

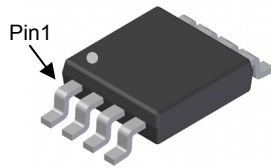
## Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(on)}$ max	$I_D$ $T_A = +25^\circ C$
Q1 N-Channel	60V	40m $\Omega$ @ $V_{GS} = 10V$	6.5 A
		55m $\Omega$ @ $V_{GS} = 4.5V$	5.6 A
Q2 P-Channel	-60V	110m $\Omega$ @ $V_{GS} = -10V$	-3.9 A
		130m $\Omega$ @ $V_{GS} = -4.5V$	-3.6 A

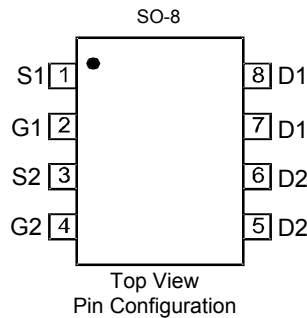
## Description and Applications

This new generation 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.

- DC-DC Converters
- Power Management Functions
- Backlighting



Top View

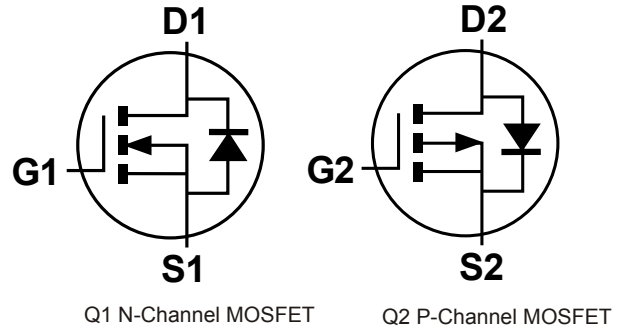


## Features and Benefits

- Low Input Capacitance
- Low On-Resistance
- 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: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208  $\text{e3}$
- Weight: 0.074 grams (approximate)

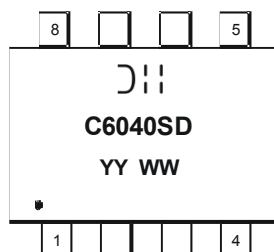
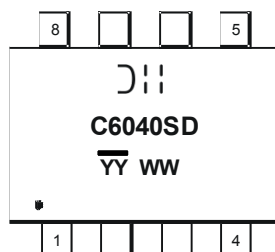


## Ordering Information (Note 4)

Part Number	Case	Packaging
DMC6040SSD-13	SO-8	2,500/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



- ☺|| = Manufacturer's Marking
- C6040SD = Product Type Marking Code
- YYWW = Date Code Marking
- YY or YY = Year (ex: 14= 2014)
- WW = Week (01 - 53)
- YY = Date Code Marking for SAT (Shanghai Assembly/ Test site)
- YY = Date Code Marking for CAT (Chengdu Assembly/ Test site)

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

Characteristic			Symbol	Q1	Q2	Units
Drain-Source Voltage			V <sub>DSS</sub>	60	-60	V
Gate-Source Voltage			V <sub>GSS</sub>	±20	±20	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = -10V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	5.1 4.1	-3.1 -2.5	A
	t < 10s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	6.5 5.2	-3.9 -3.1	A
Maximum Body Diode Forward Current (Note 6)			I <sub>S</sub>	2.1	-2.1	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I <sub>DM</sub>	28	-19	A
Avalanche Current (Note 7) L = 0.1mH			I <sub>AS</sub>	17.2	-17.6	A
Avalanche Energy (Note 7) L = 0.1mH			E <sub>AS</sub>	14.7	15.4	mJ

**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>	1.24	W
	T <sub>A</sub> = +70°C		0.8	
Thermal Resistance, Junction to Ambient (Note 5)	Steady state	R <sub>θJA</sub>	101	°C/W
	t < 10s		61	
Total Power Dissipation (Note 6)	T <sub>A</sub> = +25°C	P <sub>D</sub>	1.56	W
	T <sub>A</sub> = +70°C		1.0	
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	R <sub>θJA</sub>	80	°C/W
	t < 10s		49	
Thermal Resistance, Junction to Case (Note 6)		R <sub>θJC</sub>	14.7	°C
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**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 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	µA	V <sub>DS</sub> = 48V, 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 (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1	—	3	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	—	33	40	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 8A
		—	37	55		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5A
Diode Forward Voltage	V <sub>SD</sub>	—	0.7	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	1130	—	pF	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	69	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	42	—		
Gate Resistance	R <sub>G</sub>	—	1.7	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	20.8	—	nC	V <sub>DS</sub> = 30V, I <sub>D</sub> = 4.3A
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	9.4	—		
Gate-Source Charge	Q <sub>gs</sub>	—	3.3	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	3.0	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.6	—	nS	V <sub>GS</sub> = 10V, V <sub>DD</sub> = 30V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = 4.3A
Turn-On Rise Time	t <sub>r</sub>	—	1.8	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	20.1	—		
Turn-Off Fall Time	t <sub>f</sub>	—	4.3	—		
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	14.2	—	nS	I <sub>S</sub> = 4.3A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	7.5	—	nC	I <sub>S</sub> = 4.3A, di/dt = 100A/µs

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - UIS in production with L = 0.1mH, starting T<sub>A</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

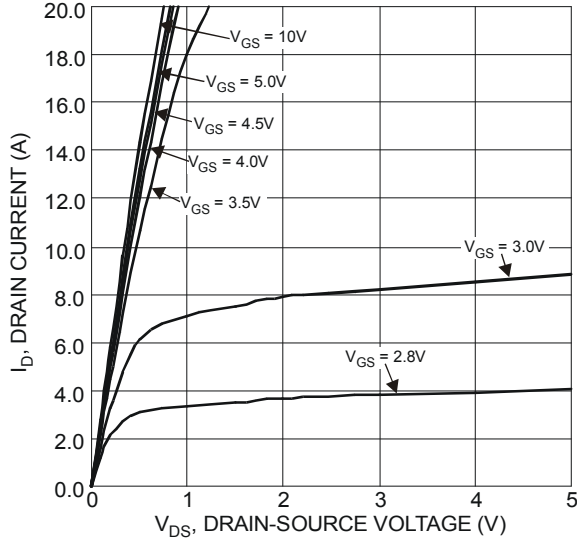


Figure 1 Typical Output Characteristics

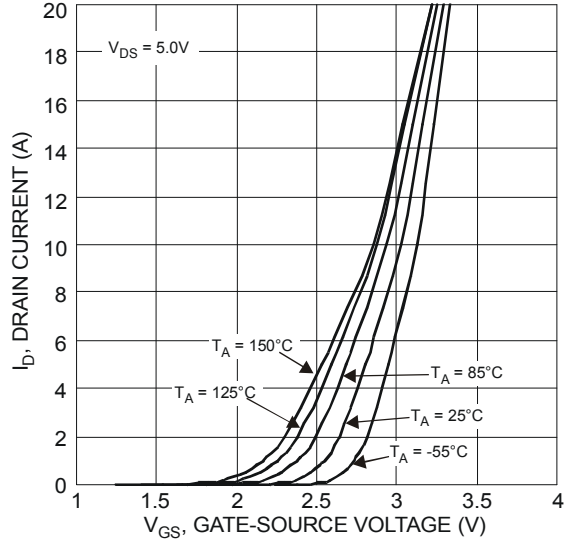


Figure 2 Typical Transfer Characteristics

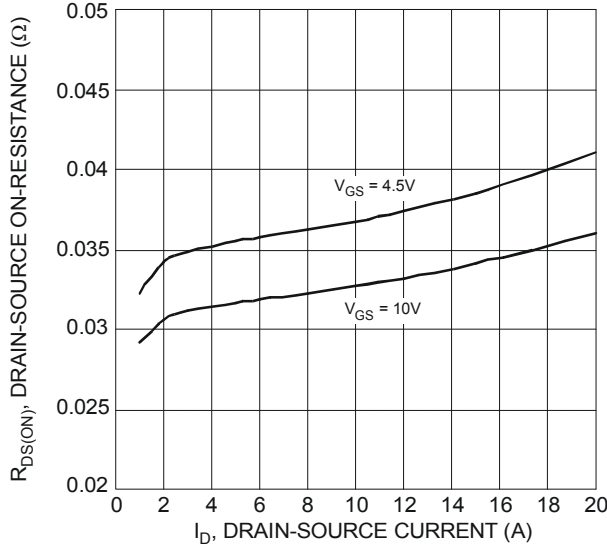


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

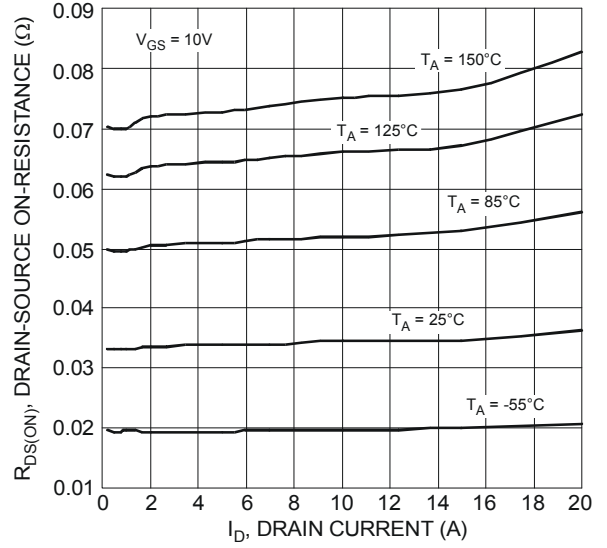


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

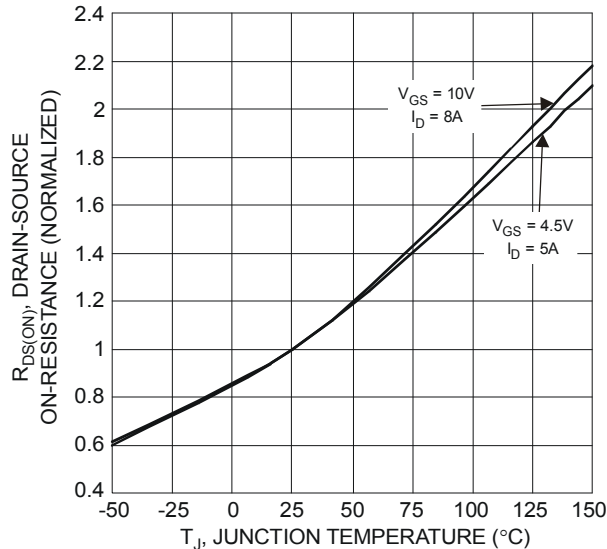


Figure 5 On-Resistance Variation with Temperature

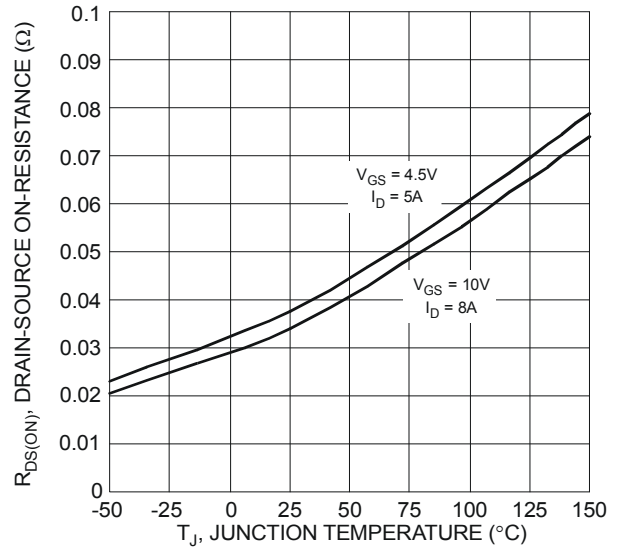


Figure 6 On-Resistance Variation with Temperature

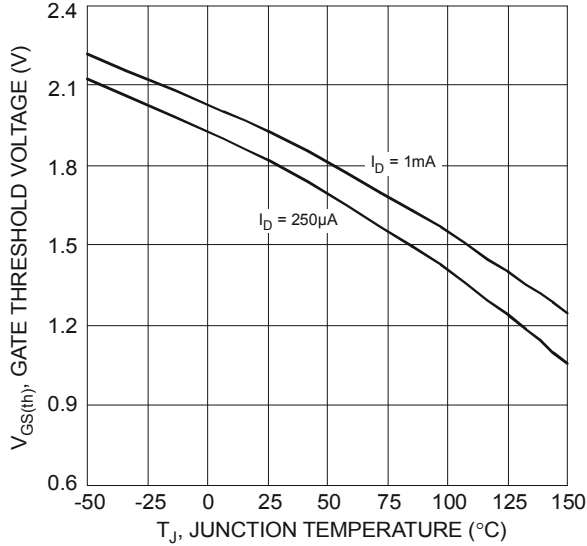


Figure 7 Gate Threshold Variation vs. Ambient Temperature

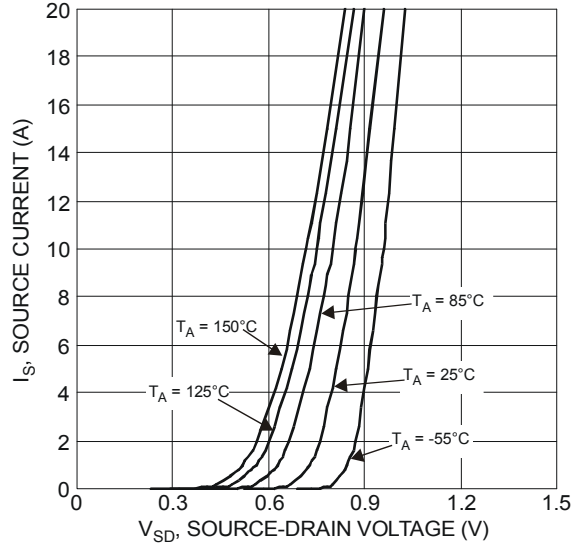


Figure 8 Diode Forward Voltage vs. Current

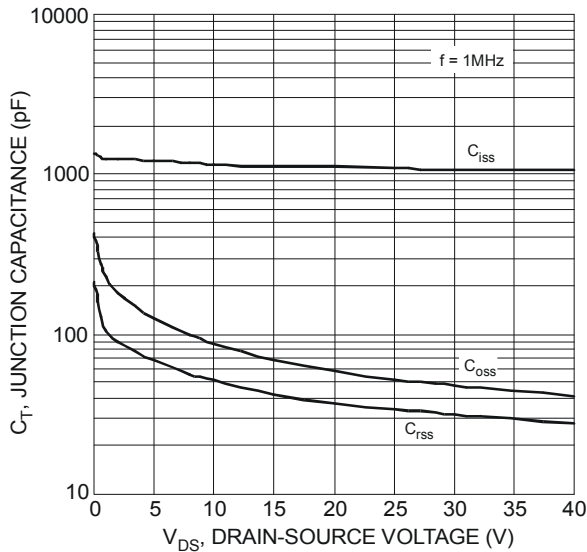


Figure 9 Typical Junction Capacitance

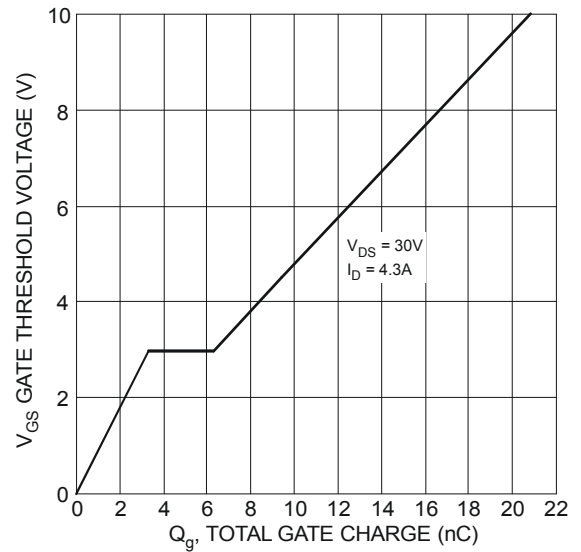


Figure 10 Gate Charge

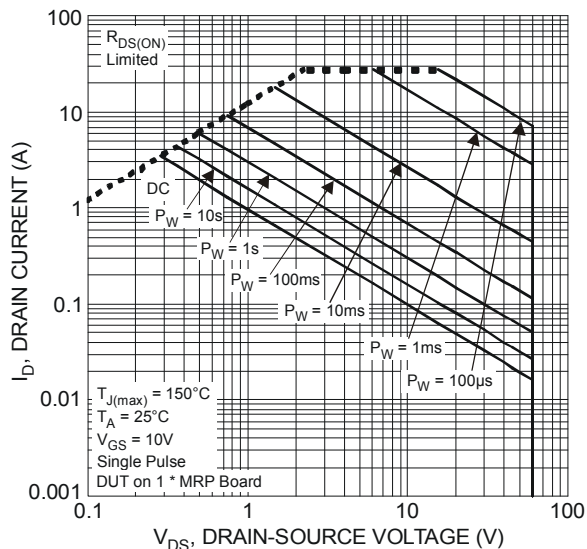
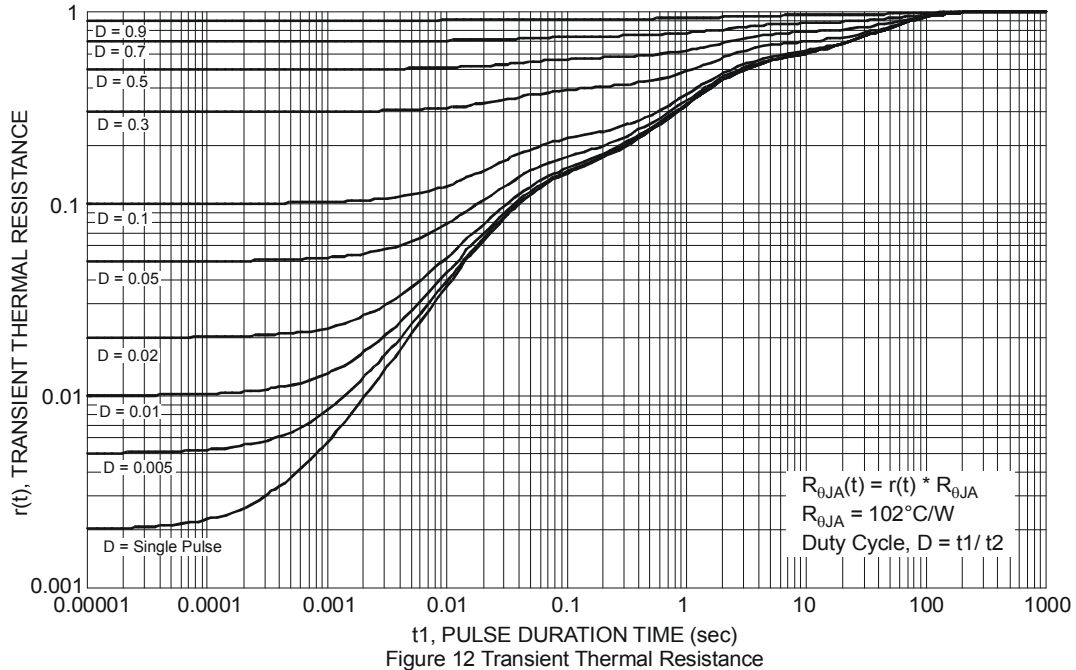


Figure 11 SOA, Safe Operation Area



**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 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1	μA	V <sub>DS</sub> = -48V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	100	nA	V <sub>GS</sub> = ±16V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-1	—	-3	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	—	86	110	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -4.5A
		—	98	130		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.5A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.7	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	1030	—	pF	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	49.1	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	38.7	—		
Gate Resistance	R <sub>G</sub>	—	13.6	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Q <sub>g</sub>	—	9.5	—	nC	V <sub>DS</sub> = -30V, I <sub>D</sub> = -5A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	19.4	—		
Gate-Source Charge	Q <sub>gs</sub>	—	2.3	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	3.6	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.7	—	nS	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -30V, R <sub>GEN</sub> = 6Ω, I <sub>D</sub> = -5A
Turn-On Rise Time	t <sub>r</sub>	—	6.3	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	58.7	—		
Turn-Off Fall Time	t <sub>f</sub>	—	26.1	—		
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	14.85	—	nS	I <sub>S</sub> = -5A, di/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	8.8	—	nC	I <sub>S</sub> = -5A, di/dt = 100A/μs

- 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.  
 7. UIS in production with L = 0.1mH, starting T<sub>A</sub> = +25°C.  
 8. Short duration pulse test used to minimize self-heating effect.  
 9. Guaranteed by design. Not subject to product testing.

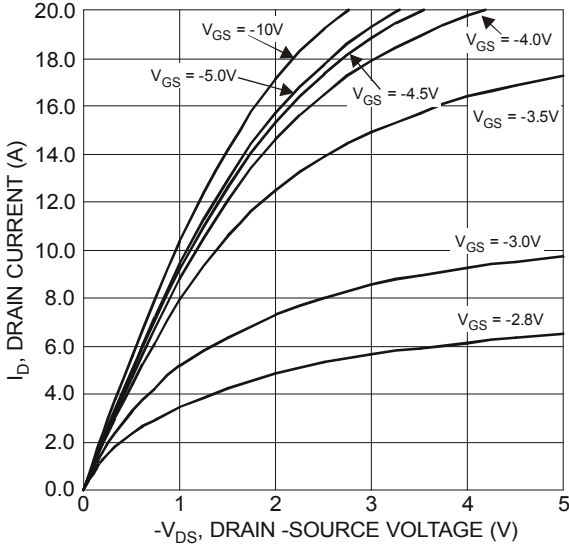


Figure 13 Typical Output Characteristics

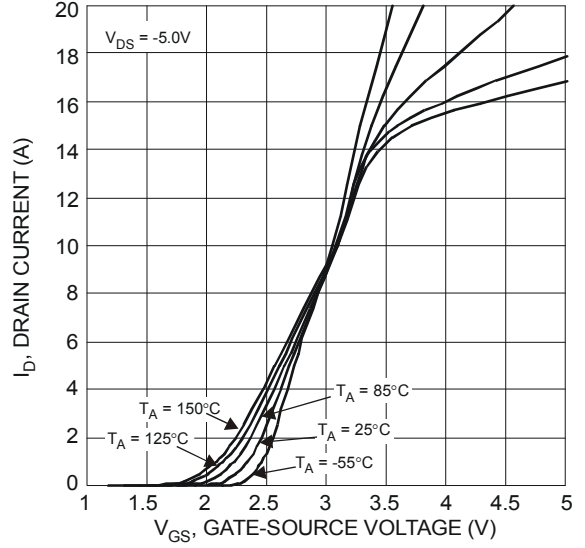


Figure 14 Typical Transfer Characteristics

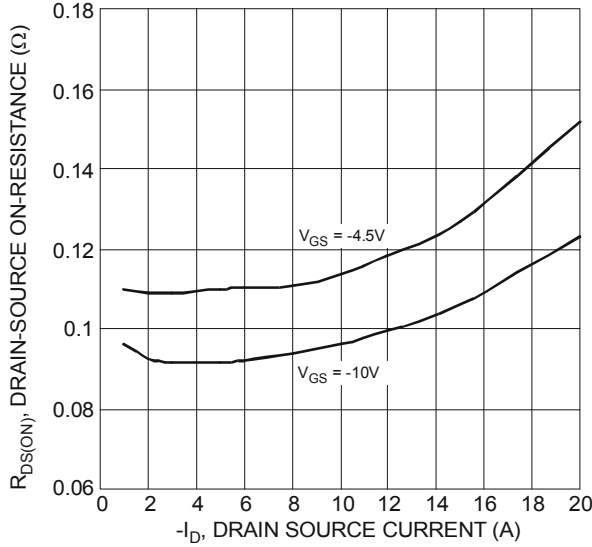


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

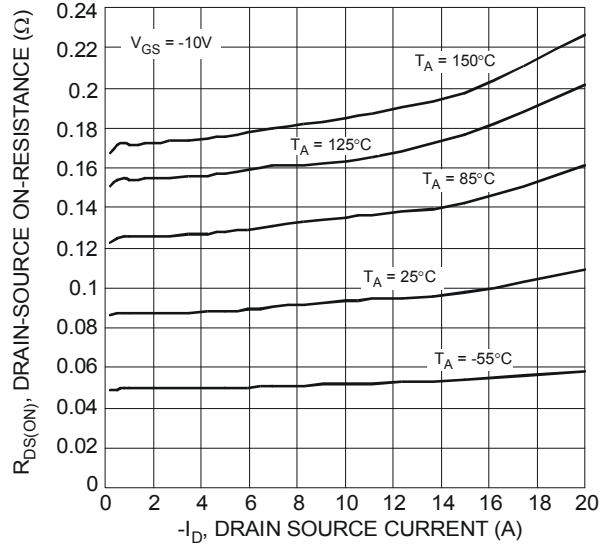


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

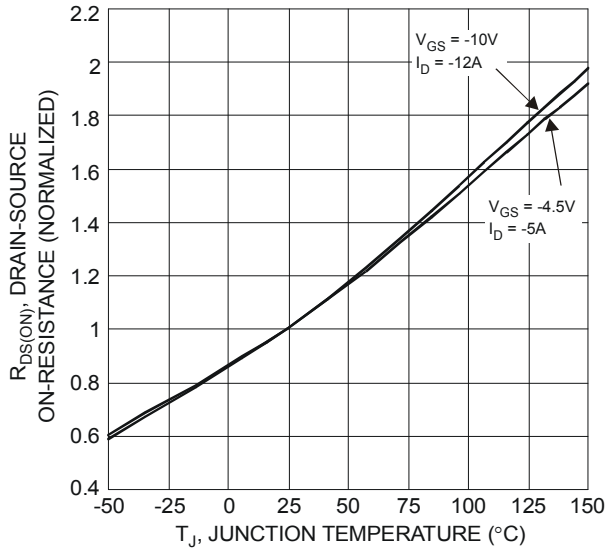


Fig. 17 On-Resistance Variation with Temperature

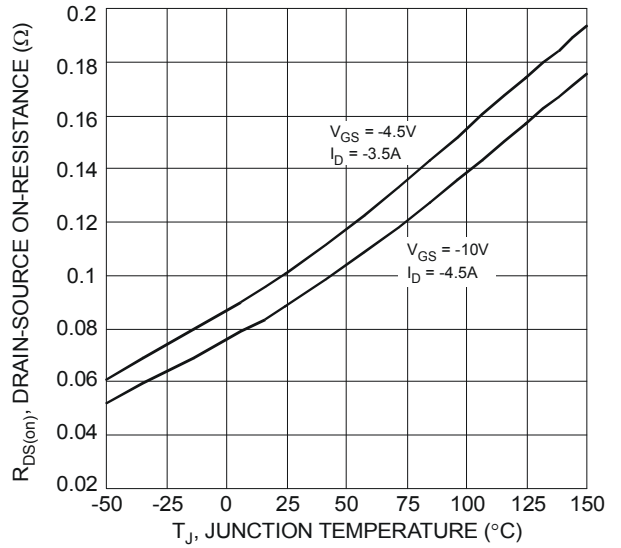


Figure 18 On-Resistance Variation with Temperature

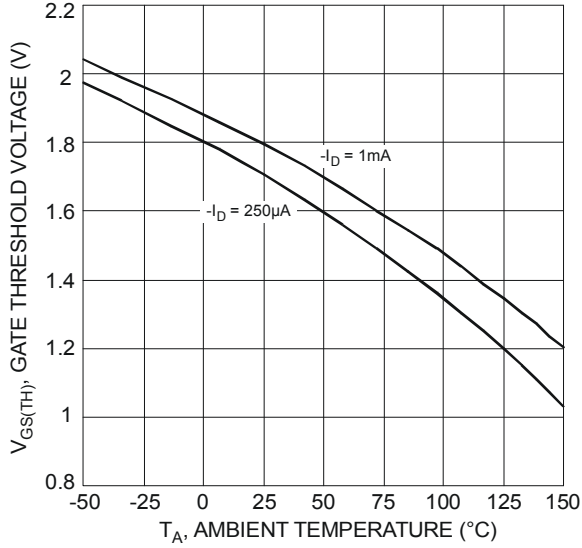


Figure 19 Gate Threshold Variation vs. Ambient Temperature

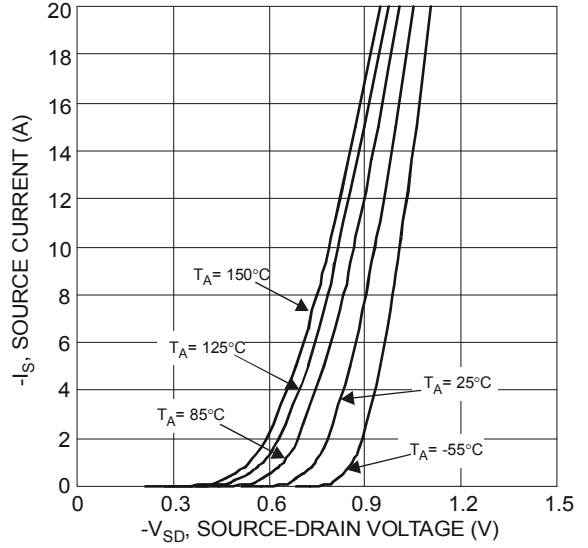


Figure 20 Diode Forward Voltage vs. Current

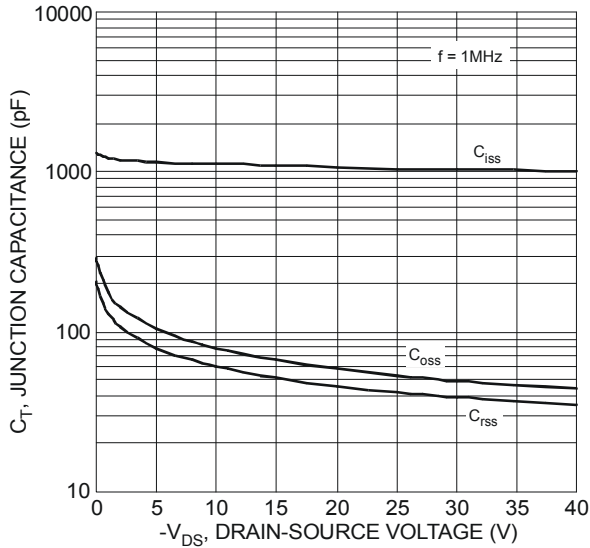


Figure 21 Typical Junction Capacitance

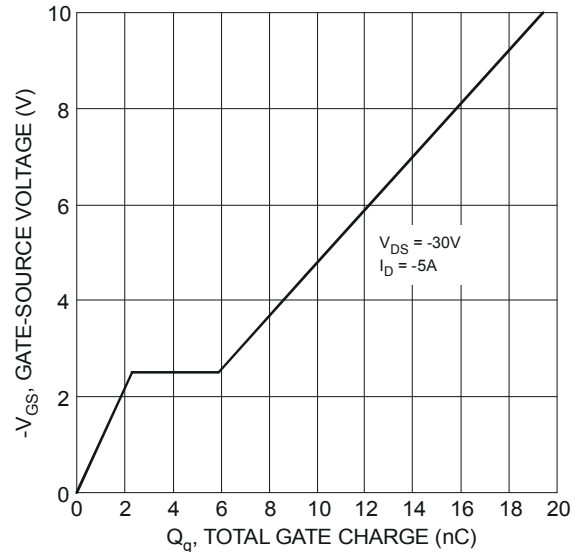


Figure 22 Gate-Charge Characteristics

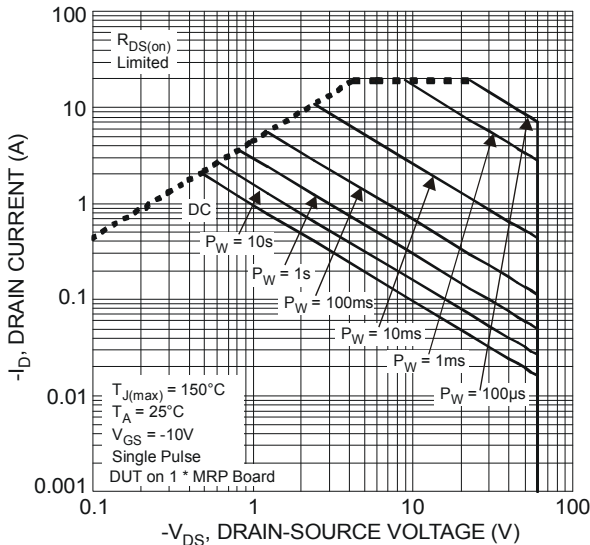
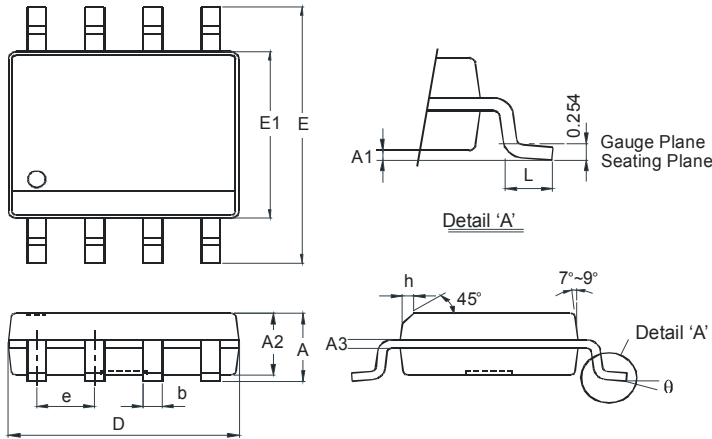


Figure 23 SOA, Safe Operation Area

**Package Outline Dimensions**

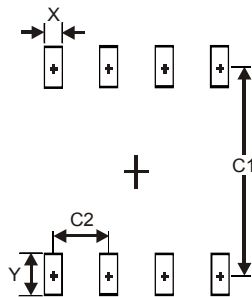
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



SO-8		
Dim	Min	Max
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
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)
X	0.60
Y	1.55
C1	5.4
C2	1.27



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