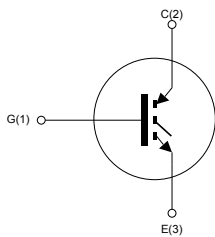

TO-3PF


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

$T_C = 25\text{ °C}$ unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$		1.5	1.9	V
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 150\text{ °C}$		1.4		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$			150	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ °C}$			1	mA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			± 100	nA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\text{ V}, I_C = 20\text{ A}$		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	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	2200	-	pF
C_{oes}	Output capacitance		-	185	-	
C_{res}	Reverse transfer capacitance		-	48.5	-	
Q_g	Total gate charge	$V_{CC} = 480\text{ V}, I_C = 20\text{ A}, V_{GE} = 15\text{ V}$ (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	$V_{CC} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	21.5	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	8.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2280	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	20.5	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	9.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2150	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	85	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	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	$V_{CC} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	155	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	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	$V_{CE} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	300	-	μ J
E_{off}	Turn-off switching energy	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	1275	-	μ J
E_{ts}	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	1575	-	μ J
E_{on}	Turn-on switching energy	$V_{CE} = 480\text{ V}$, $I_C = 20\text{ A}$,	-	430	-	μ J
E_{off}	Turn-off switching energy	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	1965	-	μ J
E_{ts}	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	2395	-	μ J

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

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

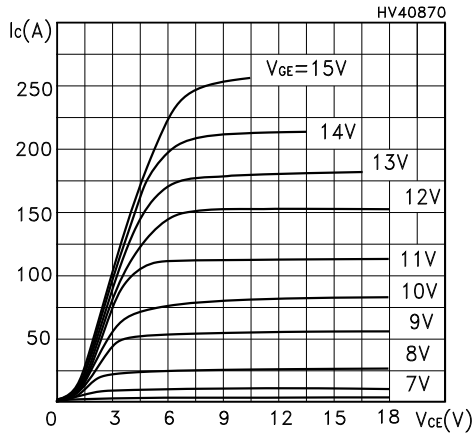


Figure 2. Transfer characteristics

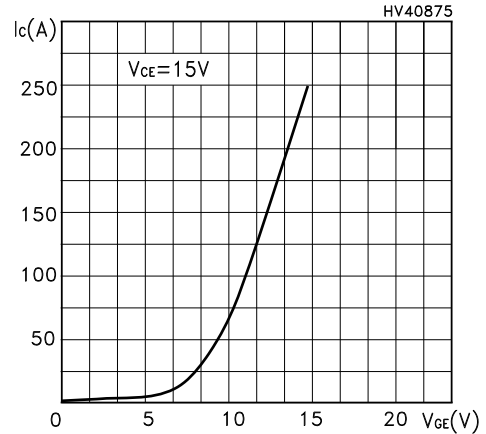


Figure 3. Transconductance

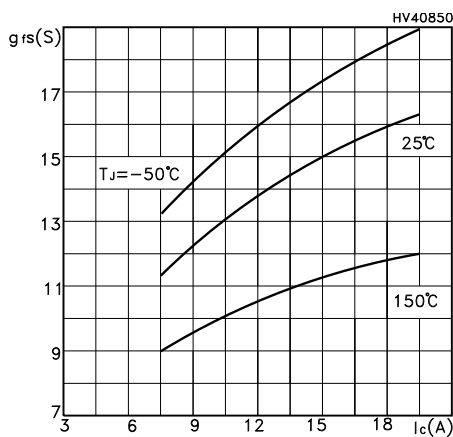


Figure 4. Collector-emitter on voltage vs temperature

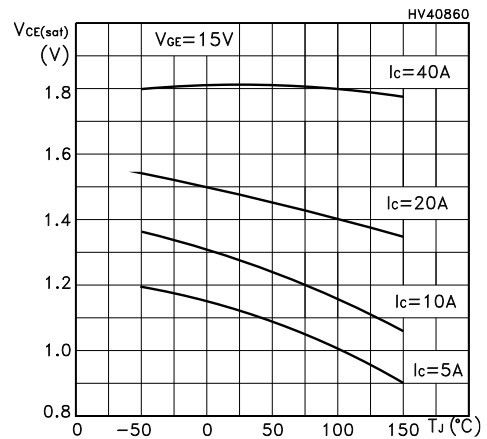


Figure 5. Gate charge vs gate-source voltage

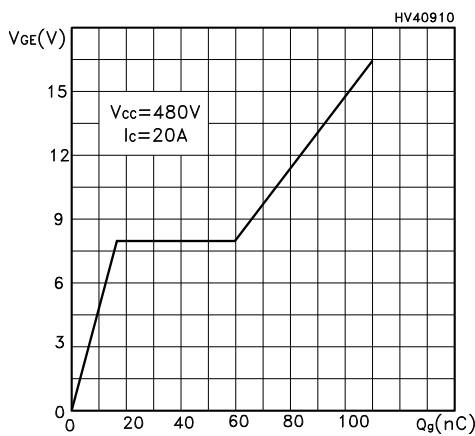


Figure 6. Capacitance variations

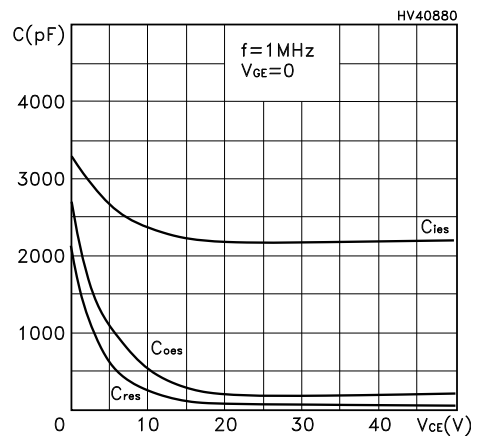


Figure 7. Normalized gate threshold voltage vs temperature

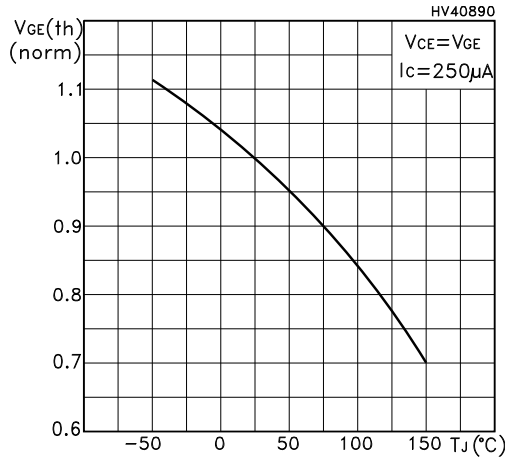


Figure 8. Collector-emitter on voltage vs collector current

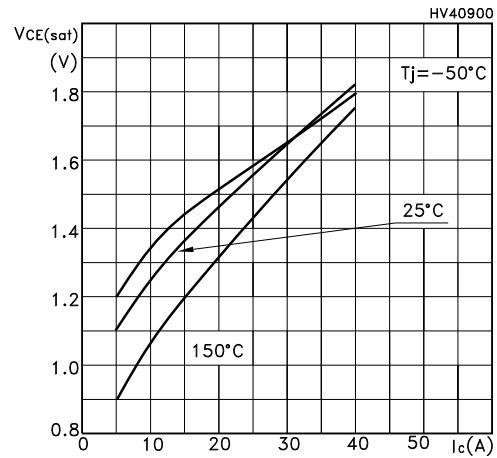


Figure 9. Normalized breakdown voltage vs temperature

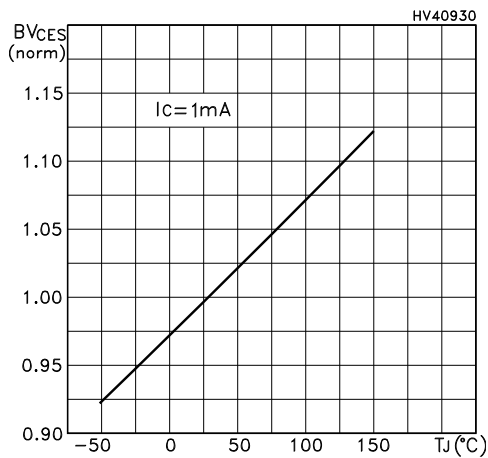


Figure 10. Switching losses vs temperature

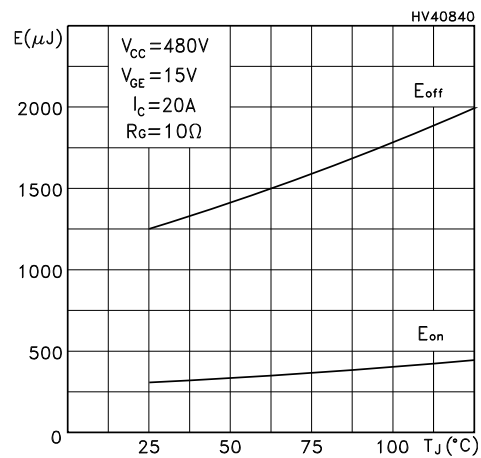


Figure 11. Switching losses vs gate resistance

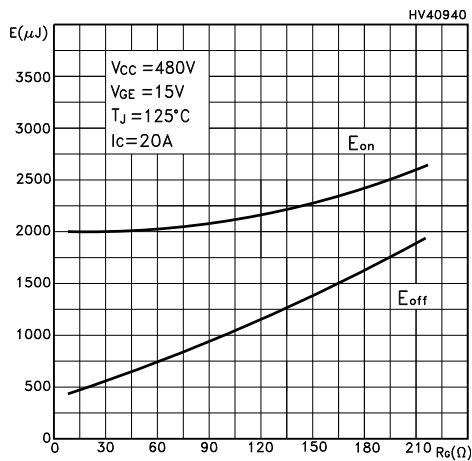


Figure 12. Switching losses vs collector current

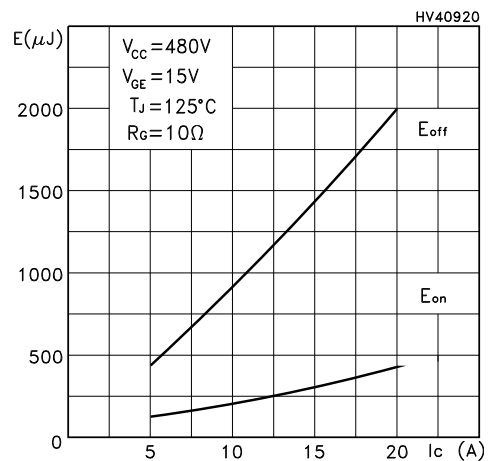


Figure 13. Turn-off SOA

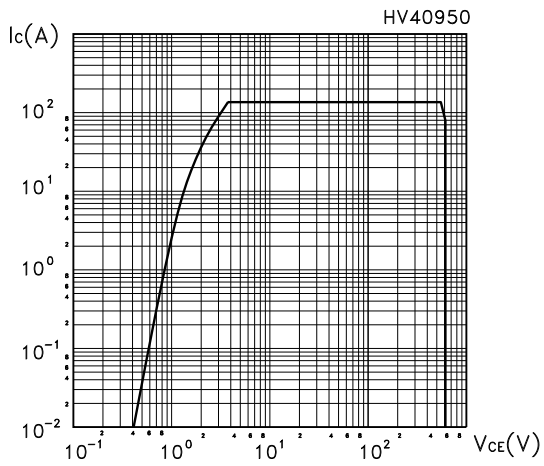
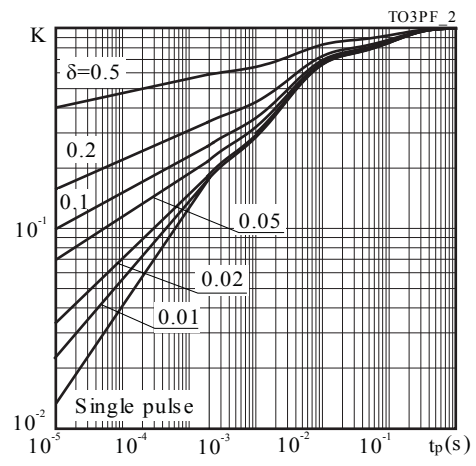
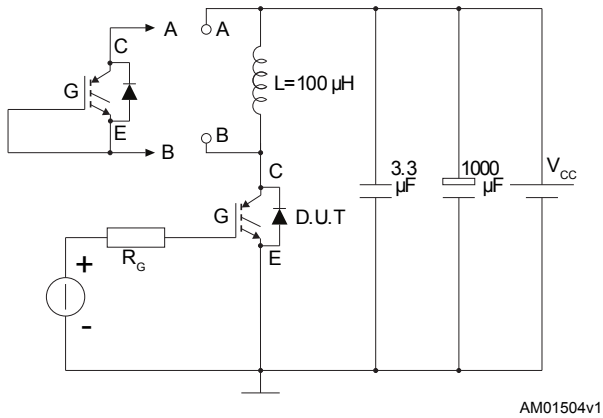
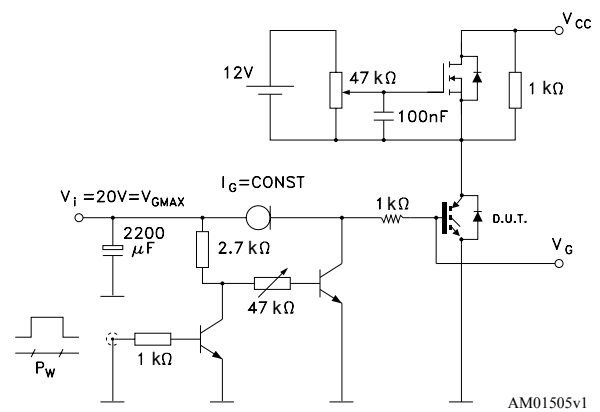
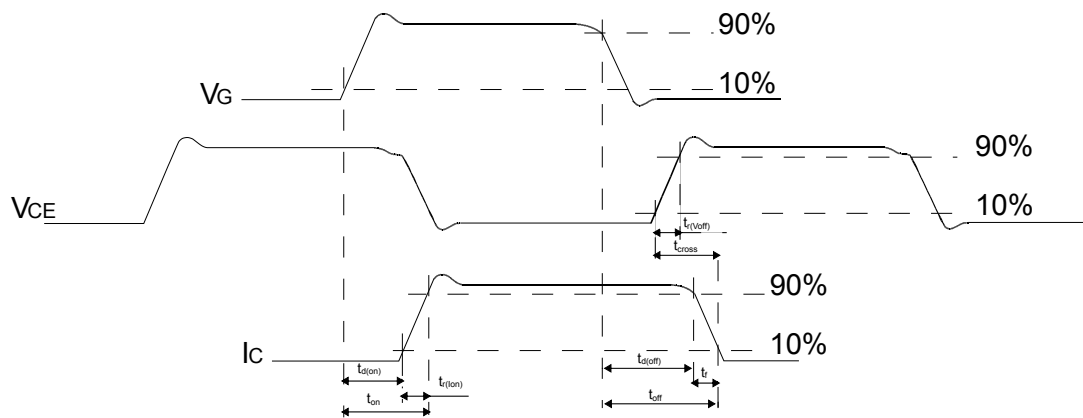


Figure 14. Thermal Impedance



3 Test circuits

Figure 15. Test circuit for inductive load switching

Figure 16. Gate charge test circuit

Figure 17. Switching waveform


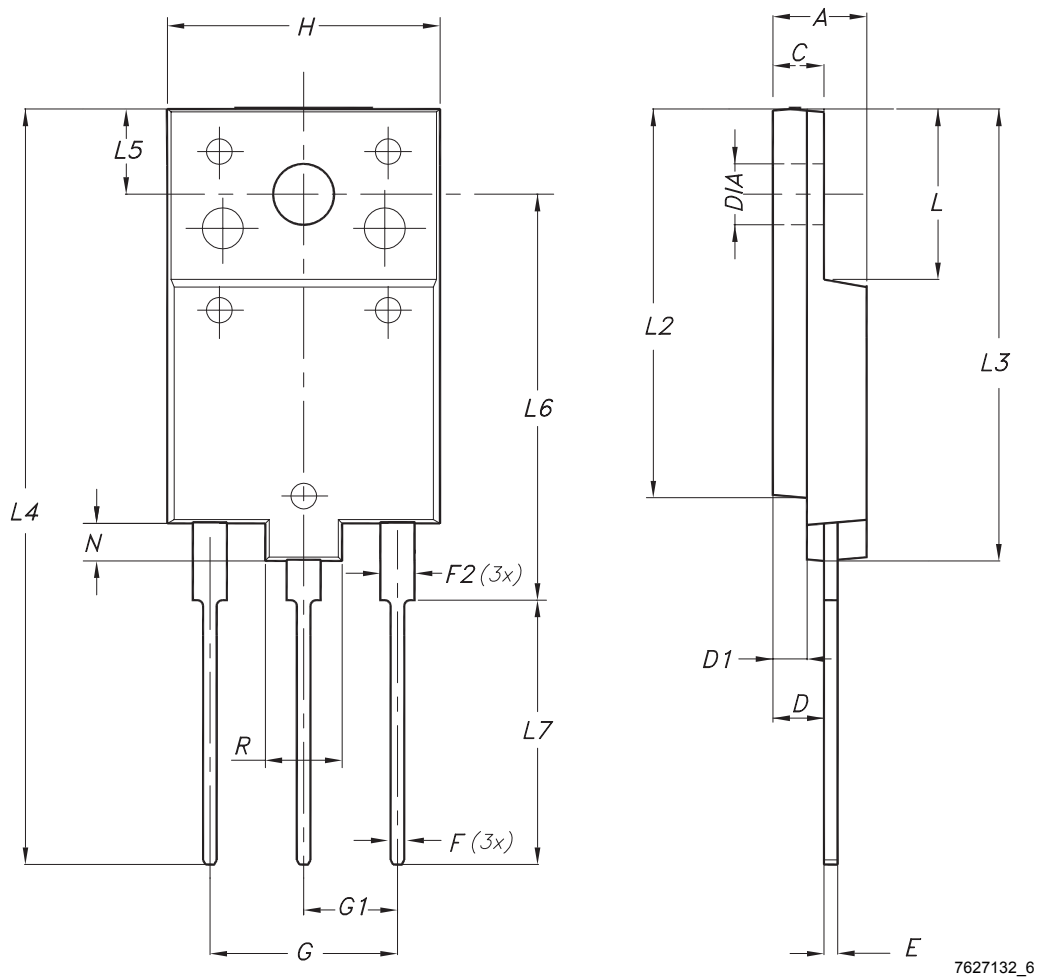
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4 Package information

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



7627132_6

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 <i>Table 2</i> and <i>Table 3</i> – Modified <i>Figure 17</i>
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 .

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