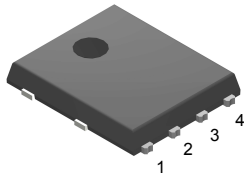
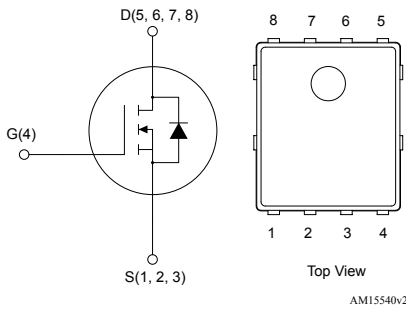



Automotive N-channel 40 V, 1.35 mΩ typ., 120 A, STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 package


PowerFLAT™ 5x6


Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL210N4LF7AG	40 V	1.6 mΩ	120 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 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.



Product status link

[STL210N4LF7AG](#)

Product summary

Order code	STL210N4LF7AG
Marking	210N4LF7
Package	PowerFLAT™ 5x6
Packing	Tape and reel

1 Electrical ratings

Table 1. 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 $T_C = 25\text{ }^\circ\text{C}$	120	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
I_{AV}	Avalanche current, repetitive or not repetitive (pulse width limited by maximum junction temperature)	30	A
E_{AS}	Single pulse avalanche energy ($T_j = 25\text{ }^\circ\text{C}$, $I_{AV} = 30\text{ A}$, $V_{DD} = 25\text{ V}$, $R_g \text{ min} = 47\text{ Ohm}$)	450	mJ
T_j	Operating junction temperature range	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature range		

1. This value is limited by package.
2. Pulse width limited by safe operating area.

Table 2. Thermal data

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

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

2 Electrical characteristics

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

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$	40			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 40\text{ V}$			10	μA
I_{GSS}	Gate-body leakage current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 30\text{ A}$		1.35	1.6	m Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 30\text{ A}$		2	2.5	

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	4210	-	pF
C_{oss}	Output capacitance		-	1165	-	pF
C_{riss}	Reverse transfer capacitance		-	60	-	pF
Q_g	Total gate charge	$V_{DD} = 20\text{ V}$, $I_D = 120\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 13. Test circuit for gate charge behavior)	-	56	-	nC
Q_{gs}	Gate-source charge		-	16	-	nC
Q_{gd}	Gate-drain charge		-	7	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$, $I_D = 60\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	15	-	ns
t_r	Rise time		-	5.4	-	ns
$t_{d(off)}$	Turn-off delay time		-	42	-	ns
t_f	Fall time		-	22	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				120	A
$V_{SD}^{(1)}$	Source-drain voltage	$I_{SD} = 120\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 120\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	46		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 32\text{ V}$	-	34		nC
I_{RRM}	Reverse recovery current	(see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	1.5		A

1. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

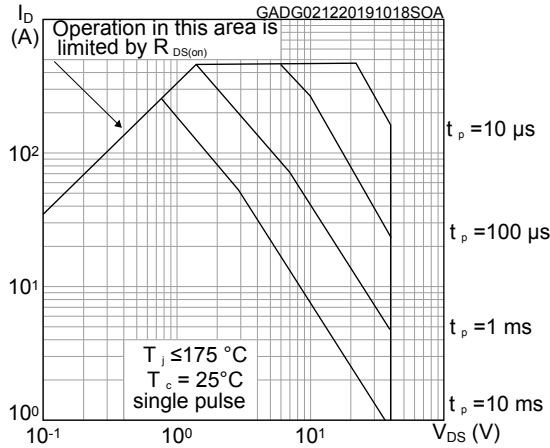


Figure 2. Maximum transient thermal impedance

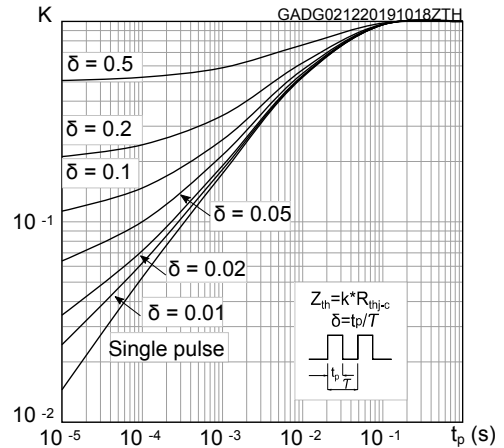


Figure 3. Typical output characteristics

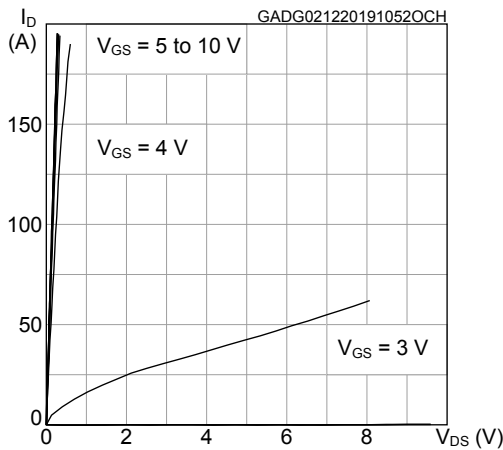


Figure 4. Typical transfer characteristics

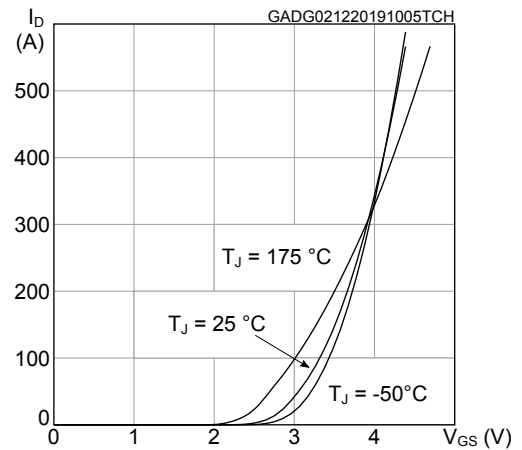


Figure 5. Typical gate charge characteristics

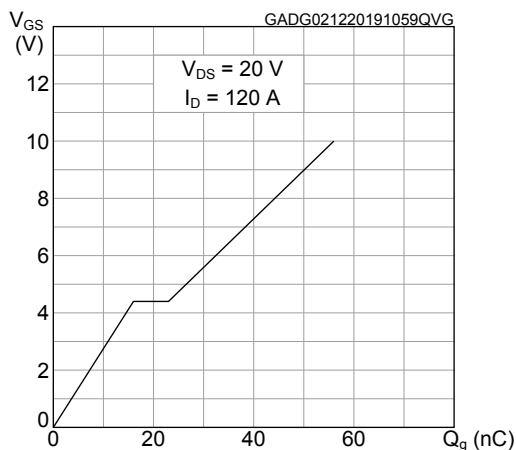


Figure 6. Typical drain-source on-resistance

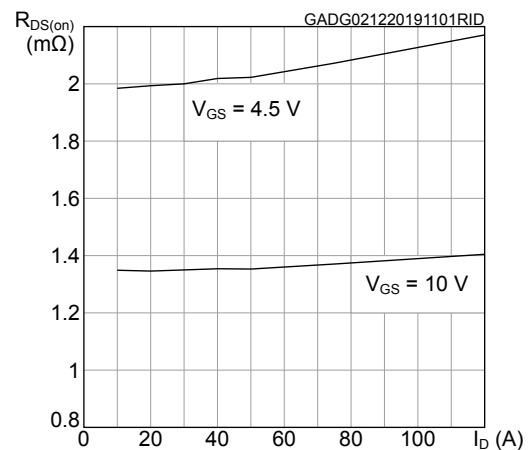


Figure 7. Typical capacitance characteristics

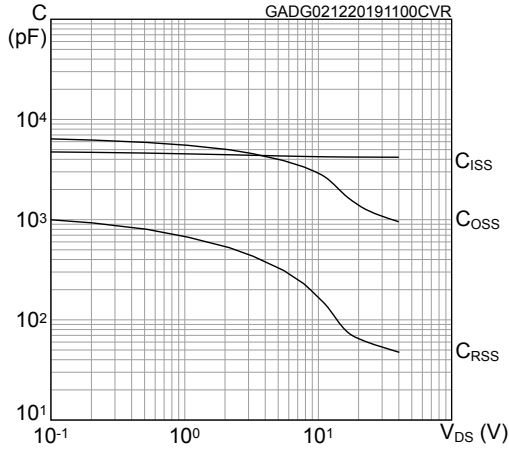


Figure 8. Normalized gate threshold voltage vs temperature

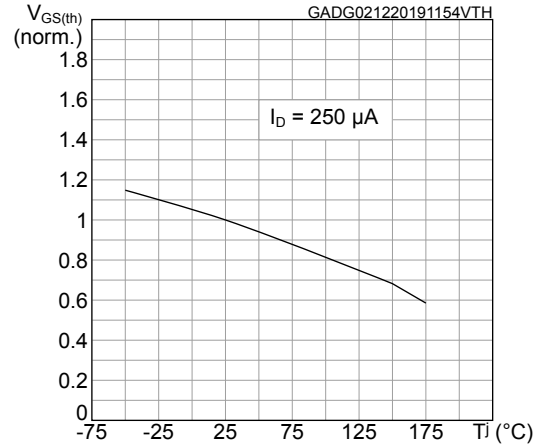


Figure 9. Normalized on-resistance vs temperature

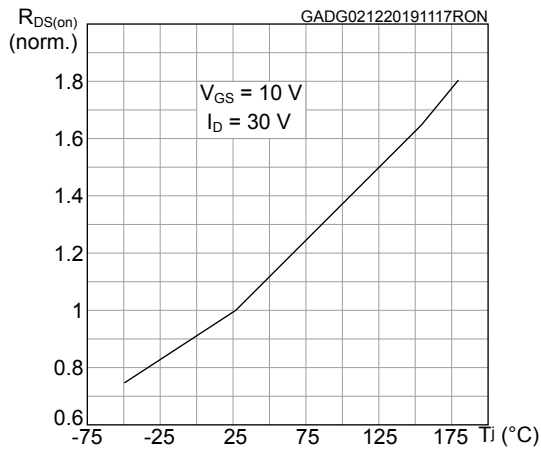


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

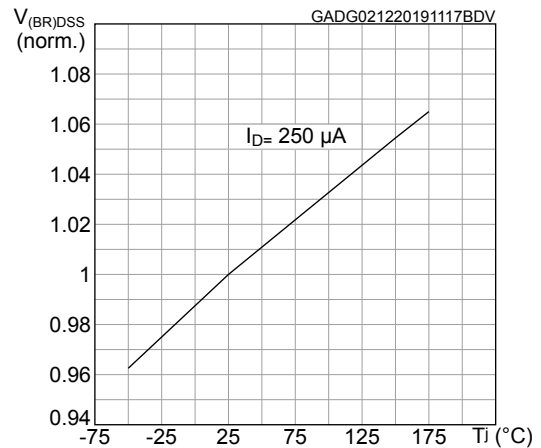
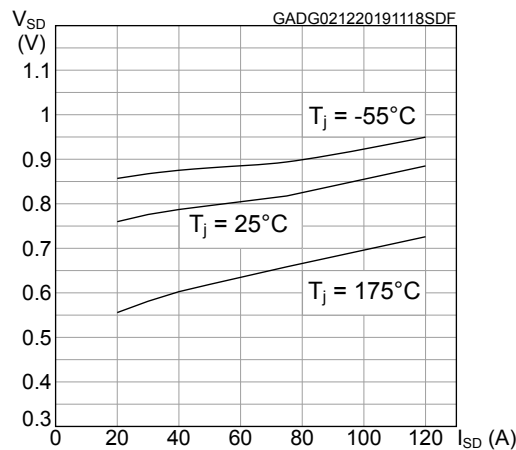
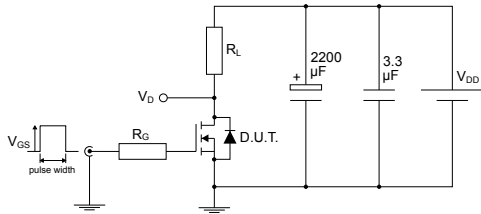


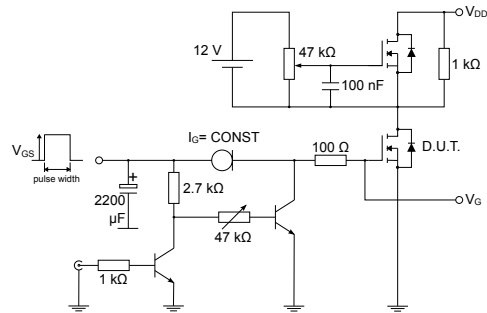
Figure 11. Typical reverse diode forward characteristics



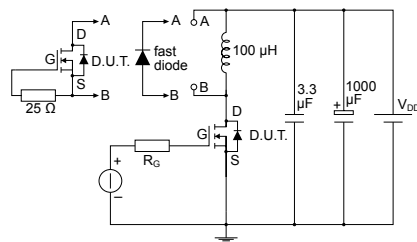
3 Test circuits

Figure 12. Test circuit for resistive load switching times


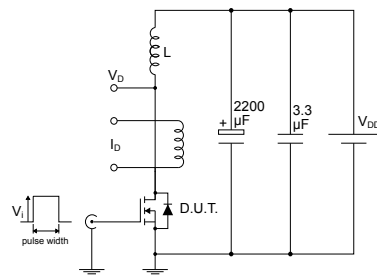
AM01468v1

Figure 13. Test circuit for gate charge behavior


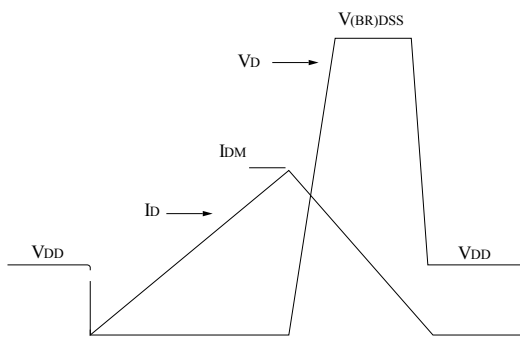
AM01469v1

Figure 14. Test circuit for inductive load switching and diode recovery times


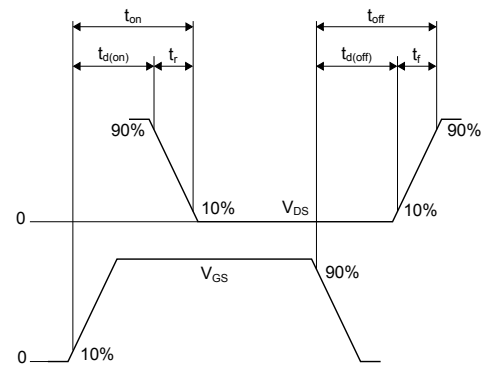
AM01470v1

Figure 15. Unclamped inductive load test circuit


AM01471v1

Figure 16. Unclamped inductive waveform


AM01472v1

Figure 17. Switching time waveform


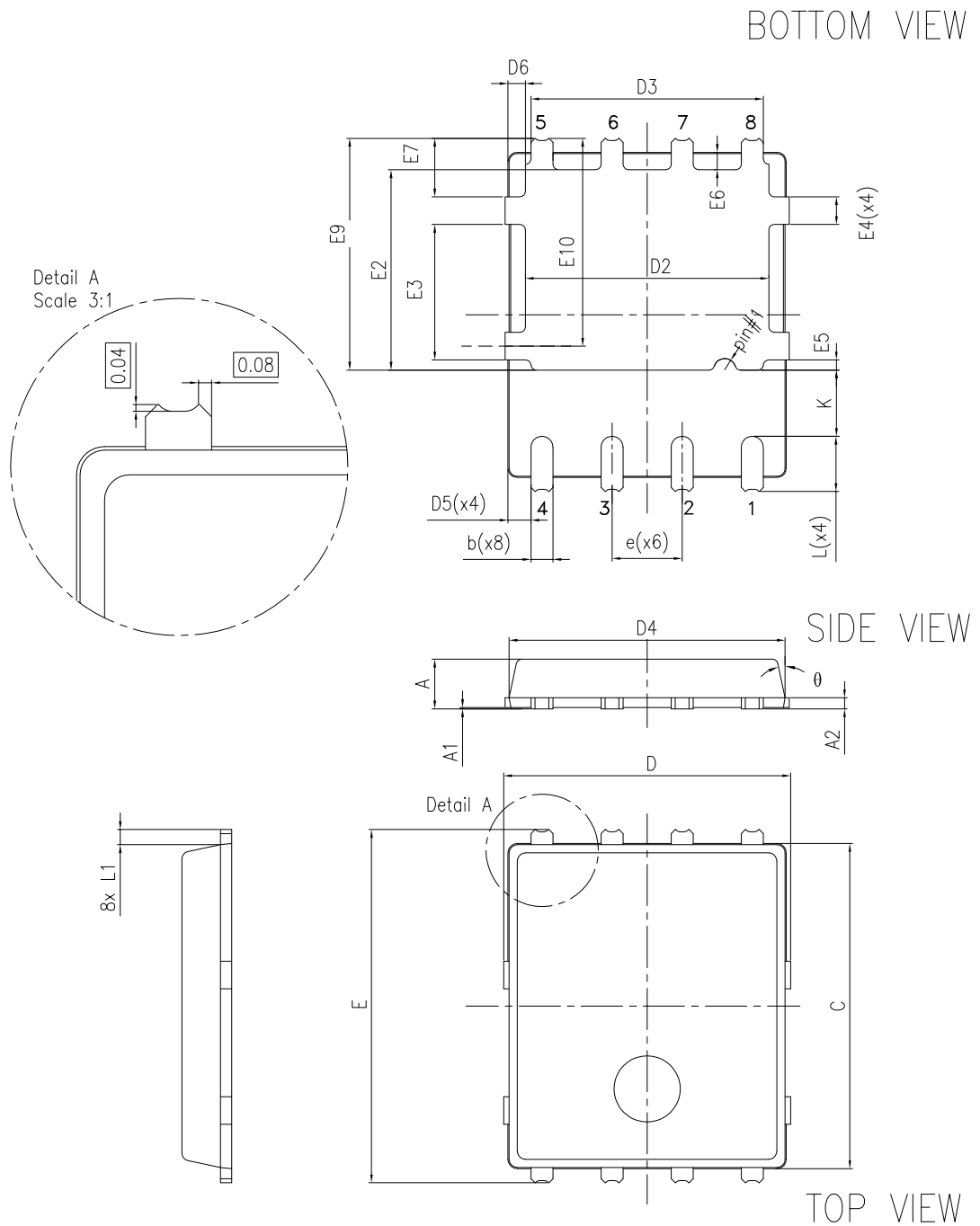
AM01473v1

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 18. PowerFLAT™ 5x6 WF type C package outline

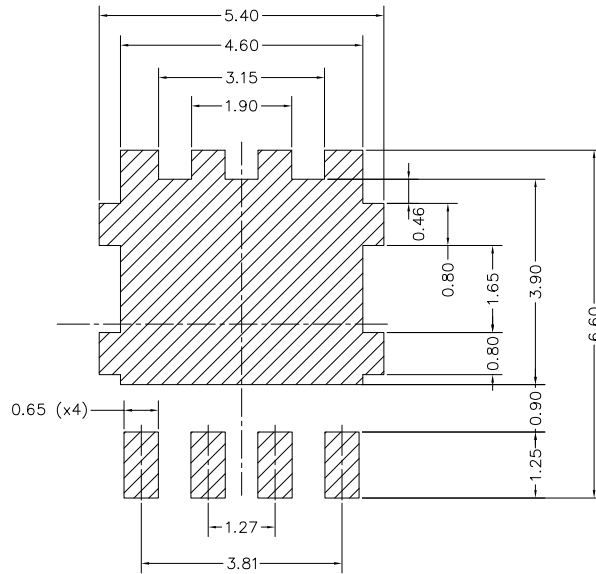


8231817_WF_typeC_r20

Table 7. PowerFLAT™ 5x6 WF type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.00		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°

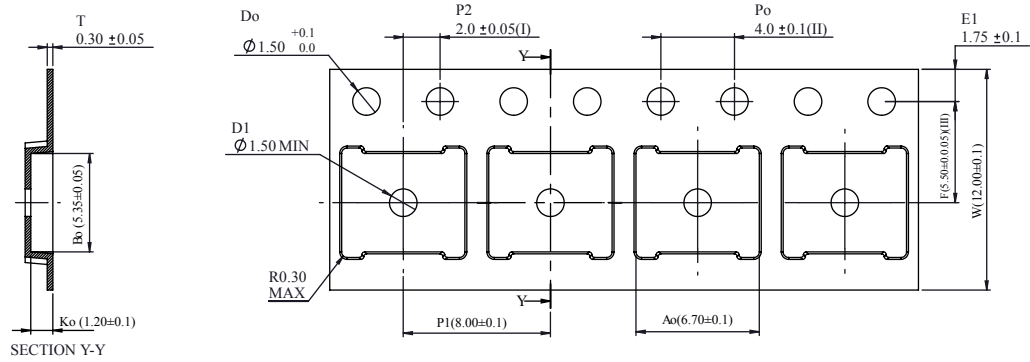
Figure 19. PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



8231817_FOOTPRINT_rev20

4.2 PowerFLAT™ 5x6 WF packing information

Figure 20. PowerFLAT™ 5x6 WF tape (dimensions are in mm)



- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.

Base and bulk quantity 3000 pcs

8234350_TapeWF_rev_C

Figure 21. PowerFLAT™ 5x6 package orientation in carrier tape

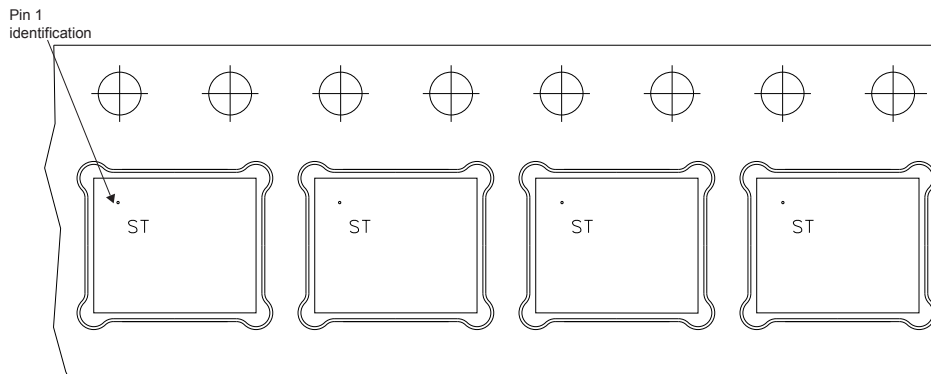
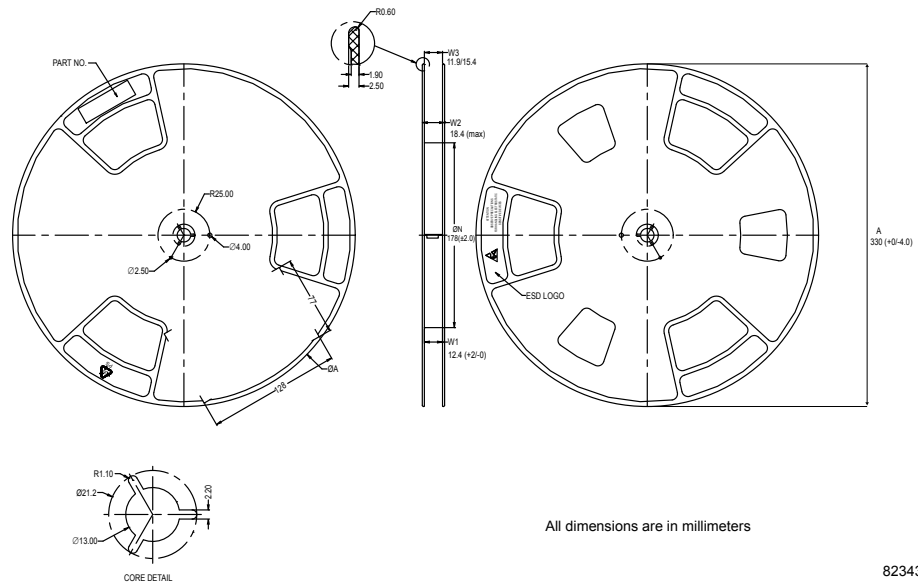


Figure 22. PowerFLAT™ 5x6 reel (dimensions are in mm)



8234350_Reel_rev_C

Revision history

Table 8. Document revision history

Date	Version	Changes
16-Jan-2019	1	First release
07-Mar-2019	2	Modified <i>Table 3. On/off states</i> . Minor text changes.
02-Dec-2019	3	Updated Section 1 Electrical ratings and Section 2 Electrical characteristics . Added Section 2.1 Electrical characteristics (curves) .

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