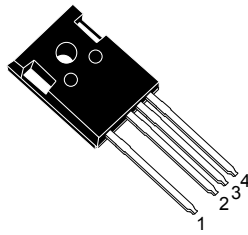
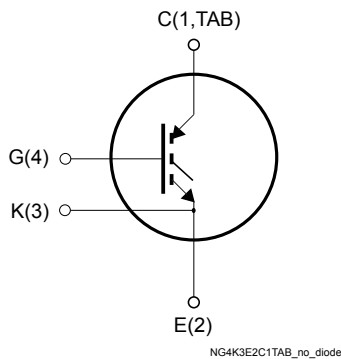


## Trench gate field-stop, 650 V, 100 A, high-speed HB2 series IGBT in a TO247-4 package



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 ( $t_p \leq 1\text{ }\mu\text{s}$ , $T_J < 175\text{ °C}$ )	300	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage ( $t_p \leq 10\text{ }\mu\text{s}$ )	$\pm 30$	
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	441	W
$T_{STG}$	Storage temperature range	-55 to 150	$^{\circ}\text{C}$
$T_J$	Operating junction temperature range	-55 to 175	$^{\circ}\text{C}$

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	$^{\circ}\text{C/W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	$^{\circ}\text{C/W}$

## 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)**

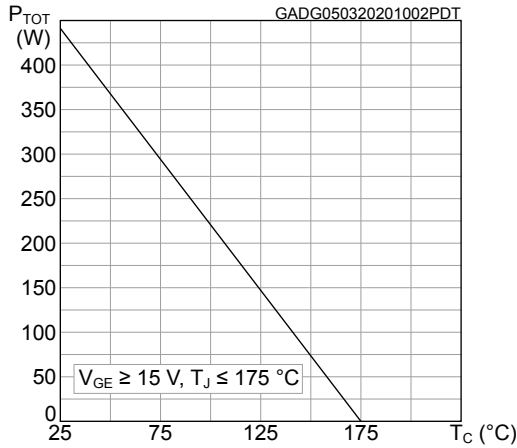
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 400\text{ V}$ , $I_C = 100\text{ A}$ , $V_{GK} = 15\text{ V}$ , $R_{G(on)} = 8.2\ \Omega$ , $R_{G(off)} = 3.3\ \Omega$ (see Figure 21. Test circuit for inductive load switching)	-	23	-	ns
$t_r$	Current rise 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.

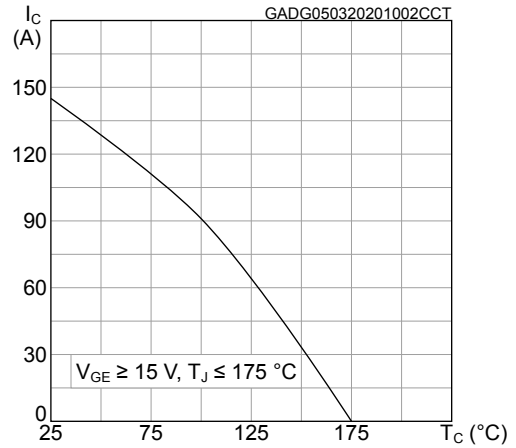
2. Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

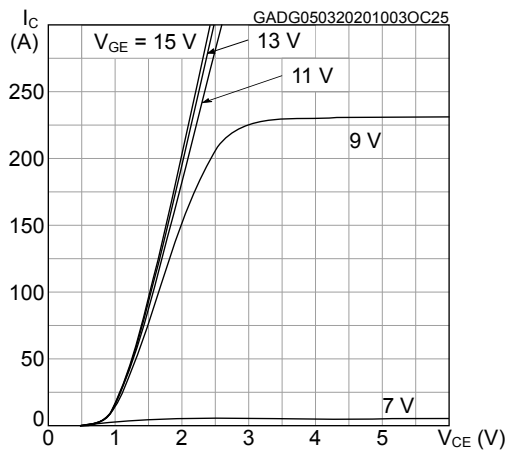
**Figure 1. Power dissipation vs case temperature**



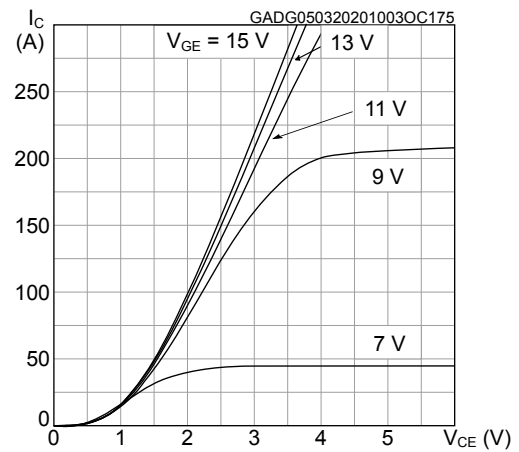
**Figure 2. Collector current vs case temperature**



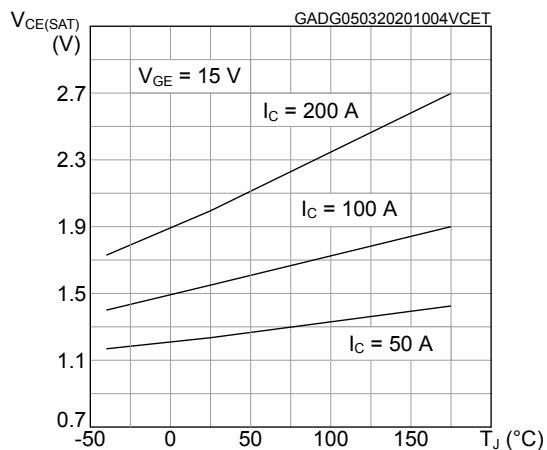
**Figure 3. Output characteristics ( $T_J = 25 \text{ }^\circ\text{C}$ )**



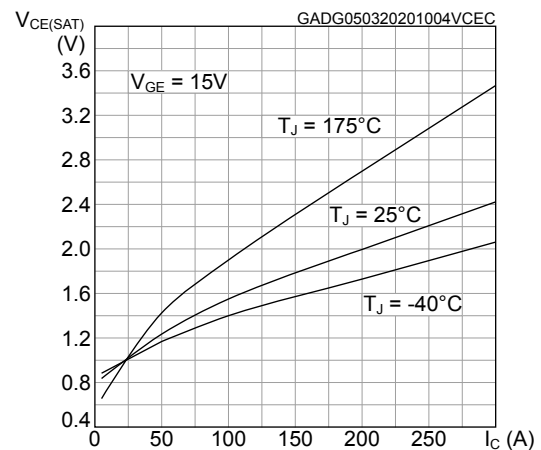
**Figure 4. Output characteristics ( $T_J = 175 \text{ }^\circ\text{C}$ )**



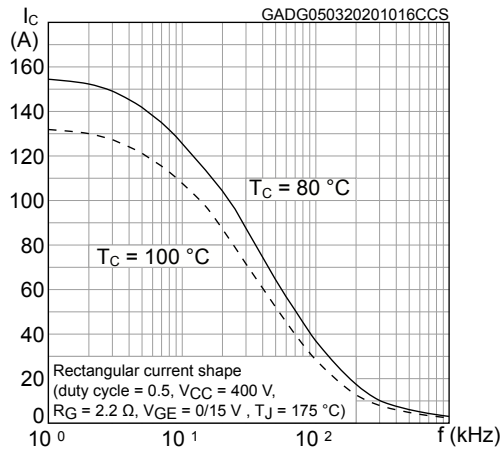
**Figure 5.  $V_{CE(sat)}$  vs junction temperature**



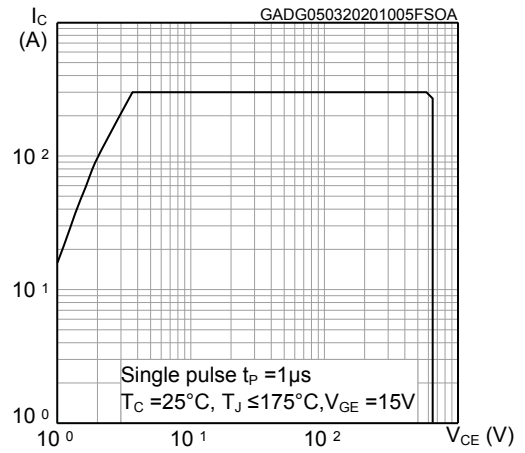
**Figure 6.  $V_{CE(sat)}$  vs collector current**



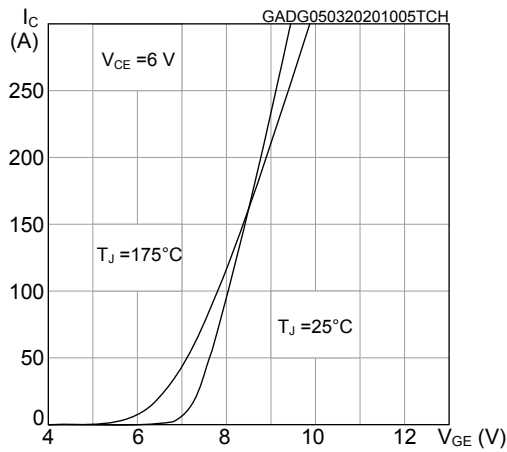
**Figure 7. Collector current vs switching frequency**



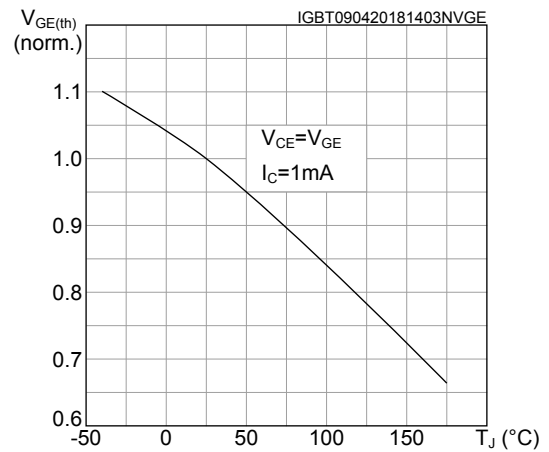
**Figure 8. Forward bias safe operating area**



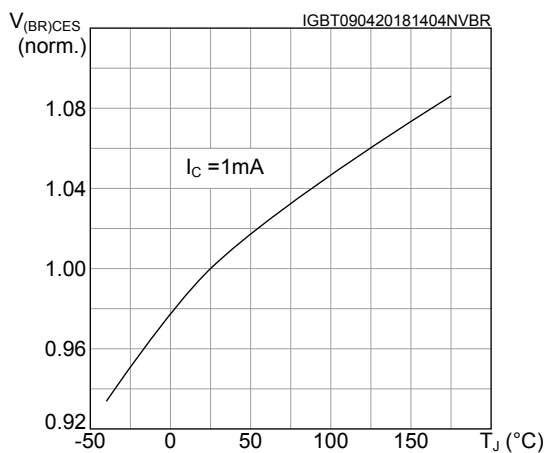
**Figure 9. Transfer characteristics**



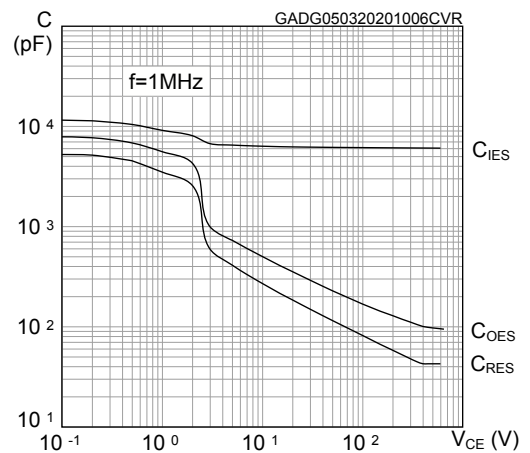
**Figure 10. Normalized VGE(th) vs junction temperature**



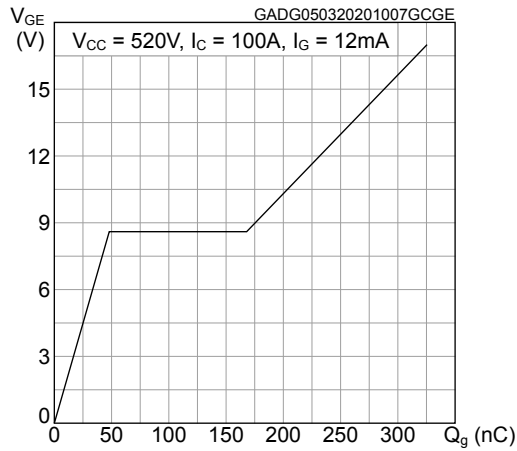
**Figure 11. Normalized V(BR)CES vs junction temperature**



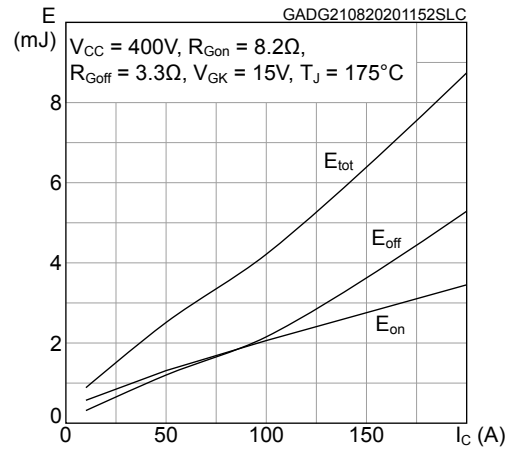
**Figure 12. Capacitance variations**



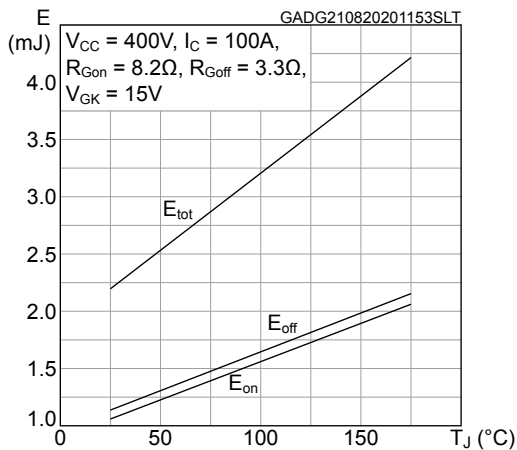
**Figure 13. Gate charge vs gate-emitter voltage**



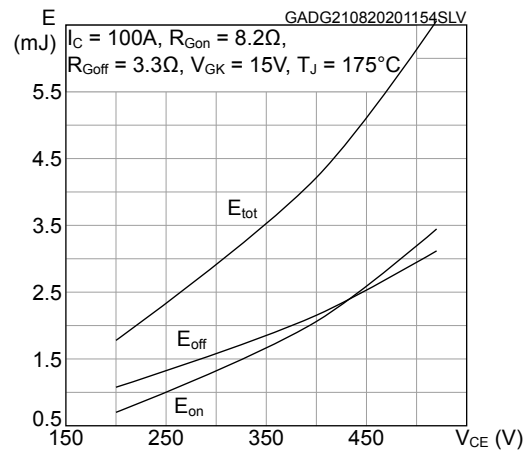
**Figure 14. Switching energy vs collector current**



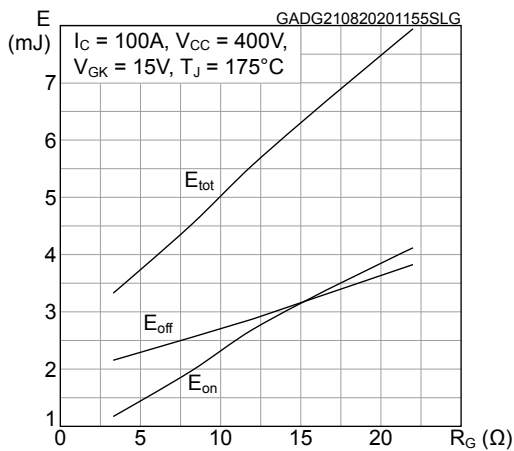
**Figure 15. Switching energy vs temperature**



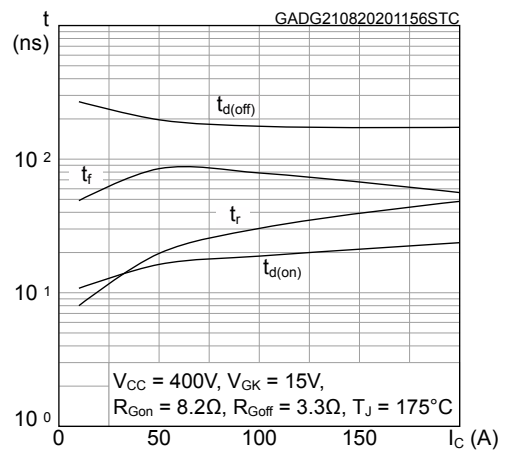
**Figure 16. Switching energy vs collector emitter voltage**



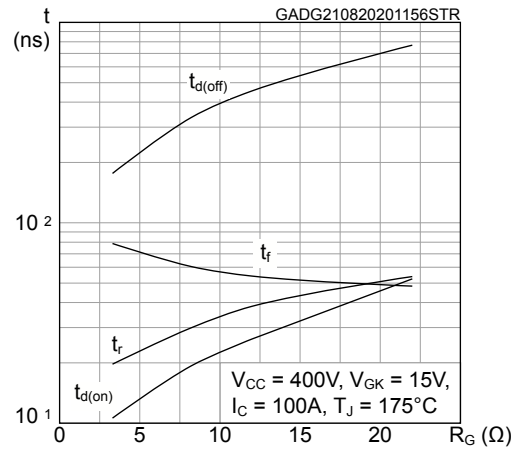
**Figure 17. Switching energy vs gate resistance**



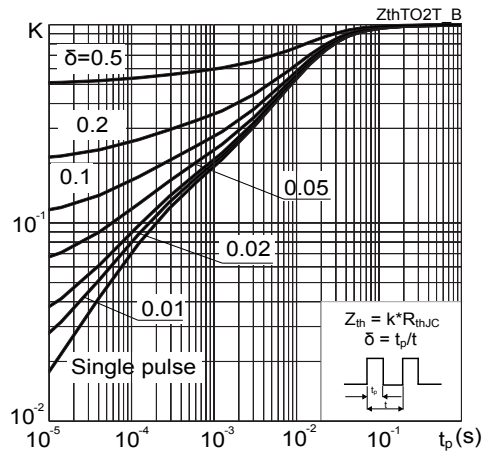
**Figure 18. Switching times vs collector current**



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



**Figure 20. Thermal impedance**





### 3 Test circuits

Figure 21. Test circuit for inductive load switching

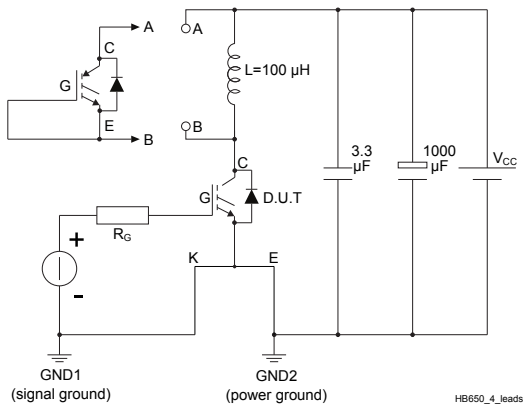


Figure 22. Gate charge test circuit

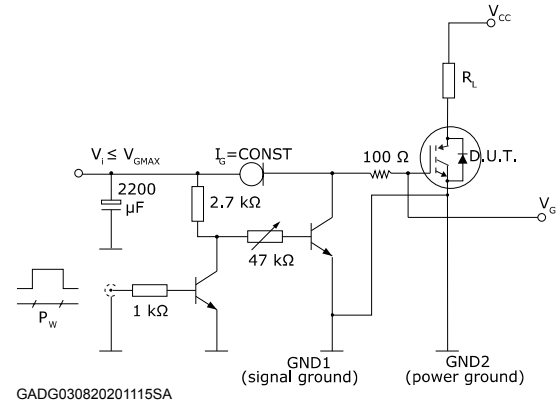
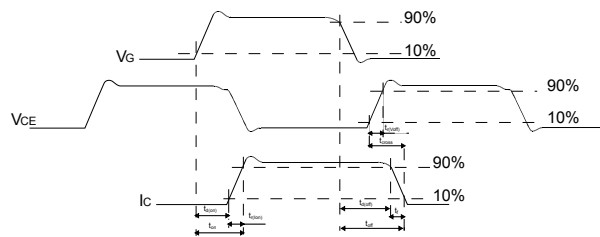


Figure 23. Switching waveform



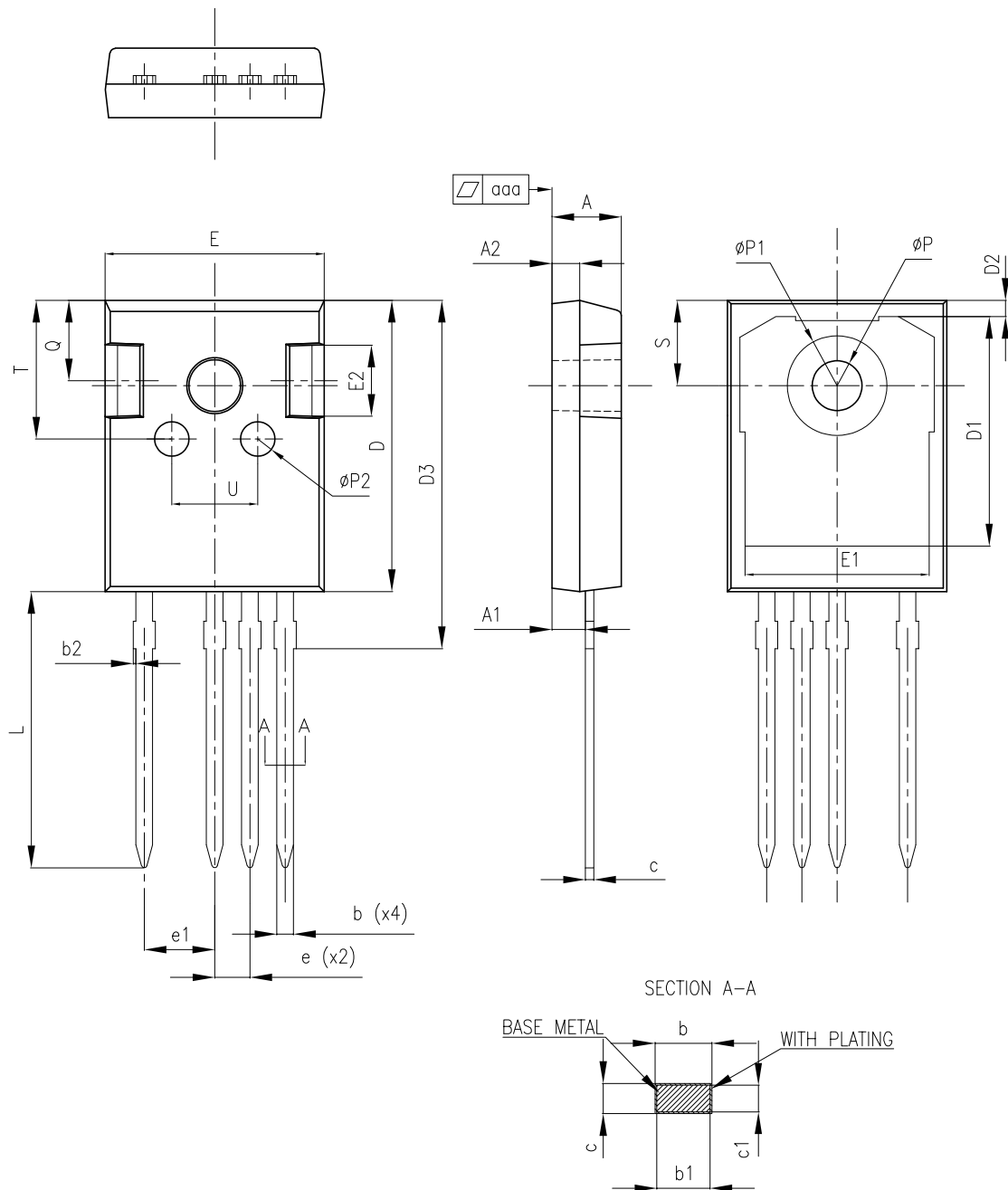
AM01506v1

## 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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