## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ max | $I_D$ max $T_A$ = +25°C |
|---|---|---|
| 30V | 12mΩ @ $V_{GS}$ = 10V | 10A |
| | 16mΩ @ $V_{GS}$ = 4.5V | 8.5A |

## Features and Benefits

- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm$^2$
- Low Gate Threshold Voltage
- Low On-Resistance
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Description and Applications

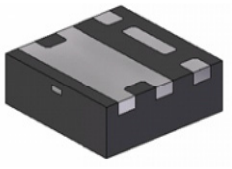
This MOSFET has been designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Battery Management Application
- Power Management Functions
- DC-DC Converters

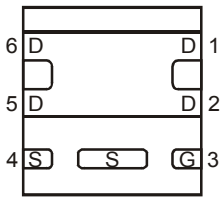
## Mechanical Data

- Case: U-DFN2020-6 Type E
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.0065 grams (approximate)

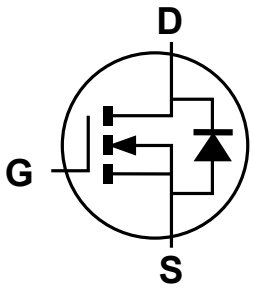
U-DFN2020-6
Type E



Bottom View




Pin Out




Internal Schematic

## Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---|---|---|
| DMN3016LFDE-7 | U-DFN2020-6 Type E | 3,000/Tape & Reel |
| DMN3016LFDE-13 | U-DFN2020-6 Type E | 10,000/Tape & Reel |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information

NR = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: Y = 2011)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|
| Code | Y | Z | A | B | C | D | E |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |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## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = 10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 10<br>8 | A |
| | t<10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 12<br>9 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | | $I_S$ | 2.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | 90 | A |
| Avalanche Current (Note 7) L = 0.1mH | | | $I_{AR}$ | 22 | A |
| Repetitive Avalanche Energy (Note 7) L = 0.1mH | | | $E_{AR}$ | 24 | mJ |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | $T_A$ = +25°C | $P_D$ | 0.73 | W |
| | $T_A$ = +70°C | | 0.47 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady state | $R_{\theta JA}$ | 171 | °C/W |
| | t<10s | | 121 | |
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 2.02 | W |
| | $T_A$ = +70°C | | 1.30 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | $R_{\theta JA}$ | 62 | °C/W |
| | t<10s | | 42 | |
| Thermal Resistance, Junction to Case (Note 6) | Steady state | $R_{\theta JC}$ | 9.3 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 30 | - | - | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | - | - | 1 | µA | $V_{DS}$ = 30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.4 | - | 2.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | - | 8 | 12 | mΩ | $V_{GS}$ = 10V, $I_D$ = 11A |
| | | - | 12 | 16 | | $V_{GS}$ = 4.5V, $I_D$ = 9A |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | - | 32 | - | S | $V_{DS}$ = 5V, $I_D$ = 12A |
| Diode Forward Voltage | $V_{SD}$ | - | 0.70 | 1.0 | V | $V_{GS}$ = 0V, $I_S$ = 1A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 1415 | - | pF | $V_{DS}$ = 15V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | - | 119 | - | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 82 | - | | |
| Gate resistance | $R_g$ | - | 2.6 | 3.2 | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1.0MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | - | 11.3 | - | nC | $V_{DS}$ = 15V, $I_D$ = 12A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | - | 25.1 | - | | |
| Gate-Source Charge | $Q_{gs}$ | - | 3.5 | - | | |
| Gate-Drain Charge | $Q_{gd}$ | - | 3.6 | - | | |
| Turn-On Delay Time | $t_{D(on)}$ | - | 4.8 | - | ns | $V_{DD}$ = 15V, $V_{GS}$ = 10V, $R_L$ = 1.25Ω, $R_G$ = 3Ω, |
| Turn-On Rise Time | $t_r$ | - | 16.5 | - | | |
| Turn-Off Delay Time | $t_{D(off)}$ | - | 26.1 | - | | |
| Turn-Off Fall Time | $t_f$ | - | 5.6 | - | | |
| Reverse Recovery Time | $t_{rr}$ | - | 12.3 | - | ns | $I_F$ = 12A, di/dt = 500A/µs |
| Reverse Recovery Charge | $Q_{rr}$ | - | 10.4 | - | nC | |

Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
7. $I_{AR}$ and $E_{AR}$ rating are based on low frequency and duty cycles to keep $T_J$ = +25°C
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.


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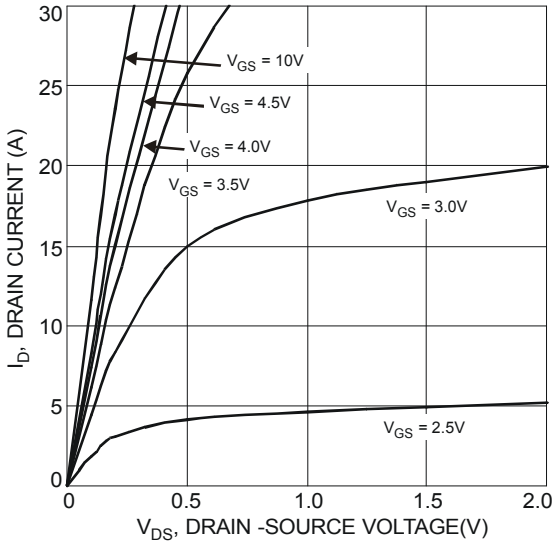


Fig. 1 Typical Output Characteristics

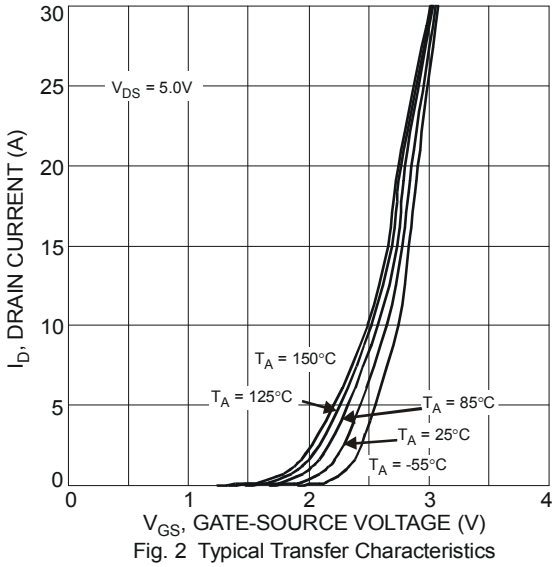


Fig. 2 Typical Transfer Characteristics

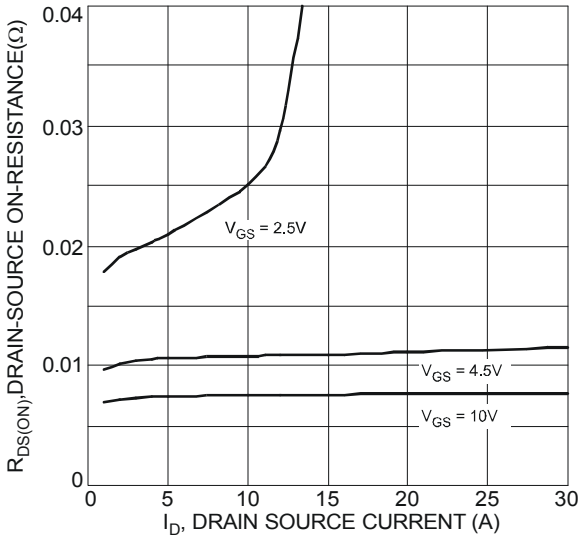


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

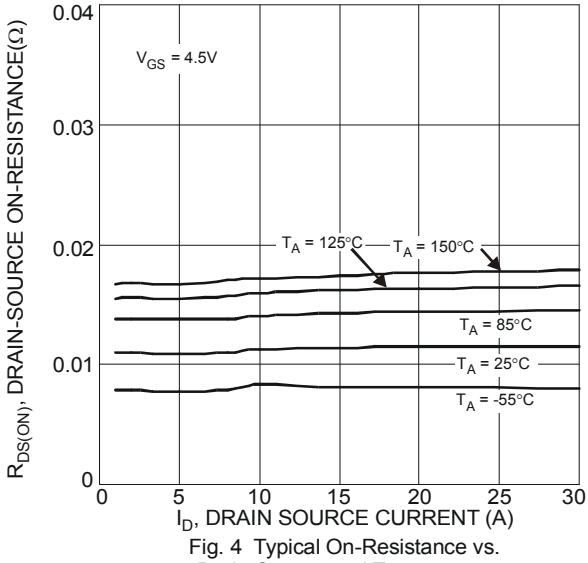


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

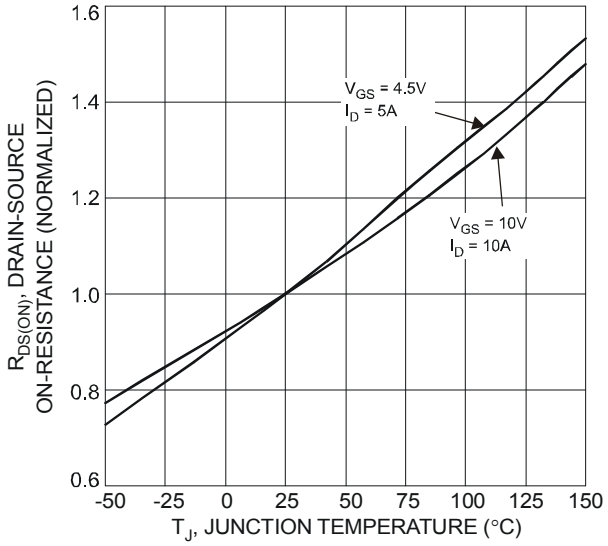


Fig. 5 On-Resistance Variation with Temperature

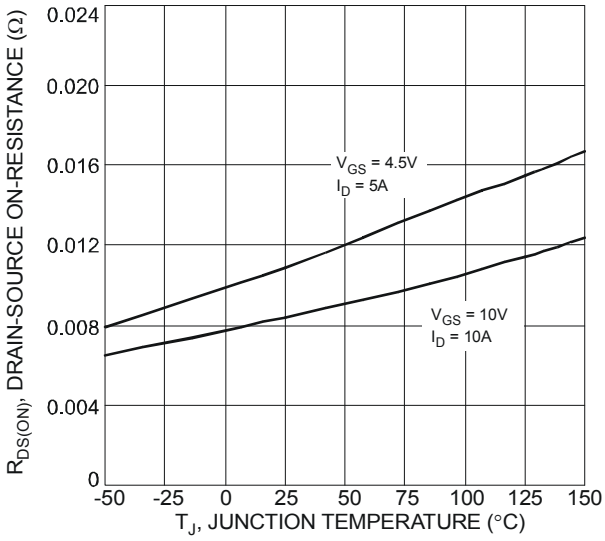


Fig. 6 On-Resistance Variation with Temperature


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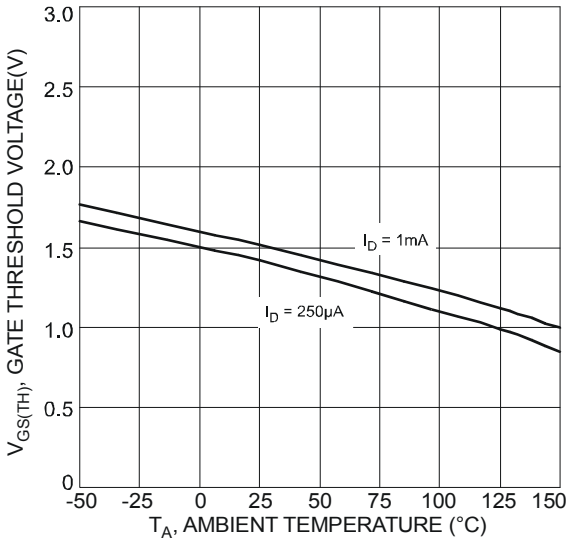


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

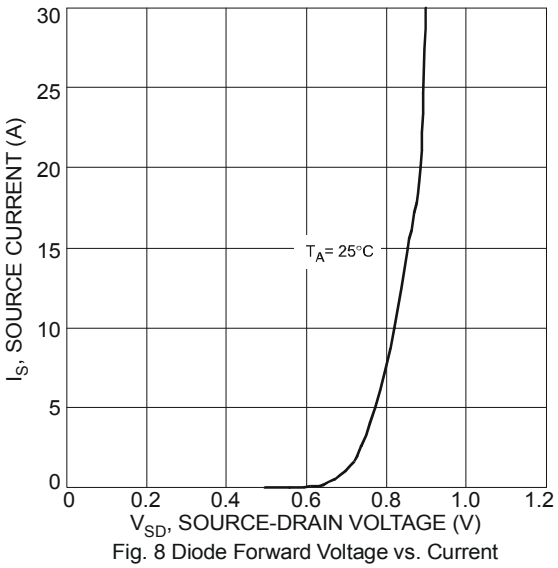


Fig. 8 Diode Forward Voltage vs. Current

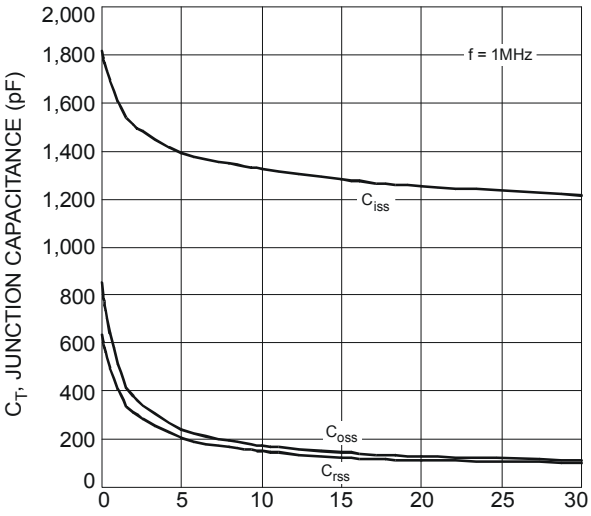


Fig. 9 Typical Junction Capacitance

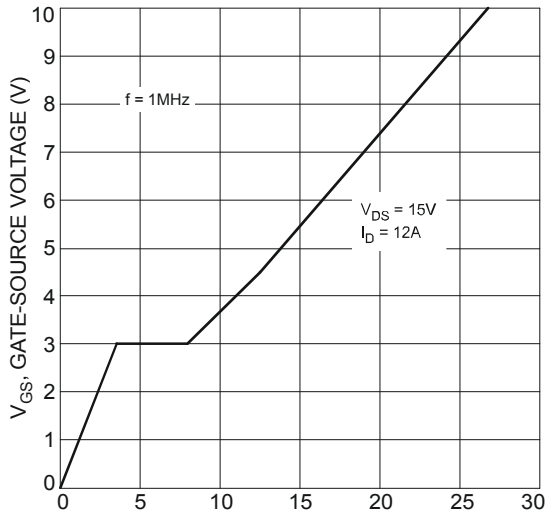


Fig. 10 Gate-Charge Characteristics

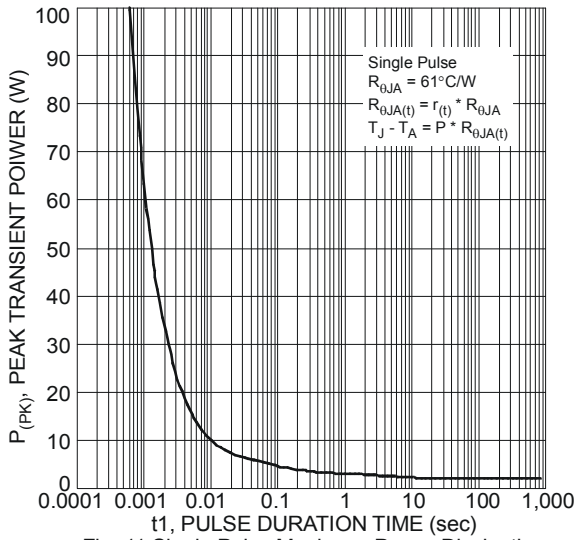


Fig. 11 Single Pulse Maximum Power Dissipation


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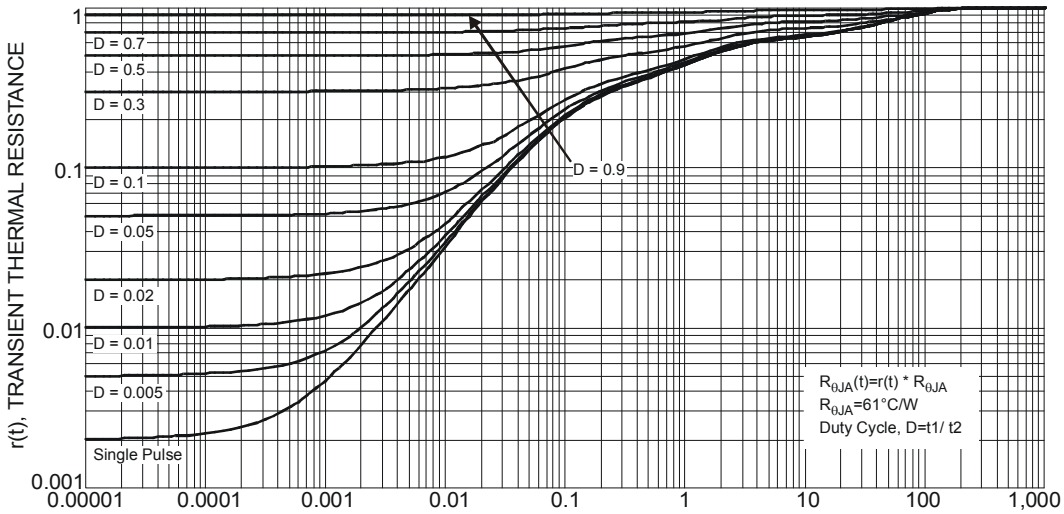
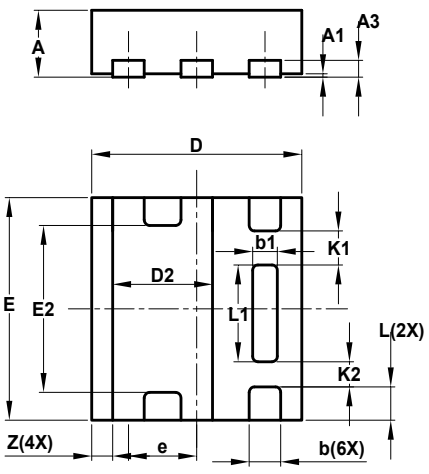


Fig. 12 Transient Thermal Resistance

## Package Outline Dimension

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| U-DFN2020-6 Type E | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.57 | 0.63 | 0.60 |
| **A1** | 0 | 0.05 | 0.03 |
| **A3** | – | – | 0.15 |
| **b** | 0.25 | 0.35 | 0.30 |
| **b1** | 0.185 | 0.285 | 0.235 |
| **D** | 1.95 | 2.05 | 2.00 |
| **D2** | 0.85 | 1.05 | 0.95 |
| **E** | 1.95 | 2.05 | 2.00 |
| **E2** | 1.40 | 1.60 | 1.50 |
| **e** | – | – | 0.65 |
| **L** | 0.25 | 0.35 | 0.30 |
| **L1** | 0.82 | 0.92 | 0.87 |
| **K1** | – | – | 0.305 |
| **K2** | – | – | 0.225 |
| **Z** | – | – | 0.20 |
| **All Dimensions in mm** | | | |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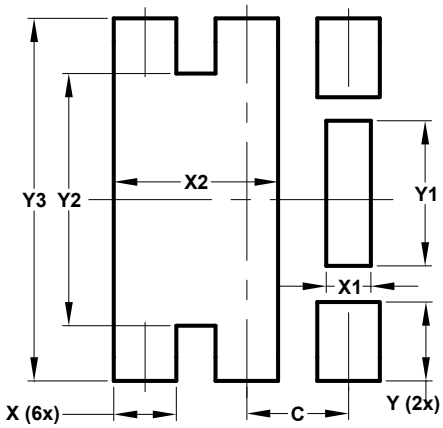
## Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.




| Dimensions | Value (in mm) |
|---|---|
| C | 0.650 |
| X | 0.400 |
| X1 | 0.285 |
| X2 | 1.050 |
| Y | 0.500 |
| Y1 | 0.920 |
| Y2 | 1.600 |
| Y3 | 2.300 |

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