# P-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ | $I_D$ $T_A$ = 25°C |
|---|---|---|
| -20V | 70mΩ @ $V_{GS}$ = -4.5V | 3.5 A |
| | 90mΩ @ $V_{GS}$ = -2.5V | 3.0 A |

## Features and Benefits

- Low $Q_g$ & $Q_{gd}$
- Small Footprint
- Low Profile 0.62mm height
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device Halogen and Antimony Free (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Description and Applications

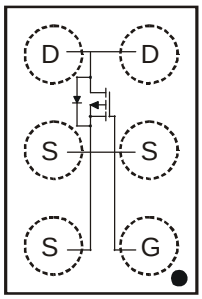
This new generation MOSFET has been designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Battery Management
- Load Switch
- Battery Protection

## Mechanical Data

- Case: U-WLB1510-6
- Terminal Connections: See Diagram Below
- Weight: 0.0018 grams (approximate)

U-WLB1510-6



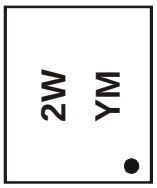

Top View

## Ordering Information (Note 3)

| Part Number | Case | Packaging |
|---|---|---|
| DMP2070UCB6-7 | U-WLB1510-6 | 3000/Tape & Reel |

Notes: 1. No purposefully added lead.
2. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com.
3. For packaging details, go to our website at http://www.diodes.com

## Marking Information




2W = 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°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 4) $V_{GS}$ = -4.5V | Steady State | $T_A$ = 25°C<br>$T_A$ = 70°C | $I_D$ | -2.5<br>-2.0 | A |
| Continuous Drain Current (Note 5) $V_{GS}$ = -4.5V | Steady State | $T_A$ = 25°C<br>$T_A$ = 70°C | $I_D$ | -3.5<br>-2.8 | A |
| Pulsed Drain Current **(Note 6)** | | | $I_{DM}$ | -12 | A |
| Maximum Continuous Body Diode Forward Current (Note 5) | | | $I_S$ | -1.8 | A |

## Thermal Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Units |
|---|---|---|---|
| Total Power Dissipation (Note 4) | $P_D$ | 0.92 | W |
| Total Power Dissipation (Note 5) | $P_D$ | 1.47 | W |
| Thermal Resistance, Junction to Ambient (Note 4) | $R_{\theta JA}$ | 136 | °C/W |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 84 | °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, $I_D$ = -250µA |
| Zero Gate Voltage Drain Current @$T_C$ = 25°C | $I_{DSS}$ | - | - | -1 | µA | $V_{DS}$ = -16V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$ = ±8V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -0.4 | -0.6 | -1.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | - | 55 | 70 | mΩ | $V_{GS}$ = -4.5V, $I_D$ = - 1A |
| | | | 70 | 90 | | $V_{GS}$ = -2.5V, $I_D$ = -1A |
| | | | 90 | 110 | | $V_{GS}$ = -1.8V, $I_D$ = -1A |
| | | | 110 | 150 | | $V_{GS}$ = -1.5V, $I_D$ = -1A |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | - | 12 | - | S | $V_{DS}$ = -10V, $I_D$ = -1A |
| Diode Forward Voltage (Note 5) | $V_{SD}$ | - | -0.7 | -1 | V | $V_{GS}$ = 0V, $I_S$ = -1A |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | - | 210 | - | pF | $V_{DS}$ = -10V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | - | 92 | - | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 38 | - | pF | |
| Series Gate Resistance | $R_G$ | | 5.3 | - | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge (4.5V) | $Q_g$ | - | 2.9 | - | nC | $V_{GS}$ = -4.5V, $V_{DS}$ = -10V, $I_D$ = -1A , |
| Gate-Source Charge | $Q_{gs}$ | - | 0.3 | - | nC | |
| Gate-Drain Charge | $Q_{gd}$ | - | 0.5 | - | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | - | 7.3 | - | ns | $V_{DD}$ = -10V, $V_{GS}$ = -4.5V, $I_{DS}$ = -1A, $R_G$ = 20Ω, |
| Turn-On Rise Time | $t_r$ | - | 14.0 | - | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | - | 42.6 | - | ns | |
| Turn-Off Fall Time | $t_f$ | - | 32 | - | ns | |

Notes:
4. Device mounted on FR-4 PCB with minimum recommended pad layout.
5. Device mounted on FR4 material with 1-inch$^2$ (6.45-cm$^2$), 2-oz. (0.071-mm thick) Cu
6 300ms pulse, pulse duty cycle ≤ 2%
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to production testing.

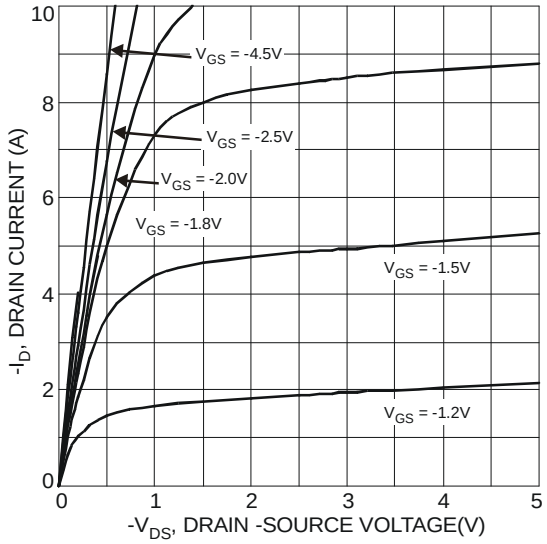



Fig. 1 Typical Output Characteristics

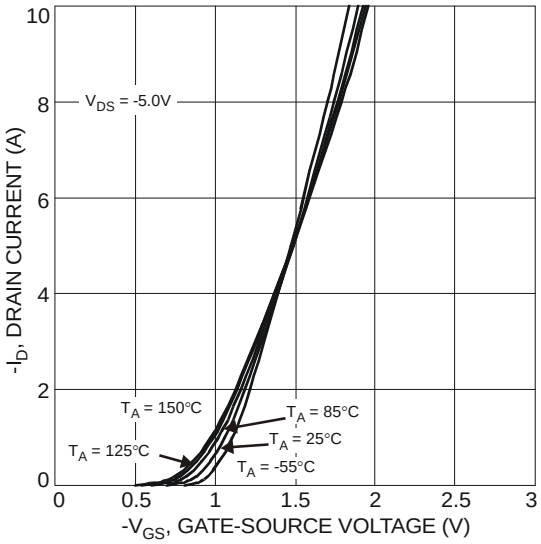



Fig. 2 Typical Transfer Characteristics

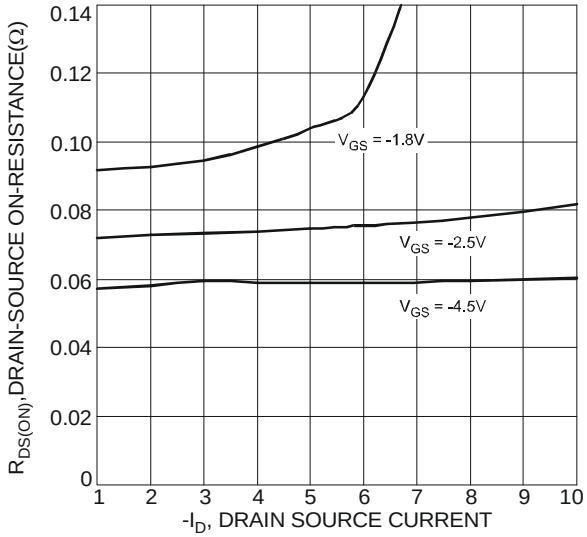



Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

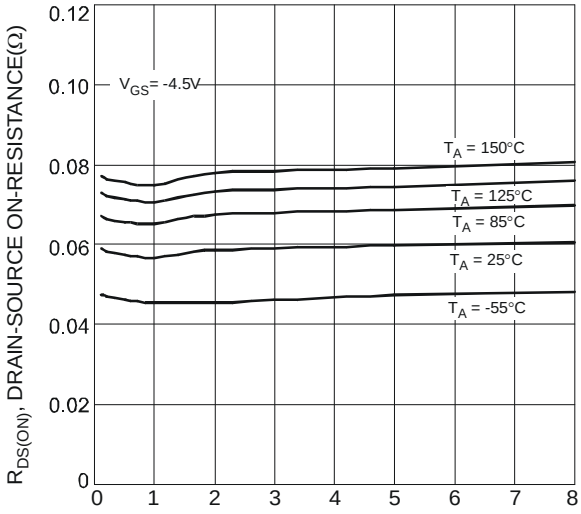



Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

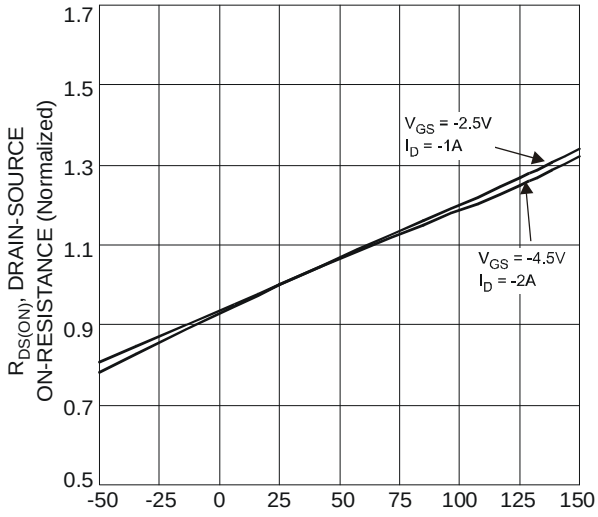



Fig. 5 On-Resistance Variation with Temperature

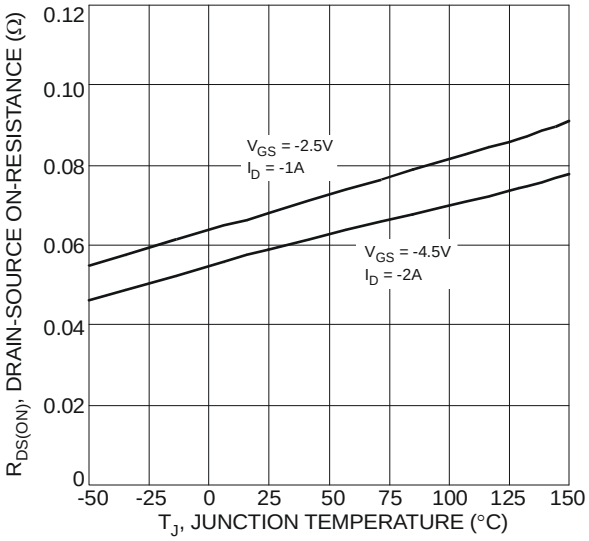



Fig. 6 On-Resistance Variation with Temperature

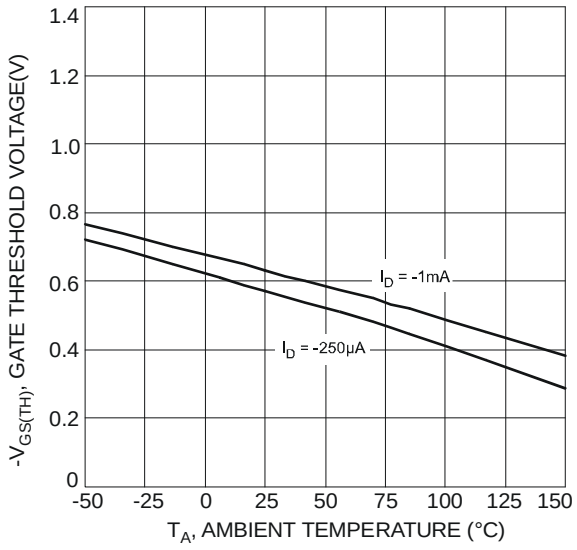



Fig. 7 Gate Threshold Variation vs. Ambient Temperature

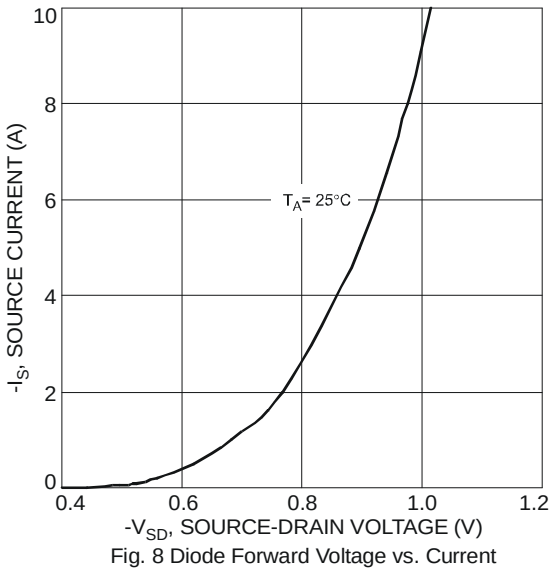



Fig. 8 Diode Forward Voltage vs. Current

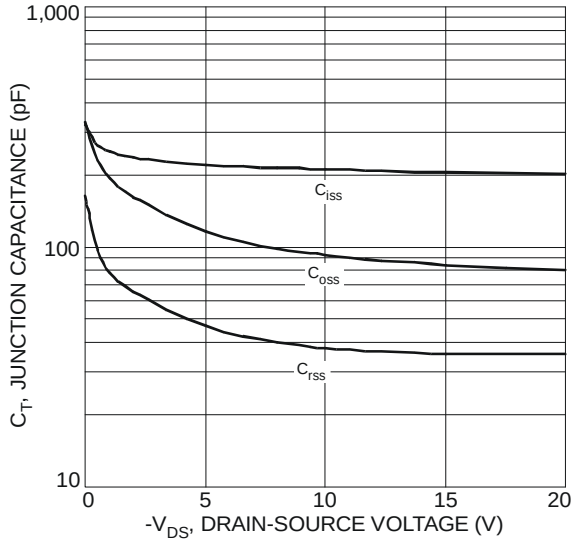



Fig. 9 Typical Junction Capacitance

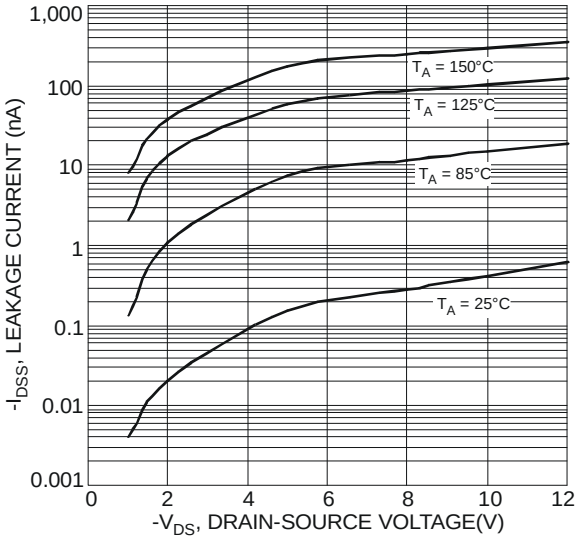



Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

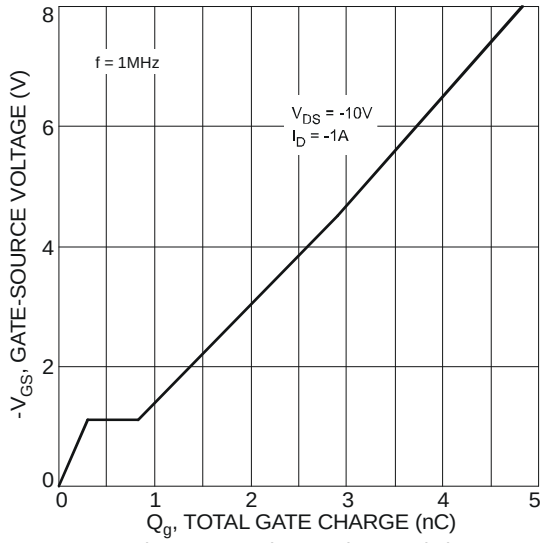



Fig. 11 Gate-Charge Characteristics

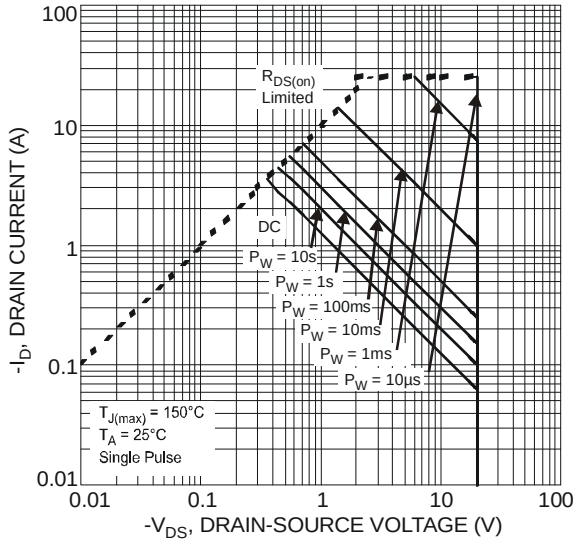



Fig. 12 SOA, Safe Operation Area

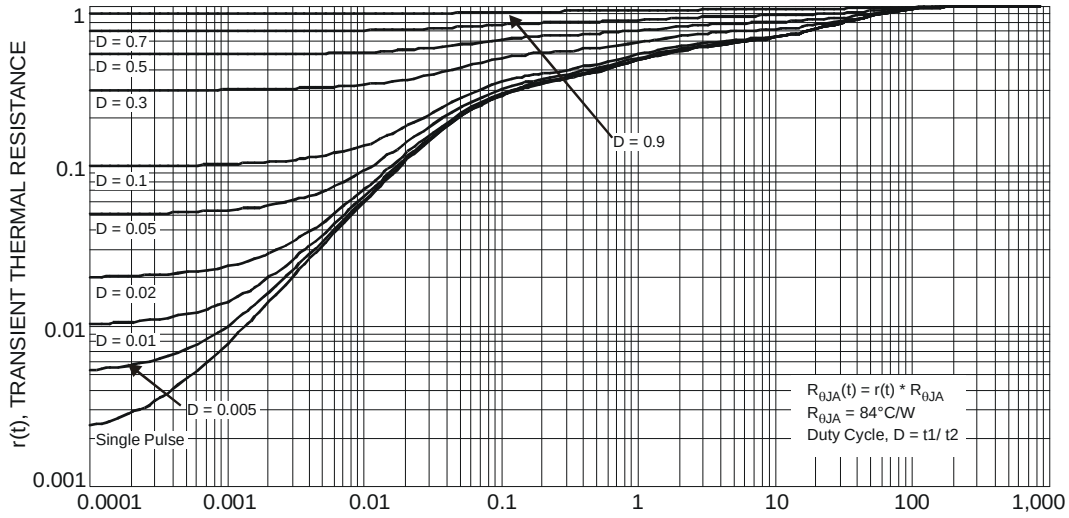
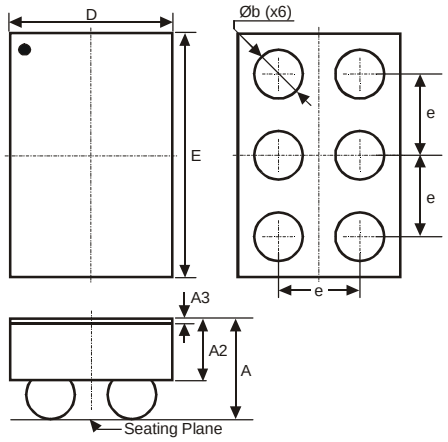


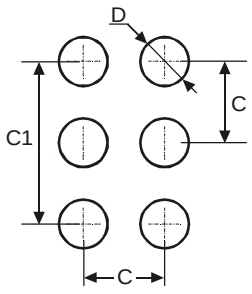

Fig. 13 Transient Thermal Resistance

## Package Outline Dimensions




| U-WLB1510-6 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **D** | 0.90 | 1.00 | 1.00 |
| **E** | 1.40 | 1.50 | 1.50 |
| **A** | – | 0.62 | – |
| **A2** | – | – | 0.38 |
| **A3** | 0.020 | 0.030 | 0.025 |
| **b** | 0.27 | 0.37 | 0.32 |
| **e** | – | – | 0.50 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.50 |
| **C1** | 1.00 |
| **D** | 0.25 |

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