

N-channel 100 V, 0.007 Ω typ., 70 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

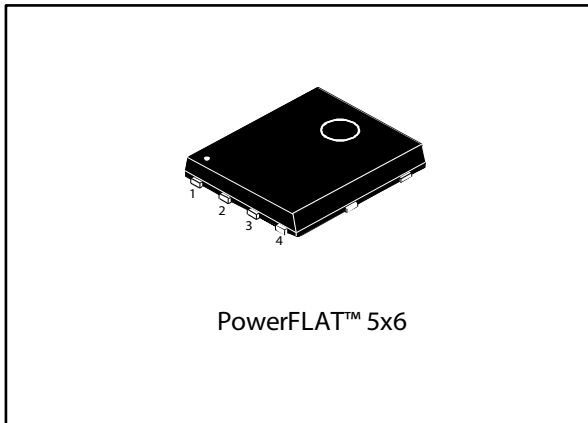
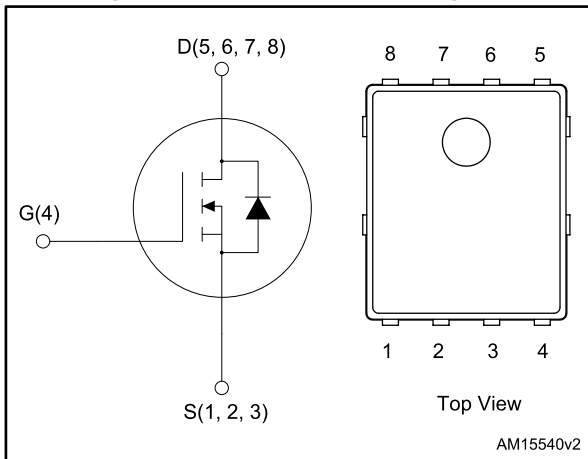


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL90N10F7	100 V	0.008 Ω	70 A	100 W

- 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

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
STL90N10F7	90N10F7	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	100	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	70	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	50	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	16	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	11	A
$I_{DM}^{(1)(3)}$	Drain current (pulsed)	280	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	64	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	100	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	5	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	300	mJ
T_{stg}	Storage temperature	- 55 to 175	$^\circ\text{C}$
T_j	Maximum junction temperature	175	$^\circ\text{C}$

Notes:

- (1) This value is rated according to R_{thj-c} .
 (2) This value is rated according to $R_{thj-pcb}$.
 (3) Pulse width is limited by safe operating area.
 (4) Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 10\text{ A}$, $V_{DD} = 50\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	1.5	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31	

Notes:

- (1) When mounted on 1 inch², 2 Oz. Cu FR-4 board

2 Electrical characteristics

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

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	100			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 100\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 100\text{ V}$, $T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2.5	3.5	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 8\text{ A}$		0.007	0.008	Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	3100	4030	pF
C_{oss}	Output capacitance		-	700	910	pF
C_{rss}	Reverse transfer capacitance		-	45	58	pF
Q_g	Total gate charge	$V_{DD} = 50\text{ V}$, $I_D = 16\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Gate charge test circuit")	-	45	60	nC
Q_{gs}	Gate-source charge		-	18		nC
Q_{gd}	Gate-drain charge		-	13		nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}$, $I_D = 8\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13: "Switching times test circuit for resistive load" and Figure 18: "Switching time waveform")	-	19	-	ns
t_r	Rise time		-	32	-	ns
$t_{d(off)}$	Turn-off-delay time		-	36	-	ns
t_f	Fall time		-	13	-	ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		16	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		64	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 16\text{ A}$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 16\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 80\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see <i>Figure 15: "Test circuit for inductive load switching and diode recovery times")</i>)	-	70	90	ns
Q_{rr}	Reverse recovery charge		-	125		nC
I_{RRM}	Reverse recovery current		-	3.6		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)

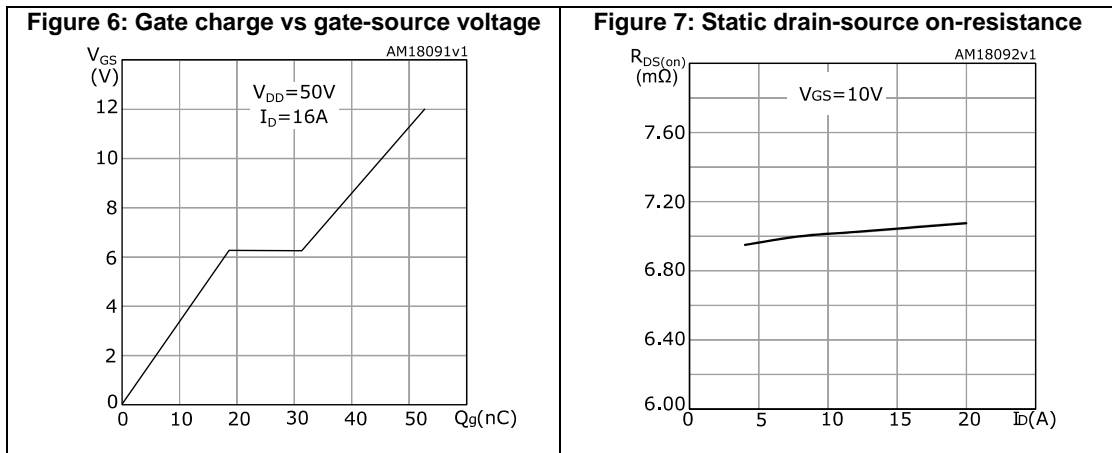
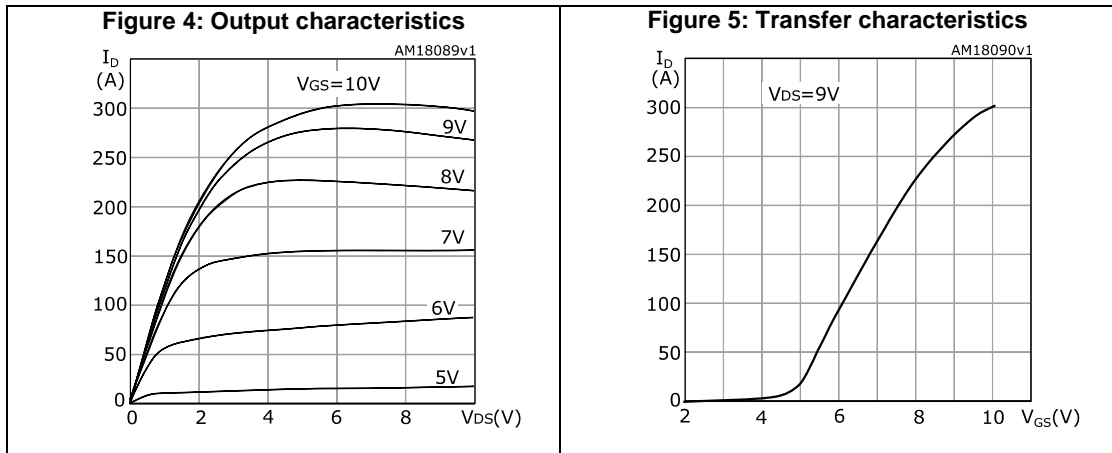
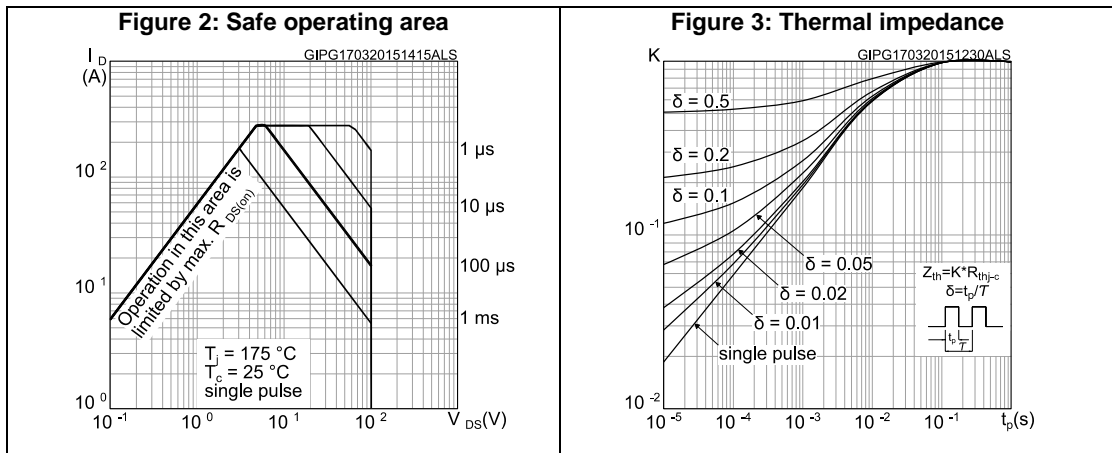


Figure 8: Capacitance variations

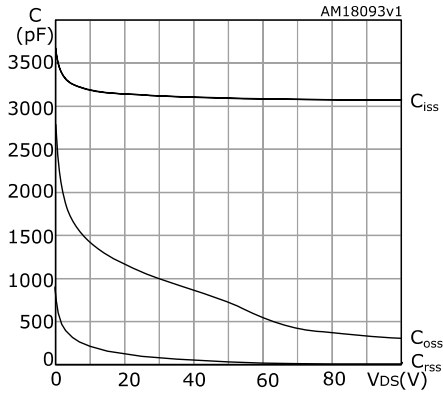


Figure 9: Normalized gate threshold voltage vs temperature

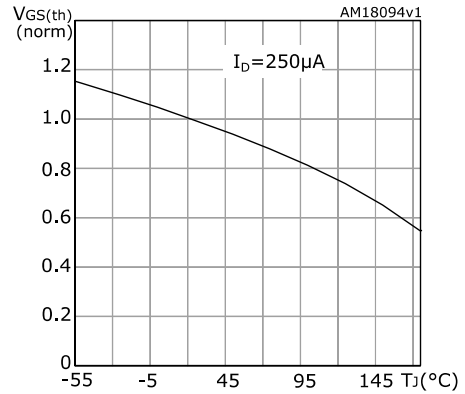


Figure 10: Normalized on-resistance vs temperature

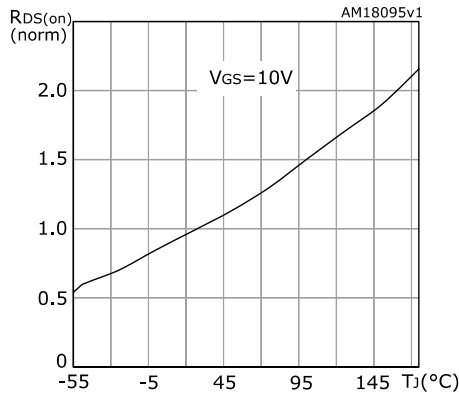


Figure 11: Normalized V(BR)DSS vs temperature

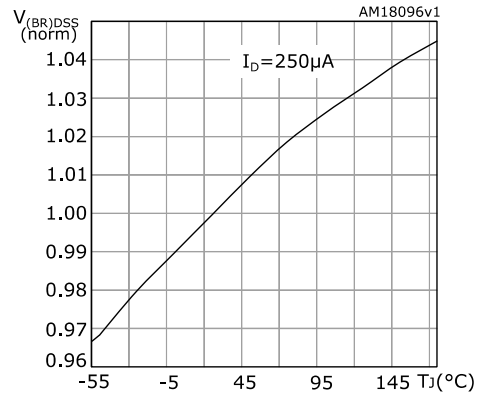
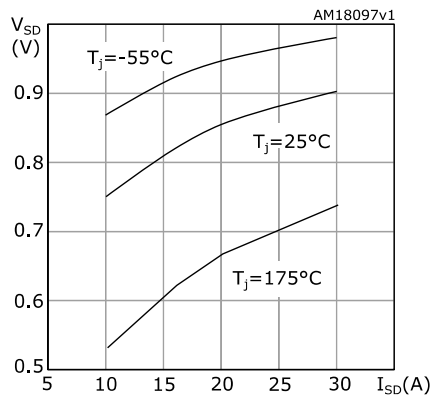
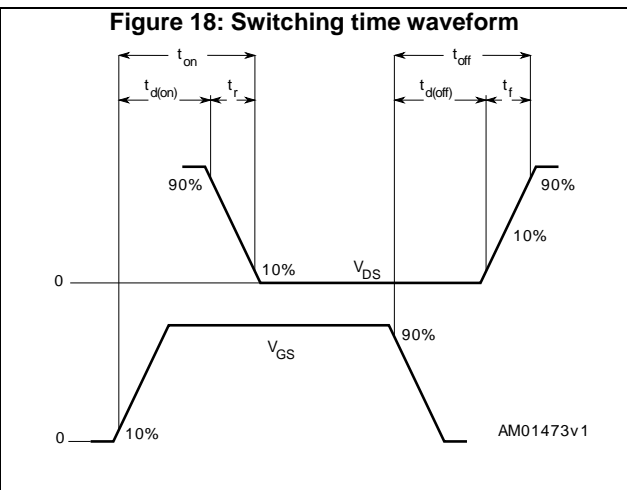
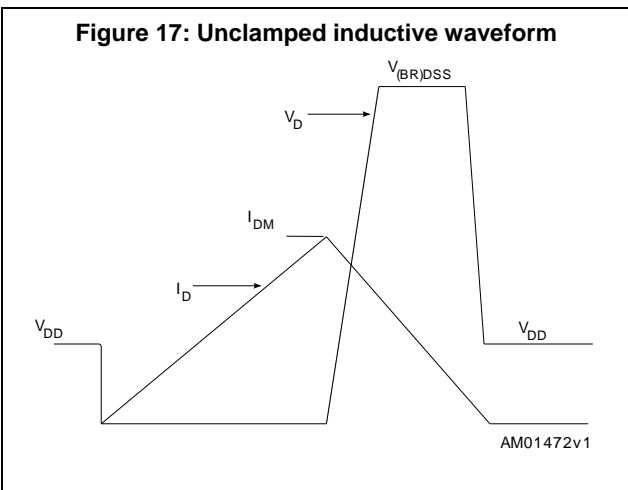
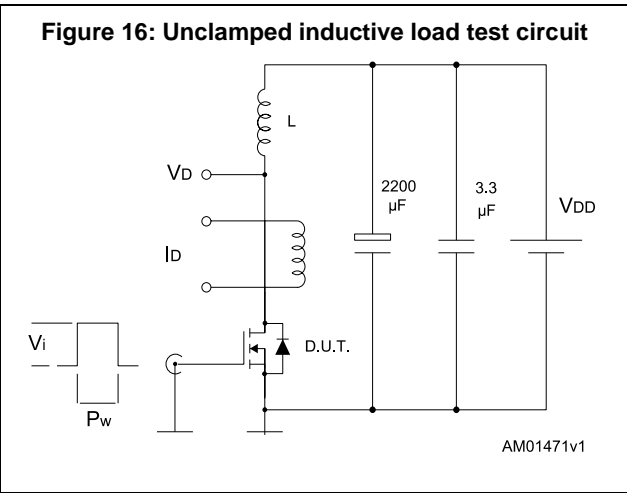
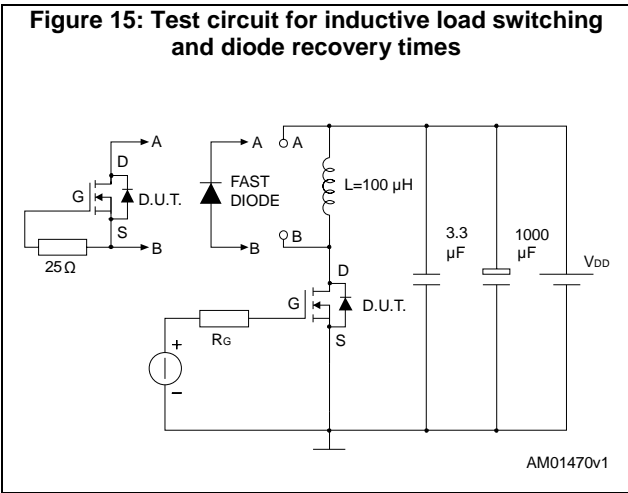
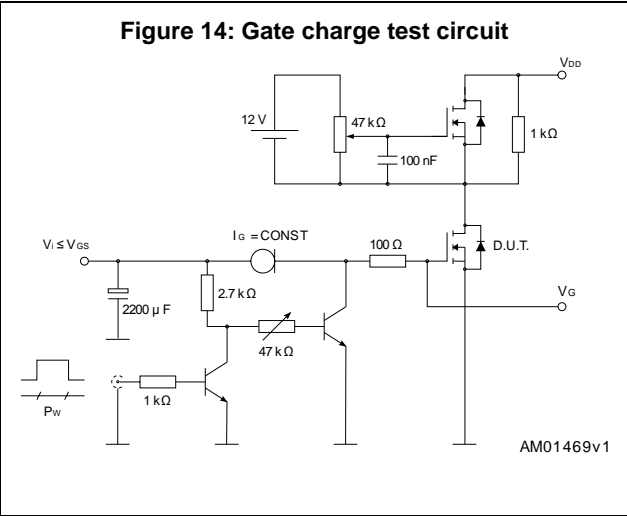
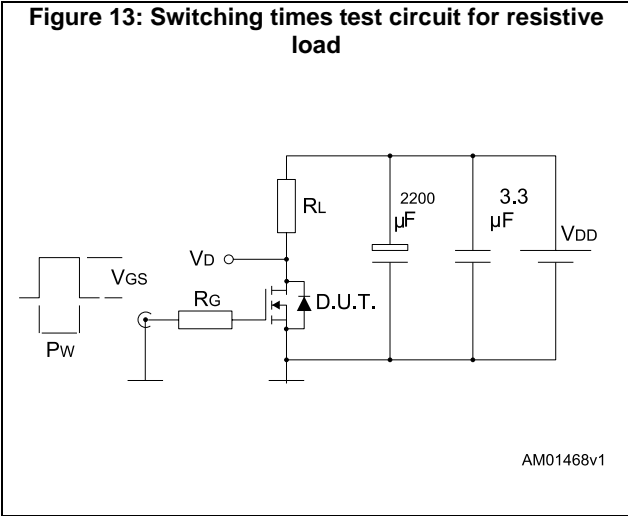


Figure 12: Source-drain diode forward characteristics



3 Test circuits



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 R package information

Figure 19: PowerFLAT[™] 5x6 type R package outline

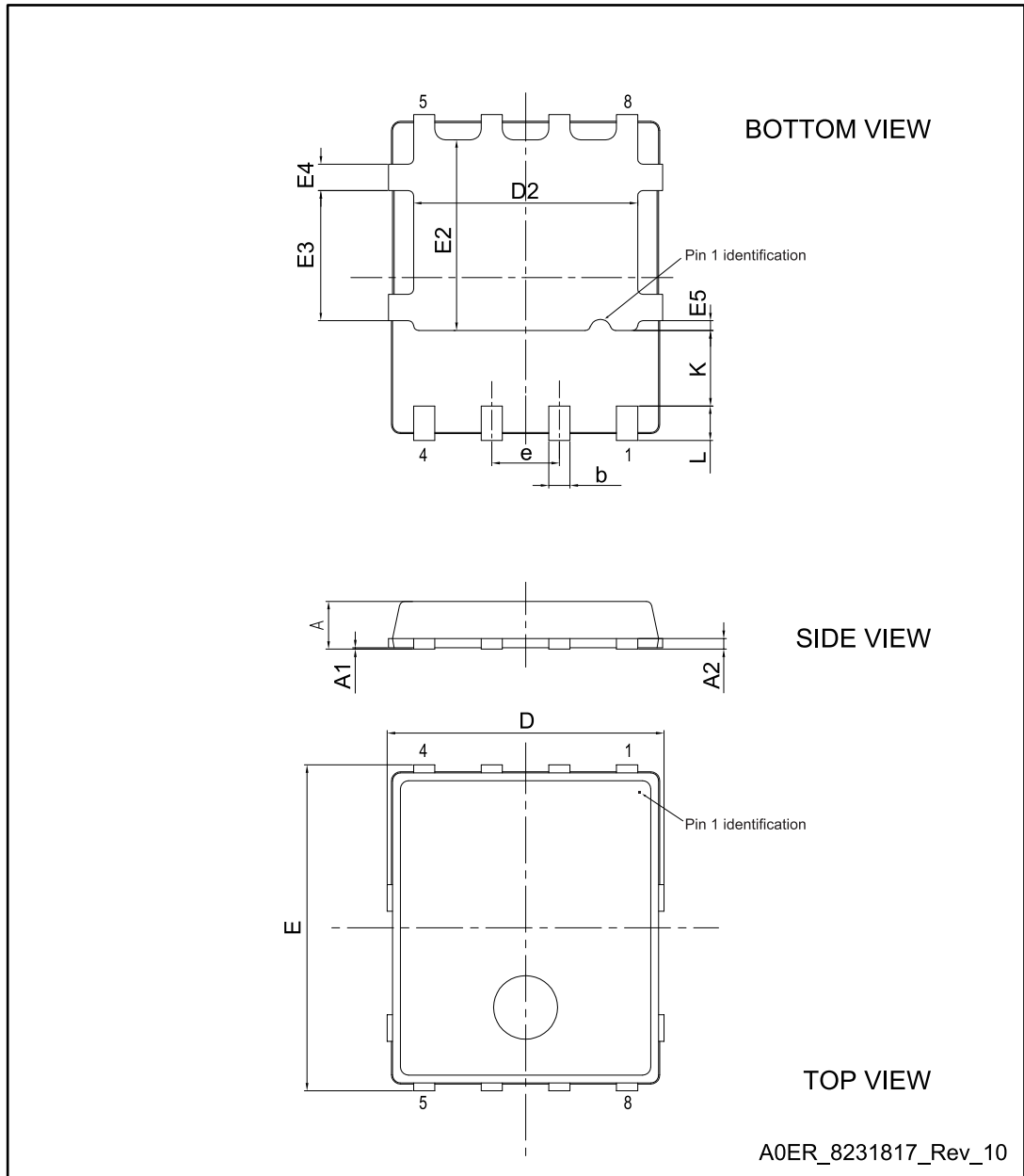
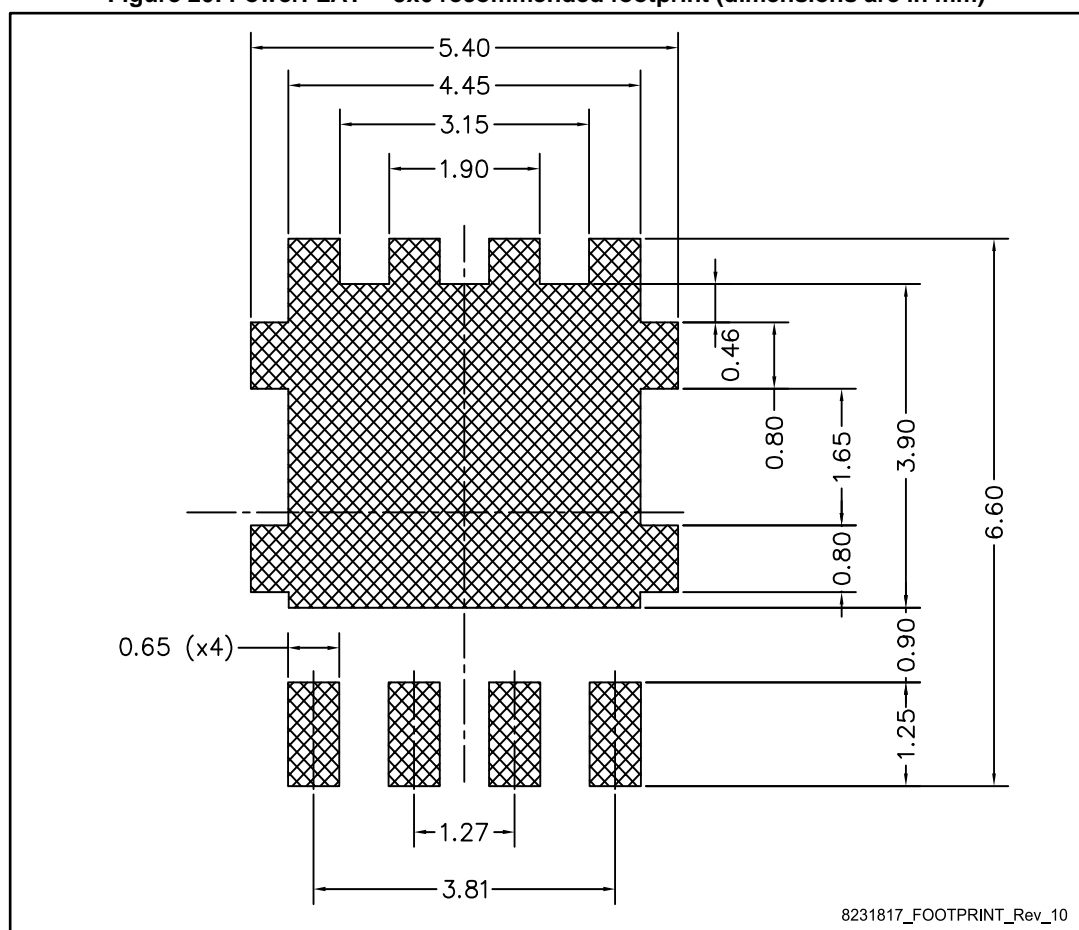


Table 8: PowerFLAT™ 5x6 type R mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D	5.00	5.20	5.40
E	5.95	6.15	6.35
D2	4.11		4.31
e		1.27	
L	0.60		0.80
K	1.275		1.575
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28

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



4.2 PowerFLAT™ 5x6 packing information

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

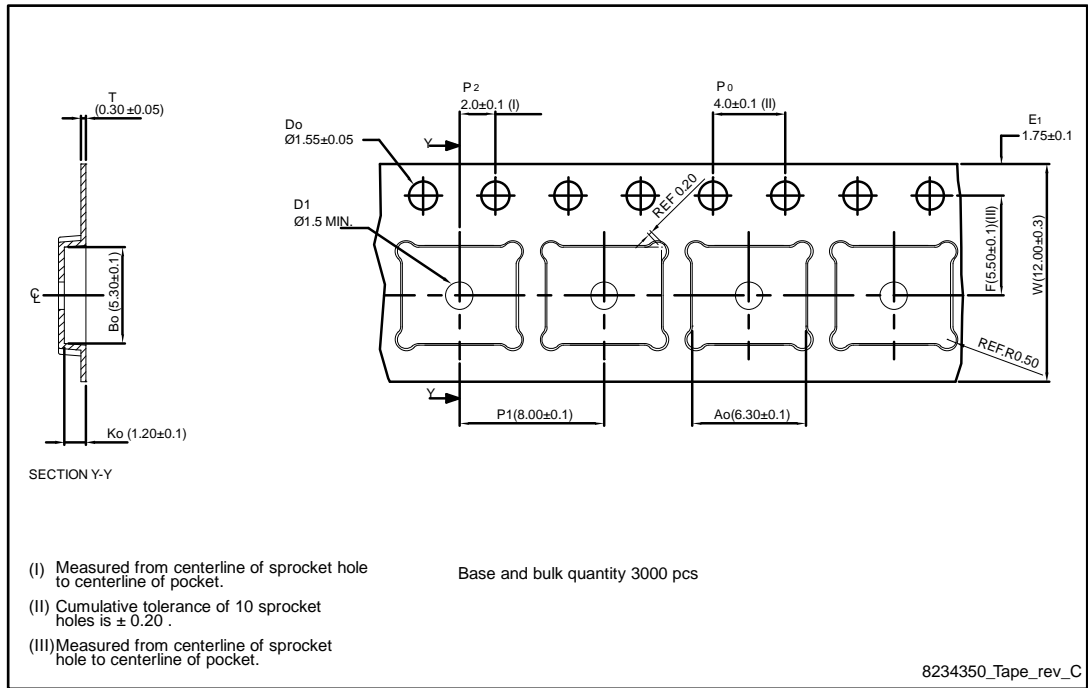


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

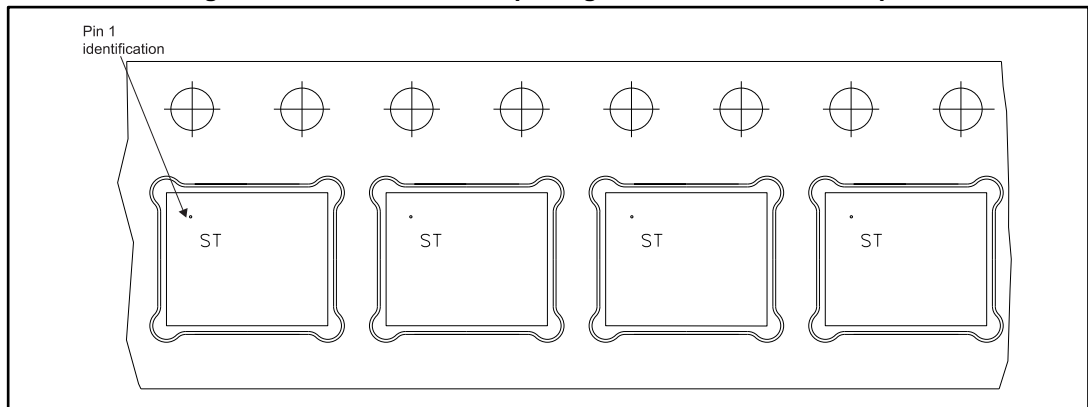
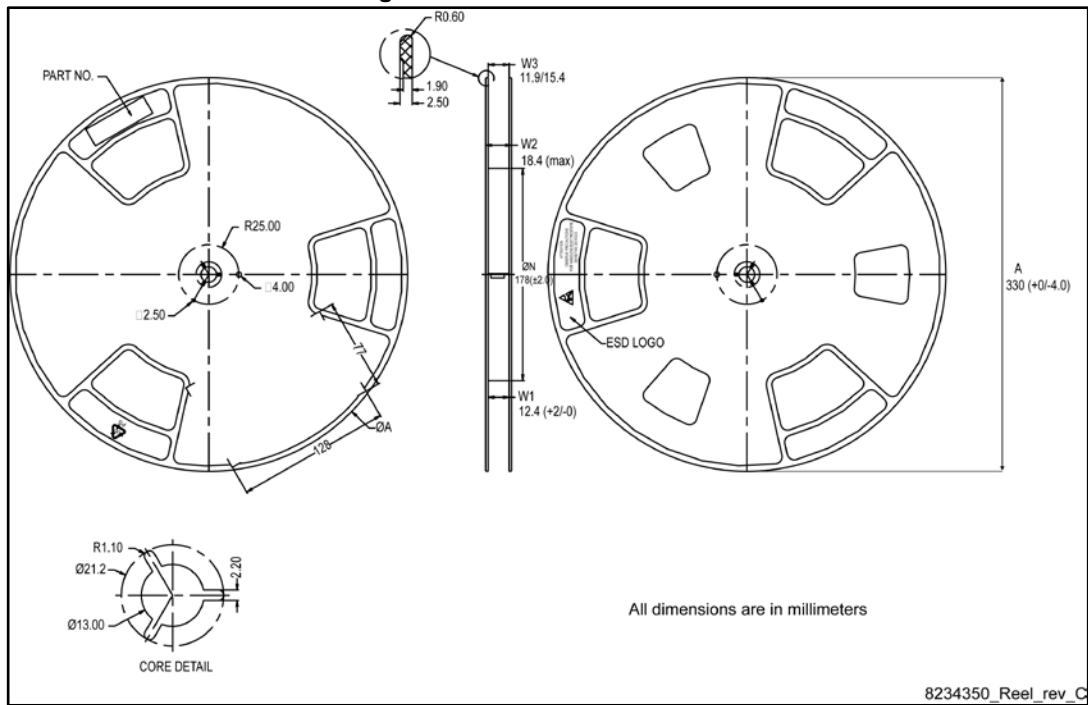


Figure 23: PowerFLAT™ 5x6 reel



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
16-Apr-2013	1	First release.
06-Mar-2014	2	<ul style="list-style-type: none"> – Modified: $R_{DS(on)}$ value in cover page – Modified: $V_{GS(th)}$ values in Table 4 – Modified: $R_{DS(on)}$ typ. and max values in Table 4 – Modified: typical values in Table 5, 6 and 7 – Updated: Section 4: Package mechanical data – Added: Section 2.1: Electrical characteristics (curves) – Updated: Section 4: Package mechanical data – Document status promoted from preliminary data to production data
16-Dec-2014	3	<ul style="list-style-type: none"> – Updated title, features and description in cover page. – Updated $R_{DS(on)}$ values and Figure 7: Static drain-source onresistance.
17-Mar-2015	4	<ul style="list-style-type: none"> –Text edits throughout document –Updated cover page title description –Updated cover page features table –In table 2. Absolute maximum ratings, added "E_{AS}" information and footnote 4 –In table 3. Thermal data, added footnote 1 –Renamed table 4. Static (was On/off states) –Updated table 5. Dynamic –Updated table 7. Source drain diode –In Section 2.1 Electrical characteristics (curves), updated figures 2, 3, 10 and 11 –Updated and renamed Section 4 Package information

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