

COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET
Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(ON)}$ | I_D $T_A = +25^\circ C$ |
|--------|---------------|----------------------------------|------------------------------|
| Q1 | 20V | 35m Ω @ $V_{GS} = 4.5V$ | 4.5A |
| | | 56m Ω @ $V_{GS} = 1.8V$ | 3.5A |
| Q2 | -20V | 74m Ω @ $V_{GS} = -4.5V$ | -3.1A |
| | | 168m Ω @ $V_{GS} = -1.8V$ | -2.0A |

Description

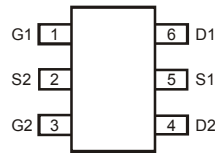
This MOSFET has been designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

Applications

- Motor Control
- Power Management Functions
- DC-DC Converters
- Backlighting



Top View

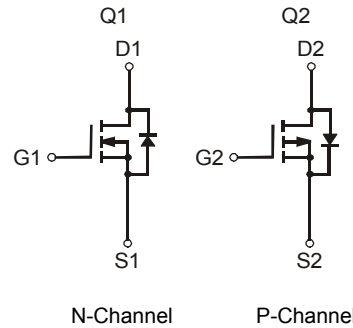

 Top View
Pin Configuration

Features

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Fast Switching Speed
- **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**

Mechanical Data

- Case: TSOT26
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals — Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208 E3
- Terminal Connections Indicator: See diagram
- Weight: 0.013 grams (approximate)



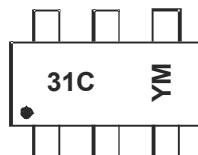
N-Channel

P-Channel

Ordering Information (Note 4)

| Part Number | Compliance | Case | Packaging |
|---------------|------------|--------|------------------|
| DMC2038LVT-7 | Standard | TSOT26 | 3000/Tape & Reel |
| DMC2038LVTQ-7 | Automotive | TSOT26 | 3000/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 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/products/packages.html>

Marking Information


31C = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: X = 2010)
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------|------|------|------|------|------|------|------|
| Code | X | Y | Z | A | B | C | D |

| 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 – Q1 (@T_A = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Units |
|--|--------------|--|------------------|------------|-------|
| Drain-Source Voltage | | | V _{DSS} | 20 | V |
| Gate-Source Voltage | | | V _{GSS} | ±12 | V |
| Continuous Drain Current (Note 5) V _{GS} = 4.5V | Steady State | T _A = +25°C T _A = +70°C | I _D | 3.7 3.0 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | 4.1 3.2 | A |
| Continuous Drain Current (Note 6) V _{GS} = 4.5V | Steady State | T _A = +25°C T _A = +70°C | I _D | 4.5 3.6 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | 5.2 4.2 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | | I _S | 1.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | I _{DM} | 25 | A |

Maximum Ratings P-CHANNEL – Q2 (@T_A = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Units |
|---|--------------|--|------------------|--------------|-------|
| Drain-Source Voltage | | | V _{DSS} | -20 | V |
| Gate-Source Voltage | | | V _{GSS} | ±12 | V |
| Continuous Drain Current (Note 5) V _{GS} = -4.5V | Steady State | T _A = +25°C T _A = +70°C | I _D | -2.6 -2.1 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | -2.9 -2.4 | A |
| Continuous Drain Current (Note 6) V _{GS} = -4.5V | Steady State | T _A = +25°C T _A = +70°C | I _D | -3.1 -2.5 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | -3.8 -3.0 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | | I _S | -1.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | I _{DM} | -17 | A |

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Units |
|--|------------------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 5) | T _A = +25°C | P _D | 0.8 | W |
| | T _A = +70°C | | 0.5 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | R _{θJA} | 168 | °C/W |
| | t < 10s | | 120 | |
| Total Power Dissipation (Note 6) | T _A = +25°C | P _D | 1.1 | W |
| | T _A = +70°C | | 0.7 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | R _{θJA} | 114 | °C/W |
| | t < 10s | | 72 | |
| Thermal Resistance, Junction to Case (Note 6) | | R _{θJC} | 39 | |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -55 to +150 | °C |

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

Electrical Characteristics N-CHANNEL – Q1 (@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} | — | — | 1.0 | μA | V _{DS} = 16V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±12V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | 0.4 | — | 1.0 | V | V _{DS} = V _{GS} , I _D = 250μA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 27 | 35 | mΩ | V _{GS} = 4.5V, I _D = 4.0A |
| | | — | 33 | 43 | | V _{GS} = 2.5V, I _D = 2.5A |
| | | — | 43 | 56 | | V _{GS} = 1.8V, I _D = 1.5A |
| Forward Transfer Admittance | Y _{fs} | — | 9 | — | S | V _{DS} = 5V, I _D = 3.4A |
| Diode Forward Voltage | V _{SD} | 0.4 | — | 1.1 | V | V _{GS} = 0V, I _S = 1A |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iss} | — | 400 | 530 | pF | V _{DS} = 10V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 70 | 90 | pF | |
| Reverse Transfer Capacitance | C _{rss} | — | 65 | 100 | pF | |
| Gate Resistance | R _g | — | 1.9 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = 4.5V) | Q _g | — | 5.7 | — | nC | V _{DS} = 15V, I _D = 5.8A |
| Total Gate Charge (V _{GS} = 10V) | Q _g | — | 12 | 17 | nC | |
| Gate-Source Charge | Q _{gs} | — | 0.7 | — | nC | |
| Gate-Drain Charge | Q _{gd} | — | 1.4 | — | nC | |
| Turn-On Delay Time | t _{D(on)} | — | 5 | 10 | ns | V _{DS} = 10V, V _{GS} = 4.5V, R _G = 6Ω, I _{DS} = 1A, |
| Turn-On Rise Time | t _r | — | 8 | 16 | ns | |
| Turn-Off Delay Time | t _{D(off)} | — | 25 | 40 | ns | |
| Turn-Off Fall Time | t _f | — | 8 | 16 | ns | |

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

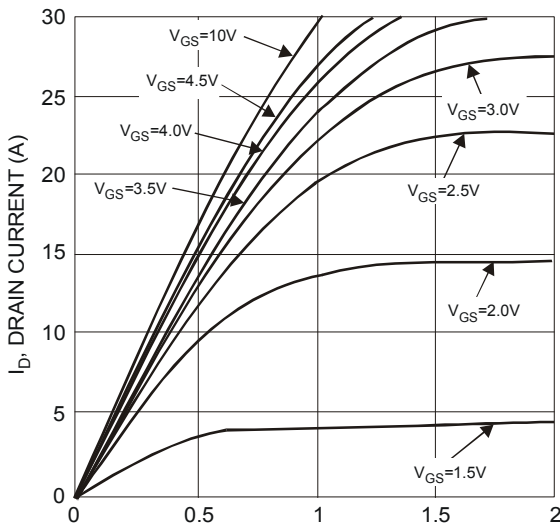


Fig. 1 Typical Output Characteristics

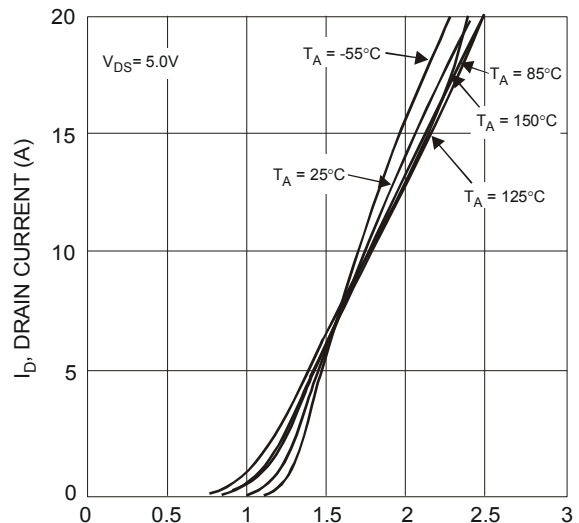


Fig. 2 Typical Transfer Characteristics

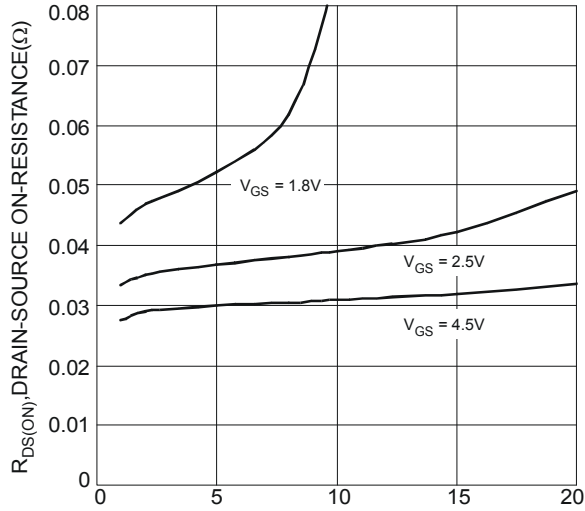


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

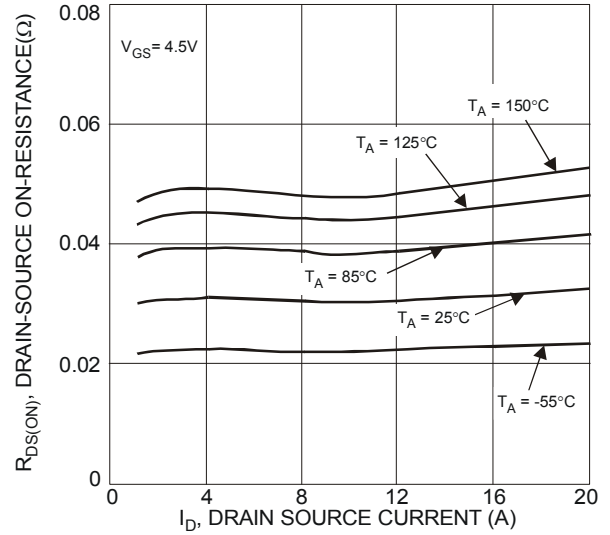


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

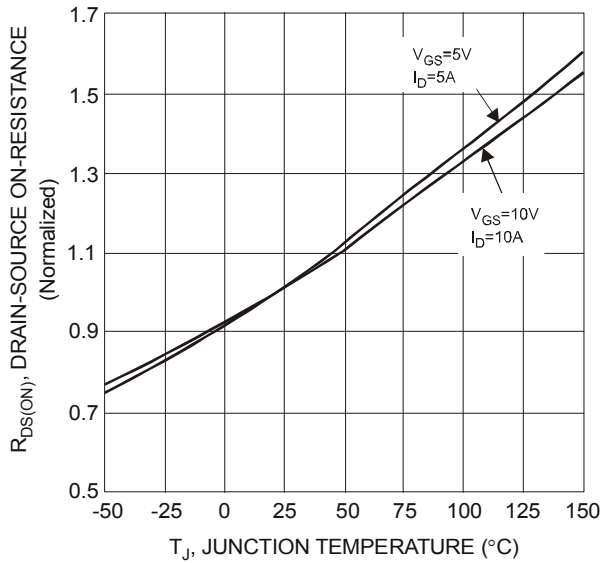


Fig. 5 On-Resistance Variation with Temperature

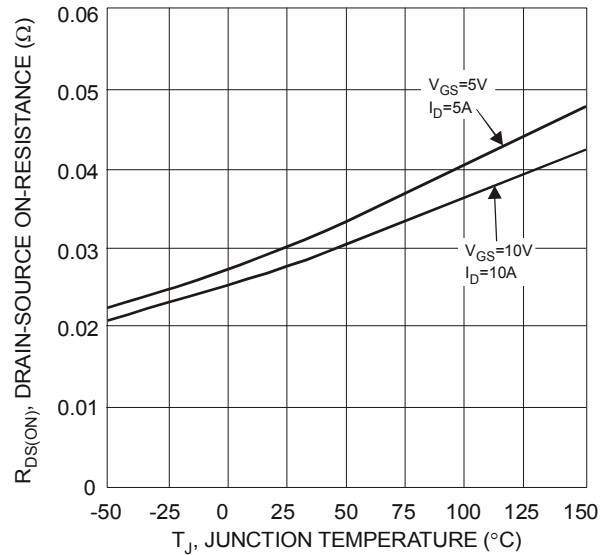


Fig. 6 On-Resistance Variation with Temperature

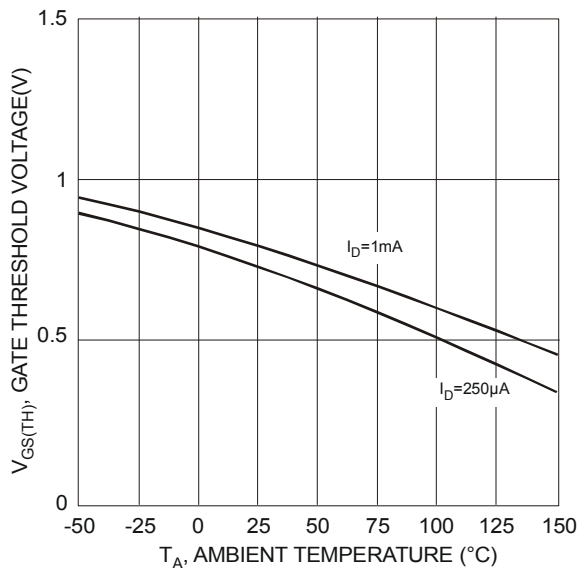


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

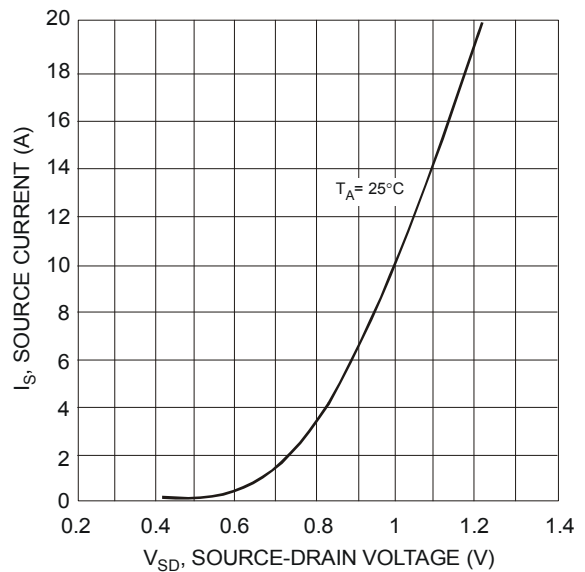
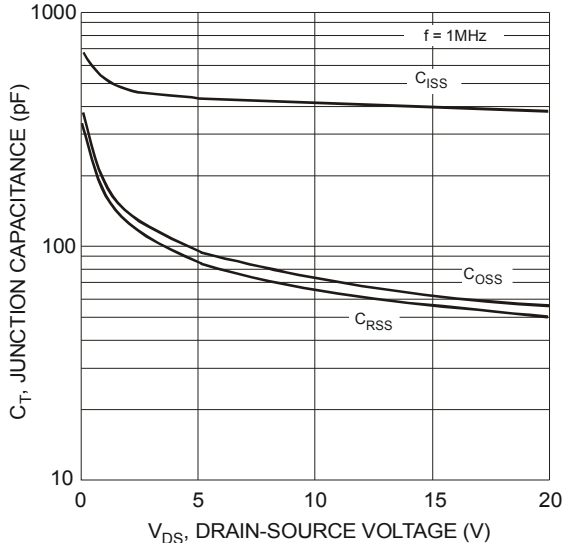
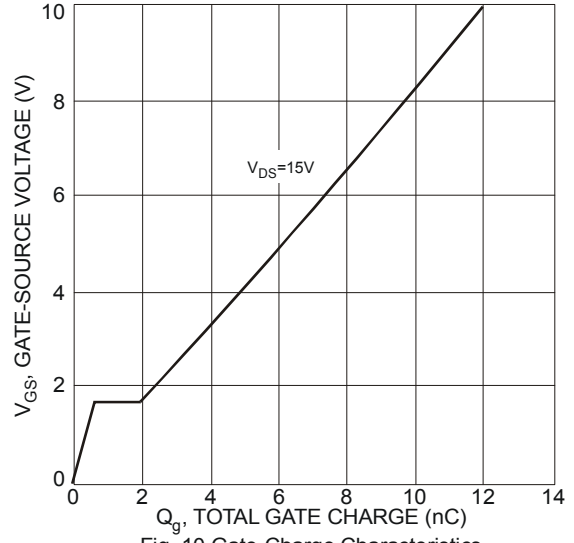


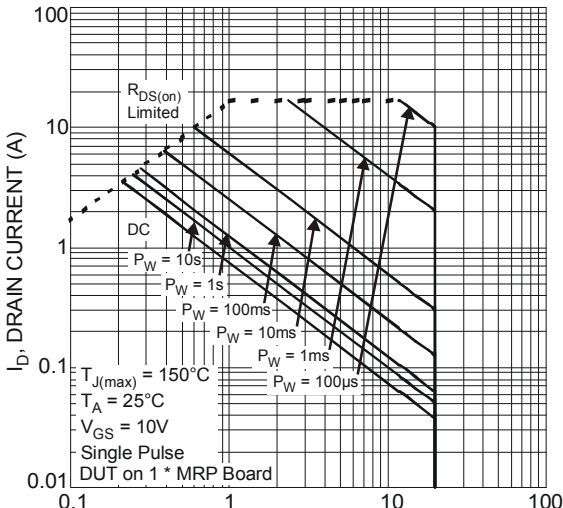
Fig. 8 Diode Forward Voltage vs. Current



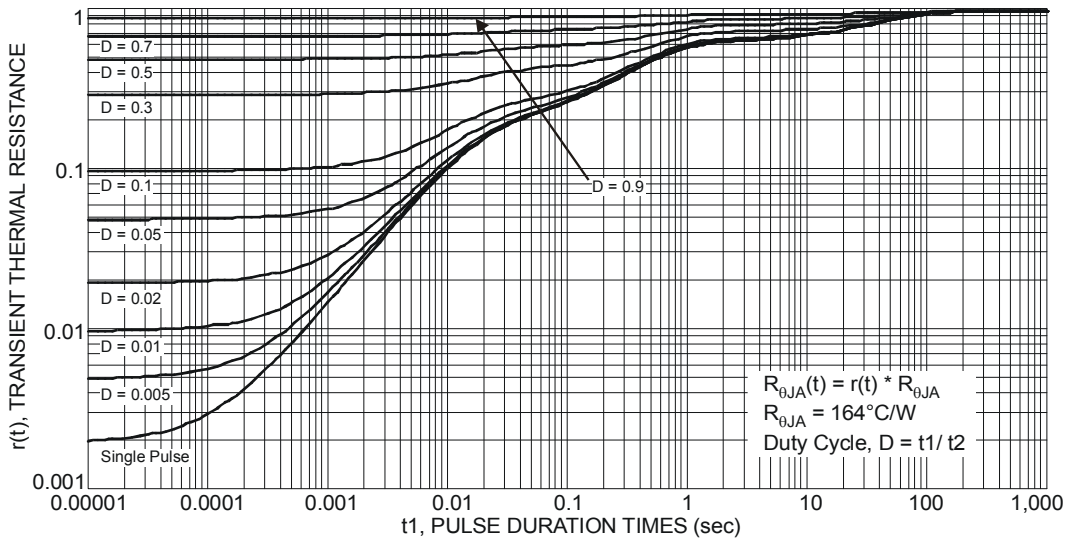
V_{DS} , DRAIN-SOURCE VOLTAGE (V)
Fig. 9 Typical Junction Capacitance



Q_g , TOTAL GATE CHARGE (nC)
Fig. 10 Gate-Charge Characteristics



V_{DS} , DRAIN-SOURCE VOLTAGE (V)
Fig. 11 SOA, Safe Operation Area



t_1 , PULSE DURATION TIMES (sec)
Fig. 12 Transient Thermal Resistance

Electrical Characteristics P-CHANNEL – Q2 (@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} | — | — | -1.0 | μA | V _{DS} = -16V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±12V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | -0.4 | — | -1.0 | V | V _{DS} = V _{GS} , I _D = -250μA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 57 | 74 | mΩ | V _{GS} = -4.5V, I _D = -3.0A |
| | | — | 76 | 110 | | V _{GS} = -2.5V, I _D = -1.5A |
| | | — | 102 | 168 | | V _{GS} = -1.8V, I _D = -1.0A |
| Forward Transfer Admittance | Y _{fs} | — | 10 | — | S | V _{DS} = -5V, I _D = -3.0A |
| Diode Forward Voltage | V _{SD} | — | -0.8 | -1.0 | V | V _{GS} = 0V, I _S = -0.6A |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iss} | — | 530 | 705 | pF | V _{DS} = -10V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 70 | 95 | pF | |
| Reverse Transfer Capacitance | C _{rss} | — | 60 | 90 | pF | |
| Gate Resistance | R _g | — | 72 | - | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = -4.5V) | Q _g | — | 7 | 10 | nC | V _{DS} = -15V, I _D = -6A |
| Total Gate Charge (V _{GS} = -10V) | Q _g | — | 14 | — | nC | |
| Gate-Source Charge | Q _{gs} | — | 0.95 | — | nC | |
| Gate-Drain Charge | Q _{gd} | — | 1.2 | — | nC | |
| Turn-On Delay Time | t _{D(on)} | — | 11 | 20 | nS | V _{DS} = -10V, V _{GS} = -4.5V, R _G = 6Ω, I _S = -1A, |
| Turn-On Rise Time | t _r | — | 12 | 22 | nS | |
| Turn-Off Delay Time | t _{D(off)} | — | 21 | 34 | nS | |
| Turn-Off Fall Time | t _f | — | 13 | 23 | nS | |

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

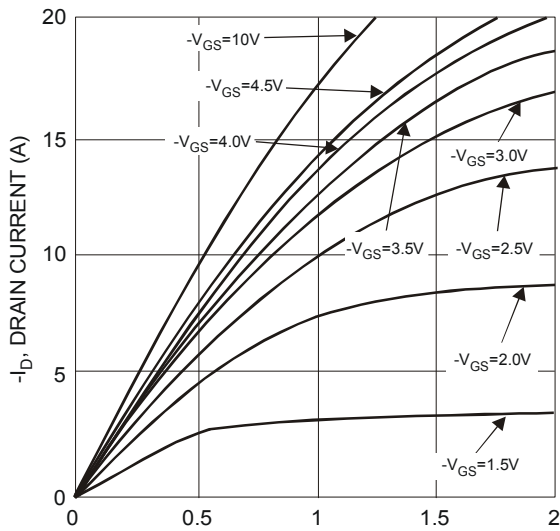


Fig. 13 Typical Output Characteristics

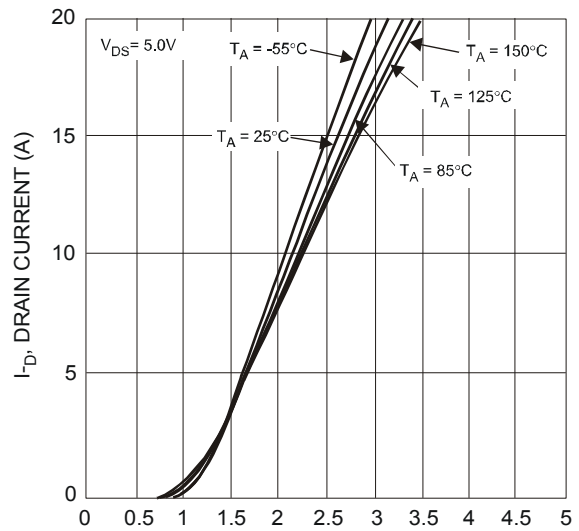


Fig. 14 Typical Transfer Characteristics

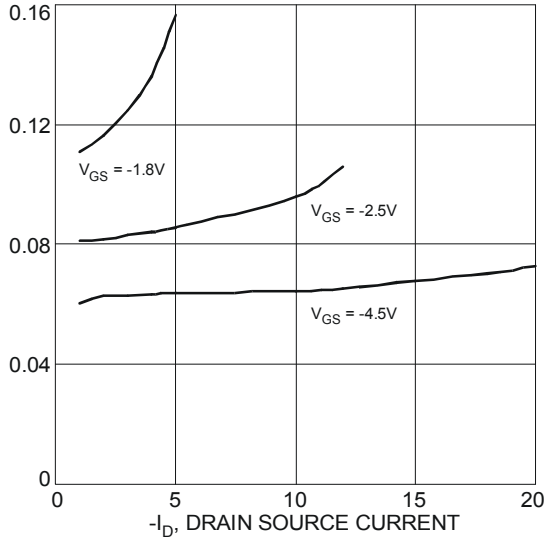


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

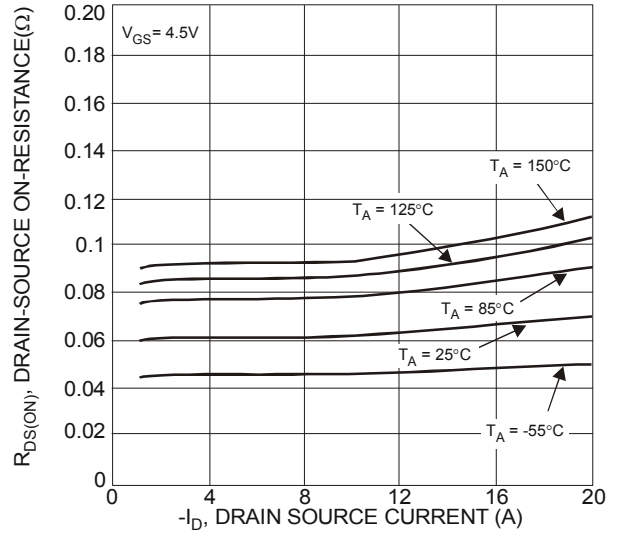


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

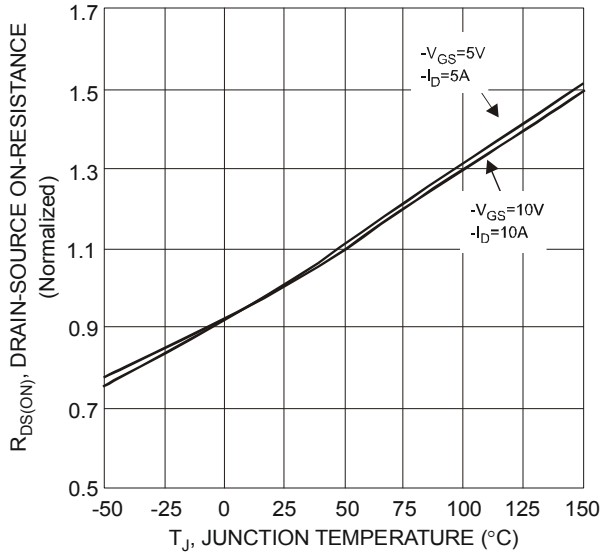


Fig. 17 On-Resistance Variation with Temperature

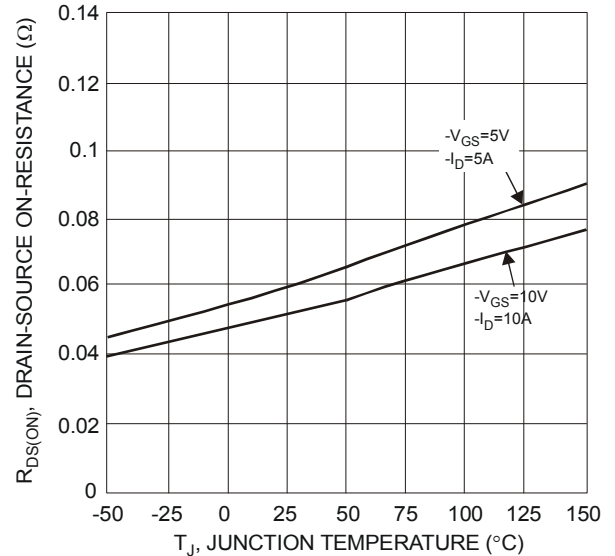


Fig. 18 On-Resistance Variation with Temperature

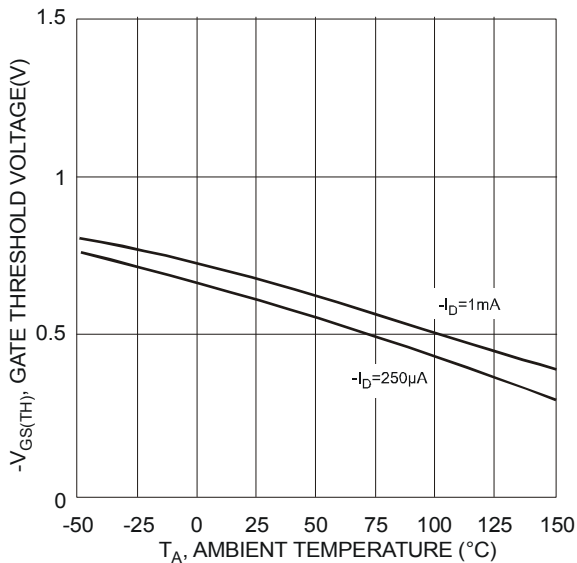


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

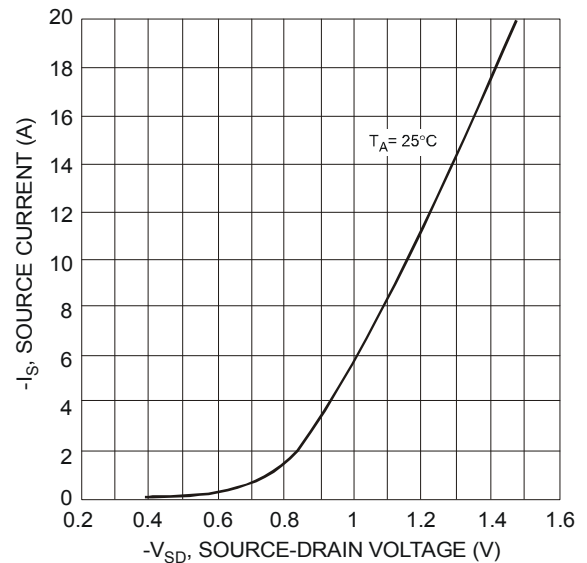
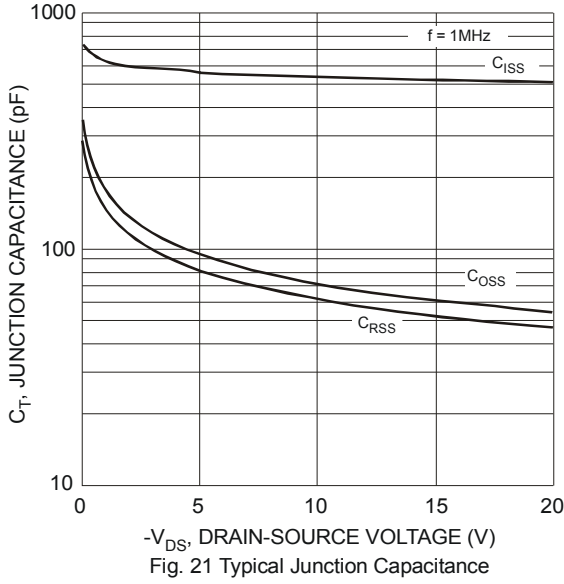


Fig. 20 Diode Forward Voltage vs. Current



-V_{DS}, DRAIN-SOURCE VOLTAGE (V)
Fig. 21 Typical Junction Capacitance

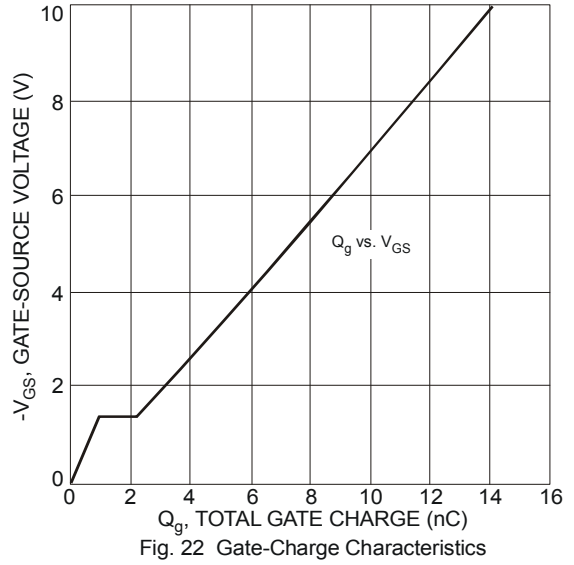
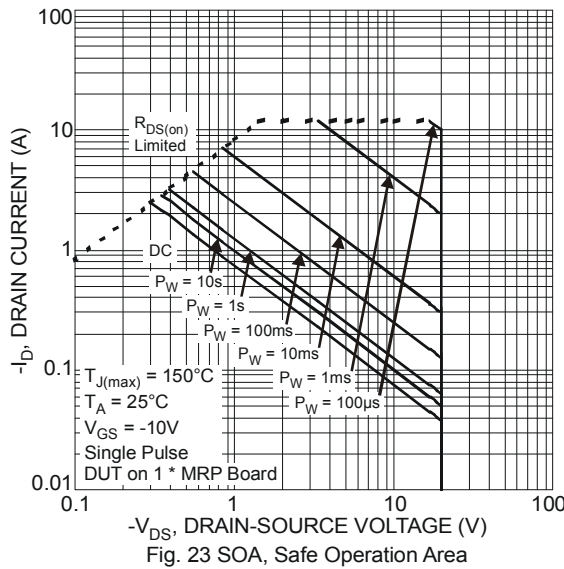


Fig. 22 Gate-Charge Characteristics



-V_{DS}, DRAIN-SOURCE VOLTAGE (V)
Fig. 23 SOA, Safe Operation Area

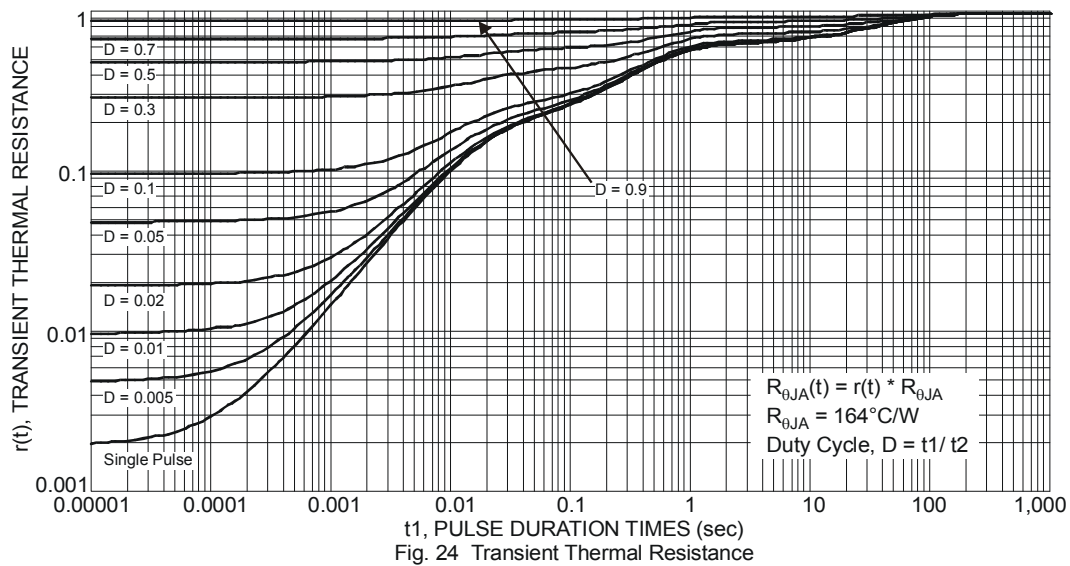
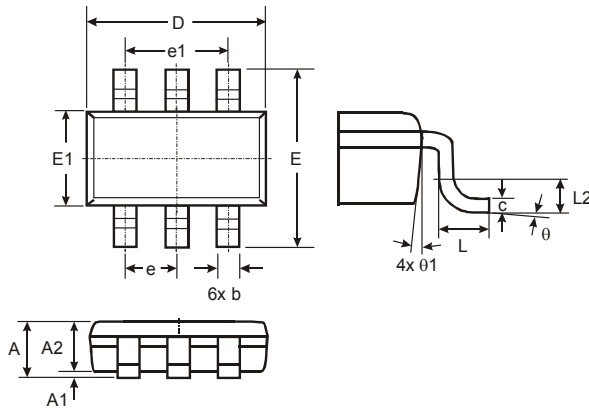


Fig. 24 Transient Thermal Resistance

Package Outline Dimensions

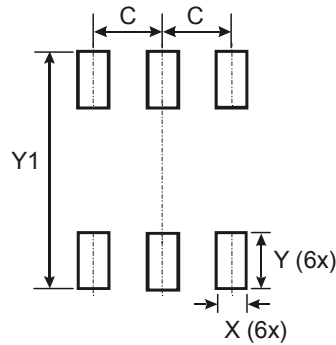
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| TSOT26 | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | - | 1.00 | - |
| A1 | 0.01 | 0.10 | - |
| A2 | 0.84 | 0.90 | - |
| D | 2.85 | 2.95 | 2.90 |
| E | 2.70 | 2.90 | 2.80 |
| E1 | 1.55 | 1.65 | 1.60 |
| b | 0.30 | 0.45 | - |
| c | 0.12 | 0.20 | - |
| e | BSC | BSC | 0.95 |
| e1 | BSC | BSC | 1.90 |
| L | 0.30 | 0.50 | - |
| L2 | BSC | BSC | 0.25 |
| theta | 0° | 8° | 4° |
| theta1 | 4° | 12° | - |
| All Dimensions in mm | | | |

Suggested Pad Layout

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



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.950 |
| X | 0.700 |
| Y | 1.000 |
| Y1 | 3.199 |

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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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[AZV3002S-13](#) [PAM2863EV1](#) [SBRT25U60SLP-13](#) [LM2904AQM8-13](#) [GBPC1506](#) [GBU804](#) [GBU808](#) [BCR401UW6-7](#) [DMP4013LFG-7](#)
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[BC858C-7-F](#) [BCX53TA](#) [B550C-13-F](#) [BAV20W-7-F](#) [6A6-T](#) [BZT52C15T-7](#) [BZX84C5V1TS-7-F](#) [DMP6180SK3-13](#) [BZT52C15LP-7](#)
[74LVC1G58W6-7](#) [DDTC114ELP-7](#) [BAS40](#) [1N5402-T](#) [ZMR330FTA](#) [ZVN4525E6TA](#) [SBR40100CT](#) [FZT605TA](#) [BZT52C15SQ-7-F](#)
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