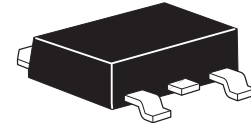


# ZXMN6A09K

## 60V N-channel enhancement mode MOSFET in DPAK

### Summary

$V_{(BR)DSS}=60V$  ;  $R_{DS(on)}=0.040\Omega$ ;  $I_D=12.2A$

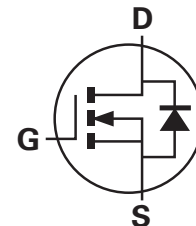


### Description

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.

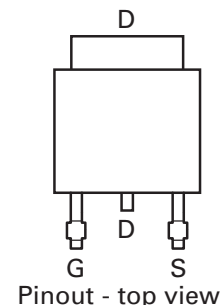
### Features

- Low on-resistance
- Fast switching speed
- Low threshold
- Low gate drive
- DPAK (T0-252) package



### Applications

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



### Ordering information

| Device      | Reel size (inches) | Tape width (mm) | Quantity per reel |
|-------------|--------------------|-----------------|-------------------|
| ZXMN6A09KTC | 13                 | 16              | 2500              |

### Device marking

ZXMN  
6A09K

# ZXMN6A09K

## 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 @ $V_{GS}=10V$ ; $T_{amb}=25^{\circ}C^{(b)}$ | $I_D$          | 12.2        | A               |
| @ $V_{GS}=10V$ ; $T_{amb}=70^{\circ}C^{(b)}$                          |                | 9.8         |                 |
| @ $V_{GS}=10V$ ; $T_{amb}=25^{\circ}C^{(a)}$                          |                | 7.9         |                 |
| Pulsed drain current <sup>(c)</sup>                                   | $I_{DM}$       | 43          | A               |
| Continuous source current (body diode) <sup>(b)</sup>                 | $I_S$          | 10.8        | A               |
| Pulsed source current (body diode) <sup>(c)</sup>                     | $I_{SM}$       | 43          | A               |
| Power dissipation at $T_{amb}=25^{\circ}C^{(a)}$                      | $P_D$          | 4.3         | W               |
| Linear derating factor  |                | 34.4        | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb}=25^{\circ}C^{(a)}$                      | $P_D$          | 10.1        | W               |
| Linear derating factor  |                | 80.8        | mW/ $^{\circ}C$ |
| Power dissipation at $T_{amb}=25^{\circ}C^{(a)}$                      | $P_D$          | 2.15        | W               |
| Linear derating factor  |                | 17.2        | mW/ $^{\circ}C$ |
| Operating and storage temperature range                               | $T_J, T_{stg}$ | -55 to +150 | $^{\circ}C$     |

## Thermal resistance

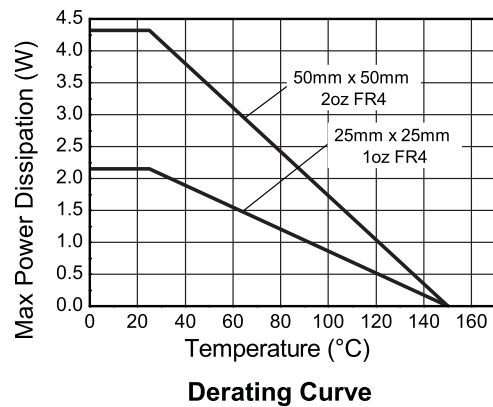
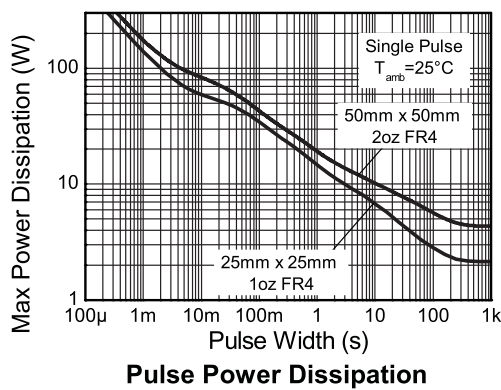
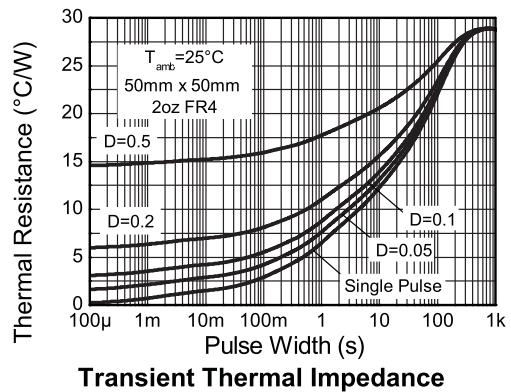
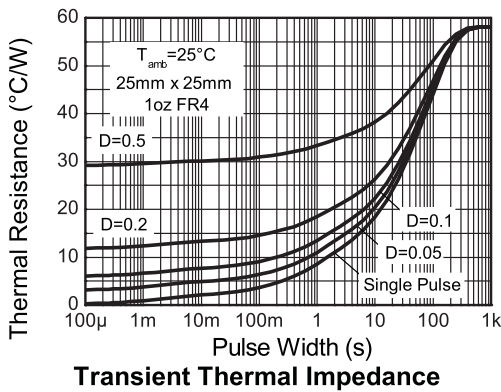
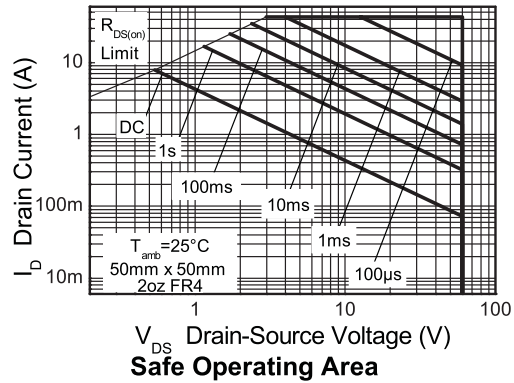
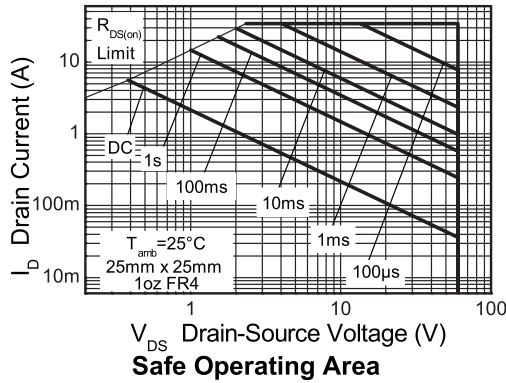
| Parameter                          | Symbol          | Limit | Unit          |
|------------------------------------|-----------------|-------|---------------|
| Junction to ambient <sup>(a)</sup> | $R_{\theta JA}$ | 29    | $^{\circ}C/W$ |
| Junction to ambient <sup>(b)</sup> | $R_{\theta JA}$ | 12.3  | $^{\circ}C/W$ |
| Junction to ambient <sup>(d)</sup> | $R_{\theta JA}$ | 58.1  | $^{\circ}C/W$ |

### NOTES:

- (a) For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions.
- (b) For a device surface mounted on FR4 PCB measured at  $t \leq 10$  sec.
- (c) Repetitive rating 50mm x 50mm x 1.6mm FR4 PCB,  $D=0.02$  pulse width=300 $\mu$ s - pulse width limited by maximum junction temperature.
- (d) For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.

# ZXMN6A09K

## Characteristics



# ZXMN6A09K

## 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 | $\Omega$      | $V_{GS} = 10\text{V}$ , $I_D = 7.3\text{A}$   |
|   |               |      |      | 0.060 | $\Omega$      | $V_{GS} = 4.5\text{V}$ , $I_D = 5.6\text{A}$  |
| Forward transconductance(*) (‡)             | $g_{fs}$      |      | 15   |       | S             | $V_{DS} = 15\text{V}$ , $I_D = 7.3\text{A}$   |
| <b>Dynamic (‡)</b>                          |               |      |      |       |               |   |
| Input capacitance                           | $C_{iss}$     |      | 1426 |       | pF            | $V_{DS} = 30\text{V}$ , $V_{GS} = 0\text{V}$<br>$f = 1\text{MHz}$   |
| Output capacitance                          | $C_{oss}$     |      | 134  |       | pF            |   |
| Reverse transfer capacitance                | $C_{rss}$     |      | 64   |       | pF            |   |
| <b>Switching (†) (‡)</b>                    |               |      |      |       |               |   |
| Turn-on-delay time                          | $t_{d(on)}$   |      | 4.8  |       | ns            | $V_{DD} = 30\text{V}$ , $I_D = 1\text{A}$<br>$R_G \approx 6.0\Omega$ , $V_{GS} = 10\text{V}$<br>(refer to test circuit) |
| Rise time                                   | $t_r$         |      | 4.6  |       | ns            |   |
| Turn-off delay time                         | $t_{d(off)}$  |      | 32.5 |       | ns            |   |
| Fall time                                   | $t_f$         |      | 14.5 |       | ns            |   |
| Total gate charge                           | $Q_g$         |      | 15   |       | nC            | $V_{DS} = 30\text{V}$ , $V_{GS} = 4.5\text{V}$<br>$I_D = 5.6\text{A}$   |
| Total gate charge                           | $Q_g$         |      | 29   |       | nC            | $V_{DS} = 30\text{V}$ , $V_{GS} = 10\text{V}$<br>$I_D = 7.3\text{A}$  |
| Gate-source charge                          | $Q_{gs}$      |      | 7.0  |       | nC            |   |
| Gate drain charge                           | $Q_{gd}$      |      | 4.7  |       | 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(‡)                    | $t_{rr}$      |      | 25.6 |       | ns            | $T_j = 25^{\circ}\text{C}$ , $I_S = 3\text{A}$ ,<br>$di/dt = 100\text{A}/\mu\text{s}$                                   |
| Reverse Recovery charge(‡)                  | $Q_{rr}$      |      | 26.0 |       | nC            |   |

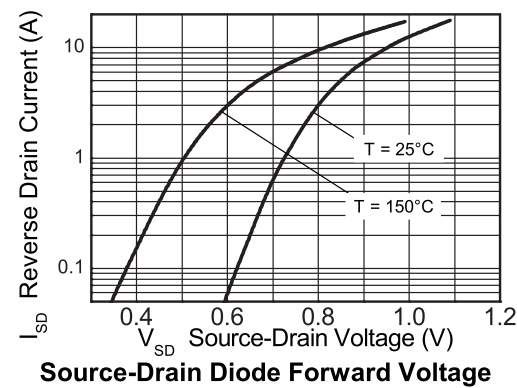
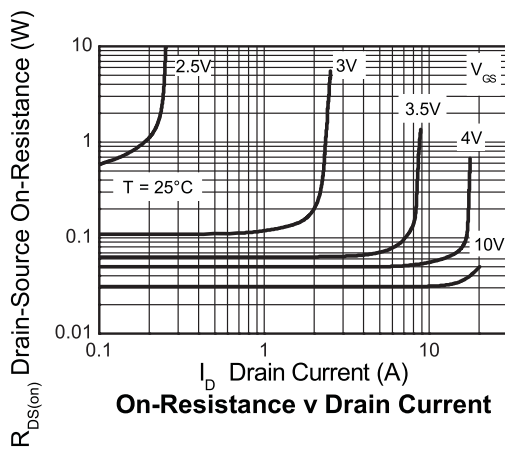
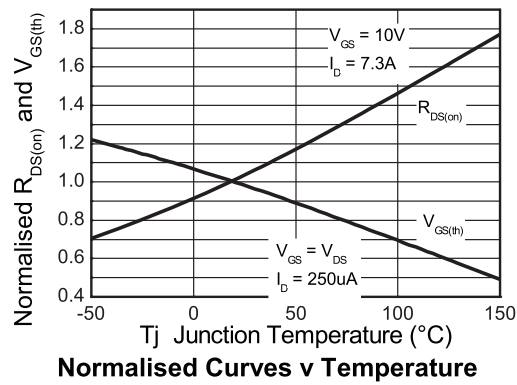
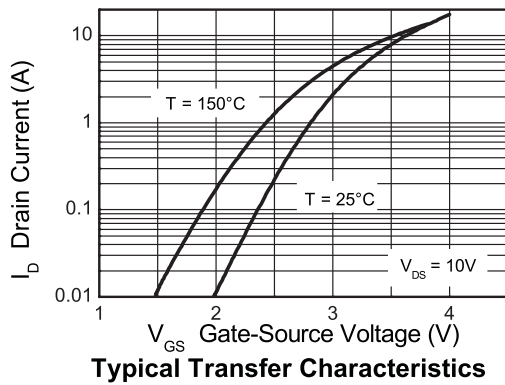
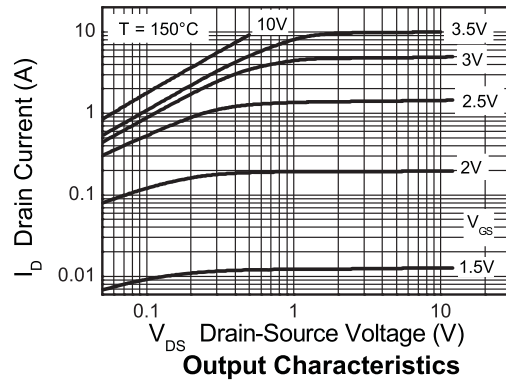
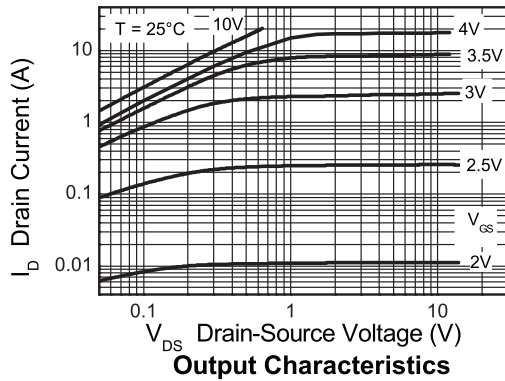
### NOTES:

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

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

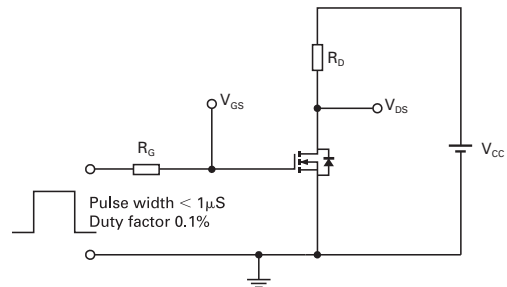
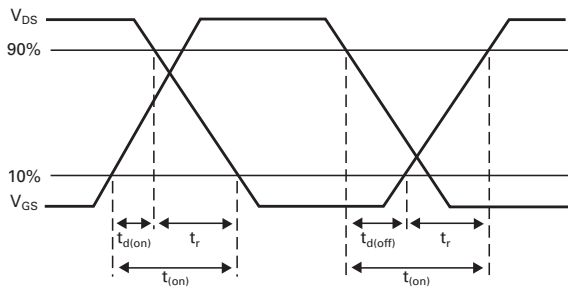
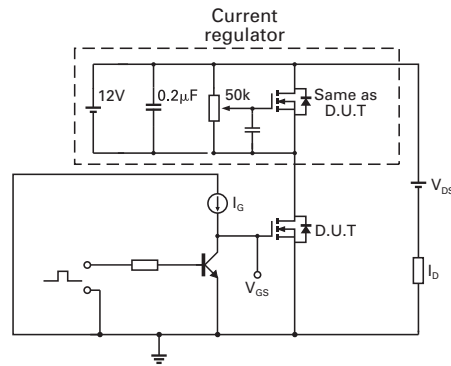
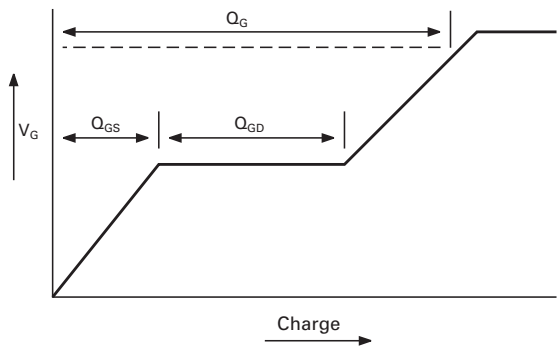
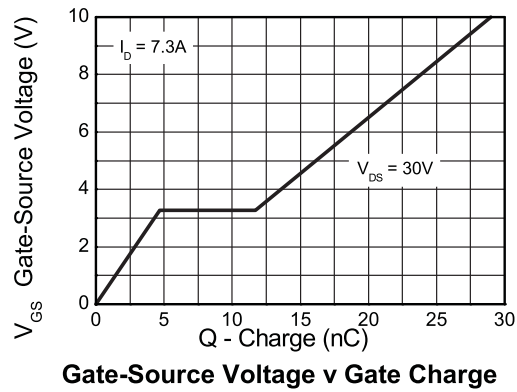
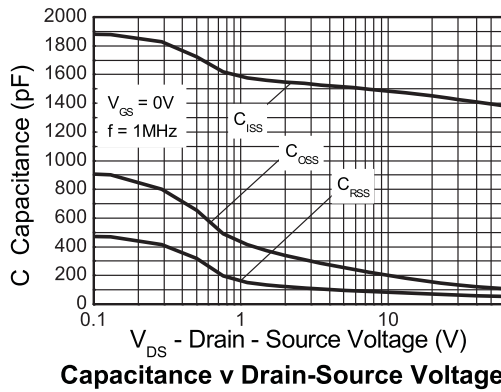
(‡) For design aid only, not subject to production testing.

## Typical characteristics



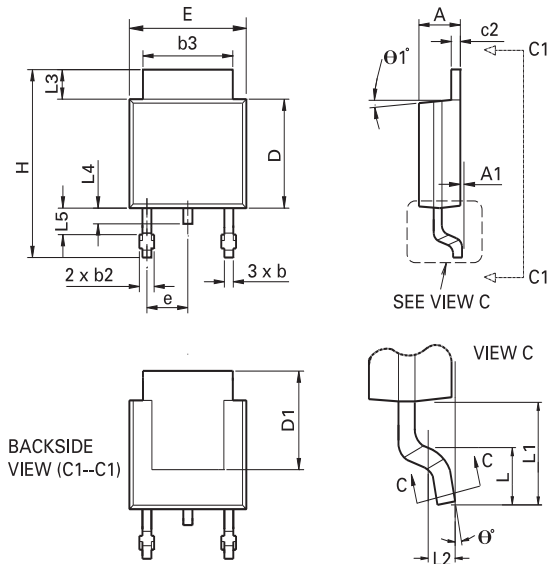
# ZXMN6A09K

## Typical characteristics



# ZXMN6A09K

## Package outline - DPAK



| DIM | Inches |       | Millimeters |       | DIM      | Inches    |       | Millimeters |       |
|-----|--------|-------|-------------|-------|----------|-----------|-------|-------------|-------|
|     | Min    | Max   | Min         | Max   |          | Min       | Max   | Min         | Max   |
| A   | 0.086  | 0.094 | 2.18        | 2.39  | e        | 0.090 BSC |       | 2.29 BSC    |       |
| A1  | -      | 0.005 | -           | 0.127 | H        | 0.370     | 0.410 | 9.40        | 10.41 |
| b   | 0.020  | 0.035 | 0.508       | 0.89  | L        | 0.055     | 0.070 | 1.40        | 1.78  |
| b2  | 0.030  | 0.045 | 0.762       | 1.14  | L1       | 0.108 REF |       | 2.74 REF    |       |
| b3  | 0.205  | 0.215 | 5.21        | 5.46  | L2       | 0.020 BSC |       | 0.508 BSC   |       |
| c   | 0.018  | 0.024 | 0.457       | 0.61  | L3       | 0.035     | 0.065 | 0.89        | 1.65  |
| c2  | 0.018  | 0.023 | 0.457       | 0.584 | L4       | 0.025     | 0.040 | 0.635       | 1.016 |
| D   | 0.213  | 0.245 | 5.41        | 6.22  | L5       | 0.045     | 0.060 | 1.14        | 1.52  |
| D1  | 0.205  | -     | 5.21        | -     | theta 1° | 0°        | 10°   | 0°          | 10°   |
| E   | 0.250  | 0.265 | 6.35        | 6.73  | theta°   | 0°        | 15°   | 0°          | 15°   |
| E1  | 0.170  | -     | 4.32        | -     | -        | -         | -     | -           | -     |

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

# ZXMN6A09K

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### Product status key:

|                                   |  |
|-----------------------------------|--|
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| "Active"                          | Product status recommended for new designs                                     |
| "Last time buy (LTB)"             | Device will be discontinued and last time buy period and delivery is in effect |
| "Not recommended for new designs" | Device is still in production to support existing designs and production       |
| "Obsolete"                        | Production has been discontinued   |

### Datasheet status key:

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