

## Product Summary

Device	BV <sub>DSS</sub>	R <sub>D(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>D(on)</sub>), yet maintain superior switching performance, making it ideal for high efficiency power management applications.

## Applications

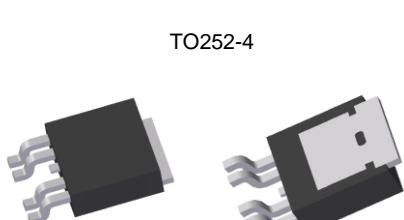
- DC-DC Converters
- Power Management Functions
- Backlighting

## Features and Benefits

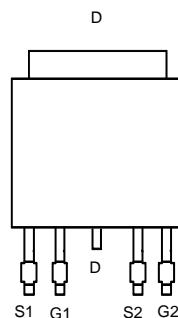
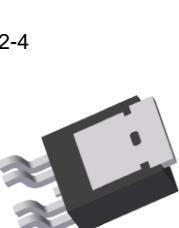
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- Halogen and Antimony Free. "Green" Device (Note 3)**

## Mechanical Data

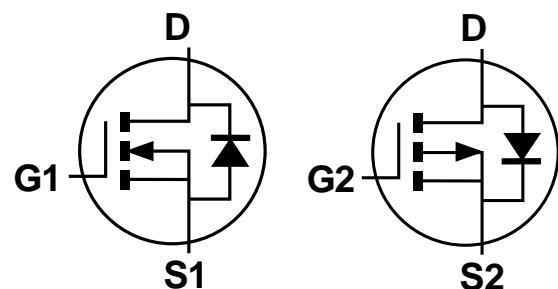
- Case: TO252-4
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (83)
- Weight: 0.34 grams (Approximate)



Top View



Pin-Out Top View



N-Channel MOSFET

P-Channel MOSFET

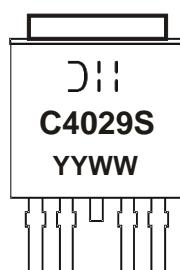
## Ordering Information (Note 4)

Part Number	Case	Packaging
DMC4029SK4-13	TO252-4	2,500/Tape & Reel

Notes:

- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- 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.
- Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



DII = Manufacturer's Marking  
 C4029S = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 16 = 2016)  
 WW = Week (01 to 53)

**Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic			Symbol	Value_Q1	Value_Q2	Unit
Drain-Source Voltage			$V_{DSS}$	40	-40	V
Gate-Source Voltage			$V_{GSS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	8.3	-6.1	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$		6.7	-4.9	
Maximum Body Diode Forward Current (Note 6)			$I_S$	2.5	-2.5	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	45	-35	A
Avalanche Current, $L = 0.1\text{mH}$ (Note 8)			$I_{AS}$	21	-20	A
Avalanche Energy, $L = 0.1\text{mH}$ (Note 8)			$E_{AS}$	22	20	$\text{mJ}$

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$		$P_D$	1.5	W
	$T_A = +70^\circ\text{C}$			1.0	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State		$R_{\theta JA}$	88	$^\circ\text{C/W}$
	$t < 10\text{s}$			40	
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$		$P_D$	2.9	W
	$T_A = +70^\circ\text{C}$			1.6	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State		$R_{\theta JA}$	42	$^\circ\text{C/W}$
	$t < 10\text{s}$			20	
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$		$R_{\theta JC}$	4.5	
Operating and Storage Temperature Range	$T_J, T_{STG}$		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

**Electrical Characteristics — Q1 N-Channel** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 9)						
Drain-Source Breakdown Voltage	$BV_{DSS}$	40	—	—	V	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 40\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS</b> (Note 9)						
Gate Threshold Voltage	$V_{GS(\text{TH})}$	1.0	—	3.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(\text{ON})}$	—	15	24	$\text{m}\Omega$	$V_{GS} = 10\text{V}, I_D = 6\text{A}$
		—	20	32		$V_{GS} = 4.5\text{V}, I_D = 5\text{A}$
Diode Forward Voltage	$V_{SD}$	—	0.7	1.0	V	$V_{GS} = 0\text{V}, I_S = 1.0\text{A}$
<b>DYNAMIC CHARACTERISTICS</b> (Note 10)						
Input Capacitance	$C_{ISS}$	—	1,060	—	$\text{pF}$	$V_{DS} = 20\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Output Capacitance	$C_{OSS}$	—	84	—		
Reverse Transfer Capacitance	$C_{RSS}$	—	58	—		
Gate Resistance	$R_G$	—	1.6	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$
Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )	$Q_G$	—	8.8	—	$\text{nC}$	$V_{DS} = 20\text{V}, I_D = 8\text{A}$
Total Gate Charge ( $V_{GS} = 10\text{V}$ )	$Q_G$	—	19.1	—		
Gate-Source Charge	$Q_{GS}$	—	3.0	—		
Gate-Drain Charge	$Q_{GD}$	—	2.5	—		
Turn-On Delay Time	$t_{D(\text{ON})}$	—	5.3	—	$\text{ns}$	$V_{DD} = 25\text{V}, R_L = 2.5\Omega$ $V_{GS} = 10\text{V}, R_G = 3\Omega$
Turn-On Rise Time	$t_R$	—	7.1	—		
Turn-Off Delay Time	$t_{D(\text{OFF})}$	—	15.1	—		
Turn-Off Fall Time	$t_F$	—	4.8	—		
Body Diode Reverse Recovery Time	$t_{RR}$	—	10.5	—	$\text{ns}$	$I_F = 8\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	$Q_{RR}$	—	4.15	—	$\text{nC}$	$I_F = 8\text{A}, di/dt = 100\text{A}/\mu\text{s}$

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 (Note 9)</b>						
Drain-Source Breakdown Voltage	$\text{BV}_{\text{DSS}}$	-40	—	—	V	$\text{V}_{\text{GS}} = 0\text{V}$ , $\text{I}_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current	$\text{I}_{\text{DSS}}$	—	—	-1	$\mu\text{A}$	$\text{V}_{\text{DS}} = -40\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$
Gate-Source Leakage	$\text{I}_{\text{GSS}}$	—	—	$\pm 100$	nA	$\text{V}_{\text{GS}} = \pm 20\text{V}$ , $\text{V}_{\text{DS}} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 9)</b>						
Gate Threshold Voltage	$\text{V}_{\text{GS(TH)}}$	-1.0	—	-3.0	V	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}$ , $\text{I}_D = -250\mu\text{A}$
Static Drain-Source On-Resistance	$\text{R}_{\text{DS(ON)}}$	—	33	45	$\text{m}\Omega$	$\text{V}_{\text{GS}} = -10\text{V}$ , $\text{I}_D = -5\text{A}$
		—	40	55		$\text{V}_{\text{GS}} = -4.5\text{V}$ , $\text{I}_D = -4\text{A}$
Diode Forward Voltage	$\text{V}_{\text{SD}}$	—	-0.7	-1.0	V	$\text{V}_{\text{GS}} = 0\text{V}$ , $\text{I}_S = -1.0\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 10)</b>						
Input Capacitance	$\text{C}_{\text{iss}}$	—	1,154	—	pF	$\text{V}_{\text{DS}} = -20\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$ $f = 1.0\text{MHz}$
Output Capacitance	$\text{C}_{\text{oss}}$	—	84	—		
Reverse Transfer Capacitance	$\text{C}_{\text{rss}}$	—	66	—		
Gate Resistance	$\text{R}_{\text{G}}$	—	12.6	—	$\Omega$	$\text{V}_{\text{DS}} = 0\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$ , $f = 1.0\text{MHz}$
Total Gate Charge ( $\text{V}_{\text{GS}} = -4.5\text{V}$ )	$\text{Q}_{\text{G}}$	—	10.6	—	nC	$\text{V}_{\text{DS}} = -20\text{V}$ , $\text{I}_D = -4.9\text{A}$
Total Gate Charge ( $\text{V}_{\text{GS}} = -10\text{V}$ )	$\text{Q}_{\text{G}}$	—	21.5	—		
Gate-Source Charge	$\text{Q}_{\text{GS}}$	—	2.2	—		
Gate-Drain Charge	$\text{Q}_{\text{GD}}$	—	3.3	—		
Turn-On Delay Time	$\text{t}_{\text{D(ON)}}$	—	8.7	—	ns	$\text{V}_{\text{DS}} = -20\text{V}$ , $\text{I}_D = -3.9\text{A}$ $\text{V}_{\text{GS}} = -4.5\text{V}$ , $\text{R}_{\text{G}} = 1\Omega$
Turn-On Rise Time	$\text{t}_{\text{R}}$	—	19.6	—		
Turn-Off Delay Time	$\text{t}_{\text{D(OFF)}}$	—	34.9	—		
Turn-Off Fall Time	$\text{t}_{\text{F}}$	—	25.5	—		
Body Diode Reverse Recovery Time	$\text{t}_{\text{RR}}$	—	9.61	—	ns	$\text{I}_S = -3.9\text{A}$ , $\text{di}/\text{dt} = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	$\text{Q}_{\text{RR}}$	—	3.3	—	nC	$\text{I}_S = -3.9\text{A}$ , $\text{di}/\text{dt} = 100\text{A}/\mu\text{s}$

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.  $\text{I}_{\text{AS}}$  and EAS rating are based on low frequency and duty cycles to keep  $\text{T}_J = +25^\circ\text{C}$ .
9. Short duration pulse test used to minimize self-heating effect.
10. Guaranteed by design. Not subject to product testing.

## Typical Characteristics — N-Channel

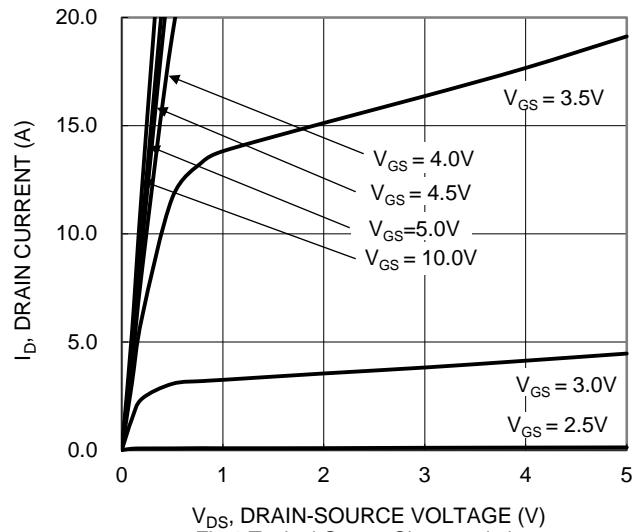


Fig.1 Typical Output Characteristic

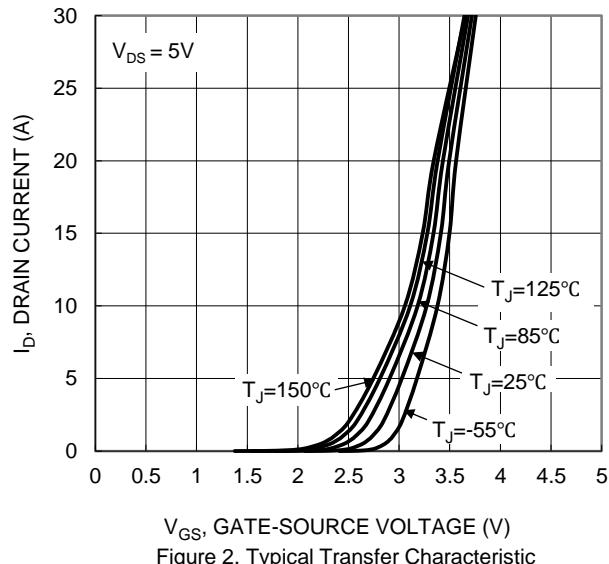


Figure 2. Typical Transfer Characteristic

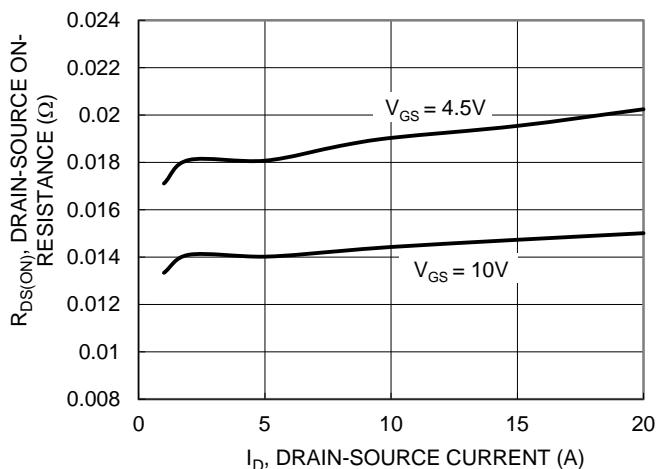


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

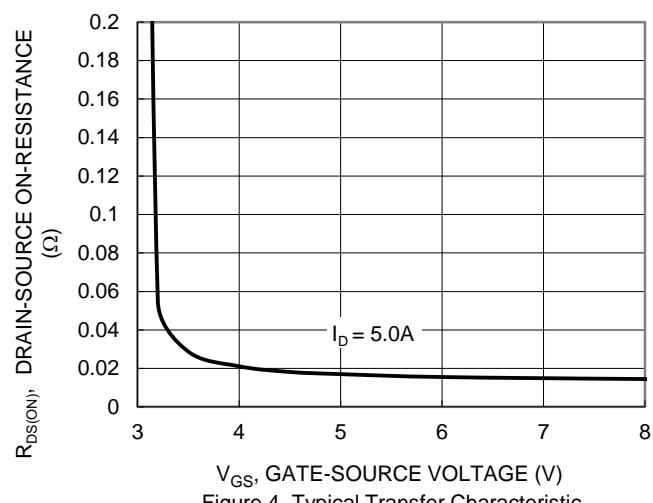


Figure 4. Typical Transfer Characteristic

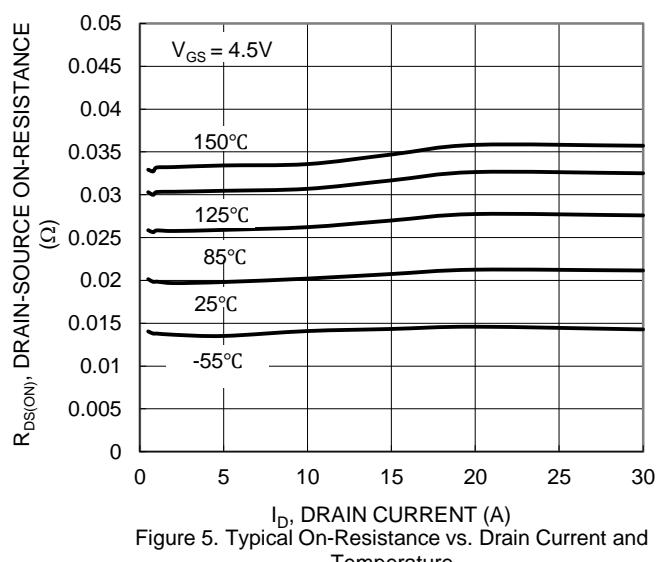


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

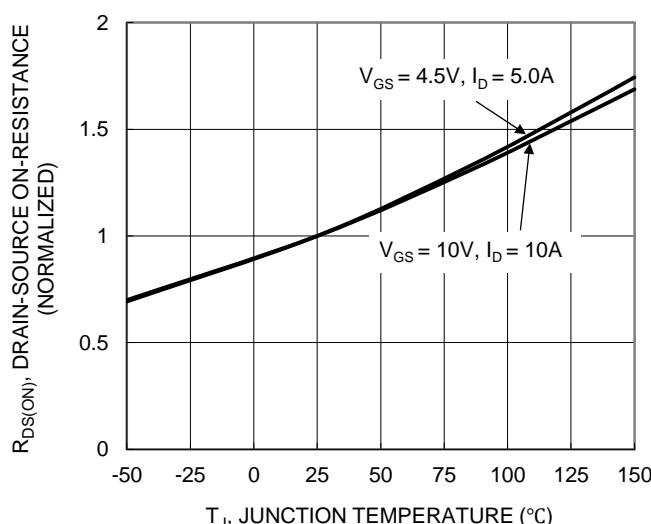
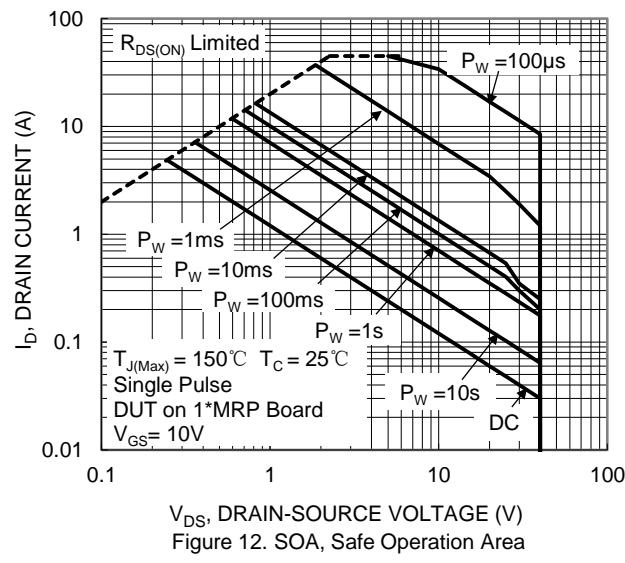
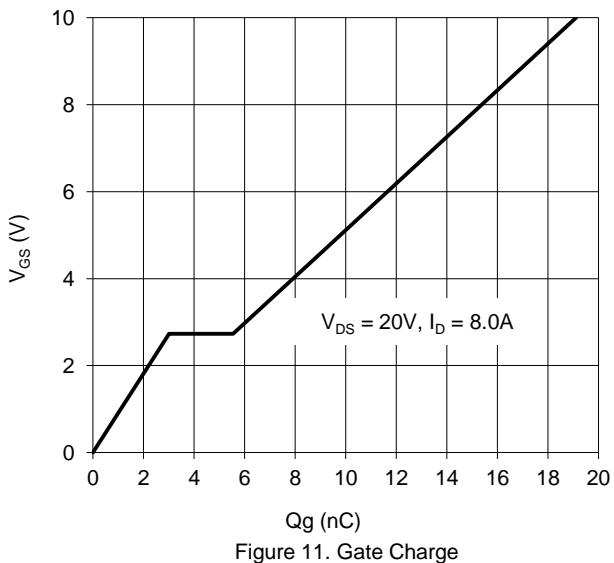
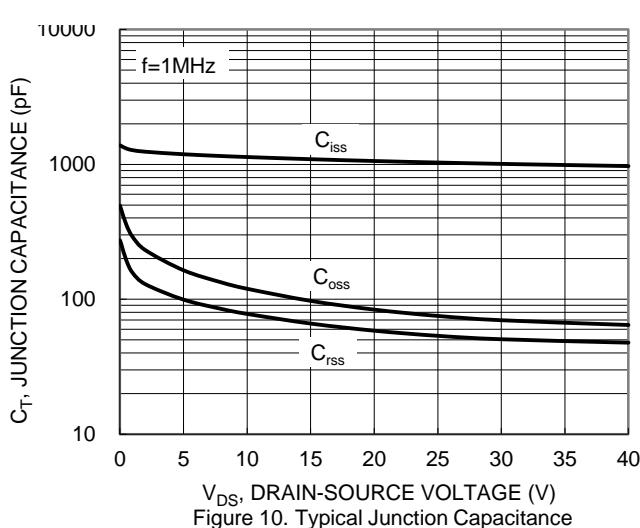
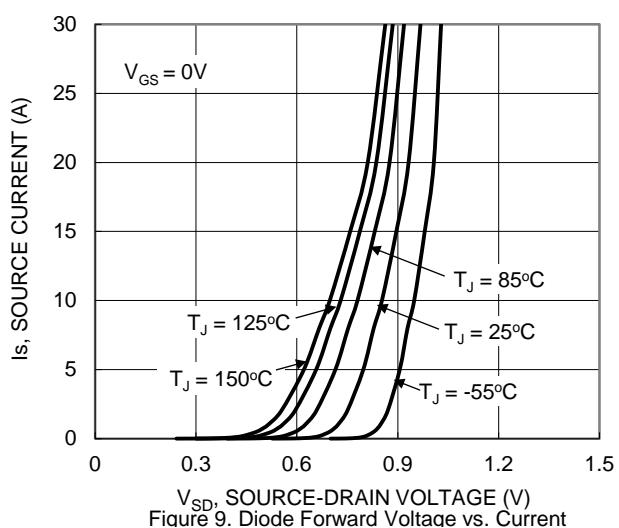
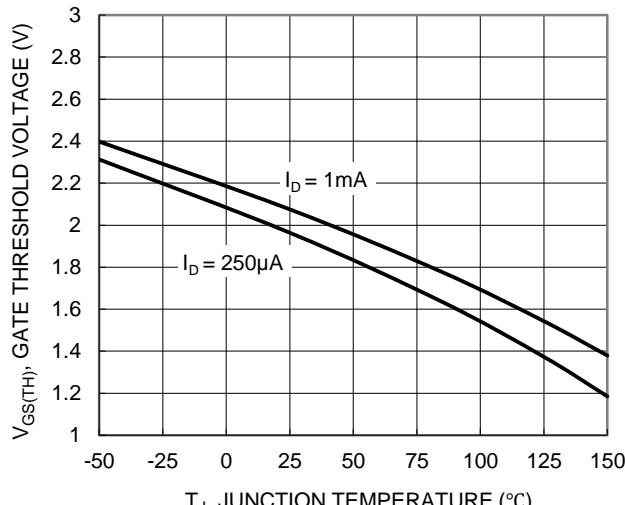
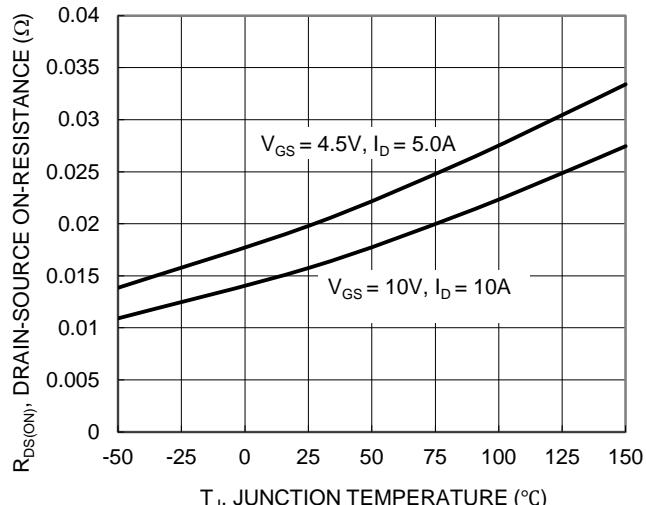


Figure 6. On-Resistance Variation with Temperature

Typical Characteristics — N-Channel (Continued)



## Typical Characteristics — P-Channel

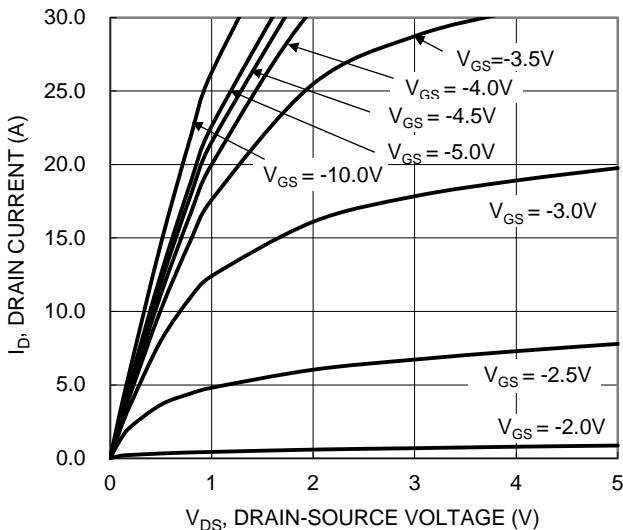


Figure 1. Typical Output Characteristic

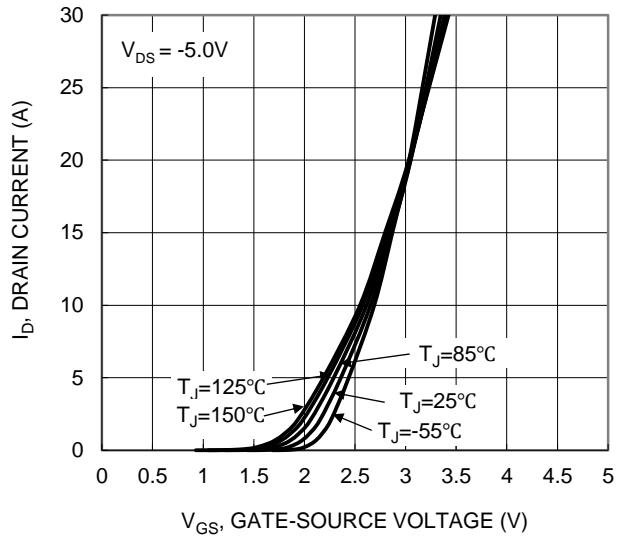


Figure 2. Typical Transfer Characteristic

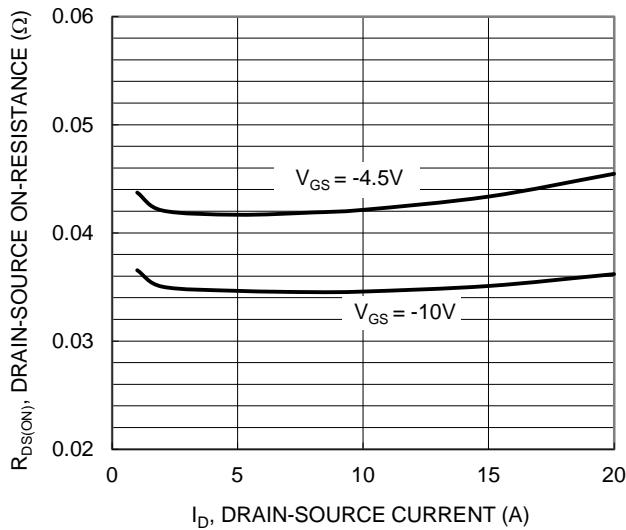


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

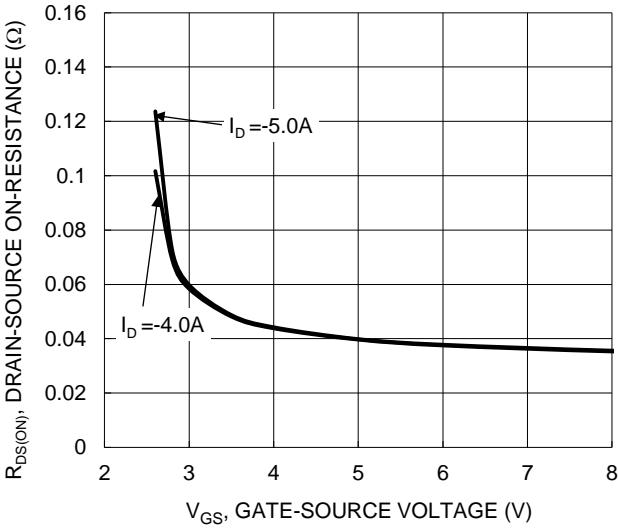


Figure 4. Typical Transfer Characteristic

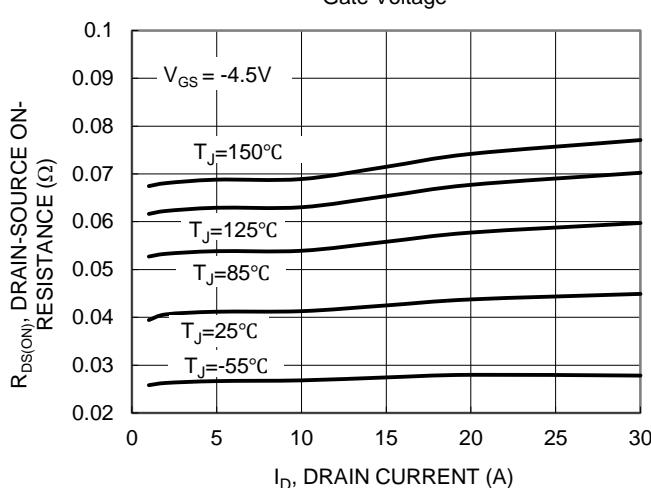


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

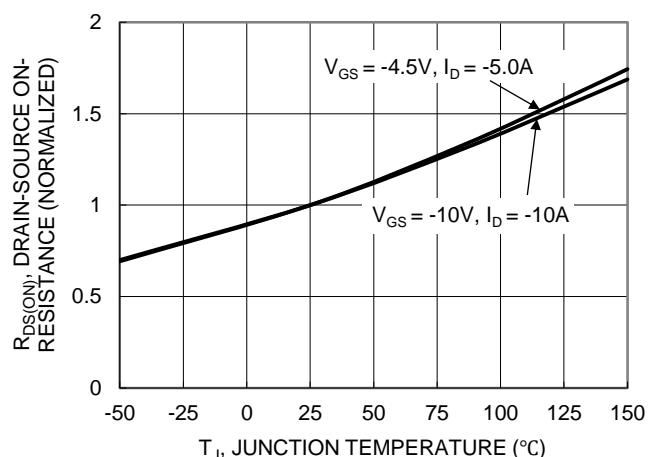


Figure 6. On-Resistance Variation with Temperature

Typical Characteristics — P-Channel (Continued)

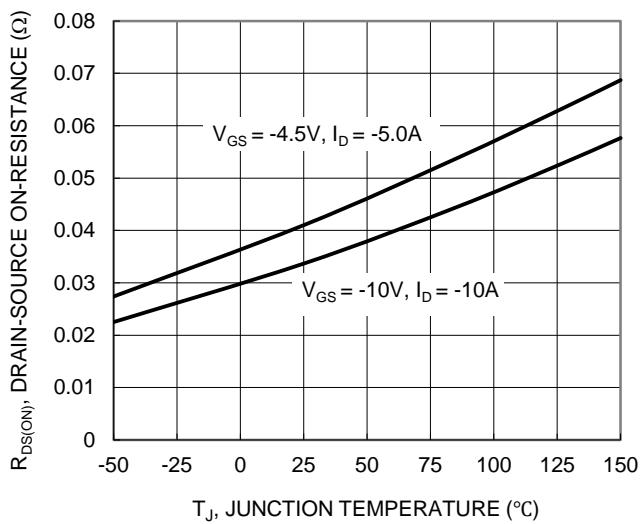


Figure 7. On-Resistance Variation with Temperature

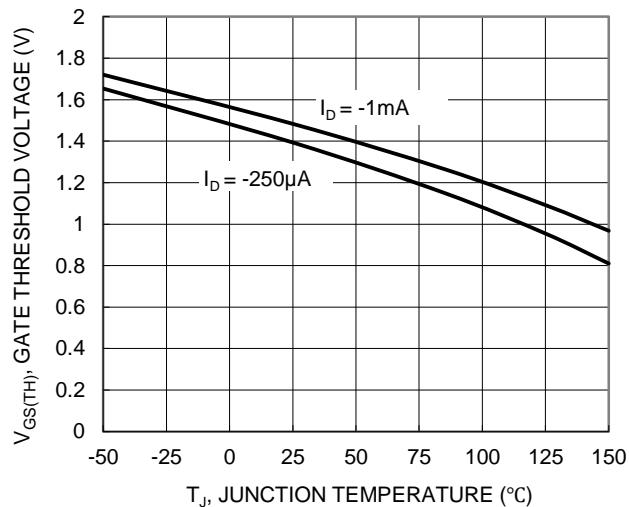


Figure 8. Gate Threshold Variation vs. Temperature

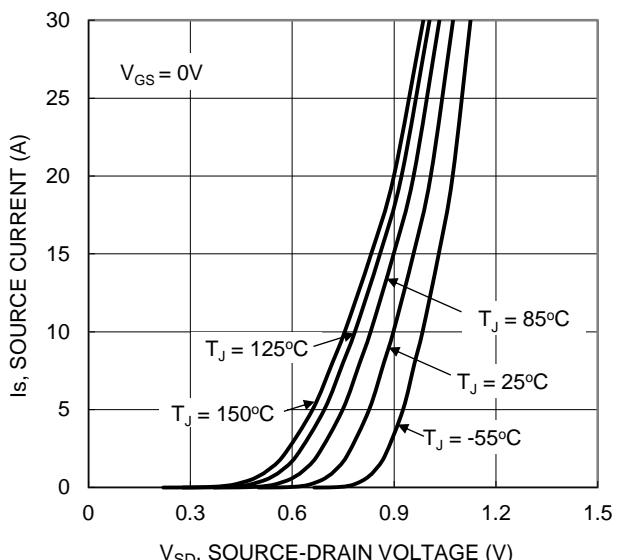


Figure 9. Diode Forward Voltage vs. Current

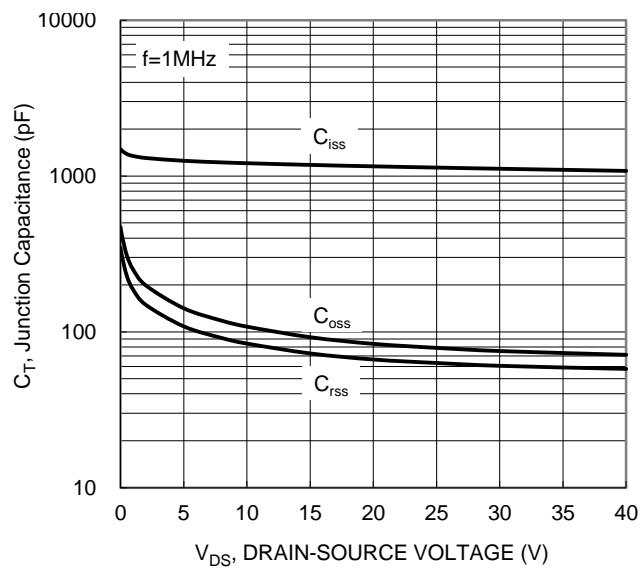


Figure 10. Typical Junction Capacitance

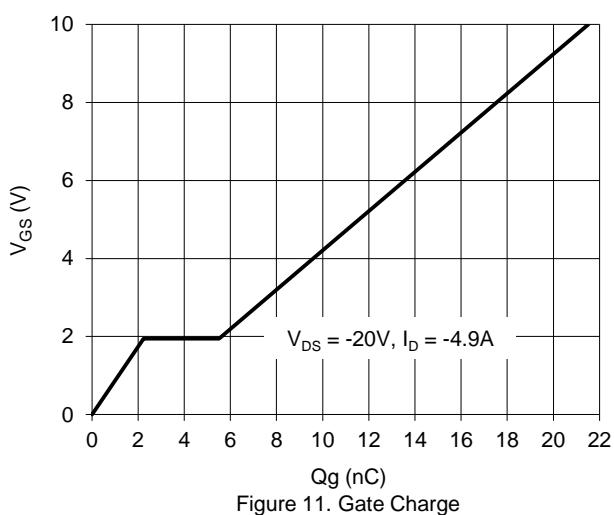


Figure 11. Gate Charge

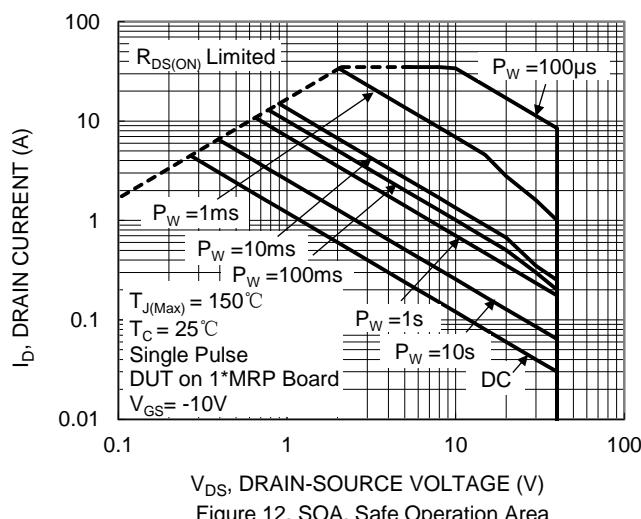


Figure 12. SOA, Safe Operation Area

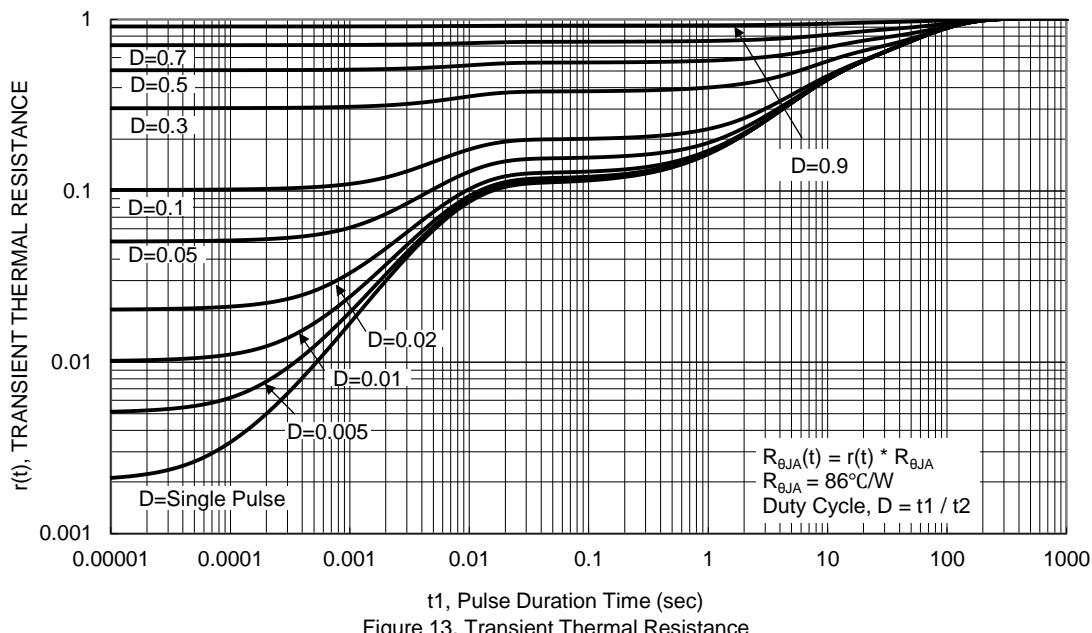
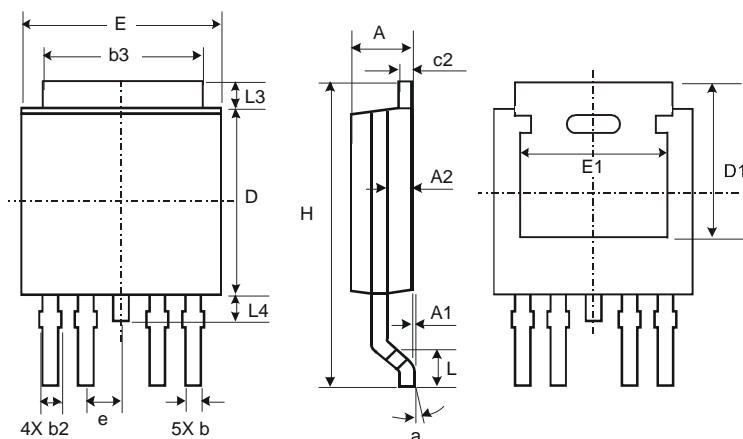


Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

TO252-4



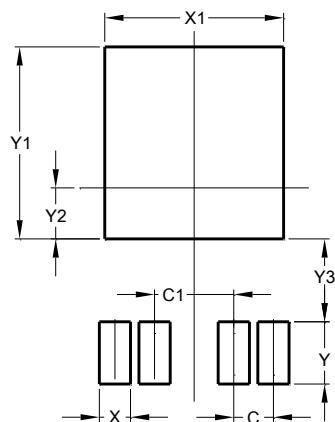
TO252-4			
Dim	Min	Max	Typ
<b>A</b>	2.19	2.39	2.29
<b>A1</b>	0.00	0.13	0.08
<b>A2</b>	0.97	1.17	1.07
<b>b</b>	0.51	0.71	0.583
<b>b2</b>	0.61	0.79	0.70
<b>b3</b>	5.21	5.46	5.33
<b>c2</b>	0.45	0.58	0.531
<b>D</b>	6.00	6.20	6.10
<b>D1</b>	5.21	-	-
<b>e</b>	-	-	1.27
<b>E</b>	6.45	6.70	6.58
<b>E1</b>	4.32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

All Dimensions in mm

## Suggested Pad Layout

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

TO252-4



Dimensions	Value (in mm)
<b>C</b>	1.27
<b>C1</b>	2.54
<b>X</b>	1.00
<b>X1</b>	5.73
<b>Y</b>	2.00
<b>Y1</b>	6.17
<b>Y2</b>	1.64
<b>Y3</b>	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.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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