

# ZXMC6A09DN8

## COMPLEMENTARY 60V ENHANCEMENT MODE MOSFET

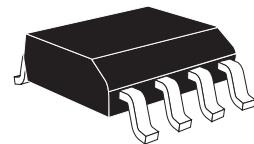
### SUMMARY

N-Channel  $V_{(BR)DSS} = 60V$ ;  $R_{DS(ON)} = 0.045\Omega$ ;  $I_D = 5.1A$

P-Channel  $V_{(BR)DSS} = -60V$ ;  $R_{DS(ON)} = 0.055\Omega$ ;  $I_D = -4.8A$

### DESCRIPTION

This new generation of trench MOSFETs from Zetex utilizes a unique structure that combines the benefits of low on-resistance with fast switching speed. This makes them ideal for high efficiency, low voltage, power management applications.



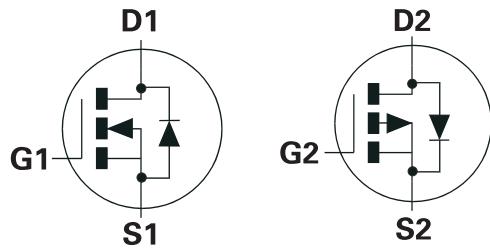
SO8

### FEATURES

- Low on-resistance
- Fast switching speed
- Low threshold
- Low gate drive
- Low profile SOIC package

### APPLICATIONS

- Motor drive
- LCD backlighting



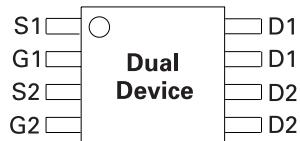
Q1 = N-CHANNEL

Q2 = P-CHANNEL

### ORDERING INFORMATION

| DEVICE        | REEL | TAPE WIDTH | QUANTITY PER REEL |
|---------------|------|------------|-------------------|
| ZXMC6A09DN8TA | 7"   | 12mm       | 500 units         |
| ZXMC6A09DN8TC | 13"  | 12mm       | 2500 units        |

### PINOUT



Top view

### DEVICE MARKING

ZXMC  
6A09

# ZXMC6A09DN8

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER  | SYMBOL        | N-Channel<br>I    | P-Channel            | UNIT                |
|--|---------------|-------------------|----------------------|---------------------|
| Drain-Source Voltage   | $V_{DSS}$     | 60                | -60                  | V                   |
| Gate-Source Voltage  | $V_{GS}$      | $\pm 20$          | $\pm 20$             | V                   |
| Continuous Drain Current@ $V_{GS}=10V$ ; $T_A=25^\circ C$ (b)(d)<br>@ $V_{GS}=10V$ ; $T_A=25^\circ C$ (b)(d)<br>@ $V_{GS}=10V$ ; $T_A=25^\circ C$ (a)(d) | $I_D$         | 5.1<br>4.1<br>3.9 | -4.8<br>-3.8<br>-3.7 | A<br>A              |
| Pulsed Drain Current (c)   | $I_{DM}$      | 25.4              | -23.8                | A                   |
| Continuous Source Current (Body Diode) (b)   | $I_S$         | 3.5               | -3.3                 | A                   |
| Pulsed Source Current (Body Diode) (c)   | $I_{SM}$      | 25.4              | -23.8                | A                   |
| Power Dissipation at $T_A=25^\circ C$ (a)(d)<br>Linear Derating Factor   | $P_D$         | 1.25<br>10        |                      | W<br>mW/ $^\circ C$ |
| Power Dissipation at $T_A=25^\circ C$ (a)(e)<br>Linear Derating Factor   | $P_D$         | 1.8<br>14         |                      | W<br>mW/ $^\circ C$ |
| Power Dissipation at $T_A=25^\circ C$ (b)(d)<br>Linear Derating Factor   | $P_D$         | 2.1<br>17         |                      | W<br>mW/ $^\circ C$ |
| Operating and Storage Temperature Range  | $T_j:T_{stg}$ | -55 to +150       |                      | $^\circ C$          |

## THERMAL RESISTANCE

| PARAMETER                  | SYMBOL          | VALUE | UNIT         |
|----------------------------|-----------------|-------|--------------|
| Junction to Ambient (a)(d) | $R_{\theta JA}$ | 100   | $^\circ C/W$ |
| Junction to Ambient (b)(e) | $R_{\theta JA}$ | 69    | $^\circ C/W$ |
| Junction to Ambient (b)(d) | $R_{\theta JA}$ | 58    | $^\circ C/W$ |

### Notes:

(a) For a dual device surface mounted on 25mm x 25mm FR4 PCB with coverage of single sided 1oz copper in still air conditions.

(b) For a dual device surface mounted on FR4 PCB measured at  $t \leq 10$  sec.

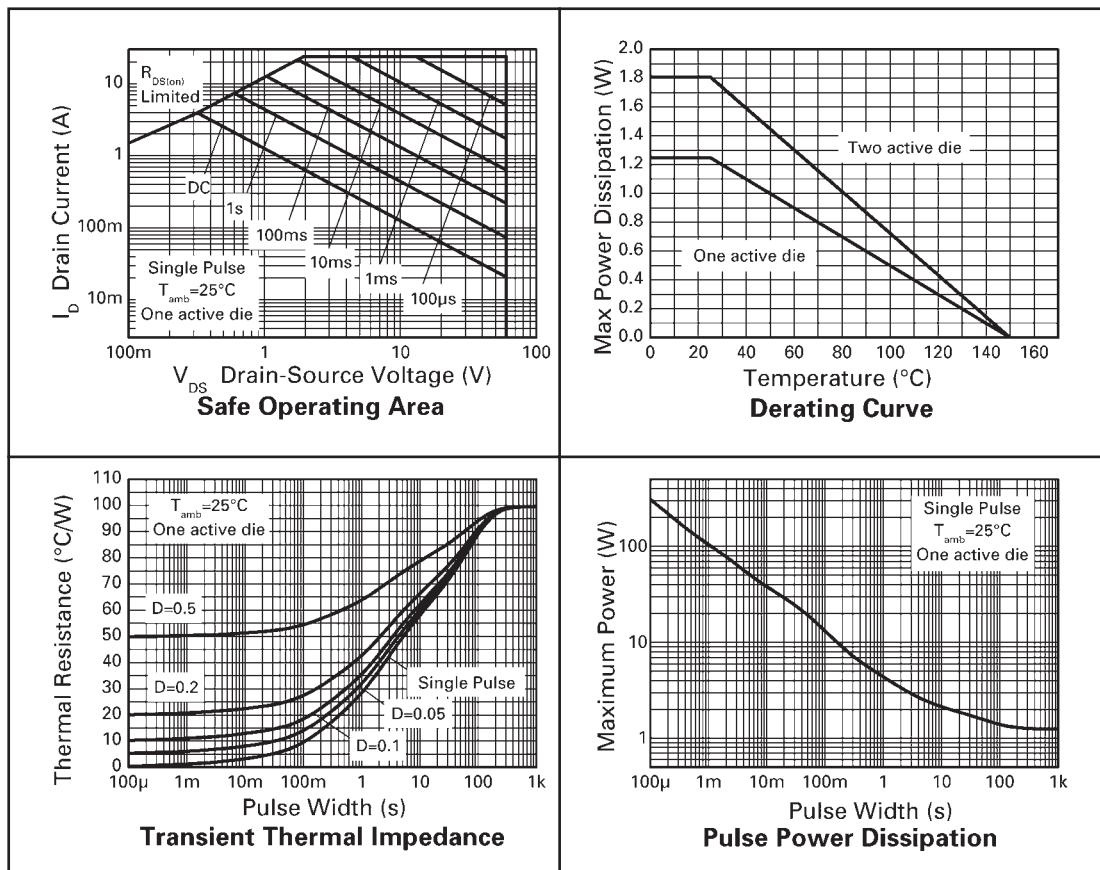
(c) Repetitive rating 25mm x 25mm FR4 PCB,  $D=0.02$  pulse width=300 $\mu s$  - pulse width limited by maximum junction temperature.

(d) For a dual device with one active die.

(e) For dual device with 2 active die running at equal power.

# ZXMC6A09DN8

## CHARACTERISTICS



# ZXMC6A09DN8

## N-CHANNEL

ELECTRICAL CHARACTERISTICS (at  $T_{amb} = 25^\circ C$  unless otherwise stated)

| PARAMETER  | SYMBOL        | MIN. | TYP. | MAX.           | UNIT     | CONDITIONS  |
|--|---------------|------|------|----------------|----------|---|
| <b>STATIC</b>  |               |      |      |                |          |   |
| Drain-Source Breakdown Voltage                         | $V_{(BR)DSS}$ | 60   |      |                | V        | $I_D=250\mu A, V_{GS}=0V$                             |
| Zero Gate Voltage Drain Current                        | $I_{DSS}$     |      |      | 1.0            | $\mu A$  | $V_{DS}=60V, V_{GS}=0V$                               |
| Gate-Body Leakage                                      | $I_{GSS}$     |      |      | 100            | nA       | $V_{GS}=\pm 20V, V_{DS}=0V$                           |
| Gate-Source Threshold Voltage                          | $V_{GS(th)}$  | 1.0  |      |                | V        | $I_D=250\mu A, V_{DS}=V_{GS}$                         |
| Static Drain-Source On-State Resistance <sup>(1)</sup> | $R_{DS(on)}$  |      |      | 0.045<br>0.070 | $\Omega$ | $V_{GS}=10V, I_D=8.2A$<br>$V_{GS}=4.5V, I_D=7.4A$     |
| Forward Transconductance <sup>(1)(3)</sup>             | $g_{fs}$      |      | 15   |                | S        | $V_{DS}=15V, I_D=8.2A$                                |
| <b>DYNAMIC <sup>(3)</sup></b>                          |               |      |      |                |          |   |
| Input Capacitance                                      | $C_{iss}$     |      | 1407 |                | pF       | $V_{DS}=40V, V_{GS}=0V,$<br>$f=1MHz$                  |
| Output Capacitance                                     | $C_{oss}$     |      | 121  |                | pF       |   |
| Reverse Transfer Capacitance                           | $C_{rss}$     |      | 59   |                | pF       |   |
| <b>SWITCHING <sup>(2) (3)</sup></b>                    |               |      |      |                |          |   |
| Turn-On Delay Time                                     | $t_{d(on)}$   |      | 4.9  |                | ns       | $V_{DD}=30V, I_D=1.0A$<br>$R_G=6.0\Omega, V_{GS}=10V$ |
| Rise Time  | $t_r$         |      | 3.3  |                | ns       |   |
| Turn-Off Delay Time                                    | $t_{d(off)}$  |      | 28.5 |                | ns       |   |
| Fall Time  | $t_f$         |      | 11.0 |                | ns       |   |
| Gate Charge  | $Q_g$         |      | 12.4 |                | nC       | $V_{DS}=15V, V_{GS}=5V,$<br>$I_D=3.5A$                |
| Total Gate Charge                                      | $Q_g$         |      | 24.2 |                | nC       | $V_{DS}=15V, V_{GS}=10V,$<br>$I_D=3.5A$               |
| Gate-Source Charge                                     | $Q_{gs}$      |      | 5.2  |                | nC       |   |
| Gate-Drain Charge                                      | $Q_{gd}$      |      | 3.5  |                | nC       |   |
| <b>SOURCE-DRAIN DIODE</b>                              |               |      |      |                |          |   |
| Diode Forward Voltage <sup>(1)</sup>                   | $V_{SD}$      |      | 0.85 | 0.95           | V        | $T_J=25^\circ C, I_S=6.6A,$<br>$V_{GS}=0V$            |
| Reverse Recovery Time <sup>(3)</sup>                   | $t_{rr}$      |      | 26.3 |                | ns       | $T_J=25^\circ C, I_F=3.5A,$<br>$di/dt=100A/\mu s$     |
| Reverse Recovery Charge <sup>(3)</sup>                 | $Q_{rr}$      |      | 26.6 |                | nC       |   |

## NOTES

(1) Measured under pulsed conditions. Width  $\leq 300\mu s$ . Duty cycle  $\leq 2\%$ .

(2) Switching characteristics are independent of operating junction temperature.

(3) For design aid only, not subject to production testing.



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# ZXMC6A09DN8

## P-CHANNEL

ELECTRICAL CHARACTERISTICS (at  $T_{amb} = 25^\circ C$  unless otherwise stated)

| PARAMETER  | SYMBOL        | MIN. | TYP.  | MAX.           | UNIT     | CONDITIONS   |
|--|---------------|------|-------|----------------|----------|--|
| <b>STATIC</b>  |               |      |       |                |          |  |
| Drain-Source Breakdown Voltage                         | $V_{(BR)DSS}$ | -60  |       |                | V        | $I_D=-250\mu A, V_{GS}=0V$                             |
| Zero Gate Voltage Drain Current                        | $I_{DSS}$     |      |       | -1.0           | $\mu A$  | $V_{DS}=-60V, V_{GS}=0V$                               |
| Gate-Body Leakage                                      | $I_{GSS}$     |      |       | 100            | nA       | $V_{GS}=\pm 20V, V_{DS}=0V$                            |
| Gate-Source Threshold Voltage                          | $V_{GS(th)}$  | -1.0 |       |                | V        | $I_D=-250\mu A, V_{DS}=V_{GS}$                         |
| Static Drain-Source On-State Resistance <sup>(1)</sup> | $R_{DS(on)}$  |      |       | 0.055<br>0.080 | $\Omega$ | $V_{GS}=-10V, I_D=-3.5A$<br>$V_{GS}=-4.5V, I_D=-2.9A$  |
| Forward Transconductance <sup>(1)(3)</sup>             | $g_{fs}$      |      | 9.3   |                | S        | $V_{DS}=-15V, I_D=-3.5A$                               |
| <b>DYNAMIC <sup>(3)</sup></b>                          |               |      |       |                |          |  |
| Input Capacitance                                      | $C_{iss}$     |      | 1706  |                | pF       |  |
| Output Capacitance                                     | $C_{oss}$     |      | 111   |                | pF       | $V_{DS}=-30V, V_{GS}=0V,$<br>$f=1MHz$                  |
| Reverse Transfer Capacitance                           | $C_{rss}$     |      | 68.0  |                | pF       |  |
| <b>SWITCHING <sup>(2)(3)</sup></b>                     |               |      |       |                |          |  |
| Turn-On Delay Time                                     | $t_{d(on)}$   |      | 2.3   |                | ns       |  |
| Rise Time  | $t_r$         |      | 29.0  |                | ns       |  |
| Turn-Off Delay Time                                    | $t_{d(off)}$  |      | 59.8  |                | ns       | $V_{DD}=-30V, I_D=-1A$<br>$R_G=6.0\Omega, V_{GS}=-10V$ |
| Fall Time  | $t_f$         |      | 28.1  |                | ns       |  |
| Gate Charge  | $Q_g$         |      | 20.8  |                | nC       | $V_{DS}=-30V, V_{GS}=-5V,$<br>$I_D=-3.5A$              |
| Total Gate Charge                                      | $Q_g$         |      | 41.0  |                | nC       | $V_{DS}=-30V, V_{GS}=-10V,$<br>$I_D=-3.5A$             |
| Gate-Source Charge                                     | $Q_{gs}$      |      | 4.1   |                | nC       |  |
| Gate-Drain Charge                                      | $Q_{gd}$      |      | 6.8   |                | nC       |  |
| <b>SOURCE-DRAIN DIODE</b>                              |               |      |       |                |          |  |
| Diode Forward Voltage <sup>(1)</sup>                   | $V_{SD}$      |      | -0.85 | -0.95          | V        | $T_J=25^\circ C, I_S=-4.2A,$<br>$V_{GS}=0V$            |
| Reverse Recovery Time <sup>(3)</sup>                   | $t_{rr}$      |      | 30.6  |                | ns       | $T_J=25^\circ C, I_F=-2.1A,$<br>$dI/dt=100A/\mu s$     |
| Reverse Recovery Charge <sup>(3)</sup>                 | $Q_{rr}$      |      | 41.3  |                | nC       |  |

## NOTES

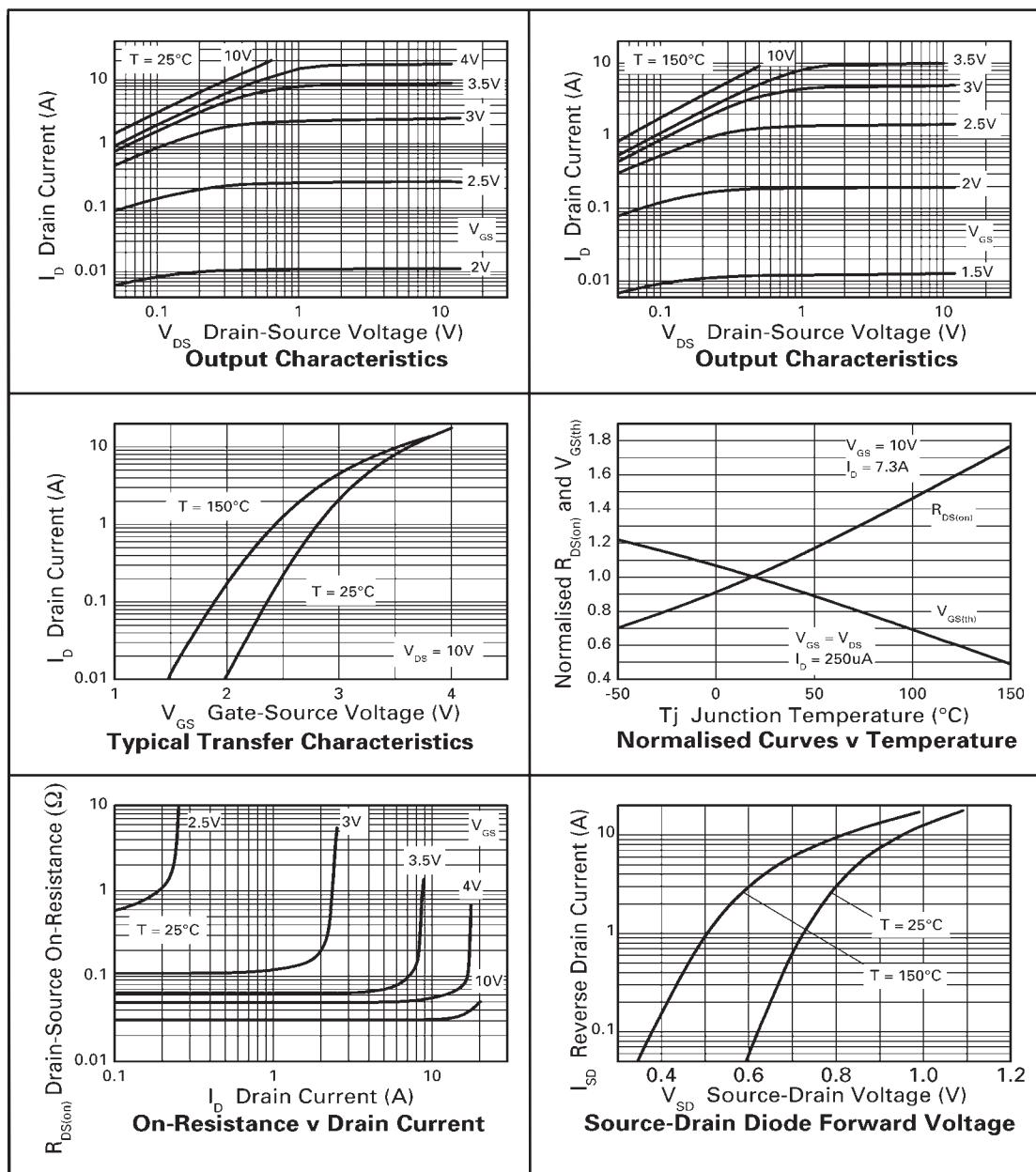
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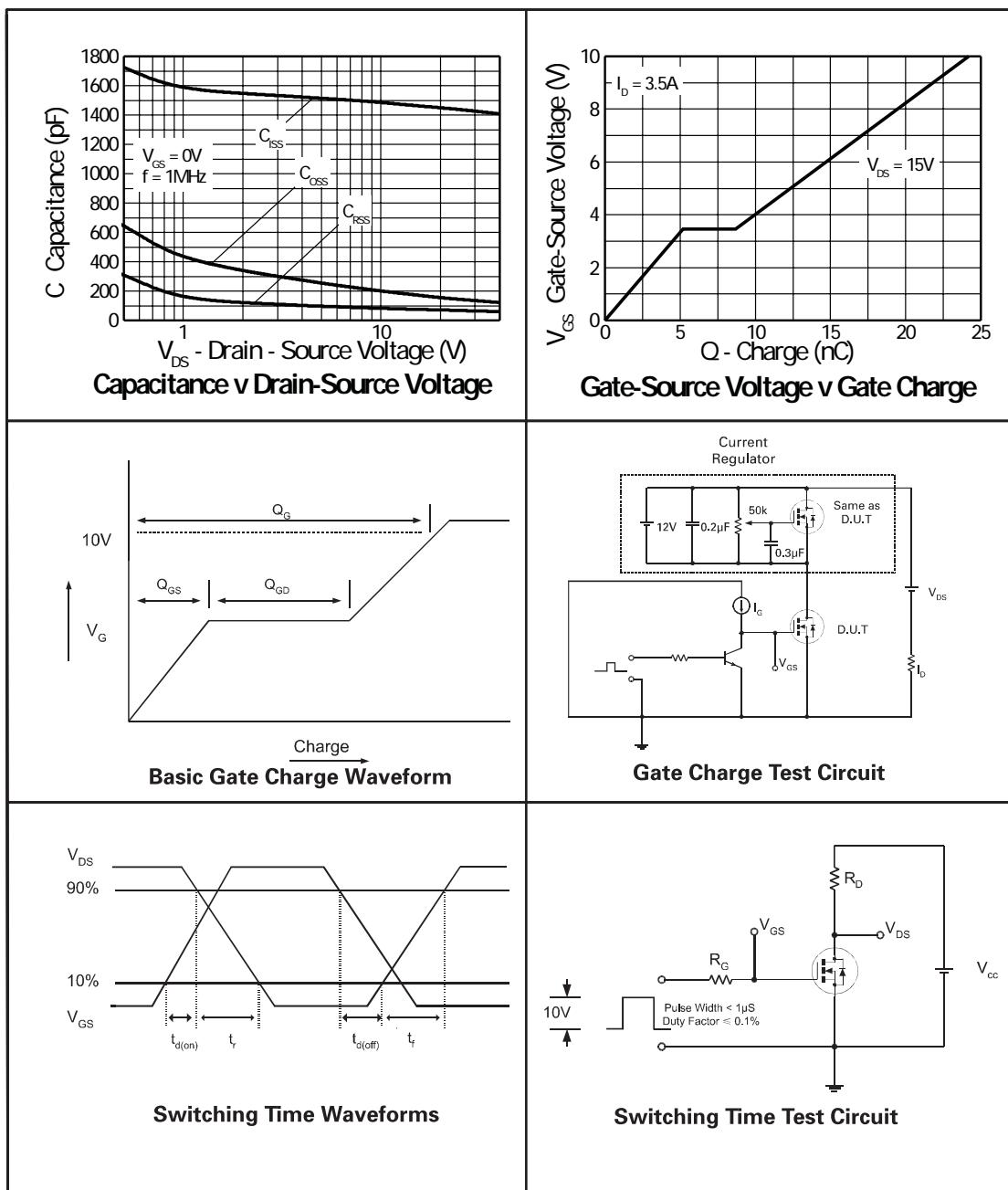
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## N-CHANNEL TYPICAL CHARACTERISTICS



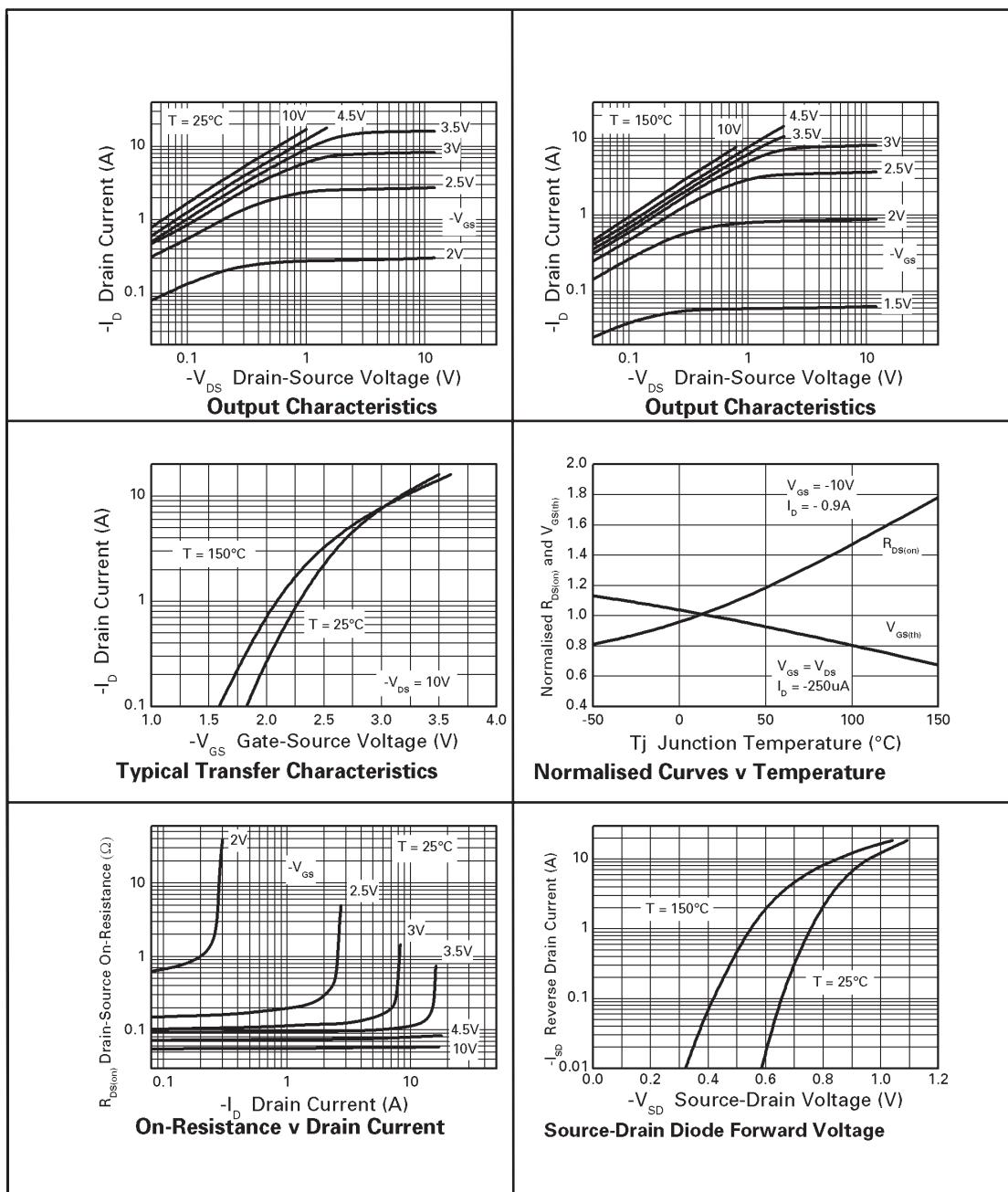
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## N-CHANNEL TYPICAL CHARACTERISTICS



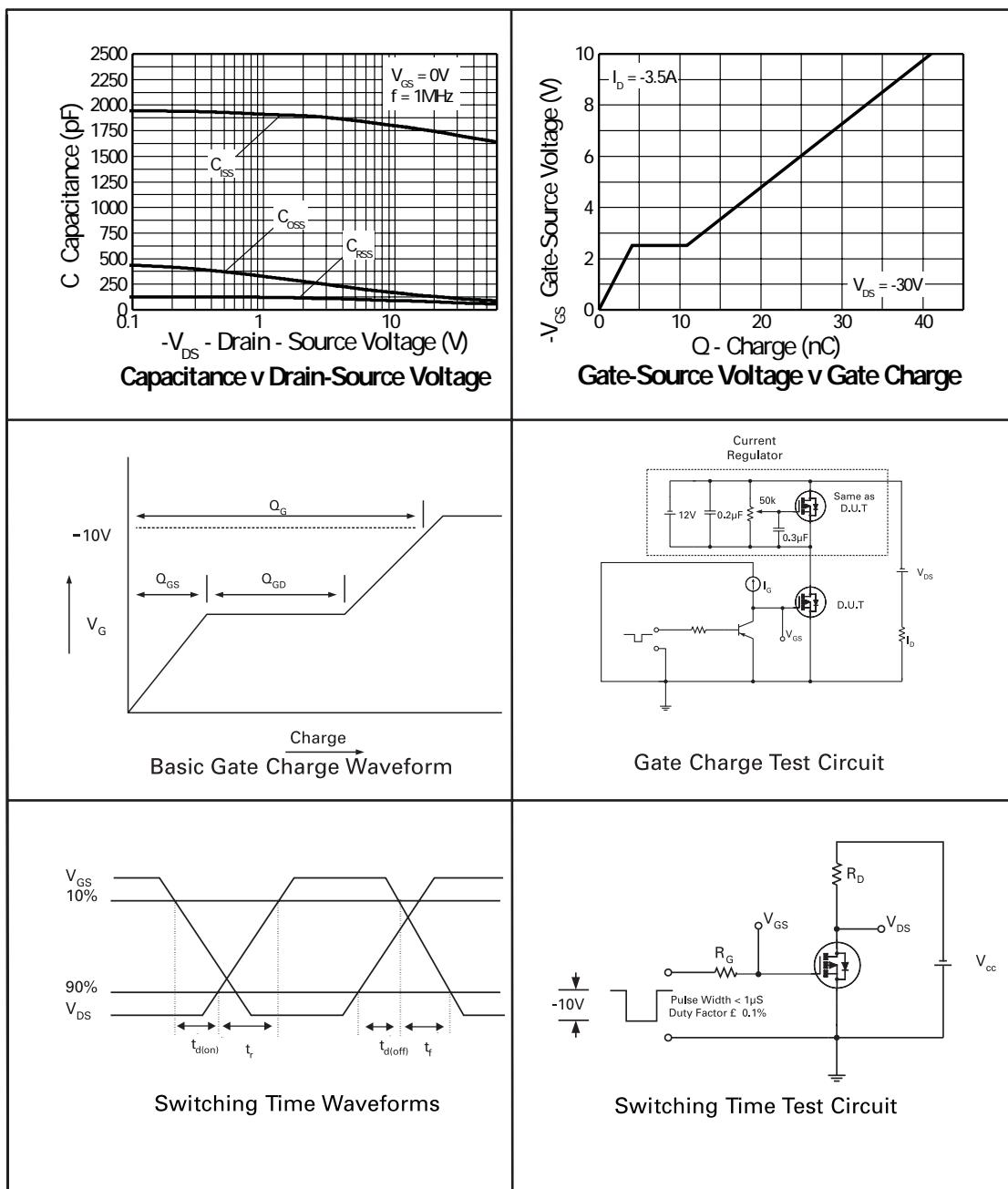
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## P-CHANNEL TYPICAL CHARACTERISTICS



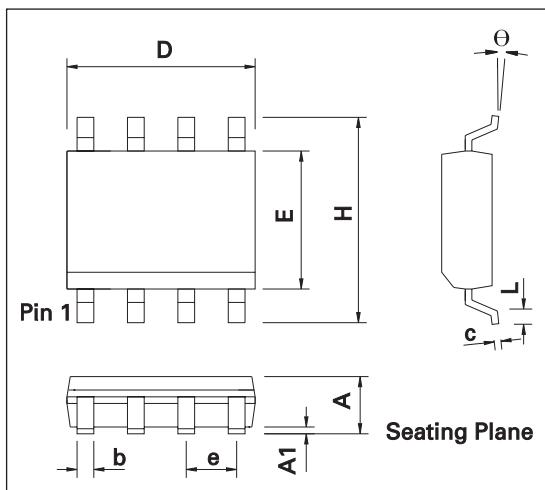
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## P-CHANNEL TYPICAL CHARACTERISTICS



# ZXMC6A09DN8

## PACKAGE OUTLINE



CONTROLLING DIMENSIONS ARE IN INCHES  
APPROX IN MILLIMETERS

## PACKAGE DIMENSIONS

| DIM | Millimeters |      | Inches |       | DIM | Millimeters |      | Inches    |       |
|-----|-------------|------|--------|-------|-----|-------------|------|-----------|-------|
|     | Min         | Max  | Min    | Max   |     | Min         | Max  | Min       | Max   |
| A   | 1.35        | 1.75 | 0.053  | 0.069 | e   | 1.27 BSC    |      | 0.050 BSC |       |
| A1  | 0.10        | 0.25 | 0.004  | 0.010 | b   | 0.33        | 0.51 | 0.013     | 0.020 |
| D   | 4.80        | 5.00 | 0.189  | 0.197 | c   | 0.19        | 0.25 | 0.008     | 0.010 |
| H   | 5.80        | 6.20 | 0.228  | 0.244 | θ   | 0°          | 8°   | 0°        | 8°    |
| E   | 3.80        | 4.00 | 0.150  | 0.157 | h   | 0.25        | 0.50 | 0.010     | 0.020 |
| L   | 0.40        | 1.27 | 0.016  | 0.050 | -   | -           | -    | -         | -     |

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