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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

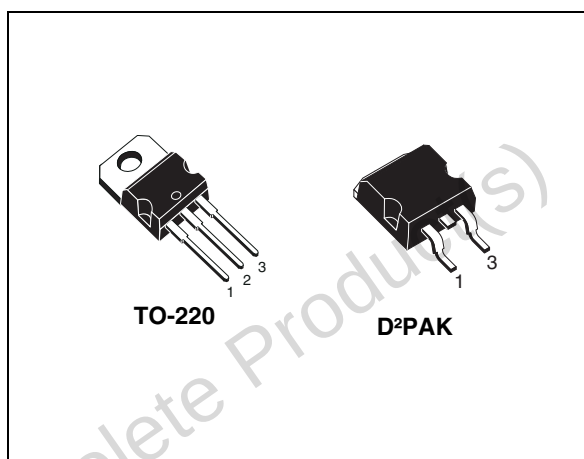


Figure 1. Internal schematic diagram

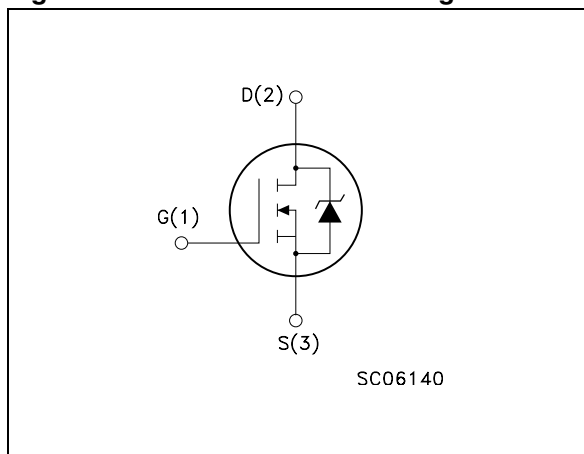


Table 1. Device summary

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

Contents

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STB300NH02L - STP300NH02L

Electrical ratings

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

Electrical characteristics

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2 Electrical characteristics

(T_{CASE}=25°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°C				1 10	μA μA
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{DS} = ±20V				±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250μA		1		2	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10V, I _D = 80A	TO-220 D ² PAK		1.8 1.4	2.2 1.8	mΩ mΩ
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10V, I _D = 80A @ 100°C	TO-220 D ² PAK		2.7 2.1		mΩ mΩ

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 15V, f = 1 MHz, V _{GS} = 0		7055 3251 307		pF pF pF
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 12V, I _D = 120A, V _{GS} = 10V (see Figure 14)		109.4 30.2 26.4		nC nC nC
R _G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test signal level = 20mV open drain		4.4		Ω

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Electrical characteristics

Table 7. Switching times

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

Table 8. Source drain diode

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

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

Electrical characteristics

STB300NH02L - STP300NH02L

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

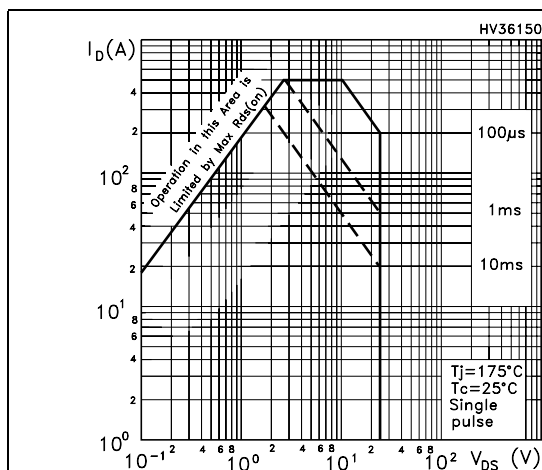


Figure 3. Thermal impedance

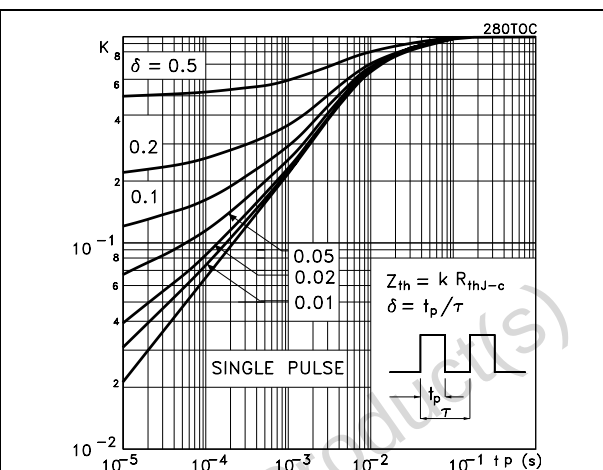


Figure 4. Output characteristics

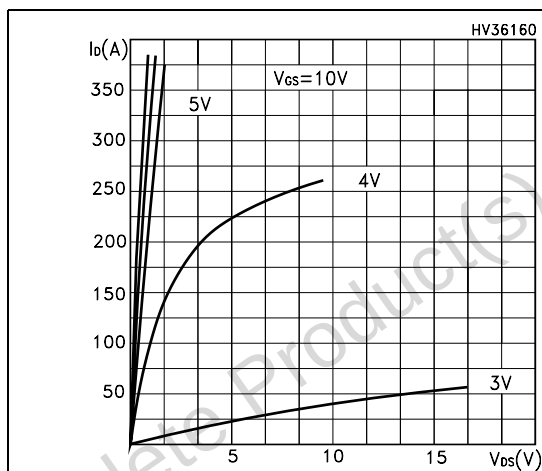


Figure 5. Transfer characteristics

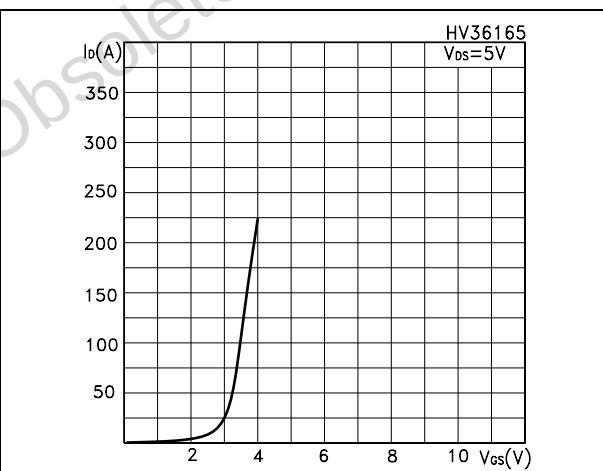


Figure 6. Static drain-source on resistance

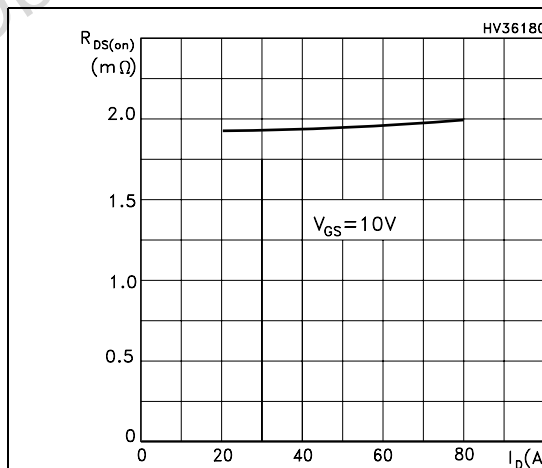
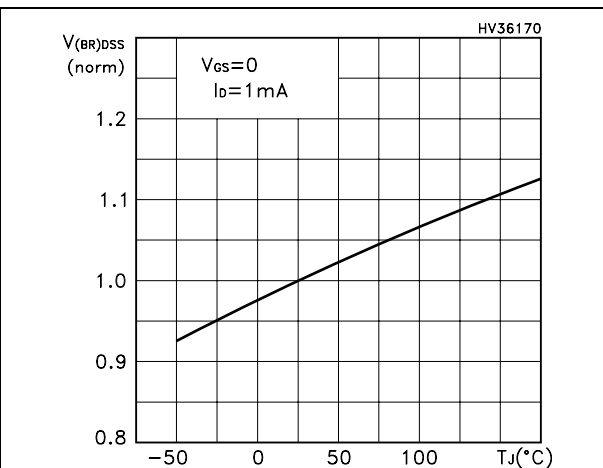


Figure 7. Normalized BVDS vs temperature



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Electrical characteristics

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

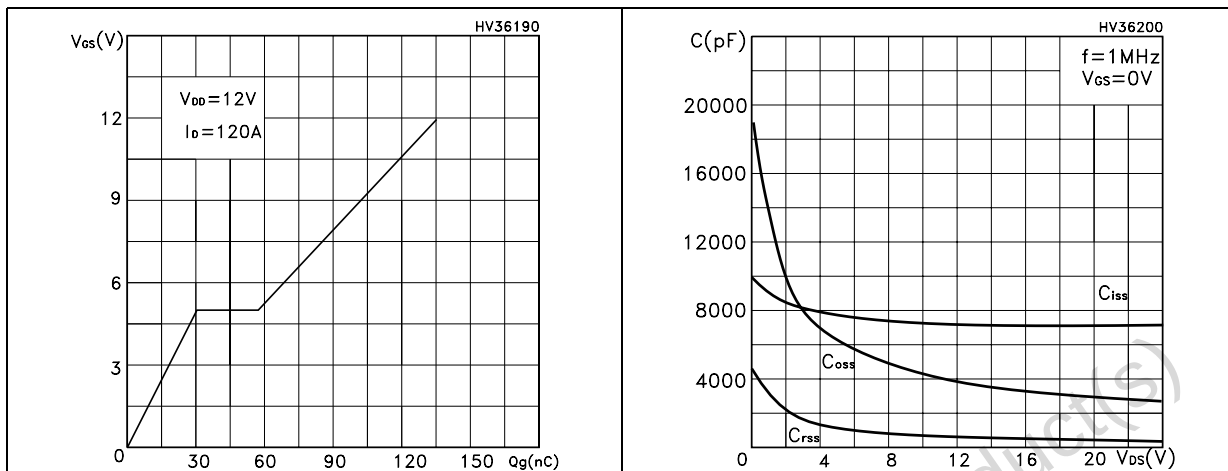


Figure 10. Normalized gate threshold voltage vs temperature **Figure 11. Normalized on resistance vs temperature**

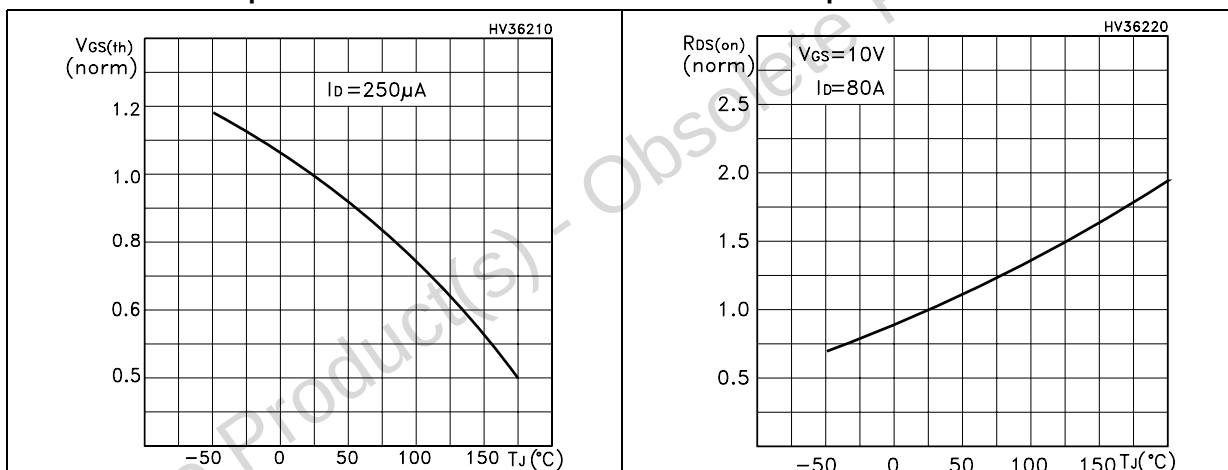
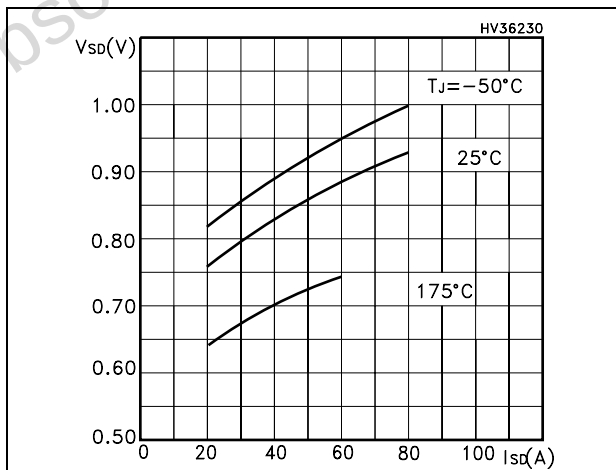


Figure 12. Source-drain diode forward characteristics



Test circuit

STB300NH02L - STP300NH02L

3 Test circuit

Figure 13. Switching times test circuit for resistive load

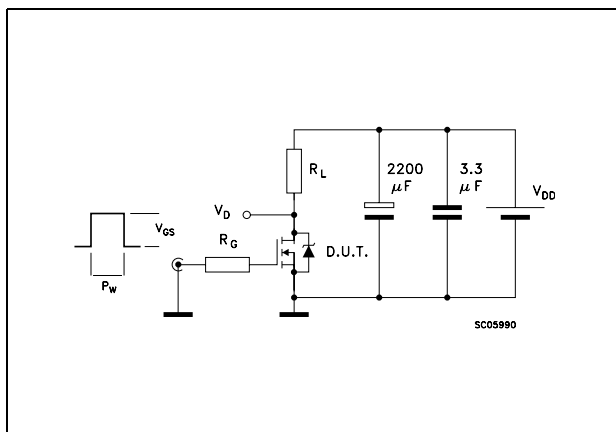


Figure 14. Gate charge test circuit

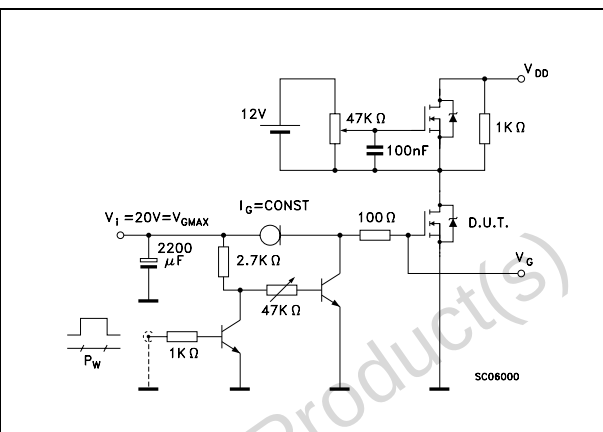


Figure 15. Test circuit for inductive load switching and diode recovery times

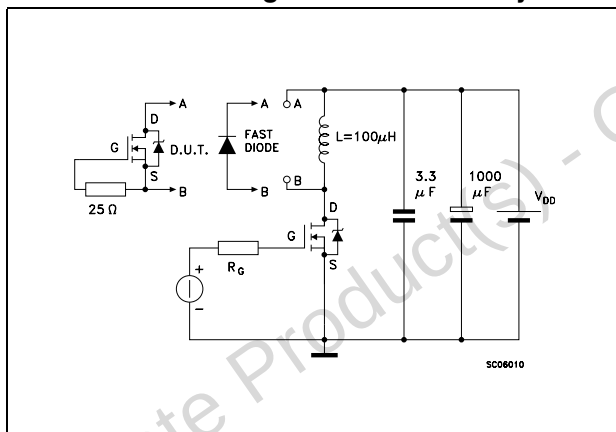


Figure 16. Unclamped inductive load test circuit

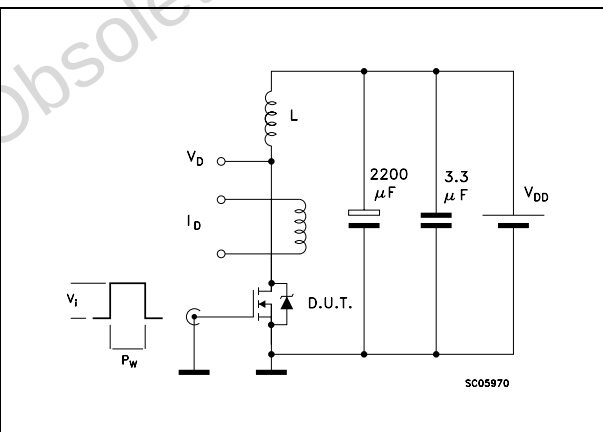


Figure 17. Unclamped inductive waveform

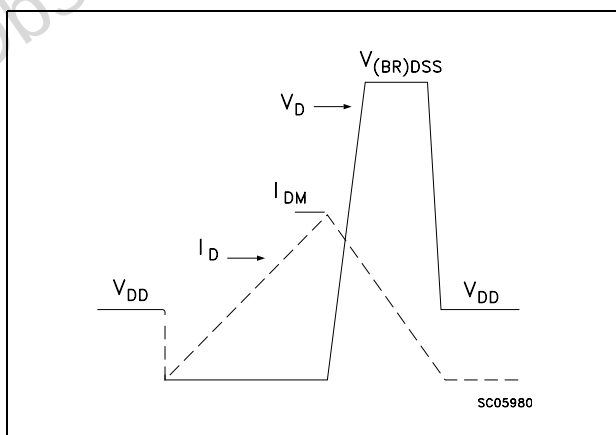
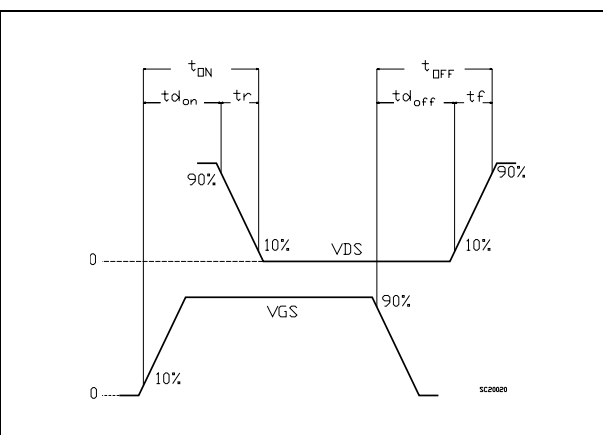


Figure 18. Switching time waveform



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

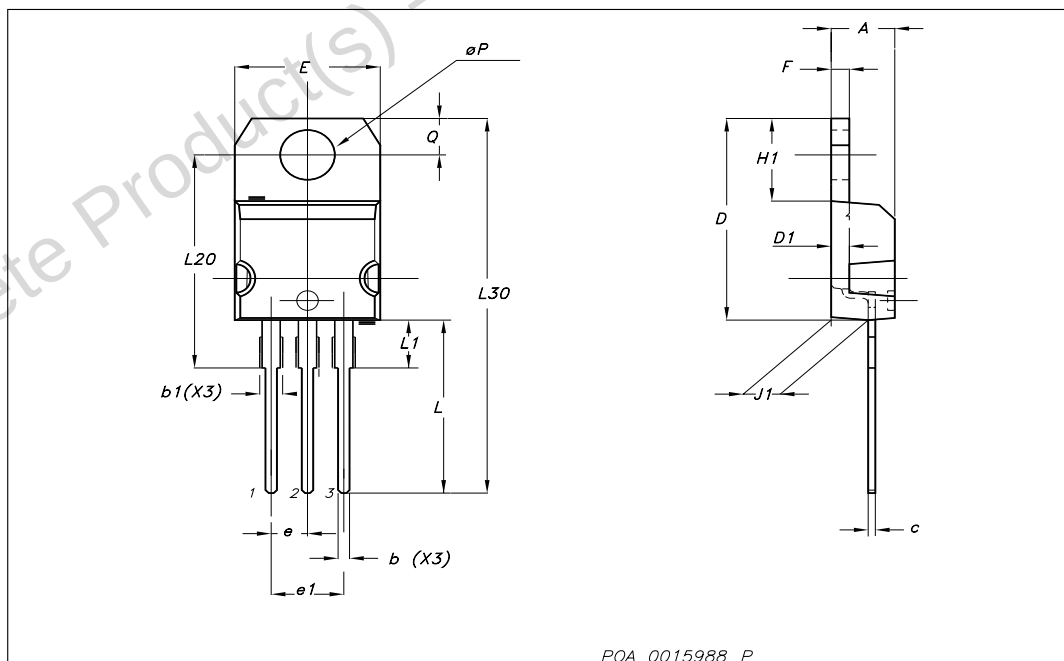
Obsolete Product(s) - Obsolete Product(s)

Package mechanical data

STB300NH02L - STP300NH02L

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

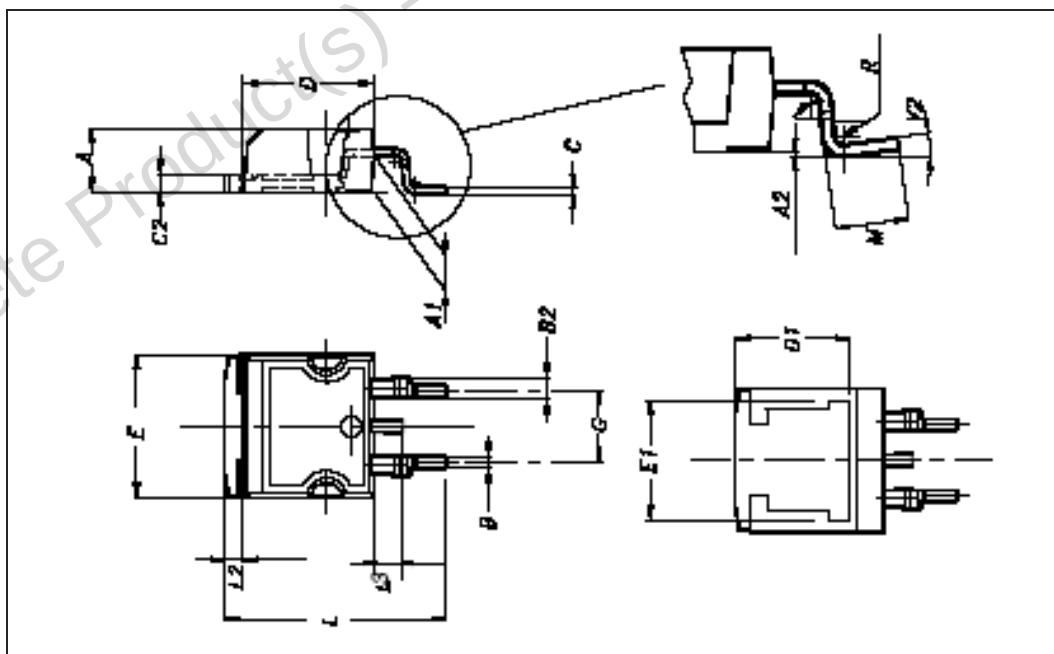


STB300NH02L - STP300NH02L

Package mechanical data

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°			

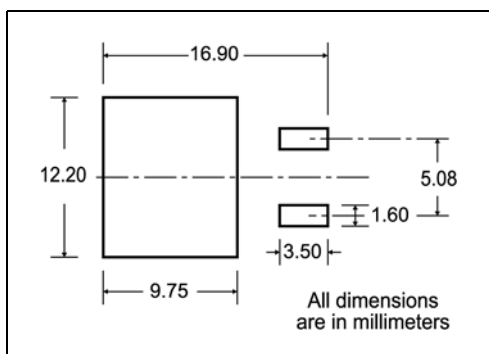


Packaging mechanical data

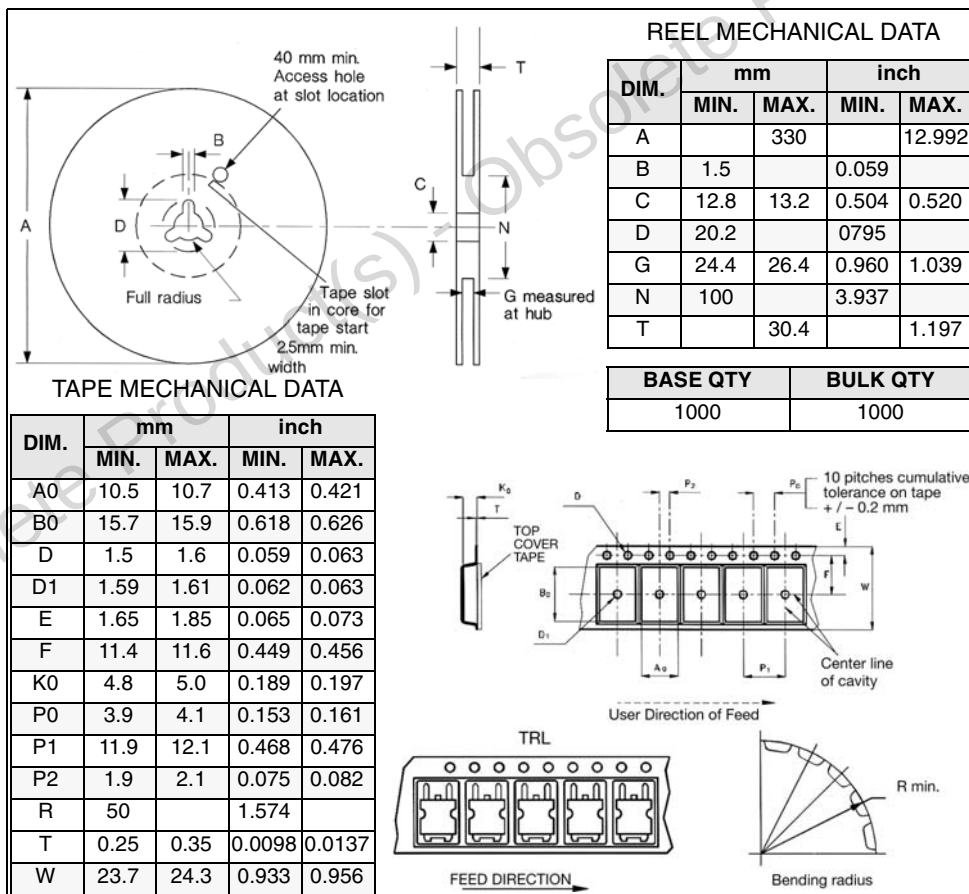
STB300NH02L - STP300NH02L

5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* 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>

STB300NH02L - STP300NH02L

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