



STP10NB20 STP10NB20FP

N-CHANNEL 200V - 0.25 Ω - 10A TO-220/TO-220FP
PowerMESH™ MOSFET

Table 1. General Features

Type	V _{DSS}	R _{DS(on)}	I _D
STP10NB20	200 V	< 0.40 Ω	10 A
STP10NB20FP	200 V	< 0.40 Ω	6 A

FEATURES SUMMARY

- TYPICAL R_{DS(on)} = 0.25 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R_{DS(on)} per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE

Figure 1. Package

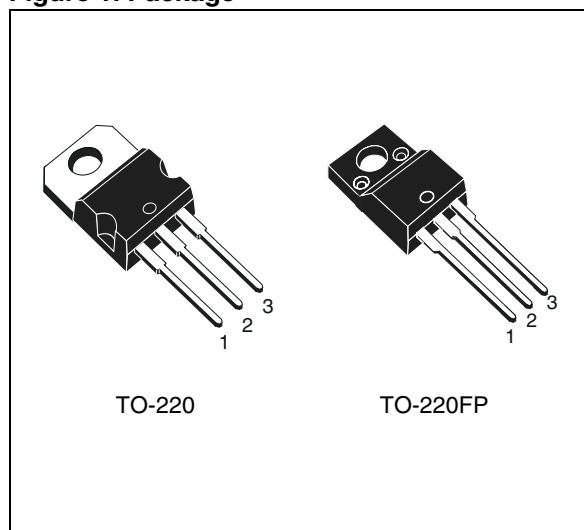


Figure 2. Internal Schematic Diagram

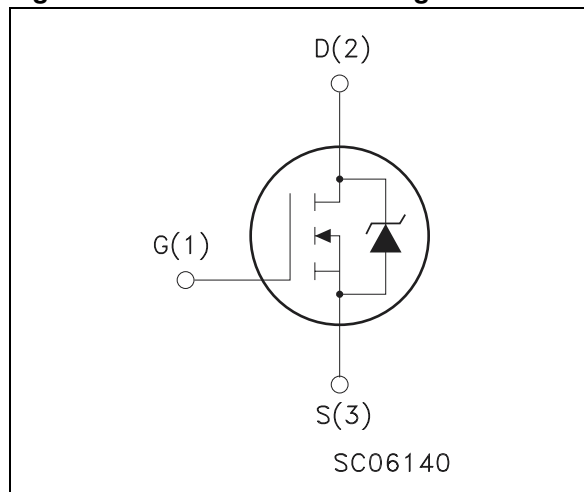


Table 2. Order Codes

Part Number	Marking	Package	Packaging
STP10NB20	P10NB20	TO-220	TUBE
STP10NB20FP	P10NB20FP	TO-220FP	TUBE

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Table 3. Absolute Maximum Ratings

Symbol	Parameter	Value		Unit
		STP10NB20	STP10NB20FP	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	200		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	200		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (cont.) at T _C = 25 °C	10	6	A
I _D	Drain Current (cont.) at T _C = 100 °C	6	4	A
I _{DM} (1)	Drain Current (pulsed)	40	40	A
P _{tot}	Total Dissipation at T _C = 25 °C	85	30	W
	Derating Factor	0.68	0.24	W/°C
dv/dt (2)	Peak Diode Recovery voltage slope	5.5	5.5	V/ns
V _{ISO}	Insulation Withstand Voltage (DC)	-	2000	V
T _{stg}	Storage Temperature	-65 to 150		°C

Note: 1. Pulse width limited by safe operating area
 2. I_{SD} ≤ 7A, di/dt ≤ 200 A/μs, V_{DD} ≤ V(BR)DSS, T_j ≤ T_{JMAX}

Table 4. Thermal Data

Symbol	Parameter	Value		Unit
		TO-220	TO220-FP	
R _{thj-case}	Thermal Resistance Junction-case Max	1.47	4.17	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient Max	62.5		°C/W
T _l	Maximum Lead Temperature For Soldering Purpose	300		°C

Table 5. Avalanche Characteristics

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max, δ < 1%)	10	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C; I _D = I _{AR} ; V _{DD} = 50 V)	150	mJ

ELECTRICAL CHARACTERISTICS ($T_{\text{case}} = 25^{\circ}\text{C}$ unless otherwise specified)**Table 6. Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source Breakdown Voltage	$I_{\text{D}} = 250 \mu\text{A}$ $V_{\text{GS}} = 0$	200			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{\text{GS}} = 0$)	$V_{\text{DS}} = \text{Max Rating}$ $V_{\text{DS}} = \text{Max Rating}; T_{\text{c}} = 125^{\circ}\text{C}$			1 10	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{\text{DS}} = 0$)	$V_{\text{GS}} = \pm 30 \text{ V}$			± 100	nA

Table 7. On ⁽¹⁾

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}; I_{\text{D}} = 250 \mu\text{A}$	3	4	5	V
$R_{\text{DS(on)}}$	Static Drain-source On Resistance	$V_{\text{GS}} = 10\text{V}; I_{\text{D}} = 5 \text{ A}$		0.25	0.40	Ω

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %**Table 8. Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} ⁽¹⁾	Forward Transconductance	$V_{\text{DS}} > I_{\text{D(on)}} \times R_{\text{DS(on)max}}; I_{\text{D}} = 5 \text{ A}$	3	4		S
C_{iss}	Input Capacitance	$V_{\text{DS}} = 25 \text{ V}; f = 1 \text{ MHz}; V_{\text{GS}} = 0$		470	650	pF
C_{oss}	Output Capacitance			135	190	pF
C_{rss}	Reverse Transfer Capacitance			22	30	pF

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %**Table 9. Switching On**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on Time	$V_{\text{DD}} = 100 \text{ V}; I_{\text{D}} = 5 \text{ A}; R_{\text{G}} = 4.7 \Omega$ $V_{\text{GS}} = 10 \text{ V}$ (see test circuit, Figure 5)		10	14	ns
t_{r}	Rise Time			15	20	ns
Q_{g}	Total Gate Charge	$V_{\text{DD}} = 160 \text{ V}; I_{\text{D}} = 10 \text{ A}; V_{\text{GS}} = 10 \text{ V}$		17	24	nC
Q_{gs}	Gate-Source Charge			7.5		nC
Q_{gd}	Gate-Drain Charge			5.5		nC

Table 10. Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{\text{r(Voff)}}$	Off-voltage Rise Time	$V_{\text{DD}} = 160 \text{ V}; I_{\text{D}} = 10 \text{ A}; R_{\text{G}} = 4.7 \Omega$ $V_{\text{GS}} = 10 \text{ V}$; (see test circuit, Figure 7)		8	11	ns
t_{f}	Fall Time			10	14	ns
t_{c}	Cross-over Time			20	28	ns

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Table 11. Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				10	A
$I_{SDM}^{(1)}$	Source-drain Current (pulsed)				40	A
$V_{SD}^{(2)}$	Forward On Voltage	$I_{SD} = 10 \text{ A}; V_{GS} = 0$			1.5	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 10 \text{ A}; di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 50 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$ (see test circuit, Figure 7)		170		ns
Q_{rr}	Reverse RecoveryCharge			980		μC
I_{RRAM}	Reverse RecoveryCharge			11.5		A

Note: 1. Pulse width limited by safe operating area

2. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

Figure 3. Unclamped Inductive Load Test Circuit

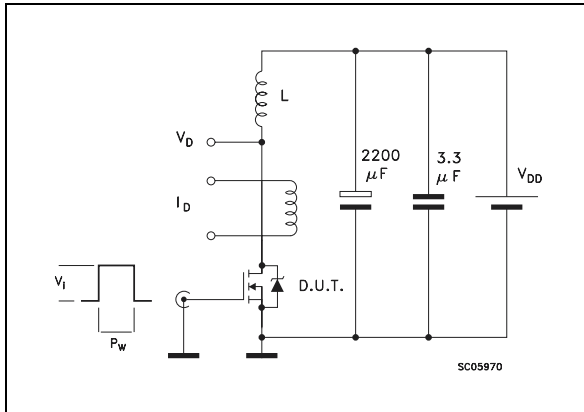


Figure 4. Unclamped Inductive Waveforms

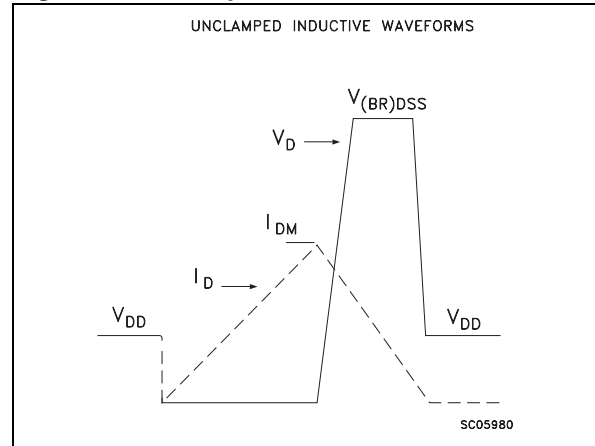


Figure 5. Switching Times Test Circuits For Resistive Load

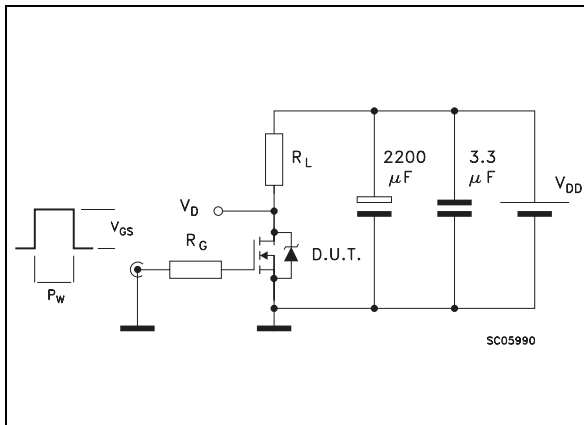


Figure 6. Gate Charge Test Circuit

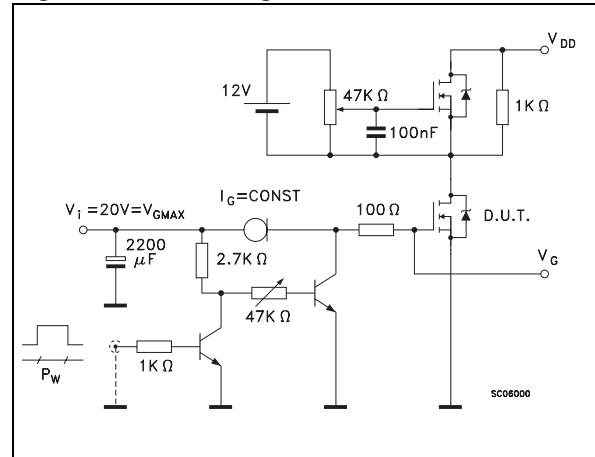
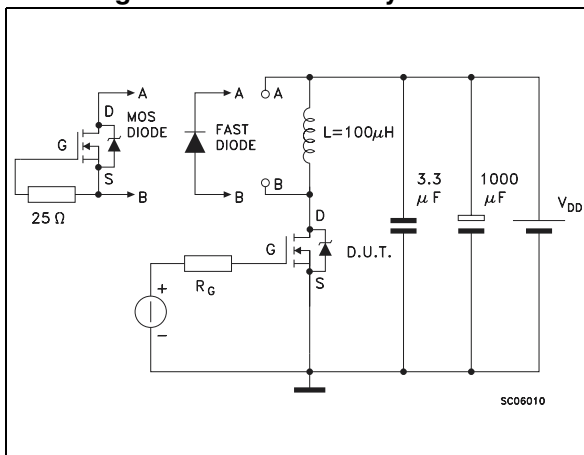


Figure 7. Test Circuit For Inductive Load Switching And Diode Recovery Times



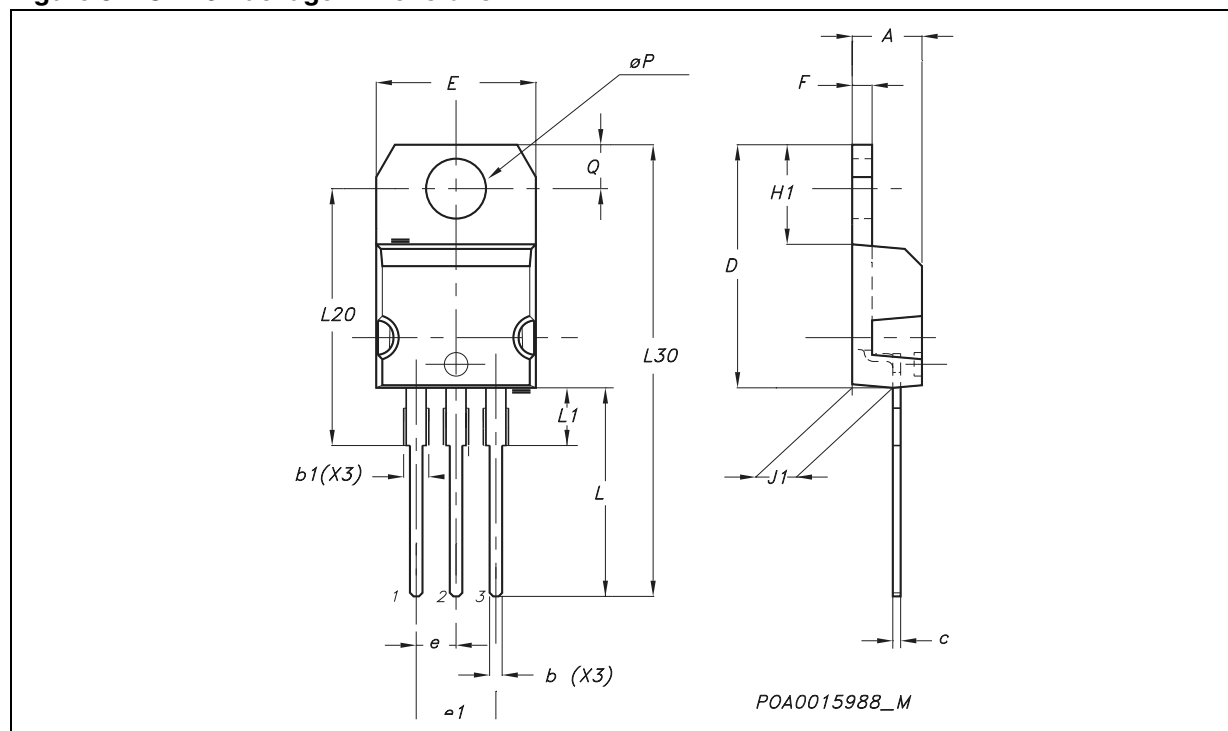
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PACKAGE MECHANICAL

Table 12. TO-220 Mechanical Data

Symbol	millimeters			inches		
	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

Figure 8. TO-220 Package Dimensions

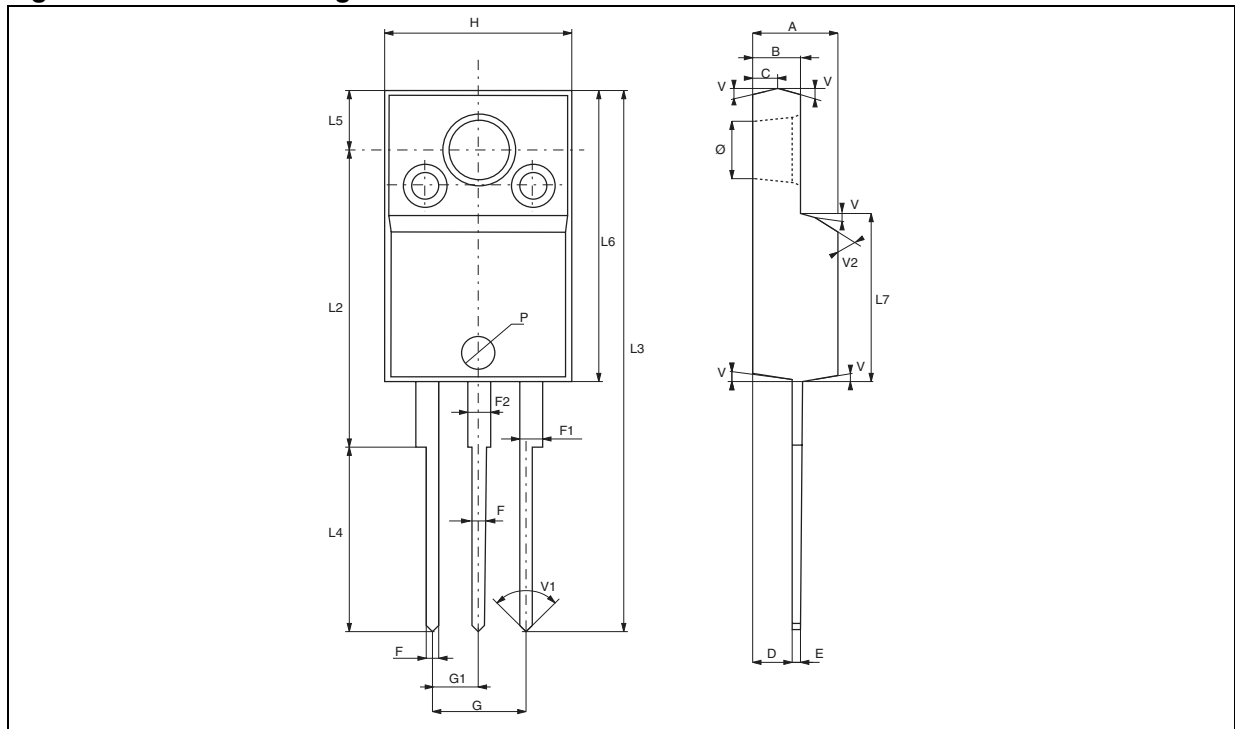


Note: Drawing is not to scale.

Table 13. TO-220FP Mechanical Data

Symbol	millimeters			inches		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
B	2.50		2.70	0.098		0.106
C	1.00		1.30	0.039		0.051
D	2.50		2.75	0.098		0.108
E	0.40		0.70	0.016		0.027
F	0.75		1.00	0.030		0.039
F1	1.15		1.70	0.045		0.066
F2	1.15		1.70	0.045		0.066
G	4.95		5.20	0.195		0.204
G1	2.40		2.70	0.094		0.106
H	10.00		10.40	0.393		0.409
L2		16.00			0.630	
L3	28.60		30.60	1.126		1.204
L4	9.80		10.60	0.385		0.417
L5	3.30		3.50	0.129		0.137
L6	15.90		16.40	0.626		0.645
L7	9.00		9.30	0.354		0.366
P			1.60			0.063
V		5°			5°	
V1	50°		100°	50°		100°
V2	44°		46°	44°		46°
Ø	3.00		3.20	0.118		0.126

Figure 9. TO-220FP Package Dimensions



Note: Drawing is not to scale.

REVISION HISTORY

Table 14. Revision History

Date	Revision	Description of Changes
October-1997	1	First Issue
14-Apr-2004	2	Stylesheet update. No content change.

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