

Trench gate field-stop IGBT, HB series 650 V, 80 A high speed

Datasheet - production data

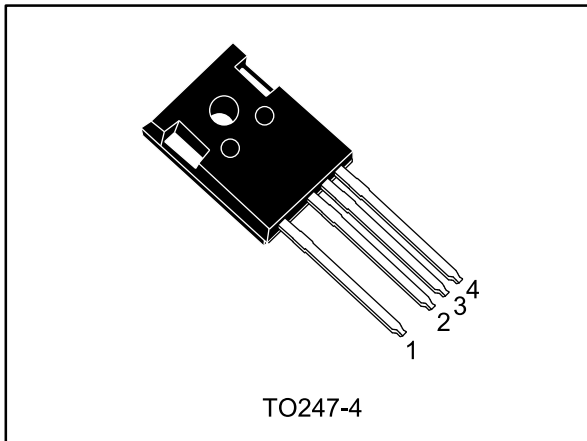
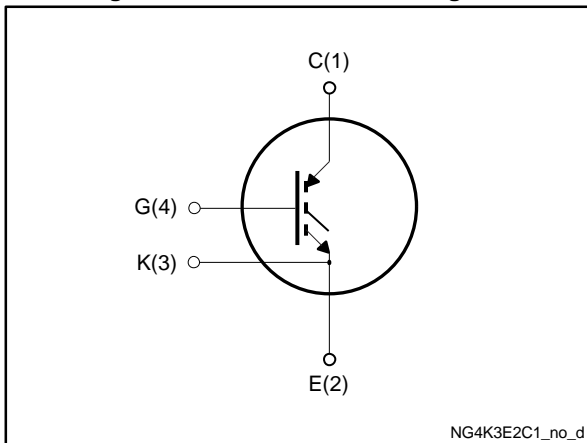


Figure 1: Internal schematic diagram



Features

- $V_{CE(sat)} = 1.6 \text{ V (typ.) @ } I_c = 80 \text{ A}$
- Maximum junction temperature: $T_J = 175 \text{ }^\circ\text{C}$
- High speed switching series
- Minimized tail current
- Tight parameter distribution
- Safe paralleling
- Low thermal resistance

Applications

- Photovoltaic inverter
- High frequency converter

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.

Table 1: Device summary

Order code	Marking	Package	Packaging
STGW80H65FB-4	G80H65FB	TO247-4	Tube

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1 Electrical ratings

Table 2: 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	120 ⁽¹⁾	A
	Continuous collector current at $T_C = 100$ °C	80	
I_{CP} ⁽¹⁾⁽²⁾	Pulsed collector current	240	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at $T_C = 25$ °C	469	W
T_{STG}	Storage temperature range	- 55 to 175	°C
T_J	Operating junction temperature range		

Notes:

⁽¹⁾ Current level is limited by bond wires.

⁽²⁾ Pulse width limited by maximum junction temperature.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	0.32	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	

2 Electrical characteristics

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

Table 4: Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 80\text{ A}$		1.6	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	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5	6	7	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$			100	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 250	nA

Table 5: Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	10.5	-	nF
C_{oes}	Output capacitance		-	0.38	-	
C_{res}	Reverse transfer capacitance		-	0.21	-	
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 23: "Gate charge test circuit")	-	414	-	nC
Q_{ge}	Gate-emitter charge		-	78	-	
Q_{gc}	Gate-collector charge		-	170	-	

Table 6: IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (see Figure 22: "Test circuit for inductive load switching")	-	75	-	ns
t_r	Current rise time		-	35	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1750	-	A/ μ s
$t_{d(off)}$	Turn-off-delay time		-	336	-	ns
t_f	Current fall time		-	23	-	ns
$E_{on}^{(1)}$	Turn-on switching energy		-	1	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy		-	1.7	-	mJ
E_{ts}	Total switching energy		-	2.7	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ $T_J = 175\text{ }^\circ\text{C}$ (see Figure 22: "Test circuit for inductive load switching")	-	66	-	ns
t_r	Current rise time		-	38	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1670	-	A/ μ s
$t_{d(off)}$	Turn-off-delay time		-	403	-	ns
t_f	Current fall time		-	45	-	ns
$E_{on}^{(1)}$	Turn-on switching energy		-	1.5	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy		-	2.47	-	mJ
E_{ts}	Total switching energy		-	3.97	-	mJ

Notes:

⁽¹⁾Including the reverse recovery of the external diode. The diode is the same of the co-packed STGW80H65DFB-4.

⁽²⁾Including the tail of the collector current.

2.1 Electrical characteristics (curves)

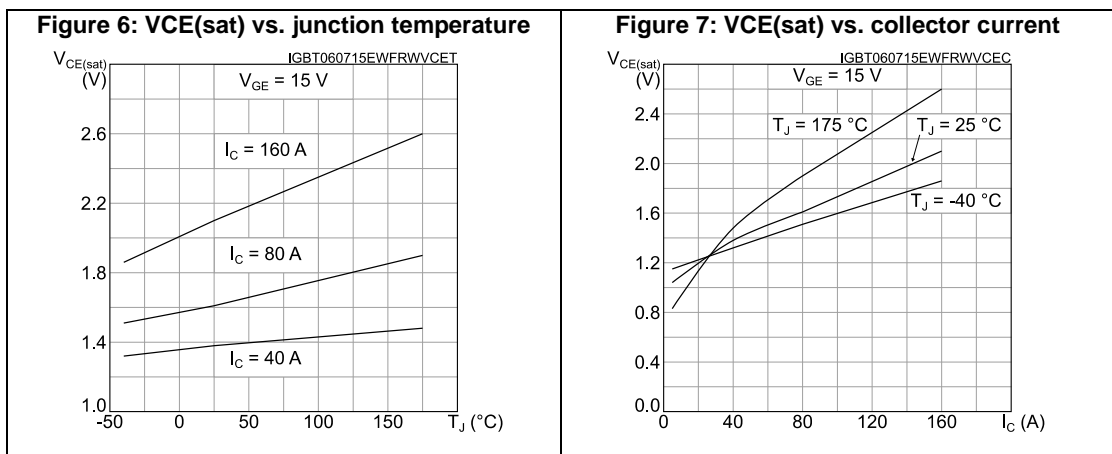
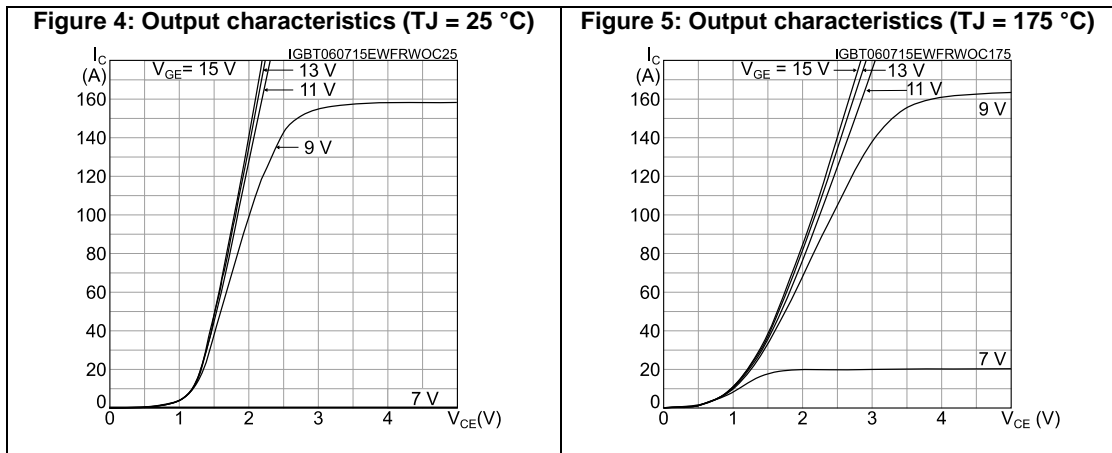
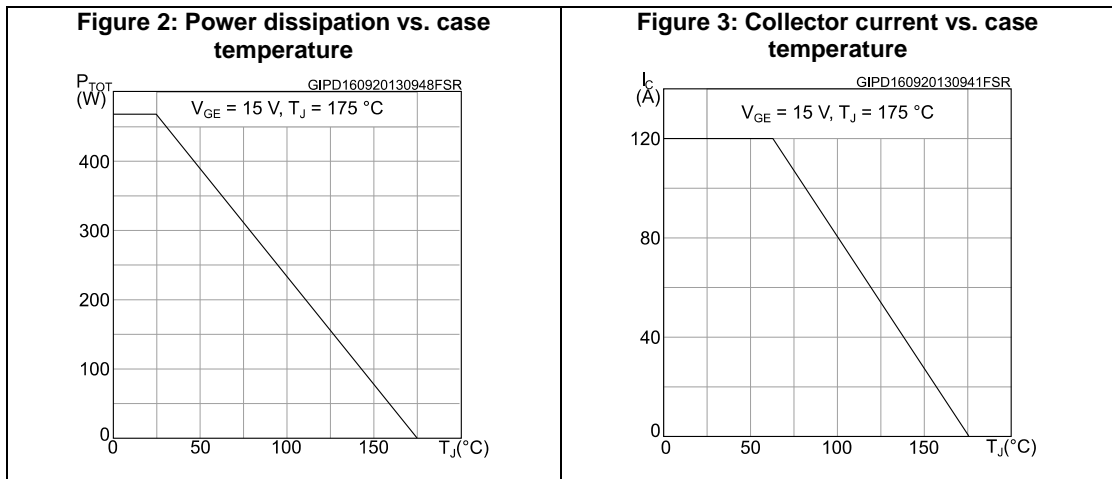


Figure 8: Collector current vs. switching frequency

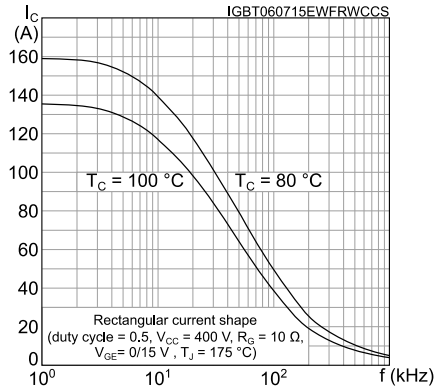


Figure 9: Forward bias safe operating area

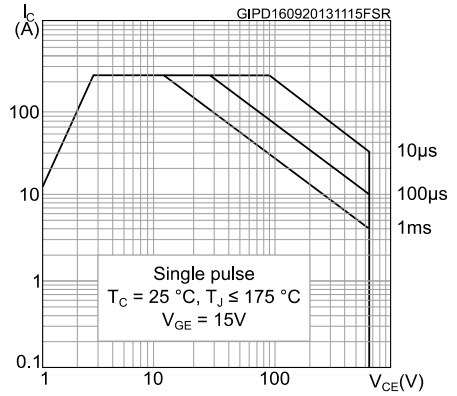


Figure 10: Transfer characteristics

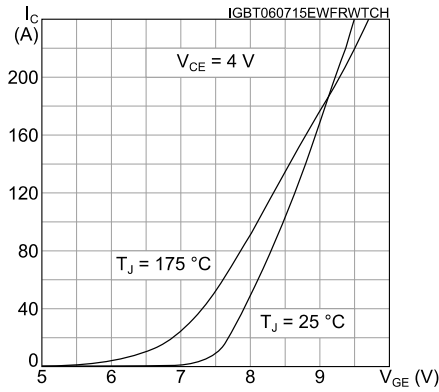


Figure 11: Normalized VGE(th) vs. junction temperature

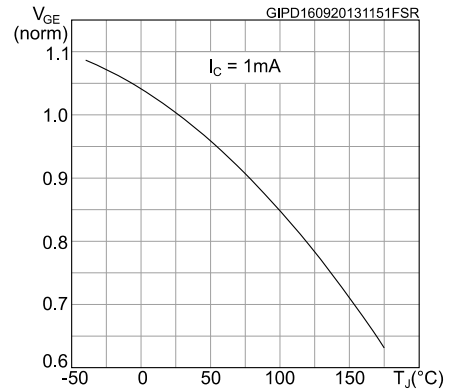


Figure 12: Normalized V(BR)CES vs. junction temperature

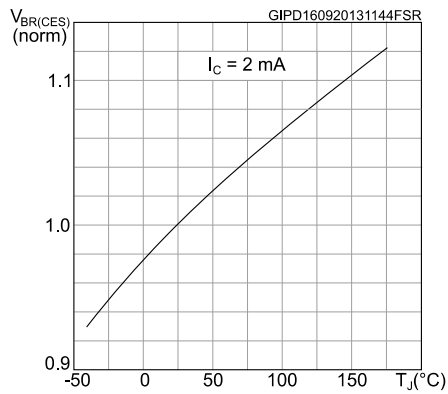
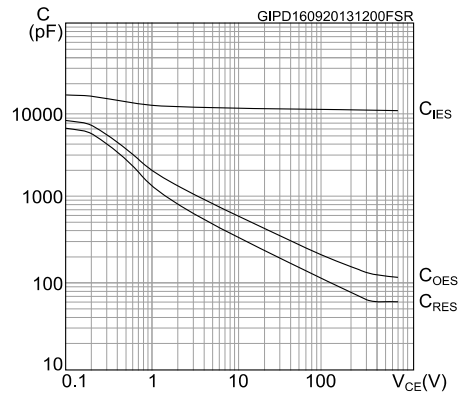


Figure 13: Capacitance variations



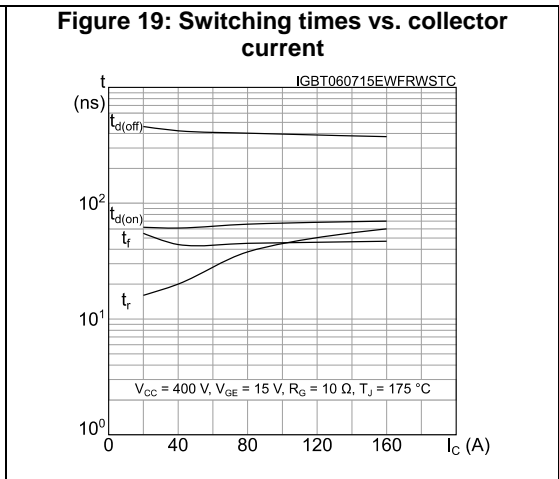
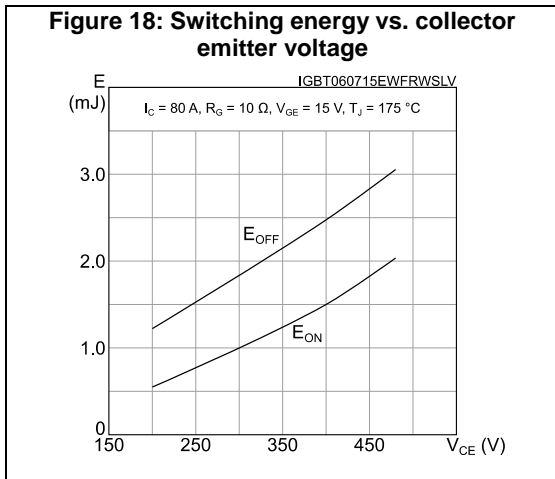
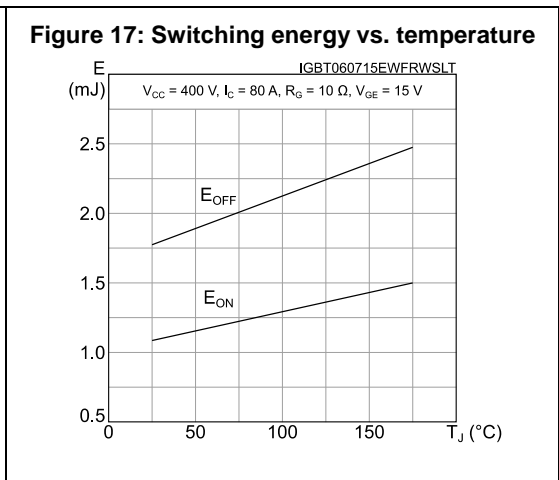
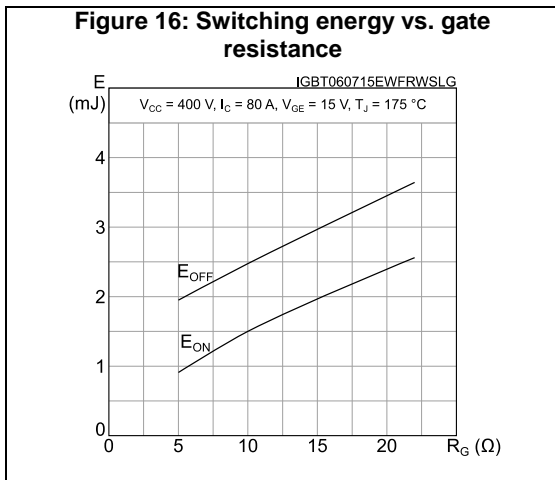
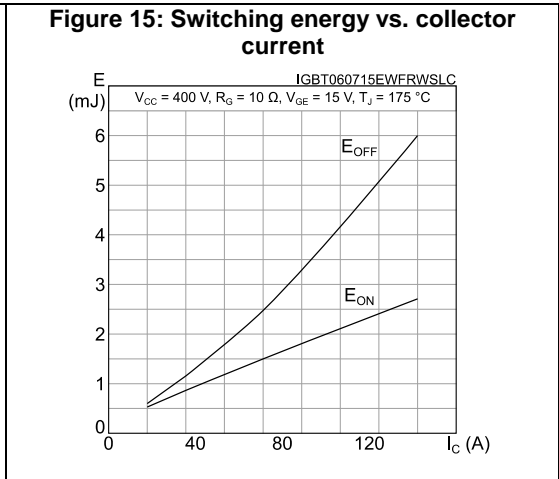
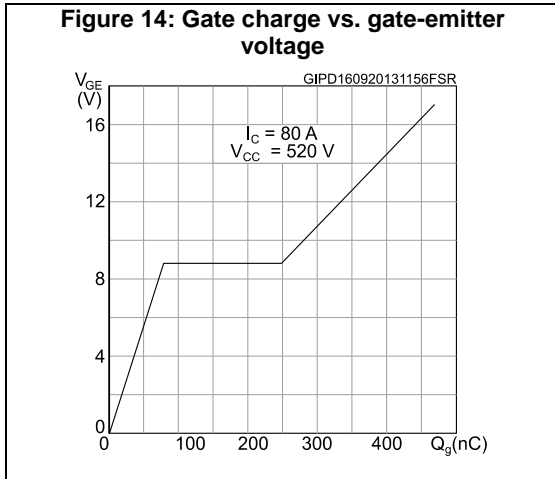


Figure 20: Switching times vs. gate resistance

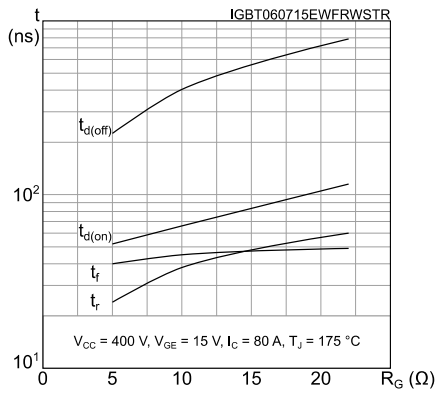
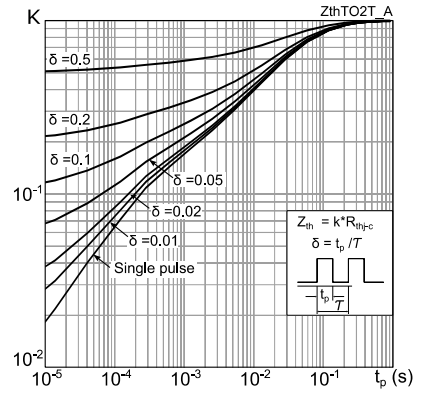
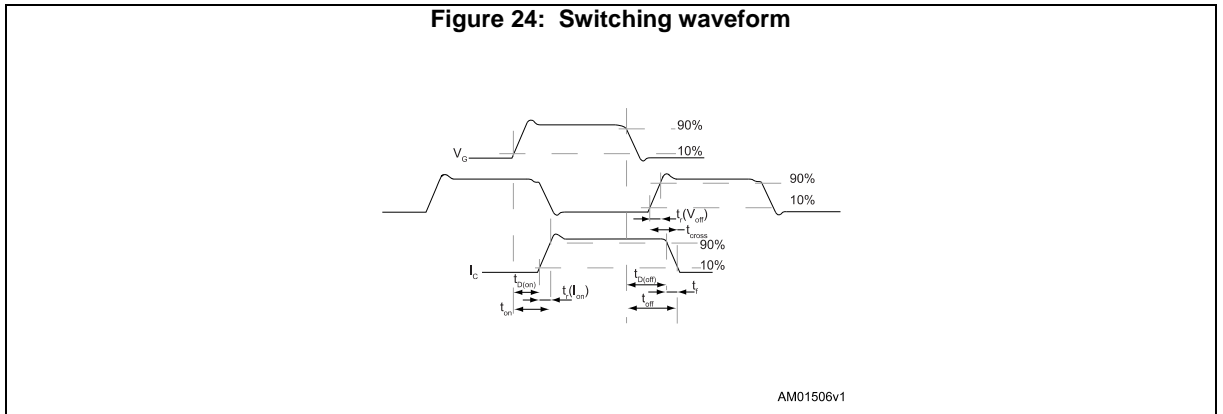
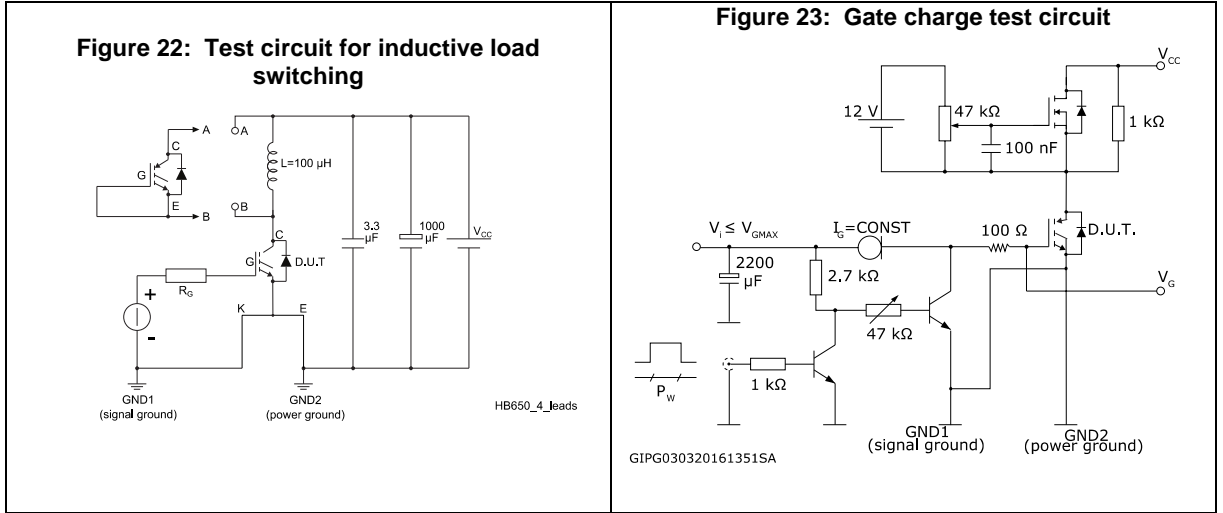


Figure 21: Thermal impedance



3 Test circuits



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 25: TO247-4 package outline

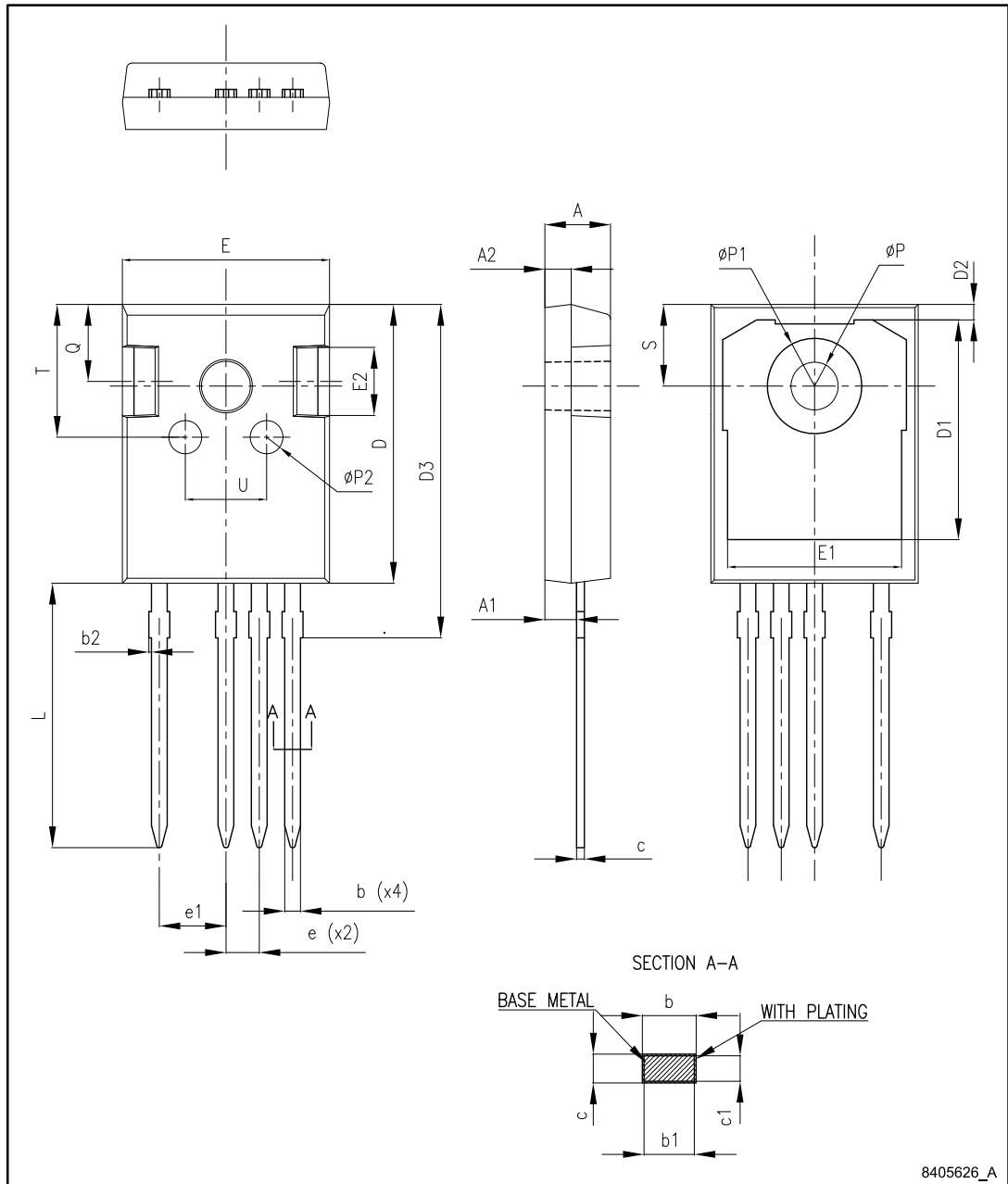


Table 7: TO247-4 mechanical data

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

5 Revision history

Table 8: Document revision history

Date	Revision	Changes
13-Apr-2016	1	First release.
22-Apr-2016	2	Minor text changes to improve the document readability.

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