

Features

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

Description

The L78MxxC 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, 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.

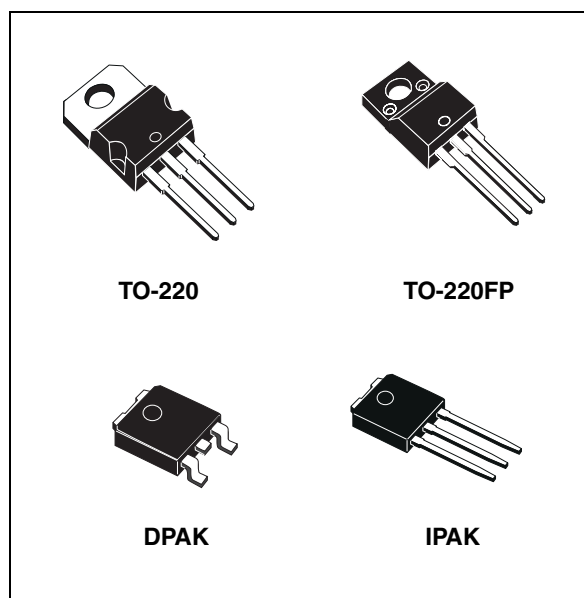


Table 1. Device summary

Part numbers	Order codes					Output voltages
	TO-220	TO-220 ⁽¹⁾	TO-220FP	DPAK	IPAK	
L78M05C	L78M05CV	L78M05CV-DG	L78M05CP	L78M05CDT-TR	L78M05CDT-1	5 V
L78M06C				L78M06CDT-TR	L78M06CDT-1 ⁽²⁾	6 V
L78M08C	L78M08CV	L78M08CV-DG		L78M08CDT-TR	L78M08CDT-1 ⁽²⁾	8 V
L78M09C	L78M09CV	L78M09CV-DG		L78M09CDT-TR	L78M09CDT-1 ⁽²⁾	9 V
L78M12C	L78M12CV	L78M12CV-DG		L78M12CDT-TR		12 V
L78M15C	L78M15CV	L78M15CV-DG		L78M15CDT-TR		15 V
L78M24C	L78M24CV	L78M24CV-DG	L78M24CP ⁽²⁾	L78M24CDT-TR	L78M24CDT-1 ⁽²⁾	24 V

1. TO-220 Dual Gauge frame

2. Available on request

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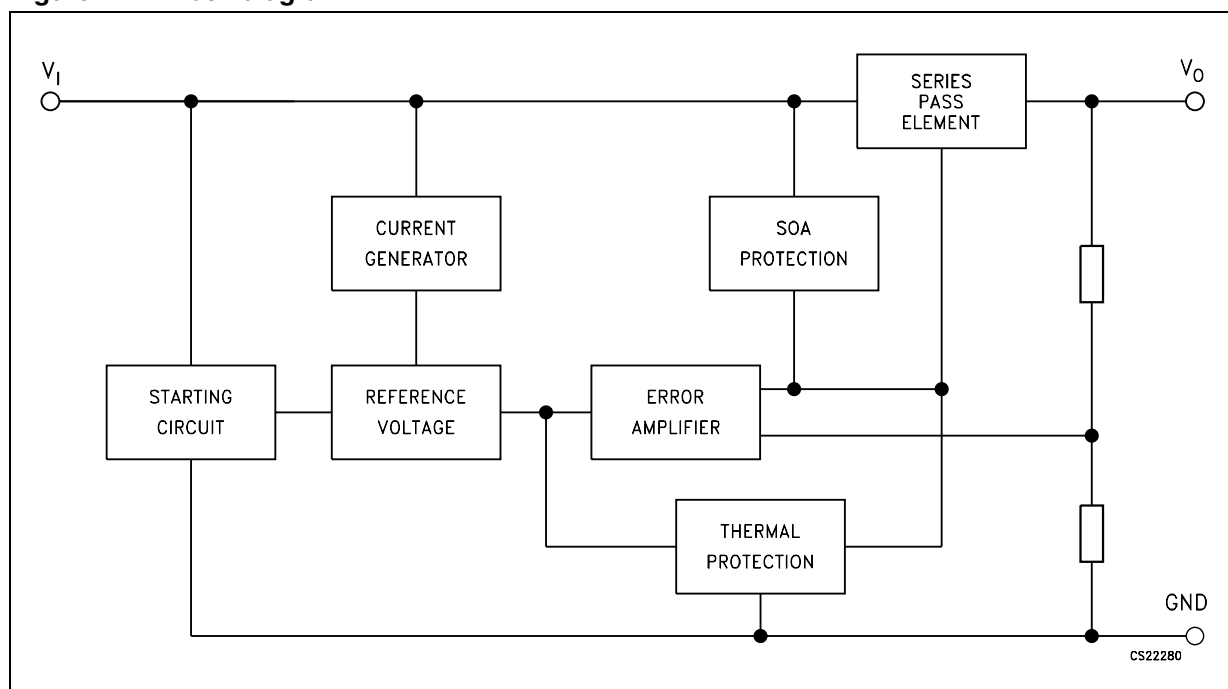
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1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)

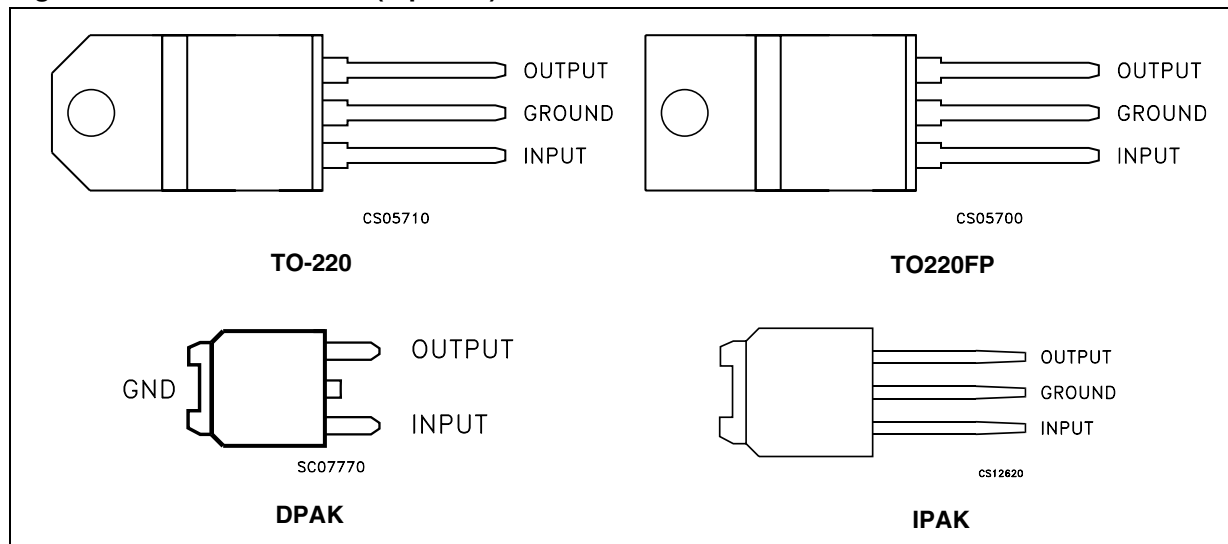
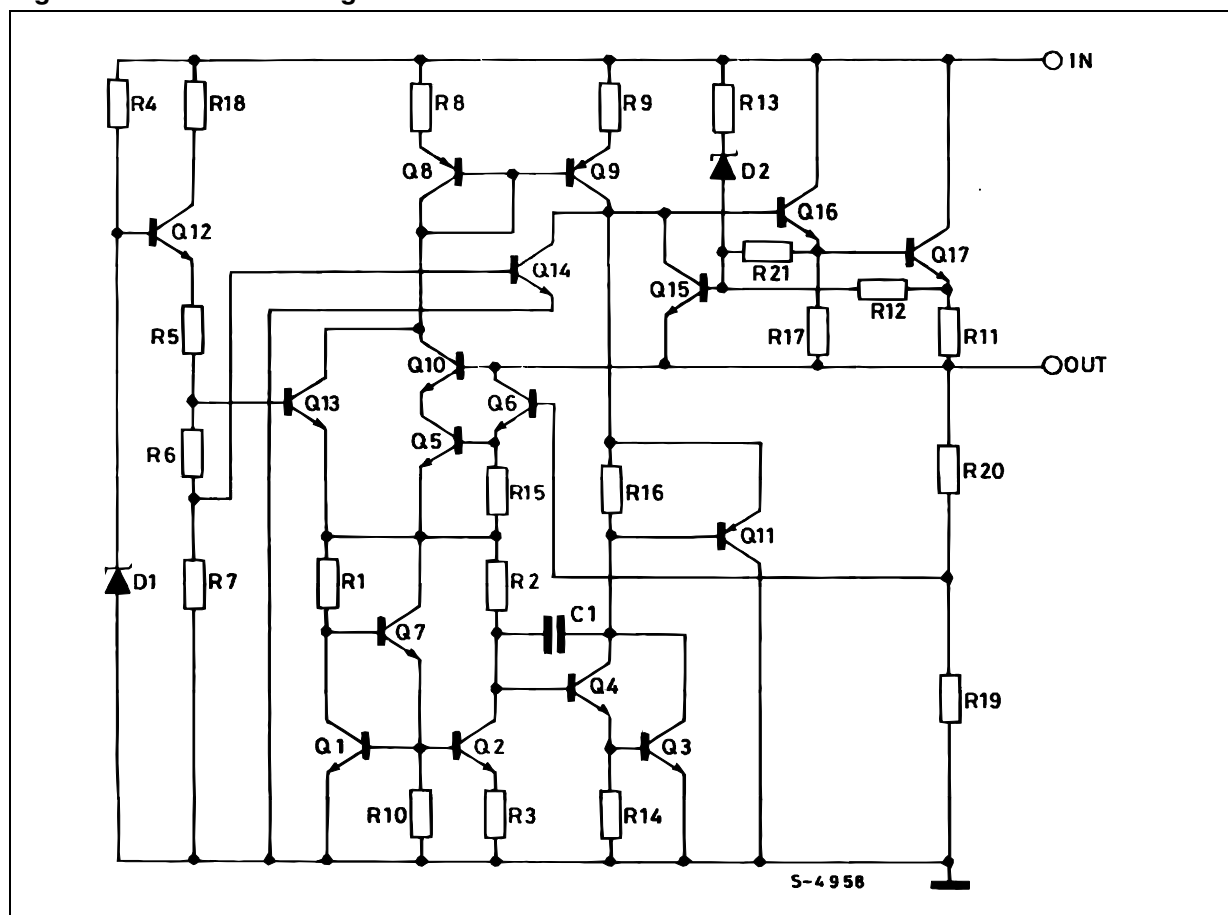


Figure 3. Schematic diagram



3 Maximum ratings

Table 2. Absolute maximum ratings

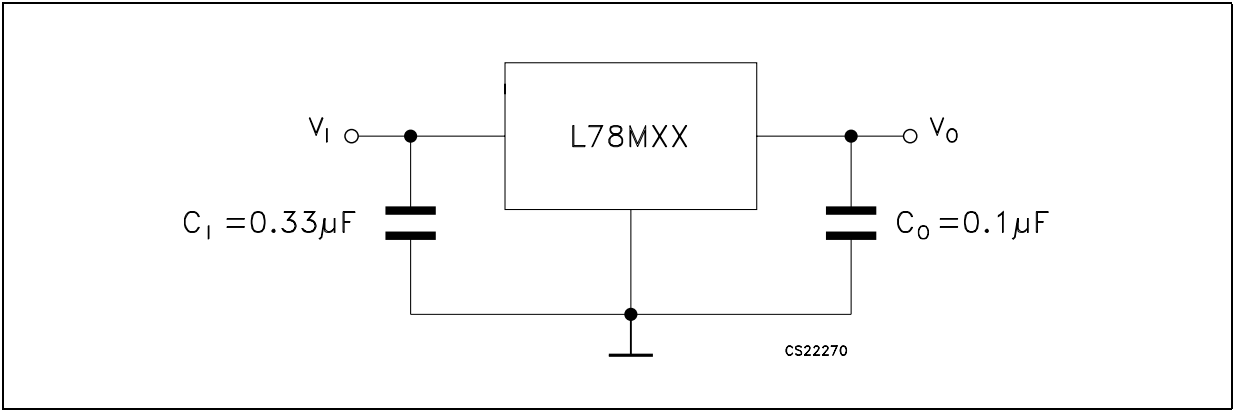
Symbol	Parameter		Value	Unit
V_I	DC input voltage	for $V_O = 5$ to 18 V	35	V
		for $V_O = 20, 24$ V	40	
I_O	Output current		Internally limited	mA
P_D	Power dissipation		Internally limited	mW
T_{STG}	Storage temperature range		- 65 to 150	°C
T_{OP}	Operating junction temperature range		0 to 150	°C

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

Table 3. Thermal data

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

Figure 4. Application circuit



4 Test circuits

Figure 5. DC parameter

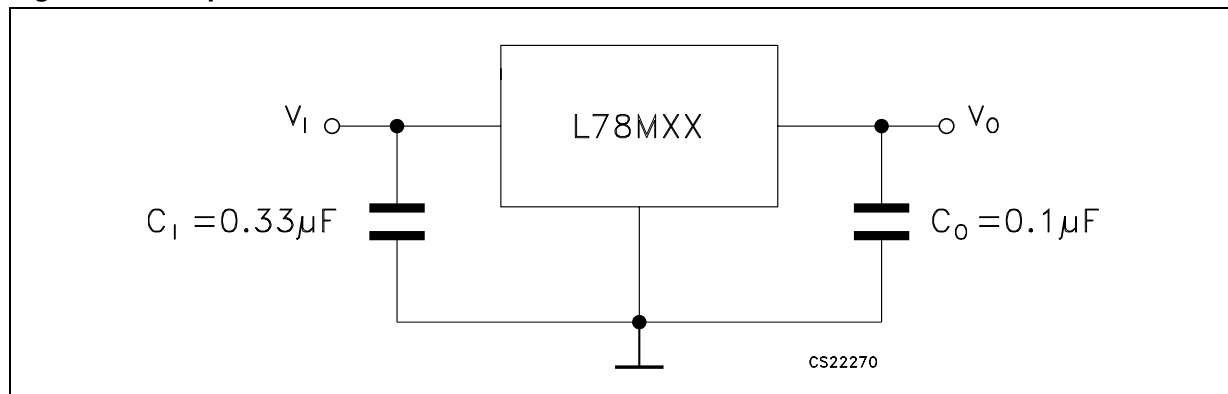


Figure 6. Load regulation

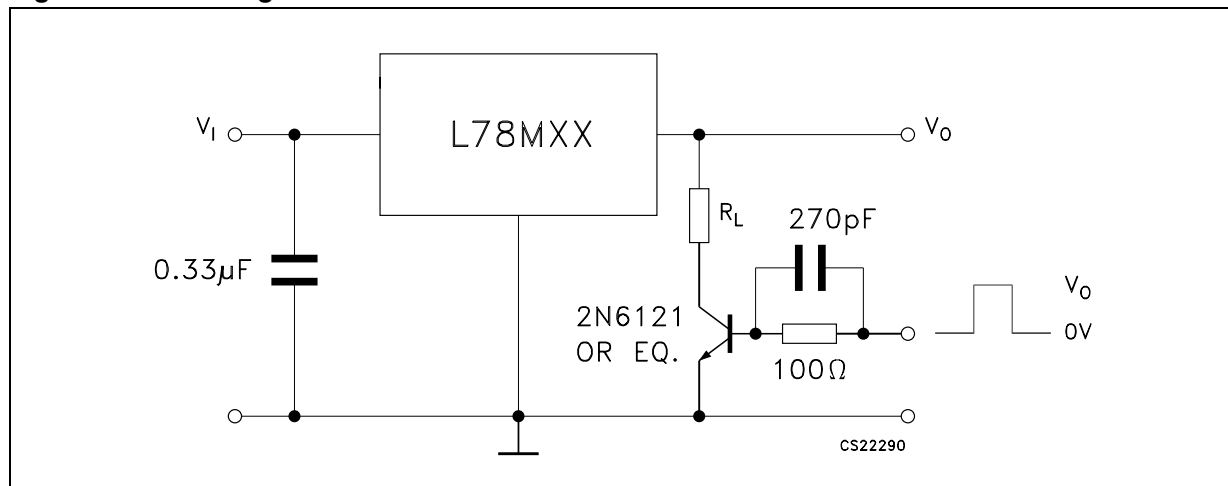
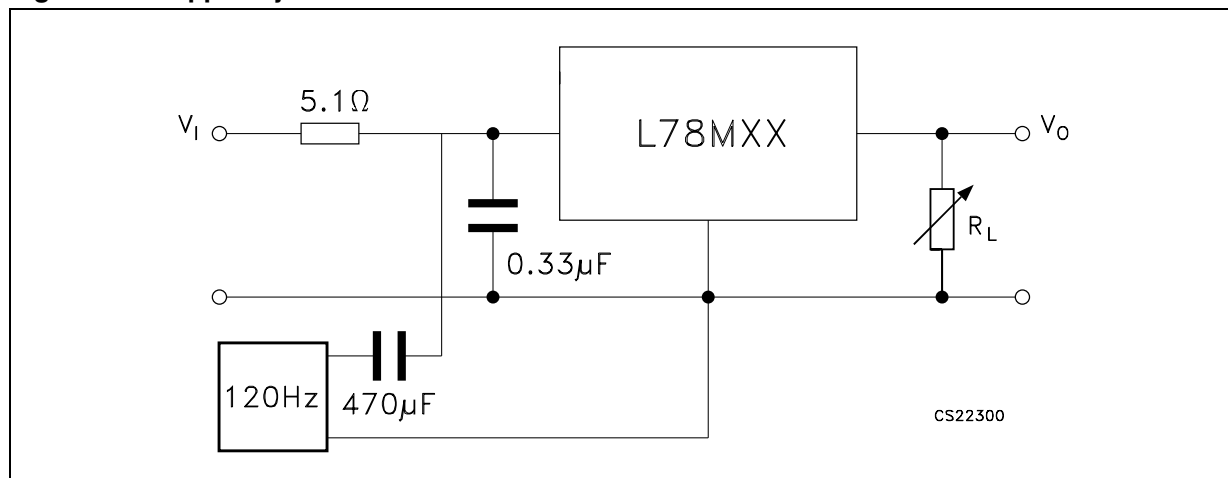


Figure 7. Ripple rejection



5 Electrical characteristics

Refer to the test circuits, $T_J = 25\text{ °C}$, $V_I = 10\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 4. 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 7\text{ to }20\text{ V}$	4.75	5	5.25	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ °C}$			100	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ °C}$			50	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ °C}$		-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		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		300		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 11\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 8\text{ to }21\text{ V}$	5.7	6	6.3	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			120	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			60	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-0.5		mV/ $^{\circ}\text{C}$
SVR	Supply voltage rejection	$V_I = 9\text{ to }19\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$	59			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$		45		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		270		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 14\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 6. 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 10.5\text{ to }23\text{ V}$	7.6	8	8.4	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			160	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			80	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-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		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		250		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 15\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 7. 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 11.5\text{ to }24\text{ V}$	8.55	9	9.45	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			180	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			90	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-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		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		250		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 19\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 8. 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 14.5\text{ to }27\text{ V}$	11.4	12	12.6	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			240	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			120	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-1		mV/ $^{\circ}\text{C}$
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		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		240		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 23\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 9. 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	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 17.5\text{ to }30\text{ V}$	14.25	15	15.75	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			300	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			150	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-1		mV/ $^{\circ}\text{C}$
SVR	Supply voltage rejection	$V_I = 18.5\text{ to }28.5\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$	54			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$		90		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		240		mA

Refer to the test circuits, $T_J = 25\text{ }^{\circ}\text{C}$, $V_I = 23\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$ unless otherwise specified.

Table 10. Electrical characteristics of L78M24C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage		23	24	25	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 27\text{ to }38\text{ V}$	22.8	24	25.2	V
ΔV_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	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			480	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$			240	
I_d	Quiescent current				6	mA
ΔI_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	$I_O = 5\text{ mA}$, $T_J = 0\text{ to }125\text{ }^{\circ}\text{C}$		-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		μV
V_d	Dropout voltage			2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$		240		mA

6 Typical performance

Figure 8. Dropout voltage vs. junction temp.

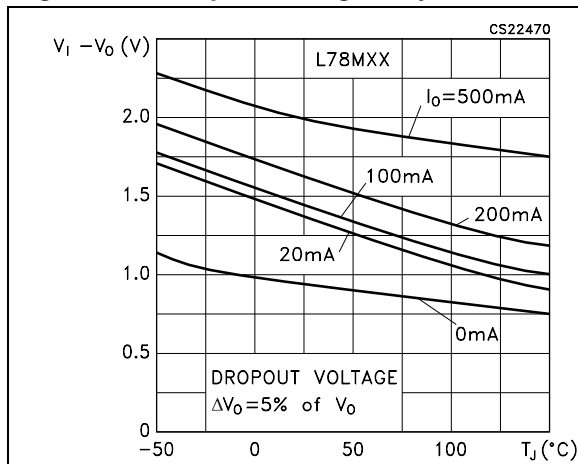


Figure 9. Dropout characteristics

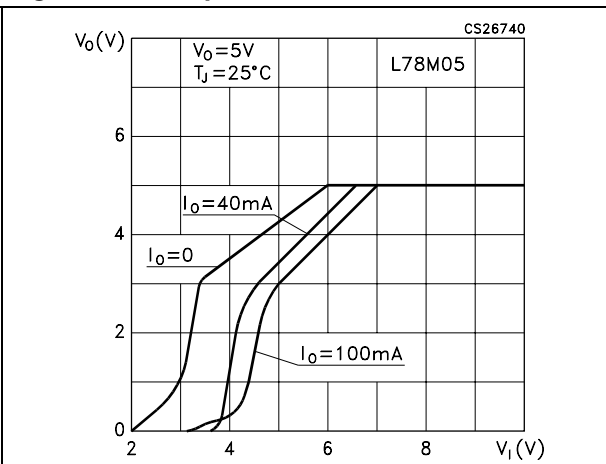


Figure 10. Peak output current vs. input-output differential voltage

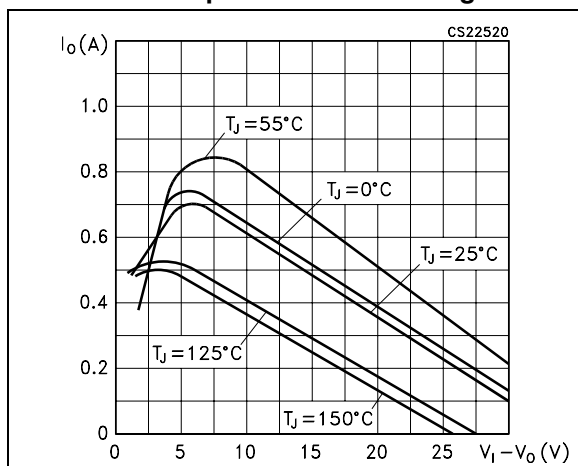


Figure 11. Output voltage vs. junction temperature

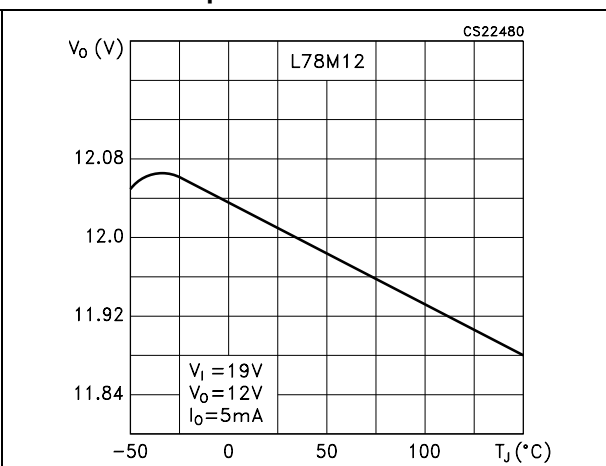


Figure 12. Supply voltage rejection vs. frequency

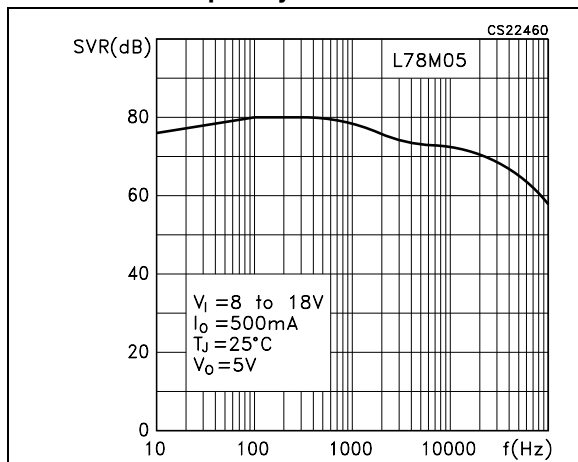


Figure 13. Quiescent current vs. junction temperature

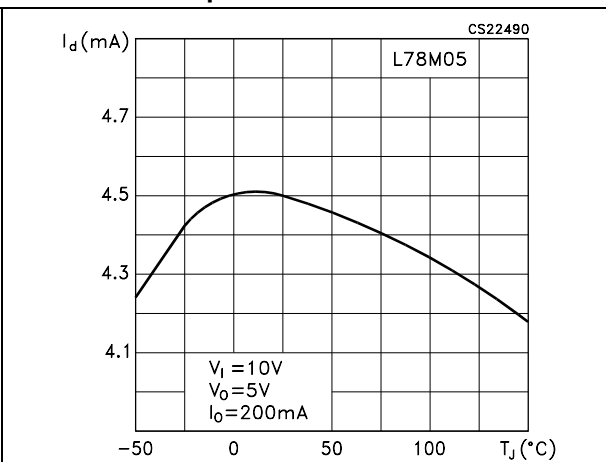


Figure 14. Load transient response

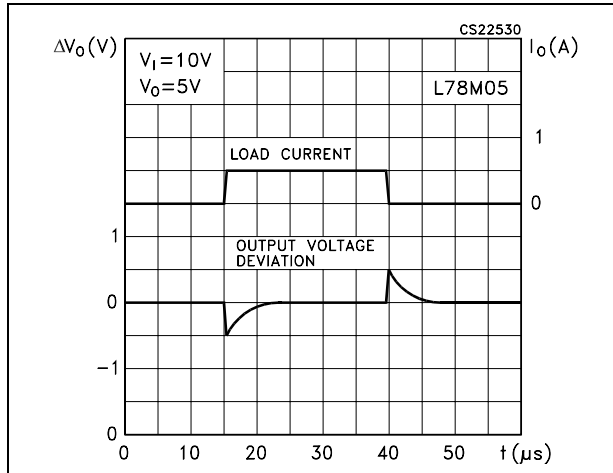


Figure 15. Line transient response

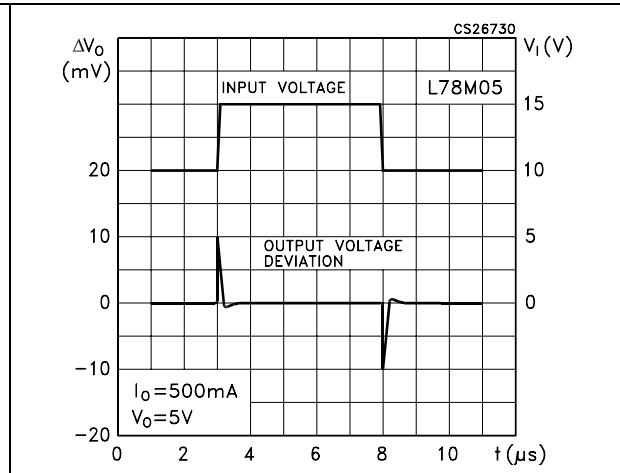


Figure 16. Quiescent current vs. input voltage

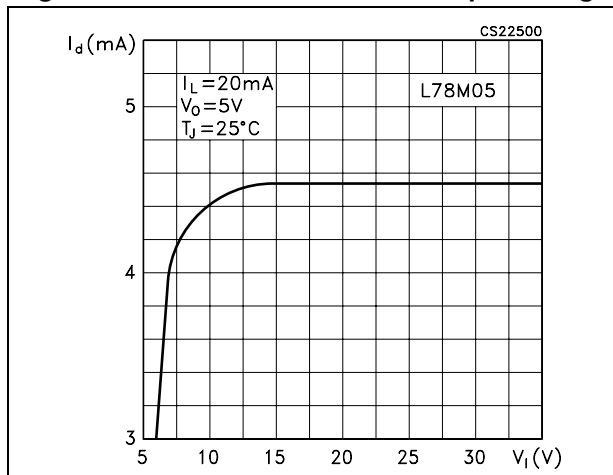
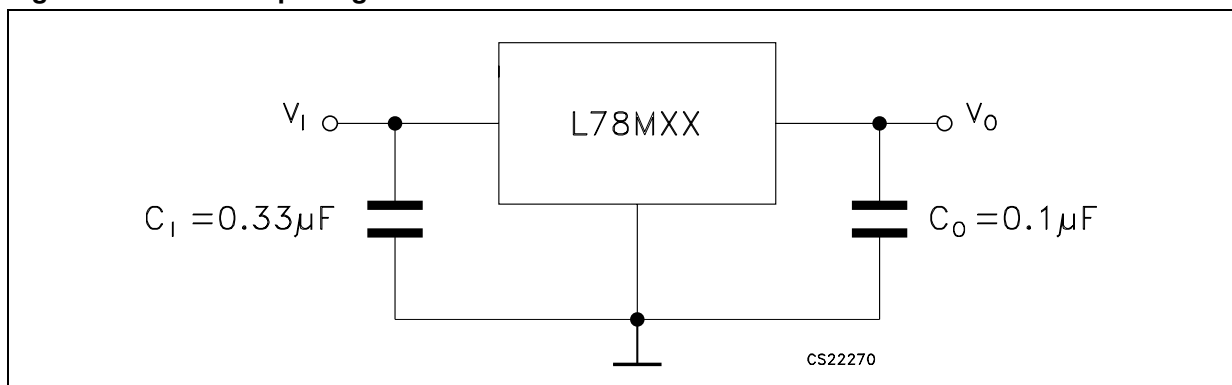


Figure 17. Fixed output regulator



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

Figure 18. Constant current regulator

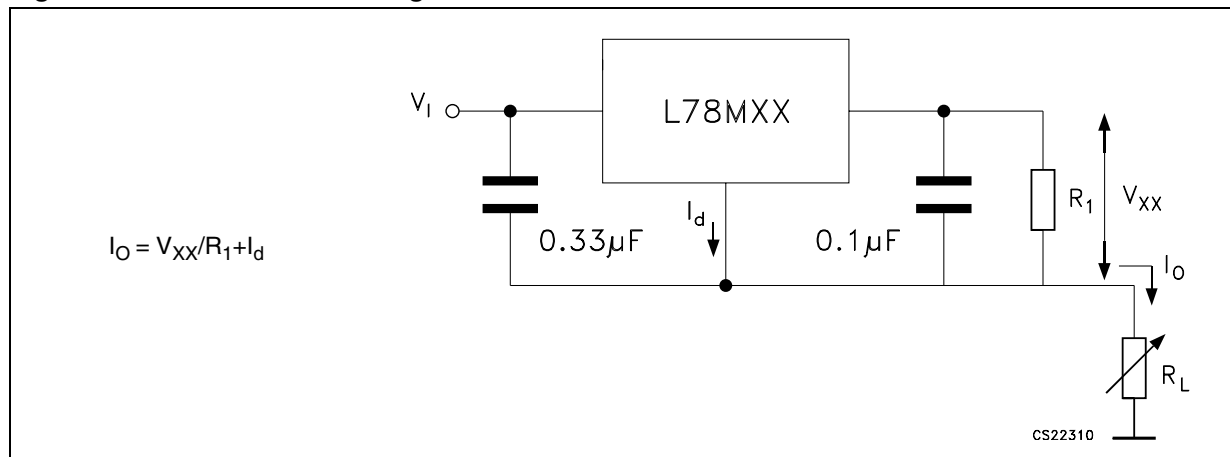


Figure 19. Circuit for increasing output voltage

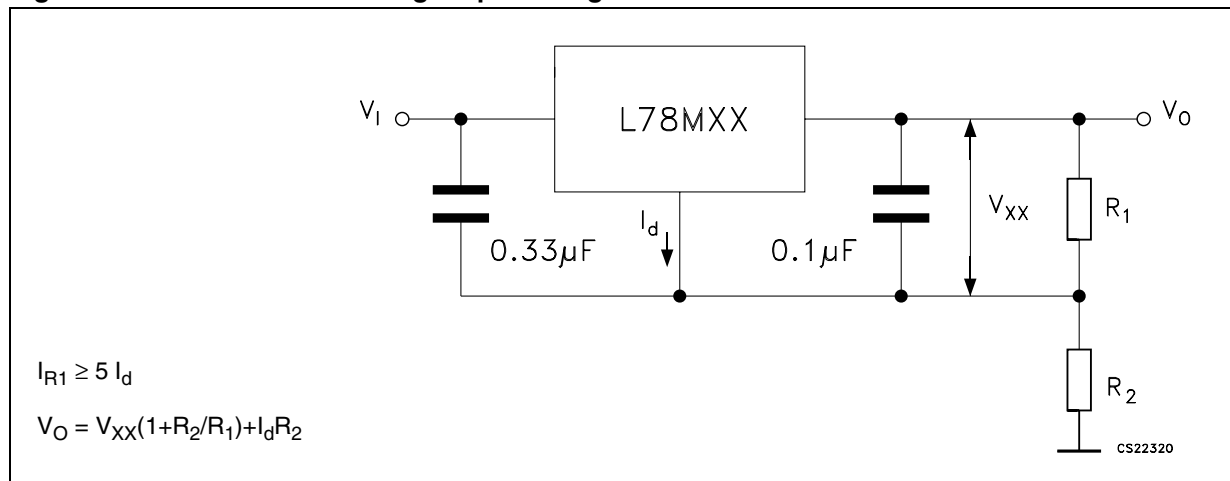


Figure 20. Adjustable output regulator (7 to 30 V)

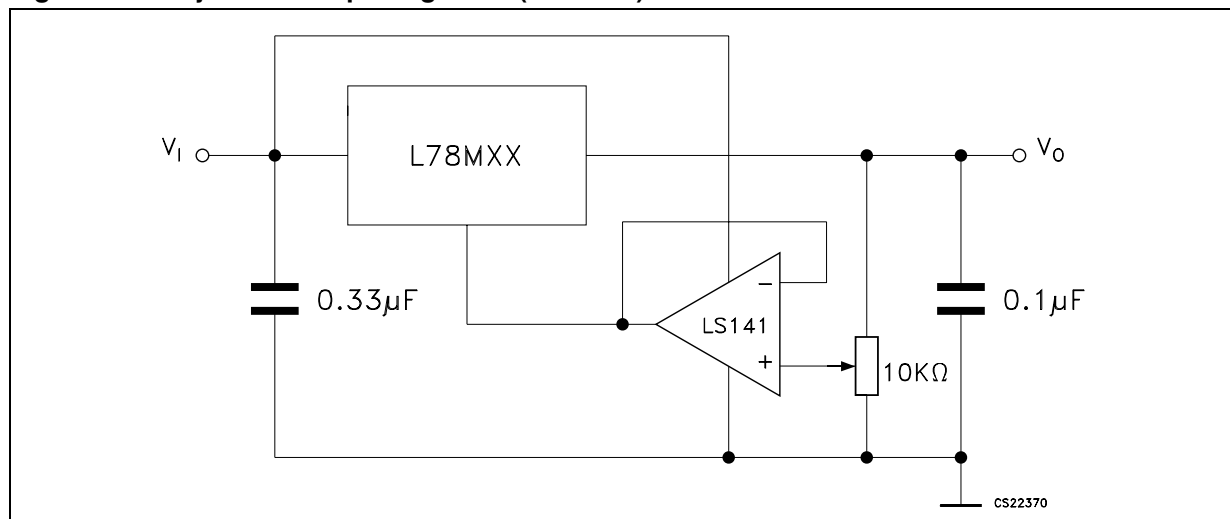


Figure 21. 0.5 to 10 V regulator

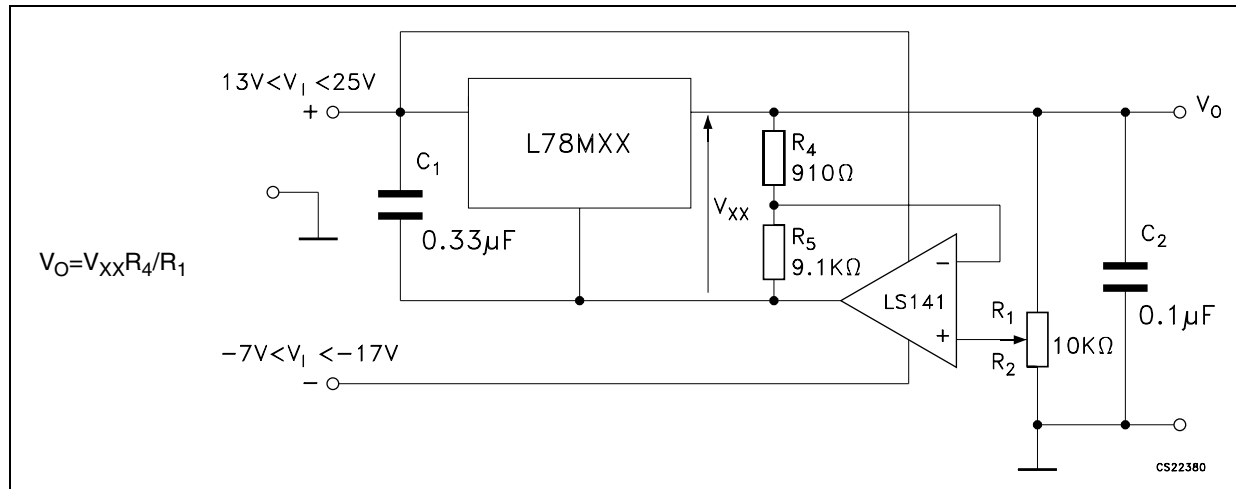


Figure 22. High current voltage regulator

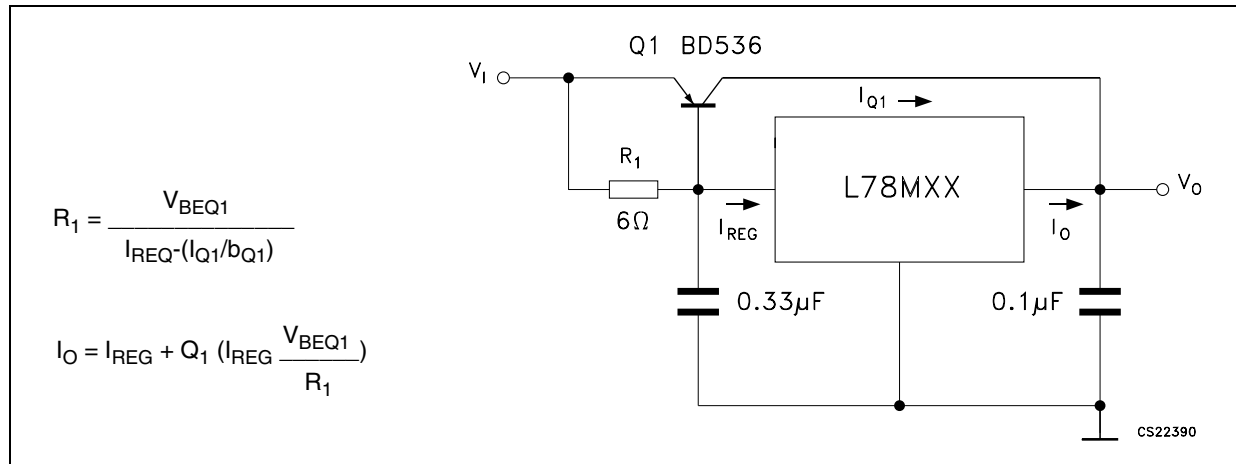


Figure 23. High output current with short circuit protection

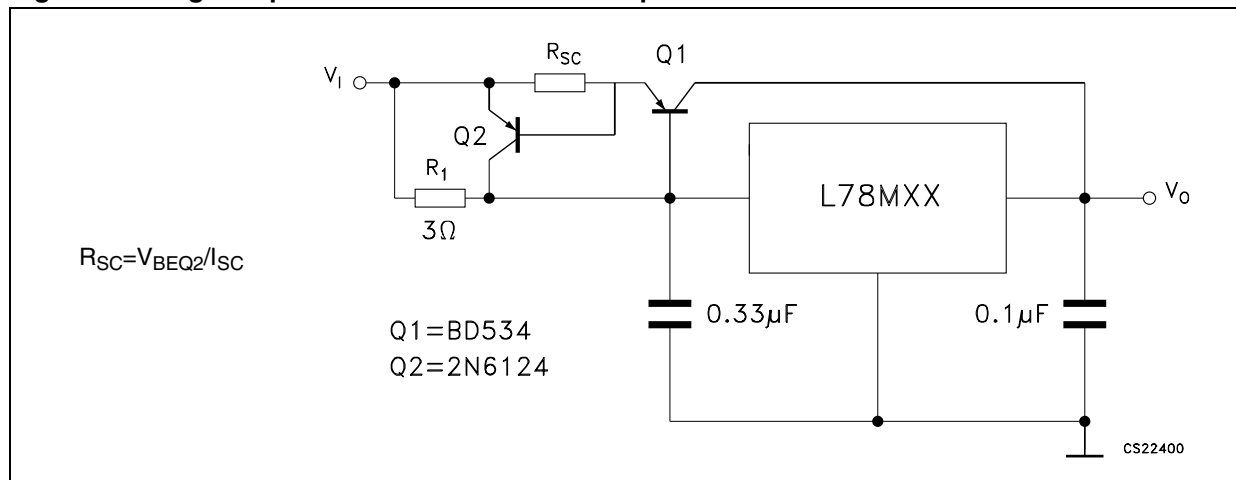


Figure 24. Tracking voltage regulator

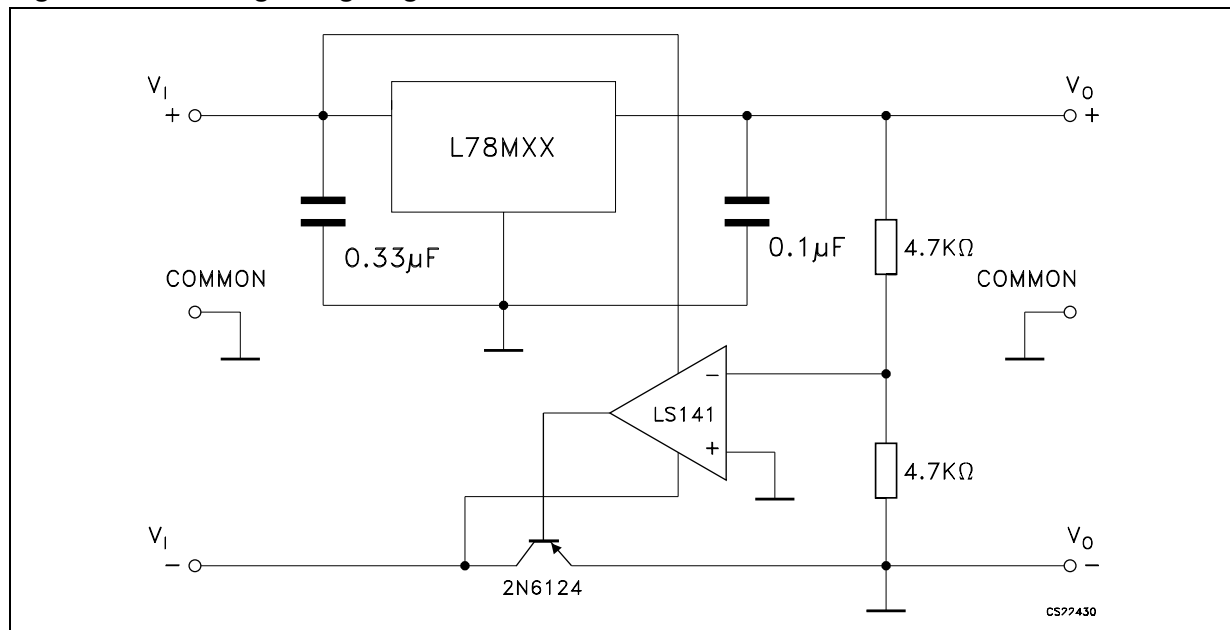


Figure 25. High input voltage circuit

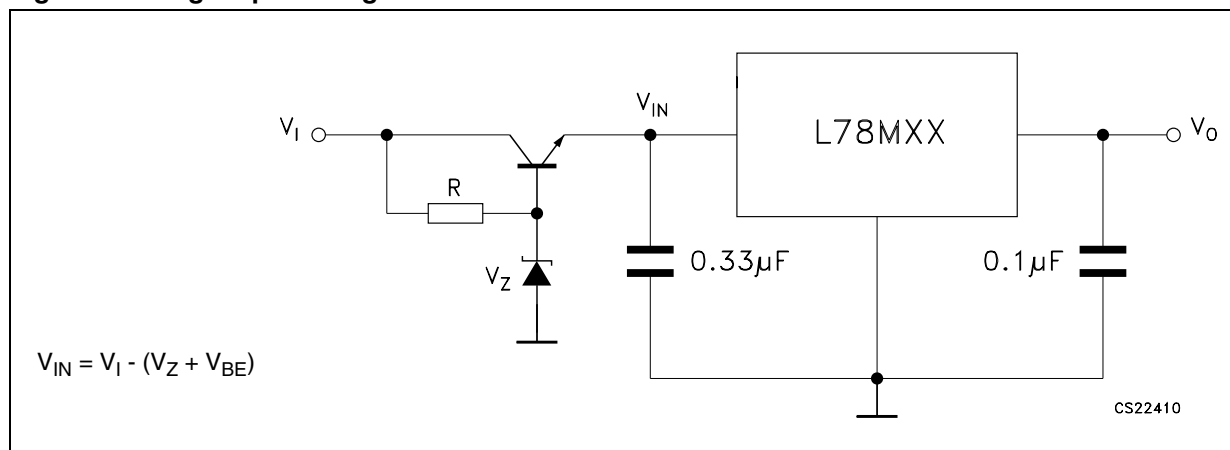


Figure 26. Reducing power dissipation with dropping resistor

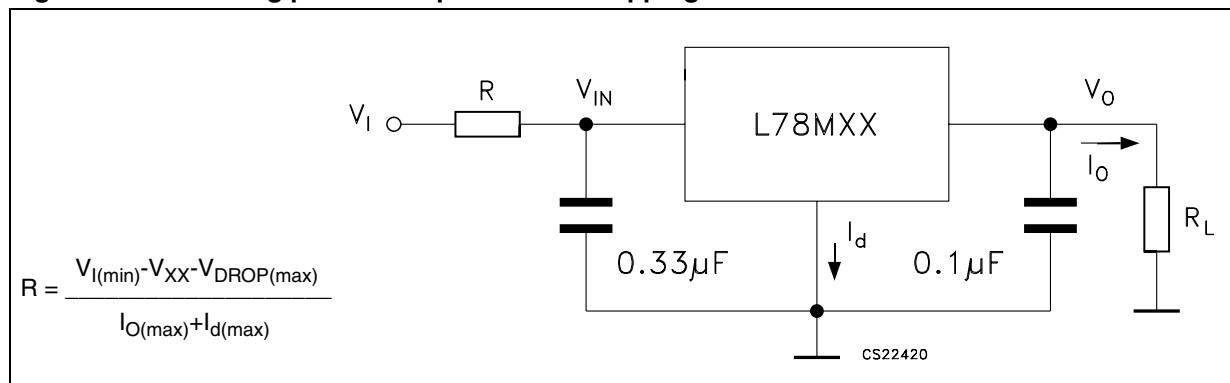
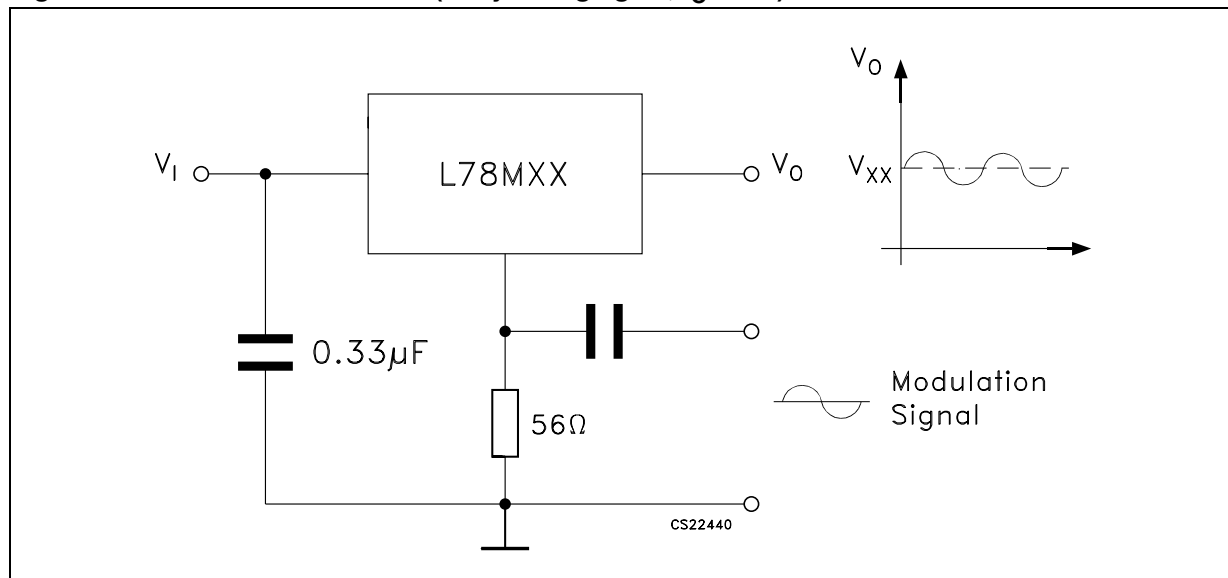
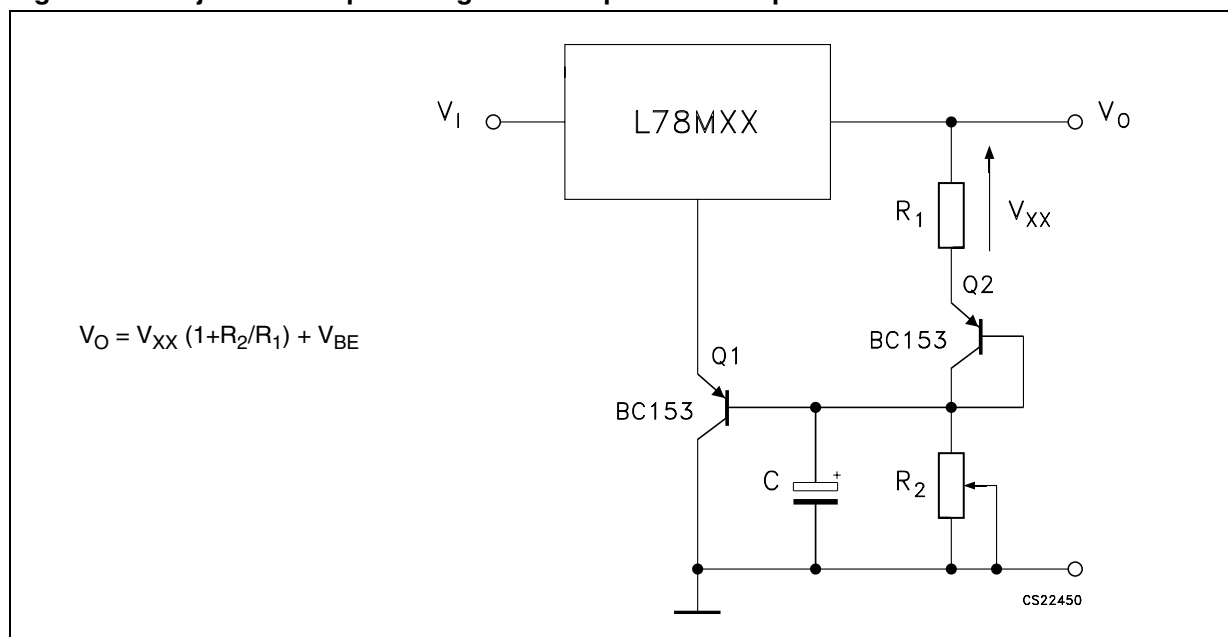


Figure 27. Power AM modulator (unity voltage gain, $I_O \leq 0.5$)

Note: The circuit performs well up to 100 kHz.

Figure 28. Adjustable output voltage with temperature compensation

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

7 Package mechanical data

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

Table 11. TO-220 mechanical data

Dim.	Type STD - ST Dual Gauge			Type STD - ST Single Gauge		
	mm.			mm.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	4.40		4.60
b	0.61		0.88	0.61		0.88
b1	1.14		1.70	1.14		1.70
c	0.48		0.70	0.48		0.70
D	15.25		15.75	15.25		15.75
D1		1.27				
E	10.00		10.40	10.00		10.40
e	2.40		2.70	2.40		2.70
e1	4.95		5.15	4.95		5.15
F	1.23		1.32	0.51		0.60
H1	6.20		6.60	6.20		6.60
J1	2.40		2.72	2.40		2.72
L	13.00		14.00	13.00		14.00
L1	3.50		3.93	3.50		3.93
L20		16.40			16.40	
L30		28.90			28.90	
ØP	3.75		3.85	3.75		3.85
Q	2.65		2.95	2.65		2.95

In spite of some difference in tolerances, the packages are compatible.

TYPE "A"
STD-ST

"GATE"
Notes 1-2

ϕP

E

Q

$L20$

$L30$

$L1$

L

$b1(X3)$

1 2 3

e

$b(X3)$

$e1$

"GATE"
Notes 1-2

A

F

$H1$

D

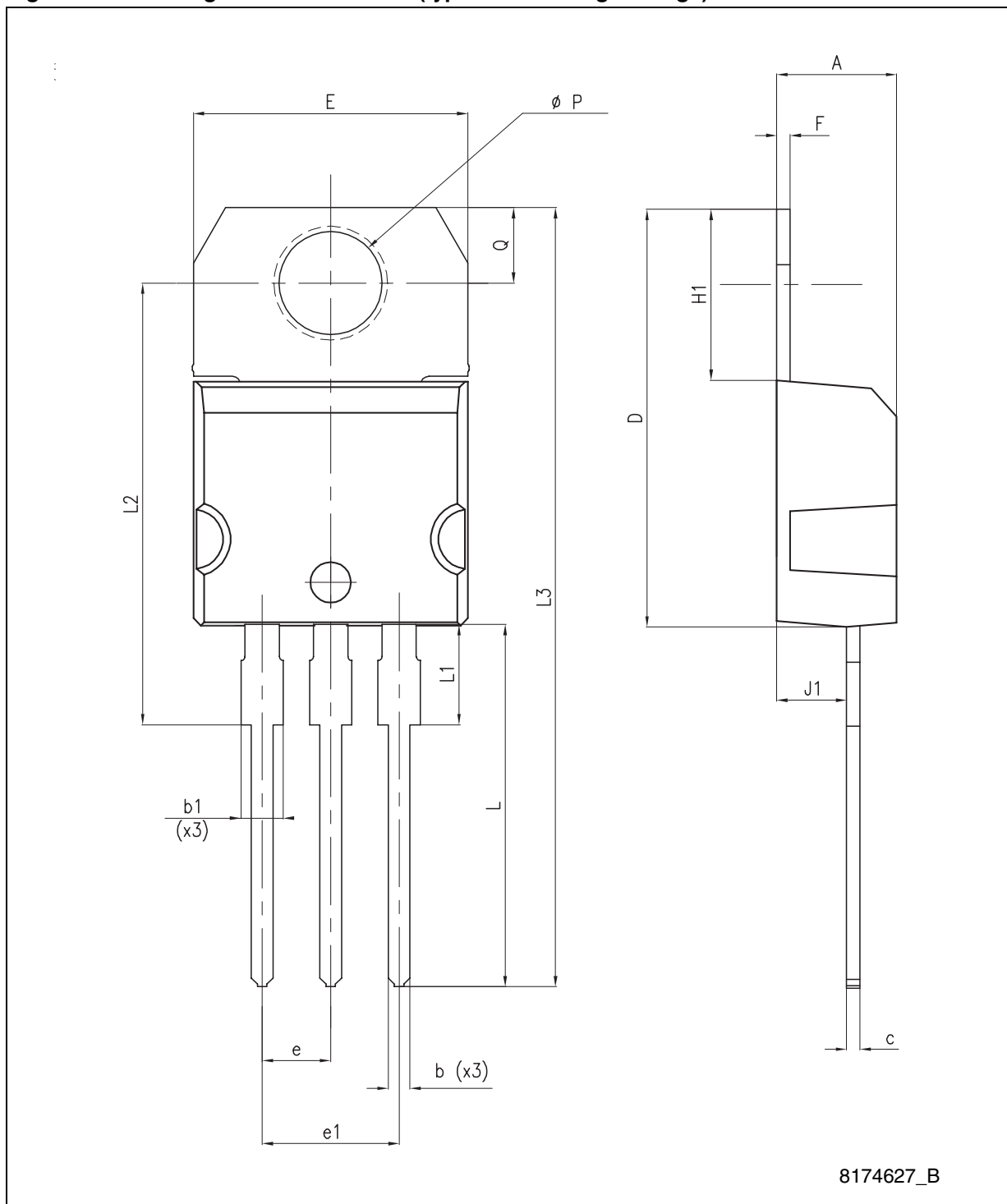
$D1$

$J1$

c

0015988_S

Figure 30. Drawing dimension TO-220 (type STD-ST Single Gauge)



SECTION A-A

Technical drawing of a mechanical part showing three views: a cross-section (SECTION A-A), a side view, and a front view. The drawing includes dimensions and feature callouts.

Dimensions:

- Cross-section (SECTION A-A):**
 - Overall width: 31.4 ± 0.2 (5)
 - Top flange width: 5.5 (8)
 - Top flange thickness: 16.3 ± 0.2 (7)
 - Top flange hole diameter: $\phi 5.9 \pm 0.1$ (4)
 - Top flange hole position: 3.1 ± 0.05 (6)
 - Bottom flange width: 2.2 (2)
 - Bottom flange thickness: 0.75 ± 0.1 (1)
 - Bottom flange hole diameter: $\phi 3.1$ (3)
 - Bottom flange hole position: 4.4 (3)
- Side View:**
 - Overall length: 532 ± 0.5 (11)
 - Top flange thickness: 7 ± 0.2 (9)
 - Bottom flange thickness: 7 ± 0.2 (10)
 - Bottom flange hole diameter: 6.5 ± 0.2 (12)
 - Bottom flange hole position: 6.5 ± 0.2 (13)
- Front View:**
 - Overall width: 113 (15)
 - Top flange width: 10 (17)
 - Top flange thickness: 2 (18)
 - Top flange hole diameter: 94 (16)
 - Top flange hole position: 56 (14)
 - Top flange hole diameter: 56 (14)

Feature Callouts:

- MARKING SIDE:** Indicated by an arrow pointing to the top flange.
- PRINTING AREA - SEE SPEC. DOC. Nr. 0062566**
- PRINT HEIGHT "A" = 3mm.**

Technical drawing of a mechanical part, showing three views: a cross-section (Section A-A), a side view, and a top view.

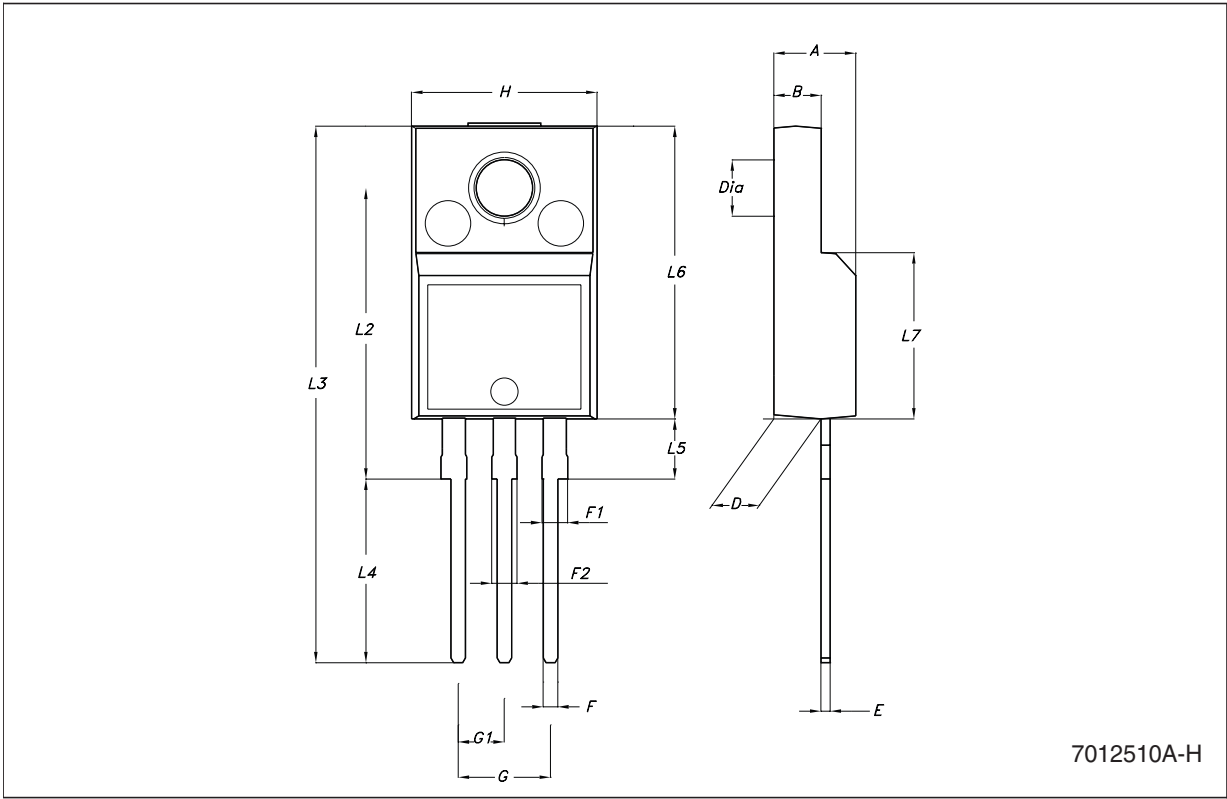
Section A-A (Left View): Shows a cross-section of the part. Dimensions include a total width of 5.0 ± 0.2 , a total height of 31.4 ± 0.2 , a central hole diameter of 16.2 ± 0.15 , a distance of 4.4 from the bottom edge to the center of the hole, a distance of 0.75 ± 0.1 from the left edge to the center of the hole, and a distance of 2.2 ± 0.2 from the right edge to the center of the hole.

Side View (Top): Shows the side profile of the part. Dimensions include a total length of 10.0 , a thickness of 2.0 , and a break symbol indicating the part continues.

Top View (Bottom): Shows the top surface of the part. Dimensions include a total length of 532 ± 0.5 , a distance of 7 ± 0.2 from the left edge to the center of the first hole, a distance of 16.0 between the centers of the first two holes, a distance of 6.5 ± 0.2 from the left edge to the center of the third hole, a distance of 6.5 ± 0.2 from the right edge to the center of the fourth hole, a distance of 6.0 between the centers of the third and fourth holes, and a distance of 7 ± 0.2 from the bottom edge to the center of the third hole. The part is marked with a break symbol. The marking side is indicated by an arrow pointing to the left edge. The part is labeled "INSERTED PIN" and "A" at the right end.

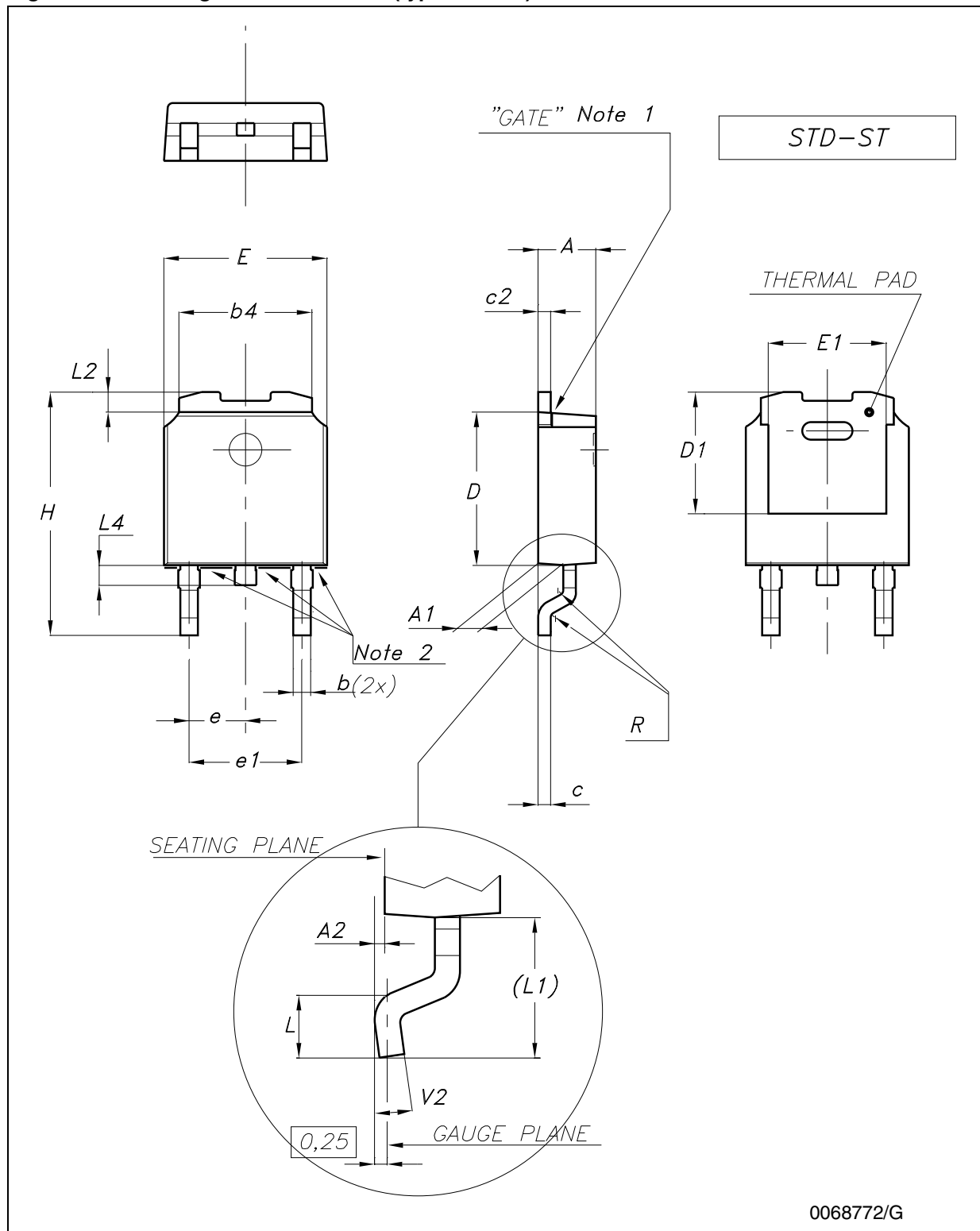
TO-220FP mechanical data

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



7012510A-H

Figure 33. Drawing dimension DPAK (type STD-ST)



Note: 1 Max resin gate protrusion: 0.5 mm.

2 Max resin protrusion: 0.25 mm.

Figure 34. Drawing dimension DPAK (type FUJITSU-subcon.)

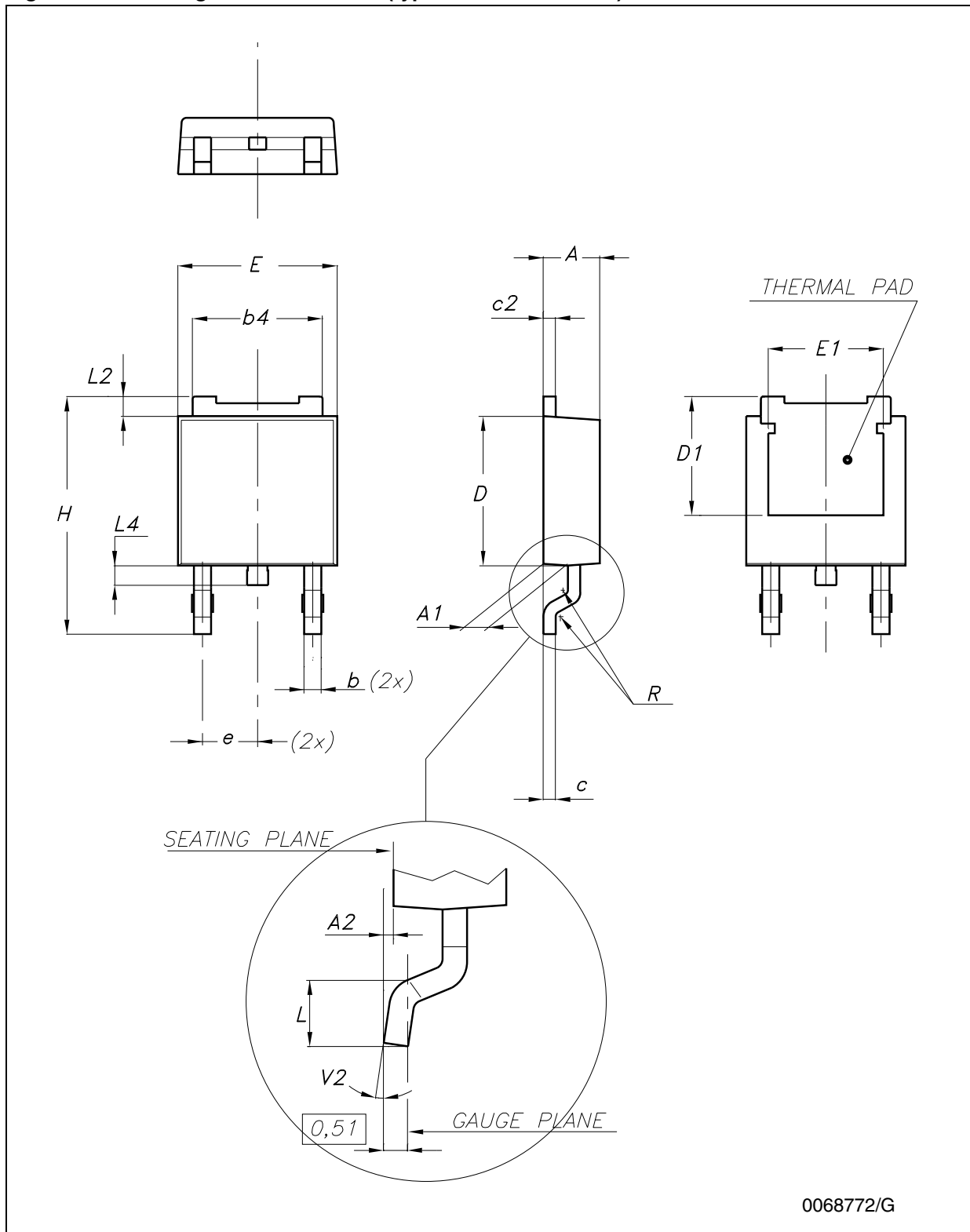


Figure 35. Drawing dimension DPAK (type IDS-subcon.)

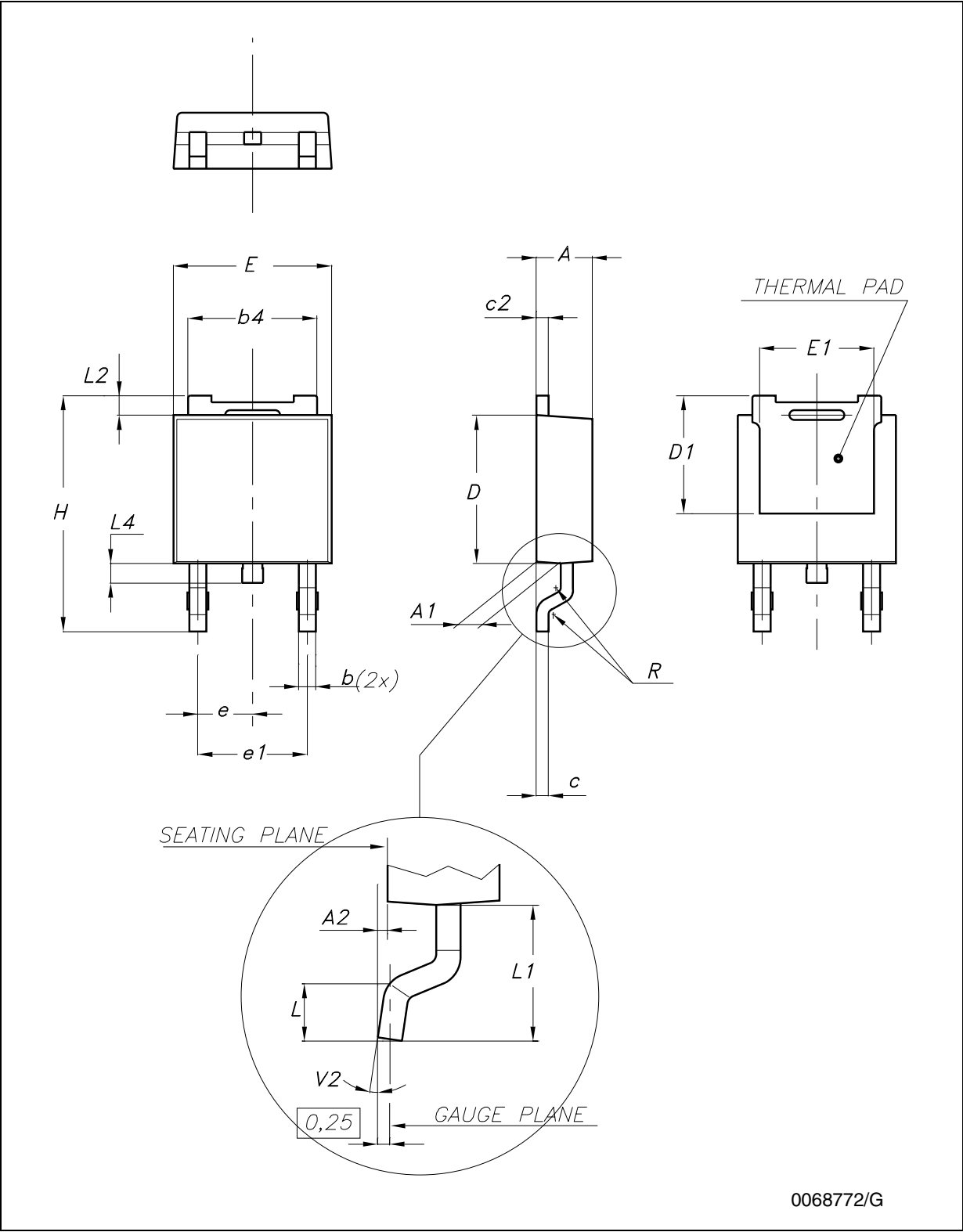


Table 12. DPAK mechanical data

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 36. DPAK footprint recommended data

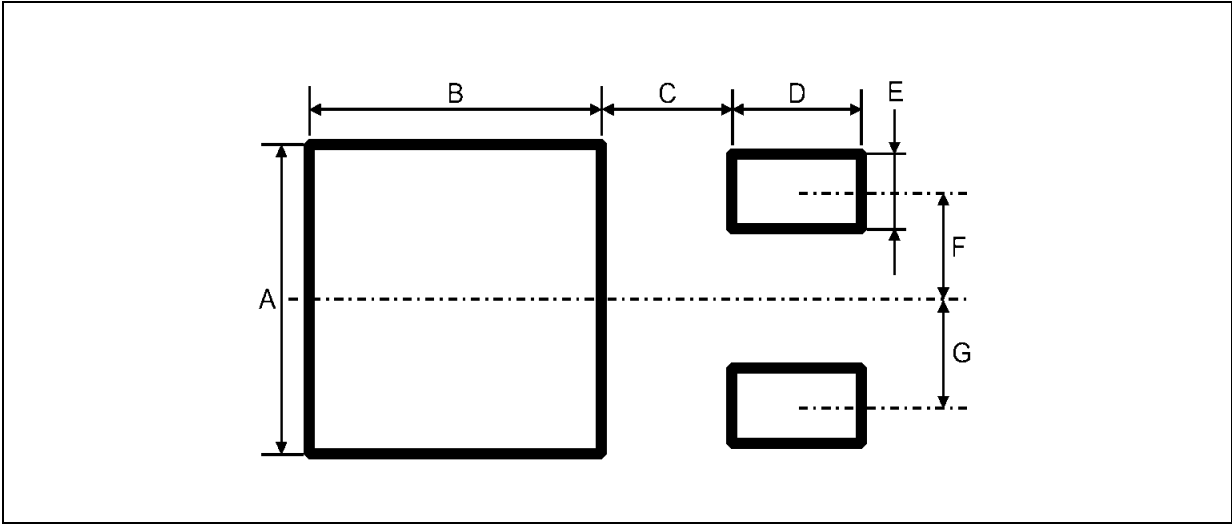
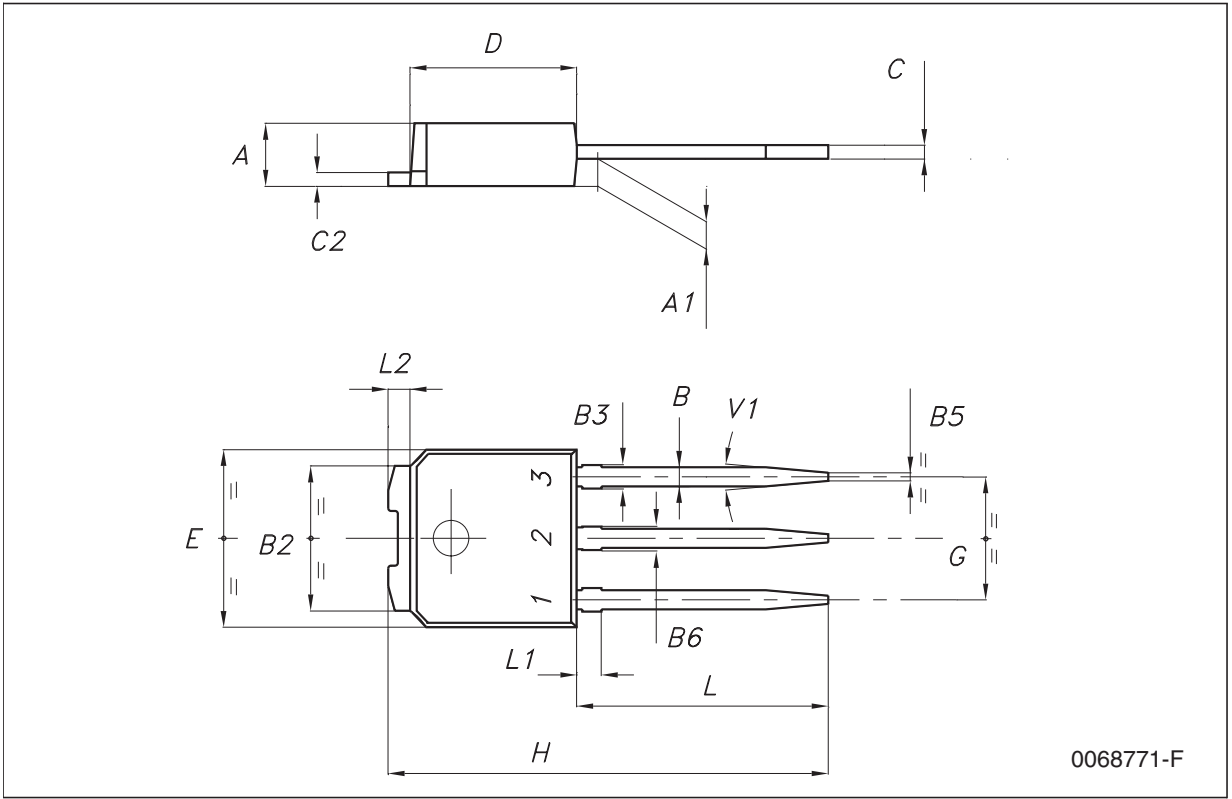


Table 13. Footprint data

Values		
Dim.	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

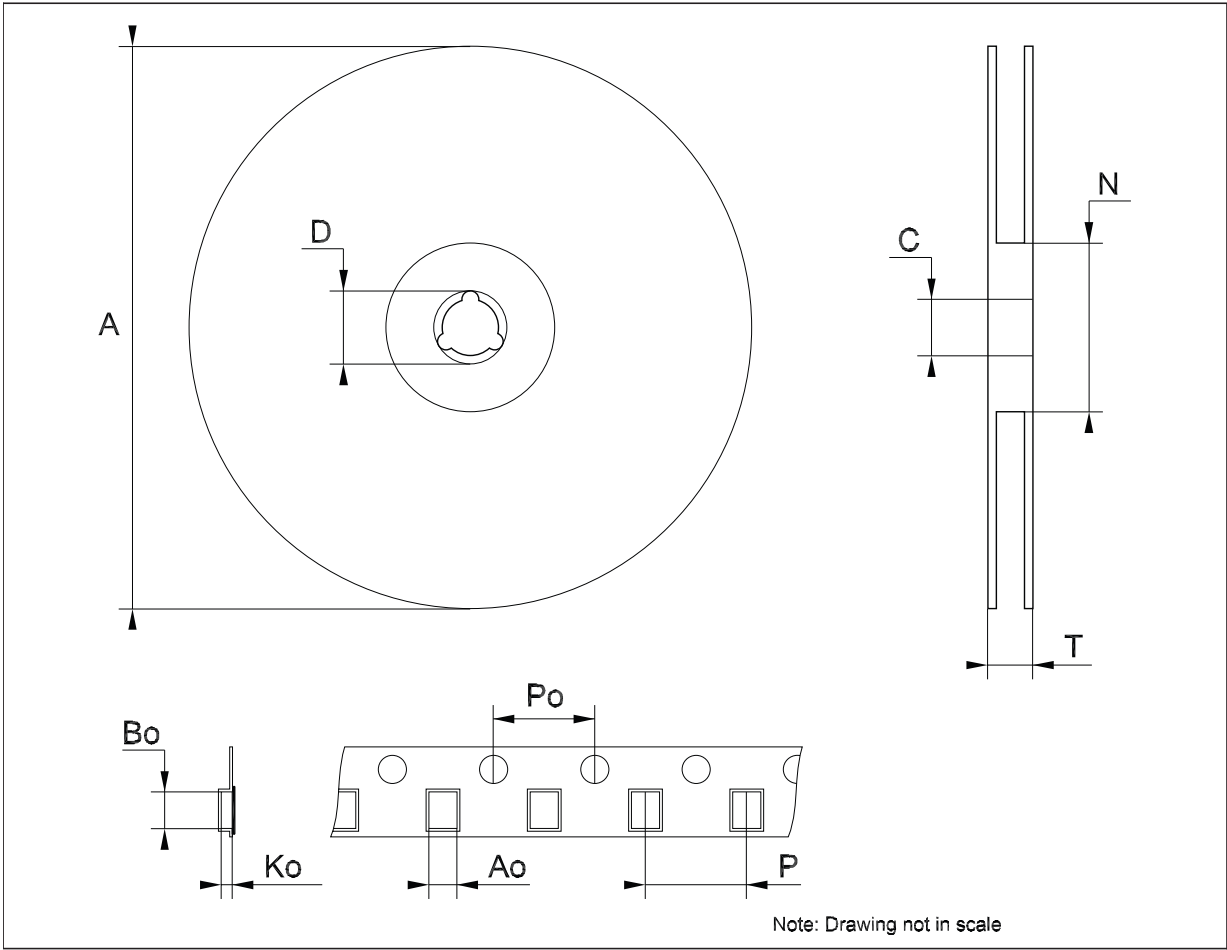
IPAK mechanical data

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



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



8 Revision history

Table 14. 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 1 .
19-Feb-2008	11	Modified: Table 1 on page 1 .
15-Jul-2008	12	Modified: Table 1 on page 1 and Table 14 on page 29 .
07-Apr-2009	13	Modified: Figure 9 on page 11 and Figure 15 on page 12 .
14-Jun-2010	14	Added: Table 11 on page 17 , Figure 29 on page 18 , Figure 30 on page 19 , Figure 31 and Figure 32 on page 20 .
11-Nov-2010	15	Modified: R_{thJC} value for TO-220 Table 3 on page 5 .
08-Feb-2012	16	Added: order codes L78M05CV-DG, L78M12CV-DG and L78M15CV-DG Table 1 on page 1 .
09-Mar-2012	17	Added: order codes L78M08CV-DG and L78M09CV-DG Table 1 on page 1 .
15-May-2012	18	Added: order codes L78M24CV-DG Table 1 on page 1 .

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