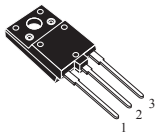




STFW3N150, STH3N150-2 STP3N150, STW3N150

Datasheet

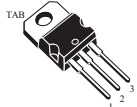
N-channel 1500 V, 2.5 A, 6 Ω typ., PowerMESH Power MOSFETs
in TO-3PF, H²PAK-2, TO-220 and TO247 packages



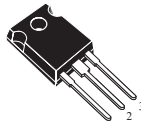
TO-3PF



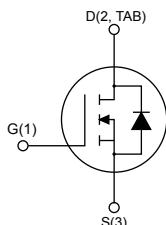
H²PAK-2



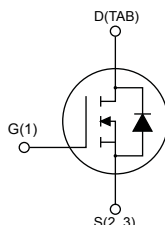
TO-220



TO-247



(TO-3PF, TO-220 and TO-247)



(H²PAK-2)

AM15557v1

Features

Order codes	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STFW3N150	1500 V	9 Ω	2.5 A	63 W
STH3N150-2				140 W
STP3N150				
STW3N150				

- 100% avalanche tested
- Intrinsic capacitances and Q_g minimized
- High speed switching

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. Absolute maximum ratings

Symbol	Parameter	Value				Unit
		TO-3PF	H ² PAK-2	TO-220	TO-247	
V _{DS}	Drain-source voltage	1500				V
V _{GS}	Gate-source voltage	±30				V
I _D	Drain current (continuous) at T _C = 25 °C	2.5 ⁽¹⁾	2.5			A
	Drain current (continuous) at T _C = 100 °C	1.6 ⁽¹⁾	1.6			
I _{DM} ⁽²⁾	Drain current (pulsed)	10				A
P _{TOT}	Total power dissipation at T _C = 25 °C	63	140			W
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C)	3.5				kV
T _{stg}	Storage temperature range	-55 to 150				°C
T _J	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 ² PAK-2	TO-220	TO-247	
R _{thJC}	Thermal resistance, junction-to-case	2	0.89			°C/W
R _{thJA}	Thermal resistance, junction-to-ambient	50	35 ⁽¹⁾	62.5	50	°C/W

1. When mounted on a standard 1 inch² area of FR-4 PCB with 2-oz copper.

Table 3. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I _{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T _J max.)	2.5	A
E _{AS}	Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	450	mJ

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ 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	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 1500\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$ ⁽¹⁾			500	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 30\text{ V}$			± 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	Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	939	-	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	-	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	-	Ω
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	$V_{DD} = 750\text{ V}$, $I_D = 1.25\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	24	-	ns
t_r	Rise time		-	47	-	
$t_{d(off)}$	Turn-off delay time	(see Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform)	-	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	$I_{SD} = 2.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	410		ns
Q_{rr}	Reverse recovery charge		-	2.4		μC
I_{RRM}	Reverse recovery current		-	11.7		A
t_{rr}	Reverse recovery time	$I_{SD} = 2.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	540		ns
Q_{rr}	Reverse recovery charge		-	3.3		μC
I_{RRM}	Reverse recovery current		-	12.3		A

1. Pulse width is limited by safe operating area.

2. Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

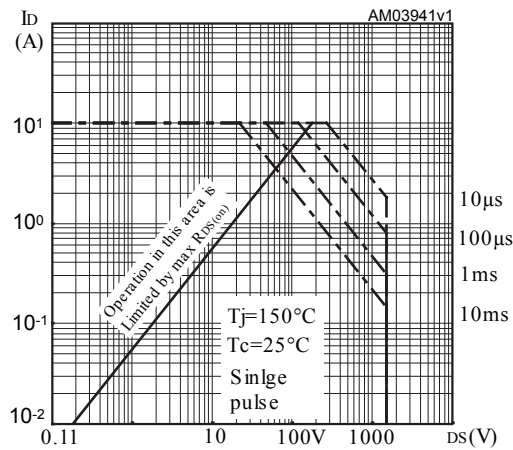
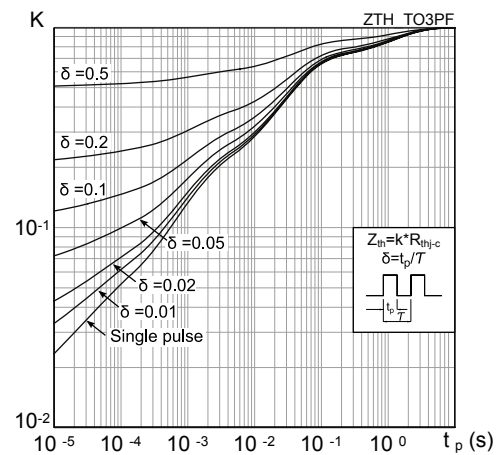
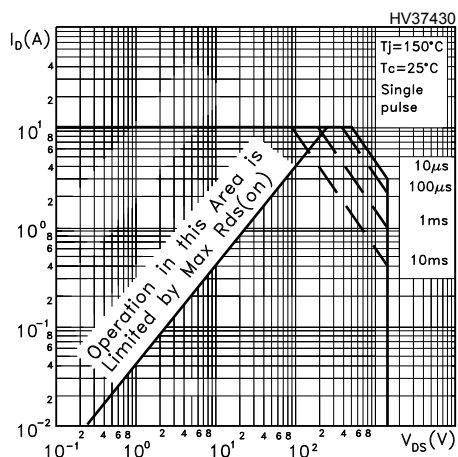
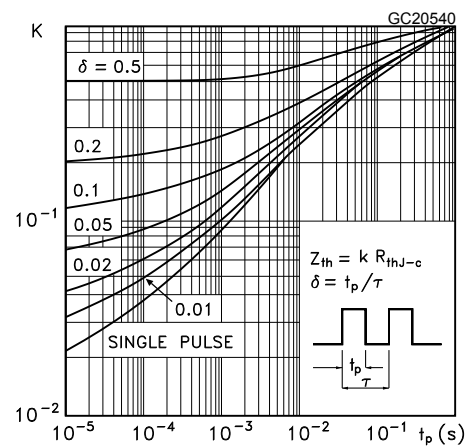
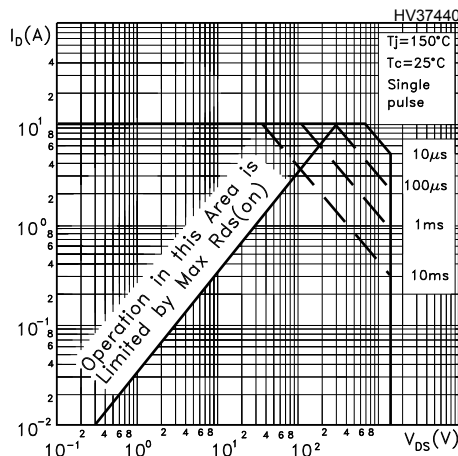
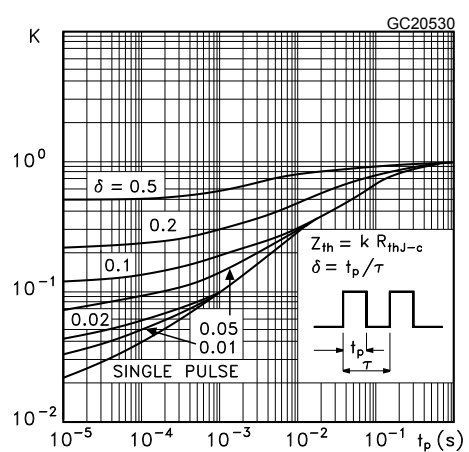
Figure 1. Safe operating area for TO-3PF

Figure 2. Thermal impedance for TO-3PF

Figure 3. Safe operating area for H²PAK-2 and TO-220

Figure 4. Thermal impedance for H²PAK-2 and TO-220

Figure 5. Safe operating area for TO-247

Figure 6. Thermal impedance for TO-247


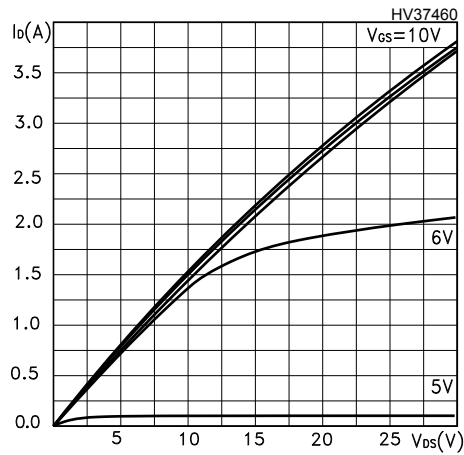
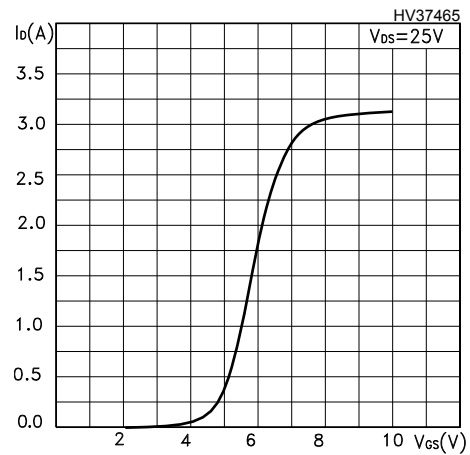
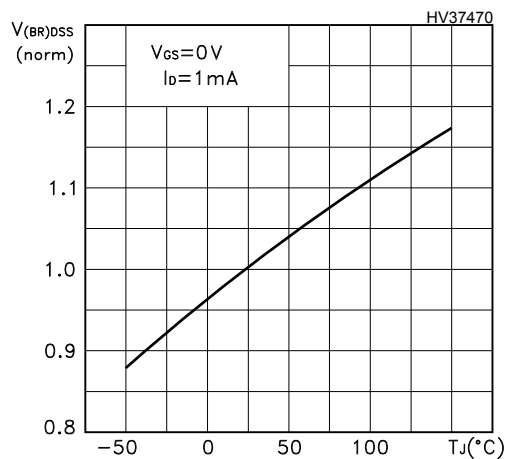
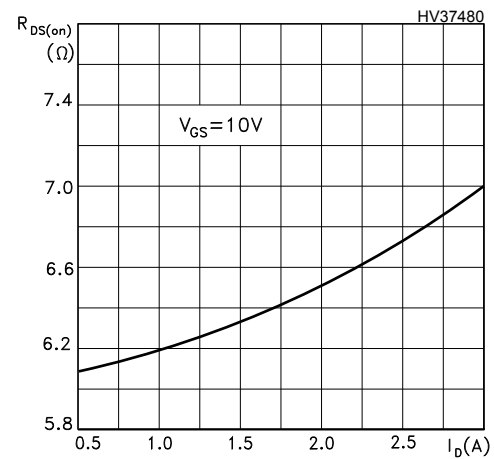
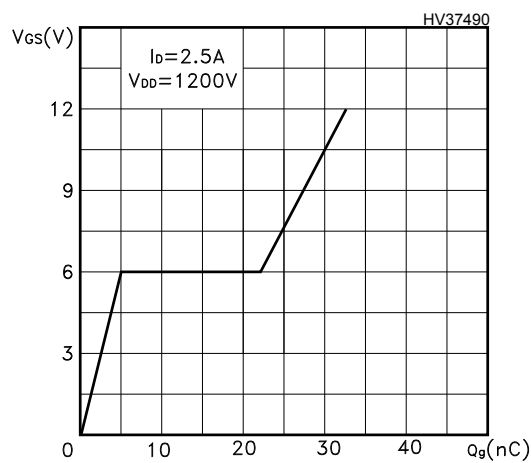
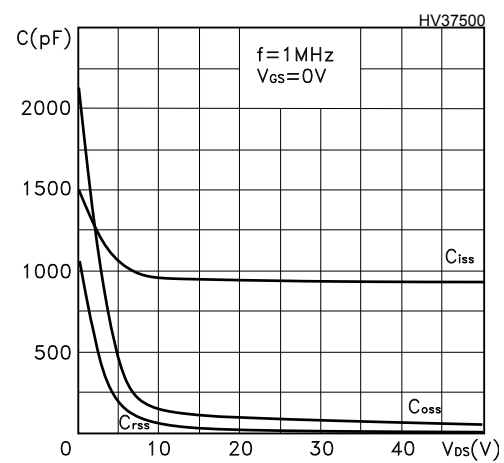
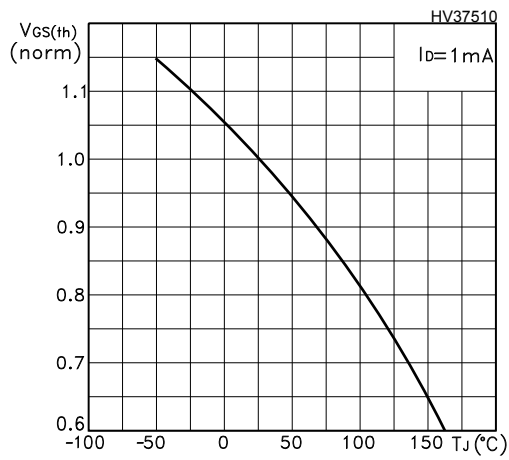
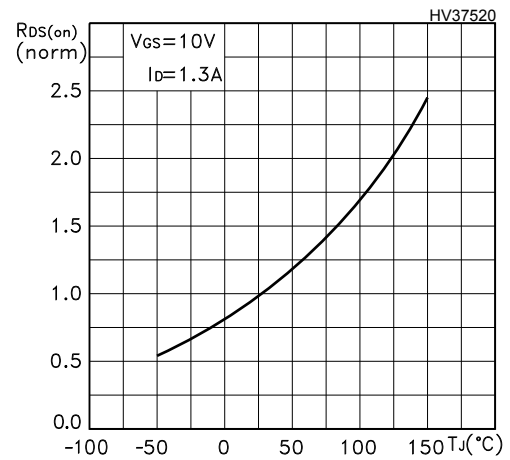
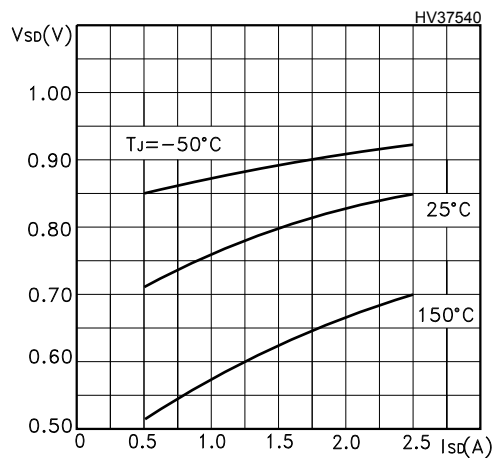
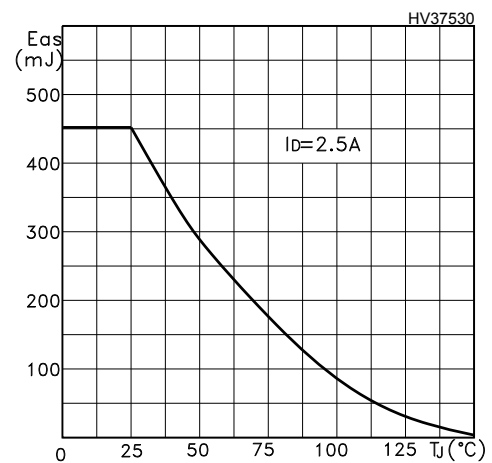
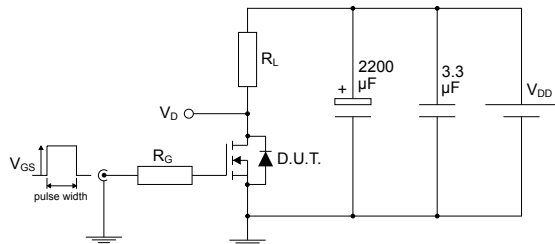
Figure 7. Output characteristics

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


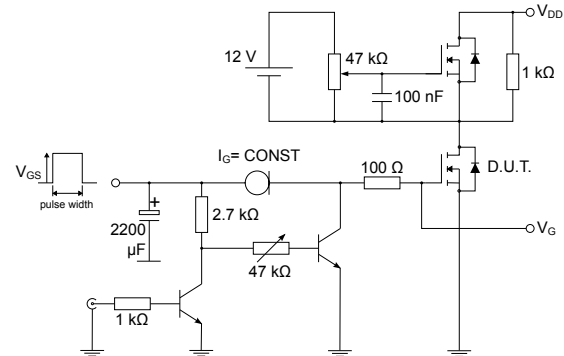
3 Test circuits

Figure 17. Test circuit for resistive load switching times



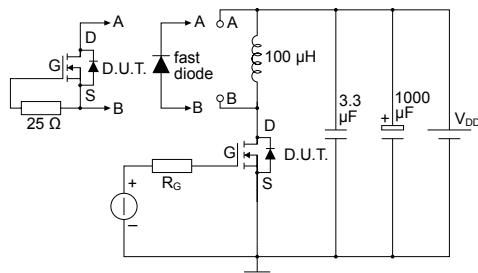
AM01468v1

Figure 18. Test circuit for gate charge behavior



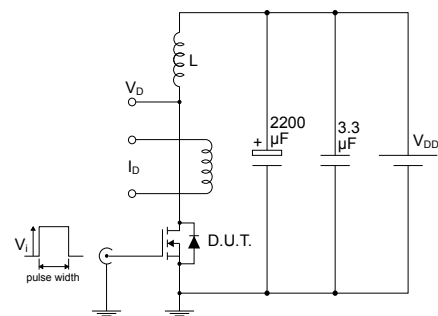
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Figure 19. Test circuit for inductive load switching and diode recovery times



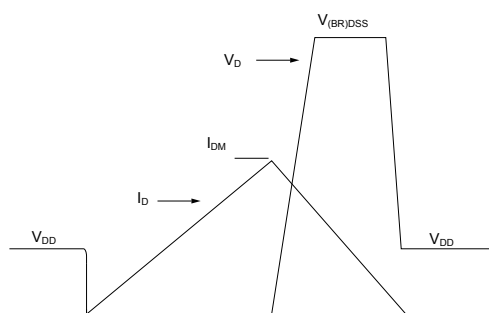
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Figure 20. Unclamped inductive load test circuit



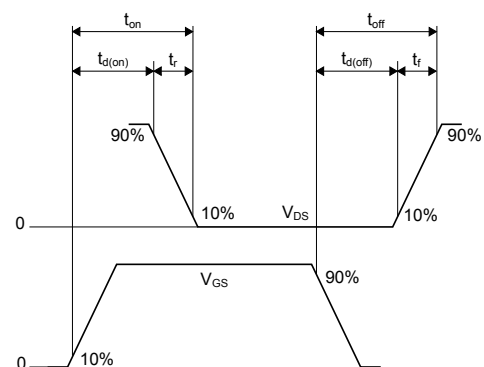
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Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

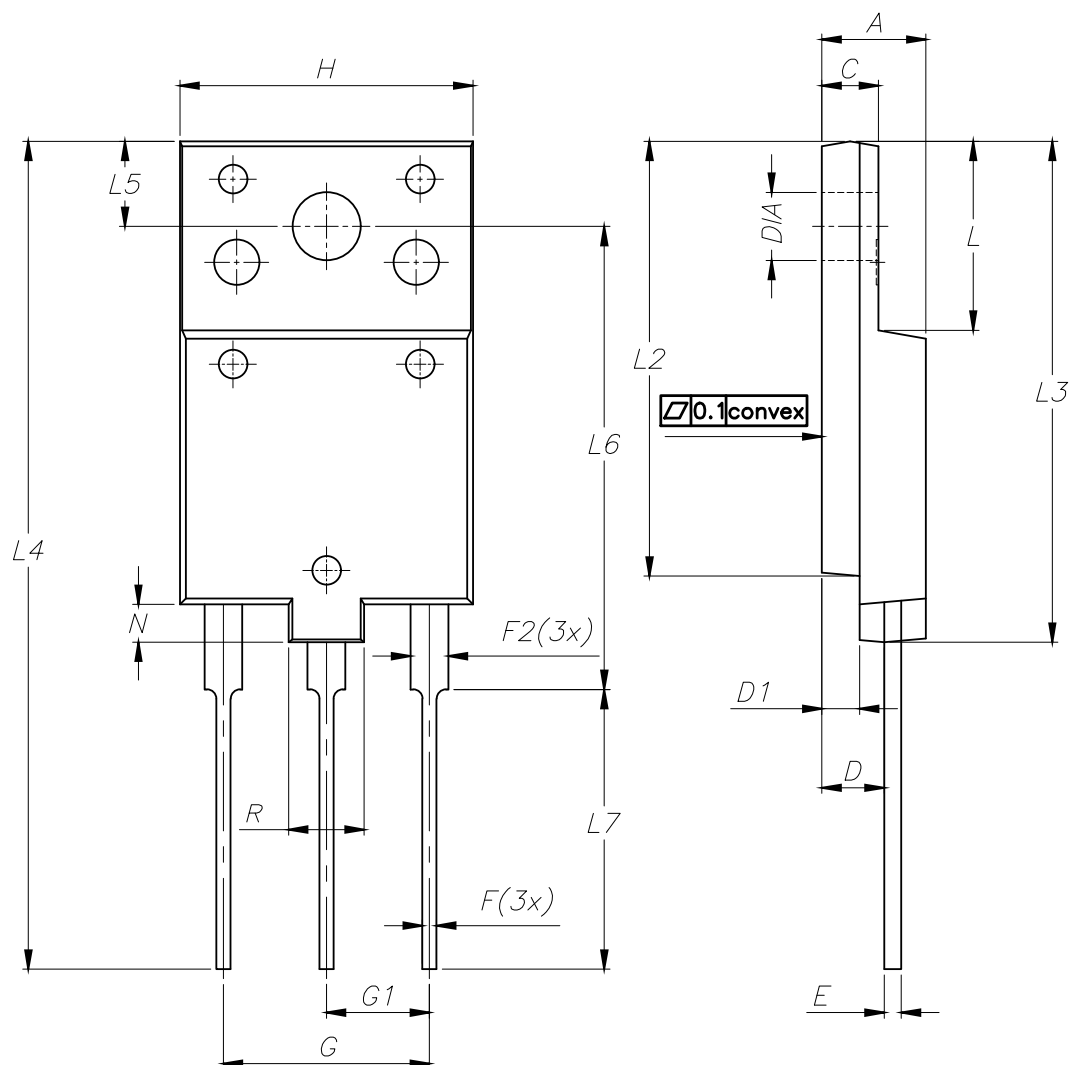


4 Package information

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 type A package information

Figure 23. TO-3PF type A package outline



7627132_type_A_9

Table 8. TO-3PF type A mechanical data

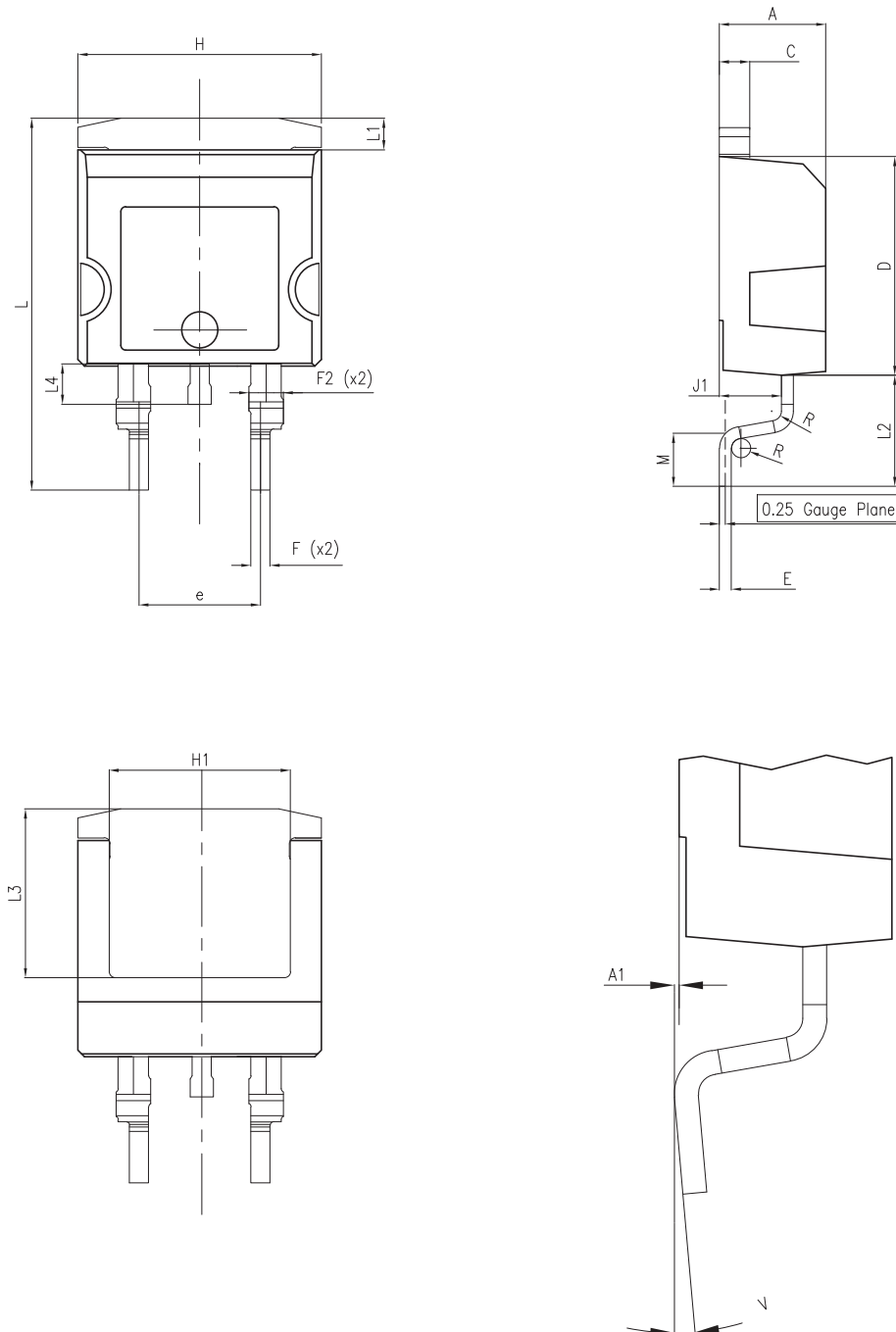
Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.00
F	0.65		0.85
F2	1.80		2.20
G	10.80		11.00
G1	5.35	5.45	5.55
H	15.30		15.70
L	9.80	10.00	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.60		44.00
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15.00
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

Table 9. TO-3PF type B mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	5.30	5.50	5.70
C	2.80	3.00	3.20
D	3.10	3.30	3.50
D1	1.80	2.00	2.20
E	0.80	0.95	1.10
F	0.65	0.80	0.95
F2	1.80	2.00	2.20
G	10.30	10.90	11.50
G1		5.45	
H	15.30	15.50	15.70
L	9.80	10.00	10.20
L2	22.80	23.00	23.20
L3	26.30	26.50	26.70
L4	43.20	43.80	44.40
L5	4.30	4.50	4.70
L6	24.30	24.50	24.70
L7	14.60	14.80	15.00
N	1.80	2.00	2.20
R	3.80	4.00	4.20
Dia	3.40	3.60	3.80

4.3 H²PAK-2 package information

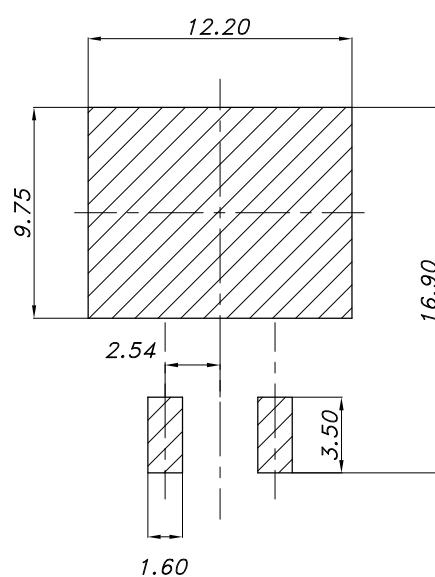
Figure 25. H²PAK-2 package outline



8159712_10

Table 10. H²PAK-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°

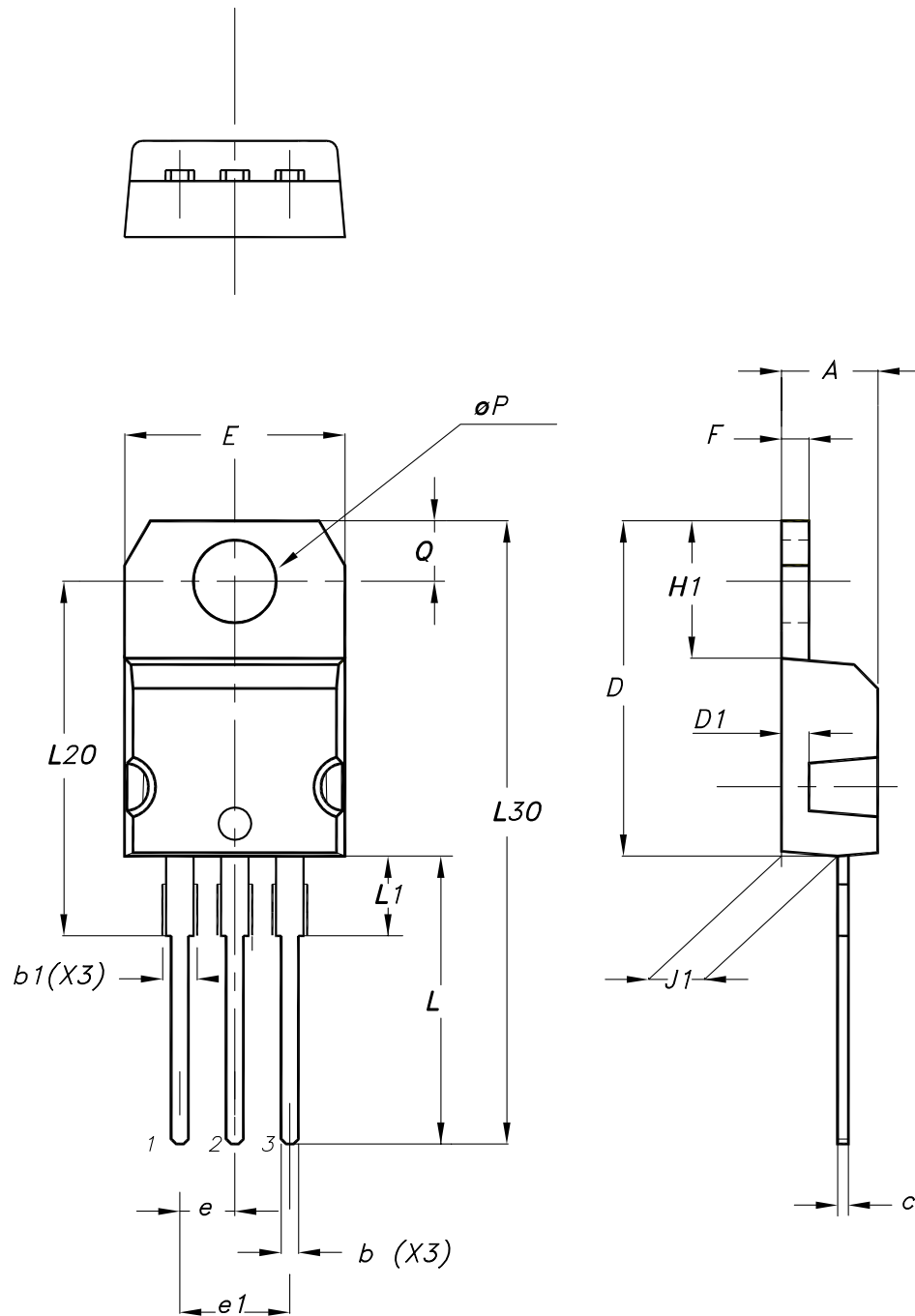
Figure 26. H²PAK-2 recommended footprint


8159712_10

Note: Dimensions are in mm.

4.4 TO-220 type A package information

Figure 27. TO-220 type A package outline



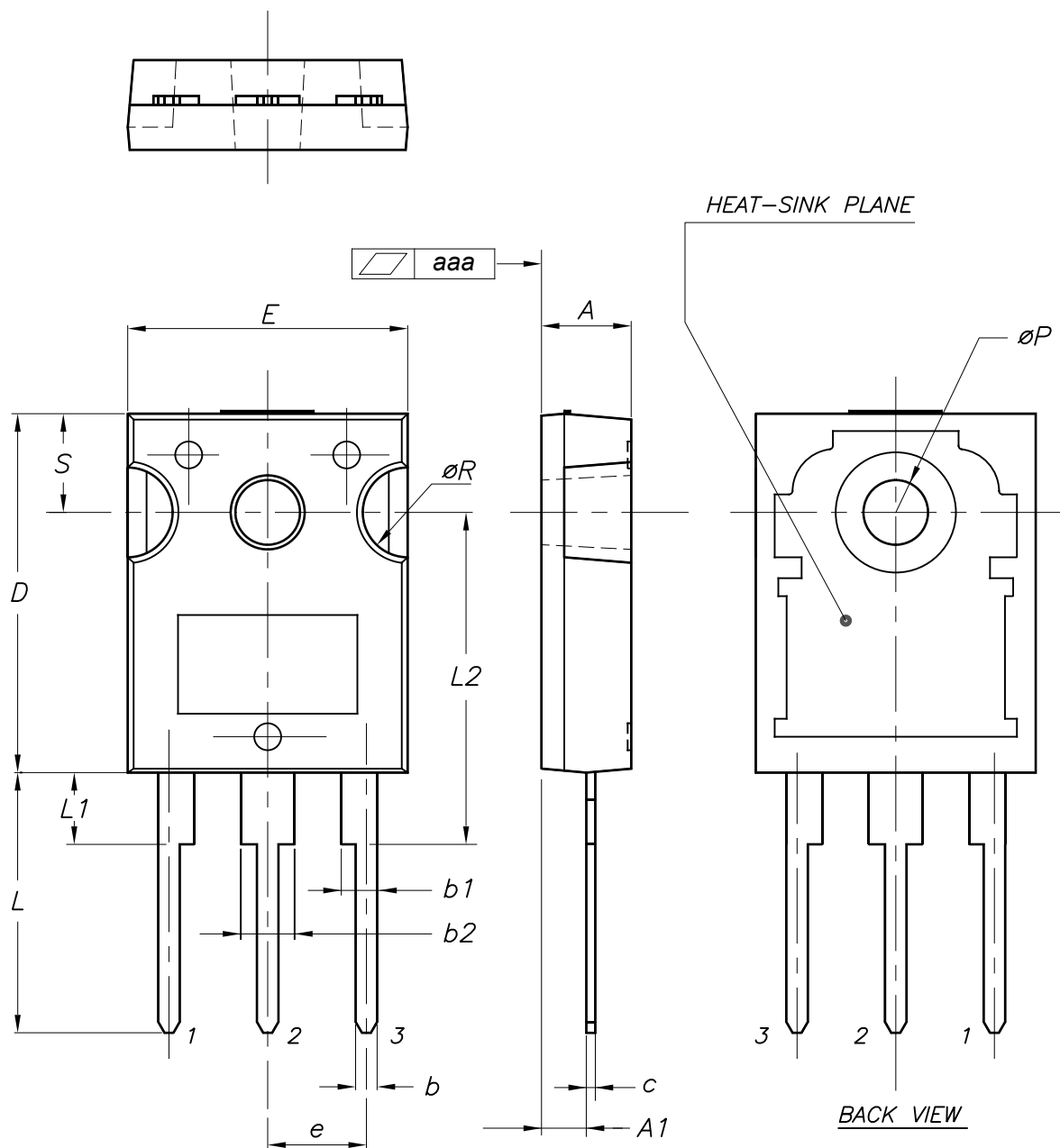
0015988_typeA_Rev_24

Table 11. 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

4.5 TO-247 package information

Figure 28. TO-247 package outline



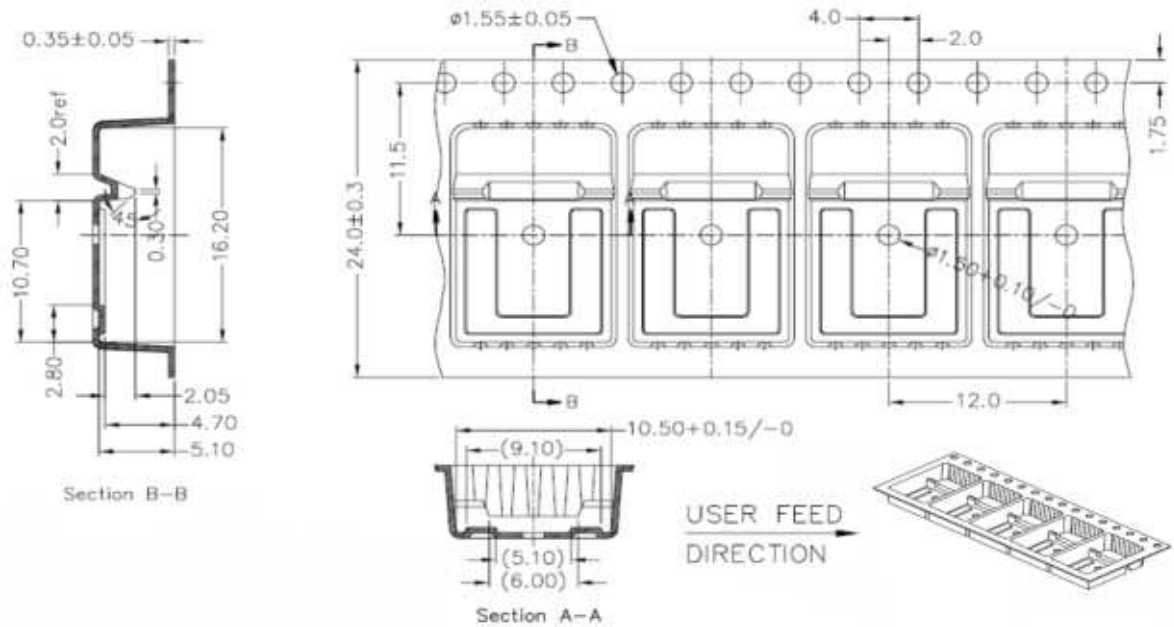
0075325_10

Table 12. 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
aaa		0.04	0.10

4.6 H²PAK-2 packing information

Figure 29. H²PAK-2 tape drawing (dimensions are in mm)



DM01095771_2



5 Ordering information

Table 13. Order codes

Order codes	Marking	Package	Packing
STFW3N150	3N150	TO-3PF	Tube
STH3N150-2	H3N150	H ² 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	– Document status promoted from preliminary data to datasheet – Removed TO-220FH package and mechanical data
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	– Minor text changes – Modified: <i>Table 3</i> – Changed: <i>Figure 1</i> – Added: H ² PAK-2 package
18-Feb-2014	11	– Modified: <i>Figure 1</i> – Updated: <i>Figure 18, 19, 20 and 21</i> – Updated: <i>Figure 27 and Table 11</i> – Updated: <i>Section 4: Package mechanical data</i> – Minor text changes
12-May-2020	12	Updated <i>Section 5 Ordering information</i> . Minor text changes.
29-Jul-2025	13	Updated <i>Section 4: Package information</i> . Added <i>Section 4.2: TO-3PF type B package information</i> . Minor text changes.



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4.2	TO-3PF type B package information	12
4.3	H ² PAK-2 package information	14
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