



# STP200NF03 STB200NF03 STB200NF03-1

N-CHANNEL 30V - 0.0032  $\Omega$  - 120A D<sup>2</sup>PAK/I<sup>2</sup>PAK/TO-220  
STripFET™ II POWER MOSFET

AUTOMOTIVE SPECIFIC

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB200NF03/-1	30 V	<0.0036 $\Omega$	120 A(**)
STP200NF03	30 V	<0.0036 $\Omega$	120 A(**)

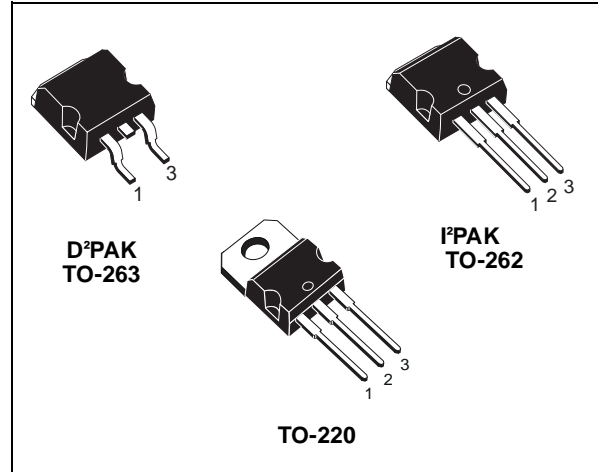
- TYPICAL R<sub>DS(on)</sub> = 0.0032 $\Omega$
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

## DESCRIPTION

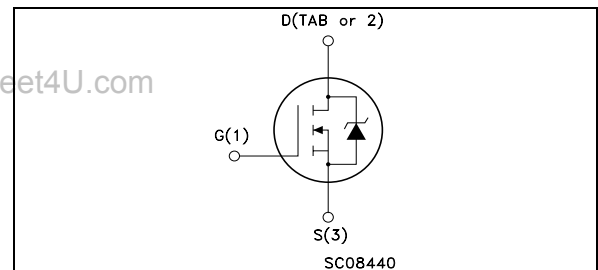
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED
- DC-DC & DC-AC CONVERTERS
- SOLENOID AND RELAY DRIVERS



## INTERNAL SCHEMATIC DIAGRAM



## Ordering Information

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB200NF03T4	B200NF03	D <sup>2</sup> PAK	TAPE & REEL
STP200NF03	P200NF03	TO-220	TUBE
STB200NF03-1	B200NF03	I <sup>2</sup> PAK	TUBE

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	30	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ )	30	V
V <sub>GS</sub>	Gate- source Voltage	$\pm 20$	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	300	W
	Derating Factor	2.0	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	1.5	V/ns
E <sub>AS</sub> (2)	Single Pulse Avalanche Energy	1.45	J
T <sub>stg</sub>	Storage Temperature	-55 to 175	°C
T <sub>j</sub>	Operating Junction Temperature		

(•) Pulse width limited by safe operating area.

(\*\*) Current Limited by Package

(1) I<sub>SD</sub>  $\leq$  120A, di/dt  $\leq$  400A/ $\mu$ s, V<sub>DD</sub>  $\leq$  V<sub>(BR)DSS</sub>, T<sub>j</sub>  $\leq$  T<sub>JMAX</sub>

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

**STB200NF03/-1 STP200NF03****THERMAL DATA**

Rthj-case	Thermal Resistance Junction-case	Max	0.5	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	°C/W
Rthj-pcb	Thermal Resistance Junction-pcb	Max	see curve on page 6	°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose (for 10 sec. 1.6 mm from case)	Typ	300	°C

**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)**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	30			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

**ON (\*)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 μA	2		4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V I <sub>D</sub> = 60 A		0.0032	0.0036	Ω

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> = 15 V I <sub>D</sub> = 60 A		200		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		4950		pF
C <sub>OSS</sub>	Output Capacitance			1750		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			280		pF

## ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 15\text{ V}$ $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load, Figure 3)		30 195		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 24\text{ V}$ $I_D = 120\text{ A}$ $V_{GS} = 10\text{ V}$		113 32 41	140	nC nC nC

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ $t_f$	Turn-off Delay Time Fall Time	$V_{DD} = 15\text{ V}$ $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (Resistive Load, Figure 3)		75 60		ns ns

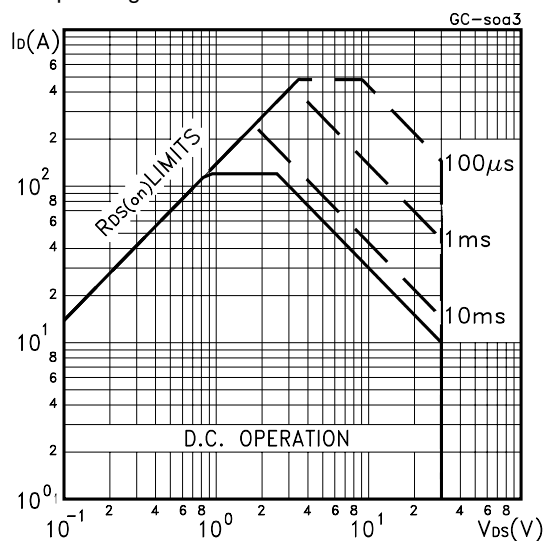
## SOURCE DRAIN DIODE

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	$I_{SD} = 120\text{ A}$ $V_{GS} = 0$			1.3	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 120\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150^\circ\text{C}$ (see test circuit, Figure 5)		70 170 5		ns nC A

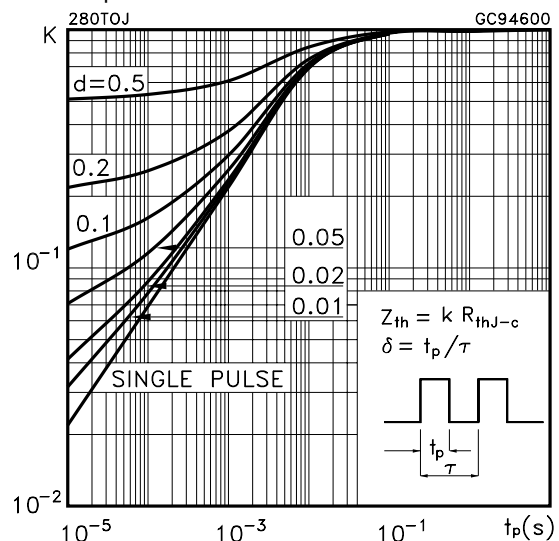
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

(●) Pulse width limited by safe operating area.

## Safe Operating Area

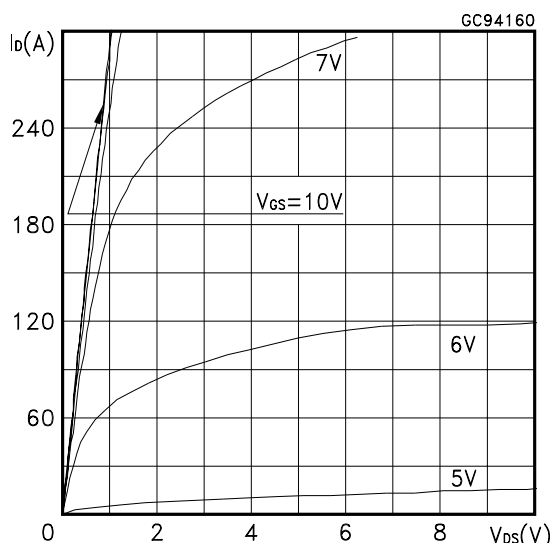


## Thermal Impedance

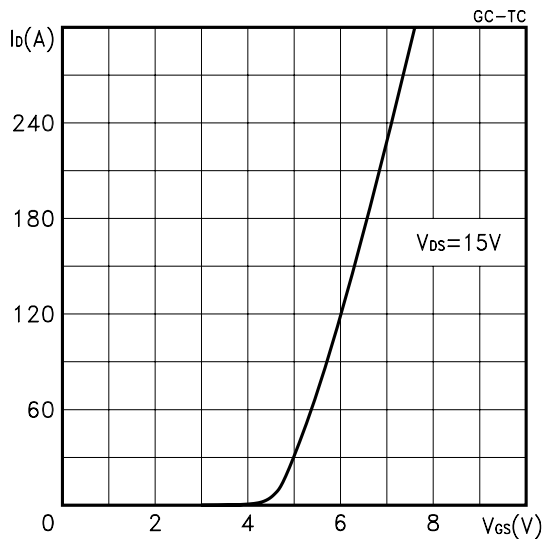


# STB200NF03/-1 STP200NF03

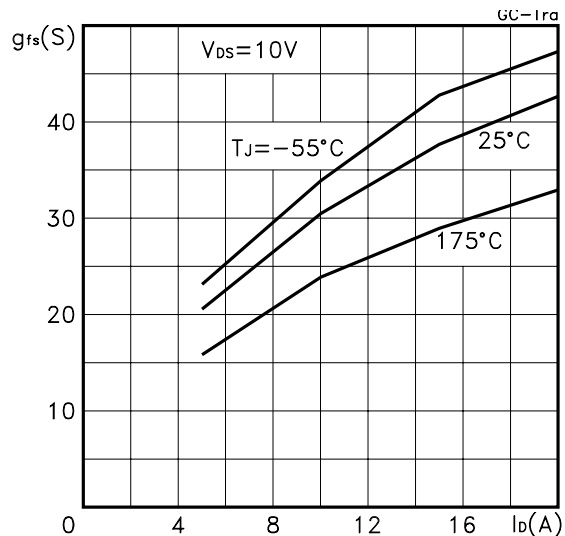
Output Characteristics



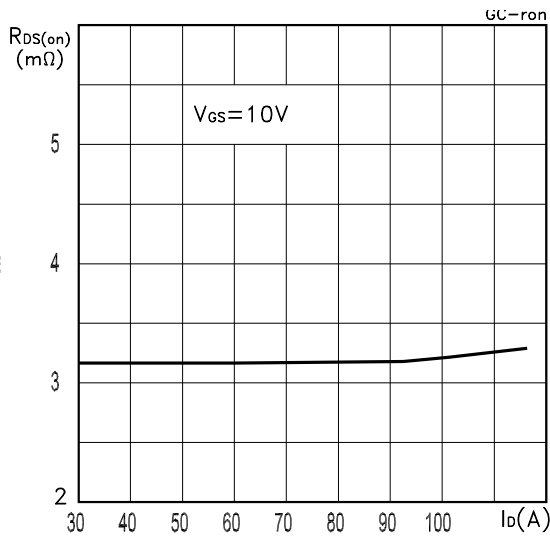
Transfer Characteristics



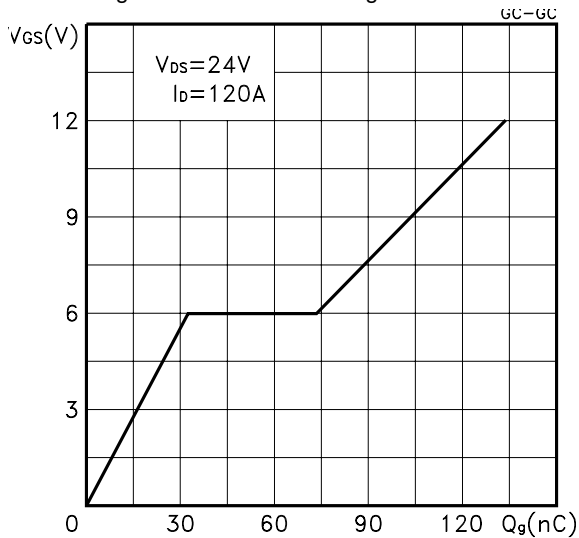
Transconductance



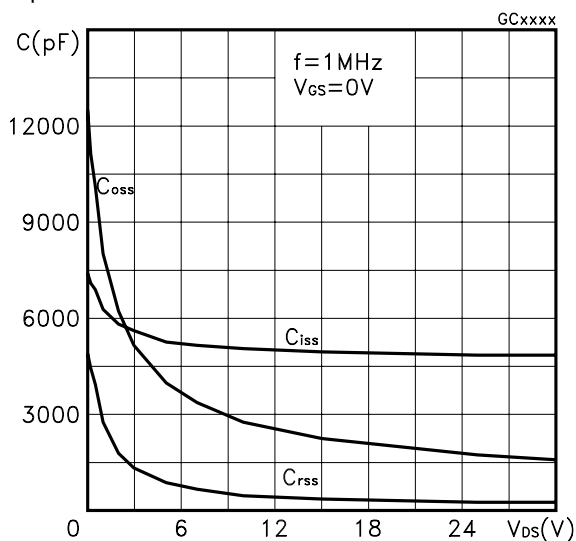
Static Drain-source On Resistance



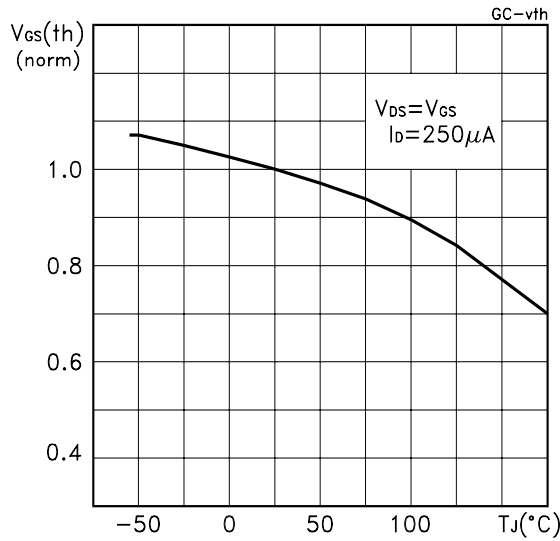
Gate Charge vs Gate-source Voltage



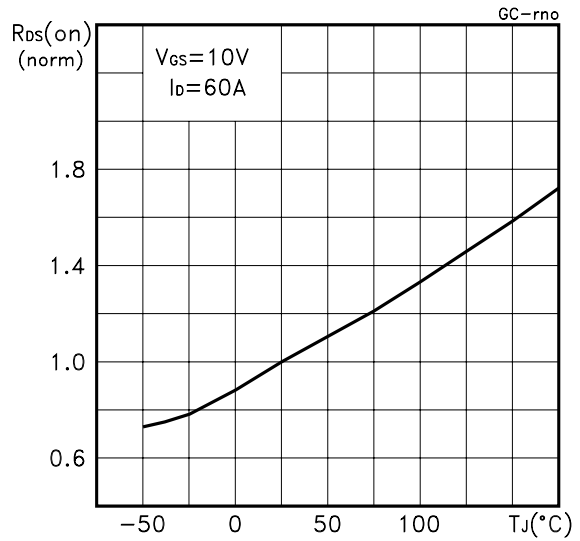
Capacitance Variations



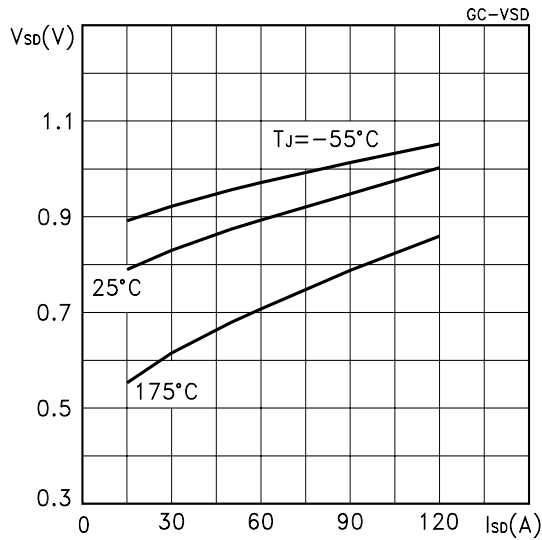
Normalized Gate Threshold Voltage vs Temperature



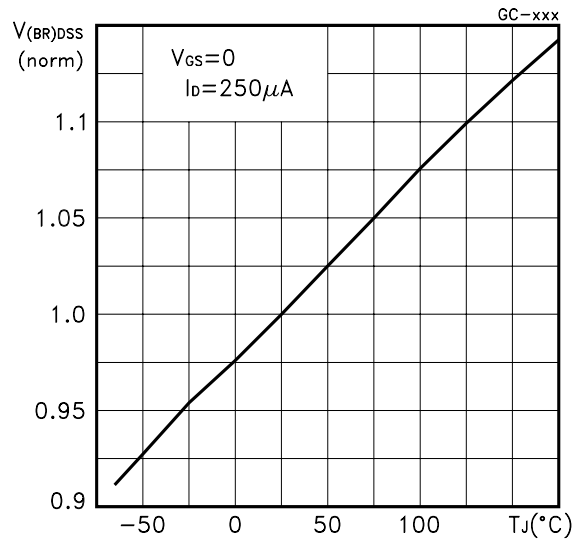
Normalized on Resistance vs Temperature



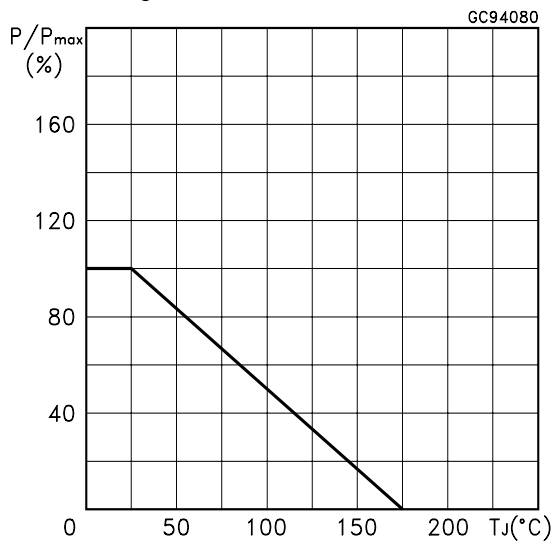
Source-drain Diode Forward Characteristics



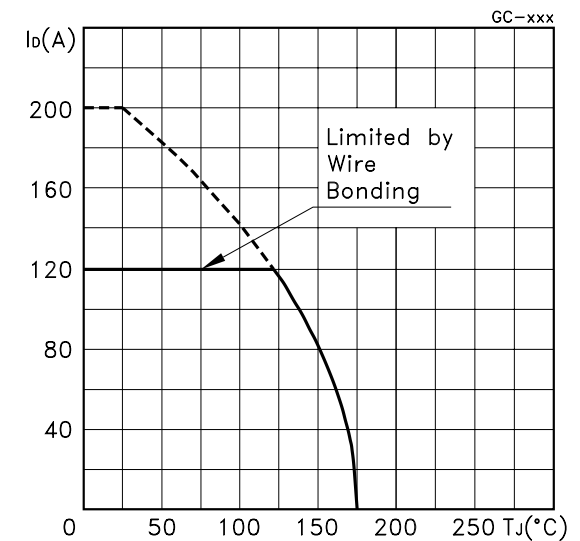
Normalized Breakdown Voltage vs Temperature.



Power Derating vs Tc

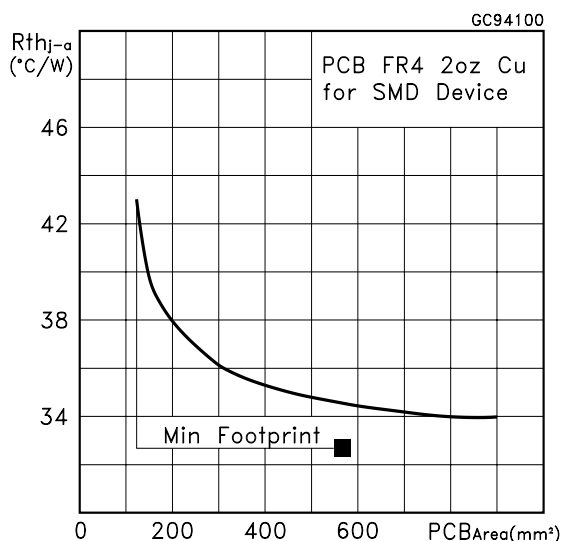


Max Id Current vs Tc.

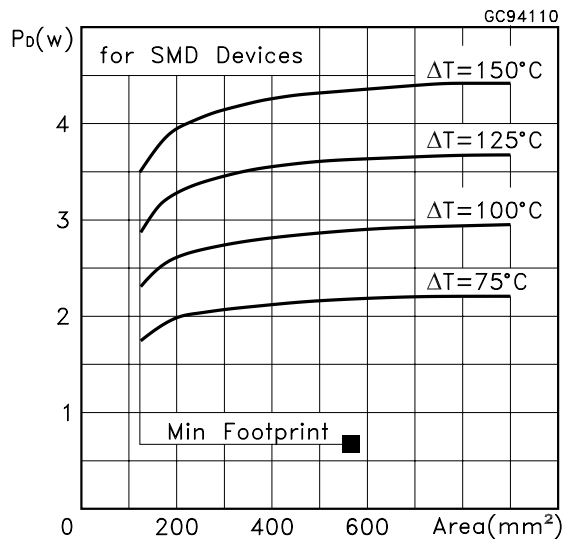


## STB200NF03/-1 STP200NF03

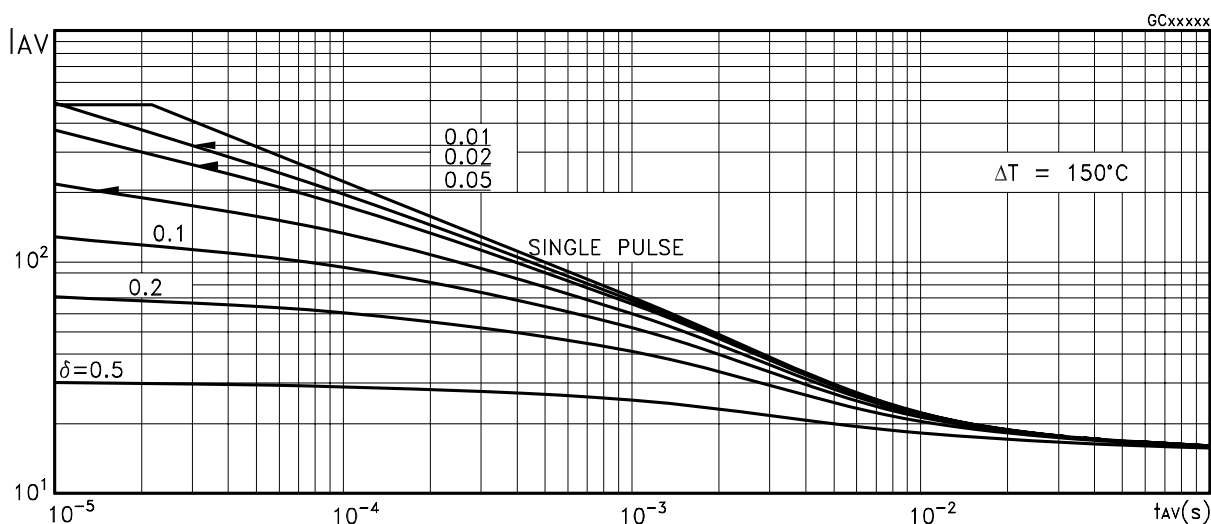
Thermal Resistance Rthj-a vs PCB Copper Area



Max Power Dissipation vs PCB Copper Area



### Allowable Iav 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 °C, at fixed  $I_{AV}$ , the following equation must be applied:

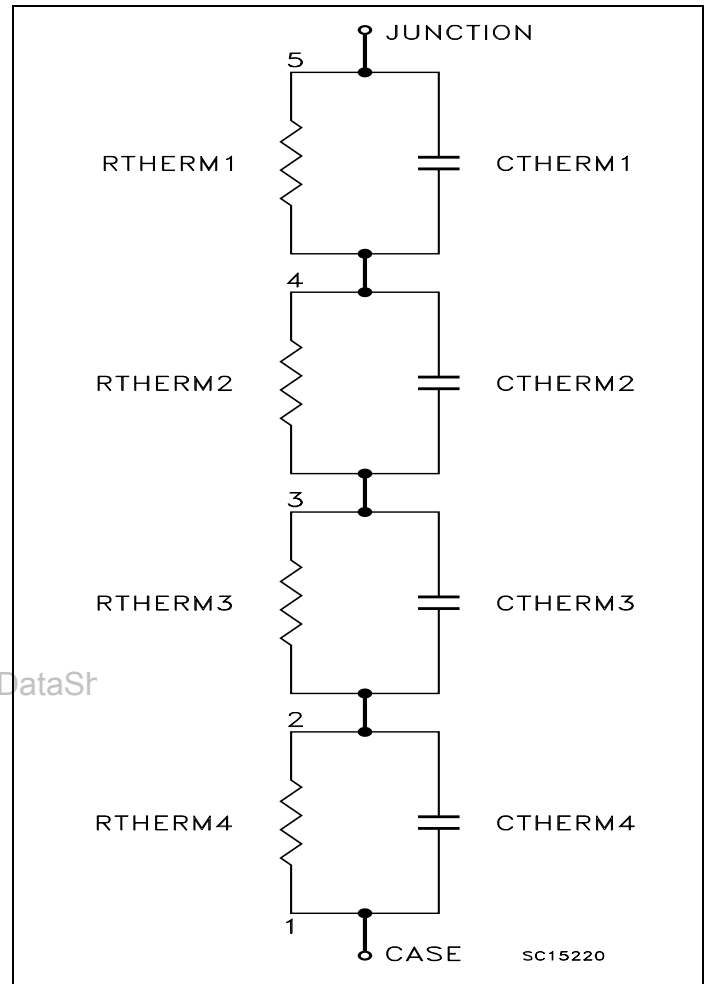
$$I_{AV} = 2 * (T_{jmax} - T_{CASE}) / (1.3 * BV_{DSS} * Z_{th})$$

Where:

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

<b>SPICE THERMAL MODEL</b>
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Parameter	Node	Value
CTHERM1	5 - 4	0.011
CTHERM2	4 - 3	0.0012
CTHERM3	3 - 2	0.05
CTHERM4	2 - 1	0.1
R THERM1	5 - 4	0.09
R THERM2	4 - 3	0.02
R THERM3	3 - 2	0.11
R THERM4	2 - 1	0.17

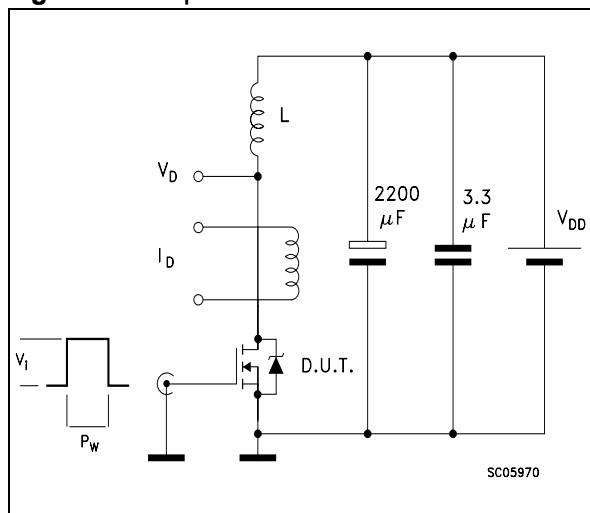


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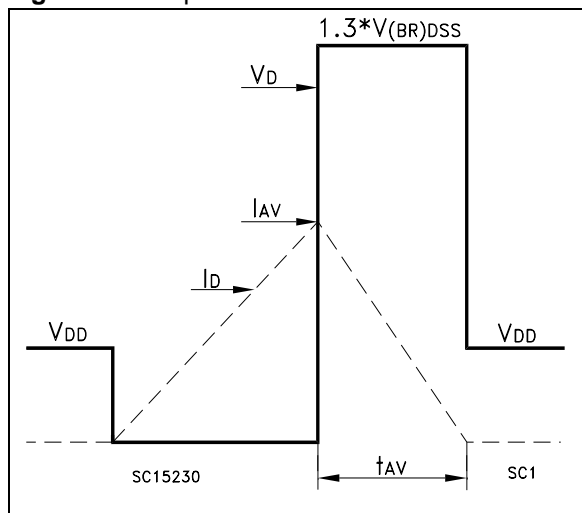
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## STB200NF03/-1 STP200NF03

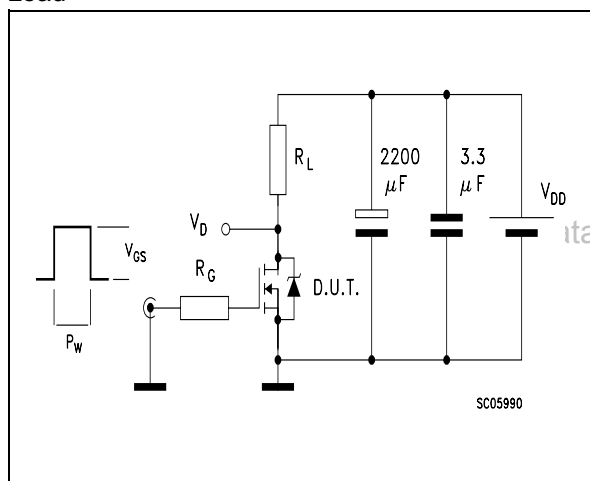
**Fig. 1: Unclamped Inductive Load Test Circuit**



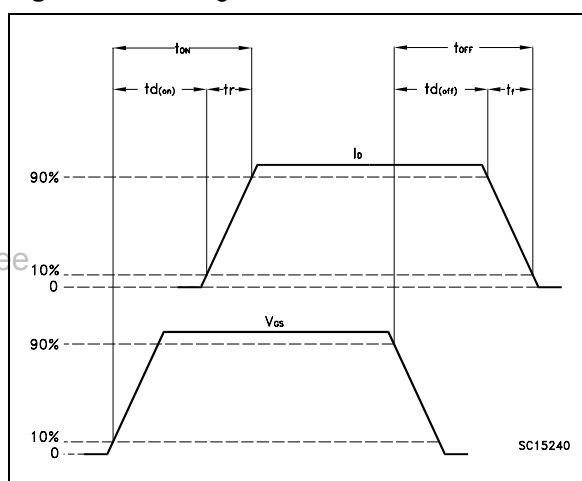
**Fig. 2: Unclamped Inductive Waveform**



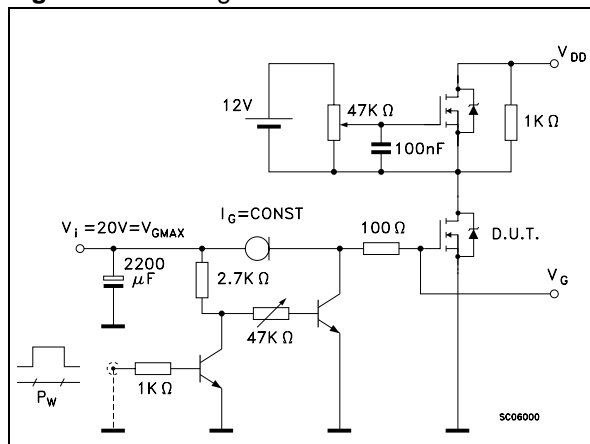
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 3.1: Switching Time Waveform**



**Fig. 4: Gate Charge Test Circuit**



**Fig. 4.1: Gate Charge Test Waveform**

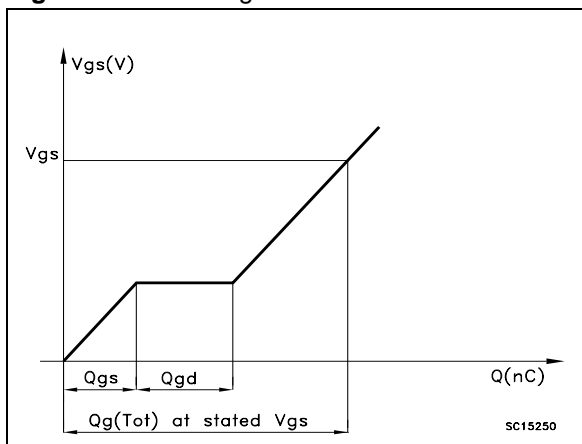




Fig. 5: Diode Switching Test Circuit

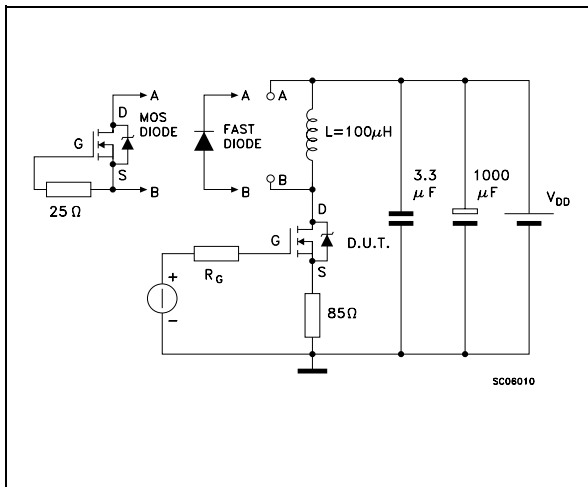
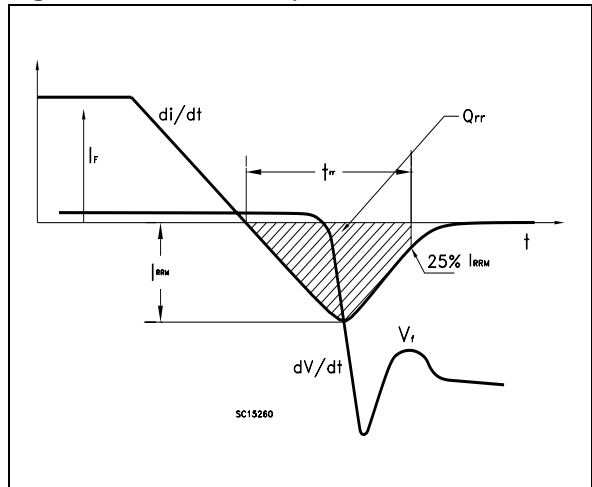


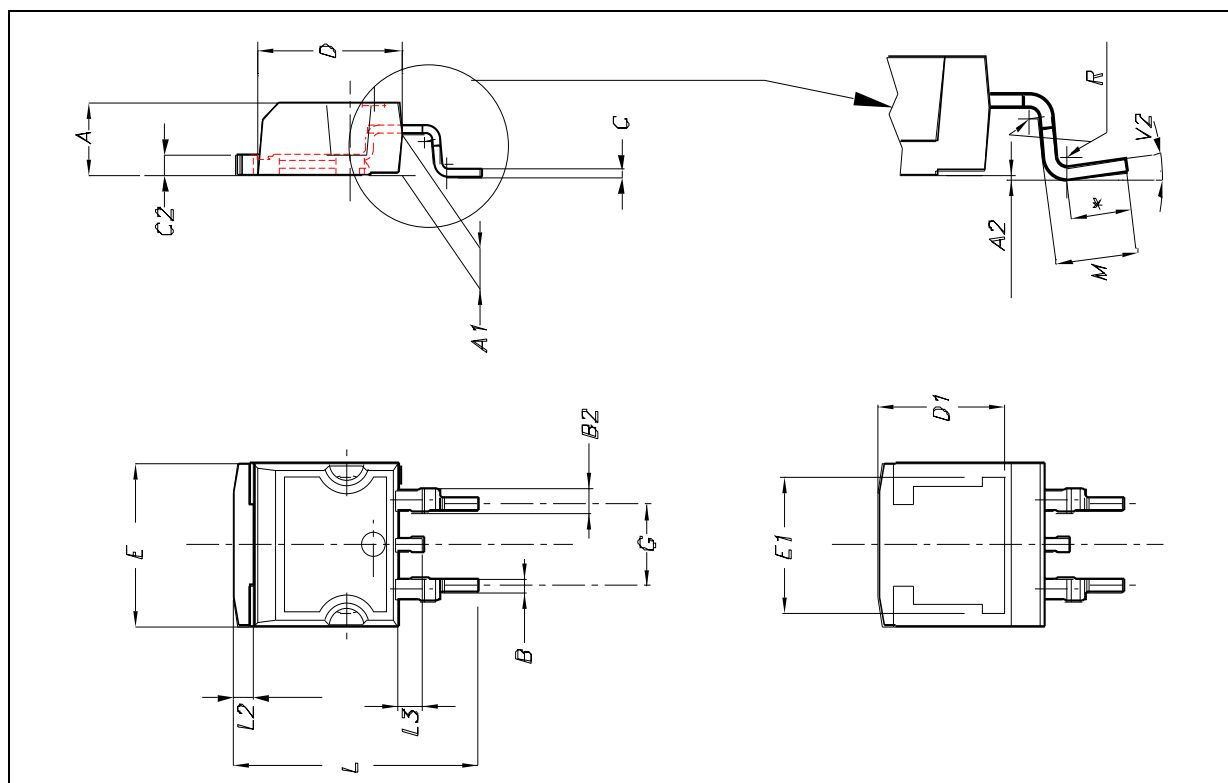
Fig. 5.1: Diode Recovery Times Waveform



## STB200NF03/-1 STP200NF03

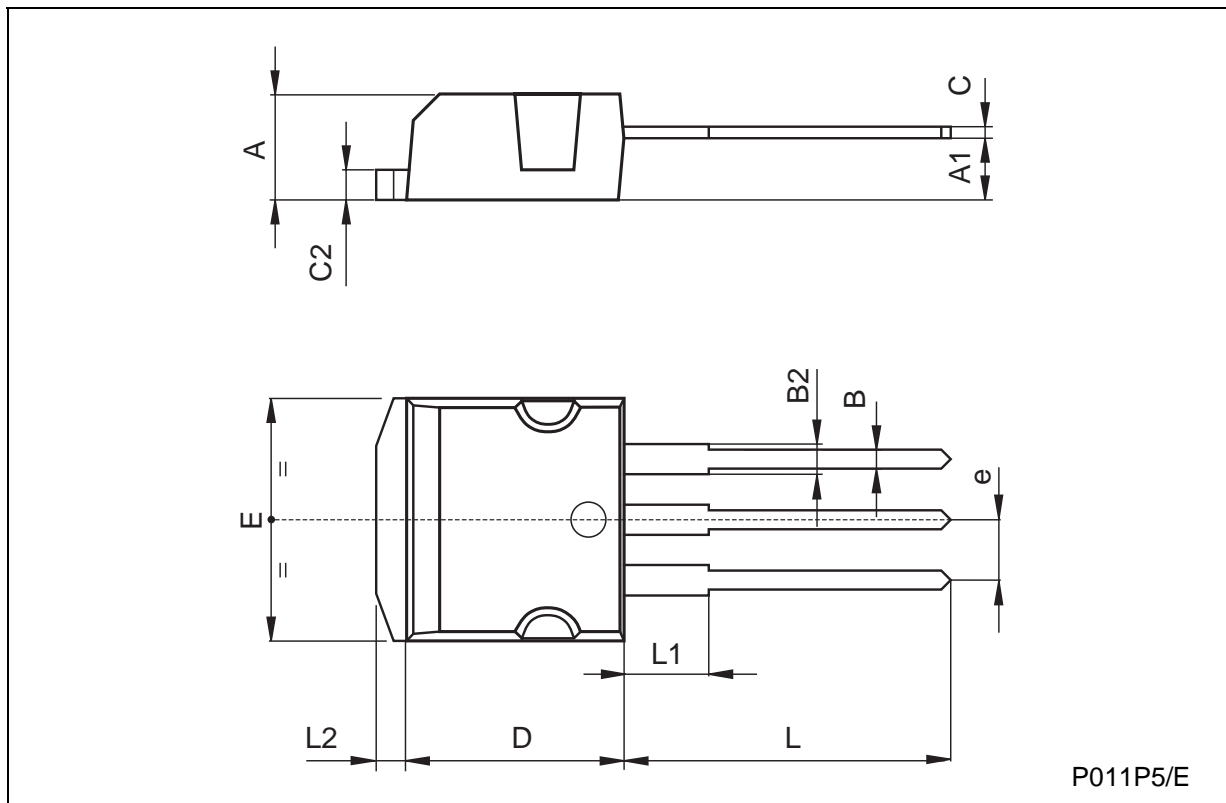
D<sup>2</sup>PAK MECHANICAL DATA

DIM.	mm.			inch.		
	MIN.	TYP.	MAX.	MIN.	TYP.	TYP.
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	0.028		0.037
B2	1.14		1.7	0.045		0.067
C	0.45		0.6	0.018		0.024
C2	1.21		1.36	0.048		0.054
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.394		0.409
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.591		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.069
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			8°



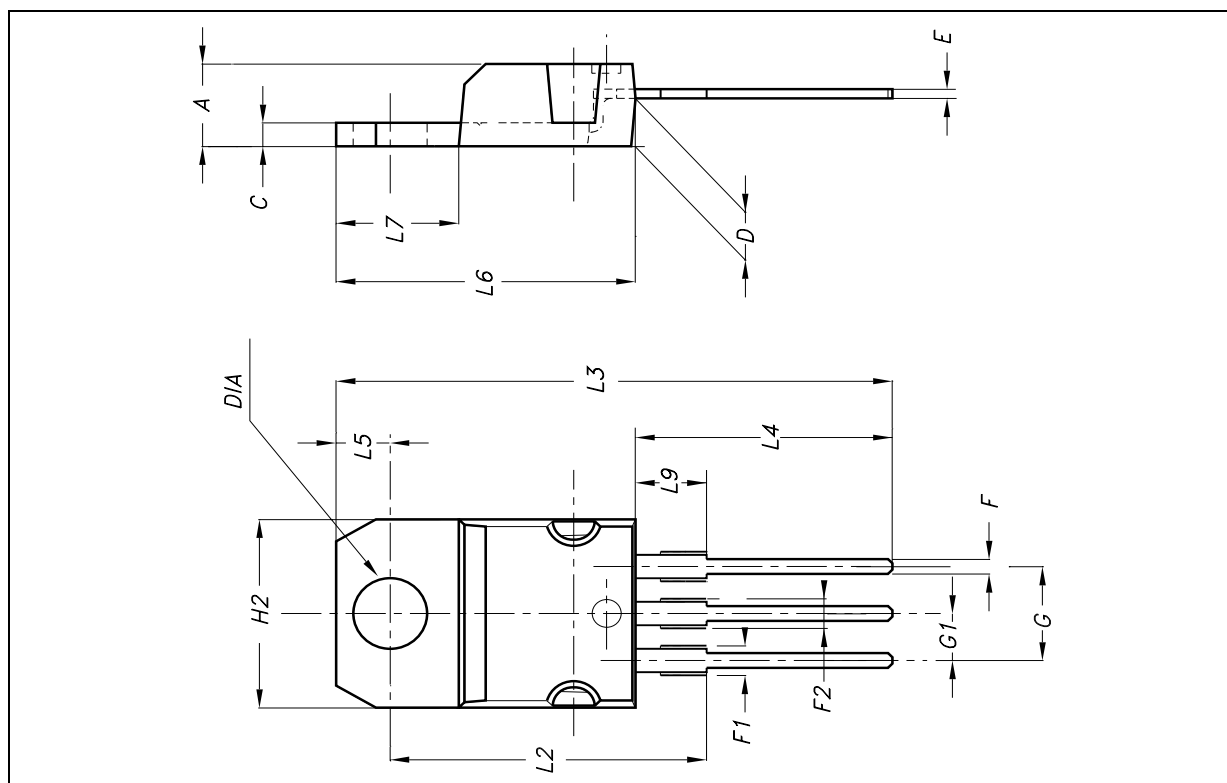
TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

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
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
e	2.4		2.7	0.094		0.106
E	10		10.4	0.393		0.409
L	13.1		13.6	0.515		0.531
L1	3.48		3.78	0.137		0.149
L2	1.27		1.4	0.050		0.055

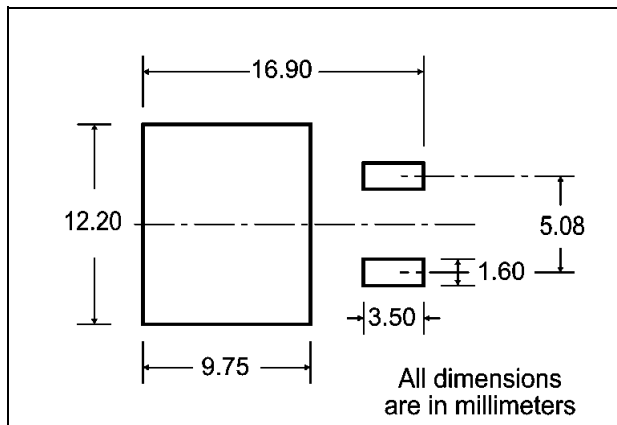


**STB200NF03/-1 STP200NF03****TO-220 MECHANICAL DATA**

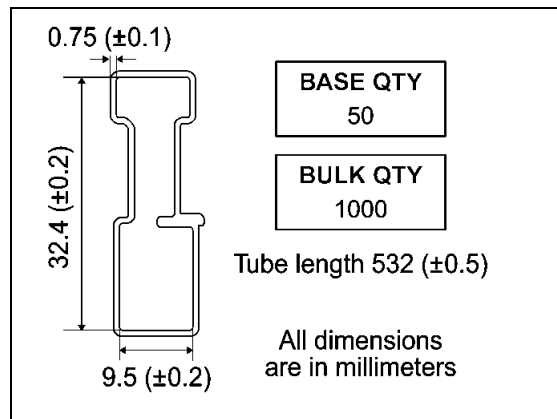
DIM.	mm.			inch.		
	MIN.	TYP.	MAX.	MIN.	TYP.	TYP.
<b>A</b>	4.4		4.6	0.173		0.181
<b>C</b>	1.23		1.32	0.048		0.051
<b>D</b>	2.40		2.72	0.094		0.107
<b>E</b>	0.49		0.70	0.019		0.027
<b>F</b>	0.61		0.88	0.024		0.034
<b>F1</b>	1.14		1.70	0.044		0.067
<b>F2</b>	1.14		1.70	0.044		0.067
<b>G</b>	4.95		5.15	0.194		0.203
<b>G1</b>	2.40		2.70	0.094		0.106
<b>H2</b>	10		10.40	0.393		0.409
<b>L2</b>		16.40			0.645	
<b>L3</b>		28.90			1.137	
<b>L4</b>	13		14	0.511		0.551
<b>L5</b>	2.65		2.95	0.104		0.116
<b>L6</b>	15.25		15.75	0.600		0.620
<b>L7</b>	6.20		6.60	0.244		0.260
<b>L9</b>	3.50		3.93	0.137		0.154
<b>DIA</b>	3.75		3.85	0.147		0.151



**D2PAK FOOTPRINT**



**TUBE SHIPMENT (no suffix)\***



**TAPE AND REEL SHIPMENT (suffix "T4")\***

40 mm min. Access hole at slot location

Full radius

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

T

C

N

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

TOP COVER TAPE

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius

R min.

\* on sales type



## STB200NF03/-1 STP200NF03

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