

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

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

**Description**

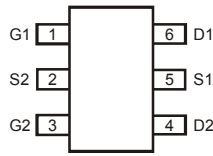
This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

**Applications**

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



Top View

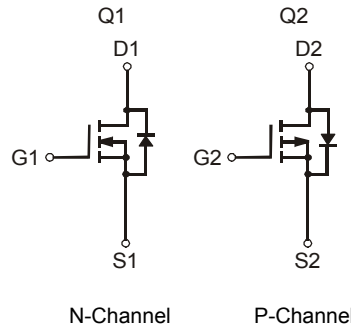

 Top View  
Pin Configuration

**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  $\text{E3}$
- Terminal Connections Indicator: See diagram
- Weight: 0.013 grams (approximate)



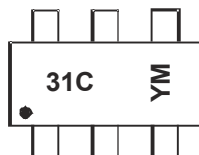
N-Channel

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](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<sub>A</sub> = +25°C, unless otherwise specified.)

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

**Maximum Ratings P-CHANNEL – Q2** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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

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

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)	T <sub>A</sub> = +25°C	P <sub>D</sub>	0.8	W
	T <sub>A</sub> = +70°C		0.5	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	R <sub>θJA</sub>	168	°C/W
	t < 10s		120	
Total Power Dissipation (Note 6)	T <sub>A</sub> = +25°C	P <sub>D</sub>	1.1	W
	T <sub>A</sub> = +70°C		0.7	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	R <sub>θJA</sub>	114	°C/W
	t < 10s		72	
Thermal Resistance, Junction to Case (Note 6)		R <sub>θJC</sub>	39	
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</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 @T <sub>c</sub> = +25°C	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	0.4	—	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>	—	27	35	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4.0A
		—	33	43		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 2.5A
		—	43	56		V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 1.5A
Forward Transfer Admittance	Y <sub>fs</sub>	—	9	—	S	V <sub>DS</sub> = 5V, I <sub>D</sub> = 3.4A
Diode Forward Voltage	V <sub>SD</sub>	0.4	—	1.1	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iSS</sub>	—	400	530	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	70	90	pF	
Reverse Transfer Capacitance	C <sub>rSS</sub>	—	65	100	pF	
Gate Resistance	R <sub>g</sub>	—	1.9	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	5.7	—	nC	V <sub>DS</sub> = 15V, I <sub>D</sub> = 5.8A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	12	17	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	0.7	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	1.4	—	nC	
Turn-On Delay Time	t <sub>D(on)</sub>	—	5	10	ns	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 4.5V, R <sub>G</sub> = 6Ω, I <sub>DS</sub> = 1A,
Turn-On Rise Time	t <sub>r</sub>	—	8	16	ns	
Turn-Off Delay Time	t <sub>D(off)</sub>	—	25	40	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	8	16	ns	

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

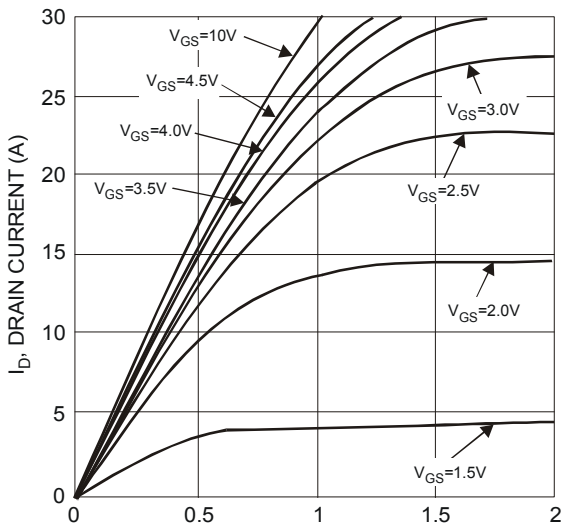


Fig. 1 Typical Output Characteristics

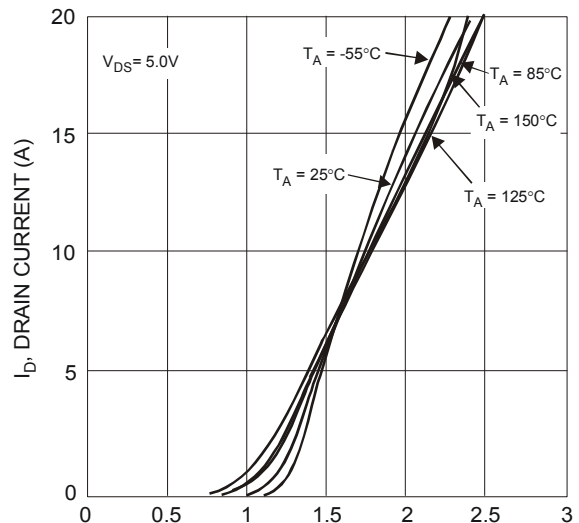


Fig. 2 Typical Transfer Characteristics

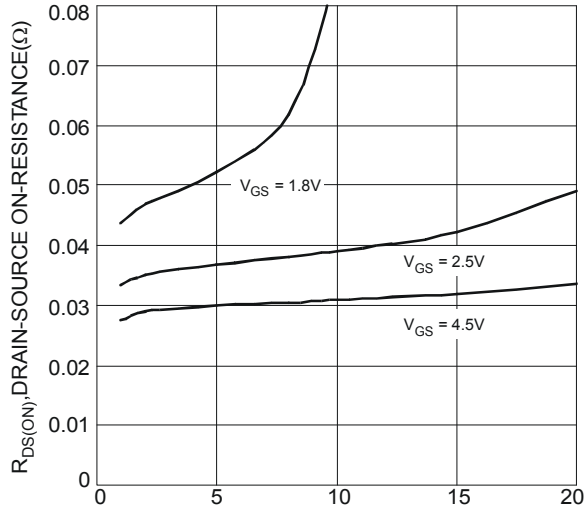


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

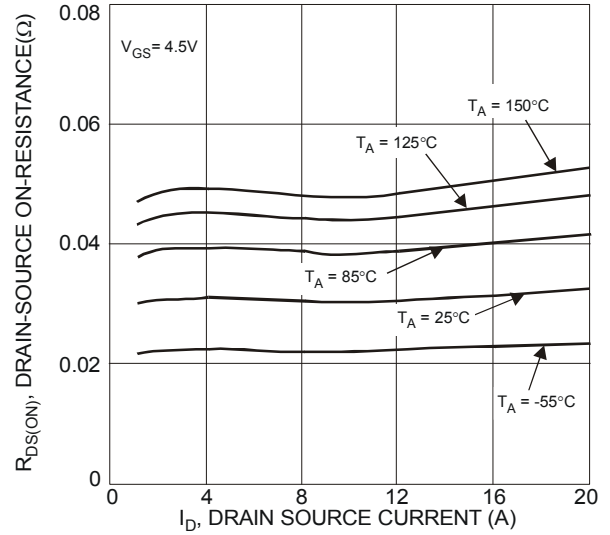


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

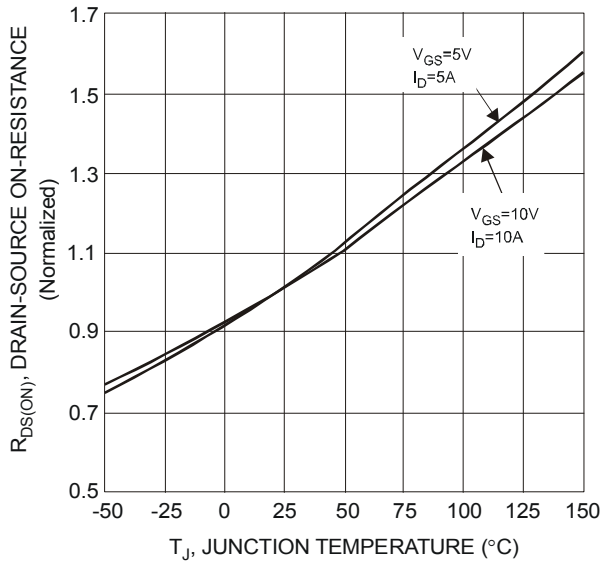


Fig. 5 On-Resistance Variation with Temperature

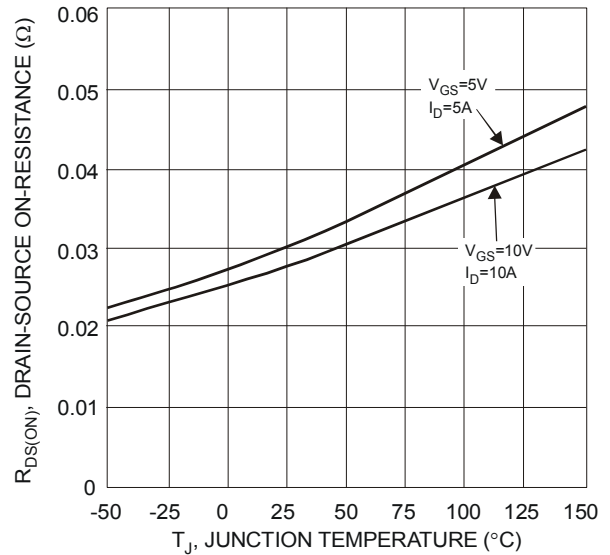


Fig. 6 On-Resistance Variation with Temperature

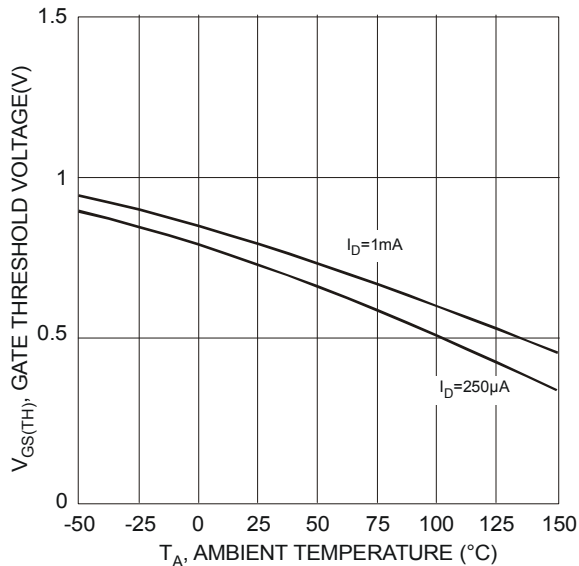


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

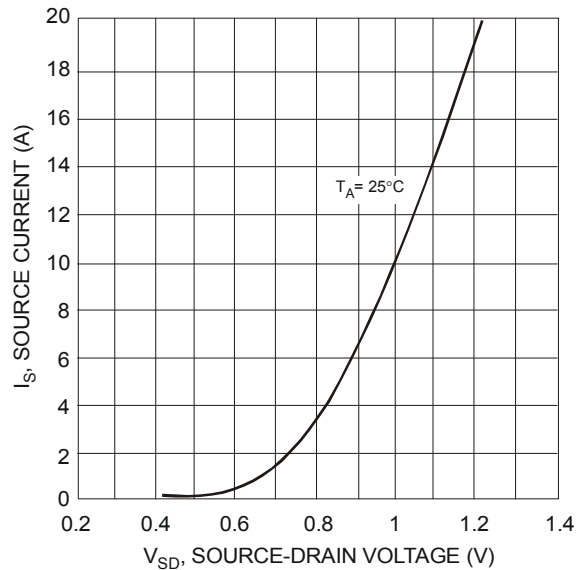


Fig. 8 Diode Forward Voltage vs. Current

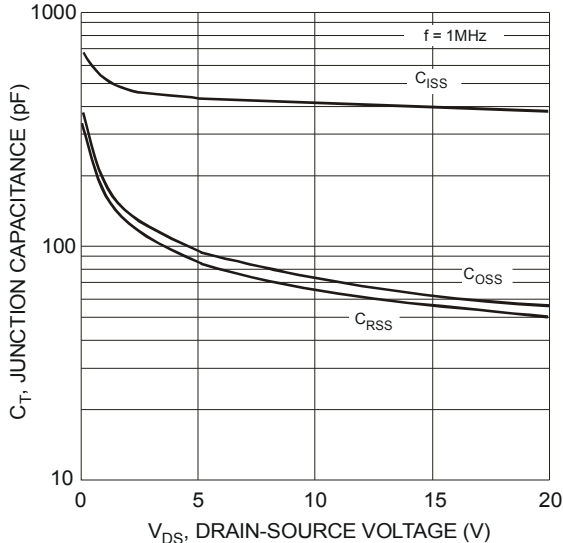


Fig. 9 Typical Junction Capacitance

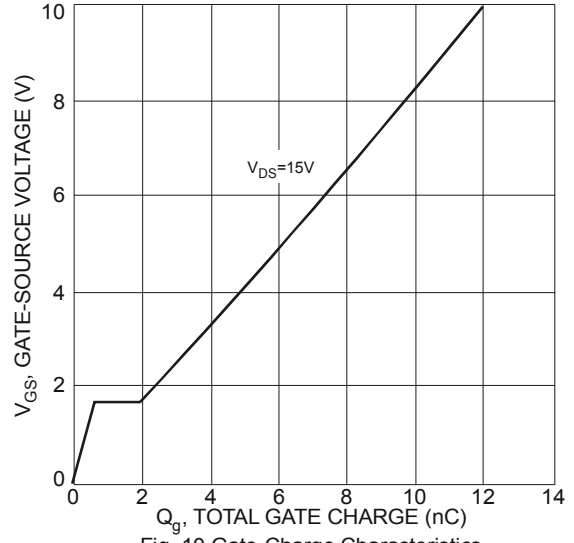


Fig. 10 Gate-Charge Characteristics

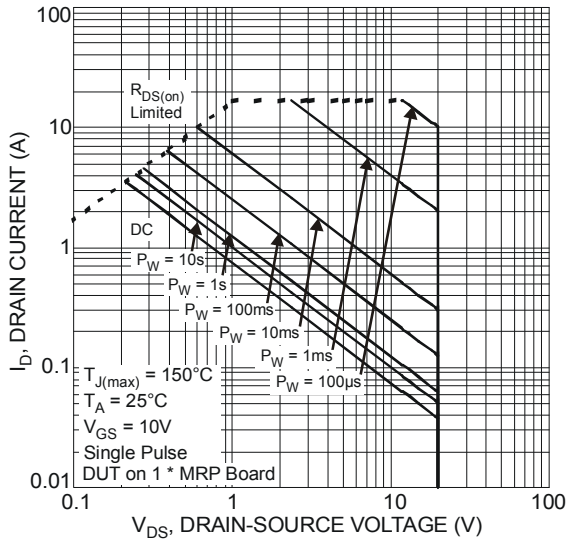


Fig. 11 SOA, Safe Operation Area

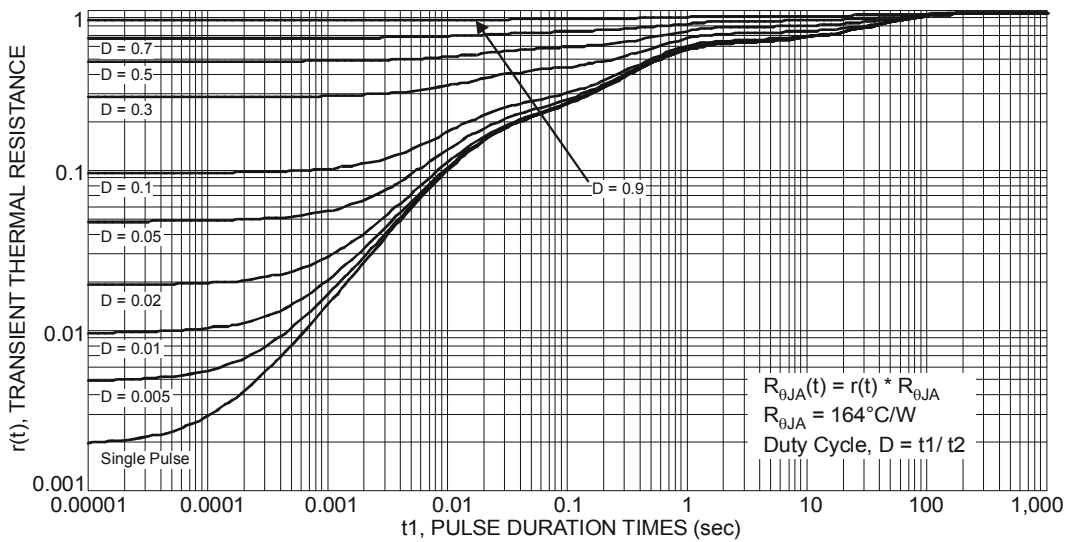


Fig. 12 Transient Thermal Resistance

**Electrical Characteristics P-CHANNEL – Q2** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</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 @T <sub>c</sub> = +25°C	I <sub>DSS</sub>	—	—	-1.0	μA	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-0.4	—	-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>	—	57	74	mΩ	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.0A
		—	76	110		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -1.5A
		—	102	168		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -1.0A
Forward Transfer Admittance	Y <sub>fs</sub>	—	10	—	S	V <sub>DS</sub> = -5V, I <sub>D</sub> = -3.0A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.8	-1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -0.6A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	530	705	pF	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	70	95	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	60	90	pF	
Gate Resistance	R <sub>g</sub>	—	72	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Q <sub>g</sub>	—	7	10	nC	V <sub>DS</sub> = -15V, I <sub>D</sub> = -6A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	14	—	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	0.95	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	1.2	—	nC	
Turn-On Delay Time	t <sub>D(on)</sub>	—	11	20	nS	V <sub>DS</sub> = -10V, V <sub>GS</sub> = -4.5V, R <sub>G</sub> = 6Ω, I <sub>S</sub> = -1A,
Turn-On Rise Time	t <sub>r</sub>	—	12	22	nS	
Turn-Off Delay Time	t <sub>D(off)</sub>	—	21	34	nS	
Turn-Off Fall Time	t <sub>f</sub>	—	13	23	nS	

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

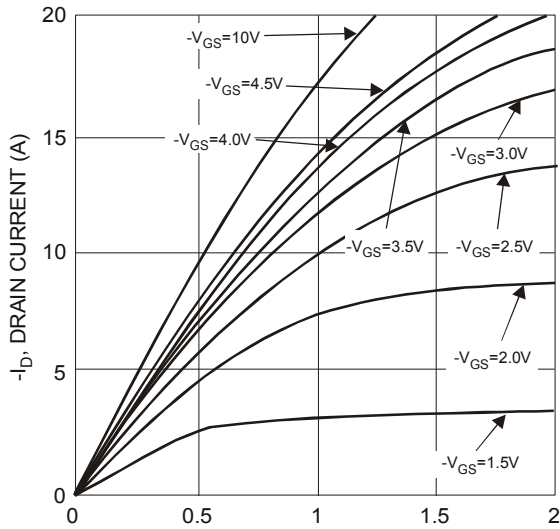


Fig. 13 Typical Output Characteristics

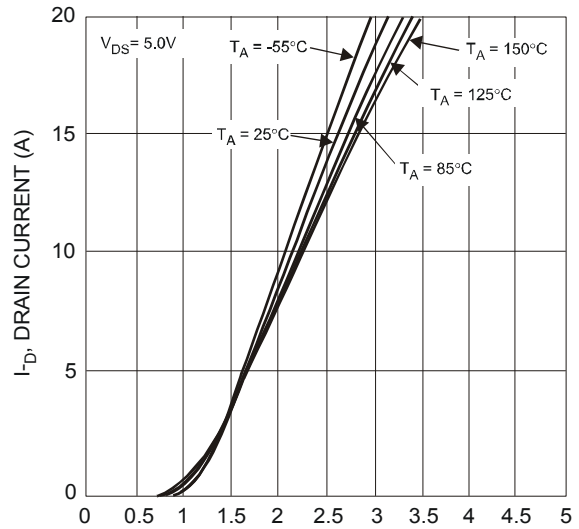


Fig. 14 Typical Transfer Characteristics

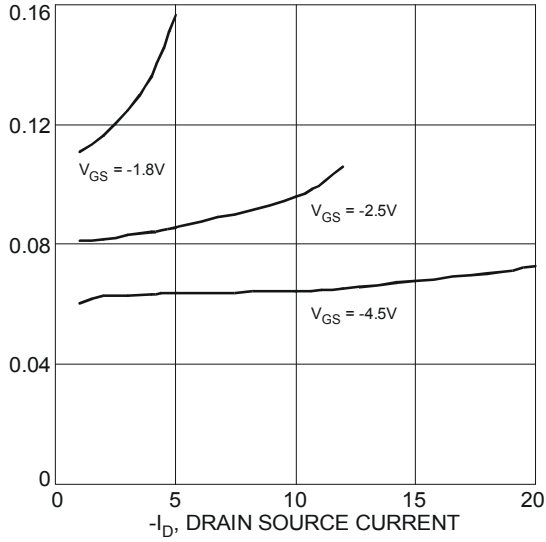


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

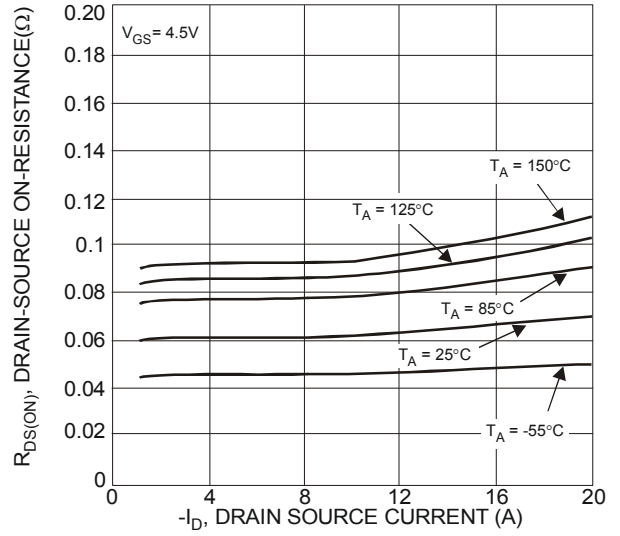


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

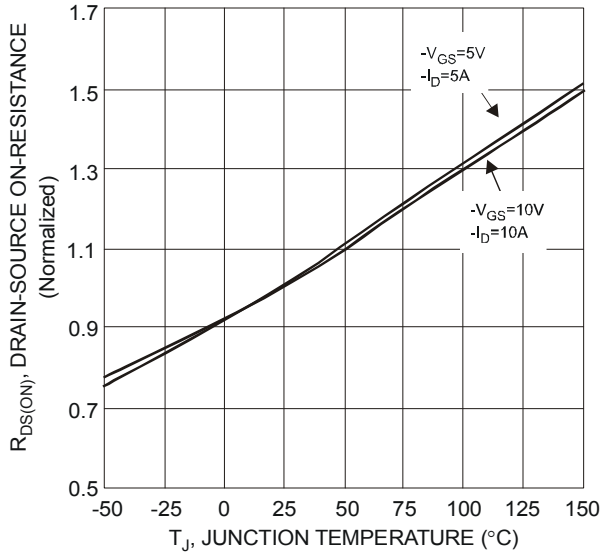


Fig. 17 On-Resistance Variation with Temperature

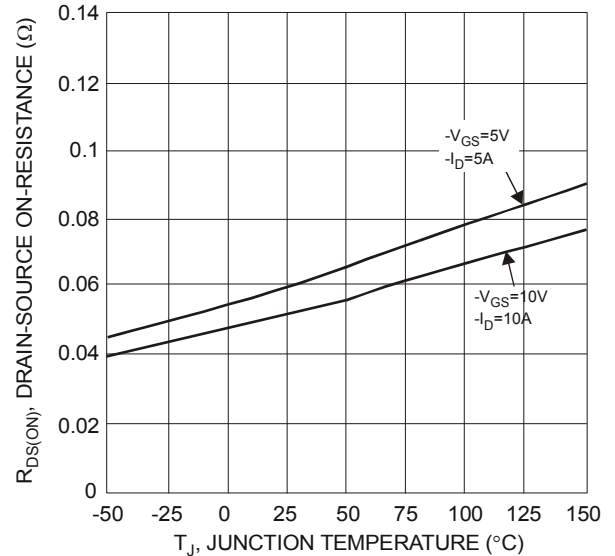


Fig. 18 On-Resistance Variation with Temperature

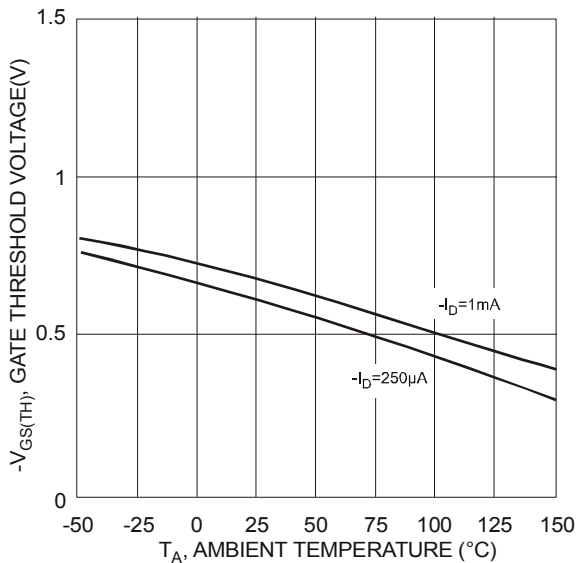


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

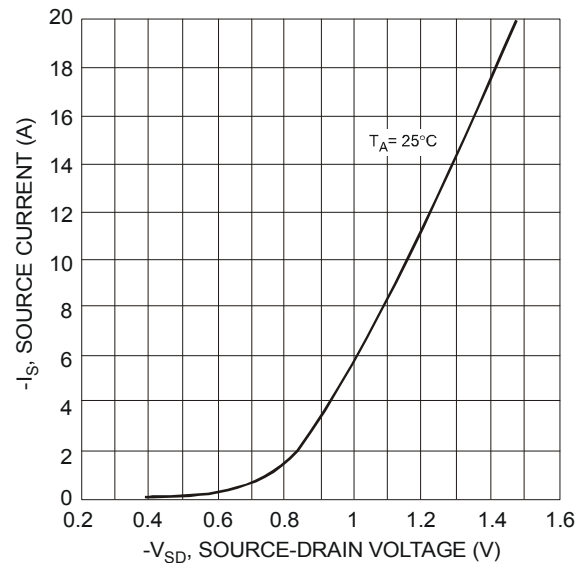
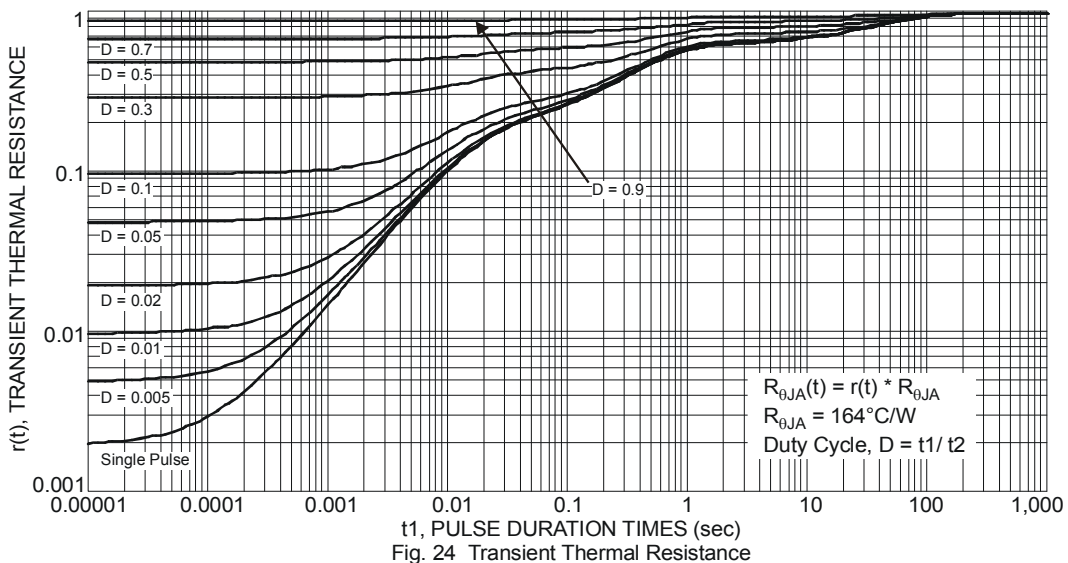
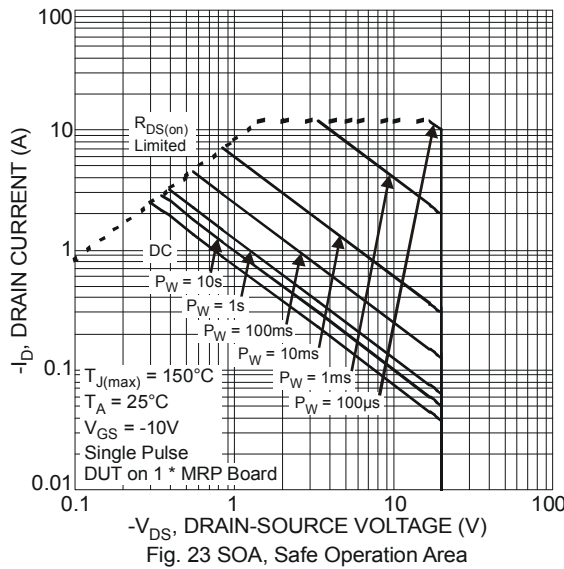
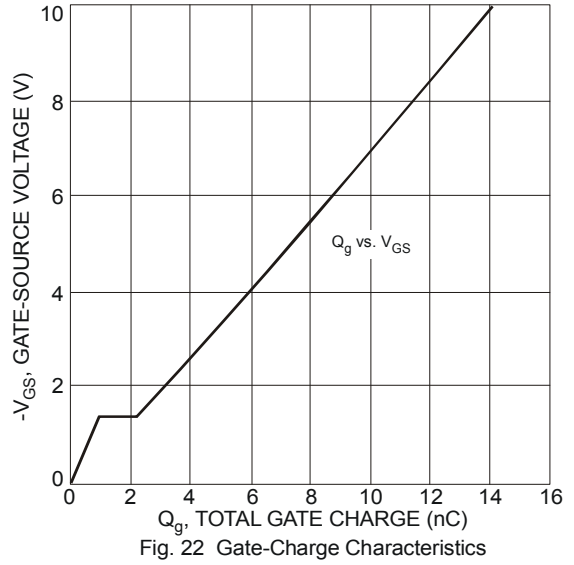
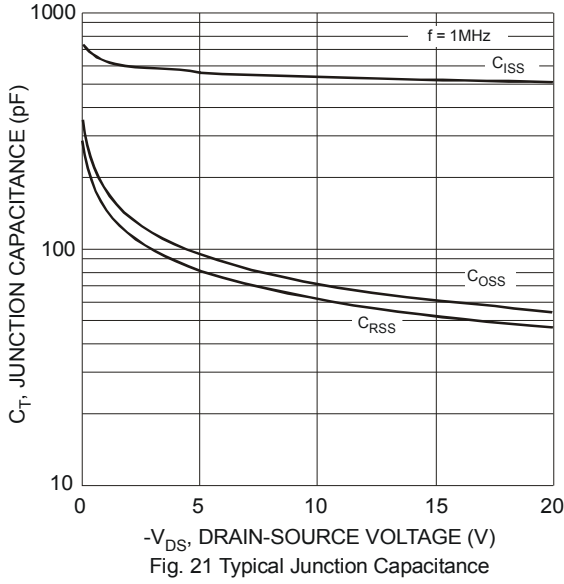


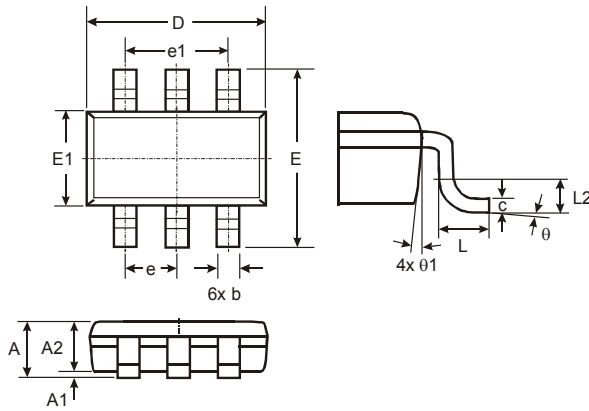
Fig. 20 Diode Forward Voltage vs. Current





**Package Outline Dimensions**

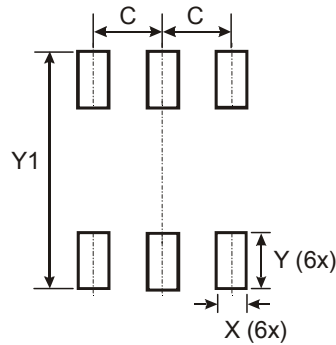
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



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
θ	0°	8°	4°
θ1	4°	12°	–
<b>All Dimensions in mm</b>			

**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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