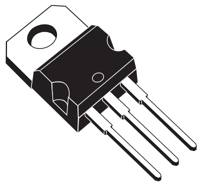
LM117
LM217, LM317

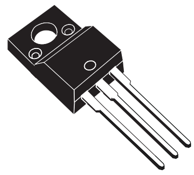
1.2 V to 37 V adjustable voltage regulators

Features

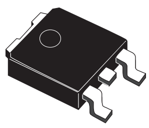
- Output voltage range: 1.2 to 37 V
- Output current in excess of 1.5 A
- 0.1 % line and load regulation
- Floating operation for high voltages
- Complete series of protections: current limiting, thermal shutdown and SOA control



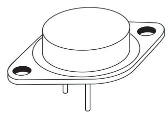
TO-220



TO-220FP



D²PAK



TO-3

Description

The LM117, LM217, LM317 are monolithic integrated circuits in TO-220, TO-220FP, TO-3 and D²PAK packages intended for use as positive adjustable voltage regulators. They are designed to supply more than 1.5 A of load current with an output voltage adjustable over a 1.2 to 37 V range. The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.

Table 1. Device summary

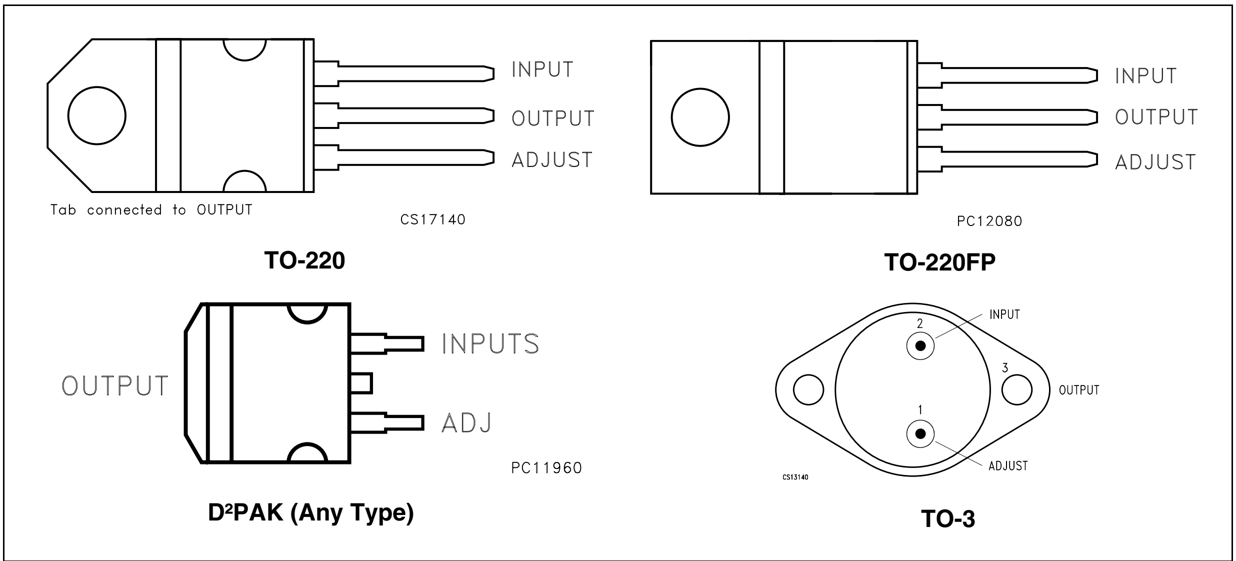
Order codes				
TO-220		**D²PAK (tape and reel)**	**TO-220FP**	**TO-3**
				LM117K
LM217T	LM217T-DG [(1)]	LM217D2T-TR		LM217K
LM317T	LM317T-DG [(1)]	LM317D2T-TR	LM317P	LM317K

1. TO-220 Dual Gauge frame.

Contents

1 Pin configuration

Figure 1. Pin connections (top view)



2 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_I - V_O	Input-reference differential voltage		40	V
I_O	Output current		Internally limited	
T_{OP}	Operating junction temperature for:	LM117	- 55 to 150	°C
		LM217	- 25 to 150	
		LM317	0 to 125	
P_D	Power dissipation		Internally limited	
T_{STG}	Storage temperature		- 65 to 150	°C

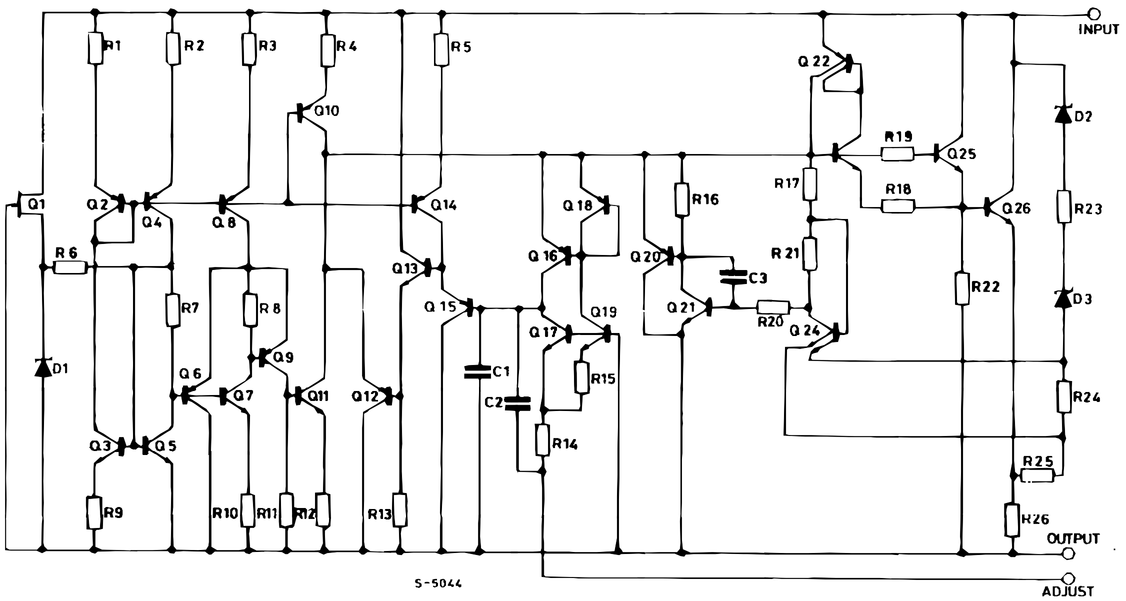
Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 3. Thermal data

Symbol	Parameter	D²PAK	TO-220	TO-220FP	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	3	5	5	4	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	50	60	35	°C/W

3 Diagram

Figure 2. Schematic diagram



4 Electrical characteristics

V_I - V_O = 5 V, I_O = 500 mA, I_{MAX} = 1.5 A and P_{MAX} = 20 W, T_J = - 55 to 150 °C for LM117, T_J = - 25 to 150 °C for LM217, unless otherwise specified.

Table 4. Electrical characteristics for LM117/LM217

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V	T_J = 25°C		0.01	0.02	%/V
					0.02	0.05	
ΔV_O	Load regulation	$V_O \leq 5$ V I_O = 10 mA to I_{MAX}	T_J = 25°C		5	15	mV
					20	50	
		$V_O \geq 5$ V, I_O = 10 mA to I_{MAX}	T_J = 25°C		0.1	0.3	%
					0.3	1	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 2.5 to 40V I_O = 10 mA to I_{MAX}			0.2	5	µA
V_{REF}	Reference voltage (between pin 3 and pin 1)	V_I - V_O = 2.5 to 40V I_O= 10 mA to I_{MAX} $P_D \leq P_{MAX}$		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				1		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	5	mA
$I_{O(max)}$	Maximum load current	V_I - $V_O \leq$ 15 V, $P_D < P_{MAX}$		1.5	2.2		A
		V_I - V_O = 40 V, $P_D < P_{MAX}$, T_J = 25°C			0.4		
eN	Output noise voltage (percentage of V_O)	B = 10Hz to 100kHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection [(1)]	T_J = 25°C, f = 120Hz	C_{ADJ}=0		65		dB
			C_{ADJ}=10µF	66	80		

1. C_{ADJ} is connected between pin 1 and ground.

V_I - V_O = 5 V, I_O = 500 mA, I_{MAX} = 1.5 A and P_{MAX} = 20 W, T_J = 0 to 125°C, unless otherwise specified.

Table 5. Electrical characteristics for LM317

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V	T_J = 25°C		0.01	0.04	%/V
					0.02	0.07	
ΔV_O	Load regulation	$V_O \leq 5$ V I_O = 10 mA to I_{MAX}	T_J = 25°C		5	25	mV
					20	70	
		$V_O \geq 5$ V, I_O = 10 mA to I_{MAX}	T_J = 25°C		0.1	0.5	%
					0.3	1.5	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 2.5 to 40V, I_O = 10 mA to 500mA			0.2	5	µA
V_{REF}	Reference voltage (between pin 3 and pin 1)	V_I - V_O = 2.5 to 40V I_O = 10 mA to 500mA $P_D \leq P_{MAX}$		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				1		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	10	mA
$I_{O(max)}$	Maximum load current	V_I - $V_O \leq 15$ V, $P_D < P_{MAX}$		1.5	2.2		A
		V_I - V_O = 40 V, $P_D < P_{MAX}$, T_J = 25°C			0.4		
eN	Output noise voltage (percentage of V_O)	B = 10Hz to 100kHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection (1)	T_J = 25°C, f = 120Hz	C_{ADJ}=0		65		dB
			C_{ADJ}=10µF	66	80		

1. C_{ADJ} is connected between pin 1 and ground.

5 Typical characteristics

Figure 3. Output current vs. input-output differential voltage

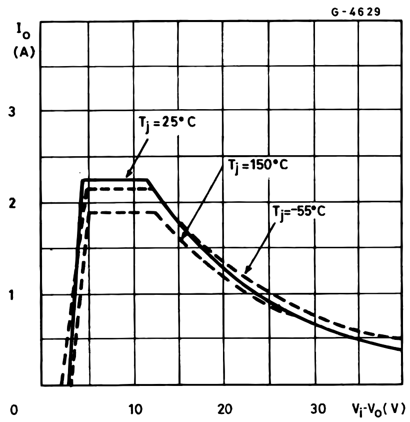


Figure 4. Dropout voltage vs. junction temperature

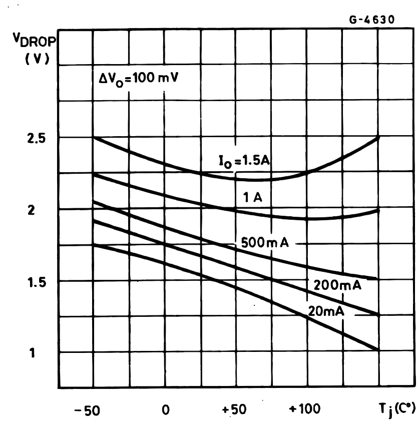


Figure 5. Reference voltage vs. junction

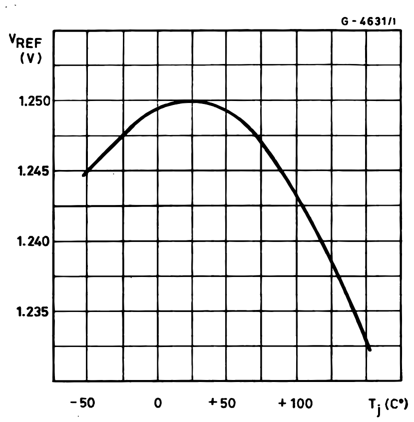
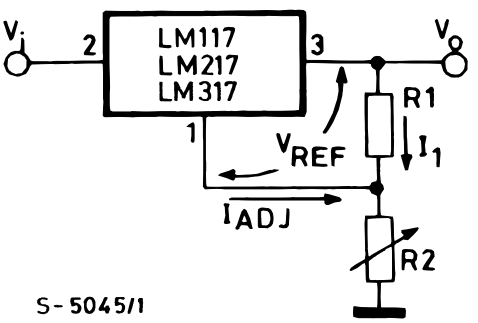


Figure 6. Basic adjustable regulator



6 Application information

The LM117, LM217, LM317 provides an internal reference voltage of 1.25 V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see *Figure 3*), giving an output voltage V_O of:

$V_O = V_{REF} (1 + R_2/R_1) + I_{ADJ} R_2$

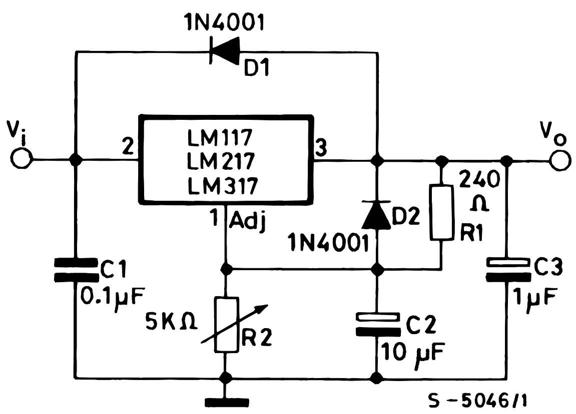
The device was designed to minimize the term I_{ADJ} (100 µA max) and to maintain it very constant with line and load changes. Usually, the error term $I_{ADJ} \times R_2$ can be neglected. To obtain the previous requirement, all the regulator quiescent current is returned to the output terminal, imposing a minimum load current condition. If the load is insufficient, the output voltage will rise. Since the LM117, LM217, LM317 is a floating regulator and "sees" only the input-to-output differential voltage, supplies of very high voltage with respect to ground can be regulated as long as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulator are easily obtainable and, by connecting a fixed resistor between the adjustment and output, the device can be used as a precision current regulator. In order to optimize the load regulation, the current set resistor R_1 (see *Figure 3*) should be tied as close as possible to the regulator, while the ground terminal of R_2 should be near the ground of the load to provide remote ground sensing. Performance may be improved with added capacitance as follow:

An input bypass capacitor of 0.1 µF

An adjustment terminal to ground 10 µF capacitor to improve the ripple rejection of about 15 dB (CADJ).

An 1 µF tantalum (or 25 µF Aluminium electrolytic) capacitor on the output to improve transient response. In additional to external capacitors, it is good practice to add protection diodes, as shown in *Figure 4* D1 protect the device against input short circuit, while D2 protect against output short circuit for capacitance discharging.

Figure 7. Voltage regulator with protection diodes



Note: D1 protect the device against input short circuit, while D2 protects against output short circuit for capacitors discharging.

Figure 8. Slow turn-on 15 V regulator

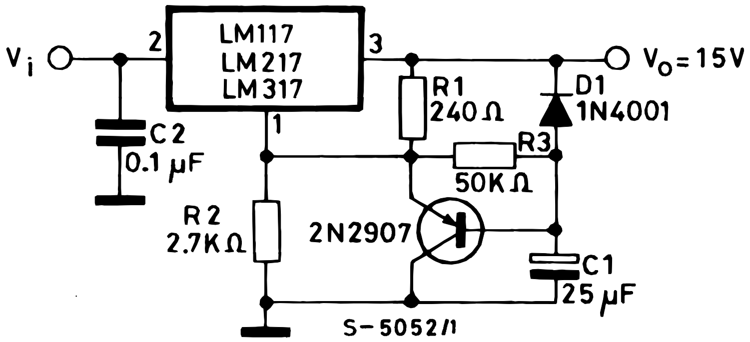
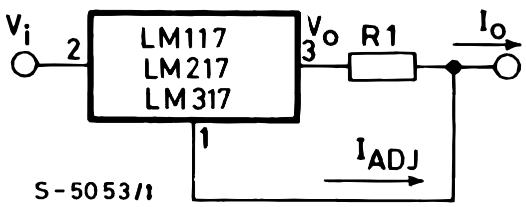


Figure 9. Current regulator



$I_O = (V_{REF} / R_1) + I_{ADJ} = 1.25\ V / R_1$

Figure 10. 5 V electronic shut-down regulator

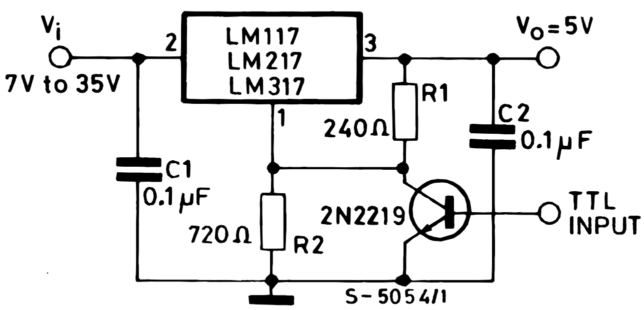
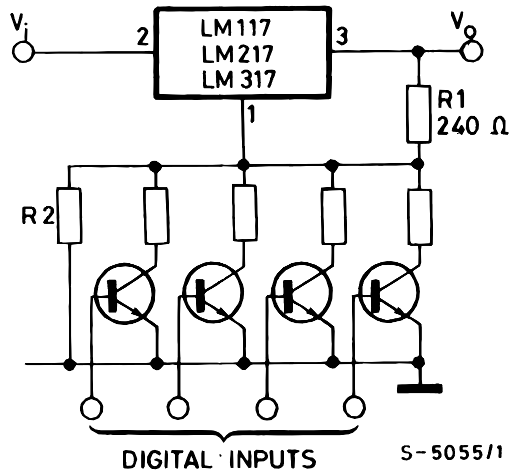
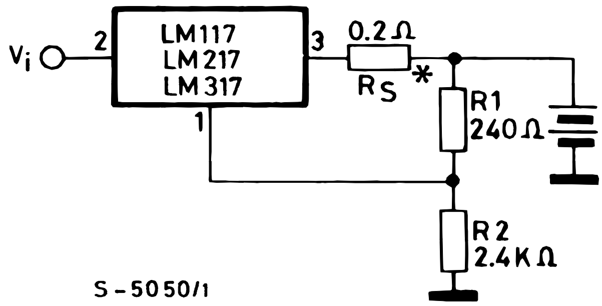


Figure 11. Digitally selected outputs



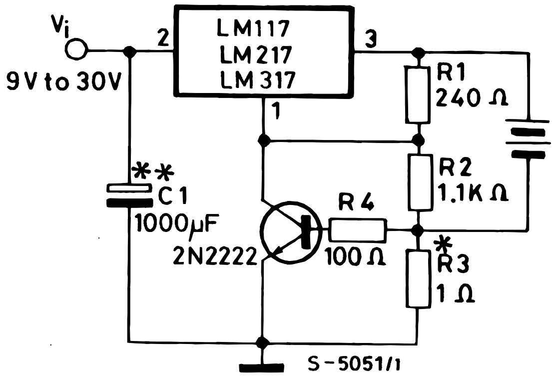
(R_2 sets maximum V_O)

Figure 12. Battery charger (12 V)



* R_S sets output impedance of charger $Z_O = R_S$ $(1 + R_2/R_1)$. Use of R_S allows low charging rates whit fully charged battery.

Figure 13. Current limited 6 V charger



* R3 sets peak current (0.6 A for 1 0).

** C1 recommended to filter out input transients.

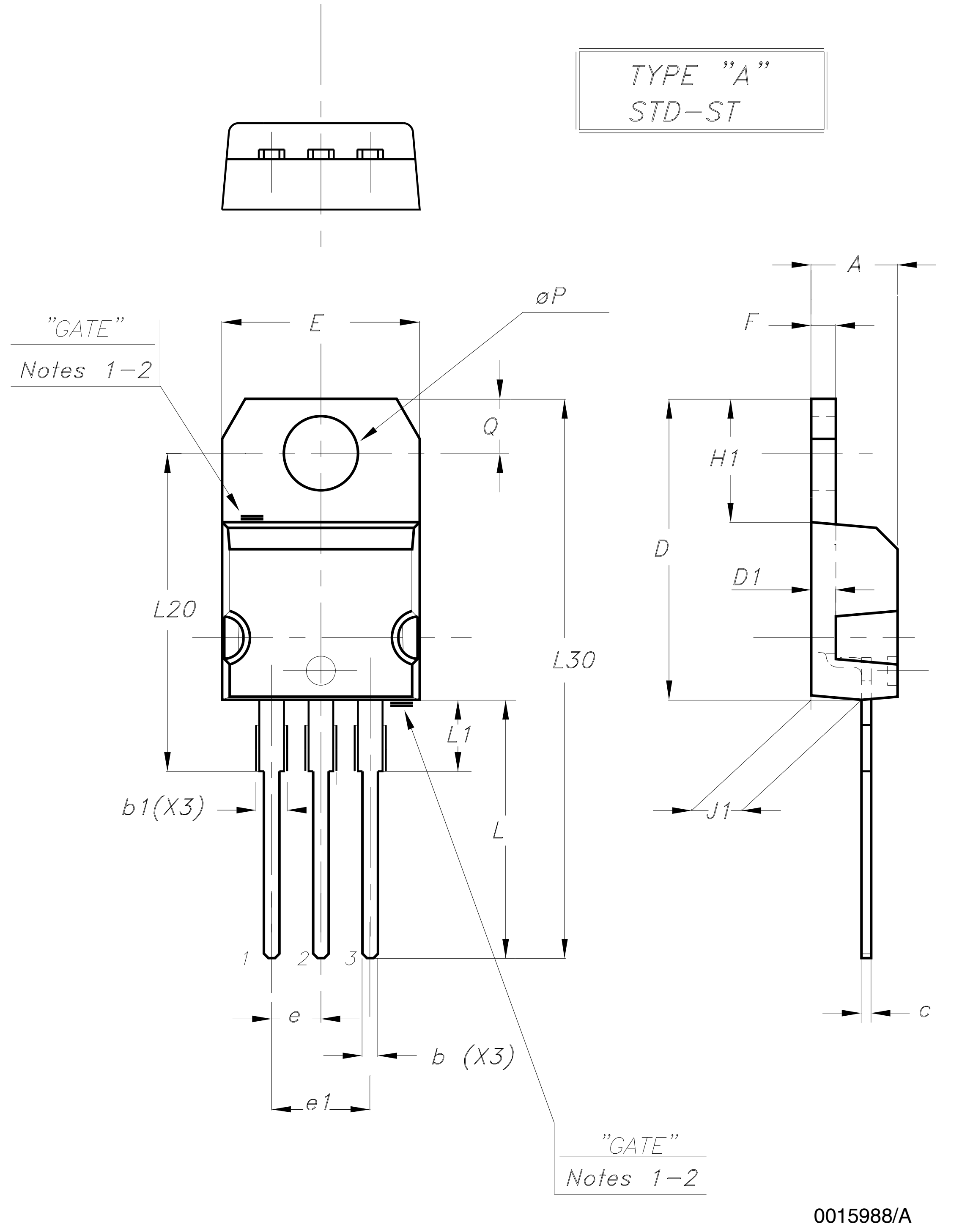
7 Package mechanical data

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 6. 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	
∅P	3.75		3.85	3.75		3.85
Q	2.65		2.95	2.65		2.95

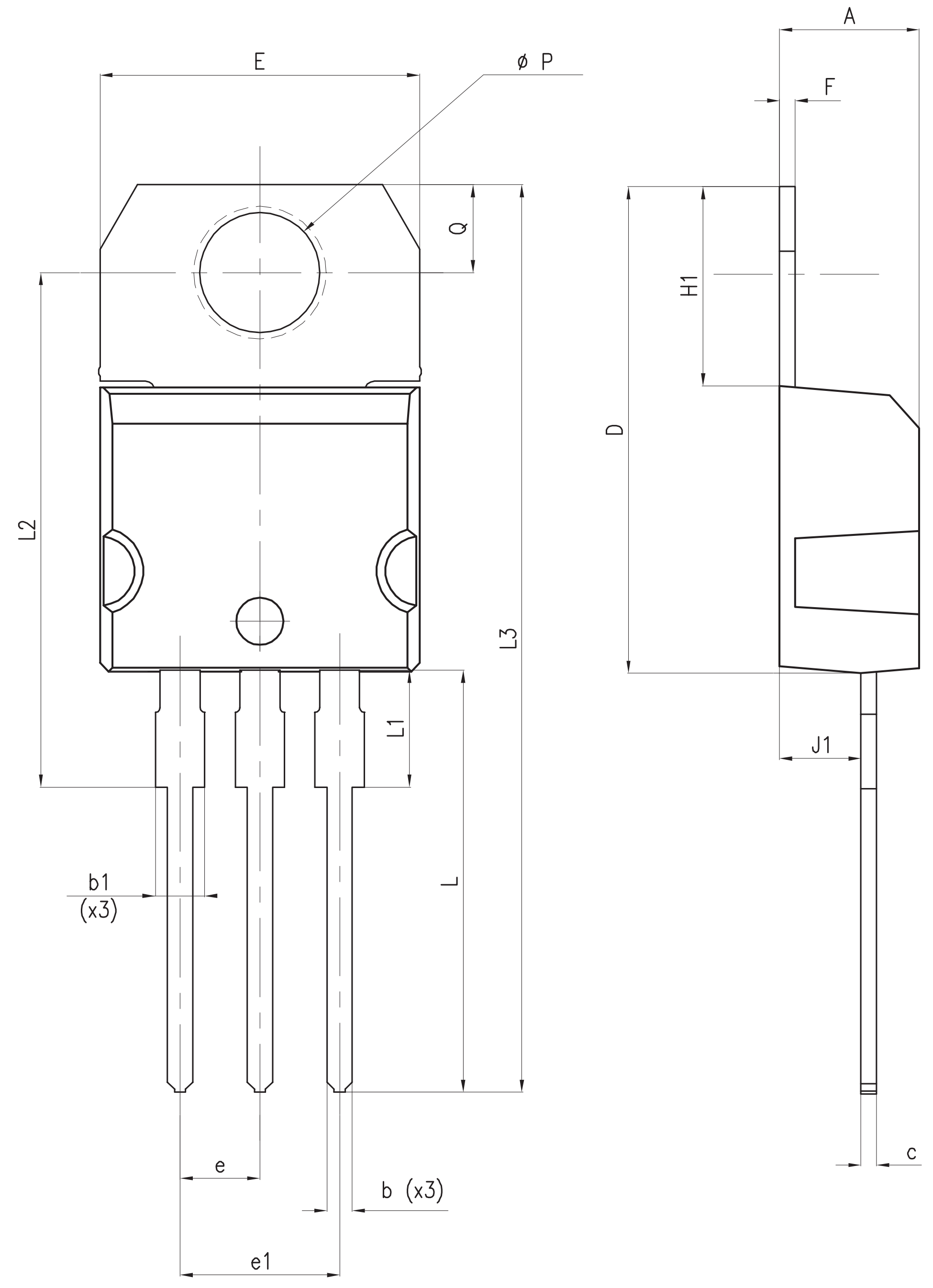
Figure 14. Drawing dimension TO-220 (type STD-ST Dual Gauge)



Note: 1 *Max resin gate protrusion: 0.5 mm.*

2 *Resin gate position is accepted in each of the two positions shown on the drawing, or their symmetrical.*

Figure 15. Drawing dimension TO-220 (type STD-ST Single Gauge)



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

Figure 16. Drawing dimension tube for TO-220 Dual Gauge (mm.)

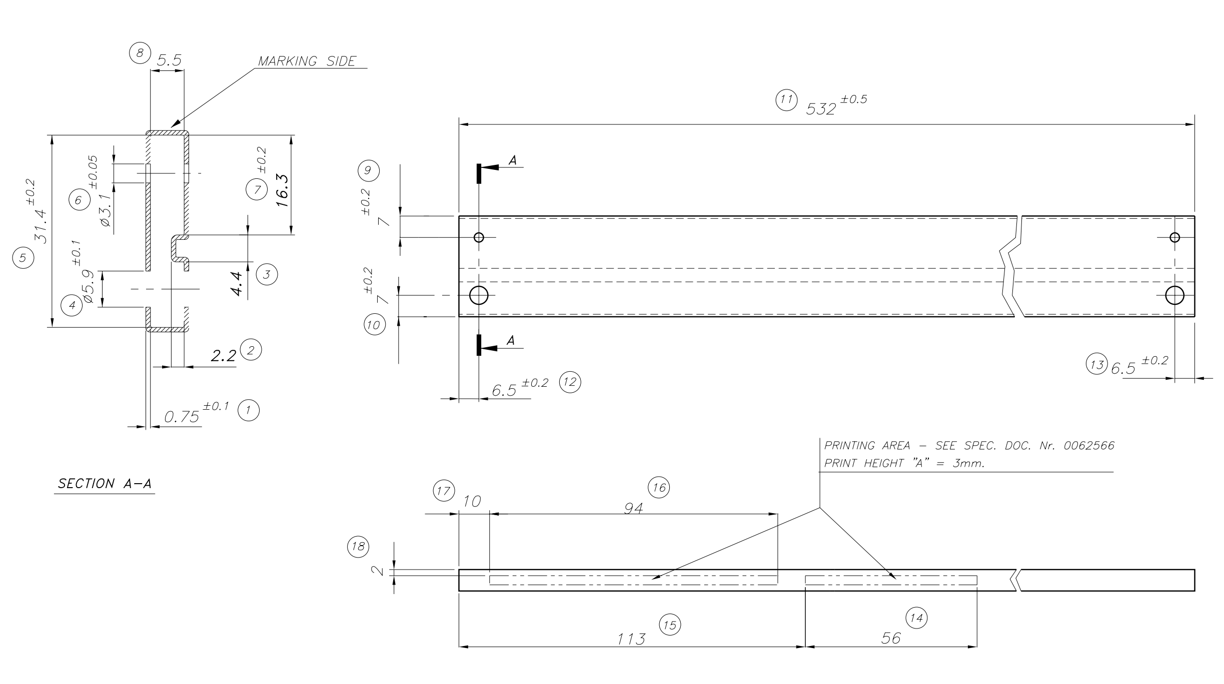
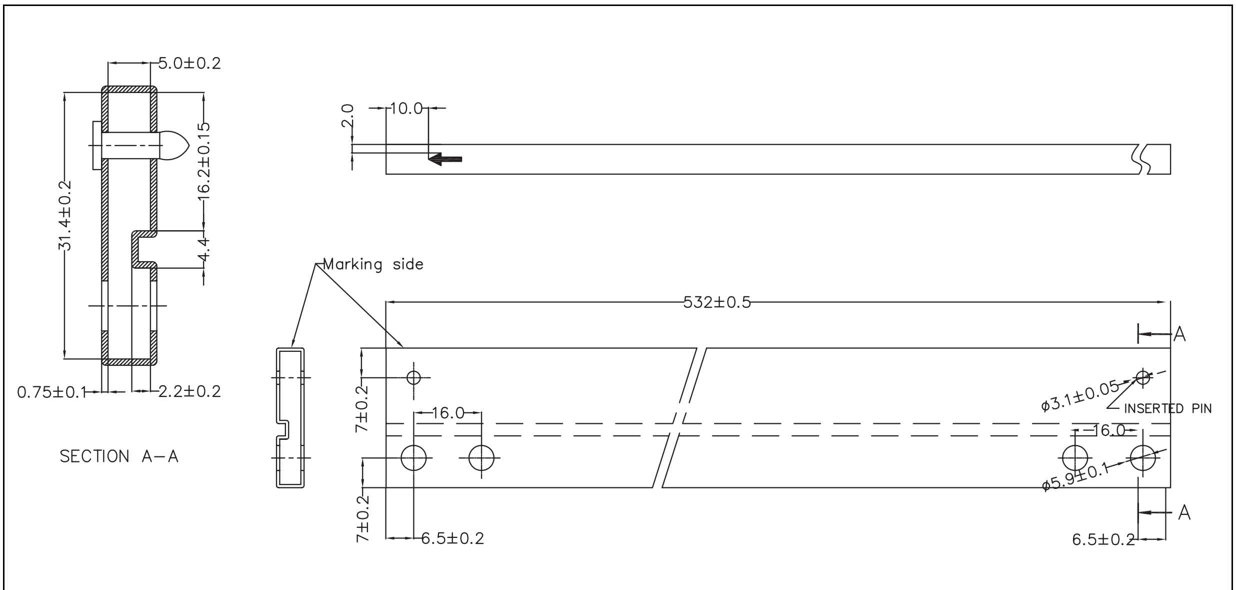
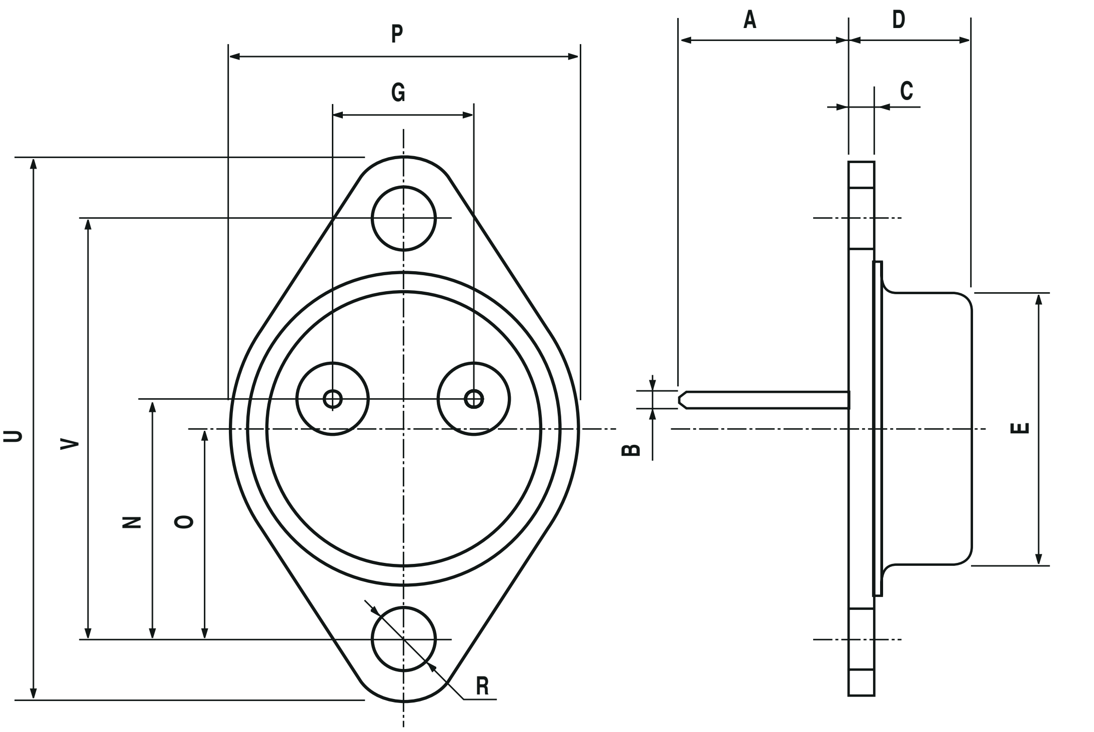


Figure 17. Drawing dimension tube for TO-220 Single Gauge (mm.)



TO-3 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		11.85			0.466	
B	0.96	1.05	1.10	0.037	0.041	0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.5			1.555
V		30.10			1.185	



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

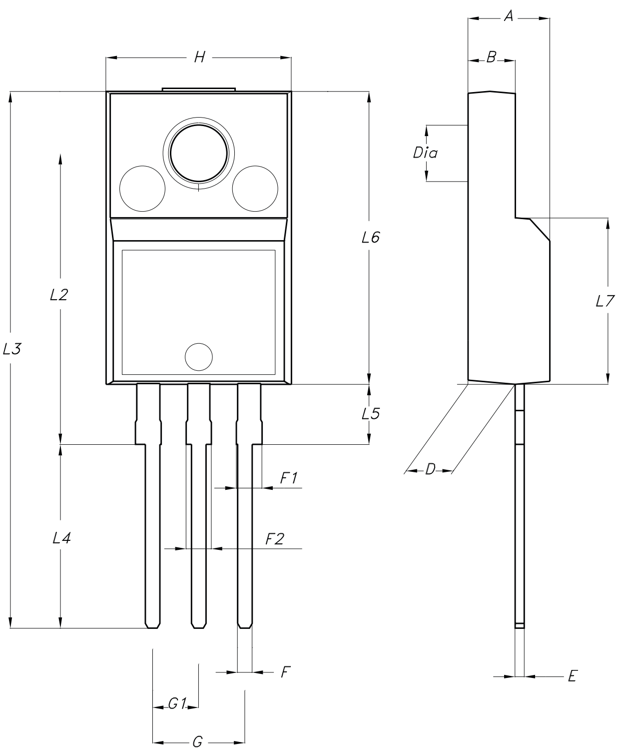


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Figure 18. Drawing dimension D²PAK (type STD-ST)

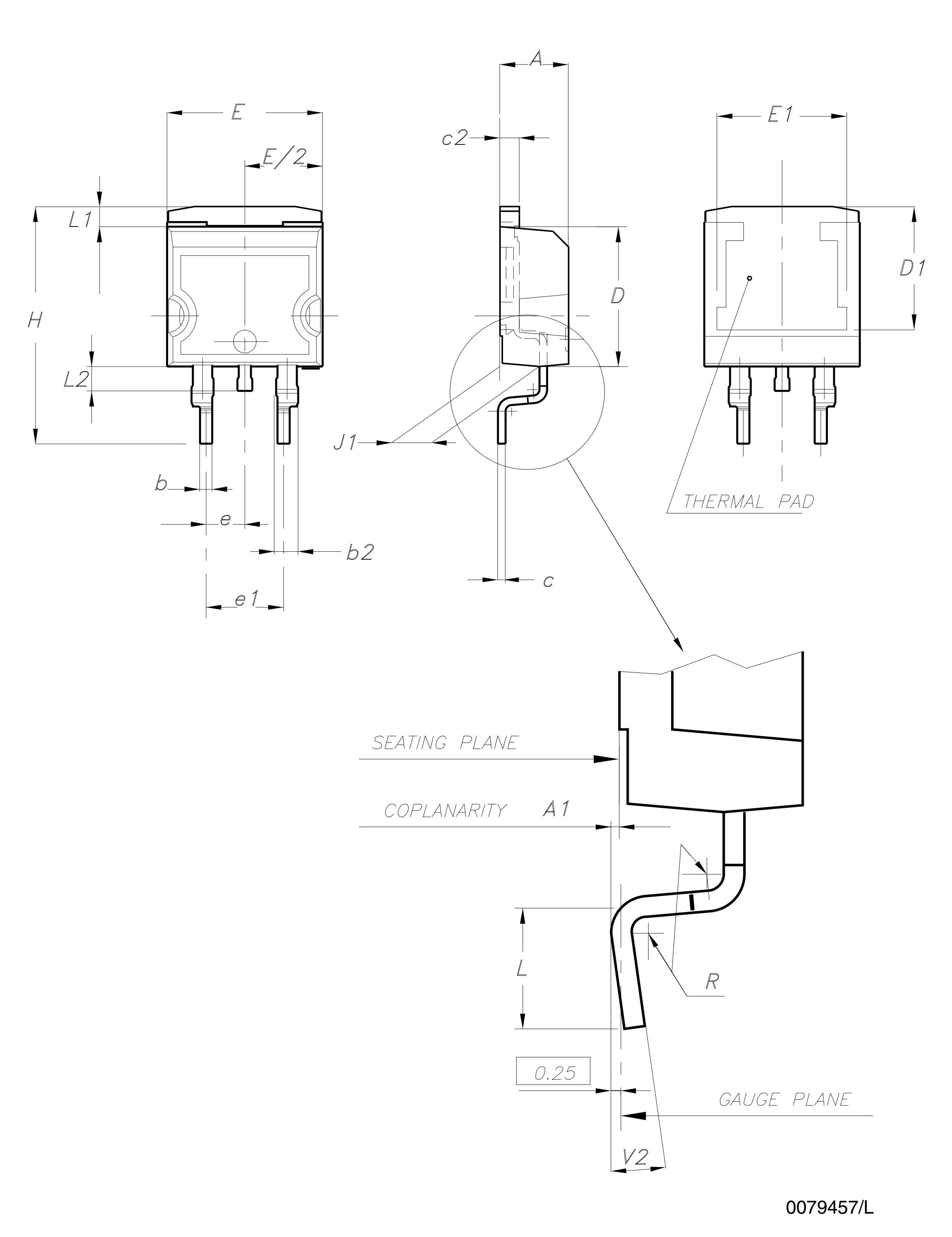


Figure 19. Drawing dimension D²PAK (type WOOSEOK-SUBCON.)

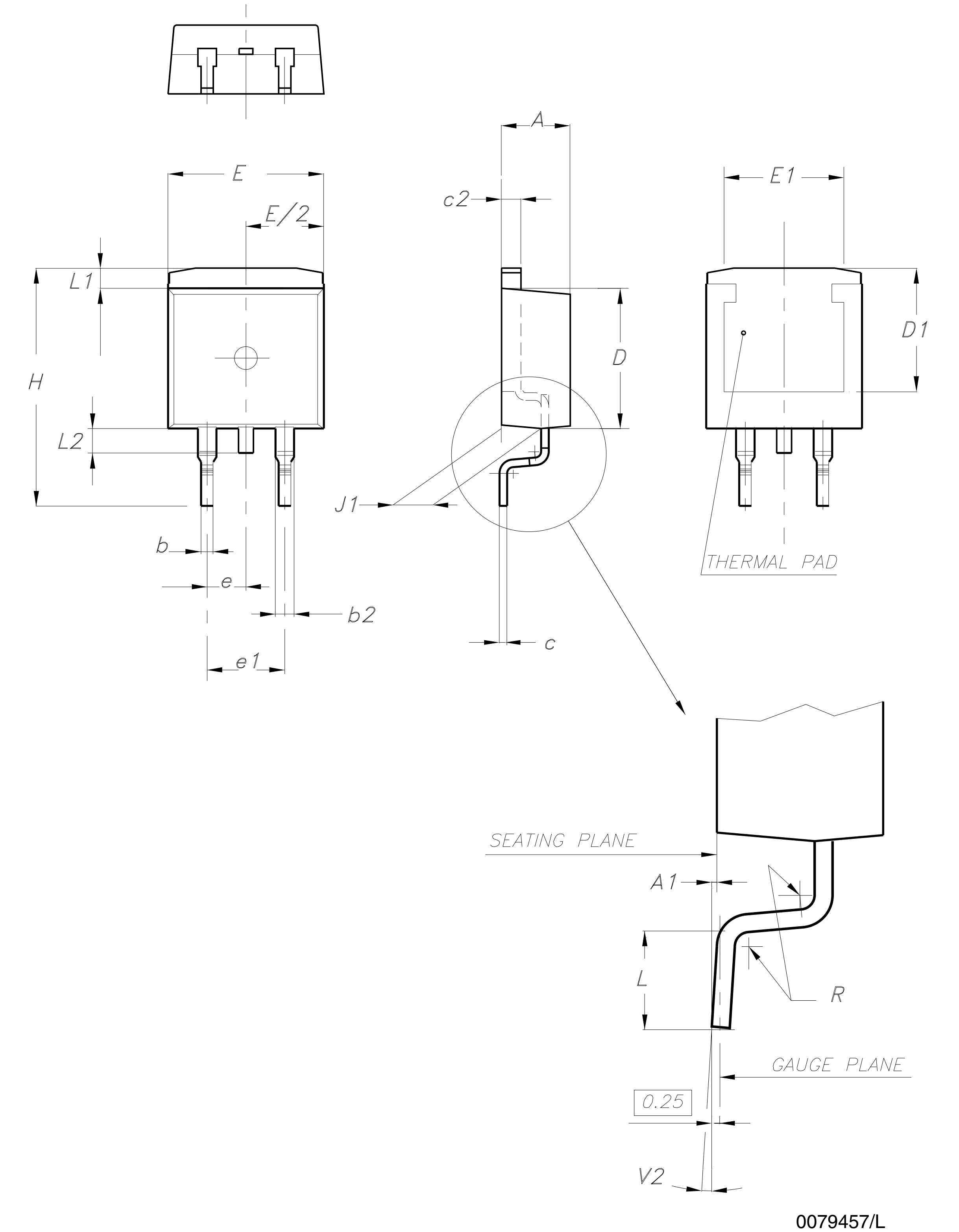


Table 7. D²PAK mechanical data

Dim.	Type STD-ST			Type WOOSEOK-Subcon.		
	mm.			mm.		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	4.30		4.70
A1	0.03		0.23	0		0.20
b	0.70		0.93	0.70		0.90
b2	1.14		1.70	1.17		1.37
c	0.45		0.60	0.45	0.50	0.60
c2	1.23		1.36	1.25	1.30	1.40
D	8.95		9.35	9	9.20	9.40
D1	7.50			7.50		
E	10		10.40	9.80		10.20
E1	8.50			7.50		
e		2.54			2.54	
e1	4.88		5.28		5.08	
H	15		15.85	15	15.30	15.60
J1	2.49		2.69	2.20		2.60
L	2.29		2.79	1.79		2.79
L1	1.27		1.40	1		1.40
L2	1.30		1.75	1.20		1.60
R		0.4			0.30	
V2	0°		8°	0°		3°

Note: The D²PAK package coming from the subcontractor Wooseok is fully compatible with the ST's package suggested footprint.

Figure 20. D²PAK footprint recommended data

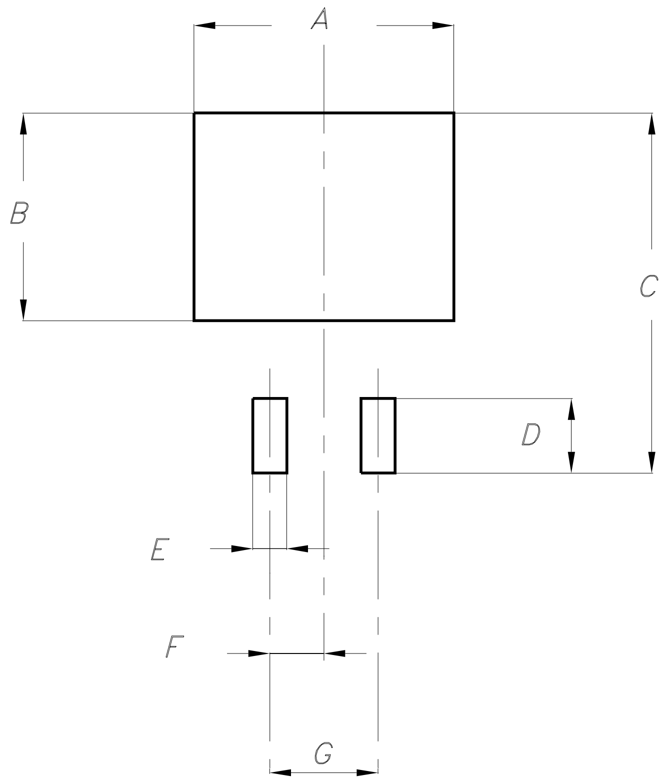
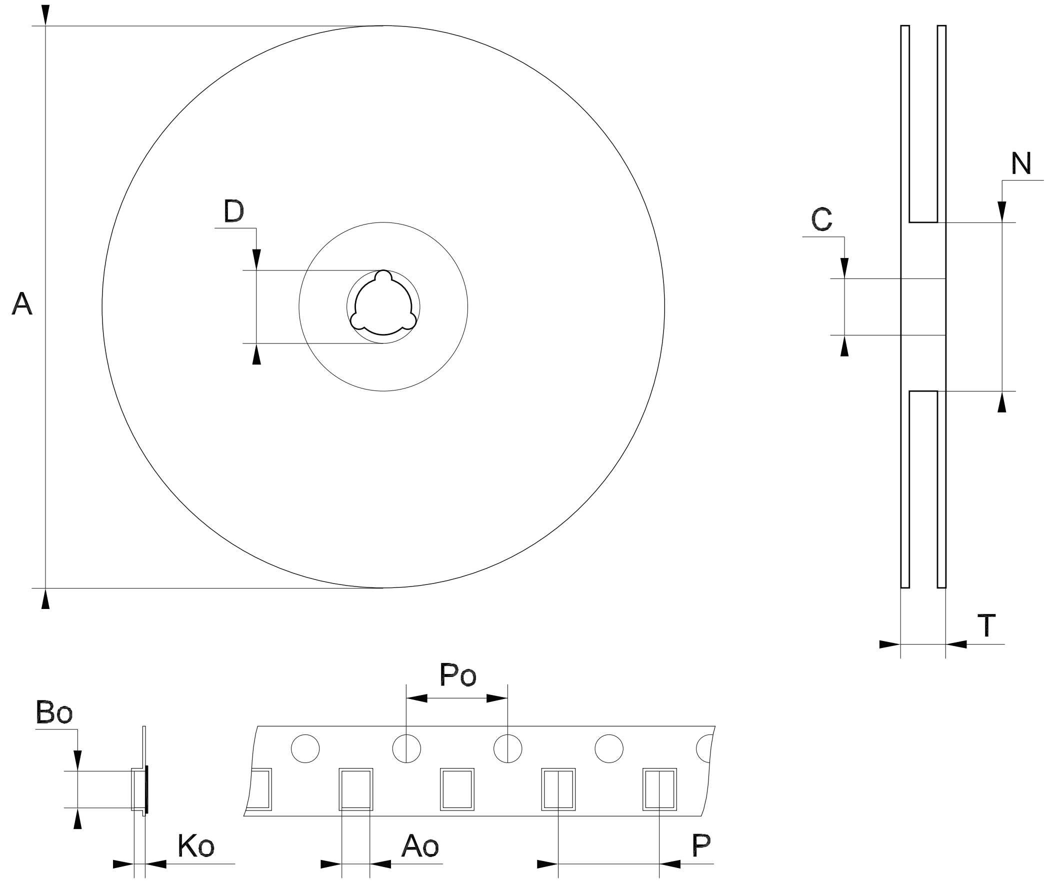


Table 8. Footprint data

Values		
Dim.	**mm.**	**inch.**
A	12.20	0.480
B	9.75	0.384
C	16.90	0.665
D	3.50	0.138
E	1.60	0.063
F	2.54	0.100
G	5.08	0.200

Tape & reel D^2PAK-P^2PAK-D^2PAK/A-P^2PAK/A mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.086
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	10.50	10.6	10.70	0.413	0.417	0.421
Bo	15.70	15.80	15.90	0.618	0.622	0.626
Ko	4.80	4.90	5.00	0.189	0.193	0.197
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	11.9	12.0	12.1	0.468	0.472	0.476



Note: Drawing not in scale

8 Revision history

Table 9. Document revision history

Date	Revision	Changes
01-Sep-2004	10	Mistake V_{REF} ==> V_O, tables 1, 4 and 5.
19-Jan-2007	11	D²PAK mechanical data has been updated, add footprint data and the document has been reformatted.
13-Jun-2007	12	Change values ΔI_{ADJ} and V_{REF} test condition of I_O = 10 mA to I_{MAX} ==> I_O = 10 mA to 500 mA on *Table 5*.
23-Nov-2007	13	Added *Table 1*.
06-Feb-2008	14	Added: TO-220 mechanical data *Figure 14 on page 14* and *Table 6 on page 13*.
02-Mar-2010	15	Added: notes *Figure 14 on page 14*, *Figure 15 on page 15*, *Figure 16* and *Figure 17 on page 16*.
17-Nov-2010	16	Modified: R_{thJC} value for TO-220 *Table 3 on page 4*.
18-Nov-2011	17	Added: order code LM317T-DG *Table 1 on page 1*.
13-Feb-2012	18	Added: order code LM217T-DG *Table 1 on page 1*.

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Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9