

## Trench gate field-stop IGBT, HB series 650 V, 80 A high speed in TO247-4 package

Datasheet - production data

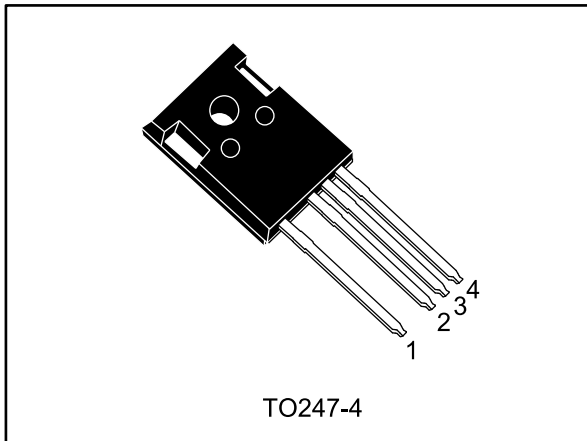
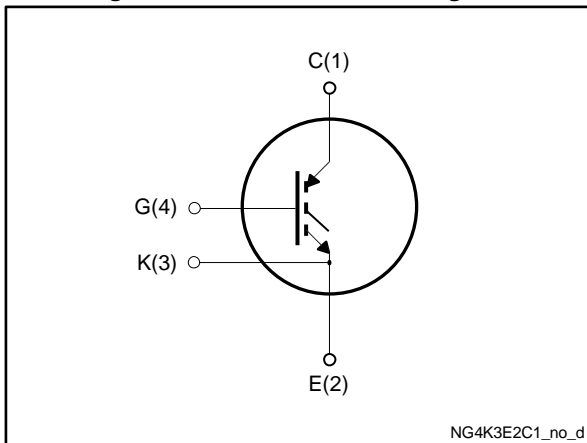


Figure 1: Internal schematic diagram



### Features

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

### 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 <sup>(1)</sup>	A
	Continuous collector current at $T_C = 100$ °C	80	
$I_{CP}$ <sup>(2)(3)</sup>	Pulsed collector current	300	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 150	°C
$T_J$	Operating junction temperature range	-55 to 175	

**Notes:**

<sup>(1)</sup>Current level is limited by bond wires.

<sup>(2)</sup>Pulse width is limited by maximum junction temperature ( $t_p < 1$  ms,  $T_J < 175$  °C).

<sup>(3)</sup>Defined by design, not tested.

**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	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$			$\pm 250$	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	$V_{CC} = 520\text{ V}$ , $I_C = 80\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$ (see <a href="#">Figure 23: "Gate charge test circuit"</a> )	-	414	-	nC
$Q_{ge}$	Gate-emitter charge		-	78	-	
$Q_{gc}$	Gate-collector charge		-	170	-	

Table 6: IGBT switching characteristics (inductive load)

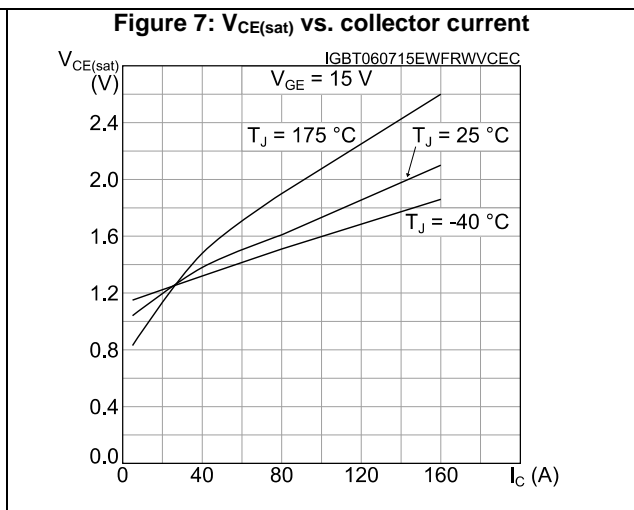
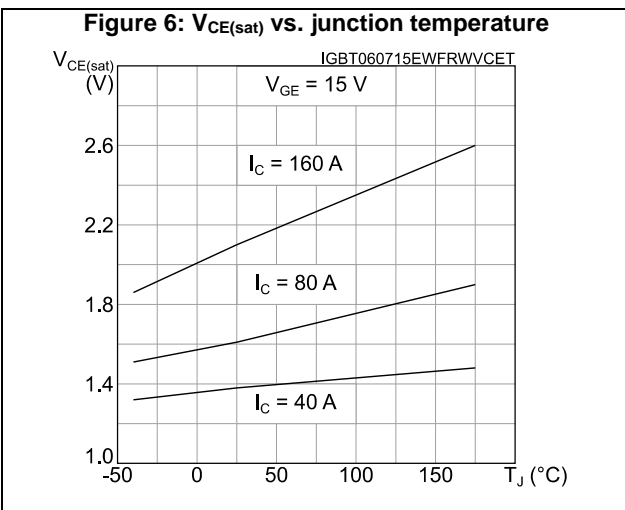
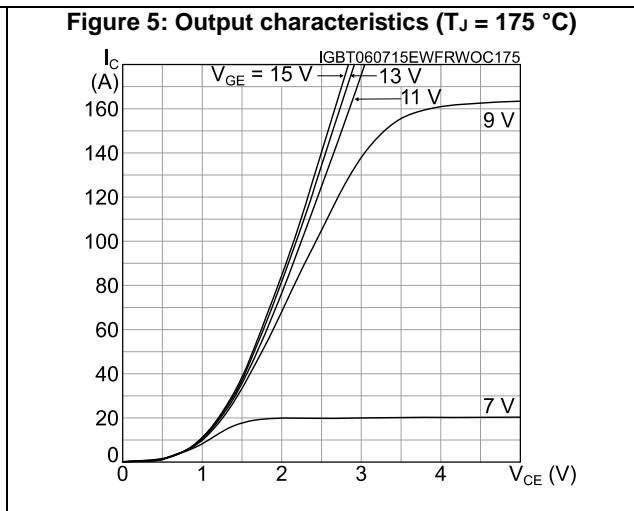
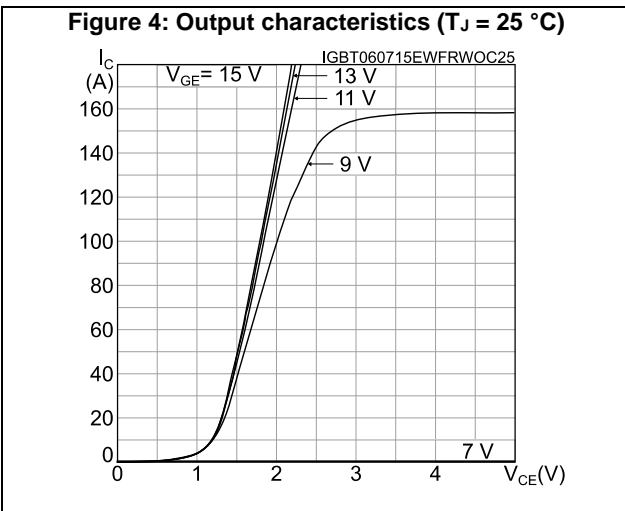
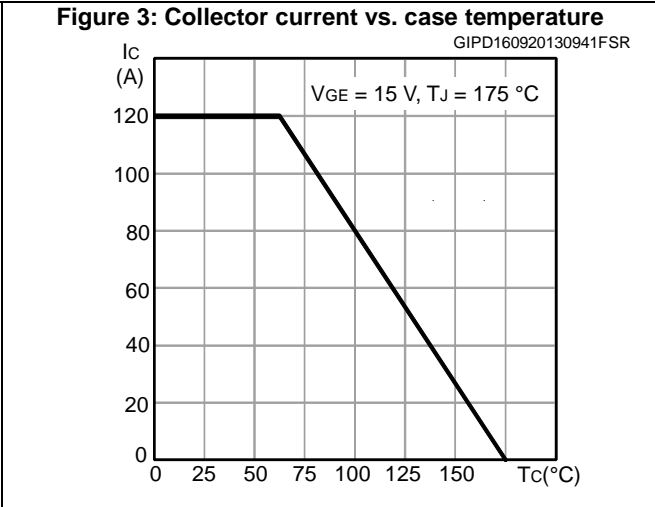
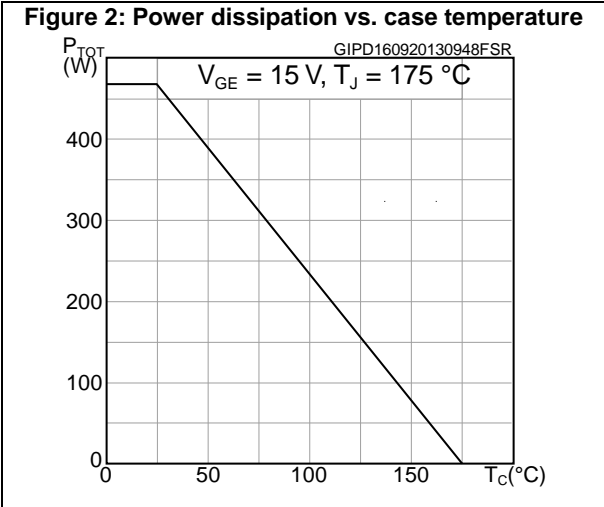
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 400\text{ V}$ , $I_C = 80\text{ A}$ , $V_{GE} = 15\text{ V}$ , $R_G = 10\ \Omega$ (see <a href="#">Figure 22: "Test circuit for inductive load switching"</a> )	-	75	-	ns
$t_r$	Current rise time		-	35	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1750	-	A/ $\mu$ 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 <a href="#">Figure 22: "Test circuit for inductive load switching"</a> )	-	66	-	ns
$t_r$	Current rise time		-	38	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1670	-	A/ $\mu$ 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

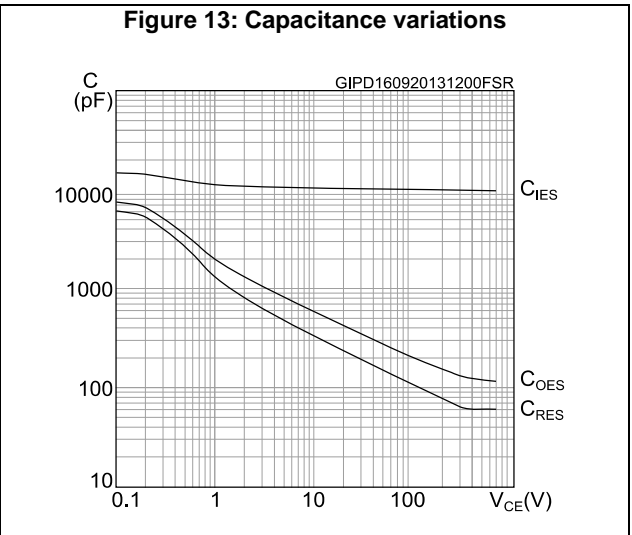
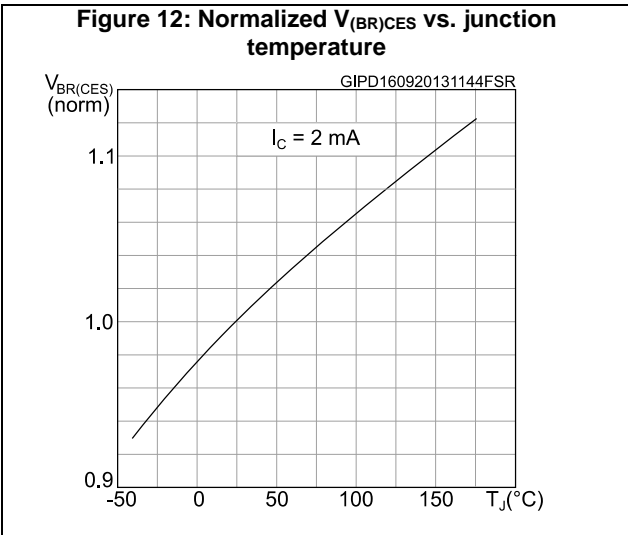
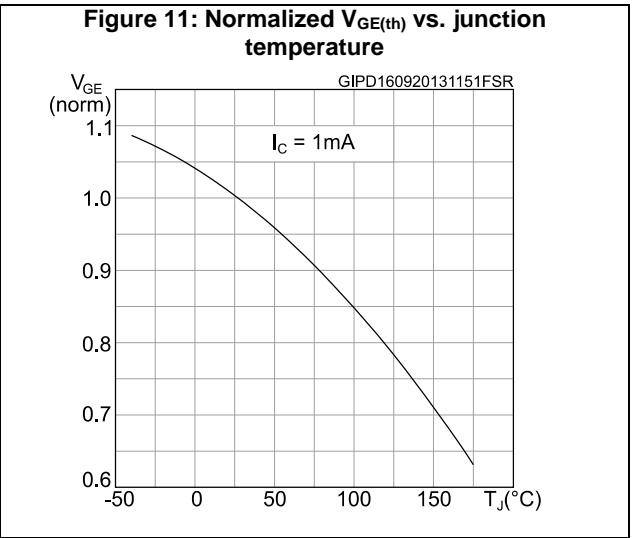
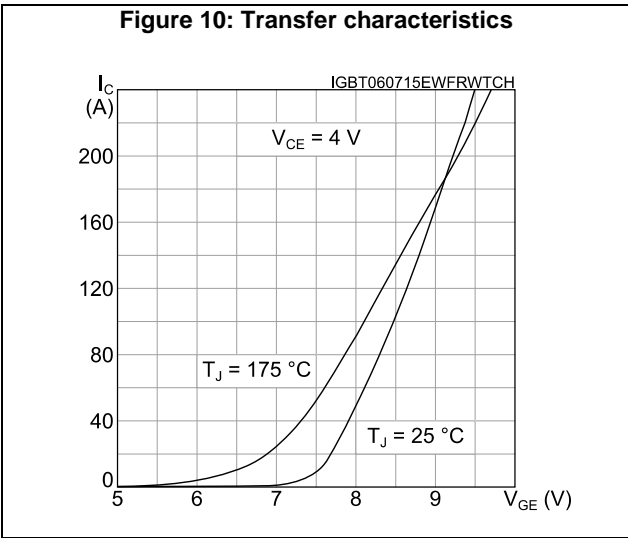
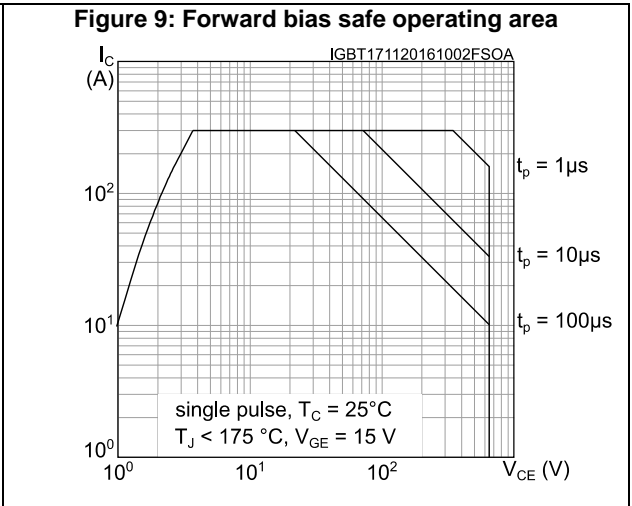
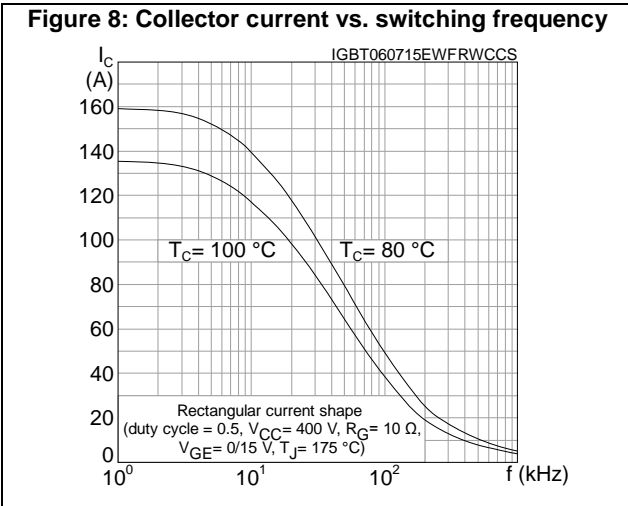
**Notes:**

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

<sup>(2)</sup>Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)





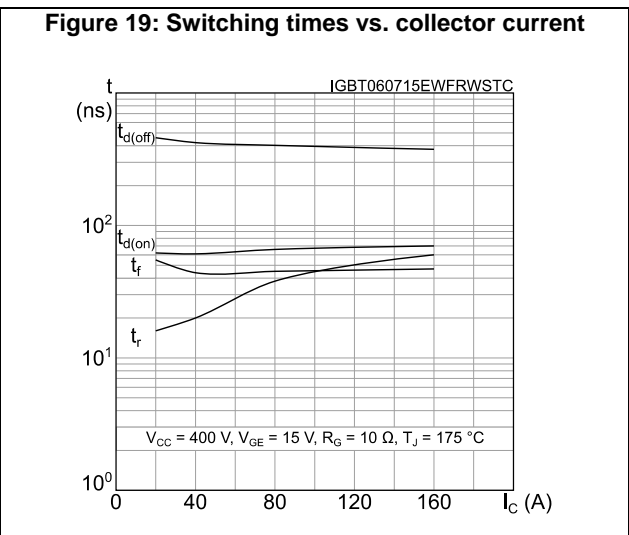
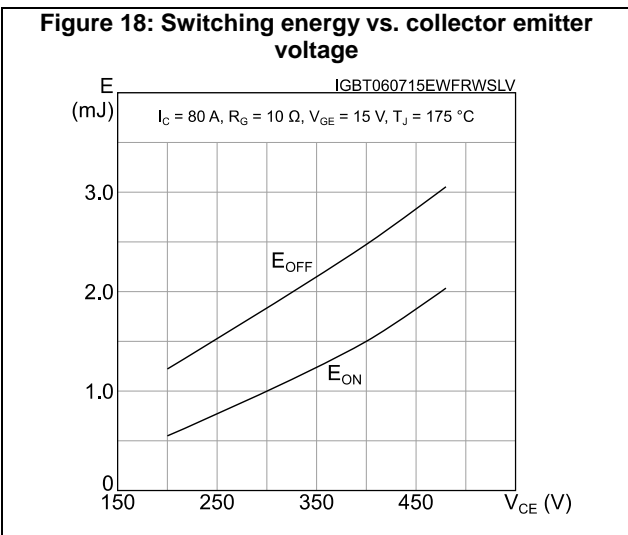
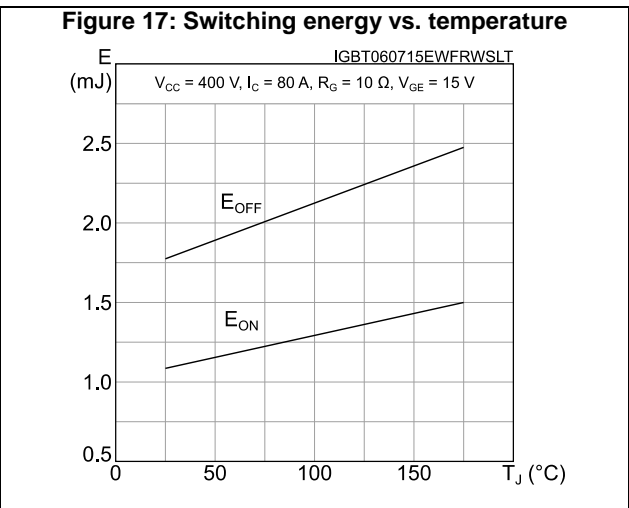
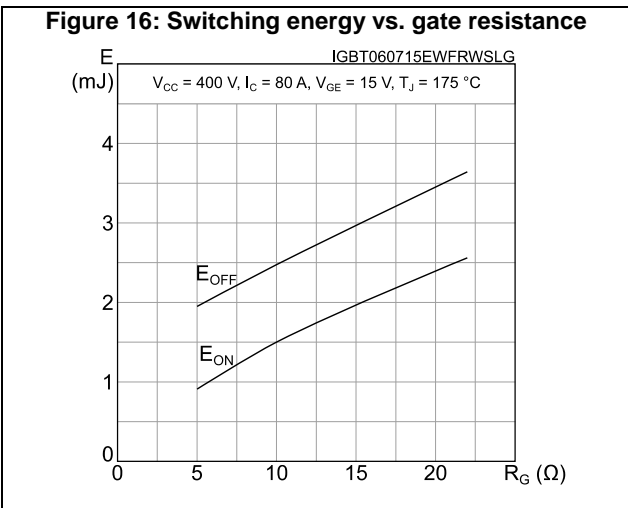
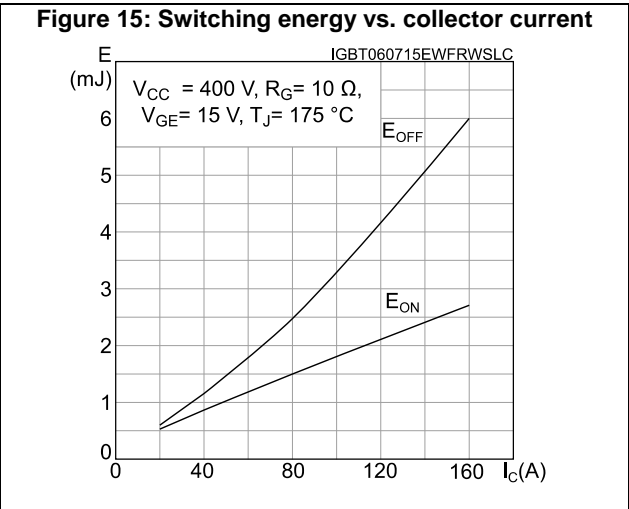
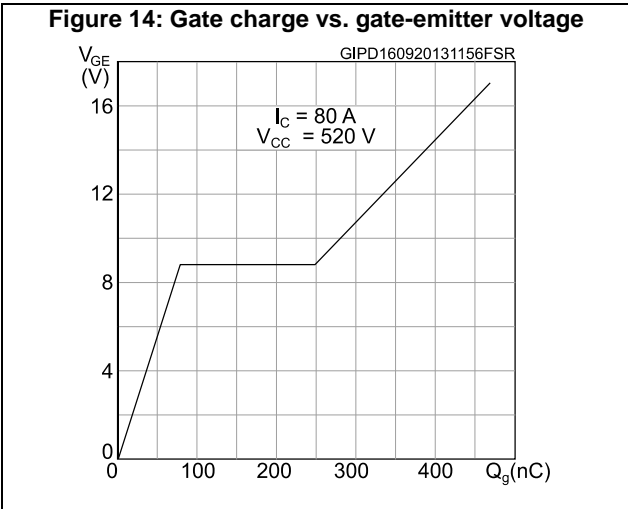




Figure 20: Switching times vs. gate resistance

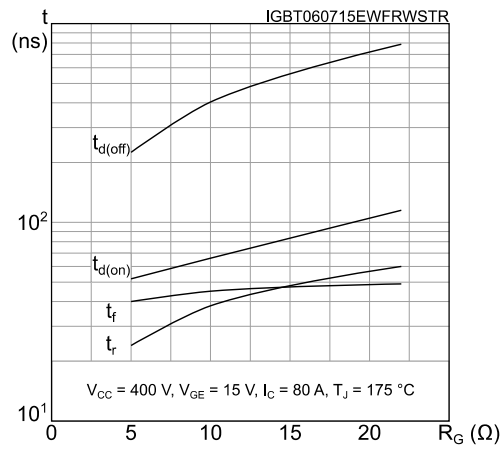
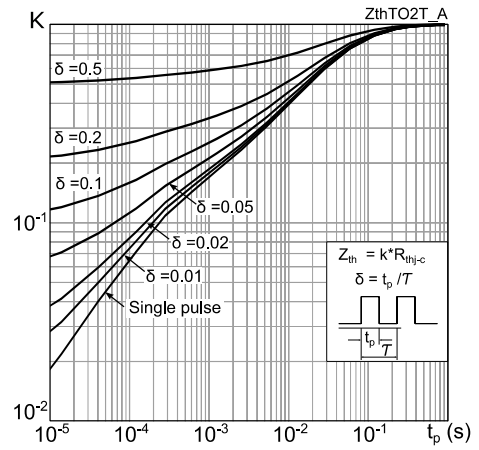
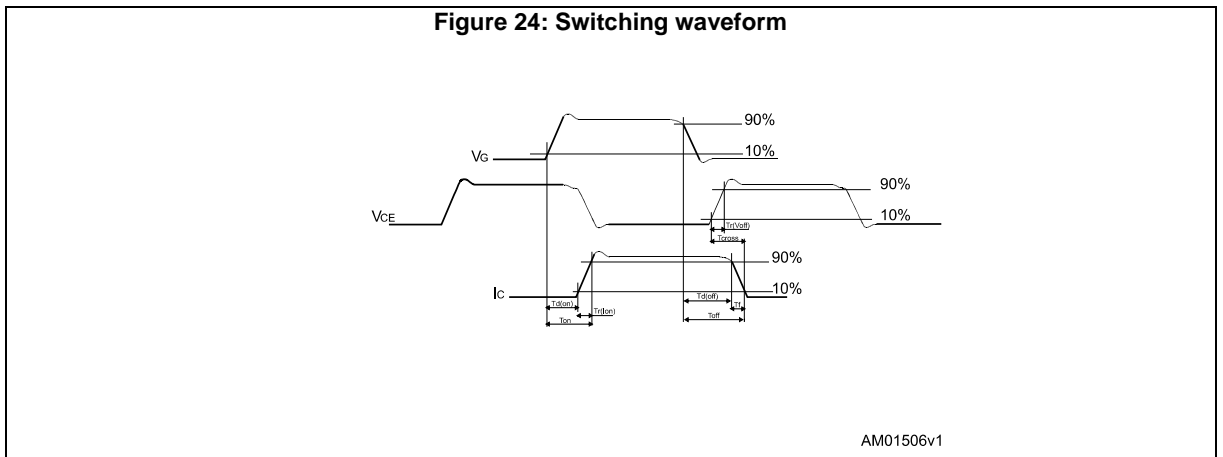
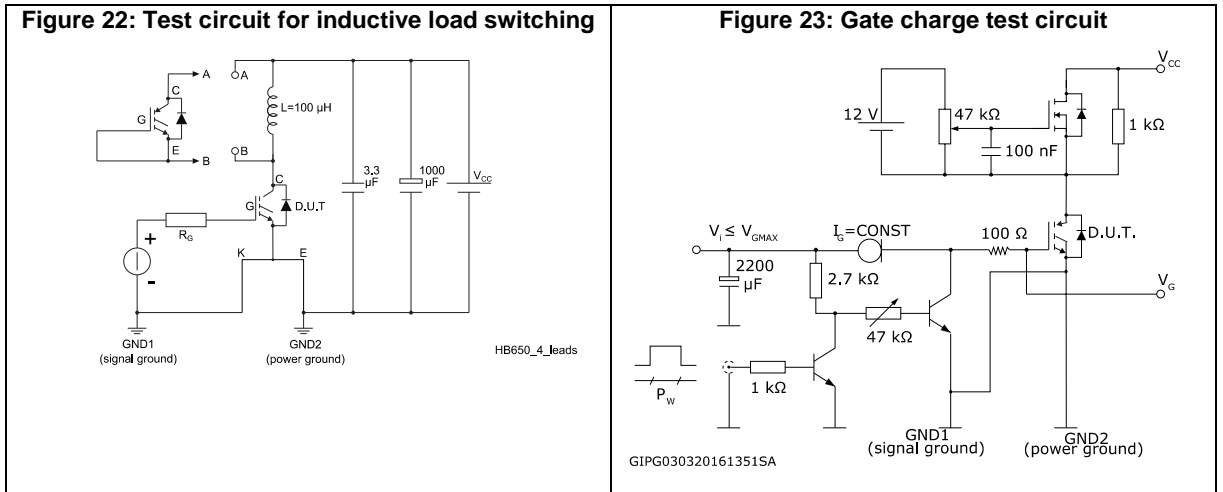


Figure 21: Thermal impedance



### 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 TO247-4 package information

Figure 25: TO247-4 package outline

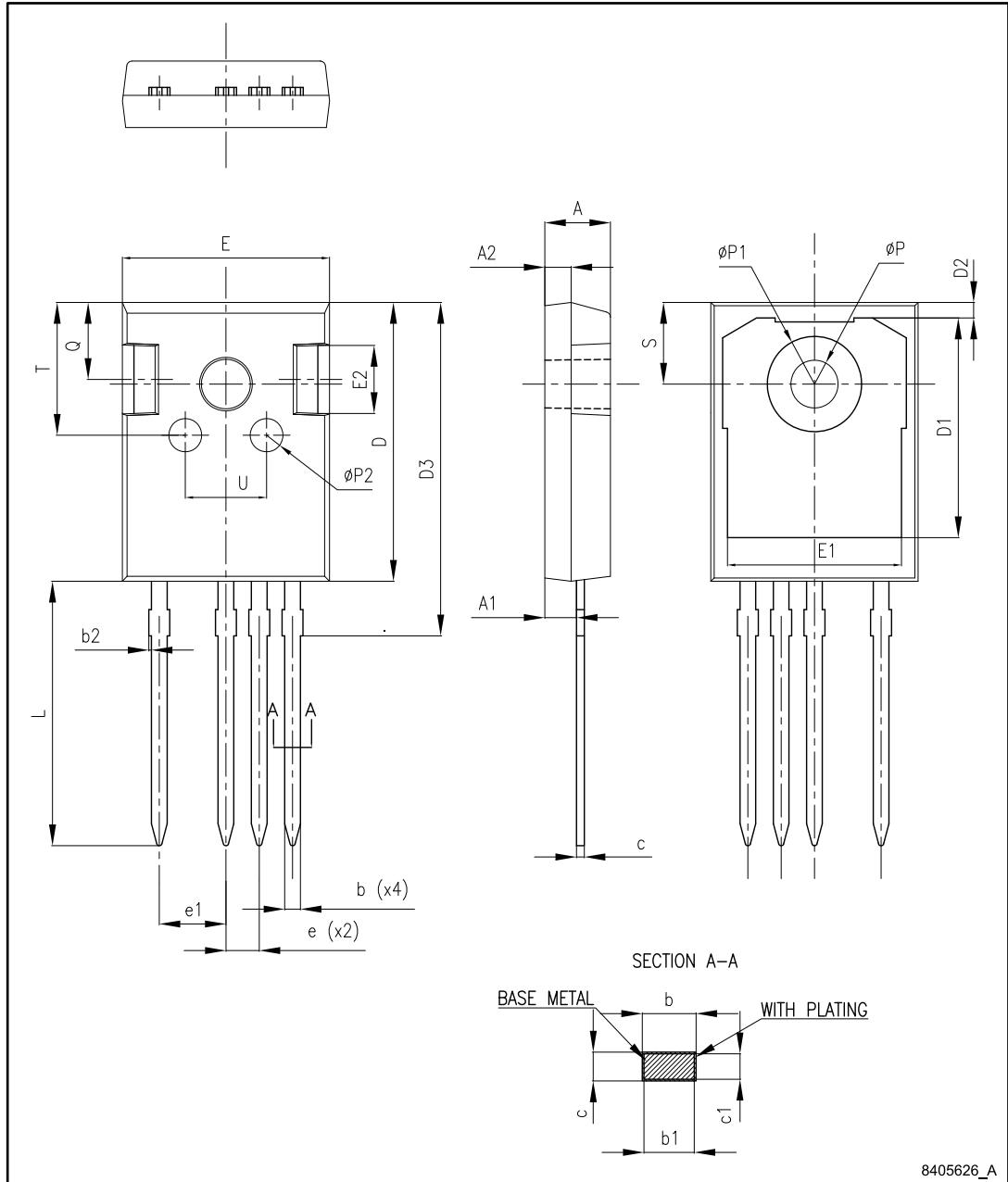


Table 7: TO247-4 mechanical data

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
03-Apr-2017	3	Updated title and features on cover page. Updated <a href="#">Table 2: "Absolute maximum ratings"</a> . Updated <a href="#">Figure 9: "Forward bias safe operating area"</a> . Minor text changes

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