

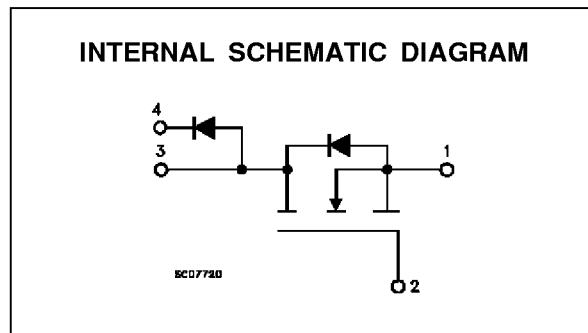
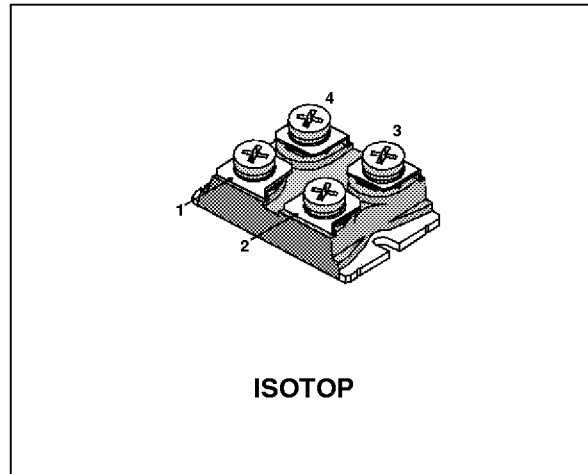
## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR AND ULTRA-FAST DIODE IN ISOTOP PACKAGE

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STE36N50-DK	500 V	< 0.14 Ω	36 A

- DEDICATED FOR POWER FACTOR CORRECTOR APPLICATIONS
- LOW GATE CHARGE MOSFET
- TURBOSWITCH DIODE INCORPORATED
- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- EXTREMELY LOW R<sub>th</sub> JUNCTION TO CASE
- VERY LOW DRAIN TO CASE CAPACITANCE
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY < 5 nH)
- ISOLATED PACKAGE UL RECOGNIZED (FILE No E81743)

### INDUSTRIAL APPLICATIONS:

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- POWER FACTOR CORRECTOR
- ASYMMETRICAL HALF BRIDGE SMPS (WITH COMPLIMENTARY STE36N50-DA)



### MOSFET ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
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	36	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	24	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	144	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	380	W
	Derating Factor	3.3	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

## STE36N50-DK

### DIODE ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	600	V
$V_{RSM}$	Non Repetitive Peak Reverse Voltage	600	V
$I_{F(RMS)}$	RMS Forward Current	50	A
$I_{FRM}$	Repet. Peak Forward Current ( $t_p = 5 \mu s$ , $f = 5KHz$ )	300	A
$P_{tot}$	Total Dissipation at $T_c = 25^\circ C$	70	W
	Derating Factor	0.56	W/ $^\circ C$

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case (MOSFET)	Max	0.3	$^\circ C/W$
$R_{thj-case}$	Thermal Resistance Junction-case (DIODE)	Max	1.78	$^\circ C/W$
$R_{thc-h}$	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	$^\circ C/W$

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$ )	14	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^\circ C$ , $I_D = I_{AR}$ , $V_{DD} = 50 V$ )	100	mJ
$E_{AR}$	Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$ )	40	mJ
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive ( $T_c = 100^\circ C$ , pulse width limited by $T_j$ max, $\delta < 1\%$ )	9	A

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1 mA$ $V_{GS} = 0$	500			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^\circ C$			300 1500	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 V$			$\pm 300$	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 1 mA$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 18 A$ $V_{GS} = 10V$ $I_D = 18 A$ $T_c = 100^\circ C$		0.12	0.14 0.28	$\Omega$ $\Omega$
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	36			A

**MOSFET ELECTRICAL CHARACTERISTICS** (continued)

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 18$ A	16			S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$			8000 1300 350	pF pF pF

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 250$ V $I_D = 18$ A $R_G = 4.7$ $\Omega$ $V_{GS} = 10$ V (see test circuit, figure 1)		45 85	65 120	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400$ V $I_D = 36$ A $R_G = 4.7$ $\Omega$ $V_{GS} = 10$ V (see test circuit, figure 3)		700		A/ $\mu$ s
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400$ V $I_D = 36$ A $V_{GS} = 10$ V		295 35 145		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 $I_D = 36$ A $R_G = 4.7$ $\Omega$ $V_{GS} = 10$ V (see test circuit, figure 3)		100 45 160	140 65 225	ns ns ns

## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				36 144	A A
$V_{SD}$ (*)	Forward On Voltage	$I_{SD} = 36$ A $V_{GS} = 0$			1.4	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 36$ A $di/dt = 100$ A/ $\mu$ s $V_{DD} = 100$ V $T_j = 150$ °C (see test circuit, figure 3)		1 29 58		$\mu$ s $\mu$ C A

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

(\bullet) Pulse width limited by safe operating area

# STE36N50-DK

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

### STATIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$ (#)	Forward Voltage Drop	$I_F = 20\text{ A}$ $T_j = 25\text{ }^{\circ}\text{C}$			1.75	V
		$I_F = 20\text{ A}$ $T_j = 125\text{ }^{\circ}\text{C}$			1.5	V
$I_R$ (##)	Reverse Leakage Current	$V_R = V_{RRM} \times 0.8$ $T_j = 25\text{ }^{\circ}\text{C}$			100	$\mu\text{A}$
		$V_R = V_{RRM} \times 0.8$ $T_j = 125\text{ }^{\circ}\text{C}$			6	$\text{mA}$

### DINAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse Recovery Time	$I_F = 0.5\text{ A}$ $I_R = 1\text{ A}$ $I_{rr} = 0.25\text{ A}$ $T_j = 25\text{ }^{\circ}\text{C}$		30		ns
		$I_F = 1\text{ A}$ $dI_F/dt = -50\text{ A}/\mu\text{s}$ $V_R = 30\text{ v}$ $T_j = 25\text{ }^{\circ}\text{C}$			60	ns
$I_{RM}$	Maximum Reverse Recovery Current	$V_R = 400\text{ V}$ $I_F = 20\text{ A}$ $T_j = 125\text{ }^{\circ}\text{C}$ $dI_F/dt = -160\text{ A}/\mu\text{s}$ $dI_F/dt = -500\text{ A}/\mu\text{s}$		17.5	12.5	A A

### TURN-ON SWITCHING

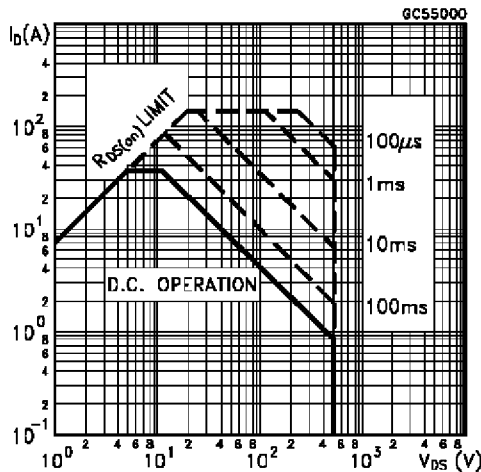
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{fr}$	Forward Recovery Time	$I_F = 20\text{ A}$ $dI_F/dt = 160\text{ A}/\mu\text{s}$ Measured at: $1.1 \times V_{f(MAX)}$ $T_j = 25\text{ }^{\circ}\text{C}$			600	ns
$V_{FP}$	Peak Forward Voltage	$T_j = 25\text{ }^{\circ}\text{C}$			12	V

(#) Pulsed: Pulse duration = 380  $\mu\text{s}$ , duty cycle < 2%

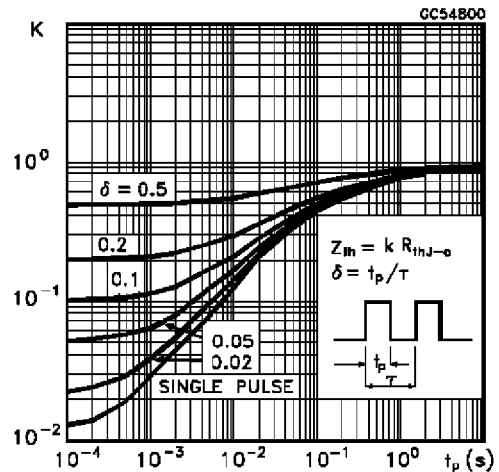
(##) Pulsed: Pulse duration = 5  $\mu\text{s}$ , duty cycle < 2%

NOTE: For the complete DIODE characterization refer to STTA2006P datasheet

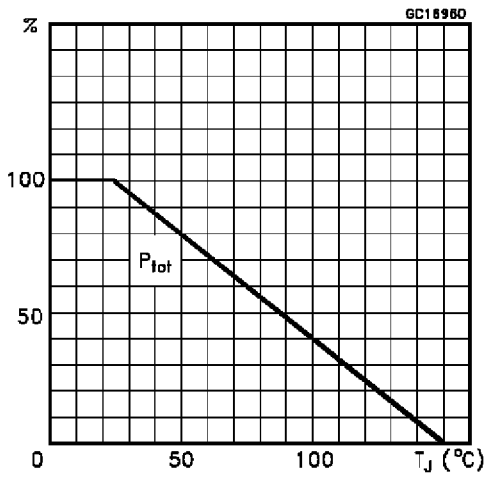
### Safe Operating Areas



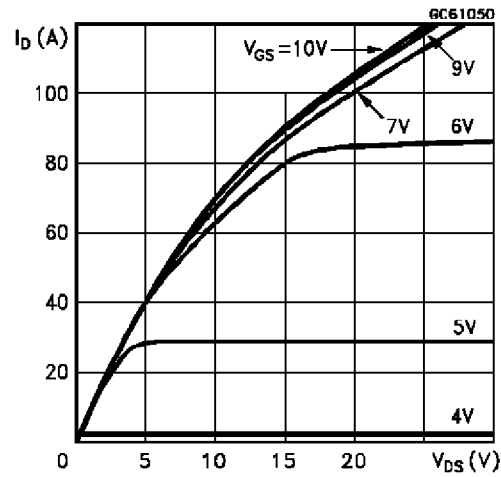
### Thermal Impedance



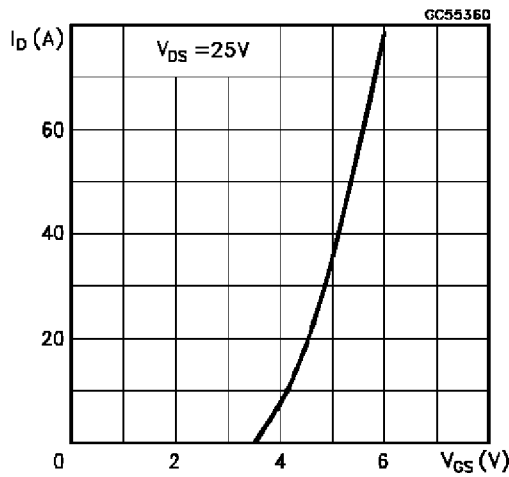
Derating Curve



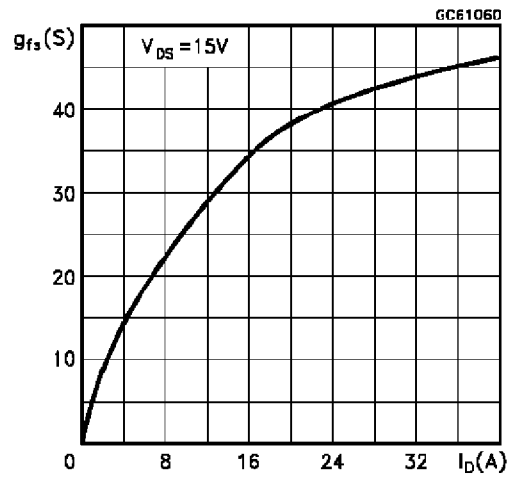
Output Characteristics



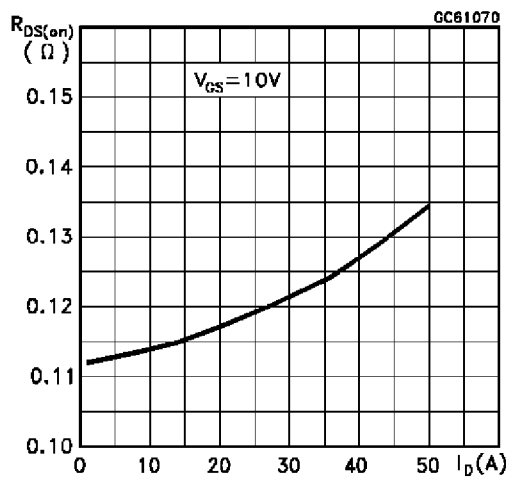
Transfer Characteristics



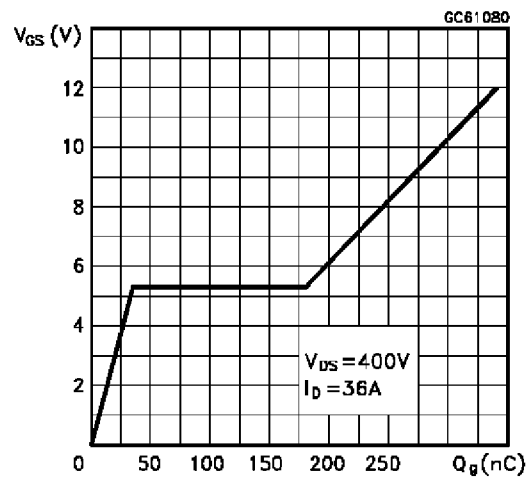
Transconductance



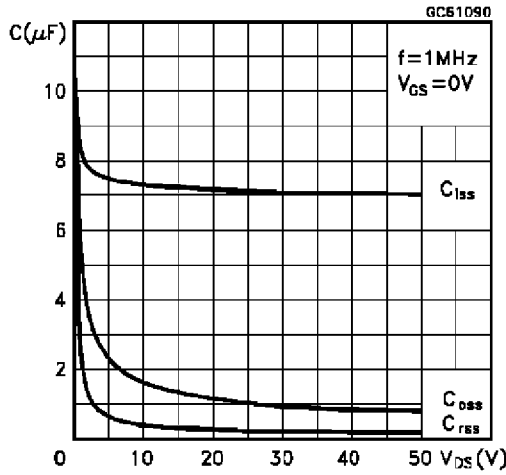
Static Drain-source On Resistance



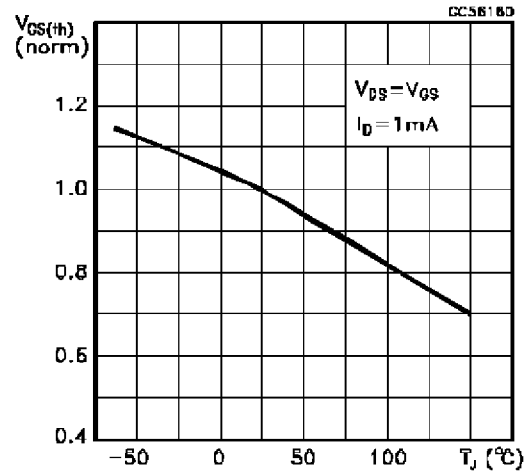
Gate Charge vs Gate-source Voltage



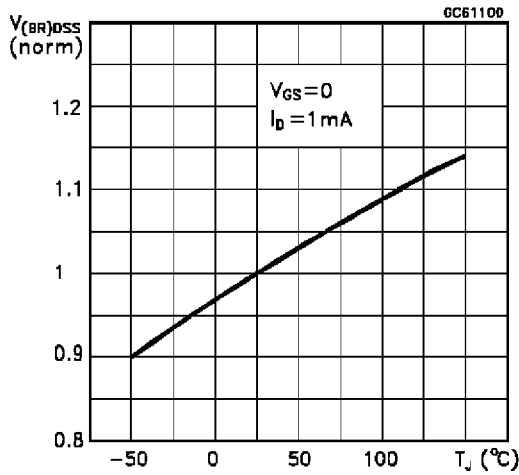
Capacitance Variations



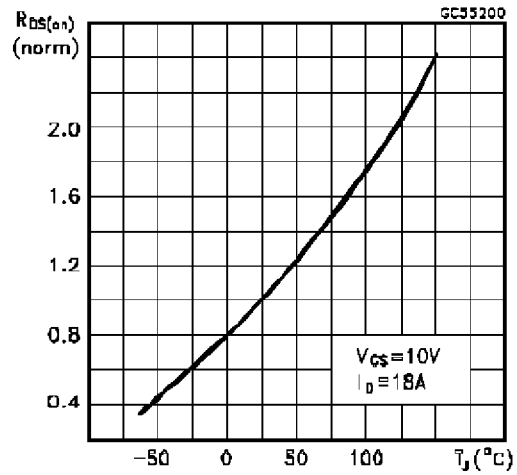
Normalized Gate Threshold Voltage vs Temperature



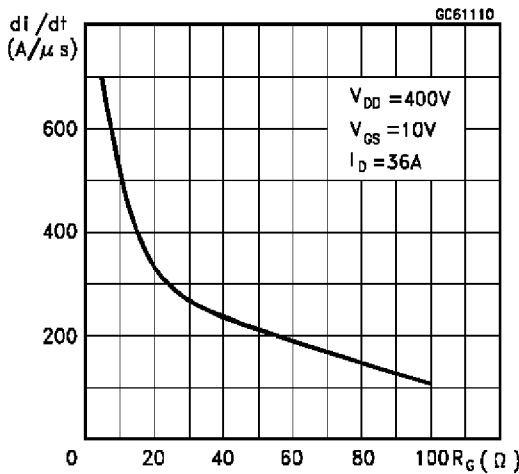
Normalized Breakdown Voltage vs Temperature



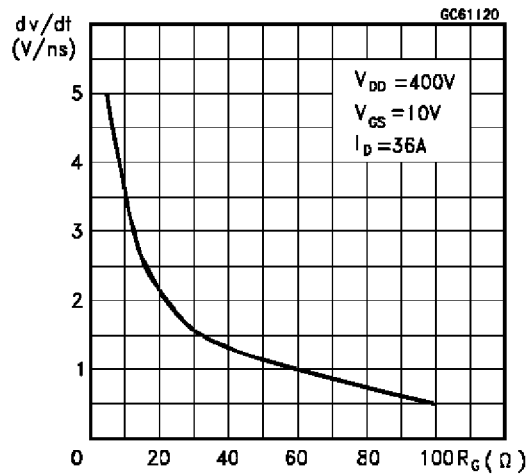
Normalized On Resistance vs Temperature



Turn-on Current Slope



Turn-off Drain-source Voltage Slope



Cross-over Time

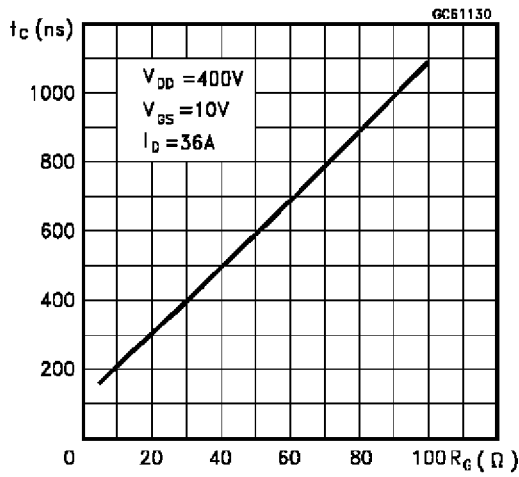
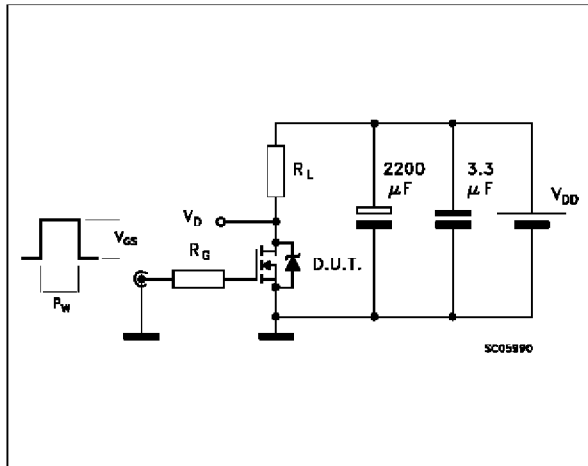


Fig. 1: Switching Times Test Circuits For Resistive Load



Source-drain Diode Forward Characteristics

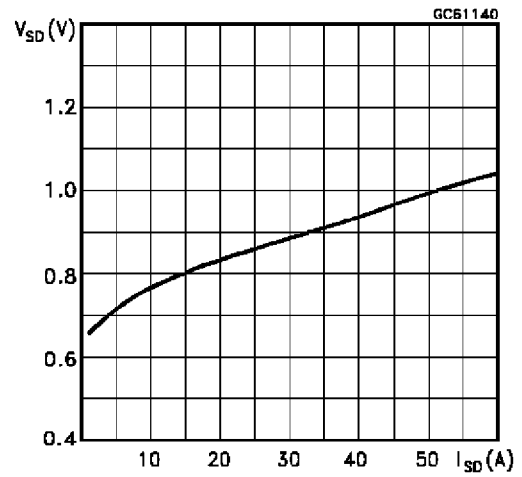


Fig. 2: Gate Charge Test Circuit

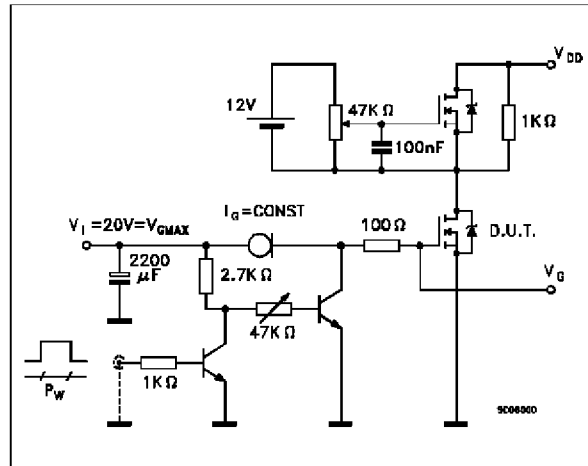
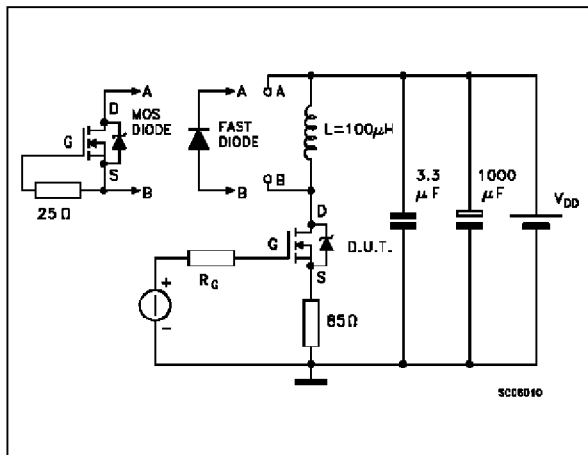
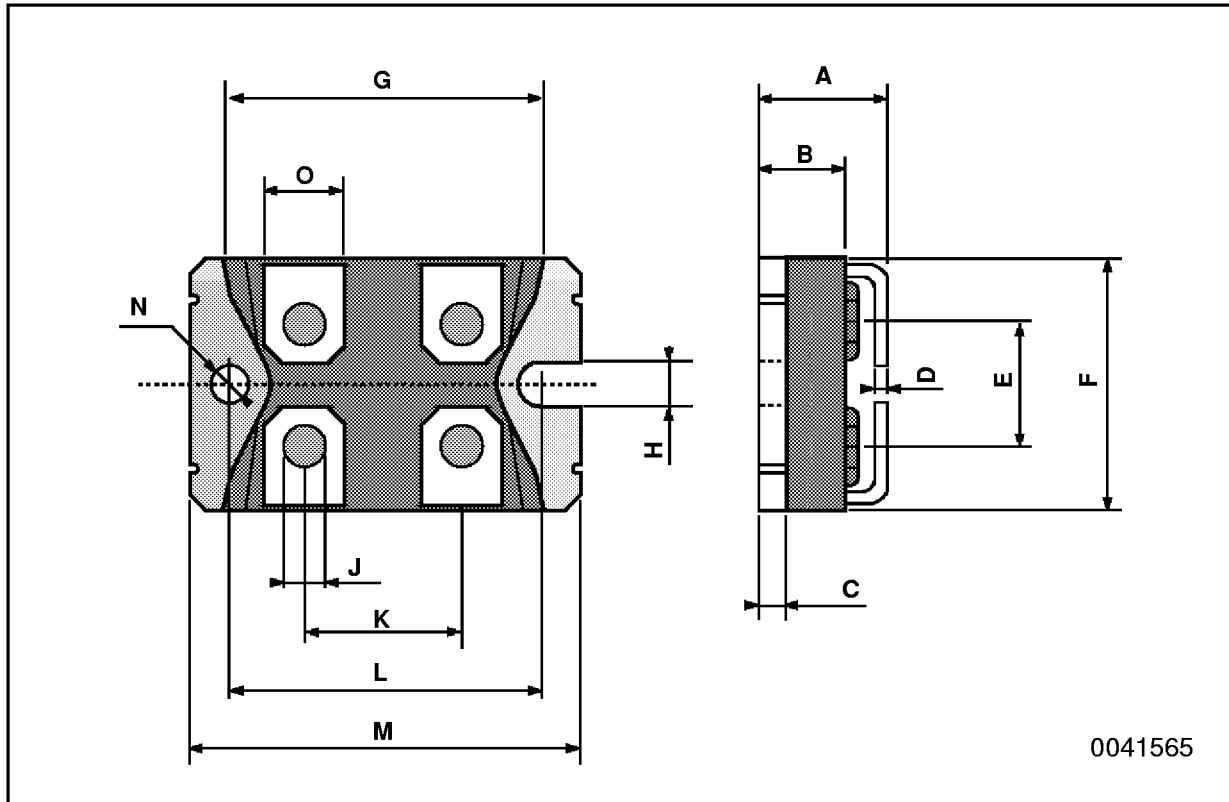


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times



**ISOTOP MECHANICAL DATA**

DIM.	mm			Inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322
P	5.5			0.216		





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