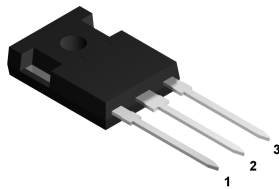
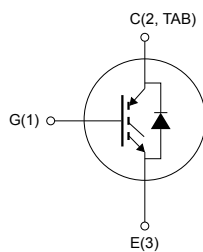


## Trench gate field-stop 1350 V, 25 A, soft-switching IH2 series IGBT in a TO-247 long leads package



TO-247 long leads



NG1E3C2T



### 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

### 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.

# 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 ( $t_p \leq 10$ 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

$T_C = 25\text{ °C}$  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)

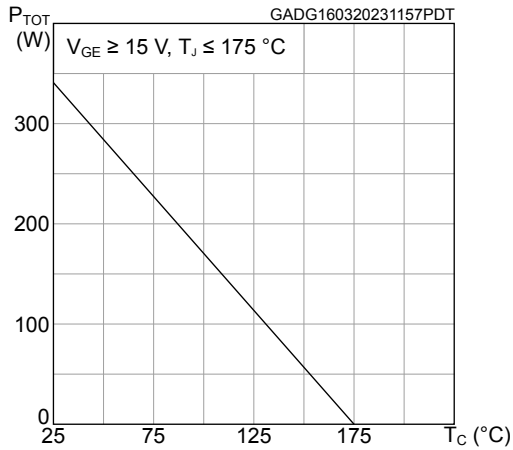
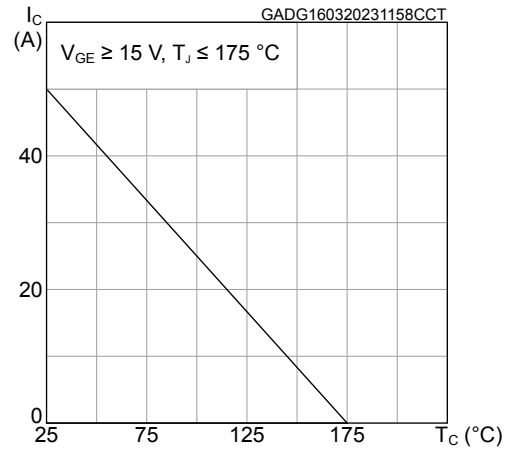
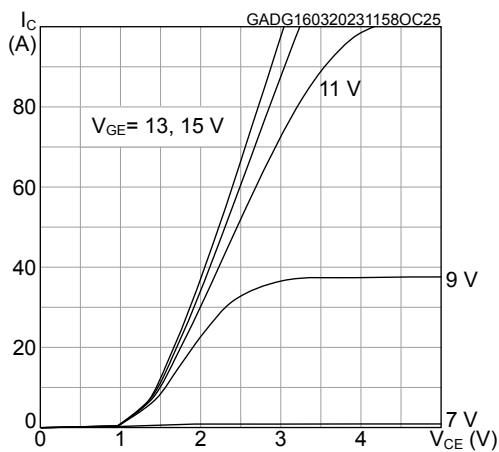
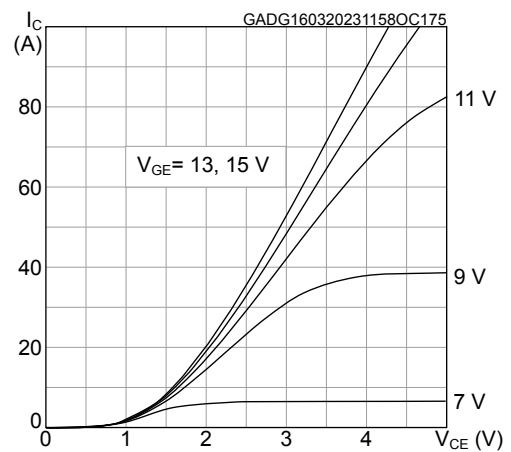
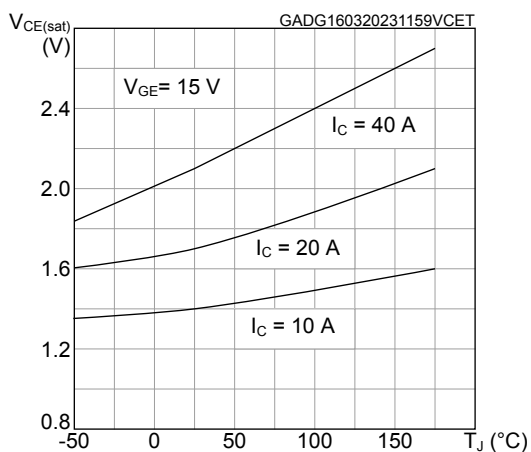
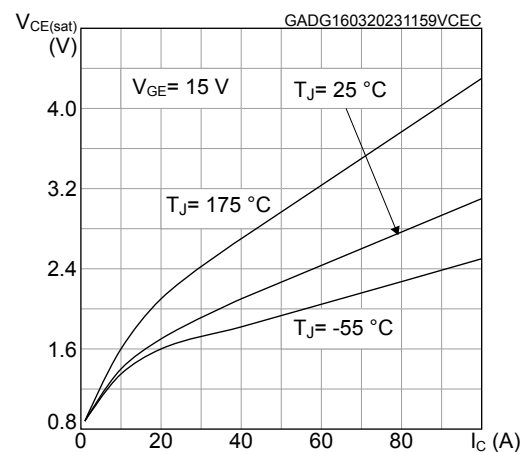
**Figure 1. Total power dissipation vs temperature**

**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

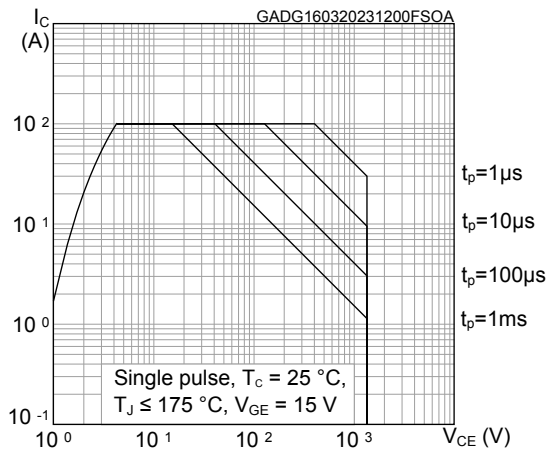


Figure 8. Transfer characteristics

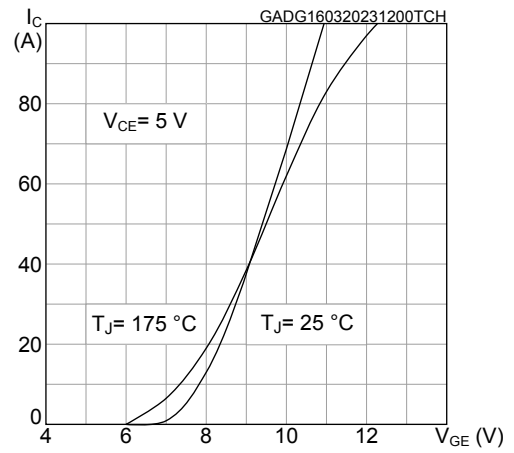


Figure 9. Typical diode  $V_F$  vs forward current

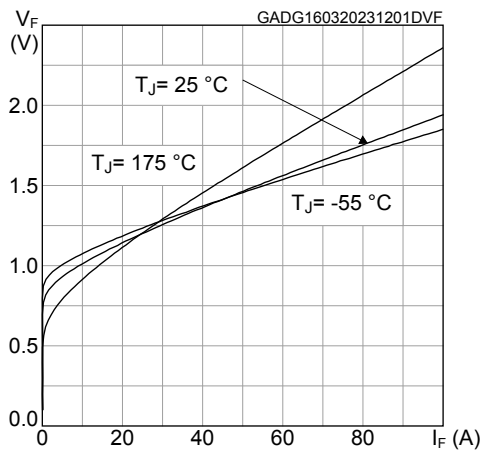


Figure 10. Normalized  $V_{GE(th)}$  vs temperature

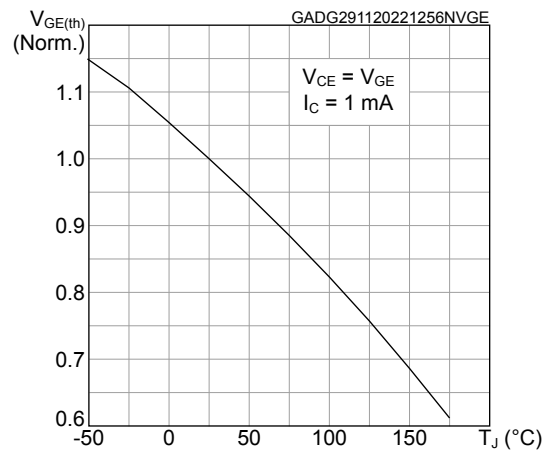


Figure 11. Normalized  $V_{(BR)CES}$  vs temperature

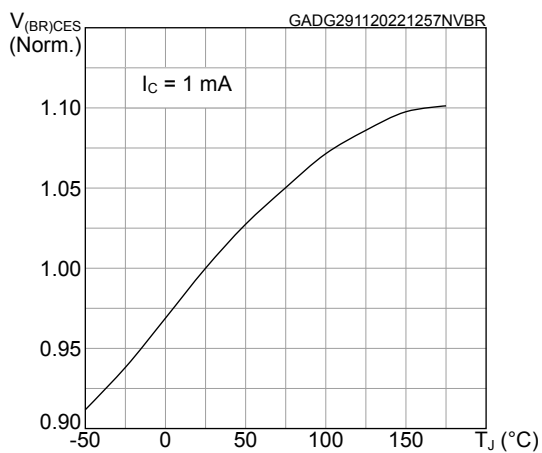
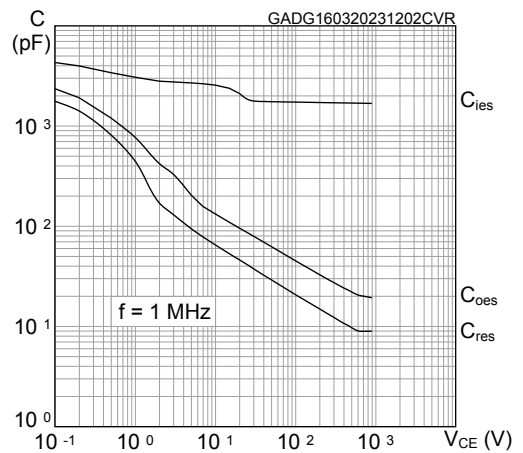
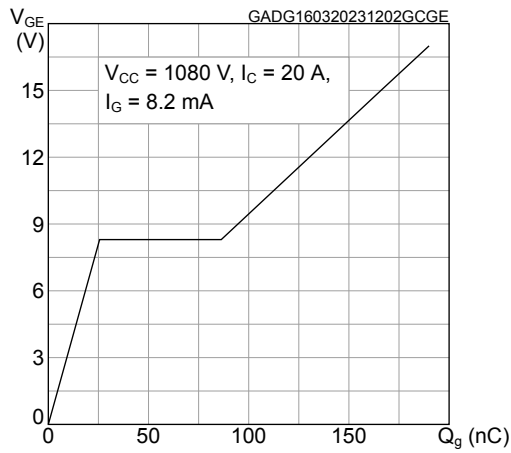
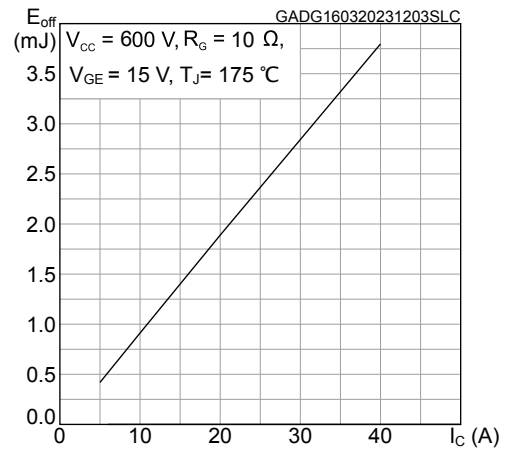
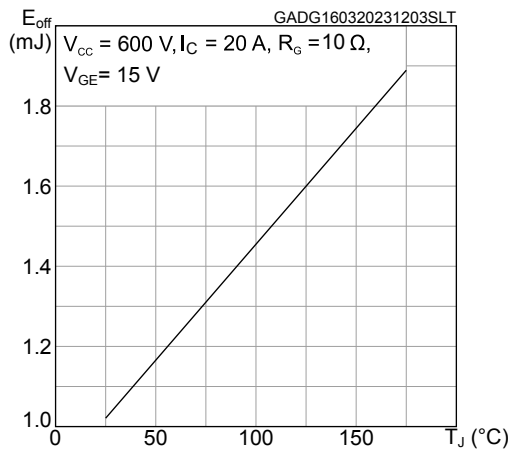
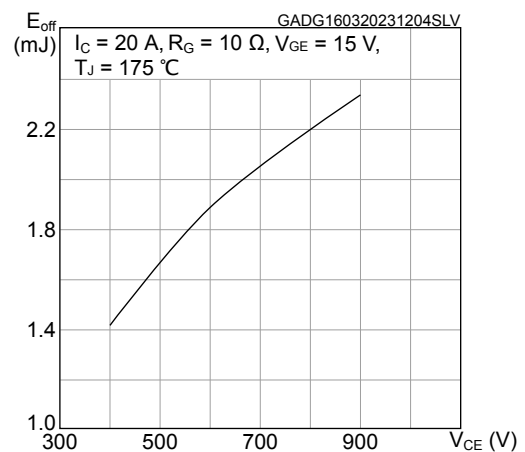
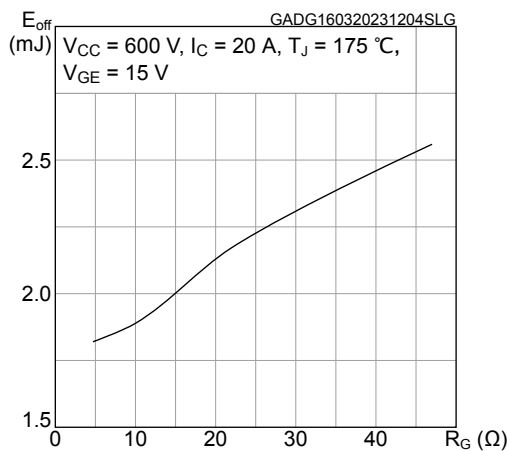
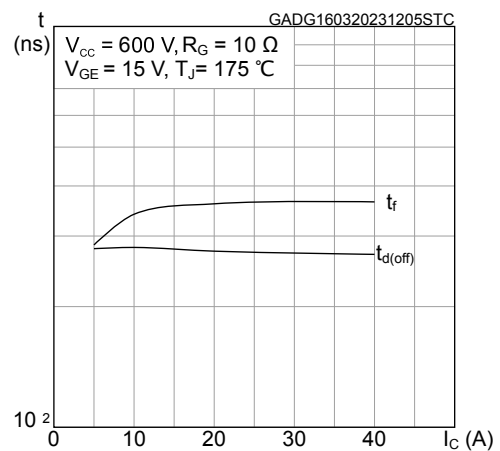
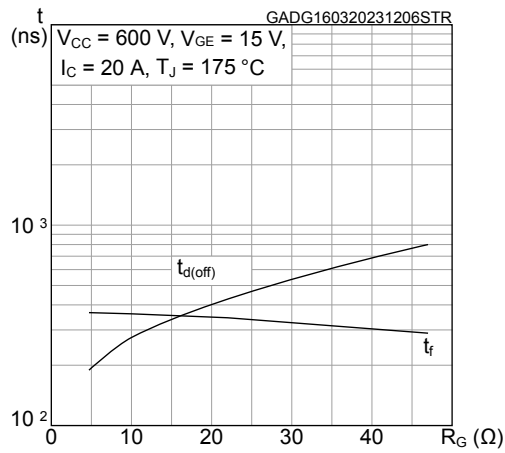
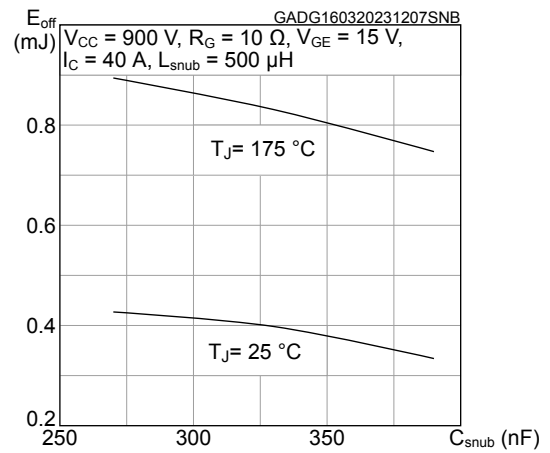
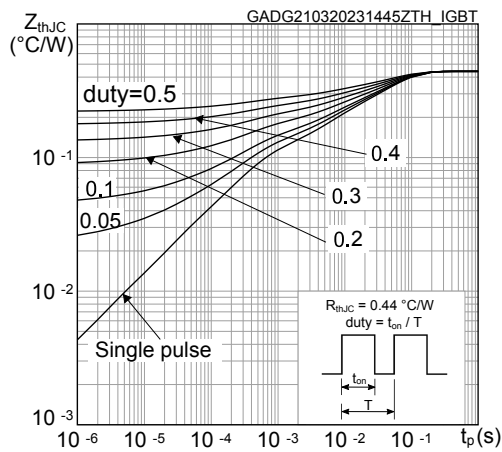
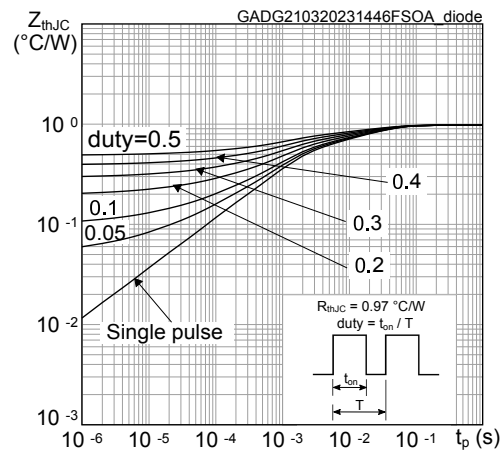


Figure 12. Typical capacitance characteristics

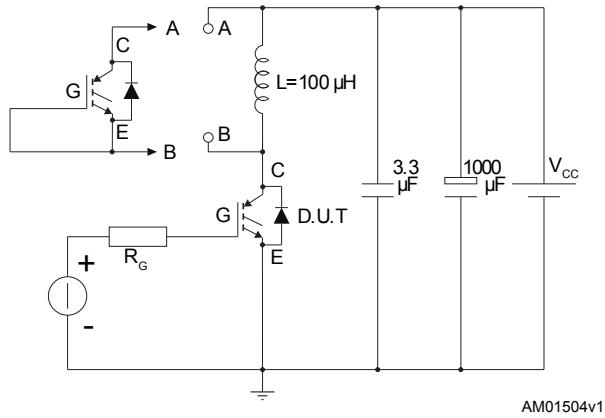
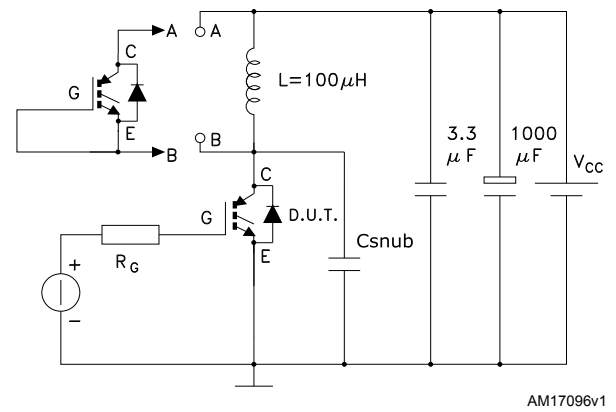
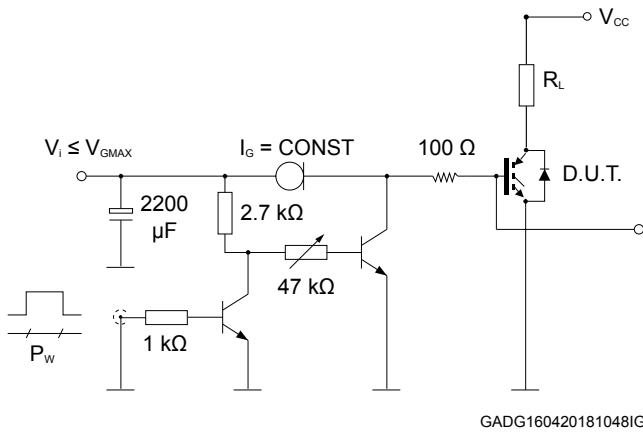
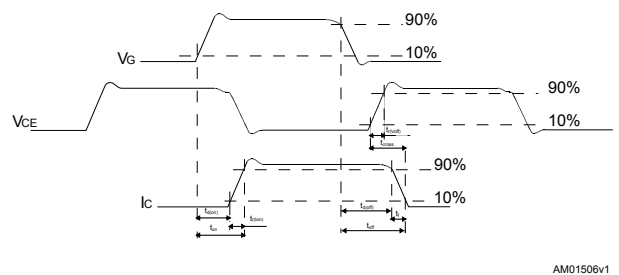


**Figure 13. Typical gate charge characteristics**

**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

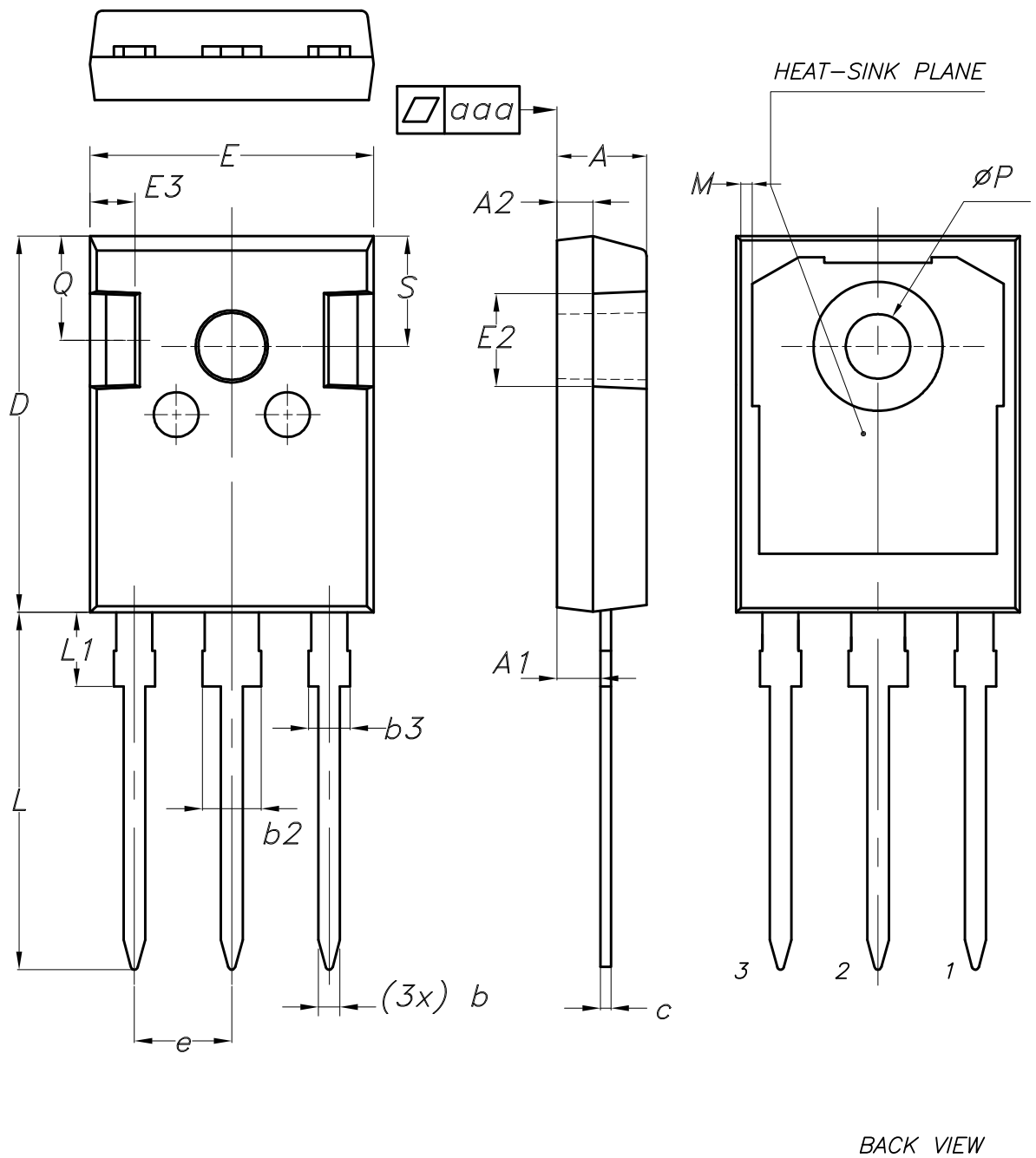
**Figure 23. Test circuit for inductive load switching**

**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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## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>2</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>3</b>
<b>2.1</b>	<b>Electrical characteristics (curves)</b> .....	<b>5</b>
<b>3</b>	<b>Test circuits</b> .....	<b>9</b>
<b>4</b>	<b>Package information</b> .....	<b>10</b>
<b>4.1</b>	<b>TO-247 long leads package information</b> .....	<b>10</b>
	<b>Revision history</b> .....	<b>12</b>

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