

N-channel 100 V, 0.0036 Ω typ., 110 A, STripFET™ F7 Power MOSFETs in I²PAK and TO-220 packages

Datasheet – production data

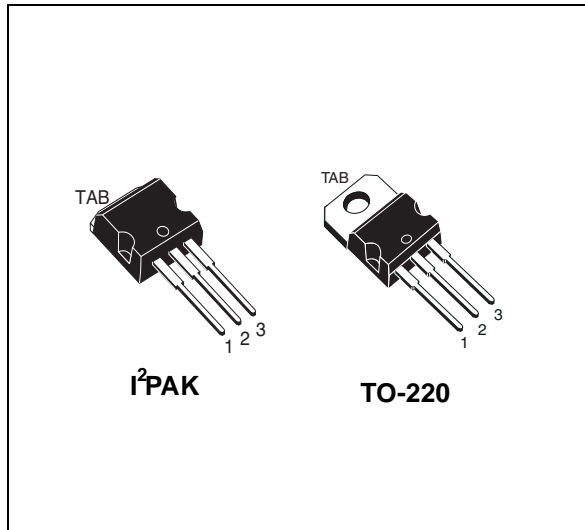
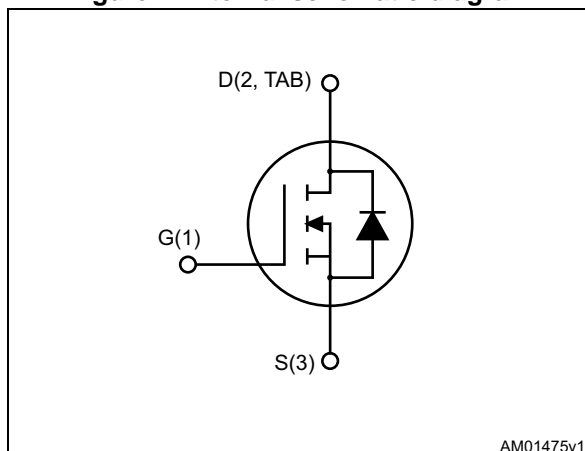


Figure 1. Internal schematic diagram



Features

| Order codes | V _{DS} | R _{DS(on)max} | I _D | P _{TOT} |
|-------------|-----------------|------------------------|----------------|------------------|
| STI150N10F7 | 100 V | 0.0042 Ω | 110 A | 250 W |
| STP150N10F7 | | | | |

- Among the lowest R_{DS(on)} on the market
- Excellent figure of merit (FoM)
- Low Crss/Ciss ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|----------|--------------------|-----------|
| STI150N10F7 | 150N10F7 | I ² PAK | Tube |
| STP150N10F7 | | TO-220 | |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------------------|
| V_{DS} | Drain-source voltage | 100 | V |
| V_{GS} | Gate- source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 110 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 110 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 440 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 250 | W |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 495 | mJ |
| T_J | Operating junction temperature | -55 to 175 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | | $^\circ\text{C}$ |

1. Pulse width is limited by safe operating area

2. Starting $T_j=25\text{ }^\circ\text{C}$, $I_D=30\text{ A}$, $V_{DD}=50\text{ V}$

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|--------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max | 0.6 | $^\circ\text{C/W}$ |
| $R_{thj-amb}$ | Thermal resistance junction-ambient max | 62.5 | $^\circ\text{C/W}$ |

2 Electrical characteristics

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

Table 4. On /off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|--|------|--------|--------|----------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0, I_D = 250\ \mu A$ | 100 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0, V_{DS} = 100\ V$ | | | 1 | μA |
| | | $V_{GS} = 0, V_{DS} = 100\ V, T_C = 125\text{ °C}$ | | | 100 | μA |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0, V_{GS} = +20\ V$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu A$ | 2.5 | | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\ V, I_D = 55\ A$ | | 0.0036 | 0.0042 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| C_{iss} | Input capacitance | $V_{DS} = 50\ V, f = 1\ MHz, V_{GS} = 0$ | - | 8115 | - | pF |
| C_{oss} | Output capacitance | | - | 1510 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 67 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 50\ V, I_D = 110\ A, V_{GS} = 10\ V$ (see Figure 14) | - | 117 | - | nC |
| Q_{gs} | Gate-source charge | | - | 47 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 26 | - | nC |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 50\ V, I_D = 55\ A, R_G = 4.7\ \Omega, V_{GS} = 10\ V$ (see Figure 13) | - | 33 | - | ns |
| t_r | Rise time | | - | 57 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 72 | - | ns |
| t_f | Fall time | | - | 33 | - | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 110 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 440 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 110 \text{ A}$, $V_{GS} = 0$ | - | | 1.2 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 110 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 80 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$ (see Figure 15) | - | 70 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 165 | | nC |
| I_{RRM} | Reverse recovery current | | - | 4.7 | | 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

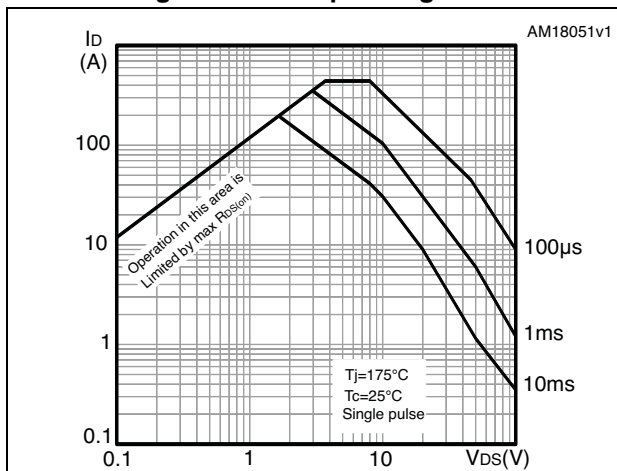


Figure 3. Thermal impedance

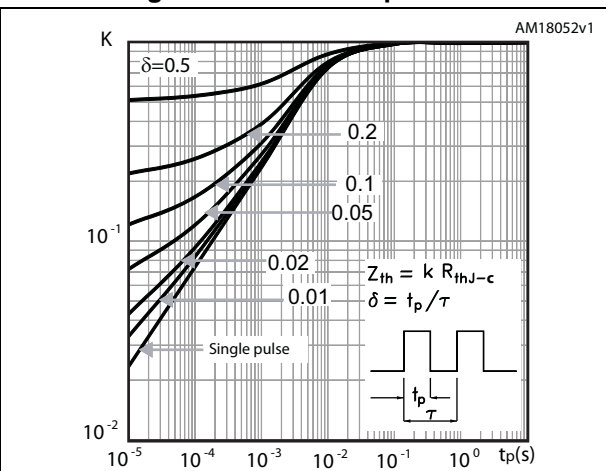


Figure 4. Output characteristics

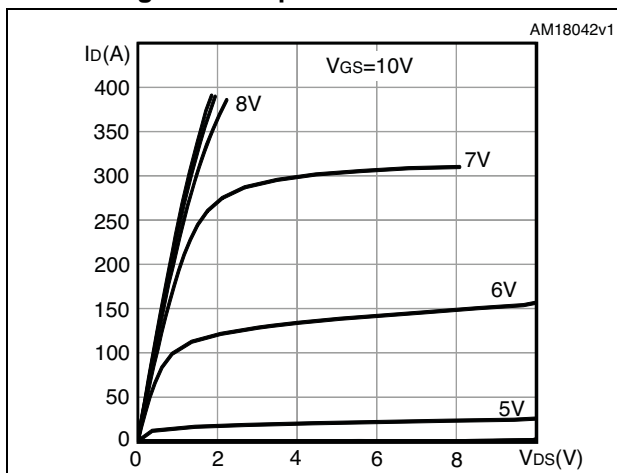


Figure 5. Transfer characteristics

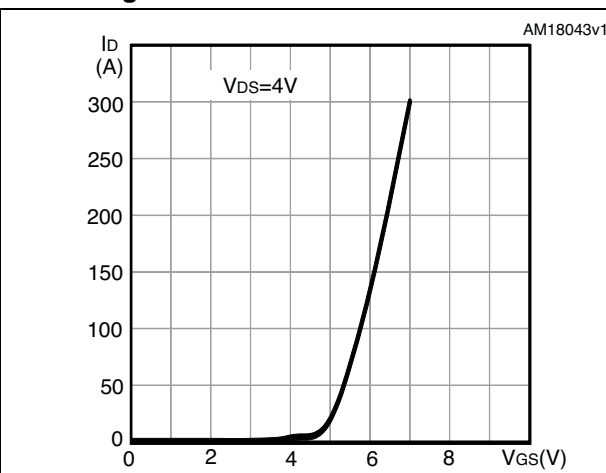


Figure 6. Gate charge vs gate-source voltage

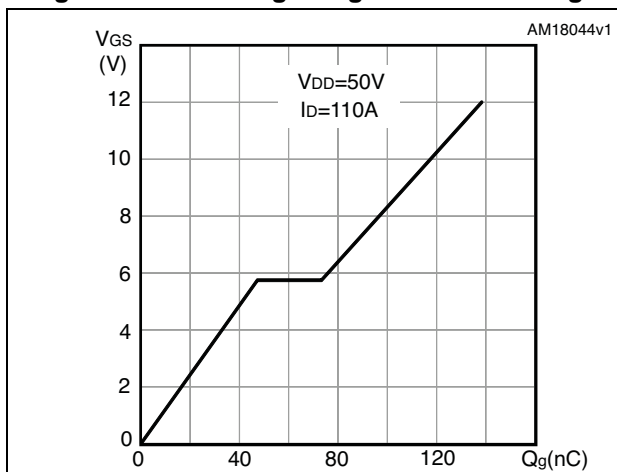


Figure 7. Static drain-source on-resistance

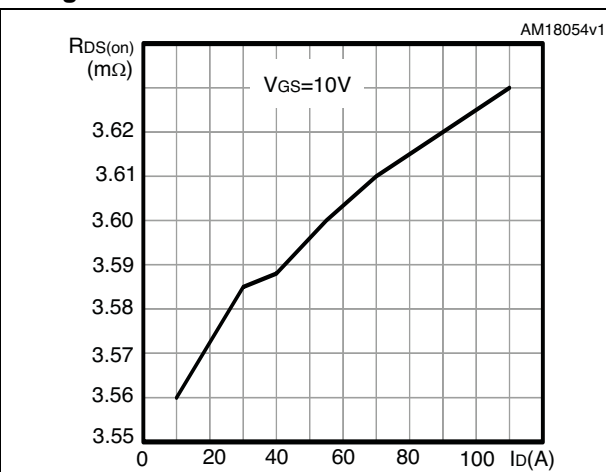


Figure 8. Capacitance variations

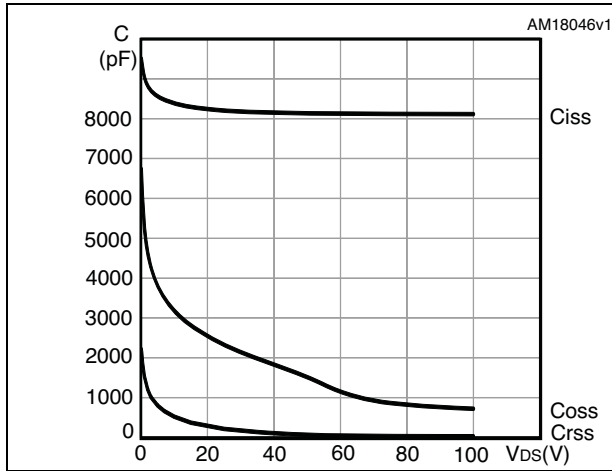


Figure 9. Normalized gate threshold voltage vs temperature

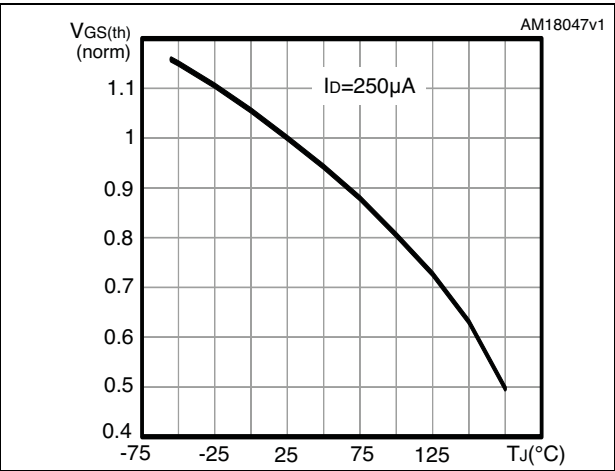


Figure 10. Normalized on-resistance vs temperature

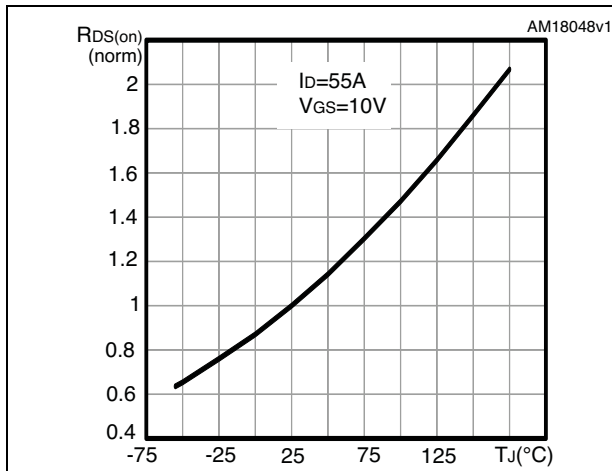


Figure 11. Normalized V(BR)DSS vs temperature

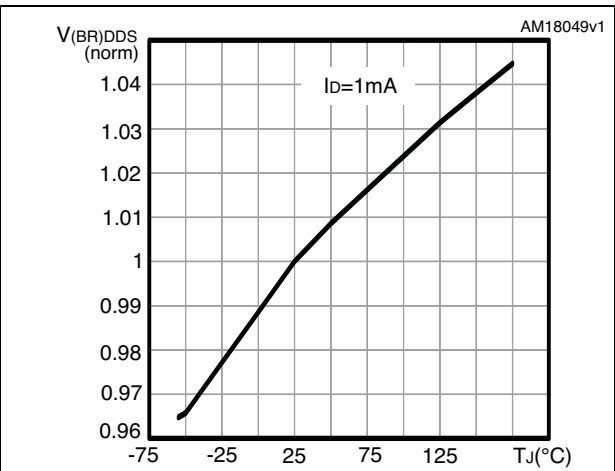
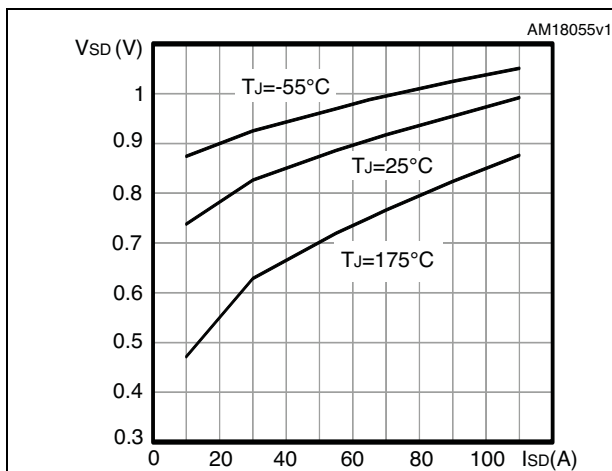


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

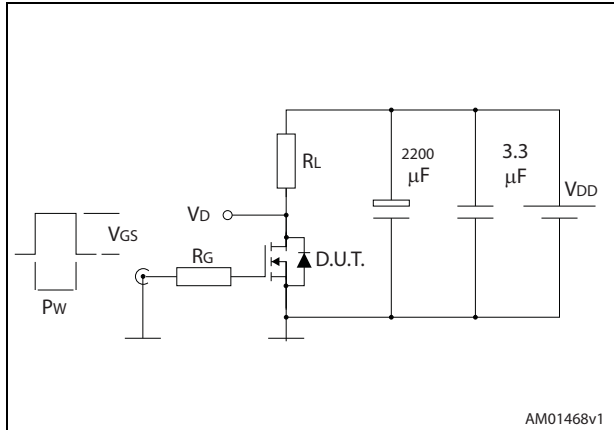


Figure 14. Gate charge test circuit

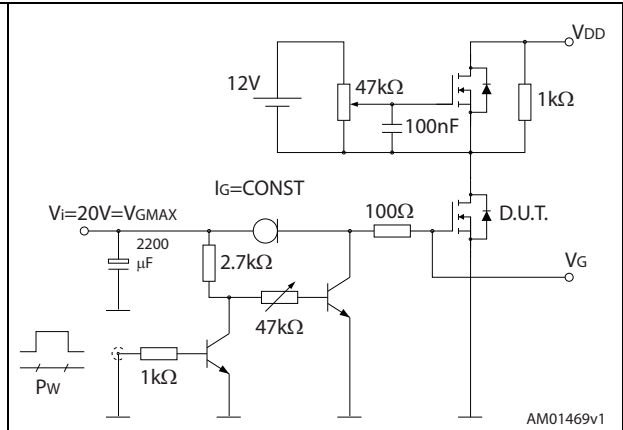


Figure 15. Test circuit for inductive load switching and diode recovery times

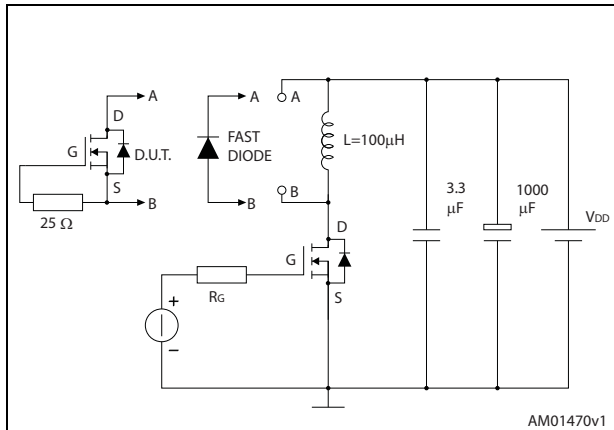


Figure 16. Unclamped inductive load test circuit

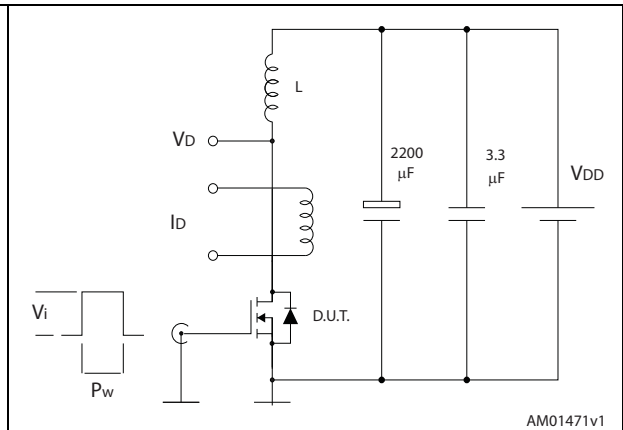


Figure 17. Unclamped inductive waveform

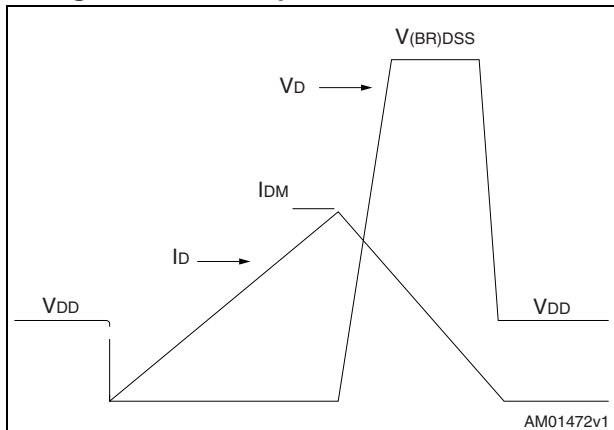
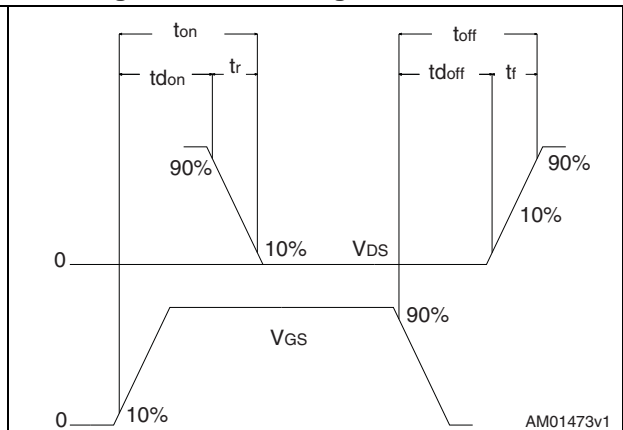


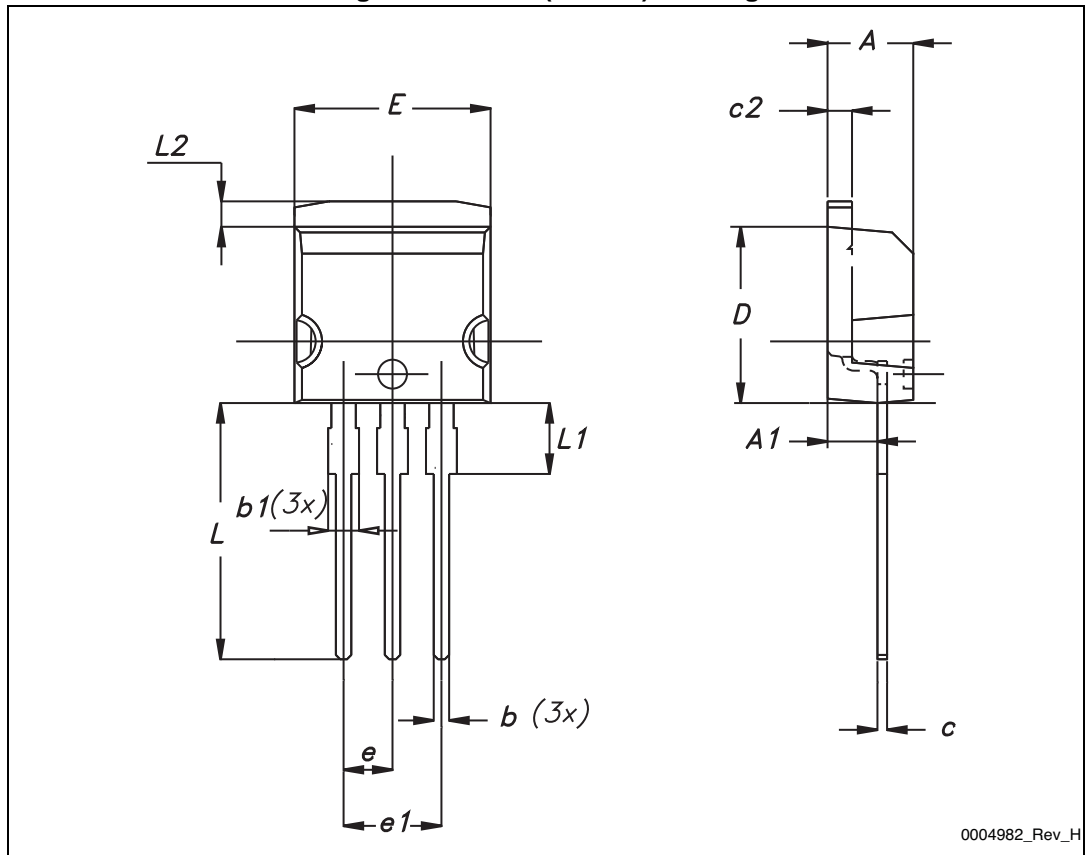
Figure 18. Switching time waveform



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.

Figure 19. I²PAK (TO-262) drawing

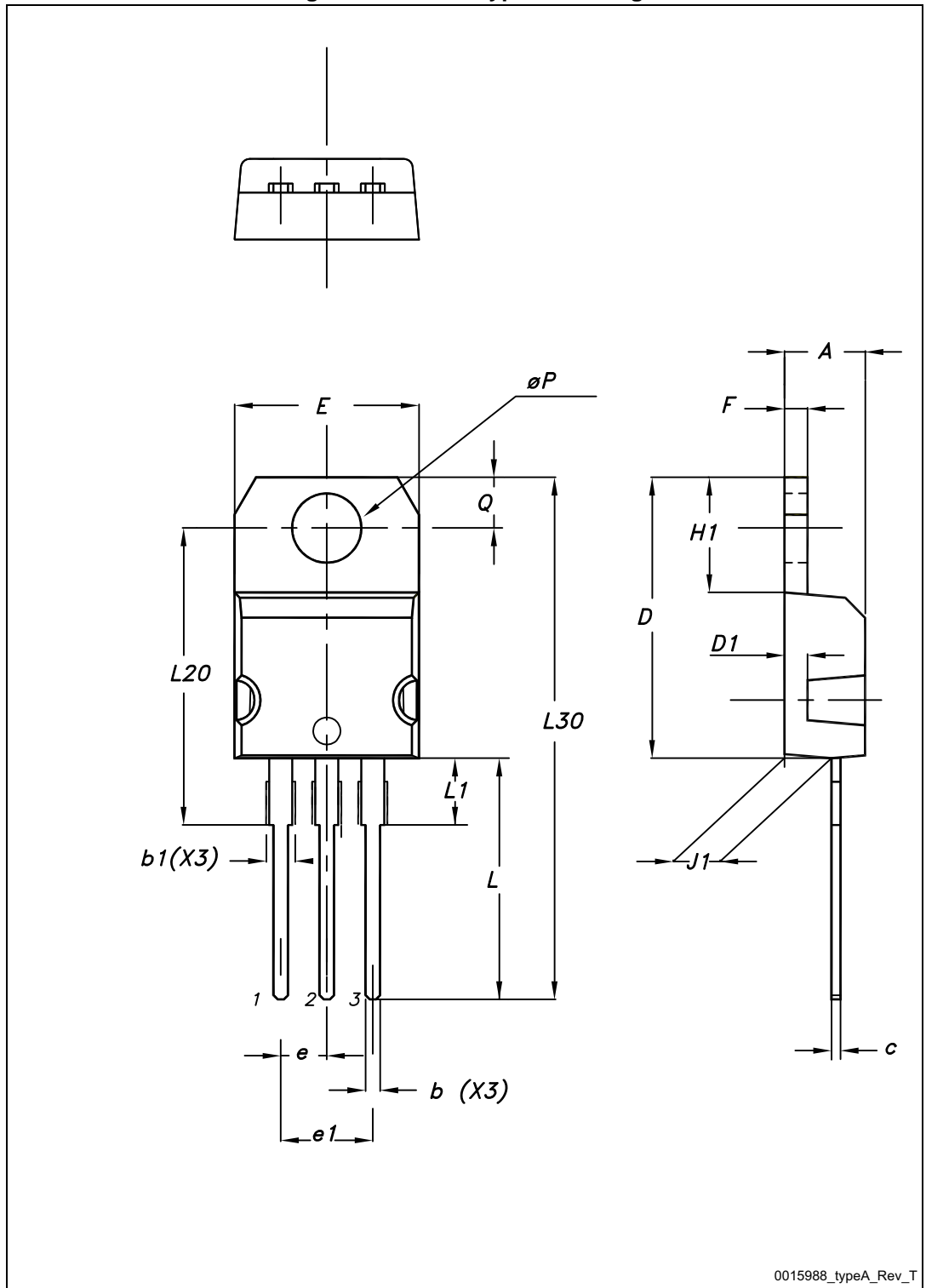


0004982_Rev_H

Table 8. I²PAK (TO-262) mechanical data

| DIM. | mm. | | |
|------|------|-----|-------|
| | min. | typ | max. |
| A | 4.40 | | 4.60 |
| A1 | 2.40 | | 2.72 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.49 | | 0.70 |
| c2 | 1.23 | | 1.32 |
| D | 8.95 | | 9.35 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| E | 10 | | 10.40 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L2 | 1.27 | | 1.40 |

Figure 20. TO-220 type A drawing



0015988_typeA_Rev_T

Table 9. TO-220 type A mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

5 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 16-Apr-2013 | 1 | First release. |
| 22-Jan-2014 | 2 | <ul style="list-style-type: none"> – The part number STH150N10F7-2 has been moved to a separate datasheet – Added: I²PAK package – Modified: Figure 1 – Modified: I_D and I_{DM} values in Table 2 – Modified: R_{thj-case} value in Table 3 – Modified: R_{DS(on)} values in Table 4 – Modified: V_{SD}, I_D and the entire typical values in Table 5, 6 and 7 – Updated: Figure 13, 14, 15 and 16 – Updated: Section 4: Package mechanical data – Added: Section 2.1: Electrical characteristics (curves) – Minor text changes |
| 24-Feb-2014 | 3 | <ul style="list-style-type: none"> – Datasheet status promoted from preliminary data to production data – Modified: Figure 10 – Minor text changes |
| 20-Aug-2014 | | <ul style="list-style-type: none"> – Updated title, features and description in cover page. – Added E_{AS} parameter in Table 2: Absolute maximum ratings. – Minor text changes |

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