



STGD6NC60HD

N-CHANNEL 6A - 600V DPAK Very Fast PowerMESH™ IGBT

TARGET SPECIFICATION

Table 1: General Features

TYPE	V _{CES}	V _{CE(sat)} (Max) @25°C	I _C @100°C
STGD6NC60HDT4	600 V	< 2.5 V	6 A

- LOWER ON-VOLTAGE DROP (V_{cesat})
- OFF LOSSES INCLUDE TAIL CURRENT
- LOSSES INCLUDE DIODE RECOVERY ENERGY
- LOWER C_{RES}/C_{IES} RATIO
- HIGH FREQUENCY OPERATION
- VERY SOFT ULTRA FAST RECOVERY ANTI PARALLEL DIODE
- NEW GENERATION PRODUCTS WITH TIGHTER PARAMETER DISTRIBUTION

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 t_{fall}) maintaining a low voltage drop.

APPLICATIONS

- HIGH FREQUENCY INVERTERS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- MOTOR DRIVERS

Figure 1: Package

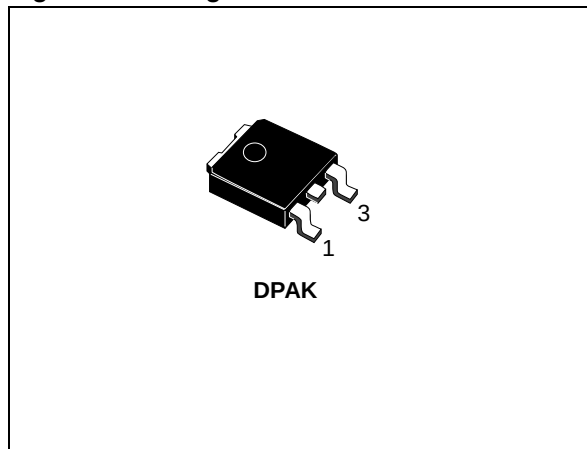


Figure 2: Internal Schematic Diagram

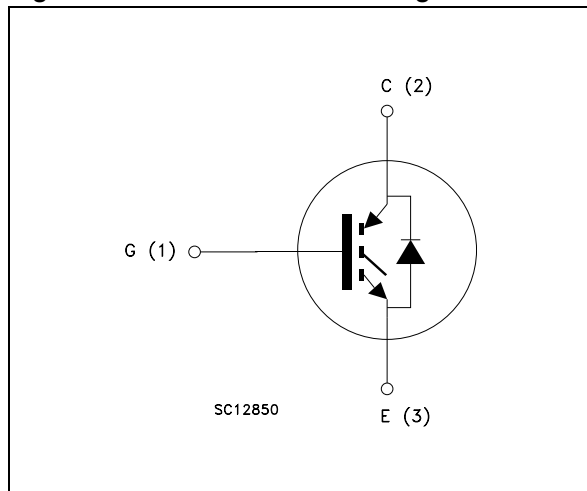


Table 2: Order Code

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGD6NC60HDT4	GD6NC60HD	DPAK	TAPE & REEL

Rev. 1

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V _{CES}	Collector-Emitter Voltage (V _{GS} = 0)	600	V
V _{ECR}	Emitter-Collector Voltage	20	V
V _{GE}	Gate-Emitter Voltage	±20	V
I _C	Collector Current (continuous) at T _C = 25°C (#)	10	A
I _C	Collector Current (continuous) at T _C = 100°C (#)	6	A
I _{CM} (▢)	Collector Current (pulsed)	24	A
I _F	Diode RMS Forward Current at T _C = 25°C	TBD	A
P _{TOT}	Total Dissipation at T _C = 25°C	50	W
	Derating Factor	0.40	W/°C
T _{stg}	Storage Temperature	– 55 to 150	°C
T _j	Operating Junction Temperature		

(▢) Pulse width limited by max. junction temperature.

Table 4: Thermal Data

		Min.	Typ.	Max.	
R _{thj-case}	Thermal Resistance Junction-case			2.5	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient			100	°C/W
T _L	Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.)		275		°C

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C UNLESS OTHERWISE SPECIFIED)**Table 5: Main Parameters**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{BR(CES)}	Collector-Emitter Breakdown Voltage	I _C = 1 mA, 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			10 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	3.75		5.75	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 3 A V _{GE} = 15V, I _C = 3 A, T _C = 125°C		1.9 1.7	2.5	V V

(#) Calculated according to the iterative formula:

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

ELECTRICAL CHARACTERISTICS (CONTINUED)**Table 6: Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{CE} = 15\text{ V}$, $I_C = 3\text{ A}$		TBD		S
C_{ies}	Input Capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$		320		pF
C_{oes}	Output Capacitance			28		pF
C_{res}	Reverse Transfer Capacitance			7.2		pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 5)		15 TBD TBD	TBD	nC nC nC
I_{CL}	Turn-Off SOA Minimum Current	$V_{clamp} = 480\text{ V}$, $T_J = 150^\circ\text{C}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	TBD			A

(1) Pulsed: Pulse duration= 300 μs , duty cycle 1.5%**Table 7: Switching On**

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	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 25^\circ\text{C}$ (see Figure 3)		TBD TBD TBD		ns ns A/ μs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125^\circ\text{C}$ (see Figure 3)		TBD TBD TBD		ns ns A/ μs

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 25^\circ\text{C}$ (see Figure 3)		TBD TBD 70		ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 125^\circ\text{C}$ (see Figure 3)		TBD TBD TBD		ns ns ns

Table 9: Switching Energy

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
E_{on} (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 25^\circ\text{C}$ (see Figure 3)		TBD TBD TBD		μJ μJ μJ
E_{on} (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125^\circ\text{C}$ (see Figure 3)		TBD TBD TBD		μJ μJ μJ

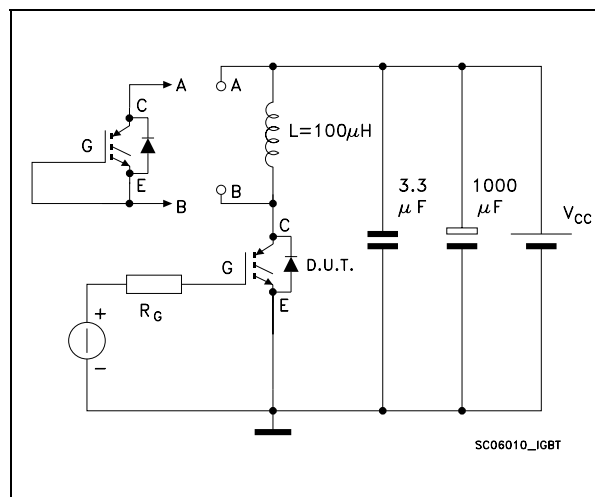
(2) E_{on} is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & DIODE are at the same temperature (25°C and 125°C)

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

Table 10: Collector-Emitter Diode

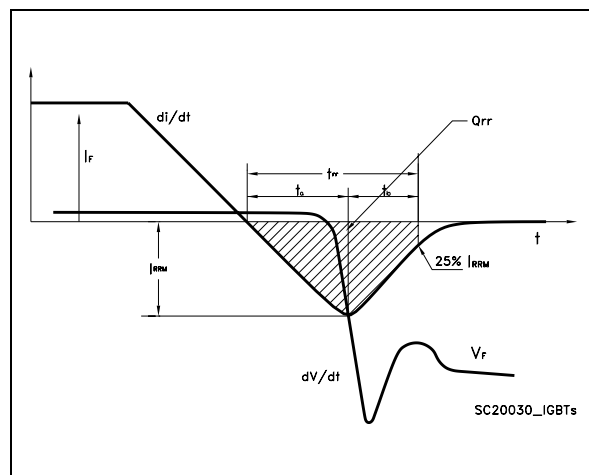
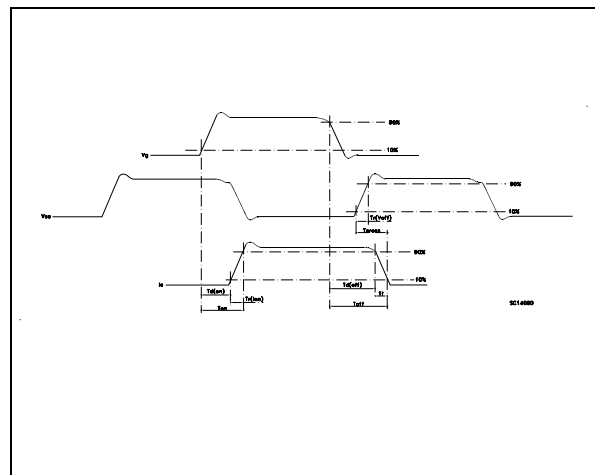
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_f	Forward On-Voltage	$I_f = 1.5 \text{ A}$ $I_f = 1.5 \text{ A}, T_j = 125 \text{ }^\circ\text{C}$		1.6 1.3	2.1	V V
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	$I_f = 1.5 \text{ A}, V_R = 40 \text{ V},$ $T_j = 25 \text{ }^\circ\text{C}, di/dt = 100 \text{ A}/\mu\text{s}$ (see Figure 6)		TBD TBD TBD TBD TBD		ns ns nC A
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	$I_f = 1.5 \text{ A}, V_R = 40 \text{ V},$ $T_j = 125 \text{ }^\circ\text{C}, di/dt = 100 \text{ A}/\mu\text{s}$ (see Figure 6)		TBD TBD TBD TBD TBD		ns ns nC A

Figure 5: Gate Charge Test Circuit



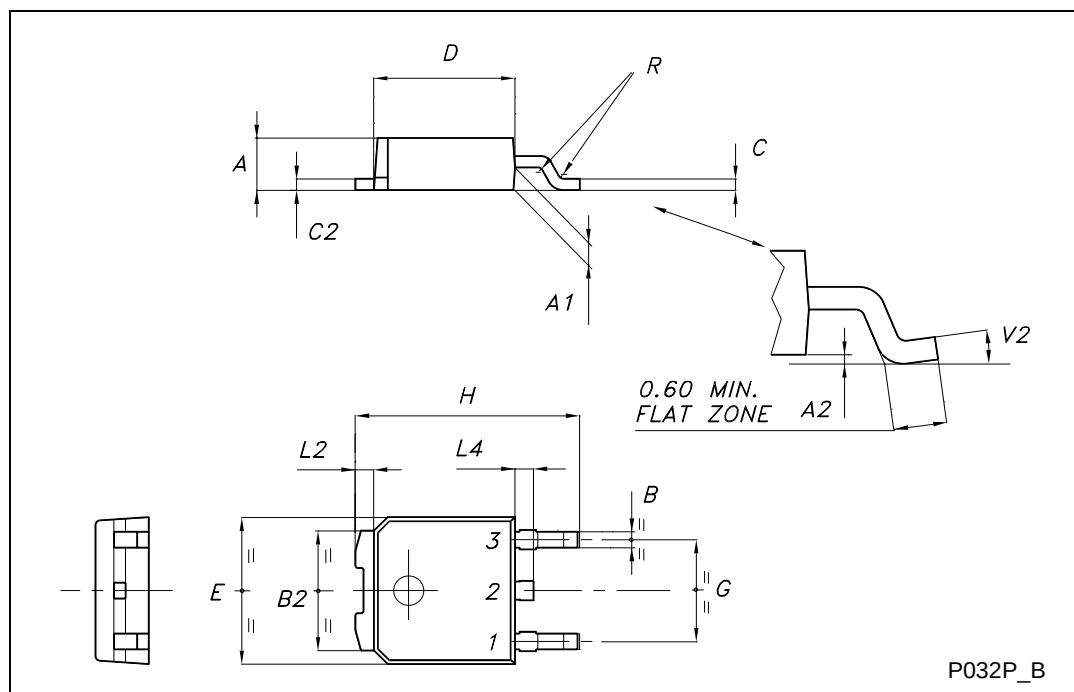
The circuit diagram shows a 100-ps, 10-V CMOS inverter with a programmable load. The input is labeled $V_I = 20V = V_{GMAX}$ and the output is labeled V_G . The circuit includes a 12V supply, a 47KΩ resistor, a 100nF capacitor, a 1KΩ resistor, a 2.7KΩ resistor, a 47KΩ resistor, a 1KΩ resistor, a 2200μF capacitor, a 1KΩ resistor, and a 100pF capacitor. The circuit is labeled SC09910.

Figure 6: Diode Recovery Time Waveforms

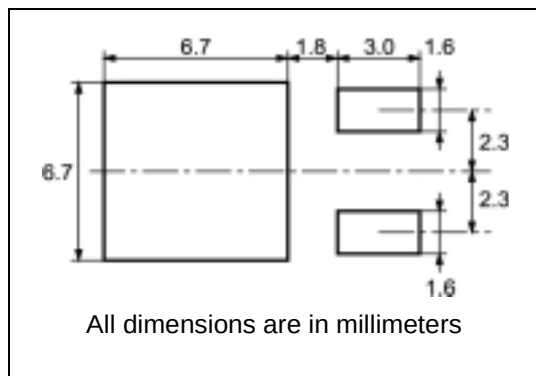


TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



DPAK FOOTPRINT



TAPE AND REEL SHIPMENT

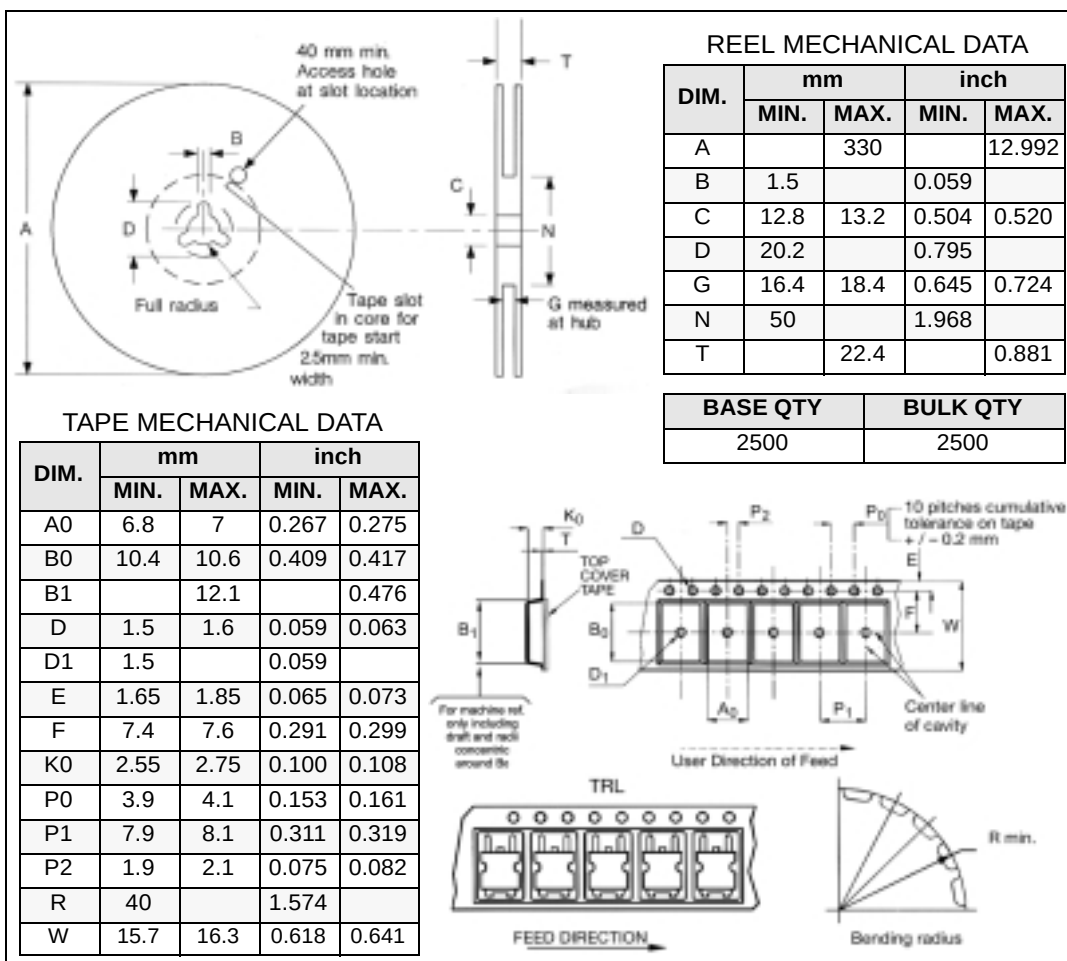


Table 11: Revision History

Date	Revision	Description of Changes
14-Jun-2005	1	First release

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