

**COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**
**Product Summary**

| Device          | BV <sub>bss</sub> | R <sub>DS(ON)</sub> Max         | I <sub>D</sub> Max<br>T <sub>A</sub> = +25°C |
|-----------------|-------------------|---------------------------------|--|
| Q1<br>N-Channel | 20V               | 35mΩ @ V <sub>GS</sub> = 4.5V   | 4.6A   |
|                 |                   | 43mΩ @ V <sub>GS</sub> = 2.5V   | 4.1A   |
| Q2<br>P-Channel | -20V              | 75mΩ @ V <sub>GS</sub> = -4.5V  | -3.1A  |
|                 |                   | 110mΩ @ V <sub>GS</sub> = -2.5V | -2.6A  |

**Features**

- PCB Footprint of 4mm<sup>2</sup>
- Low On-Resistance
- Low Input Capacitance
- Low Profile, 0.6mm Maximum Height
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free. "Green" Device (Note 3)**
- **The DMC2053UFDBQ is suitable for automotive applications requiring specific change control; This part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

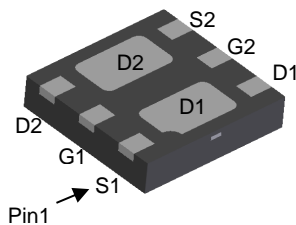
**Description and Applications**

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

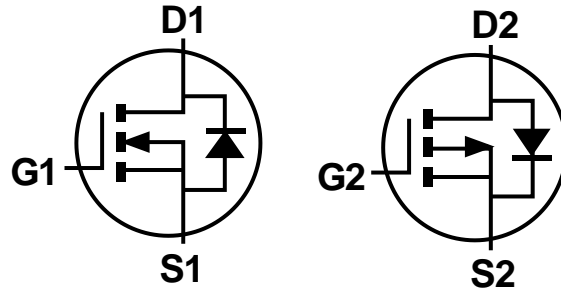
- Load switches
- Power management functions
- Portable power adaptors

**Mechanical Data**

- Package: U-DFN2020-6
- Package 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 Lead-Frame. Solderable per MIL-STD-202, Method 208 (4)
- Terminals Connections: See Diagram Below
- Weight: 0.0065 grams (Approximate)

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


Bottom View



N-Channel MOSFET

P-Channel MOSFET

Internal Schematic

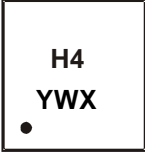
**Ordering Information (Note 4)**

| Part Number     | Package              | Packing |             |
|-----------------|----------------------|---------|-------------|
|                 |                      | Qty.    | Carrier     |
| DMC2053UFDBQ-7  | U-DFN2020-6 (Type B) | 3,000   | Tape & Reel |
| DMC2053UFDBQ-13 | U-DFN2020-6 (Type B) | 10,000  | Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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

### U-DFN2020-6 (Type B)



H4 = Product Type Marking Code  
 YWX = Date Code Marking  
 Y = Year (ex: 3 = 2023)  
 W = Week (ex: a = Week 27; z Represents Week 52 and 53)  
 X = Internal Code (ex: U = Monday)

Date Code Key

|             |             |          |             |             |             |             |             |             |             |             |             |             |
|-------------|-------------|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>Year</b> | <b>2020</b> | <b>-</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> | <b>2029</b> | <b>2030</b> | <b>2031</b> | <b>2032</b> |
| <b>Code</b> | 0           | -        | 3           | 4           | 5           | 6           | 7           | 8           | 9           | 0           | 1           | 2           |

|             |             |              |           |
|-------------|-------------|--------------|-----------|
| <b>Week</b> | <b>1-26</b> | <b>27-52</b> | <b>53</b> |
| <b>Code</b> | A-Z         | a-z          | z         |

|                      |            |            |            |            |            |            |            |
|----------------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Internal Code</b> | <b>Sun</b> | <b>Mon</b> | <b>Tue</b> | <b>Wed</b> | <b>Thu</b> | <b>Fri</b> | <b>Sat</b> |
| <b>Code</b>          | T          | U          | V          | W          | X          | Y          | Z          |

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

| Characteristic   |              |                           | Symbol    | Q1<br>N-CHANNEL | Q2<br>P-CHANNEL | Unit |
|--|--------------|---------------------------|-----------|-----------------|-----------------|------|
| Drain-Source Voltage   |              |                           | $V_{DSS}$ | 20              | -20             | V    |
| Gate-Source Voltage  |              |                           | $V_{GSS}$ | $\pm 12$        | $\pm 12$        | V    |
| Continuous Drain Current (Note 6) $V_{GS} = 4.5\text{V}$       | Steady State | $T_A = +25^\circ\text{C}$ | $I_D$     | 4.6             | -3.1            | A    |
|  |              | $T_A = +70^\circ\text{C}$ |           | 3.7             | -2.5            |      |
| Maximum Continuous Body Diode Forward Current (Note 6)         |              |                           | $I_S$     | 1.1             | -1.05           | A    |
| Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%) |              |                           | $I_{DM}$  | 24              | -15             | A    |

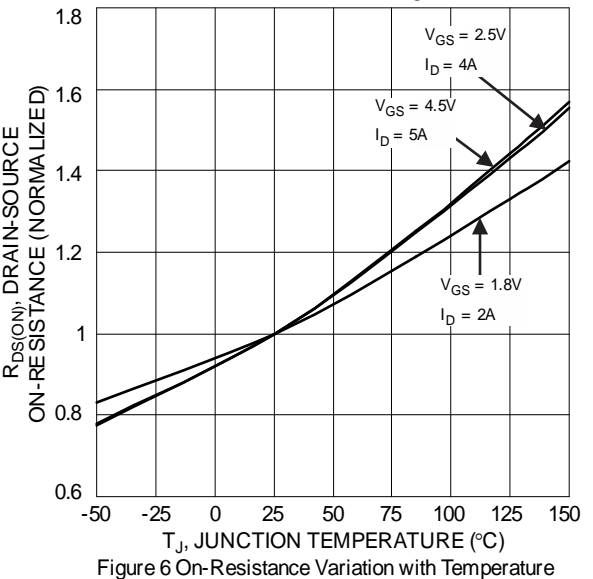
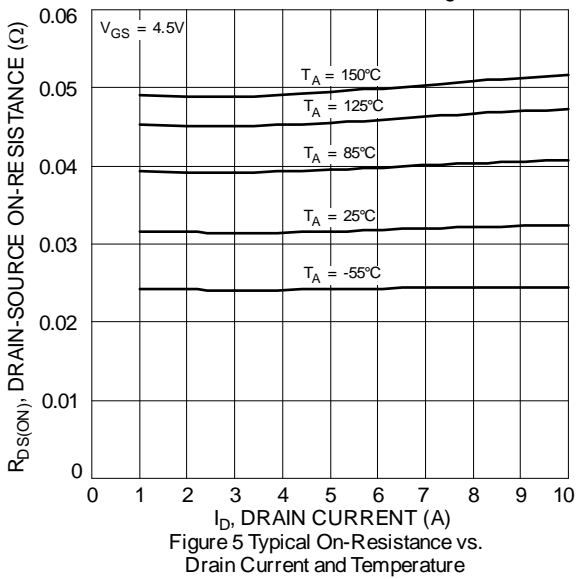
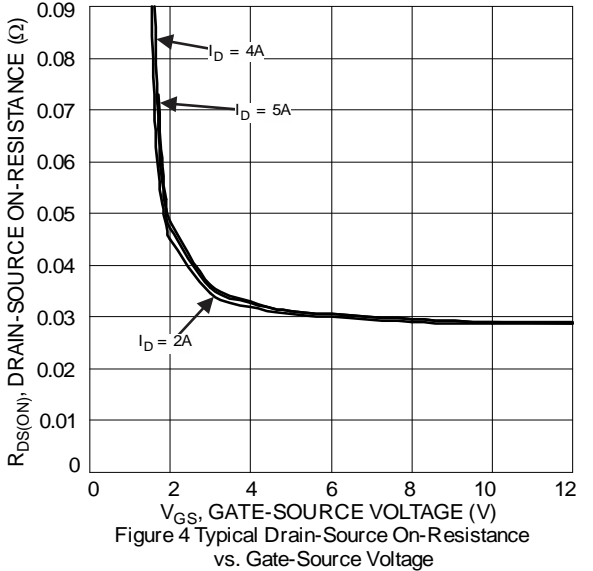
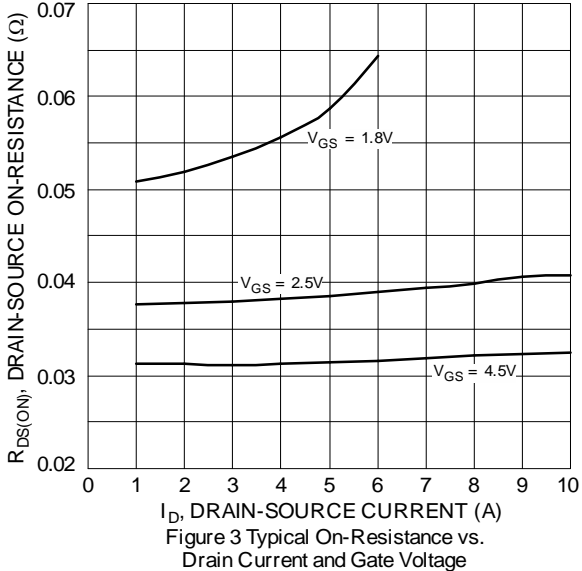
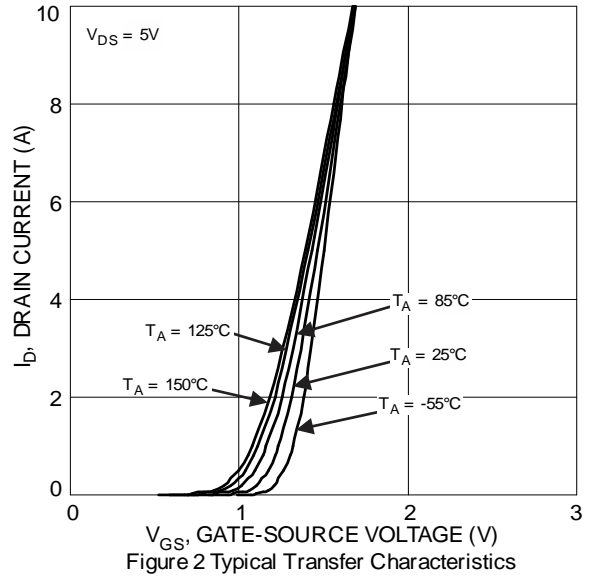
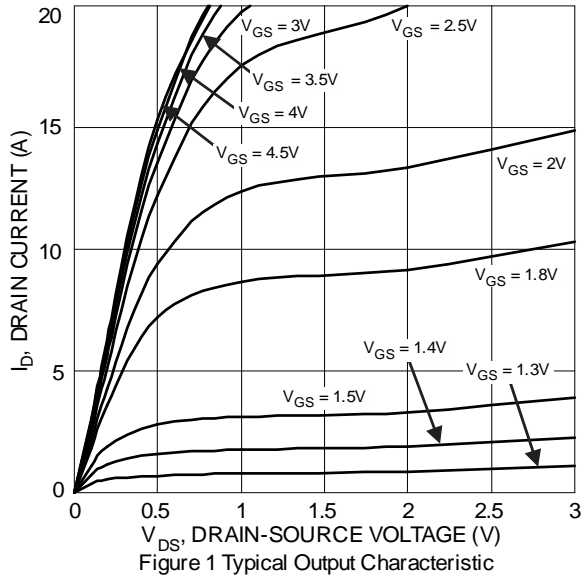
**Thermal Characteristics**

| Characteristic                                   | Symbol                             | Value          | Unit                            |
|--|------------------------------------|----------------|---------------------------------|
| Total Power Dissipation (Note 5)                 | $T_A = +25^\circ\text{C}$<br>$P_D$ | 0.82           | W                               |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State<br>$R_{\theta JA}$    | 153            | $^\circ\text{C/W}$              |
| Total Power Dissipation (Note 6)                 | $T_A = +25^\circ\text{C}$<br>$P_D$ | 1.14           | W                               |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State<br>$R_{\theta JA}$    | 110            | $^\circ\text{C/W}$              |
| Operating and Storage Temperature Range          |                                    | $T_J, T_{STG}$ | -55 to +150<br>$^\circ\text{C}$ |

**Electrical Characteristics Q1 N-CHANNEL** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic  | Symbol       | Min | Typ  | Max       | Unit          | Test Condition  |
|---|--------------|-----|------|-----------|---------------|---|
| <b>OFF CHARACTERISTICS (Note 7)</b>                       |              |     |      |           |               |   |
| Drain-Source Breakdown Voltage                            | $BV_{DSS}$   | 20  | —    | —         | V             | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$  |
| Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$ | $I_{DSS}$    | —   | —    | 1.0       | $\mu\text{A}$ | $V_{DS} = 20\text{V}, V_{GS} = 0\text{V}$   |
| Gate-Source Leakage                                       | $I_{GSS}$    | —   | —    | $\pm 100$ | nA            | $V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$   |
| <b>ON CHARACTERISTICS (Note 7)</b>                        |              |     |      |           |               |   |
| Gate Threshold Voltage                                    | $V_{GS(TH)}$ | 0.4 | —    | 1.0       | V             | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$   |
| Static Drain-Source On-Resistance                         | $R_{DS(ON)}$ | —   | 24   | 35        | m $\Omega$    | $V_{GS} = 4.5\text{V}, I_D = 5\text{A}$   |
|   |              |     | 30   | 43        |               | $V_{GS} = 2.5\text{V}, I_D = 4\text{A}$   |
|   |              |     | 44   | 56        |               | $V_{GS} = 1.8\text{V}, I_D = 2\text{A}$   |
| Diode Forward Voltage                                     | $V_{SD}$     | —   | 0.7  | 1.2       | V             | $V_{GS} = 0\text{V}, I_S = 1\text{A}$   |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b>                   |              |     |      |           |               |   |
| Input Capacitance   | $C_{iss}$    | —   | 369  | —         | pF            | $V_{DS} = 10\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$                                |
| Output Capacitance  | $C_{oss}$    | —   | 54   | —         |               |   |
| Reverse Transfer Capacitance                              | $C_{rss}$    | —   | 32   | —         |               |   |
| Gate Resistance   | $R_g$        | —   | 4.1  | —         | $\Omega$      | $V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$                                   |
| Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )              | $Q_g$        | —   | 3.6  | —         | nC            | $V_{DS} = 10\text{V}, I_D = 6\text{A}$  |
| Total Gate Charge ( $V_{GS} = 10\text{V}$ )               | $Q_g$        | —   | 7.7  | —         |               |   |
| Gate-Source Charge  | $Q_{gs}$     | —   | 0.4  | —         |               |   |
| Gate-Drain Charge   | $Q_{gd}$     | —   | 1.0  | —         |               |   |
| Turn-On Delay Time  | $t_{D(ON)}$  | —   | 2.6  | —         | ns            | $V_{DS} = 10\text{V}, V_{GS} = 4.5\text{V}, R_g = 6\Omega, R_L = 10\Omega, I_D = 6\text{A}$ |
| Turn-On Rise Time   | $t_r$        | —   | 3.0  | —         |               |   |
| Turn-Off Delay Time                                       | $t_{D(OFF)}$ | —   | 12.5 | —         |               |   |
| Turn-Off Fall Time  | $t_f$        | —   | 3.6  | —         |               |   |
| Reverse Recovery Time                                     | $t_{RR}$     | —   | 6.0  | —         | ns            | $I_F = 1\text{A}, di/dt = 100\text{A}/\mu\text{s}$  |
| Reverse Recovery Charge                                   | $Q_{RR}$     | —   | 0.9  | —         | nC            | $I_F = 1\text{A}, di/dt = 100\text{A}/\mu\text{s}$  |

- Notes:
- Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PCB, 2oz copper, with 1inch square copper plate.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.



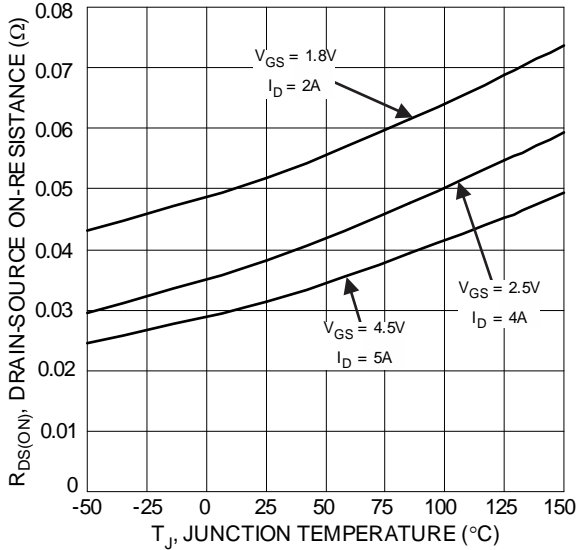


Figure 7 On-Resistance Variation with Temperature

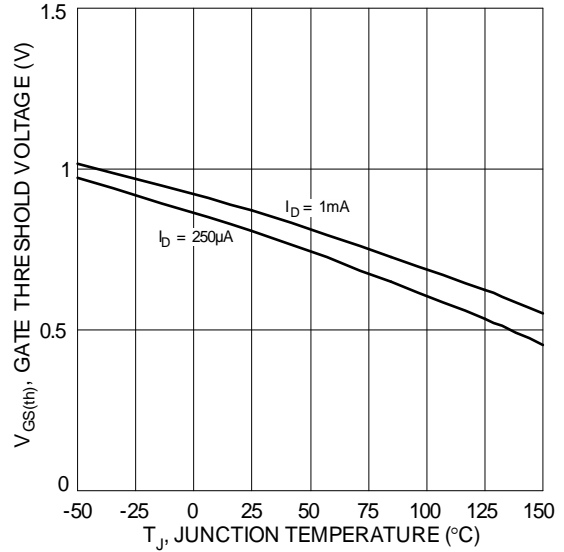


Figure 8 Gate Threshold Variation vs. Junction Temperature

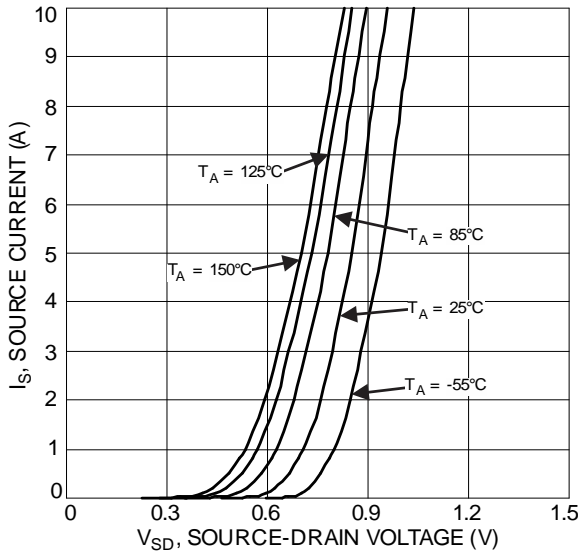


Figure 9 Diode Forward Voltage vs. Current

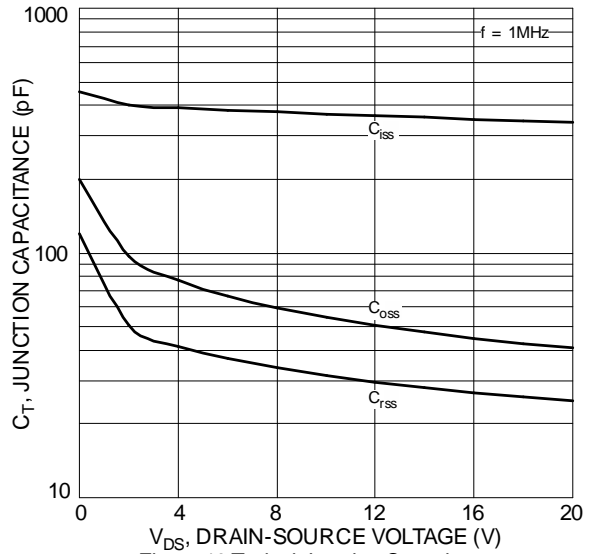


Figure 10 Typical Junction Capacitance

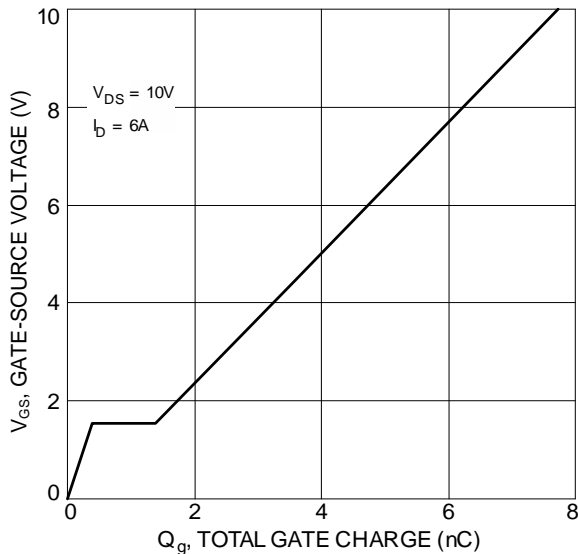


Figure 11 Gate Charge

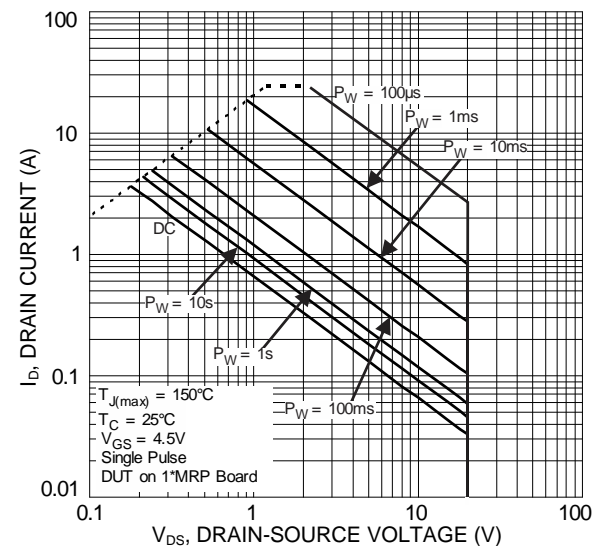


Figure 12 SOA, Safe Operation Area

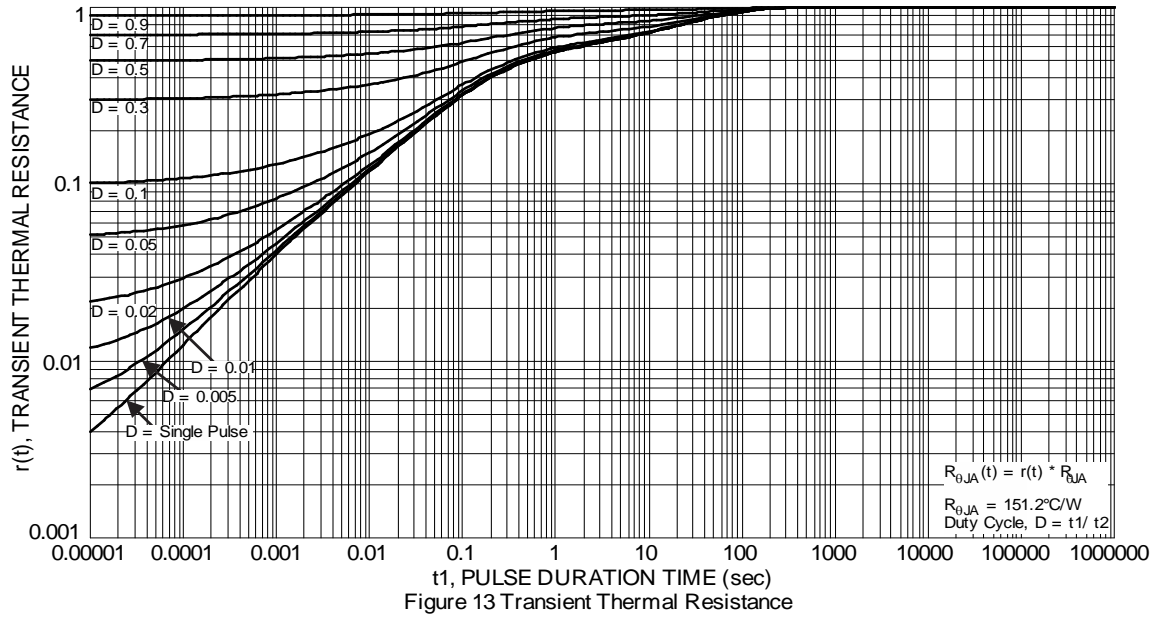


Figure 13 Transient Thermal Resistance

**Electrical Characteristics Q2 P-CHANNEL** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic  | Symbol       | Min   | Typ  | Max       | Unit       | Test Condition   |
|---|--------------|-------|------|-----------|------------|--|
| <b>OFF CHARACTERISTICS (Note 7)</b>                       |              |       |      |           |            |  |
| Drain-Source Breakdown Voltage                            | $BV_{DSS}$   | -20   | —    | —         | V          | $V_{GS} = 0V, I_D = -250\mu A$                               |
| Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$ | $I_{DSS}$    | —     | —    | -1.0      | $\mu A$    | $V_{DS} = -20V, V_{GS} = 0V$                                 |
| Gate-Source Leakage                                       | $I_{GSS}$    | —     | —    | $\pm 100$ | nA         | $V_{GS} = \pm 12V, V_{DS} = 0V$                              |
| <b>ON CHARACTERISTICS (Note 7)</b>                        |              |       |      |           |            |  |
| Gate Threshold Voltage                                    | $V_{GS(TH)}$ | -0.45 | —    | -1.0      | V          | $V_{DS} = V_{GS}, I_D = -250\mu A$                           |
| Static Drain-Source On-Resistance                         | $R_{DS(ON)}$ | —     | 57   | 75        | m $\Omega$ | $V_{GS} = -4.5V, I_D = -3.5A$                                |
|   |              | —     | 73   | 110       |            | $V_{GS} = -2.5V, I_D = -3.0A$                                |
|   |              | —     | 105  | 168       |            | $V_{GS} = -1.8V, I_D = -2.0A$                                |
| Diode Forward Voltage                                     | $V_{SD}$     | —     | -0.7 | -1.2      | V          | $V_{GS} = 0V, I_S = -1.0A$                                   |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b>                   |              |       |      |           |            |  |
| Input Capacitance   | $C_{iss}$    | —     | 440  | —         | pF         | $V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz$                     |
| Output Capacitance  | $C_{oss}$    | —     | 60   | —         | pF         |  |
| Reverse Transfer Capacitance                              | $C_{rss}$    | —     | 48   | —         | pF         |  |
| Gate Resistance   | $R_g$        | —     | 8.5  | —         | $\Omega$   | $V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$                         |
| Total Gate Charge ( $V_{GS} = -4.5V$ )                    | $Q_g$        | —     | 5.9  | —         | nC         | $V_{DS} = -4V, I_D = -3.5A$                                  |
| Total Gate Charge ( $V_{GS} = -8V$ )                      |              | —     | 12.7 | —         | nC         |  |
| Gate-Source Charge  | $Q_{gs}$     | —     | 0.6  | —         | nC         |  |
| Gate-Drain Charge   | $Q_{gd}$     | —     | 2.1  | —         | nC         |  |
| Turn-On Delay Time  | $t_{D(ON)}$  | —     | 3.2  | —         | ns         | $V_{DS} = -4V, V_{GS} = -4.5V, R_L = 4\Omega, R_g = 6\Omega$ |
| Turn-On Rise Time   | $t_R$        | —     | 7.8  | —         | ns         |  |
| Turn-Off Delay Time                                       | $t_{D(OFF)}$ | —     | 31   | —         | ns         |  |
| Turn-Off Fall Time  | $t_F$        | —     | 18   | —         | ns         |  |
| Body Diode Reverse Recovery Time                          | $t_{RR}$     | —     | 10.5 | —         | ns         | $I_S = -2.0A, dI/dt = 100A/\mu s$                            |
| Body Diode Reverse Recovery Charge                        | $Q_{RR}$     | —     | 3.0  | —         | nC         | $I_S = -2.0A, dI/dt = 100A/\mu s$                            |

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

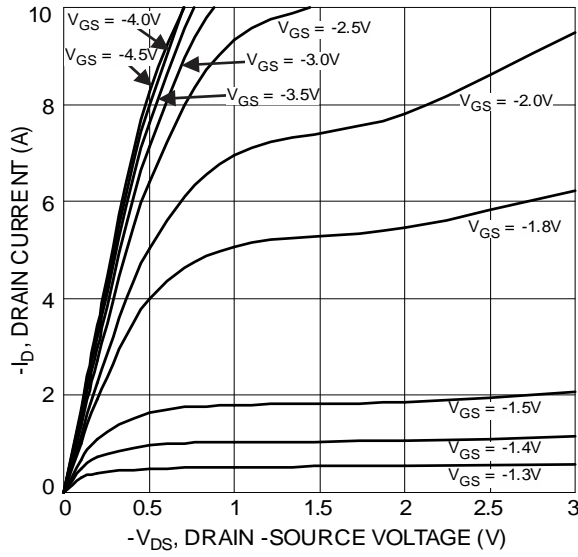


Figure 14 Typical Output Characteristics

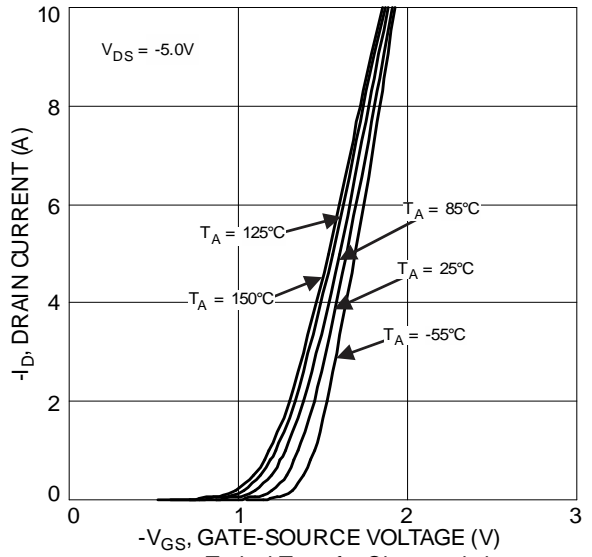


Figure 15 Typical Transfer Characteristics

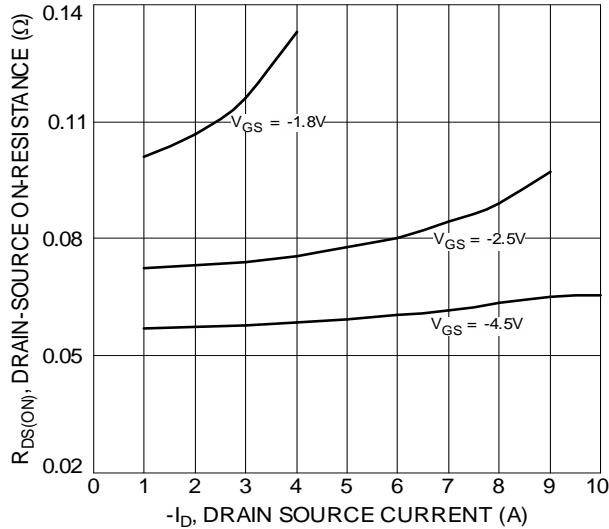


Figure 16 Typical On-Resistance vs. Drain Current and Gate Voltage

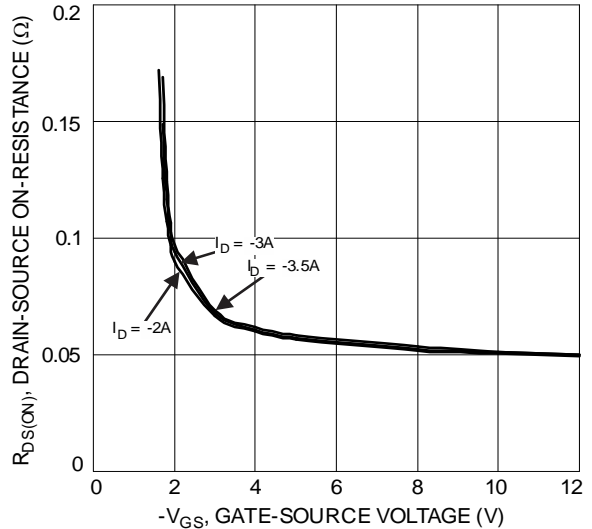


Figure 17 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

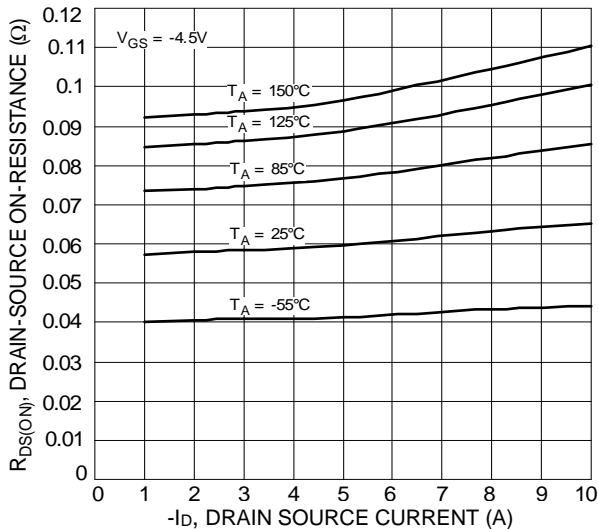


Figure 18 Typical On-Resistance vs. Drain Current and Temperature

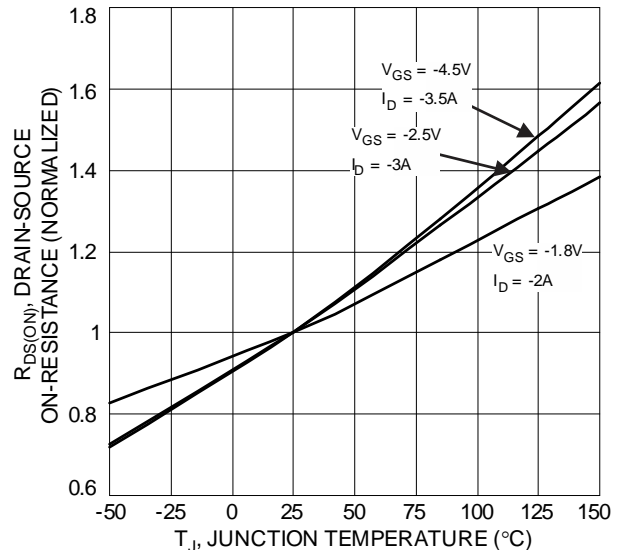


Figure 19 On-Resistance Variation with Temperature



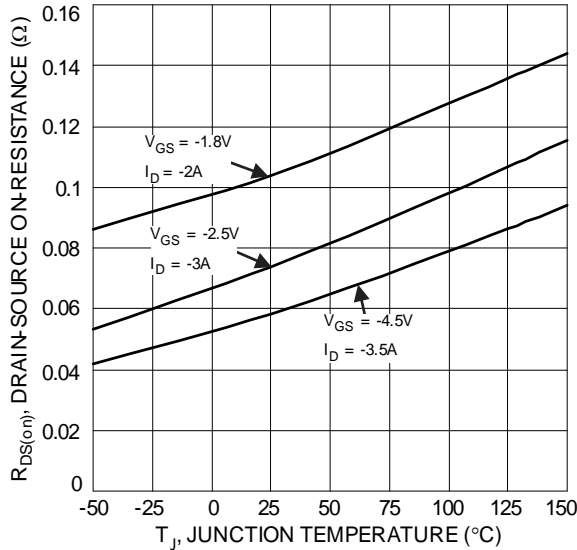


Figure 20 On-Resistance Variation with Temperature

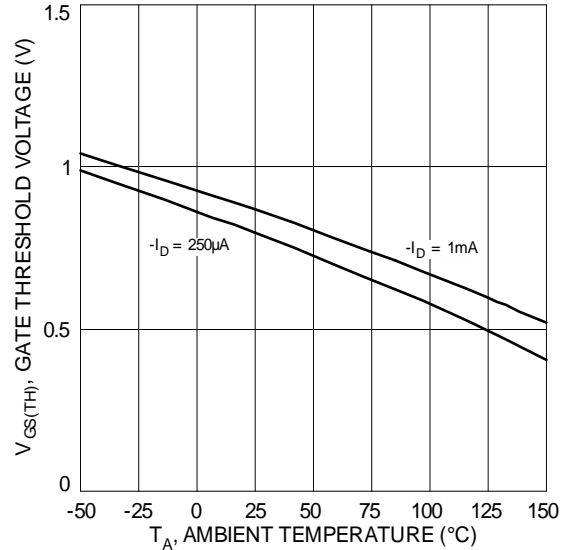


Figure 21 Gate Threshold Variation vs. Ambient Temperature

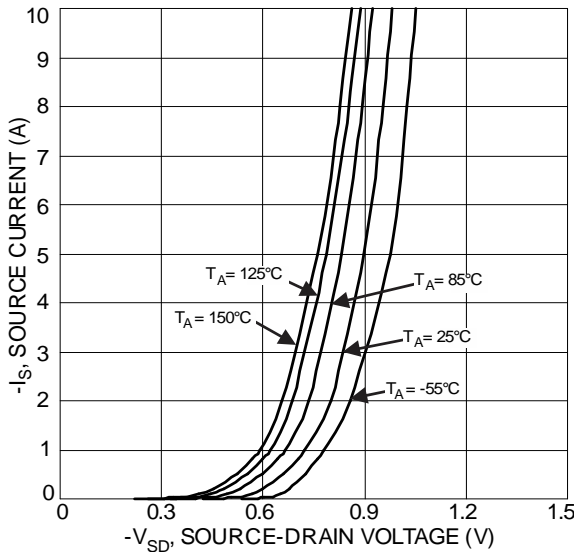


Figure 22 Diodes Forward Voltage vs. Current

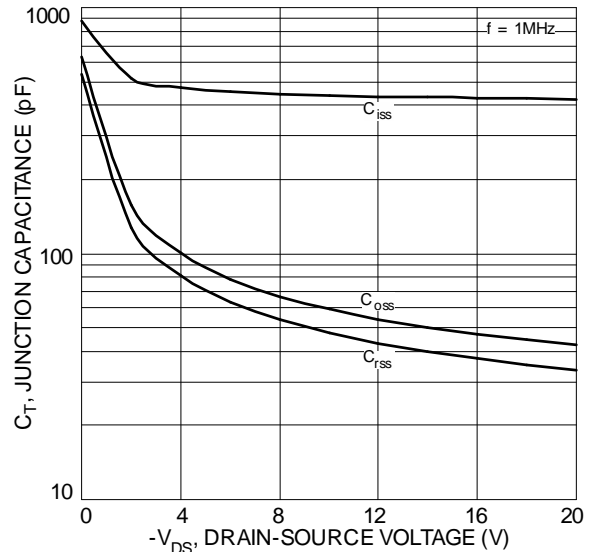


Figure 23 Typical Junction Capacitance

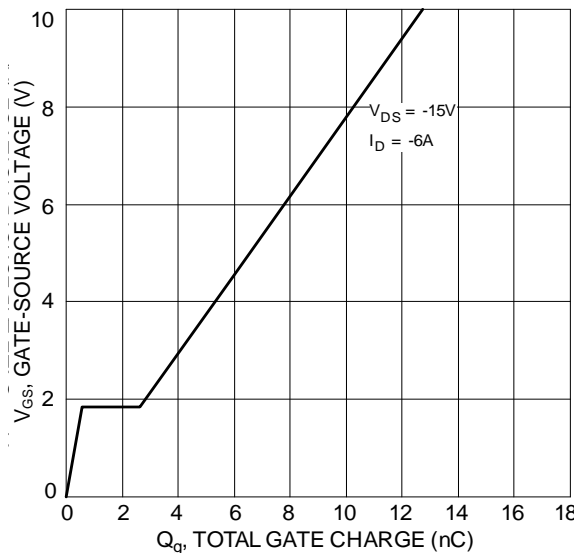


Figure 24 Gate Charge

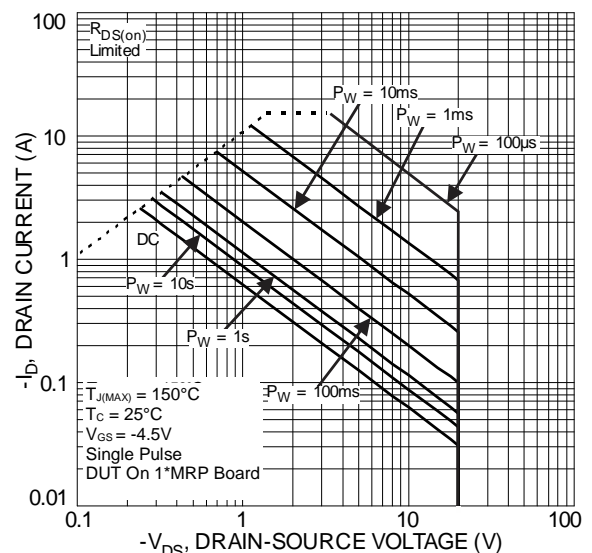
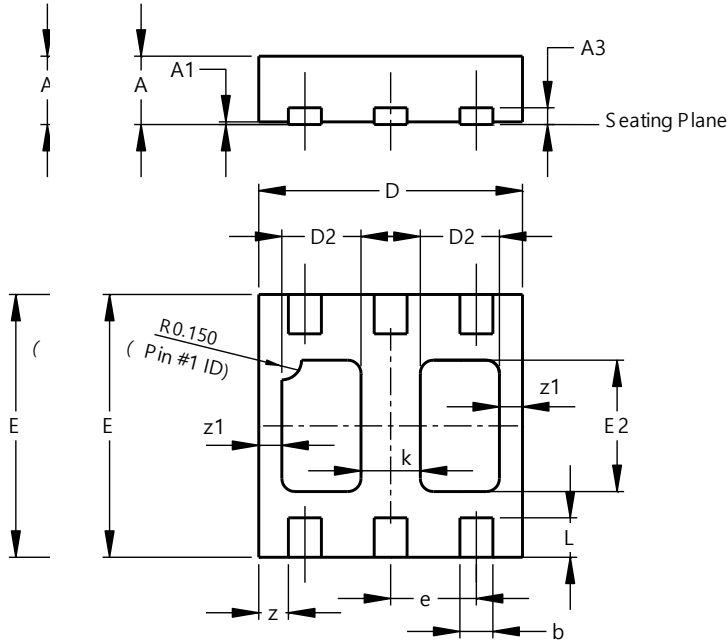


Figure 25 SOA, Safe Operation Area

**Package Outline Dimensions**

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

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

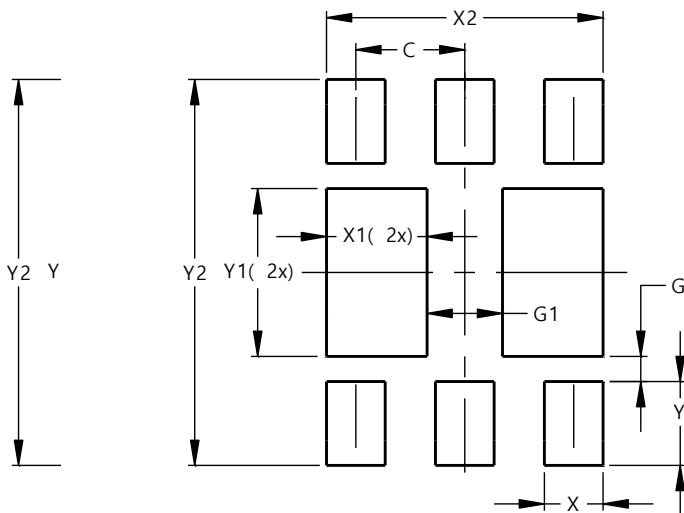


| U-DFN2020-6<br>Type B |       |       |       |
|-----------------------|-------|-------|-------|
| Dim                   | Min   | Max   | Typ   |
| A                     | 0.545 | 0.605 | 0.575 |
| A1                    | 0.00  | 0.05  | 0.02  |
| A3                    | -     | -     | 0.13  |
| b                     | 0.20  | 0.30  | 0.25  |
| D                     | 1.95  | 2.075 | 2.00  |
| D2                    | 0.50  | 0.70  | 0.60  |
| e                     | -     | -     | 0.65  |
| E                     | 1.95  | 2.075 | 2.00  |
| E2                    | 0.90  | 1.10  | 1.00  |
| k                     | -     | -     | 0.45  |
| L                     | 0.25  | 0.35  | 0.30  |
| z                     | -     | -     | 0.225 |
| z1                    | -     | -     | 0.175 |
| All Dimensions in mm  |       |       |       |

**Suggested Pad Layout**

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

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



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.650         |
| G          | 0.150         |
| G1         | 0.450         |
| X          | 0.350         |
| X1         | 0.600         |
| X2         | 1.650         |
| Y          | 0.500         |
| Y1         | 1.000         |
| Y2         | 2.300         |

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