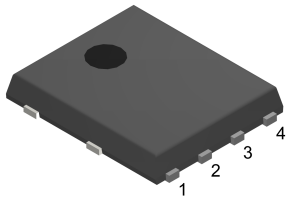
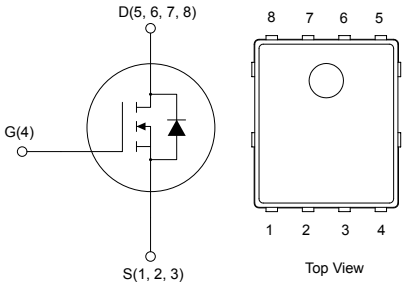
N-channel 100 V, 20 mΩ typ., 10 A STripFET F7 Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT 5x6



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STL40N10F7	100 V	24 mΩ	10 A	5 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

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.

STPOWER

Product status link
STL40N10F7

Product summary	
Order code	STL40N10F7
Marking	40N10F7
Package	PowerFLAT 5x6
Packing	Tape and reel

1 Electrical ratings

Table 1. 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 °C	40	A
	Drain current (continuous) at T_C = 100 °C	28	A
I_D (2)	Drain current (continuous) at T_{pcb} = 25 °C	10	A
	Drain current (continuous) at T_{pcb} = 100 °C	7	A
I_{DM} (2)(3)	Drain current (pulsed)	40	A
P_{TOT} (1)	Total power dissipation at T_C = 25 °C	70	W
P_{TOT} (2)	Total power dissipation at T_{pcb} = 25 °C	5	W
T_{stg}	Storage temperature range	- 55 to 175	°C
T_J	Operating junction temperature range		°C

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

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max.	2.08	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max.	30	

1. *When mounted on a 1-inch² FR-4 board, 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 = 250 µA, V_{GS} = 0 V	100			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 100 V			10	µA
		V_{GS} = 0 V, V_{DS} = 100 V, T_C = 125° C			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 10 A		20	24	mΩ

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	1270	-	pF
C_{oss}	Output capacitance		-	290	-	pF
C_{rss}	Reverse transfer capacitance		-	24	-	pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 32 A, V_{GS} = 10 V (see Figure 13. Test circuit for gate charge behavior)	-	19	-	nC
Q_{gs}	Gate-source charge		-	9	-	nC
Q_{gd}	Gate-drain charge		-	4.5	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50 V, I_D = 16 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 12. Test circuit for resistive load switching times)	-	12	-	ns
t_r	Rise time		-	17.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	22	-	ns
t_f	Fall time		-	5.6	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain curren	I_{SD} = 32 A, V_{GS} = 0 V	-		32	A
I_{SDM} (1)	Source-drain current (pulsed)				128	A
V_{SD} (2)	Forward on voltage				1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 32 A, di/dt = 100 A/µs, V_{DD} = 80 V, T_J = 150° C (see Figure 14. Test circuit for inductive load switching and diode recovery times	-	41		ns
Q_{rr}	Reverse recovery charge		-	47		nC
I_{RRM}	Reverse recovery current		-	2.3		A

1. *Pulse width limited by safe operating area.*
2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

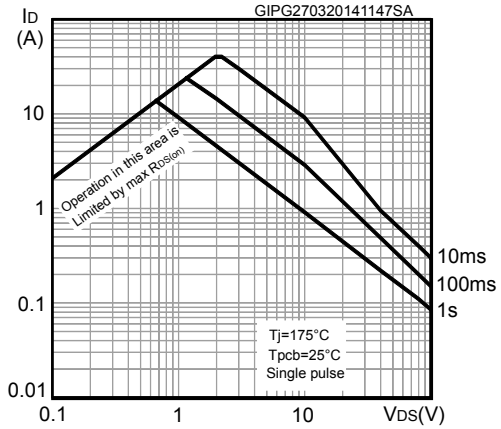


Figure 2. Thermal impedance

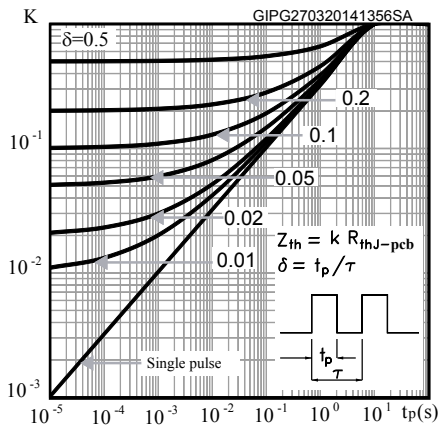


Figure 3. Output characteristics

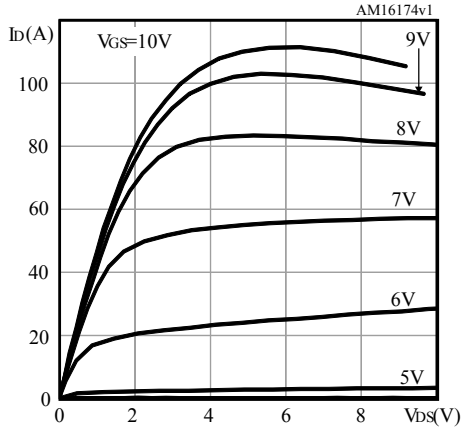


Figure 4. Transfer characteristics

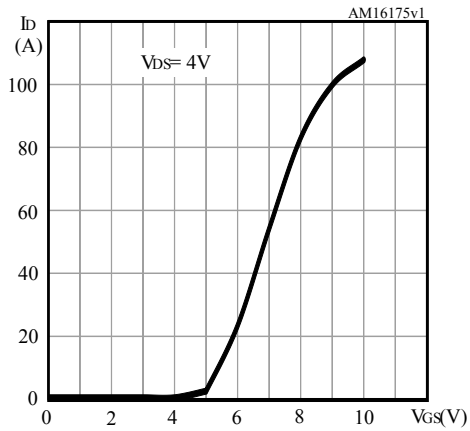


Figure 5. Gate charge vs gate-source voltage

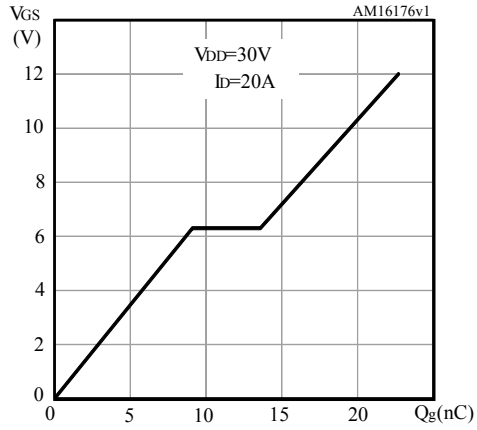


Figure 6. Static drain-source on-resistance

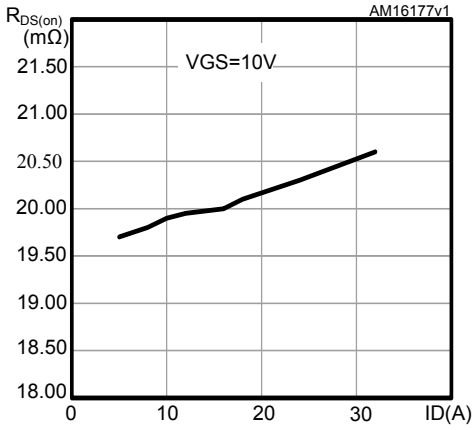


Figure 7. Capacitance variations

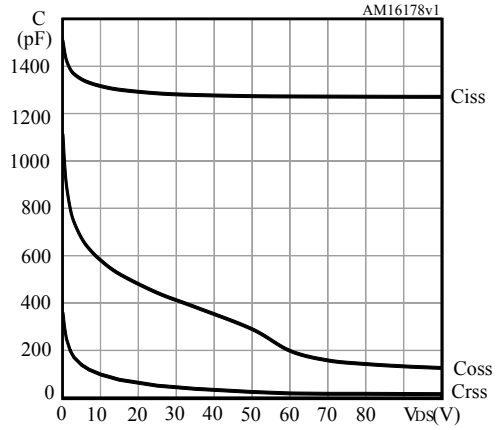


Figure 8. Normalized gate threshold voltage vs temperature

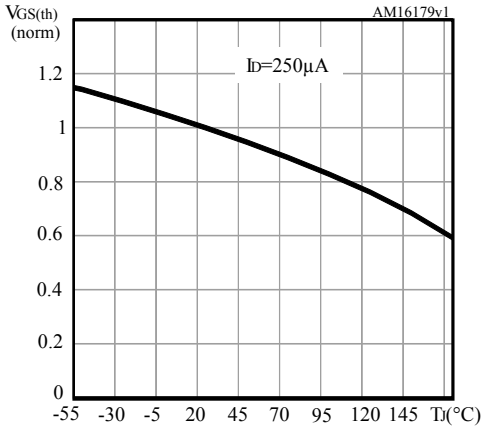


Figure 9. Normalized on-resistance vs temperature

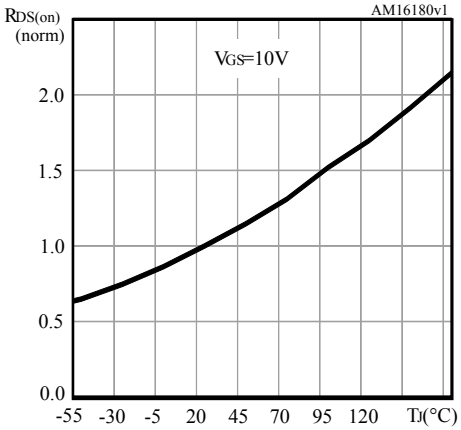


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

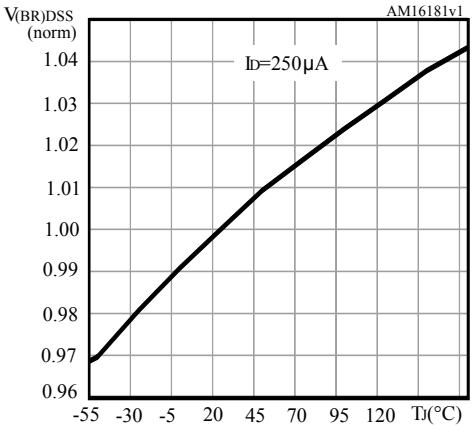
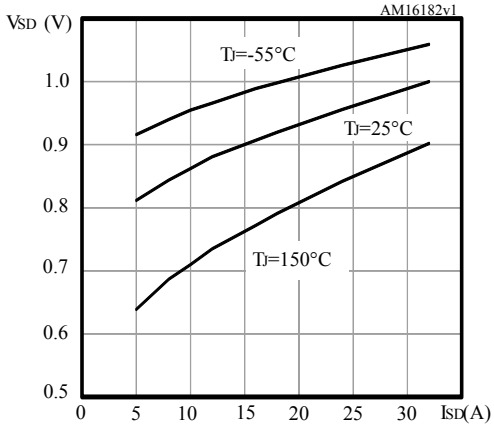


Figure 11. Source-drain diode forward characteristics



3 Test circuits

Figure 12. Test circuit for resistive load switching times

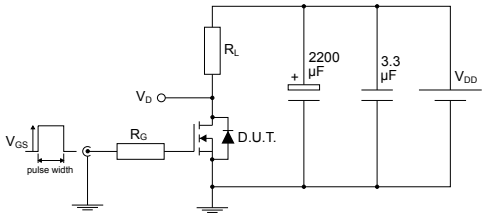


Figure 13. Test circuit for gate charge behavior

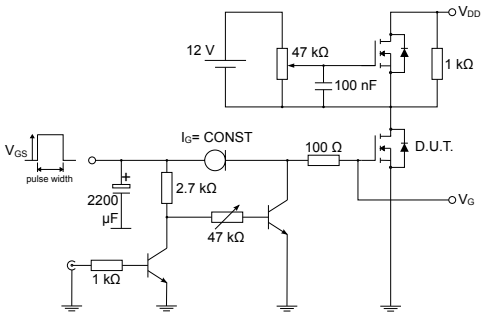


Figure 14. Test circuit for inductive load switching and diode recovery times

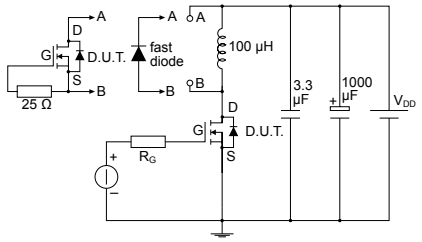


Figure 15. Unclamped inductive load test circuit

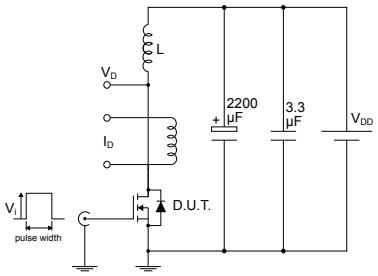


Figure 16. Unclamped inductive waveform

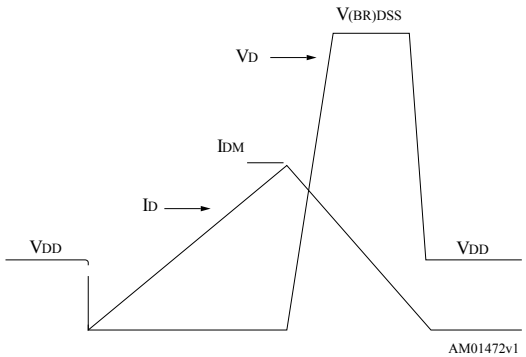
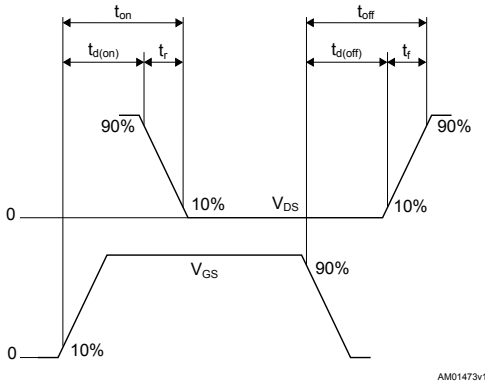


Figure 17. Switching time waveform



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 type R package information

Figure 18. PowerFLAT 5x6 type R package outline

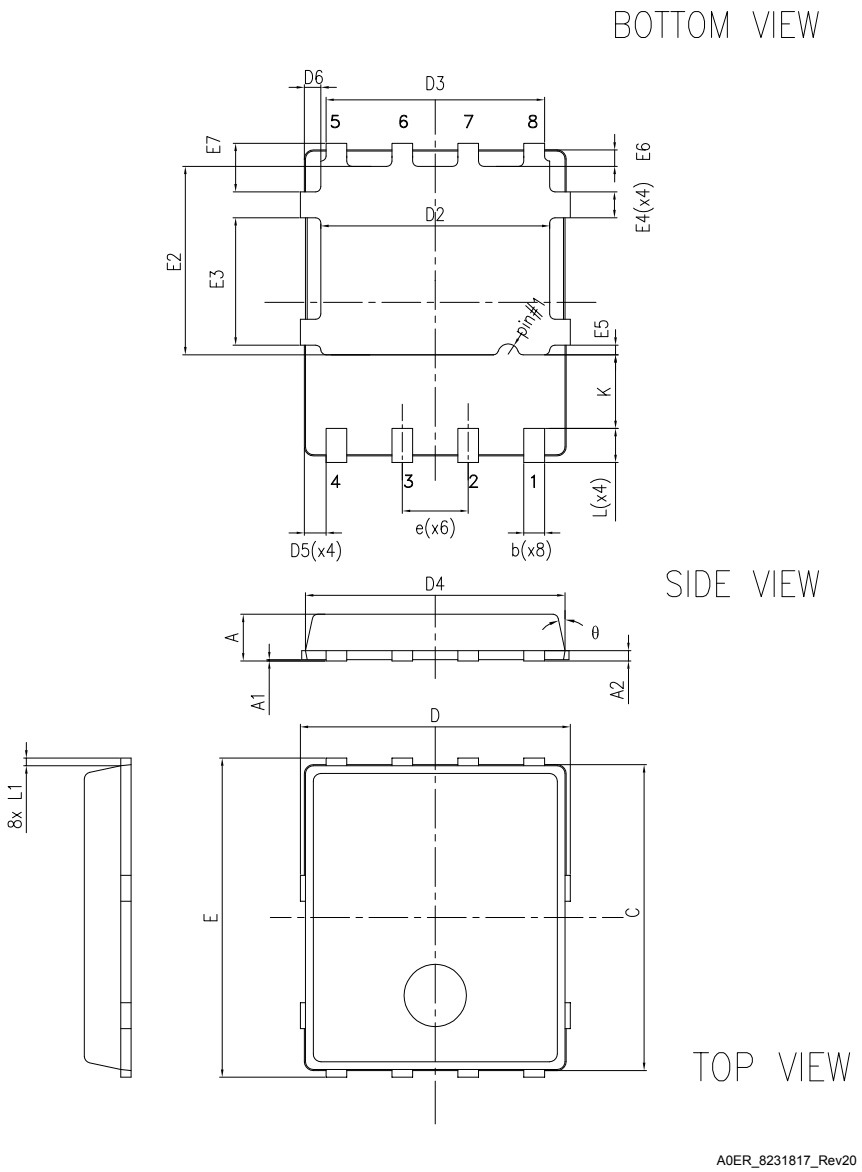


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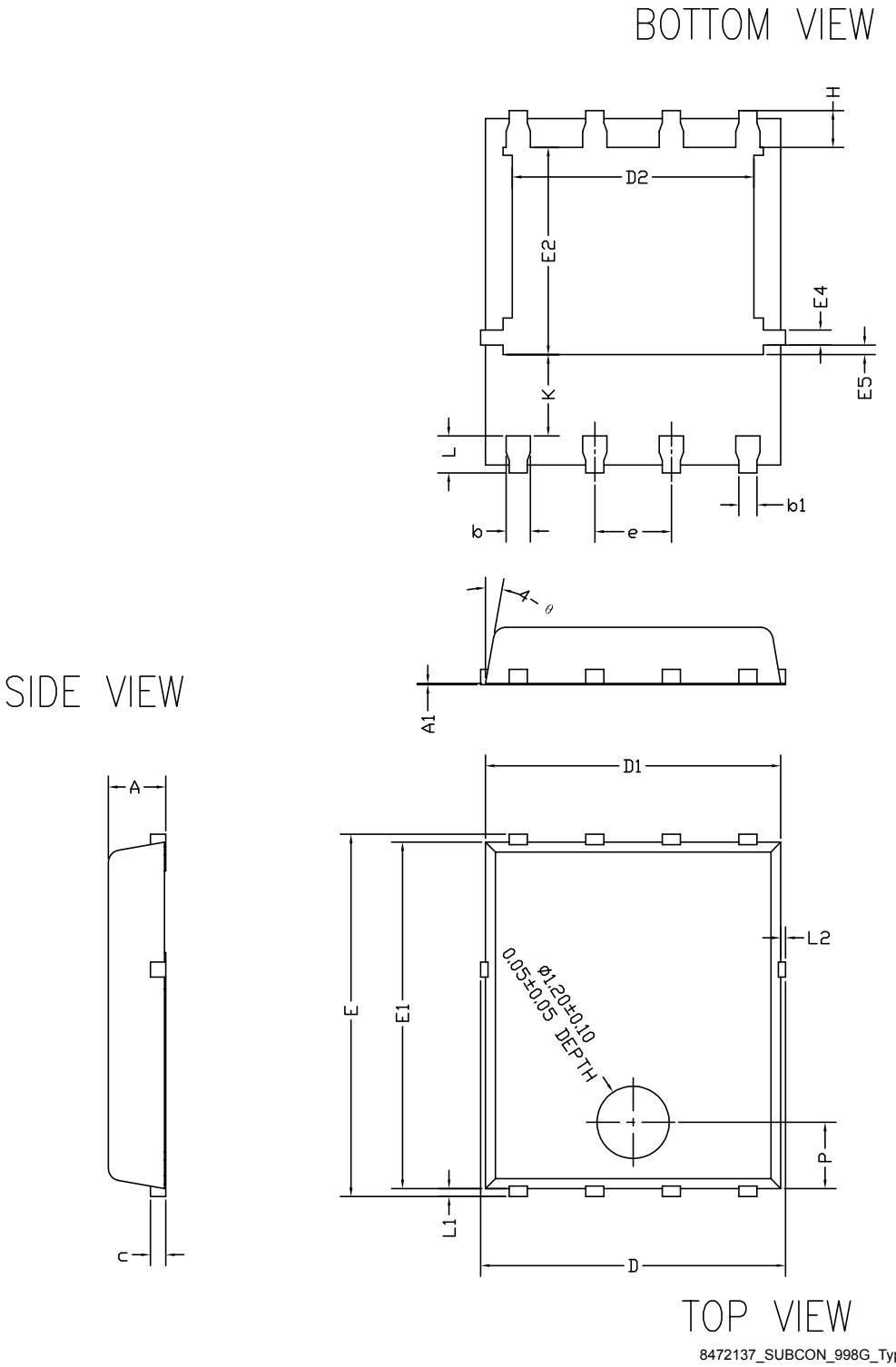
Table 7. **PowerFLAT 5x6 type R mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
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	1.275		1.575
L	0.60		0.80
L1	0.05	0.15	0.25
θ	0°		12°

4.2 PowerFLAT 5x6 type R SUBCON package information

Figure 19. **PowerFLAT 5x6 type R SUBCON package outline**

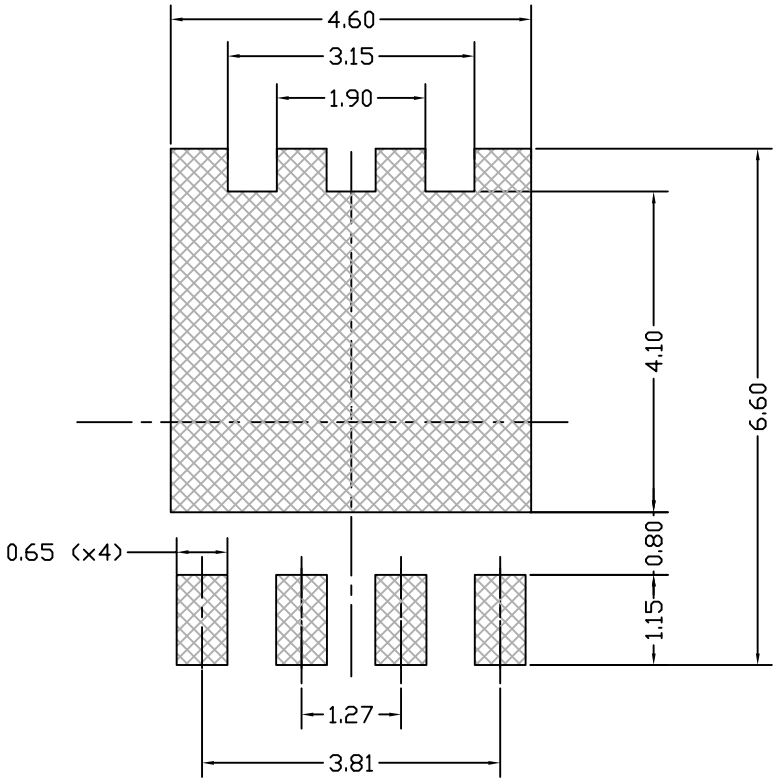


8472137_SUBCON_998G_Type_R_REV4

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

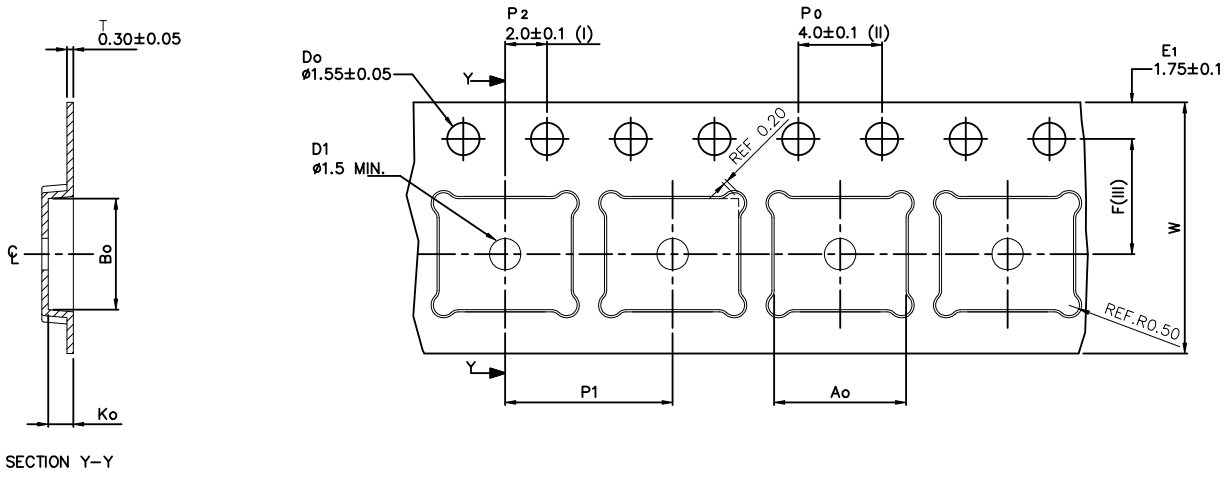
Dim.	mm		
	Min.	Typ.	Max.
A	0.90	0.95	1.00
A1		0.02	
b	0.35	0.40	0.45
b1		0.30	
c	0.21	0.25	0.34
D			5.10
D1	4.80	4.90	5.00
D2	3.91	4.01	4.11
e	1.17	1.27	1.37
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.34	3.44	3.54
E4	0.15	0.25	0.35
E5	0.06	0.16	0.26
H	0.51	0.61	0.71
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	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)**



4.3 PowerFLAT 5x6 packing information

Figure 21. 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 22. PowerFLAT 5x6 package orientation in carrier tape

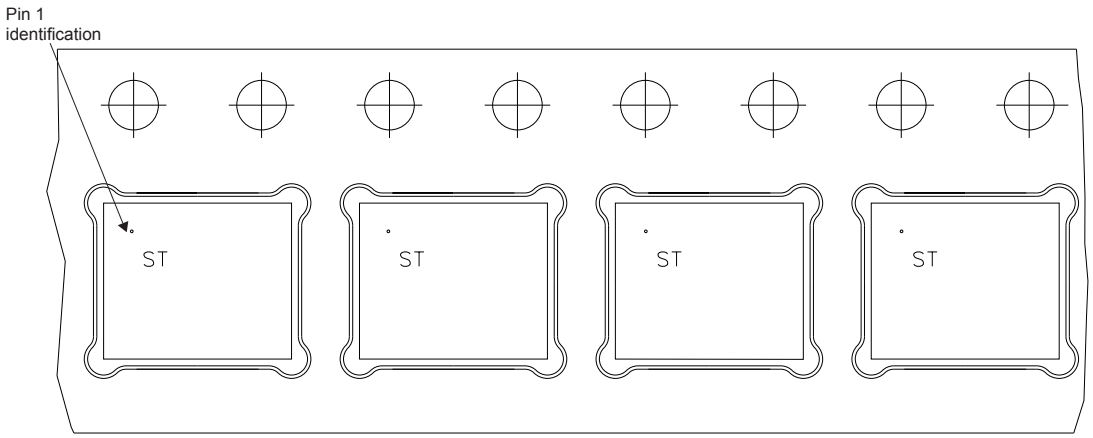
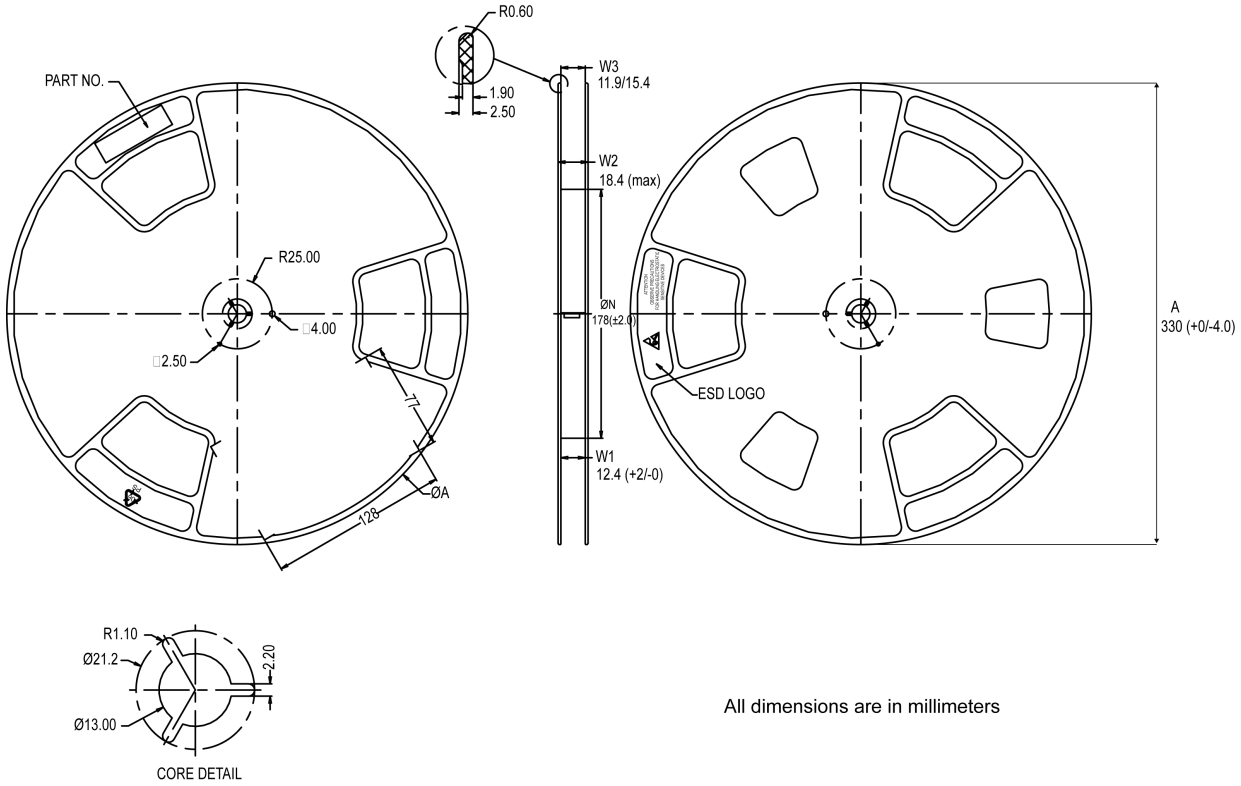


Figure 23. PowerFLAT 5x6 reel



All dimensions are in millimeters

8234350_Reel_rev_C

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
20-May-2015	1	First release.
02-Nov-2015	2	Document status promoted from preliminary to production data. Modified: $V_{GS(th)}$ values in tab 4. Updated the entire typical values in tab 5, tab 6 and tab7 Added Electrical characteristics (curves) Updated Figure 13, 14, 15 and 16 Minor text changes.
18-Dec-2015	3	Updated title, features and description. Updated *Table 2: "Absolute maximum ratings"* and *Table 4: "On/Off states"*. Minor text changes.
01-Feb 2016	4	Updated *Table 5: "Dynamic"*. Minor text changes.
21-Feb-2020	5	Updated Section 4 Package information. Minor text changes.

Contents