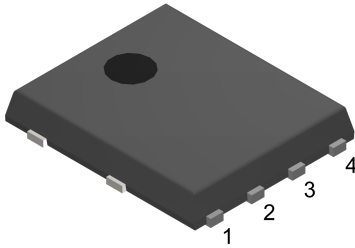
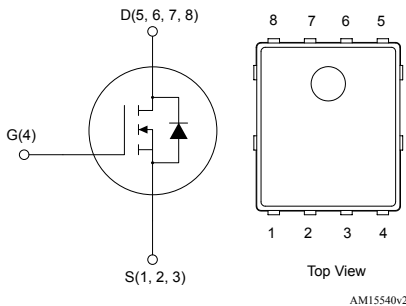


## N-channel 60 V, 2.4 mΩ typ., 140 A, STripFET F7 Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT™ 5x6



### 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
- Logic level  $V_{GS(th)}$

### 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

STL140N6F7

#### Product summary

<b>Order code</b>	STL140N6F7
<b>Marking</b>	140N6F7
<b>Package</b>	PowerFLAT 5x6
<b>Packing</b>	Tape and reel

# 1 Electrical ratings

**Table 1. 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 $T_{case} = 25\text{ °C}$	140	A
	Drain current (continuous) at $T_{case} = 100\text{ °C}$	107	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	560	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ °C}$	30	A
	Drain current (continuous) at $T_{pcb} = 100\text{ °C}$	21	
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	116	A
$P_{TOT}^{(1)}$	Total power dissipation at $T_{case} = 25\text{ °C}$	125	W
$P_{TOT}^{(3)}$	Total power dissipation at $T_{pcb} = 25\text{ °C}$	4.8	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	38	mJ
$T_{stg}$	Storage temperature range	-55 to 175	°C
$T_j$	Operating junction temperature range		

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  $T_j = 25\text{ °C}$ ,  $I_D = 16\text{ A}$ ,  $V_{DD} = 40\text{ V}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	°C/W
$R_{thj-case}$	Thermal resistance junction-case	1.2	

1. When mounted on a 1-inch<sup>2</sup> FR-4 board, 2oz Cu,  $t < 10\text{ s}$

## 2 Electrical characteristics

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

**Table 3. 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	$\mu\text{A}$
$I_{GSS}$	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	$\text{m}\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	3110	-	$\text{pF}$
$C_{oss}$	Output capacitance		-	1520	-	
$C_{riss}$	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 13. Test circuit for gate charge behavior)	-	55	-	nC
$Q_{gs}$	Gate-source charge		-	19	-	
$Q_{gd}$	Gate-drain charge		-	18	-	

**Table 5. 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 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	24	-	ns
$t_r$	Rise time		-	68	-	
$t_{d(off)}$	Turn-off delay time		-	39	-	
$t_f$	Fall time		-	20	-	

**Table 6. 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 14. 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

1. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

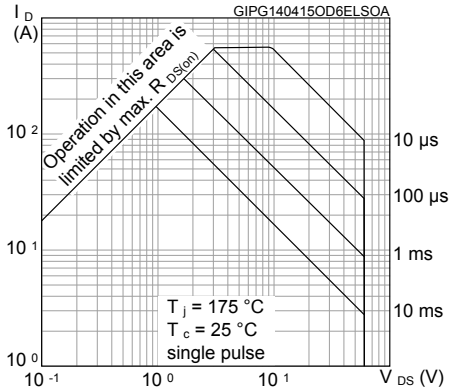


Figure 2. Thermal impedance

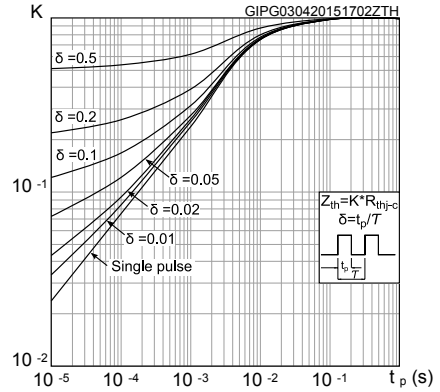


Figure 3. Output characteristics

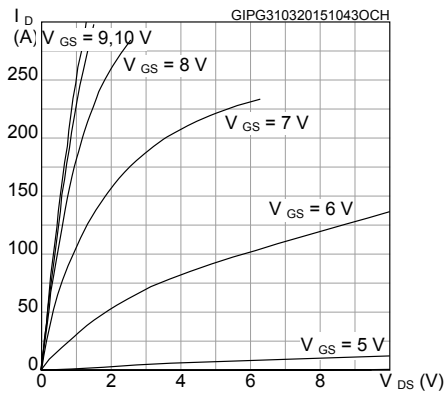


Figure 4. Transfer characteristics

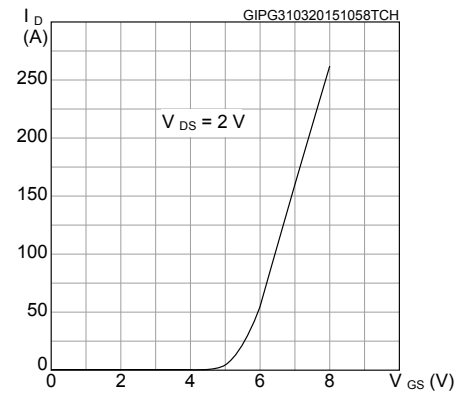


Figure 5. Gate charge vs gate-source voltage

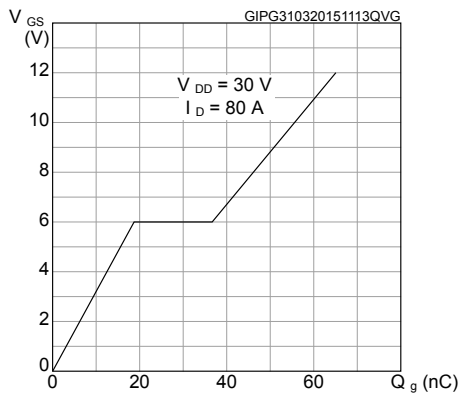


Figure 6. Static drain-source on-resistance

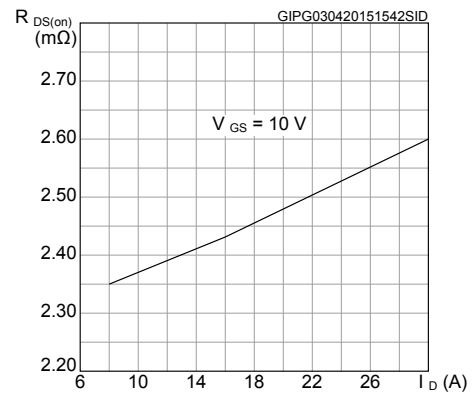


Figure 7. Capacitance variations

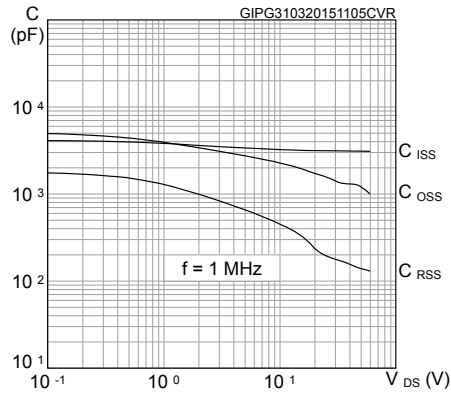


Figure 8. Normalized gate threshold voltage vs temperature

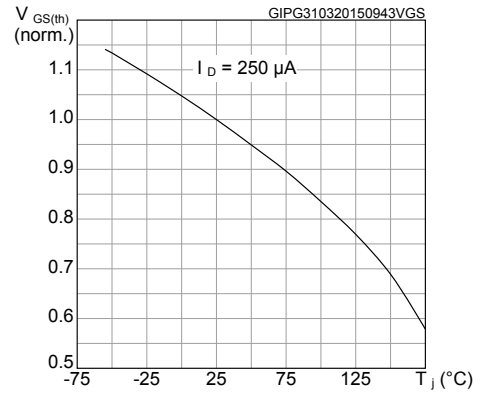


Figure 9. Normalized on-resistance vs temperature

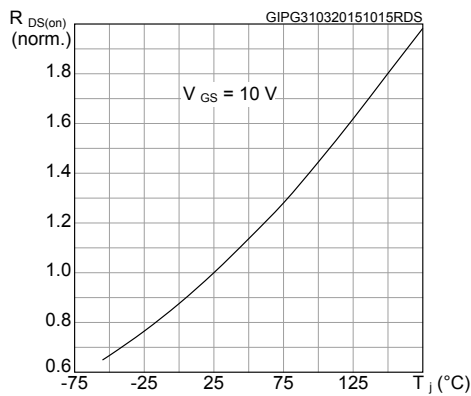


Figure 10. Normalized  $V_{(BR)DSS}$  vs temperature

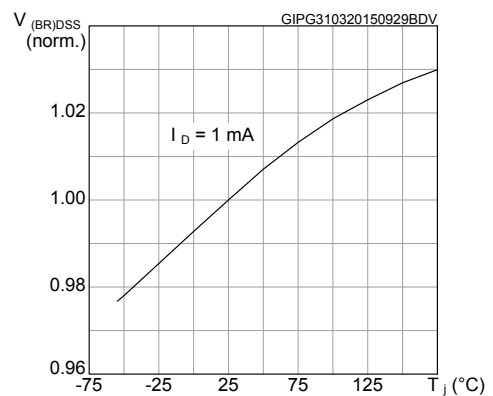
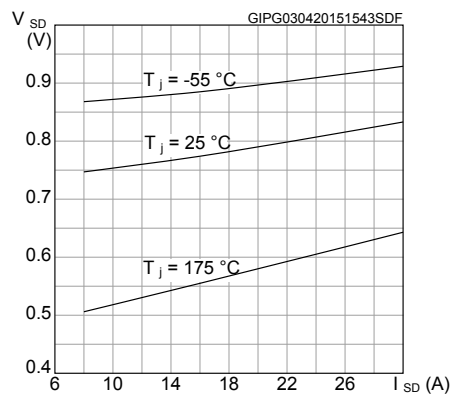
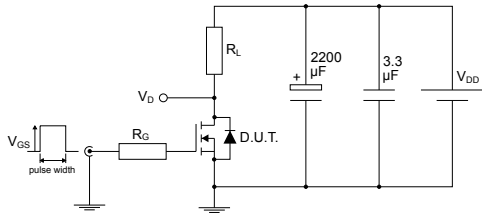


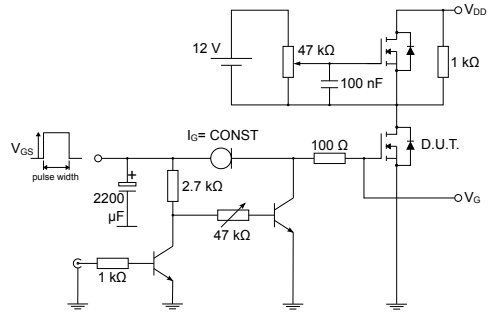
Figure 11. Source-drain diode forward characteristics



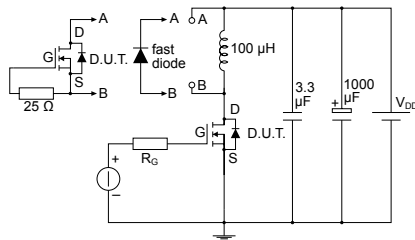
### 3 Test circuits

**Figure 12. Test circuit for resistive load switching times**


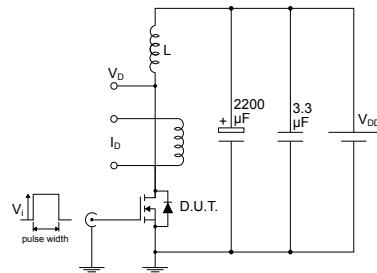
AM01468v1

**Figure 13. Test circuit for gate charge behavior**


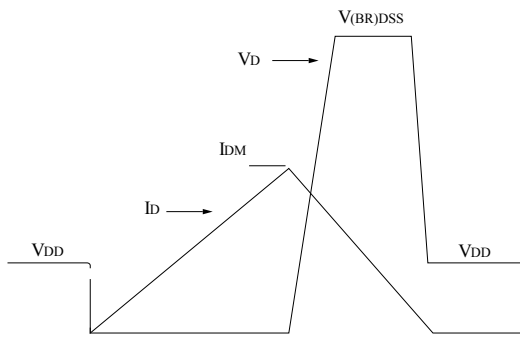
AM01469v1

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


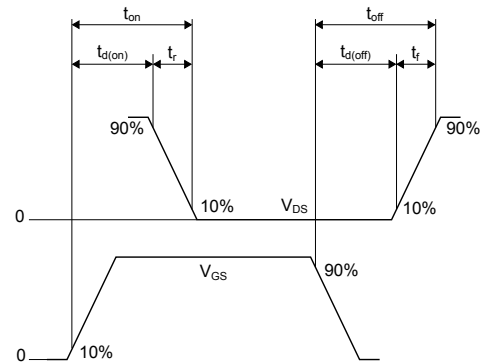
AM01470v1

**Figure 15. Unclamped inductive load test circuit**


AM01471v1

**Figure 16. Unclamped inductive waveform**


AM01472v1

**Figure 17. Switching time waveform**


AM01473v1

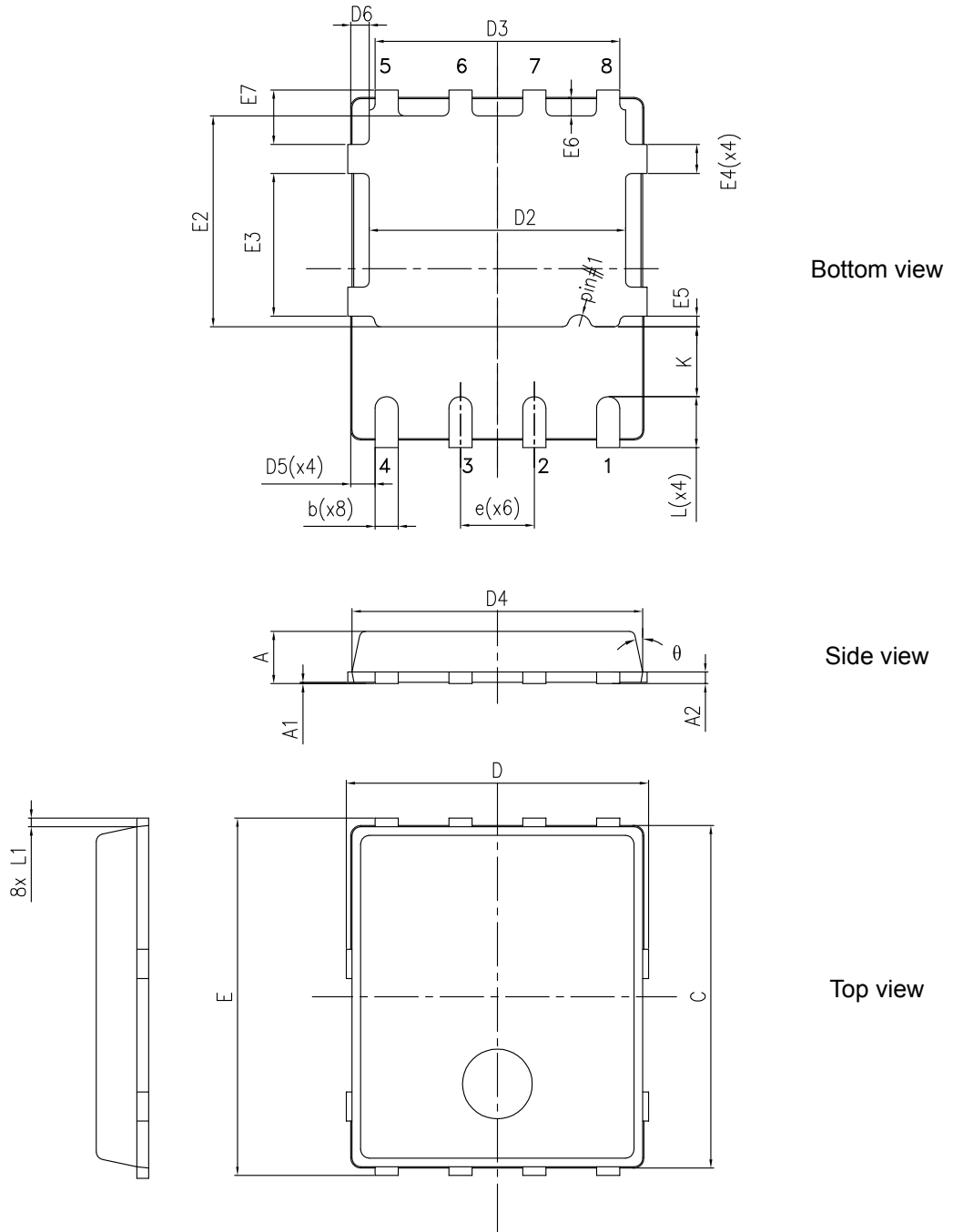
## 4 Package information

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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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 PowerFLAT 5x6 type C package information

Figure 18. PowerFLAT 5x6 type C package outline



8231817\_typeC\_Rev18

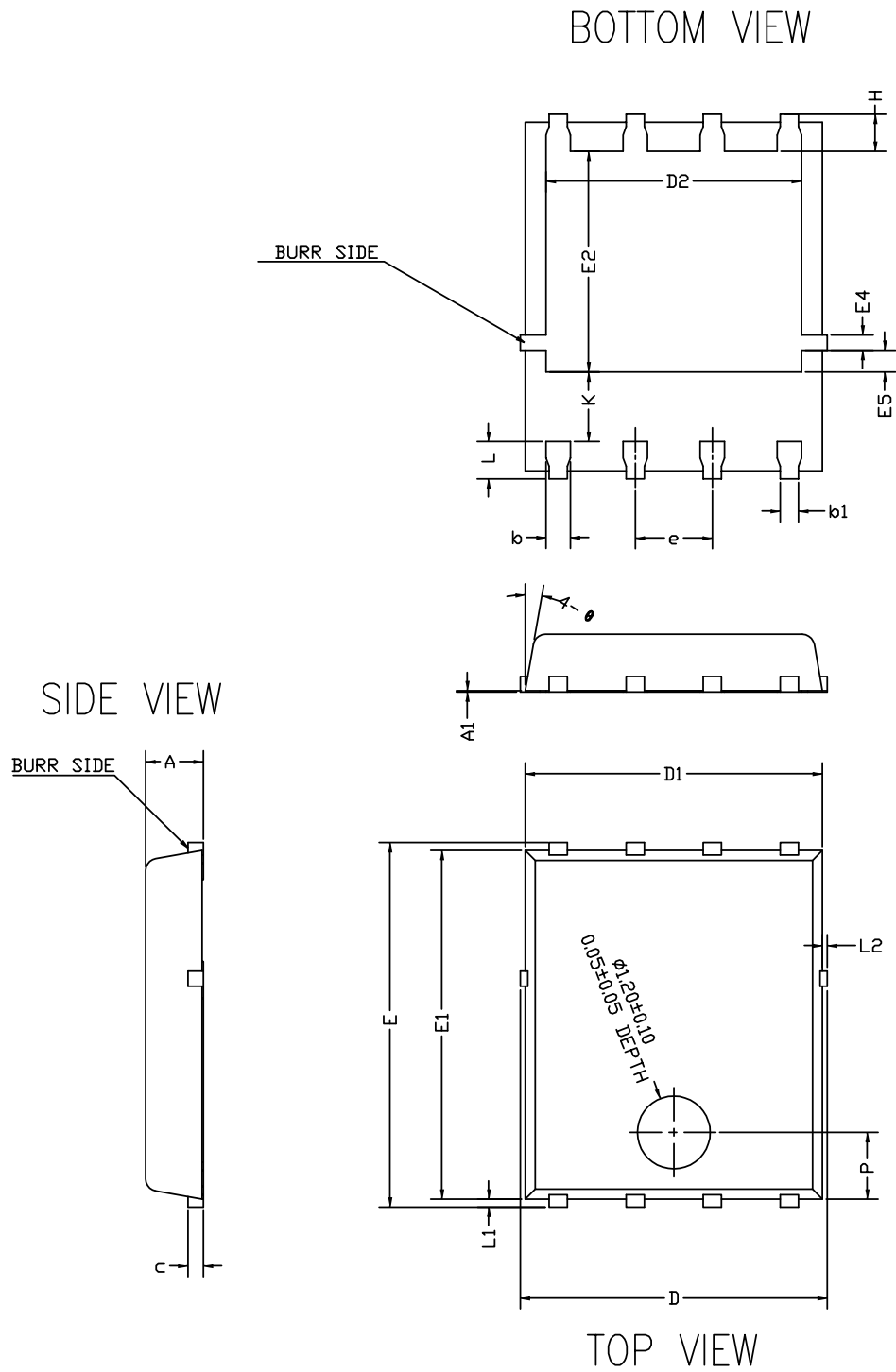


**Table 7. PowerFLAT 5x6 type C package mechanical data**

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°

## 4.2 PowerFLAT 5x6 type SUBCON package information

Figure 19. PowerFLAT 5x6 type SUBCON package outline

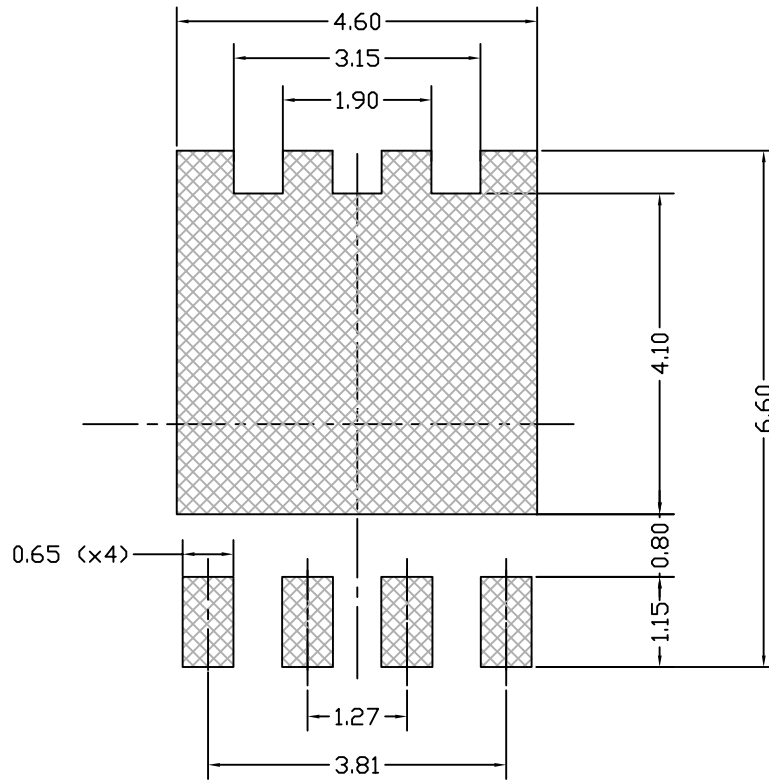


8231817\_SUBCON\_REV4

**Table 8. PowerFLAT 5x6 type SUBCON package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	0.90	0.95	1.00
A1		0.02	
b	0.35	0.40	0.45
b1		0.30	
c	0.21	0.25	0.34
D	4.80		5.10
D1	4.80	4.90	5.00
D2	4.01	4.21	4.31
e	1.17	1.27	1.37
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.54	3.64	3.74
E4	0.15	0.25	0.35
E5	0.26	0.36	0.46
H	0.51	0.61	0.71
K	0.95		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2			0.10
P	1.00	1.10	1.20
θ	8°	10°	12°

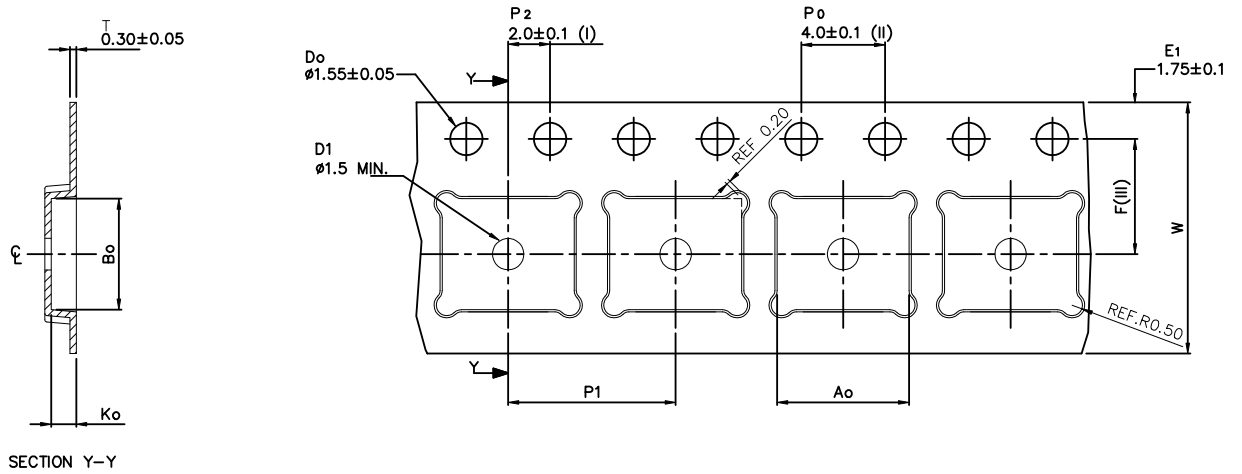
Figure 20. PowerFLAT 5x6 recommended footprint (dimensions are in mm)



8231817\_FOOTPRINT\_simp\_Rev\_18

### 4.3 PowerFLAT 5x6 packing information

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



A <sub>0</sub>	6.30 +/- 0.1
B <sub>0</sub>	5.30 +/- 0.1
K <sub>0</sub>	1.20 +/- 0.1
F	5.50 +/- 0.1
P <sub>1</sub>	8.00 +/- 0.1
W	12.00 +/- 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.

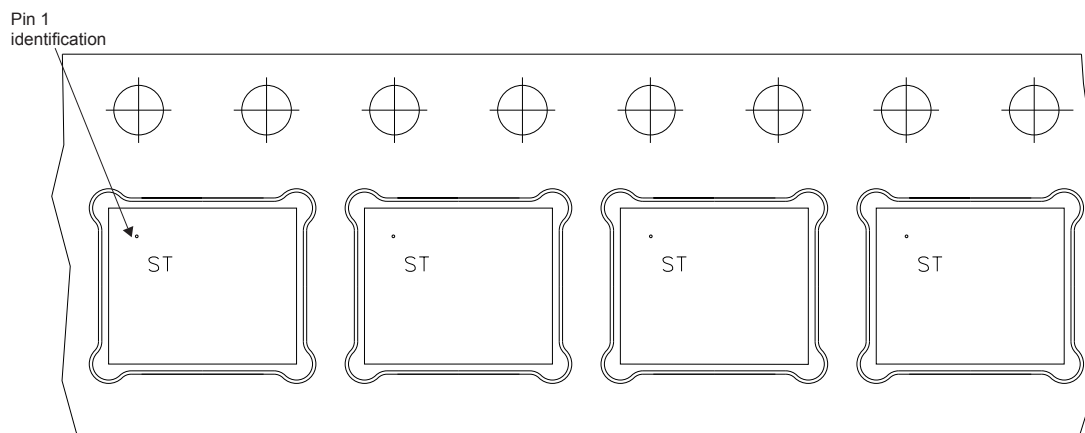
(II) Cumulative tolerance of 10 sprocket holes is  $\pm 0.20$ .

(III) Measured from centreline of sprocket hole to centreline of pocket

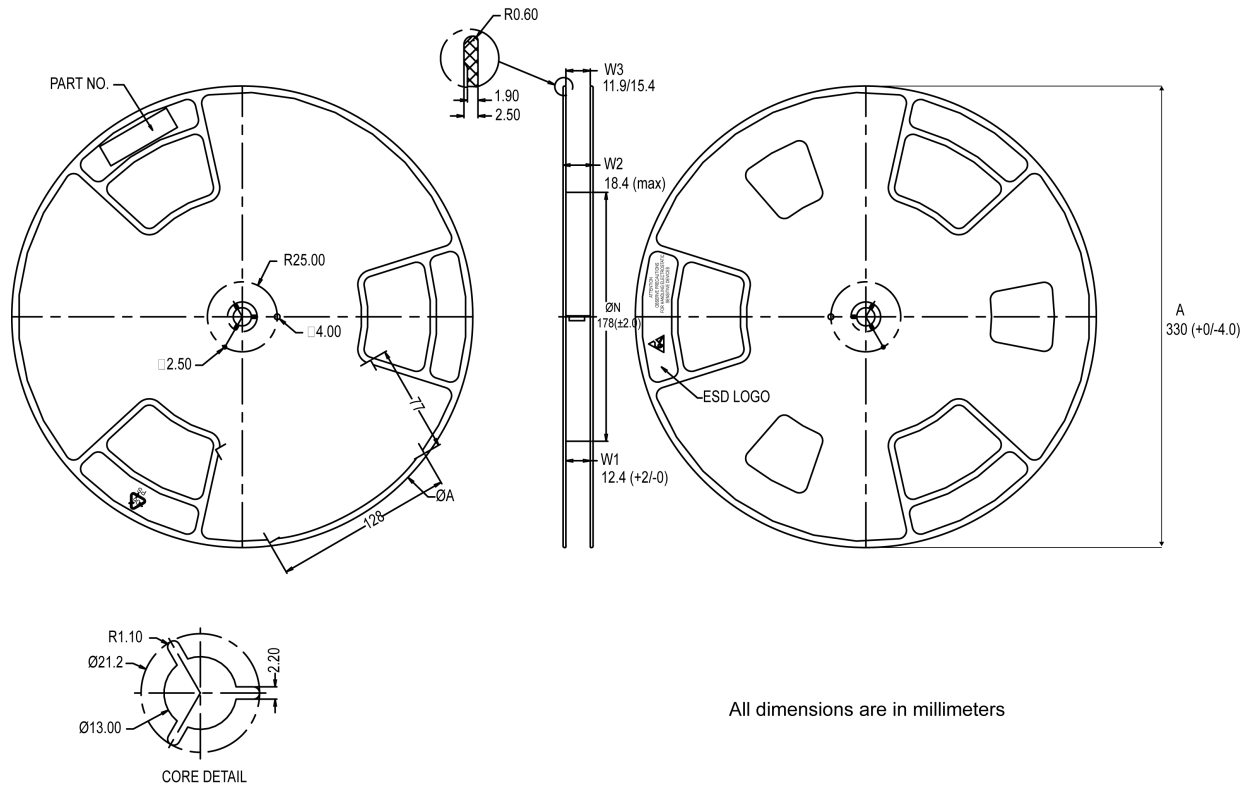
Base and bulk quantity 3000 pcs  
All dimensions are in millimeters

8234350\_Tape\_rev\_C

Figure 22. PowerFLAT 5x6 package orientation in carrier tape



**Figure 23. PowerFLAT 5x6 reel**



All dimensions are in millimeters

8234350\_Reel\_rev\_C

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## Revision history

**Table 9. Document revision history**

Date	Revision	Changes
02-Aug-2013	1	First release.
18-Mar-2014	2	Updated $V_{DS}$ value in <i>Table 2: Absolute maximum ratings</i> and <i>Table 4: On /off states</i> . Updated <i>Section 4: Package mechanical data</i> . 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 <i>section 1 Electrical ratings</i> Updated <i>section 2 Electrical characteristics</i> Added <i>section 2.1 Electrical characteristics (curves)</i> Updated and renamed <i>Section 4 Package information</i> (was <i>Package mechanical data</i> ) Updated and renamed <i>Section 4.2 Packing information</i> (was <i>Section 5 Packaging mechanical data</i> )
19-May-2015	4	In <i>Section 2.1 Electrical characteristics (curves)</i> : - Updated <i>Figure 24: Capacitance variations</i>
21-Apr-2017	5	Added $E_{AS}$ in <i>Table 2: "Absolute maximum ratings"</i> Updated <i>Section 4.1: "PowerFLAT™ 5x6 type C package information"</i> Minor text changes.
10-Sep-2019	6	Added: <i>Section 4.2 PowerFLAT 5x6 type SUBCON package information</i> . Minor text changes.
01-Oct-2019	7	Updated <a href="#">Section 4.2 PowerFLAT 5x6 type SUBCON package information</a> . Minor text changes



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