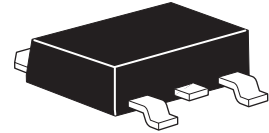


# ZXMN6A09K

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

### Summary

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

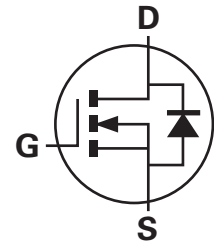


### Description

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.

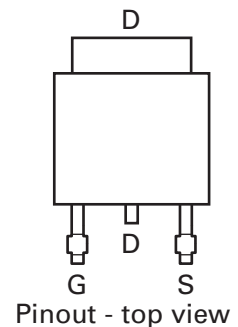
### Features

- 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	$^{\circ}C$

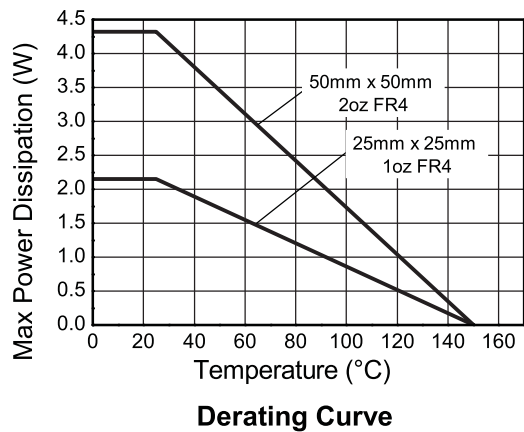
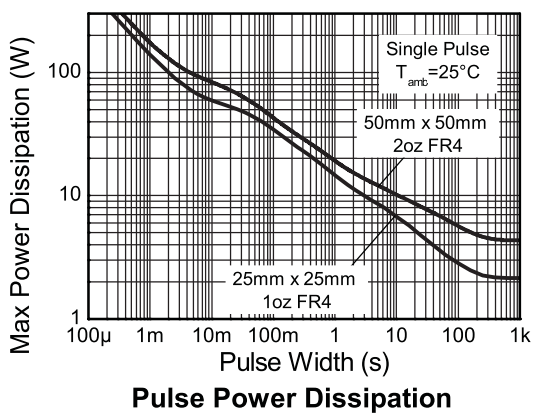
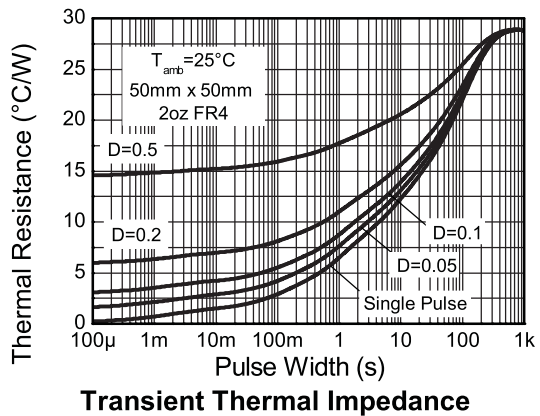
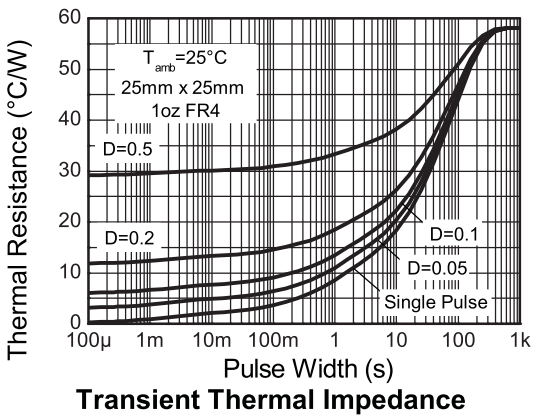
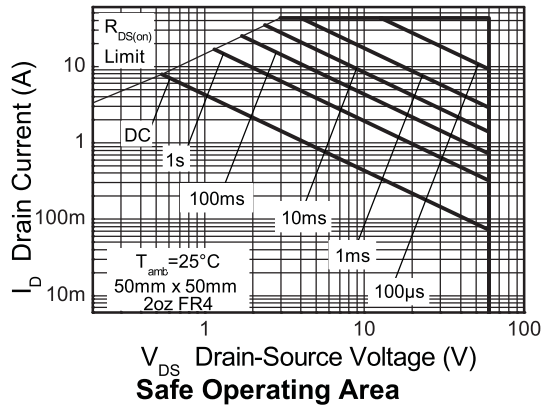
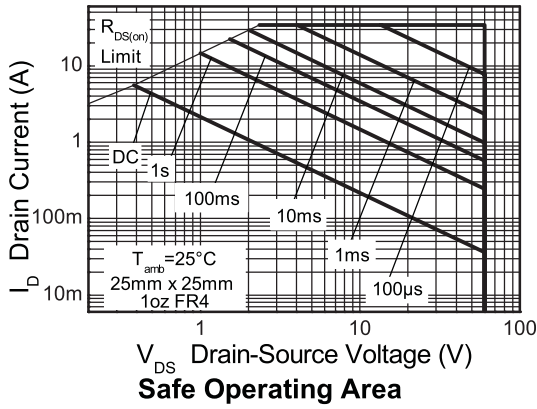
## Thermal resistance

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.

## 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	$V_{DS} = 30\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
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	$V_{DD} = 30\text{V}$ , $I_D = 1\text{A}$ $R_G \approx 6.0\Omega$ , $V_{GS} = 10\text{V}$ (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	$V_{DS} = 30\text{V}$ , $V_{GS} = 4.5\text{V}$ $I_D = 5.6\text{A}$
Total gate charge	$Q_g$		29		nC	$V_{DS} = 30\text{V}$ , $V_{GS} = 10\text{V}$ $I_D = 7.3\text{A}$
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	$T_j = 25^{\circ}\text{C}$ , $I_S = 6.6\text{A}$ , $V_{GS} = 0\text{V}$
Reverse recovery time (‡)	$t_{rr}$		25.6		ns	$T_j = 25^{\circ}\text{C}$ , $I_S = 3\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery charge (‡)	$Q_{rr}$		26.0		nC	

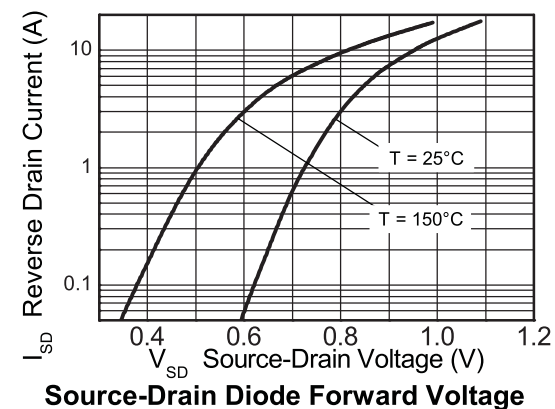
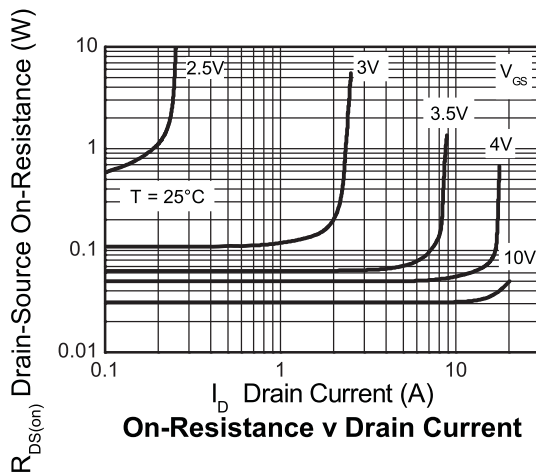
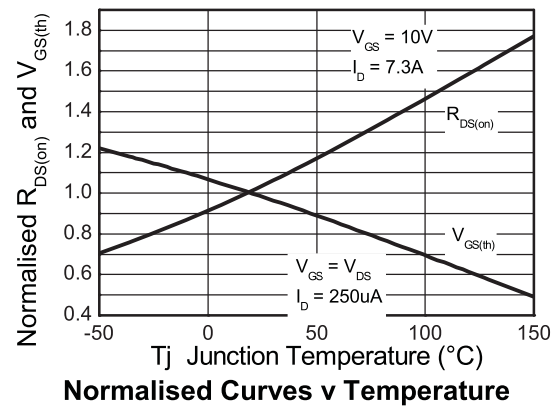
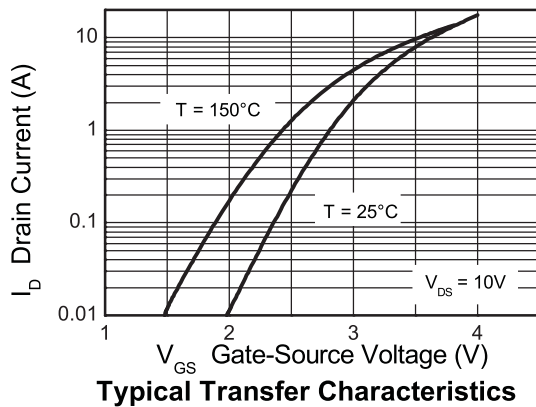
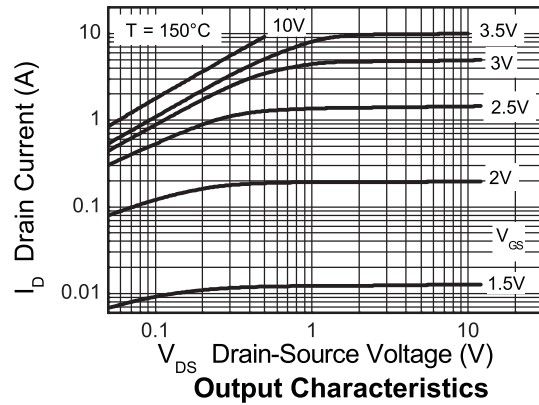
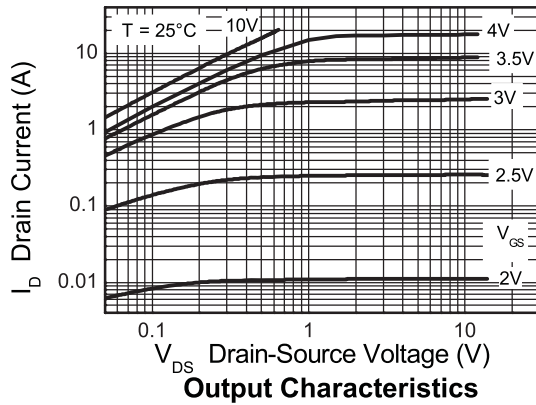
### NOTES:

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

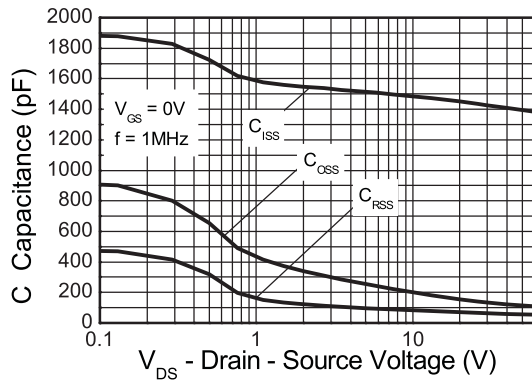
(†) Switching characteristics are independent of operating junction temperature.

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

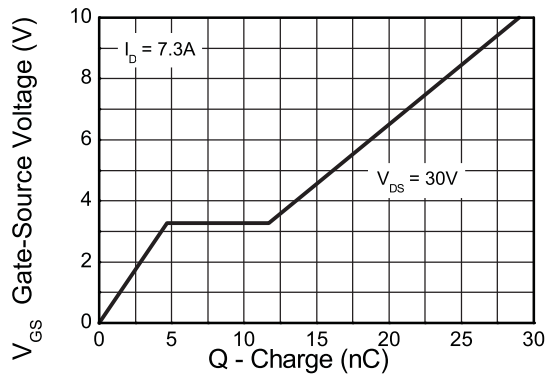
## Typical characteristics



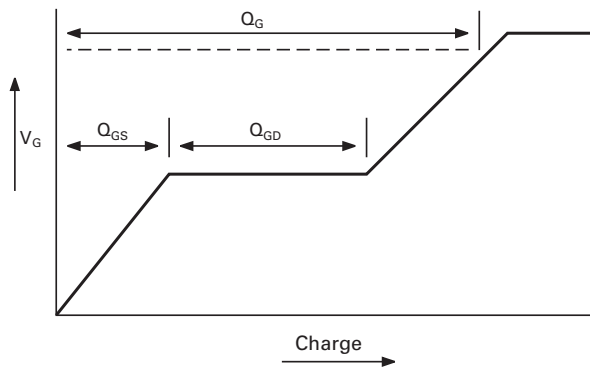
## Typical characteristics



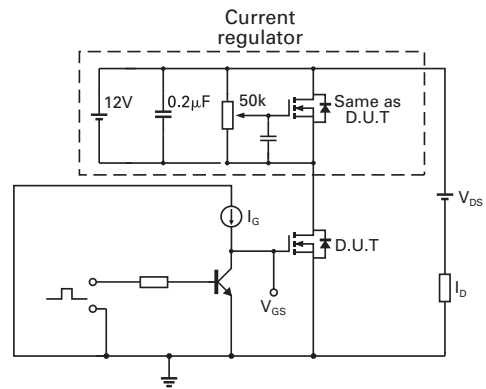
Capacitance v Drain-Source Voltage



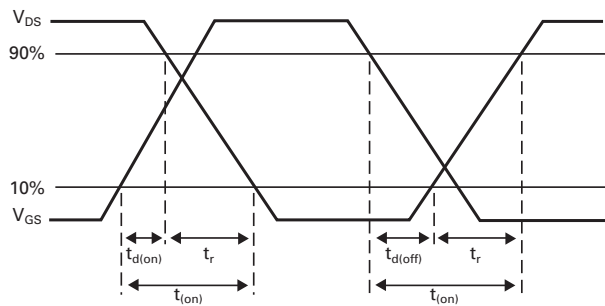
Gate-Source Voltage v Gate Charge



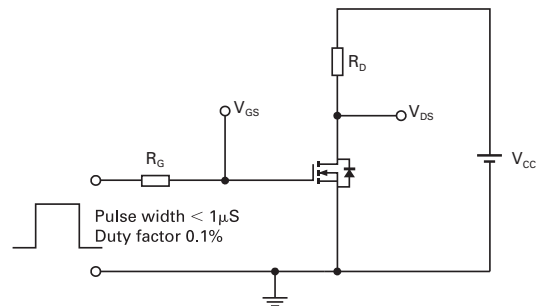
Basic gate charge waveform



Gate charge test circuit



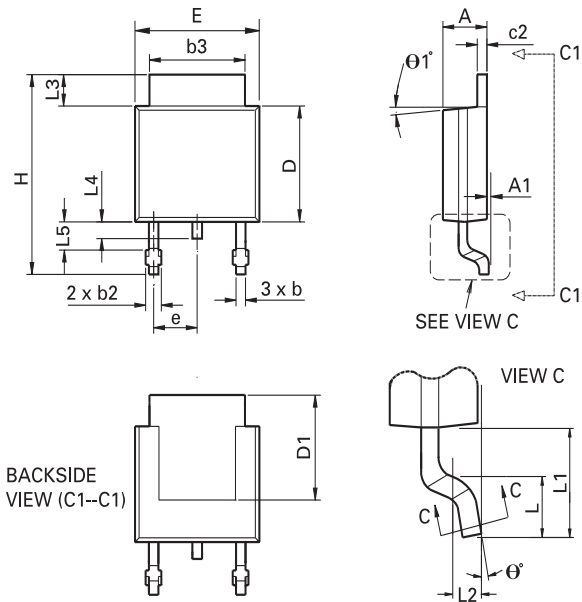
Switching time waveforms



Switching time test circuit

# 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°	0°	15°	0°	15°
E1	0.170	-	4.32	-	-	-	-	-	-

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

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### Zetex sales offices

Europe	Americas	Asia Pacific	Corporate Headquarters
Zetex GmbH Kustermann-park Balanstraße 59 D-81541 München Germany Telephone: (49) 89 45 49 49 0 Fax: (49) 89 45 49 49 49 europe.sales@zetex.com	Zetex Inc 700 Veterans Memorial Highway Hauppauge, NY 11788 USA Telephone: (1) 631 360 2222 Fax: (1) 631 360 8222 usa.sales@zetex.com	Zetex (Asia Ltd) 3701-04 Metroplaza Tower 1 Hing Fong Road, Kwai Fong Hong Kong Telephone: (852) 26100 611 Fax: (852) 24250 494 asia.sales@zetex.com	Zetex Semiconductors plc Zetex Technology Park, Chadderton Oldham, OL9 9LL United Kingdom Telephone: (44) 161 622 4444 Fax: (44) 161 622 4446 hq@zetex.com

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