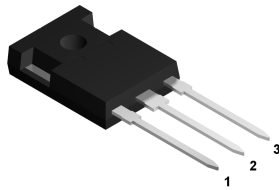
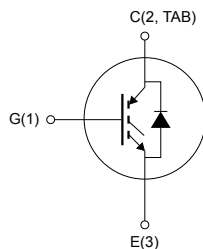


Trench gate field-stop 1350 V, 35 A, soft-switching IH2 series IGBT in a TO-247 long leads package



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 $I_C = 30\text{ A}$
- 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

[STGWA35IH135DF2](#)

Product summary

Order code	STGWA35IH135DF2
Marking	G35IH135DF2
Package	TO-247 long leads
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0\text{ V}$)	1350	V
I_C	Continuous collector current at $T_C = 25\text{ °C}$	70	A
	Continuous collector current at $T_C = 100\text{ °C}$	35	
$I_{CP}^{(1)}$	Pulsed collector current	140	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at $T_C = 25\text{ °C}$	43 ⁽²⁾	A
	Continuous forward current at $T_C = 100\text{ °C}$	35	
$I_{FP}^{(1)}$	Pulsed forward current	140	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	416	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range	- 55 to 175	

1. Pulse width limited by maximum junction temperature.
2. Current level is limited by bond wires.

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

Prerelease product(s)

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	$V_{GE} = 15\text{ V}, I_C = 30\text{ A}$		1.7	2.2	V
		$V_{GE} = 15\text{ V}, I_C = 30\text{ A}, T_J = 125\text{ °C}$		1.9		
		$V_{GE} = 15\text{ V}, I_C = 30\text{ A}, T_J = 175\text{ °C}$		2		
V_F	Forward on-voltage	$I_F = 30\text{ A}$		1.25		V
		$I_F = 30\text{ A}, T_J = 125\text{ °C}$		1.3		
		$I_F = 30\text{ A}, T_J = 175\text{ °C}$		1.3		
$V_{GE(th)}$	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	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			± 250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	2920	-	pF
C_{oes}	Output capacitance		-	124	-	pF
C_{res}	Reverse transfer capacitance		-	69	-	pF
Q_g	Total gate charge	$V_{CC} = 1080\text{ V}, I_C = 30\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 25. Gate charge test circuit)	-	258	-	nC
Q_{ge}	Gate-emitter charge		-	22	-	nC
Q_{gc}	Gate-collector charge		-	147	-	nC

Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}, I_C = 30\text{ A},$	-	368	-	ns
t_f	Current fall time	$V_{GE} = 15\text{ V}, R_G = 10\ \Omega$	-	121	-	ns
$E_{off}^{(1)}$	Turn-off switching energy	(see Figure 23. Test circuit for inductive load switching)	-	1.6	-	mJ
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}, I_C = 30\text{ A},$	-	407	-	ns
t_f	Current fall time	$V_{GE} = 15\text{ V}, R_G = 10\ \Omega, T_J = 175\text{ °C}$	-	281	-	ns
$E_{off}^{(1)}$	Turn-off switching energy	(see Figure 23. Test circuit for inductive load switching)	-	2.68	-	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	$V_{CC} = 900\text{ V}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $I_C = 60\text{ A}$, $L = 500\ \mu\text{H}$, $C_{sn} = 330\text{ nF}$ (see Figure 24. Test circuit for snubbed inductive load switching)	-	588	-	μJ
		$V_{CC} = 900\text{ V}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $I_C = 60\text{ A}$, $L = 500\ \mu\text{H}$, $C_{sn} = 330\text{ nF}$, $T_J = 175\text{ }^\circ\text{C}$ (see Figure 24. Test circuit for snubbed inductive load switching)	-	1030	-	

1. Including the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 1. Total power dissipation vs temperature

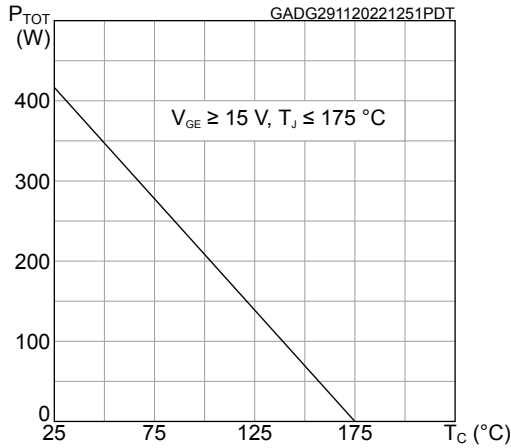


Figure 2. Collector current vs temperature

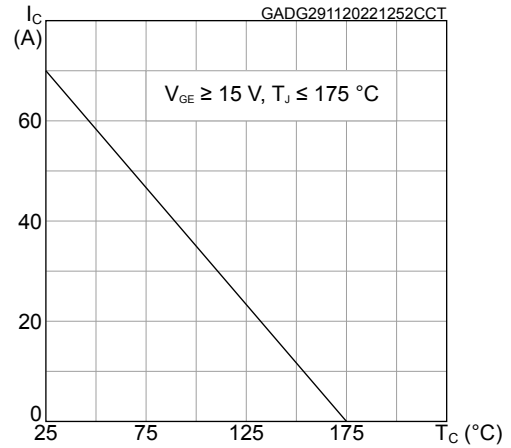


Figure 3. Typical output characteristics ($T_J = 25$ °C)

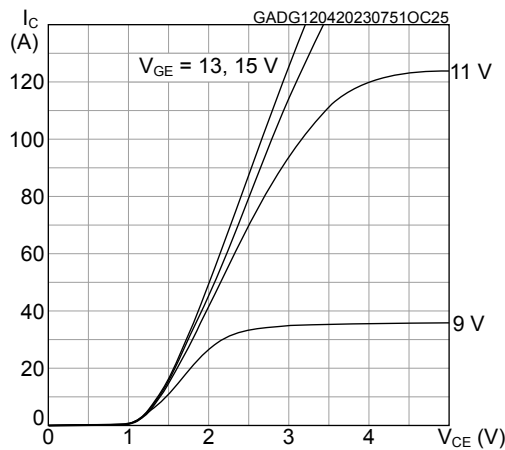


Figure 4. Typical output characteristics ($T_J = 175$ °C)

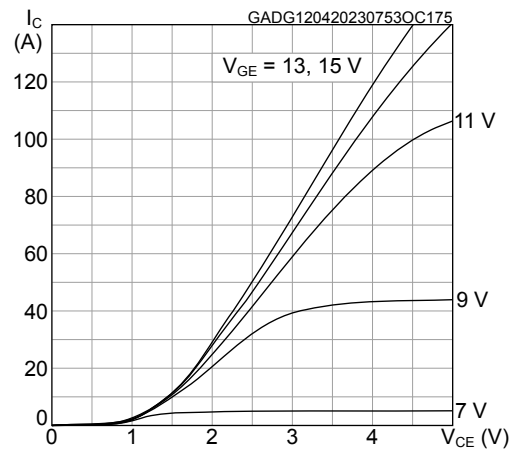


Figure 5. Typical $V_{CE(sat)}$ vs temperature

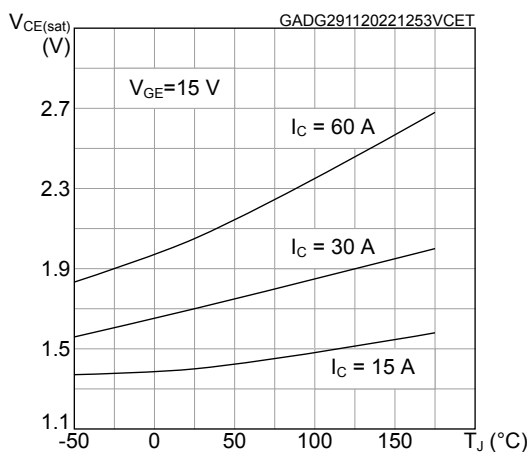


Figure 6. Typical $V_{CE(sat)}$ vs collector current

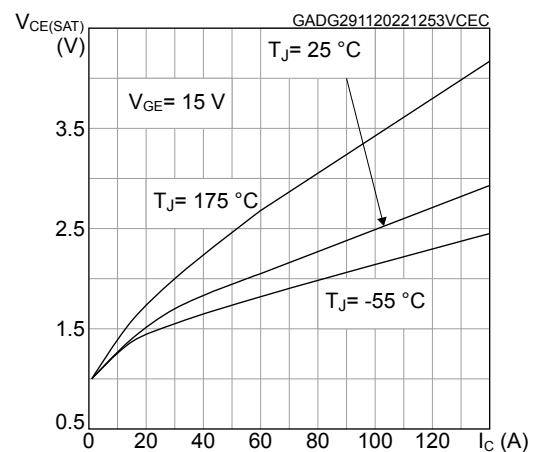


Figure 7. Forward bias safe operating area

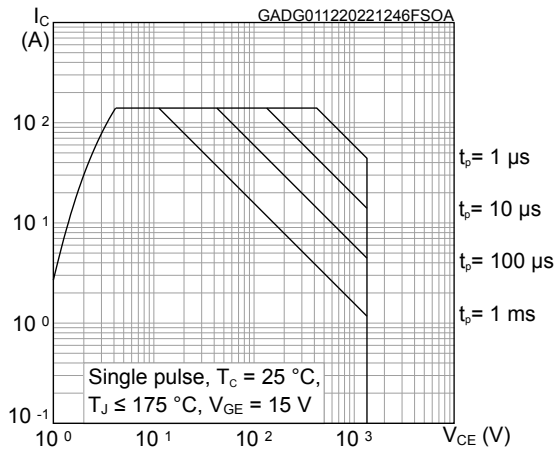


Figure 8. Transfer characteristics

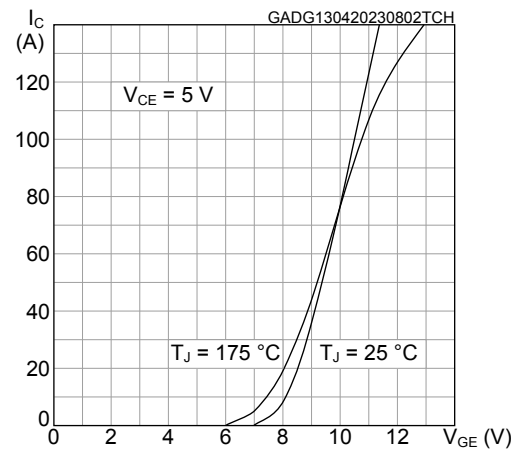


Figure 9. Typical diode V_F vs forward current

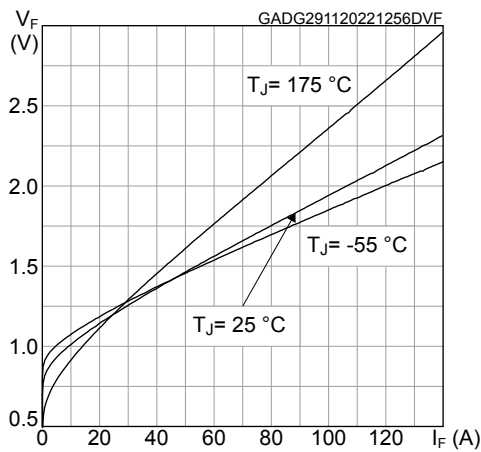


Figure 10. Normalized $V_{GE(th)}$ vs temperature

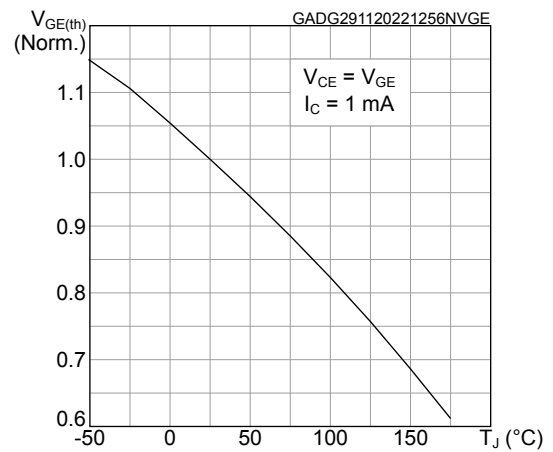


Figure 11. Normalized $V_{(BR)CES}$ vs temperature

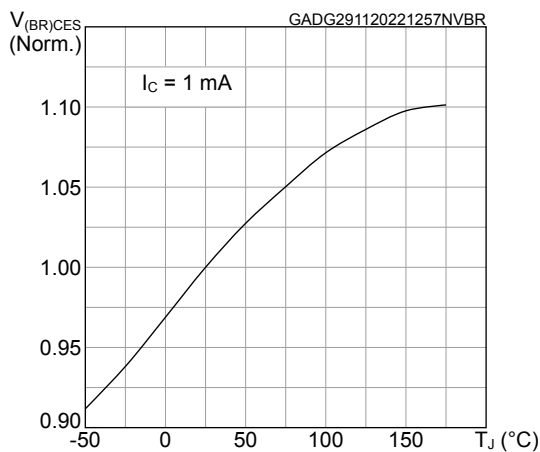
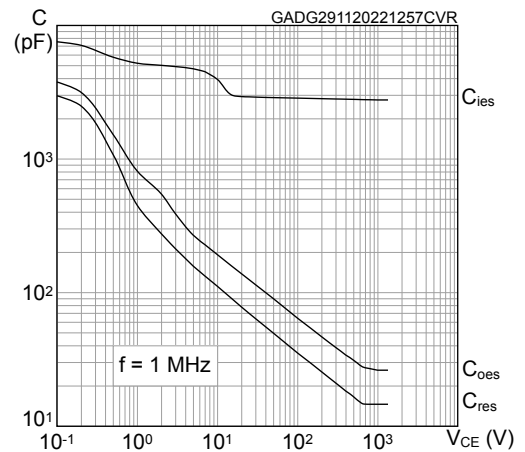


Figure 12. Typical capacitance characteristics



Prerelease product(s)

Figure 13. Typical gate charge characteristics

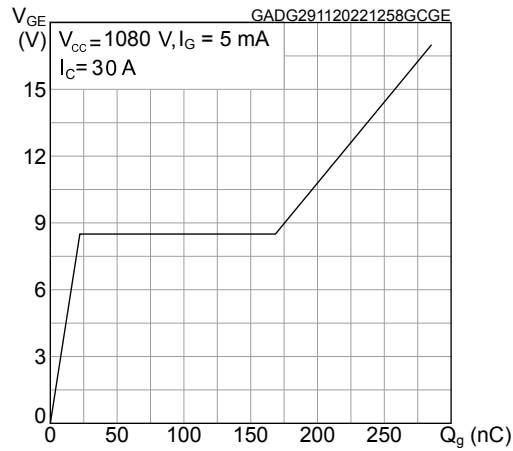


Figure 14. Typical switching energy vs collector current

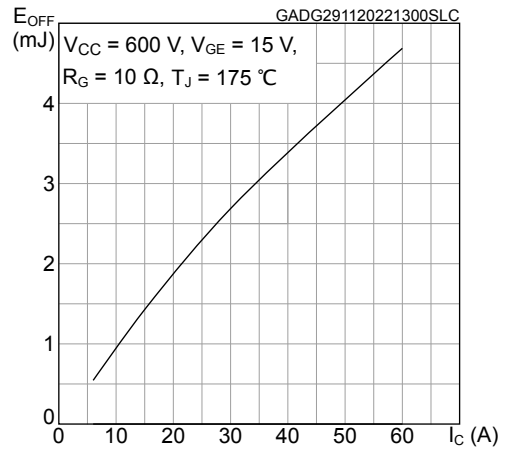


Figure 15. Typical switching energy vs temperature

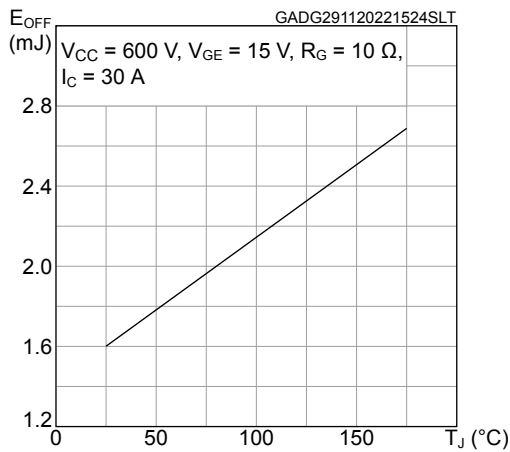


Figure 16. Typical switching energy vs collector emitter voltage

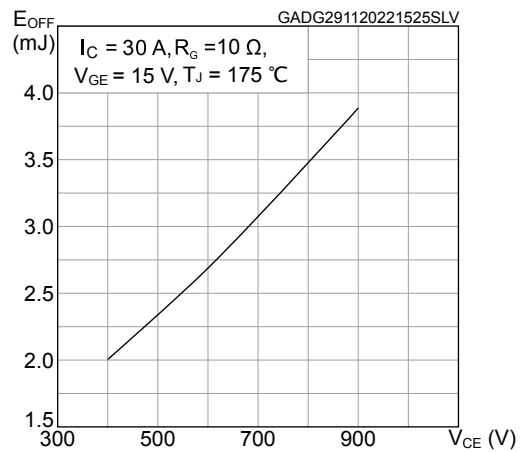


Figure 17. Typical switching energy vs R_G

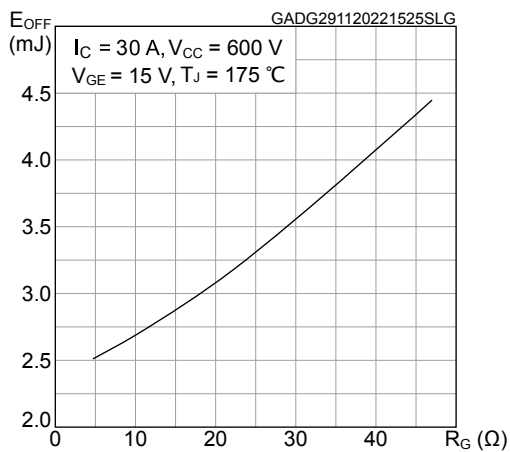
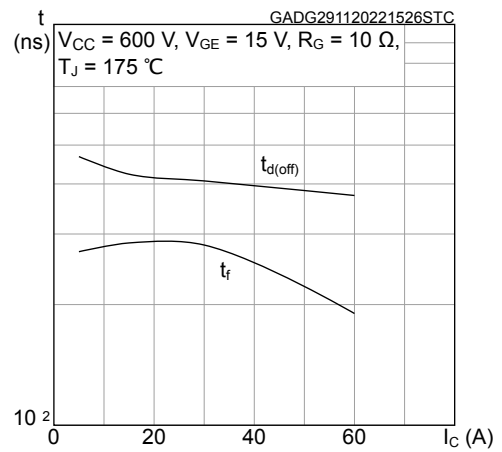


Figure 18. Typical switching times vs collector current



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Figure 19. Typical switching times vs gate resistance

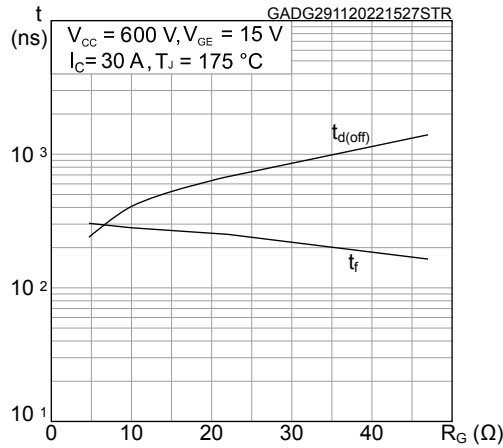


Figure 20. Typical switching energy vs snubber capacitance

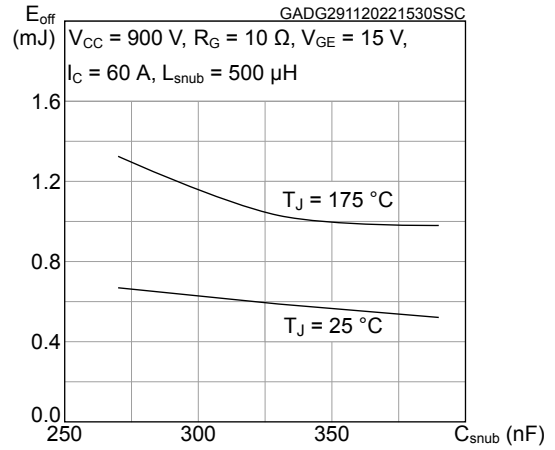


Figure 21. Maximum transient thermal impedance for IGBT

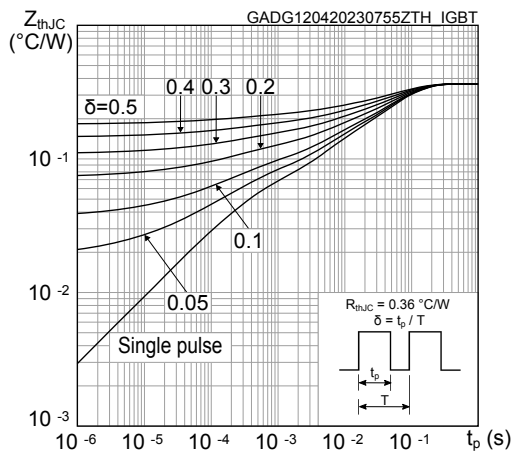
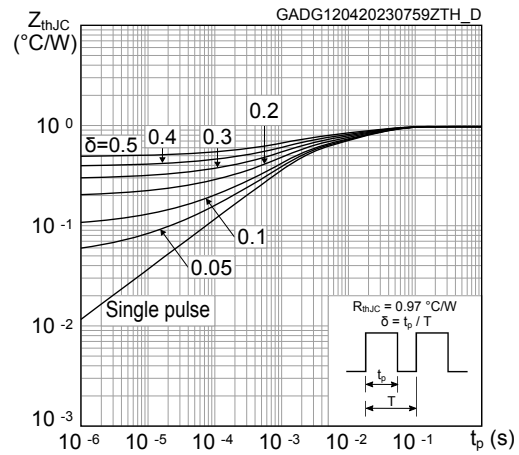
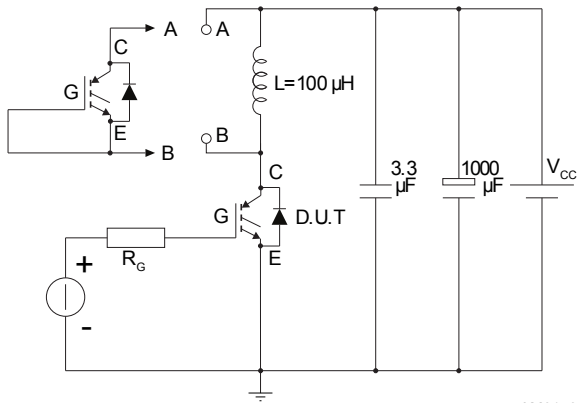


Figure 22. Maximum transient thermal impedance for diode

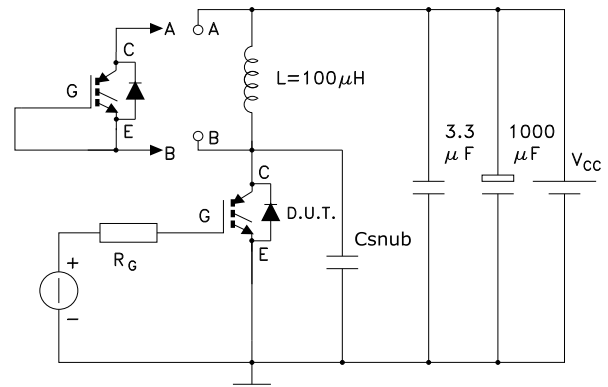


Prerelease product(s)

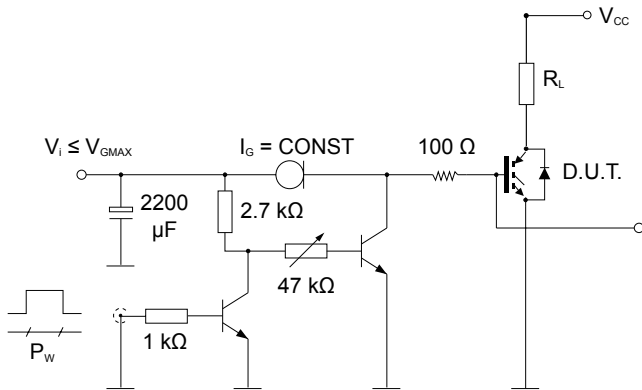
3 Test circuits

Figure 23. Test circuit for inductive load switching


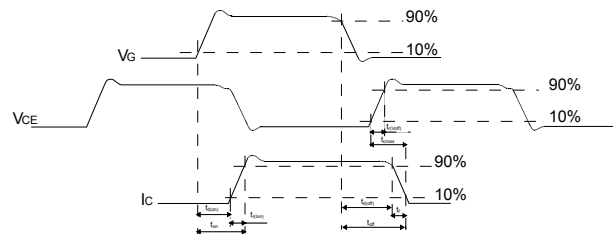
AM01504v1

Figure 24. Test circuit for snubbed inductive load switching


AM17096v1

Figure 25. Gate charge test circuit


GADG160420181048IG

Figure 26. Switching waveform


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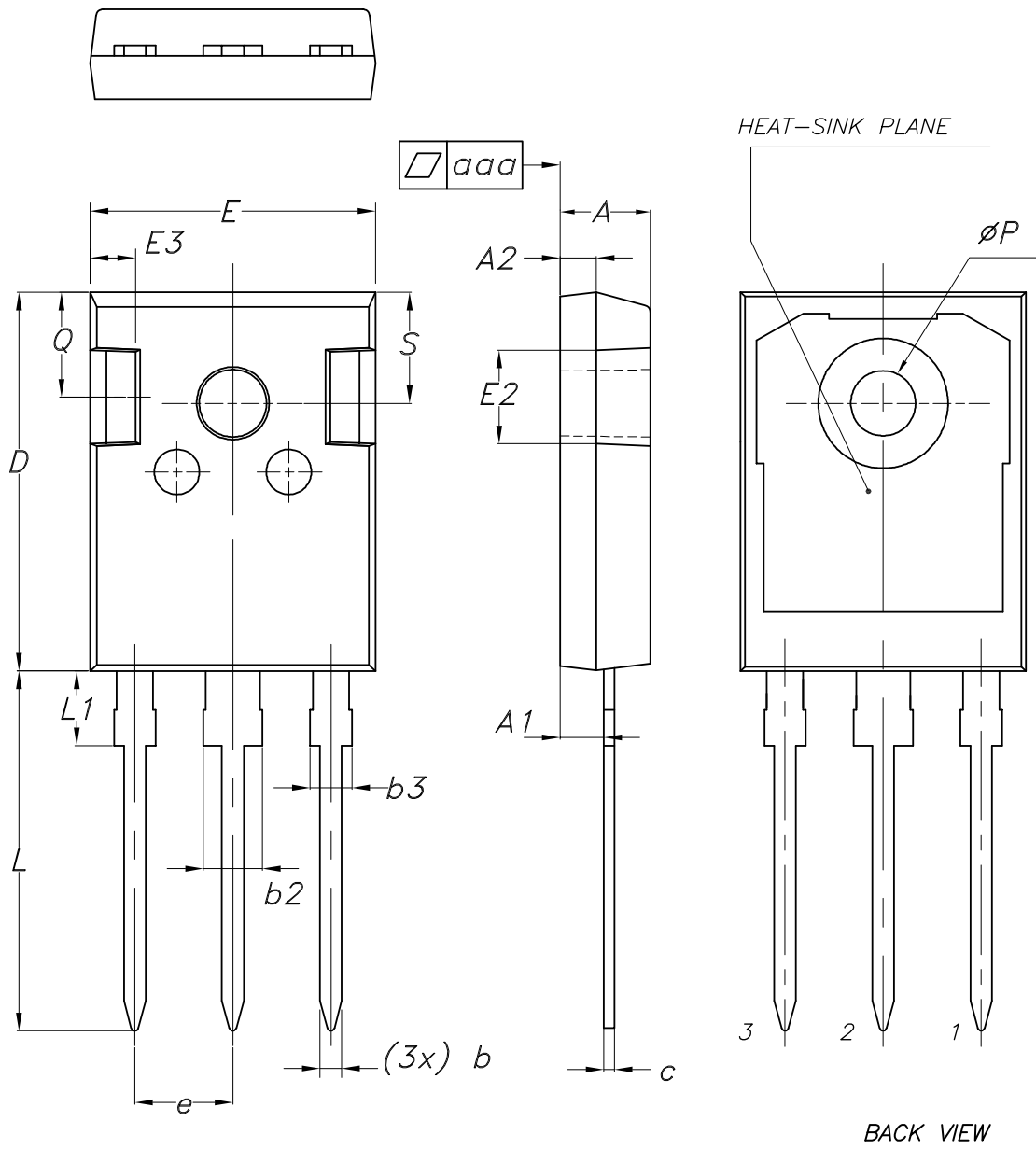
Prerelease product(s)

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



Prerelease product(s)

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

Prerelease product(s)

Revision history

Table 8. Document revision history

Date	Revision	Changes
06-Dec-2022	1	First release.
15-Feb-2023	2	Updated <i>Table 1. Absolute maximum ratings.</i> Updated <i>Table 2. Thermal data.</i> Updated <i>Figure 14. Typical switching energy vs collector current, Figure 15. Typical switching energy vs temperature, Figure 16. Typical switching energy vs collector emitter voltage and Figure 17. Typical switching energy vs R_G.</i>
13-Apr-2023	3	Updated <i>Figure 3. Typical output characteristics ($T_J = 25\text{ }^\circ\text{C}$), Figure 4. Typical output characteristics ($T_J = 175\text{ }^\circ\text{C}$), Figure 8. Transfer characteristics, Figure 21. Maximum transient thermal impedance for IGBT and Figure 22. Maximum transient thermal impedance for diode.</i> Minor text changes.

Contents

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

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