

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STD12N05	50 V	< 0.15 Ω	12 A
STD12N06	60 V	< 0.15 Ω	12 A

- TYPICAL R_{DS(on)} = 0.1 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION
- THROUGH-HOLE IPAK (TO-251) POWER PACKAGE IN TUBE (SUFFIX "-1")
- SURFACE-MOUNTING DPAK (TO-252) POWER PACKAGE IN TAPE & REEL (SUFFIX "T4")

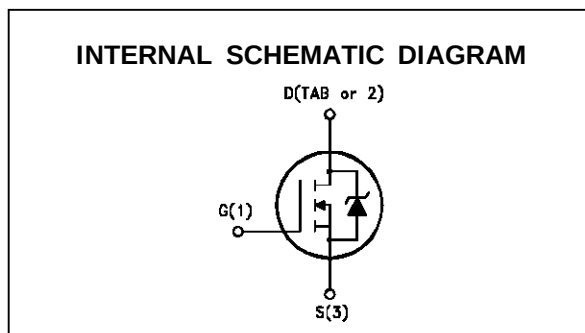
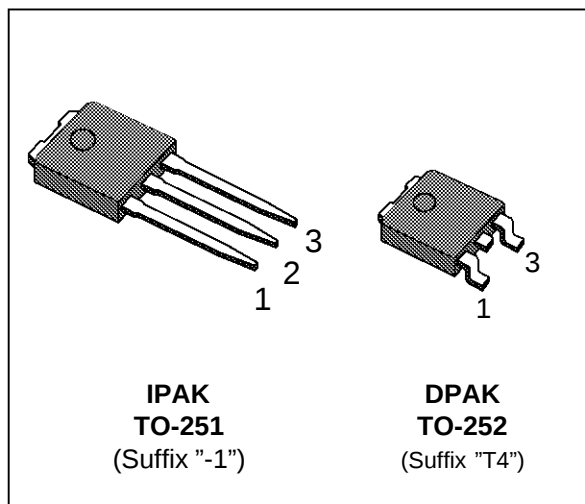
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STD12N05	STD12N06	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	50	60	V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 k Ω)	50	60	V
V _{GS}	Gate-source Voltage	± 20		V
I _D	Drain Current (continuous) at T _c = 25 °C	12		A
I _D	Drain Current (continuous) at T _c = 100 °C	8		A
I _{DM} (•)	Drain Current (pulsed)	48		A
P _{tot}	Total Dissipation at T _c = 25 °C	45		W
	Derating Factor	0.3		W/°C
T _{stg}	Storage Temperature	-65 to 175		°C
T _j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area



THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	3.33	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	100	$^{\circ}C/W$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	1.5	$^{\circ}C/W$
T_l	Maximum Lead Temperature For Soldering Purpose		275	$^{\circ}C$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	12	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 25 V$)	30	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	7	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100^{\circ}C$, pulse width limited by T_j max, $\delta < 1\%$)	8	A

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	$I_D = 250 \mu A$ $V_{GS} = 0$ for STD12N05 for STD12N06	50 60			V V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$			1 10	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 6 A$		0.1	0.15	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	12			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 6 A$	3	5		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		330 150 40	450 250 60	pF pF pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	$V_{DD} = 25\text{ V}$ $I_D = 6\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		40 80	60 120	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_G = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		210		A/ μ s
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$		15 6 5	25	nC nC nC

SWITCHING OFF

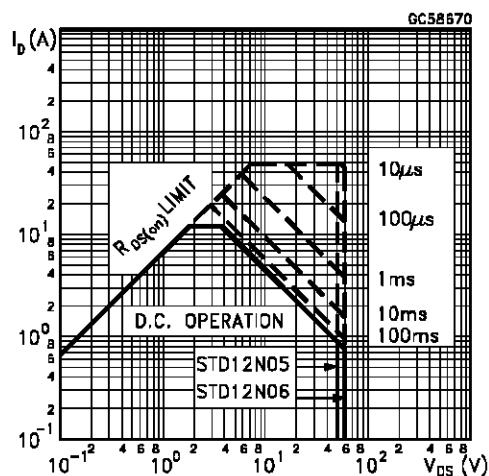
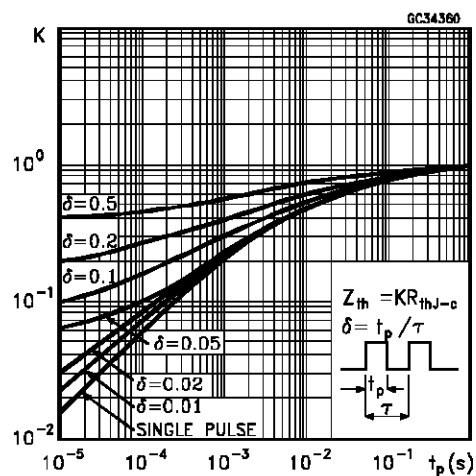
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 40\text{ V}$ $I_D = 12\text{ A}$ $R_{GS} = 50\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit figure)		30 40 80	45 60 120	ns ns ns

SOURCE DRAIN DIODE

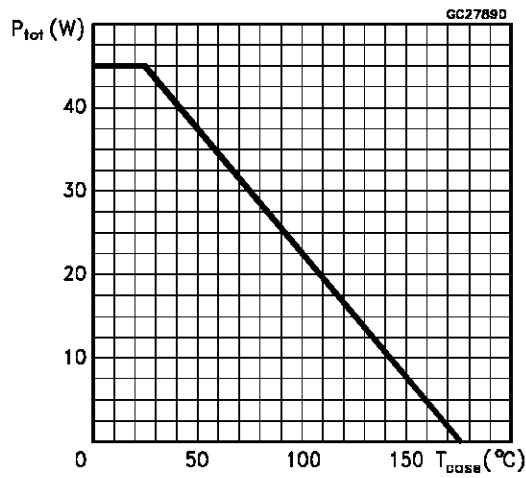
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				12 48	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 12\text{ A}$ $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 12\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$		60 0.12 4		ns μC A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

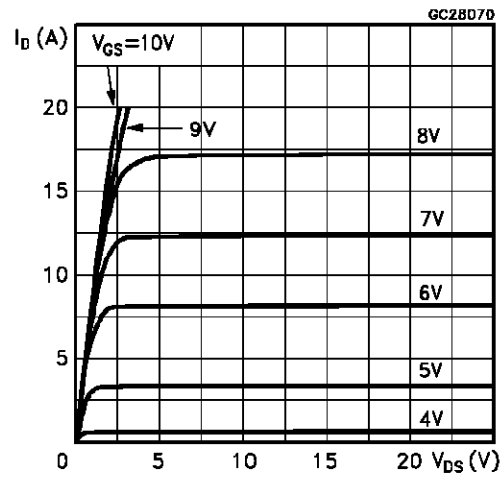
(\bullet) Pulse width limited by safe operating area

Safe Operating Area**Thermal Impedance**

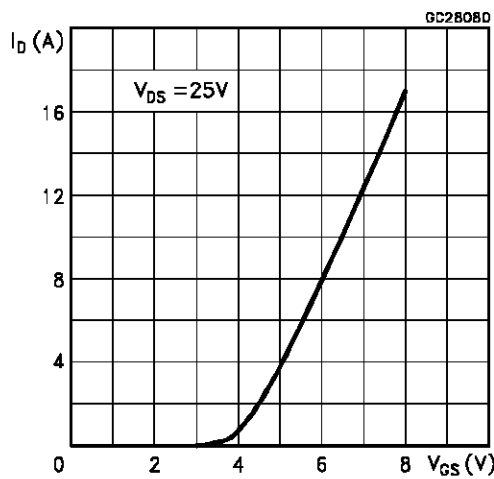
Derating Curve



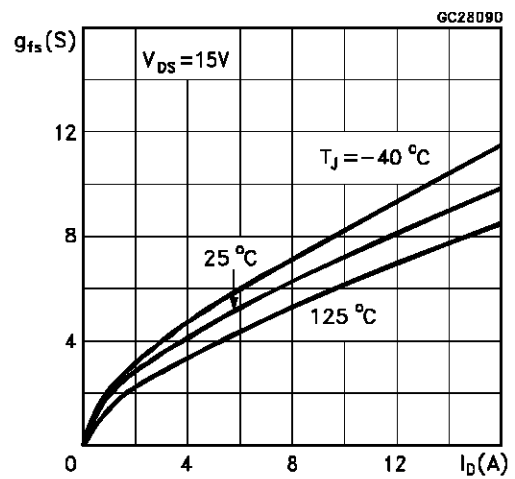
Output Characteristics



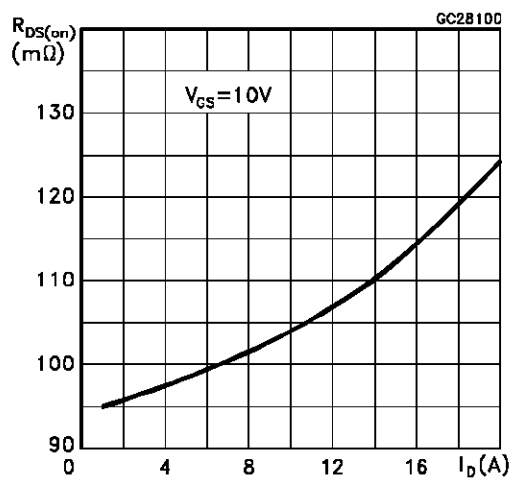
Transfer Characteristics



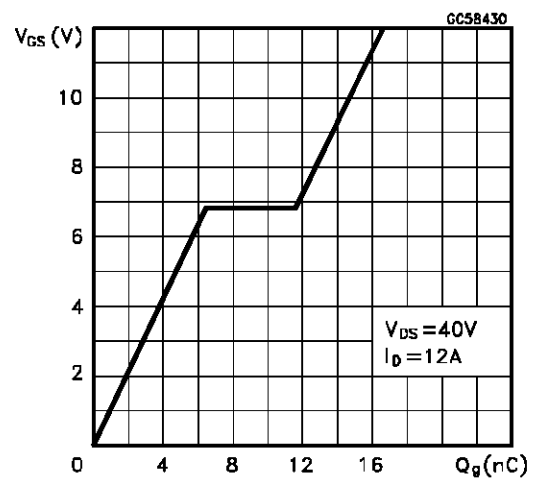
Transconductance



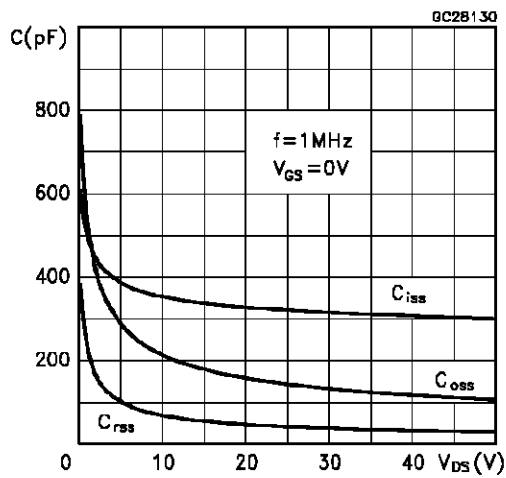
Static Drain-source On Resistance



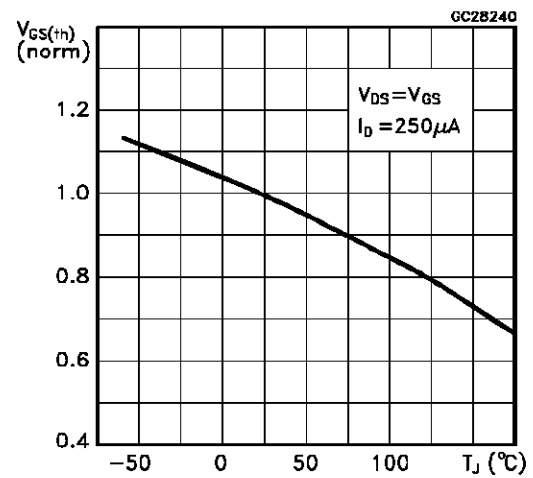
Gate Charge vs Gate-source Voltage



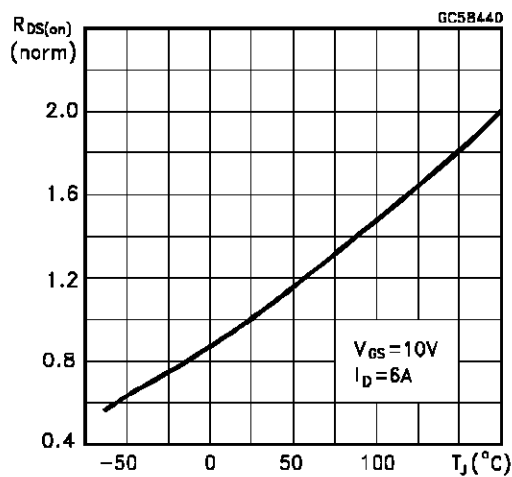
Capacitance Variations



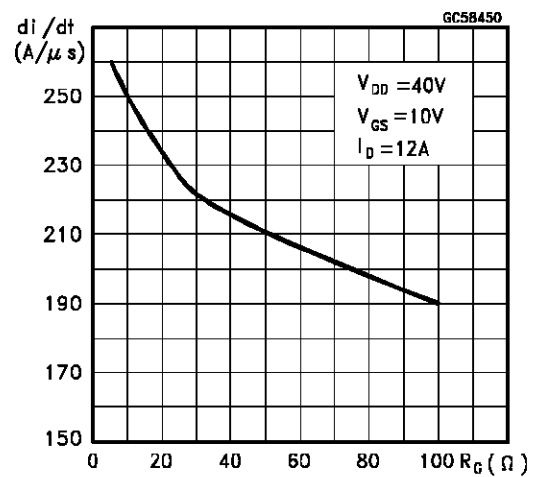
Normalized Gate Threshold Voltage vs Temperature



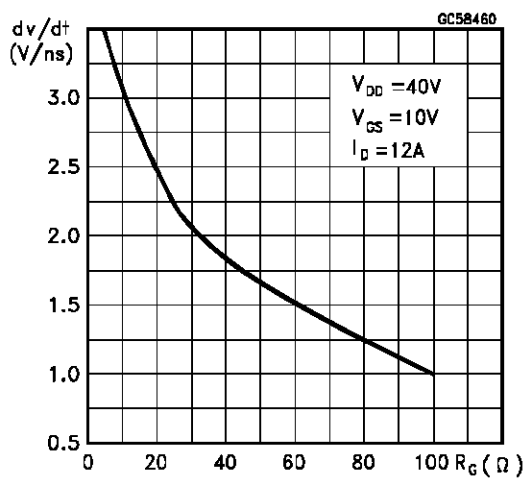
Normalized On Resistance vs Temperature



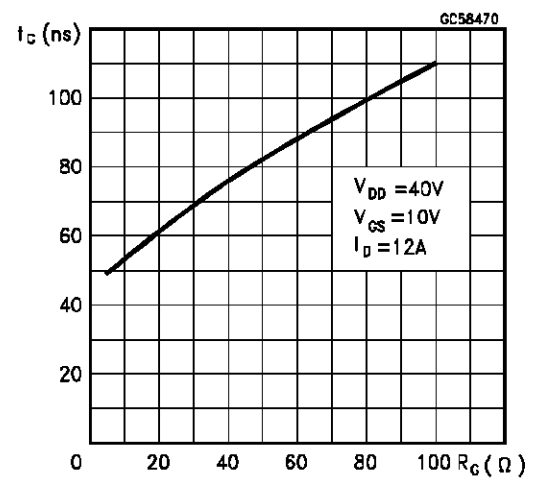
Turn-on Current Slope



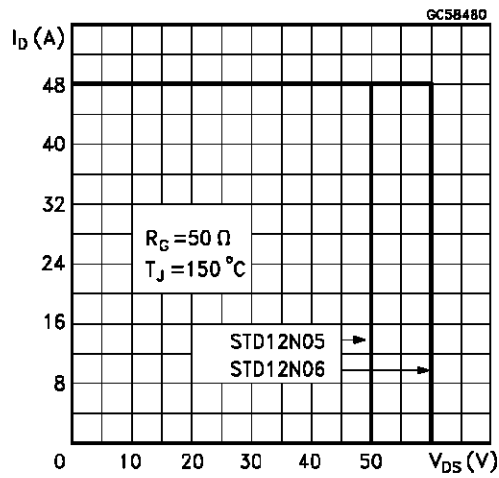
Turn-off Drain-source Voltage Slope



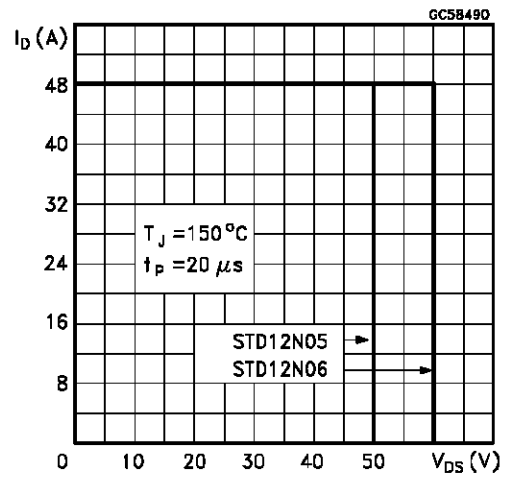
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

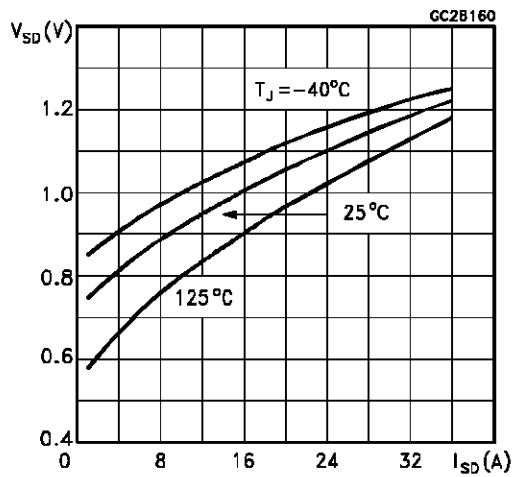


Fig. 1: Unclamped Inductive Load Test Circuits

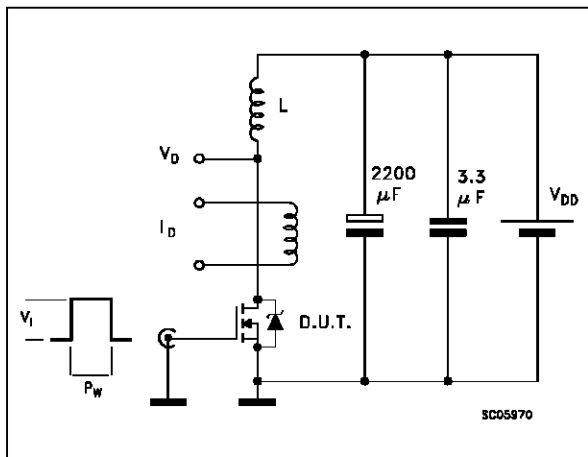


Fig. 2: Unclamped Inductive Waveforms

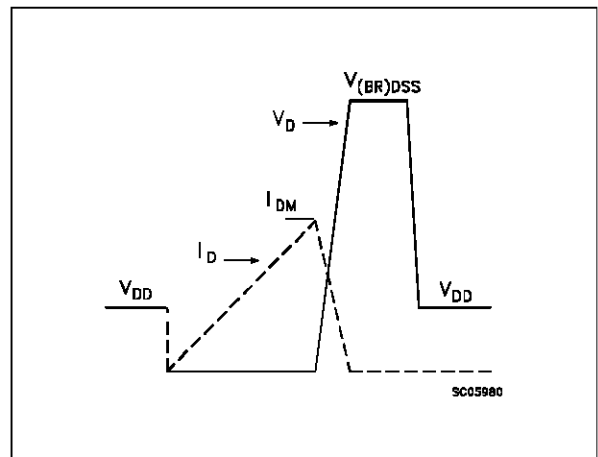


Fig. 3: Switching Times Test Circuits For Resistive Load

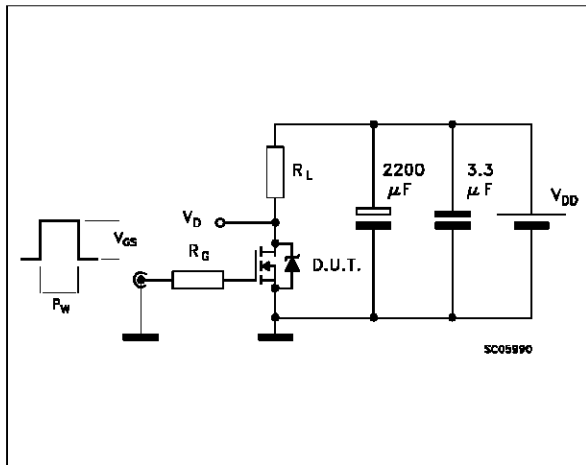


Fig. 4: Gate Charge Test Circuit

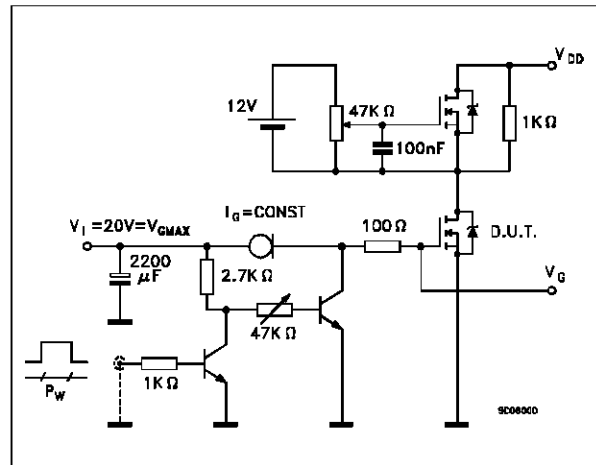
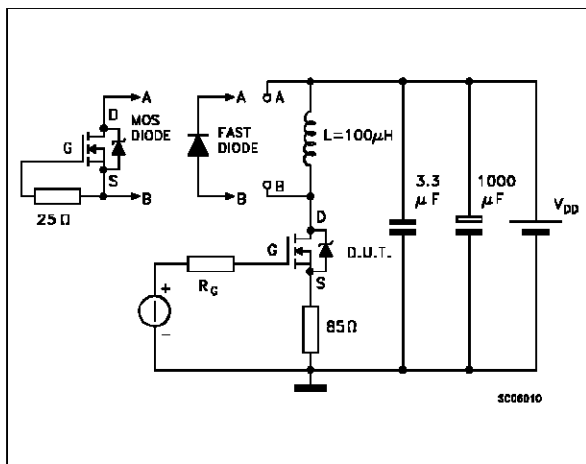
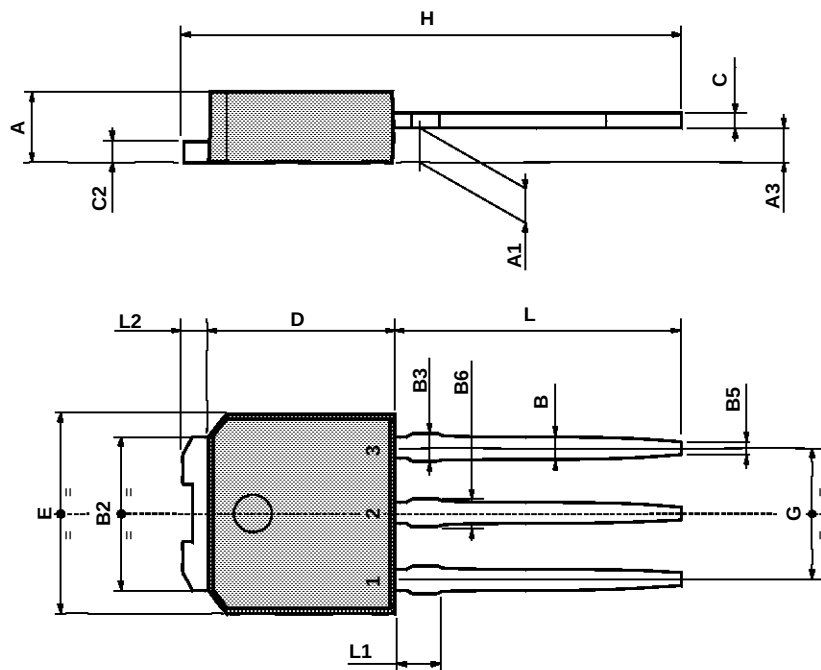


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-251 (IPAK) MECHANICAL DATA

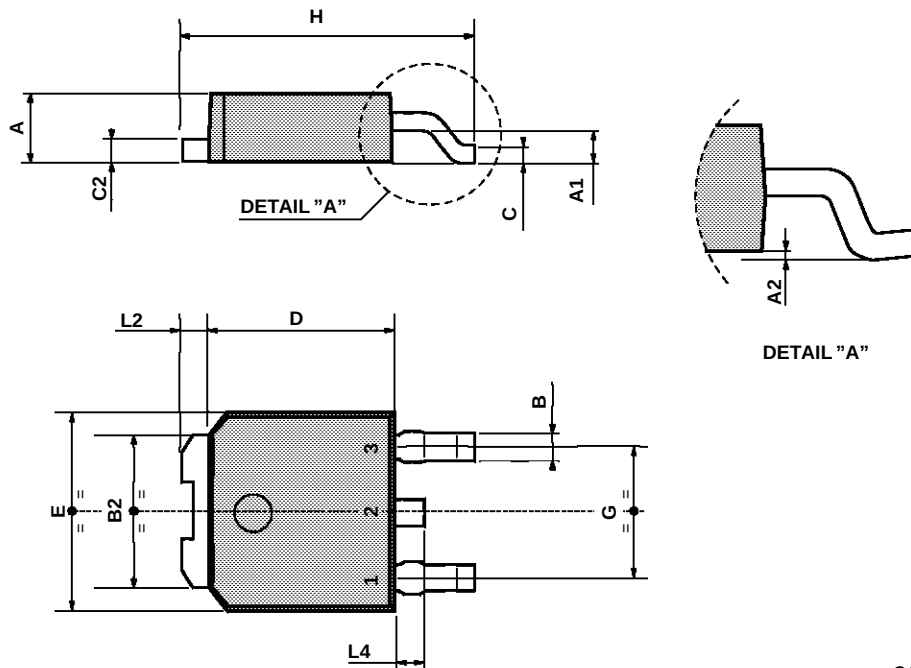
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



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TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
B2	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L2		0.8			0.031	
L4	0.6		1	0.023		0.039



0068772-B

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