



STB300NH02L STP300NH02L

N-channel 24V - 120A - TO-220 / D²PAK
STripFET™ Power MOSFET

Preliminary Data

Features

Type	V _{DSS}	R _{DS(on)} Max	I _D
STB300NH02L	24V	< 1.8mΩ	120A
STP300NH02L	24V	< 2.2mΩ	120A

- R_{DS(on)}*Q_g industry's benchmark
- Conduction losses reduced
- Switching losses reduced
- Low profile, very low parasitic inductance

Description

This product utilizes the latest advanced design rules of ST's proprietary STripFET™ technology. This is suitable for high current OR-ing application.

Applications

- Switching application
 - Specifically designed and optimized for high efficiency DC/DC converters
 - OR-ing

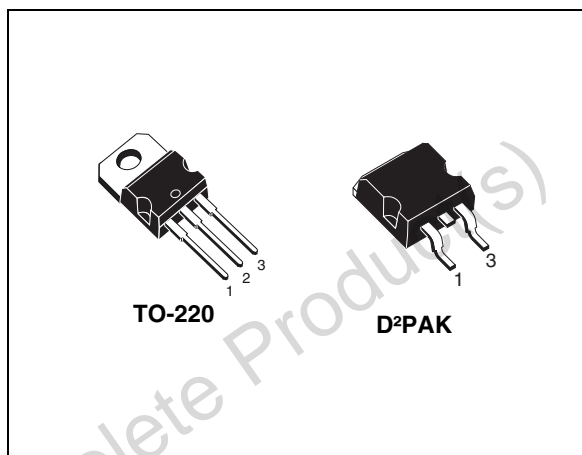


Figure 1. Internal schematic diagram

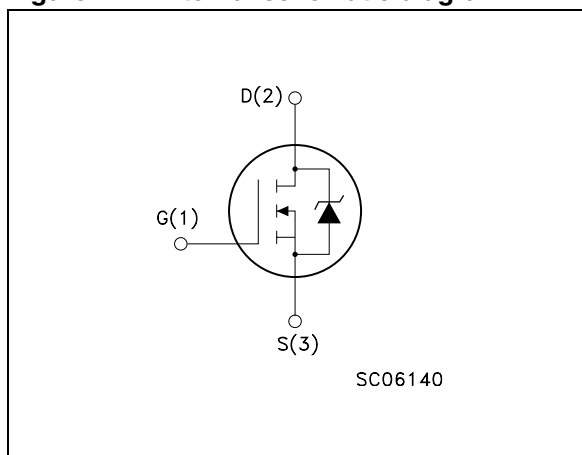


Table 1. Device summary

Order codes	Marking	Package	Packaging
STP300NH02L	P300NH02L	TO-220	Tube
STB300NH02L	B300NH02L	D ² PAK	Tape & reel

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Obsolete Product(s) - Obsolete Product(s)



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	24	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
T_j	Operating junction temperature	-55 to 175	$^\circ\text{C}$

1. This value is silicon limited
2. Pulse width limited by safe operating area
3. This value is rated according Rthj-case

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	0.5	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AV}	Not-repetitive avalanche current (pulse width limited by T_j max)	60	A
$E_{AS}^{(1)}$	Single pulse avalanche energy	1.6	J

1. Starting $T_j = 25^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 20\text{V}$

2 Electrical characteristics

($T_{CASE}=25^{\circ}C$ unless otherwise specified)

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	24			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 20V,$ $V_{DS} = 20V, T_c = 125^{\circ}C$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{DS} = \pm 20V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1		2	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 80A$		1.8 1.4	2.2 1.8	$m\Omega$ $m\Omega$
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 80A$ @ $100^{\circ}C$		2.7 2.1		$m\Omega$ $m\Omega$

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 15V, f = 1 MHz, V_{GS} = 0$		7055		pF
C_{oss}	Output capacitance			3251		pF
C_{rss}	Reverse transfer capacitance			307		pF
Q_g	Total gate charge	$V_{DD} = 12V, I_D = 120A,$ $V_{GS} = 10V$ <i>(see Figure 14)</i>		109.4		nC
Q_{gs}	Gate-source charge			30.2		nC
Q_{gd}	Gate-drain charge			26.4		nC
R_G	Gate input resistance	$f = 1 MHz$ Gate DC Bias = 0 Test signal level = 20mV open drain		4.4		Ω

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD} = 10V, I_D = 60A$ $R_G = 4.7\Omega, V_{GS} = 10V,$ (see Figure 13)		18 275		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD} = 10V, I_D = 60A$ $R_G = 4.7\Omega, V_{GS} = 10V,$ (see Figure 13)		138 94.4		ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD} I_{SD}	Source-drain current Source-drain current (pulsed)				120 640	A A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 120 A, V_{GS} = 0$			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 120A, V_{DD} = 20V,$ $di/dt = 100A/\mu s$ $T_j = 25^\circ C$ (see Figure 18)		63 85 2.7		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 120A, V_{DD} = 20V$ $di/dt = 100A/\mu s$ $T_j = 150^\circ C$ (see Figure 18)		63.2 88 2.8		ns nC A

1. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

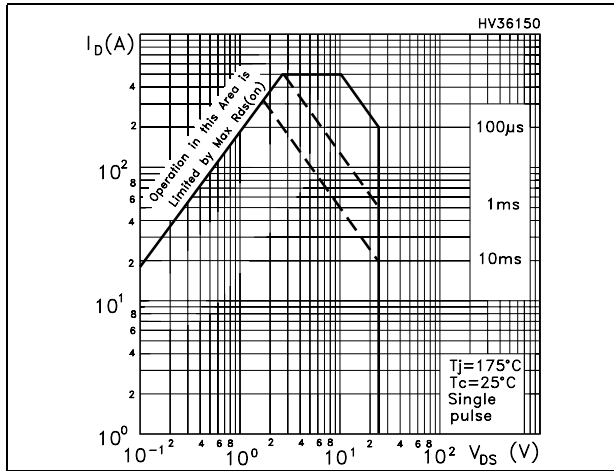


Figure 3. Thermal impedance

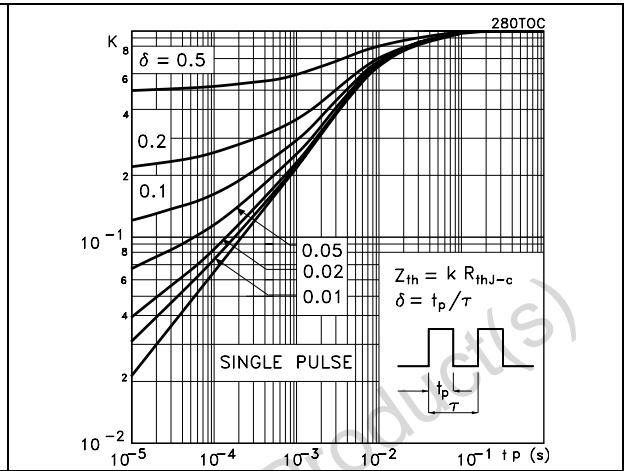


Figure 4. Output characteristics

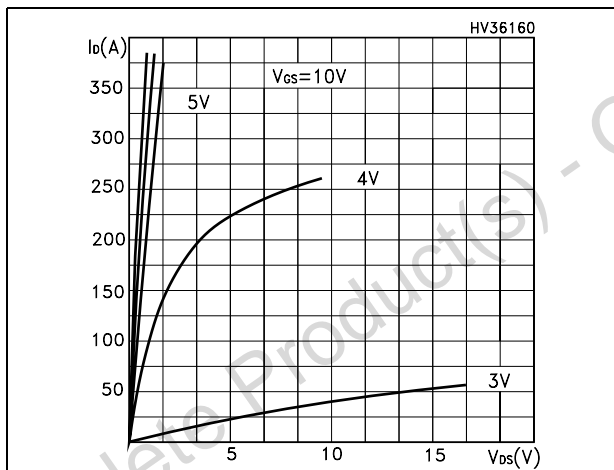


Figure 5. Transfer characteristics

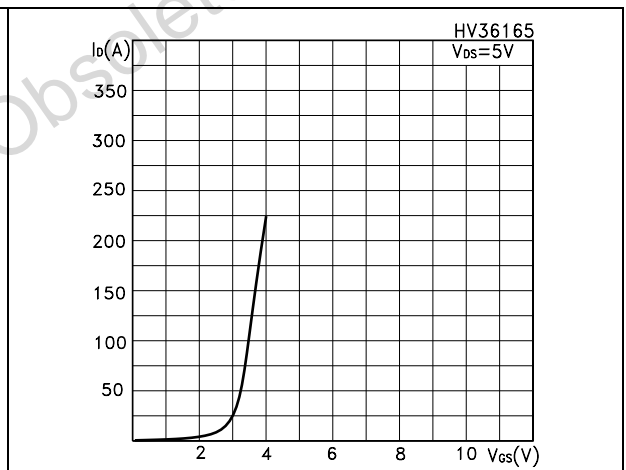


Figure 6. Static drain-source on resistance

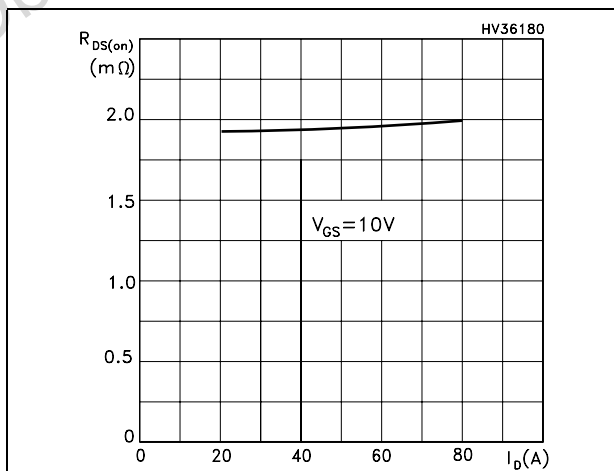


Figure 7. Normalized BV_{DSS} vs temperature

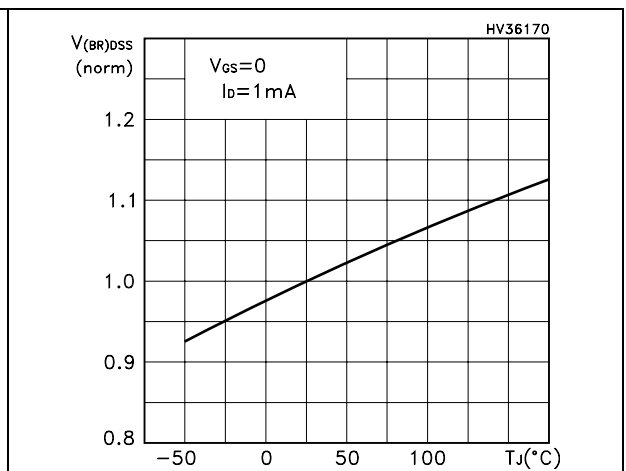


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

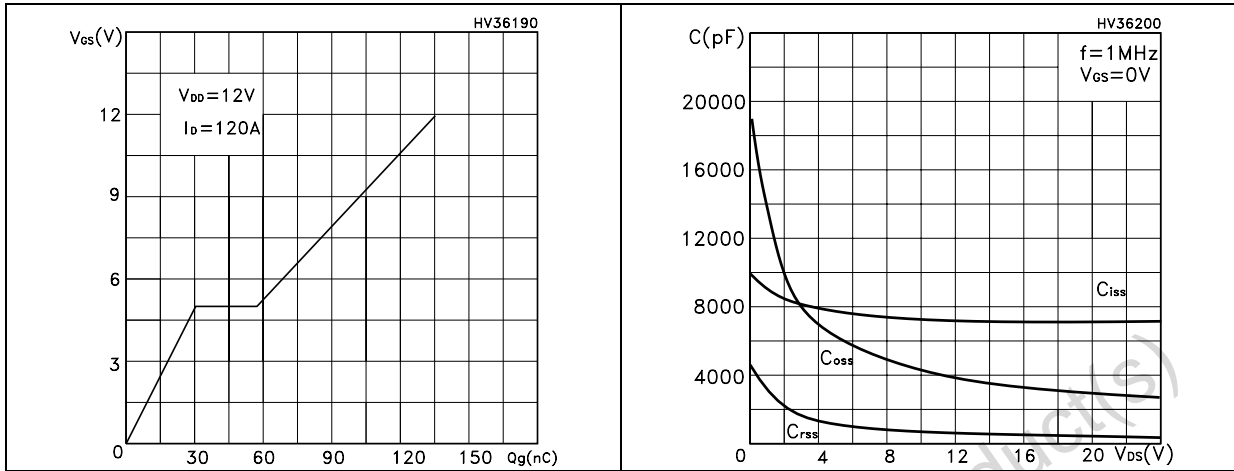


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

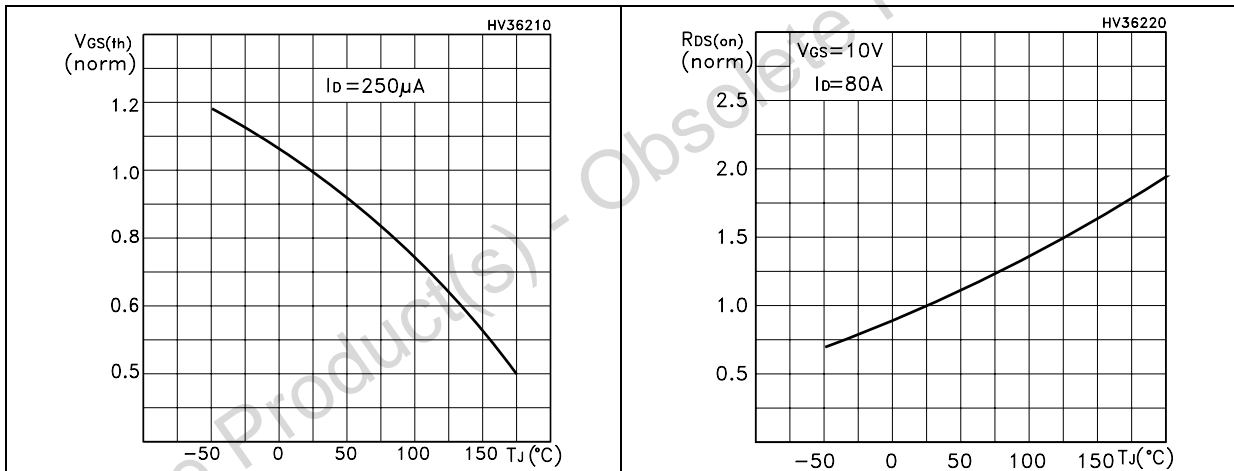
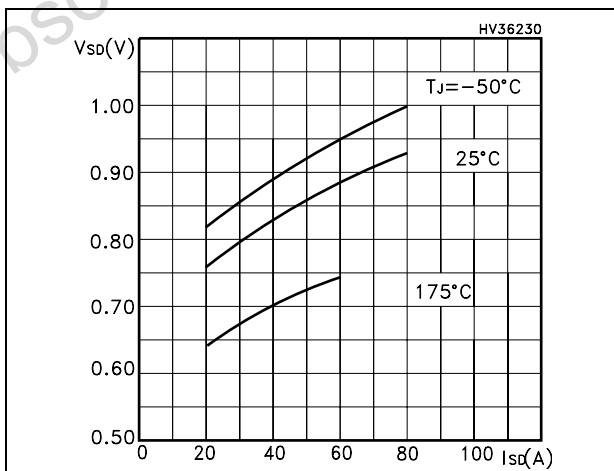


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

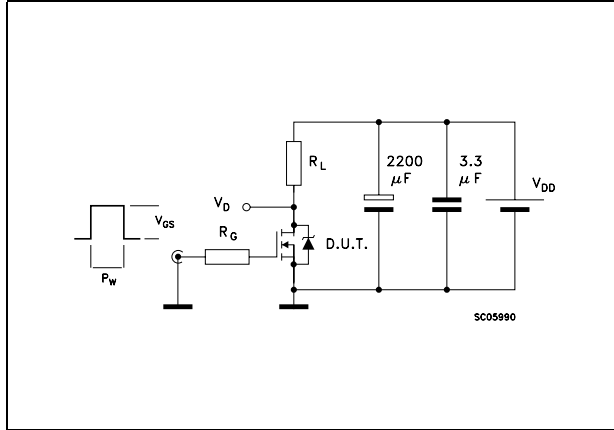


Figure 14. Gate charge test circuit

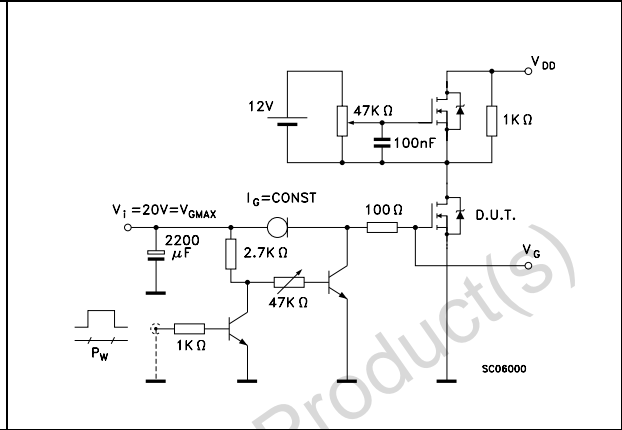


Figure 15. Test circuit for inductive load switching and diode recovery times

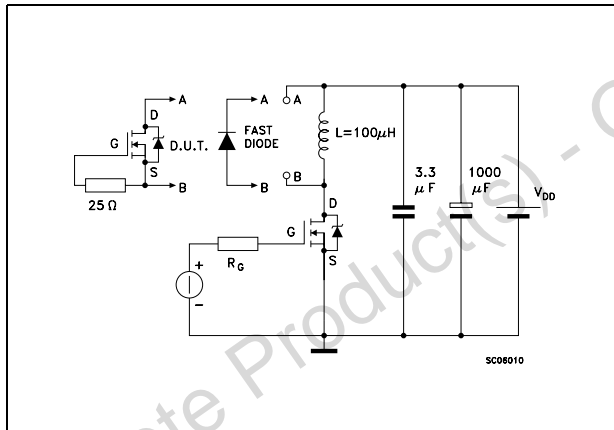


Figure 16. Unclamped inductive load test circuit

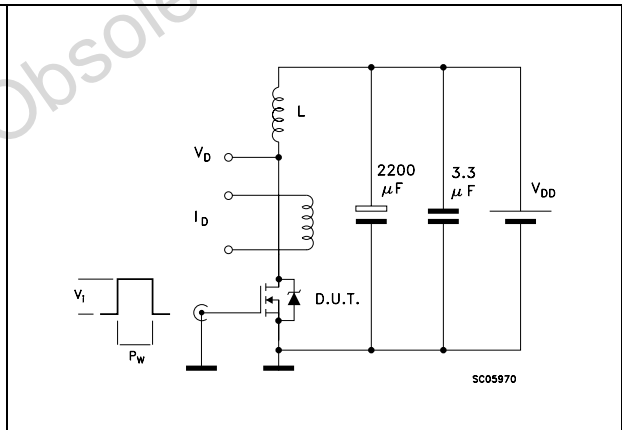


Figure 17. Unclamped inductive waveform

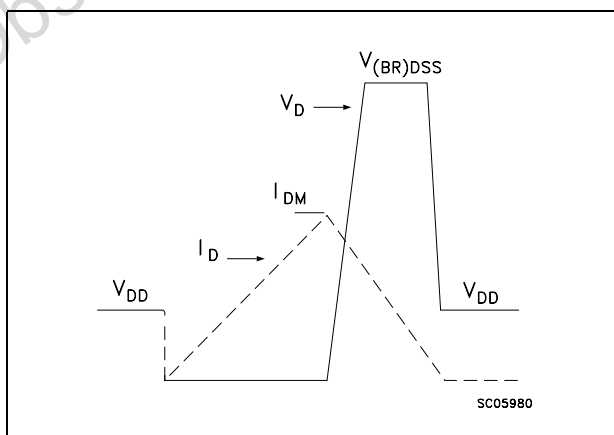
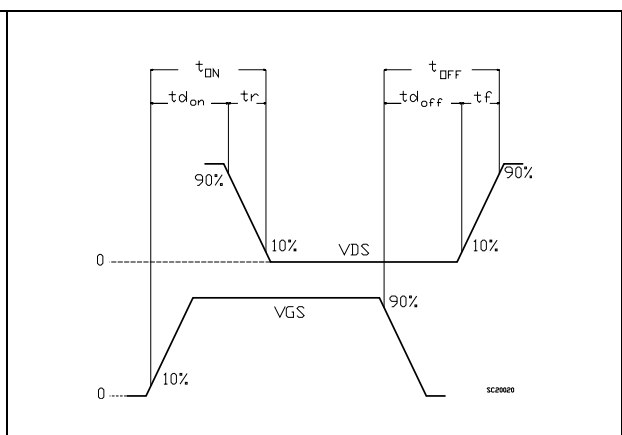


Figure 18. Switching time waveform



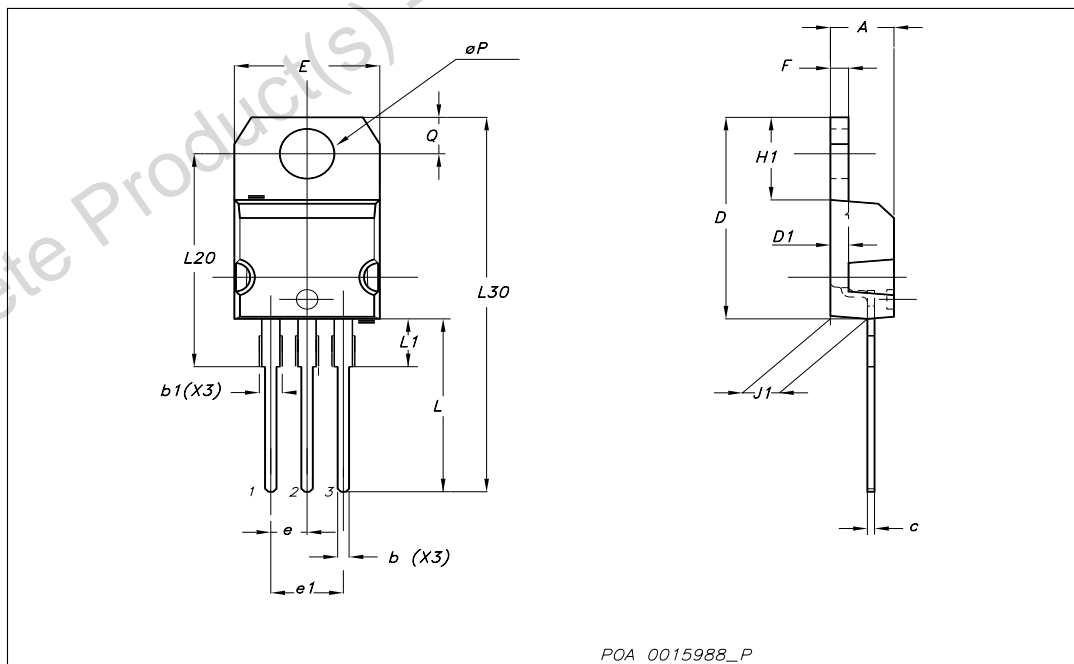
4 Package mechanical data

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

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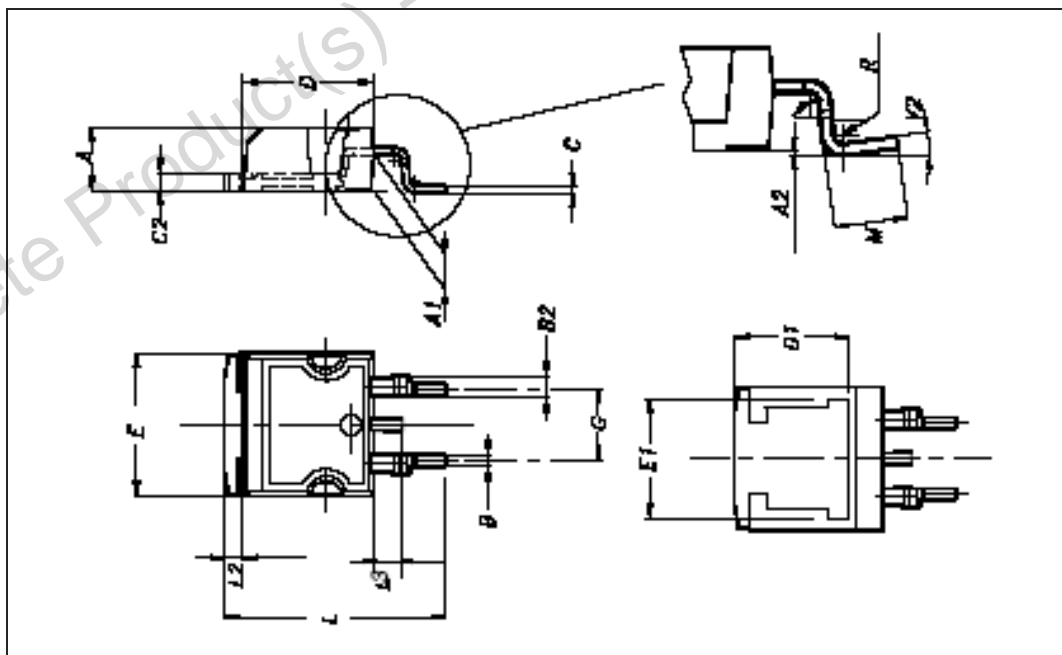
TO-220 mechanical data

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	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
ØP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



D²PAK mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		0.409
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.50		0.55
L3	1.4		1.75	0.055		0.68
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius R min.

* on sales type

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
21-Feb-2007	1	First release
25-Sep-2007	2	Corrected value on <i>Avalanche characteristics</i>

Obsolete Product(s) - Obsolete Product(s)

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