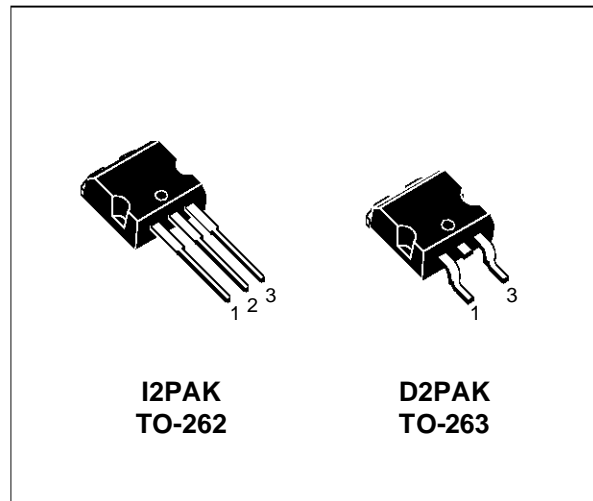


## N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

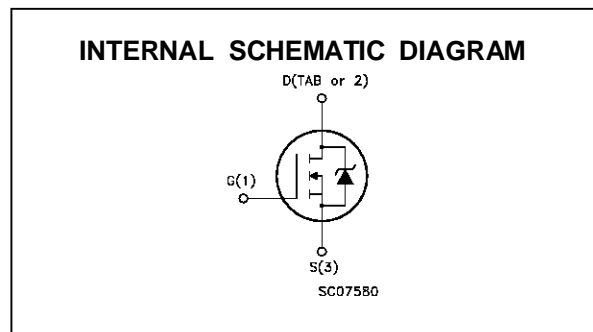
TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB7NA40	400 V	< 1 Ω	6.5 A

- TYPICAL R<sub>DS(on)</sub> = 0.82 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD
- THROUGH-HOLE I2PAK (TO-262) POWER PACKAGE IN TUBE (SUFFIX "-1")
- SURFACE-MOUNTING D2PACK (TO-263) POWER PACKAGE IN TUBE (NO SUFFIX) OR IN TAPE & REEL (SUFFIX "T4")



### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	400	V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	400	V
V <sub>GS</sub>	Gate-source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	6.5	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	4.1	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	26	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	100	W
	Derating Factor	0.8	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

## STB7NA40

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.25	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.5	°C/W
T <sub>J</sub>	Maximum Lead Temperature For Soldering Purpose		300	°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>J</sub> max, δ < 1%)	6.5	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>J</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	210	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy (pulse width limited by T <sub>J</sub> max, δ < 1%)	8.4	mJ
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (T <sub>c</sub> = 100 °C, pulse width limited by T <sub>J</sub> max, δ < 1%)	4.1	A

### ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA V <sub>GS</sub> = 0	400			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating x 0.8 T <sub>c</sub> = 125 °C			250 1000	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 100	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 μA	2.25	3	3.75	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 3.5 A V <sub>GS</sub> = 10V I <sub>D</sub> = 3.5 A T <sub>c</sub> = 100°C		0.82	1 2	Ω Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	6.5			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> I <sub>D</sub> = 3.5 A	3.1	4.6		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		700	900	pF
C <sub>oss</sub>	Output Capacitance			120	160	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			31	43	pF

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 200\text{ V}$ $I_D = 3.5\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		25	35	ns
$t_r$	Rise Time			75	100	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 320\text{ V}$ $I_D = 7\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		220		A/ $\mu$ s
$Q_g$	Total Gate Charge	$V_{DD} = 320\text{ V}$ $I_D = 7\text{ A}$ $V_{GS} = 10\text{ V}$		34	45	nC
$Q_{gs}$	Gate-Source Charge			7		nC
$Q_{gd}$	Gate-Drain Charge			15		nC

**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 320\text{ V}$ $I_D = 7\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		40	55	ns
$t_f$	Fall Time			25	35	ns
$t_c$	Cross-over Time			75	100	ns

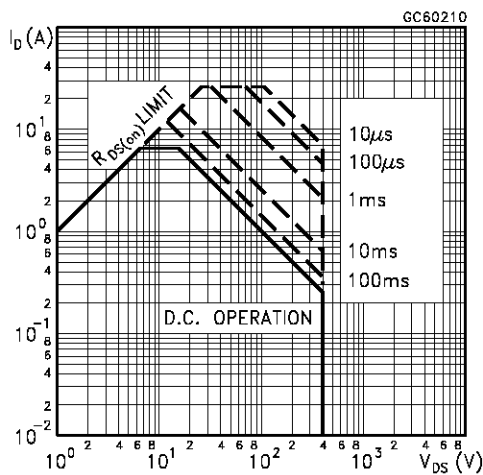
**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				6.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				26	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 6.5\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 7\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		380		ns
$Q_{rr}$	Reverse Recovery Charge			4.8		$\mu$ C
$I_{RRM}$	Reverse Recovery Current			25		A

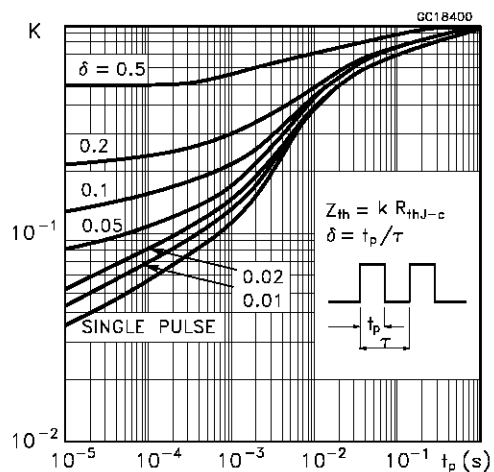
(\*) Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5 %

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

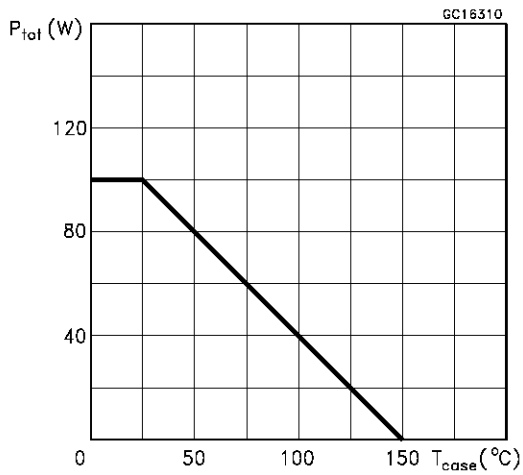
**Safe Operating Area**



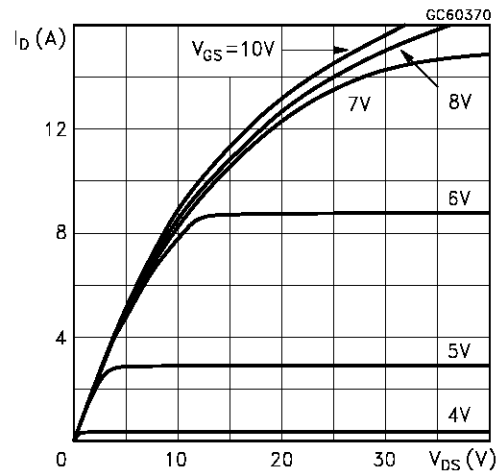
**Thermal Impedance**



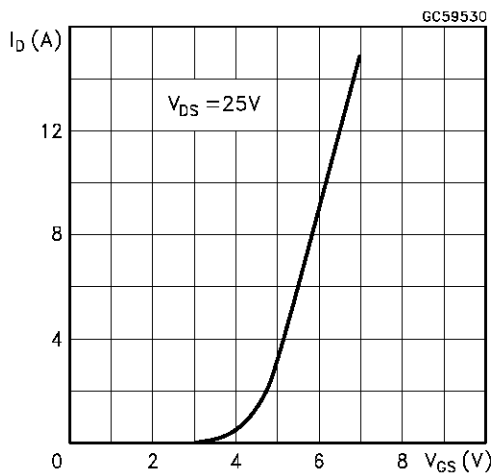
Derating Curve



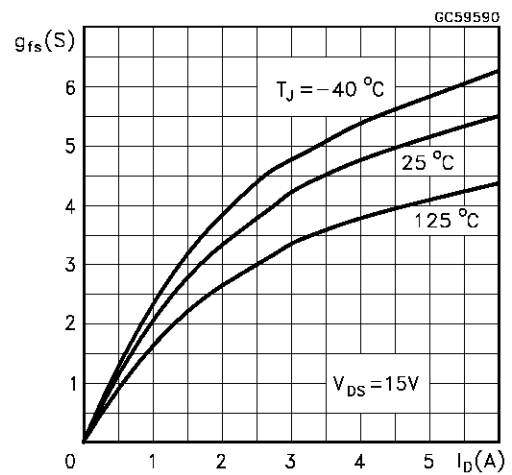
Output Characteristics



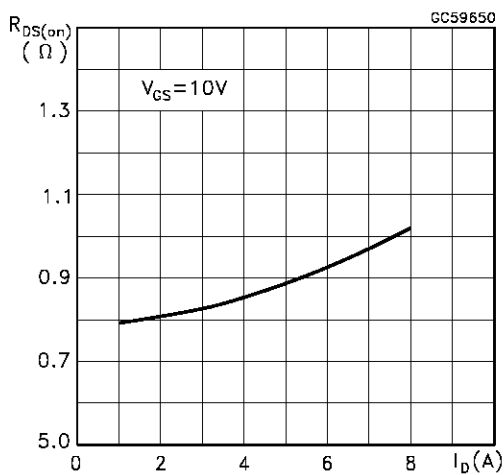
Transfer Characteristics



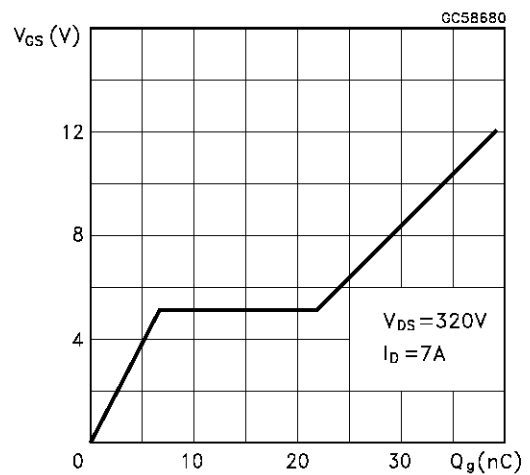
Transconductance



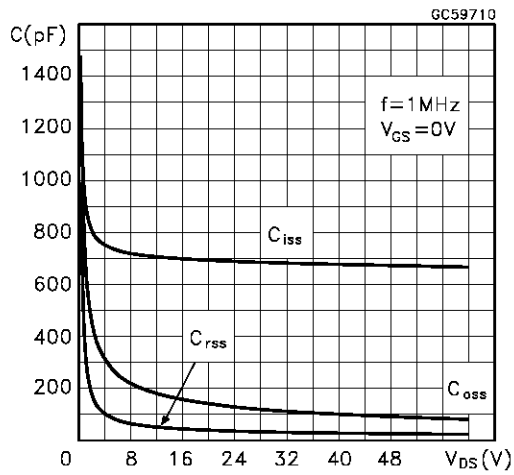
Static Drain-source On Resistance



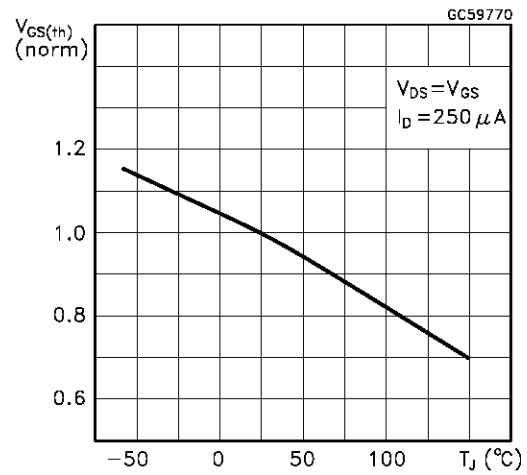
Gate Charge vs Gate-source Voltage



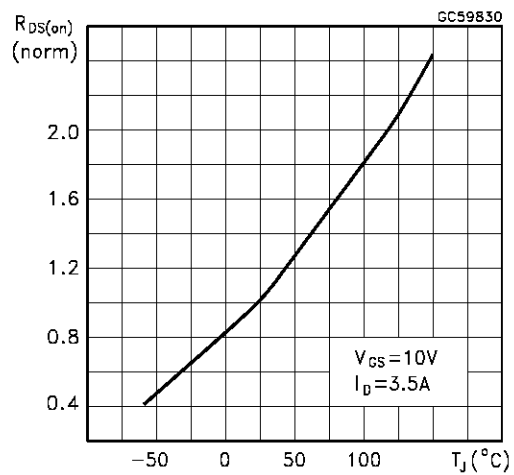
Capacitance Variations



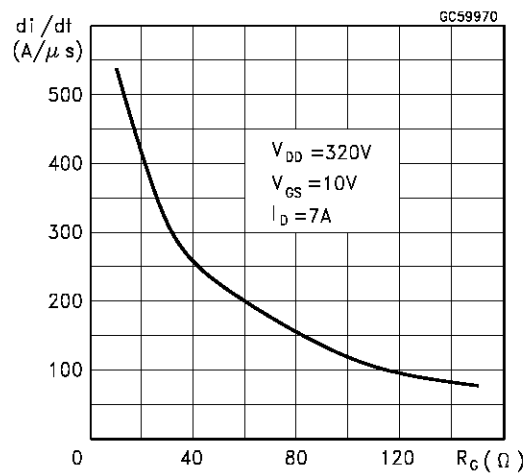
Normalized Gate Threshold Voltage vs Temperature



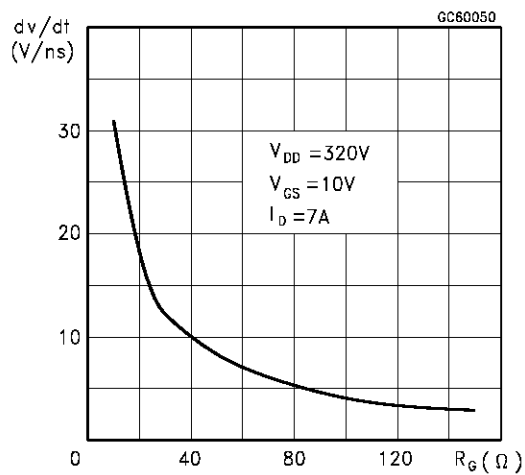
Normalized On Resistance vs Temperature



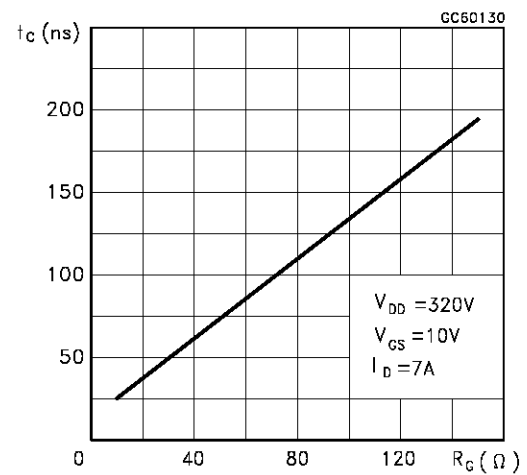
Turn-on Current Slope



Turn-off Drain-source Voltage Slope

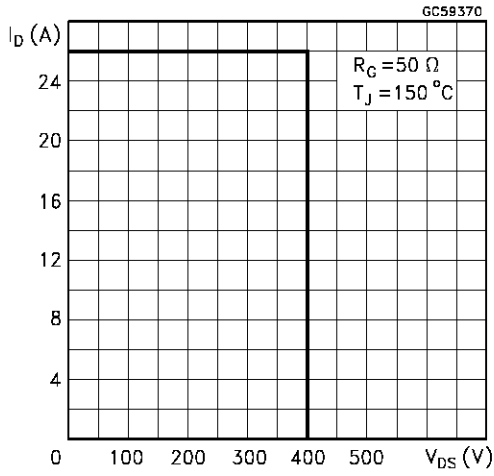


Cross-over Time

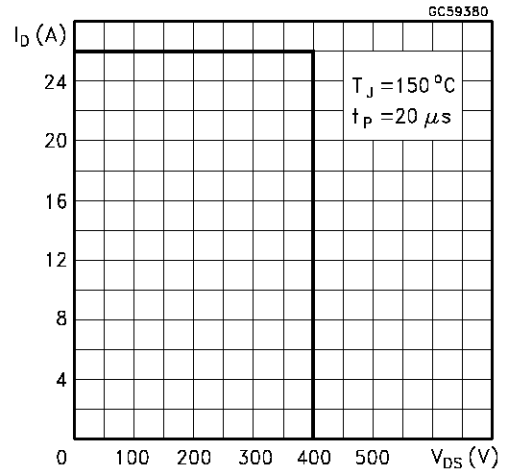


# STB7NA40

## Switching Safe Operating Area



## Accidental Overload Area



## Source-drain Diode Forward Characteristics

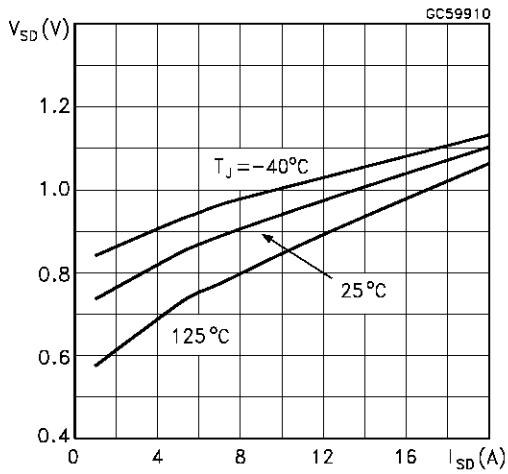
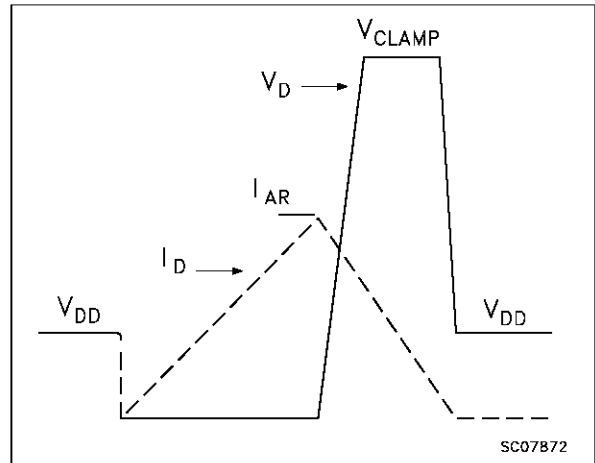
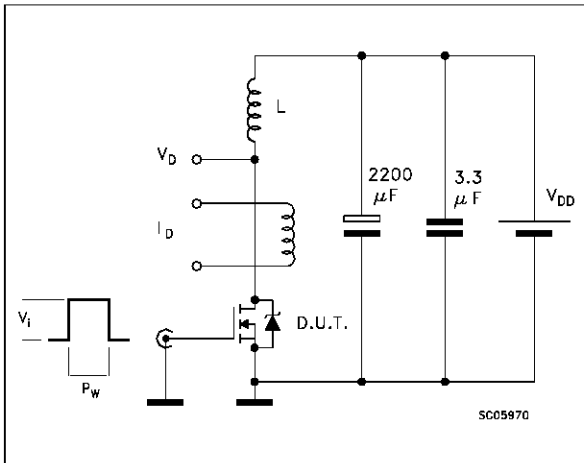
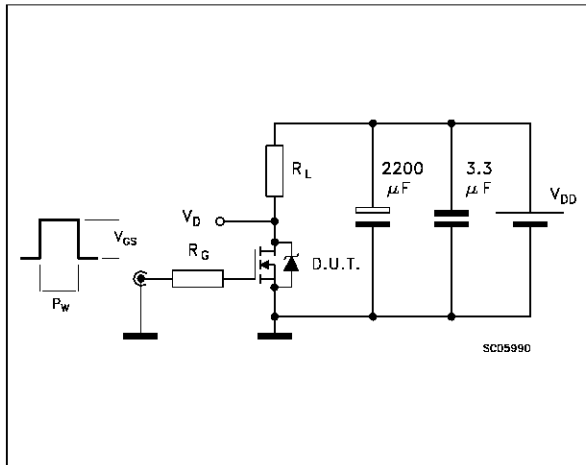


Fig. 1: Unclamped Inductive Load Test Circuit

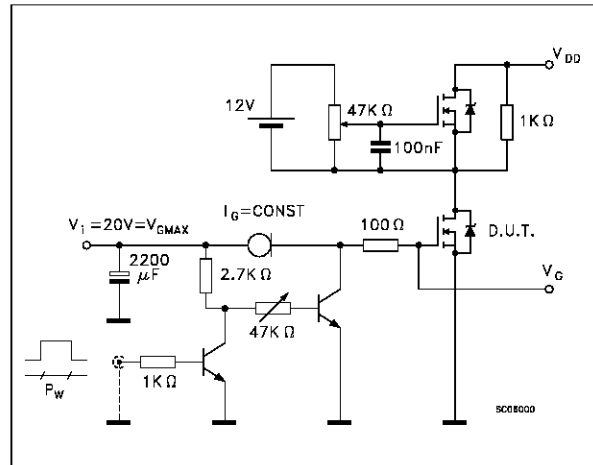
Fig. 2: Unclamped Inductive Waveform



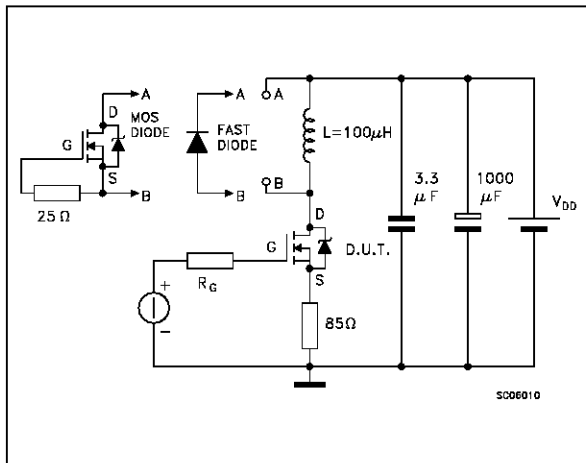
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

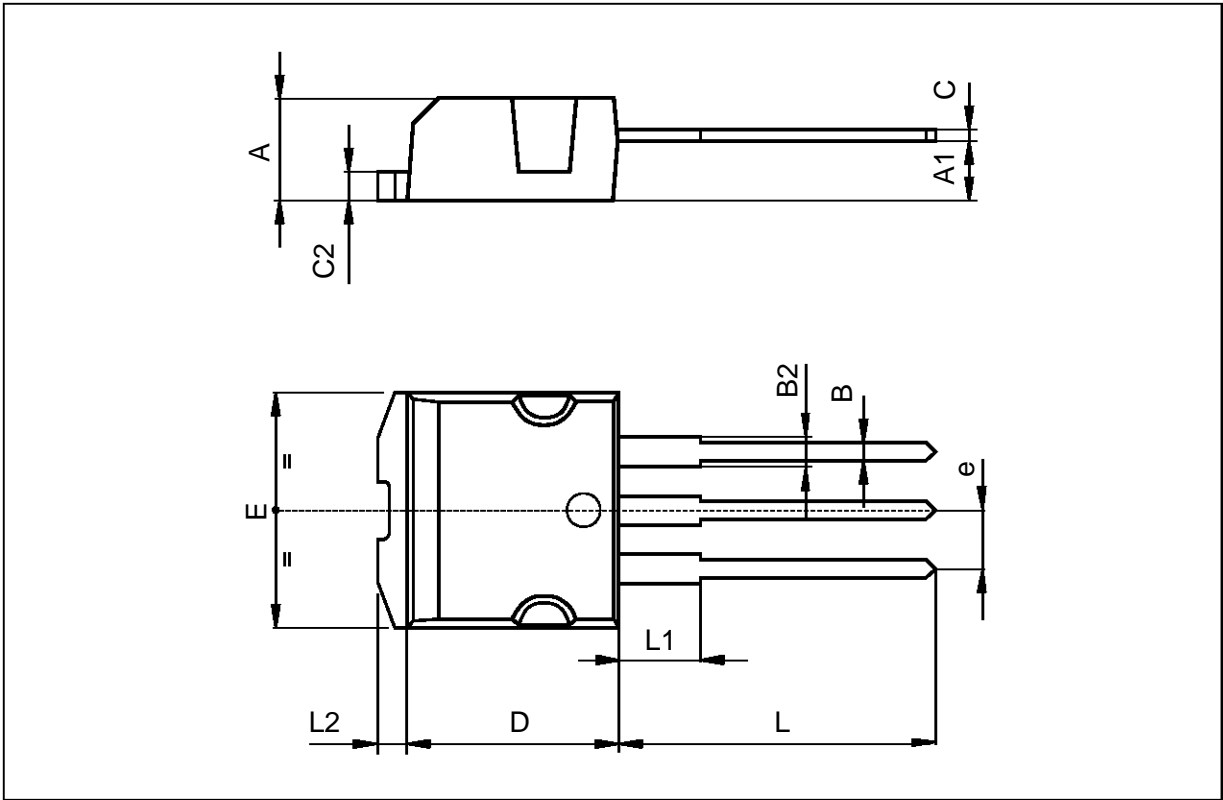


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



**TO-262 (I2PAK) MECHANICAL DATA**

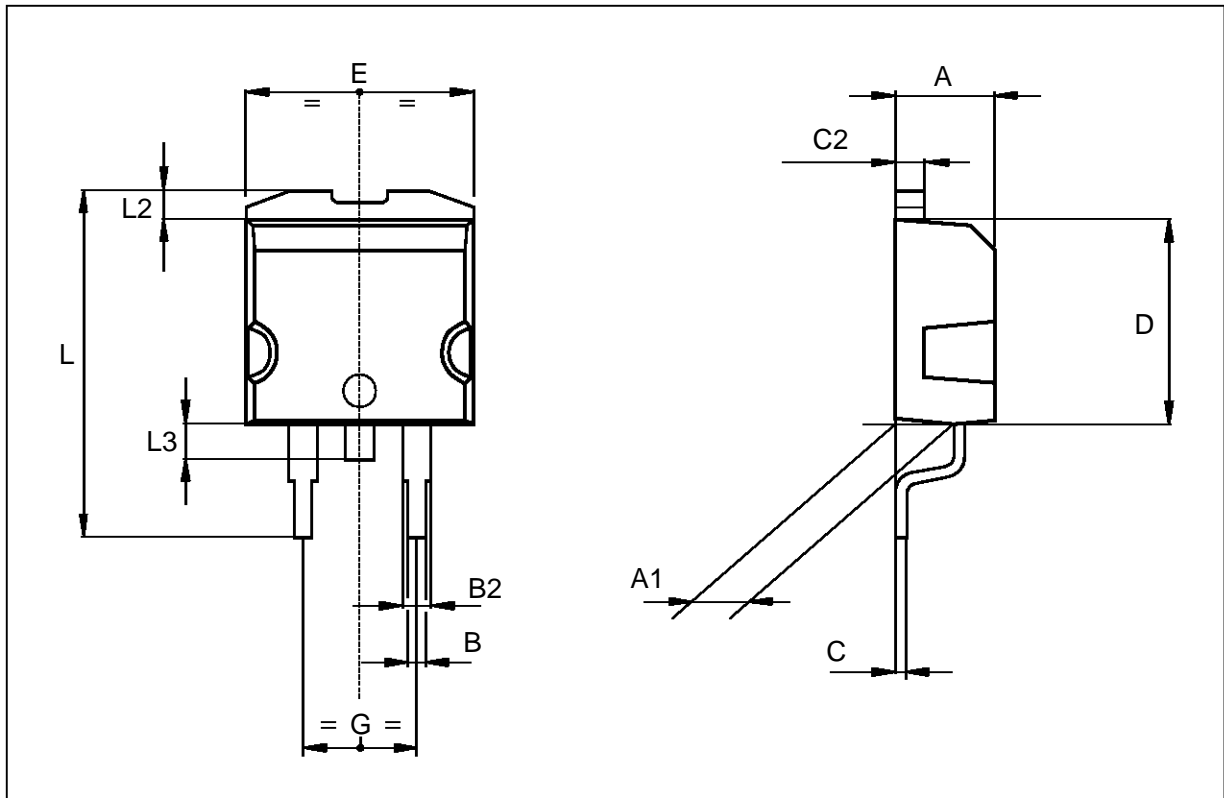
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B1	1.2		1.38	0.047		0.054
B2	1.25		1.4	0.049		0.055
C	0.45		0.6	0.017		0.023
C2	1.21		1.36	0.047		0.053
D	9		9.35	0.354		0.368
e	2.44		2.64	0.096		0.104
E	10		10.28	0.393		0.404
L	13.2		13.5	0.519		0.531
L1	3.48		3.78	0.137		0.149
L2	1.27		1.37	0.050		0.054





## TO-263 (D2PAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.25		1.4	0.049		0.055
C	0.45		0.6	0.017		0.023
C2	1.21		1.36	0.047		0.053
D	9		9.35	0.354		0.368
E	10		10.28	0.393		0.404
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.624
L2	1.27		1.37	0.050		0.054
L3	1.4		1.75	0.055		0.068



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