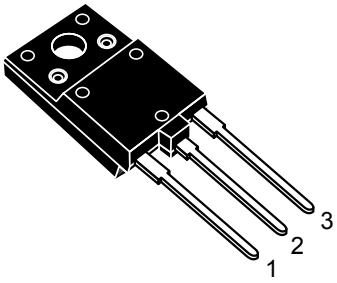
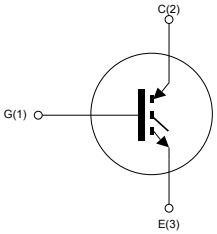
STGWF30NC60S

Datasheet

30 A, 600 V, fast IGBT



TO-3PF



SC12650

Features

- Optimized performance for medium operating frequencies up to 5 kHz in hard switching
- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability

Applications

- Motor drive

Description

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

Product status link
STGWF30NC60S

Product summary	
Order code	STGWF30NC60S
Marking	G30NC60S
Package	TO-3PF
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	600	V
I_C(1)	Continuous collector current at T_C = 25 °C	35	A
	Continuous collector current at T_C = 100 °C	18	
I_{CL}(2)	Turn-off latching current	150	A
I_{CP}(3)	Pulsed collector current	150	A
V_{GE}	Gate-emitter voltage	±20	V
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T_C = 25 °C)	2.5	kV
P_{TOT}	Total power dissipation at T_C = 25 °C	79	W
T_J	Operating junction temperature range	- 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 junction temperature and turn-off within RBSOA.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	1.58	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A		1.5	1.9	V
		V_{GE} = 15 V, I_C = 20 A, T_J = 150 °C		1.4		
$V_{GE(th)}$	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, V_{CE} = 600 V			150	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±100	nA
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V, I_C = 20 A		10		S

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

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2200	-	pF
C_{oes}	Output capacitance		-	185	-	
C_{res}	Reverse transfer capacitance		-	48.5	-	
Q_g	Total gate charge	V_{CC} = 480 V, I_C = 20 A, V_{GE} = 15 V (see Figure 16. Gate charge test circuit)	-	96	-	nC
Q_{ge}	Gate-emitter charge		-	14	-	
Q_{gc}	Gate-collector charge		-	44.5	-	

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 20 A,	-	21.5	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V	-	8.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2280	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 480 V, I_C = 20 A,	-	20.5	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	9.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2150	-	A/µs
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 480 V, I_C = 20 A,	-	85	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V	-	180	-	ns
t_f	Current fall time	(see Figure 15. Test circuit for inductive load switching)	-	200	-	ns
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 480 V, I_C = 20 A,	-	155	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	260	-	ns
t_f	Current fall time	(see Figure 15. Test circuit for inductive load switching)	-	295	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{CE} = 480 V, I_C = 20 A,	-	300	-	µJ
E_{off}	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V	-	1275	-	µJ
E_{ts}	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	1575	-	µJ
E_{on}	Turn-on switching energy	V_{CE} = 480 V, I_C = 20 A,	-	430		µJ
E_{off}	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	1965		µJ
E_{ts}	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	2395		µJ

1. *Turn-off losses include also the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

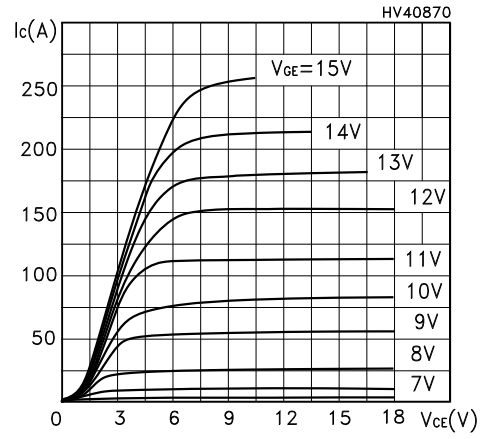


Figure 2. Transfer characteristics

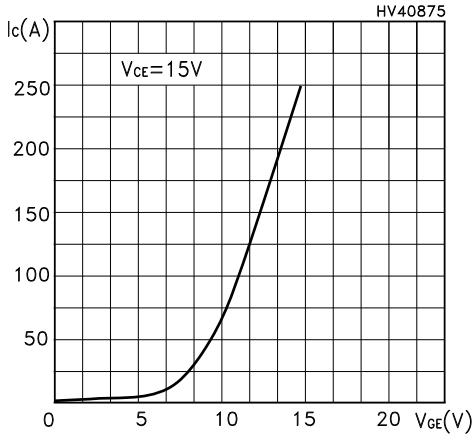


Figure 3. Transconductance

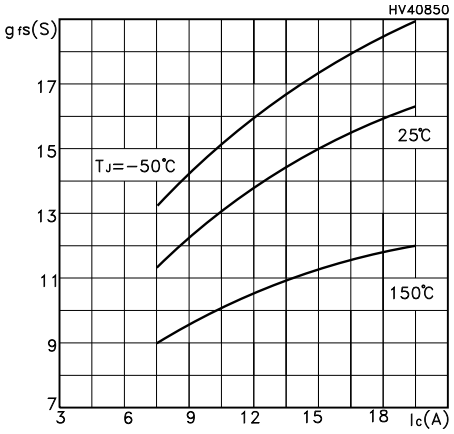


Figure 4. Collector-emitter on voltage vs temperature

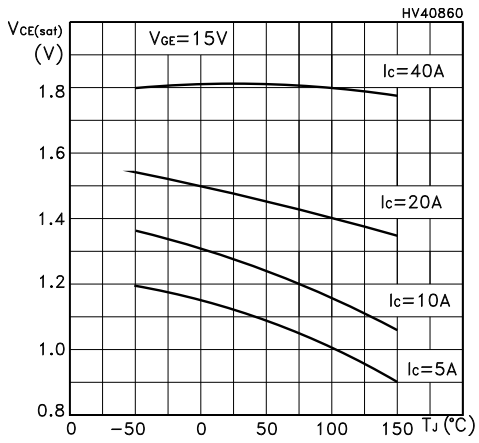


Figure 5. Gate charge vs gate-source voltage

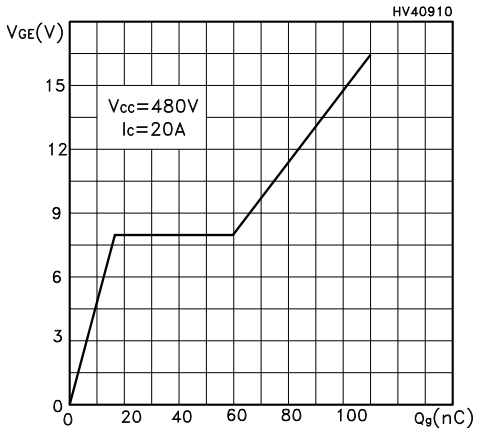


Figure 6. Capacitance variations

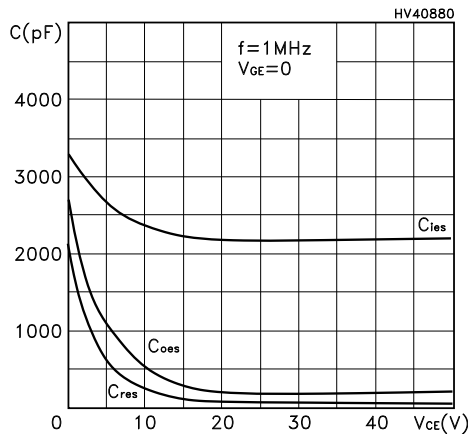


Figure 7. Normalized gate threshold voltage vs temperature

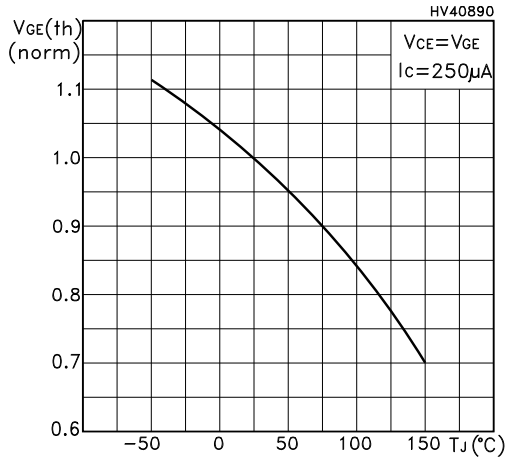


Figure 8. Collector-emitter on voltage vs collector current

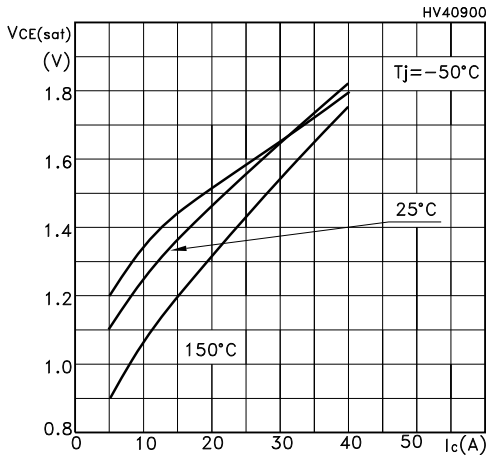


Figure 9. Normalized breakdown voltage vs temperature

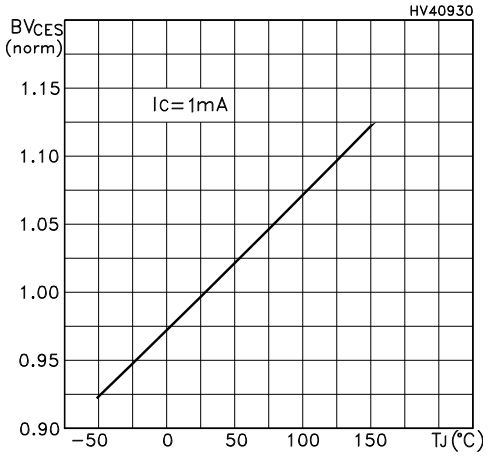


Figure 10. Switching losses vs temperature

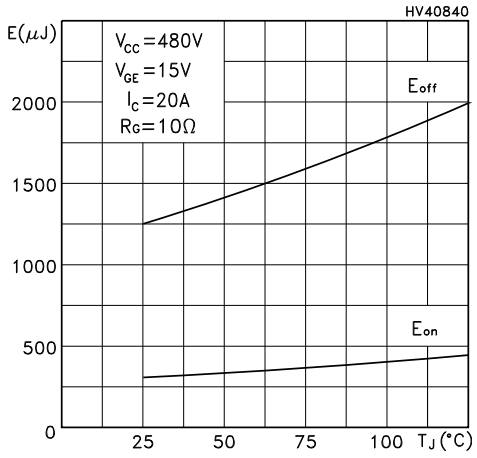


Figure 11. Switching losses vs gate resistance

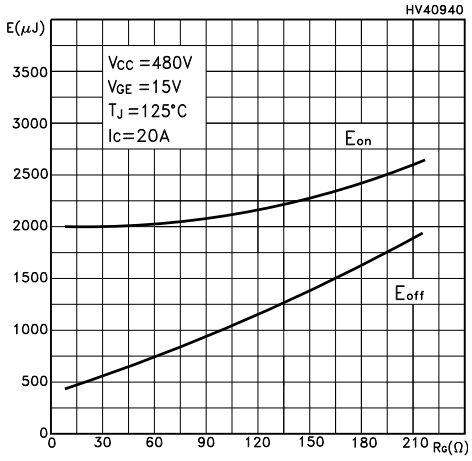


Figure 12. Switching losses vs collector current

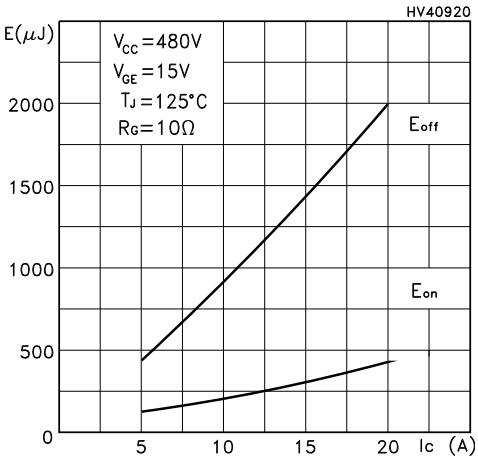


Figure 13. Turn-off SOA

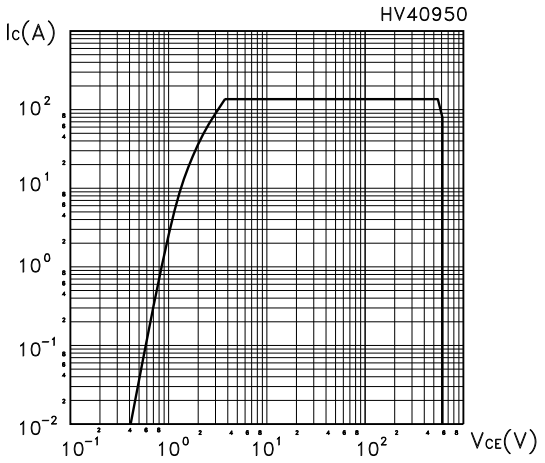
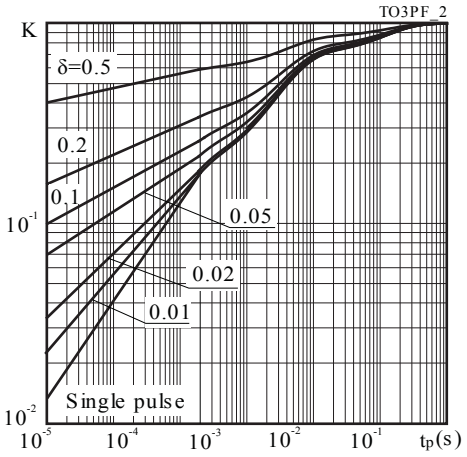


Figure 14. Thermal Impedance



3 Test circuits

Figure 15. Test circuit for inductive load switching

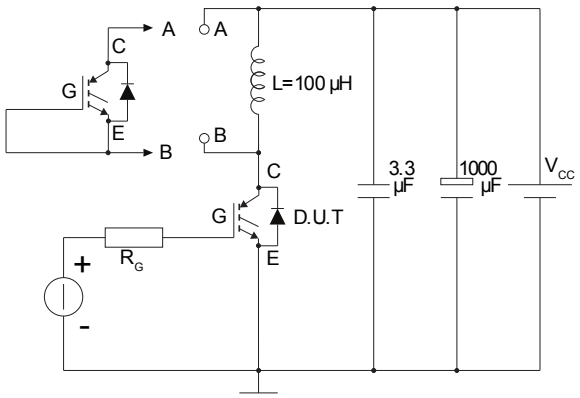


Figure 16. Gate charge test circuit

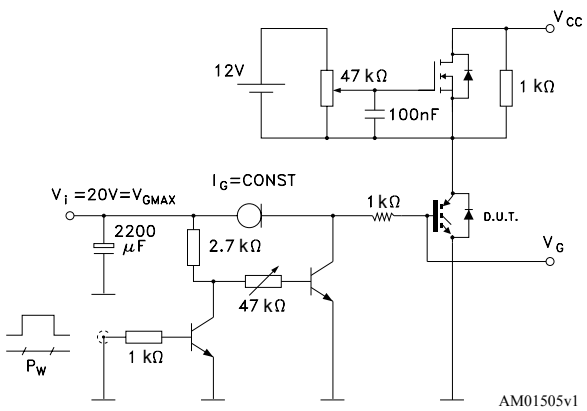
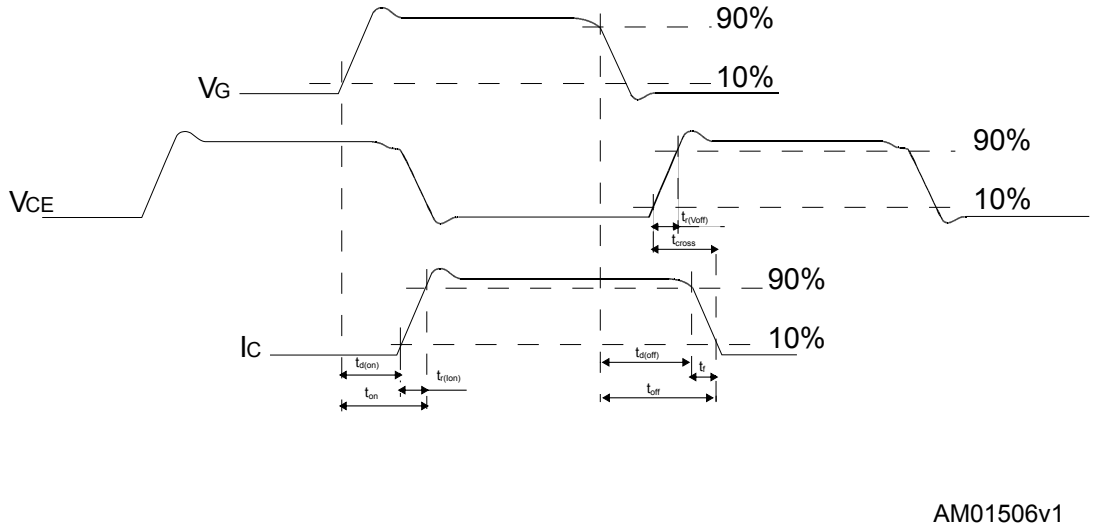


Figure 17. Switching waveform



4 Package information

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.

4.1 TO-3PF package information

Figure 18. TO-3PF package outline

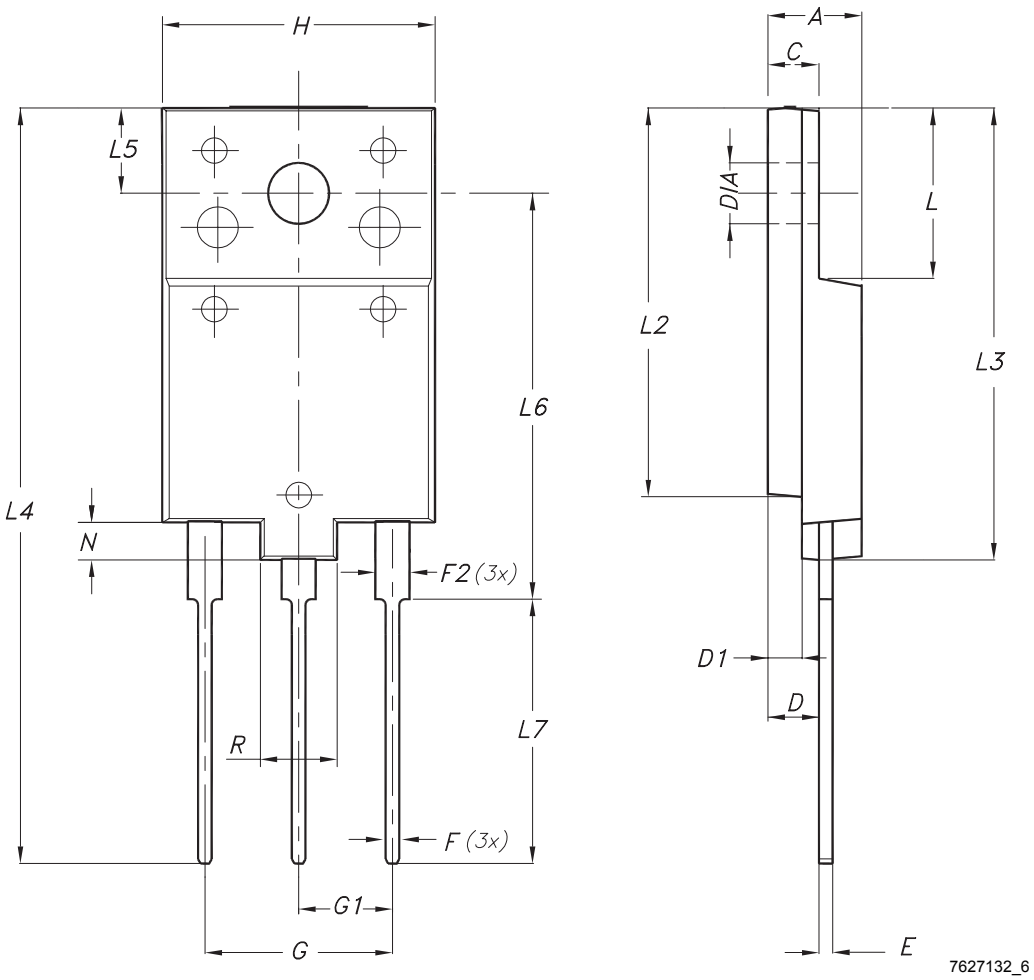


Table 7. **TO-3PF mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10.00	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15.00
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
02-Jul-2007	1	Initial release
20-Nov-2007	2	Document status promoted from preliminary data to datasheet
04-May-2009	3	Added new package, mechanical data: TO-220FP
30-Jun-2010	4	Added new package, mechanical data: TO-3PF
11-Nov-2010	5	– Updated data for TO-3PF in *Table 2* and *Table 3* – Modified *Figure 17*
04-May-2020	6	The part numbers STGF30NC60S and STGP30NC60S have been moved to a separate datasheet and the document has been updated accordingly. Updated Device summary.

Contents

1 **Electrical ratings** 2

2 **Electrical characteristics** 3

2.1 Electrical characteristics (curves) 5

3 **Test circuits** 8

4 **Package information** 9

4.1 TO-3PF package information 9

Revision history 11

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2020 STMicroelectronics – All rights reserved