



# STGW30NC120HD

N-channel 1200V - 30A - TO-247  
very fast PowerMESH™ IGBT

## Features

Type	V <sub>CES</sub>	V <sub>CE(sat)</sub> @25°C	I <sub>C</sub> @100°C
STGW30NC120HD	1200V	< 2.75V	30A

- Low on-losses
- Low on-voltage drop (V<sub>cesat</sub>)
- High current capability
- High input impedance (voltage driven)
- Low gate charge
- Ideal for soft switching application

## Application

- Induction heating

## Description

Using the latest high voltage technology based on its patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, with outstanding performances. The suffix “H” identifies a family optimized for high frequency application in order to achieve very high switching performances (reduced t<sub>fall</sub>) maintaining a low voltage drop.

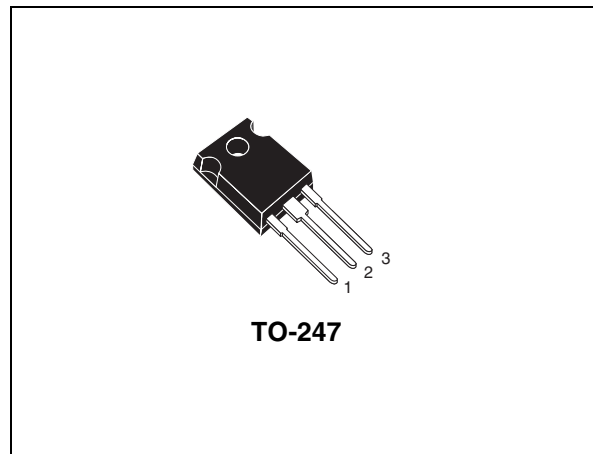


Figure 1. Internal schematic diagram

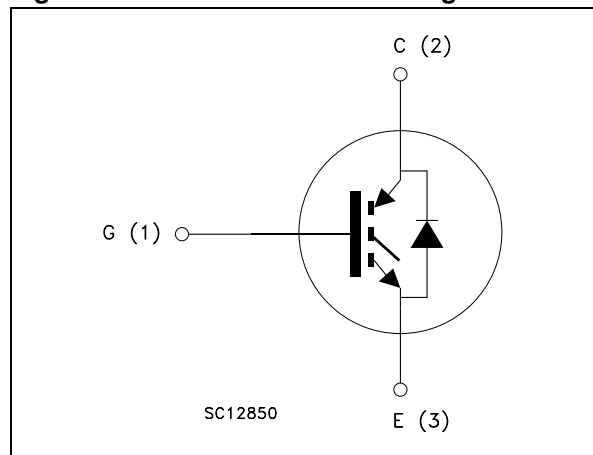


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW30NC120HD	GW30NC120HD	TO-247	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GS} = 0$ )	1200	V
$I_C^{(1)}$	Collector current (continuous) at 25°C	60	A
$I_C^{(1)}$	Collector current (continuous) at 100°C	30	A
$I_{CL}^{(2)}$	Collector current (pulsed)	135	A
$V_{GE}$	Gate-emitter voltage	±25	V
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	220	W
$I_f$	Diode RMS forward current at $T_C = 25^\circ\text{C}$	30	A
$T_j$	Operating junction temperature	-55 to 150	°C

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.  $V_{clamp}=80\%$  of  $BV_{ces}$ ,  $T_j=150^\circ\text{C}$ ,  $R_G=10\Omega$ ,  $V_{GE}=15\text{V}$

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.57	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient (diode)	1.6	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient (IGBT)	30	°C/W

## 2 Electrical characteristics

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

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	$I_C = 1mA, V_{GE} = 0$	1200			V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$V_{GE}= 15V, I_C= 20A, T_j= 25^{\circ}C$ $V_{GE}= 15V, I_C= 20A, T_j=125^{\circ}C$		2.2 2.0	2.75	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 ( $V_{GE} = 0$ )	$V_{CE} = \text{Max rating}, T_c=25^{\circ}C$ $V_{CE} = \text{Max rating}, T_c=125^{\circ}C$			500 10	$\mu A$ mA
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20V, V_{CE} = 0$			$\pm 100$	nA
$g_{fs}$	Forward transconductance	$V_{CE} = 25V, I_C= 20A$		14		S

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25V, f = 1 \text{ MHz}, V_{GE}=0$		2510		pF
$C_{oes}$	Output capacitance			175		pF
$C_{res}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{CE} = 960V,$ $I_C= 20A, V_{GE}=15V$		110		nC
$Q_{ge}$	Gate-emitter charge			16		nC
$Q_{gc}$	Gate-collector charge			49		nC

**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 960V, I_C = 20A$		29		ns
$t_r$	Current rise time	$R_G = 10\Omega, V_{GE} = 15V,$		11		ns
$(di/dt)_{on}$	Turn-on current slope	$T_j = 25^\circ C$ (see Figure 17)		1820		A/ $\mu s$
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 960V, I_C = 20A$		27		ns
$t_r$	Current rise time	$R_G = 10\Omega, V_{GE} = 15V,$		14		ns
$(di/dt)_{on}$	Turn-on current slope	$T_j = 125^\circ C$ (see Figure 17)		1580		A/ $\mu s$
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 960V, I_C = 20A$		90		ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\Omega, V_{GE} = 15V,$		275		ns
$t_f$	Current fall time	$T_j = 25^\circ C$ (see Figure 17)		312		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 960V, I_C = 20A$		150		ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\Omega, V_{GE} = 15V,$		336		ns
$t_f$	Current fall time	$T_j = 125^\circ C$ (see Figure 17)		592		ns

**Table 7. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 960V, I_C = 20A$		1660		$\mu J$
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\Omega, V_{GE} = 15V,$		4438		$\mu J$
$E_{ts}$	Total switching losses	$T_j = 25^\circ C$ (see Figure 17)		6098		$\mu J$
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 960V, I_C = 20A$		3015		$\mu J$
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\Omega, V_{GE} = 15V,$		6900		$\mu J$
$E_{ts}$	Total switching losses	$T_j = 125^\circ C$ (see Figure 17)		9915		$\mu J$

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-pack 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 8. Collector-emitter diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_f$	Forward on-voltage	$I_f = 20A, T_j = 25^\circ C$ $I_f = 20A, T_j = 125^\circ C$		1.9 1.7	2.5	V V
$t_{rr}$	Reverse recovery time	$I_f = 20A, V_R = 27V,$		152		ns
$Q_{rr}$	Reverse recovery charge	$T_j = 125^\circ C, di/dt = 100A/\mu s$		722		nC
$I_{rrm}$	Reverse recovery current	(see Figure 20)		9		A

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

Figure 3. Transfer characteristics

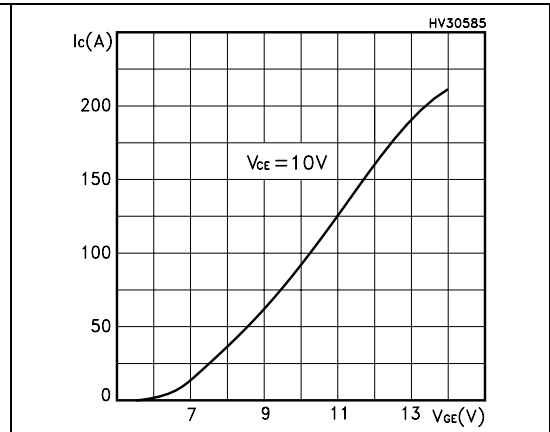
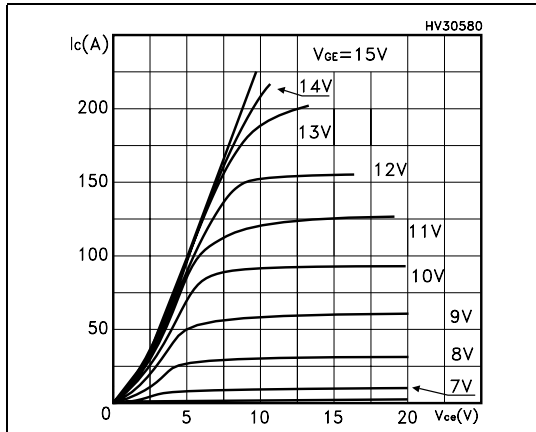


Figure 4. Transconductance

Figure 5. Collector-emitter on voltage vs. temperature

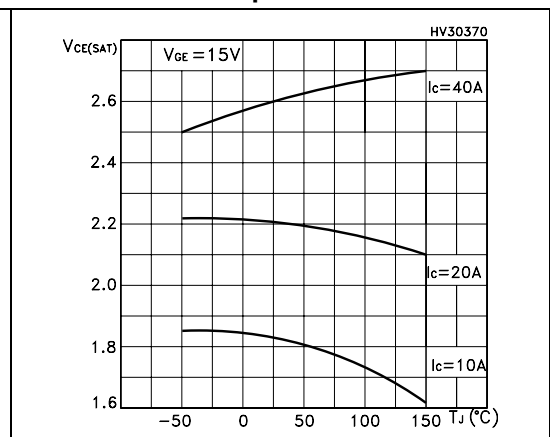
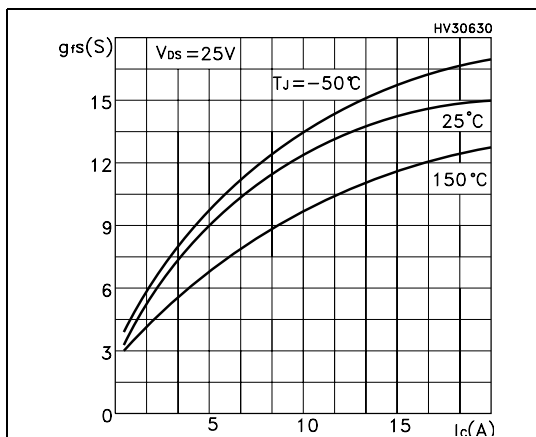
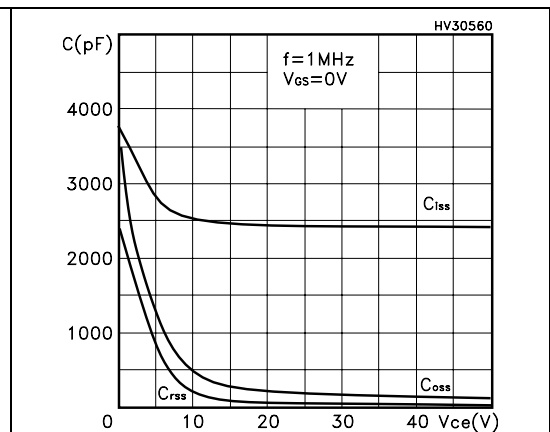
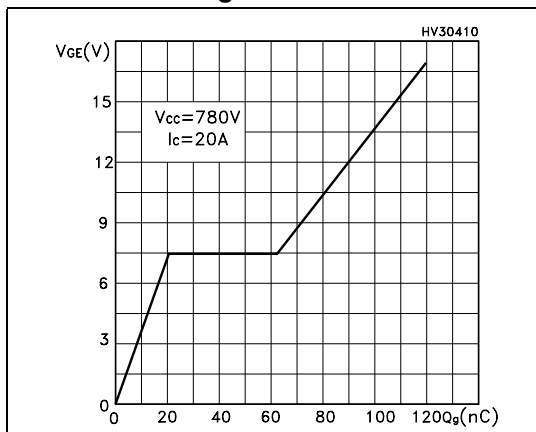
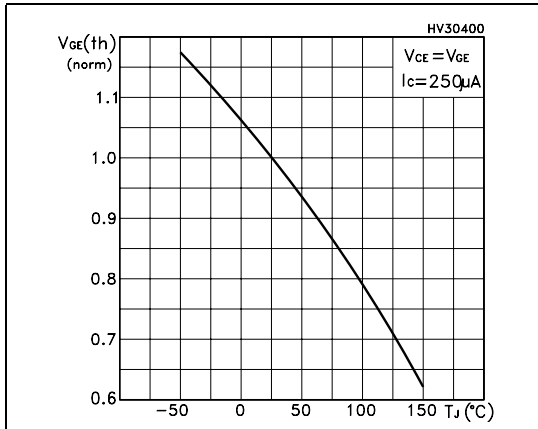


Figure 6. Gate charge vs. gate-source voltage

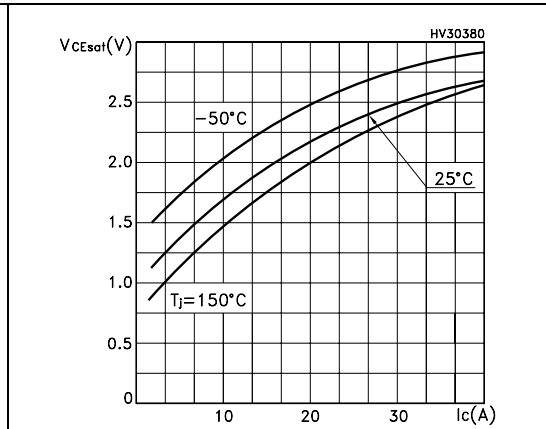
Figure 7. Capacitance variations



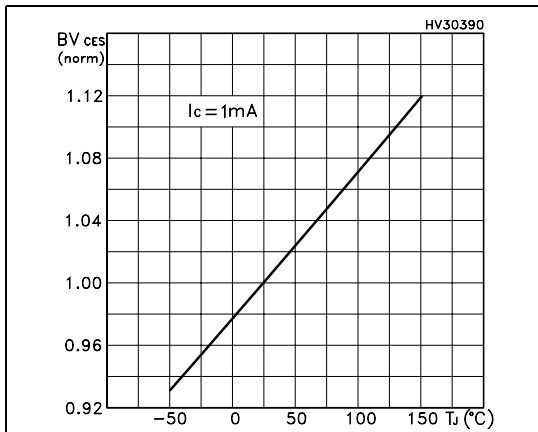
**Figure 8. Normalized gate threshold voltage vs. temperature**



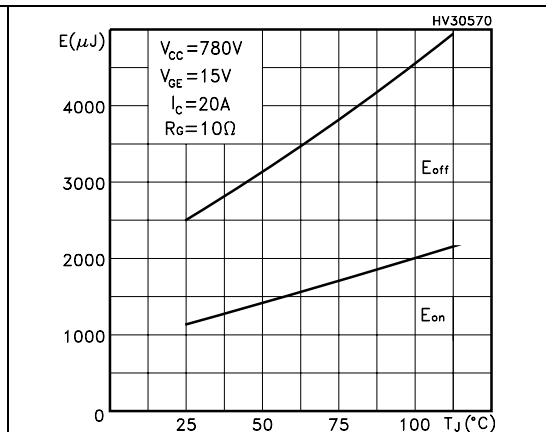
**Figure 9. Collector-emitter on voltage vs. collector current**



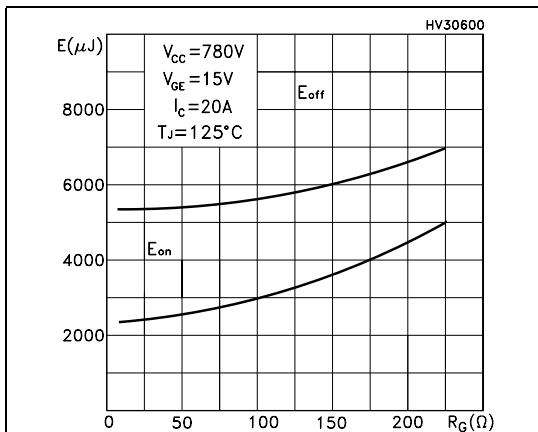
**Figure 10. Normalized breakdown voltage vs. temperature**



**Figure 11. Switching losses vs. temperature**



**Figure 12. Switching losses vs. gate resistance**



**Figure 13. Switching losses vs. collector current**

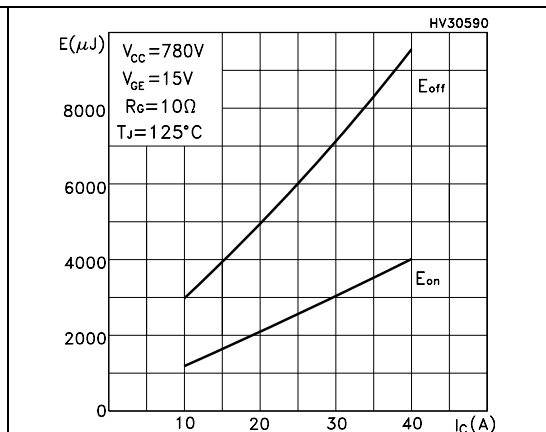


Figure 14. Thermal Impedance

Figure 15. Turn-off SOA

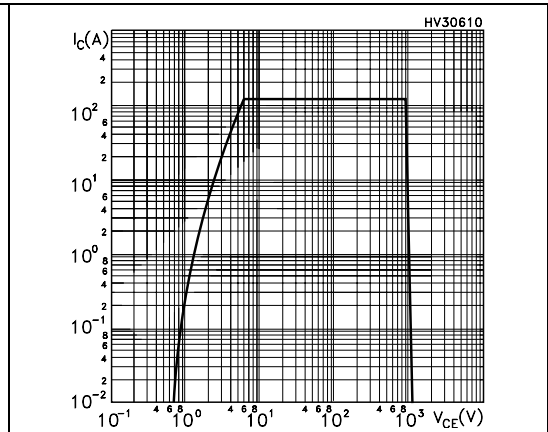
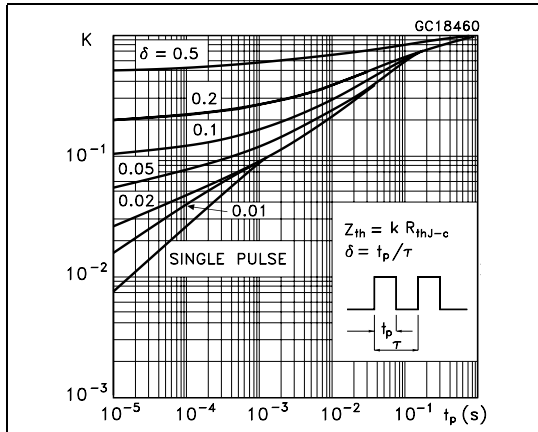
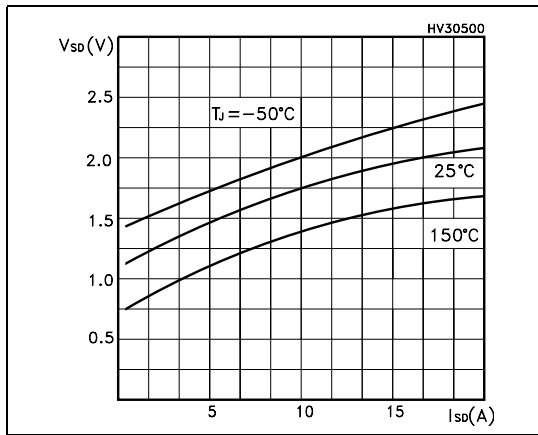


Figure 16. Emitter-collector diode characteristics





### 3 Test circuit

Figure 17. Test circuit for inductive load switching

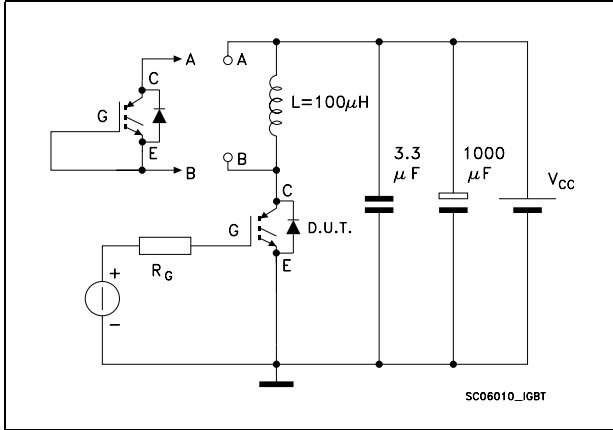


Figure 19. Switching waveform

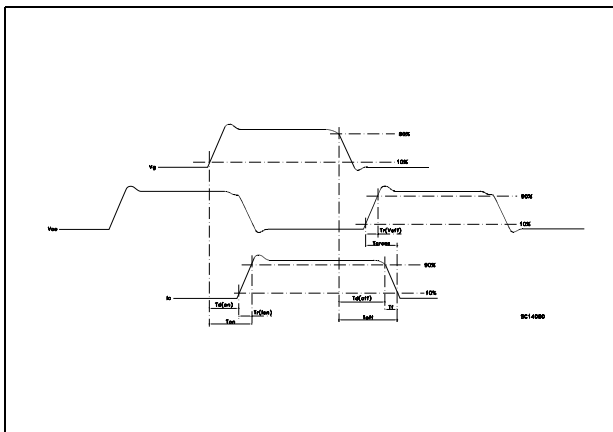


Figure 18. Gate charge test circuit

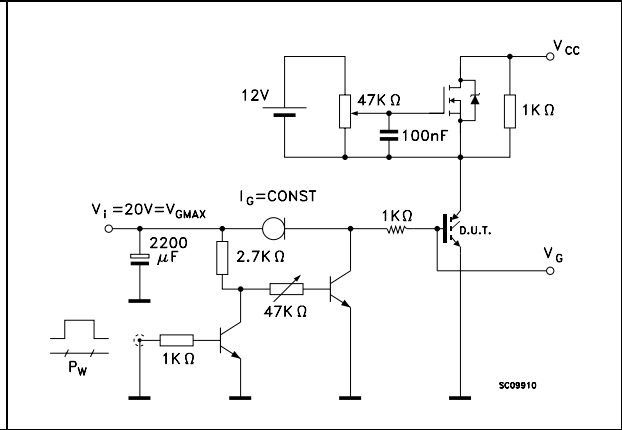
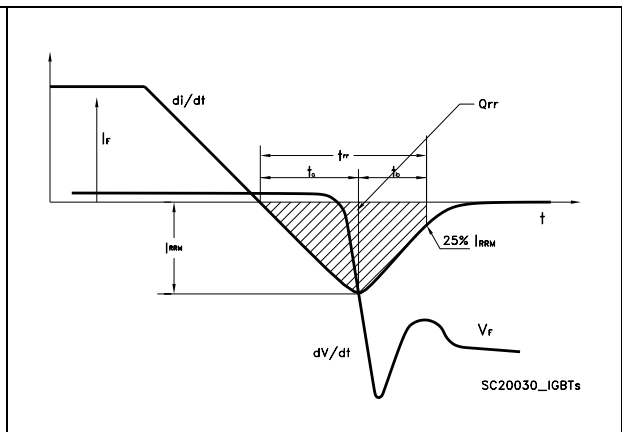


Figure 20. Diode recovery time waveform

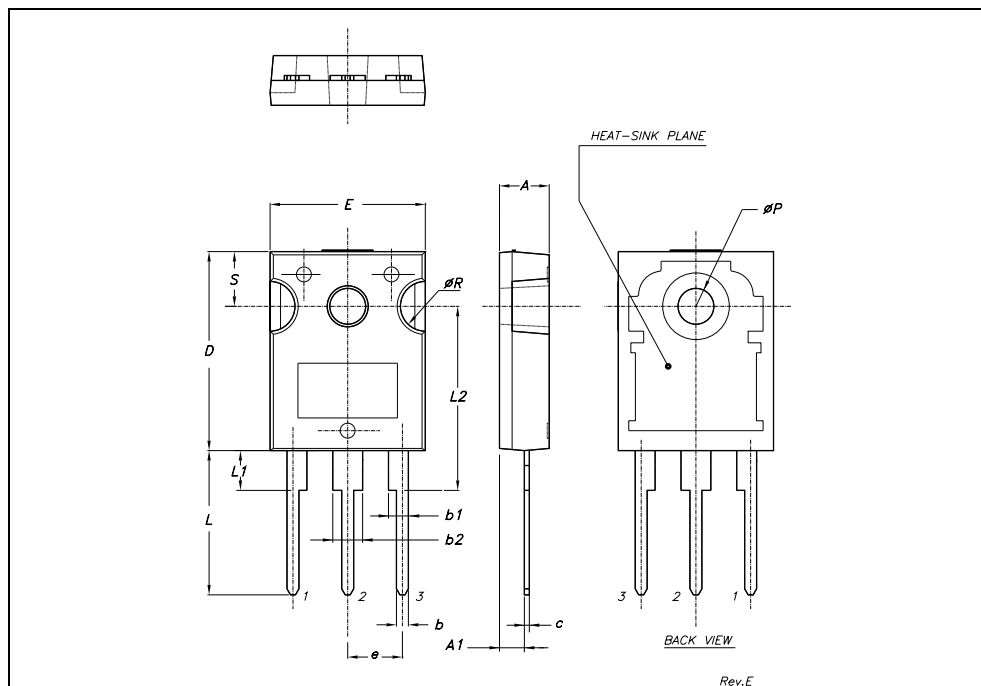


## 4 Package mechanical data

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 9. Document revision history**

Date	Revision	Changes
23-Nov-2005	1	First issue.
17-Mar-2006	2	Complete version
05-May-2006	3	Modified value on <a href="#">Table 2.: Absolute maximum ratings</a>
30-May-2006	4	New values on <a href="#">Table 3: Thermal resistance</a>
23-Jun-2006	5	Modified value on <a href="#">Table 4.: Static</a>
07-Sep-2006	6	Modified T <sub>J</sub> temperature range to 150°C in <a href="#">Table 2.: Absolute maximum ratings</a>
14-Nov-2006	7	Modified <a href="#">Figure 5.</a> and <a href="#">Figure 9.</a>
26-Jan-2007	8	Typing error on first page.
04-Oct-2007	9	Modified test conditions in <a href="#">Table 4.: Static</a>

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**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331