



# STP200N4F3 STB200N4F3

N-channel 40 V, 0.0025  $\Omega$ , 120 A, D<sup>2</sup>PAK, TO-220  
planar STripFET™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>w</sub>
STB200N4F3	40 V	<0.0031 $\Omega$	120 A	300 W
STP200N4F3	40 V	<0.0035 $\Omega$	120 A	300 W

- 100 % avalanche tested
- Standard threshold drive

## Application

- Switching applications
- Automotive

## Description

This STripFET™ III Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance providing superior switching performances.

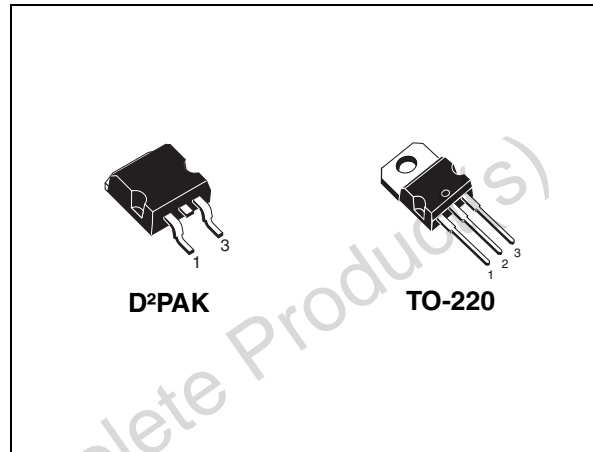


Figure 1. Internal schematic diagram

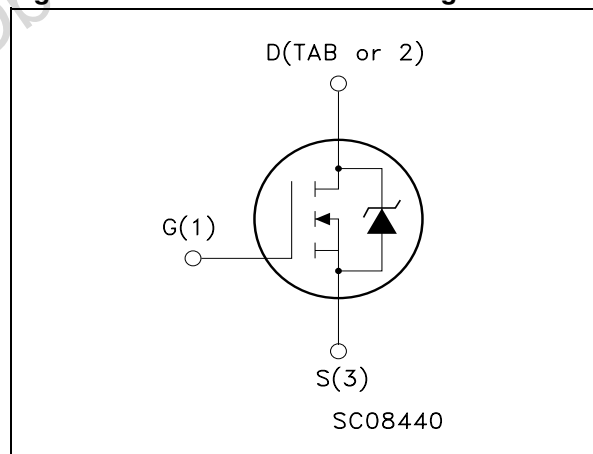


Table 1. Device summary

Order code	Marking	Package	Packaging
STB200N4F3	200N4F3	D <sup>2</sup> PAK	Tape and reel
STP200N4F3	200N4F3	TO-220	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2.0	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	862	mJ
$dv/dt^{(4)}$	Peak diode recovery voltage slope	4.2	V/ns
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Current limited by package
2. Pulse width limited by safe operating area
3. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 25\text{ V}$
4.  $I_{SD} \leq 60\text{ A}$ ,  $di/dt \leq 440\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$ .

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-220	D <sup>2</sup> PAK	
$R_{thJC}$	Thermal resistance junction-case max	0.50		$^\circ\text{C}/\text{W}$
$R_{thJ-PCB}^{(1)}$	Thermal resistance junction-pcb max		35	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance junction-ambient max	62.5		$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board, 1inch<sup>2</sup> 2 oz. Cu.

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	40			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ , $V_{DS} = \text{Max rating @ } 125\text{ °C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ \text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\ \text{V}$ , $I_D = 60\ \text{A}$ D <sup>2</sup> PAK TO-220		0.0025 0.0030	0.0031 0.0035	$\Omega$ $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 10\ \text{V}$ , $I_D = 80\ \text{A}$	-	200	-	S
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0$	-	5100	-	pF
$C_{oss}$	Output capacitance			1270		pF
$C_{rss}$	Reverse transfer capacitance			37		pF
$Q_g$	Total gate charge	$V_{DD} = 20\ \text{V}$ , $I_D = 120\ \text{A}$	-	75	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\ \text{V}$		23		nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)		17		nC

1. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD} = 20\text{ V}$ , $I_D = 60\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 13)	-	19 180	-	ns ns
$t_{d(off)}$ $t_f$	Off-voltage rise time Fall time	$V_{DD} = 20\text{ V}$ , $I_D = 60\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 13)	-	90 65	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$	Source-drain current Source-drain current (pulsed)		-		120 480	A A
$V_{SD}$	Forward on voltage	$I_{SD} = 120\text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 120\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 20\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$ (see Figure 18)	-	67 130 4		ns nC A

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

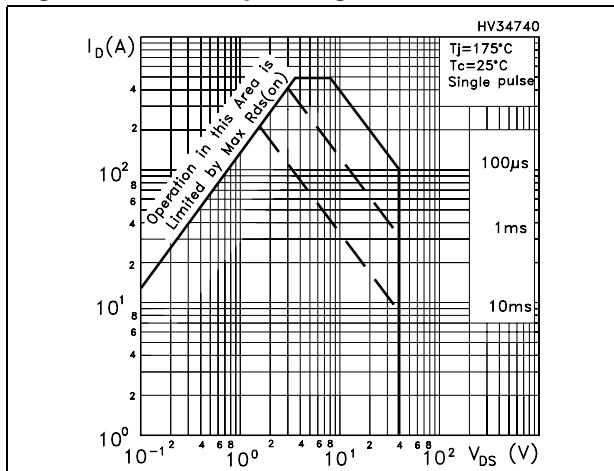


Figure 3. Thermal impedance

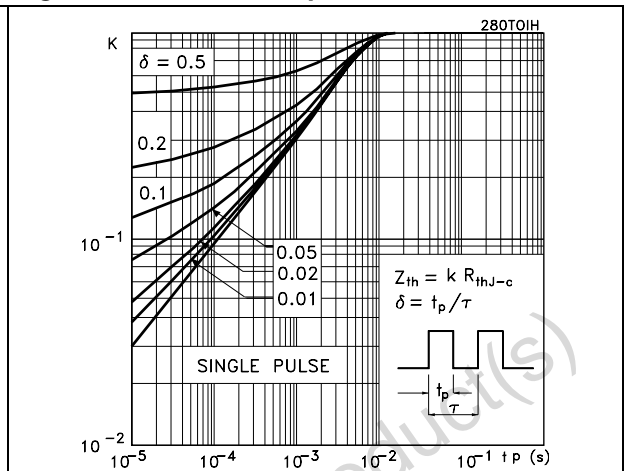


Figure 4. Output characteristics

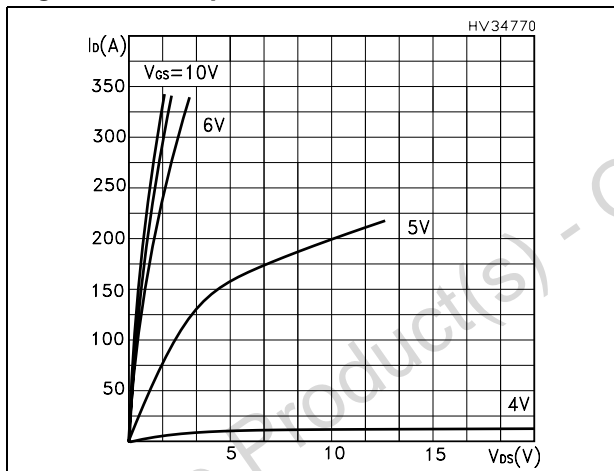


Figure 5. Transfer characteristics

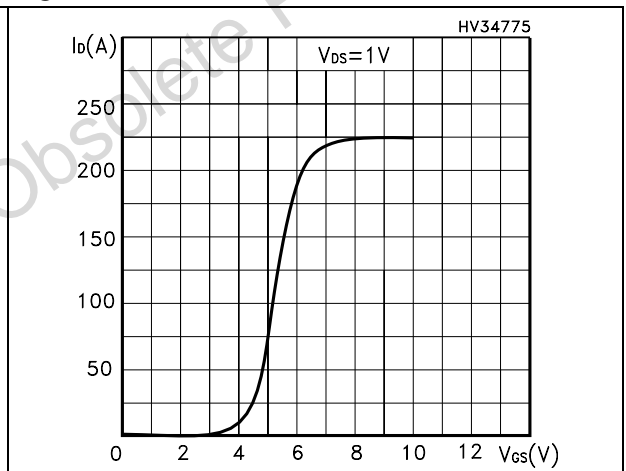


Figure 6. Normalized  $B_{V_{DS}}$  vs. temperature

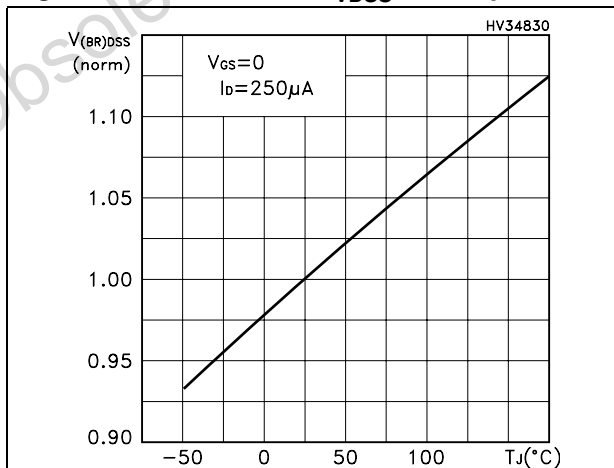


Figure 7. Static drain-source on resistance

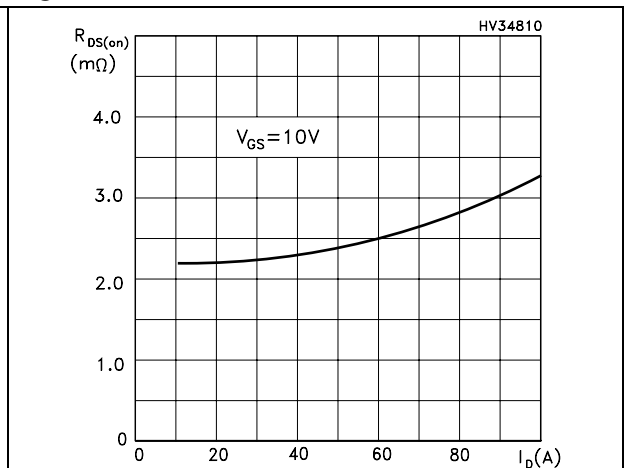


Figure 8. Gate charge vs. gate-source voltage

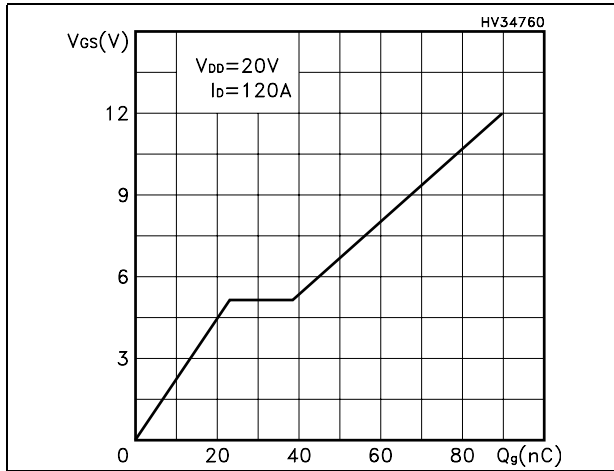


Figure 9. Capacitance variations

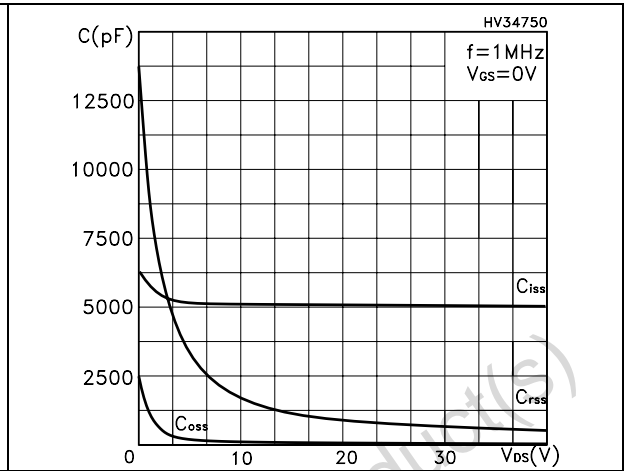


Figure 10. Normalized gate threshold voltage vs. temperature

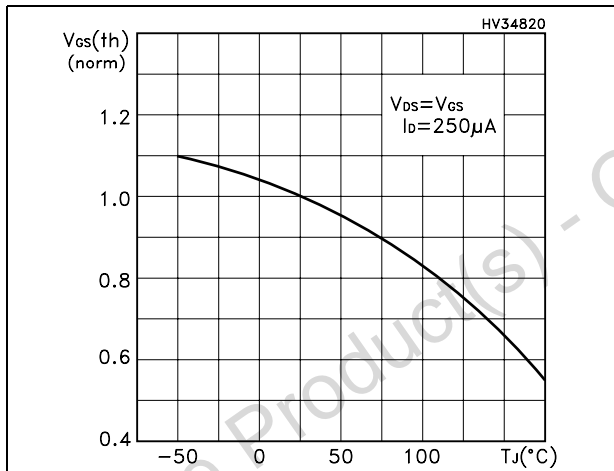


Figure 11. Normalized on resistance vs. temperature

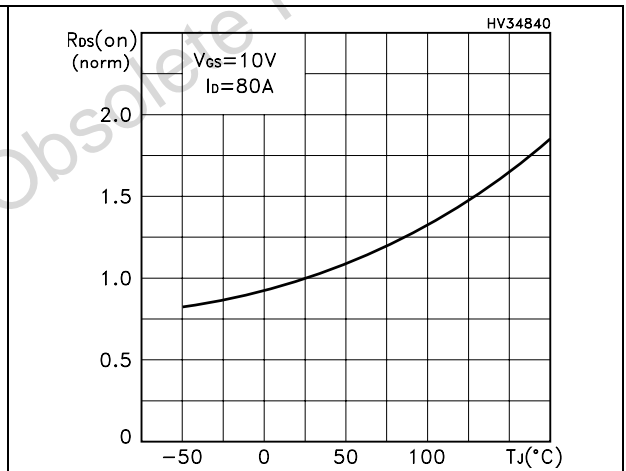
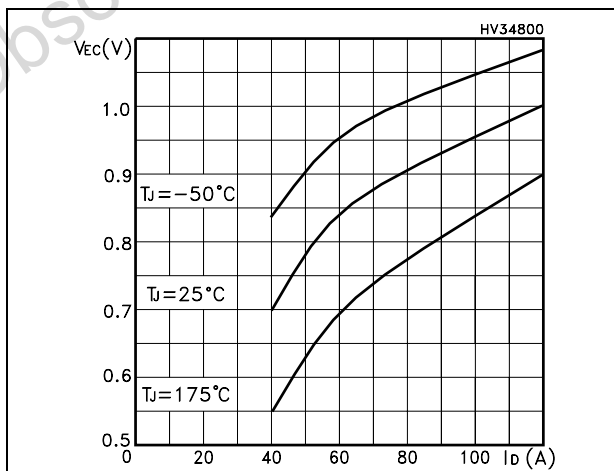


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

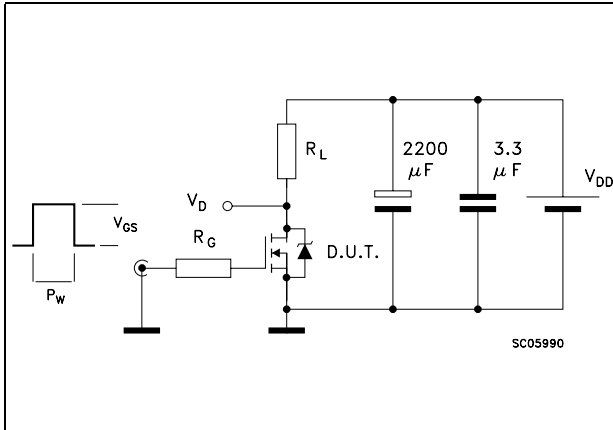


Figure 14. Gate charge test circuit

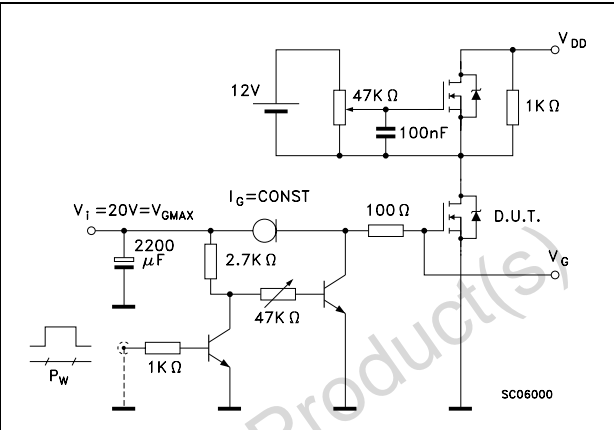


Figure 15. Test circuit for inductive load switching and diode recovery times

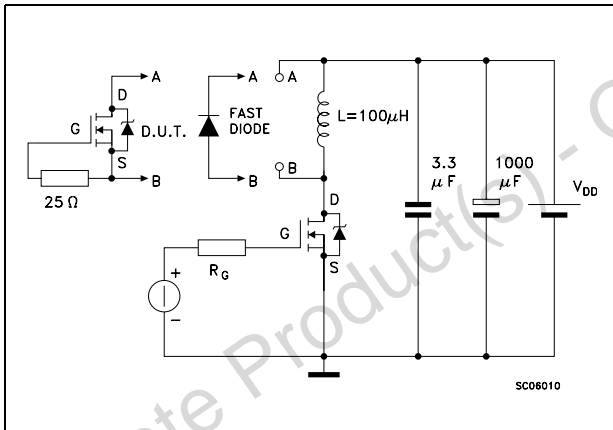


Figure 16. Unclamped inductive load test circuit

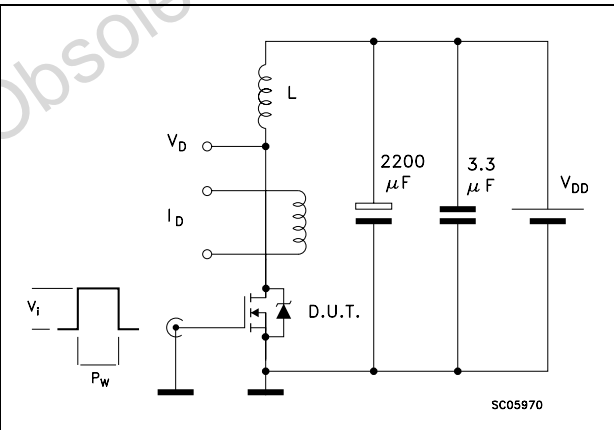


Figure 17. Unclamped inductive waveform

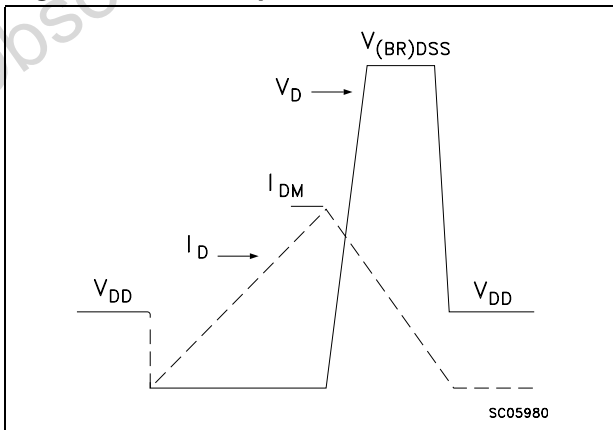
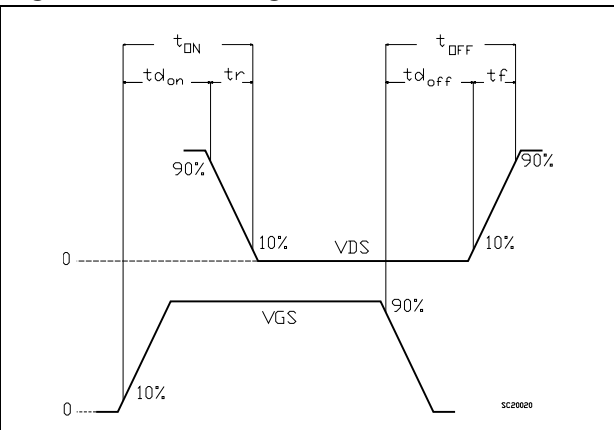


Figure 18. Switching time waveform





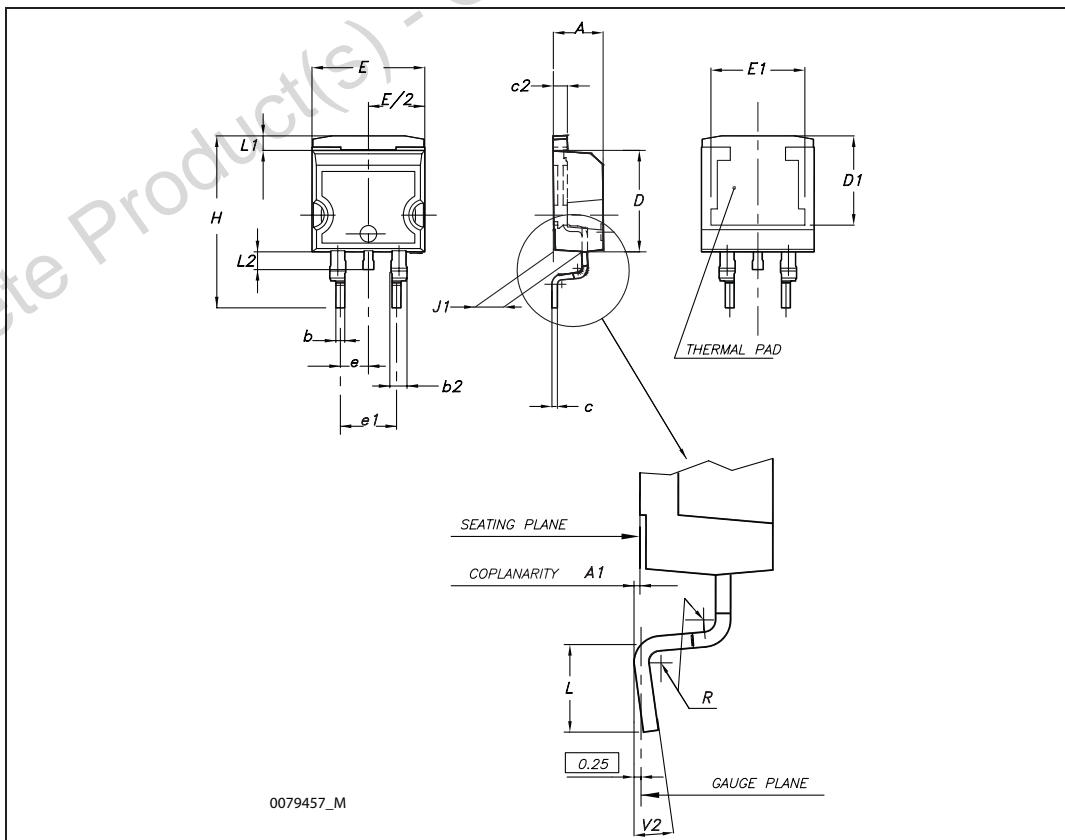
## 4 Package mechanical data

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

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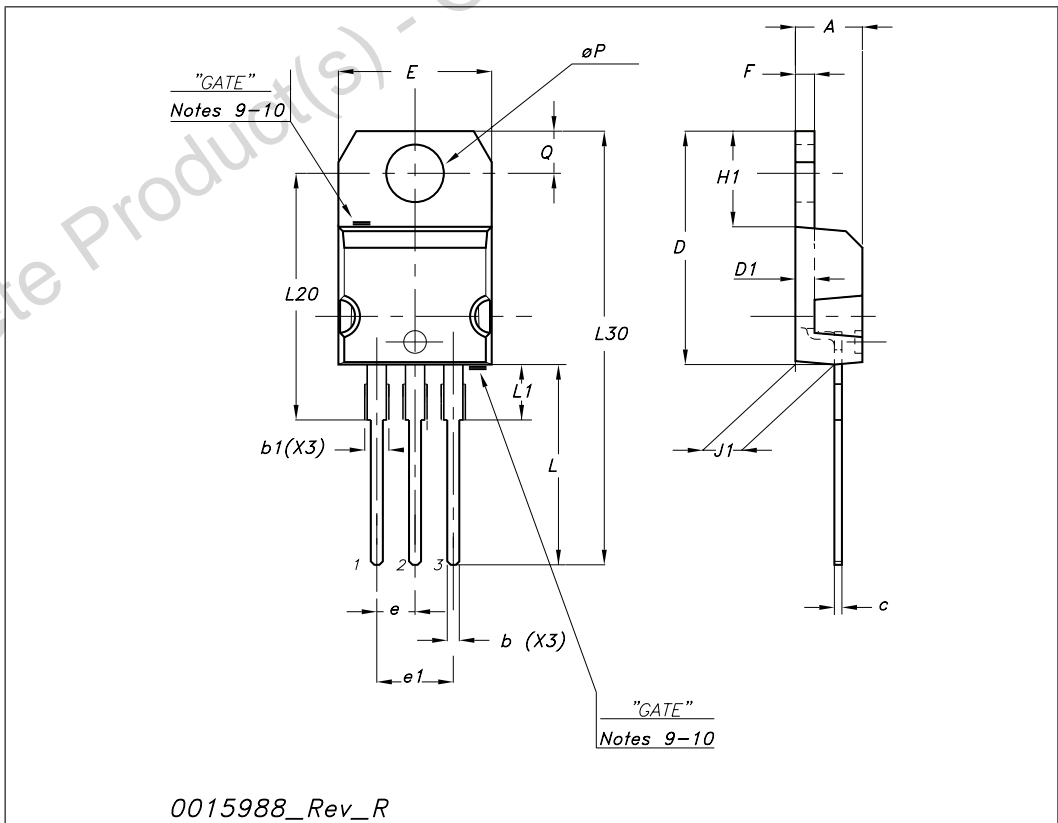
D<sup>2</sup>PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



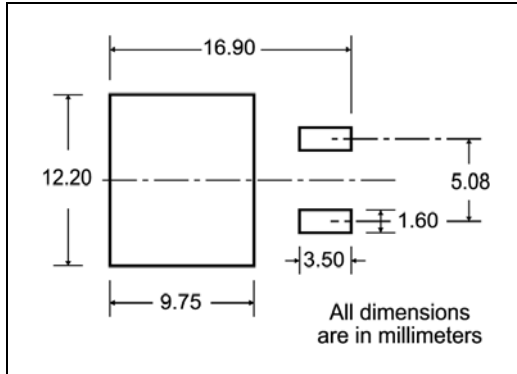
TO-220 mechanical data

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	0.48		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	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



## 5 Packaging mechanical data

### D<sup>2</sup>PAK FOOTPRINT



### TAPE AND REEL SHIPMENT

**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

**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

\* on sales type

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
02-Mar-2007	1	First release
02-Oct-2007	2	Added TO-220 package
23-Jun-2009	3	Updated $R_{DS(on)}$ limits in <a href="#">Table 4</a> and <a href="#">Figure 7</a>

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