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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|------------|--------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 450 | V |
| V_{GS} | Gate- source voltage | ± 30 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$ | 0.6 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 2.4 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$ | 3 | W |
| $I_{AR}^{(2)}$ | Avalanche current, repetitive or not-repetitive | 0.6 | A |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{V}$) | 45 | mJ |
| $dv/dt^{(4)}$ | Peak diode recovery voltage slope | 12 | V/ns |
| $V_{esd(g-s)}$ | G-S ESD (HBM $C = 100\text{ pF}$, $R = 1.5\text{ k}\Omega$) | 1000 | V |
| T_{stg} | Storage temperature | -55 to 150 | $^{\circ}\text{C}$ |
| T_j | Max. operating junction temperature | 150 | $^{\circ}\text{C}$ |

1. Pulse width limited by safe operating area.
2. Pulse width limited by $T_{j\text{ max}}$.
3. Starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.
4. $I_{SD} \leq 0.6\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS\text{ peak}} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$.

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|-------------------------------------|-------|-----------------------------|
| $R_{thj-case}$ | Thermal resistance junction-ambient | 42 | $^{\circ}\text{C}/\text{W}$ |

2 Electrical characteristics

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

Table 4. On /off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|------|----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 1\text{ mA}$, $V_{GS} = 0$ | 450 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 450\text{ V}$ $V_{DS} = 450\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$ | | | 1 50 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 10 | μA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$ | 3 | 3.75 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\text{ V}$, $I_D = 0.6\text{ A}$ | | 3.3 | 4 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|---------------------------------------|--|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 164 | - | pF |
| C_{oss} | Output capacitance | | - | 17 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 3 | - | pF |
| $C_{o(tr)}^{(1)}$ | Equivalent capacitance time related | $V_{DS} = 0\text{ to }360\text{ V}$, $V_{GS} = 0$ | - | 13 | - | pF |
| $C_{o(er)}^{(2)}$ | Equivalent capacitance energy related | | - | 18 | - | pF |
| R_G | Intrinsic gate resistance | $f = 1\text{ MHz}$ open drain | - | 8 | - | Ω |
| Q_g | Total gate charge | $V_{DD} = 360\text{ V}$, $I_D = 1.8\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 16) | - | 9.5 | - | nC |
| Q_{gs} | Gate-source charge | | - | 2 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 6 | - | nC |

1. $C_{oss\text{ eq}}$ time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}
2. $C_{oss\text{ eq}}$ energy related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|--------------|---------------------|--|------|------|-----|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 225\text{ V}$, $I_D = 0.9\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 15) | - | 6.5 | - | ns |
| t_r | Rise time | | - | 5.4 | - | ns |
| $t_{d(off)}$ | Turn-off-delay time | | - | 17 | - | ns |
| t_f | Fall time | | - | 22 | - | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 0.6 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 2.4 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 0.6\text{ A}$, $V_{GS} = 0$ | - | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 1.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 20) | - | 175 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 550 | | nC |
| I_{RRM} | Reverse recovery current | | - | 6 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 1.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 20) | - | 185 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 600 | | nC |
| I_{RRM} | Reverse recovery current | | - | 6.5 | | A |

1. Pulse width limited by safe operating area.

2. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%.

Table 8. Gate-source Zener diode

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---------------|-------------------------------|--|-----|-----|-----|------|
| $V_{(BR)GSO}$ | Gate-source breakdown voltage | $I_{GS} = \pm 1\text{ mA}$, $I_D = 0$ | 30 | - | - | V |

The built-in back-to-back Zener diodes have been specifically designed to enhance not only the device's ESD capability, but also to make them capable of safely absorbing any voltage transients that may occasionally be applied from gate to source. In this respect, the Zener voltage is appropriate to achieve efficient and cost-effective protection of device integrity. The integrated Zener diodes thus eliminate the need for external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

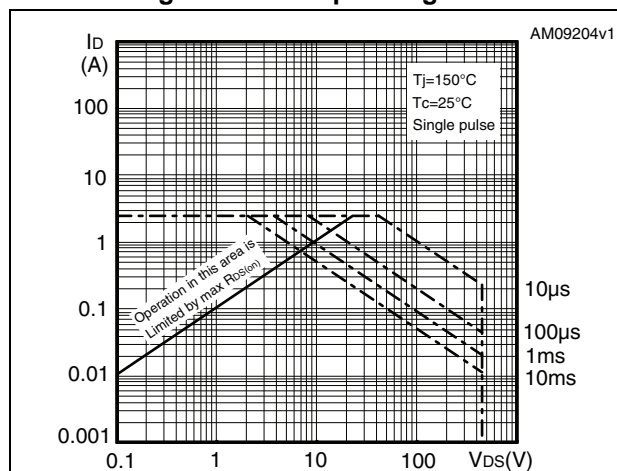


Figure 3. Thermal impedance

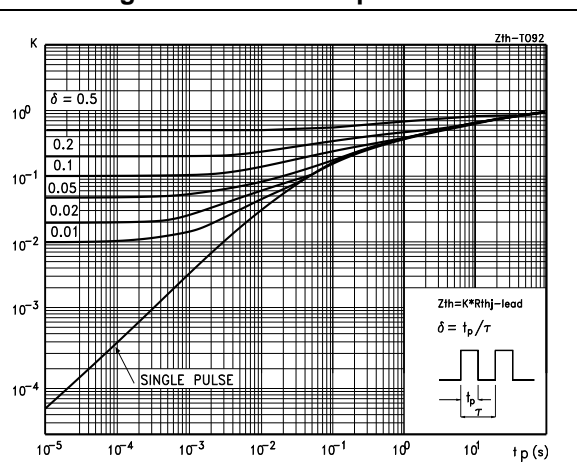


Figure 4. Output characteristics

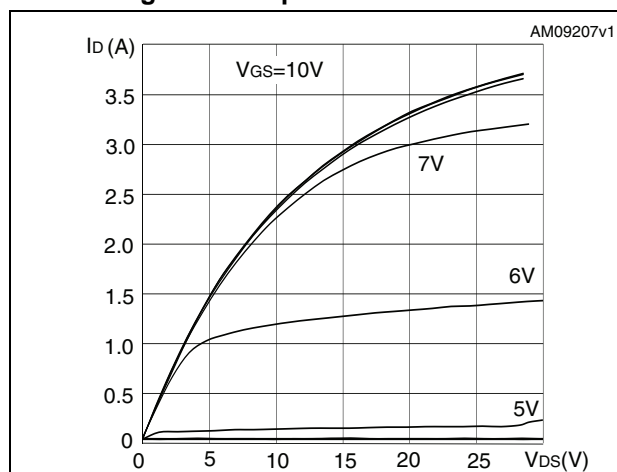


Figure 5. Transfer characteristics

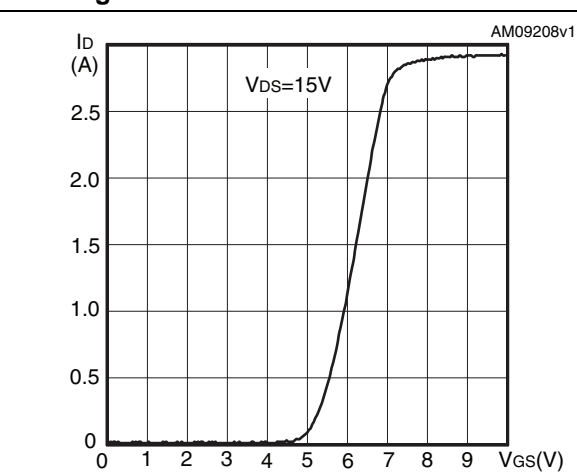


Figure 6. Gate charge vs gate-source voltage

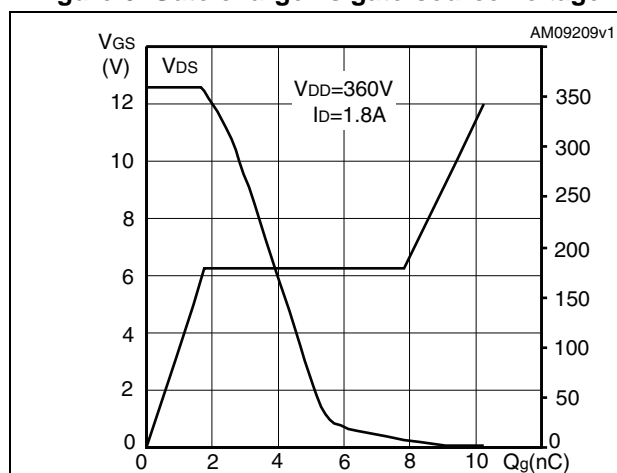


Figure 7. Static drain-source on resistance

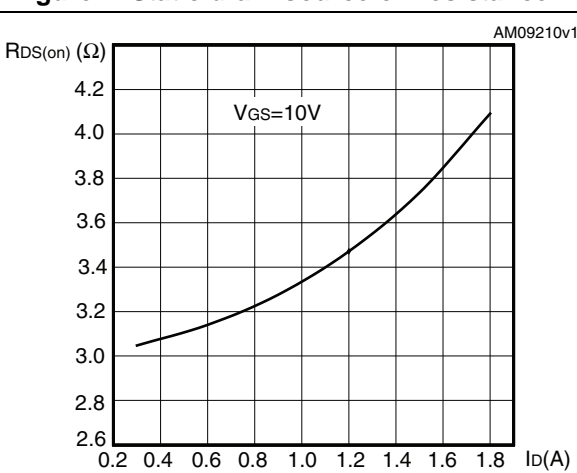


Figure 8. Capacitance variations

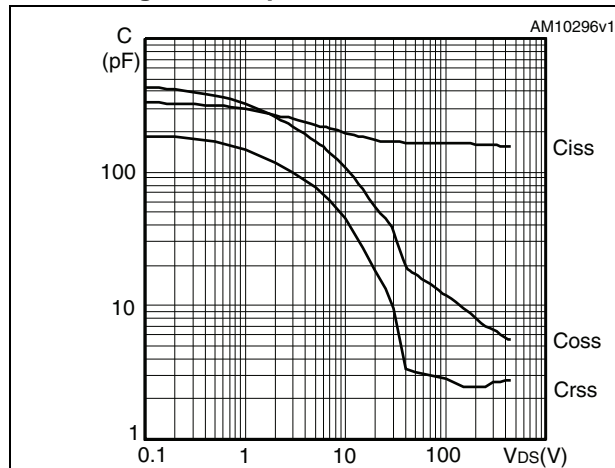


Figure 9. Output capacitance stored energy

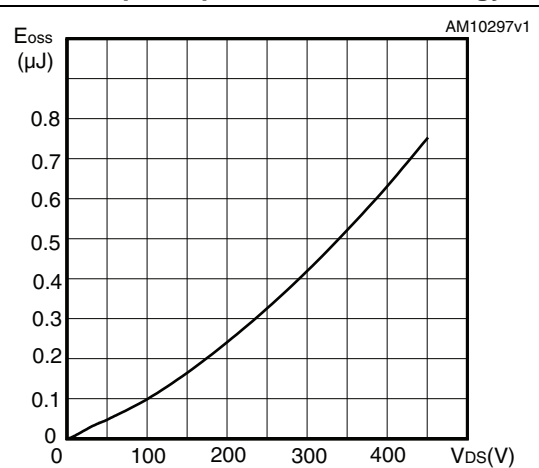


Figure 10. Normalized gate threshold voltage vs temperature

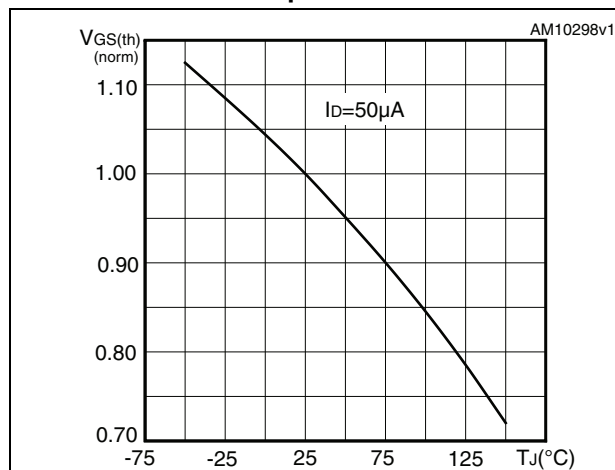


Figure 11. Normalized on-resistance vs temperature

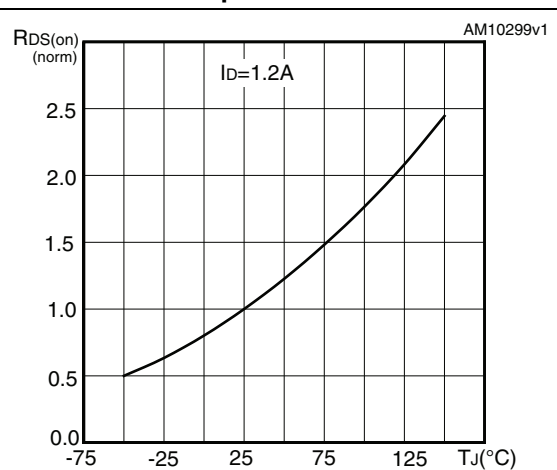
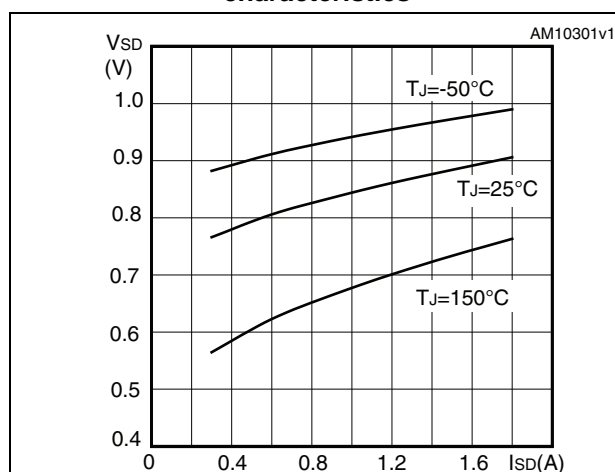
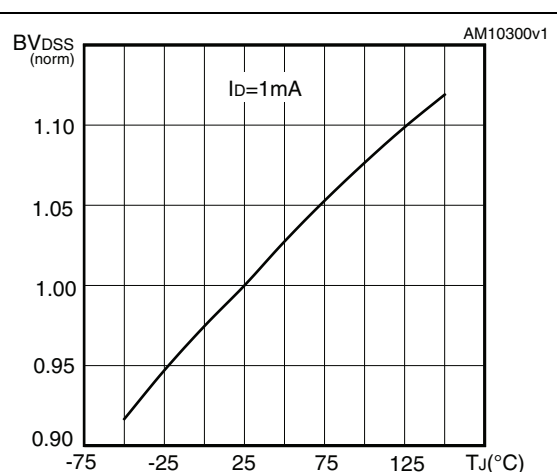
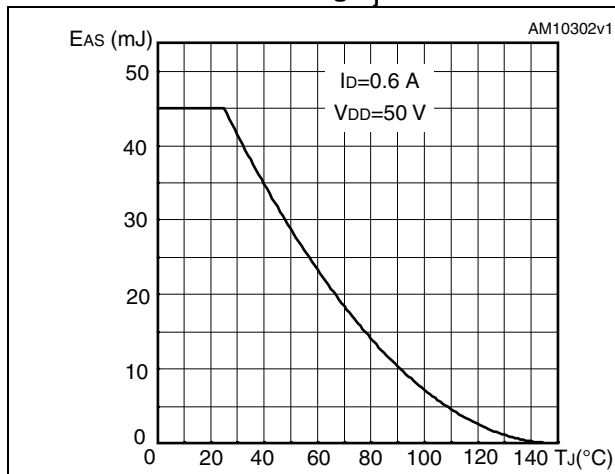
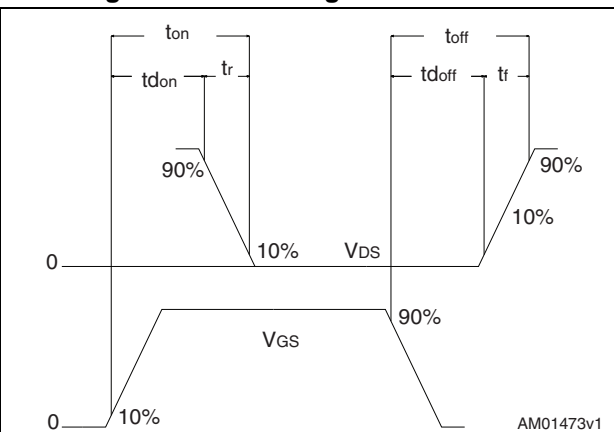
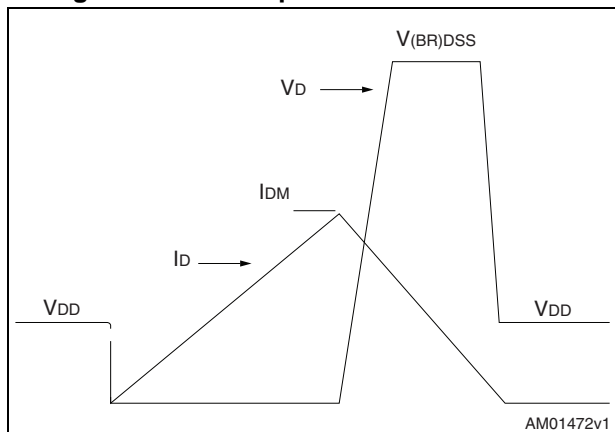
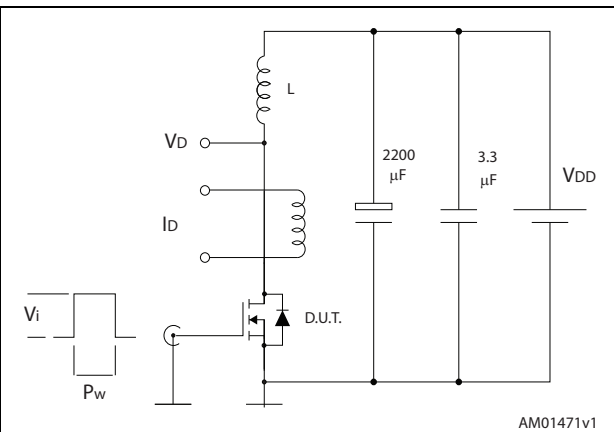
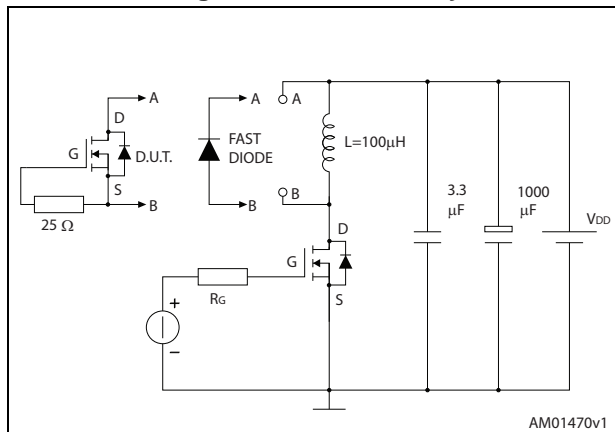
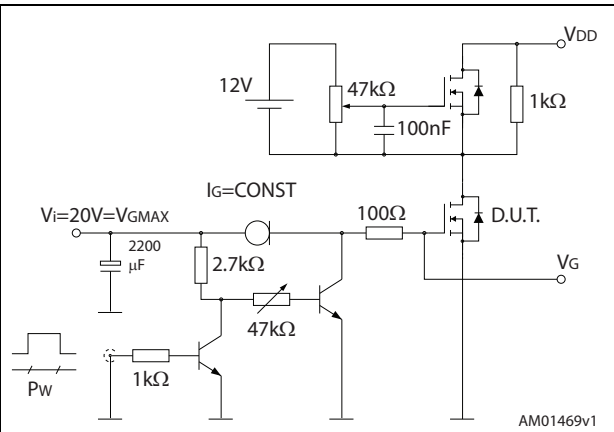
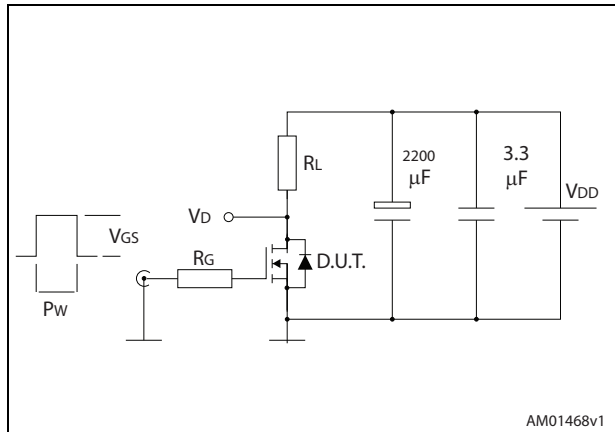


Figure 12. Source-drain diode forward characteristics

Figure 13. Normalized $B_{V_{DS}}$ vs temperature

**Figure 14. Maximum avalanche energy vs
starting T_j**





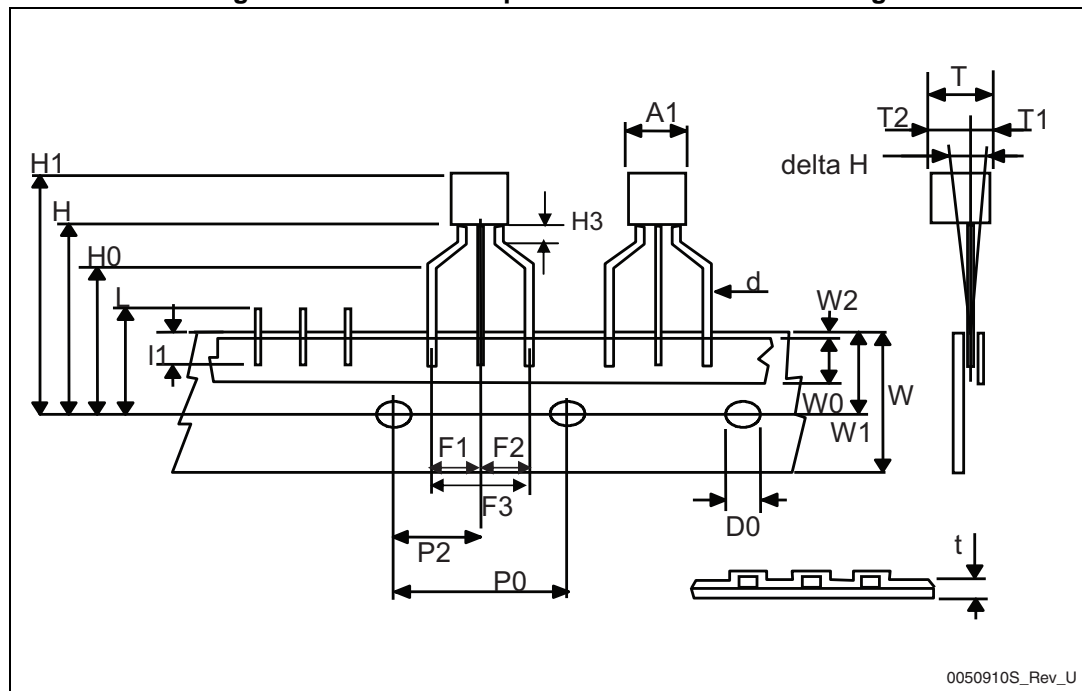
4 Package mechanical data

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. TO-92 ammopack mechanical data

| Dim. | mm | | |
|---------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A1 | | | 4.80 |
| T | | | 3.80 |
| T1 | | | 1.60 |
| T2 | | | 2.30 |
| d | 0.45 | 0.47 | 0.48 |
| P0 | 12.50 | 12.70 | 12.90 |
| P2 | 5.65 | 6.35 | 7.05 |
| F1, F2 | 2.40 | 2.50 | 2.94 |
| F3 | 4.98 | 5.08 | 5.48 |
| delta H | -2.00 | | 2.00 |
| W | 17.50 | 18.00 | 19.00 |
| W0 | 5.5 | 6.00 | 6.5 |
| W1 | 8.50 | 9.00 | 9.25 |
| W2 | | | 0.50 |
| H | | 18.50 | 21 |
| H3 | 0.5 | 1 | 2 |
| H0 | 15.50 | 16.00 | 18.8 |
| H1 | | 25.0 | 27.0 |
| D0 | 3.80 | 4.00 | 4.20 |
| t | | | 0.90 |
| L | | | 11.00 |
| l1 | 3.00 | | |
| delta P | -1.00 | | 1.00 |

Figure 21. TO-92 ammpack mechanical data drawing



5 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 24-Jun-2013 | 1 | First release. Part number previously included in datasheet DocID17206 |

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