

## Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(on) max}$	$I_D$ $T_A = +25^\circ C$
Q2	60V	55m $\Omega$ @ $V_{GS} = 10V$	4.7A
Q1	-60V	105m $\Omega$ @ $V_{GS} = -10V$	-3.9A

## Description

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.

## Applications

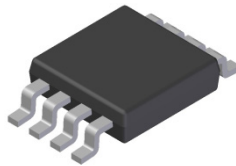
- DC-DC Converters
- Power Management Functions
- Backlighting

## Features and Benefits

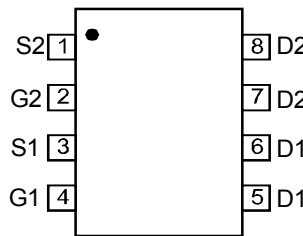
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

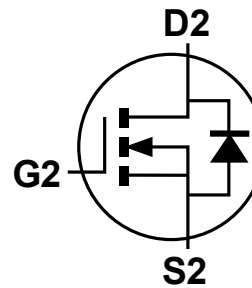
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Tin Finish annealed over Copper leadframe Solderable per MIL-STD-202, Method 208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



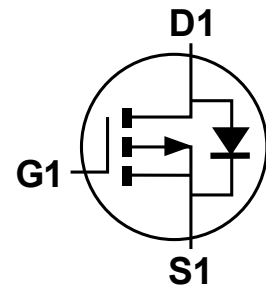
Top View



TOP VIEW  
Internal Schematic



N-Channel MOSFET



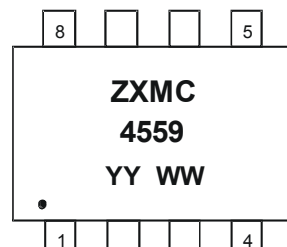
P-Channel MOSFET

## Ordering Information (Note 4)

Part Number	Compliance	Case	Packaging
ZXMC4559DN8TA	Standard	SO-8	500/Tape & Reel
ZXMC4559DN8TC	Standard	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



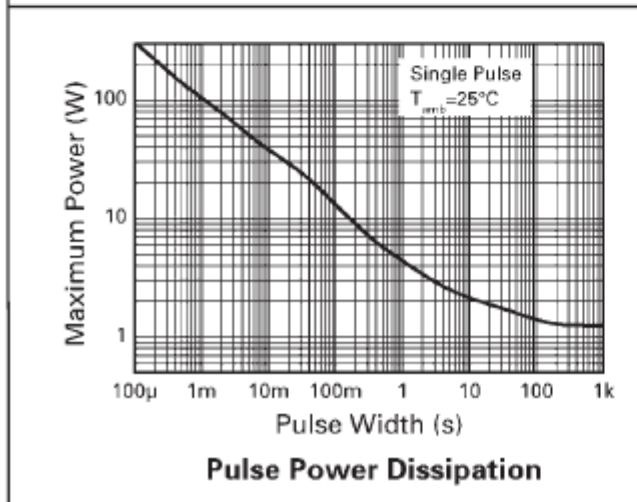
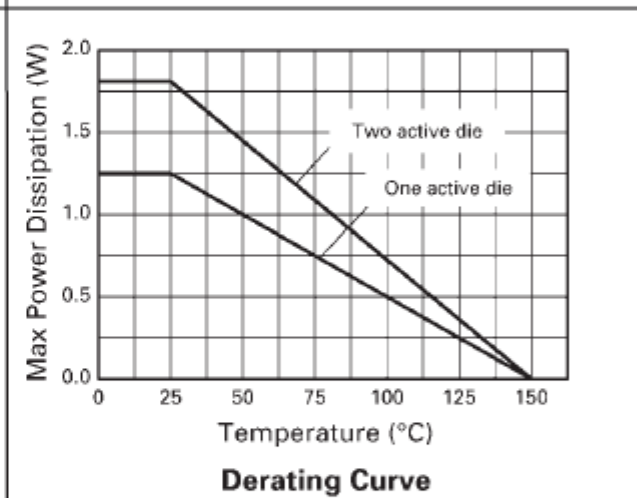
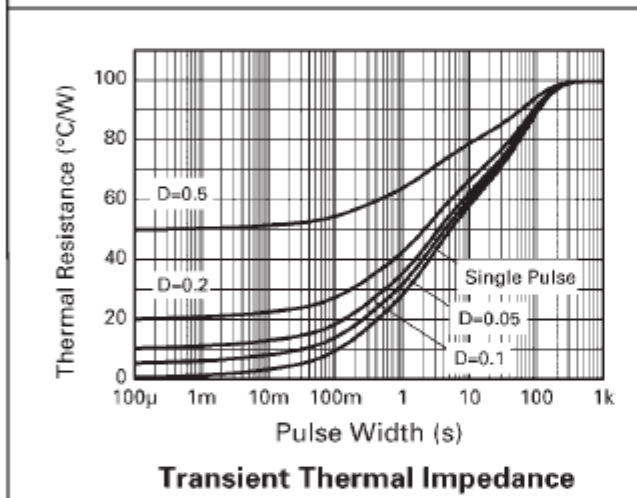
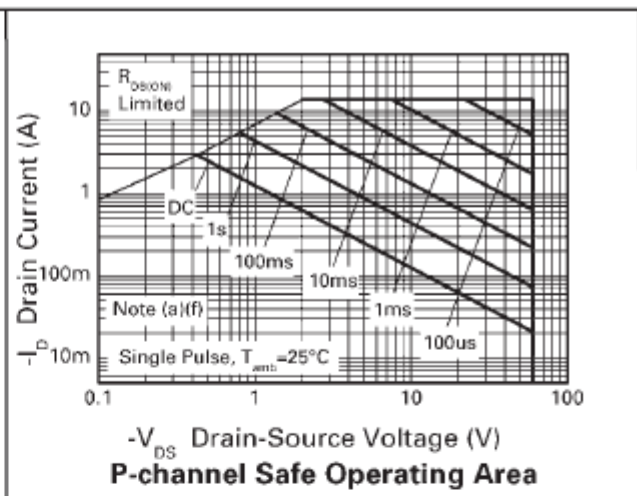
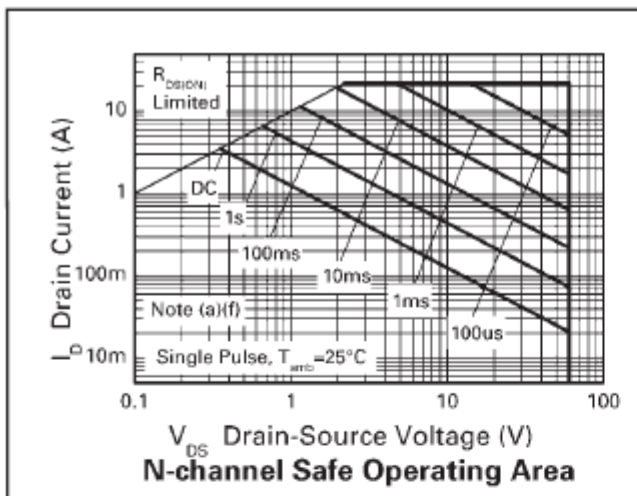
ZXMC4559 = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 14 = 2014)  
 WW = Week (01 - 53)

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

Characteristic	Symbol	Value_Q2	Value_Q1	Units	
Drain-Source Voltage	V <sub>DSS</sub>	60	-60	V	
Gate-Source Voltage	V <sub>GSS</sub>	±20	±20	V	
Continuous Drain Current V <sub>GS</sub> = 10V	SteadyState (Note 5)	I <sub>D</sub>	3.6	-2.6	A
	t<10s (Note 6)	I <sub>D</sub>	4.7	-3.9	A
Maximum Body Diode Forward Current at t<10s (Note 6)	I <sub>S</sub>	3.4	-3.2	A	
Pulsed Drain Current (300µs pulse, duty cycle = 2%)	I <sub>DM</sub>	22.2	-18.3	A	
Pulsed Source Current (Body Diode) (300µs pulse, duty cycle = 2%)	I <sub>SM</sub>	22.2	-18.3	A	

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

Characteristic	Symbol	Value	Units
Power Dissipation	P <sub>D</sub>	1.25	W
Linear Derating Factor (Note 5)		10	mW/°C
Power Dissipation	P <sub>D</sub>	2.1	W
Linear Derating Factor (Note 6)		17	mW/°C
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	100	°C/W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	58	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

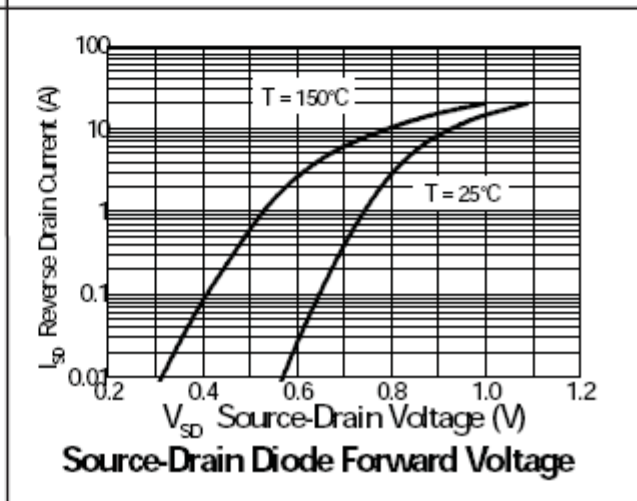
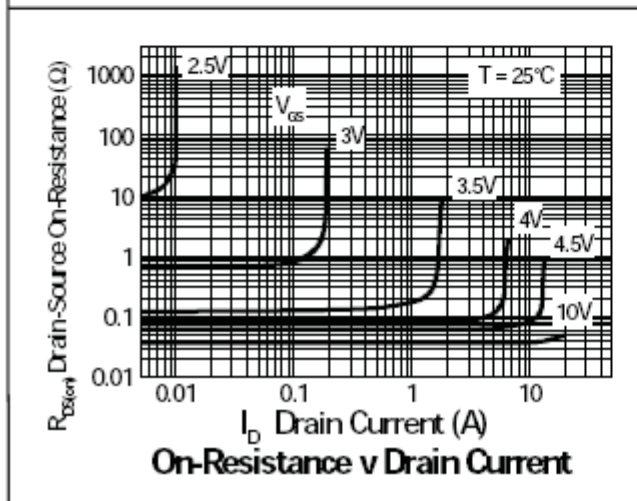
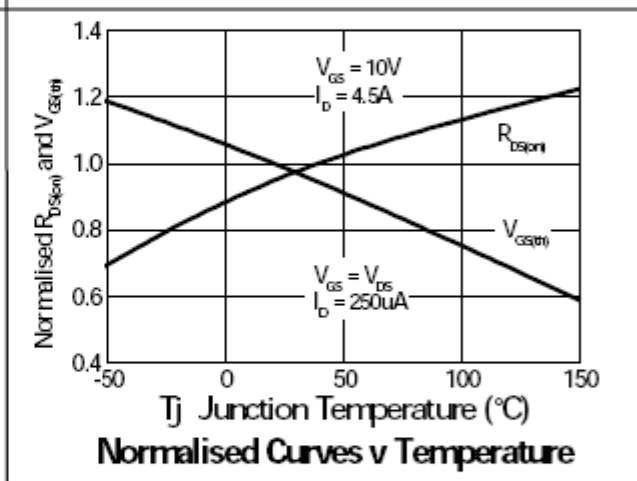
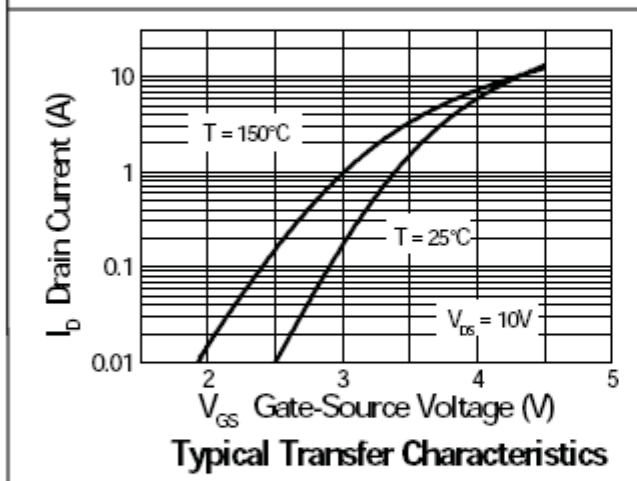
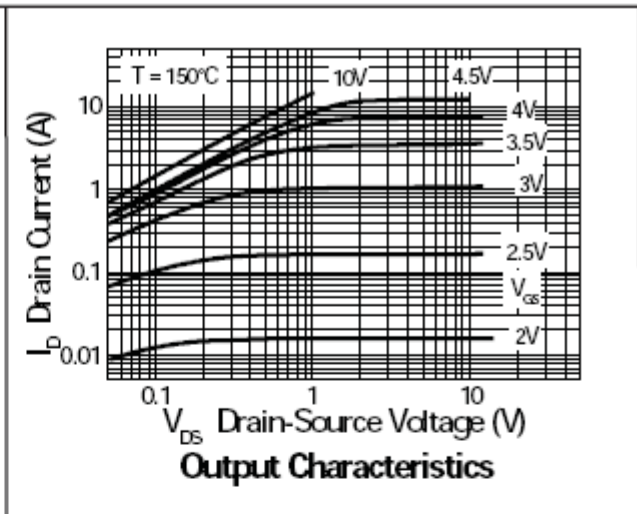
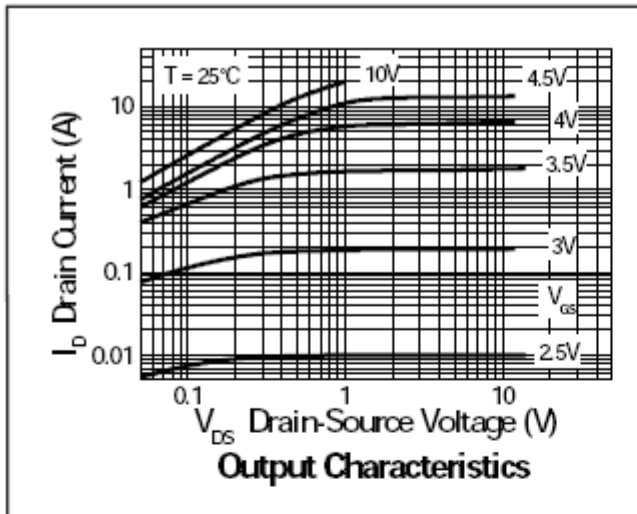


**Electrical Characteristics N-Channel Q2** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

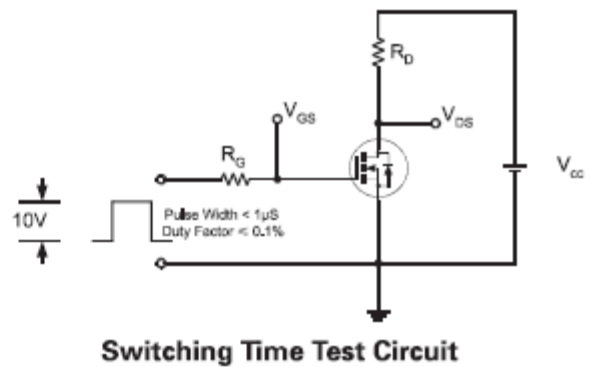
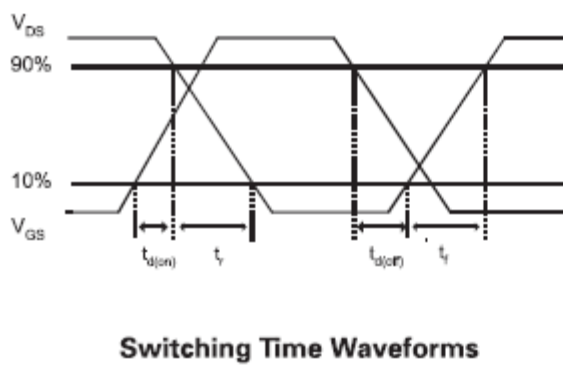
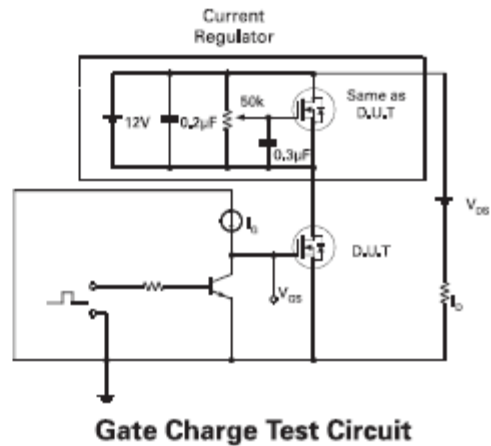
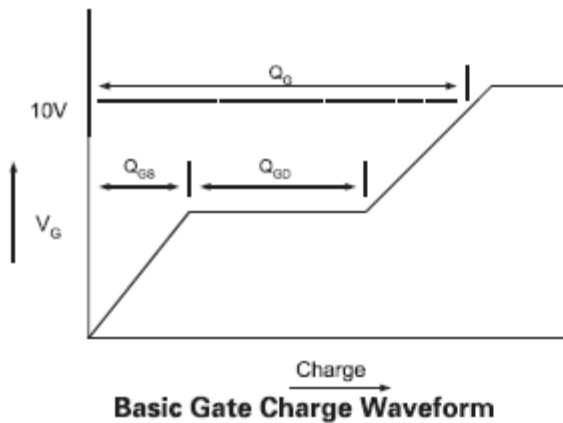
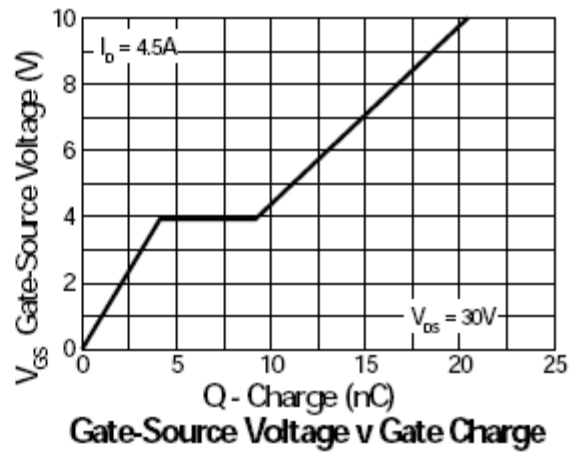
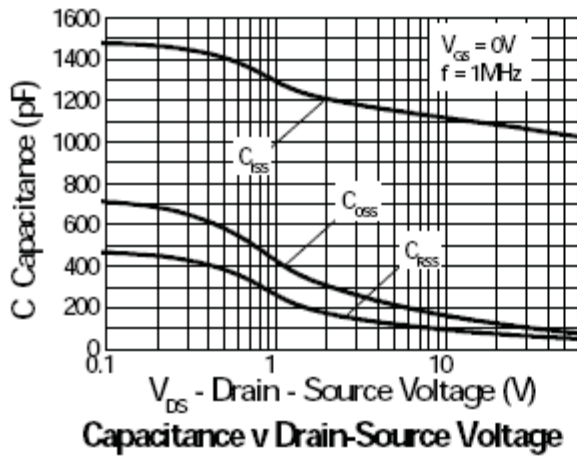
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b> (Note 7)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1.0	—	—	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	—	55	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 4.5A
		—	—	75		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4.0A
Diode Forward Voltage	V <sub>SD</sub>	—	0.85	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 5.5A
Forward Transconductance	g <sub>fs</sub>	—	10.2	—	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 4.5A
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	C <sub>iSS</sub>	—	1063	—	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	104	—		
Reverse Transfer Capacitance	C <sub>rSS</sub>	—	64	—		
Total Gate Charge (V <sub>GS</sub> = 5.0V)	Q <sub>g</sub>	—	11	—	nC	V <sub>DS</sub> = 30V, I <sub>D</sub> = 4.5A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	20.4	—		
Gate-Source Charge	Q <sub>gs</sub>	—	4.1	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	5.1	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.5	—	nS	V <sub>DD</sub> = 30V, I <sub>D</sub> = 1.0A V <sub>GS</sub> = 10V, R <sub>G</sub> = 6.0Ω
Turn-On Rise Time	t <sub>r</sub>	—	4.1	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	26.2	—		
Turn-Off Fall Time	t <sub>f</sub>	—	10.6	—		
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	22	—	nS	I <sub>F</sub> = 2.2A, di/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	21.4	—	nC	I <sub>F</sub> = 2.2A, di/dt = 100A/μs

**N-Channel Typical Characteristics**

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**N-Channel Typical Characteristics (cont.)**



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

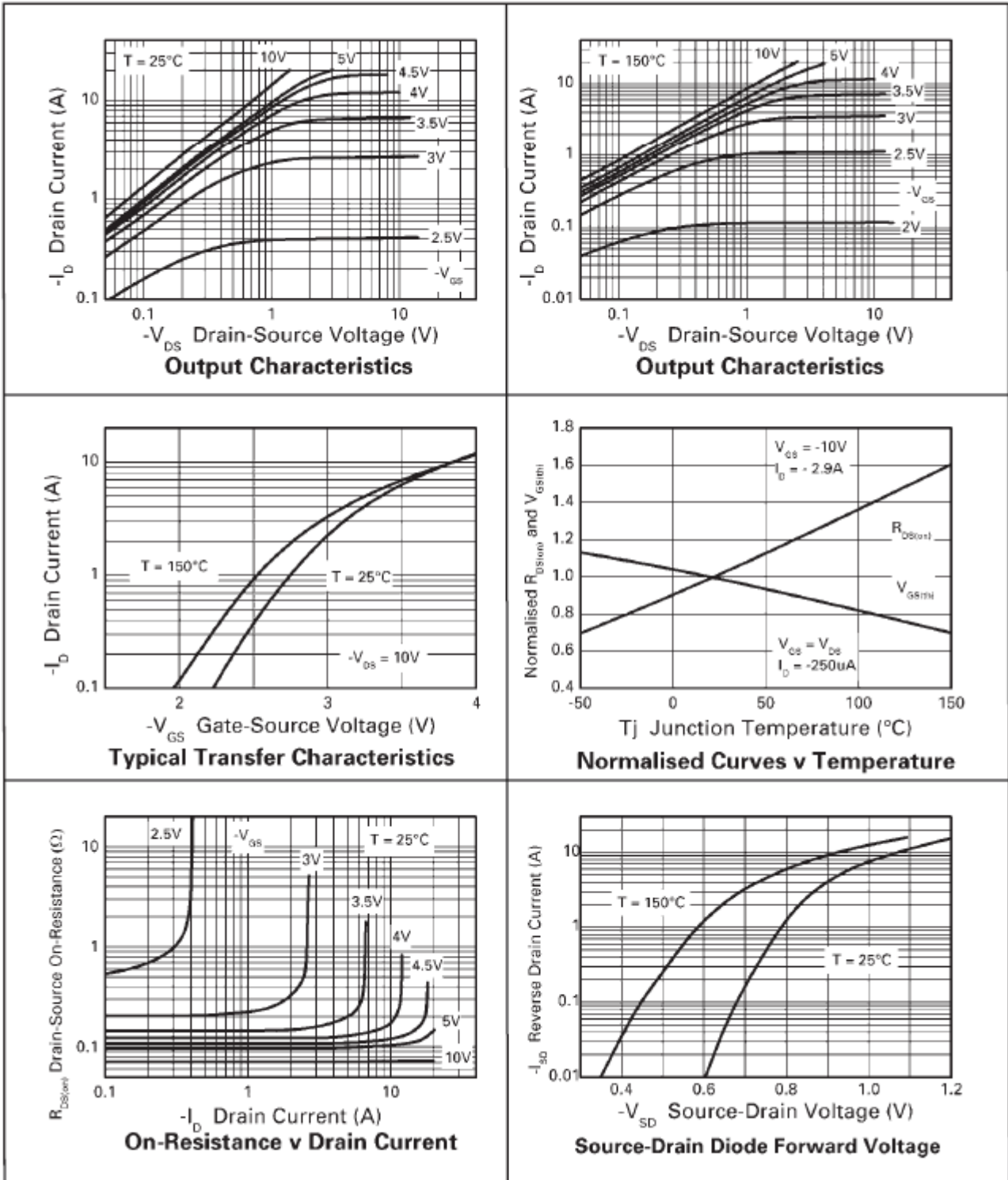
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-1.0	μA	V <sub>DS</sub> = -60V, V <sub>GS</sub> = 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 7)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-1.0	—	—	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	—	—	85	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -2.9A
		—	—	125		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -2.4A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.85	-0.95	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -3.4A
Forward Transconductance	g <sub>fs</sub>	—	7.2	—	S	V <sub>DS</sub> = -15V, I <sub>D</sub> = -2.9A
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	C <sub>iSS</sub>	—	1021	—	pF	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	83.1	—		
Reverse Transfer Capacitance	C <sub>rSS</sub>	—	56.4	—		
Total Gate Charge (V <sub>GS</sub> = -5.0V)	Q <sub>g</sub>	—	12.1	—	nC	V <sub>DS</sub> = -30V, I <sub>D</sub> = -2.9A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	24.2	—		
Gate-Source Charge	Q <sub>gs</sub>	—	2.5	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	3.7	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.5	—	nS	V <sub>DD</sub> = -30V, I <sub>D</sub> = -1.0A V <sub>GS</sub> = -10V, R <sub>G</sub> = 6.0Ω
Turn-On Rise Time	t <sub>r</sub>	—	4.1	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	35	—		
Turn-Off Fall Time	t <sub>f</sub>	—	10	—		
Body Diode Reverse Recovery Time	t <sub>rr</sub>	—	29.2	—	nS	I <sub>S</sub> = -2.0A, dI/dt = 100A/μs
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	—	39.6	—	nC	I <sub>S</sub> = -2.0A, dI/dt = 100A/μs

- Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  7. Short duration pulse test used to minimize self-heating effect.
  8. Guaranteed by design. Not subject to product testing.



**P-Channel Typical Characteristics**

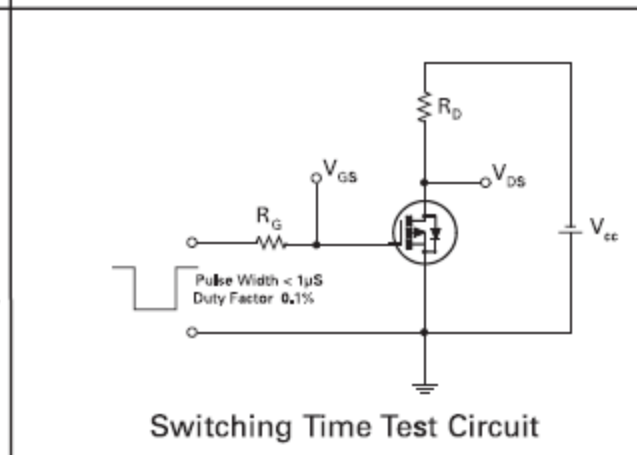
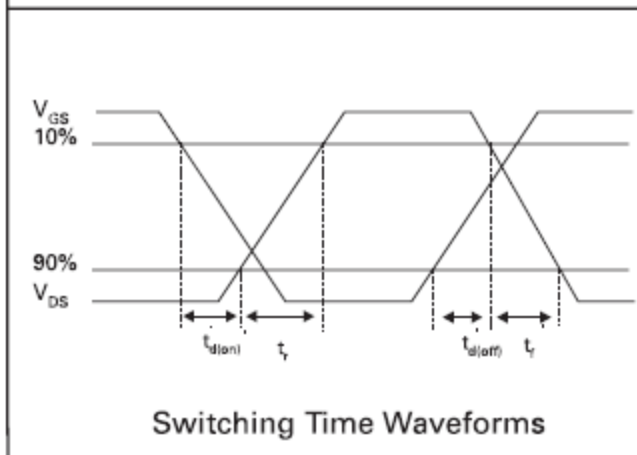
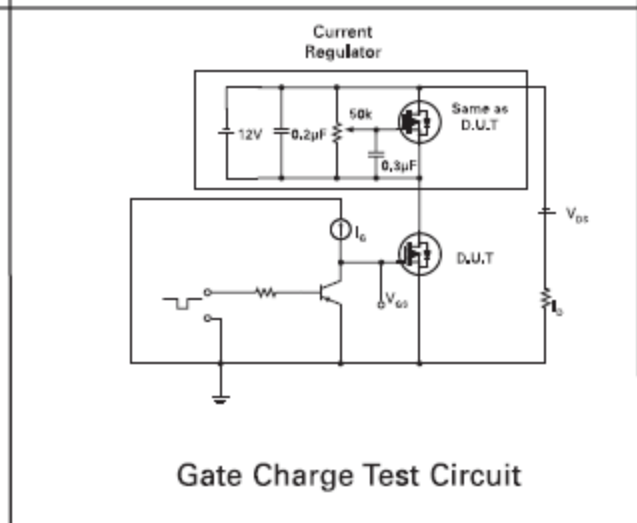
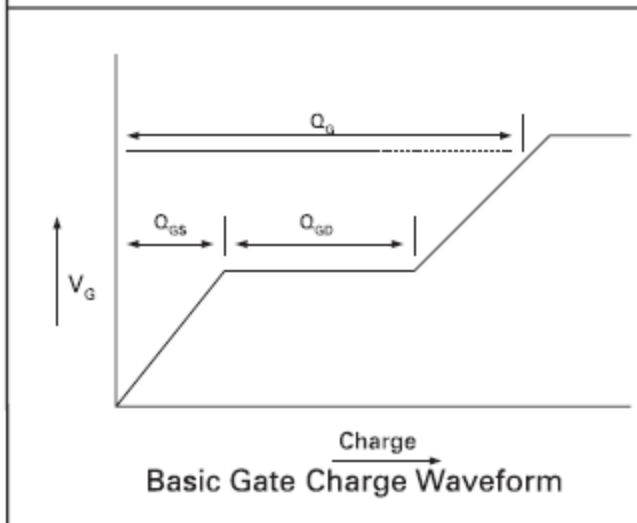
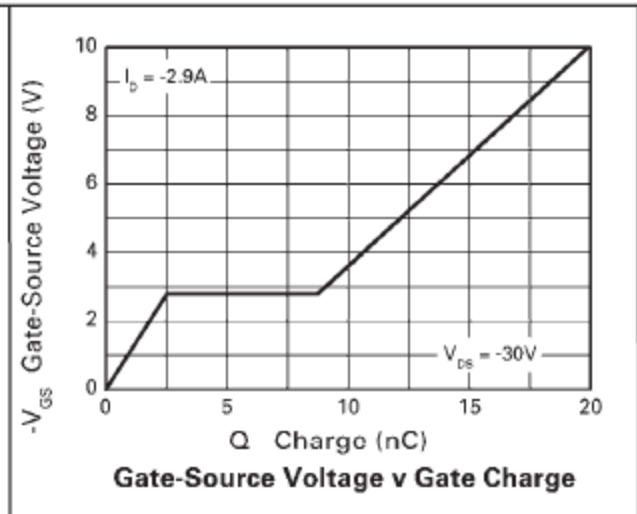
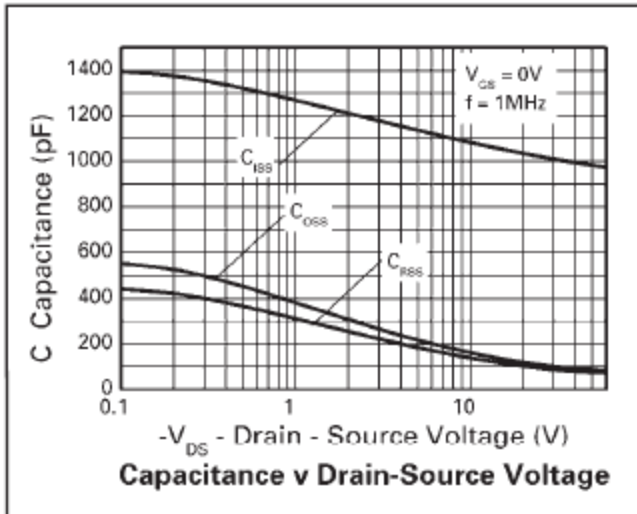
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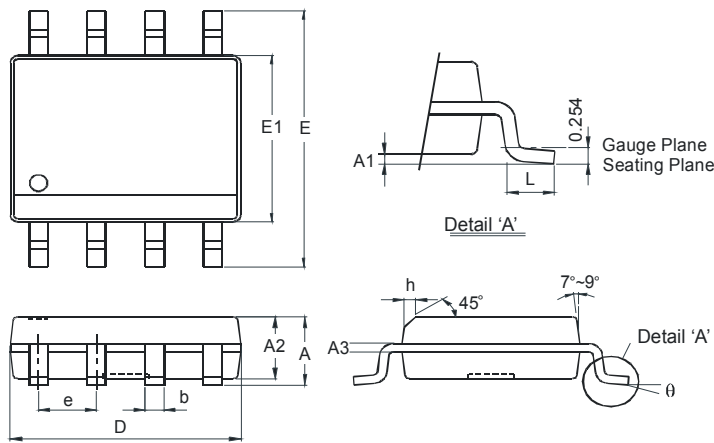
**P-Channel Typical Characteristics (cont.)**

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**Package Outline Dimensions**

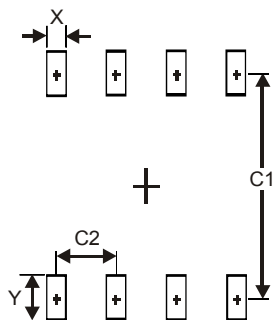
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



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 latest version.



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

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