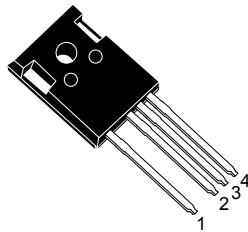
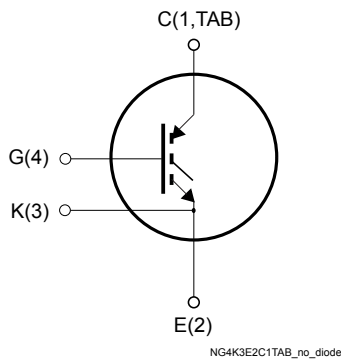


## Trench gate field-stop, 650 V, 100 A, high-speed HB2 series IGBT in a TO247-4 package



TO247-4



### Features

- Maximum junction temperature:  $T_J = 175\text{ °C}$
- Low  $V_{CE(sat)} = 1.55\text{ V (typ.) @ } I_C = 100\text{ A}$
- Minimized tail current
- Tight parameter distribution
- Low thermal resistance
- Positive  $V_{CE(sat)}$  temperature coefficient
- Excellent switching performance thanks to the extra driving kelvin pin

### Applications

- Welding
- Power factor correction
- UPS
- Solar inverters
- Chargers

### Description

The newest IGBT 650 V HB2 series represents an evolution of the advanced proprietary trench gate field-stop structure. The performance of the HB2 series is optimized in terms of conduction, thanks to a better  $V_{CE(sat)}$  behavior at low current values, as well as in terms of reduced switching energy. The result is a product specifically designed to maximize efficiency for a wide range of fast applications.

#### Product status link

[STGW100H65FB2-4](#)

#### Product summary

Order code	STGW100H65FB2-4
Marking	G100H65FB2
Package	TO247-4
Packing	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 $T_C = 25\text{ °C}$	145	A
	Continuous collector current at $T_C = 100\text{ °C}$	91	
$I_{CP}^{(1)}$	Pulsed collector current ( $t_p \leq 1\ \mu\text{s}$ , $T_J < 175\text{ °C}$ )	300	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage ( $t_p \leq 10\ \mu\text{s}$ )	$\pm 30$	
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	441	W
$T_{STG}$	Storage temperature range	-55 to 150	°C
$T_J$	Operating junction temperature range	-55 to 175	°C

1. Defined by design, not subject to production test.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.34	°C/W
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	°C/W

## 2 Electrical characteristics

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

**Table 3. Static characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$		1.55	2.00	V
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ °C}$		1.8		
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 175\text{ °C}$		1.9		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	4.5	5.5	6.5	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}$			25	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 250$	nA

**Table 4. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	6227	-	pF
$C_{oes}$	Output capacitance		-	318	-	pF
$C_{res}$	Reverse transfer capacitance		-	165	-	pF
$Q_g$	Total gate charge	$V_{CC} = 520\text{ V}, I_C = 100\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 22. Gate charge test circuit)	-	288	-	nC
$Q_{ge}$	Gate-emitter charge		-	48	-	nC
$Q_{gc}$	Gate-collector charge		-	120	-	nC

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

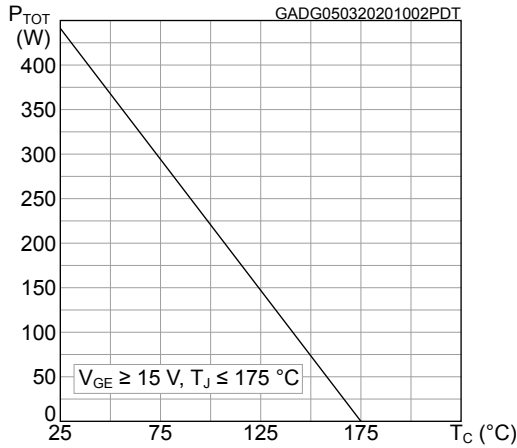
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 400\text{ V}$ , $I_C = 100\text{ A}$ , $V_{GK} = 15\text{ V}$ , $R_{G(on)} = 8.2\ \Omega$ , $R_{G(off)} = 3.3\ \Omega$ (see Figure 21. Test circuit for inductive load switching)	-	23	-	ns
$t_r$	Current rise time		-	28	-	ns
$E_{on}^{(1)}$	Turn-on switching energy		-	1059	-	$\mu\text{J}$
$t_{d(off)}$	Turn-off delay time		-	141	-	ns
$t_f$	Current fall time		-	13	-	ns
$E_{off}^{(2)}$	Turn-off switching energy		-	1137	-	$\mu\text{J}$
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 400\text{ V}$ , $I_C = 100\text{ A}$ , $V_{GK} = 15\text{ V}$ , $R_{G(on)} = 8.2\ \Omega$ , $R_{G(off)} = 3.3\ \Omega$ , $T_J = 175\text{ }^\circ\text{C}$ (see Figure 21. Test circuit for inductive load switching)	-	19	-	ns
$t_r$	Current rise time		-	30	-	ns
$E_{on}^{(1)}$	Turn-on switching energy		-	2061	-	$\mu\text{J}$
$t_{d(off)}$	Turn-off delay time		-	176	-	ns
$t_f$	Current fall time		-	79	-	ns
$E_{off}^{(2)}$	Turn-off switching energy		-	2154	-	$\mu\text{J}$

1. Including the reverse recovery of the diode. The diode is the same of the co-packed STGWA100H65DFB2.

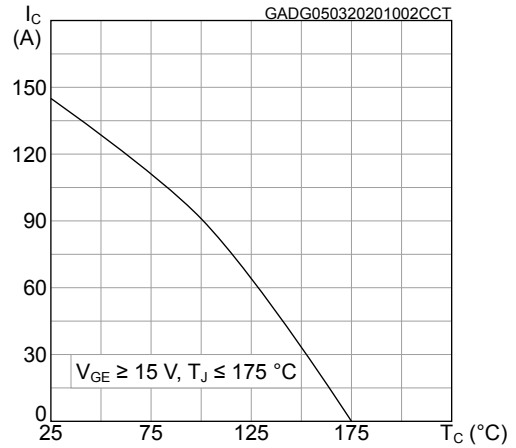
2. Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

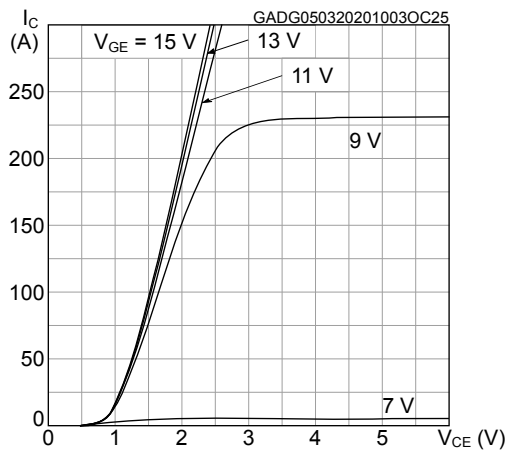
**Figure 1. Power dissipation vs case temperature**



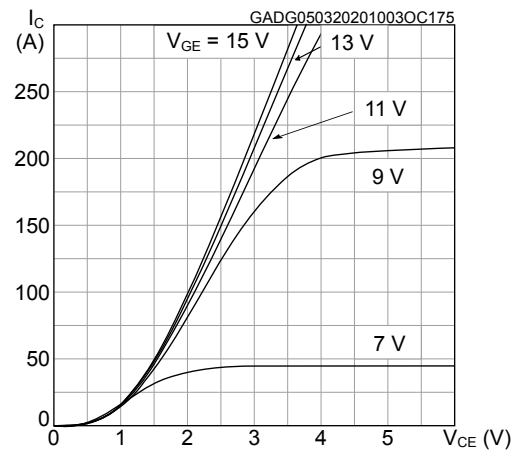
**Figure 2. Collector current vs case temperature**



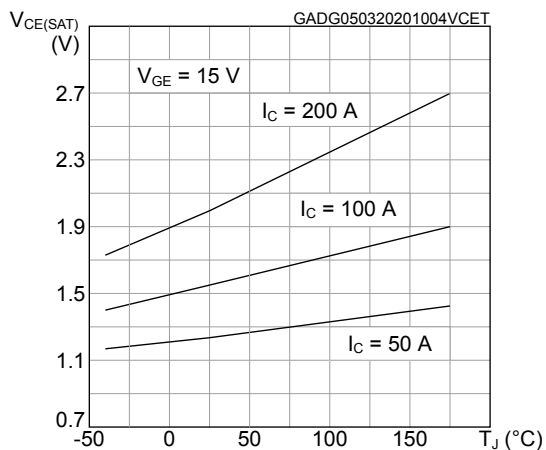
**Figure 3. Output characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )**



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



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



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

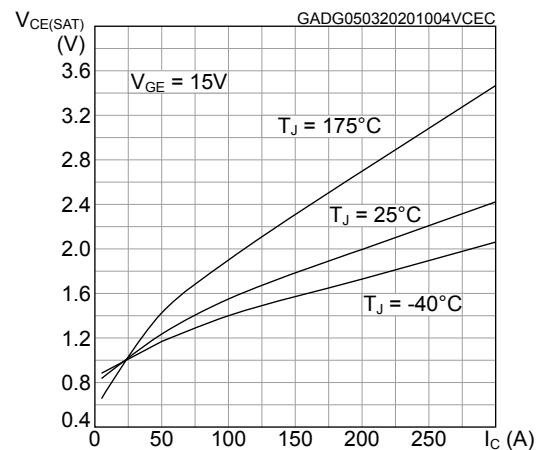


Figure 7. Collector current vs switching frequency

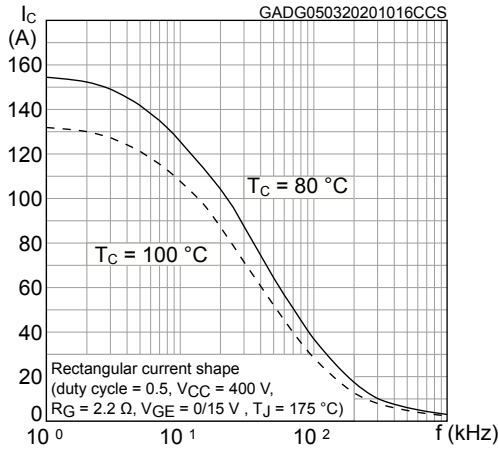


Figure 8. Forward bias safe operating area

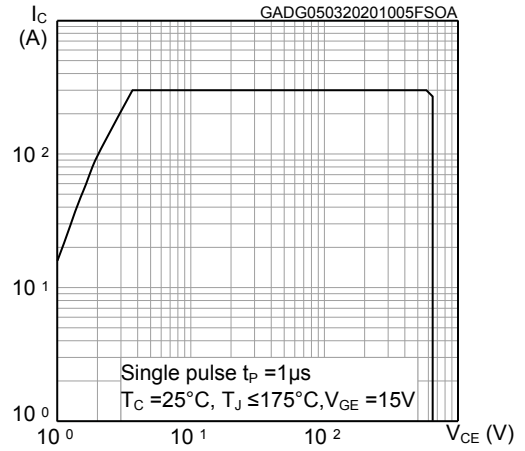


Figure 9. Transfer characteristics

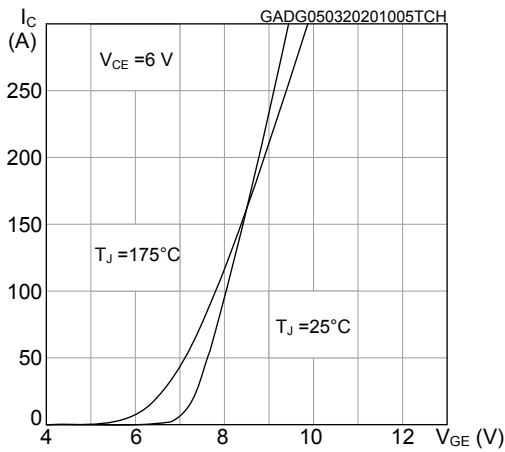


Figure 10. Normalized VGE(th) vs junction temperature

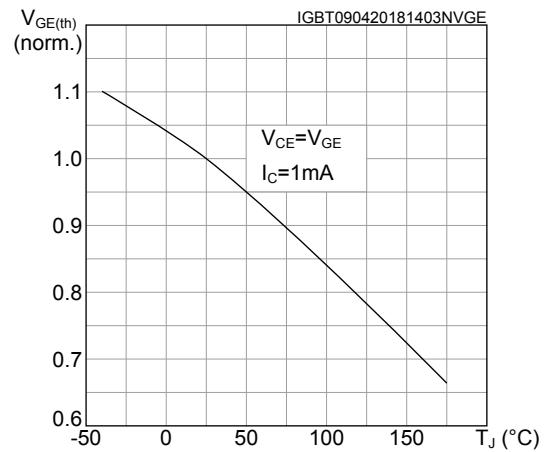


Figure 11. Normalized V(BR)CES vs junction temperature

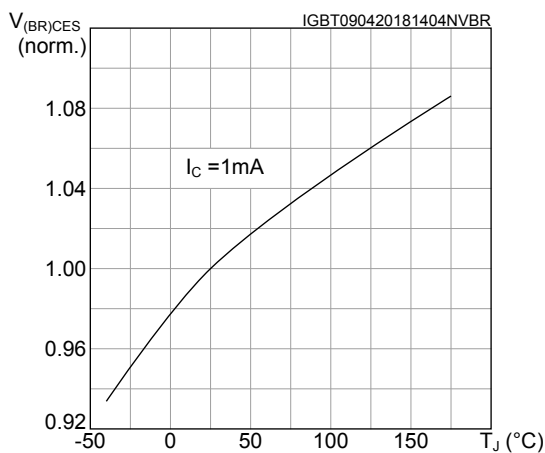
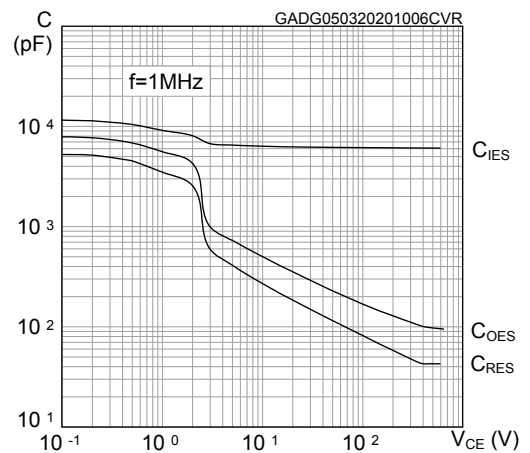
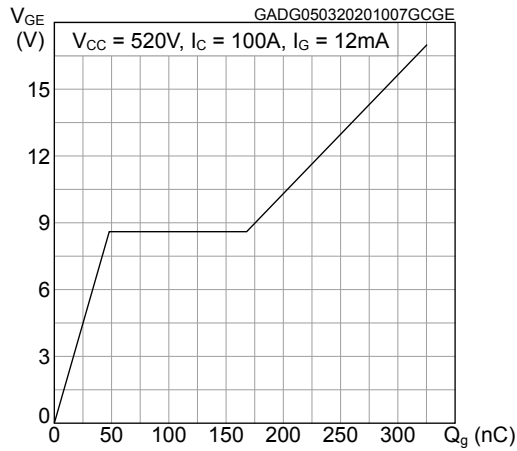


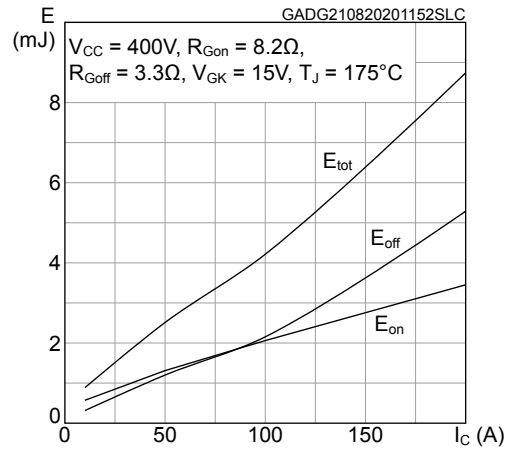
Figure 12. Capacitance variations



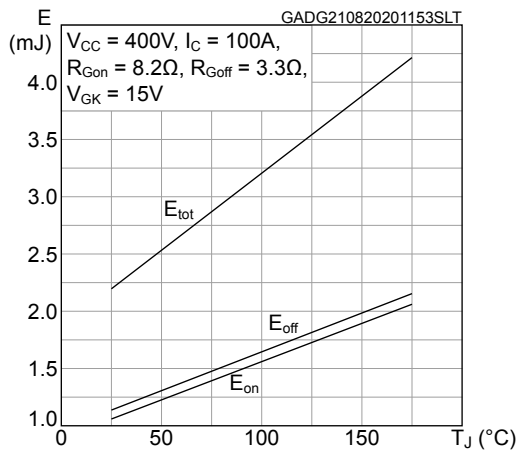
**Figure 13. Gate charge vs gate-emitter voltage**



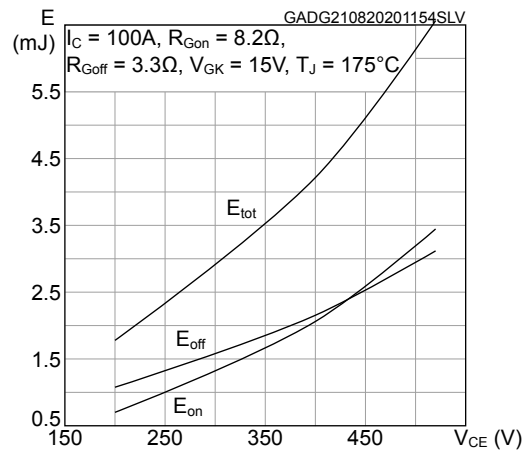
**Figure 14. Switching energy vs collector current**



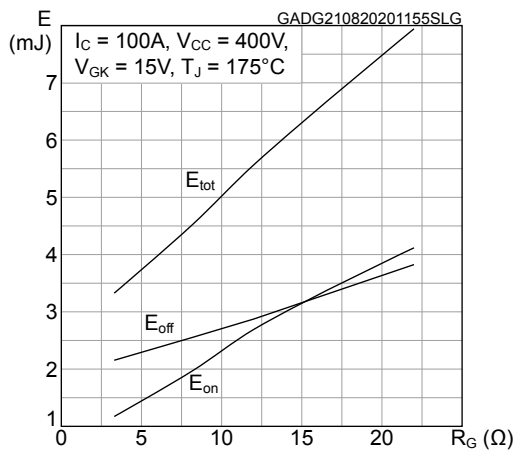
**Figure 15. Switching energy vs temperature**



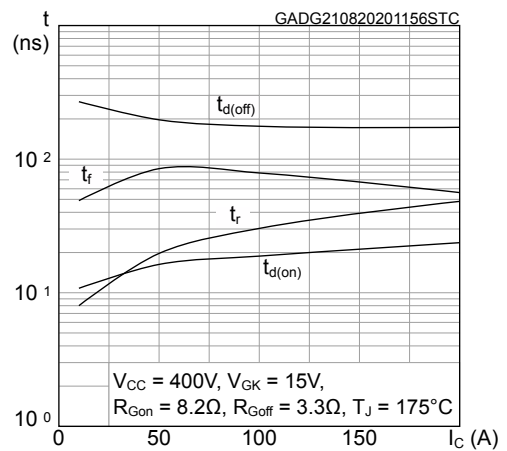
**Figure 16. Switching energy vs collector emitter voltage**



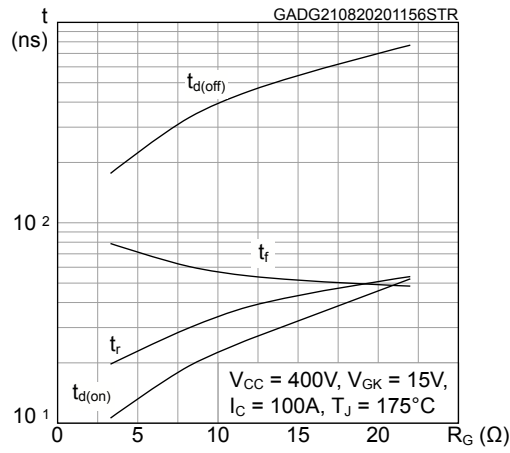
**Figure 17. Switching energy vs gate resistance**



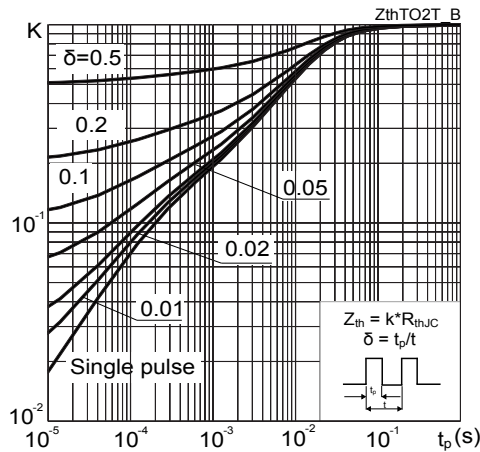
**Figure 18. Switching times vs collector current**



**Figure 19. Switching times vs gate resistance**

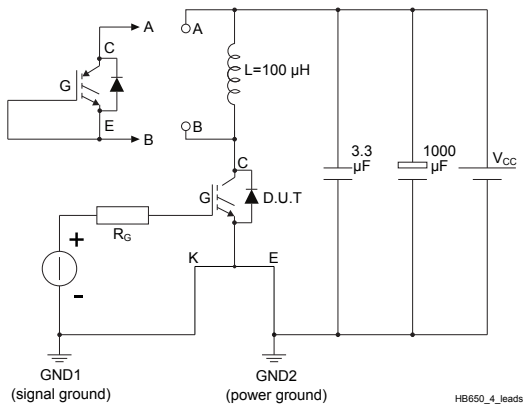
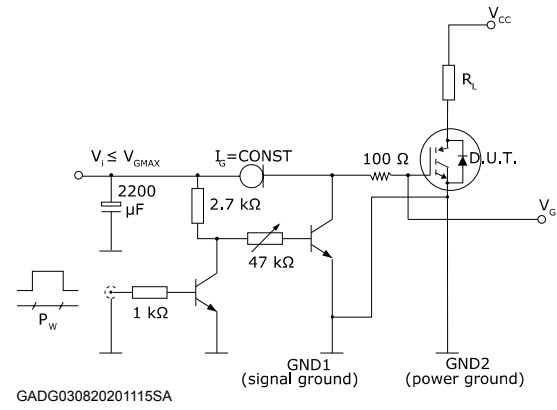
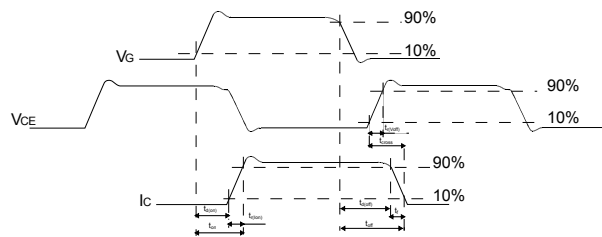


**Figure 20. Thermal impedance**





### 3 Test circuits

**Figure 21. Test circuit for inductive load switching**

**Figure 22. Gate charge test circuit**

**Figure 23. Switching waveform**


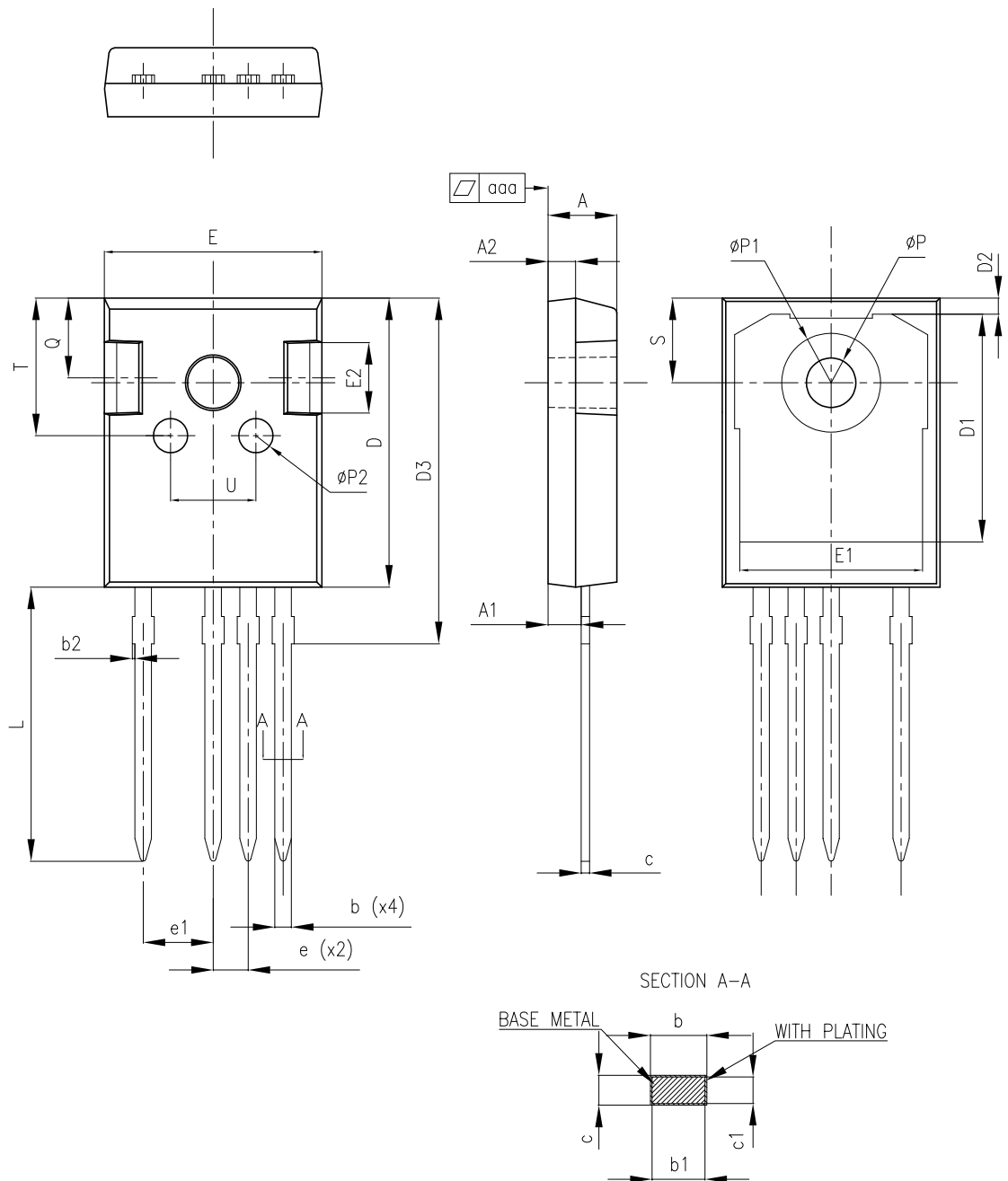
AM01506v1

## 4 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.

### 4.1 TO247-4 package information

Figure 24. TO247-4 package outline



**Table 6. TO247-4 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		1.29
b1	1.15	1.20	1.25
b2	0		0.20
c	0.59		0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
T	9.80		10.20
U	6.00		6.40
aaa		0.04	0.10

## Revision history

**Table 7. Document revision history**

Date	Version	Changes
09-Sep-2020	1	First release.
10-Sep-2020	2	Updated product status link in cover page.
02-Jul-2021	3	Updated <a href="#">Table 3. Static characteristics</a> . Updated <a href="#">Section 4 Package information</a> . Minor text changes.

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