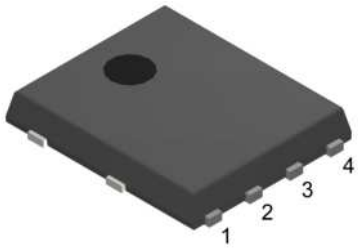
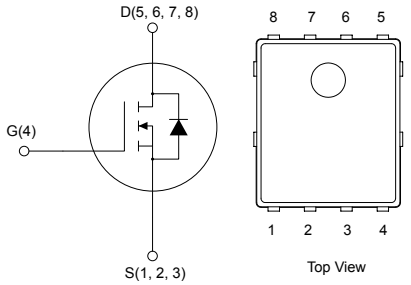
N-channel 60 V, 1.2 mΩ typ., 120 A STripFET F7 Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT 5x6



Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL220N6F7	60 V	1.4 mΩ	120 A

- 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

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
STL220N6F7

Product summary	
Order code	STL220N6F7
Marking	220N6F7
Package	PowerFLAT 5x6
Packing	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_C = 25 °C	120	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	120	A
I_{DM} (2) (1)	Drain current (pulsed)	480	A
I_D (3)	Drain current (continuous) at T_{pcb} = 25 °C	40	A
I_D (3)	Drain current (continuous) at T_{pcb} = 100 °C	28.5	A
I_{DM} (2) (3)	Drain current (pulsed)	160	A
E_{AS}	Single pulse avalanche energy (starting T_j =25 °C, I_{AS} = 20 A)	900	mJ
P_{TOT} (1)	Total power dissipation at T_C = 25 °C	188	W
P_{TOT} (3)	Total power dissipation at T_{pcb} = 25 °C	4.8	W
T_j	Operating junction temperature range	-55 to 175	°C
	Storage temperature range		

1. *This value is rated according to $R_{thj\text{-}c}$.*
2. *Pulse width limited by safe operating area.*
3. *This value is rated according to $R_{thj\text{-}pcb}$.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	31.3	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.8	°C/W

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 3. 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	60			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V V_{DS} = 60 V			1	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	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 20 A		1.2	1.4	mΩ

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	6500	-	pF
C_{oss}	Output capacitance		-	3200	-	pF
C_{rss}	Reverse transfer capacitance		-	230	-	pF
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 40 A, V_{GS} = 0 to 10 V (see Figure 13. Test circuit for gate charge behavior)	-	98	-	nC
Q_{gs}	Gate-source charge		-	38	-	nC
Q_{gd}	Gate-drain charge		-	28	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 30 V, I_D = 20 A, R_G = 4.7 Ω, V_{GS} = 10 V (see and Figure 17. Switching time waveform)	-	41	-	ns
t_r	Rise time		-	45	-	ns
$t_{d(off)}$	Turn-off delay time		-	68	-	ns
t_f	Fall time		-	35	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD} (1)	Forward on voltage	I_{SD} = 40 A, V_{GS} = 0 V	-		1.2	V
t_{rr}	Reverse recovery time	I_D = 40 A, di/dt = 100 A/µs	-	69		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 48 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	103		nC
I_{RRM}	Reverse recovery current		-	3		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

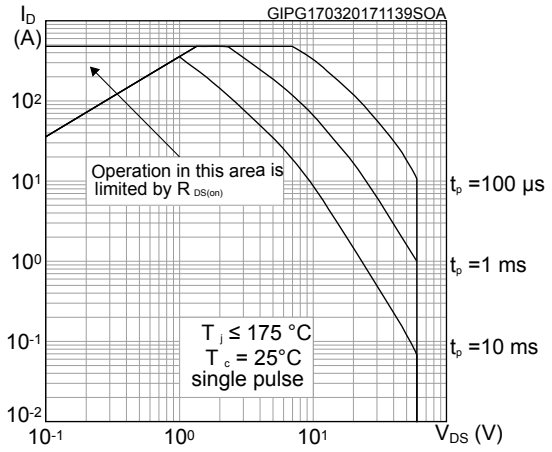


Figure 2. Thermal impedance

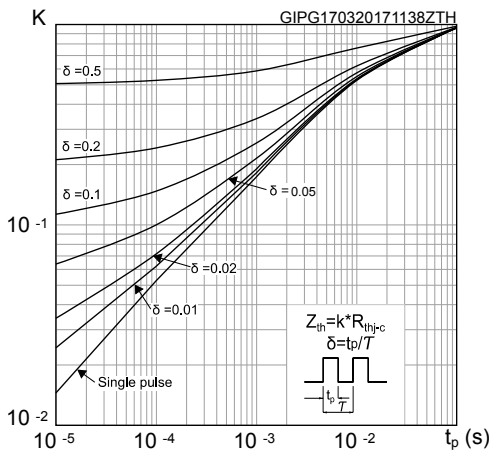


Figure 3. Output characteristics

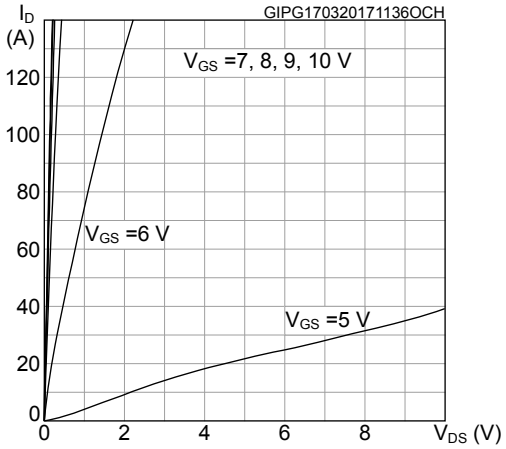


Figure 4. Transfer characteristics

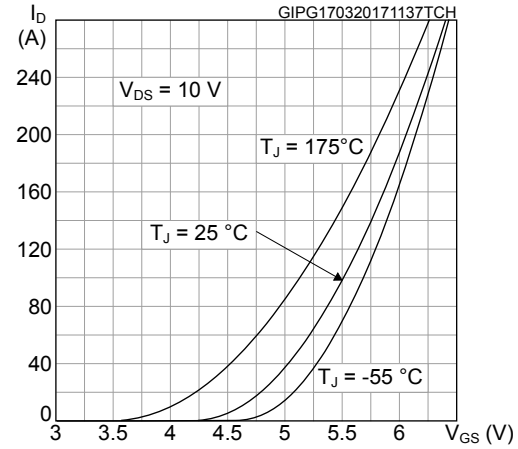


Figure 5. Static drain-source on-resistance

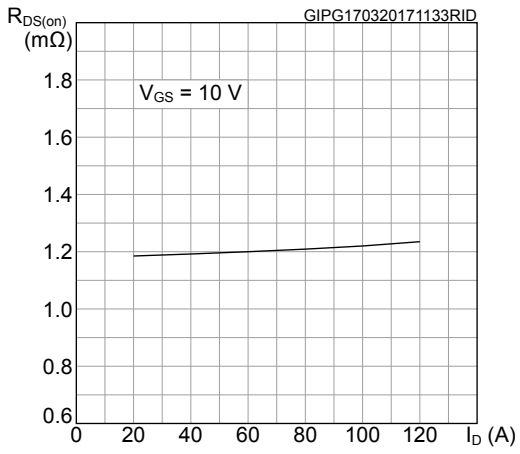


Figure 6. Gate charge vs gate-source voltage

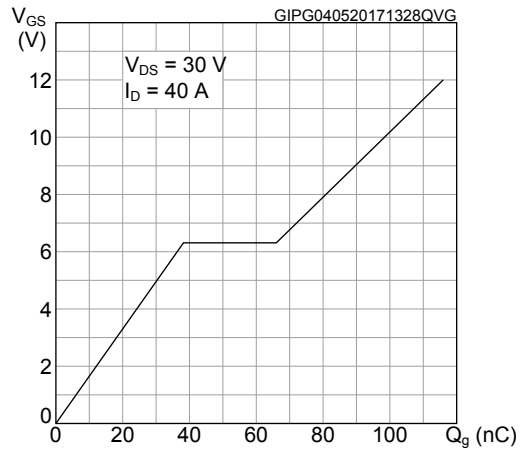


Figure 7. Capacitance variations

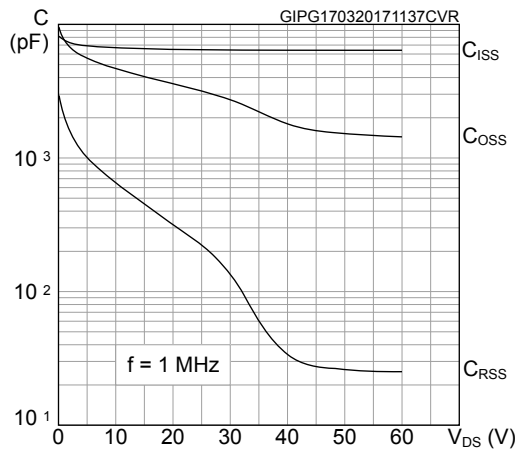


Figure 8. Normalized gate threshold voltage vs temperature

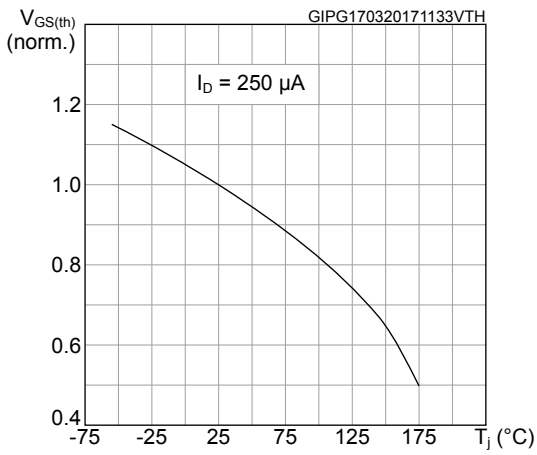


Figure 9. Normalized on-resistance vs temperature

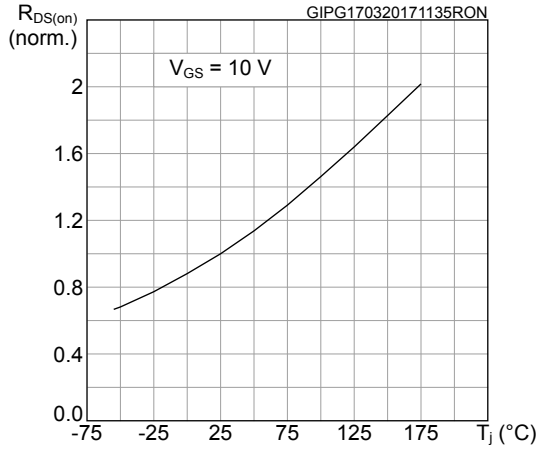


Figure 10. Source-drain diode forward characteristics

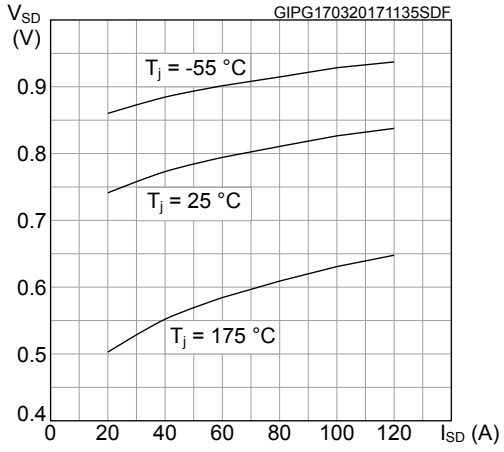
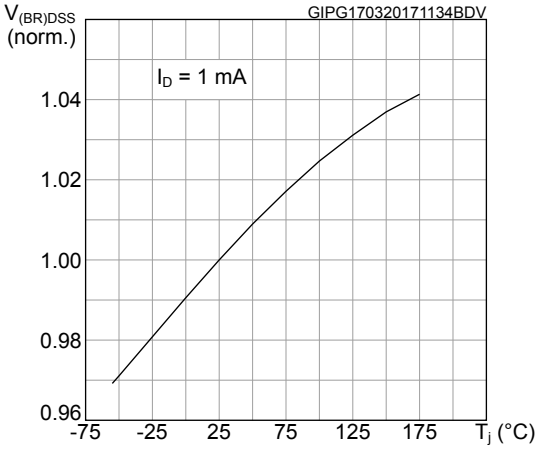
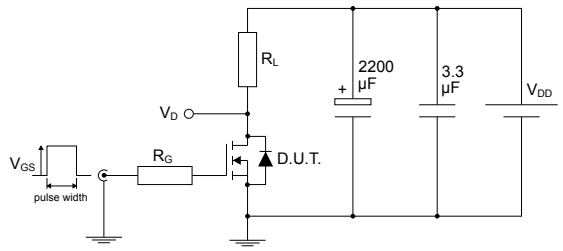


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature



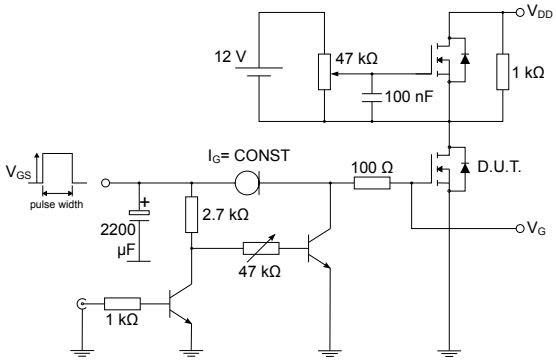
3 Test circuits

Figure 12. Test circuit for resistive load switching times



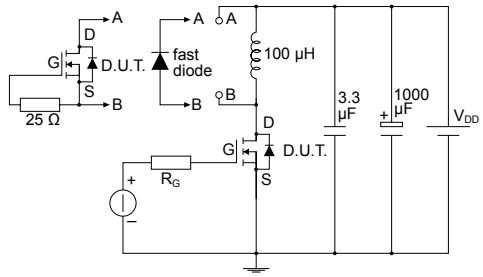
AM01468v1

Figure 13. Test circuit for gate charge behavior



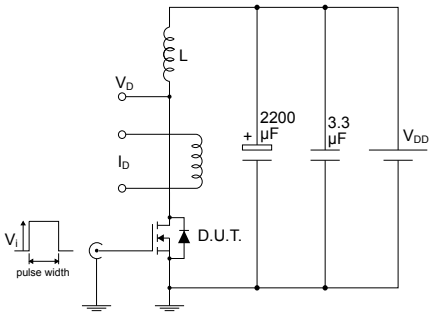
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Figure 14. Test circuit for inductive load switching and diode recovery times



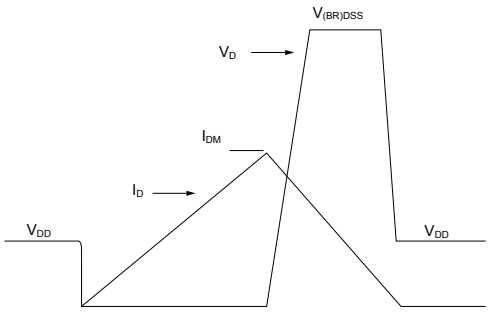
AM01470v1

Figure 15. Unclamped inductive load test circuit



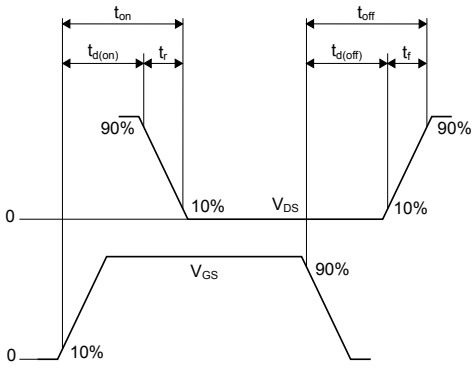
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Figure 16. Unclamped inductive waveform



AM01472v1

Figure 17. Switching time waveform



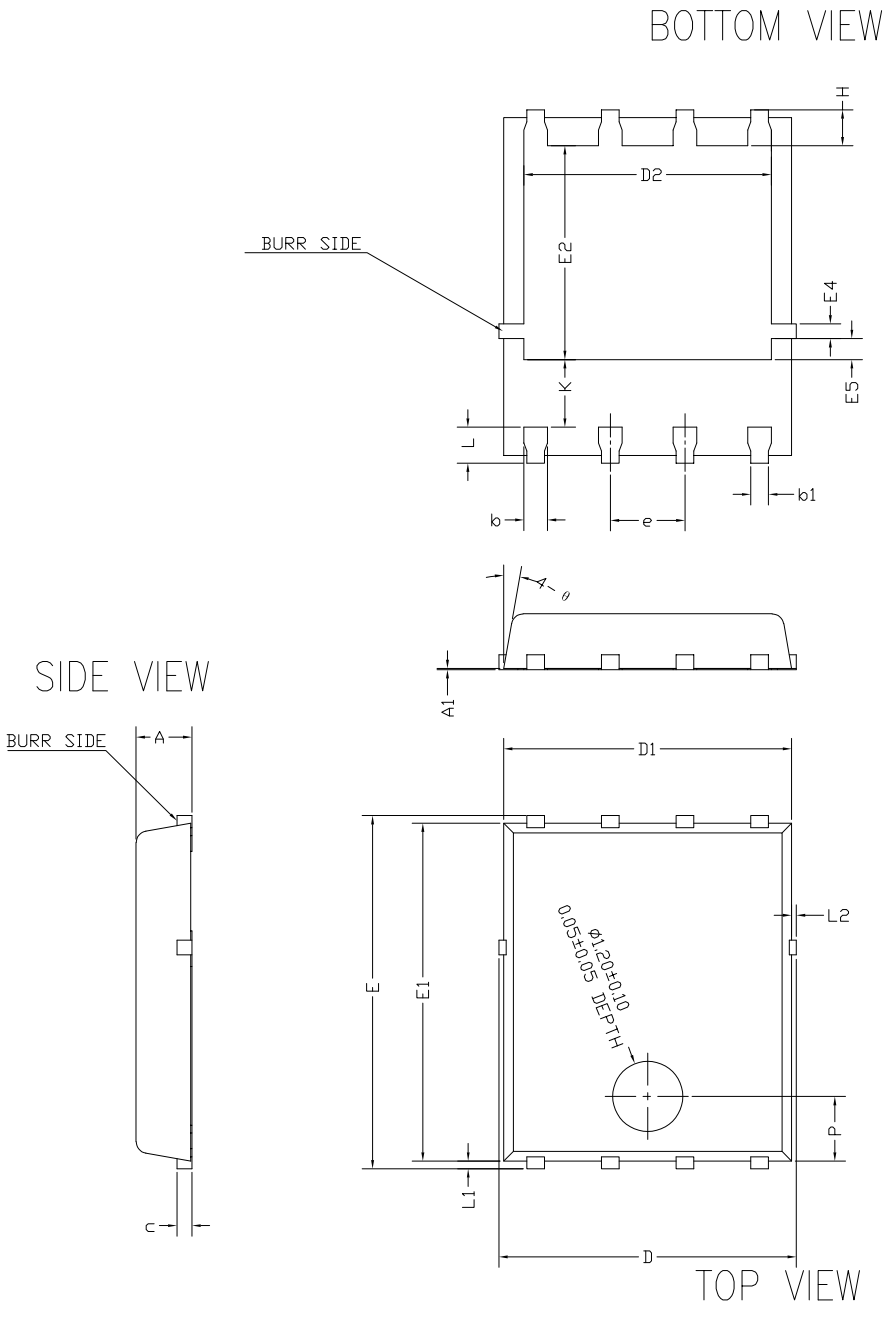
AM01473v1

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 type B package information

Figure 18. PowerFLAT 5x6 type B package outline

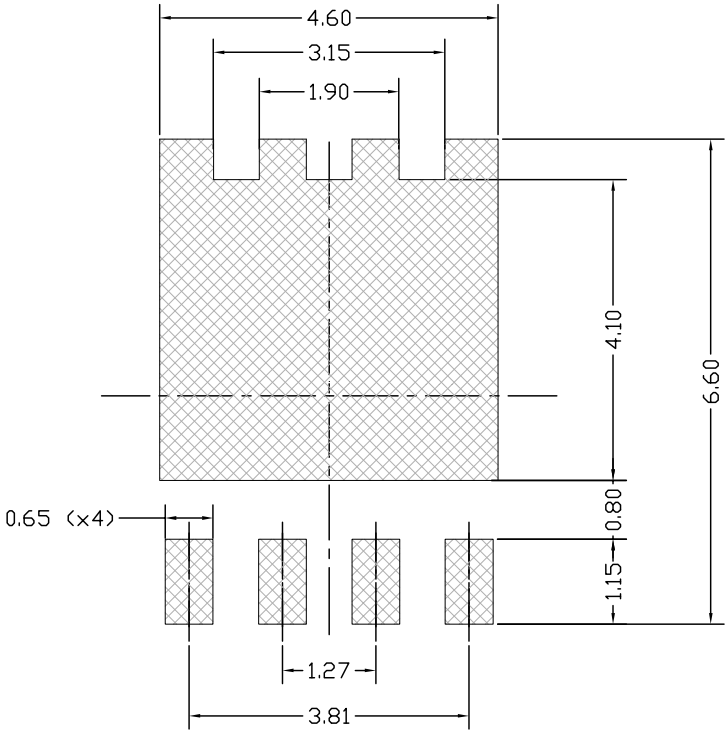


Drawing_8472137_typeB rev5

Table 7. **PowerFLAT 5x6 type B 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 19. **PowerFLAT 5x6 recommended footprint (dimensions are in mm)**



Footprint_8472137_typeB rev5

4.2 PowerFLAT 5x6 type C package information

Figure 20. **PowerFLAT 5x6 type C package outline**

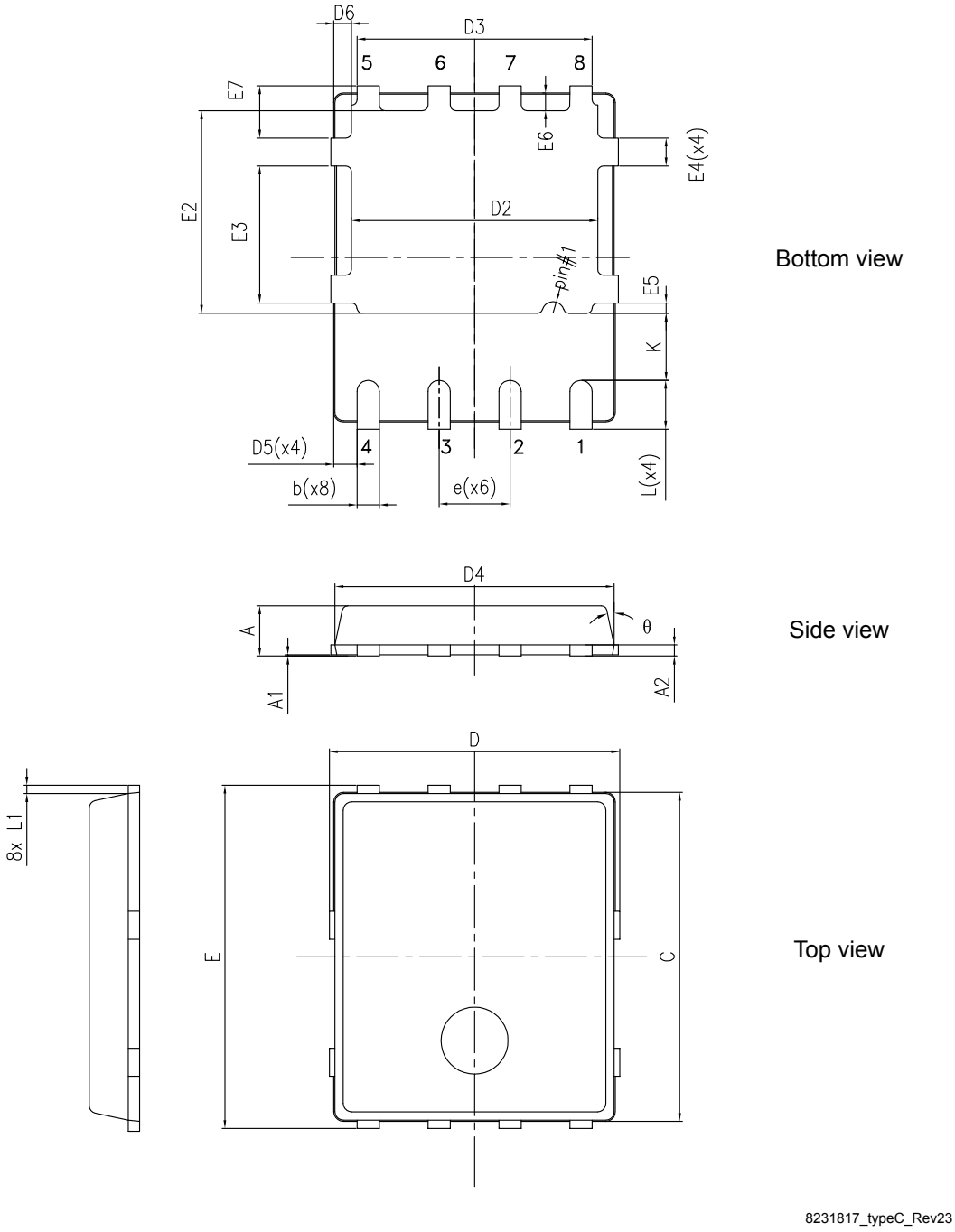
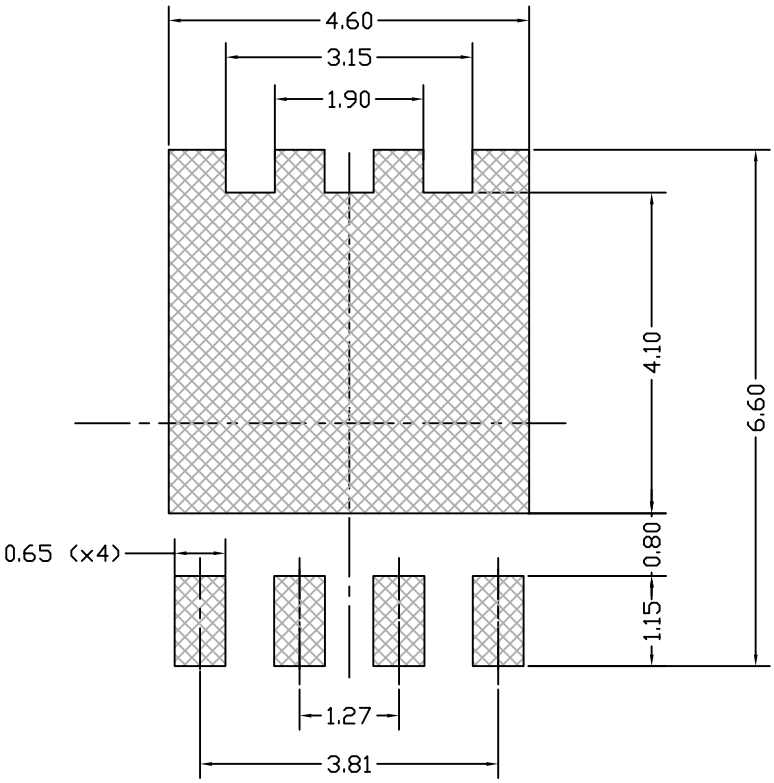


Table 8. **PowerFLAT 5x6 type C package mechanical data**

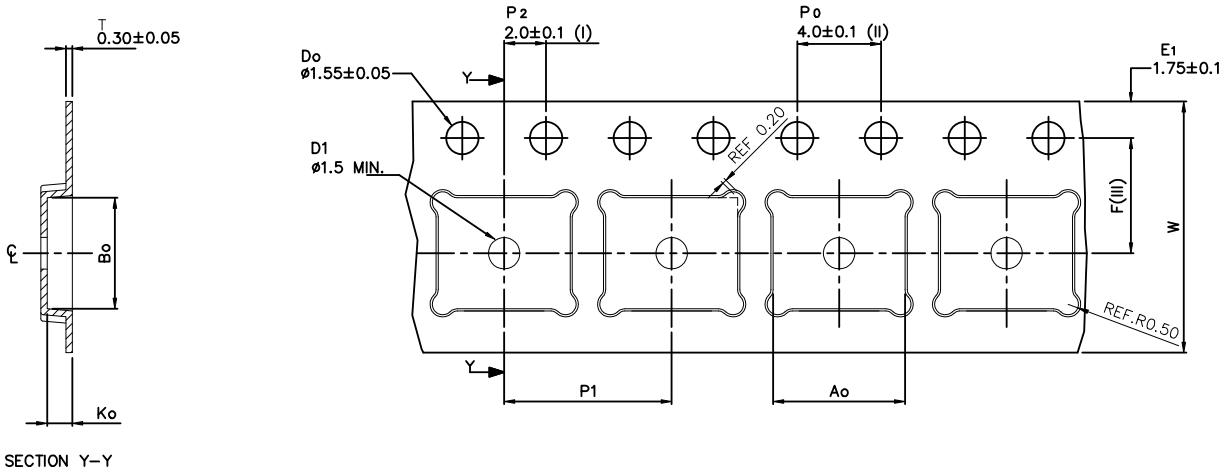
Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1			0.05
A2		0.25	
b	0.30		0.50
C	5.80	6.00	6.20
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.00	5.20
D5	0.25	0.40	0.55
D6	0.15	0.30	0.45
e		1.27	
E	5.95	6.15	6.35
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
E6	0.20	0.325	0.45
E7	0.75	0.90	1.05
K	1.05		1.35
L	0.725		1.025
L1	0.05	0.15	0.25
θ	0°		12°

Figure 21. **PowerFLAT 5x6 recommended footprint (dimensions are in mm)**



4.3 PowerFLAT 5x6 packing information

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



Ao	6.30 +/– 0.1
Bo	5.30 +/– 0.1
Ko	1.20 +/– 0.1
F	5.50 +/– 0.1
P1	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 ±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 23. PowerFLAT 5x6 package orientation in carrier tape

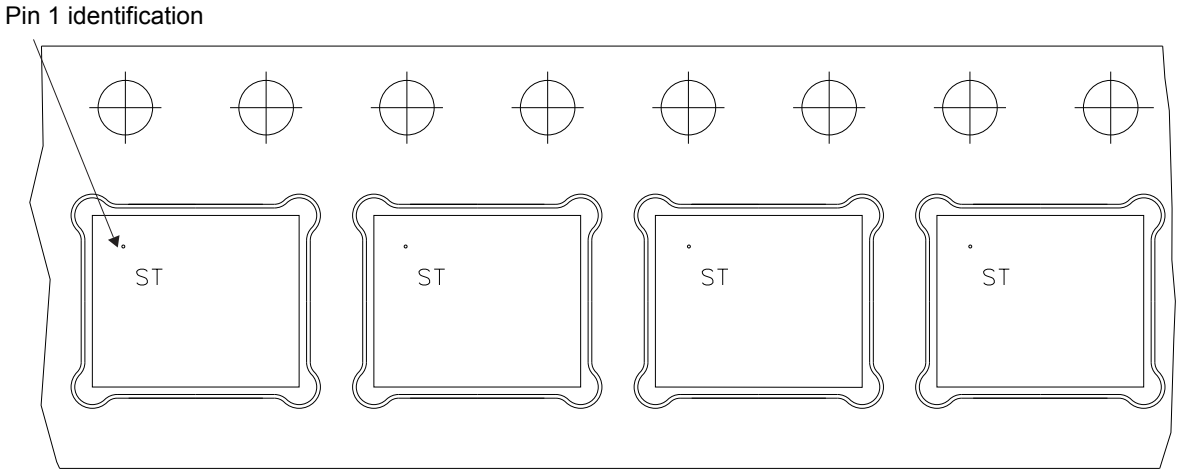
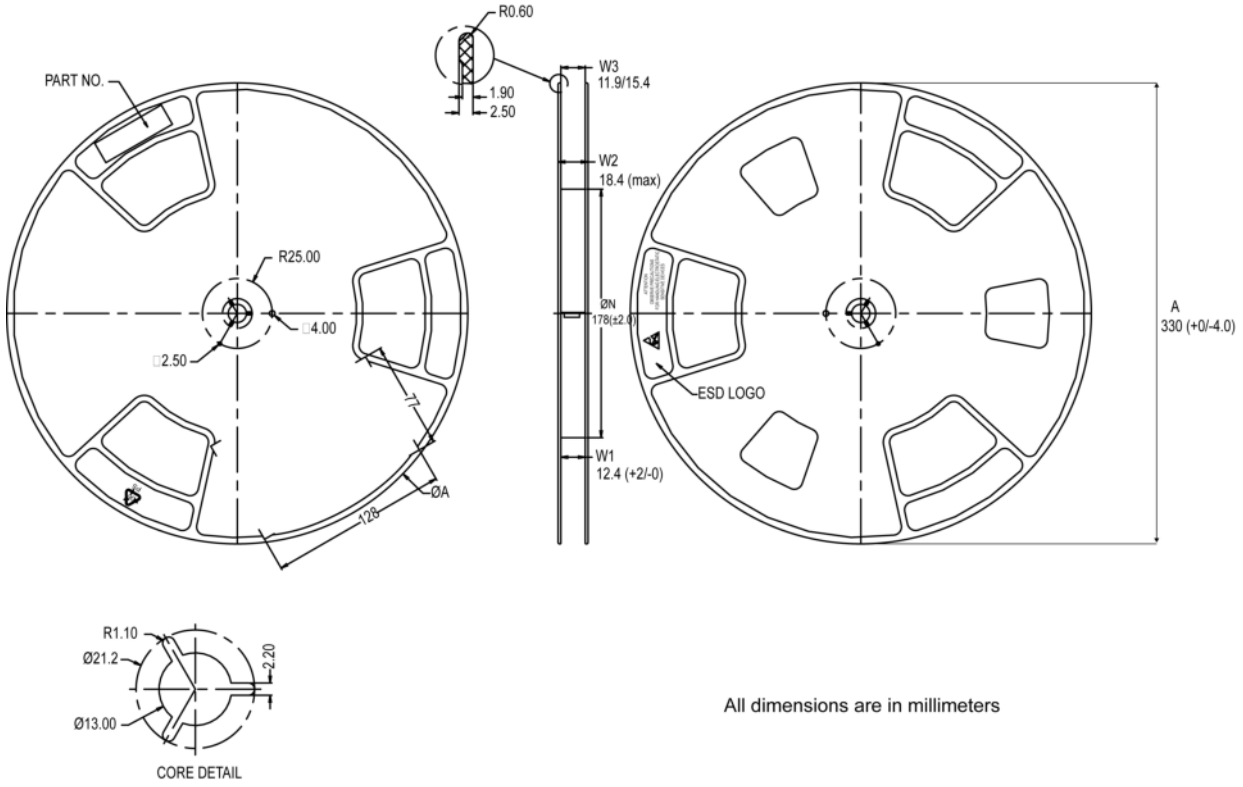


Figure 24. **PowerFLAT 5x6 reel**



Revision history

Table 9. **Document revision history**

Date	Revision	Changes
13-Jun-2014	1	First release.
22-Sep-2014	2	Updated title, features and description in cover page. Updated *Table 2: "Absolute maximum ratings", Table 4: "On /off states", Table 5: "Dynamic", Table 6: "Switching times" and Table 7: "Source-drain diode".* Added *Section 3: "Electrical characteristics (curves)".*
14-Jan-2015	3	Document status promoted from preliminary to production data.
02-May-2017	4	Modified title and features table on cover page. Modified *Table 1. Absolute maximum ratings, Table 3. On /off states, Table 4. Dynamic, Table 5. Switching times and Table 6. Source-drain diode.* Modified *Section 2.1 Electrical characteristics (curves).* Minor text changes.
20-Sep-2022	5	Inserted *Section 4.1 PowerFLAT 5x6 type B package information*. Minor text changes.
15-Mar-2023	6	Updated Section 4.2 PowerFLAT 5x6 type C package information.

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