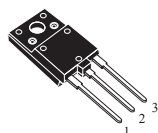




STFW3N150, STH3N150-2 STP3N150, STW3N150

Datasheet

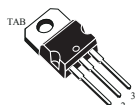
N-channel 1500 V, 2.5 A, 6 Ω typ., PowerMESH Power MOSFETs
in TO-3PF, H²PAK-2, TO-220 and TO247 packages



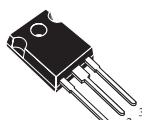
TO-3PF



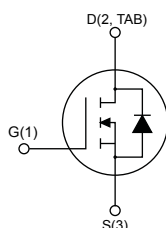
H²PAK-2



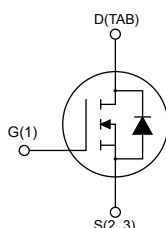
TO-220



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)

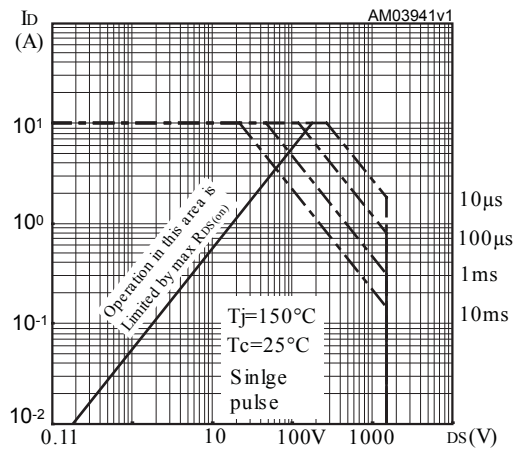
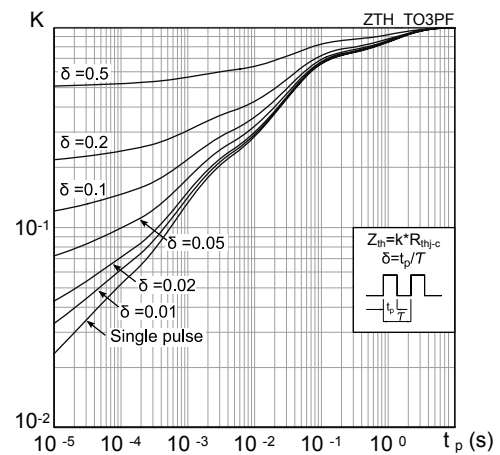
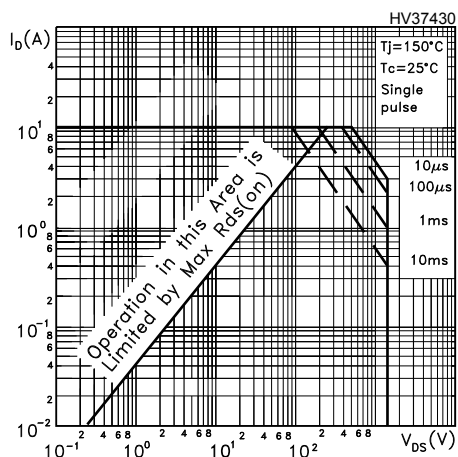
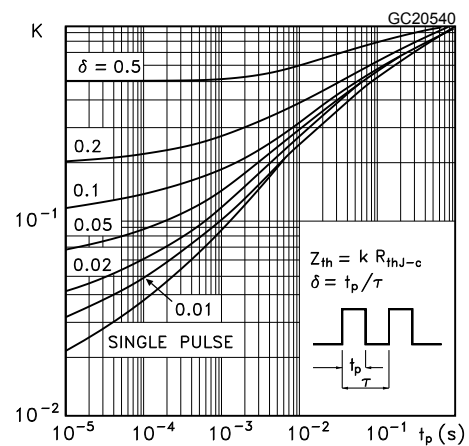
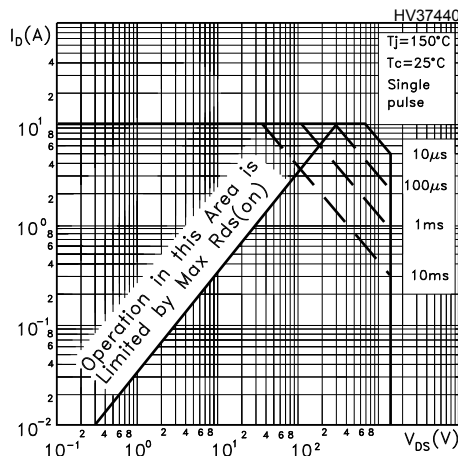
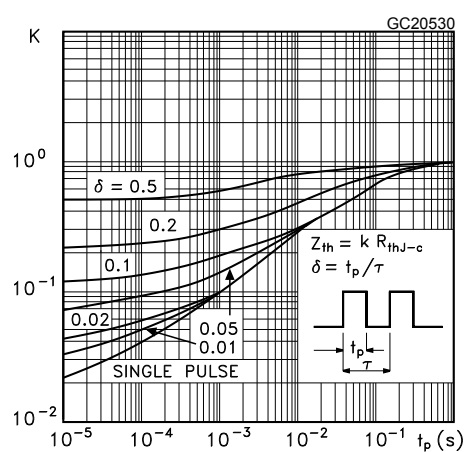
Figure 1. Safe operating area for TO-3PF

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


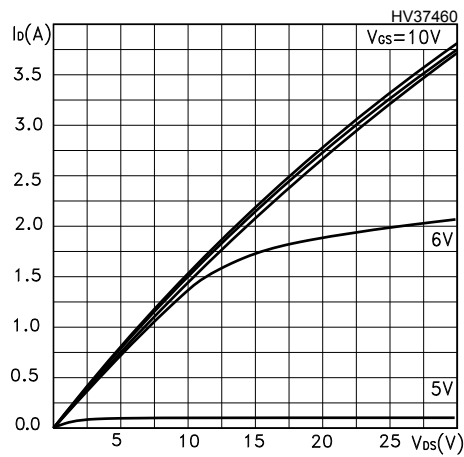
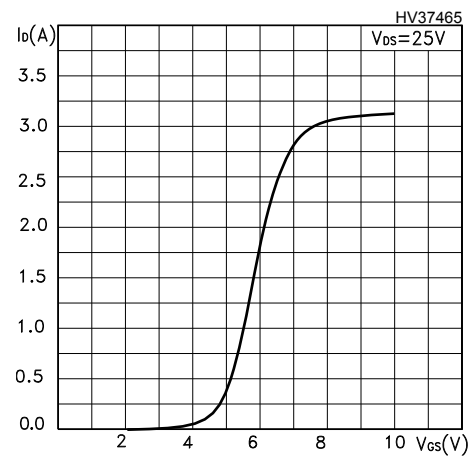
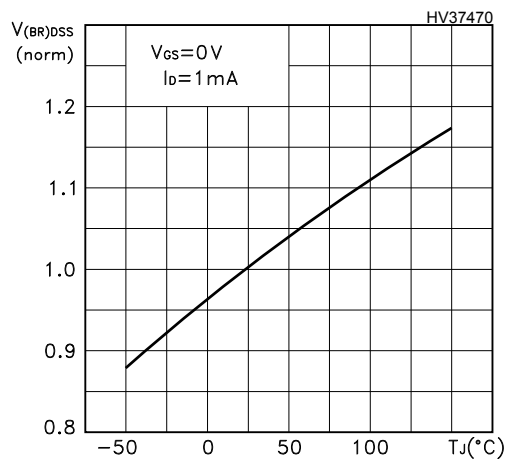
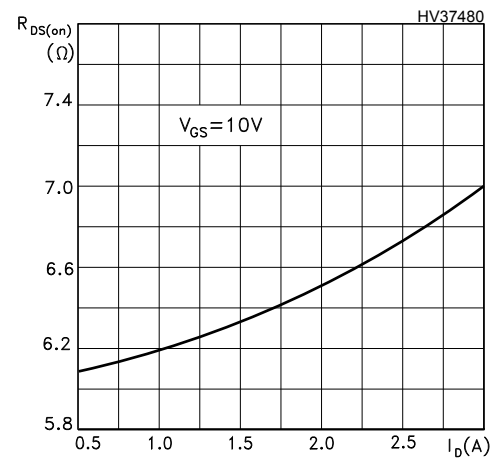
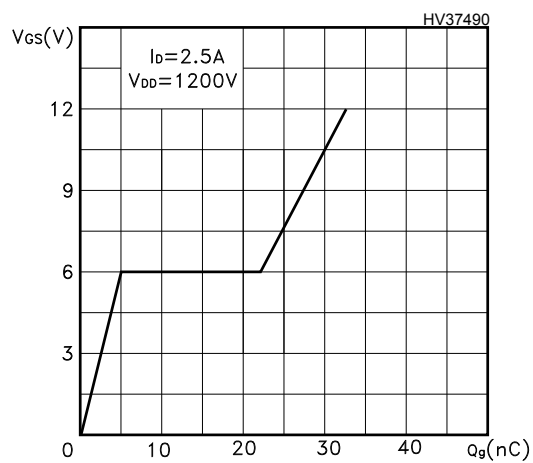
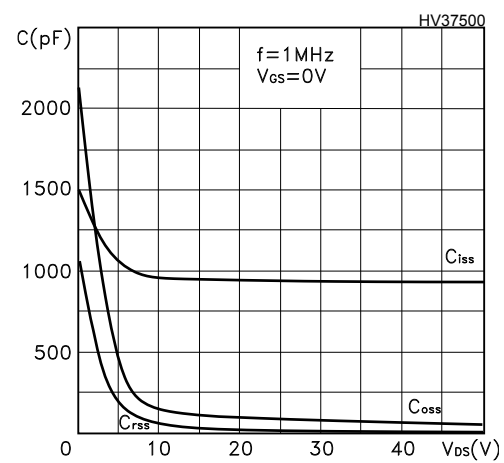
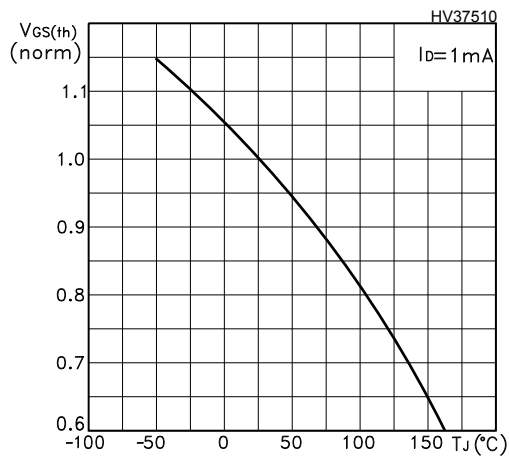
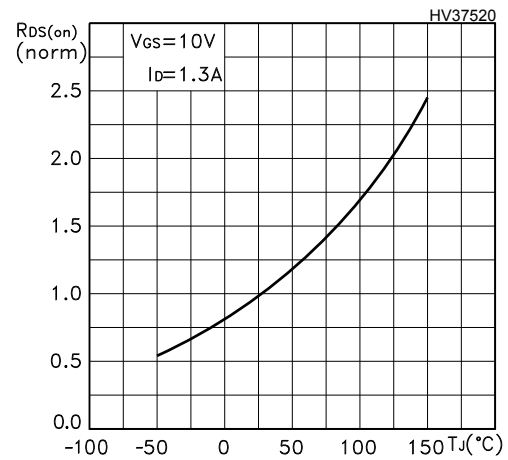
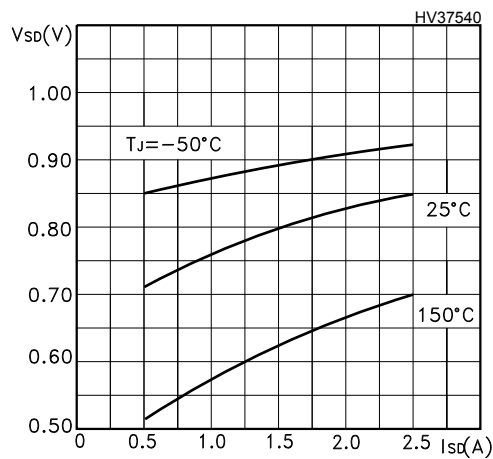
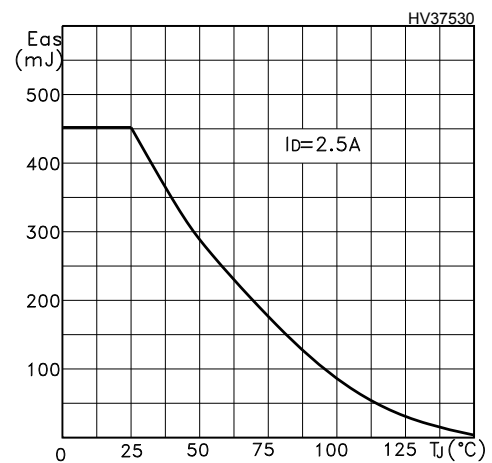
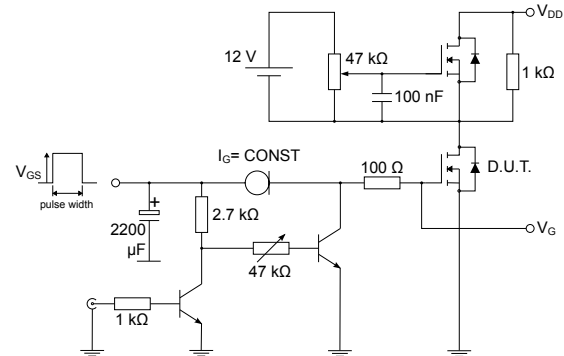
Figure 7. Output characteristics

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


AM01469v1

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

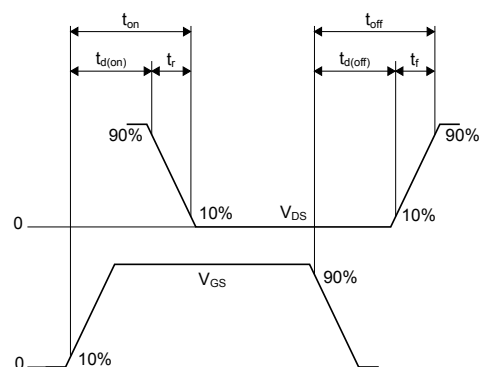

AM01470v1

Figure 20. Unclamped inductive load test circuit


AM01471v1

Figure 21. Unclamped inductive waveform


AM01472v1

Figure 22. Switching time waveform


AM01473v1

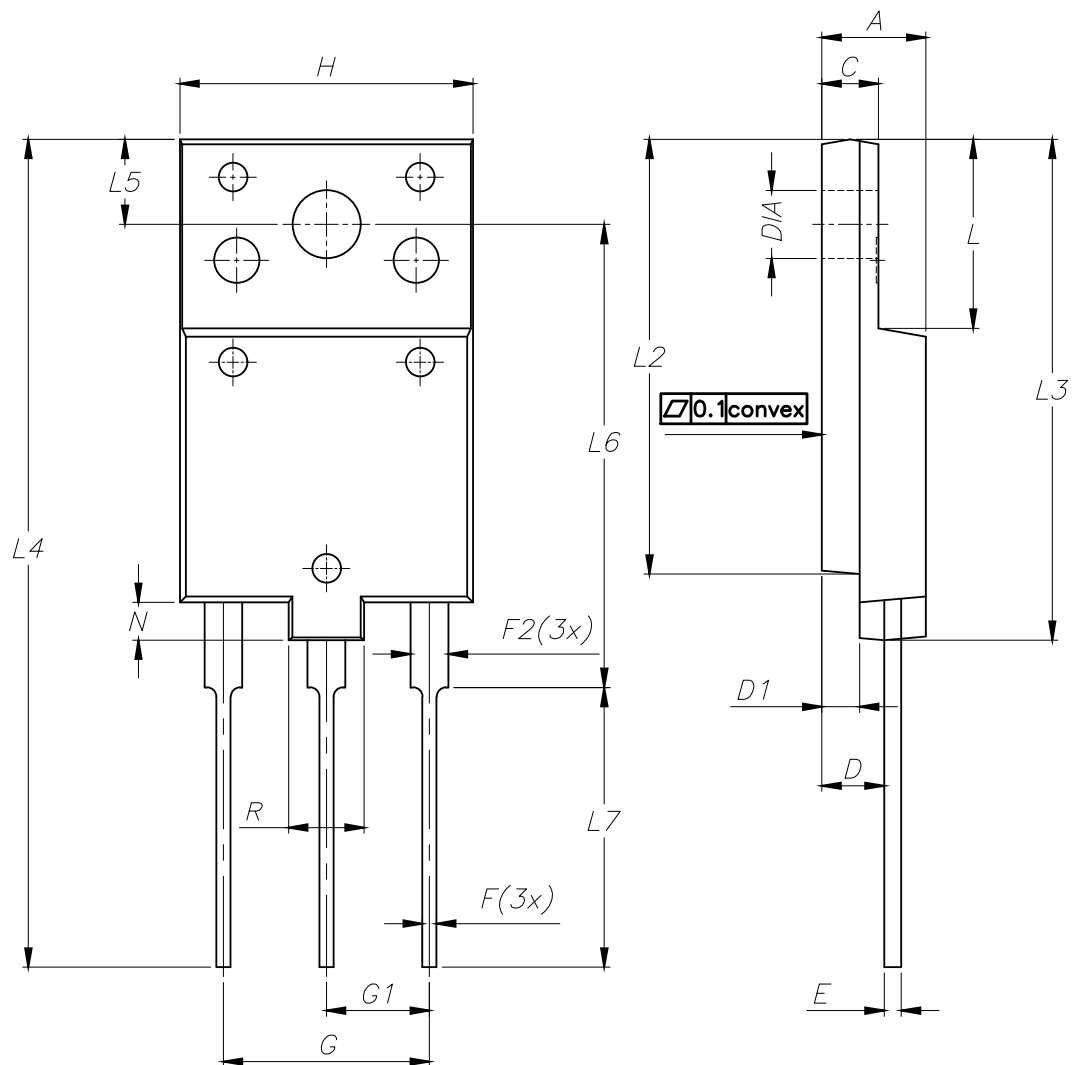


4 Package information

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



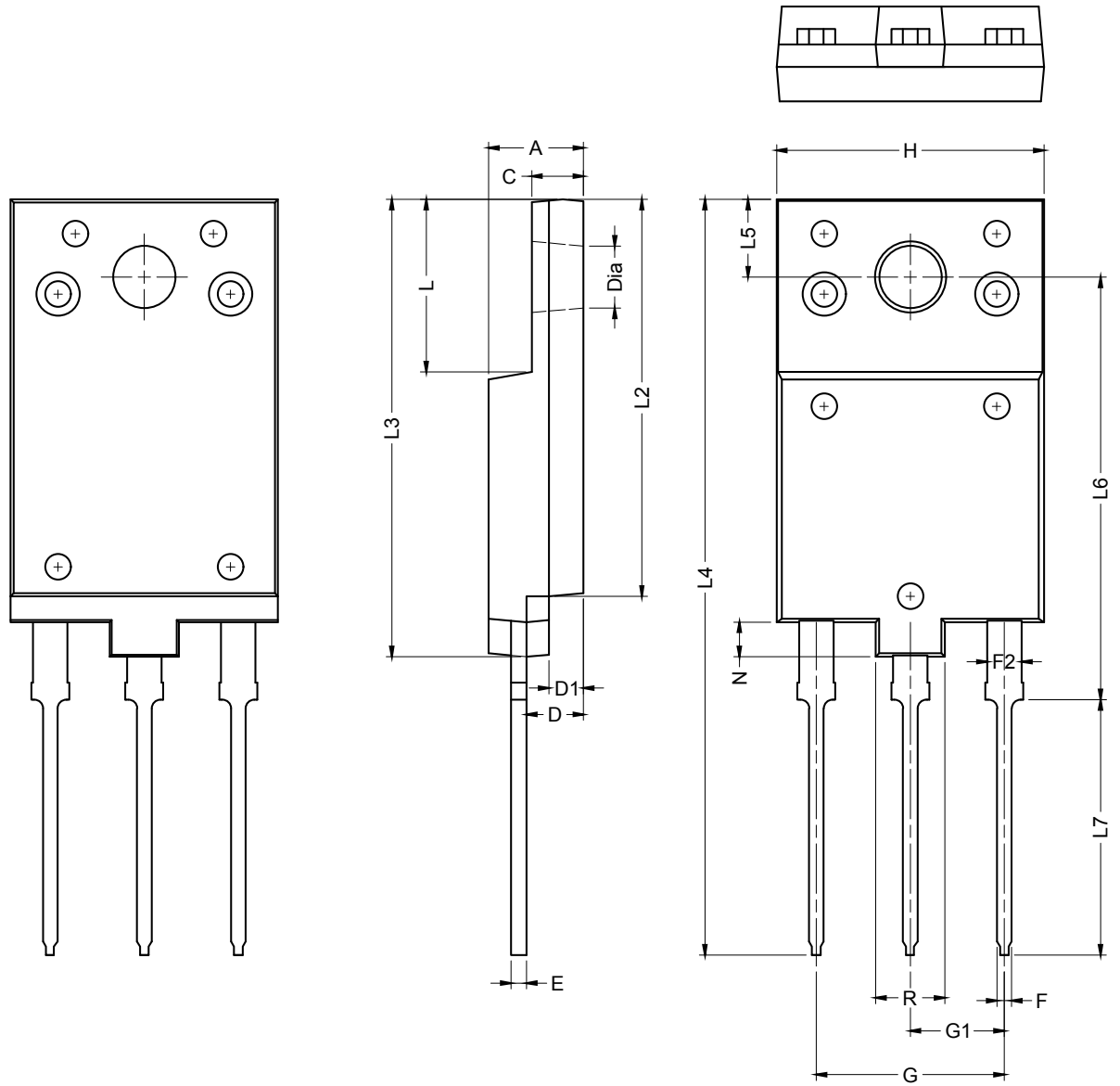
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Table 8. TO-3PF type A mechanical data

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

4.2 TO-3PF type B package information

Figure 24. TO-3PF type B package outline



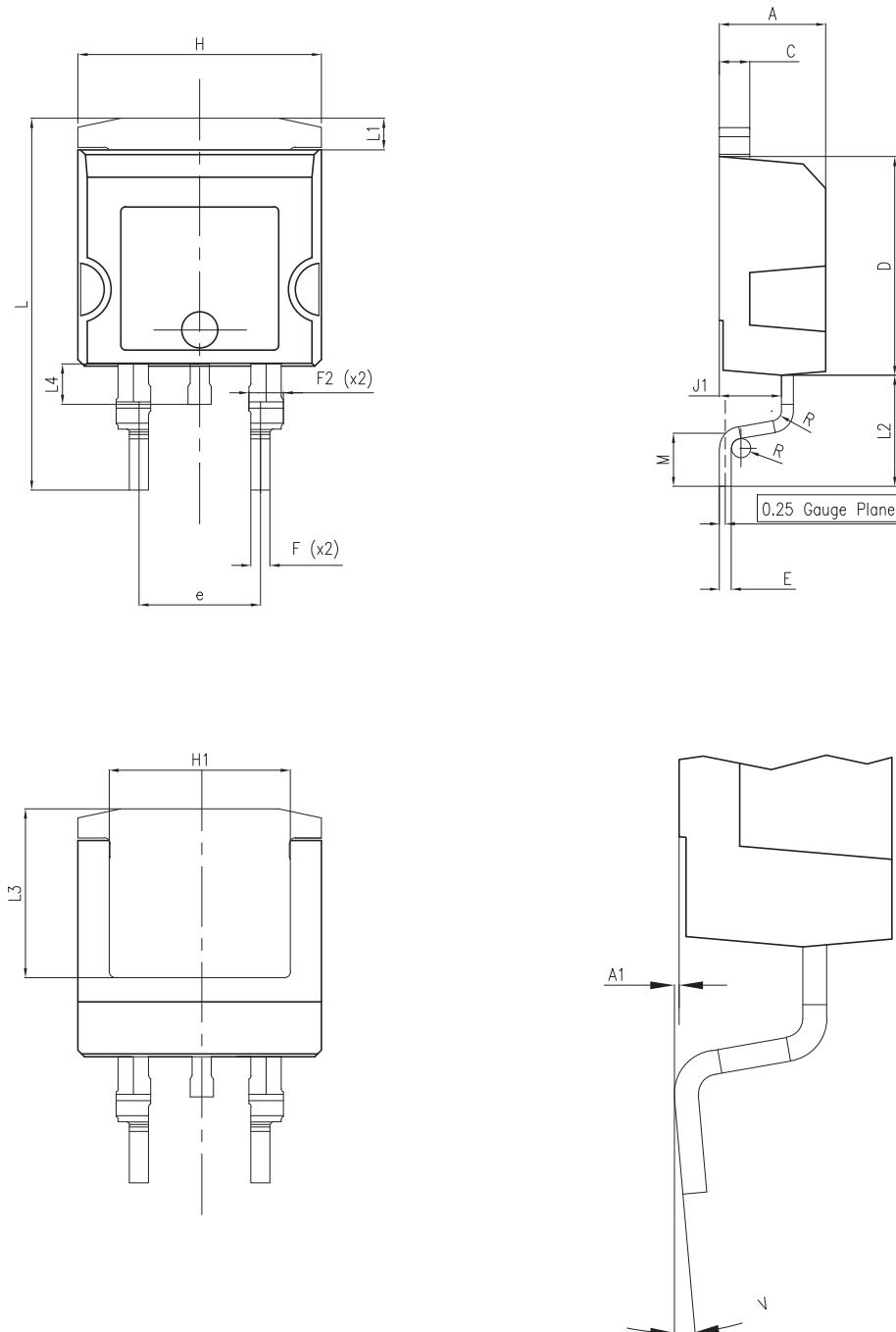
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Table 9. TO-3PF type B mechanical data

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

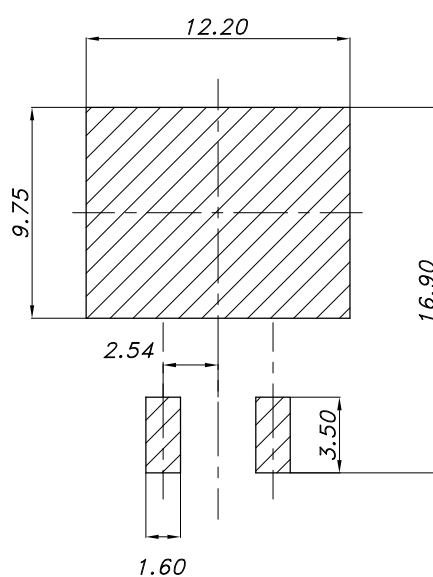
Figure 25. H²PAK-2 package outline



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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°

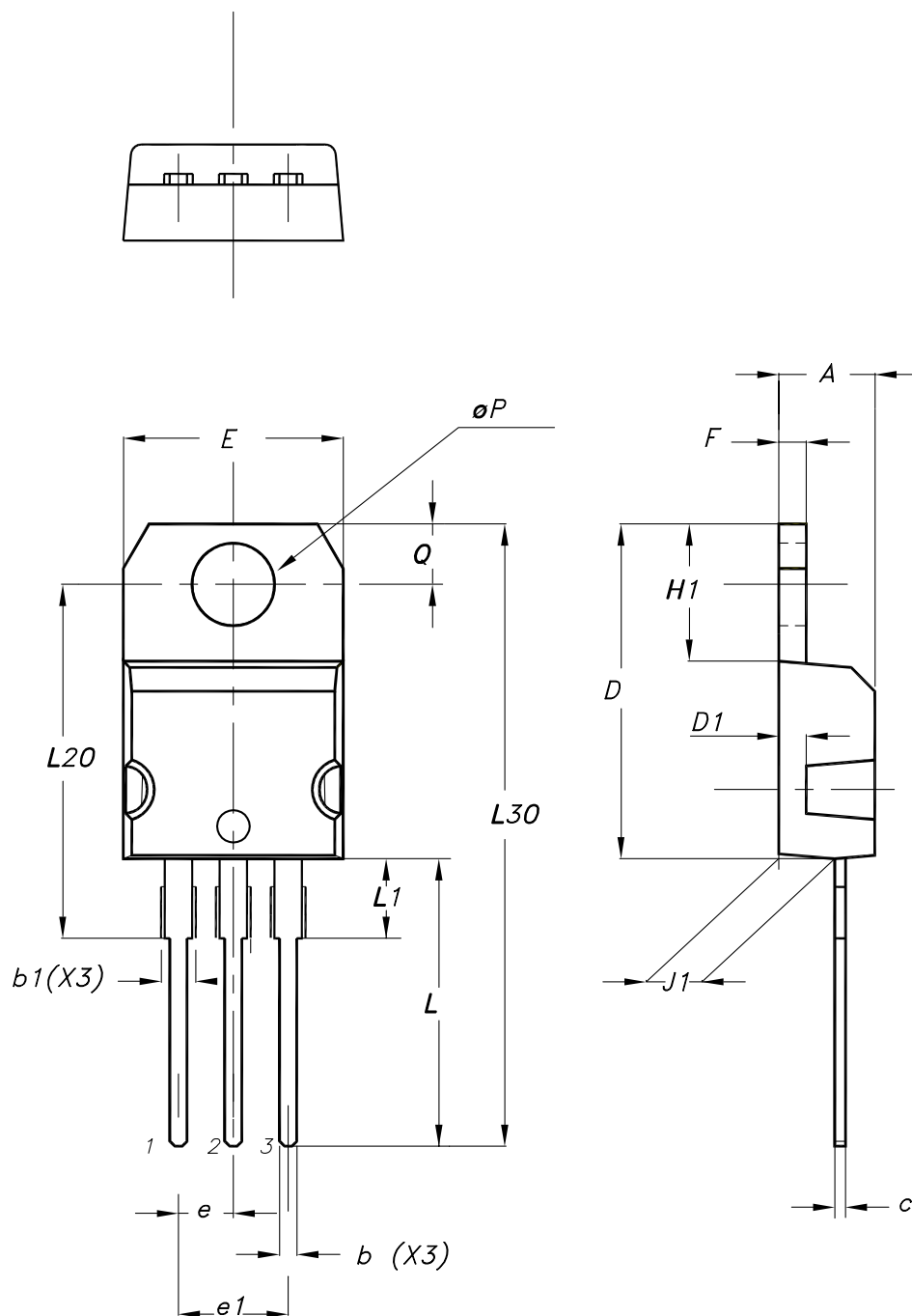
Figure 26. H²PAK-2 recommended footprint


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Note: Dimensions are in mm.

4.4 TO-220 type A package information

Figure 27. TO-220 type A package outline



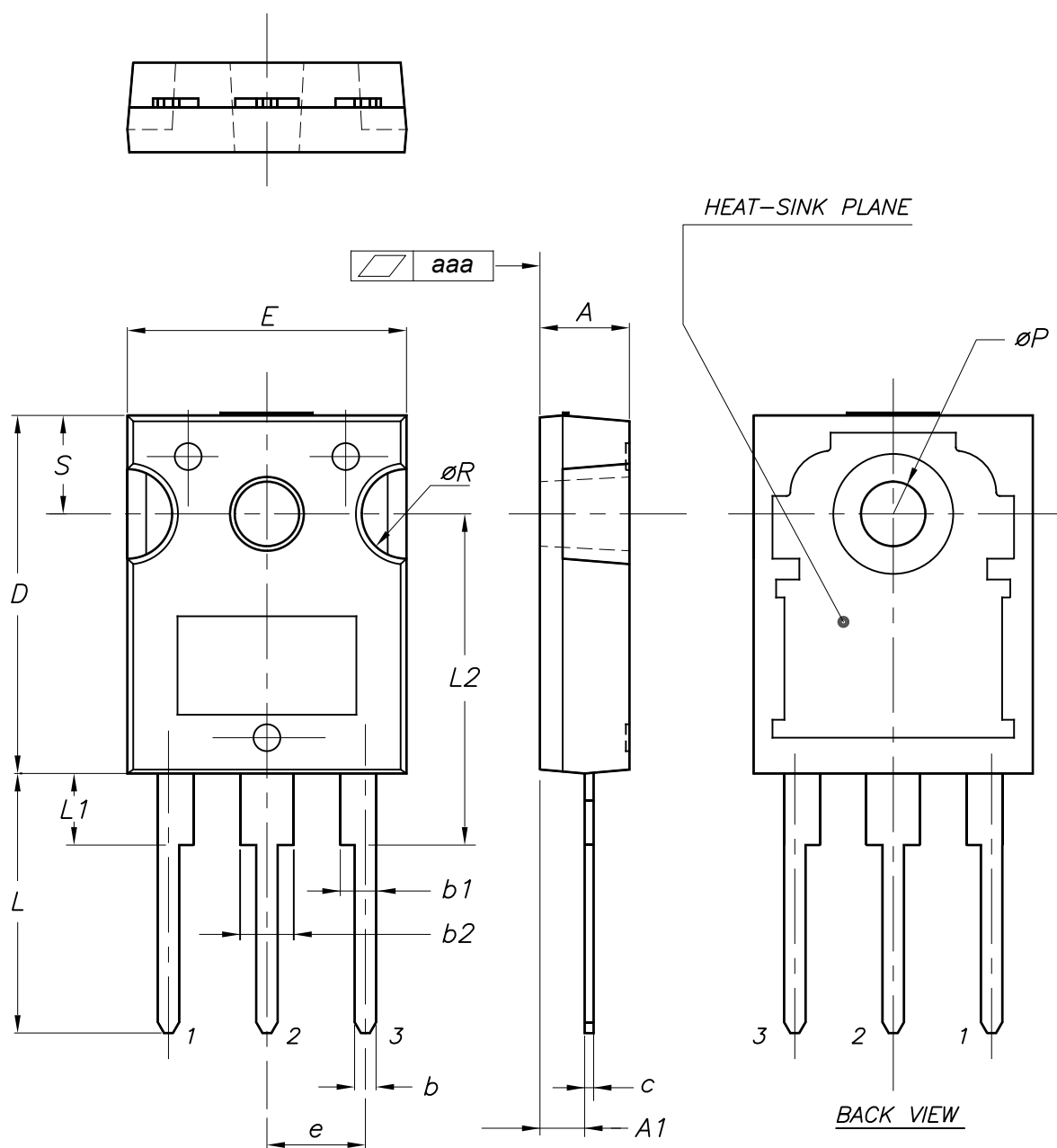
0015988_typeA_Rev_24

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



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.



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 type A package information	10
4.2	TO-3PF type B package information	12
4.3	H ² PAK-2 package information	14
4.4	TO-220 type A package information	16
4.5	TO-247 package information	18
4.6	H ² PAK-2 packing information	20
5	Ordering information	21
	Revision history	22



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