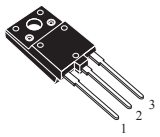
STFW3N150, STH3N150-2
STP3N150, STW3N150

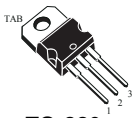
Datasheet

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

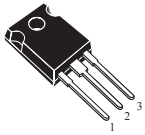


TO-3PF

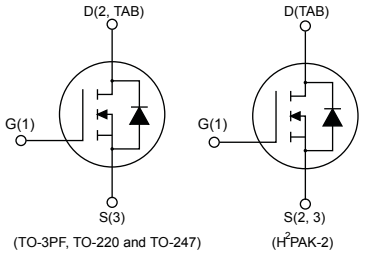
H²PAK-2



TO-220



TO-247



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 Qg 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^2PAK-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
	Derating factor	0.5	1.12			W/°C
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^2PAK-2	TO-220	TO-247	
$R_{thj\text{-}case}$	Thermal resistance junction-case	2	0.89			°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50		62.5	50	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb		35			°C/W

1. *When mounted on 1 inch^2 FR-4 board, 2 oz Cu.*

Table 3.

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 °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 V, I_D = 1 mA	1500			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 1500 V			10	µA
		V_{GS} = 0 V, V_{DS} = 1500 V, T_C = 125 °C (1)			500	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±30 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 1.3 A		6	9	Ω

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 V, f = 1 MHz, V_{GS} = 0 V	-	939	-	pF
C_{oss}	Output capacitance		-	102	-	
C_{rss}	Reverse transfer capacitance		-	13.2	-	
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 1200 V, V_{GS} = 0 V	-	100	-	pF
R_g	Gate input resistance	f = 1 MHz, gate DC Bias = 0, test signal level = 20 mV, I_D = 0 A	-	4	-	Ω
Q_g	Total gate charge	V_{DD} = 1200 V, I_D = 2.5 A, V_{GS} = 0 to 10 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. *$C_{oss\ eq.}$ 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 V, I_D = 1.25 A, R_G = 4.7 Ω, V_{GS} = 10 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 V, I_{SD} = 2.5 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 2.5 A, di/dt = 100 A/µs, V_{DD} = 60 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 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_J = 150 °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

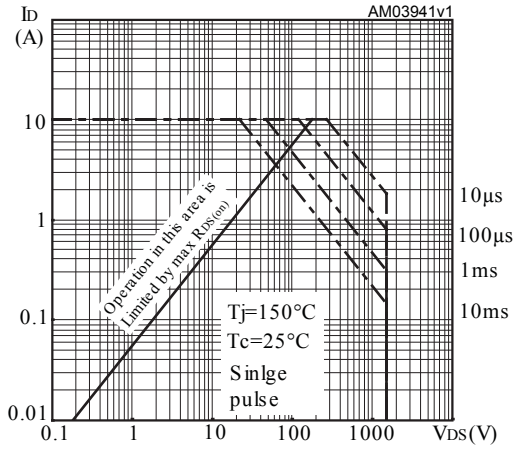


Figure 2. Thermal impedance for TO-3PF

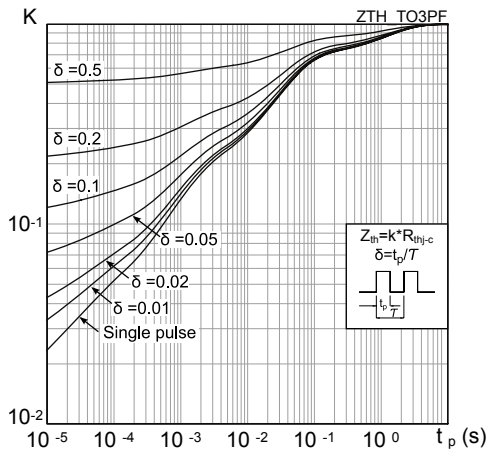


Figure 3. Safe operating area for H²PAK-2 and TO-220

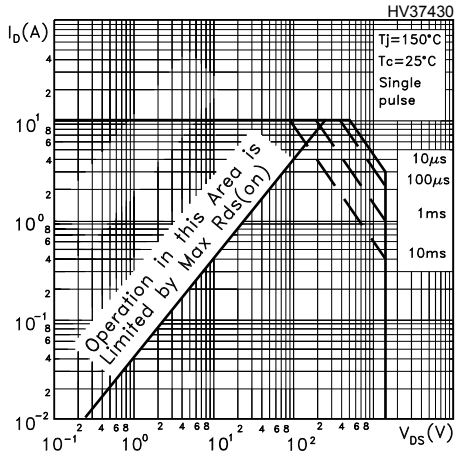


Figure 4. Thermal impedance for H²PAK-2 and TO-220

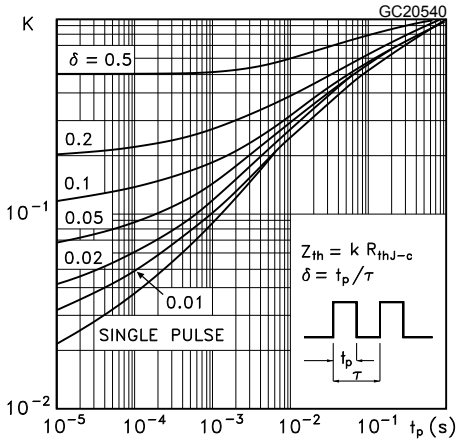


Figure 5. Safe operating area for TO-247

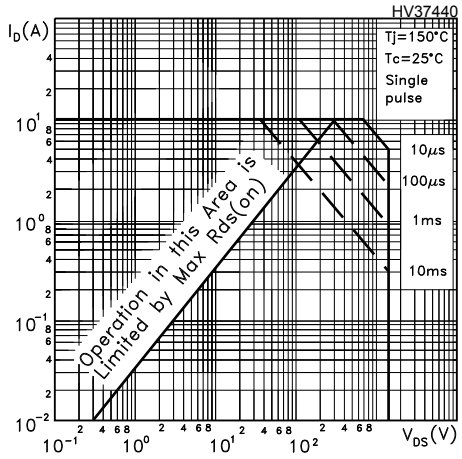


Figure 6. Thermal impedance for TO-247

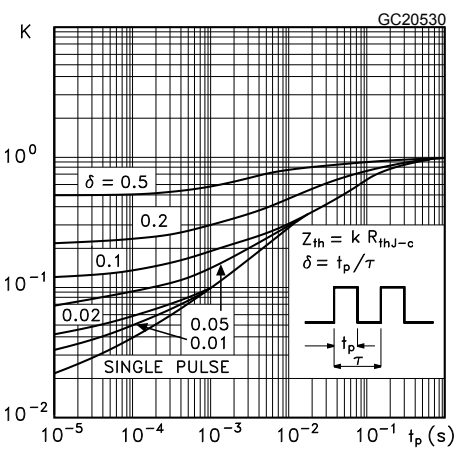


Figure 7. Output characteristics

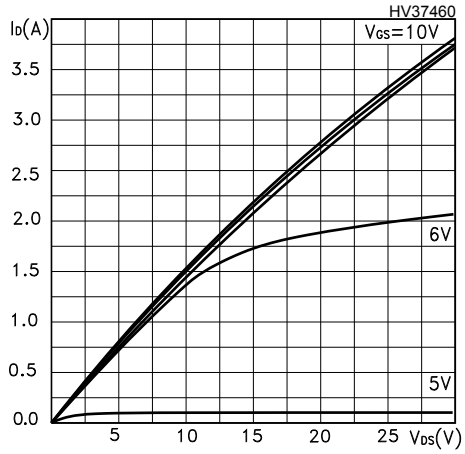


Figure 8. Transfer characteristics

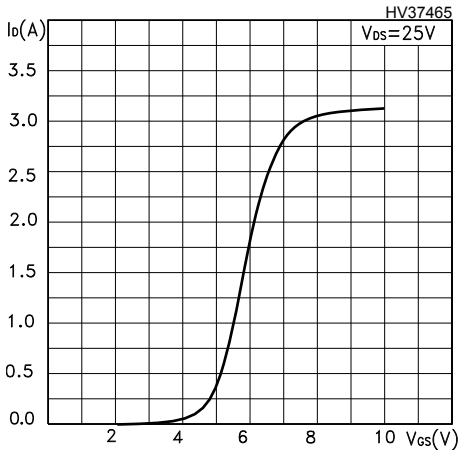


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

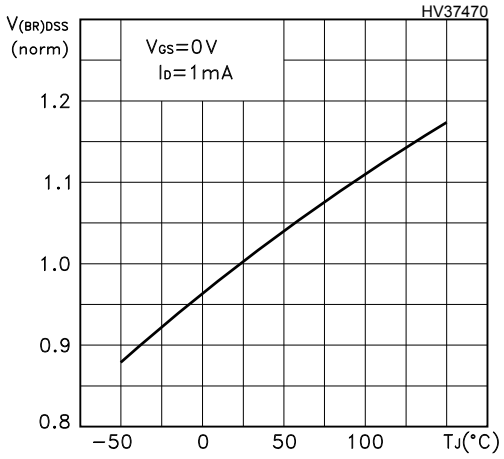


Figure 10. Static drain-source on-resistance

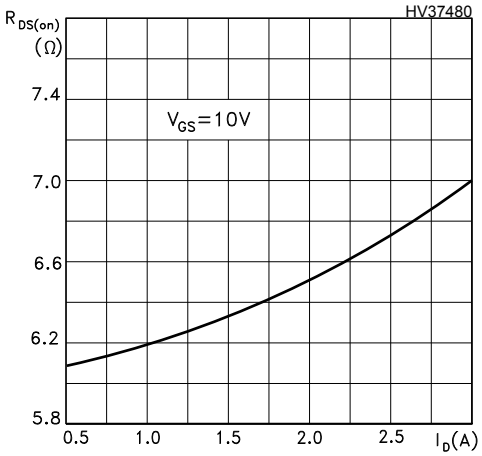


Figure 11. Gate charge vs gate-source voltage

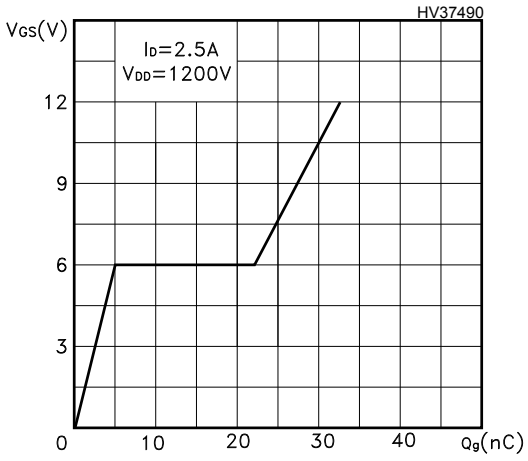


Figure 12. Capacitance variations

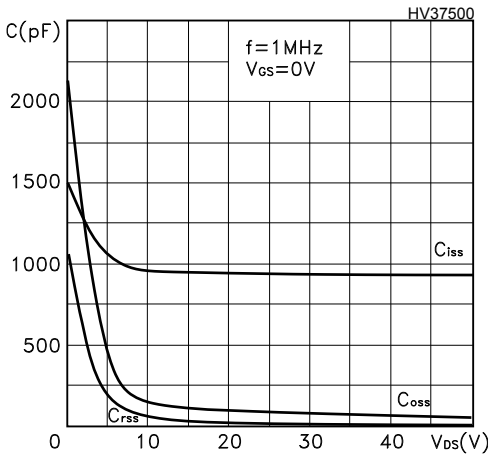


Figure 13. Normalized gate threshold voltage vs temperature

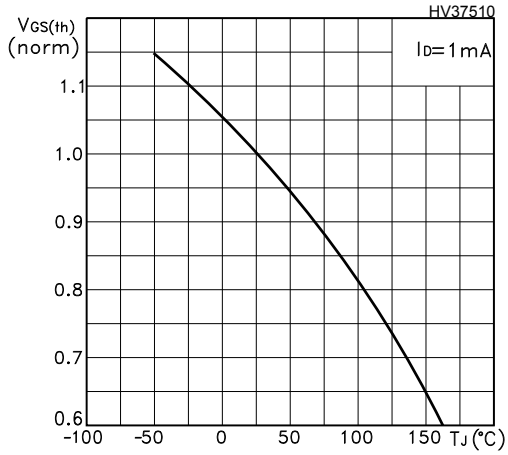


Figure 14. Normalized on resistance vs temperature

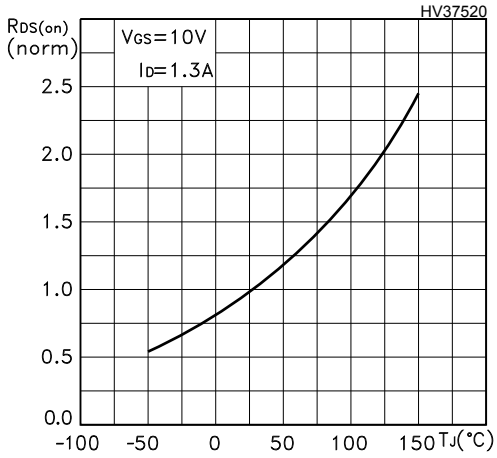


Figure 15. Source-drain diode forward characteristics

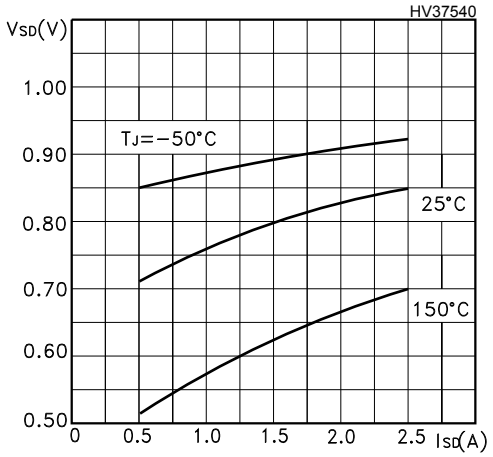
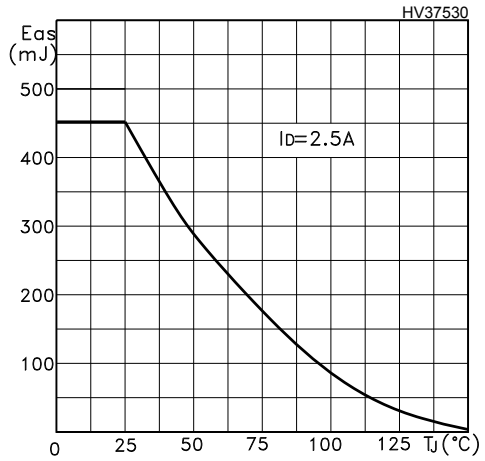


Figure 16. Maximum avalanche energy vs T_J



3 Test circuits

Figure 17. Test circuit for resistive load switching times

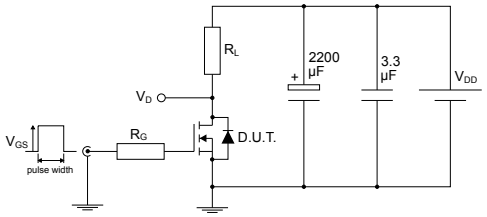


Figure 18. Test circuit for gate charge behavior

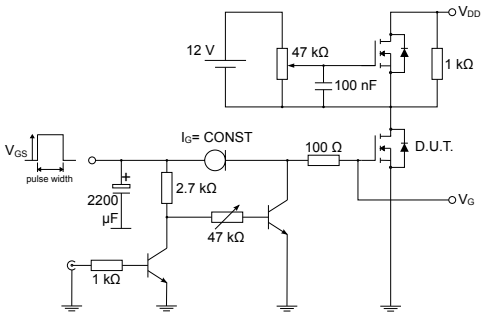


Figure 19. Test circuit for inductive load switching and diode recovery times

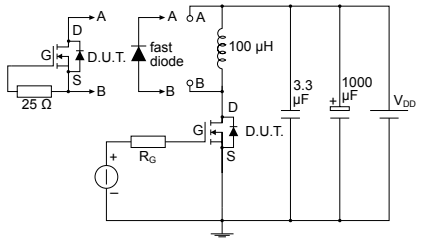


Figure 20. Unclamped inductive load test circuit

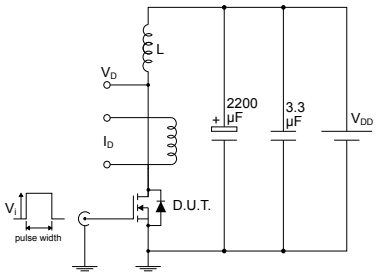


Figure 21. Unclamped inductive waveform

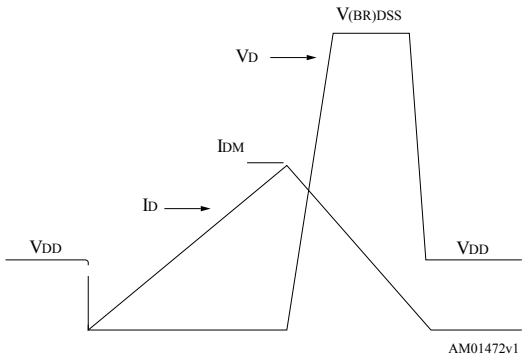
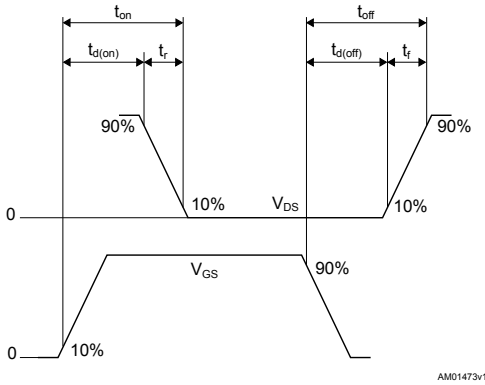


Figure 22. Switching time waveform



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-220 type A package information

Figure 23. **TO-220 type A package outline**

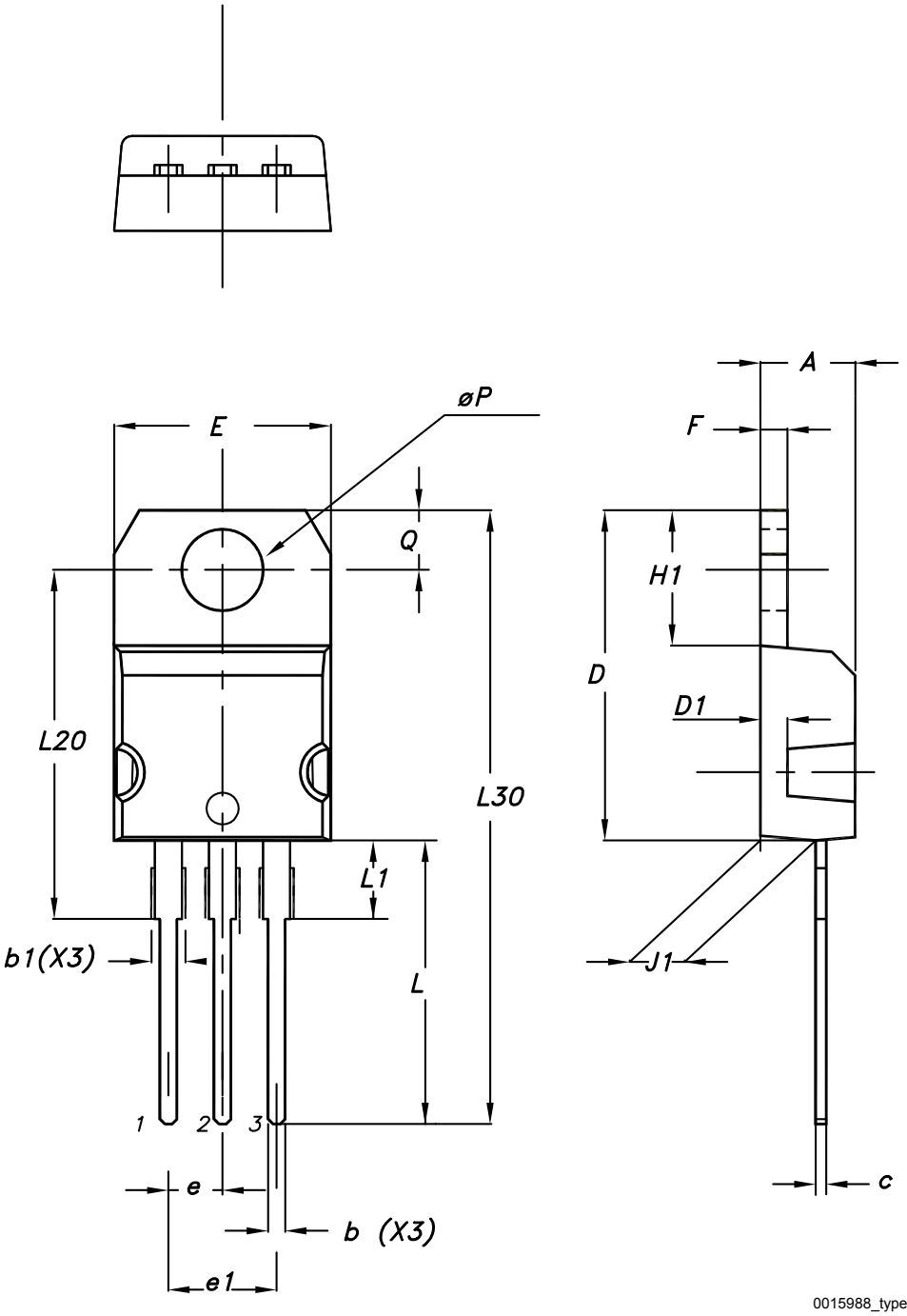


Table 8. **TO-220 type A package mechanical data**

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 H²PAK-2 package information

Figure 24. **H²PAK-2 package outline**

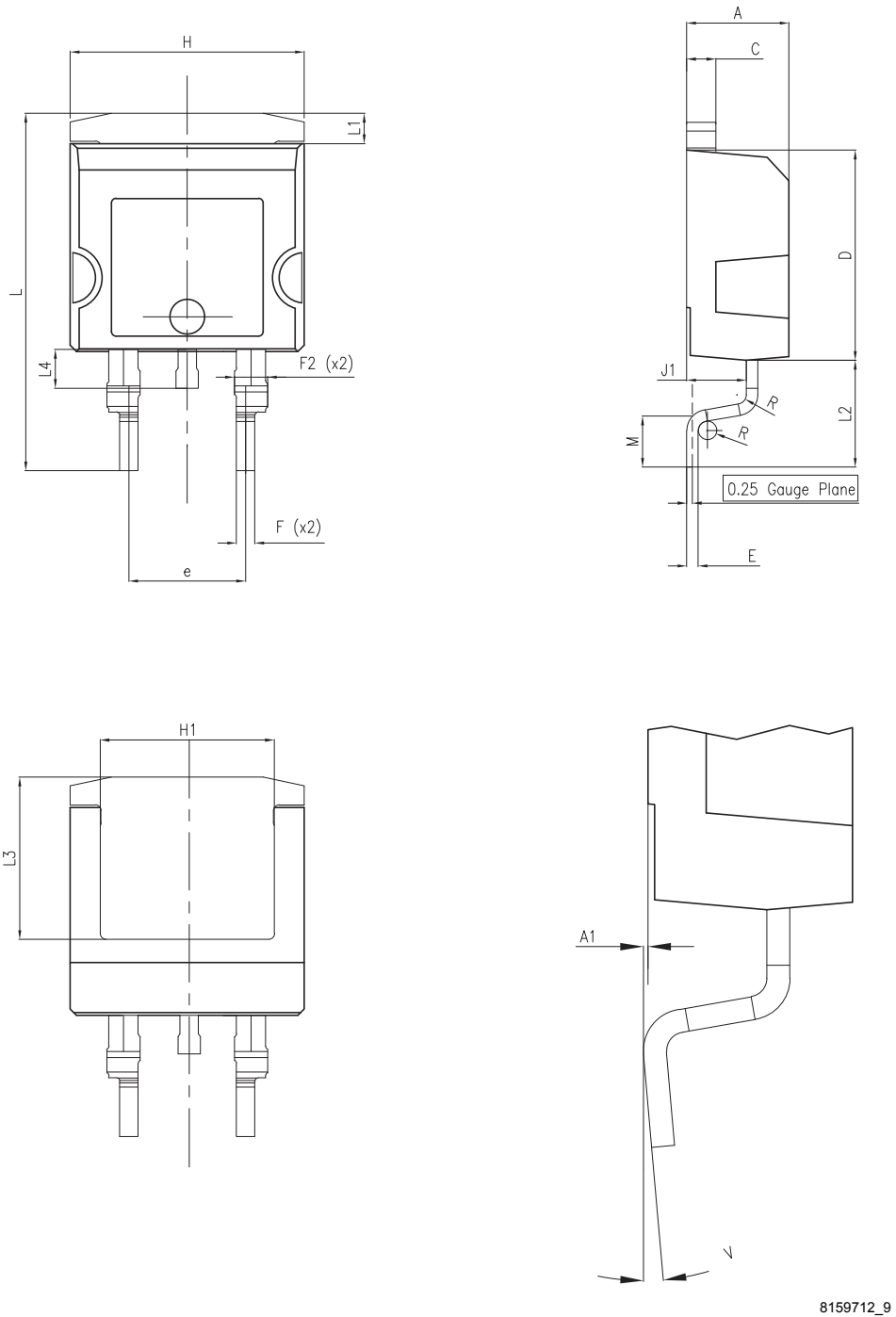
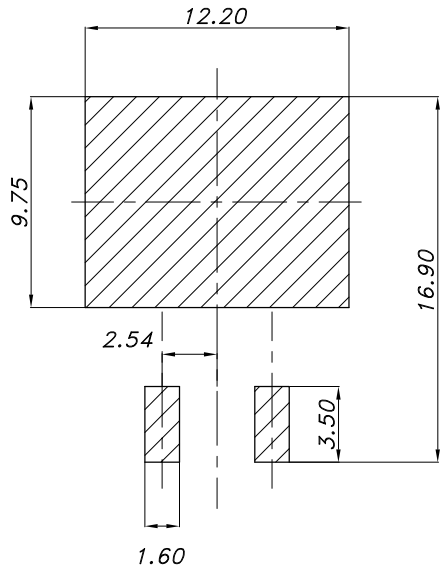


Table 9. **H²PAK-2 package mechanical data**

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 25. **H²PAK-2 recommended footprint**



Note: Dimensions are in mm.

4.3 TO-247 package information

Figure 26. **TO-247 package outline**

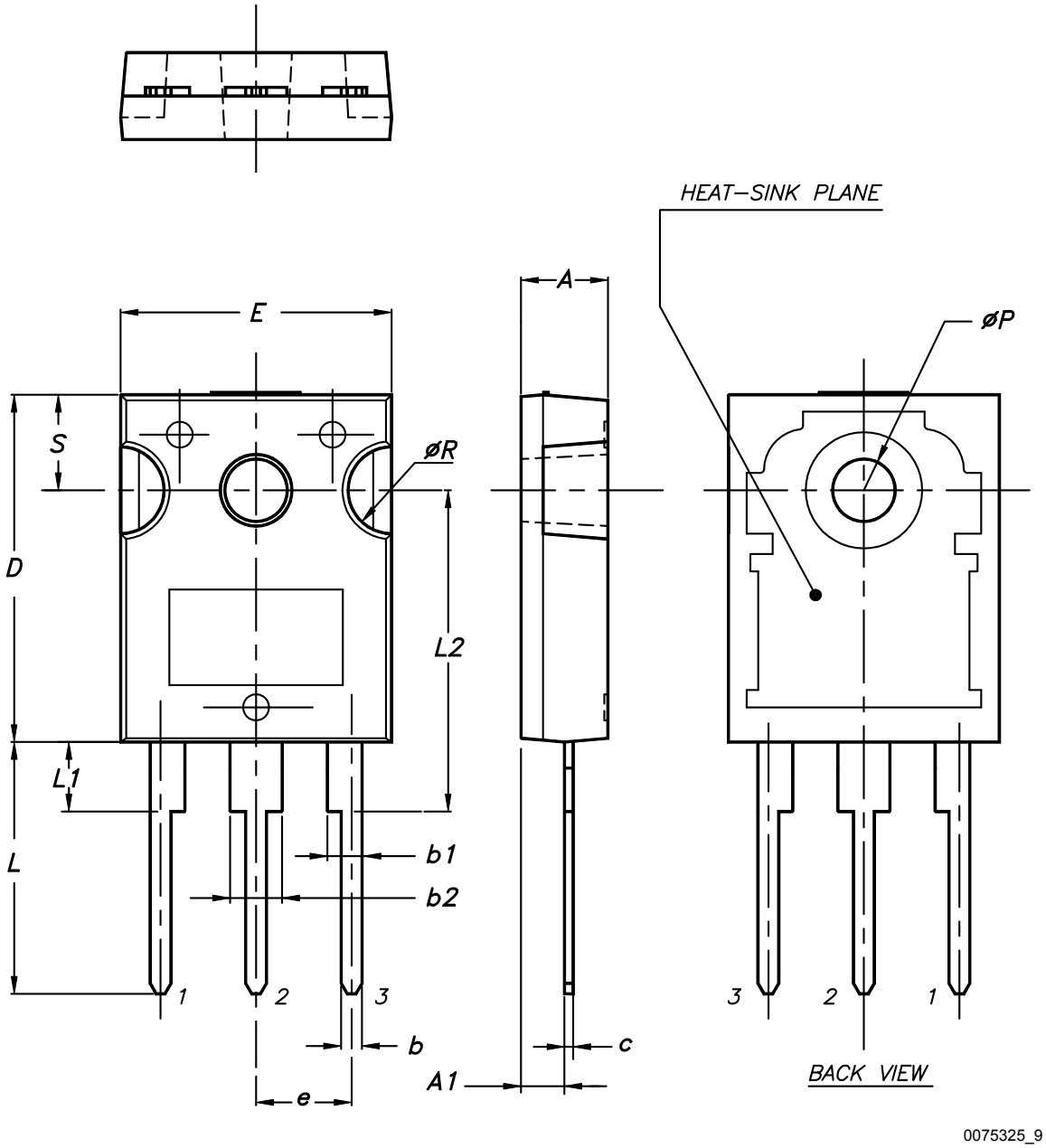


Table 10. **TO-247 package mechanical data**

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**

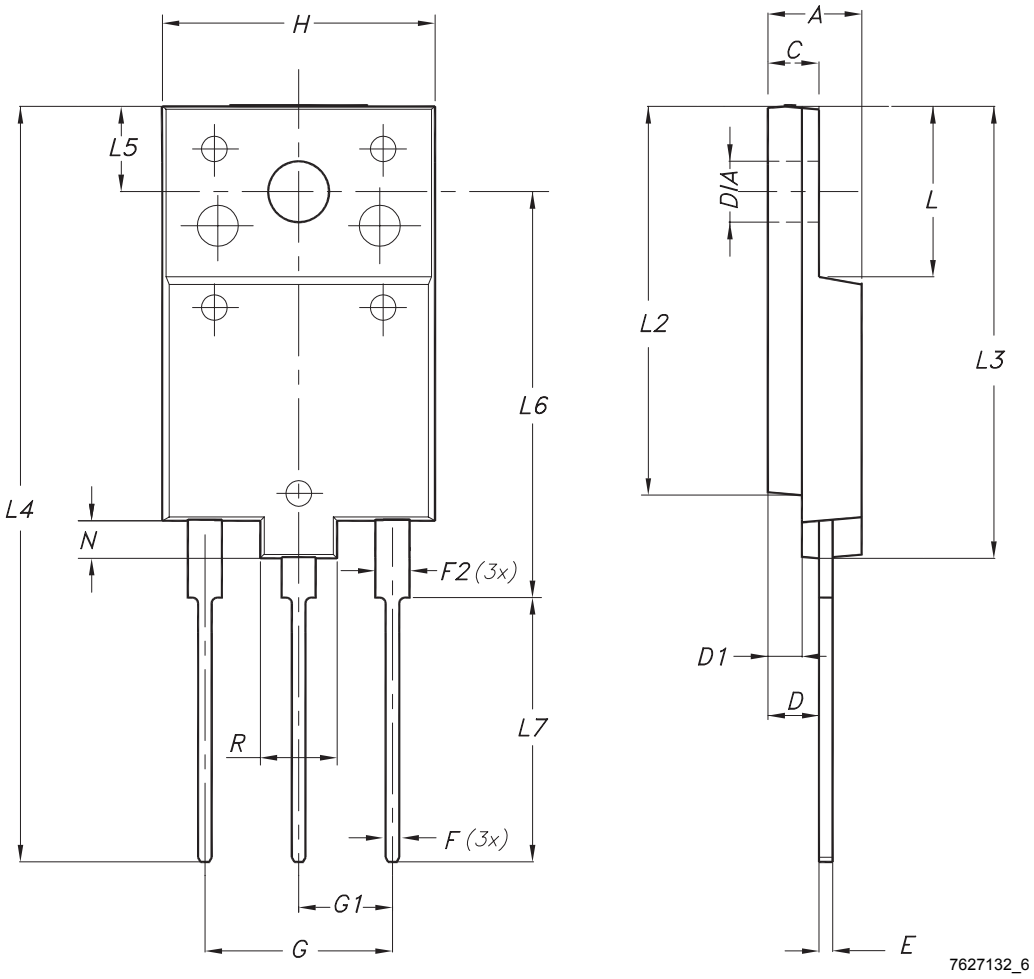
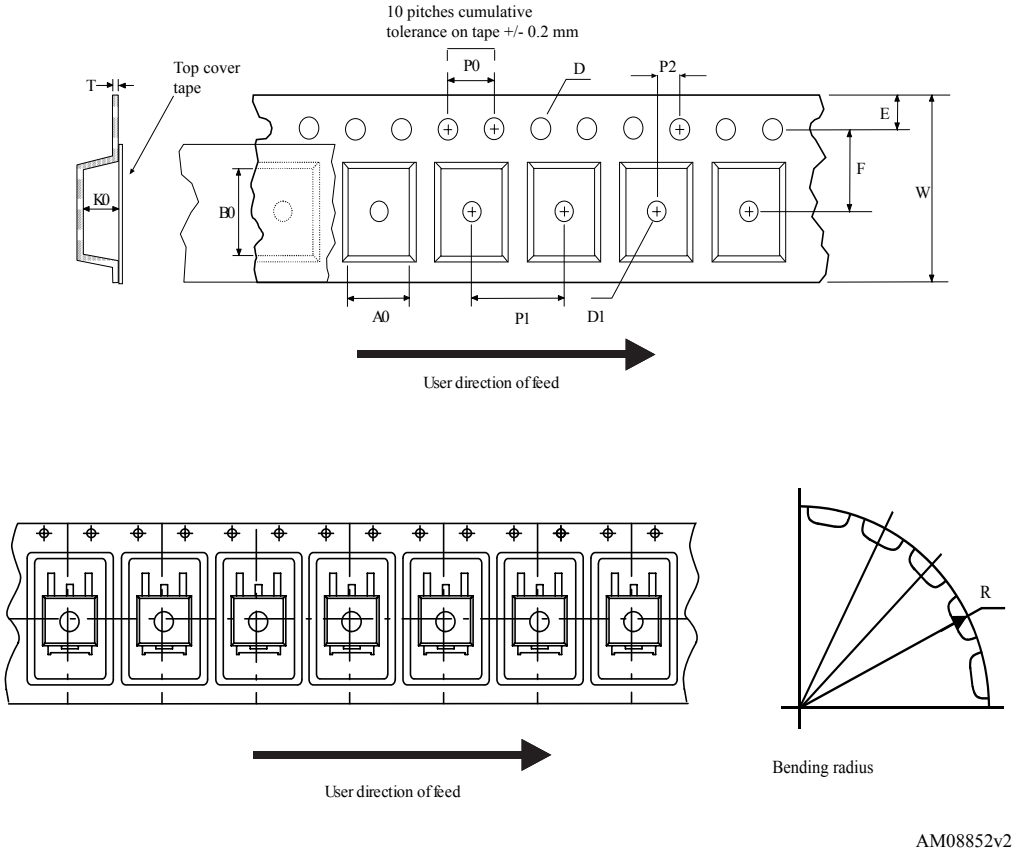


Table 11. **TO-3PF mechanical data**

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**

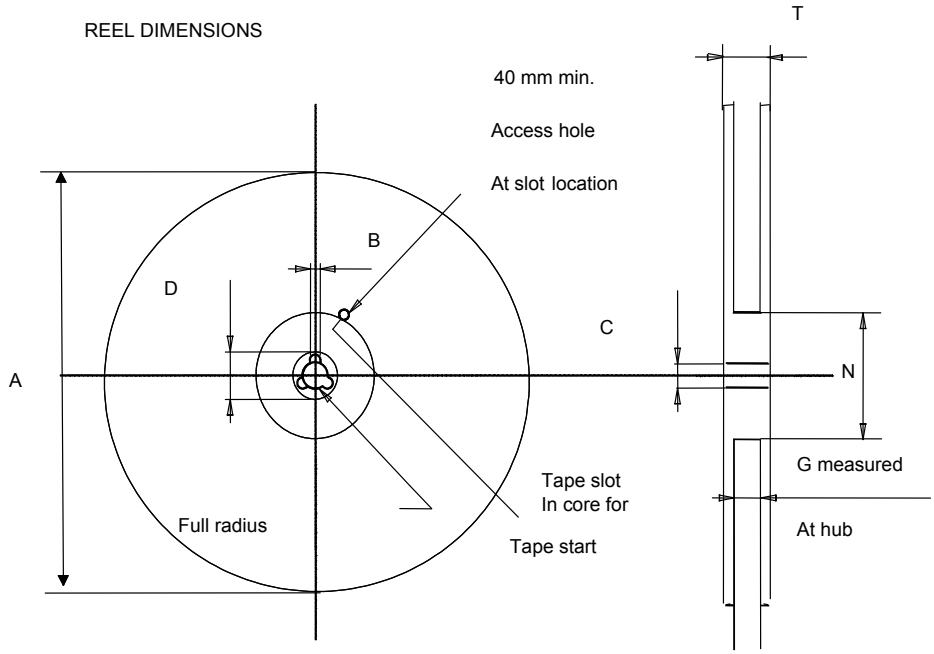


Table 12. **Tape and reel mechanical data**

Tape			Reel		
Dim.	mm		Dim.	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^2PAK-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 *Table 6*.
14-May-2007	3	The document has been reformatted
29-Aug-2007	4	RDS(on) value changed, updated *Figure 15*
09-Apr-2008	5	Added new package: TO-3PF
13-Feb-2009	6	Added PTOT value for TO-3PF (*Table 2: Absolute maximum ratings*)
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 *Table 2: Absolute maximum ratings*
29-Jun-2010	9	Corrected unit in *Table 3*.
08-Feb-2013	10	– Minor text changes – Modified: *Table 3* – Changed: *Figure 1* – Added: H^2PAK-2 package
18-Feb-2014	11	– Modified: *Figure 1* – Updated: *Figure 18*, *19*, *20* and *21* – Updated: *Figure 27* and *Table 11* – Updated: *Section 4: Package mechanical data* – Minor text changes
12-May-2020	12	Updated Section 5 Ordering information. Minor text changes.

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