



# STGW30NC60VD

N-channel 40A - 600V - TO-247  
Very fast switching PowerMESH™ IGBT

## General features

Type	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max)@ 25°C	I <sub>C</sub> @100°C
STGW30NC60VD	600V	<2.5V	40A

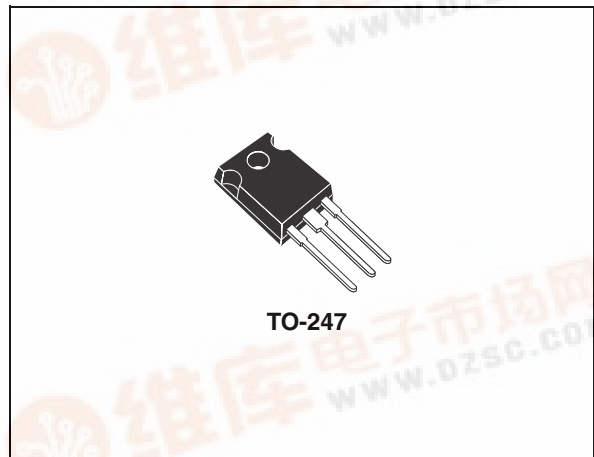
- High current capability
- High frequency operation up to 50KHz
- Very soft ultra fast recovery antiparallel diode
- New generation products with tighter parameter distribution

## Description

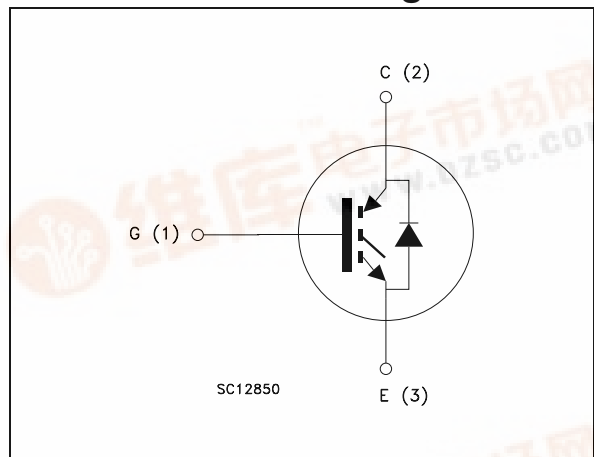
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "V" identifies a family optimized for high frequency.

## Applications

- High frequency inverters, UPS
- Motor drivers
- SMPS and PFC in both hard switch and resonant topologies



## Internal schematic diagram



## Order code

Part number	Marking	Package	Packaging
STGW30NC60VD	GW30NC60VD	TO-247	Tube



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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>GS</sub> = 0)	600	V
I <sub>C</sub> <sup>(1)</sup>	Collector current (continuous) at 25°C	80	A
I <sub>C</sub> <sup>(1)</sup>	Collector current (continuous) at 100°C	40	A
I <sub>CM</sub> <sup>(2)</sup>	Collector current (pulsed)	100	A
I <sub>CL</sub>	Turn-off soa minimum current	100	A
V <sub>GE</sub>	Gate-emitter voltage	± 20	V
I <sub>F</sub>	Diode RMS forward current at T <sub>C</sub> =25°C	30	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	250	W
T <sub>j</sub>	Operating junction temperature	- 55 to 150	°C
T <sub>stg</sub>	Storage temperature		

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

2. Pulse width limited by max junction temperature

**Table 2. Thermal resistance**

Symbol	Parameter	Min.	Typ.	Max.	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case IGBT			0.48	°C/W
	Thermal resistance junction-case diode			1.5	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient			62.5	°C/W

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 3. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	$I_C = 1\text{mA}, V_{GE} = 0$	600			V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$V_{GE}=15\text{V}, I_C=20\text{A}, T_j=25^{\circ}C$ $V_{GE}=15\text{V}, I_C=20\text{A}, T_j=125^{\circ}C$		1.8 1.7	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE}=V_{GE}, I_C=250\mu\text{A}$	3.75		5.75	V
$I_{CES}$	Collector-emitter leakage current ( $V_{GE} = 0$ )	$V_{CE} = \text{Max rating}, T_c=25^{\circ}C$ $V_{CE} = \text{Max rating}, T_c=125^{\circ}C$			250 1	$\mu\text{A}$ mA
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{V}, V_{CE} = 0$			$\pm 100$	nA
$g_{fs}$	Forward transconductance	$V_{CE} = 15\text{V}, I_C = 20\text{A}$		15		S

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{V}, f = 1\text{MHz}, V_{GE} = 0$		2200		pF
$C_{oes}$	Output capacitance			225		pF
$C_{res}$	Reverse transfer capacitance			50		pF
$Q_g$	Total gate charge	$V_{CE} = 390\text{V}, I_C = 20\text{A},$ $V_{GE} = 15\text{V},$ <i>(see Figure 17)</i>		100	140	nC
$Q_{ge}$	Gate-emitter charge			16		nC
$Q_{gc}$	Gate-collector charge			45		nC

**Table 5. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		31		ns
$t_r$	Current rise time	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$		11		ns
$(di/dt)_{onf}$	Turn-on current slope	$T_j=25^\circ\text{C}$ (see Figure 16)		1600		A/ $\mu\text{s}$
$t_{d(on)}$	Turn-on delay time	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		31		ns
$t_r$	Current rise time	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$		11.5		ns
$(di/dt)_{on}$	Turn-on current slope	$T_j=125^\circ\text{C}$ (see Figure 16)		1500		A/ $\mu\text{s}$
$t_{r(Voff)}$	Off voltage rise time	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		28		ns
$t_{d(off)}$	Turn-off delay time	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$		100		ns
$t_f$	Current fall time	$T_j=25^\circ\text{C}$ (see Figure 16)		75		ns
$t_{r(Voff)}$	Off voltage rise time	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		66		ns
$t_{d(off)}$	Turn-off delay time	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$		150		ns
$t_f$	Current fall time	$T_j=125^\circ\text{C}$ (see Figure 16)		130		ns

**Table 6. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		220	300	$\mu\text{J}$
$E_{off}$	Turn-off switching losses	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$ ,		330	450	$\mu\text{J}$
$E_{ts}$	Total switching losses	$T_j=25^\circ\text{C}$ (see Figure 18)		550	750	$\mu\text{J}$
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC}=390\text{ V}$ , $I_C=20\text{ A}$ ,		450		$\mu\text{J}$
$E_{off}$	Turn-off switching losses	$R_G=3.3\Omega$ , $V_{GE}=15\text{ V}$ ,		770		$\mu\text{J}$
$E_{ts}$	Total switching losses	$T_j=125^\circ\text{C}$ (see Figure 18)		1220		$\mu\text{J}$

1.  $E_{on}$  is the turn-on losses when a typical diode is used in the test circuit in Figure 18.  $E_{on}$  include diode recovery energy. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature ( $25^\circ\text{C}$  and  $125^\circ\text{C}$ )

**Table 7. Collector-emitter diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$V_f$	Forward on-voltage	$I_f=10\text{ A}$ $I_f=10\text{ A}$ , $T_j=125^\circ\text{C}$		1.3 1	2.0	V V
$t_{rr}$	Reverse recovery time	$I_f=20\text{ A}$ , $V_R=40\text{ V}$ ,		44		ns
$Q_{rr}$	Reverse recovery charge	$T_j=25^\circ\text{C}$ , $di/dt=100\text{ A}/\mu\text{s}$		66		nC
$I_{rrm}$	Reverse recovery current	(see Figure 19)		3		A
$t_{rr}$	Reverse recovery time	$I_f=20\text{ A}$ , $V_R=40\text{ V}$ ,		88		ns
$Q_{rr}$	Reverse recovery charge	$T_j=125^\circ\text{C}$ ,		237		nC
$I_{rrm}$	Reverse recovery current	$di/dt=100\text{ A}/\mu\text{s}$ (see Figure 19)		5.4		A

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

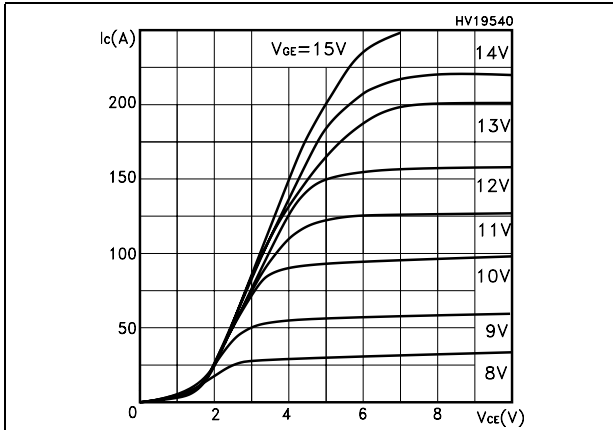


Figure 2. Transfer characteristics

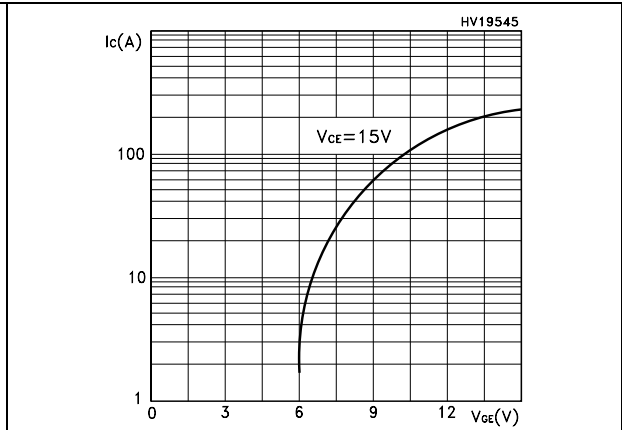


Figure 3. Transconductance

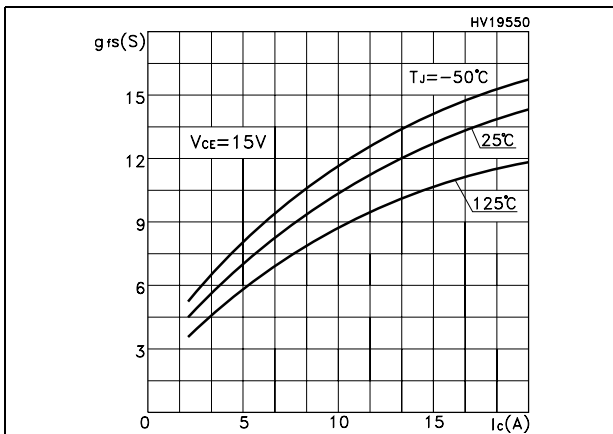


Figure 4. Collector-emitter on voltage vs temperature

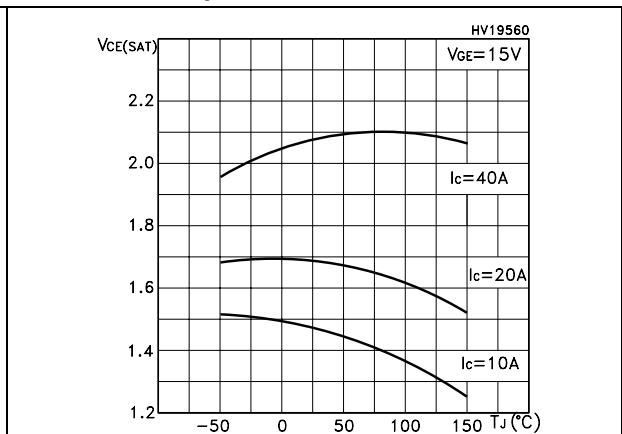


Figure 5. Collector-emitter on voltage vs collector current

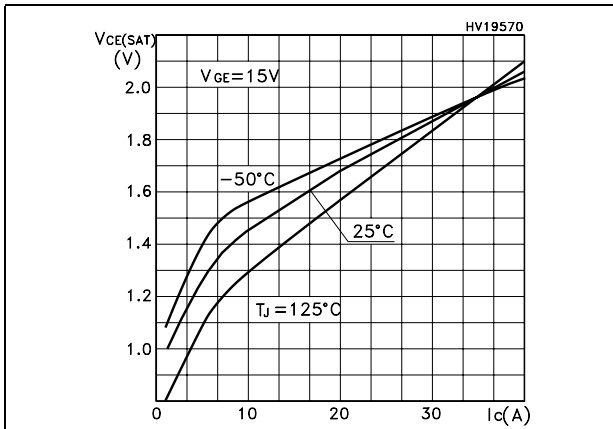


Figure 6. Normalized gate threshold vs temperature

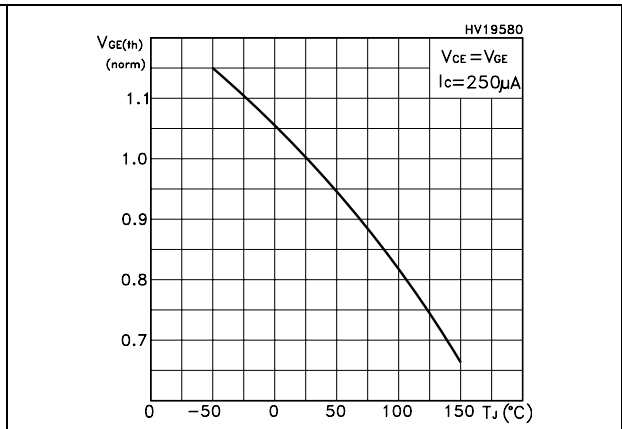


Figure 7. Normalized breakdown voltage vs temperature

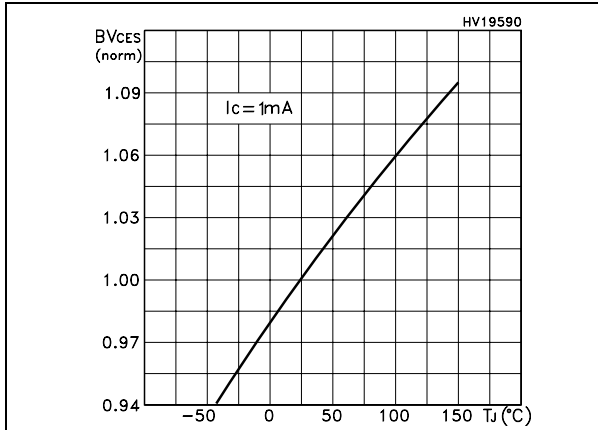


Figure 8. Gate charge vs gate-emitter voltage

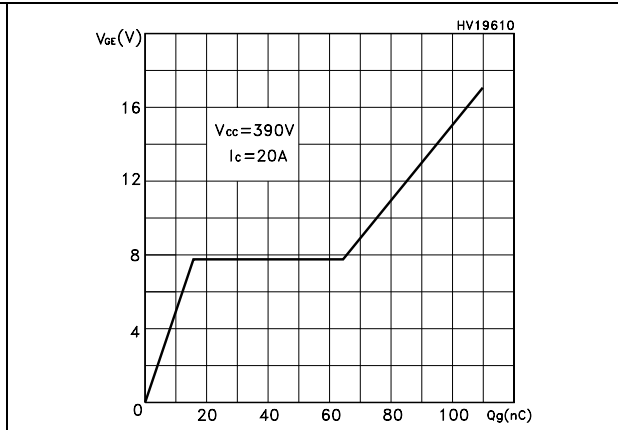


Figure 9. Capacitance variations

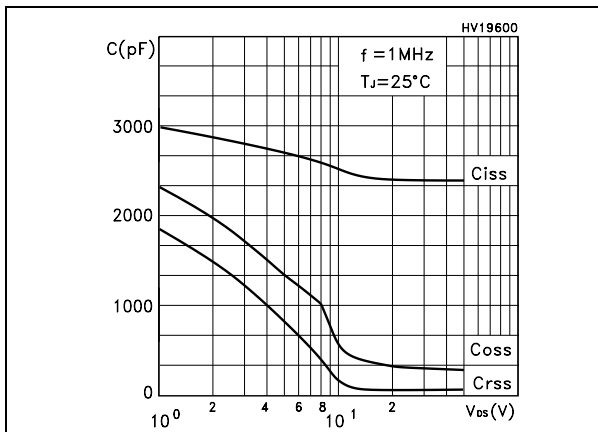


Figure 10. Switching losses vs temperature

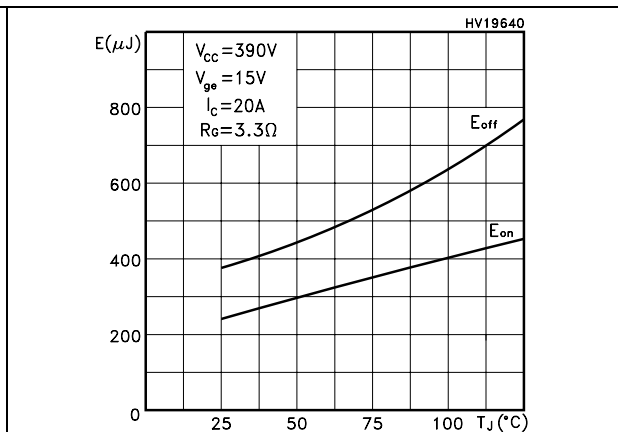


Figure 11. Switching losses vs gate resistance

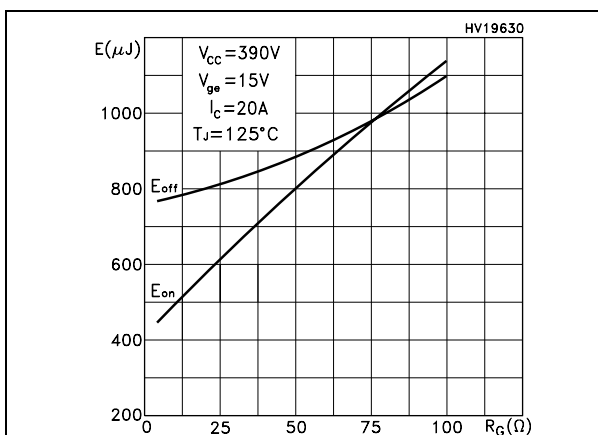


Figure 12. Switching losses vs collector current

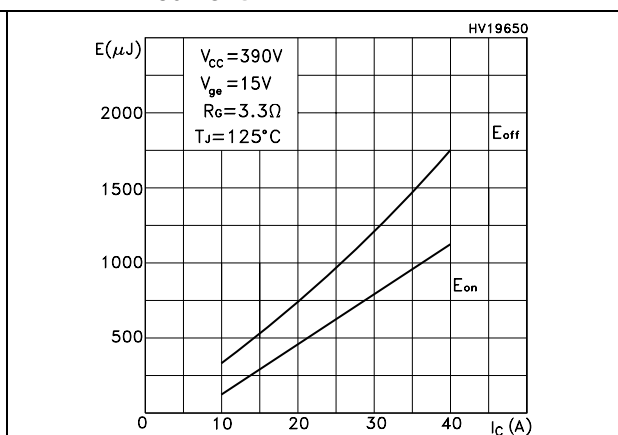


Figure 13. Thermal impedance

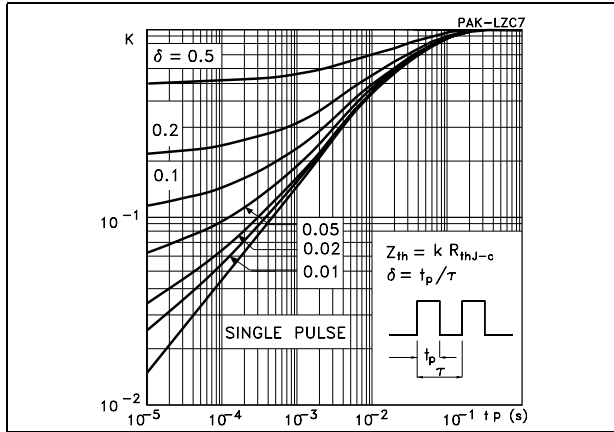


Figure 14. Turn-off SOA

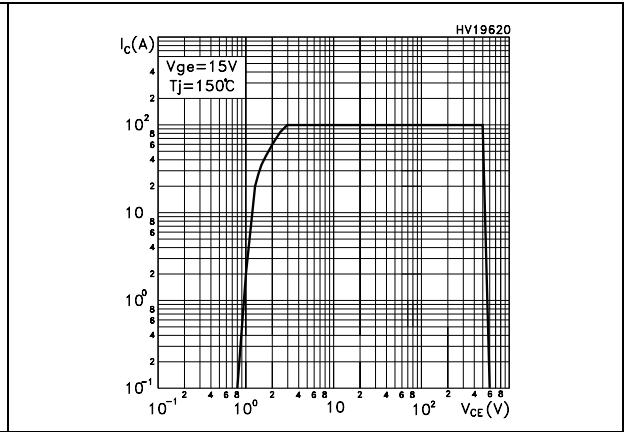
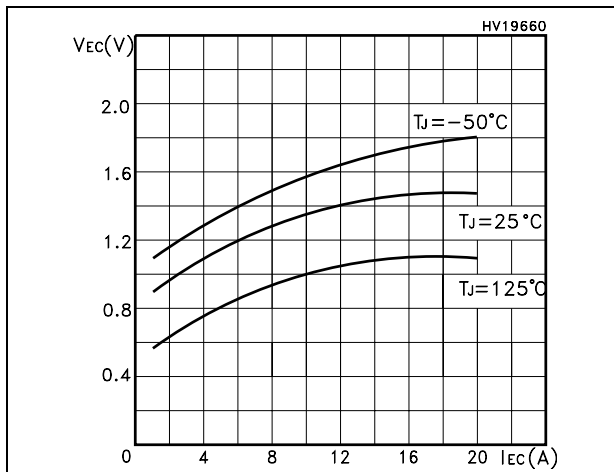


Figure 15. Emitter-collector diode characteristics





### 3 Test circuit

Figure 16. Test circuit for inductive load switching

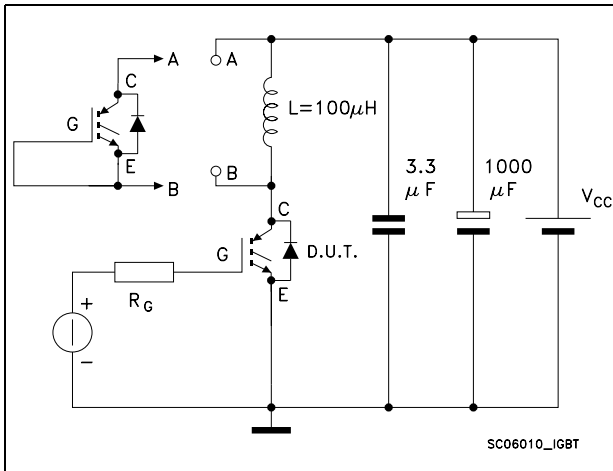


Figure 18. Switching waveforms

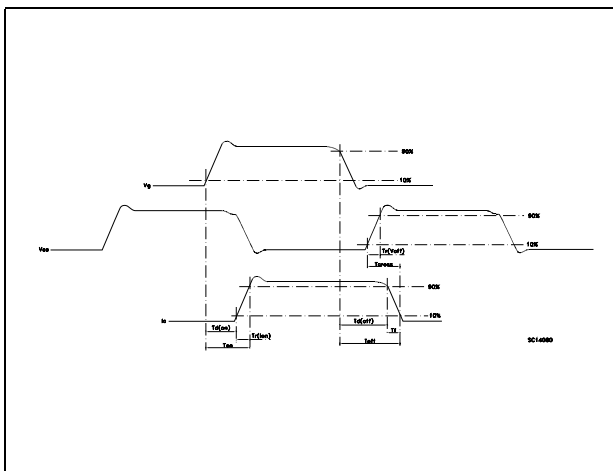


Figure 17. Gate charge test circuit

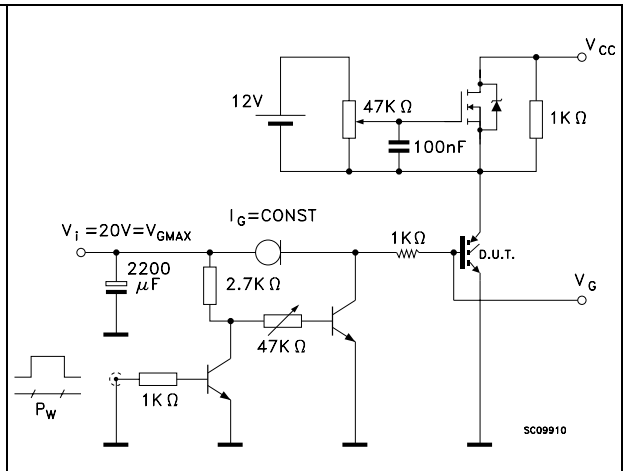
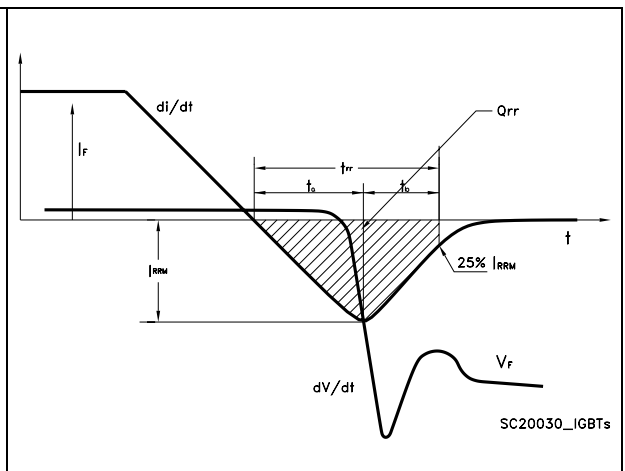


Figure 19. Diode recovery times waveform

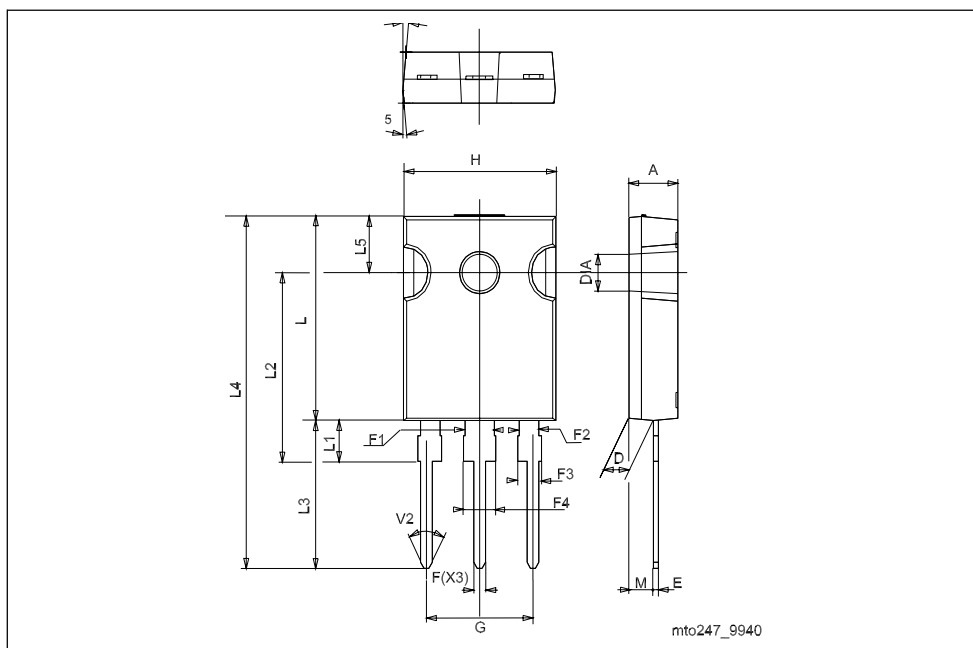


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

## TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.90		5.16	0.193		0.203
D	2.35		2.45	0.093		0.096
E	0.6		0.76	0.024		0.030
F	1.2		1.33	0.047		0.052
F1		3			0.118	
F2		2			0.078	
F3	1.9		2.13	0.075		0.084
F4	3.04		3.2	0.120		0.126
G		10.90			0.429	
H	15.77		16.03	0.621		0.631
L	20.83		21.09	0.820		0.830
L1	3.93		4.45	0.155		0.175
L2	18.72		19.18	0.737		0.755
L3	20.04		20.31	0.789		0.800
L4	40.88		41.40	1.609		1.630
L5	6.04		6.30	0.238		0.248
M	2		3		0.078	0.118
V		5°			5°	
V2		60°			60°	
Diam	3.56		3.66	0.140		0.144



## 5 Revision history

**Table 8. Revision history**

Date	Revision	Changes
12-Feb-2007	1	First release
19-Feb-2007	2	<a href="#">Figure 5.</a> has been updated

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