

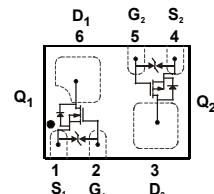
**COMPLEMENTARY PAIR ENHANCEMENT MODE FIELD EFFECT TRANSISTOR**
**Features**

- Low On-Resistance
- Low Gate Threshold Voltage  $V_{GS(th)} < 1V$
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Complementary Pair MOSFET
- Ultra-Small Surface Mount Package
- **ESD Protected Gate**
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- Qualified to AEC-Q101 Standards for High Reliability

**Mechanical Data**

- Case: X1-DFN1612-6
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminal Connections: See Diagram
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208 
- Marking Information: See Page 6
- Ordering Information: See Page 6
- Weight: 0.003 grams (approximate)

X1-DFN1612-6

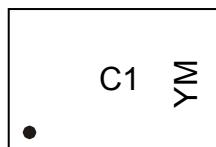

TOP VIEW  
Internal Schematic

**Ordering Information** (Note 4)

| Part Number  | Case         | Packaging        |
|--------------|--------------|------------------|
| DMC2004LPK-7 | X1-DFN1612-6 | 3000/Tape & Reel |

## Notes:

1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See <http://www.diodes.com> 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 <http://www.diodes.com/datasheets/ap02007.pdf>.

**Marking Information**


C1 = Marking Code  
YM = Date Code Marking  
Y = Year (ex: Z = 2012)  
M = Month (ex: 9 = September)

## Date Code Key

| Year  | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |     |     |     |     |     |
|-------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|
| Code  | Z    | A    | B    | C    | D    | E    | F    |     |     |     |     |     |
| 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 N-CHANNEL – Q<sub>1</sub>** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic         | Symbol           | Value      | Unit |
|------------------------|------------------|------------|------|
| Drain Source Voltage   | V <sub>DSS</sub> | 20         | V    |
| Gate-Source Voltage    | V <sub>GSS</sub> | ±8         | V    |
| Drain Current (Note 5) | I <sub>D</sub>   | 750<br>540 | mA   |

**Maximum Ratings P-CHANNEL – Q<sub>2</sub>** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic         | Symbol           | Value        | Unit |
|------------------------|------------------|--------------|------|
| Drain Source Voltage   | V <sub>DSS</sub> | -20          | V    |
| Gate-Source Voltage    | V <sub>GSS</sub> | ±8           | V    |
| Drain Current (Note 5) | I <sub>D</sub>   | -600<br>-430 | mA   |

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

| Characteristic                          | Symbol                            | Value       | Unit |
|---|-----------------------------------|-------------|------|
| Power Dissipation (Note 5)              | P <sub>D</sub>                    | 500         | mW   |
| Thermal Resistance, Junction to Ambient | R <sub>θJA</sub>                  | 250         | °C/W |
| Operating and Storage Temperature Range | T <sub>J</sub> , T <sub>STG</sub> | -65 to +150 | °C   |

**Electrical Characteristics N-CHANNEL – Q<sub>1</sub>** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

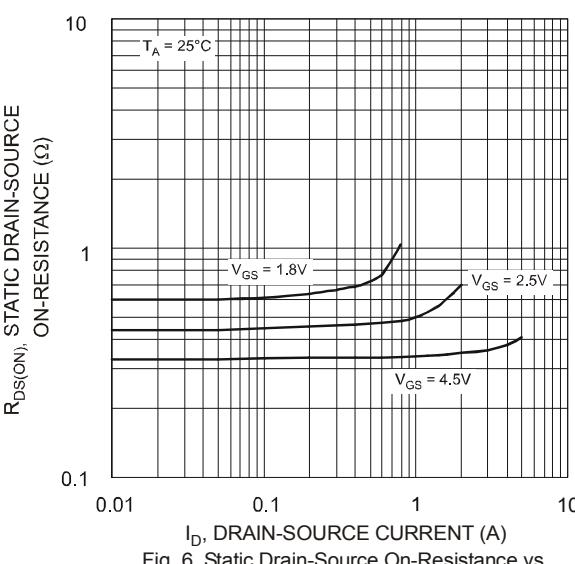
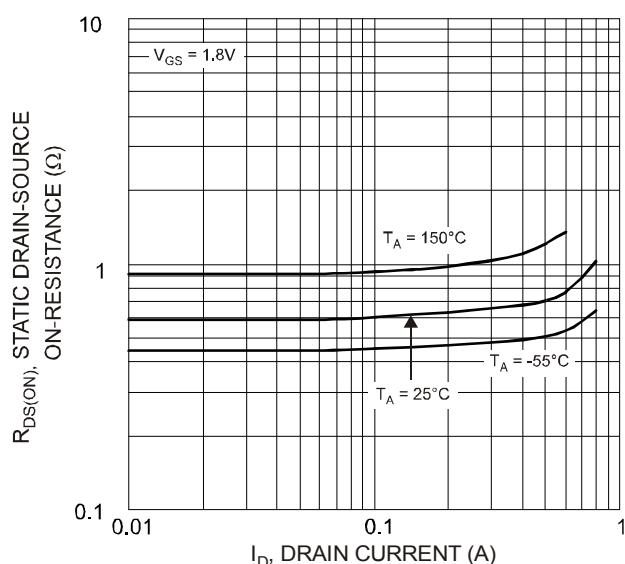
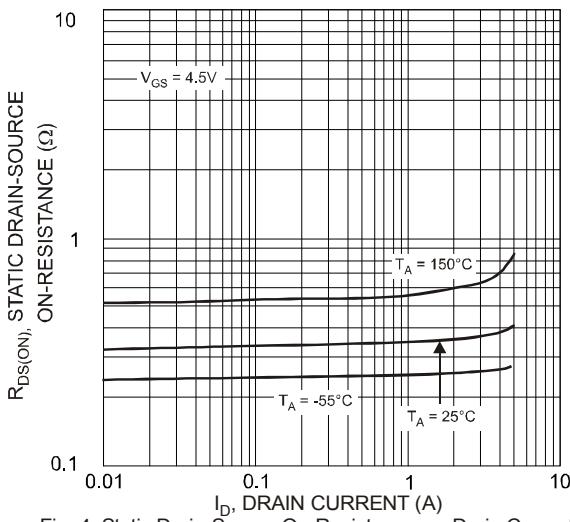
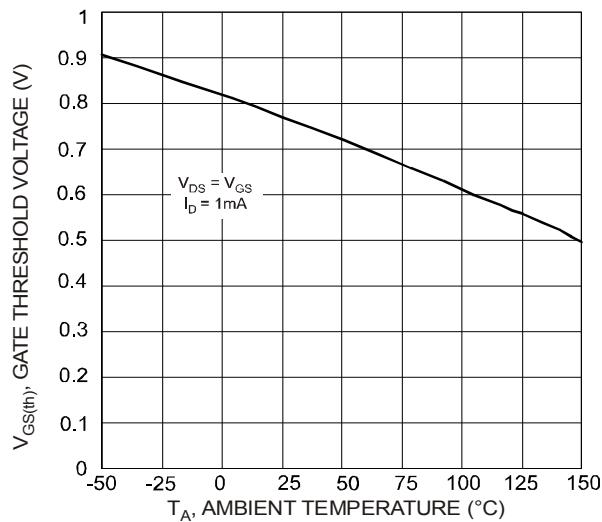
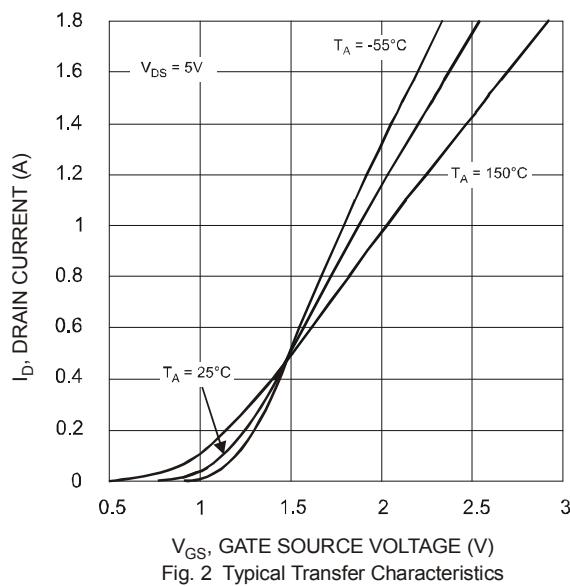
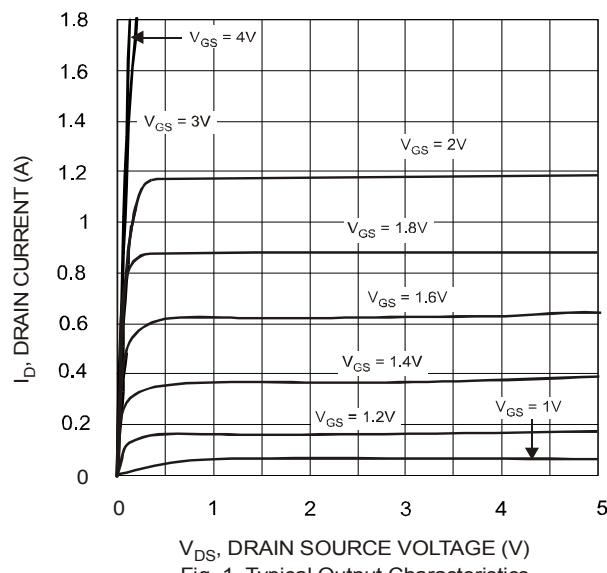
| Characteristic                      | Symbol               | Min | Typ               | Max                  | Unit | Test Condition   |
|-------------------------------------|----------------------|-----|-------------------|----------------------|------|--|
| <b>OFF CHARACTERISTICS (Note 6)</b> |                      |     |                   |                      |      |  |
| Drain-Source Breakdown Voltage      | BV <sub>DSS</sub>    | 20  | —                 | —                    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 10µA  |
| Zero Gate Voltage Drain Current     | I <sub>DSS</sub>     | —   | —                 | 1                    | µA   | V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V  |
| Gate-Source Leakage                 | I <sub>GSS</sub>     | —   | —                 | ± 1                  | µA   | V <sub>GS</sub> = ±4.5V, V <sub>DS</sub> = 0V  |
| <b>ON CHARACTERISTICS (Note 6)</b>  |                      |     |                   |                      |      |  |
| Gate Threshold Voltage              | V <sub>GS(th)</sub>  | 0.5 | —                 | 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> | —   | 0.4<br>0.5<br>0.7 | 0.55<br>0.70<br>0.90 | Ω    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 540mA<br>V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 500mA<br>V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 350mA |
| Forward Transfer Admittance         | Y <sub>fs</sub>      | 200 | —                 | —                    | mS   | V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.2A   |
| Diode Forward Voltage (Note 6)      | V <sub>SD</sub>      | 0.5 | —                 | 1.2                  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 115mA   |
| <b>DYNAMIC CHARACTERISTICS</b>      |                      |     |                   |                      |      |  |
| Input Capacitance                   | C <sub>iss</sub>     | —   | —                 | 150                  | pF   | V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V<br>f = 1.0MHz  |
| Output Capacitance                  | C <sub>oss</sub>     | —   | —                 | 25                   | pF   |  |
| Reverse Transfer Capacitance        | C <sub>rss</sub>     | —   | —                 | 20                   | pF   |  |

**Electrical Characteristics P-CHANNEL – Q<sub>2</sub>** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                      | Symbol               | Min  | Typ               | Max               | Unit | Test Condition   |
|-------------------------------------|----------------------|------|-------------------|-------------------|------|--|
| <b>OFF CHARACTERISTICS (Note 6)</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     | I <sub>DSS</sub>     | —    | —                 | -1.0              | µA   | 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 6)</b>  |                      |      |                   |                   |      |  |
| Gate Threshold Voltage              | V <sub>GS(th)</sub>  | -0.5 | —                 | -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> | —    | 0.7<br>1.1<br>1.7 | 0.9<br>1.4<br>2.0 | Ω    | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -430mA<br>V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -300mA<br>V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -150mA |
| Forward Transfer Admittance         | Y <sub>fs</sub>      | 200  | —                 | —                 | mS   | V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.2A   |
| Diode Forward Voltage (Note 5)      | V <sub>SD</sub>      | -0.5 | —                 | -1.2              | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = -115mA  |
| <b>DYNAMIC CHARACTERISTICS</b>      |                      |      |                   |                   |      |  |
| Input Capacitance                   | C <sub>iss</sub>     | —    | —                 | 175               | pF   | V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V<br>f = 1.0MHz   |
| Output Capacitance                  | C <sub>oss</sub>     | —    | —                 | 30                | pF   |  |
| Reverse Transfer Capacitance        | C <sub>rss</sub>     | —    | —                 | 20                | pF   |  |

Notes: 5. Device mounted on FR-4 PCB.  
6. Short duration pulse test used to minimize self-heating effect.

**Q<sub>1</sub>, N-CHANNEL**



**Q<sub>1</sub>, N-CHANNEL, (cont.)**

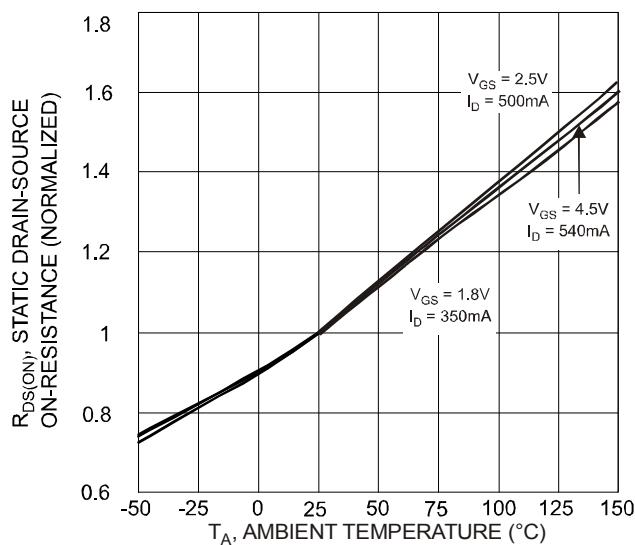


Fig. 7 Static Drain-Source On-State Resistance vs. Ambient Temperature

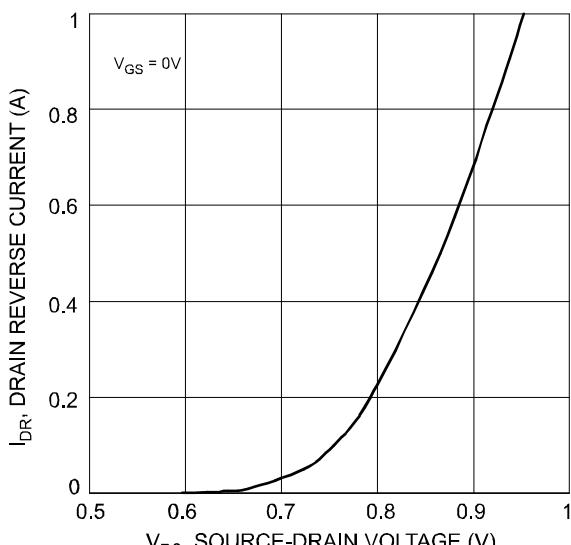


Fig. 8 Drain Reverse Current vs. Source-Drain Voltage

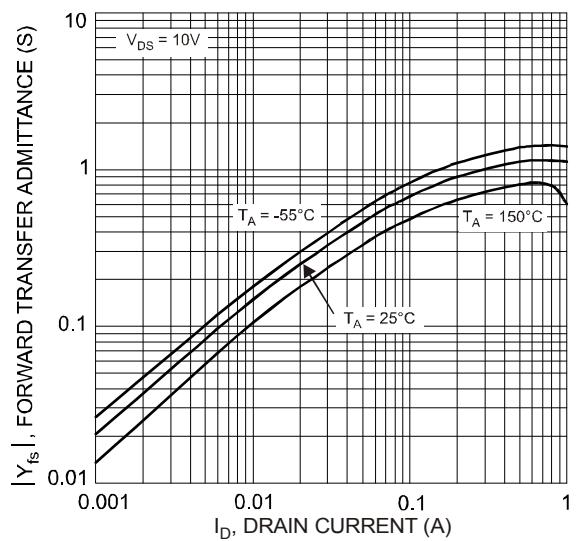


Fig. 9 Forward Transfer Admittance vs. Drain Current

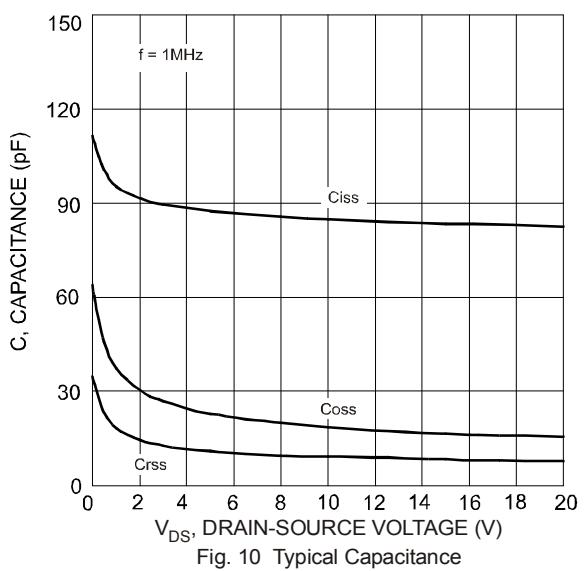
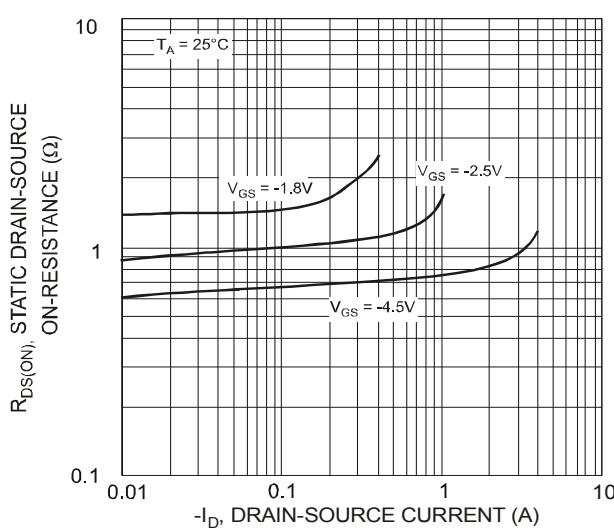
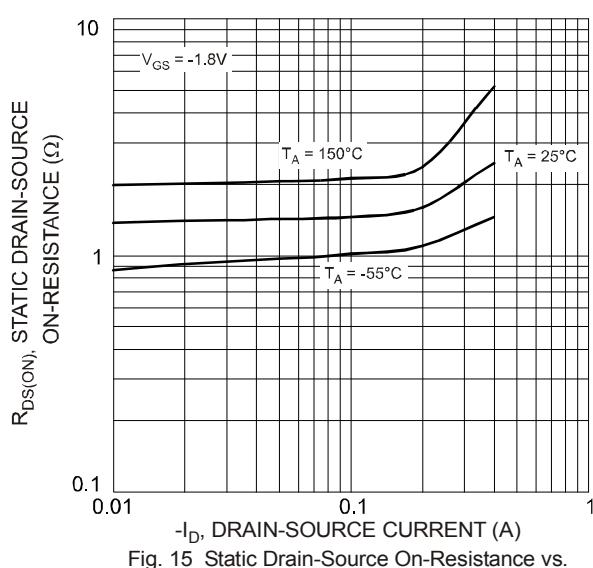
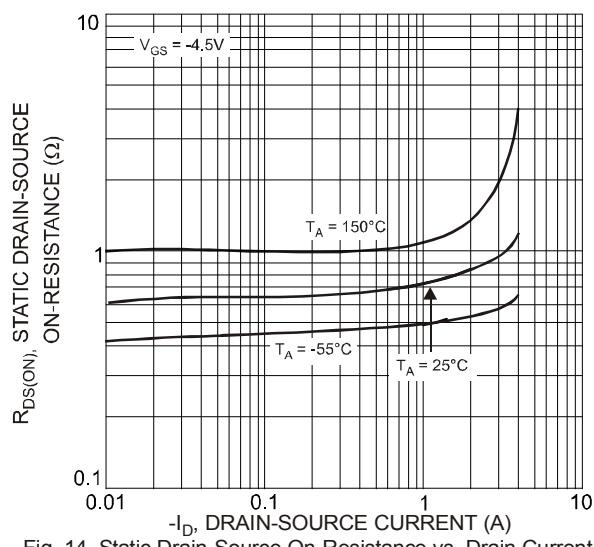
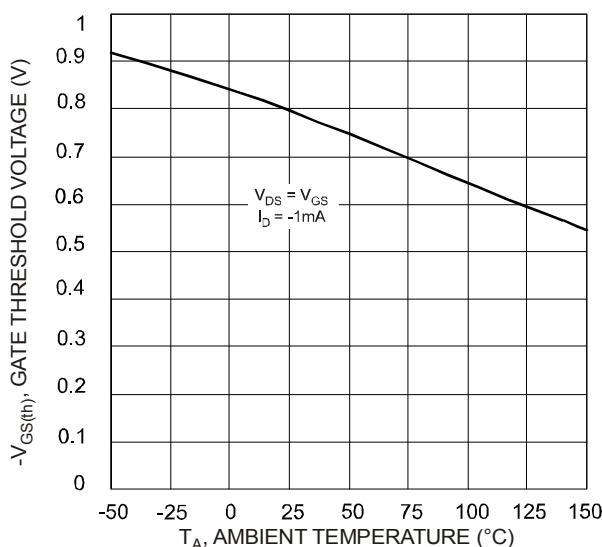
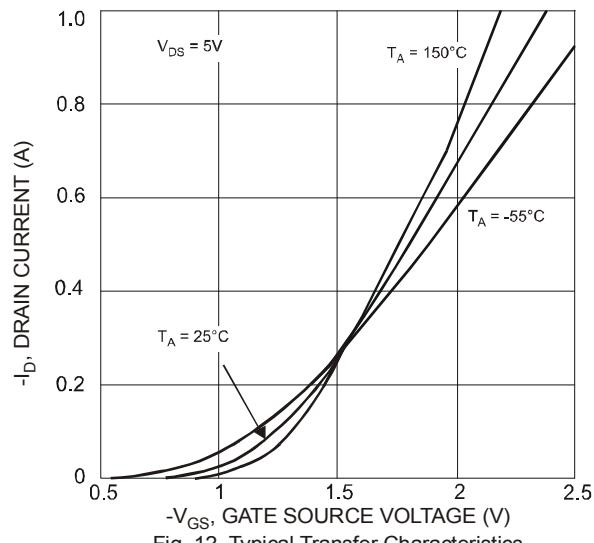
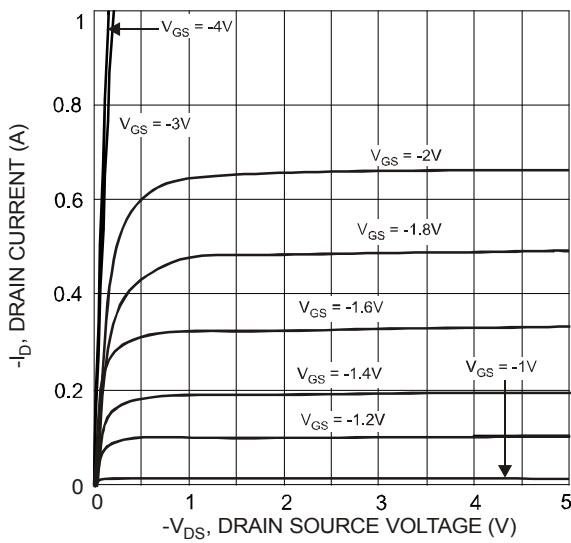


Fig. 10 Typical Capacitance

**Q<sub>2</sub>, P-CHANNEL**



**Q<sub>2</sub>, P-CHANNEL, (cont.)**

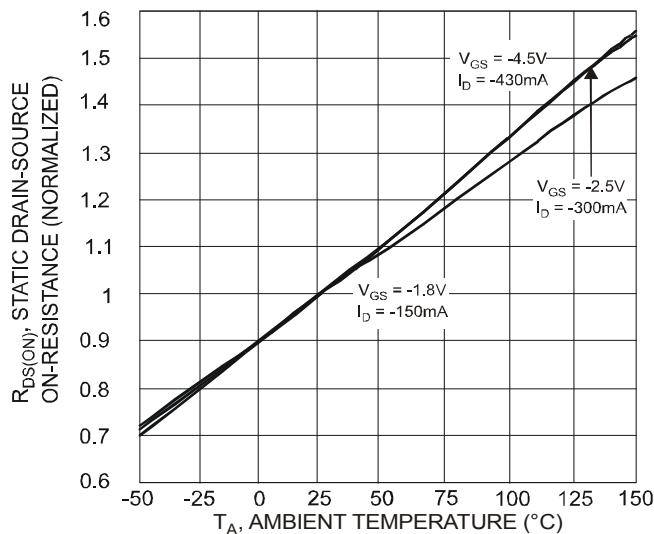


Fig. 17 Static Drain-Source On-State Resistance vs. Ambient Temperature

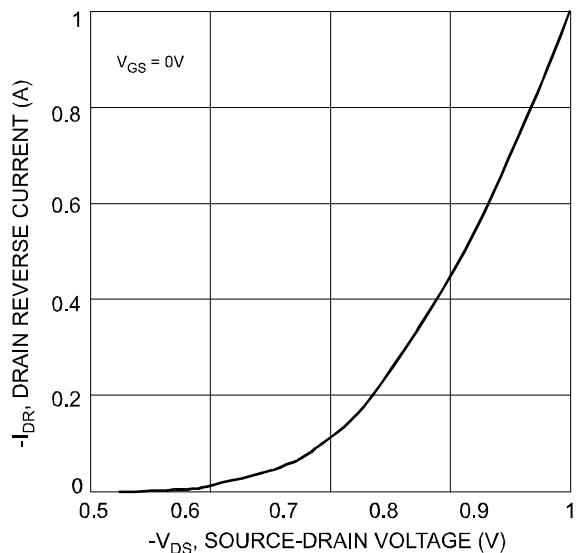


Fig. 18 Drain Reverse Current vs. Source-Drain Voltage

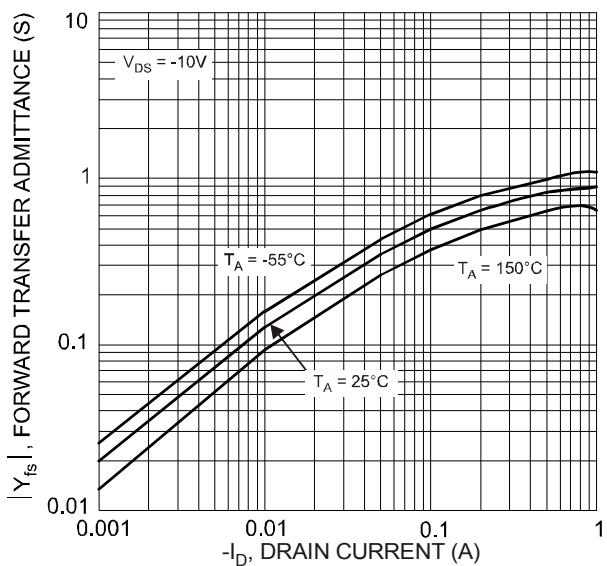


Fig. 19 Forward Transfer Admittance vs. Drain Current

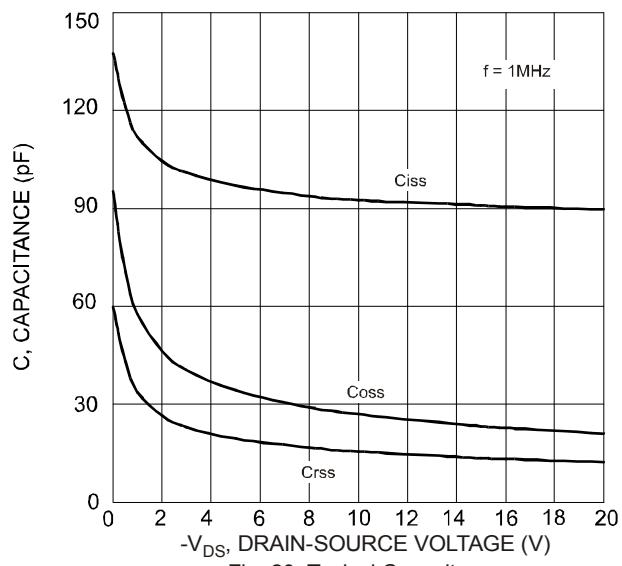
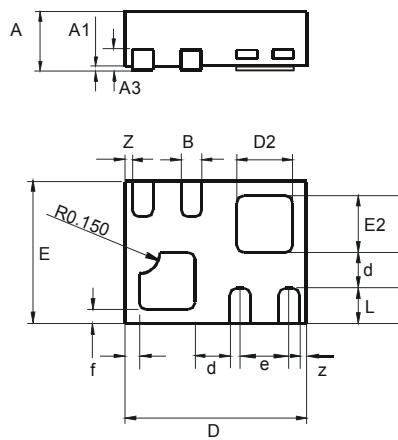


Fig. 20 Typical Capacitance

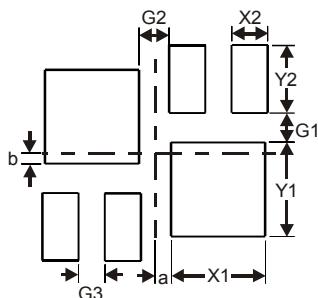
## Package Outline Dimensions



| X1-DFN1612-6 |      |       |      |
|--------------|------|-------|------|
| Dim          | Min  | Max   | Typ  |
| <b>A</b>     | 0.47 | 0.53  | 0.50 |
| <b>A1</b>    | 0    | 0.05  | 0.02 |
| <b>A3</b>    | —    | —     | 0.13 |
| <b>b</b>     | 0.15 | 0.25  | 0.20 |
| <b>D</b>     | 1.55 | 1.675 | 1.60 |
| <b>d</b>     | —    | —     | 0.25 |
| <b>D2</b>    | 0.40 | 0.60  | 0.50 |
| <b>E</b>     | 1.15 | 1.28  | 1.20 |
| <b>e</b>     | —    | —     | 0.40 |
| <b>E2</b>    | 0.45 | 0.65  | 0.55 |
| <b>f</b>     | —    | —     | 0.15 |
| <b>L</b>     | 0.20 | 0.30  | 0.25 |
| <b>z</b>     | —    | —     | 0.10 |

All Dimensions in mm

## Suggested Pad Layout



| Dimensions | Value (in mm) |
|------------|---------------|
| <b>G1</b>  | 0.15          |
| <b>G2</b>  | 0.175         |
| <b>G3</b>  | 0.15          |
| <b>X1</b>  | 0.60          |
| <b>X2</b>  | 0.25          |
| <b>Y1</b>  | 0.65          |
| <b>Y2</b>  | 0.45          |
| <b>a</b>   | 0.10          |
| <b>b</b>   | 0.15          |

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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