

12V P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | I _D Max T _A = +25°C |
|-------------------|----------------------------------|--|
| -12V | 16mΩ @ V _{GS} = -4.5V | -9.1A |
| | 21.5mΩ @ V _{GS} = -2.5V | -7.9A |
| | 26mΩ @ V _{GS} = -1.8V | -7.0A |
| | 32mΩ @ V _{GS} = -1.5V | -6.3A |

Description

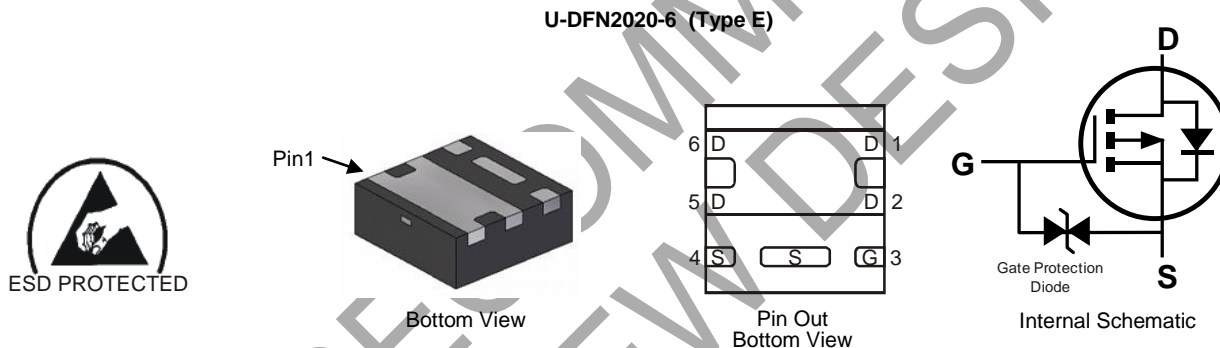
This MOSFET is designed specifically for use in battery management applications.

Features

- 0.6mm Profile – Ideal For Low Profile Applications
- PCB Footprint of 4mm²
- 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**
- **An Automotive-Compliant Part is Available Under Separate Datasheet ([DMP1022UFDEQ](#))**

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)

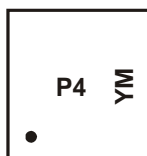


Ordering Information (Note 4)

| Part Number | Marking | Reel Size (inches) | Quantity Per Reel |
|---------------|---------|--------------------|-------------------|
| DMP1022UFDE-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 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 <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

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

| Characteristic | | | Symbol | Value | Unit |
|---|-----------------|--|-----------|---------------|------|
| Drain-Source Voltage | | | V_{DSS} | -12 | V |
| Gate-Source Voltage | | | V_{GSS} | ± 8 | V |
| Continuous Drain Current (Note 6) $V_{GS} = -4.5\text{V}$ | Steady State | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | -9.1 -7.2 | A |
| | $t < 5\text{s}$ | $T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$ | I_D | -11.2 -9.0 | A |
| Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%) | | | I_{DM} | -90 | A |
| Continuous Source-Drain Diode Current | | $T_A = +25^\circ\text{C}$ $T_C = +25^\circ\text{C}$ | I_S | -2.5 -7.1 | A |
| Pulsed Source-Drain Diode Current (10 μs Pulse, Duty Cycle = 1%) | | | I_{SM} | -50 | A |

Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|--|---------------------------|-----------------|-------------|--------------------|
| Total Power Dissipation (Note 5) | $T_A = +25^\circ\text{C}$ | P_D | 0.66 | W |
| | $T_A = +70^\circ\text{C}$ | | 0.42 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 189 | $^\circ\text{C/W}$ |
| | $t < 5\text{s}$ | | 123 | |
| Total Power Dissipation (Note 6) | $T_A = +25^\circ\text{C}$ | P_D | 2.03 | W |
| | $T_A = +70^\circ\text{C}$ | | 1.3 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 61 | $^\circ\text{C/W}$ |
| | $t < 5\text{s}$ | | 40 | |
| 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 | $^\circ\text{C}$ |

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

NOT RECOMMENDED FOR NEW DESIGN

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} | -12 | — | — | V | V _{GS} = 0V, I _D = -250μA |
| Zero Gate Voltage Drain Current (T _J = +25°C) | I _{DSS} | — | — | -200 | nA | V _{DS} = -12V, V _{GS} = 0V |
| Zero Gate Voltage Drain Current (T _J = +55°C) (Note 8) | I _{DSS} | — | — | -2 | μA | V _{DS} = -12V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±2 | μA | V _{GS} = ±5V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | -0.35 | — | -0.8 | V | V _{DS} = V _{GS} , I _D = -250μA |
| V _{GS(TH)} Temperature Coefficient | ΔV _{GS(TH)} /ΔT _J | — | 2.5 | — | mV/°C | I _D = -250μA |
| On-State Drain Current | I _{D(ON)} | -10 | — | — | A | V _{GS} = -4.5V, V _{DS} < -5A |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 12 | 16 | mΩ | V _{GS} = -4.5V, I _D = -8.2A |
| | | | 15 | 21.5 | | V _{GS} = -2.5V, I _D = -7.2A |
| | | | 20 | 26 | | V _{GS} = -1.8V, I _D = -6.6A |
| | | | 23 | 32 | | V _{GS} = -1.5V, I _D = -1A |
| | | | 80 | 160 | | V _{GS} = -1.2V, I _D = -1A |
| Forward Transfer Admittance | Y _{fs} | — | 12 | — | S | V _{DS} = -4V, I _D = -8.2A |
| Diode Forward Voltage | V _{SD} | — | -0.8 | -1.2 | V | V _{GS} = 0V, I _S = -8A |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iss} | — | 2,953 | — | pF | V _{DS} = -4V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 756 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 678 | — | | |
| Gate Resistance | R _g | — | 8.6 | 18 | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge | Q _g | — | 28.4 | 42.6 | nC | V _{GS} = -5V, V _{DS} = -4V, I _D = -10A |
| Total Gate Charge | Q _g | — | 25.3 | 38 | | |
| Gate-Source Charge | Q _{gs} | — | 2.3 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 7.2 | — | | |
| Turn-On Delay Time | t _{D(ON)} | — | 20 | 30 | | |
| Turn-On Rise Time | t _r | — | 28 | 42 | ns | V _{DS} = -4V, V _{GS} = -4.5V, R _G = 1Ω, R _L = 0.4Ω, I _D = -9.8A |
| Turn-Off Delay Time | t _{D(OFF)} | — | 117 | 176 | | |
| Turn-Off Fall Time | t _f | — | 93 | 139 | | |
| BODY DIODE CHARACTERISTICS | | | | | | |
| Diode Forward Voltage | V _{SD} | — | -0.8 | -1.2 | V | V _{GS} = 0V, I _S = -9.8A |
| Continuous Source-Drain Diode Current (Note 6) | I _S | — | — | -2.5 | A | T _A = +25°C |
| | | | | -7.1 | | T _C = +25°C |
| Pulse Diode Forward Current (Note 8) | I _{SM} | — | — | -50 | ns | I _S = -9.8A, dI/dt = 100A/μs |
| Body Diode Reverse Recovery Time (Note 8) | t _{RR} | — | 28 | 56 | | |
| Reverse Recovery Fall Time | t _A | — | 10 | — | | |
| Reverse Recovery Rise Time | t _B | — | 18 | — | | |
| Body Diode Reverse Recovery Charge (Note 8) | Q _{RR} | — | 13 | 26 | | |

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to production testing.

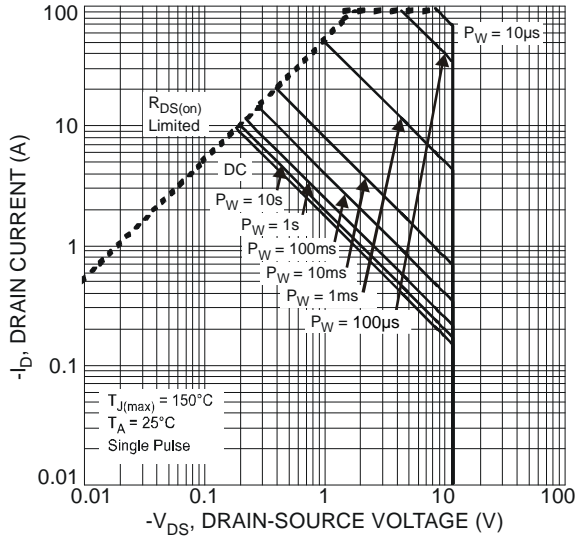


Fig. 1 SOA, Safe Operation Area

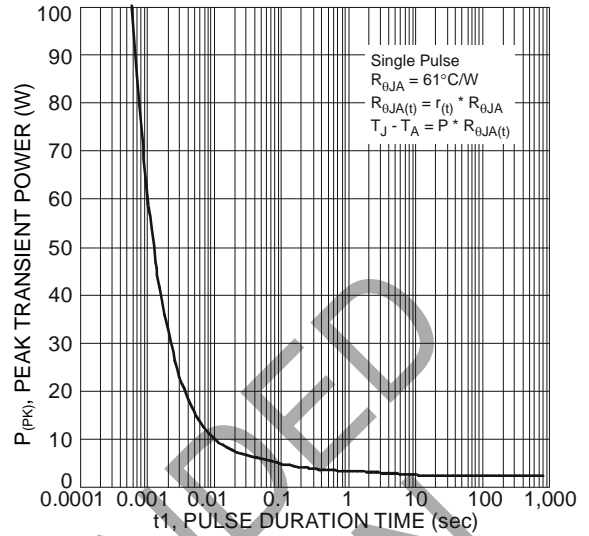


Fig. 2 Single Pulse Maximum Power Dissipation

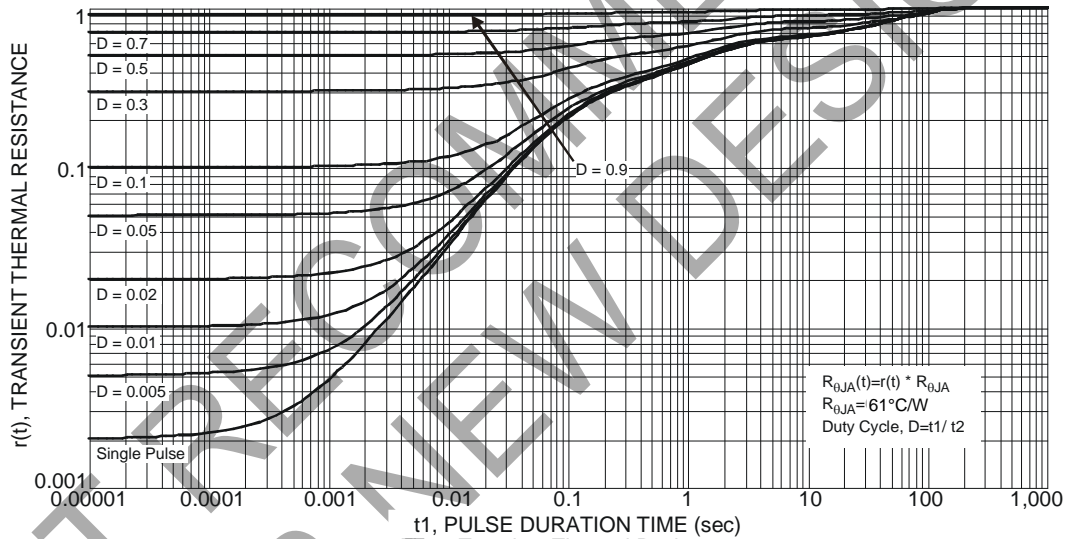


Fig. 3 Transient Thermal Resistance

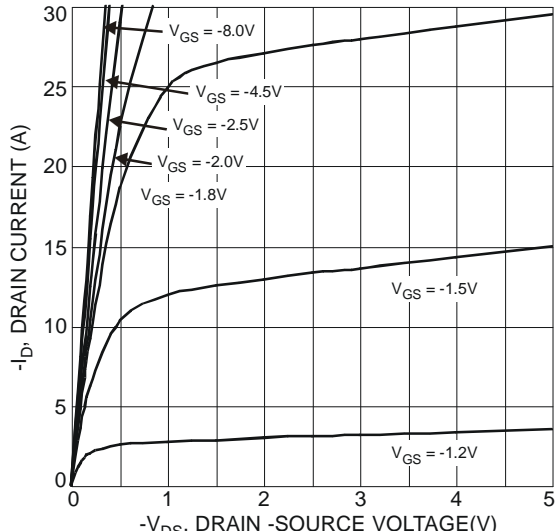


Fig. 4 Typical Output Characteristics

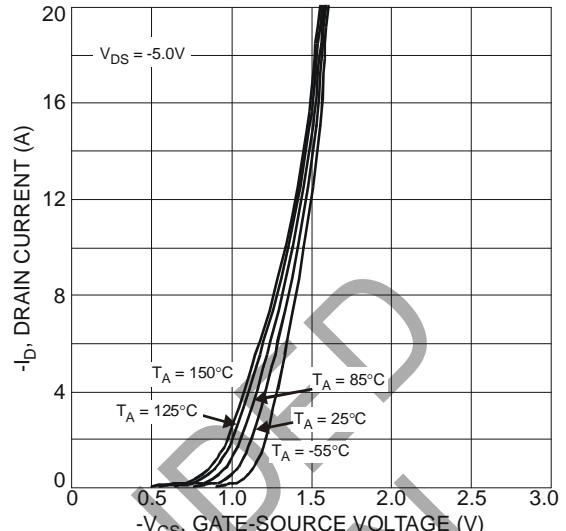


Fig. 5 Typical Transfer Characteristics

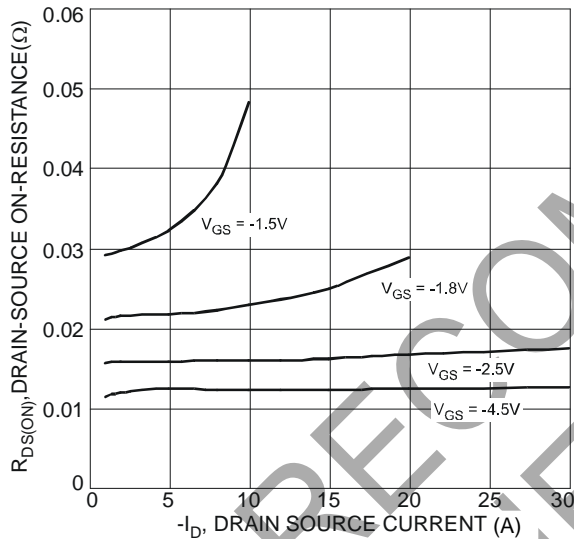


Fig. 6 Typical On-Resistance vs. Drain Current and Gate Voltage

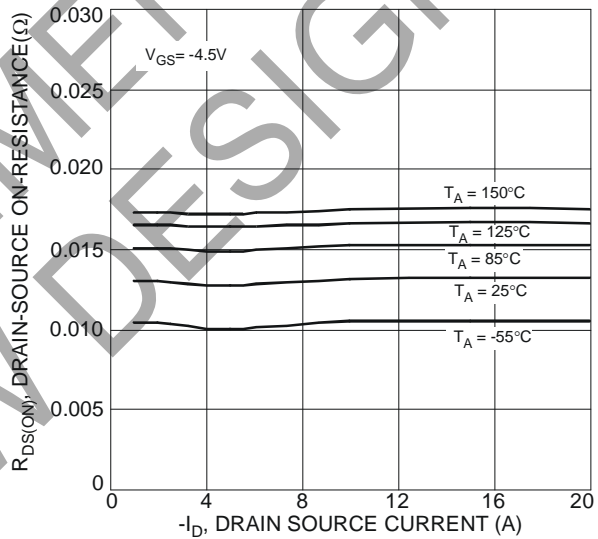


Fig. 7 Typical On-Resistance vs. Drain Current and Temperature

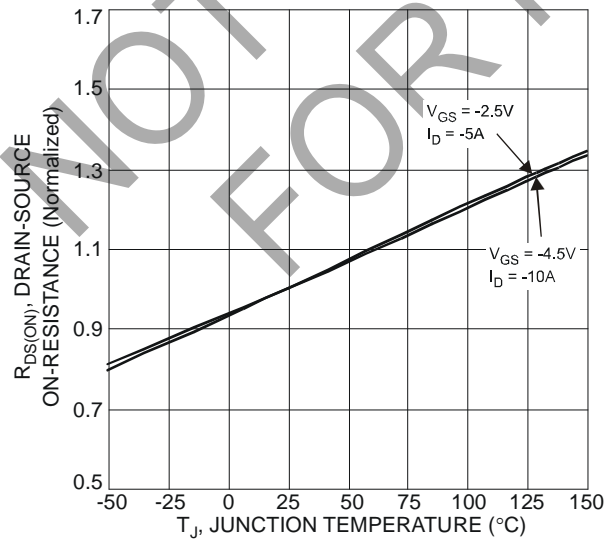


Fig. 8 On-Resistance Variation with Temperature

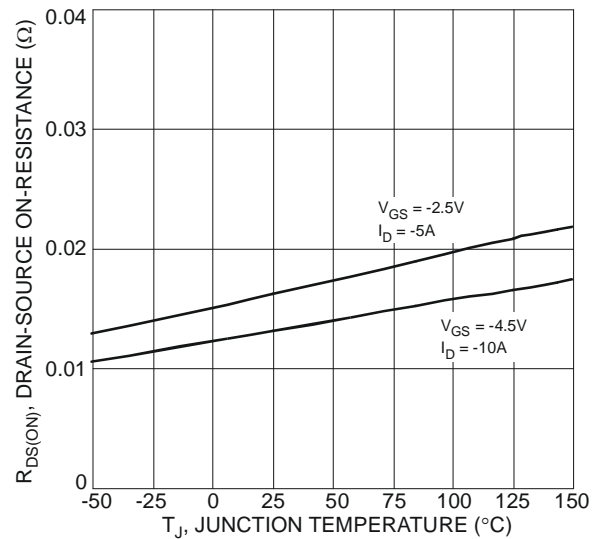


Fig. 9 On-Resistance Variation with Temperature

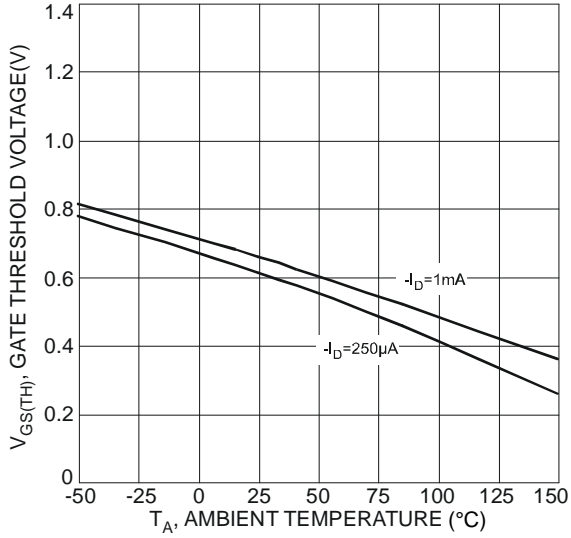


Fig. 10 Gate Threshold Variation vs. Ambient Temperature

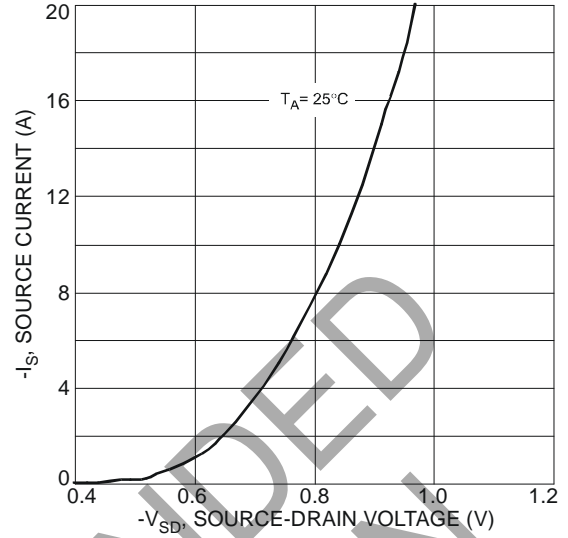


Fig. 11 Diode Forward Voltage vs. Current

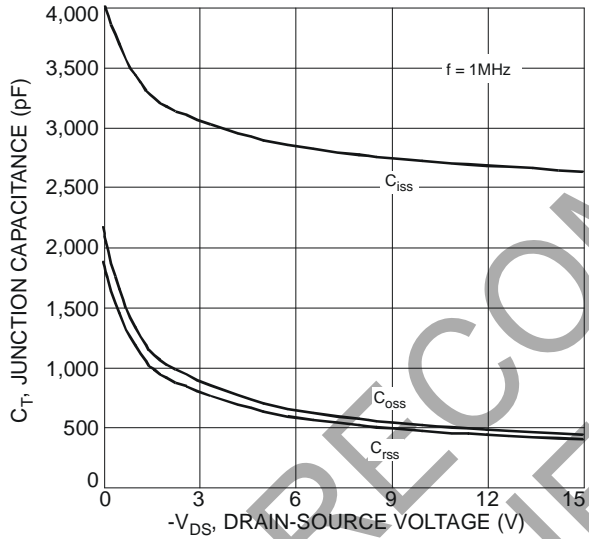


Fig. 12 Typical Junction Capacitance

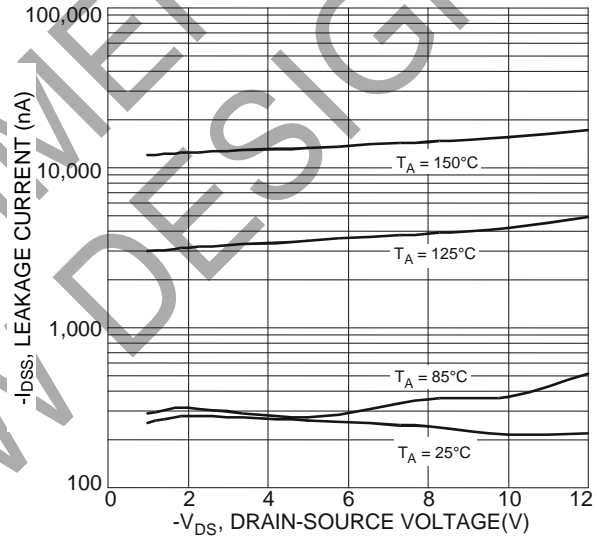


Fig. 13 Typical Drain-Source Leakage Current vs. Voltage

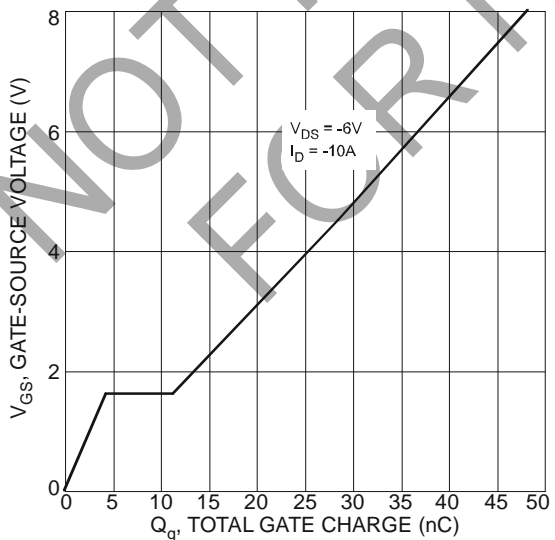
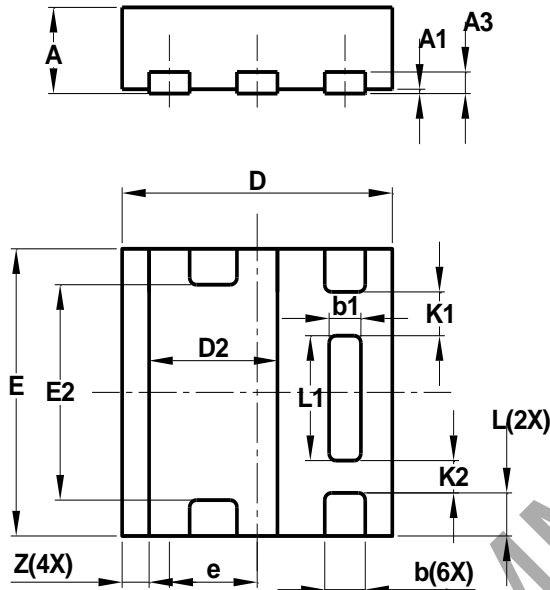


Fig. 14 Gate-Charge Characteristics

Package Outline Dimensions

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

U-DFN2020-6 (Type E)

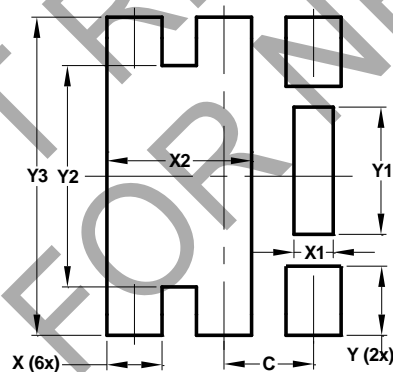


| U-DFN2020-6 (Type E) | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.57 | 0.63 | 0.60 |
| A1 | 0 | 0.05 | 0.03 |
| A3 | - | - | 0.15 |
| b | 0.25 | 0.35 | 0.30 |
| b1 | 0.185 | 0.285 | 0.235 |
| D | 1.95 | 2.05 | 2.00 |
| D2 | 0.85 | 1.05 | 0.95 |
| E | 1.95 | 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 (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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