

Automotive-grade N-channel 60 V, 27 mΩ typ., 20 A STripFET™ II Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

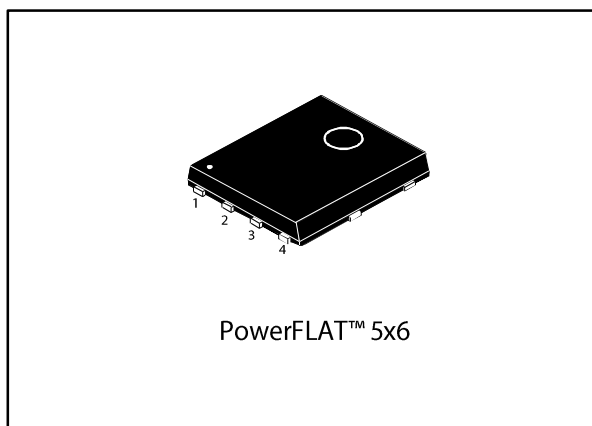
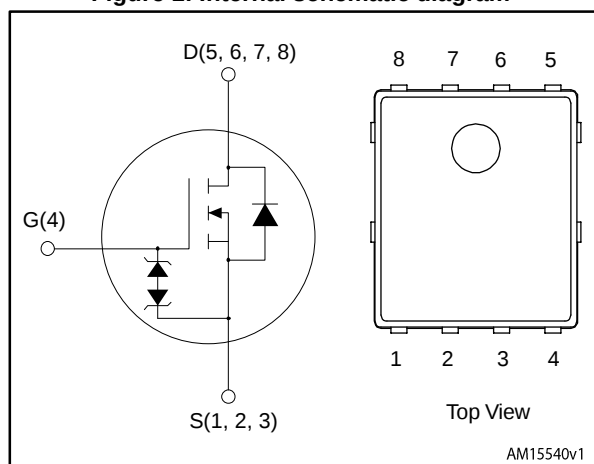


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL20NF06LAG	60 V	40 mΩ	20 A	75 W

- Designed for Automotive applications and AEC-Q101 qualified
- PowerFLAT™ 5x6 with wettable flanks
- Logic level V_{GS(th)}
- Maximum junction temperature: T_J = 175 °C

Applications

- Switching applications

Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process is specifically designed to minimize input capacitance and gate charge. It is therefore ideal as a primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer applications. It is also suitable for any application with low gate charge drive requirements.

Table 1: Device summary

Order code	Marking	Package	Packing
STL20NF06LAG	20NF06L	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
$I_D^{(1)(2)}$	Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$	20	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	20	
$I_{DM}^{(1)(3)}$	Drain current (pulsed)	80	A
$I_D^{(4)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	7.4	A
	Drain current (continuous) at $T_{pcb} = 100\text{ }^{\circ}\text{C}$	5.2	
I_{DM}	Drain current (pulsed)	29.6	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	75	W
P_{TOT}	Total dissipation at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	4.8	
T_{stg}	Storage temperature	-55 to 175	$^{\circ}\text{C}$
T_j	Operating junction temperature		

Notes:

- (1) This value is rated according to R_{thj-c} .
 (2) Current limited by package.
 (3) Pulse width is limited by safe operating area.
 (4) This value is rated according to $R_{thj-pcb}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.0	$^{\circ}\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	

Notes:

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

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AV}	Avalanche current, not repetitive	7.4	A
$E_{AS}^{(1)}$	Single pulse avalanche energy	210	mJ

Notes:

- (1) starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AV}$.

2 Electrical characteristics

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

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 60\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 60\text{ V}$, $T_{\text{C}} = 125\text{ }^{\circ}\text{C}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 20\text{ V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 4\text{ A}$		27	40	m Ω
		$V_{\text{GS}} = 5\text{ V}$, $I_{\text{D}} = 4\text{ A}$		32	50	

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	670	-	pF
C_{oss}	Output capacitance		-	170	-	
C_{rss}	Reverse transfer capacitance		-	56	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 25\text{ V}$, $I_{\text{D}} = 7.4\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 15: "Gate charge test circuit")	-	22.5	-	nC
Q_{gs}	Gate-source charge		-	2.5	-	
Q_{gd}	Gate-drain charge		-	7	-	

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 30\text{ V}$, $I_{\text{D}} = 3.7\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform")	-	7	-	ns
t_{r}	Rise time		-	15.4	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	36.8	-	
t_{f}	Fall time		-	7.7	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		7.4	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		29.6	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 7.4\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 7.4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 48\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	28		ns
Q_{rr}	Reverse recovery charge		-	31.6		nC
I_{RRM}	Reverse recovery current		-	2.26		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)

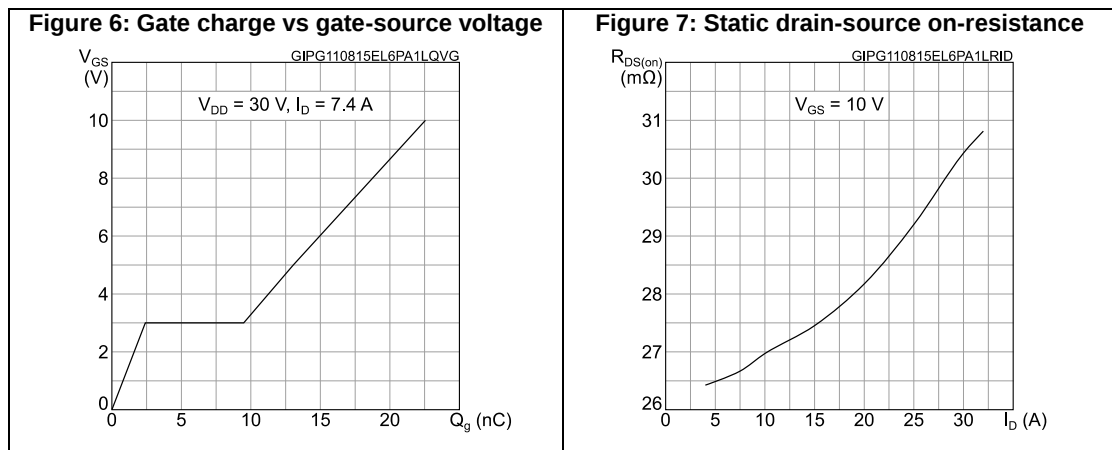
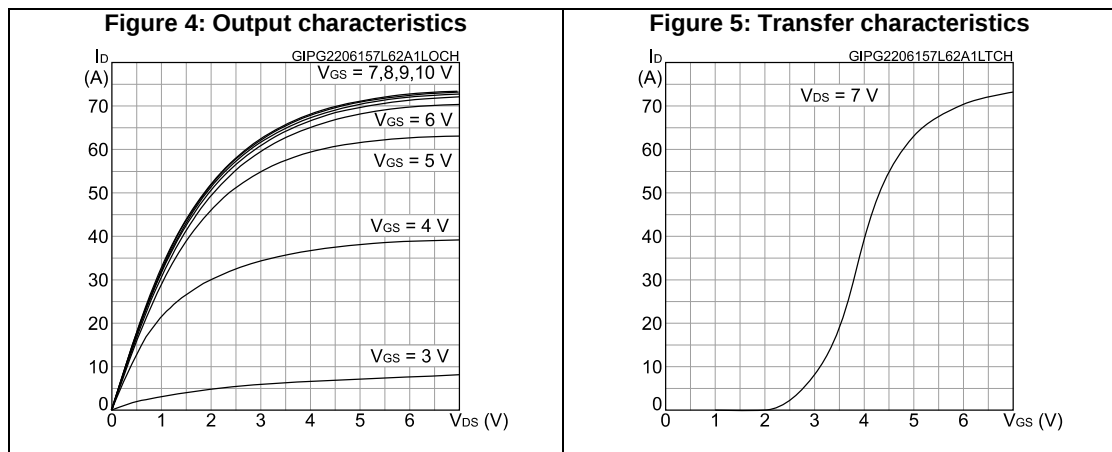
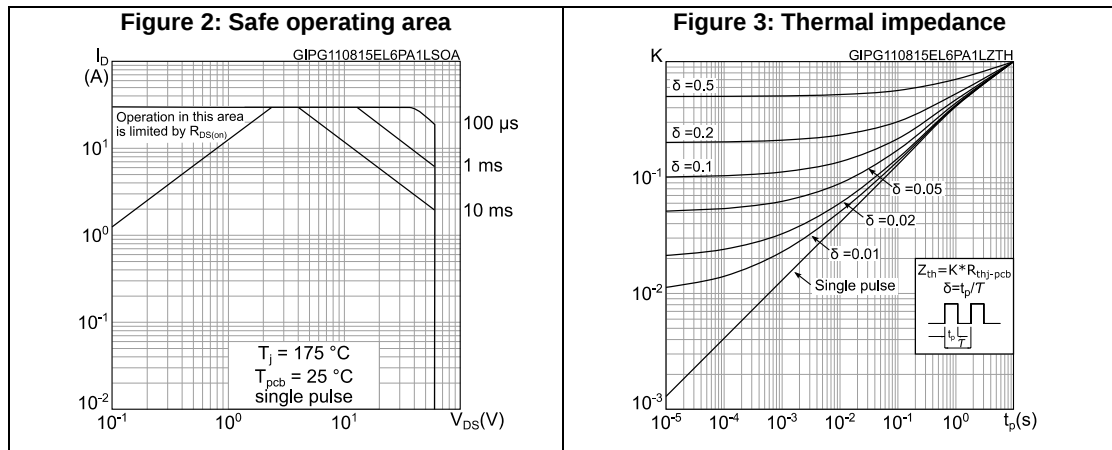


Figure 8: Capacitance variations

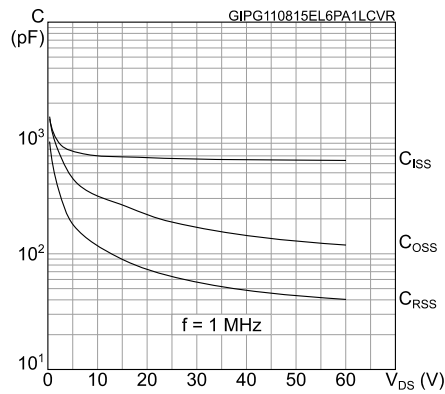


Figure 9: Normalized gate threshold voltage vs temperature

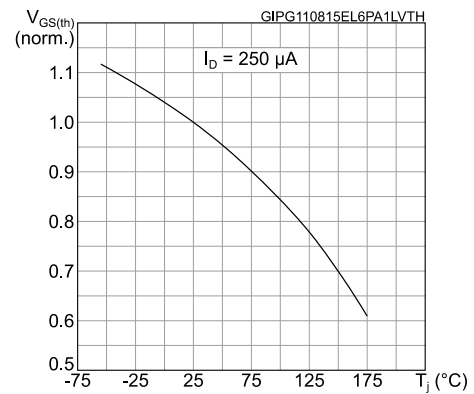


Figure 10: Normalized on-resistance vs temperature (VGS = 5 V)

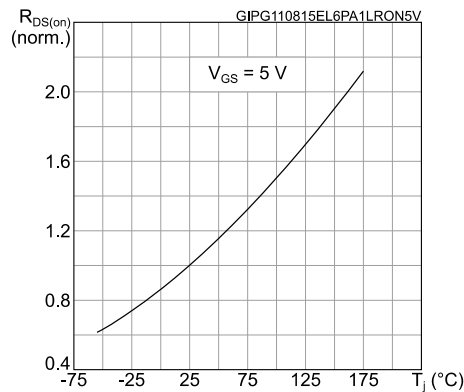


Figure 11: Normalized on-resistance vs temperature (VGS = 10 V)

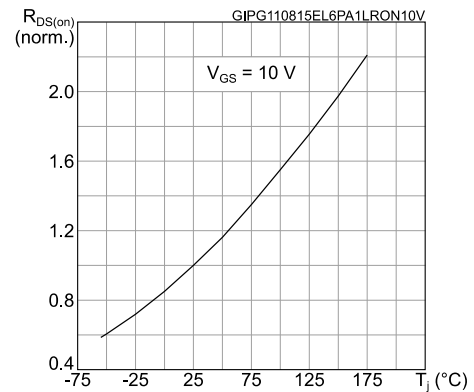


Figure 12: Normalized V(BR)DSS vs temperature

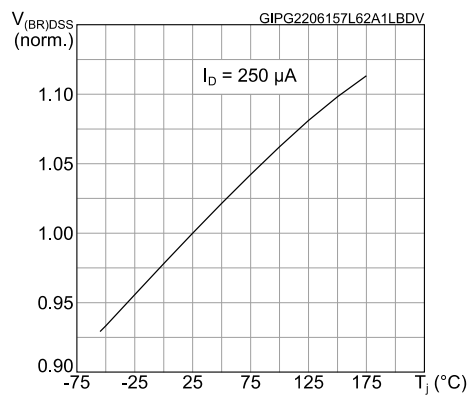
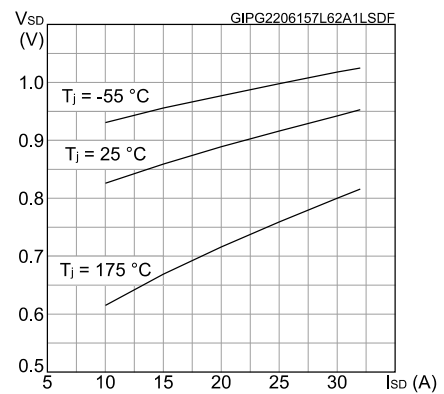


Figure 13: Source-drain diode forward characteristics



3 Test circuits

Figure 14: Switching times test circuit for resistive load

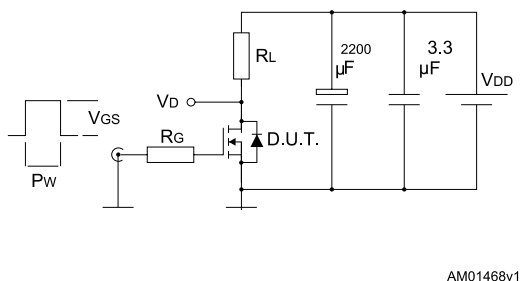


Figure 15: Gate charge test circuit

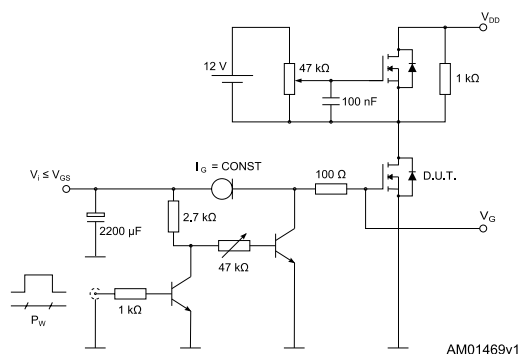


Figure 16: Test circuit for inductive load switching and diode recovery times

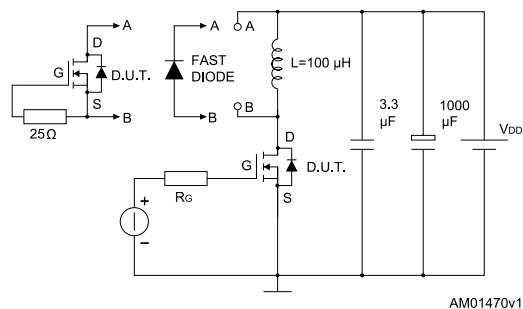


Figure 17: Unclamped inductive load test circuit

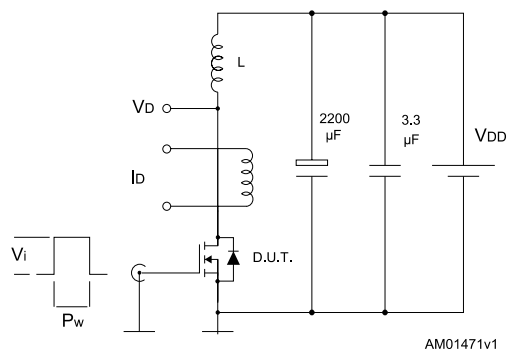


Figure 18: Unclamped inductive waveform

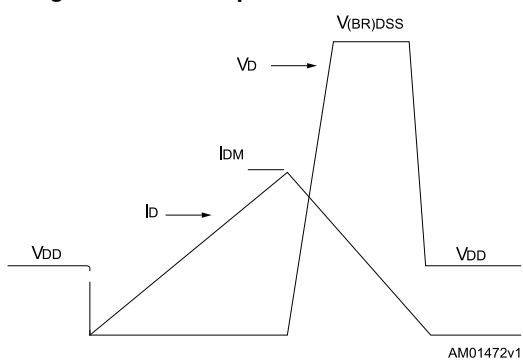
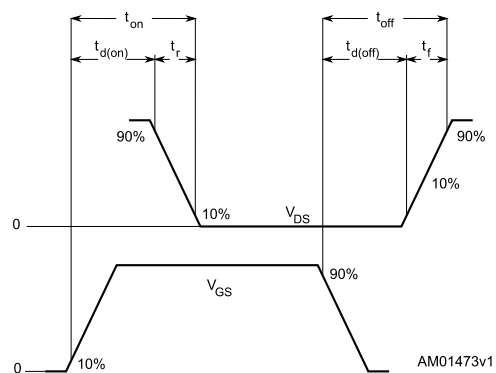


Figure 19: Switching time waveform



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 R package information

Figure 20: PowerFLAT™ 5x6 WF type R package outline

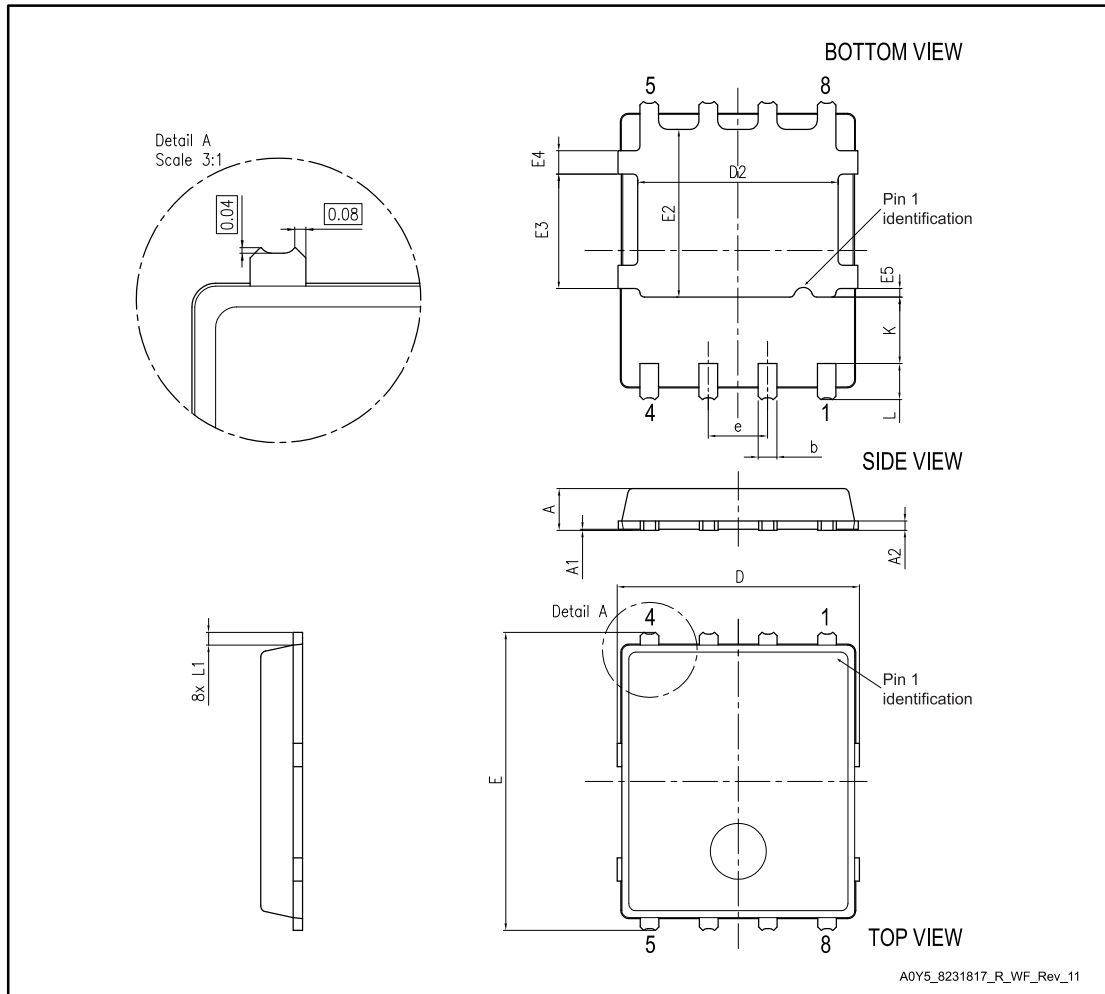
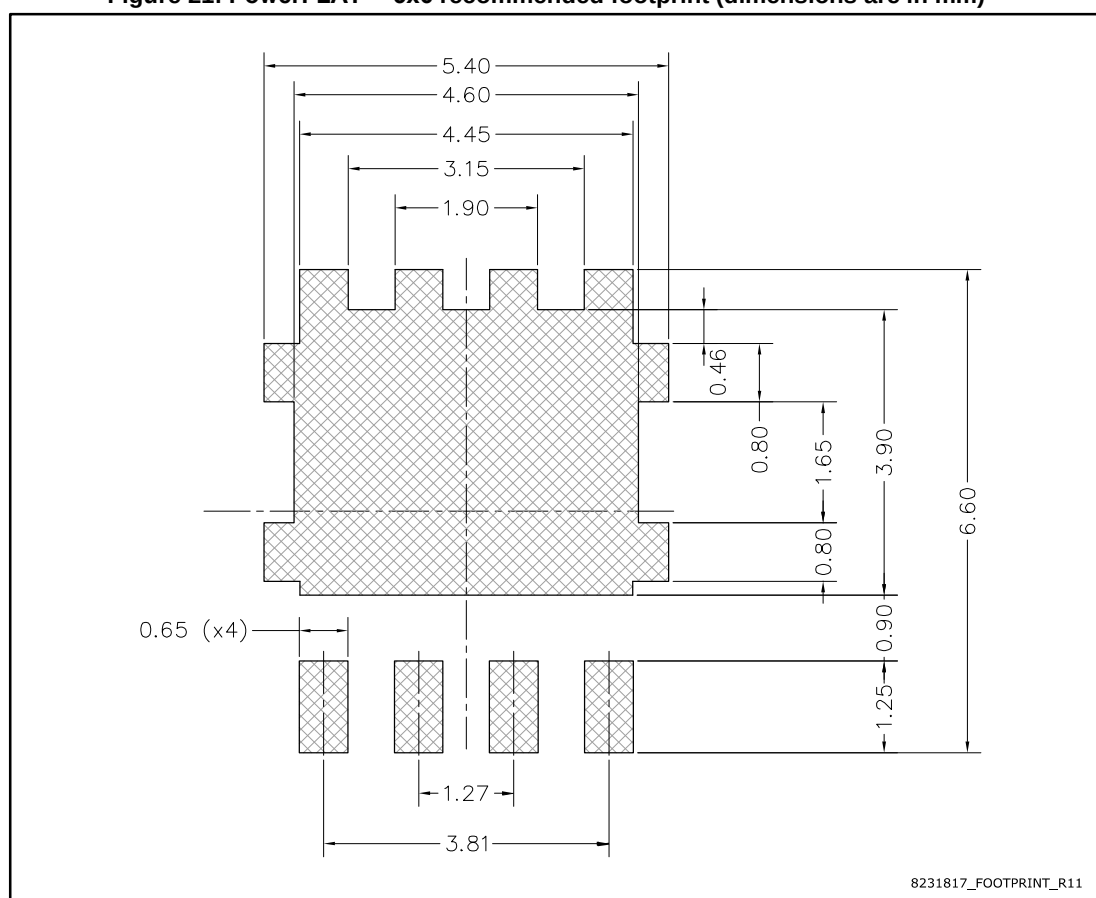


Table 9: PowerFLAT™ 5x6 WF type R mechanical data

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	6.20	6.40	6.60
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
L	0.70		0.90
L1		0.275	
K	1.275		1.575
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28

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



4.2 PowerFLAT™ 5x6 WF packing information

Figure 22: PowerFLAT™ 5x6 WF tape

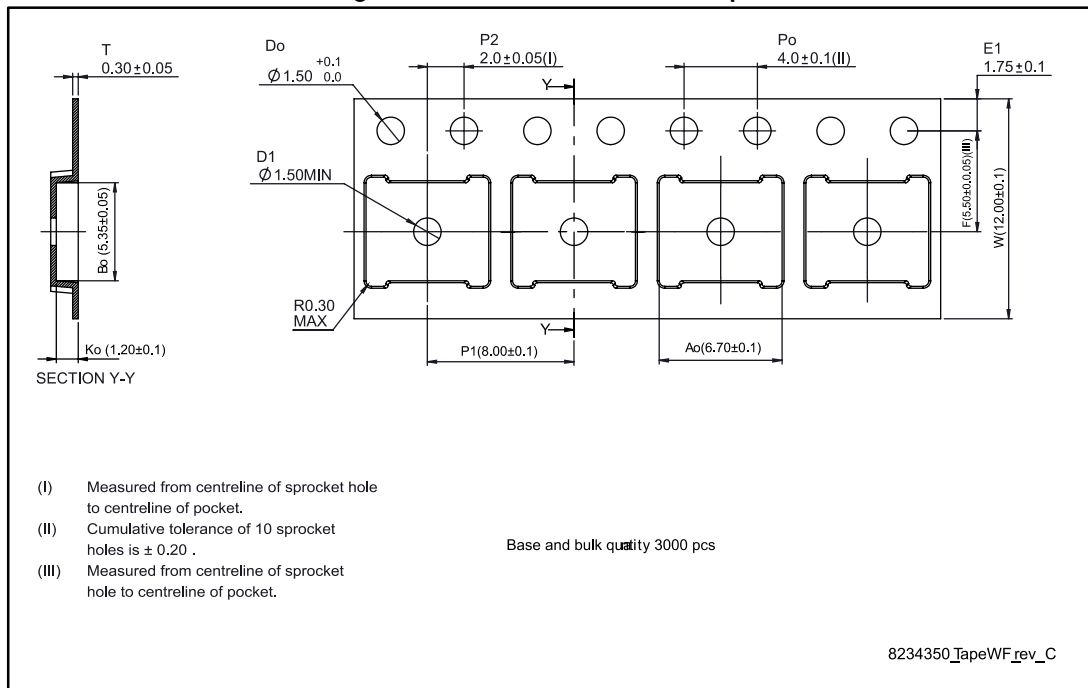
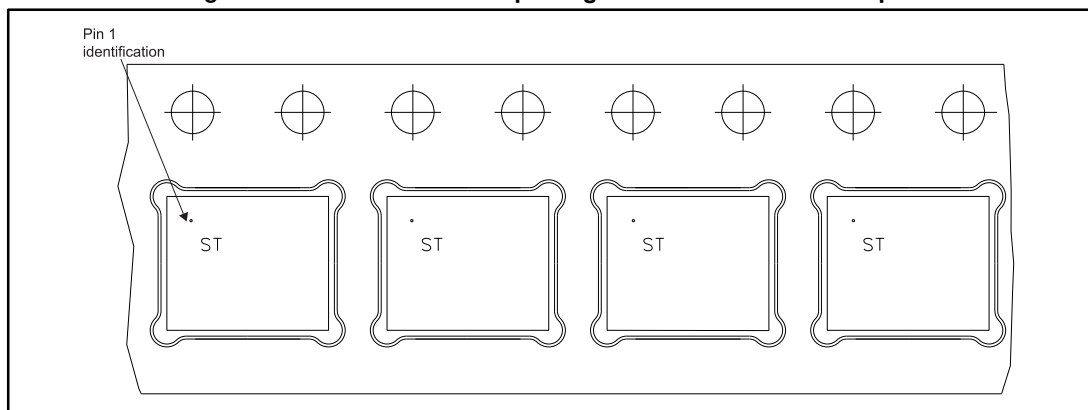


Figure 23: PowerFLAT™ 5x6 package orientation in carrier tape



Technical drawing of a reel showing top, side, and core details with dimensions in millimeters.

Top View (Left): Shows a circular reel with a central hub. Dimensions include: PART NO. (pointing to a label area), R25.00 (inner radius), 4.00 (inner diameter), 2.50 (inner hole diameter), and 128 (angle).

Top View (Right): Shows the outer rim of the reel. Dimensions include: A 330 (+0/-4.0) (overall diameter), 178±2.0 (width), and 12.4 (+2/-0) (width). An ESD LOGO is indicated.

Side View (Center): Shows the profile of the reel. Dimensions include: W3 11.9/15.4 (top width), W2 18.4 (max) (middle width), 2N 178±2.0 (width), and W1 12.4 (+2/-0) (bottom width).

Core Detail (Bottom Left): Shows a cross-section of the core. Dimensions include: R1.10 (radius), Ø21.2 (outer diameter), Ø13.00 (inner diameter), and 2.20 (height).

Notes:

- All dimensions are in millimeters
- ESD LOGO

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
28-Sep-2015	1	First release.

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