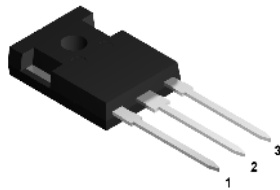
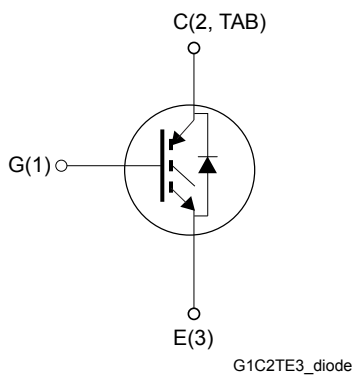



Automotive-grade trench gate field-stop 650 V, 80 A high speed HB series IGBT in a TO-247 long leads



TO-247 long leads



Features

- AEC-Q101 qualified 
- High-speed switching series
- Maximum junction temperature: $T_J = 175\text{ °C}$
- Low $V_{CE(sat)} = 1.65\text{ V (typ.) @ } I_C = 80\text{ A}$
- Minimized tail current
- Tight parameter distribution
- Positive temperature $V_{CE(sat)}$ coefficient
- Soft and very fast recovery antiparallel diode

Applications

- PFC
- High frequency converters

Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the new HB series of IGBTs, which represents an optimum compromise between conduction and switching loss to maximize the efficiency of any frequency converter. Furthermore, the slightly positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in safer paralleling operation.

Product status link

[STGWA80H65DFBAG](#)

Product summary

Order code	STGWA80H65DFBAG
Marking	G80H65DFBAG
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	120 ⁽¹⁾	A
	Continuous collector current at $T_C = 100$ °C	80	
I_{CP} ⁽²⁾	Pulsed collector current ($t_p = 1$ ms)	240	A
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage ($t_p \leq 10$ μs)	±30	
I_F	Continuous forward current at $T_C = 25$ °C	120 ⁽¹⁾	A
	Continuous forward current at $T_C = 100$ °C	80	
I_{FP} ⁽²⁾	Pulsed forward current	240	A
P_{TOT}	Total power dissipation at $T_C = 25$ °C	535	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	°C

1. Current limited by package.
2. Pulse width is limited by maximum junction temperature.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case IGBT	0.28	°C/W
	Thermal resistance, junction-to-case diode	0.41	
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

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

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 80\text{ A}$		1.65	2.0	V
		$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 125\text{ °C}$		1.8		
		$V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 175\text{ °C}$		1.9		
V_F	Forward on-voltage	$I_F = 80\text{ A}$		1.9		V
		$I_F = 80\text{ A}, T_J = 125\text{ °C}$		1.55		
		$I_F = 80\text{ A}, T_J = 175\text{ °C}$		1.4		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	4.5	5.5	6.5	V

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	10460	-	pF
C_{oes}	Output capacitance		-	390	-	pF
C_{res}	Reverse transfer capacitance		-	215	-	pF
Q_g	Total gate charge	$V_{CC} = 520\text{ V}, I_C = 80\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$	-	453	-	nC

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 400\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$	-	360	-	ns
t_r	Current rise time		-	84	-	ns
$di/dt_{(on)}$	Turn-on current slope		-	720	-	A/ μ s
$E_{on}^{(1)}$	Turn-on switching energy		-	3.26	-	mJ
$t_{d(off)}$	Turn-off delay time		-	360	-	ns
t_f	Current fall time		-	66	-	ns
$E_{off}^{(2)}$	Turn-off switching energy		-	2.33	-	mJ
E_{ts}	Total switching energy		-	5.59	-	mJ
$t_{d(off)}$	Turn-off delay time		$V_{CC} = 400\text{ V}$, $I_C = 80\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$	-	375	-
t_r	Current rise time	-		90	-	ns
$di/dt_{(on)}$	Turn-on current slope	-		690	-	A/ μ s
$E_{on}^{(1)}$	Turn-on switching energy	-		5.24	-	mJ
$t_{d(off)}$	Turn-off delay time	-		375	-	ns
t_f	Current fall time	-		65	-	ns
$E_{off}^{(2)}$	Turn-off switching energy	-		2.56	-	mJ
E_{ts}	Total switching energy	-		7.8	-	mJ

1. Including the reverse recovery of the diode.

2. Including the tail of the collector current.

Table 6. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	$I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$	-	64	-	ns
Q_{rr}	Reverse recovery charge		-	0.7	-	μ C
I_{rrm}	Reverse recovery current		-	15	-	A
E_{rr}	Reverse recovery energy		-	92	-	μ J
t_{rr}	Reverse recovery time	$I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $T_J = 175\text{ }^\circ\text{C}$	-	120	-	ns
Q_{rr}	Reverse recovery charge		-	3.7	-	μ C
I_{rrm}	Reverse recovery current		-	47	-	A
E_{rr}	Reverse recovery energy		-	595	-	μ J

2.1 Electrical characteristics (curves)

Figure 1. Total power dissipation vs temperature

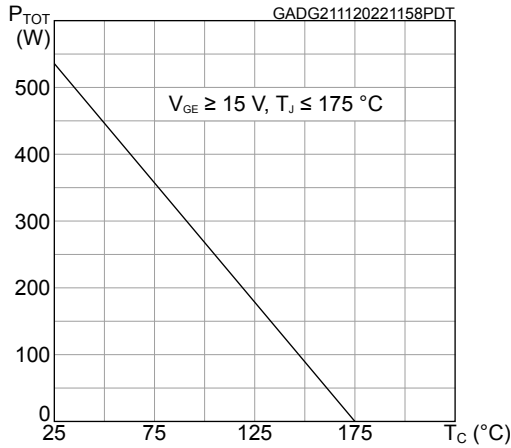


Figure 2. Collector current vs temperature

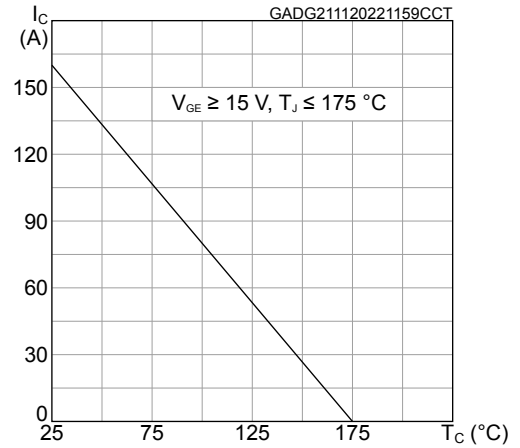


Figure 3. Typical output characteristics (T_J = 25 °C)

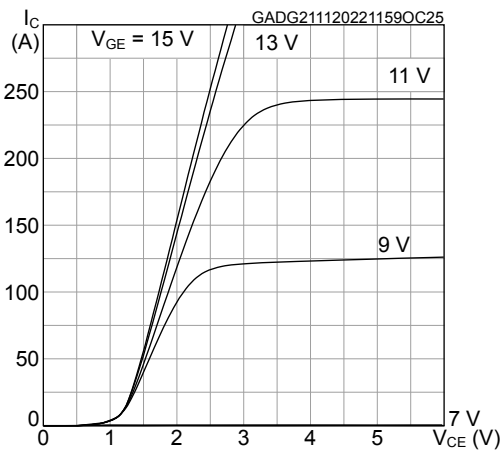


Figure 4. Typical output characteristics (T_J = 175 °C)

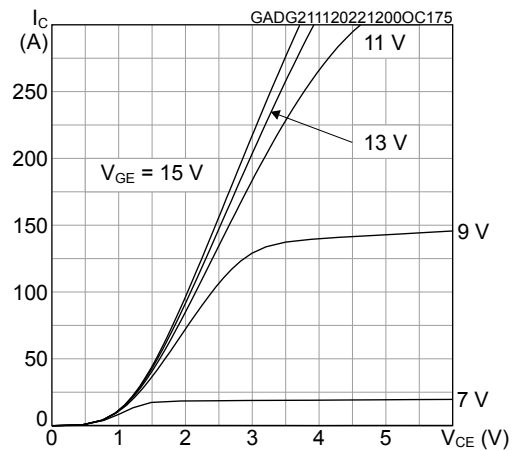


Figure 5. Typical V_{CE(sat)} vs temperature

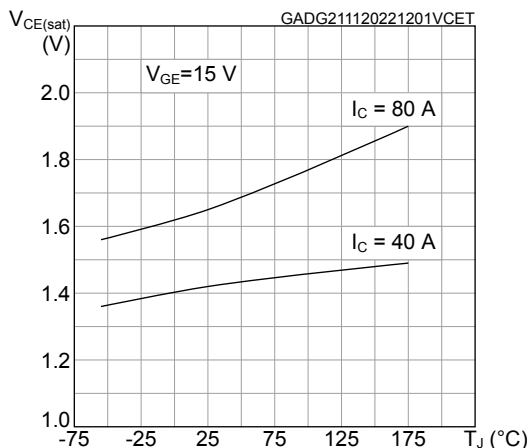


Figure 6. Typical V_{CE(sat)} vs collector current

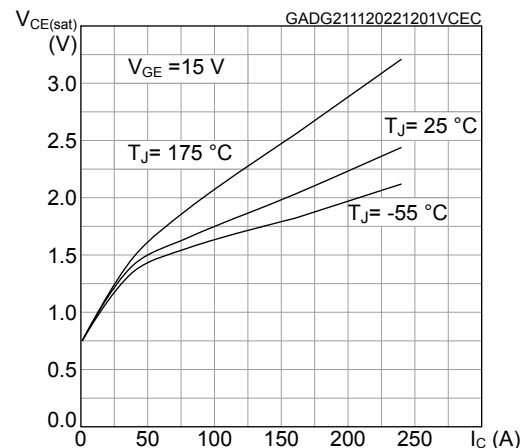


Figure 7. Forward bias safe operating area

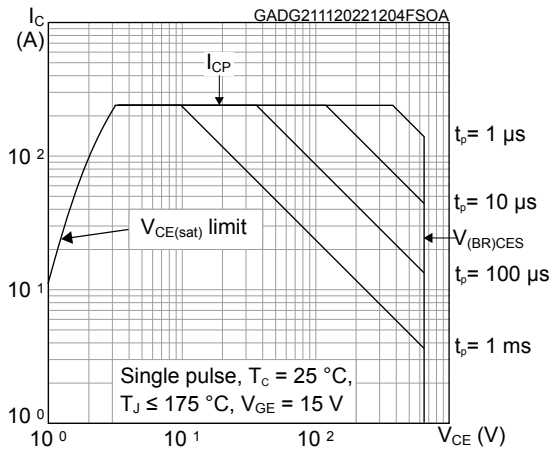


Figure 8. Collector current vs switching frequency

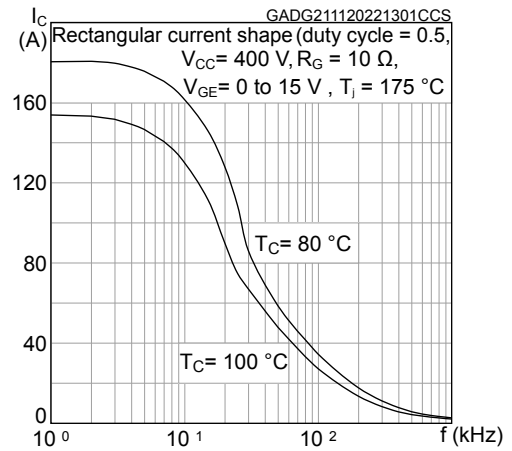


Figure 9. Typical transfer characteristics

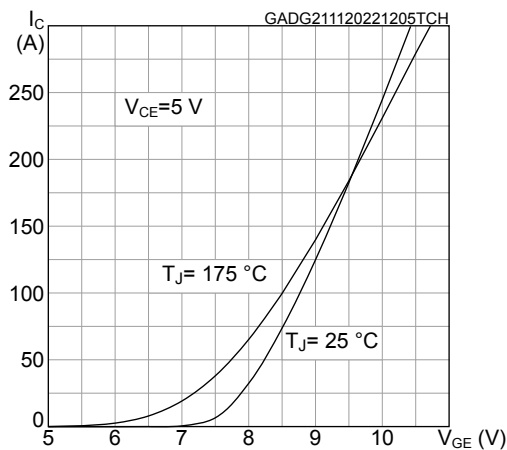


Figure 10. Typical diode V_F vs forward current

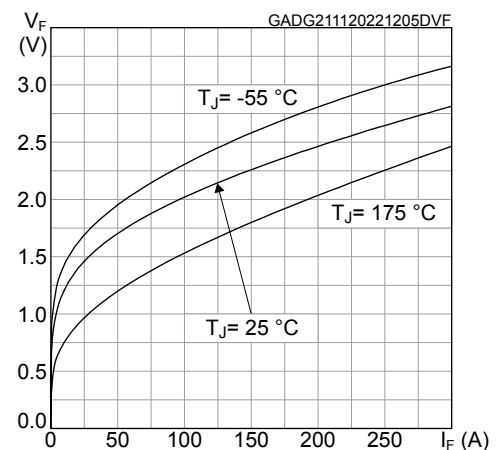


Figure 11. Normalized V_GE(th) vs temperature

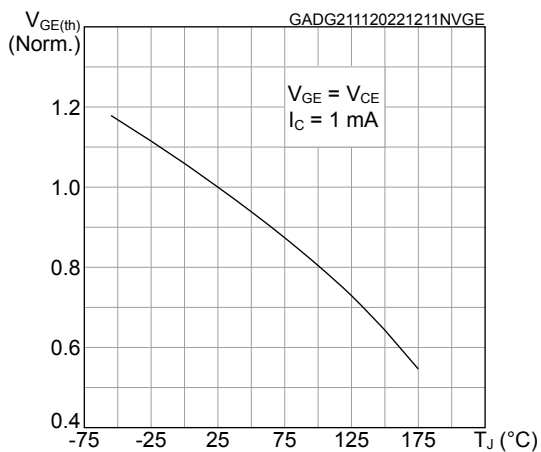


Figure 12. Normalized V_(BR)CES vs temperature

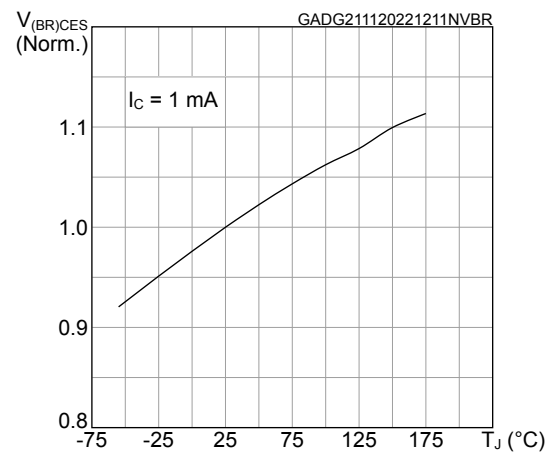


Figure 13. Typical capacitance characteristics

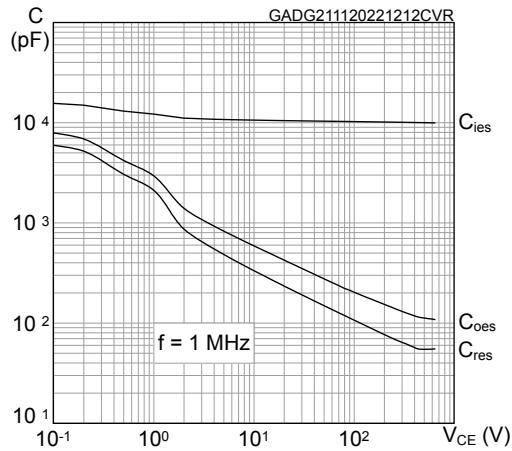


Figure 14. Typical gate charge characteristics

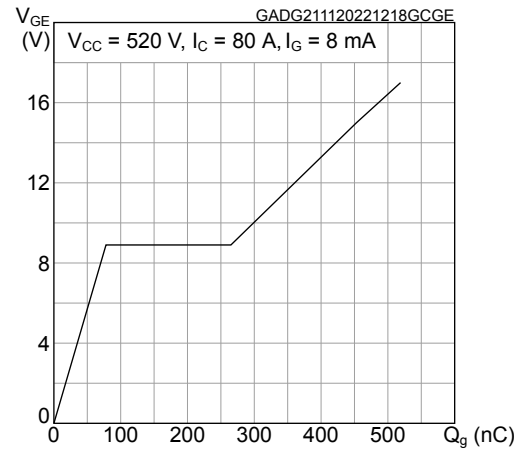


Figure 15. Typical switching energy vs collector current

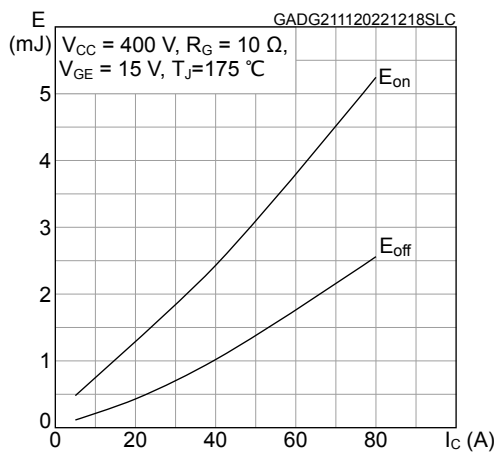


Figure 16. Typical switching energy vs temperature

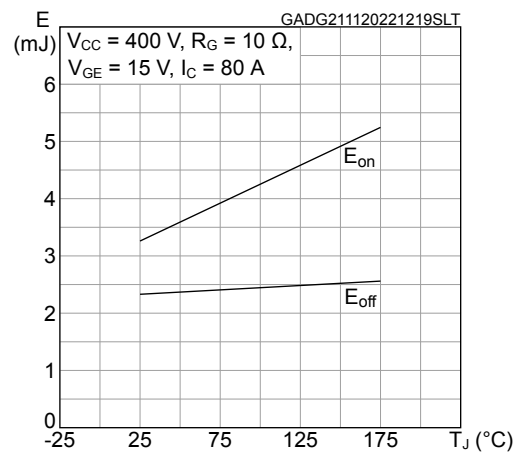


Figure 17. Typical switching energy vs collector emitter voltage

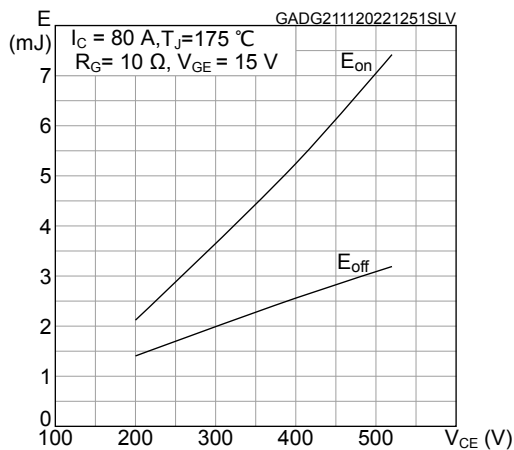


Figure 18. Typical switching energy vs R_G

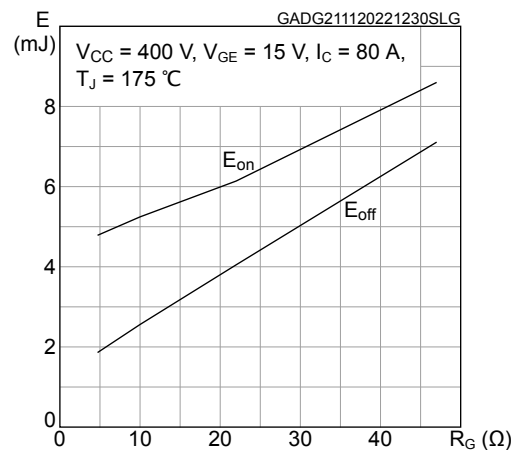


Figure 19. Typical switching times vs collector current

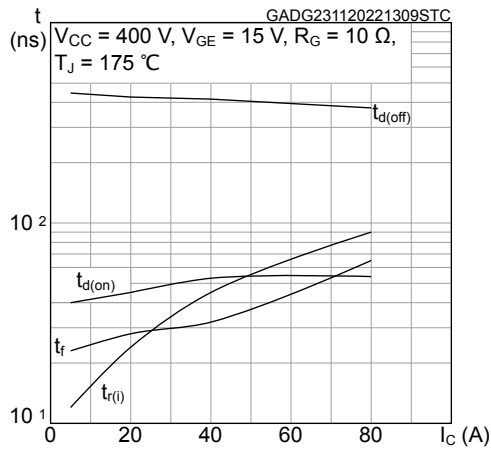


Figure 20. Typical switching times vs gate resistance

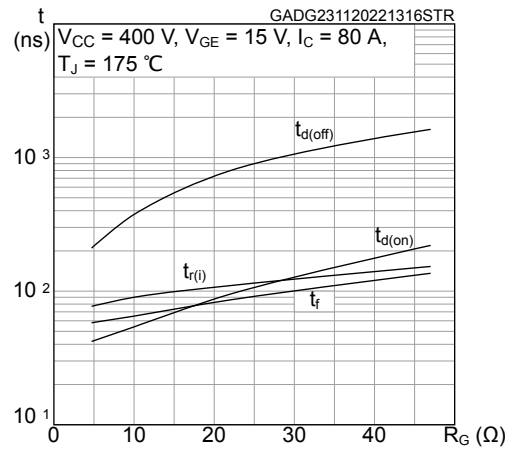


Figure 21. Typical reverse recovery current vs diode current slope

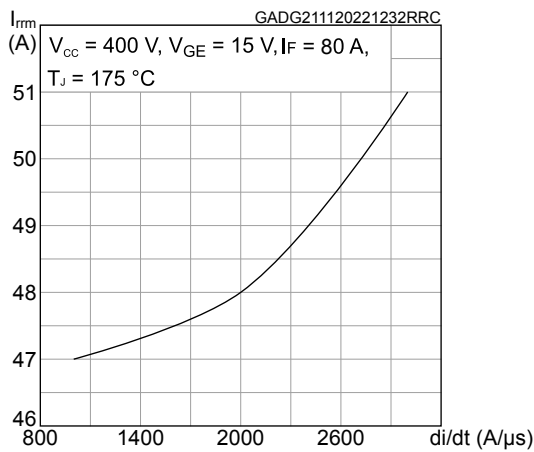


Figure 22. Typical reverse recovery time vs diode current slope

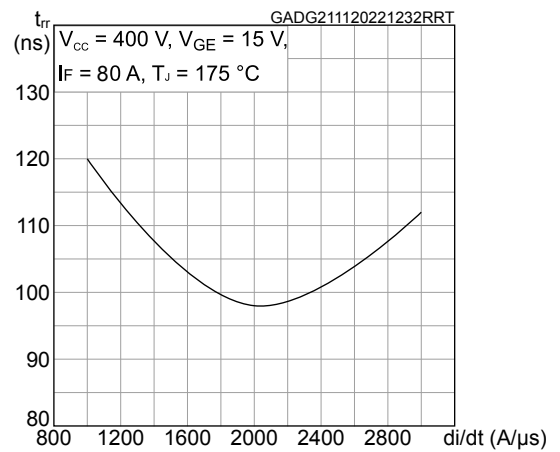


Figure 23. Typical reverse recovery charge vs diode current slope

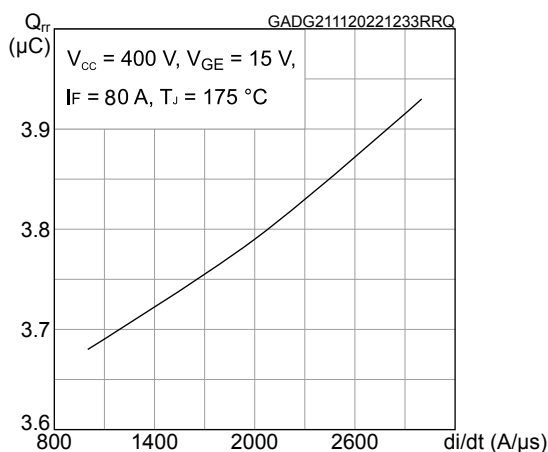


Figure 24. Typical reverse recovery energy vs diode current slope

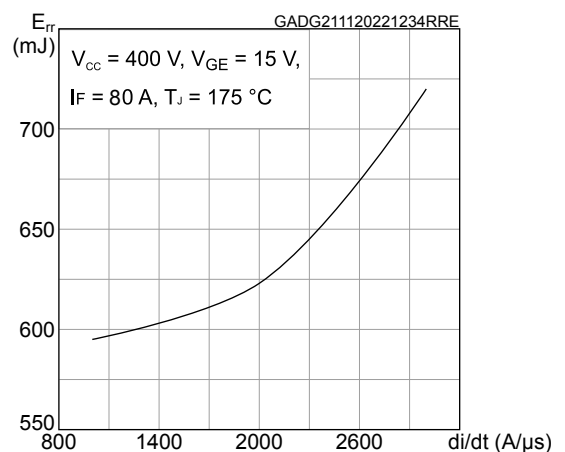


Figure 25. Maximum transient thermal impedance for IGBT

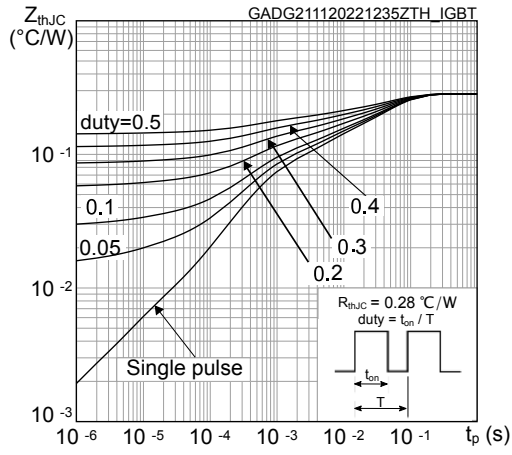
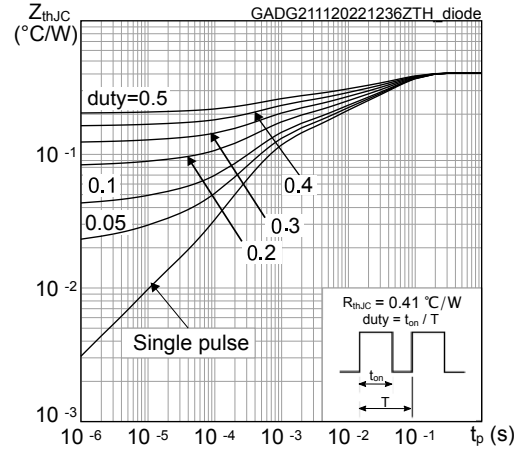


Figure 26. Maximum transient thermal impedance for diode



3 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.

3.1 TO-247 long leads package information

Figure 27. TO-247 long leads package outline

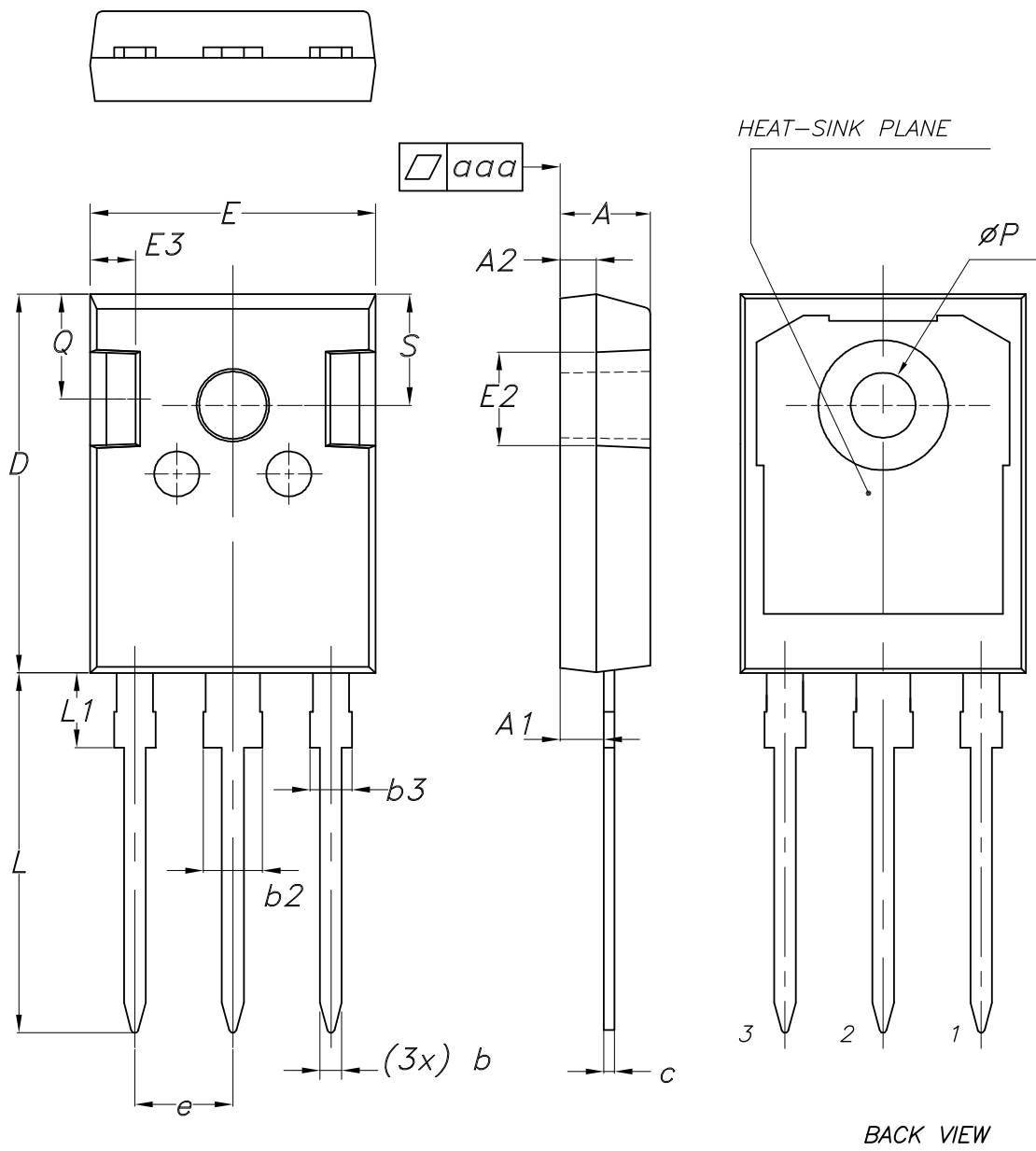


Table 7. TO-247 long leads package mechanical data

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
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
06-Dec-2022	1	First release.

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2.1	Electrical characteristics (curves)	5
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3.1	TO-247 long leads package information	10
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