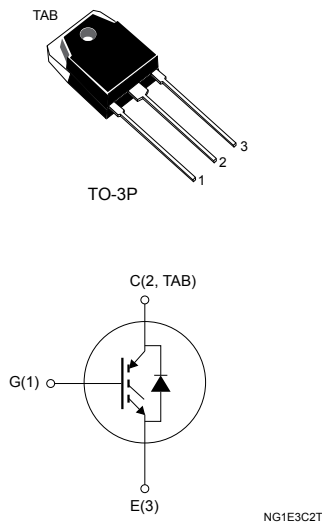


Trench gate field-stop 650 V, 30 A high speed HB series IGBT



Features

- Maximum junction temperature: $T_J = 175\text{ }^{\circ}\text{C}$
- High speed switching series
- Minimized tail current
- Low saturation voltage: $V_{CE(sat)} = 1.6\text{ V (typ.) @ } I_C = 40\text{ A}$
- 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 ($V_{GE} = 0\text{ V}$)	650	V
I_C	Continuous collector current at $T_C = 25\text{ °C}$	60	A
	Continuous collector current at $T_C = 100\text{ °C}$	30	
$I_{CP}^{(1)}$	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	± 20	V
	Transient gate-emitter voltage ($t_p \leq 10\text{ }\mu\text{s}$)	± 30	
$I_F^{(2)}$	Continuous forward current at $T_C = 25\text{ °C}$	5	A
	Continuous forward current at $T_C = 100\text{ °C}$	5	
$I_{FP}^{(3)}$	Pulsed forward current	10	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	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

$T_C = 25\text{ °C}$ unless otherwise specified

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 2\text{ mA}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$		1.55	2.0	V
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 125\text{ °C}$		1.65		
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 175\text{ °C}$		1.75		
V_F	Forward on-voltage	$I_F = 5\text{ A}$		2.0		V
		$I_F = 5\text{ A}$, $T_J = 125\text{ °C}$		1.85		
		$I_F = 5\text{ A}$, $T_J = 175\text{ °C}$		1.75		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5	6	7	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	3659	-	pF
C_{oes}	Output capacitance		-	101	-	
C_{res}	Reverse transfer capacitance		-	76	-	
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (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	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$,	-	146	-	ns
t_f	Current fall time	$R_G = 10\text{ }\Omega$	-	23	-	ns
$E_{off}^{(1)}$	Turn-off switching energy	(see Figure 27. Test circuit for inductive load switching)	-	293	-	μJ
$t_{d(off)}$	Turn-off-delay time	$V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$,	-	158	-	ns
t_f	Current fall time	$R_G = 10\text{ }\Omega$, $T_J = 175\text{ °C}$	-	65	-	ns
E_{off}	Turn-off switching energy	(see Figure 27. Test circuit for inductive load switching)	-	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	$I_F = 5\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$ (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	$I_F = 5\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $T_J = 175\text{ }^\circ\text{C}$ (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)

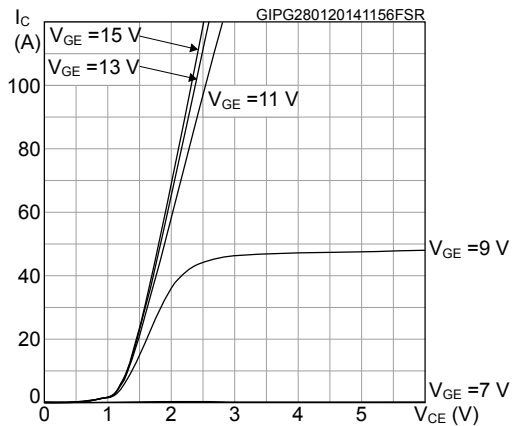
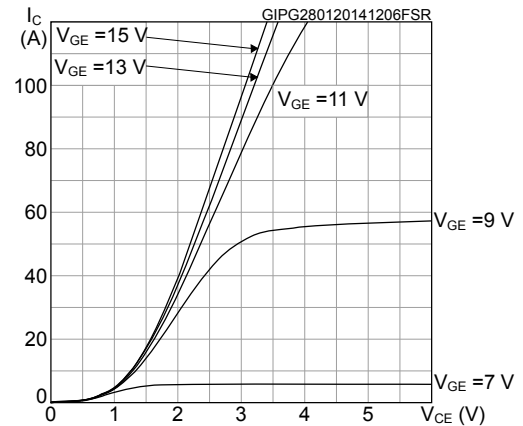
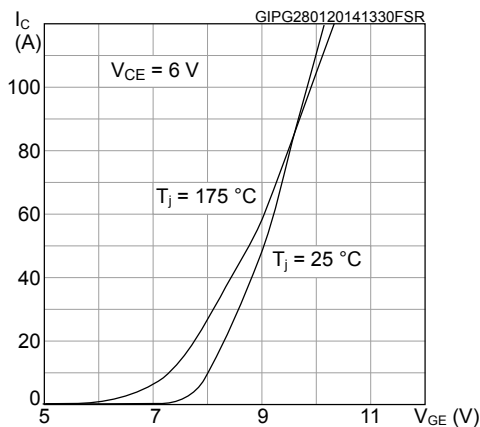
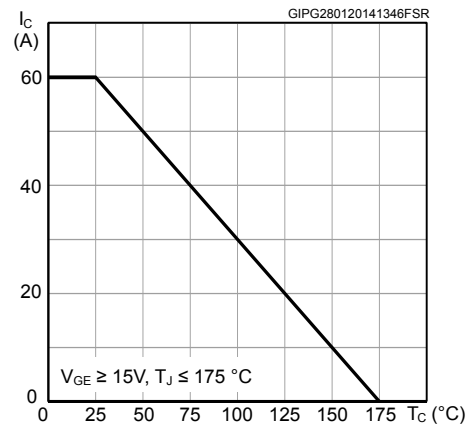
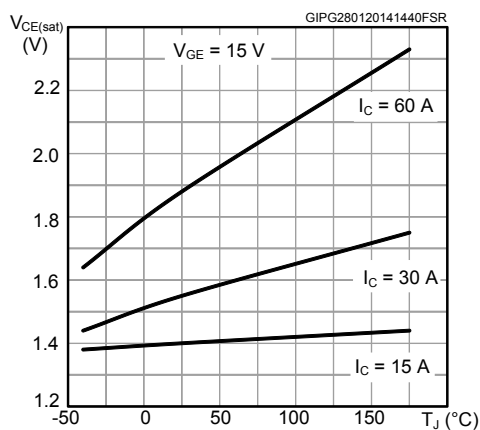
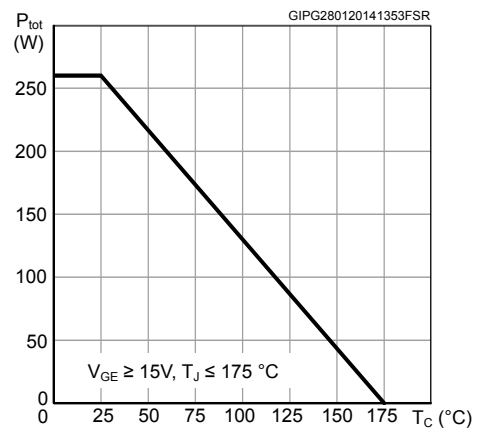
Figure 1. Output characteristics ($T_J = 25^\circ\text{C}$)

Figure 2. Output characteristics ($T_J = 175^\circ\text{C}$)

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


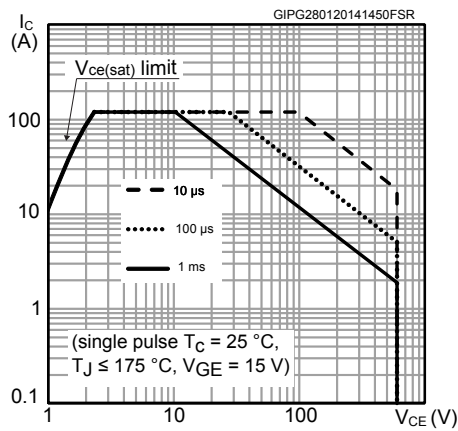
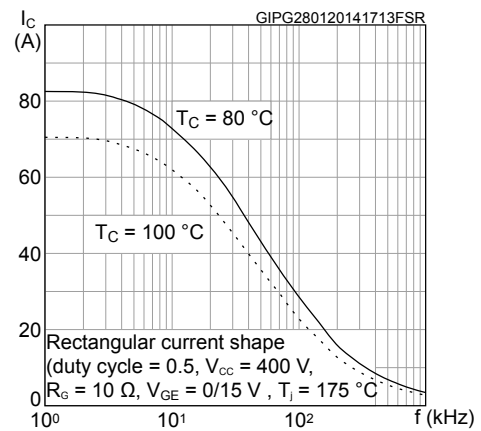
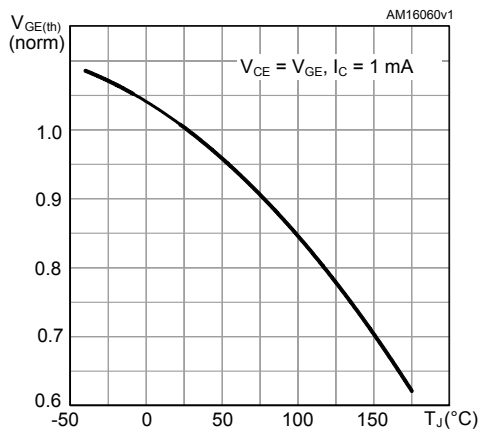
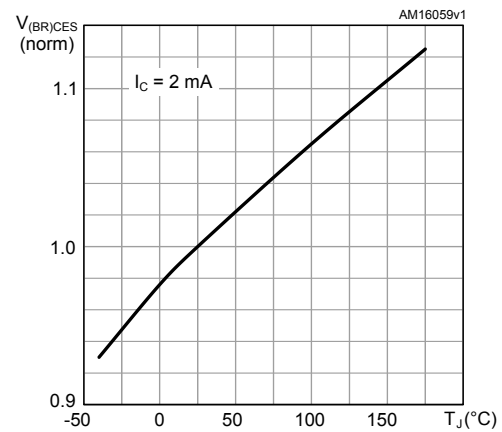
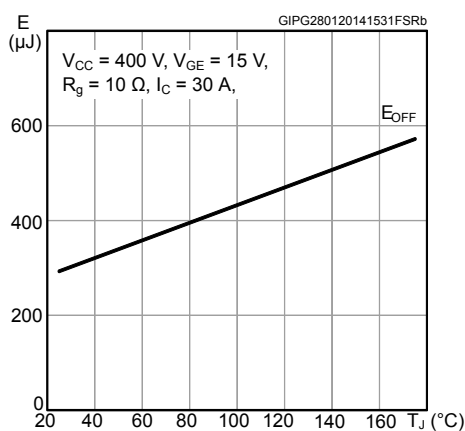
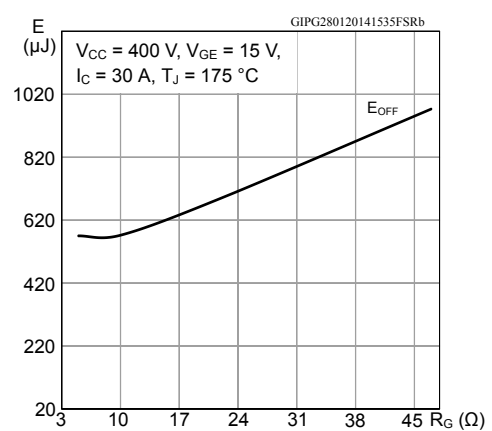
Figure 7. Forward bias safe operating area

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


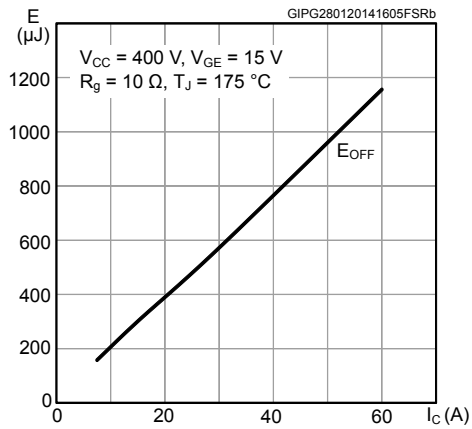
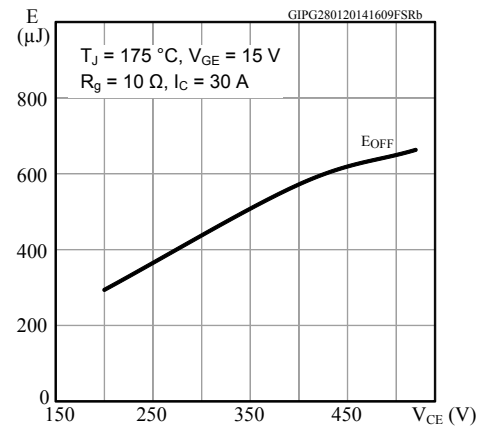
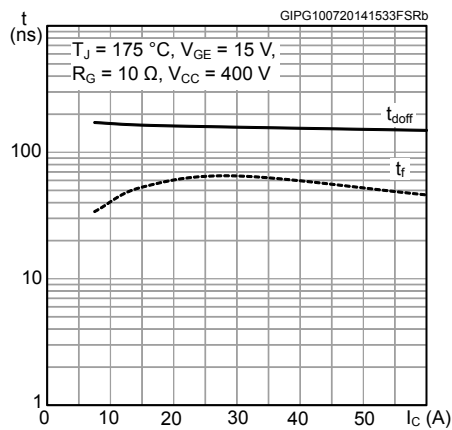
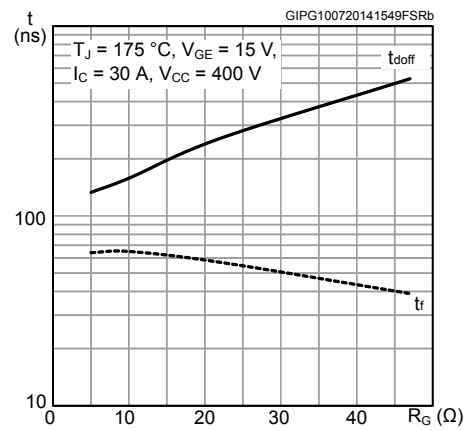
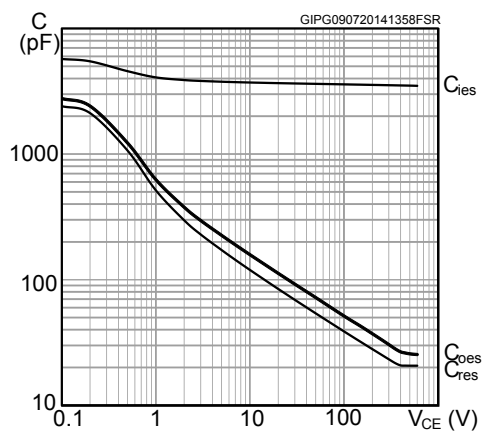
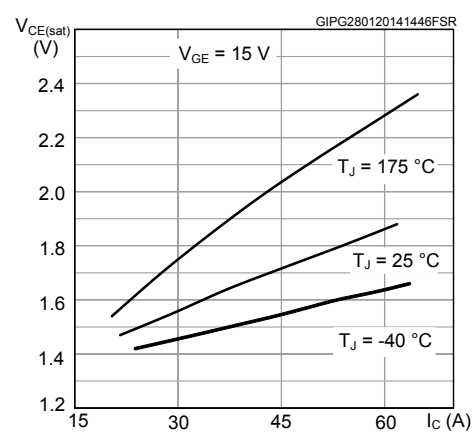
Figure 13. Switching energy vs collector current

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


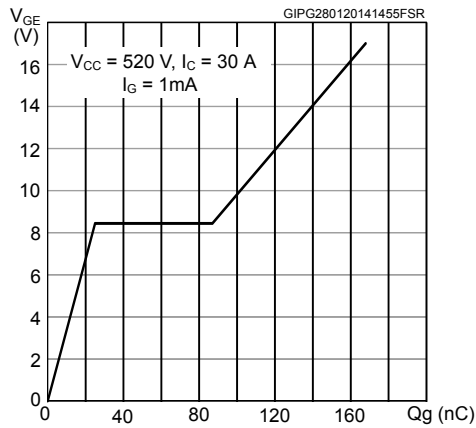
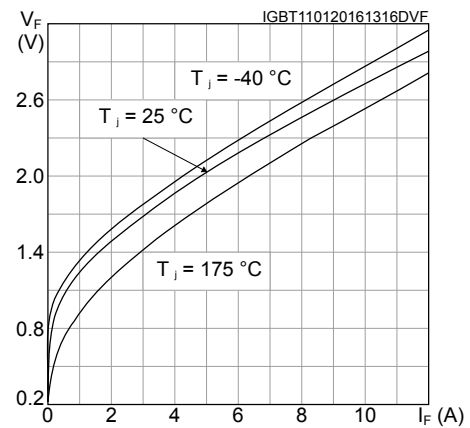
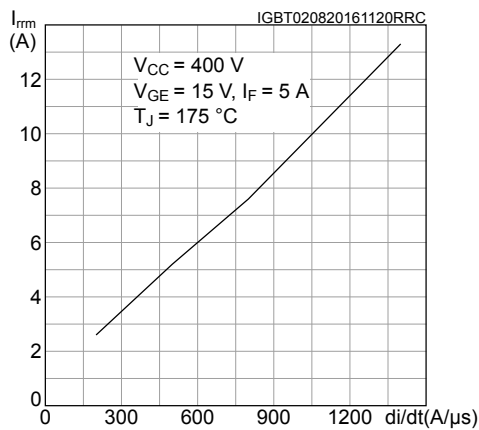
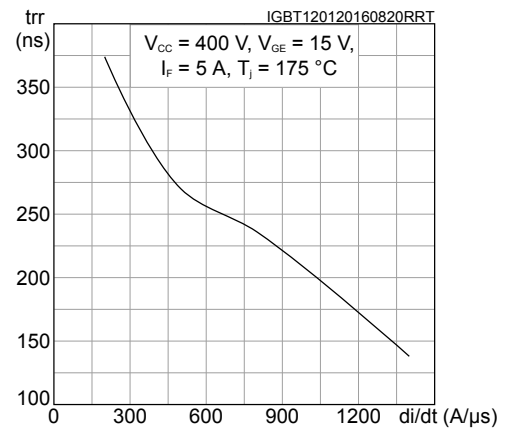
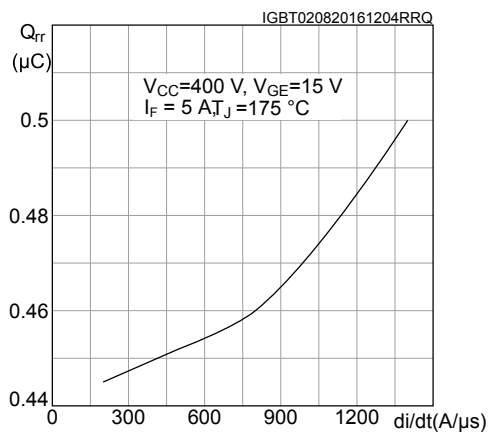
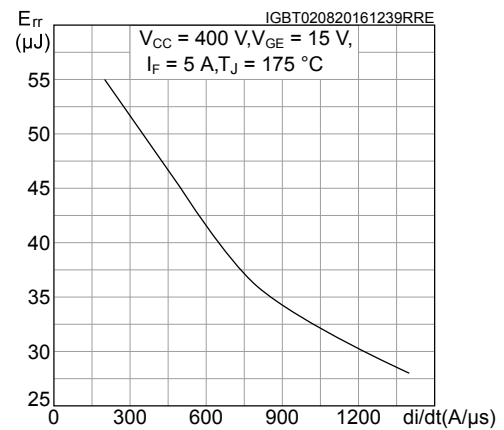
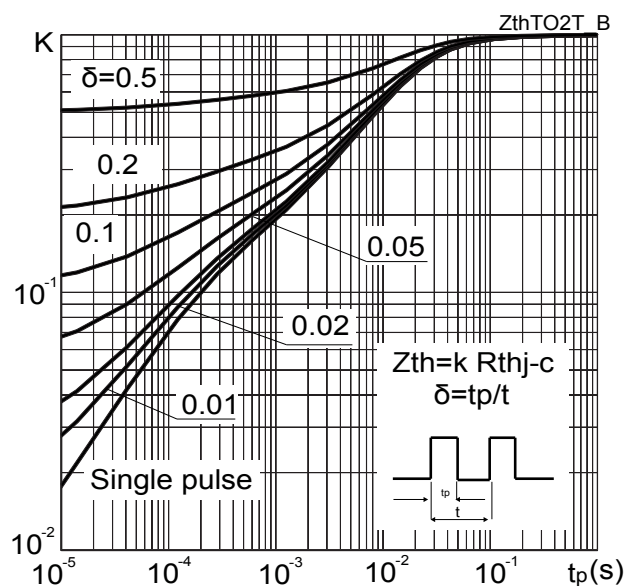
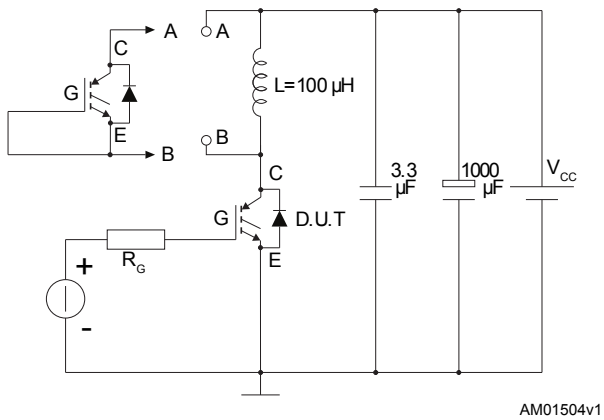
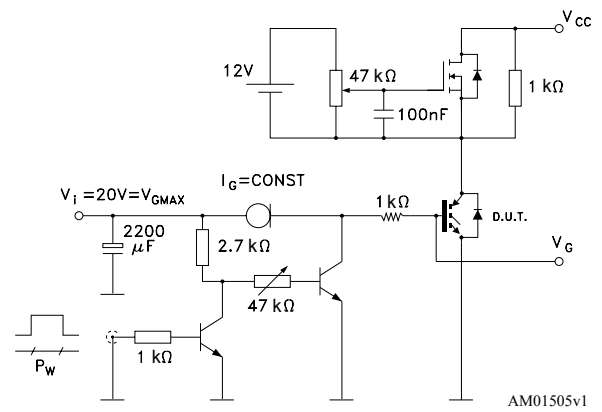
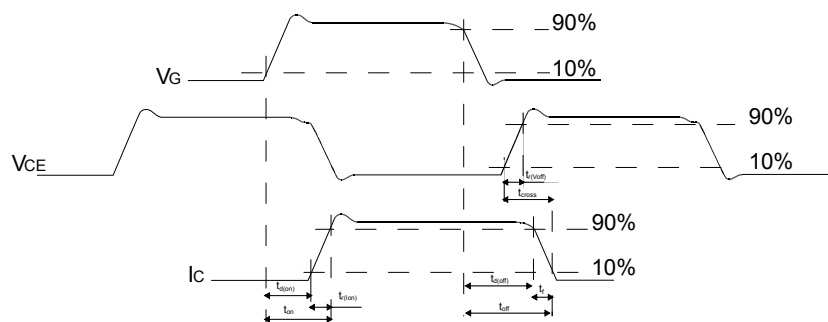
Figure 19. Gate charge vs gate-emitter voltage

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


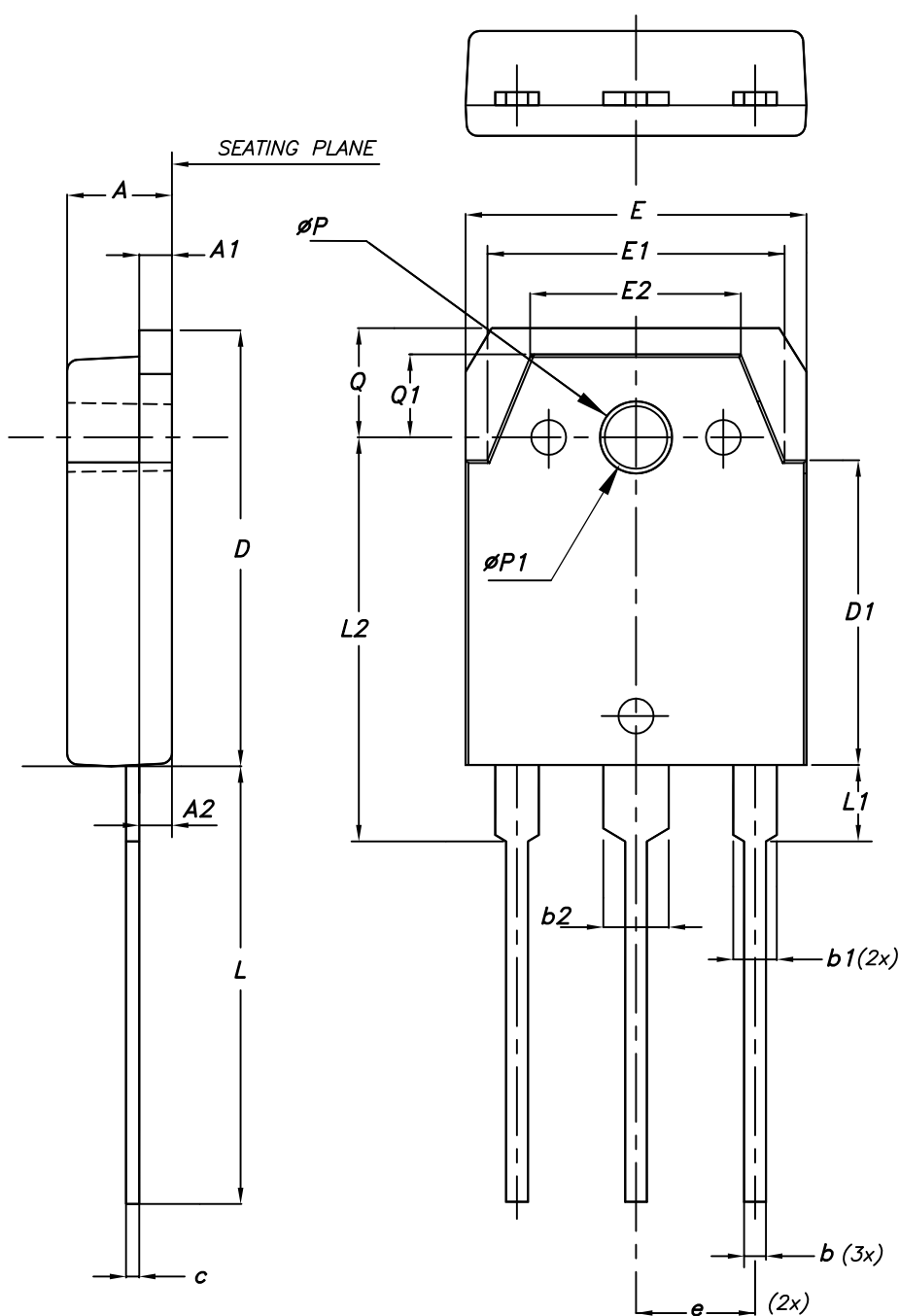
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4 Package information

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



8045950_3

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 <i>Features</i> on cover page. Updated <i>Section 1: "Electrical ratings"</i> and <i>Section 2: "Electrical characteristics"</i> . Minor text changes.
09-Jul-2019	3	Updated Table 1. Absolute maximum ratings . Updated Section 4 Package information . Minor text changes.

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