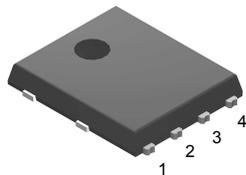
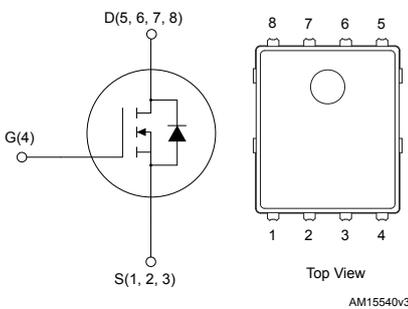


Automotive N-channel logic level 40 V, 0.59 mΩ max., 420 A Smart STripFET F8 Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT 5x6



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL059N4S8AG	40 V	0.59 mΩ	420 A

- AEC-Q101 qualified 
- MSL1 grade
- 175 °C operating temperature
- 100% avalanche tested
- Wettable flank package
- Extremely low $R_{DS(on)}$

Applications

- Power distribution

Description

The **STL059N4S8AG** is a 40 V N-channel enhancement mode Power MOSFET designed in Smart STripFET F8, the new dedicated STripFET F8 based technology aimed for Power distribution applications, featuring an enhanced trench gate structure.

The Smart STripFET F8 ensures an extremely low on state resistance, which makes it excellent, in combination with STi²Fuse gate drivers, for high current Power distribution units.



Product status link

[STL059N4S8AG](#)

Product summary

Order code	STL059N4S8AG
Marking	059N4S8
Package	PowerFLAT 5x6
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings (at $T_C = 25\text{ °C}$ unless otherwise specified)

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 $T_C = 25\text{ °C}^{(3)}$	420	A
	Drain current (continuous) at $T_C = 100\text{ °C}^{(3)}$	297	
	Drain current (continuous) at $T_C = 25\text{ °C}^{(2)}$	120	
$I_{DM}^{(1)(3)(4)}$	Drain current (pulsed), $t_P = 10\text{ }\mu\text{s}$	1680	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	187	W
I_{AS}	Single pulse avalanche current (pulse width limited by maximum junction temperature)	60	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ °C}$, $I_D = 60\text{ A}$, $R_{Gmin} = 25\text{ }\Omega$)	603	mJ
T_J	Operating junction temperature range	-55 to 175	$^{\circ}\text{C}$
T_{stg}	Storage temperature range		$^{\circ}\text{C}$

1. Specified by design, not tested in production.
2. This current value is limited by package.
3. This is the theoretical current value only related to the silicon.
4. Pulse width is limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thJA}^{(1)}$	Thermal resistance, junction-to-ambient (on 2s2p FR-4 board vertical in still area)	15	$^{\circ}\text{C/W}$
R_{thJC}	Thermal resistance, junction-to-case	0.8	$^{\circ}\text{C/W}$

1. Defined according to JEDEC standards (JESD51-5, -7).

2 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	40	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}^{(1)}$	-	-	100	
I_{GSS}	Gate-body leakage current	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.2	-	2.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 60\text{ A}$	-	0.45	0.59	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 60\text{ A}$	-	0.65	0.85	

1. Specified by design and evaluated by characterization, not tested in production.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}^{(1)}$	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	11000	-	pF
$C_{oss}^{(1)}$	Output capacitance		-	2200	-	pF
$C_{riss}^{(1)}$	Reverse transfer capacitance		-	2100	-	pF
$Q_g^{(1)}$	Total gate charge	$V_{DD} = 20\text{ V}, I_D = 120\text{ A}, V_{GS} = 0\text{ to }4.5\text{ V}$	-	170	-	nC
		$V_{DD} = 20\text{ V}, I_D = 120\text{ A}, V_{GS} = 0\text{ to }10\text{ V}$	-	275	-	
$Q_{gs}^{(1)}$	Gate-source charge	$V_{DD} = 20\text{ V}, I_D = 120\text{ A}, V_{GS} = 0\text{ to }4.5\text{ V}$	-	35	-	nC
$Q_{gd}^{(1)}$	Gate-drain charge		-	110	-	nC

1. Specified by design and evaluated by characterization, not tested in production.

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}^{(1)}$	Turn-on delay time	$V_{DD} = 20\text{ V}, I_D = 60\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$	-	24	-	ns
$t_r^{(1)}$	Rise time		-	67	-	ns
$t_{d(off)}^{(1)}$	Turn-off delay time		-	165	-	ns
$t_f^{(1)}$	Fall time		-	223	-	ns

1. Specified by design and evaluated by characterization, not tested in production.

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)(2)}$	Forward on current (continuous)	$T_C = 25\text{ °C}$	-		125	A
V_{SD}	Forward on voltage	$I_{SD} = 60\text{ A}, V_{GS} = 0\text{ V}$	-		1.1	V
$t_{rr}^{(1)}$	Reverse recovery time	$I_D = 60\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 32\text{ V}$	-	75		ns
$Q_{rr}^{(1)}$	Reverse recovery charge		-	95		nC
$I_{RRM}^{(1)}$	Reverse recovery current		-	2.6		A

1. Specified by design and evaluated by characterization, not tested in production.
2. This is the theoretical current value only related to the silicon.

2.1 Electrical characteristics (curves)

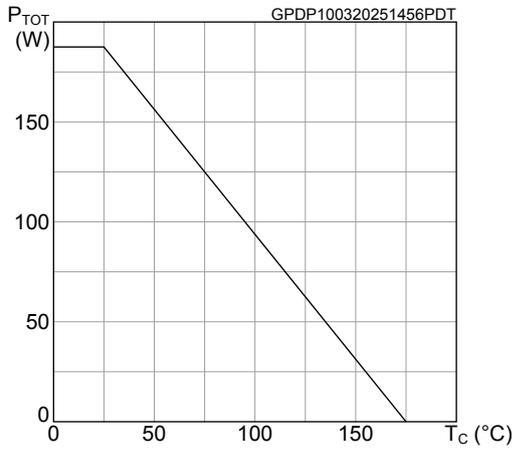
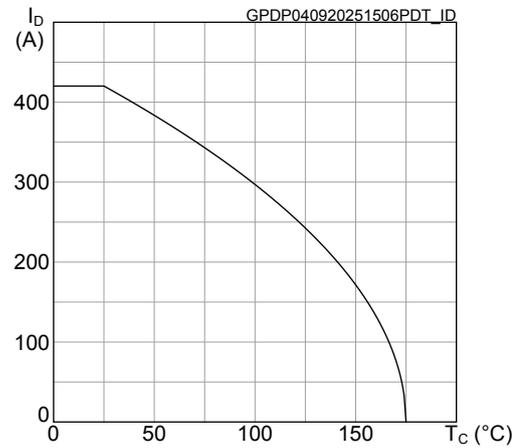
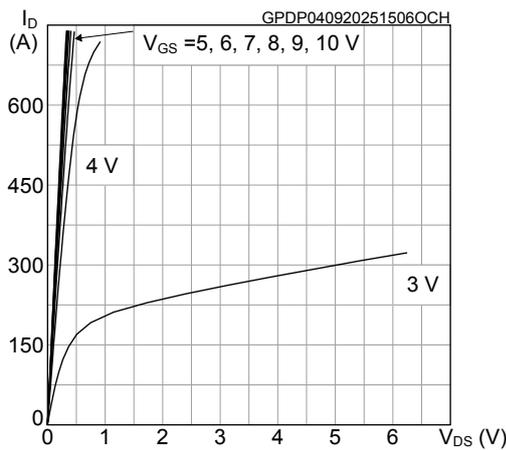
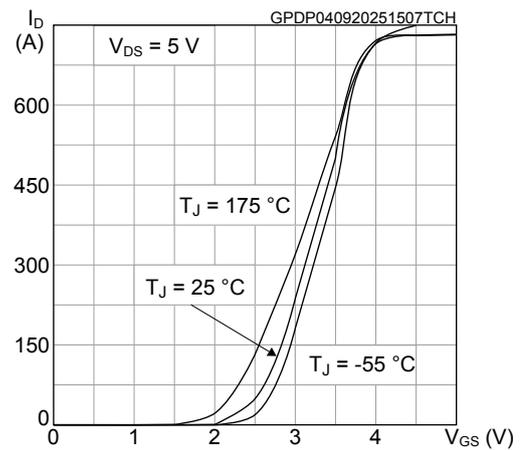
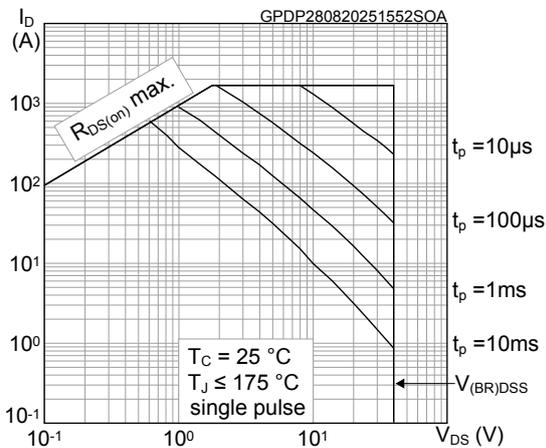
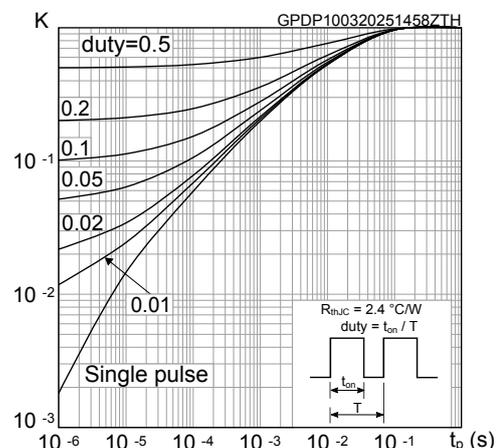
Figure 1. Total power dissipation

Figure 2. Drain current vs case temperature

Figure 3. Typical output characteristics

Figure 4. Typical transfer characteristics

Figure 5. Safe operating area

Figure 6. Normalized transient thermal impedance


Figure 7. Typical gate charge characteristics

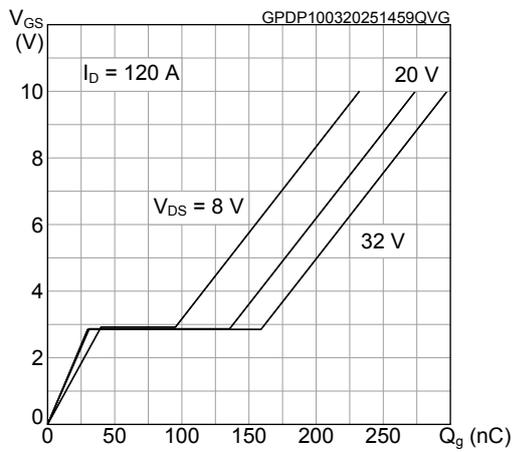


Figure 8. Typical capacitance characteristics

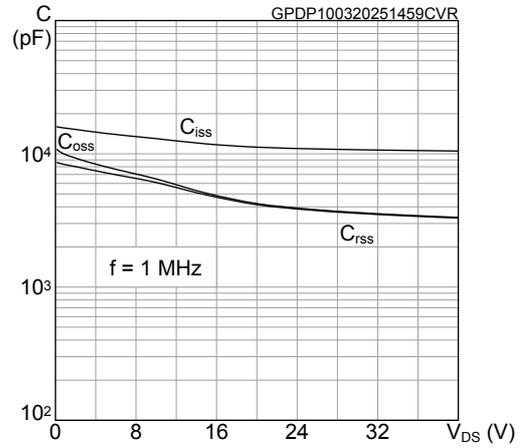


Figure 9. Avalanche characteristics

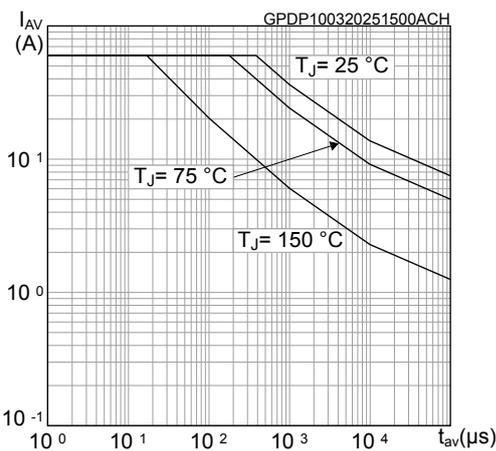


Figure 10. Avalanche energy

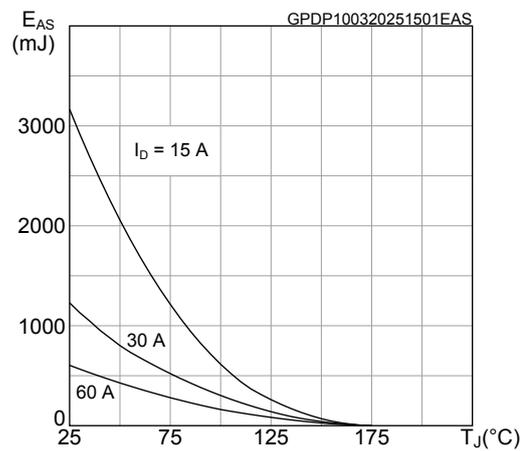


Figure 11. Typical drain-source on-resistance

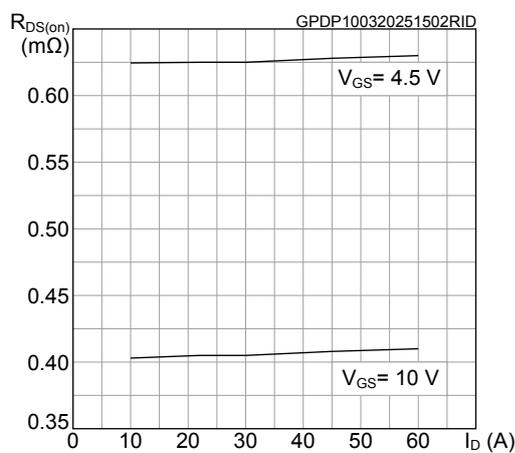


Figure 12. Typical on-resistance vs gate-source voltage

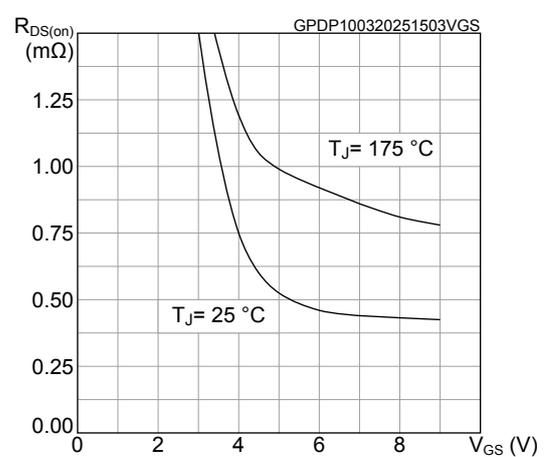


Figure 13. Normalized on-resistance vs temperature

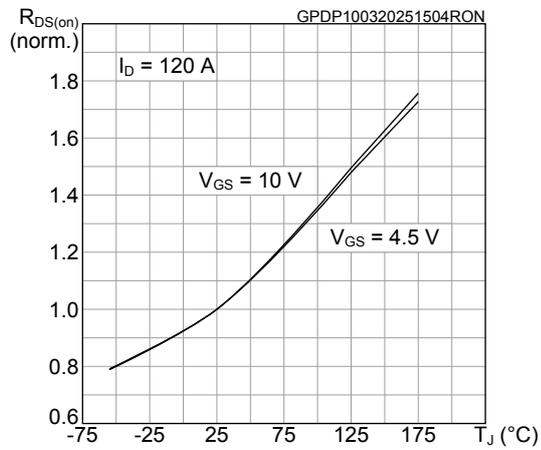


Figure 14. Normalized gate threshold voltage vs temperature

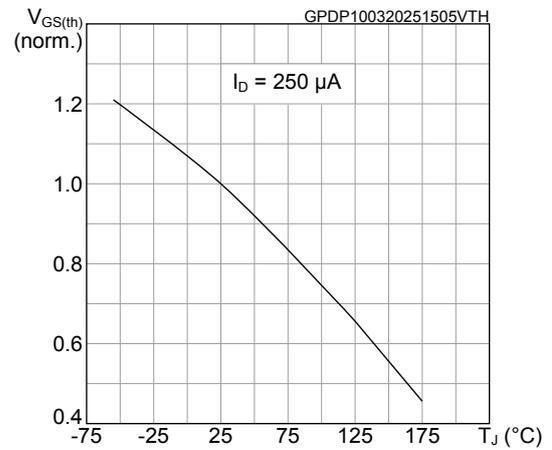


Figure 15. Typical reverse diode forward characteristics

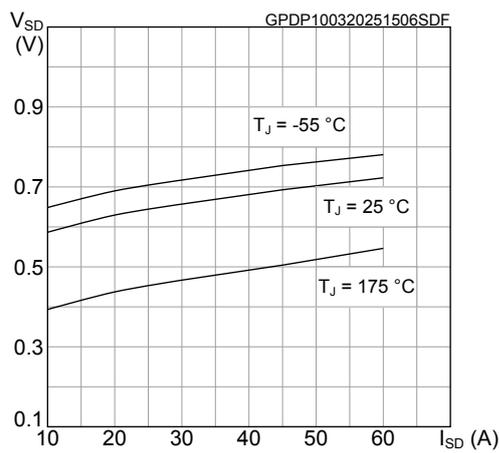


Figure 16. Normalized $V_{(BR)DSS}$ vs temperature

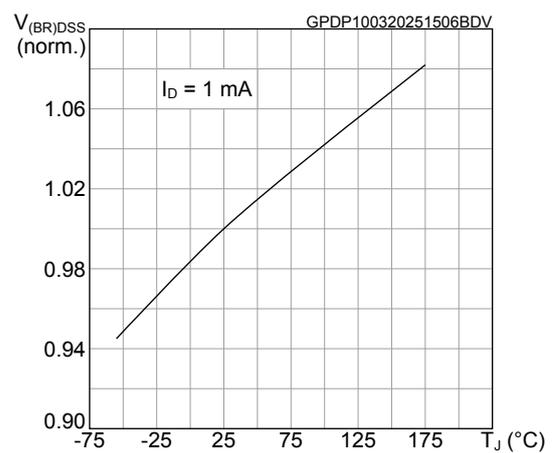
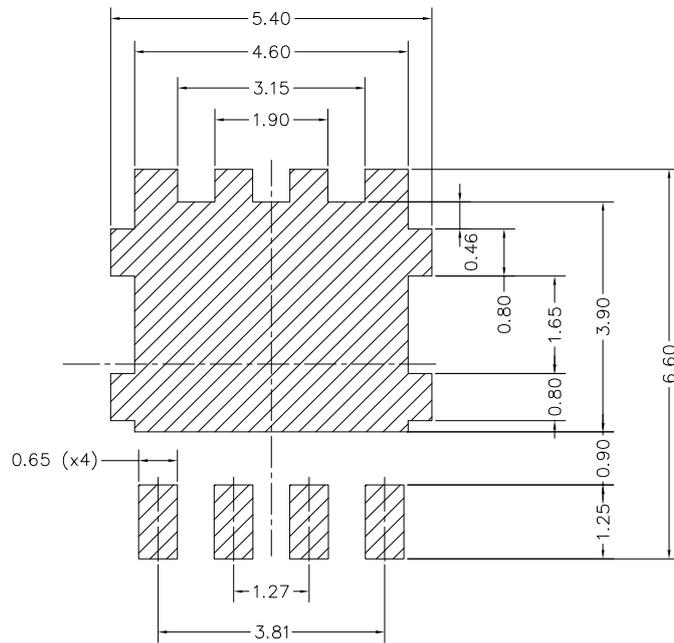


Table 7. PowerFLAT 5x6 WF type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.00		0.05
A2	0.20	0.25	0.30
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°

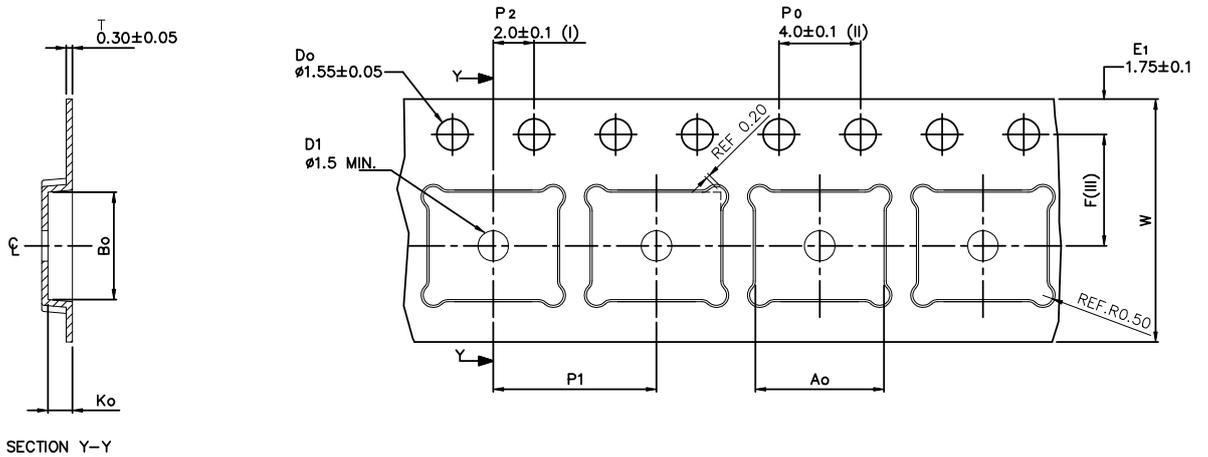
Figure 18. PowerFLAT 5x6 recommended footprint (dimensions are in mm)



8231817_FOOTPRINT_rev24

3.2 PowerFLAT 5x6 packing information

Figure 19. PowerFLAT 5x6 tape (dimensions are in mm)



SECTION Y-Y

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 20. PowerFLAT 5x6 package orientation in carrier tape

Pin 1 identification

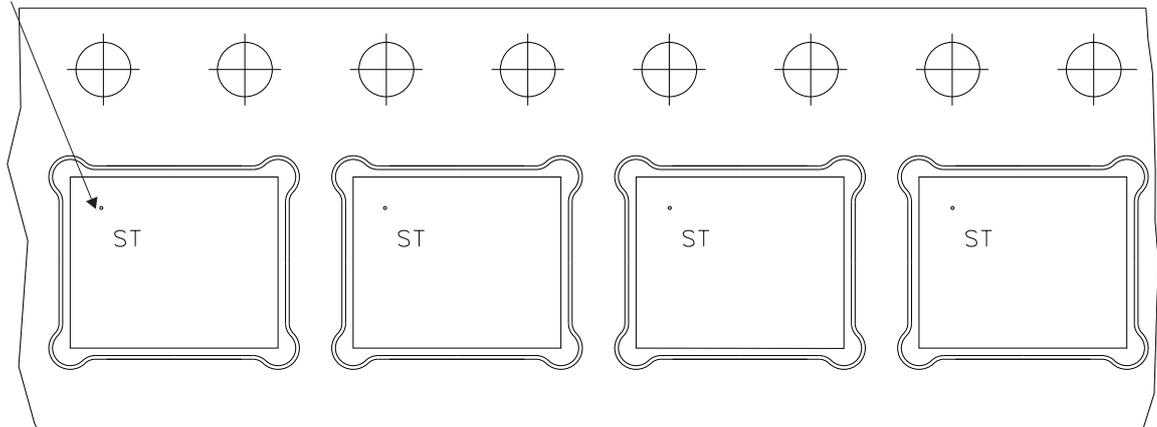
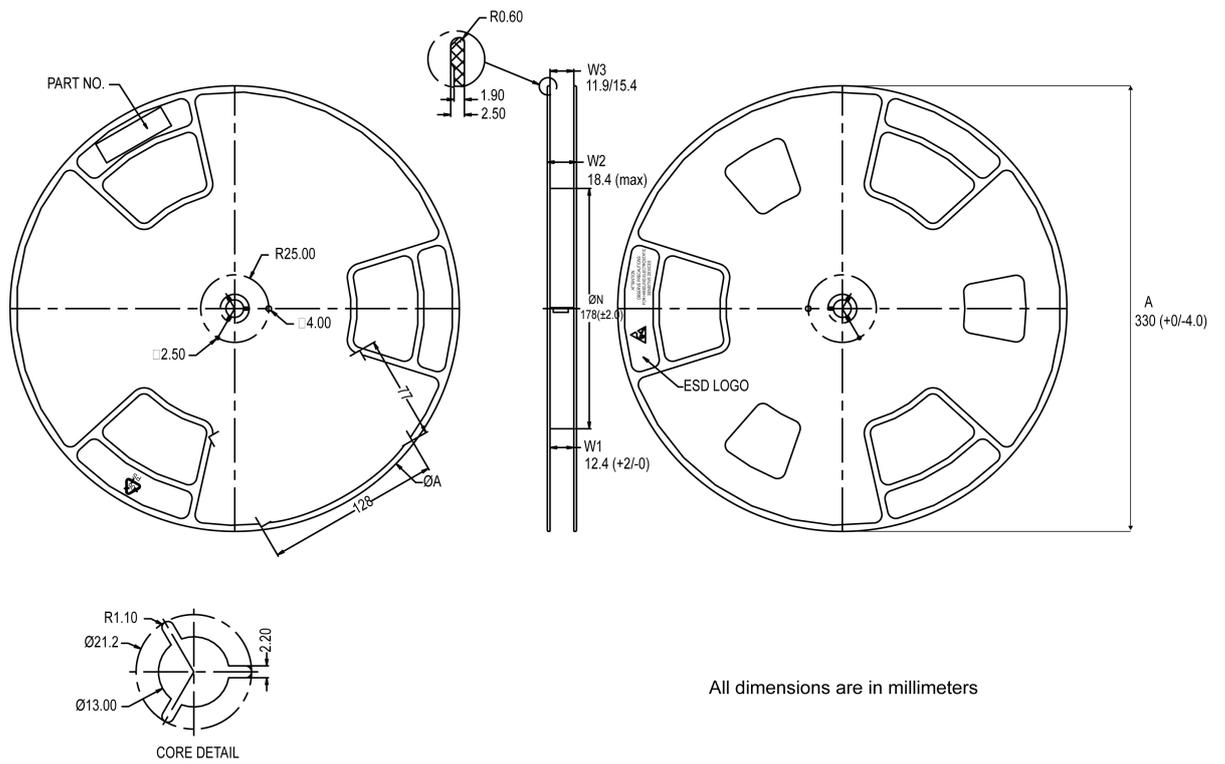


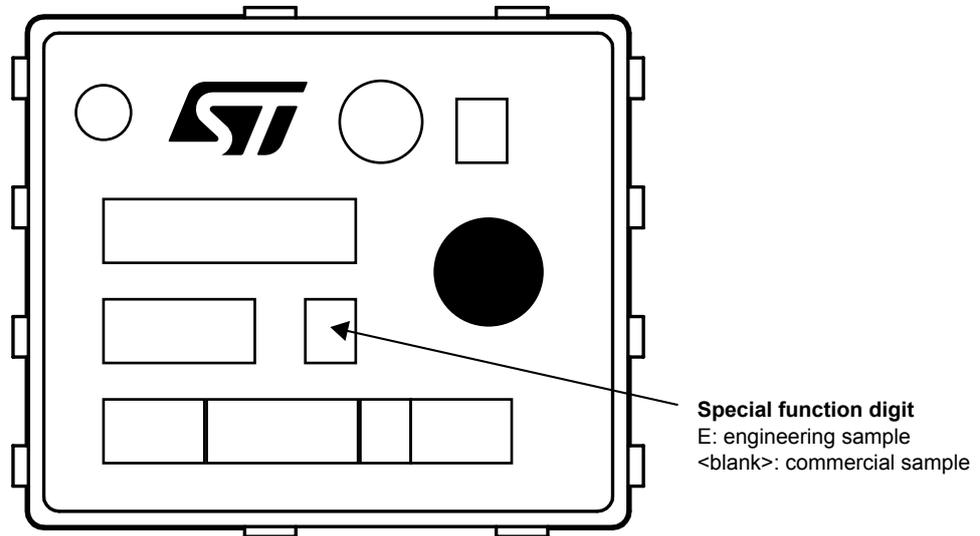
Figure 21. PowerFLAT 5x6 reel



8234350_Reel_rev_C

3.3 PowerFLAT 5x6 marking information

Figure 22. PowerFLAT 5x6 marking information



Note: **Engineering Samples:** these samples can be clearly identified by a dedicated special symbol in the marking of each unit. These samples are intended to be used for electrical compatibility evaluation only; usage for any other purpose may be agreed only upon written authorization by ST. ST is not liable for any customer usage in production and/or in reliability qualification trials.

Commercial Samples: fully qualified parts from ST standard production with no usage restrictions.

Revision history

Table 8. Document revision history

Date	Revision	Changes
22-Nov-2023	1	First release.
04-Nov-2024	2	Updated <i>Table 1. Absolute maximum ratings (at TC = 25 °C unless otherwise specified)</i> , <i>Table 4. Dynamic</i> and <i>Table 6. Source-drain diode</i> .
18-Mar-2025	3	Added <i>Section 2.1: Electrical characteristics (curves)</i> . Updated <i>Table 5. Switching times</i> . Minor text changes in <i>Table 1. Absolute maximum ratings (at TC = 25 °C unless otherwise specified)</i> .
04-Sep-2025	4	Updated <i>Table 2. Thermal data</i> . Updated <i>Figure 5. Safe operating area</i> , <i>Figure 2. Drain current vs case temperature</i> , <i>Figure 3. Typical output characteristics</i> and <i>Figure 4. Typical transfer characteristics</i> .

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