

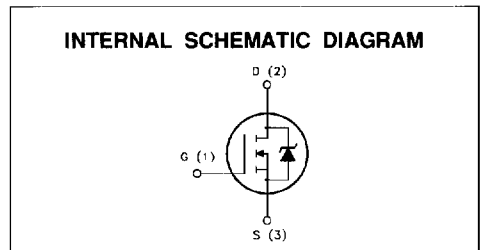
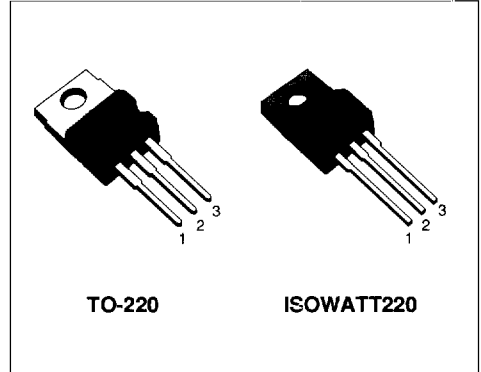
## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP5N50	500 V	1.6 Ω	4.5 A
STP5N50FI	500 V	1.6 Ω	3 A

- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION
- ISOLATED PACKAGE UL RECOGNIZED, ISOLATION TO 2000V DC

### APPLICATIONS

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



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5N50	STP5N50FI	
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	± 20		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	4.5	3	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	3	1.8	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	15	15	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
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

## THERMAL DATA

			TO-200	ISOWATT220	
$R_{th(j-c)}$	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
$R_{th(j-a)}$	Thermal Resistance Junction-ambient	Max		62.5	°C/W
$R_{th(c-sink)}$	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, $\delta < 1\%$ )	4.5	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	280	mJ
$E_{AR}$	Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$ )	7.4	mJ
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive ( $T_c = 100\text{ °C}$ , pulse width limited by $T_j$ max, $\delta < 1\%$ )	2.5	A

## ELECTRICAL CHARACTERISTICS ( $T_{case} = 25\text{ °C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$	500			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$			250 1000	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ $I_D = 2.5\text{ A}$ $T_c = 100\text{ °C}$			1.6 3.2	$\Omega$ $\Omega$
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{ V}$	4.5			A

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 2.5\text{ A}$	2.7			S
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$			800	pF
$C_{oss}$	Output Capacitance				130	pF
$C_{rss}$	Reverse Transfer Capacitance				55	pF

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)			60 42	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		170		A/ $\mu$ s
$Q_g$	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $V_{GS} = 10\text{ V}$		42	52	nC

**SWITCHING OFF**

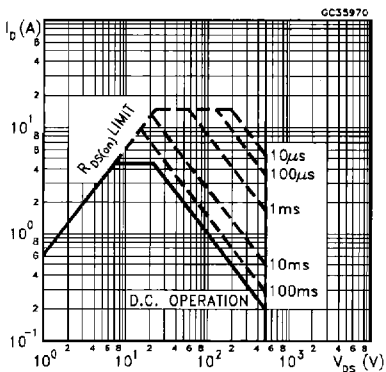
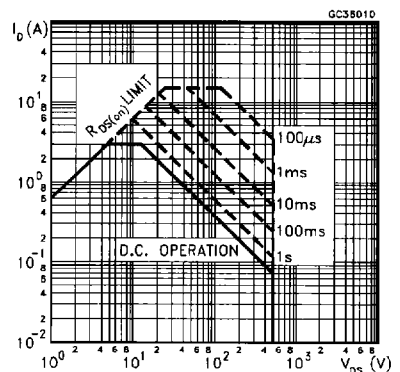
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$			45	ns
$t_f$	Fall Time	$R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$			55	ns
$t_c$	Cross-over Time	(see test circuit, figure 5)			75	ns

**SOURCE DRAIN DIODE**

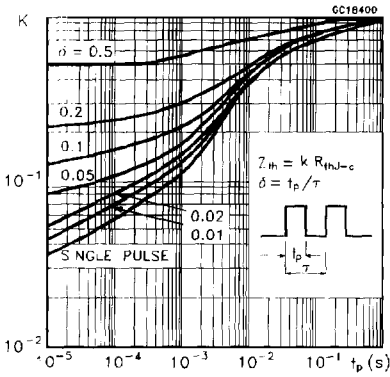
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				4.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				15	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 4.5\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 4.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		430		ns
$Q_{rr}$	Reverse Recovery Charge			3.8		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			17.5		A

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

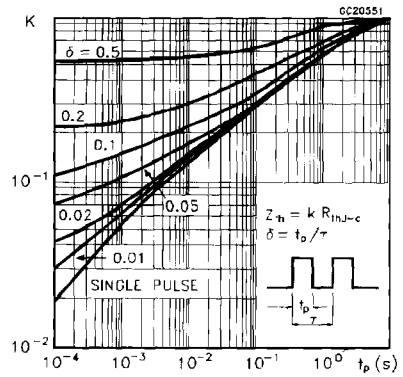
( $\bullet$ ) Pulse width limited by safe operating area

**Safe Operating Areas For TO-220****Safe Operating Areas For ISOWATT220**

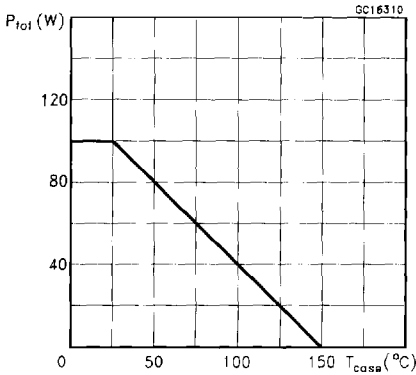
Thermal Impedance For TO-220



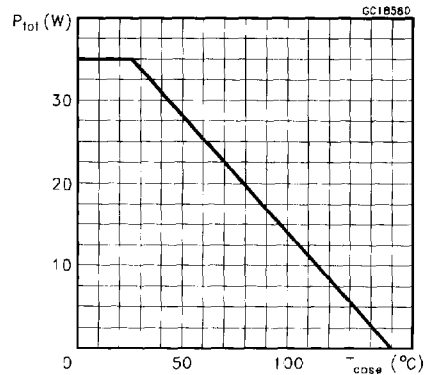
Thermal Impedance For ISOWATT220



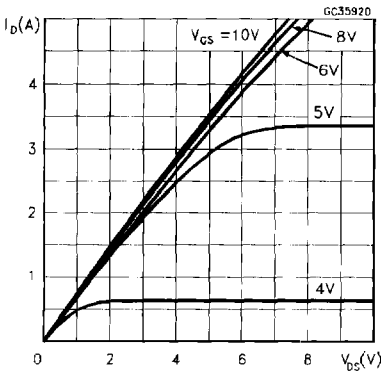
Derating Curve For TO-220



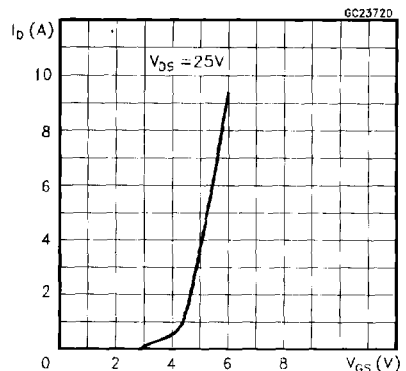
Derating Curve For ISOWATT220



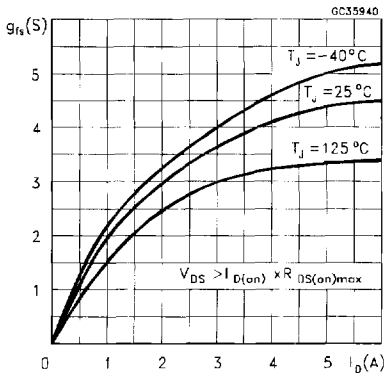
Output Characteristics



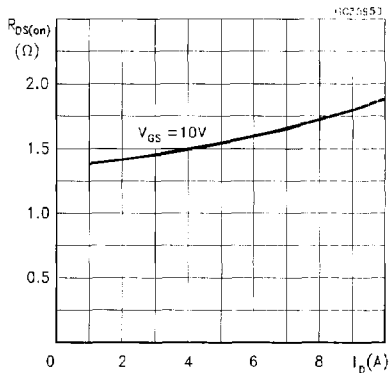
Transfer Characteristics



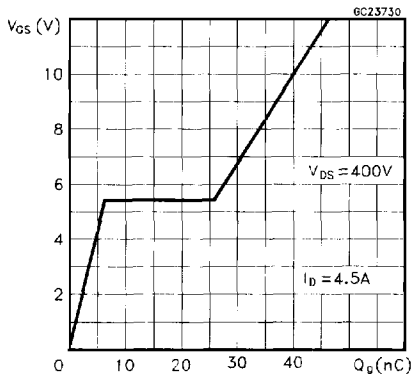
Transconductance



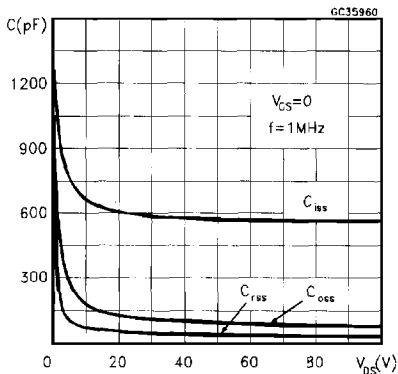
Static Drain-source On Resistance



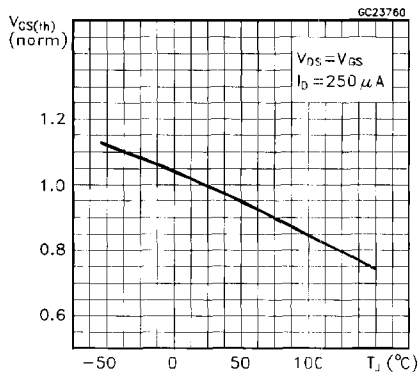
Gate Charge vs Gate-source Voltage



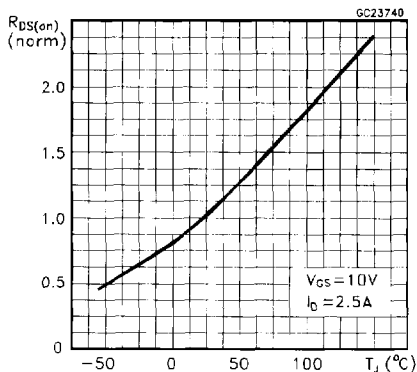
Capacitance Variations



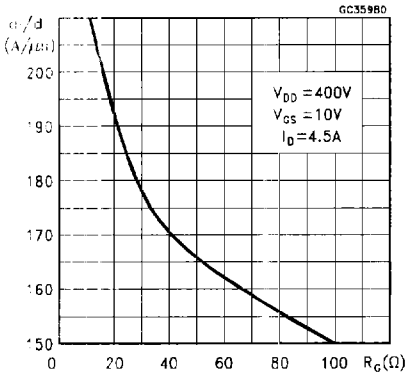
Normalized Gate Threshold Voltage vs Temperature



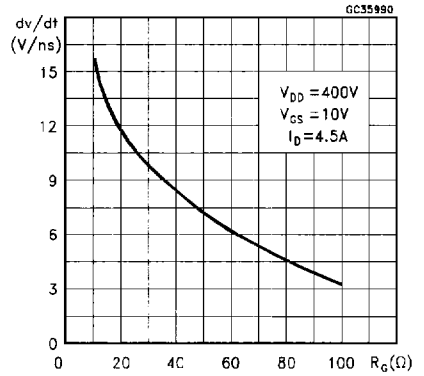
Normalized On Resistance vs Temperature



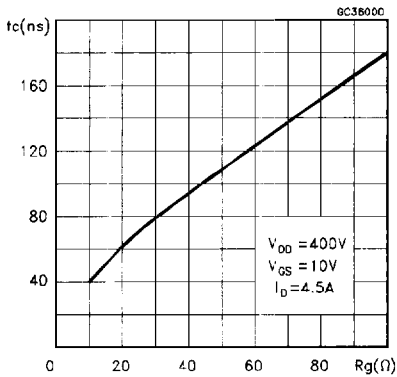
Turn-on Current Slope



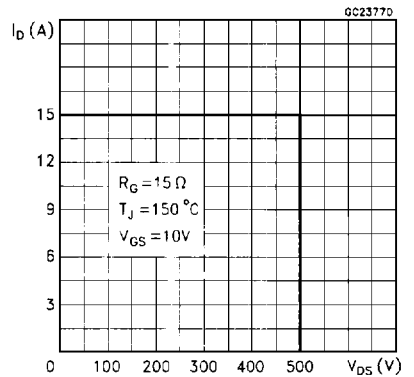
Turn-off Drain-source Voltage Slope



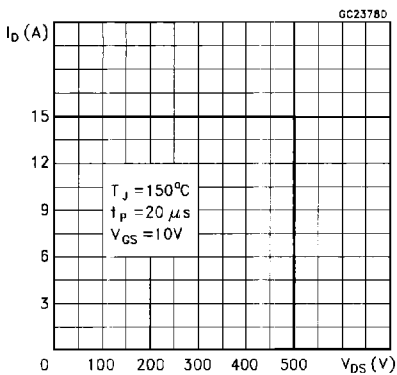
Cross-over Time



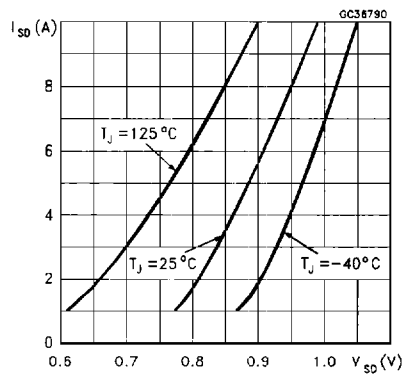
Switching Safe Operating Area



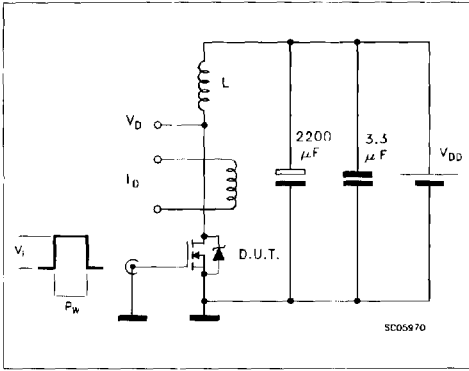
Accidental Overload Area



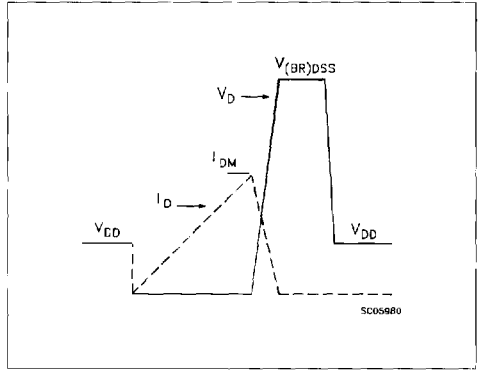
Source-drain Diode Forward Characteristics



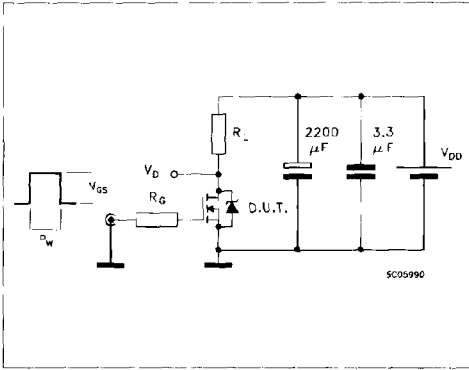
**Fig. 1: Unclamped Inductive Load Test Circuits**



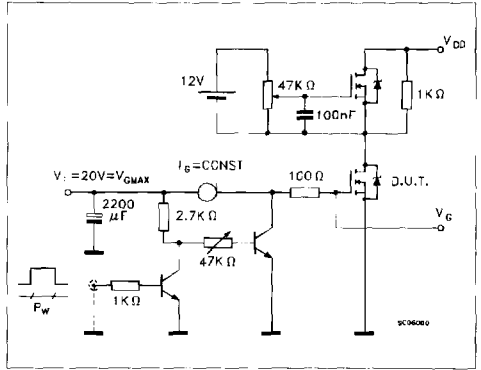
**Fig. 2: Unclamped Inductive Waveforms**



**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**

