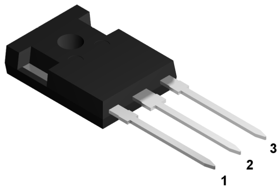
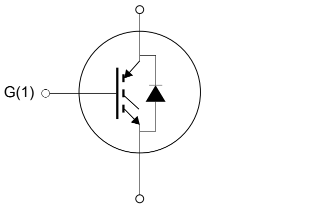
Trench gate field-stop 1350 V, 25 A, soft-switching IH2 series IGBT in a TO-247 long leads package



TO-247 long leads



Features

- Designed for soft-commutation
- Maximum junction temperature: T_J = 175 °C
- $V_{CE(sat)}$ = 1.7 V (typ.) at I_C = 20 A
- Minimized tail current
- Tight parameter distribution
- Low thermal resistance
- Very low drop and soft recovery co-packaged diode
- Positive $V_{CE(sat)}$ temperature coefficient

Applications

- Induction heating
- Resonant converters
- Microwave ovens

Description

The newest IGBT 1350 V IH2 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
STGWA25IH135DF2

Product summary	
Order code	STGWA25IH135DF2
Marking	G25IH135DF2
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)	13520	V
I_C	Continuous collector current at T_C = 25 °C	50	A
	Continuous collector current at T_C = 100 °C	25	
I_{CP}	Pulsed collector current	100	
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage (tp ≤ 10 μs, D < 0.01)	±25	
I_F	Continuous forward current at T_C = 25 °C	43	A
	Continuous forward current at T_C = 100 °C	25	
I_{FP}	Pulsed forward current	100	
P_{TOT}	Total power dissipation at T_C = 25 °C	340	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case, IGBT	0.36	°C/W
	Thermal resistance, junction-to-case, diode	0.97	
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

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 = 1 mA	1350			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A		1.7	2.2	V
		V_{GE} = 15 V, I_C = 20 A, T_J = 125 °C		1.9		
		V_{GE} = 15 V, I_C = 20 A, T_J = 175 °C		2.1		
V_F	Forward on-voltage	I_F = 20 A		1.15		V
		I_F = 20 A, T_J = 125 °C		1.10		
		I_F = 20 A, T_J = 175 °C		1.10		
$V_{GE(th)}$	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} = 1350 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	-	1858	-	pF
C_{oes}	Output capacitance		-	87	-	
C_{res}	Reverse transfer capacitance		-	41	-	
Q_g	Total gate charge	V_{CC} = 1080 V, I_C = 20 A, V_{GE} = 0 to 15 V (see Figure 25. Gate charge test circuit)	-	166	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	
Q_{gc}	Gate-collector charge		-	60	-	

Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CC} = 600 V, I_C = 20 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 23. Test circuit for inductive load switching)	-	245	-	ns
t_f	Current fall time		-	165	-	ns
E_{off} (1)	Turn-off switching energy		-	1.0	-	mJ
$t_{d(off)}$	Turn-off delay time	V_{CC} = 600 V, I_C = 20 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see Figure 23. Test circuit for inductive load switching)	-	275	-	ns
t_f	Current fall time		-	361	-	ns
E_{off} (1)	Turn-off switching energy		-	1.9	-	mJ

1. *Including the tail of the collector current.*

Table 6. IGBT switching characteristics (capacitive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off}[(1)]	Turn-off switching energy	V_{CC} = 900 V, V_{GE} = 15 V, R_G = 10 Ω, I_C = 40 A, L = 500 µH, Csn = 330 nF (see Figure 24. Test circuit for snubbed inductive load switching)	-	398	-	µJ
		V_{CC} = 900 V, V_{GE} = 15 V, R_G = 10 Ω, I_C = 40 A, L = 500 µH, Csn = 330 nF, T_J = 175 °C (see Figure 24. Test circuit for snubbed inductive load switching)	-	830	-	

1. *Including the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Total power dissipation vs temperature

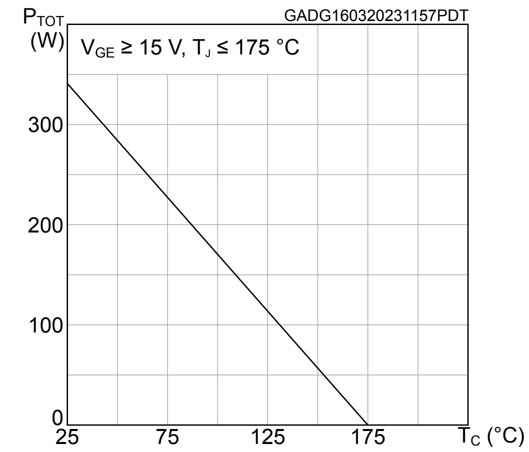


Figure 2. Collector current vs temperature

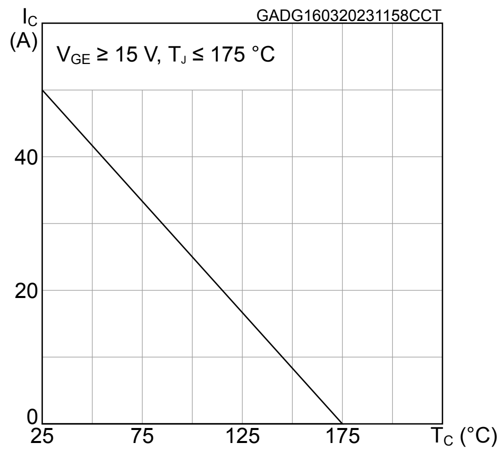


Figure 3. Typical output characteristics (T_J = 25 °C)

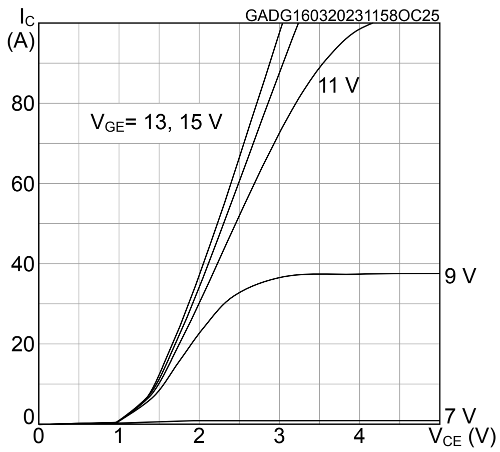


Figure 4. Typical output characteristics (T_J = 175 °C)

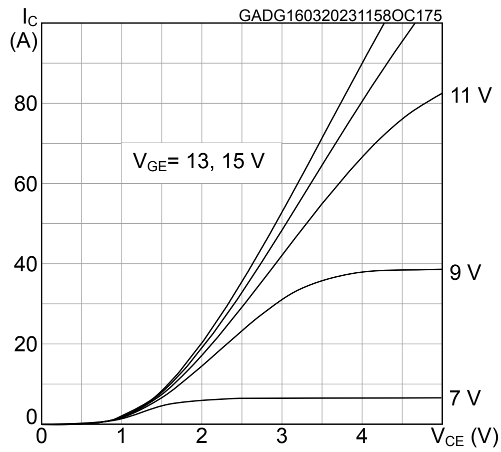


Figure 5. Typical $V_{CE(sat)}$ vs temperature

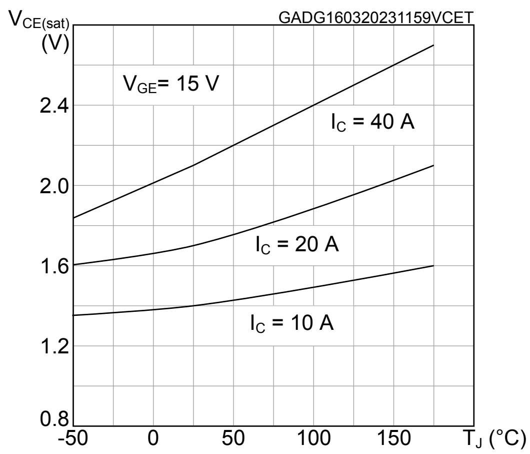


Figure 6. Typical $V_{CE(sat)}$ vs collector current

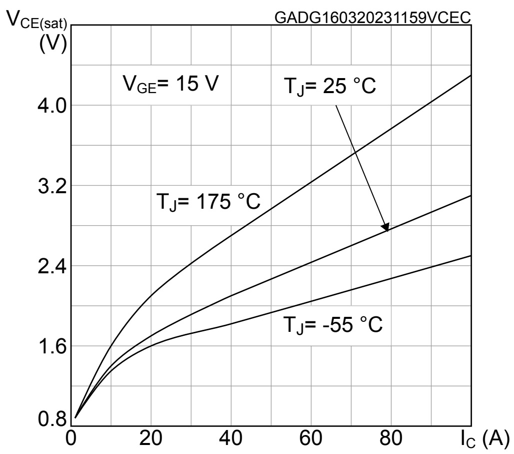


Figure 7. Forward bias safe operating area

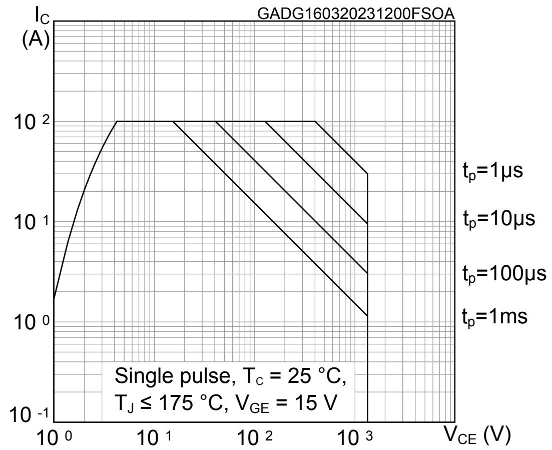


Figure 8. Transfer characteristics

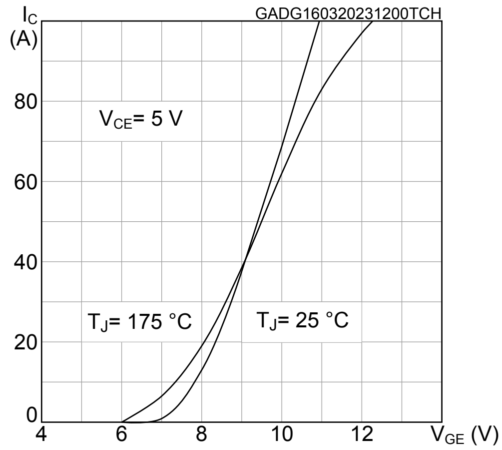


Figure 9. Typical diode V_F vs forward current

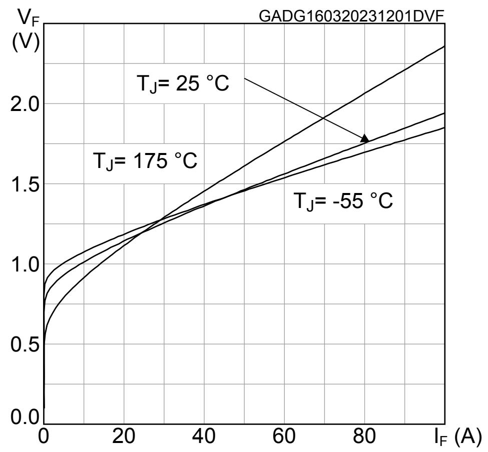


Figure 10. Normalized $V_{GE(th)}$ vs temperature

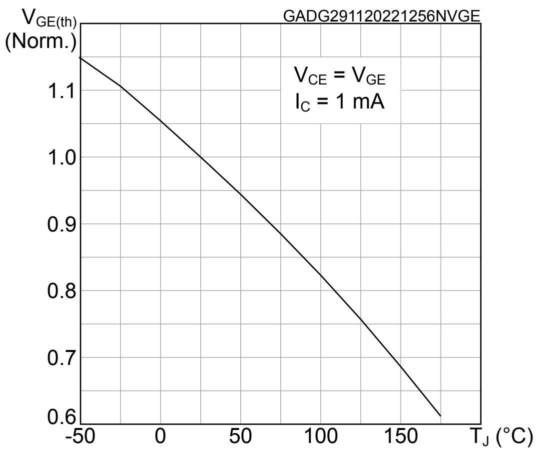


Figure 11. Normalized $V_{(BR)CES}$ vs temperature

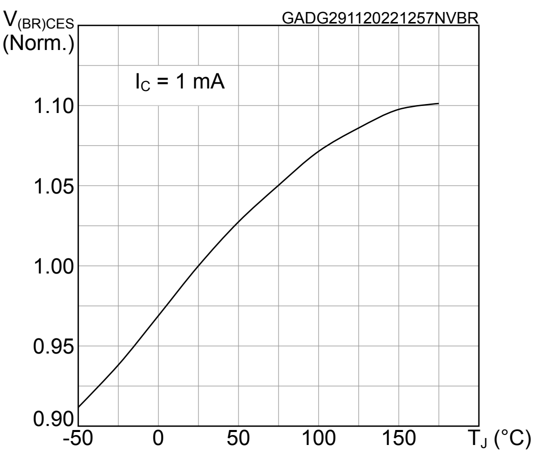


Figure 12. Typical capacitance characteristics

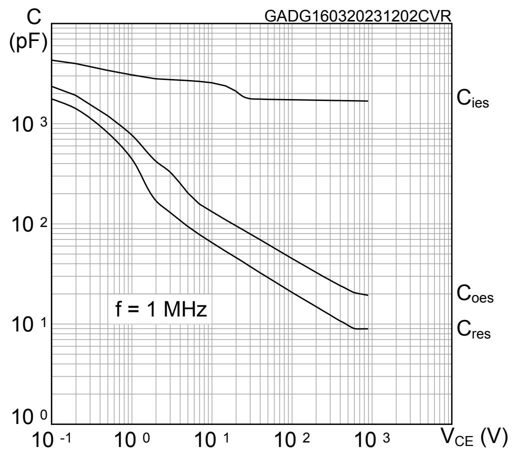


Figure 13. Typical gate charge characteristics

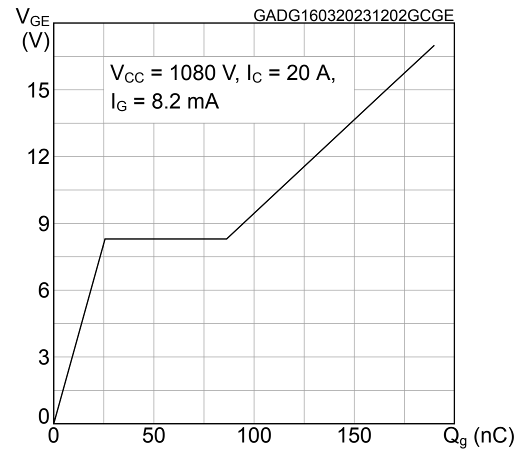


Figure 14. Typical switching energy vs collector current

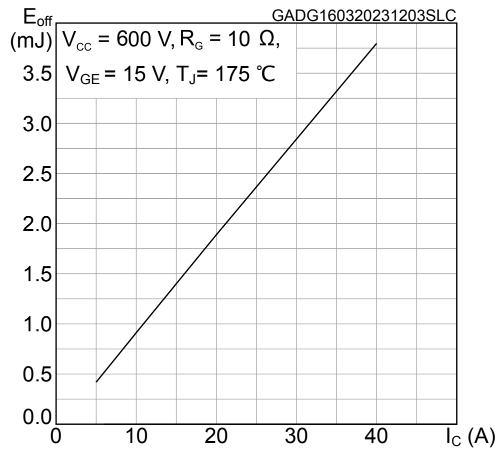


Figure 15. Typical switching energy vs temperature

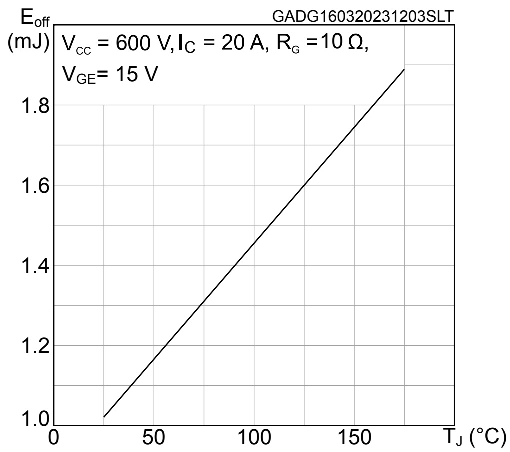


Figure 16. Typical switching energy vs collector emitter voltage

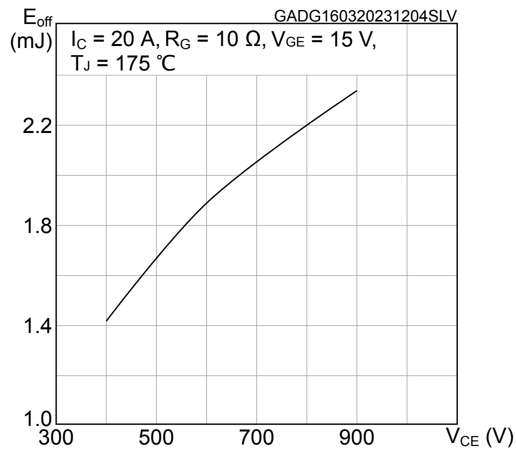


Figure 17. Typical switching energy vs gate resistance

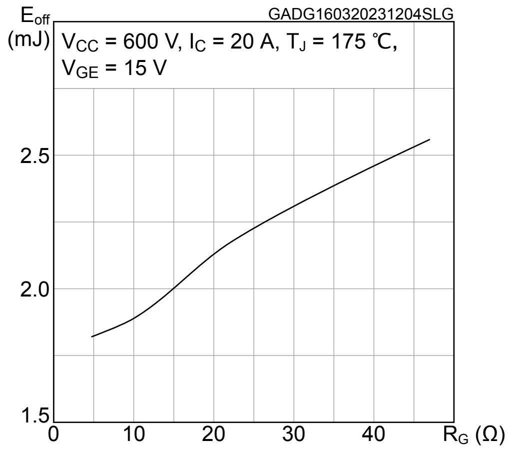


Figure 18. Typical switching times vs collector current

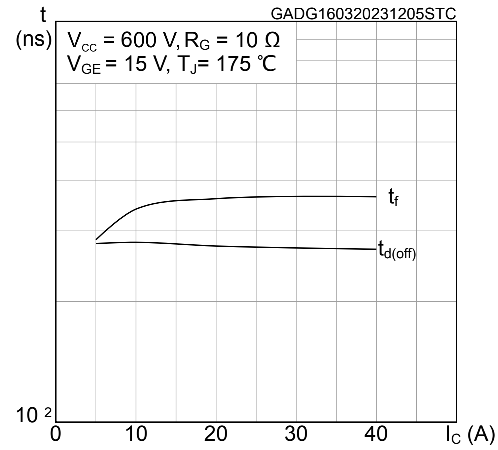


Figure 19. Typical switching times vs gate resistance

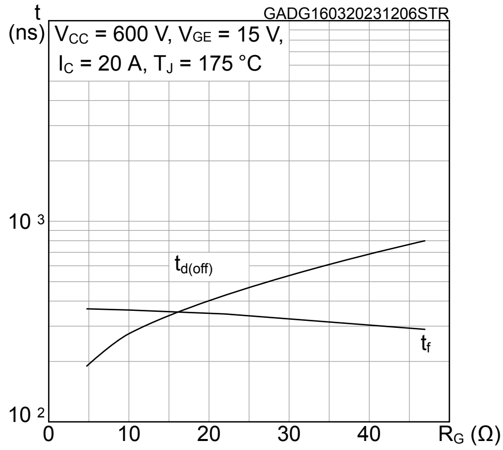


Figure 20. Typical switching energy vs snubber capacitance

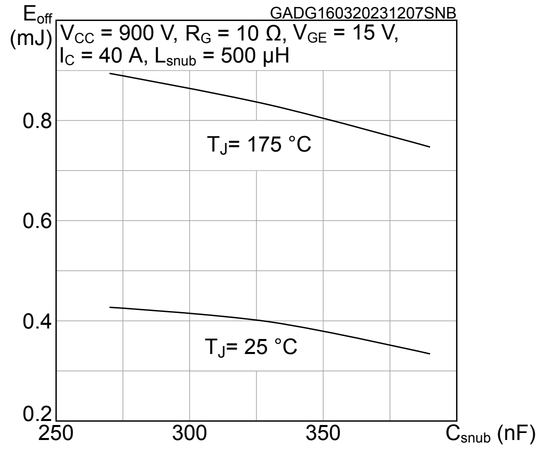


Figure 21. Maximum transient thermal impedance for IGBT

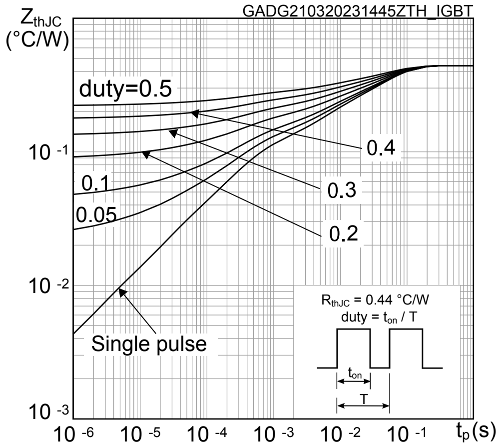
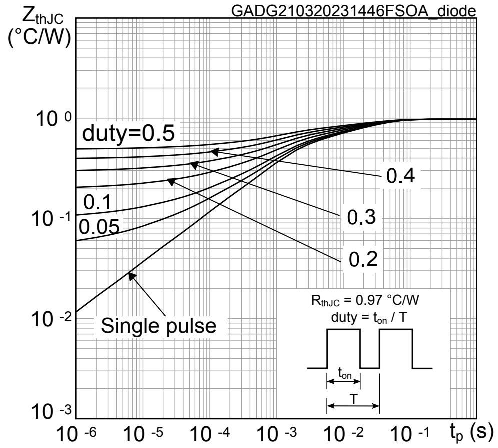


Figure 22. Maximum transient thermal impedance for diode



3 Test circuits

Figure 23. Test circuit for inductive load switching

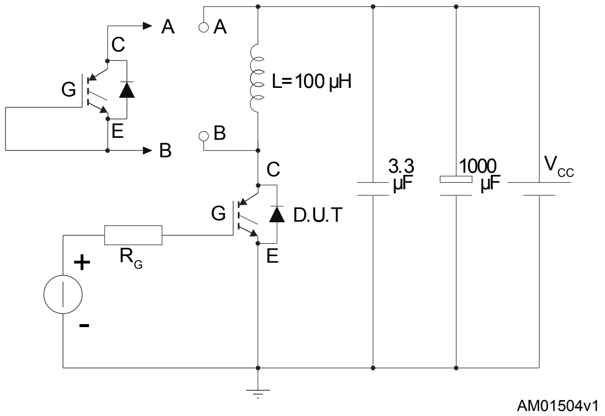


Figure 24. Test circuit for snubbed inductive load switching

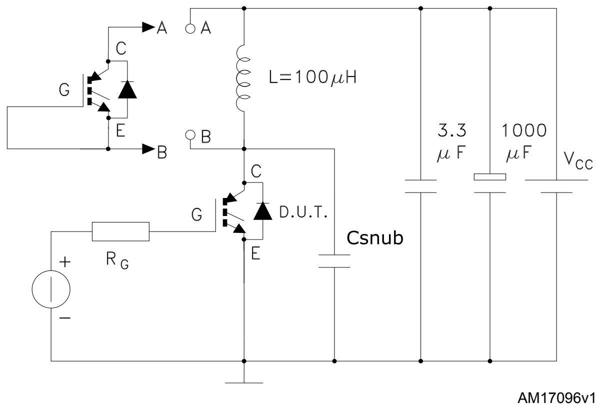


Figure 25. Gate charge test circuit

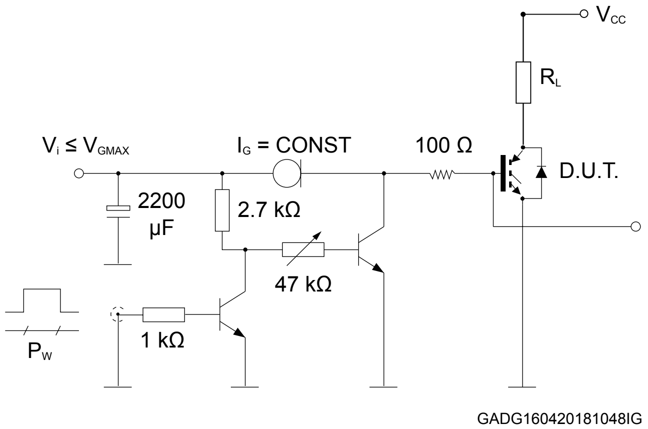
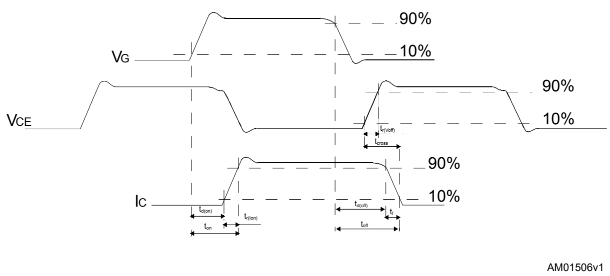


Figure 26. Switching waveform



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 27. **TO-247 long leads package outline**

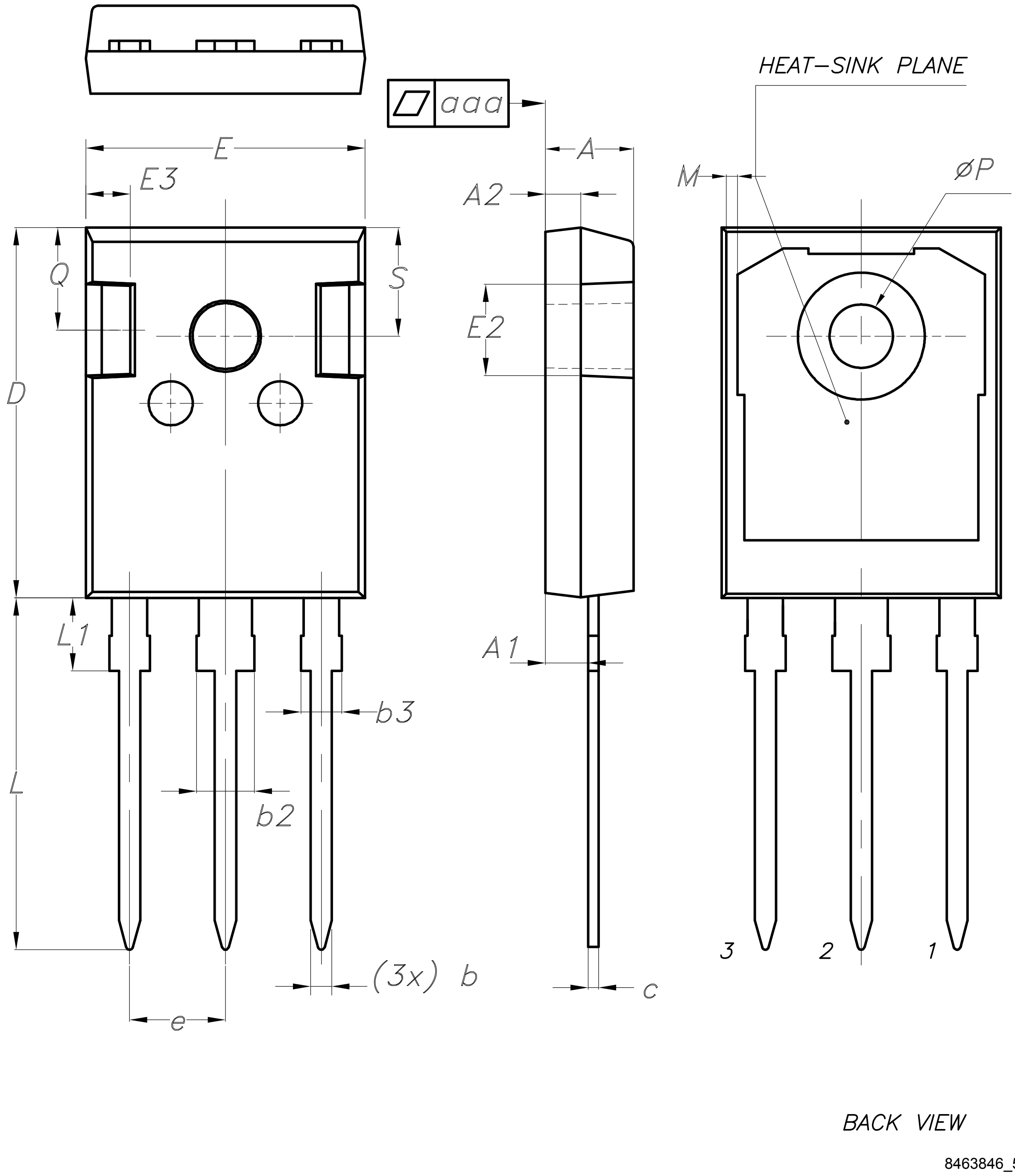


Table 7. TO-247 long leads package mechanical data

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
M	0.35		0.95
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25
aaa		0.04	0.10

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
16-Mar-2023	1	First release.
15-Dec-2023	2	Updated Table 1. Absolute maximum ratings.

Contents