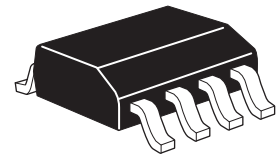


# ZXMN6A09DN8

## 60V SO8 N-channel enhancement mode MOSFET

### Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) |
|---------------|---------------------------|-----------|
| 60            | 0.040 @ $V_{GS} = 10V$    | 5.6       |
|               | 0.060 @ $V_{GS} = 4.5V$   | 4.6       |

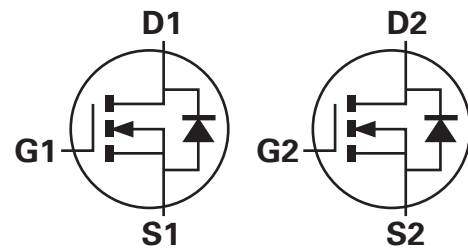


### Description

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.

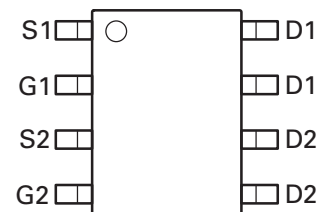
### Features

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



### Applications

- DC-DC converters
- Power management functions
- Disconnect switches
- Motor control



Top view

### Ordering information

| Device        | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---------------|--------------------|-----------------|-------------------|
| ZXMN6A09DN8TA | 7                  | 12              | 500               |

### Device marking

ZXMN  
6A09D

# ZXMN6A09DN8

## Absolute maximum ratings

| Parameter   | Symbol         | Limit       | Unit            |
|---|----------------|-------------|-----------------|
| Drain-source voltage  | $V_{DSS}$      | 60          | V               |
| Gate-source voltage   | $V_{GS}$       | $\pm 20$    | V               |
| Continuous drain current @ $V_{GS}=10V$ ; $T_{amb}=25^{\circ}C^{(b)}$ | $I_D$          | 5.6         | A               |
| @ $V_{GS}=10V$ ; $T_{amb}=70^{\circ}C^{(b)}$                          |                | 4.5         |                 |
| @ $V_{GS}=10V$ ; $T_{amb}=25^{\circ}C^{(a)}$                          |                | 4.3         |                 |
| Pulsed drain current <sup>(c)</sup>                                   | $I_{DM}$       | 27          | A               |
| Continuous source current (body diode) <sup>(b)</sup>                 | $I_S$          | 3.5         | A               |
| Pulsed source current (body diode) <sup>(c)</sup>                     | $I_{SM}$       | 27          | A               |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(a)(d)}$                 | $P_D$          | 1.25        | W               |
| Linear derating factor  |                | 10          | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(b)(e)}$                 | $P_D$          | 1.8         | W               |
| Linear derating factor  |                | 14          | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb} = 25^{\circ}C^{(b)(d)}$                 | $P_D$          | 2.1         | W               |
| Linear derating factor  |                | 17          | mW/ $^{\circ}C$ |
| Operating and storage temperature range                               | $T_j, T_{stg}$ | -55 to +150 | $^{\circ}C$     |

## Thermal resistance

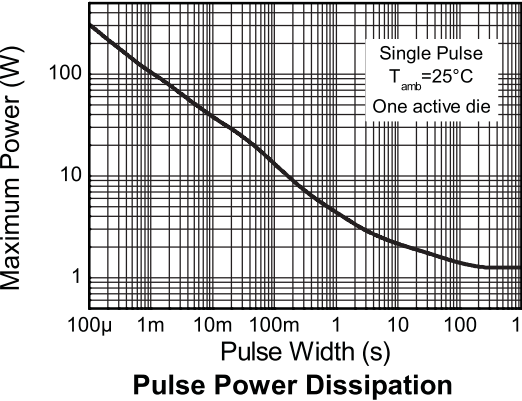
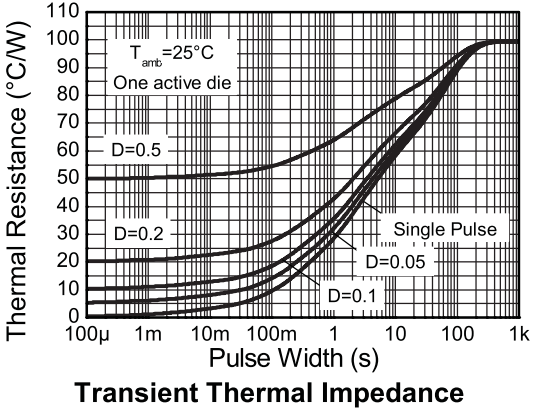
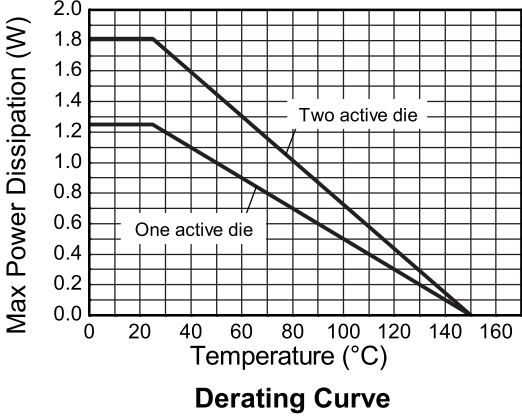
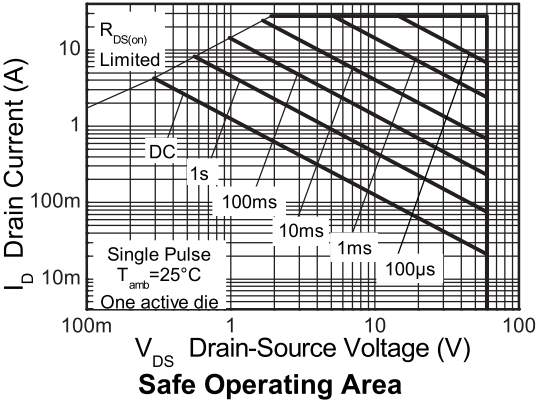
| Parameter                             | Symbol          | Limit | Unit          |
|---------------------------------------|-----------------|-------|---------------|
| Junction to ambient <sup>(a)(d)</sup> | $R_{\theta JA}$ | 100   | $^{\circ}C/W$ |
| Junction to ambient <sup>(a)(e)</sup> | $R_{\theta JA}$ | 70    | $^{\circ}C/W$ |
| Junction to ambient <sup>(b)(d)</sup> | $R_{\theta JA}$ | 60    | $^{\circ}C/W$ |

### NOTES:

- (a) For a device surface mounted on 25mm x 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.
- (b) For a 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 a device with two active die running at equal power.

# ZXMN6A09DN8

## Characteristics



# ZXMN6A09DN8

## Electrical characteristics (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated)

| Parameter                                   | Symbol        | Min. | Typ. | Max.  | Unit          | Conditions   |
|---|---------------|------|------|-------|---------------|--|
| <b>Static</b>                               |               |      |      |       |               |  |
| Drain-source breakdown voltage              | $V_{(BR)DSS}$ | 60   |      |       | V             | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$  |
| Zero gate voltage drain current             | $I_{DSS}$     |      |      | 1     | $\mu\text{A}$ | $V_{DS} = 60\text{V}$ , $V_{GS} = 0\text{V}$   |
| Gate-body leakage                           | $I_{GSS}$     |      |      | 100   | nA            | $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$   |
| Gate-source threshold voltage               | $V_{GS(th)}$  | 1.0  |      | 3.0   | V             | $I_D = 250\mu\text{A}$ , $V_{DS} = V_{GS}$   |
| Static drain-source on-state resistance (*) | $R_{DS(on)}$  |      |      | 0.040 | $\Omega$      | $V_{GS} = 10\text{V}$ , $I_D = 8.2\text{A}$  |
|   |               |      |      | 0.060 | $\Omega$      | $V_{GS} = 4.5\text{V}$ , $I_D = 7.4\text{A}$   |
| Forward transconductance(*) (‡)             | $g_{fs}$      |      | 15   |       | S             | $V_{DS} = 15\text{V}$ , $I_D = 8.2\text{A}$  |
| <b>Dynamic</b> (‡)                          |               |      |      |       |               |  |
| Input capacitance                           | $C_{iss}$     |      | 1407 |       | pF            | $V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$<br>$f = 1\text{MHz}$                              |
| Output capacitance                          | $C_{oss}$     |      | 121  |       | pF            |  |
| Reverse transfer capacitance                | $C_{rss}$     |      | 59   |       | pF            |  |
| <b>Switching</b> (†) (‡)                    |               |      |      |       |               |  |
| Turn-on-delay time                          | $t_{d(on)}$   |      | 4.9  |       | ns            | $V_{DD} = 15\text{V}$ , $I_D = 3.5\text{A}$<br>$R_G \approx 6.0\Omega$ , $V_{GS} = 10\text{V}$ |
| Rise time                                   | $t_r$         |      | 5.0  |       | ns            |  |
| Turn-off delay time                         | $t_{d(off)}$  |      | 25.3 |       | ns            |  |
| Fall time                                   | $t_f$         |      | 4.6  |       | ns            |  |
| Total gate charge                           | $Q_g$         |      | 12.4 |       | nC            | $V_{DS} = 15\text{V}$ , $V_{GS} = 5\text{V}$<br>$I_D = 3.5\text{A}$                            |
| Total gate charge                           | $Q_g$         |      | 24.2 |       | nC            | $V_{DS} = 15\text{V}$ , $V_{GS} = 5\text{V}$<br>$I_D = 3.5\text{A}$                            |
| Gate-source charge                          | $Q_{gs}$      |      | 5.2  |       | nC            |  |
| Gate drain charge                           | $Q_{gd}$      |      | 3.5  |       | nC            |  |
| <b>Source-drain diode</b>                   |               |      |      |       |               |  |
| Diode forward voltage(*)                    | $V_{SD}$      |      | 0.85 | 0.95  | V             | $T_j = 25^{\circ}\text{C}$ , $I_S = 6.6\text{A}$ ,<br>$V_{GS} = 0\text{V}$                     |
| Reverse recovery time(‡)                    | $t_{rr}$      |      | 26.3 |       | ns            | $T_j = 25^{\circ}\text{C}$ , $I_S = 3.5\text{A}$ ,<br>$di/dt = 100\text{A}/\mu\text{s}$        |
| Reverse recovery charge(‡)                  | $Q_{rr}$      |      | 26.6 |       | nC            |  |

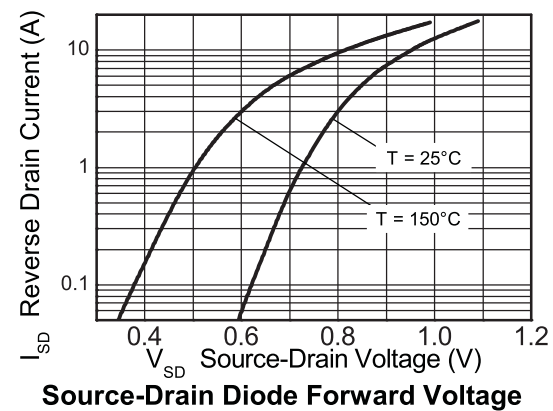
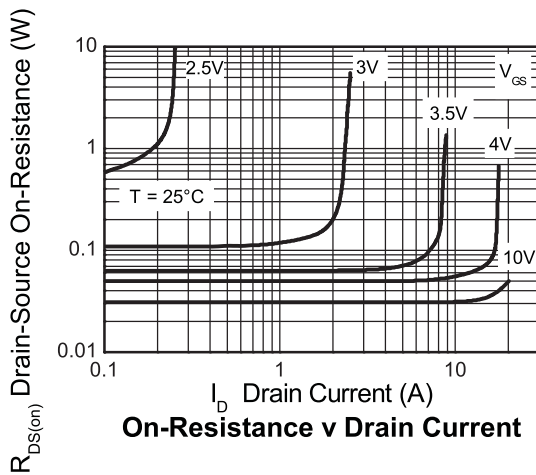
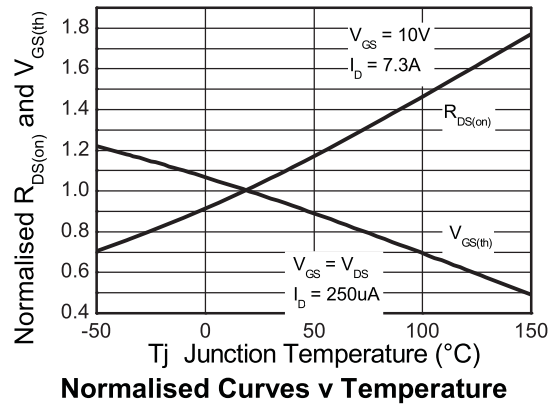
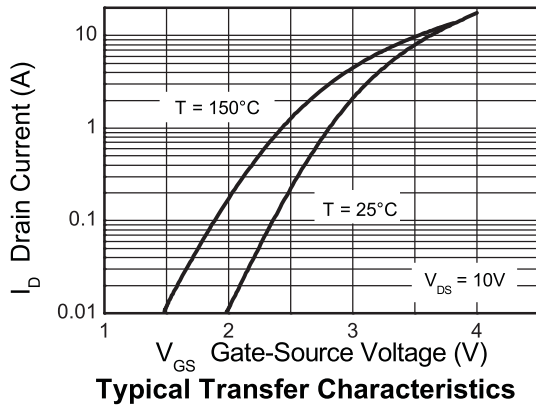
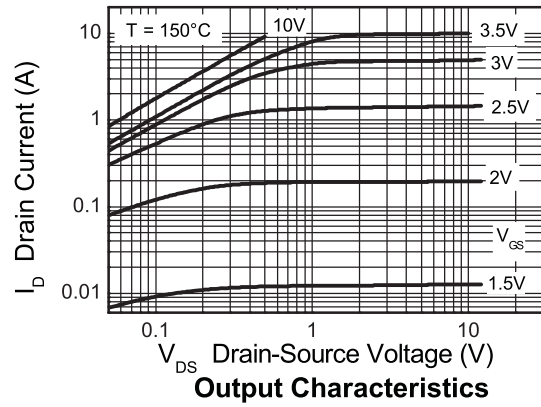
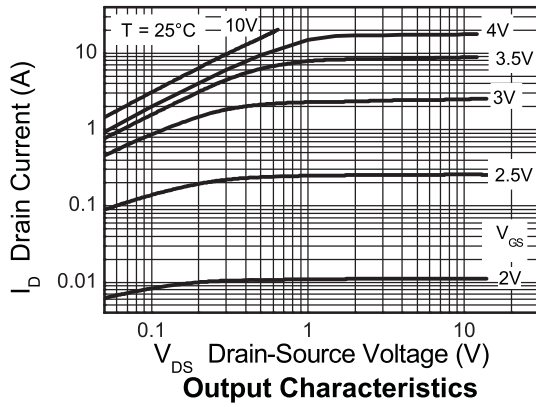
### NOTES:

(\*) Measured under pulsed conditions. Pulse width  $\leq 300\text{ s}$ ; duty cycle  $\leq 2\%$ .

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

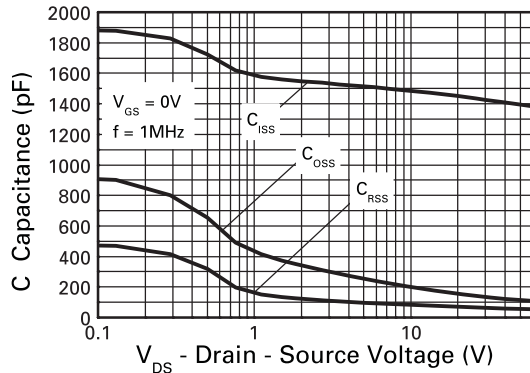
(‡) For design aid only, not subject to production testing.

## Typical characteristics

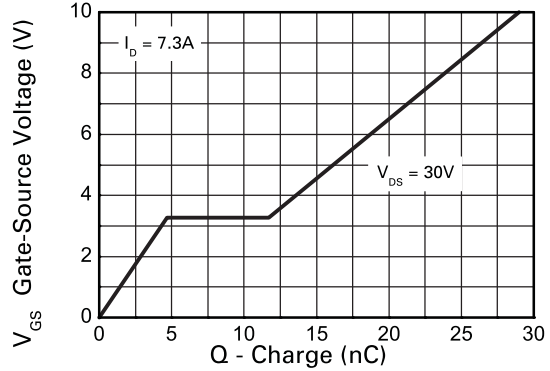


# ZXMN6A09DN8

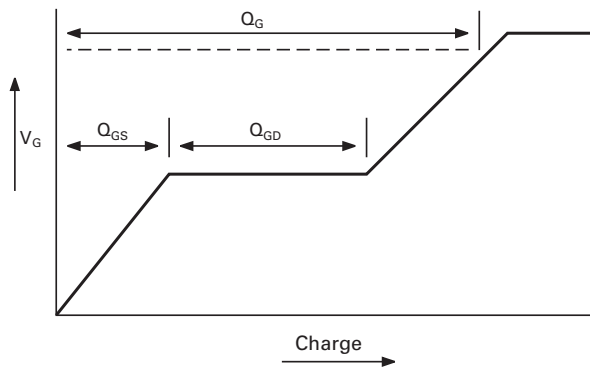
## Typical characteristics



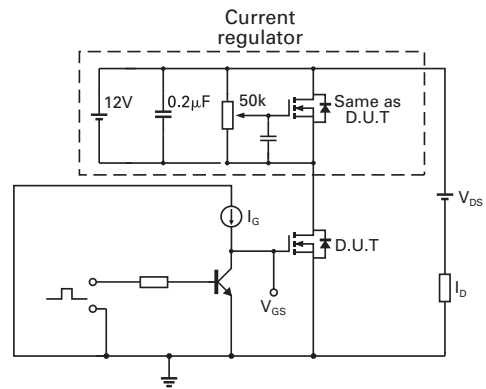
Capacitance v Drain-Source Voltage



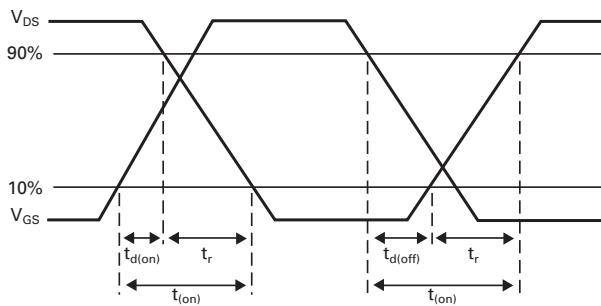
Gate-Source Voltage v Gate Charge



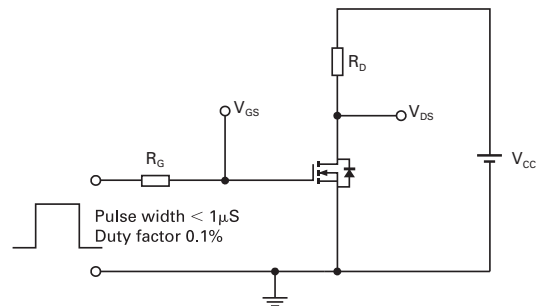
Basic gate charge waveform



Gate charge test circuit



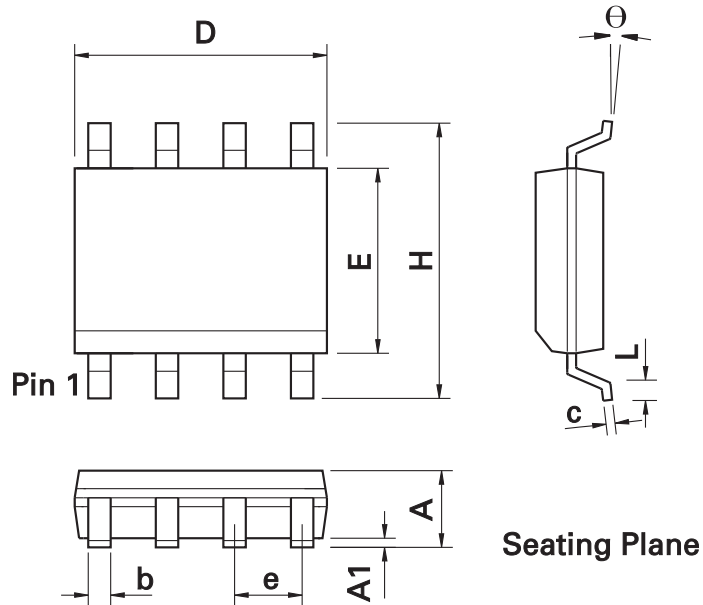
Switching time waveforms



Switching time test circuit

# ZXMN6A09DN8

## Package outline - SO8



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

**Note:** Controlling dimensions are in inches. Approximate dimensions are provided in millimeters

# ZXMN6A09DN8

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|-----------------------------------|--|
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|                       |   |
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