



# STGW30NC60WD

N-CHANNEL 30A - 600V - TO-247  
Ultra 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
STGW30NC60WD	600V	< 2.5V	30A

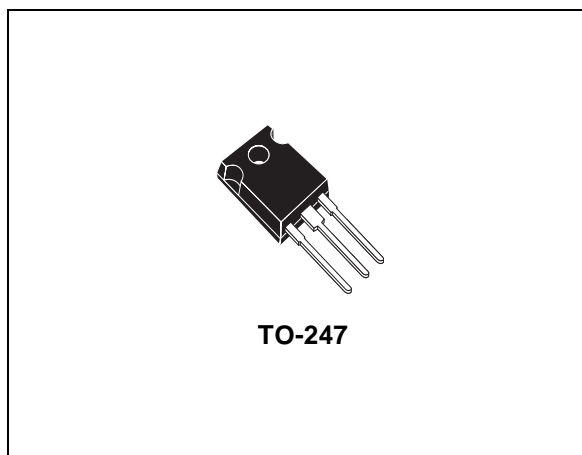
- High frequency operation
- Lower C<sub>RES</sub> / C<sub>IES</sub> ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode

## 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 “W” identifies a family optimized for very high frequency application.

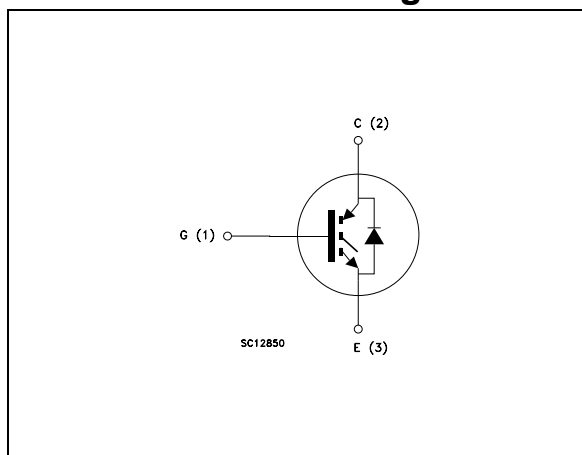
## Applications

- High frequency motor controls, inverters, ups
- HF, SMPS and PFC in both hard switch and resonant topologies



TO-247

## Internal schematic diagram



## Order codes

Sales Type	Marking	Package	Packaging
STGW30NC60WD	GW30NC60WD	TO-247	Tube

## Contents:

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	600	V
$I_C$	Collector Current (continuous) at 25°C	60	A
$I_C$	Collector Current (continuous) at 100°C	30	A
$I_{CM}^{(1)}$	Collector Current (pulsed)	200	A
$V_{GE}$	Gate-Emitter Voltage	± 20	V
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	200	W
$T_{stg}$	Storage Temperature	- 55 to 150	°C
$T_j$	Operating Junction Temperature		
$T_L$	Maximum Lead Temperature for Soldering Purpose (1.6mm from case, for 10 sec.)	300	°C

1. Pulse width limited by max junction temperature

**Table 2. Thermal resistance**

		Min.	Typ.	Max.	Unit
Rthj-case	Thermal Resistance Junction-case			0.625	°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
$V_{BR(CES)}$	Collectro-Emitter Breakdown Voltage	$I_C = 1\text{mA}, V_{GE} = 0$	600			V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}, I_C= 20\text{A}, T_j= 25^{\circ}\text{C}$ $V_{GE}=15\text{V}, I_C= 20\text{A}, T_j= 125^{\circ}\text{C}$		2.1 1.8	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 ( $V_{CE} = 0$ )	$V_{CE} = \text{Max Rating}, T_c=25^{\circ}\text{C}$ $V_{CE} = \text{Max Rating}, T_c=125^{\circ}\text{C}$			10 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
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25\text{V}, f = 1\text{MHz}, V_{GE}=0$		2080 175 52		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 390\text{V}, I_C = 20\text{A},$ $V_{GE} = 15\text{V},$ (see Figure 16)		102 17.5 47	140	nC nC nC
$I_{CL}$	Turn-Off SOA Minimum Current	$V_{clamp} = 480\text{V}, T_j = 150^{\circ}\text{C}$ $R_G = 10\Omega, V_{GE}= 15\text{V}$	200			A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 390V, I_C = 20A$		29.5		ns
$t_r$	Current Rise Time	$R_G = 10\Omega, V_{GE} = 15V,$		12		ns
$(di/dt)_{on}$	Turn-on Current Slope	$T_J = 25^\circ C$ (see Figure 16)		1640		A/ $\mu s$
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 390V, I_C = 20A$		29		ns
$t_r$	Current Rise Time	$R_G = 10\Omega, V_{GE} = 15V,$		13.5		ns
$(di/dt)_{on}$	Turn-on Current Slope	$T_J = 125^\circ C$ (see Figure 16)		1600		A/ $\mu s$
$t_r(V_{off})$	Off Voltage Rise Time	$V_{CC} = 390V, I_C = 20A,$		19.5		ns
$t_{d(off)}$	Turn-off Delay Time	$R_{GE} = 10\Omega,$		118		ns
$t_f$	Current Fall Time	$V_{GE} = 15V, T_J = 25^\circ C$ (see Figure 18)		27		ns
$t_r(V_{off})$	Off Voltage Rise Time	$V_{CC} = 390V, I_C = 20A,$		46		ns
$t_{d(off)}$	Turn-off Delay Time	$R_{GE} = 10\Omega, V_{GE} = 15V,$		151		ns
$t_f$	Current Fall Time	$T_J = 125^\circ C$ (see Figure 18)		38		ns

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on Switching Losses	$V_{CC} = 390V, I_C = 20A$		116		$\mu J$
$E_{off}^{(2)}$	Turn-off Switching Losses	$R_G = 10\Omega, V_{GE} = 15V,$		181		$\mu J$
$E_{ts}$	Total Switching Losses	$T_J = 25^\circ C$ (see Figure 18)		297		$\mu J$
$E_{on}^{(1)}$	Turn-on Switching Losses	$V_{CC} = 390V, I_C = 20A$		239		$\mu J$
$E_{off}^{(2)}$	Turn-off Switching Losses	$R_G = 10\Omega, V_{GE} = 15V,$		355		$\mu J$
$E_{ts}$	Total Switching Losses	$T_J = 125^\circ C$ (see Figure 18)		594		$\mu J$

1.  $E_{on}$  is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25°C and 125°C)
2. Turn-off losses include also the tail of the collector current

Table 7. Collector-emitter diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_f$	Forward On-Voltage	$I_f = 10A$ $I_f = 10A, T_j = 125^\circ C$		1.5 1.1	2	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$ S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	$I_f = 20A, V_R = 50V,$ $di/dt=100A/\mu s, T_j=25^\circ C$ (see Figure 19)		44 66 3 0.375		ns nC A
$t_{rr}$ $Q_{rr}$ $I_{rrm}$ S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	$I_f = 20A, V_R = 50V,$ $di/dt=100A/\mu s, T_j=125^\circ C$ (see Figure 19)		88 237 5.4 0.57		ns nC A

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

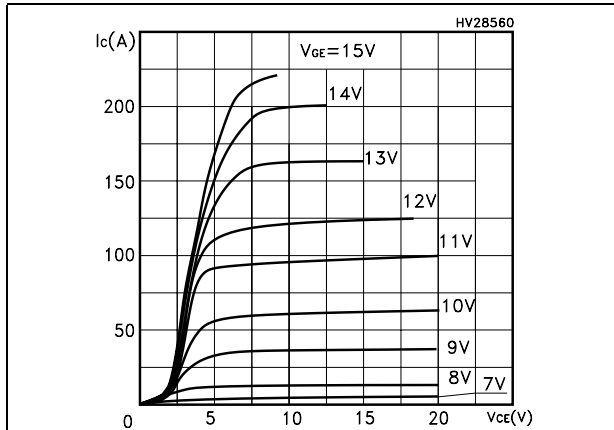


Figure 2. Transfer characteristics

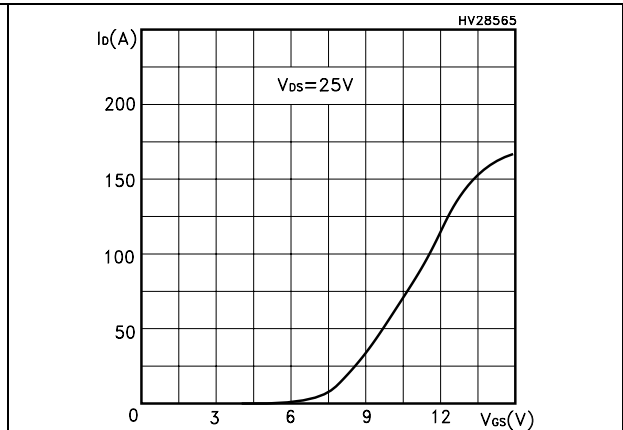


Figure 3. Transconductance

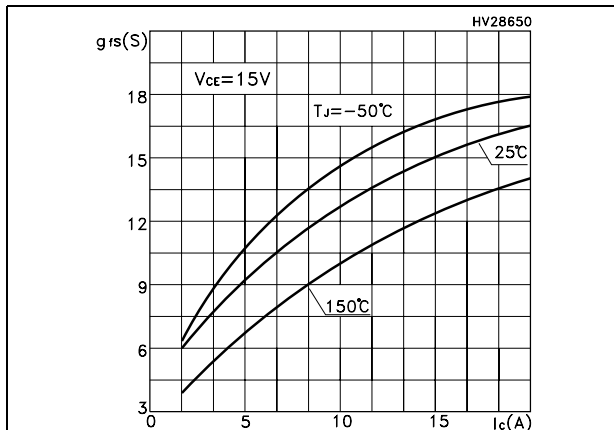


Figure 4. Collector-emitter on voltage vs temperature

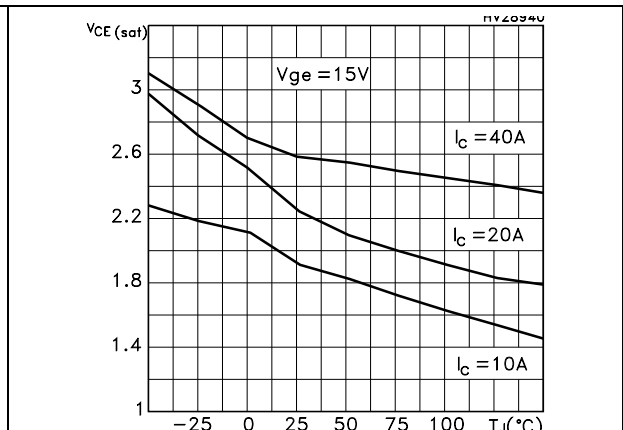


Figure 5. Gate charge vs gate-source voltage

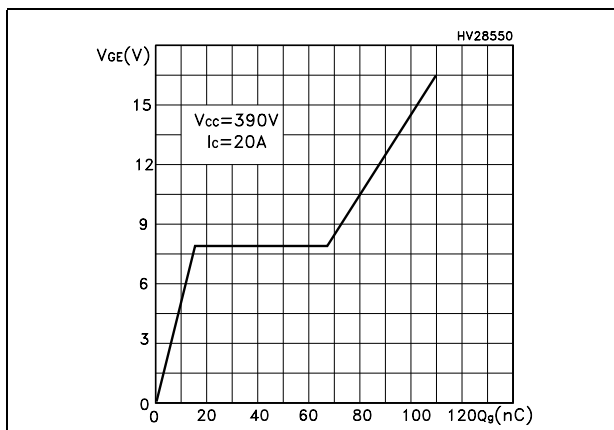


Figure 6. Capacitance variations

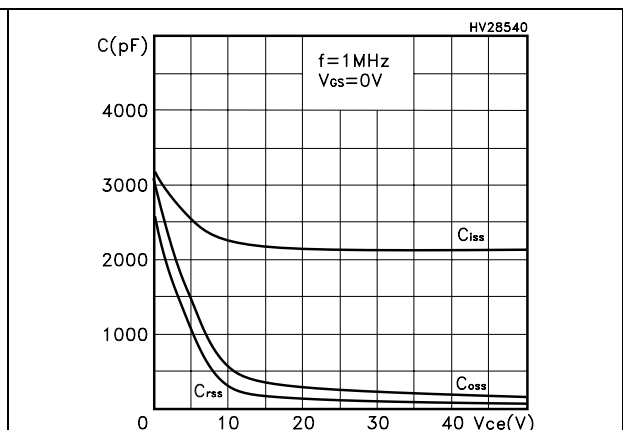


Figure 7. Normalized gate threshold voltage vs temperature

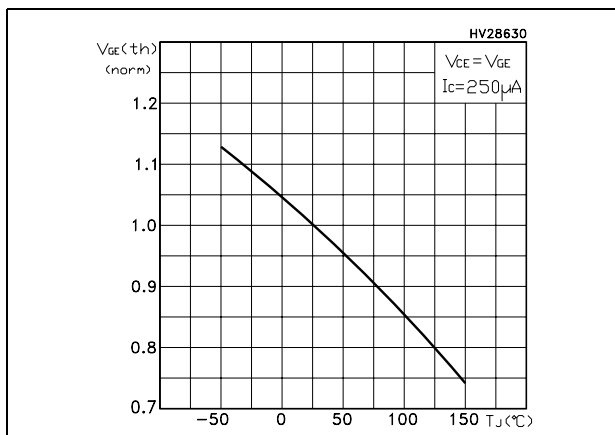


Figure 8. Collector-emitter on voltage vs collector current

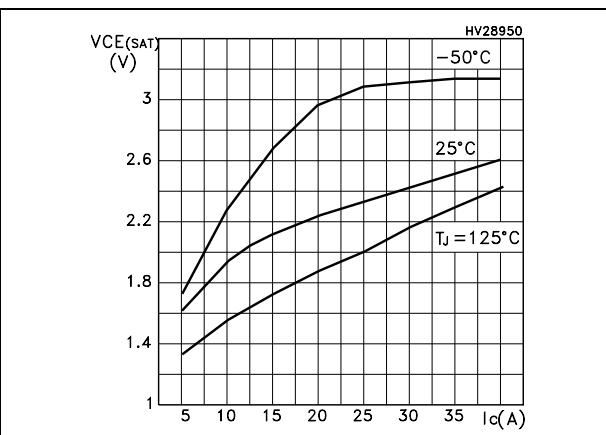


Figure 9. Normalized breakdown voltage vs temperature

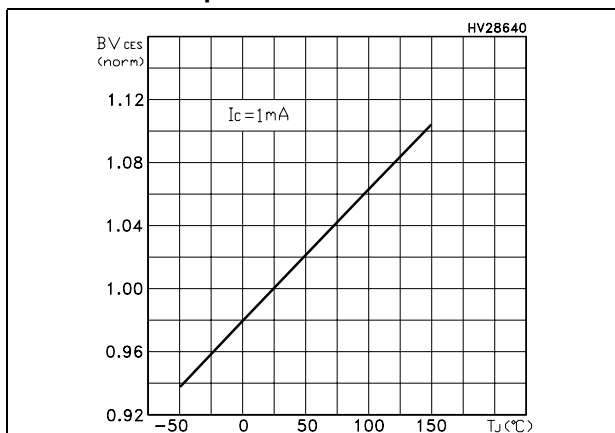


Figure 10. Switching losses vs temperature

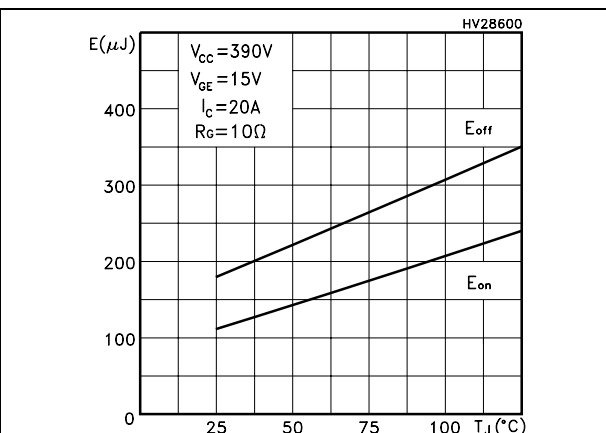


Figure 11. Switching losses vs gate resistance

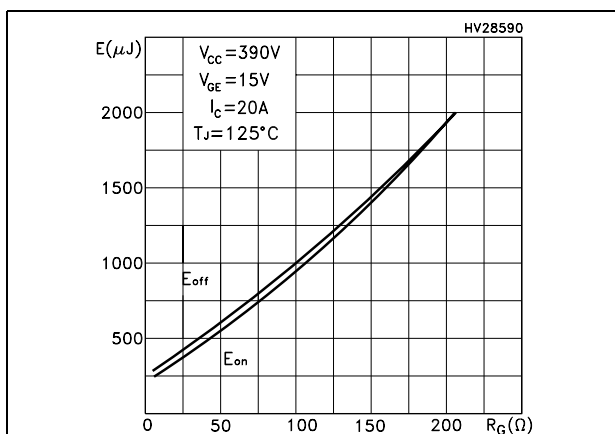


Figure 12. Switching losses vs collector current

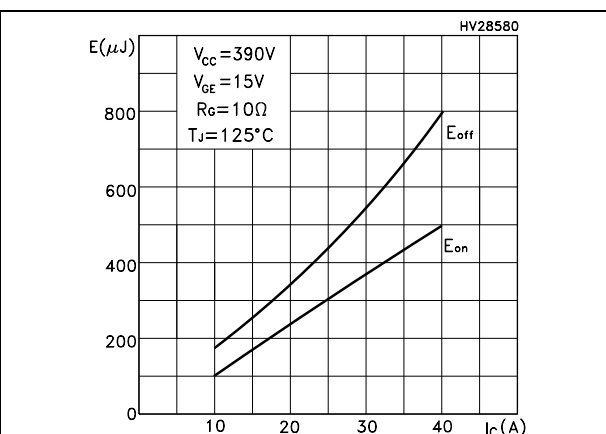




Figure 13. Thermal impedance

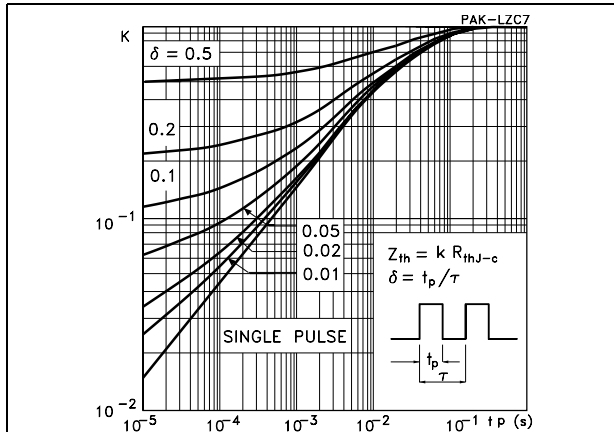


Figure 14. Turn-off SOA

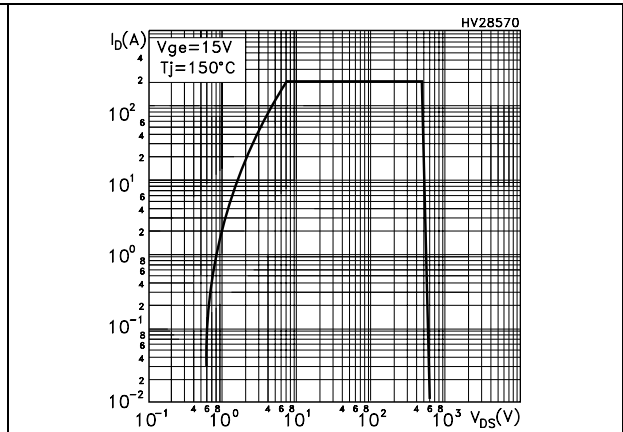
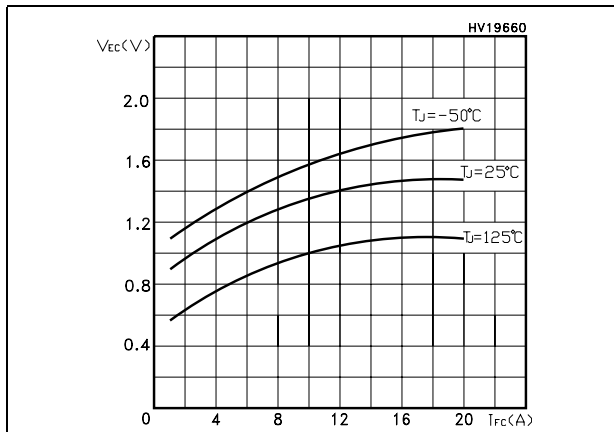


Figure 15. Emitter-collector diode characteristics



### 3 Test circuit

Figure 16. Test circuit for inductive load switching

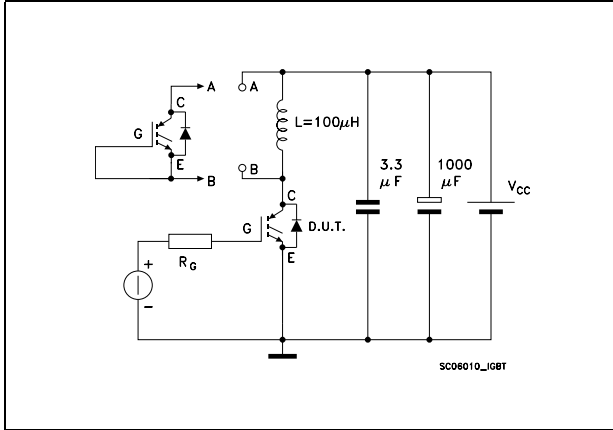


Figure 17. Gate charge test circuit

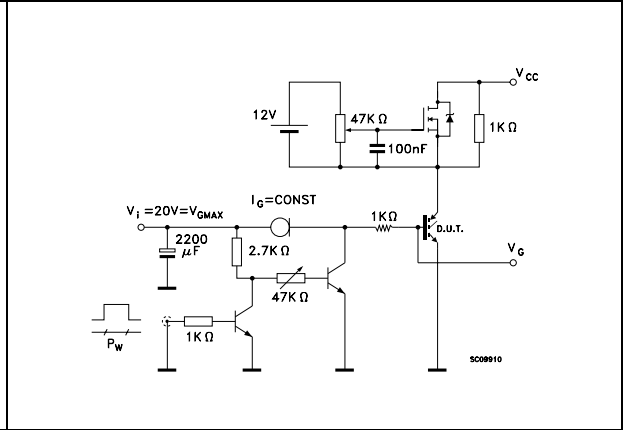


Figure 18. Switching waveform

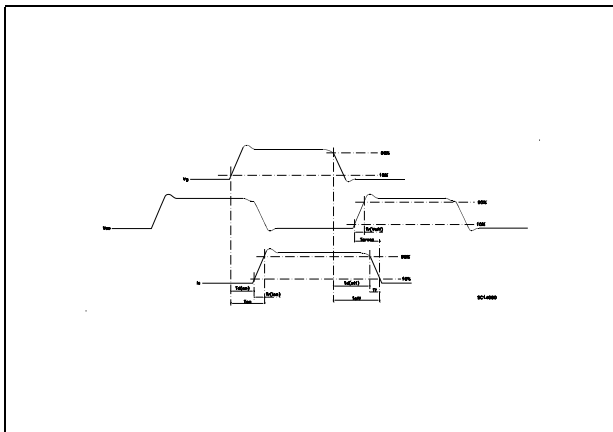
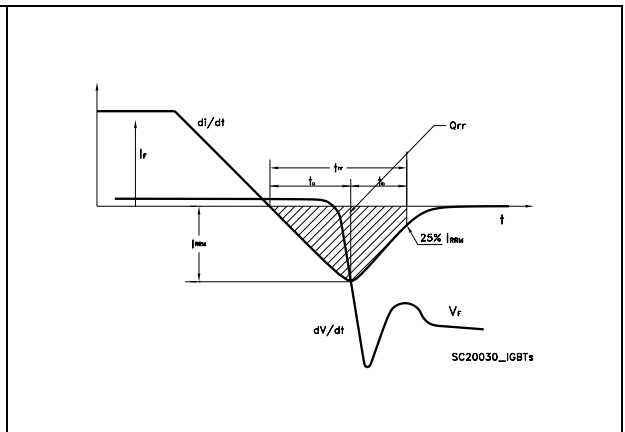


Figure 19. Diode recovery time waveform

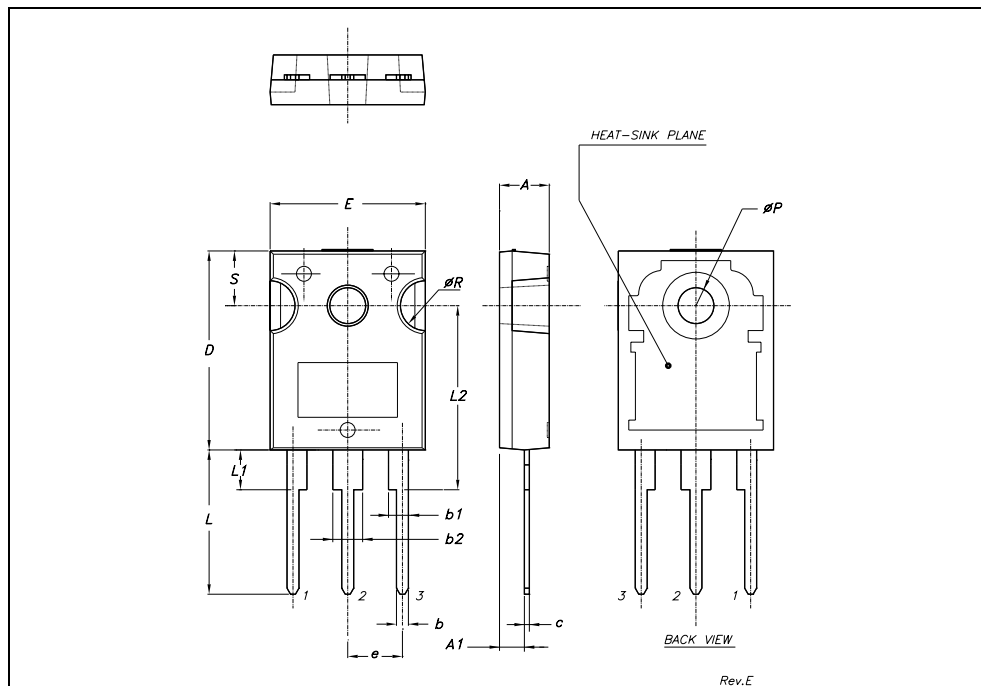


## 4 Package mechanical data

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	4.85		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	



## 5 Revision history

**Table 8. Revision history**

Date	Revision	Changes
21-Nov-2005	1	Initial release.
29-Nov-2005	2	Modified <a href="#">Figure 4</a> and <a href="#">Figure 5</a>
06-Mar-2006	3	New template

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