



# STL15DN4F5

Dual N-channel 40 V, 8 mΩ, 15 A  
PowerFLAT™(5x6) double island, STripFET™ V Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max.</sub>	I <sub>D</sub>
STL15DN4F5	40 V	9 mΩ	15 A <sup>(1)</sup>

1. The value is rated according R<sub>thj-pcb</sub>

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- Very low switching gate charge
- Low gate drive power losses

## Application

- Switching applications
  - Automotive

## Description

The device is a dual N-channel STripFET™ V. This Power MOSFET technology is among the latest improvements, which have been especially tailored to achieve very low on-state resistance providing also one of the best-in-class figure of merit (FOM).

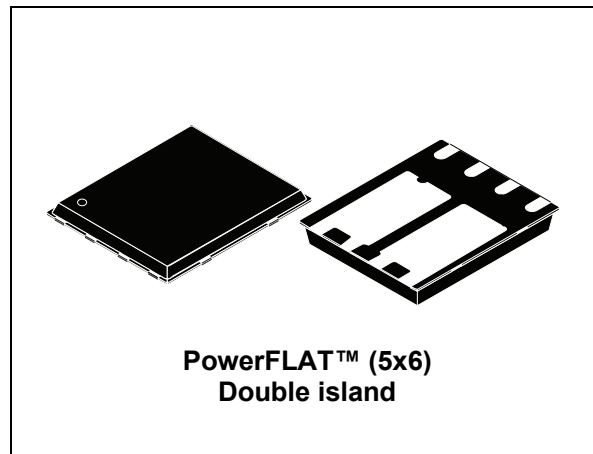


Figure 1. Internal schematic diagram

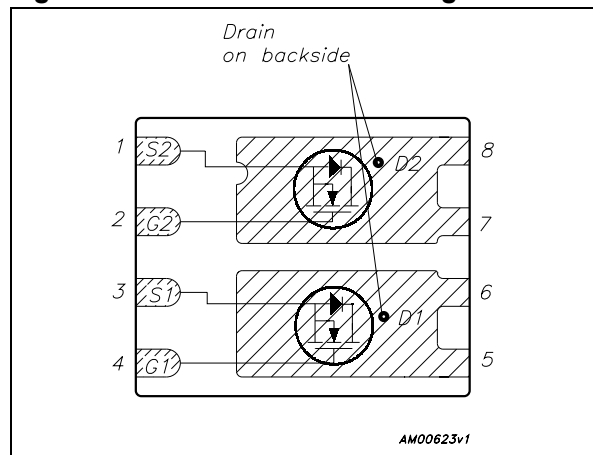


Table 1. Device summary

Order code	Marking	Package	Packaging
STL15DN4F5	15DN4F5	PowerFLAT™(5x6) Double island	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$ (silicon limited)	60	A
$I_D^{(2)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	15	A
$I_D^{(2)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	10	A
$I_{DM}^{(3)}$	Drain current (pulsed)	60	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25^\circ\text{C}$	60	W
$P_{TOT}^{(2)}$	Total dissipation at $T_C = 25^\circ\text{C}$ , $t < 10$ sec	4.3	W
	Derating factor	0.03	W/ $^\circ\text{C}$
$T_J$ $T_{stg}$	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 (drain) (steady state)	2.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient	35	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu,  $t < 10$  sec (see [Figure 3](#))

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current, (pulse width limited by $T_J$ max.)	7.5	A
$E_{AS}^{(1)}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 24$ V)	150	mJ

1. Tested at wafer level only.

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	40			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ , $V_{DS} = \text{Max rating @ } 125\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 7.5\text{ A}$		8	9	m $\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ $V_{GS} = 0$		1550		pF
$C_{oss}$	Output capacitance		-	230	-	pF
$C_{rss}$	Reverse transfer capacitance				25	
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}$ , $I_D = 15\text{ A}$		25		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$	-	6	-	nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)		5.5		nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$ , $I_D = 7.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ <i>(see Figure 13)</i>		18		ns	
$t_r$	Rise time			45		ns	
$t_{d(off)}$	Turn-off delay time				32	-	ns
$t_f$	Fall time				5		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit	
$I_{SD}$	Source-drain current		-		15	A	
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		60	A	
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 15\text{ A}$ , $V_{GS} = 0$	-		1.1	V	
$t_{rr}$	Reverse recovery time	$I_{SD} = 15\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 32\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$		30		ns	
$Q_{rr}$	Reverse recovery charge				35		nC
$I_{RRM}$	Reverse recovery current				2.2		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

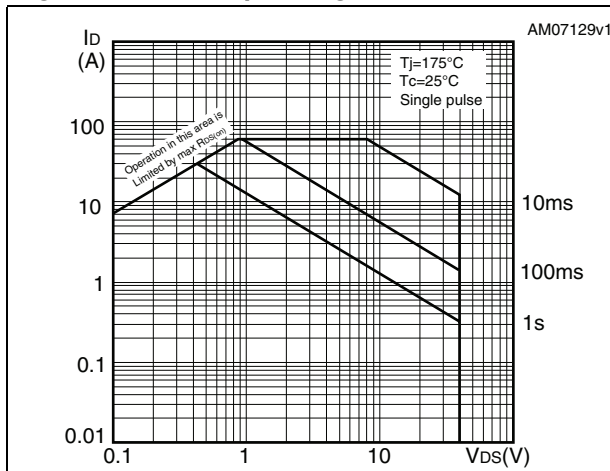


Figure 3. Thermal impedance

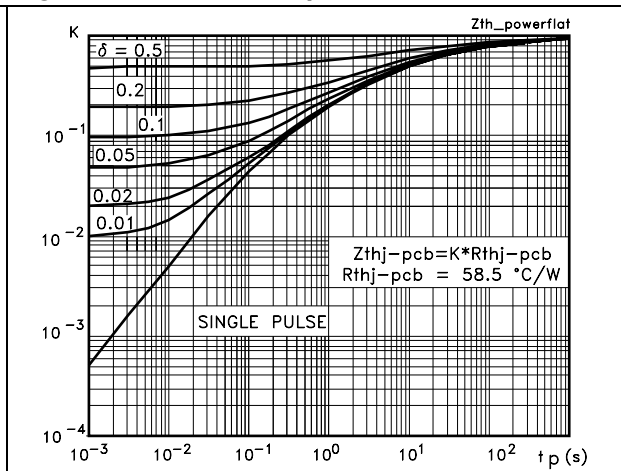


Figure 4. Output characteristics

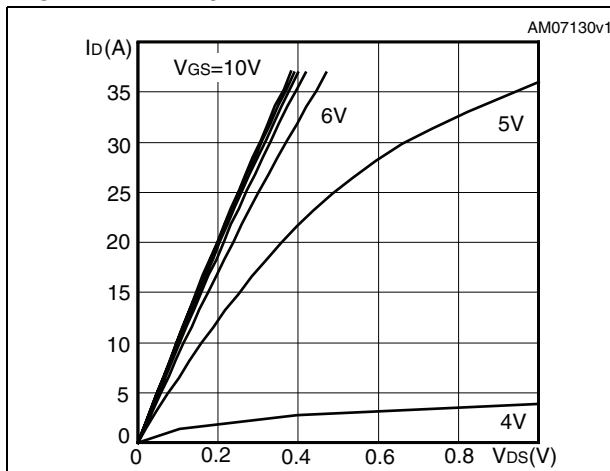


Figure 5. Transfer characteristics

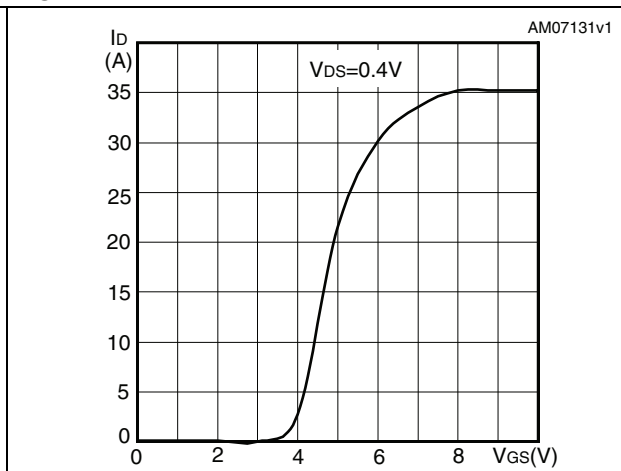


Figure 6. Normalized BV<sub>DSS</sub> vs temperature

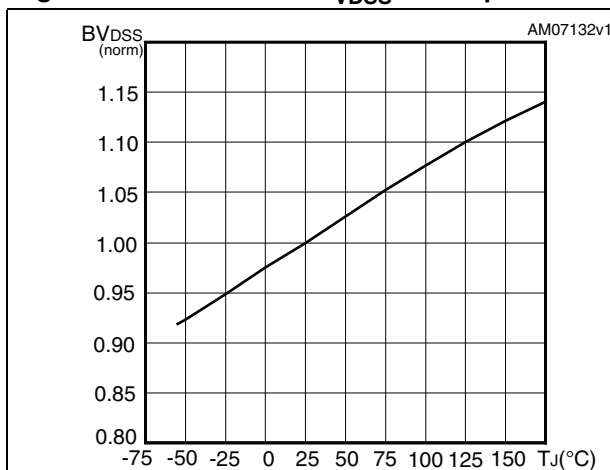


Figure 7. Static drain-source on resistance

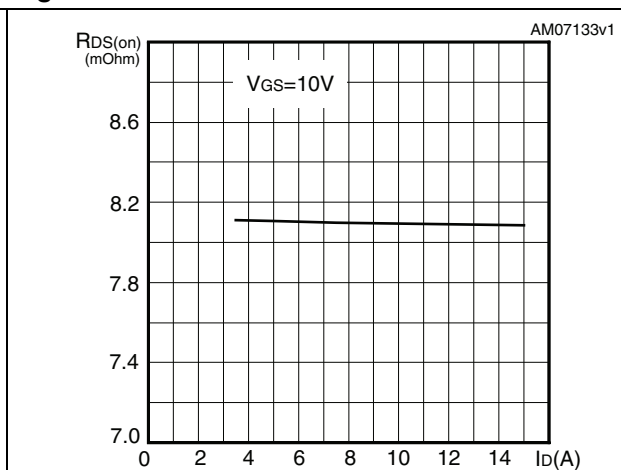


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

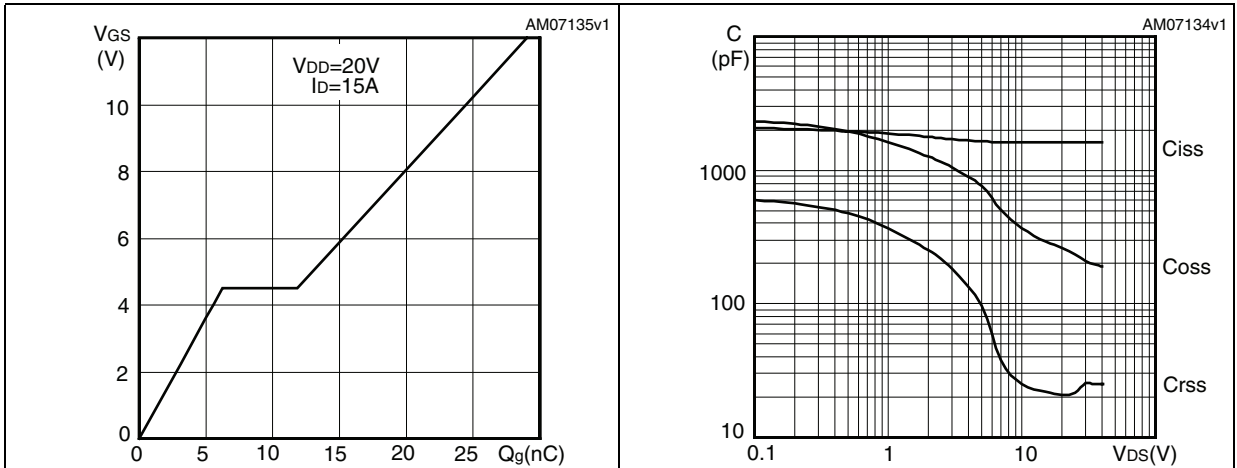


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

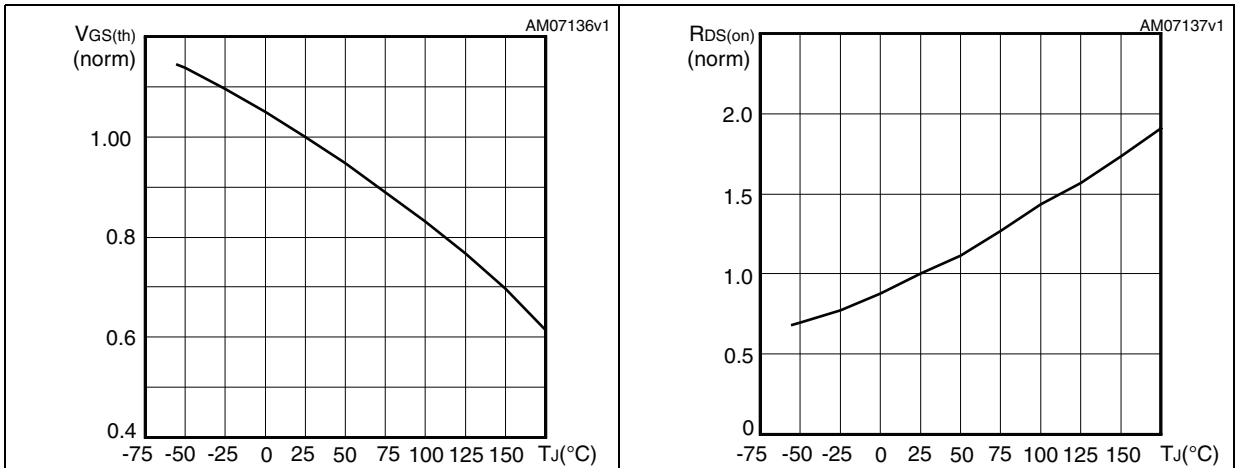
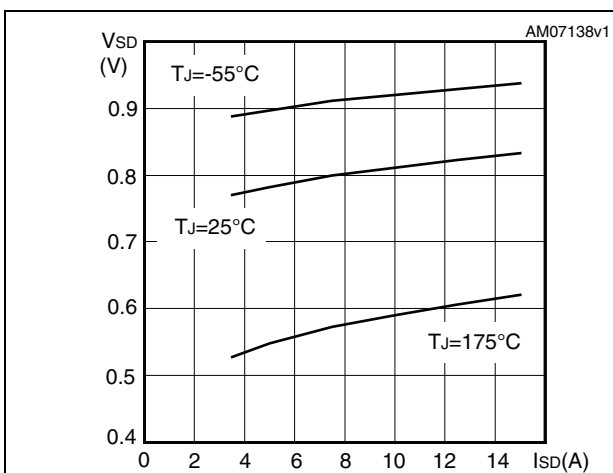
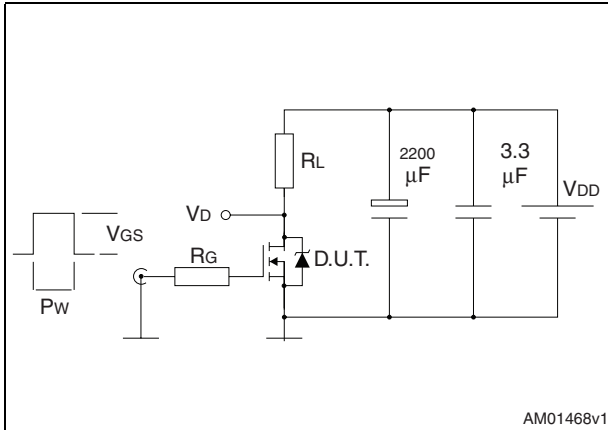


Figure 12. Source-drain diode forward characteristics

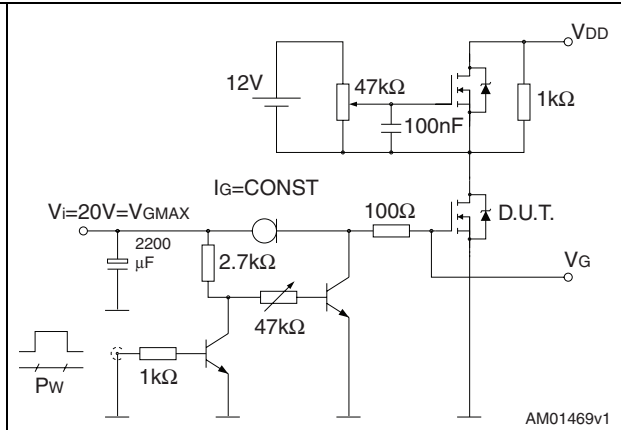


### 3 Test circuits

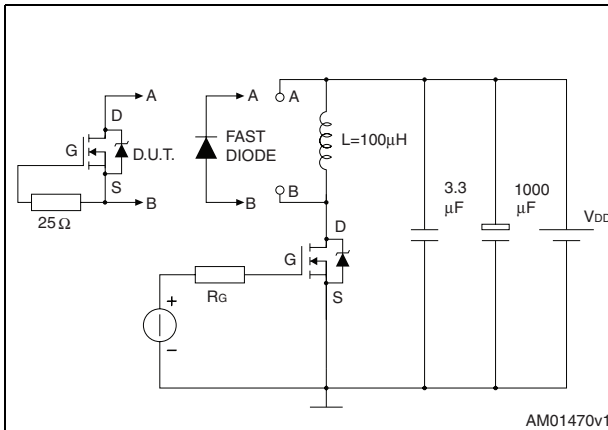
**Figure 13. Switching times test circuit for resistive load**



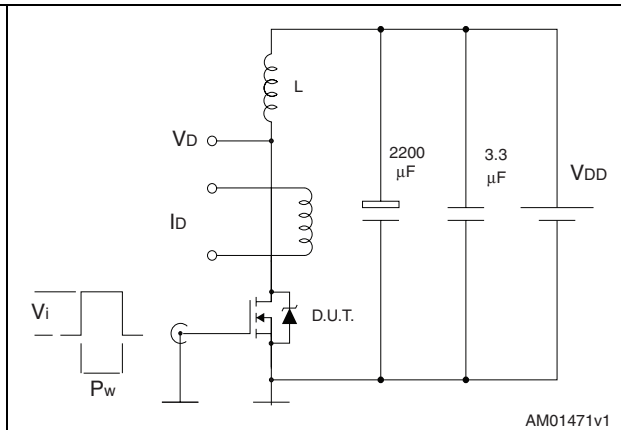
**Figure 14. Gate charge test circuit**



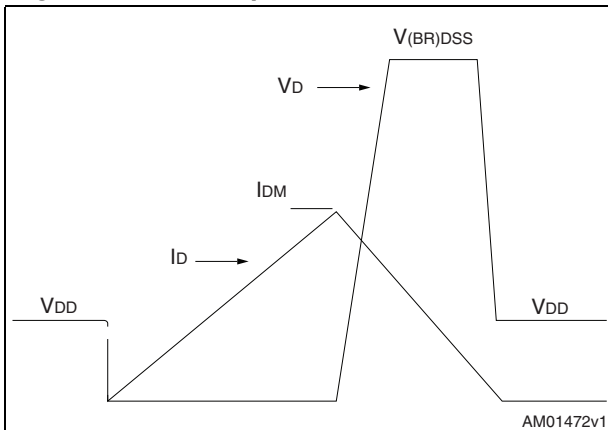
**Figure 15. Test circuit for inductive load switching and diode recovery times**



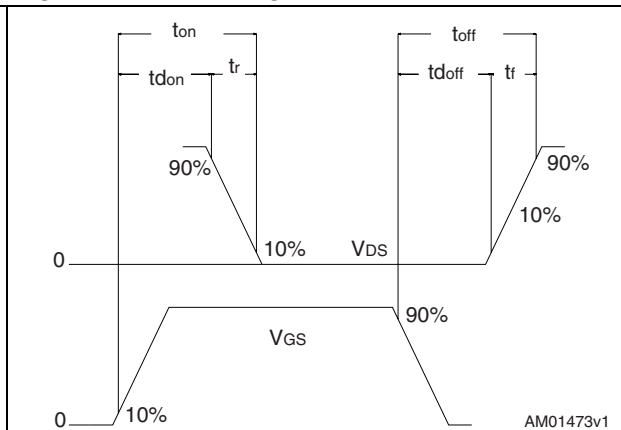
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



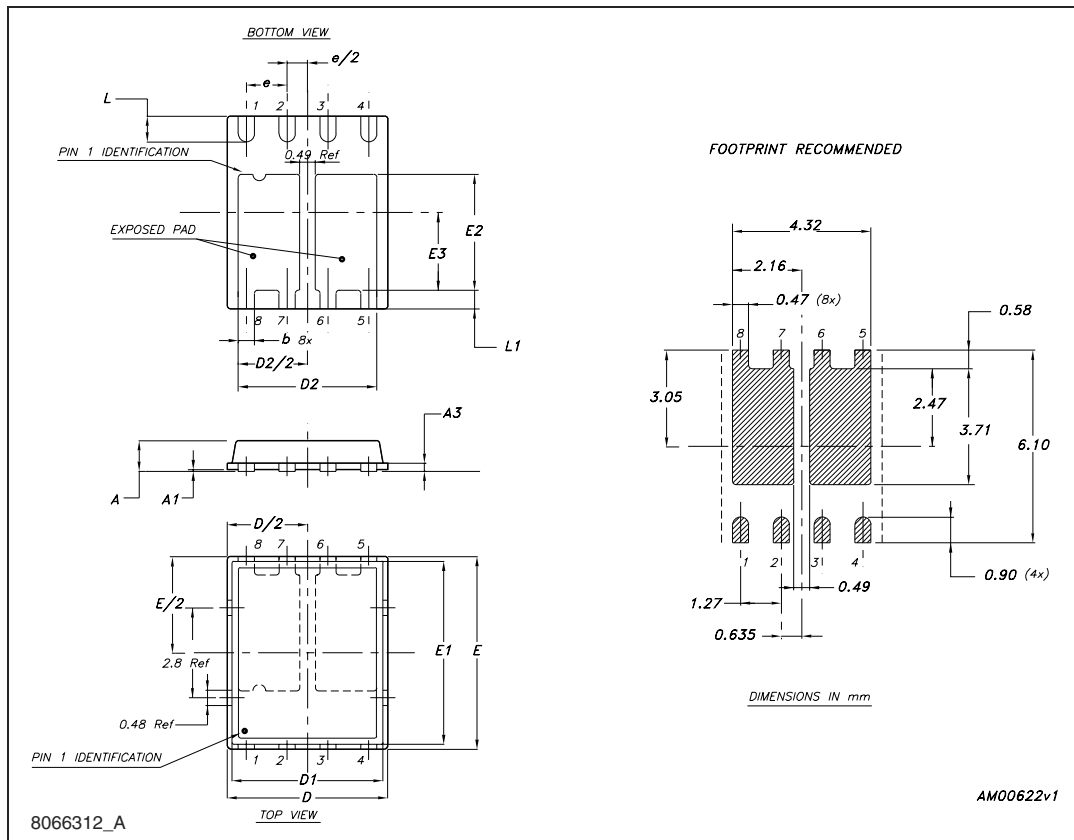


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and products status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

**PowerFLAT™ (5x6) double island mechanical data**

Dim	mm		
	Min	Typ	Max
A	0.80	0.83	0.90
A1		0.02	0.05
A3		0.20	
b	0.35	0.40	0.47
D		5.00	
D1		4.75	
D2	4.11	4.21	4.31
E		6.00	
E1		5.75	
E2	3.51	3.61	3.71
E3	2.32	2.42	2.52
e		1.27	
L	0.70	0.80	0.90
L1	0.48	0.58	0.68



## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
02-Sep-2010	1	First release

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