STH315N10F7-2, STH315N10F7-6

Automotive-grade N-channel 100 V, 2.1 mΩ typ., 180 A STripFET™ F7 Power MOSFETs

Datasheet - production data

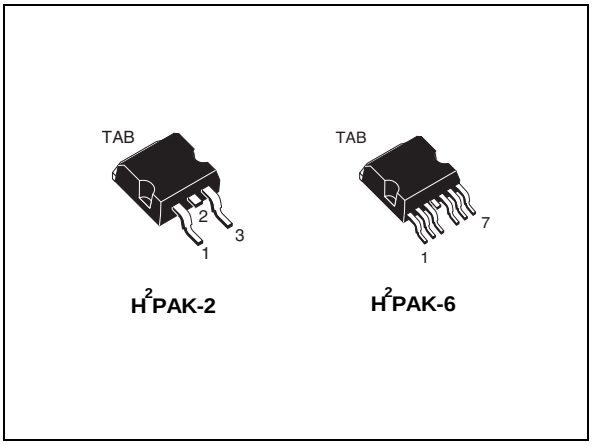
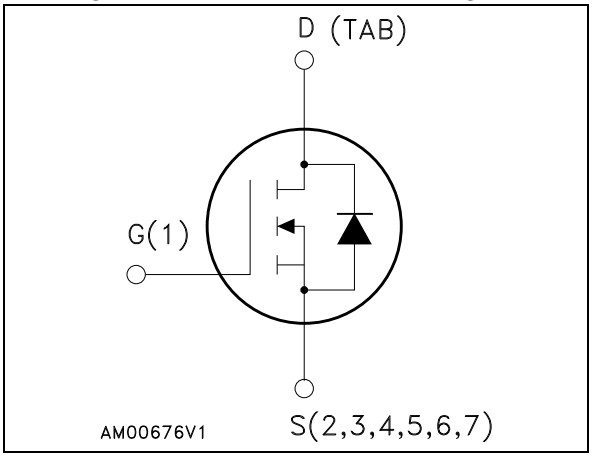


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STH315N10F7-2	100 V	2.3 mΩ	180 A
STH315N10F7-6			

- Designed for automotive applications and AEC-Q101 qualified
- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- 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.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STH315N10F7-2	315N10F7	H^2PAK-2	Tape and reel
STH315N10F7-6		H^2PAK-6	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	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	120	A
I_{DM} (2)	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at T_C = 25°C	315	W
	Derating factor	2.1	W/°C
E_{AS}(3)	Single pulse avalanche energy (T_J = 25 °C, L=0.55 mH, I_{as}= 65 A)	1	J
T_j T_{stg}	Operating junction temperature storage temperature	- 55 to 175	°C

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. Starting T_J=25°C, I_D=60 A, V_{DD}=50 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.48	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb max	35	°C/W

1. When mounted on 1 inch² FR-4 board, 2oz Cu

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified).

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS}= 0, I_D = 250 µA	100			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS}= 100 V			1	µA
		V_{GS} = 0, V_{DS}= 100 V, T_C= 125°C			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0, V_{GS} = 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	2.5	3.5	4.5	V
$R_{DS(on)}$	Static drain-source on- resistance	V_{GS}= 10 V, I_D= 60 A		2.1	2.3	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	-	12800	-	pF
C_{oss}	Output capacitance		-	3500	-	pF
C_{rss}	Reverse transfer capacitance		-	170	-	pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 180 A, V_{GS} = 10 V (see *Figure 14*)	-	180	-	nC
Q_{gs}	Gate-source charge		-	78	-	nC
Q_{gd}	Gate-drain charge		-	34	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50 V, I_D = 90 A R_G = 4.7 Ω V_{GS} = 10 V (see *Figure 13*, *Figure 18*)	-	62	-	ns
t_r	Rise time		-	108	-	ns
$t_{d(off)}$	Turn-off delay time		-	148	-	ns
t_f	Fall time		-	40	-	ns

Table 7. 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)	Forward on voltage	I_{SD}=60 A, V_{GS}=0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD}=180 A, di/dt = 100 A/µs, V_{DD}=80 V, T_j=150°C (see *Figure 15*)	-	85		ns
Q_{rr}	Reverse recovery charge		-	200		nC
I_{RRM}	Reverse recovery current		-	4.7		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

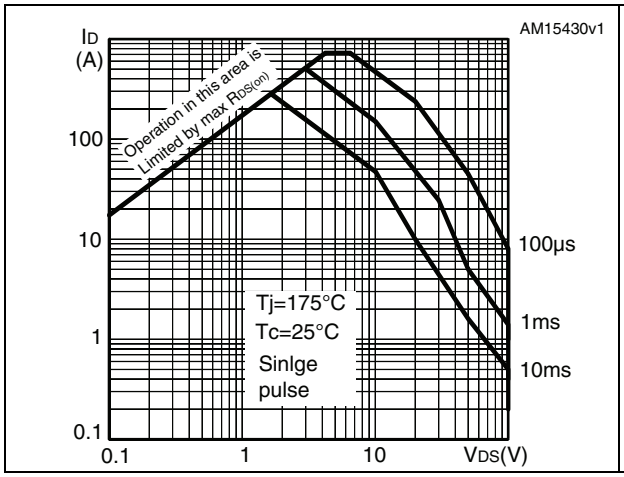


Figure 3. Thermal impedance

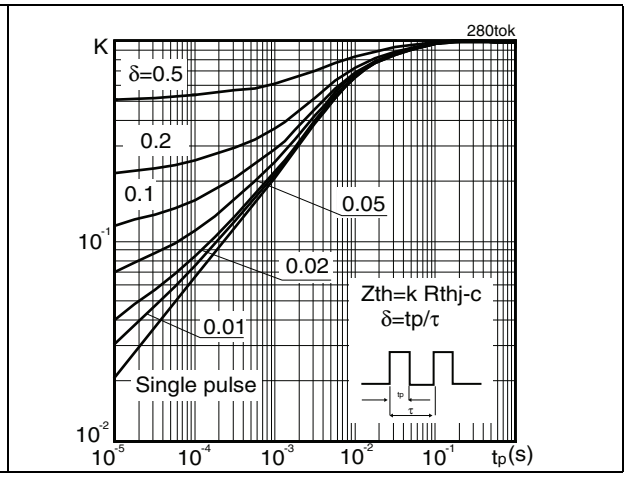


Figure 4. Output characteristics

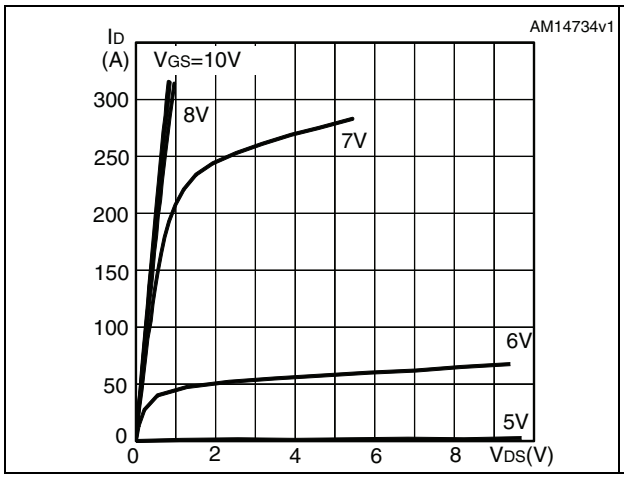


Figure 5. Transfer characteristics

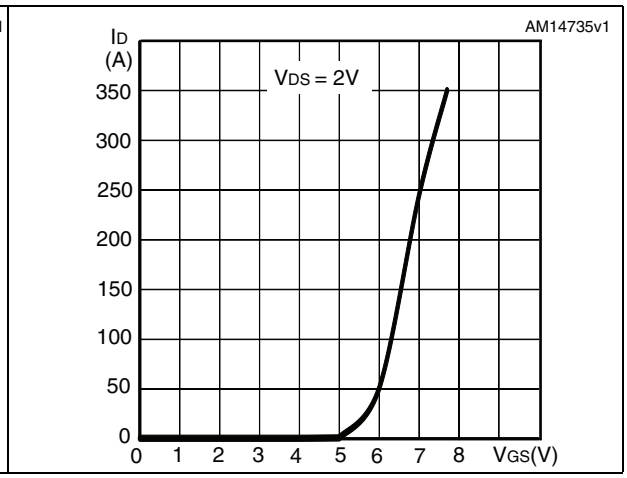


Figure 6. Gate charge vs gate-source voltage

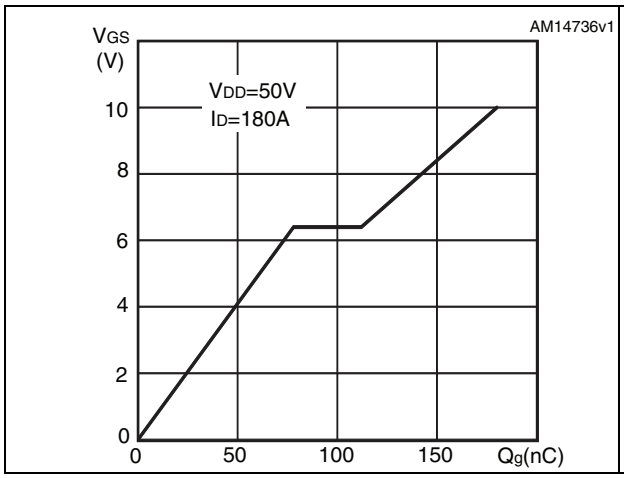


Figure 7. Static drain-source on-resistance

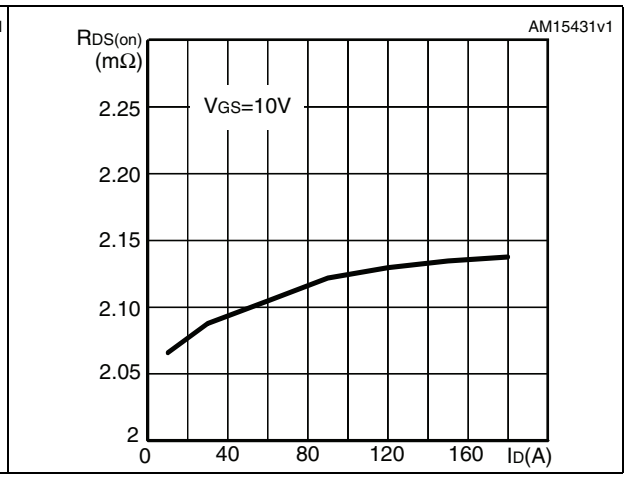


Figure 8. Normalized $V_{(BR)DSS}$ vs temperature

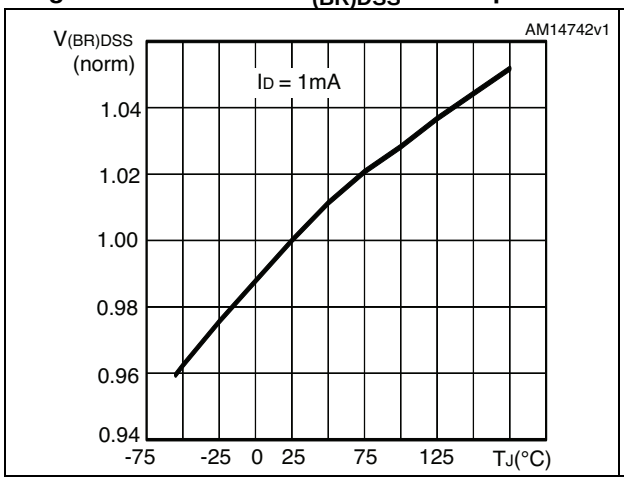


Figure 9. Capacitance variations

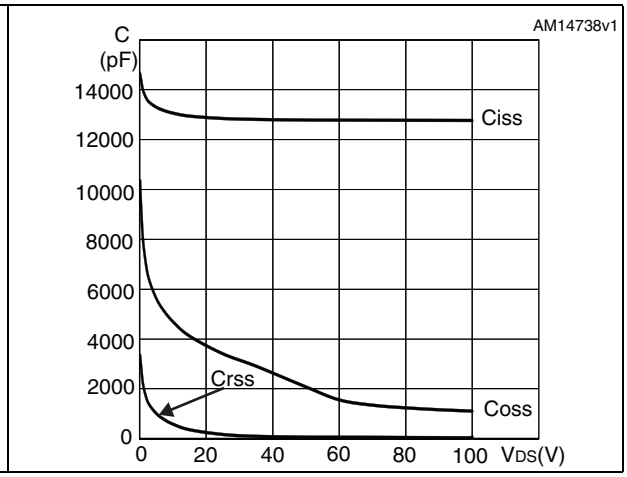


Figure 10. Source-drain diode forward characteristics

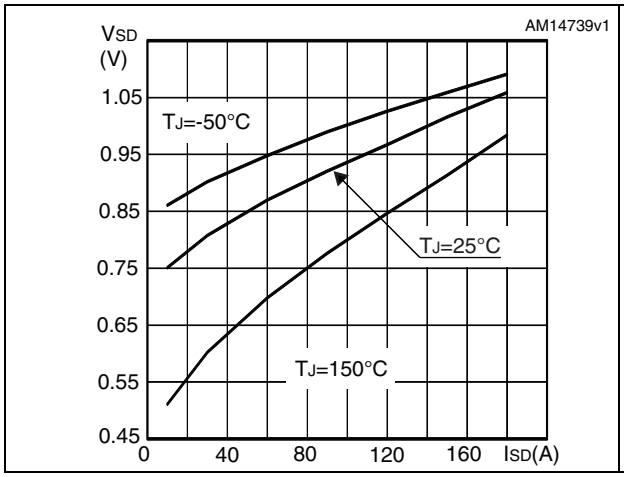


Figure 11. Normalized gate threshold voltage vs temperature

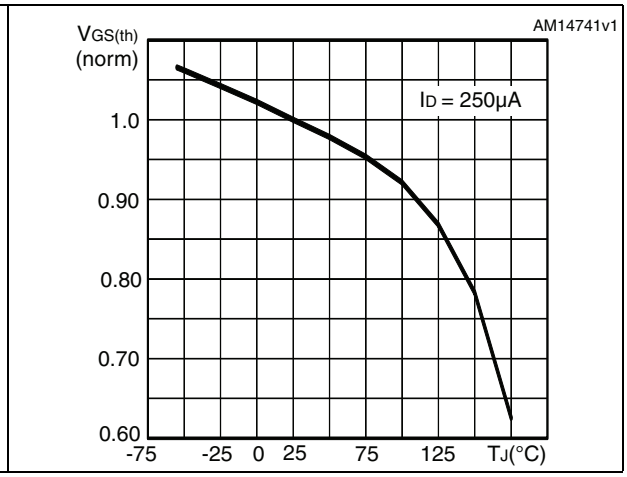
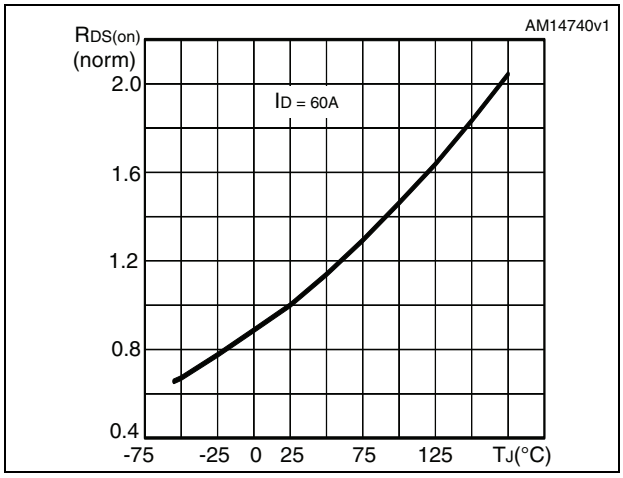


Figure 12. Normalized on-resistance vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

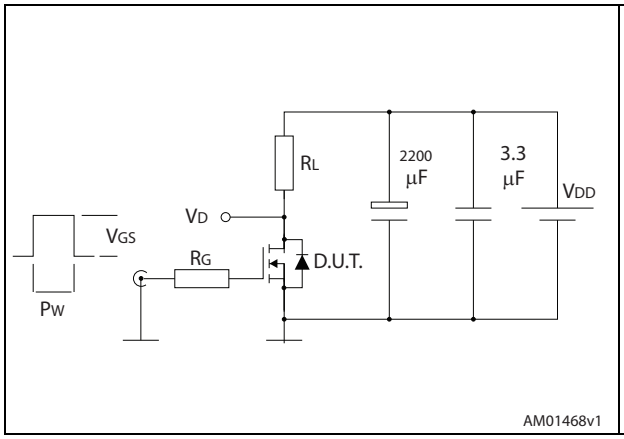


Figure 14. Gate charge test circuit

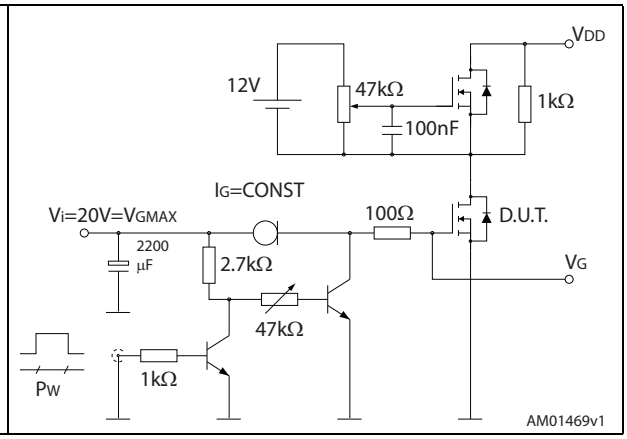


Figure 15. Test circuit for inductive load switching and diode recovery times

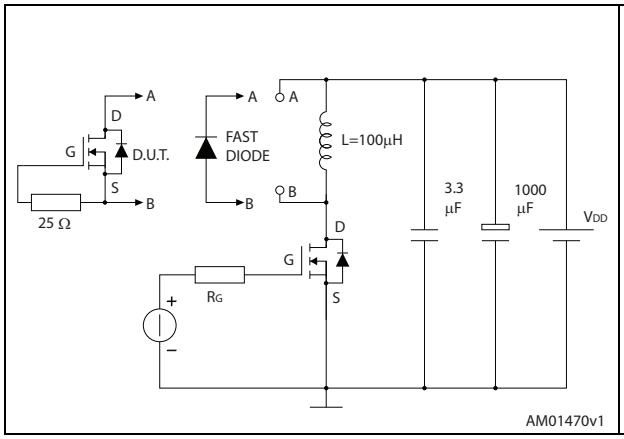


Figure 16. Unclamped inductive load test circuit

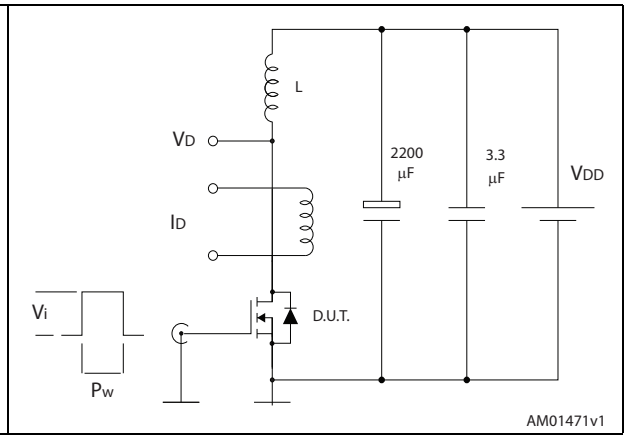


Figure 17. Unclamped inductive waveform

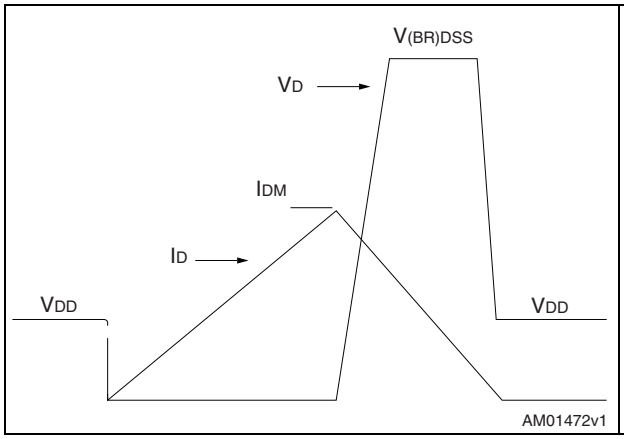
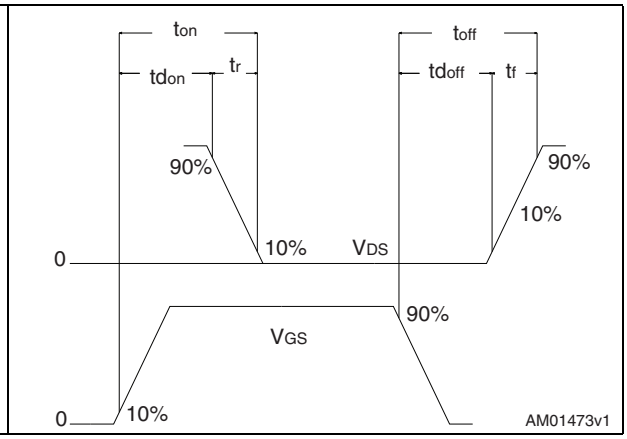


Figure 18. Switching time waveform



4 Package mechanical data

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, STH315N10F7-2

Figure 19. H²PAK-2 drawing

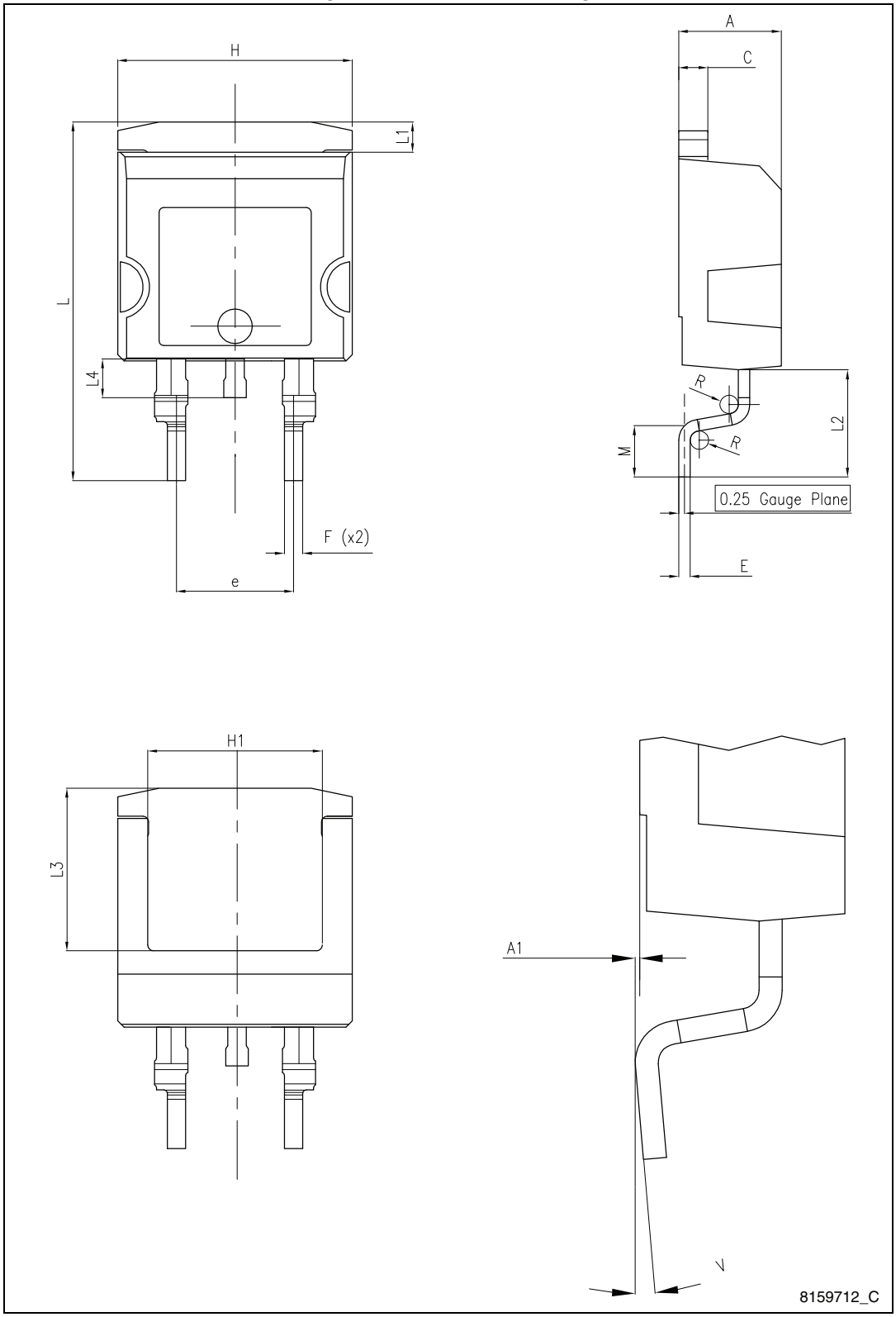
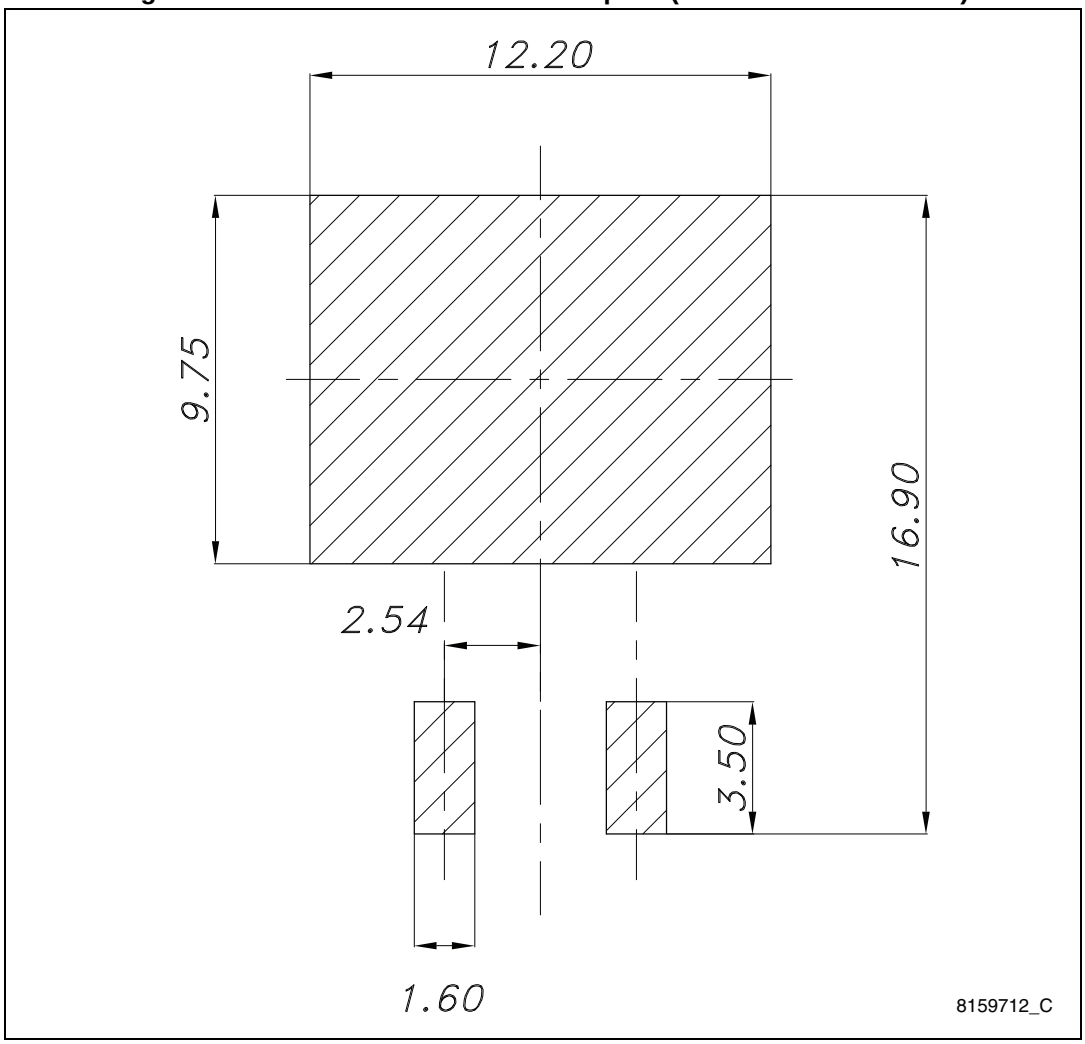


Table 8. H²PAK-2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30	-	4.80
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

Figure 20. H²PAK-2 recommended footprint (dimensions are in mm)



4.2 H²PAK-6, STH315N10F7-6

Figure 21. H²PAK-6 drawing

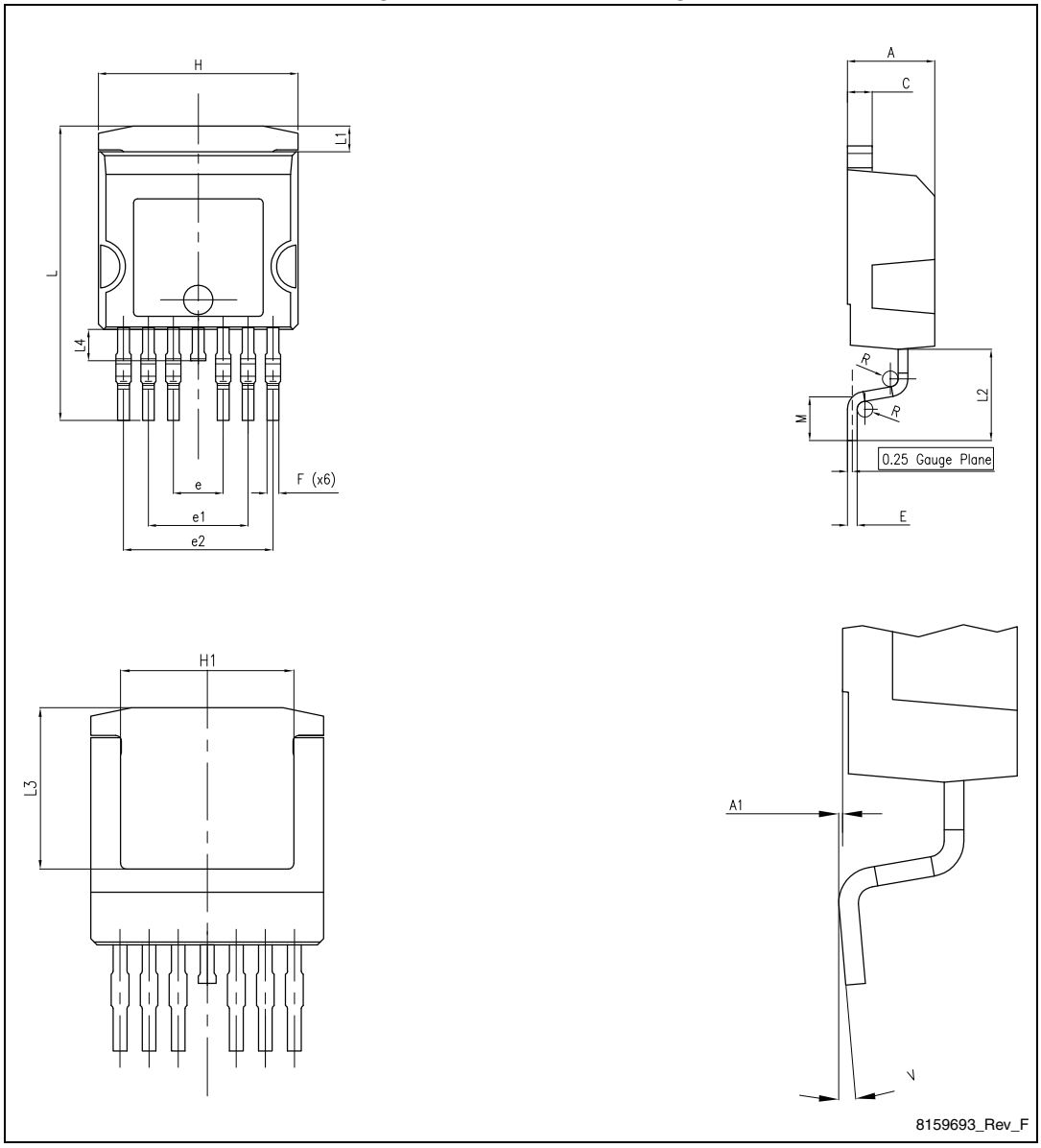
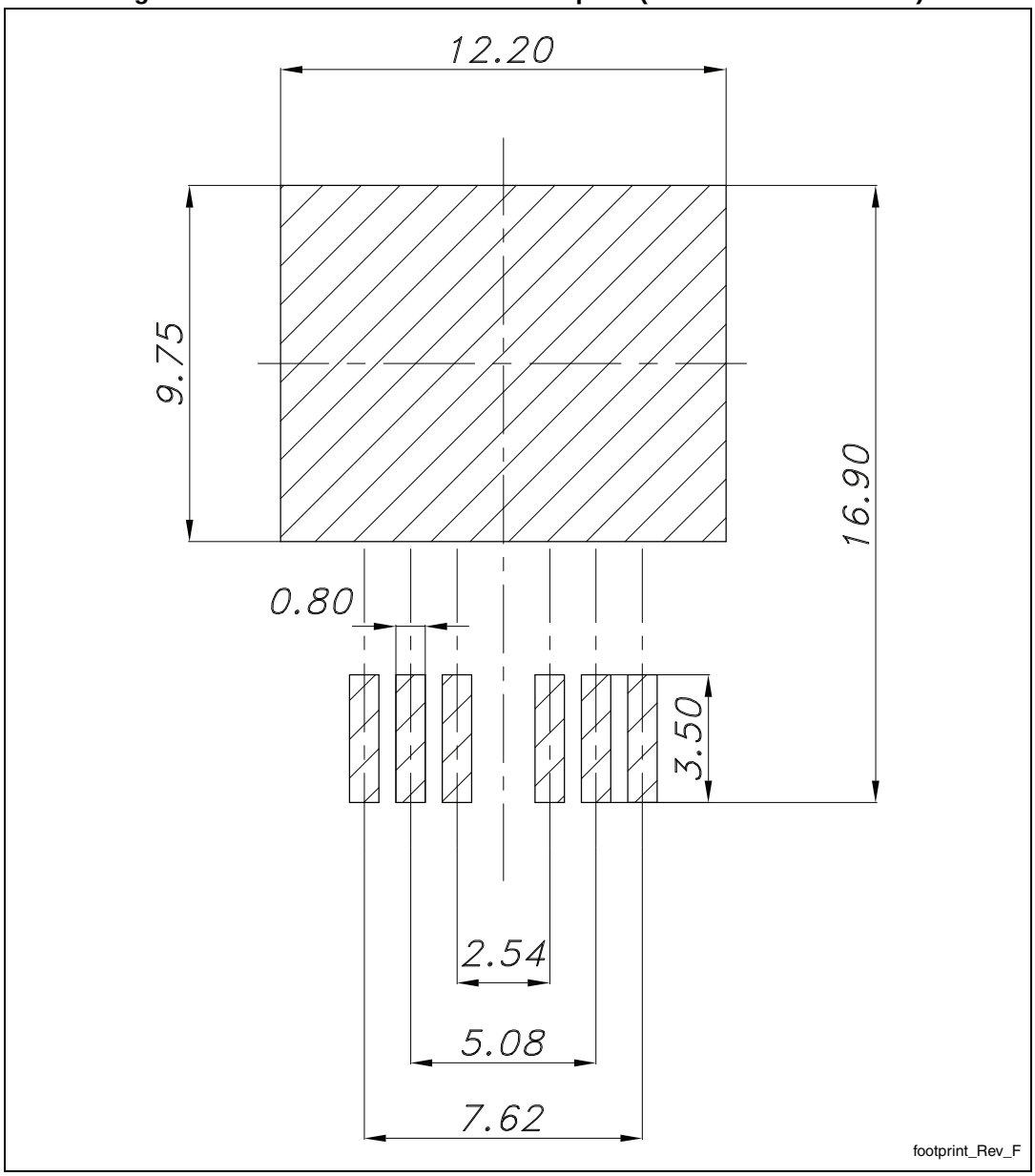


Table 9. H²PAK-6 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		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	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 22. H²PAK-6 recommended footprint (dimensions are in mm)



5 Packaging mechanical data

Figure 23. Tape

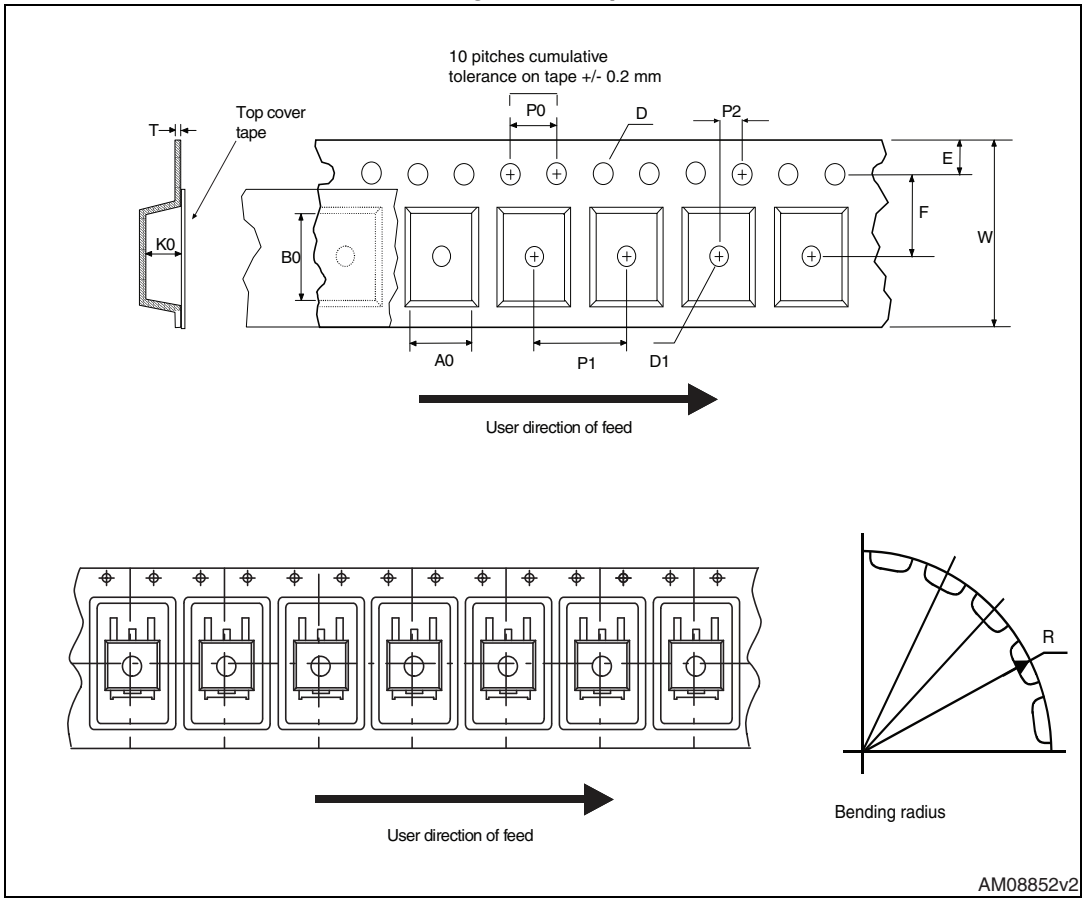
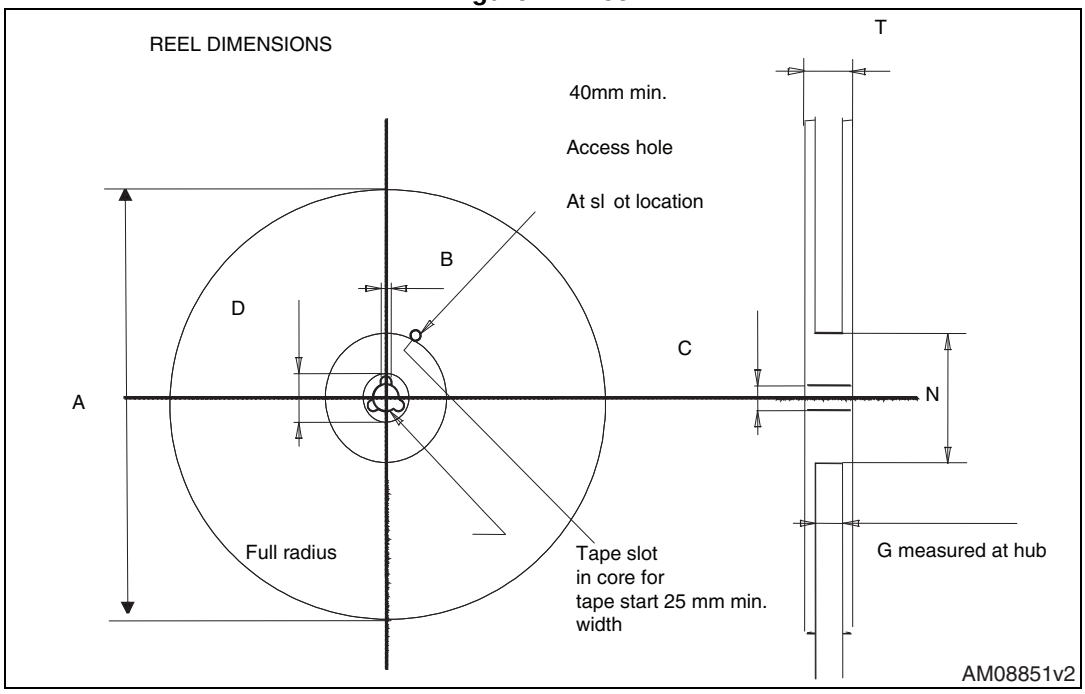


Table 10. Tape and reel mechanical data

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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 24. Reel



6 Revision history

Table 11. Document revision history

Date	Revision	Changes
02-Aug-2013	1	Initial release.
03-Sep-2013	2	– Modified: *Table 1*, $R_{DS(on)}$ typical value in *Table 4* – Minor text changes
27-May-2014	3	– Modified: title and *Features* in cover page – Updated: *Section 4: Package mechanical data* – Minor text changes
12-Sep-2014	4	– Modified: title, features and description in cover page.