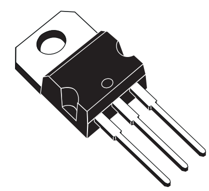
L7900 series

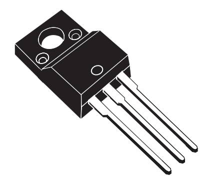
Negative voltage regulators

Features

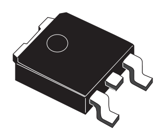
- Output current up to 1.5A
- Output voltages of -5; -6; -8; -12; -15; -18; -20; -24V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection



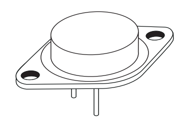
TO-220



TO-220FP



D^{2}PAK



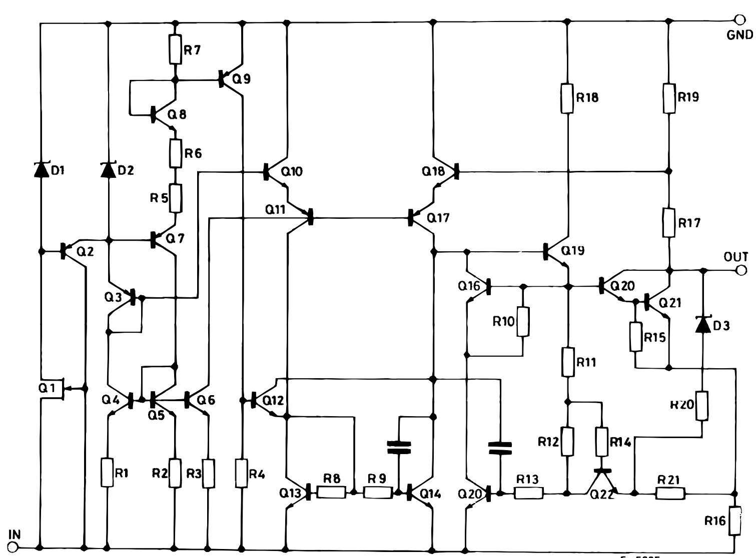
TO-3

Description

The L7900 series of three-terminal negative regulators is available in TO-220, TO-220FP, TO-3 and D^{2}PAK packages and 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; furthermore, having the same voltage option as the L7800 positive standard series, they are particularly suited for split power supplies. If adequate heat sinking is provided, they can deliver over 1.5A output current.

Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

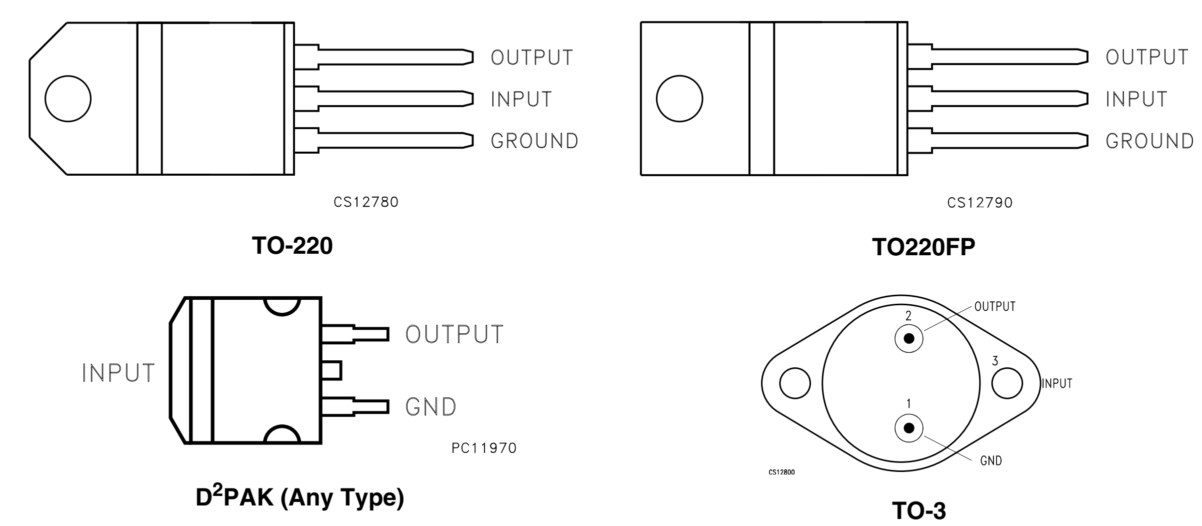
Schematic diagram



Contents

1 Pin configuration

Figure 1. Pin connections (top view)



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	
P_D	Power dissipation		Internally Limited	
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range		0 to 150	°C

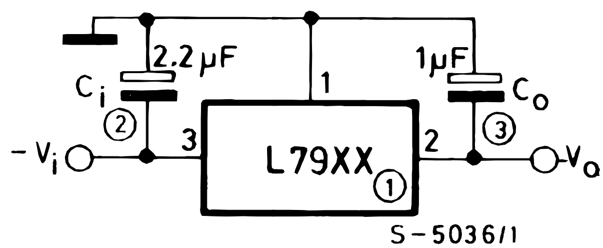
Note: Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied

Table 2. Thermal Data

Symbol	Parameter	D^2PAK	TO-220	TO-220FP	TO-3	Unit
R_{thJC}	Thermal resistance junction-case	3	3	5	4	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	50	60	35	°C/W

3 Test circuit

Figure 2. Test circuit



4 Electrical characteristics

Table 3. Electrical characteristics of L7905C (refer to the test circuits, T_J = 0 to 125°C, V_I = -10V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-4.8	-5	-5.2	V
V_O	Output voltage	I_O = -5 mA to -1 A, $P_O \leq$15 W V_I = -8 to -20 V	-4.75	-5	-5.25	V
ΔV_O(1)	Line regulation	V_I = -7 to -25 V, T_J = 25°C			100	mV
		V_I = -8 to -12 V, T_J = 25°C			50	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			100	mV
		I_O = 250 to 750 mA, T_J = 25°C			50	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -8 to -25 V			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.4		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		100		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.4		V
I_{sc}	Short circuit current			2.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 4. Electrical characteristics of L7906C (refer to the test circuits, T_J = 0 to 125°C, V_I = -11V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-5.75	-6	-6.25	V
V_O	Output voltage	I_O = -5 mA to -1 A, P_O ≤15 W V_I = -9.5 to -21.5 V	-5.7	-6	-6.3	V
ΔV_O(1)	Line regulation	V_I = -8.5 to -25 V, T_J = 25°C			120	mV
		V_I = -9 to -15 V, T_J = 25°C			60	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			120	mV
		I_O = 250 to 750 mA, T_J = 25°C			60	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -9.5 to -25 V			1.3	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.6		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		144		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.4		V
I_{sc}	Short circuit current			2		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 5. Electrical characteristics of L7908C (refer to the test circuits, T_J = 0 to 125°C, V_I = -14V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-7.7	-8	-8.3	V
V_O	Output voltage	I_O = -5 mA to -1 A, P_O ≤15 W V_I = -11.5 to -23 V	-7.6	-8	-8.4	V
ΔV_O(1)	Line regulation	V_I = -10.5 to -25 V, T_J = 25°C			160	mV
		V_I = -11 to -17 V, T_J = 25°C			80	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			160	mV
		I_O = 250 to 750 mA, T_J = 25°C			80	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -11.5 to -25 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.6		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		175		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			1.5		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 6. Electrical characteristics of L7912C (refer to the test circuits, T_J = 0 to 125°C, V_I = -19V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-11.5	-12	-12.5	V
V_O	Output voltage	I_O = -5 mA to -1 A, P_O ≤15 W V_I = -15.5 to -27 V	-11.4	-12	-12.6	V
ΔV_O(1)	Line regulation	V_I = -14.5 to -30 V, T_J = 25°C			240	mV
		V_I = -16 to -22 V, T_J = 25°C			120	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			240	mV
		I_O = 250 to 750 mA, T_J = 25°C			120	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -15 to -30 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.8		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		200		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			1.5		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 7. Electrical characteristics of L7915C (refer to the test circuits, T_J = 0 to 125°C, V_I = -23V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-14.4	-15	-15.6	V
V_O	Output voltage	I_O = -5 mA to -1 A, P_O ≤15 W V_I = -18.5 to -30 V	-14.3	-15	-15.7	V
ΔV_O(1)	Line regulation	V_I = -17.5 to -30 V, T_J = 25°C			300	mV
		V_I = -20 to -26 V, T_J = 25°C			150	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			300	mV
		I_O = 250 to 750 mA, T_J = 25°C			150	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -18.5 to -30 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-0.9		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		250		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			1.3		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 8. Electrical characteristics of L7918C (refer to the test circuits, T_J = 0 to 125°C, V_I = -27V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-17.3	-18	-18.7	V
V_O	Output voltage	I_O = -5 mA to -1 A, $P_O \leq$15 W V_I = -22 to -33 V	-17.1	-18	-18.9	V
ΔV_O(1)	Line regulation	V_I = -21 to -33 V, T_J = 25°C			360	mV
		V_I = -24 to -30 V, T_J = 25°C			180	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			360	mV
		I_O = 250 to 750 mA, T_J = 25°C			180	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -22 to -33 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		300		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			1.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Table 9. Electrical characteristics of L7920C (refer to the test circuits, T_J = 0 to 125°C, V_I = -29V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-19.2	-20	-20.8	V
V_O	Output voltage	I_O = -5 mA to -1 A, $P_O \leq$15 W V_I = -24 to -35 V	-19	-20	-21	V
ΔV_O(1)	Line regulation	V_I = -23 to -35 V, T_J = 25°C			400	mV
		V_I = -26 to -32 V, T_J = 25°C			200	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			400	mV
		I_O = 250 to 750 mA, T_J = 25°C			200	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -24 to -35 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1.1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		350		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			0.9		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

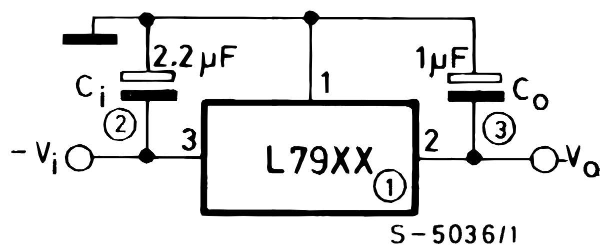
Table 10. Electrical characteristics of L7924C (refer to the test circuits, T_J = 0 to 125°C, V_I = -33V, I_O = 500 mA, C_I = 2.2 µF, C_O = 1 µF unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	T_J = 25°C	-23	-24	-24.5	V
V_O	Output voltage	I_O = -5 mA to -1 A, P_O ≤15 W V_I = -27 to -38 V	-22.8	-24	-25.2	V
ΔV_O(1)	Line regulation	V_I = -27 to -38 V, T_J = 25°C			480	mV
		V_I = -30 to -36 V, T_J = 25°C			240	
ΔV_O(1)	Load regulation	I_O = 5 mA to 1.5 A, T_J = 25°C			480	mV
		I_O = 250 to 750 mA, T_J = 25°C			240	
I_d	Quiescent current	T_J = 25°C			3	mA
ΔI_d	Quiescent current change	I_O = 5 mA to 1 A			0.5	mA
		V_I = -27 to -38 V			1	
$\Delta V_O/\Delta T$	Output voltage drift	I_O = 5 mA		-1		mV/°C
eN	Output noise voltage	B = 10Hz to 100KHz, T_J = 25°C		400		µV
SVR	Supply voltage rejection	ΔV_I = 10 V, f = 120Hz	54	60		dB
V_d	Dropout voltage	I_O = 1 A, T_J = 25°C, ΔV_O = 100 mV		1.1		V
I_{sc}	Short circuit current			1.1		A

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

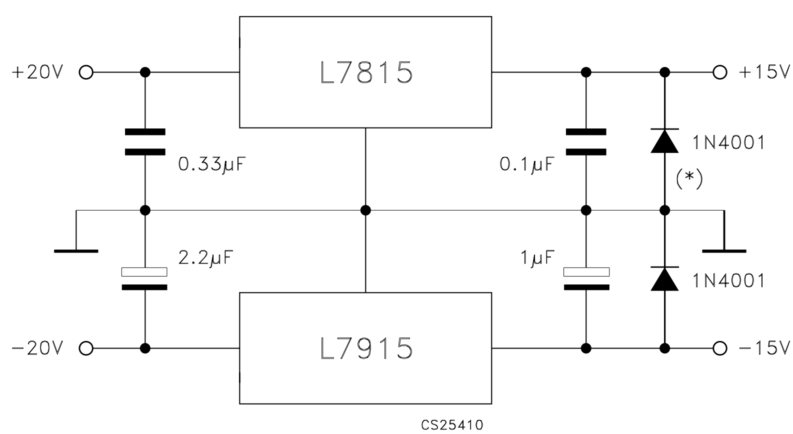
5 Application information

Figure 3. Fixed output regulator



1. To specify an output voltage, substitute voltage value for "XX".
2. Required for stability. For value given, capacitor must be solid tantalum. If aluminium electrolytic are used, at least ten times value should be selected. C1 is required if regulator is located an appreciable distance from power supply filter.
3. To improve transient response. If large capacitors are used, a high current diode from input to output (1N4001 or similar) should be introduced to protect the device from momentary input short circuit.

Figure 4. Split power supply (± 15V - 1 A)

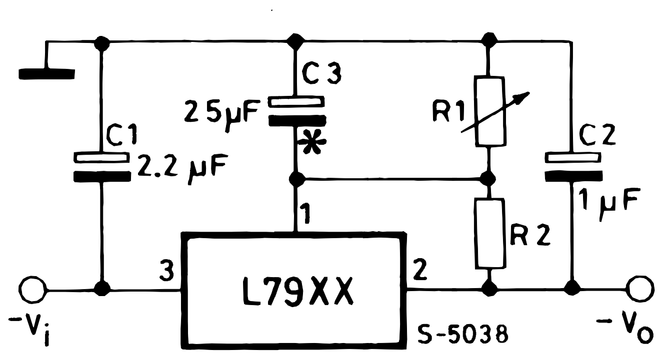


(*) Against potential latch-up problems.

Figure 5. Circuit for increasing output voltage

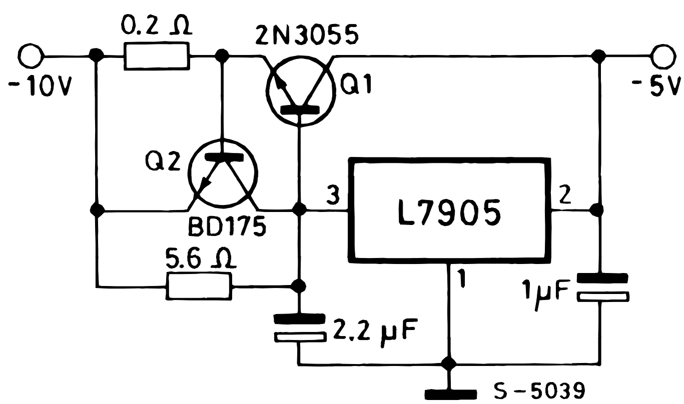
$V_O=V_{XX}(R_1+R_2)/R_2$

$V_{XX}/R_2 > 3I_d$



C3 Optional for improved transient response and ripple rejection.

Figure 6. High current negative regulator (-5V/4A with 5A current limiting)

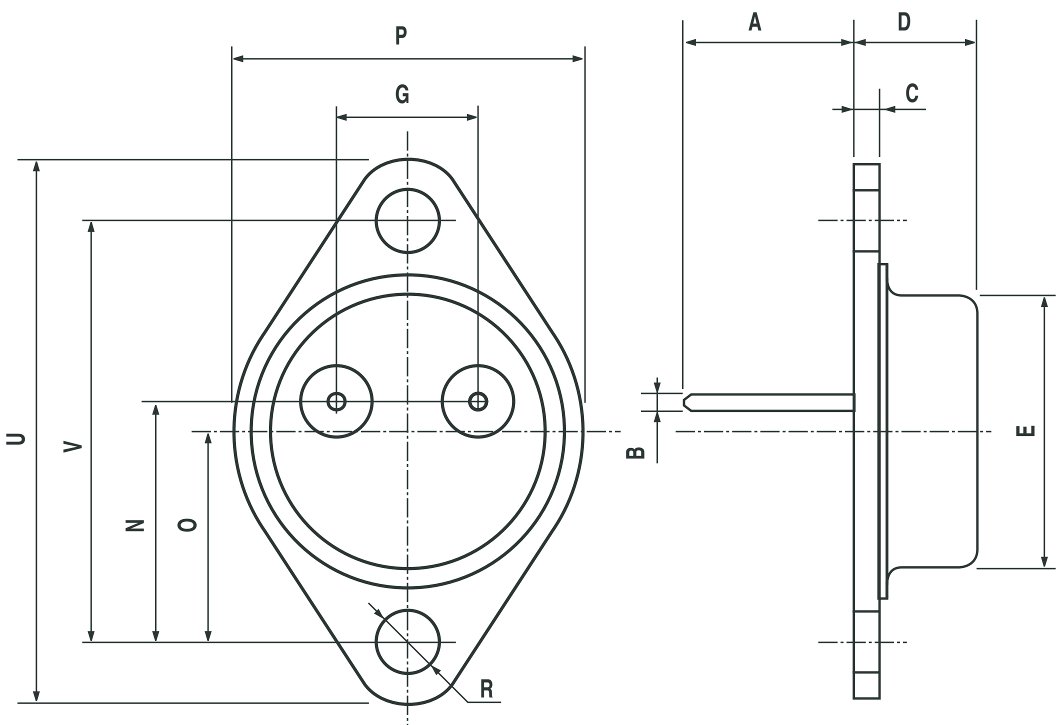


6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® 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.

TO-3 MECHANICAL DATA

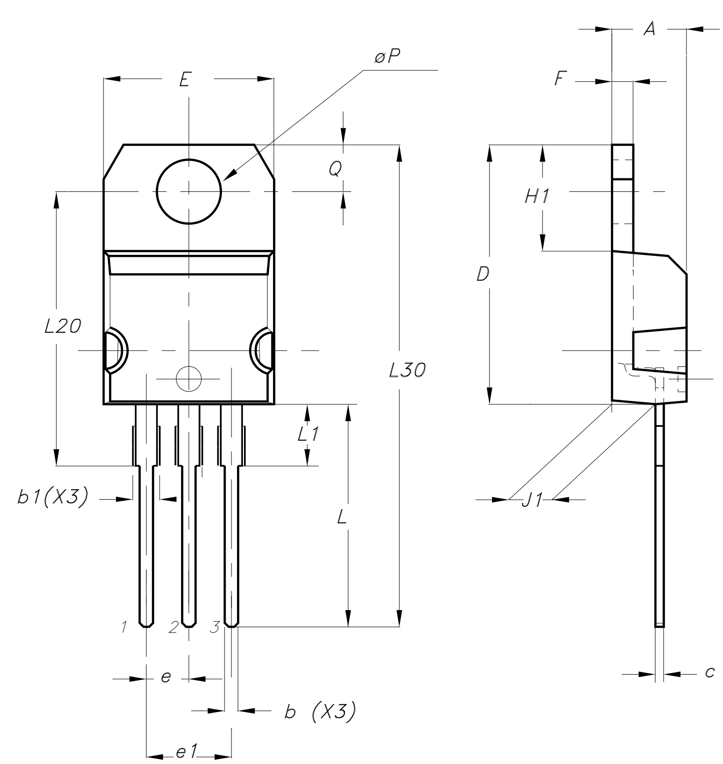
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		11.85			0.466	
B	0.96	1.05	1.10	0.037	0.041	0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.5			1.555
V		30.10			1.185	



P003C/C

TO-220 (A TYPE) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.067
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.600		0.620
E	10.0		10.40	0.393		0.409
e	2.4		2.7	0.094		0.106
e1	4.95		5.15	0.194		0.203
F	1.23		1.32	0.048		0.051
H1	6.2		6.6	0.244		0.260
J1	2.40		2.72	0.094		0.107
L	13.0		14.0	0.511		0.551
L1	3.5		3.93	0.137		0.154
L20		16.4			0.645	
L30		28.9			1.138	
φP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



0015988/N

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

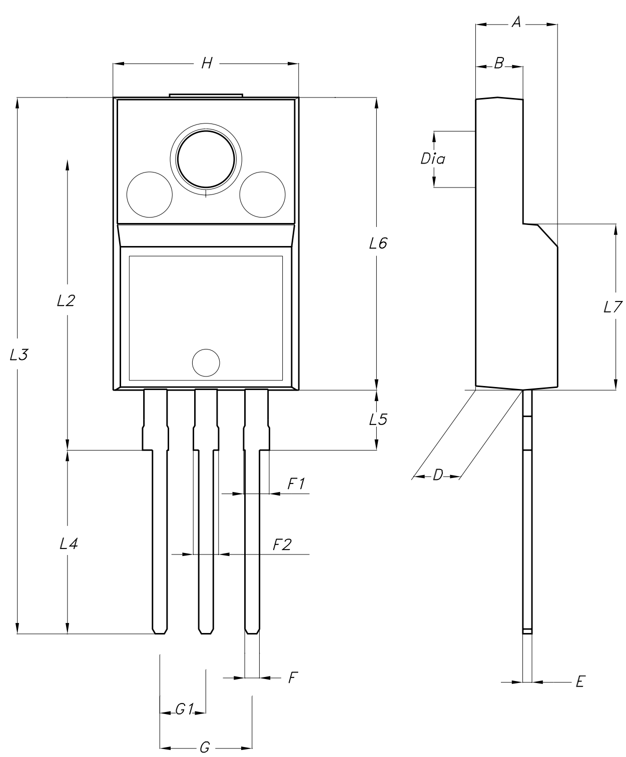


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Figure 7. DRAWING DIMENSION D²PAK (TYPE STD-ST)

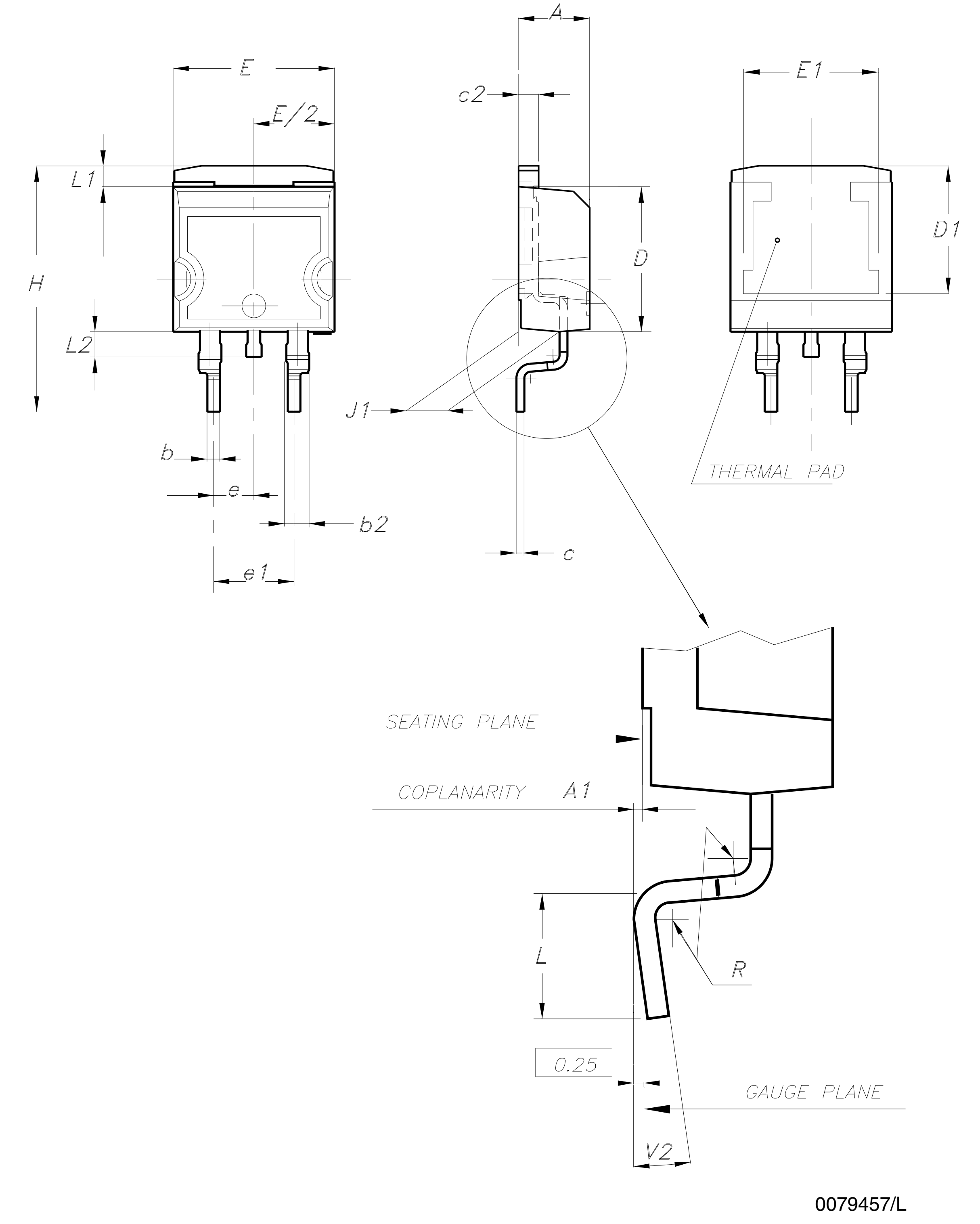


Figure 8. DRAWING DIMENSION D²PAK (TYPE WOOSEOK-SUBCON.)

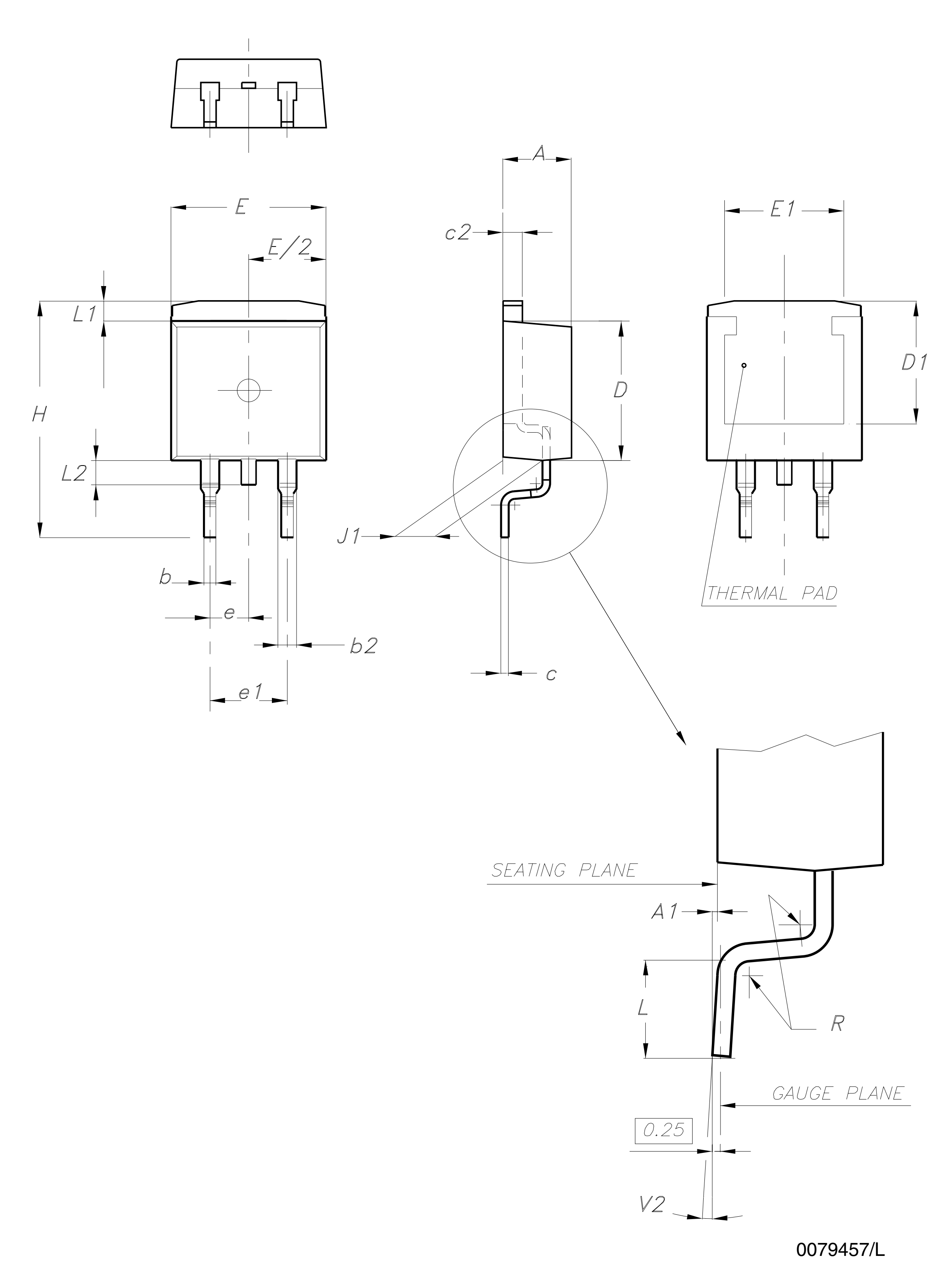


Table 11. D^2PAK MECHANICAL DATA

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 D^2PAK package coming from the subcontractor Wooseok is fully compatible with the ST's package suggested footprint.

Figure 9. D²PAK FOOTPRINT RECOMMENDED DATA

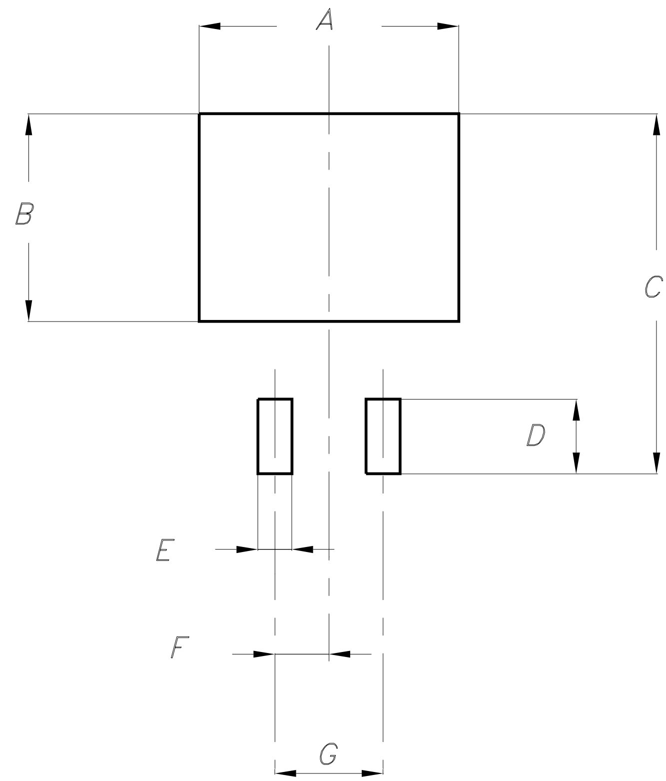
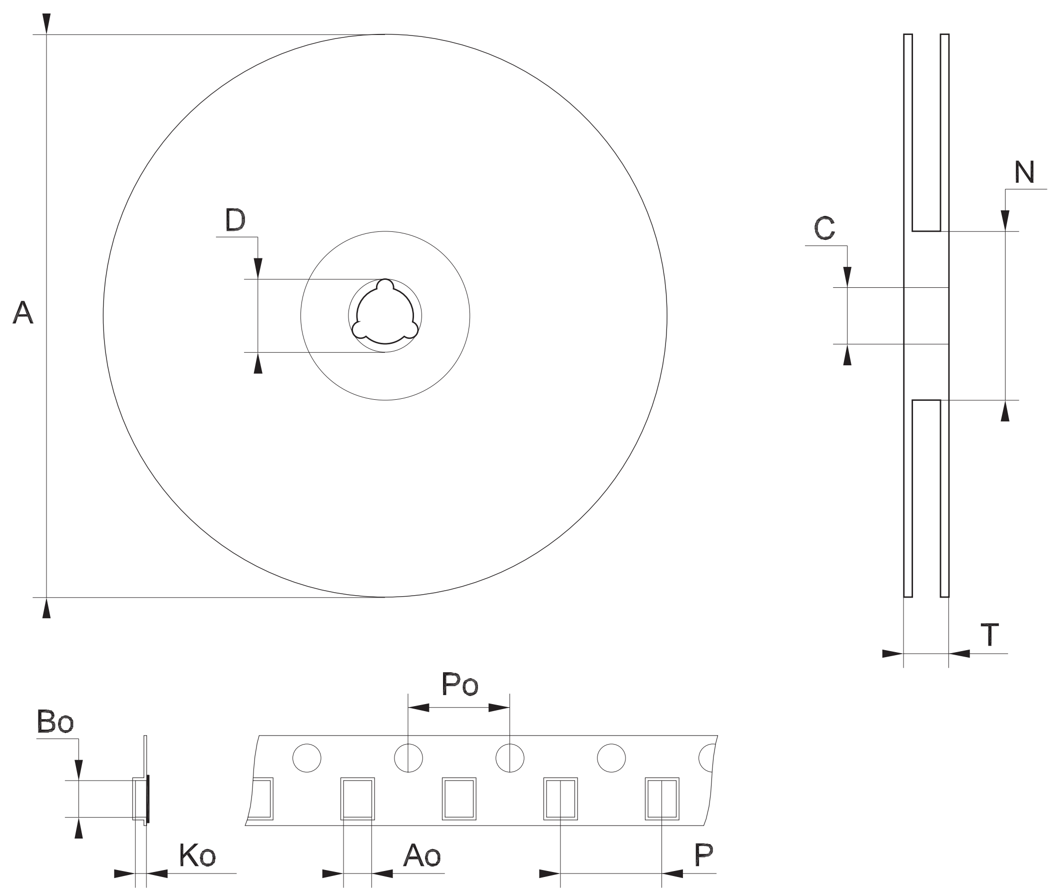


Table 12. FOOTPRINT DATA

VALUES		
	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

7 Order codes

Table 13. Order codes

Part numbers	Packaging				
	TO-220 (A Type)	D^2PAK	TO-220FP	TO-3	OUT. VOLT.
L7905C	L7905CV	L7905CD2T-TR	L7905CP	L7905CT(1)	-5 V
L7906C	L7906CV	L7906CD2T-TR	L7906CP(1)	L7906CT(1)	-6 V
L7908C	L7908CV		L7908CP(1)	L7908CT(1)	-8 V
L7912C	L7912CV	L7912CD2T-TR	L7912CP	L7912CT(1)	-12 V
L7915C	L7915CV	L7915CD2T-TR	L7915CP	L7915CT	-15 V
L7918C	L7918CV	L7918CD2T-TR(1)	L7918CP(1)	L7918CT(1)	-18 V
L7920C	L7920CV	L7920CD2T-TR(1)	L7920CP(1)	L7920CT(1)	-20 V
L7924C	L7924CV	L7924CD2T-TR(1)	L7924CP(1)	L7924CT	-24 V

1. Available on Request.

8 Revision history

Table 14. Revision history

Date	Revision	Changes
22-Jun-2004	9	Order Codes updated Table 3, pag. 3.
31-Aug-2005	10	Add new order codes (TO-220 E Type) on Table 3, pag. 3.
19-Jan-2007	11	D^2PAK mechanical data has been updated, add footprint data and the document has been reformatted.
06-Jun-2007	12	Order codes has been updated.