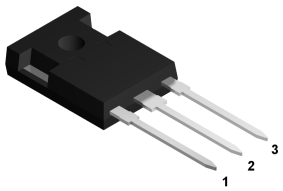
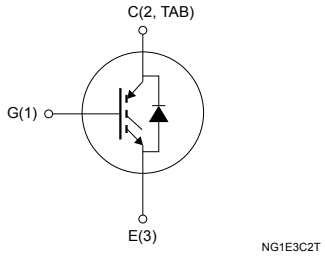
STGWA50IH65R

Datasheet

Reverse-conducting 650 V, 50 A, soft-switching IHR series IGBT in a TO-247 long leads package



TO-247 long leads



Features

- Designed for soft-commutation only
- Maximum junction temperature: T_J = 175 °C
- $V_{CE(sat)}$ = 1.45 V (typ.) @ I_C = 50 A
- Minimized tail current
- Tight parameter distribution
- Low thermal resistance
- Monolithic integrated diode with low voltage drop
- Positive $V_{CE(sat)}$ temperature coefficient

Applications

- Induction cooking
- Resonant converter
- Microwave ovens

Description

The new reverse-conducting IGBT 650 V has been developed using an advanced proprietary trench gate field-stop structure with monolithic integrated body diode, whose performances are optimized both in conduction and switching losses for soft commutation.

The result is a product specifically designed to maximize efficiency for any resonant and soft-switching applications.

Product status link
STGWA50IH65R

Product summary	
Order code	STGWA50IH65R
Marking	G50IH65R
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	97	A
	Continuous collector current at T_C = 100 °C	61	
I_{CP}(1)	Pulsed collector current	200	A
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage (t_p ≤ 10 µs), D < 0.01	±30	
I_F	Continuous forward current at T_C = 25 °C	86	A
	Continuous forward current at T_C = 100 °C	52	
I_{FP}(1)	Pulsed forward current	200	A
P_{TOT}	Total power dissipation at T_C = 25 °C	306	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range	- 55 to 175	°C

1. *Pulse width limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case, IGBT	0.49	°C/W
	Thermal resistance, junction-to-case, diode	0.7	
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	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A		1.45	1.75	V
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C		1.65		
		V_{GE} = 15 V, I_C = 50 A, T_J = 175 °C		1.75		
V_F	Forward on-voltage	I_F = 50 A		1.45	1.75	V
		I_F = 50 A, T_J = 125 °C		1.50		
		I_F = 50 A, T_J = 175 °C		1.55		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	4.5	5.5	6.5	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	-	2949	-	pF
C_{oes}	Output capacitance		-	102	-	pF
C_{res}	Reverse transfer capacitance		-	80	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 50 A, V_{GE} = 0 to 15 V (see Figure 25. Gate charge test circuit)	-	154	-	nC
Q_{ge}	Gate-emitter charge		-	23	-	nC
Q_{gc}	Gate-collector charge		-	77	-	nC

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 V, I_C = 50 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 23. Test circuit for inductive load switching)	-	177	-	ns
t_f	Current fall time		-	38	-	ns
E_{off}	Turn-off switching energy		-	736	-	µJ
$t_{d(off)}$	Turn-off-delay time	V_{CC} = 400 V, I_C = 50 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 175 °C (see Figure 23. Test circuit for inductive load switching)	-	208	-	ns
t_f	Current fall time		-	75	-	ns
E_{off}	Turn-off switching energy		-	1070	-	µJ

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_{snub} = 22 nF V_{CC} = 400 V, R_G = 10 Ω, I_C = 50 A (see Figure 24. Test circuit for snubbed inductive load switching)	-	236	-	µJ
		L = 100 µH, C_{snub} = 22 nF, V_{CC} = 400 V, R_G = 10 Ω, I_C = 50 A, T_J = 175 °C (see Figure 24. Test circuit for snubbed inductive load switching)	-	474	-	

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

2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs case temperature

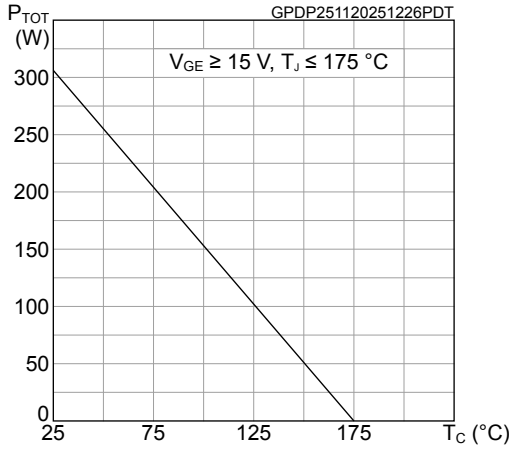


Figure 2. Collector current vs case temperature

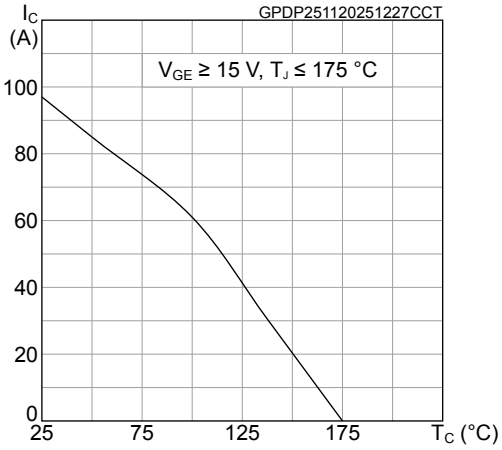


Figure 3. Output characteristics (T_J = 25 °C)

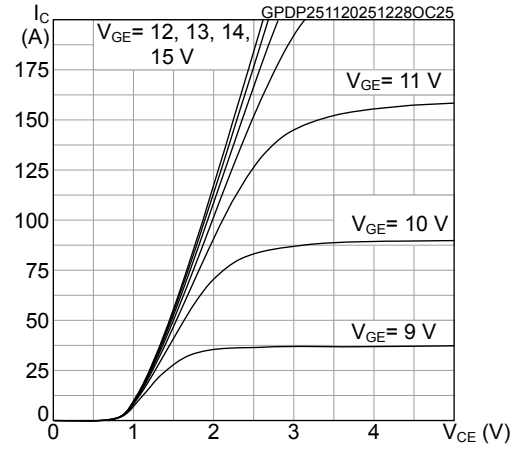


Figure 4. Output characteristics (T_J = 175 °C)

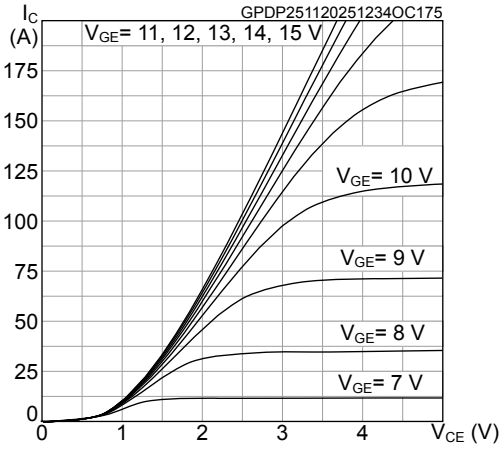


Figure 5. $V_{CE(sat)}$ vs junction temperature

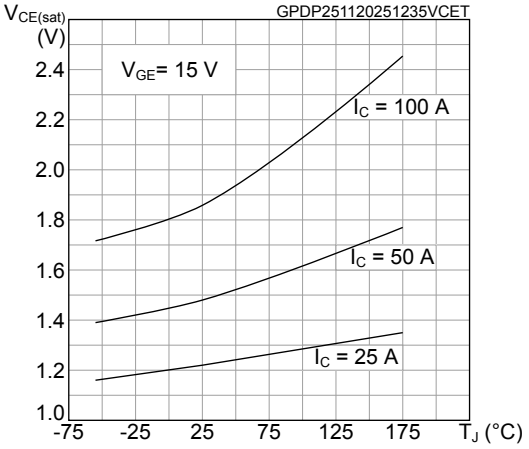


Figure 6. $V_{CE(sat)}$ vs collector current

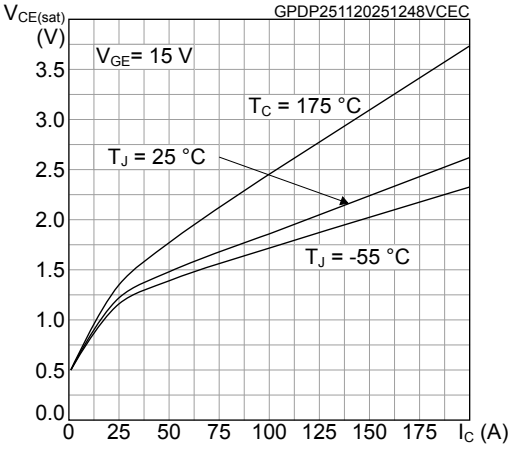


Figure 7. Forward bias safe operating area

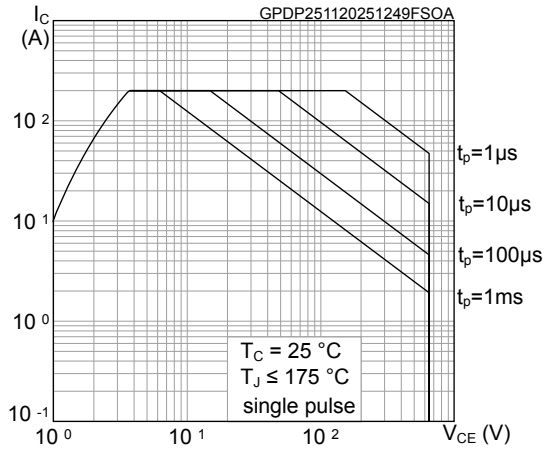


Figure 8. Transfer characteristics

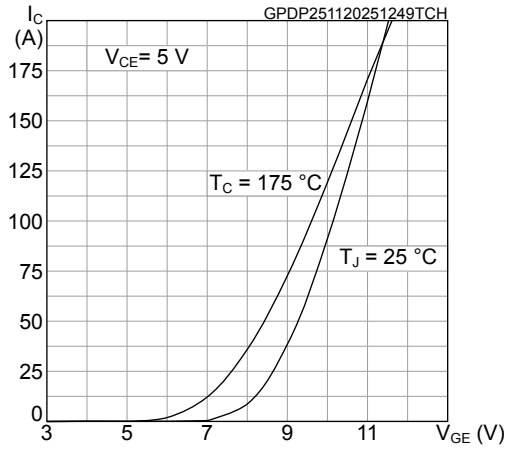


Figure 9. Diode V_F vs forward current

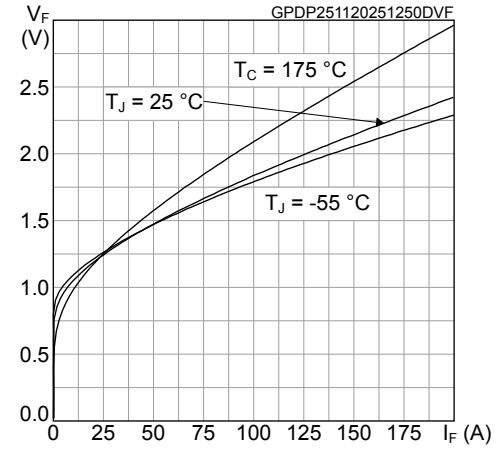


Figure 10. Normalized $V_{GE(th)}$ vs junction temperature

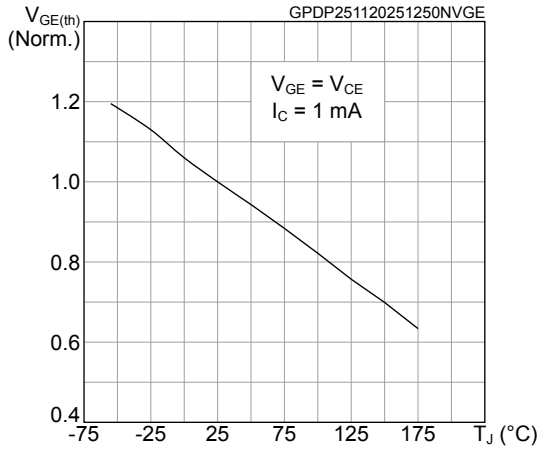


Figure 11. Normalized $V_{(BR)CES}$ vs junction temperature

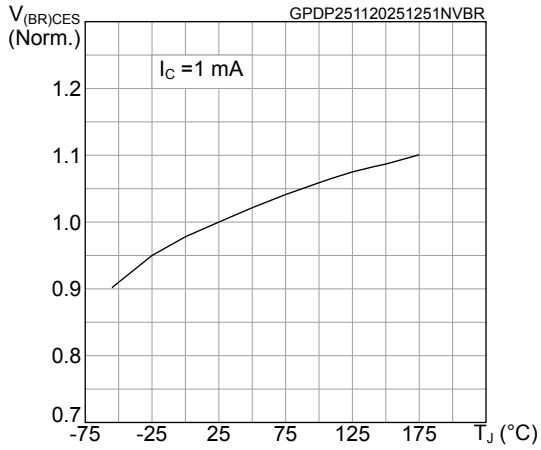


Figure 12. Capacitance variations

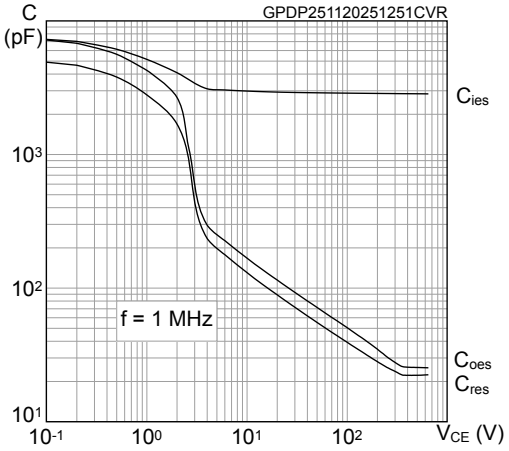


Figure 13. Gate charge vs gate-emitter voltage

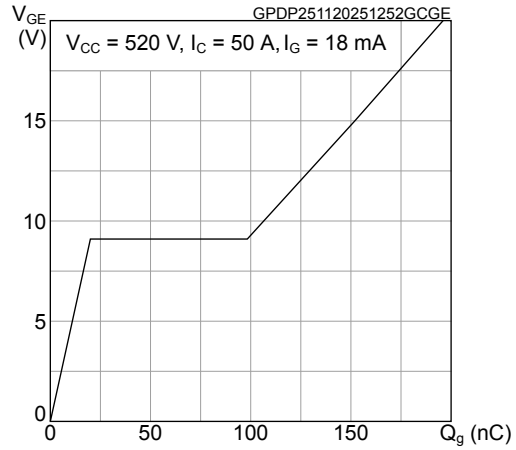


Figure 14. Switching energy vs collector current

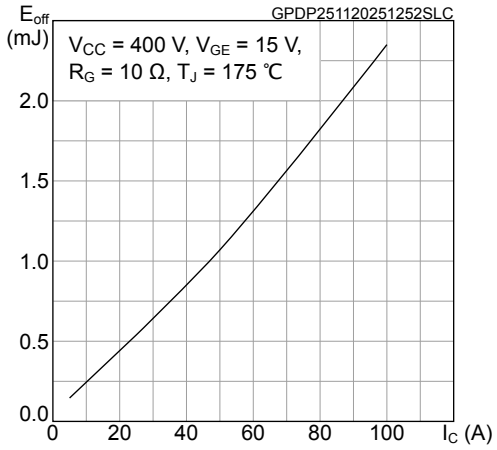


Figure 15. Switching energy vs temperature

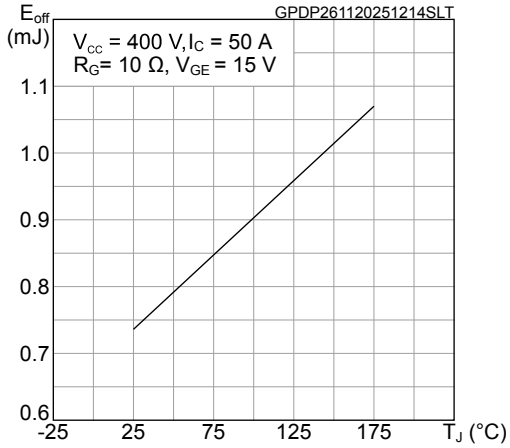


Figure 16. Switching energy vs collector-emitter voltage

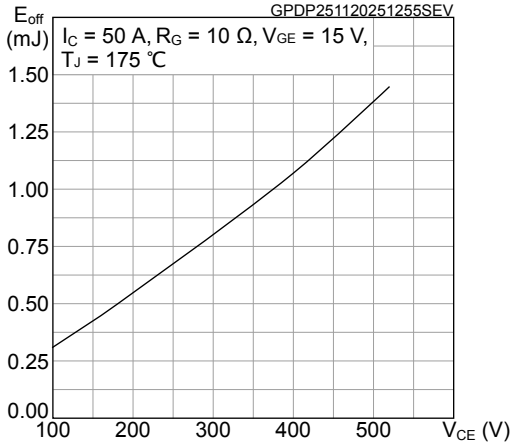


Figure 17. Switching energy vs gate resistance

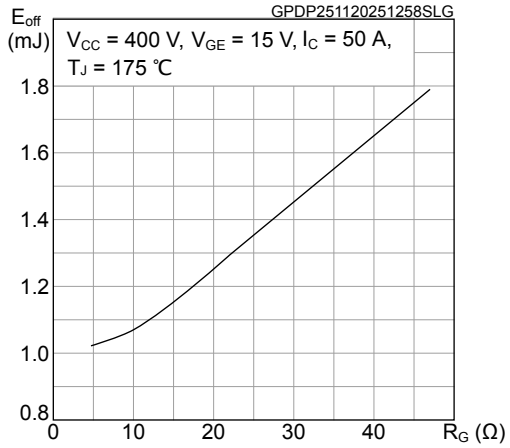


Figure 18. Switching times vs collector current

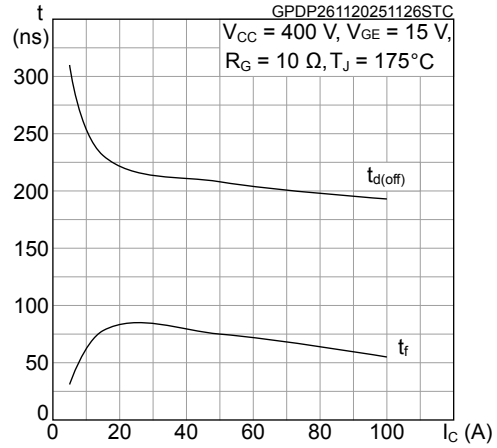


Figure 19. Switching times vs. gate resistance

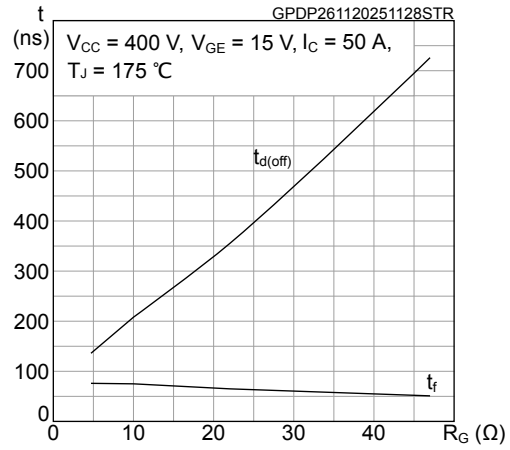


Figure 20. Switching energy vs snubber capacitance

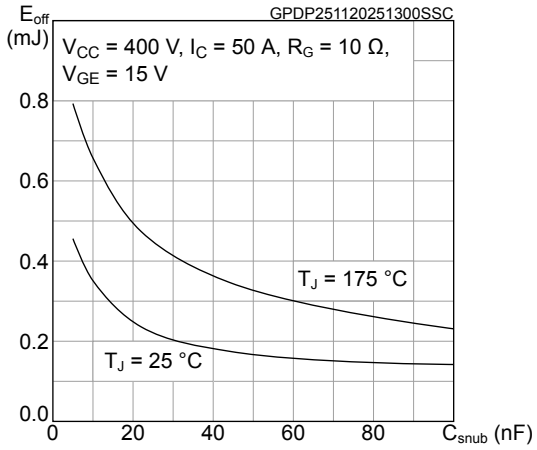


Figure 21. Diode maximum transient thermal impedance

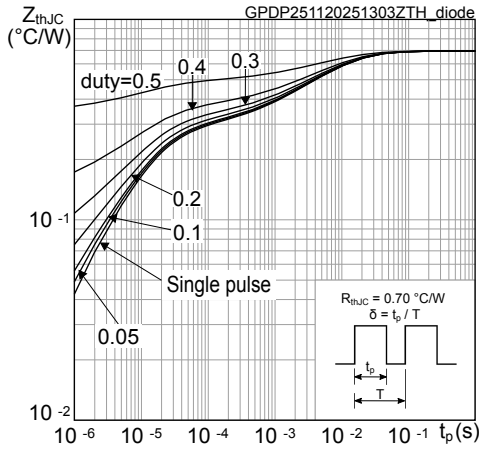
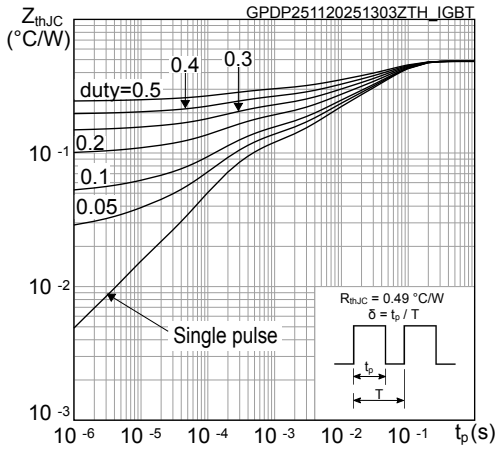


Figure 22. IGBT maximum transient thermal impedance



3 Test circuits

Figure 23. Test circuit for inductive load switching

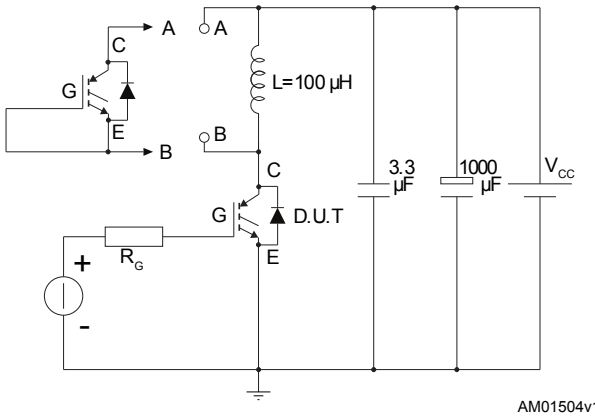


Figure 24. Test circuit for snubbed inductive load switching

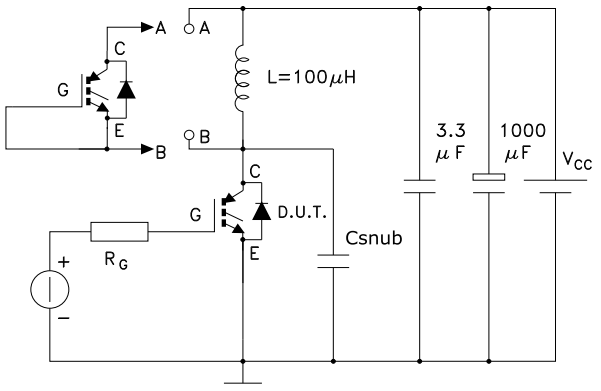


Figure 25. Gate charge test circuit

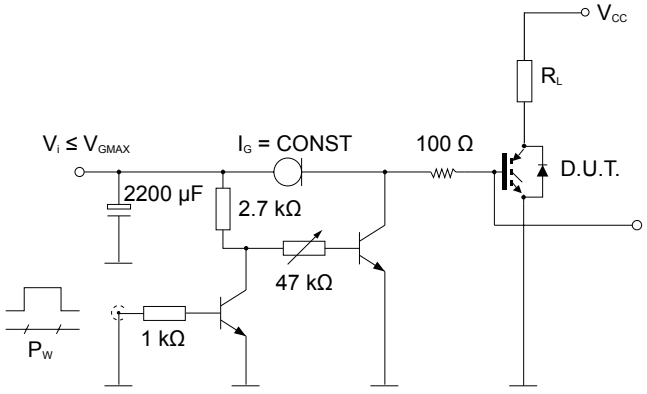
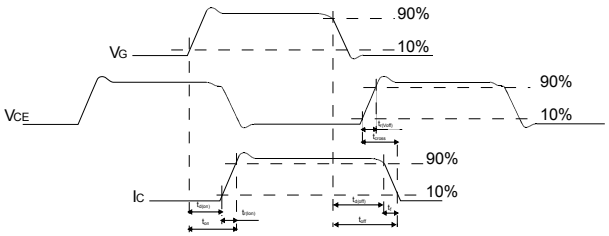


Figure 26. Switching waveform



4 Package information

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

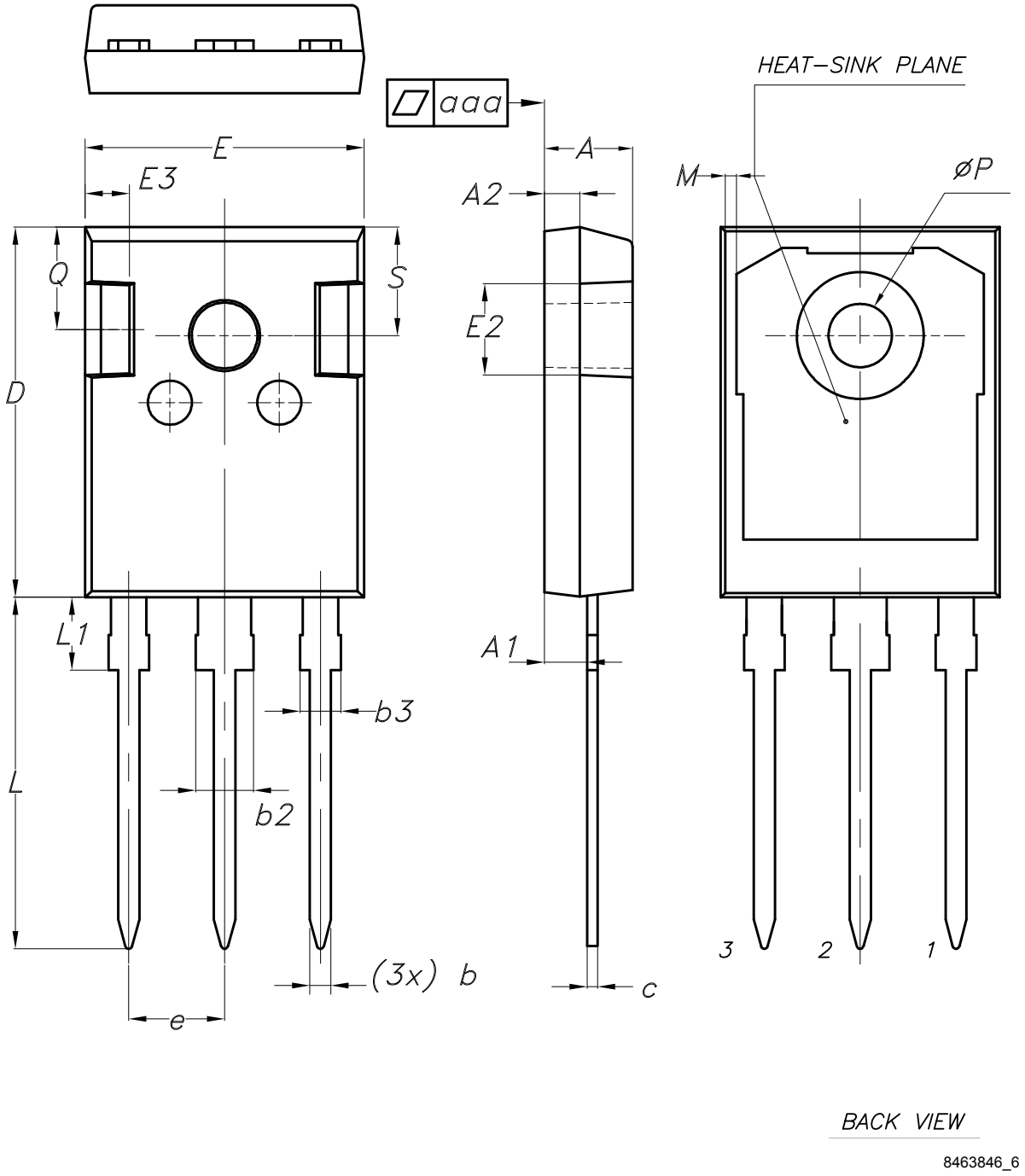


Table 7. **TO-247 long leads package mechanical data**

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
01-Dec-2025	1	First release.

Contents

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