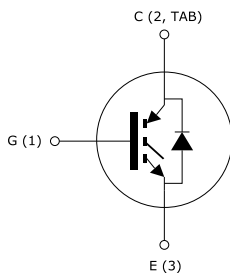
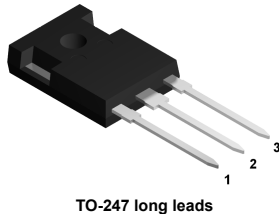


Trench gate field-stop 650 V, 80 A high speed HB series IGBT



Product status link

[STGWA80H65DFB](#)

Product summary

Order code	STGWA80H65DFB
Marking	GWA80H65DFB
Package	TO-247 long leads
Packing	Tube

Features

- Maximum junction temperature: $T_J = 175\text{ }^{\circ}\text{C}$
- High speed switching series
- Minimized tail current
- Low saturation voltage: $V_{CE(sat)} = 1.6\text{ V (typ.) @ } I_C = 80\text{ A}$
- Tight parameter distribution
- Safe paralleling
- Positive $V_{CE(sat)}$ temperature coefficient
- Low thermal resistance
- Very fast soft recovery antiparallel diode

Applications

- Solar inverters (string and central)
- AC-DC 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.

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 $T_C = 25\text{ °C}$	120 ⁽¹⁾	A
	Continuous collector current at $T_C = 100\text{ °C}$	80	
I_{CP}	Pulsed collector current ($t_p \leq 1\text{ }\mu\text{s}$, $T_J < 175\text{ °C}$)	300	A
V_{GE}	Gate-emitter voltage	± 20	V
	Transient gate-emitter voltage	± 30	V
I_F	Continuous forward current at $T_C = 25\text{ °C}$	120 ⁽¹⁾	A
	Continuous forward current at $T_C = 100\text{ °C}$	80	
I_{FP}	Pulsed forward current ($t_p \leq 1\text{ }\mu\text{s}$, $T_J < 175\text{ °C}$)	300	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	470	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range	- 55 to 175	

1. Limited by bonding wires.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.32	°C/W
R_{thJC}	Thermal resistance junction-case diode	0.66	
R_{thJA}	Thermal resistance junction-ambient	50	

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	$V_{GE} = 0\text{ V}$, $I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 80\text{ A}$		1.6	2	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_F	Forward on-voltage	$I_F = 80\text{ A}$		1.9	2.3	V
		$I_F = 80\text{ A}$, $T_J = 125\text{ °C}$		1.6		
		$I_F = 80\text{ A}$, $T_J = 175\text{ °C}$		1.5		
$V_{GE(th)}$	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 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	10524	-	pF
C_{oes}	Output capacitance		-	385	-	
C_{res}	Reverse transfer capacitance		-	215	-	
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 28. Gate charge test circuit)	-	414	-	nC
Q_{ge}	Gate-emitter charge		-	78	-	
Q_{gc}	Gate-collector charge		-	170	-	

Table 5. 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 27. Test circuit for inductive load switching)		84	-	ns
t_r	Current rise time			52	-	
$(di/dt)_{on}$	Turn-on current slope			1270	-	A/ μ s
$t_{d(off)}$	Turn-off-delay time			280	-	ns
t_f	Current fall time			31	-	
$E_{on}^{(1)}$	Turn-on switching energy			2.1	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			1.5	-	
E_{ts}	Total switching energy			3.6	-	
$t_{d(on)}$	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 27. Test circuit for inductive load switching)		77	-	ns
t_r	Current rise time			51	-	
$(di/dt)_{on}$	Turn-on current slope			1270	-	A/ μ s
$t_{d(off)}$	Turn-off-delay time			328	-	ns
t_f	Current fall time			30	-	
$E_{on}^{(1)}$	Turn-on switching energy			4.4	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			2.1	-	
E_{ts}	Total switching energy			6.5	-	

1. Including the reverse recovery of the diode.

2. Including the tail of the collector current.

Table 6. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	$I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$ di/ $dt = 100\text{ A}/\mu\text{s}$ (see Figure 27. Test circuit for inductive load switching)	-	85	-	ns
Q_{rr}	Reverse recovery charge		-	1105	-	nC
I_{rrm}	Reverse recovery current		-	26	-	A
di_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	722	-	A/ μ s
E_{rr}	Reverse recovery energy		-	267	-	μ J
t_{rr}	Reverse recovery time	$I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $T_J = 175\text{ }^\circ\text{C}$ di/ $dt = 100\text{ A}/\mu\text{s}$ (see Figure 27. Test circuit for inductive load switching)	-	149	-	ns
Q_{rr}	Reverse recovery charge		-	4920	-	nC
I_{rrm}	Reverse recovery current		-	66	-	A
di_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	546	-	A/ μ s
E_{rr}	Reverse recovery energy		-	1172	-	μ J

2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs case temperature

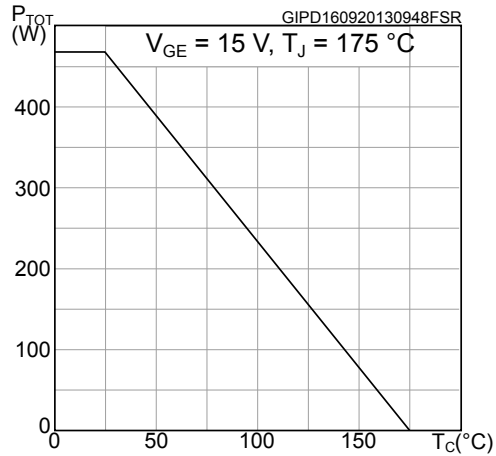


Figure 2. Collector current vs case temperature

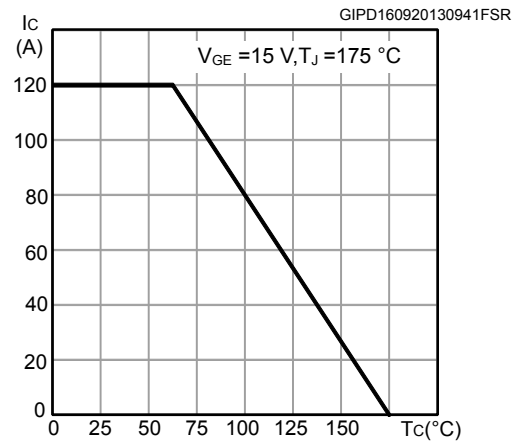


Figure 3. Output characteristics ($T_J = 25^\circ\text{C}$)

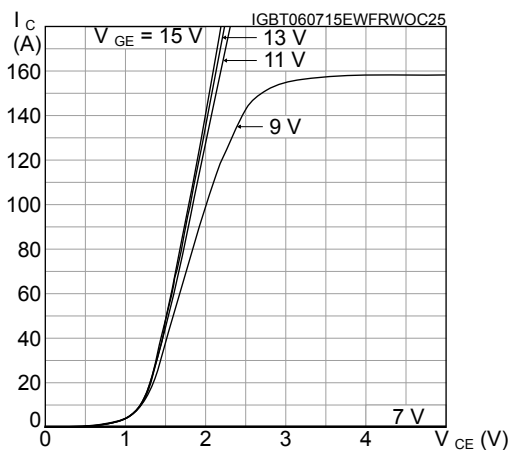


Figure 4. Output characteristics ($T_J = 175^\circ\text{C}$)

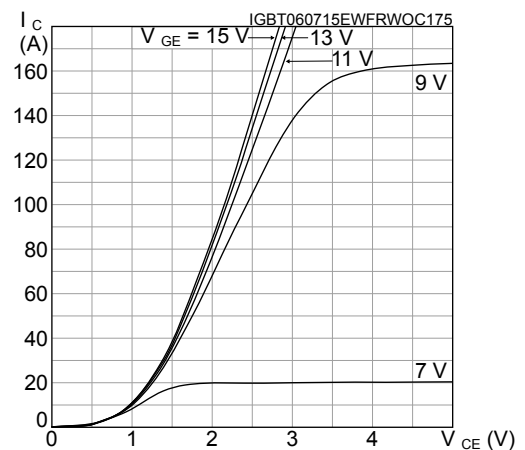


Figure 5. $V_{CE(sat)}$ vs junction temperature

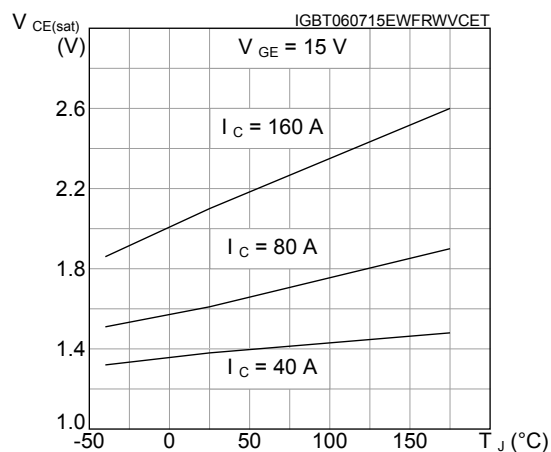


Figure 6. $V_{CE(sat)}$ vs collector current

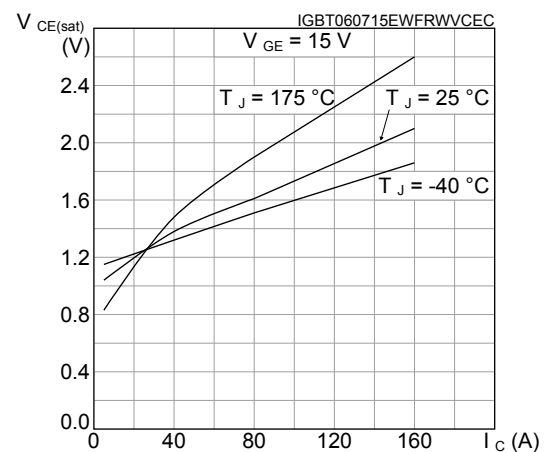


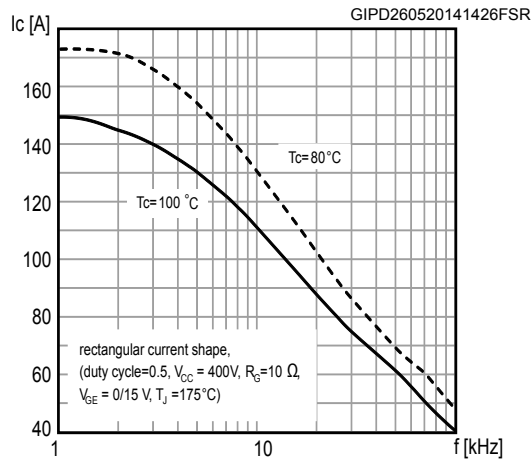
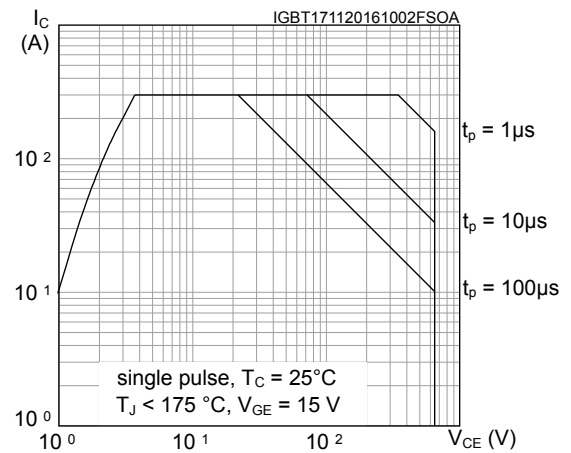
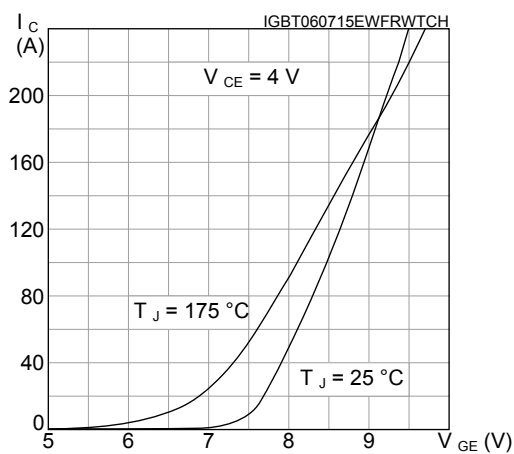
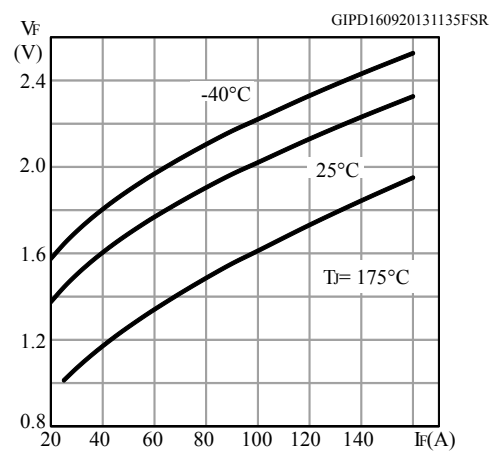
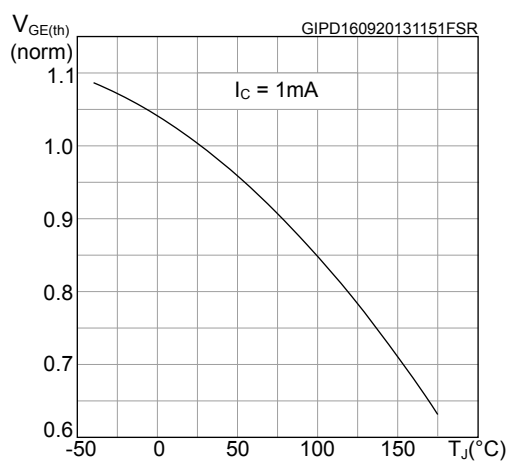
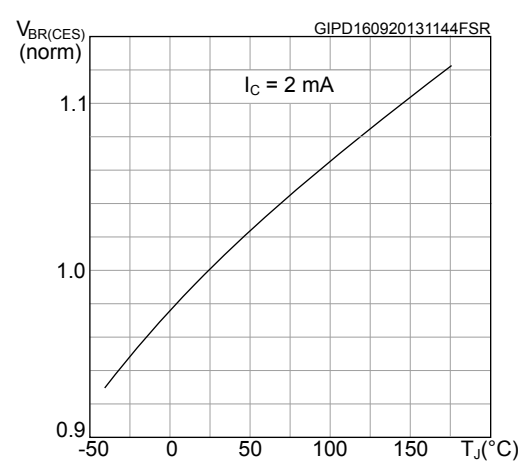
Figure 7. Collector current vs switching frequency

Figure 8. Forward bias safe operating area

Figure 9. Transfer characteristics

Figure 10. Diode V_F vs forward current

Figure 11. Normalized $V_{GE(th)}$ vs junction temperature

Figure 12. Normalized $V_{(BR)CES}$ vs junction temperature


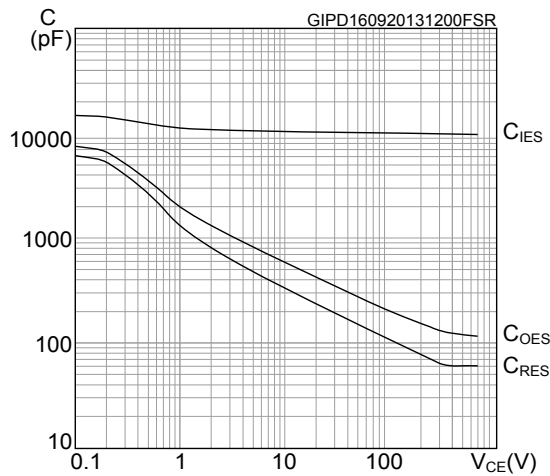
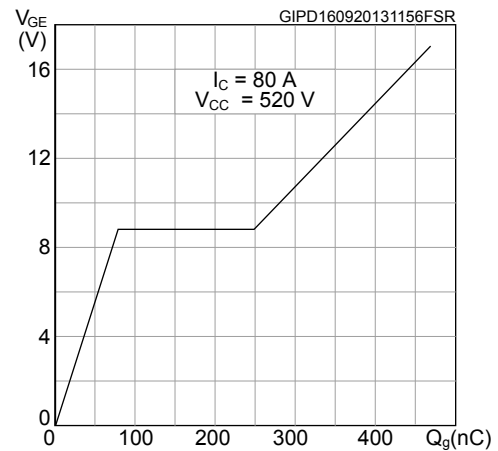
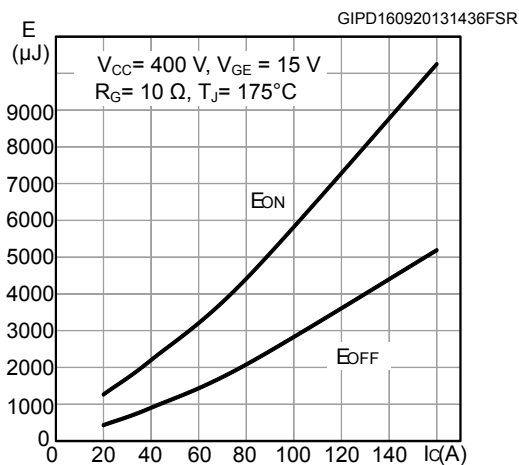
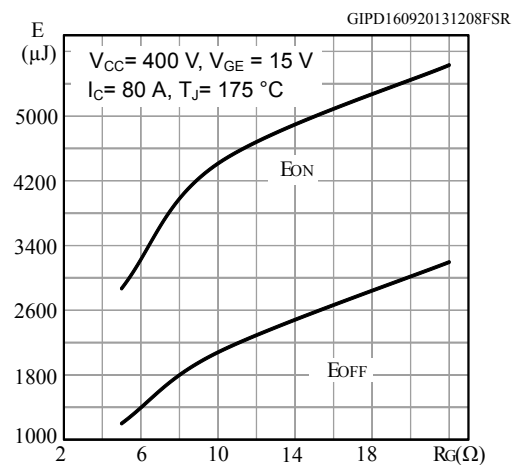
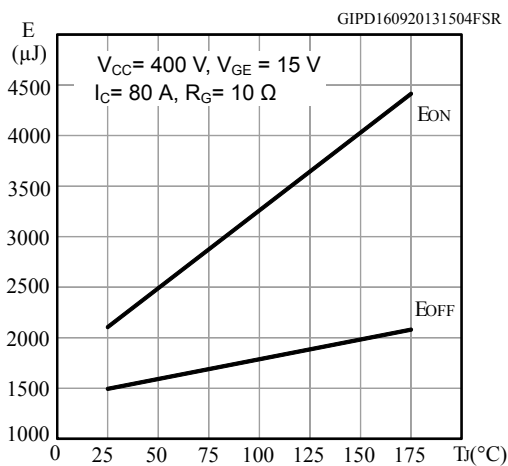
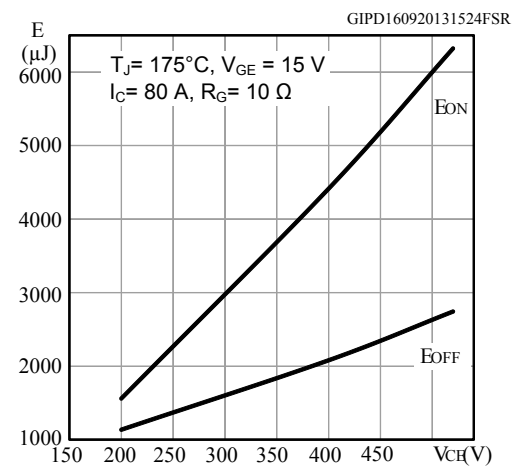
Figure 13. Capacitance variations

Figure 14. Gate charge vs gate-emitter voltage

Figure 15. Switching energy vs collector current

Figure 16. Switching energy vs gate resistance

Figure 17. Switching energy vs temperature

Figure 18. Switching energy vs collector emitter voltage


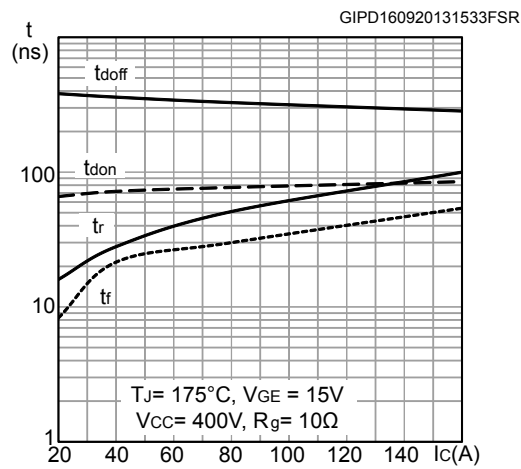
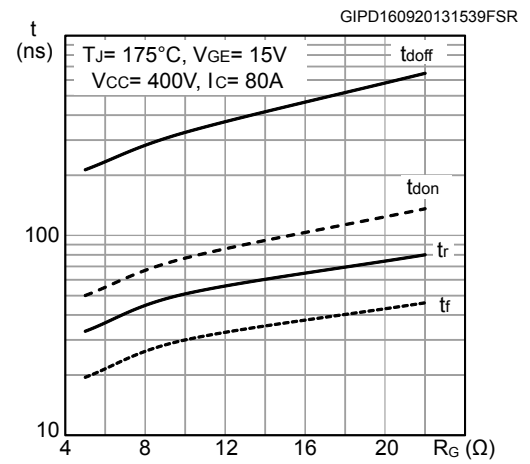
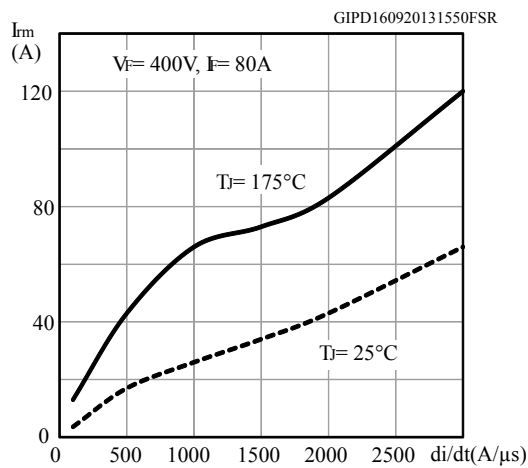
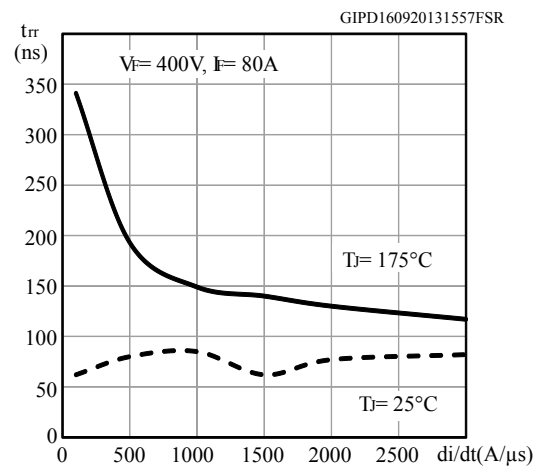
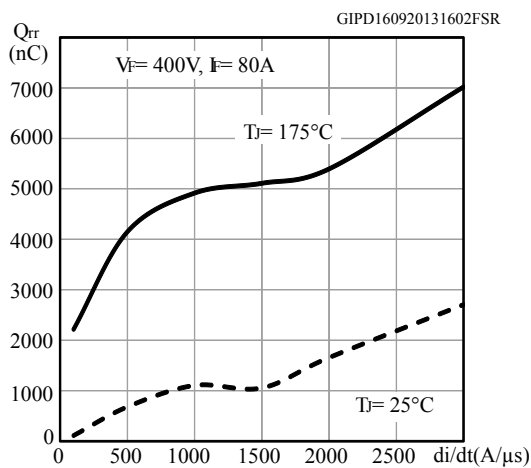
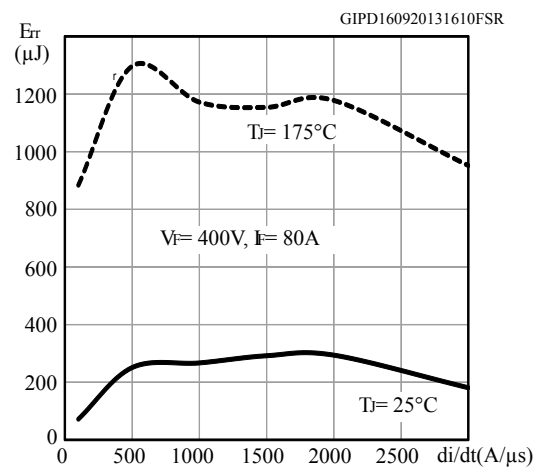
Figure 19. Switching times vs collector current

Figure 20. Switching times vs gate resistance

Figure 21. Reverse recovery current vs diode current slope

Figure 22. Reverse recovery time vs diode current slope

Figure 23. Reverse recovery charge vs diode current slope

Figure 24. Reverse recovery energy vs diode current slope


Figure 25. Thermal impedance for IGBT

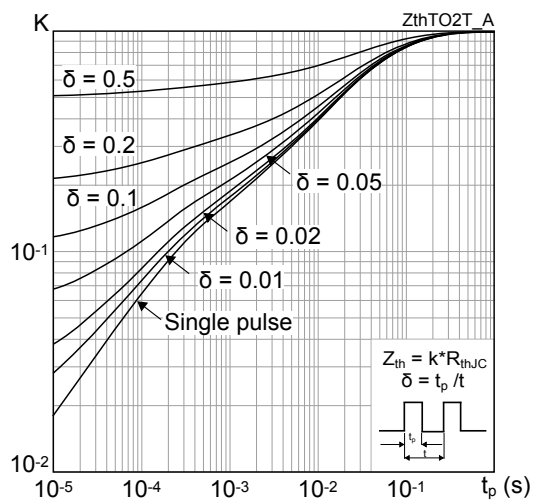
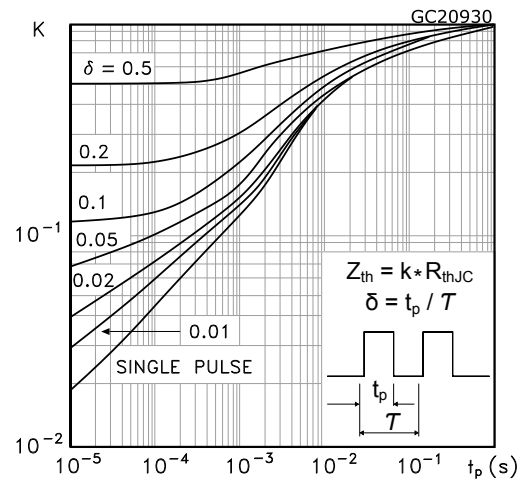


Figure 26. Thermal impedance for diode

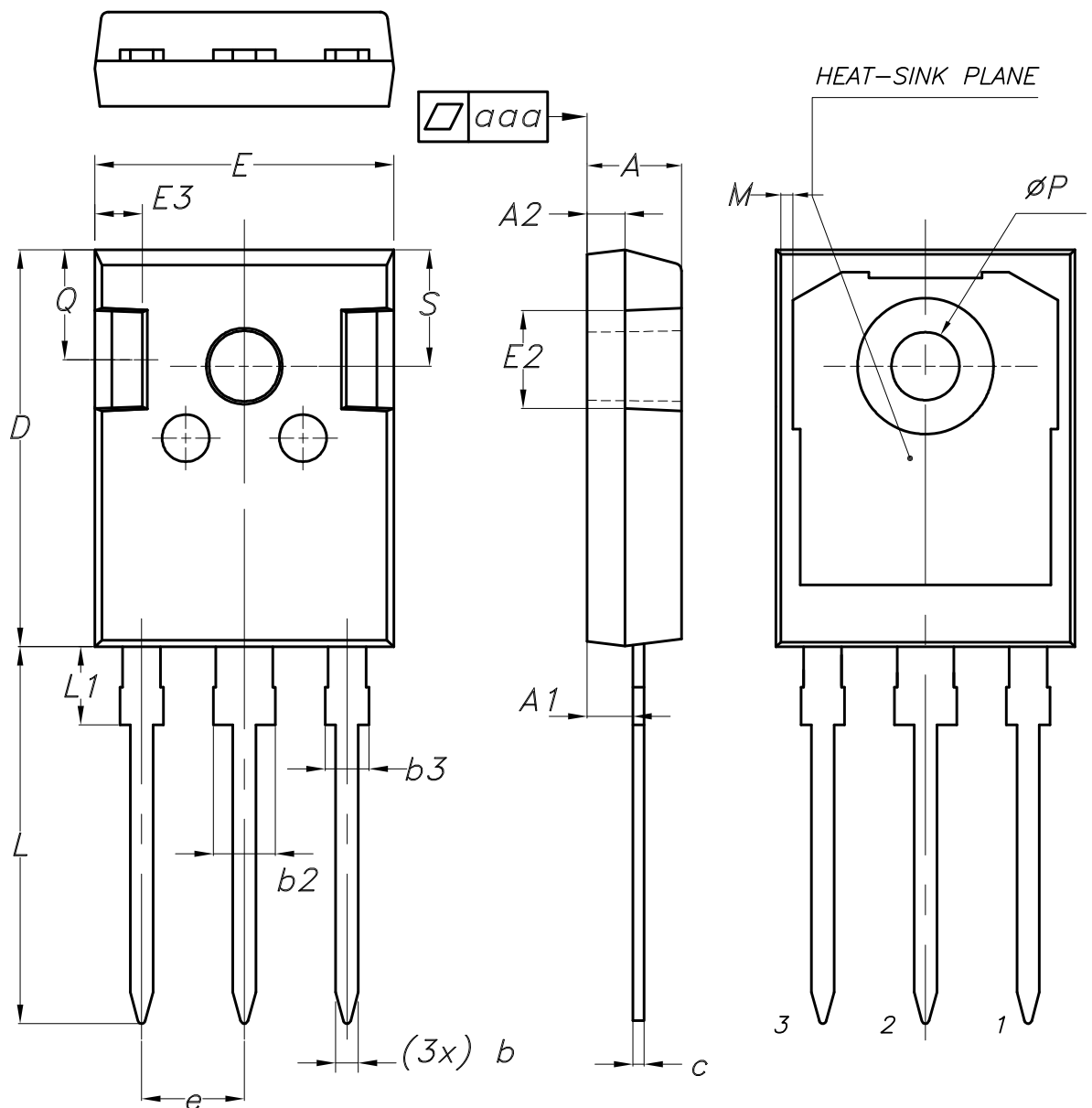


4 Package information

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 TO-247 long leads package information

Figure 31. TO-247 long leads package outline



BACK VIEW

8463846_6

Table 7. 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
M	0.35		0.95
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25
aaa		0.04	0.10

Revision history

Table 8. Document revision history

Date	Revision	Changes
17-Nov-2016	1	First release. Part number previously included in datasheet DocID024366.
25-Jun-2019	2	Modified <i>Table 1. Absolute maximum ratings</i> . Minor text changes.
19-Mar-2025	3	Updated Section 4.1: TO-247 long leads package information . Minor text changes.

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