



STGW30NC60VD

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

General features

Type	V _{CES}	V _{CE(sat)} (Max)@ 25°C	I _C @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

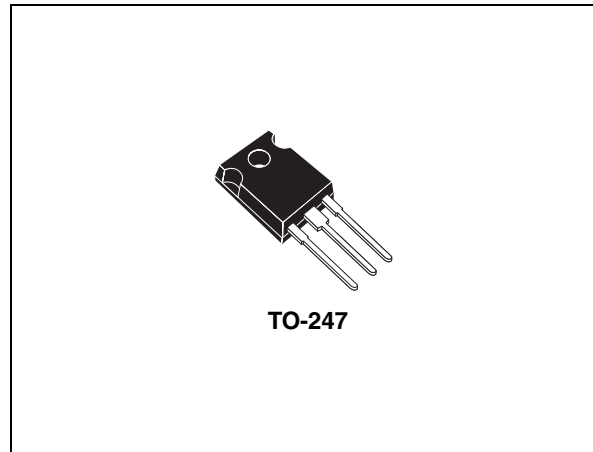
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "V" identifies a family optimized for high frequency.

Applications

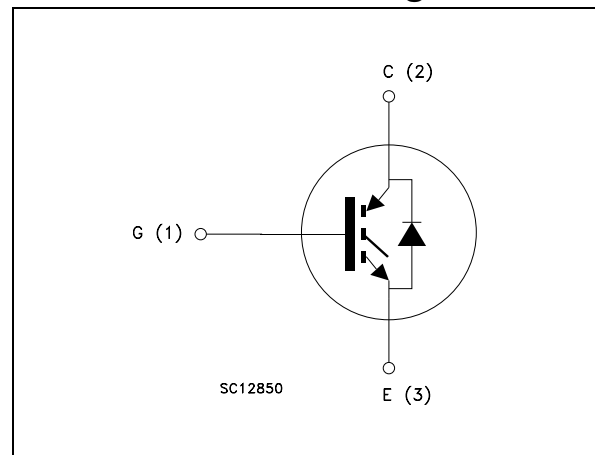
- High frequency inverters, UPS
- Motor drivers
- SMPS and PFC in both hard switch and resonant topologies

Order code

Part number	Marking	Package	Packaging
STGW30NC60VD	GW30NC60VD	TO-247	Tube



Internal schematic diagram



Contents

1 **Electrical ratings** 3

2 **Electrical characteristics** 4

 2.1 Electrical characteristics (curves) 6

3 **Test circuit** 9

4 **Package mechanical data** 10

5 **Revision history** 12

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GS} = 0$)	600	V
$I_C^{(1)}$	Collector current (continuous) at 25°C	80	A
$I_C^{(1)}$	Collector current (continuous) at 100°C	40	A
$I_{CM}^{(2)}$	Collector current (pulsed)	100	A
I_{CL}	Turn-off soa minimum current	100	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Diode RMS forward current at $T_C = 25^\circ\text{C}$	30	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	250	W
T_j	Operating junction temperature	– 55 to 150	°C
T_{stg}	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
Rthj-case	Thermal resistance junction-case IGBT			0.48	°C/W
	Thermal resistance junction-case diode			1.5	°C/W
Rthj-amb	Thermal resistance junction-ambient			62.5	°C/W

2 Electrical characteristics

($T_{CASE}=25^{\circ}\text{C}$ 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	$V_{GE}=15\text{V}$, $I_C=20\text{A}$, $T_j=25^{\circ}\text{C}$ $V_{GE}=15\text{V}$, $I_C=20\text{A}$, $T_j=125^{\circ}\text{C}$		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 ($V_{GE} = 0$)	$V_{CE} = \text{Max rating}$, $T_c=25^{\circ}\text{C}$ $V_{CE}= \text{Max rating}$, $T_c=125^{\circ}\text{C}$			250 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{V}$, $V_{CE} = 0$			± 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	$V_{CE} = 390\text{V}$, $I_C = 20\text{A}$, $V_{GE} = 15\text{V}$, (see Figure 17)		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/ μs
$t_{d(on)}$	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/ μs
$t_{r(Voff)}$	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	μJ
E_{off}	Turn-off switching losses	$R_G=3.3\Omega$, $V_{GE}=15\text{ V}$,		330	450	μJ
E_{ts}	Total switching losses	$T_j=25^\circ\text{C}$ (see Figure 18)		550	750	μJ
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC}=390\text{ V}$, $I_C=20\text{ A}$,		450		μJ
E_{off}	Turn-off switching losses	$R_G=3.3\Omega$, $V_{GE}=15\text{ V}$,		770		μJ
E_{ts}	Total switching losses	$T_j=125^\circ\text{C}$ (see Figure 18)		1220		μJ

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-pak diode, the co-pak diode is used as external diode. IGBTs & Diode are at the same temperature (25°C and 125°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

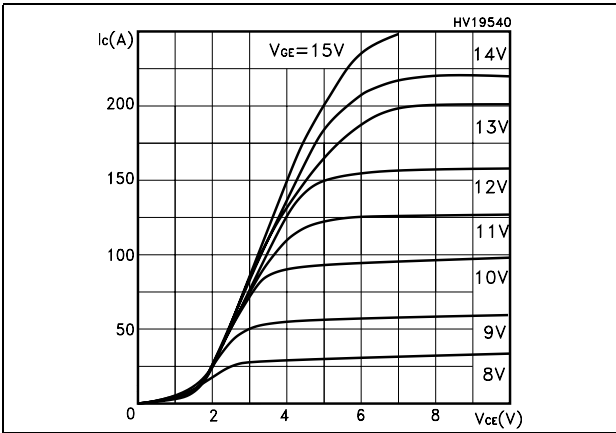


Figure 2. Transfer characteristics

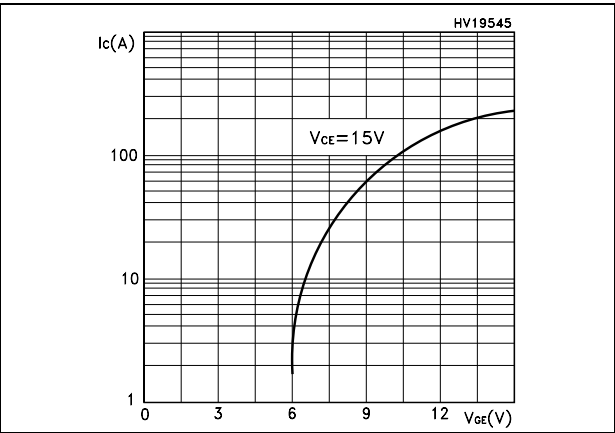


Figure 3. Transconductance

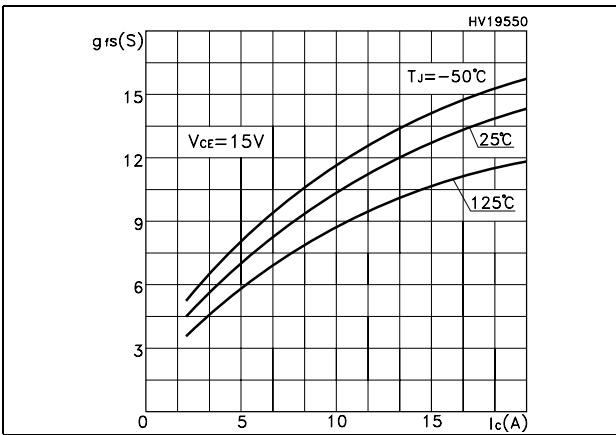


Figure 4. Collector-emitter on voltage vs temperature

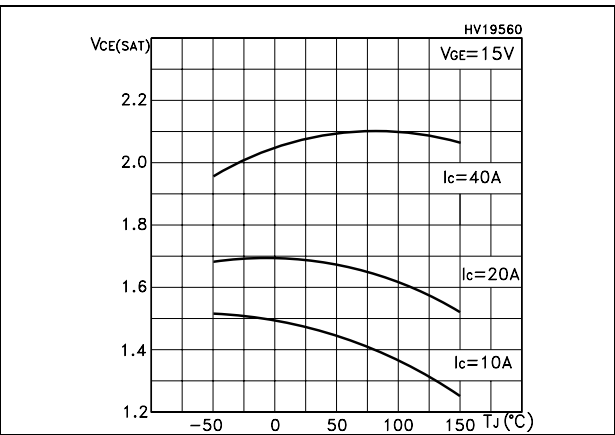


Figure 5. Collector-emitter on voltage vs collector current

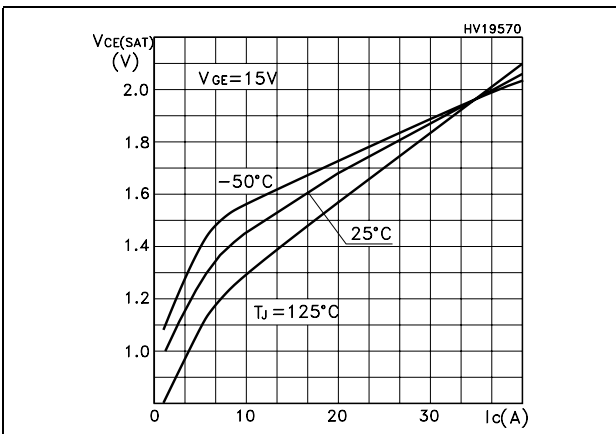


Figure 6. Normalized gate threshold vs temperature

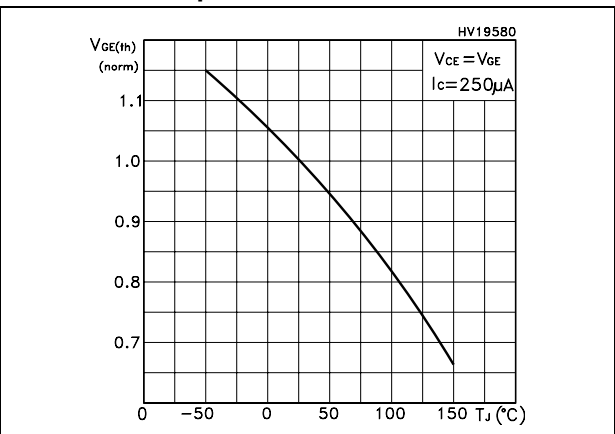


Figure 7. Normalized breakdown voltage vs temperature

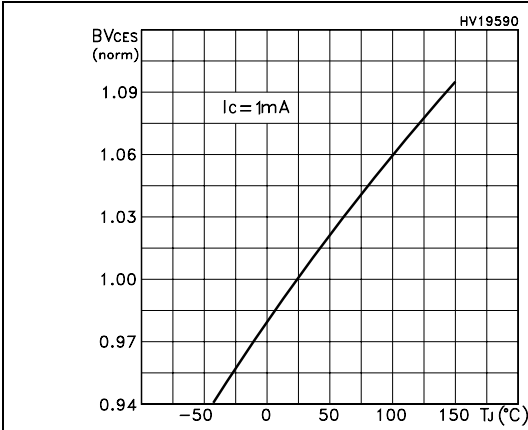


Figure 8. Gate charge vs gate-emitter voltage

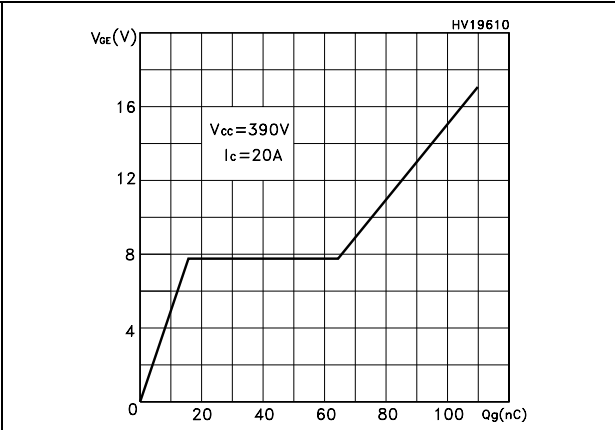


Figure 9. Capacitance variations

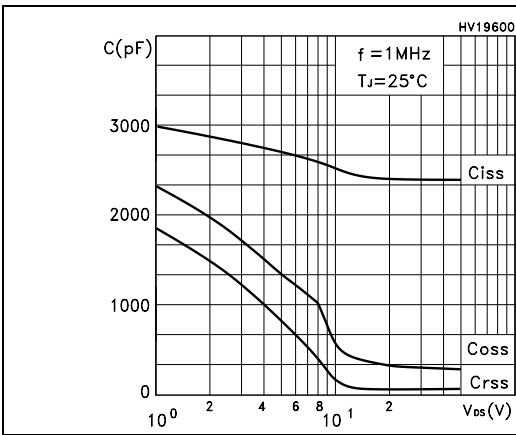


Figure 10. Switching losses vs temperature

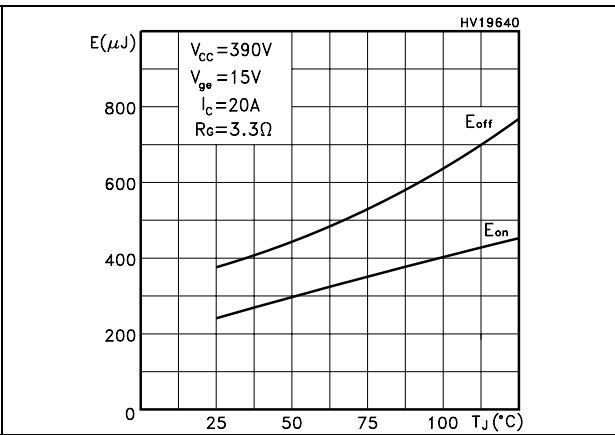


Figure 11. Switching losses vs gate resistance

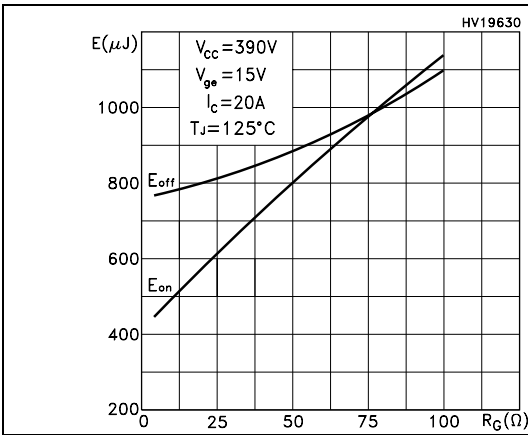


Figure 12. Switching losses vs collector current

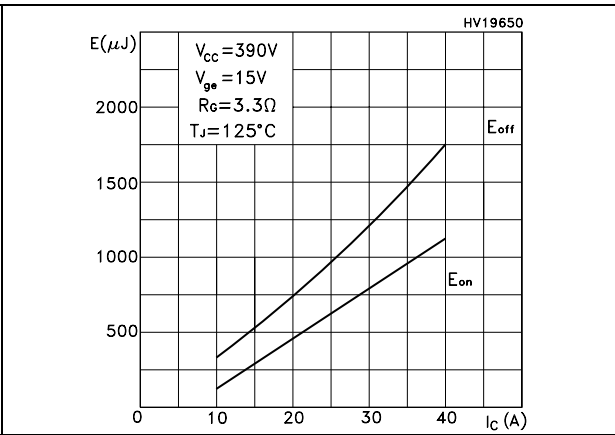


Figure 13. Thermal impedance

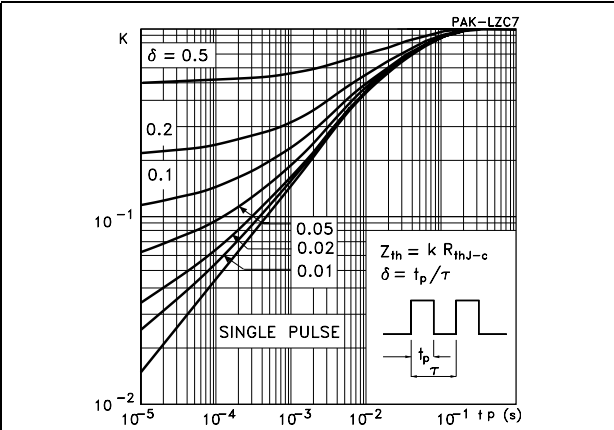


Figure 14. Turn-off SOA

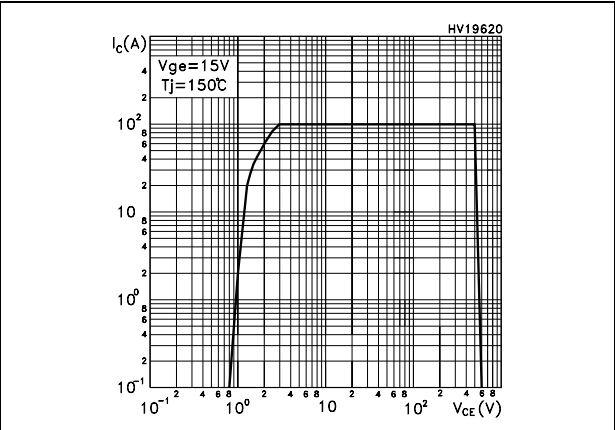
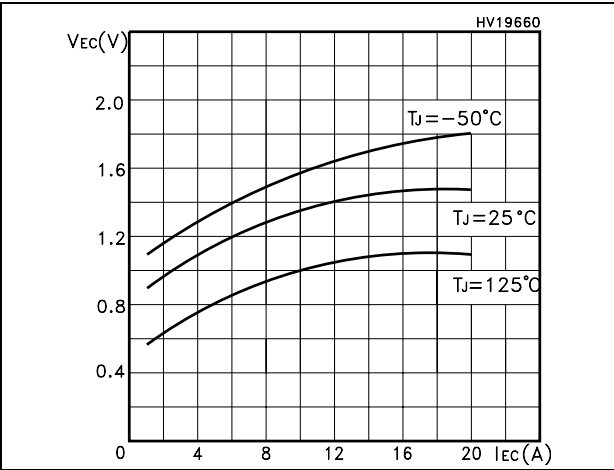


Figure 15. Emitter-collector diode characteristics



3 Test circuit

Figure 16. Test circuit for inductive load switching

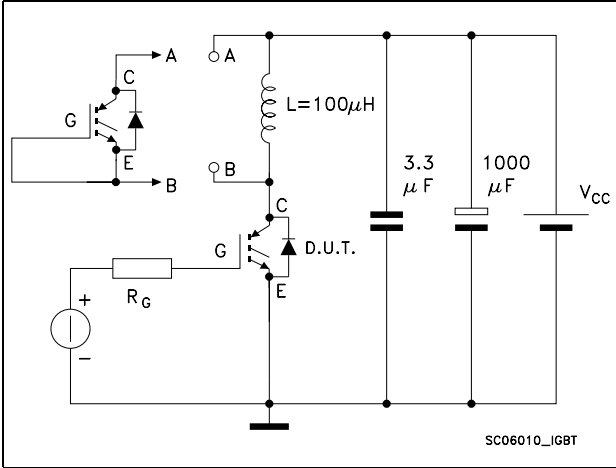


Figure 17. Gate charge test circuit

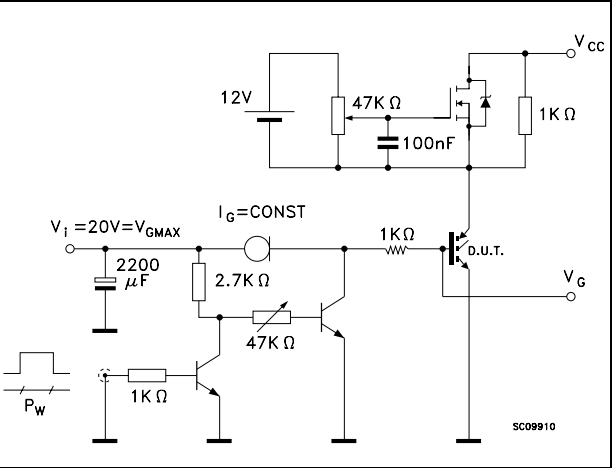


Figure 18. Switching waveforms

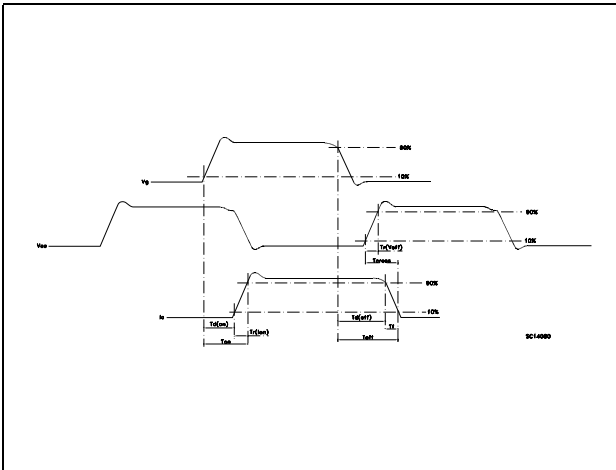
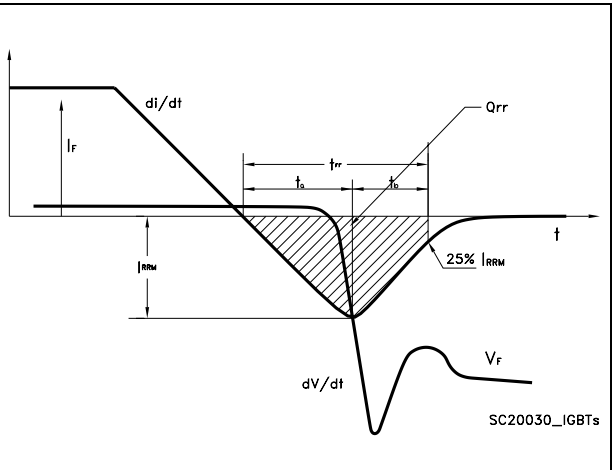


Figure 19. Diode recovery times waveform

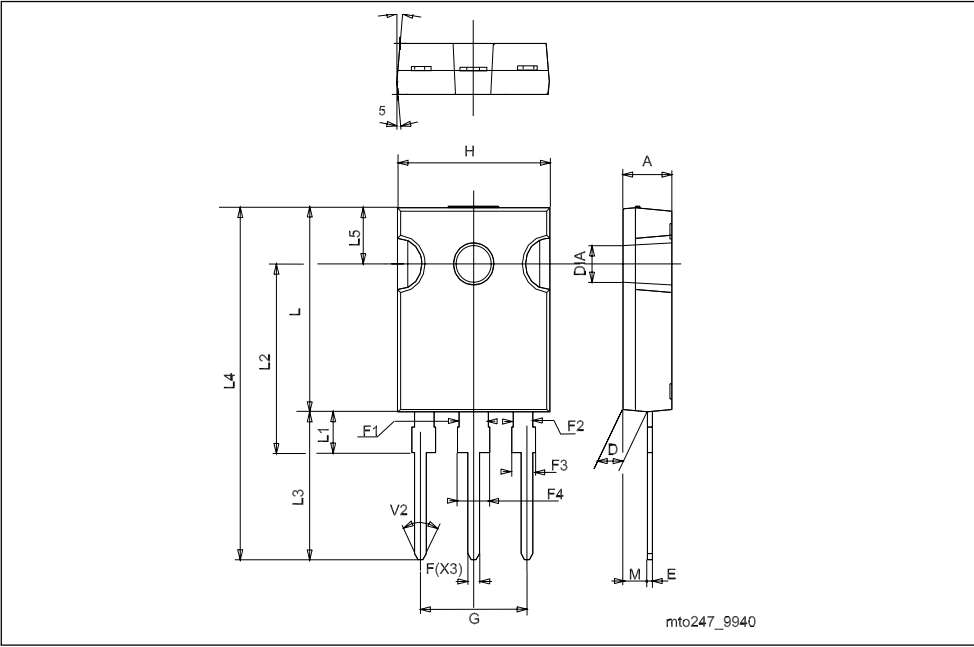


4 **Package mechanical data**

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

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	<i>Figure 5.</i> has been updated

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2007 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com