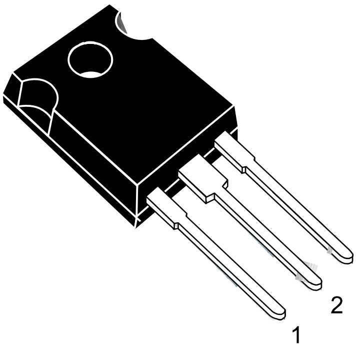
STGWA80H65DFB

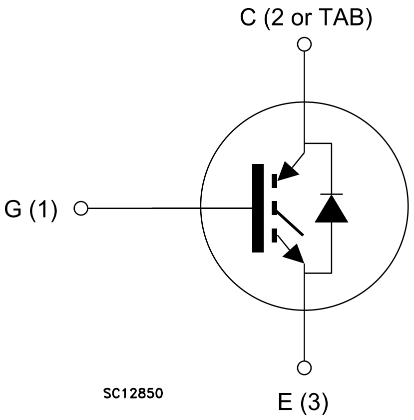
Trench gate field-stop IGBT, HB series 650 V, 80 A high speed

Datasheet - production data



TO-247 long leads

Figure 1: Internal schematic diagram



Features

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

Applications

- Photovoltaic inverters
- High frequency 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	Packing
STGWA80H65DFB	GWA80H65DFB	TO-247 long leads	Tube

Contents

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}[(2)(3)]	Pulsed collector current	300	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at T_C = 25 °C	120[(1)]	A
	Continuous forward current at T_C = 100 °C	80	
I_{FP}[(2)(3)]	Pulsed forward current	300	A
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:

[(1)]Current level is limited by bond wires

[(2)]Pulse width limited by maximum junction temperature. (t_p < 1ms , T_J < 175 °C)

[(3)]Defined by design, not tested.

Table 3: 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 °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 V, I_C = 2 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 80 A		1.6	2	V
		V_{GE} = 15 V, I_C = 80 A, T_J = 125 °C		1.8		
		V_{GE} = 15 V, I_C = 80 A, T_J = 175 °C		1.9		
V_F	Forward on-voltage	I_F = 80 A		1.9	2.3	V
		I_F = 80 A, T_J = 125 °C		1.6		
		I_F = 80 A, T_J = 175 °C		1.5		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	5	6	7	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 650 V			100	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ± 20 V			±250	nA

Table 5: 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	-	10524	-	pF
C_{oes}	Output capacitance		-	385	-	
C_{res}	Reverse transfer capacitance		-	215	-	
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 80 A, V_{GE} = 15 V (see *Figure 29: " 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 V, I_C = 80 A, V_{GE} = 15 V, R_G = 10 Ω (see *Figure 28: " Test circuit for inductive load switching"*)	-	84	-	ns
t_r	Current rise time		-	52	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1270	-	A/µs
$t_{d(off)}$	Turn-off-delay time		-	280	-	ns
t_f	Current fall time		-	31	-	ns
E_{on} (1)	Turn-on switching energy		-	2.1	-	mJ
E_{off} (2)	Turn-off switching energy		-	1.5	-	mJ
E_{ts}	Total switching energy		-	3.6	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 80 A, V_{GE} = 15 V, R_G = 10 Ω , T_J = 175 °C (see *Figure 28: " Test circuit for inductive load switching"*)	-	77	-	ns
t_r	Current rise time		-	51	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1270	-	A/µs
$t_{d(off)}$	Turn-off-delay time		-	328	-	ns
t_f	Current fall time		-	30	-	ns
E_{on} (1)	Turn-on switching energy		-	4.4	-	mJ
E_{off} (2)	Turn-off switching energy		-	2.1	-	mJ
E_{ts}	Total switching energy		-	6.5	-	mJ

Notes:

(1)Including the reverse recovery of the diode.

(2)Including the tail of the collector current.

Table 7: Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	I_F = 80 A, V_R = 400 V, di/dt = 1000 A/µs V_{GE} = 15 V, (see *Figure 28: " 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/µs
E_{rr}	Reverse recovery energy		-	267	-	µJ
t_{rr}	Reverse recovery time	I_F = 80 A, V_R = 400 V, V_{GE} = 15 V ,T_J = 175 °C di/dt = 1000 A/µs (see *Figure 28: " 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/µs
E_{rr}	Reverse recovery energy		-	1172	-	µJ

2.1 Electrical characteristics (curves)

Figure 2: Output characteristics (TJ= 25 °C)

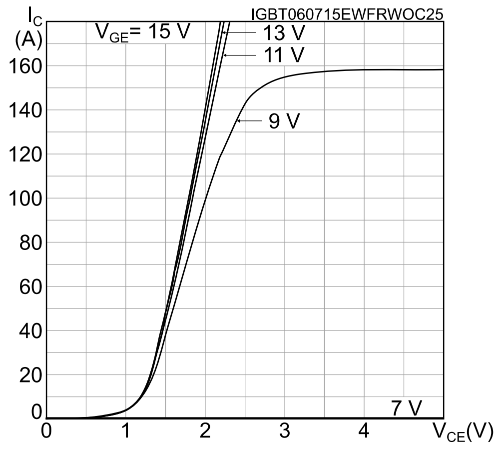


Figure 3: Output characteristics (TJ= 175 °C)

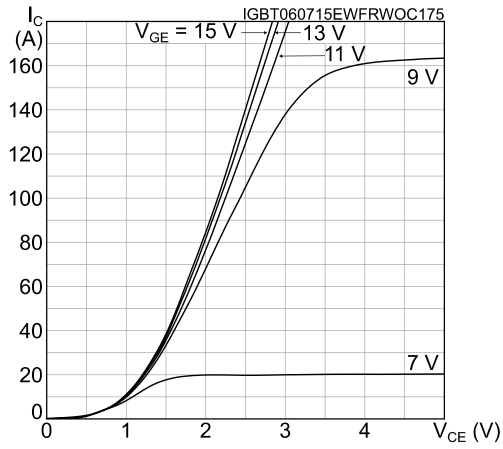


Figure 4: Transfer characteristics

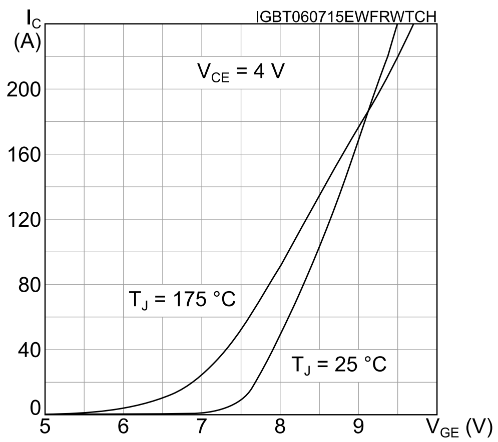


Figure 5: Collector current vs. case temperature

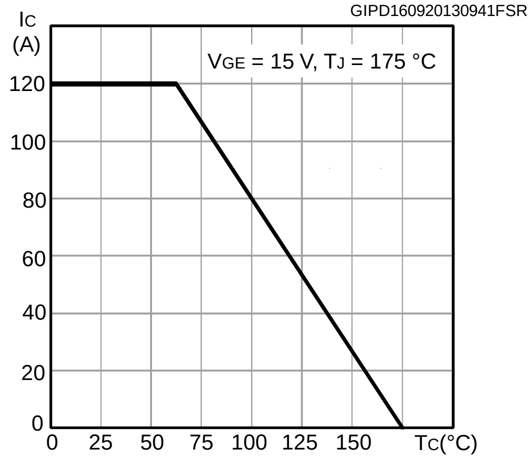


Figure 6: Power dissipation vs. case temperature

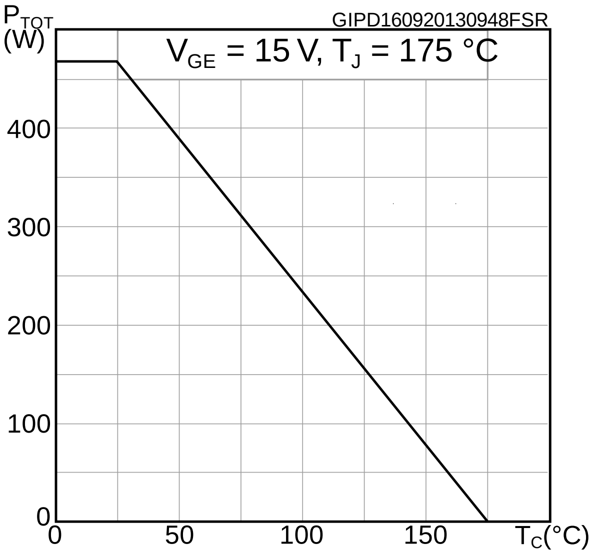


Figure 7: VCE(sat) vs. junction temperature

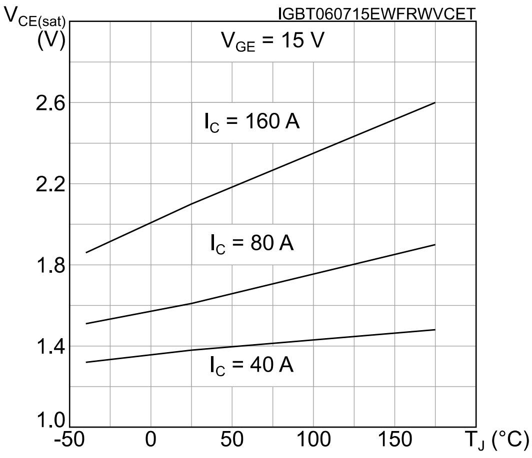


Figure 8: VCE (sat) vs. collector current

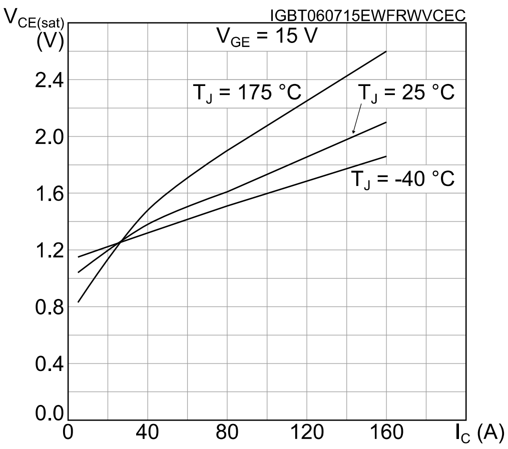


Figure 9: Forward bias safe operating area

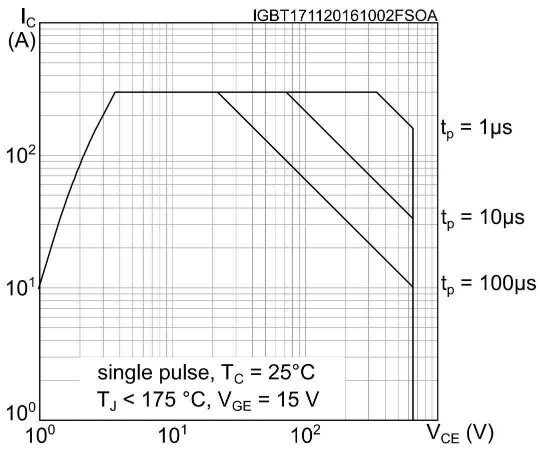


Figure 10: Diode VF vs. forward current

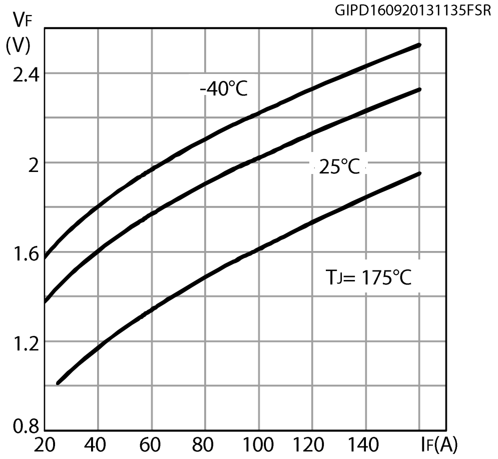


Figure 11: Normalized V(BR)CES vs. junction temperature

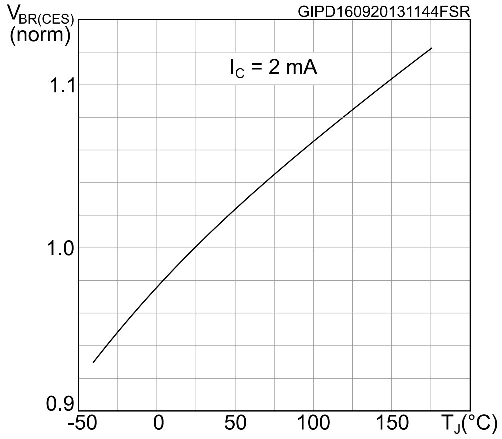


Figure 12: Normalized VGE(th) vs. junction temperature

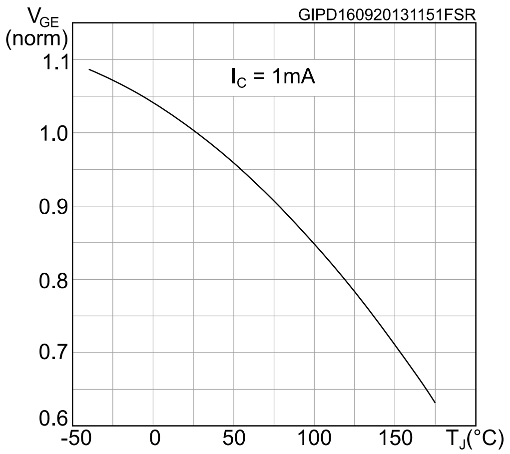


Figure 13: Gate charge vs. gate-emitter voltage

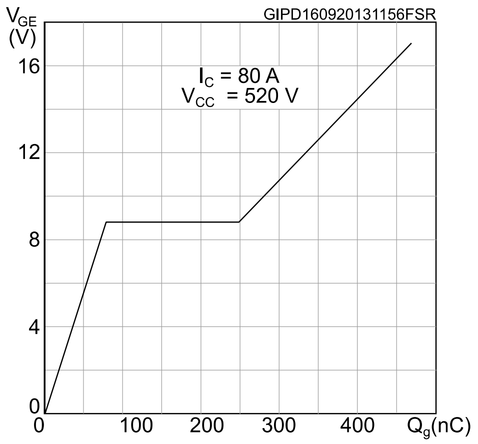


Figure 14: Switching energy vs. temperature

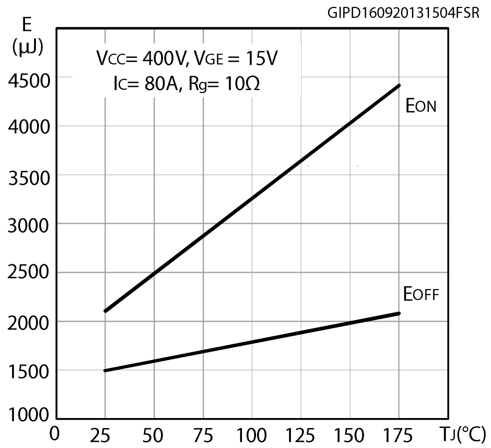


Figure 15: Switching energy vs. gate resistance

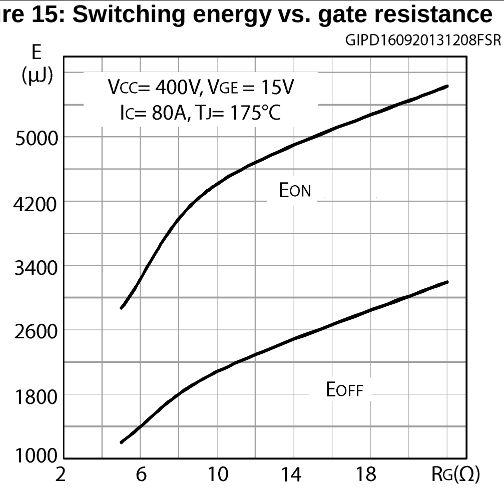


Figure 16: Switching energy vs. collector current

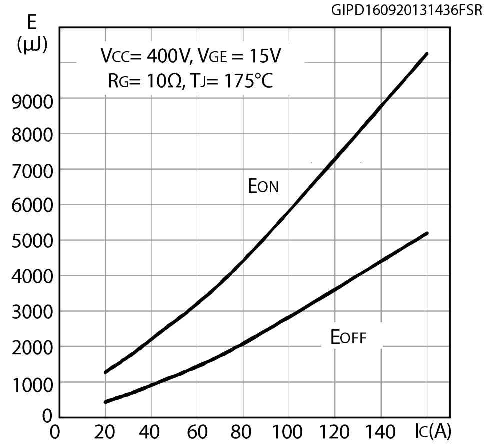


Figure 17: Switching energy vs. collector emitter voltage

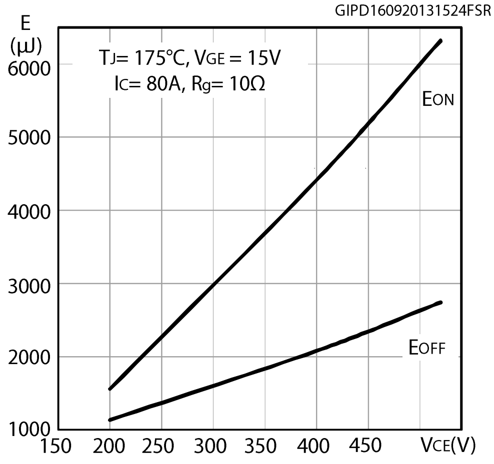


Figure 18: Switching time vs. collector temperature

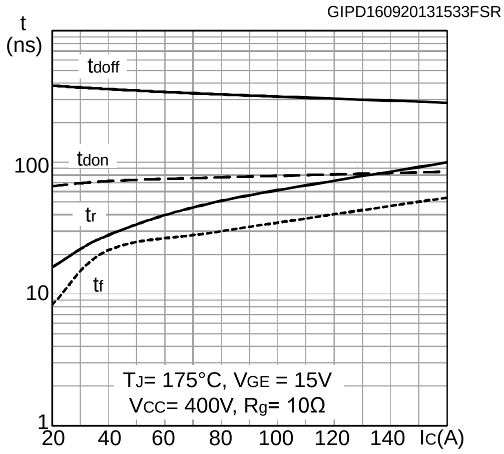


Figure 19: Switching time vs. gate resistance

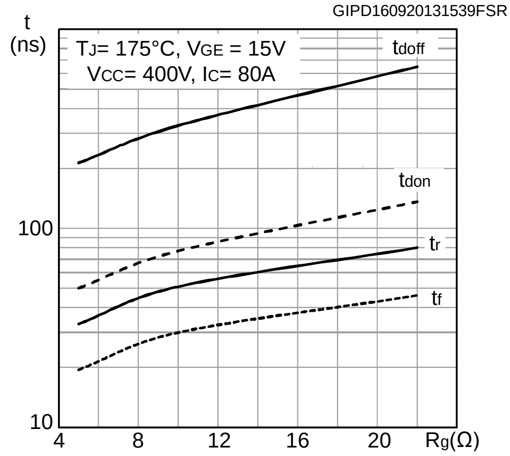


Figure 20: Reverse recovery current vs. diode current slope

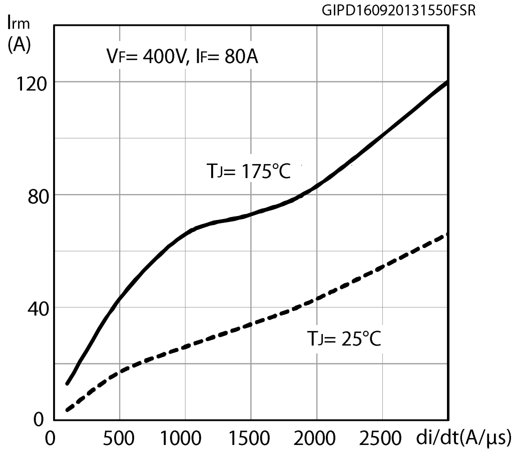


Figure 21: Reverse recovery time vs. diode current slope

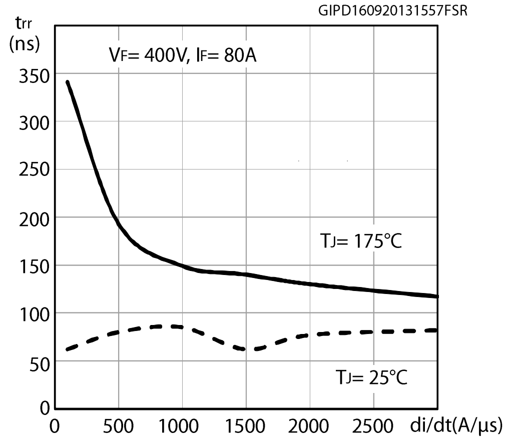


Figure 22: Reverse recovery charge vs. diode current slope

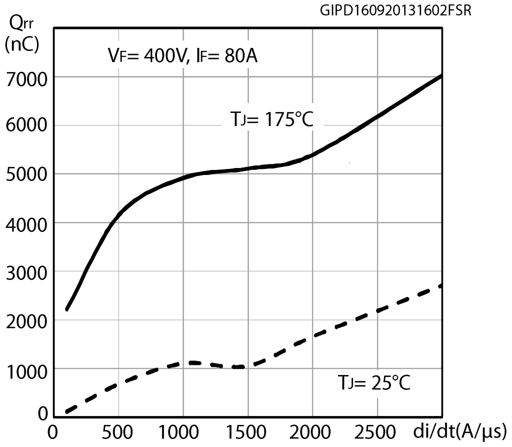


Figure 23: Reverse recovery energy vs. diode current slope

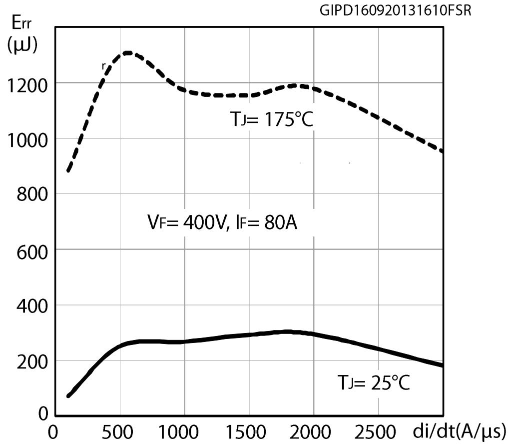


Figure 24: Capacitance variations

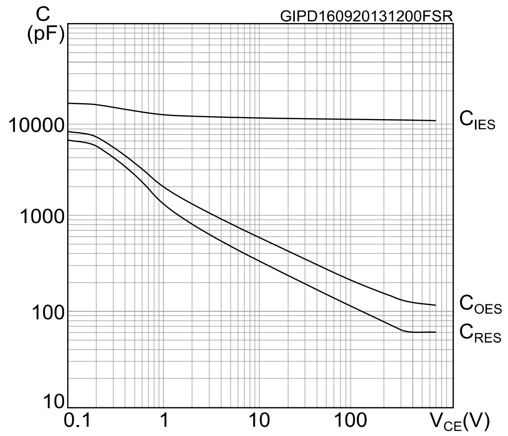


Figure 25: Collector current vs. switching frequency

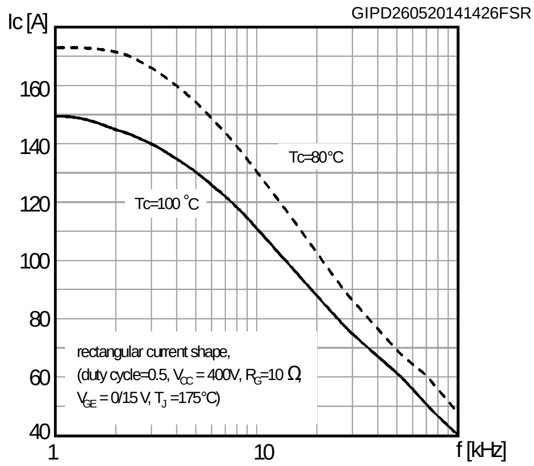


Figure 26: Thermal impedance for IGBT

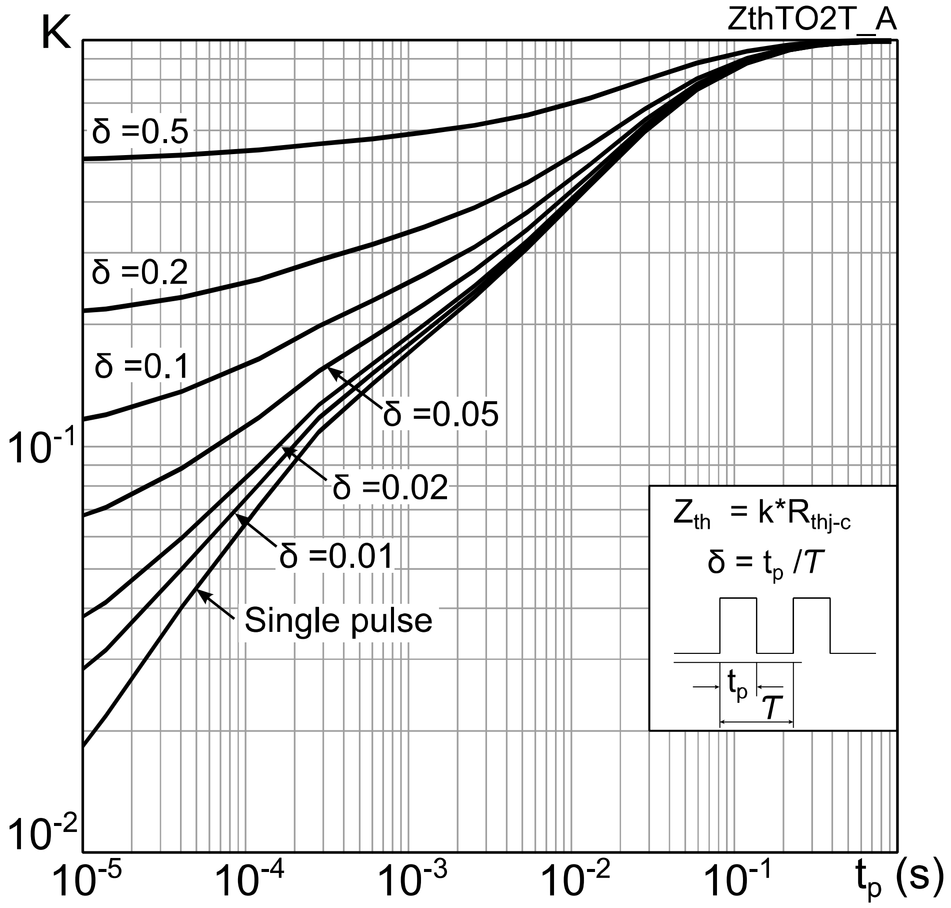
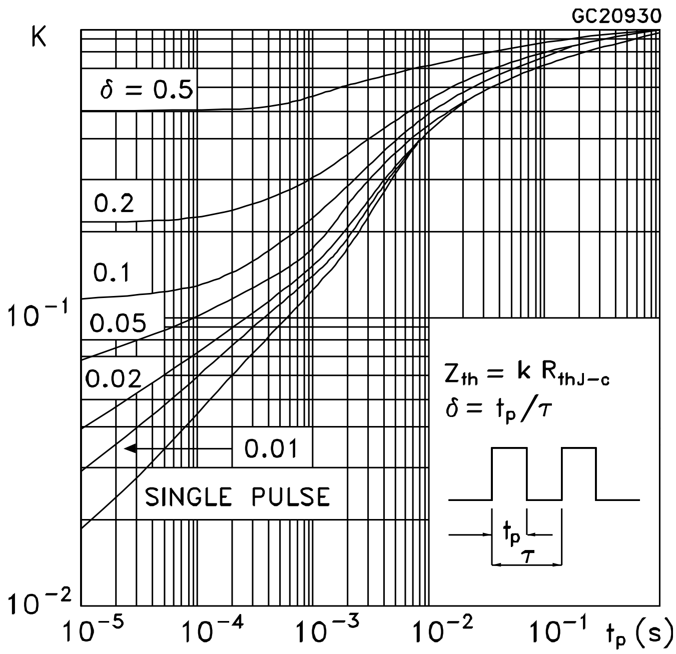


Figure 27: Thermal impedance for diode



3 Test circuits

Figure 28: Test circuit for inductive load switching

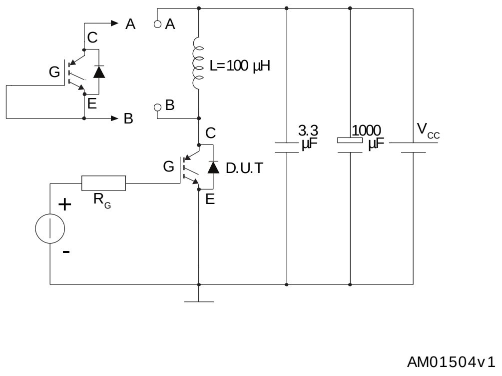


Figure 29: Gate charge test circuit

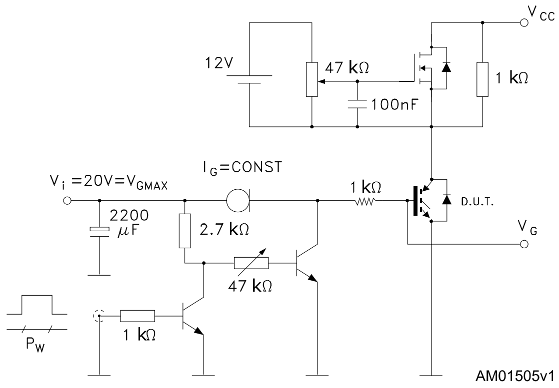


Figure 30: Switching waveform

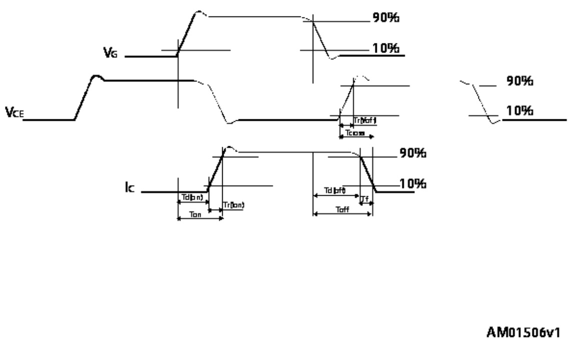
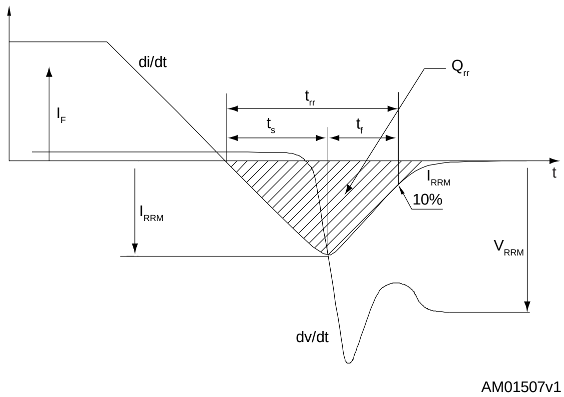


Figure 31: Diode reverse recovery waveform



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 TO-247 long leads package information

Figure 32: TO-247 long lead package outline

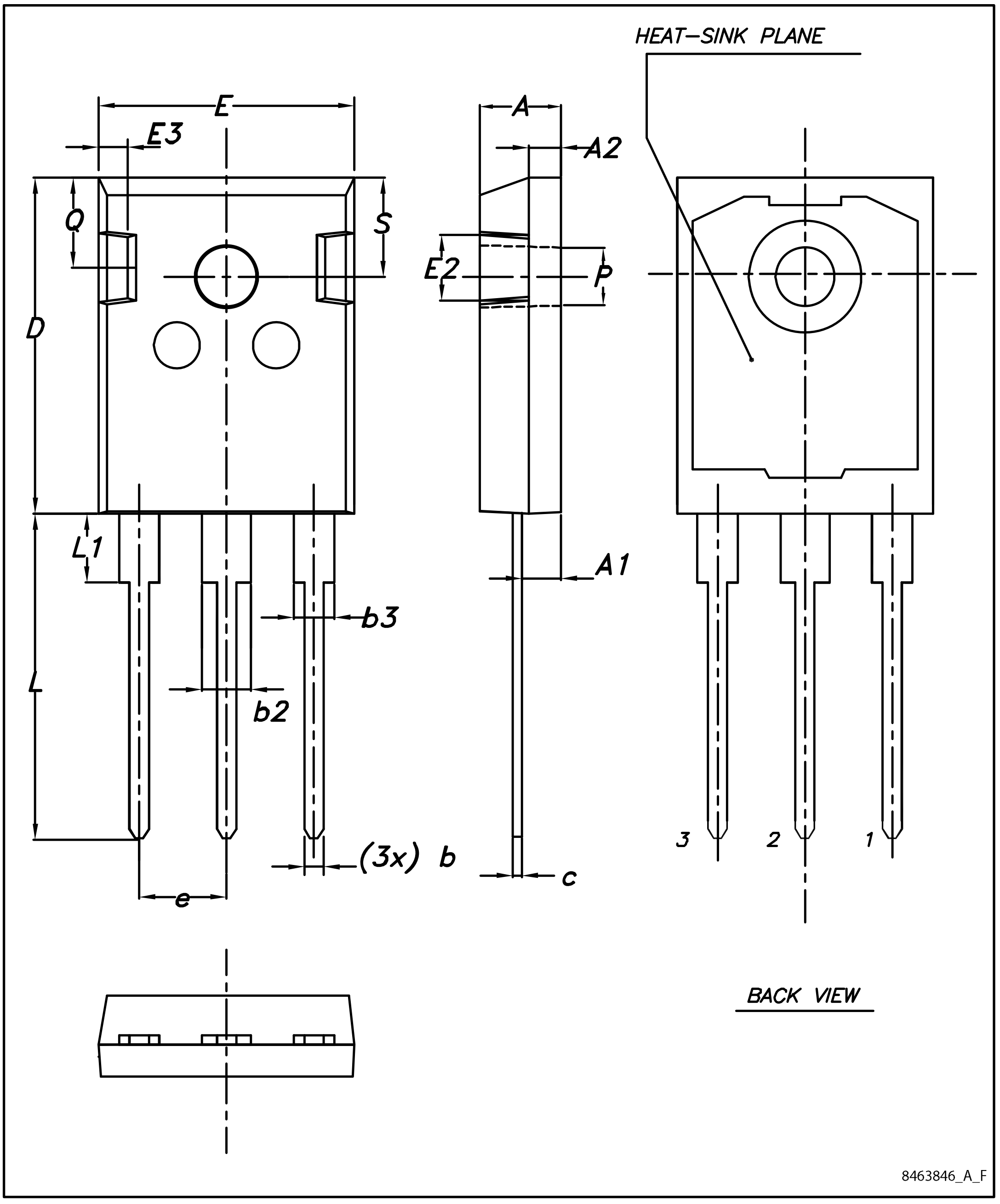


Table 8: TO-247 long lead package mechanical data

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
17-Nov-2016	1	First release. Part number previously included in datasheet DocID024366.