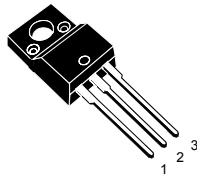
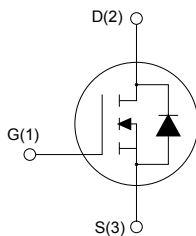


## N-channel 250 V, 195 mΩ typ., 14 A STripFET II Power MOSFET in a TO-220FP package



TO-220FP



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### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STF16NF25	250 V	235 mΩ	14 A

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

### Applications

- Switching applications

### Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.



#### Product status link

[STF16NF25](#)

#### Product summary

<b>Order code</b>	STF16NF25
<b>Marking</b>	16NF25
<b>Package</b>	TO-220FP
<b>Packing</b>	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	250	V
$V_{GS}$	Gate-source voltage	±20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	14	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	8.8	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	56	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	25	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15	V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t = 1\text{ s}$ , $T_C = 25\text{ °C}$ )	2.5	kV
$T_{stg}$	Storage temperature range	-55 to 150	°C
$T_J$	Operating junction temperature range		°C

1. This value is limited by maximum junction temperature.
2. Pulse width is limited by safe operating area.
3.  $I_{SD} \leq 13\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\%V_{(BR)DSS}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	5	°C/W
$R_{thJA}$	Thermal resistance, junction-to-ambient	62.5	°C/W

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or non-repetitive (pulse width limited by $T_J$ max.)	13	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	100	mJ

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	250			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 250\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 250\text{ V}$ , $T_C = 125\text{ °C}^{(1)}$			10	
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{ A}$		195	235	m $\Omega$

1. Specified by design, not tested in production.

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	680	-	pF
$C_{oss}$	Output capacitance		-	125	-	pF
$C_{rss}$	Reverse transfer capacitance		-	20	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }200\text{ V}$	-	48	-	pF
$R_G$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	2.1	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 200\text{ V}$ , $I_D = 13\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	18	-	nC
$Q_{gs}$	Gate-source charge		-	3	-	nC
$Q_{gd}$	Gate-drain charge		-	9	-	nC

1.  $C_{oss\text{ eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$ .

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 125\text{ V}$ , $I_D = 6.5\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$	-	9	-	ns
$t_r$	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	35	-	ns
$t_f$	Fall time		-	17	-	ns

**Table 7. Source-drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		14	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		56	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 13\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 13\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	133		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$	-	651		nC
$I_{RRM}$	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	10		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 13\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	157		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	895		nC
$I_{RRM}$	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	11		A

1. Pulse width is limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

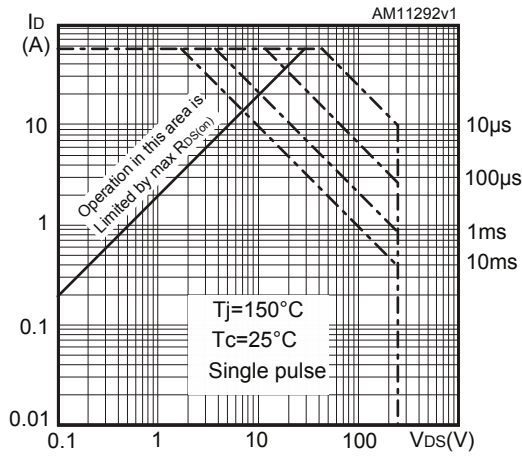


Figure 2. Thermal impedance

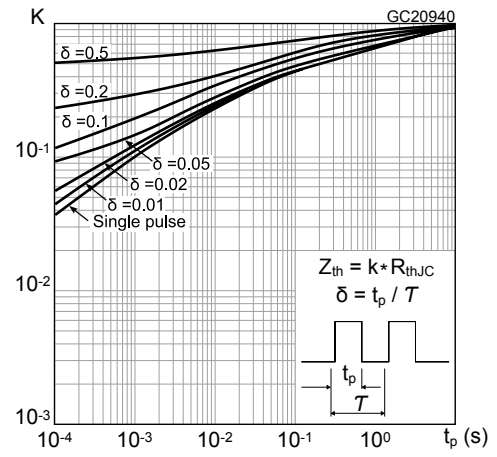


Figure 3. Output characteristics

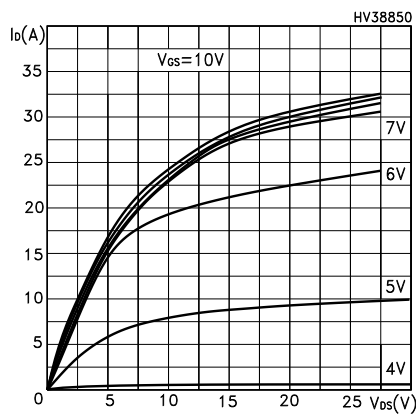


Figure 4. Transfer characteristics

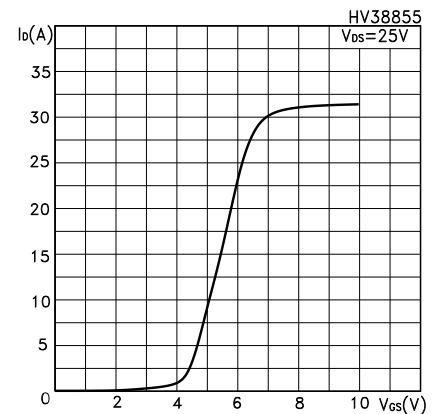


Figure 5. Normalized  $V_{(BR)DSS}$  vs temperature

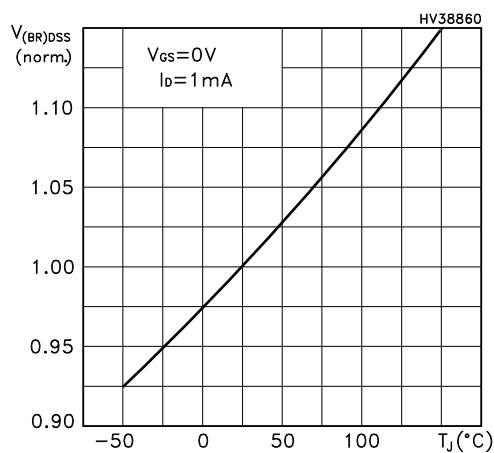


Figure 6. Static drain-source on resistance

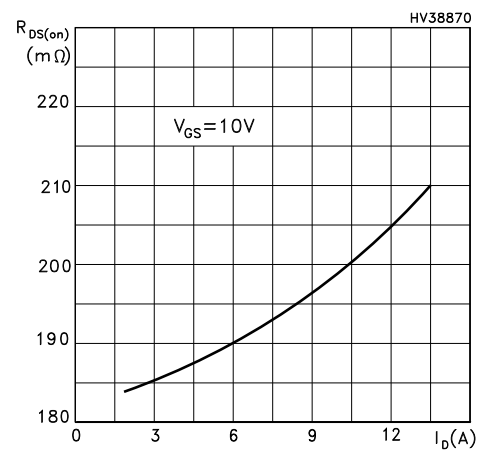


Figure 7. Gate charge vs gate-source voltage

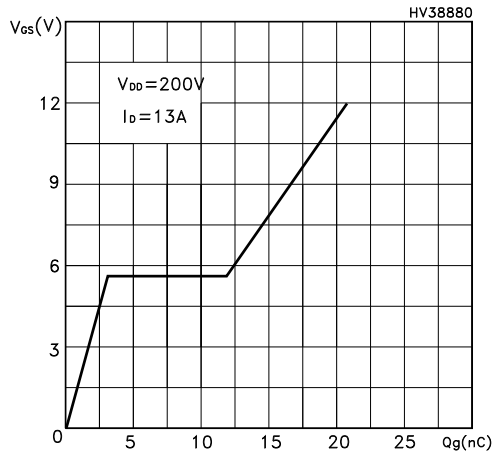


Figure 8. Capacitance variations

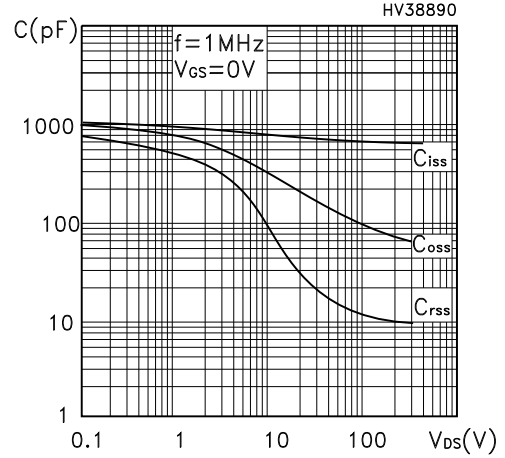


Figure 9. Normalized gate threshold voltage vs temperature

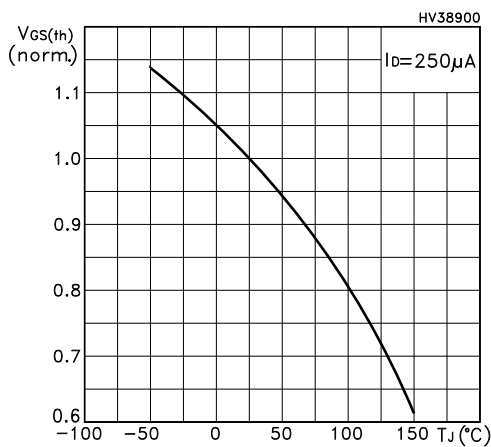


Figure 10. Normalized on resistance vs temperature

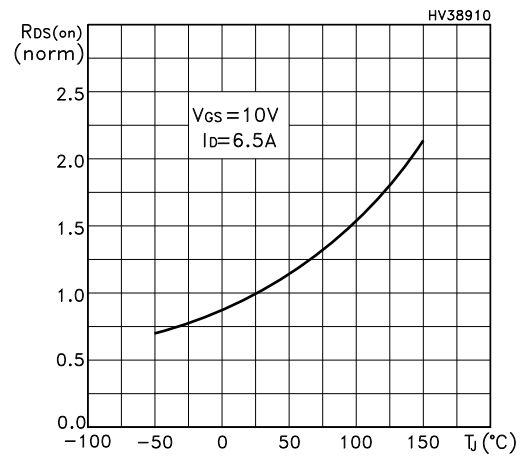


Figure 11. Source-drain diode forward characteristics

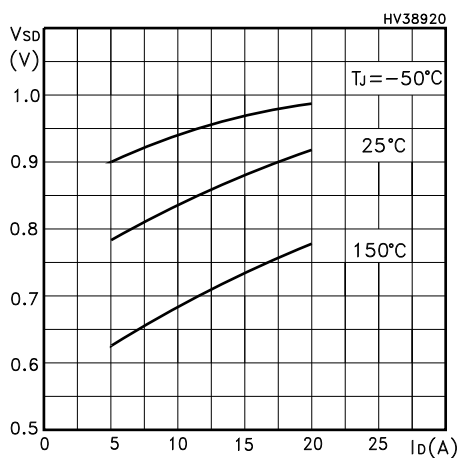
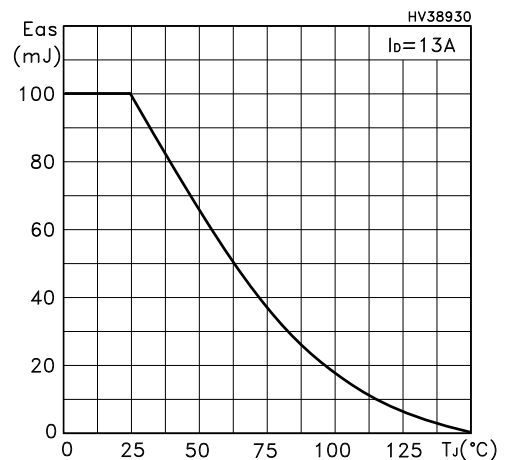


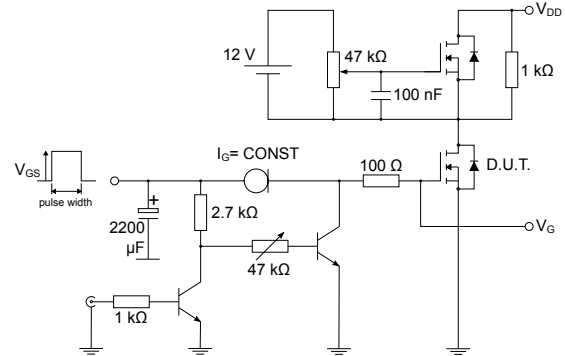
Figure 12. Maximum avalanche energy vs temperature



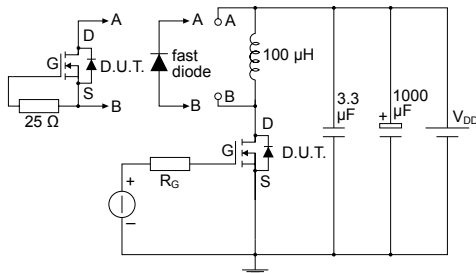
### 3 Test circuits

**Figure 13. Test circuit for resistive load switching times**

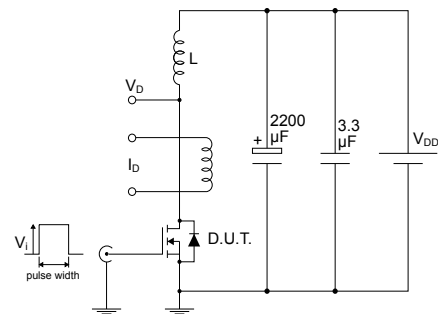

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**Figure 14. Test circuit for gate charge behavior**


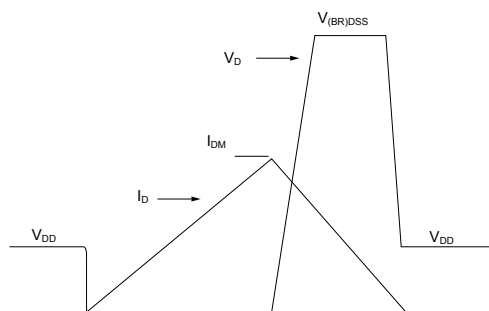
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**Figure 15. Test circuit for inductive load switching and diode recovery times**


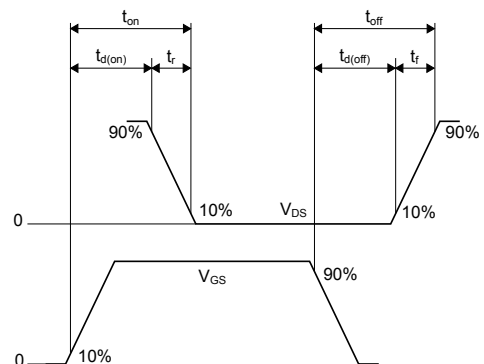
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**Figure 16. Unclamped inductive load test circuit**


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**Figure 17. Unclamped inductive waveform**


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**Figure 18. Switching time waveform**


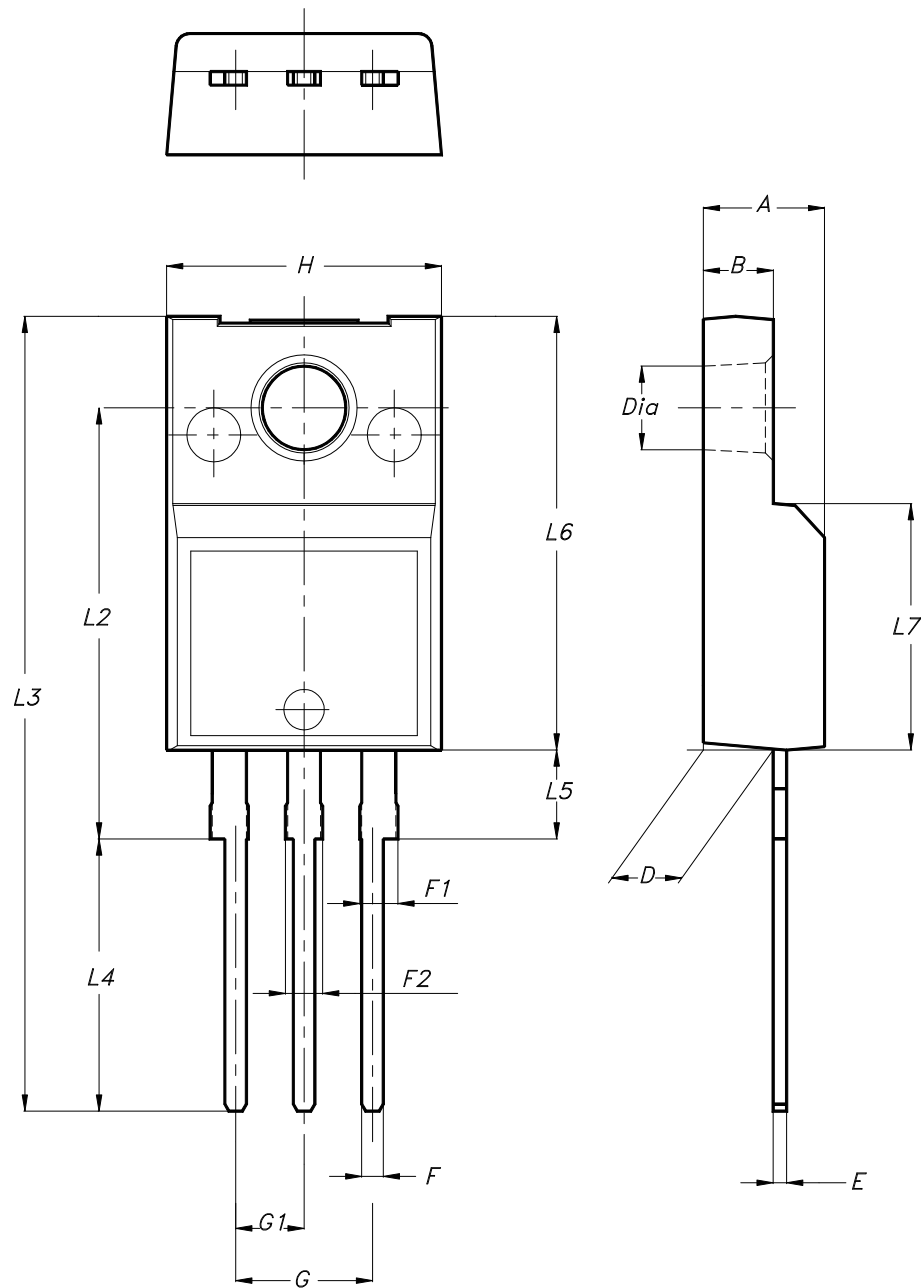
AM01473v1

## 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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 TO-220FP type B package information

Figure 19. TO-220FP type B package outline



7012510\_B\_rev.14



**Table 8. TO-220FP type B package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

## Revision history

**Table 9. Document revision history**

Date	Revision	Changes
21-Sep-2023	1	First release. The part number STF16NF25 was previously inserted in the DS5532.

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