SGS-THOMSON MICROELECTRONICS

STH14N50/FI
STW14N50

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STH14N50	500 V	< 0.45 Ω	14.1 A
STH14N50FI	500 V	< 0.45 Ω	8.8 A
STW14N50	500 V	< 0.45 Ω	14.1 A

- TYPICAL $R_{DS(on)}$ = 0.34 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- REDUCED GATE CHARGE
- 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

TO-247

TO-218 ISOWATT218

INTERNAL SCHEMATIC DIAGRAM
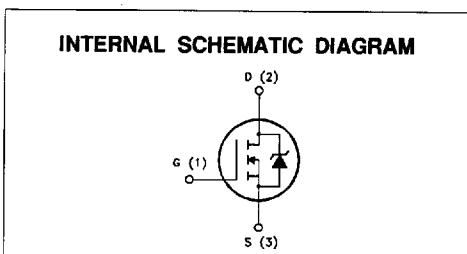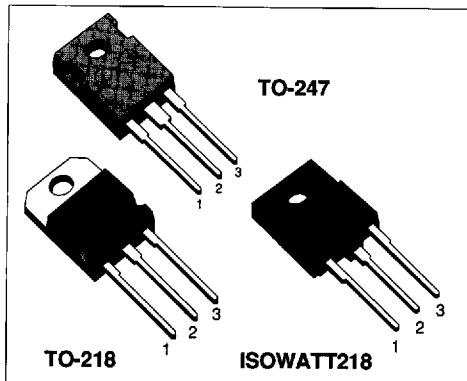
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW14N50	STH14N50FI	
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	± 20		V
I_D	Drain Current (continuous) at T_c = 25 °C	14.1	8.8	A
I_D	Drain Current (continuous) at T_c = 100 °C	8.8	5.5	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	60	60	A
P_{tot}	Total Dissipation at T_c = 25 °C	180	70	W
	Derating Factor	1.44	0.56	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

(•) Pulse width limited by safe operating area

May 1993

THERMAL DATA

			TO-218/TO-247	ISOWATT218	
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	0.69	1.78	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	30		°C/W
$R_{thc\text{-}sink}$	Thermal Resistance Case-sink	Typ	0.1		°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, $\delta < 1\%$)	14.1	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 25 V)	800	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	26	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (T_c = 100 °C, pulse width limited by T_j max, $\delta < 1\%$)	8.8	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 µA 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} = ± 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 µA	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V I_D = 7.5 A V_{GS} = 10V I_D = 7.5 A T_c = 100°C		0.34	0.45 0.9	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)}$ x $R_{DS(on)max}$ V_{GS} = 10 V	14.1			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 = 7.5 A	8.5	11.2		S
C_{iss}	Input Capacitance	V_{DS} = 25 V f = 1 MHz V_{GS} = 0		2350	3000	pF
C_{oss}	Output Capacitance			340	440	pF
C_{rss}	Reverse Transfer Capacitance			75	100	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	$V_{DD} = 210\ V$ $I_D = 7\ A$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\ V$ (see test circuit, figure 3)		60 55	80 70	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\ V$ $I_D = 15\ A$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\ V$ (see test circuit, figure 5)		270		A/µs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400\ V$ $I_D = 15\ A$ $V_{GS} = 10\ V$		90 12 48	110	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	$V_{DD} = 400\ V$ $I_D = 15\ A$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\ V$ (see test circuit, figure 5)		35 45 65	45 60 85	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)				14.1 60	A A
V_{SD} (∗)	Forward On Voltage	$I_{SD} = 14\ A$ $V_{GS} = 0$			2	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 15\ A$ $di/dt = 100\ A/µs$ $V_{DD} = 100\ V$ $T_j = 150\ °C$ (see test circuit, figure 5)		630 10.7 34		ns ·µC A

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

Safe Operating Areas For TO-218 and TO-247


### Safe Operating Areas For ISOWATT218

Thermal Impedeance For TO218 and TO-247
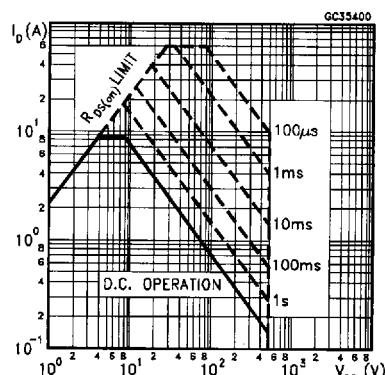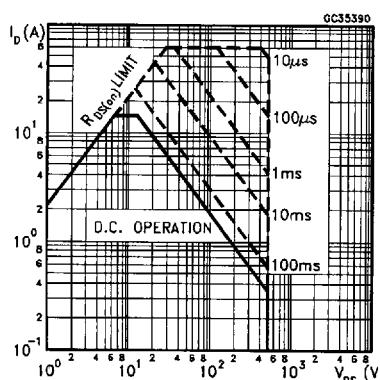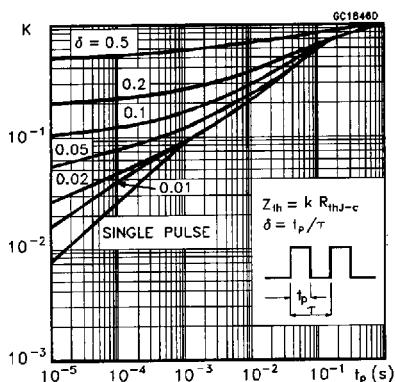
Thermal Impedance For ISOWATT218
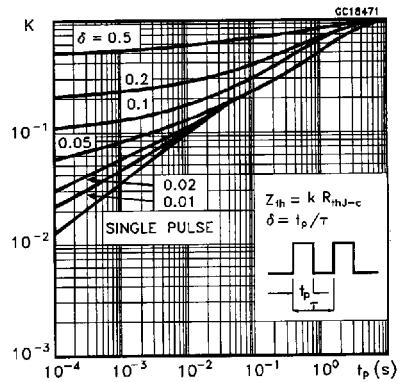
Derating Curve For TO-218 and TO-247
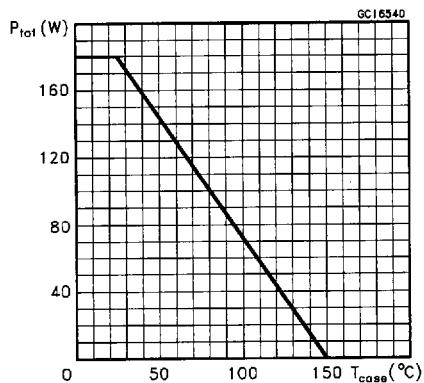
Derating Curve For ISOWATT218
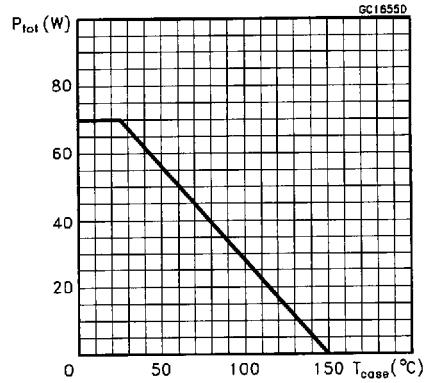
Output Characteristics
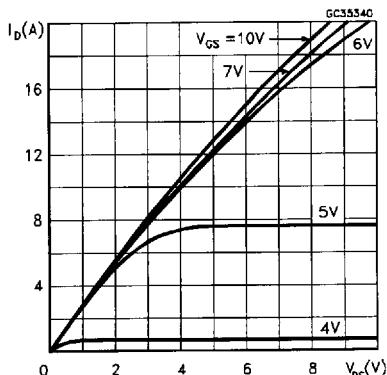
Transfer Characteristics

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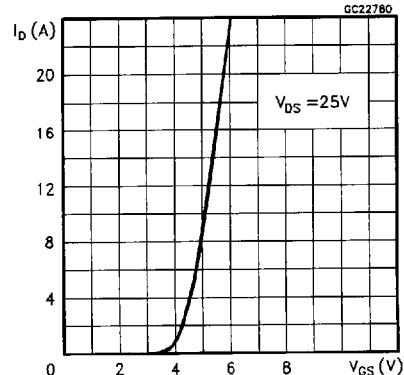
Transconductance
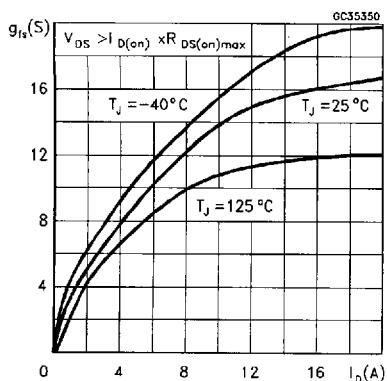
Static Drain-source On Resistance
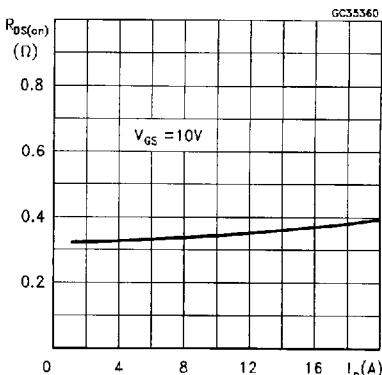


Gate Charge vs Gate-source Voltage
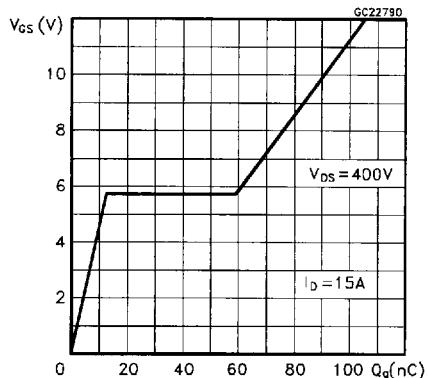
Capacitance Variations
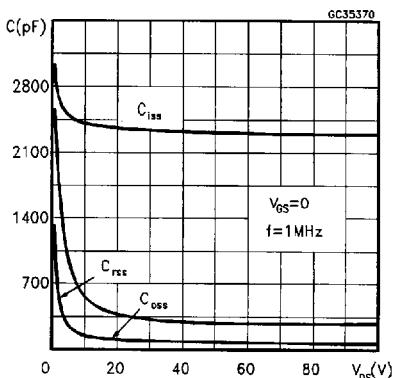
Normalized Gate Threshold Voltage vs Temperature
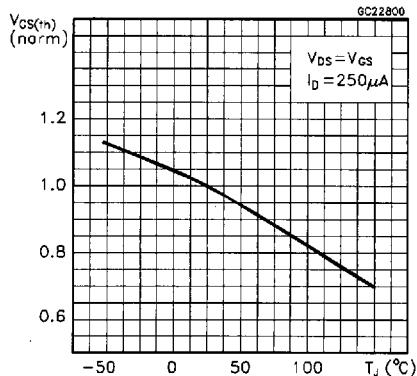
Normalized On Resistance vs Temperature

Turn-on Current Slope


GC21770

di/dt (A/µs)

$V_{DD} = 400V$
$V_{GS} = 10V$
$I_D = 15A$

240, 200, 160, 120, 80

0 20 40 60 80 $R_G (\Omega)$
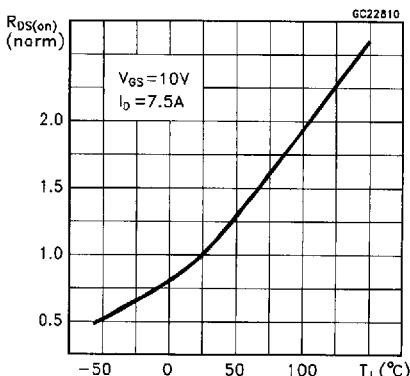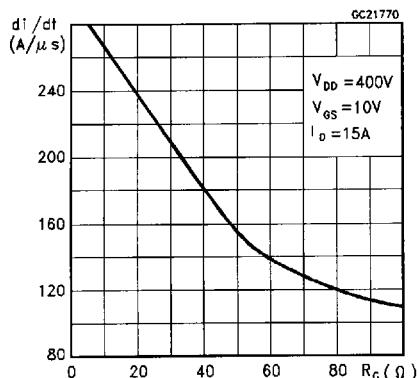
Turn-off Drain-source Voltage Slope

GC21780

dv/dt (V/ns)

$V_{DD} = 400V$
$V_{GS} = 10V$
$I_D = 15A$

16, 12, 8, 4

0 20 40 60 80 $R_G (\Omega)$

Cross-over Time

GC21790

t_C (ns)

400, 300, 200, 100

$V_{DD} = 400V$
$V_{GS} = 10V$
$I_D = 15A$

0 20 40 60 80 $R_G (\Omega)$
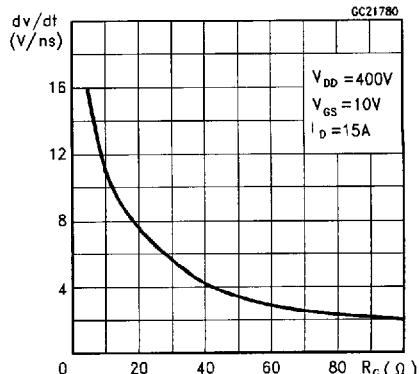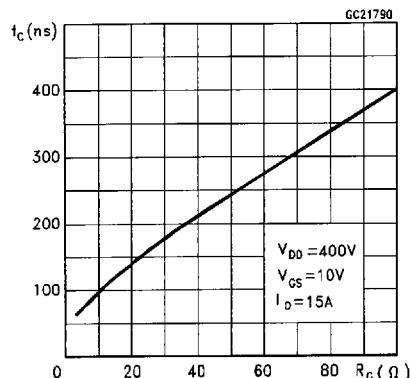
Switching Safe Operating Area

GC22820

I_D (A)

60, 50, 40, 30, 20, 10

$R_G = 4.7\Omega$
$T_J = 150\,°C$
$V_{GS} = 10V$

0 100 200 300 400 500 V_{DS} (V)
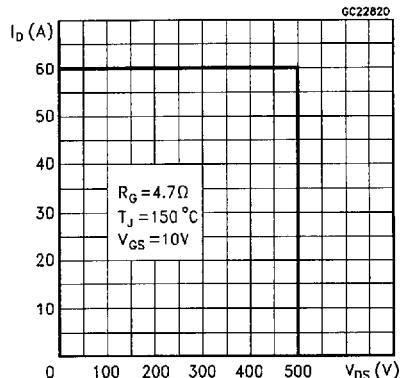
Accidental Overload Area

GC22830

I_D (A)

60, 50, 40, 30, 20, 10

$T_J = 150\,°C$
$t_P = 20\,\mu s$
$V_{GS} = 10V$

0 100 200 300 400 500 V_{DS} (V)
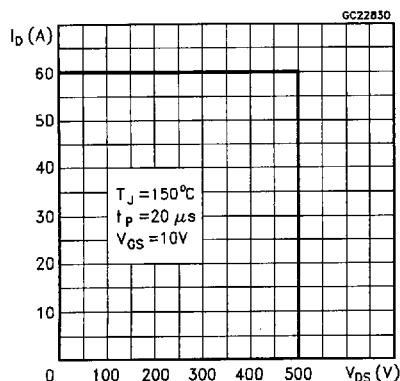
Source-drain Diode Forward Characteristics

GC22840

I_{SD} (A)

$T_J = 125\,°C$

25°C

−40°C

16, 12, 8, 4, 0

0.4 0.6 0.8 1.0 1.2 V_{SD} (V)

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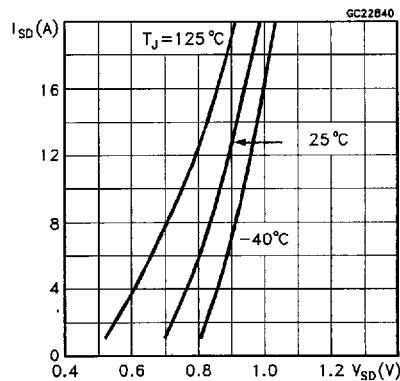
**Fig. 1:** Unclamped Inductive Load Test Circuits
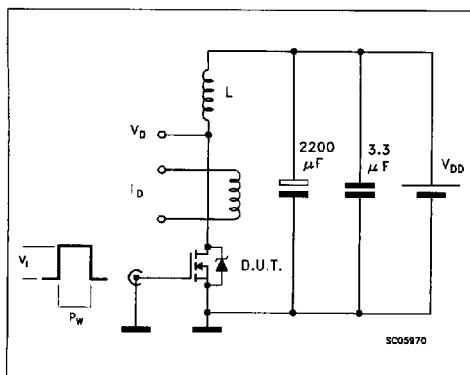
Fig. 2: Unclamped Inductive Waveforms
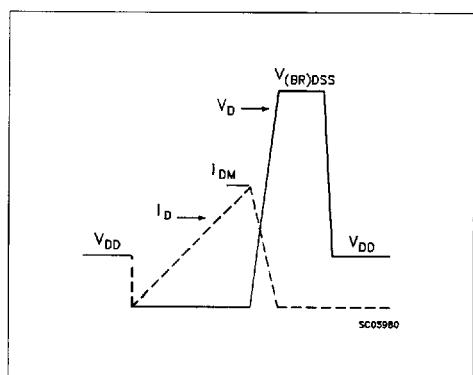

**Fig. 3:** Switching Times Test Circuits For Resistive Load
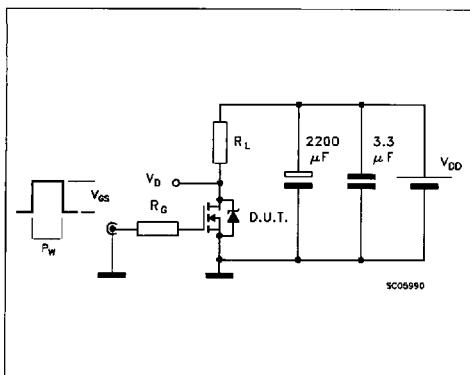
**Fig. 4:** Gate Charge Test Circuit
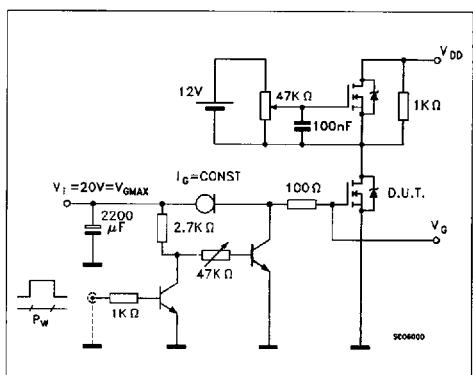
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time

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