

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max          | I <sub>D</sub> Max<br>T <sub>A</sub> = +25°C |
|-------------------|----------------------------------|----------------------------------------------|
| -12V              | 16mΩ @ V <sub>GS</sub> = -4.5V   | -9.1A                                        |
|                   | 21.5mΩ @ V <sub>GS</sub> = -2.5V | -7.9A                                        |
|                   | 26mΩ @ V <sub>GS</sub> = -1.8V   | -7.0A                                        |
|                   | 32mΩ @ V <sub>GS</sub> = -1.5V   | -6.3A                                        |

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Engine Management Systems
- DC-DC Converters
- Body Control Electronics

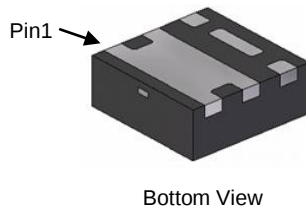
## Features

- 0.6mm Profile – Ideal For Low Profile Applications
- PCB Footprint of 4mm<sup>2</sup>
- Low Gate Threshold Voltage
- Fast Switching Speed
- ESD Protected to 3kV
- **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)**

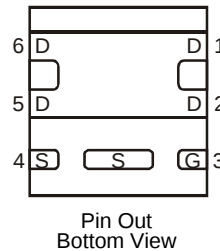
## Mechanical Data

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

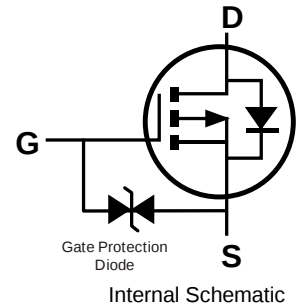
U-DFN2020-6 (Type E)



Bottom View



Pin Out Bottom View

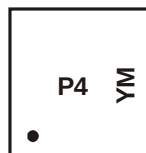


## Ordering Information (Note 5)

| Part Number    | Marking | Reel Size (inches) | Quantity Per Reel |
|----------------|---------|--------------------|-------------------|
| DMP1022UFDEQ-7 | P4      | 7                  | 3,000             |

- 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](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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/product-compliance-definitions/>.
  5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



P4 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: E = 2017)  
M = Month (ex: 9 = September)

### Date Code Key

Date Code Key

| Year | 2011 | ~ | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|------|------|---|------|------|------|------|------|------|------|------|------|
| Code | Y    | ~ | C    | D    | E    | F    | G    | H    | I    | J    | K    |

| 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<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                                  |              |                                                  | Symbol           | Value         | Unit |
|-----------------------------------------------------------------|--------------|--------------------------------------------------|------------------|---------------|------|
| Drain-Source Voltage                                            |              |                                                  | V <sub>DSS</sub> | -12           | V    |
| Gate-Source Voltage                                             |              |                                                  | V <sub>GSS</sub> | ±8            | V    |
| Continuous Drain Current (Note 7) V <sub>GS</sub> = -4.5V       | Steady State | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | -9.1<br>-7.2  | A    |
|                                                                 | t < 5s       | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | -11.2<br>-9.0 | A    |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)              |              |                                                  | I <sub>DM</sub>  | -90           | A    |
| Continuous Source-Drain Diode Current                           |              | T <sub>A</sub> = +25°C                           | I <sub>S</sub>   | -2.5          | A    |
|                                                                 |              | T <sub>C</sub> = +25°C                           | I <sub>S</sub>   | -7.1          | A    |
| Pulsed Source-Drain Diode Current (10µs Pulse, Duty Cycle = 1%) |              |                                                  | I <sub>SM</sub>  | -50           | A    |

**Thermal Characteristics**

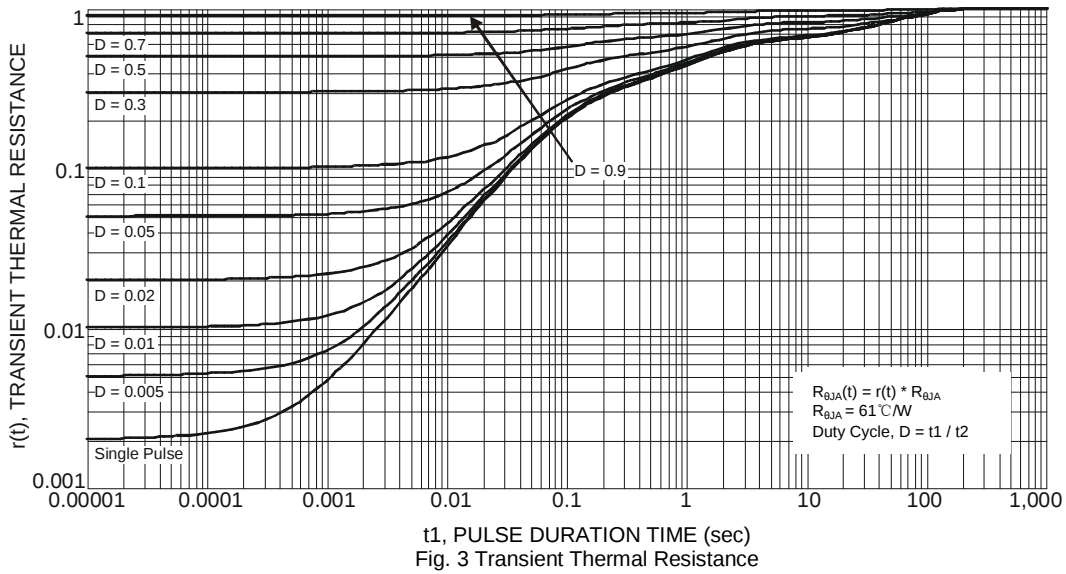
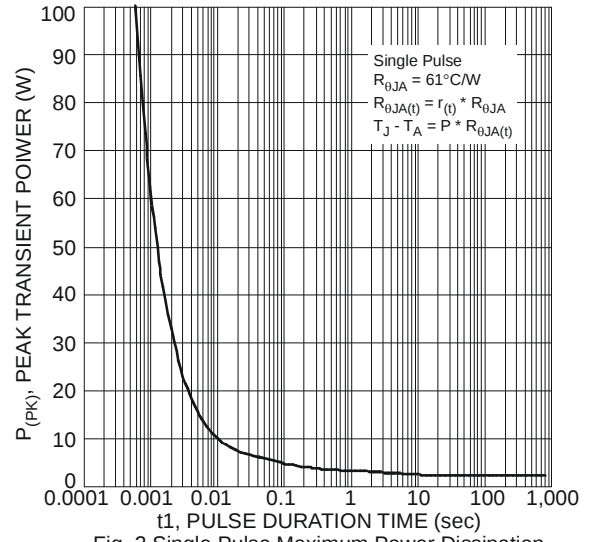
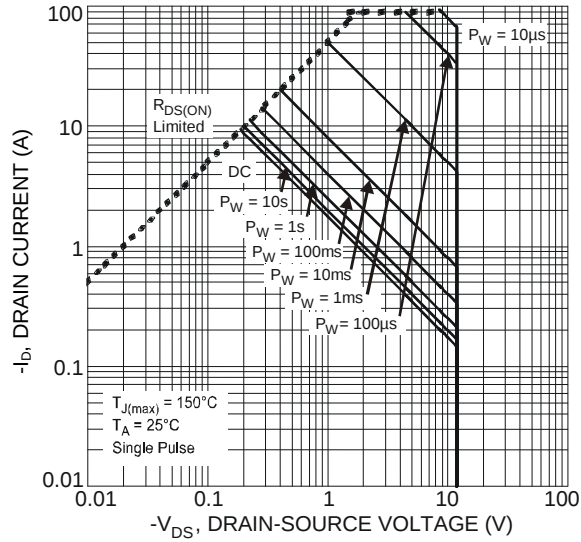
| Characteristic                                   |                        | Symbol                            | Value       | Unit |
|--------------------------------------------------|------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 6)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 0.66        | W    |
|                                                  | T <sub>A</sub> = +70°C |                                   | 0.42        |      |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State           | R <sub>θJA</sub>                  | 189         | °C/W |
|                                                  | t < 5s                 |                                   | 123         |      |
| Total Power Dissipation (Note 7)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 2.03        | W    |
|                                                  | T <sub>A</sub> = +70°C |                                   | 1.3         |      |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady State           | R <sub>θJA</sub>                  | 61          | °C/W |
|                                                  | t < 5s                 |                                   | 40          |      |
| Thermal Resistance, Junction to Case (Note 6)    | Steady State           | R <sub>θJC</sub>                  | 9.3         |      |
| Operating and Storage Temperature Range          |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

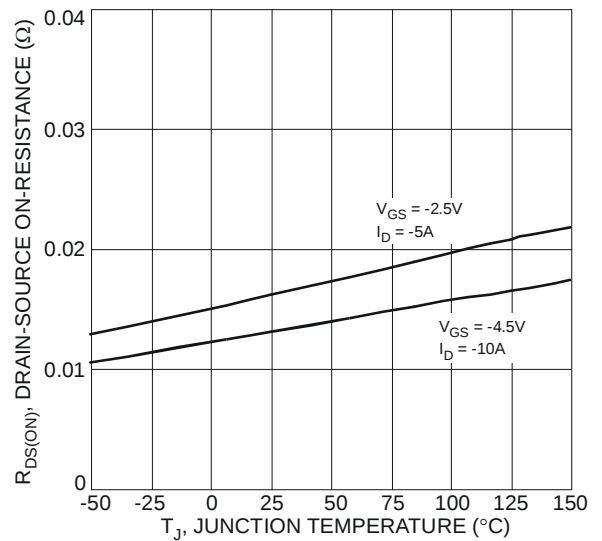
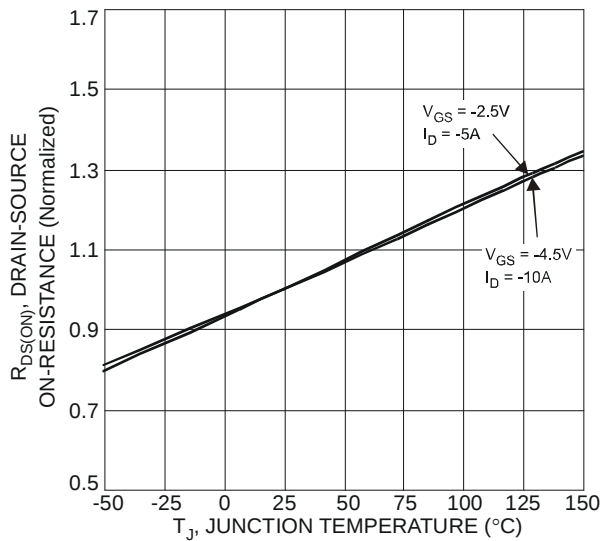
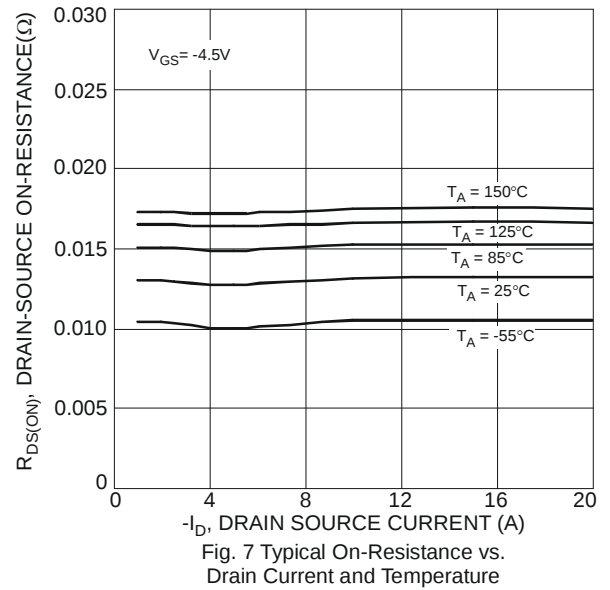
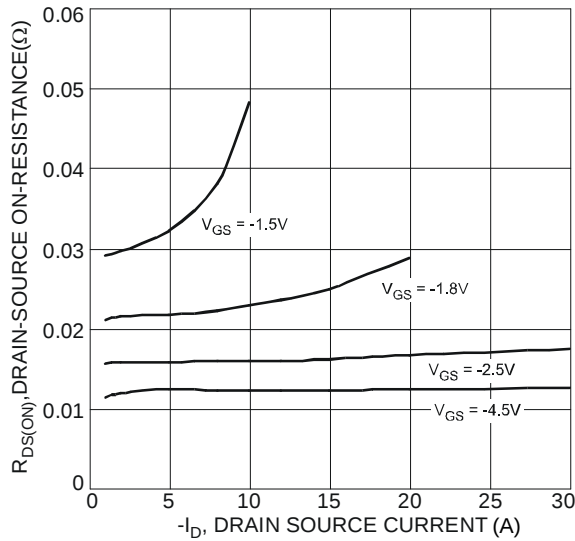
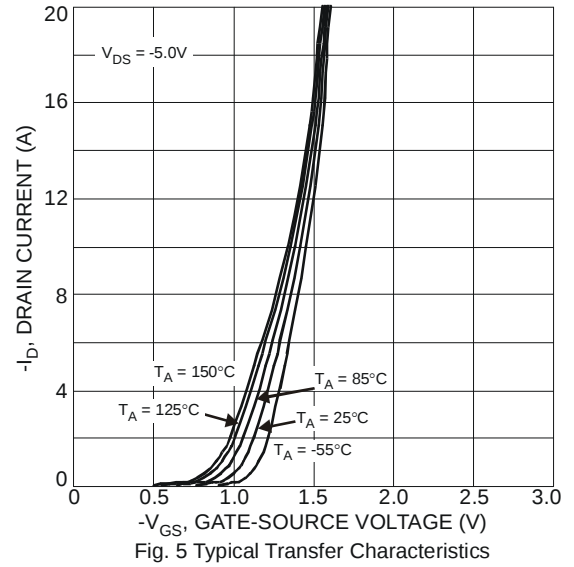
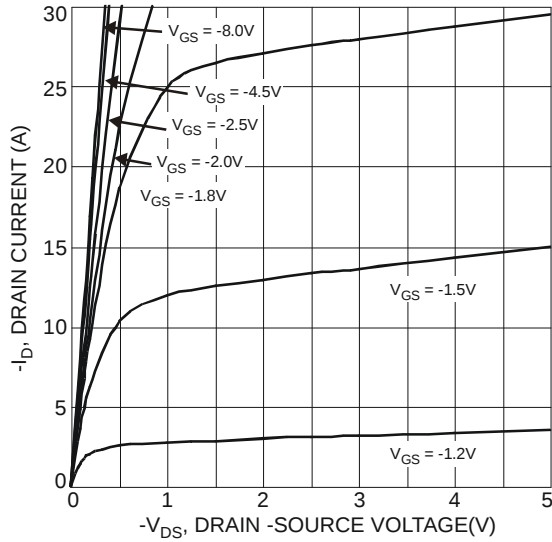
Notes: 6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.  
7. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal vias to bottom layer 1-inch square copper plate.

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                           | Symbol                                  | Min   | Typ   | Max  | Unit  | Test Condition                                                                                                        |
|----------------------------------------------------------|-----------------------------------------|-------|-------|------|-------|-----------------------------------------------------------------------------------------------------------------------|
| OFF CHARACTERISTICS (Note 8)                             |                                         |       |       |      |       |                                                                                                                       |
| Drain-Source Breakdown Voltage                           | BV <sub>DSS</sub>                       | -12   | —     | —    | V     | V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA                                                                         |
| Zero Gate Voltage Drain Current (T <sub>J</sub> = +25°C) | I <sub>DSS</sub>                        | —     | —     | -3.5 | μA    | V <sub>DS</sub> = -12V, V <sub>GS</sub> = 0V                                                                          |
| Gate-Source Leakage                                      | I <sub>GSS</sub>                        | —     | —     | ±10  | μA    | V <sub>GS</sub> = ±5V, V <sub>DS</sub> = 0V                                                                           |
| ON CHARACTERISTICS (Note 8)                              |                                         |       |       |      |       |                                                                                                                       |
| Gate Threshold Voltage                                   | V <sub>GS(TH)</sub>                     | -0.35 | —     | -0.8 | V     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA                                                           |
| V <sub>GS(TH)</sub> Temperature Coefficient              | Δ V <sub>GS(TH)</sub> /Δ T <sub>J</sub> | —     | 2.5   | —    | mV/°C | I <sub>D</sub> = -250μA                                                                                               |
| On-State Drain Current                                   | I <sub>D(ON)</sub>                      | -10   | —     | —    | A     | V <sub>GS</sub> = -4.5V, V <sub>DS</sub> < -5A                                                                        |
| Static Drain-Source On-Resistance                        | R <sub>DS(ON)</sub>                     | —     | 12    | 16   | mΩ    | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -8.2A                                                                       |
|                                                          |                                         |       | 15    | 21.5 |       | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -7.2A                                                                       |
|                                                          |                                         |       | 20    | 26   |       | V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -6.6A                                                                       |
|                                                          |                                         |       | 23    | 32   |       | V <sub>GS</sub> = -1.5V, I <sub>D</sub> = -1A                                                                         |
|                                                          |                                         |       | 80    | 160  |       | V <sub>GS</sub> = -1.2V, I <sub>D</sub> = -1A                                                                         |
| Forward Transfer Admittance                              | Y <sub>fs</sub>                         | —     | 12    | —    | S     | V <sub>DS</sub> = -4V, I <sub>D</sub> = -8.2A                                                                         |
| Diode Forward Voltage                                    | V <sub>SD</sub>                         | —     | -0.8  | -1.2 | V     | V <sub>GS</sub> = 0V, I <sub>S</sub> = -8A                                                                            |
| DYNAMIC CHARACTERISTICS (Note 9)                         |                                         |       |       |      |       |                                                                                                                       |
| Input Capacitance                                        | C <sub>iSS</sub>                        | —     | 2,953 | —    | pF    | V <sub>DS</sub> = -4V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                                            |
| Output Capacitance                                       | C <sub>oSS</sub>                        | —     | 756   | —    |       |                                                                                                                       |
| Reverse Transfer Capacitance                             | C <sub>rSS</sub>                        | —     | 678   | —    |       |                                                                                                                       |
| Gate Resistance                                          | R <sub>g</sub>                          | —     | 8.6   | 18   | Ω     | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                                                  |
| Total Gate Charge                                        | Q <sub>g</sub>                          | —     | 28.4  | 42.6 | nC    | V <sub>GS</sub> = -5V, V <sub>DS</sub> = -4V,<br>I <sub>D</sub> = -10A                                                |
| Total Gate Charge                                        | Q <sub>g</sub>                          | —     | 25.3  | 38   |       | V <sub>GS</sub> = -4.5V, V <sub>DS</sub> = -4V,<br>I <sub>D</sub> = -10A                                              |
| Gate-Source Charge                                       | Q <sub>gs</sub>                         | —     | 2.3   | —    |       |                                                                                                                       |
| Gate-Drain Charge                                        | Q <sub>gd</sub>                         | —     | 7.2   | —    |       |                                                                                                                       |
| Turn-On Delay Time                                       | t <sub>D(ON)</sub>                      | —     | 20    | 30   | ns    | V <sub>DS</sub> = -4V, V <sub>GS</sub> = -4.5V,<br>R <sub>G</sub> = 1Ω, R <sub>L</sub> = 0.4Ω, I <sub>D</sub> = -9.8A |
| Turn-On Rise Time                                        | t <sub>r</sub>                          | —     | 28    | 42   |       |                                                                                                                       |
| Turn-Off Delay Time                                      | t <sub>D(OFF)</sub>                     | —     | 117   | 176  |       |                                                                                                                       |
| Turn-Off Fall Time                                       | t <sub>f</sub>                          | —     | 93    | 139  |       |                                                                                                                       |
| BODY DIODE CHARACTERISTICS                               |                                         |       |       |      |       |                                                                                                                       |
| Diode Forward Voltage                                    | V <sub>SD</sub>                         | —     | -0.8  | -1.2 | V     | V <sub>GS</sub> = 0V, I <sub>S</sub> = -9.8A                                                                          |
| Continuous Source-Drain Diode Current (Note 6)           | I <sub>S</sub>                          | —     | —     | -2.5 | A     | T <sub>A</sub> = +25°C                                                                                                |
|                                                          |                                         | —     | —     | -7.1 |       | T <sub>C</sub> = +25°C                                                                                                |
| Pulse Diode Forward Current (Note 8)                     | I <sub>SM</sub>                         | —     | —     | -50  |       | —                                                                                                                     |
| Body Diode Reverse Recovery Time (Note 8)                | t <sub>RR</sub>                         | —     | 28    | 56   | ns    | I <sub>S</sub> = -9.8A, dI/dt = 100A/μs                                                                               |
| Reverse Recovery Fall Time                               | t <sub>a</sub>                          | —     | 10    | —    |       |                                                                                                                       |
| Reverse Recovery Rise Time                               | t <sub>b</sub>                          | —     | 18    | —    |       |                                                                                                                       |
| Body Diode Reverse Recovery Charge (Note 8)              | Q <sub>RR</sub>                         | —     | 13    | 26   | nC    |                                                                                                                       |

Notes: 8. Short duration pulse test used to minimize self-heating effect.  
9. Guaranteed by design. Not subject to production testing.





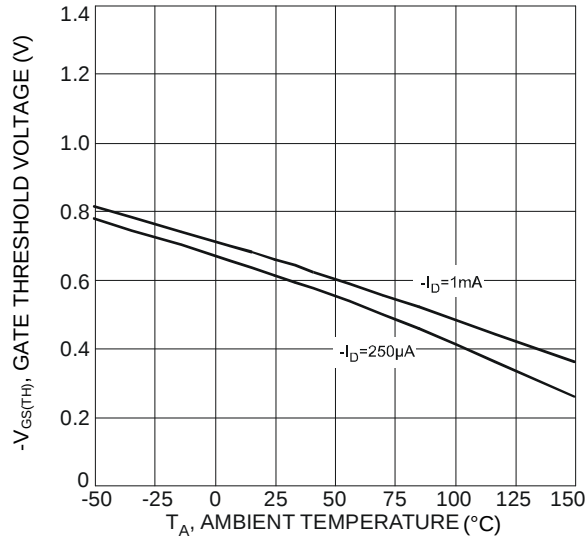


Fig. 10 Gate Threshold Variation vs. Ambient Temperature

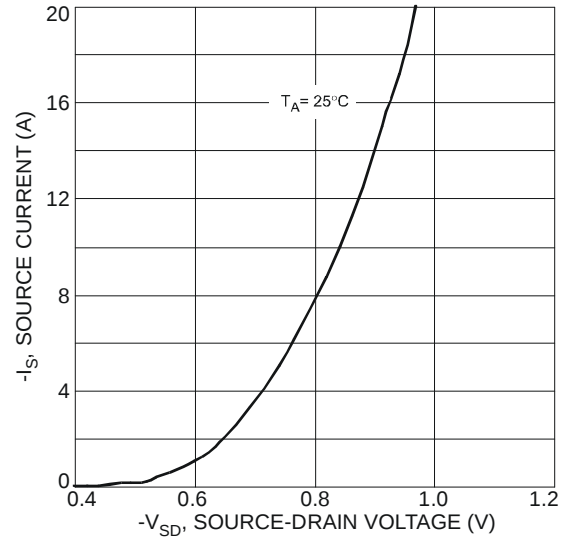


Fig. 11 Diode Forward Voltage vs. Current

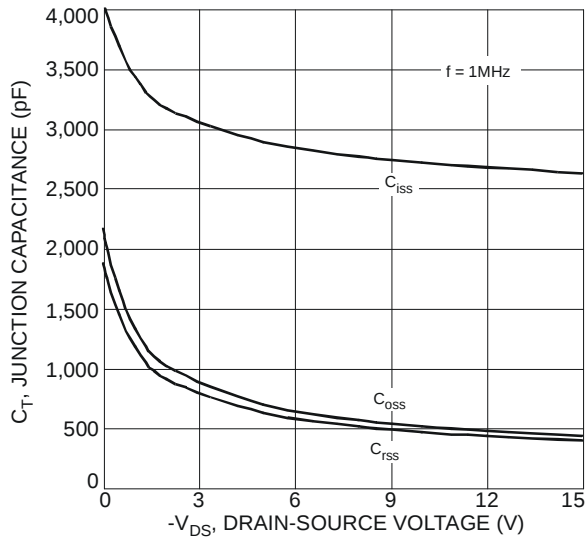


Fig. 12 Typical Junction Capacitance

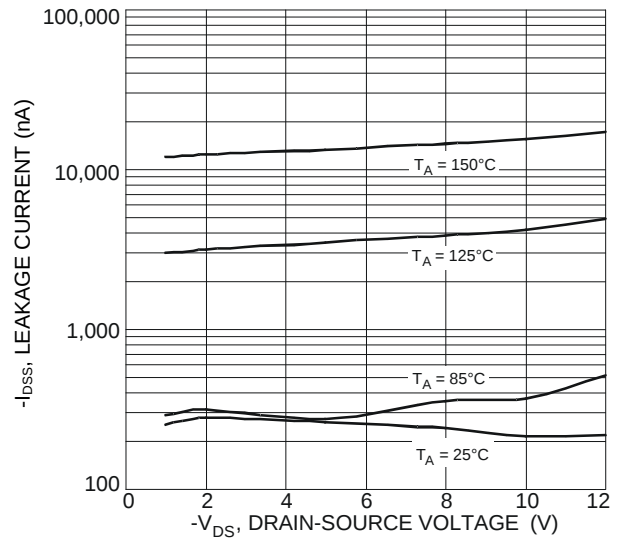


Fig. 13 Typical Drain-Source Leakage Current vs. Voltage

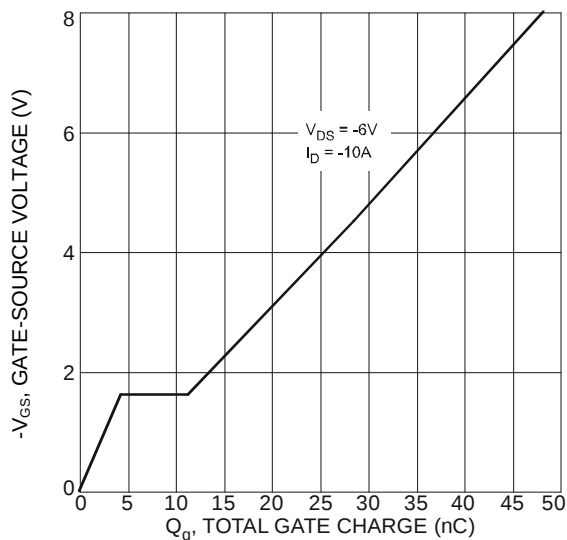
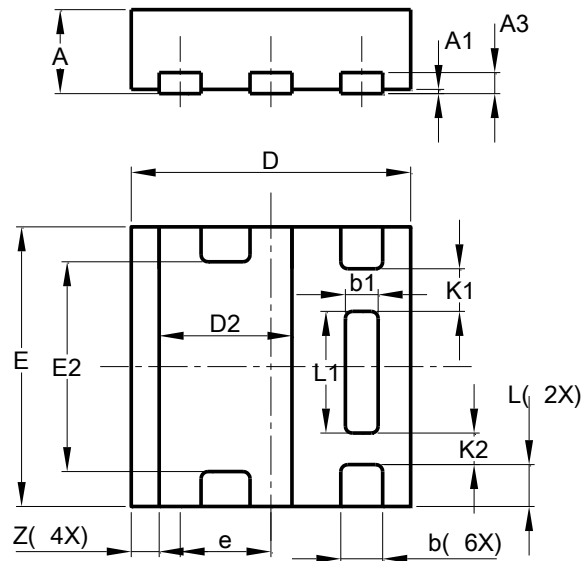


Fig. 14 Gate-Charge Characteristics

## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**U-DFN2020-6 (Type E)**

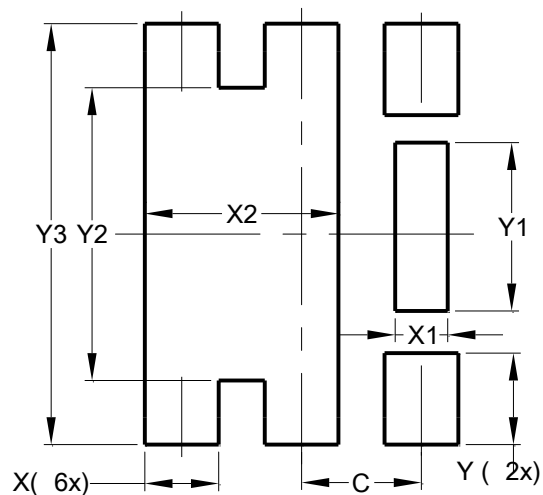


| U-DFN2020-6<br>(Type E) |       |       |       |
|-------------------------|-------|-------|-------|
| Dim                     | Min   | Max   | Typ   |
| A                       | 0.57  | 0.63  | 0.60  |
| A1                      | 0     | 0.05  | 0.03  |
| A3                      | —     | —     | 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

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**U-DFN2020-6 (Type E)**



| Dimensions | Value<br>(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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