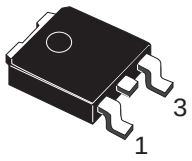
STD45NF75

N-CHANNEL 75V - 0.018 Ω -40A DPAK
STripFET™ II POWER MOSFET

AUTOMOTIVE SPECIFIC

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STD45NF75	75 V	<0.024 Ω	40 A(**)

- TYPICAL R_{DS}(on) = 0.018 Ω
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- SURFACE-MOUNTING DPAK (TO-252) POWER PACKAGE IN TAPE & REEL (SUFFIX “T4")



DPAK
TO-252
(Suffix “T4”)

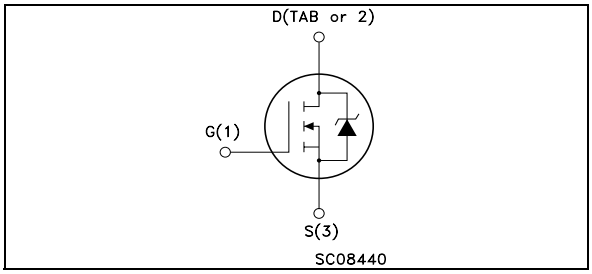
DESCRIPTION

This Power MOSFET is the latest development of STMicroelectronis unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

APPLICATIONS

- HIGH CURRENT, SWITCHING APPLICATIONS

INTERNAL SCHEMATIC DIAGRAM



Ordering Information

SALES TYPE	MARKING	PACKAGE	PACKAGING
STD45NF75T4	D45NF75	DPAK	TAPE & REEL

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	75	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	75	V
V_{GS}	Gate- source Voltage	± 20	V
I_D(**)	Drain Current (continuous) at T_C = 25°C	40	A
I_D	Drain Current (continuous) at T_C = 100°C	30	A
I_{DM}(•)	Drain Current (pulsed)	160	A
P_{tot}	Total Dissipation at T_C = 25°C	100	W
	Derating Factor	0.67	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	20	V/ns
E_{AS} (2)	Single Pulse Avalanche Energy	500	mJ
T_{stg}	Storage Temperature	-55 to 175	°C
T_j	Operating Junction Temperature		

(•) Pulse width limited by safe operating area.
(**) Current Limited by Package

(1) I_{SD} ≤40A, di/dt ≤800A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_j ≤ T_{JMAX}
(2) Starting T_j = 25 °C, I_D = 20 A, V_{DD} = 40V

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	1.5	°C/W
Rthj-pcb	Thermal Resistance Junction-pcb	Max	see curve on page 6	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose (for 10 sec. 1.6 mm from case)		275	°C

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 µA V_{GS} = 0	75			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating T_C = 125°C			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 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 µA	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10 V I_D = 20 A		0.018	0.024	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	V_{DS} = 25 V I_D = 20 A		50		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		1760 360 140		pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 37 V I_D = 20 A R_G = 4.7 Ω V_{GS} = 10 V (Resistive Load, Figure 3)		15 40		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD}=60 V I_D=40A V_{GS}= 10V (see test circuit, Figure 4)		60 13 23	80	nC nC nC

SWITCHING OFF

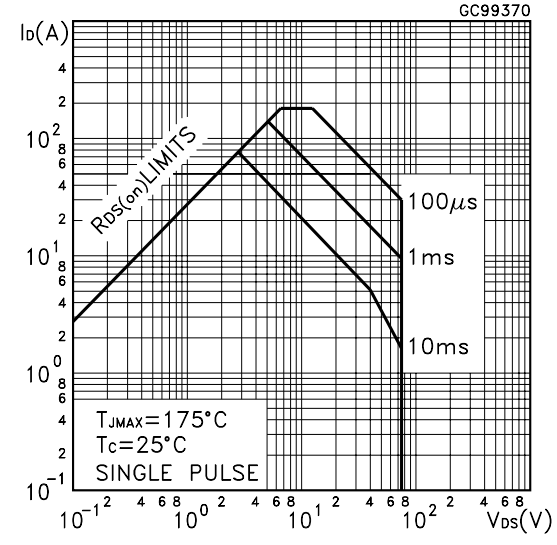
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	V_{DD} = 37 V I_D = 20 A R_G = 4.7Ω, V_{GS} = 10 V (Resistive Load, Figure 3)		55 12		ns ns

SOURCE DRAIN DIODE

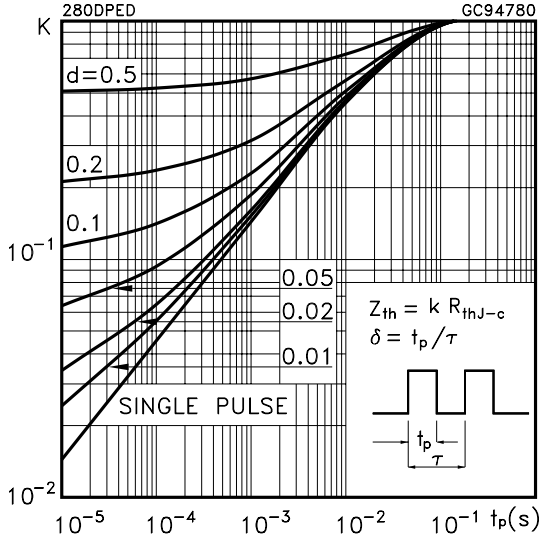
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain Current Source-drain Current (pulsed)				40 160	A A
V_{SD} (*)	Forward On Voltage	I_{SD} = 40 A V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 40 A di/dt = 100A/µs V_{DD} = 30 V T_j = 150°C (see test circuit, Figure 5)		120 410 7.5		ns nC A

(*)Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(•)Pulse width limited by safe operating area.

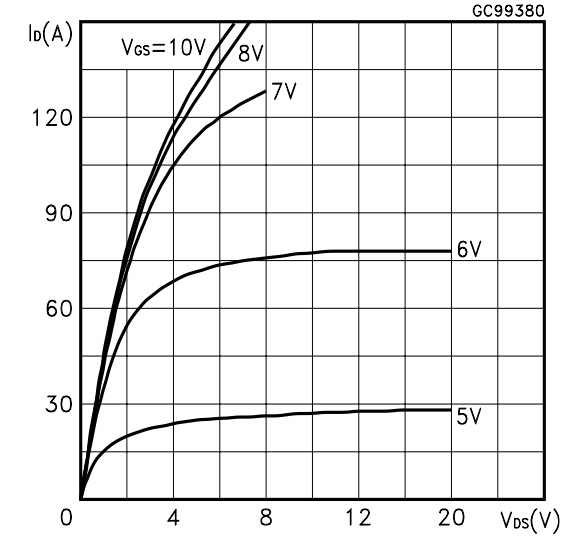
Safe Operating Area



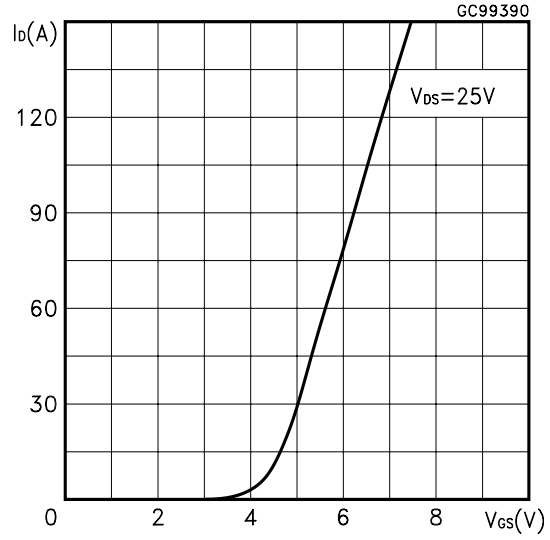
Thermal Impedance



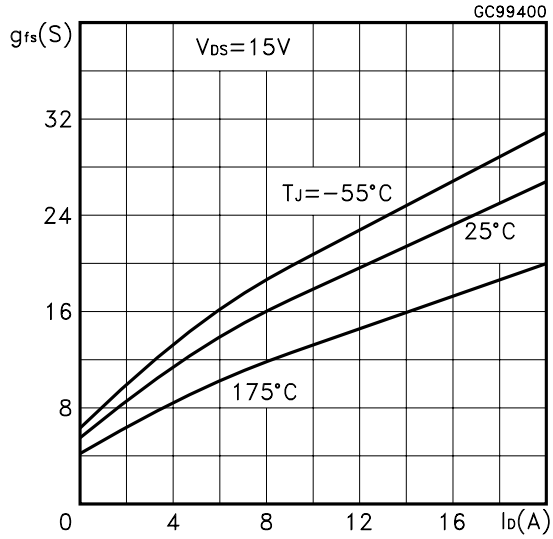
Output Characteristics



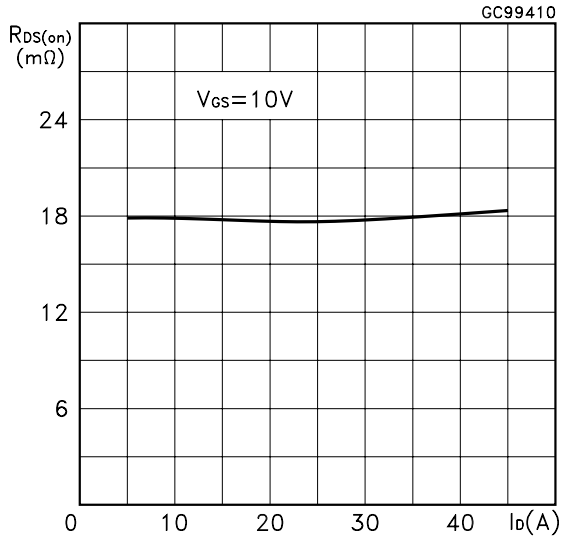
Transfer Characteristics



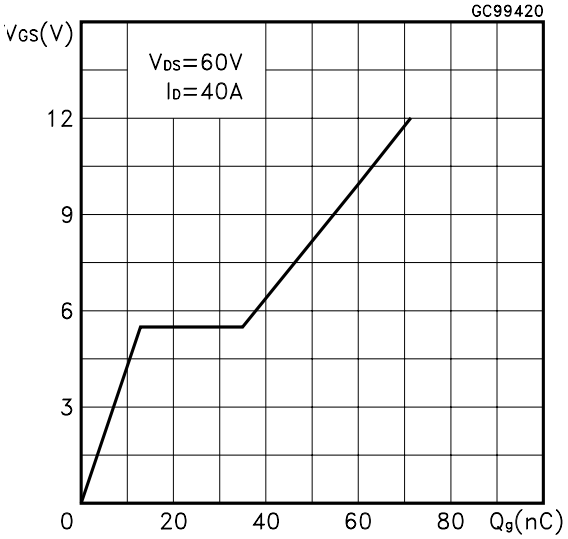
Transconductance



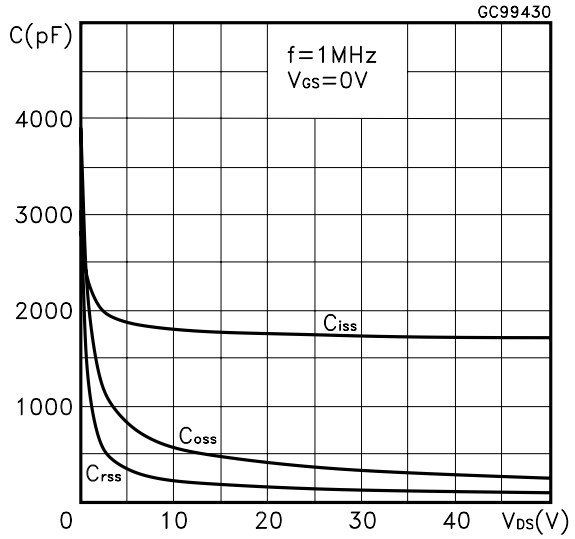
Static Drain-source On Resistance



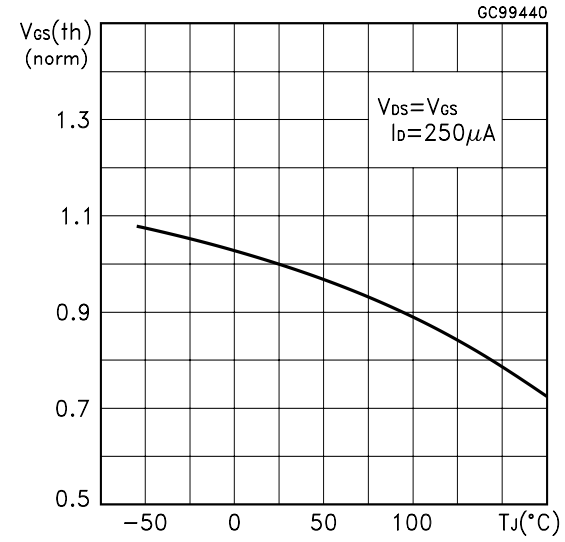
Gate Charge vs Gate-source Voltage



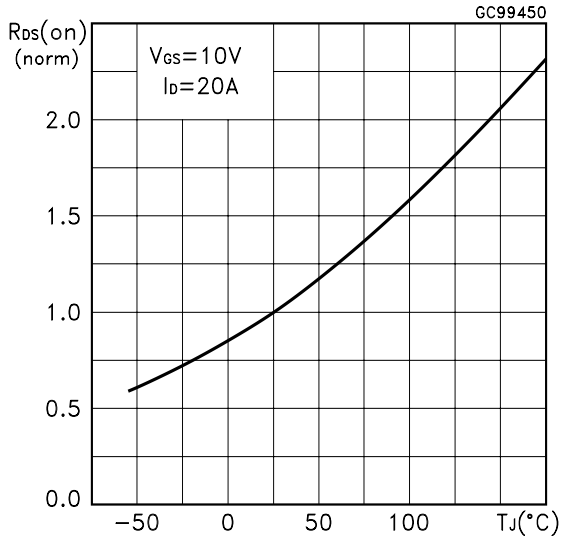
Capacitance Variations



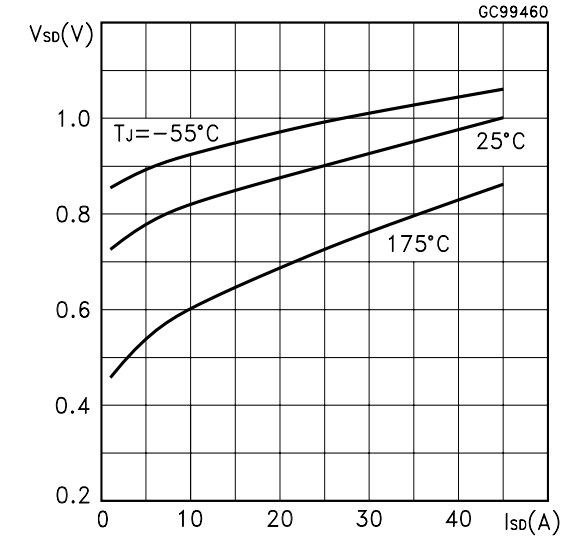
Normalized Gate Threshold Voltage vs Temperature



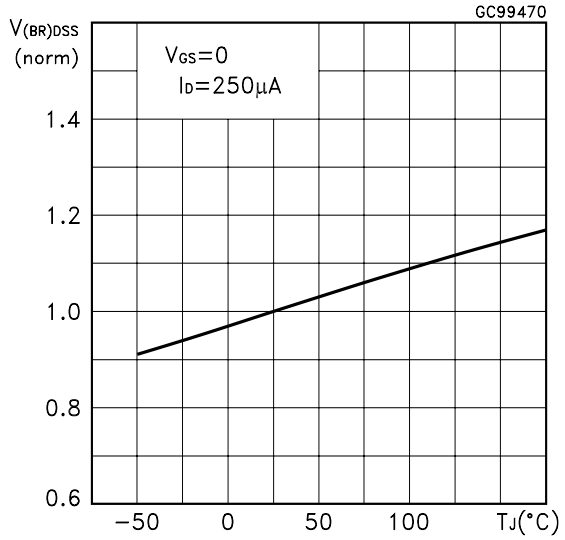
Normalized on Resistance vs Temperature



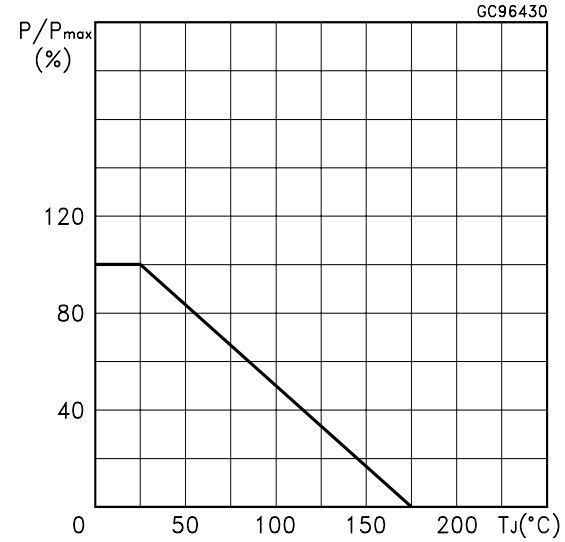
Source-drain Diode Forward Characteristics



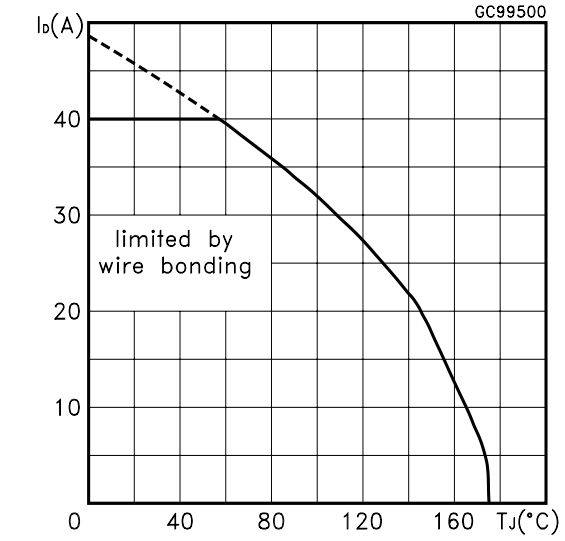
Normalized Breakdown Voltage vs Temperature.



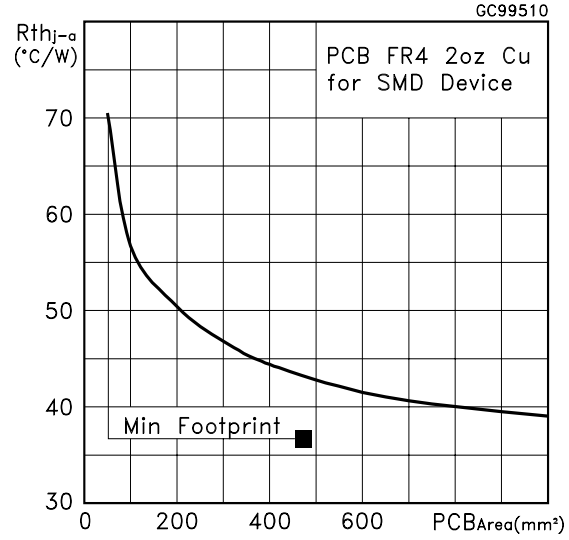
Power Derating vs Tc



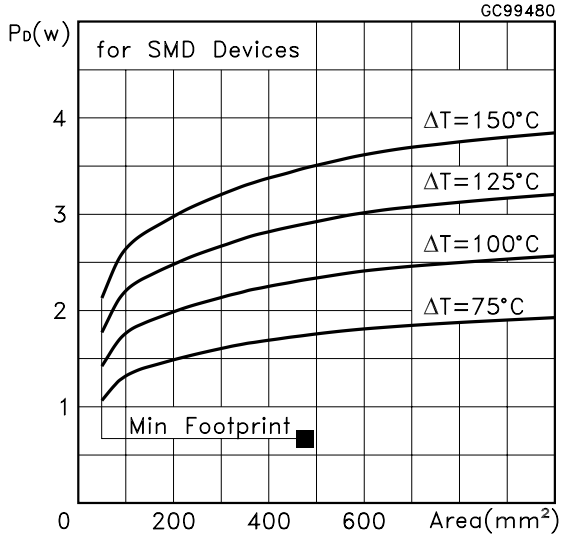
Max Id Current vs Tc.



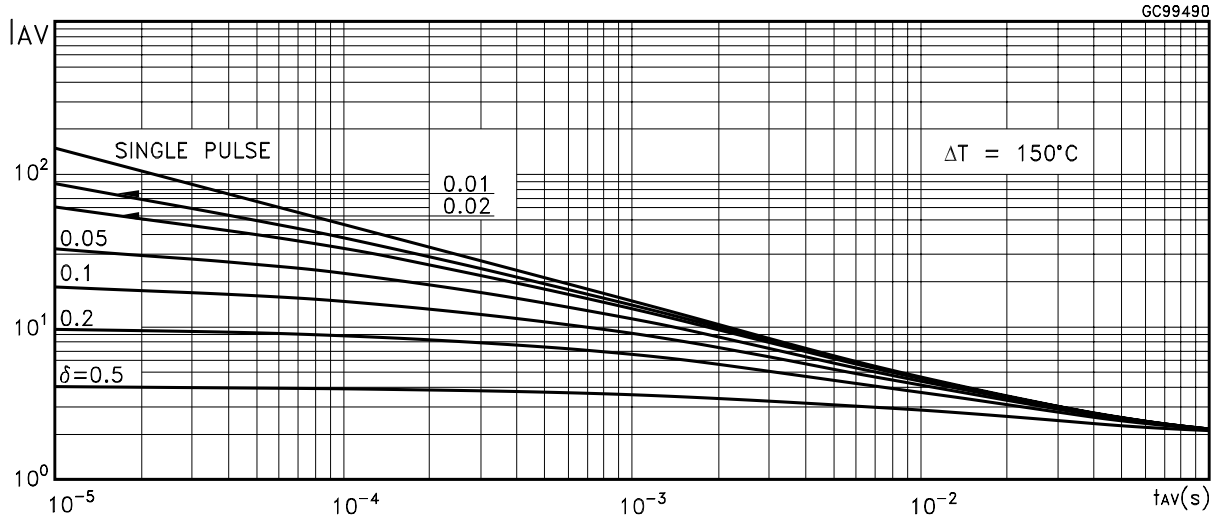
Thermal Resistance Rthj-a vs PCB Copper Area



Max Power Dissipation vs PCB Copper Area



Allowable Iav vs. Time in Avalanche



The previous curve gives the safe operating area for unclamped inductive loads, single pulse or repetitive, under the following conditions:

$P_{D(AVE)} = 0.5 * (1.3 * BV_{DSS} * I_{AV})$
$E_{AS(AR)} = P_{D(AVE)} * t_{AV}$

Where:
I_{AV} is the Allowable Current in Avalanche
$P_{D(AVE)}$ is the Average Power Dissipation in Avalanche (Single Pulse)
t_{AV} is the Time in Avalanche

To derate above 25 °C, at fixed I_{AV}, the following equation must be applied:

$$I_{AV} = 2 * (T_{jmax} - T_{CASE}) / (1.3 * BV_{DSS} * Z_{th})$$

Where:
$Z_{th} = K * R_{th}$ is the value coming from Normalized Thermal Response at fixed pulse width equal to T_{AV} .

SPICE THERMAL MODEL

Parameter	Node	Value
CTHERM1	7 - 6	$6 * 10^{-4}$
CTHERM2	6 - 5	$8 * 10^{-3}$
CTHERM3	5 - 4	$2 * 10^{-2}$
CTHERM4	4 - 3	$6 * 10^{-2}$
CTHERM5	3 - 2	$9.65 * 10^{-2}$
CTHERM6	2 - 1	$6 * 10^{-1}$
RTHERM1	7 - 6	0.045
RTHERM2	6 - 5	0.105
RTHERM3	5 - 4	0.150
RTHERM4	4 - 3	0.225
RTHERM5	3 - 2	0.375
RTHERM6	2 - 1	0.600

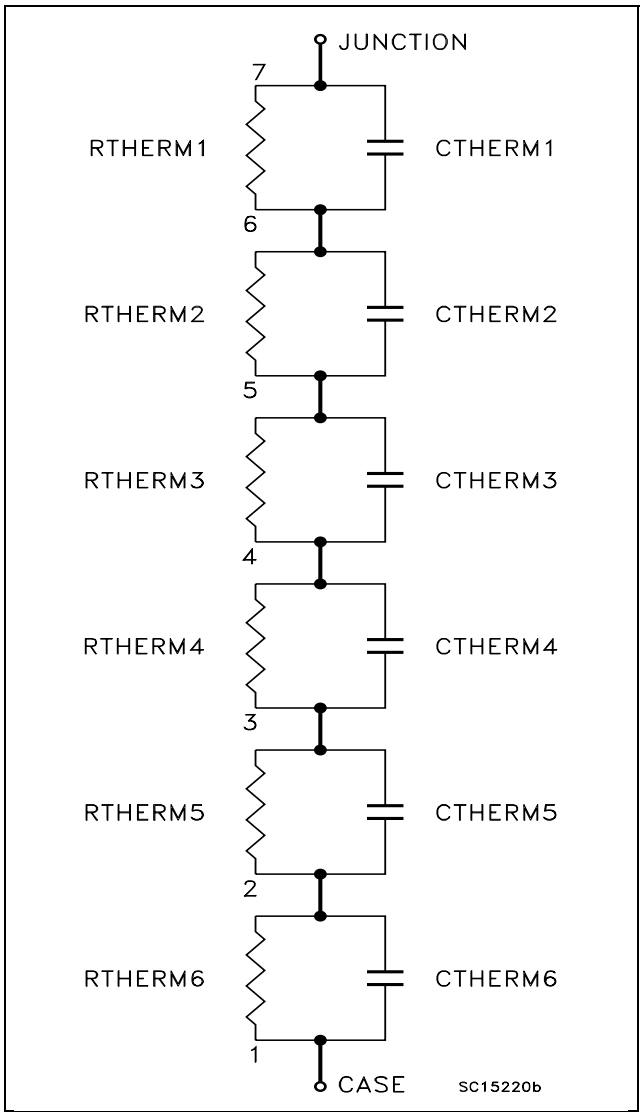


Fig. 1: Unclamped Inductive Load Test Circuit

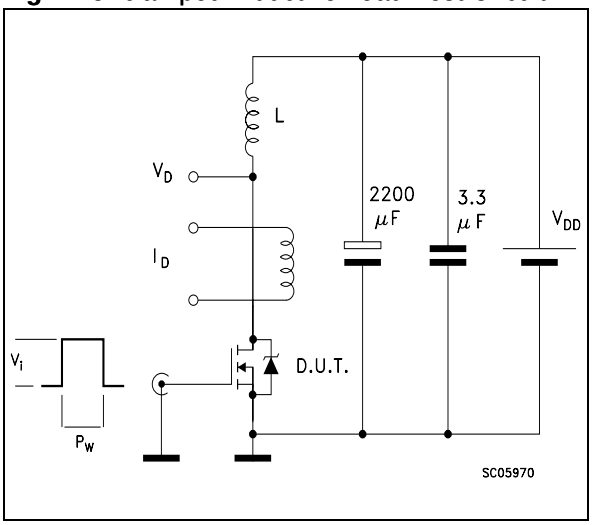


Fig. 2: Unclamped Inductive Waveform

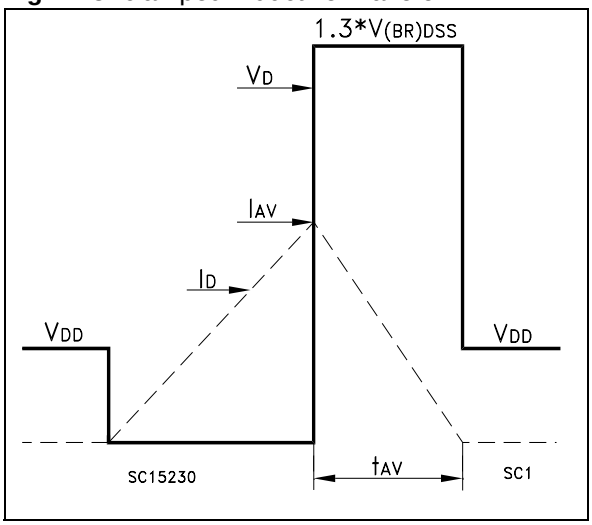


Fig. 3: Switching Times Test Circuits For Resistive Load

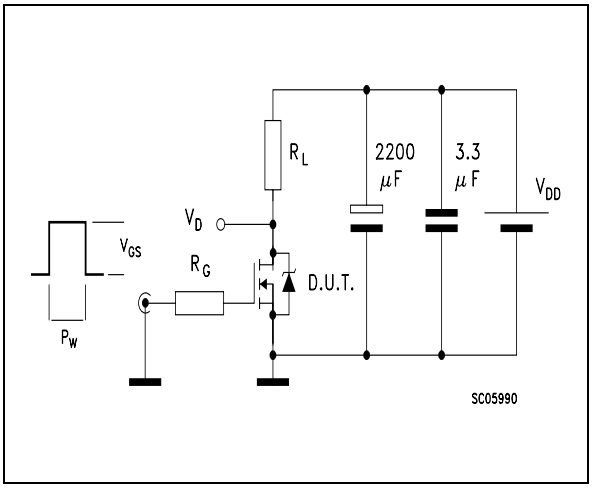


Fig. 3.1: Switching Time Waveform

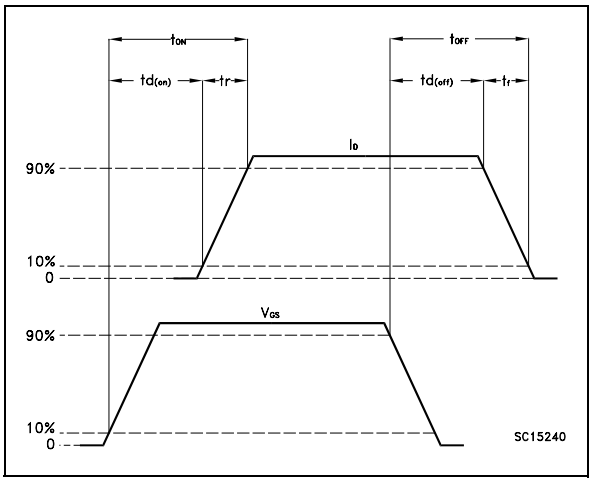


Fig. 4: Gate Charge Test Circuit

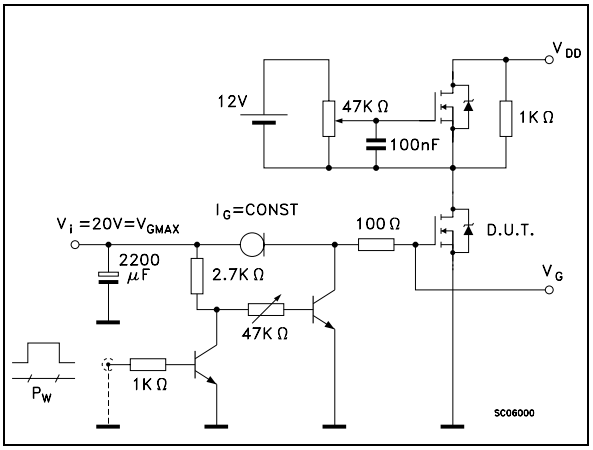


Fig. 4.1: Gate Charge Test Waveform

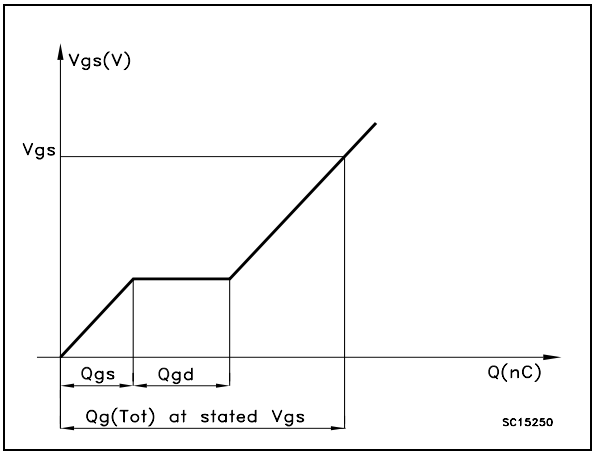


Fig. 5: Diode Switching Test Circuit

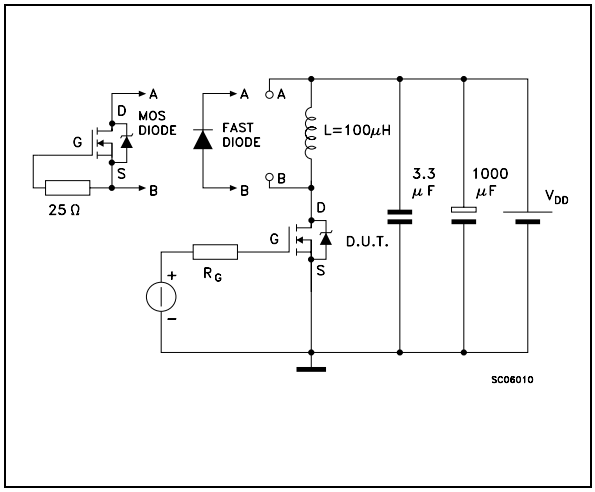
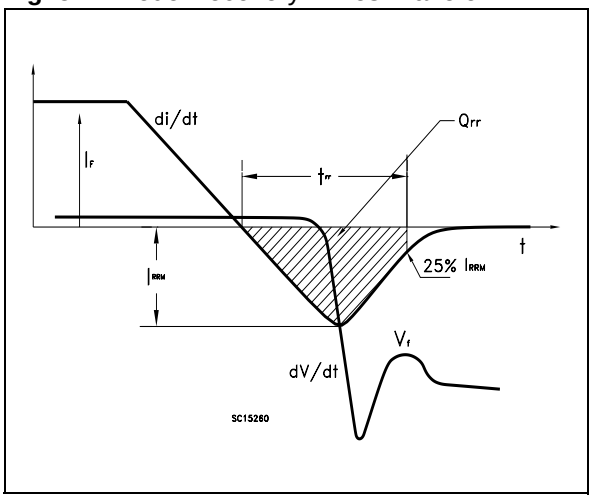
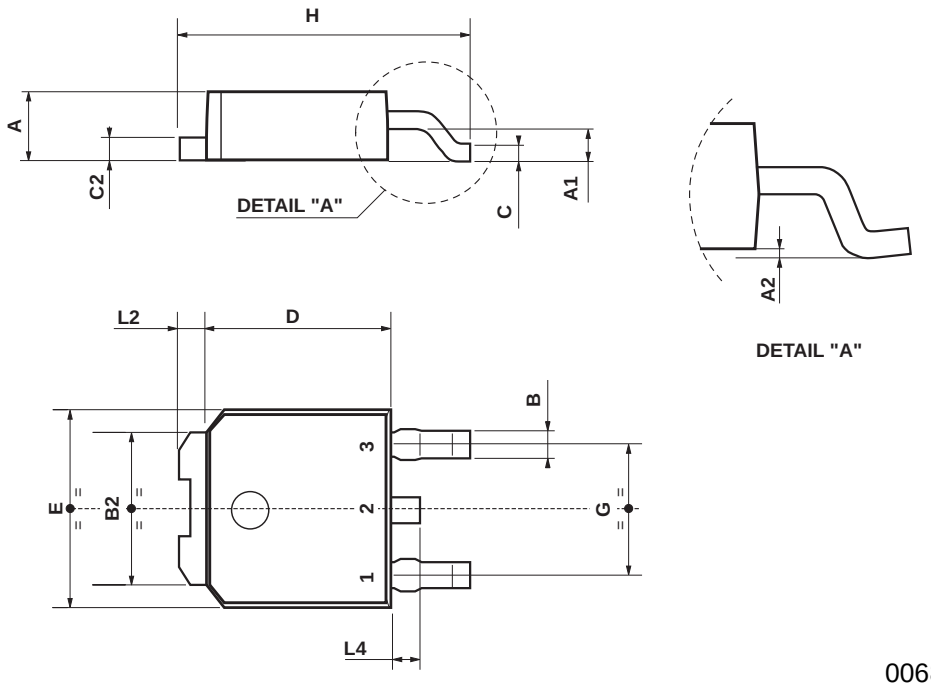


Fig. 5.1: Diode Recovery Times Waveform

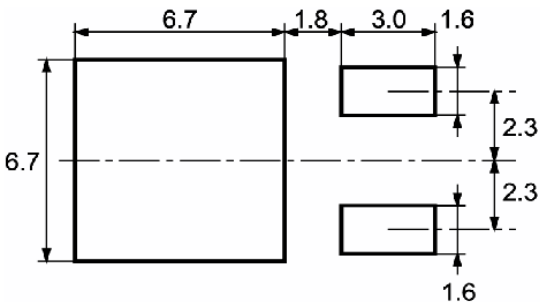


TO-252 (DPAK) MECHANICAL DATA

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

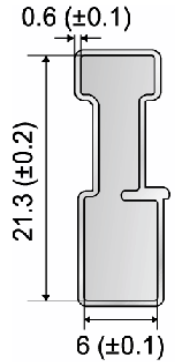


DPAK FOOTPRINT



All dimensions are in millimeters

TUBE SHIPMENT (no suffix)*



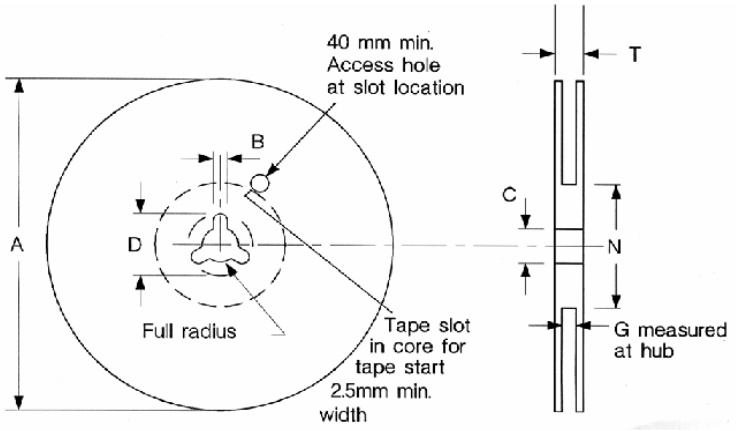
BASE QTY
75

BULK QTY
3000

Tube length 532 (±0.5)

All dimensions are in millimeters

TAPE AND REEL SHIPMENT (suffix "T4")*



REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641