



## STGW35NB60S

N-channel 35A - 600V - TO-247  
Low drop PowerMESH™ IGBT

### Features

Type	V <sub>CE(S)</sub>	V <sub>CE(sat)</sub> (Max) @ 25°C	I <sub>C</sub> @100°C
STGW35NB60S	600V	< 1.7V	35A

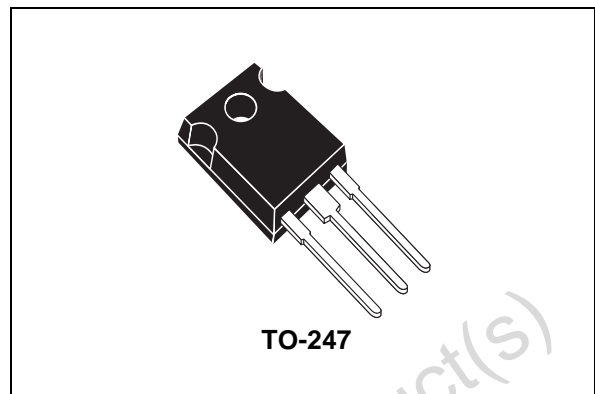
- Low on-voltage drop (V<sub>CEsat</sub>)
- Low input capacitance
- High current capability

### Description

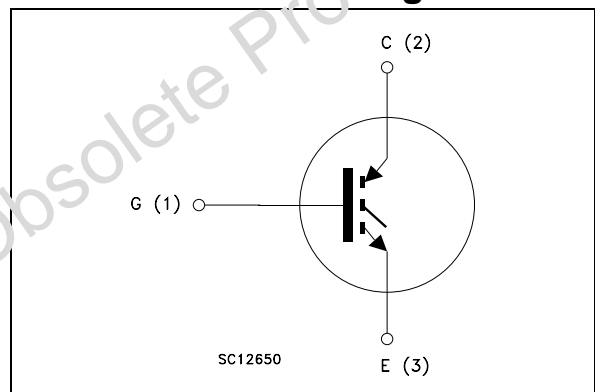
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances.

### Applications

- Light dimmer
- HID
- Welding
- Motor control
- Static relays



### Internal schematic diagram



### Order code

Part number	Marking	Package	Packaging
STGW35NB60S	GW35NB60S	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
$I_C^{(1)}$	Collector current (continuous) at 25°C	70	A
$I_C^{(1)}$	Collector current (continuous) at 100°C	35	A
$I_{CM}^{(2)}$	Collector current (pulsed)	250	A
$V_{GE}$	Gate-emitter voltage	± 20	V
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	200	W
$T_j$	Operating junction temperature	- 55 to 150	°C

1. Calculated according to the iterative formula:

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

2. Pulse width limited by max. junction temperature

**Table 2. Thermal resistance**

		Value	Unit
Rthj-case	Thermal resistance junction-case max	0.625	°C/W
Rthj-amb	Thermal resistance junction-ambient max	50	°C/W

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  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	$V_{GE} = 15\text{V}, I_C = 20\text{A},$ $V_{GE} = 15\text{V}, I_C = 20\text{A},$ $T_J = 125\text{°C}$		1.25 1.2	1.7	V V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 250\mu\text{A}$	2.5		5	V
$I_{CES}$	Collector-Emitter Leakage Current ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating},$ $V_{CE} = \text{Max Rating},$ $T_C = 125\text{°C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{V}, V_{CE} = 0$			$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{CE} = 10\text{V}, I_C = 18\text{A}$		20		S

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input Capacitance	$V_{CE} = 25\text{V}, f = 1\text{ MHz},$ $V_{GE} = 0$		1820		pF
$C_{oes}$	Output Capacitance			167		pF
$C_{res}$	Reverse Transfer Capacitance			27		pF
$Q_g$	Total Gate Charge	$V_{CE} = 480\text{V}, I_C = 20\text{A},$ $V_{GE} = 15\text{V},$ (see Figure 16)		83	115	nC
$Q_{ge}$	Gate-Emitter Charge			10		nC
$Q_{gc}$	Gate-Collector Charge			27		nC
$I_{CL}$	Turn-Off SOA Minimum Current	$V_{clamp} = 480\text{V},$ $T_J = 125\text{°C}$ $R_G = 100\Omega$	80			A

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$ $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	$V_{CC} = 480V, I_C = 20A$ $R_G = 100\Omega, V_{GE} = 15V,$ see <a href="#">Figure 15</a> and <a href="#">17</a>		92 70 340		ns ns A/ $\mu$ s
$t_{d(on)}$ $t_r$ $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	$V_{CC} = 480V, I_C = 20A$ $R_G = 100\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ see <a href="#">Figure 15</a> and <a href="#">17</a>		80 73 320		ns ns A/ $\mu$ s
$t_r(V_{off})$ $t_{d(off)}$ $t_f$	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	$V_{CC} = 480V, I_C = 20A,$ $R_{GE} = 100\Omega, V_{GE} = 5V,$ see <a href="#">Figure 15</a> and <a href="#">17</a>		0.78 1.1 0.79		$\mu$ s $\mu$ s $\mu$ s
$t_r(V_{off})$ $t_{d(off)}$ $t_f$	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	$V_{CC} = 480V, I_C = 20A,$ $R_{GE} = 100\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ see <a href="#">Figure 15</a> and <a href="#">17</a>		1.1 2.4 1.2		$\mu$ s $\mu$ s $\mu$ s

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$ $E_{off}^{(1)}$ $E_{ts}$	Turn-on Switching Losses Turn-off Switching Losses Total Switching Losses	$V_{CC} = 480V, I_C = 20A$ $R_G = 100\Omega, V_{GE} = 15V,$ see <a href="#">Figure 15</a> and <a href="#">17</a>		0.84 7.4 8.24		mJ mJ mJ
$E_{on}$ $E_{off}^{(1)}$ $E_{ts}$	Turn-on Switching Losses Turn-off Switching Losses Total Switching Losses	$V_{CC} = 480V, I_C = 20A$ $R_G = 100\Omega, V_{GE} = 15V,$ $T_j = 125^\circ C$ see <a href="#">Figure 15</a> and <a href="#">17</a>		0.86 11.5 12.4		mJ mJ mJ

1. Turn-off losses include also the tail of the collector current

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

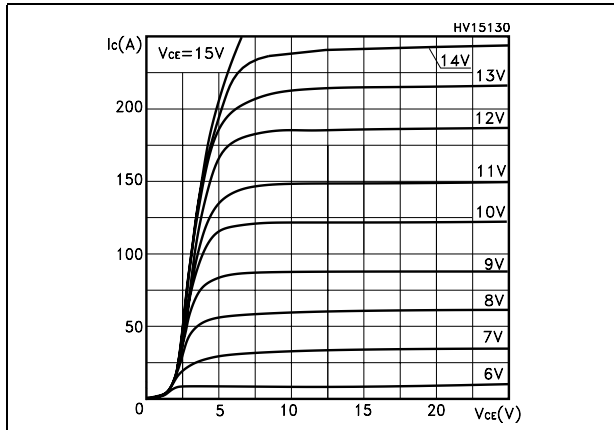


Figure 2. Transfer characteristics

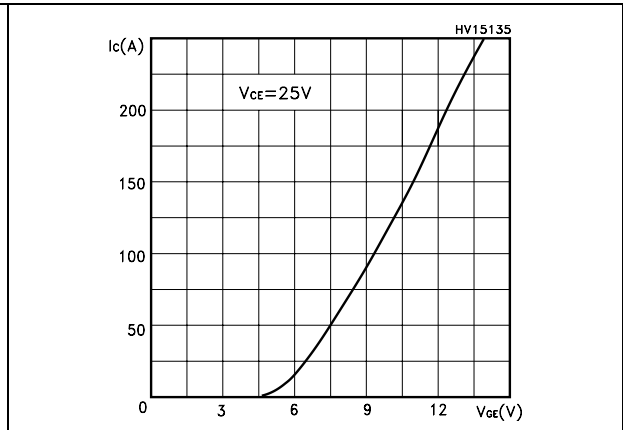


Figure 3. Transconductance

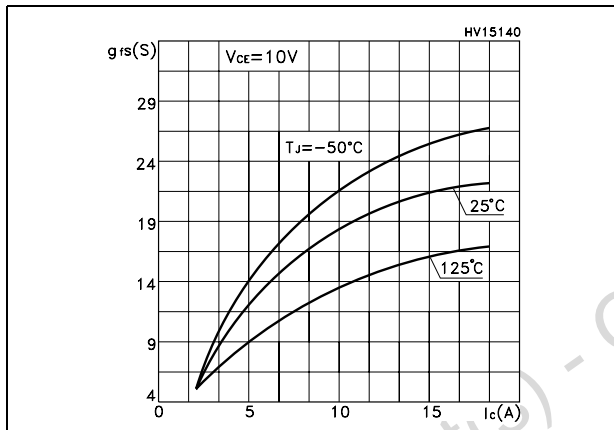


Figure 4. Normalized collector-emitter on voltage vs temperature

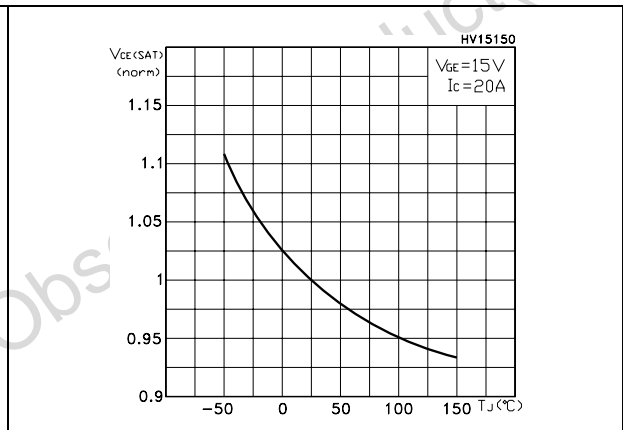


Figure 5. Collector-emitter on voltage vs collector current

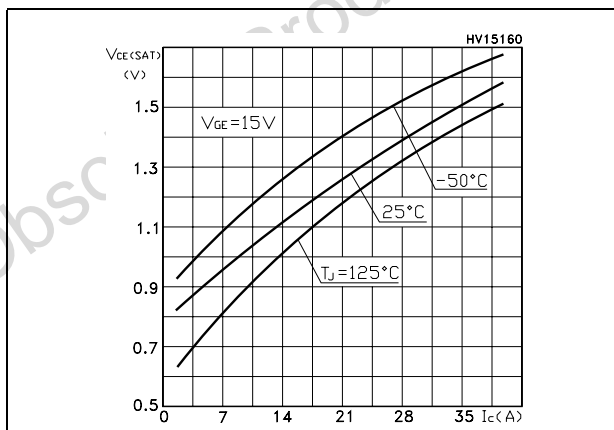


Figure 6. Gate threshold vs temperature

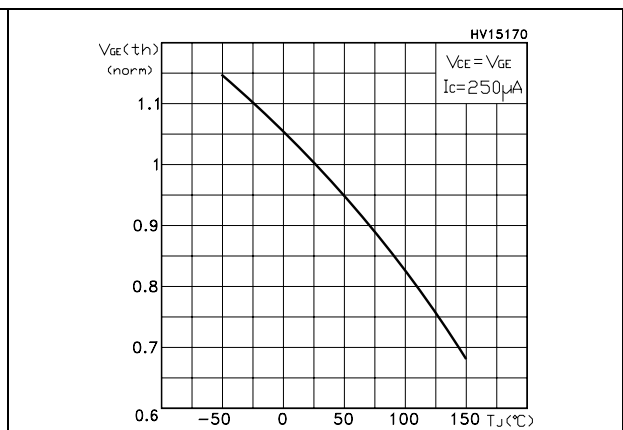


Figure 7. Normalized breakdown voltage vs temperature

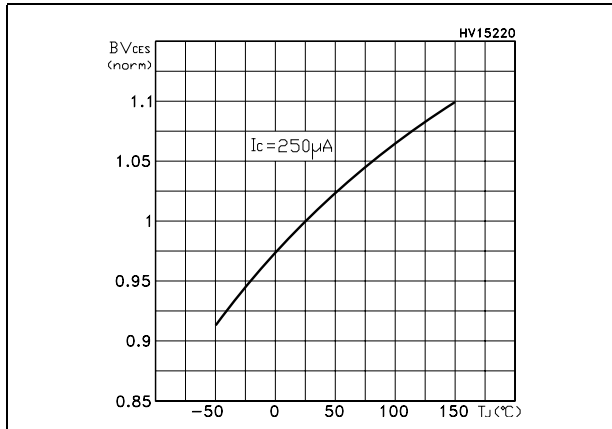


Figure 8. Gate charge vs gate-emitter voltage

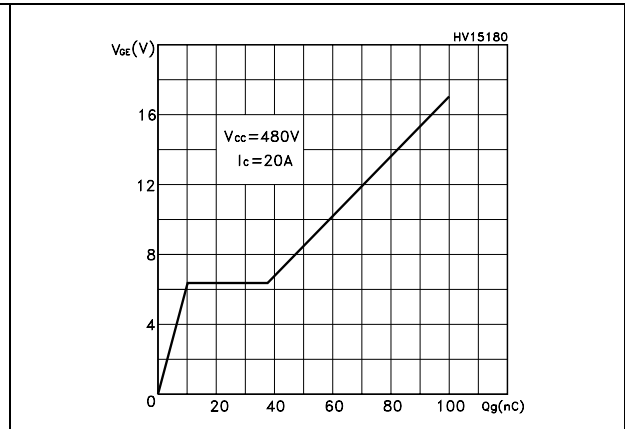


Figure 9. Capacitance variations

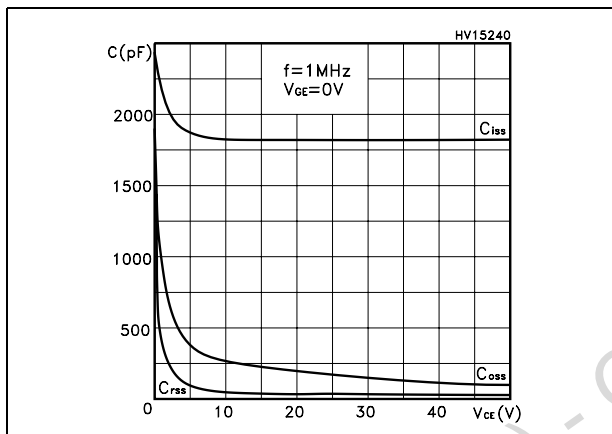


Figure 10. Switching losses vs gate charge

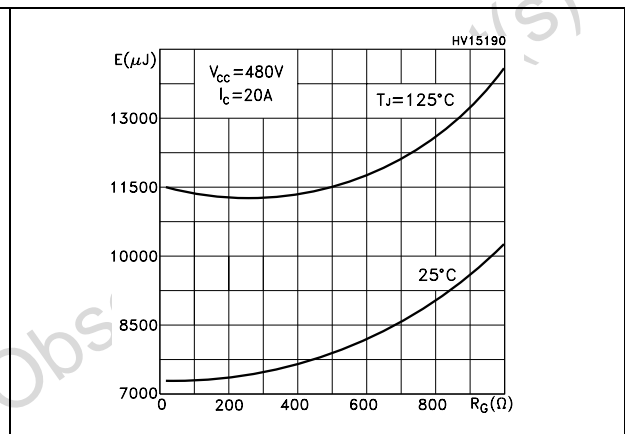


Figure 11. Switching losses vs temperature

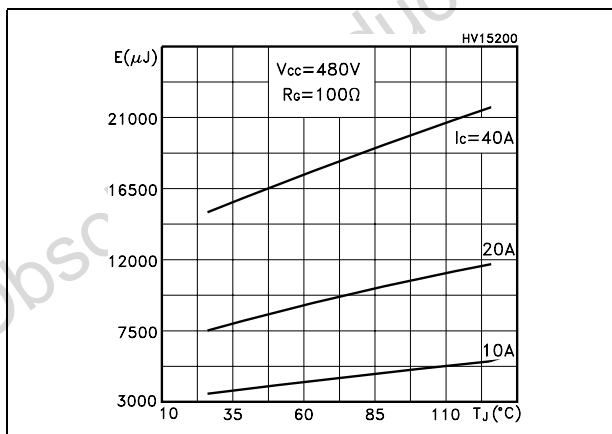


Figure 12. Switching losses vs collector current

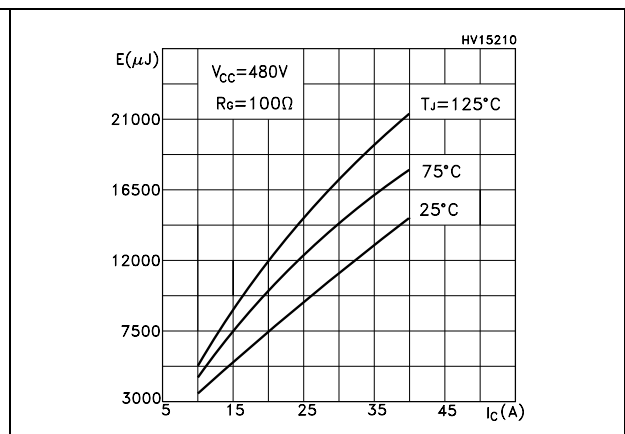


Figure 13. Thermal impedance

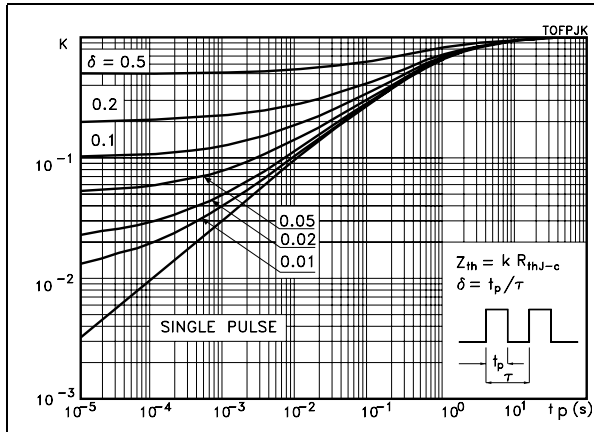
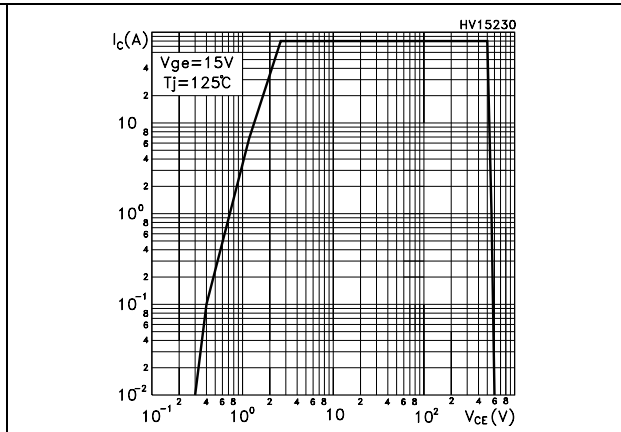


Figure 14. Turn-off SOA



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### 3 Test Circuits

Figure 15. Test circuit for inductive load switching

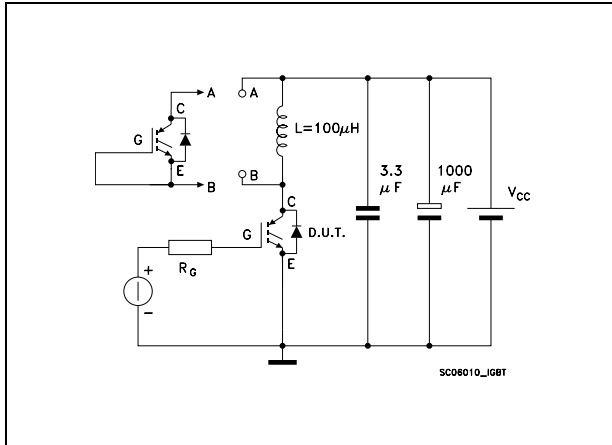


Figure 16. Gate charge test circuit

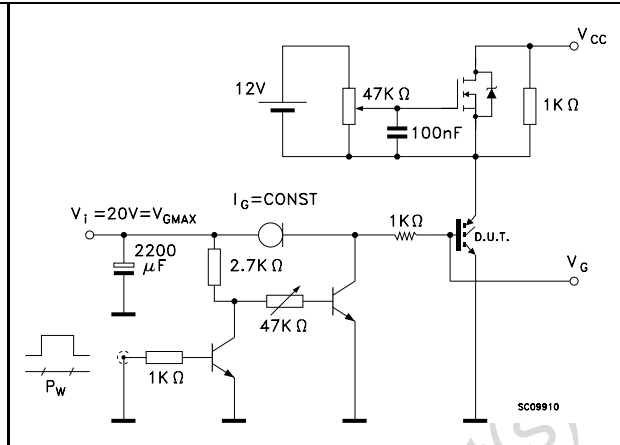
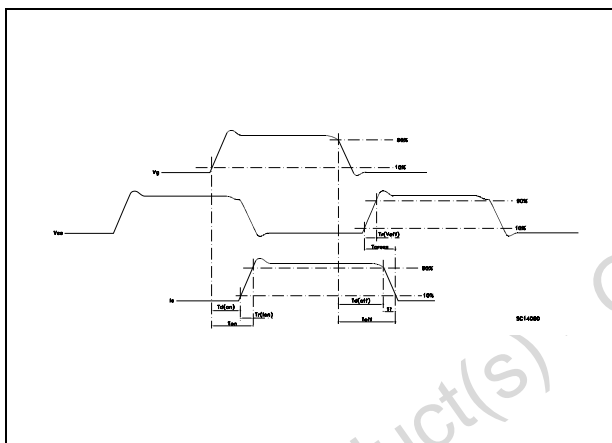


Figure 17. Switching waveform



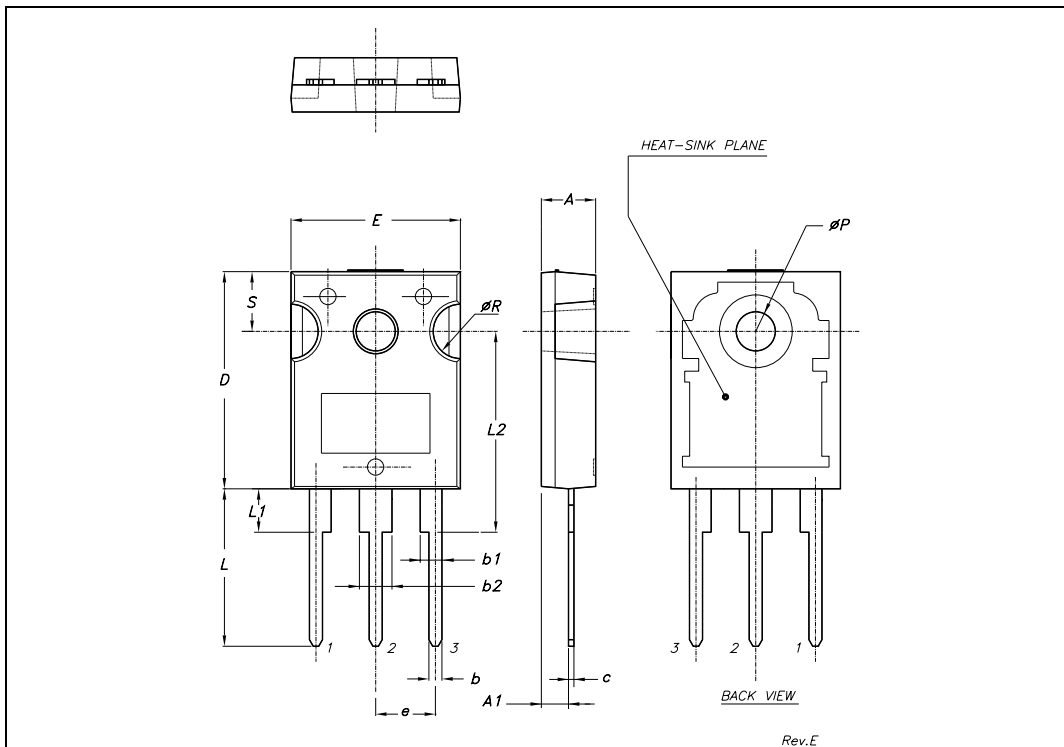
## 4 Package mechanical data

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)

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**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 7. Revision history**

Date	Revision	Changes
28-Mar-2007	1	Initial release.

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