

## Product Summary

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> T <sub>A</sub> = +25°C
Q1	40V	24mΩ @ V <sub>GS</sub> = 10V	8.3A
		32mΩ @ V <sub>GS</sub> = 4.5V	7.2A
Q2	-40V	45mΩ @ V <sub>GS</sub> = -10V	-6.1A
		55mΩ @ V <sub>GS</sub> = -4.5V	-5.5A

## Description

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

## Applications

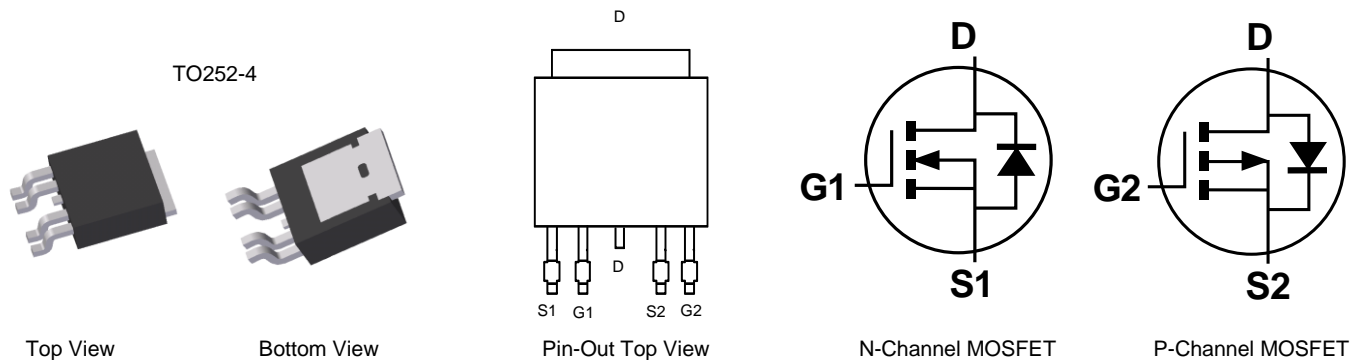
- DC-DC Converters
- Power Management Functions
- Backlighting

## 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)**

## Mechanical Data

- Case: TO252-4
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.34 grams (Approximate)

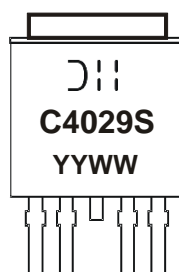


## Ordering Information (Note 4)

Part Number	Case	Packaging
DMC4029SK4-13	TO252-4	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  
 C4029S = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 16 = 2016)  
 WW = Week (01 to 53)

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

Characteristic			Symbol	Value_Q1	Value_Q2	Unit
Drain-Source Voltage			V <sub>DSS</sub>	40	-40	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>	8.3 6.7	-6.1 -4.9	A
	t < 10s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	11.8 9.4	-8.6 -6.9	A
Maximum Body Diode Forward Current (Note 6)			I <sub>S</sub>	2.5	-2.5	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I <sub>DM</sub>	45	-35	A
Avalanche Current, L = 0.1mH (Note 8)			I <sub>AS</sub>	21	-20	A
Avalanche Energy, L = 0.1mH (Note 8)			E <sub>AS</sub>	22	20	mJ

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	T <sub>A</sub> = +25°C	P <sub>D</sub>	1.5	W
	T <sub>A</sub> = +70°C		1.0	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	R <sub>θJA</sub>	88	°C/W
	t < 10s		40	
Total Power Dissipation (Note 6)	T <sub>A</sub> = +25°C	P <sub>D</sub>	2.9	W
	T <sub>A</sub> = +70°C		1.6	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	R <sub>θJA</sub>	42	°C/W
	t < 10s		20	
Thermal Resistance, Junction to Case (Note 7)		R <sub>θJC</sub>	4.5	
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**Electrical Characteristics — Q1 N-Channel** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

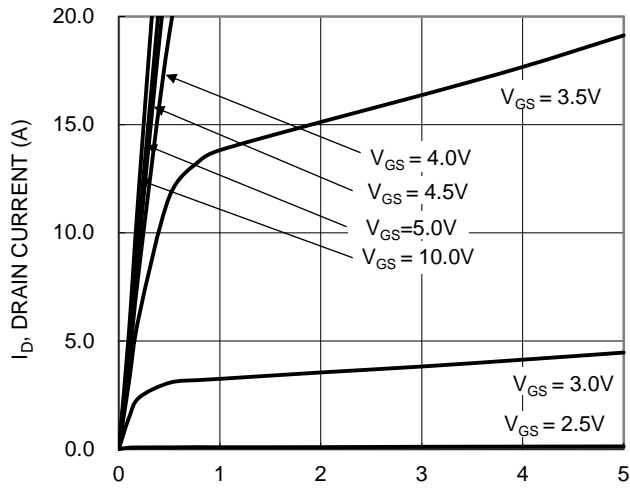
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 9)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	µA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b> (Note 9)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	1.0	—	3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	15	24	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 6A
		—	20	32		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5A
Diode Forward Voltage	V <sub>SD</sub>	—	0.7	1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1.0A
<b>DYNAMIC CHARACTERISTICS</b> (Note 10)						
Input Capacitance	C <sub>ISS</sub>	—	1,060	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>OSS</sub>	—	84	—		
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	58	—		
Gate Resistance	R <sub>G</sub>	—	1.6	—	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>	—	8.8	—	nC	V <sub>DS</sub> = 20V, I <sub>D</sub> = 8A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>G</sub>	—	19.1	—		
Gate-Source Charge	Q <sub>GS</sub>	—	3.0	—		
Gate-Drain Charge	Q <sub>GD</sub>	—	2.5	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	5.3	—	ns	V <sub>DD</sub> = 25V, R <sub>L</sub> = 2.5Ω V <sub>GS</sub> = 10V, R <sub>G</sub> = 3Ω
Turn-On Rise Time	t <sub>R</sub>	—	7.1	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	15.1	—		
Turn-Off Fall Time	t <sub>F</sub>	—	4.8	—		
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	10.5	—	ns	I <sub>F</sub> = 8A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	4.15	—	nC	I <sub>F</sub> = 8A, di/dt = 100A/µs

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

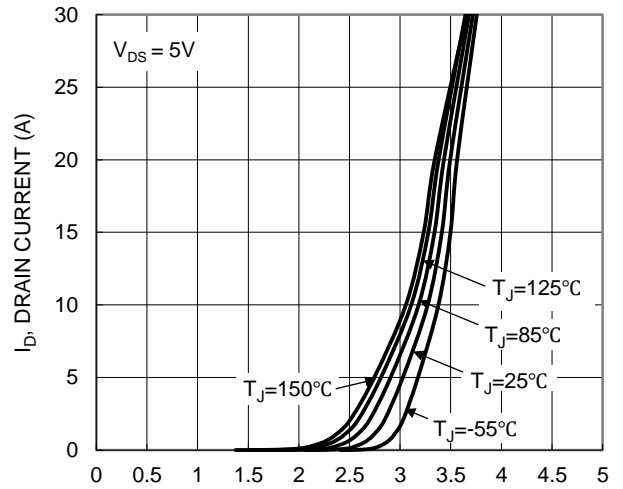
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 9)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1	μA	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b> (Note 9)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-1.0	—	-3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	33	45	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -5A
		—	40	55		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -4A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.7	-1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1.0A
<b>DYNAMIC CHARACTERISTICS</b> (Note 10)						
Input Capacitance	C <sub>ISS</sub>	—	1,154	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>OSS</sub>	—	84	—		
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	66	—		
Gate Resistance	R <sub>G</sub>	—	12.6	—	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>	—	10.6	—	nC	V <sub>DS</sub> = -20V, I <sub>D</sub> = -4.9A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>G</sub>	—	21.5	—		
Gate-Source Charge	Q <sub>GS</sub>	—	2.2	—		
Gate-Drain Charge	Q <sub>GD</sub>	—	3.3	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	8.7	—	ns	V <sub>DS</sub> = -20V, I <sub>D</sub> = -3.9A V <sub>GS</sub> = -4.5V, R <sub>G</sub> = 1Ω
Turn-On Rise Time	t <sub>R</sub>	—	19.6	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	34.9	—		
Turn-Off Fall Time	t <sub>F</sub>	—	25.5	—		
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	9.61	—	ns	I <sub>S</sub> = -3.9A, di/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	3.3	—	nC	I <sub>S</sub> = -3.9A, di/dt = 100A/μs

- Notes:
5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.
  7. Thermal resistance from junction to soldering point (on the exposed drain pad).
  8. I<sub>AS</sub> and E<sub>AS</sub> rating are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  9. Short duration pulse test used to minimize self-heating effect.
  10. Guaranteed by design. Not subject to product testing.

**Typical Characteristics — N-Channel**



V<sub>DS</sub>, DRAIN-SOURCE VOLTAGE (V)  
Fig.1 Typical Output Characteristic



V<sub>GS</sub>, GATE-SOURCE VOLTAGE (V)  
Figure 2. Typical Transfer Characteristic

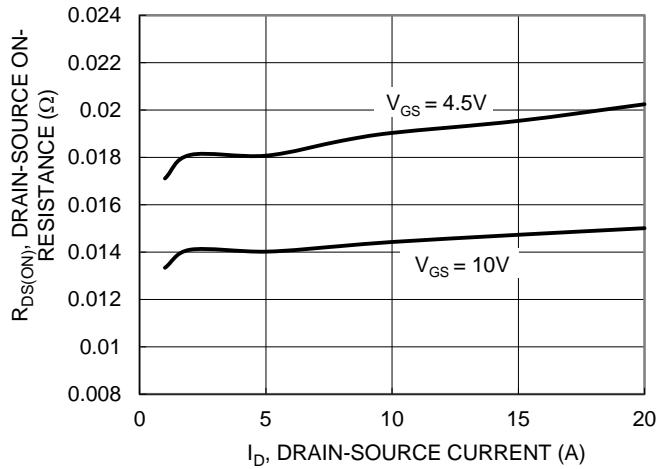
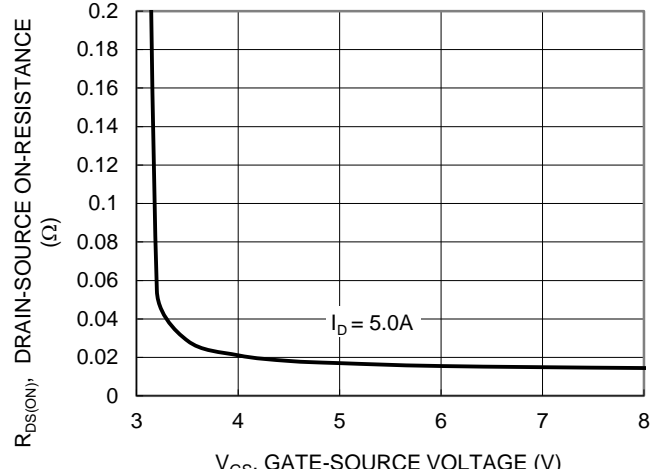


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage



V<sub>GS</sub>, GATE-SOURCE VOLTAGE (V)  
Figure 4. Typical Transfer Characteristic

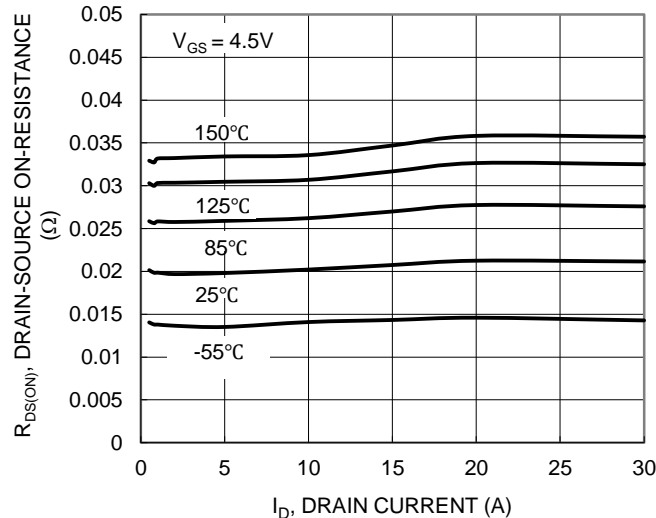


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

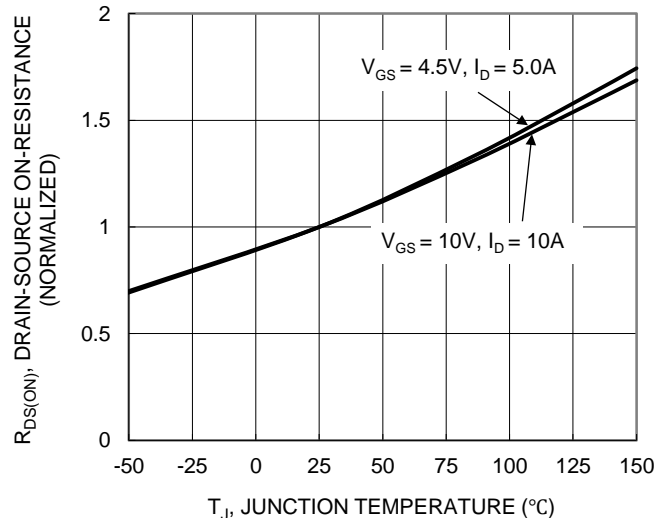


Figure 6. On-Resistance Variation with Temperature

**Typical Characteristics — N-Channel** (Continued)

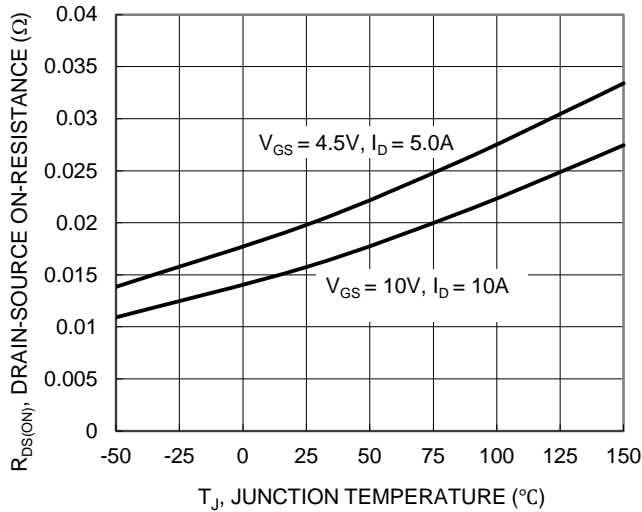


Figure 7. On-Resistance Variation with Temperature

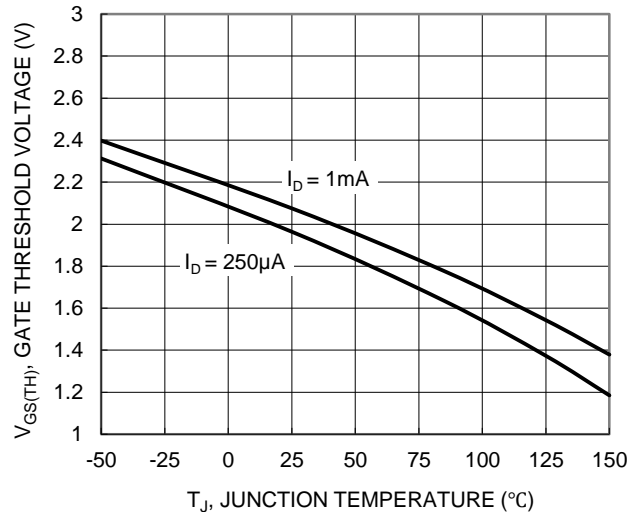


Figure 8. Gate Threshold Variation vs. Temperature

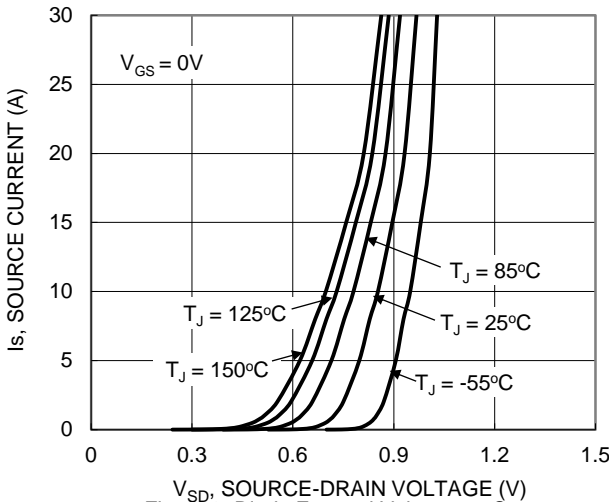


Figure 9. Diode Forward Voltage vs. Current

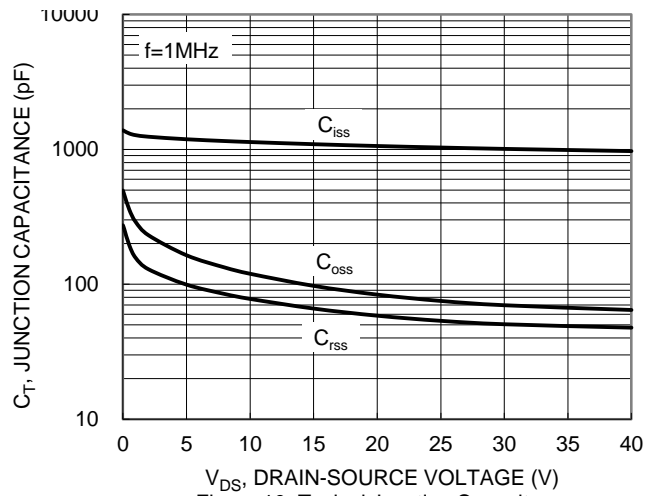


Figure 10. Typical Junction Capacitance

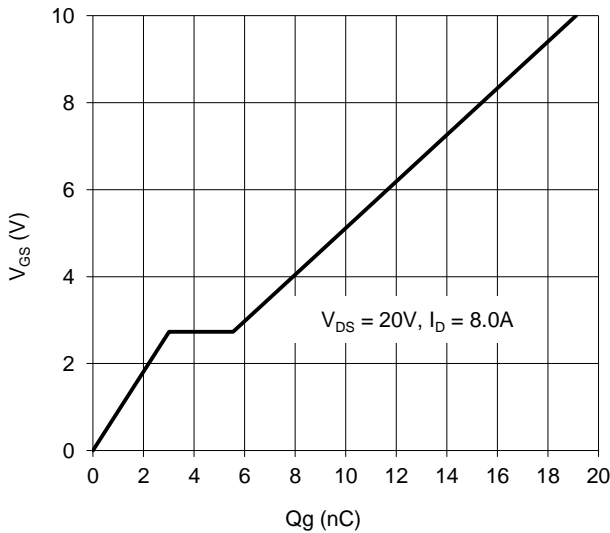


Figure 11. Gate Charge

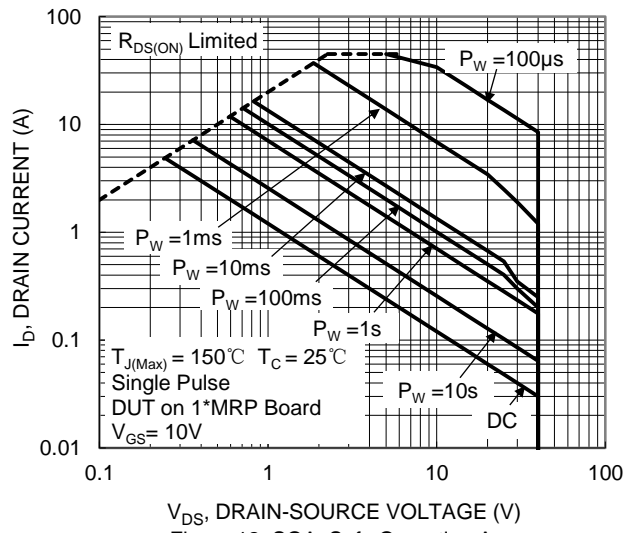


Figure 12. SOA, Safe Operation Area

**Typical Characteristics — P-Channel**

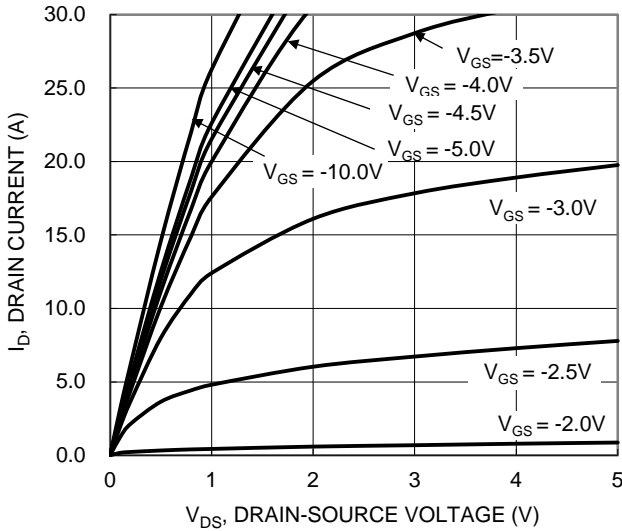


Figure 1. Typical Output Characteristic

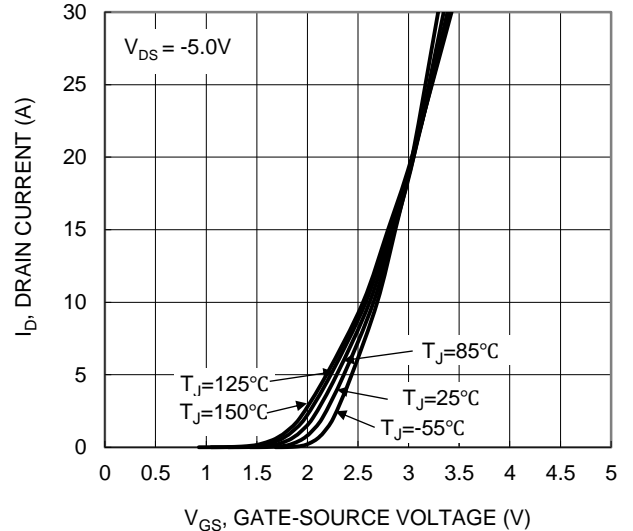


Figure 2. Typical Transfer Characteristic

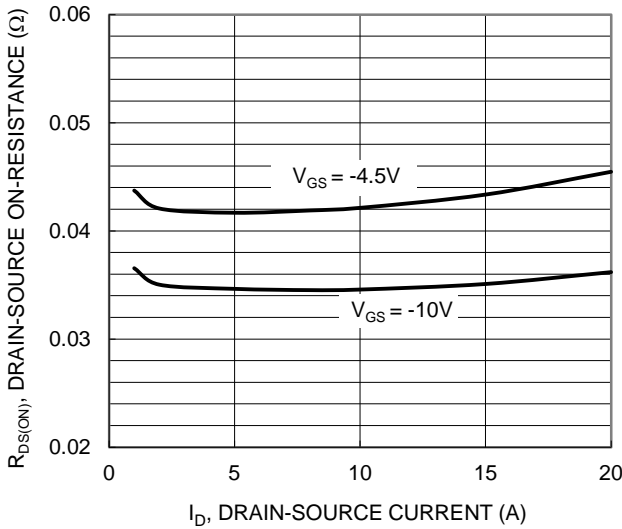


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

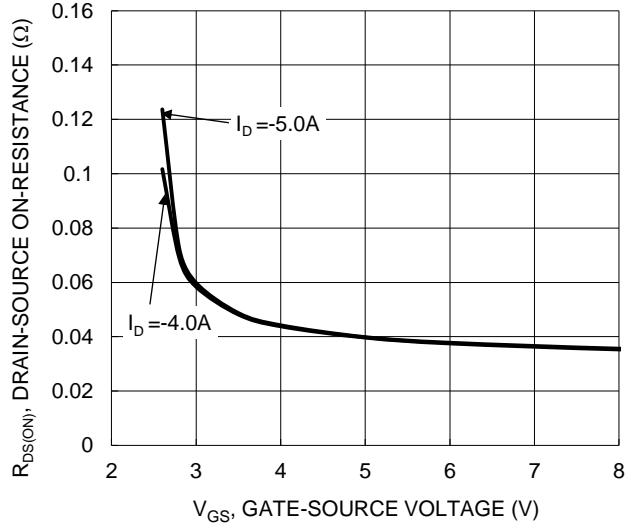


Figure 4. Typical Transfer Characteristic

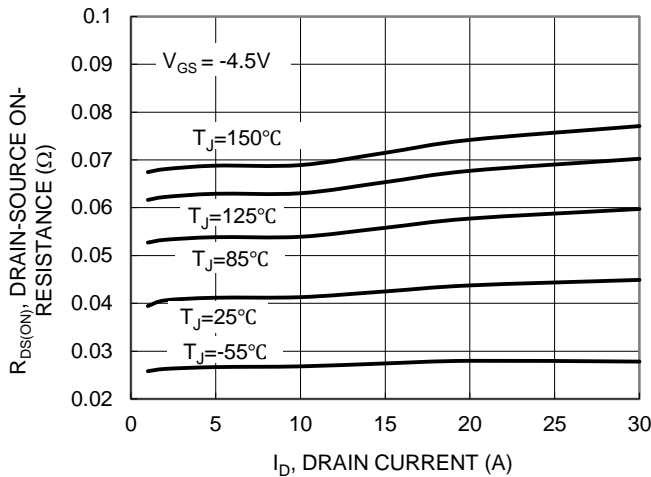


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

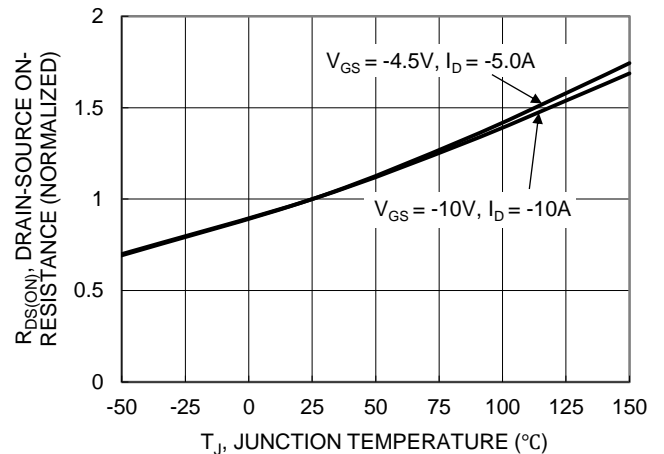


Figure 6. On-Resistance Variation with Temperature

**Typical Characteristics — P-Channel (Continued)**

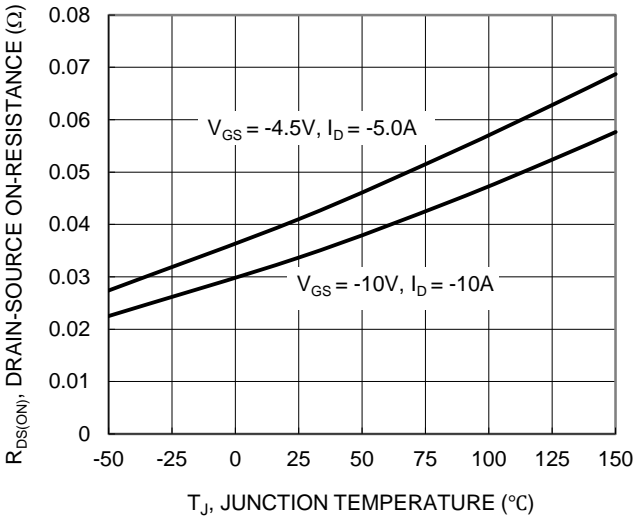


Figure 7. On-Resistance Variation with Temperature

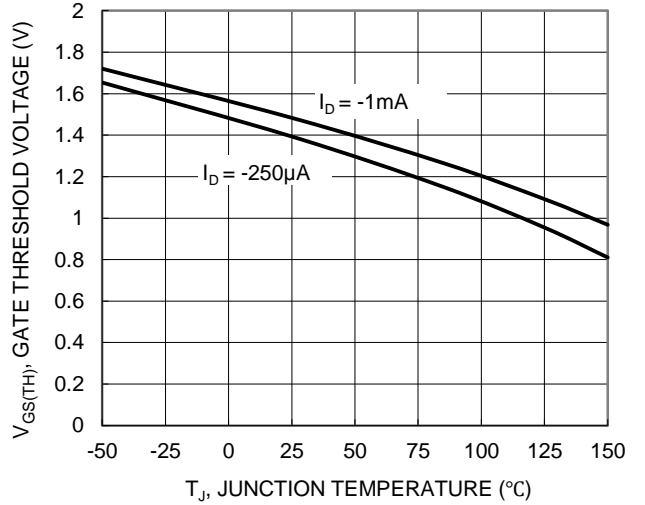


Figure 8. Gate Threshold Variation vs. Temperature

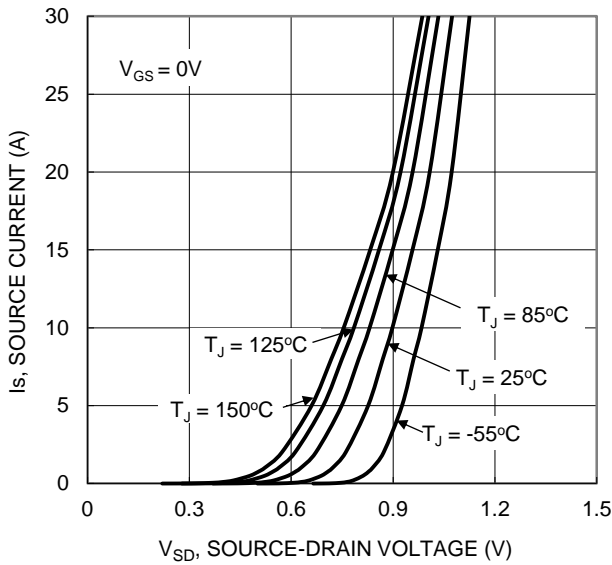


Figure 9. Diode Forward Voltage vs. Current

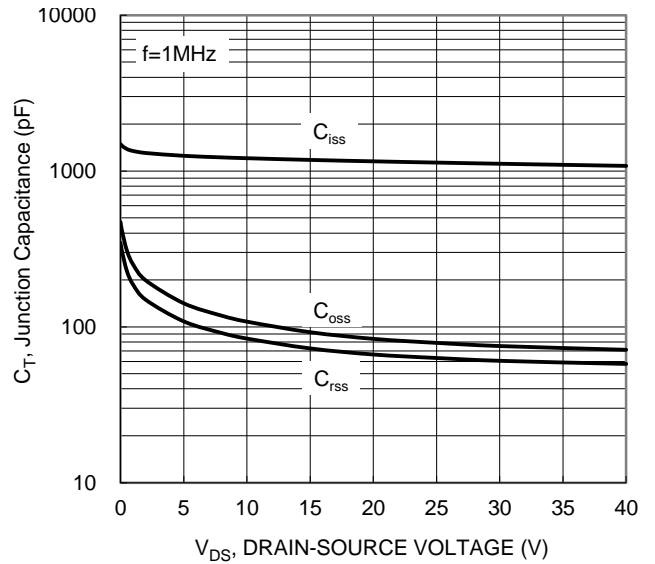


Figure 10. Typical Junction Capacitance

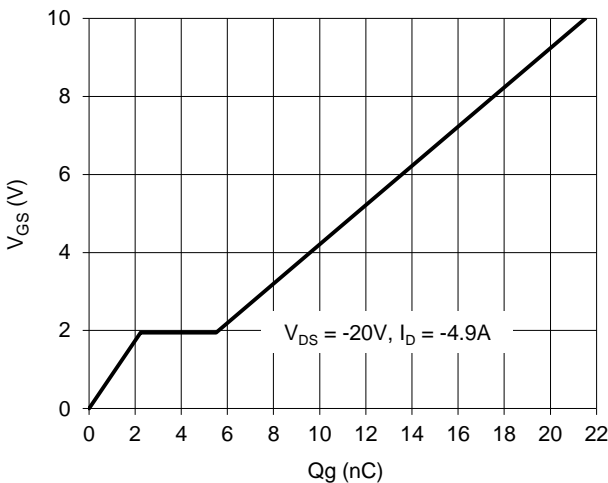


Figure 11. Gate Charge

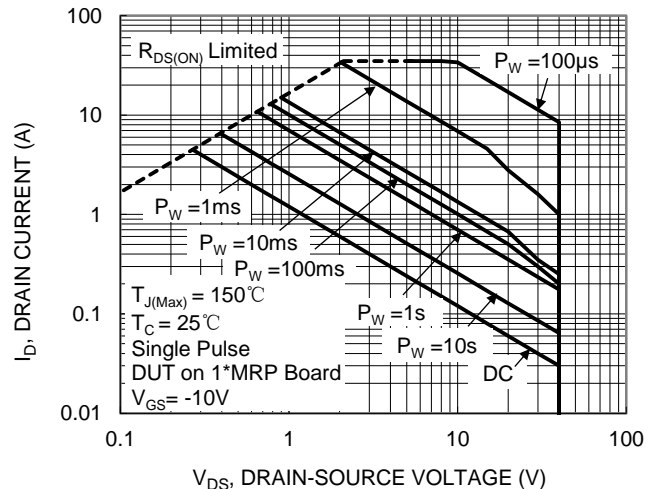


Figure 12. SOA, Safe Operation Area

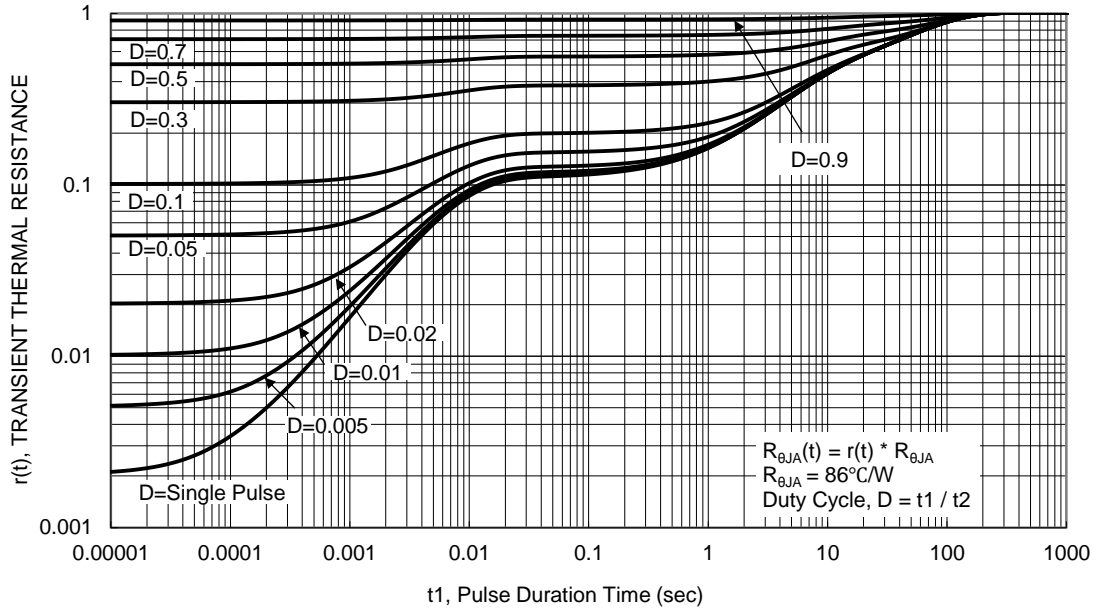


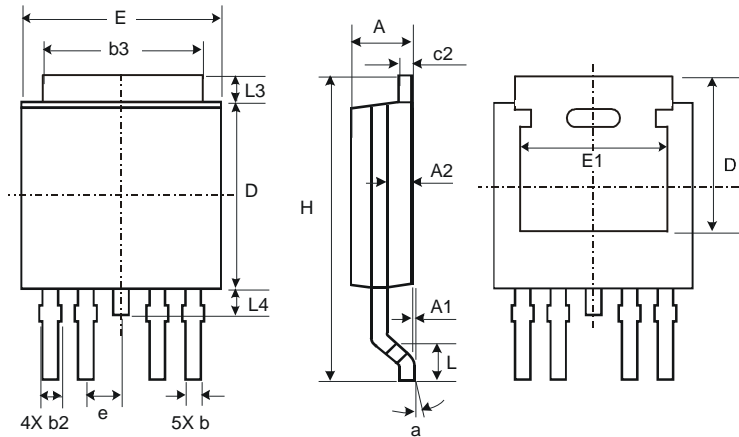
Figure 13. Transient Thermal Resistance



## Package Outline Dimensions

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

**TO252-4**

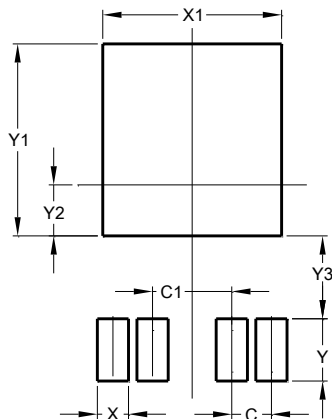


TO252-4			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.51	0.71	0.583
b2	0.61	0.79	0.70
b3	5.21	5.46	5.33
c2	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	1.27
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	-
<b>All Dimensions in mm</b>			

## Suggested Pad Layout

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

**TO252-4**



Dimensions	Value (in mm)
C	1.27
C1	2.54
X	1.00
X1	5.73
Y	2.00
Y1	6.17
Y2	1.64
Y3	2.66

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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