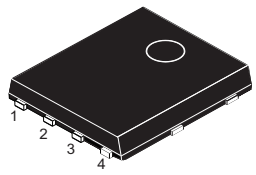
STL12P6F6

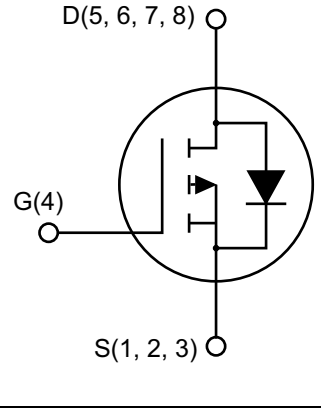
P-channel 60 V, 0.13 Ω typ., 12 A STripFET™ F6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data



PowerFLAT™ 5x6

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™ 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.

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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	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	8.5	A
I_{DM} (1)(2)	Drain current (pulsed)	48	A
I_D (3)	Drain current (continuous) at T_{pcb} = 25 °C	4	A
I_D (3)	Drain current (continuous) at T_{pcb} = 100 °C	2.8	A
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		°C

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

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	31.3	°C/W

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

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

2 Electrical characteristics

(Tcase = 25 °C unless otherwise specified).

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0, I_D = 250 µA	60			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 60 V			1	µA
		V_{GS} = 0, V_{DS} = 60 V, T_C=125 °C			10	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0, V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	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.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 48 V, f = 1 MHz	-	340	-	pF
C_{oss}	Output capacitance		-	40	-	pF
C_{rss}	Reverse transfer capacitance		-	20	-	pF
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 3 A, V_{GS} = 10 V (see *Figure 14*)	-	6.4	-	nC
Q_{gs}	Gate-source charge		-	1.7	-	nC
Q_{gd}	Gate-drain charge		-	1.7	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 48 V, I_D = 1.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 13*)	-	64	-	ns
t_r	Rise time		-	5.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	14	-	ns
t_f	Fall time		-	3.7	-	ns

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

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		12 48	A A
V_{SD} (2)	Forward on voltage	V_{GS} = 0, I_{SD} = 3 A	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs V_{DD} = 16 V, T_j = 150 °C (see *Figure 15*)	-	20		ns
Q_{rr}	Reverse recovery charge		-	17.8		nC
I_{RRM}	Reverse recovery current		-	1.8		A

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

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

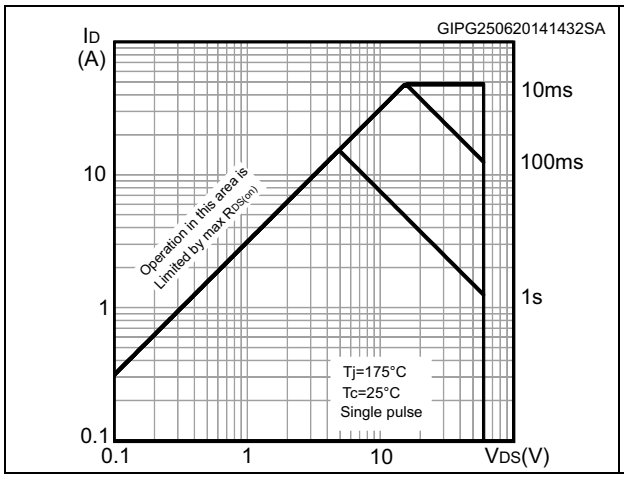


Figure 3. Thermal impedance

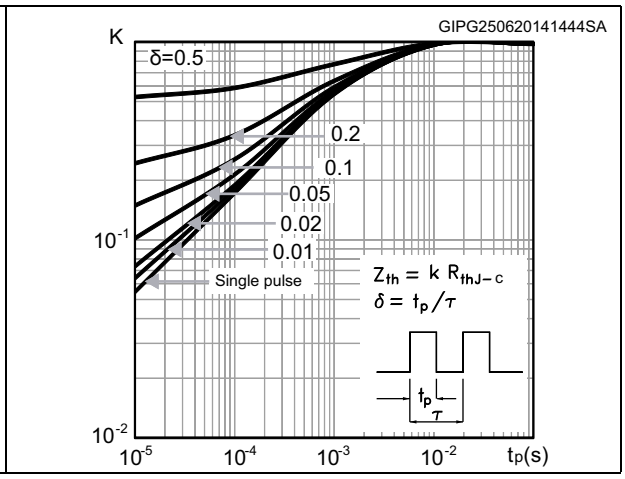


Figure 4. Output characteristics

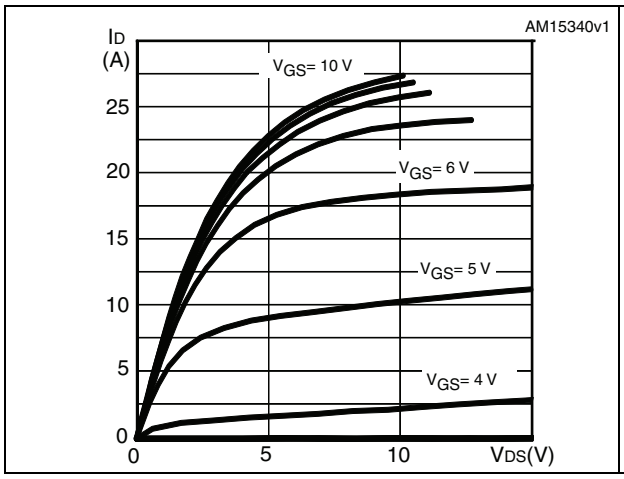


Figure 5. Transfer characteristics

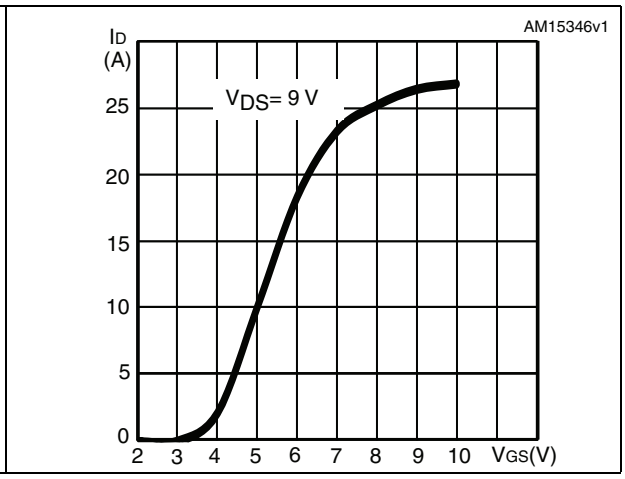


Figure 6. Gate charge vs gate-source voltage

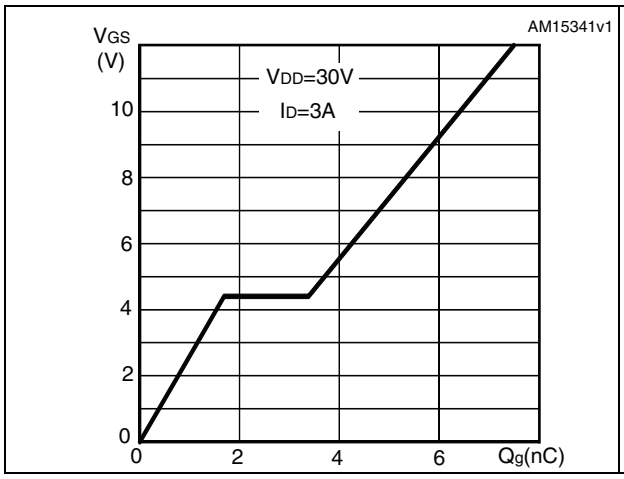


Figure 7. Static drain-source on-resistance

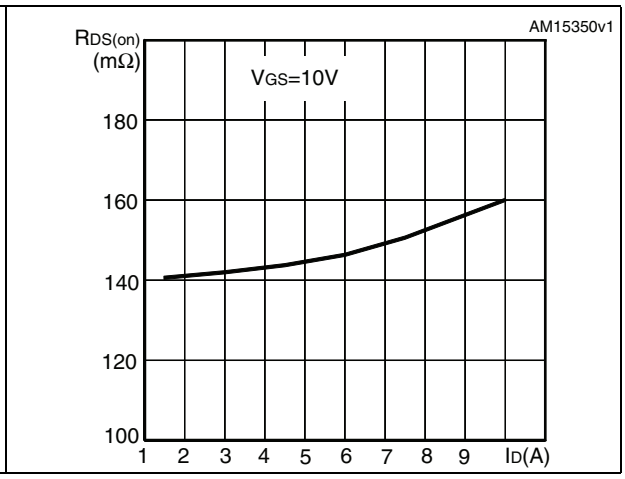


Figure 8. Capacitance variations

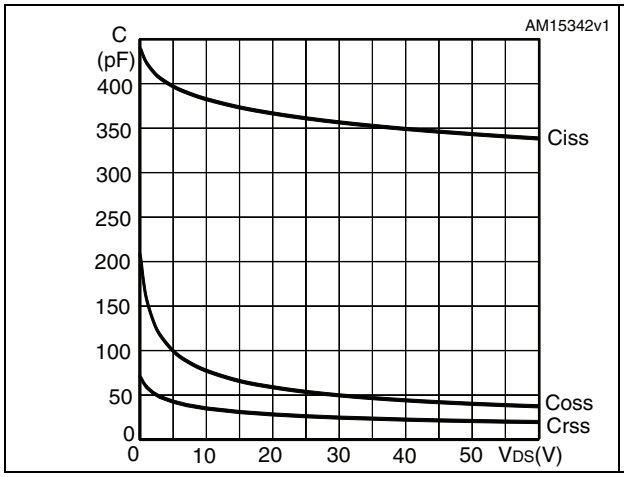


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

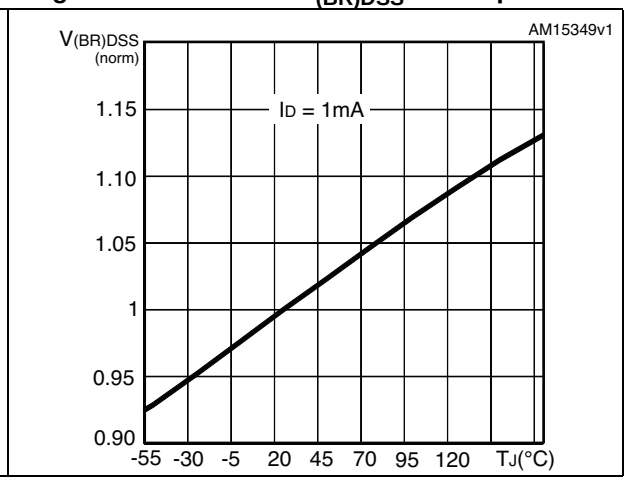


Figure 10. Normalized gate threshold voltage vs temperature

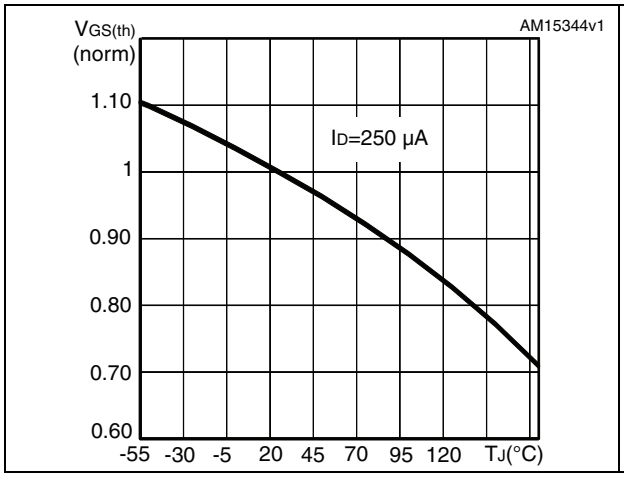


Figure 11. Normalized on-resistance vs temperature

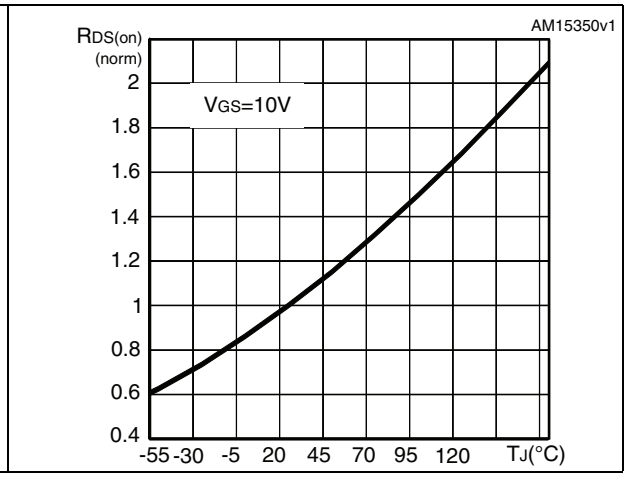
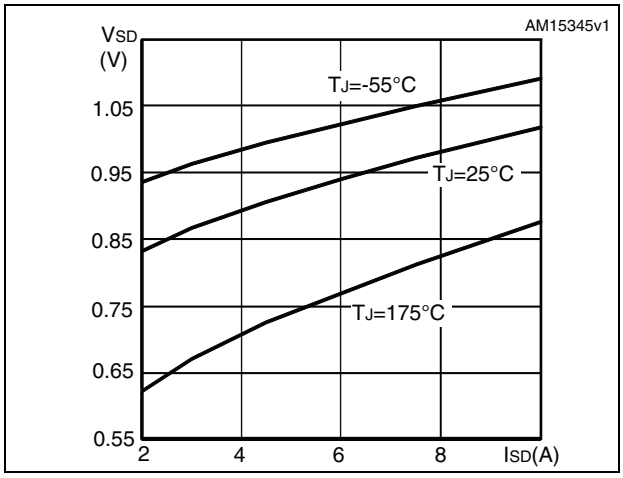


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

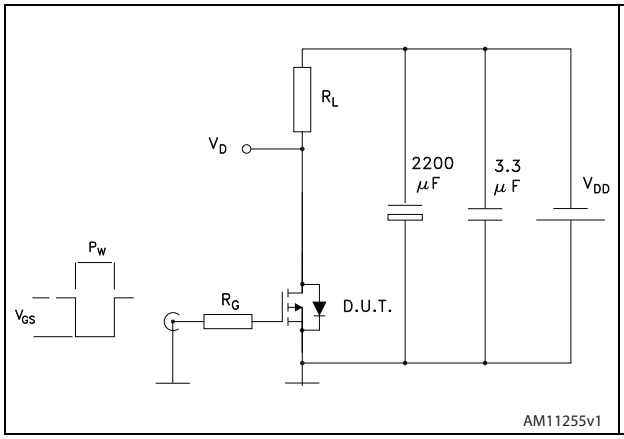


Figure 14. Gate charge test circuit

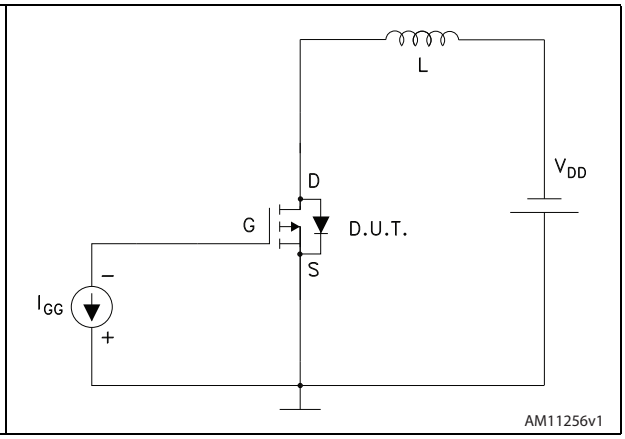
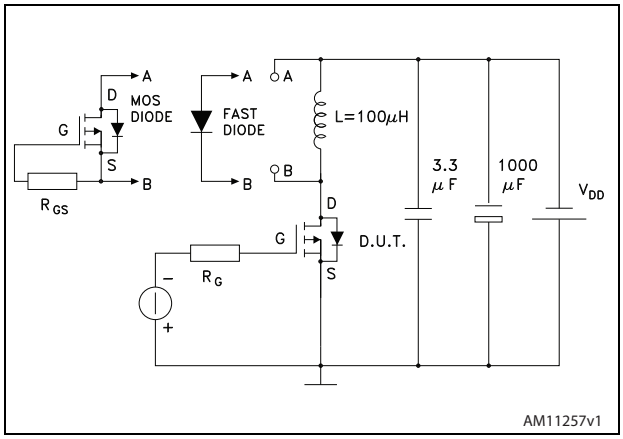


Figure 15. Test circuit for inductive load switching and diode recovery times



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.

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

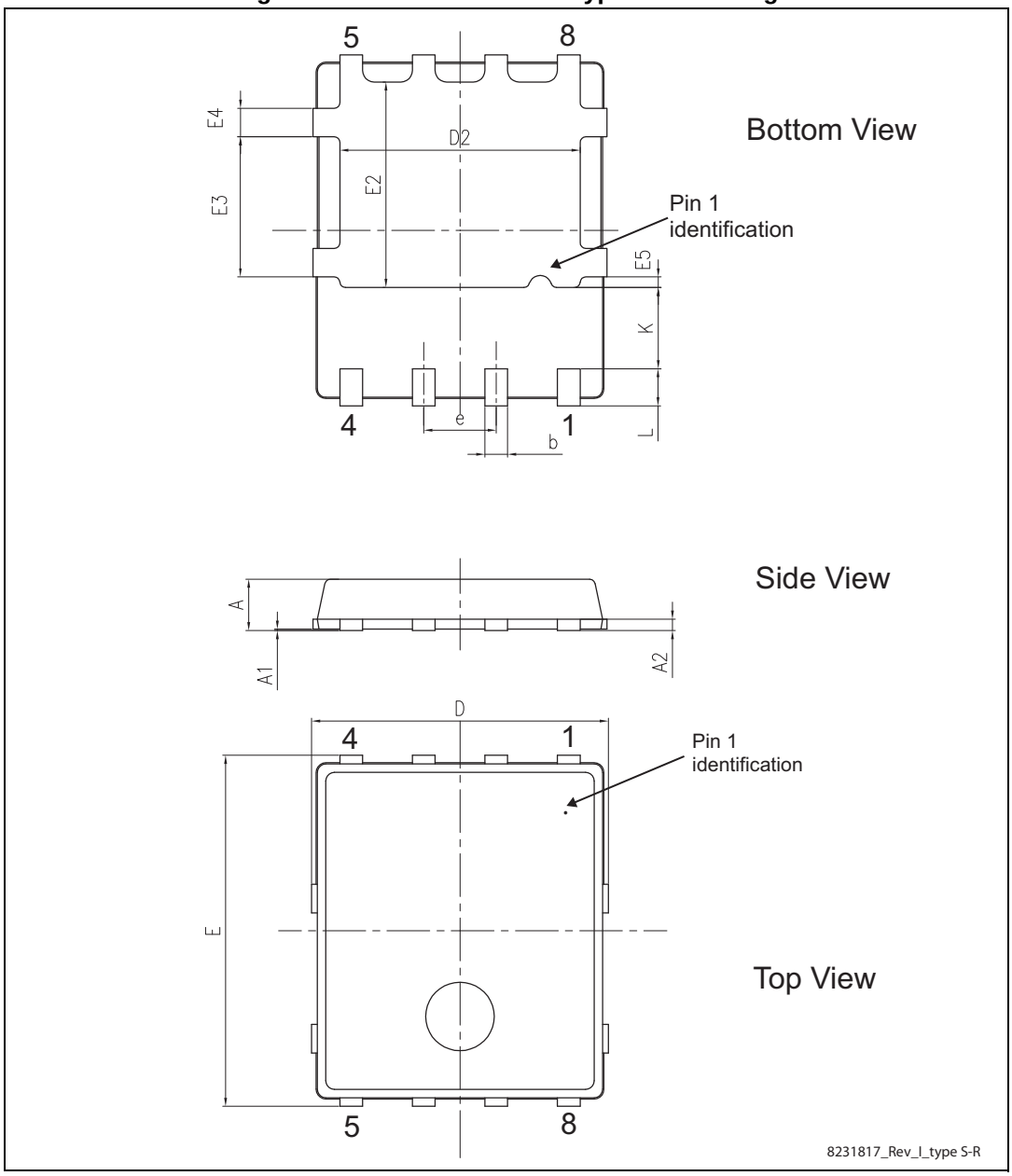
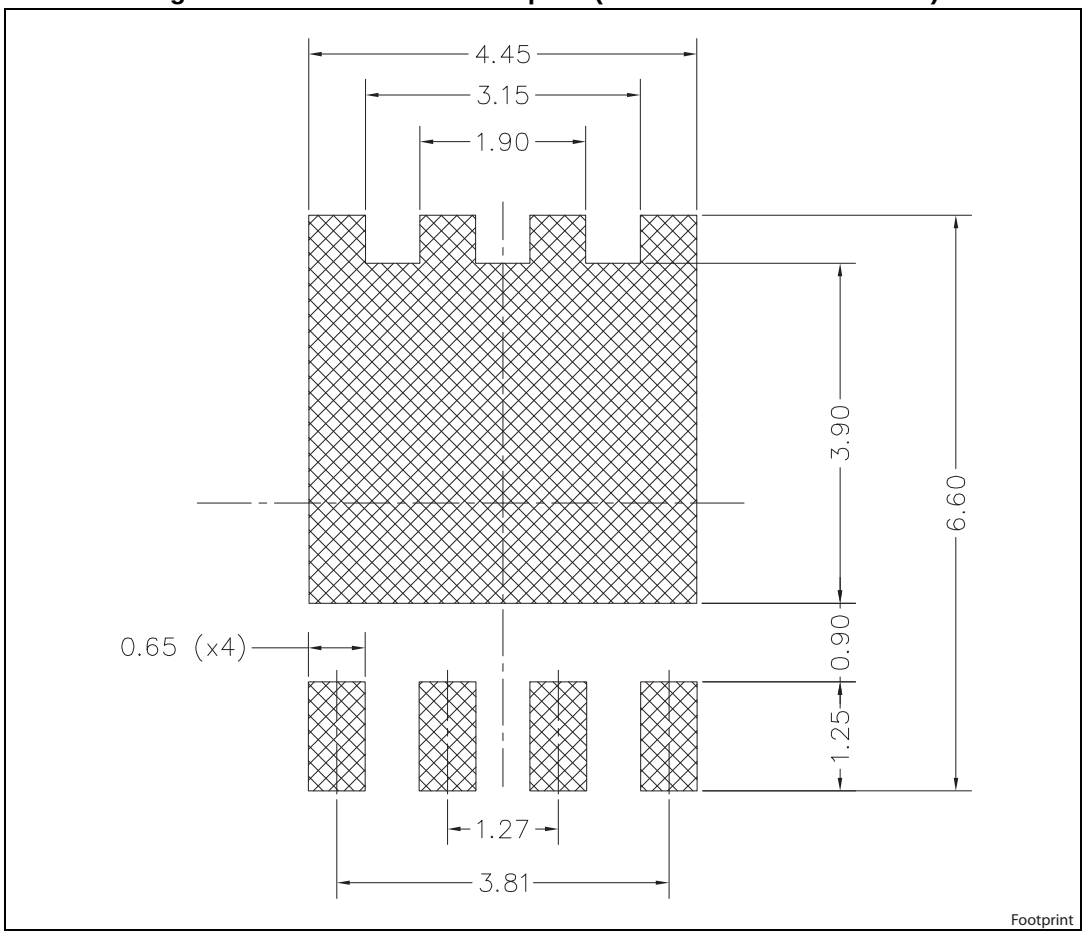


Table 8. PowerFLAT 5x6 type S-R mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D	5.00	5.20	5.40
D2	4.11		4.31
E	5.95	6.15	6.35
e		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)



5 Packaging mechanical data

Figure 18. PowerFLAT™ 5x6 tape[(a)]

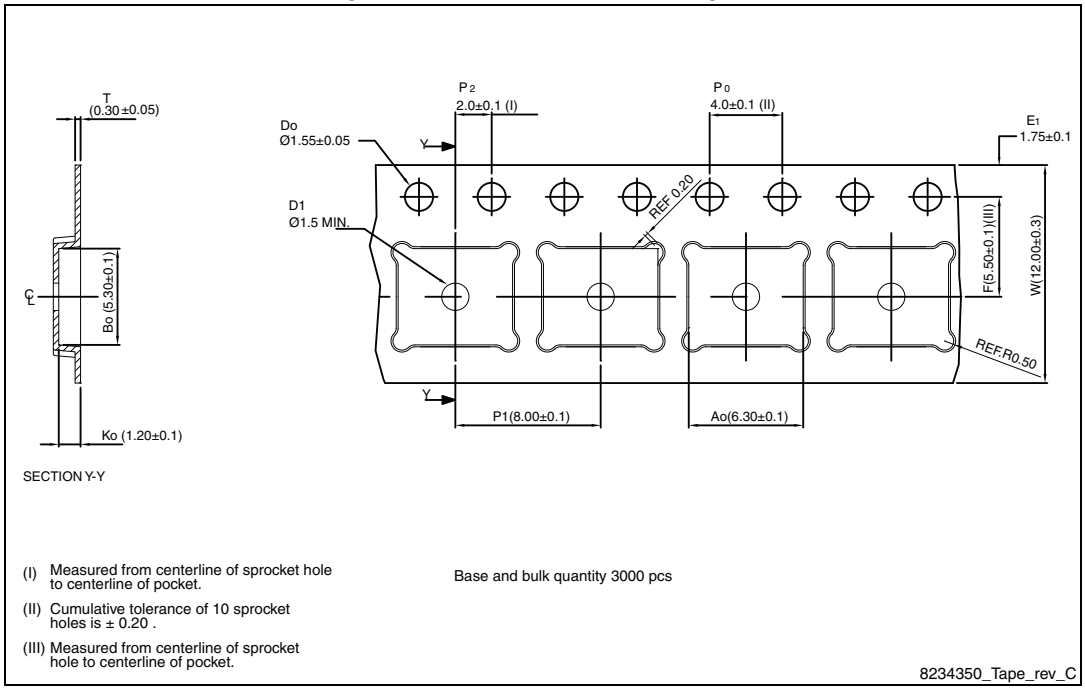
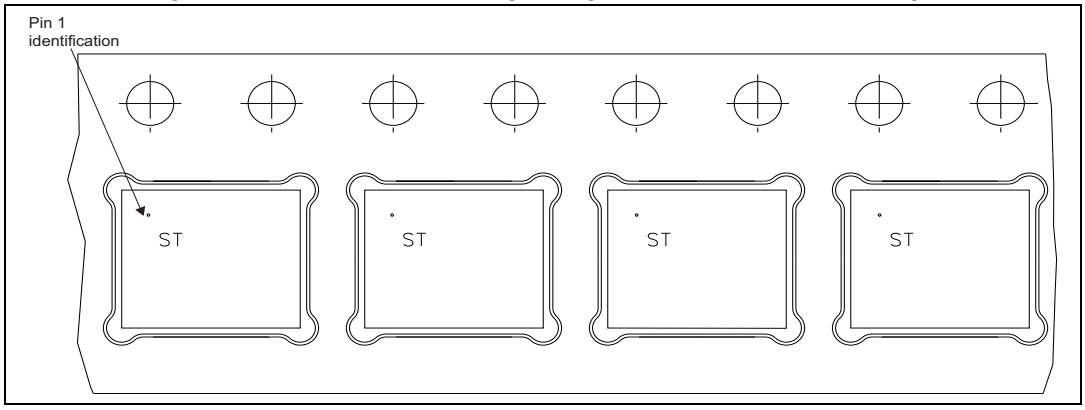
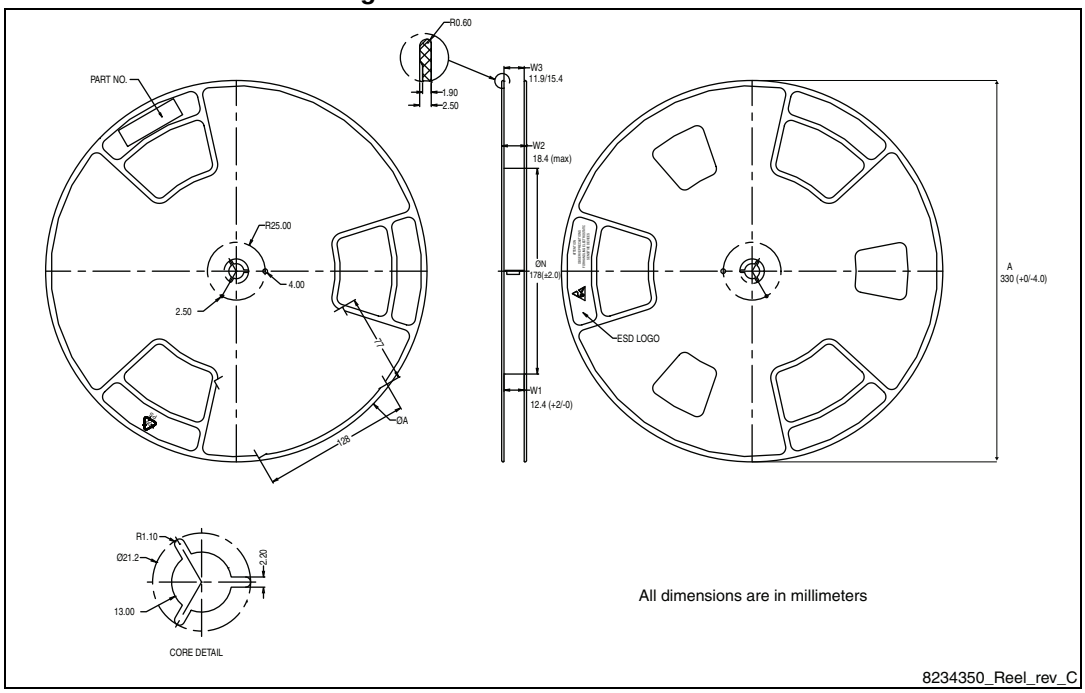


Figure 19. PowerFLAT™ 5x6 package orientation in carrier tape



a. All dimensions are in millimeters.

Figure 20. PowerFLAT™ 5x6 reel



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 *Table 2* – Modified: the entire typical values in *Table 6* – Modified: I_{SD} and I_{SDM} max values in *Table 7* – Added: *Section 2.1: Electrical characteristics (curves)* – Updated: *Section 4: Package mechanical data* – Minor text changes