# HAT2166H

## Silicon N Channel Power MOS FET Power Switching

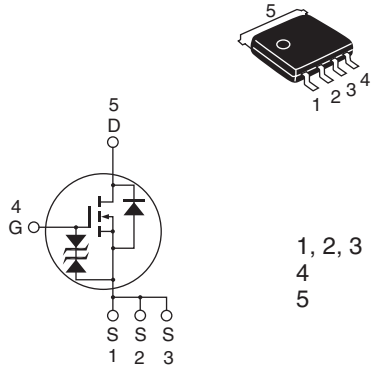
REJ03G0005-0500Z
Rev.5.00
Apr.09.2003

### Features

- High speed switching
- Capable of 4.5 V gate drive
- Low drive current
- High density mounting
- Low on-resistance
  $R_{DS(on)}$ = 2.9 mΩ typ. (at $V_{GS}$ = 10 V)

### Outline

LFPAK




| | |
|---|---|
| 1, 2, 3 | Source |
| 4 | Gate |
| 5 | Drain |

## Absolute Maximum Ratings

(Ta = 25°C)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to source voltage | $V_{DSS}$ | 30 | V |
| Gate to source voltage | $V_{GSS}$ | ±20 | V |
| Drain current | $I_D$ | 45 | A |
| Drain peak current | $I_{D(pulse)}$ Note1 | 180 | A |
| Body-drain diode reverse drain current | $I_{DR}$ | 45 | A |
| Avalanche current | $I_{AP}$ Note 2 | 25 | A |
| Avalanche energy | $E_{AR}$ Note 2 | 62.5 | mJ |
| Channel dissipation | Pch Note3 | 25 | W |
| Channel to Case Thermal Resistance | θch-C | 5.0 | °C/W |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%
2. Value at Tch = 25°C, Rg ≥ 50 Ω
3. Tc = 25°C

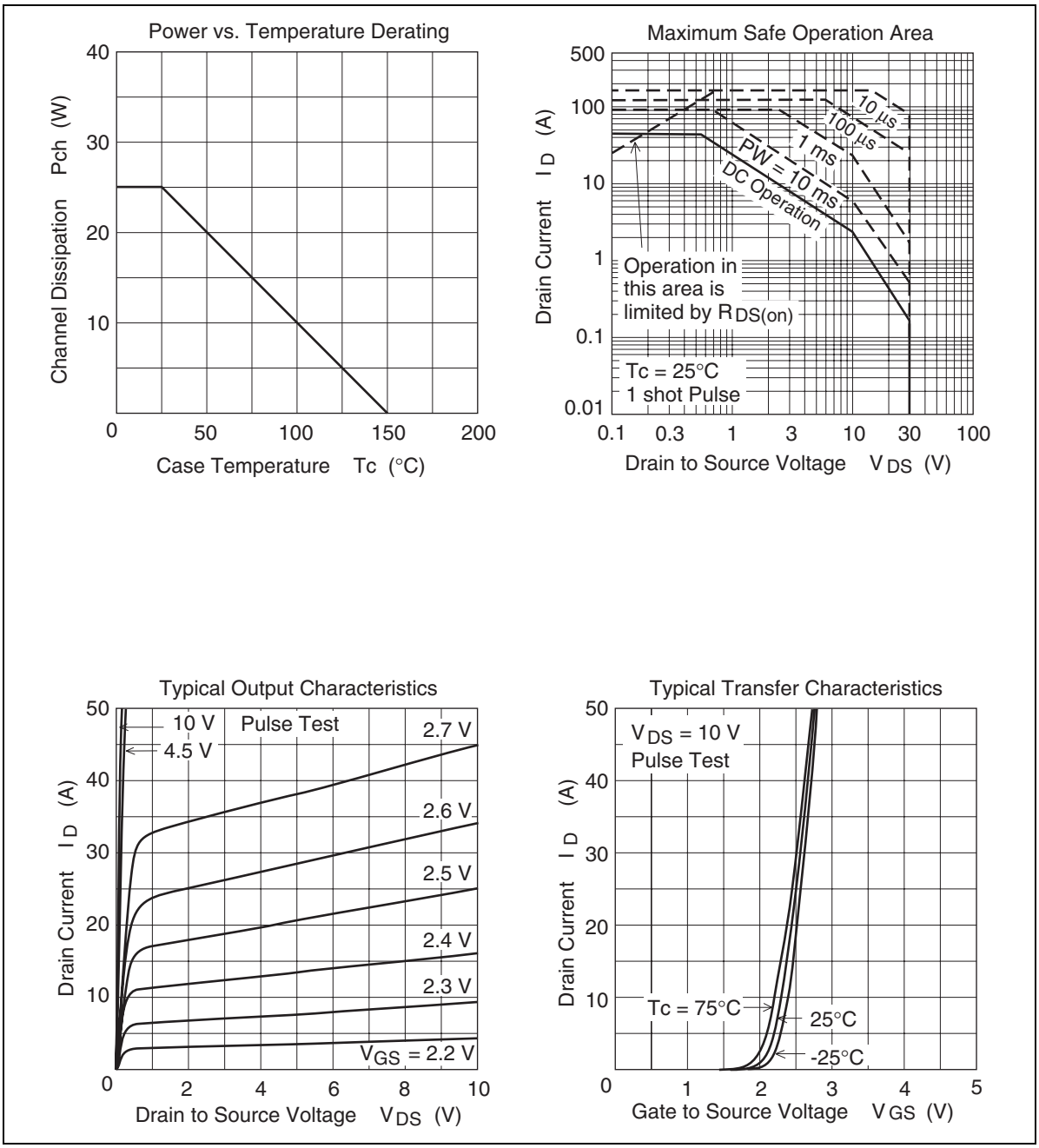
## Electrical Characteristics

(Ta = 25°C)

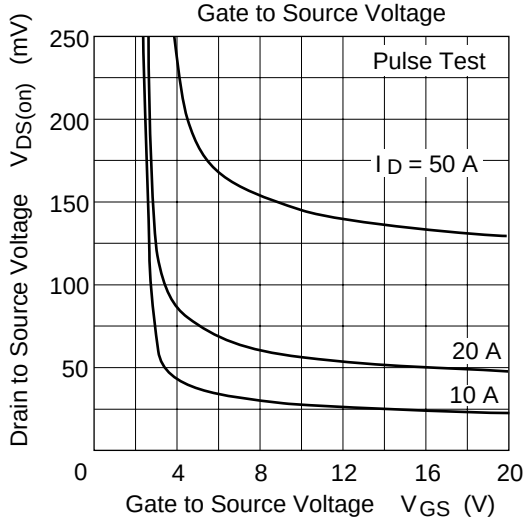
| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 30 | — | — | V | $I_D$ = 10 mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | ± 20 | — | — | V | $I_G$ = ±100 µA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS}$ | — | — | ± 10 | µA | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 |
| Zero gate voltage drain current | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 30 V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | 1.0 | — | 2.5 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 2.9 | 3.8 | mΩ | $I_D$ = 22.5 A, $V_{GS}$ = 10 V Note4 |
| | $R_{DS(on)}$ | — | 4.0 | 6.1 | mΩ | $I_D$ = 22.5 A, $V_{GS}$ = 4.5 V Note4 |
| Forward transfer admittance | $\|y_{fs}\|$ | 52 | 87 | — | S | $I_D$ = 22.5 A, $V_{DS}$ = 10 V Note4 |
| Input capacitance | Ciss | — | 4400 | — | pF | $V_{DS}$ = 10 V |
| Output capacitance | Coss | — | 1000 | — | pF | $V_{GS}$ = 0 |
| Reverse transfer capacitance | Crss | — | 330 | — | pF | f = 1 MHz |
| Gate Resistance | Rg | — | 0.5 | — | Ω | |
| Total gate charge | Qg | — | 27 | — | nc | $V_{DD}$ = 10 V |
| Gate to source charge | Qgs | — | 12 | — | nc | $V_{GS}$ = 4.5 V |
| Gate to drain charge | Qgd | — | 5.9 | — | nc | $I_D$ = 45 A |
| Turn-on delay time | $t_{d(on)}$ | — | 12 | — | ns | $V_{GS}$ = 10 V, $I_D$ = 22.5 A |
| Rise time | $t_r$ | — | 35 | — | ns | $V_{DD}$ ≅ 10 V |
| Turn-off delay time | $t_{d(off)}$ | — | 55 | — | ns | $R_L$ = 0.44 Ω |
| Fall time | $t_f$ | — | 7.5 | — | ns | Rg = 4.7 Ω |
| Body–drain diode forward voltage | $V_{DF}$ | — | 0.83 | 1.08 | V | IF = 45 A, $V_{GS}$ = 0 Note4 |
| Body–drain diode reverse recovery time | $t_{rr}$ | — | 37 | — | ns | IF = 45 A, $V_{GS}$ = 0<br>diF/ dt = 100 A/ µs |

Notes: 4. Pulse test

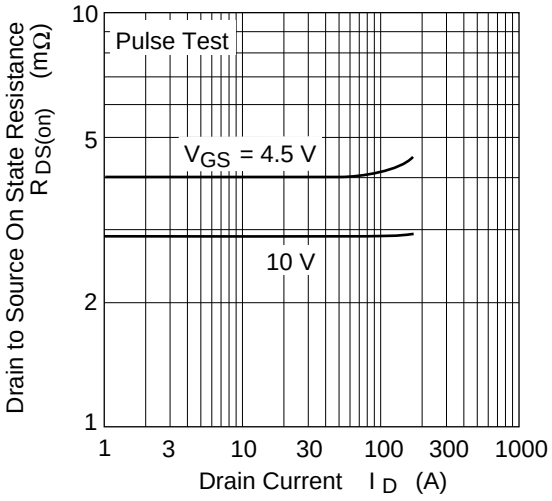
## Main Characteristics



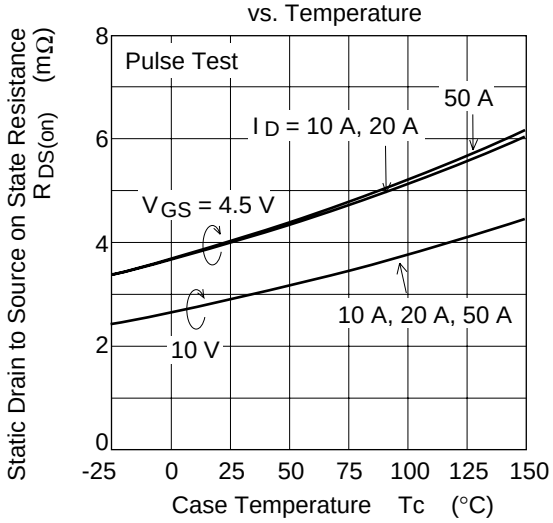
Drain to Source Saturation Voltage vs. Gate to Source Voltage



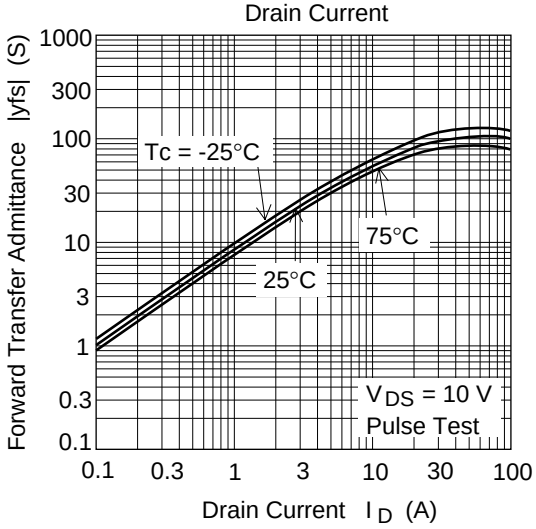

Static Drain to Source on State Resistance vs. Drain Current



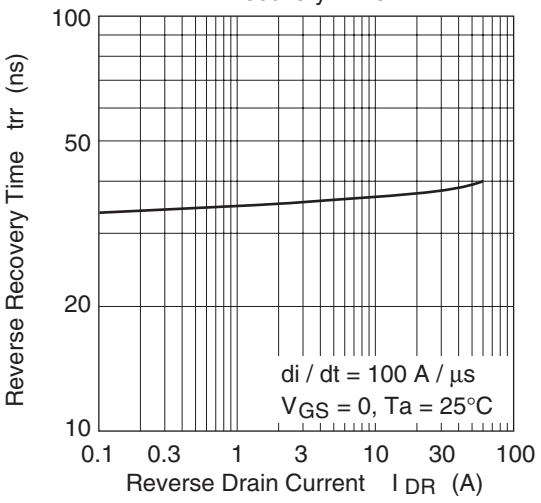

Static Drain to Source on State Resistance vs. Temperature



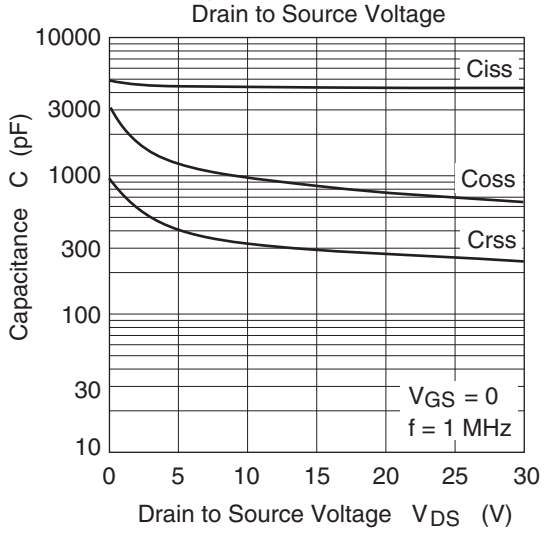

Forward Transfer Admittance vs. Drain Current



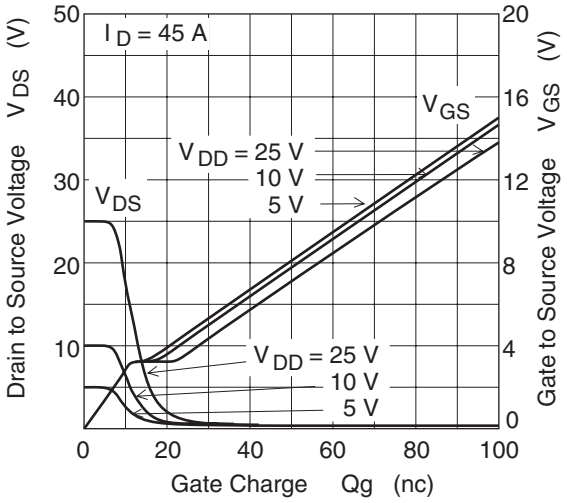
Body-Drain Diode Reverse Recovery Time



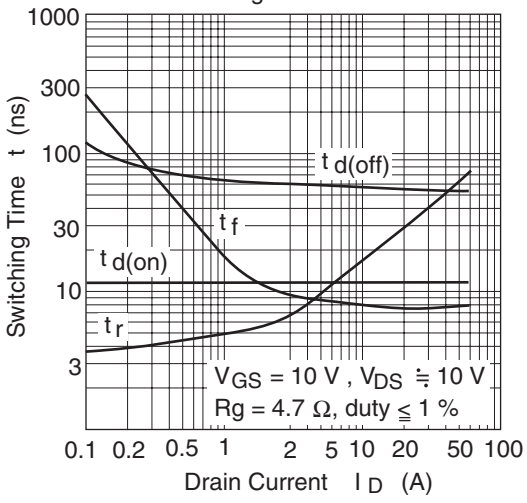

Typical Capacitance vs. Drain to Source Voltage



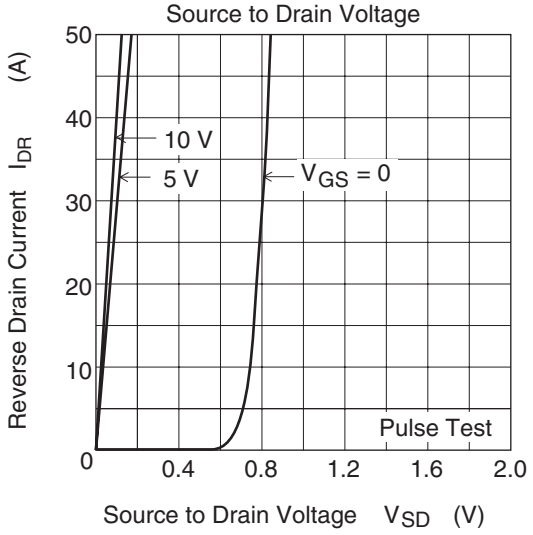

Dynamic Input Characteristics



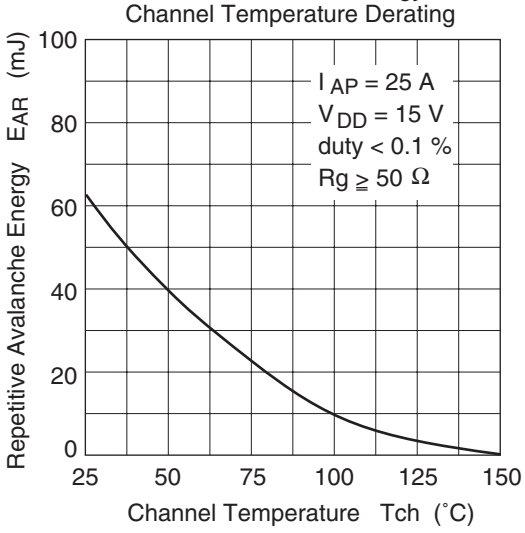

Switching Characteristics



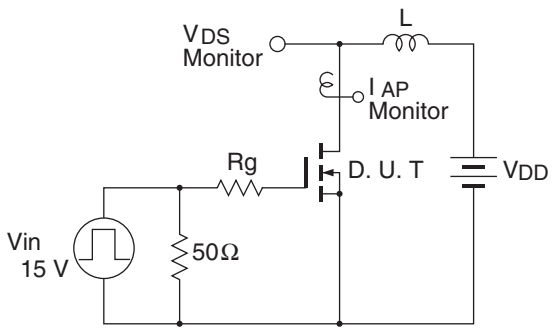
Reverse Drain Current vs. Source to Drain Voltage




Maximum Avalanche Energy vs. Channel Temperature Derating

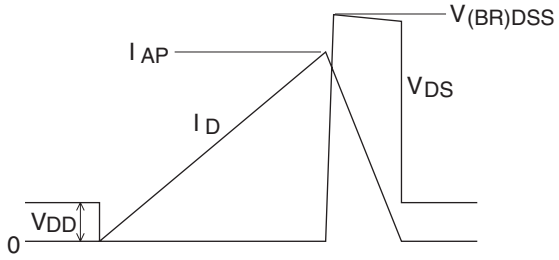



Avalanche Test Circuit

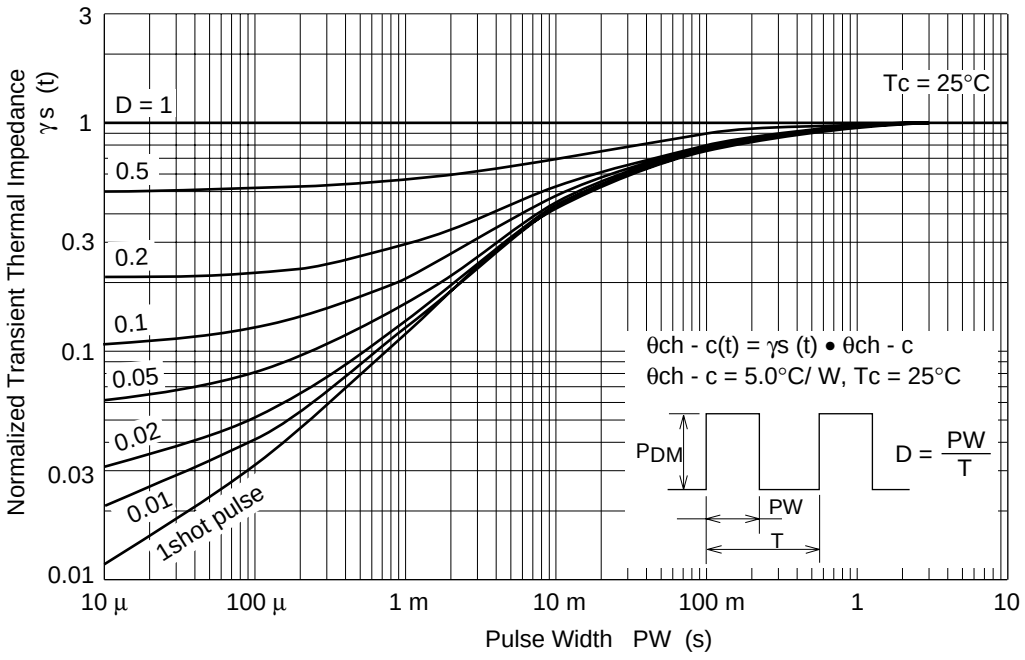



Avalanche Waveform

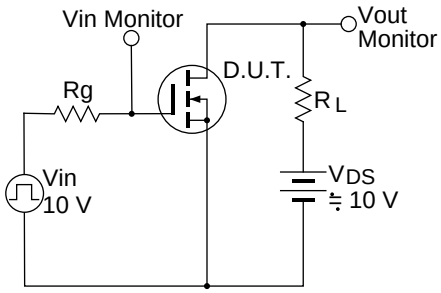
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



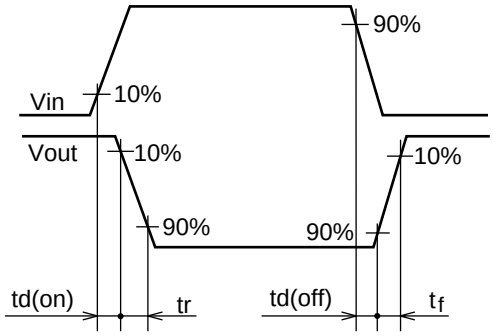
Normalized Transient Thermal Impedance vs. Pulse Width




Switching Time Test Circuit



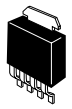

Switching Time Waveform

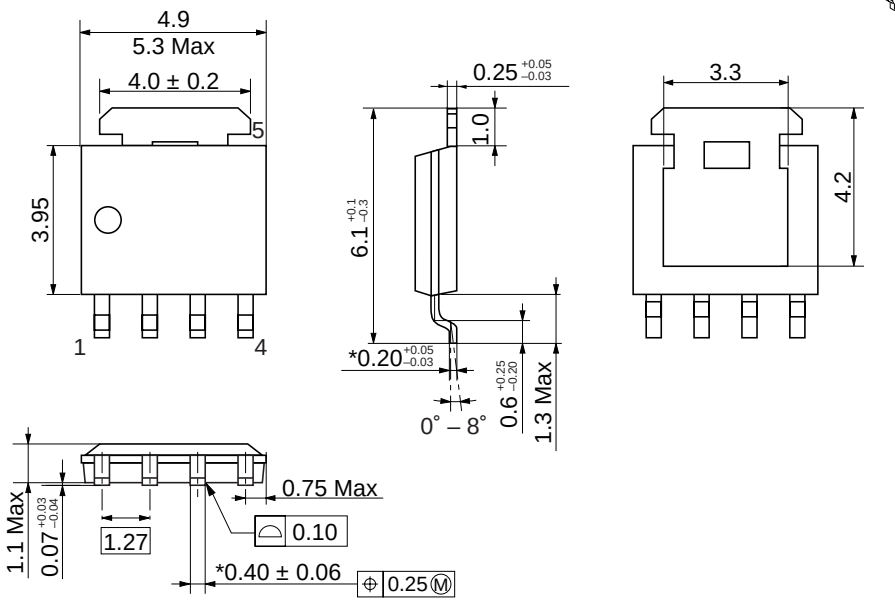


## Package Dimensions

As of January, 2003

Unit: mm






| | |
|---|---|
| Package Code | LFPAK |
| JEDEC | — |
| JEITA | — |
| Mass (reference value) | 0.080 g |

*Ni/Pd/Au plating

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Colophon 0.0