



STL160N3LLH6

N-channel 30 V, 0.0011 Ω , 35 A PowerFLAT™ 5x6
STripFET™ VI DeepGATE™ Power MOSFET

Features

| Order code | V _{DSS} | R _{DS(on)} max | I _D |
|--------------|------------------|----------------------------|---------------------|
| STL160N3LLH6 | 30 V | 0.0013 Ω | 35 A ⁽¹⁾ |

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

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses



Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Figure 1. Internal schematic diagram

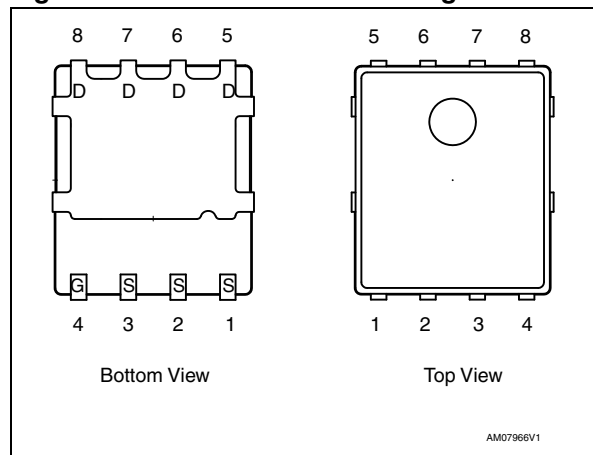


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|--------------|-----------|----------------|---------------|
| STL160N3LLH6 | 160N3LLH6 | PowerFLAT™ 5x6 | 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 | 30 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 160 | A |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 100 | A |
| $I_D^{(2)}$ | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 35 | A |
| $I_D^{(2)}$ | Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$ | 21.8 | A |
| $I_{DM}^{(3)}$ | Drain current (pulsed) | 140 | A |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 80 | W |
| $P_{TOT}^{(3)}$ | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 4 | W |
| | Derating factor | 0.03 | W/ $^\circ\text{C}$ |
| T_j | Operating junction temperature | -55 to 150 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | | |

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

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|--|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case (drain, steady state) | 1.56 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-ambient | 31.3 | $^\circ\text{C}/\text{W}$ |

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

Table 4. Avalanche data

| Symbol | Parameter | Value | Unit |
|----------|---|-------|------|
| I_{AV} | Not-repetitive avalanche current, (pulse width limited by T_j max) | 35 | A |
| E_{AS} | Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$) | 900 | mJ |

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 | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0$ | 30 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 30\text{ V}$, $V_{DS} = 30\text{ V}$ at $T_C = 125\text{ °C}$ | | | 1 10 | μA 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 | | | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\text{ V}$, $I_D = 17.5\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 17.5\text{ A}$ | | 0.0011 0.0016 | 0.0013 0.0020 | Ω Ω |

Table 6. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 6375 | - | pF |
| C_{oss} | Output capacitance | | | 1230 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 675 | | pF |
| Q_g | Total gate charge | $V_{DD} = 15\text{ V}$, $I_D = 35\text{ A}$ $V_{GS} = 4.5\text{ V}$ (see Figure 14) | - | 61.5 | - | nC |
| Q_{gs} | Gate-source charge | | | 20 | | nC |
| Q_{gd} | Gate-drain charge | | | 24 | | nC |
| R_G | Gate input resistance | $f = 1\text{ MHz}$ gate DC bias = 0 test signal level = 20 mV open drain | - | 1.4 | - | Ω |

Table 7. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|-------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}=15\text{ V}$, $I_D=17.5\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 13) | - | 18.5 | - | ns |
| t_r | Rise time | | | 32 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | 107.5 | | ns |
| t_f | Fall time | | | 54 | | ns |

Table 8. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 35 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 140 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD}=35\text{ A}$, $V_{GS}=0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD}=35\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$, $V_{DD}=25\text{ V}$ | - | 37.2 | | ns |
| Q_{rr} | Reverse recovery charge | | | 36 | | nC |
| I_{RRM} | Reverse recovery current | | | 1.9 | | 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

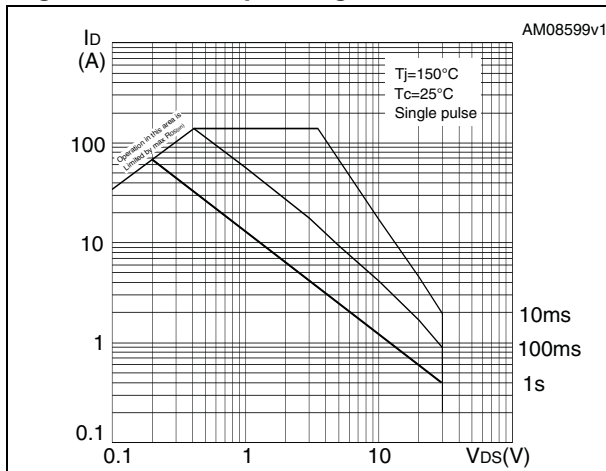


Figure 3. Thermal impedance

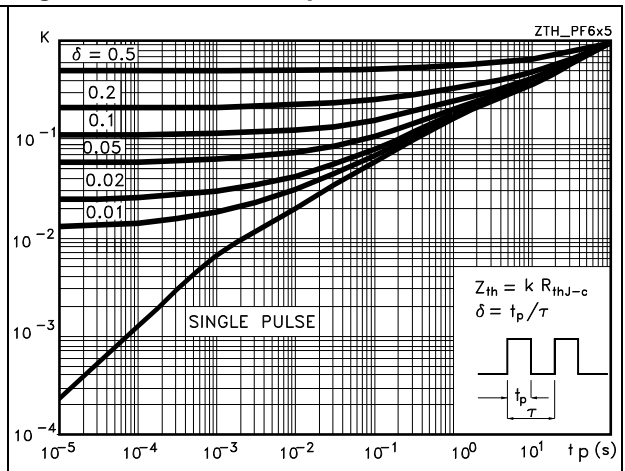


Figure 4. Output characteristics

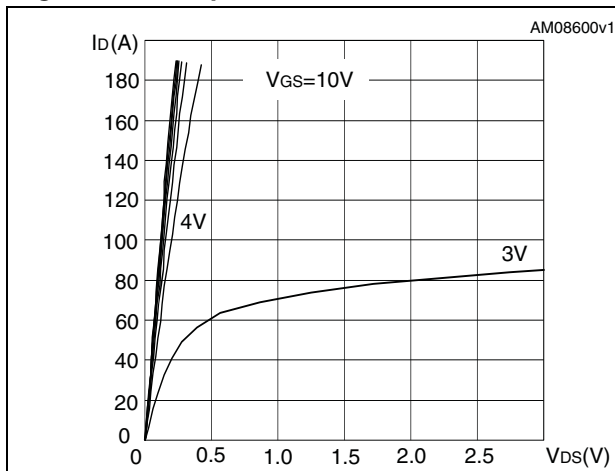


Figure 5. Transfer characteristics

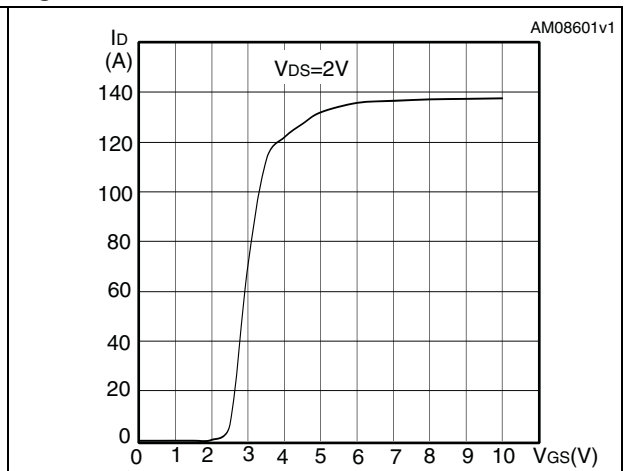


Figure 6. Normalized $B_{V_{DSS}}$ vs temperature

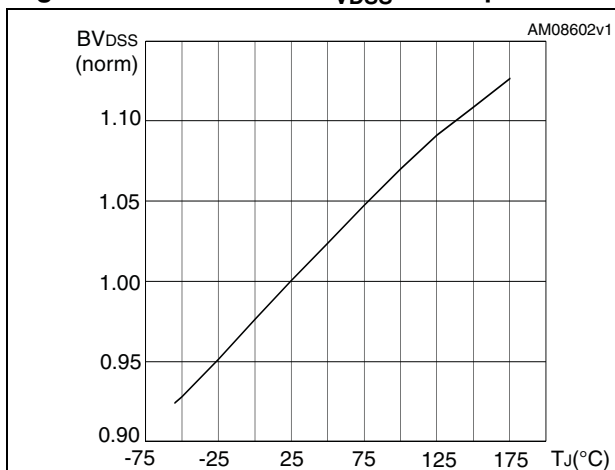


Figure 7. Static drain-source on resistance

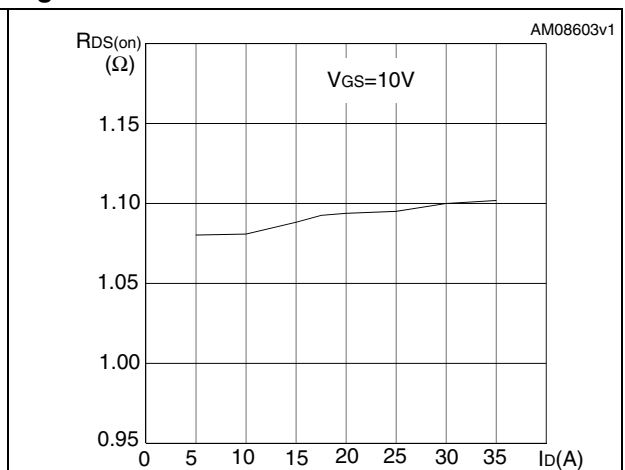


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

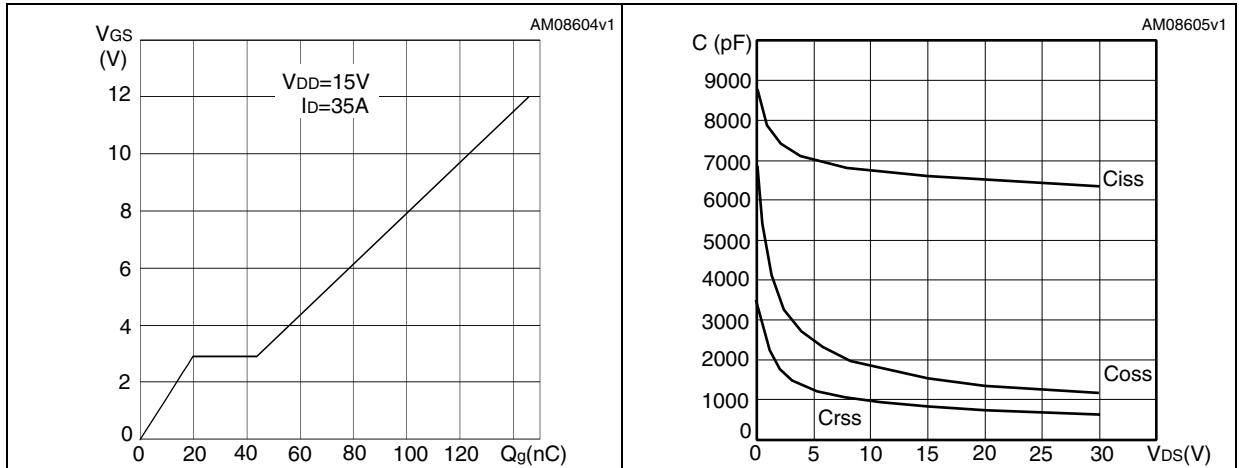


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

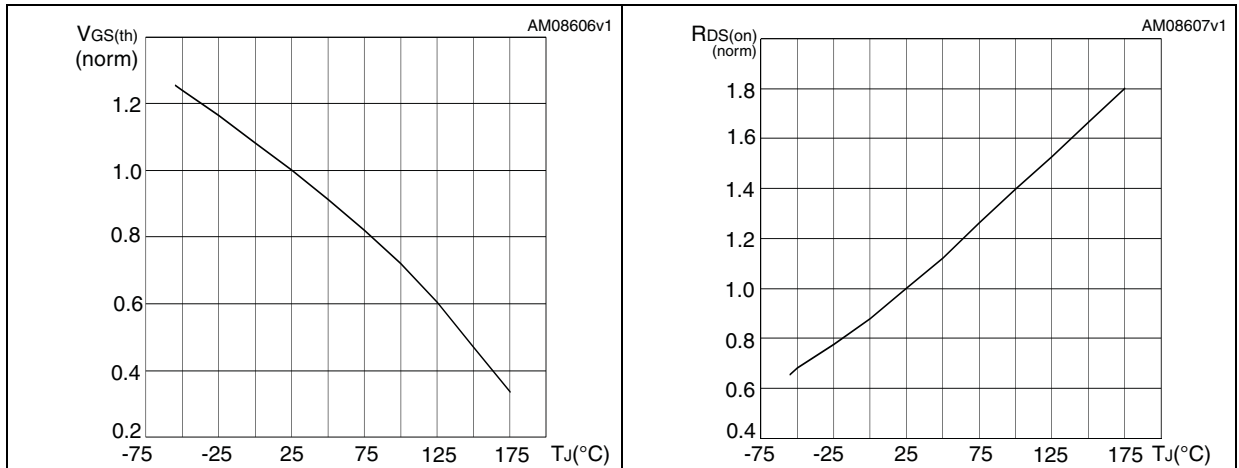
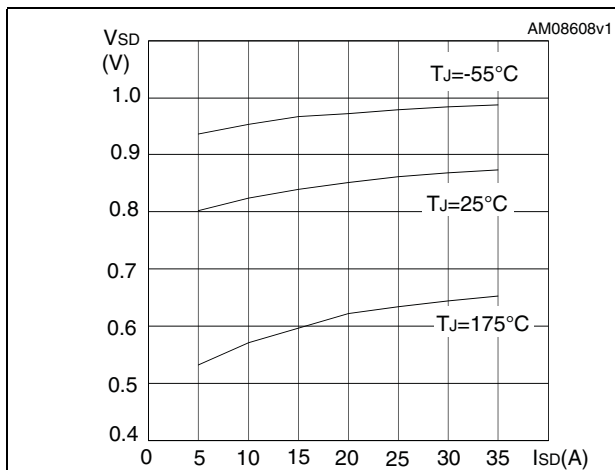


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

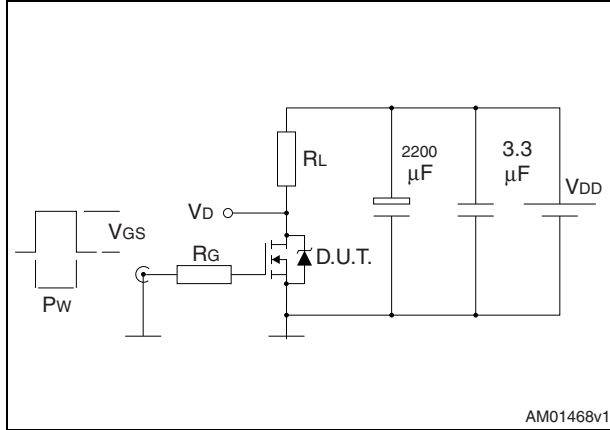


Figure 14. Gate charge test circuit

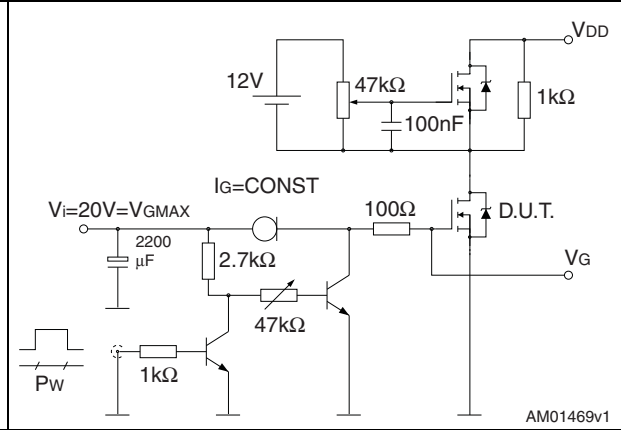


Figure 15. Test circuit for inductive load switching and diode recovery times

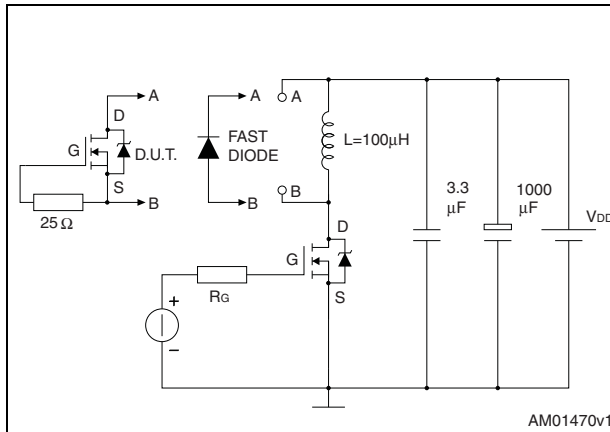


Figure 16. Unclamped inductive load test circuit

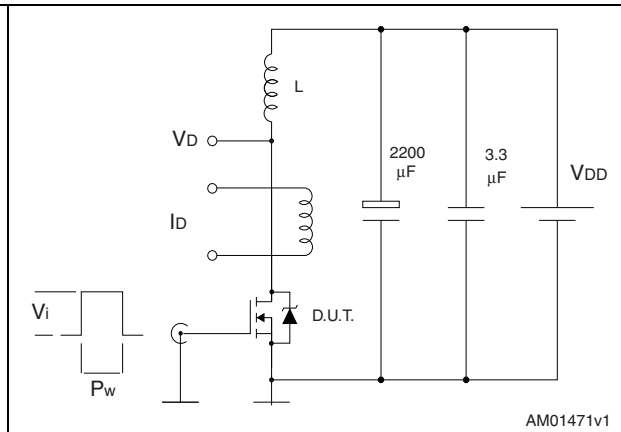


Figure 17. Unclamped inductive waveform

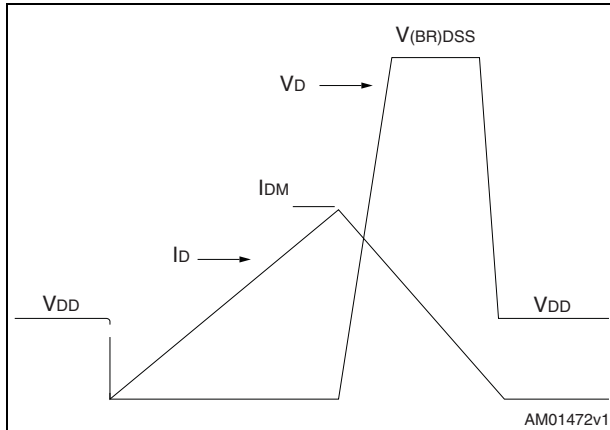
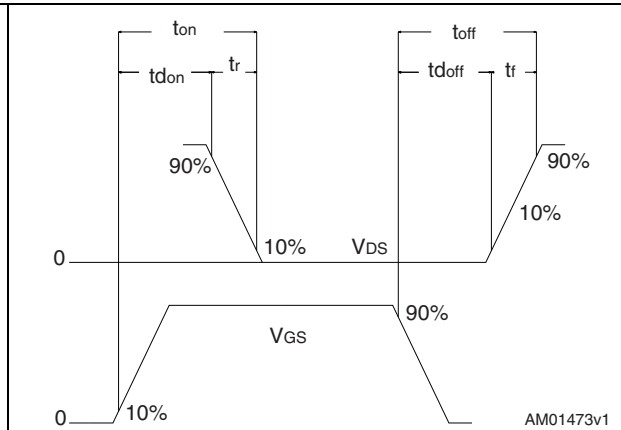


Figure 18. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] 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 9. PowerFLAT™ 5x6 type C-B mechanical data

| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | 0.80 | 0.83 | 0.93 |
| A1 | 0 | 0.02 | 0.05 |
| A3 | | 0.20 | |
| b | 0.35 | 0.40 | 0.47 |
| D | | 5.00 | |
| D1 | | 4.75 | |
| D2 | 4.15 | 4.20 | 4.25 |
| E | | 6.00 | |
| E1 | | 5.75 | |
| E2 | 3.43 | 3.48 | 3.53 |
| E4 | 2.58 | 2.63 | 2.68 |
| e | | 1.27 | |
| L | 0.70 | 0.80 | 0.90 |

Figure 19. PowerFLAT™ 5x6 type C-B drawing

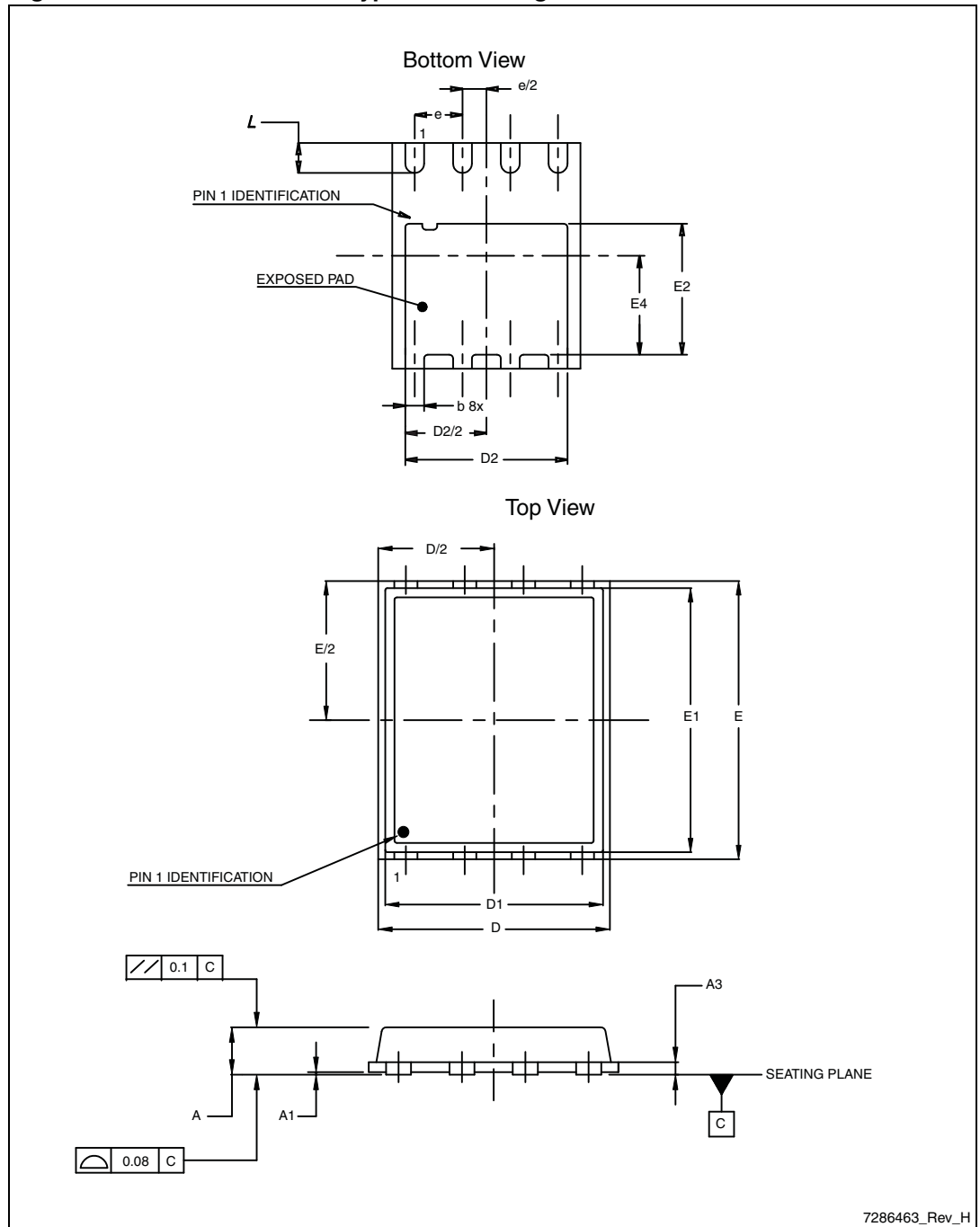


Table 10. PowerFLAT™ 5x6 type S-C mechanical data

| Dim. | mm | | |
|------|-------|------|-------|
| | Min. | Typ. | Max. |
| A | 0.80 | | 1.00 |
| A1 | 0.02 | | 0.05 |
| A2 | | 0.25 | |
| b | 0.30 | | 0.50 |
| D | | 5.20 | |
| E | | 6.15 | |
| D2 | 4.11 | | 4.31 |
| E2 | 3.50 | | 3.70 |
| e | | 1.27 | |
| e1 | | 0.65 | |
| L | 0.715 | | 1.015 |
| K | 1.05 | | 1.35 |

Figure 20. PowerFLAT™ 5x6 type S-C mechanical data

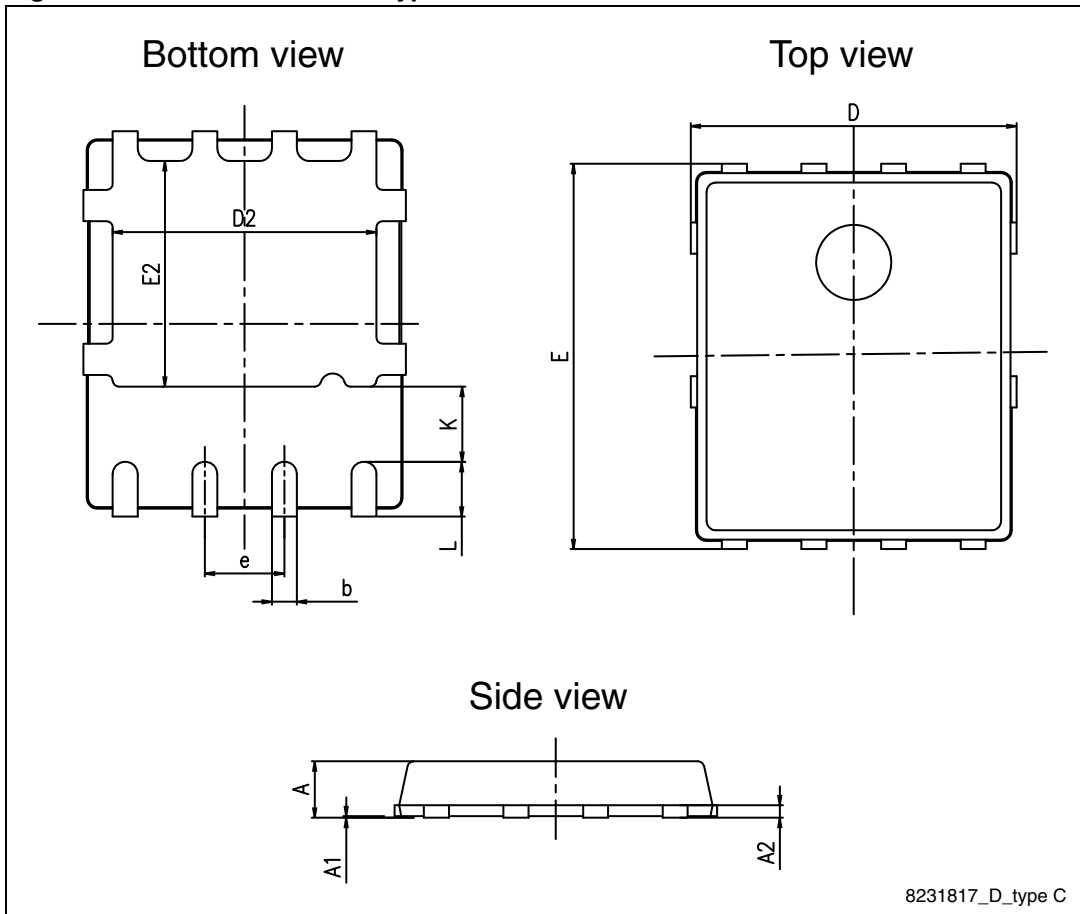
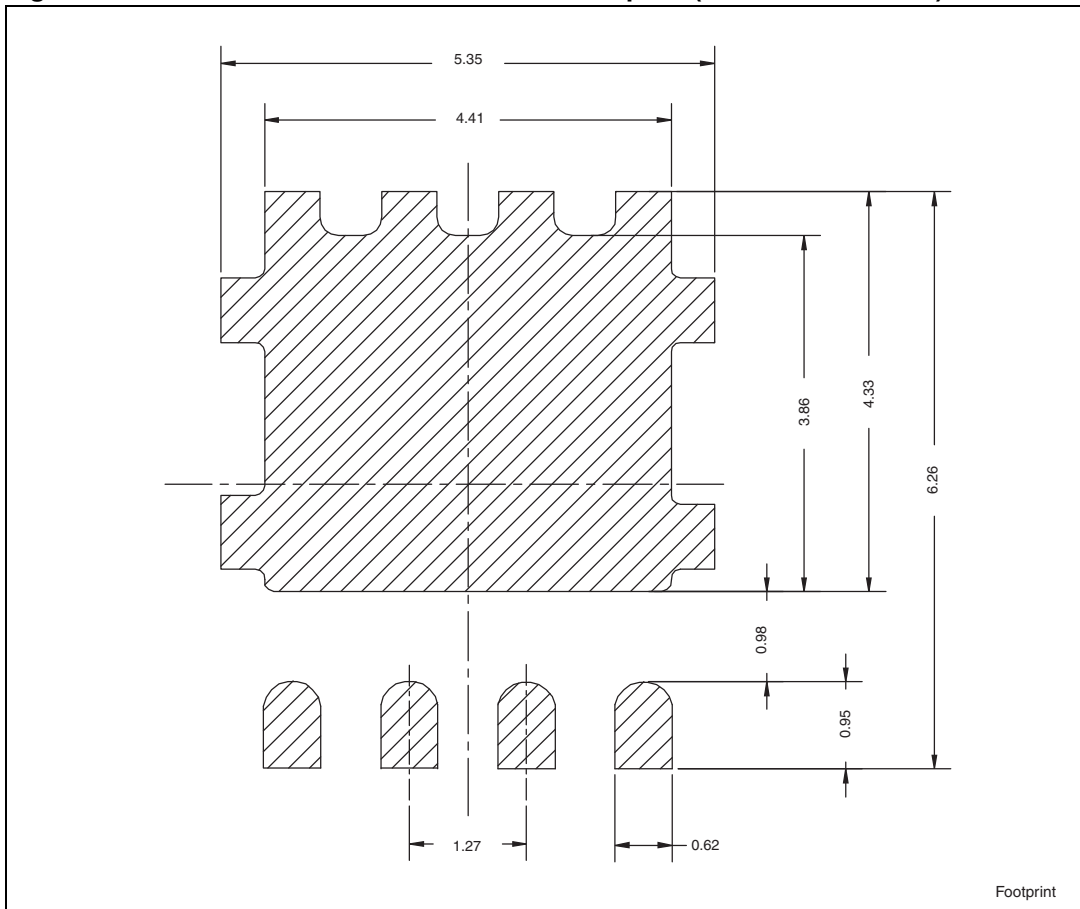


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



5 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 10-Nov-2010 | 1 | First release. |
| 10-Nov-2011 | 2 | <i>Section 4: Package mechanical data</i> has been updated. Minor text changes. |

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