



# STGW50NB60M

N-CHANNEL 50A - 600V - TO-247

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (25°C)	I <sub>C</sub>
STGW50NB60M	600 V	< 1.9 V	50 A

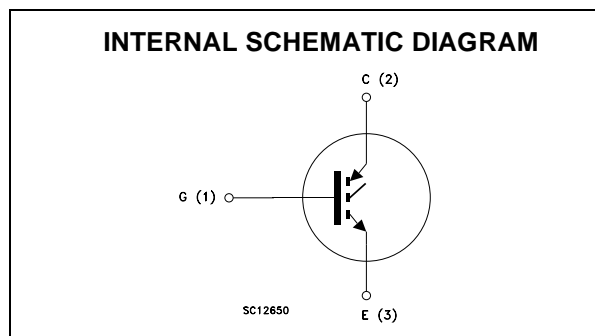
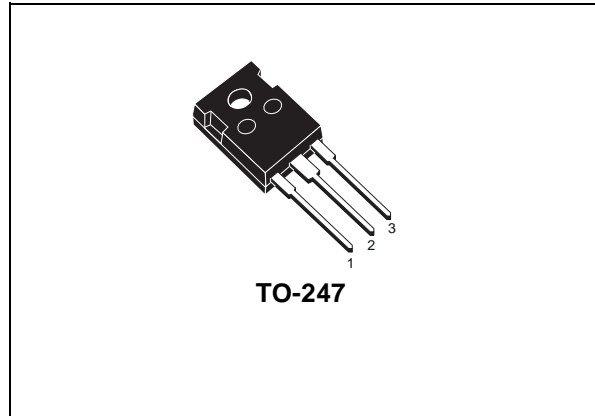
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>CESAT</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY

## DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "M" identifies a family optimized to achieve very low saturation on voltage for frequency applications <10 KHz.

## APPLICATIONS

- MOTOR CONTROL
- WELDING EQUIPMENTS



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>ECR</sub>	Reverse Battery Protection	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	±20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 25°C	100	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	50	A
I <sub>CM</sub> (■)	Collector Current (pulsed)	400	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	250	W
	Derating Factor	2	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

## STGW50NB60M

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	0.5	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	30	°C/W
Rthc-h	Thermal Resistance Case-heatsink Typ	0.1	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 250 μA, V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 25 °C V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 125 °C			10 100	μA μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20 V, V <sub>CE</sub> = 0			± 100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250 μA	3	4	5	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 30 A @25°C V <sub>GE</sub> = 15V, I <sub>C</sub> = 30 A @100°C V <sub>GE</sub> = 15V, I <sub>C</sub> = 50 A @25°C V <sub>GE</sub> = 15V, I <sub>C</sub> = 50 A @100°C		1.3 1.2 1.5 1.35	1.9	V V V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 15 V, I <sub>C</sub> = 18 A		22		S
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>CE</sub> = 25 V, f = 1 MHz, V <sub>GE</sub> = 0		4500 400 70		pF pF pF
Q <sub>g</sub> Q <sub>ge</sub> Q <sub>gc</sub>	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V <sub>CE</sub> = 480 V, I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V		231 28 97		nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V, T <sub>j</sub> = 125°C R <sub>G</sub> = 10 Ω	300			A

### SWITCHING ON

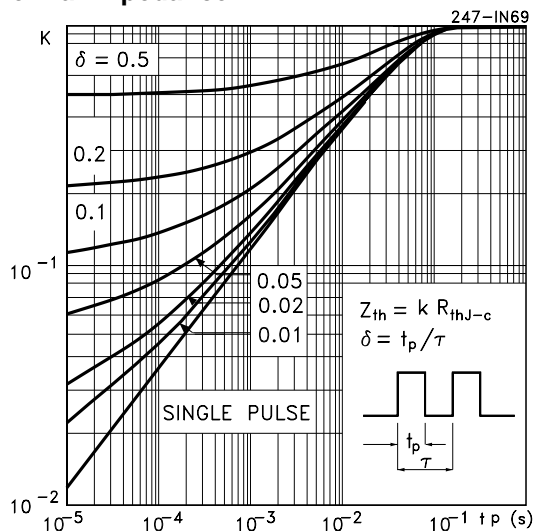
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Turn-on Delay Time Rise Time	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 50 A R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15 V		45 30		ns ns
(di/dt) <sub>on</sub> E <sub>on</sub>	Turn-on Current Slope Turn-on Switching Losses	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 50 A R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V T <sub>j</sub> = 125°C		1600 800		A/μs μJ

**ELECTRICAL CHARACTERISTICS (CONTINUED)****SWITCHING OFF**

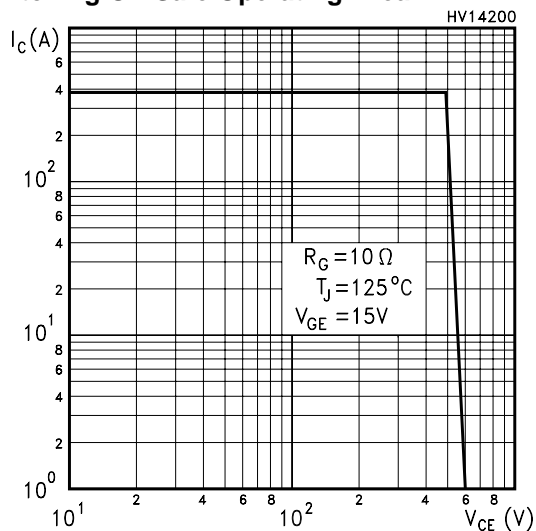
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 50 \text{ A}$		450		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		130		ns
$t_{d(off)}$	Delay Time			410		ns
$t_f$	Fall Time			300		ns
$E_{off(**)}$	Turn-off Switching Loss			4		mJ
$E_{ts}$	Total Switching Loss			4.1		mJ
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 50 \text{ A}$		730		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		265		ns
$t_{d(off)}$	Delay Time	$T_j = 125 \text{ }^\circ\text{C}$		565		ns
$t_f$	Fall Time			440		ns
$E_{off(**)}$	Turn-off Switching Loss			6.6		mJ
$E_{ts}$	Total Switching Loss			7.1		mJ

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*) Losses include Also the Tail (Jedec Standardization)

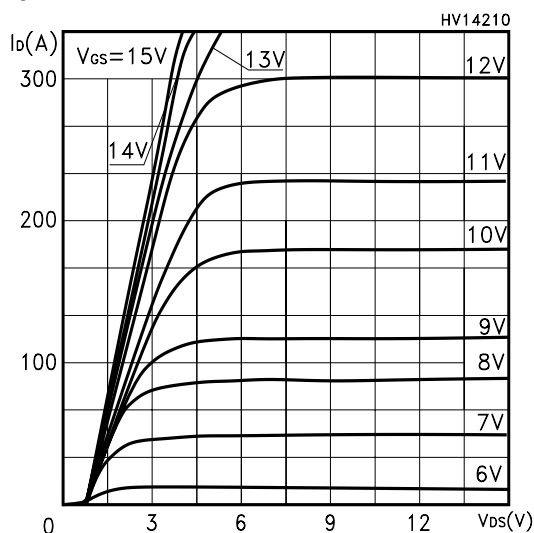
Thermal Impedance



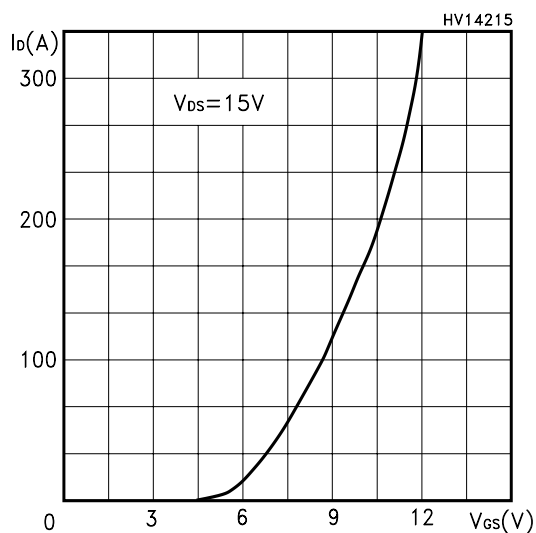
Switching Off Safe Operating Area



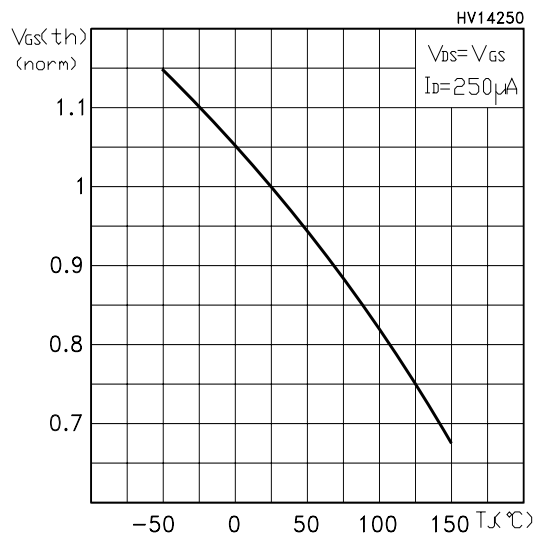
Output Characteristics



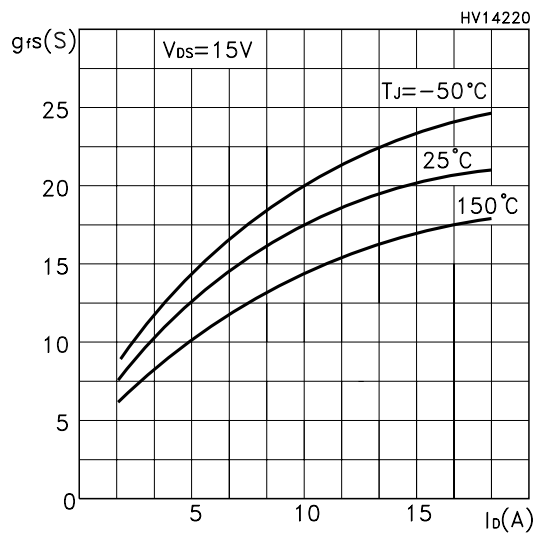
Transfer Characteristics



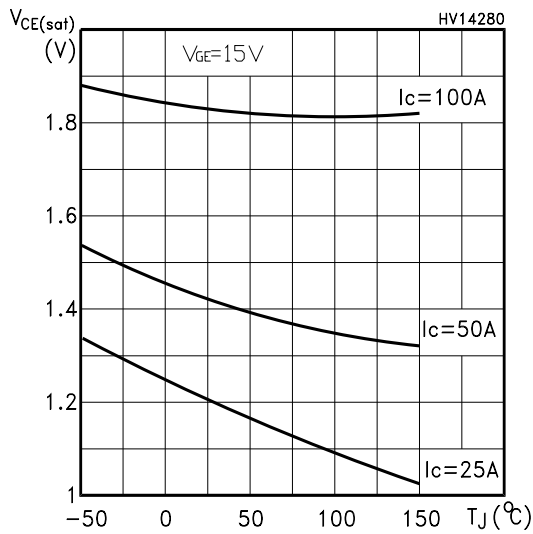
Normalized Gate Threshold Voltage vs Temp.



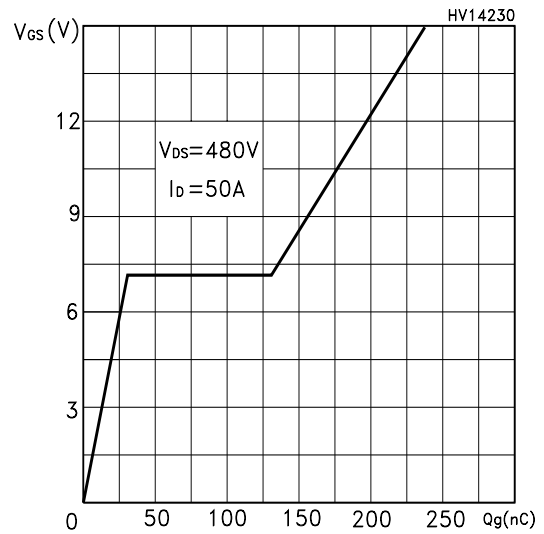
Transconductance



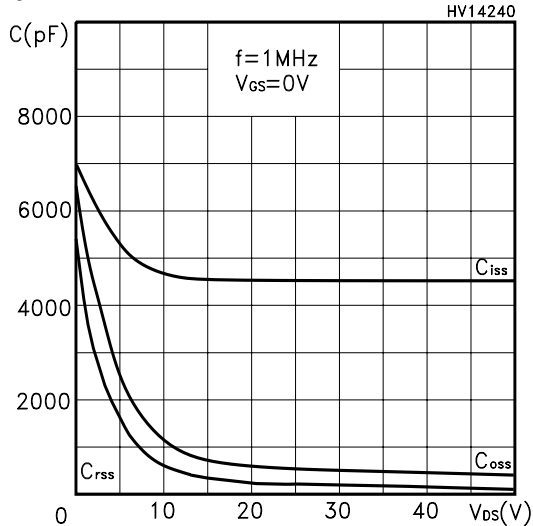
Collector-Emitter On Voltage vs Temperature



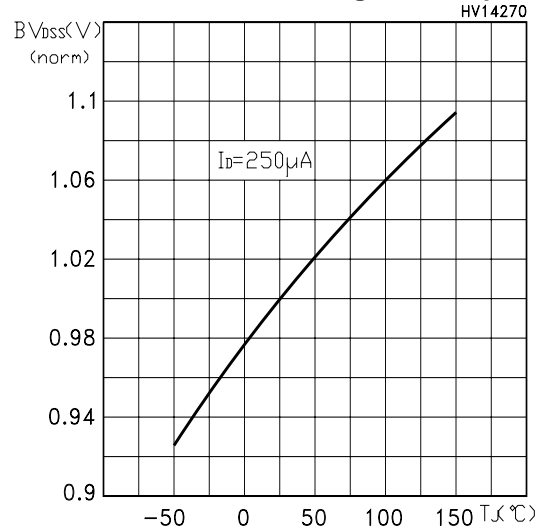
Gate-Charge vs Gate-Emitter Voltage



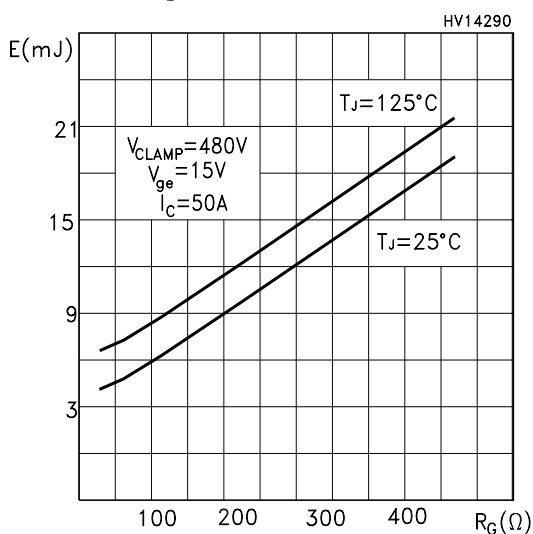
Capacitance Variations



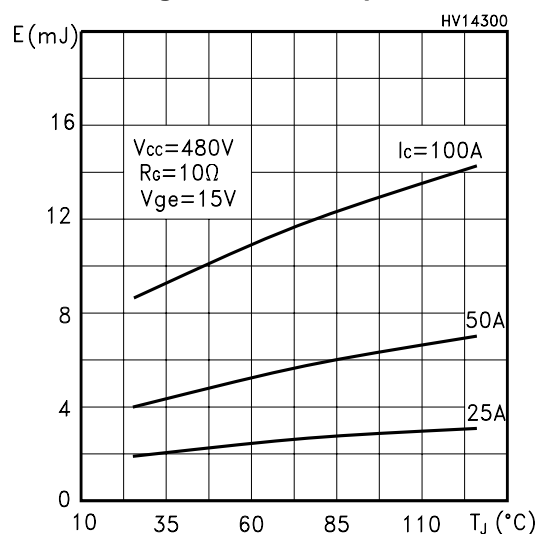
Normalized Break-down Voltage vs Temp.



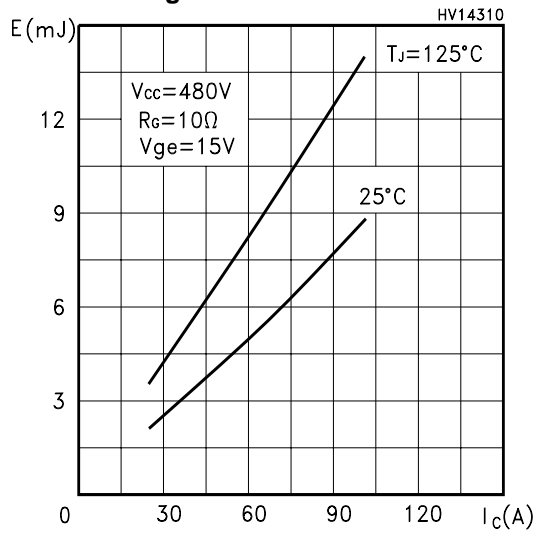
Total Switching losses vs Gate Resistance



Total Switching losses vs Temperature



Total Switching losses vs  $I_c$



Collector-Emitter on Voltage vs Current

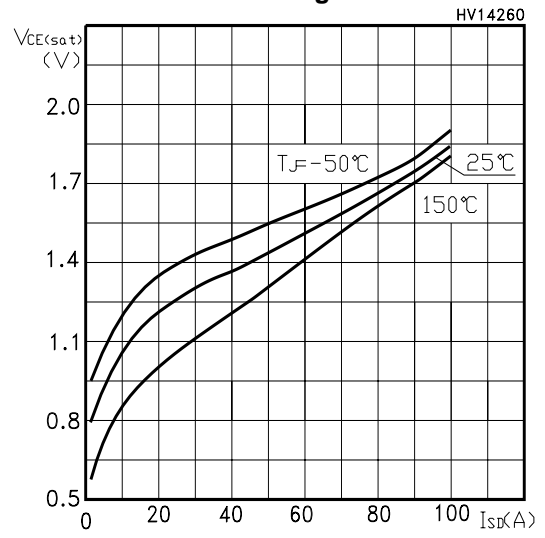


Fig. 1: Gate Charge test Circuit

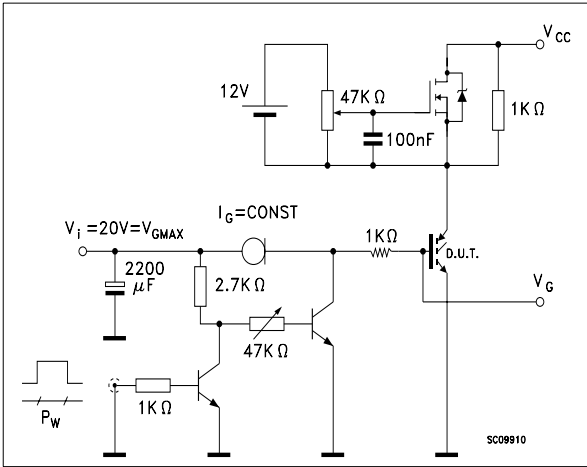
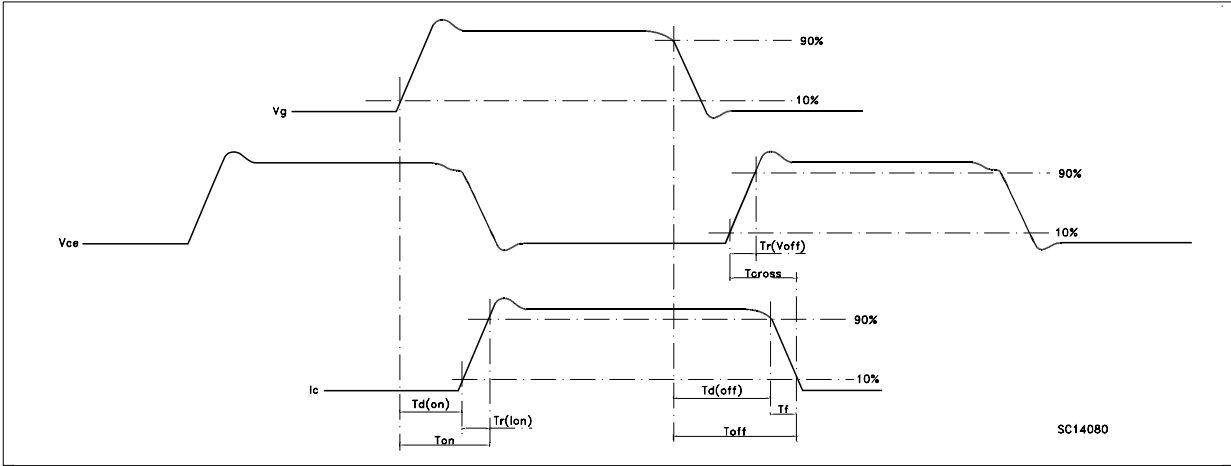
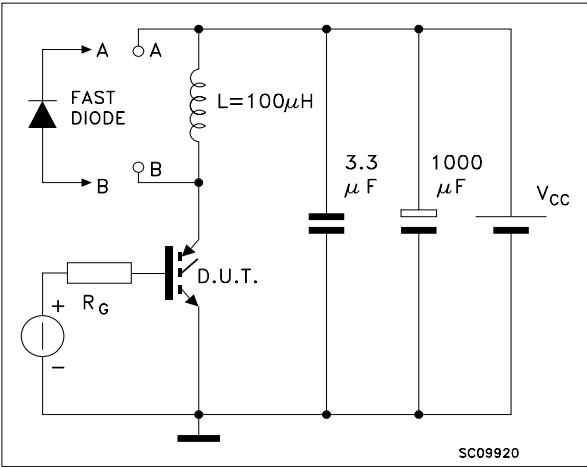
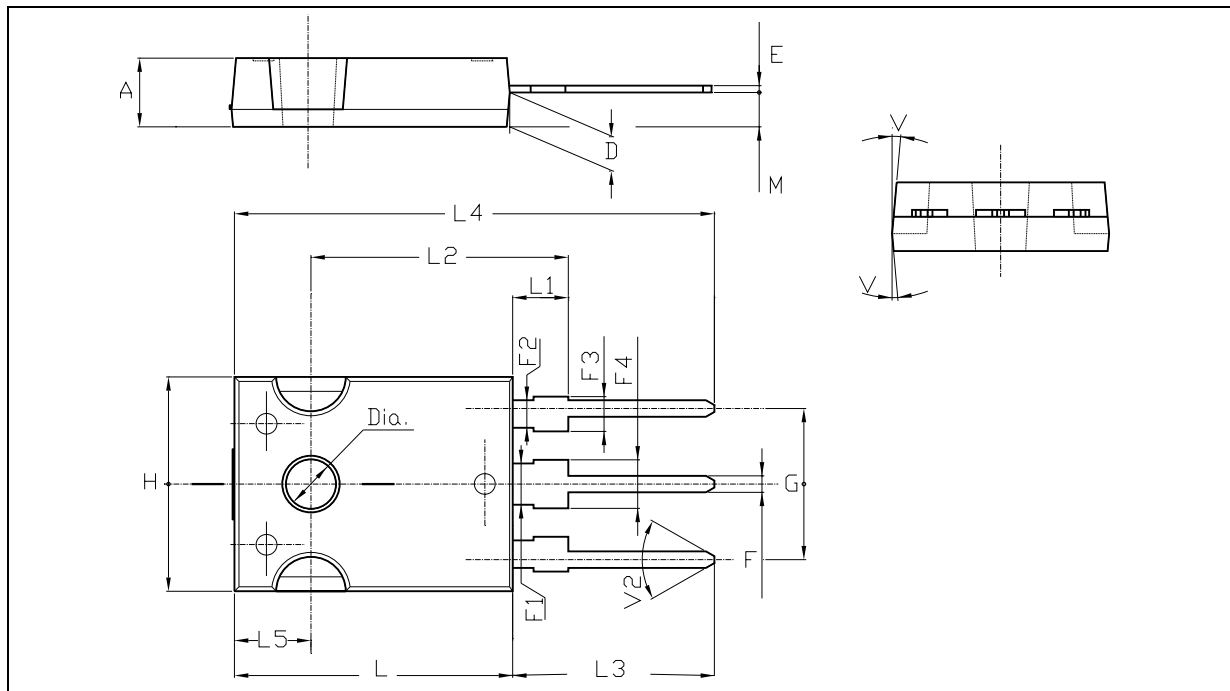


Fig. 2: Test Circuit For Inductive Load Switching



**TO-247 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
D	2.20		2.60	0.08		0.10
E	0.40		0.80	0.015		0.03
F	1		1.40	0.04		0.05
F1		3			0.11	
F2		2			0.07	
F3	2		2.40	0.07		0.09
F4	3		3.40	0.11		0.13
G		10.90			0.43	
H	15.45		15.75	0.60		0.62
L	19.85		20.15	0.78		0.79
L1	3.70		4.30	0.14		0.17
L2		18.50			0.72	
L3	14.20		14.80	0.56		0.58
L4		34.60			1.36	
L5		5.50			0.21	
M	2		3	0.07		0.11
V		5°			5°	
V2		60°			60°	
Dia	3.55		3.65	0.14		0.143





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