

P-channel 30 V, 0.048 Ω typ., 5 A STripFET™ H6 DeepGATE™ Power MOSFET in an SO-8 package

Datasheet - preliminary data

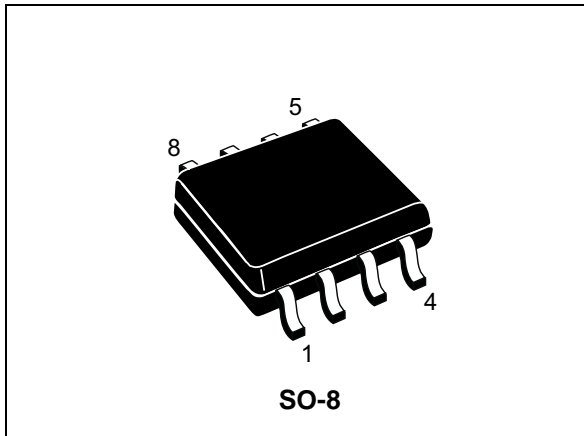
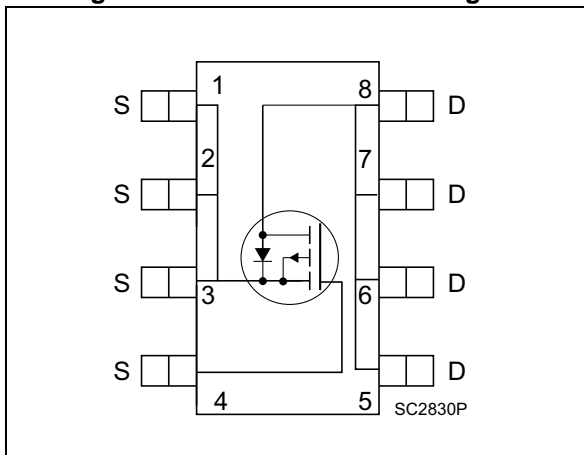


Figure 1. Internal schematic diagram



Features

| Order code | V_{DS} | $R_{DS(on)}$ max | I_D |
|------------|----------|------------------------|-------|
| STS5P3LLH6 | 30 V | 0.056 Ω at 10 V | 5 A |

- Very low on-resistance $R_{DS(on)}$
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications

Description

This device is a P-channel Power MOSFET developed using the STripFET™ H6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low $R_{DS(on)}$ in all packages.

Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|---------------|
| STS5P3LLH6 | 5K3L | SO-8 | Tape and reel |

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

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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 | Drain current (continuous) at $T_{amb} = 25\text{ }^\circ\text{C}$ | 5 | A |
| I_D | Drain current (continuous) at $T_{amb} = 100\text{ }^\circ\text{C}$ | 3.2 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 20 | A |
| P_{TOT} | Total dissipation at $T_{amb} = 25\text{ }^\circ\text{C}$ | 2.7 | W |
| T_J | Operating junction temperature | 150 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | -55 to 150 | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|---------------------------------|-------|--------------------|
| $R_{thj-amb}^{(1)}$ | Thermal resistance junction-amb | 47 | $^\circ\text{C/W}$ |

1. When mounted on 1 inch² FR-4 board, 2 oz. Cu., $t \leq 10\text{ sec}$

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

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 | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 30 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V},$ | | | 1 | μA |
| | | $V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V},$ $T_J = 125\text{ °C}$ | | | 10 | |
| I_{GSS} | Gate body leakage current | $V_{DS} = 0, V_{GS} = \pm 20\text{ V}$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 1 | | 2.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$ | | 0.048 | 0.056 | Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 2.5\text{ A}$ | | 0.075 | 0.09 | |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-----------|------------------------------|---|-----|-----|-----|-------------|
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}, f = 1\text{ MHz}$ $V_{GS} = 0$ | - | 639 | - | pF |
| C_{oss} | Output capacitance | | - | 79 | - | |
| C_{rss} | Reverse transfer capacitance | | - | 52 | - | |
| Q_g | Total gate charge | $V_{DD} = 15\text{ V}, I_D = 5\text{ A}$ $V_{GS} = 4.5\text{ V}$ | - | 6 | - | nC |
| Q_{gs} | Gate-source charge | | - | 1.9 | - | |
| Q_{gd} | Gate-drain charge | | - | 2.1 | - | |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--------------|---------------------|--|-----|------|-----|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 15\text{ V}, I_D = 5\text{ A},$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ | - | 5.4 | - | ns |
| t_r | Rise time | | - | 5 | - | |
| $t_{d(off)}$ | Turn-off delay time | | - | 19.2 | - | |
| t_f | Fall time | | - | 3.4 | - | |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------------|--------------------------|---|-----|------|-----|------|
| $V_{SD}^{(1)}$ | Forward on voltage | $I_{SD} = 5 \text{ A}$, $V_{GS} = 0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 16 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$ | - | 11.2 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 3.5 | | nC |
| I_{RRM} | Reverse recovery current | | - | 0.6 | | A |

1. Pulsed: pulse duration=300 μs , duty cycle 1.5%

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

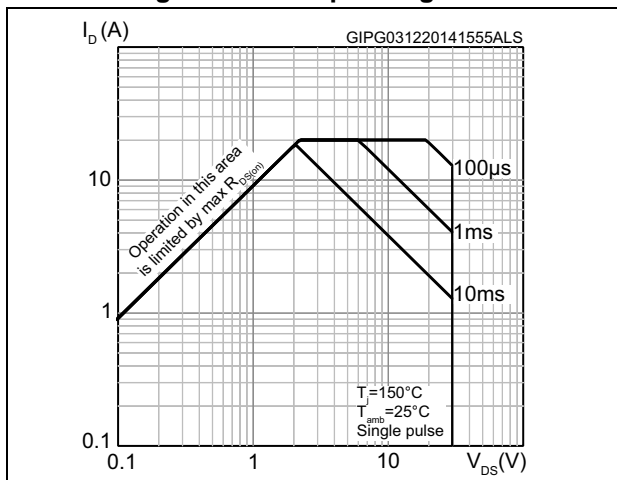


Figure 3. Thermal impedance

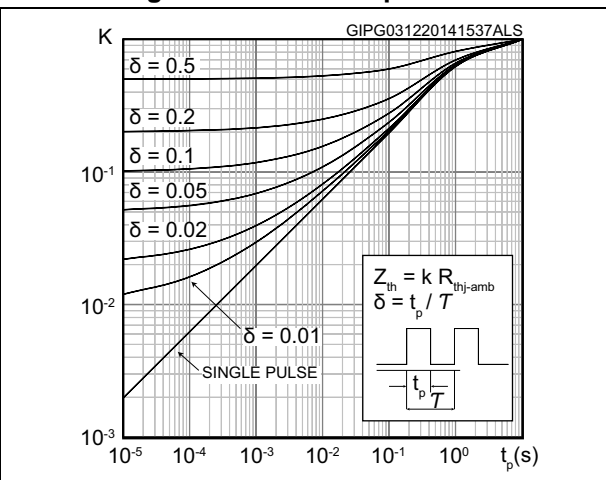


Figure 4. Output characteristics

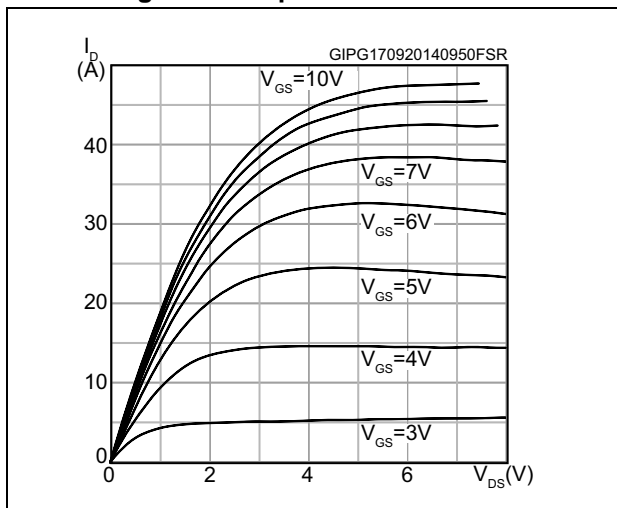


Figure 5. Transfer characteristics

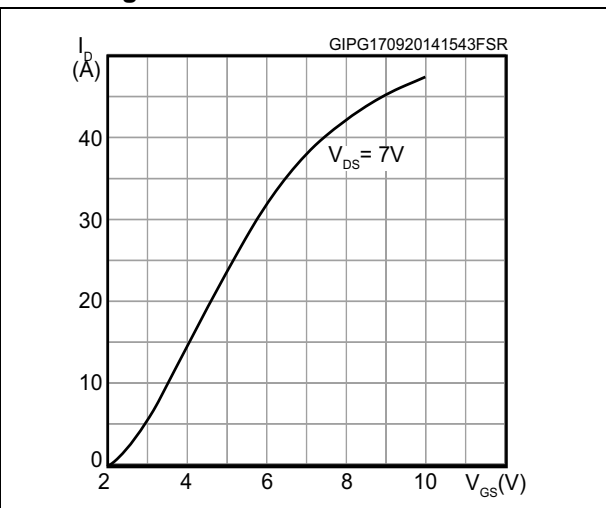


Figure 6. Gate charge vs gate-source voltage

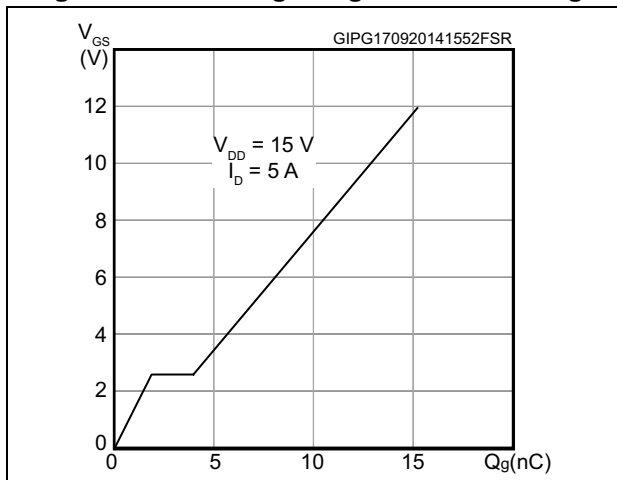


Figure 7. Static drain-source on-resistance

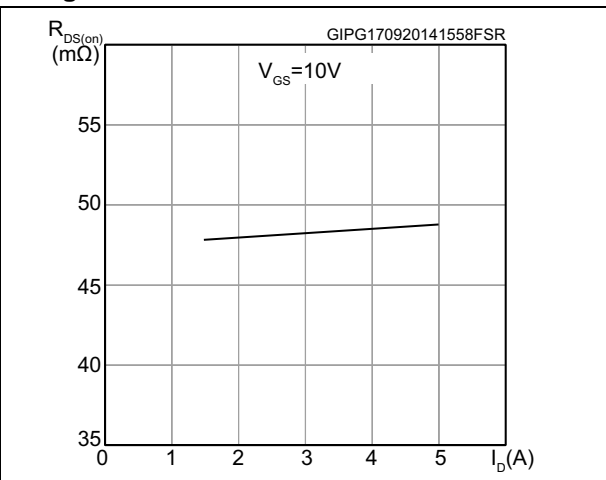


Figure 8. Normalized $V_{(BR)DSS}$ vs temperature

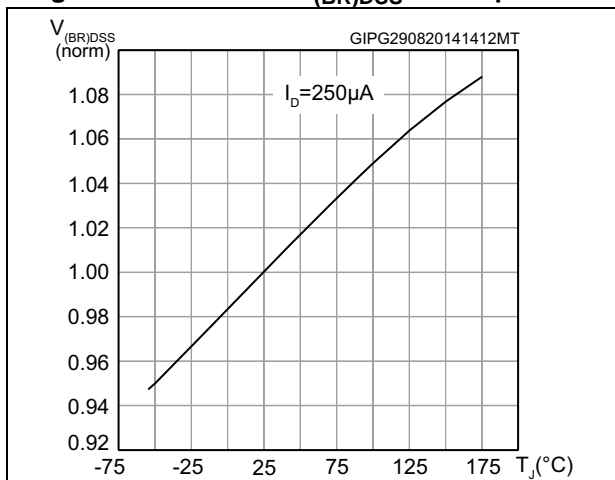


Figure 9. Capacitance variations

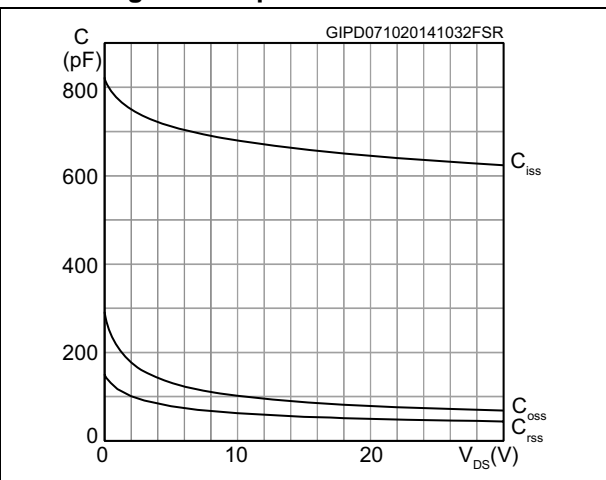


Figure 10. Normalized gate threshold voltage vs. temperature

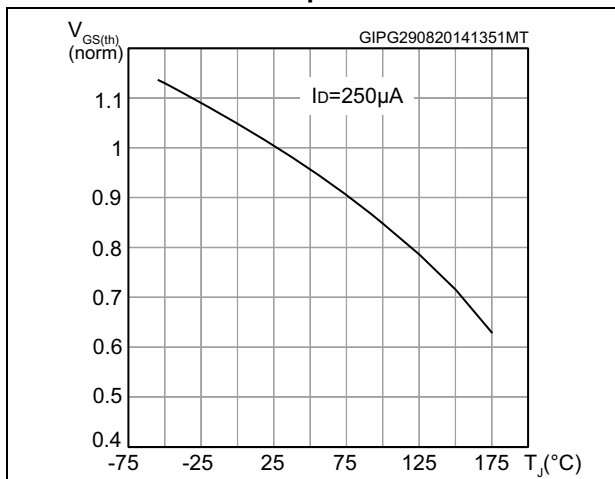


Figure 11. Normalized on-resistance vs. temperature

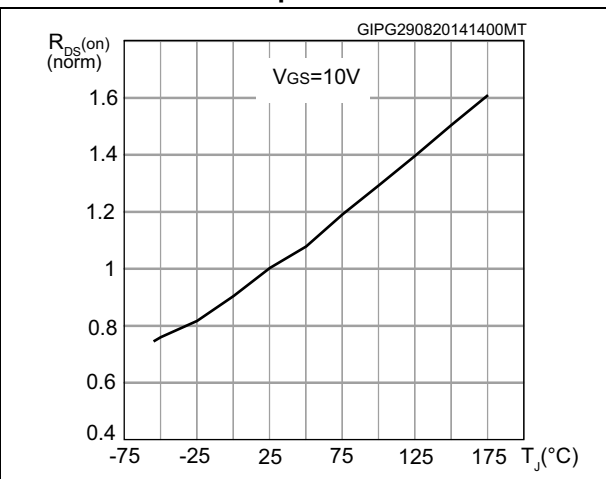
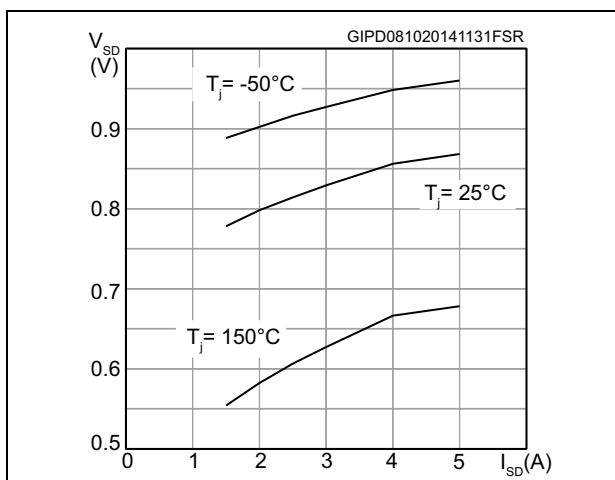


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

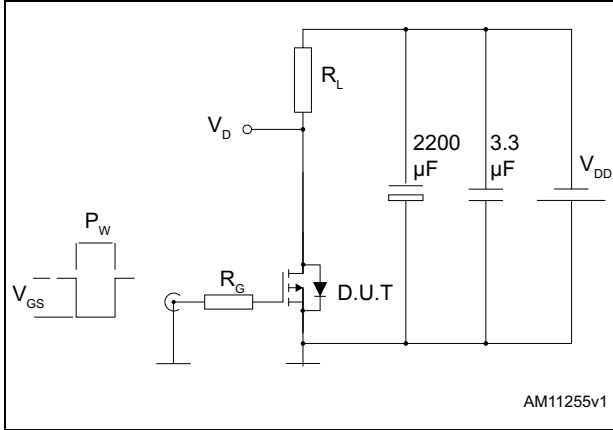


Figure 14. Gate charge test circuit

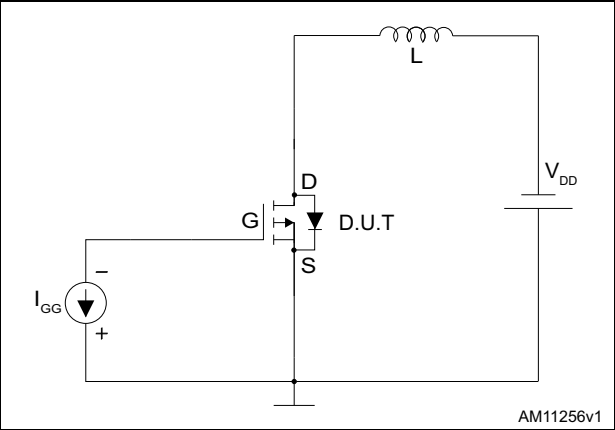
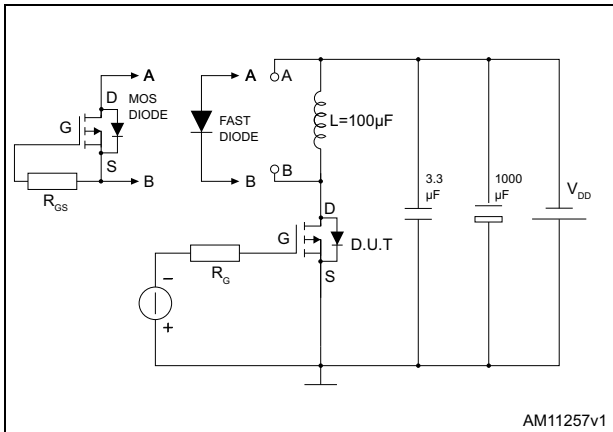


Figure 15. Test circuit for inductive load switching and diode recovery times



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. SO-8 drawing

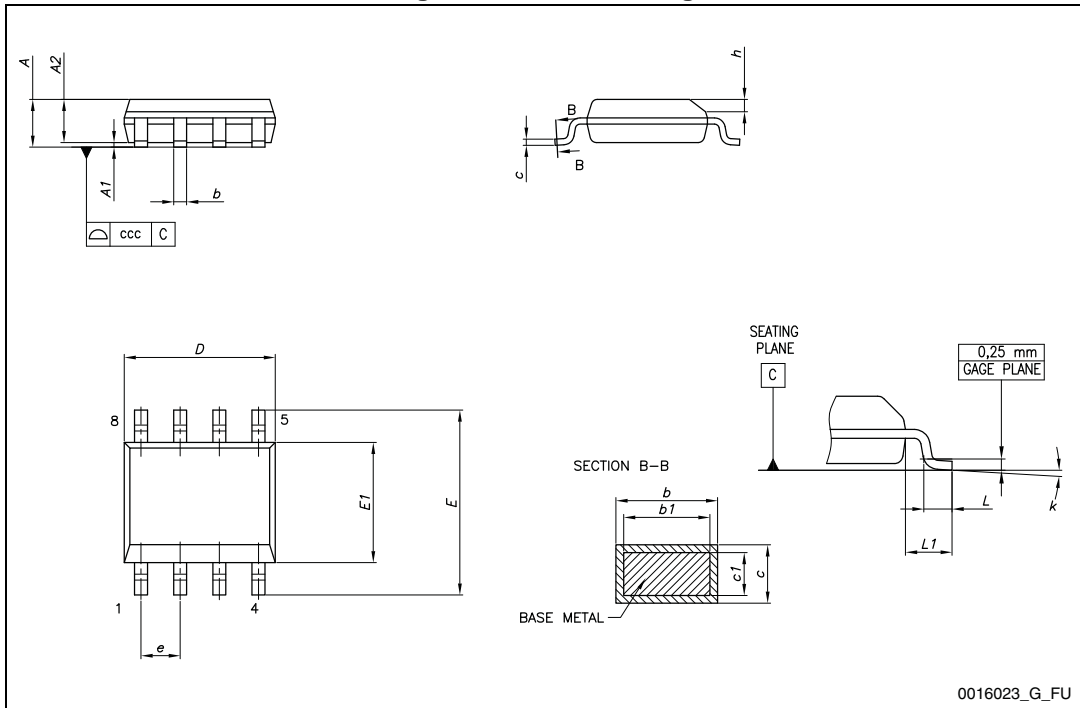
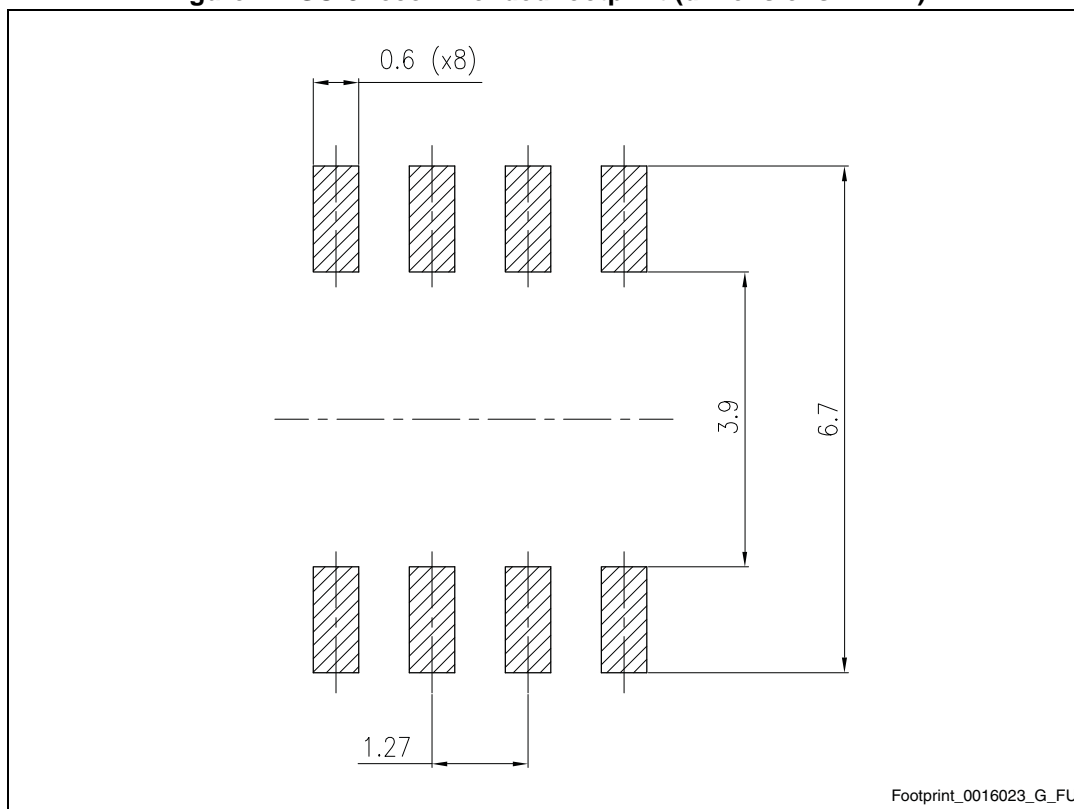


Table 8. SO-8 mechanical data

| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | | | 1.75 |
| A1 | 0.10 | | 0.25 |
| A2 | 1.25 | | |
| b | 0.31 | | 0.51 |
| b1 | 0.28 | | 0.48 |
| c | 0.10 | | 0.25 |
| c1 | 0.10 | | 0.23 |
| D | 4.80 | 4.90 | 5.00 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | | 1.27 | |
| h | 0.25 | | 0.50 |
| L | 0.40 | | 1.27 |
| L1 | | 1.04 | |
| L2 | | 0.25 | |
| k | 0° | | 8° |
| ccc | | | 0.10 |

Figure 17. SO-8 recommended footprint (dimensions in mm)

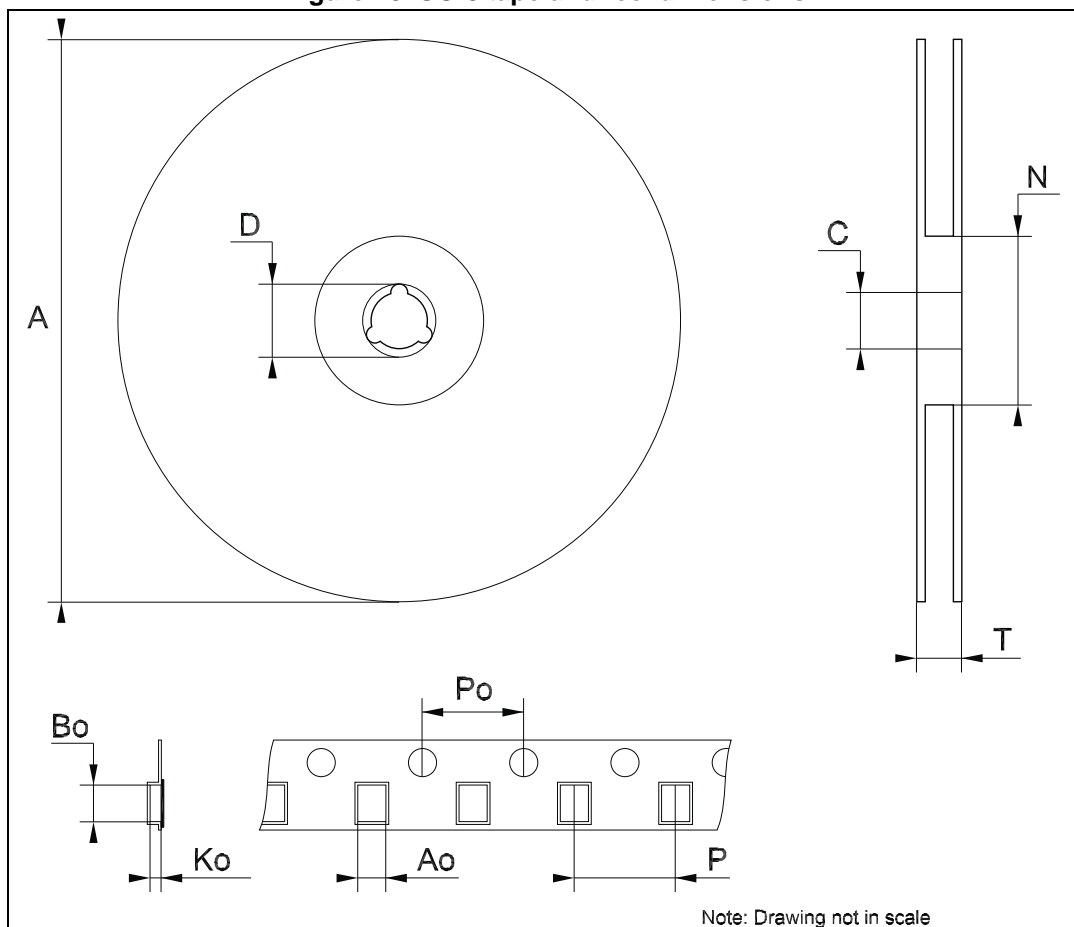


5 Packaging mechanical data

Table 9. SO-8 tape and reel mechanical data

| Dim | mm | | |
|-----|------|-----|------|
| | Min | Typ | Max |
| A | | | 330 |
| C | 12.8 | | 13.2 |
| D | 20.2 | | |
| N | 60 | | |
| T | | | 22.4 |
| Ao | 8.1 | | 8.5 |
| Bo | 5.5 | | 5.9 |
| Ko | 2.1 | | 2.3 |
| Po | 3.9 | | 4.1 |
| P | 7.9 | | 8.1 |

Figure 18. SO-8 tape and reel dimensions



6 Revision history

Table 10. Revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 09-May-2013 | 1 | First revision. |
| 11-Dec-2014 | 2 | Text edits throughout document On cover page: – changed title description – updated <i>Features</i> – updated <i>Description</i> In Table 4 , changed $R_{DS(on)}$ values In Table 5 , changed values and test conditions In Table 6 , changed values and test conditions In Table 7 , changed values and test conditions Added Section 2.1: Electrical characteristics (curves) Updated Section 3: Test circuits Updated Section 4: Package mechanical data |

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