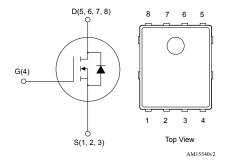




N-channel 30 V, 7.6 mΩ typ., 56 A STripFET H5 Power MOSFET in a PowerFLAT 5x6 package



PowerFLAT 5x6



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL56N3LLH5 30 V		9 mΩ	56 A

- Low on-resistance R_{DS(on)}
- · High avalanche ruggedness
- · Low gate drive power loss

Applications

· Switching applications

Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET H5 technology. The device has been optimized to achieve very low onstate resistance, contributing to a FoM that is among the best in its class.



Product status link STL56N3LLH5

Product summary		
Order code STL56N3LLH5		
Marking	56N3LLH5	
Package	PowerFLAT 5x6	
Packing	Tape and reel	



1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	V _{DS} Drain-source voltage		V
V _{GS}	Gate-source voltage	+22 / -20	V
I _D ⁽¹⁾	Drain current (continuous) at T _C = 25 °C	56	Α
ID(·)	Drain current (continuous) at T _C = 100 °C	37	Α
1 (2)	Drain current (continuous) at T _{pcb} = 25 °C	15	Α
I _D ⁽²⁾	Drain current (continuous) at T _{pcb} = 100 °C	10	Α
I _{DM} ⁽¹⁾⁽³⁾	I _{DM} ⁽¹⁾⁽³⁾ Drain current (pulsed)		А
I _{DM} ⁽²⁾⁽³⁾	I _{DM} ⁽²⁾⁽³⁾ Drain current (pulsed)		А
P _{TOT} ⁽¹⁾	Total power dissipation at T _C = 25 °C	62.5	W
P _{TOT} ⁽²⁾	Total power dissipation at T _{pcb} = 25 °C	4	W
E _{AS} ⁽⁴⁾	E _{AS} ⁽⁴⁾ Single pulse avalanche energy		mJ
T _{stg}	Storage temperature range	- 55 to 150	°C
TJ	Operating junction temperature range	- 55 (0 150	°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.
- 4. Starting $T_J = 25$ °C, $I_D = 56$ A, $V_{DD} = 50$ V.

Table 2. Thermal data

Symbo	Parameter	Value	Unit
R _{thj-cas}	Thermal resistance junction-case	2	°C/W
R _{thj-pcb} ⁽	Thermal resistance junction-pcb 31.3		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	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	30			V
l	Zoro goto voltago drain ourrent	V _{GS} = 0 V, V _{DS} = 30 V			1	μA
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V, V _{DS} = 30 V, T _C = 125 °C			10	μA
I _{GSS}	Gate-body leakage current	V _{DS} = 0 V, V _{GS} = +22 / -20 V			±100	nA
V _{GS(th)}	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1		2.5	V
Prov	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 7.5 A		7.6	9	mΩ
R _{DS(on)}		V _{GS} = 4.5 V, I _D = 7.5 A		9.9	11.2	11122

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0 V		950		pF
C _{oss}	Output capacitance			193		pF
C _{rss}	Reverse transfer capacitance		-	27		pF
Qg	Total gate charge	V _{DD} = 15 V, I _D = 15 A, V _{GS} = 4.5 V (see Figure 13. Test circuit for gate	-	6.5	10	nC
Q _{gs}	Gate-source charge		-	3.3		nC
Q _{gd}	Gate-drain charge	charge behavior)		2.4		nC
R _g	Gate input resistance	f = 1 MHz, gate DC Bias = 0 V, test signal level = 20 mV, I _D = 0 A	-	1.7	2.5	Ω

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 15 V, I _D = 7.5 A,	-	10.8	-	ns
t _r	Rise time	$R_G = 4.7 \Omega, V_{GS} = 10 V$	-	15.6	-	ns
t _{d(off)}	Turn-off-delay time	(see Figure 12. Test circuit for resistive load switching times and	-	14.2	-	ns
t _f	Fall time	Figure 17. Switching time waveform)	-	6	-	ns

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Table 6. Source-drain diode

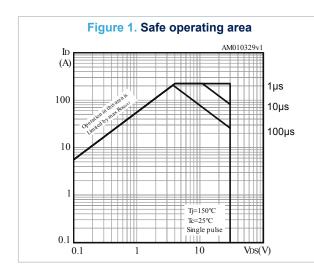
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source-drain current		-		56	Α
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)		-		224	Α
V _{SD} ⁽²⁾	Forward on voltage	V _{GS} = 0 V, I _{SD} = 15 A	-		1.1	V
t _{rr}	Reverse recovery time	I _{SD} = 15 A, di/dt = 100 A/μs,	-	20	36	ns
Qrr	Reverse recovery charge	V _{DD} = 25 V, T _J = 150 °C	-	10	18	nC
I _{RRM}	Reverse recovery current	(see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	1		Α

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

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2.1 Electrical characteristics (curves)



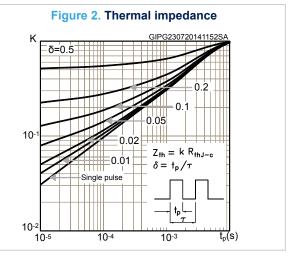
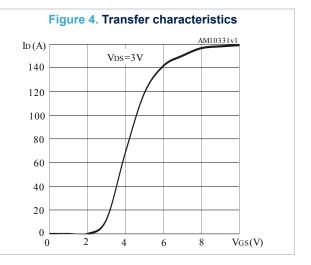
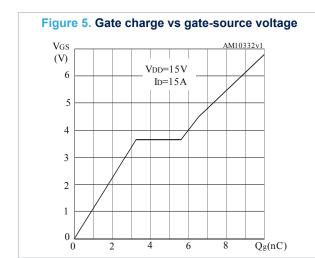
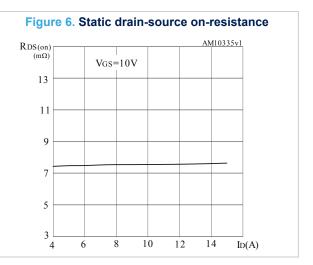


Figure 3. Output characteristics AM10330v1 (A) V_Gs=10V 6V 140 120 5V 100 80 4V 60 40 20 3V 2 3 4 VDS(V)

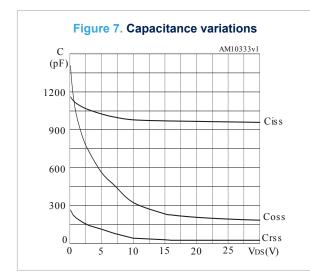




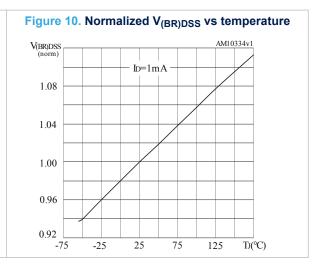


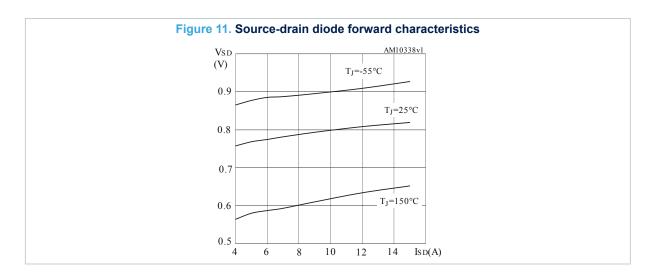
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RDS(on) | ID=7.5A | VGS=10V | 1.6 | 1.2 | 0.8 | 0.4 | -75 | -25 | 25 | 75 | 125 | TJ(°C)





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3 Test circuits

Figure 12. Test circuit for resistive load switching times

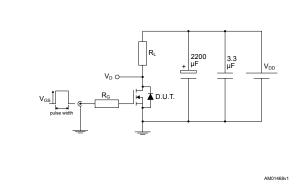


Figure 13. Test circuit for gate charge behavior

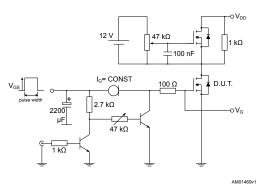


Figure 14. Test circuit for inductive load switching and diode recovery times

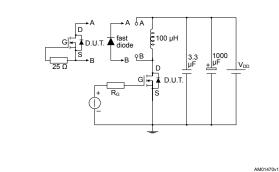


Figure 15. Unclamped inductive load test circuit

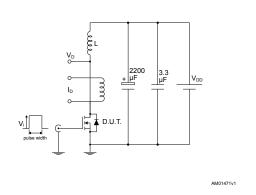


Figure 16. Unclamped inductive waveform

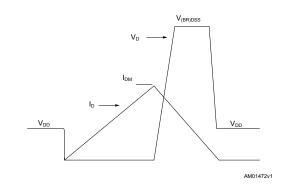
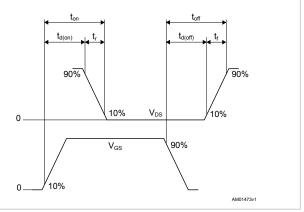


Figure 17. Switching time waveform



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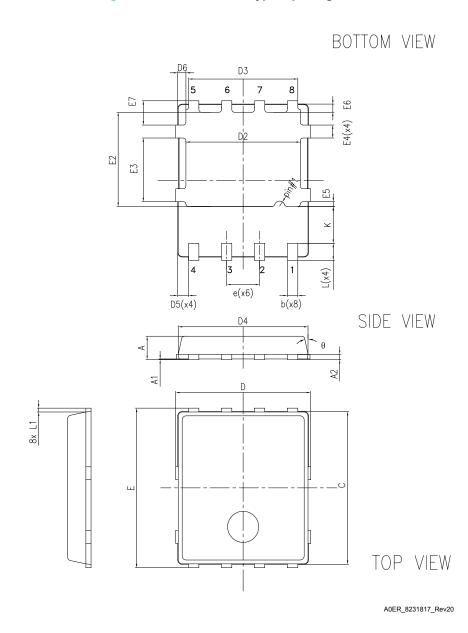


4 Package information

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.
А	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	
Е	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°

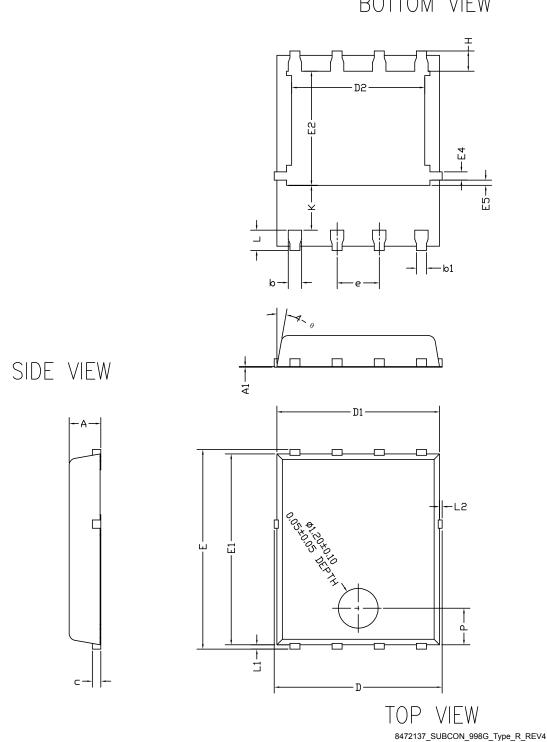
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PowerFLAT 5x6 type R SUBCON package information 4.2

Figure 19. PowerFLAT 5x6 type R SUBCON package outline

BOTTOM VIEW



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

Dim.	mm				
Dilli.	Min.	Тур.	Max.		
Α	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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0.65 (x4) -1.27 -3.81

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

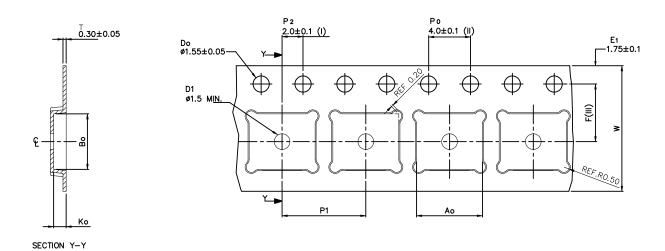
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4.3 PowerFLAT 5x6 packing information

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



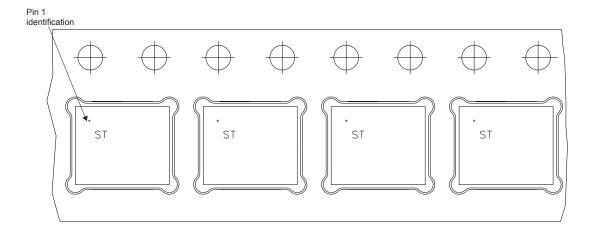
Ao	6.30 +/- 0.1
Во	5.30 +/- 0.1
Ko	1.20 +/- 0.1
F	5.50 +/- 0.1
P1	8.00 +/- 0.1
W	12.00 +/- 0.3

- (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



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PART NO

R25.00

R25.00

R25.00

R25.00

R25.00

R25.00

R25.00

R25.00

R1.10

R27.00

R27.00

R27.00

R28.00

R28.00

R29.00

Figure 23. PowerFLAT 5x6 reel

8234350_Reel_rev_C

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Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Jan-2011	1	First release.
01-Jul-2011	2	Document status promoted from preliminary data to datasheet.
27-Apr-2012	3	Added E _{AS} value in <i>Table 2: Absolute maximum ratings</i> . Updated Table <i>3: Thermal resistance</i> , <i>Table 4: On/off states</i> , <i>Table 5: Dynamic</i> and <i>Table 7: Source drain diode</i> . Minor text changes.
13-Feb-2013	4	Added: Section 5: Packaging mechanical data.Updated Section 4: Package mechanical data.
25-Jul-2014	5	 Modified: title, features and description in cover page Modified: I_{SD} and I_{SDM} max values in <i>Table 7</i> Updated: <i>Figure 2</i> and 3 Updated: <i>Figure 13</i>, <i>14</i>, <i>15</i> and <i>16</i> Updated: <i>Section 4: Package mechanical data</i> Minor text changes
19-Feb-2020	6	Updated Section 4 Package information Minor text changes.
20-May-2021	7	Updated marking in cover page.

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	4.3	PowerFLAT 5x6 packing information	13
Rev	Revision history		



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