



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

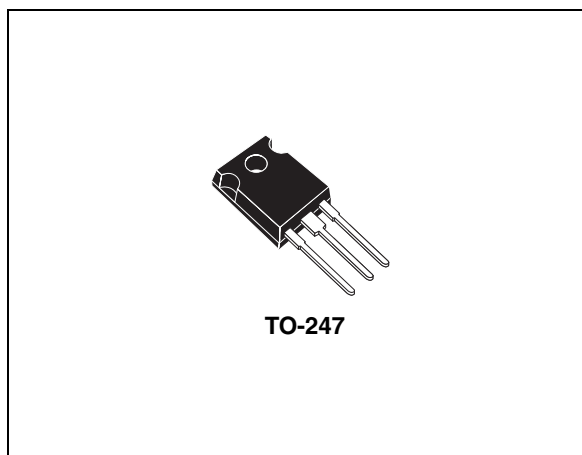
- High current capability
- High frequency operation up to 50KHz
- Very soft ultra fast recovery antiparallel diode
- New generation products with tighter parameter distribution

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

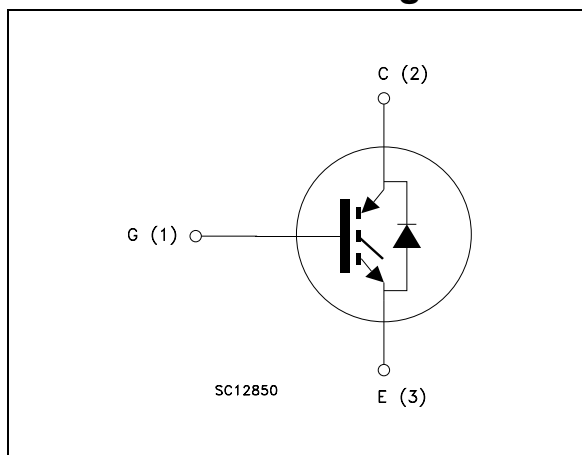
- High frequency inverters, UPS
- Motor drivers
- SMPS and PFC in both hard switch and resonant topologies



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°C	30	A
P _{TOT}	Total dissipation at T _C = 25°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
R _{thj-case}	Thermal resistance junction-case IGBT			0.48	°C/W
	Thermal resistance junction-case diode			1.5	°C/W
R _{thj-amb}	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	$I_C = 1mA, V_{GE} = 0$	600			V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$V_{GE}=15V, I_C=20A, T_j=25^{\circ}C$ $V_{GE}=15V, I_C=20A, T_j=125^{\circ}C$		1.8 1.7	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE}= V_{GE}, I_C= 250\mu A$	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	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20V, V_{CE} = 0$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15V, I_C = 20A$		15		S

Table 4. Dynamic

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

Table 5. Switching on/off (inductive load)

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

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC}=390\text{ V}$, $I_C=20\text{ A}$, $R_G=3.3\Omega$, $V_{GE}=15\text{ V}$, $T_j=25^\circ\text{C}$ (see Figure 18)		220	300	μJ
E_{off}	Turn-off switching losses			330	450	μJ
E_{ts}	Total switching losses			550	750	μJ
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC}=390\text{ V}$, $I_C=20\text{ A}$, $R_G=3.3\Omega$, $V_{GE}=15\text{ V}$, $T_j=125^\circ\text{C}$ (see Figure 18)		450		μJ
E_{off}	Turn-off switching losses			770		μJ
E_{ts}	Total switching losses			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	$I_f = 20\text{ A}$, $V_R = 40\text{ V}$, $T_j = 25^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19)		44		ns
Q_{rr}	Reverse recovery charge			66		nC
I_{rrm}	Reverse recovery current			3		A
t_{rr}	Reverse recovery time	$I_f = 20\text{ A}$, $V_R = 40\text{ V}$, $T_j = 125^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19)		88		ns
Q_{rr}	Reverse recovery charge			237		nC
I_{rrm}	Reverse recovery current			5.4		A

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

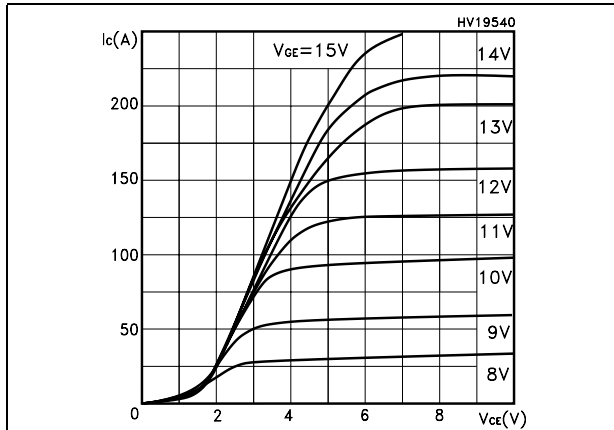


Figure 2. Transfer characteristics

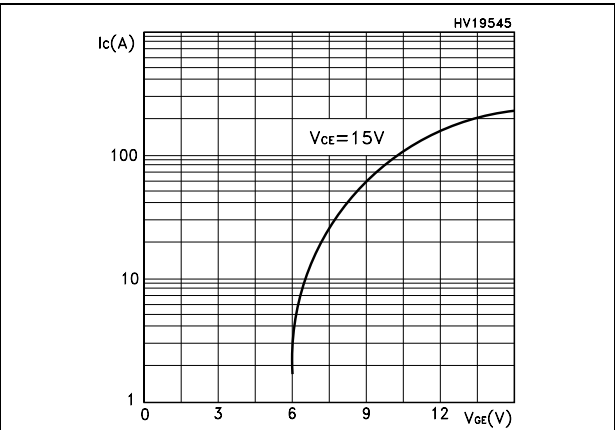


Figure 3. Transconductance

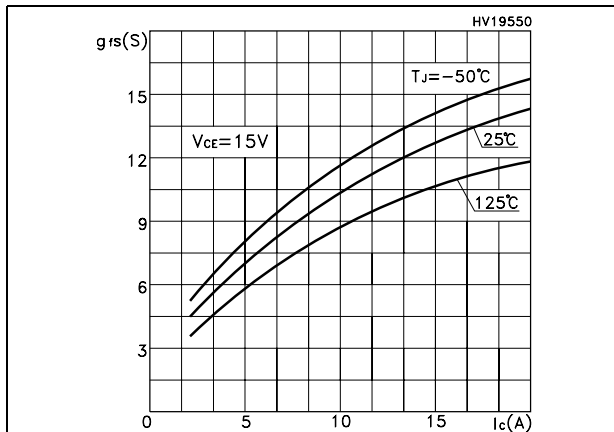


Figure 4. Collector-emitter on voltage vs temperature

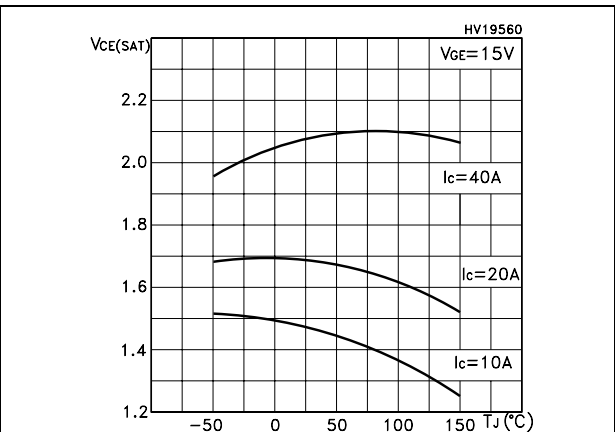


Figure 5. Collector-emitter on voltage vs collector current

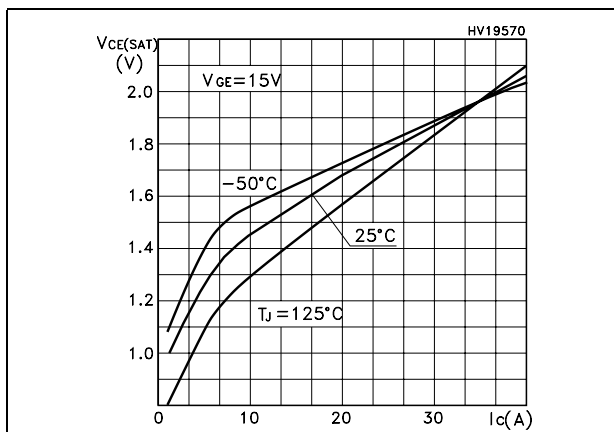


Figure 6. Normalized gate threshold vs temperature

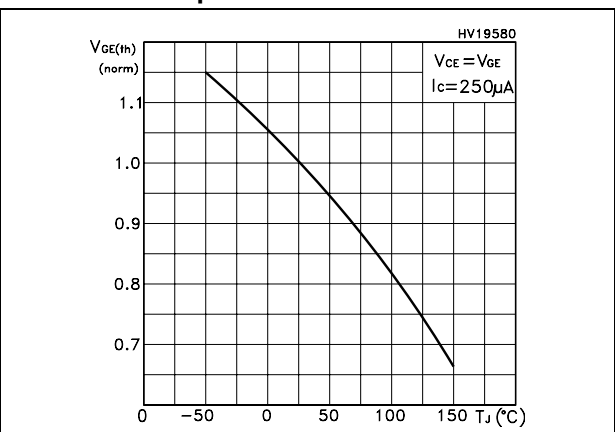


Figure 7. Normalized breakdown voltage vs temperature

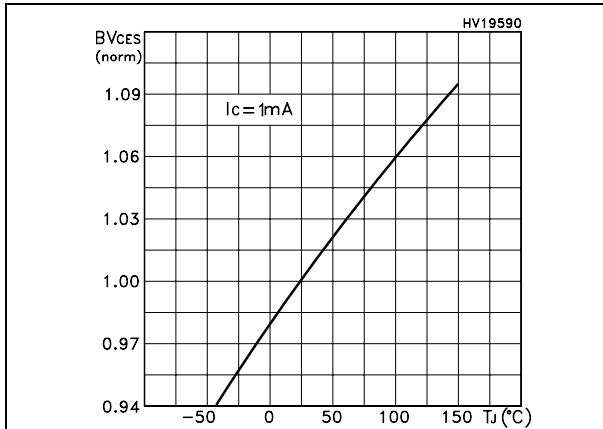


Figure 8. Gate charge vs gate-emitter voltage

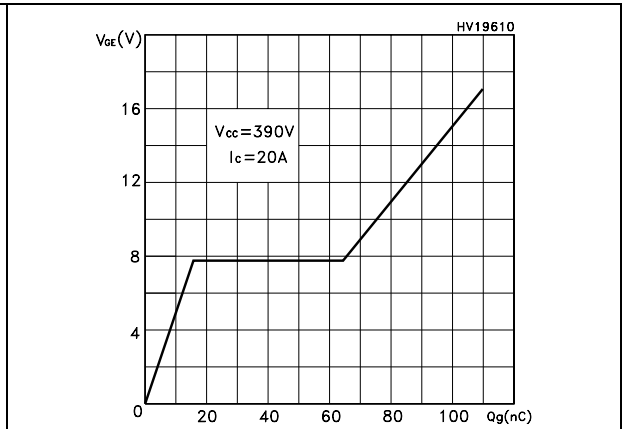


Figure 9. Capacitance variations

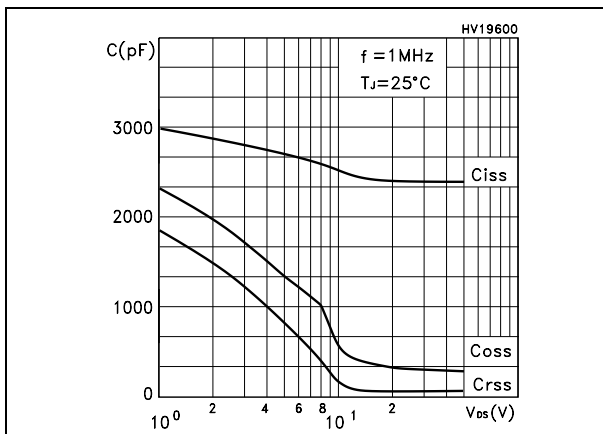


Figure 10. Switching losses vs temperature

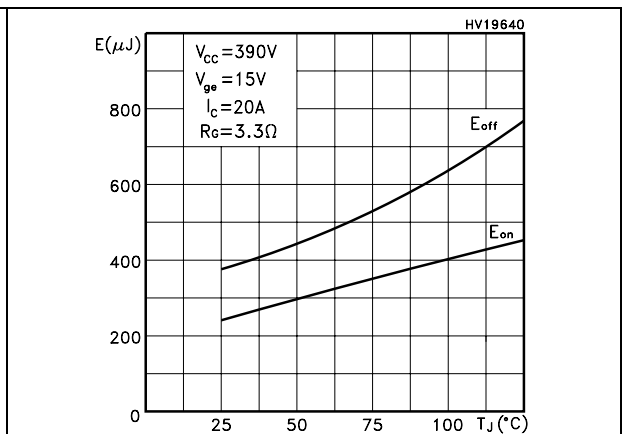


Figure 11. Switching losses vs gate resistance Figure 12. Switching losses vs collector current

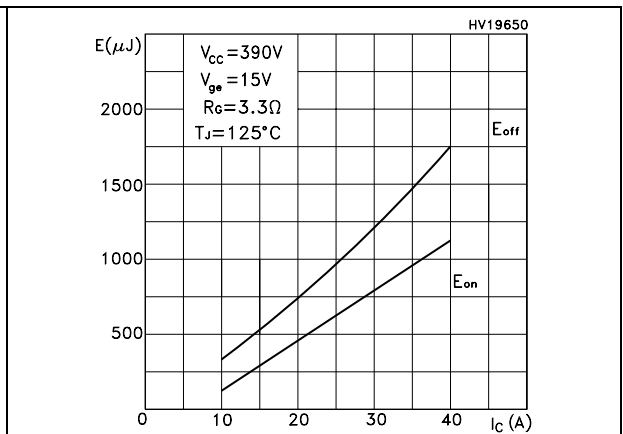
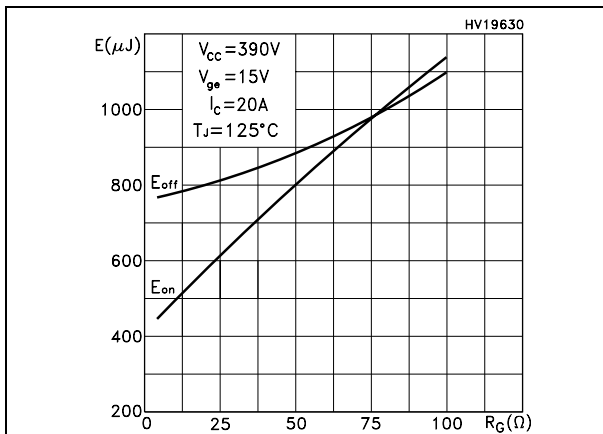


Figure 13. Thermal impedance

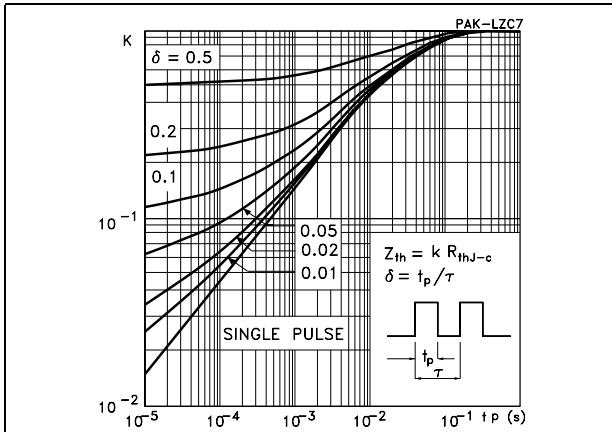


Figure 14. Turn-off SOA

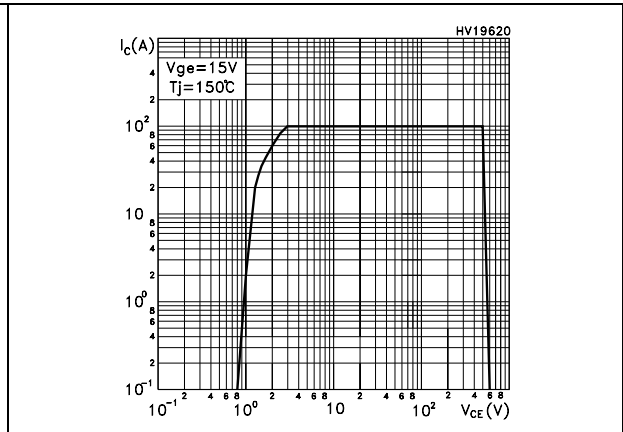
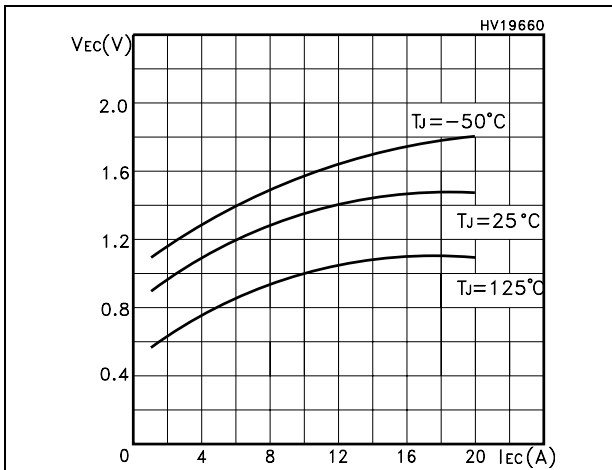


Figure 15. Emitter-collector diode characteristics



3 Test circuit

Figure 16. Test circuit for inductive load switching

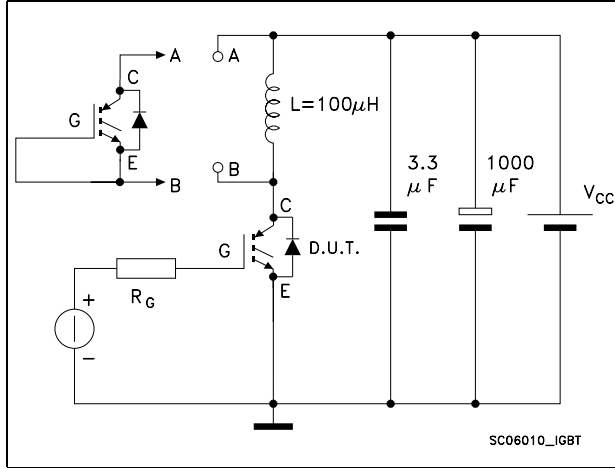


Figure 17. Gate charge test circuit

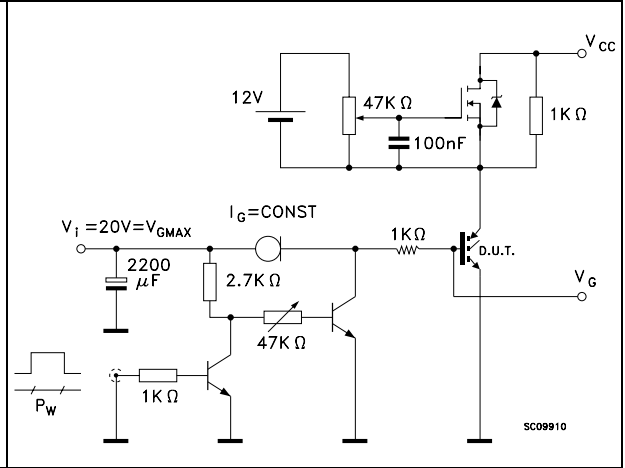


Figure 18. Switching waveforms

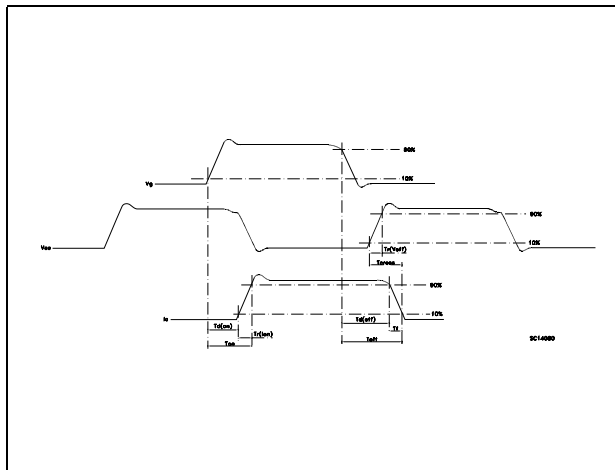
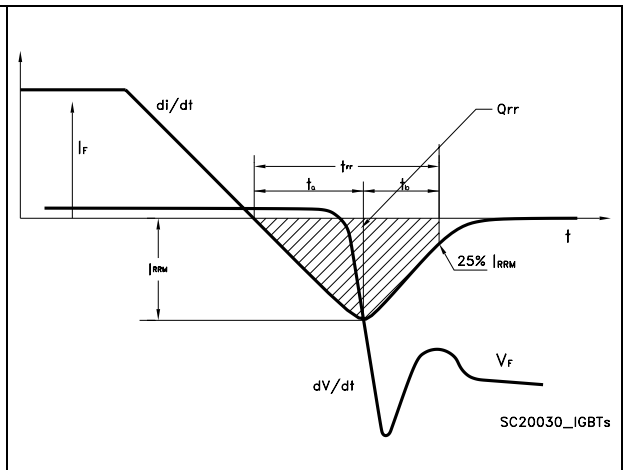


Figure 19. Diode recovery times waveform

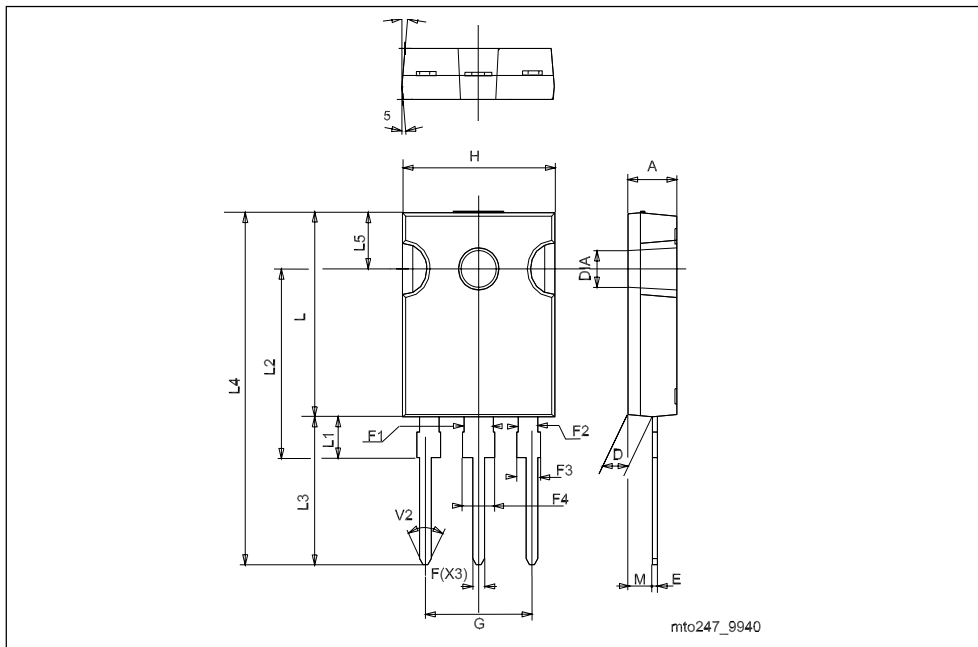


4 Package mechanical data

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

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