SGS-THOMSON
MICROELECTRONICS

STP3N50XI

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP3N50XI	500 V	< 4 Ω	1.7 A

- TYPICAL $R_{DS(on)}$ = 2.5 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT

ISOWATT221

INTERNAL SCHEMATIC DIAGRAM
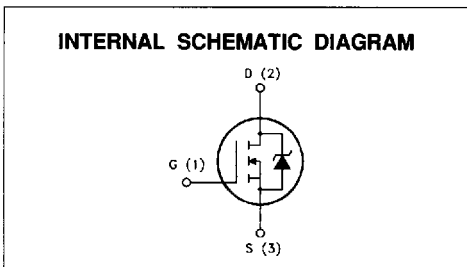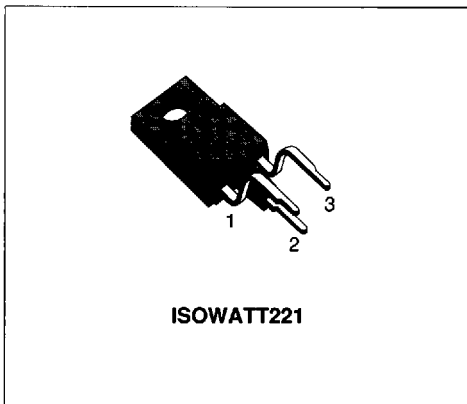
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	500	V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	500	V
V_{GS}	Gate-source Voltage	$\pm$ 20	V
I_D	Drain Current (continuous) at T_c = 25 °C	1.7	A
I_D	Drain Current (continuous) at T_c = 100 °C	1.1	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	6.8	A
P_{tot}	Total Dissipation at T_c = 25 °C	25	W
	Derating Factor	0.2	W/°C
V_{ISO}	Insulation Withstand Voltage (DC)	4000	V
T_{stg}	Storage Temperature	-65 to 150	°C
T_j	Max. Operating Junction Temperature	150	°C

($\bullet$) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	5	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	60	°C/W
$R_{thj-amb}$	Thermal Resistance Case-sink	Typ	0.5	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	2.7	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\ °C$, $I_D = I_{AR}$, $V_{DD} = 50\ V$)	200	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	5	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ °C$, pulse width limited by T_j max, $\delta < 1\%$)	1.6	A

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	$I_D = 250\ \mu A$ $V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	V_{DS} = Max Rating V_{DS} = Max Rating x 0.8 $T_c = 125\ °C$			250 1000	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 1.5\ A$ $V_{GS} = 10V$ $I_D = 1.5\ A$ $T_c = 100°C$		2.5	4 8	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)}$ x $R_{DS(on)max}$ $V_{GS} = 10\ V$	1.7			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)}$ x $R_{DS(on)max}$ $I_D = 1.5\ A$	0.8	1.93		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\ V$ $f = 1\ MHz$ $V_{GS} = 0$		350 60 25	460 80 35	pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250$ V $I_D = 1.5$ A		35	45	ns
t_r	Rise Time	$R_G = 50\ \Omega$ $V_{GS} = 10$ V		85	110	ns
		(see test circuit, figure 3)				
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400$ V $I_D = 3$ A		120		A/μs
		$R_G = 50\ \Omega$ $V_{GS} = 10$ V				
		(see test circuit, figure 5)				
Q_g	Total Gate Charge	$V_{DD} = 400$ V $I_D = 3$ A $V_{GS} = 10$ V		25	35	nC
Q_{gs}	Gate-Source Charge			6		nC
Q_{gd}	Gate-Drain Charge			11		nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400$ V $I_D = 3$ A		50	65	ns
t_f	Fall Time	$R_G = 50\ \Omega$ $V_{GS} = 10$ V		20	30	ns
t_c	Cross-over Time	(see test circuit, figure 5)		80	105	ns

SOURCE DRAIN DIODE

| Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				1.7	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				6.8	A
V_{SD} (*)	Forward On Voltage	$I_{SD} = 1.7$ A $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 2.8$ A $di/dt = 100$ A/μs		380		ns
Q_{rr}	Reverse Recovery Charge	$V_{DD} = 100$ V $T_j = 150\ ^{\circ}$C (see test circuit, figure 5)		3.8		μC
I_{RRM}	Reverse Recovery Current			20		A

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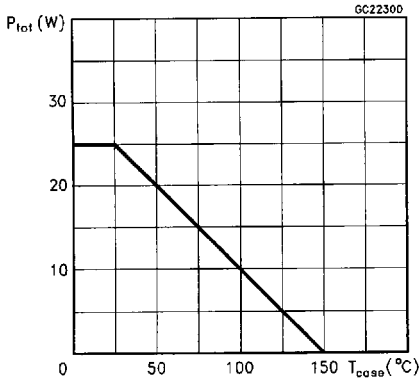(•) Pulse width limited by safe operating area
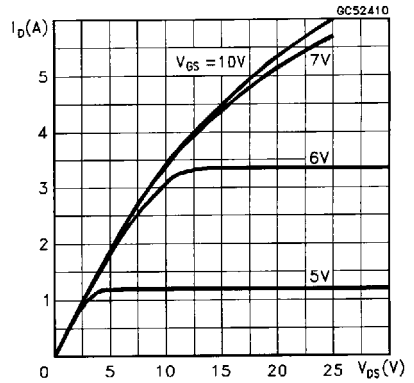
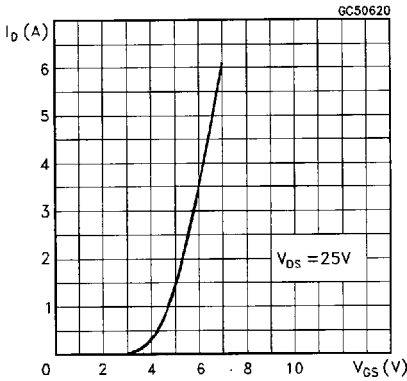Safe Operating Area   Thermal Impedance

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Derating Curve

GC22300
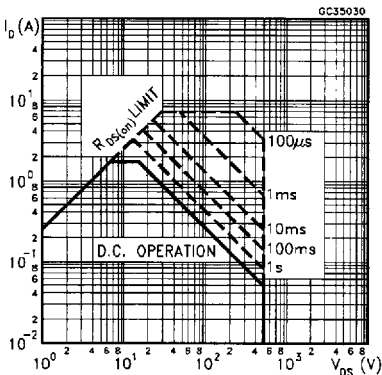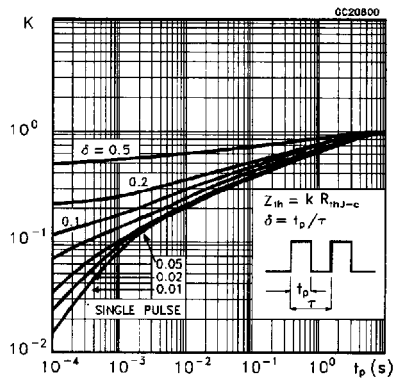
Output Characteristics

GC52410

Transfer Characteristics

GC50620

Transconductance

GC50790
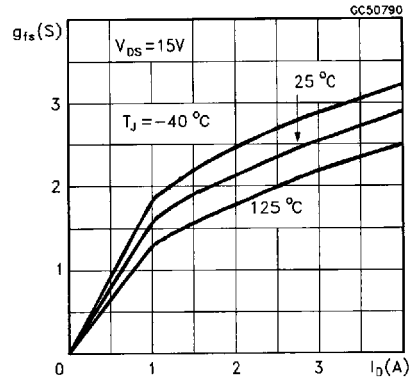
Static Drain-source On Resistance

GC51320
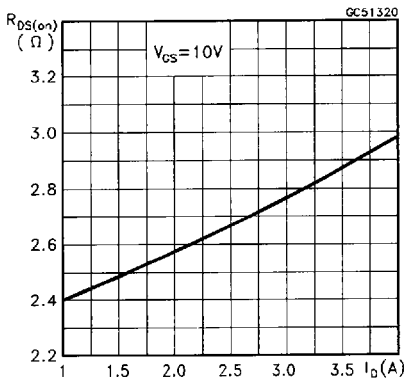
Gate Charge vs Gate-source Voltage

GC51910

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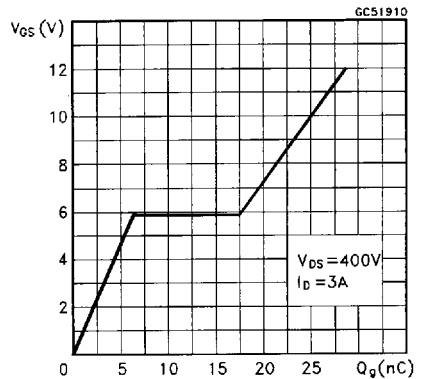
Capacitance Variations

GC52200

C(pF)

f=1MHz
V_{GS} =0V

C_{iss}

C_{oss} C_{rss}

0   16   32   48 V_{DS}(V)
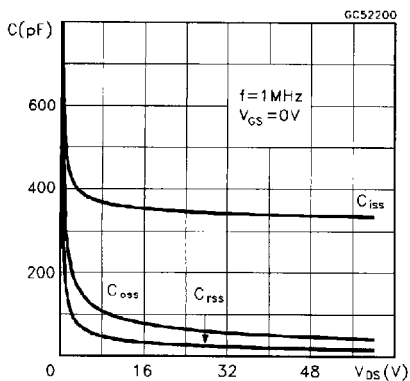
Normalized Gate Threshold Voltage vs Temperature

GC52590

$V_{GS(th)}$ (norm)

$V_{DS}=V_{GS}$
I_D =250μA

−50   0   50   100 T_J (°C)
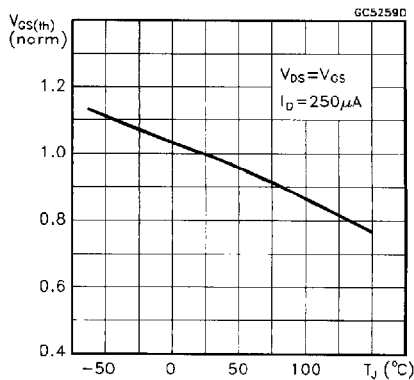
Normalized On Resistance vs Temperature

GC52810

$R_{DS(on)}$ (norm)

V_{GS} =10V
I_D =1.5A

−50   0   50   100 T_J (°C)

Turn-on Current Slope

GC53230

di /dt (A/μ s)

V_{DD} =400V
V_{GS} =10V
I_D =3A

0   40   80   120 R_G (Ω)
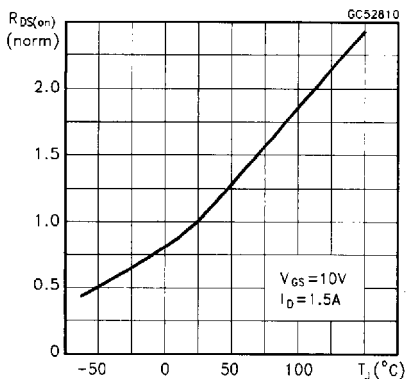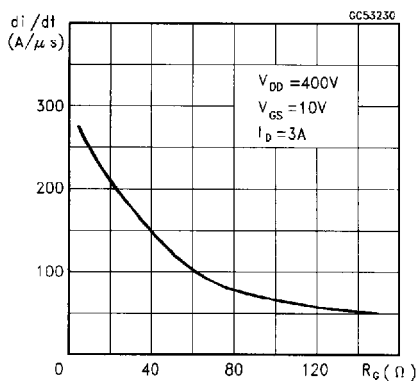
Turn-off Drain-source Voltage Slope

GC53380

dv/dt (V/ns)

V_{DD} =400V
V_{GS} =10V
I_D =3A

0   40   80   120 R_G (Ω)

Cross-over Time

GC53590

t_C (ns)

V_{DD} =400V
V_{GS} =10V
I_D =3A

0   40   80   120 R_G (Ω)

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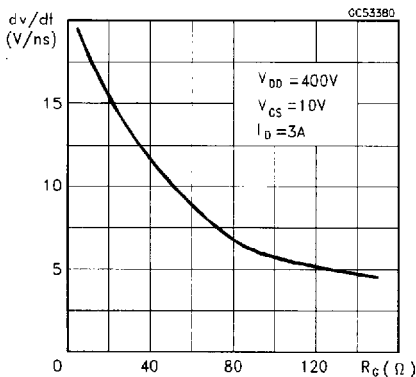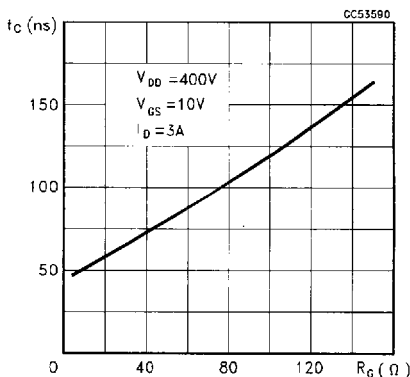
Switching Safe Operating Area

GC22880

$R_G = 50\,\Omega$
$T_J = 150\,°C$
$V_{GS} = 10V$

Accidental Overload Area

GC22890

$T_J = 150°C$
$t_P = 20\,\mu s$
$V_{GS} = 10V$
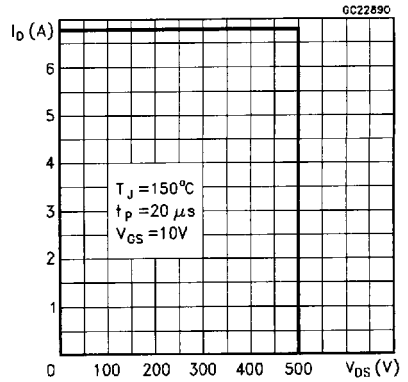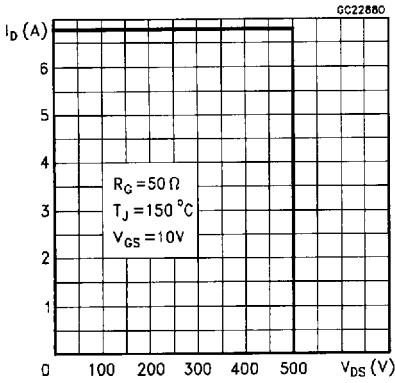
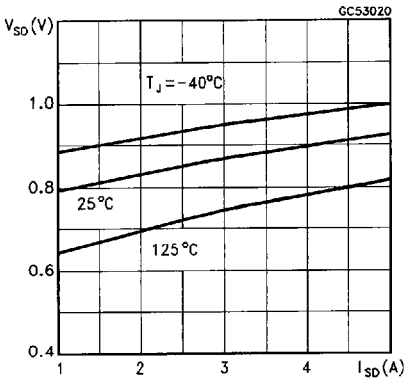Source-drain Diode Forward Characteristics

GC53020

$T_J = -40°C$

25°C

125°C

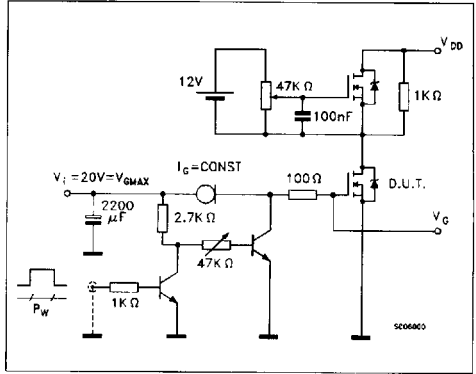**Fig. 1:** Unclamped Inductive Load Test Circuits

L

V_D

I_D

2200 μF 3.3 μF V_{DD}

V_i

P_W

D.U.T.

SC05970

Fig. 2: Unclamped Inductive Waveforms

$V_{(BR)DSS}$

$V_D \rightarrow$

I_{DM}

$i_D \rightarrow$

V_{DD}

V_{DD}

SC05980

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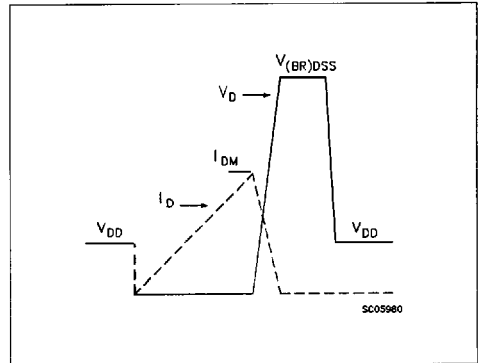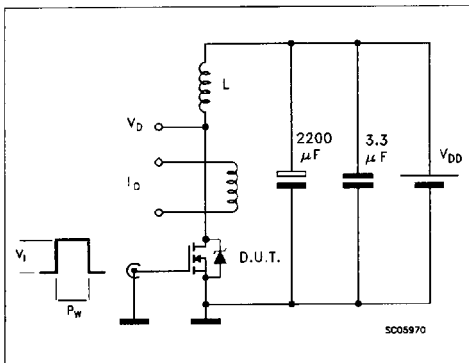
Fig. 3: Switching Times Test Circuits For Resistive Load
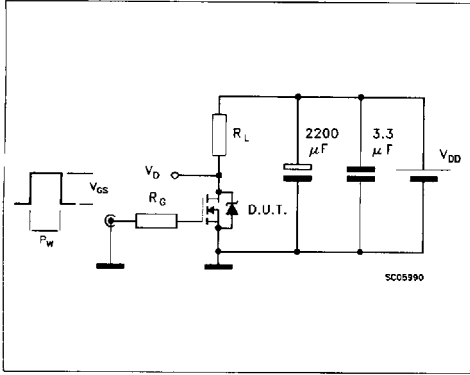
Fig. 4: Gate Charge Test Circuit

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

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