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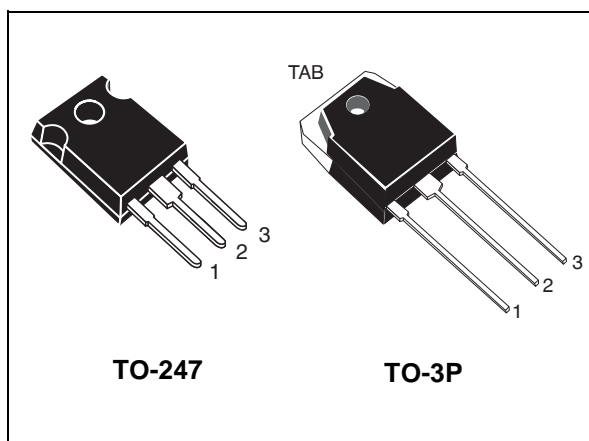
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# STGW28IH125DF STGWT28IH125DF

1250 V, 30 A IH series  
trench gate field-stop IGBT

Datasheet - production data



## Features

- Designed for soft commutation only
- Maximum junction temperature:  $T_J = 175\text{ }^\circ\text{C}$
- Minimized tail current
- $V_{CE(sat)} = 2.0\text{ V (typ.) @ } I_C = 25\text{ A}$
- Tight parameters distribution
- Safe paralleling
- 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.

Figure 1. Internal schematic diagram

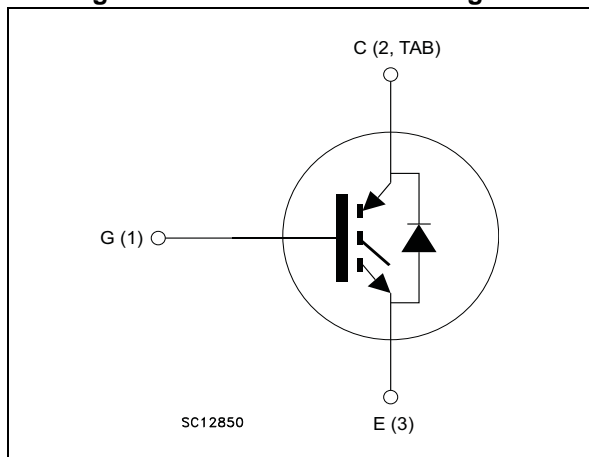


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW28IH125DF	G28IH125DF	TO-247	Tube
STGWT28IH125DF	G28IH125DF	TO-3P	Tube

## Contents

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**Electrical ratings**

# 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 $T_C = 25\text{ °C}$	60	A
$I_C$	Continuous collector current at $T_C = 100\text{ °C}$	30	A
$I_{CP}^{(1)}$	Pulsed collector current	120	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$I_F$	Continuous forward current at $T_C = 25\text{ °C}$	60	A
$I_F$	Continuous forward current at $T_C = 100\text{ °C}$	30	A
$I_{FP(1)}$	Pulsed forward current	120	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	375	W
$T_{STG}$	Storage temperature range	- 55 to 150	$^{\circ}\text{C}$
$T_J$	Operating junction temperature	- 55 to 175	$^{\circ}\text{C}$

1. Pulse width limited by maximum junction temperature.

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case IGBT	0.4	$^{\circ}\text{C/W}$
$R_{thJC}$	Thermal resistance junction-case diode	1.47	$^{\circ}\text{C/W}$
$R_{thJA}$	Thermal resistance junction-ambient	50	$^{\circ}\text{C/W}$

Electrical characteristics

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## 2 Electrical characteristics

T<sub>J</sub> = 25 °C unless otherwise specified.

Table 4. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)CES</sub>	Collector-emitter breakdown voltage (V <sub>GE</sub> = 0)	I <sub>C</sub> = 2 mA	1250			V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 25 A		2	2.5	V
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 25 A T <sub>J</sub> = 125 °C		2.2		
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 25 A T <sub>J</sub> = 175 °C		2.3		
		V <sub>GE</sub> = 15 V, I <sub>C</sub> = 50 A		2.65		
V <sub>F</sub>	Forward on-voltage	I <sub>F</sub> = 25 A		1.2	1.6	V
		I <sub>F</sub> = 50 A		1.45		
		I <sub>F</sub> = 25 A T <sub>J</sub> = 125 °C		1.2		
		I <sub>F</sub> = 25 A T <sub>J</sub> = 175 °C		1.2		
V <sub>GE(th)</sub>	Gate threshold voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1 mA	5	6	7	V
I <sub>CES</sub>	Collector cut-off current (V <sub>GE</sub> = 0)	V <sub>CE</sub> = 1250 V			25	μA
I <sub>GES</sub>	Gate-emitter leakage current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20 V			250	nA

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 25 V, f = 1 MHz, V <sub>GE</sub> = 0	-	2035	-	pF
C <sub>oes</sub>	Output capacitance		-	139	-	pF
C <sub>res</sub>	Reverse transfer capacitance		-	52	-	pF
Q <sub>g</sub>	Total gate charge	V <sub>CC</sub> = 960 V, I <sub>C</sub> = 25 A, V <sub>GE</sub> = 15 V, see <a href="#">Figure 25</a>	-	114	-	nC
Q <sub>ge</sub>	Gate-emitter charge		-	11	-	nC
Q <sub>gc</sub>	Gate-collector charge		-	69	-	nC

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Electrical characteristics

Table 6. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CE} = 600\text{ V}$ , $I_C = 25\text{ A}$ , $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , see <a href="#">Figure 23</a>	-	128	-	ns
$t_f$	Current fall time		-	82	-	ns
$E_{off}^{(1)}$	Turn-off switching losses		-	0.72	-	mJ
$t_{d(off)}$	Turn-off delay time	$V_{CE} = 600\text{ V}$ , $I_C = 25\text{ A}$ , $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$ , see <a href="#">Figure 23</a>	-	132	-	ns
$t_f$	Current fall time		-	190	-	ns
$E_{off}^{(1)}$	Turn-off switching losses		-	1.53	-	mJ

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	$V_{CC} = 900\text{ V}$ , $R_G = 10\ \Omega$ , $I_C = 50\text{ A}$ , $L = 500\ \mu\text{H}$ , $C_{snub} = 330\text{ nF}$ , see <a href="#">Figure 24</a>	-	230	-	$\mu\text{J}$
		$V_{CC} = 900\text{ V}$ , $R_G = 10\ \Omega$ , $I_C = 50\text{ A}$ , $L = 500\ \mu\text{H}$ , $C_{snub} = 330\text{ nF}$ , $T_J = 175\text{ }^\circ\text{C}$ , see <a href="#">Figure 24</a>	-	520	-	

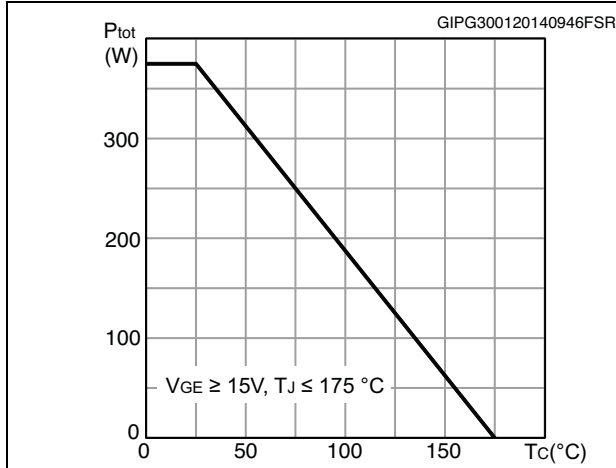
1. Turn-off losses include also the tail of the collector current.

**Electrical characteristics**

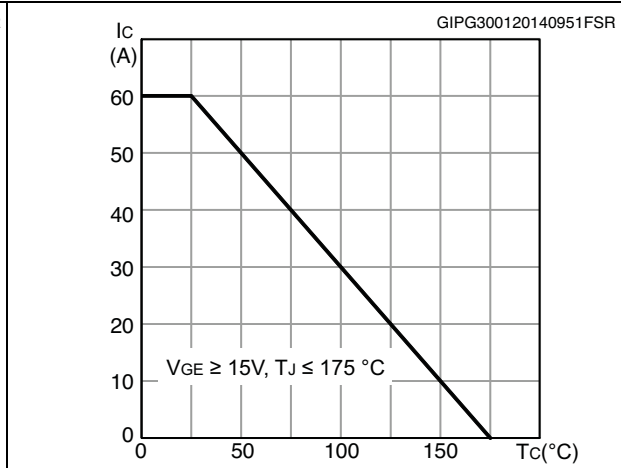
**STGW28IH125DF, STGWT28IH125DF**

**2.1 Electrical characteristics (curves)**

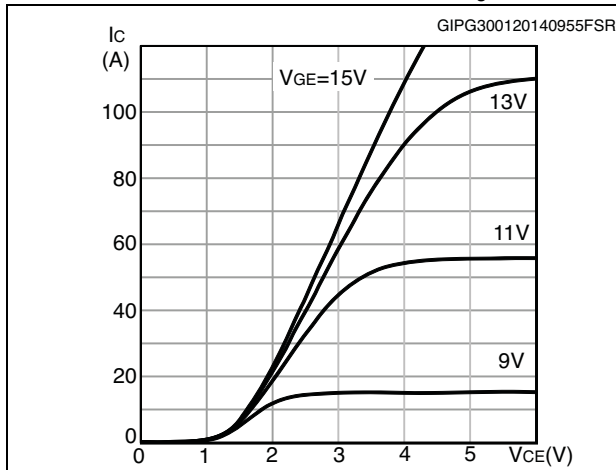
**Figure 2. Power dissipation vs. case temperature**



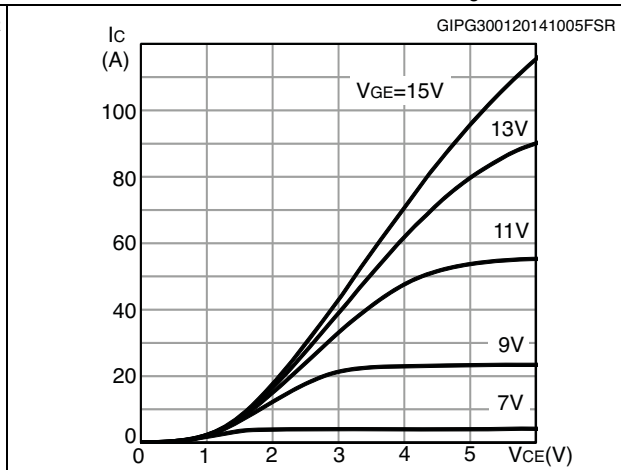
**Figure 3. Collector current vs. case temperature**



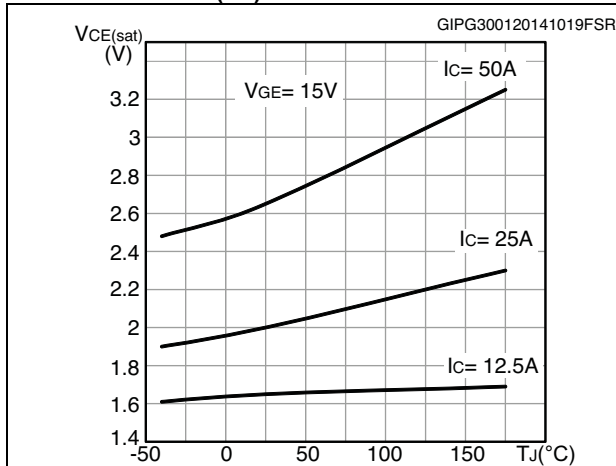
**Figure 4. Output characteristics (T<sub>J</sub> = 25°C)**



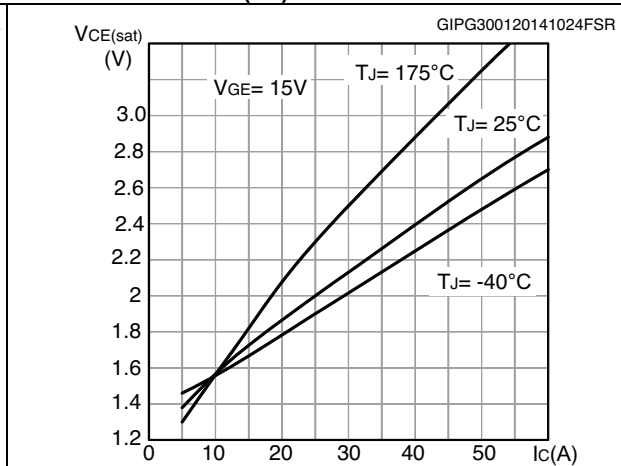
**Figure 5. Output characteristics (T<sub>J</sub> = 175°C)**



**Figure 6. V<sub>CE(sat)</sub> vs. junction temperature**



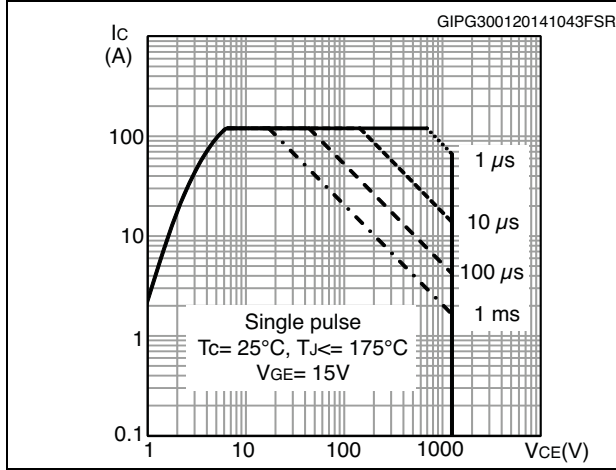
**Figure 7. V<sub>CE(sat)</sub> vs. collector current**



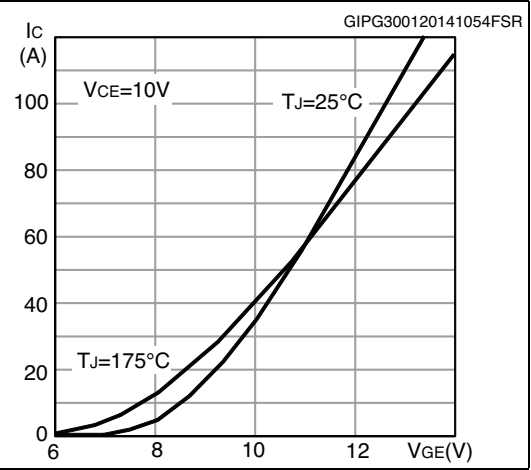
**STGW28IH125DF, STGWT28IH125DF**

**Electrical characteristics**

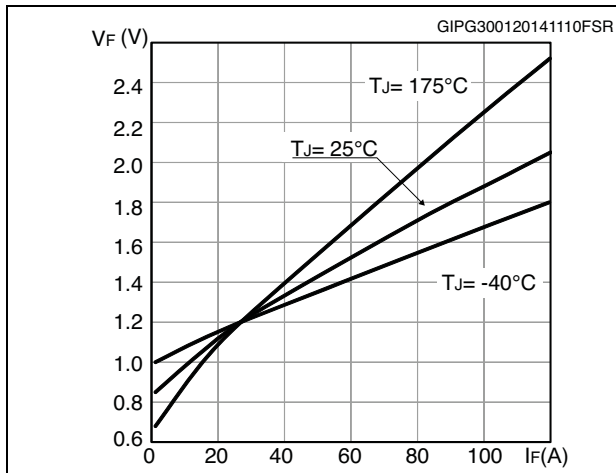
**Figure 8. Forward bias safe operating area**



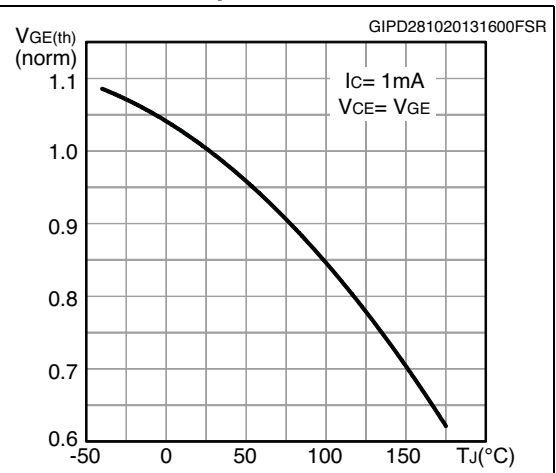
**Figure 9. Transfer characteristics**



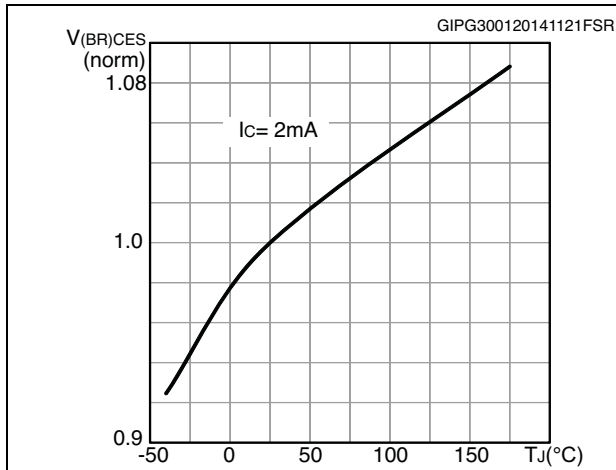
**Figure 10. Diode VF vs. forward current**



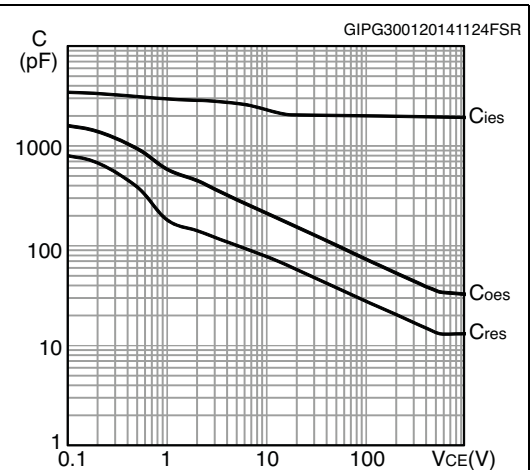
**Figure 11. Normalized VGE(th) vs junction temperature**



**Figure 12. Normalized V(BR)CES vs. junction temperature**



**Figure 13. Capacitance variation**

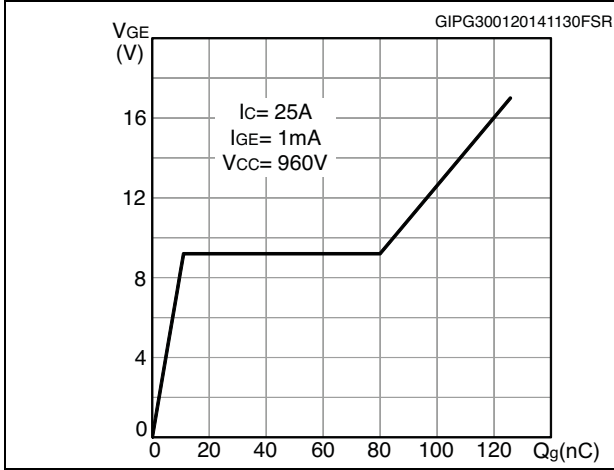




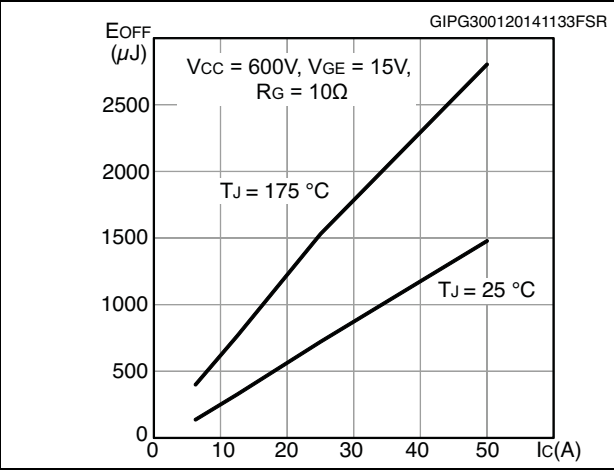
**Electrical characteristics**

**STGW28IH125DF, STGWT28IH125DF**

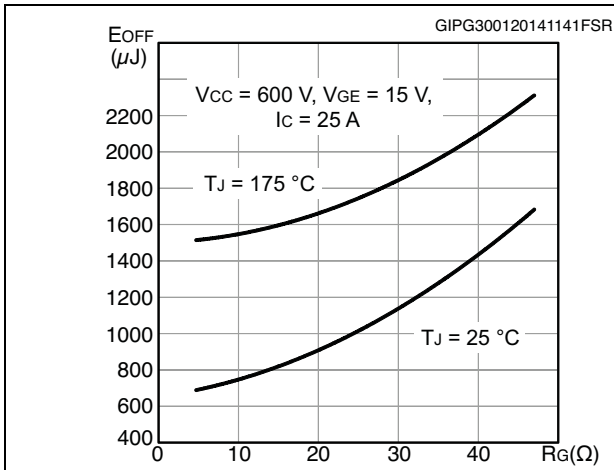
**Figure 14. Gate charge vs. gate-emitter voltage**



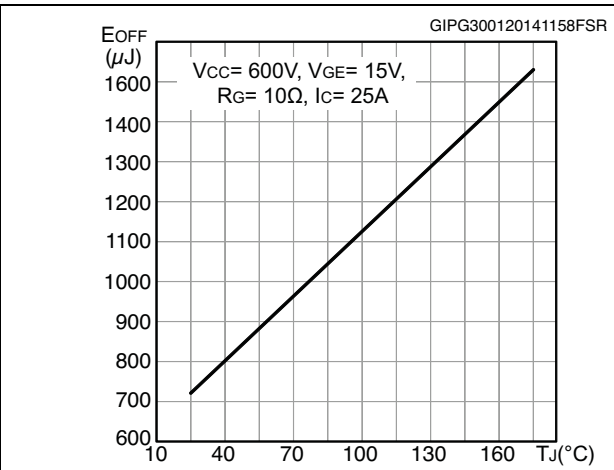
**Figure 15. Switching loss vs collector current**



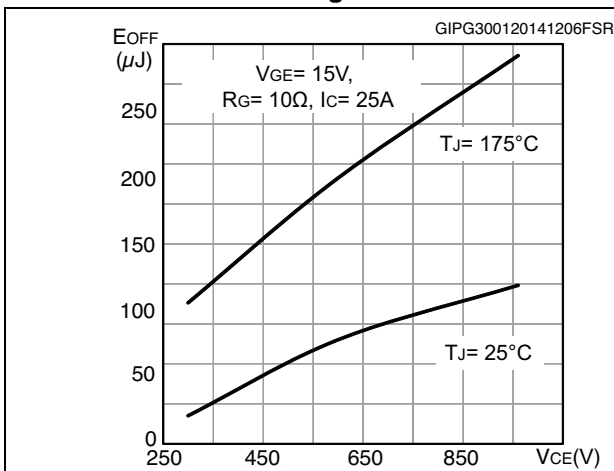
**Figure 16. Switching loss vs gate resistance**



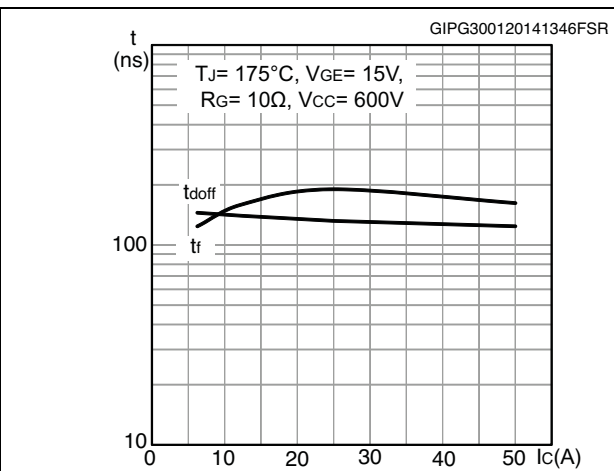
**Figure 17. Switching loss vs temperature**



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



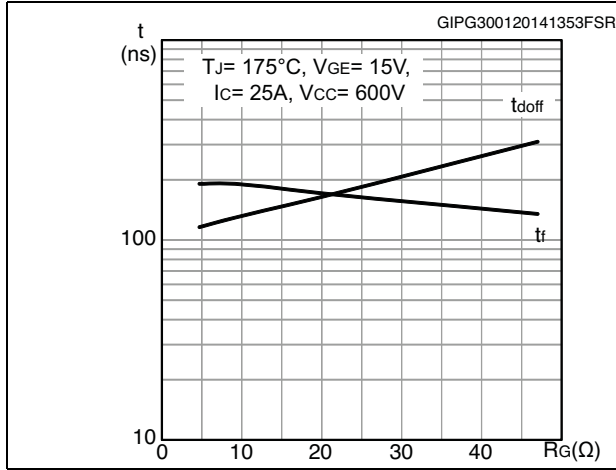
**Figure 19. Switching times vs. collector current**



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**Electrical characteristics**

**Figure 20. Switching times vs. gate resistance**



Electrical characteristics

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Figure 21. Thermal impedance for IGBT

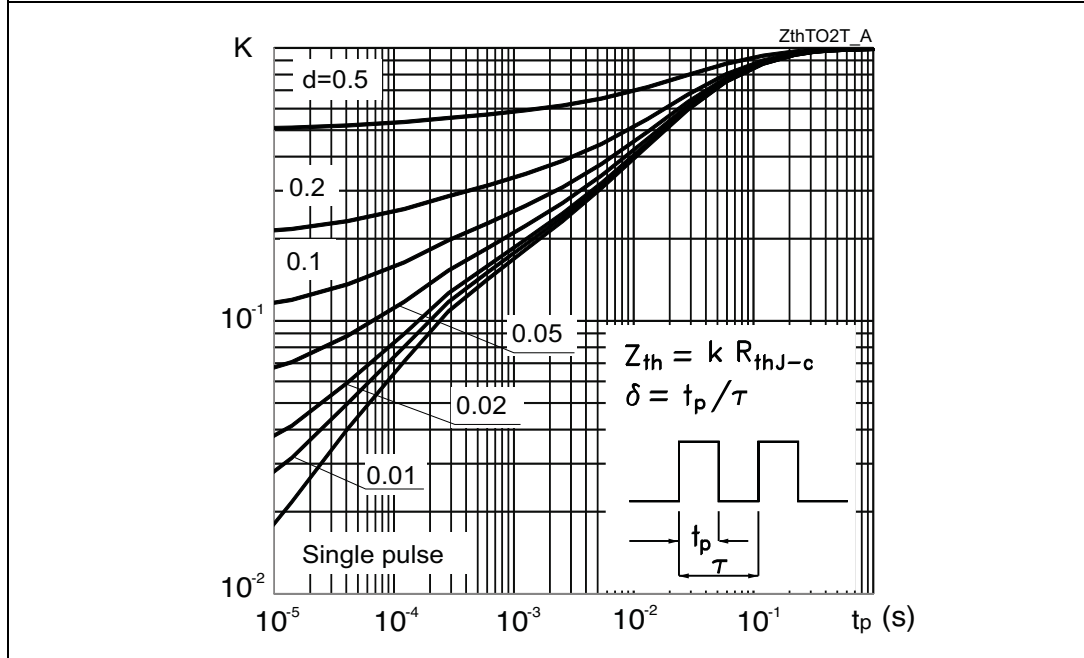
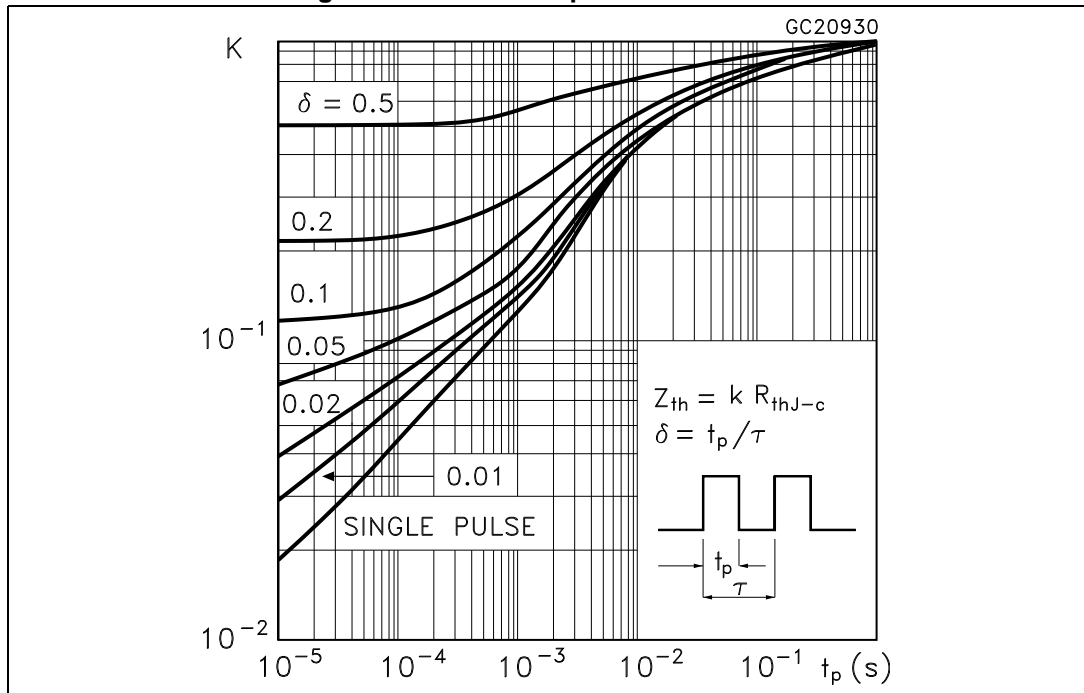


Figure 22. Thermal impedance for diode

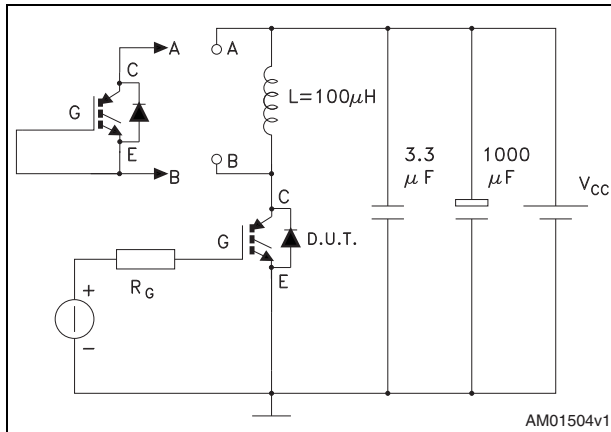


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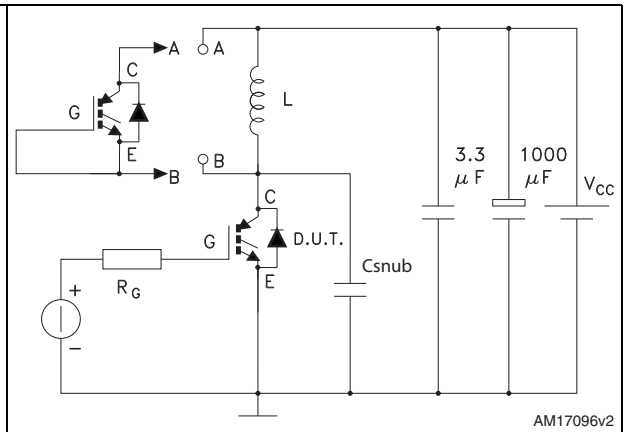
**Test circuits**

**3 Test circuits**

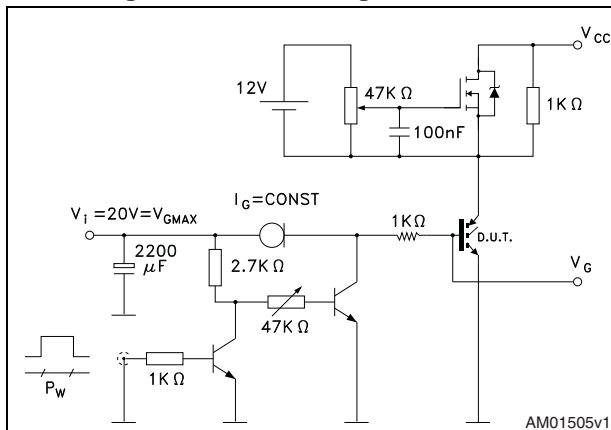
**Figure 23. Test circuit for inductive load switching**



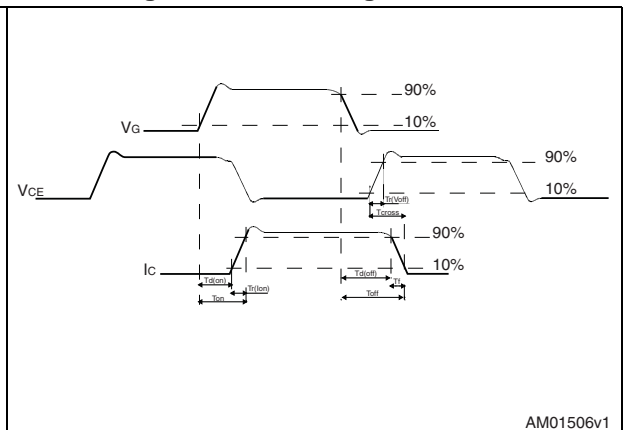
**Figure 24. Test circuit for capacitive load switching**



**Figure 25. Gate charge test circuit**



**Figure 26. Switching waveform**



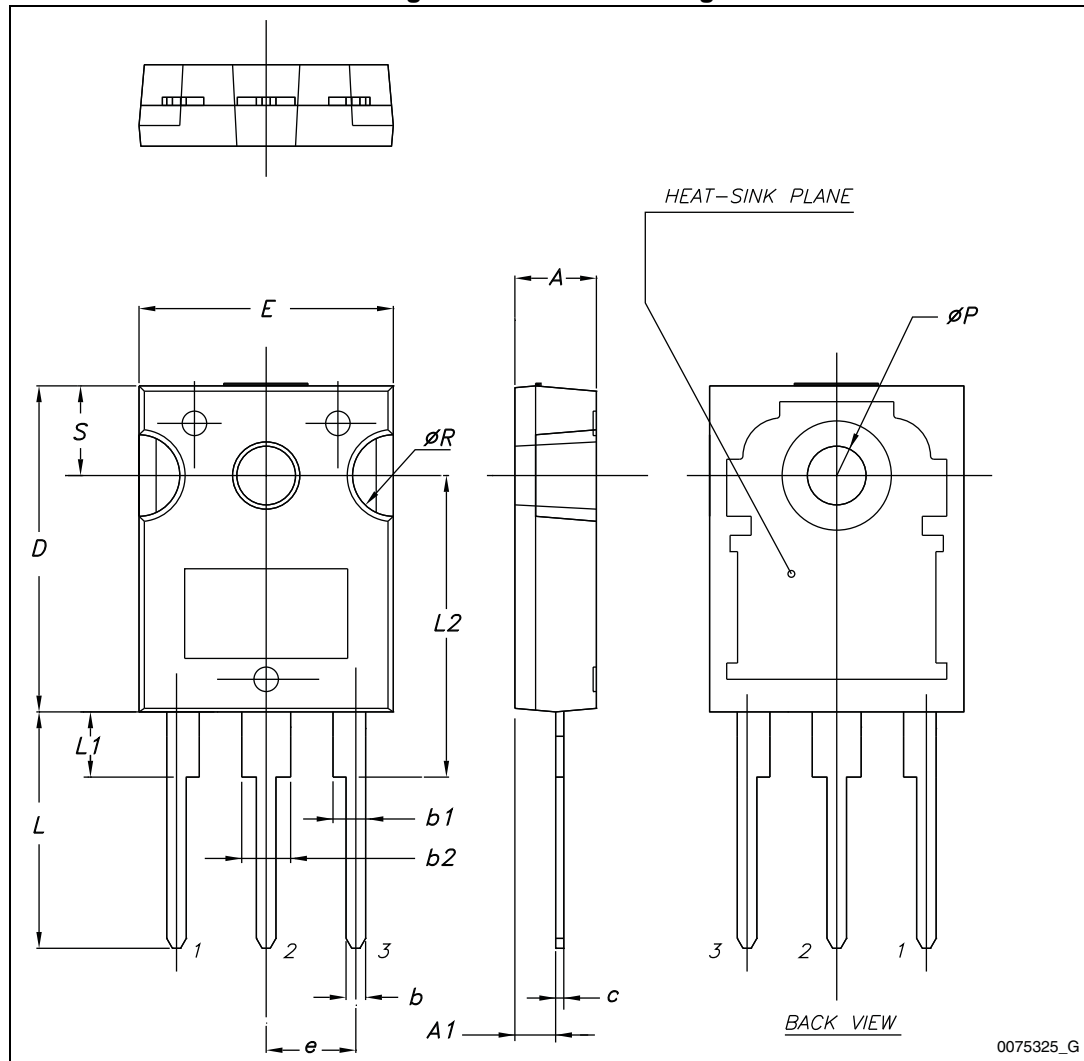
Package mechanical data

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**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**



0075325\_G

**STGW28IH125DF, STGWT28IH125DF**

**Package mechanical data**

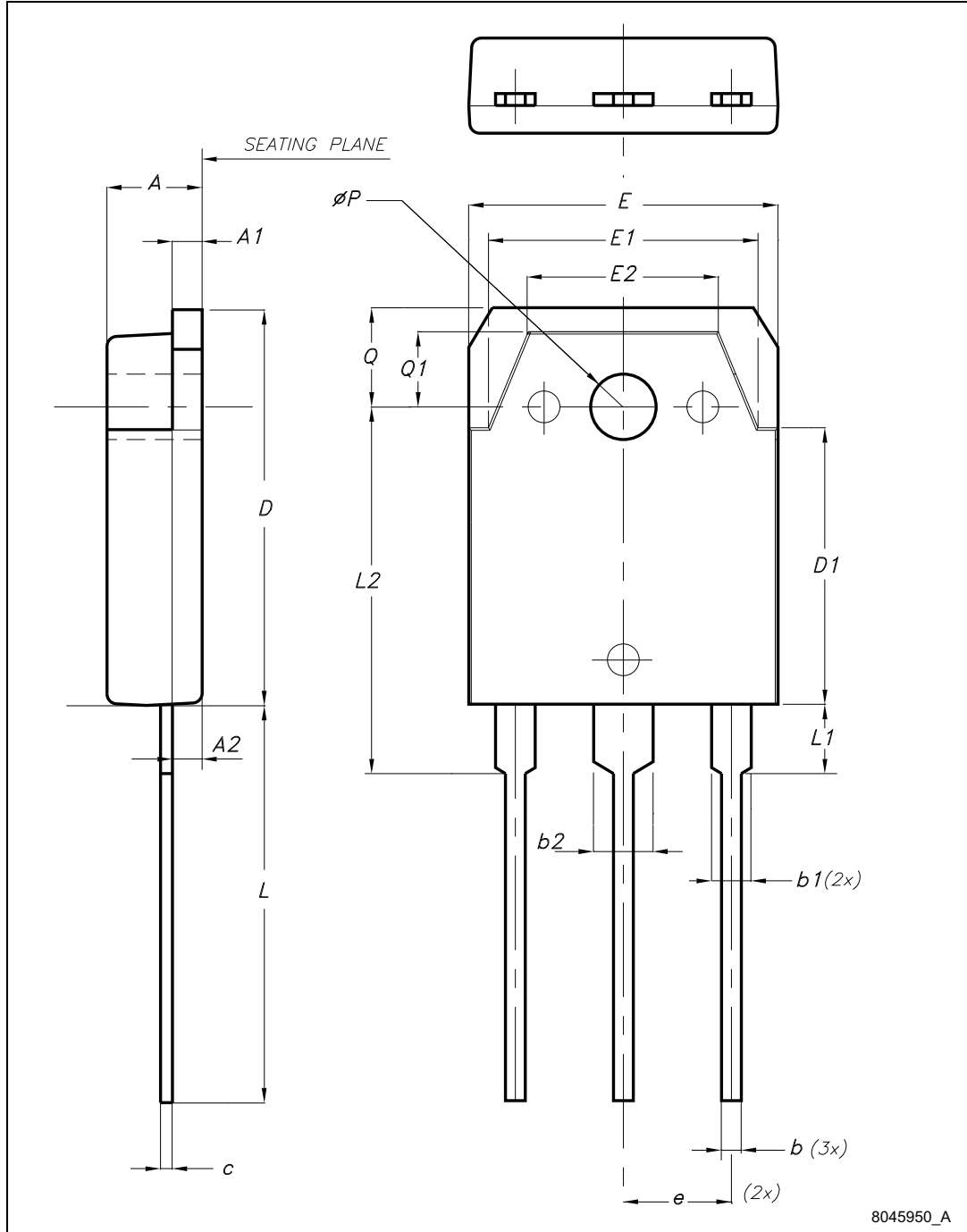
**Table 8. TO-247 mechanical data**

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	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

Package mechanical data

STGW28IH125DF, STGWT28IH125DF

Figure 28. TO-3P drawing



8045950\_A

**STGW28IH125DF, STGWT28IH125DF**

**Package mechanical data**

**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
20-Jan-2014	1	Initial release.
03-Feb-2014	2	Document status promoted from preliminary to production data. Updated <i>Table 2: Absolute maximum ratings</i> , <i>Table 4: Static characteristics</i> , <i>Table 5: Dynamic characteristics</i> , <i>Table 6: IGBT switching characteristics (inductive load)</i> and <i>Table 7: IGBT switching characteristics (capacitive load)</i> . Inserted <i>Section 2.1: Electrical characteristics (curves)</i> . Minor text changes.

## STGW28IH125DF, STGWT28IH125DF

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