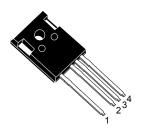
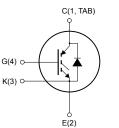


Trench gate field-stop 650 V, 80 A high speed HB series IGBT



TO247-4



NG4K3E2C1_TAB



Product status link

STGW80H65DFB-4

Product summary				
Order code	STGW80H65DFB-4			
Marking	G80H65DFB			
Package	TO247-4			
Packing	Tube			

Features

- $V_{CE(sat)} = 1.6 \text{ V (typ.)} @ I_C = 80 \text{ A}$
- Maximum junction temperature: T_J = 175 °C
- · High speed switching series
- · Minimized tail current
- Tight parameter distribution
- · Safe paralleling
- · Low thermal resistance
- · Very fast soft recovery antiparallel diode
- Excellent switching performance thanks to the extra driving kelvin pin

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. A faster switching event can be achieved by the Kelvin pin, which separates power path from driving signal. Furthermore, the slightly positive $V_{\text{CE(sat)}}$ 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 V)	650	V
I.	Continuous collector current at T _C = 25 °C	120 (1)	Α
I _C	Continuous collector current at T _C = 100 °C	80	_ A
I _{CP} (2)	Pulsed collector current (t _p ≤ 1 μs, T _J < 175 °C)	300	А
V _{GE}	Gate-emitter voltage	±20	V
V GE	Transient gate-emitter voltage	±30	V
I _F	Continuous forward current at T _C = 25 °C	120 (1)	A
'F	Continuous forward current at T _C = 100 °C	80	
I _{FP} (2)	Pulsed forward current (t _p ≤ 1 μs, T _J < 175 °C)	300	А
P _{TOT}	Total power dissipation at T _C = 25 °C	470	W
T _{STG}	Storage temperature range	- 55 to 150	°C
T _J	Operating junction temperature range	- 55 to 175	

^{1.} Current level is limited by bond wires

Table 2. Thermal data

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

DS11137 - Rev 5 page 2/15

^{2.} Defined by design, not subject to production test.



2 Electrical characteristics

 T_C = 25 °C unless otherwise specified

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)CES}	Collector-emitter breakdown voltage	V _{GE} = 0 V, I _C = 2 mA	650			٧
		V _{GE} = 15 V, I _C = 80 A		1.6	2.0	
$V_{\text{CE(sat)}}$	Collector-emitter saturation voltage	V _{GE} = 15 V, I _C = 80 A, T _J = 125 °C		1.8		V
		V _{GE} = 15 V, I _C = 80 A, T _J = 175 °C		1.9		
V _F	Forward on-voltage	I _F = 80 A		2.15	2.8	V
		I _F = 80 A, T _J = 125 °C		1.8		
		I _F = 80 A, T _J = 175 °C		1.7		
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	μΑ
I _{GES}	Gate-emitter leakage current	V _{CE} = 0 V, V _{GE} = ±20 V			±250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C _{ies}	Input capacitance		-	10524	-	
C _{oes}	Output capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	385	-	pF
C _{res}	Reverse transfer capacitance		-	215	-	
Qg	Total gate charge	V _{CC} = 520 V, I _C = 80 A, V _{GE} = 0 to 15 V (see Figure 29. Gate charge test circuit)	-	414	-	
Q _{ge}	Gate-emitter charge		-	78	-	nC
Q _{gc}	Gate-collector charge	(300) Igure 23. Gate charge test circuit)	-	170	-	

DS11137 - Rev 5 page 3/15



Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time			75	-	
t _r	Current rise time			35	-	ns
(di/dt) _{on}	Turn-on current slope	V = 400 V L = 20 A V = 45 V		1750	-	A/µs
t _{d(off)}	Turn-off-delay time	V_{CE} = 400 V, I_{C} = 80 A, V_{GE} = 15 V, R_{G} = 10 Ω		336	-	
t _f	Current fall time	(see Figure 28. Test circuit for inductive		23	-	ns
E _{on} (1)	Turn-on switching energy	load switching)		1	-	
E _{off} (2)	Turn-off switching energy			1.7	-	mJ
E _{ts}	Total switching energy			2.7	-	
t _{d(on)}	Turn-on delay time			66	-	
t _r	Current rise time			38	-	ns
(di/dt) _{on}	Turn-on current slope	V - 400 V I - 20 A V - 45 V		1670	-	A/µs
t _{d(off)}	Turn-off-delay time	V_{CE} = 400 V, I_{C} = 80 A, V_{GE} = 15 V, R_{G} = 10 Ω, T_{J} = 175 °C		403	-	
t _f	Current fall time	(see Figure 28. Test circuit for inductive		45	-	ns
E _{on} (1)	Turn-on switching energy	load switching)		1.5	-	
E _{off} (2)	Turn-off switching energy			2.47	-	mJ
E _{ts}	Total switching energy			3.97	-	

^{1.} Including the reverse recovery of the diode.

Table 6. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{rr}	Reverse recovery time		-	112	-	ns
Q _{rr}	Reverse recovery charge	I _F = 80 A, V _R = 400 V, V _{GE} = 15 V	-	955	-	nC
I _{rrm}	Reverse recovery current	di/dt = 1000 A/μs (see Figure 28. Test circuit for inductive load switching)	-	27.2	-	Α
dI _{rr} /dt	Peak rate of fall of reverse recovery current during t _b		-	1515	-	A/µs
Err	Reverse recovery energy		-	170	-	μJ
t _{rr}	Reverse recovery time		-	164	-	ns
Q _{rr}	Reverse recovery charge	I _F = 80 A, V _R = 400 V, V _{GE} = 15 V,	-	3838	-	nC
I _{rrm}	Reverse recovery current	$T_J = 175 ^{\circ}\text{C di/dt} = 1000 \text{A/µs}$	-	52	-	Α
dI _{rr} /dt	Peak rate of fall of reverse recovery current during t _b	(see Figure 28. Test circuit for inductive load switching)	-	785	-	A/µs
Err	Reverse recovery energy		-	635	-	μJ

DS11137 - Rev 5 page 4/15

^{2.} Including the tail of the collector current.



2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs. case temperature

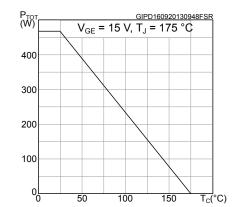


Figure 2. Collector current vs. case temperature

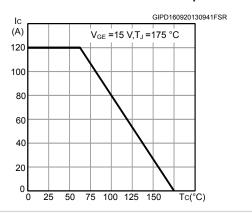


Figure 3. Output characteristics (T_J = 25 °C)

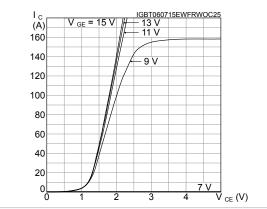


Figure 4. Output characteristics $(T_J = 175 \text{ °C})$

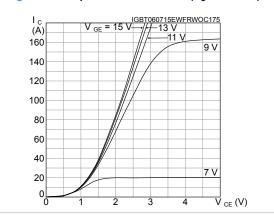


Figure 5. V_{CE}(sat) vs. junction temperature

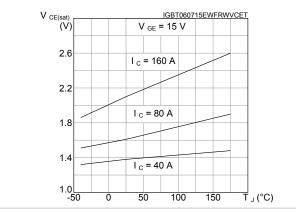
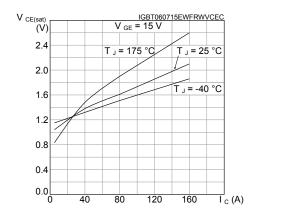


Figure 6. V_{CE}(sat) vs. collector current



DS11137 - Rev 5 page 5/15



Figure 7. Collector current vs. switching frequency

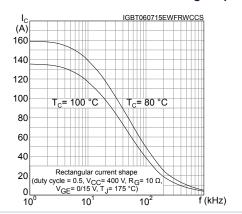


Figure 8. Forward bias safe operating area

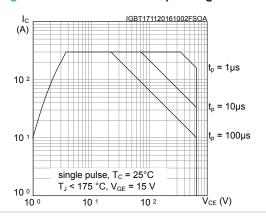


Figure 9. Transfer characteristics

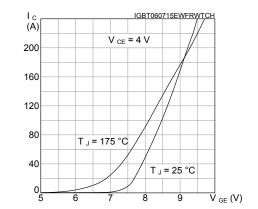


Figure 10. Diode V_F vs. forward current

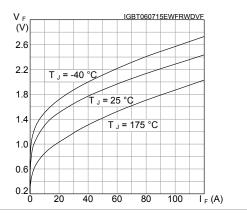


Figure 11. Normalized $V_{\text{GE(th)}}$ vs. junction temperature

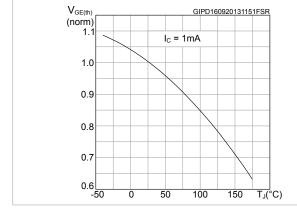
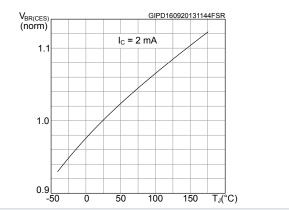


Figure 12. Normalized V_{(BR)CES} vs. junction temperature



DS11137 - Rev 5 page 6/15



Figure 13. Capacitance variations

C
(pF)

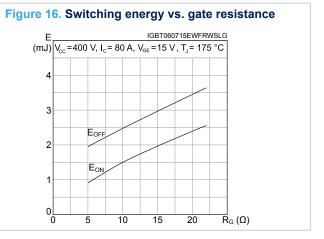
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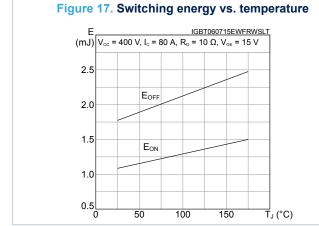
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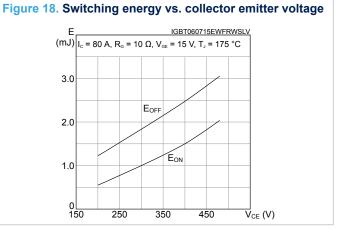
Ccies

Coes
CRES

Coes
CRES







DS11137 - Rev 5 page 7/15



Figure 19. Switching times vs. collector current

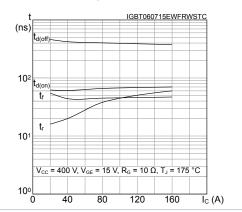


Figure 20. Switching times vs. gate resistance

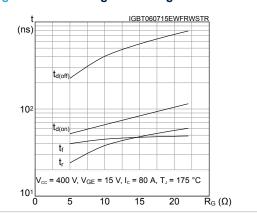


Figure 21. Reverse recovery current vs. diode current slope

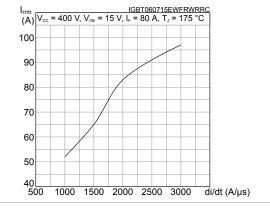


Figure 22. Reverse recovery time vs. diode current slope

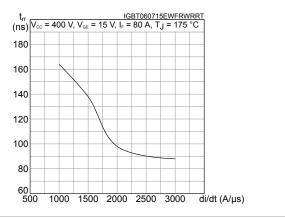


Figure 23. Reverse recovery charge vs. diode current slope

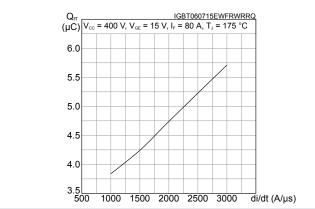
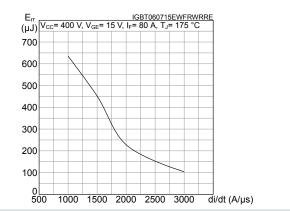
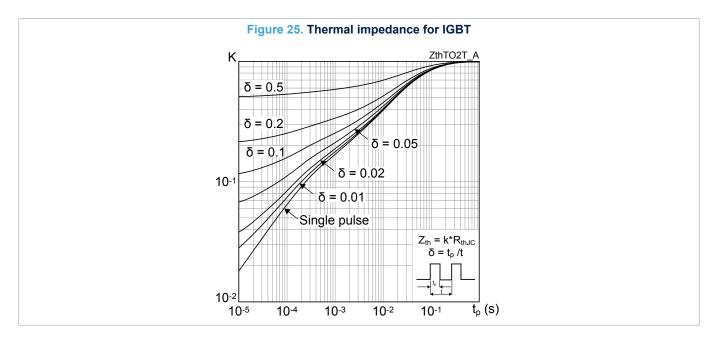


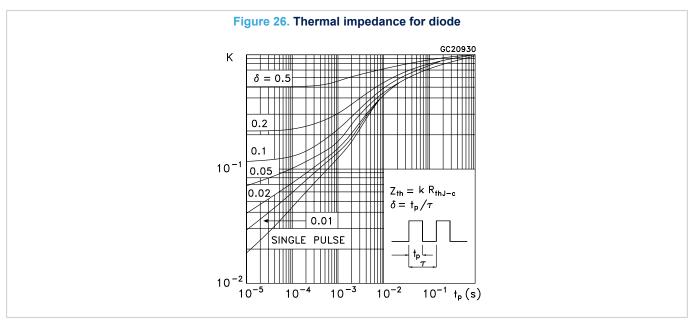
Figure 24. Reverse recovery energy vs. diode current slope



DS11137 - Rev 5 page 8/15







DS11137 - Rev 5 page 9/15



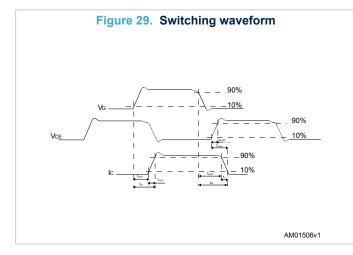
3 Test circuits

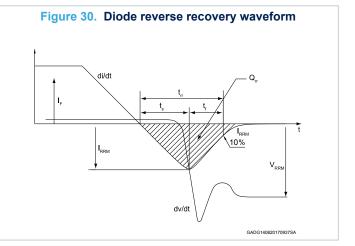
Figure 28. Gate charge test circuit

12 V 47 KΩ 100 nF

12 V 47 KΩ 100 nF

100





DS11137 - Rev 5 page 10/15



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

Α2 \Box D3 øP2 E1 Α1 b2 b (x4) e(x2)SECTION A-A BASE METAL WITH PLATING b1

Figure 31. TO247-4 package outline

8405626_Rev_3

DS11137 - Rev 5 page 11/15



Table 7. TO247-4 mechanical data

Dim.		mm	
DIM.	Min.	Тур.	Max.
Α	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
С	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
е	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
Р	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
Т	9.80		10.20
U	6.00		6.40
aaa		0.04	0.10

DS11137 - Rev 5 page 12/15



Revision history

Table 8. Document revision history

Date	Revision	Changes
05-Aug-2015	1	First release.
17-Nov-2016	2	Updated features in cover page. Updated Table 2: "Absolute maximum ratings" and Figure 9: "Forward bias safe operating area". Minor text changes.
03-Mar-2017	3	Updated the title in cover page, <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 4: "Static characteristics"</i> and <i>Table 6: "IGBT switching characteristics (inductive load)"</i> . Minor text changes.
03-Jul-2019	4	Updated <i>Table 1. Absolute maximum ratings.</i> Minor text changes.
03-Dec-2021	5	Updated Table 4. Dynamic characteristics. Updated Section 4.1 TO247-4 package information.

DS11137 - Rev 5 page 13/15



Contents

1	Elec	trical ratings	2
2	Elec	etrical characteristics	3
	2.1	Electrical characteristics (curves)	5
3	Test	circuits	10
4	Pac	kage information	11
	4.1	TO247-4 package information	11
Rev	/ision	history	13



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DS11137 - Rev 5 page 15/15