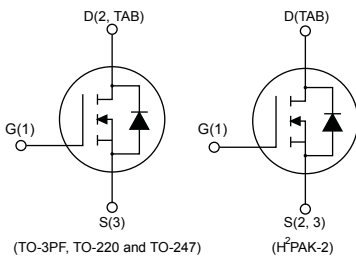
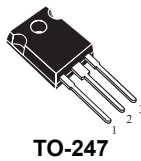
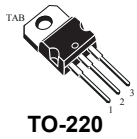
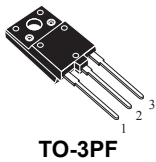


N-channel 1500 V, 2.5 A, 6  $\Omega$  typ., PowerMESH Power MOSFETs  
in TO-3PF, H<sup>2</sup>PAK-2, TO-220 and TO247 packages



AM15557v1



## Features

Order codes	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STFW3N150	1500 V	9 $\Omega$	2.5 A	63 W
STH3N150-2				140 W
STP3N150				
STW3N150				

- 100% avalanche tested
- Intrinsic capacitances and Q<sub>g</sub> minimized
- High speed switching
- Fully isolated TO-3PF plastic package, creepage distance path is 5.4 mm (typ.)

## Applications

- Switching applications

## Description

These Power MOSFETs are designed using the STMicroelectronics consolidated strip-layout-based MESH OVERLAY process. The result is a product that matches or improves on the performance of comparable standard parts from other manufacturers.

### Product status link

[STFW3N150](#)

[STH3N150-2](#)

[STP3N150](#)

[STW3N150](#)

# 1 Electrical ratings

**Table 1.**

Symbol	Parameter	Value				Unit
		TO-3PF	H <sup>2</sup> PAK-2	TO-220	TO-247	
V <sub>DS</sub>	Drain-source voltage	1500				V
V <sub>GS</sub>	Gate-source voltage	±30				V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	2.5 <sup>(1)</sup>	2.5			A
	Drain current (continuous) at T <sub>C</sub> = 100 °C	1.6 <sup>(1)</sup>	1.6			
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	10				A
P <sub>TOT</sub>	Total power dissipation at T <sub>C</sub> = 25 °C	63	140			W
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T <sub>C</sub> = 25 °C)	3.5				kV
	Derating factor	0.5	1.12			W/°C
T <sub>stg</sub>	Storage temperature range	-55 to 150				°C
T <sub>J</sub>	Operating junction temperature range					

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.

**Table 2. Thermal data**

Symbol	Parameter	Value				Unit
		TO-3PF	H <sup>2</sup> PAK-2	TO-220	TO-247	
R <sub>thj-case</sub>	Thermal resistance junction-case	2	0.89			°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	50		62.5	50	°C/W
R <sub>thj-pcb</sub> <sup>(1)</sup>	Thermal resistance junction-pcb		35			°C/W

1. When mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz Cu.

**Table 3.**

Symbol	Parameter	Max value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>J</sub> max)	2.5	A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>J</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	450	mJ

## 2 Electrical characteristics

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

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	1500			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1500\text{ V}$			10	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = 1500\text{ V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup>			500	
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 30\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 1.3\text{ A}$		6	9	$\Omega$

1. Defined by design, not subject to production test.

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	939	-	$\text{pF}$
$C_{oss}$	Output capacitance		-	102	-	
$C_{rss}$	Reverse transfer capacitance		-	13.2	-	
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }1200\text{ V}$ , $V_{GS} = 0\text{ V}$	-	100	-	$\text{pF}$
$R_g$	Gate input resistance	$f = 1\text{ MHz}$ , gate DC Bias = 0, test signal level = 20 mV, $I_D = 0\text{ A}$	-	4	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 1200\text{ V}$ , $I_D = 2.5\text{ A}$ , $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 18. Test circuit for gate charge behavior)	-	29.3	-	nC
$Q_{gs}$	Gate-source charge		-	4.6	-	
$Q_{gd}$	Gate-drain charge		-	17	-	

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**

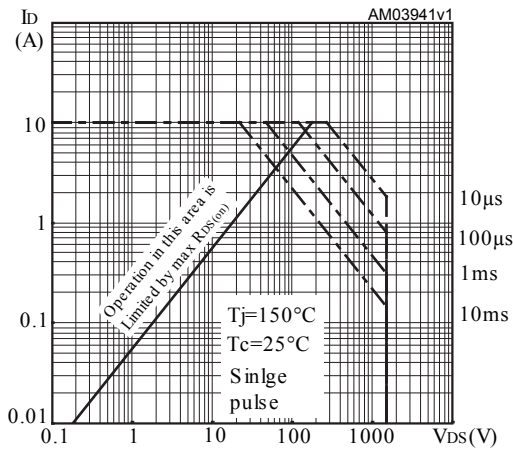
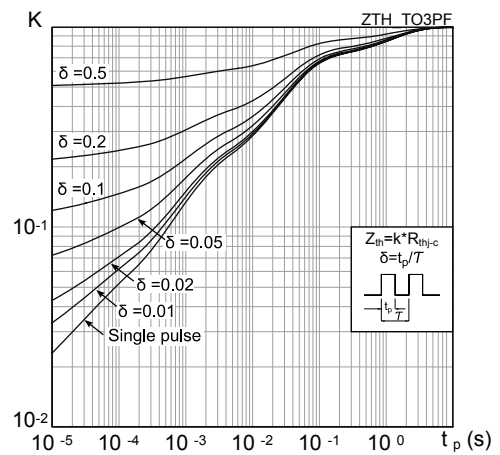
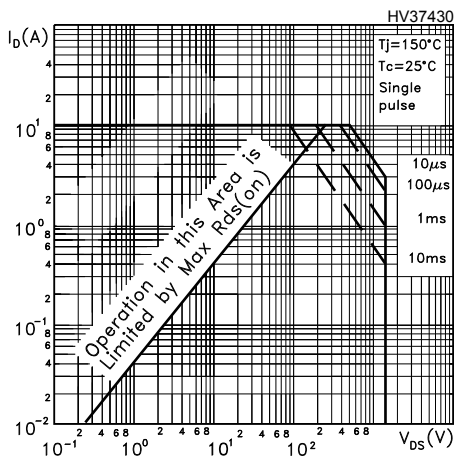
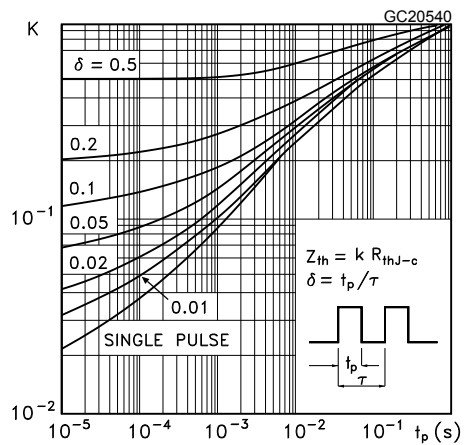
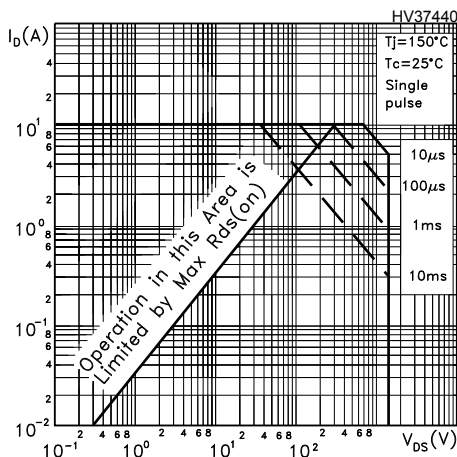
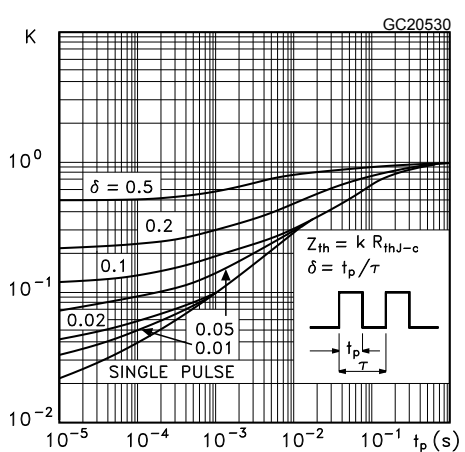
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 750\text{ V}$ , $I_D = 1.25\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform)	-	24	-	ns
$t_r$	Rise time		-	47	-	
$t_{d(off)}$	Turn-off delay time		-	45	-	
$t_f$	Fall time		-	61	-	

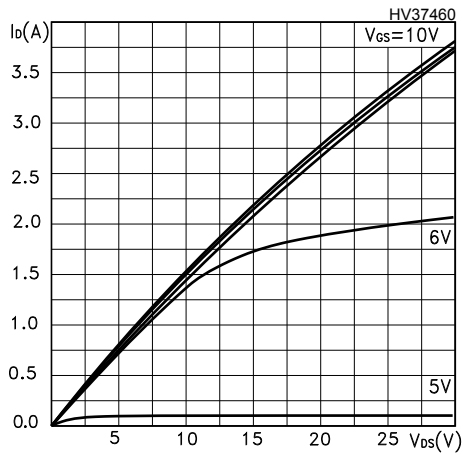
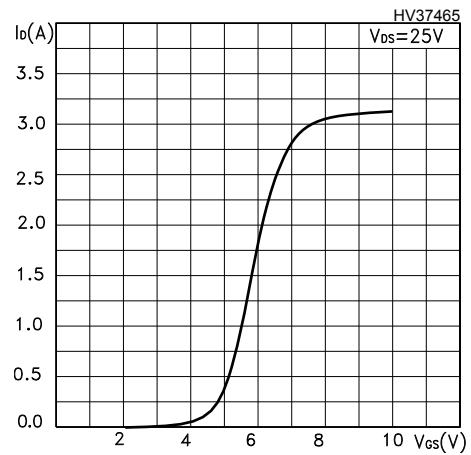
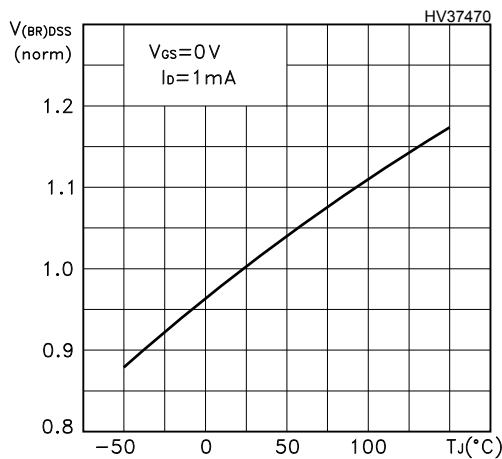
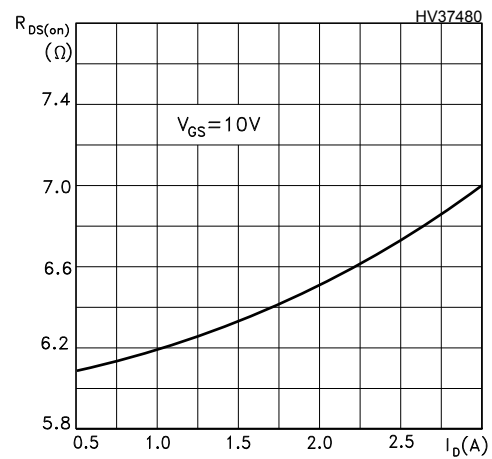
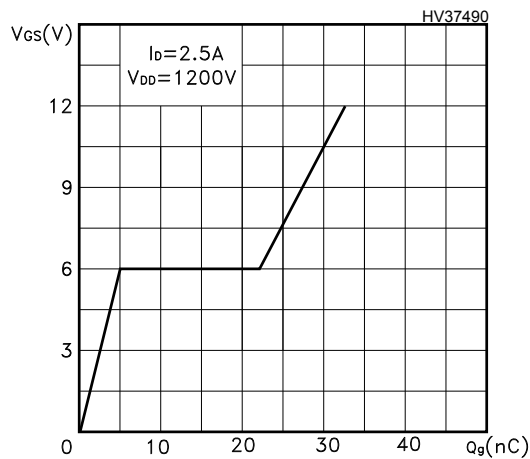
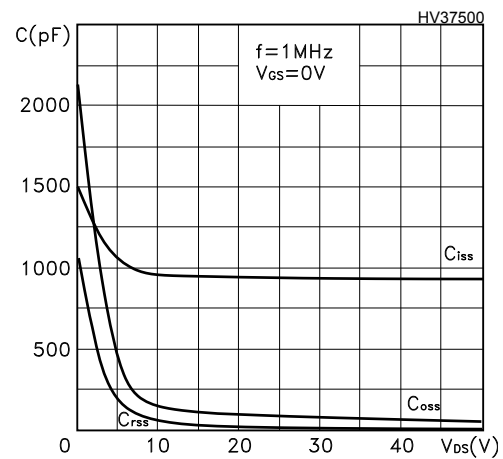
**Table 7. Source-drain diode**

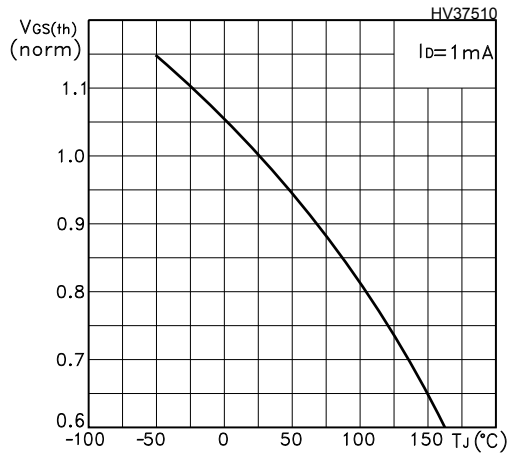
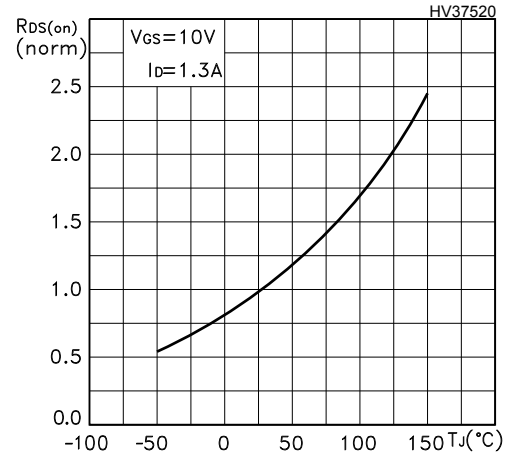
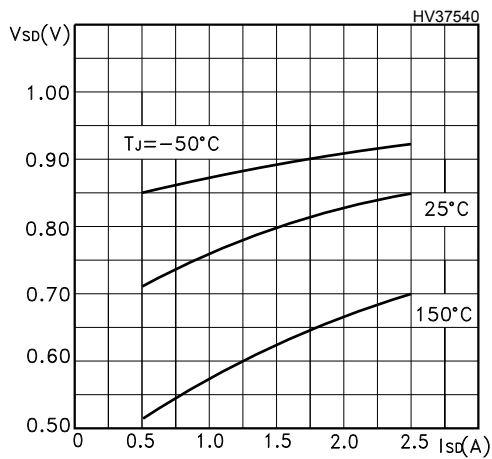
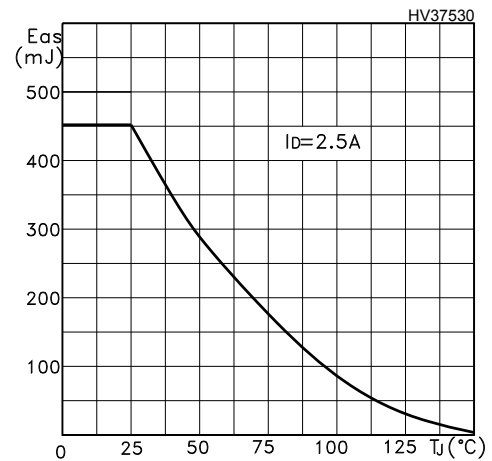
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		2.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		10	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 2.5\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 2.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	410		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$	-	2.4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	11.7		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 2.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	540		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	3.3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	12.3		A

1. Pulse width is limited by safe operating area.

2. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

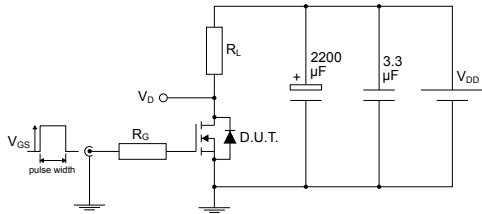
**2.1 Electrical characteristics (curves)**
**Figure 1. Safe operating area for TO-3PF**

**Figure 2. Thermal impedance for TO-3PF**

**Figure 3. Safe operating area for H<sup>2</sup>PAK-2 and TO-220**

**Figure 4. Thermal impedance for H<sup>2</sup>PAK-2 and TO-220**

**Figure 5. Safe operating area for TO-247**

**Figure 6. Thermal impedance for TO-247**


**Figure 7. Output characteristics**

**Figure 8. Transfer characteristics**

**Figure 9. Normalized  $V_{(BR)DSS}$  vs temperature**

**Figure 10. Static drain-source on-resistance**

**Figure 11. Gate charge vs gate-source voltage**

**Figure 12. Capacitance variations**


**Figure 13. Normalized gate threshold voltage vs temperature**

**Figure 14. Normalized on resistance vs temperature**

**Figure 15. Source-drain diode forward characteristics**

**Figure 16. Maximum avalanche energy vs  $T_J$** 


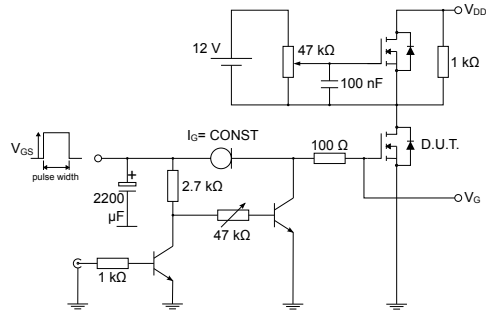
### 3 Test circuits

Figure 17. Test circuit for resistive load switching times



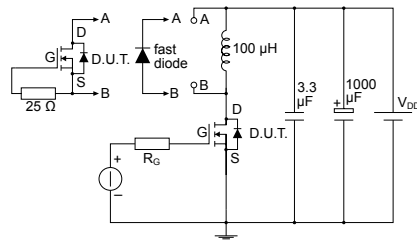
AM01468v1

Figure 18. Test circuit for gate charge behavior



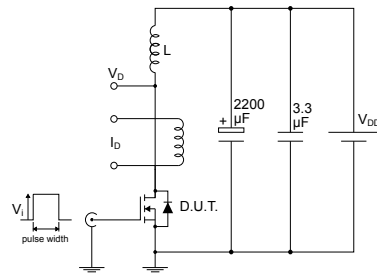
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Figure 19. Test circuit for inductive load switching and diode recovery times



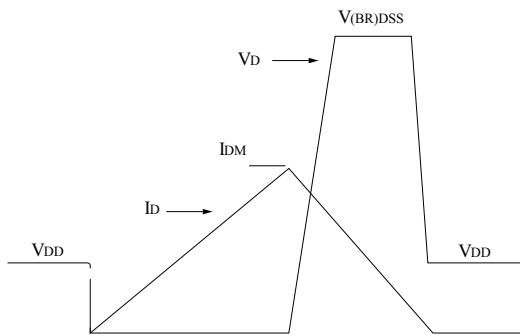
AM01470v1

Figure 20. Unclamped inductive load test circuit



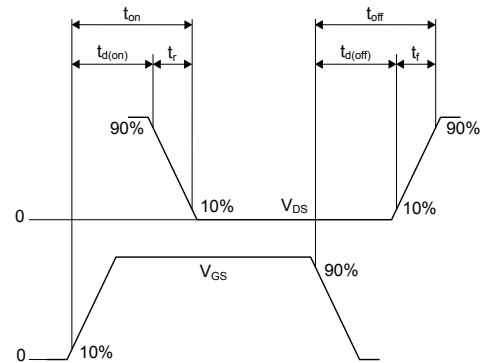
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

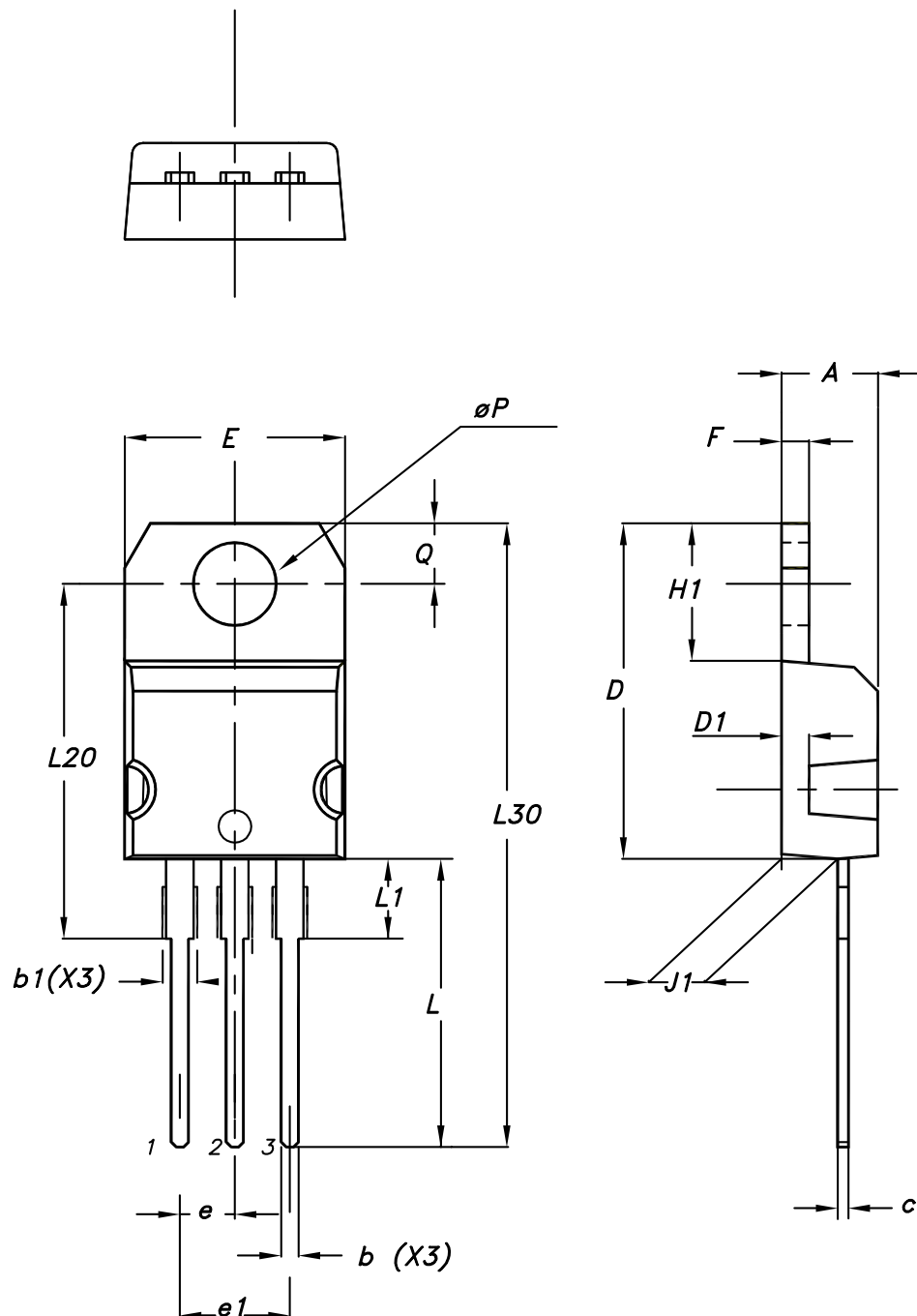


## 4 Package information

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-220 type A package information

Figure 23. TO-220 type A package outline



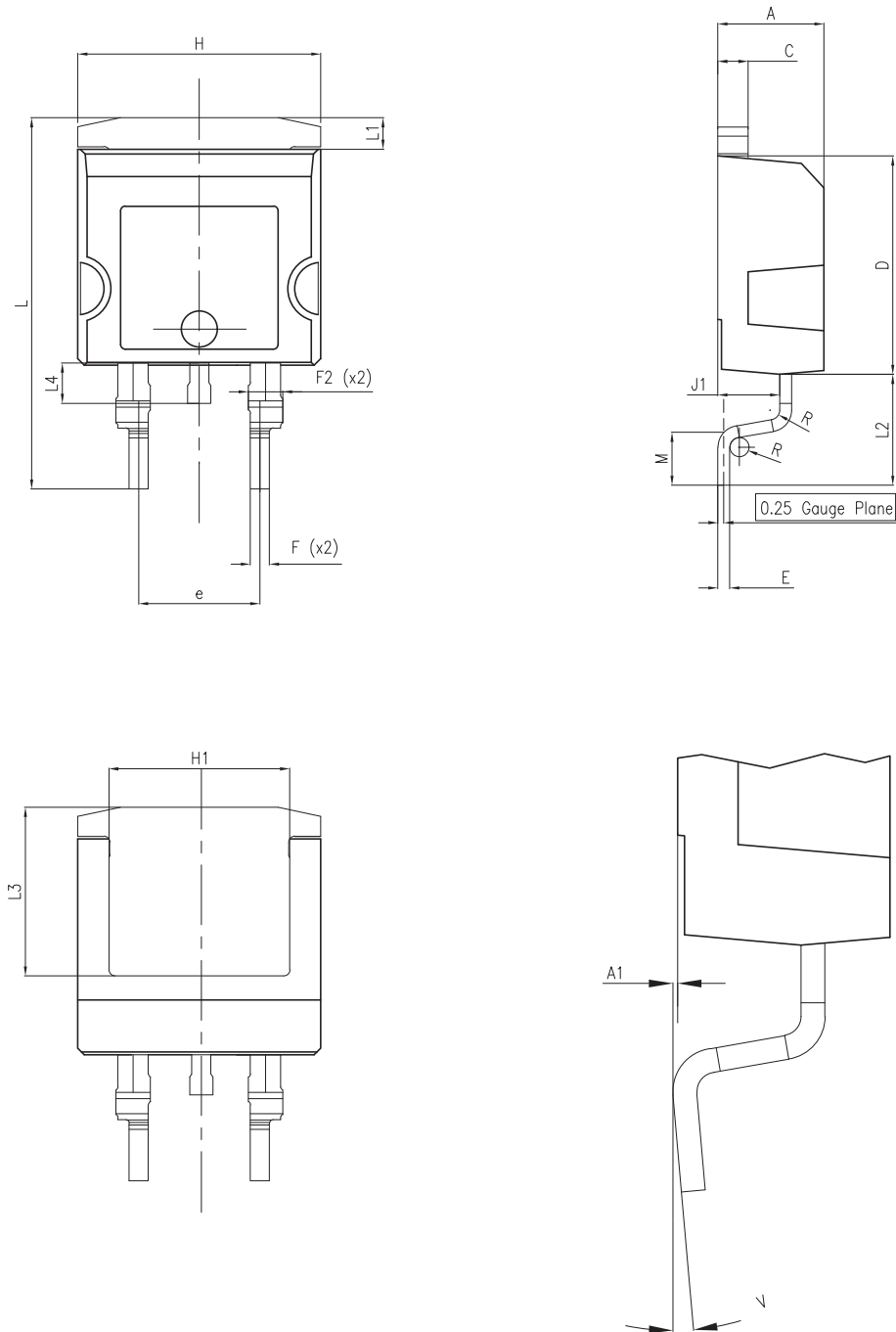
0015988\_typeA\_Rev\_23

**Table 8. TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

## 4.2 H<sup>2</sup>PAK-2 package information

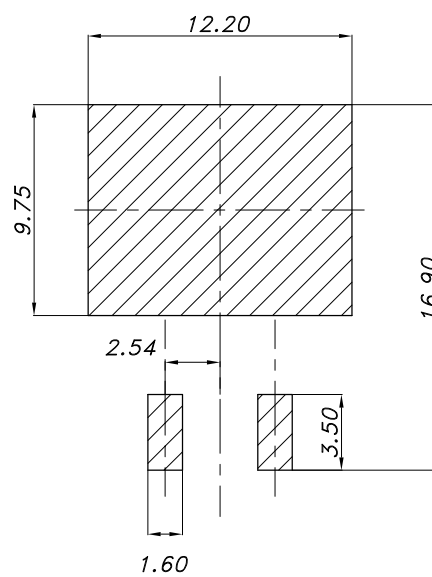
Figure 24. H<sup>2</sup>PAK-2 package outline



8159712\_9

**Table 9. H<sup>2</sup>PAK-2 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
D	8.95		9.35
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
F2	1.14		1.70
H	10.00		10.40
H1	7.40	-	7.80
J1	2.49		2.69
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.50		1.70
M	2.60		2.90
R	0.20		0.60
V	0°		8°

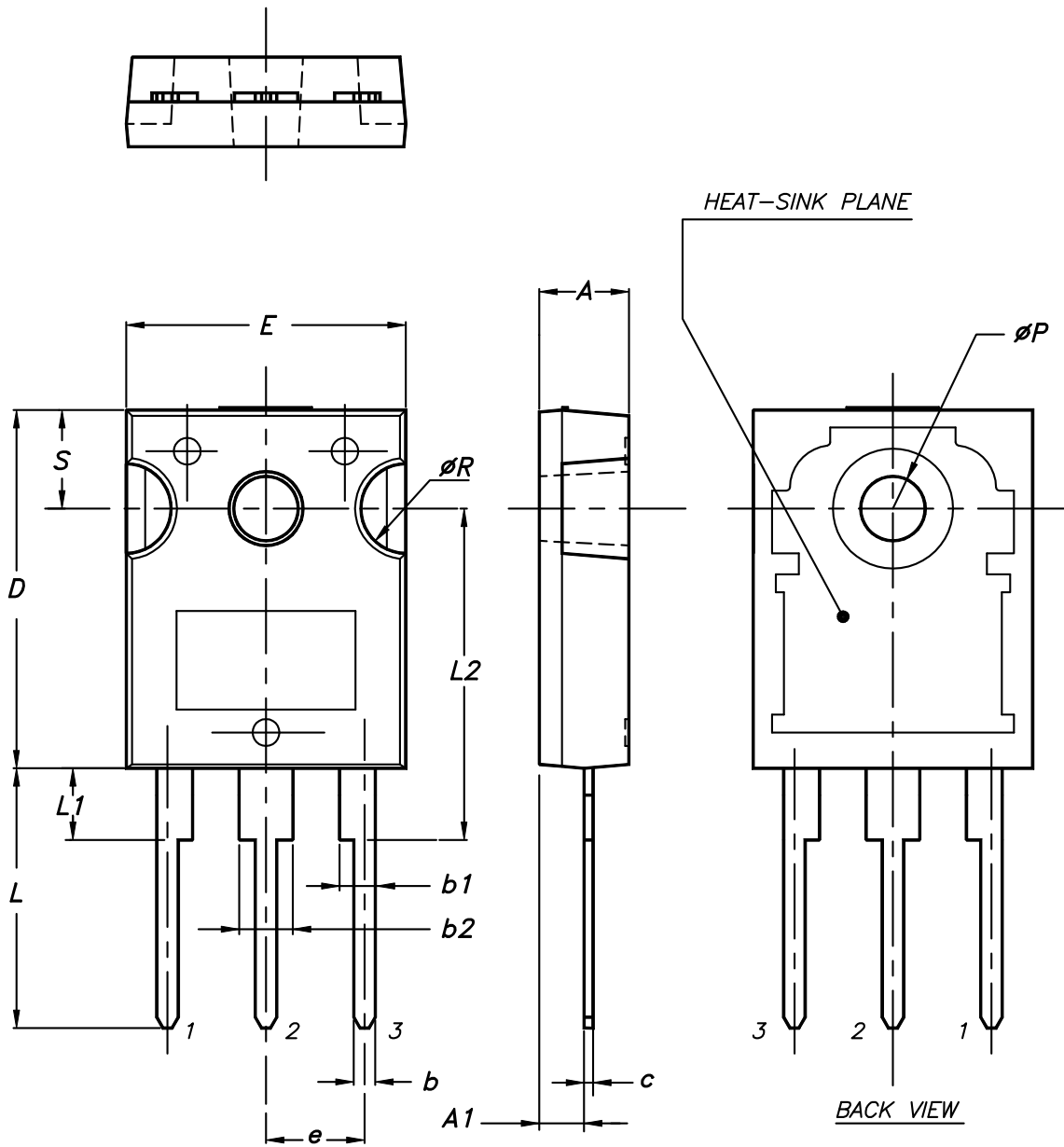
**Figure 25. H<sup>2</sup>PAK-2 recommended footprint**


8159712\_9

Note: Dimensions are in mm.

### 4.3 TO-247 package information

Figure 26. TO-247 package outline



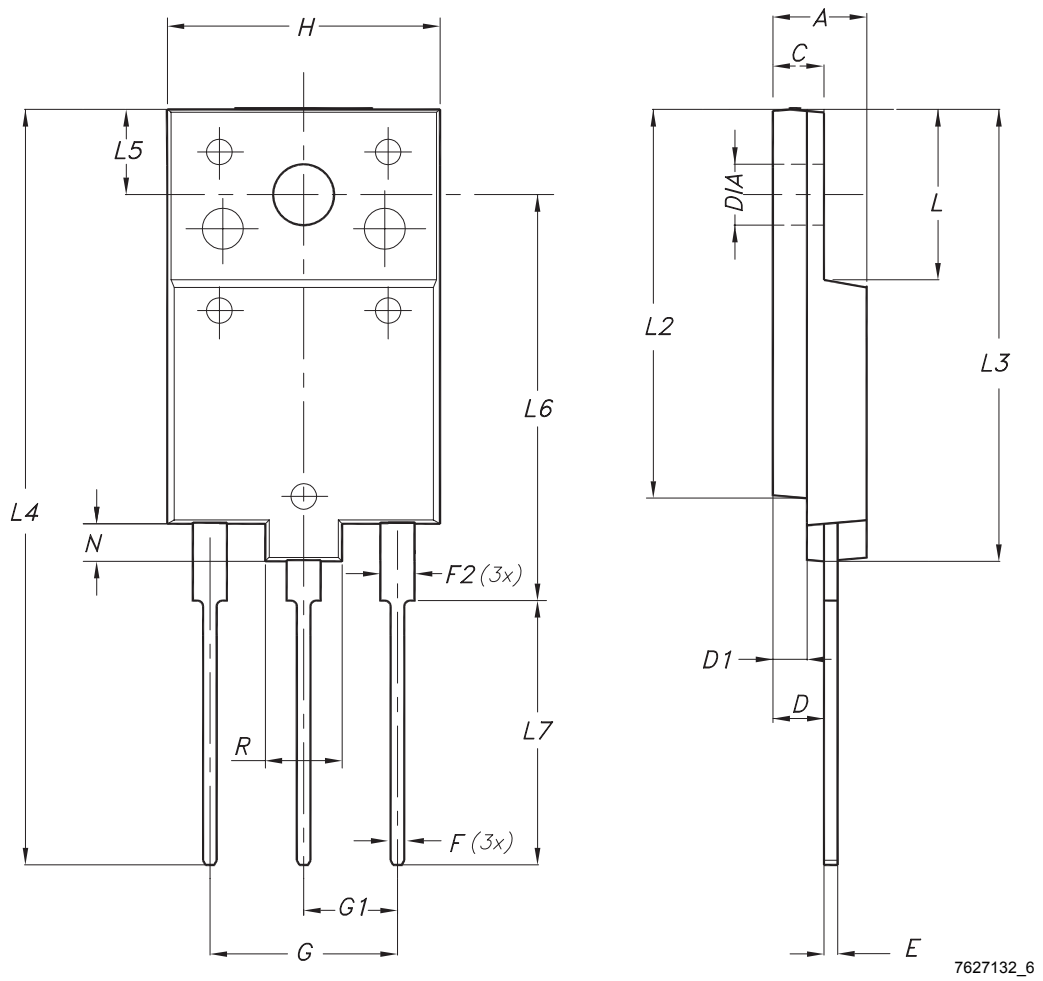
0075325\_9

**Table 10. TO-247 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

#### 4.4 TO-3PF package information

Figure 27. TO-3PF package outline



7627132\_6

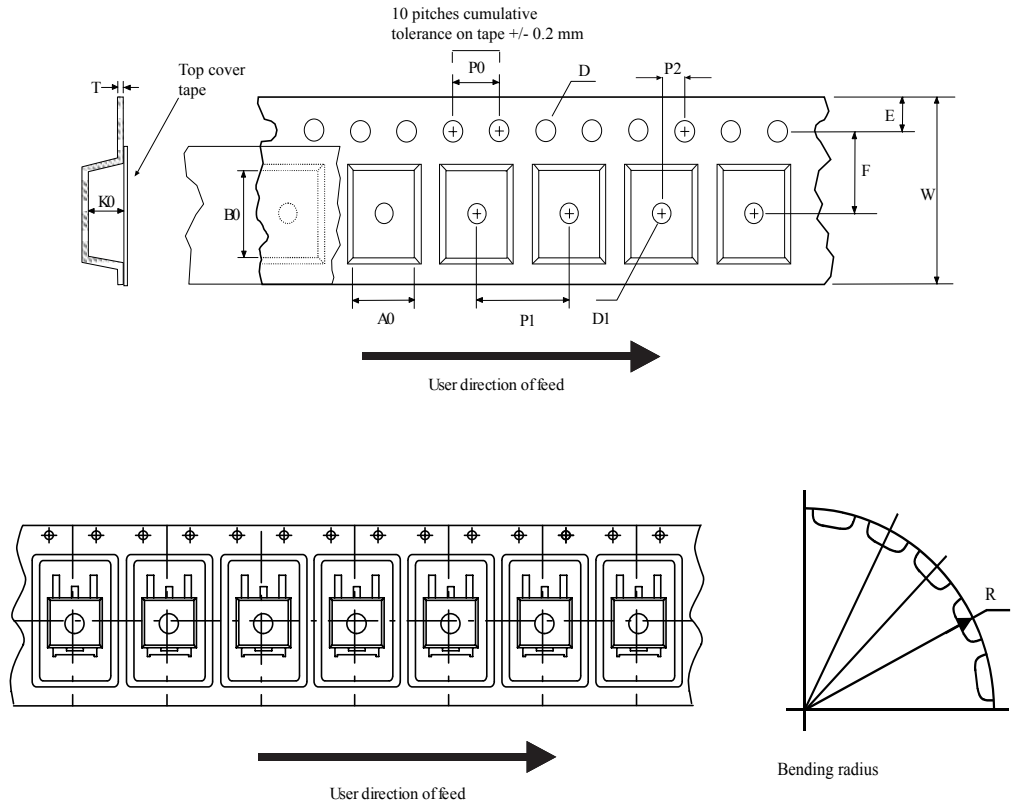
**Table 11. TO-3PF mechanical data**

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

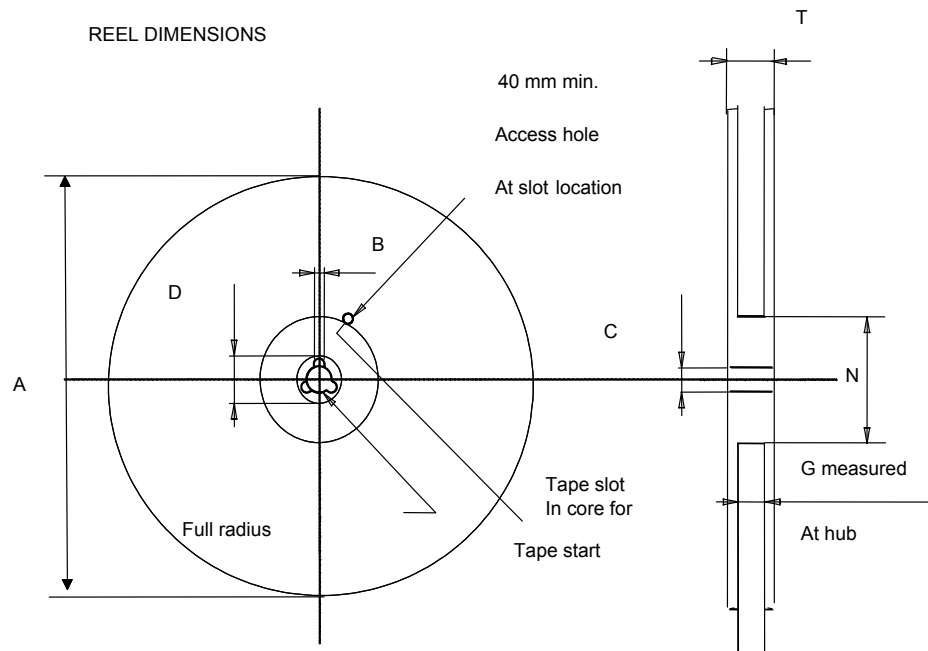


## 4.5 Packing information

Figure 28. Tape outline



AM08852v2

**Figure 29. Reel outline**

**Table 12. Tape and reel mechanical data**

Dim.	Tape		Dim.	Reel	
	mm			mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 5 Ordering information

**Table 13. Order codes**

Order codes	Marking	Package	Packing
STFW3N150	3N150	TO-3PF	Tube
STH3N150-2	H3N150	H <sup>2</sup> PAK-2	Tape and reel
STP3N150	P3N150	TO-220	Tube
STW3N150	3N150	TO-247	

## Revision history

**Table 14. Document revision history**

Date	Revision	Changes
12-Jan-2007	1	First release
17-Apr-2007	2	Added new value on <i>Table 6</i> .
14-May-2007	3	The document has been reformatted
29-Aug-2007	4	RDS(on) value changed, updated <i>Figure 15</i>
09-Apr-2008	5	Added new package: TO-3PF
13-Feb-2009	6	Added PTOT value for TO-3PF ( <i>Table 2: Absolute maximum ratings</i> )
01-Dec-2009	7	<ul style="list-style-type: none"> <li>– Document status promoted from preliminary data to datasheet</li> <li>– Removed TO-220FH package and mechanical data</li> </ul>
10-Dec-2009	8	Corrected VISO value in <i>Table 2: Absolute maximum ratings</i>
29-Jun-2010	9	Corrected unit in <i>Table 3</i> .
08-Feb-2013	10	<ul style="list-style-type: none"> <li>– Minor text changes</li> <li>– Modified: <i>Table 3</i></li> <li>– Changed: <i>Figure 1</i></li> <li>– Added: H<sup>2</sup>PAK-2 package</li> </ul>
18-Feb-2014	11	<ul style="list-style-type: none"> <li>– Modified: <i>Figure 1</i></li> <li>– Updated: <i>Figure 18, 19, 20 and 21</i></li> <li>– Updated: <i>Figure 27 and Table 11</i></li> <li>– Updated: <i>Section 4: Package mechanical data</i></li> <li>– Minor text changes</li> </ul>
12-May-2020	12	Updated <a href="#">Section 5 Ordering information</a> . Minor text changes.

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