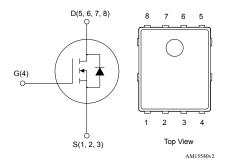


N-channel 100 V, 14.5 mΩ typ., 12 A, STripFET F7 DeepGATE Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT 5x6



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL60N10F7	100 V	18 mΩ	12 A	5 W

- Among the lowest R_{DS(on)} on the market
- Excellent FoM (figure of merit)
- $\bullet \quad \text{Low C_{rss}/C_{iss} ratio for EMI immunity}\\$
- · 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 STL60N10F7

Product summary		
Order code STL60N10F7		
Marking	60N10F7	
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	46	А
ID(**)	Drain current (continuous) at T _C = 100 °C	33	А
L (2)	Drain current (continuous) at T _{pcb} = 25 °C	12	А
I _D ⁽²⁾	Drain current (continuous) at T _{pcb} = 100 °C	9	А
I _{DM} ⁽²⁾⁽³⁾	Drain current (pulsed)		А
P _{TOT} ⁽¹⁾	Total power dissipation at T _C = 25 °C	72	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	- 55 to 175	°C

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

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal resistance junction-case	2.08	°C/W
R _{thj-pcb} ⁽¹⁾	Thermal resistance junction-pcb	31	C/VV

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

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2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	V _{GS} = 0 V, I _D = 1 mA	100			V
leas	Zoro goto voltago droin ourrent	V _{GS} = 0 V, V _{DS} = 100 V			1	μA
I _{DSS}	Zero gate voltage drain current	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	2.5		4.5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 6 A		14.5	18	mΩ

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C _{iss}	Input capacitance			1640	-	pF
C _{oss}	Output capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	360	-	pF
C _{rss}	Reverse transfer capacitance		-	25	-	pF
Qg	Total gate charge	V _{DD} = 50 V, I _D = 12 A, V _{GS} = 10 V (see Figure 13. Test circuit for gate	-	25	-	nC
Q _{gs}	Gate-source charge		-	12	-	nC
Q _{gd}	Gate-drain charge	charge behavior)		5	-	nC
Q _{oss}	Output charge	V _{DD} = 40 V, V _{GS} = 0 V	-	28	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 50 V, I _D = 6 A,	-	15	-	ns
t _r	Rise time	$R_G = 4.7 \Omega, V_{GS} = 10 V$	-	17	-	ns
t _{d(off)}	Turn-off-delay time	(see Figure 12. Test circuit for resistive load switching times and	-	24	-	ns
t _f	Fall time	Figure 17. Switching time waveform)	-	8	-	ns

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Table 6. Source-drain diode

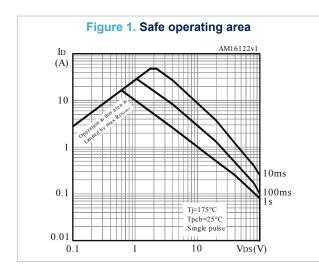
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source-drain current		-		12	Α
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)		-		48	Α
V _{SD} (2)	Forward on voltage	V _{GS} = 0 V, I _{SD} = 16 A	-		1.1	V
t _{rr}	Reverse recovery time	I _{SD} = 12 A, di/dt = 100 A/μs,	-	53		ns
Q _{rr}	Reverse recovery charge	V _{DD} = 50 V, T _J = 150 °C	-	67		nC
I _{RRM}	Reverse recovery current	(see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	2.5		Α

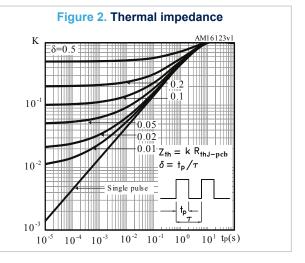
- 1. Pulse width limited by safe operating area.
- 2. Pulse test: pulse duration = $300 \mu s$, duty cycle 1.5%.

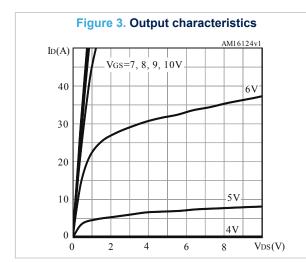
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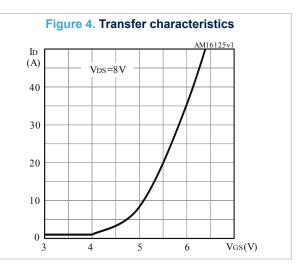


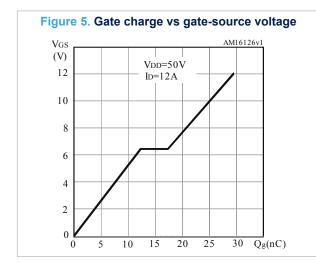
2.1 Electrical characteristics (curves)

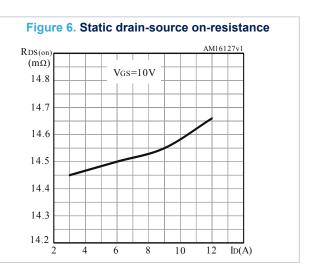






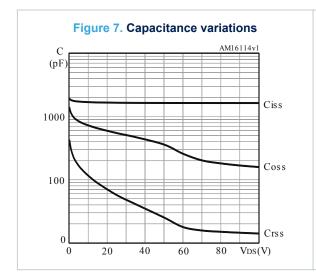




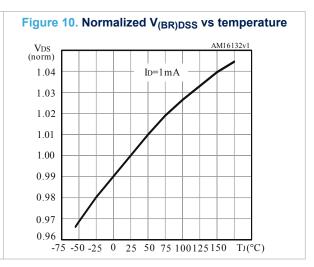


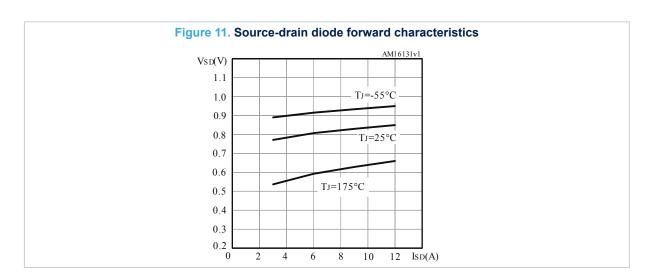
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RDS(on) (norm) | ID=6A | VGS=10V | 1.5 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0





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3 Test circuits

Figure 12. Test circuit for resistive load switching times

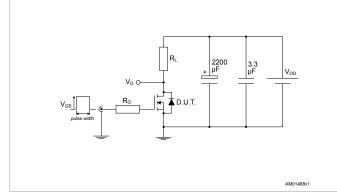


Figure 13. Test circuit for gate charge behavior

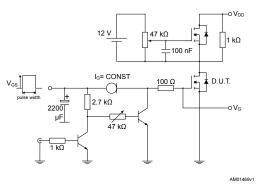


Figure 14. Test circuit for inductive load switching and diode recovery times

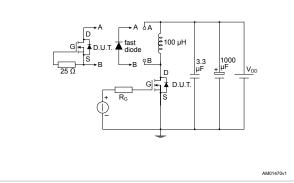


Figure 15. Unclamped inductive load test circuit

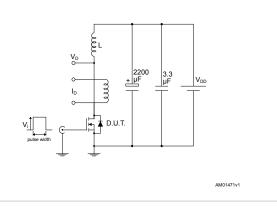


Figure 16. Unclamped inductive waveform

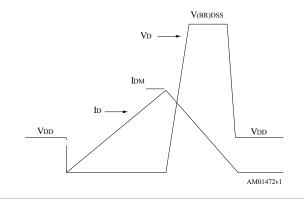
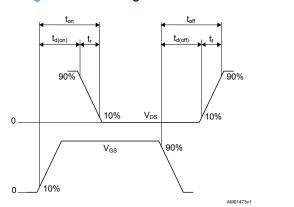


Figure 17. Switching time waveform



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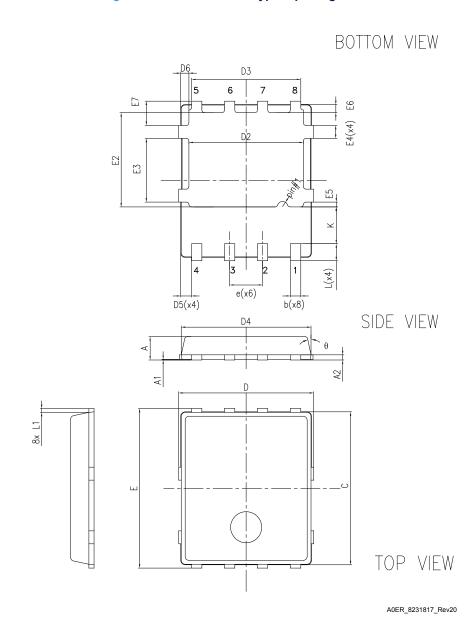


4 Package information

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	
Dim.	Min.	Тур.	Max.
Α	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
С	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
е		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°

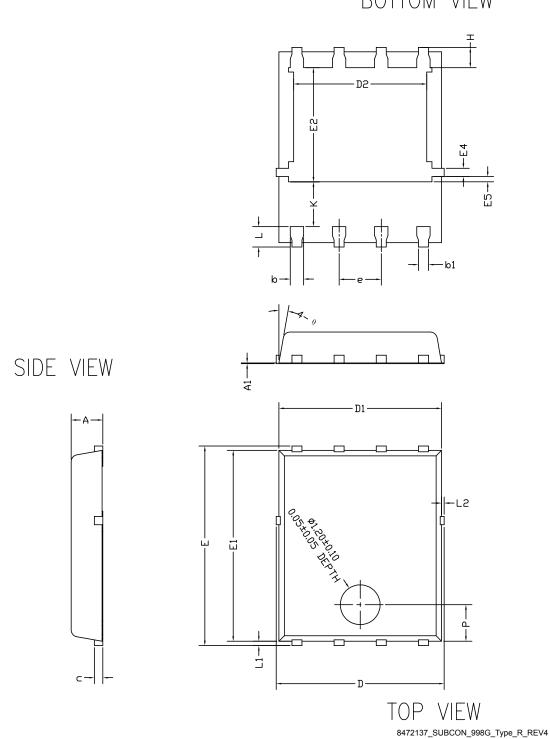
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4.2 PowerFLAT 5x6 type R SUBCON package information

Figure 19. PowerFLAT 5x6 type R SUBCON package outline





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

Dim.		mm	
DIM.	Min.	Тур.	Max.
А	0.90	0.95	1.00
A1		0.02	
b	0.35	0.40	0.45
b1		0.30	
С	0.21	0.25	0.34
D			5.10
D1	4.80	4.90	5.00
D2	3.91	4.01	4.11
е	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
Н	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
Р	1.00	1.10	1.20
θ	8°	10°	12°

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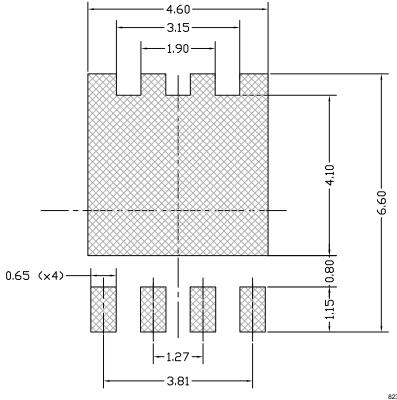


Figure 20. PowerFLAT 5x6 recommended footprint (dimensions are in mm)

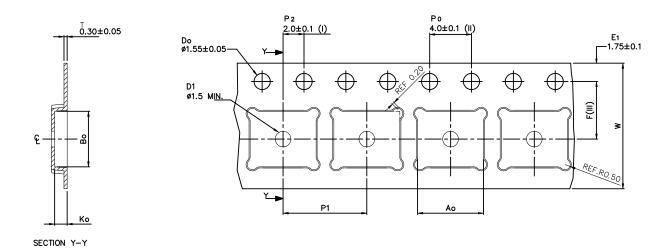
8231817_FOOTPRINT_simp_Rev_20

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4.3 PowerFLAT 5x6 packing information

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



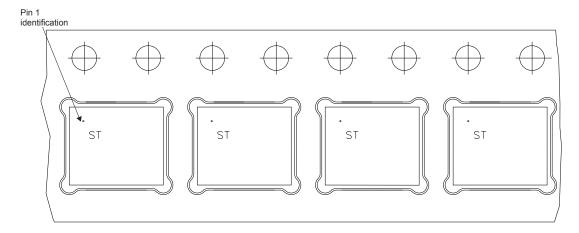
Ao	6.30 +/- 0.1
Во	5.30 +/- 0.1
Ko	1.20 +/- 0.1
F	5.50 +/- 0.1
P1	8.00 +/- 0.1
w	1200 1/- 03

- (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



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PART NO.

R25.00

R25.00

R25.00

R25.00

R1.10

R25.00

All dimensions are in millimeters

CORE DETAIL

Figure 23. PowerFLAT 5x6 reel

8234350_Reel_rev_C

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Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Mar-2013	1	First release.
23-May-2013	2	 Document status promoted from target data to production data Modified: V_{GS(th)} values in <i>Table 4</i>
28-Oct-2013	3	 Modified: title, R_{DS(on)} in cover page Modified: R_{DS(on)} typical and max values in <i>Table 4</i>, C_{iss} typical value in table 5 Added: Q_{SS} in <i>Table 5</i> Modified: t_{d(on)} and T_r typical values Modified: T_{rr}, Q_{rr} and I_{RRM} typical values in <i>Table 7</i> Added: <i>Section 2.1: Electrical characteristics (curves)</i> Updated: <i>Section 4: Package mechanical data</i> Minor text changes
13-Feb-2020	4	Updated Section 4 Package information. Minor text changes.

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3	Test	circuits	7
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	4.1	PowerFLAT 5x6 type R package information	8
	4.2	PowerFLAT 5x6 type R SUBCON package information	9
	4.3	PowerFLAT 5x6 packing information	12
Rev	Revision history		



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