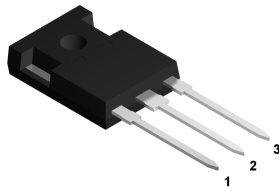
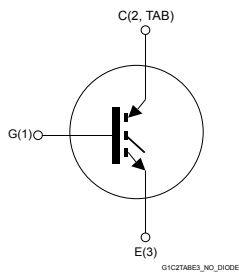



# Automotive-grade trench gate field-stop 650 V, 80 A high speed HB series IGBT in a TO-247 long leads



TO-247 long leads



## Features

- AEC-Q101 qualified 
- Maximum junction temperature:  $T_J = 175\text{ °C}$
- High-speed switching series
- Minimized tail current
- $V_{CE(sat)} = 1.65\text{ V (typ.) @ } I_C = 80\text{ A}$
- Tight parameters distribution
- Safer paralleling
- Low thermal resistance

## Applications

- PFC
- High frequency converters

## Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the new HB series of IGBTs, which represents an optimum compromise between conduction and switching loss to maximize the efficiency of any frequency converter. Furthermore, the slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.

### Product status link

[STGWA80H65FBAG](#)

### Product summary

<b>Order code</b>	STGWA80H65FBAG
<b>Marking</b>	G80H65FBAG
<b>Package</b>	TO-247 long leads
<b>Packing</b>	Tube

## 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )	650	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	120 <sup>(1)</sup>	A
	Continuous collector current at $T_C = 100\text{ °C}$	80	
$I_{CP}$ <sup>(2)</sup>	Pulsed collector current ( $t_p = 1\text{ ms}$ )	240	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage ( $t_p \leq 10\text{ }\mu\text{s}$ )	$\pm 30$	
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	535	W
$T_{STG}$	Storage temperature range	-55 to 150	°C
$T_J$	Operating junction temperature range	-55 to 175	°C

1. Current limited by package.
2. Pulse width is limited by maximum junction temperature.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.28	°C/W
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	°C/W

## 2 Electrical characteristics

$T_J = 25\text{ °C}$  unless otherwise specified.

**Table 3. Static characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}$		1.65	2.0	V
		$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 125\text{ °C}$		1.8		
		$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 175\text{ °C}$		1.9		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	4.5	5.5	6.5	V

**Table 4. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	10460	-	pF
$C_{oes}$	Output capacitance		-	390	-	pF
$C_{res}$	Reverse transfer capacitance		-	215	-	pF
$Q_g$	Total gate charge	$V_{CC} = 520\text{ V}, I_C = 80\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$	-	453	-	nC

**Table 5. Switching characteristics (inductive load)**

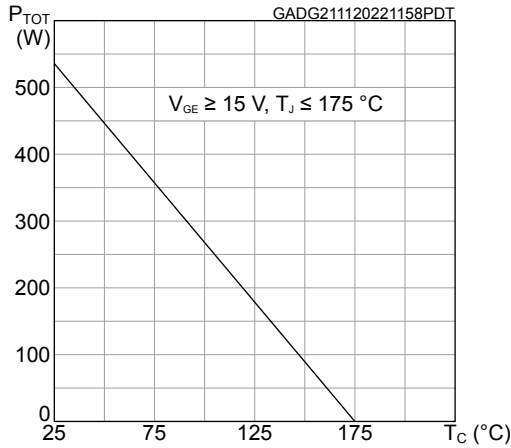
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 400\text{ V}, I_C = 80\text{ A}, V_{GE} = 15\text{ V}, R_G = 10\ \Omega$	-	360	-	ns
$t_r$	Current rise time		-	84	-	ns
$di/dt_{(on)}$	Turn-on current slope		-	720	-	A/ $\mu$ s
$E_{on}^{(1)}$	Turn-on switching energy		-	3.26	-	mJ
$t_{d(off)}$	Turn-off delay time		-	360	-	ns
$t_f$	Current fall time		-	66	-	ns
$E_{off}^{(2)}$	Turn-off switching energy		-	2.33	-	mJ
$E_{ts}$	Total switching energy	-	5.59	-	mJ	
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 400\text{ V}, I_C = 80\text{ A}, V_{GE} = 15\text{ V}, R_G = 10\ \Omega, T_J = 175\text{ °C}$	-	375	-	ns
$t_r$	Current rise time		-	90	-	ns
$di/dt_{(on)}$	Turn-on current slope		-	690	-	A/ $\mu$ s
$E_{on}^{(1)}$	Turn-on switching energy		-	5.24	-	mJ
$t_{d(off)}$	Turn-off delay time		-	375	-	ns
$t_f$	Current fall time		-	65	-	ns
$E_{off}^{(2)}$	Turn-off switching energy		-	2.56	-	mJ
$E_{ts}$	Total switching energy	-	7.8	-	mJ	

1. Including the reverse recovery of the external diode. The diode is the same of the co-packed STGWA80H65DFBAG.

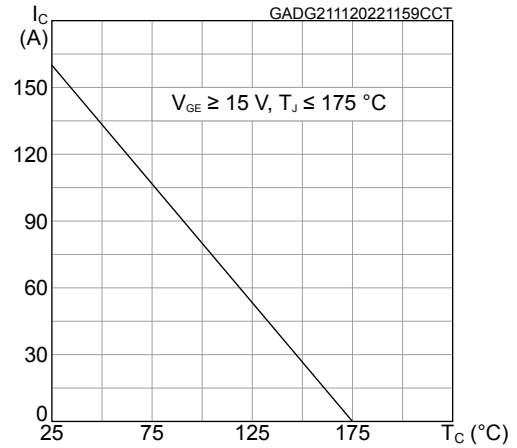
2. Including the tail of the collector current

## 2.1 Electrical characteristics (curves)

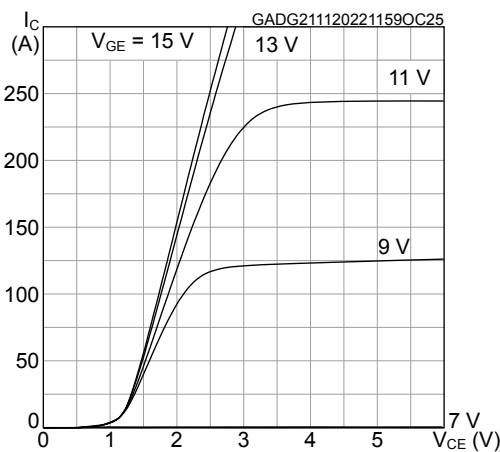
**Figure 1. Total power dissipation vs temperature**



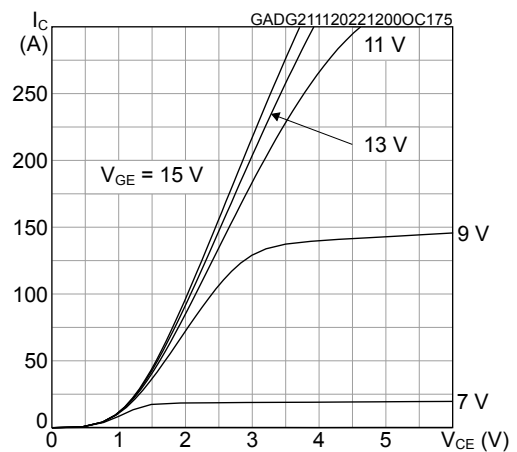
**Figure 2. Collector current vs temperature**



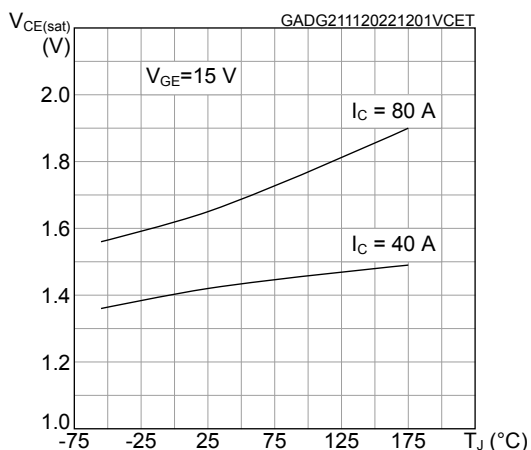
**Figure 3. Typical output characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )**



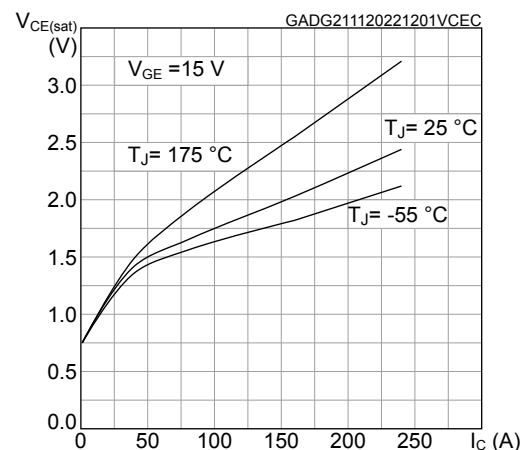
**Figure 4. Typical output characteristics ( $T_J = 175 \text{ }^\circ\text{C}$ )**



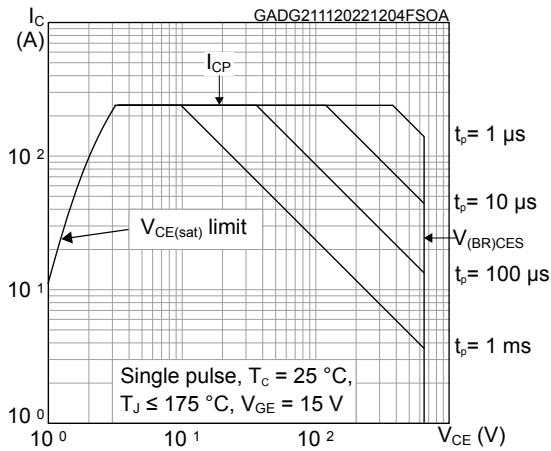
**Figure 5. Typical  $V_{CE(sat)}$  vs temperature**



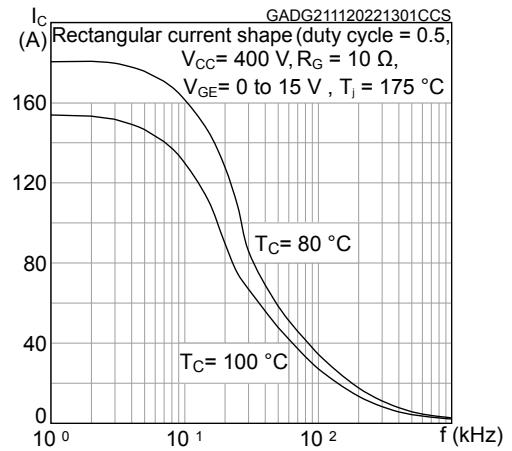
**Figure 6. Typical  $V_{CE(sat)}$  vs collector current**



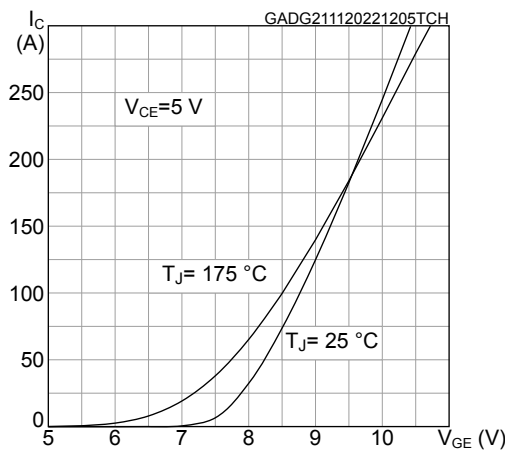
**Figure 7. Forward bias safe operating area**



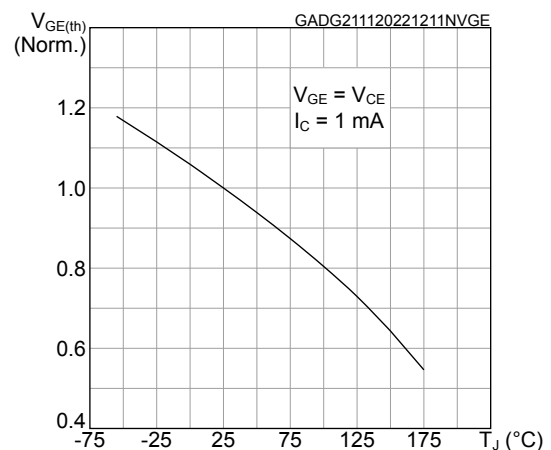
**Figure 8. Collector current vs switching frequency**



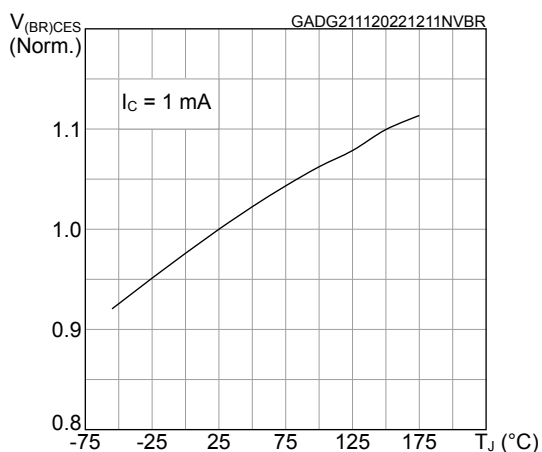
**Figure 9. Typical transfer characteristics**



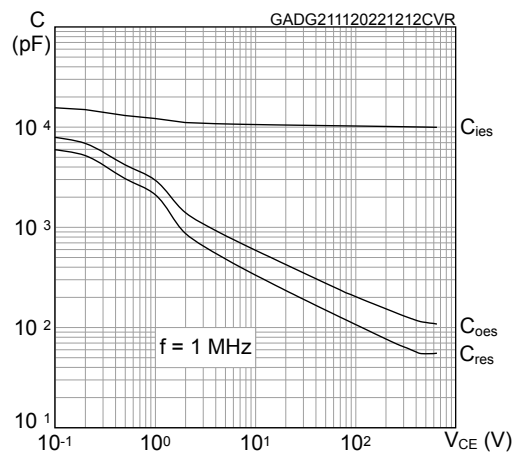
**Figure 10. Normalized V\_GE(th) vs temperature**



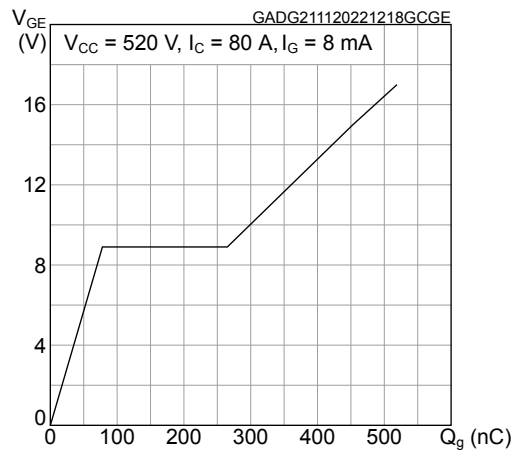
**Figure 11. Normalized V\_(BR)CES vs temperature**



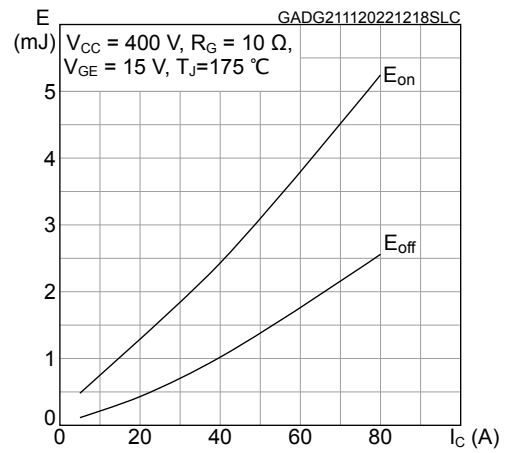
**Figure 12. Typical capacitance characteristics**



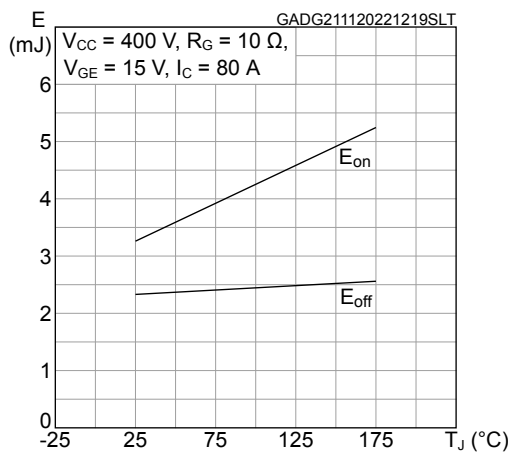
**Figure 13. Typical gate charge characteristics**



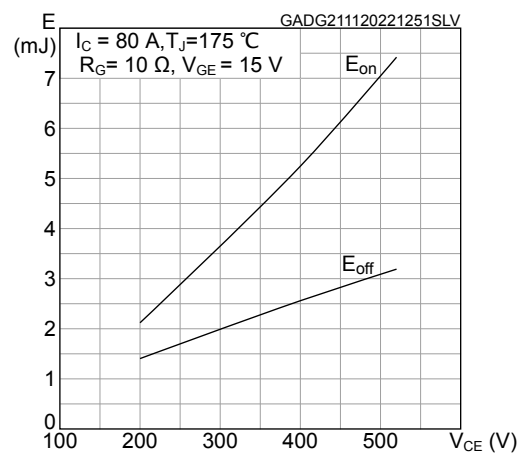
**Figure 14. Typical switching energy vs collector current**



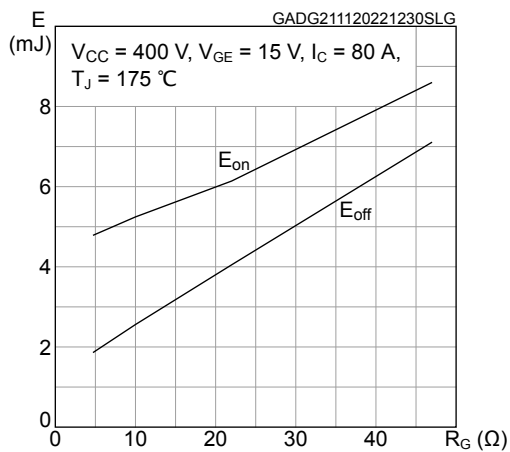
**Figure 15. Typical switching energy vs temperature**



**Figure 16. Typical switching energy vs collector emitter voltage**



**Figure 17. Typical switching energy vs RG**



**Figure 18. Typical switching times vs collector current**

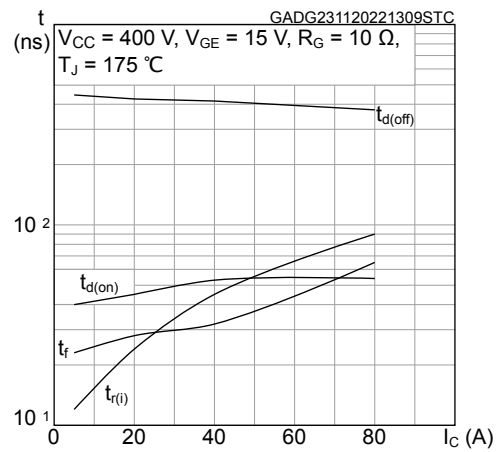


Figure 19. Typical switching times vs gate resistance

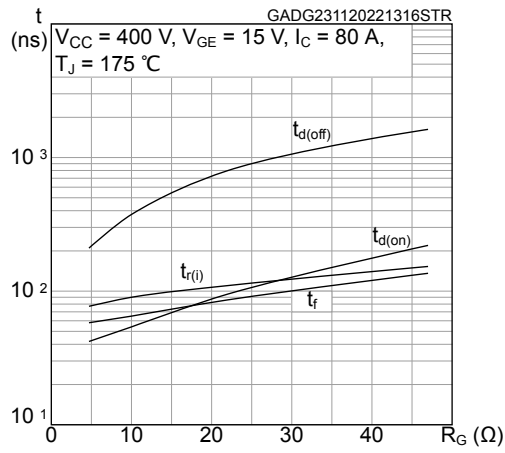
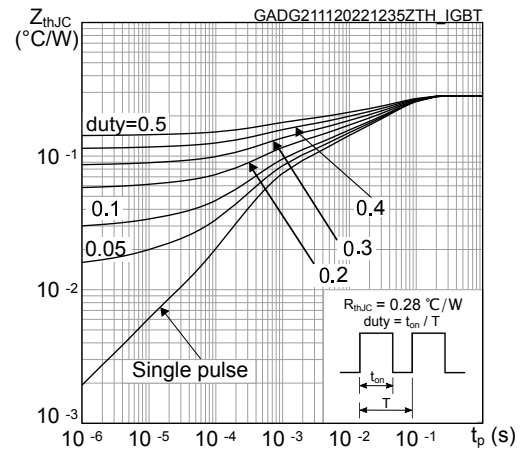


Figure 20. Maximum transient thermal impedance

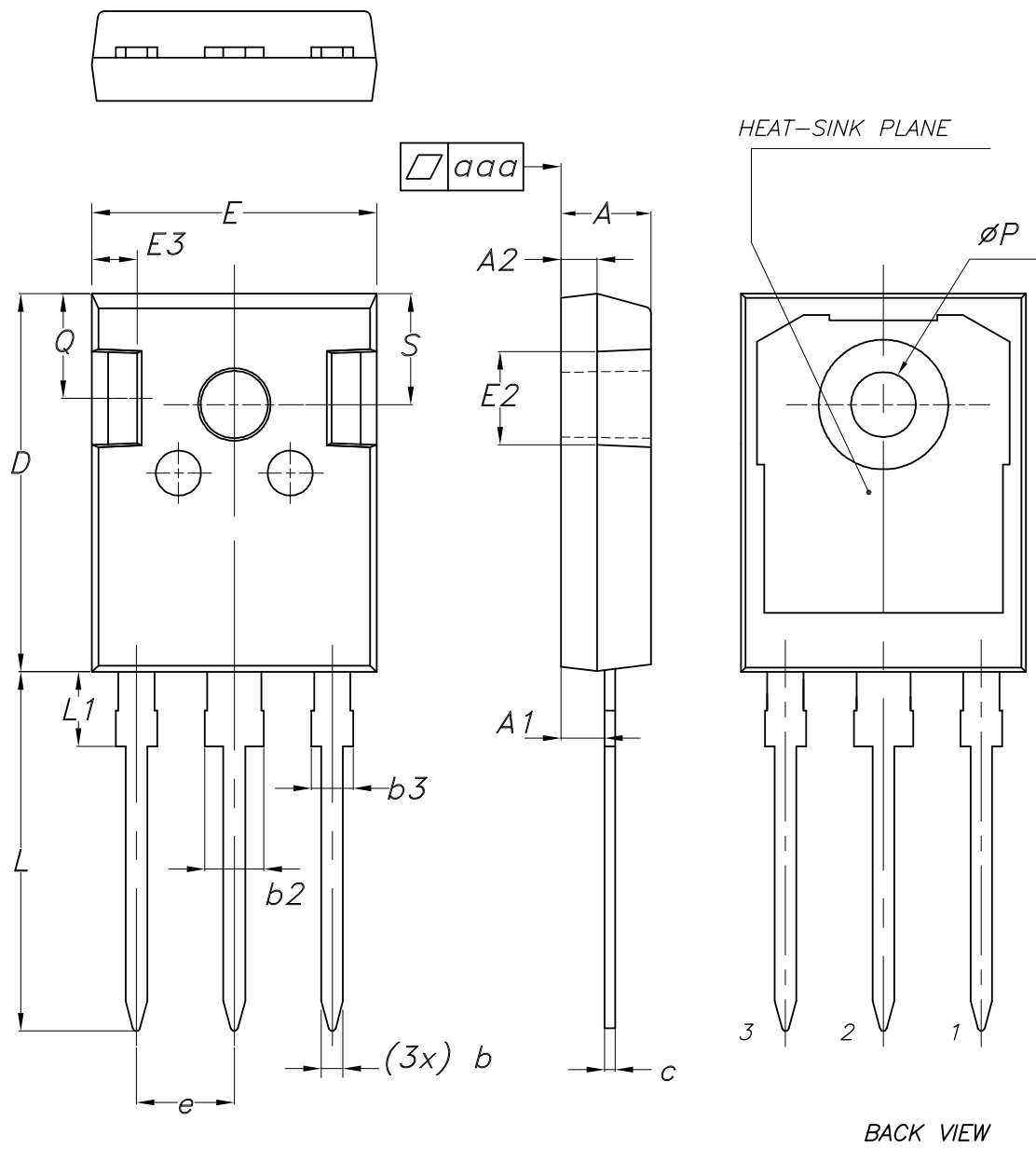


### 3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

#### 3.1 TO-247 long leads package information

Figure 21. TO-247 long leads package outline





**Table 6. TO-247 long leads package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25
aaa		0.04	0.10

## Revision history

Table 7. Document revision history

Date	Revision	Changes
16-Feb-2023	1	First release.

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