

P-channel 60 V, 0.13 Ω typ., 12 A STripFETTM F6 Power MOSFET in a PowerFLATTM 5x6 package

Datasheet - production data

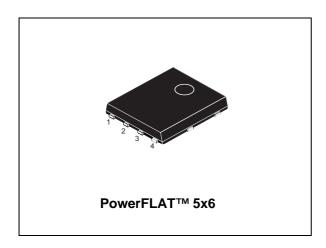
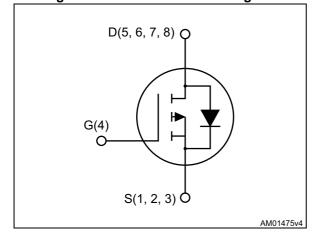


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	R _{DS(on)max}	I _D
STL12P6F6	60 V	0.16 Ω @ 10 V	12 A

- Very low on-resistance
- Very low gate charge
- · High avalanche ruggedness
- · Low gate drive power loss

Applications

· Switching applications

Description

This device is an P-channel Power MOSFET developed using the STripFET $^{\text{TM}}$ F6 technology, with a new trench gate structure. The resulting Power MOSFET exhibits a very low $R_{DS(on)}$ in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL12P6F6	12P6F6	PowerFLAT 5x6	Tape and reel

Note: For the P-channel Power MOSFET the actual polarity of the voltages and the current must be reversed.

July 2014 DocID024400 Rev 2 1/16

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STL12P6F6 Electrical ratings

1 Electrical ratings

Table 2. 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	12	Α
I _D ⁽¹⁾	Drain current (continuous) at T _C = 100 °C	8.5	Α
I _{DM} ⁽¹⁾⁽²⁾	Drain current (pulsed)	48	Α
I _D ⁽³⁾	Drain current (continuous) at T _{pcb} = 25 °C	4	Α
I _D ⁽³⁾	Drain current (continuous) at T _{pcb} = 100 °C	2.8	Α
P _{TOT} (1)	Total dissipation at T _C = 25 °C	75	W
P _{TOT} (3)	Total dissipation at T _{pcb} = 25 °C	4.8	W
T _j	Operating junction temperature	-55 to 175	°C
T _{stg}	Storage temperature	-55 10 175	

^{1.} The value is according to $\boldsymbol{R}_{thj\text{-case}}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal resistance junction-case max	2	°C/W
R _{thj-pcb} ⁽¹⁾	Thermal resistance junction-pcb max	31.3	°C/W

^{1.} When mounted on FR-4 board of 15 mm², 2 Oz Cu, t<10 sec

Note:

For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.

^{2.} Pulse width is limited by safe operating area.

^{3.} The value is according to $R_{\mbox{\scriptsize thj-pcb}}$

Electrical characteristics STL12P6F6

2 Electrical characteristics

(Tcase = 25 °C unless otherwise specified).

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	$V_{GS} = 0$, $I_D = 250 \mu A$	60			V
Zero gate voltage	$V_{GS} = 0, V_{DS} = 60 \text{ V}$			1	μΑ	
I _{DSS}	drain current	V _{GS} = 0, V _{DS} = 60 V, T _C =125 °C			10	μА
I _{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20 \text{ V}$			±100	nA
V _{GS(th)}	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2		4	V
R _{DS(on)}	Static drain-source on- resistance	V _{GS} = 10 V, I _D = 1.5 A		0.13	0.16	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C _{iss}	Input capacitance		-	340	-	pF
C _{oss}	Output capacitance	V _{GS} = 0, V _{DS} = 48 V, f = 1 MHz	-	40	-	pF
C _{rss}	Reverse transfer capacitance		-	20	-	pF
Qg	Total gate charge	V _{DD} = 30 V, I _D = 3 A, V _{GS} = 10 V	-	6.4	-	nC
Q _{gs}	Gate-source charge		-	1.7	-	nC
Q_{gd}	Gate-drain charge	(see Figure 14)	-	1.7	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t _{d(on)}	Turn-on delay time	$V_{DD} = 48 \text{ V}, I_{D} = 1.5 \text{ A},$ $R_{G} = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see <i>Figure 13</i>)	-	64	-	ns
t _r	Rise time		-	5.3	-	ns
t _{d(off)}	Turn-off delay time		-	14	-	ns
t _f	Fall time		-	3.7	1	ns

Note: For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.

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Unit **Symbol Parameter Test conditions** Min. Тур. Max. I_{SD} Source-drain current 12 Α I_{SDM} (1) Source-drain current (pulsed) 48 Α V_{SD} (2) ٧ Forward on voltage $V_{GS} = 0, I_{SD} = 3 A$ 1.1 20 t_{rr} Reverse recovery time ns $I_{SD} = 5 A$, $di/dt = 100 A/\mu s$ Q_{rr} Reverse recovery charge $V_{DD} = 16 \text{ V}, T_i = 150 \text{ }^{\circ}\text{C}$ 17.8 nC _ (see Figure 15) Reverse recovery current 1.8 Α I_{RRM}

Table 7. Source drain diode

Note: For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.



^{1.} Pulse width limited by safe operating area.

^{2.} Pulse duration = 300 μ s, duty cycle 1.5%

Electrical characteristics STL12P6F6

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

Figure 3. Thermal impedance

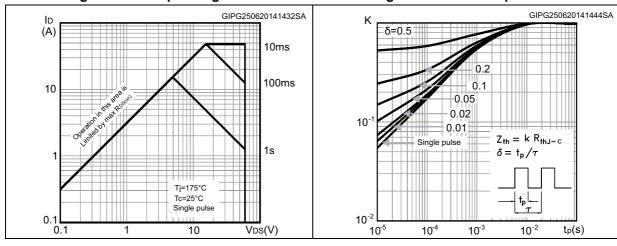


Figure 4. Output characteristics

Figure 5. Transfer characteristics

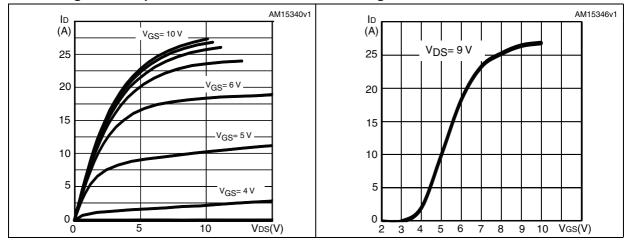
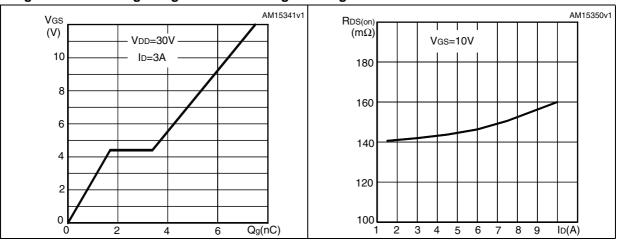


Figure 6. Gate charge vs gate-source voltage

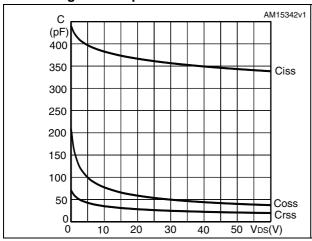
Figure 7. Static drain-source on-resistance



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Figure 8. Capacitance variations

Figure 9. Normalized $V_{(BR)DSS}$ vs temperature



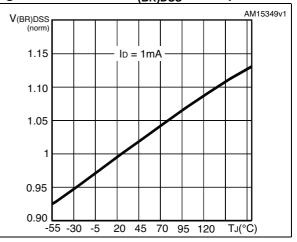
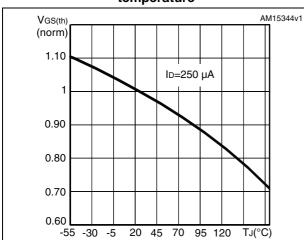


Figure 10. Normalized gate threshold voltage vs temperature

Figure 11. Normalized on-resistance vs temperature



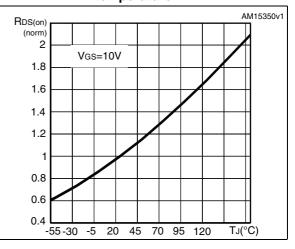
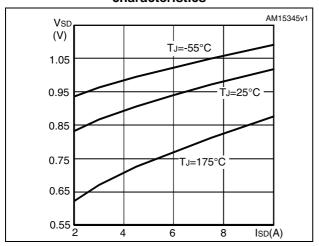


Figure 12. Source-drain diode forward characteristics



Test circuits STL12P6F6

3 Test circuits

Figure 13. Switching times test circuit for resistive load

Figure 14. Gate charge test circuit

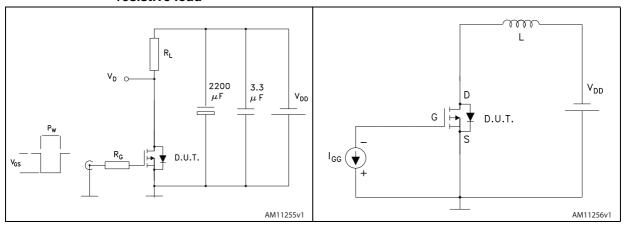
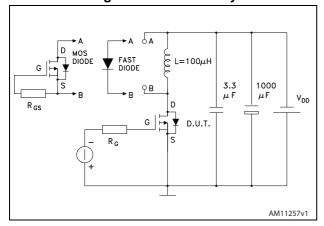


Figure 15. Test circuit for inductive load switching and diode recovery times



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4 Package mechanical data

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.



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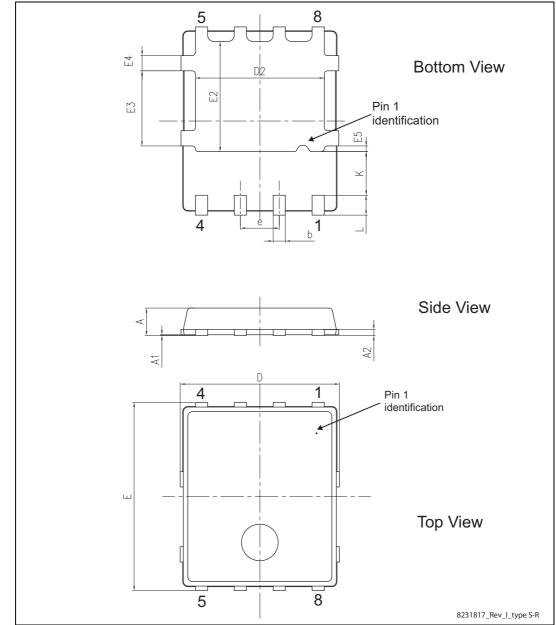


Figure 16. PowerFLAT™ 5x6 type S-R drawing

Table 8. PowerFLAT 5x6 type S-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			
D	5.00	5.20	5.40			
D2	4.11		4.31			
E	5.95	6.15	6.35			
е		1.27				
E2	3.50		3.70			
E3	2.35		2.55			
E4	0.40		0.60			
E5	0.08		0.28			
K	1.275		1.575			
L	0.60		0.80			



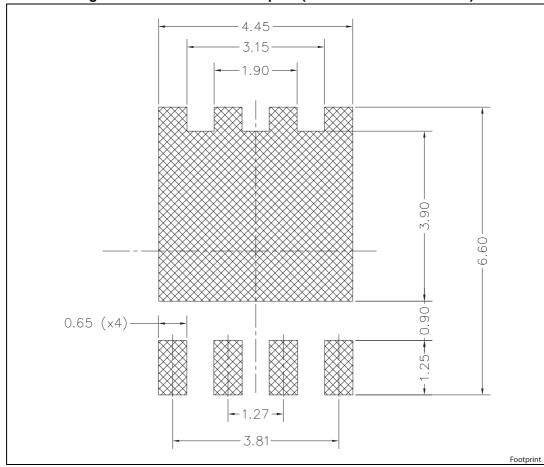


Figure 17. Recommended footprint (dimensions in millimeters)

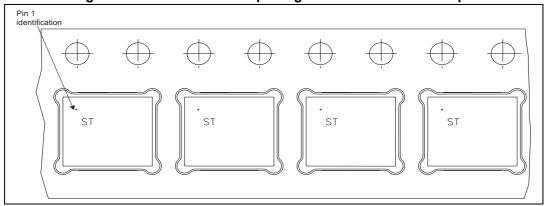
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5 Packaging mechanical data

P₀ 4.0±0.1 (II) T (0.30±0.05) E₁ -- 1.75±0.1 Do Ø1.55±0.05 F(5.50±0.1)(III) W(12.00±0.3) P1(8.00±0.1) Ko (1.20±0.1) SECTION Y-Y (I) Measured from centerline of sprocket hole to centerline of pocket. Base and bulk quantity 3000 pcs (II) Cumulative tolerance of 10 sprocket holes is $\pm\ 0.20$.

Figure 18. PowerFLAT™ 5x6 tape^(a)

Figure 19. PowerFLAT™ 5x6 package orientation in carrier tape



(III) Measured from centerline of sprocket hole to centerline of pocket.

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a. All dimensions are in millimeters.

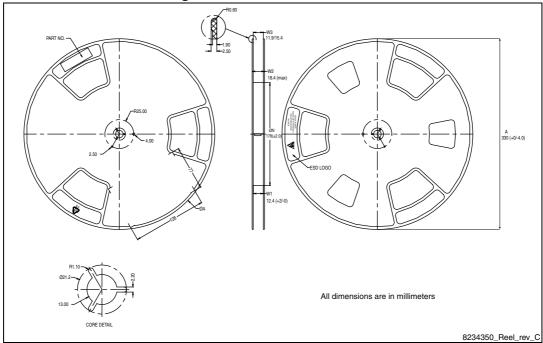


Figure 20. PowerFLAT™ 5x6 reel

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STL12P6F6 Revision history

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
20-Mar-2013	1	First release.
14-Jul-2014	2	 Modified: I_D, and I_{DM} values in <i>Table 2</i> Modified: the entire typical values in <i>Table 6</i> Modified: I_{SD} and I_{SDM} max 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

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