

Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | Package | I_D $T_A = +25^\circ\text{C}$ |
|---------------|---------------------------------------|-------------|------------------------------------|
| 20V | 11m Ω @ $V_{GS} = 4.5\text{V}$ | U-DFN2020-6 | 10.5A |
| | 13m Ω @ $V_{GS} = 2.5\text{V}$ | U-DFN2020-6 | 9.4A |
| | 30m Ω @ $V_{GS} = 1.8\text{V}$ | U-DFN2020-6 | 6.5A |
| | 50m Ω @ $V_{GS} = 1.5\text{V}$ | U-DFN2020-6 | 5.5A |

Description

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.

Applications

- General Purpose Interfacing Switch
- Power Management Functions



U-DFN2020-6



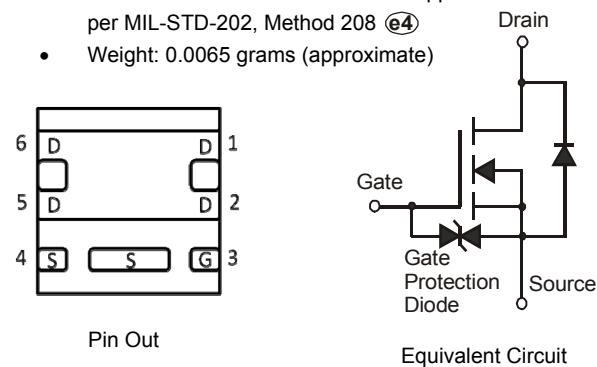
Bottom View

Features

- 0.6mm profile – ideal for low profile applications
- PCB footprint of 4mm²
- Low Gate Threshold Voltage
- 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
- PPAP Capable (Note 4)

Mechanical Data

- Case: U-DFN2020-6
- 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 (e4)
- Weight: 0.0065 grams (approximate)



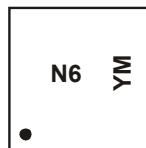
Ordering Information (Note 5)

| Part Number | Compliance | Case | Quantity per reel |
|-----------------|------------|-------------|-------------------|
| DMN2013UFDE-7 | Standard | U-DFN2020-6 | 3,000 |
| DMN2013UFDEQ-7 | Automotive | U-DFN2020-6 | 3,000 |
| DMN2013UFDE-13 | Standard | U-DFN2020-6 | 10,000 |
| DMN2013UFDEQ-13 | Automotive | U-DFN2020-6 | 10,000 |

Notes:

- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- 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.
- Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_grade_definitions/.
- For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information



N6 = 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 |

Maximum Ratings (@ $T_A = +25^\circ\text{C}$, 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 7) $V_{GS} = 4.5\text{V}$ | Steady State | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | 10.5 8.5 | A |
| | $t < 10\text{s}$ | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | 12.5 10.0 | A |
| Continuous Drain Current (Note 7) $V_{GS} = 2.5\text{V}$ | Steady State | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | 9.4 7.5 | A |
| | $t < 10\text{s}$ | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | 11.2 8.8 | A |
| Pulsed Drain Current (10 μs pulse, duty cycle = 1%) | | | I_{DM} | 80 | A |
| Maximum Body Diode Continuous Current | | | I_S | 2.5 | A |

Thermal Characteristics

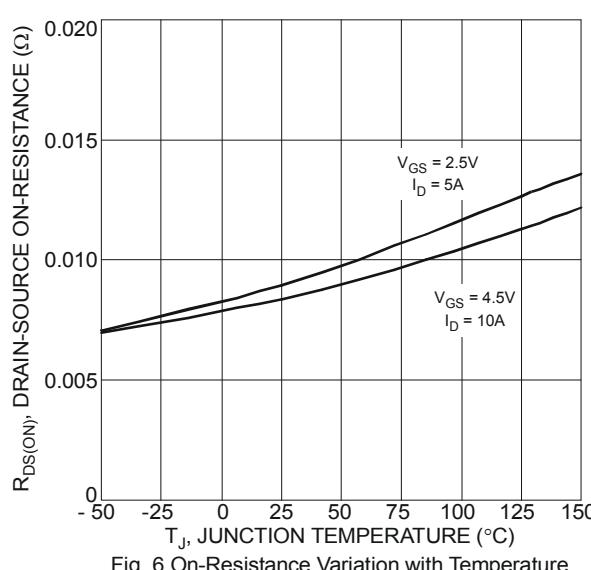
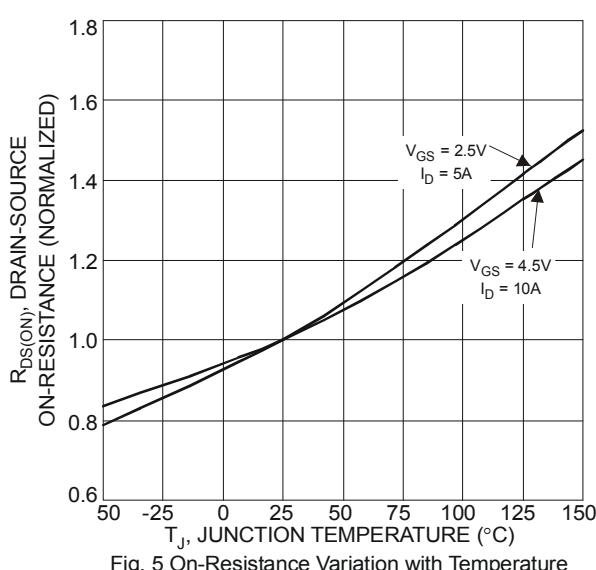
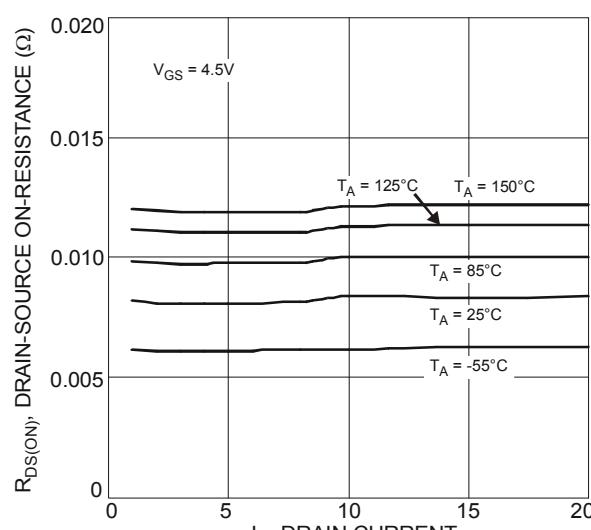
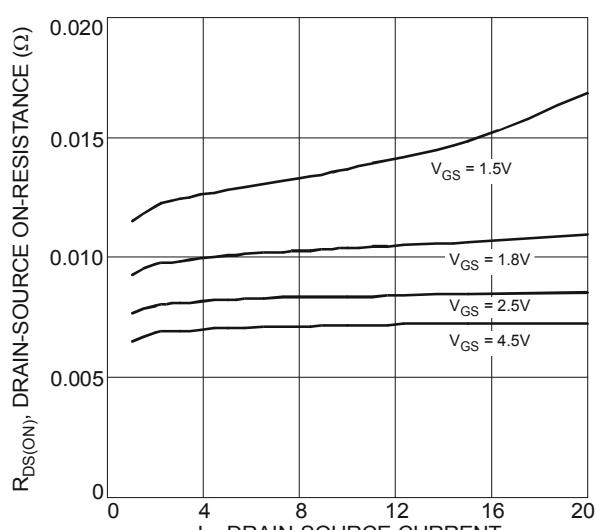
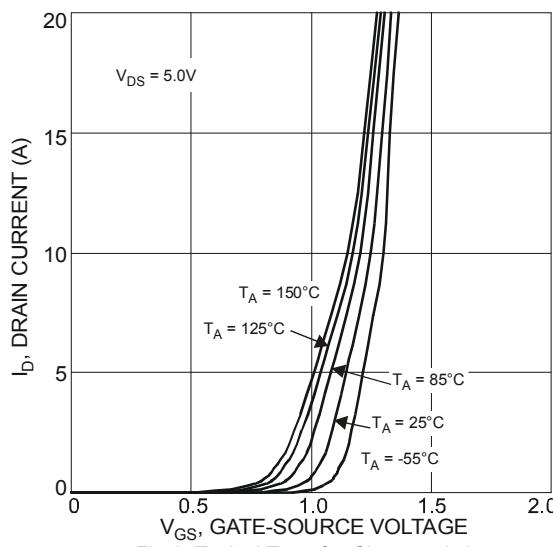
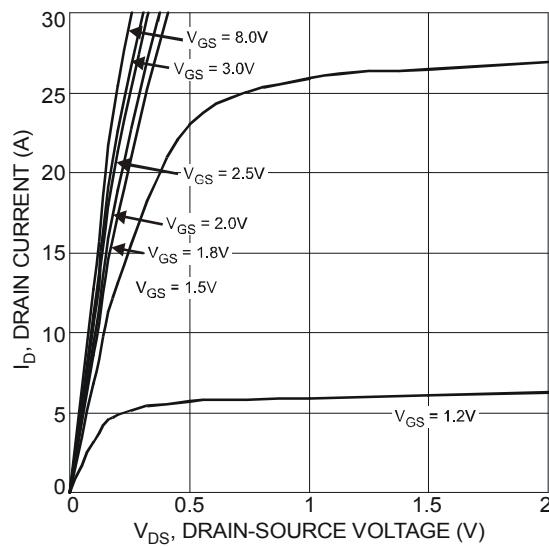
| Characteristic | | | Symbol | Value | Units |
|--|---------------------------|---------------------------|-----------------|-------------|--------------------|
| Total Power Dissipation (Note 6) | | $T_A = +25^\circ\text{C}$ | P_D | 0.66 | W |
| | | $T_A = +70^\circ\text{C}$ | | 0.42 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | | $R_{\theta JA}$ | 189 | $^\circ\text{C/W}$ |
| | $t < 10\text{s}$ | | | 132 | |
| Total Power Dissipation (Note 7) | $T_A = +25^\circ\text{C}$ | | P_D | 2.03 | W |
| | $T_A = +70^\circ\text{C}$ | | | 1.31 | |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady state | | $R_{\theta JA}$ | 61 | $^\circ\text{C/W}$ |
| | $t < 10\text{s}$ | | | 43 | |
| Thermal Resistance, Junction to Case (Note 7) | | | $R_{\theta JC}$ | 9.3 | |
| Operating and Storage Temperature Range | | | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---------------------|-----|------|---------|------------------|---|
| OFF CHARACTERISTICS (Note 8) | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | 20 | — | — | V | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$ |
| Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$ | I_{DSS} | — | — | 1 | μA | $V_{DS} = 16\text{V}, V_{GS} = 0\text{V}$ |
| Gate-Source Leakage | I_{GSS} | — | — | ± 2 | μA | $V_{GS} = \pm 8\text{V}, V_{DS} = 0\text{V}$ |
| ON CHARACTERISTICS (Note 8) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 0.5 | — | 1.1 | V | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$ |
| Static Drain-Source On-Resistance | $R_{DS(\text{ON})}$ | — | 8.4 | 11 | $\text{m}\Omega$ | $V_{GS} = 4.5\text{V}, I_D = 8.5\text{A}$ |
| | | | 9.8 | 13 | | $V_{GS} = 2.5\text{V}, I_D = 8.5\text{A}$ |
| | | | 12 | 30 | | $V_{GS} = 1.8\text{V}, I_D = 1\text{A}$ |
| | | | 15 | 50 | | $V_{GS} = 1.5\text{V}, I_D = 0.5\text{A}$ |
| Forward Transfer Admittance | $ Y_{fs} $ | — | 10 | — | S | $V_{DS} = 5\text{V}, I_D = 4\text{A}$ |
| Diode Forward Voltage | V_{SD} | — | — | 1.2 | V | $V_{GS} = 0\text{V}, I_S = 8.5\text{A}$ |
| DYNAMIC CHARACTERISTICS (Note 9) | | | | | | |
| Input Capacitance | C_{iss} | — | 2453 | — | pF | $V_{DS} = 10\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$ |
| Output Capacitance | C_{oss} | — | 275 | — | pF | |
| Reverse Transfer Capacitance | C_{rss} | — | 257 | — | pF | |
| Gate Resistance | R_g | — | 1.2 | — | Ω | $V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ |
| Total Gate Charge ($V_{GS} = 4.5\text{V}$) | Q_g | — | 14.3 | — | nC | $V_{DS} = 10\text{V}, I_D = 8.5\text{A}$ |
| Total Gate Charge ($V_{GS} = 8\text{V}$) | Q_g | — | 25.8 | — | nC | |
| Gate-Source Charge | Q_{gs} | — | 1.8 | — | nC | |
| Gate-Drain Charge | Q_{gd} | — | 2.1 | — | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 9.9 | — | ns | $V_{DS} = 10\text{V}, I_D = 8.5\text{A}$ $V_{GS} = 4.5\text{V}, R_G = 1.8\Omega$ |
| Turn-On Rise Time | t_r | — | 24.5 | — | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 66.4 | — | ns | |
| Turn-Off Fall Time | t_f | — | 20.8 | — | ns | |

Notes:

6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided
7. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate
8. Short duration pulse test used to minimize self-heating effect
9. Guaranteed by design. Not subject to production testing



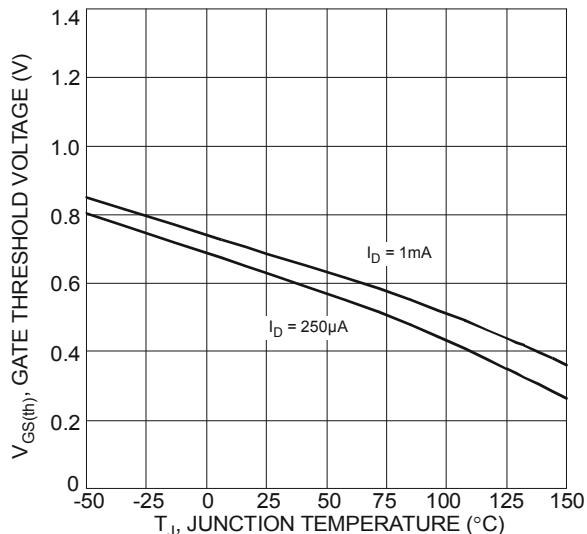


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

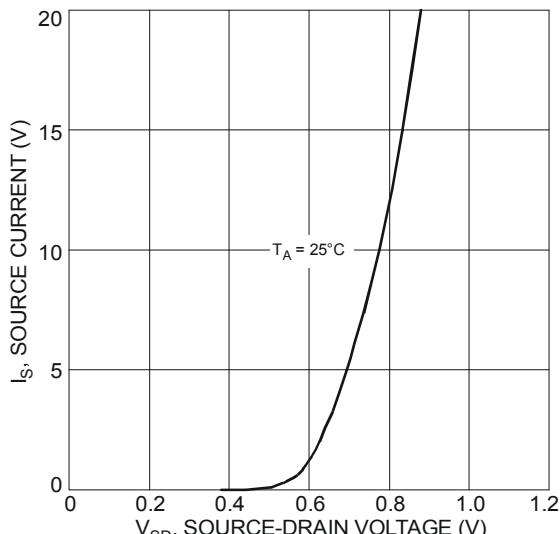


Fig. 8 Diode Forward Voltage vs. Current

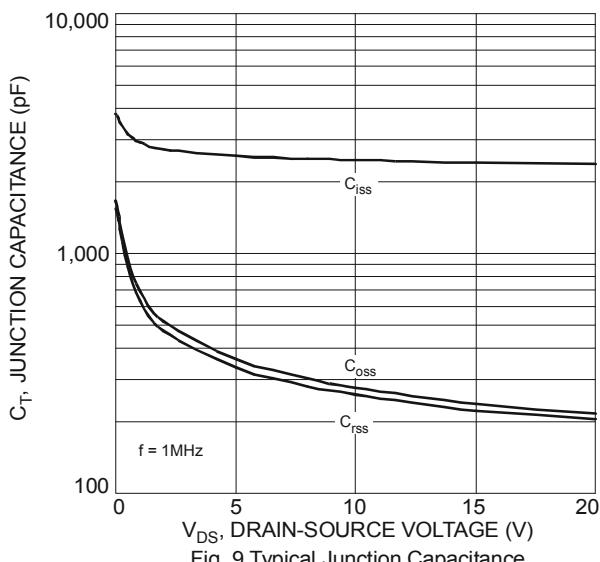


Fig. 9 Typical Junction Capacitance

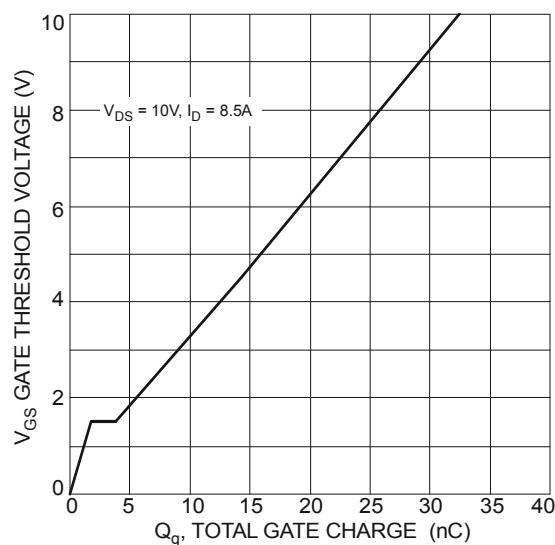


Fig. 10 Gate Charge

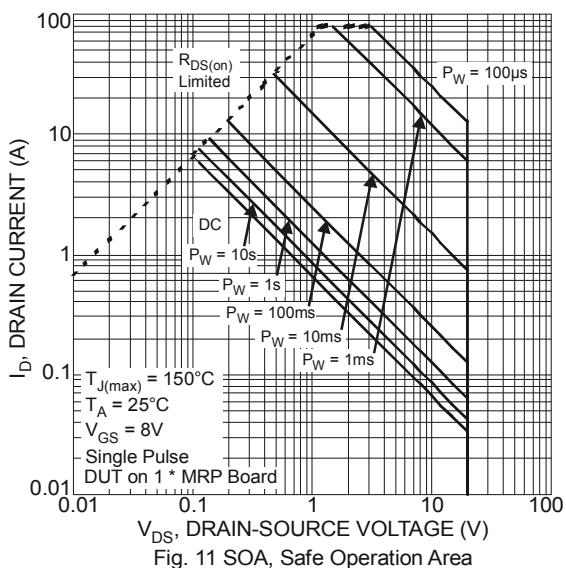
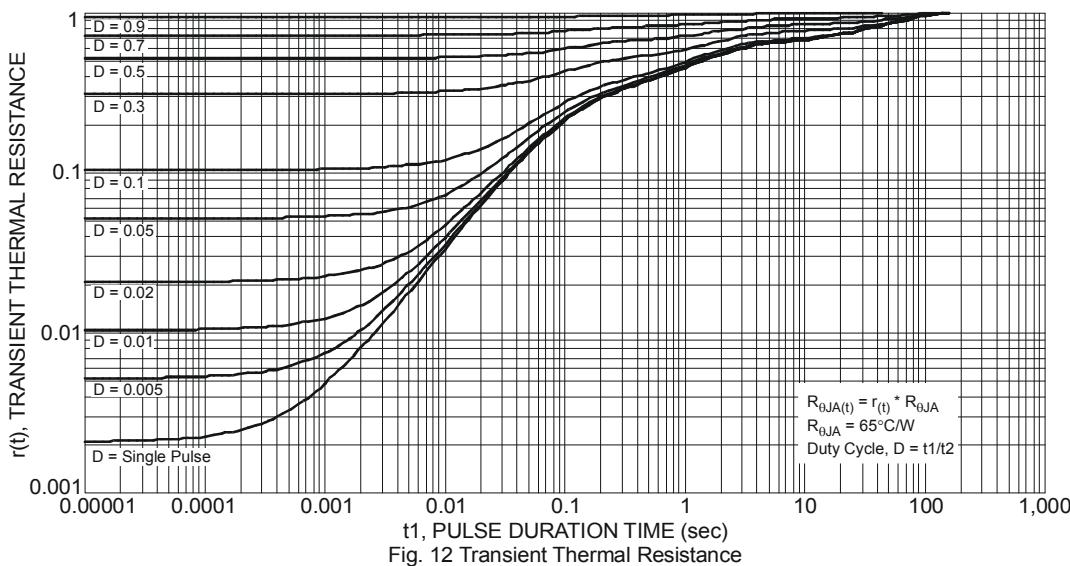
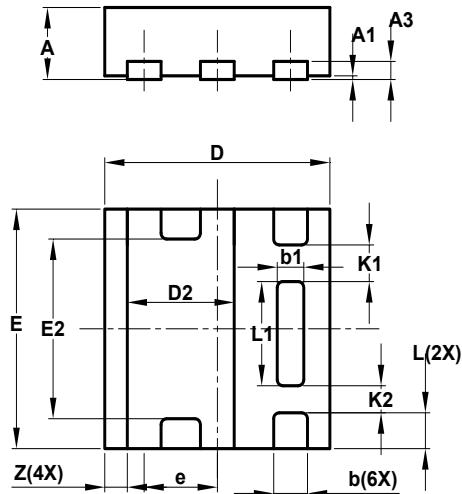


Fig. 11 SOA, Safe Operation Area



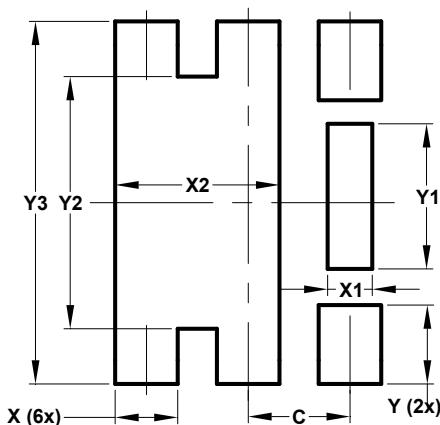
Package Outline Dimensions



| 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

Suggested Pad Layout



| 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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