



# THE DATASHEET OF STP200NF04





# STP200NF04 STB200NF04 - STB200NF04-1

N-CHANNEL 40V - 120A TO-220/D<sup>2</sup>PAK/I<sup>2</sup>PAK  
STripFET™ II POWER MOSFET

PRELIMINARY DATA

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STP200NF04	40 V	< 0.0037 Ω	120 A	310 W
STB200NF04	40 V	< 0.0037 Ω	120 A	310 W
STB200NF04-1	40 V	< 0.0037 Ω	120 A	310 W

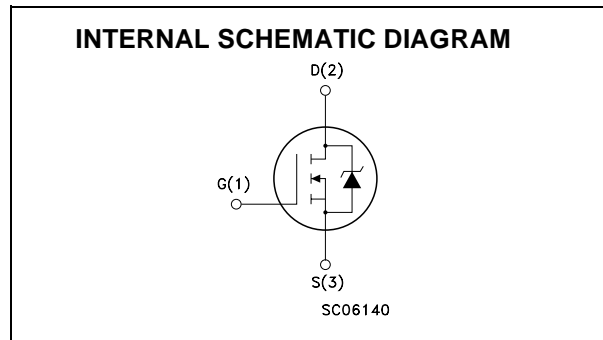
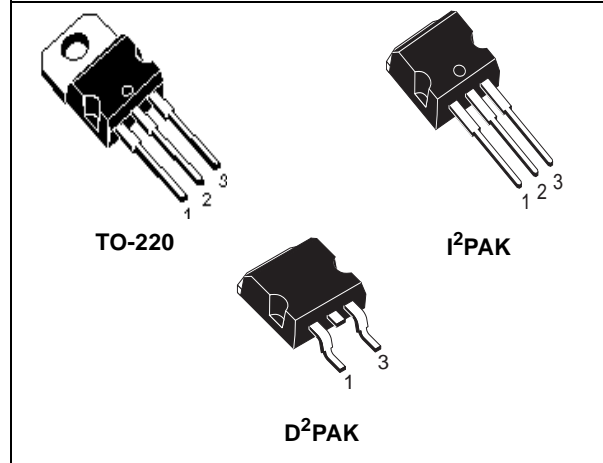
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

## DESCRIPTION

This MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED
- AUTOMOTIVE



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP200NF04	P200NF04	TO-220	TUBE
STB200NF04T4	B200NF04	D <sup>2</sup> PAK	TAPE & REEL
STB200NF04-1	B200NF04	I <sup>2</sup> PAK	TUBE

## STP200NF04 - STB200NF04 - STB200NF04-1

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	40	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	40	V
V <sub>GS</sub>	Gate- source Voltage	± 20	V
I <sub>D</sub> (#)	Drain Current (continuous) at T <sub>C</sub> = 25°C	120	A
I <sub>D</sub> (#)	Drain Current (continuous) at T <sub>C</sub> = 100°C	120	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	480	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	310	W
	Derating Factor	2.07	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	1.5	V/ns
E <sub>AS</sub> (2)	Single Pulse Avalanche Energy	1.3	J
T <sub>j</sub> T <sub>stg</sub>	Operating Junction Temperature Storage Temperature	-55 to 175	°C

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 120A, di/dt ≤ 500A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

(2) Starting T<sub>j</sub> = 25°C, I<sub>d</sub> = 60A, V<sub>DD</sub> = 30 V

(#) Current Limited by Package

### THERMAL DATA

		TO-220 / I <sup>2</sup> PAK / D <sup>2</sup> PAK	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	0.48	°C/W
R <sub>thj-pcb</sub>	Thermal Resistance Junction-pcb Max	See Curve on page 4	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient (Free air) Max	62.5	°C/W
T <sub>I</sub>	Maximum Lead Temperature For Soldering Purpose	300	°C

### ELECTRICAL CHARACTERISTICS (TCASE = 25°C UNLESS OTHERWISE SPECIFIED)

ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			1 10	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2		4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 90 A			0.0037	Ω

**ELECTRICAL CHARACTERISTICS (CONTINUED)**

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (1)	Forward Transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 90\text{ A}$		150		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		5100 1600 600		pF pF pF

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 20\text{ V}$ , $I_D = 90\text{ A}$ $R_G = 4.7\Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		30 320		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 20\text{ V}$ , $I_D = 120\text{ A}$ , $V_{GS} = 10\text{ V}$ (see, Figure 4)		170 30 45	210	nC nC nC

**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ $t_f$	Turn-off Delay Time Fall Time	$V_{DD} = 20\text{ V}$ , $I_D = 90\text{ A}$ $R_G = 4.7\Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		140 120		ns ns

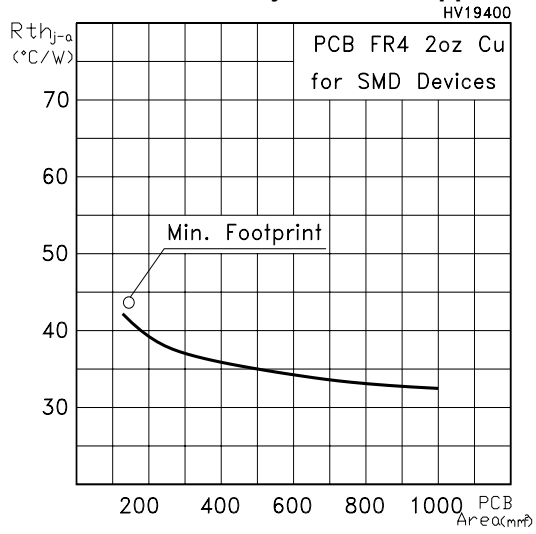
**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$ (2)	Source-drain Current Source-drain Current (pulsed)				120 480	A A
$V_{SD}$ (1)	Forward On Voltage	$I_{SD} = 120\text{ A}$ , $V_{GS} = 0$			1.3	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 120\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 30\text{ V}$ , $T_j = 150^\circ\text{C}$ (see test circuit, Figure 5)		85 190 4.5		ns nC A

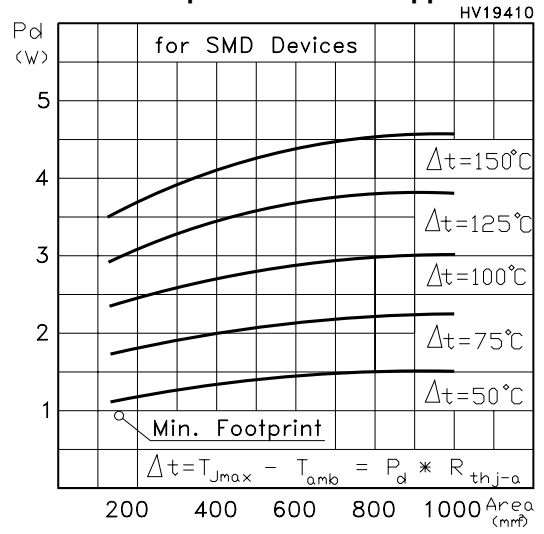
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

**STP200NF04 - STB200NF04 - STB200NF04-1**

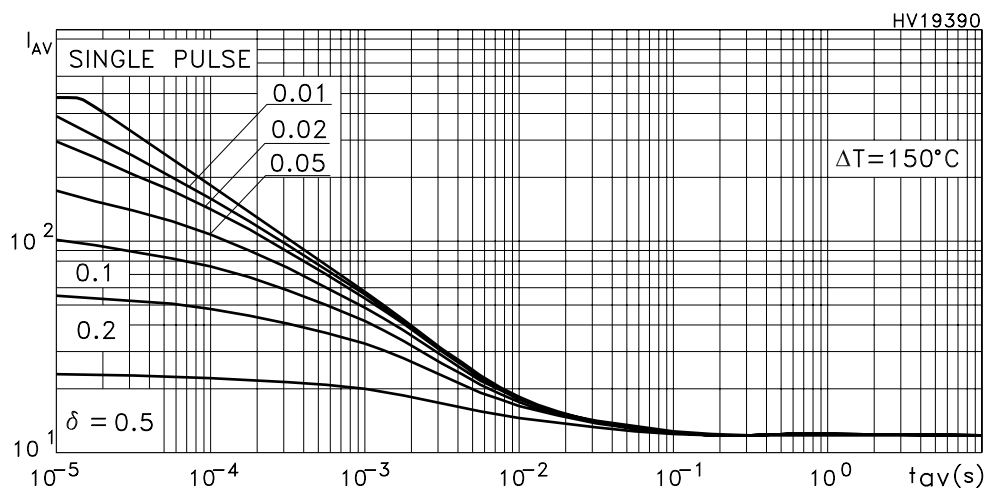
**Thermal Resistance Rthj-a vs PCB Copper Area**



**Max Power Dissipation vs PCB Copper Area**



**Allowable  $I_{AV}$  vs. Time in Avalanche**



The previous curve gives the safe operating area for unclamped inductive loads, single pulse or repetitive, under the following conditions:

$$P_{D(AVE)} = 0.5 * (1.3 * BV_{DSS} * I_{AV})$$

$$E_{AS(AR)} = P_{D(AVE)} * t_{AV}$$

Where:

$I_{AV}$  is the Allowable Current in Avalanche

$P_{D(AVE)}$  is the Average Power Dissipation in Avalanche (Single Pulse)

$t_{AV}$  is the Time in Avalanche

To derate above  $25^\circ C$ , at fixed  $I_{AV}$ , the following equation must be applied:

$$I_{AV} = 2 * (T_{jmax} - T_{CASE}) / (1.3 * BV_{DSS} * Z_{th})$$

Where:

$Z_{th} = K * R_{th}$  is the value coming from Normalized Thermal Response at fixed pulse width equal to  $T_{AV}$ .

**SPICE THERMAL MODEL**

Parameter	Node	Value
CTHERM1	1 - 2	1.4958E-3
CTHERM2	2 - 3	3.5074E-2
CTHERM3	3 - 4	5.939E-2
CTHERM4	4 - 5	9.7411E-2
CTHERM5	5 - 6	8.8596E-2
CTHERM6	6 - 7	8.2755E-1
R THERM1	1 - 2	0.0384
R THERM2	2 - 3	0.0624
R THERM3	3 - 4	0.072
R THERM4	4 - 5	0.0912
R THERM5	5 - 6	0.1008
R THERM6	6 - 7	0.1152

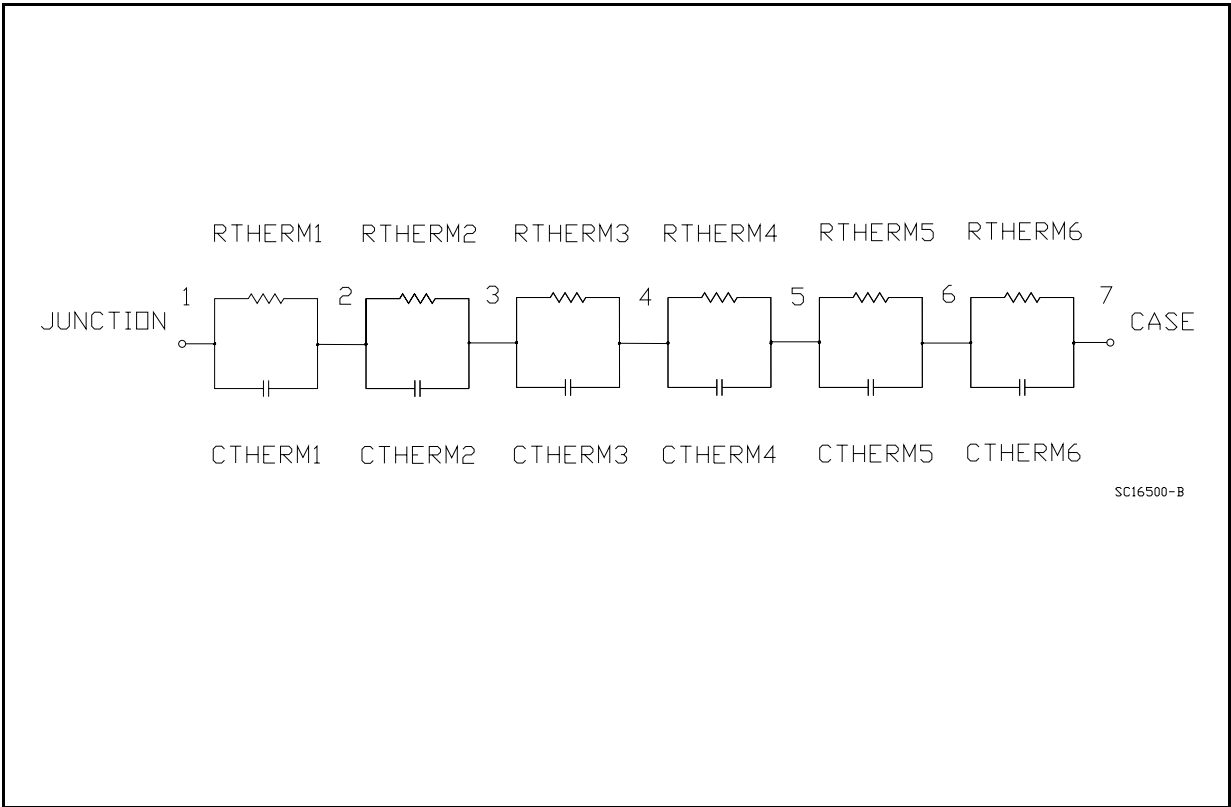


Fig. 1: Unclamped Inductive Load Test Circuit

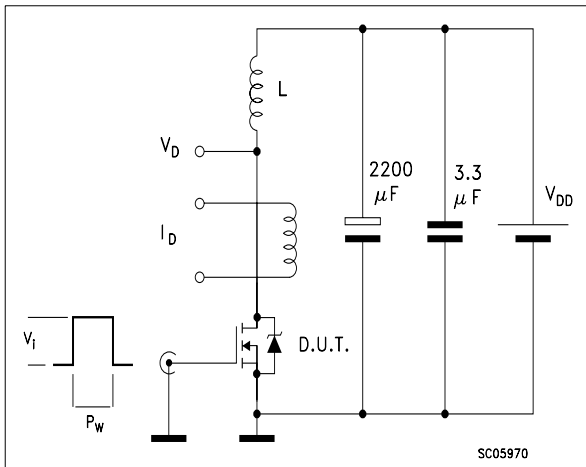


Fig. 2: Unclamped Inductive Waveform

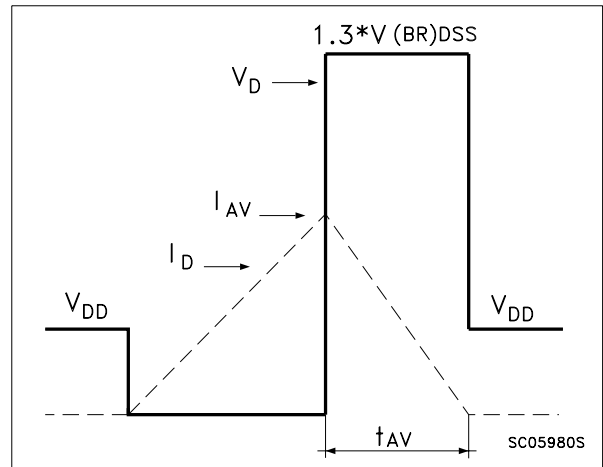


Fig. 3: Switching Times Test Circuit For Resistive Load

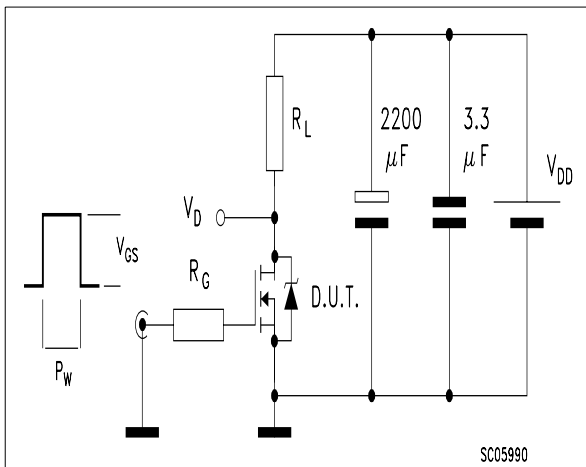


Fig. 3.1: Inductive Load Switching And Diode Recovery Times Waveform

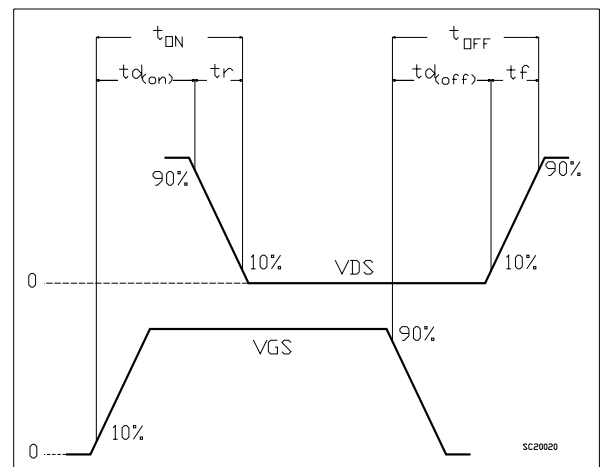


Fig. 4: Gate Charge test Circuit

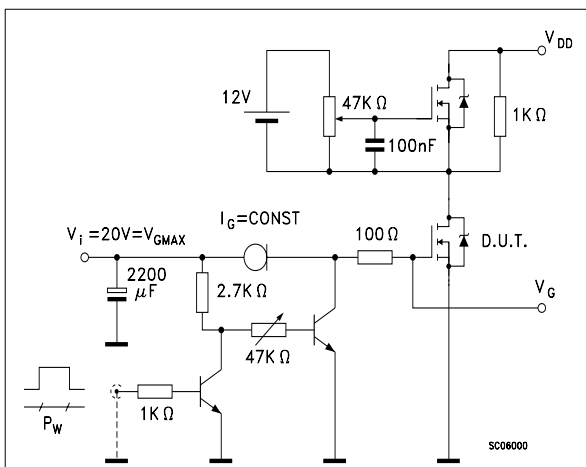


Fig. 4.1: Gate Charge test Waveform

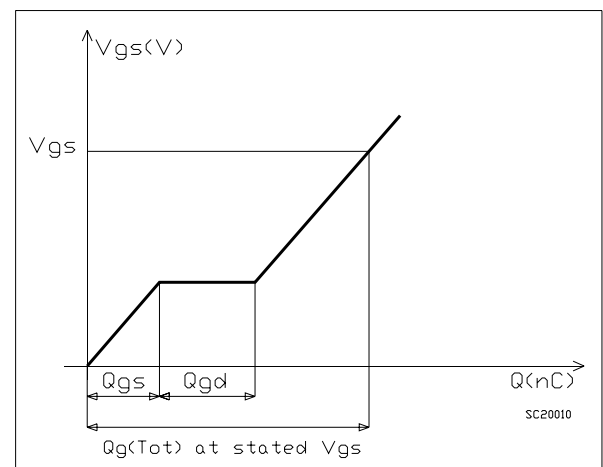


Fig. 5: Test Circuit For Diode Recovery Times

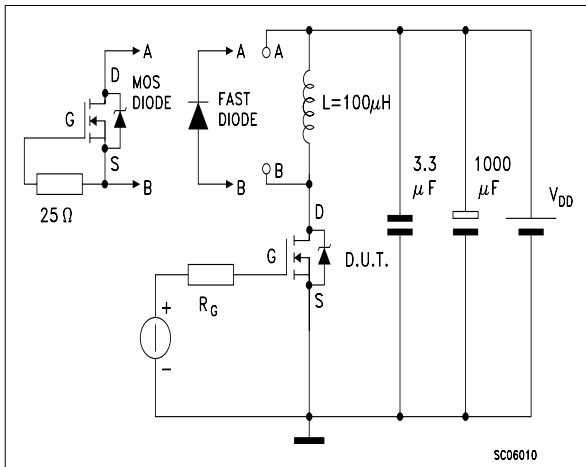
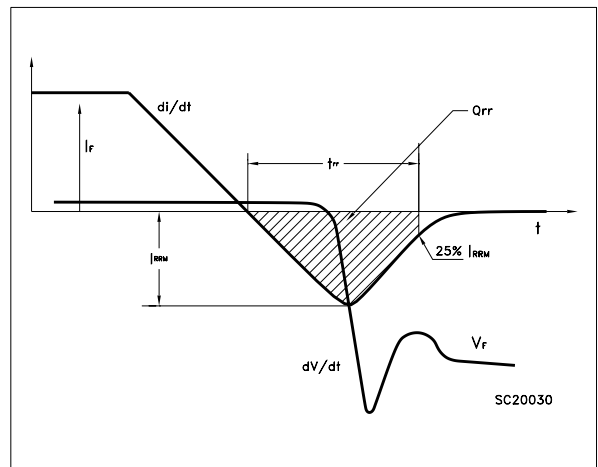
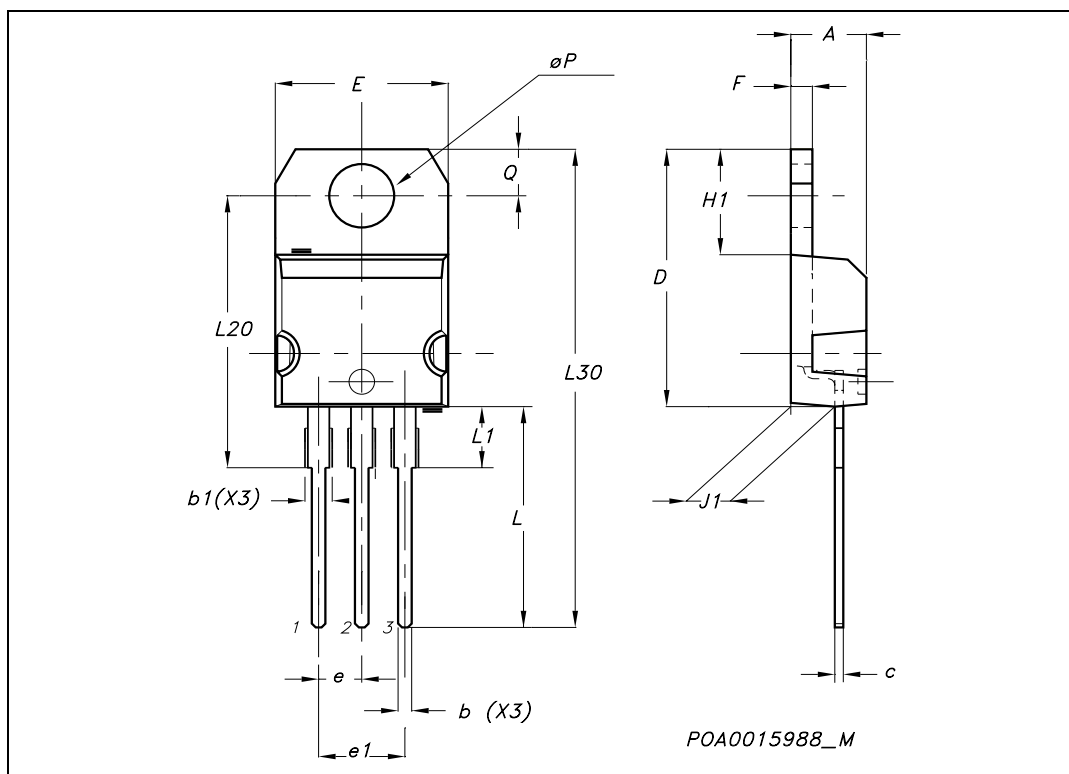


Fig. 5.1: Diode Recovery Times Waveform



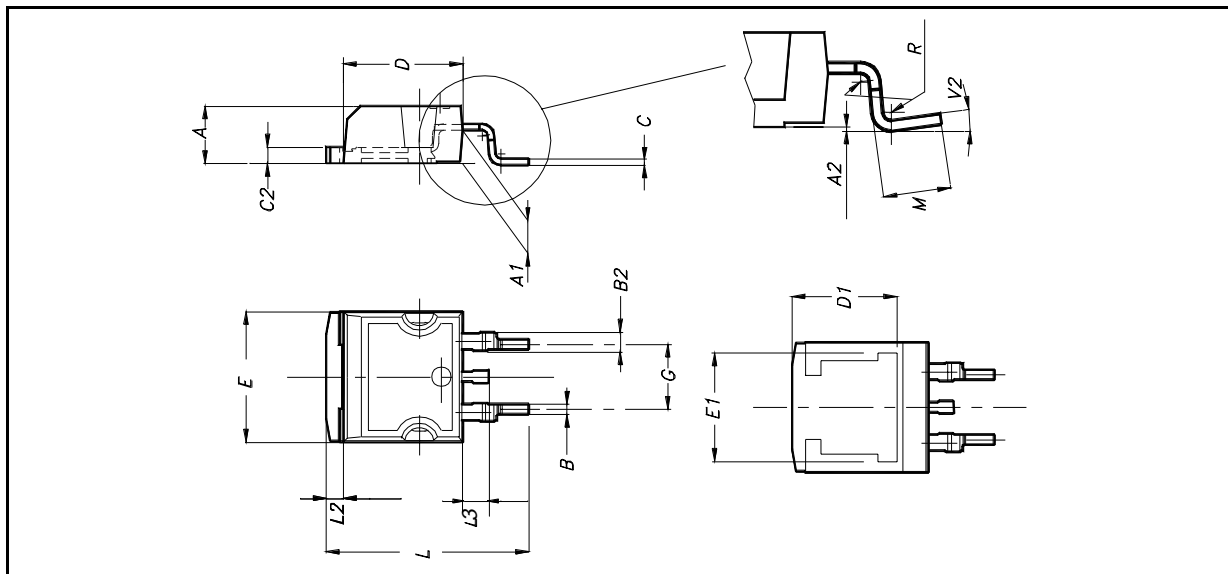
TO-220 MECHANICAL DATA

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	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
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		0.052
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



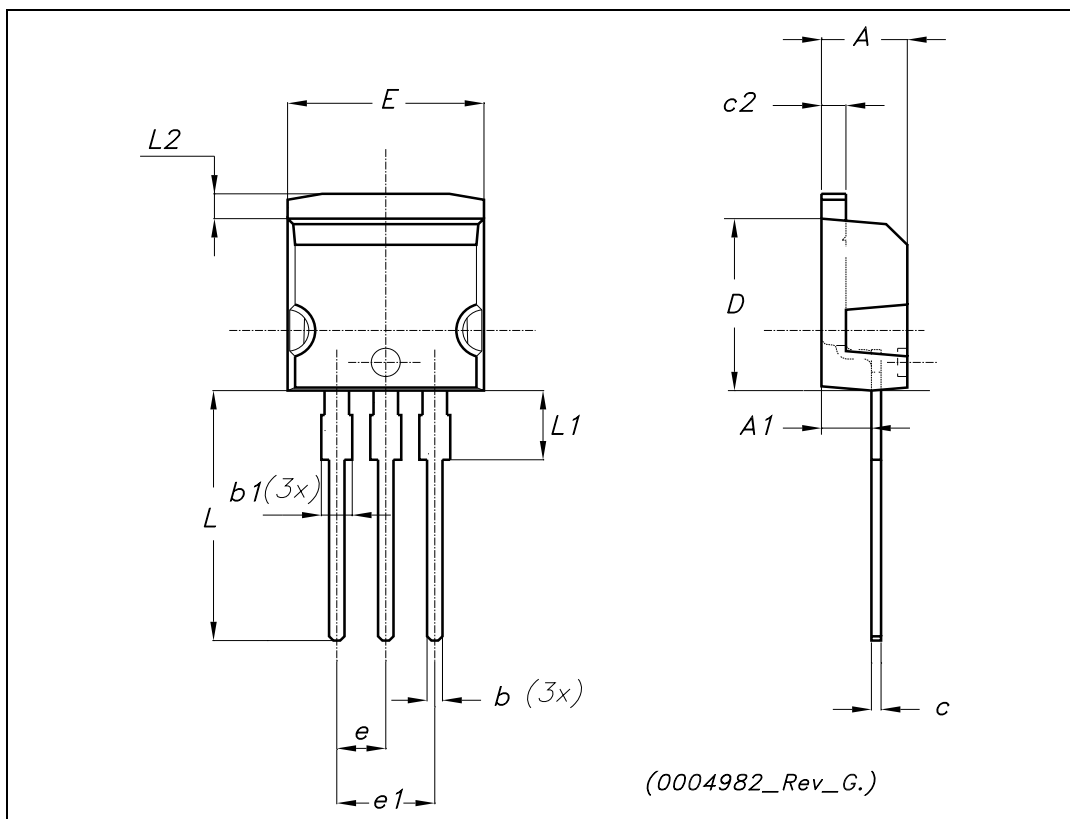
**D<sup>2</sup>PAK MECHANICAL DATA**

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		
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	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			



TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
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
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055





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