



STGF14HF60KD STGP14HF60KD

14 A - 600 V - short-circuit rugged IGBT

Preliminary data

Features

- Low on-voltage drop ($V_{CE(sat)}$)
- Operating junction temperature up to 175 °C
- Low C_{res} / C_{ies} ratio (no cross conduction susceptibility)
- Tight parameter distribution
- Ultrafast soft-recovery antiparallel diode
- Short-circuit rugged

Applications

- Motor drives
- High frequency inverters
- SMPS and PFC in both hard switch and resonant topologies

Description

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

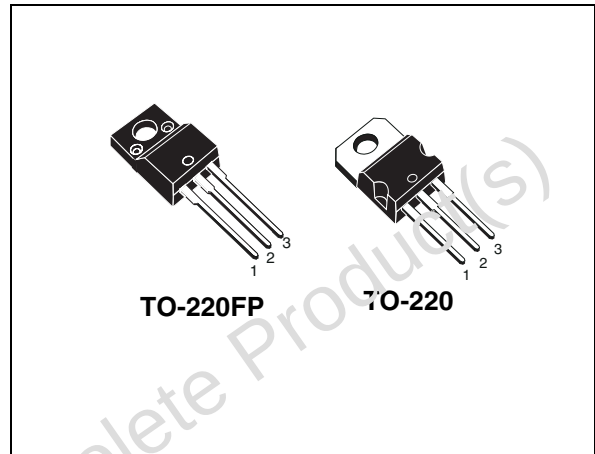


Figure 1. Internal schematic diagram

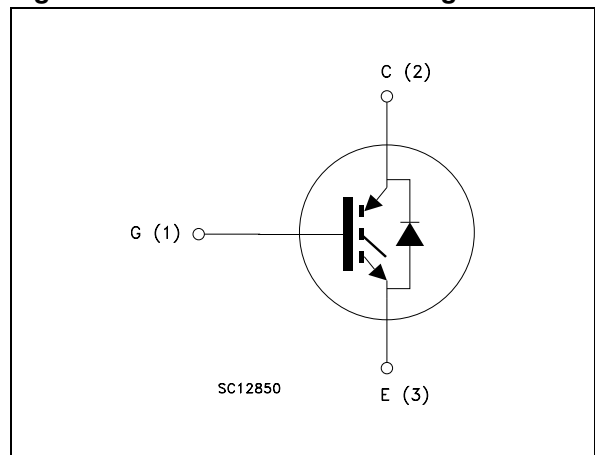


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGF14HF60KD	GF14HF60KD	TO-220FP	Tube
STGP14HF60KD	GP14HF60KD	TO-220	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
3	Test circuits	7
4	Package mechanical data	8
5	Revision history	11

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	600		V
$I_C^{(1)}$	Collector current (continuous) at $T_C = 25\text{ °C}$	25	11	A
$I_C^{(1)}$	Collector current (continuous) at $T_C = 100\text{ °C}$	14	7	A
$I_{CL}^{(2)}$	Turn-off latching current	50		A
$I_{CP}^{(3)}$	Pulsed collector current	50		A
V_{GE}	Gate-emitter voltage	± 20		V
I_F	Diode RMS forward current at $T_C = 25\text{ °C}$	20		A
I_{FSM}	Surge non repetitive forward current $t_p = 10\text{ ms}$ sinusoidal	55		A
V_{ISO}	Isolations withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ °C}$)	--	2500	V
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	95	33	W
t_{scw}	Short-circuit withstand time, $V_{CE} = 0.5V_{(BR)CES}$, $T_C = 125\text{ °C}$, $R_G = 10\text{ }\Omega$, $V_{GE} = 12\text{ V}$	5		μs
T_j	Operating junction temperature	- 40 to 175		$^{\circ}\text{C}$

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. $V_{clamp} = 80\%$ of V_{CES} , $T_j = 175\text{ °C}$, $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$

3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case IGBT	1.58	4.55	$^{\circ}\text{C/W}$
$R_{thj-case}$	Thermal resistance junction-case diode	2.2	5.6	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5		$^{\circ}\text{C/W}$

2 Electrical characteristics

($T_j = 25\text{ °C}$ unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$		2.1		V
		$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$, $T_j = 150\text{ °C}$		1.8		V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	4.5		6.5	V
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$, $T_j = 150\text{ °C}$			± 100	nA
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$			150	μA
		$V_{CE} = 600\text{ V}$, $T_j = 150\text{ °C}$			1	mA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 7\text{ A}$		3		S

1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	TBD	-	pF
C_{oes}	Output capacitance			TBD		pF
C_{res}	Reverse transfer capacitance			TBD		pF
Q_g	Total gate charge	$V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 3)	-	TBD	-	nC
Q_{ge}	Gate-emitter charge			TBD		nC
Q_{gc}	Gate-collector charge			TBD		nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, (see Figure 2)	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope			TBD		A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope			TBD		A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$,		TBD		ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 2)	-	TBD	-	ns
t_f	Current fall time			TBD		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$,		TBD		ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	TBD	-	ns
t_f	Current fall time			TBD		ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$		TBD		μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	TBD	-	μ J
E_{ts}	Total switching losses	(see Figure 2)		TBD		μ J
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$		TBD		μ J
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	TBD	-	μ J
E_{tc}	Total switching losses	$T_j = 150\text{ }^\circ\text{C}$ (see Figure 2)		TBD		μ J

1. E_{on} is the turn-on losses when a typical diode is used in the test circuit. 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	$I_F = 7\text{ A}$ $I_F = 7\text{ A}, T_j = 150\text{ °C}$	-	1.8 1.2	2.1	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_F = 7\text{ A}, V_R = 40\text{ V},$ $di/dt = 100\text{ A/}\mu\text{s}$ (see Figure 5)	-	37 40 2.2		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_F = 7\text{ A}, V_R = 40\text{ V},$ $T_j = 150\text{ °C},$ $di/dt = 100\text{ A/}\mu\text{s}$ (see Figure 5)	-	123 220 3.6		ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

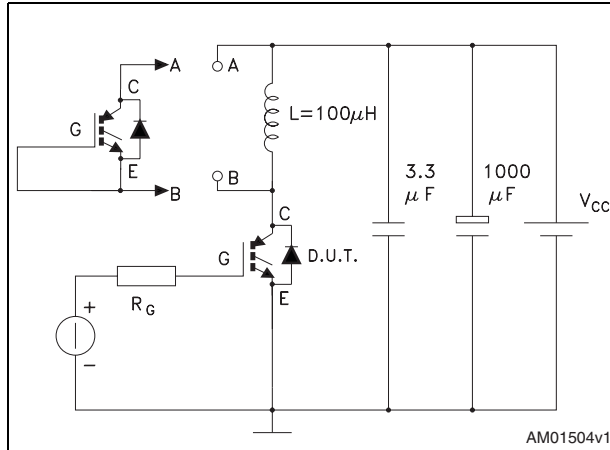


Figure 3. Gate charge test circuit

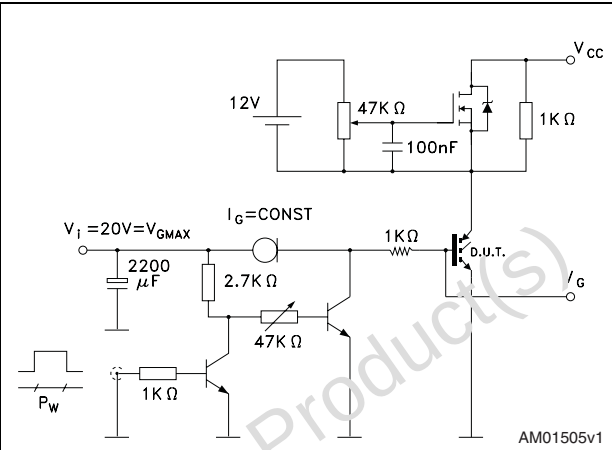


Figure 4. Switching waveforms

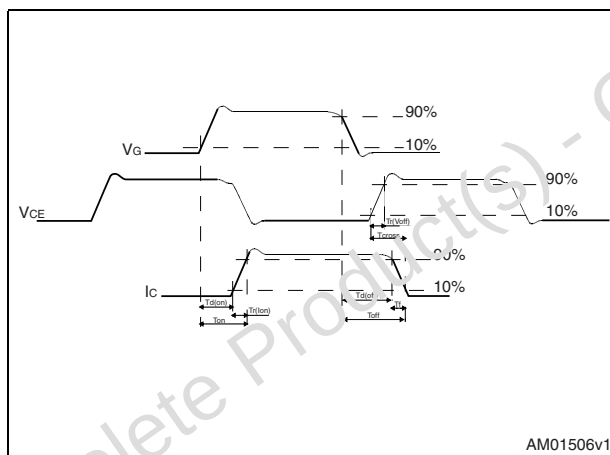
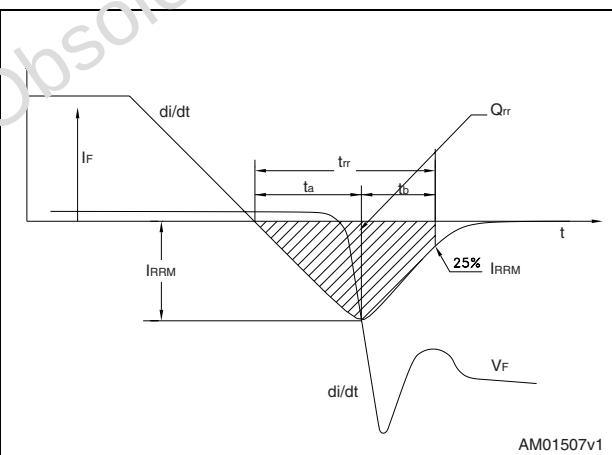


Figure 5. Diode recovery times waveform



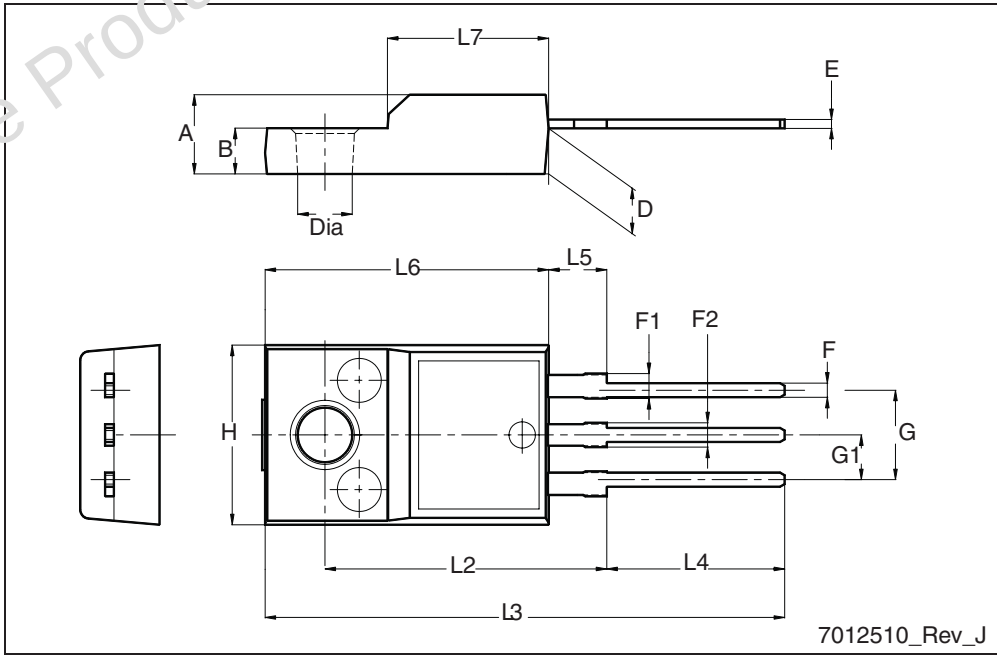
4 Package mechanical data

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.

Obsolete Product(s) - Obsolete Product(s)

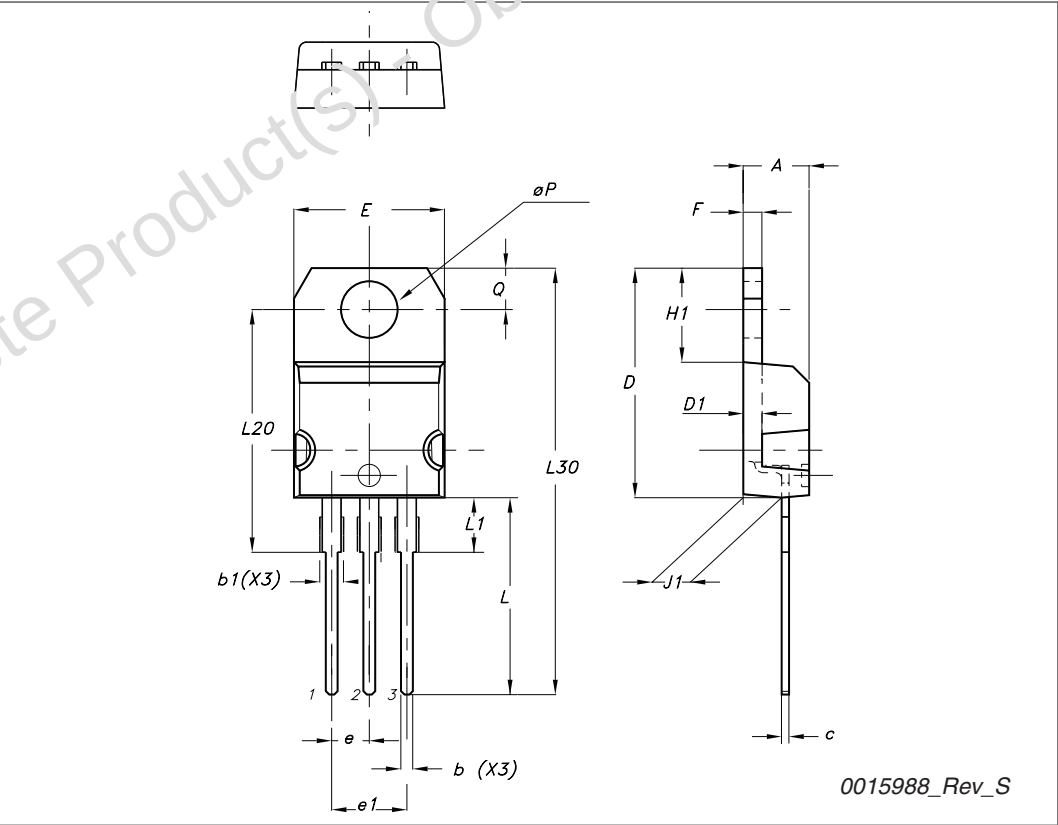
TO-220FP mechanical data

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



TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
17-Aug-2009	1	Initial release.

Obsolete Product(s) - Obsolete Product(s)

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 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 - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com