

Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$ max | I_D $T_A = 25^\circ C$ |
|---------------|-------------------------|-----------------------------|
| -20V | 1.0Ω @ $V_{GS} = -4.5V$ | -700mA |
| | 1.5Ω @ $V_{GS} = -2.5V$ | -600mA |
| | 2.0Ω @ $V_{GS} = -1.8V$ | -500mA |
| | 3.0Ω @ $V_{GS} = -1.5V$ | -380mA |

Features and Benefits

- Low On-Resistance
- Very Low Gate Threshold Voltage $V_{GS(TH)}$, 1.0V max
- Low Input Capacitance
- Fast Switching Speed
- Ultra-Small Surfaced Mount Package
- Ultra-low package profile, 0.4mm maximum package height
- ESD Protected Gate
- **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 new generation 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.

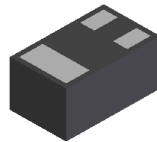
- DC-DC Converters
- Power management functions

Mechanical Data

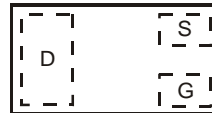
- Case: X2-DFN1006-3
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.001 grams (approximate)



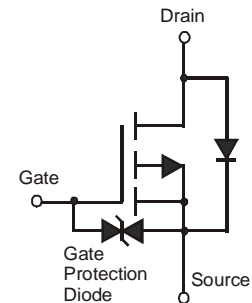
X2-DFN1006-3



Bottom View



Top View
Internal Schematic



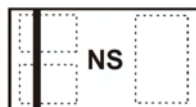
Equivalent Circuit

Ordering Information (Note 4)

| Part Number | Case | Packaging |
|----------------|--------------|--------------------|
| DMP21D5UFB4-7B | X2-DFN1006-3 | 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> 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>.

Marking Information



NS = Product Type Marking Code

Top View
Bar Denotes Gate
and Source Side

Maximum Ratings @T_A = 25°C unless otherwise specified

| Characteristic | | | Symbol | Value | Units |
|---|--------------|--|------------------|--------------|-------|
| Drain-Source Voltage | | | V _{DSS} | -20 | V |
| Gate-Source Voltage | | | V _{GSS} | ±8 | V |
| Continuous Drain Current (Note 6) V _{GS} = -4.5V | Steady State | T _A = 25°C T _A = 70°C | I _D | -700 -600 | mA |
| | t < 10s | T _A = 25°C T _A = 70°C | I _D | -850 -670 | mA |
| Continuous Drain Current (Note 6) V _{GS} = -1.8V | Steady State | T _A = 25°C T _A = 70°C | I _D | -500 -400 | mA |
| | t < 10s | T _A = 25°C T _A = 70°C | I _D | -600 -550 | mA |
| Pulsed Drain Current (10μs pulse, duty cycle = 1%) | | | I _{DM} | -2 | A |
| Maximum Body Diode continuous Current | | | I _S | -800 | mA |

Thermal Characteristics @T_A = 25°C unless otherwise specified

| Characteristic | | Symbol | Value | Units |
|--|--------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 5) | | P _D | 0.46 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady state | R _{θJA} | 279 | °C/W |
| | t < 10s | | 210 | °C/W |
| Total Power Dissipation (Note 6) | | P _D | 0.95 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | R _{θJA} | 134 | °C/W |
| | t < 10s | | 100 | °C/W |
| 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 7) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | -20 | - | - | V | V _{GS} = 0V, I _D = -1mA |
| Zero Gate Voltage Drain Current T _J = 25°C | I _{DSS} | - | - | -100 | nA | V _{DS} = -20V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | - | - | ±1.0 | μA | V _{GS} = ±5V, V _{DS} = 0V |
| | | - | - | ±5.0 | | V _{GS} = ±8V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | -0.5 | - | -1.0 | V | V _{DS} = V _{GS} , I _D = -250μA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | - | 0.67 | 0.97 | Ω | V _{GS} = -5V, I _D = -100mA |
| | | - | 0.7 | 1.0 | | V _{GS} = -4.5V, I _D = -100mA |
| | | - | 0.9 | 1.5 | | V _{GS} = -2.5V, I _D = -80mA |
| | | - | 1.2 | 2.0 | | V _{GS} = -1.8V, I _D = -40mA |
| | | - | 1.5 | 3.0 | | V _{GS} = -1.5V, I _D = -30mA |
| | | - | 5 | - | | V _{GS} = -1.2V, I _D = -1mA |
| Forward Transfer Admittance | Y _{fs} | - | 0.7 | - | S | V _{DS} = -3V, I _D = -100mA |
| Diode Forward Voltage | V _{SD} | - | -0.75 | -1.2 | V | V _{GS} = 0V, I _S = -330mA, |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iSS} | - | 46.1 | - | pF | V _{DS} = 10V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oSS} | - | 7.2 | - | | |
| Reverse Transfer Capacitance | C _{rSS} | - | 4.9 | - | | |
| Gate Resistance | R _g | - | 14.3 | - | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1.0MHz |
| Total Gate Charge V _{GS} = -4.5V | Q _g | - | 0.5 | - | nC | V _{DS} = -10V, I _D = -250mA |
| Gate-Source Charge | Q _{gs} | - | 0.09 | - | | |
| Gate-Drain Charge | Q _{gd} | - | 0.09 | - | | |
| Turn-On Delay Time | t _{D(on)} | - | 8.5 | - | ns | V _{DD} = -3V, V _{GS} = -2.5V, R _L = 300Ω, R _G = 25Ω, I _D = -100mA |
| Turn-On Rise Time | t _r | - | 4.3 | - | | |
| Turn-Off Delay Time | t _{D(off)} | - | 20.2 | - | | |
| Turn-Off Fall Time | t _f | - | 19.2 | - | | |

- 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. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

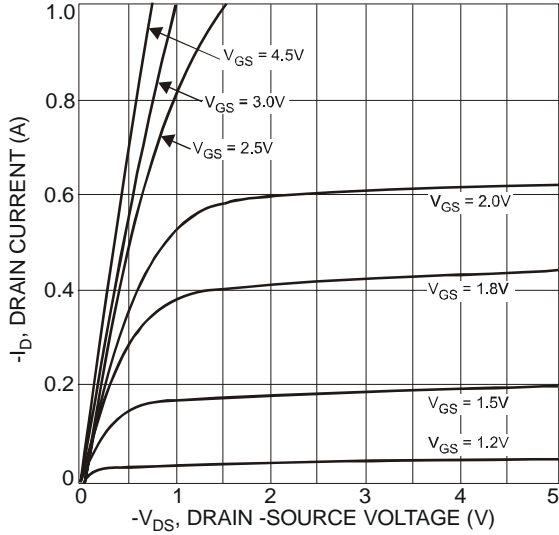


Fig. 1 Typical Output Characteristics

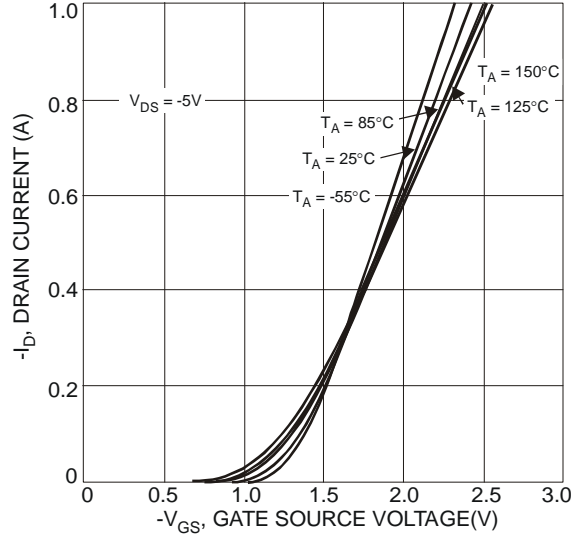


Fig. 2 Typical Transfer Characteristics

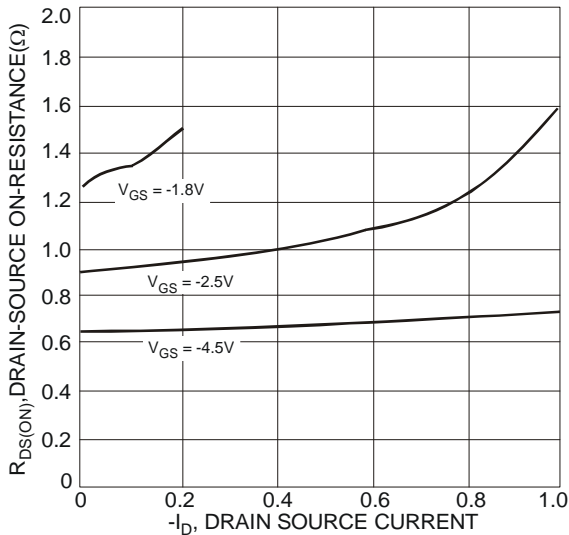


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

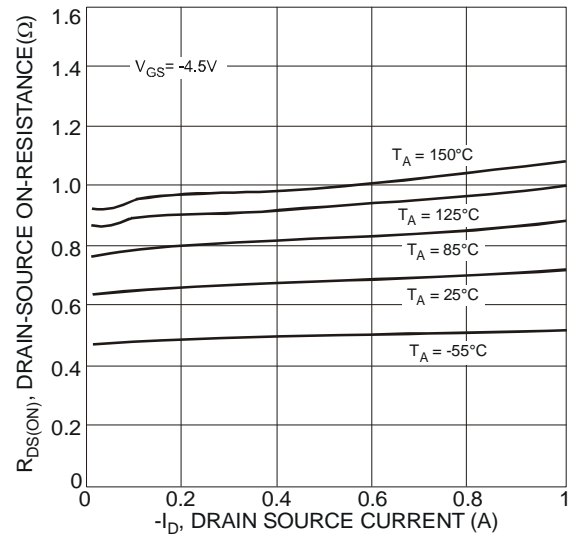


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

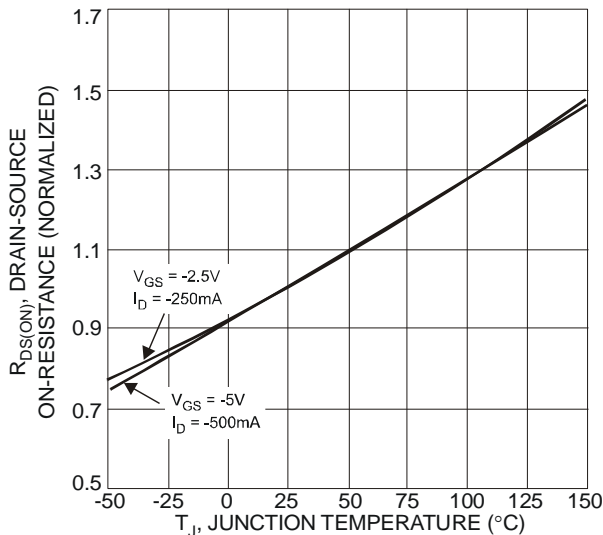


Fig. 5 On-Resistance Variation with Temperature

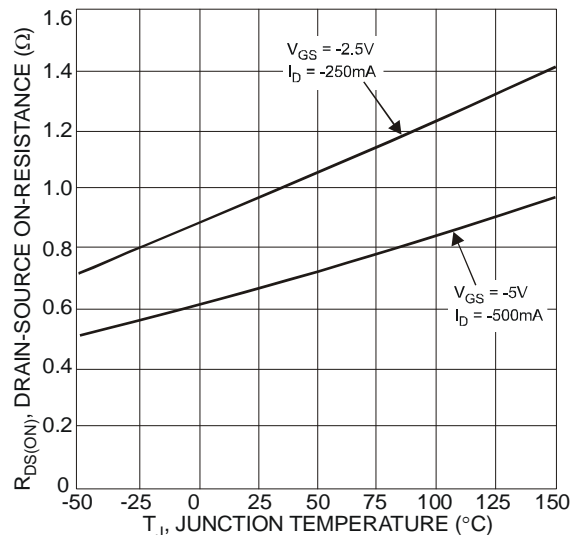


Fig. 6 On-Resistance vs. Temperature

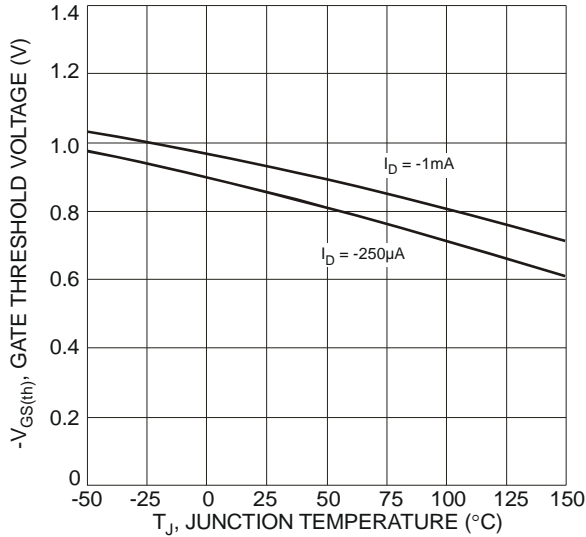


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

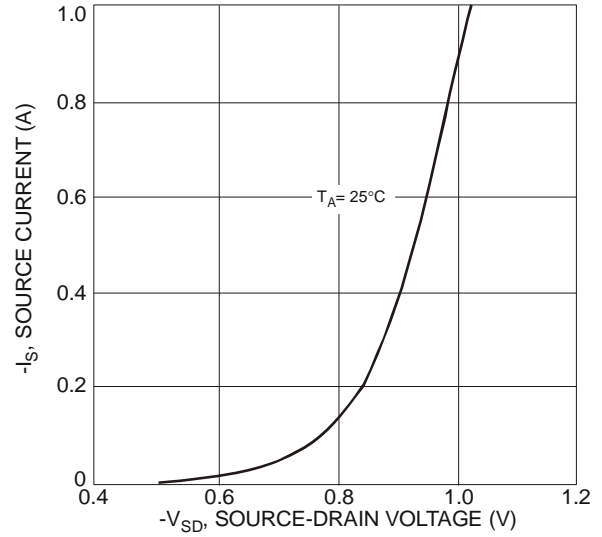


Fig. 8 Diode Forward Voltage vs. Current

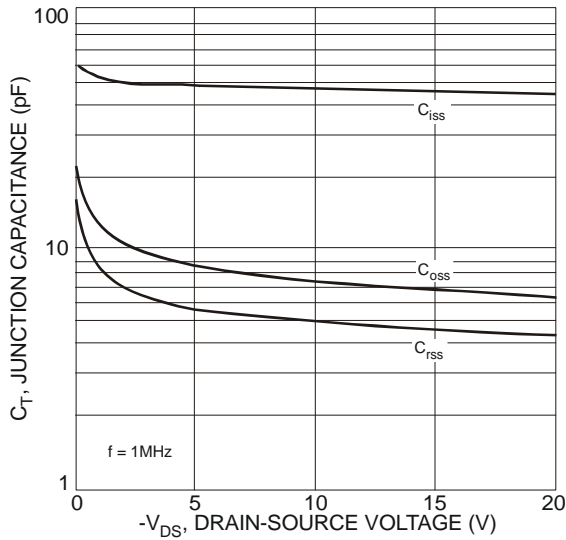


Fig. 9 Typical Junction Capacitance

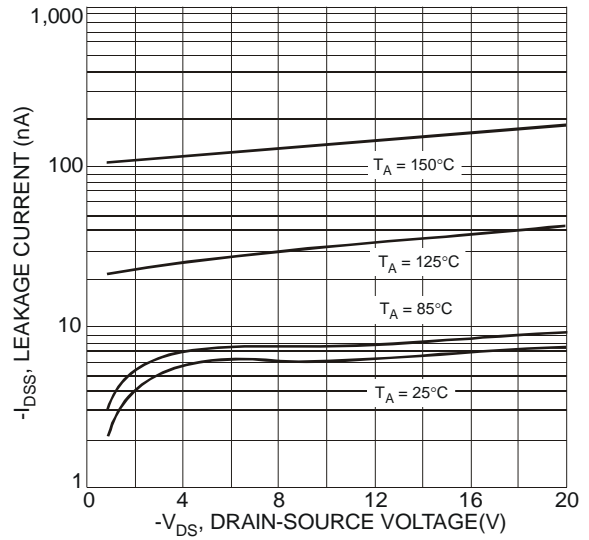


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

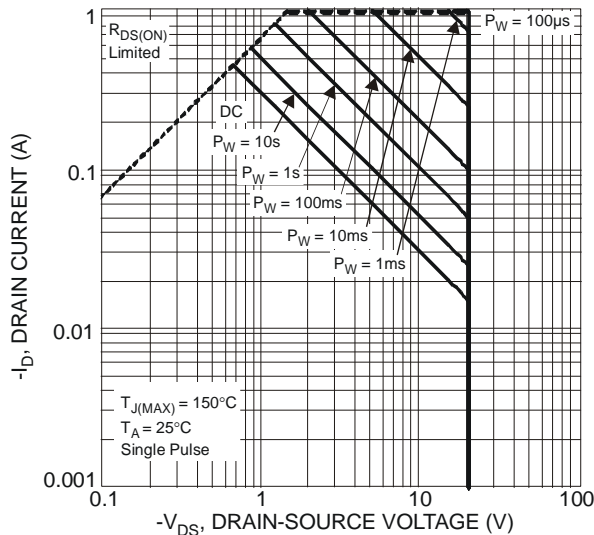


Fig. 11 SOA, Safe Operation Area

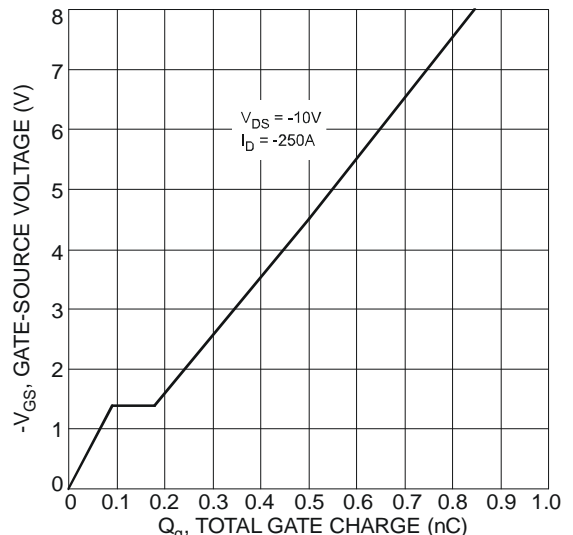


Fig. 12 Gate-Charge Characteristics

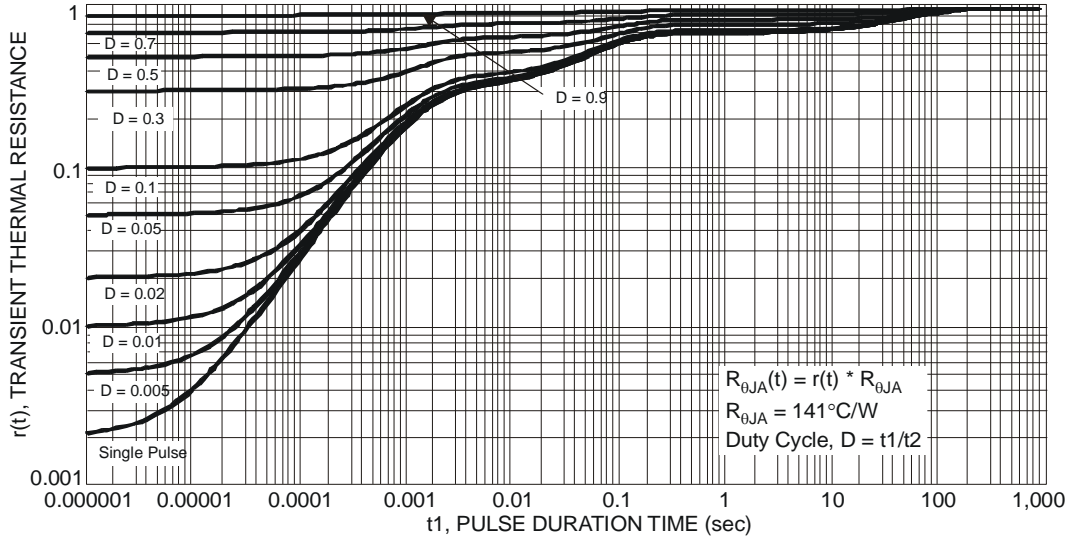
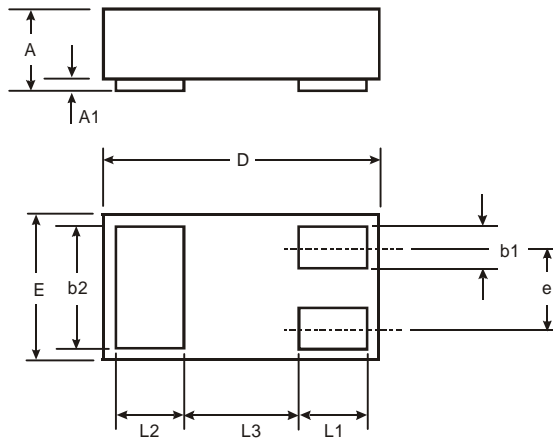


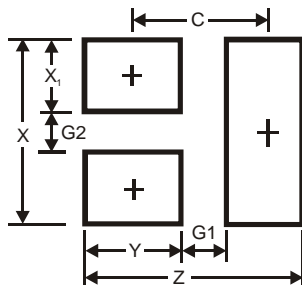
Fig. 13 Transient Thermal Resistance

Package Outline Dimensions



| X2-DFN1006-3 | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | — | 0.40 | — |
| A1 | 0 | 0.05 | 0.02 |
| b1 | 0.10 | 0.20 | 0.15 |
| b2 | 0.45 | 0.55 | 0.50 |
| D | 0.95 | 1.05 | 1.00 |
| E | 0.55 | 0.65 | 0.60 |
| e | — | — | 0.35 |
| L1 | 0.20 | 0.30 | 0.25 |
| L2 | 0.20 | 0.30 | 0.25 |
| L3 | — | — | 0.40 |
| All Dimensions in mm | | | |

Suggested Pad Layout



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 1.1 |
| G1 | 0.3 |
| G2 | 0.2 |
| X | 0.7 |
| X1 | 0.25 |
| Y | 0.4 |
| C | 0.7 |

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