

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub>           | I <sub>D</sub><br>T <sub>A</sub> = +25°C |
|-------------------|-------------------------------|------------------------------------------|
| 20V               | 0.6Ω @ V <sub>GS</sub> = 4.5V | 0.9A                                     |
|                   | 0.8Ω @ V <sub>GS</sub> = 2.5V | 0.7A                                     |
|                   | 1.0Ω @ V <sub>GS</sub> = 1.8V | 0.5A                                     |
|                   | 1.6Ω @ V <sub>GS</sub> = 1.5V | 0.3A                                     |

## Description and Applications

This MOSFET is designed to minimize the on-state resistance (R<sub>DS(on)</sub>) and yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

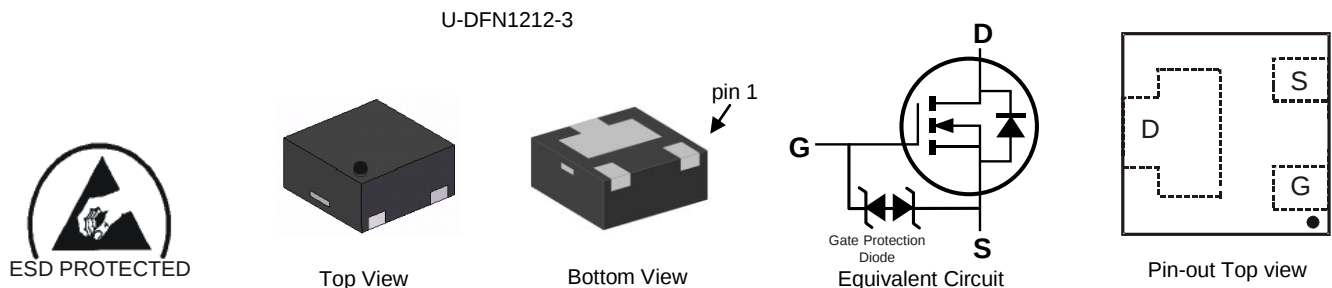
- Power Management Functions
- Battery Operated Systems and Solid-State Relays
- Load Switch

## Features and Benefits

- Low On-Resistance
- Very low Gate Threshold Voltage, 1.0V Max.
- Low Input Capacitance
- Fast Switching Speed
- 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-DFN1212-3
- Case Material: Molded Plastic;  
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)
- Terminal Connections: See Diagram
- Weight: 0.005 grams (Approximate)



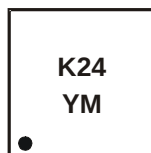
## Ordering Information (Note 5)

| Part Number    | Case        | Packaging          |
|----------------|-------------|--------------------|
| DMN2400UFDQ-7  | U-DFN1212-3 | 3,000/Tape & Reel  |
| DMN2400UFDQ-13 | U-DFN1212-3 | 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/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. 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\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information

U-DFN1212-3



K24 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: C = 2015)  
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | C    | D    | E    | F    | G    | H    | I    | J    | K    | L    | M    |

| 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      | Units |
|----------------------------------------------------------|--------------|--------------------------------------------------|------------------|------------|-------|
| Drain-Source Voltage                                     |              |                                                  | V <sub>DSS</sub> | 20         | V     |
| Gate-Source Voltage                                      |              |                                                  | V <sub>GSS</sub> | ±12        | 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>   | 0.9<br>0.7 | A     |
| Continuous Drain Current (Note 7) V <sub>GS</sub> = 2.5V | Steady State | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 0.7<br>0.5 | A     |
| Pulsed Drain Current (10μs pulse, duty cycle = 1%)       |              |                                                  | I <sub>DM</sub>  | 3.0        | A     |
| Maximum Body Diode Forward Current (Note 7)              |              |                                                  | I <sub>S</sub>   | 0.8        | A     |

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

| Characteristic                                   |              | Symbol                            | Value       | Units |
|--------------------------------------------------|--------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 6)                 |              | P <sub>D</sub>                    | 0.4         | W     |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | R <sub>θJA</sub>                  | 283         | °C/W  |
| Total Power Dissipation (Note 7)                 |              | P <sub>D</sub>                    | 0.8         | W     |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady State | R <sub>θJA</sub>                  | 147         | °C/W  |
| Thermal Resistance, Junction to Case (Note 7)    |              | R <sub>θJC</sub>                  | 112         | °C/W  |
| Operating and Storage Temperature Range          |              | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C    |

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

| Characteristic                                         | Symbol              | Min  | Typ   | Max       | Unit | Test Condition                                                                                                          |
|--------------------------------------------------------|---------------------|------|-------|-----------|------|-------------------------------------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 8)</b>                    |                     |      |       |           |      |                                                                                                                         |
| Drain-Source Breakdown Voltage                         | BV <sub>DSS</sub>   | 20   | -     | -         | 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>    | -    | -     | 80<br>100 | nA   | V <sub>DS</sub> = 4.5V, V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V                             |
| Gate-Source Leakage                                    | I <sub>GSS</sub>    | -    | -     | ±1.0      | µA   | V <sub>GS</sub> = ±4.5V, V <sub>DS</sub> = 0V                                                                           |
| <b>ON CHARACTERISTICS (Note 8)</b>                     |                     |      |       |           |      |                                                                                                                         |
| Gate Threshold Voltage                                 | V <sub>GS(th)</sub> | 0.45 | -     | 1.0       | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                                              |
| Static Drain-Source On-Resistance                      | R <sub>DS(on)</sub> | -    | 0.35  | 0.6       | Ω    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 200mA                                                                          |
|                                                        |                     | -    | 0.45  | 0.8       |      | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 200mA                                                                          |
|                                                        |                     | -    | 0.6   | 1.0       |      | V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 100mA                                                                          |
|                                                        |                     | -    | 0.7   | 1.6       |      | V <sub>GS</sub> = 1.5V, I <sub>D</sub> = 50mA                                                                           |
|                                                        |                     | -    | 0.7   | 1.6       |      | V <sub>GS</sub> = 1.5V, I <sub>D</sub> = 50mA                                                                           |
| Forward Transfer Admittance                            | Y <sub>fs</sub>     | -    | 1.4   | -         | S    | V <sub>DS</sub> = 3V, I <sub>D</sub> = 200mA                                                                            |
| Diode Forward Voltage                                  | V <sub>SD</sub>     | -    | 0.7   | 1.2       | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 500mA,                                                                           |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b>                |                     |      |       |           |      |                                                                                                                         |
| Input Capacitance                                      | C <sub>iss</sub>    | -    | 37.0  | -         | pF   | V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                                              |
| Output Capacitance                                     | C <sub>oss</sub>    | -    | 5.7   | -         | pF   |                                                                                                                         |
| Reverse Transfer Capacitance                           | C <sub>rss</sub>    | -    | 4.2   | -         | pF   |                                                                                                                         |
| Gate Resistance                                        | R <sub>g</sub>      | -    | 68    | -         | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz                                                                  |
| Total Gate Charge                                      | Q <sub>g</sub>      | -    | 0.5   | -         | nC   | V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V,<br>I <sub>D</sub> = 250mA                                                |
| Gate-Source Charge                                     | Q <sub>gs</sub>     | -    | 0.07  | -         | nC   |                                                                                                                         |
| Gate-Drain Charge                                      | Q <sub>gd</sub>     | -    | 0.1   | -         | nC   |                                                                                                                         |
| Turn-On Delay Time                                     | t <sub>D(on)</sub>  | -    | 4.06  | -         | ns   | V <sub>DD</sub> = 10V, V <sub>GS</sub> = 4.5V,<br>R <sub>L</sub> = 47Ω, R <sub>G</sub> = 10Ω,<br>I <sub>D</sub> = 200mA |
| Turn-On Rise Time                                      | t <sub>r</sub>      | -    | 7.28  | -         | ns   |                                                                                                                         |
| Turn-Off Delay Time                                    | t <sub>D(off)</sub> | -    | 13.74 | -         | ns   |                                                                                                                         |
| Turn-Off Fall Time                                     | t <sub>f</sub>      | -    | 10.54 | -         | 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 vias to bottom layer 1-inch square copper plate.
  8. Short duration pulse test used to minimize self-heating effect.
  9. Guaranteed by design. Not subject to production testing.

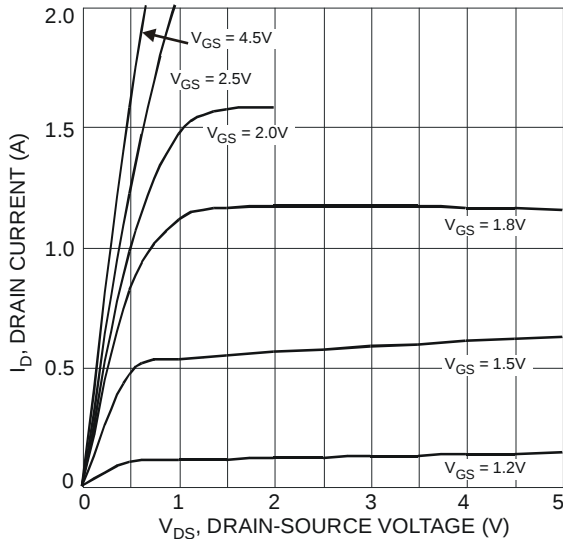


Fig. 1 Typical Output Characteristics

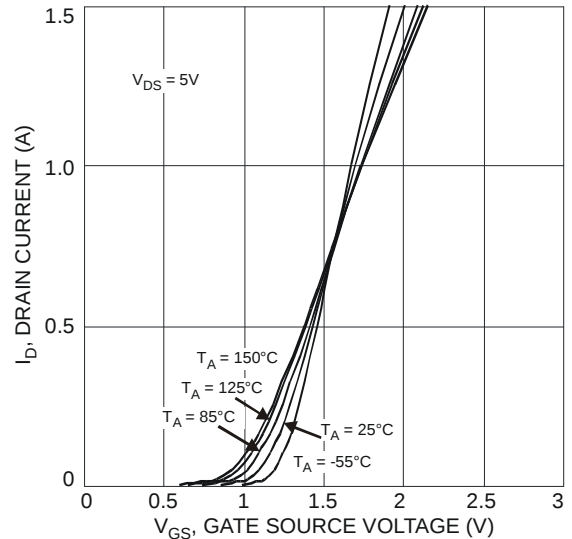


Fig. 2 Typical Transfer Characteristics

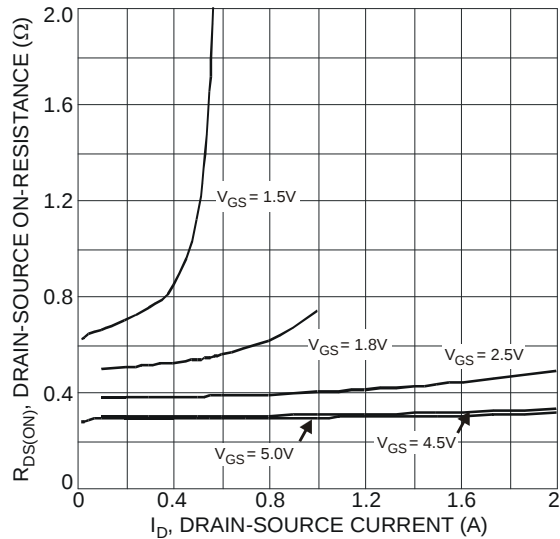


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

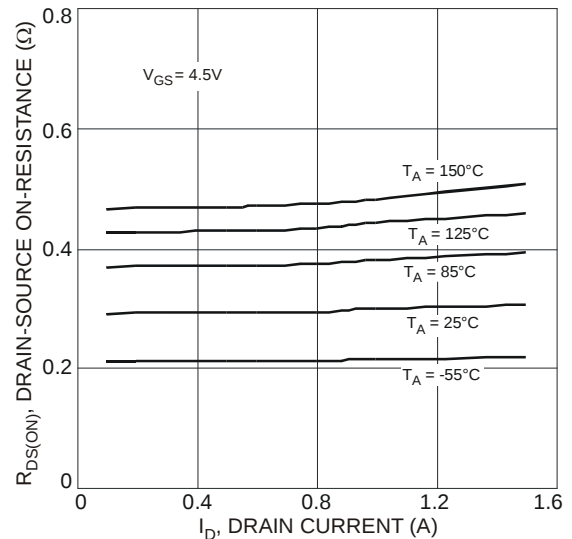


Fig. 4 Typical Drain-Source On-Resistance vs. Drain Current and Temperature

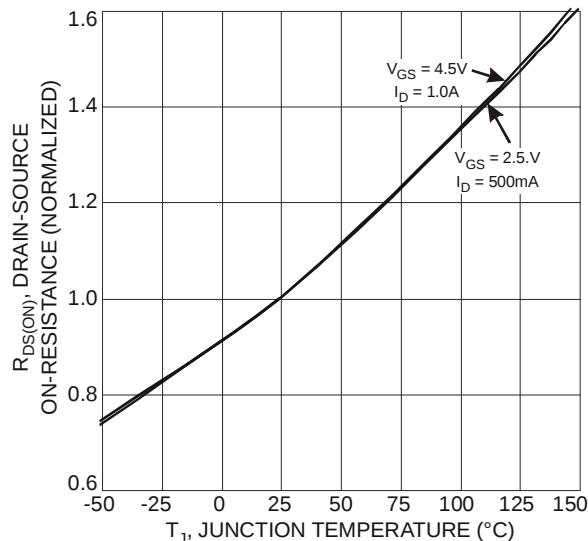


Fig. 5 On-Resistance Variation with Temperature

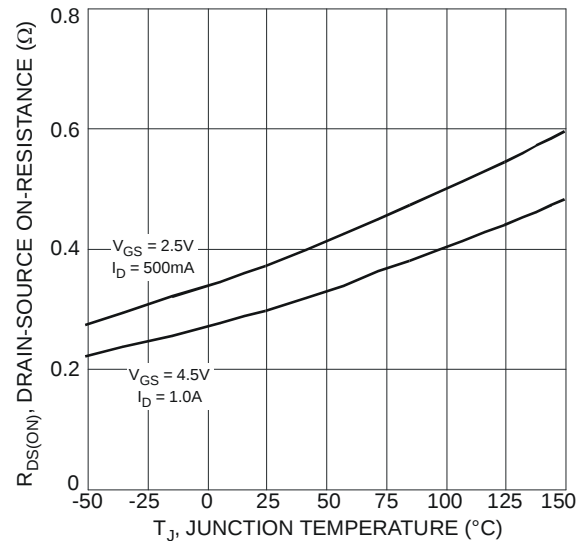


Fig. 6 On-Resistance Variation with Temperature

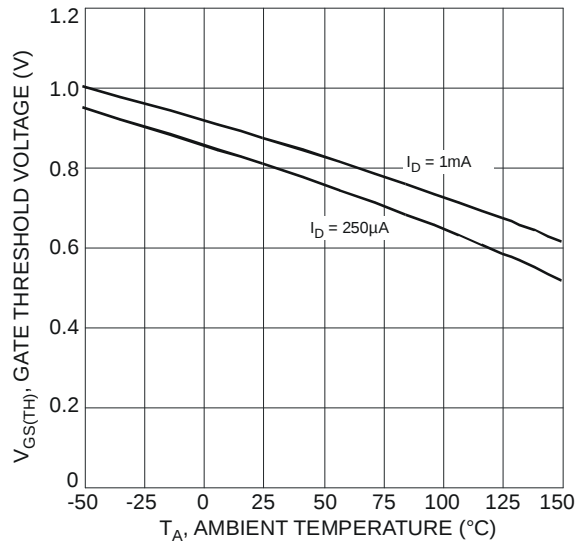


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

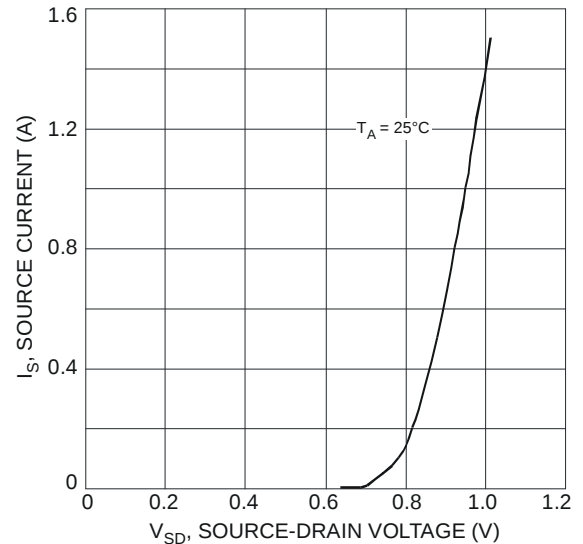


Fig. 8 Diode Forward Voltage vs. Current

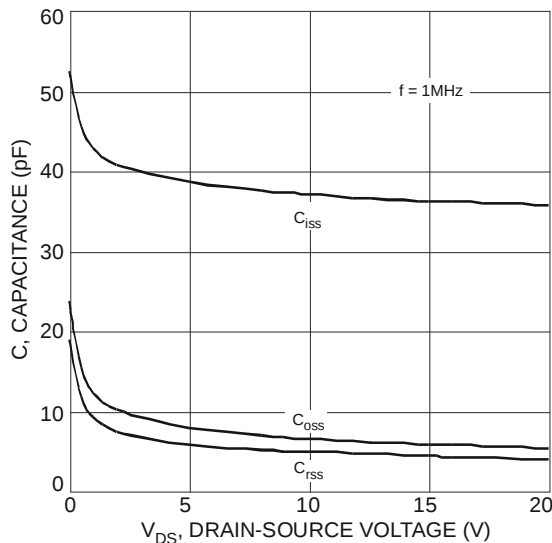


Fig. 9 Typical Capacitance

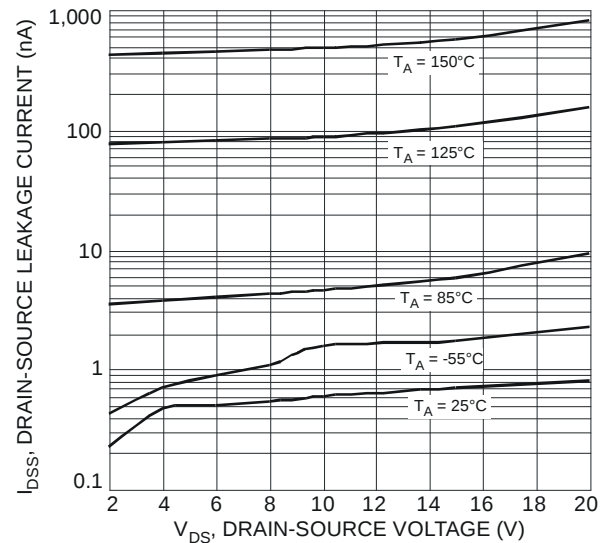


Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

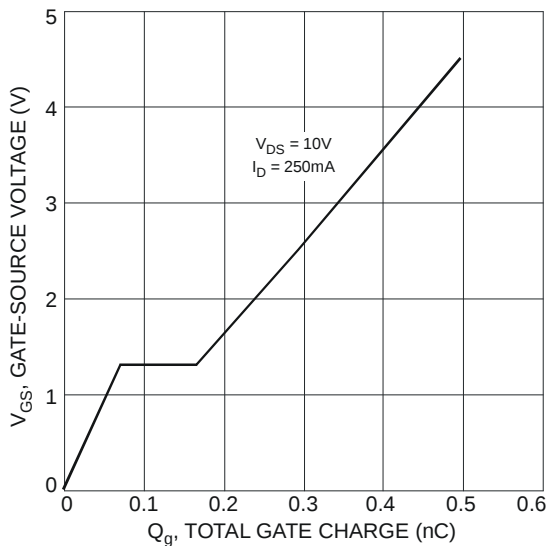


Fig. 11 Gate-Charge Characteristics

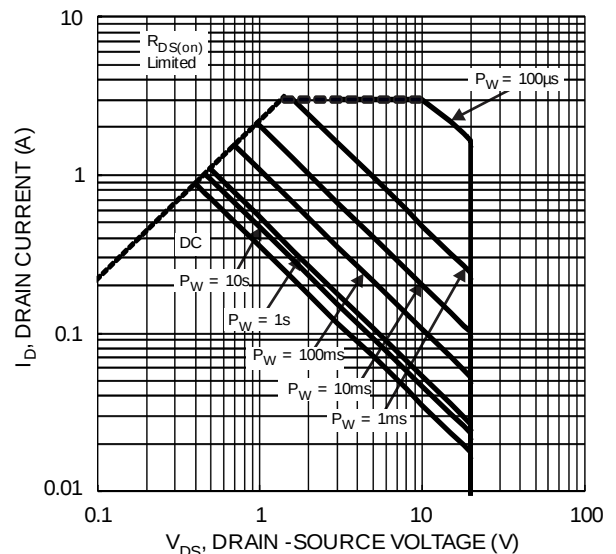
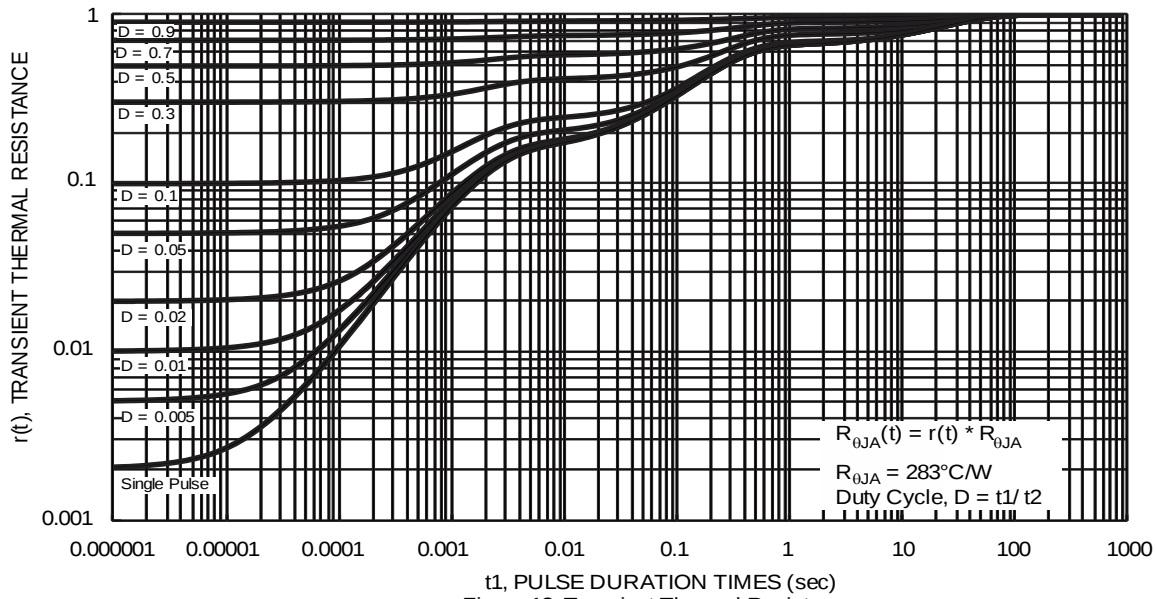
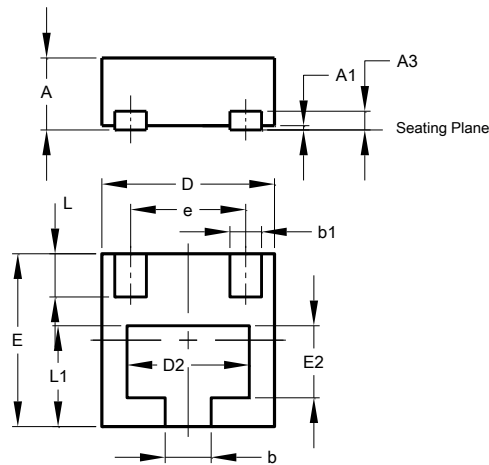


Figure 12 Typical Output Characteristics



### Package Outline Dimensions

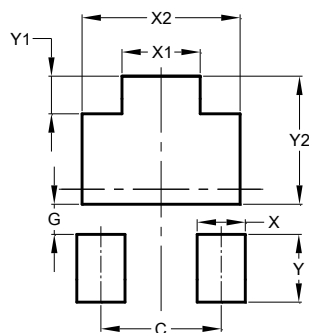
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



| U-DFN1212-3<br>(Type C) |      |      |      |
|-------------------------|------|------|------|
| Dim                     | Min  | Max  | Typ  |
| A                       | 0.47 | 0.53 | 0.50 |
| A1                      | 0    | 0.05 | 0.02 |
| A3                      | -    | -    | 0.13 |
| b                       | 0.27 | 0.37 | 0.32 |
| b1                      | 0.17 | 0.27 | 0.22 |
| D                       | 1.15 | 1.25 | 1.20 |
| D2                      | 0.75 | 0.95 | 0.85 |
| e                       | -    | -    | 0.80 |
| E                       | 1.15 | 1.25 | 1.20 |
| E2                      | 0.40 | 0.60 | 0.50 |
| L                       | 0.25 | 0.35 | 0.30 |
| L1                      | 0.65 | 0.75 | 0.70 |
| All Dimensions in mm    |      |      |      |

### Suggested Pad Layout

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



| U-DFN1212-3<br>(Type C) |       |
|-------------------------|-------|
| Dimensions              | Value |
| C                       | 0.800 |
| G                       | 0.200 |
| X                       | 0.320 |
| X1                      | 0.520 |
| X2                      | 1.050 |
| Y                       | 0.450 |
| Y1                      | 0.250 |
| Y2                      | 0.850 |
| All Dimensions in mm    |       |

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