



STGD3NC60HD

N-CHANNEL 3A - 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
STGD3NC60HDT4	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

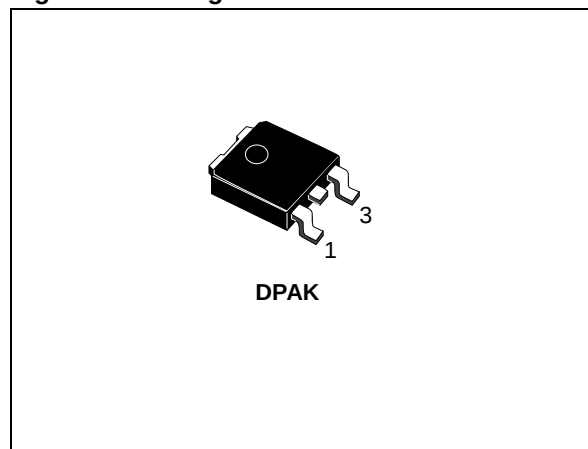


Figure 2: Internal Schematic Diagram

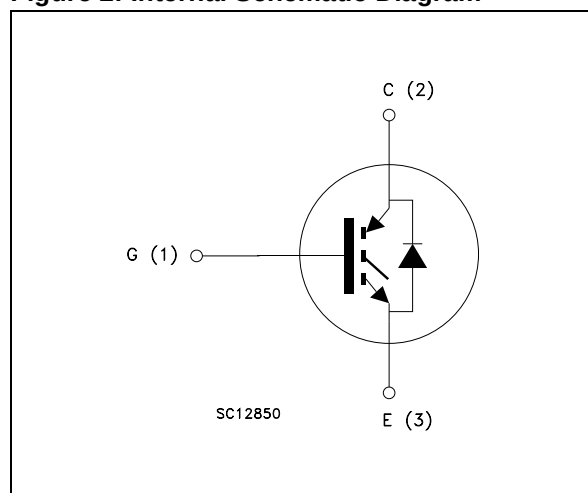


Table 2: Order Code

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGD3NC60HDT4	GD3NC60HD	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)

www.DataSheet4U.com

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

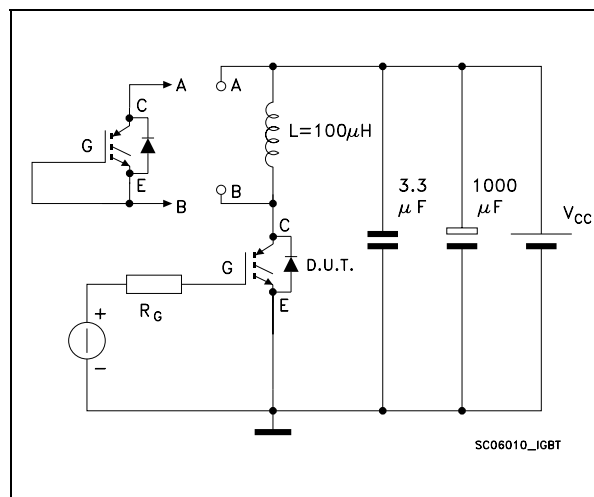
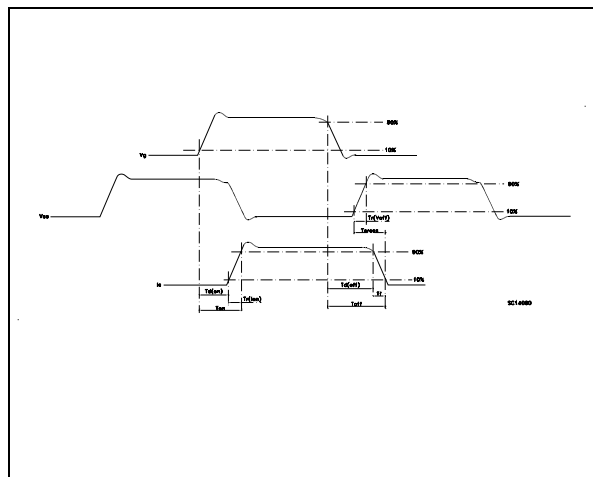
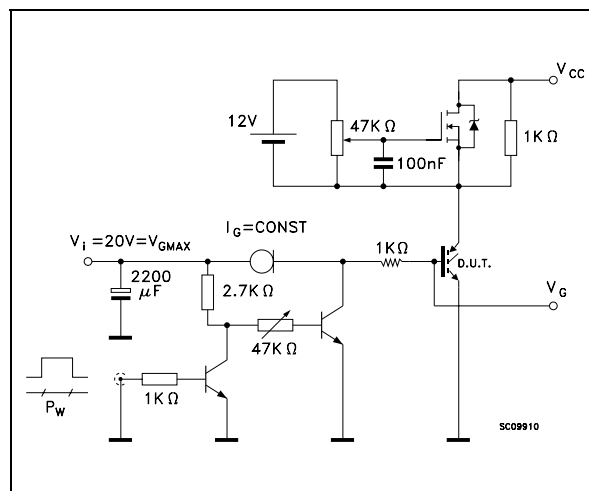
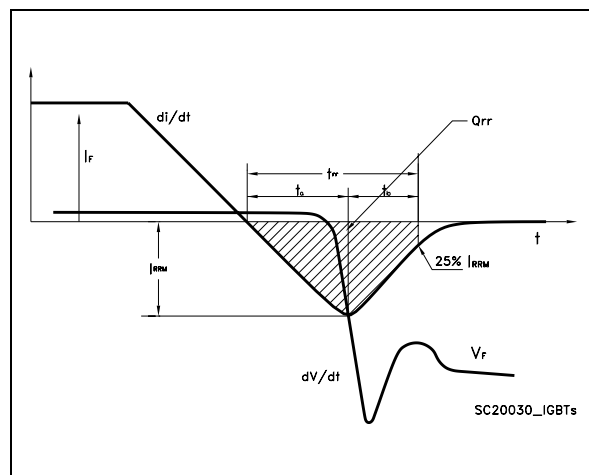
(2) E_{on} is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & DIODE are at the same temperature (25°C and 125°C)

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

Table 10: Collector-Emitter Diode

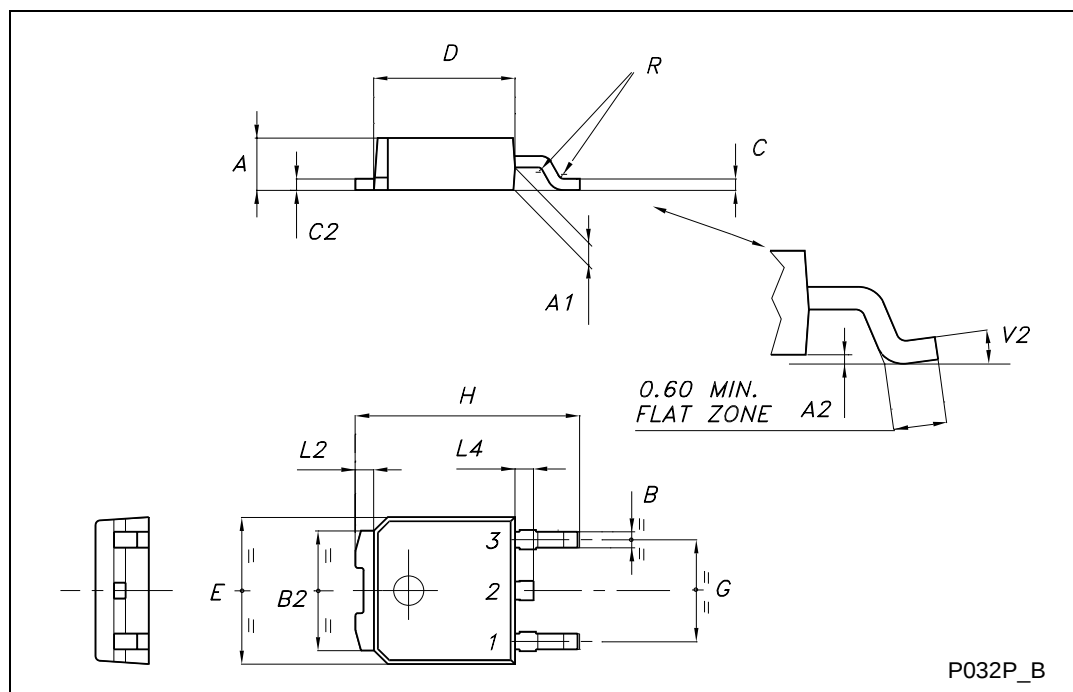
www.DataSheet4U.com

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

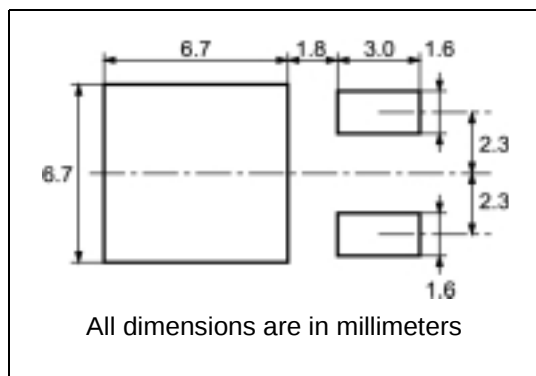
Figure 3: Test Circuit for Inductive Load Switching

Figure 4: Switching Waveforms

Figure 5: Gate Charge Test Circuit

Figure 6: Diode Recovery Time Waveforms


TO-252 (DPAK) MECHANICAL DATA

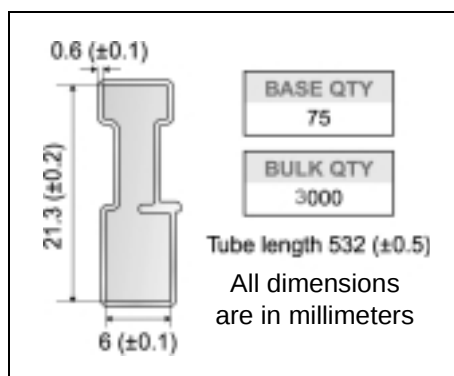
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		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°



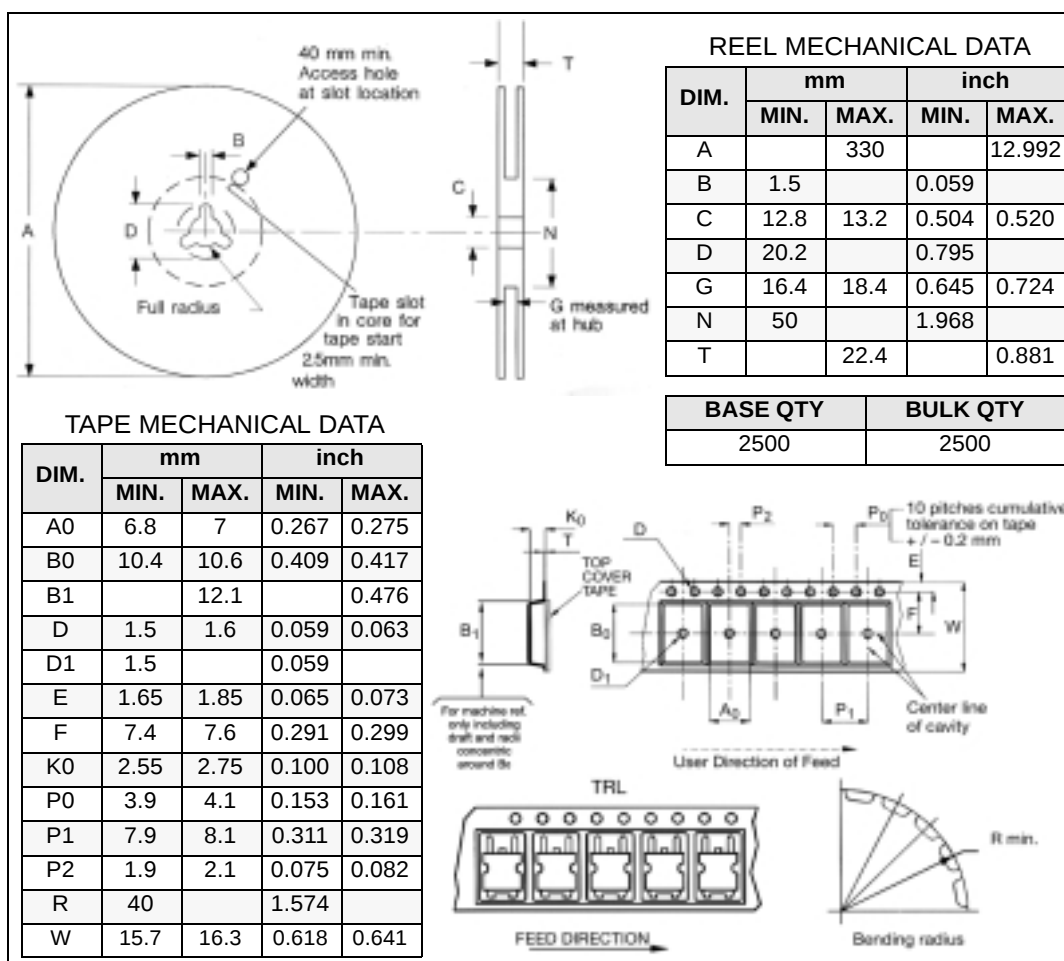
DPAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



* on sales type

Table 11: Revision History

Date	Revision	Description of Changes
11-Feb-2005	1	First release

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics

All other names are the property of their respective owners

© 2005 STMicroelectronics - All Rights Reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America