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STGW20IH125DF
STGWT20IH125DF

1250 V, 20 A IH series trench gate field-stop IGBT

Datasheet - production data

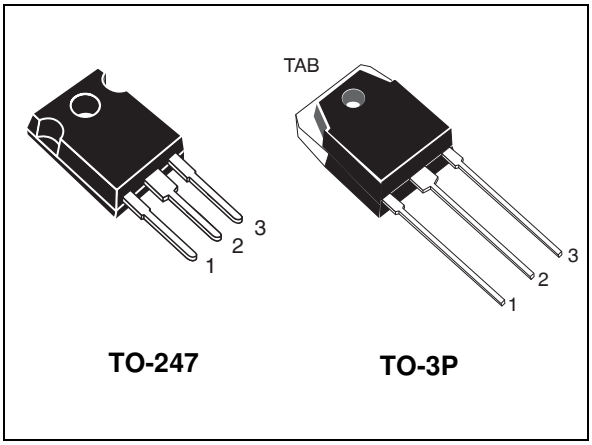
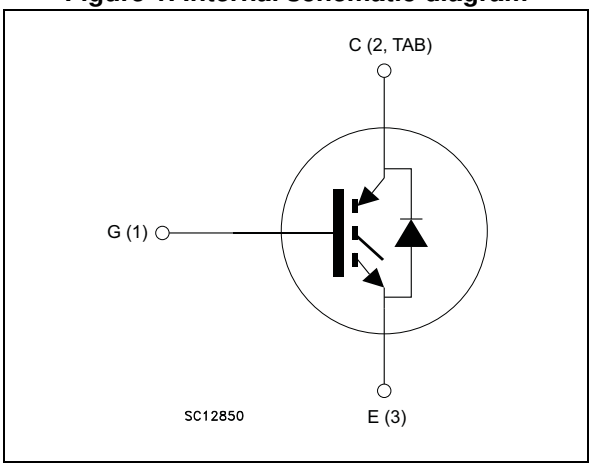


Figure 1. Internal schematic diagram



Features

- Designed for soft commutation only
- Maximum junction temperature: T_J = 175 °C
- Minimized tail current
- $V_{CE(sat)}$ = 2.0 V (typ.) @ I_C = 15 A
- Tight parameters distribution
- Safe paralleling
- Very low V_F soft recovery co-packaged diode
- Low thermal resistance
- Lead free package

Applications

- Induction heating
- Microwave oven
- Resonant converters

Description

These IGBTs are developed using an advanced proprietary trench gate field-stop structure and performance is optimized in both conduction and switching losses. A freewheeling diode with a low drop forward voltage is co-packaged. The result is a product specifically designed to maximize efficiency for any resonant and soft-switching application.

Table 1. Device summary

Order code	Marking	Package	Packaging
STGW20IH125DF	G20IH125DF	TO-247	Tube
STGWT20IH125DF	G20IH125DF	TO-3P	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1250	V
I_C	Continuous collector current at T_C = 25 °C	40	A
I_C	Continuous collector current at T_C = 100 °C	20	A
I_{CP}(1)	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous forward current at T_C = 25 °C	40	A
I_F	Continuous forward current at T_C = 100 °C	20	A
I_{FP}(1)	Pulsed forward current	80	A
P_{TOT}	Total dissipation at T_C = 25 °C	259	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature	- 55 to 175	°C

1. Pulse width limited by maximum junction temperature

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.58	°C/W
R_{thJC}	Thermal resistance junction-case diode	1.47	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 4. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 2 mA	1250			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 15 A		2	2.5	V
		V_{GE} = 15 V, I_C = 15 A T_J = 125 °C		2.2		
		V_{GE} = 15 V, I_C = 15 A T_J = 175 °C		2.3		
		V_{GE} = 15 V, I_C = 30 A		2.55		
V_F	Forward on-voltage	I_F = 15 A		1.1	1.5	V
		I_F = 15 A T_J = 125 °C		1.05		
		I_F = 15 A T_J = 175 °C		1		
		I_F= 30A		1.25		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 500 µA	5	6	7	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 1250 V			25	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ± 20 V			250	nA

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	1290	-	pF
C_{oes}	Output capacitance		-	96	-	pF
C_{res}	Reverse transfer capacitance		-	30.6	-	pF
Q_g	Total gate charge	V_{CC} = 600 V, I_C = 15 A, V_{GE} = 15 V, see *Figure 25*	-	69	-	nC
Q_{ge}	Gate-emitter charge		-	7.2	-	nC
Q_{gc}	Gate-collector charge		-	40.8	-	nC

Table 6. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CE} = 600 V, I_C = 15 A, R_G = 10 Ω, V_{GE} = 15 V, see *Figure 23*		106		ns
t_f	Current fall time		-	79	-	ns
E_{off}(1)	Turn-off switching losses		-	410	-	µJ
$t_{d(off)}$	Turn-off delay time	V_{CE} = 600 V, I_C = 15 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C, see *Figure 23*		109		ns
t_f	Current fall time		-	176	-	ns
E_{off}(1)	Turn-off switching losses		-	820	-	µJ

1. Turn-off losses include also the tail of the collector current.

Table 7. IGBT switching characteristics (capacitive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off}(1)	Turn-off switching losses	V_{CC} = 900V, R_G = 10 Ω, I_C = 30 A, L = 500 µH, C_{snub} = 330 nF, see *Figure 24*	-	163	-	µJ
		V_{CC} = 900V, R_G = 10 Ω, I_C = 30 A, L = 500 µH, C_{snub} = 330 nF, T_J = 175 °C, see *Figure 24*	-	366	-	

1. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2. Power dissipation vs. case temperature

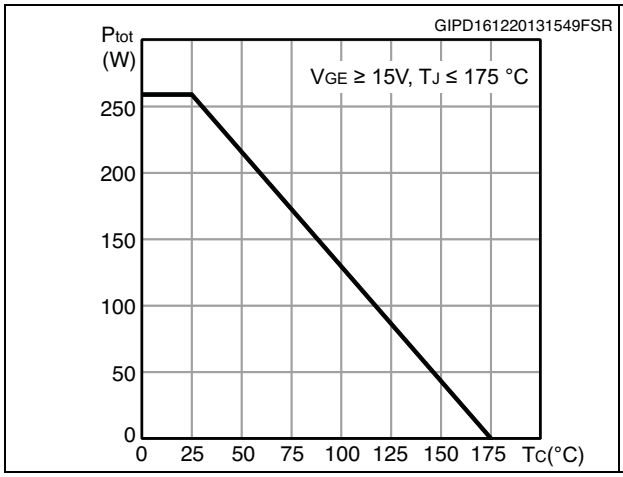


Figure 3. Collector current vs. case temperature

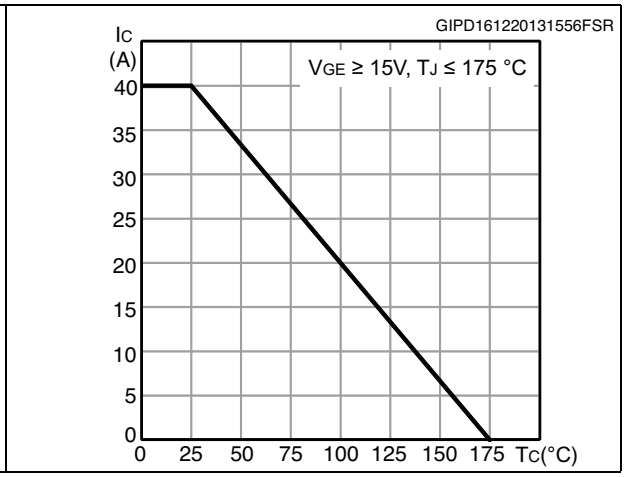


Figure 4. Output characteristics (T_J = 25°C)

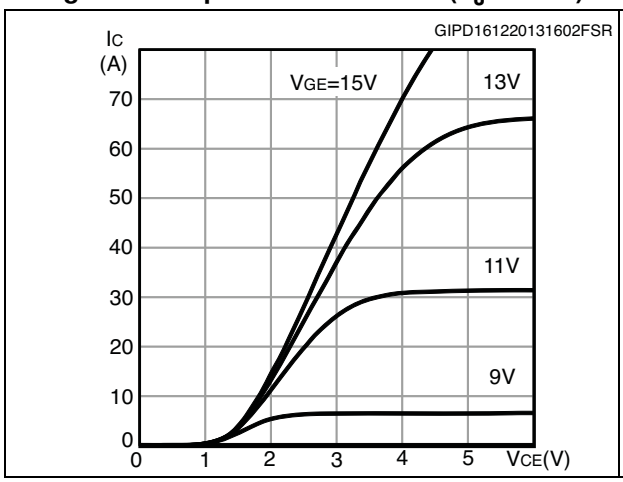


Figure 5. Output characteristics (T_J = 175°C)

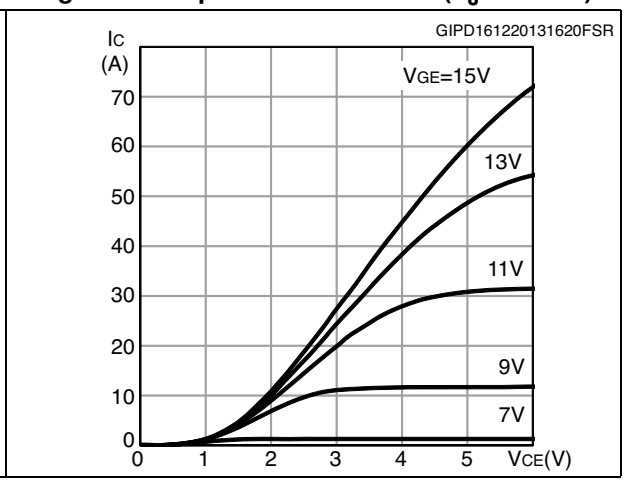


Figure 6. $V_{CE(sat)}$ vs. junction temperature

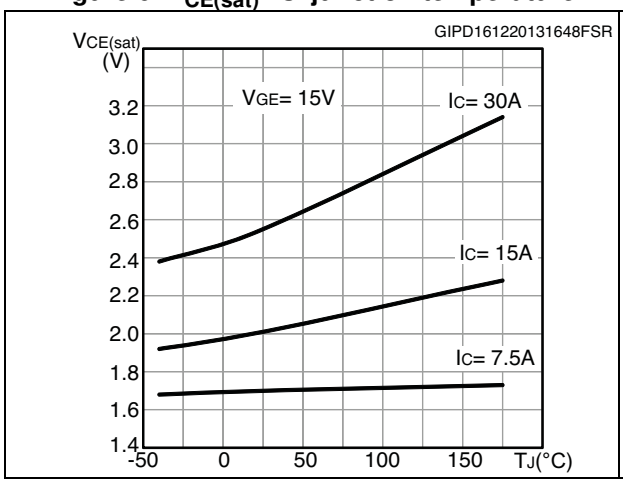


Figure 7. $V_{CE(sat)}$ vs. collector current

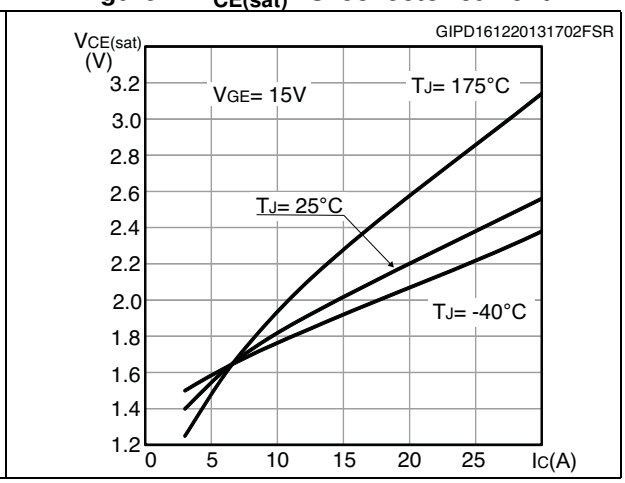


Figure 8. Forward bias safe operating area

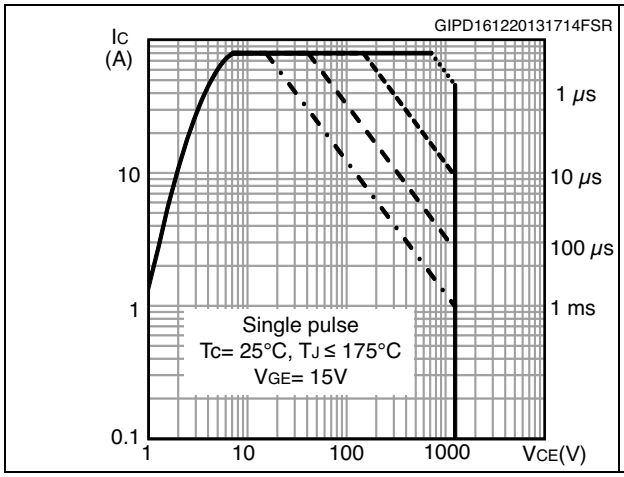


Figure 9. Transfer characteristics

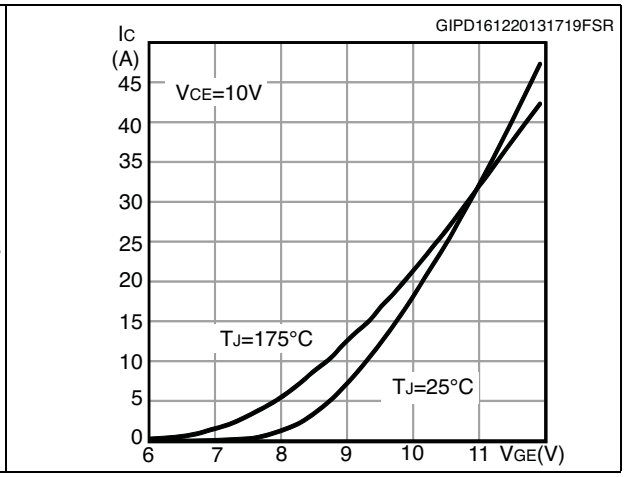


Figure 10. Diode V_F vs. forward current

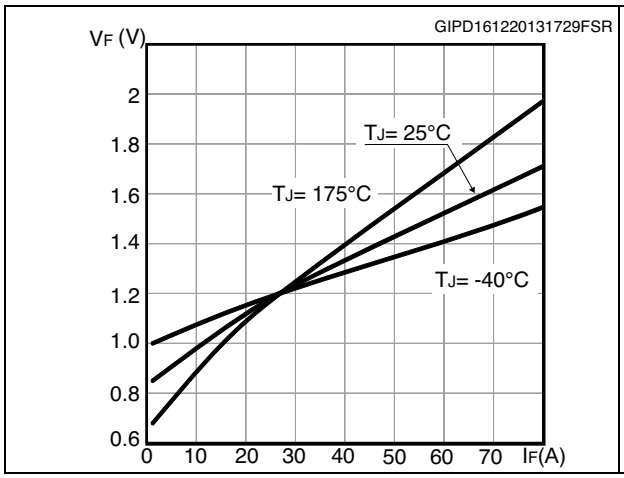


Figure 11. Normalized $V_{GE(th)}$ vs junction temperature

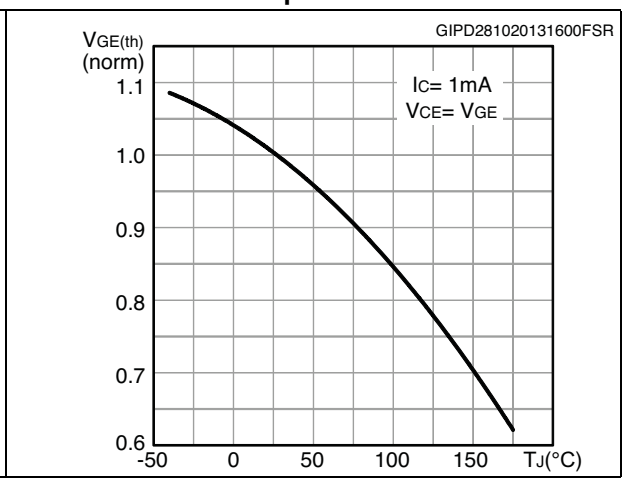


Figure 12. Normalized $V_{(BR)CES}$ vs. junction temperature

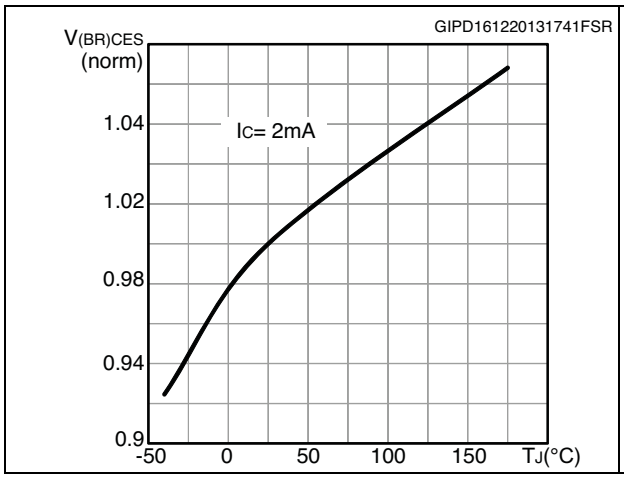


Figure 13. Capacitance variation

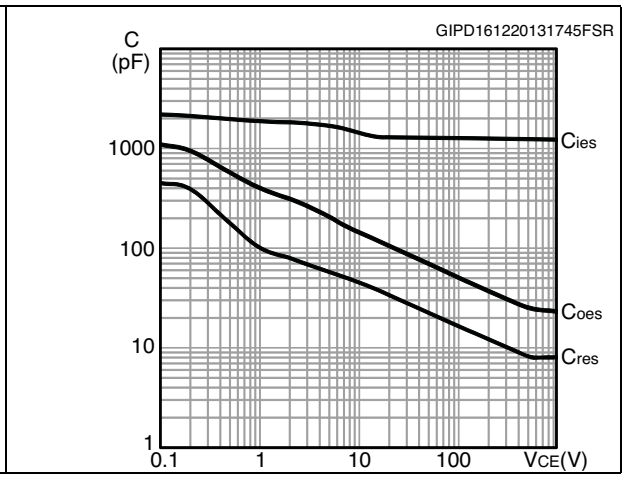


Figure 14. Gate charge vs. gate-emitter voltage

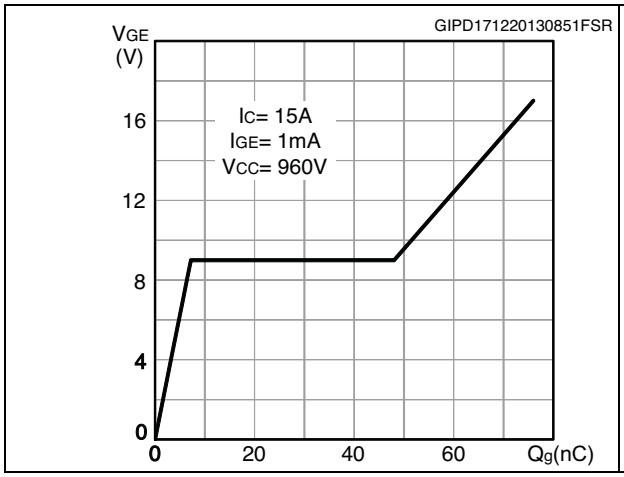


Figure 15. Switching loss vs collector current

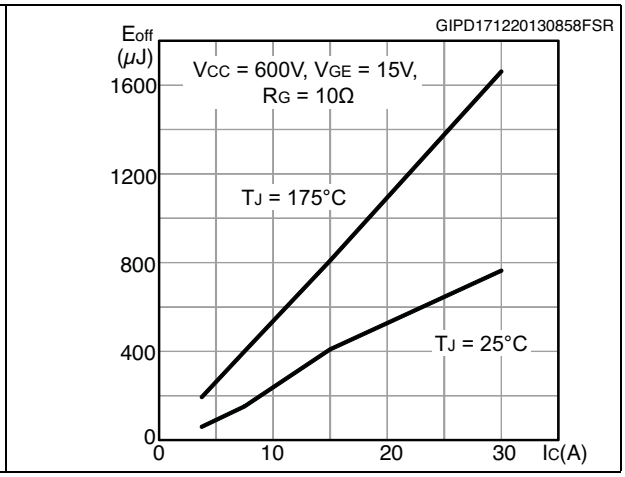


Figure 16. Switching-off loss vs gate resistance

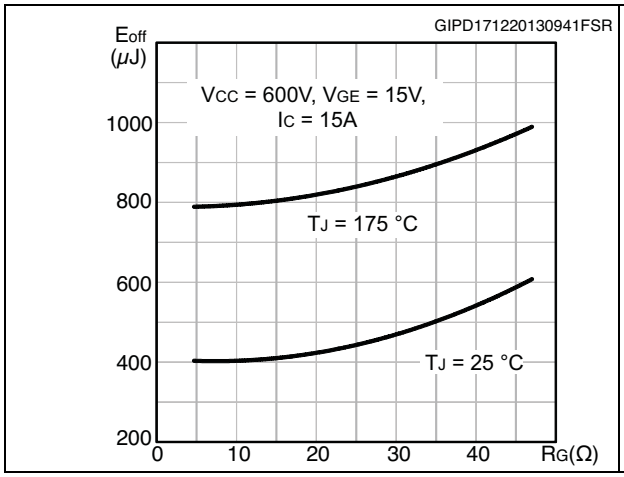


Figure 17. Switching-off loss vs temperature

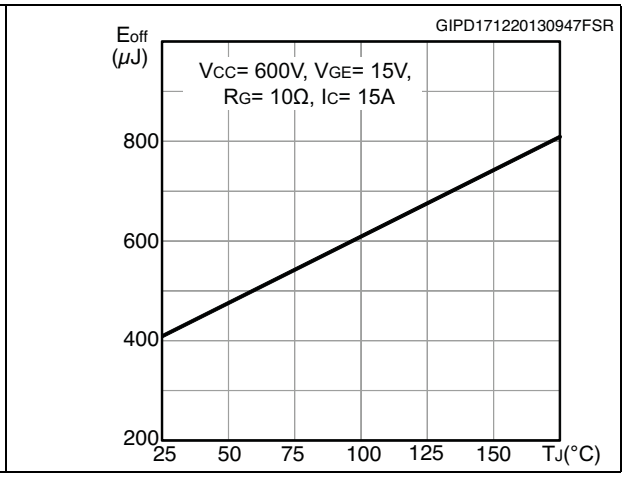


Figure 18. Switching-off loss vs collector-emitter voltage

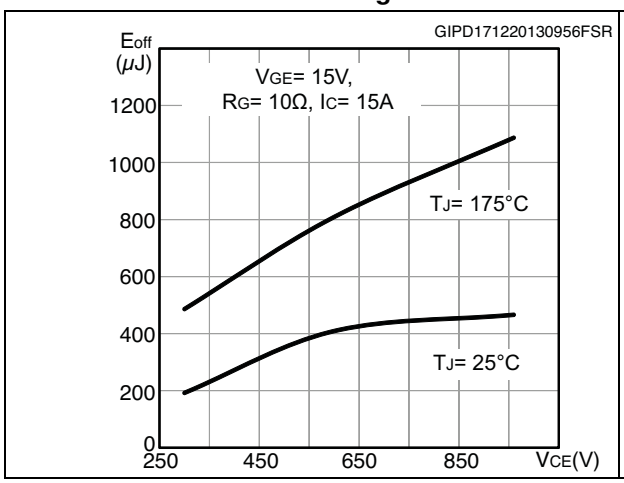


Figure 19. Switching times vs. collector current

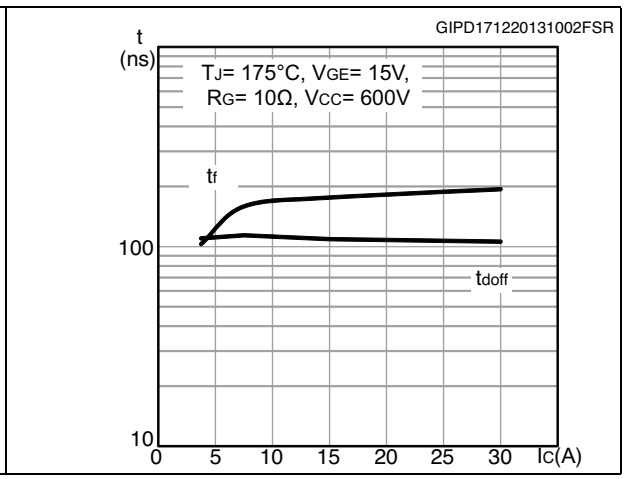


Figure 20. Switching times vs. gate resistance

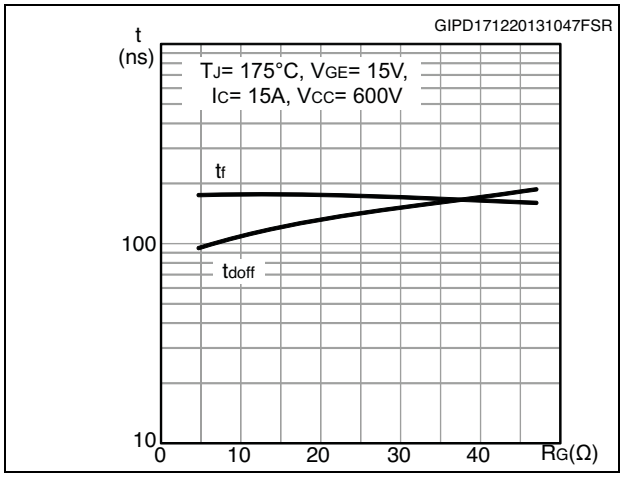


Figure 21. Thermal impedance for IGBT

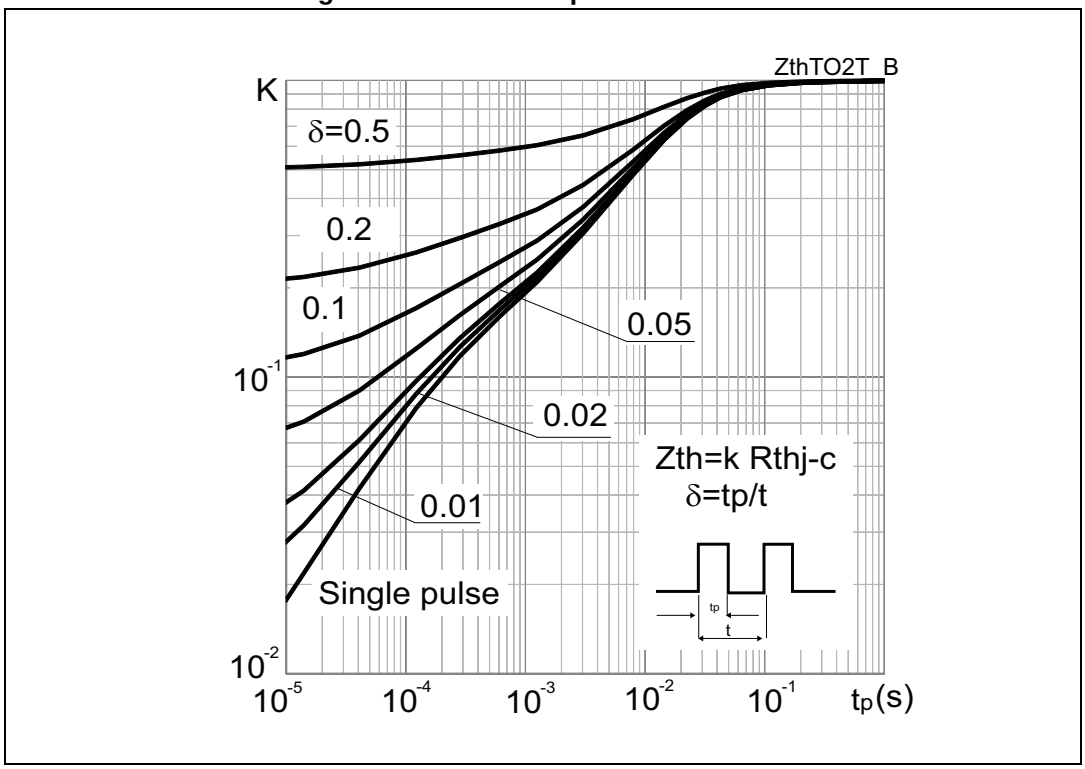
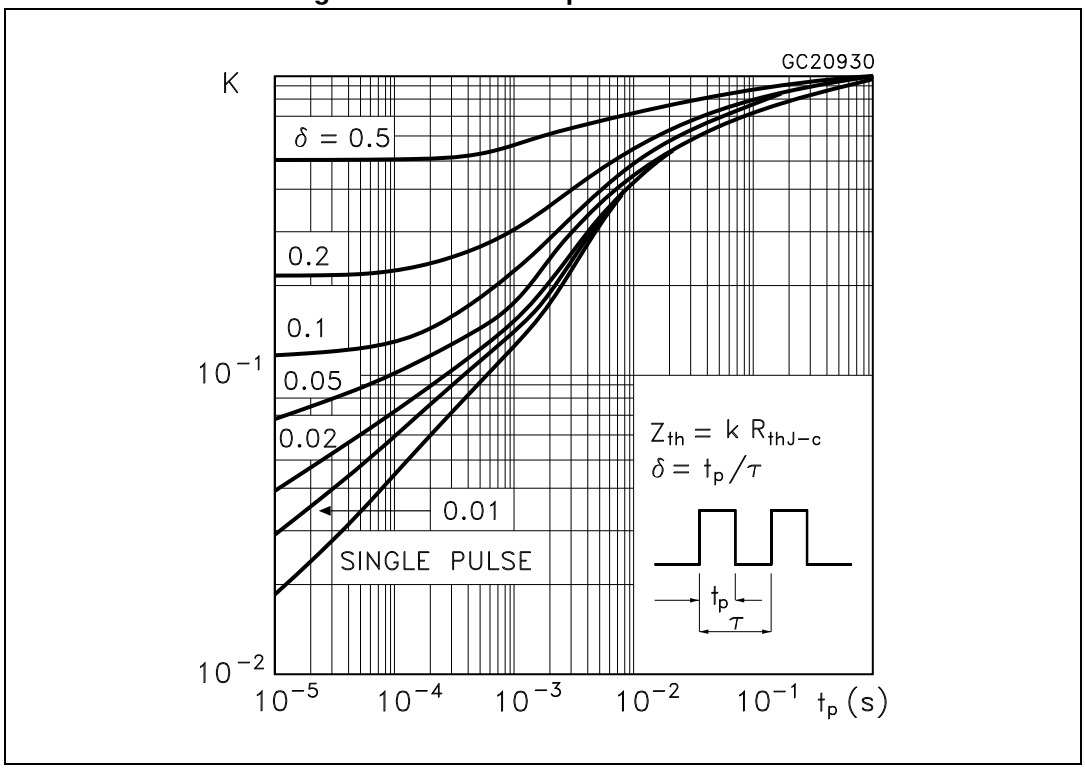


Figure 22. Thermal impedance for diode



3 Test circuits

Figure 23. Test circuit for inductive load switching

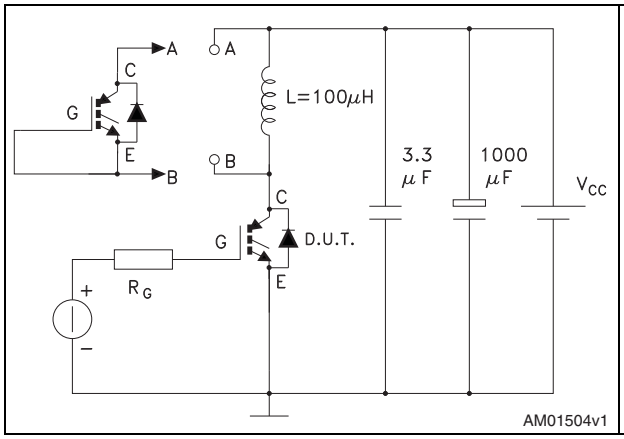


Figure 24. Test circuit for capacitive load switching

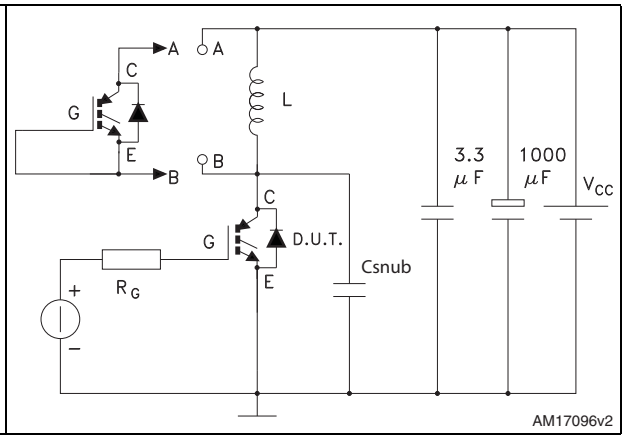


Figure 25. Gate charge test circuit

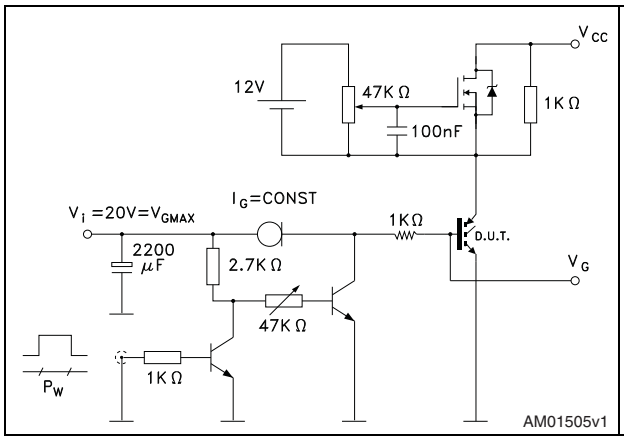
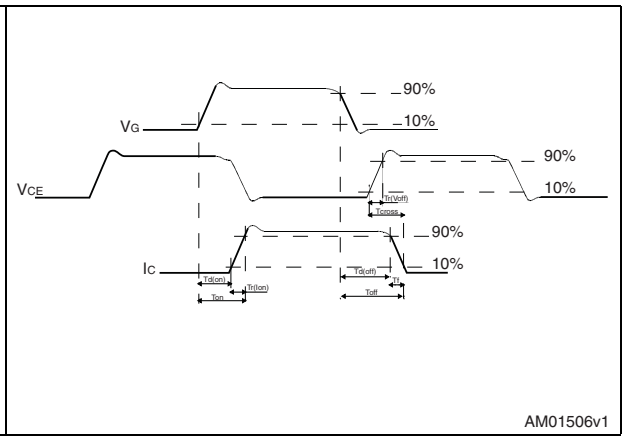


Figure 26. Switching waveform



4 Package mechanical data

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.

Figure 27. TO-247 drawing

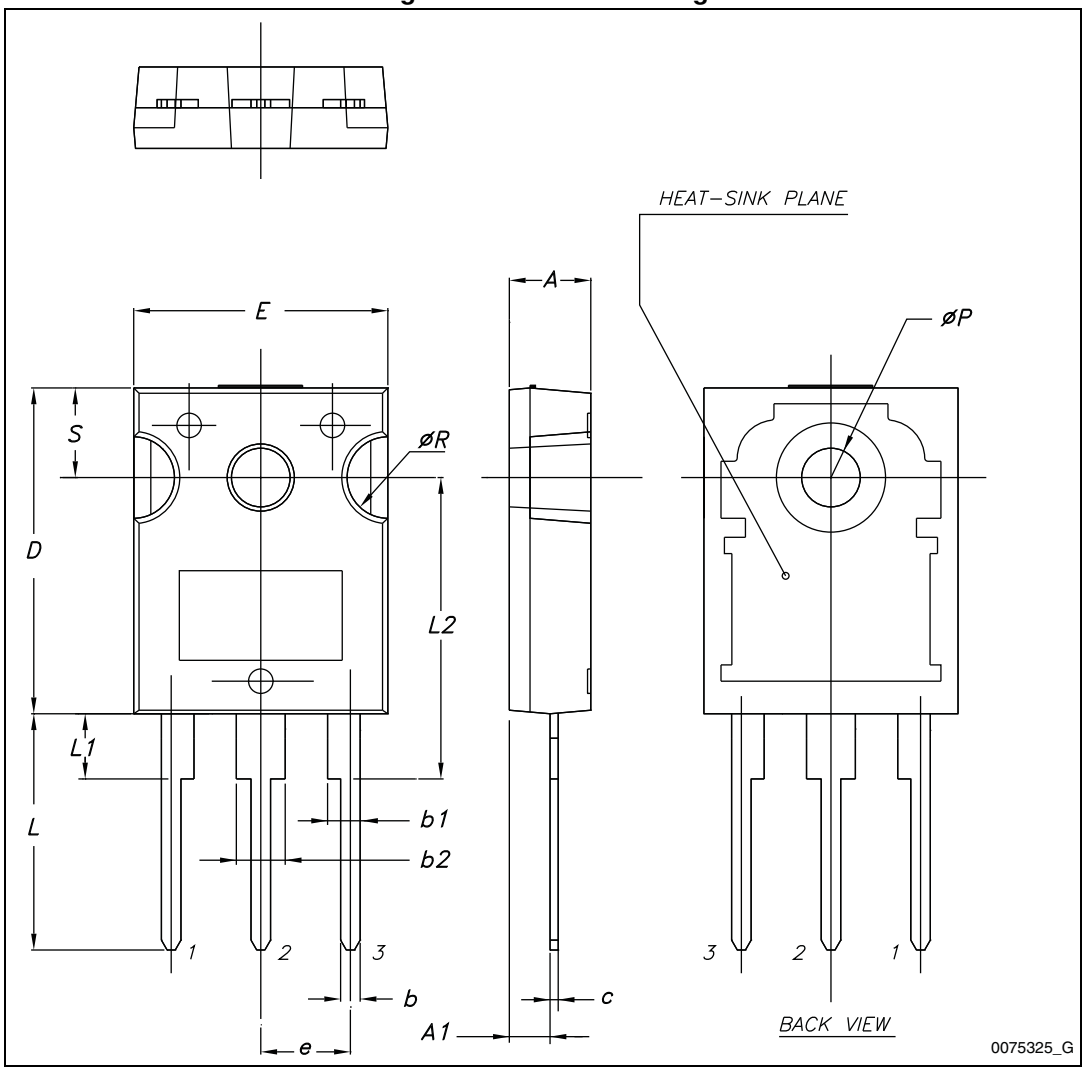


Table 8. TO-247 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 28. TO-3P drawing

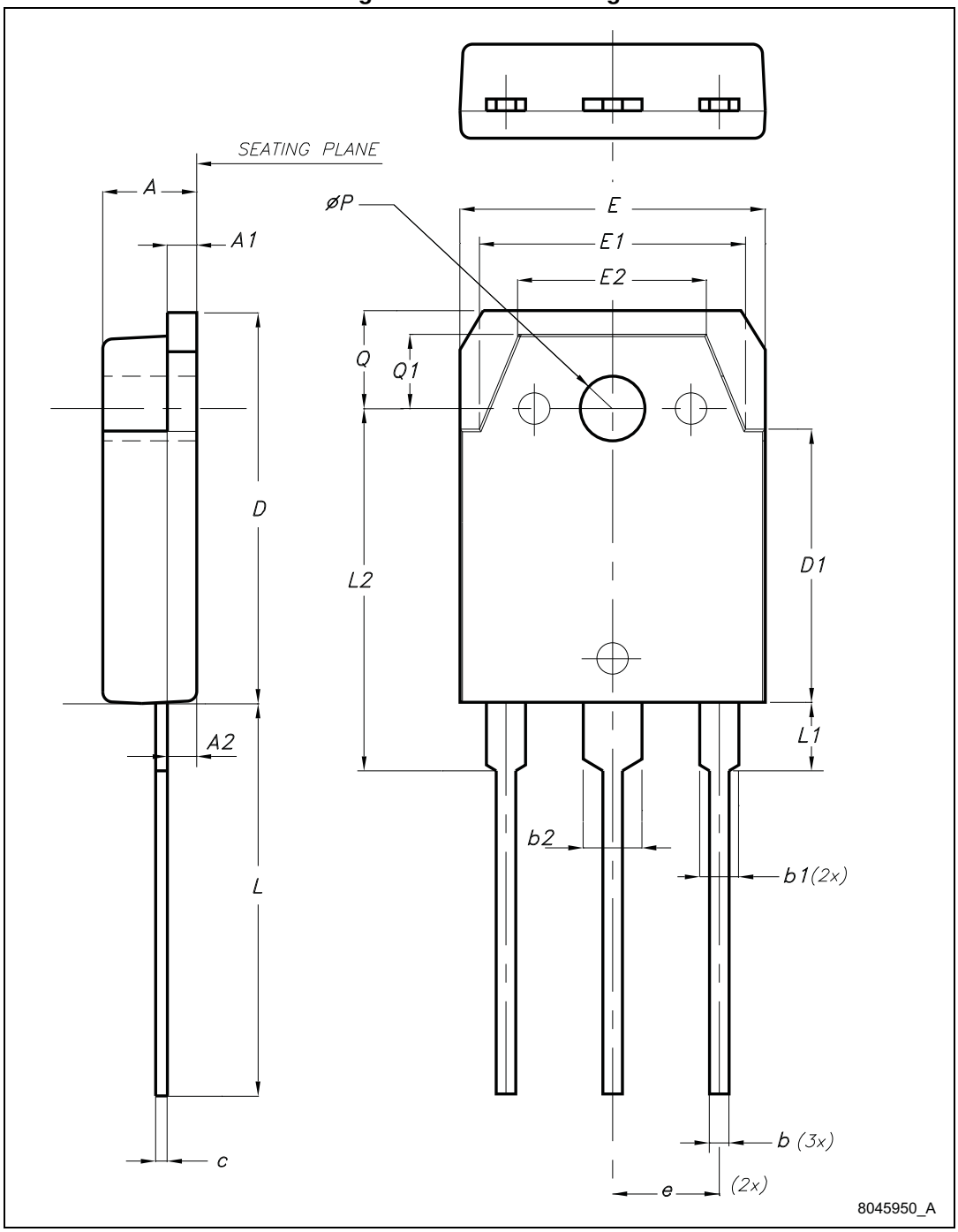


Table 9. TO-3P mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60		5
A1	1.45	1.50	1.65
A2	1.20	1.40	1.60
b	0.80	1	1.20
b1	1.80		2.20
b2	2.80		3.20
c	0.55	0.60	0.75
D	19.70	19.90	20.10
D1		13.90	
E	15.40		15.80
E1		13.60	
E2		9.60	
e	5.15	5.45	5.75
L	19.50	20	20.50
L1		3.50	
L2	18.20	18.40	18.60
øP	3.10		3.30
Q		5	
Q1		3.80	

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
13-Jan-2014	1	Initial release.
03-Feb-2014	2	Added $V_{CE(sat)}$ max value in *Table 5: Dynamic characteristics*. Minor text changes.

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