

Automotive-grade dual N-channel 40 V, 5 mΩ typ., 40 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 DI

Datasheet - production data

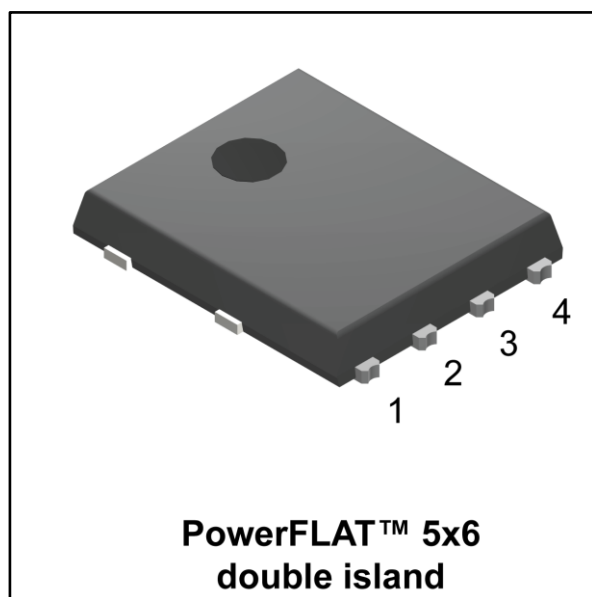
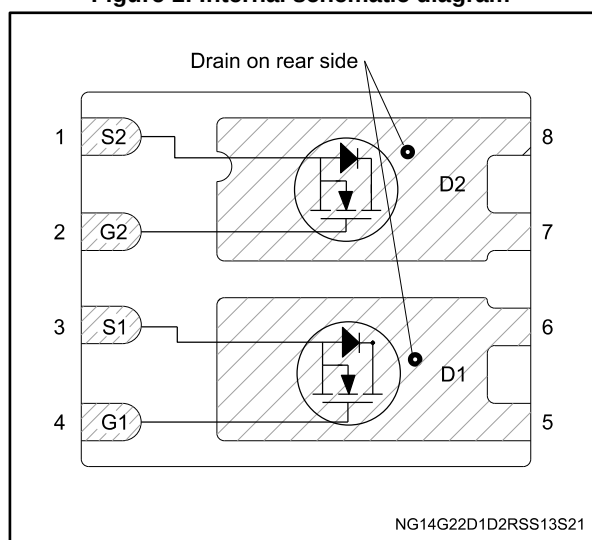


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL76DN4LF7AG	40 V	6 mΩ	40 A



- 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 dual 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
STL76DN4LF7AG	76DN4LF7	PowerFLAT™ 5x6 double island	Tape and reel

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	40	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	40	A
$I_{DM}^{(2)}$	Drain current (pulsed)	160	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	71	W
T_j	Operating junction temperature range	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature range		

Notes:

⁽¹⁾Drain current is limited by package, the current capability of the silicon is 79 A at 25 °C and 56 A at 100 °C.

⁽²⁾Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.1	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	32	$^\circ\text{C/W}$

Notes:

⁽¹⁾When mounted on FR-4 board of 1 inch², 2oz Cu, t < 10 s.

2 Electrical characteristics

(T_C = 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	I _D = 1 mA, V _{GS} = 0 V	40			V
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V V _{DS} = 40 V			10	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	1.5		2.5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 10 A		5	6	mΩ
		V _{GS} = 4.5 V, I _D = 10 A		7	12	

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0 V	-	956	-	pF
C _{oss}	Output capacitance		-	241	-	
C _{rss}	Reverse transfer capacitance		-	28	-	
Q _g	Total gate charge	V _{DD} = 20 V, I _D = 20 A, V _{GS} = 0 to 10 V (see Figure 14: "Test circuit for gate charge behavior")	-	17	-	nC
Q _{gs}	Gate-source charge		-	3.2	-	
Q _{gd}	Gate-drain charge		-	4.3	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 32 V, I _D = 10 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	9	-	ns
t _r	Rise time		-	4.3	-	
t _{d(off)}	Turn-off delay time		-	39	-	
t _f	Fall time		-	10	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		40	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)		-		160	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 40\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 32\text{ V}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	27		ns
Q_{rr}	Reverse recovery charge		-	19.5		nC
I_{RRM}	Reverse recovery current		-	1.4		A

Notes:

(1) Drain current is limited by package, the current capability of the silicon is 79 A at 25 °C.

(2) Pulse width limited by safe operating area .

(3) Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

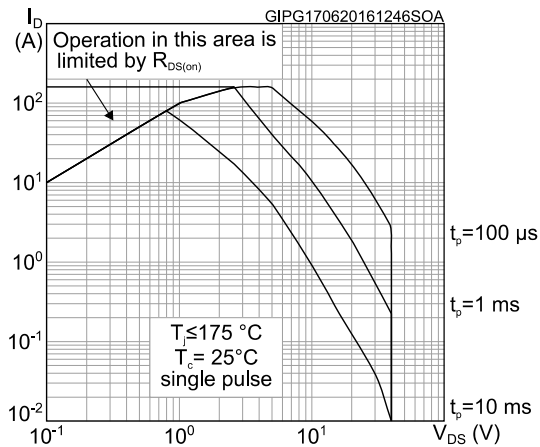


Figure 3: Thermal impedance

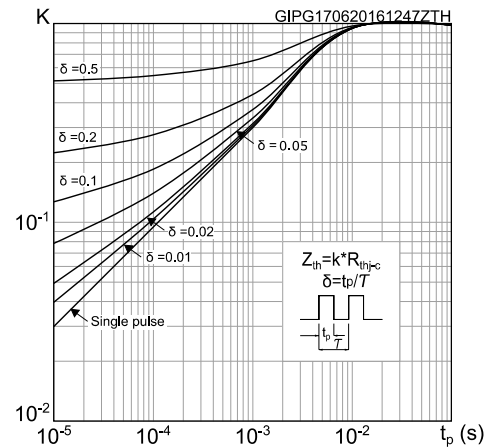


Figure 4: Output characteristics

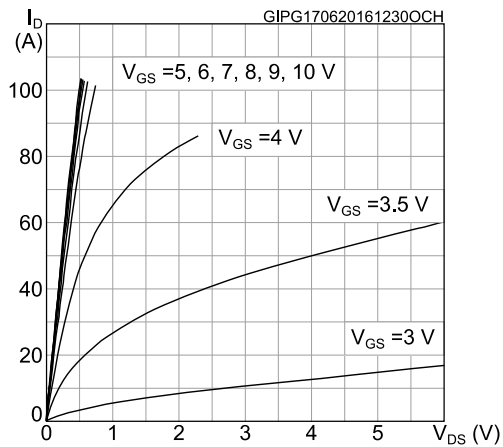


Figure 5: Transfer characteristics

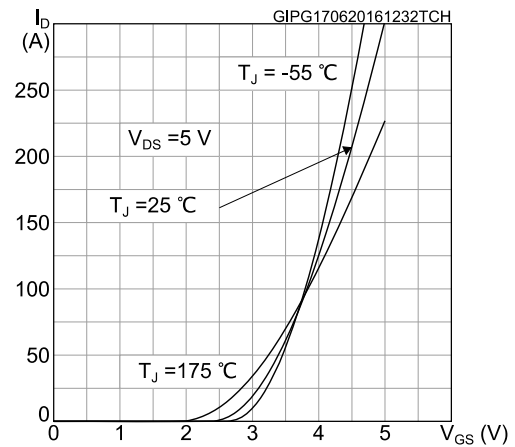


Figure 6: Gate charge vs gate-source voltage

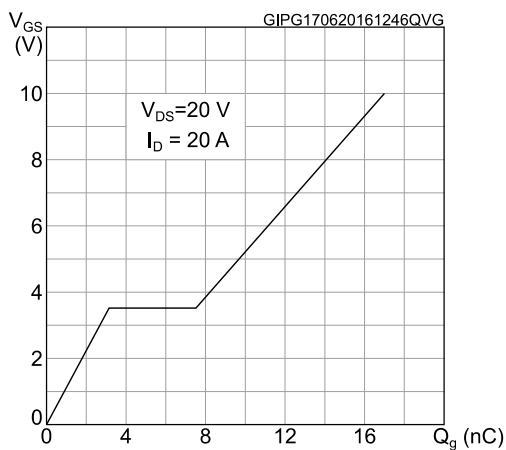


Figure 7: Static drain-source on-resistance

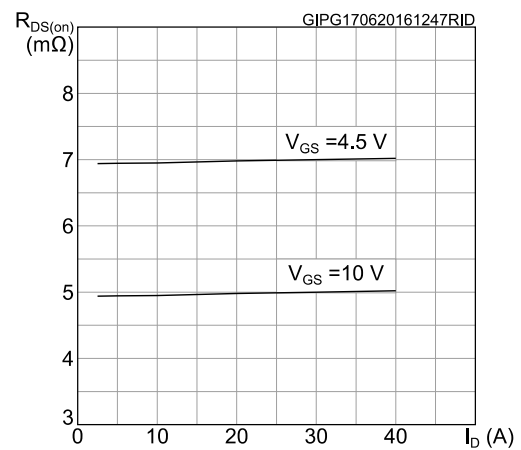


Figure 8: Capacitance variations

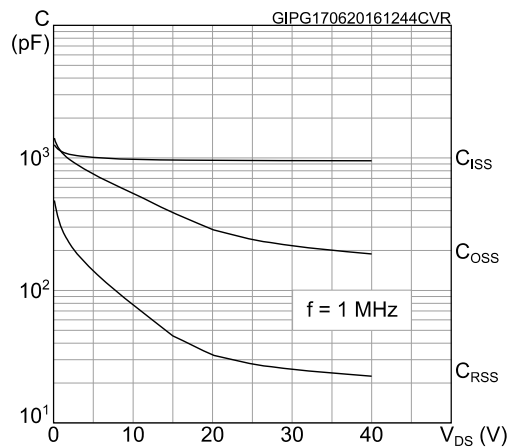


Figure 9: Normalized gate threshold voltage vs temperature

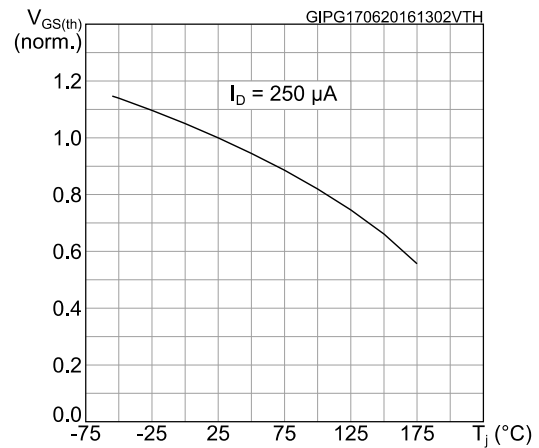


Figure 10: Normalized on-resistance vs temperature

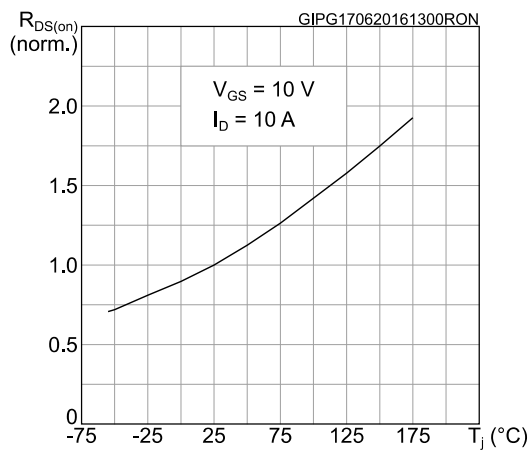
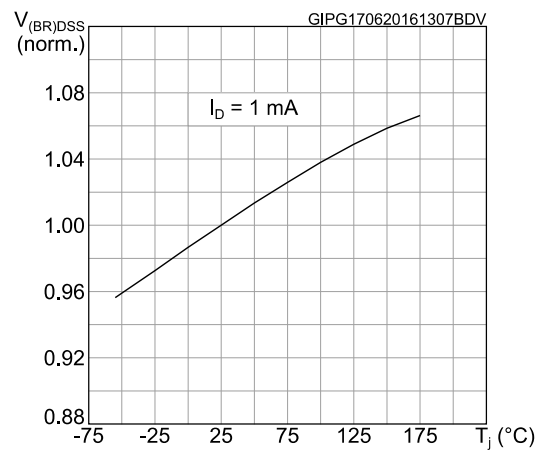
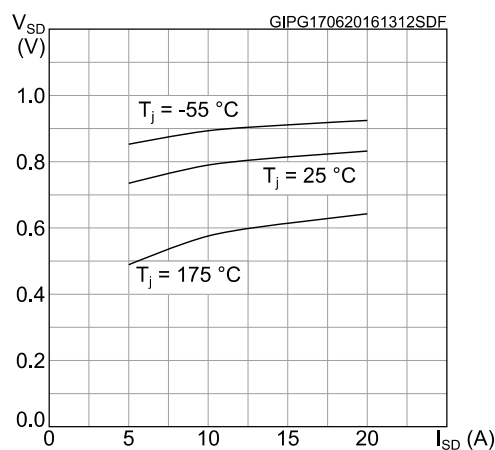
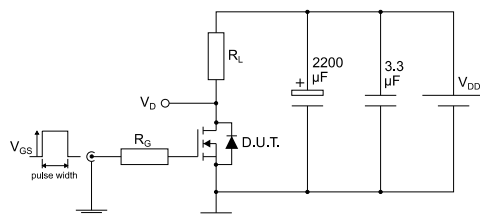
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



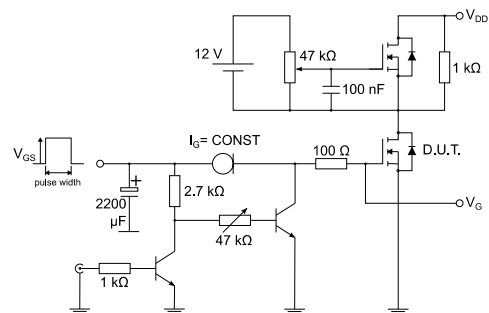
3 Test circuits

Figure 13: Test circuit for resistive load switching times



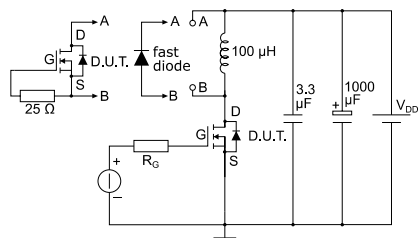
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Figure 14: Test circuit for gate charge behavior



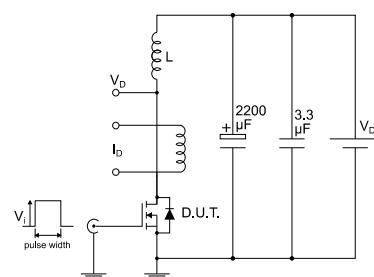
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Figure 15: Test circuit for inductive load switching and diode recovery times



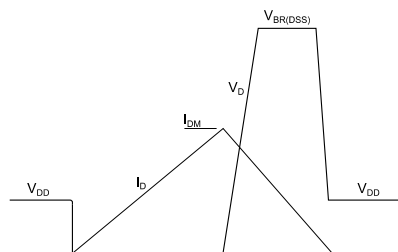
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Figure 16: Unclamped inductive load test circuit



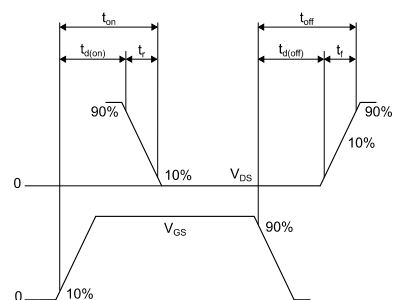
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Figure 17: Unclamped inductive waveform



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 double island WF type C package information

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

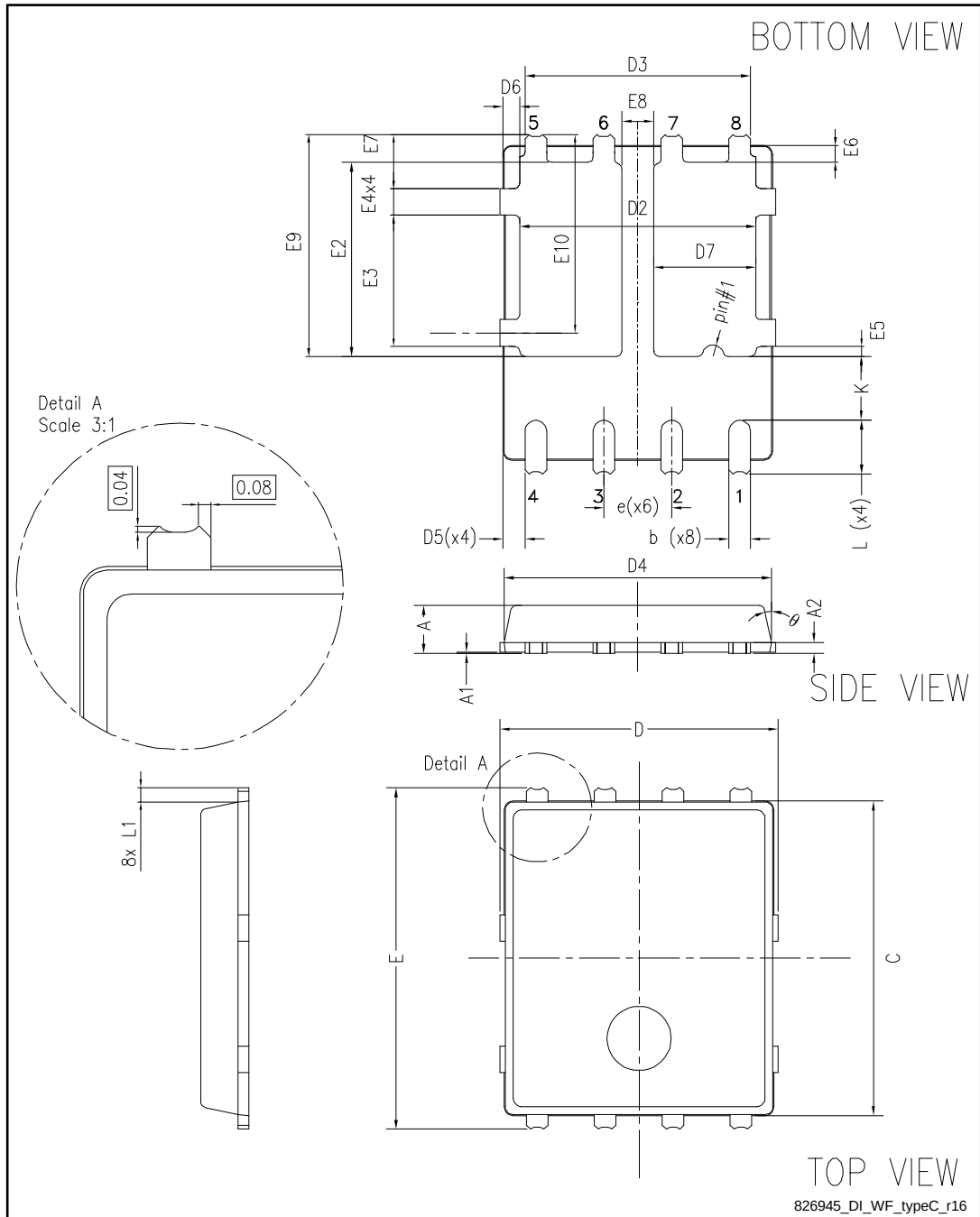


Table 8: PowerFLAT™ 5x6 double island WF type C mechanical data

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
D7	1.68		1.98
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
E8	0.55		0.75
E9	4.00	4.20	4.40
E10	3.55	3.70	3.85
L	0.90	1.00	1.10
L1	0.175	0.275	0.375
K	1.05		1.35
Θ	0°		12°

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



4.2 Packing information

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

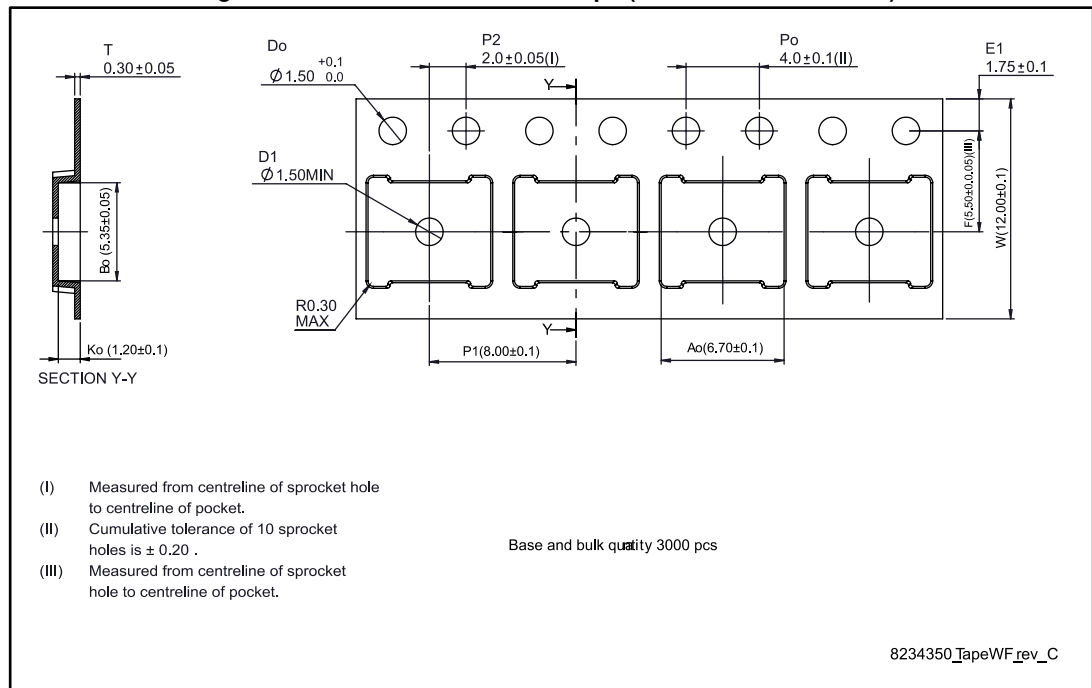


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

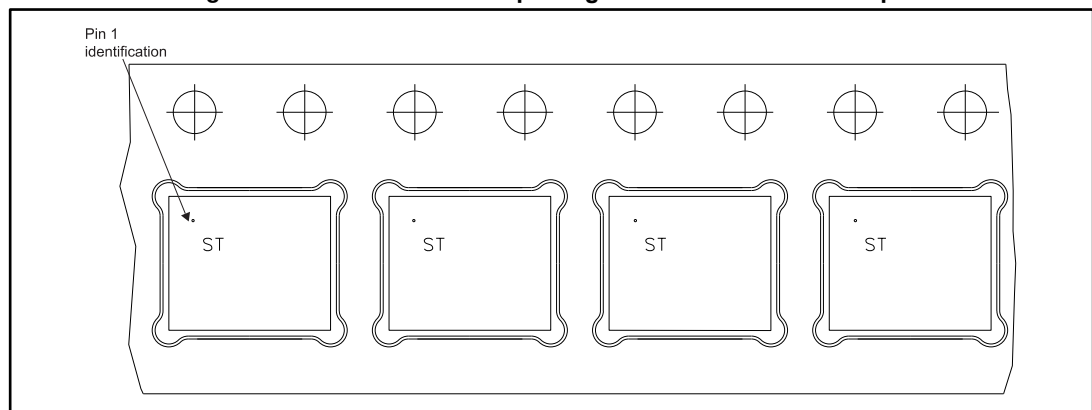
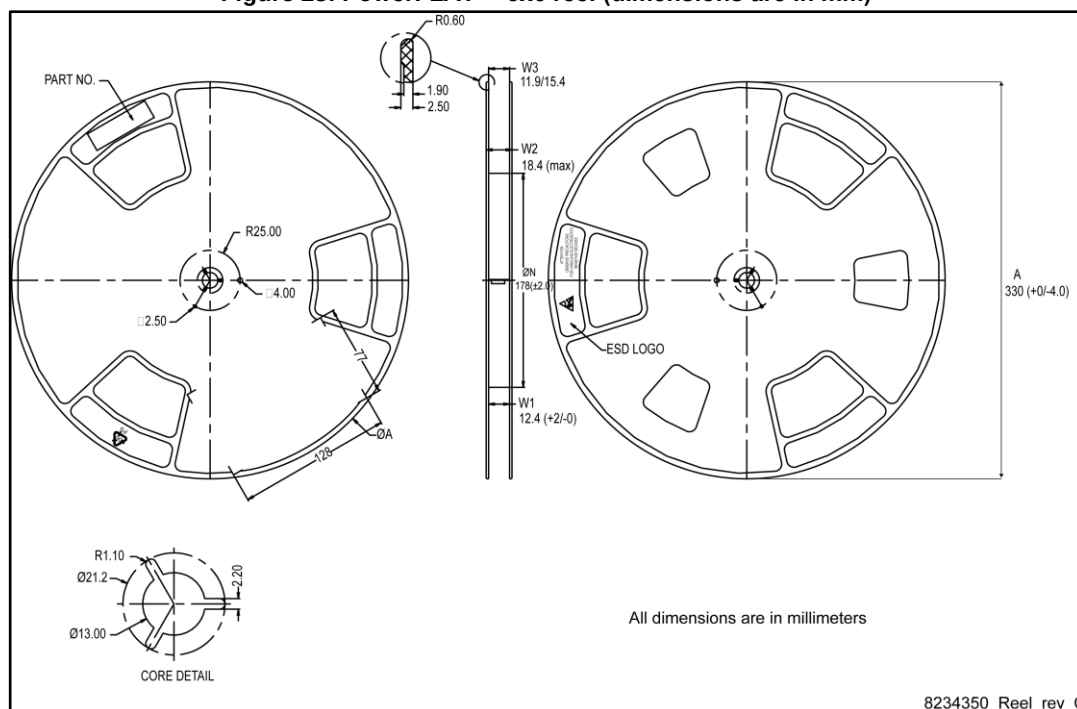


Figure 23: PowerFLAT™ 5x6 reel (dimensions are in mm)



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
20-Apr-2016	1	First release.
23-Jun-2016	2	Modified: title, features and description in cover page. Modified: <i>Table 4: "On/Off states"</i> , <i>Table 5: "Dynamic"</i> , <i>Table 6: "Switching times"</i> and <i>Table 7: "Source-drain diode"</i> . Added: <i>Section 4.1: "Electrical characteristics (curves)"</i> . Updated: <i>Section 6.1: "PowerFLAT 5x6 double island WF type C package information"</i> . Minor text changes
27-Jul-2016	3	Updated <i>Table 4: "On/Off states"</i> .
16-Dec-2016	4	Updated <i>Section 4: "Package information"</i> . Minor text changes
27-Jul-2017	5	Updated title and features in cover page. Document status updated from preliminary to production data.

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