

**40V COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

**Product Summary**

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max (A) T <sub>A</sub> = +25 °C (Notes 6 & 8)
Q1	40V	25mΩ @ V <sub>GS</sub> = 10V	7.5
		40mΩ @ V <sub>GS</sub> = 4.5V	6.2
Q2	-40V	25mΩ @ V <sub>GS</sub> = -10V	-7.3
		45mΩ @ V <sub>GS</sub> = -4.5V	-5.7

**Description**

This MOSFET is designed to ensure that R<sub>DS(ON)</sub> of N and P channel FET are matched to minimize losses in both arms of the bridge. The DIODES™ DMC4040SSD is optimized for use in a 3-phase brushless DC motor circuit (BLDC), and CCFL backlighting.

**Applications**

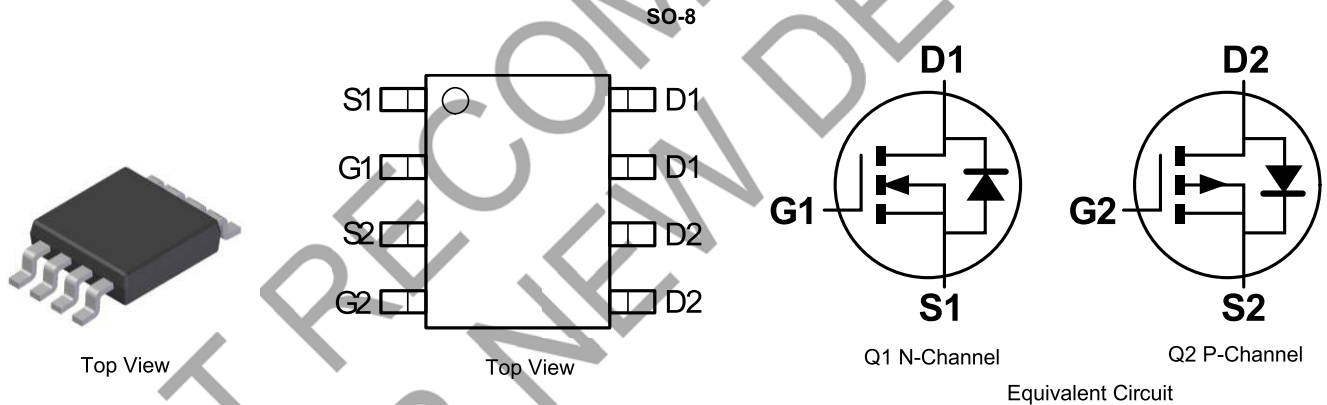
- 3-Phase BLDC motors
- CCFL backlighting

**Features and Benefits**

- Matched N & P R<sub>DS(ON)</sub> – Minimizes Power Losses
- Fast Switching – Minimizes Switching Losses
- Dual Device – Reduces PCB Area
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **An Automotive-Compliant Part is Available Under Separate Datasheet ([DMC4040SSDQ](#))**

**Mechanical Data**

- Package: SO-8
- Package Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 Ⓒ3
- Weight: 0.074 grams (Approximate)

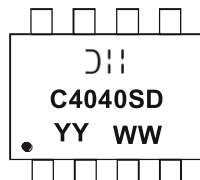


**Ordering Information** (Note 4)

Part Number	Package	Marking Code	Reel Size (Inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DMC4040SSD-13	SO-8	C4040SD	13	12	2,500	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**



- ⌋⌋⌋ = Manufacturer's Marking
- C4040SD = Product Type Marking Code
- YYWW = Date Code Marking
- YY or YY = Year (ex: 23 = 2023)
- WW = Week (01 to 53)

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

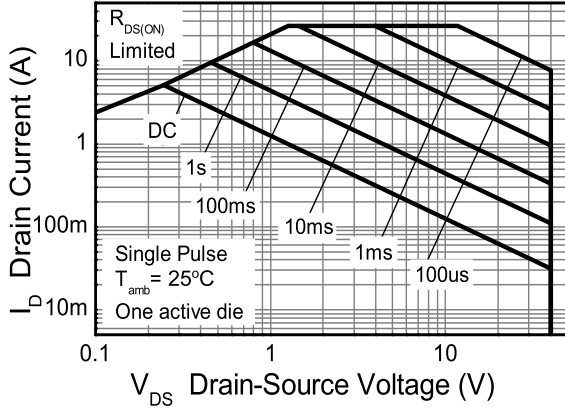
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Drain-Source Voltage			V <sub>DSS</sub>	40	-40	V
Gate-Source Voltage			V <sub>GSS</sub>	±20	±20	
Continuous Drain Current	V <sub>GS</sub> = 10V	(Notes 6 & 8)	I <sub>D</sub>	7.5	-7.5	A
		T <sub>A</sub> = +70 °C (Notes 6 & 8)		5.8	-5.8	
		(Notes 5 & 8)		5.7	-5.7	
		(Notes 5 & 9)		6.8	-6.8	
Pulsed Drain Current	V <sub>GS</sub> = 10V	(Notes 7 & 8)	I <sub>DM</sub>	29.0	-29.0	
Continuous Source Current (Body Diode)			I <sub>S</sub>	3.0	-3.0	
Pulsed Source Current (Body Diode)			I <sub>SM</sub>	29.0	-29.0	

**Thermal Characteristics**

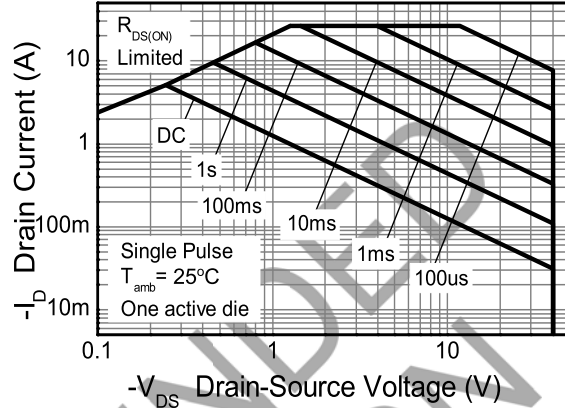
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P <sub>D</sub>	1.25		W mW/ °C
			10		
	(Notes 5 & 9)		1.8		
			14.3		
Thermal Resistance, Junction to Ambient	(Notes 6 & 8)	R <sub>θJA</sub>	2.14		°C/W
	(Notes 5 & 8)		100		
	(Notes 5 & 9)		70		
	(Notes 6 & 8)		58		
Thermal Resistance, Junction to Lead		R <sub>θJL</sub>	51		
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150		°C

- Notes:
- 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.
  - Same as note (5), except the device is measured at t ≤ 10 sec.
  - Same as note (5), except the device is pulsed with D = 0.02 and pulse width 300 μs.
  - For a dual device with one active die.
  - For a device with two active die running at equal power.
  - Thermal resistance from junction to solder-point (at the end of the drain lead).

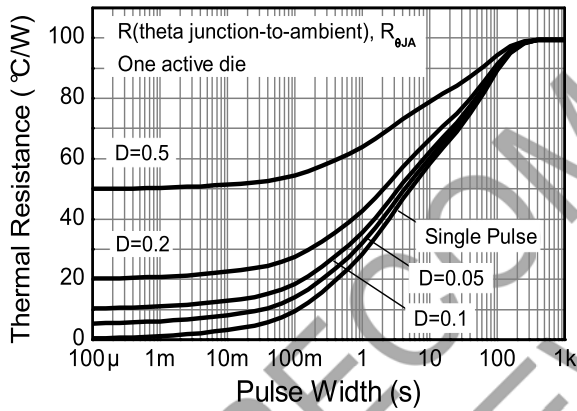
**Thermal Characteristics (Continued)**



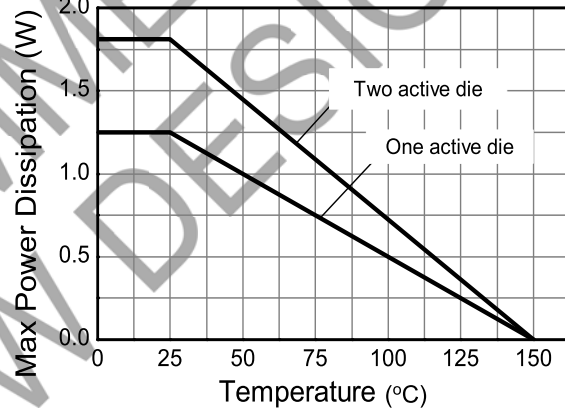
**N-channel Safe Operating Area**



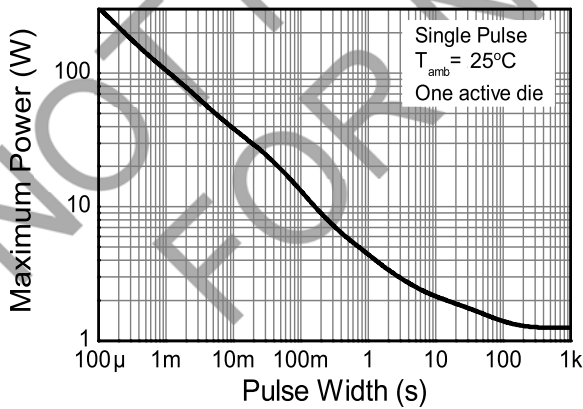
**P-channel Safe Operating Area**



**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>	40	—	—	V	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.8	1.3	1.8	V	I <sub>D</sub> = 250 μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 11)	R <sub>DS(ON)</sub>	—	0.013	0.025	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A
			0.028	0.040		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3A
Forward Transconductance (Notes 11 & 12)	G <sub>fs</sub>	—	12.6	—	S	V <sub>DS</sub> = 5V, I <sub>D</sub> = 3A
Diode Forward Voltage (Note 11)	V <sub>SD</sub>	—	0.7	1.0	V	I <sub>S</sub> = 1A, V <sub>GS</sub> = 0V
<b>DYNAMIC CHARACTERISTICS</b> (Note 12)						
Input Capacitance	C <sub>iss</sub>	—	1,790	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	160	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	120	—		
Gate Resistance	R <sub>g</sub>	—	1.03	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	16.0	—	nC	V <sub>GS</sub> = 4.5V V <sub>DS</sub> = 20V I <sub>D</sub> = 3A
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	37.6	—		
Gate-Source Charge (Note 13)	Q <sub>gs</sub>	—	7.8	—		
Gate-Drain Charge (Note 13)	Q <sub>gd</sub>	—	6.6	—		
Turn-On Delay Time (Note 13)	t <sub>D(ON)</sub>	—	8.1	—	ns	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V I <sub>D</sub> = 3A
Turn-On Rise Time (Note 13)	t <sub>R</sub>	—	15.1	—		
Turn-Off Delay Time (Note 13)	t <sub>D(OFF)</sub>	—	24.3	—		
Turn-Off Fall Time (Note 13)	t <sub>F</sub>	—	5.3	—		

**Electrical Characteristics (Q2 P-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>	-40	—	—	V	I <sub>D</sub> = -250 μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1.0	μA	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-0.8	-1.3	-1.8	V	I <sub>D</sub> = -250 μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 11)	R <sub>DS(ON)</sub>	—	0.018	0.025	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -3A
			0.030	0.045		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A
Forward Transconductance (Notes 11 & 12)	G <sub>fs</sub>	—	16.6	—	S	V <sub>DS</sub> = -5V, I <sub>D</sub> = -3A
Diode Forward Voltage (Note 11)	V <sub>SD</sub>	—	-0.7	-1.0	V	I <sub>S</sub> = -1A, V <sub>GS</sub> = 0V
<b>DYNAMIC CHARACTERISTICS</b> (Note 12)						
Input Capacitance	C <sub>iss</sub>	—	1,643	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	179	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	128	—		
Gate Resistance	R <sub>g</sub>	—	6.43	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	14.0	—	nC	V <sub>GS</sub> = -4.5V V <sub>DS</sub> = -20V I <sub>D</sub> = -3A
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	33.7	—		
Gate-Source Charge (Note 13)	Q <sub>gs</sub>	—	5.5	—		
Gate-Drain Charge (Note 13)	Q <sub>gd</sub>	—	7.3	—		
Turn-On Delay Time (Note 13)	t <sub>D(ON)</sub>	—	6.9	—	ns	V <sub>DD</sub> = -20V, V <sub>GS</sub> = -10V I <sub>D</sub> = -3A
Turn-On Rise Time (Note 13)	t <sub>R</sub>	—	14.7	—		
Turn-Off Delay Time (Note 13)	t <sub>D(OFF)</sub>	—	53.7	—		
Turn-Off Fall Time (Note 13)	t <sub>F</sub>	—	30.9	—		

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

**Typical Characteristics (Q1 N-Channel)**

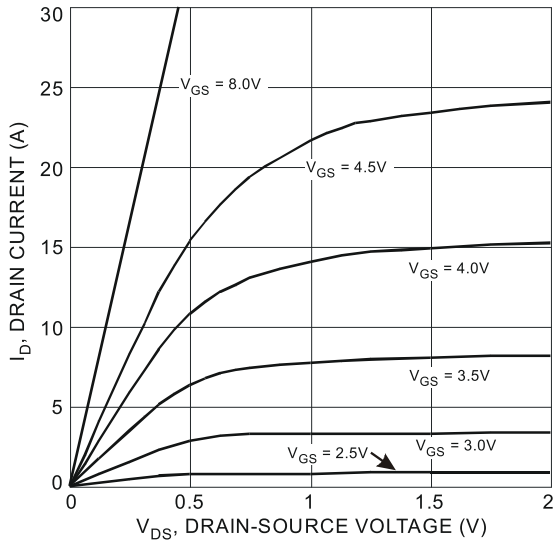


Fig. 1 Typical Output Characteristic

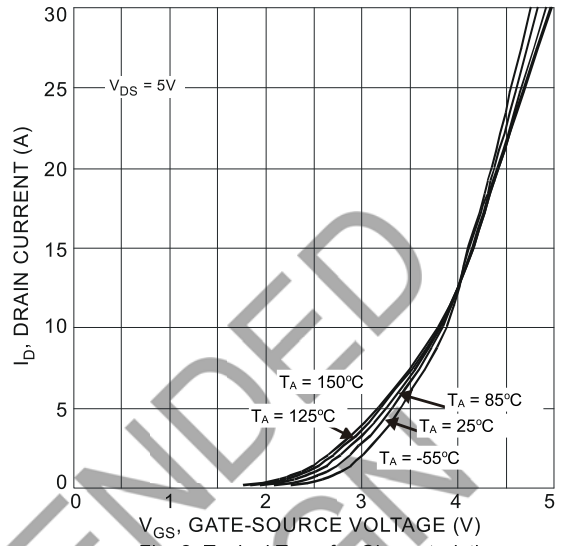


Fig. 2 Typical Transfer Characteristic

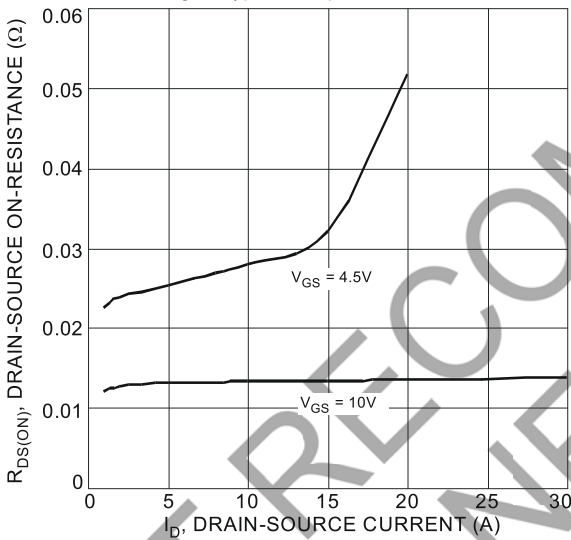


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

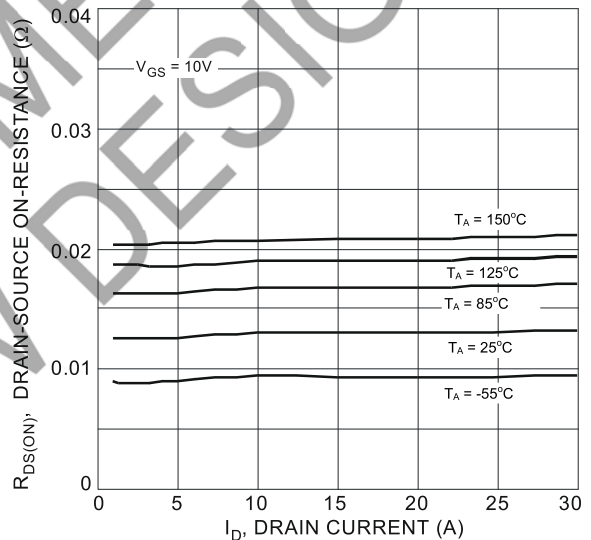


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

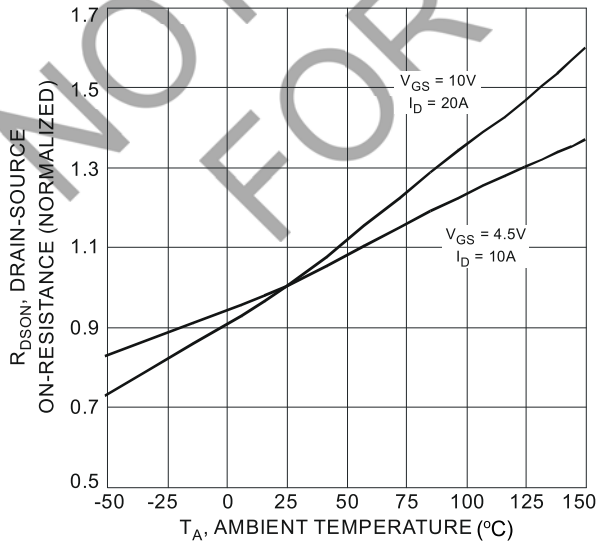


Fig. 5 On-Resistance Variation with Temperature

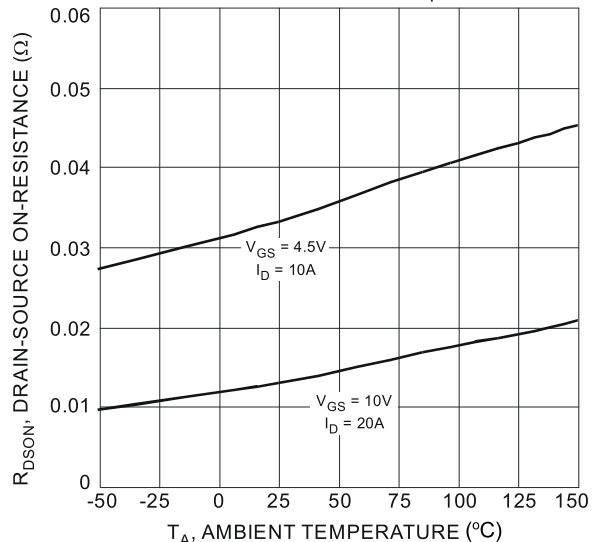


Fig. 6 On-Resistance Variation with Temperature

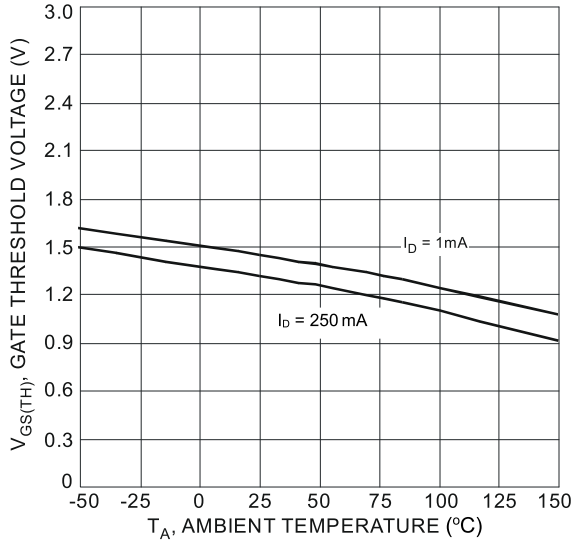


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

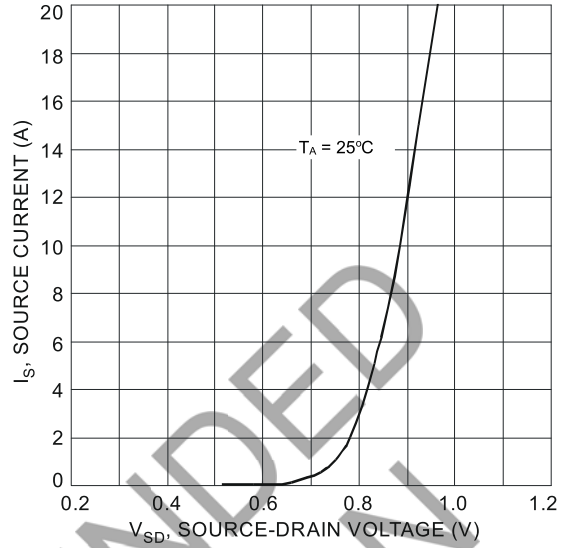


Fig. 8 Diode Forward Voltage vs. Current

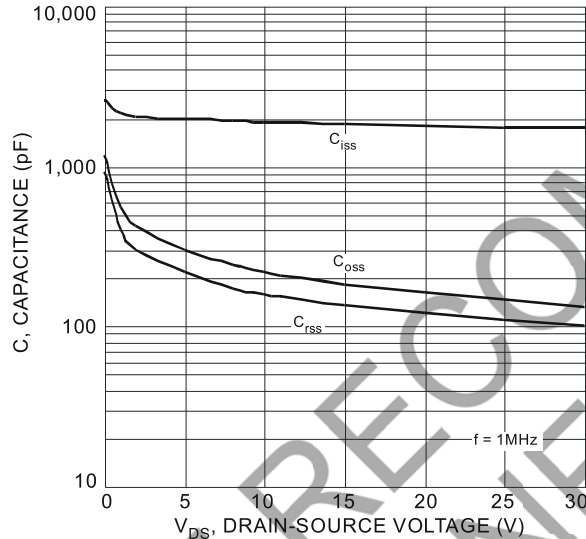


Fig. 9 Typical Total Capacitance

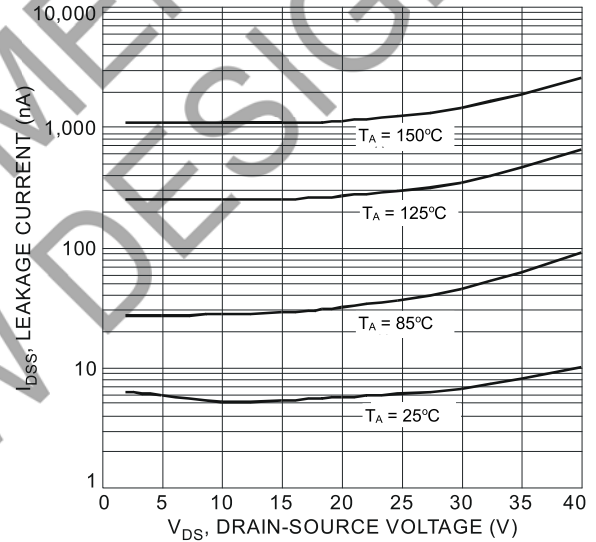


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

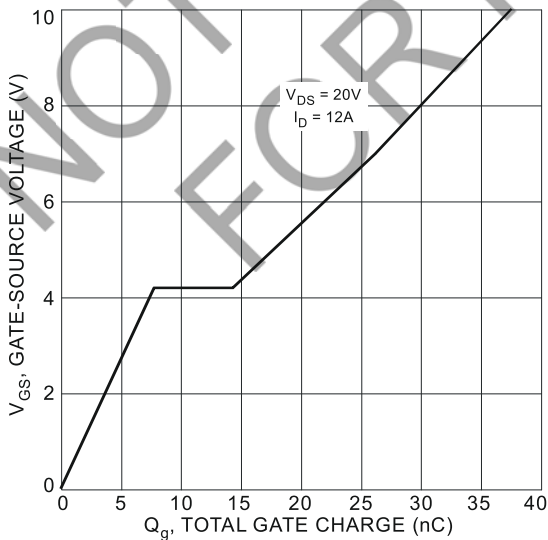


Fig. 11 Gate-Charge Characteristics



**Typical Characteristics (Q2 P-Channel)**

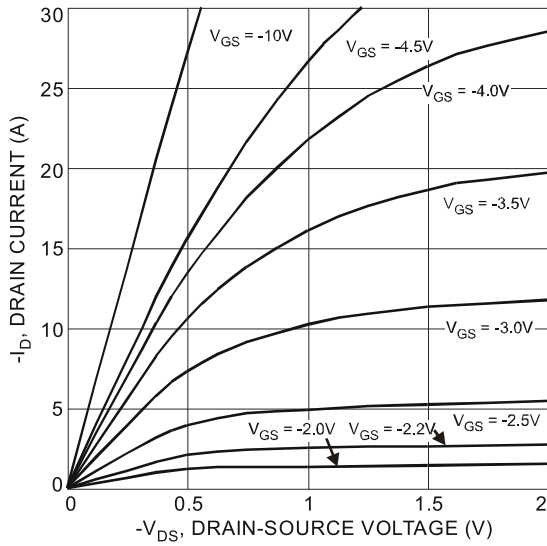


Fig. 12 Typical Output Characteristic

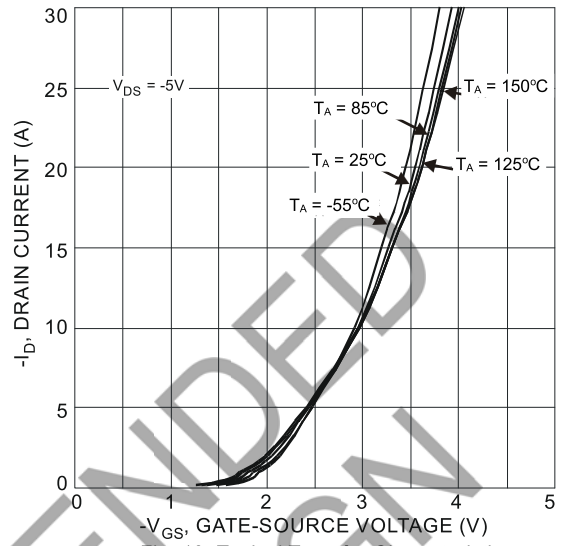


Fig. 13 Typical Transfer Characteristic

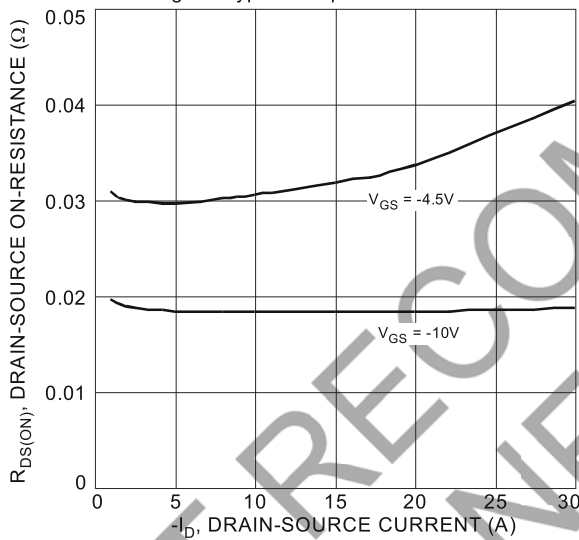


Fig. 14 Typical On-Resistance vs. Drain Current and Gate Voltage

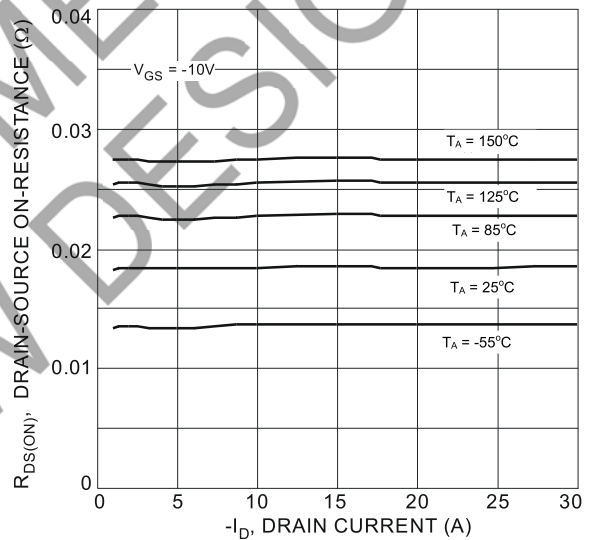


Fig. 15 Typical On-Resistance vs. Drain Current and Temperature

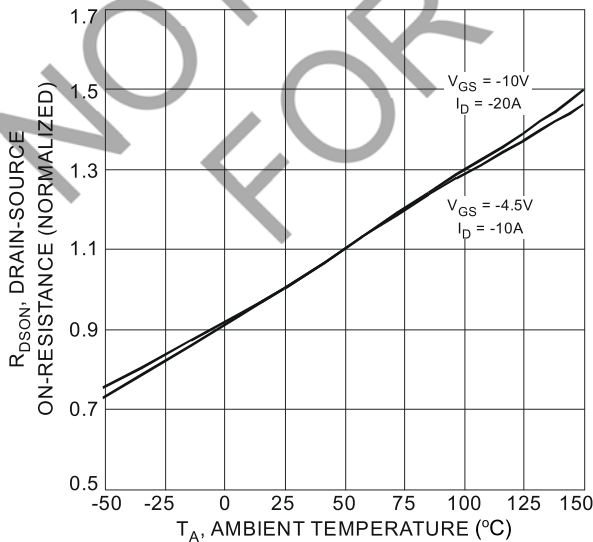


Fig. 16 On-Resistance Variation with Temperature

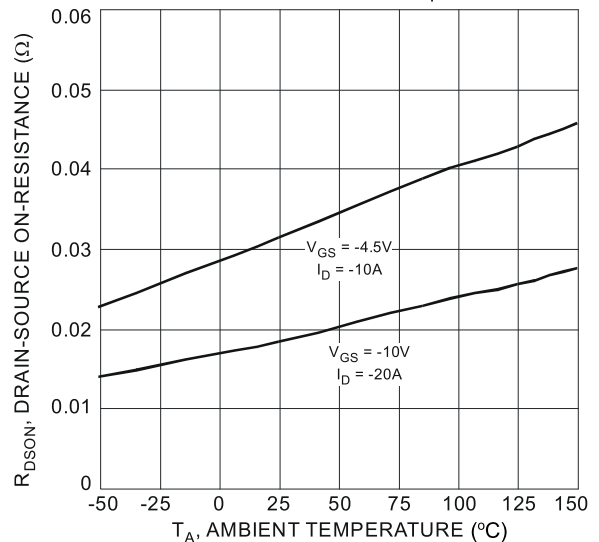


Fig. 17 On-Resistance Variation with Temperature

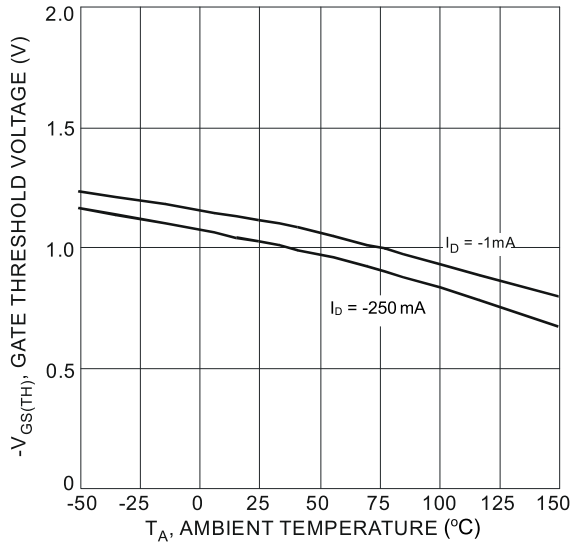


Fig. 18 Gate Threshold Variation vs. Ambient Temperature

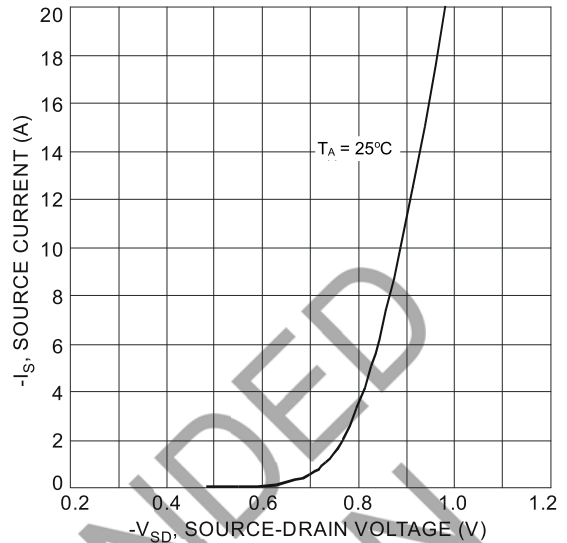


Fig. 19 Diode Forward Voltage vs. Current

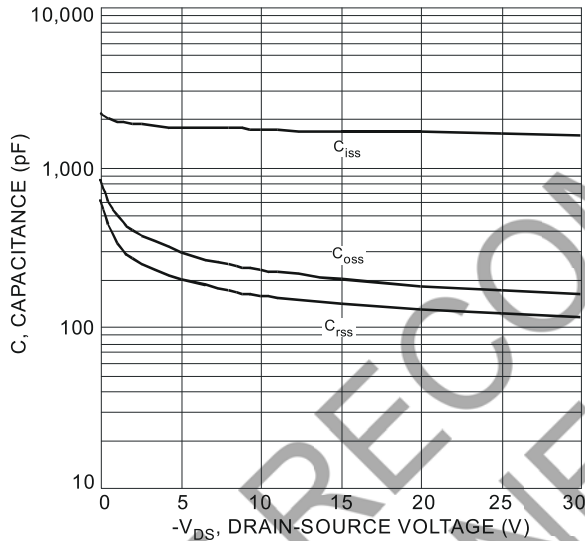


Fig. 20 Typical Total Capacitance

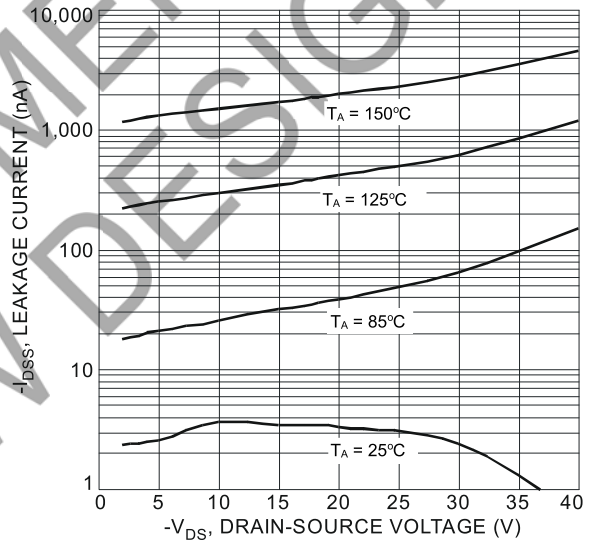


Fig. 21 Typical Leakage Current vs. Drain-Source Voltage

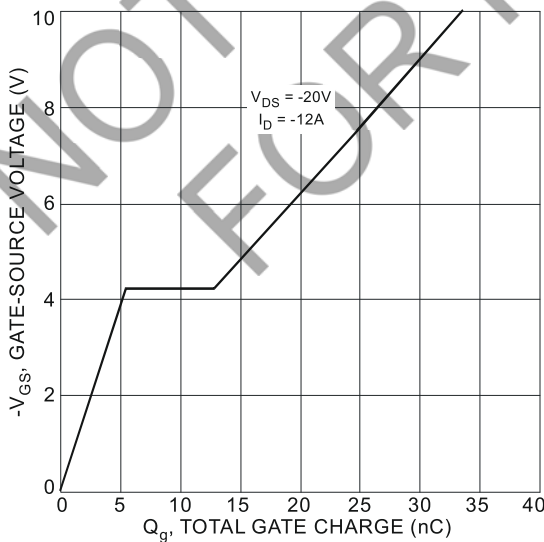


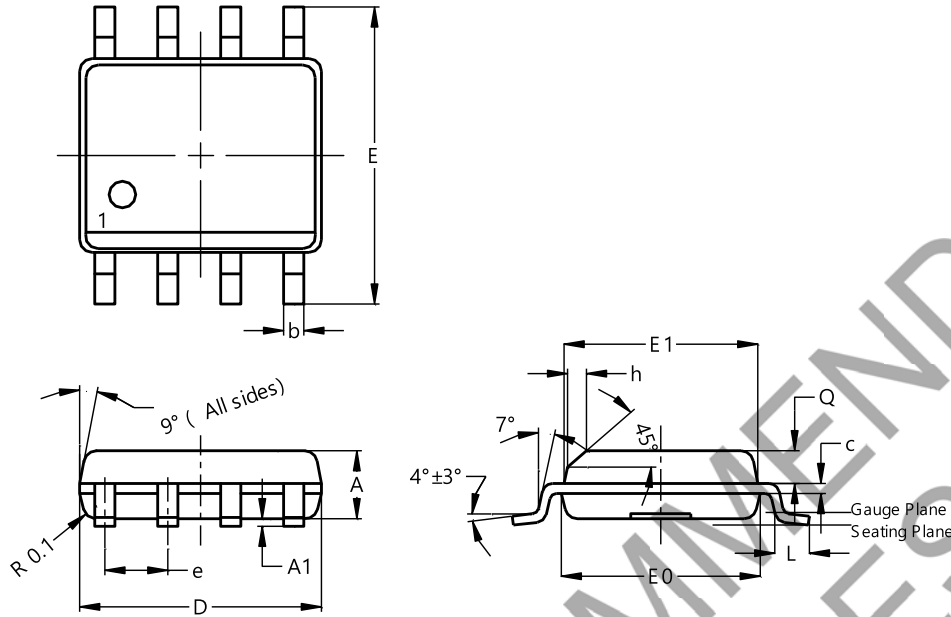
Fig. 22 Gate-Charge Characteristics



**Package Outline Dimensions**

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

SO-8

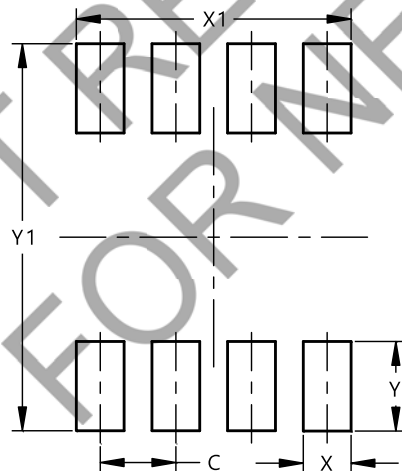


SO-8			
Dim	Min	Max	Typ
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	-	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65
All Dimensions in mm			

**Suggested Pad Layout**

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

SO-8



Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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