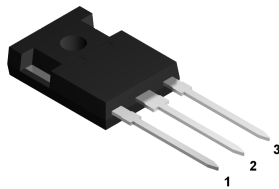
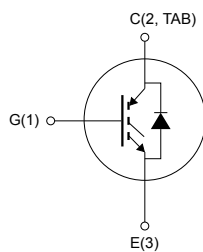


## Trench gate field-stop 1350 V, 25 A, soft-switching IH2 series IGBT in a TO-247 long leads package



TO-247 long leads



NG1E3C2T



### Features

- Designed for soft-commutation
- Maximum junction temperature:  $T_J = 175\text{ °C}$
- $V_{CE(sat)} = 1.7\text{ V}$  (typ.) at  $I_C = 20\text{ A}$
- 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

<b>Order code</b>	STGWA25IH135DF2
<b>Marking</b>	G25IH135DF2
<b>Package</b>	TO-247 long leads
<b>Packing</b>	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )	13520	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	50	A
	Continuous collector current at $T_C = 100\text{ °C}$	25	
$I_{CP}$	Pulsed collector current	100	
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage ( $t_p \leq 10\text{ }\mu\text{s}$ , $D < 0.01$ )	$\pm 25$	
$I_F$	Continuous forward current at $T_C = 25\text{ °C}$	43	A
	Continuous forward current at $T_C = 100\text{ °C}$	25	
$I_{FP}$	Pulsed forward current	100	
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	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

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

**Table 3. Static characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1350			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$		1.7	2.2	V
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 125\text{ °C}$		1.9		
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 175\text{ °C}$		2.1		
$V_F$	Forward on-voltage	$I_F = 20\text{ A}$		1.15		V
		$I_F = 20\text{ A}, T_J = 125\text{ °C}$		1.10		
		$I_F = 20\text{ A}, T_J = 175\text{ °C}$		1.10		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	5	6	7	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{ V}, V_{CE} = 1350\text{ V}$			25	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 250$	nA

**Table 4. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	1858	-	pF
$C_{oes}$	Output capacitance		-	87	-	
$C_{res}$	Reverse transfer capacitance		-	41	-	
$Q_g$	Total gate charge	$V_{CC} = 1080\text{ V}, I_C = 20\text{ A},$	-	166	-	nC
$Q_{ge}$	Gate-emitter charge	$V_{GE} = 0\text{ to }15\text{ V}$	-	25	-	
$Q_{gc}$	Gate-collector charge	(see Figure 25. Gate charge test circuit)	-	60	-	

**Table 5. IGBT switching characteristics (inductive load)**

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

1. Including the tail of the collector current.

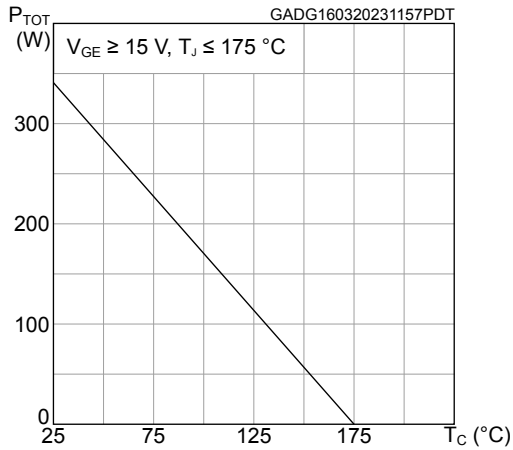
**Table 6. IGBT switching characteristics (capacitive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{\text{off}}^{(1)}$	Turn-off switching energy	$V_{\text{CC}} = 900 \text{ V}$ , $V_{\text{GE}} = 15 \text{ V}$ , $R_{\text{G}} = 10 \text{ } \Omega$ , $I_{\text{C}} = 40 \text{ A}$ , $L = 500 \text{ } \mu\text{H}$ , $C_{\text{sn}} = 330 \text{ nF}$ (see Figure 24. Test circuit for snubbed inductive load switching)	-	398	-	$\mu\text{J}$
		$V_{\text{CC}} = 900 \text{ V}$ , $V_{\text{GE}} = 15 \text{ V}$ , $R_{\text{G}} = 10 \text{ } \Omega$ , $I_{\text{C}} = 40 \text{ A}$ , $L = 500 \text{ } \mu\text{H}$ , $C_{\text{sn}} = 330 \text{ nF}$ , $T_{\text{J}} = 175 \text{ } ^\circ\text{C}$ (see Figure 24. Test circuit for snubbed inductive load switching)	-	830	-	

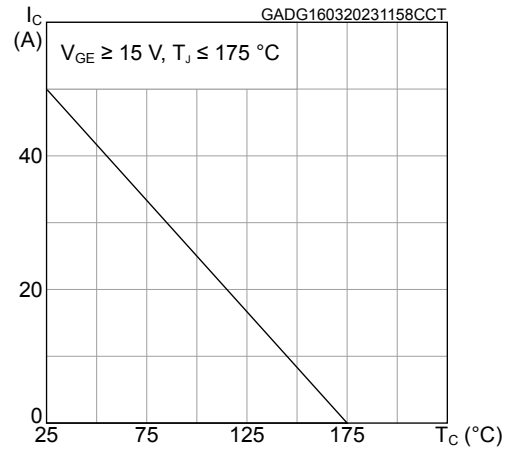
1. Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

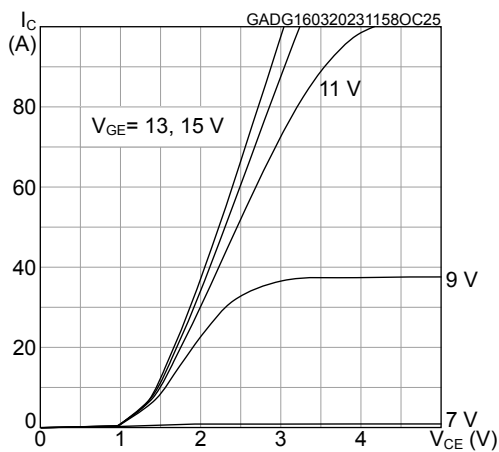
**Figure 1. Total power dissipation vs temperature**



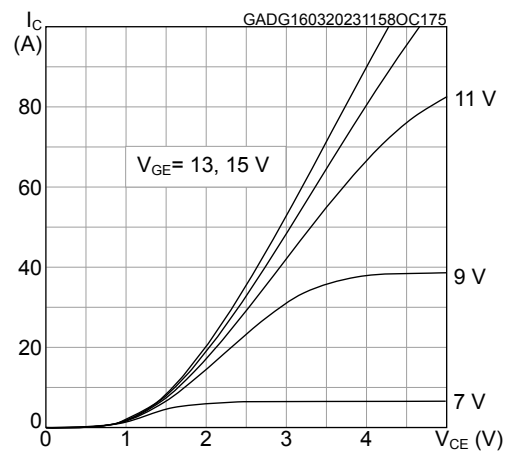
**Figure 2. Collector current vs temperature**



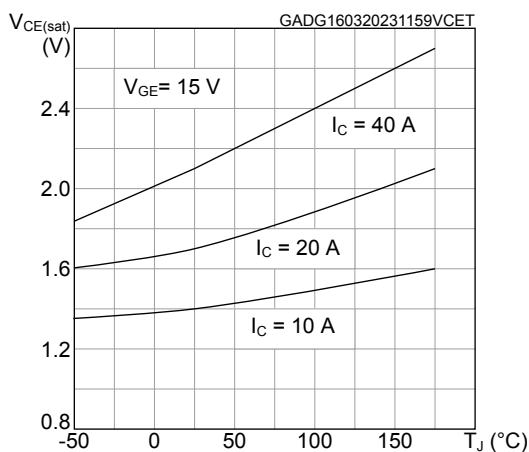
**Figure 3. Typical output characteristics (T<sub>J</sub> = 25 °C)**



**Figure 4. Typical output characteristics (T<sub>J</sub> = 175 °C)**



**Figure 5. Typical V<sub>CE(sat)</sub> vs temperature**



**Figure 6. Typical V<sub>CE(sat)</sub> vs collector current**

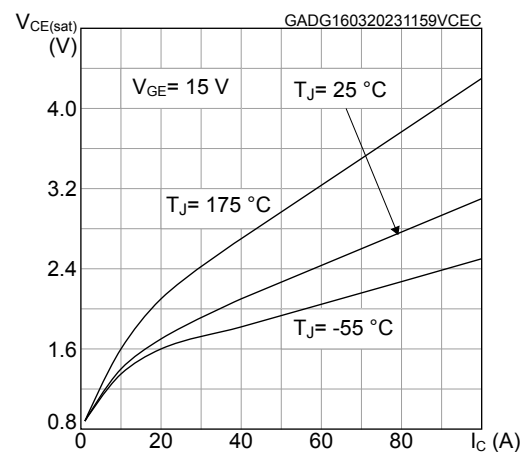


Figure 7. Forward bias safe operating area

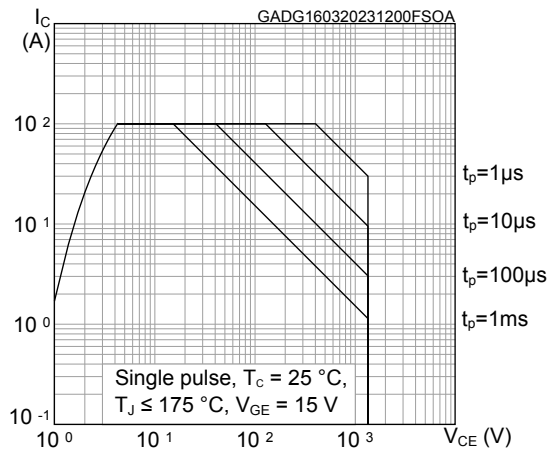


Figure 8. Transfer characteristics

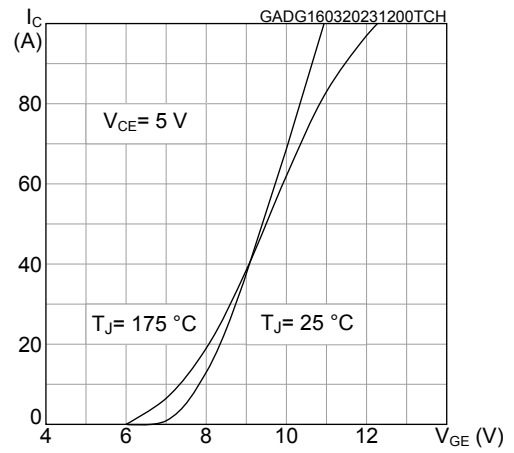


Figure 9. Typical diode  $V_F$  vs forward current

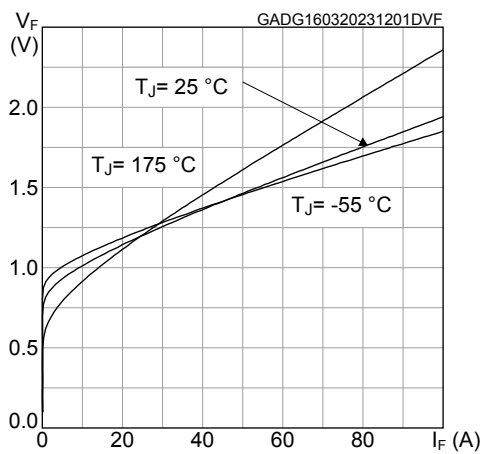


Figure 10. Normalized  $V_{GE(th)}$  vs temperature

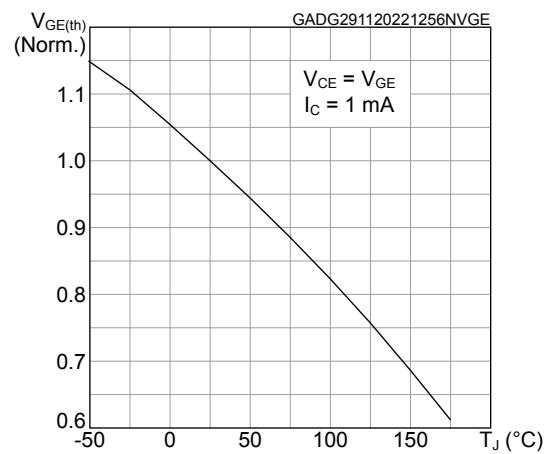


Figure 11. Normalized  $V_{(BR)CES}$  vs temperature

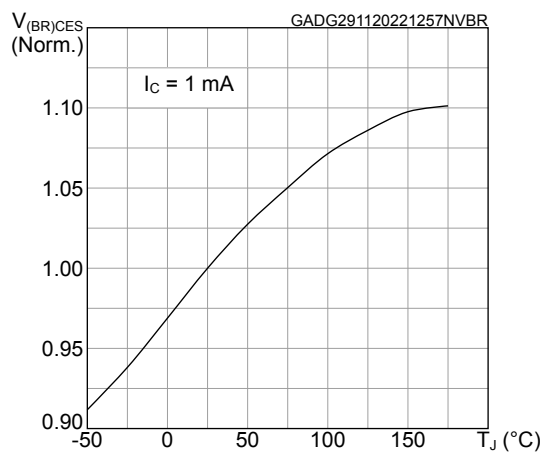


Figure 12. Typical capacitance characteristics

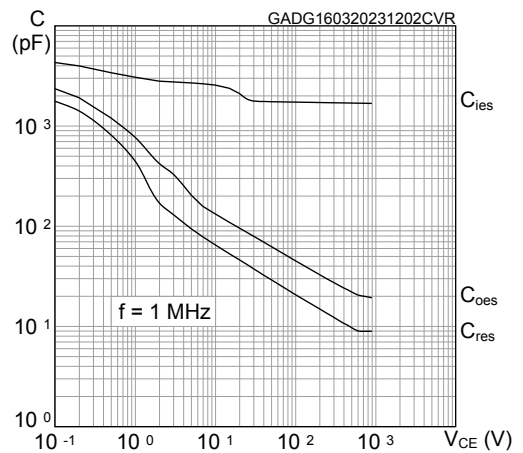


Figure 13. Typical gate charge characteristics

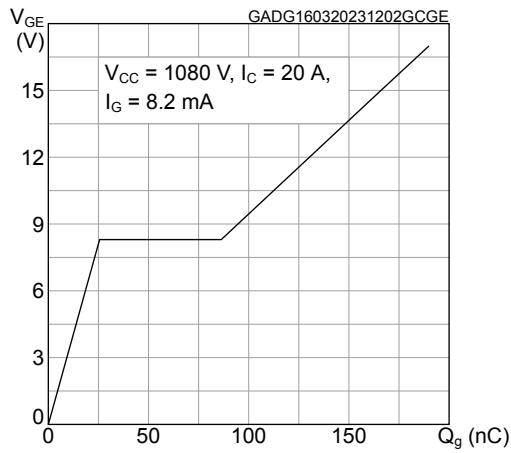


Figure 14. Typical switching energy vs collector current

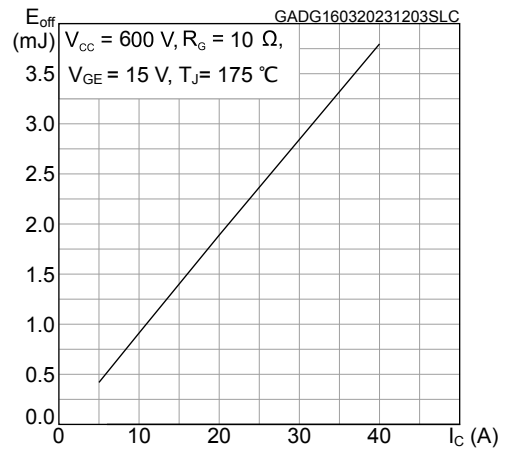


Figure 15. Typical switching energy vs temperature

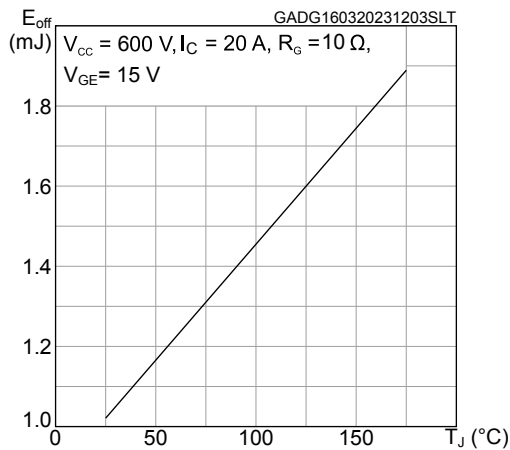


Figure 16. Typical switching energy vs collector emitter voltage

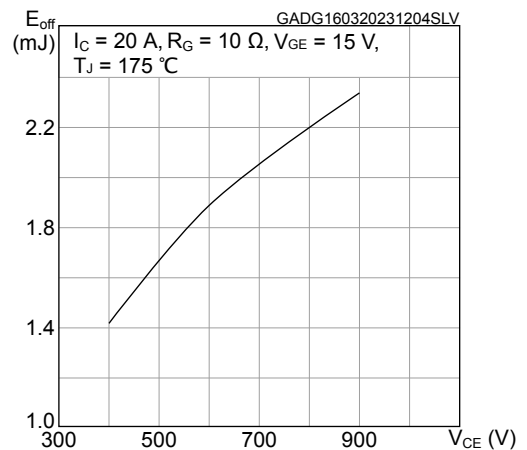


Figure 17. Typical switching energy vs gate resistance

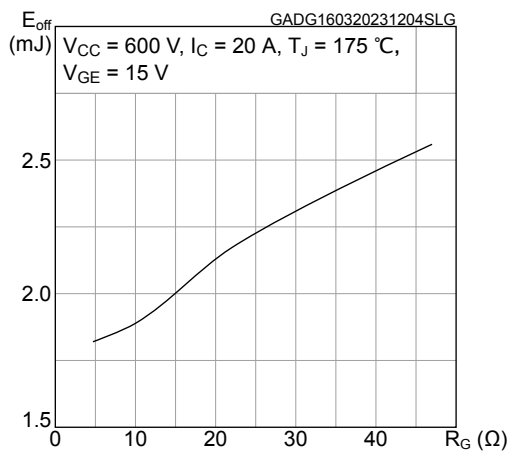


Figure 18. Typical switching times vs collector current

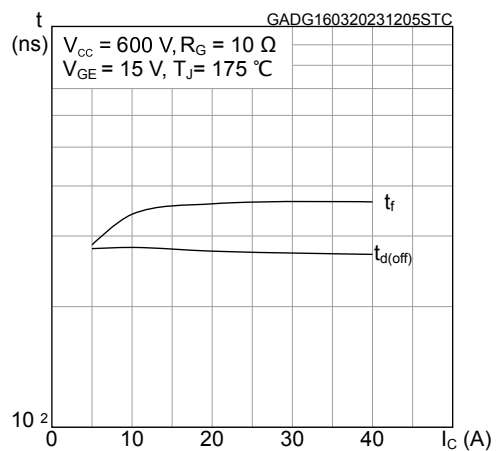


Figure 19. Typical switching times vs gate resistance

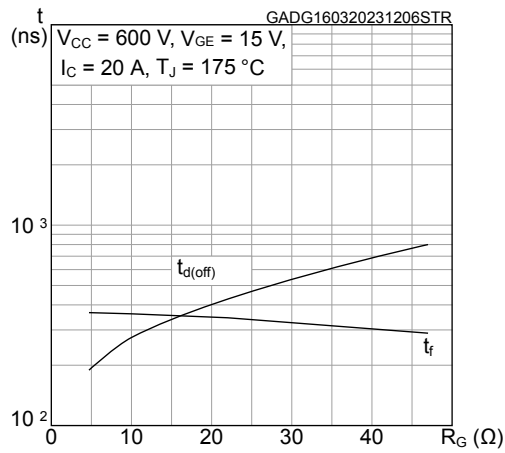


Figure 20. Typical switching energy vs snubber capacitance

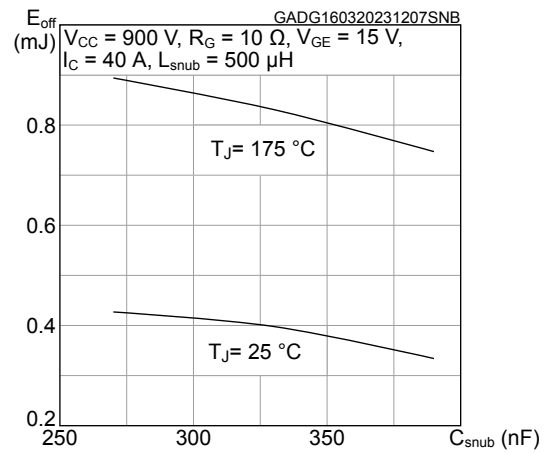


Figure 21. Maximum transient thermal impedance for IGBT

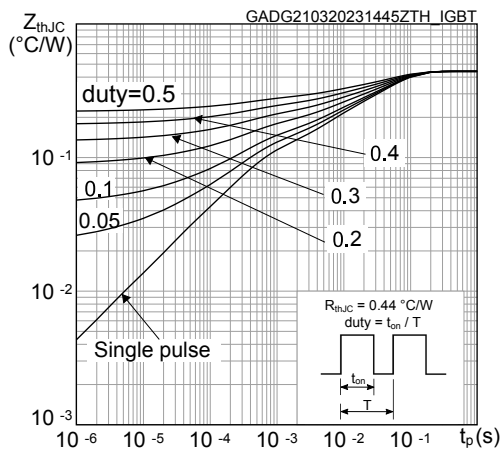
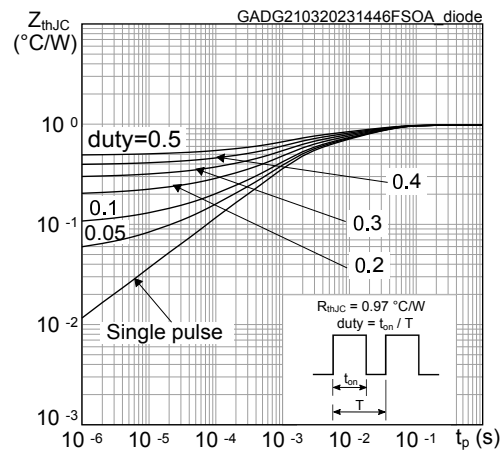
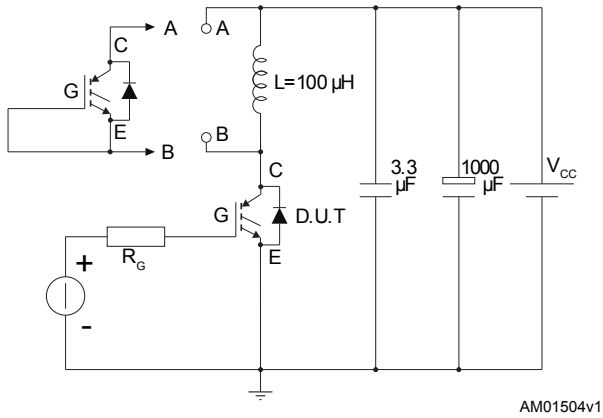
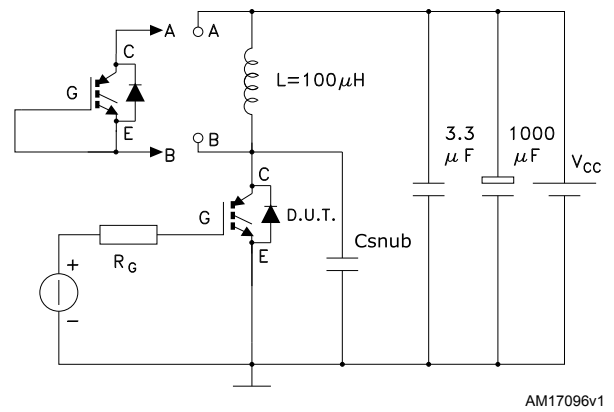
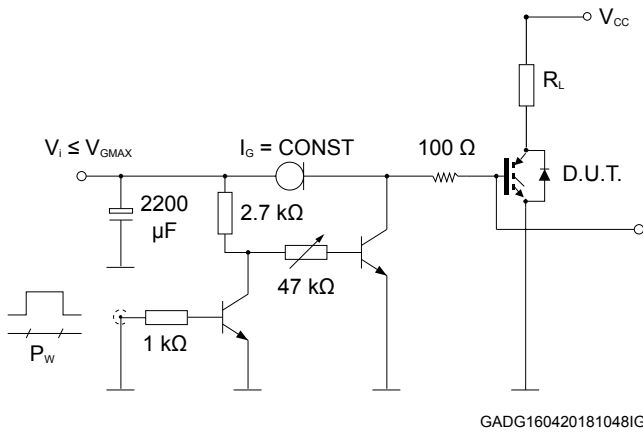
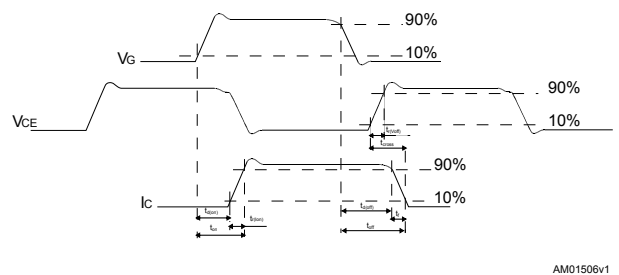


Figure 22. Maximum transient thermal impedance for diode



### 3 Test circuits

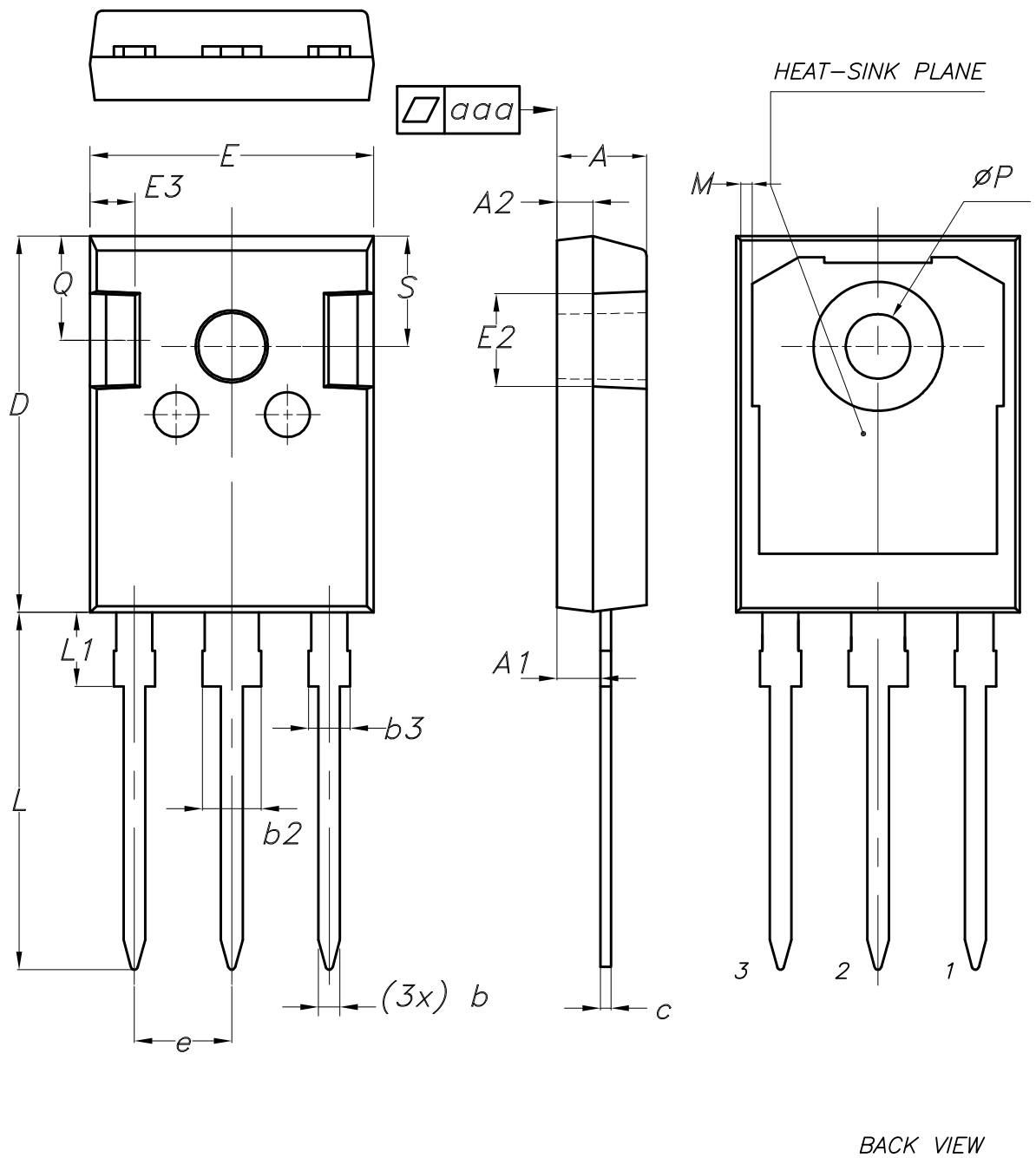
**Figure 23. Test circuit for inductive load switching**

**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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 TO-247 long leads package information

Figure 27. TO-247 long leads package outline



8463846\_5

**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 <a href="#">Table 1</a> . Absolute maximum ratings.

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