



# STQ1NC60R

N-CHANNEL 600V - 12Ω - 0.3A TO-92

PowerMESH™II Power MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STQ1NC60R	600 V	< 15 Ω	0.3 A

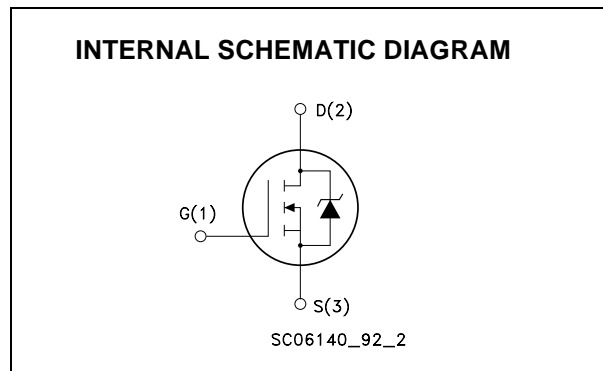
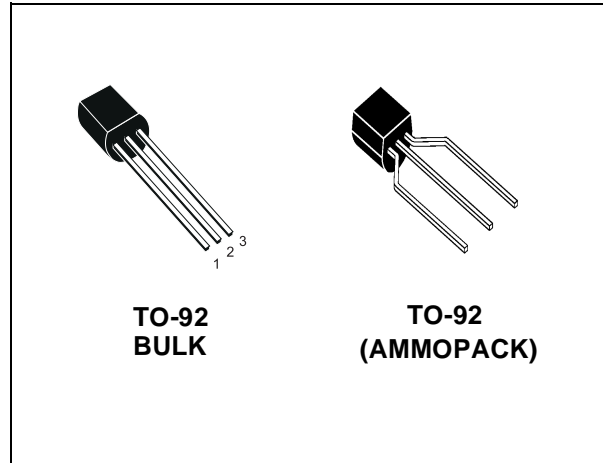
- TYPICAL R<sub>DS(on)</sub> = 12 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

## DESCRIPTION

Using the latest high voltage MESH OVERLAY™II process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R<sub>DS(on)</sub> per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

- LOW SWITCH MODE POWER SUPPLIES (SMPS)
- BATTERY CHARGER



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STQ1NC60R	Q1NC60R	TO-92	BULK
STQ1NC60R-AP	Q1NC60R	TO-92	AMMOPACK

## STQ1NC60R

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	600	V
V <sub>GS</sub>	Gate- source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	0.3	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	0.19	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	1.2	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	3.1	W
	Derating Factor	0.025	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	3	V/ns
T <sub>j</sub>	Operating Junction Temperature	-65 to 150	°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 0.3A, di/dt ≤ 100A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

### THERMAL DATA

		TO-92	
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	120	°C/W
R <sub>thj-lead</sub>	Thermal Resistance Junction-lead Max	40	°C/W
T <sub>I</sub>	Maximum Lead Temperature For Soldering Purpose	260	°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)	0.3	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)	60	mJ

### ELECTRICAL CHARACTERISTICS (TCASE = 25°C UNLESS OTHERWISE SPECIFIED)

ON/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	600			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, T <sub>C</sub> = 125 °C			1 50	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.3 A		12	15	Ω

**ELECTRICAL CHARACTERISTICS (TCASE =25°C UNLESS OTHERWISE SPECIFIED)  
DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (1)	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 0.3\text{ A}$		0.87		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$		108 18 2.5		pF pF pF

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 300\text{ V}, I_D = 0.5\text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		7.2 8		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 4.7\Omega$		7.3 3.4 2.5	10	nC nC nC

**SWITCHING OFF**

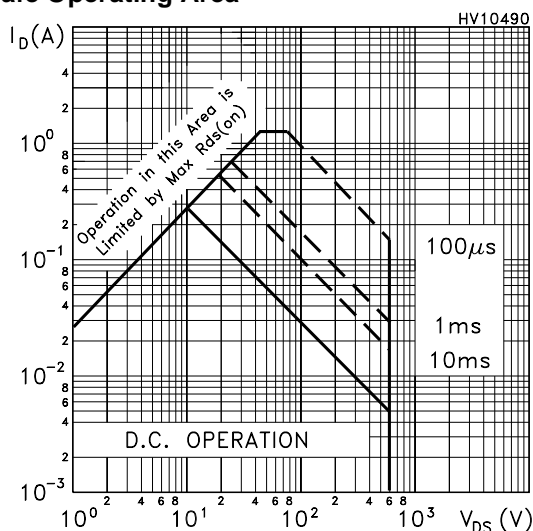
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 480\text{ V}, I_D = 1\text{ A},$ $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (Inductive Load see, Figure 5)		33 11 43		ns ns ns

**SOURCE DRAIN DIODE**

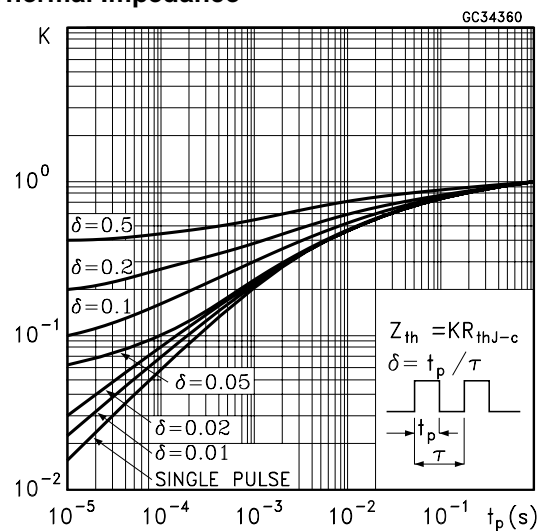
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$ (2)	Source-drain Current Source-drain Current (pulsed)				0.3 1.2	A A
$V_{SD}$ (1)	Forward On Voltage	$I_{SD} = 0.3\text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 1\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 25\text{ V}, T_j = 150^\circ\text{C}$ (see test circuit, Figure 5)		450 720 3.2		ns $\mu\text{C}$ A

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

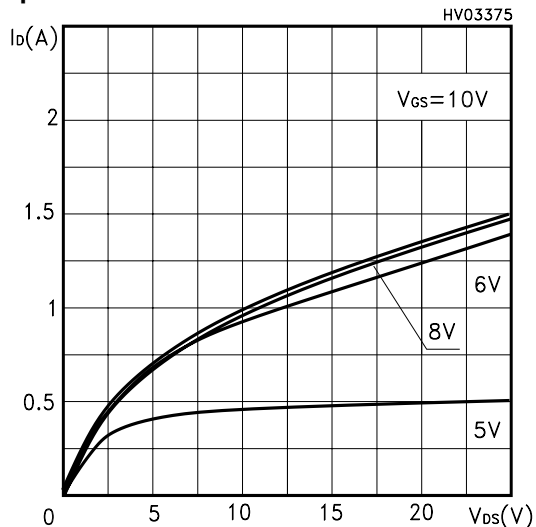
**Safe Operating Area**



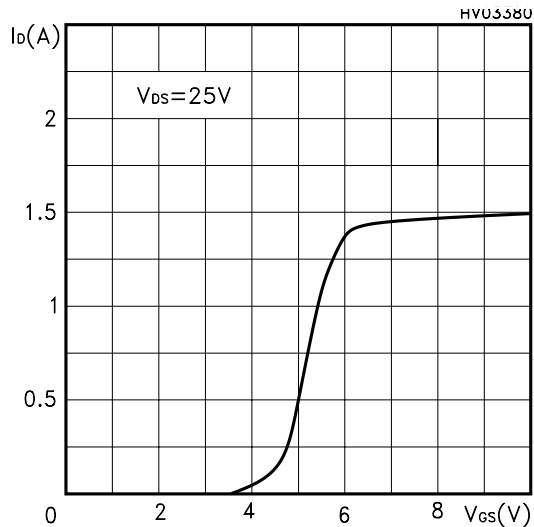
**Thermal Impedance**



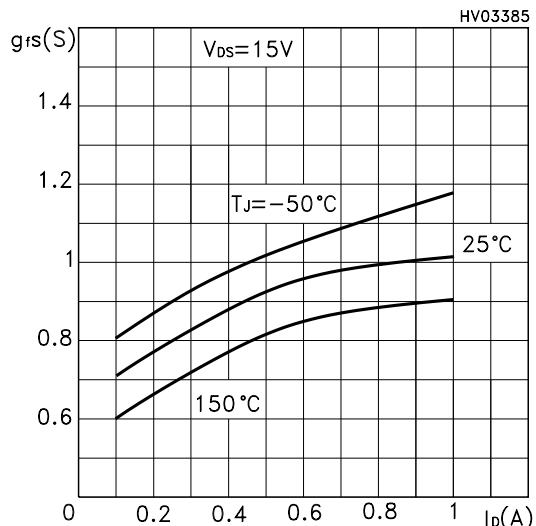
Output Characteristics



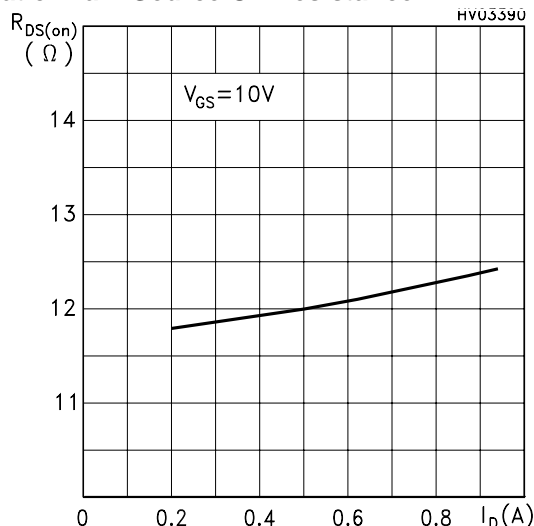
Transfer Characteristics



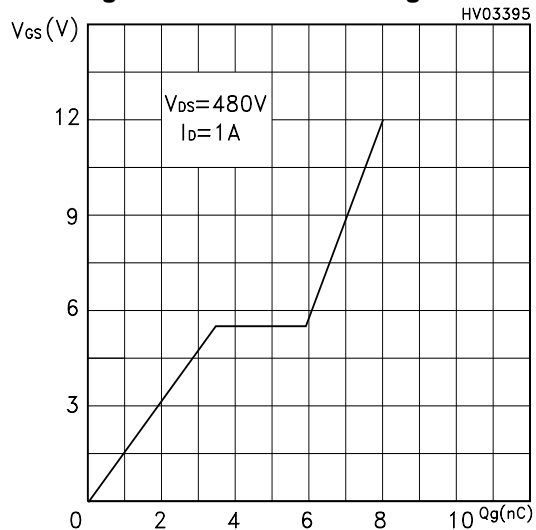
Tranconductance



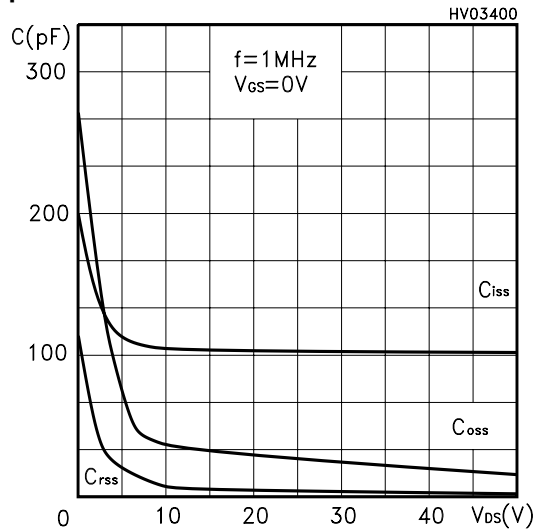
Static Drain-Source On Resistance



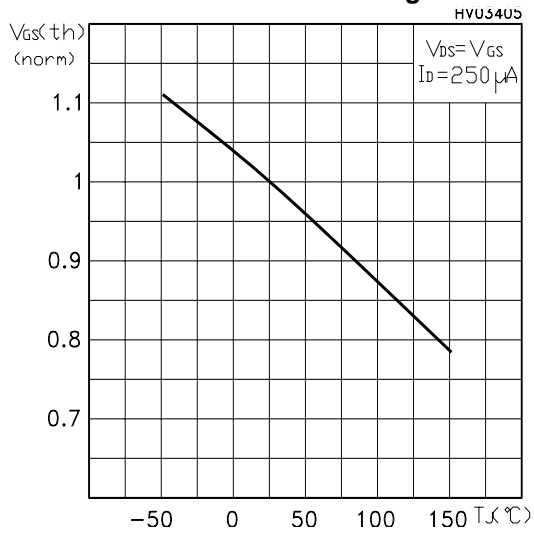
Gate Charge vs Gate-source Voltage



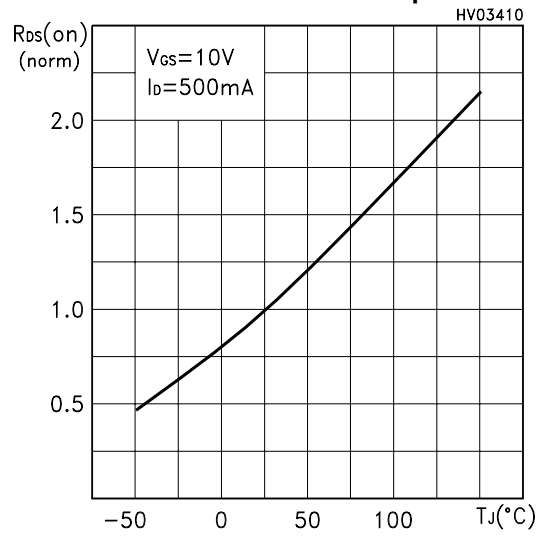
Capacitance Variations



**Normalized Gate Threshold Voltage vs Temp.**



**Normalized On Resistance vs Temperature**



**Source-drain Diode Forward Characteristics**

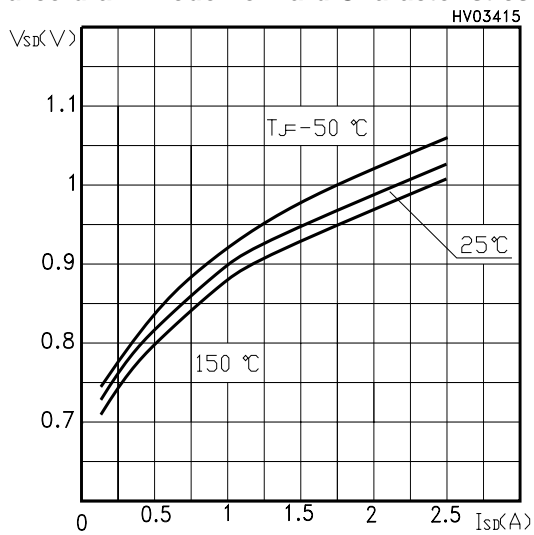


Fig. 1: Unclamped Inductive Load Test Circuit

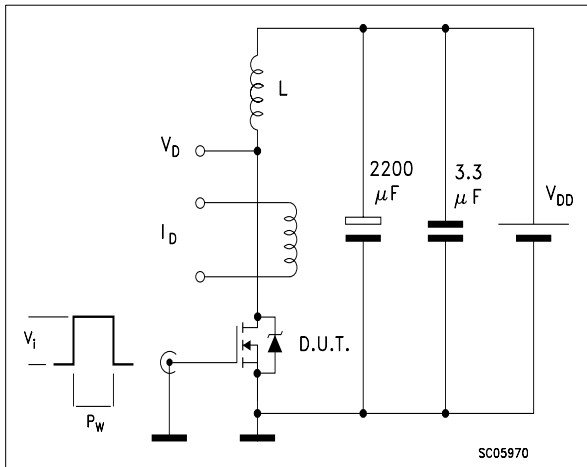


Fig. 2: Unclamped Inductive Waveform

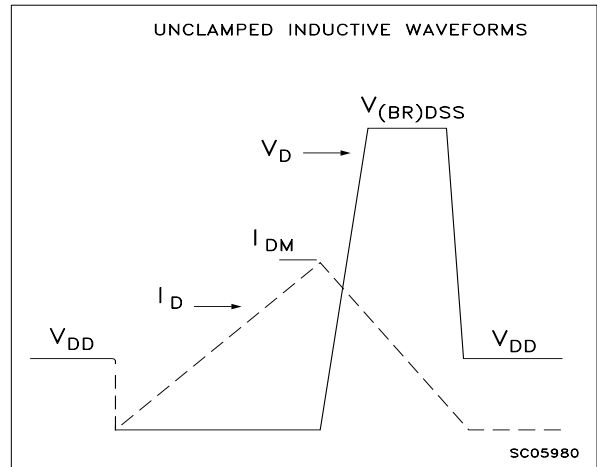


Fig. 3: Switching Times Test Circuit For Resistive Load

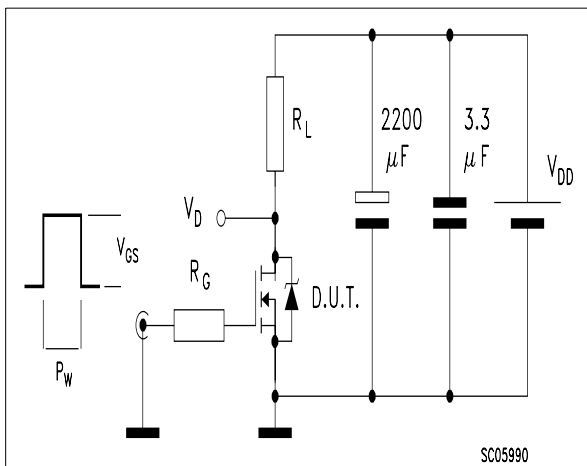


Fig. 4: Gate Charge test Circuit

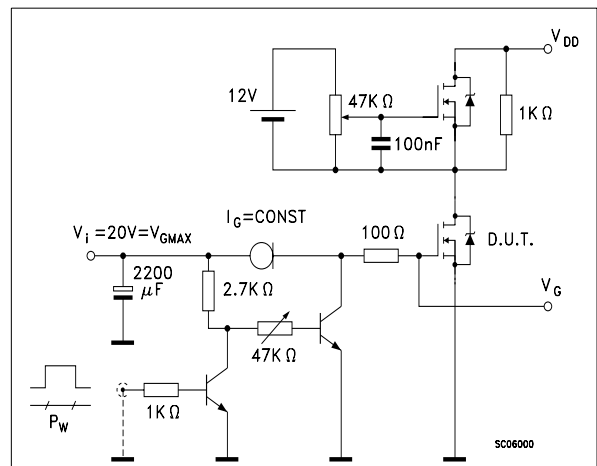
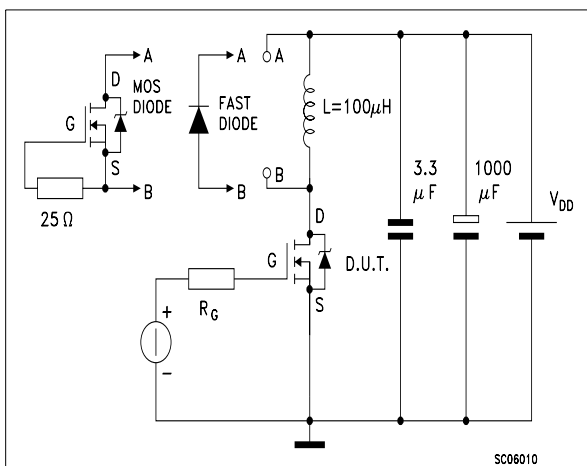
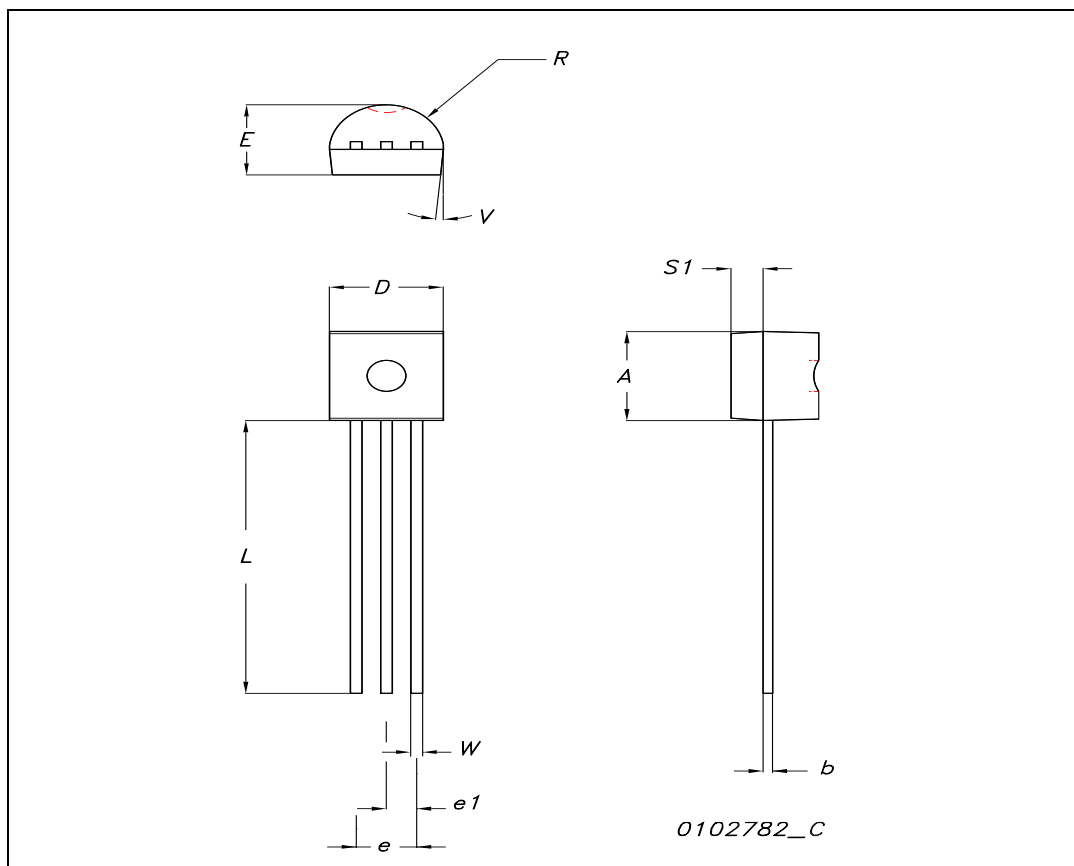


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



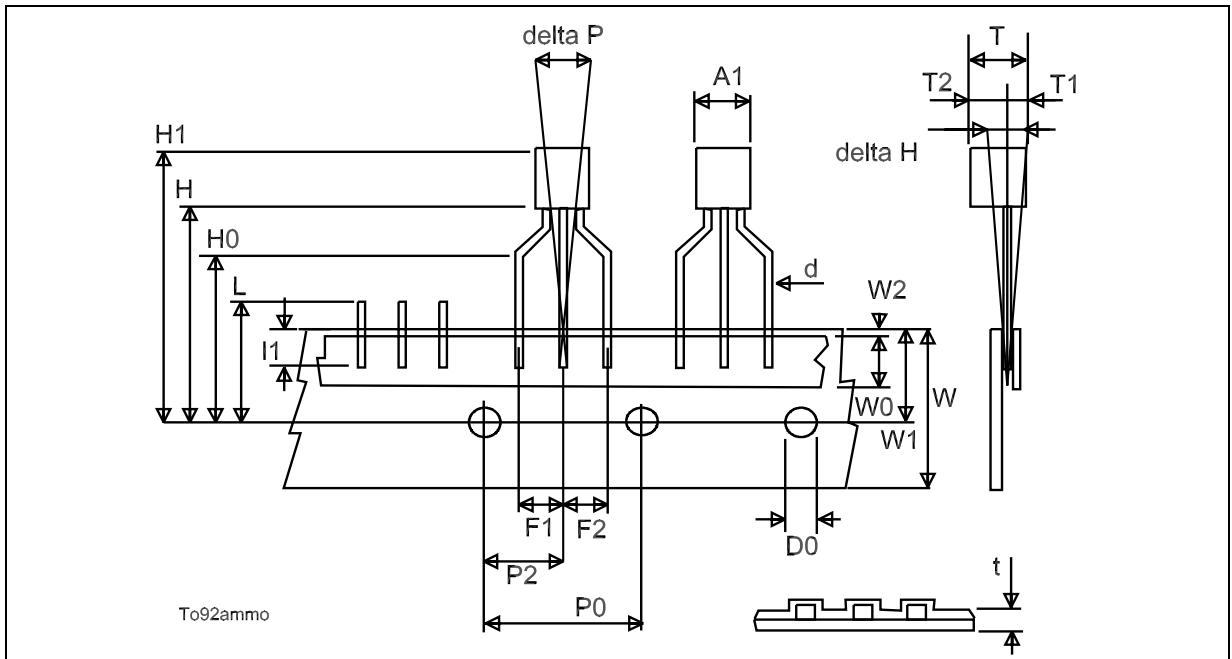
## TO-92 MECHANICAL DATA

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°	



**TO-92 AMMOPACK**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A1			4.8			0.19
T			3.8			0.15
T1			1.6			0.06
T2			2.3			0.09
d			0.48			0.02
P0	12.5	12.7	12.9	0.49	0.5	0.51
P2	5.65	6.35	7.05	0.22	0.25	0.27
F1, F2	2.44	2.54	2.94	0.09	0.1	0.11
delta H	-2		2	-0.08		0.08
W	17.5	18	19	0.69	0.71	0.74
W0	5.7	6	6.3	0.22	0.23	0.24
W1	8.5	9	9.25	0.33	0.35	0.36
W2			0.5			0.02
H	18.5		20.5	0.72		0.80
H0	15.5	16	16.5	0.61	0.63	0.65
H1			25			0.98
D0	3.8	4	4.2	0.15	0.157	0.16
t			0.9			0.035
L			11			0.43
l1	3			0.11		
delta P	-1		1	-0.04		0.04





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