

N-channel 60 V, 2.4 mΩ typ., 140 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

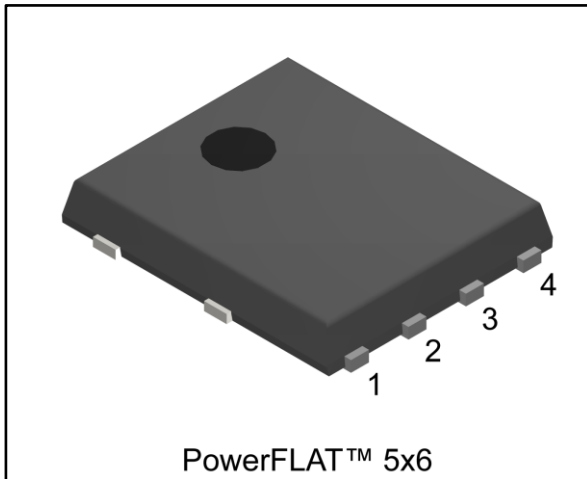
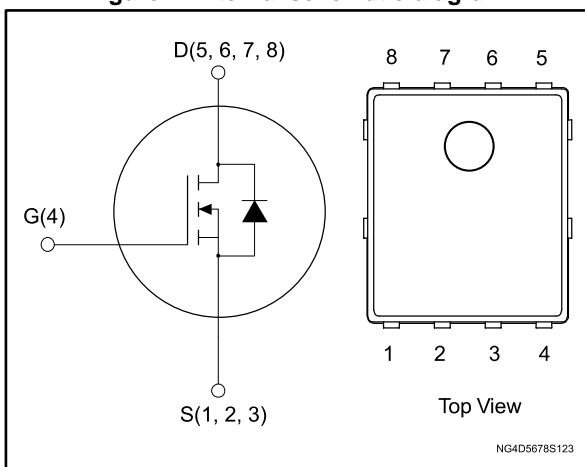


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL140N6F7	60 V	2.8 mΩ	140 A	125 W

- 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

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
STL140N6F7	140N6F7	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	60	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	140	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	107	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	560	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	30	A
	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	21	
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	116	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	125	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.8	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	38	mJ
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 $T_j = 25\text{ }^\circ\text{C}$, $I_D = 16\text{ A}$, $V_{DD} = 40\text{ V}$

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	1.2	

Notes:

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

2 Electrical characteristics

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

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$			1	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 15\text{ A}$		2.4	2.8	m Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	3110	-	pF
C_{oss}	Output capacitance		-	1520	-	
C_{rss}	Reverse transfer capacitance		-	193	-	
Q_g	Total gate charge	$V_{DD} = 30\text{ V}$, $I_D = 30\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 14 : "Test circuit for gate charge behavior")	-	55	-	nC
Q_{gs}	Gate-source charge		-	19	-	
Q_{gd}	Gate-drain charge		-	18	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 15\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13 : "Test circuit for resistive load switching times" and Figure 18 : "Switching time waveform")	-	24	-	ns
t_r	Rise time		-	68	-	
$t_{d(off)}$	Turn-off delay time		-	39	-	
t_f	Fall time		-	20	-	

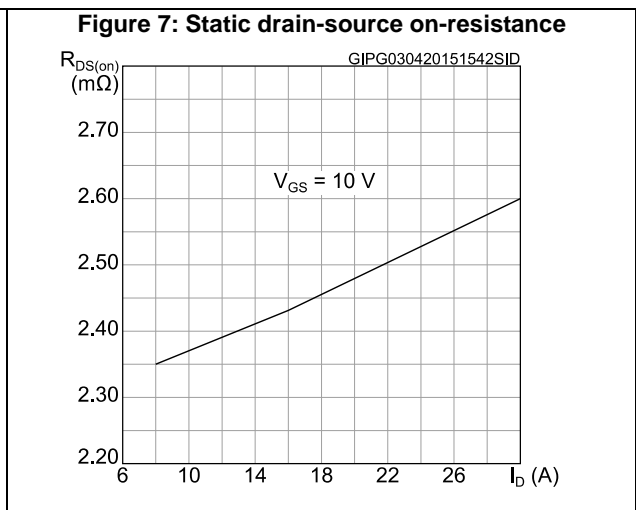
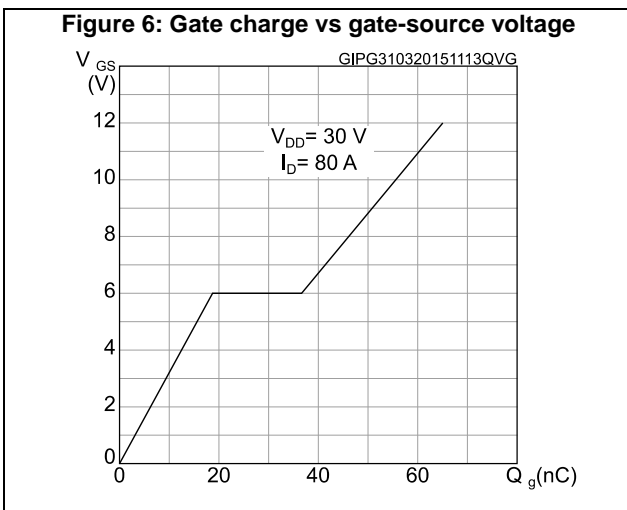
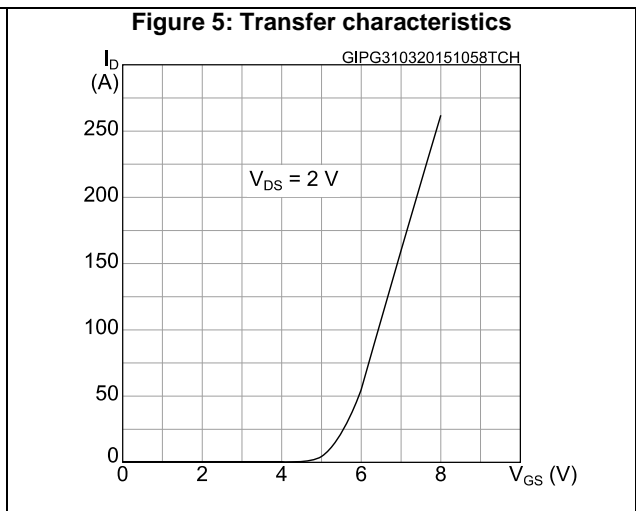
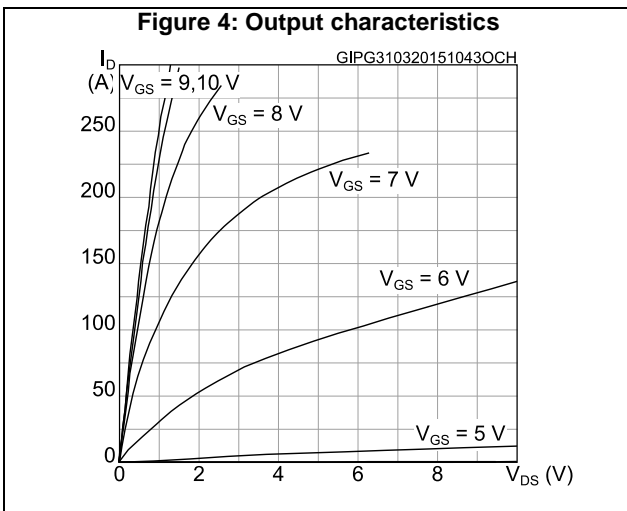
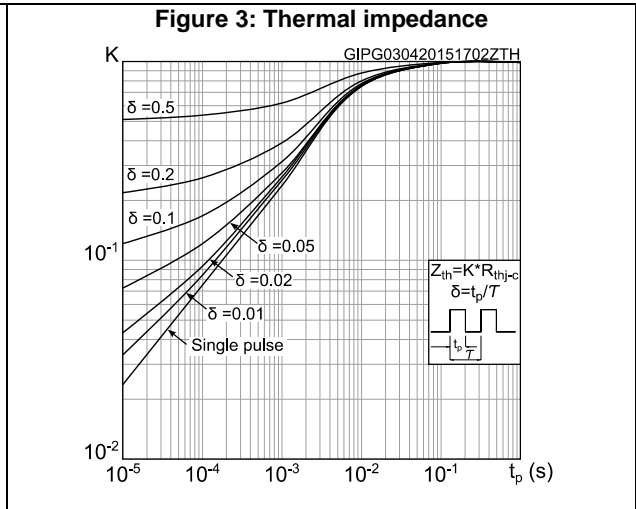
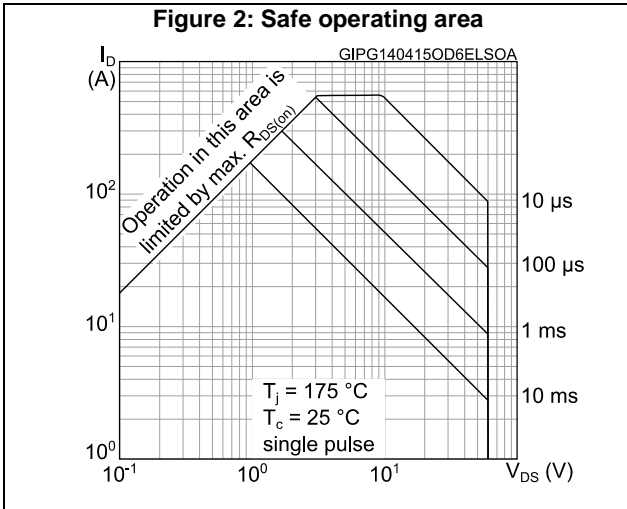
Table 7: Source-drain diode

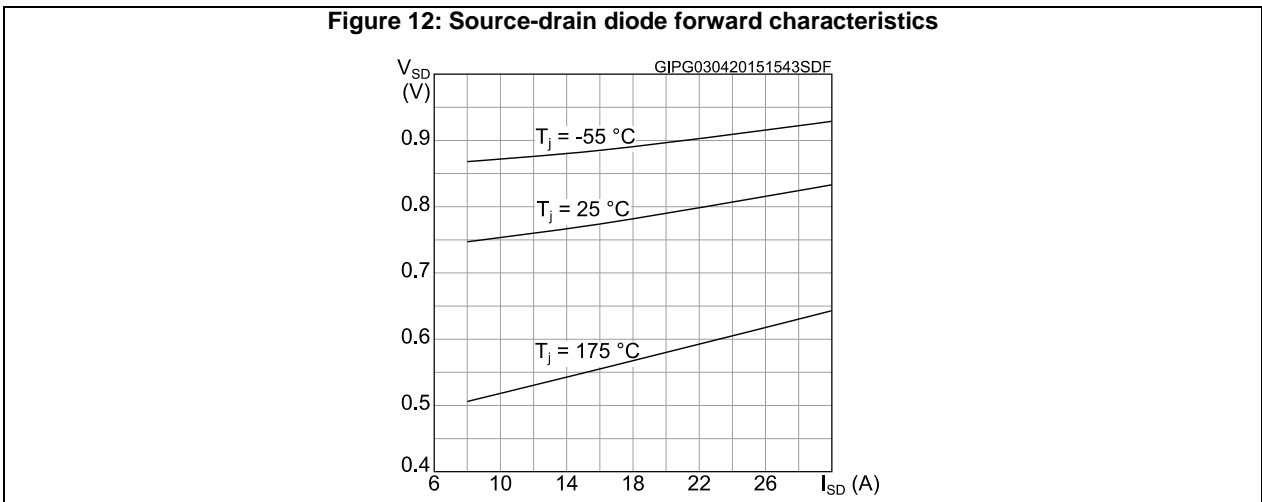
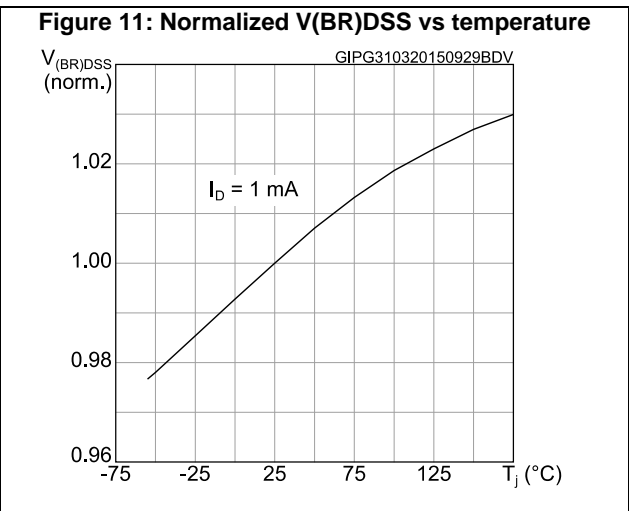
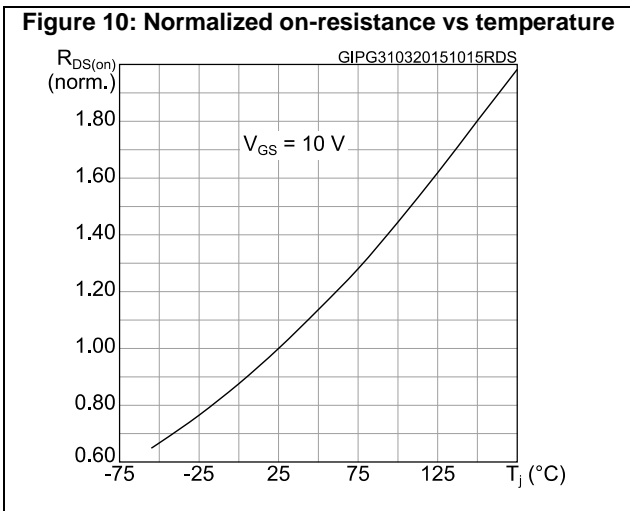
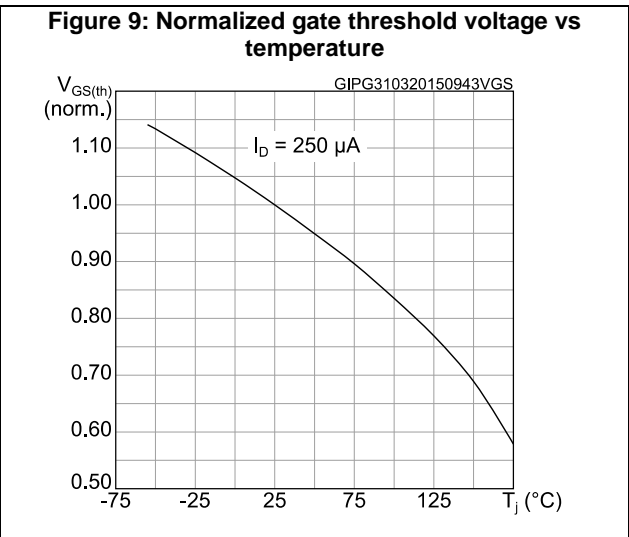
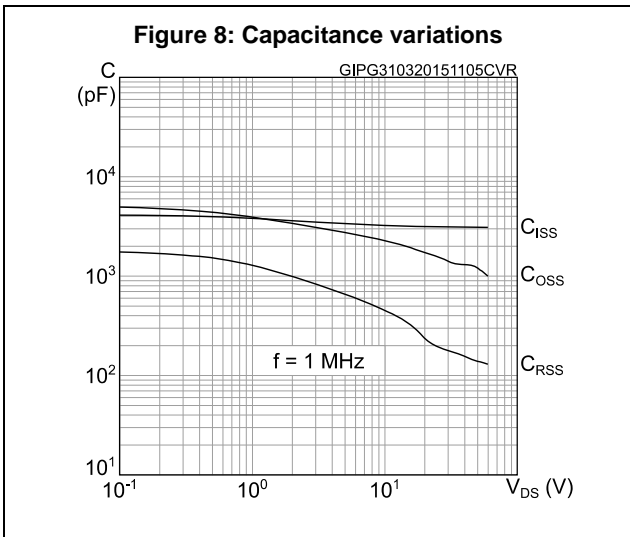
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 30\text{ A}$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 30\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 48\text{ V}$ (see Figure 15 : "Test circuit for inductive load switching and diode recovery times")	-	42.4		ns
Q_{rr}	Reverse recovery charge		-	38.2		nC
I_{RRM}	Reverse recovery current		-	1.8		A

Notes:

(1) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

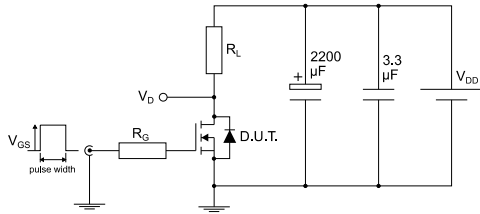
2.1 Electrical characteristics (curves)





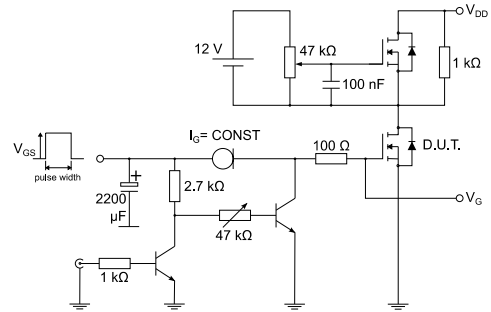
3 Test circuits

Figure 13: Test circuit for resistive load switching times



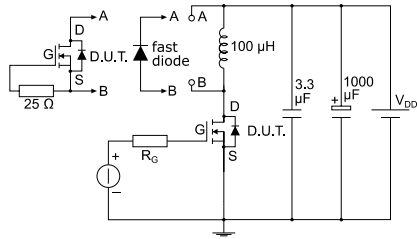
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Figure 14: Test circuit for gate charge behavior



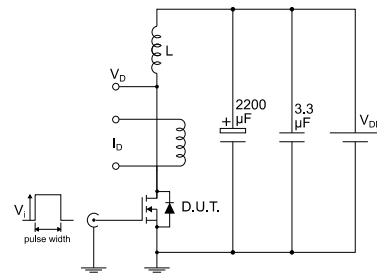
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Figure 15: Test circuit for inductive load switching and diode recovery times



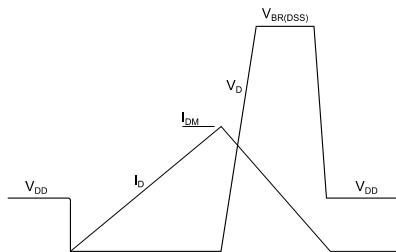
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Figure 16: Unclamped inductive load test circuit



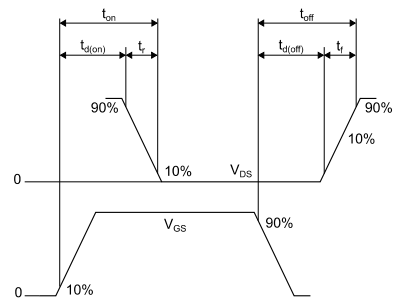
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Figure 17: Unclamped inductive waveform



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Figure 18: 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 PowerFLAT™ 5x6 type C package information

Figure 19: PowerFLAT™ 5x6 type C package outline

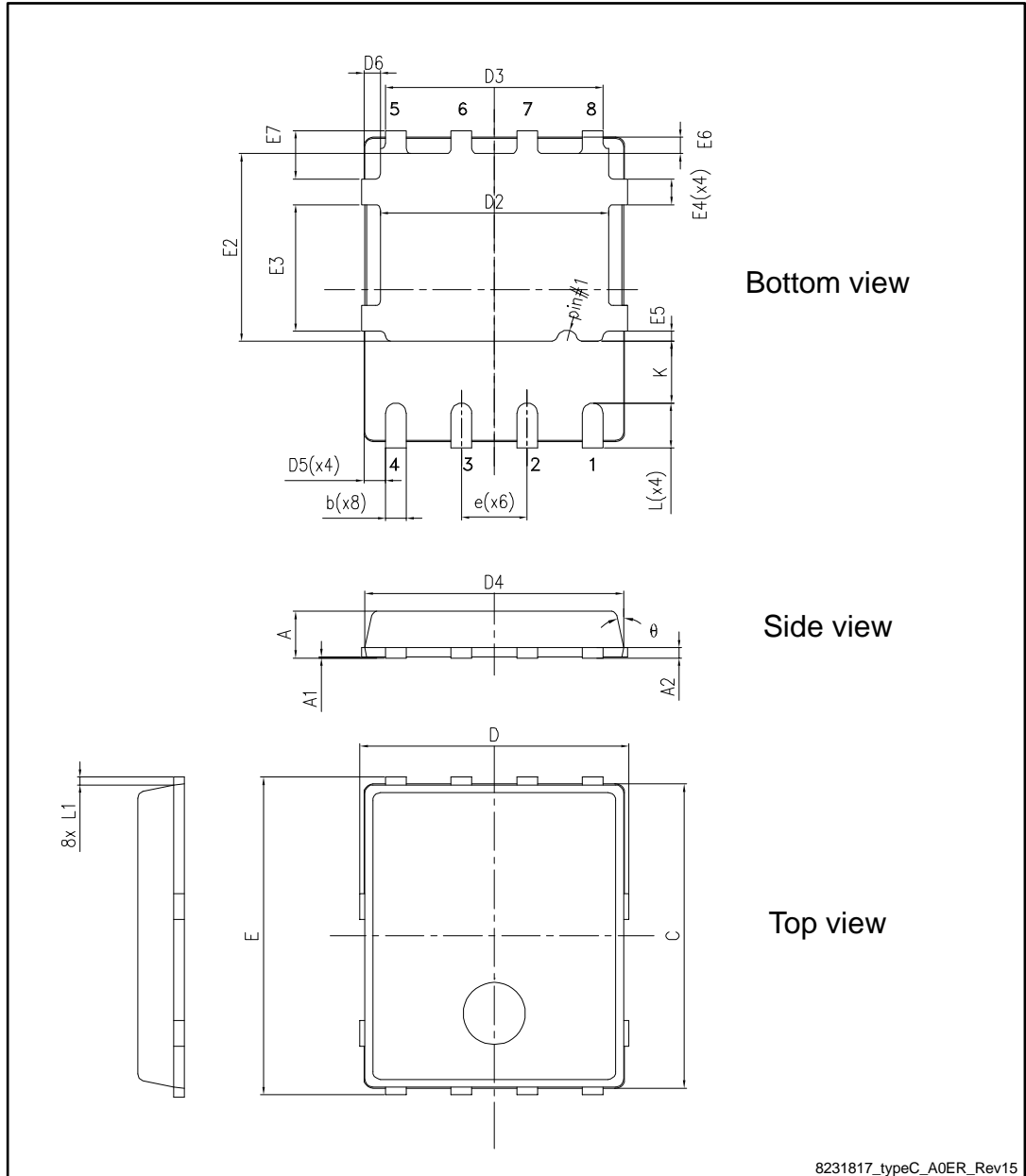


Table 8: PowerFLAT™ 5x6 type C package mechanical data

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	6.20
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.00	5.20
D5	0.25	0.40	0.55
D6	0.15	0.30	0.45
e		1.27	
E	5.95	6.15	6.35
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	0.75	0.90	1.05
K	1.05		1.35
L	0.725		1.025
L1	0.05	0.15	0.25
θ	0°		12°

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

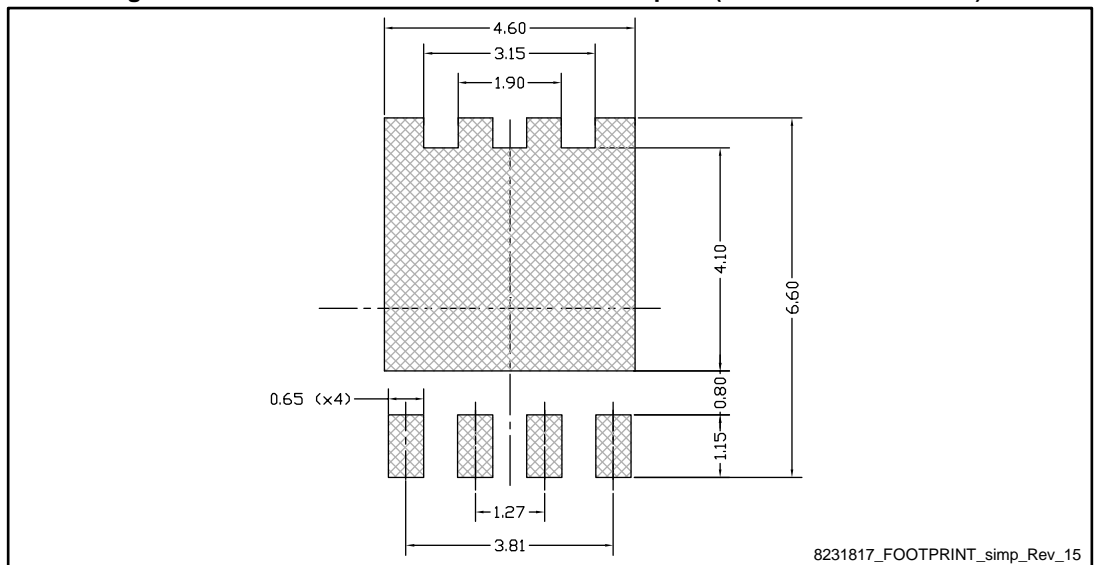
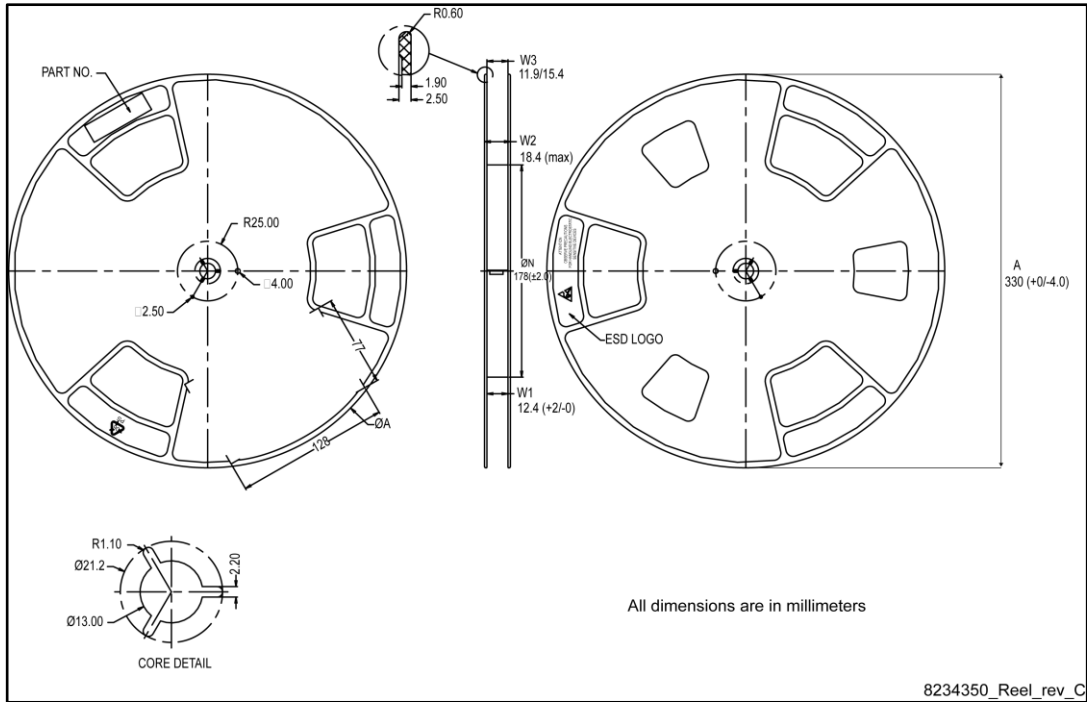


Figure 23: PowerFLAT™ 5x6 reel



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
02-Aug-2013	1	First release.
18-Mar-2014	2	Updated VDS value in Table 2: Absolute maximum ratings and Table 4: On /off states. Updated Section 4: Package mechanical data. Minor text changes.
09-Apr-2015	3	Text edits and formatting changes throughout document On cover page: -updated title description -updated device 'Features' and 'Description' Updated section 1 Electrical ratings Updated section 2 Electrical characteristics Added section 2.1 Electrical characteristics (curves) Updated and renamed Section 4 Package information (was Package mechanical data) Updated and renamed Section 4.2 Packing information (was Section 5 Packaging mechanical data)
19-May-2015	4	In section 2.1 Electrical characteristics (curves): - Updated Figure 24: Capacitance variations
21-Apr-2017	5	Added E _{AS} in Table 2: "Absolute maximum ratings" Updated Section 4.1: "PowerFLAT™ 5x6 type C package information" Minor text changes.

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