

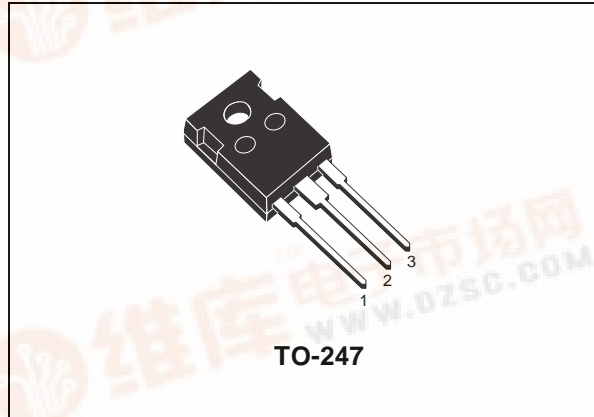


# STGW20NB60K

## N-CHANNEL 20A - 600V - TO-247 SHORT CIRCUIT PROOF PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGW20NB60K	600 V	< 2.8 V	20 A

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- LATCH CURRENT FREE OPERATION

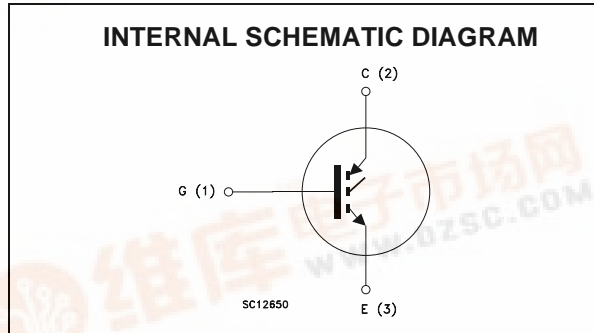


### DESCRIPTION

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 "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

### APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- U.P.S.
- 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>	Emitter-Collector Voltage	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	40	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	20	A
I <sub>CM</sub> (■)	Collector Current (pulsed)	80	A
T <sub>sc</sub>	Short Circuit Withstand	10	μs
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	150	W
	Derating Factor	1	W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>J</sub>	Max. Operating Junction Temperature	150	°C

## STGW20NB60K

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	0.83	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
Rthc-h	Thermal Resistance Case-heatsink Typ	0.5	°C/W

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collectro-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> = ±20V, 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> = 250μA	5		7	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 20 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 20 A, T <sub>j</sub> = 125°C		2.3 1.9	2.8	V V

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V, I <sub>C</sub> = 20 A		8		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		1300		pF
C <sub>oes</sub>	Output Capacitance			200		pF
C <sub>res</sub>	Reverse Transfer Capacitance			30		pF
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 480V, I <sub>C</sub> = 20 A, V <sub>GE</sub> = 15V		90		nC
Q <sub>ge</sub>	Gate-Emitter Charge			T.B.D.		nC
Q <sub>gc</sub>	Gate-Collector Charge			T.B.D.		nC
t <sub>scw</sub>	Short Circuit Withstand Time	V <sub>ce</sub> = 0.5 BV <sub>ces</sub> , V <sub>GE</sub> = 15 V, T <sub>j</sub> = 125°C, R <sub>G</sub> = 10 Ω	10			μs

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 20 A R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15 V		20		ns
t <sub>r</sub>	Rise Time			70		ns
(di/dt) <sub>on</sub>	Turn-on Current Slope	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 20 A R <sub>G</sub> = 10Ω V <sub>GE</sub> = 15 V, T <sub>j</sub> = 125°C		350		A/μs
E <sub>on</sub>	Turn-on Switching Losses			300		μJ

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING OFF

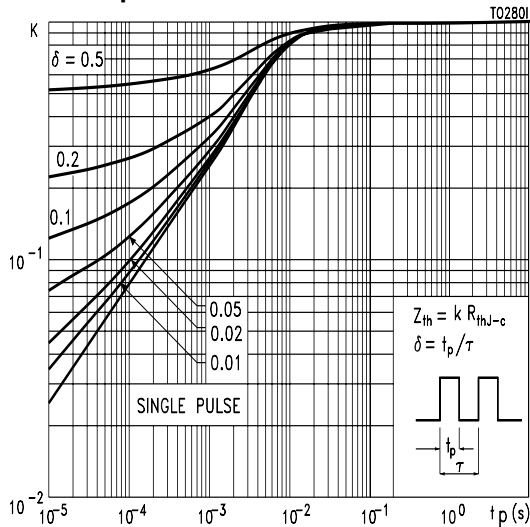
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 20 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		120		ns
$t_r(V_{off})$	Off Voltage Rise Time			35		ns
$t_{d(off)}$	Delay Time			130		ns
$t_f$	Fall Time			80		ns
$E_{off(**)}$	Turn-off Switching Loss			0.45		mJ
$E_{ts}$	Total Switching Loss			0.6		mJ
$t_c$	Cross-over Time		$V_{CC} = 480 \text{ V}$ , $I_C = 20 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_j = 125 \text{ }^\circ\text{C}$		190	
$t_r(V_{off})$	Off Voltage Rise Time			55		ns
$t_{d(off)}$	Delay Time			160		ns
$t_f$	Fall Time			150		ns
$E_{off(**)}$	Turn-off Switching Loss			0.75		mJ
$E_{ts}$	Total Switching Loss			1.05		mJ

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

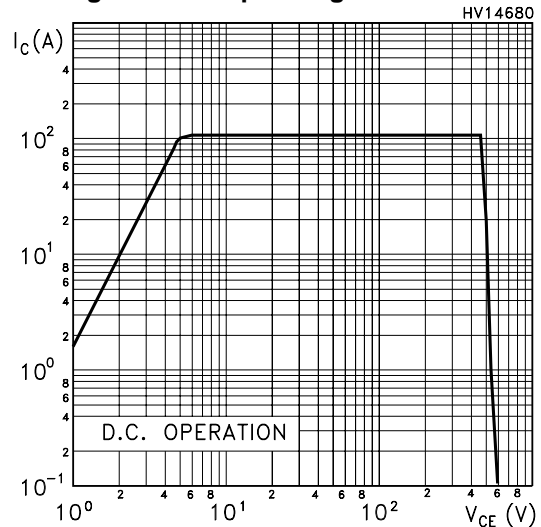
2. Pulse width limited by max. junction temperature.

(\*\*) Losses include Also the Tail (Jedec Standardization)

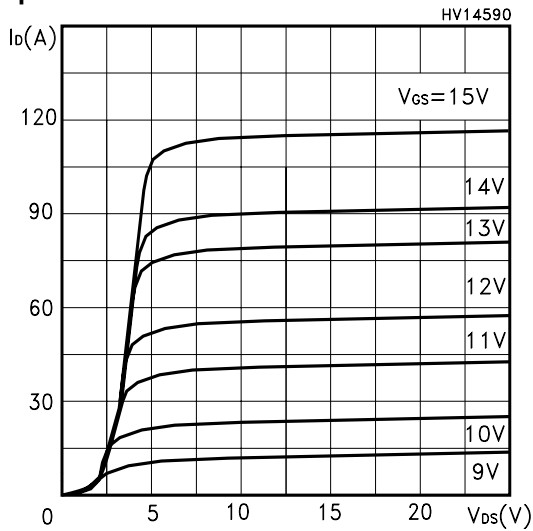
**Thermal Impedance**



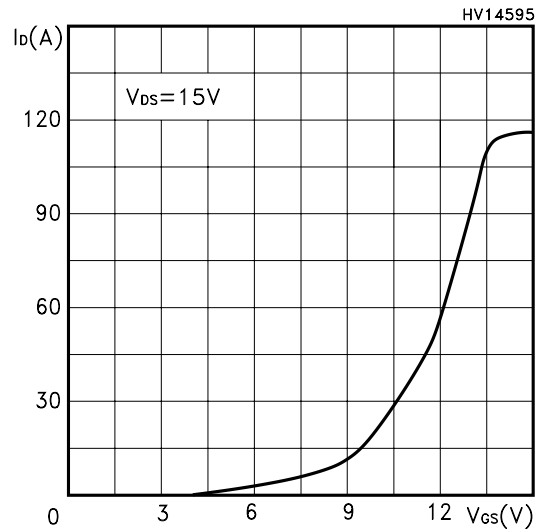
**Switching Off Safe Operating Area**



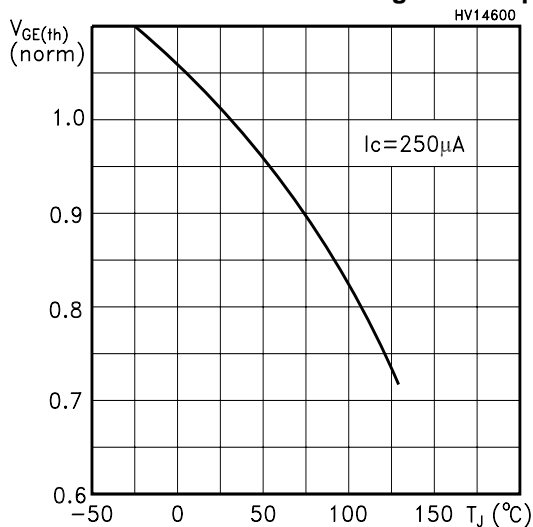
**Output Characteristics**



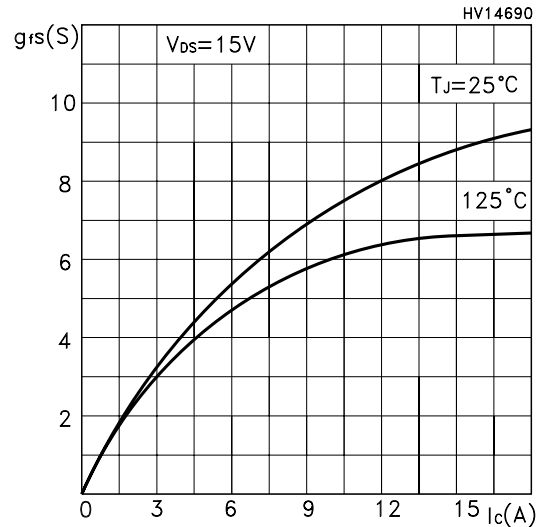
**Transfer Characteristics**



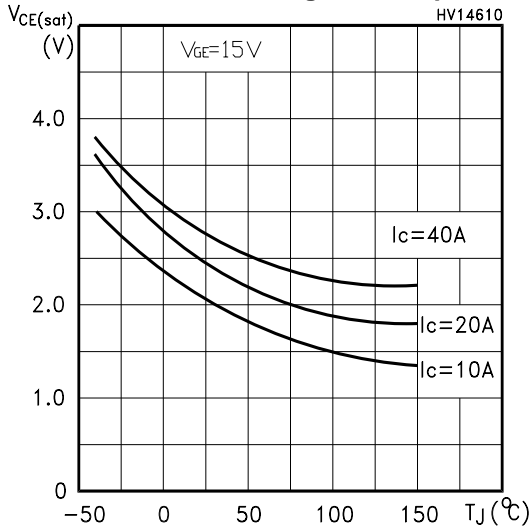
**Normalized Gate Threshold Voltage vs Temp.**



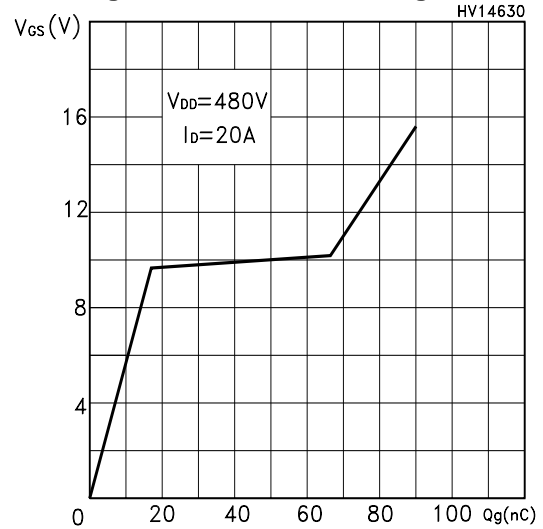
**Transconductance**



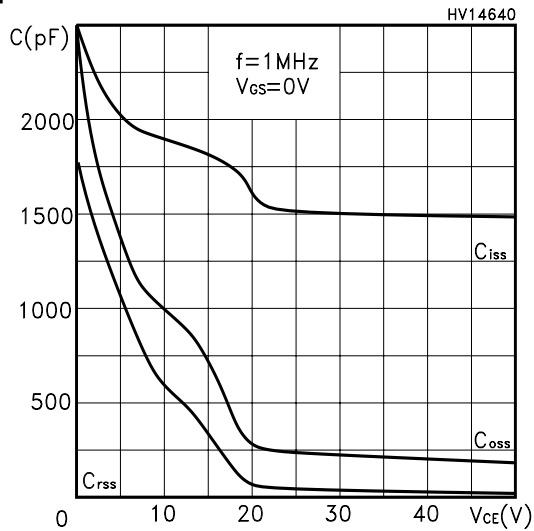
Collector-Emitter On Voltage vs Temperature



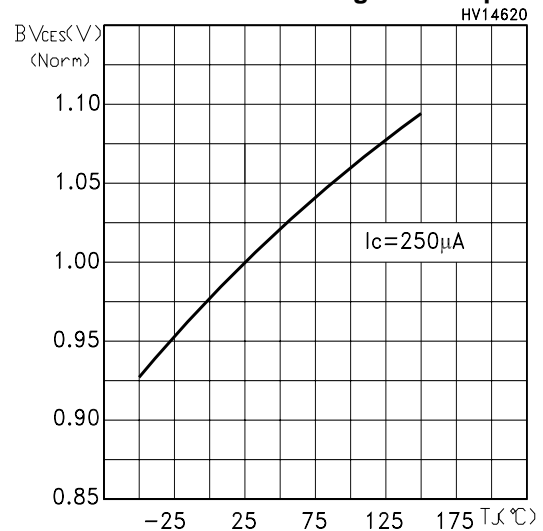
Gate-Charge vs Gate-Emitter Voltage



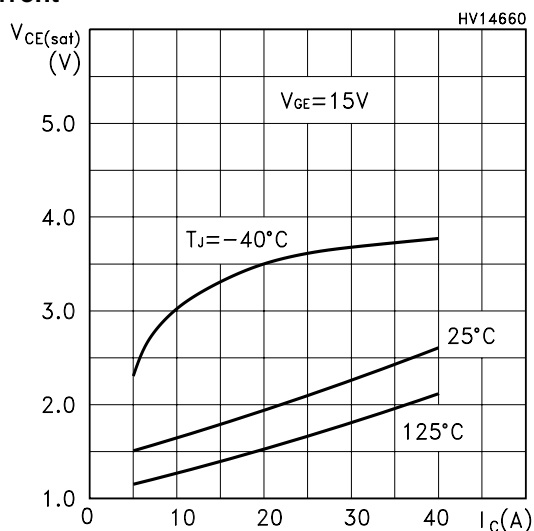
Capacitance Variations



Normalized Break-down Voltage vs Temp.



Collector-Emitter on Voltage vs Collector Current



Turn-Off Energy Losses vs Temperature

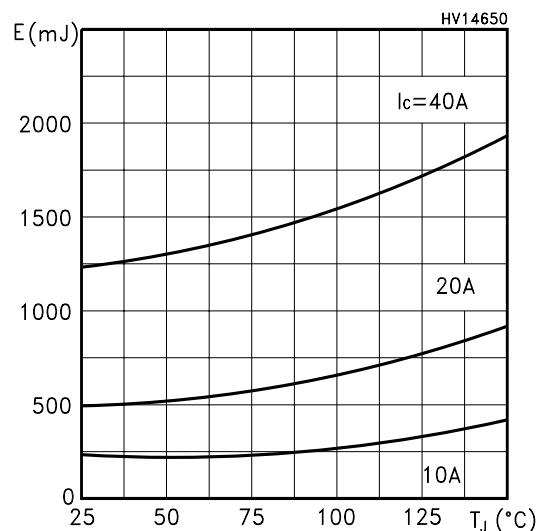


Fig. 1: Gate Charge test Circuit

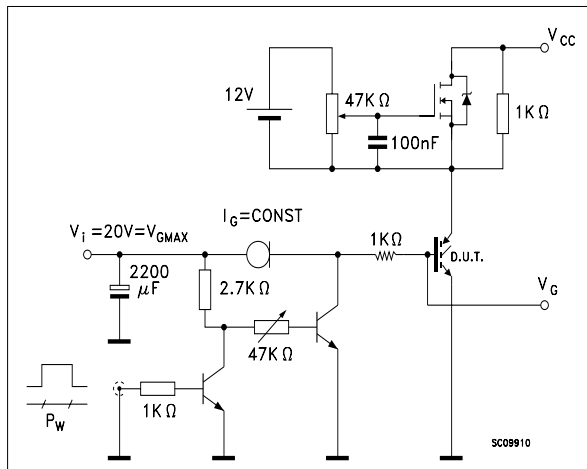
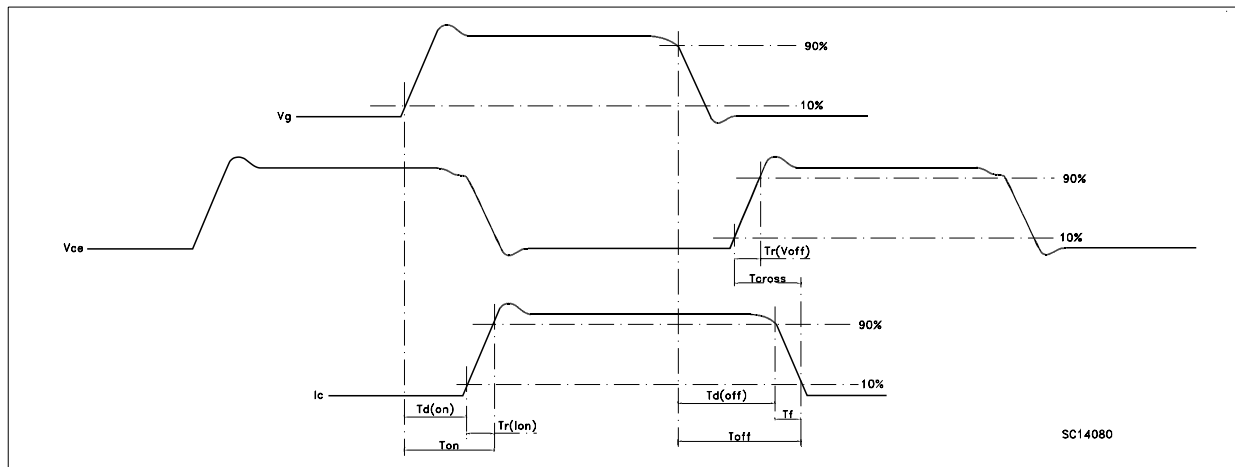
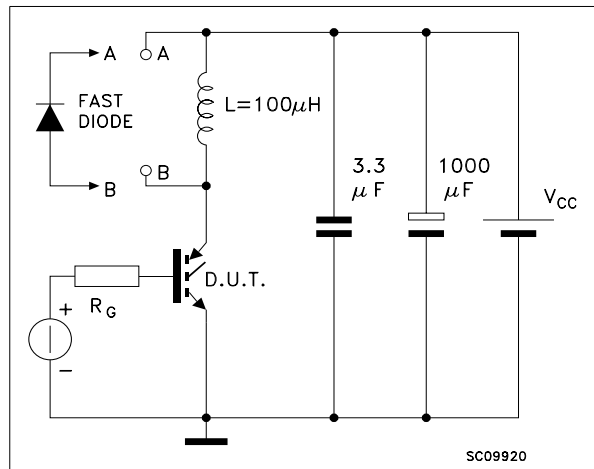
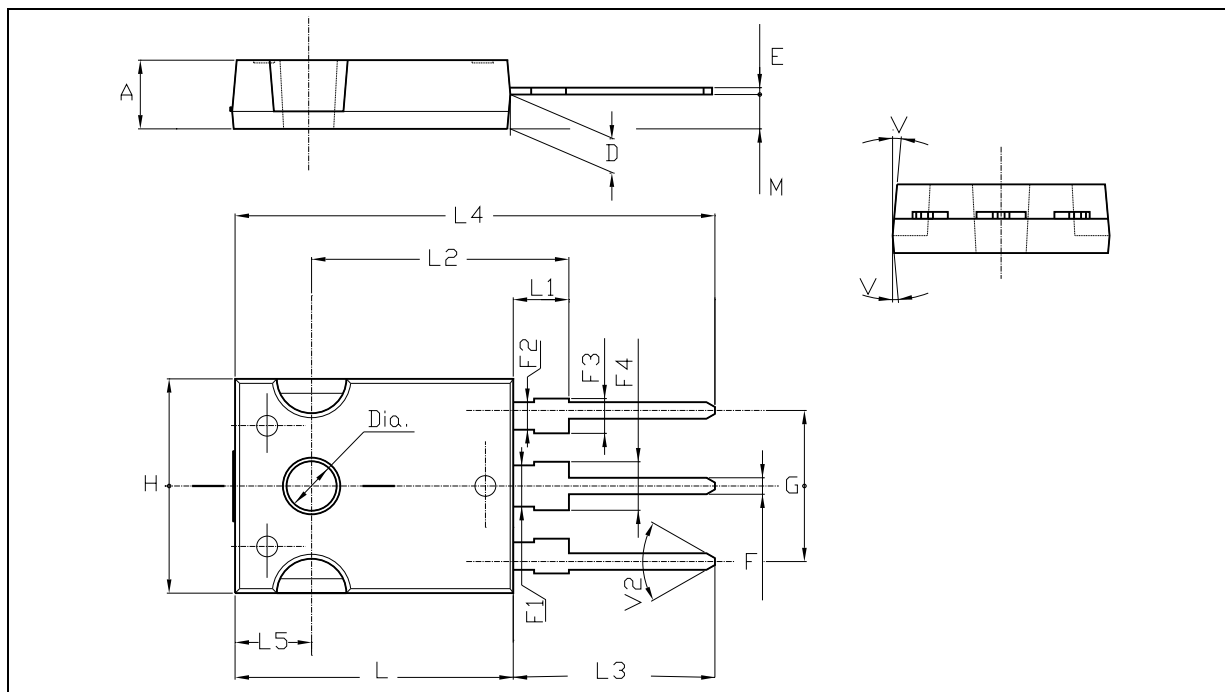


Fig. 2: Test Circuit For Inductive Load Switching



## 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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