



STD60NF06

N-channel 60V - 0.014Ω - 60A - DPAK
STripFET™ II Power MOSFET

General features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|-----------|------------------|---------------------|----------------|
| STD60NF06 | 60V | <0.016Ω | 60A |

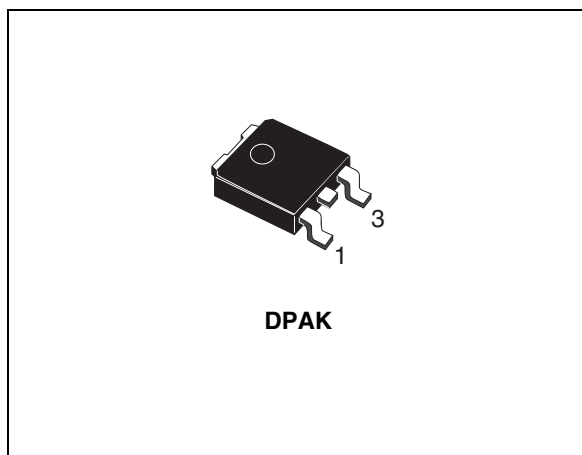
- Exceptional dv/dt capability
- Application oriented characterization
- 100% avalanche tested

Description

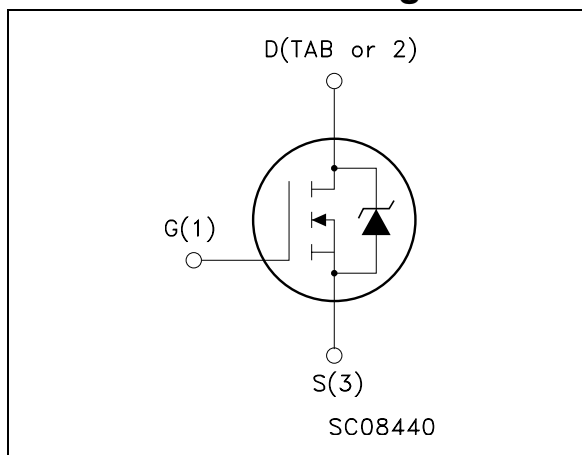
This Power Mosfet series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is also intended for any application with low gate charge drive requirements.

Applications

- Switching application



Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|-------------|---------|---------|-------------|
| STD60NF06T4 | D60NF06 | DPAK | Tape & reel |

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1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 60 | V |
| V_{DGR} | Drain-gate voltage ($R_{GS} = 20\text{ k}\Omega$) | 60 | V |
| V_{GS} | Gate- source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 60 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 42 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 240 | A |
| P_{tot} | Total dissipation at $T_C = 25^\circ\text{C}$ | 110 | W |
| | Derating Factor | 0.73 | W/°C |
| $dv/dt^{(2)}$ | Peak diode recovery avalanche energy | 4 | V/ns |
| T_{stg} | Storage temperature | -55 to 175 | °C |
| T_j | Max. operating junction temperature | | |

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 60\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq 24\text{V}$, $T_j \leq T_{JMAX}$

Table 2. Thermal data

| | | | |
|----------------|--|------|------|
| $R_{thj-case}$ | Thermal resistance junction-case max | 1.36 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-to ambient max | 100 | °C/W |
| T_J | Maximum lead temperature for soldering purpose | 275 | °C |

Table 3. Avalanche characteristics

| Symbol | Parameter | Max value | Unit |
|----------|---|-----------|------|
| I_{AR} | Avalanche Current, Repetitive Or Not-repetitive (pulse width limited by T_j max) | 30 | A |
| E_{AS} | Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 30\text{ V}$) | 350 | mJ |

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\mu A, V_{GS} = 0$ | 60 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating},$ $T_C = 175^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20V$ | | | ± 100 | 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 | $V_{GS} = 10V, I_D = 30A$ | | 0.014 | 0.016 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|--|------|-----------------------|------|----------------------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 15V, I_D = 30A$ | | 20 | | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$ | | 1810 360 125 | | pF pF pF |
| $t_{d(on)}$ t_r $t_{d(off)}$ t_f | Turn-on delay time Rise time Turn-off delay time Fall time | $V_{DD} = 30V, I_D = 30A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12) | | 16 108 43 20 | | ns ns ns ns |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 48V, I_D = 60A,$ $V_{GS} = 10V$ (see Figure 13) | | 49 18 14 | 66 | nC nC nC |

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

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) | | | | 60 240 | A A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 60A, V_{GS} = 0$ | | | 1.3 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD} = 60A, di/dt = 100A/\mu s,$ $V_{DD} = 25V, T_j = 150^\circ C$ (see Figure 14) | | 73 182 5 | | ns nC 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 1. Safe operating area

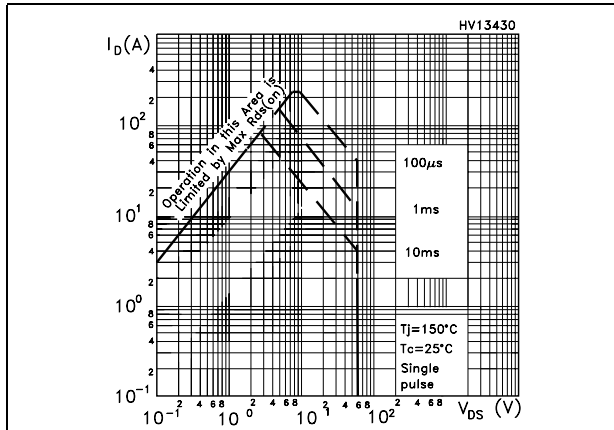


Figure 2. Thermal impedance

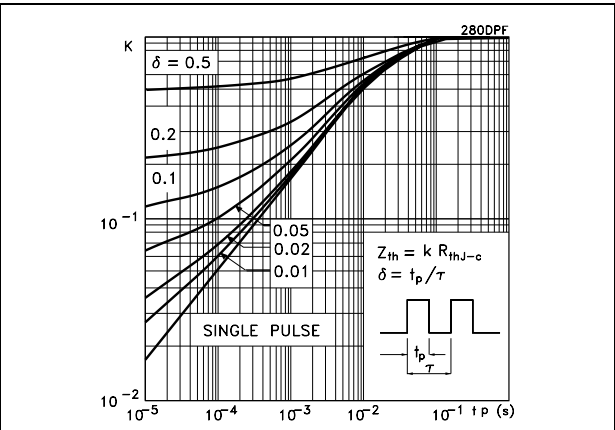


Figure 3. Output characteristics

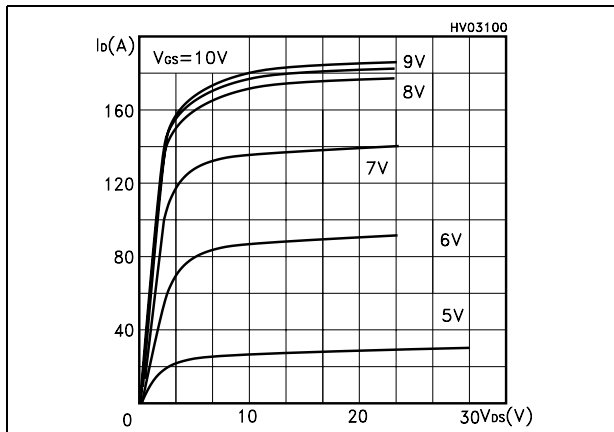


Figure 4. Transfer characteristics

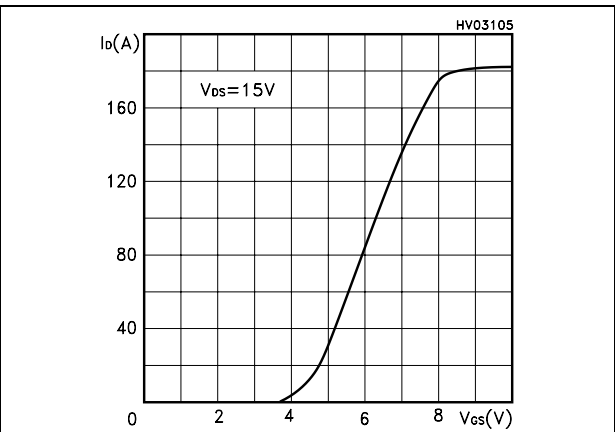


Figure 5. Transconductance

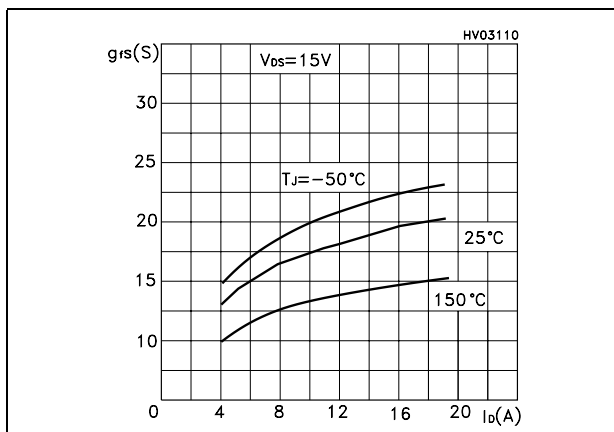


Figure 6. Static drain-source on resistance

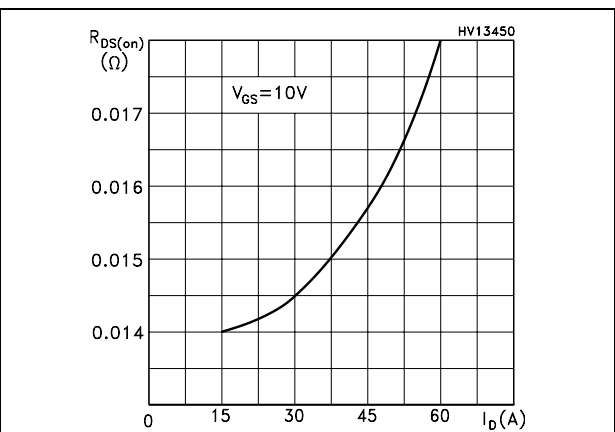


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

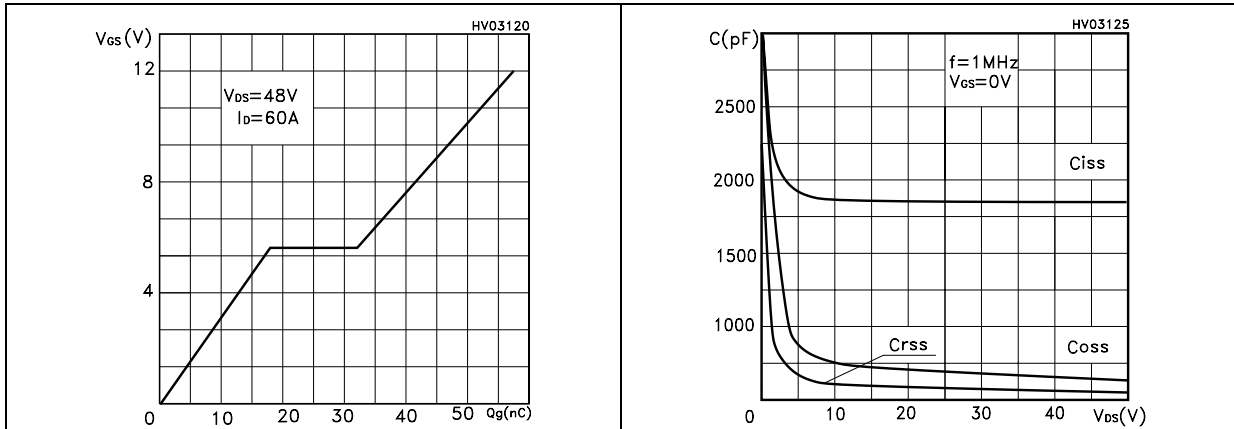


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

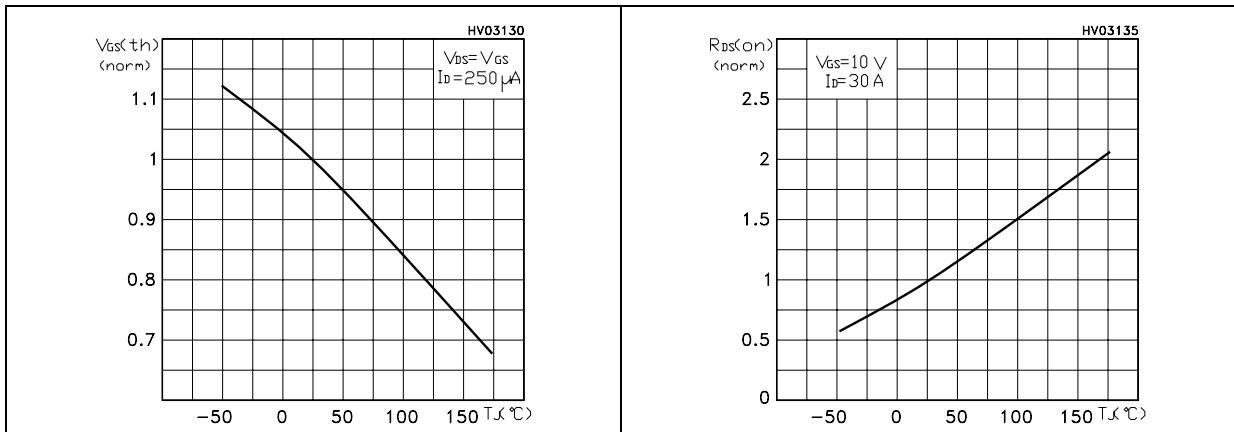
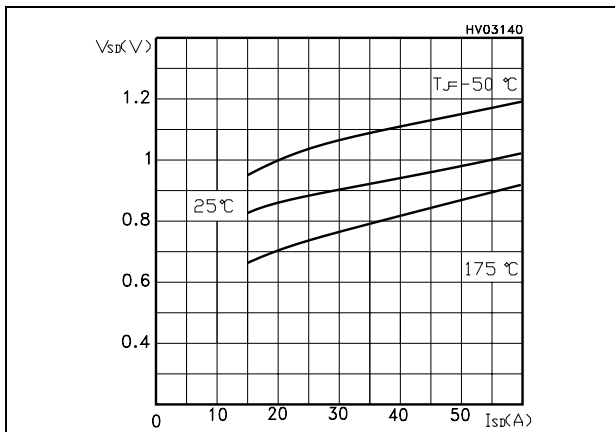


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load



Figure 13. Gate charge test circuit

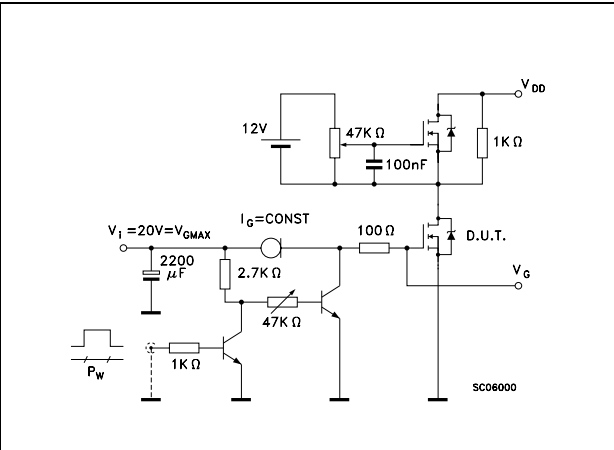


Figure 14. Test circuit for inductive load switching and diode recovery times



Figure 15. Unclamped Inductive load test circuit

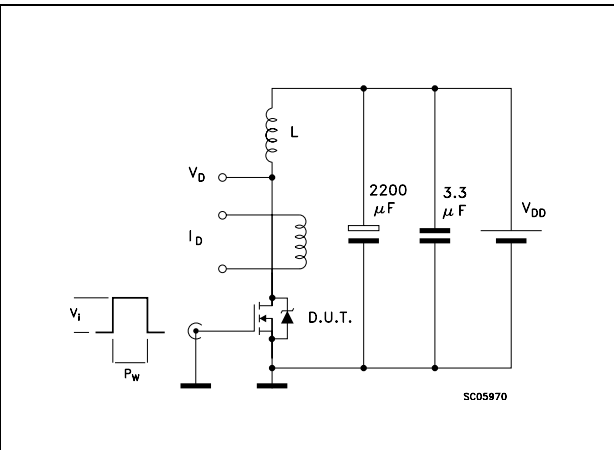


Figure 16. Unclamped inductive waveform

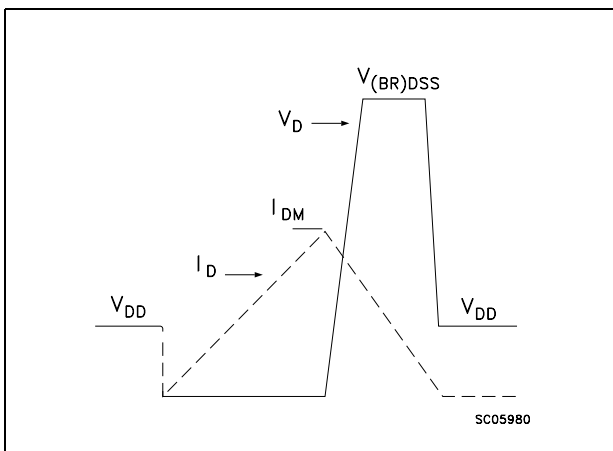
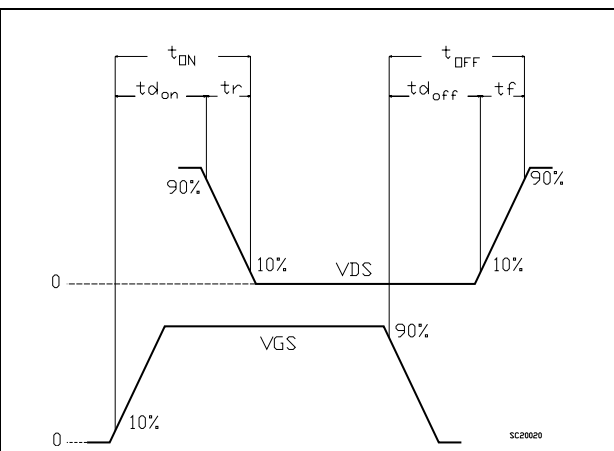


Figure 17. Switching time waveform

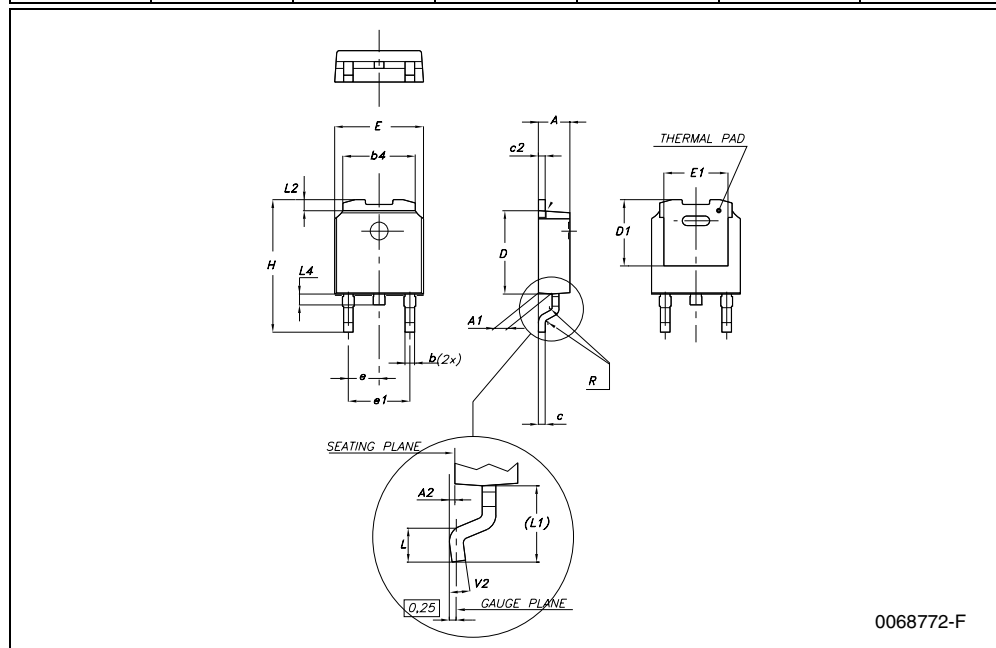


4 Package mechanical data

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

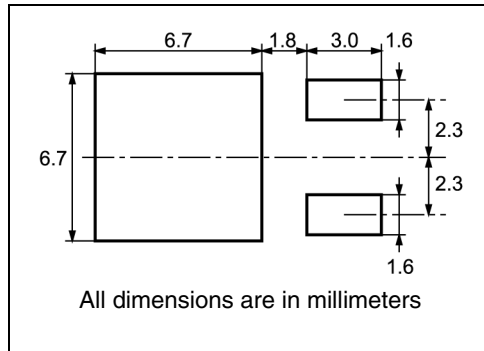
DPAK MECHANICAL DATA

| 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° |



5 Packing 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

REEL MECHANICAL DATA

| 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 |

TAPE MECHANICAL DATA

| 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

FEED DIRECTION

Bending radius R min.

Center line of cavity

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 |
|-------------|-----------------|---------------------------------|
| 21-Jun-2004 | 1 | Preliminary document |
| 13-Jul-2006 | 2 | New template, no content change |

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