优尚

YOUSHANG SEMICONDUCTOR

# 设计研发新型功率器件

## 各类小信号开关

## 中低压及高压大电流等场效应管

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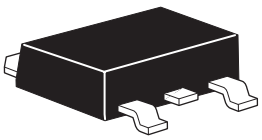
## Summary

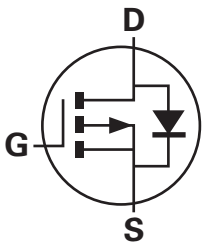


**$V_{(BR)DSS}$= -40V; $R_{DS(ON)}$= 0.060Ω $I_D$= -9.9A**

## 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 package

## Applications

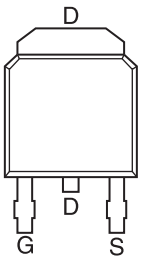
- DC - DC converters
- Audio output stages
- Relay and solenoid driving
- Motor control

## Ordering information

| Device | Reel size (inches) | Tape width | Quantity per reel |
|---|---|---|---|
| NK-ZXMP4A16KTC | 13 | 16mm | 2500 units |

## Device marking

NK-ZXMP
4A16




Pinout - Top view

## Absolute maximum rating

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-source voltage | $V_{DSS}$ | -40 | V |
| Gate-source voltage | $V_{GS}$ | ±20 | V |
| Continuous drain current<br>$V_{GS}$= -10V; $T_A$=25°C (b)<br>$V_{GS}$= -10V; $T_A$=70°C (b)<br>$V_{GS}$= -10V; $T_A$=25°C (a) | $I_D$ | <br>-9.9<br>-8.0<br>-6.6 | <br>A<br>A<br>A |
| Pulsed drain current (c) | $I_{DM}$ | -35 | A |
| Continuous source current (body diode) (b) | $I_S$ | -10.1 | A |
| Pulsed source current (body diode) (c) | $I_{SM}$ | -35 | A |
| Power dissipation at $T_A$=25°C (a)<br>Linear derating factor | $P_D$ | 4.2<br>33.6 | W<br>mW/°C |
| Power dissipation at $T_A$=25°C (b)<br>Linear derating factor | $P_D$ | 9.5<br>76 | W<br>mW/°C |
| Power dissipation at $T_A$=25°C (d)<br>Linear derating factor | $P_D$ | 2.15<br>17.2 | W<br>mW/°C |
| Operating and storage temperature range | $T_j$:$T_{stg}$ | -55 to +150 | °C |

## Thermal resistance

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction to ambient (a) | $R_{\Theta JA}$ | 30 | °C/W |
| Junction to ambient (b) | $R_{\Theta JA}$ | 13.2 | °C/W |
| Junction to ambient (d) | $R_{\Theta JA}$ | 58 | °C/W |

**NOTES:**

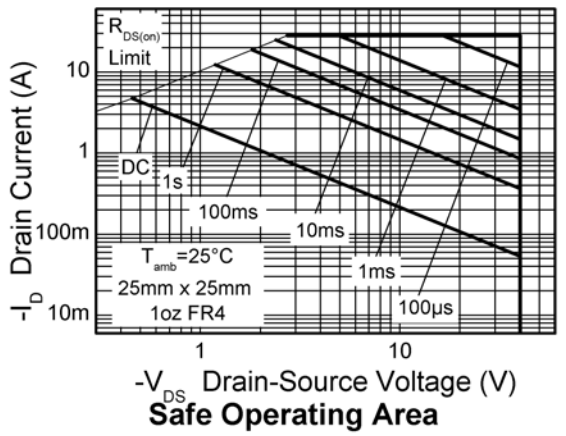
(a) For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions.

(b) For a device surface mounted on FR4 PCB measured at t ≤10 sec.

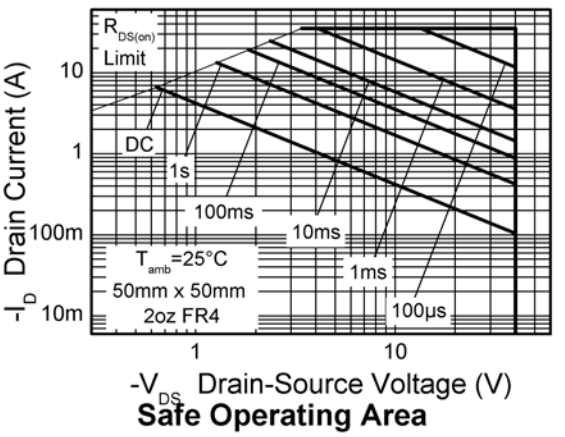
(c) Repetitive rating 50mm x 50mm x 1.6mm FR4 PCB, D=0.02 pulse width=300μs - pulse width limited by maximum junction temperature.

(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.

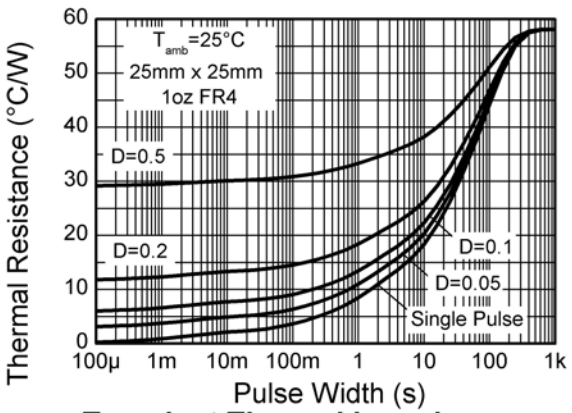
## Characteristics



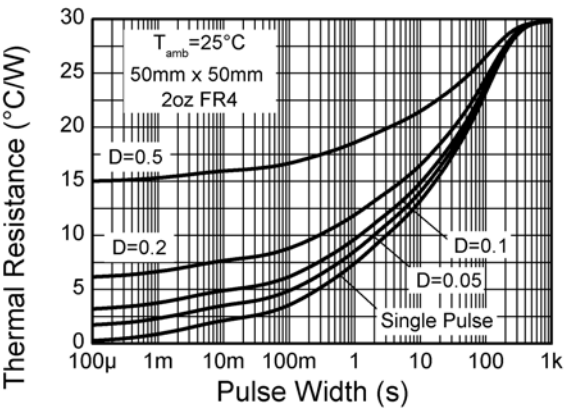
Safe Operating Area



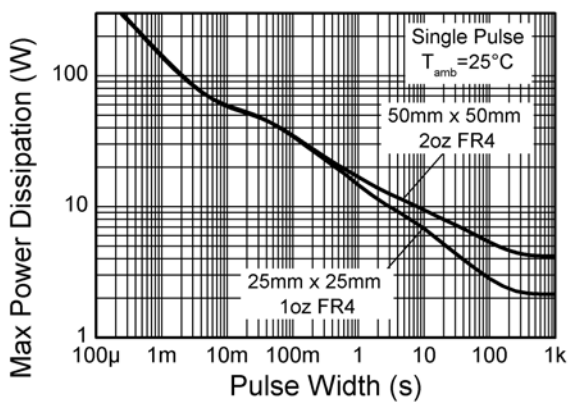
Safe Operating Area



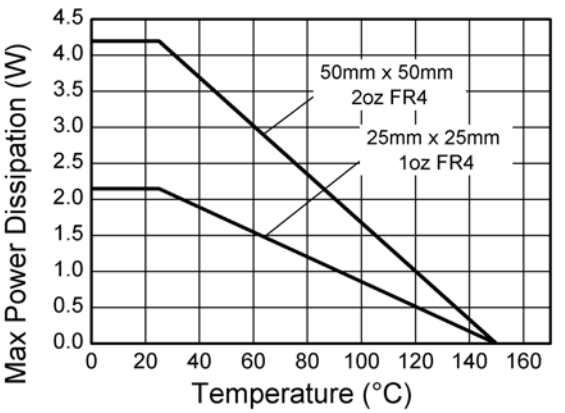
Transient Thermal Impedance



Transient Thermal Impedance



Pulse Power Dissipation



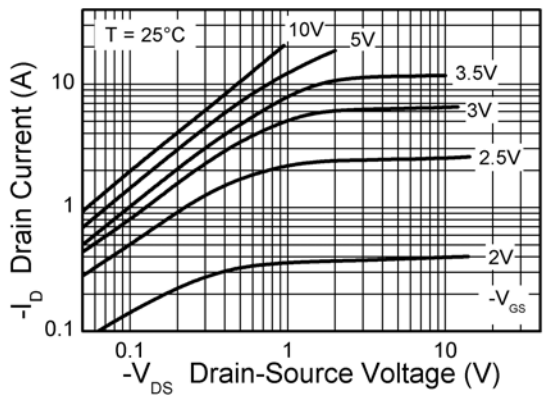
Derating Curve

## Electrical characteristics (at $T_A$ = 25°C unless otherwise stated)

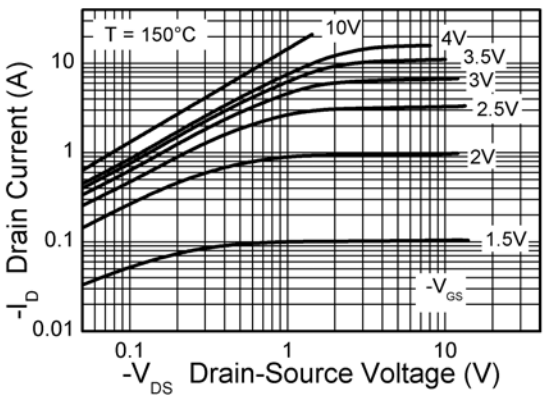
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | -40 | | | V | $I_D$=-250μA, $V_{GS}$=0V |
| Zero gate voltage drain current | $I_{DSS}$ | | | -1 | μA | $V_{DS}$=-40V, $V_{GS}$=0V |
| Gate-body leakage | $I_{GSS}$ | | | 100 | nA | $V_{GS}$ =±20V, $V_{DS}$=0V |
| Gate-source threshold voltage | $V_{GS(th)}$ | -1.0 | | | V | $I_D$=-250μA, $V_{DS}$=$V_{GS}$ |
| Static drain-source on-state resistance (*) | $R_{DS(on)}$ | | | 0.060<br>0.100 | Ω<br>Ω | $V_{GS}$=-10V, $I_D$=-3.8A<br>$V_{GS}$=-4.5V, $I_D$=-2.9A |
| Forward transconductance (*)(‡) | $g_{fs}$ | | 7.4 | | S | $V_{DS}$=-15V,$I_D$=-3.8A |
| **Dynamic** (‡) | | | | | | |
| Input capacitance | $C_{iss}$ | | 965 | | pF | $V_{DS}$=-20V, $V_{GS}$=0V, f=1MHz |
| Output capacitance | $C_{oss}$ | | 180 | | pF | |
| Reverse transfer capacitance | $C_{rss}$ | | 158 | | pF | |
| **Switching** (†) (‡) | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | | 4.0 | | ns | $V_{DD}$ =-20V, $I_D$=-1A $R_G$=6.0Ω,$V_{GS}$=-10V |
| Rise time | $t_r$ | | 6.0 | | ns | |
| Turn-off delay time | $t_{d(off)}$ | | 36.8 | | ns | |
| Fall time | $t_f$ | | 17.1 | | ns | |
| Gate charge | $Q_g$ | | 16.5 | | nC | $V_{DS}$=-20V,$V_{GS}$=-5V, $I_D$=-3.8A |
| Total gate charge | $Q_g$ | | 29.6 | | nC | $V_{DS}$=-20V,$V_{GS}$=-10V, $I_D$=-3.8A |
| Gate-source charge | $Q_{gs}$ | | 2.8 | | nC | |
| Gate-drain charge | $Q_{gd}$ | | 8.1 | | nC | |
| **Source-drain diode** | | | | | | |
| Diode forward voltage (*) | $V_{SD}$ | | -0.89 | -1.2 | V | $T_J$=25°C, $I_S$=-3.8A, $V_{GS}$=0V |
| Reverse recovery time (‡) | $t_{rr}$ | | 29.8 | | ns | $T_J$=25°C, $I_F$=-3.8A, di/dt= 100A/μs |
| Reverse recovery charge (‡) | $Q_{rr}$ | | 37.2 | | nC | |

**NOTES:**
(*) Measured under pulsed conditions. Width ≤ 300μs. Duty cycle ≤ 2%.
(†) Switching characteristics are independent of operating junction temperature.
(‡) For design aid only, not subject to production testing.

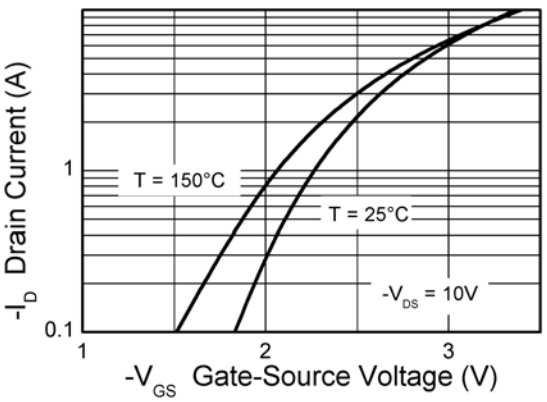
## Typical characteristics



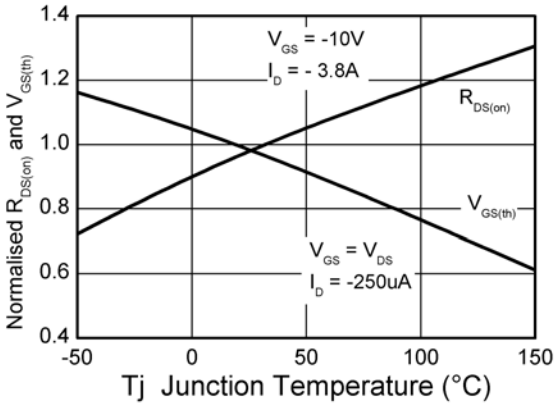

**Output Characteristics**



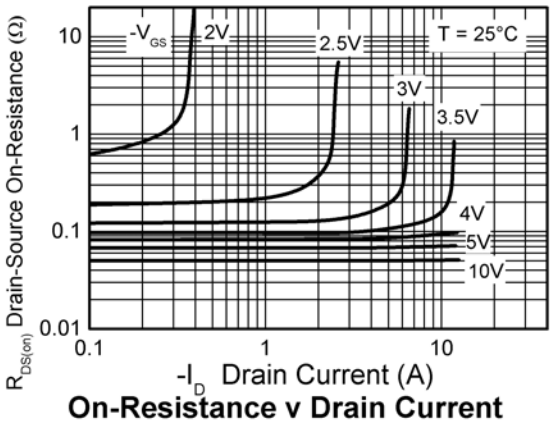

**Output Characteristics**



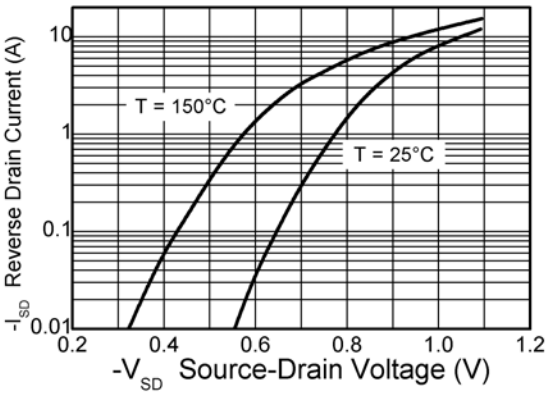

**Typical Transfer Characteristics**




**Normalised Curves v Temperature**

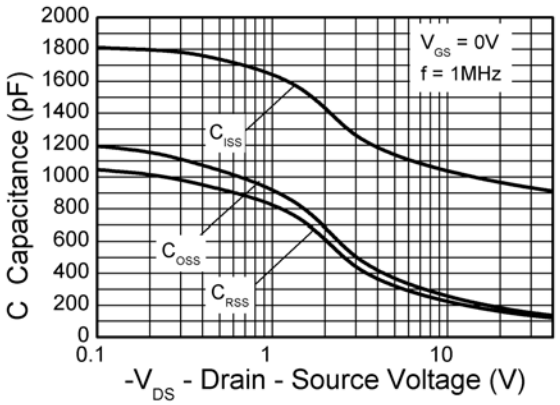



**On-Resistance v Drain Current**

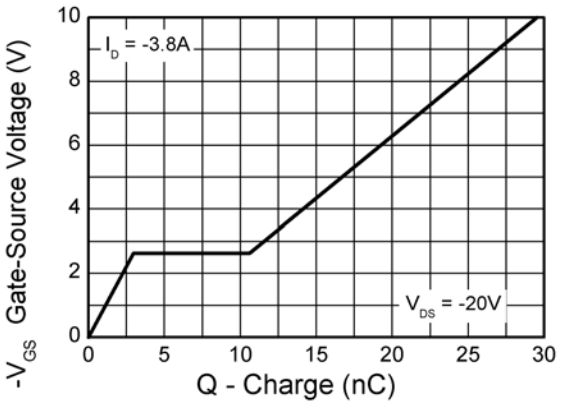



**Source-Drain Diode Forward Voltage**

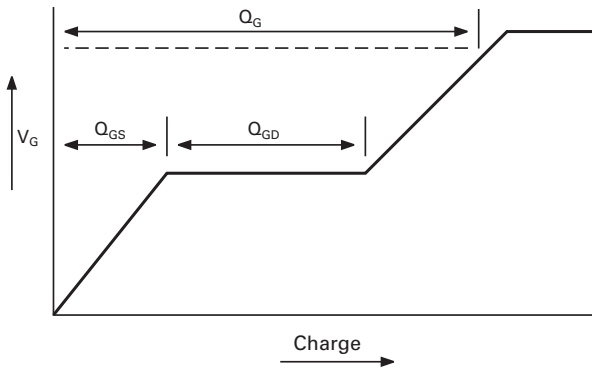
## Typical characteristics



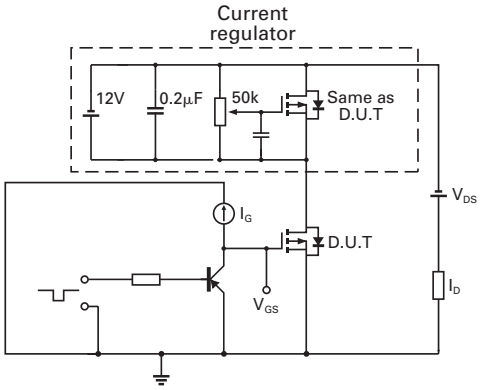

**Capacitance v Drain-Source Voltage**



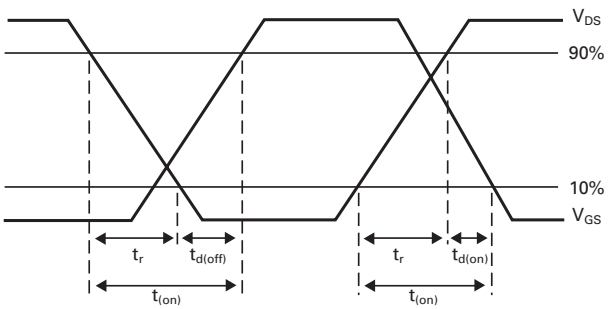

**Gate-Source Voltage v Gate Charge**



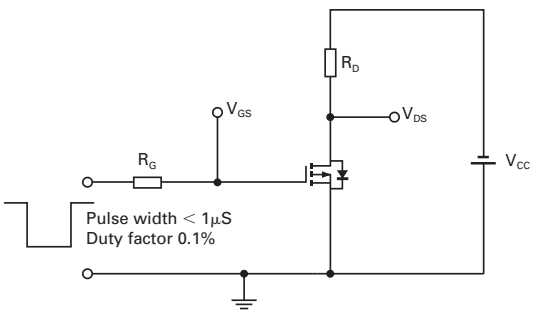

**Basic gate charge waveform**




**Gate charge test circuit**

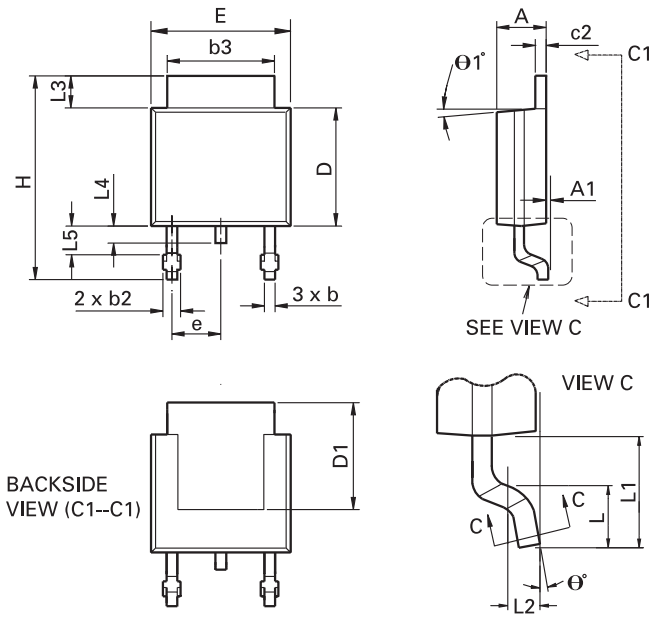



**Switching time waveforms**




**Switching time test circuit**

## Package details - DPAK




## Package dimensions

| 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 | - | Θ1° | 0° | 10° | 0° | 10° |
| E | 0.250 | 0.265 | 6.35 | 6.73 | Θ° | 0° | 15° | 0° | 15° |
| E1 | 0.170 | - | 4.32 | - | - | - | - | - | - |

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