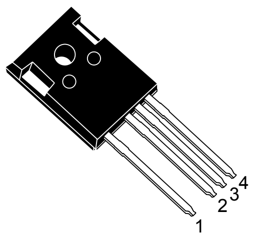
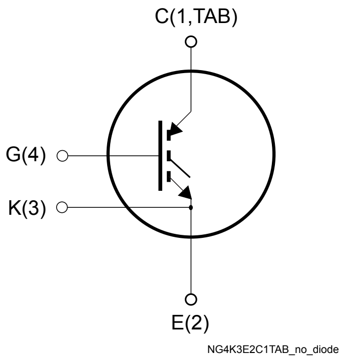
Trench gate field-stop, 650 V, 100 A, high-speed HB2 series IGBT in a TO247-4 package



TO247-4



Product status link
STGW100H65FB2-4

Product summary	
Order code	STGW100H65FB2-4
Marking	G100H65FB2
Package	TO247-4
Packing	Tube

Features

- Maximum junction temperature: T_J = 175 °C
- Low $V_{CE(sat)}$ = 1.55 V (typ.) @ I_C = 100 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.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	650	V
I_C	Continuous collector current at T_C = 25 °C	145	A
	Continuous collector current at T_C = 100 °C	91	
I_{CP} (1)	Pulsed collector current (t_p ≤ 1 µs, T_J < 175 °C)	300	A
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage (t_p ≤ 10 µs)	±30	
P_{TOT}	Total power dissipation at T_C = 25 °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 °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 V, I_C = 1 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 100 A		1.55	2.00	V
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C		1.8		
		V_{GE} = 15 V, I_C = 100 A, T_J = 175 °C		1.9		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	4.5	5.5	6.5	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 650 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	6227	-	pF
C_{oes}	Output capacitance		-	318	-	pF
C_{res}	Reverse transfer capacitance		-	165	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 100 A, V_{GE} = 0 to 15 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 V, I_C = 100 A, V_{GK} = 15 V, $R_{G(on)}$ = 8.2 Ω, $R_{G(off)}$ = 3.3 Ω (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	-	µJ
$t_{d(off)}$	Turn-off delay time		-	141	-	ns
t_f	Current fall time		-	13	-	ns
E_{off} (2)	Turn-off switching energy		-	1137	-	µJ
$t_{d(on)}$	Turn-on delay time	V_{CC} = 400 V, I_C = 100 A, V_{GK} = 15 V, $R_{G(on)}$ = 8.2 Ω, $R_{G(off)}$ = 3.3 Ω, T_J = 175 °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	-	µJ
$t_{d(off)}$	Turn-off delay time		-	176	-	ns
t_f	Current fall time		-	79	-	ns
E_{off} (2)	Turn-off switching energy		-	2154	-	µJ

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

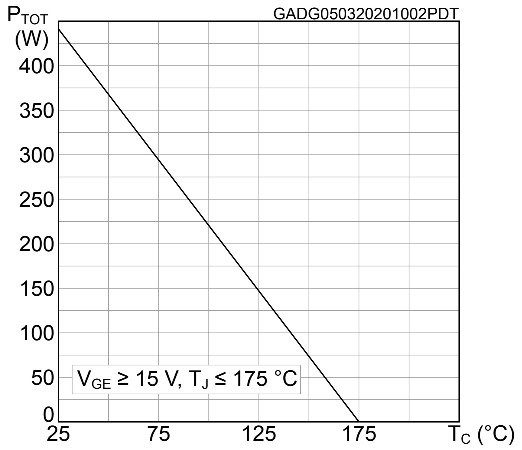


Figure 2. Collector current vs case temperature

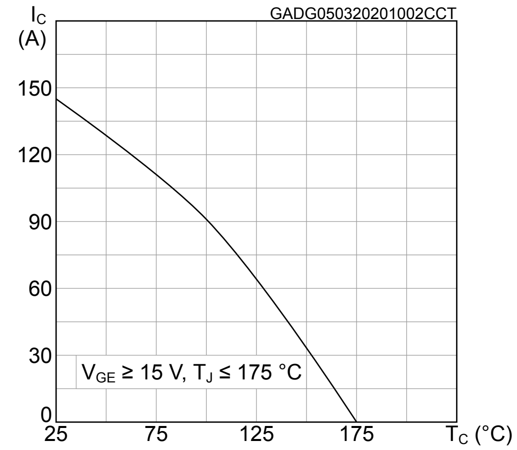


Figure 3. Output characteristics (T_J = 25 °C)

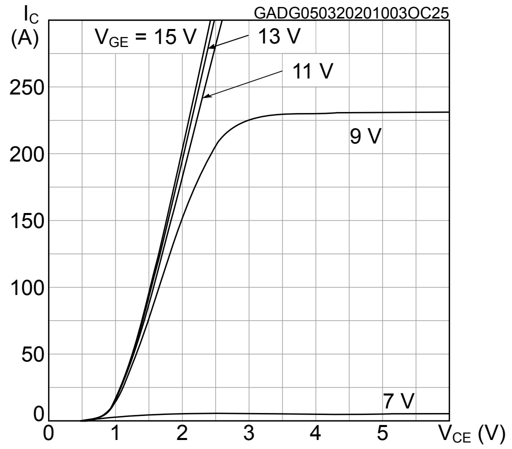


Figure 4. Output characteristics (T_J = 175 °C)

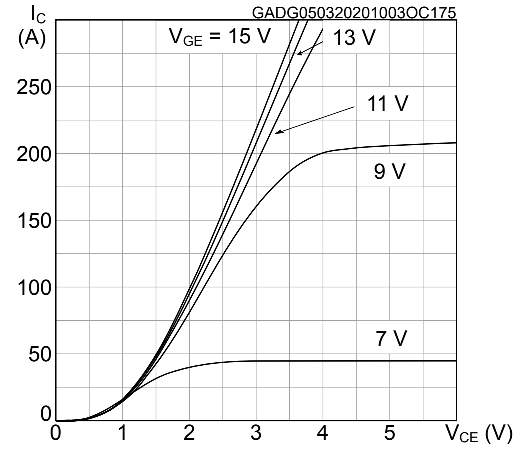


Figure 5. $V_{CE(sat)}$ vs junction temperature

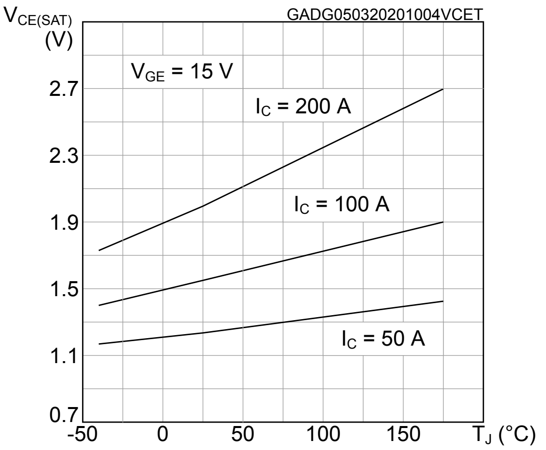


Figure 6. $V_{CE(sat)}$ vs collector current

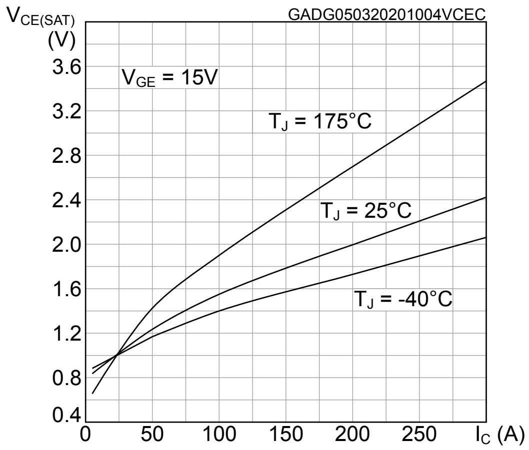


Figure 7. Collector current vs switching frequency

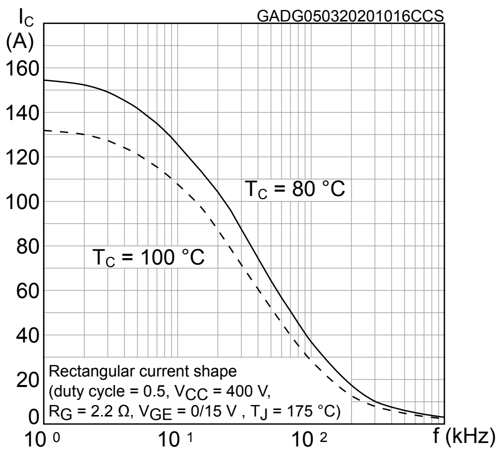


Figure 8. Forward bias safe operating area

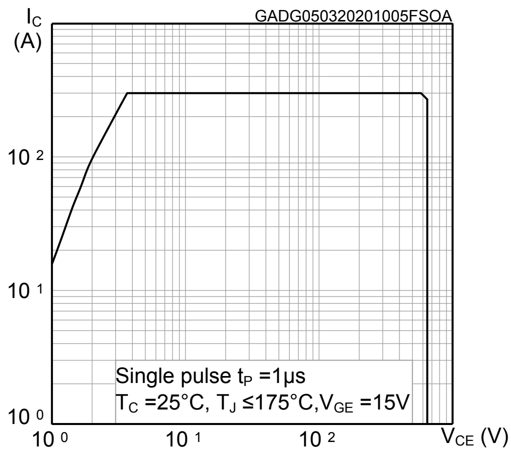


Figure 9. Transfer characteristics

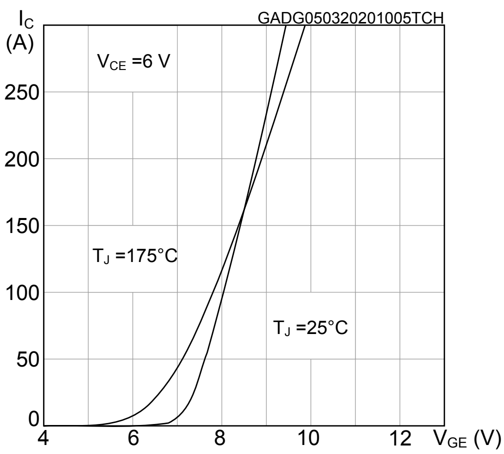


Figure 10. Normalized $V_{GE(th)}$ vs junction temperature

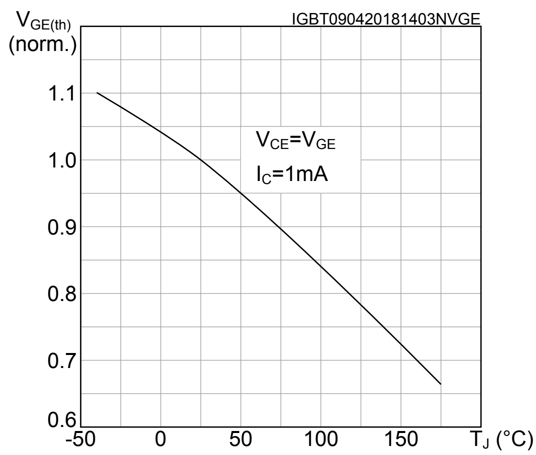


Figure 11. Normalized $V_{(BR)CES}$ vs junction temperature

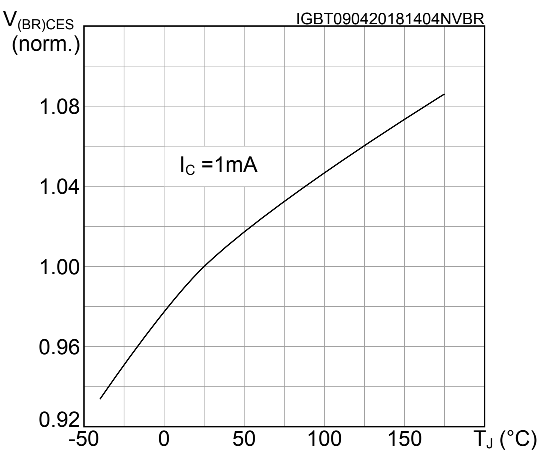


Figure 12. Capacitance variations

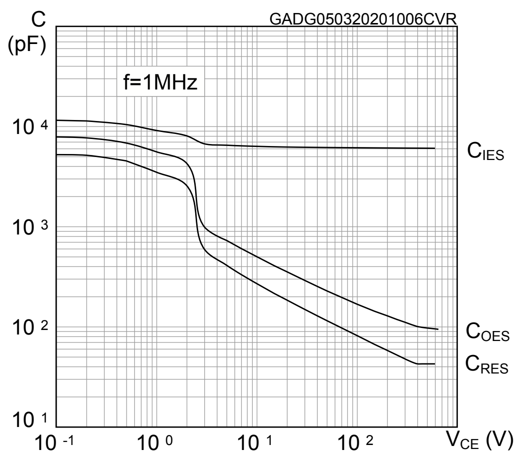


Figure 13. Gate charge vs gate-emitter voltage

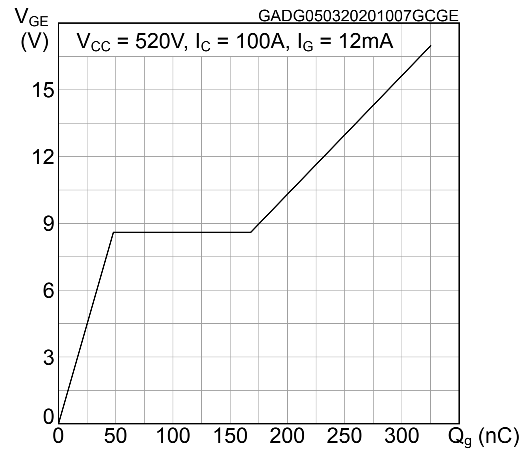


Figure 14. Switching energy vs collector current

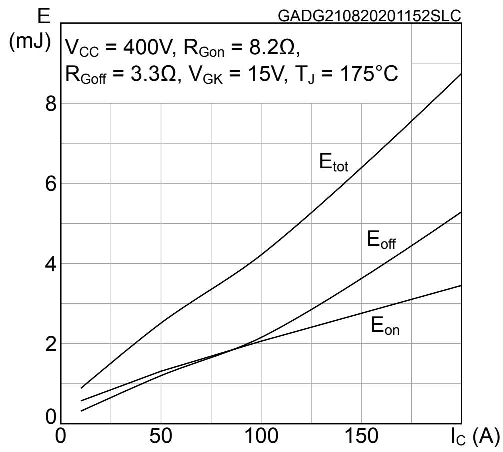


Figure 15. Switching energy vs temperature

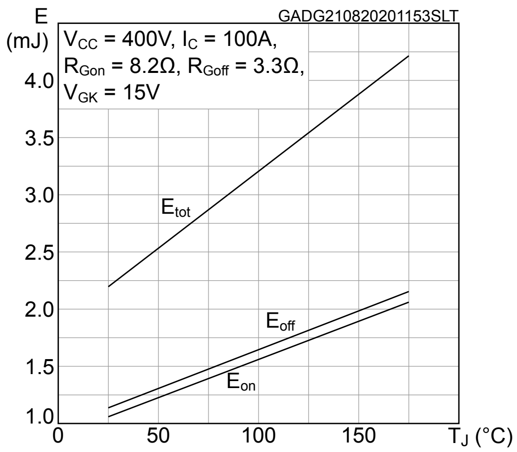


Figure 16. Switching energy vs collector emitter voltage

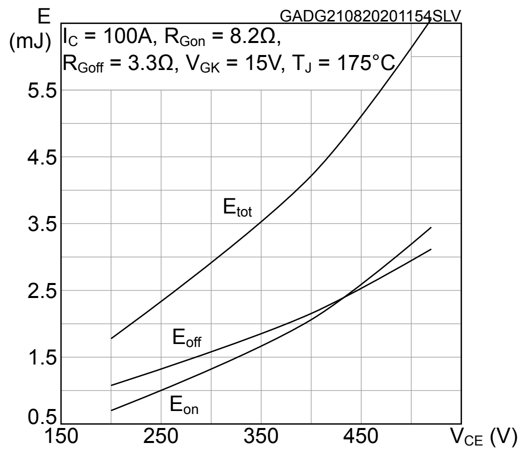


Figure 17. Switching energy vs gate resistance

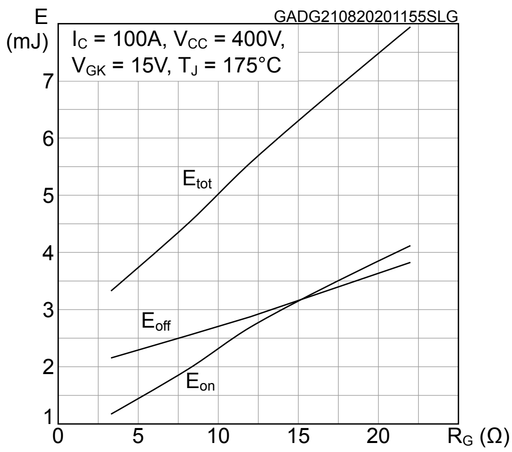


Figure 18. Switching times vs collector current

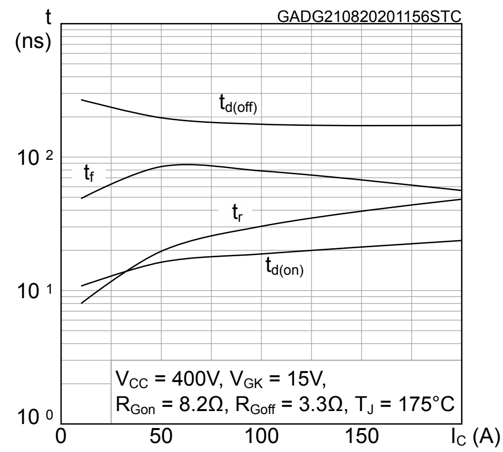


Figure 19. Switching times vs gate resistance

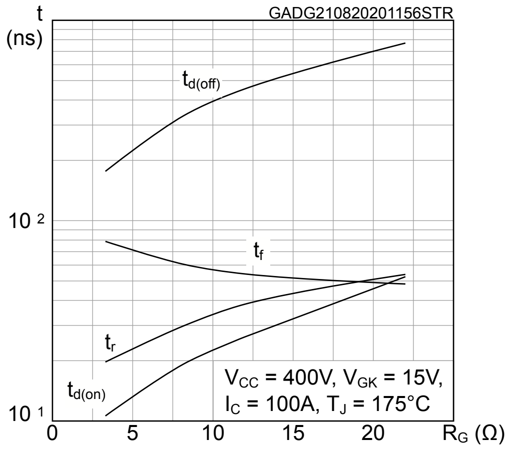
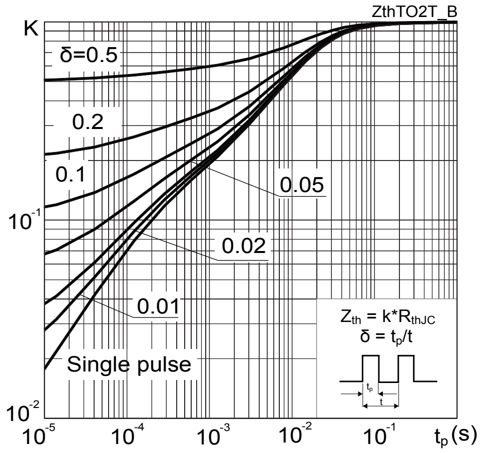


Figure 20. Thermal impedance



3 Test circuits

Figure 21. Test circuit for inductive load switching

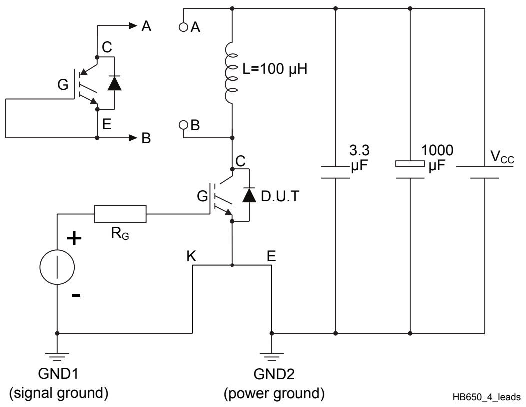


Figure 22. Gate charge test circuit

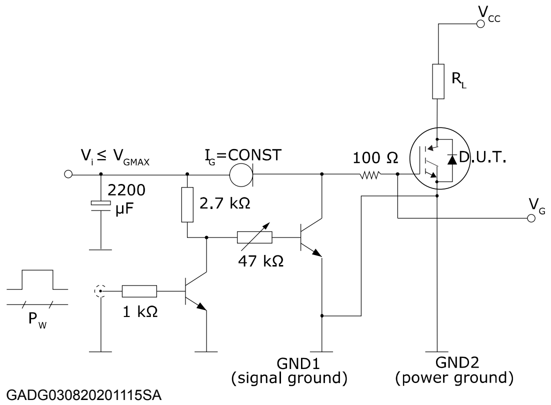
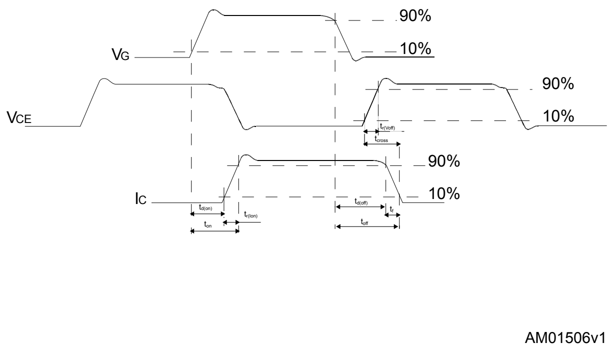


Figure 23. Switching waveform



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. ECOPACK is an ST trademark.

4.1 TO247-4 package information

Figure 24. TO247-4 package outline

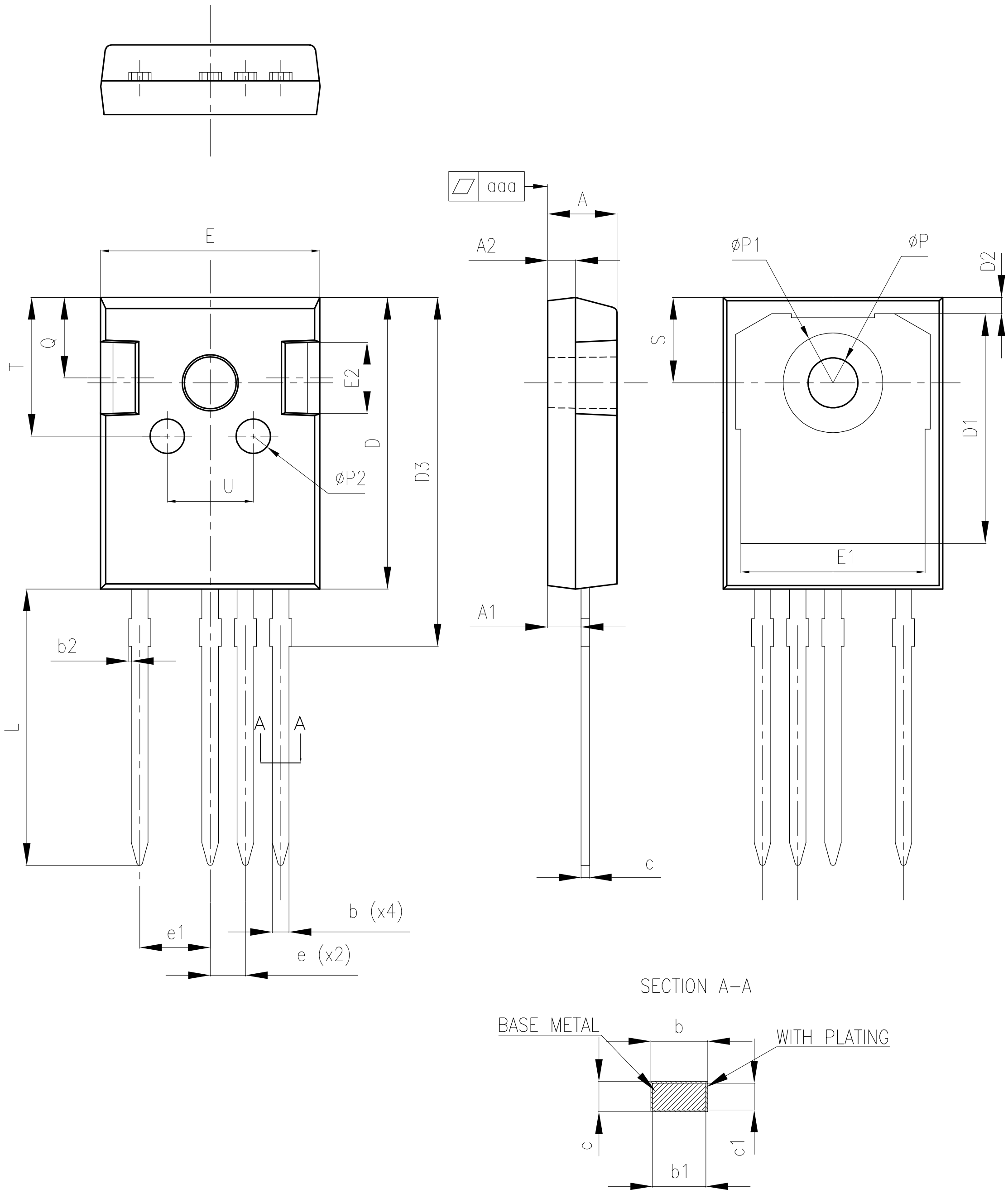


Table 6. **TO247-4 mechanical data**

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 Table 3. Static characteristics. Updated Section 4 Package information. Minor text changes.

Contents