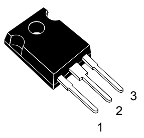
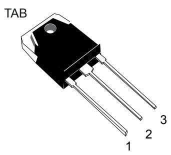
STGW80H65DFB, STGWT80H65DFB

Datasheet

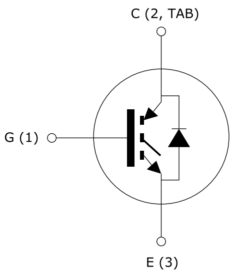
Trench gate field-stop 650 V, 80 A high speed HB series IGBT



TO-247



TO-3P



Features

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

Applications

- Photovoltaic inverters
- High frequency converters

Description

These devices are IGBTs developed using an advanced proprietary trench gate field-stop structure. These devices are part of the new HB series of IGBTs, which represent 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.

STPOWER

Product status link
STGW80H65DFB
STGWT80H65DFB

Product summary	
Order code	STGW80H65DFB
Marking	GW80H65DFB
Package	TO-247
Packing	Tube
Order code	STGWT80H65DFB
Marking	GWT80H65DFB
Package	TO-3P
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	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)	Pulsed collector current (t_p ≤ 1 μs, T_J < 175 °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 °C	120 (1)	A
	Continuous forward current at T_C = 100 °C	80	
I_{FP} (2)	Pulsed forward current (t_p ≤ 1 μs, T_J < 175 °C)	300	A
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*
2. *Defined by design, not subject to production test.*

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 °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 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 4. 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 5. 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	-	
$(di/dt)_{on}$	Turn-on current slope			1270	-	A/µs
$t_{d(off)}$	Turn-off-delay time			280	-	ns
t_f	Current fall time			31	-	
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 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	-	
$(di/dt)_{on}$	Turn-on current slope			1270	-	A/µs
$t_{d(off)}$	Turn-off-delay time			328	-	ns
t_f	Current fall time			30	-	
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 A, V_R = 400 V, V_{GE} = 15 V di/dt = 100 A/µs (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 = 100 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 1. Power dissipation vs case temperature

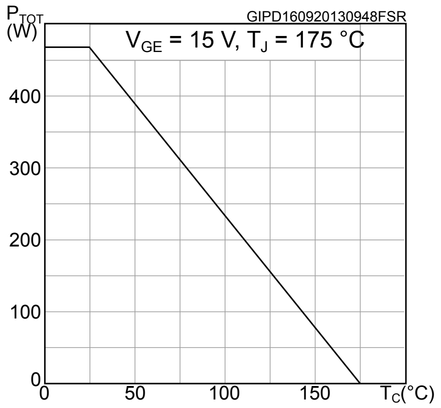


Figure 2. Collector current vs case temperature

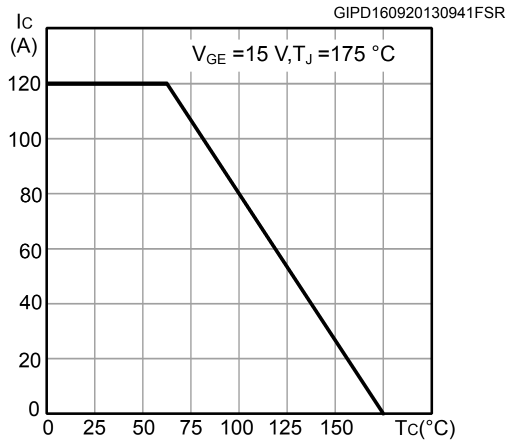


Figure 3. Output characteristics (T_J = 25 °C)

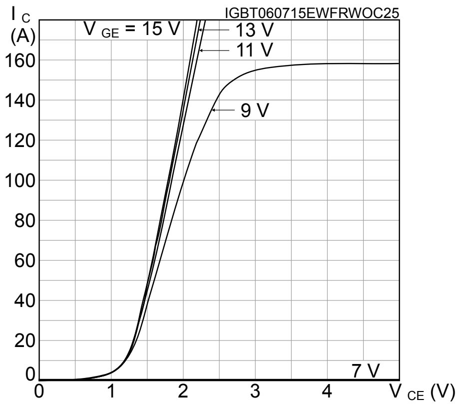


Figure 4. Output characteristics (T_J = 175 °C)

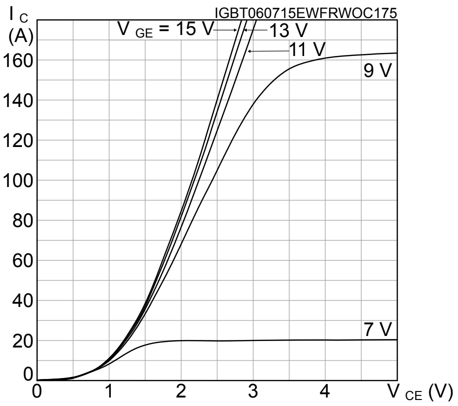


Figure 5. $V_{CE(sat)}$ vs junction temperature

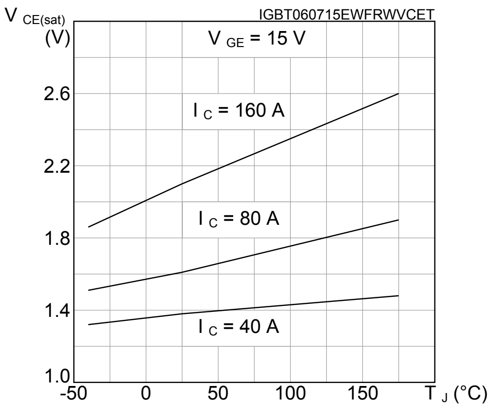


Figure 6. $V_{CE(sat)}$ vs collector current

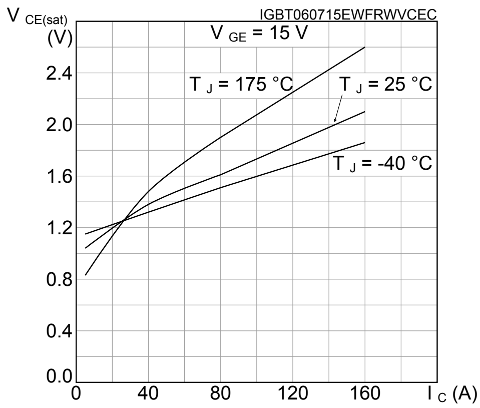


Figure 7. Collector current vs switching frequency

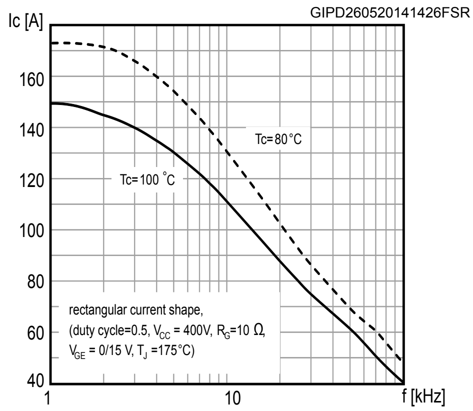


Figure 8. Forward bias safe operating area

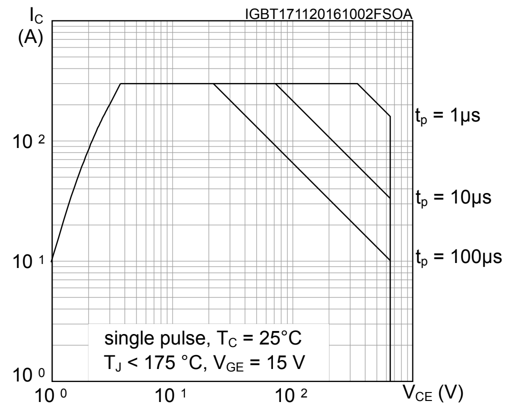


Figure 9. Transfer characteristics

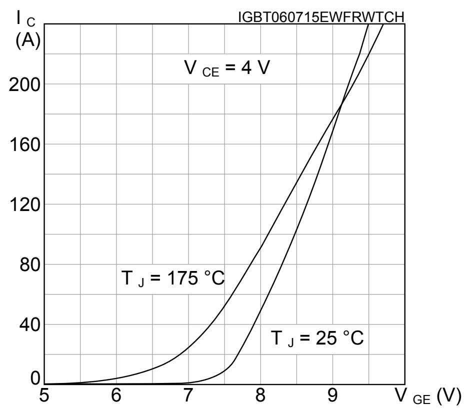


Figure 10. Diode V_F vs forward current

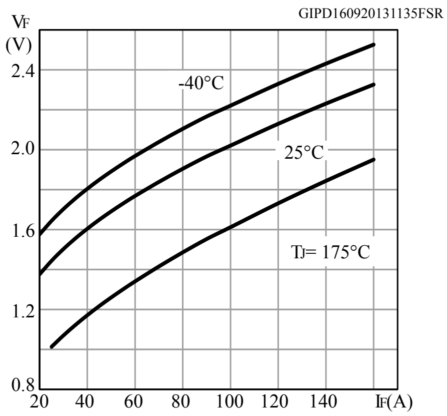


Figure 11. Normalized $V_{GE(th)}$ vs junction temperature

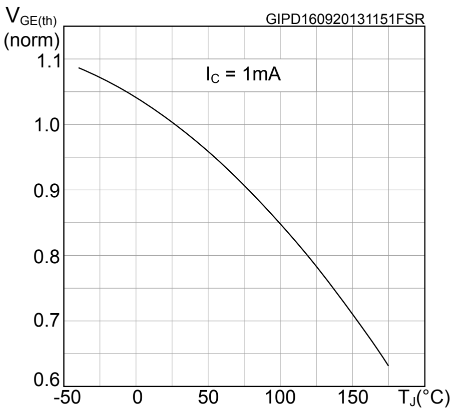


Figure 12. Normalized $V_{(BR)CES}$ vs junction temperature

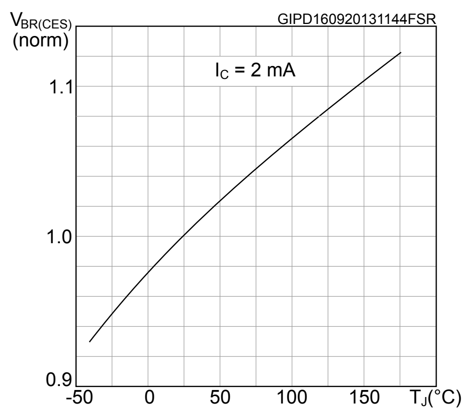


Figure 13. Capacitance variations

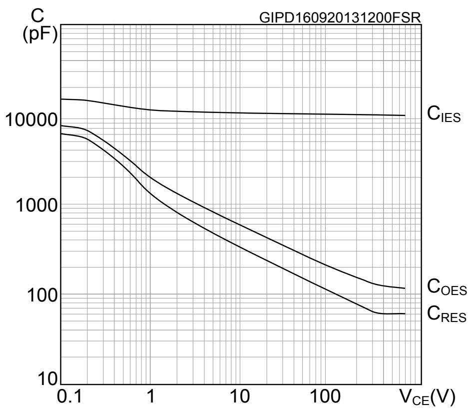


Figure 14. Gate charge vs gate-emitter voltage

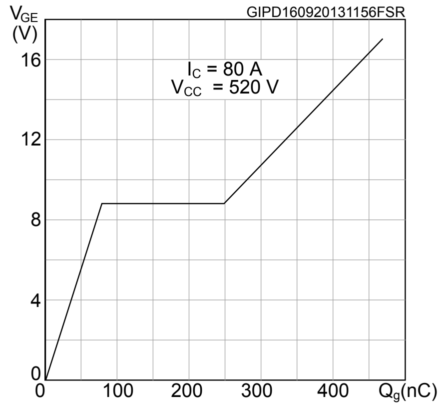


Figure 15. Switching energy vs collector current

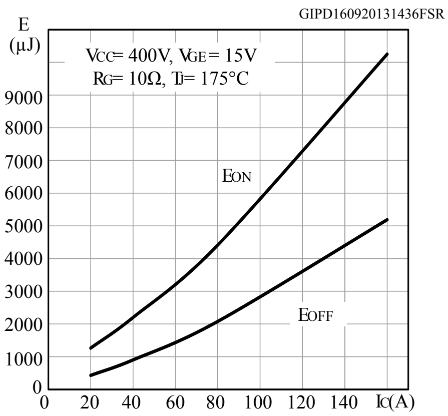


Figure 16. Switching energy vs gate resistance

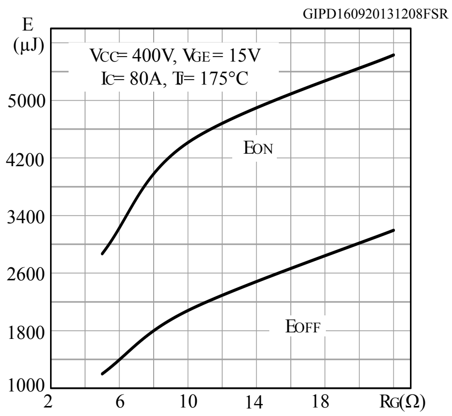


Figure 17. Switching energy vs temperature

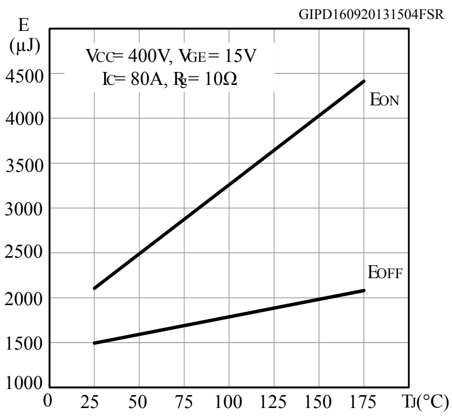


Figure 18. Switching energy vs collector emitter voltage

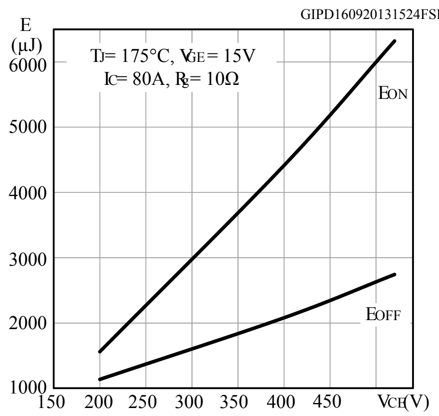


Figure 19. Switching times vs collector current

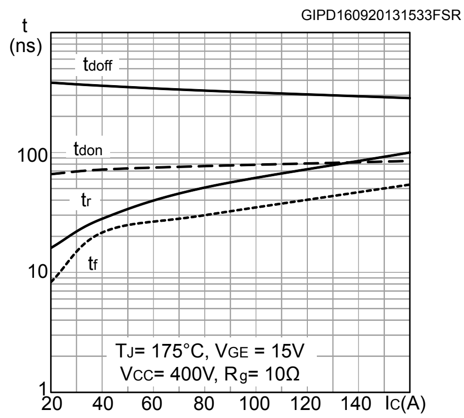


Figure 20. Switching times vs gate resistance

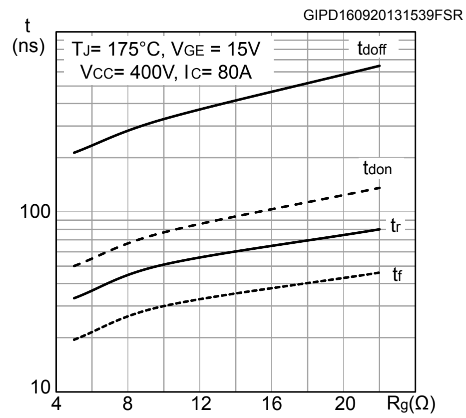


Figure 21. Reverse recovery current vs diode current slope

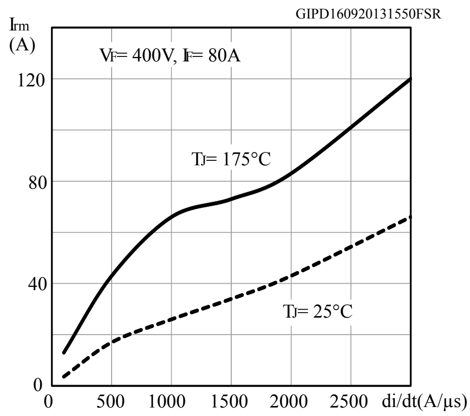


Figure 22. Reverse recovery time vs diode current slope

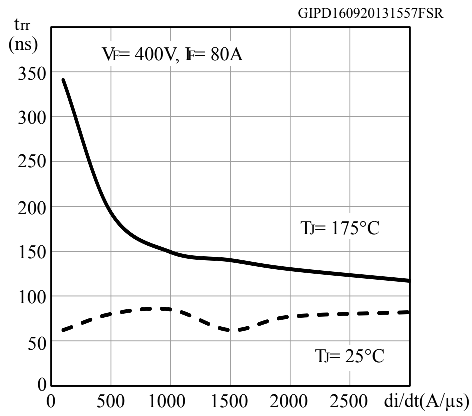


Figure 23. Reverse recovery charge vs diode current slope

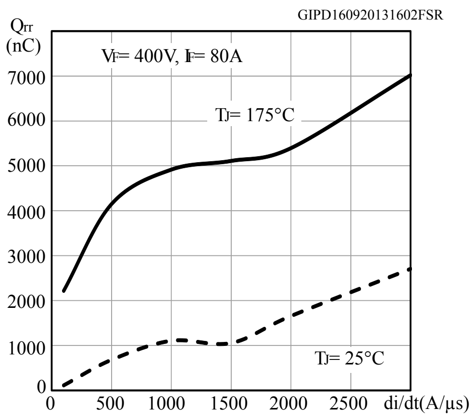


Figure 24. Reverse recovery energy vs diode current slope

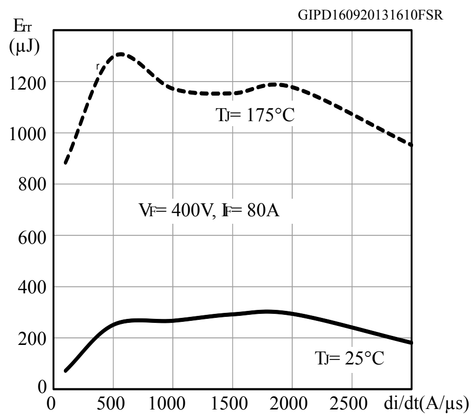


Figure 25. **Thermal impedance for IGBT**

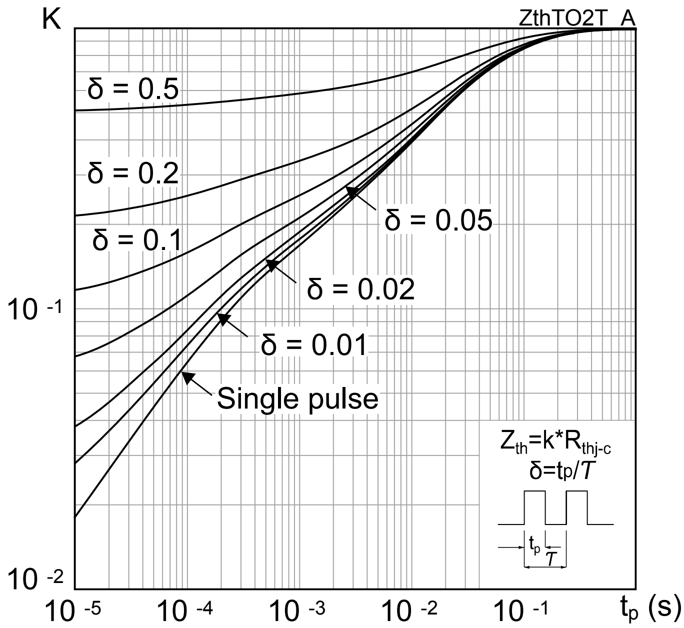
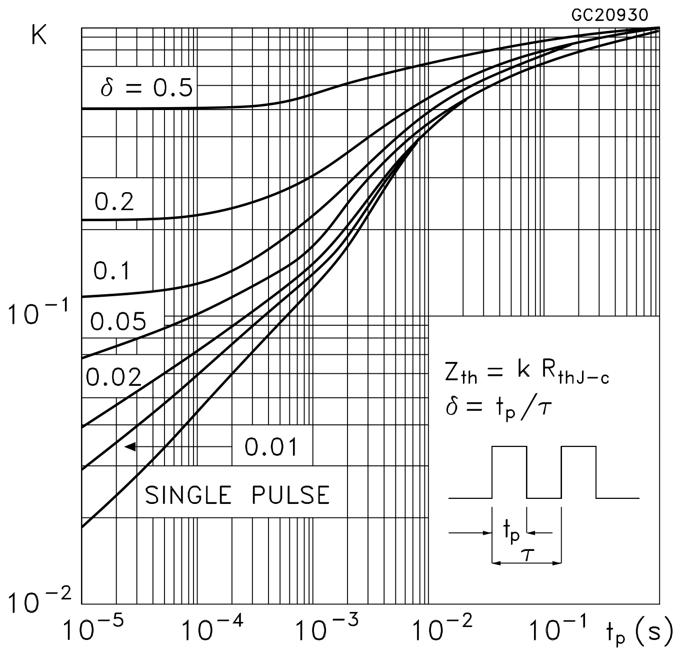


Figure 26. **Thermal impedance for diode**



3 Test circuits

Figure 27. Test circuit for inductive load switching

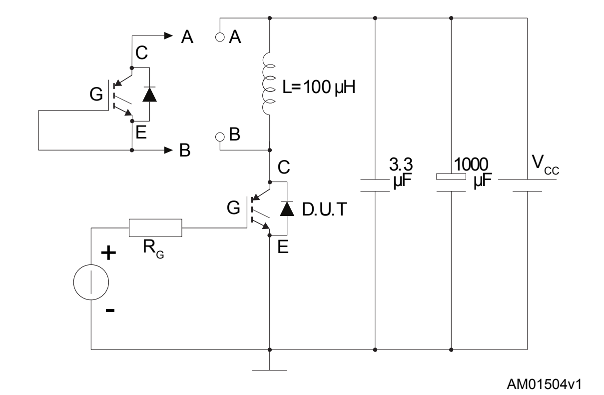


Figure 28. Gate charge test circuit

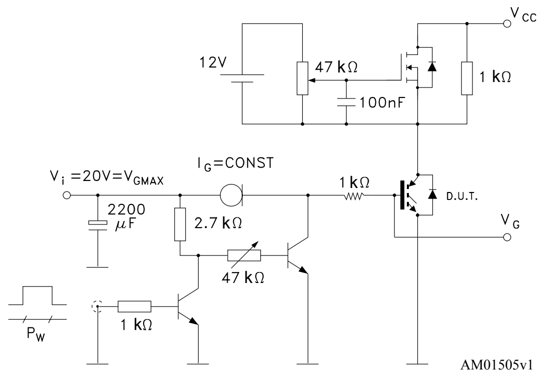


Figure 29. Switching waveform

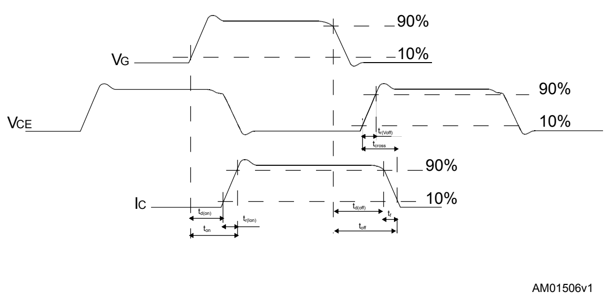
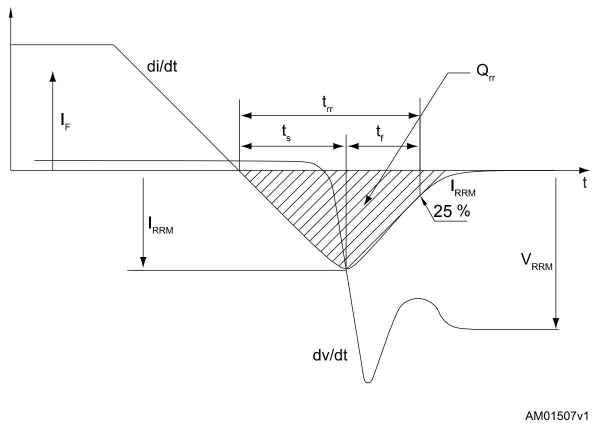


Figure 30. Diode reverse recovery waveform



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 package information

Figure 31. TO-247 package outline

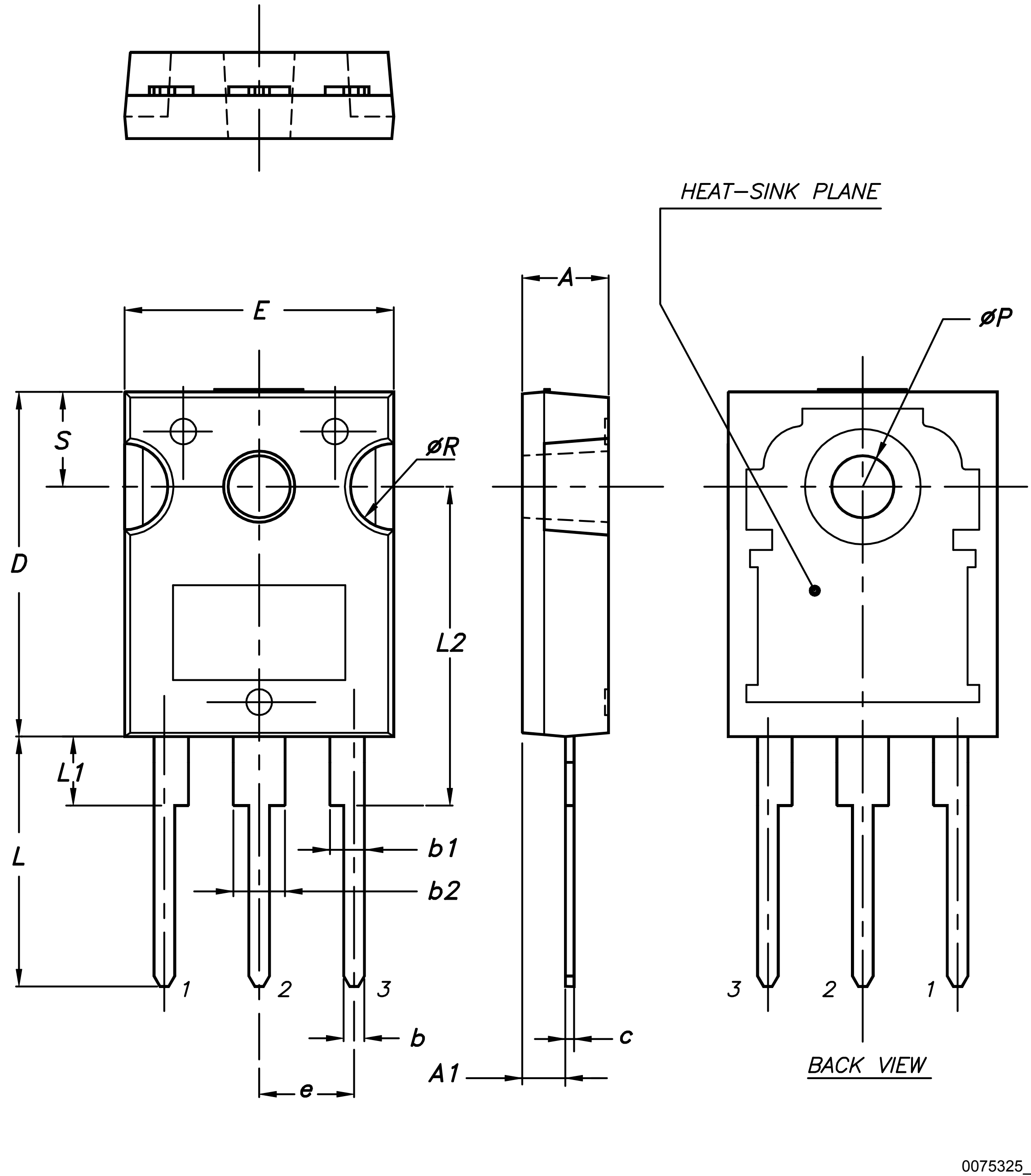


Table 7. TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

4.2 TO-3P package information

Figure 32. TO-3P package outline

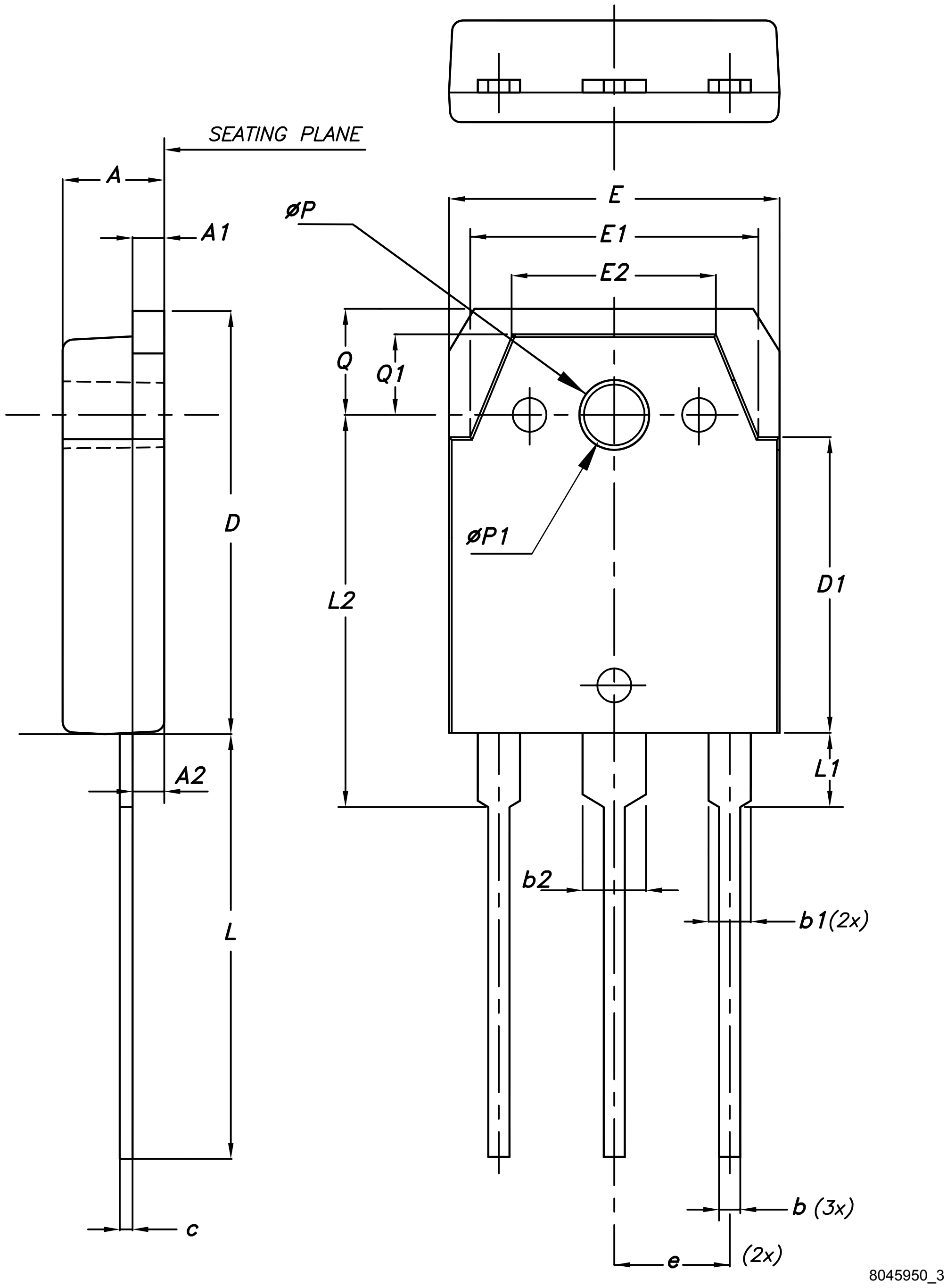


Table 8. **TO-3P package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.60	4.80	5.00
A1	1.45	1.50	1.65
A2	1.20	1.40	1.60
b	0.80	1.00	1.20
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.55	0.60	0.75
D	19.70	19.90	20.10
D1	13.70	13.90	14.10
E	15.40	15.60	15.80
E1	13.40	13.60	13.80
E2	9.40	9.60	9.90
e	5.15	5.45	5.75
L	19.80	20.00	20.20
L1	3.30	3.50	3.70
L2	18.20	18.40	18.60
ØP	3.30	3.40	3.50
ØP1	3.10	3.20	3.30
Q	4.80	5.00	5.20
Q1	3.60	3.80	4.00

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
12-Mar-2013	1	First release.
18-Sep-2013	2	Document status promoted from preliminary to production data. Added Section *2.1: Electrical characteristics (curves)*
20-Nov-2013	3	Added device in Max247. Modified *Table 1* accordingly. Updated *Section 4: Package information.* Minor text changes in cover page.
24-Jan-2014	4	Updated title and description in cover page. Updated *Table 6: IGBT switching characteristics (inductive load), Table 7: Diode switching characteristics (inductive load)*, *Figure 9: Forward bias safe operating area* and*Figure 14: Switching energy vs. temperature.*
13-Jun-2014	5	Updated *Figure 5: Collector current vs. case temperature, Figure 6: Power dissipation vs. case temperature, Figure 18: Switching times vs. collector current, Figure 19: Switching times vs. gate resistance* and *Figure 24: Capacitance variations.* Added *Figure 25: Collector current vs. switching frequency*. Updated *Section 4: Package information*. Minor text changes.
07-May-2015	6	Added TO-247 long leads package information.
21-Sep-2016	7	Updated *Figure 2: "Output characteristics (TJ= 25 °C) "*, *Figure 3: "Output characteristics (TJ= 175 °C) "*, *Figure 4: "Transfer characteristics "*, *Figure 7: "VCE(sat) vs. junction temperature"* and *Figure 8: "VCE (sat) vs. collector current"*. The part number STGY80H65DFB has been moved to a separate datasheet. Minor text changes.
17-Nov-2016	8	Updated *Table 2: "Absolute maximum ratings"* and *Figure 9: "Forward bias safe operating area"*. The part number STGWA80H65DFB has been moved to a separate datasheet. Updated document accordingly.
14-Jun-2019	9	Modified Table 1. Absolute maximum ratings. Updated Section 4.1 TO-247 package information. Minor text changes.

Contents

OCEAN CHIPS
Океан Электроники
Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения **«JONHON»**, а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов **«FORSTAR»**.

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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