



STGW39NC60VD

N-CHANNEL 40A - 600V - TO-247

Very Fast PowerMESH™ IGBT

TARGET SPECIFICATION

Table 1: General Features

TYPE	V _{CEs}	V _{CE(sat)} (Max) @ 25°C	I _C @ 100°C
STGW39NC60VD	600V	< 2.5 V	40 A

- HIGH CURRENT CAPABILITY
- HIGH FREQUENCY OPERATION UP TO 50 KHz
- LOSSES INCLUDE DIODE RECOVERY ENERGY
- OFF LOSSES INCLUDE TAIL CURRENT
- LOWER C_{RES} / C_{IES} RATIO
- 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 "V" identifies a family optimized for high frequency.

APPLICATIONS

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

Figure 1: Package

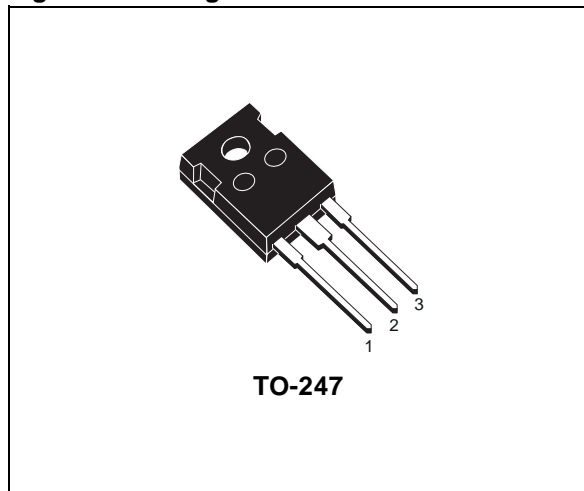


Figure 2: Internal Schematic Diagram

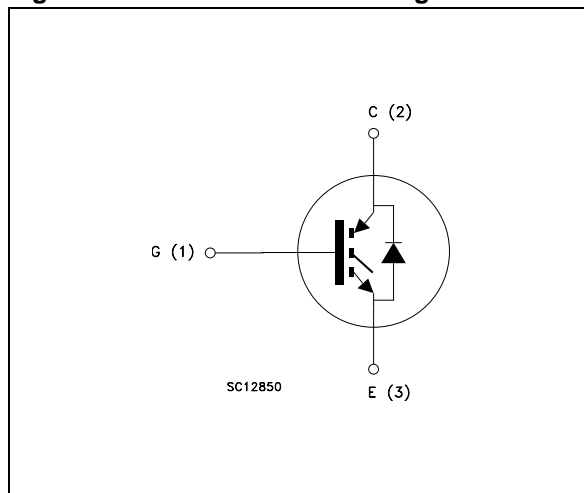


Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGW39NC60VD	GW39NC60VD	TO-247	TUBE

Rev. 1

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V _{CES}	Collector-Emitter Voltage (V _{GS} = 0)	600	V
V _{ECR}	Reverse Battery Protection	20	V
V _{GE}	Gate-Emitter Voltage	± 20	V
I _C	Collector Current (continuous) at 25°C (#)	70	A
I _C	Collector Current (continuous) at 100°C (#)	40	A
I _{CM} (1)	Collector Current (pulsed)	100	A
I _f	Diode RMS Forward Current at T _c = 25°C	40	A
P _{TOT}	Total Dissipation at T _C = 25°C	215	W
	Derating Factor	1.72	W/°C
T _{stg}	Storage Temperature	- 55 to 150	°C
T _j	Operating Junction Temperature		

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

Table 4: Thermal Data

		Min.	Typ.	Max.	Unit
R _{thj-case}	Thermal Resistance Junction-case			0.58	°C/W
R _{thj-case}	Thermal Resistance Junction-case (Diode)			1.5	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient			50	°C/W
T _L	Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.)		300		°C

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{BR(CES)}	Collectro-Emitter Breakdown Voltage	I _C = 1mA, V _{GE} = 0	600			V
I _{CES}	Collector-Emitter Leakage Current (V _{CE} = 0)	V _{GE} = Max Rating, T _c =25°C 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

Table 6: On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GE(th)}	Gate Threshold Voltage	V _{CE} = V _{GE} , I _C = 250µA	3.75		5.75	V
V _{CE(SAT)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 30A, T _j = 25°C V _{GE} = 15V, I _C = 30A, T _j = 125°C		1.8 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 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs(1)}$	Forward Transconductance	$V_{CE} = 15V, I_C = 30A$		TBD		S
C_{ies} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25V, f = 1MHz, V_{GE} = 0$		TBD TBD TBD		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 390V, I_C = 30A,$ $V_{GE} = 15V,$ (see Figure 5)		TBD TBD TBD		nC nC nC
I_{CL}	Turn-Off SOA Minimum Current	$V_{clamp} = 480V, T_j = 150^\circ C$ $R_G = 100\Omega, V_{GE} = 15V$	200			A

Table 8: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$ $E_{on(2)}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 390V, I_C = 30A$ $R_G = 3.3\Omega, V_{GE} = 15V, T_j = 25^\circ C$ (see Figure 3)		TBD TBD TBD TBD		ns ns A/ μs μJ
$t_{d(on)}$ t_r $(di/dt)_{on}$ $E_{on(2)}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 390V, I_C = 30A$ $R_G = 3.3\Omega, V_{GE} = 15V, T_j = 125^\circ C$ (see Figure 3)		TBD TBD TBD TBD		ns ns A/ μs 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 ($25^\circ C$ and $125^\circ C$)

Table 9: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(3)}$ E_{ts}	Off Voltage Rise Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 390V, I_C = 30A,$ $R_{GE} = 3.3\Omega, V_{GE} = 15V$ $T_j = 25^\circ C$ (see Figure 3)		TBD TBD TBD TBD TBD		ns ns ns μJ μJ
$t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(3)}$ E_{ts}	Off Voltage Rise Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 390V, I_C = 30A,$ $R_{GE} = 3.3\Omega, V_{GE} = 15V$ $T_j = 125^\circ C$ (see Figure 3)		TBD TBD TBD TBD TBD		ns ns ns μJ μJ

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

Table 10: Collector-Emitter Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_f	Forward On-Voltage	$I_f = 30A$ $I_f = 30A, T_j = 125^\circ C$		1.4 1.1	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	$I_f = 30A, V_R = 40V,$ $T_j = 25^\circ C, di/dt = 100A/\mu s$ (see Figure 6)		44 32 66 3 0.375		ns ns nC A A
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	$I_f = 30A, V_R = 40V,$ $T_j = 125^\circ C, di/dt = 100A/\mu s$ (see Figure 6)		88 56 237 5.4 0.57		ns ns nC A A

Figure 3: Test Circuit for Inductive Load Switching

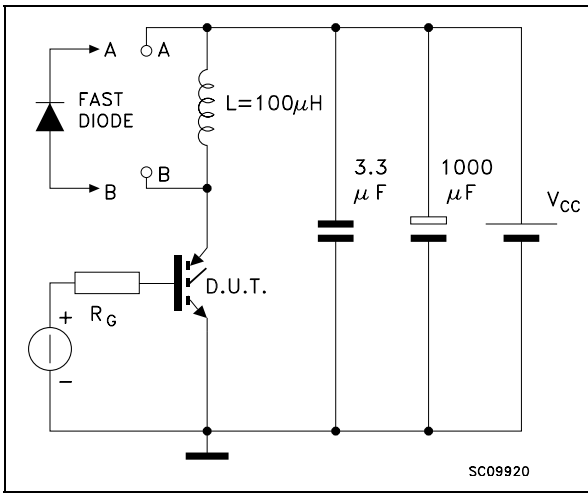


Figure 4: Switching Waveforms

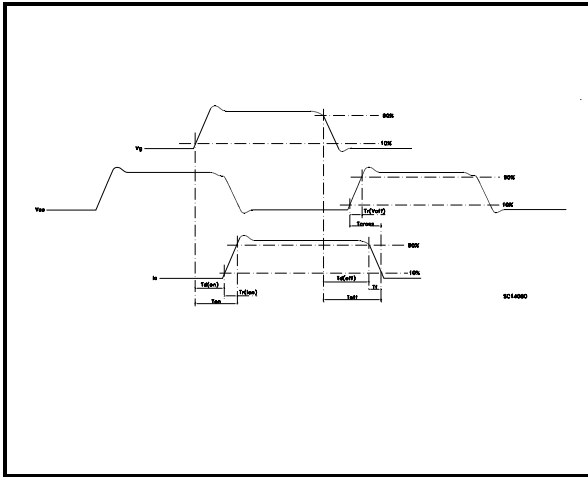


Figure 5: Gate Charge Test Circuit

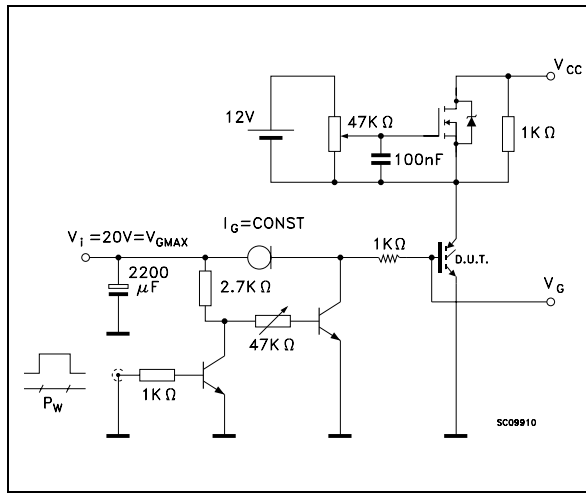
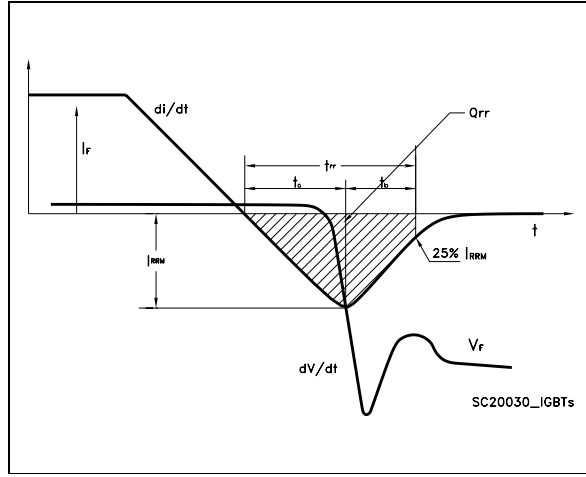


Figure 6: Diode Recovery Times Waveform



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-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	

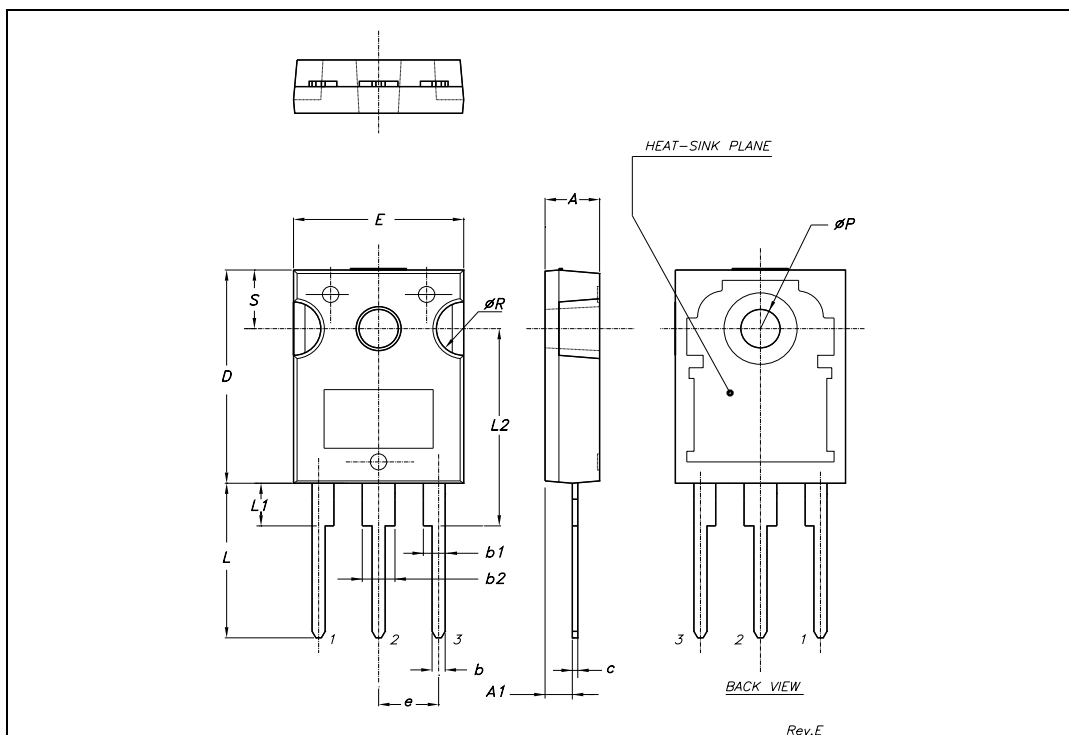


Table 11: Revision History

Date	Revision	Description of Changes
17-Nov-2005	1	First Release

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