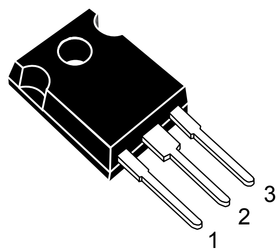
STGW19NC60W

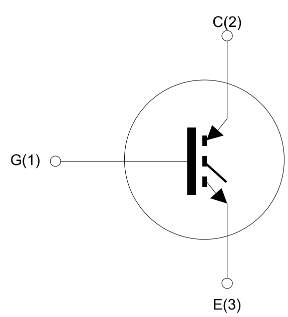
19 A, 600 V - ultrafast IGBT

Datasheet - production data



TO-247

Figure 1: Internal schematic diagram



Features

- High frequency operation
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)

Applications

- High frequency inverters
- High frequency motor controls, inverters, UPS
- HF, SMPS and PFC in both hard switch and resonant topologies

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

Table 1: Device summary

Order code	Marking	Package	Packaging
STGW19NC60W	GW19NC60W	TO-247	Tube

This is information on a product in full production.

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C (1)	Continuous collector current at T_C = 25 °C	42	A
I_C (1)	Continuous collector current at T_C = 100 °C	23	A
I_{CL} (2)	Turn-off latching current	30	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total dissipation at T_C = 25 °C	140	W
T_{stg}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range		

Notes:

(1)Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_{J(max)} \times I_C(T_C))}$$

(2)V_{CLAMP} = 80% (V_{CES}), V_{GE} = 15 V, R_G = 10 Ω, T_J = 150 °C

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.9	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 12 A		2.1	2.5	V
		V_{GE} = 15 V, I_C = 12 A, T_J = 125 °C		1.8		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 600 V			150	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_C=125 °C [(1)]			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ± 20 V			±100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C= 12 A		10		S

Notes:

[(1)]Defined by design, not subject to production test.

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE}= 25 V, f = 1 MHz, V_{GE} = 0 V	-	1180	-	pF
C_{oes}	Output capacitance		-	130	-	
C_{res}	Reverse transfer capacitance		-	26	-	
Q_g	Total gate charge	V_{CE} = 390 V, I_C = 12 A, V_{GE} = 15 V (see *Figure 16: "Gate charge test circuit"*)	-	53	-	nC
Q_{ge}	Gate-emitter charge		-	10	-	
Q_{gc}	Gate-collector charge		-	21	-	

Table 6: Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 12 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 17: "Switching waveform")	-	25	-	ns
t_r	Current rise time		-	7	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1600	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 12 A, V_{GE} = 15 V, R_G = 10 Ω, T_C = 125°C (see Figure 17: "Switching waveform")	-	25	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1400	-	A/µs
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 12 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 17: "Switching waveform")	-	22	-	ns
$t_d(_{off})$	Turn-off delay time		-	90	-	ns
t_f	Current fall time		-	43	-	ns
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 12 A, V_{GE} = 15 V, R_G = 10 Ω, T_C = 125°C (see Figure 17: "Switching waveform")	-	47	-	ns
$t_d(_{off})$	Turn-off delay time		-	127	-	ns
t_f	Current fall time		-	77	-	ns

Table 7: Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}(1)	Turn-on switching energy	V_{CC} = 390 V, I_C = 12 A, R_G= 10 Ω, V_{GE}= 15 V (see Figure 17: "Switching waveform")	-	81	-	µJ
E_{off}(2)	Turn-off switching energy		-	125	-	µJ
E_{ts}	Total switching energy		-	206	-	µJ
E_{on}(1)	Turn-on switching energy		-	161	-	µJ
E_{off}(2)	Turn-off switching energy		-	255	-	µJ
E_{ts}	Total switching energy	V_{CC} = 390 V, I_C = 12 A, R_G= 10 Ω, V_{GE}= 15 V, T_C = 125°C (see Figure 17: "Switching waveform")	-	416	-	µJ

Notes:

(1)Including the reverse recovery of the external diode. The diode is the same of the co-packed STGW19NC60WD.

(2)including the tail of the collector current.

2.2 Electrical characteristics (curves)

Figure 2: Output characteristics

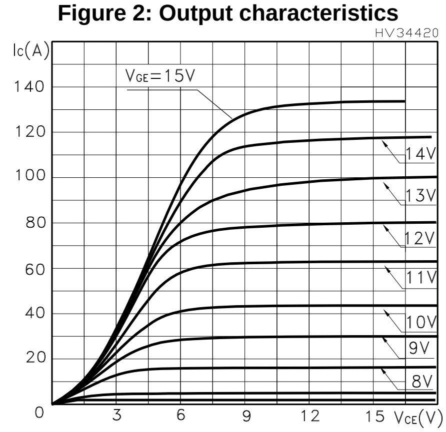


Figure 3: Transfer characteristics

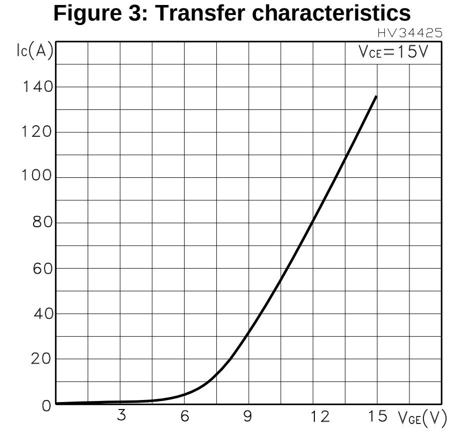


Figure 4: Transconductance

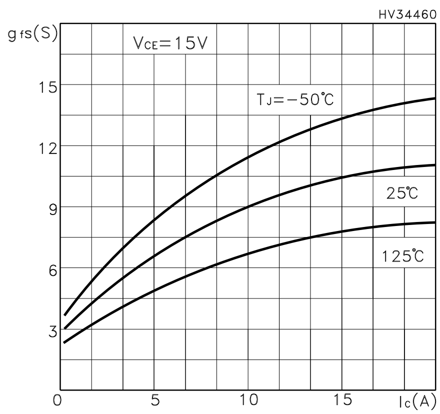


Figure 5: Collector-emitter on voltage vs temperature

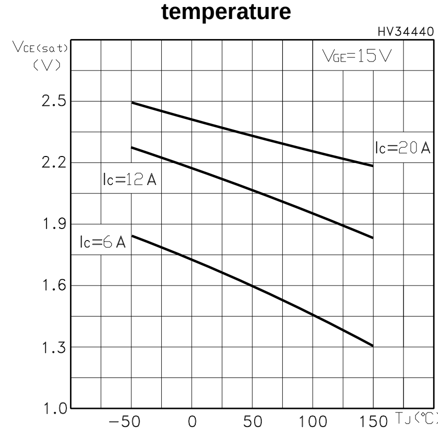


Figure 6: Gate charge vs gate-source voltage

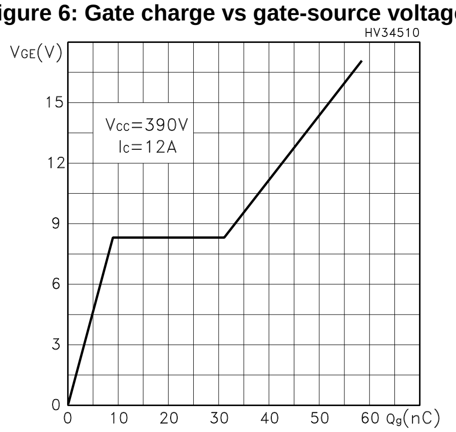


Figure 7: Capacitance variations

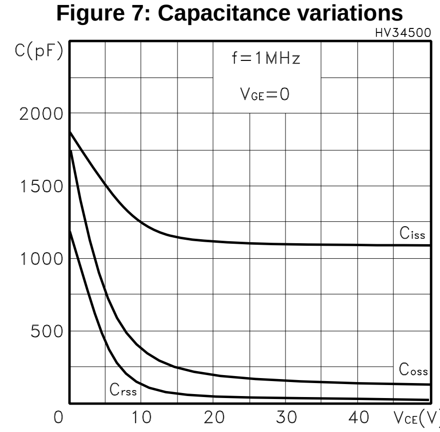


Figure 8: Normalized gate threshold voltage vs temperature

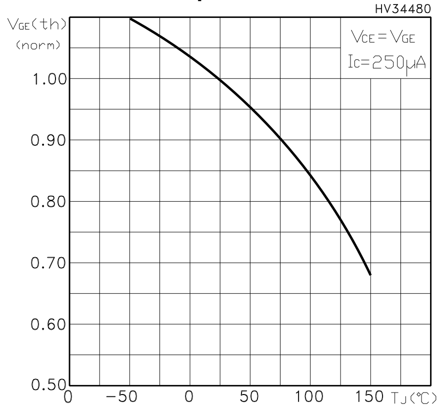


Figure 9: Collector-emitter on voltage vs collector current

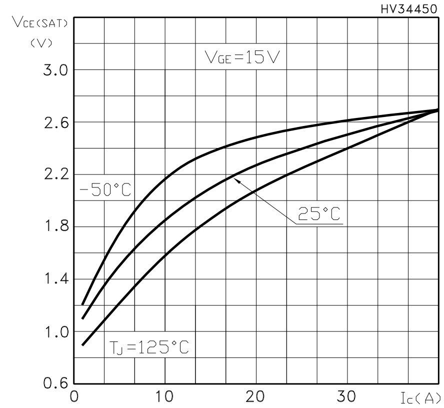


Figure 10: Normalized breakdown voltage vs temperature

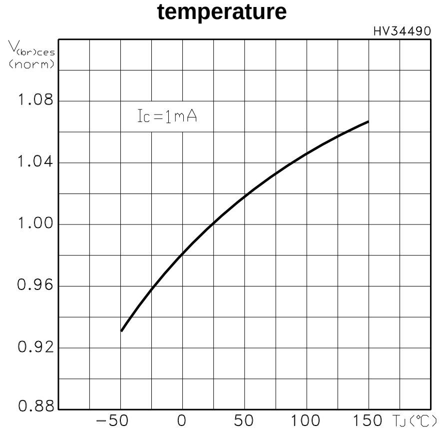


Figure 11: Switching energy vs temperature

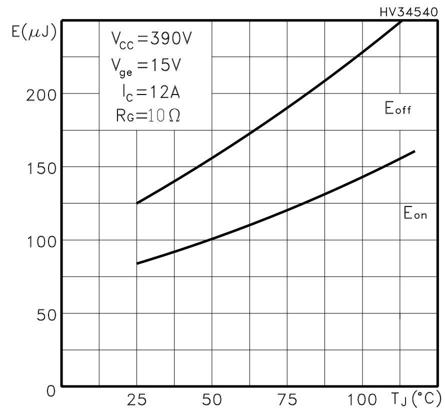


Figure 12: Switching energy vs gate resistance

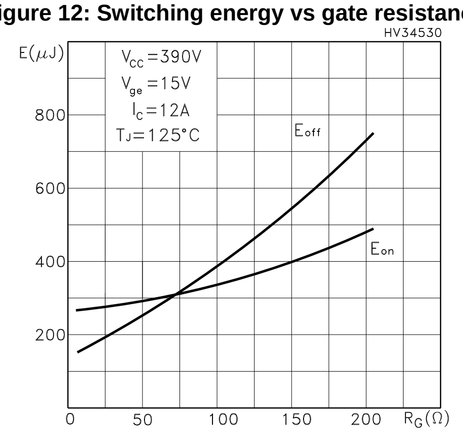


Figure 13: Switching energy vs collector current

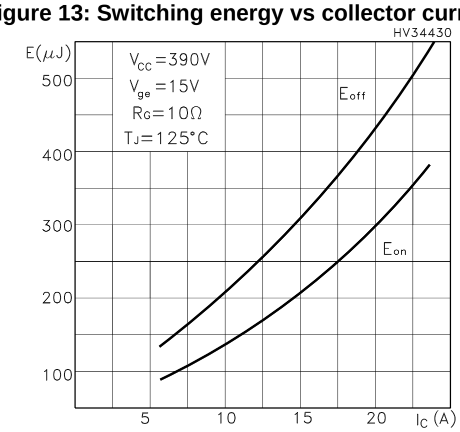
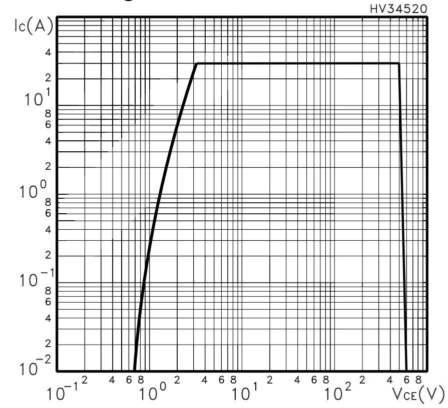


Figure 14: Turn-off SOA



3 Test circuits

Figure 15: Test circuit for inductive load switching

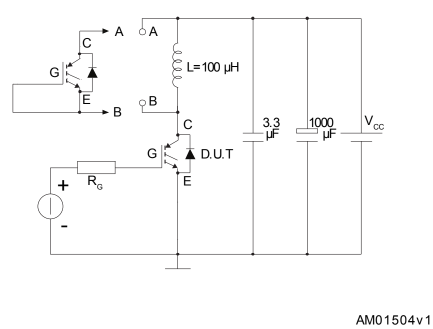


Figure 16: Gate charge test circuit

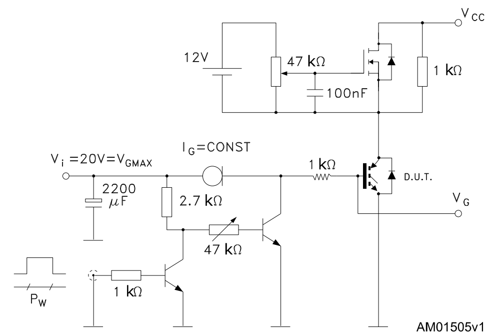
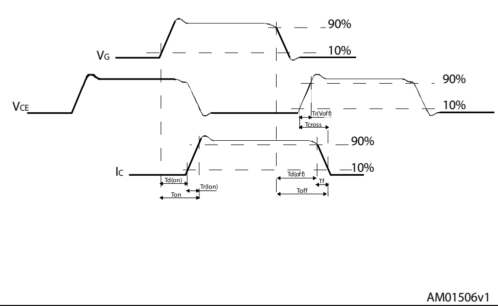


Figure 17: Switching waveform



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***. ECOPACK® is an ST trademark.

4.1 TO-247 package information

Figure 18: TO-247 package outline

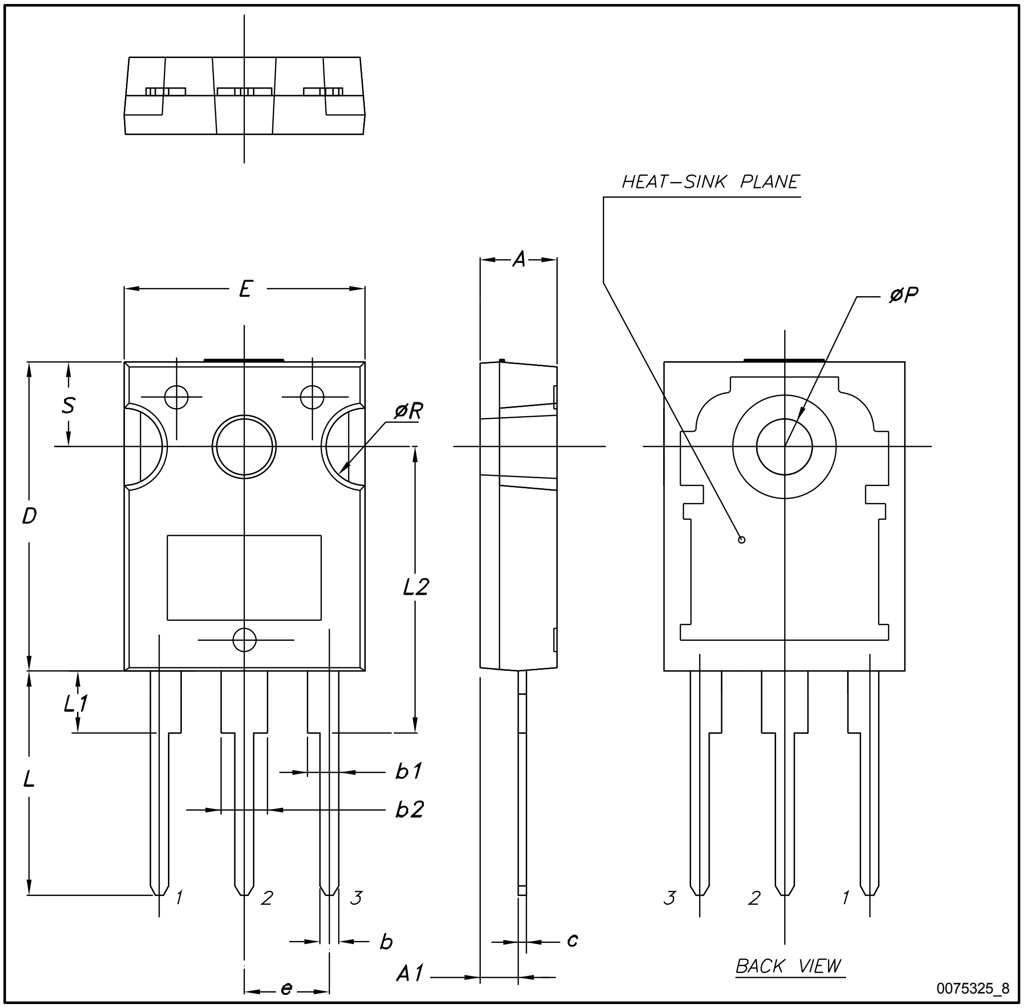


Table 8: TO-247 package mechanical data

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

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
04-Oct-2006	1	Initial release.
08-May-2007	2	Modified value on *Table 2*
20-Nov-2008	3	Inserted packages: D2PAK and TO-247
07-Nov-2016	4	The part numbers STGB19NC60W and STGP19NC60W have been moved to a separate datasheet Modified: *Table 2: "Absolute maximum ratings"*, *Table 4: "Static"* and *Table 7: "Switching energy (inductive load)"* Minor text changes