

Automotive-grade dual N-channel 30 V, 0.016 Ω typ., 11 A STripFET™ H5 Power MOSFET in PowerFLAT™ 5x6 double island

Datasheet - production data

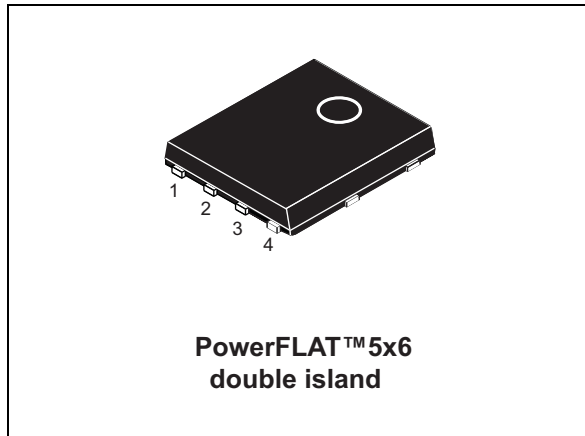
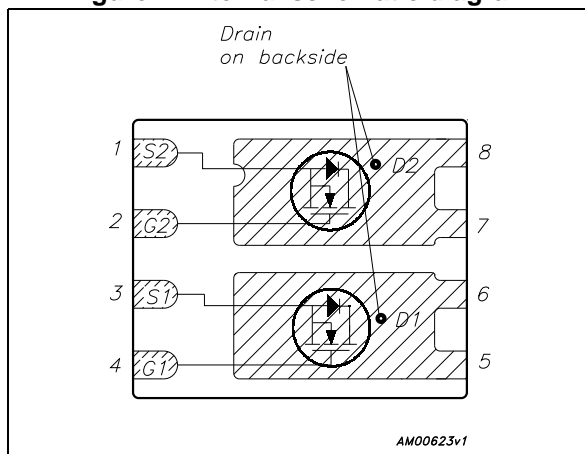


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL40DN3LLH5	30 V	0.018 Ω	11 A

- Designed for automotive application and AEC-Q101 qualified
- Low on-resistance
- High avalanche ruggedness
- Low gate drive power loss
- Wettable flank package

Applications

- Switching applications

Description

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

Table 1. Device summary

Order code	Marking	Package	Packaging
STL40DN3LLH5	40DN3LLH5	PowerFLAT™ 5x6 double island ⁽¹⁾	Tape and reel

1. For wettable flank option, please contact ST sale offices.

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	30	V
V_{GS}	Gate-source voltage	± 22	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	44	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	26	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25^\circ\text{C}$	11	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb}=100^\circ\text{C}$	7	A
$I_{DM}^{(3)}$	Drain current (pulsed)	44	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25^\circ\text{C}$	72	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25^\circ\text{C}$	4.7	W
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

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

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.08	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient	32	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1inch², 2oz Cu, $t < 10$ sec

2 Electrical characteristics

($T_{CASE}=25\text{ °C}$ unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 30\text{ V}$, $V_{DS} = 30\text{ V}$, $T_J = 125\text{ °C}$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	1	1.5		V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 5.5\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 5.5\text{ A}$		0.016 0.02	0.018 0.025	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	475	-	pF
C_{oss}	Output capacitance		-	97	-	pF
C_{rss}	Reverse transfer capacitance		-	19	-	pF
Q_g	Total gate charge	$V_{DD} = 15\text{ V}$, $I_D = 11\text{ A}$ $V_{GS} = 4.5\text{ V}$ (see Figure 13)	-	4.5	-	nC
Q_{gs}	Gate-source charge		-	1.7	-	nC
Q_{gd}	Gate-drain charge		-	1.9	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$, $I_D = 11\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 12)	-	4	-	ns
t_r	Rise time		-	22	-	ns
$t_{d(off)}$	Turn-off delay time		-	13	-	ns
t_f	Fall time		-	2.8	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		11	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		44	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 11 \text{ A}, V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 11 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 25 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	16.2		ns
Q_{rr}	Reverse recovery charge		-	1		nC
I_{RRM}	Reverse recovery current		-	8.1		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

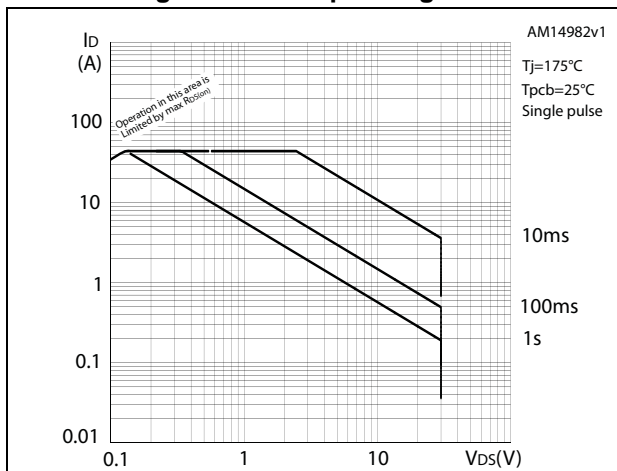


Figure 3. Thermal impedance

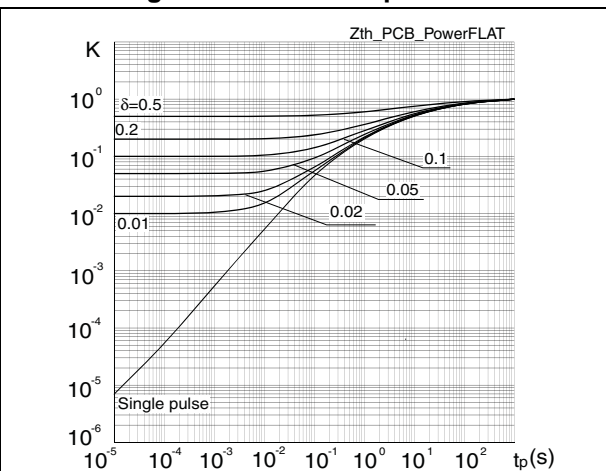


Figure 4. Output characteristics

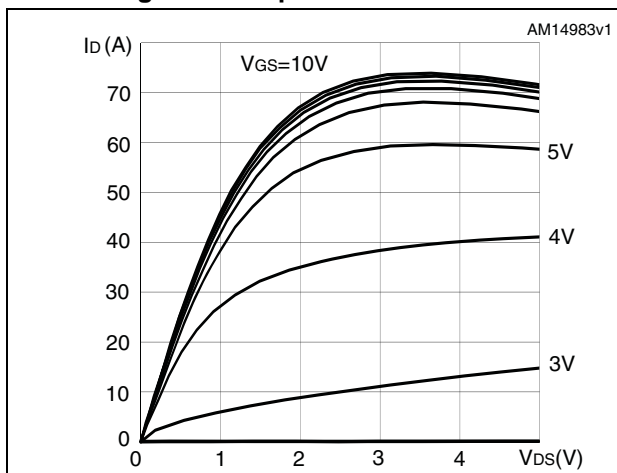


Figure 5. Transfer characteristics

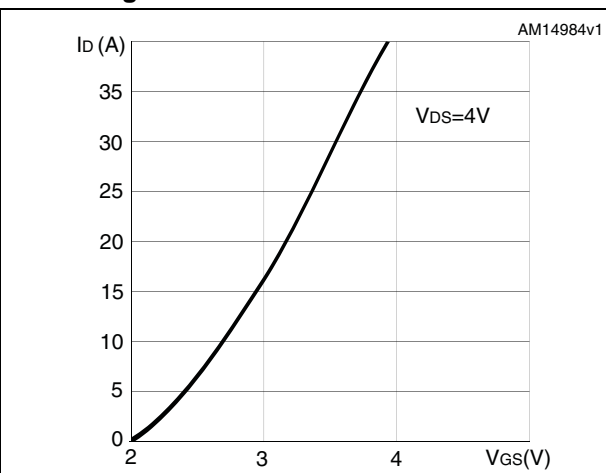


Figure 6. Normalized $V_{(BR)DSS}$ vs temperature

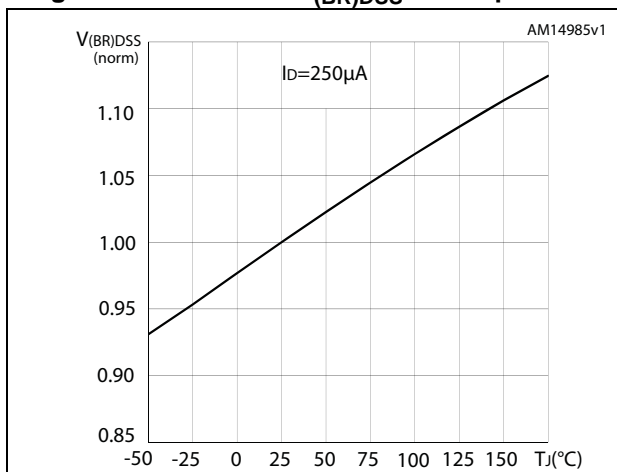


Figure 7. Static drain-source on-resistance

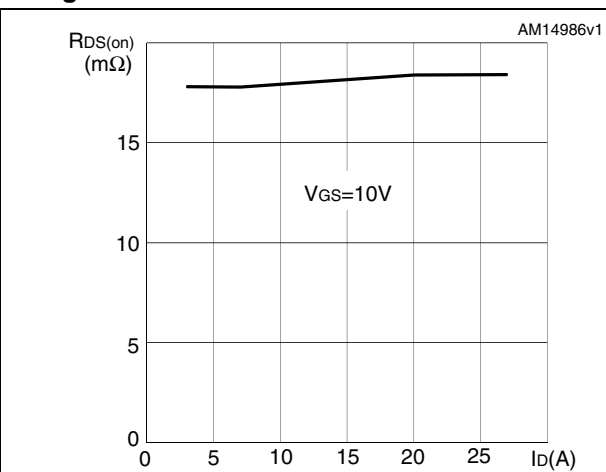


Figure 8. Gate charge vs gate-source voltage

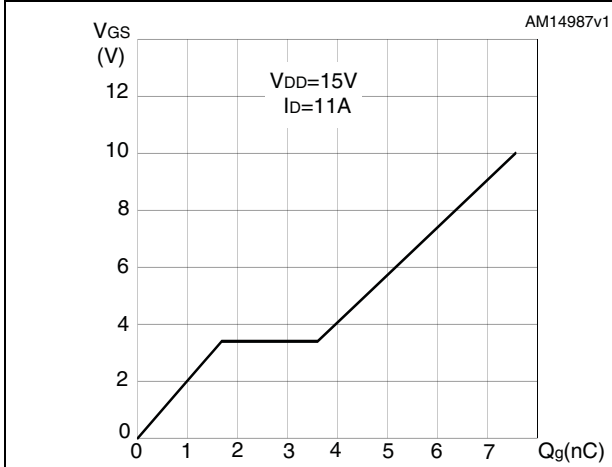


Figure 9. Capacitance variations

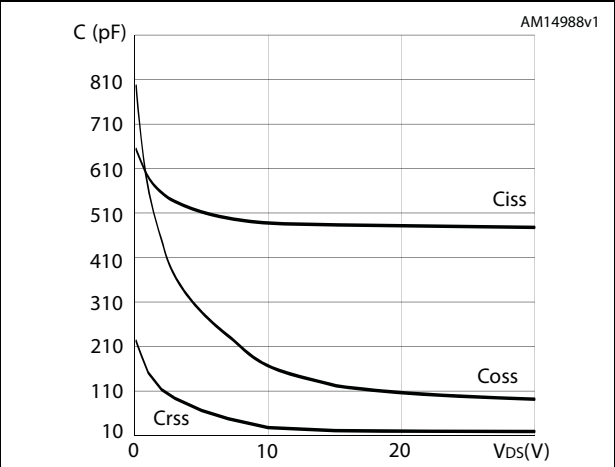


Figure 10. Normalized gate threshold voltage vs temperature

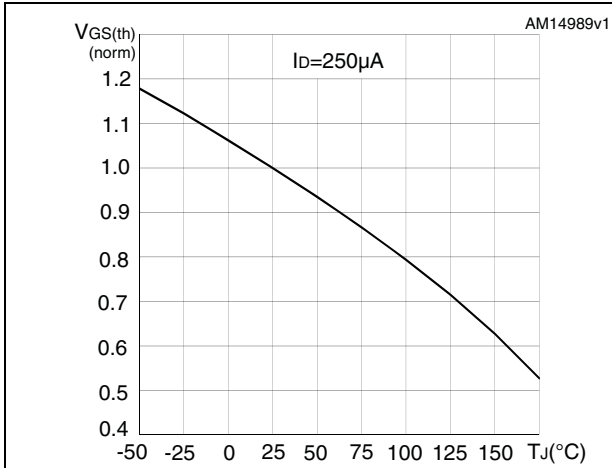
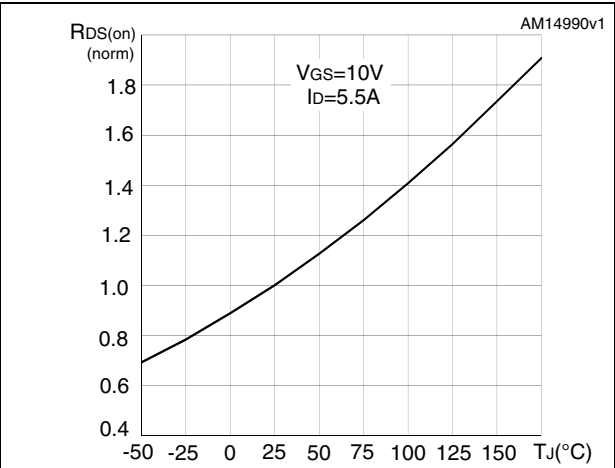
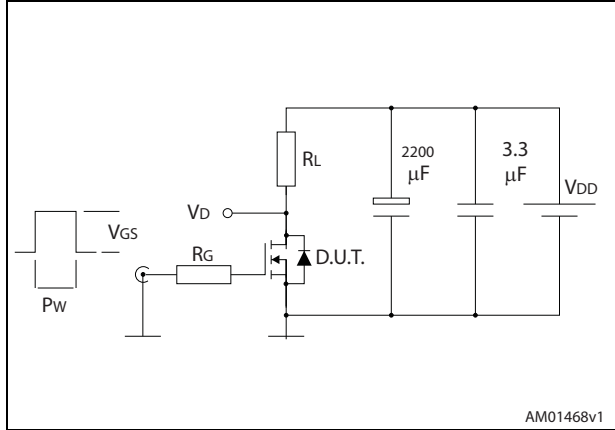


Figure 11. Normalized on-resistance vs temperature



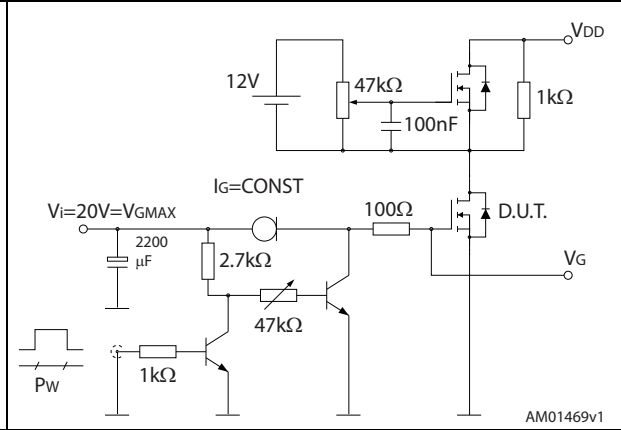
3 Test circuits

Figure 12. Switching times test circuit for resistive load



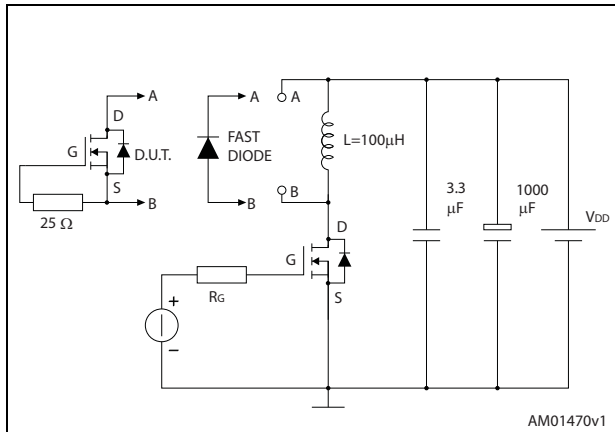
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Figure 13. Gate charge test circuit



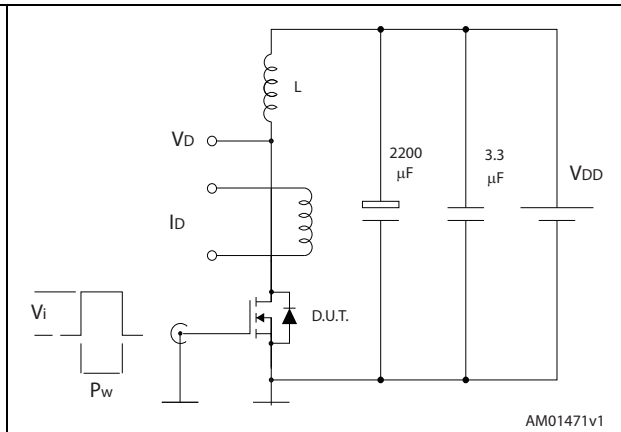
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Figure 14. Test circuit for inductive load switching and diode recovery times



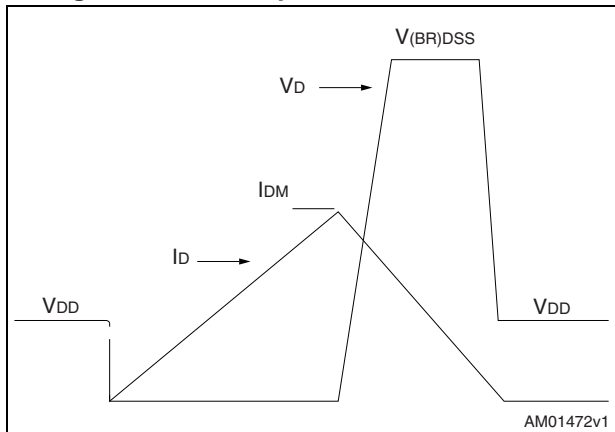
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Figure 15. Unclamped inductive load test circuit



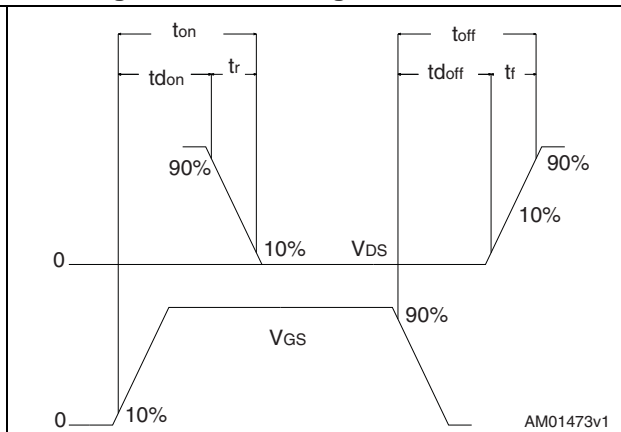
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Figure 16. Unclamped inductive waveform



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Figure 17. Switching time waveform

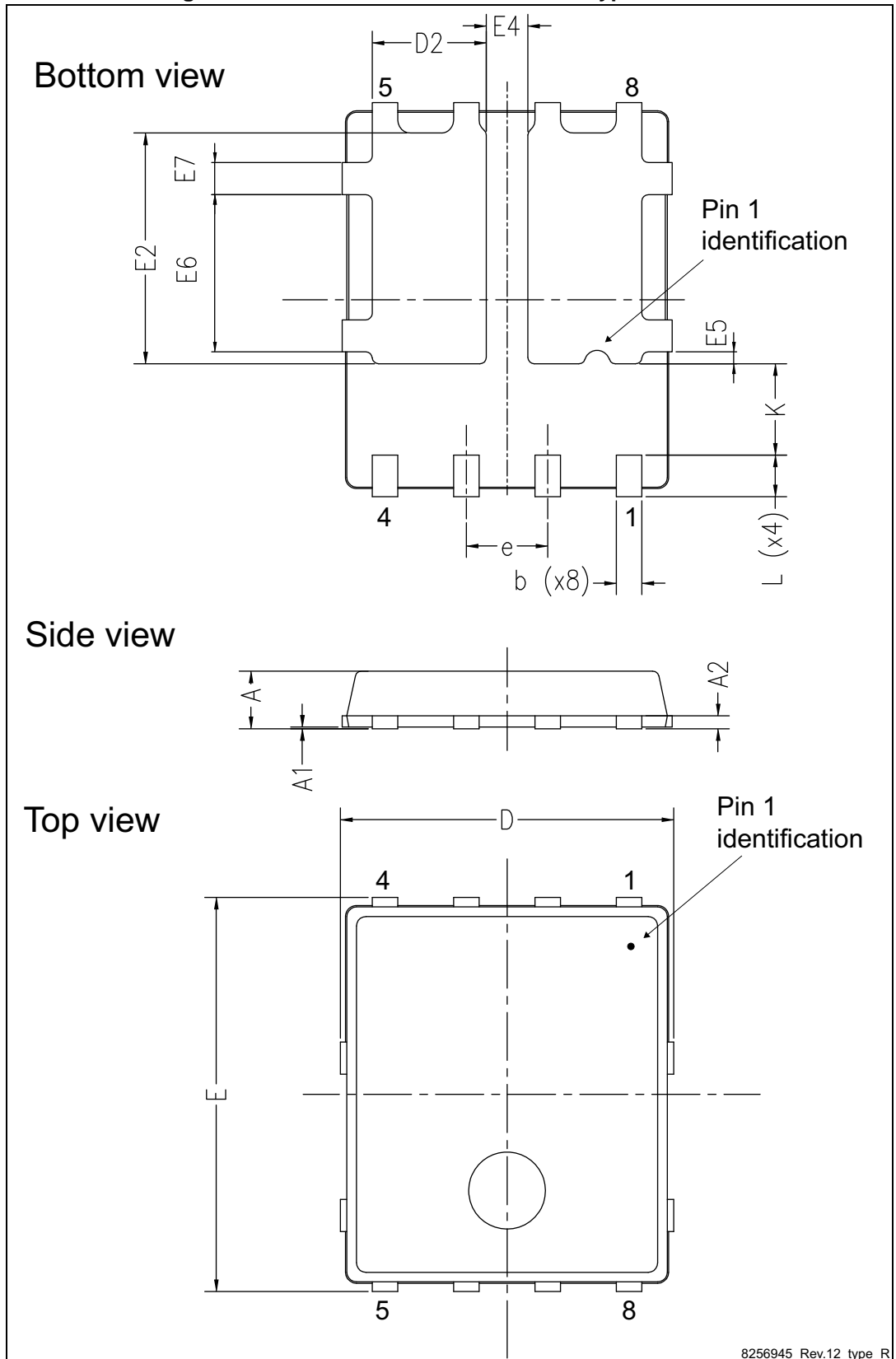


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4 Package mechanical data

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.

Figure 18. PowerFLAT 5X6 double island type R outline



8256945_Rev.12_type_R

Table 8. PowerFLAT 5x6 double island type R mechanical data

Ref.	Dimensions (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	1.68		1.88
E	5.95	6.15	6.35
E2	3.50		3.70
E4	0.55		0.75
E5	0.08		0.28
E6	2.35		2.55
E7	0.40		0.60
e		1.27	
L	0.60		0.80
K	1.275		1.575

Figure 19. PowerFLAT 5x6 double island WF type R outline

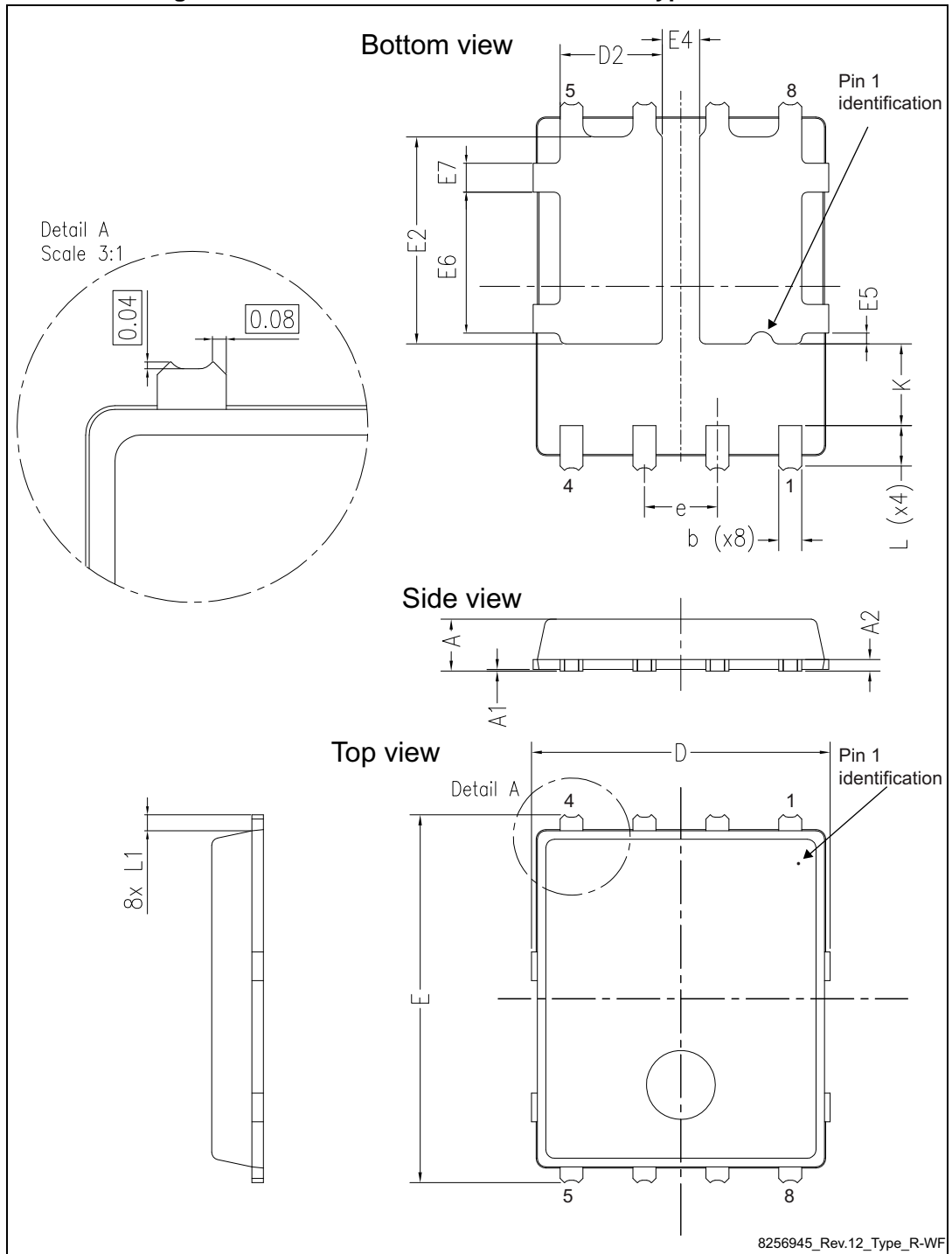
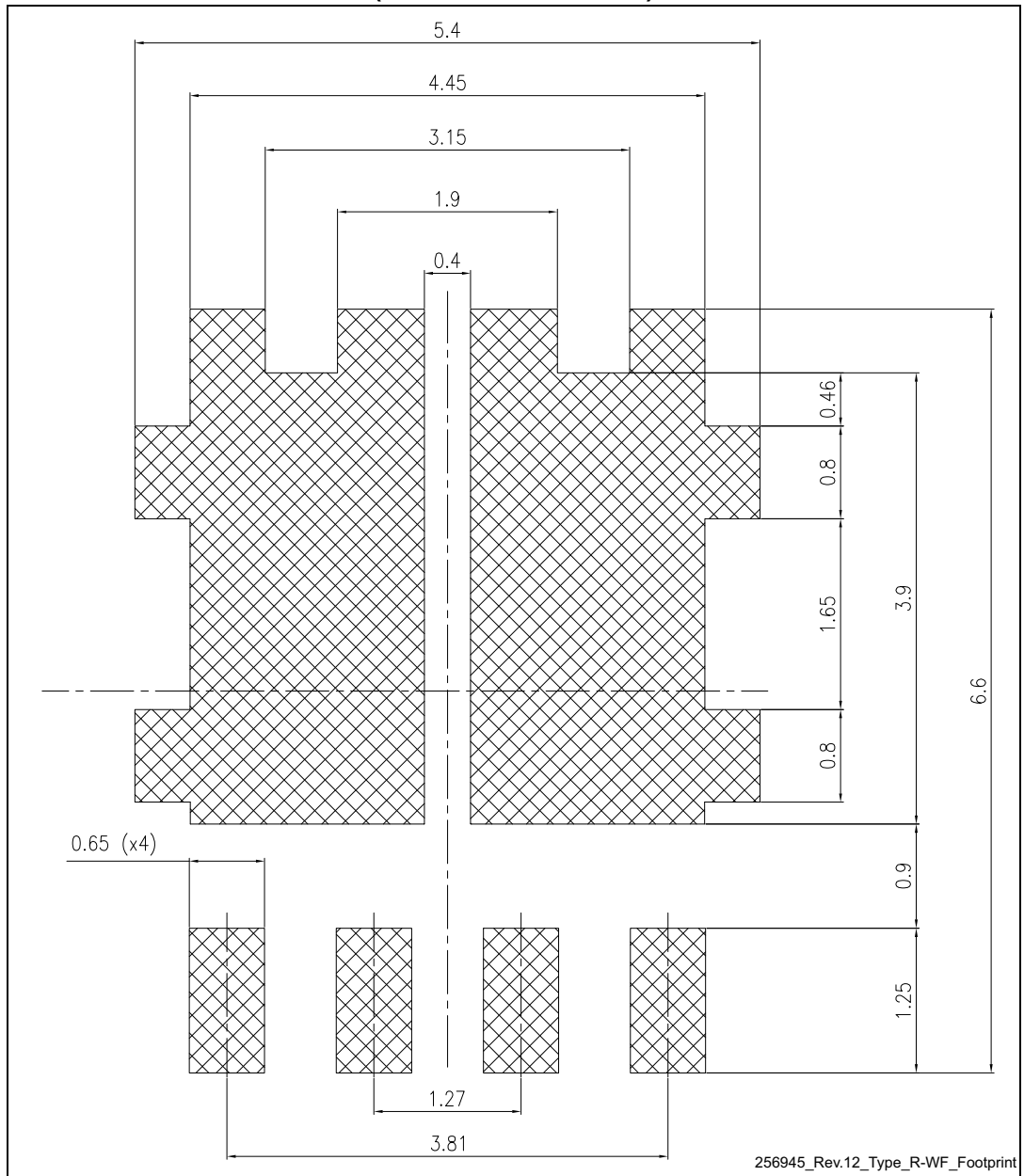


Table 9. PowerFLAT 5x6 double island WF type R mechanical data

Ref.	Dimensions (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	1.68		1.88
E	6.20	6.40	6.60
E2	3.50		3.70
E4	0.55		0.75
E5	0.08		0.28
E6	2.35		2.55
E7	0.40		0.60
e		1.27	
L	0.70		0.90
L1		0.275	
K	1.275		1.575

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



5 Packing information

Figure 21. PowerFLAT™ 5x6 tape^(a)

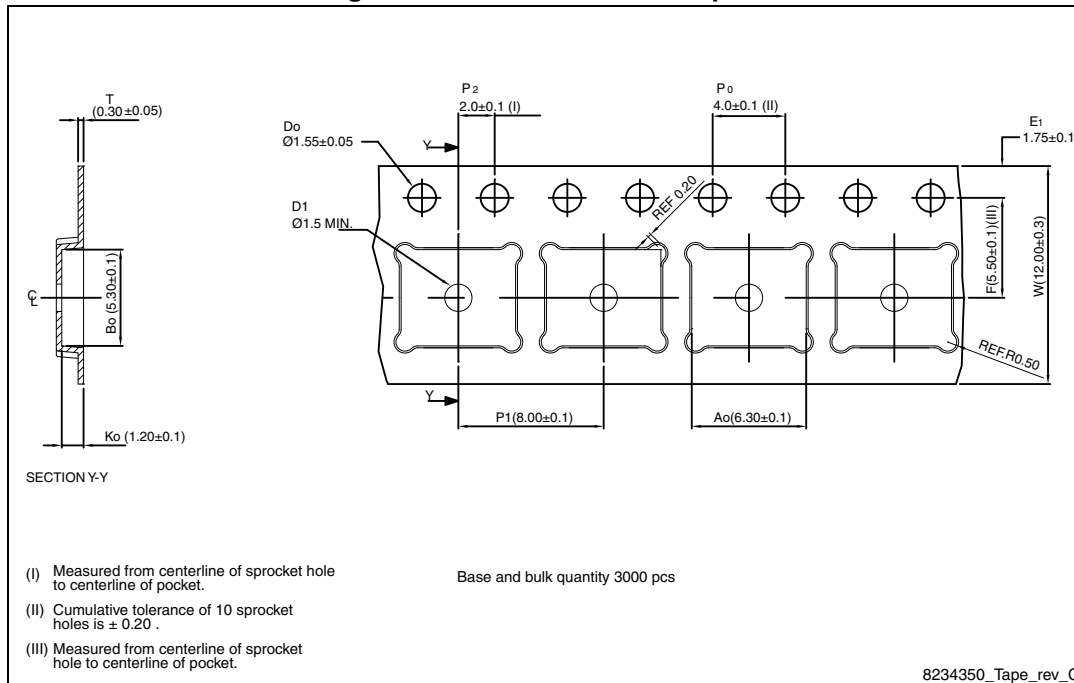
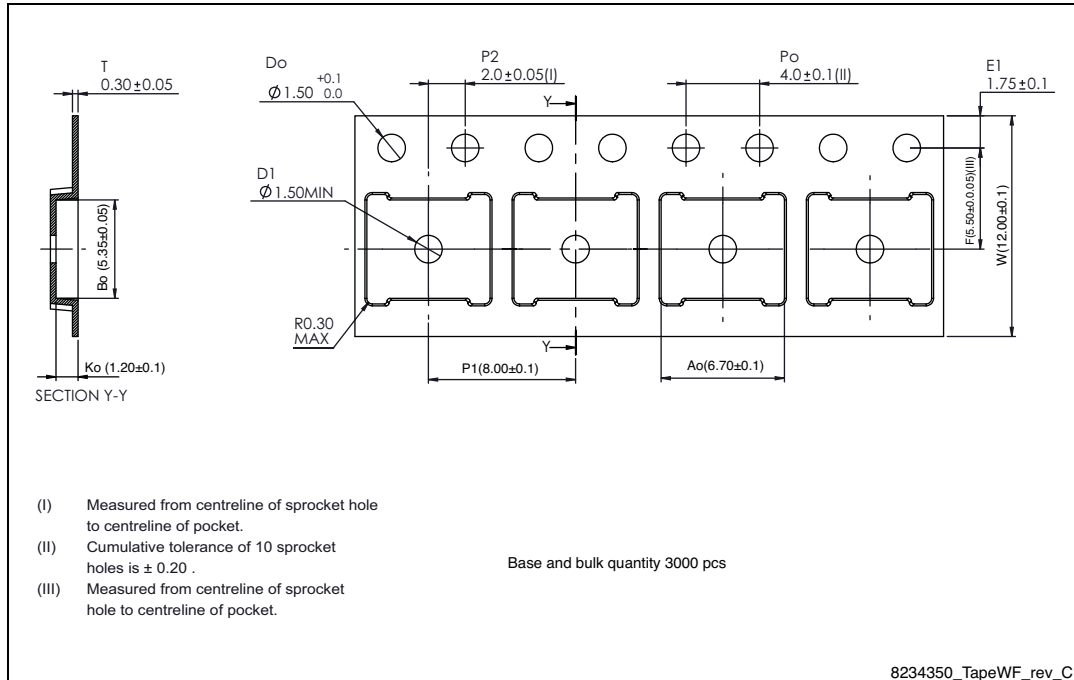


Figure 22. PowerFLAT 5x6 WF tape^(a)



a. All dimensions are in millimeters.

6 Revision history

Table 10. Document revision history

Date	Revision	Changes
24-Jan-2011	1	First release.
03-Oct-2012	2	Section 2.1: Electrical characteristics (curves) has been added. Document status promoted from preliminary data to datasheet. Minor text changes.
14-Dec-2012	3	Modified the Applications section on the coverpage to "Automotive switching applications".
23-Feb-2015	4	Updated Section 4: Package mechanical data and added Section 5: Packing information . Updated title and features in cover page. Minor text changes.

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