

## Trench gate field-stop IGBT, HB series 600 V, 40 A high speed in a TO-247 long leads package

Datasheet - production data

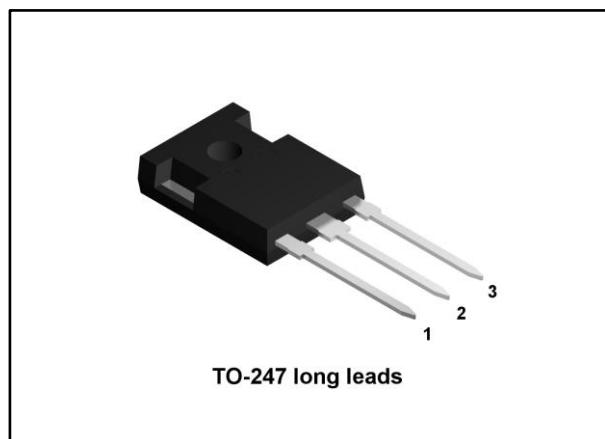
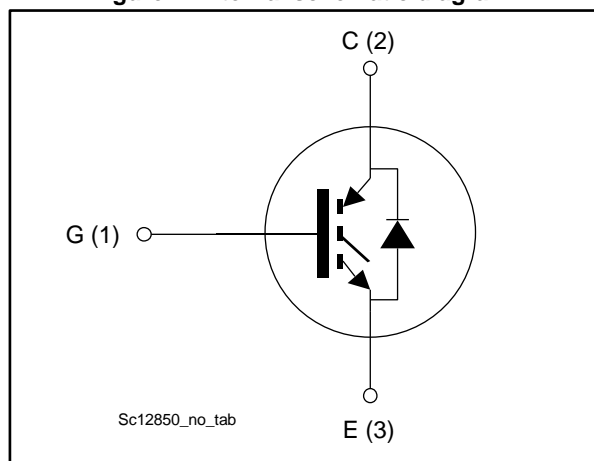


Figure 1: Internal schematic diagram



### Features

- Maximum junction temperature:  $T_J = 175\text{ °C}$
- High speed switching series
- Minimized tail current
- Low saturation voltage:  $V_{CE(sat)} = 1.6\text{ V (typ.)}$  @  $I_C = 40\text{ A}$
- Tight parameter distribution
- Safe paralleling
- Low thermal resistance
- Low  $V_F$  soft recovery co-packaged diode

### Applications

- Induction heating
- Microwave oven
- Resonant converters

### 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
STGWA40H60DLFB	G40H60DLFB	TO-247 long leads	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)	600	V
$I_C$	Continuous collector current at $T_C = 25$ °C	80	A
$I_C$	Continuous collector current at $T_C = 100$ °C	40	A
$I_{CP}^{(1)}$	Pulsed collector current	160	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$I_F$	Continuous forward current at $T_C = 25$ °C	80	A
$I_F$	Continuous forward current at $T_C = 100$ °C	40	A
$I_{FP}^{(1)}$	Pulsed forward current	160	A
$P_{TOT}$	Total dissipation at $T_C = 25$ °C	283	W
$T_{STG}$	Storage temperature range	-55 to 150	°C
$T_J$	Operating junction temperature range	-55 to 175	°C

**Notes:**

<sup>(1)</sup>Pulse width limited by maximum junction temperature.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case IGBT	0.53	°C/W
$R_{thJC}$	Thermal resistance junction-case diode	1.47	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	50	°C/W

## 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	$V_{GE} = 0\text{ V}$ , $I_C = 2\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 40\text{ A}$		1.6	2	V
		$V_{GE} = 15\text{ V}$ , $I_C = 40\text{ A}$ , $T_J = 125\text{ °C}$		1.7		
		$V_{GE} = 15\text{ V}$ , $I_C = 40\text{ A}$ , $T_J = 175\text{ °C}$		1.8		
$V_F$	Forward on-voltage	$I_F = 40\text{ A}$		1.55	1.8	V
		$I_F = 40\text{ A}$ , $T_J = 125\text{ °C}$		1.3		
		$I_F = 40\text{ A}$ , $T_J = 175\text{ °C}$		1.25		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$	5	6	7	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{ V}$ , $V_{CE} = 600\text{ V}$			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 5: Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 15\text{ V}$	-	5412	-	pF
$C_{oes}$	Output capacitance		-	198	-	
$C_{res}$	Reverse transfer capacitance		-	107	-	
$Q_g$	Total gate charge	$V_{CC} = 520\text{ V}$ , $I_C = 40\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$ (see <a href="#">Figure 27: "Gate charge test circuit"</a> )	-	210	-	nC
$Q_{ge}$	Gate-emitter charge		-	39	-	
$Q_{gc}$	Gate-collector charge		-	82	-	

**Table 6: IGBT switching characteristics (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CE} = 400\text{ V}$ , $I_C = 40\text{ A}$ , $V_{GE} = 15\text{ V}$ , $R_G = 10\ \Omega$ (see <a href="#">Figure 25: "Test circuit for inductive load switching"</a> )	-	142	-	ns
$t_f$	Current fall time		-	27.6	-	ns
$E_{off}^{(1)}$	Turn-off switching energy		-	363	-	$\mu\text{J}$
$t_{d(off)}$	Turn-off delay time	$V_{CE} = 400\text{ V}$ , $I_C = 40\text{ A}$ , $V_{GE} = 15\text{ V}$ , $R_G = 10\ \Omega$ , $T_J = 175\text{ °C}$ (see <a href="#">Figure 25: "Test circuit for inductive load switching"</a> )	-	141	-	ns
$t_f$	Current fall time		-	61	-	ns
$E_{off}^{(1)}$	Turn-off switching energy		-	764	-	$\mu\text{J}$

**Notes:**

<sup>(1)</sup>Including the tail of the collector current.

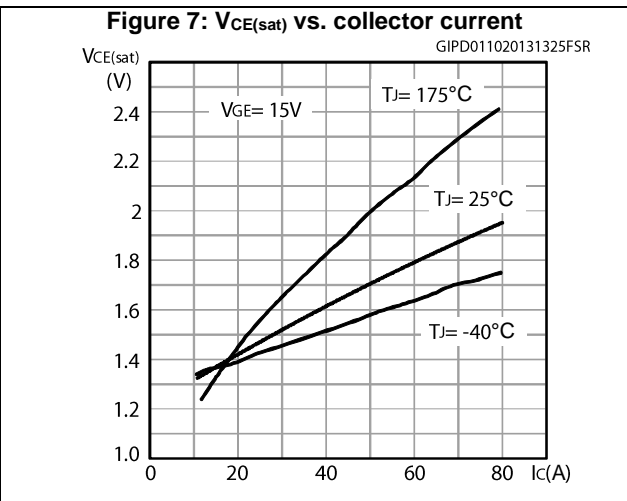
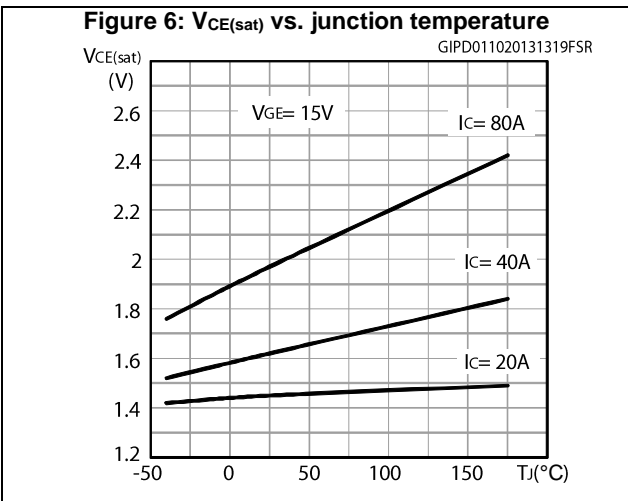
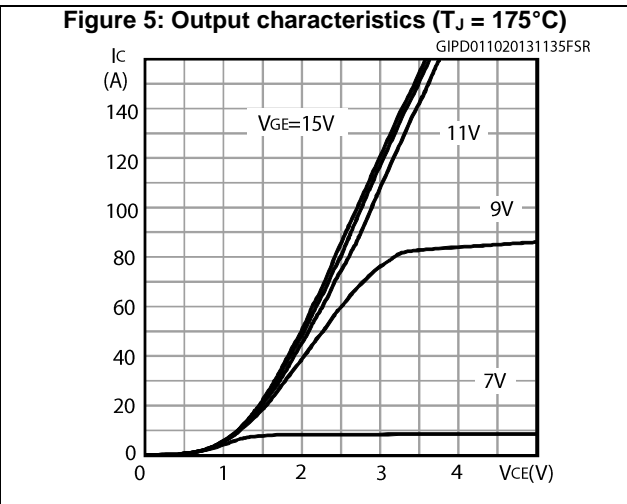
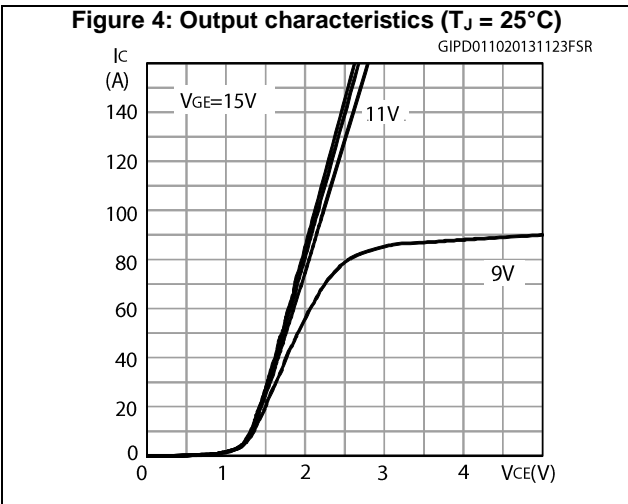
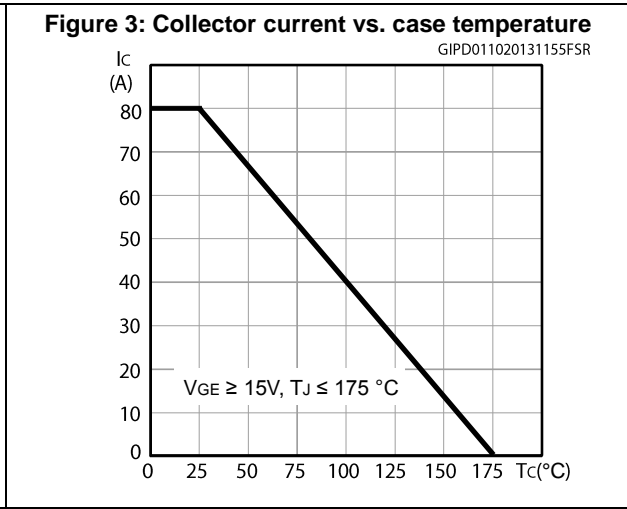
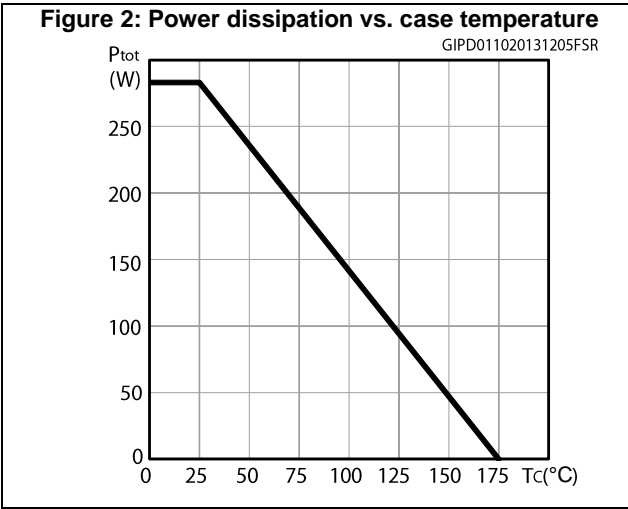
Table 7: IGBT switching characteristics (capacitive load)

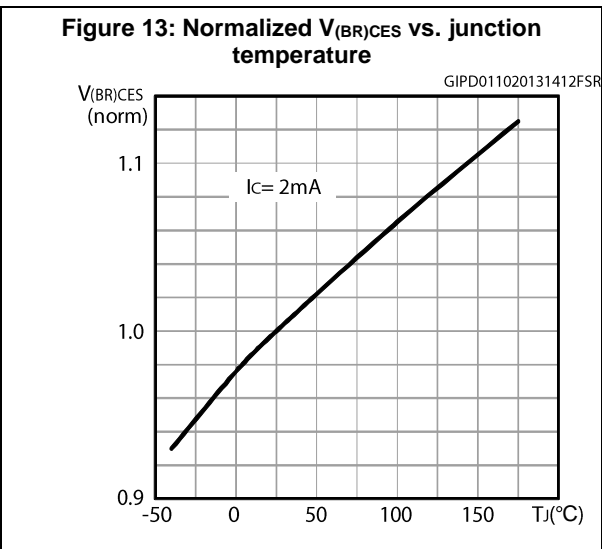
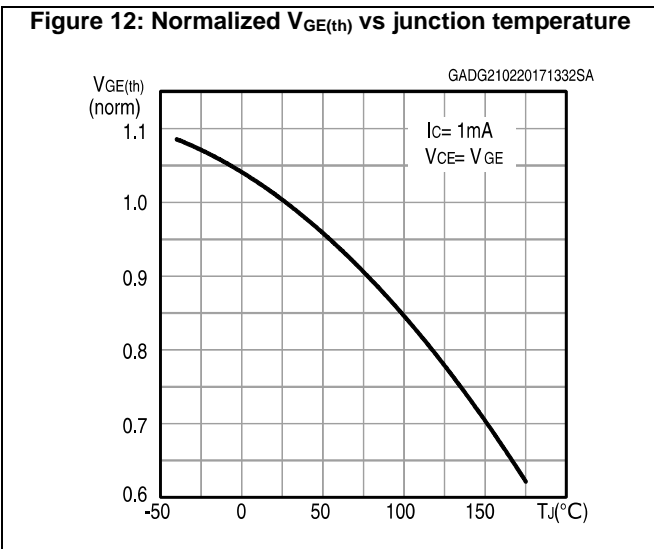
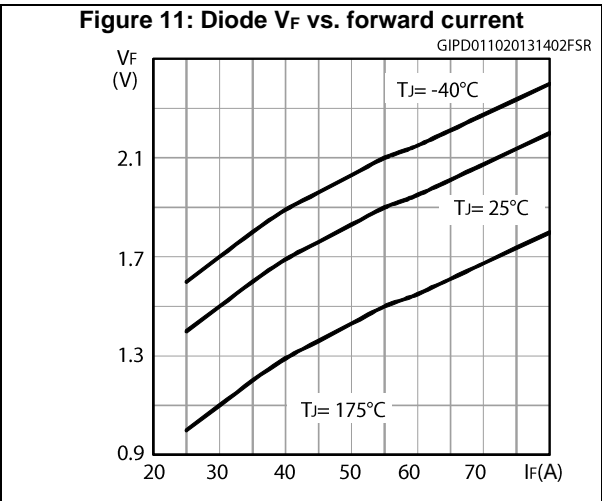
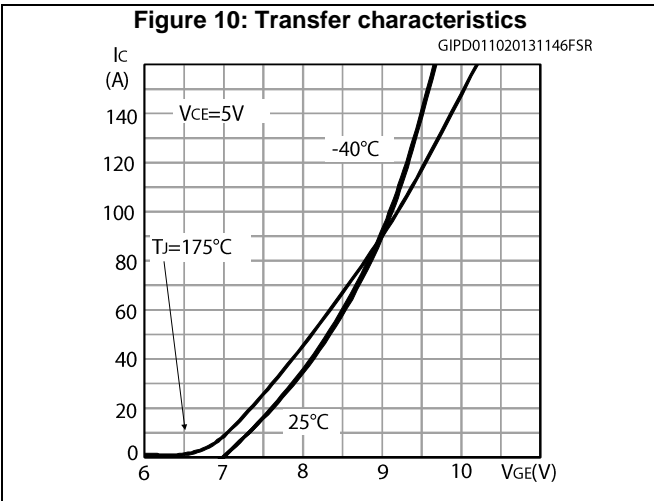
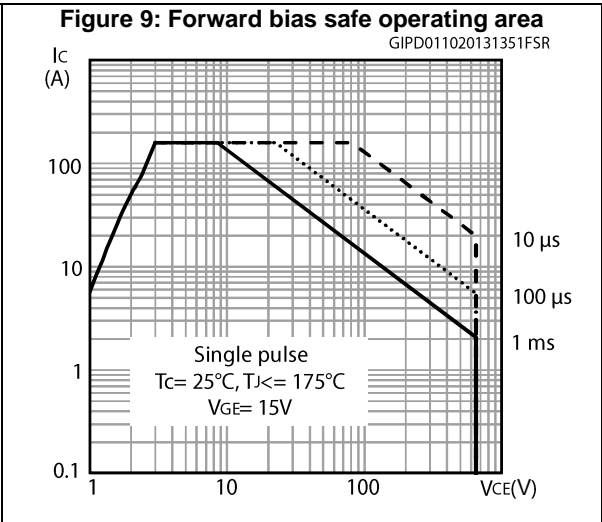
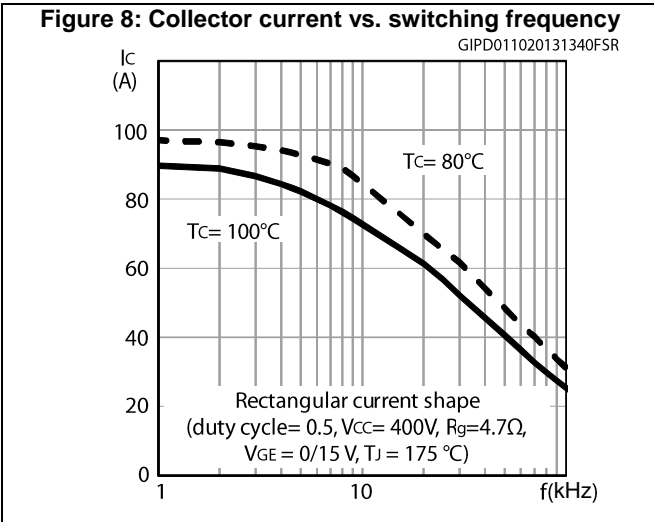
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{off}^{(1)}$	Turn-off switching energy	$V_{CC} = 320\text{ V}$ , $R_G = 10\ \Omega$ , $I_C = 40\text{ A}$ , $L = 100\ \mu\text{H}$ , $C_{snub} = 20\text{ nF}$ (see <a href="#">Figure 26: "Test circuit for capacitive load switching"</a> )	-	190	-	$\mu\text{J}$
		$V_{CC} = 320\text{ V}$ , $R_G = 10\ \Omega$ , $I_C = 40\text{ A}$ , $L = 100\ \mu\text{H}$ , $C_{snub} = 20\text{ nF}$ , $T_J = 175\text{ }^\circ\text{C}$ , (see <a href="#">Figure 26: "Test circuit for capacitive load switching"</a> )	-	290	-	

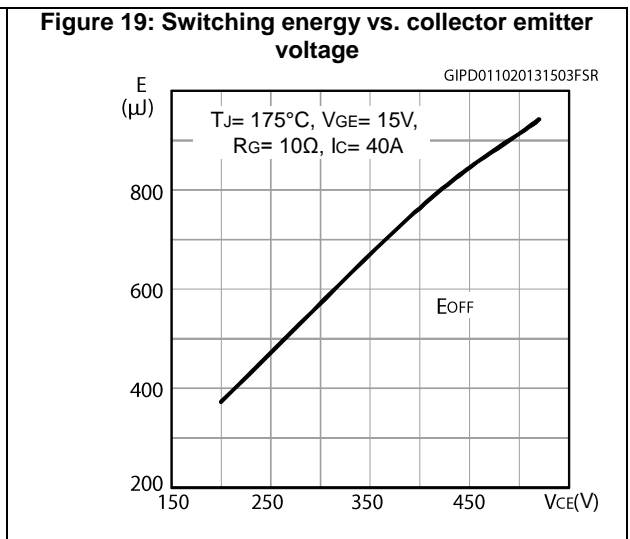
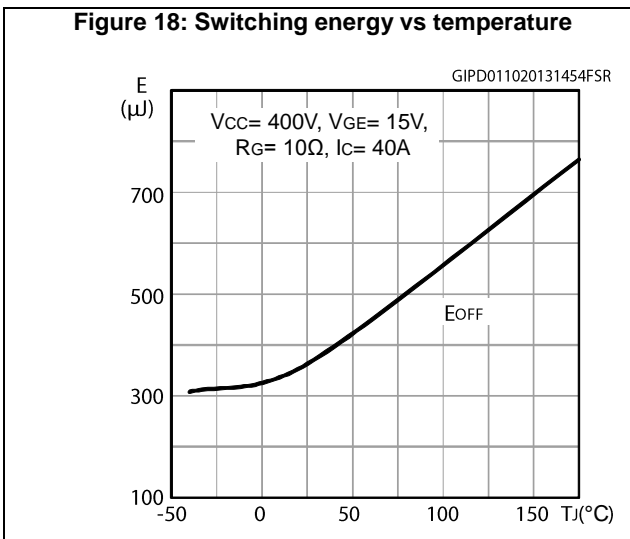
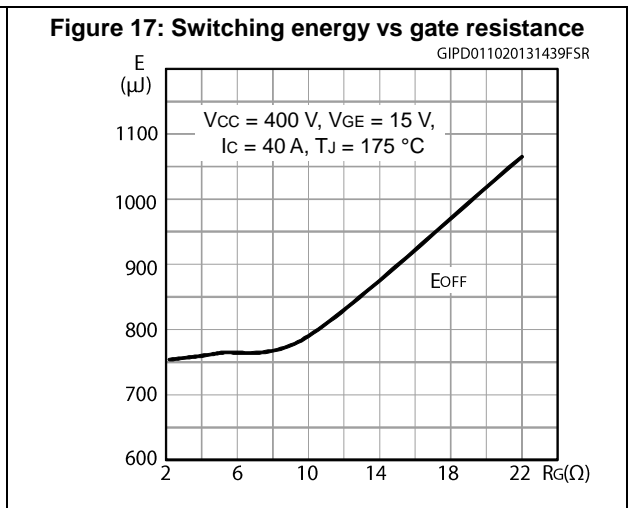
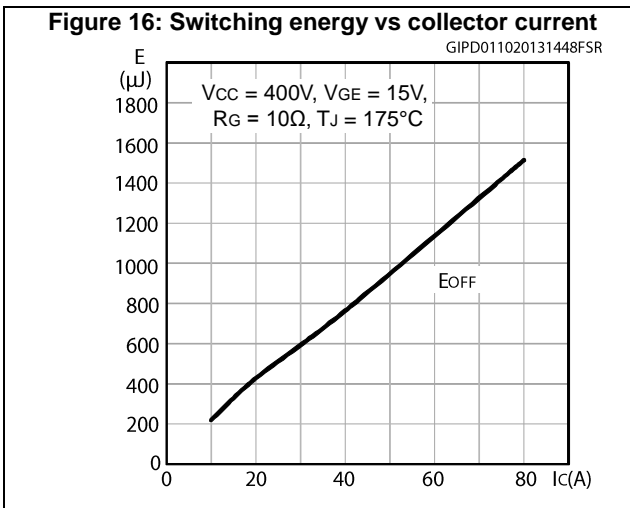
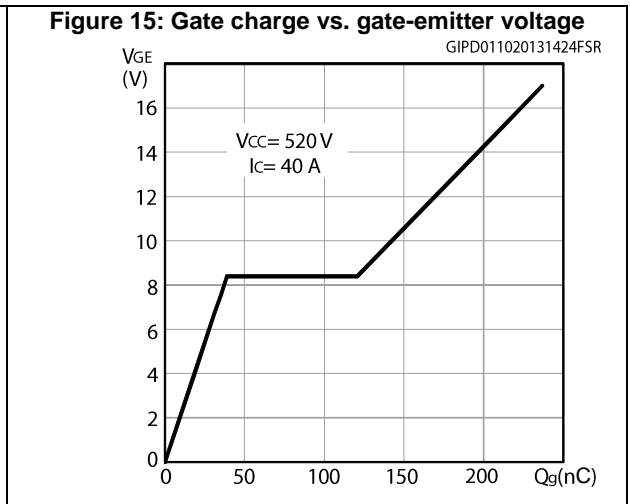
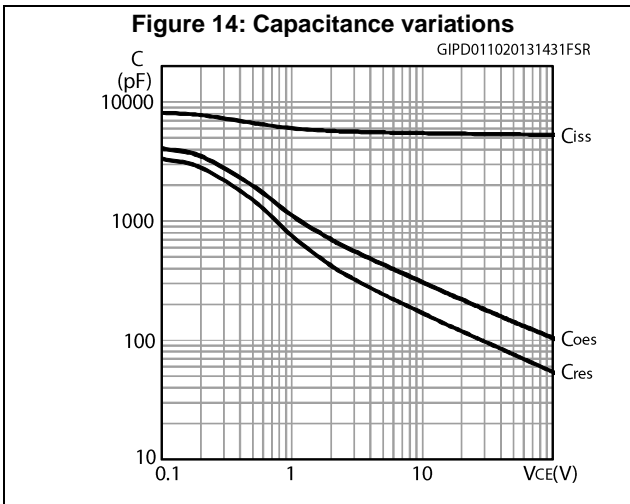
**Notes:**

<sup>(1)</sup>Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)









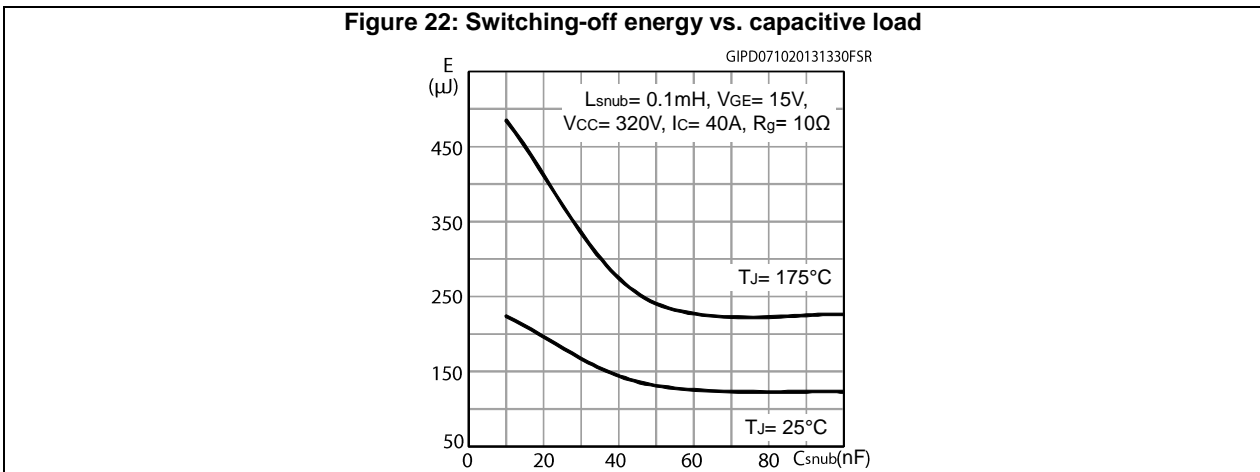
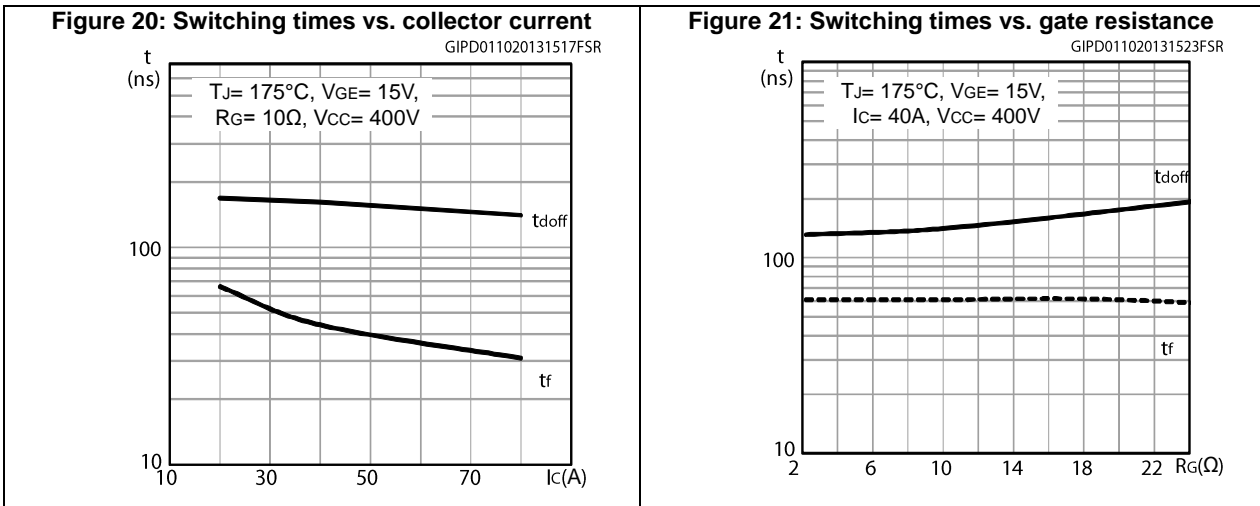


Figure 23: Thermal impedance

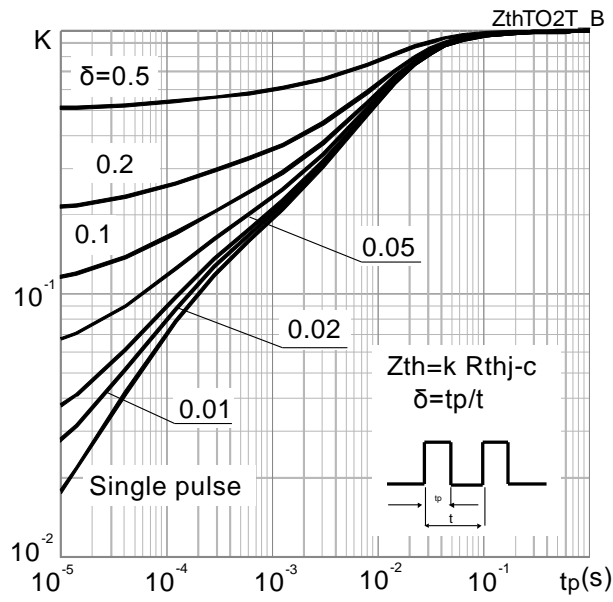
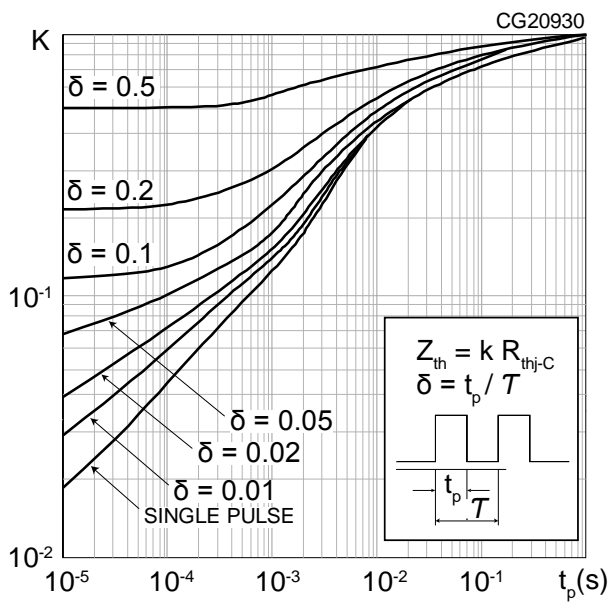


Figure 24: Thermal impedance for diode





## 4 Package mechanical data

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 long leads package mechanical data

Figure 29: TO-247 long leads package outline

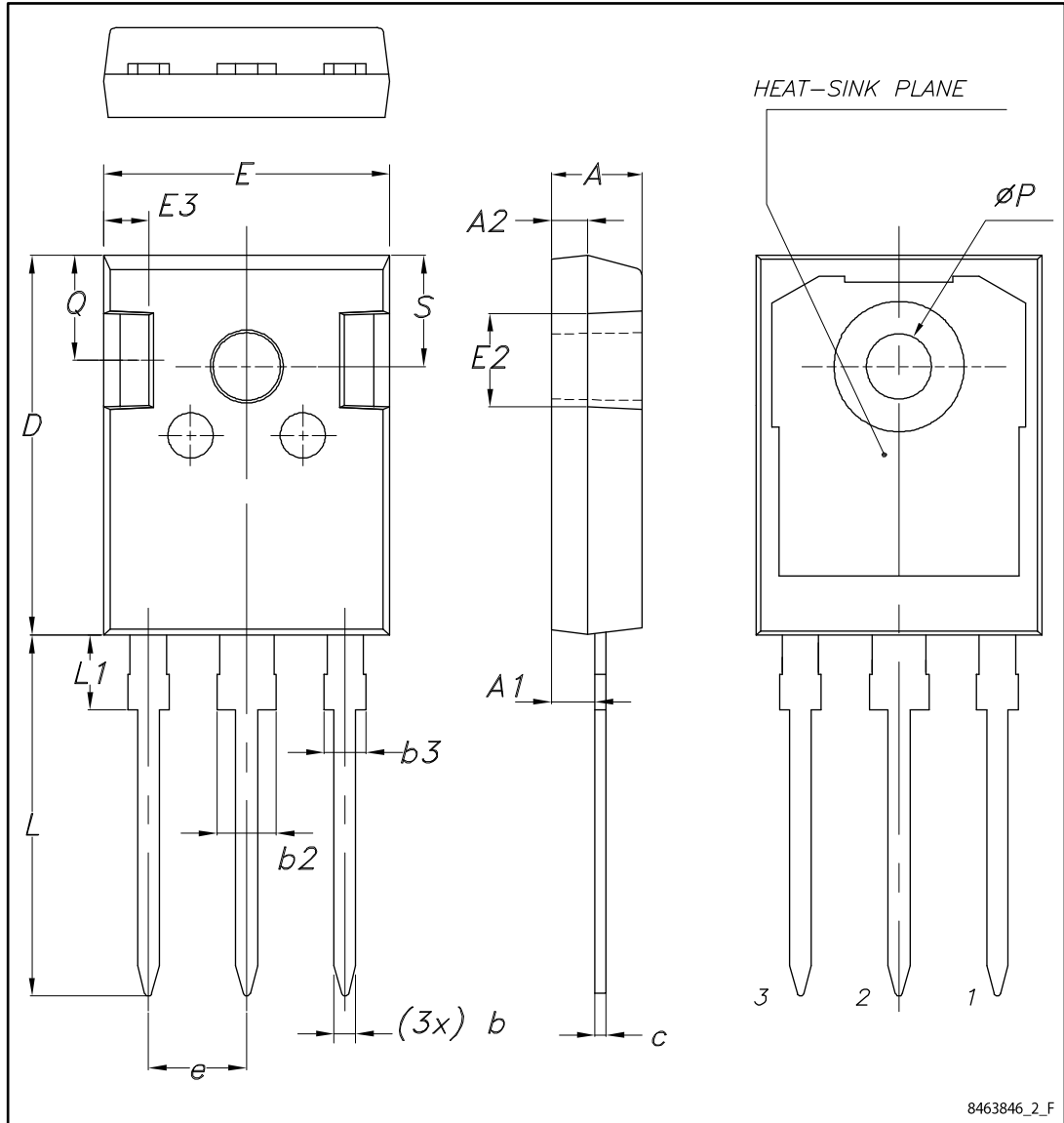


Table 8: TO-247 long leads package mechanical data

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		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25

## 5 Revision history

Table 9: Document revision history

Date	Revision	Changes
03-Mar-2017	1	First release.

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