STGW40N120KD

40 A, 1200 V, short circuit rugged IGBT

Features

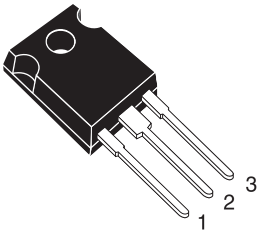
- Low on-losses
- High current capability
- Low gate charge
- Short circuit withstand time 10 µs
- IGBT co-packaged with ultra fast free-wheeling diode

Application

- Motor control

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.



TO-247

Figure 1. Internal schematic diagram

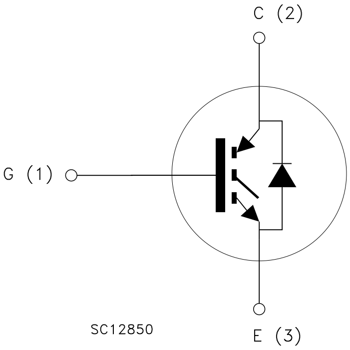


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW40N120KD	GW40N120KD	TO-247	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1200	V
I_C (1)	Continuous collector current at T_C= 25 °C	80	A
I_C (1)	Continuous collector current at T_C= 100 °C	40	A
I_{CL} (2)	Turn-off latching current	85	A
I_{CP} (3)	Pulsed collector current	120	A
V_{GE}	Gate-emitter voltage	±25	V
t_{SCW}	Short circuit withstand time, $V_{CE} = 0.5\ V_{(BR)CES}$ T_j = 125 °C, R_G = 10 Ω, V_{GE} = 12 V	10	µs
P_{TOT}	Total dissipation at T_C = 25 °C	240	W
I_F	Diode RMS forward current at T_C = 25 °C	30	A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	100	A
T_j	Operating junction temperature	– 55 to 125	°C

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Vclamp = 80% of V_{CES}, T_j =125 °C, R_G=10 Ω, V_{GE}=15 V
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	0.42	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case diode	1.6	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

(T_J = 25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 30 A V_{GE}= 15 V, I_C= 30 A, T_J =125 °C		2.8 2.7	3.85	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 1mA	4.5		6.5	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} =1200 V V_{CE} =1200 V, T_J =125 °C			500 10	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} =± 20 V			± 100	nA

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	2577 196 39.5	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 960 V, I_C= 30 A,V_{GE}=15 V	-	126 22.2 67	-	nC nC nC

Table 6. 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} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*	-	48 40 540	-	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} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 2)*	-	45 38 665	-	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} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*	-	84 338 210	-	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} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 2)*	-	144 420 360	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon [1] E_{off} [2] E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*	-	3.7 5.7 9.4	-	mJ mJ mJ
Eon [1] E_{off} [2] E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 960 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 2)*	-	4.7 9.3 14	-	mJ mJ mJ

1. Eon 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 and diode are at the same temperature (25°C and 125°C)
2. Turn-off losses include also the tail of the collector current

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 20 A I_F = 20 A, T_J = 125 °C	-	1.9 1.7	-	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 20 A, V_R = 45 V, di/dt = 100 A/µs *(see Figure 5)*	-	84 235 5.6	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 20 A, V_R = 45 V, T_J = 125 °C, di/dt = 100 A/µs *(see Figure 5)*	-	152 722 9	-	ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

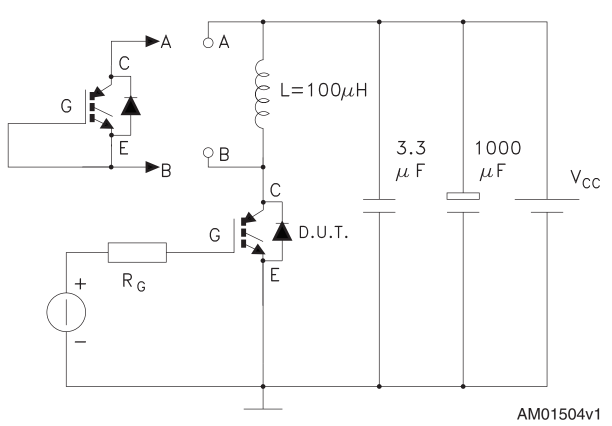


Figure 3. Gate charge test circuit

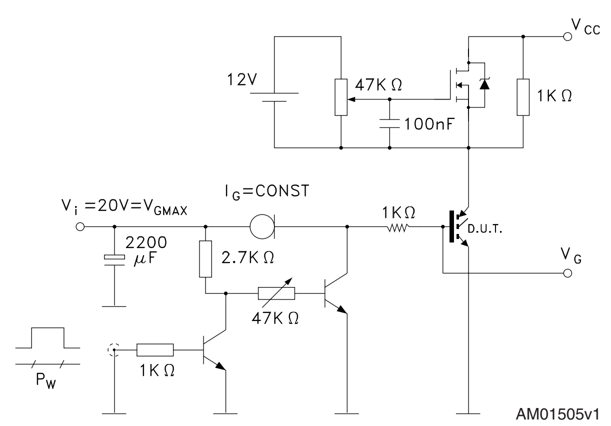


Figure 4. Switching waveform

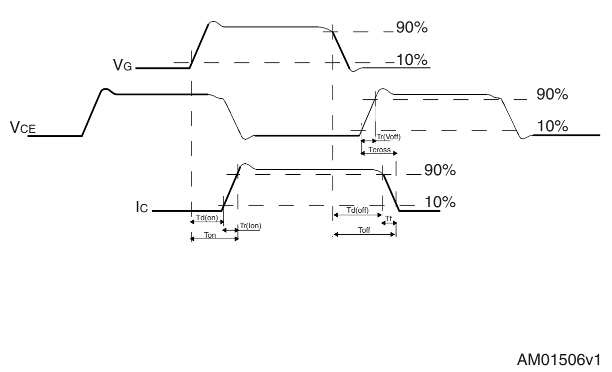
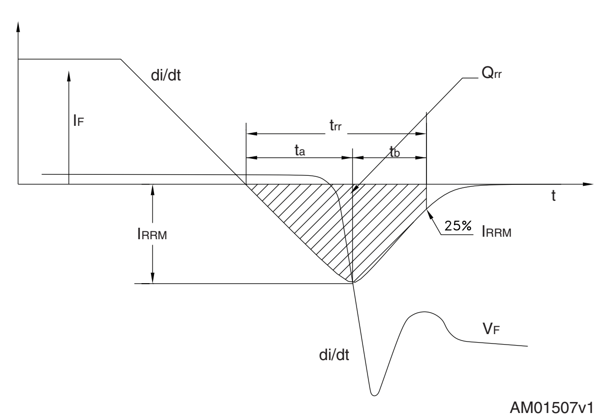


Figure 5. Diode recovery time waveform

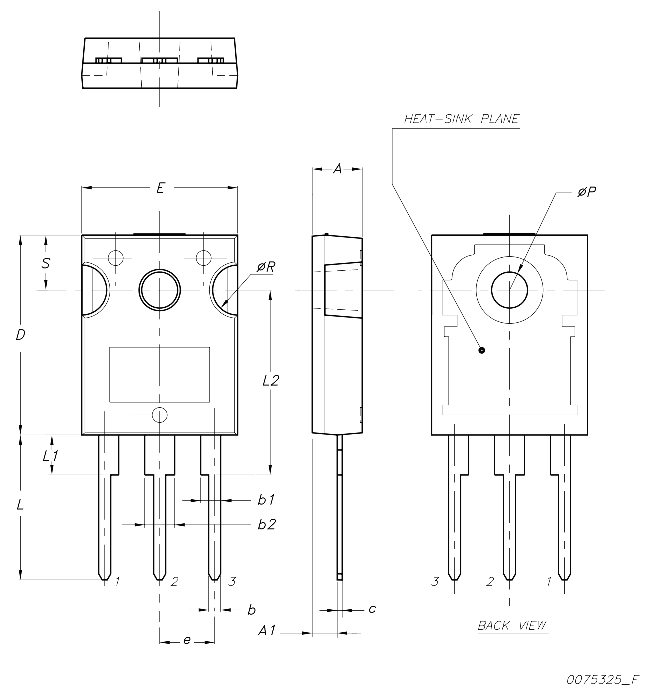


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

TO-247 mechanical data

Dim.	mm.		
	Min.	**Typ.**	**Max.**
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
22-Jan-2009	1	Initial release
29-Jun-2009	2	Document status promoted from preliminary data to datasheet.
09-Jul-2009	3	Inserted dynamic values *Table 5 on page 4*, *Table 6 on page 5* and *Table 7 on page 5*.

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