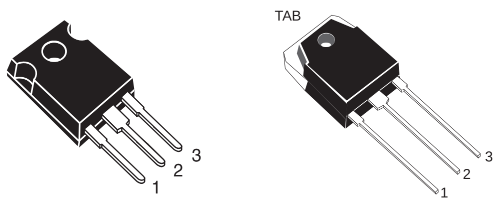
STGW80H65FB, STGWA80H65FB, STGWT80H65FB

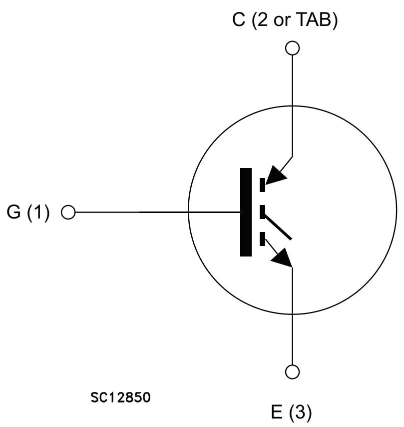
Trench gate field-stop IGBT, HB series 650 V, 80 A high speed

Datasheet - production data



TO-247
TO-247 long leads **TO-3P**

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
- Tight parameter distribution
- Safe paralleling
- Low thermal resistance

Applications

- Photovoltaic inverters
- High frequency converters

Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. The device is part of the new "HB" series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of any frequency converter. Furthermore, a 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
STGW80H65FB	GW80H65FB	TO-247	Tube
STGWA80H65FB	GWA80H65FB	TO-247 long leads	Tube
STGWT80H65FB	GWT80H65FB	TO-3P	Tube

Contents

1 Electrical ratings

Table 2. 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
I_C	Continuous collector current at T_C = 100 °C	80	A
I_{CP}(2)	Pulsed collector current	240	A
V_{GE}	Gate-emitter voltage	±20	V
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	- 55 to 175	°C

1. Current level is limited by bond wires.
2. Pulse width limited by maximum junction temperature.

Table 3. Thermal data

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

2 Electrical characteristics

T_J = 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)	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		
$V_{GE(th)}$	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_{CE} = 650 V			100	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	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	-	10524	-	pF
C_{oes}	Output capacitance		-	385	-	pF
C_{res}	Reverse transfer capacitance		-	215	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 80 A, V_{GE} = 15 V, see *Figure 23*	-	414	-	nC
Q_{ge}	Gate-emitter charge		-	78	-	nC
Q_{gc}	Gate-collector charge		-	170	-	nC

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, R_G = 10 Ω, V_{GE} = 15 V, see *Figure 22*	-	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 losses		-	2.1	-	mJ
E_{off}(2)	Turn-off switching losses		-	1.5	-	mJ
E_{ts}	Total switching losses		-	3.6	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 80 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C, see *Figure 22*	-	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 losses		-	4.4	-	mJ
E_{off}(2)	Turn-off switching losses		-	2.1	-	mJ
E_{ts}	Total switching losses		-	6.5	-	mJ

1. Energy losses include reverse recovery of the external diode. The diode is the same of the co-packed STGW80H65DFB
2. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics (T_J = 25°C)

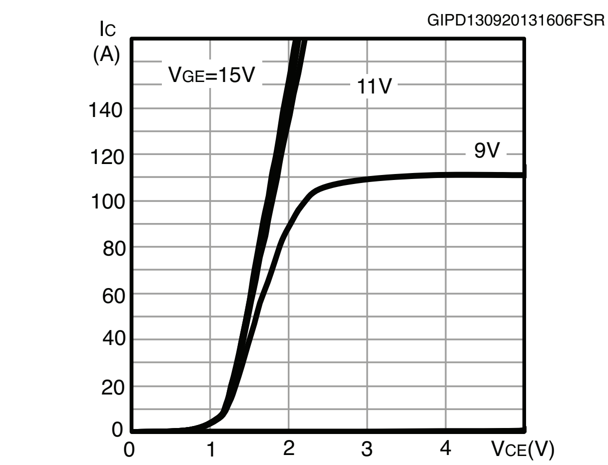


Figure 3. Output characteristics (T_J = 175°C)

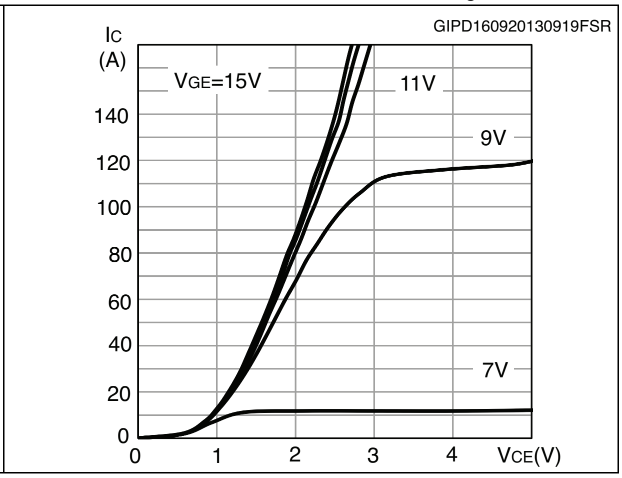


Figure 4. Transfer characteristics

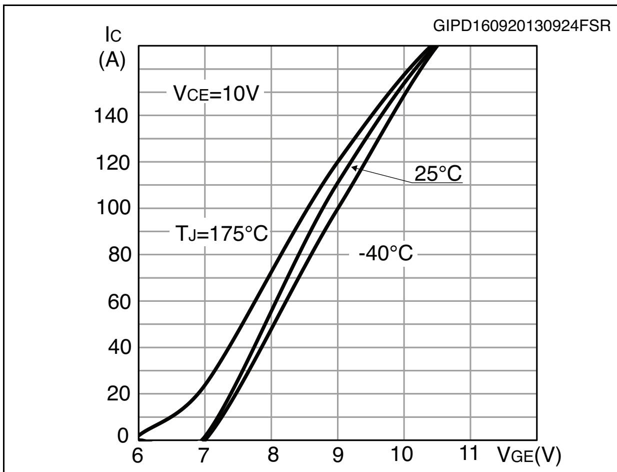


Figure 5. Collector current vs. case temperature

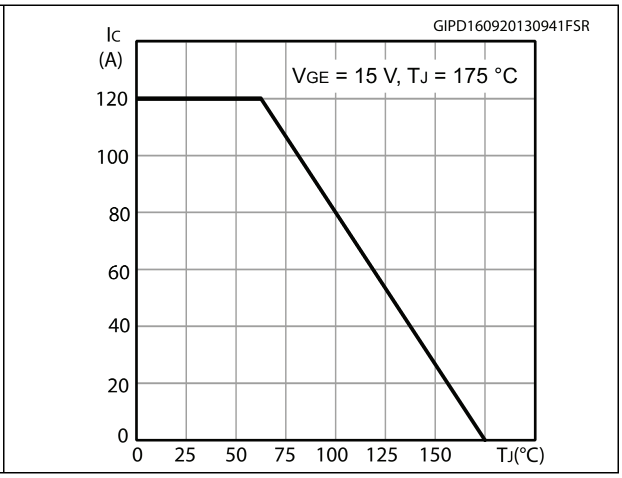


Figure 6. Power dissipation vs. case temperature

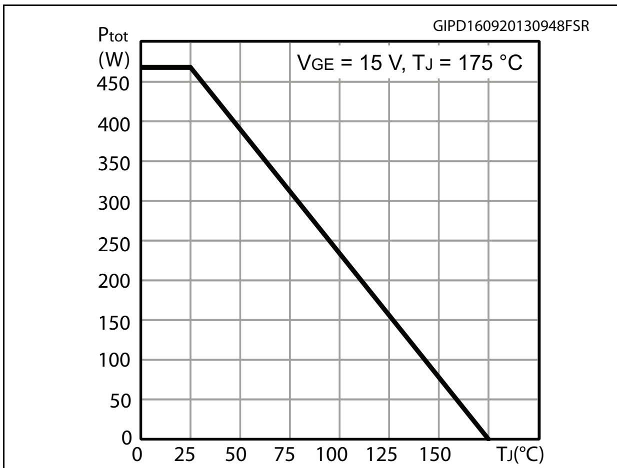


Figure 7. $V_{CE(sat)}$ vs. junction temperature

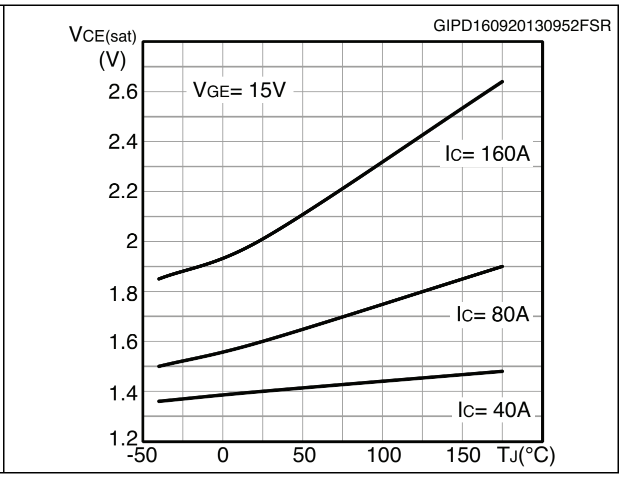


Figure 8. $V_{CE(sat)}$ vs. collector current

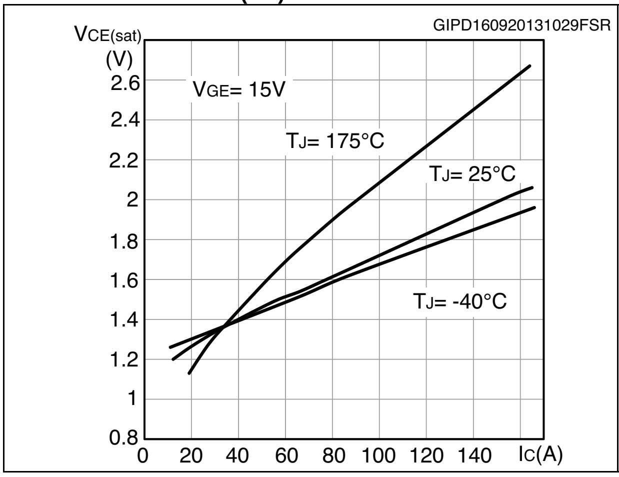


Figure 9. Forward bias safe operating area

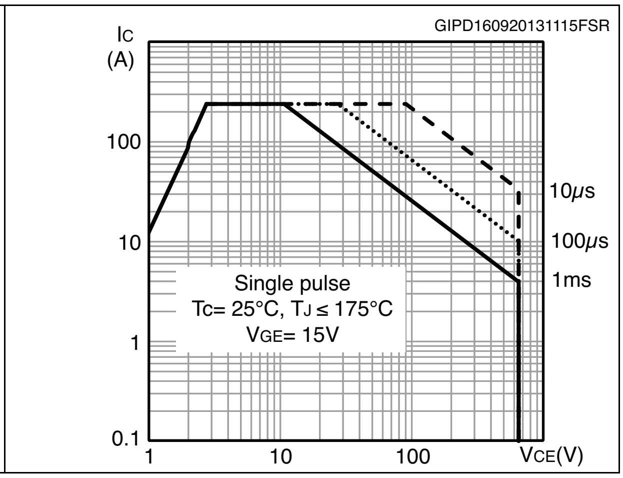


Figure 10. Capacitance variations

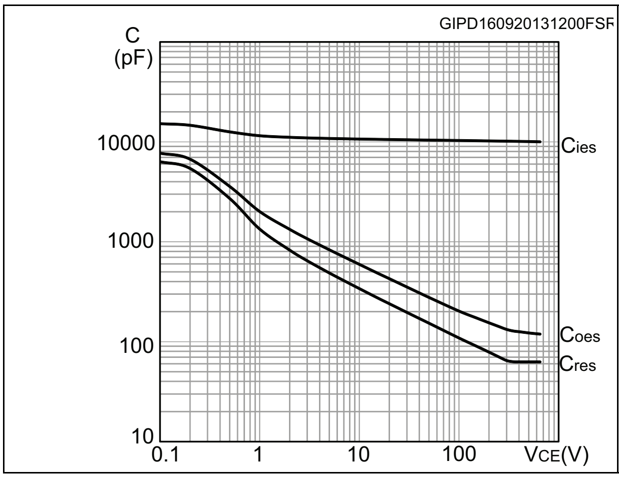


Figure 11. Normalized $V_{(BR)CES}$ vs. junction temperature

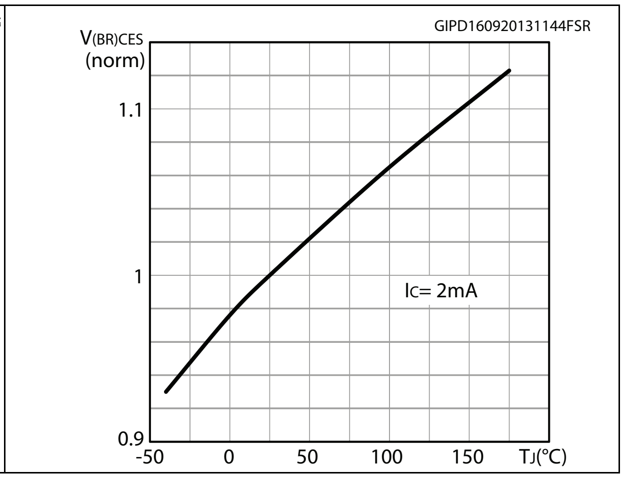


Figure 12. Normalized $V_{GE(th)}$ vs. junction temperature

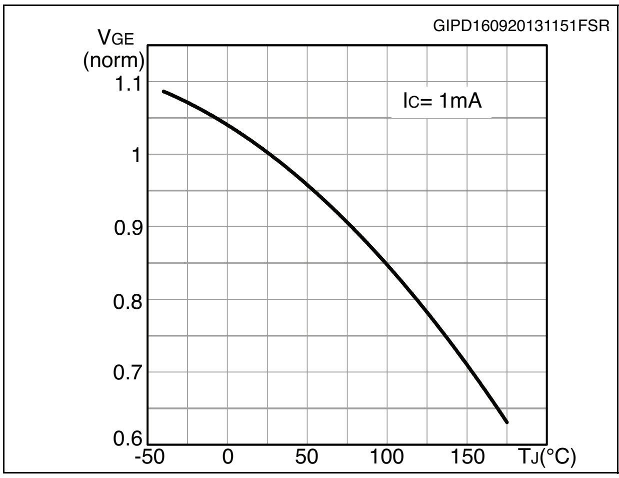


Figure 13. Gate charge vs. gate-emitter voltage

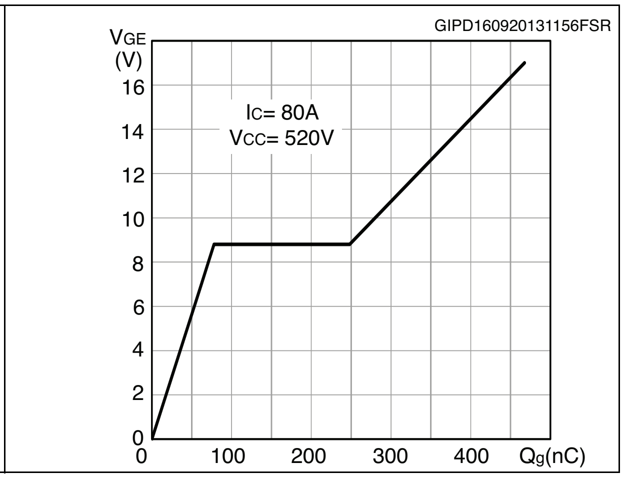


Figure 14. Switching loss vs temperature

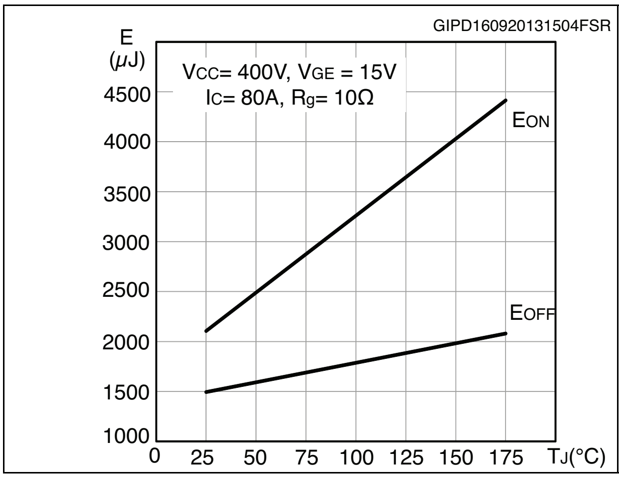


Figure 15. Switching loss vs gate resistance

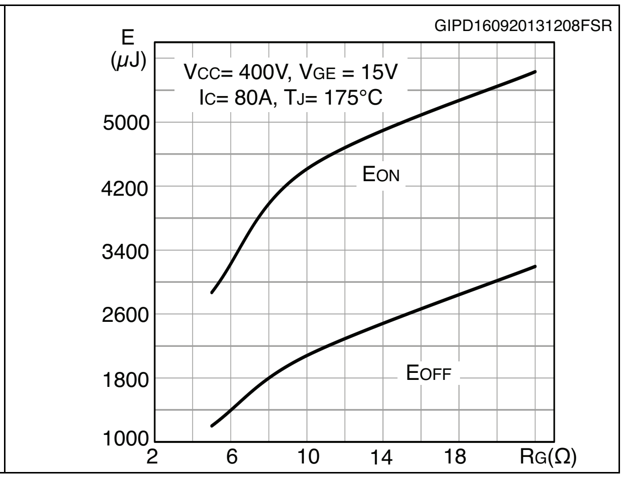


Figure 16. Switching loss vs collector current

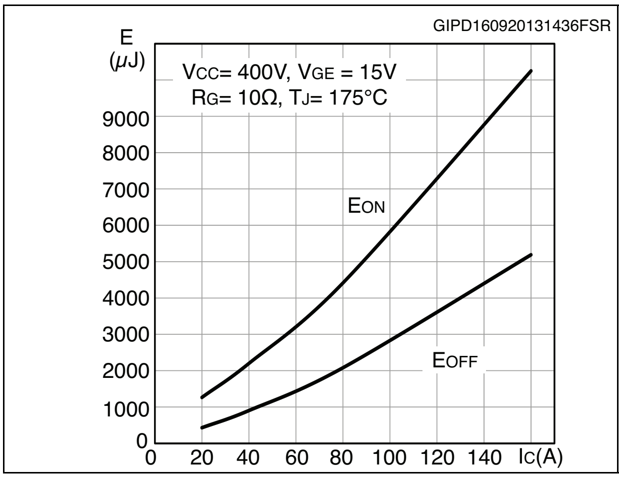


Figure 17. Switching loss vs collector emitter voltage

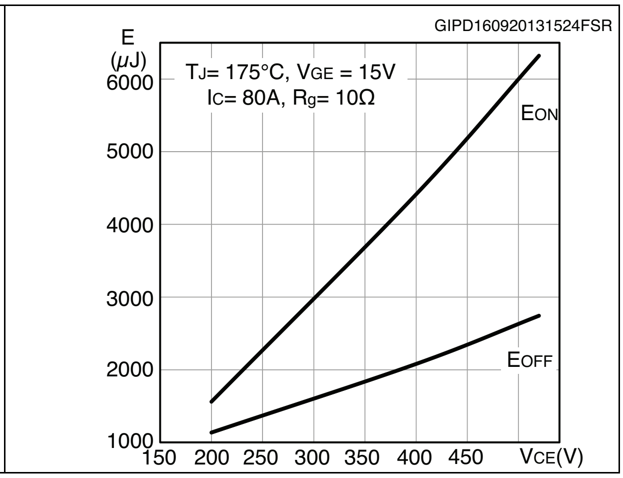


Figure 18. Switching times vs. collector current

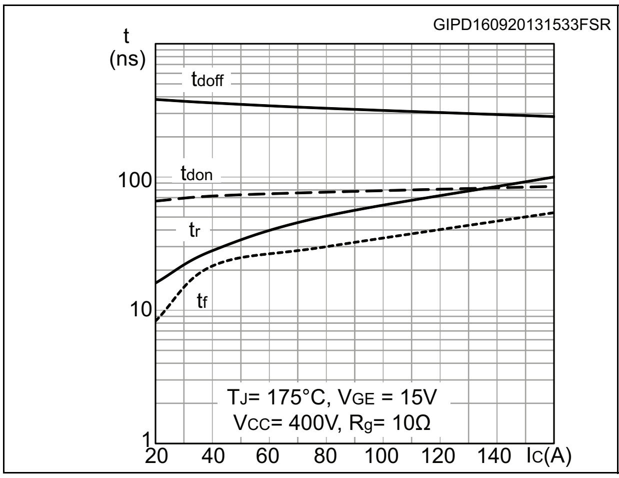


Figure 19. Switching times vs. gate resistance

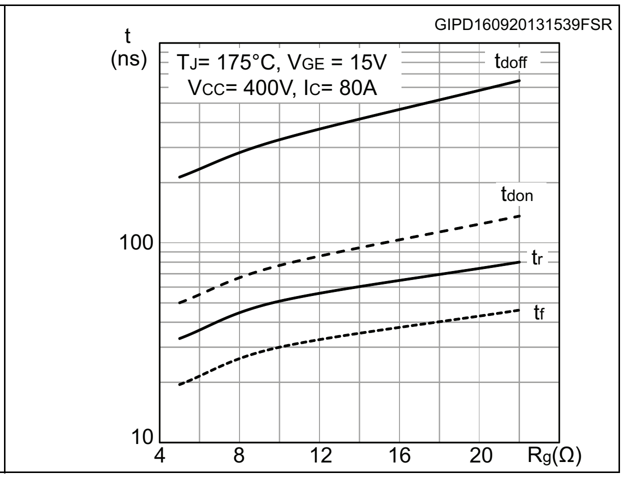


Figure 20. Collector current vs. switching frequency

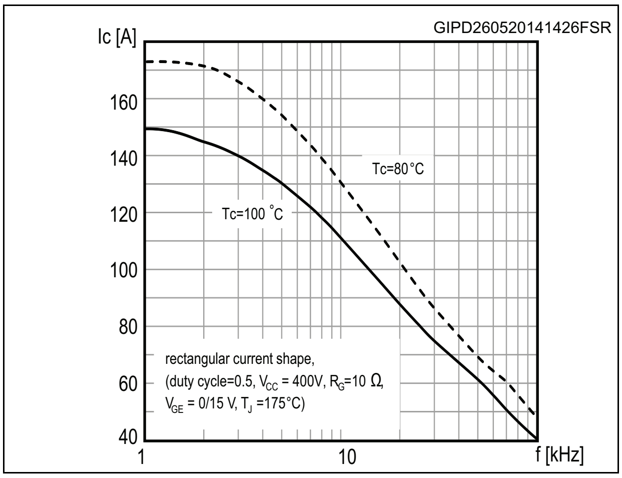
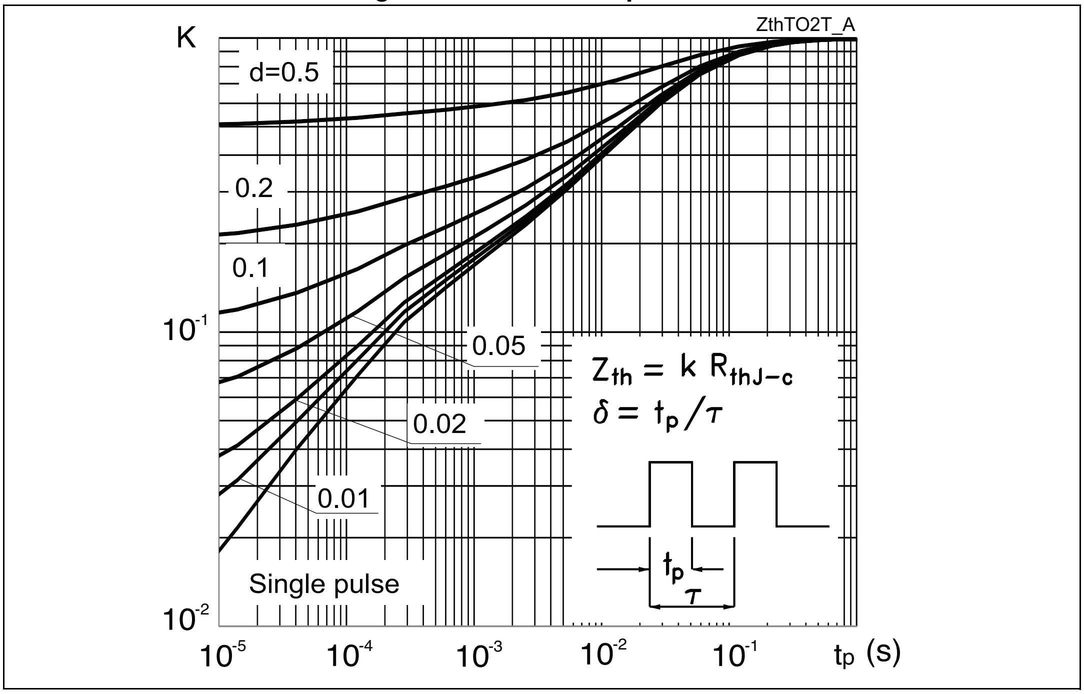


Figure 21. Thermal impedance



3 Test circuits

Figure 22. Test circuit for inductive load switching

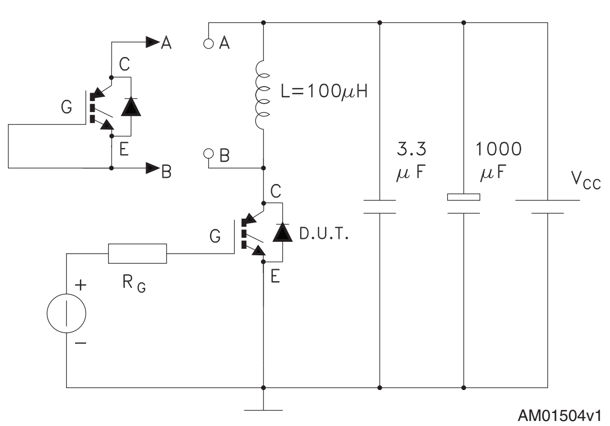


Figure 23. Gate charge test circuit

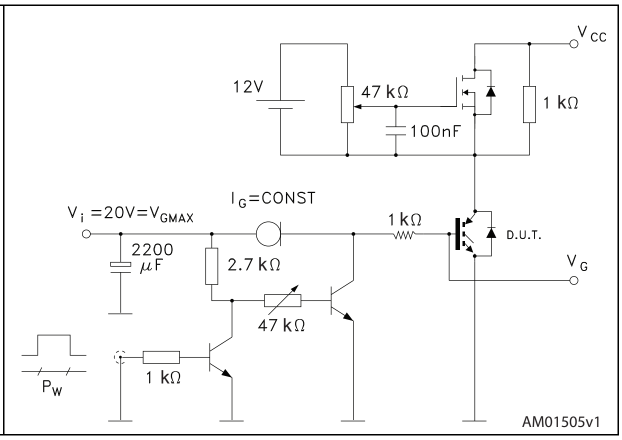
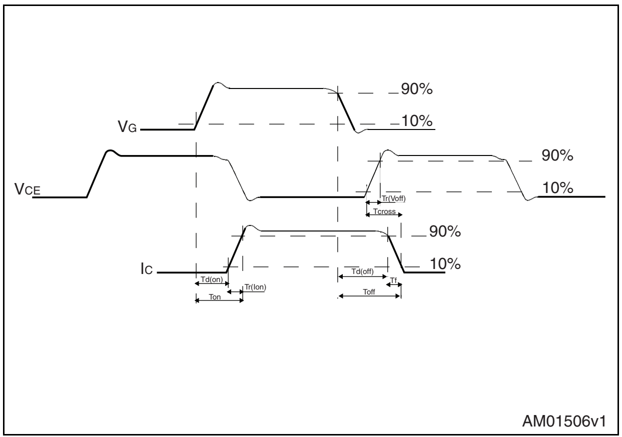


Figure 24. Switching waveform



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. ECOPACK is an ST trademark.

4.1 TO-247, STGW80H65FB

Figure 25. TO-247 drawing

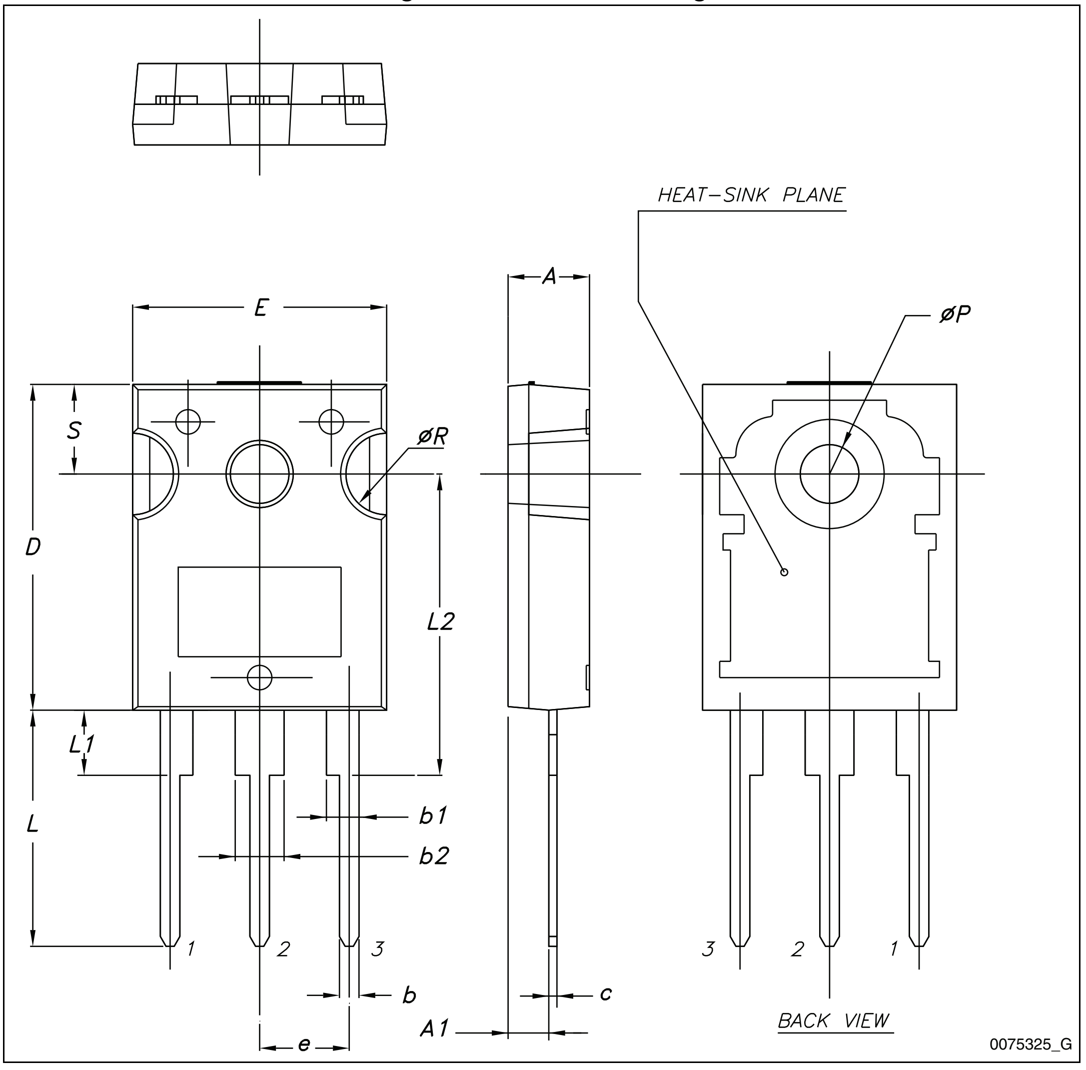


Table 7. TO-247 mechanical data

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	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

4.2 TO-247 long leads, STGWA80H65FB

Figure 26. TO-247 long leads drawing

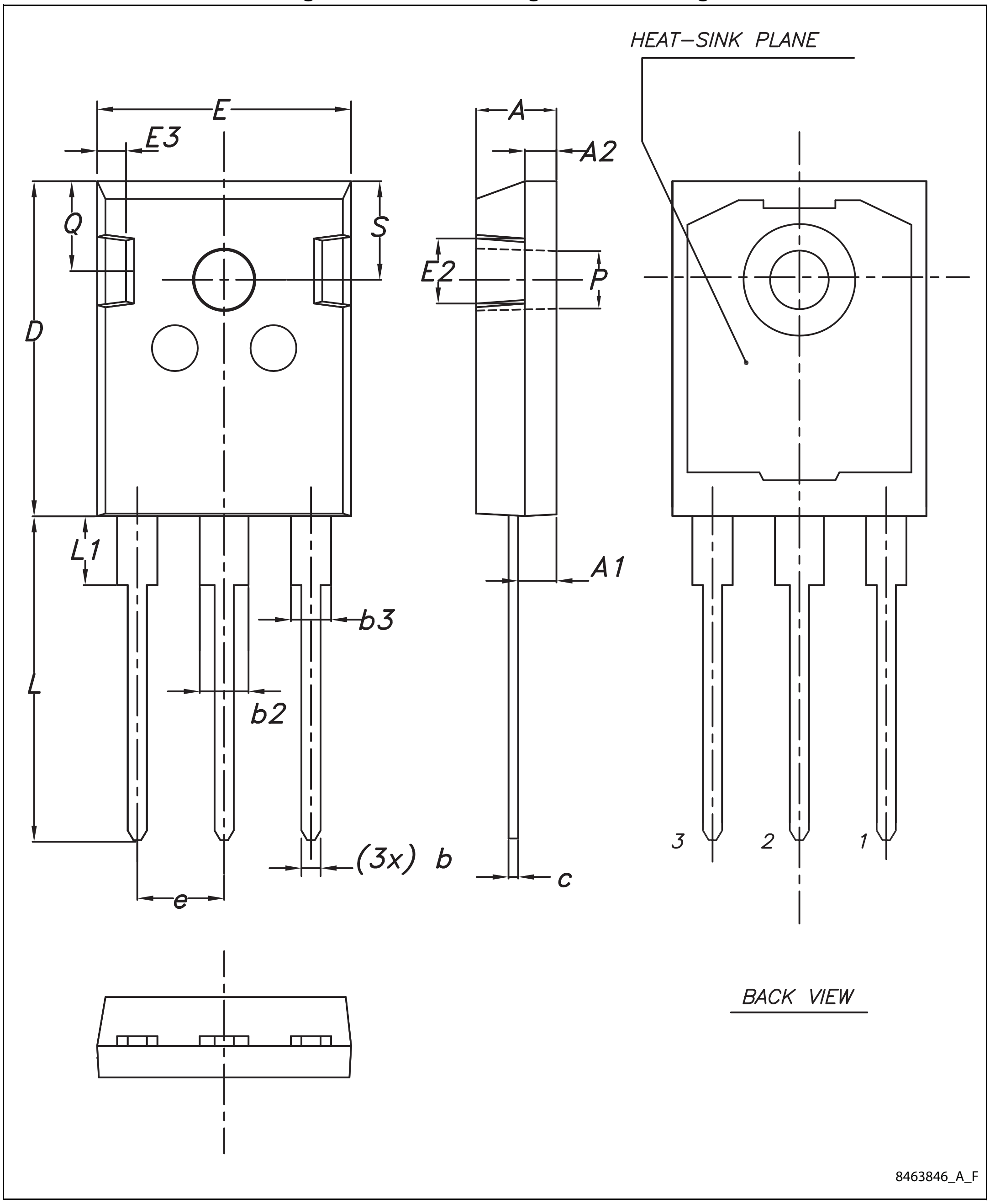


Table 8. TO-247 long leads mechanical data

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

4.3 TO-3P, STGWT80H65FB

Figure 27. TO-3P drawing

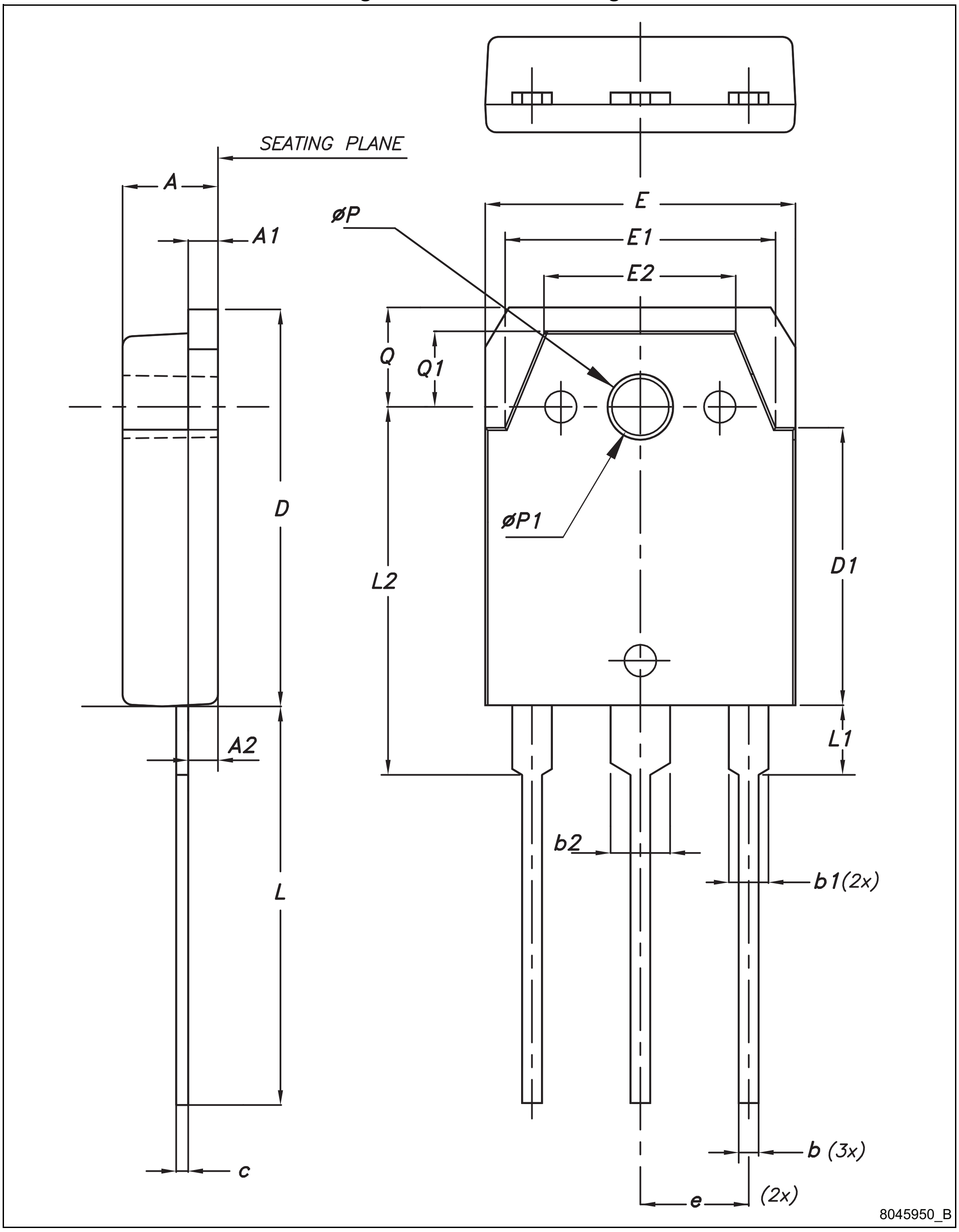


Table 9. TO-3P mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60	4.80	5
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	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	5.20
Q1	3.60	3.80	4

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
13-Jun-2014	1	Initial release.