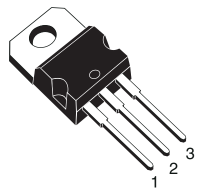
STGP10NC60H

N-channel 10A - 600V - TO-220
Very fast PowerMESH™ IGBT

General features

Type	V_{CES}	$V_{CE(sat)}$ (Max)@ 25°C	I_C @100°C
STGP10NC60H	600V	< 2.5V	10A

- Low on-voltage drop (V_{cesat})
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptbility)
- Very soft ultra fast recovery antiparallel diode

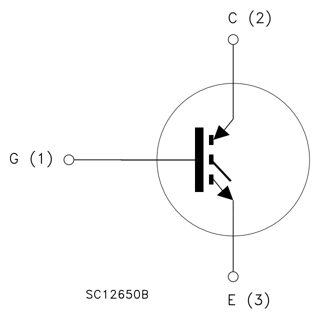


TO-220

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized for high frequency applications in order to achieve very high switching performances (reduced tfall) mantaining a low voltage drop.

Internal schematic diagram



Applications

- High frequency motor controls
- SMPS and PFC in both hard switch and resonant topologies
- Motor drivers

Order codes

Part number	Marking	Package	Packaging
STGP10NC60H	GP10NC60H	TO-220	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GS} = 0)	600	V
I_C (1)	Collector current (continuous) at T_C = 25°C	20	A
I_C (1)	Collector current (continuous) at T_C = 100°C	10	A
I_{CL} (2)	Collector current (pulsed)	40	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total dissipation at T_C = 25°C	60	W
T_{stg}	Storage temperature	– 55 to 150	°C
T_j	Operating junction temperature		

1. Calculated according to the iterative formula:

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

2. V_{clamp}=480V, Tj=150°C, R_G=10Ω, V_{GE}=15V

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	2.08	°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5	°C/W

2 Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	I_C= 1mA, V_{GE}= 0	600			V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= Max rating,T_C= 25°C V_{CE}=Max rating,T_C= 125°C			150 1	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±20V , V_{CE}= 0			±100	nA
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	5		5.75	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15V, I_C= 5A V_{GE}= 15V, I_C= 5A, Tc= 125°C		1.9 1.7	2.5	V V
g_{fs}	Forward transconductance	V_{CE} = 15V, I_C= 5A		3.5		S

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25V, f = 1MHz, V_{GE} = 0		365 43 8.3		pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390V, I_C = 5A, V_{GE} = 15V, *(see Figure 16)*		19.2 4.5 7		nC nC nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, *(see Figure 17)*		14.2 5 1000		ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, Tj=125°C *(see Figure 17)*		14 5 920		ns ns A/µs
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{cc} = 390V, I_C = 5A, R_{GE} = 10Ω , V_{GE} = 15V, *(see Figure 17)*		27 72 85		ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{cc} = 390V, I_C = 5A, R_{GE}=10Ω , V_{GE} =15V, Tj=125°C *(see Figure 17)*		50 108 139		ns ns ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390V, I_C = 75A R_G= 10Ω, V_{GE}=15V, Tj=25°C *(see Figure 17)*		31.8 95 126.8		µJ µJ µJ
E_{on} (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching Losses Total switching losses	V_{CC} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, Tj= 125°C *(see Figure 17)*		61.8 173 234.8		µJ µJ µJ

1. E_{on} is the tun-on losses when a typical diode is used in the test circuit in *(see Figure 16)*. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25°C and 125°C)
2. Turn-off losses include also the tail of the collector current

2.1 Electrical characteristics (curves)

Figure 1. Output characterisics

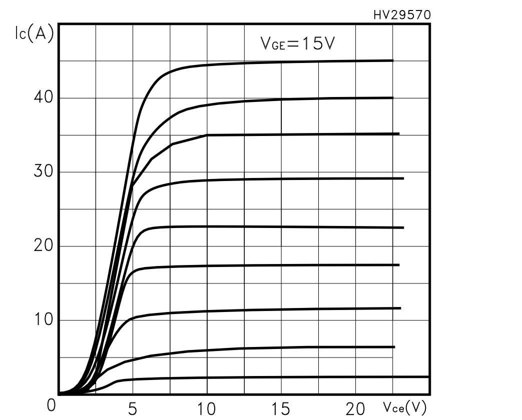


Figure 2. Transfer charactristics

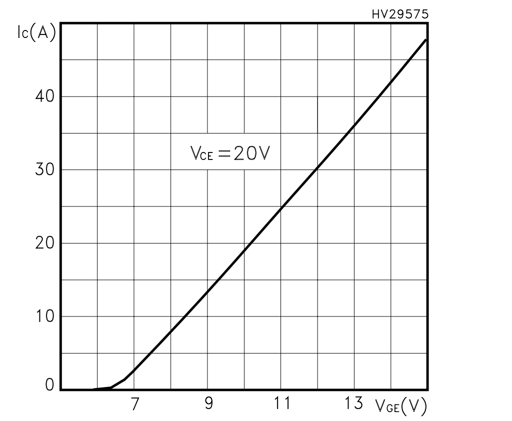


Figure 3. Transconductance

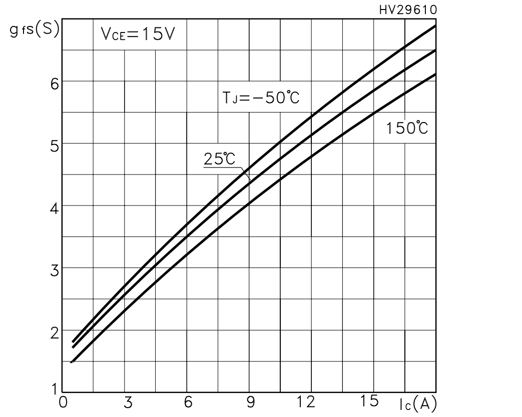


Figure 4. Collector-emitter on voltage vs temperature

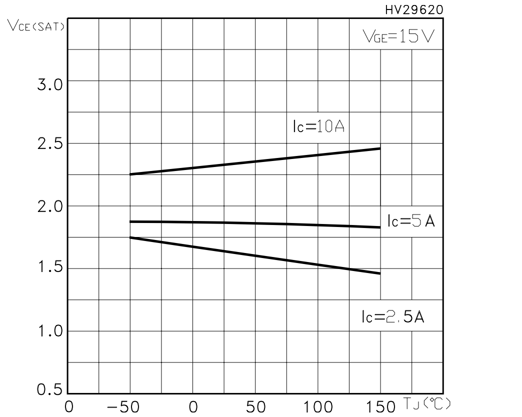


Figure 5. Gate charge vs gate-source voltage

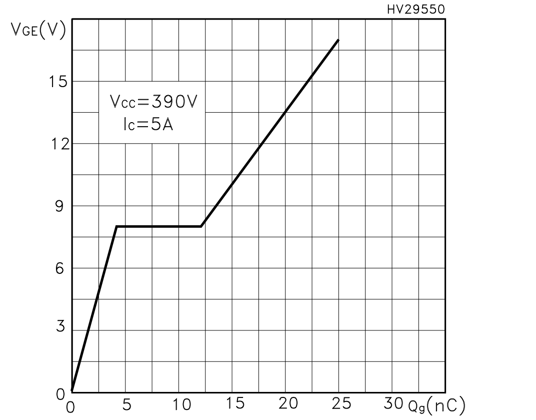


Figure 6. Capacitance variations

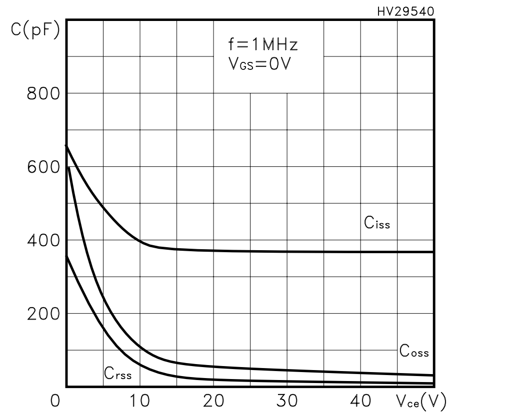


Figure 7. Normalized gate threshold voltage vs temperature

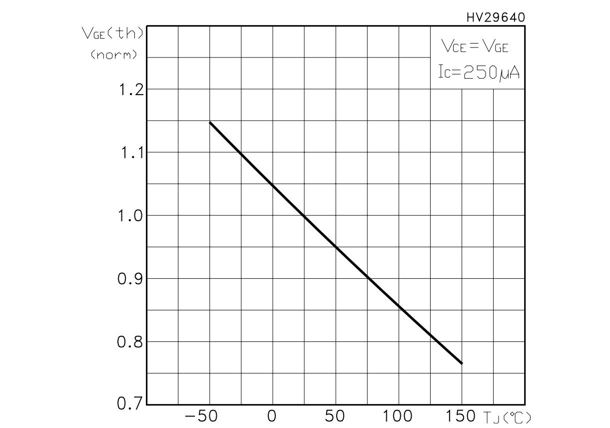


Figure 8. Collector-emitter on voltage vs collector current

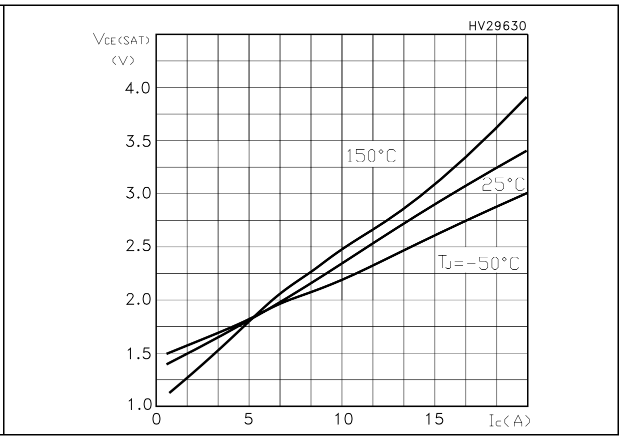


Figure 9. Normalized breakdown voltage vs temperature

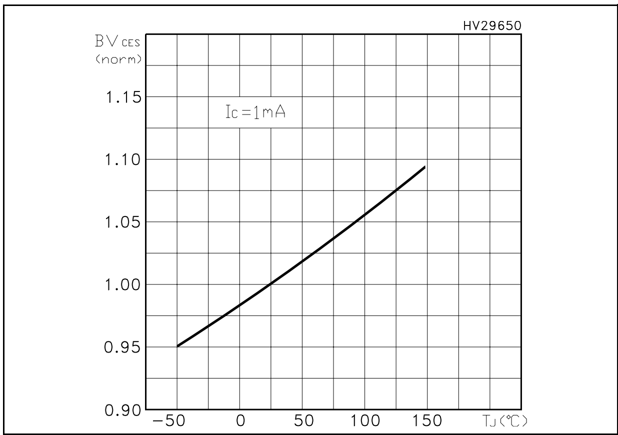


Figure 10. Switching losses vs temperature

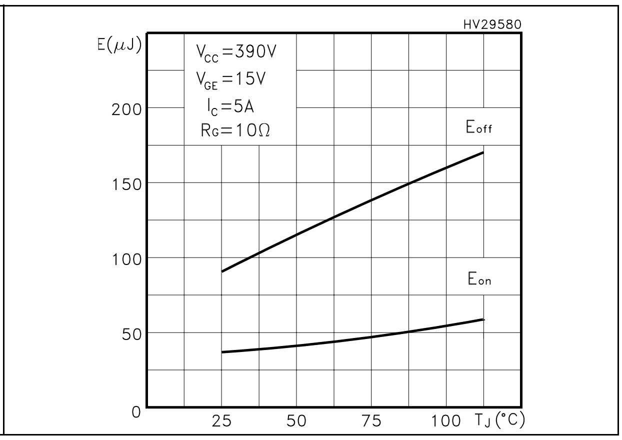


Figure 11. Switching losses vs gate resistance

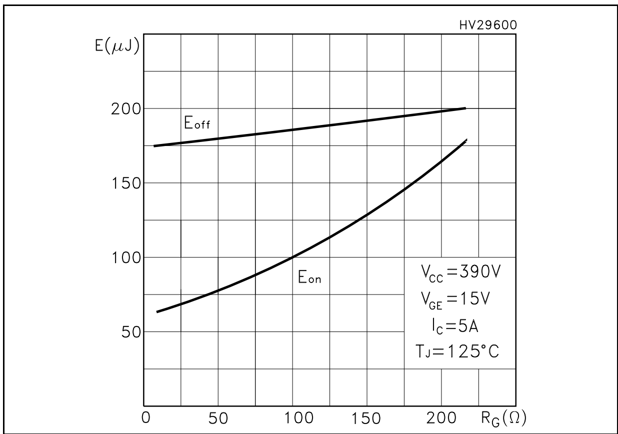


Figure 12. Switching losses vs collector current

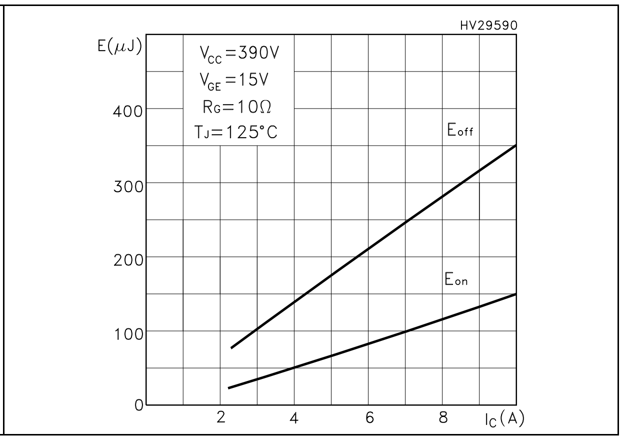


Figure 13. Thermal Impedance

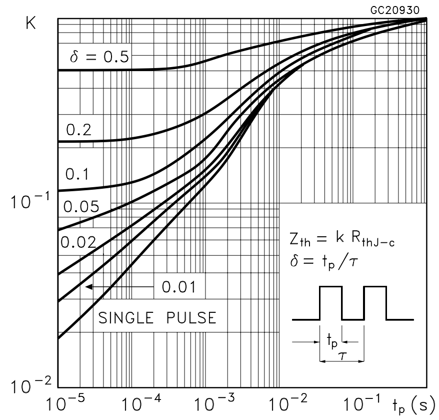
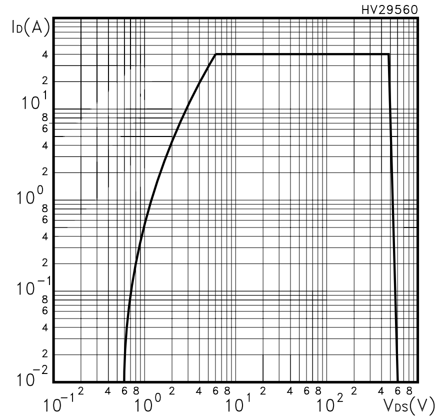


Figure 14. Turn-off SOA



3 Test circuits

Figure 15. Test circuit for inductive load switching

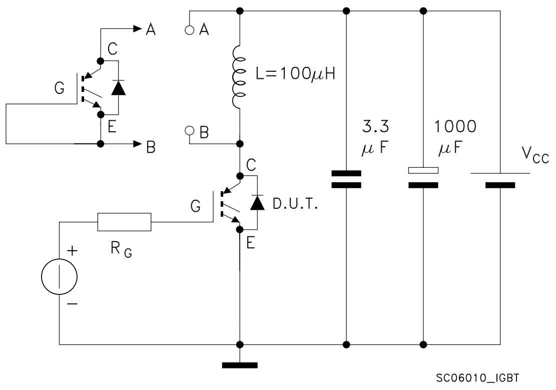


Figure 16. Gate charge test circuit

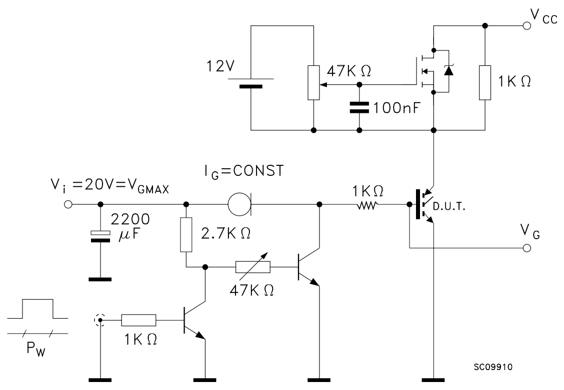
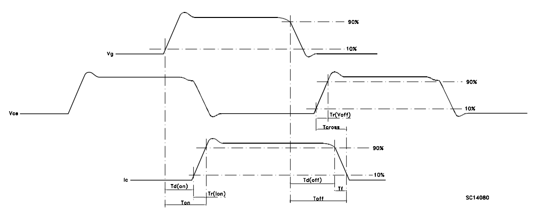


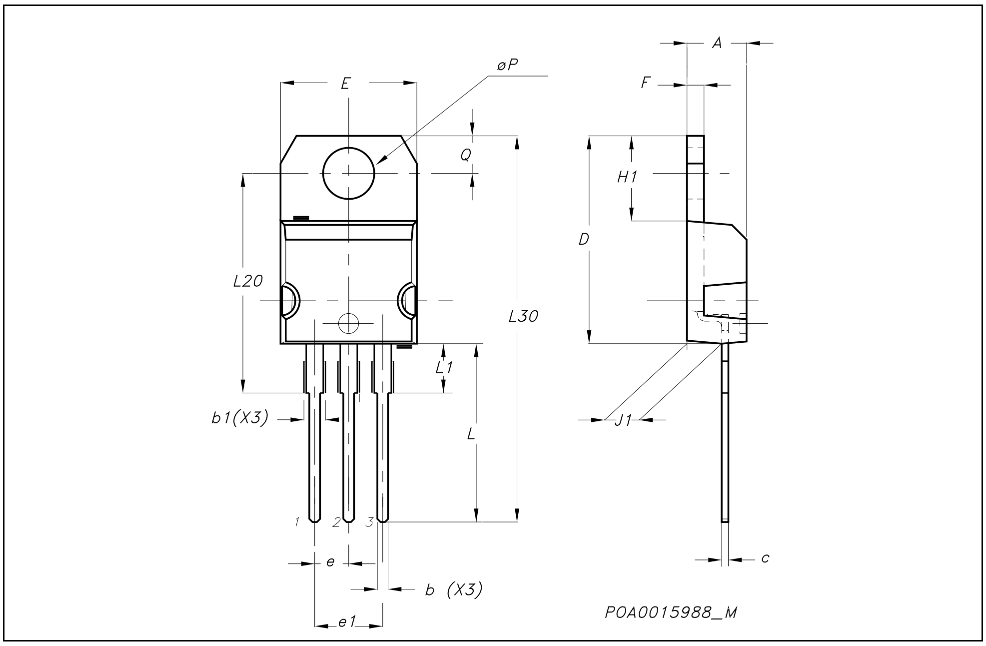
Figure 17. Switching waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: *www.st.com*

TO-220 MECHANICAL DATA						
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 7. Revision history

Date	Revision	Changes
18-Nov-2005	1	Initial release.
12-Oct-2006	2	New template, complete version

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