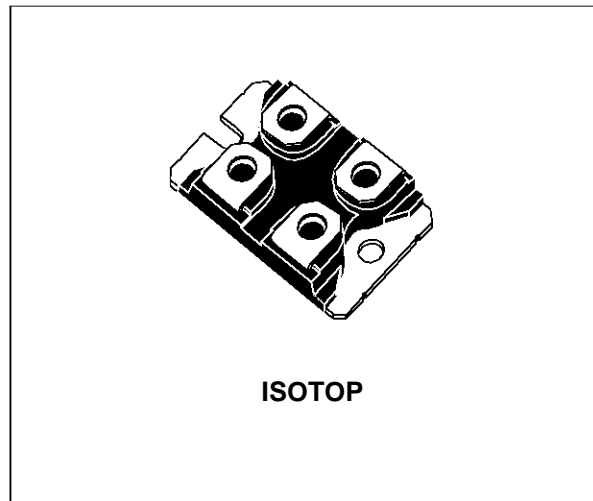


## N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

PRELIMINARY DATA

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STE110NA20	200 V	< 0.019 Ω	110 A

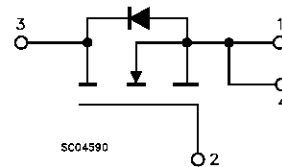
- TYPICAL R<sub>DS(on)</sub> = 0.015 Ω
- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW R<sub>th</sub> (Junction to case)
- VERY LOW INTERNAL PARASITIC INDUCTANCE
- ISOLATED PACKAGE UL RECOGNIZED



### APPLICATIONS

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	200	V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	200	V
V <sub>GS</sub>	Gate-source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	110	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	73	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	440	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	450	W
	Derating Factor	3.6	W/°C
T <sub>stg</sub>	Storage Temperature	-55 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C
V <sub>ISO</sub>	Insulation Withstand Voltage (AC-RMS)	2500	V

(●) Pulse width limited by safe operating area

# STE110NA20

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.27	$^{\circ}\text{C}/\text{W}$
$R_{thc-h}$	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^{\circ}\text{C}/\text{W}$

## AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$ )	55	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{V}$ )	500	mJ
$E_{AR}$	Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$ )	175	mJ
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive ( $T_c = 100^{\circ}\text{C}$ , pulse width limited by $T_j$ max, $\delta < 1\%$ )	32.5	A

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{mA}$ $V_{GS} = 0$	200			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}\text{C}$			400 200	$\mu\text{A}$ mA
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30\text{V}$			$\pm 400$	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1\text{mA}$	2.25	3	3.75	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$ $I_D = 55\text{A}$ $V_{GS} = 10\text{V}$ $I_D = 55\text{A}$ $T_c = 100^{\circ}\text{C}$		0.015	0.019	$\Omega$ $\Omega$
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10\text{V}$	110			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} = 15\text{V}$ $I_D = 55\text{A}$	38			S
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}$ $f = 1\text{MHz}$ $V_{GS} = 0$		12.9		nF
$C_{oss}$	Output Capacitance			2870		pF
$C_{rss}$	Reverse Transfer Capacitance			980		pF

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 100\text{ V}$ $I_D = 55\text{ A}$		70	100	ns
$t_r$	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		95	125	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 160\text{ V}$ $I_D = 110\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		290		A/ $\mu\text{s}$
$Q_g$	Total Gate Charge	$V_{DD} = 160\text{ V}$ $I_D = 110\text{ A}$ $V_{GS} = 10\text{ V}$		470	600	nC
$Q_{gs}$	Gate-Source Charge			43		nC
$Q_{gd}$	Gate-Drain Charge			226		nC

**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 160\text{ V}$ $I_D = 110\text{ A}$		115	150	ns
$t_f$	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		68	100	ns
$t_c$	Cross-over Time	(see test circuit, figure 5)		160	210	ns

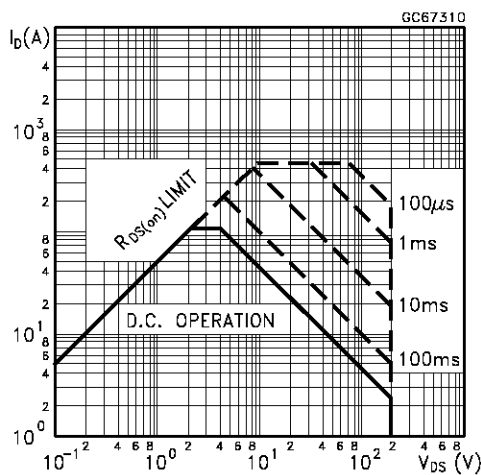
**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				110	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				440	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 110\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 110\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 50\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		625		ns
$Q_{rr}$	Reverse Recovery Charge			11		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			35		A

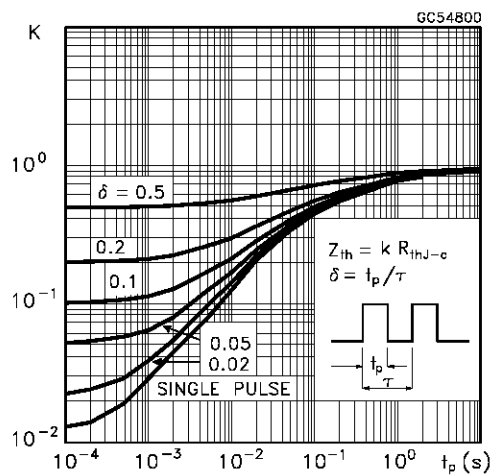
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

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

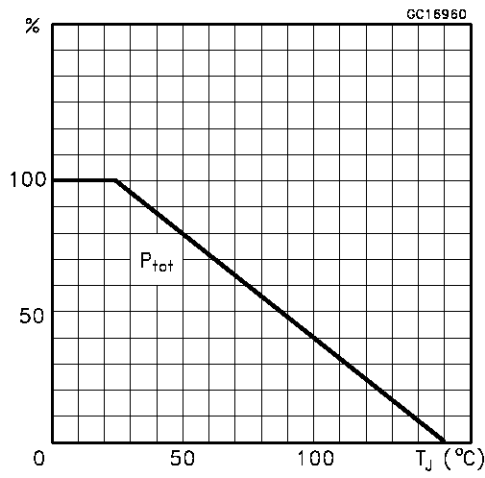
**Safe Operating Area**



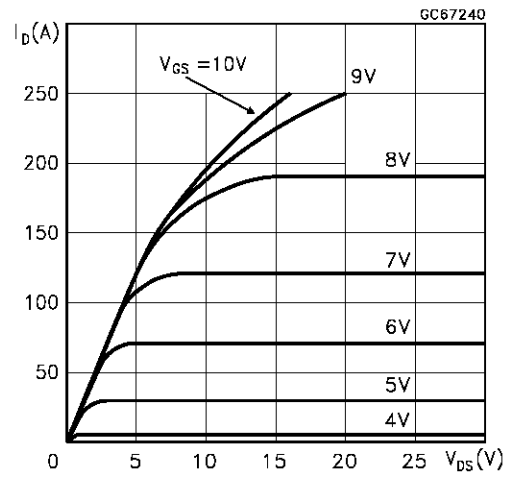
**Thermal Impedance**



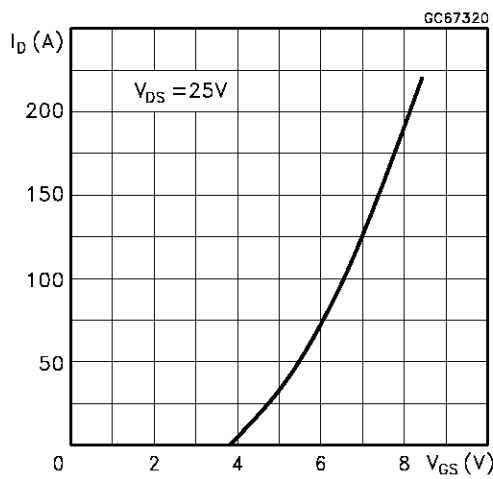
Derating Curve



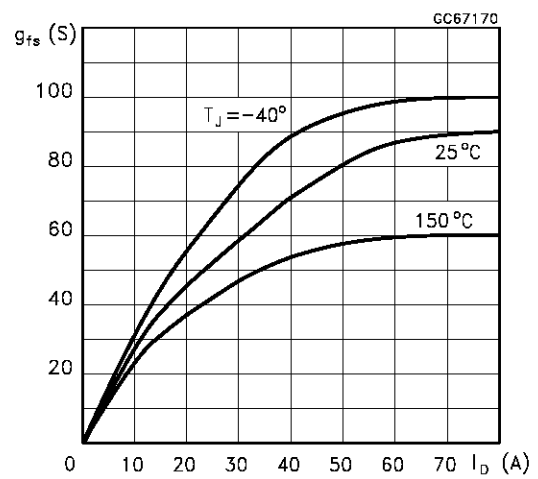
Output Characteristics



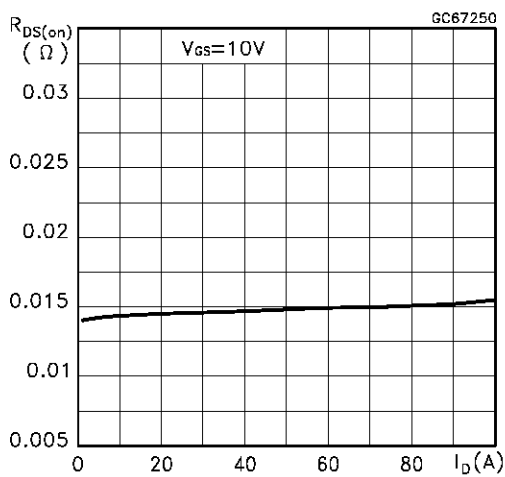
Transfer Characteristics



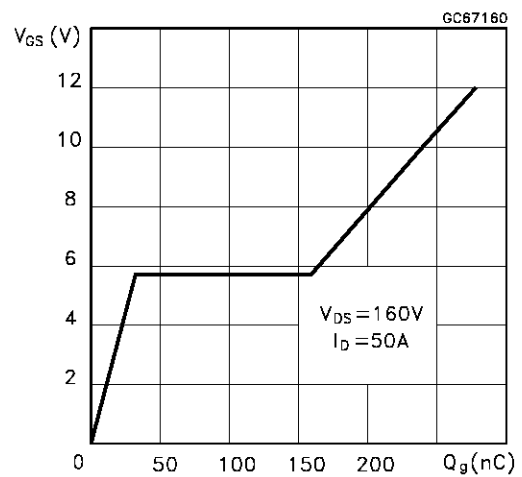
Transconductance



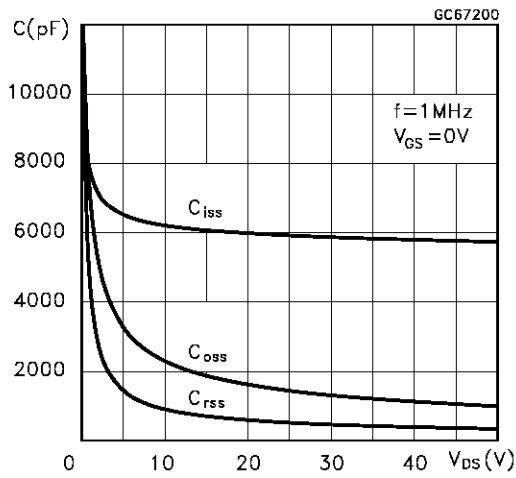
Static Drain-source On Resistance



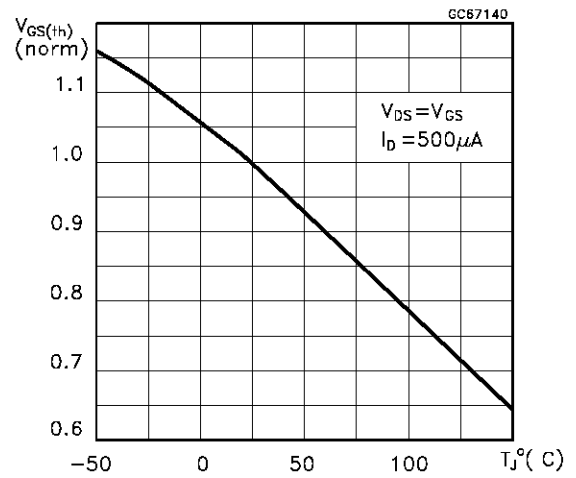
Gate Charge vs Gate-source Voltage



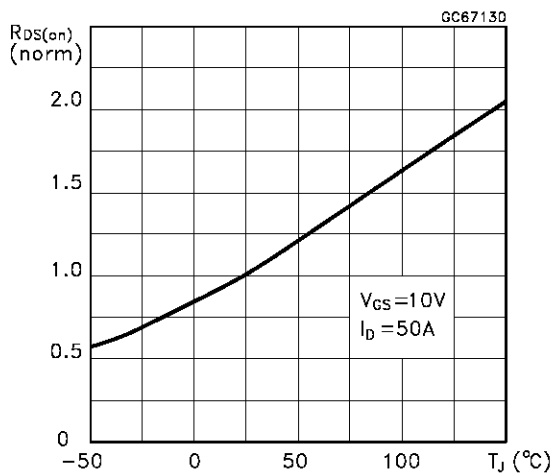
Capacitance Variations



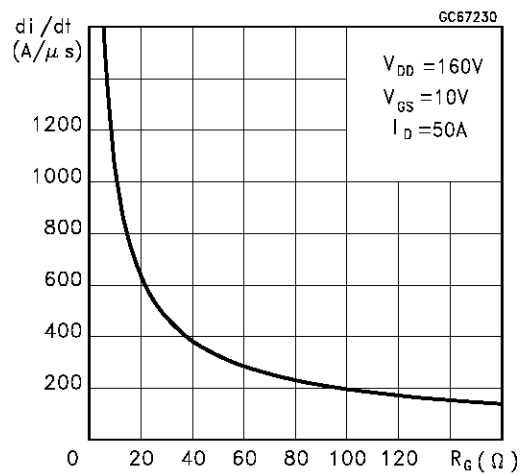
Normalized Gate Threshold Voltage vs Temperature



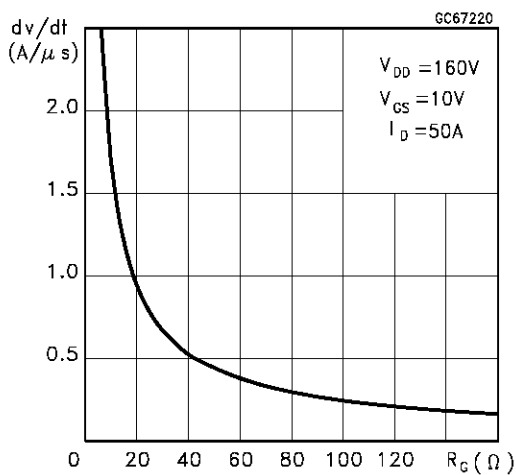
Normalized On Resistance vs Temperature



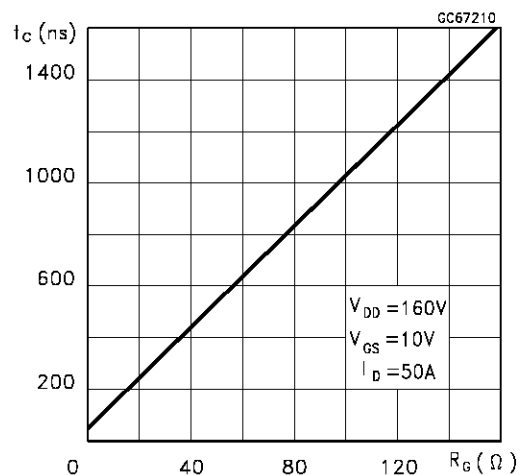
Turn-on Current Slope



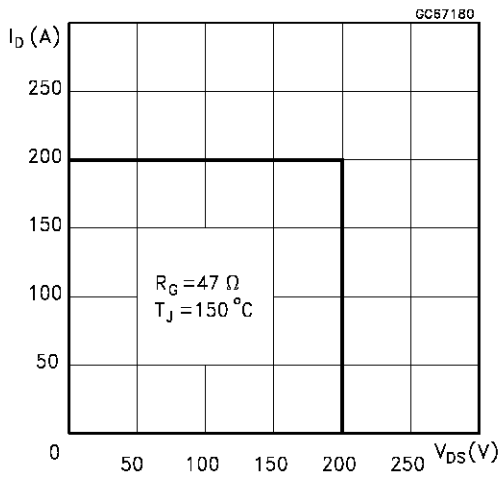
Turn-off Drain-source Voltage Slope



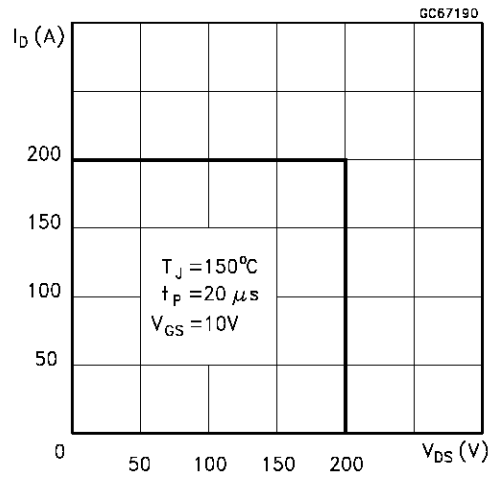
Cross-over Time



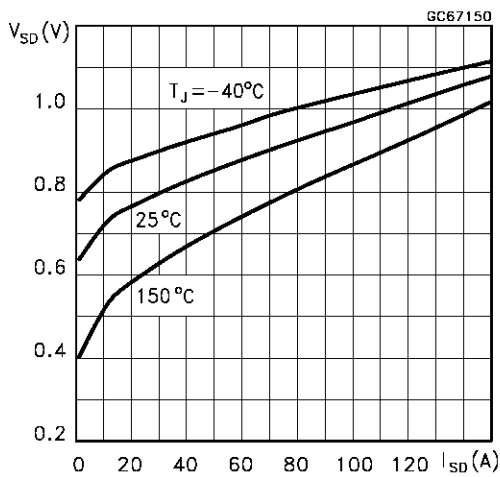
Switching Safe Operating Area



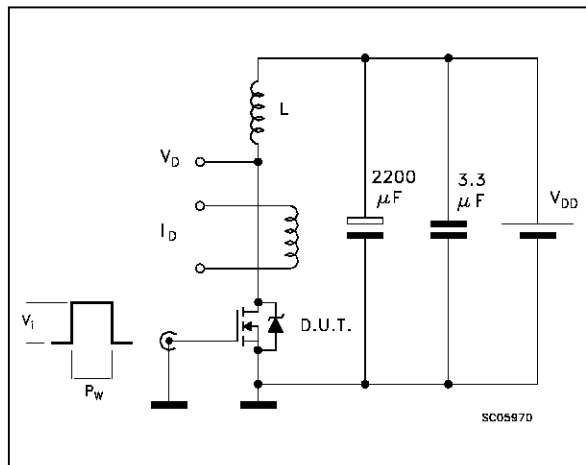
Accidental Overload Area



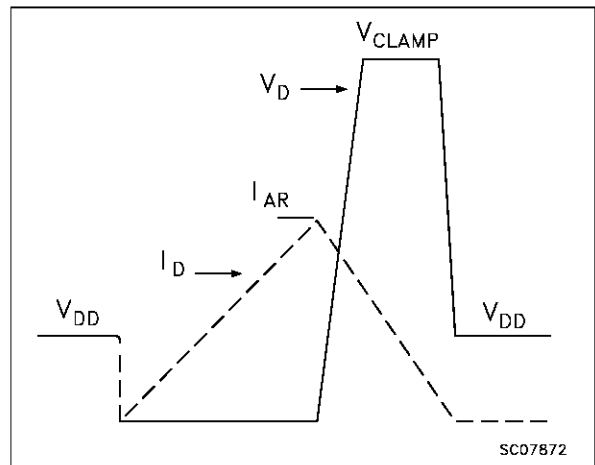
Source-drain Diode Forward Characteristics



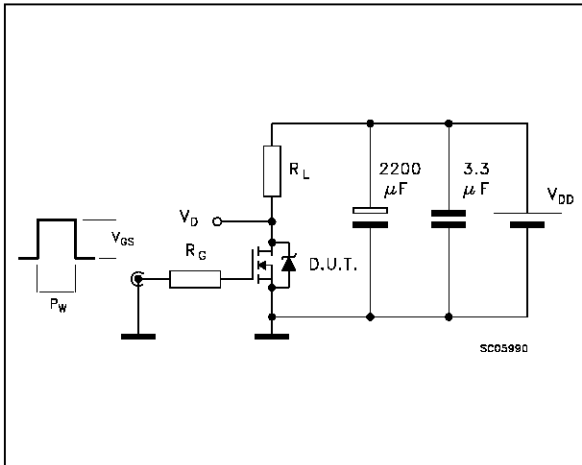
**Fig. 1:** Unclamped Inductive Load Test Circuit



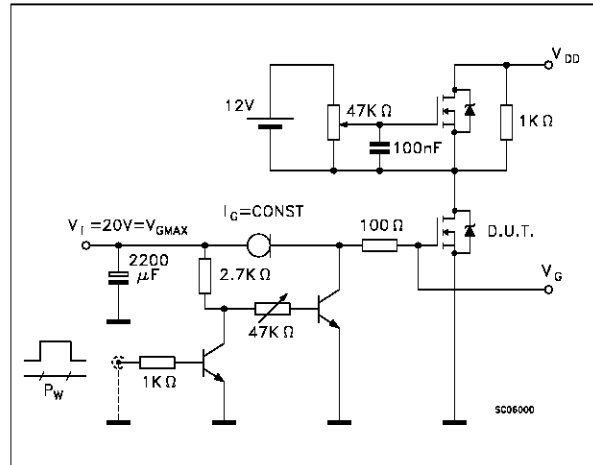
**Fig. 2:** Unclamped Inductive Waveform



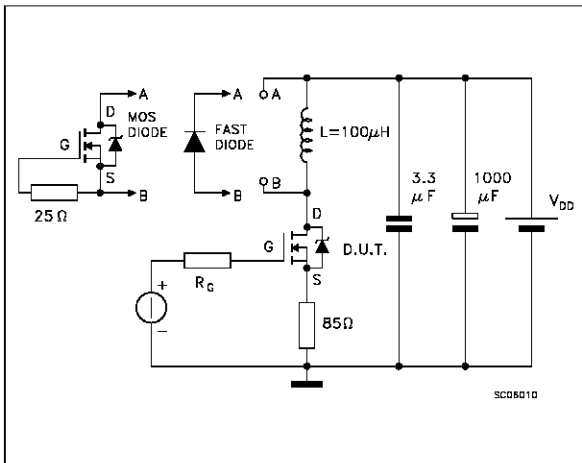
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 4: Gate Charge test Circuit**



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



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