STGD10NC60SD
STGF10NC60SD

10 A - 600 V fast IGBT

Features

- Very low on-voltage drop ($V_{CE(sat)}$)
- Very soft ultra fast antiparallel diode
- Minimum power losses at 5 kHz in hard switching
- Optimized performance for medium operating frequencies

Application

- Medium frequency motor control

Description

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

DPAK TO-220FP

Figure 1. Internal schematic diagram

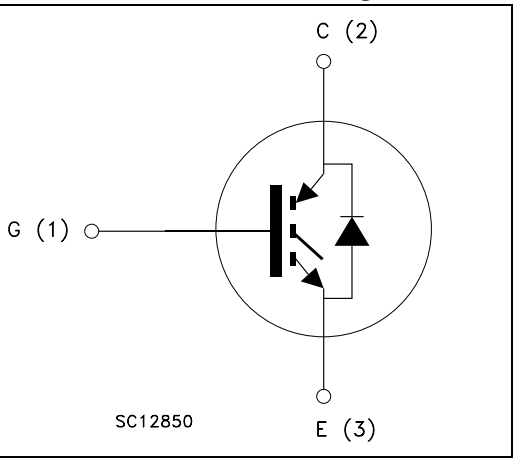


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGD10NC60SDT4	GD10NC60SD	DPAK	Tape and reel
STGF10NC60SD	GF10NC60SD	TO-220FP	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK	TO-220FP	
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600		V
I_C (1)	Collector current (continuous) at T_C = 25°C	18	10	A
I_C (1)	Collector current (continuous) at T_C = 100°C	10	5	A
I_{CL} (2)	Turn-off latching current	14		A
I_{CP} (3)	Pulsed collector current	25		A
I_F	Diode RMS forward current at T_C=25 °C	10		A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	20		A
V_{GE}	Gate-emitter voltage	±20		V
P_{TOT}	Total dissipation at T_C = 25 °C	60	25	W
T_j	Operating junction temperature	-55 to 150		°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. V_{clamp} = 80%,(V_{CES}), T_j =150 °C, R_G = 10 Ω, V_{GE} = 15 V
3. Pulse width limited by maximum permissible junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		DPAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	2.08	5	°C/W
	Thermal resistance junction-case diode	4.5		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	62.5	°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	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 5 A V_{GE}= 15 V, I_C= 5 A, T_J= 125 °C		1.45 1.3	1.65	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current (V_{GE}=0)	V_{CE}= 600 V V_{CE}=600 V, T_J=125 °C			150 1	µA mA
I_{GES}	Gate-emitter leakage (V_{CE}=0)	V_{GE}= ±20 V			±100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V , I_C = 5 A		3.5		S

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	-	365 44 8	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390 V, I_C = 5 A, V_{GE} = 15 V *Figure 3*	-	17 3 7	-	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} = 390 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 4*	-	19 4 1330	-	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 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125°C *Figure 4*	-	18 4.5 1000	-	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} = 390 V, I_C = 5 A, R_G = 10 Ω, V_{GE} = 15 V, *Figure 4*	-	100 160 205	-	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 V, I_C = 5 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 125°C *Figure 4*	-	165 250 310	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
E_{on} (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 2*	-	50 290 340	-	µJ µJ µJ
Eon (1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 5 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125°C *Figure 2*	-	73 485 558	-	µJ µJ µJ

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
2. Turn-off losses included also 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=5 A I_F=5 A, T_J=125 °C	-	2 1.6	-	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F=5 A, V_R=40 V, di/dt=100 A/µs *Figure 5*	-	22 14 1.3	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F=5 A, V_R=40 V, T_J=125 °C, di/dt=100 A/µs (*Figure 5*	-	35 40 2.2	-	ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

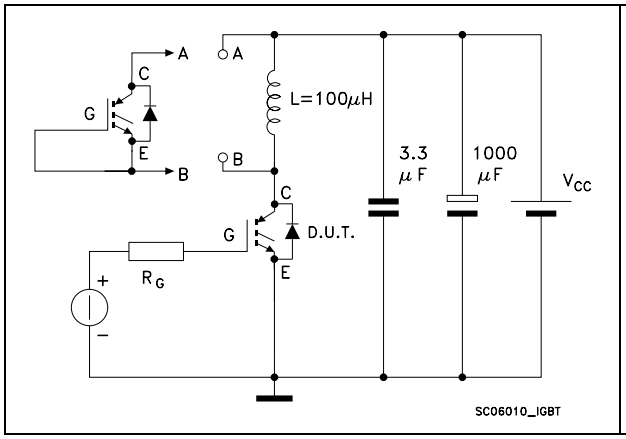


Figure 3. Gate charge test circuit

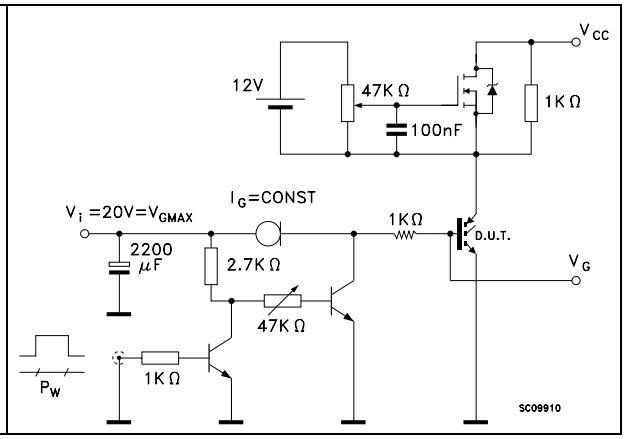


Figure 4. Switching waveforms

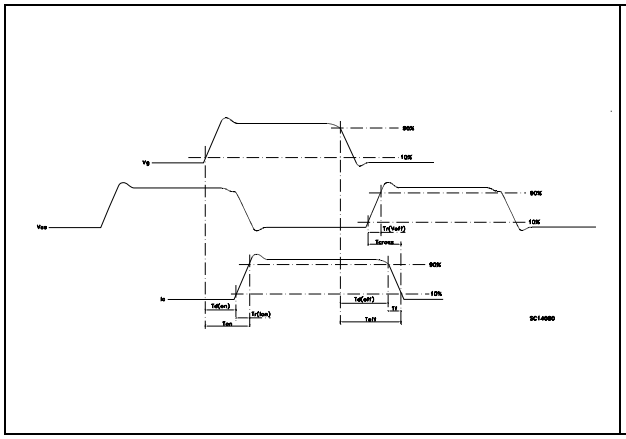
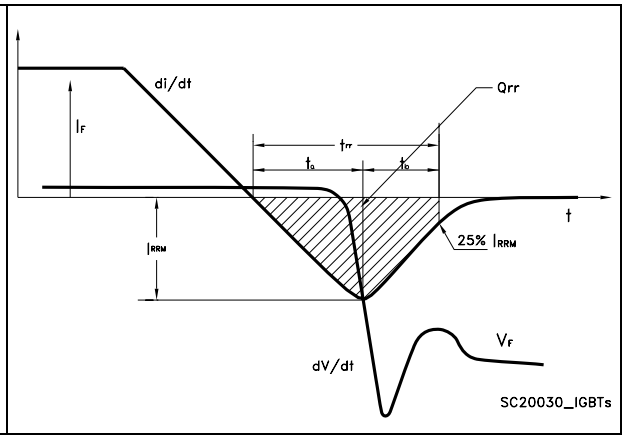


Figure 5. Diode recovery time waveform

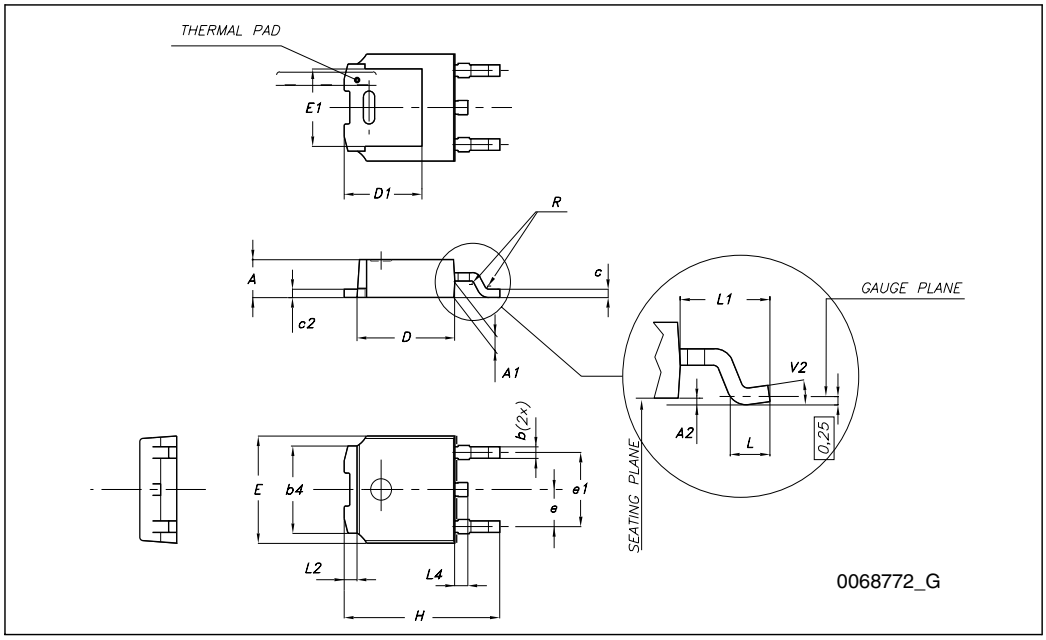


4 Package mechanical data

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.

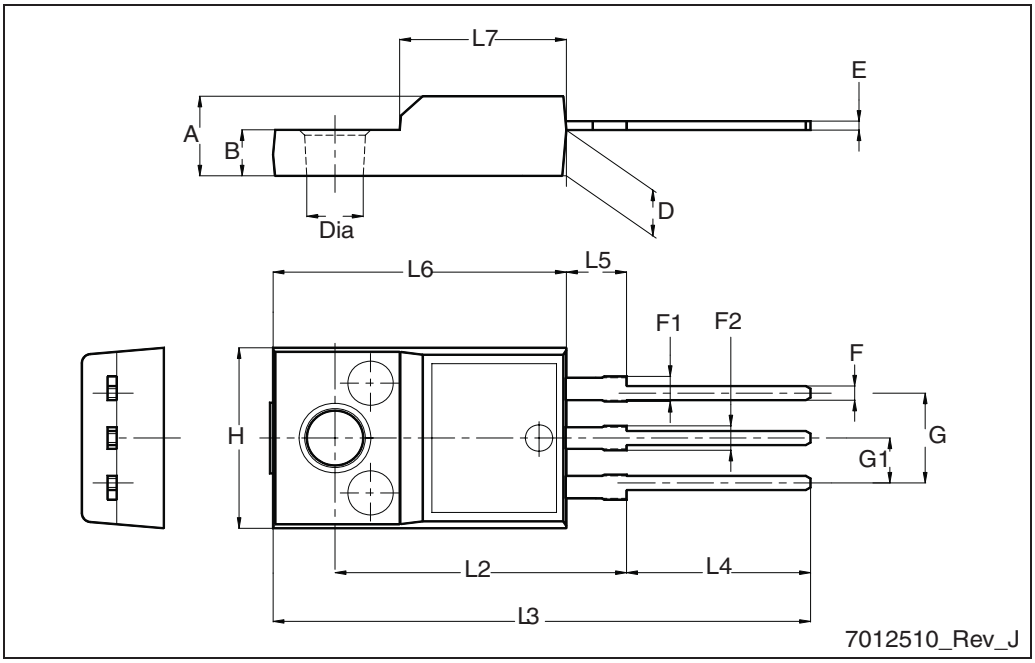
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



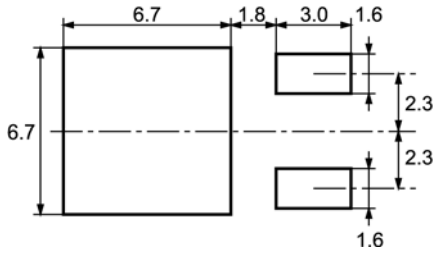
TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.5
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2



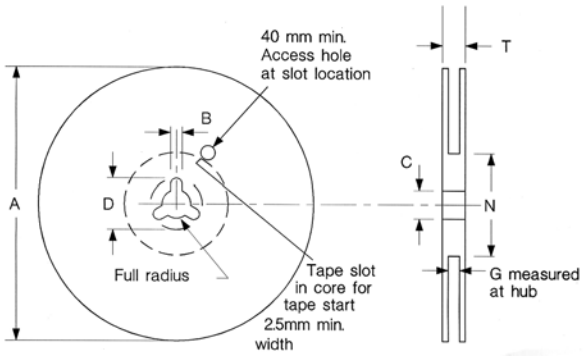
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



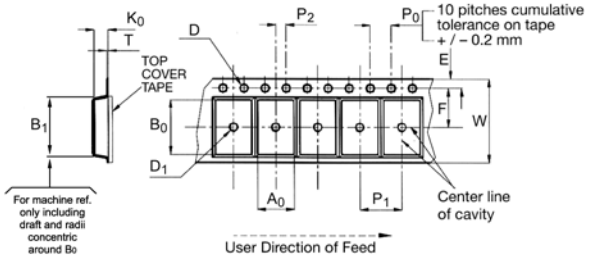
REEL MECHANICAL DATA

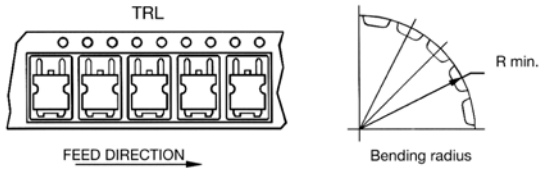
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641





6 Revision history

Table 9. Document revision history

Date	Revision	Changes
06-Jul-2009	1	Initial release

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