

1 Electrical ratings

Table 1.

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
	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 ² PAK-2	TO-220	TO-247	
R _{thj-case}	Thermal resistance junction-case	2	0.89			°C/W
R _{thj-amb}	Thermal resistance junction-ambient	50		62.5	50	°C/W
R _{thj-pcb} ⁽¹⁾	Thermal resistance junction-pcb		35			°C/W

1. When mounted on 1 inch² 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

($T_C = 25\text{ }^{\circ}\text{C}$ 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. 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	-	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	$I_{SD} = 2.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	410		ns
Q_{rr}	Reverse recovery charge		-	2.4		μC
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	$I_{SD} = 2.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	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)

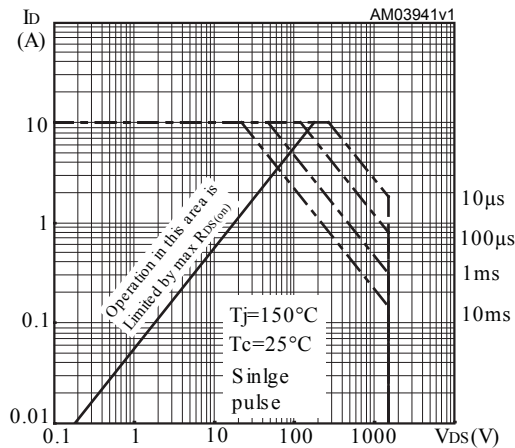
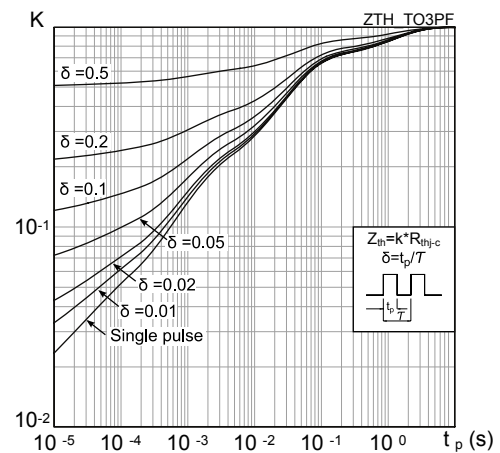
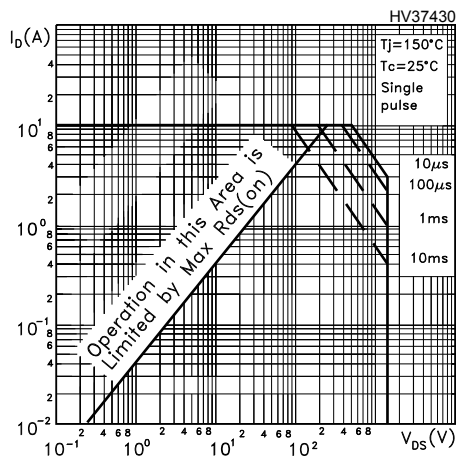
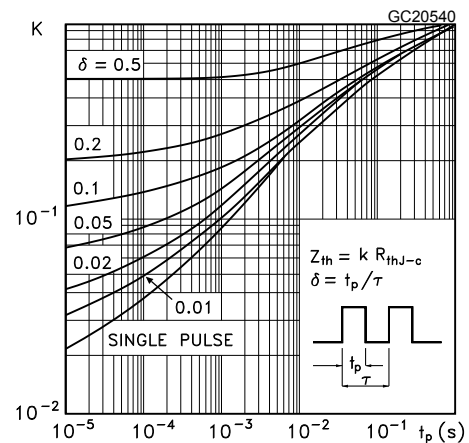
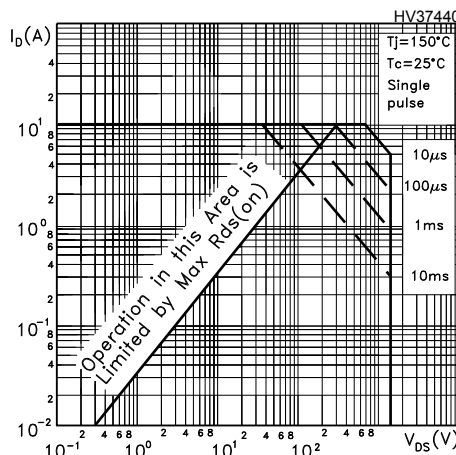
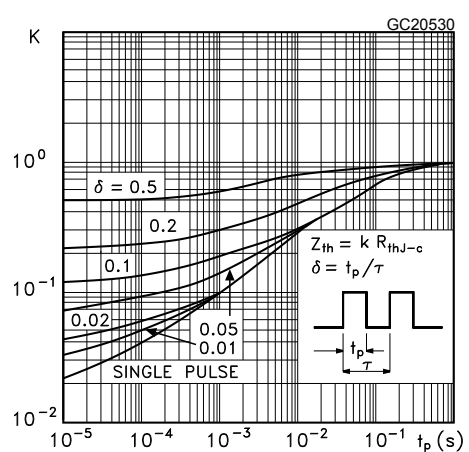
Figure 1. Safe operating area for TO-3PF

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


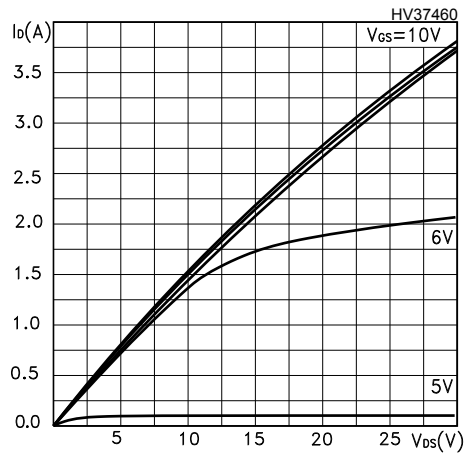
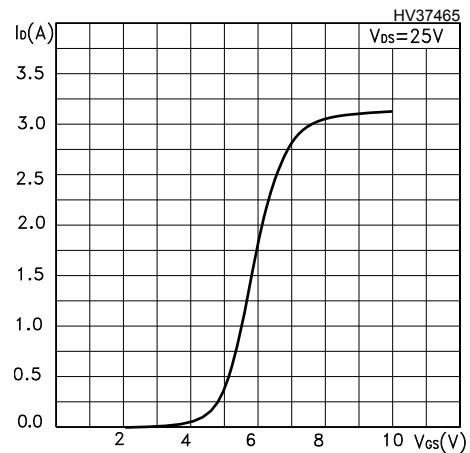
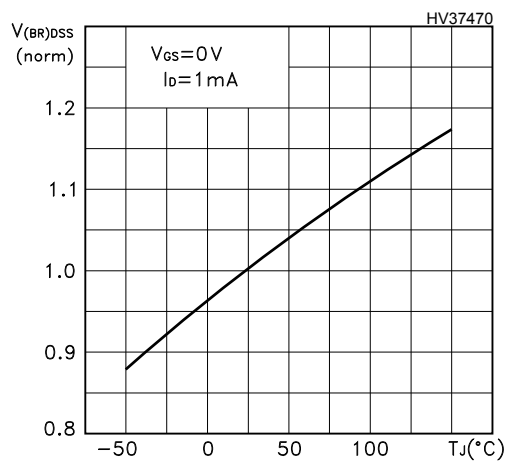
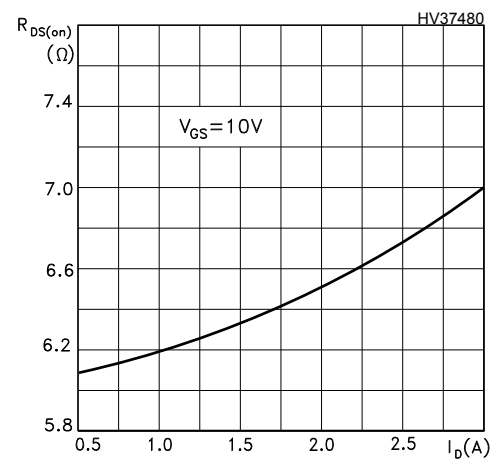
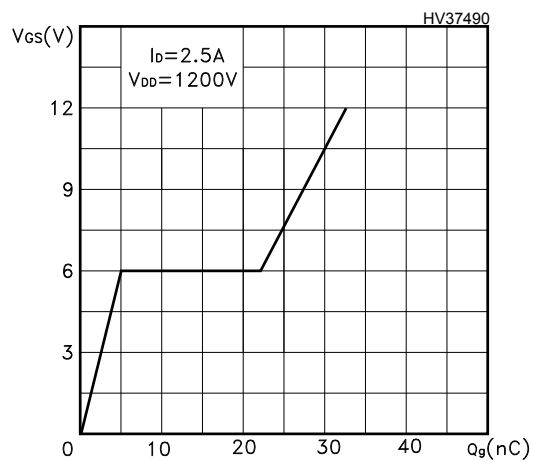
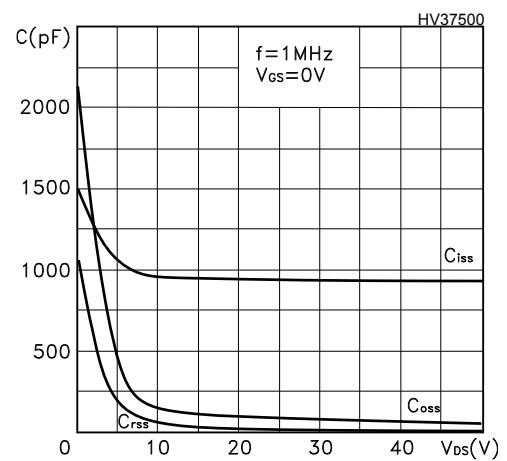
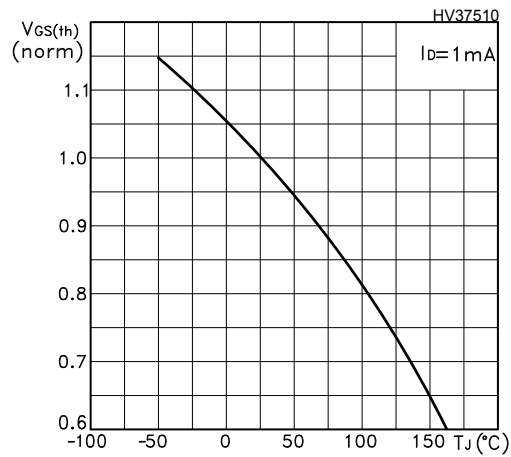
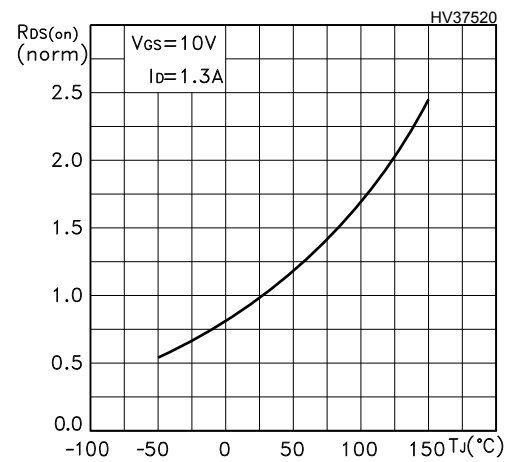
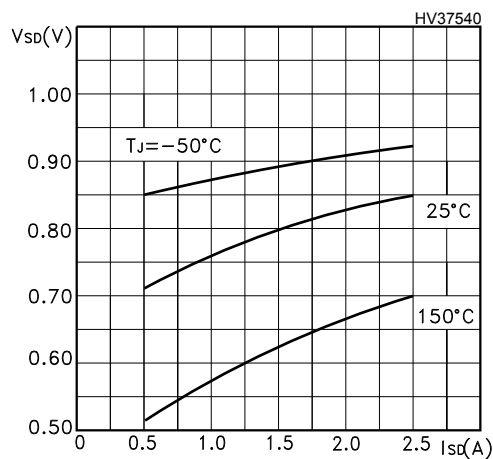
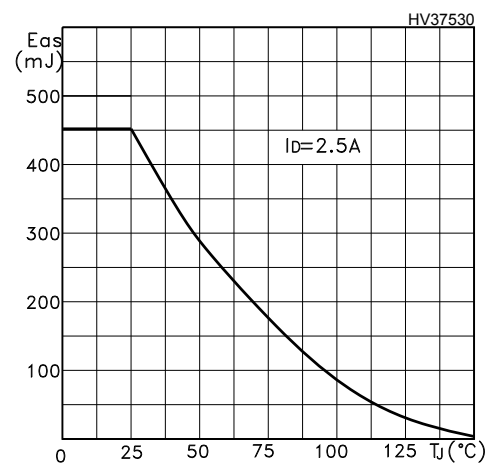
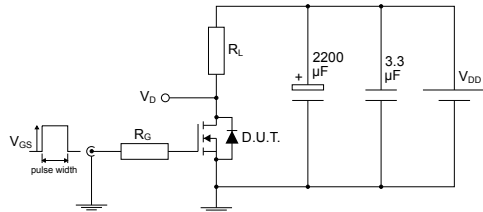
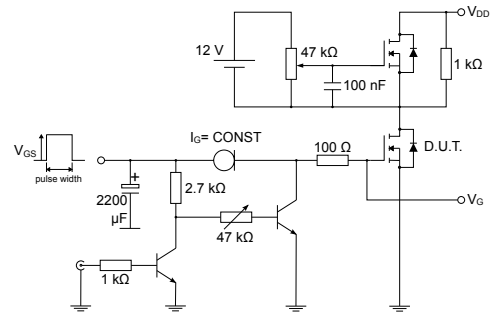
Figure 7. Output characteristics

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


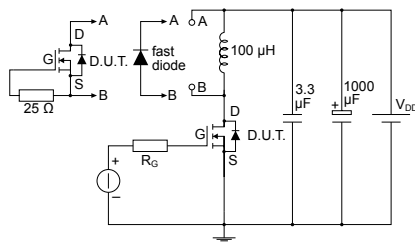
3 Test circuits

Figure 17. Test circuit for resistive load switching times


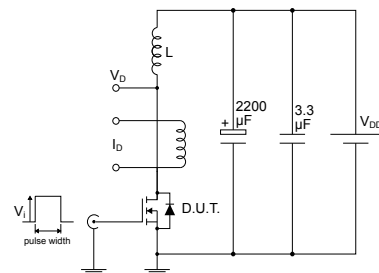
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Figure 18. Test circuit for gate charge behavior


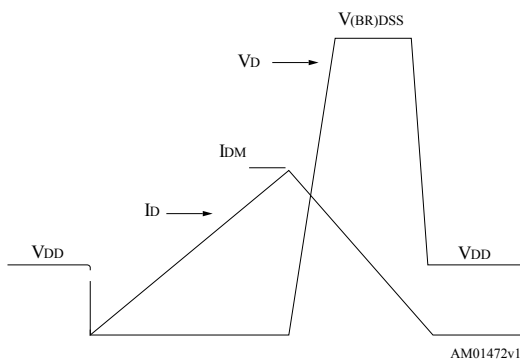
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Figure 19. Test circuit for inductive load switching and diode recovery times


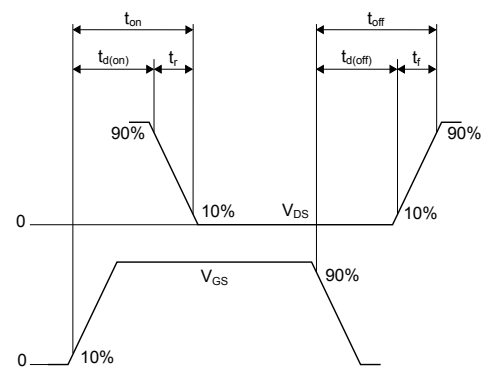
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Figure 20. Unclamped inductive load test circuit


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Figure 21. Unclamped inductive waveform


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Figure 22. Switching time waveform


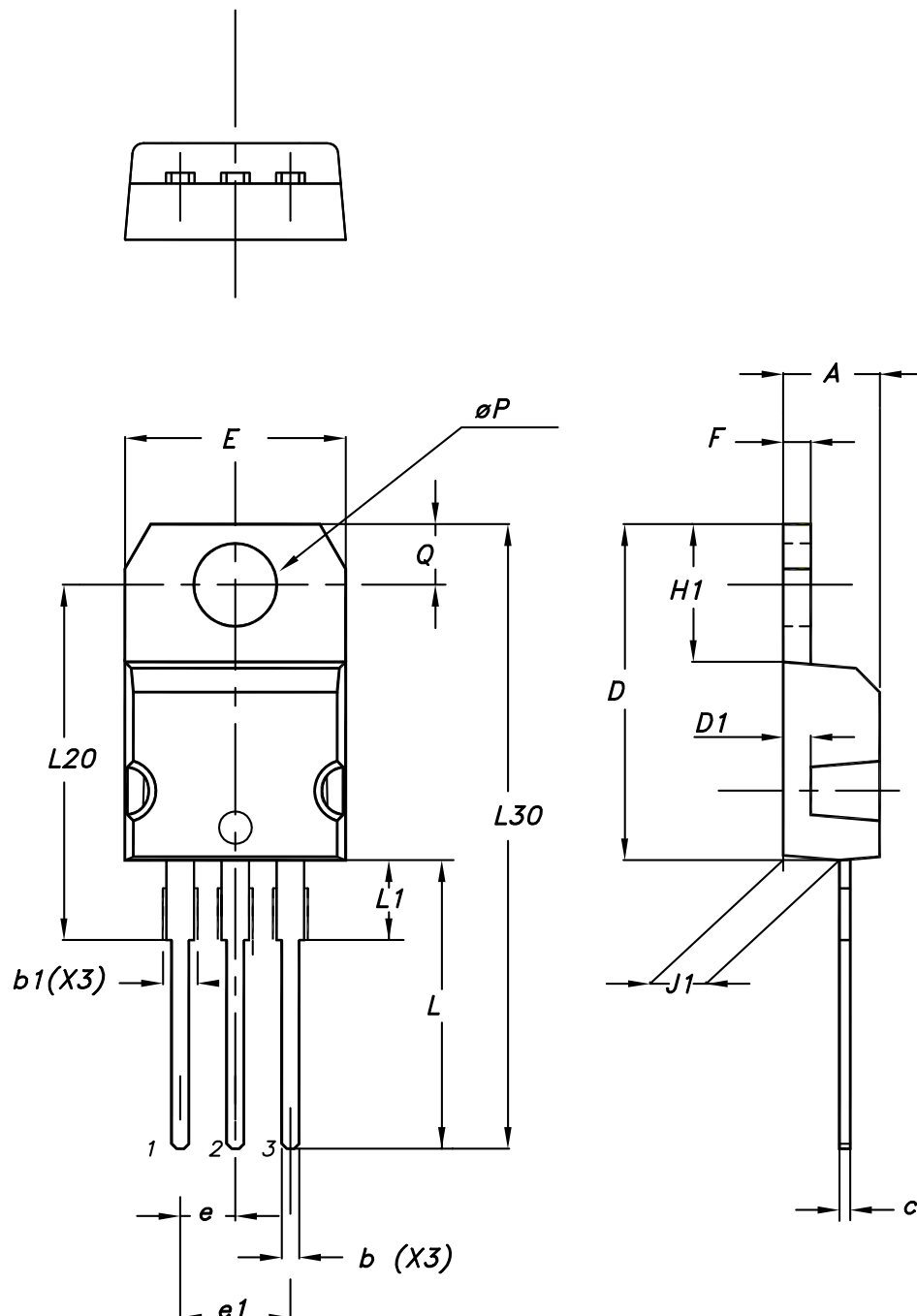
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4 Package information

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



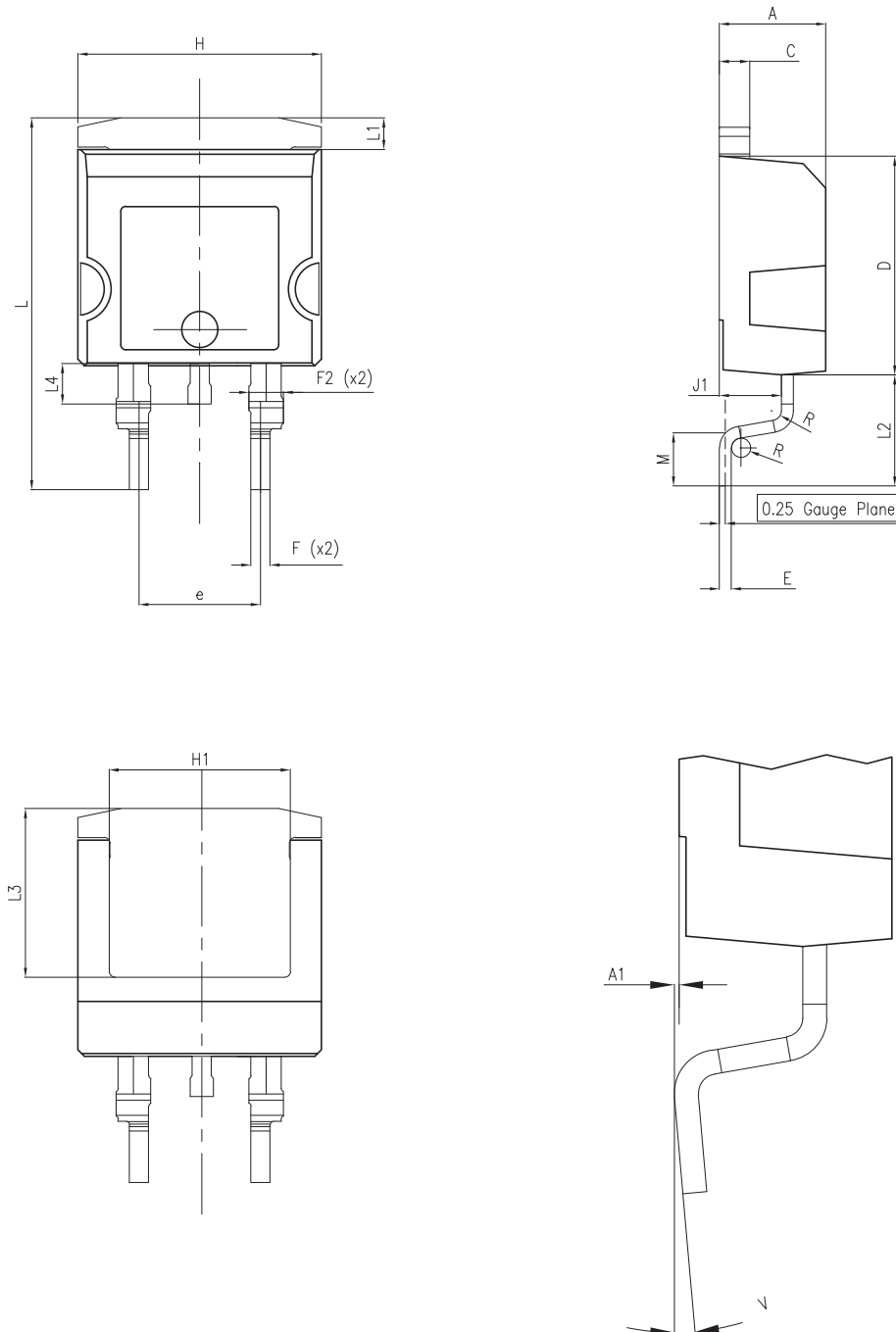
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Table 8. TO-220 type A package mechanical data

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

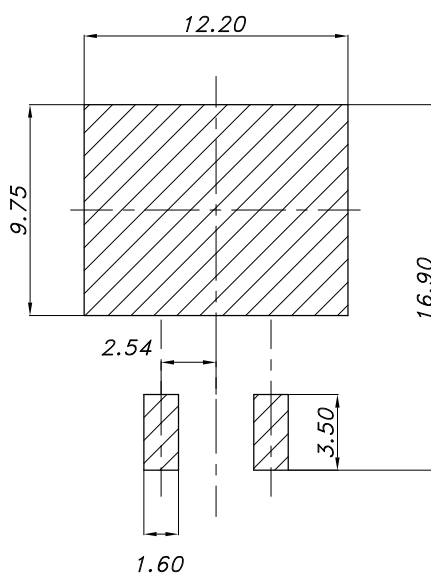
Figure 24. H²PAK-2 package outline



8159712_9

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°

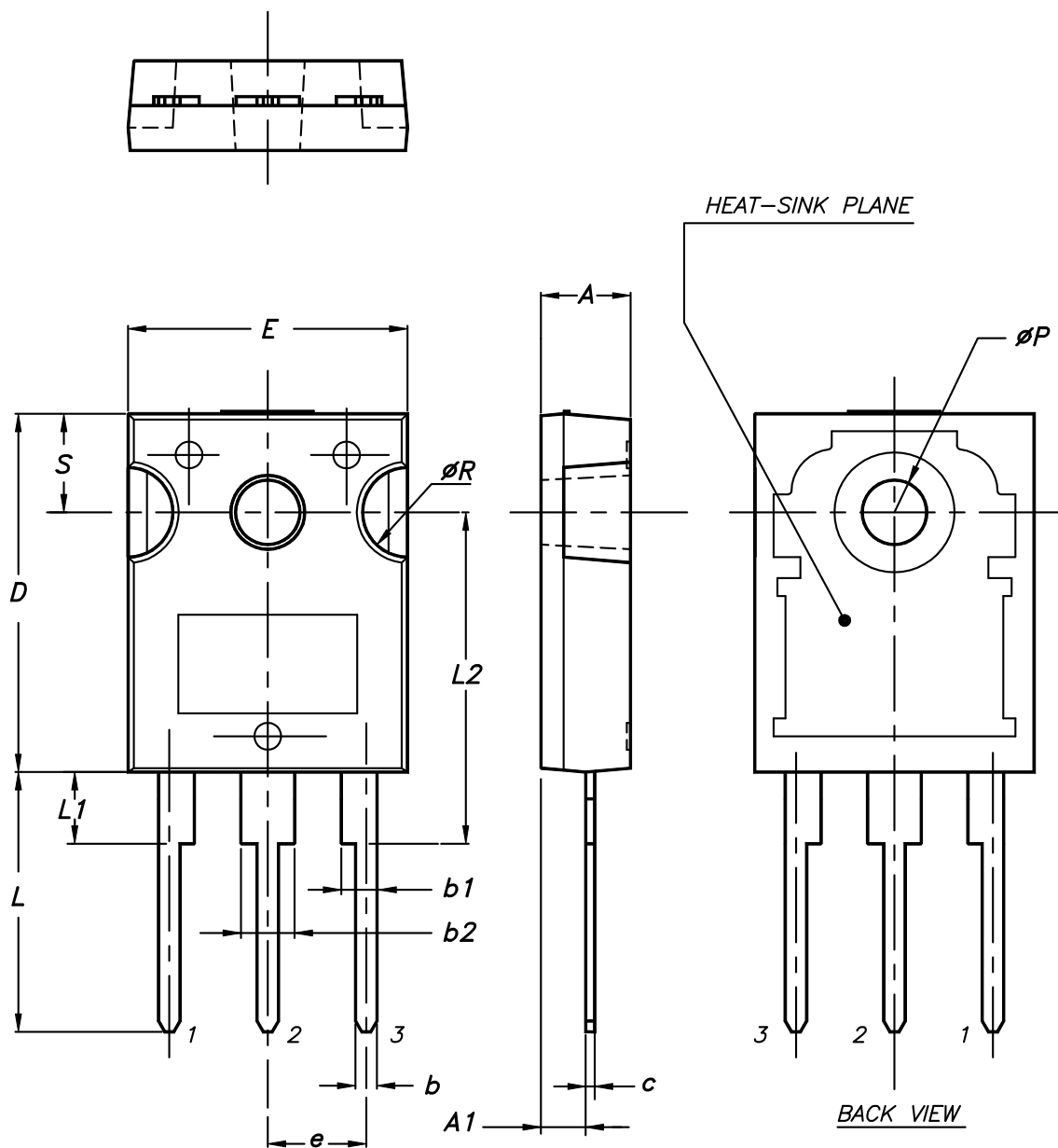
Figure 25. H²PAK-2 recommended footprint


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

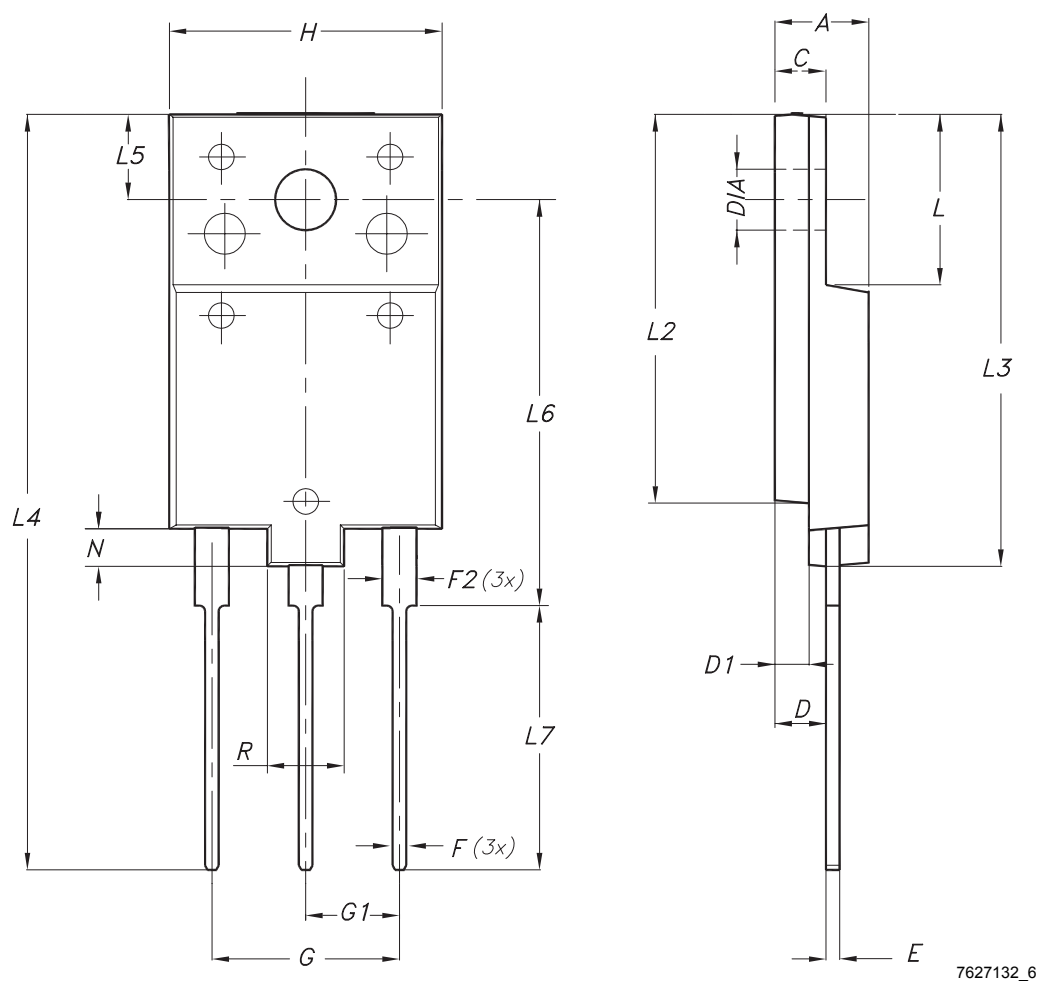
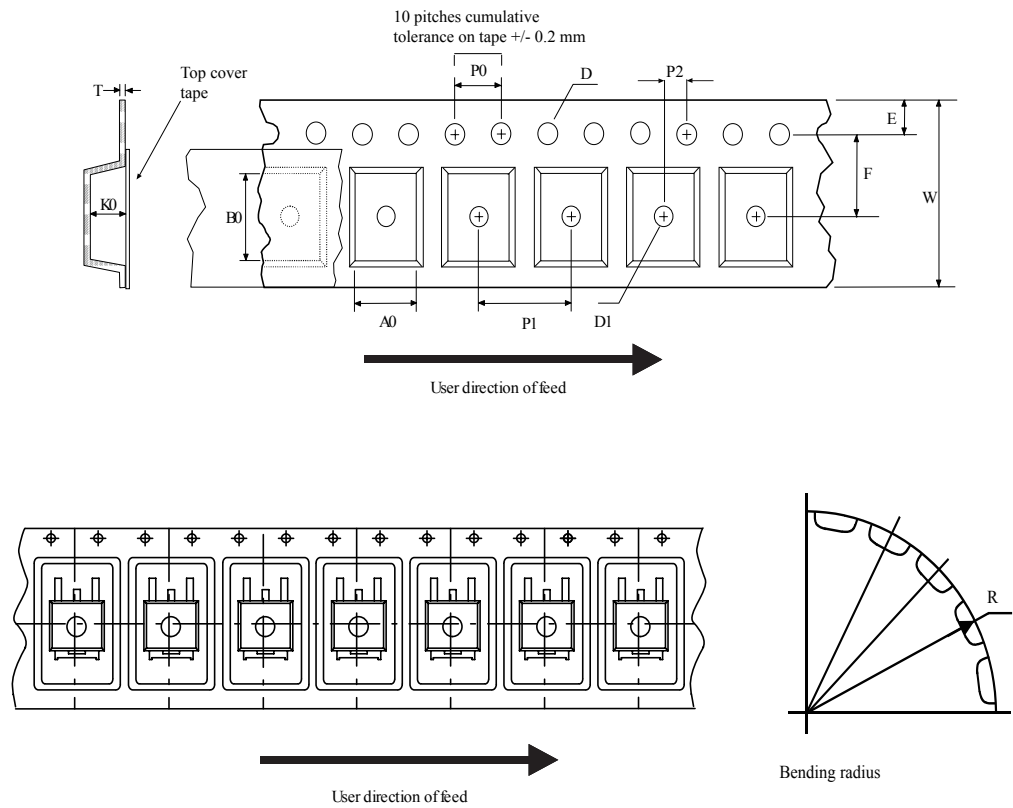


Table 11. TO-3PF mechanical data

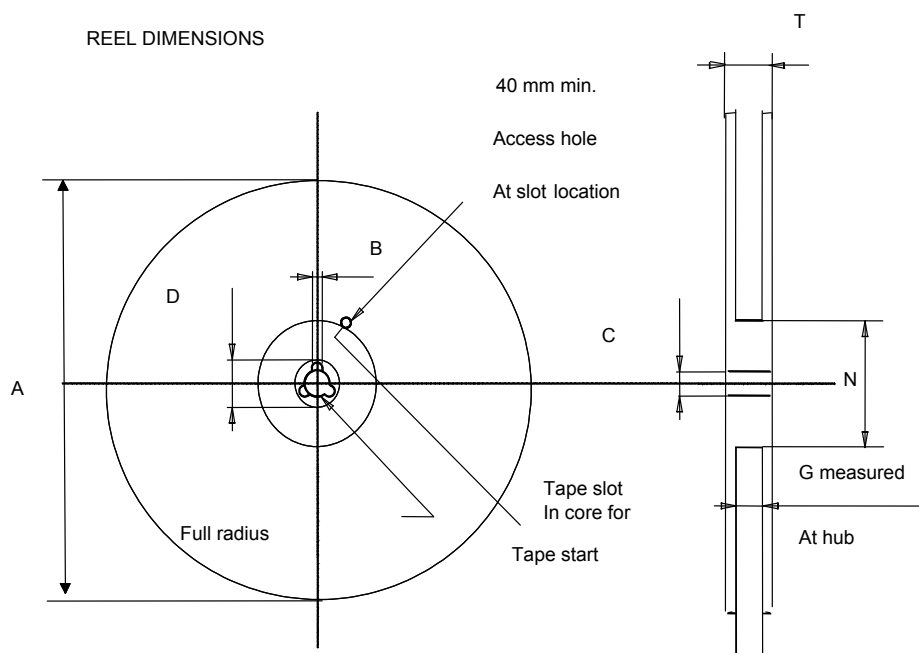
Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10.00	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15.00
N	1.80		2.20
R	3.80		4.20
Dia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

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