

Automotive-grade N-channel 80 V, 3.15 mΩ typ., 120 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

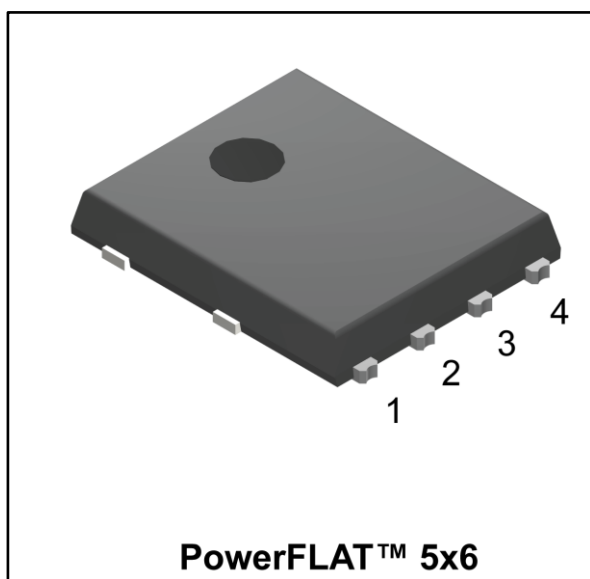
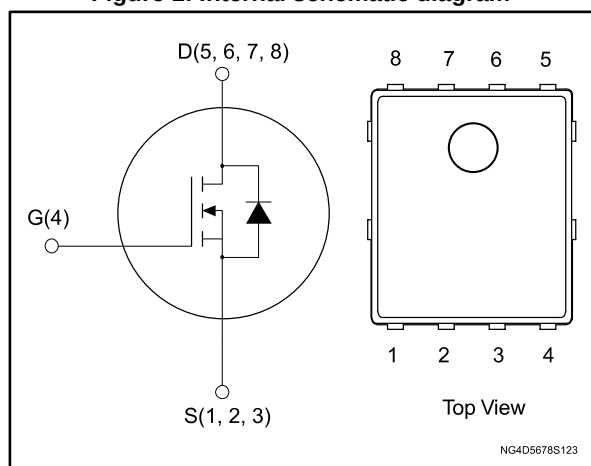


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL135N8F7AG	80 V	3.6 mΩ	120 A	135 W

- Designed for automotive applications and AEC-Q101 qualified
- 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
- Wettable flank package

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes 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 code	Marking	Package	Packing
STL135N8F7AG	135N8F7	PowerFLAT™ 5x6	Tape and reel

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1 Electrical ratings

Table 2: 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 $T_{case} = 25\text{ }^{\circ}\text{C}$	120	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	98	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	480	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	26	A
	Drain current (continuous) at $T_{pcb} = 100\text{ }^{\circ}\text{C}$	19	
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	104	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	135	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	4.8	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.2	J
T_{stg}	Storage temperature range	-55 to 175	$^{\circ}\text{C}$
T_j	Operating junction temperature range		

Notes:

- (1) This value is rated according to R_{thj-c}
 (2) Pulse width is limited by safe operating area
 (3) This value is rated according to $R_{thj-pcb}$
 (4) Starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = 13\text{ A}$, $V_{DD} = 50\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	$^{\circ}\text{C/W}$
$R_{thj-case}$	Thermal resistance junction-case	1.1	

Notes:

- (1) When mounted on a 1-inch² FR-4 board, 2oz Cu, $t < 10\text{ s}$

2 Electrical characteristics

($T_{\text{case}} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	80			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 80\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 80\text{ V}$, $T_{\text{j}} = 125\text{ }^{\circ}\text{C}$ ⁽¹⁾			10	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = 20\text{ V}$			100	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	2.5		4.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 13\text{ A}$		3.15	3.6	m Ω

Notes:

⁽¹⁾Defined by design, not subject to production test

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 40\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	6800	-	pF
C_{oss}	Output capacitance		-	1350	-	
C_{rss}	Reverse transfer capacitance		-	95	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 40\text{ V}$, $I_{\text{D}} = 26\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	103	-	nC
Q_{gs}	Gate-source charge		-	35	-	
Q_{gd}	Gate-drain charge		-	28	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 40\text{ V}$, $I_{\text{D}} = 13\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	30	-	ns
t_{r}	Rise time		-	28	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	73	-	
t_{f}	Fall time		-	30	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		26	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		104	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 26\text{ A}$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 26\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 64\text{ V}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	47		ns
Q_{rr}	Reverse recovery charge		-	66		nC
I_{RRM}	Reverse recovery current		-	2.8		A

Notes:

(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 2: Safe operating area

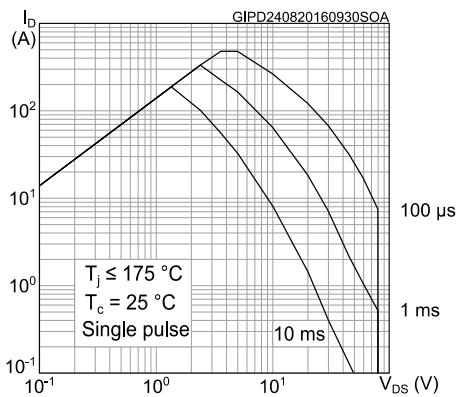


Figure 3: Thermal impedance

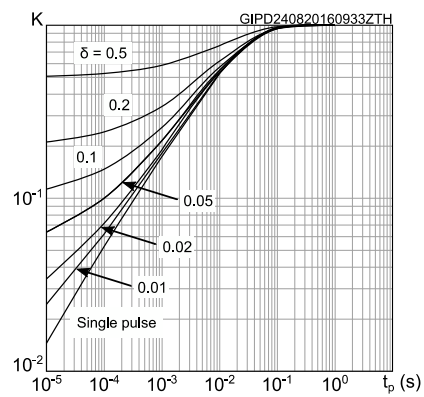


Figure 4: Output characteristics

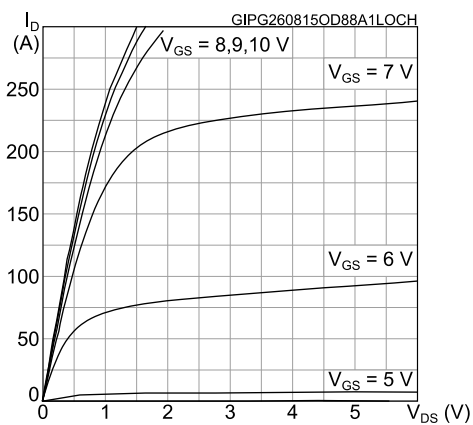


Figure 5: Transfer characteristics

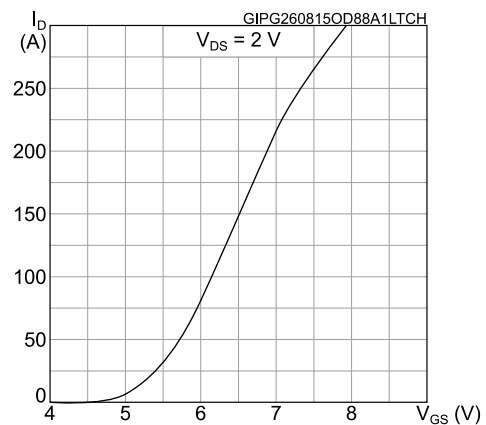


Figure 6: Gate charge vs gate-source voltage

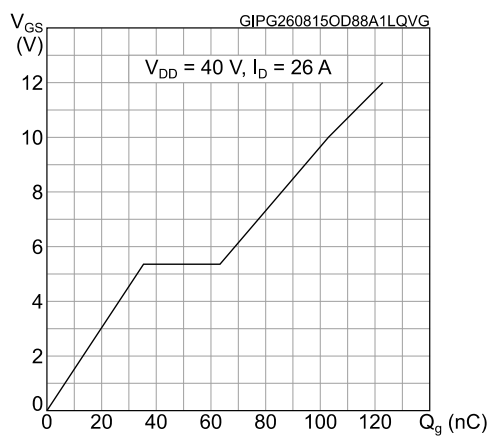


Figure 7: Static drain-source on-resistance

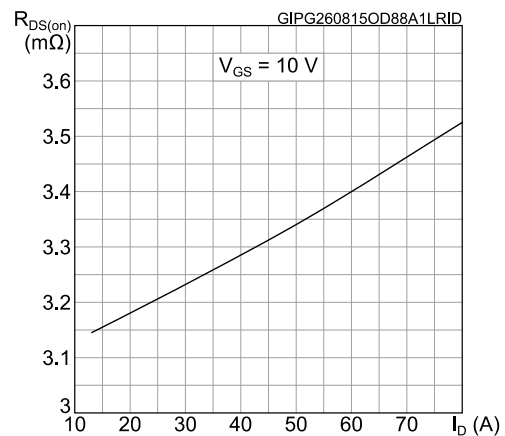


Figure 8: Capacitance variations

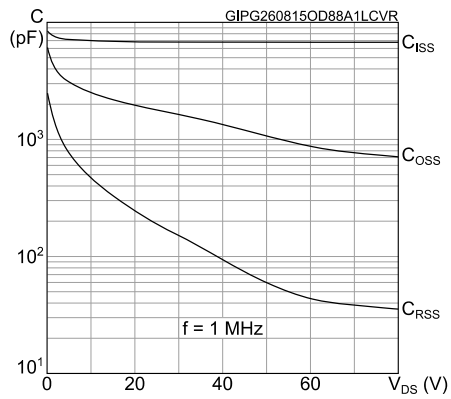


Figure 9: Normalized gate threshold voltage vs temperature

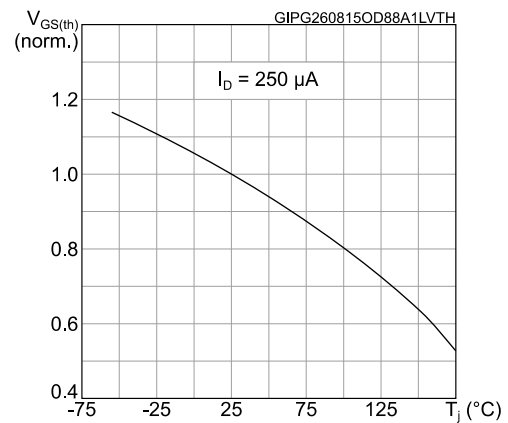


Figure 10: Normalized on-resistance vs temperature

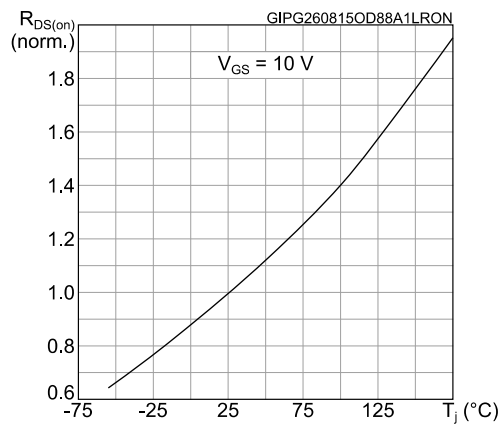
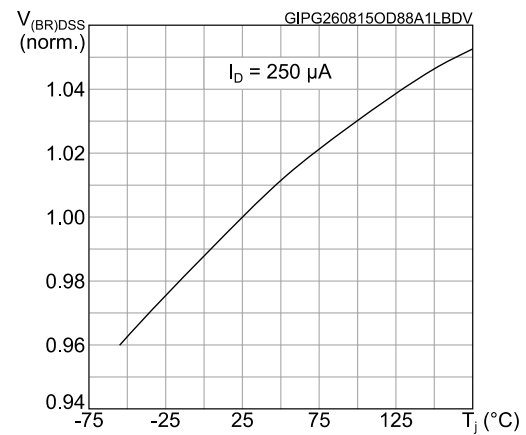
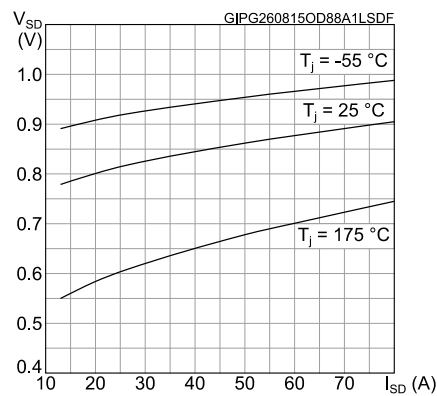
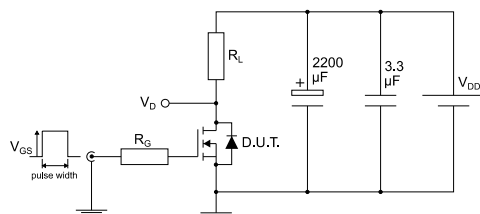
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



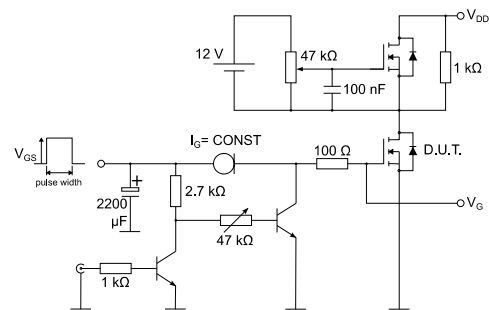
3 Test circuits

Figure 13: Test circuit for resistive load switching times



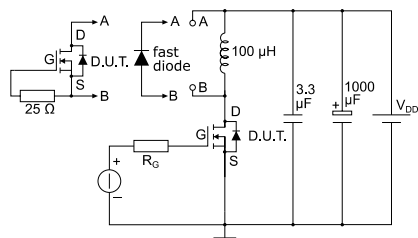
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Figure 14: Test circuit for gate charge behavior



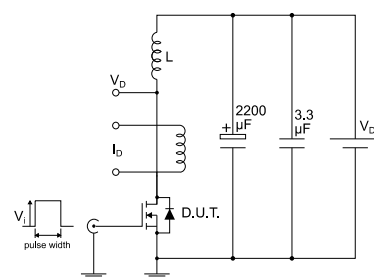
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Figure 15: Test circuit for inductive load switching and diode recovery times



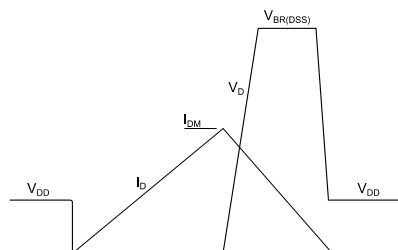
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Figure 16: Unclamped inductive load test circuit



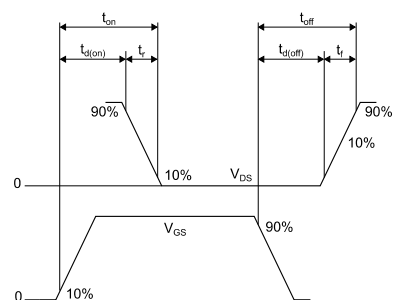
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Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

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 PowerFLAT™ 5x6 WF type C package information

Figure 19: PowerFLAT™ 5x6 WF type C package outline

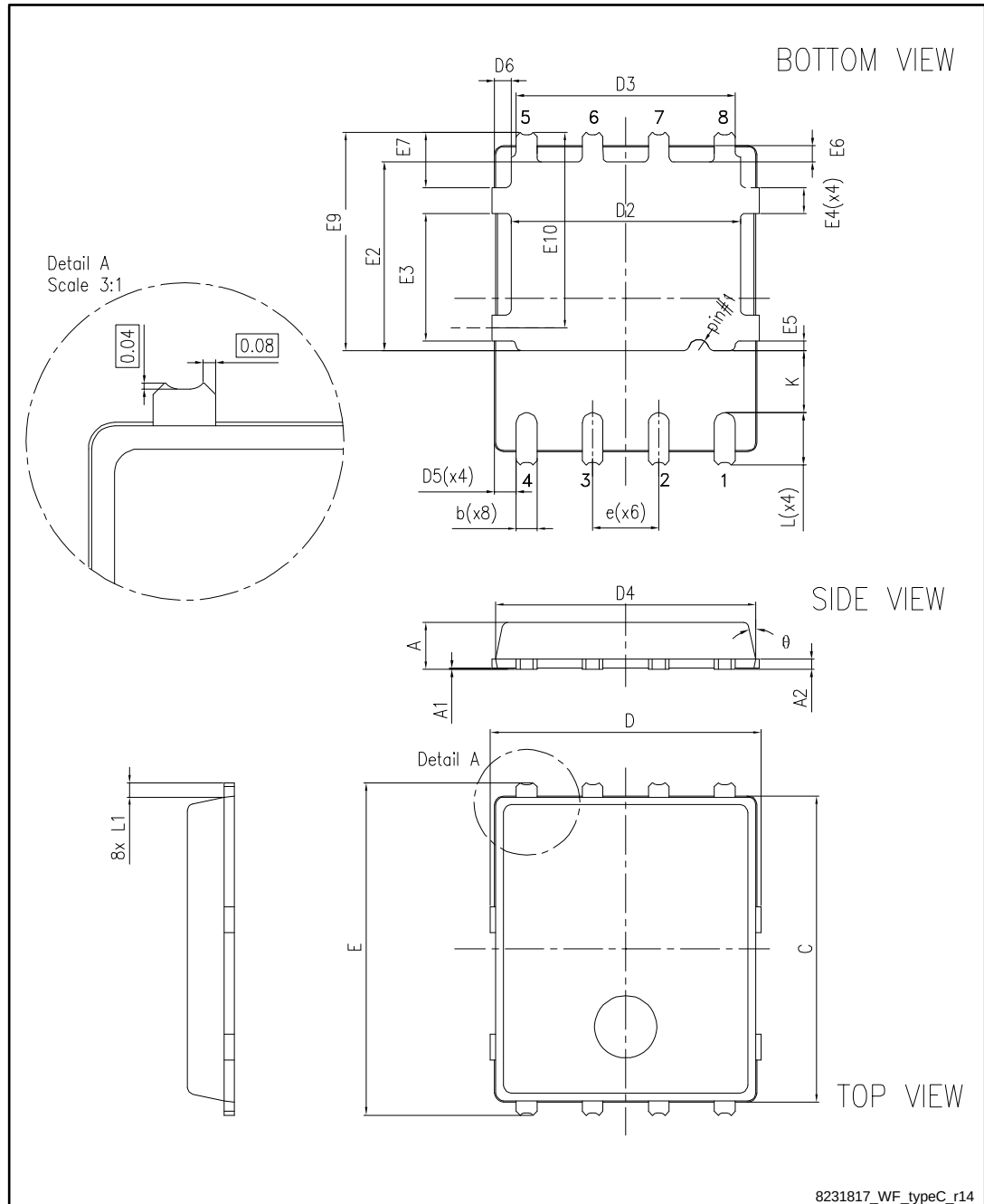
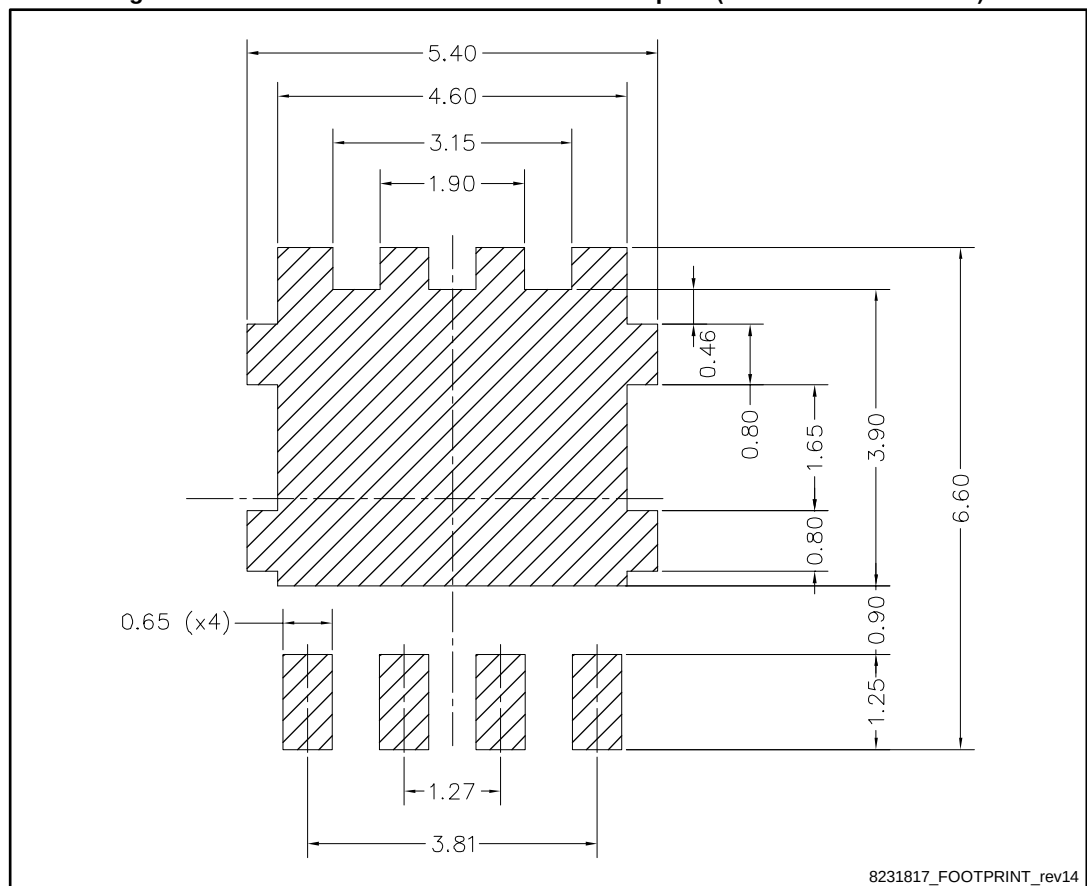


Table 8: PowerFLAT™ 5x6 WF type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
C	5.80	6.00	6.10
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.00	5.10
D5	0.25	0.40	0.55
D6	0.15	0.30	0.45
e		1.27	
E	6.20	6.40	6.60
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
E6	0.20	0.325	0.45
E7	0.85	1.00	1.15
E9	4.00	4.20	4.40
E10	3.55	3.70	3.85
K	1.05		1.35
L	0.90	1.00	1.10
L1	0.175	0.275	0.375
θ	0°		12°

Figure 20: PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



4.2 PowerFLAT™ 5x6 WF packing information

Figure 21: PowerFLAT™ 5x6 WF tape (dimensions are in mm)

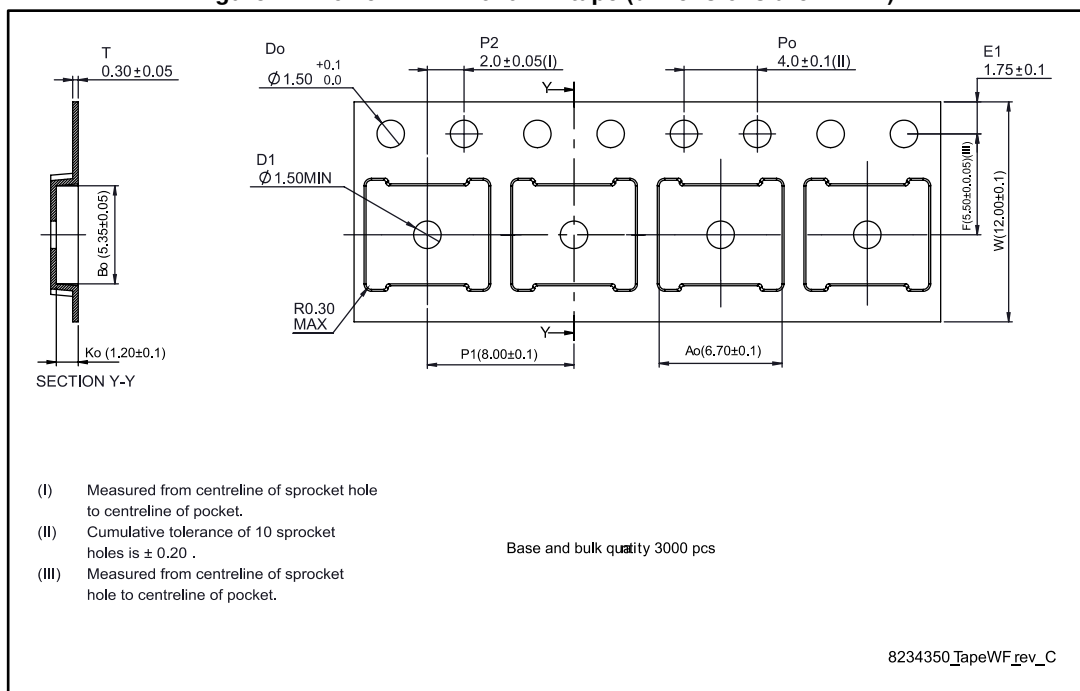


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

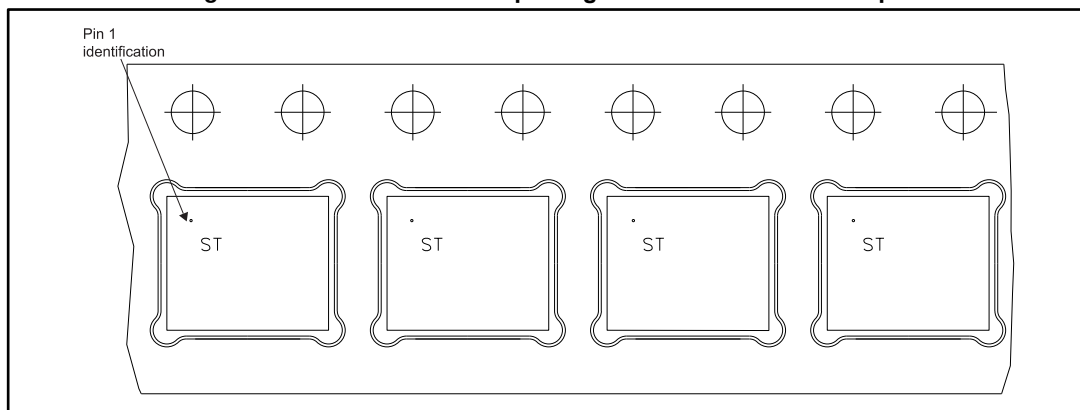
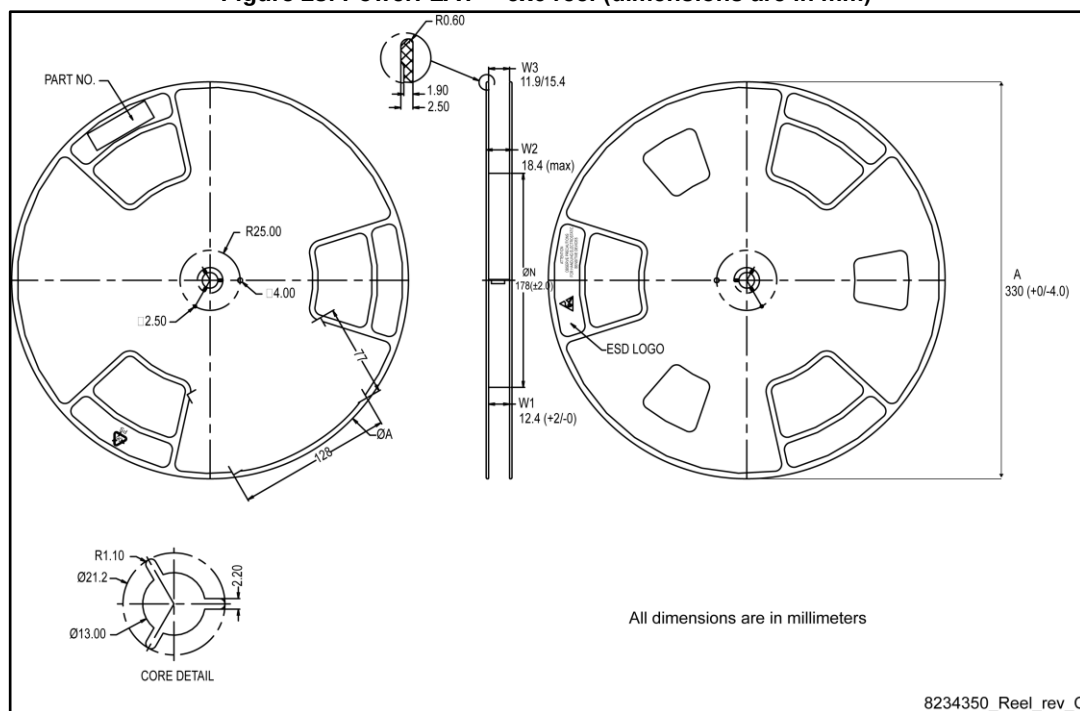


Figure 23: PowerFLAT™ 5x6 reel (dimensions are in mm)



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
07-Sep-2015	1	First release.
15-Sep-2015	2	Minor text edits. On cover page: - updated Title and Features.
26-Jan-2016	3	Updated <i>Table 2: "Absolute maximum ratings"</i> and <i>Section 4.1: "PowerFLAT™ 5x6 WF type C package information"</i> .
16-Sep-2016	4	Updated the silhouette, the title and the features in cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Figure 2: "Safe operating area"</i> and <i>Figure 3: "Thermal impedance"</i> . Minor text changes.

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9