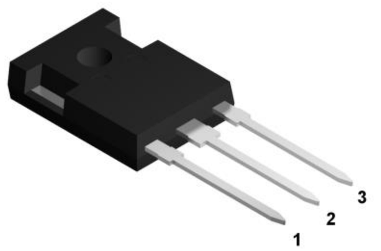
STGWA50IH65DF

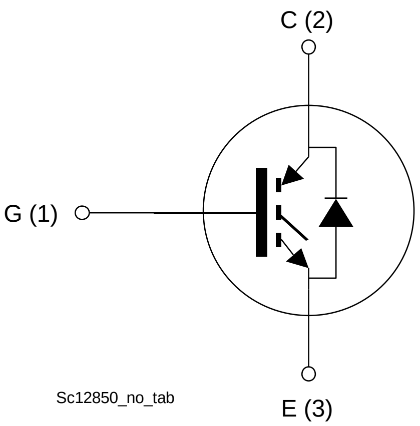
Trench gate field-stop IGBT, 650 V, 50 A soft switching IH series in a TO-247 long leads package

Datasheet - production data



TO-247 long leads

Figure 1: Internal schematic diagram



Features

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

Applications

- Induction heating
- Resonant converters
- Microwave oven

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.

Table 1: Device summary

Order code	Marking	Package	Packing
STGWA50IH65DF	G50IH65DF	TO-247 long leads	Tube

Contents

1 Electrical ratings

Table 2: 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 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	

Notes:

(1)Pulse width limited by maximum junction temperature.

Table 3: 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 °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 V, I_C = 250 μA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A		1.50	2.00	
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C		1.75		
		V_{GE} = 15 V, I_C = 50 A, T_J = 175 °C		1.90		
V_F	Forward on-voltage	I_F = 25 A		1.75	2.50	
		I_F = 25 A, T_J = 125 °C		1.50		
		I_F = 25 A, T_J = 175 °C		1.40		
		I_F = 50 A		2.15		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	5	6	7	
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 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 V	-	2980	-	pF
C_{oes}	Output capacitance		-	150	-	
C_{res}	Reverse transfer capacitance		-	81	-	
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 50 A, V_{GE} = 0 to 15 V (see *Figure 24: "Gate charge test circuit"*)	-	158	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	
Q_{gc}	Gate-collector charge		-	72	-	

Table 6: IGBT switching characteristics (inductive load)

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

Table 7: IGBT switching characteristics (snubbed inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off}[1]	Turn-off switching energy	V_{CC} = 320 V, R_G = 10 Ω, I_C = 50 A, L = 100 μH, C_{snub} = 22 nF (see *Figure 23: "Test circuit for capacitive load switching"*)	-	284	-	μJ
		V_{CC} = 320 V, R_G = 10 Ω, I_C = 50 A, L = 100 μH, C_{snub} = 22 nF T_J = 175 °C (see *Figure 23: "Test circuit for capacitive load switching"*)	-	469	-	

Notes:

[1]Including the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2: Power dissipation vs. case temperature

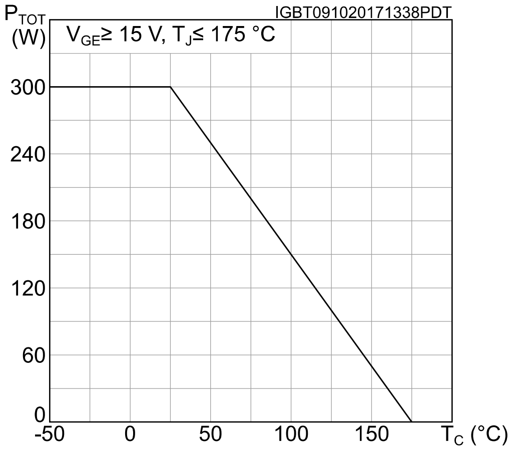


Figure 3: Collector current vs. case temperature

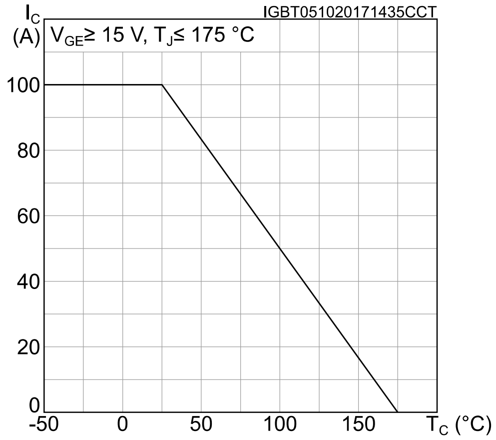


Figure 4: Output characteristics (T_J = 25 °C)

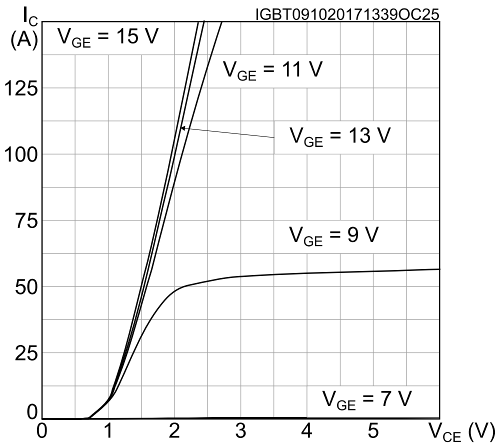


Figure 5: Output characteristics (T_J = 175 °C)

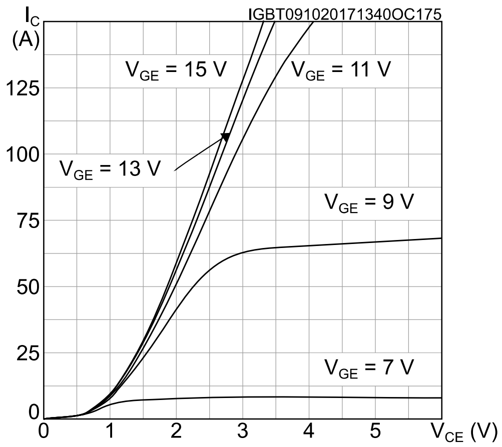


Figure 6: $V_{CE(sat)}$ vs. junction temperature

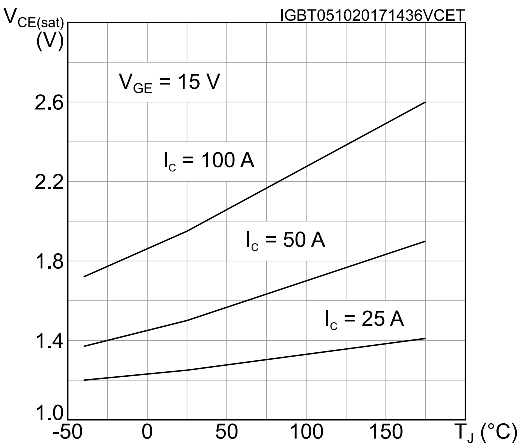


Figure 7: $V_{CE(sat)}$ vs. collector current

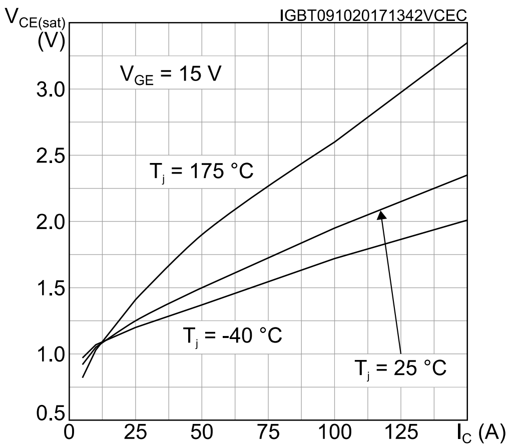


Figure 8: Forward bias safe operating area

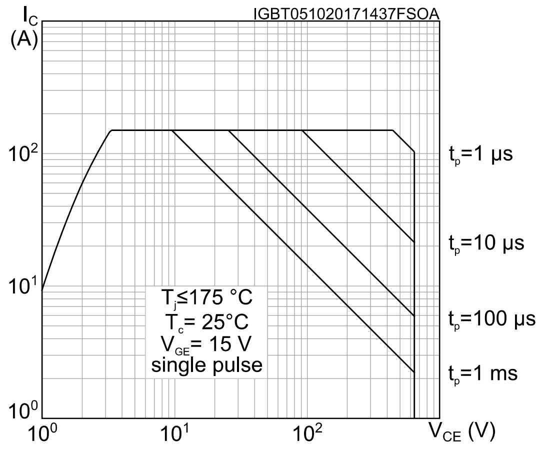


Figure 9: Transfer characteristics

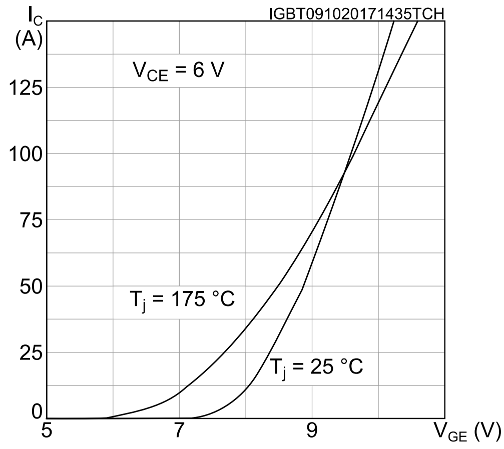


Figure 10: Diode V_F vs. forward current

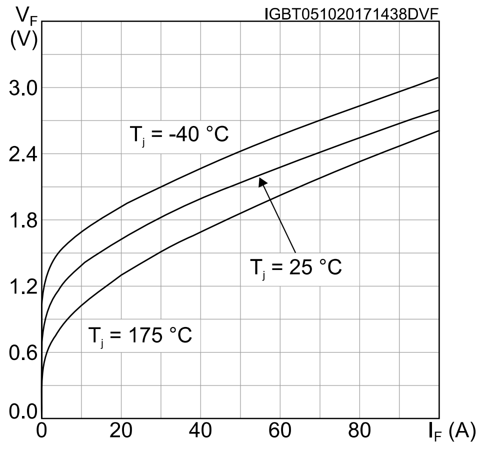


Figure 11: Normalized $V_{GE(th)}$ vs. junction temperature

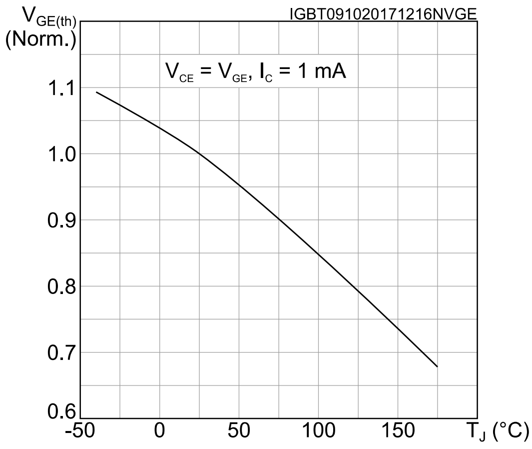


Figure 12: Normalized $V_{(BR)CES}$ vs. junction temperature

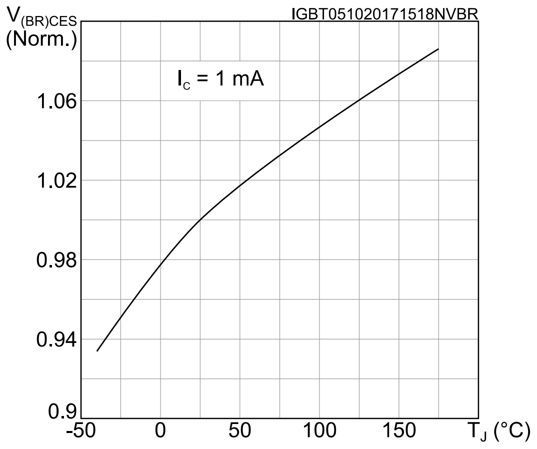


Figure 13: Capacitance variations

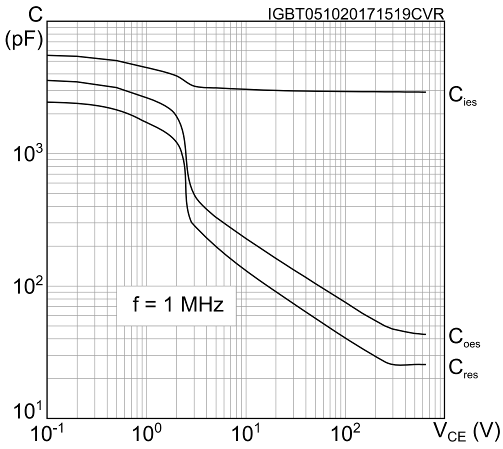


Figure 14: Gate charge vs. gate-emitter voltage

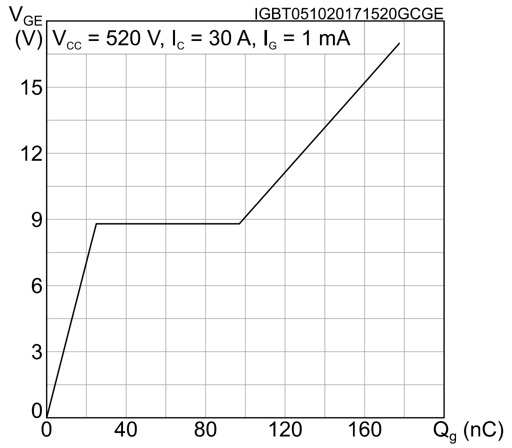


Figure 15: Switching-off energy vs. collector current

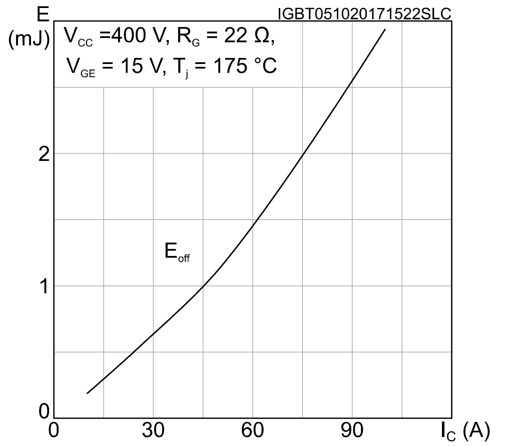


Figure 16: Switching-off energy vs. temperature

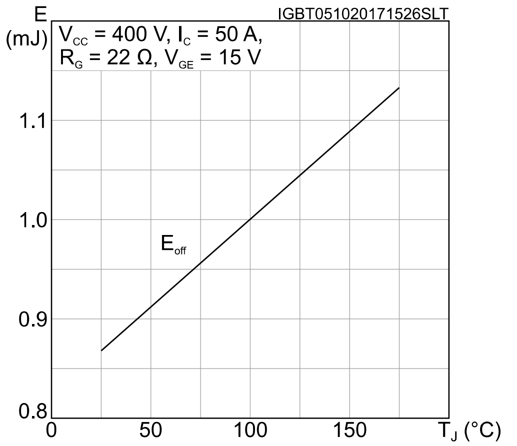


Figure 17: Switching-off energy vs. collector emitter voltage

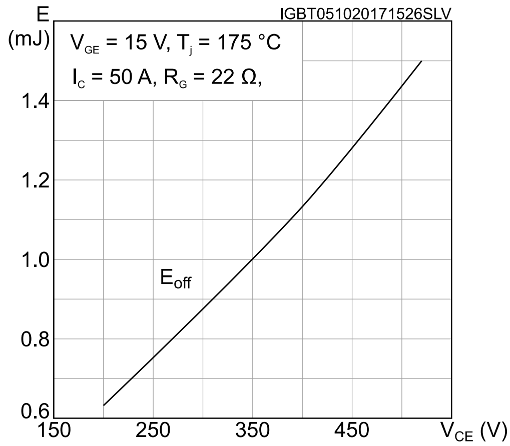


Figure 18: Switching-off times vs. collector current

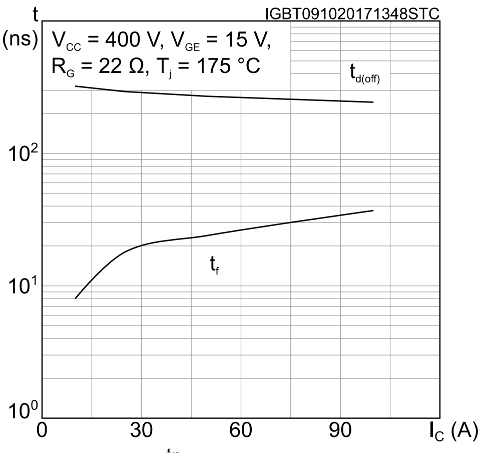


Figure 19: Switching-off energy vs snubber capacitance

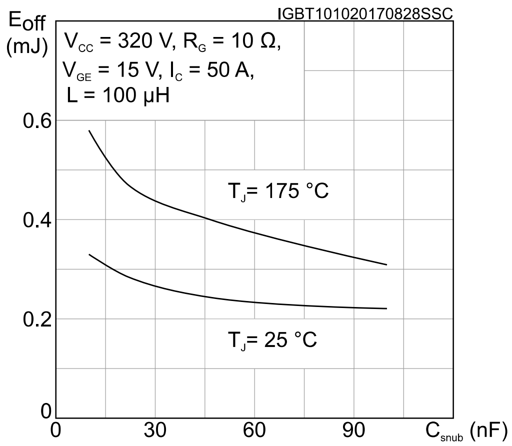


Figure 20: Thermal impedance

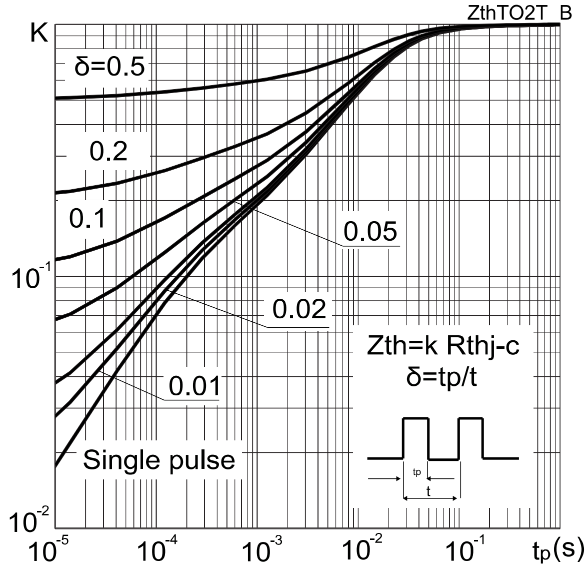
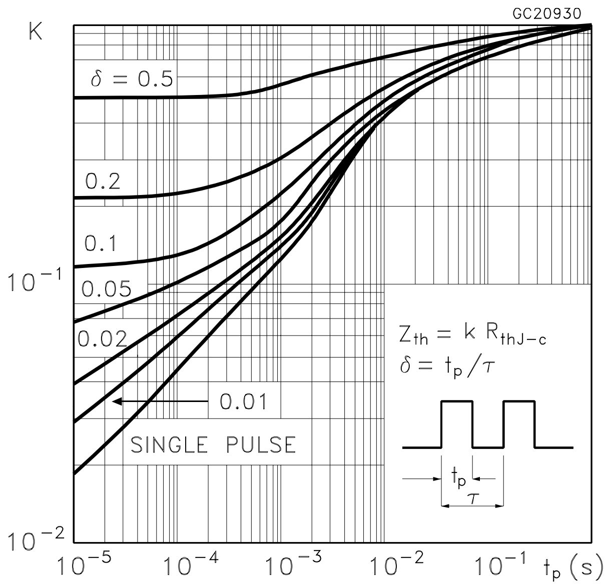


Figure 21: Thermal impedance for diode



3 Test circuits

Figure 22: Test circuit for inductive load switching

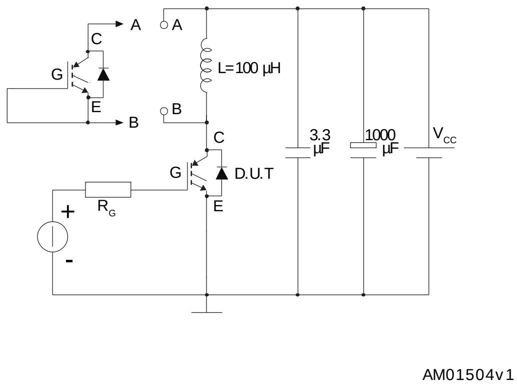


Figure 23: Test circuit for snubbed inductive load switching

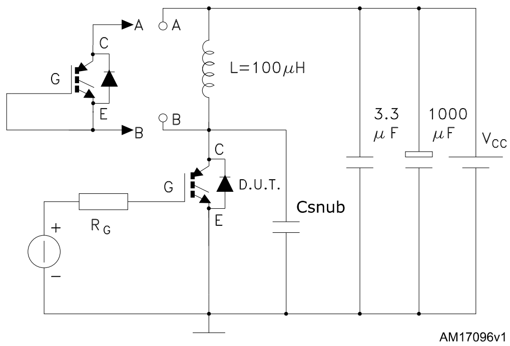


Figure 24: Gate charge test circuit

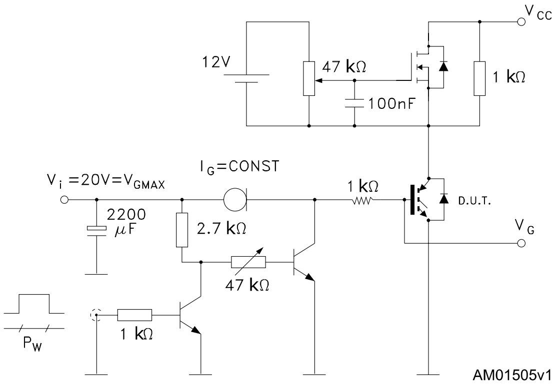
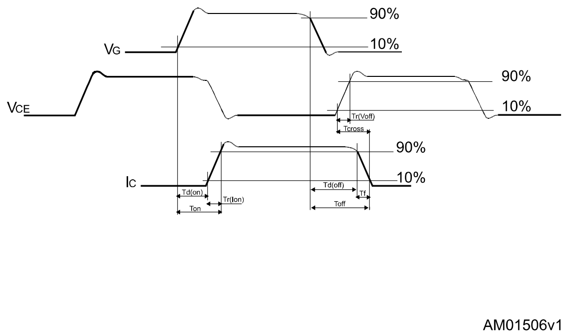


Figure 25: Switching waveform



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 26: TO-247 long leads package outline

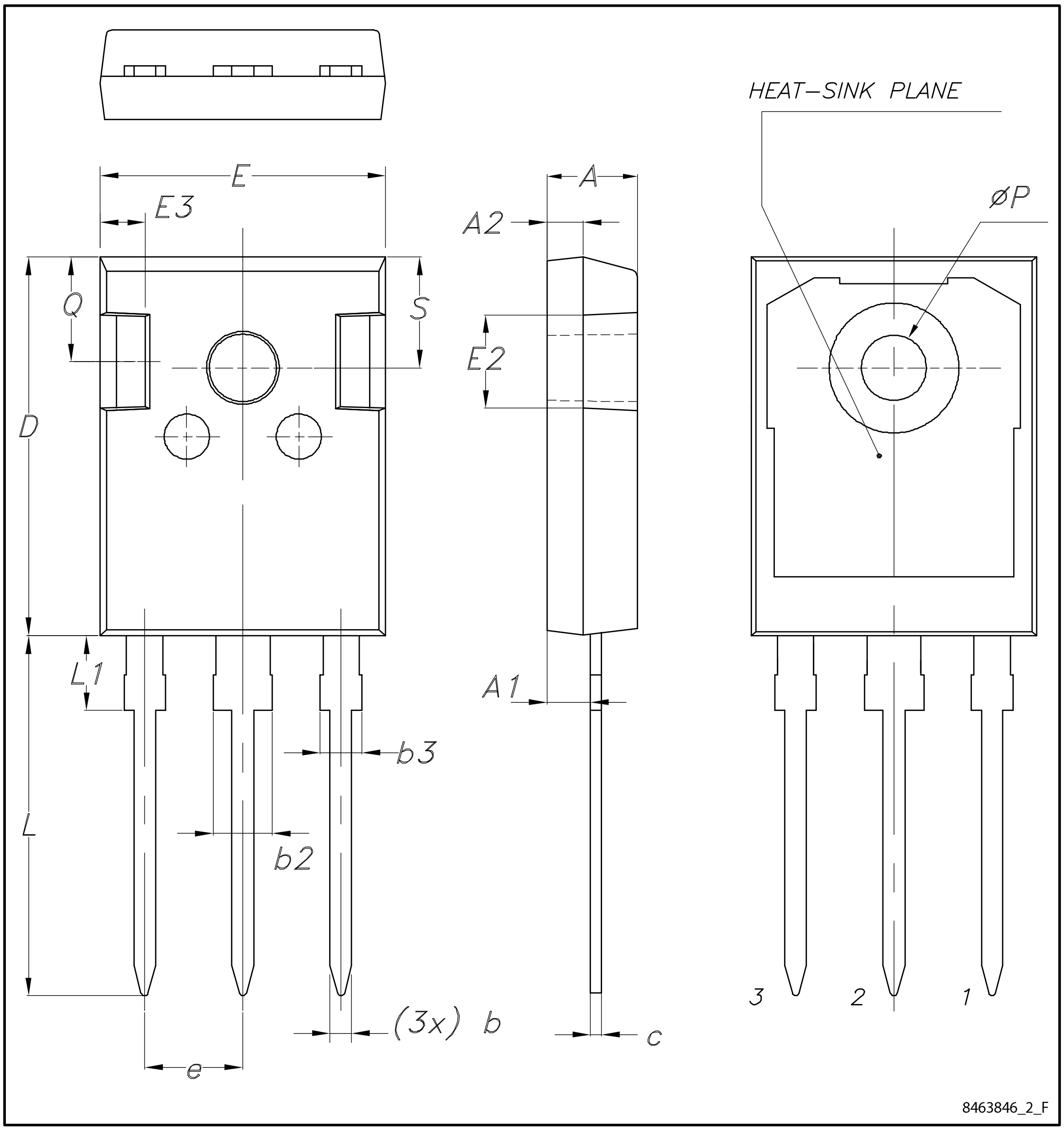


Table 8: TO-247 long leads package mechanical data

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

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
02-Sep-2016	1	First release.
05-Oct-2017	2	Modified title, silhouette, features and description. Modified *Table 2: "Absolute maximum ratings"*, *Table 3: "Thermal data"*, *Table 4: "Static characteristics"*, *Table 5: "Dynamic characteristics"*, *Table 6: "IGBT switching characteristics (inductive load)"* and *Table 7: "IGBT switching characteristics (snubbed inductive load)"*. Added *Section 2.1: "Electrical characteristics (curves)"*. Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY