V
$\Delta V_O$	Line regulation	$V_I = 12.5\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 13\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-0.5		mV/°C
SVR	Supply voltage rejection	$V_I = 13.5\text{ to }24\text{ V}$ , $f = 120\text{Hz}$ , $I_O = 300\text{mA}$	56			dB
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		64		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		245		mA

**Table 8. Electrical characteristics of L78M12C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 19\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		11.5	12	12.5	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 14.5\text{ to }27\text{ V}$	11.4	12	12.6	V
$\Delta V_O$	Line regulation	$V_I = 14.5\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 16\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-1		mV/°C
SVR	Supply voltage rejection	$V_I = 15\text{ to }25\text{ V}$ , $f = 120\text{Hz}$ , $I_O = 300\text{mA}$	55			dB
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		75		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		240		mA



**Table 9. Electrical characteristics of L78M15C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 23\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		14.4	15	15.6	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 17.5\text{ to }30\text{ V}$	14.25	15	15.75	V
$\Delta V_O$	Line regulation	$V_I = 17.5\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 20\text{ to }30\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-1		mV/°C
SVR	Supply voltage rejection	$V_I = 18.5\text{ to }28.5\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$	54			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		90		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		240		mA

**Table 10. Electrical characteristics of L78M18C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 26\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		17.3	18	18.7	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 20.5\text{ to }33\text{ V}$	17.1	18	18.9	V
$\Delta V_O$	Line regulation	$V_I = 21\text{ to }33\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 24\text{ to }33\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			360	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			180	
$I_d$	Quiescent current				6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 21\text{ to }33\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-1.1		mV/°C
SVR	Supply voltage rejection	$V_I = 22\text{ to }32\text{ V}$ , $f = 120\text{ Hz}$ , $I_O = 300\text{ mA}$	53			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		100		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		240		mA

**Table 11. Electrical characteristics of L78M20C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 29\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		19.2	20	20.8	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 23\text{ to }35\text{ V}$	19	20	21	V
$\Delta V_O$	Line regulation	$V_I = 23\text{ to }35\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 24\text{ to }35\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	Load regulation	$I_O = 5\text{ to }500\text{ mA}$ , $T_J = 25^\circ\text{C}$			400	mV
		$I_O = 5\text{ to }200\text{ mA}$ , $T_J = 25^\circ\text{C}$			200	
$I_d$	Quiescent current				6	mA
$\Delta I_d$	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$ , $V_I = 23\text{ to }35\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-1.1		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 24\text{ to }34\text{ V}$ , $f = 120\text{Hz}$ , $I_O = 300\text{mA}$	53			dB
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		110		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		240		mA

**Table 12. Electrical characteristics of L78M24C** (refer to the test circuits,  $T_J = 25^\circ\text{C}$ ,  $V_I = 23\text{V}$ ,  $I_O = 350\text{ mA}$ ,  $C_I = 0.33\ \mu\text{F}$ ,  $C_O = 0.1\ \mu\text{F}$  unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage		23	24	25	V
$V_O$	Output voltage	$I_O = 5\text{ to }350\text{ mA}$ , $V_I = 27\text{ to }38\text{ V}$	22.8	24	25.2	V
$\Delta V_O$	Line regulation	$V_I = 27\text{ to }38\text{ V}$ , $I_O = 200\text{ mA}$			100	mV
		$V_I = 28\text{ to }38\text{ V}$ , $I_O = 200\text{ mA}$			50	
$\Delta V_O$	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				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	$I_O = 5\text{ mA}$ , $T_J = 0\text{ to }125^\circ\text{C}$		-1.2		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 28\text{ to }38\text{ V}$ , $f = 120\text{Hz}$ , $I_O = 300\text{mA}$	50			dB
eN	Output noise voltage	$B = 10\text{Hz to }100\text{KHz}$		170		$\mu\text{V}$
$V_d$	Dropout voltage			2		V
$I_{sc}$	Short circuit current	$V_I = 35\text{ V}$		240		mA

# 5 Typical performance

Figure 7. Dropout voltage vs junction temp.

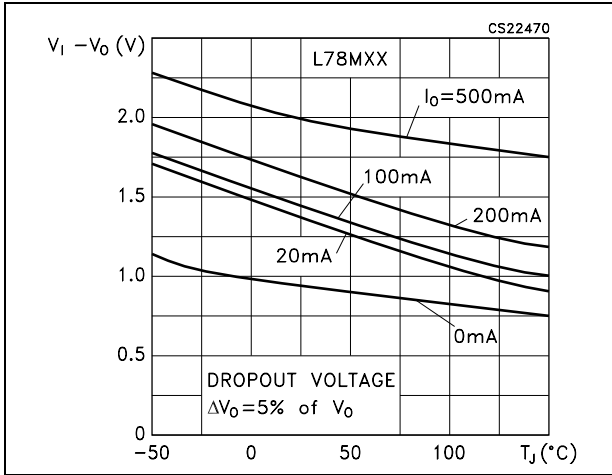


Figure 8. Dropout characteristics

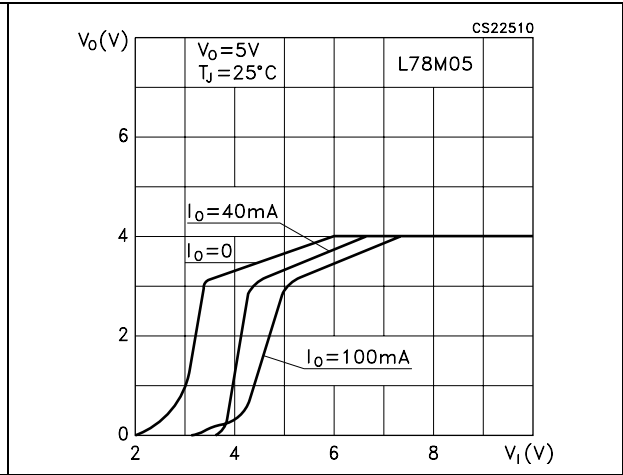


Figure 9. Peak output current vs input-output differential voltage

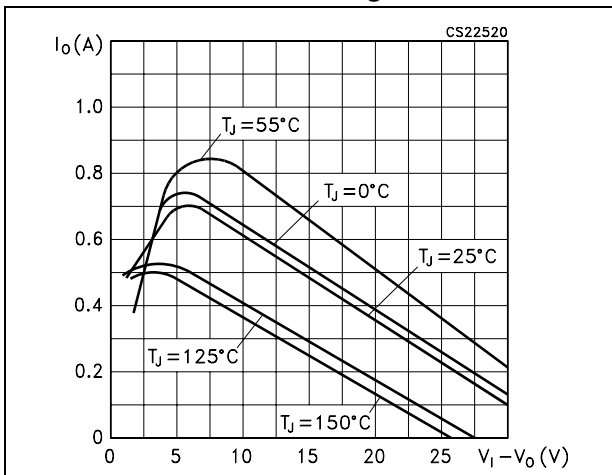


Figure 10. Output voltage vs junction temperature

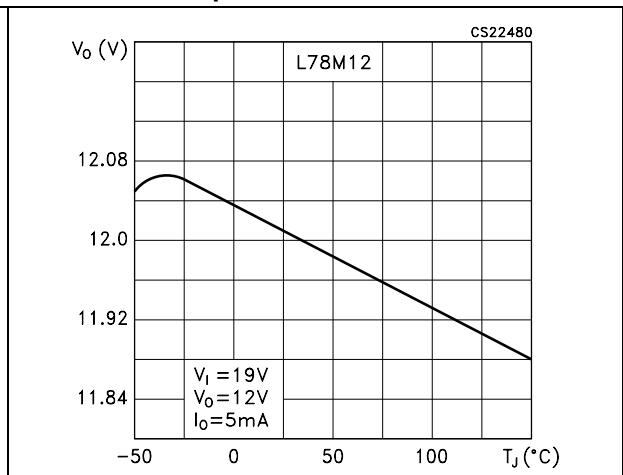


Figure 11. Supply voltage rejection vs freq.

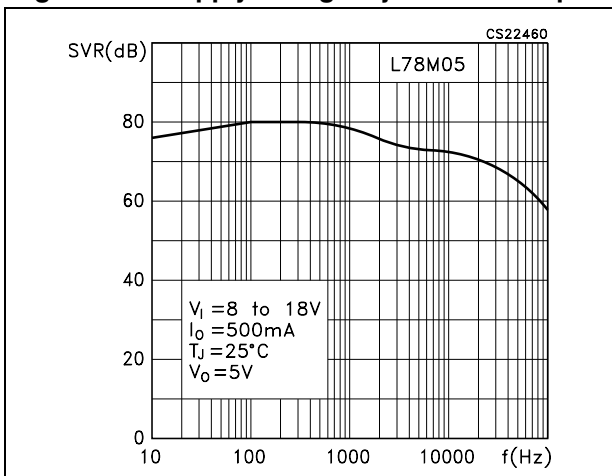


Figure 12. Quiescent current vs junction temp.

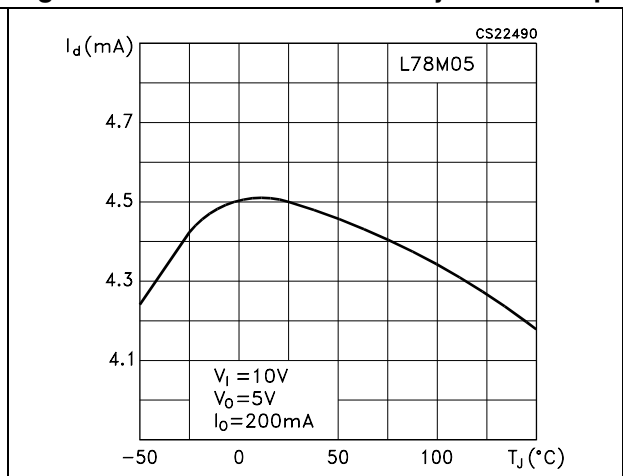


Figure 13. Load transient response

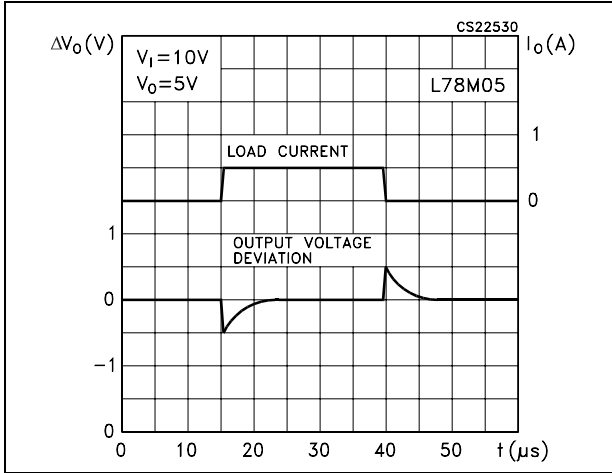


Figure 14. Line transient response

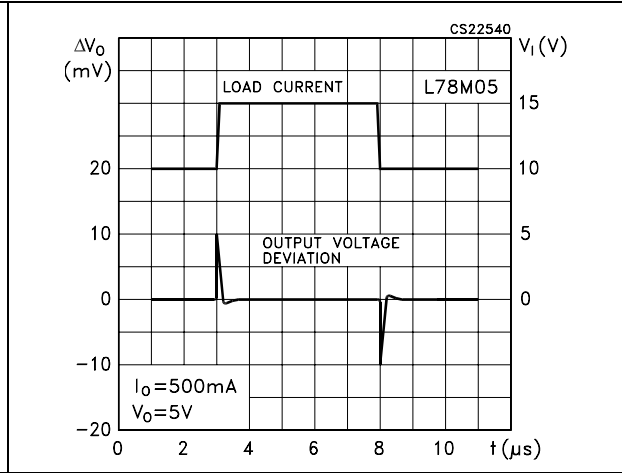


Figure 15. Quiescent current vs input voltage

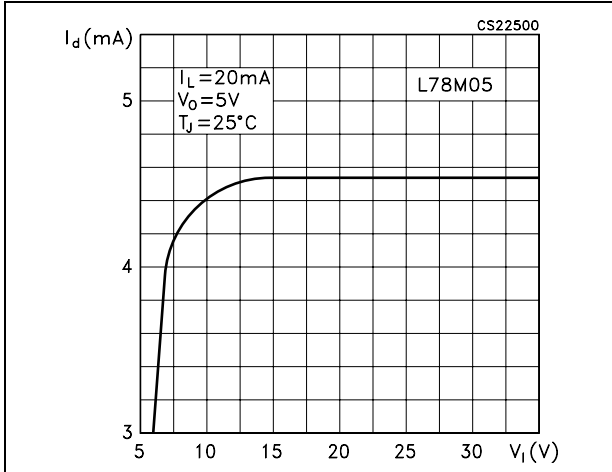
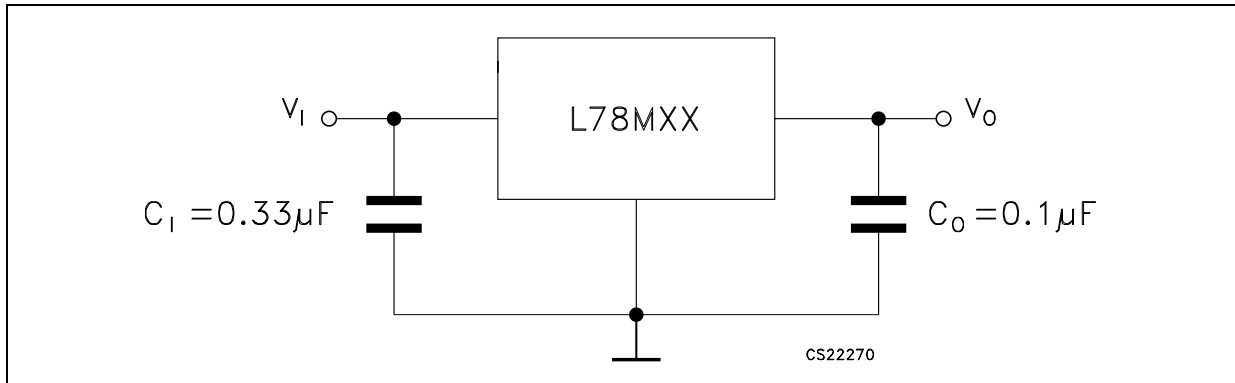


Figure 16. Fixed output regulator



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

Figure 17. Constant current regulator

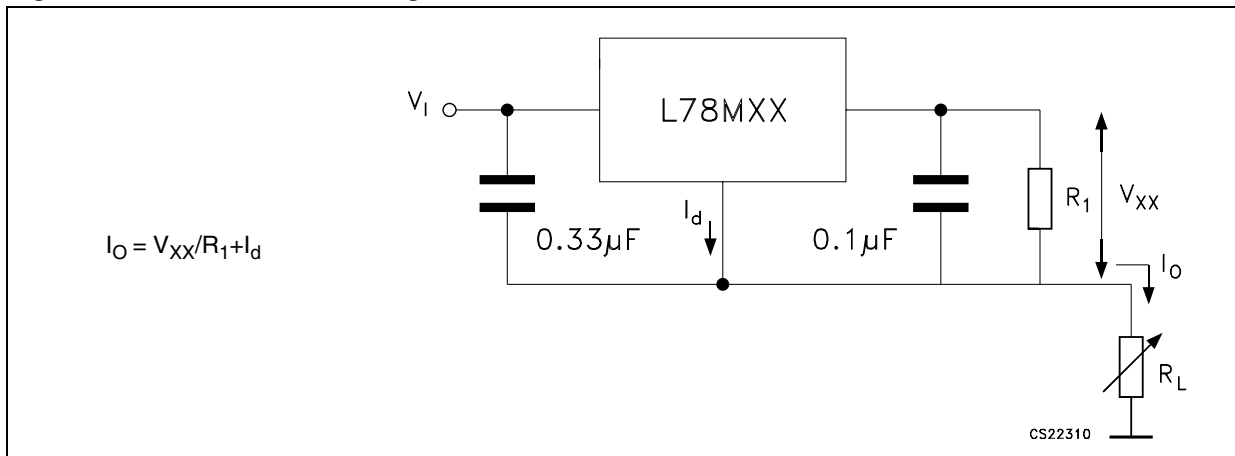


Figure 18. Circuit for increasing output voltage

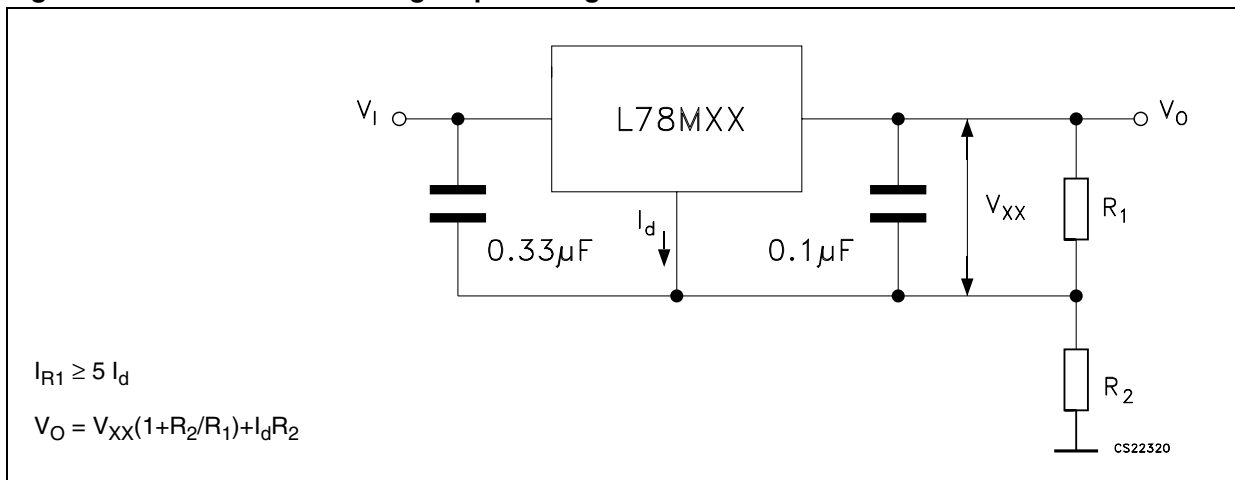


Figure 19. Adjustable output regulator (7 to 30V)

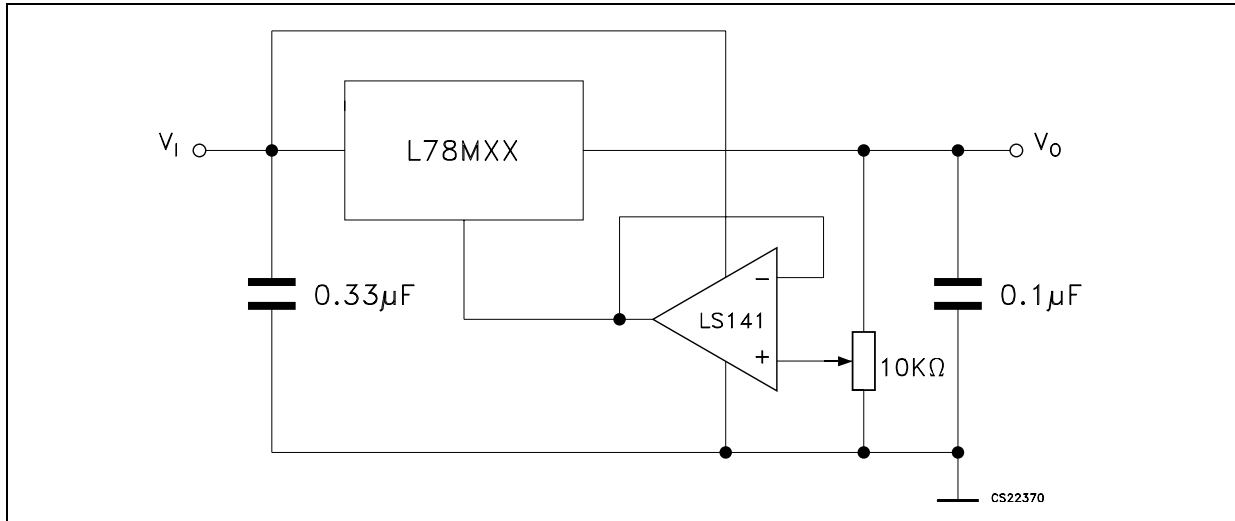


Figure 20. 0.5 to 10V Regulator

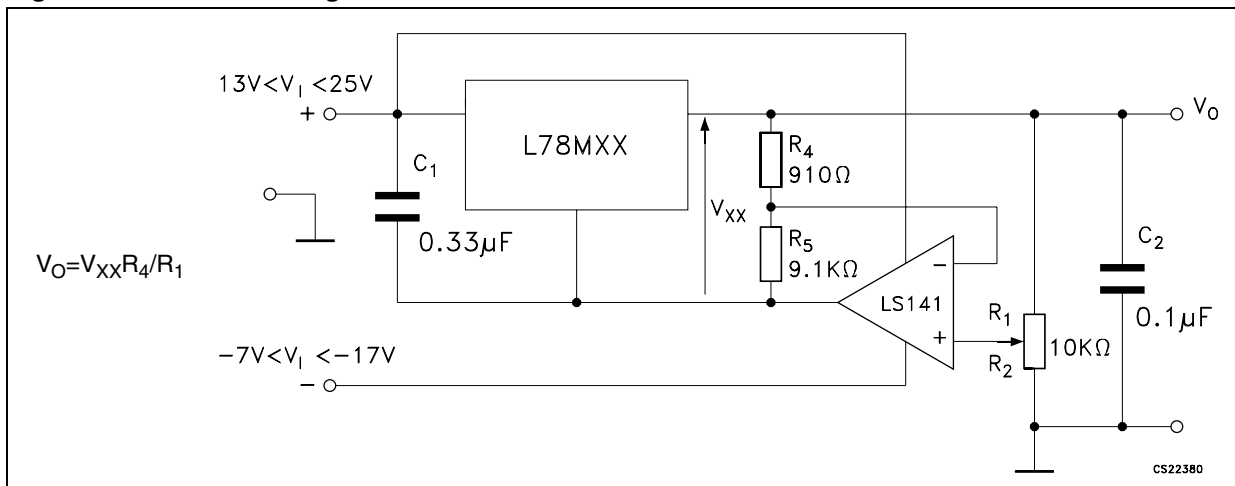


Figure 21. High current voltage regulator

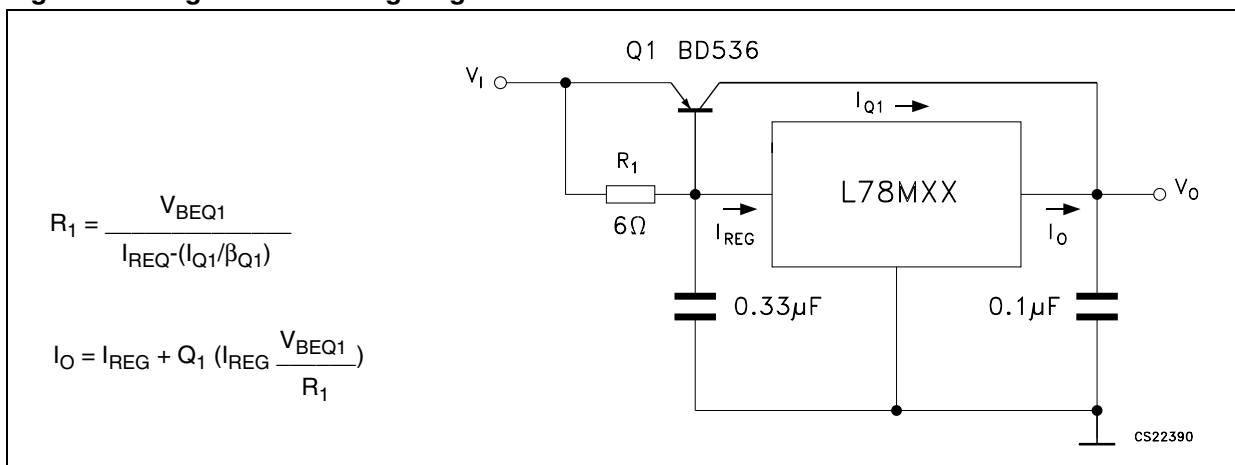


Figure 22. High output current with short circuit protection

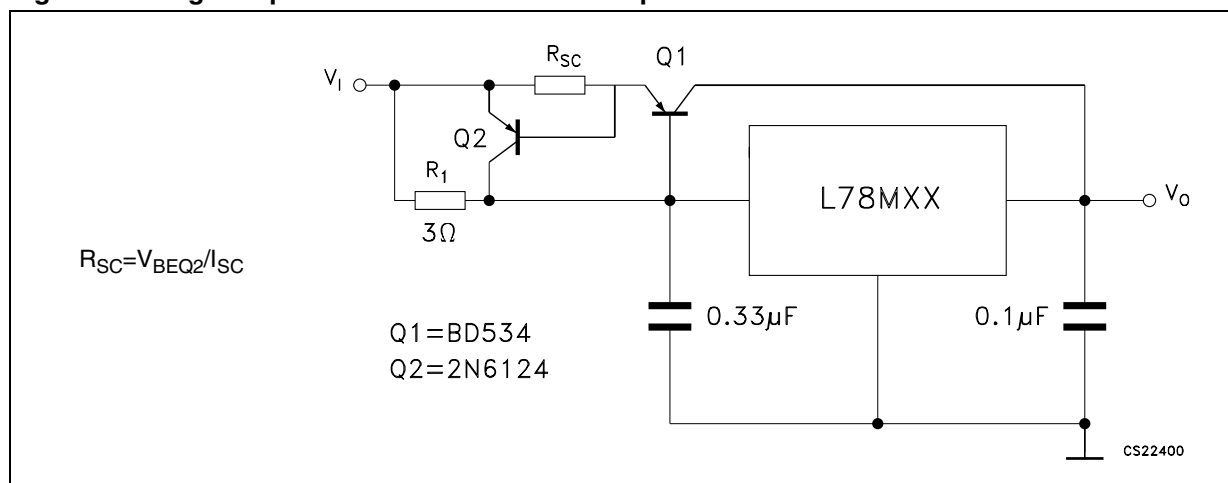


Figure 23. Tracking voltage regulator

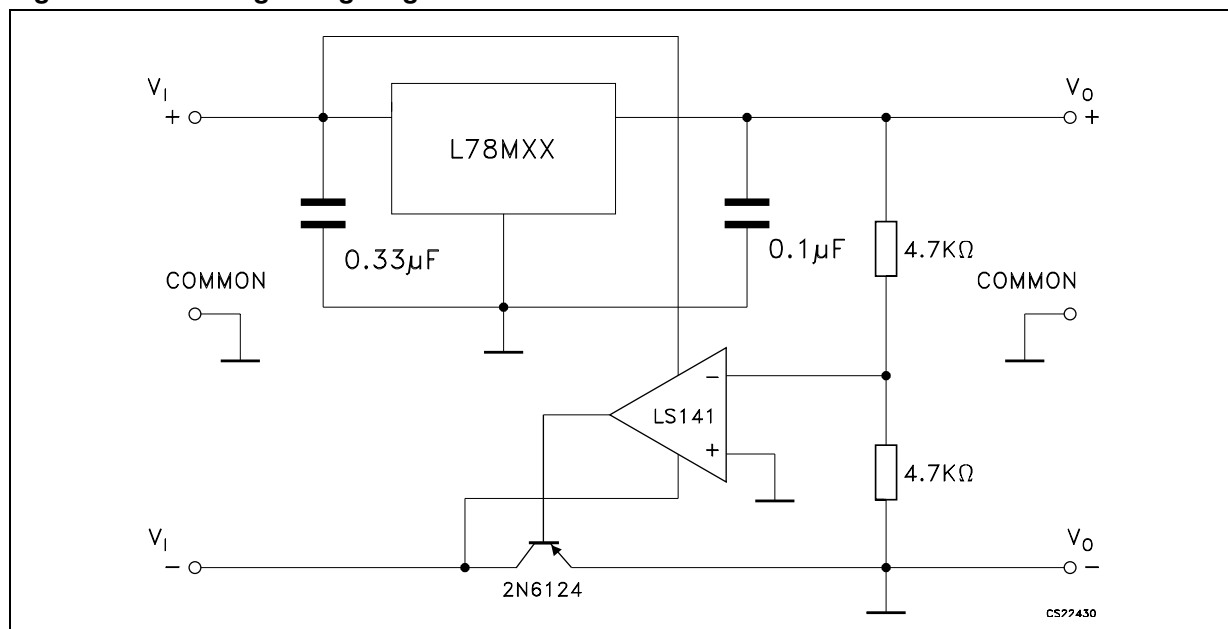


Figure 24. High input voltage circuit

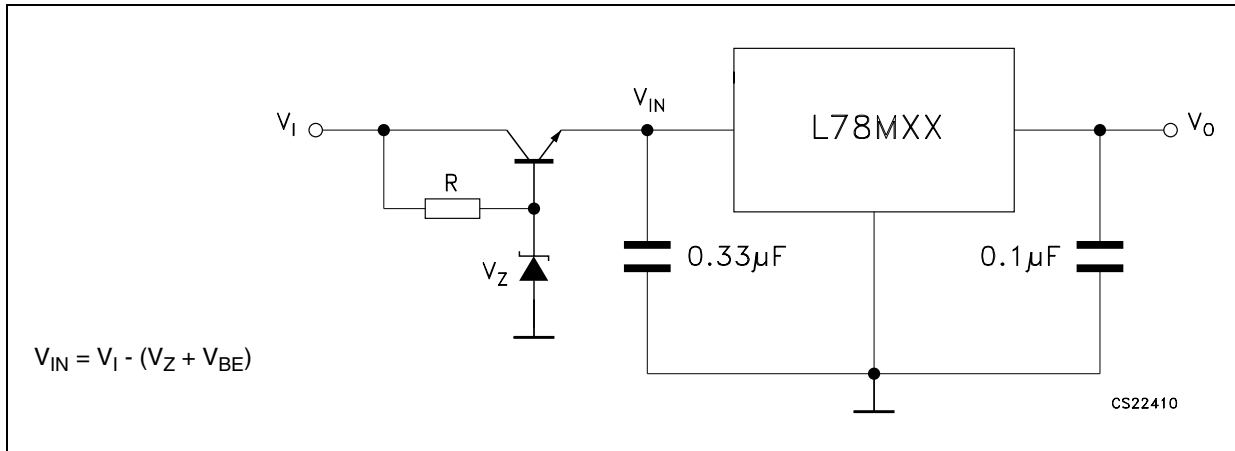


Figure 25. Reducing power dissipation with dropping resistor

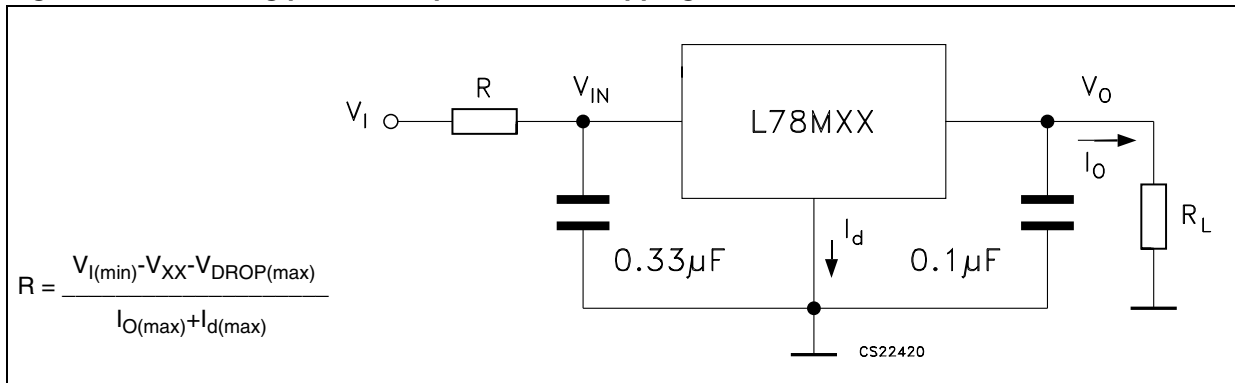
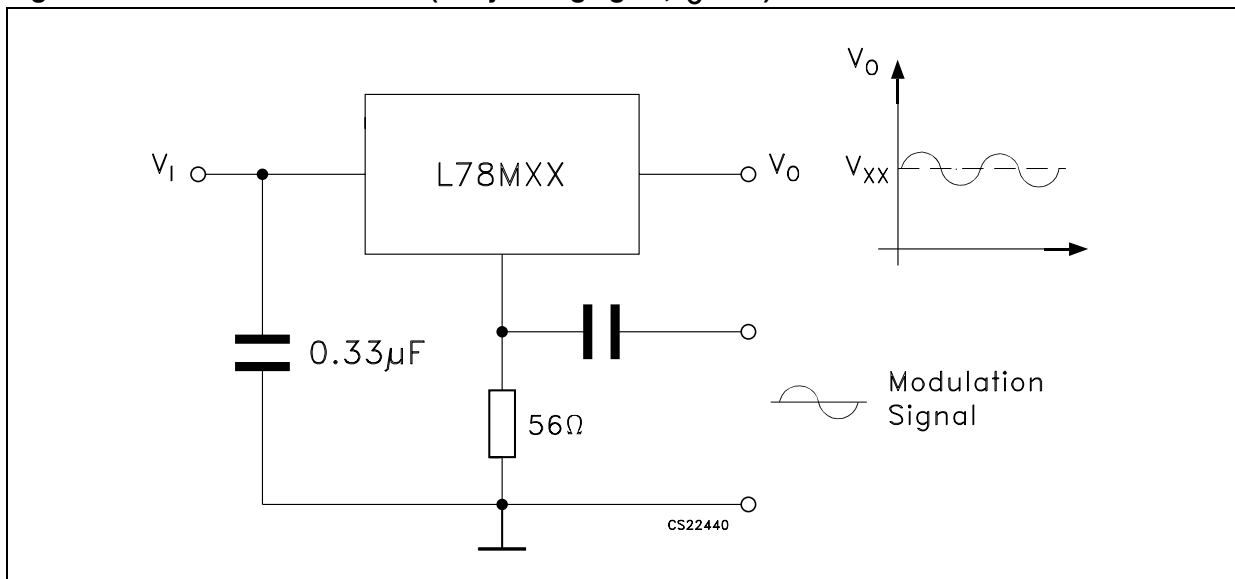


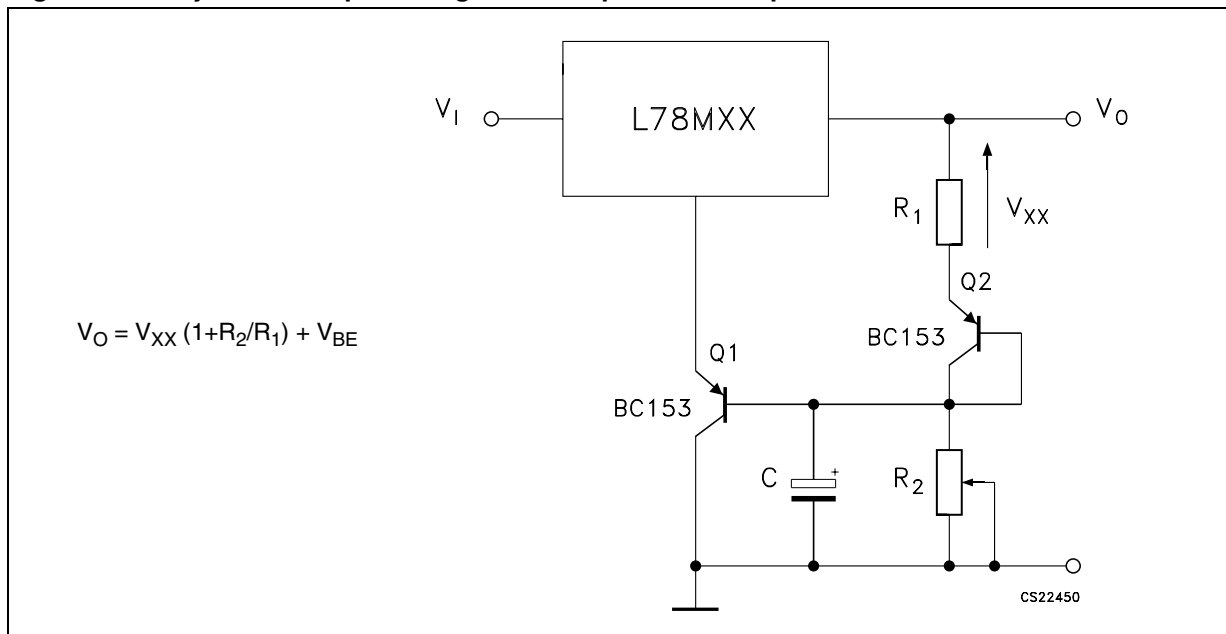
Figure 26. Power AM Modulator (unity voltage gain,  $I_O \leq 0.5$ )



Note: The circuit performs well up to 100 KHz.



Figure 27. Adjustable output voltage with temperature compensation



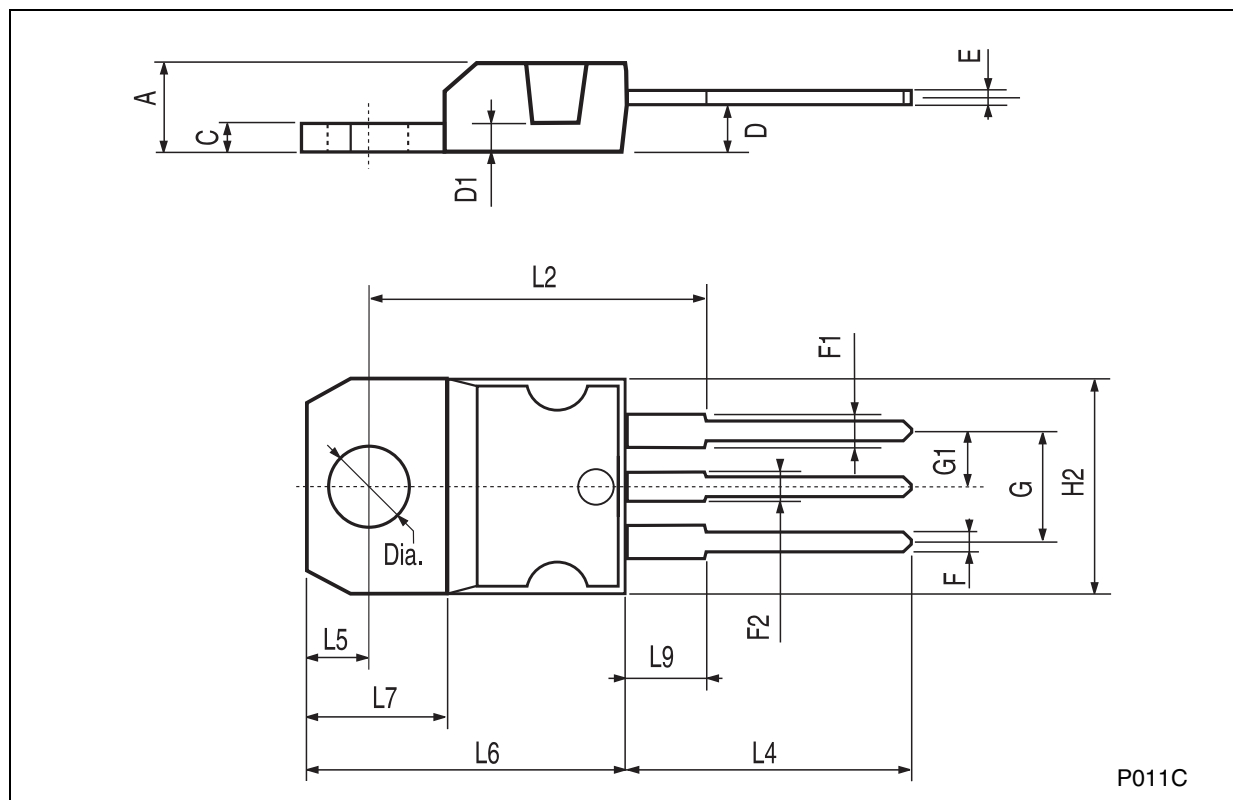
Note:  $Q_2$  is connected as a diode in order to compensate the variation of the  $Q_1$   $V_{BE}$  with the temperature.  $C$  allows a slow rise time of the  $V_O$ .

## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

**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



**TO-220FP MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.50	0.045		0.059
F2	1.15		1.50	0.045		0.059
G	4.95		5.2	0.194		0.204
G1	2.4		2.7	0.094		0.106
H	10.0		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L5	2.9		3.6	0.114		0.142
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
DIA.	3		3.2	0.118		0.126

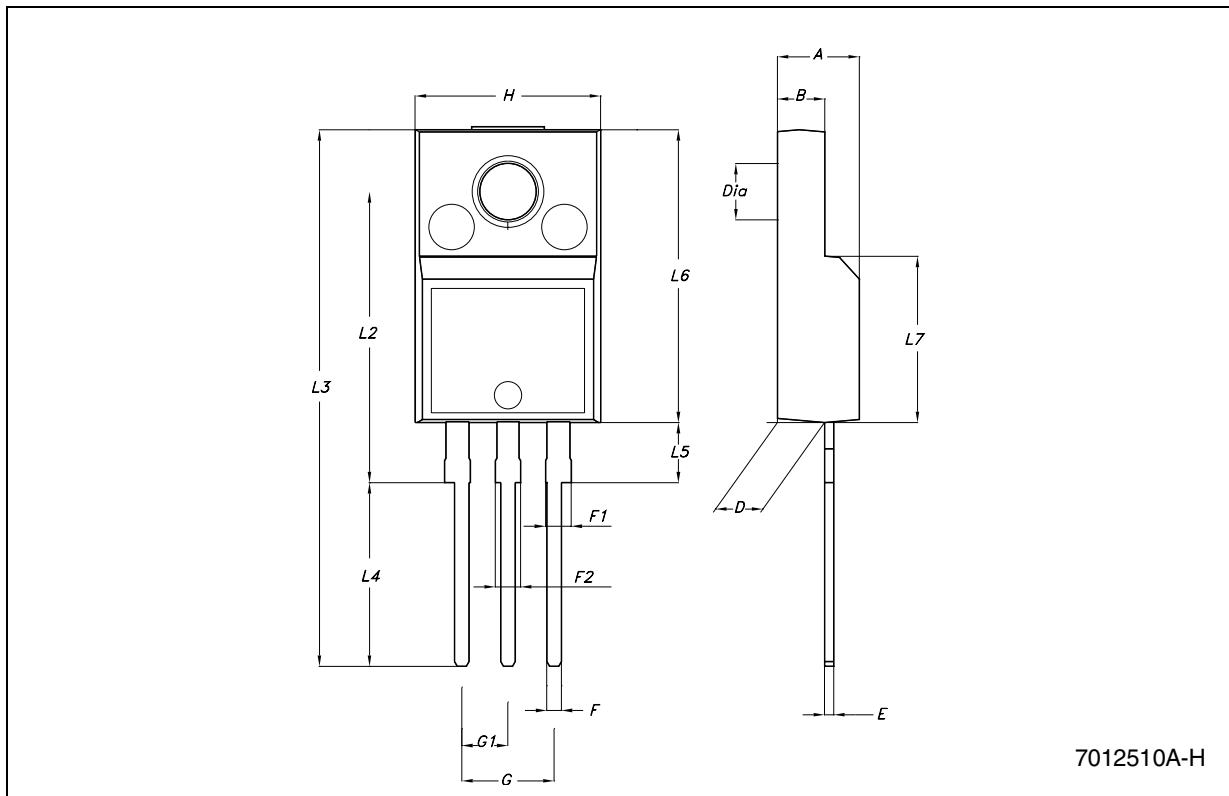


Figure 28. DRAWING DIMENSION DPAK (TYPE STD-ST)

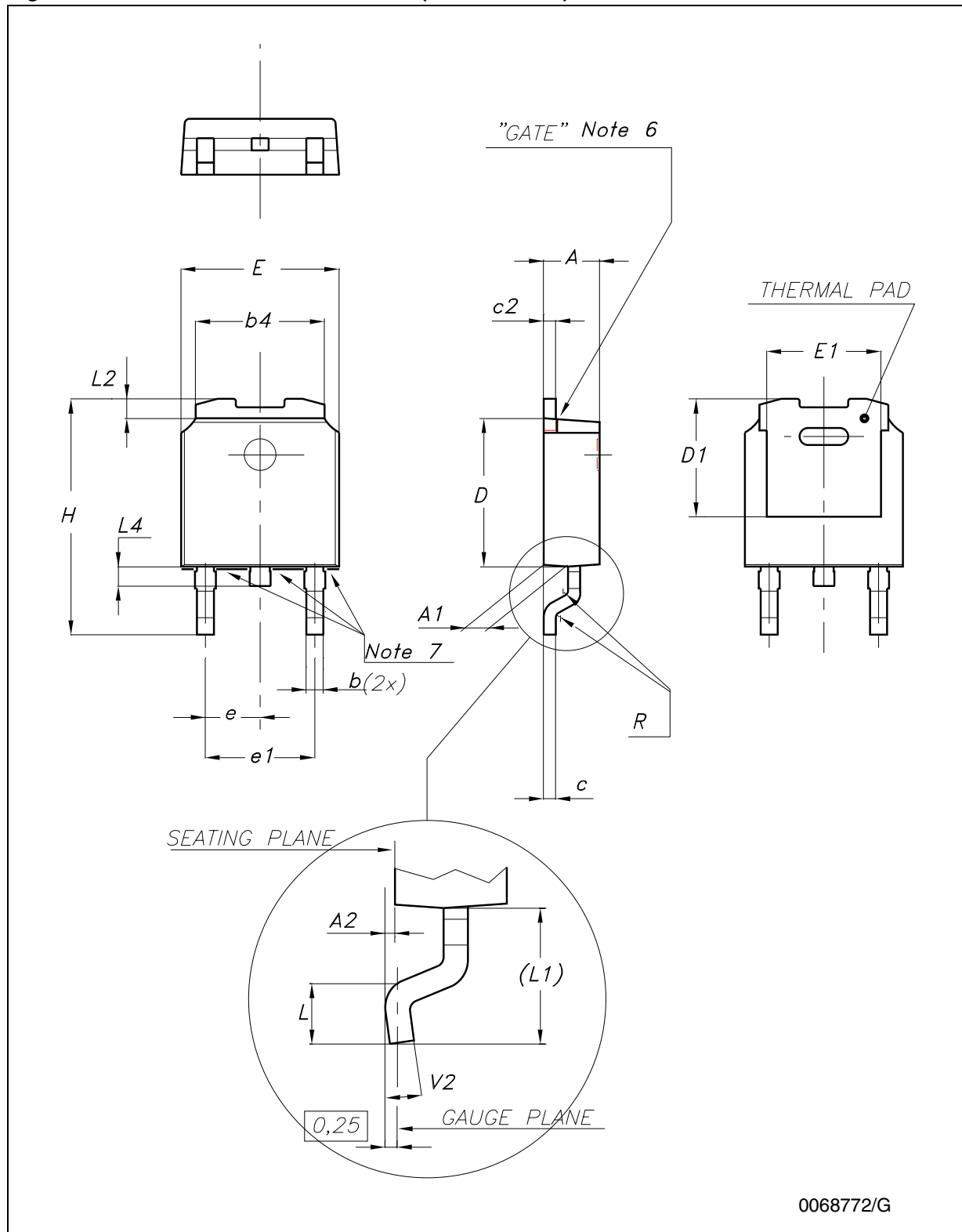


Figure 29. DRAWING DIMENSION DPAK (TYPE FUJITSU-SUBCON.)

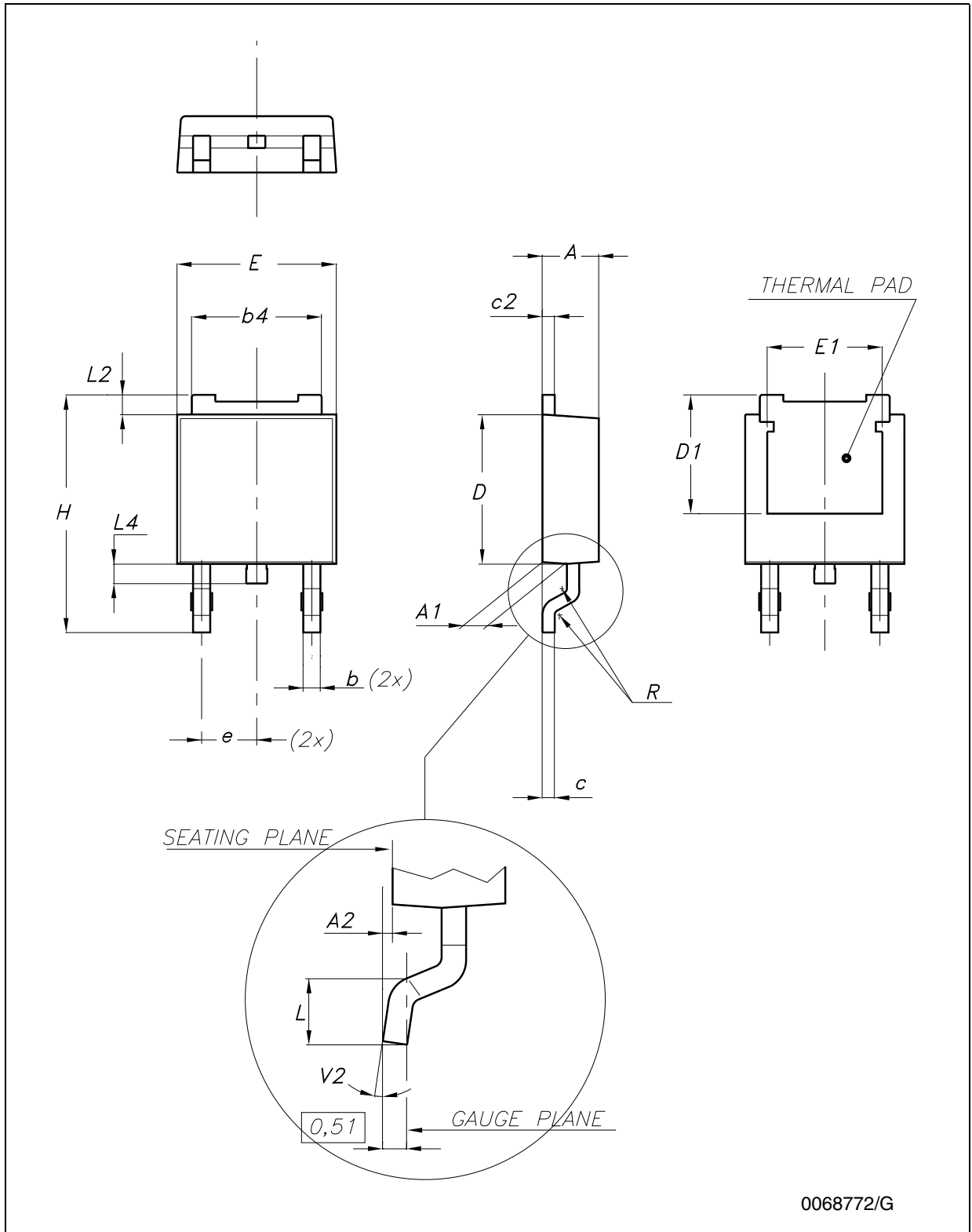


Figure 30. DRAWING DIMENSION DPAK (TYPE IDS-SUBCON.)

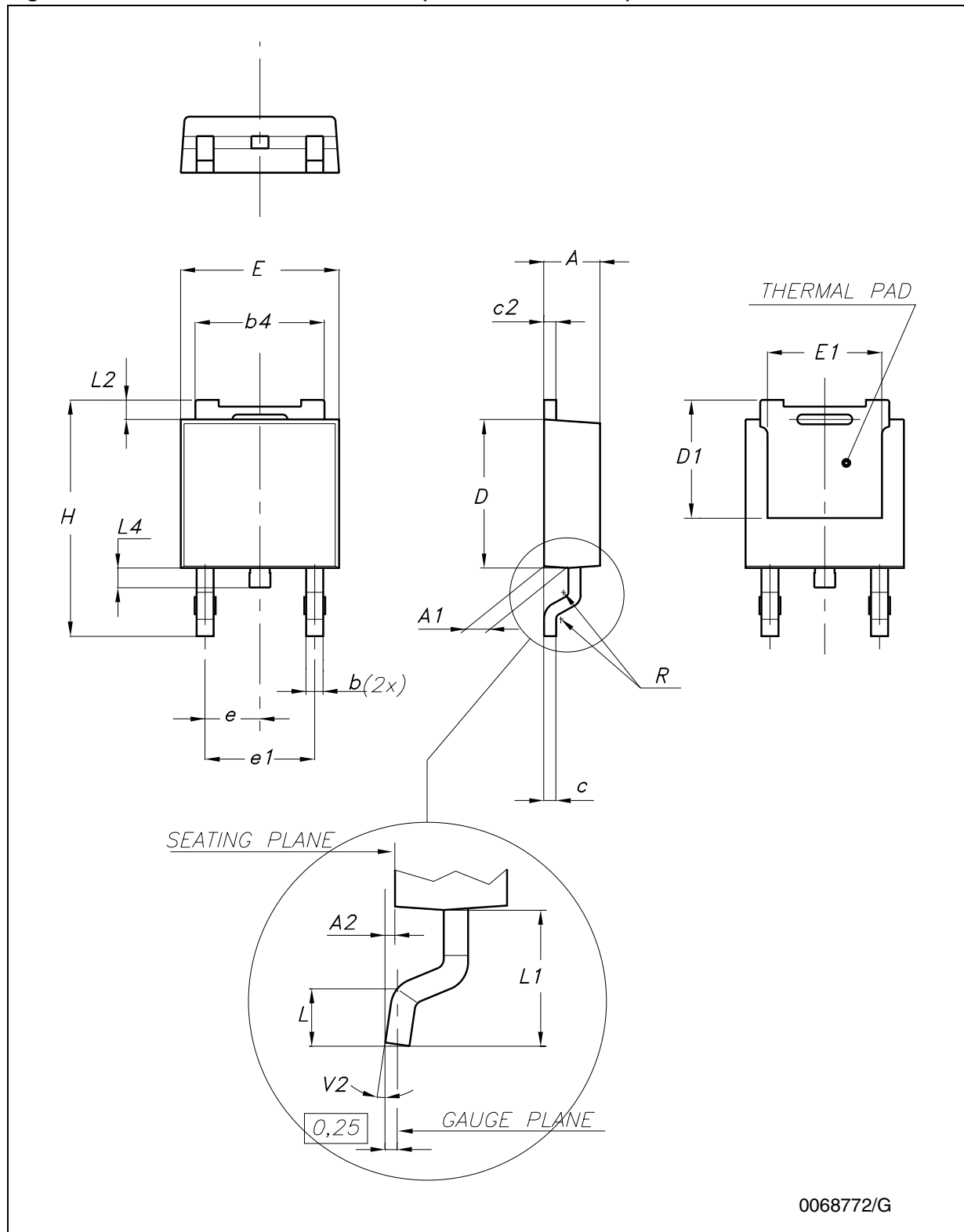


Table 13. DPAK MECHANICAL DATA

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 31. DPAK FOOTPRINT RECOMMENDED DATA

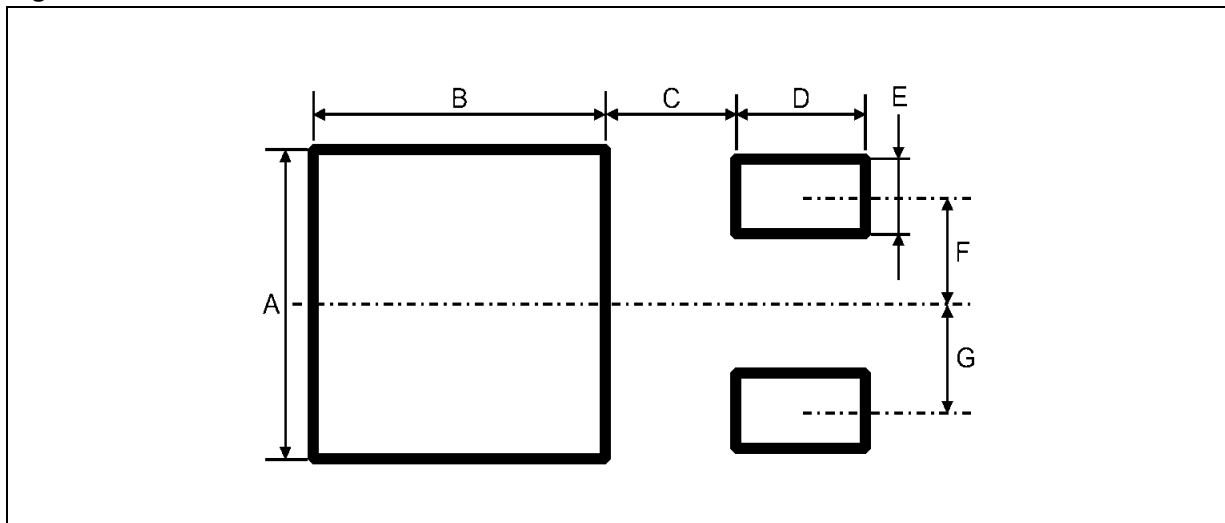
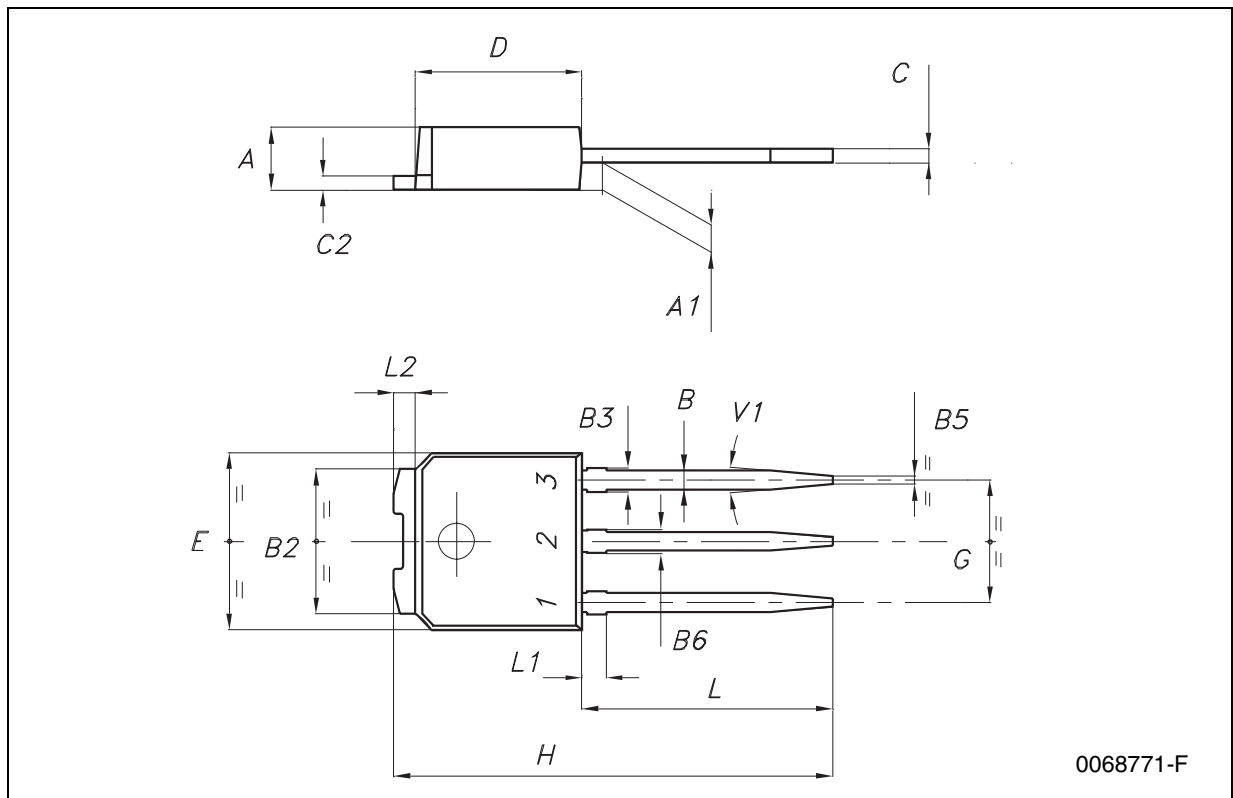


Table 14. FOOTPRINT DATA

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

**IPAK MECHANICAL DATA**

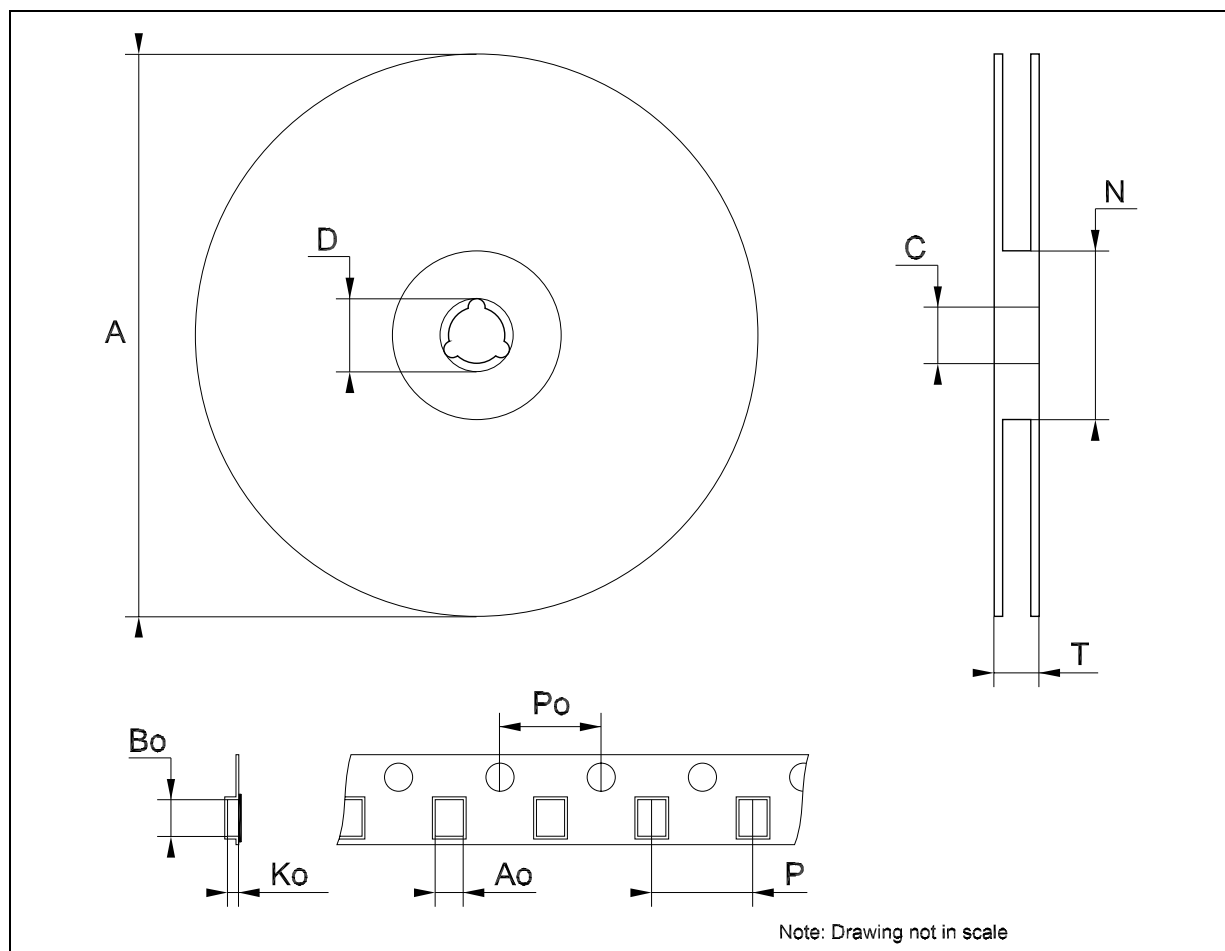
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
B	0.64		0.9	0.025		0.035
B2	5.2		5.4	0.204		0.212
B3			0.95			0.037
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



0068771-F

### 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



## 7 Order code

**Table 15. Order code**

Part numbers	Packaging				Output voltage
	TO-220	TO-220FP	DPAK	IPAK	
L78M05	L78M05CV	L78M05CP	L78M05CDT-TR	L78M05CDT-1	5 V
L78M06	L78M06CV	L78M06CP	L78M06CDT-TR	L78M06CDT-1 <sup>(1)</sup>	6 V
L78M08	L78M08CV	L78M08CP	L78M08CDT-TR	L78M08CDT-1 <sup>(1)</sup>	8 V
L78M09	L78M09CV	L78M09CP	L78M09CDT-TR	L78M09CDT-1 <sup>(1)</sup>	9 V
L78M10	L78M10CV	L78M10CP	L78M10CDT-TR	L78M10CDT-1 <sup>(1)</sup>	10 V
L78M12	L78M12CV	L78M12CP	L78M12CDT-TR	L78M12CDT-1	12 V
L78M15	L78M15CV	L78M15CP	L78M15CDT-TR	L78M15CDT-1	15 V
L78M18	L78M18CV	L78M18CP <sup>(1)</sup>	L78M18CDT-TR	L78M18CDT-1 <sup>(1)</sup>	18 V
L78M20	L78M20CV	L78M20CP <sup>(1)</sup>	L78M20CDT-TR <sup>(1)</sup>	L78M20CDT-1 <sup>(1)</sup>	20 V
L78M24	L78M24CV	L78M24CP <sup>(1)</sup>	L78M24CDT-TR	L78M24CDT-1 <sup>(1)</sup>	24 V

1. Available on request

## 8 Revision history

Table 16. Revision history

Date	Revision	Changes
21-Jun-2004	6	Document updating.
30-Aug-2006	7	Order Codes has been updated and new template.
29-Nov-2006	8	DPAK mechanical data has been updated and add footprint data.

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