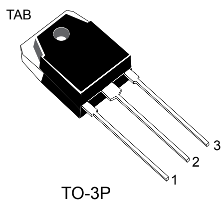
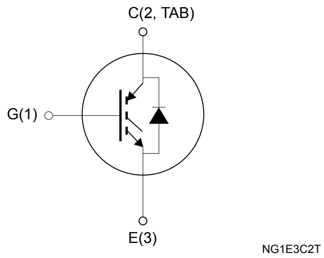
Datasheet

Trench gate field-stop 650 V, 30 A high speed HB series IGBT



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 = 40 A
- Tight parameter distribution
- Safe paralleling
- Positive $V_{CE(sat)}$ temperature coefficient
- Low thermal resistance
- Very fast soft recovery antiparallel diode

Applications

- Power factor corrector (PFC)

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.

Product status link
STGWT30HP65FB

Product summary	
Order code	STGWT30HP65FB
Marking	GWT30HP65FB
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 V)	650	V
I_C	Continuous collector current at T_C = 25 °C	60	A
	Continuous collector current at T_C = 100 °C	30	
I_{CP} (1)	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage (t_p ≤ 10 μs)	±30	
I_F (2)	Continuous forward current at T_C = 25 °C	5	A
	Continuous forward current at T_C = 100 °C	5	
I_{FP} (3)	Pulsed forward current	10	A
P_{TOT}	Total power dissipation at T_C = 25 °C	260	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	

1. *Pulse width limited by maximum junction temperature.*
2. *Limited by wires.*
3. *Pulsed forward current.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.58	°C/W
R_{thJC}	Thermal resistance junction-case diode	5	
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 = 30 A		1.55	2.0	V
		V_{GE} = 15 V, I_C = 30 A, T_J = 125 °C		1.65		
		V_{GE} = 15 V, I_C = 30 A, T_J = 175 °C		1.75		
V_F	Forward on-voltage	I_F = 5 A		2.0		V
		I_F = 5 A, T_J = 125 °C		1.85		
		I_F = 5 A, T_J = 175 °C		1.75		
$V_{GE(th)}$	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			25	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	-	3659	-	pF
C_{oes}	Output capacitance		-	101	-	
C_{res}	Reverse transfer capacitance		-	76	-	
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 30 A, V_{GE} = 0 to 15 V (see Figure 28. Gate charge test circuit)	-	149	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	
Q_{gc}	Gate-collector charge		-	62	-	

Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off-delay time	V_{CE} = 400 V, I_C = 30 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 27. Test circuit for inductive load switching)	-	146	-	ns
t_f	Current fall time		-	23	-	ns
E_{off} (1)	Turn-off switching energy		-	293	-	µJ
$t_{d(off)}$	Turn-off-delay time	V_{CE} = 400 V, I_C = 30 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see Figure 27. Test circuit for inductive load switching)	-	158	-	ns
t_f	Current fall time		-	65	-	ns
E_{off}	Turn-off switching energy		-	572	-	µJ

1. *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 = 5 A, V_R = 400 V, V_{GE} = 15 V, di/dt = 1000 A/µs (see Figure 27. Test circuit for inductive load switching)	-	140	-	ns
Q_{rr}	Reverse recovery charge		-	21	-	nC
I_{rrm}	Reverse recovery current		-	6.6	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	430	-	A/µs
E_{rr}	Reverse recovery energy		-	1.6	-	µJ
t_{rr}	Reverse recovery time	I_F = 5 A, V_R = 400 V, V_{GE} = 15 V, di/dt = 1000 A/µs, T_J = 175 °C (see Figure 27. Test circuit for inductive load switching)	-	200	-	ns
Q_{rr}	Reverse recovery charge		-	47.3	-	nC
I_{rrm}	Reverse recovery current		-	9.6	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	428	-	A/µs
E_{rr}	Reverse recovery energy		-	3.2	-	µJ

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics (T_J = 25 °C)

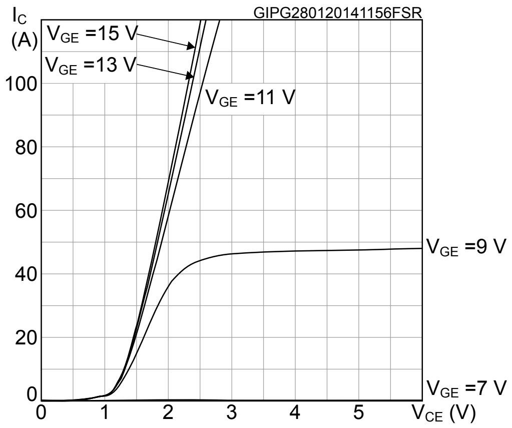


Figure 2. Output characteristics (T_J = 175 °C)

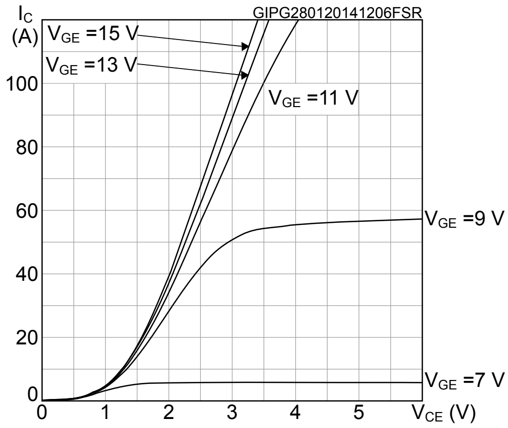


Figure 3. Transfer characteristics

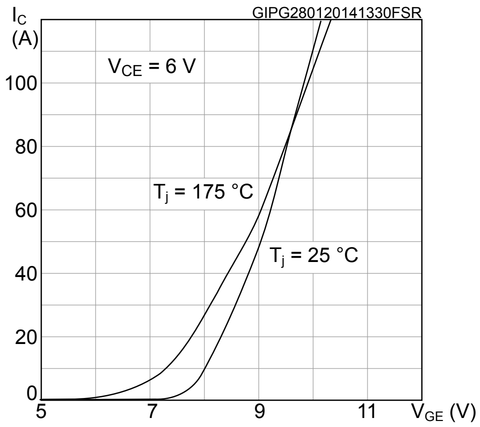


Figure 4. Collector current vs case temperature

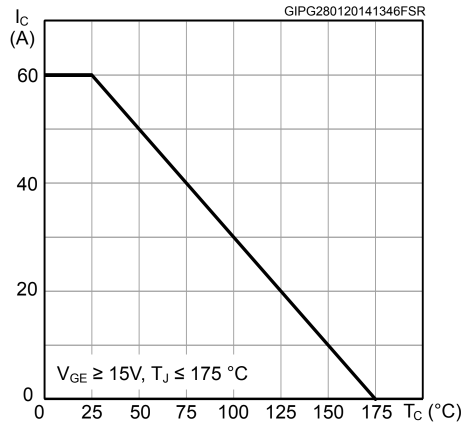


Figure 5. $V_{CE(sat)}$ vs junction temperature

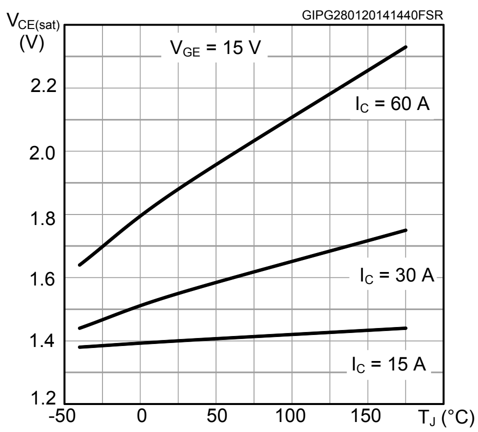


Figure 6. Total power dissipation vs case temperature

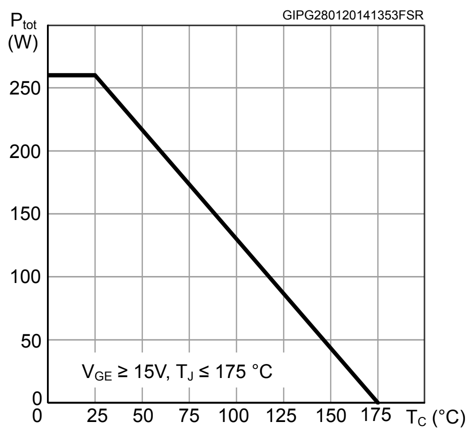


Figure 7. Forward bias safe operating area

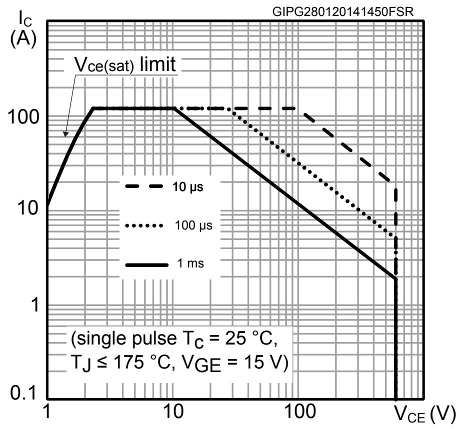


Figure 8. Collector current vs switching frequency

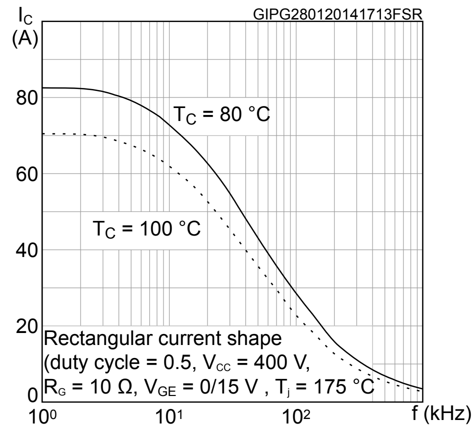


Figure 9. Normalized $V_{GE(th)}$ vs junction temperature

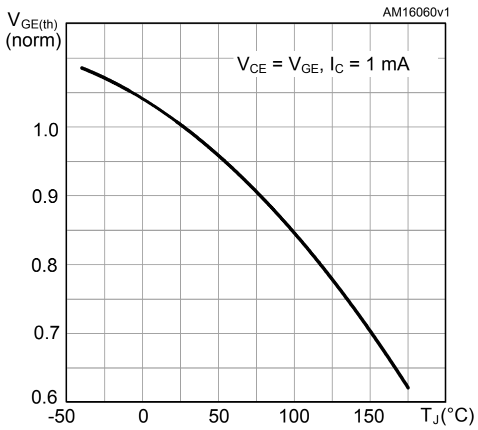


Figure 10. Normalized $V_{(BR)CES}$ vs junction temperature

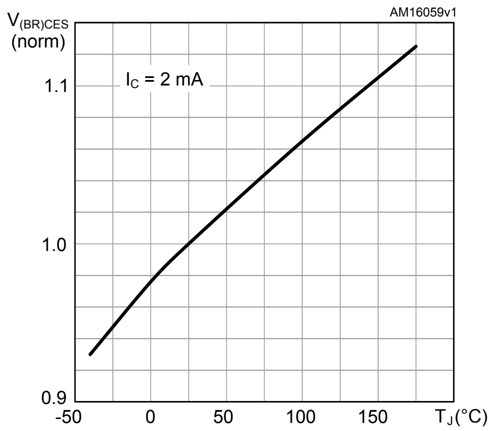


Figure 11. Switching energy vs temperature

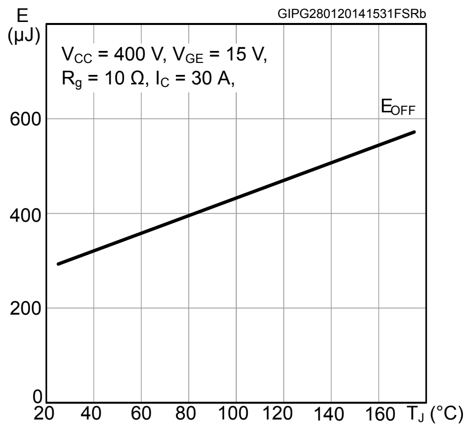
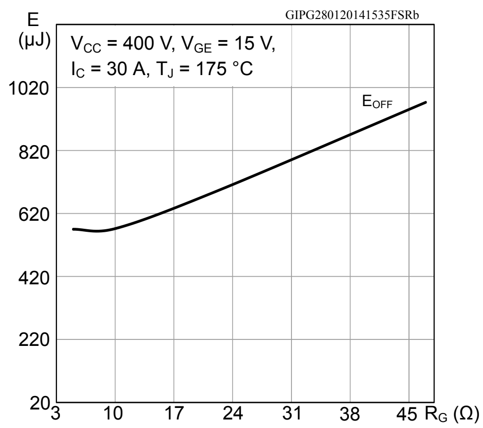


Figure 12. Switching energy vs gate resistance



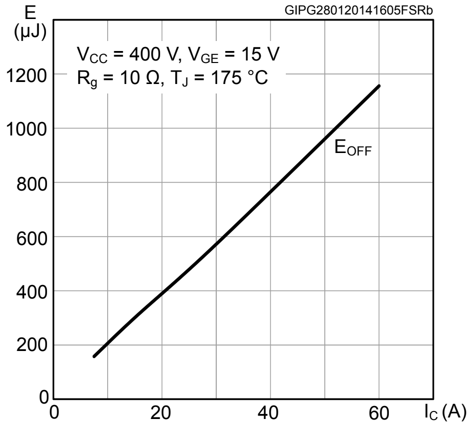


Figure 13. Switching energy vs collector current

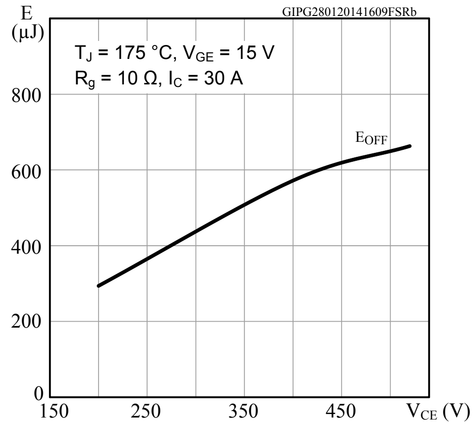


Figure 14. Switching energy vs collector emitter voltage

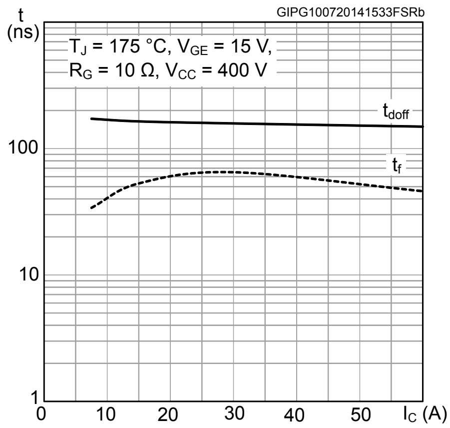


Figure 15. Switching times vs collector current

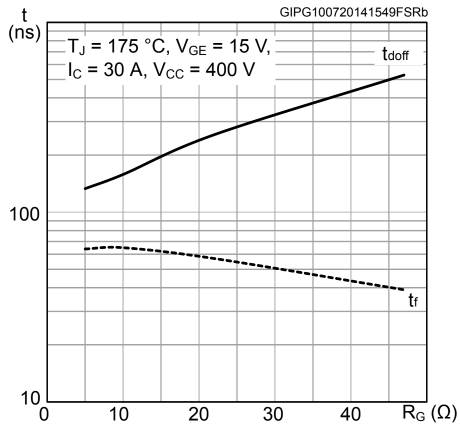


Figure 16. Switching times vs gate resistance

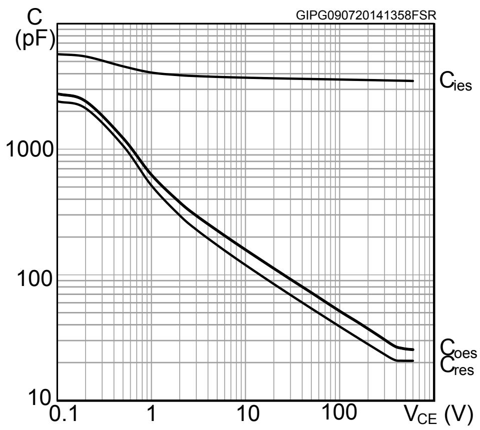


Figure 17. Capacitance variations

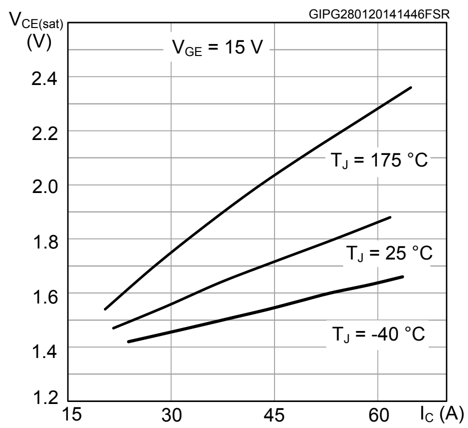


Figure 18. $V_{CE(sat)}$ vs collector current

Figure 19. Gate charge vs gate-emitter voltage

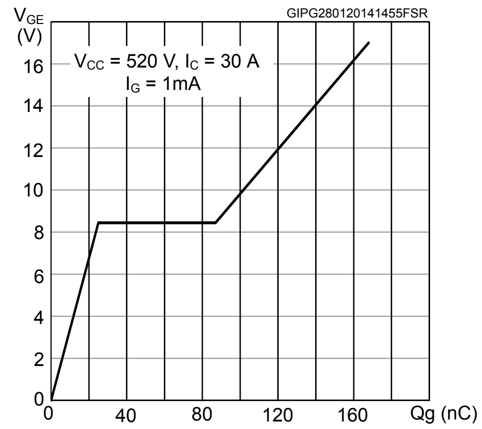


Figure 20. Diode V_F vs forward current

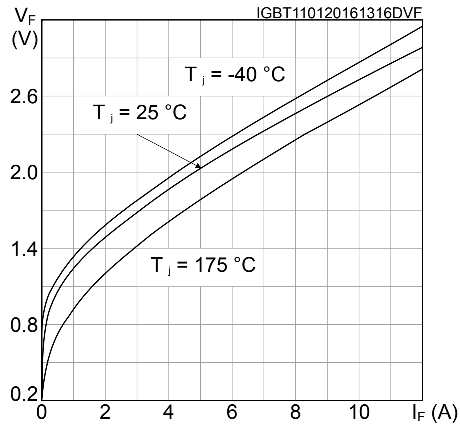


Figure 21. Reverse recovery current vs diode current slope

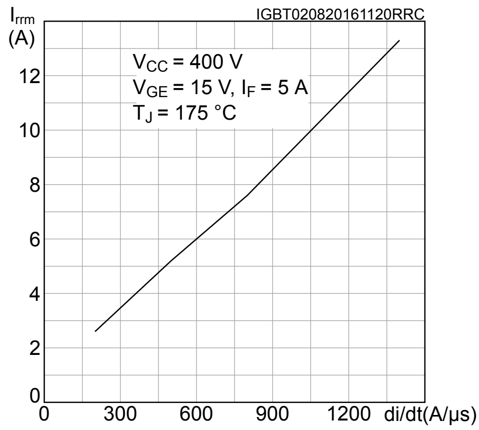


Figure 22. Reverse recovery time vs diode current slope

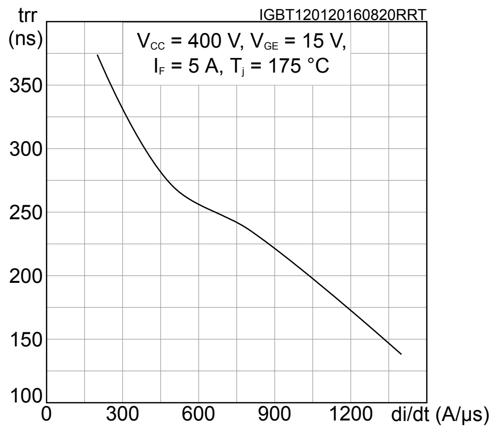


Figure 23. Reverse recovery charge vs diode current slope

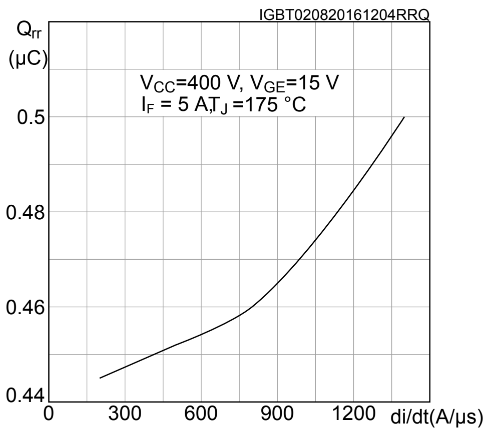


Figure 24. Reverse recovery energy vs diode current slope

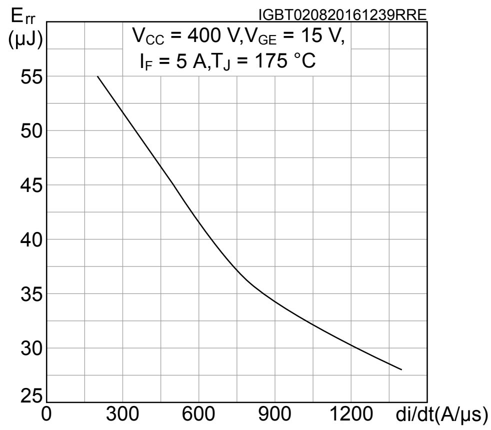
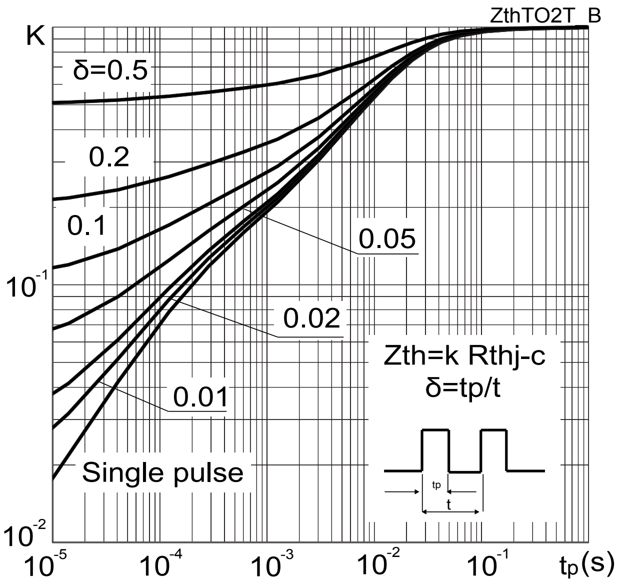


Figure 25. Thermal impedance for IGBT



3 Test circuits

Figure 26. Test circuit for inductive load switching

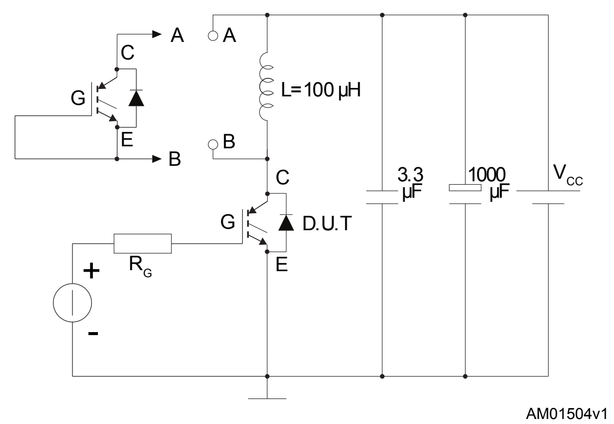


Figure 27. Gate charge test circuit

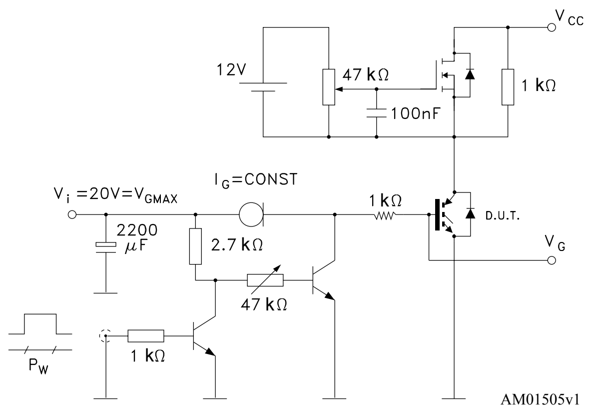
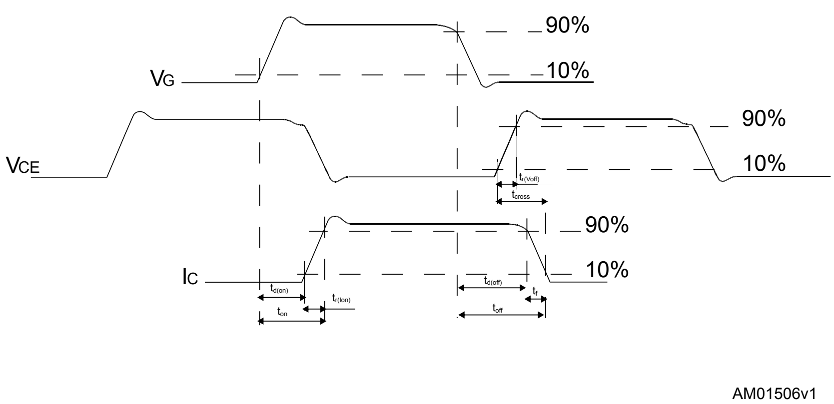


Figure 28. Switching waveform



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-3P package information

Figure 29. TO-3P package outline

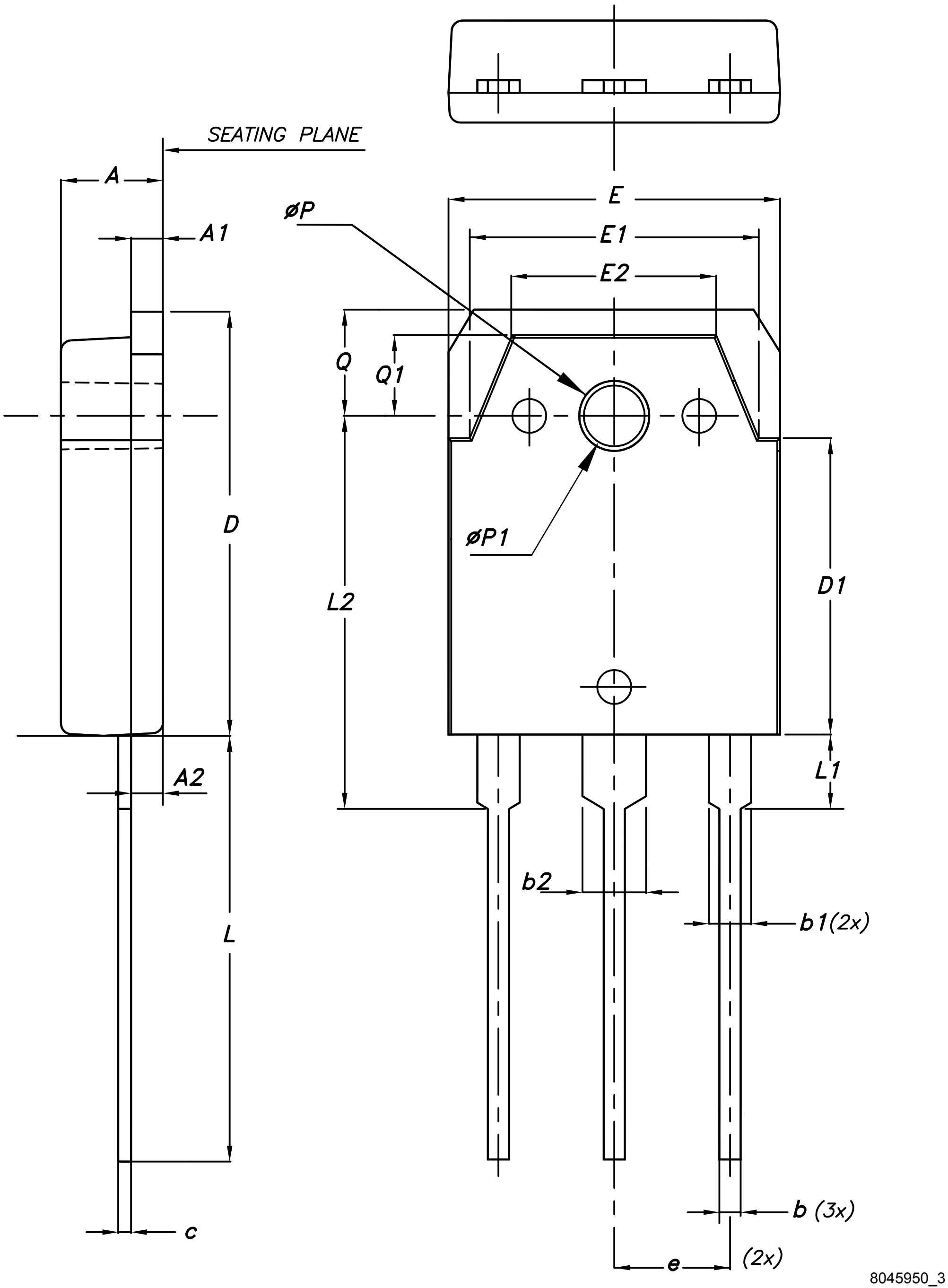


Table 7. TO-3P package mechanical data

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 8. Document revision history

Date	Revision	Changes
11-Nov-2015	1	First release
20-Jan-2017	2	Datasheet status promoted from preliminary to production data. Updated *Features* on cover page. Updated *Section 1: "Electrical ratings"* and *Section 2: "Electrical characteristics"*. Minor text changes.
09-Jul-2019	3	Updated Table 1. Absolute maximum ratings. Updated Section 4 Package information. Minor text changes.

Contents