



# STD2NC45-1 STQ1NC45

N-CHANNEL 450V - 4.1Ω - 1.5 A IPAK / TO-92

SuperMESH™ Power MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STD2NC45-1	450 V	< 4.5 Ω	1.5 A	30 W
STQ1NC45	450 V	< 4.5 Ω	0.5 A	3.1 W

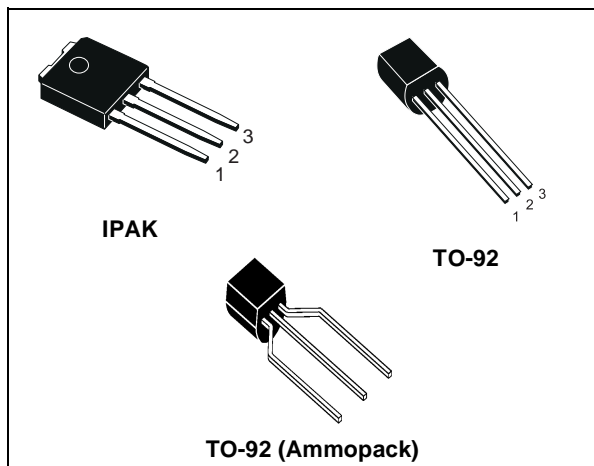
- TYPICAL R<sub>DS(on)</sub> = 4.1 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- NEW HIGH VOLTAGE BENCHMARK

## DESCRIPTION

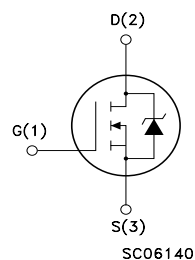
The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

## APPLICATIONS

- SWITCH MODE LOW POWER SUPPLIES (SMPS)
- LOW POWER, LOW COST CFL (COMPACT FLUORESCENT LAMPS)
- LOW POWER BATTERY CHARGERS



## INTERNAL SCHEMATIC DIAGRAM



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STD2NC45-1	D2NC45	IPAK	TUBE
STQ1NC45	Q1NC45	TO-92	BULK
STQ1NC45-AP	Q1NC45	TO-92	AMMOPAK

## STD2NC45-1, STQ1NC45

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STD2NC45-1	STQ1NC45	
$V_{DS}$	Drain-source Voltage ( $V_{GS} = 0$ )	450		V
$V_{DGR}$	Drain-gate Voltage ( $R_{GS} = 20\text{ k}\Omega$ )	450		V
$V_{GS}$	Gate- source Voltage	$\pm 30$		V
$I_D$	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	1.5	0.5	A
$I_D$	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	0.95	0.315	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	6	2	A
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	30	3.1	W
	Derating Factor	0.24	0.025	W/ $^\circ\text{C}$
dv/dt (1)	Peak Diode Recovery voltage slope	3		V/ns
$T_j$ $T_{stg}$	Operating Junction Temperature Storage Temperature	-65 to 150 -65 to 150		$^\circ\text{C}$ $^\circ\text{C}$

(●) Pulse width limited by safe operating area

(1)  $I_{SD} \leq 0.5\text{A}$ ,  $di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$ .

### THERMAL DATA

		IPAK	TO-92	
Rthj-case	Thermal Resistance Junction-case Max	4.1		$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	100	120	$^\circ\text{C}/\text{W}$
Rthj-lead	Thermal Resistance Junction-lead Max		40	$^\circ\text{C}/\text{W}$
$T_I$	Maximum Lead Temperature For Soldering Purpose	275	260	$^\circ\text{C}$

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value		Unit
		IPAK	TO-92	
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	1.5		A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	25		mJ

**ELECTRICAL CHARACTERISTICS** (TCASE = 25°C UNLESS OTHERWISE SPECIFIED)  
ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ , $V_{GS} = 0$	450			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ , $T_C = 125^\circ C$			1 50	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30V$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu A$	2.3	3	3.7	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ , $I_D = 0.5 A$		4.1	4.5	$\Omega$

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ , $I_D = 0.5 A$		1.1		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$ , $f = 1 \text{ MHz}$ , $V_{GS} = 0$		160 27.5 4.7		pF pF pF

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 225 V$ , $I_D = 0.5 A$ $R_G = 4.7 \Omega$ , $V_{GS} = 10 V$ (Resistive Load see, Figure 3)		6.7 4		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 360V$ , $I_D = 1.5 A$ , $V_{GS} = 10V$ , $R_G = 4.7 \Omega$		7 1.3 3.2	10	nC nC nC

**SWITCHING OFF**

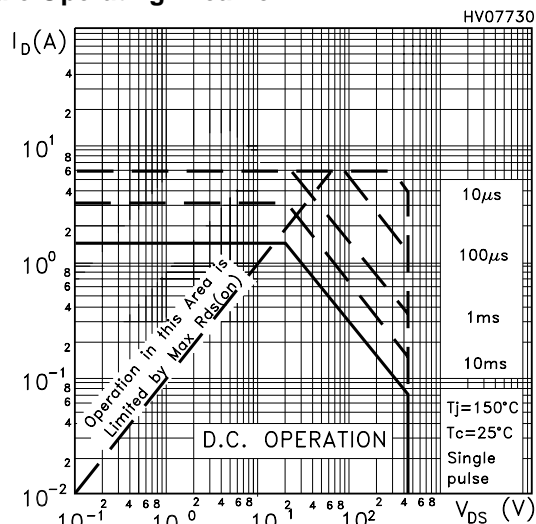
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 360V$ , $I_D = 1.5 A$ , $R_G = 4.7 \Omega$ , $V_{GS} = 10V$ (Inductive Load see, Figure 5)		8.5 12 18		ns ns ns

**SOURCE DRAIN DIODE**

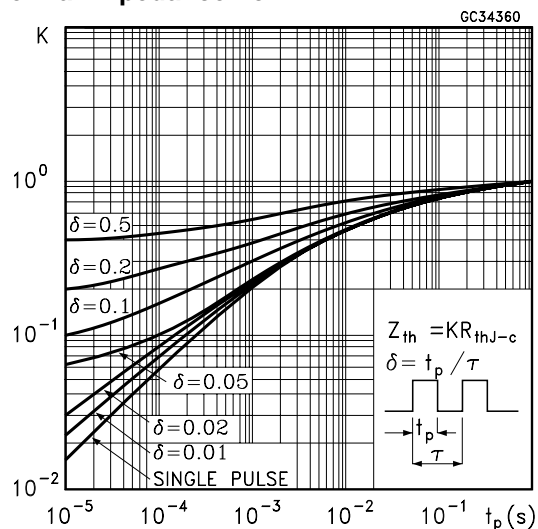
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM} (2)$	Source-drain Current Source-drain Current (pulsed)				1.5 6.0	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 1.5 A$ , $V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 1.5 A$ , $di/dt = 100A/\mu s$ $V_{DD} = 100V$ , $T_j = 150^\circ C$ (see test circuit, Figure 5)		225 530 4.7		ns $\mu C$ A

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

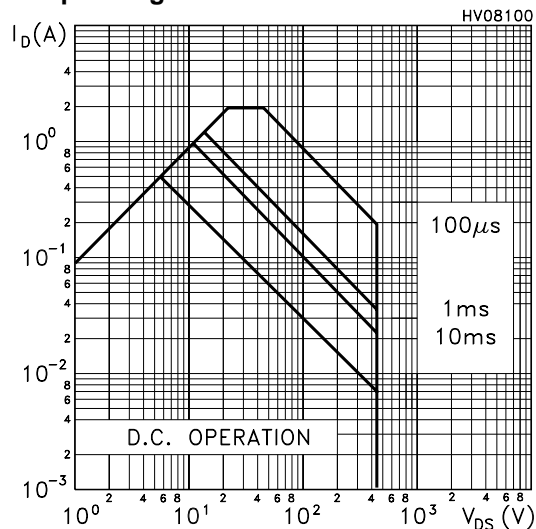
### Safe Operating Area For IPAK



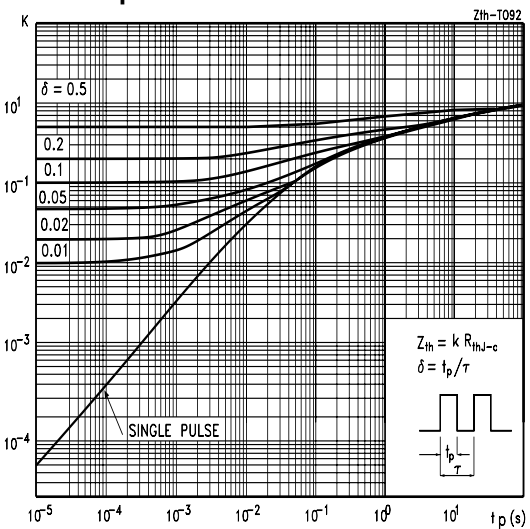
### Thermal Impedance For IPAK



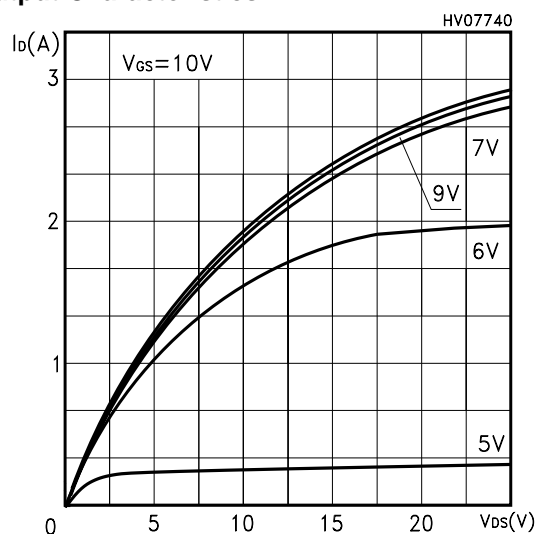
### Safe Operating Area For TO-92



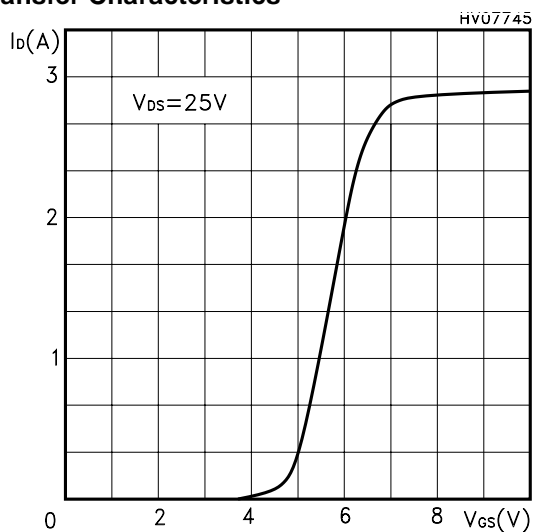
### Thermal Impedance For TO-92



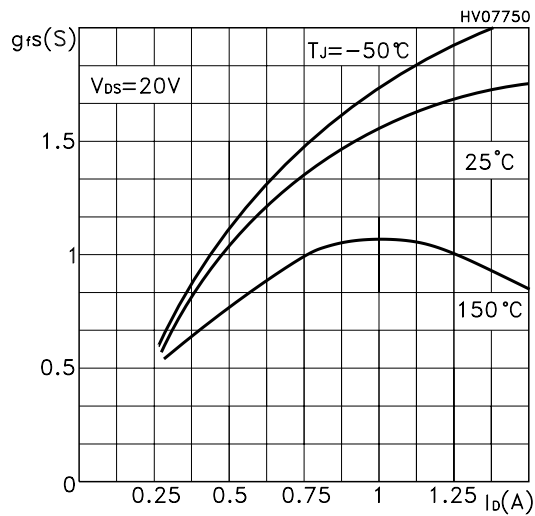
### Output Characteristics



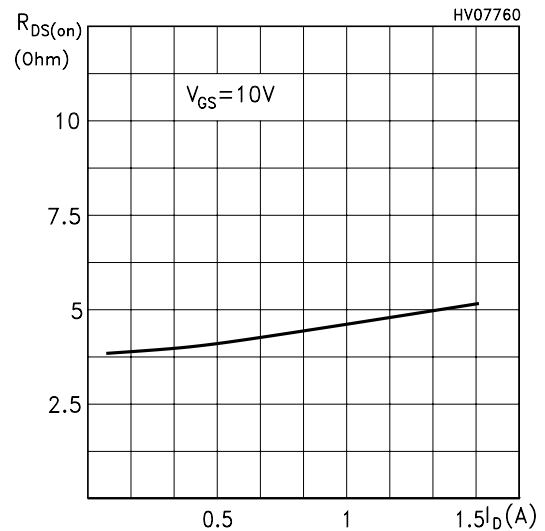
### Transfer Characteristics



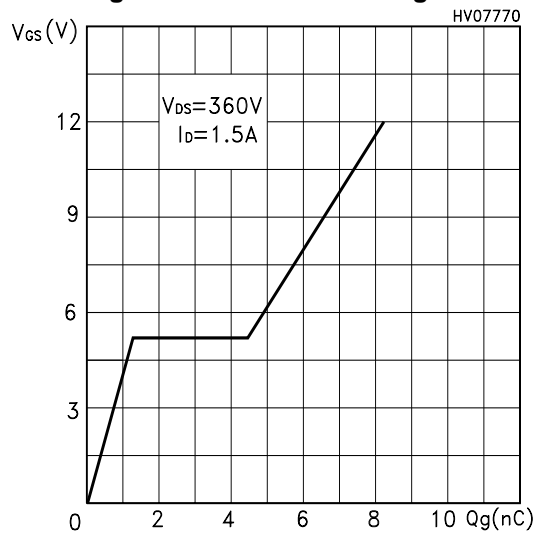
### Transconductance



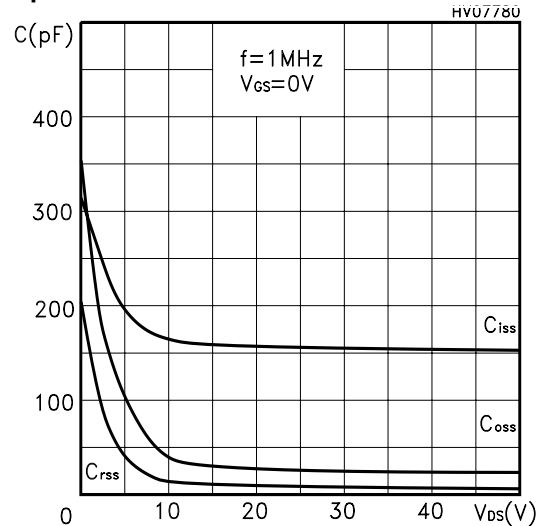
### Static Drain-source On Resistance



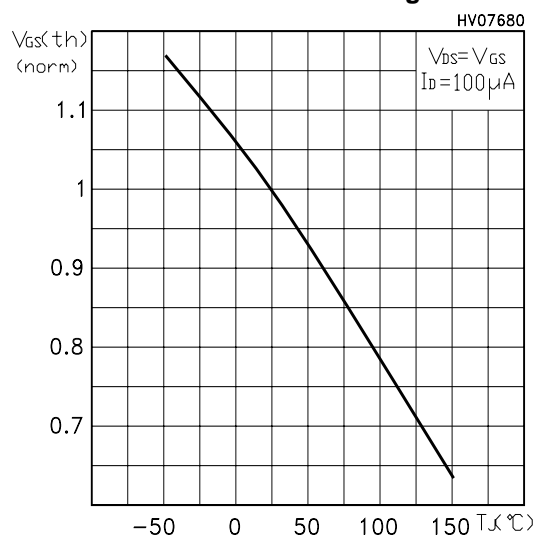
### Gate Charge vs Gate-source Voltage



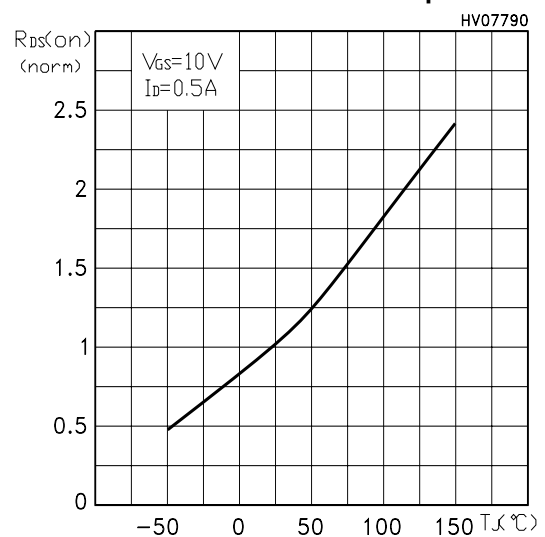
### Capacitance Variations



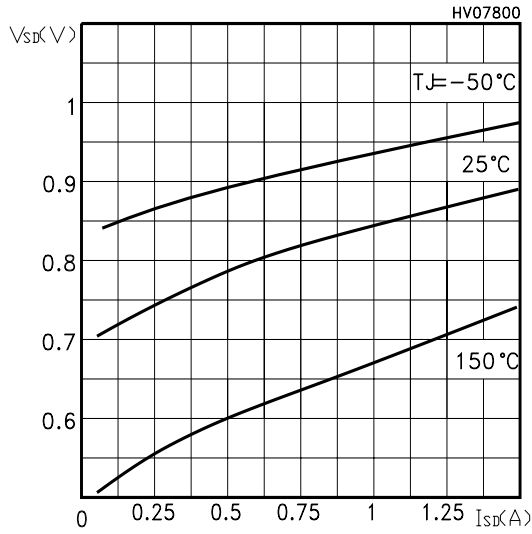
### Normalized Gate Threshold Voltage vs Temp.



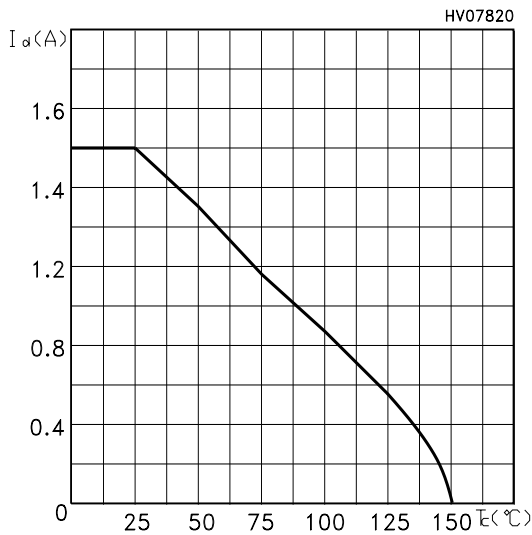
### Normalized On Resistance vs Temperature



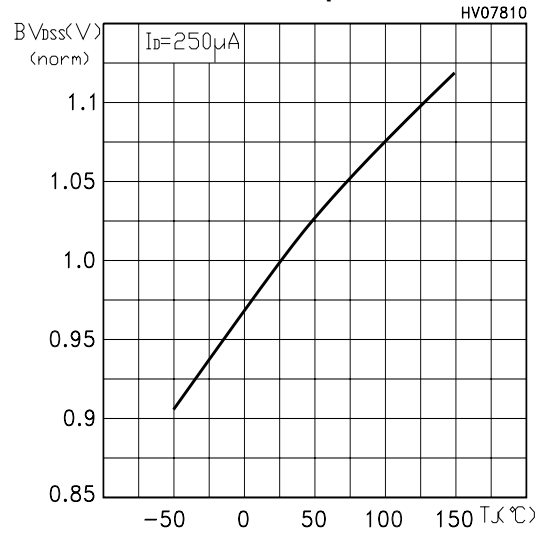
Source-drain Diode Forward Characteristics



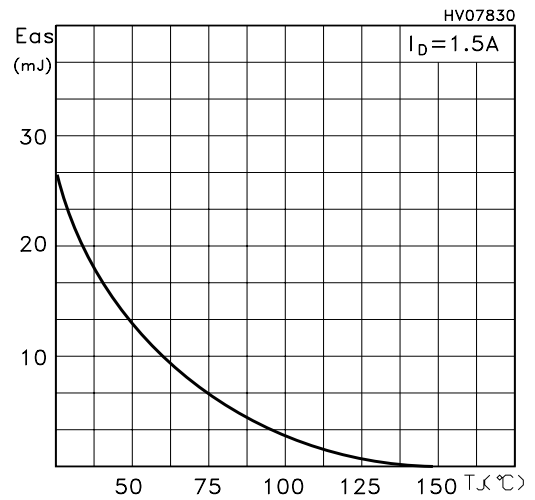
Max Id Current vs Tc



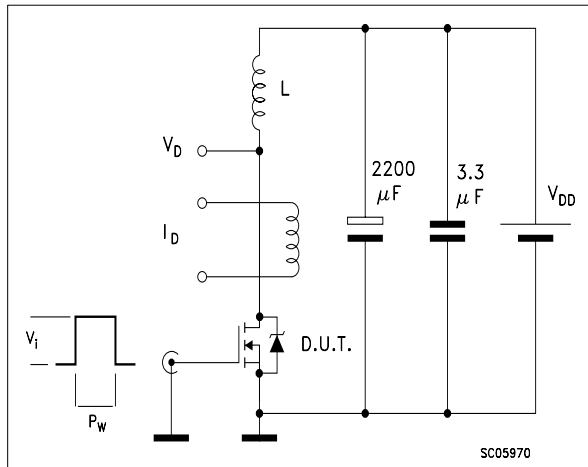
Normalized BVDSS vs Temperature



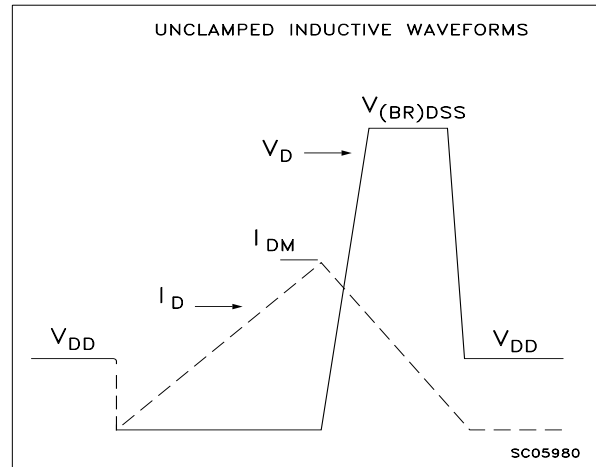
Maximum Avalanche Energy vs Temperature



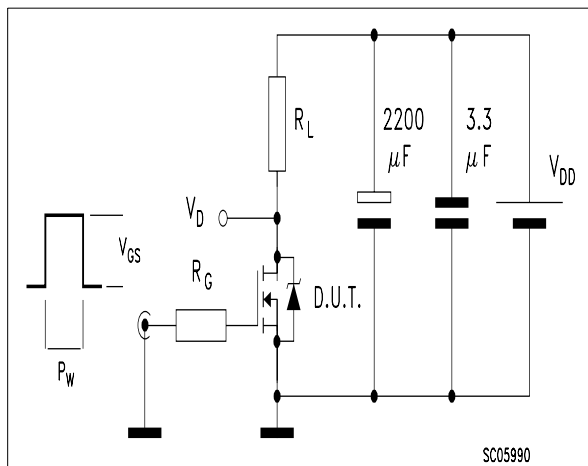
**Fig. 1: Unclamped Inductive Load Test Circuit**



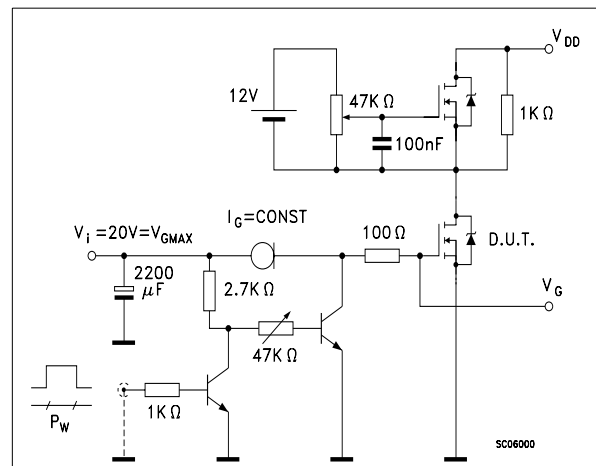
**Fig. 2: Unclamped Inductive Waveform**



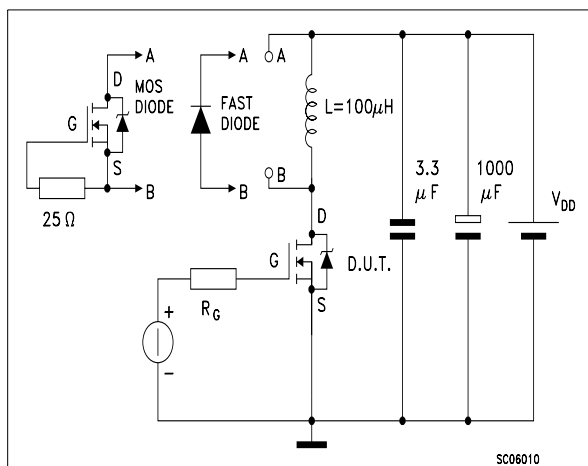
**Fig. 3: Switching Times Test Circuit For Resistive Load**



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

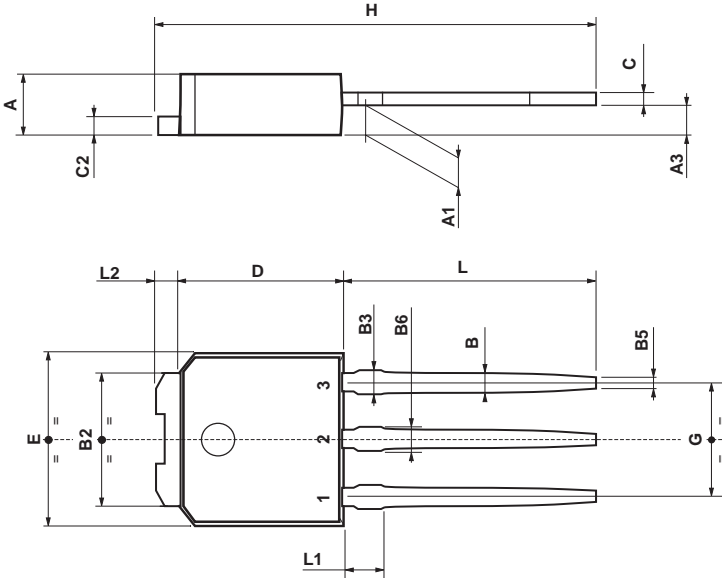


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



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

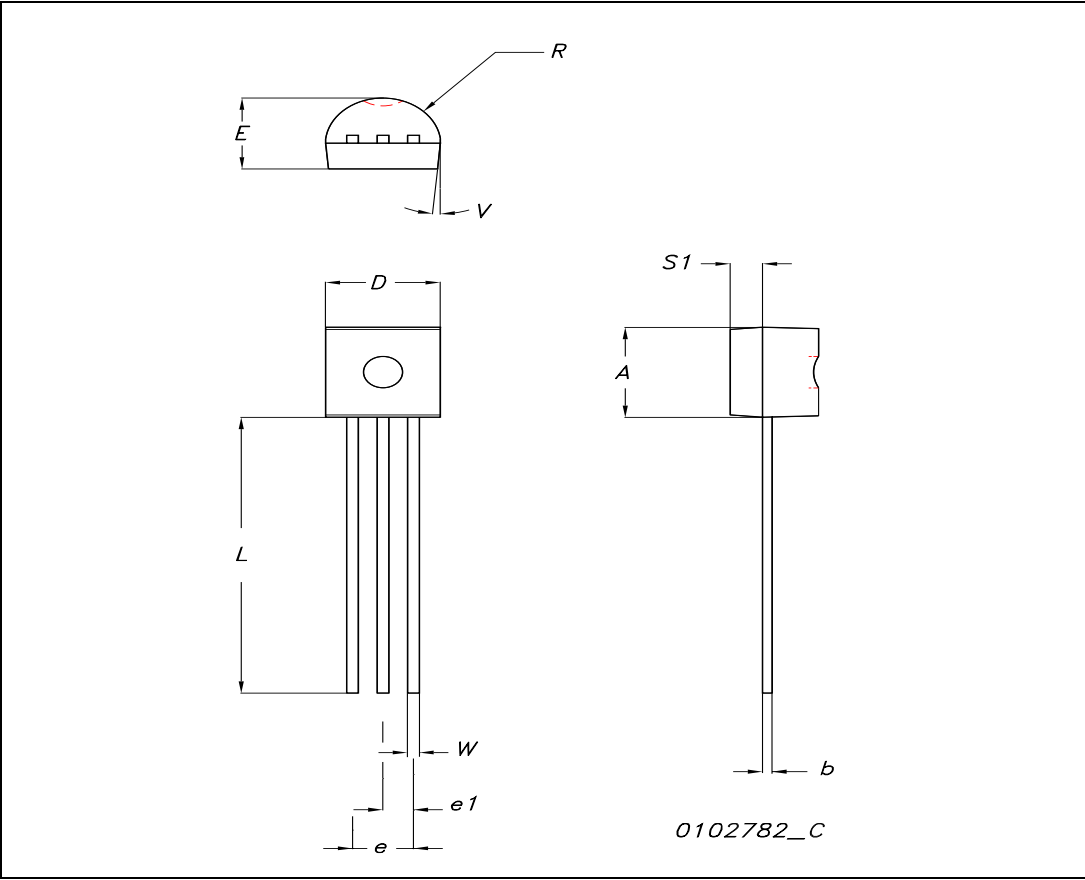


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TO-92 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	0.170		0.194
b	0.36		0.51	0.014		0.020
D	4.45		4.95	0.175		0.194
E	3.30		3.94	0.130		0.155
e	2.41		2.67	0.094		0.105
e1	1.14		1.40	0.044		0.055
L	12.70		15.49	0.50		0.610
R	2.16		2.41	0.085		0.094
S1	0.92		1.52	0.036		0.060
W	0.41		0.56	0.016		0.022
V		5°			5°	



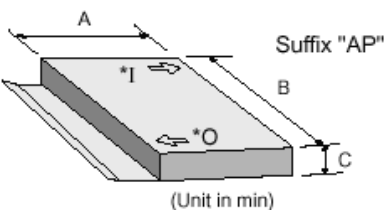
## SHIPPING METHODS

## TO-92 AMMOPACK (suffix "-AP")

One row consists of 25 elements



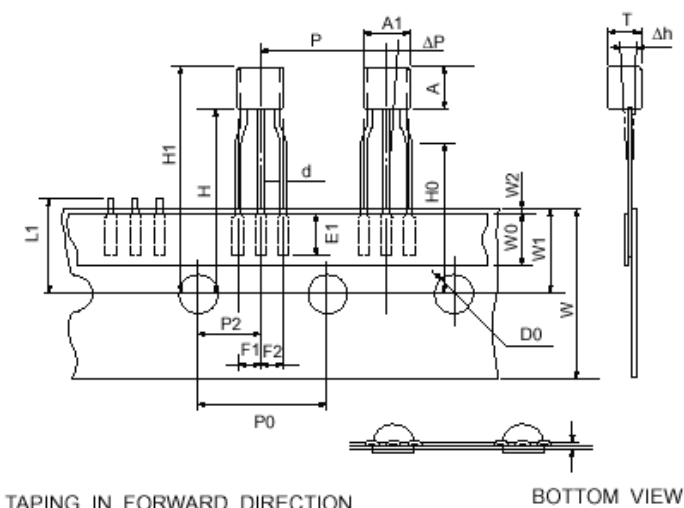
Remove more than 4 elements



(Unit in mm)

\* shows a first-out electrode of a lead.  
 O: Output first-out  
 I: Input first-out

DIM	mm	
	Min.	Max.
A	3	250
B	3	330
C	3	45



TAPING IN FORWARD DIRECTION

BOTTOM VIEW

DIM	mm	
	Min.	Max.
A1	-	5
A	-	5
T	-	4
d	-	0.45
E1	2.5	-
P	11.7	13.7
P0	12.4	13
Hole Center to Device Center	5.95	6.75
F1/F2	2.4	2.8
Δh	-1	1
ΔP	-1	1
W	17.5	19
W0	5.7	6.3
W1	8.5	9.75
W2	-	0.5
H	-	20
H0	15.5	16.5
H1	-	25
D0	3.8	4.2
t	0.4	0.8
L1	-	11

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