



STGP10NB60SD

N-CHANNEL 10A - 600V - TO-220
Low Drop PowerMESH™ IGBT

General features

Type	V _{CES}	V _{CE(sat)} (Max)@ 25°C	I _C @ 100°C
STGP10NB60SD	600V	< 1.7V	10A

- HIGH CURRENT CAPABILITY
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)

Description

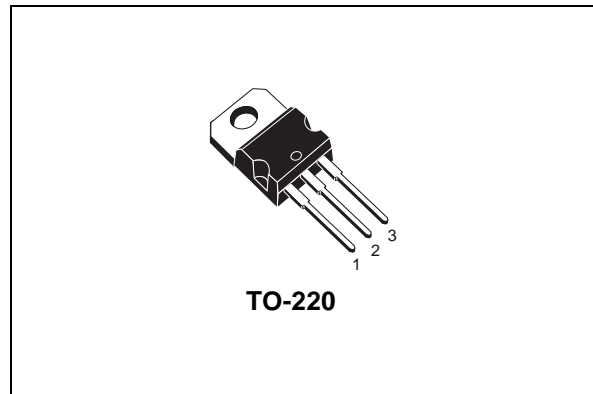
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "S" identifies a family optimized achieve minimum on-voltage drop for low frequency application (<1kHz).

Applications

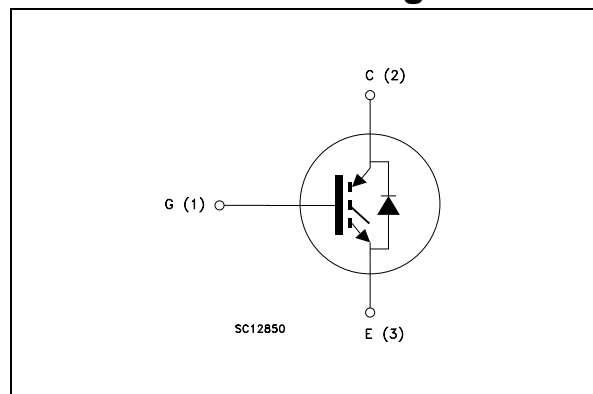
- LIGHT DIMMER
- STATIC RELAYS
- MOTOR CONTROL

Order codes

Sales Type	Marking	Package	Packaging
STGP10NB60SD	GP10NB60SD	TO-220	TUBE



Internal schematic diagram



1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage ($V_{GS} = 0$)	600	V
I_C <i>Note 5</i>	Collector Current (continuous) at $T_C = 25^\circ\text{C}$	20	A
I_C <i>Note 5</i>	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	10	A
I_{CM} <i>Note 1</i>	Collector Current (pulsed)	80	W
V_{GE}	Gate-Emitter Voltage	± 20	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	31.5	W
T_{stg}	Storage Temperature	– 65 to 150	$^\circ\text{C}$
T_j	Operating Junction Temperature		

Table 2. Thermal resistance

Rthj-case	Thermal Resistance Junction-case Max	4.7	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	$^\circ\text{C}/\text{W}$
Rthc-sink	Thermal resistance Case-sink Typ	0.5	

2 Electrical characteristics

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

Table 3. Static

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	$I_C = 250\mu A, V_{GE} = 0$	600			V
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	$I_C = 1mA, V_{GE} = 0$	20			V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15V, I_C = 5A$		1.15		V
		$V_{GE} = 15V, I_C = 10A$		1.35	1.7	V
		$V_{GE} = 15V, I_C = 10A, T_C = 125\text{ °C}$		1.25		V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 250\mu A$	2.5		5	V
I_{CES}	Collector cut-off Current ($V_{GE} = 0$)	$V_{CE} = \text{Max Rating}, T_C = 25\text{ °C}$			10	μA
		$V_{CE} = \text{Max Rating}, T_C = 125\text{ °C}$			100	μA
I_{GES}	Gate-Emitter Leakage Current ($V_{CE} = 0$)	$V_{GE} = \pm 20V, V_{CE} = 0$			± 100	nA
g_{fs}	Forward Transconductance	$V_{CE} = 25V, I_C = 10A$	5			S

Table 4. Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input Capacitance	$V_{CE} = 25V, f = 1MHz, V_{GE} = 0$		610		pF
C_{oes}	Output Capacitance			65		pF
C_{res}	Reverse Transfer Capacitance				12	pF
Q_g	Total Gate Charge	$V_{CE} = 400V, I_C = 5A, V_{GE} = 15V, (\text{see Figure 17})$		33		nC
I_{CL}	Latching Current	$V_{clamp} = 480V, R_G = 1k\Omega, T_j = 125\text{ °C}$	20			A

Table 5. Switching On/Off (inductive load)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480V, I_C = 10A$		0.7		ns
t_r	Current Rise Time	$R_G = 1k\Omega, V_{GE} = 15V, T_j = 25^\circ C$		0.46		ns
$(di/dt)_{on}$	Turn-on Current Slope	(see Figure 18)		8		A/ μs
t_c	Cross-over Time	$V_{CC} = 480V, I_C = 10A$		2.2		μs
$t_r(V_{off})$	Off Voltage Rise Time	$R_G = 1k\Omega, V_{GE} = 15V, T_j = 25^\circ C$		1.2		μs
t_f	Current Fall Time	(see Figure 18)		1.2		μs
t_c	Cross-over Time	$V_{CC} = 480V, I_C = 10A$		3.8		μs
$t_r(V_{off})$	Off Voltage Rise Time	$R_G = 1k\Omega, V_{GE} = 15V, T_j = 125^\circ C$		1.2		μs
t_f	Current Fall Time	(see Figure 18)		1.9		μs

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
E_{on} <i>Note 3</i>	Turn-on Switching Losses	$V_{CC} = 480V, I_C = 10A$		0.6		mJ
E_{off} <i>Note 4</i>	Turn-off Switching Losses	$R_G = 1k\Omega, V_{GE} = 15V, T_j = 25^\circ C$		5.0		mJ
E_{ts}	Total Switching Losses	(see Figure 18)		5.6		mJ

Table 7. Collector-emitter diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_F	Forward Current				7	A
I_{FM}	Forward Current pulsed				56	A
V_f	Forward On-Voltage	$I_f = 3.5A$ $I_f = 3.5A, T_j = 125^\circ C$		1.4 1.15	1.9	V V
t_{rr}	Reverse Recovery Time	$I_f = 7A, V_R = 35V,$		50		ns
Q_{rr}	Reverse Recovery Charge	$T_j = 125^\circ C, di/dt = 100A/\mu s$		70		nC
I_{rrm}	Reverse Recovery Current	(see Figure 19)		2.7		A

(1) Pulse width limited by max. junction temperature

(2) Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

(3) E_{on} is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pak diode, the co-pak diode is used as external diode. IGBTs & Diode are at the same temperature (25°C and 125°C)

(4) Turn-off losses include also the tail of the collector current

(5) Calculated according to the iterative formula:

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

2.1 Electrical characteristics (curves)

Figure 1. Safe Operating Area

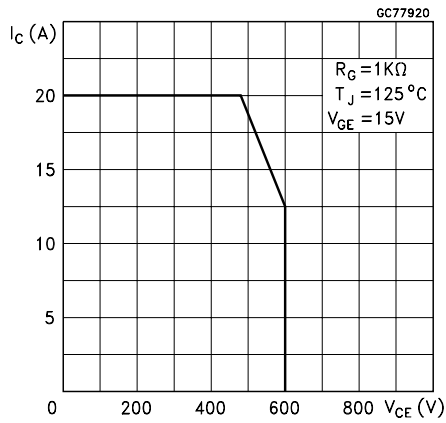


Figure 2. Thermal Impedance

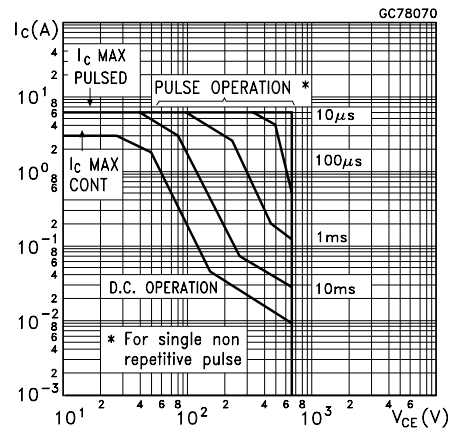


Figure 3. Output Characteristics

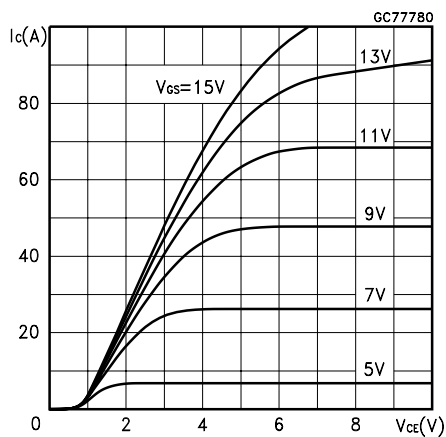


Figure 4. Transfer Characteristics

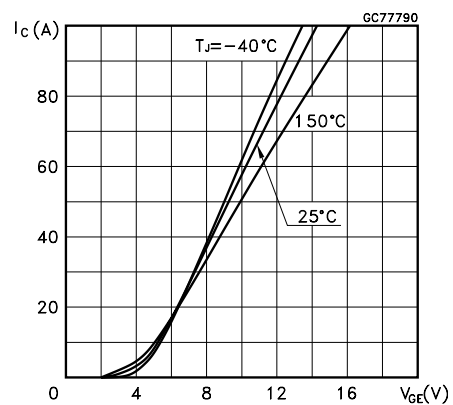


Figure 5. Transconductance

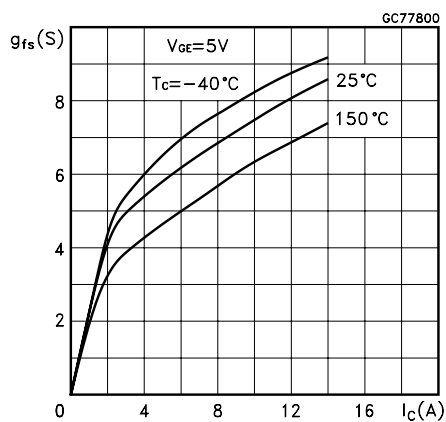


Figure 6. Collector-Emitter on Voltage vs Temperature

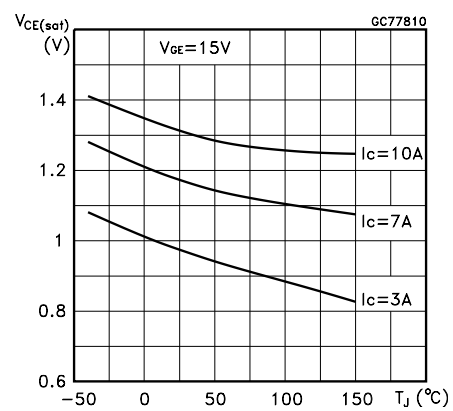


Figure 7. Collector-Emitter on Voltage vs Collector Current

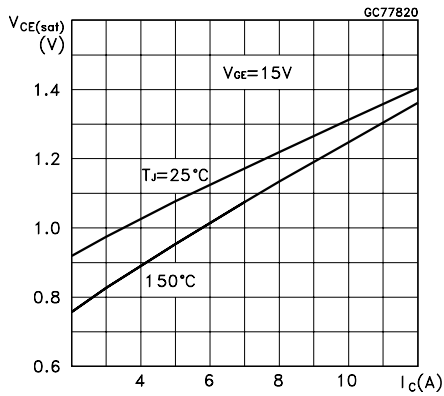


Figure 8. Gate Threshold Voltage vs Temperature

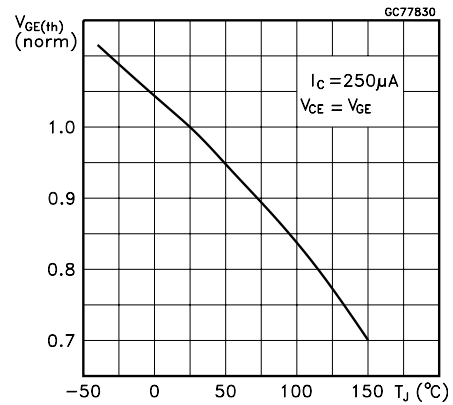


Figure 9. Capacitance Variations

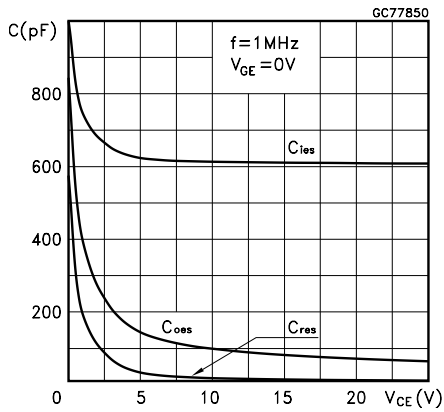


Figure 10. Gate Charge vs Gate-Emitter Voltage

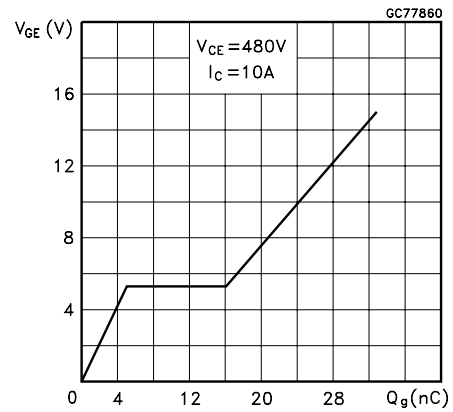


Figure 11. Switching Losses vs Gate Resistance

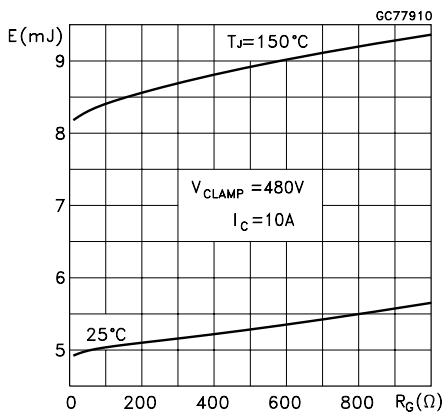


Figure 12. Switching Losses vs Collector Current

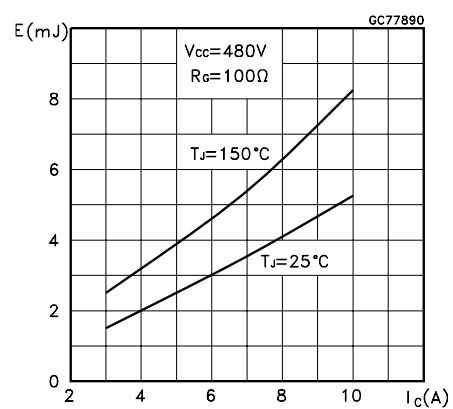


Figure 13. Switching Losses vs Temperature

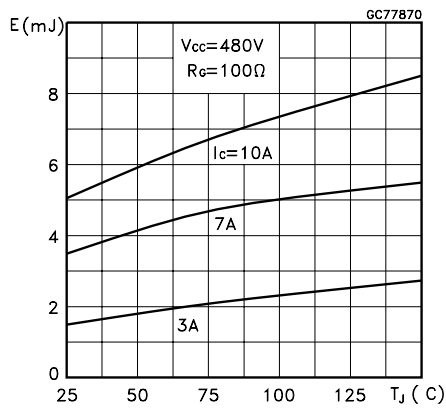


Figure 14. Normalized Breakdown Voltage vs Temperature

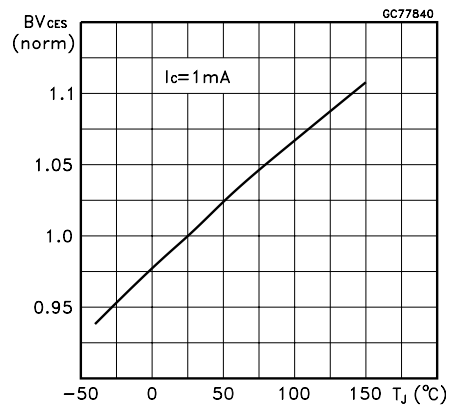
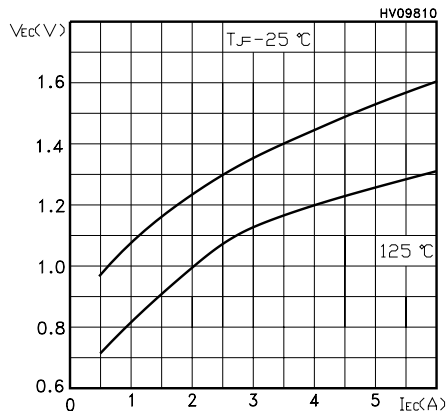


Figure 15. Emitter-Collector Diode Characteristics



3 Test Circuits

Figure 16. Test Circuit for Inductive Load Switching

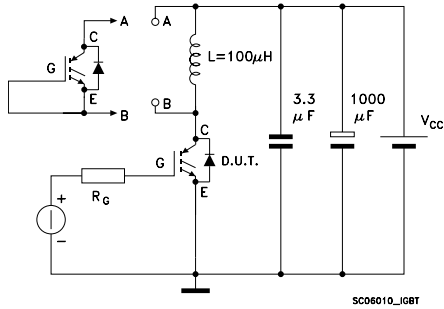


Figure 17. Gate Charge Test Circuit

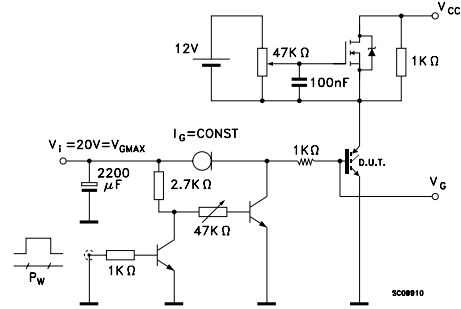


Figure 18. Switching Waveform

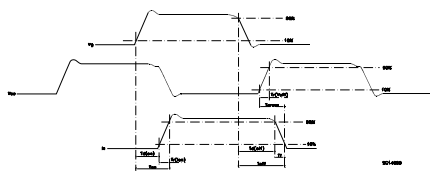
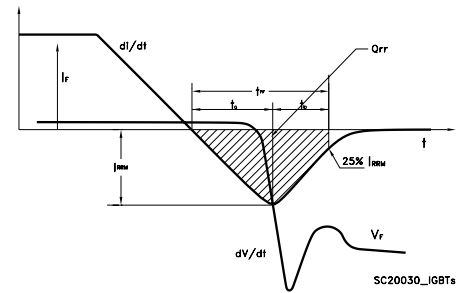


Figure 19. Diode Recovery Time Waveform

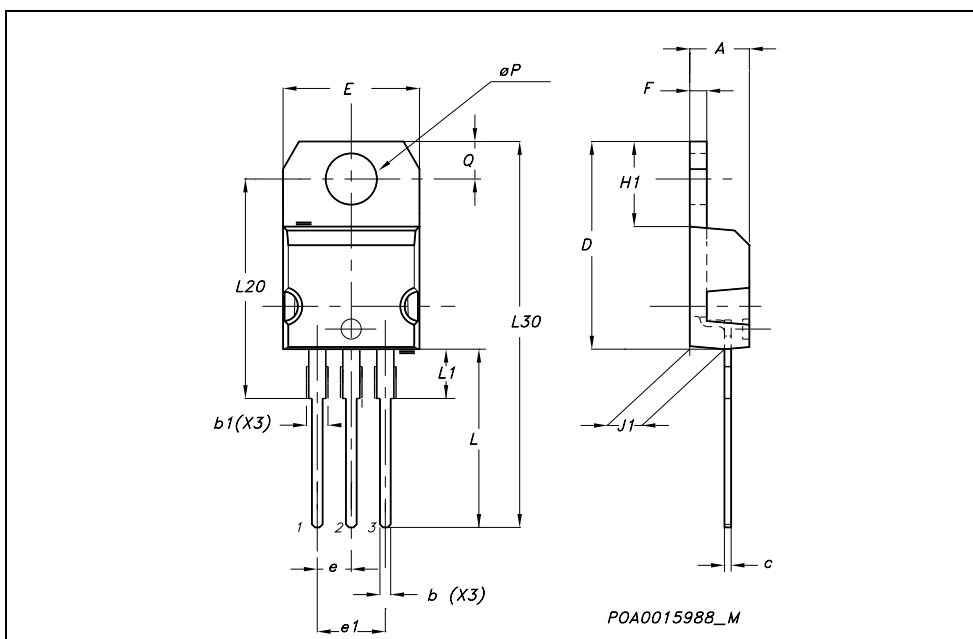


4 Package mechanical data

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

Date	Revision	Changes
18-Nov-2005	1	Initial release.

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