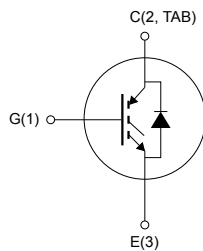


Trench gate field-stop 650 V, 50 A, soft switching IH series IGBT in a TO-247 long leads package



TO-247 long leads



NG1E3C2T

Features

- Designed for soft-commutation only
- Maximum junction temperature: $T_J = 175\text{ °C}$
- $V_{CE(sat)} = 1.5\text{ V (typ.) @ } I_C = 50\text{ A}$
- Minimized tail current
- Tight parameter distribution
- Low thermal resistance
- Low voltage drop freewheeling co-packaged diode
- Positive $V_{CE(sat)}$ temperature coefficient

Applications

- Induction heating
- Resonant converters
- Microwave ovens

Description

The newest IGBT 650 V soft-switching IH series has been developed using an advanced proprietary trench gate field-stop structure, whose performance is optimized both in conduction and switching losses for soft commutation. A freewheeling diode with a low drop forward voltage is included. The result is a product specifically designed to maximize efficiency for any resonant and soft-switching applications.



Product status link

[STGWA50IH65DF](#)

Product summary

Order code	STGWA50IH65DF
Marking	G50IH65DF
Package	TO-247 long leads
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	100	A
	Continuous collector current at $T_C = 100$ °C	50	
$I_{CP}^{(1)}$	Pulsed collector current	150	
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at $T_C = 25$ °C	50	A
	Continuous forward current at $T_C = 100$ °C	25	
$I_{FP}^{(1)}$	Pulsed forward current	150	
P_{TOT}	Total power dissipation at $T_C = 25$ °C	300	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.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.5	°C/W
	Thermal resistance junction-case diode	1.47	
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	$V_{GE} = 0\text{ V}$, $I_C = 250\text{ }\mu\text{A}$	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$		1.50	2.00	
		$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$, $T_J = 125\text{ °C}$		1.75		
		$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$, $T_J = 175\text{ °C}$		1.90		
V_F	Forward on-voltage	$I_F = 25\text{ A}$		1.75	2.50	
		$I_F = 25\text{ A}$, $T_J = 125\text{ °C}$		1.50		
		$I_F = 25\text{ A}$, $T_J = 175\text{ °C}$		1.40		
		$I_F = 50\text{ A}$		2.15		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5	6	7	
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$			25	
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	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	2980	-	pF
C_{oes}	Output capacitance		-	150	-	
C_{res}	Reverse transfer capacitance		-	81	-	
Q_g	Total gate charge	$V_{CC} = 520\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 23. Gate charge test circuit)	-	158	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	
Q_{gc}	Gate-collector charge		-	72	-	

Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off-delay time	$V_{CC} = 400\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 22\text{ }\Omega$ (see Figure 21. Test circuit for inductive load switching)	-	260	-	ns
t_f	Current fall time		-	17	-	
$t_{d(off)}$	Turn-off-delay time	$V_{CC} = 400\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 22\text{ }\Omega$, $T_J = 175\text{ °C}$ (see Figure 21. Test circuit for inductive load switching)	-	270	-	ns
t_f	Current fall time		-	24	-	

Table 6. IGBT switching characteristics (snubbed inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E _{off} ⁽¹⁾	Turn-off switching energy	L = 100 μH, C _s = 22 nF V _{CC} = 320 V, R _G = 10 Ω, I _C = 50 A (see Figure 22. Test circuit for snubbed inductive load switching)	-	284	-	μJ
		L = 100 μH, C _s = 22 nF, V _{CC} = 320 V, R _G = 10 Ω, I _C = 50 A, T _J = 175 °C (see Figure 22. Test circuit for snubbed inductive load switching)	-	469	-	

1. Including the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs case temperature

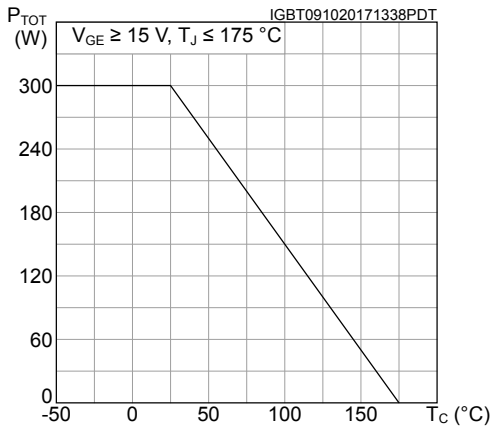


Figure 2. Collector current vs case temperature

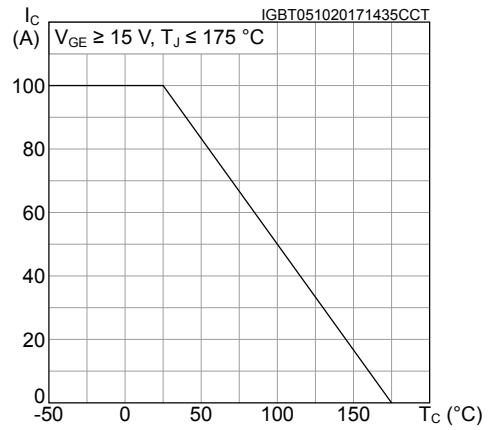


Figure 3. Output characteristics (T_J = 25 °C)

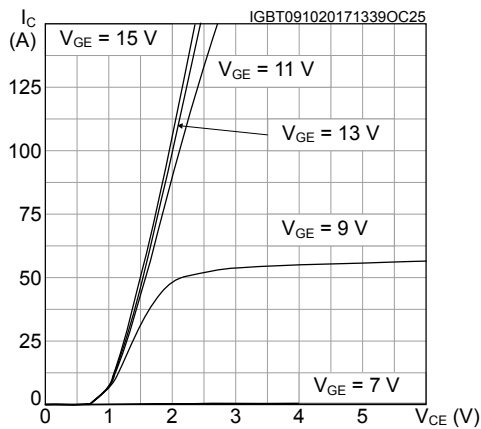


Figure 4. Output characteristics (T_J = 175 °C)

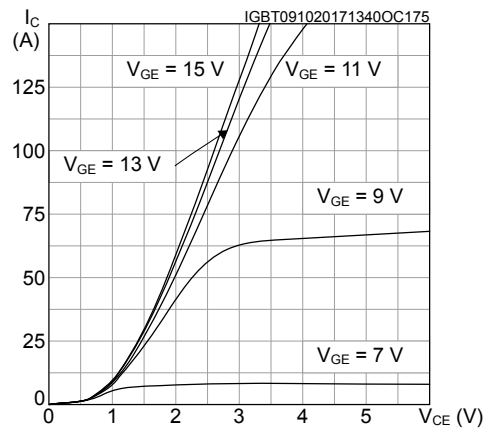


Figure 5. V_{CE(sat)} vs junction temperature

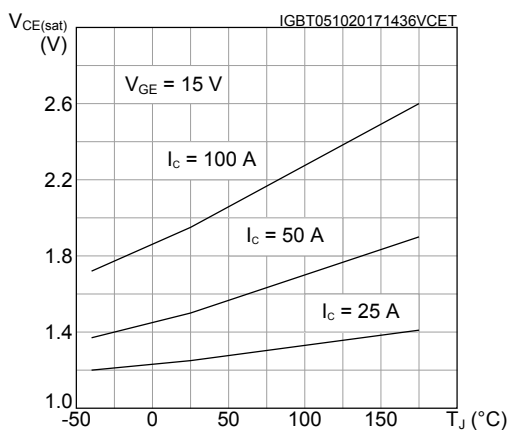


Figure 6. V_{CE(sat)} vs collector current

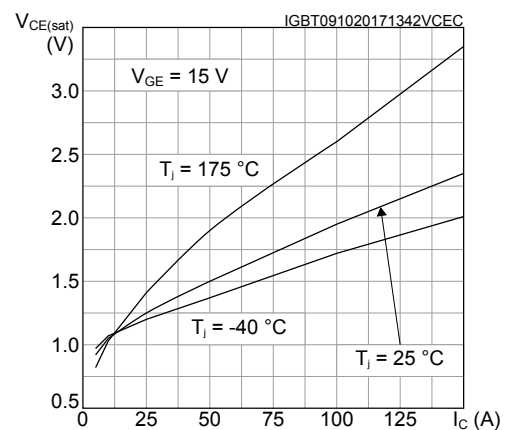


Figure 7. Forward bias safe operating area

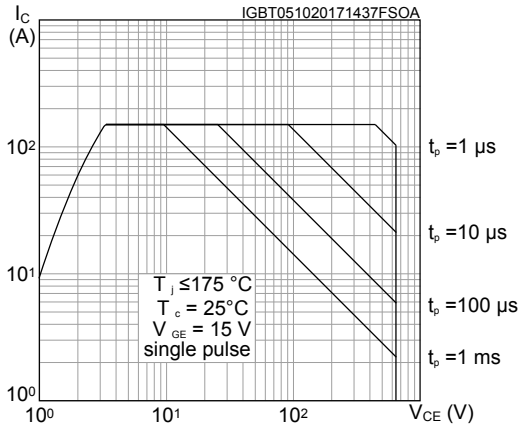


Figure 8. Transfer characteristics

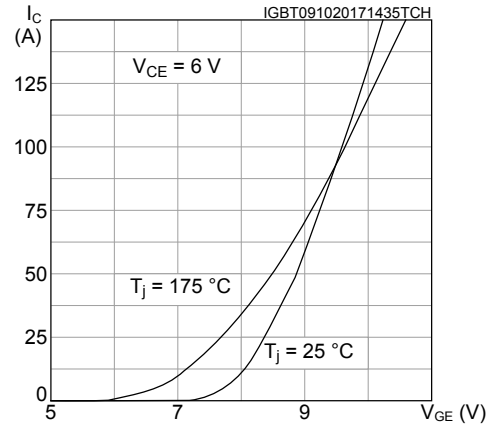


Figure 9. Diode V_F vs forward current

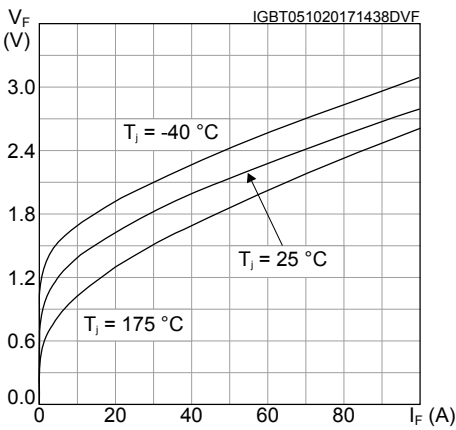


Figure 10. Normalized V_GE(th) vs junction temperature

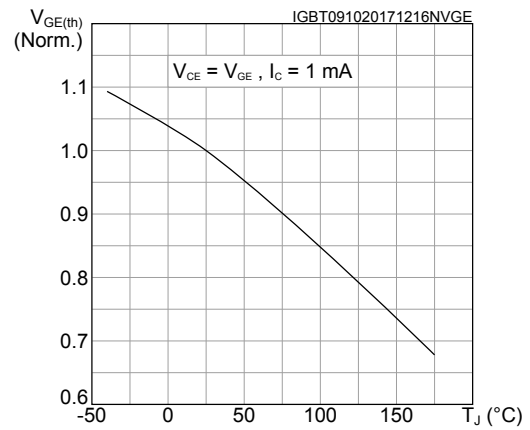


Figure 11. Normalized V_(BR)CES vs junction temperature

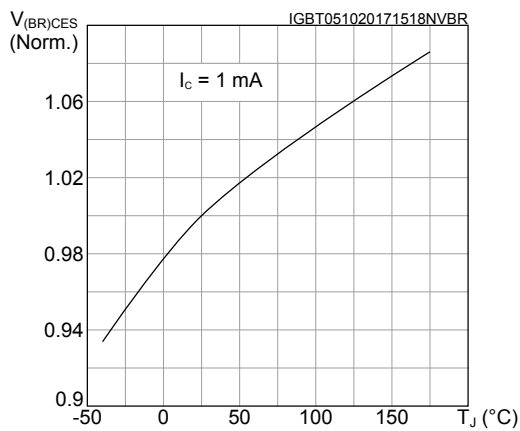


Figure 12. Capacitance variations

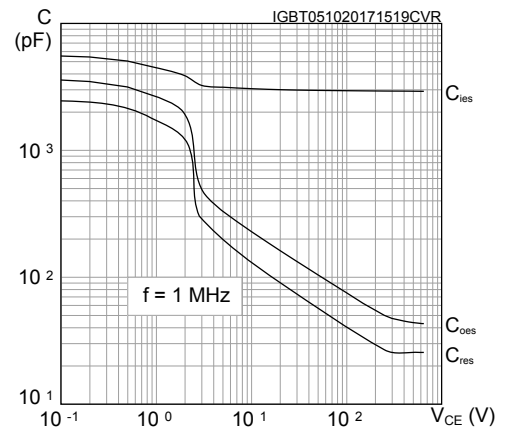


Figure 13. Gate charge vs gate-emitter voltage

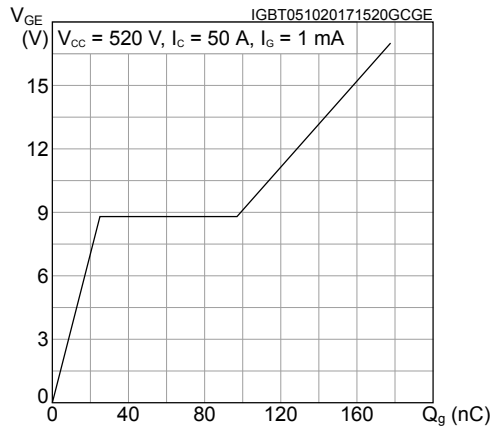


Figure 14. Switching energy vs collector current

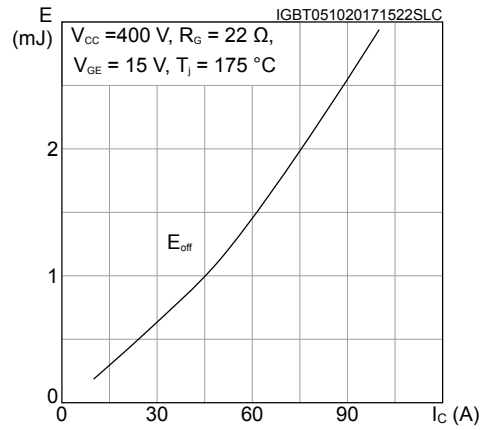


Figure 15. Switching energy vs temperature

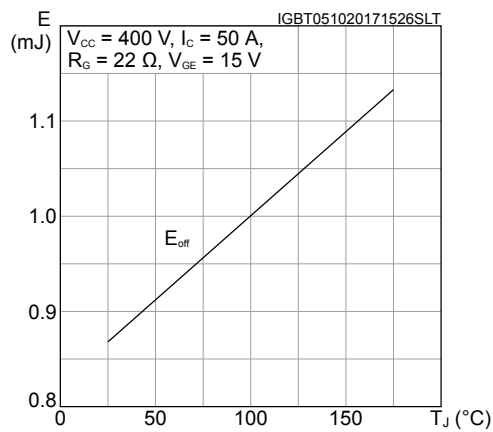


Figure 16. Switching energy vs collector-emitter voltage

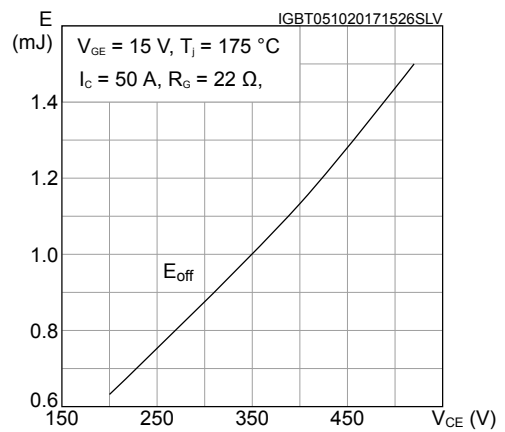


Figure 17. Switching times vs collector current

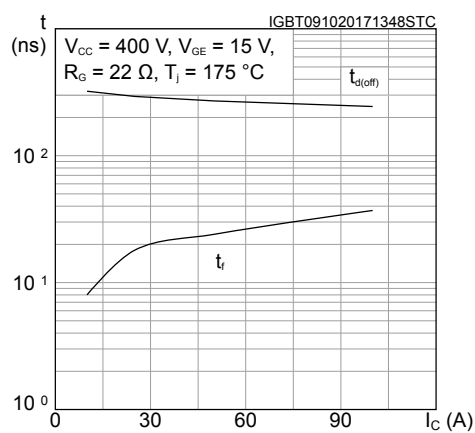


Figure 18. Switching energy vs snubber capacitance

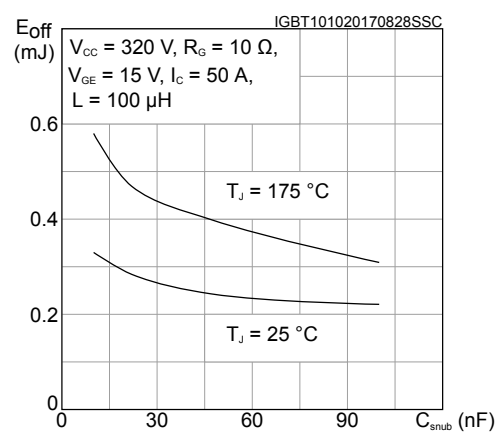


Figure 19. Thermal impedance for IGBT

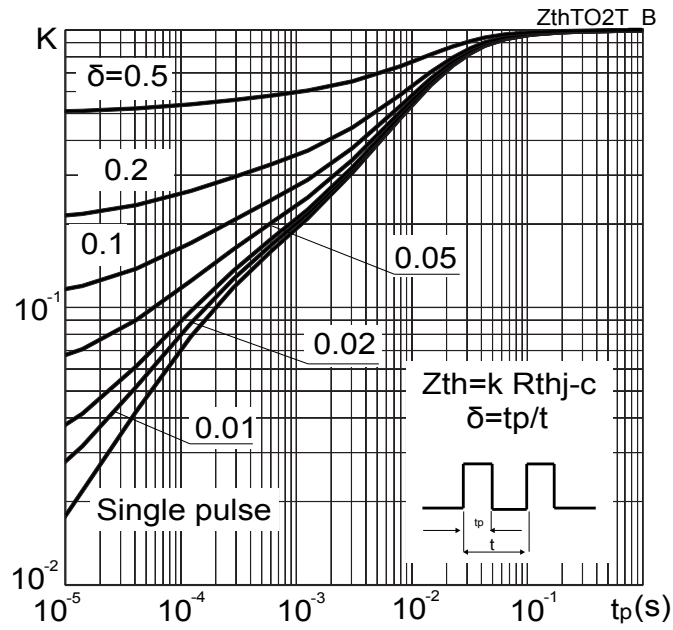
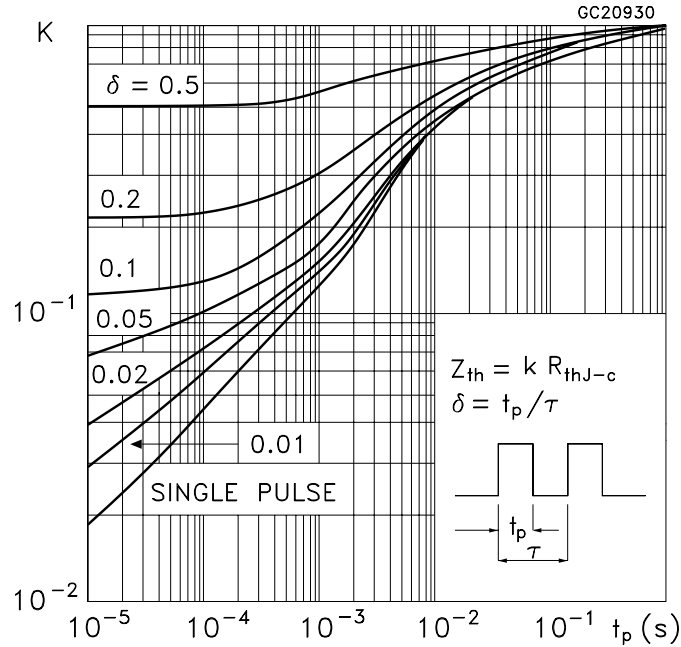


Figure 20. Thermal impedance for diode



3 Test circuits

Figure 21. Test circuit for inductive load switching

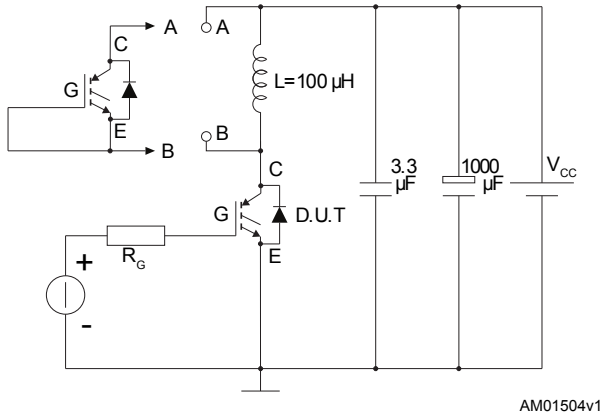


Figure 22. Test circuit for snubbed inductive load switching

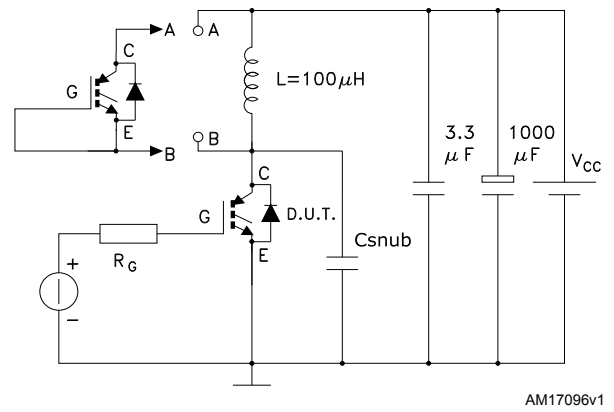


Figure 23. Gate charge test circuit

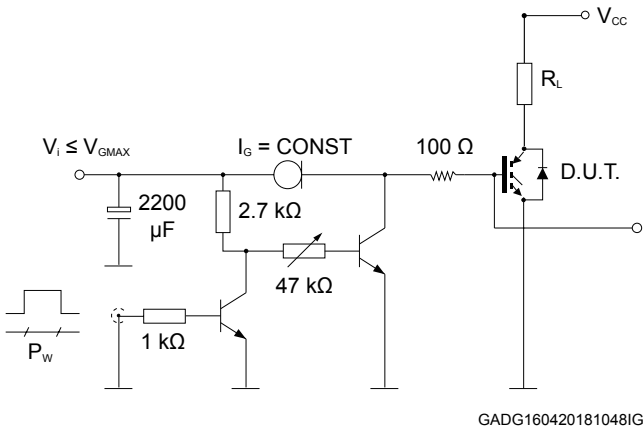
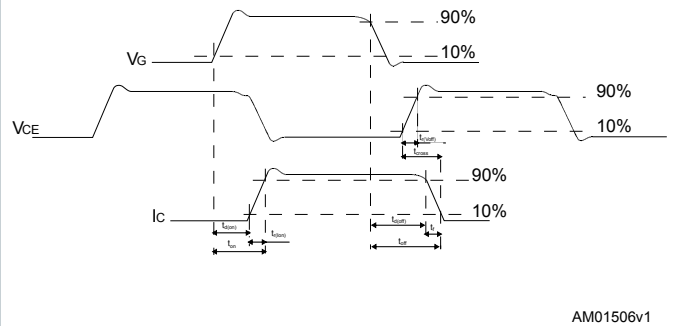


Figure 24. Switching waveform

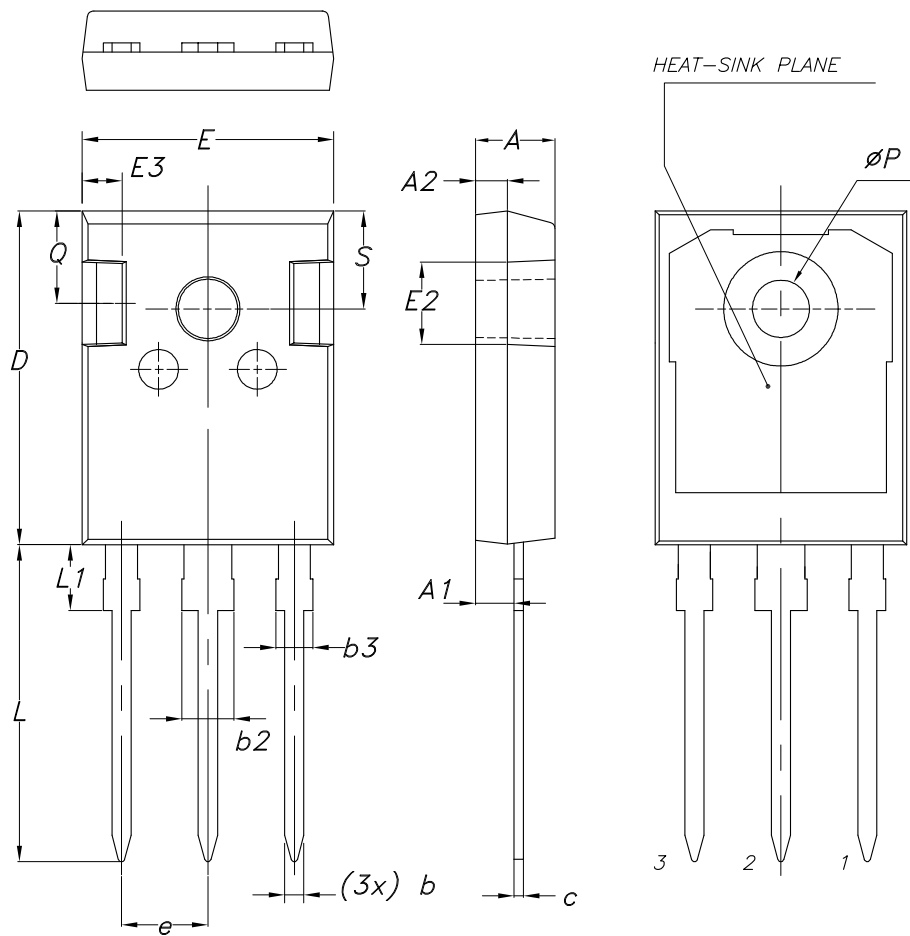


4 Package information

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-247 long leads package information

Figure 25. TO-247 long leads package outline



8463846_2_F

Table 7. TO-247 long leads package 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

Revision history

Table 8. Document revision history

Date	Revision	Changes
02-Sep-2016	1	First release.
05-Oct-2017	2	<p>Modified title, silhouette, features and description.</p> <p>Modified <i>Table 2: "Absolute maximum ratings"</i>, <i>Table 3: "Thermal data"</i>, <i>Table 4: "Static characteristics"</i>, <i>Table 5: "Dynamic characteristics"</i>, <i>Table 6: "IGBT switching characteristics (inductive load)"</i> and <i>Table 7: "IGBT switching characteristics (snubbed inductive load)"</i>.</p> <p>Added <i>Section 2.1: "Electrical characteristics (curves)"</i>.</p> <p>Minor text changes.</p>
15-Apr-2020	3	<p>Updated Internal schematic in cover page.</p> <p>Updated Figure 13. Gate charge vs gate-emitter voltage.</p> <p>Minor text changes.</p>

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