



# STB10NC50-1

## N - CHANNEL 500V - 0.48Ω - 10A - I<sup>2</sup>PAK/D<sup>2</sup>PAK PowerMESH™ MOSFET

### PRELIMINARY DATA

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB10NC50-1	500 V	< 0.52 Ω	10 A

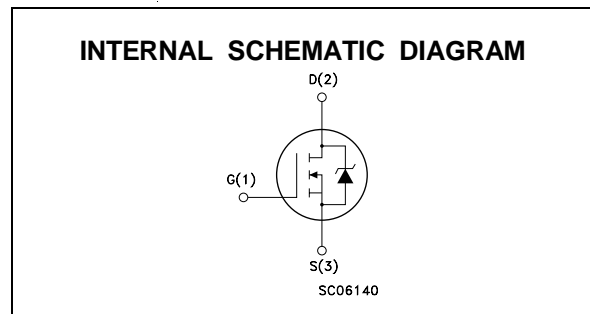
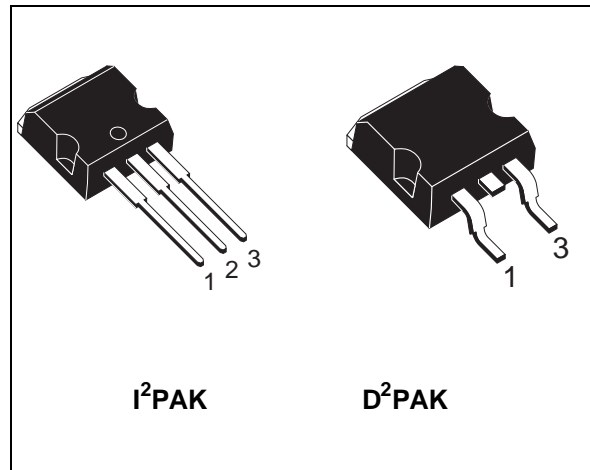
- TYPICAL R<sub>DS(on)</sub> = 0.48 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

### 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<sub>DS(on)</sub> 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



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	500	V
V <sub>GS</sub>	Gate-source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	10	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	6.3	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	40	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	135	W
	Derating Factor	1.08	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	3	V/ns
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 10 A, di/dt ≤ 100 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ T<sub>JMAX</sub>

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### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.93	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.5	°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose		300	°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	10	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	550	mJ

### 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	500			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 50	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 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	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 5 A		0.48	0.52	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	10			A

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> I <sub>D</sub> = 5 A		10		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		1480		pF
C <sub>oss</sub>	Output Capacitance			210		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			25		pF

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 5\text{ A}$		29		ns
$t_r$	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		16		ns
$Q_g$	Total Gate Charge	$V_{DD} = 160\text{ V}$ $I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$		41	49	nC
$Q_{gs}$	Gate-Source Charge			12		nC
$Q_{gd}$	Gate-Drain Charge			19		nC

**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 160\text{ V}$ $I_D = 10\text{ A}$		16		ns
$t_f$	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		18		ns
$t_c$	Cross-over Time			29		ns

**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				10.6	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				42.4	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 10\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 10\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		560		ns
$Q_{rr}$	Reverse Recovery Charge			4.9		nC
$I_{RRM}$	Reverse Recovery Current			17.5		A

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

(•) Pulse width limited by safe operating area

Fig. 1: Unclamped Inductive Load Test Circuit

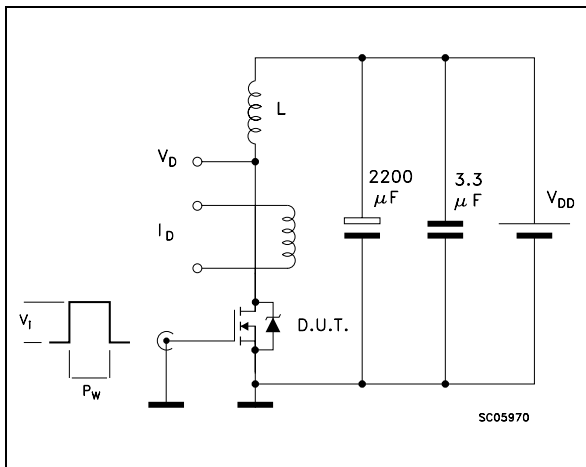


Fig. 2: Unclamped Inductive Waveform

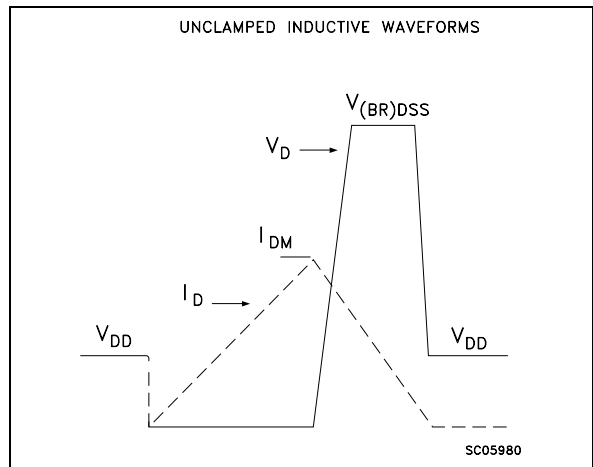


Fig. 3: Switching Times Test Circuits For Resistive Load

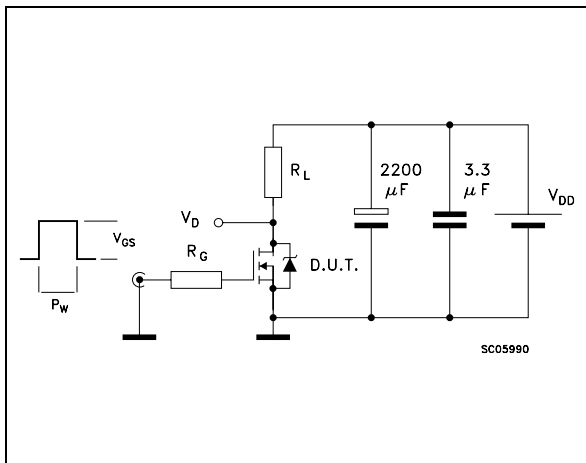


Fig. 4: Gate Charge test Circuit

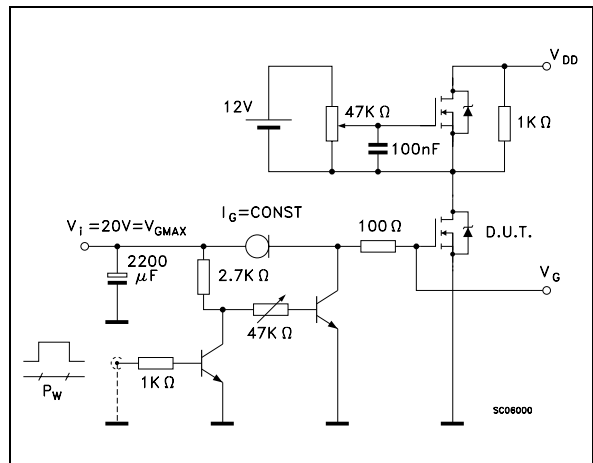
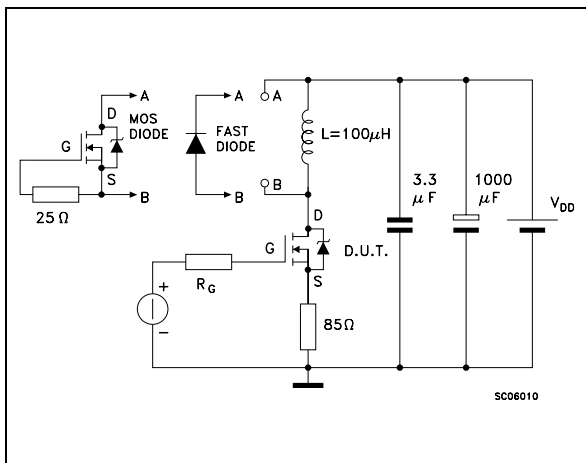
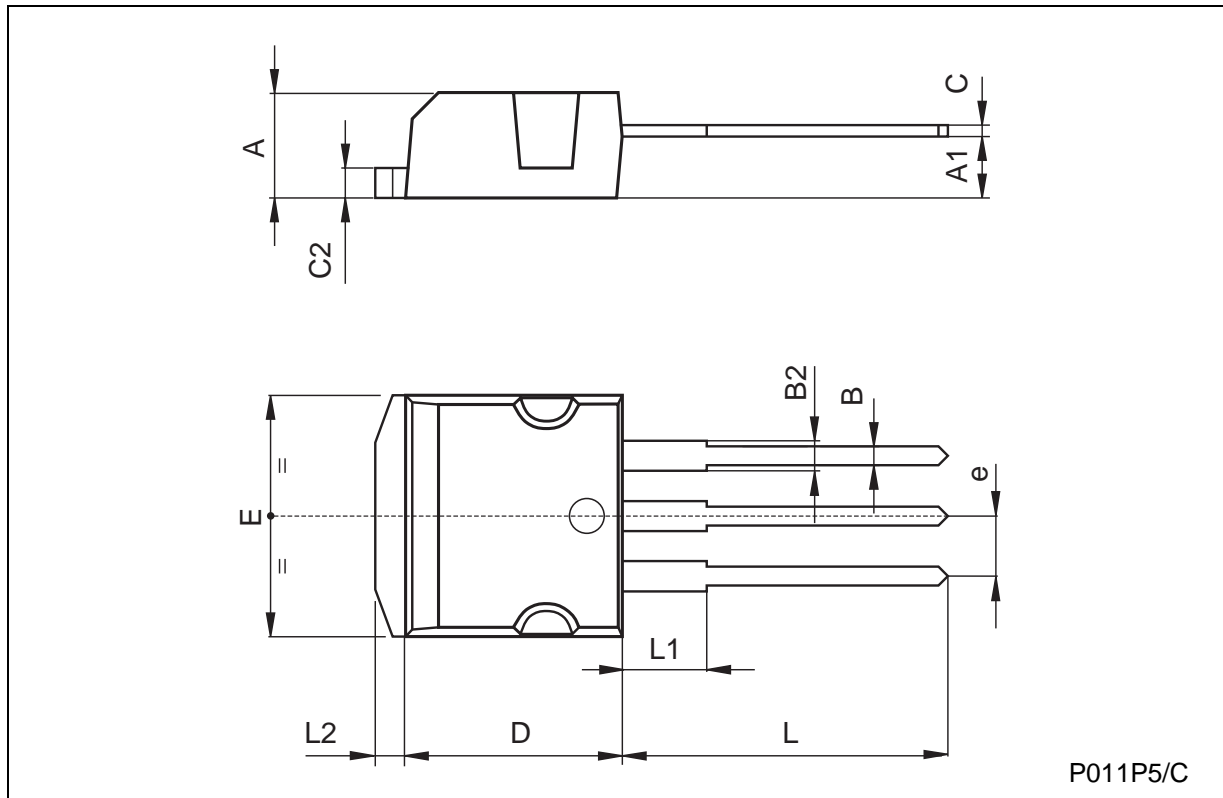


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



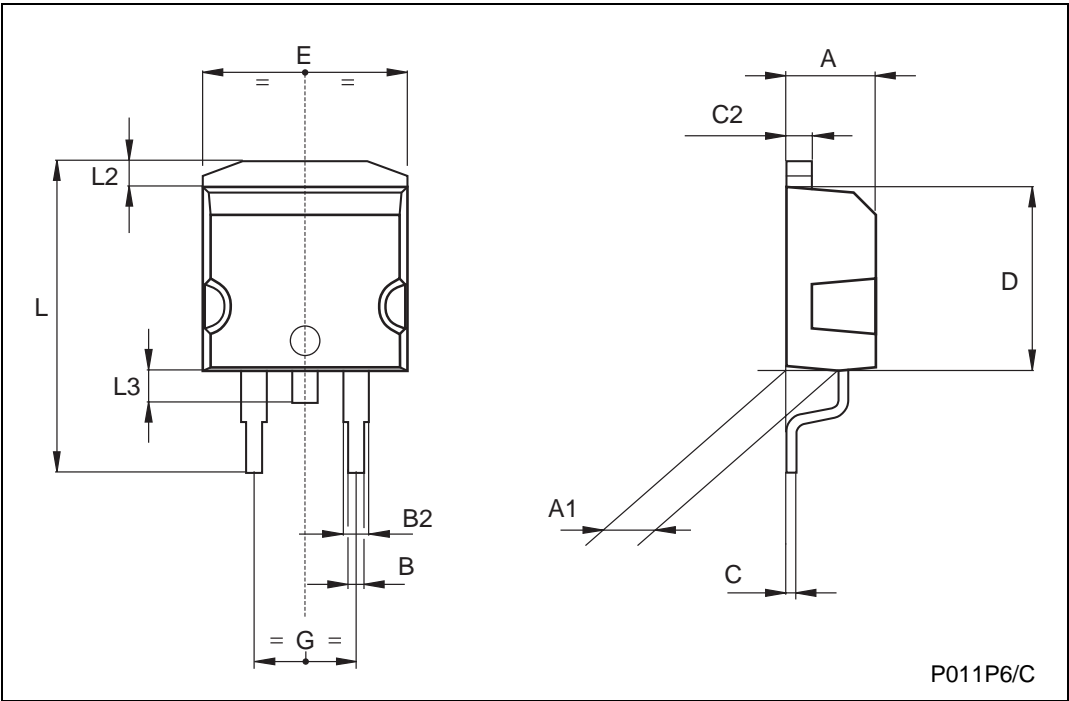
## TO-262 (I2PAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B1	1.2		1.38	0.047		0.054
B2	1.25		1.4	0.049		0.055
C	0.45		0.6	0.017		0.023
C2	1.21		1.36	0.047		0.053
D	8.95		9.35	0.352		0.368
e	2.44		2.64	0.096		0.104
E	10		10.28	0.393		0.404
L	13.2		13.5	0.519		0.531
L1	3.48		3.78	0.137		0.149
L2	1.27		1.4	0.050		0.055



**TO-263 (D<sup>2</sup>PAK) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.25		1.4	0.049		0.055
C	0.45		0.6	0.017		0.023
C2	1.21		1.36	0.047		0.053
D	8.95		9.35	0.352		0.368
E	10		10.28	0.393		0.404
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068



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