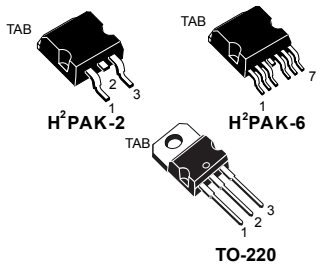
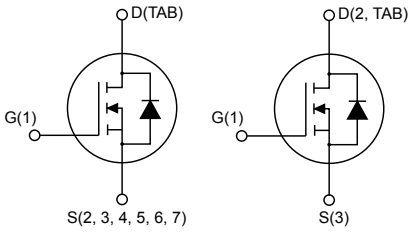
STH270N8F7-2, STH270N8F7-6, STP270N8F7

Datasheet

N-channel 80 V, 0.0017 Ω typ., 180 A STripFET F7 Power MOSFETs in an H²PAK-2, H²PAK-6 and TO-220 packages





H²PAK-2, H²PAK-6 TO-220

H2PAK_2_6_N-CHG1DTABS234567_TO-220_N-CHG1D2TABS3

Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STH270N8F7-2	80 V	0.0021 Ω	180 A
STH270N8F7-6			
STP270N8F7		0.0025 Ω	

- Among the lowest $R_{DS(on)}$ on the market
- Excellent FoM (figure of merit)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize STripFET F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Product status links
STH270N8F7-2
STH270N8F7-6
STP270N8F7

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	±20	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	180	A
I_D (1)	Drain current (continuous) at T_c = 100 °C	180	A
I_{DM} (2)	Drain current (pulsed)	720	A
P_{TOT} (3)	Total power dissipation at T_C = 25 °C	315	W
E_{AS} (4)	Single pulse avalanche energy	1.16	J
T_j	Operating junction temperature range	-55 to 175	°C
T_{stg}	Storage temperature range		

1. *Current limited by package.*
2. *Pulse width limited by safe operating area.*
3. *This value is rated according to R_{thJC}*
4. *Starting T_j=25 °C, I_D=65 A, V_{DD}=50 V*

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		H²PAK-2, H²PAK-6	TO-220	
R_{thJC}	Thermal resistance, junction-to-case	0.48		°C/W
R_{thJB} (1)	Thermal resistance, junction-to-board	35		°C/W
R_{thJA}	Thermal resistance, junction-to-ambient		62.5	°C/W

1. *When mounted on an 1 inch² FR-4, 2 Oz copper board.*

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250 µA, V_{GS} = 0 V	80			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 80 V			10	µA
		V_{GS} = 0 V, V_{DS} = 80 V, T_C=125 °C (1)			100	µA
I_{GSS}	Gate-body leakage current	V_{GS} = ±20 V, V_{DS} = 0 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS} , I_D = 250 µA	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	For H²PAK-2, H²PAK-6: V_{GS}= 10 V, I_D= 90 A		0.0017	0.0021	Ω
		For TO-220: V_{GS}= 10 V, I_D= 90 A		0.0021	0.0025	

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

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	13600	-	pF
C_{oss}	Output capacitance		-	2050	-	pF
C_{rss}	Reverse transfer capacitance		-	236	-	pF
Q_g	Total gate charge	V_{DD} = 40 V, I_D = 180 A, V_{GS} = 0 to 10 V (see Figure 20. Test circuit for gate charge behavior)	-	193	-	nC
Q_{gs}	Gate-source charge		-	96	-	nC
Q_{gd}	Gate-drain charge		-	46	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 40 V, I_D = 90 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 19. Test circuit for resistive load switching times and Figure 24. Switching time waveform)	-	56	-	ns
t_r	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
t_f	Fall time		-	42	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		180	A
I_{SDM} (1)	Source-drain current (pulsed)		-		720	A
V_{SD} (2)	Source-drain curren	I_{SD} = 90 A, V_{GS} = 0 V	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 180 A, di/dt = 100 A/µs	-	78		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 64 V, T_J = 150 °C (see Figure 21. Test circuit for inductive load switching and diode recovery times)	-	182		nC
I_{RRM}	Reverse recovery current		-	4.7		A

1. *Pulse width limited by safe operating area.*
2. *Pulsed: pulse duration=300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for H²PAK-2 and H²PAK-6

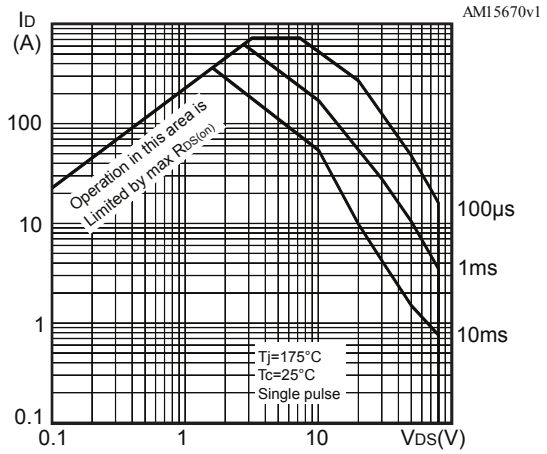


Figure 2. Safe operating area for TO-220

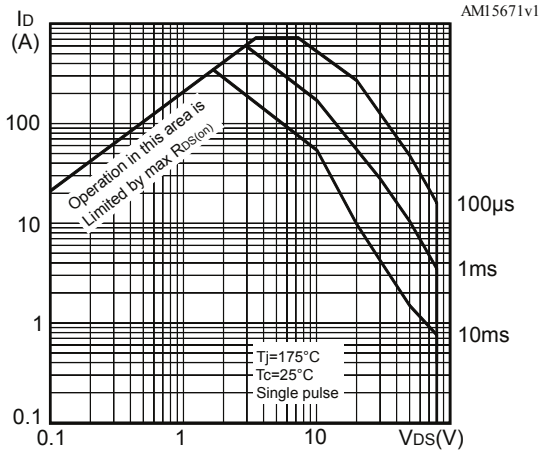


Figure 3. Normalized transient thermal impedance

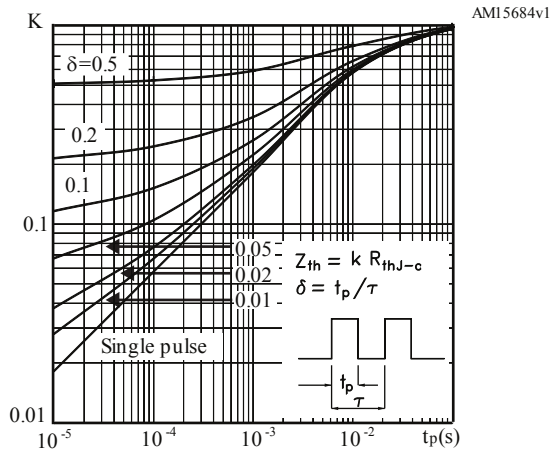


Figure 4. Typical gate charge characteristics

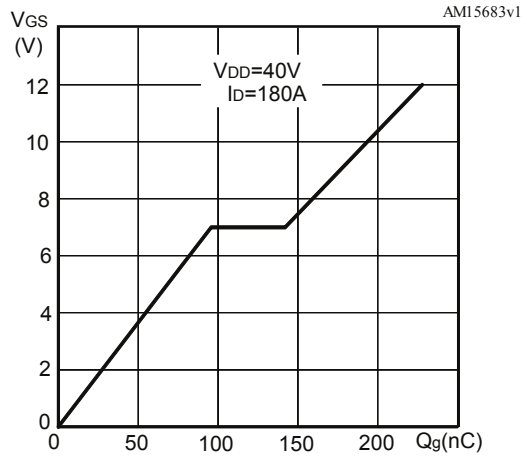


Figure 5. Typical output characteristics for TO-220

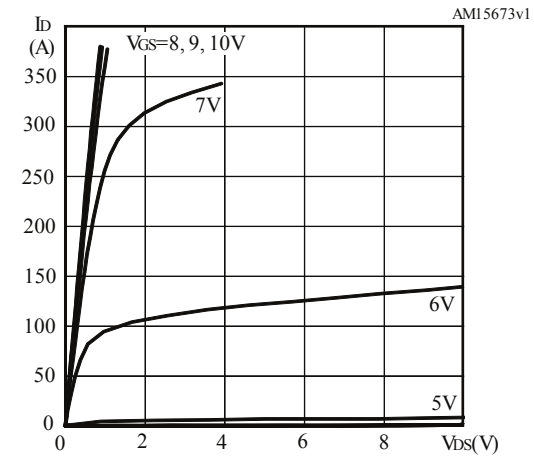


Figure 6. Typical transfer characteristics for TO-220

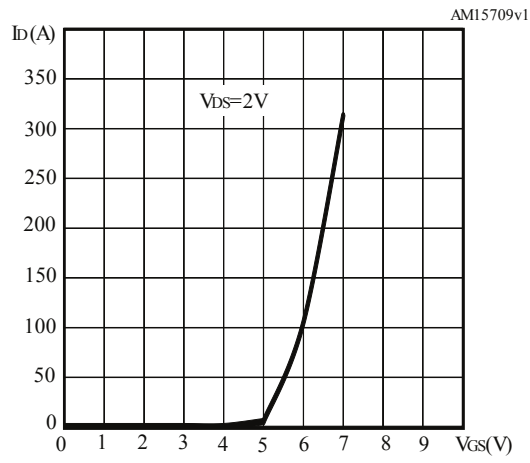


Figure 7. Typical output characteristics for H²PAK-2 and H²PAK-6

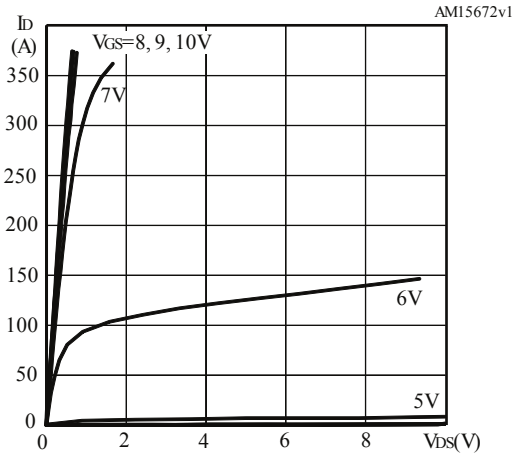


Figure 8. Typical transfer characteristics for H²PAK-2 and H²PAK-6

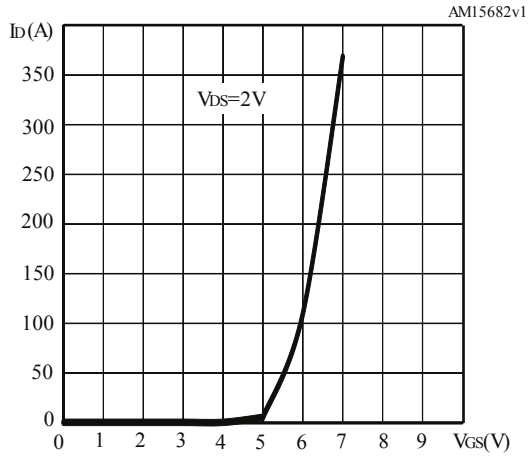


Figure 9. Normalized breakdown voltage vs temperature

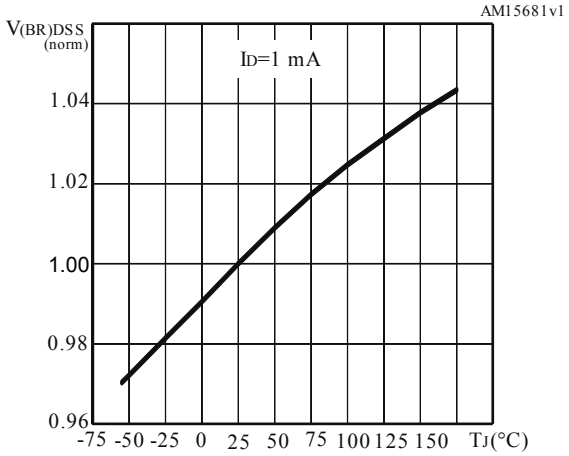


Figure 10. Typical drain-source on-resistance for H²PAK-2 and H²PAK-6

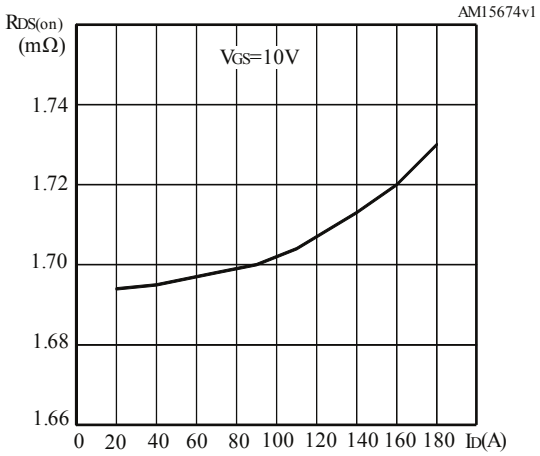


Figure 11. Typical drain-source on-resistance for TO-220

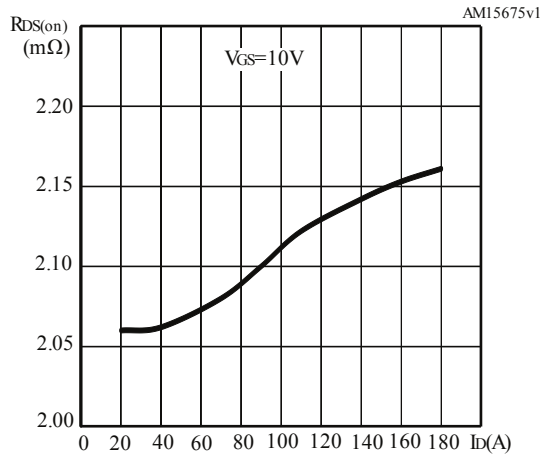


Figure 12. Typical capacitance characteristics

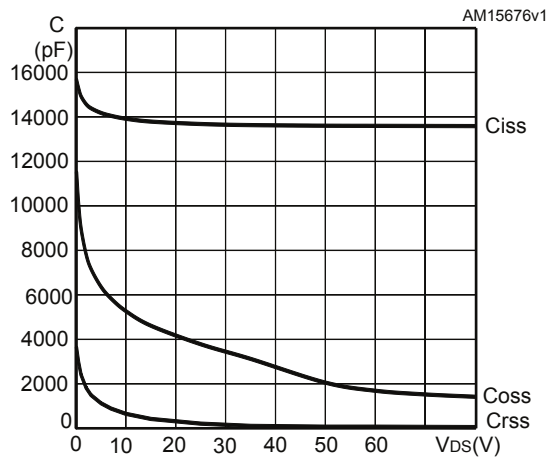


Figure 13. Typical reverse diode forward characteristics

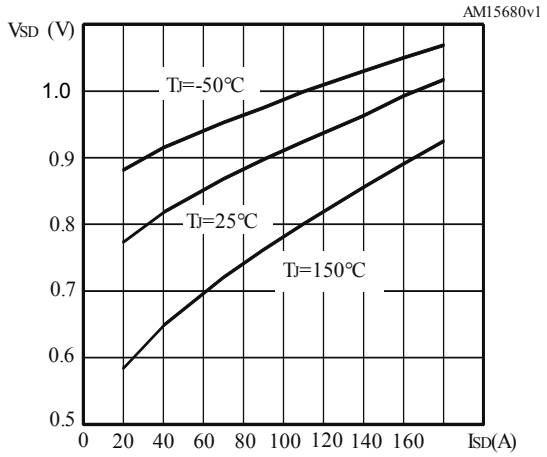


Figure 14. Normalized gate threshold vs temperature

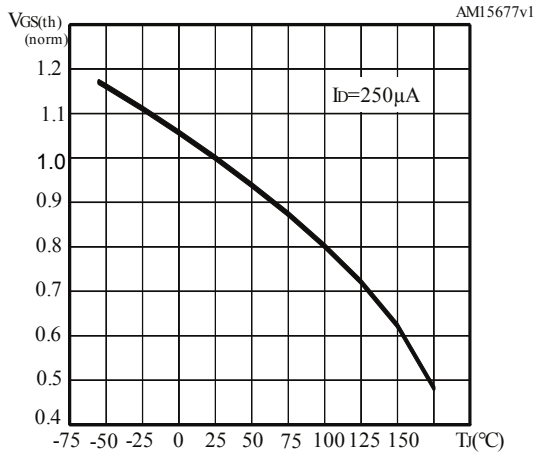


Figure 15. Normalized on-resistance vs temperature for H²PAK-2 and H²PAK-6

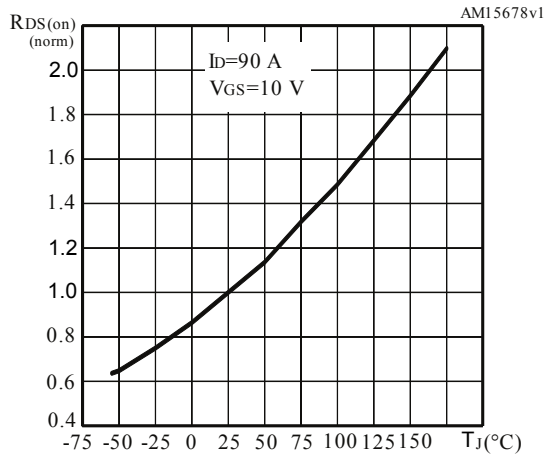
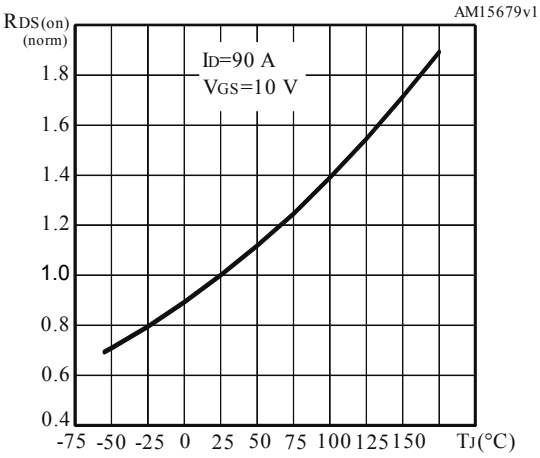


Figure 16. Normalized on-resistance vs temperature for TO-220



3 Test circuits

Figure 17. Test circuit for resistive load switching times

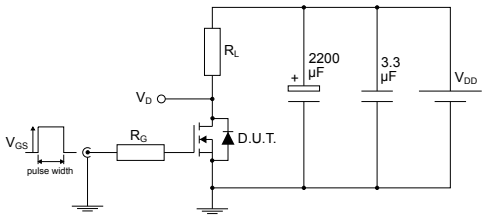


Figure 18. Test circuit for gate charge behavior

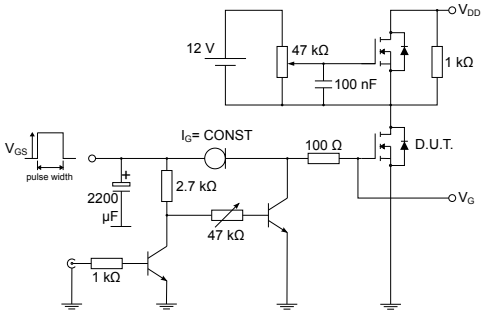


Figure 19. Test circuit for inductive load switching and diode recovery times

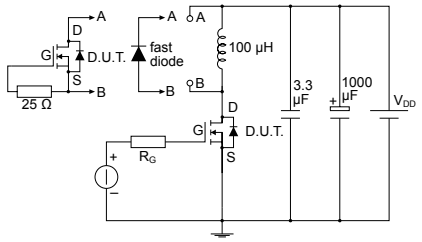


Figure 20. Unclamped inductive load test circuit

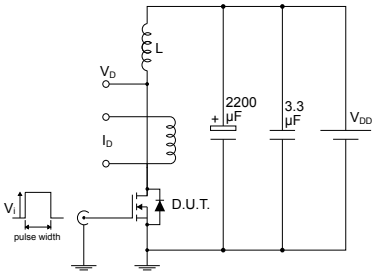


Figure 21. Unclamped inductive waveform

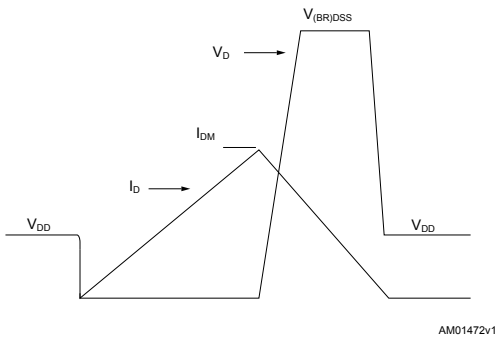
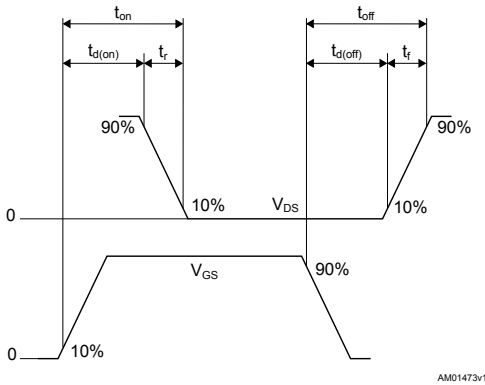


Figure 22. Switching time waveform



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 H²PAK-2 package information

Figure 23. H²PAK-2 package outline

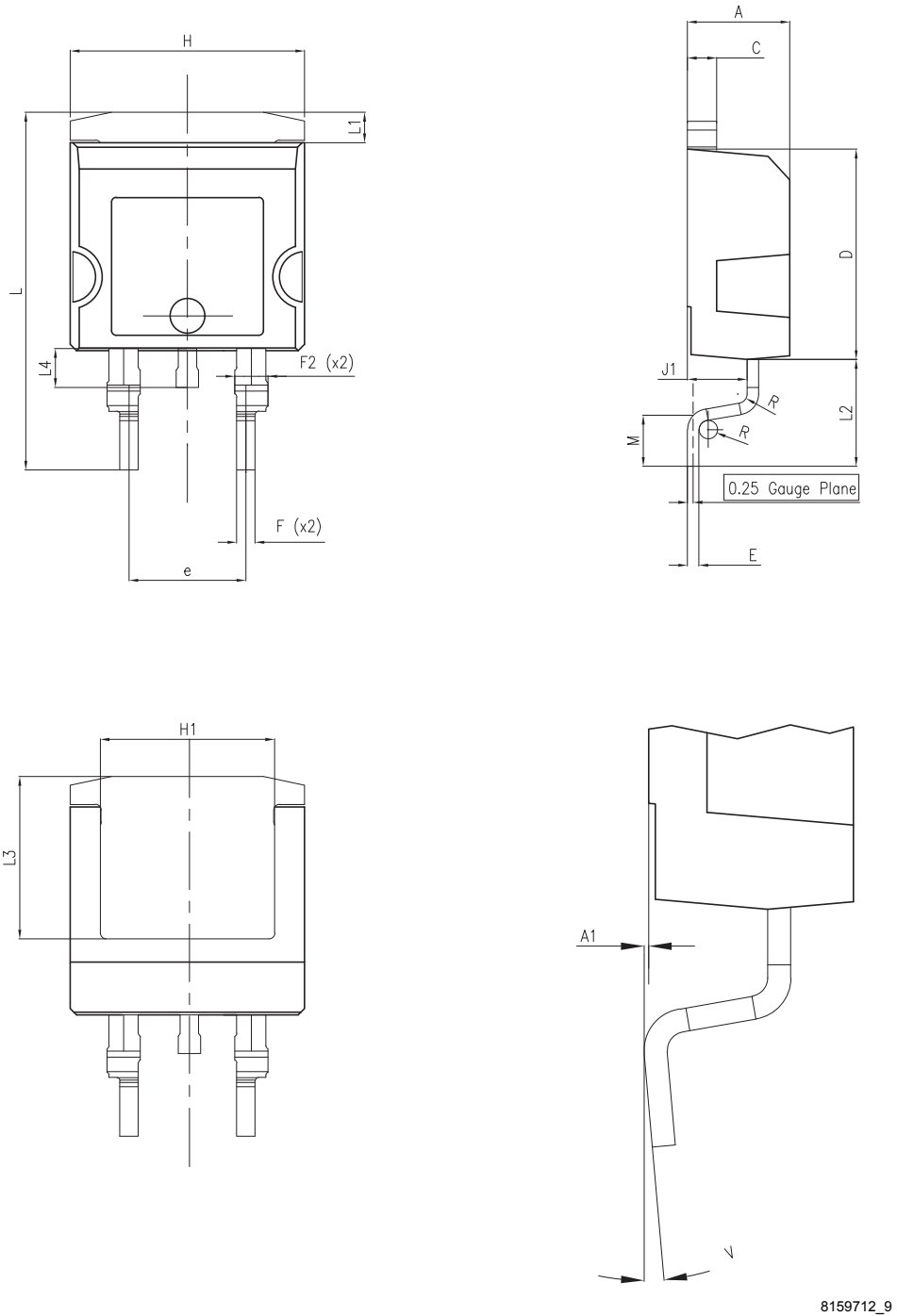
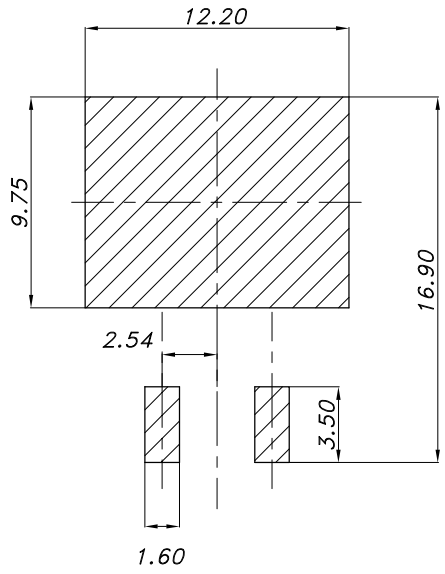


Table 7. **H²PAK-2 package mechanical data**

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 24. **H²PAK-2 recommended footprint**



Note: Dimensions are in mm.

4.2 H²PAK-6 package information

Figure 25. **H²PAK-6 package outline**

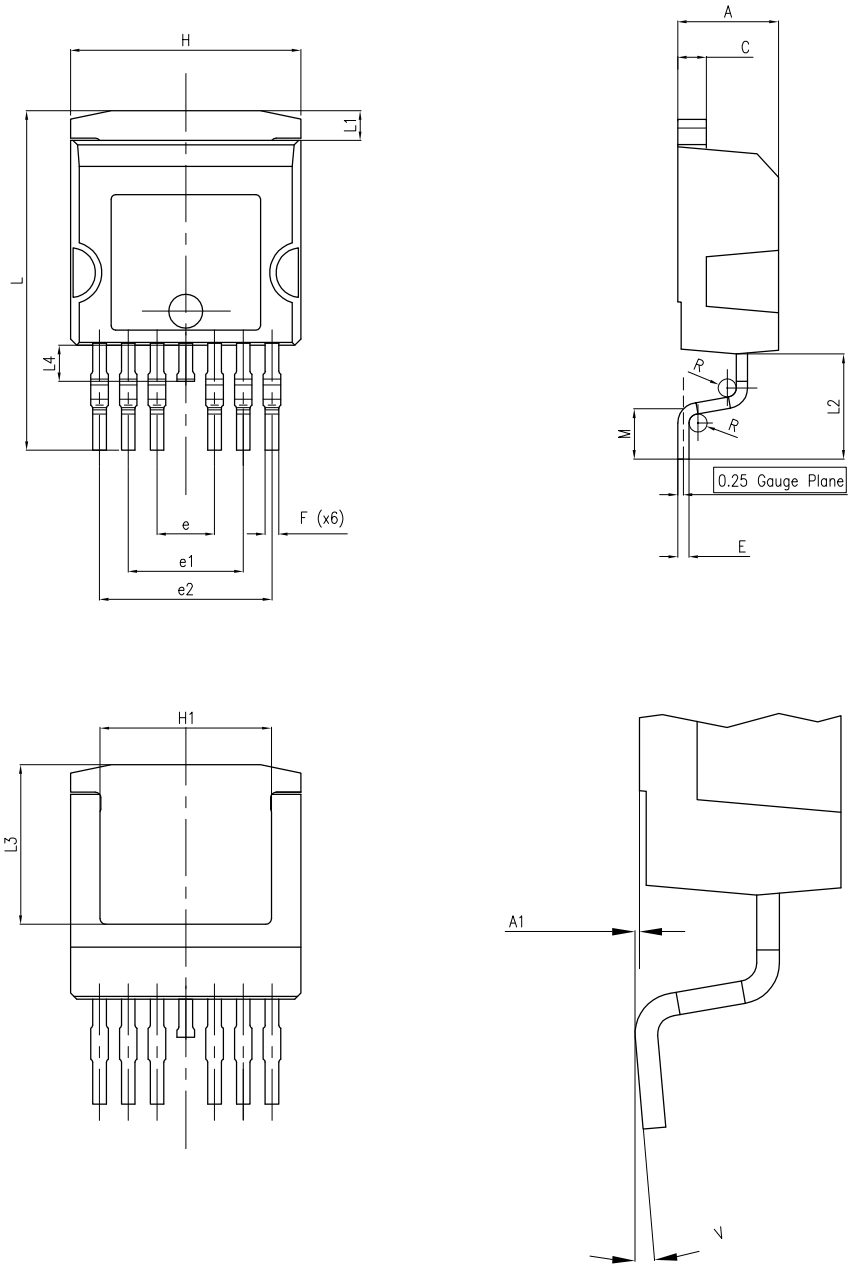


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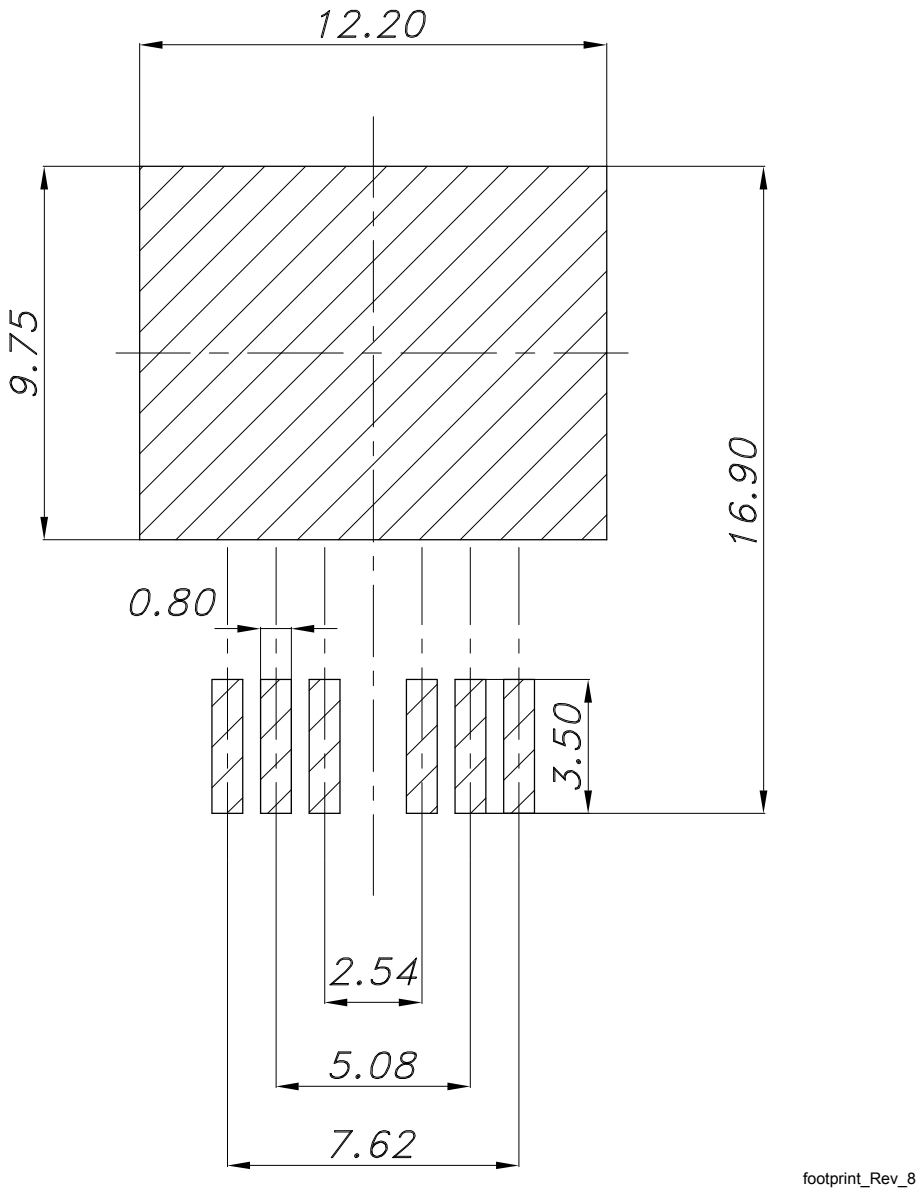
Table 8. **H²PAK-6 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
e	2.34	2.54	2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00		10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.50		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 26. **H²PAK-6 recommended footprint**



Note: Dimensions are in mm.

4.3 TO-220 type A package information

Figure 27. **TO-220 type A package outline**

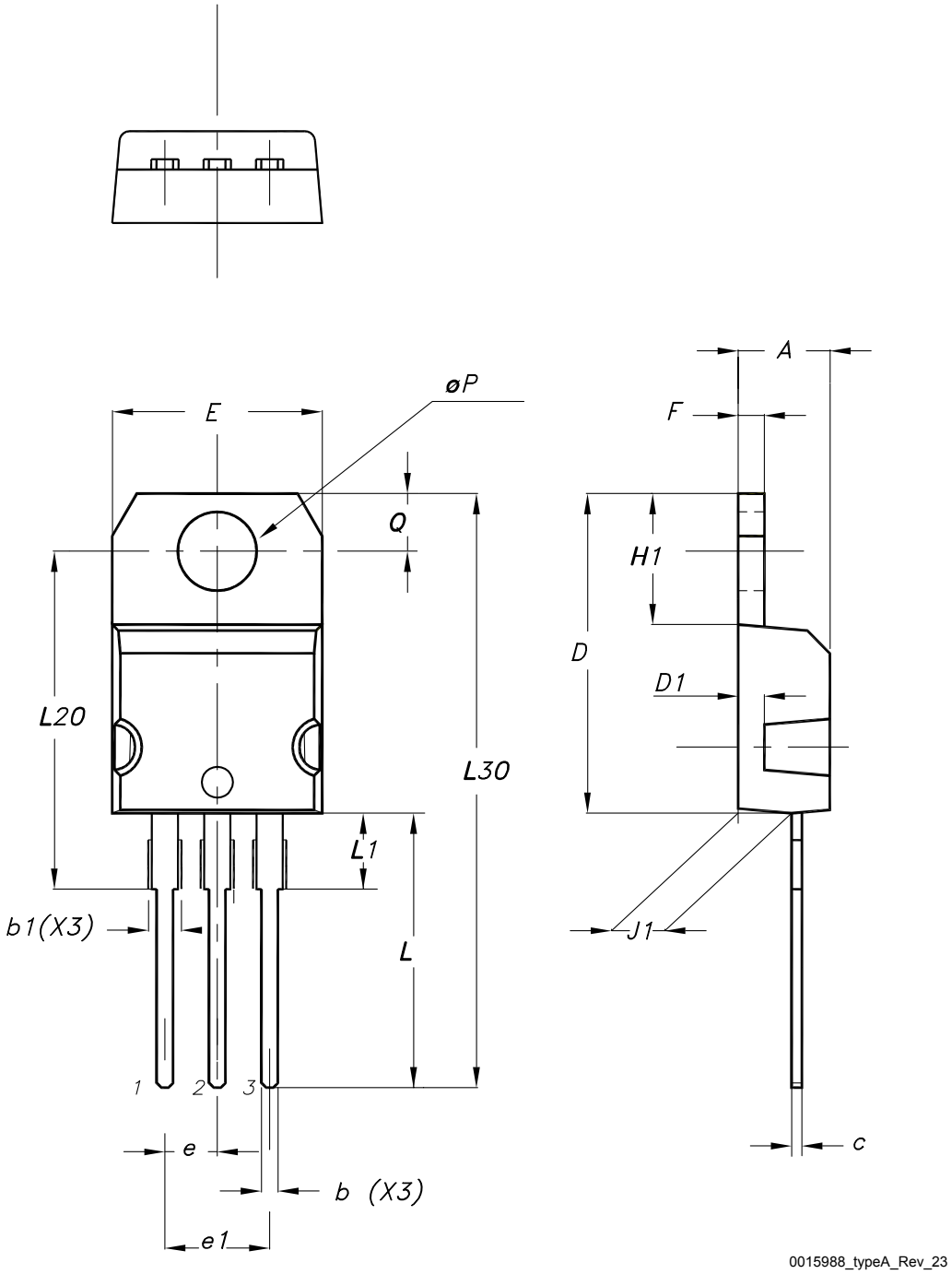


Table 9. **TO-220 type A package mechanical data**

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

4.4 Packing information

Figure 28. **Tape outline**

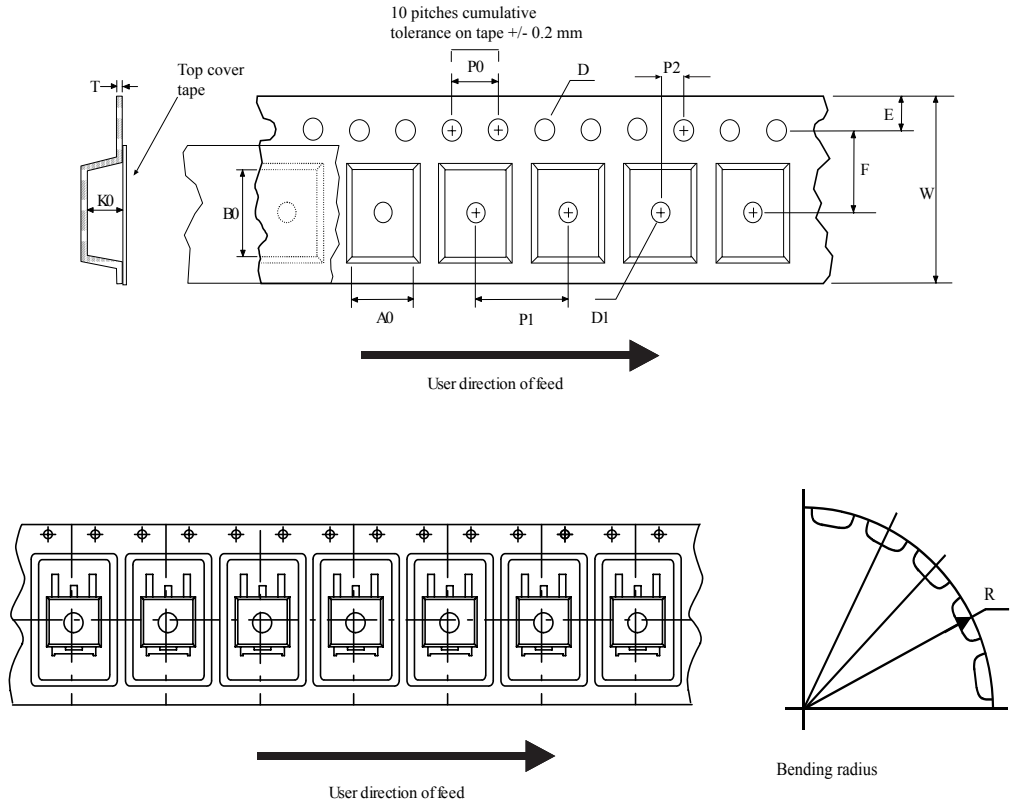


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Figure 29. **Reel outline**

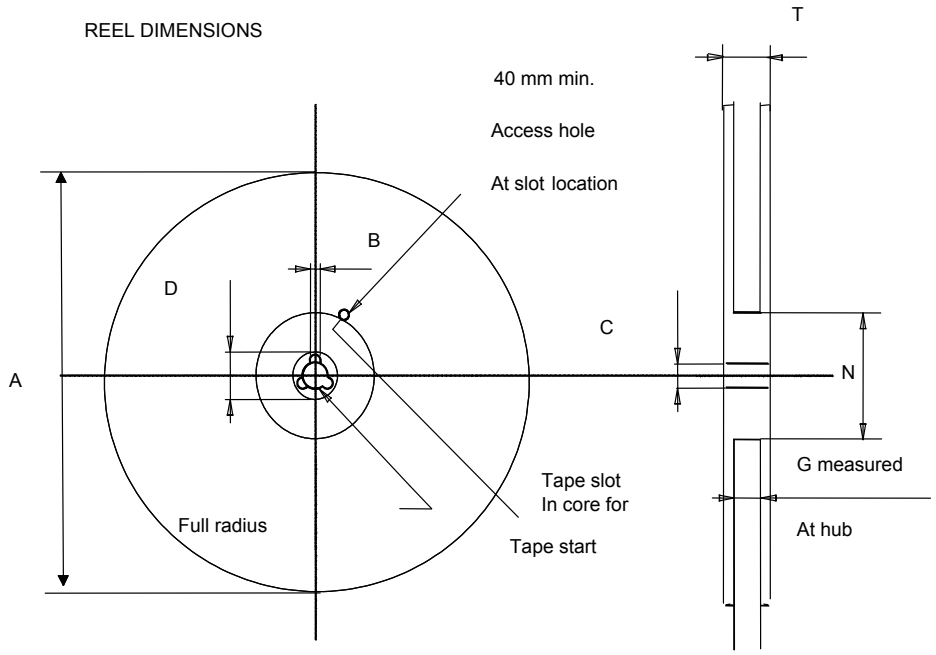

Table 10. **Tape and reel mechanical data**

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 11. **Order codes**

Order codes	Marking	Package	Packing
STH270N8F7-2	270N8F7	H²PAK-2	Tape and reel
STH270N8F7-6		H²PAK-6	
STP270N8F7		TO-220	Tube

Revision history

Table 12. **Document revision history**

Date	Version	Changes
03-Dec-2012	1	First release.
09-Apr-2013	2	– Modified: $R_{DS(on)\ max}$ values on *Features* table, I_{DSS}, I_{GSS} values on *Table 4*, $R_{DS(on)}$ value for H²PAK-2, the entire typical values on *Table 5* and 6, V_{SD} test conditions and max values, T_{RR}, Q_{RR}, I_{RRM} typical values on *Table 7* – Inserted: *Section 3: Electrical characteristics (curves)* – Document status promoted to preliminary data to production data – Added: H²PAK-6 package – Minor text changes
11-Oct-2013	3	– Modified: C_{rss} typical value in *Table 5* – Updated: *Section 5: Package information* – Updated: *Figure 18, 19, 20* and *21* – Minor text changes
14-May-2015	4	– Updated title, features and description in cover page. – Minor text changes
12-Mar-2021	5	Modified Table 3. On/off states. Minor text changes.

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