



**THE DATASHEET OF  
DMC6040SSDQ-13**



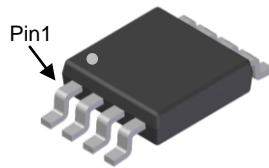
## Product Summary

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> T <sub>A</sub> = +25°C
Q1 N-Channel	60V	40mΩ @ V <sub>GS</sub> = 10V	6.5A
		55mΩ @ V <sub>GS</sub> = 4.5V	5.6A
Q2 P-Channel	-60V	110mΩ @ V <sub>GS</sub> = -10V	-3.9A
		130mΩ @ V <sub>GS</sub> = -4.5V	-3.6A

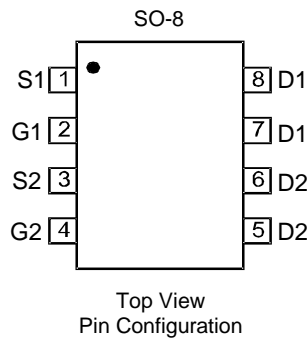
## Description and Applications

This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- DC-DC Converters
- Power Management Functions
- Backlighting



Top View



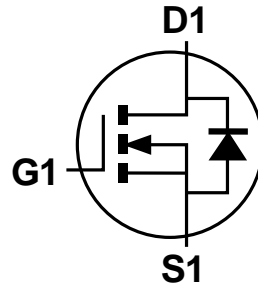
Top View  
Pin Configuration

## Features and Benefits

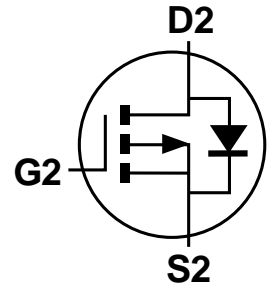
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

## 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 Ⓜ3
- Weight: 0.074 grams (Approximate)



Q1 N-Channel MOSFET



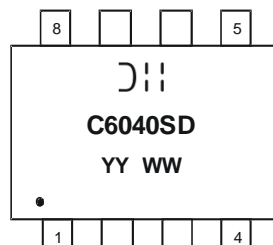
Q2 P-Channel MOSFET

## Ordering Information (Note 5)

Part Number	Case	Packaging
DMC6040SSDQ-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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html)
  5. 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: 16 = 2016)  
 WW = Week (01 - 53)

**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 7) 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 7)			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 8) L = 0.1mH			I <sub>AS</sub>	17.2	-17.6	A
Avalanche Energy (Note 8) 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 6)	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 6)	Steady State	R <sub>θJA</sub>	101	°C/W
	t < 10s		61	
Total Power Dissipation (Note 7)	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 7)	Steady State	R <sub>θJA</sub>	80	°C/W
	t < 10s		49	
Thermal Resistance, Junction to Case (Note 7)		R <sub>θJC</sub>	14.7	
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</b> (Note 9)						
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</b> (Note 9)						
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</b> (Note 10)						
Input Capacitance	C <sub>ISS</sub>	—	1,130	—	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:
6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  7. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  8. UIS in production with L = 0.1mH, starting T<sub>A</sub> = +25°C.
  9. Short duration pulse test used to minimize self-heating effect.
  10. Guaranteed by design. Not subject to product testing.

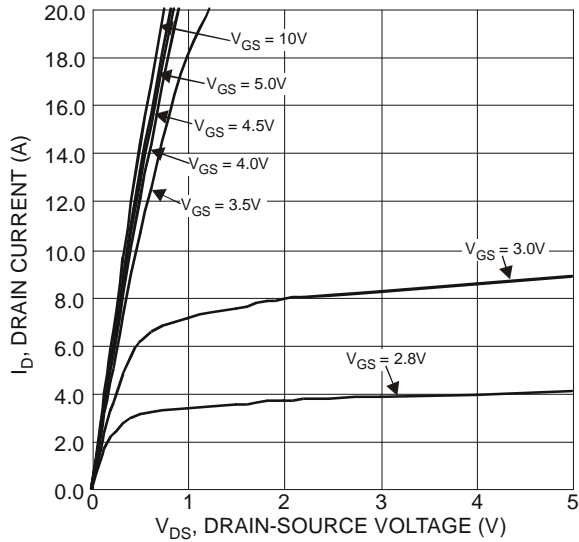


Figure 1 Typical Output Characteristics

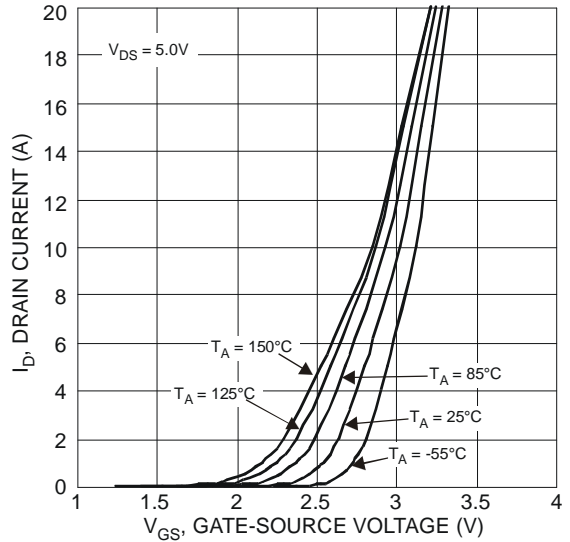


Figure 2 Typical Transfer Characteristics

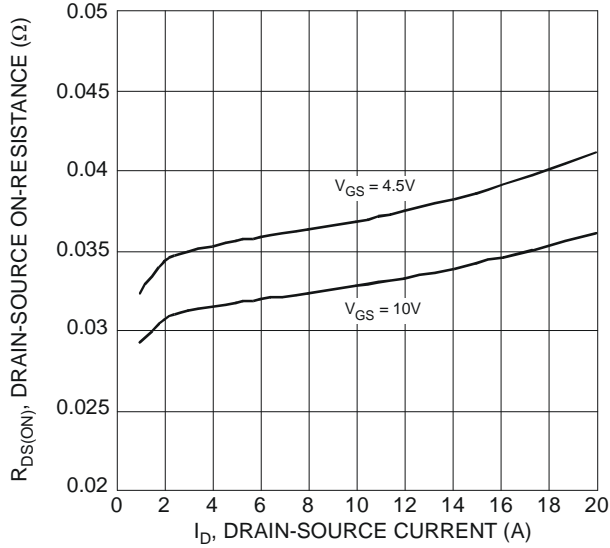


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

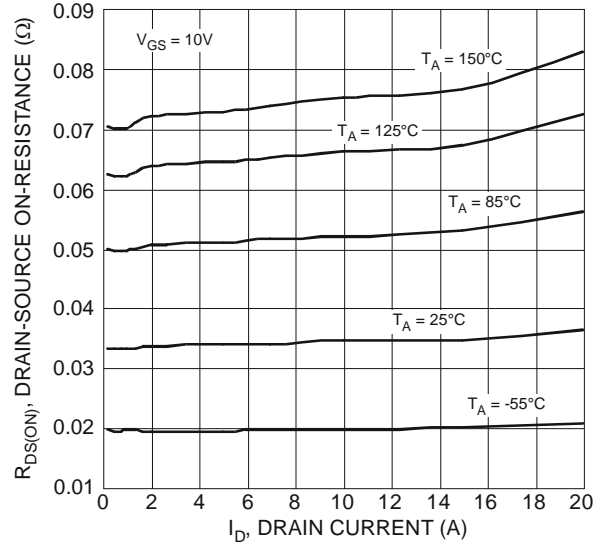


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

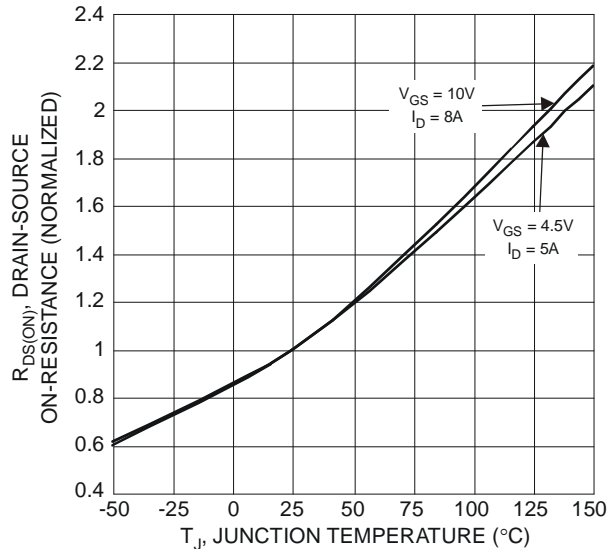


Figure 5 On-Resistance Variation with Temperature

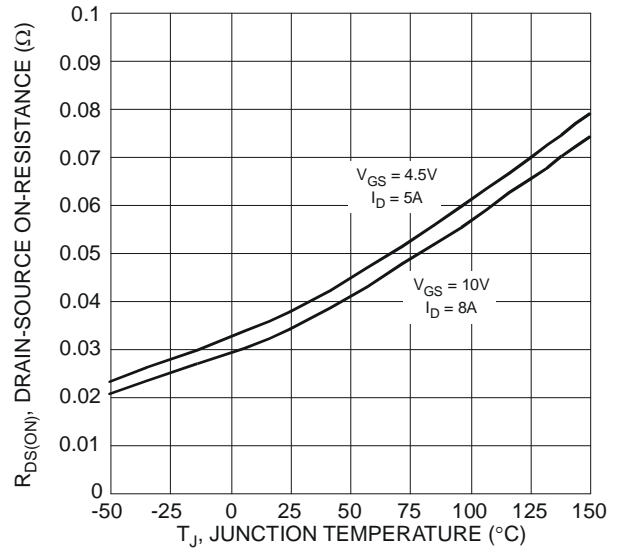


Figure 6 On-Resistance Variation with Temperature

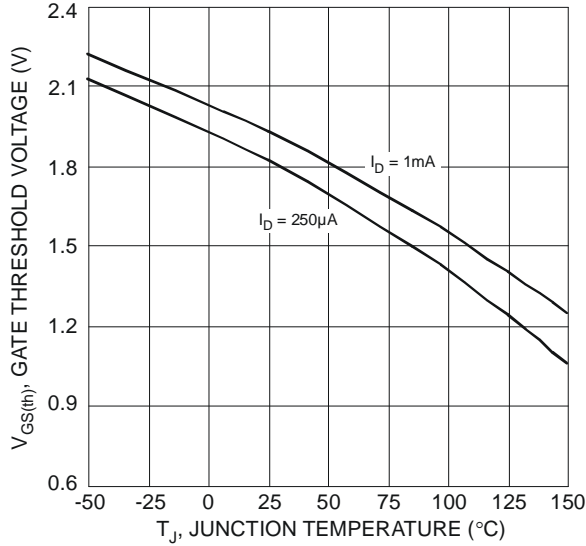


Figure 7 Gate Threshold Variation vs. Ambient Temperature

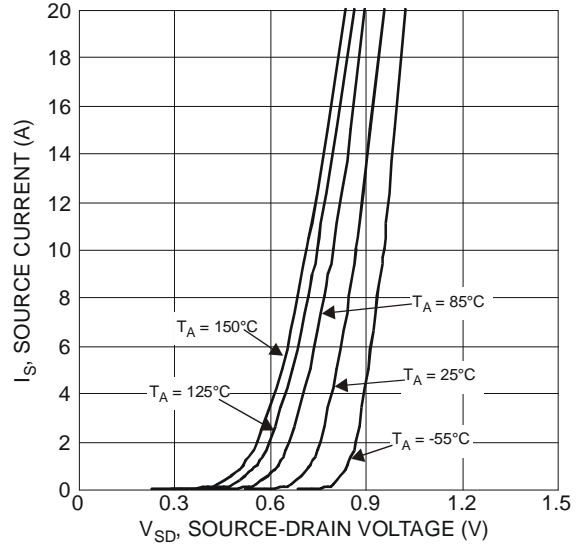


Figure 8 Diode Forward Voltage vs. Current

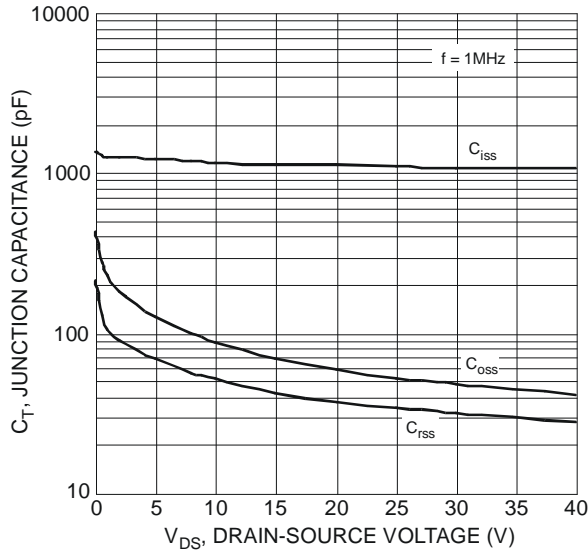


Figure 9 Typical Junction Capacitance

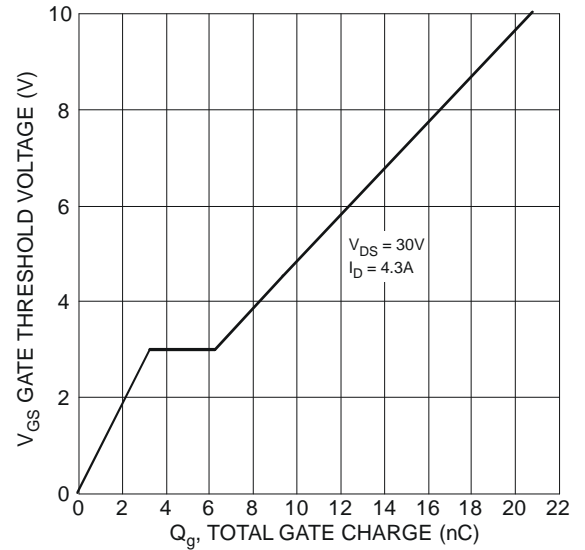


Figure 10 Gate Charge

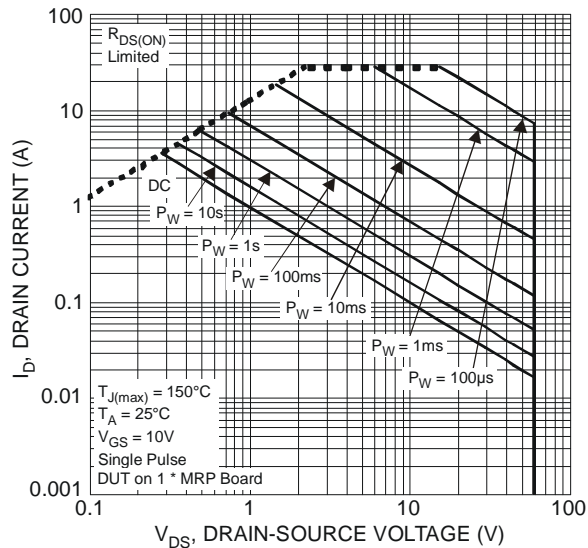
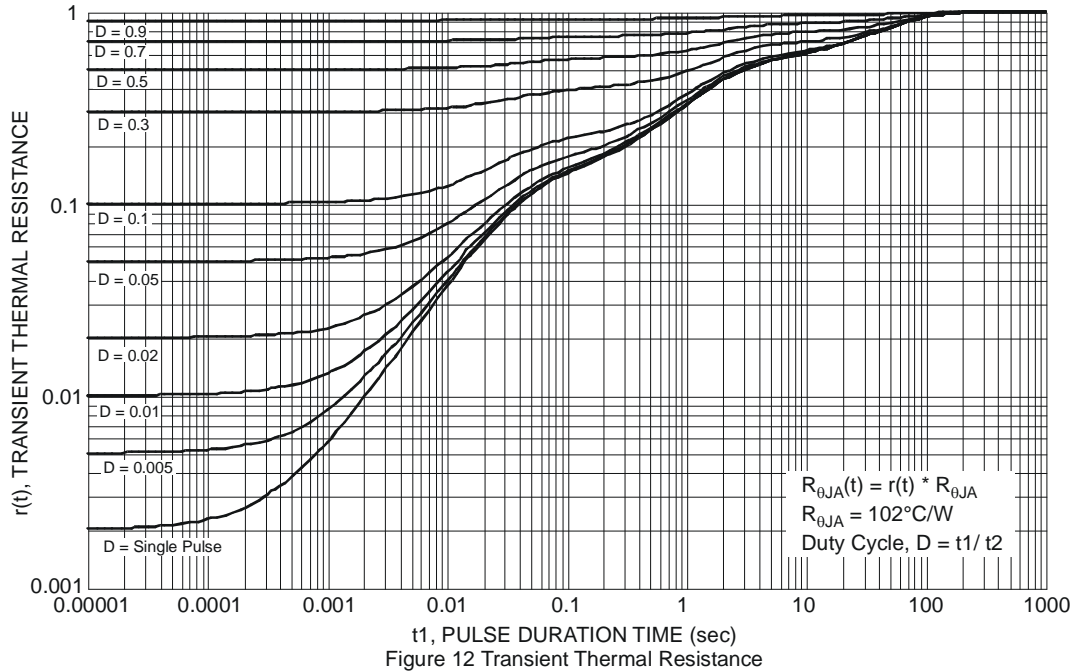


Figure 11 SOA, Safe Operation Area



**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</b> (Note 9)						
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</b> (Note 9)						
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>	—	91	110	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -4.5A
		—	110	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</b> (Note 10)						
Input Capacitance	C <sub>ISS</sub>	—	1,030	—	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: 9. Short duration pulse test used to minimize self-heating effect.  
 10. Guaranteed by design. Not subject to product testing.

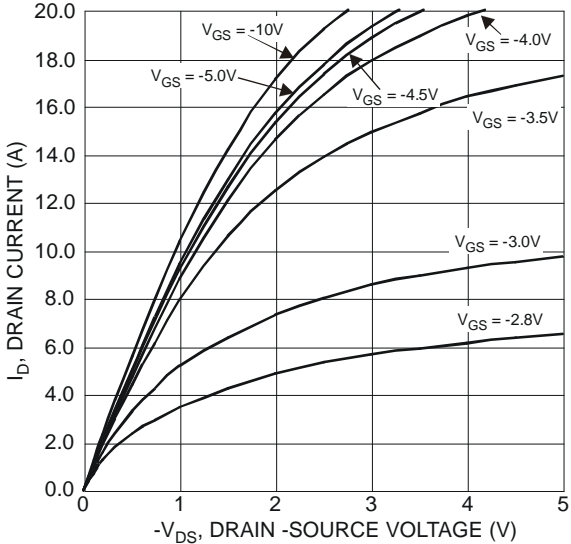


Figure 13 Typical Output Characteristics

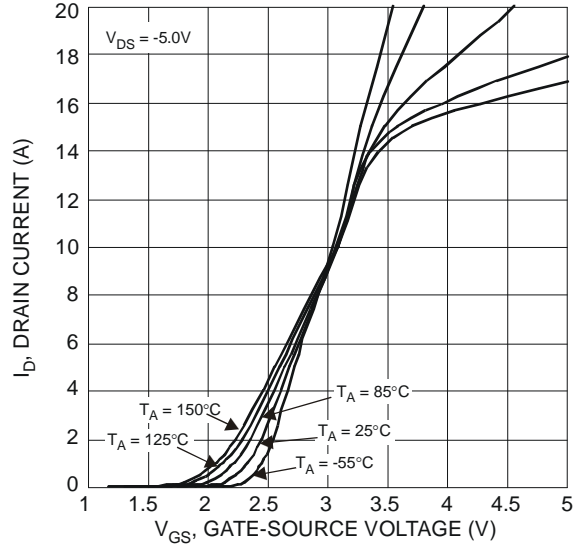


Figure 14 Typical Transfer Characteristics

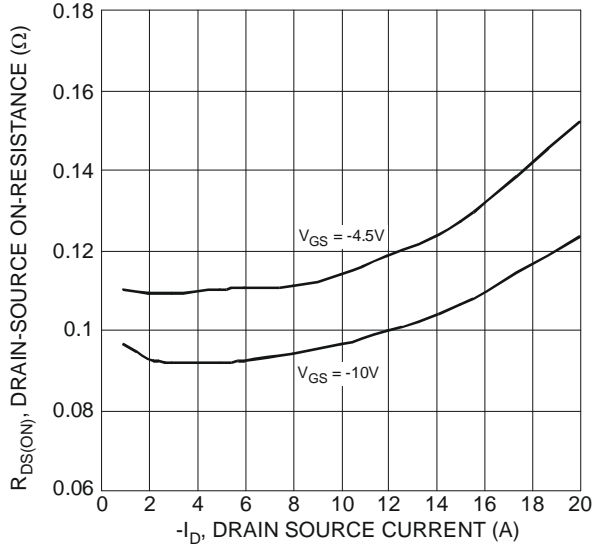


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

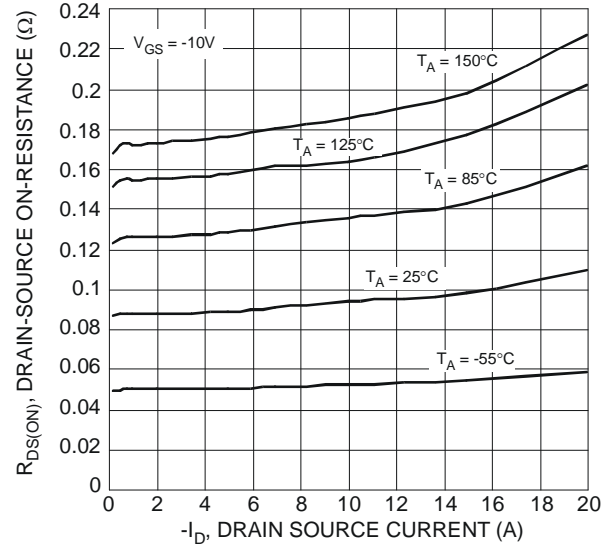


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

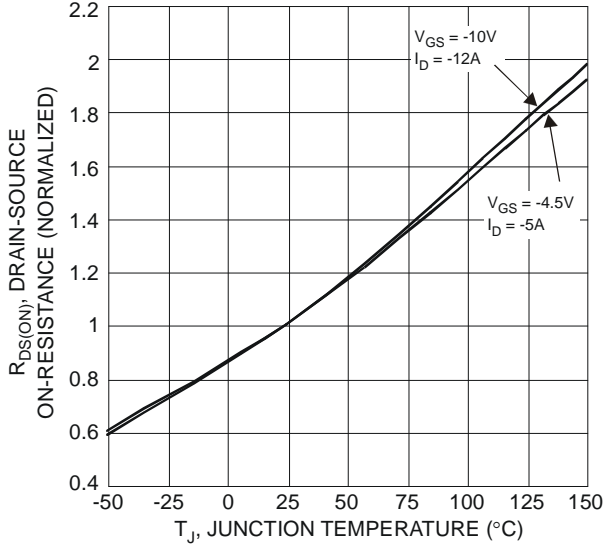


Fig. 17 On-Resistance Variation with Temperature

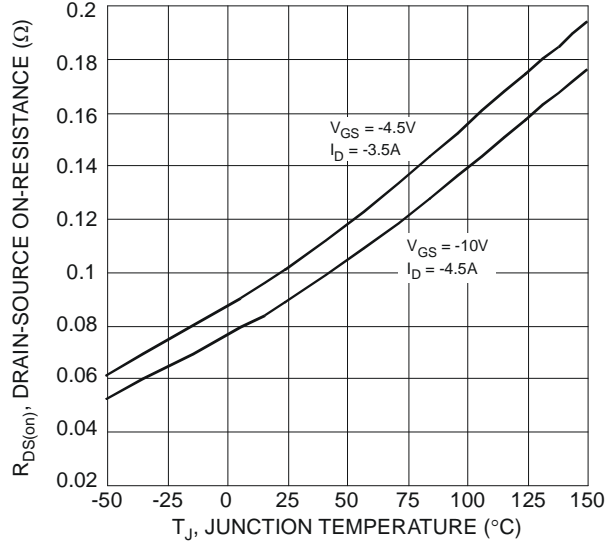


Figure 18 On-Resistance Variation with Temperature

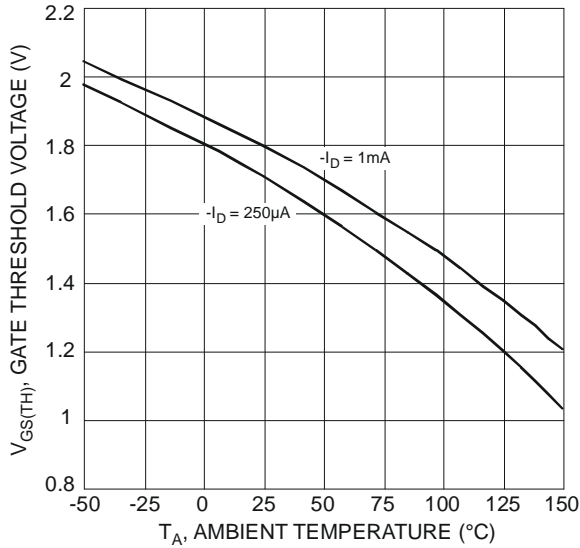


Figure 19 Gate Threshold Variation vs. Ambient Temperature

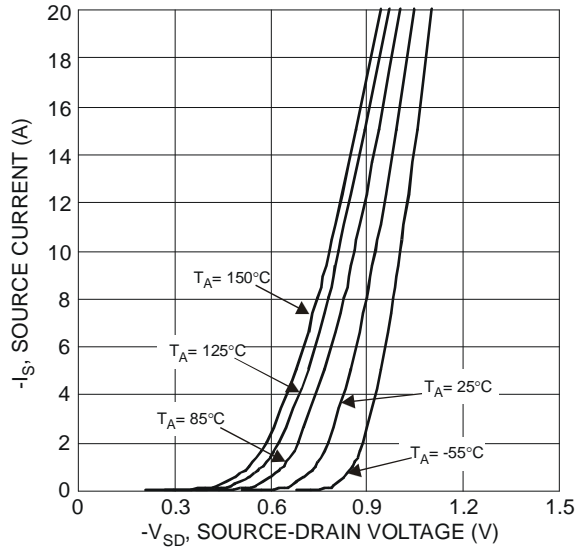


Figure 20 Diode Forward Voltage vs. Current

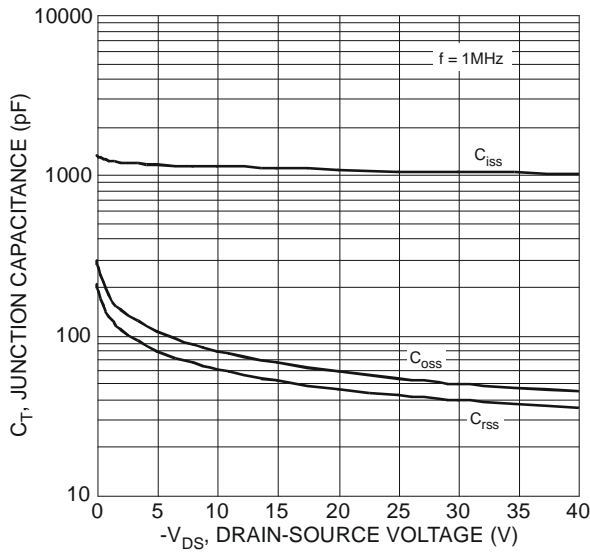


Figure 21 Typical Junction Capacitance

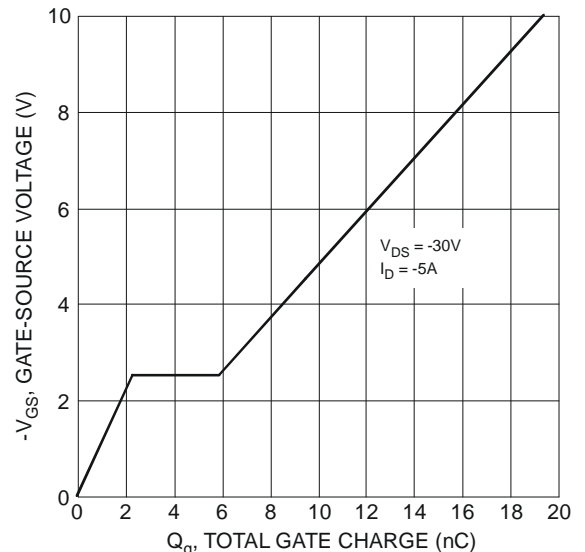


Figure 22 Gate-Charge Characteristics

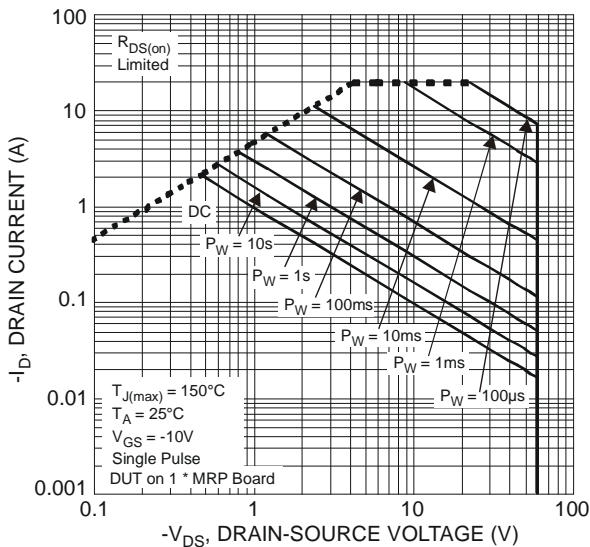
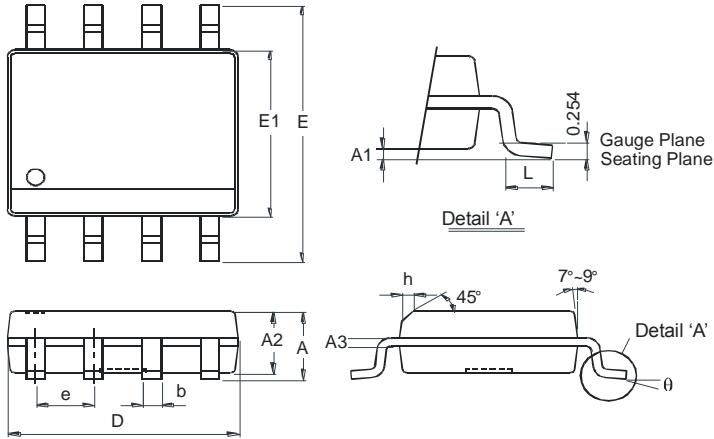


Figure 23 SOA, Safe Operation Area

**Package Outline Dimensions**

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

**SO-8**

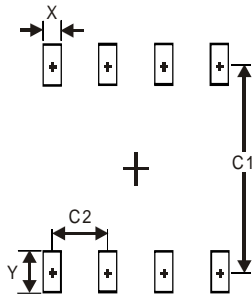


SO-8		
Dim	Min	Max
A	–	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	–	0.35
L	0.62	0.82
θ	0°	8°
<b>All Dimensions in mm</b>		

**Suggested Pad Layout**

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

**SO-8**



Dimensions	Value (in mm)
X	0.60
Y	1.55
C1	5.4
C2	1.27

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