



STL7DN6LF3

Dual N-channel 60 V, 35 mΩ typ., 6.5 A STripFET™ III Power MOSFET in PowerFLAT™ 5x6 double island package

Datasheet — production data

Features

| Order code | V _{DSS} | R _{DS(on) max} | I _D |
|------------|------------------|-------------------------|----------------------|
| STL7DN6LF3 | 60 V | < 43 mΩ | 6.5 A ⁽¹⁾ |

1. The value is rated according to R_{thj-pcb}

- Logic level V_{GS(th)}
- 175 °C junction temperature
- 100% avalanche rated

Applications

- Switching applications
- Automotive

Description

This device is a dual N-channel enhancement mode Power MOSFET produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

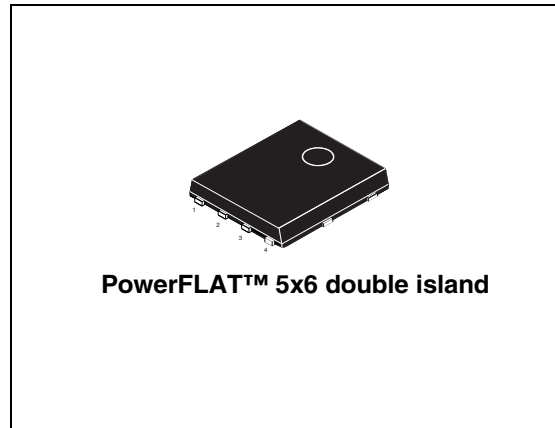


Figure 1. Internal schematic diagram

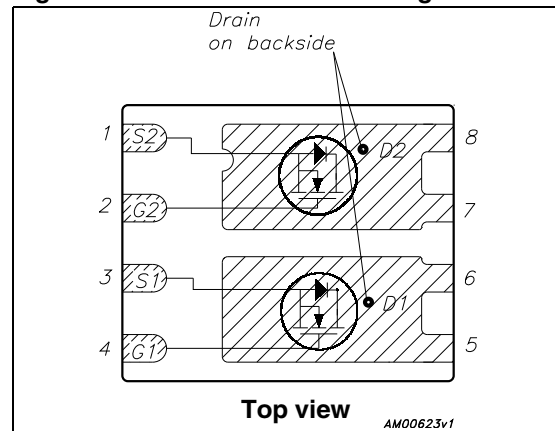


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|------------------------------|---------------|
| STL7DN6LF3 | 7DN6LF3 | PowerFLAT™ 5x6 double island | Tape and reel |

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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 |
| $I_D^{(1),(2)}$ | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 20 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 16 | A |
| $I_D^{(4)}$ | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 6.5 | A |
| $I_D^{(4)}$ | Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$ | 4.6 | A |
| $I_{DM}^{(3),(4)}$ | Drain current (pulsed) | 26 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 52 | W |
| $P_{TOT}^{(4)}$ | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 4.3 | W |
| I_{AV} | Not-repetitive avalanche current | 6.5 | A |
| $E_{AS}^{(5)}$ | Single pulse avalanche energy | 190 | mJ |
| T_J T_{stg} | Operating junction temperature Storage temperature | -55 to 175 | $^\circ\text{C}$ |

1. Specified by design. Not subject to production test.
2. Current is limited by bonding, with an $R_{thJC} = 2.9\text{ }^\circ\text{C/W}$ the chip is able to carry 22 A at $25\text{ }^\circ\text{C}$.
3. Pulse width limited by safe operating area
4. When mounted on FR-4 board of 1 inch^2 , 2oz Cu, $t < 10\text{ sec}$
5. Starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = 8\text{ A}$, $V_{DD} = 25\text{ V}$, per channel, 100% tested.

Table 3. Thermal resistance

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|--------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 2.9 | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 35 | $^\circ\text{C/W}$ |

1. When mounted on FR-4 board of 1 inch^2 , 2oz Cu, $t < 10\text{ sec}$

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 ($V_{GS} = 0$) | $I_D = 250\ \mu\text{A}$ | 60 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 60\ \text{V}$ | | | 1 | μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\ \text{V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$ | 1 | | 3 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\ \text{V}$, $I_D = 3\ \text{A}$ $V_{GS} = 5\ \text{V}$, $I_D = 3\ \text{A}$ | | 35 48 | 43 60 | $\text{m}\Omega$ $\text{m}\Omega$ |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$, $V_{GS} = 0$ | - | 432 | - | pF |
| C_{oss} | Output capacitance | | | 93 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 10.5 | | pF |
| Q_g | Total gate charge | $V_{DD} = 30\ \text{V}$, $I_D = 6.5\ \text{A}$ | - | 8.8 | - | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10\ \text{V}$ | | 2.1 | | nC |
| Q_{gd} | Gate-drain charge | Figure 13 | | 1.9 | | nC |
| R_G | Intrinsic gate resistance | $f = 1\ \text{MHz}$ open drain | - | 6.3 | - | Ω |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = \text{TBD}$, $I_D = 3\ \text{A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\ \text{V}$ Figure 12 | - | TBD | - | ns |
| t_r | Rise time | | | TBD | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | TBD | | ns |
| t_f | Fall time | | | TBD | | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|---|-----|------|-----|------|
| I_{SD} | Source-drain current | | - | | 6.5 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 26 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 6.5 \text{ A}, V_{GS} = 0$ | - | | 1.3 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 6.5 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 6.5 \text{ V}, T_J = 150 \text{ }^\circ\text{C}$ | - | 24 | | ns |
| Q_{rr} | Reverse recovery charge | | | 23.3 | | nC |
| I_{RRM} | Reverse recovery current | | | 1.94 | | 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

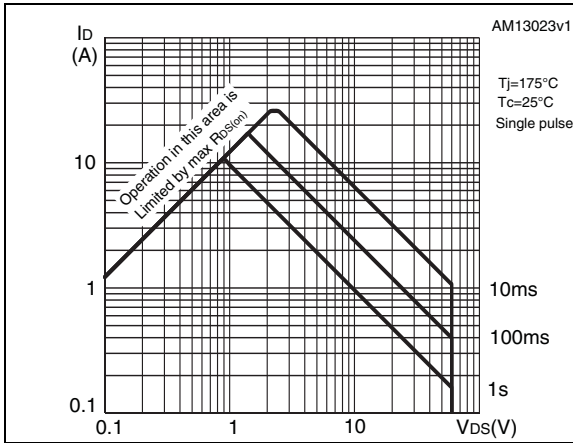


Figure 3. Thermal impedance

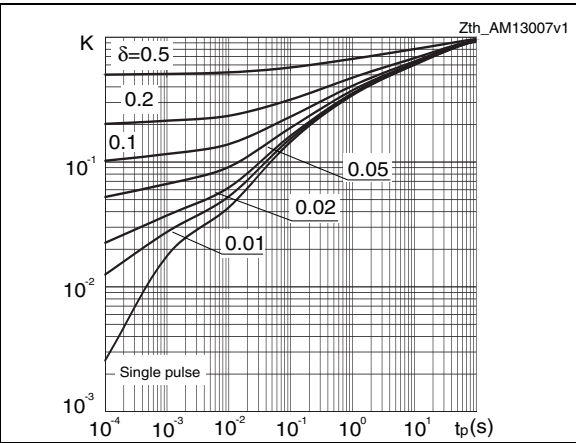


Figure 4. Output characteristics

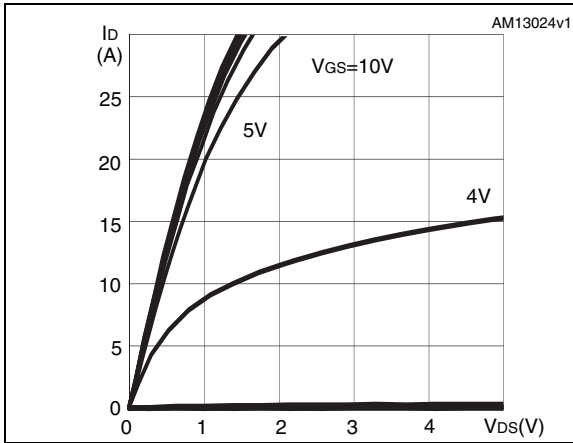


Figure 5. Transfer characteristics

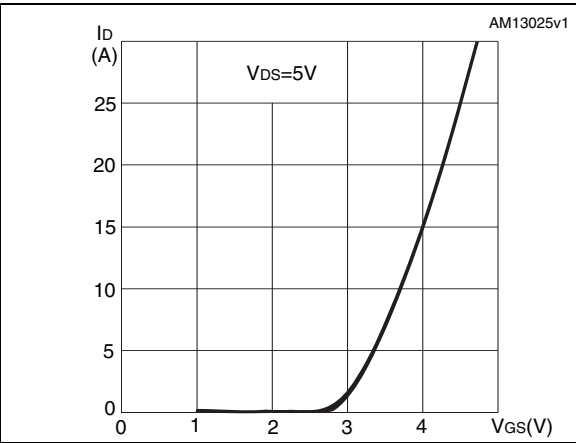


Figure 6. Normalized V_{DS} vs temperature

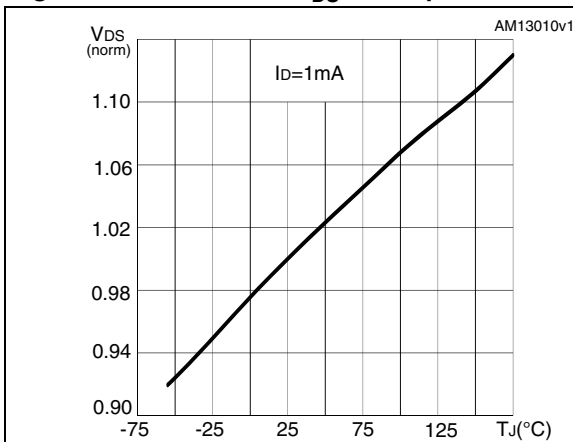


Figure 7. Static drain-source on-resistance

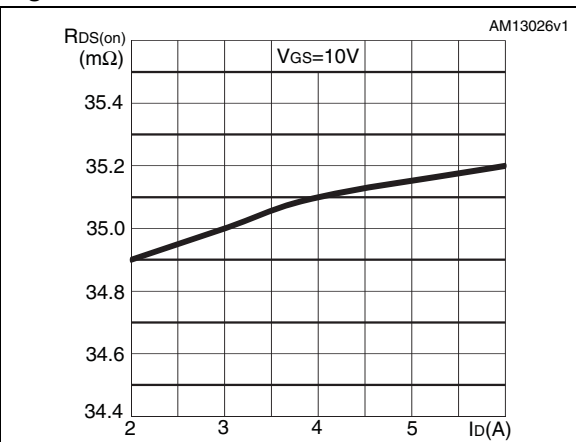


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

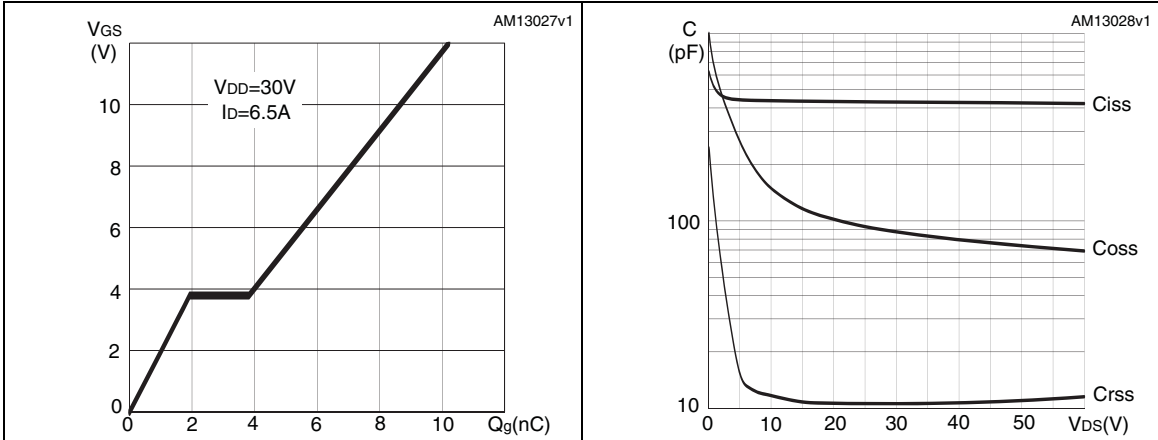
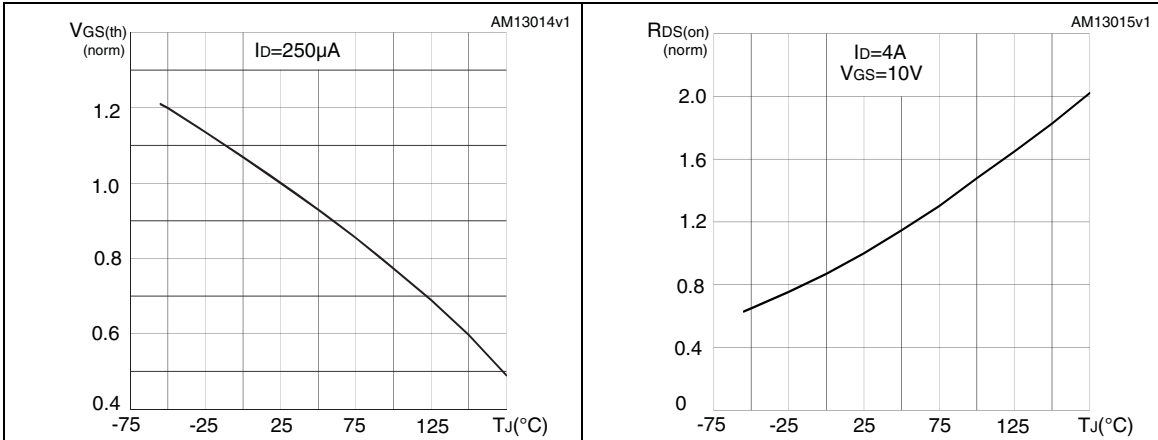


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

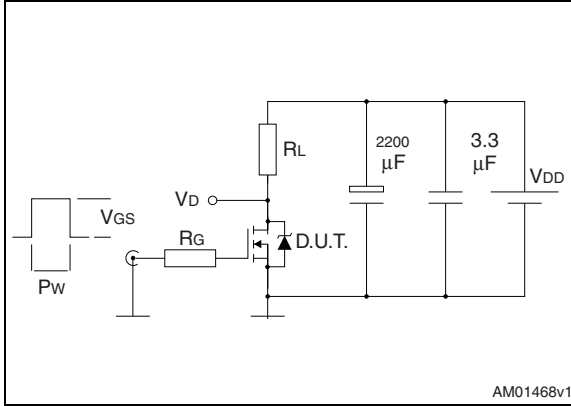


Figure 13. Gate charge test circuit

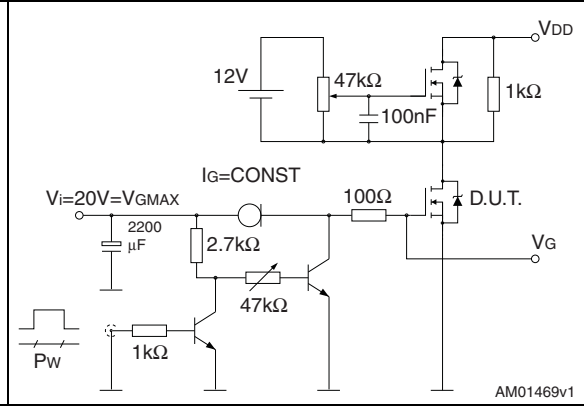


Figure 14. Test circuit for inductive load switching and diode recovery times

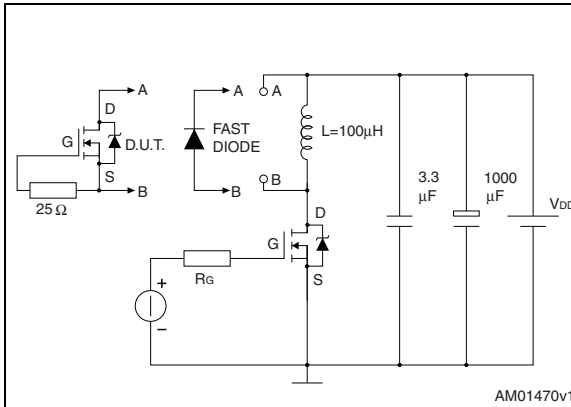


Figure 15. Unclamped inductive load test circuit

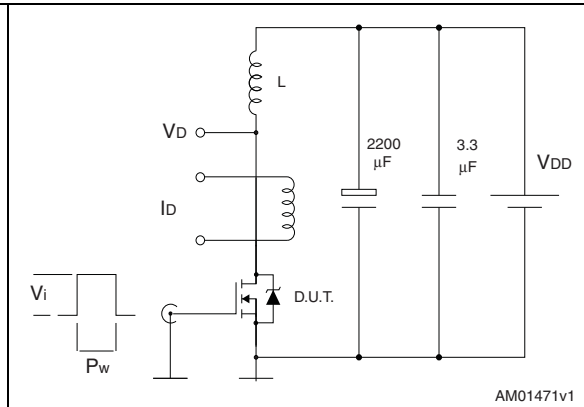


Figure 16. Unclamped inductive waveform

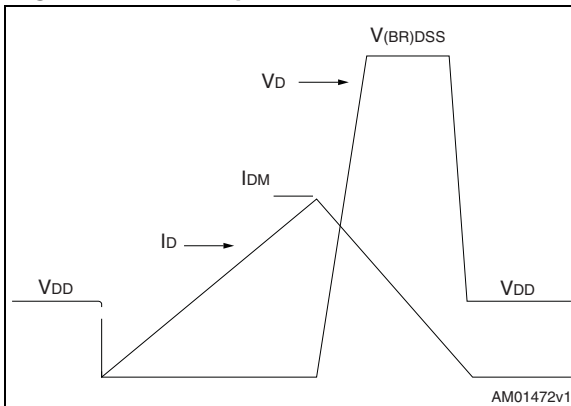
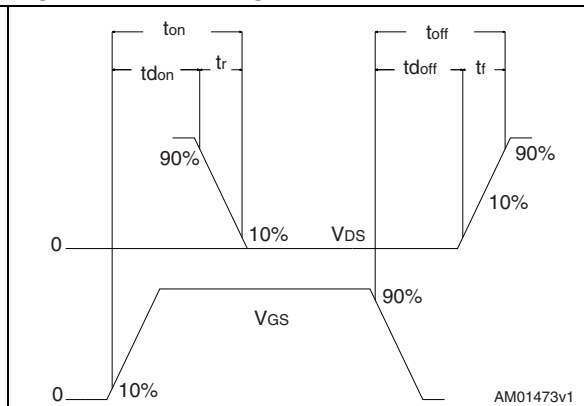


Figure 17. Switching time waveform



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.

Table 8. PowerFLAT™ 5x6 double island (ribbon) type B 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 |
| E | 5.95 | 6.15 | 6.35 |
| D2 | 1.68 | | 1.88 |
| E2 | 3.50 | | 3.70 |
| D3 | 1.68 | | 1.88 |
| E3 | 3.50 | | 3.70 |
| E4 | 0.55 | | 0.75 |
| e | | 1.27 | |
| L | 0.60 | | 0.80 |
| K | 1.275 | | 1.575 |

Figure 18. PowerFLAT™ 5x6 double island (ribbon) type B drawing

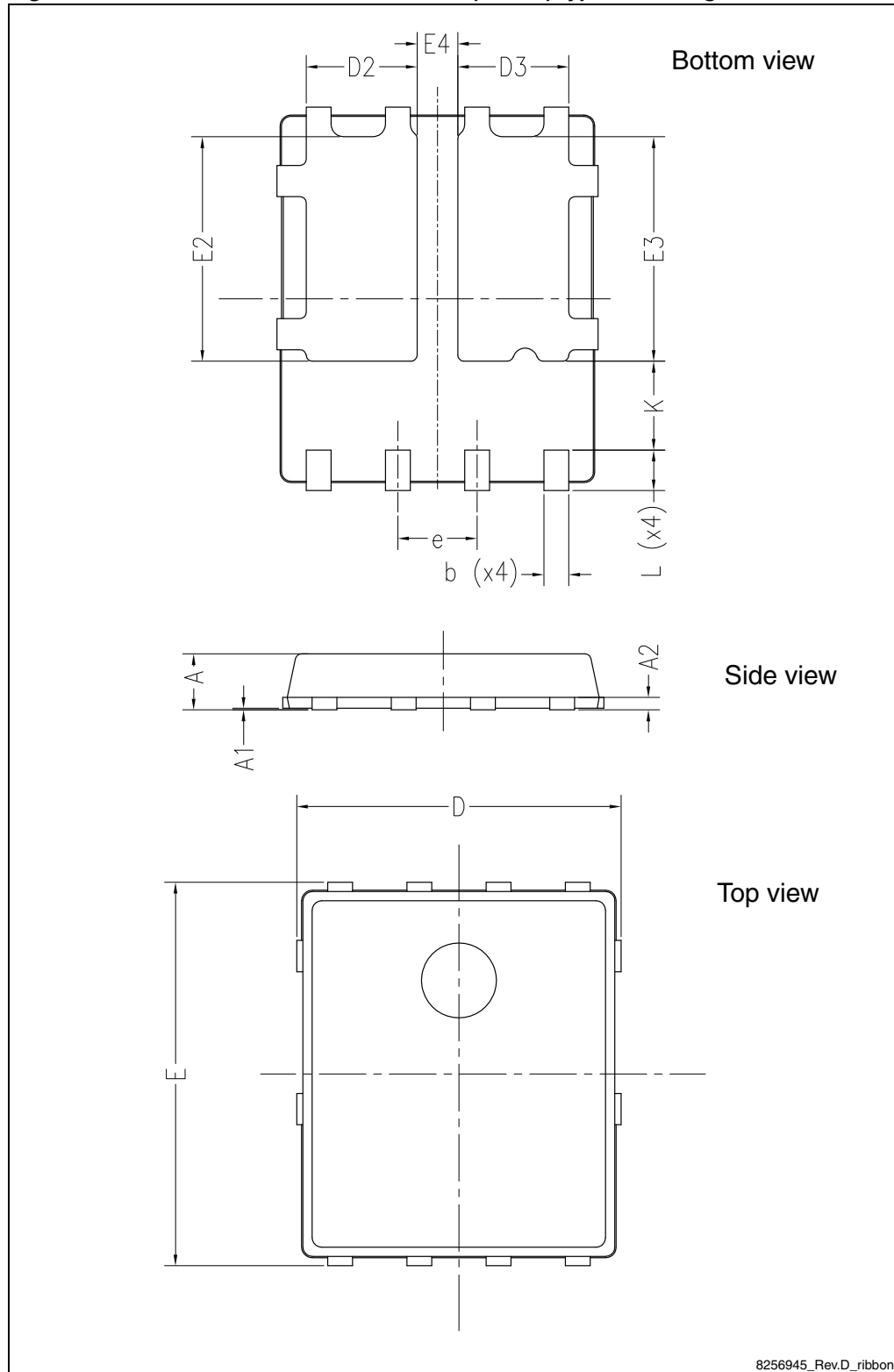
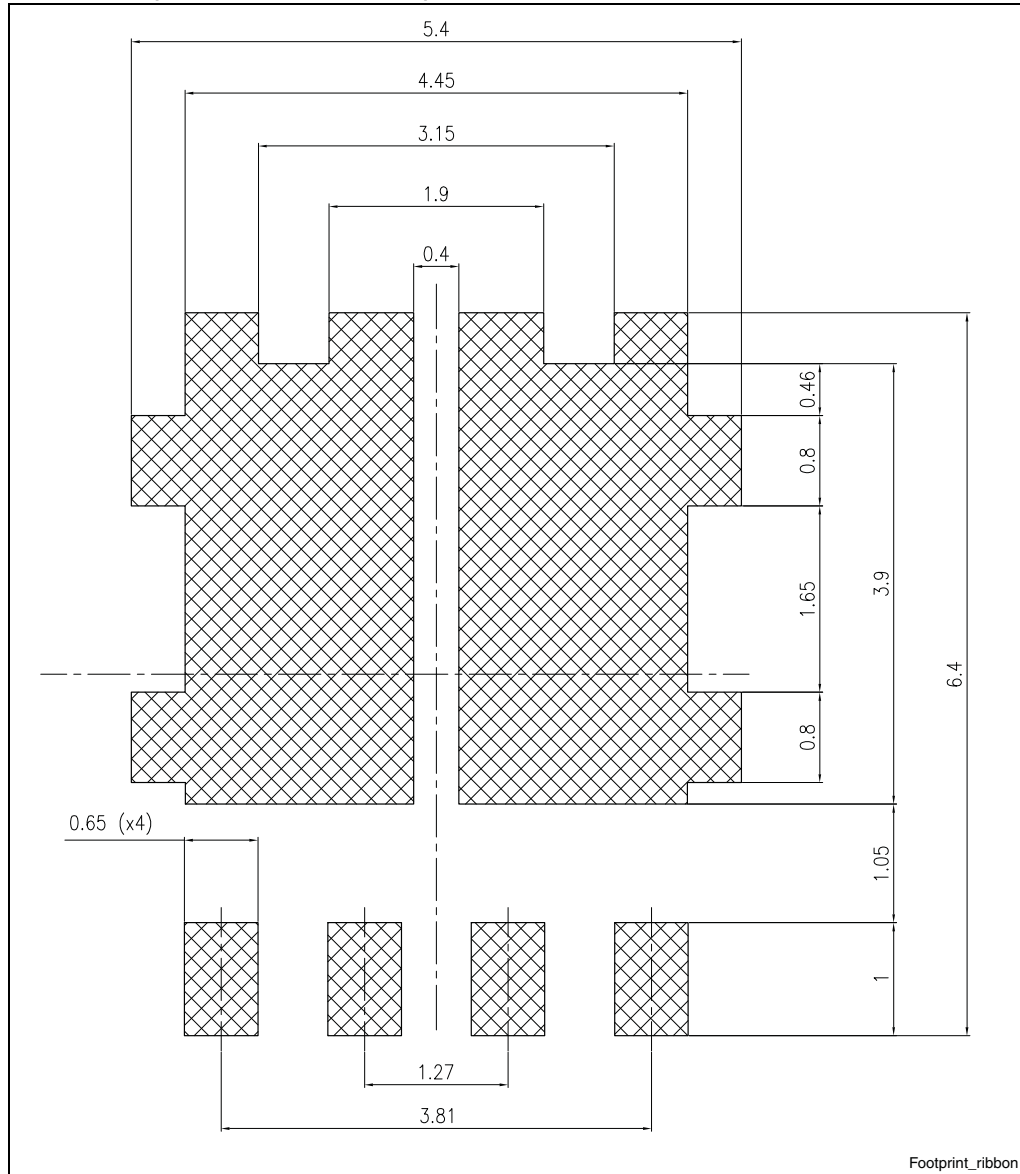


Figure 19. PowerFLAT™ 5x6 double island (ribbon) recommended footprint (dimensions are in mm)



5 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 28-Mar-2012 | 1 | First release. |
| 19-Jun-2012 | 2 | Section 2.1: Electrical characteristics (curves) has been added. Updated Section 4: Package mechanical data and tile on the coverpage. |
| 26-Jun-2012 | 3 | Document status promoted from preliminary to production data. |

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