



# STGW20NB60KD

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>
STGW20NB60KD	600 V	< 2.8 V	20 A

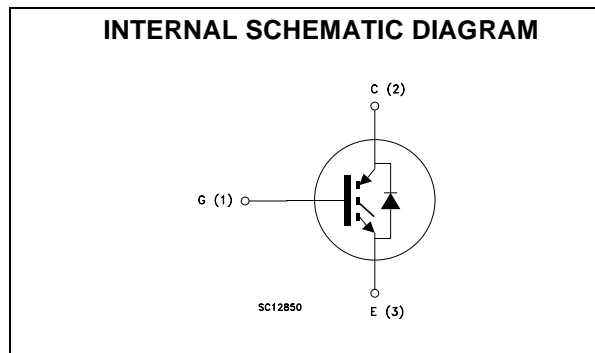
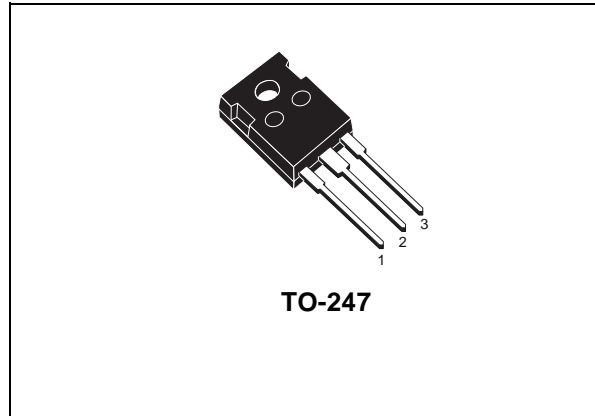
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- LATCH CURRENT FREE OPERATION

## 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



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGW20NB60KD	GW20NB60KD	TO-247	TUBE

## STGW20NB60KD

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	600	V
$V_{ECR}$	Emitter-Collector Voltage	20	V
$V_{GE}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current (continuous) at $T_C = 25^\circ\text{C}$	40	A
$I_C$	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	20	A
$I_{CM} (\bullet)$	Collector Current (pulsed)	80	A
$T_{sc}$	Short Circuit Withstand	10	$\mu\text{s}$
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	150	W
	Derating Factor	1.2	W/ $^\circ\text{C}$
$T_{stg}$	Storage Temperature	- 55 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature		

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case Max	0.83	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	50	$^\circ\text{C}/\text{W}$

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collectro-Emitter Breakdown Voltage	$I_C = 250 \mu\text{A}$ , $V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ , $T_C = 25^\circ\text{C}$ $V_{CE} = \text{Max Rating}$ , $T_C = 125^\circ\text{C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{V}$ , $V_{CE} = 0$			$\pm 100$	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 250\mu\text{A}$	5		7	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ , $I_C = 20 \text{ A}$ $V_{GE} = 15\text{V}$ , $I_C = 20 \text{ A}$ , $T_j = 125^\circ\text{C}$		2.3 1.9	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25 \text{ V}$ , $I_C = 20 \text{ A}$		8		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25\text{V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		1560		pF
$C_{oes}$	Output Capacitance			190		pF
$C_{res}$	Reverse Transfer Capacitance			38		pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480\text{V}$ , $I_C = 20 \text{ A}$ , $V_{GE} = 15\text{V}$		85 14.4 51	115	nC nC nC
$t_{scw}$	Short Circuit Withstand Time	$V_{ce} = 0.5 BV_{ces}$ , $V_{GE} = 15 \text{ V}$ , $T_j = 125^\circ\text{C}$ , $R_G = 10 \Omega$	10			$\mu\text{s}$

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480\text{ V}, I_C = 20\text{ A}$ $R_G = 10\ \Omega, V_{GE} = 15\text{ V}$		40		ns
$t_r$	Rise Time			36		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480\text{ V}, I_C = 20\text{ A}, R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}, T_j = 125^\circ\text{C}$		350		A/ $\mu\text{s}$
$E_{on}$	Turn-on Switching Losses			650		$\mu\text{J}$

SWITCHING OFF

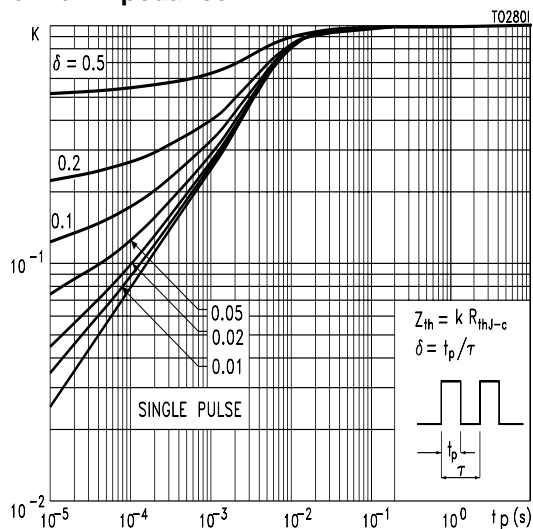
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}, I_C = 20\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$		130		ns
$t_r(V_{off})$	Off Voltage Rise Time			25		ns
$t_{d(off)}$	Delay Time			105		ns
$t_f$	Fall Time			95		ns
$E_{off(**)}$	Turn-off Switching Loss			0.5		mJ
$E_{ts}$	Total Switching Loss			0.6		mJ
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}, I_C = 20\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ $T_j = 125^\circ\text{C}$		175		ns
$t_r(V_{off})$	Off Voltage Rise Time			46		ns
$t_{d(off)}$	Delay Time			130		ns
$t_f$	Fall Time			150		ns
$E_{off(**)}$	Turn-off Switching Loss			0.70		mJ
$E_{ts}$	Total Switching Loss			1.05		mJ

COLLECTOR-EMITTER DIODE

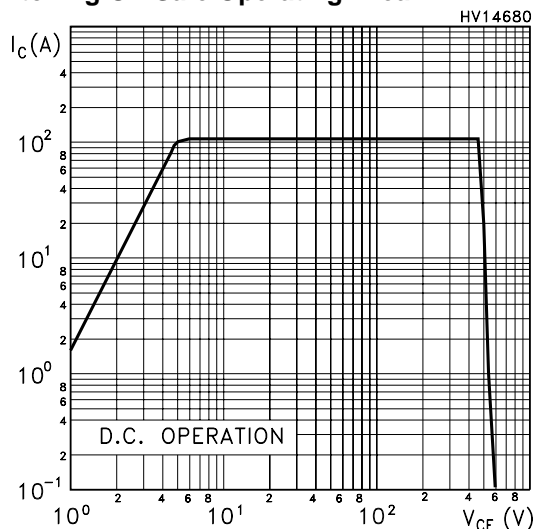
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				20	A
$I_{fm}$	Forward Current pulsed				80	A
$V_f$	Forward On-Voltage	$I_f = 10\text{ A}$ $I_f = 10\text{ A}, T_j = 125^\circ\text{C}$		1.27 1	2.0	V V
$t_{rr}$	Reverse Recovery Time	$I_f = 10\text{ A}, V_R = 27\text{ V},$ $T_j = 125^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}$		80.5		ns
$Q_{rr}$	Reverse Recovery Charge			181		nC
$I_{rrm}$	Reverse Recovery Current			4.5		A

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)

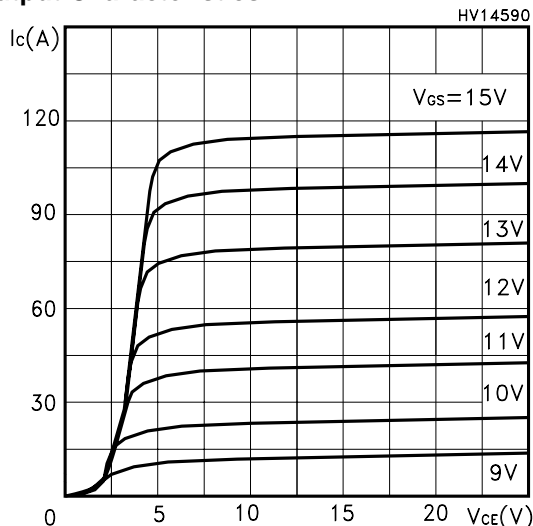
Thermal Impedance



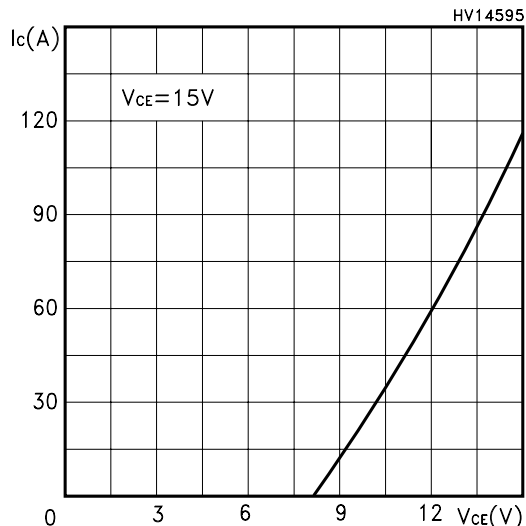
Switching Off Safe Operating Area



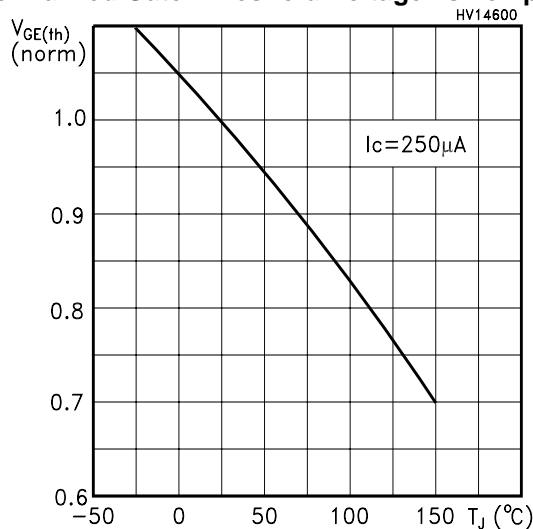
Output Characteristics



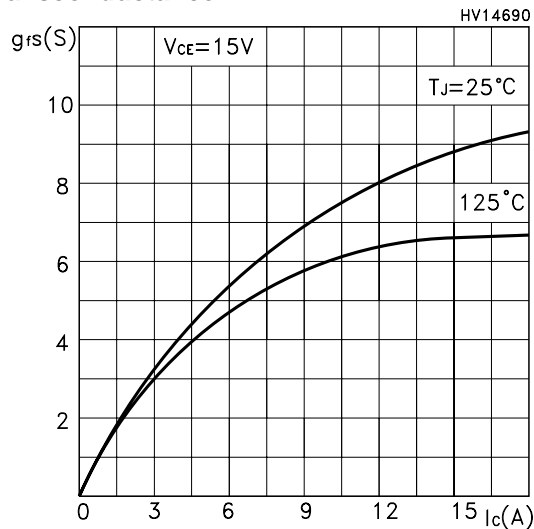
Transfer Characteristics



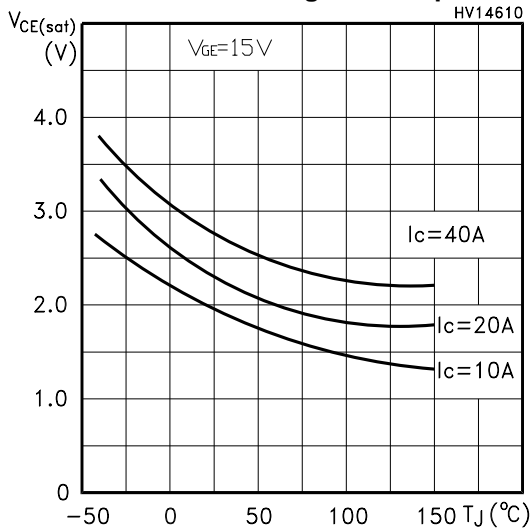
Normalized Gate Threshold Voltage vs Temp.



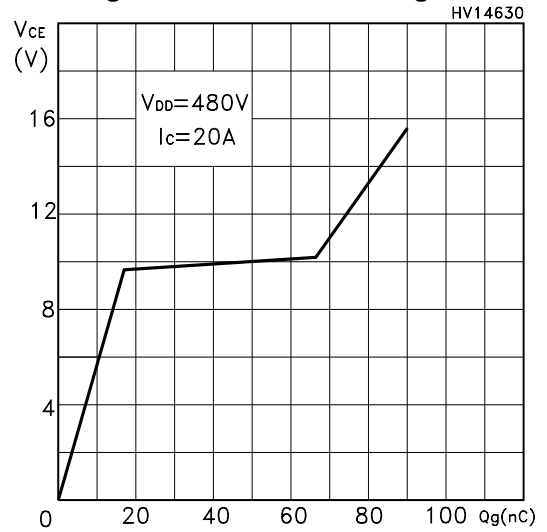
Transconductance



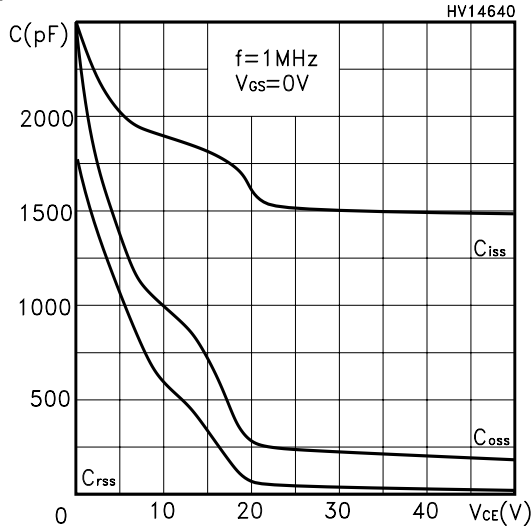
Collector-Emitter On Voltage vs Temperature



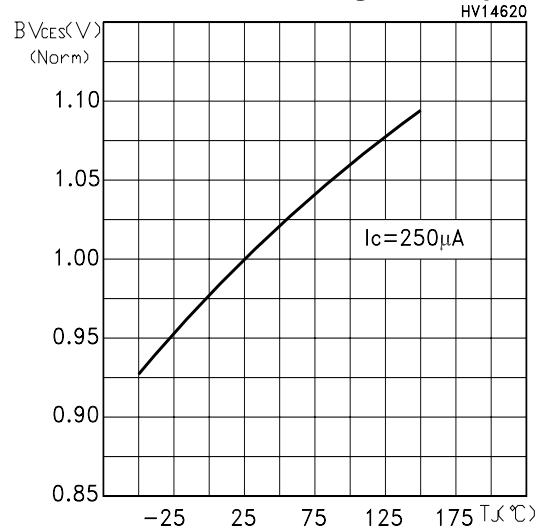
Gate-Charge vs Gate-Emitter Voltage



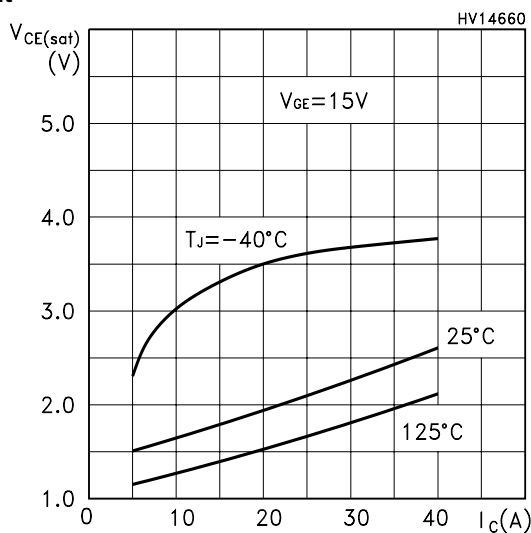
Capacitance Variations



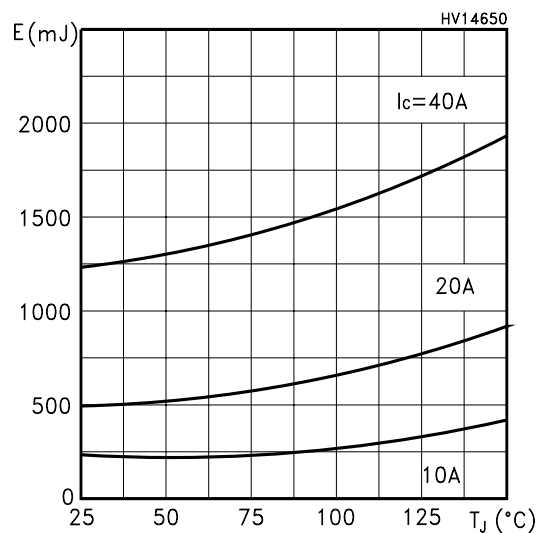
Normalized Break-down Voltage vs Temp.



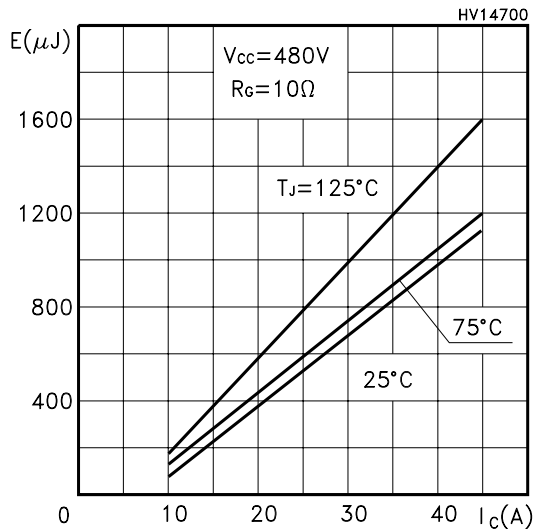
Collector-Emitter on Voltage vs Collector Current



Turn-Off Energy Losses vs Temperature



Total Switch Losses vs Collector Current



Diode Forward Voltage

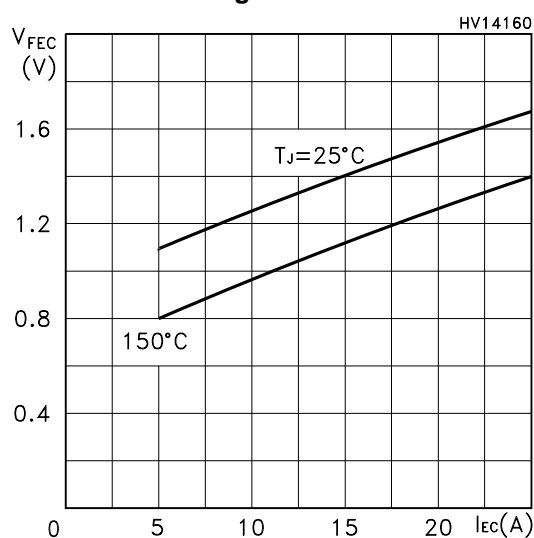


Fig. 1: Gate Charge test Circuit

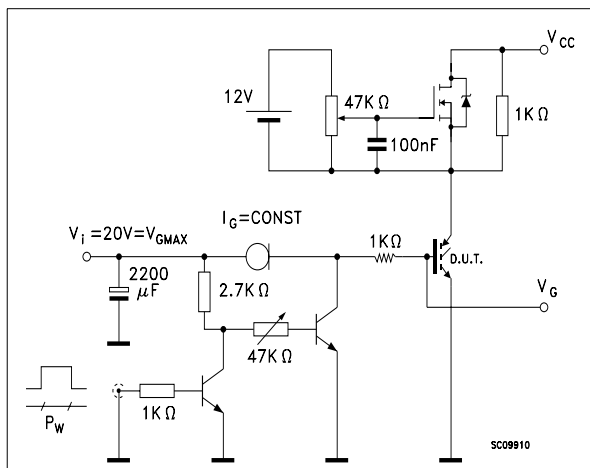
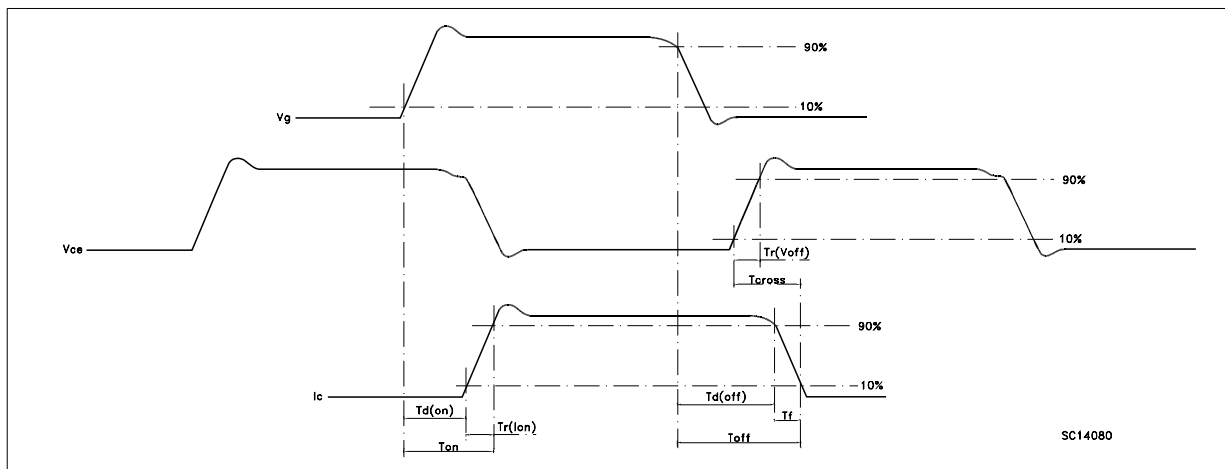
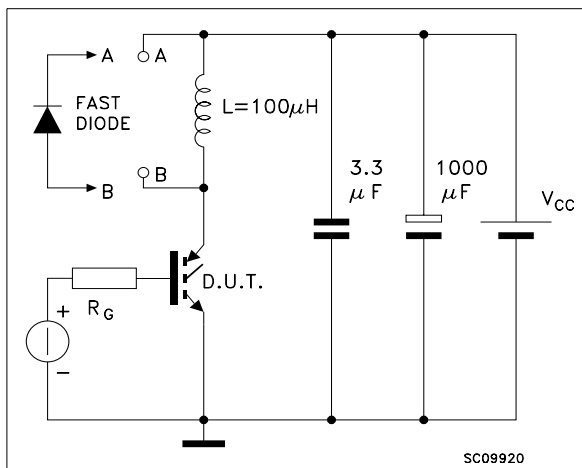
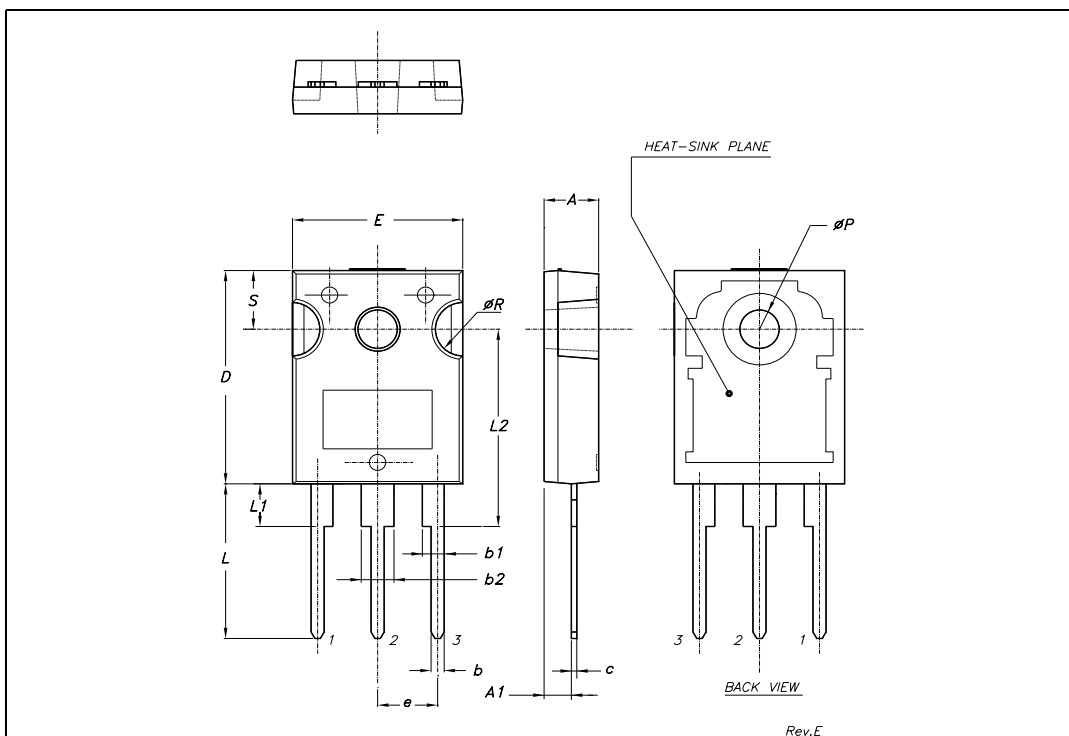


Fig. 2: Test Circuit For Inductive Load Switching



**TO-247 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



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