



STD95N04 STP95N04

N-channel 40V - 5.4mΩ - 80A - DPAK - TO-220
STripFET™ Power MOSFET

General features

| Type | V _{DSS} | R _{DS(on)} | I _D | P _w |
|----------|------------------|---------------------|----------------|----------------|
| STD95N04 | 40V | <6.5mΩ | 80A | 110W |
| STP95N04 | 40V | <6.5mΩ | 80A | 110W |

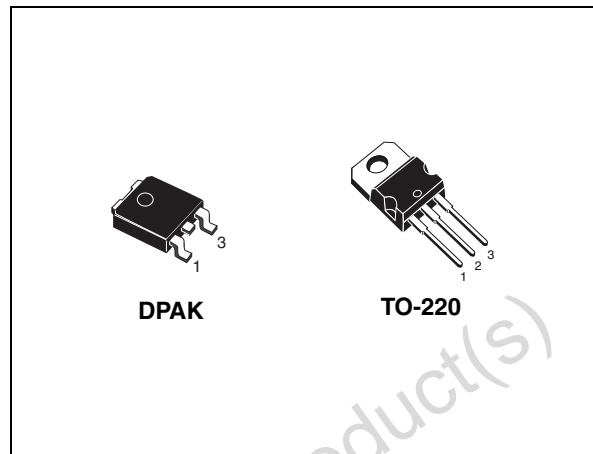
- Standard threshold drive
- 100% avalanche tested

Description

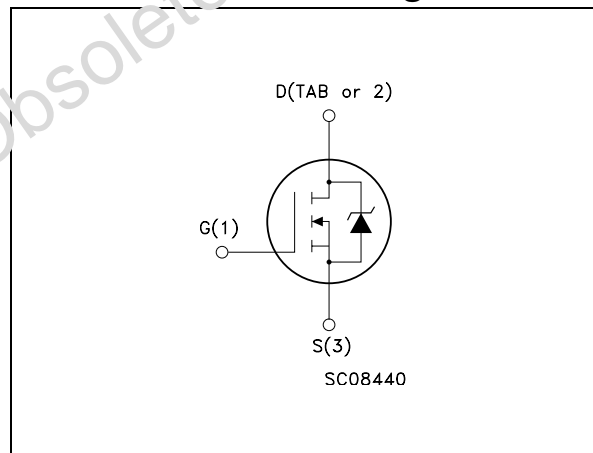
This n-channel enhancement mode Power MOSFET is the latest refinement of STMicroelectronic unique “Single Feature Size™” strip-based process with less critical alignment steps and therefore a remarkable manufacturing reproducibility. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and low gate charge.

Applications

- Switching application



Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|-------------|---------|---------|-------------|
| STD95N04 | D95N04 | DPAK | Tape & reel |
| STP95N04 | P95N04 | TO-220 | Tube |

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|------|
| V_{DS} | Drain-source voltage ($V_{GS}=0$) | 40 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 80 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 65 | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 320 | A |
| P_{TOT} | Total dissipation at $T_C = 25^\circ\text{C}$ | 110 | W |
| | Derating factor | 0.73 | W/°C |
| $dv/dt^{(3)}$ | Peak diode recovery voltage slope | 8 | V/ns |
| $E_{AS}^{(4)}$ | Single pulse avalanche energy | 400 | mJ |
| T_j T_{stg} | Operating junction temperature Storage temperature | -55 to 175 | °C |

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS} \leq V_{(BR)DSS}$, $T_j \leq T_{jmax}$
4. Starting $T_j = 25^\circ\text{C}$, $I_D = 40\text{ A}$, $V_{DD} = 30\text{ V}$

Table 2. Thermal resistance

| Symbol | Parameter | Value | | Unit |
|-------------------------|--|--------|------|------|
| | | TO-220 | DPAK | |
| Rthj-case | Thermal resistance junction-case max | 1.36 | | °C/W |
| Rthj-a | Thermal resistance junction-ambient max | 62.5 | -- | °C/W |
| Rthj-pcb ⁽¹⁾ | Thermal resistance junction-ambient max | -- | 50 | °C/W |
| T_l | Maximum lead temperature for soldering purpose | 300 | -- | °C |

1. When mounted on 1inch² FR-4 2Oz Cu board

2 Electrical characteristics

($T_{CASE}=25^{\circ}C$ unless otherwise specified)

Table 3. Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\mu A, V_{GS} = 0$ | 40 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating}, T_c = 125^{\circ}C$ | | | 10 100 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20V$ | | | ± 200 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10V, I_D = 40A$ | | 5.4 | 6.5 | m Ω |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min | Typ. | Max. | Unit |
|----------------|------------------------------|---|-----|------|------|------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 25V, I_D = 40A$ | | 100 | | S |
| C_{iss} | Input capacitance | $V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$ | | 2200 | | pF |
| C_{oss} | Output capacitance | | | 580 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 40 | | pF |
| Q_g | Total gate charge | $V_{DD} = 20V, I_D = 80A$ | | 40 | 54 | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10V$ | | 11 | | nC |
| Q_{gd} | Gate-drain charge | (see Figure 13) | | 8 | | nC |

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

Table 5. Switching on/off (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|---------------------------------|--|------|----------|------|----------|
| $t_{d(on)}$ t_r | Turn-on delay time Rise time | $V_{DD}=20V, I_D= 40A,$ $R_G=4.7\Omega, V_{GS}=10V$ <i>(see Figure 15)</i> | | 15 50 | | ns ns |
| $t_{d(off)}$ t_f | Turn-off delay time Falltime | $V_{DD}=20V, I_D= 40A,$ $R_G=4.7\Omega, V_{GS}=10V$ <i>(see Figure 15)</i> | | 40 15 | | ns ns |

Table 6. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|---|------|-----------------|-----------|---------------|
| I_{SD} $I_{SDM}^{(1)}$ | Source-drain current Source-drain current (pulsed) | | | | 80 320 | A A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD}=80A, V_{GS}=0$ | | | 1.5 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD}=80A,$ $di/dt = 100A/\mu s,$ $V_{DD}=30V, T_J=150^\circ C$ <i>(see Figure 14)</i> | | 45 60 2.8 | | ns nC A |

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

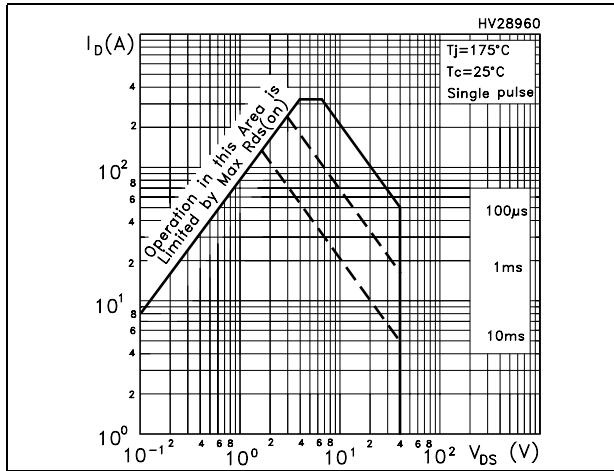


Figure 2. Thermal impedance

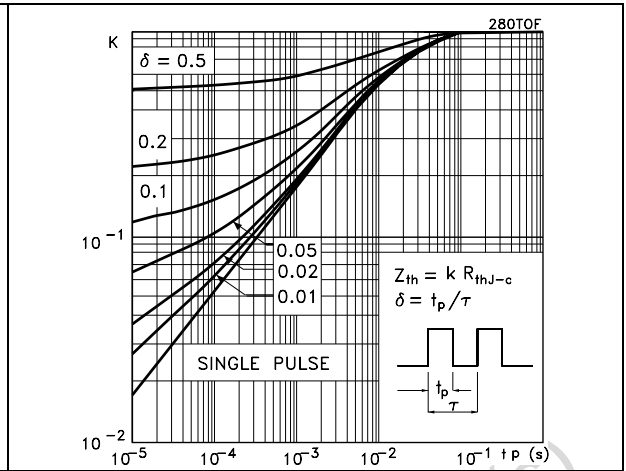


Figure 3. Output characteristics

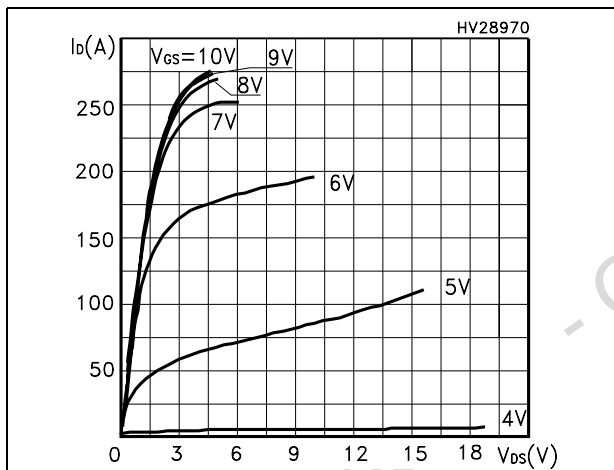


Figure 4. Transfer characteristics

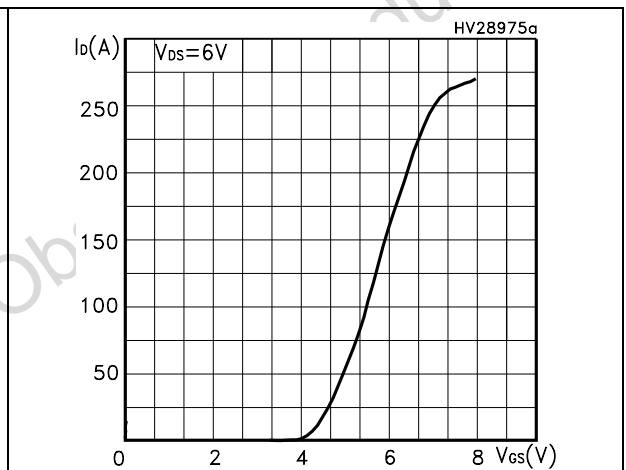


Figure 5. Static drain-source on resistance

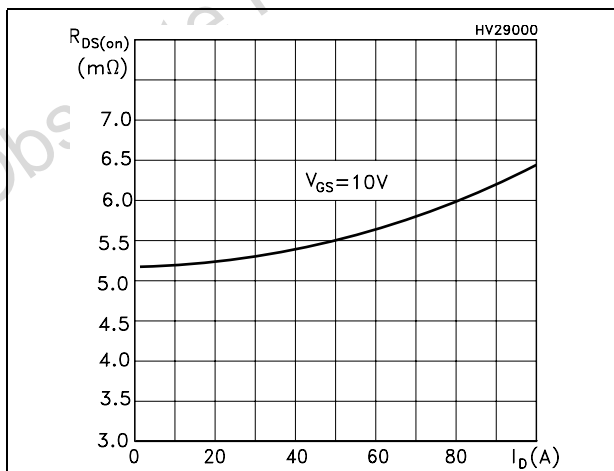


Figure 6. Normalized BV_{DSS} vs temperature

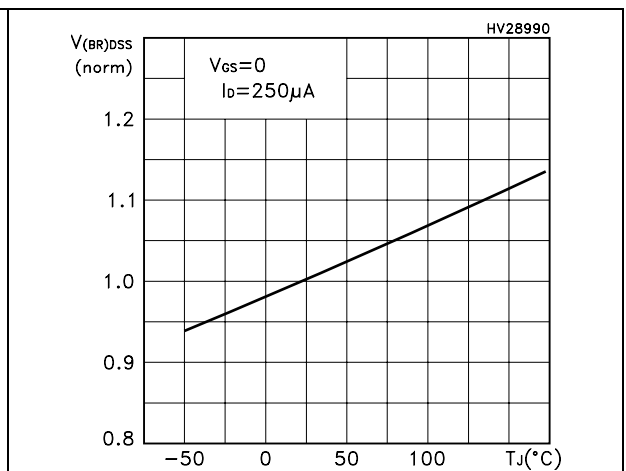


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

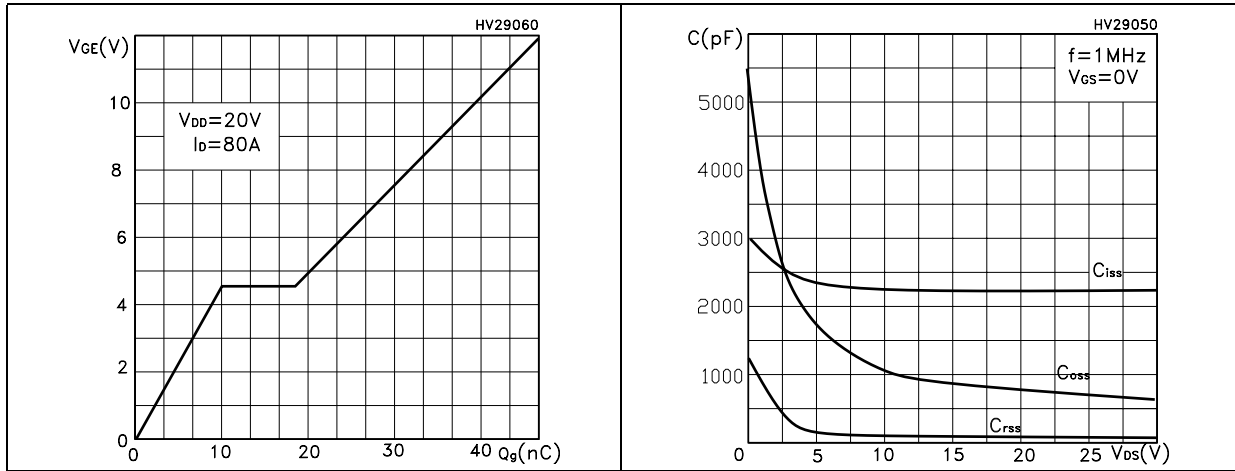


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

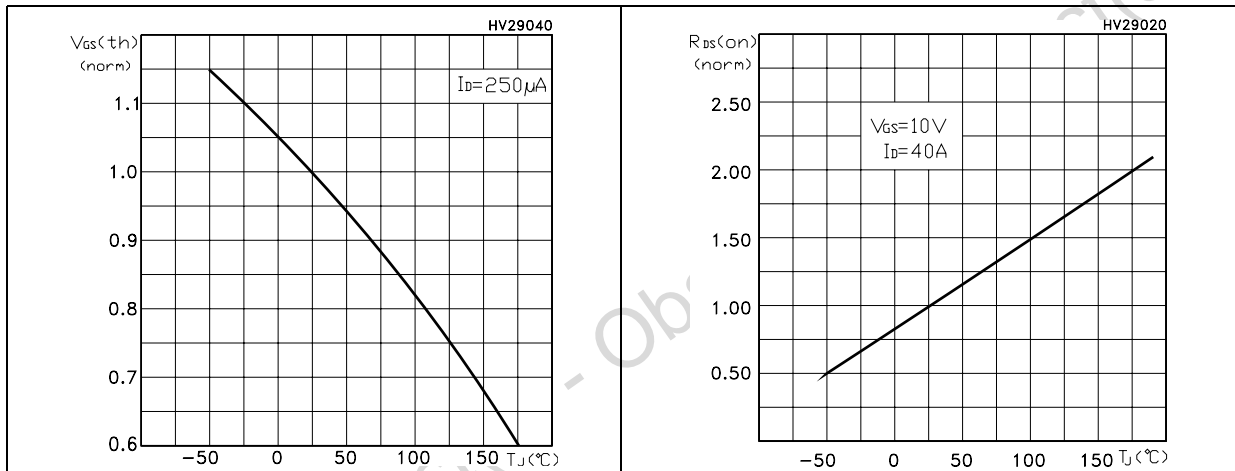
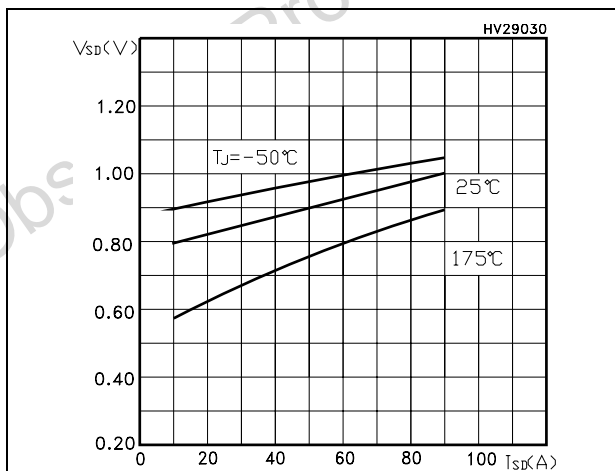


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load

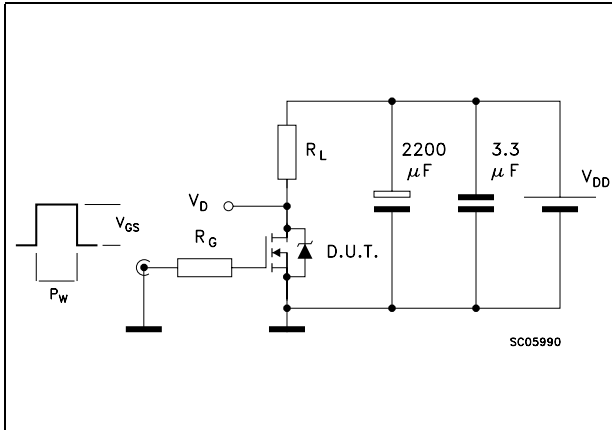


Figure 13. Gate charge test circuit

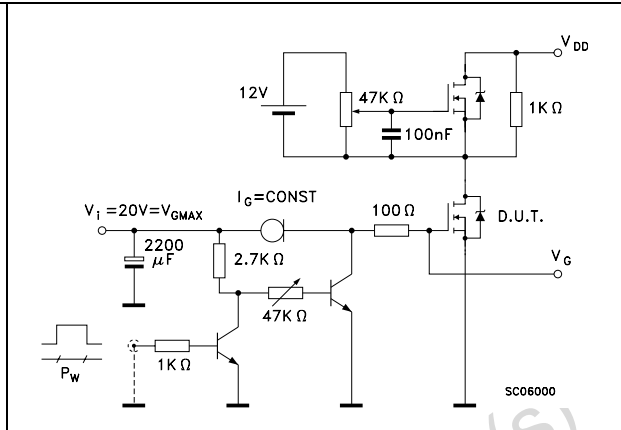


Figure 14. Test circuit for inductive load switching and diode recovery times

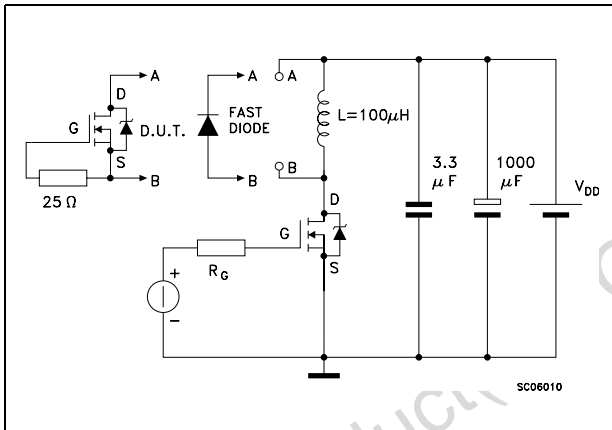


Figure 15. Unclamped Inductive load test circuit

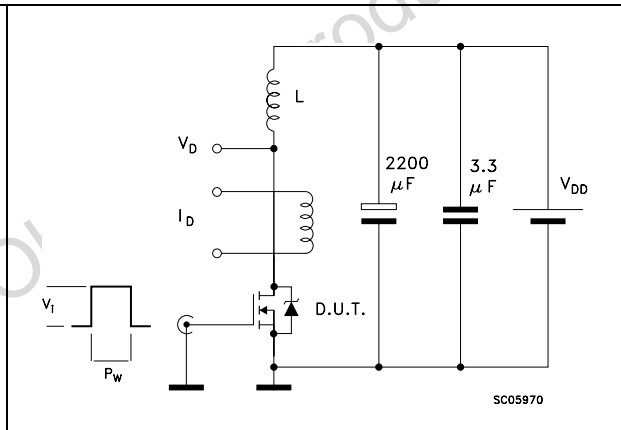


Figure 16. Unclamped inductive waveform

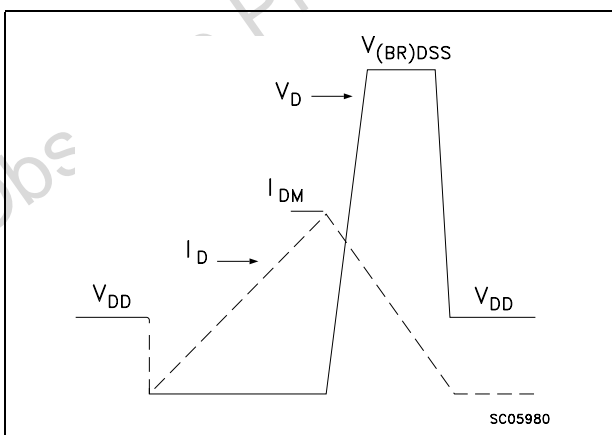
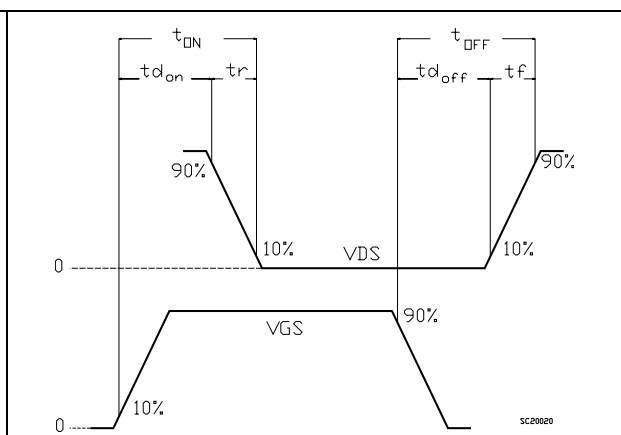


Figure 17. Switching time waveform



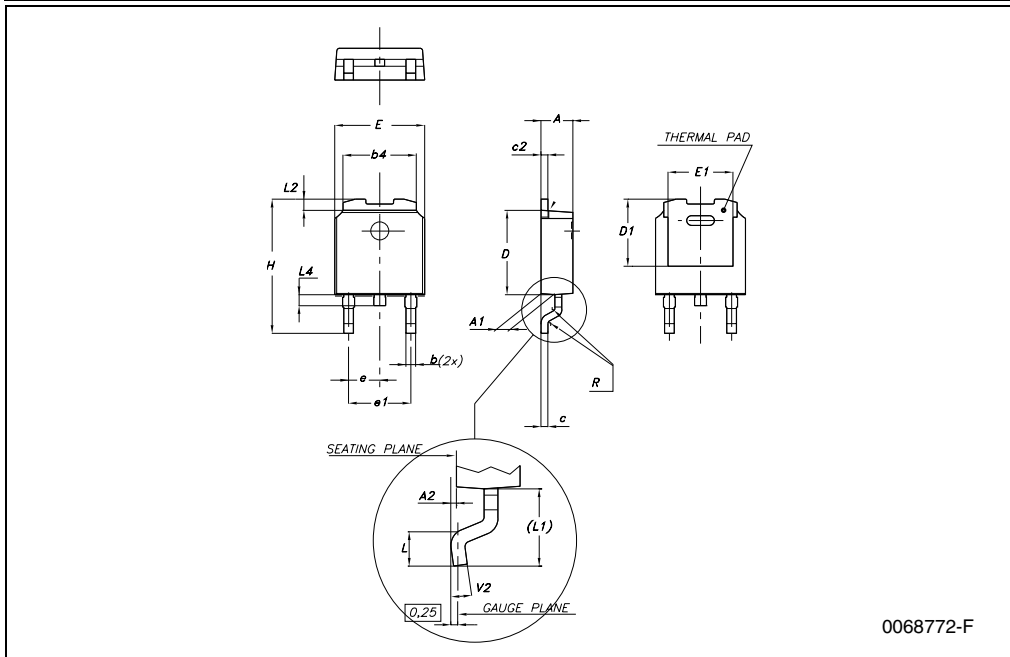
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

Obsolete Product(s) - Obsolete Product(s)

DPAK MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.9 | 0.025 | | 0.035 |
| b4 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.6 | 0.019 | | 0.023 |
| D | 6 | | 6.2 | 0.236 | | 0.244 |
| D1 | | 5.1 | | | 0.200 | |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| E1 | | 4.7 | | | 0.185 | |
| e | | 2.28 | | | 0.090 | |
| e1 | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 9.35 | | 10.1 | 0.368 | | 0.397 |
| L | 1 | | | 0.039 | | |
| (L1) | | 2.8 | | | 0.110 | |
| L2 | | 0.8 | | | 0.031 | |
| L4 | 0.6 | | 1 | 0.023 | | 0.039 |
| R | | 0.2 | | | 0.008 | |
| V2 | 0° | | 8° | 0° | | 8° |

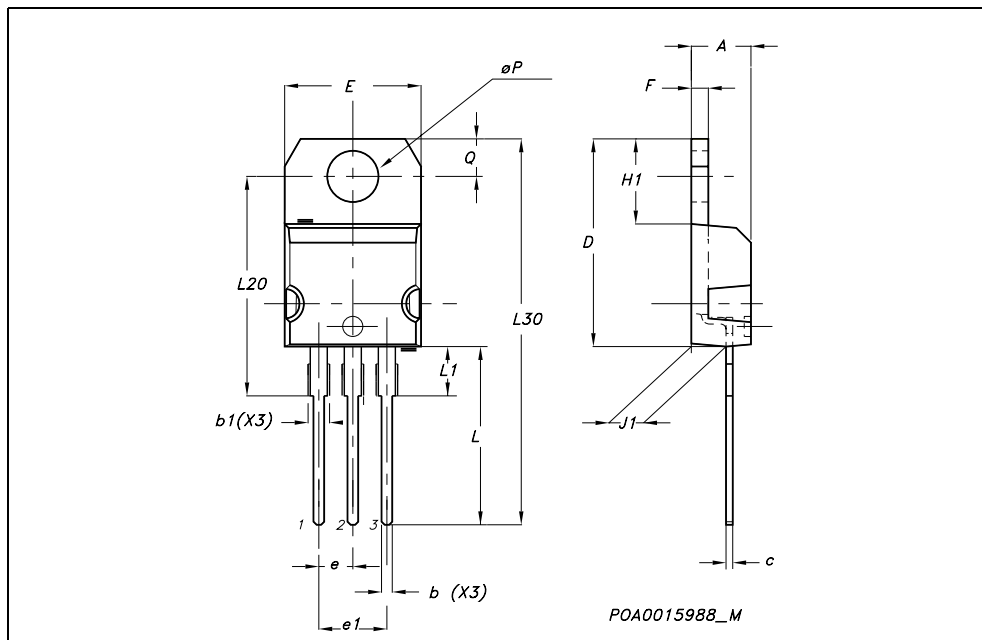


Obsole

0068772-F

TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.052 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



Obsole

5 Packaging mechanical data

DPAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

| BASE QTY | BULK QTY |
|----------|----------|
| 2500 | 2500 |

| DIM. | mm | | inch | |
|------|------|------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 6.8 | 7 | 0.267 | 0.275 |
| B0 | 10.4 | 10.6 | 0.409 | 0.417 |
| B1 | | 12.1 | | 0.476 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.5 | | 0.059 | |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 7.4 | 7.6 | 0.291 | 0.299 |
| K0 | 2.55 | 2.75 | 0.100 | 0.108 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 7.9 | 8.1 | 0.311 | 0.319 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 40 | | 1.574 | |
| W | 15.7 | 16.3 | 0.618 | 0.641 |

TOP COVER TAPE

User Direction of Feed

Center line of cavity

Bending radius R min.

FEED DIRECTION

For machine ref. only including draft and radii concentric around B0

10 pitches cumulative tolerance on tape +/- 0.2 mm

6 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|----------|---------------------------------------|
| 24-Oct-2005 | 2 | Inserted ecopack indication |
| 07-Dec-2005 | 3 | Complete version |
| 08-Jan-2006 | 4 | DPAK mechanical data has been updated |

Obsolete Product(s) - Obsolete Product(s)

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