





**DMC2020USD**

**20V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

**Product Summary**

Device	V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub> Max T <sub>A</sub> = 25°C (Notes 3 & 5)
Q1	20V	20mΩ @ V <sub>GS</sub> = 4.5V	8.5A
		28mΩ @ V <sub>GS</sub> = 2.5V	7.2A
Q2	-20V	33mΩ @ V <sub>GS</sub> = -4.5V	-6.8A
		45mΩ @ V <sub>GS</sub> = -2.5V	-5.8A

**Features and Benefits**

- Reduced footprint with two discretes in a single SO8
- Low gate drive
- Low input capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected up to 2kV**
- **“Lead Free”, RoHS Compliant (Note 1)**
- **Halogen and Antimony Free. “Green” Device (Note 1)**

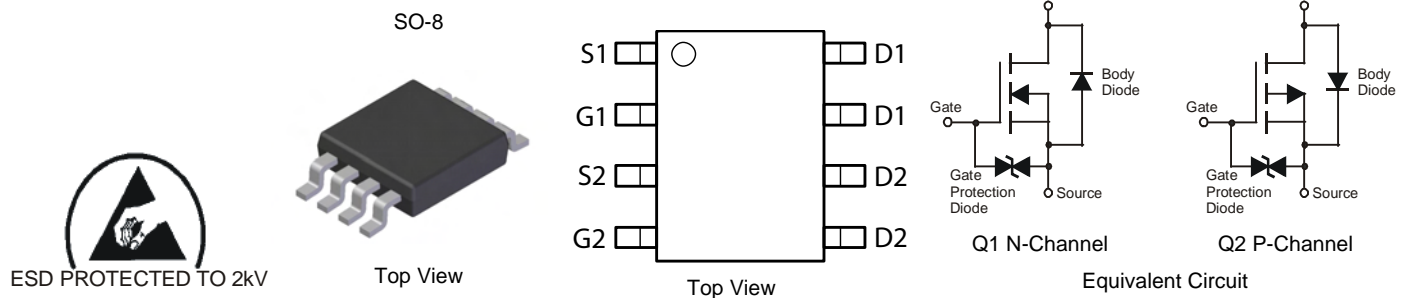
**Mechanical Data**

- Case: SO-8
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.074 grams (approximate)

**Description and Applications**

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

- Motor control
- DC-DC Converters
- Power management functions
- Notebook Computers and Printers

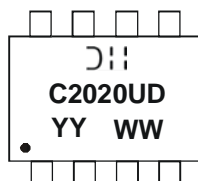


**Ordering Information** (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMC2020USD-13	C2020UD	13	12	2,500

Notes: 1. No purposefully added lead. Diodes Inc.'s "Green" policy and packaging details can be found on our website at <http://www.diodes.com>.

**Marking Information**



⏏ = Manufacturer's Marking  
 C2020UD = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 09 = 2009)  
 WW = Week (01 - 53)

**Maximum Ratings** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

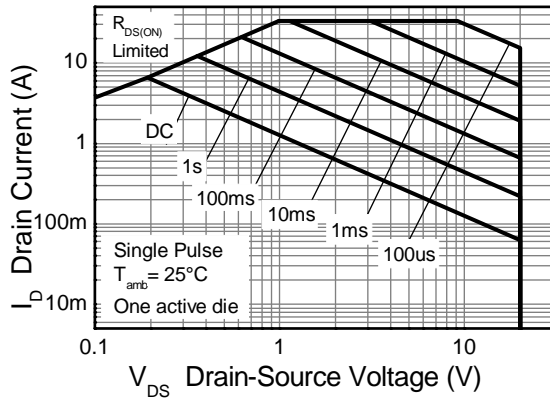
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			$V_{DSS}$	20	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 10$	$\pm 10$	
Continuous Drain Current	$V_{GS} = 4.5\text{V}$	(Notes 3 & 5)	$I_D$	8.5	-6.8	A
		$T_A = 70^\circ\text{C}$ (Notes 3 & 5)		6.8	-5.4	
		(Notes 2 & 5)		6.5	-5.2	
		(Notes 2 & 6)		7.8	-6.3	
Pulsed Drain Current	$V_{GS} = 4.5\text{V}$	(Notes 4 & 5)	$I_{DM}$	33.6	-26.8	
Continuous Source Current (Body diode)			$I_S$	4.0	-4.0	
Pulsed Source Current (Body diode)			$I_{SM}$	33.6	-26.8	

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

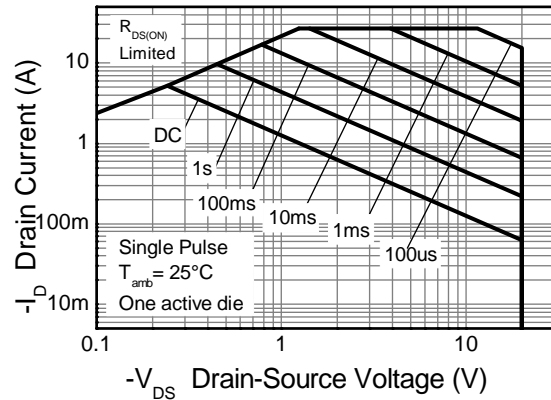
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 2 & 5)	$P_D$	1.25		W mW/ $^\circ\text{C}$
			10		
	(Notes 2 & 6)		1.8		
			14.3		
Thermal Resistance, Junction to Ambient	(Notes 3 & 5)	$R_{\theta JA}$	2.14		$^\circ\text{C}/\text{W}$
			17.2		
	(Notes 2 & 5)		100		
	(Notes 2 & 6)	$R_{\theta JA}$	70		$^\circ\text{C}/\text{W}$
	(Notes 3 & 5)		58		
Thermal Resistance, Junction to Lead	(Notes 5 & 7)	$R_{\theta JL}$	51		$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range			$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes:
2. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  3. Same as note (2), except the device is measured at  $t \leq 10$  sec.
  4. Same as note (2), except the device is pulsed with  $D = 0.02$  and pulse width 300 $\mu\text{s}$ .
  5. For a dual device with one active die.
  6. For a device with two active die running at equal power.
  7. Thermal resistance from junction to solder-point (at the end of the drain lead).

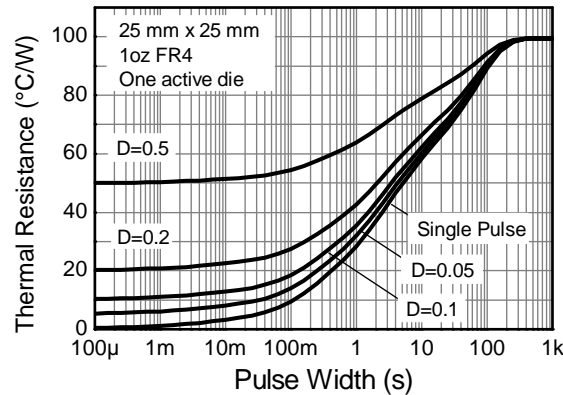
**Thermal Characteristics**



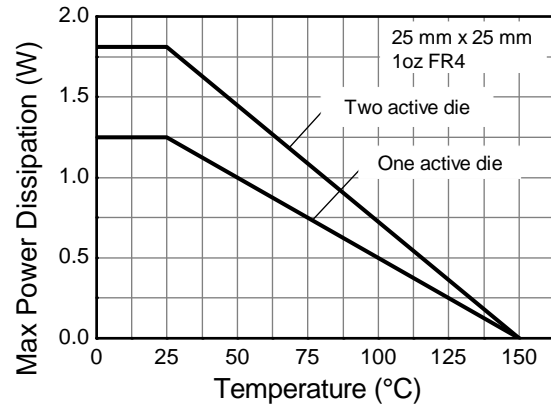
**N-channel Safe Operating Area**



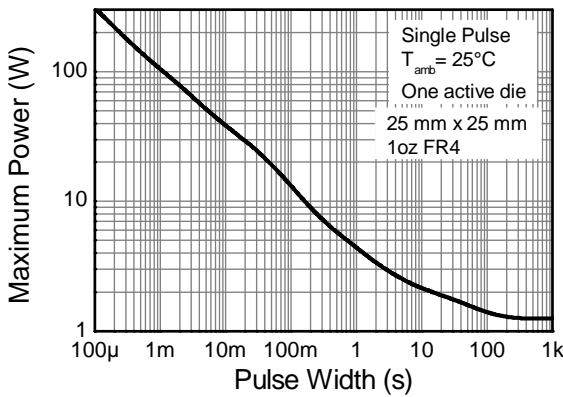
**P-channel Safe Operating Area**



**Transient Thermal Impedance**



**Derating Curve**



**Pulse Power Dissipation**

**Electrical Characteristics – Q1 N-CHANNEL** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</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>	-	-	±10	μA	V <sub>GS</sub> = ±10V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	0.5	1.1	1.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance (Note 8)	R <sub>DS(on)</sub>	-	13	20	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 7A
			18	28		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 3A
Forward Transfer Admittance (Notes 8 & 9)	Y <sub>fs</sub>	-	16	-	S	V <sub>DS</sub> = 5V, I <sub>D</sub> = 9.4A
Diode Forward Voltage (Note 8)	V <sub>SD</sub>	-	0.7	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1.3A
Continuous Source Current	I <sub>S</sub>	-	-	1.8	A	-
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	-	1149	-	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	-	157	-		
Reverse Transfer Capacitance	C <sub>rss</sub>	-	142	-		
Gate Resistance	R <sub>g</sub>	-	1.51	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (Note 10)	Q <sub>g</sub>	-	6.0	-	nC	V <sub>DS</sub> = 10V I <sub>D</sub> = 9.4A
Total Gate Charge (Note 10)	Q <sub>g</sub>	-	11.6	-		
Gate-Source Charge (Note 10)	Q <sub>gs</sub>	-	2.7	-		
Gate-Drain Charge (Note 10)	Q <sub>gd</sub>	-	3.4	-		
Turn-On Delay Time (Note 10)	t <sub>D(on)</sub>	-	11.67	-	ns	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = 1A
Turn-On Rise Time (Note 10)	t <sub>r</sub>	-	12.49	-		
Turn-Off Delay Time (Note 10)	t <sub>D(off)</sub>	-	35.89	-		
Turn-Off Fall Time (Note 10)	t <sub>f</sub>	-	12.33	-		

Notes: 8. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%  
 9. For design aid only, not subject to production testing.  
 10. Switching characteristics are independent of operating junction temperatures.

**Typical Characteristics – Q1 N-CHANNEL**

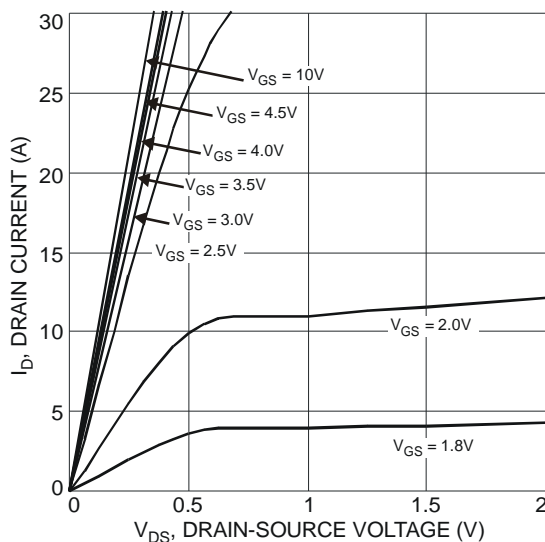


Fig. 1 Typical Output Characteristics

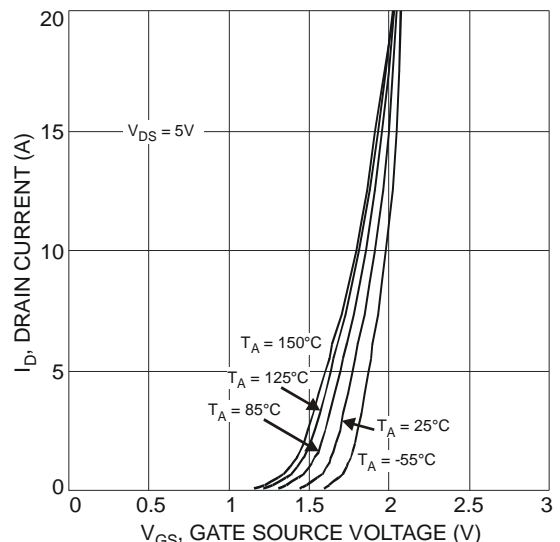
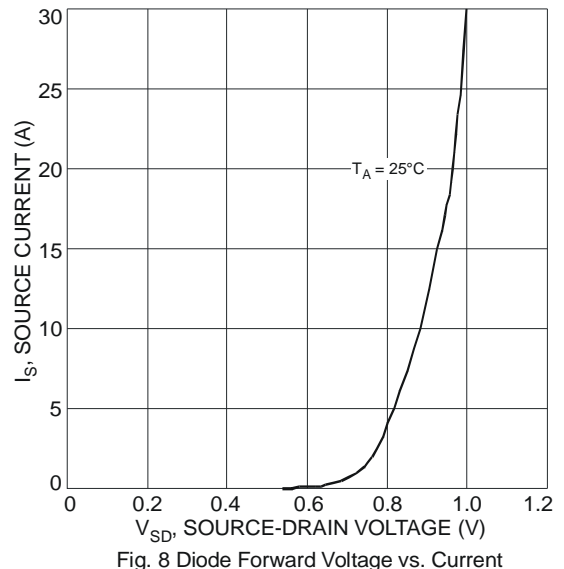
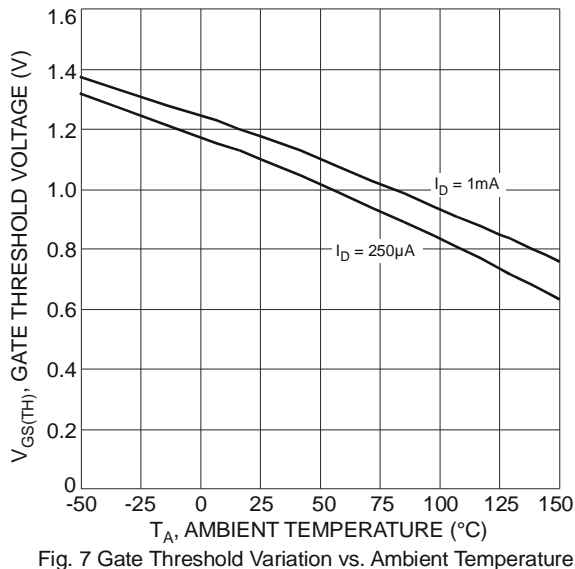
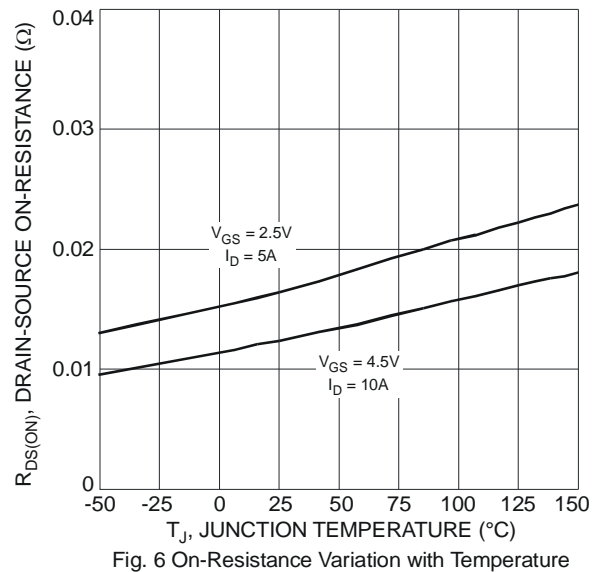
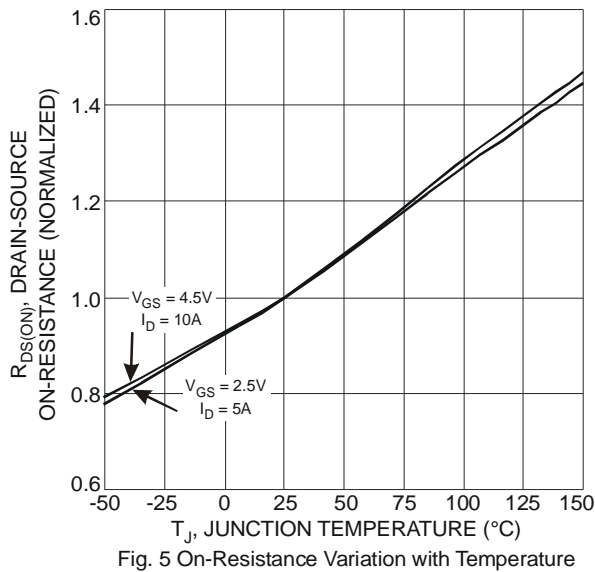
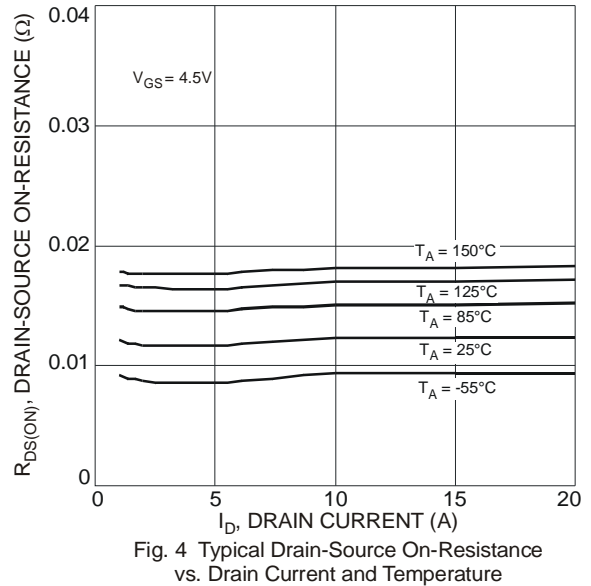
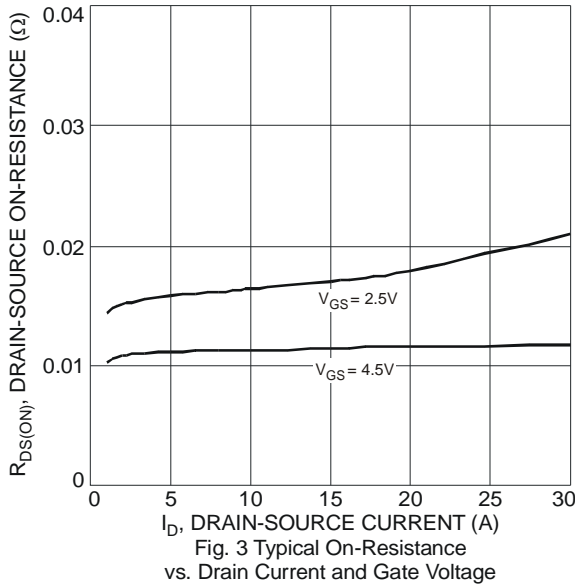


Fig. 2 Typical Transfer Characteristics

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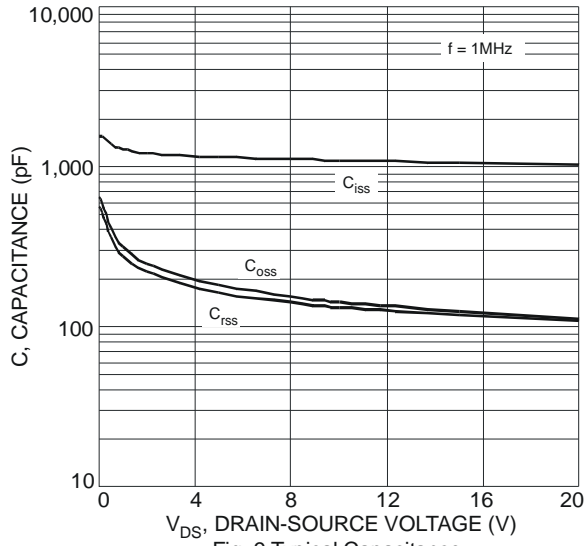


Fig. 9 Typical Capacitance

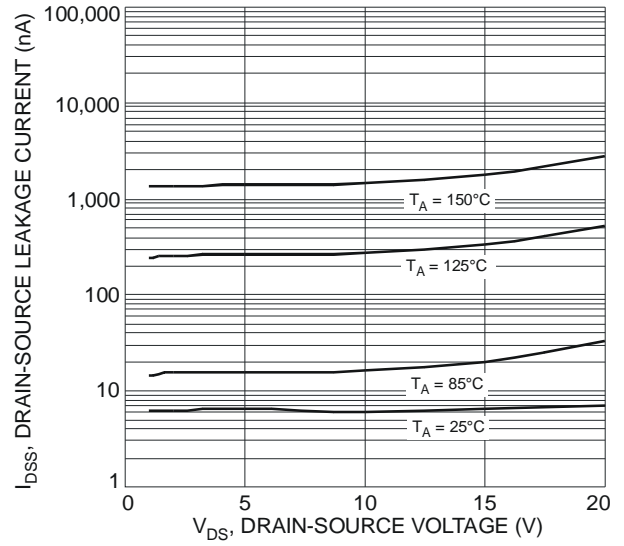


Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

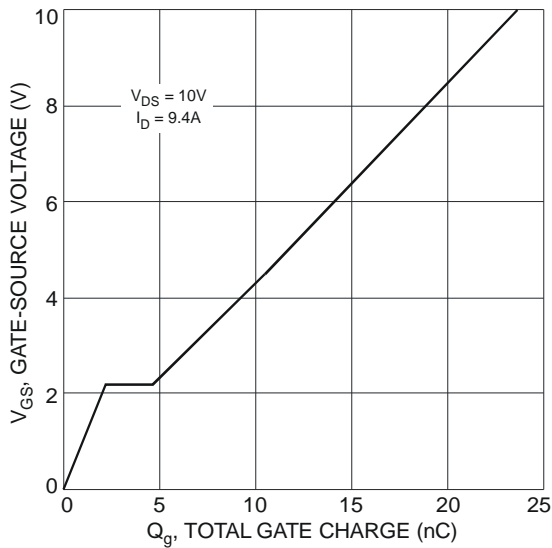


Fig. 11 Gate-Source Voltage vs. Total Gate Charge

**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</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-20	-	-	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	-	-	-1.0	$\mu A$	$V_{DS} = -20V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	-	-	$\pm 10$	$\mu A$	$V_{GS} = \pm 8V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	-0.7	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
Static Drain-Source On-Resistance (Note 11)	$R_{DS(on)}$	-	26	33	m $\Omega$	$V_{GS} = -4.5V, I_D = -6A$
			33	45		$V_{GS} = -2.5V, I_D = -3A$
Forward Transfer Admittance (Note 11 & 12)	$ Y_{fs} $	-	14	-	S	$V_{DS} = -5V, I_D = -4A$
Diode Forward Voltage (Note 11)	$V_{SD}$	-	-0.7	-1.0	V	$V_{GS} = 0V, I_S = -1A$
Continuous Source Current	$I_S$	-	-	-1.8	A	-
<b>DYNAMIC CHARACTERISTICS (Note 12)</b>						
Input Capacitance	$C_{iss}$	-	1610	-	pF	$V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz$
Output Capacitance	$C_{oss}$	-	157	-		
Reverse Transfer Capacitance	$C_{rss}$	-	145	-		
Gate Resistance	$R_g$	-	9.45	-	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$
Total Gate Charge (Note 13)	$Q_g$	-	8.0	-	nC	$V_{GS} = -2.5V$ $V_{DS} = -10V$ $I_D = -4A$
Total Gate Charge (Note 13)	$Q_{g1}$	-	15.4	-		
Gate-Source Charge (Note 13)	$Q_{gs}$	-	2.5	-		
Gate-Drain Charge (Note 13)	$Q_{gd}$	-	3.3	-		
Turn-On Delay Time (Note 13)	$t_{D(on)}$	-	16.8	-	ns	$V_{GS} = -4.5V, V_{DS} = -10V, R_G = 6\Omega, I_D = -1A$
Turn-On Rise Time (Note 13)	$t_r$	-	12.4	-		
Turn-Off Delay Time (Note 13)	$t_{D(off)}$	-	94.1	-		
Turn-Off Fall Time (Note 13)	$t_f$	-	42.4	-		

Notes: 11. Measured under pulsed conditions. Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$   
 12. For design aid only, not subject to production testing.  
 13. Switching characteristics are independent of operating junction temperatures.

**Typical Characteristics – Q2 P-CHANNEL**

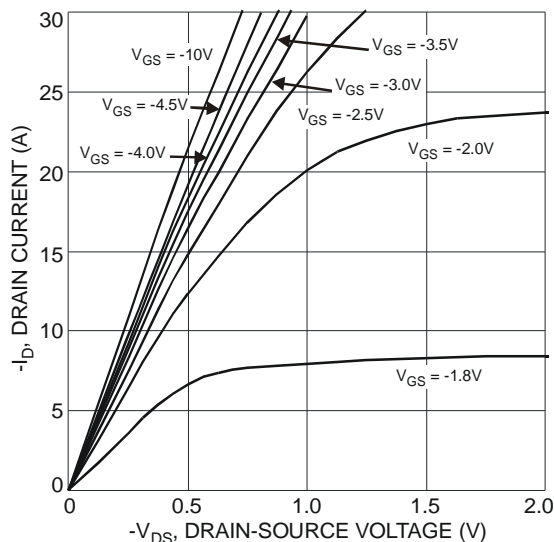


Fig. 12 Typical Output Characteristics

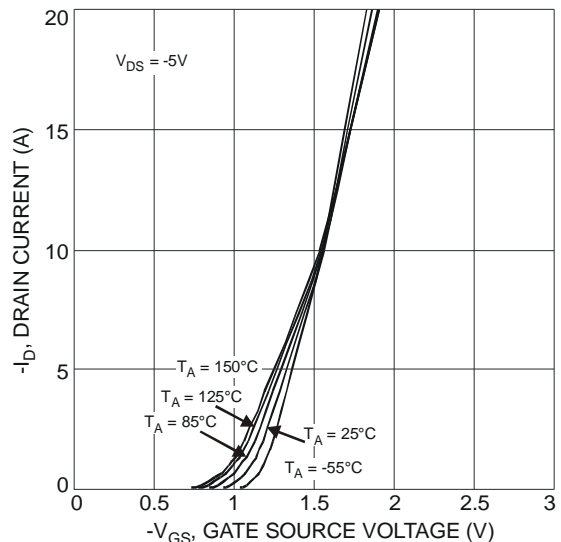


Fig. 13 Typical Transfer Characteristics

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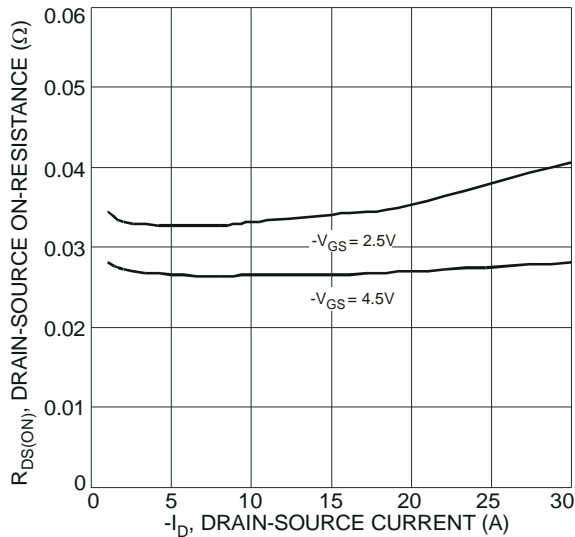


Fig. 14 Typical On-Resistance vs. Drain Current and Gate Voltage

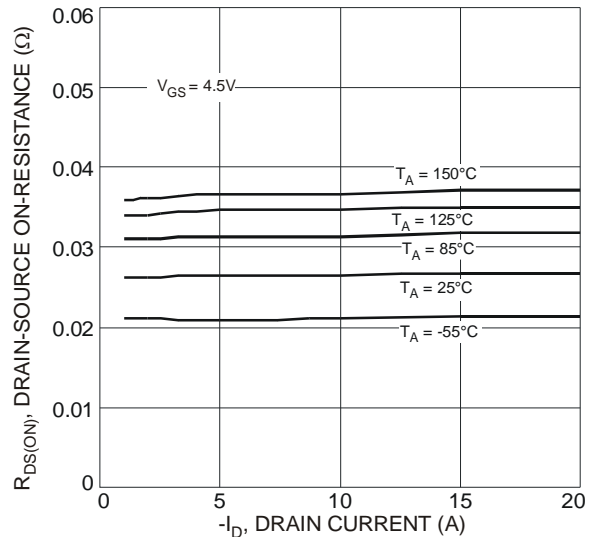


Fig. 15 Typical Drain-Source On-Resistance vs. Drain Current and Temperature

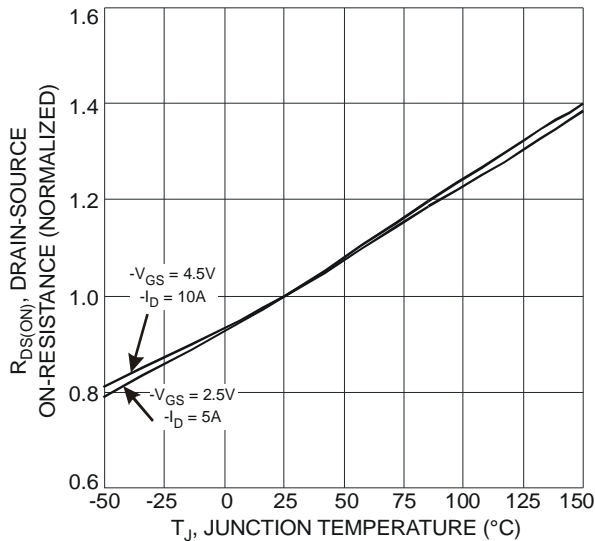


Fig. 16 On-Resistance Variation with Temperature

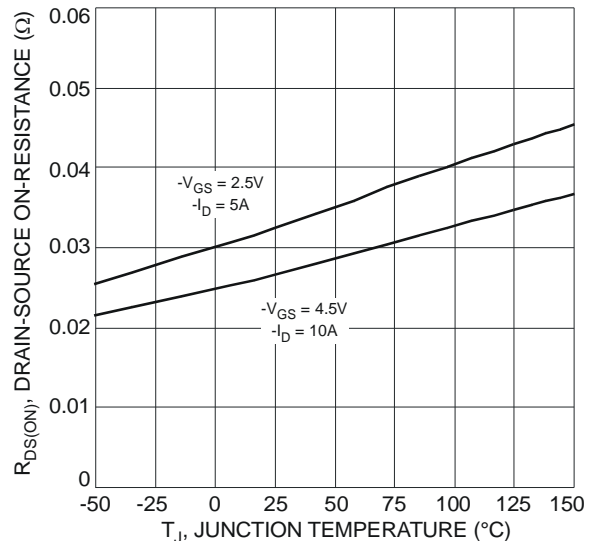


Fig. 17 On-Resistance Variation with Temperature

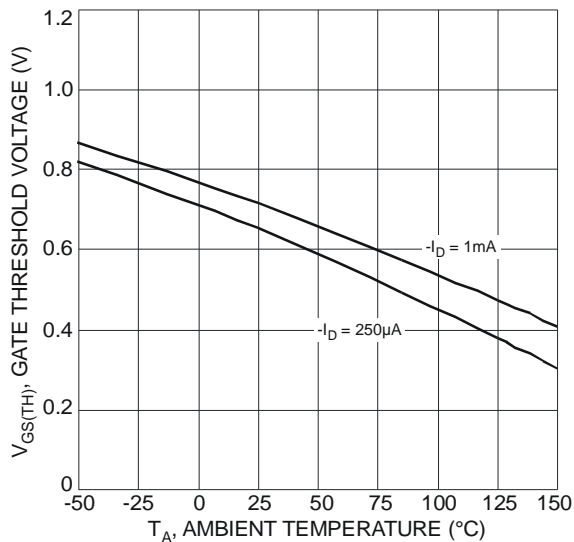


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

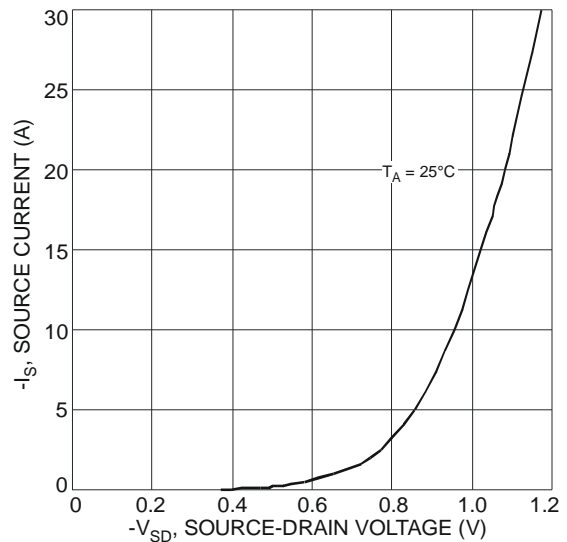
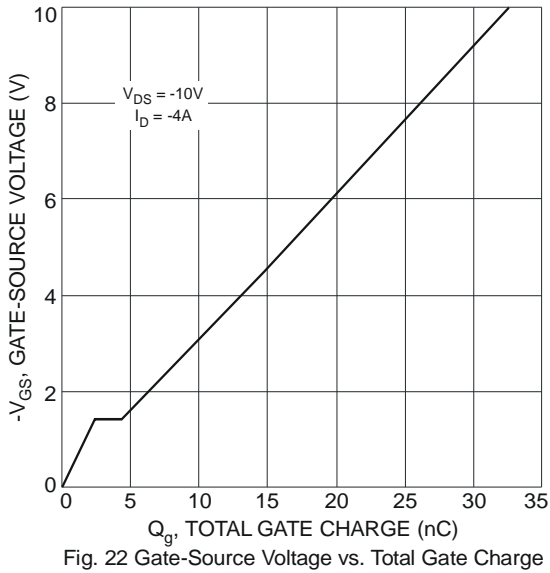
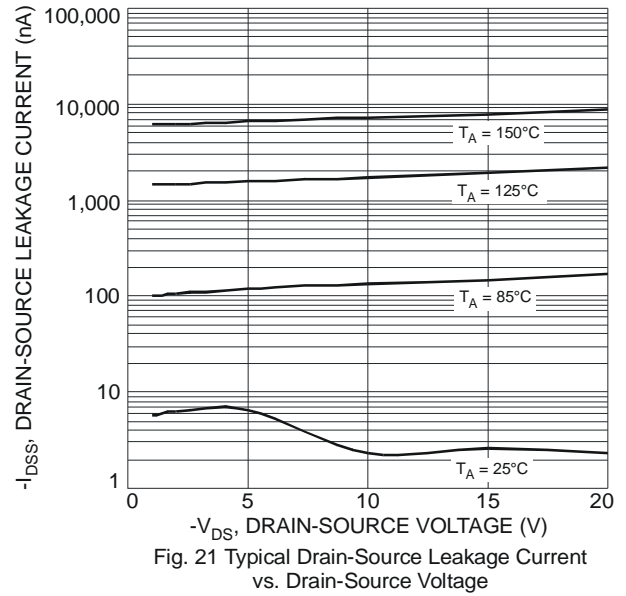
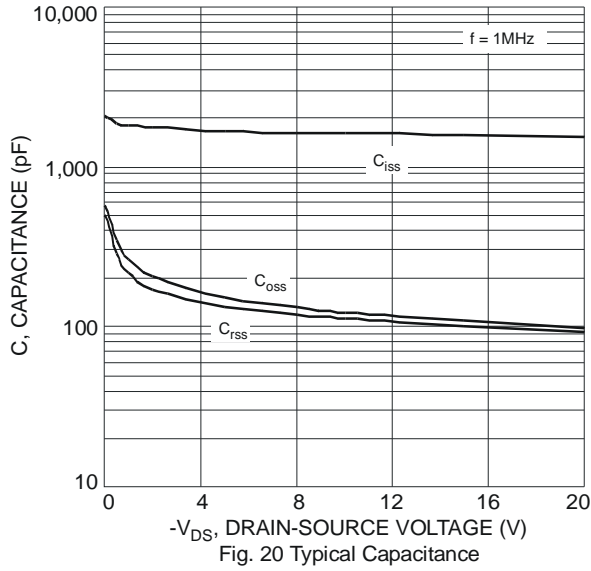
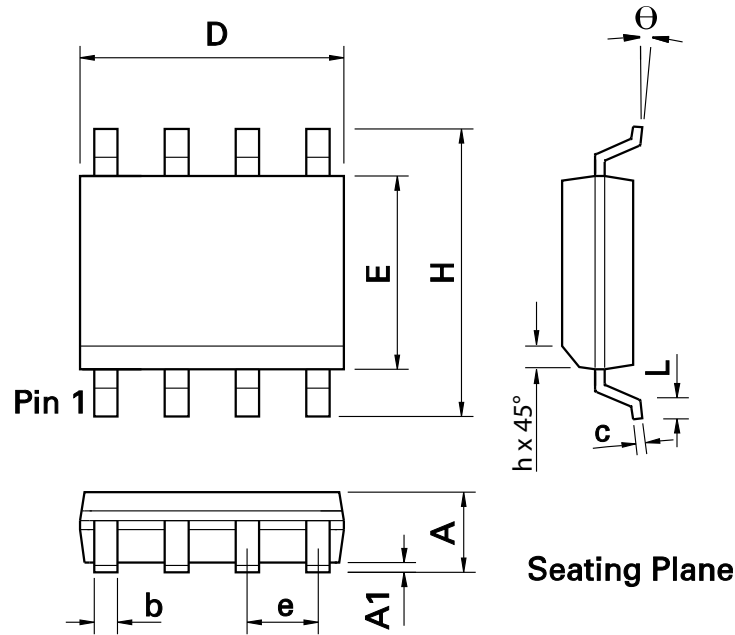


Fig. 19 Diode Forward Voltage vs. Current

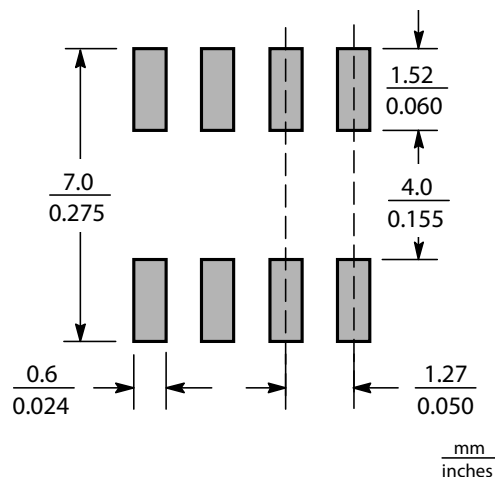


**Package Outline Dimensions**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.050 BSC		1.27 BSC	
A1	0.004	0.010	0.10	0.25	b	0.013	0.020	0.33	0.51
D	0.189	0.197	4.80	5.00	c	0.008	0.010	0.19	0.25
H	0.228	0.244	5.80	6.20	theta	0°	8°	0°	8°
E	0.150	0.157	3.80	4.00	h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27	-	-	-	-	-

**Suggested Pad Layout**



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