



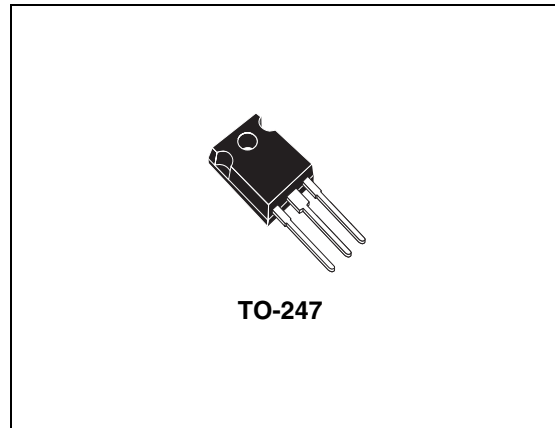
# STGW30NC120HD

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

## General 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



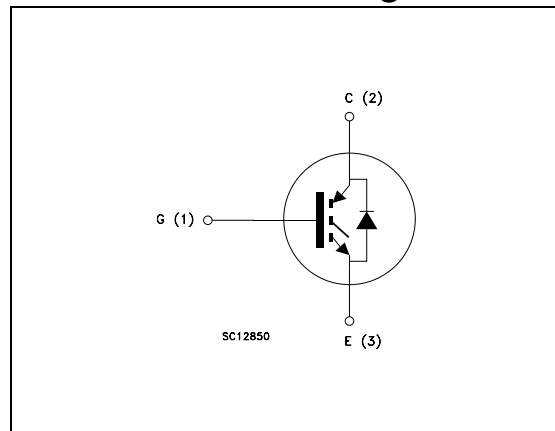
## Description

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.

## Applications

- Induction heating

## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STGW30NC120HD	GW30NC120HD	TO-247	Tube

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuit</b> .....	<b>9</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>10</b>
<b>5</b>	<b>Revision history</b> .....	<b>12</b>

# 1 Electrical ratings

**Table 1. 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
$T_{stg}$	Storage temperature		

1. Calculated according to the iterative formula:

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

2.  $V_{clamp}=960\text{V}$ ,  $T_j=125^\circ\text{C}$ ,  $R_G=10\Omega$ ,  $V_{GE}=15\text{V}$

**Table 2. 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)	50	°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	$I_C = 1mA, V_{GE} = 0$	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 ( $V_{CE} = 0$ )	$V_{GE} = \text{Max rating}, T_c=25^{\circ}C$ $V_{GE} = \text{Max rating}, T_c=125^{\circ}C$			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 4. 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	120	nC
$Q_{ge}$	Gate-emitter charge			16		nC
$Q_{gc}$	Gate-collector charge			49		nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 960V, I_C = 20A$		29		ns
$t_r$	Current rise time	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 25^\circ C$ (see Figure 16)		11		ns
$(di/dt)_{on}$	Turn-on current slope			1820		A/ $\mu s$
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 960V, I_C = 20A$		27		ns
$t_r$	Current rise time	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ (see Figure 16)		14		ns
$(di/dt)_{on}$	Turn-on current slope			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	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 25^\circ C$ (see Figure 16)		275		ns
$t_f$	Current fall time			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	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ (see Figure 16)		336		ns
$t_f$	Current fall time			592		ns

Table 6. 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	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 25^\circ C$ (see Figure 16)		4438		$\mu J$
$E_{ts}$	Total switching losses			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	$R_G = 10\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ (see Figure 16)		6900		$\mu J$
$E_{ts}$	Total switching losses			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 7. 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	$I_f = 20A, V_R = 27V,$ $T_j = 125^\circ C, di/dt = 100A/\mu s$ (see Figure 19)		152		ns
$Q_{rr}$	Reverse recovery charge			722		nC
$I_{rrm}$	Reverse recovery current			9		A

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

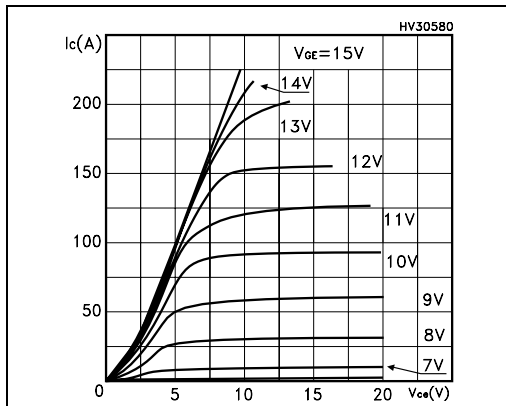


Figure 2. Transfer characteristics

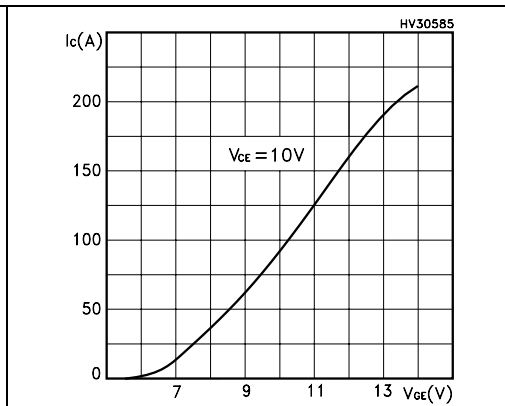


Figure 3. Transconductance

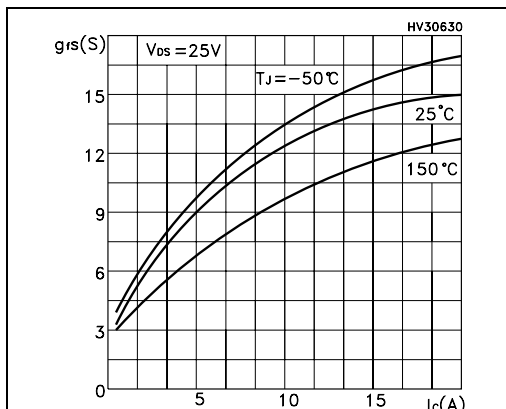


Figure 4. Collector-emitter on voltage vs. temperature

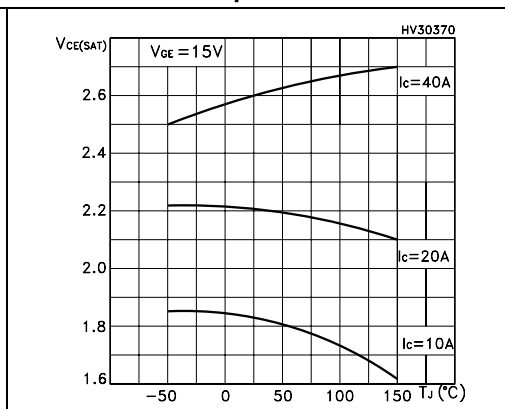


Figure 5. Gate charge vs. gate-source voltage

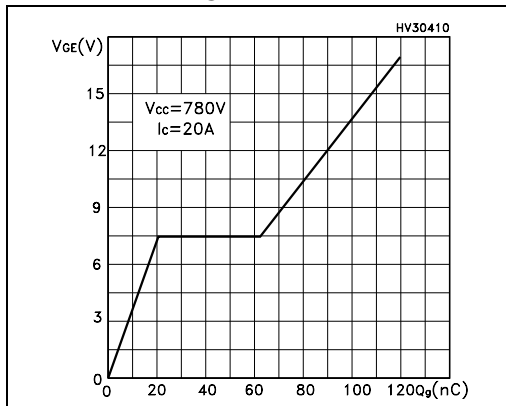
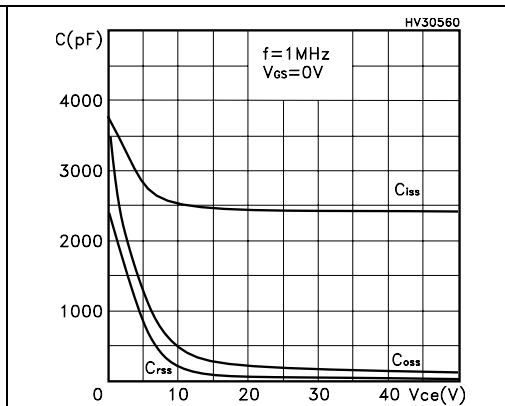
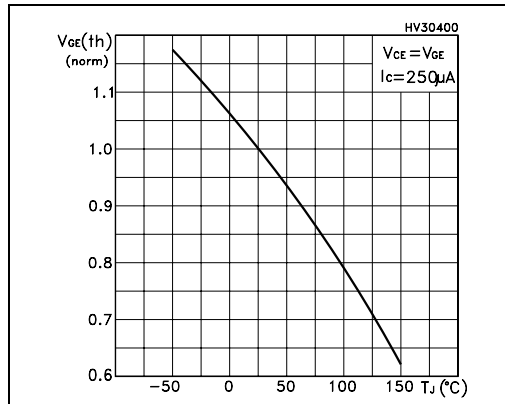


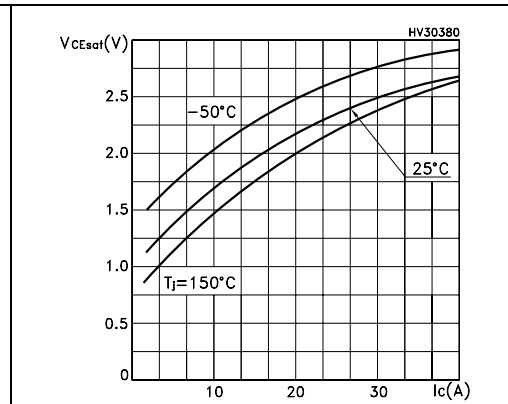
Figure 6. Capacitance variations



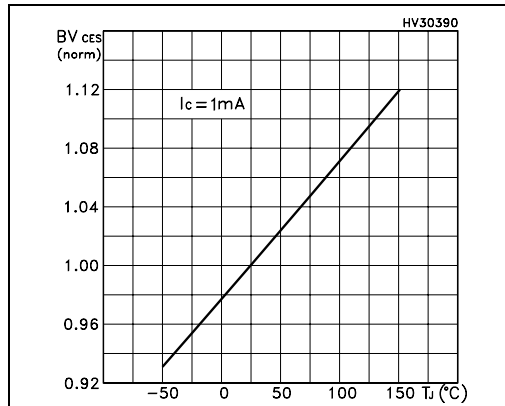
**Figure 7. Normalized gate threshold voltage vs. temperature**



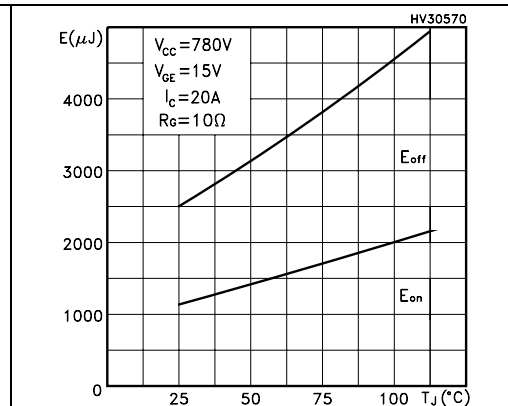
**Figure 8. Collector-emitter on voltage vs. collector current**



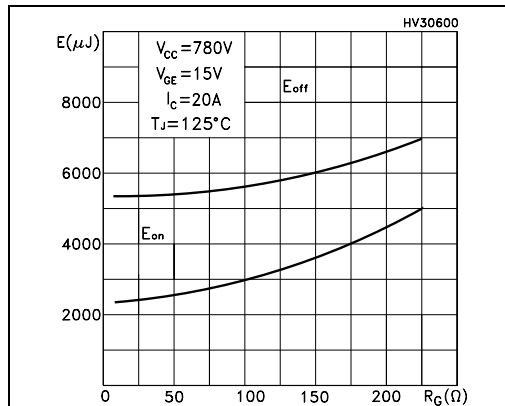
**Figure 9. Normalized breakdown voltage vs. temperature**



**Figure 10. Switching losses vs. temperature**



**Figure 11. Switching losses vs. gate resistance**



**Figure 12. Switching losses vs. collector current**

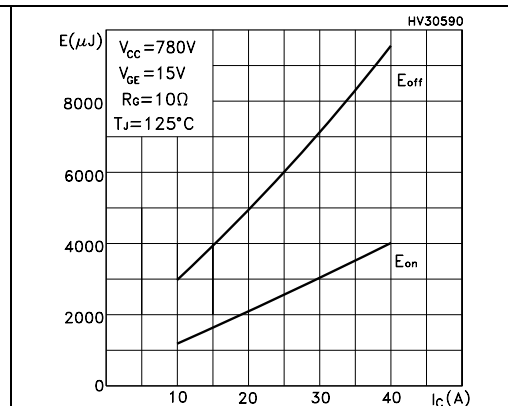


Figure 13. Thermal Impedance

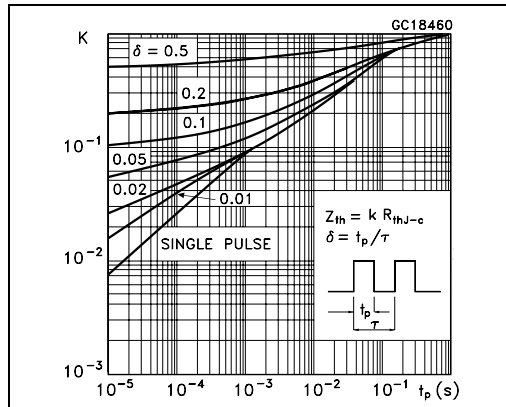


Figure 14. Turn-off SOA

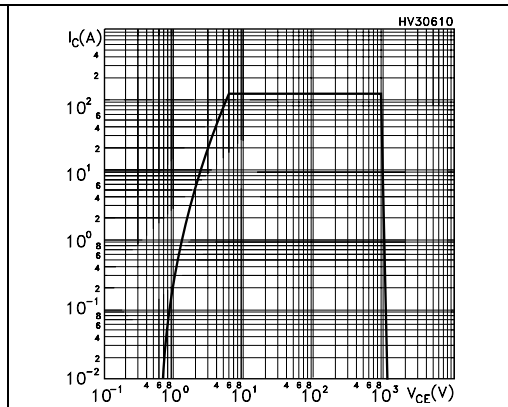
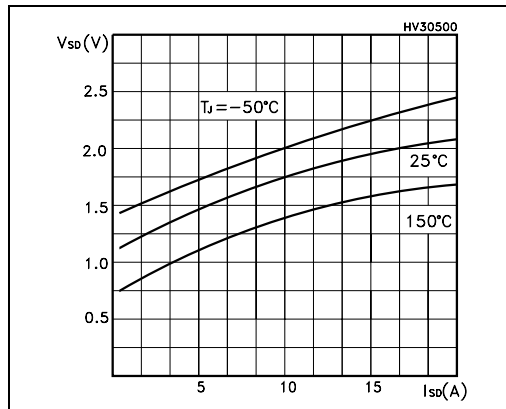


Figure 15. Emitter-collector diode characteristics





### 3 Test circuit

Figure 16. Test circuit for inductive load switching

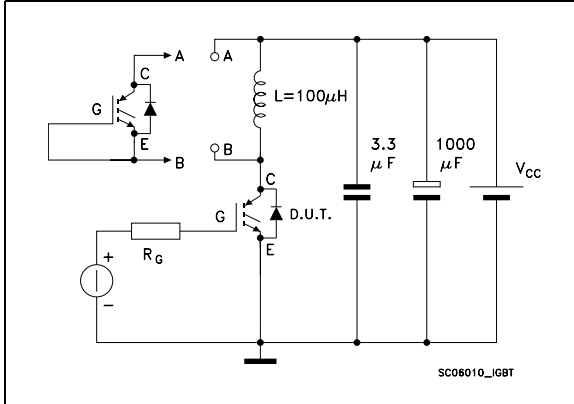


Figure 17. Gate charge test circuit

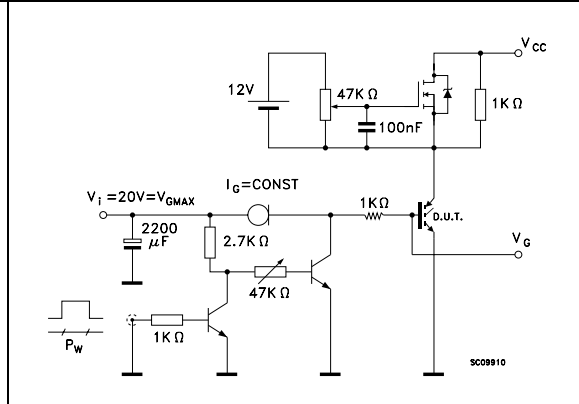


Figure 18. Switching waveform

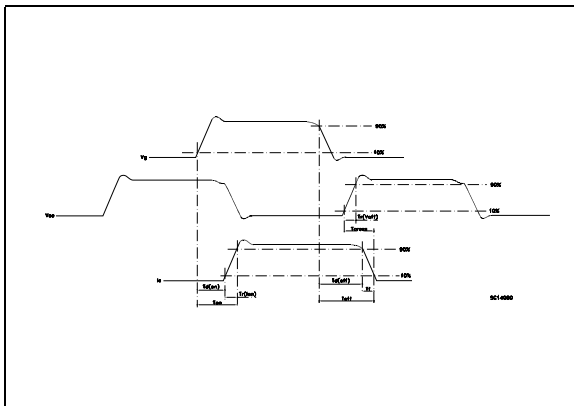
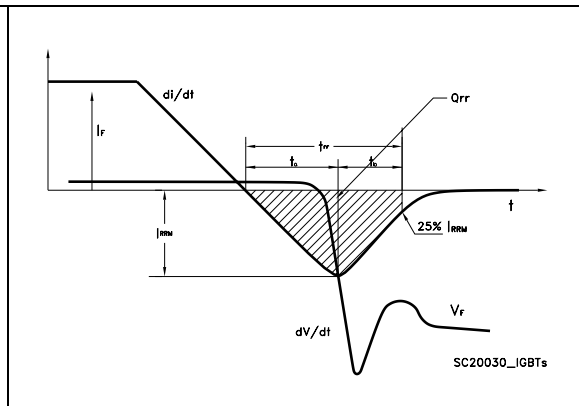


Figure 19. Diode recovery time waveform

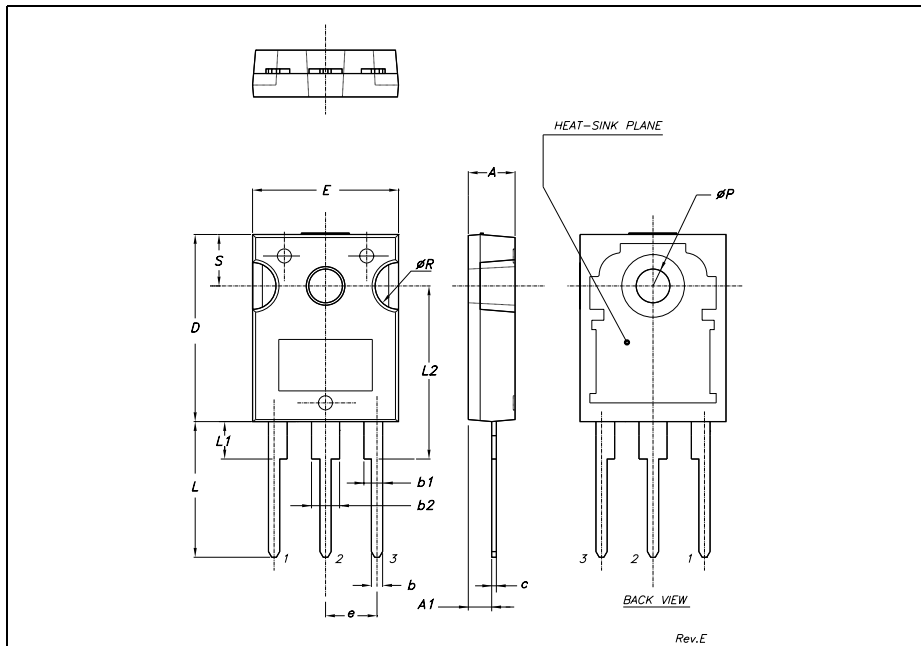


## 4 Package mechanical data

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

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