SGS-THOMSON MICROELECTRONICS

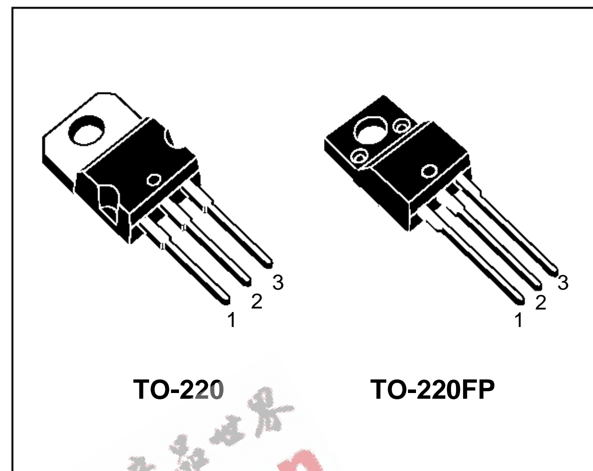
STP5NB40
STP5NB40FP

N - CHANNEL ENHANCEMENT MODE PowerMESH™ MOSFET

PRELIMINARY DATA

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP5NB40	400 V	< 1.8 Ω	4.7 A
STP5NB40FP	400 V	< 1.8 Ω	3.1 A

- TYPICAL $R_{DS(on)}$ = 1.47 Ω
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- EXTREMELY HIGH dv/dt CAPABILITY



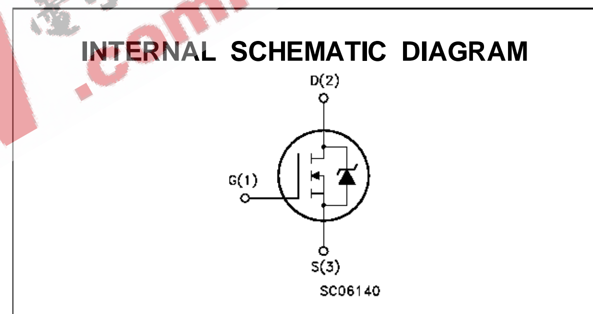
DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, SGS-Thomson has designed an advanced family of Power MOSFETs with outstanding performance. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest RDS(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

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5NB40	STP5NB40FP	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	400		V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	400		V
V_{GS}	Gate-source Voltage	± 30		V
I_D	Drain Current (continuous) at T_c = 25 °C	4.7	3.1	A
I_D	Drain Current (continuous) at T_c = 100 °C	3	2	A
I_{DM}(•)	Drain Current (pulsed)	19	19	A
P_{tot}	Total Dissipation at T_c = 25 °C	80	35	W
	Derating Factor	0.64	0.28	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	4.5	4.5	V/ns
V_{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
T_{stg}	Storage Temperature	-65 to 150		°C
T_j	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

(1) $I_{SD} \le$ 5A, di/dt $\le$ 200 A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_j \le T_{JMAX}$

This is preliminary information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

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THERMAL DATA

			TO-220	TO220-FP	
$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.56	3.57	°C/W
$R_{thj-amb}$ $R_{thc-sink}$ T_l	Thermal Resistance Junction-ambient Thermal Resistance Case-sink Maximum Lead Temperature For Soldering Purpose	Max Typ 	62.5 0.5 300		°C/W °C/W °C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	4.7	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	200	mJ

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 μA V_{GS} = 0 V	400			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating T_c = 125 °C			1 50	μA μA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 30 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ I_D = 250 μA	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V I_D = 2.3 A		1.47	1.8	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ V_{GS} = 10 V	4.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ I_D = 2.3 A	1.3	2.4		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25 V f = 1 MHz V_{GS} = 0 V		405 72 9	526 94 12	pF pF pF

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ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	V_{DD} = 200 V I_D = 2.3 A R_G = 4.7 Ω V_{GS} = 10 V (see test circuit, figure 3)		11 8	17 12	ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 320 V I_D = 4.7 A V_{GS} = 10 V		14.5 7 5.1	22	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{DD} = 320 V I_D = 4.7 A R_G = 4.7 Ω V_{GS} = 10 V (see test circuit, figure 5)		9 6 14	13 10 20	ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(•)	Source-drain Current Source-drain Current (pulsed)				4.7 19	A A
V_{SD} (∗)	Forward On Voltage	I_{SD} =4.7 A V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} =4.7 A di/dt = 100 A/μs V_{DD} = 100 V T_j = 150 °C (see test circuit, figure 5)		300 1.6 10.5		ns μC A

(∗) Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %
(•) Pulse width limited by safe operating area

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Fig. 1: Unclamped Inductive Load Test Circuit

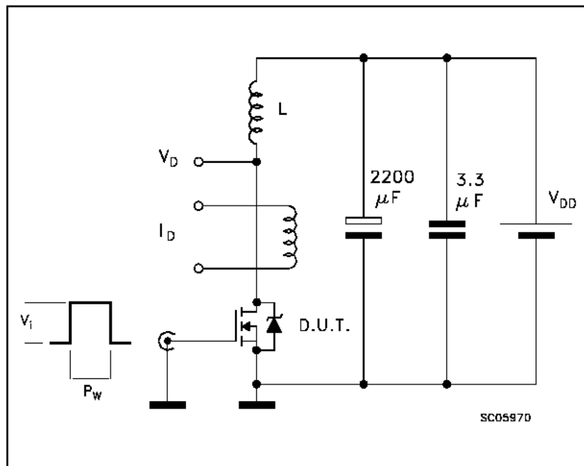


Fig. 2: Unclamped Inductive Waveform

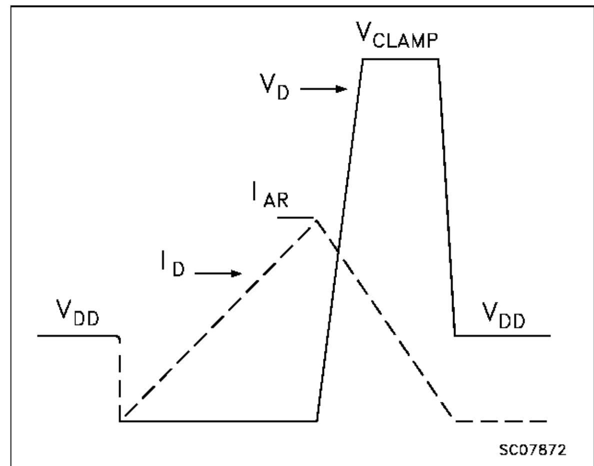


Fig. 3: Switching Times Test Circuits For Resistive Load

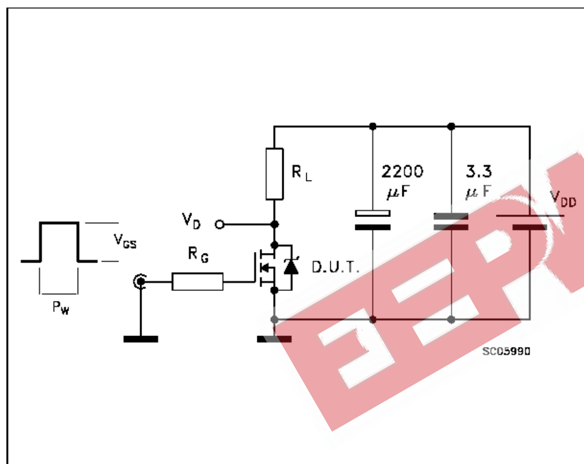


Fig. 4: Gate Charge test Circuit

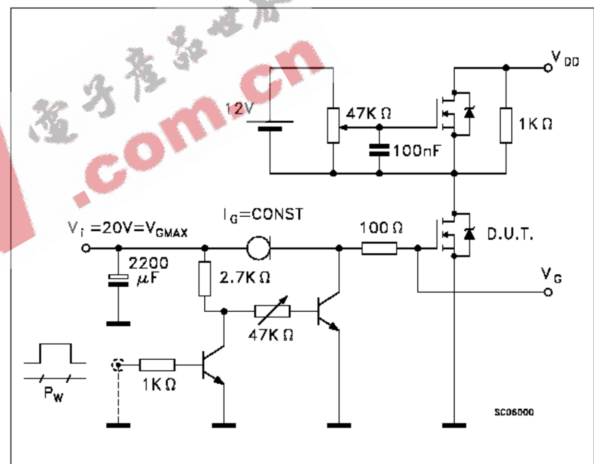
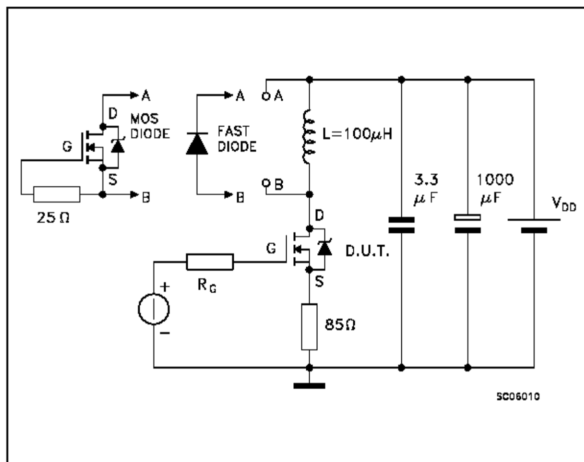
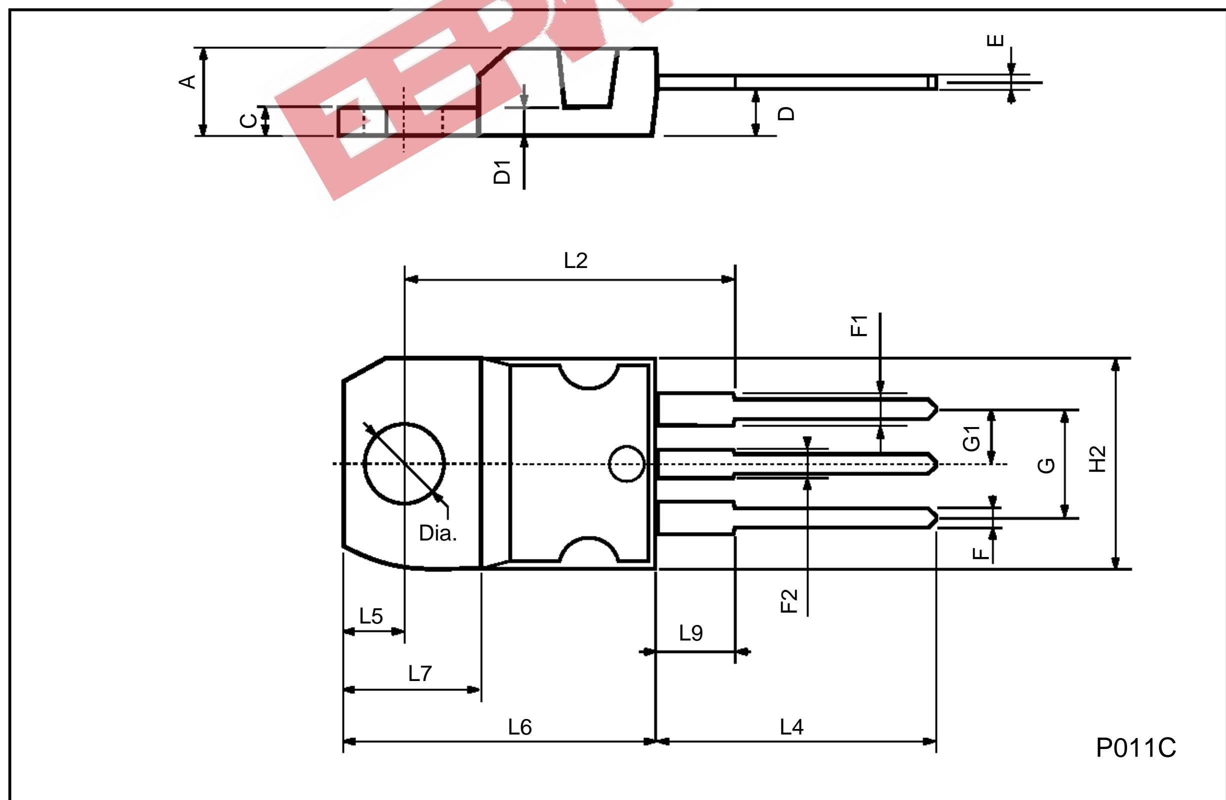


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



TO-220FP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126

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