

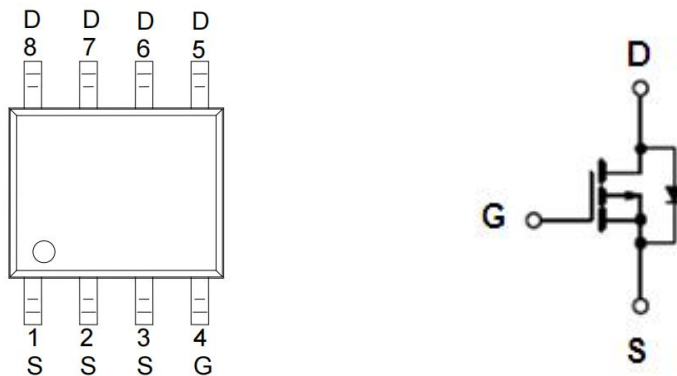
## 1. Features

- $R_{DS(on)}=40m\Omega(\text{typ})@ V_{GS}=10\text{ V}$
- Green device available
- Super low gate charge
- Excellent Cdv/dt effect decline
- Advanced high cell density trench technology

## 2. Description

The KPE4403A is the high cell density trenched P-channel MOSFET, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications. The KNE4403A meet the RoHS and Green product requirement.

## 3. Symbol



## 4. Absolute maximum ratings

Parameter	Symbol	Rating	Units
Drain-source voltage	$V_{DS}$	-30	V
Gate-source voltage	$V_{GS}$	$\pm 20$	V
Continuous drain current $V_{GS}@-10V^1$	$I_D$	$T_C=25^\circ C$	-5.0
		$T_C=70^\circ C$	-3.9
Pulsed drain current <sup>2</sup>	$I_{DM}$	-25	A
Single pulse avalanche energy <sup>3</sup>	EAS	18.1	mJ
Avalanche current	$I_{AS}$	-19	A
Total power dissipation <sup>4</sup>	$P_D$	1.5	W
Junction and storage temperature range	$T_J, T_{STG}$	-55 to 150	$^\circ C$
Thermal resistance-junction to ambient <sup>1</sup>	$R_{\theta JA}$	85	$^\circ C/W$
Thermal resistance-junction to case <sup>1</sup>	$R_{\theta JC}$	25	$^\circ C/W$

## 5. Electrical characteristics

( $T_J=25^{\circ}\text{C}$ , unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Drain-Source breakdown voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30	-	-	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^{\circ}\text{C}, I_D=-1mA$	-	-0.023	-	V/ $^{\circ}\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-24V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	-	-	1	$\mu A$
		$V_{DS}=-24V, V_{GS}=0V, T_J=55^{\circ}\text{C}$	-	-	5	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	-	-2.5	V
$V_{GS(th)}$ Temperature coefficient	$\Delta V_{GS(th)}$		-	4	-	MV/ $^{\circ}\text{C}$
Static drain-source on- resistance <sup>2</sup>	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-4A$	-	40	45	m $\Omega$
		$V_{GS}=-4.5V, I_D=-3A$	-	60	75	
Forward transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-4A$	-	10	-	S
Total gate charge	$Q_g$	$V_{DS}=-15V, V_{GS}=-4.5V$ $I_D=-4A$	-	6.5	-	nC
Gate-source charge	$Q_{gs}$		-	2.2	-	
Gate-drain charge	$Q_{gd}$		-	2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=-15V,$ $R_G=3.3\Omega, V_{GS}=-10V$ $I_D=-4A$	-	2.7	-	ns
Rise time	$t_r$		-	8.6	-	
Turn-off delay time	$t_{d(off)}$		-	40	-	
Fall time	$t_f$		-	5	-	
Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=-15V$ $F=1.0\text{MHZ}$	-	580	-	pF
Output capacitance	$C_{oss}$		-	95	-	
Reverse transfer capacitance	$C_{rss}$		-	80	-	
Diode characteristics						
Continuous source current <sup>1,5</sup>	$I_S$	$V_G=V_D=0V, \text{Force current}$	-	-	-5.0	A
Pulsed source current <sup>2,5</sup>	$I_{SM}$		-	-	-25	A
Diode forward voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V, I_S=-1A, T_J=25^{\circ}\text{C}$	-	-	-1.3	V
Reverse recovery time	$t_{rr}$	$I_F=-4A, di/dt=100A/\mu s,$ $T_J=25^{\circ}\text{C}$	-	7.5	-	nS
Reverse recovery charge	$Q_{rr}$		-	2.6	-	nC

Note:1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.

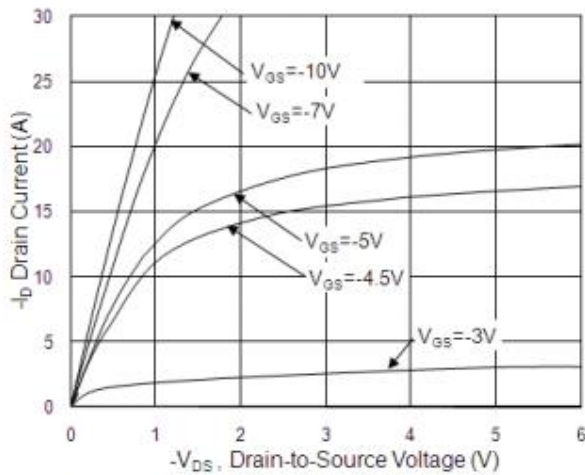
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

3. The EAS data shows Max.rating. The test condition is  $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-19A$ .

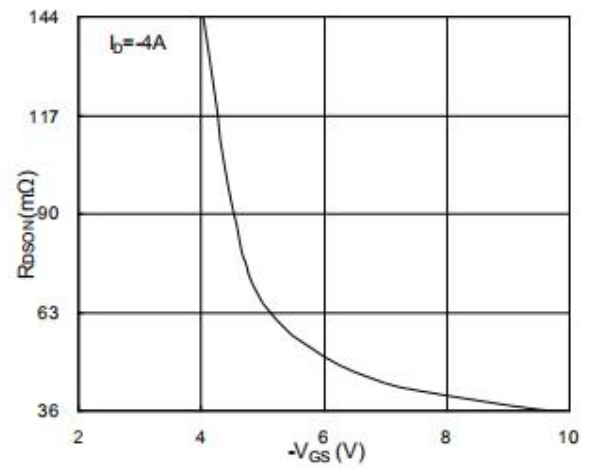
4. The power dissipation is limited by 150  $^{\circ}\text{C}$  junction temperature.

5. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

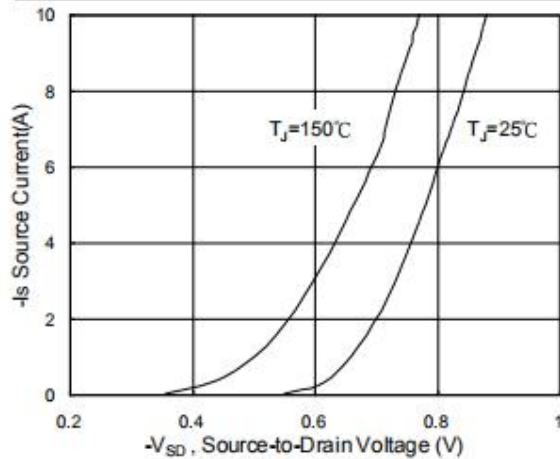
**6. Test circuits and waveforms**



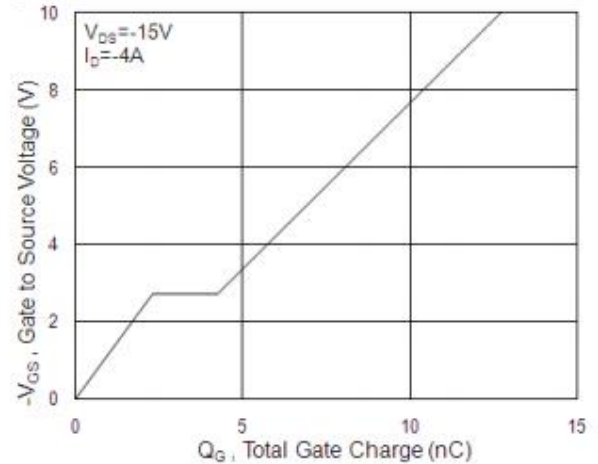
**Fig.1 Typical Output Characteristics**



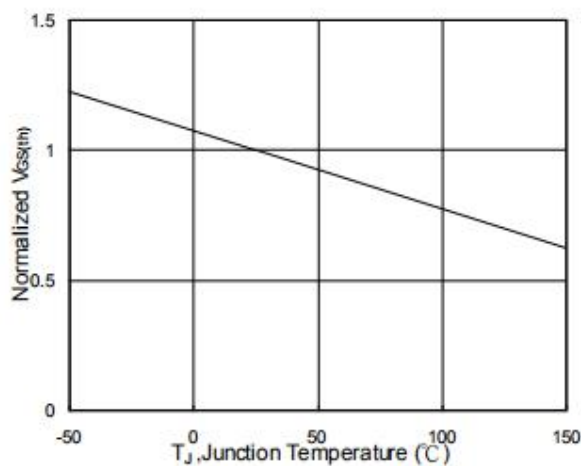
**Fig.2 On-Resistance vs. Gate-Source**



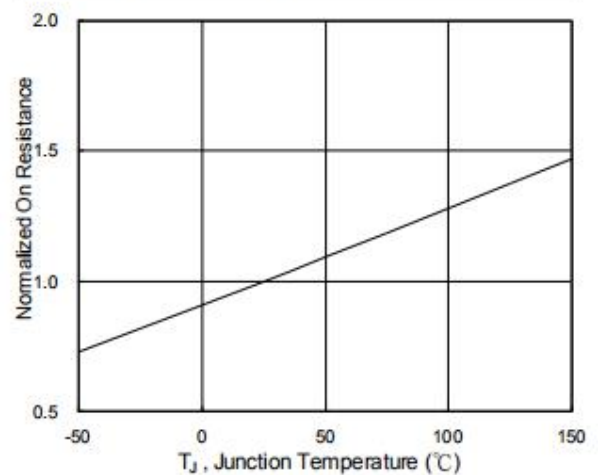
**Fig.3 Forward Characteristics of Reverse**



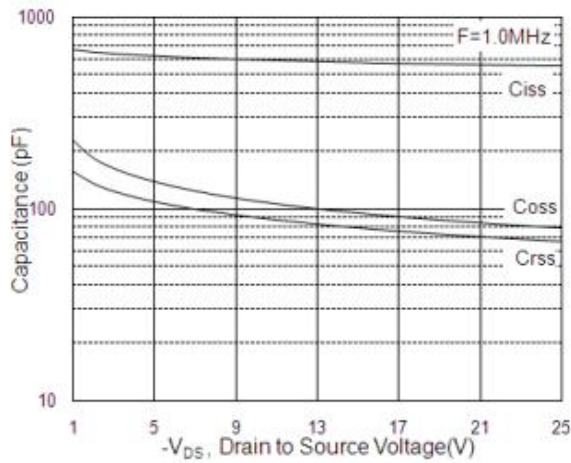
**Fig.4 Gate-Charge Characteristics**



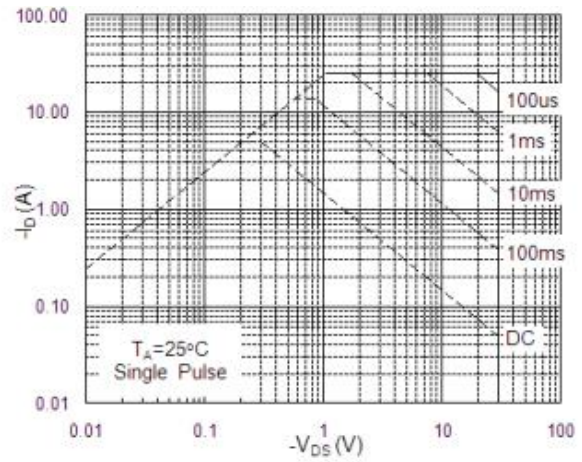
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



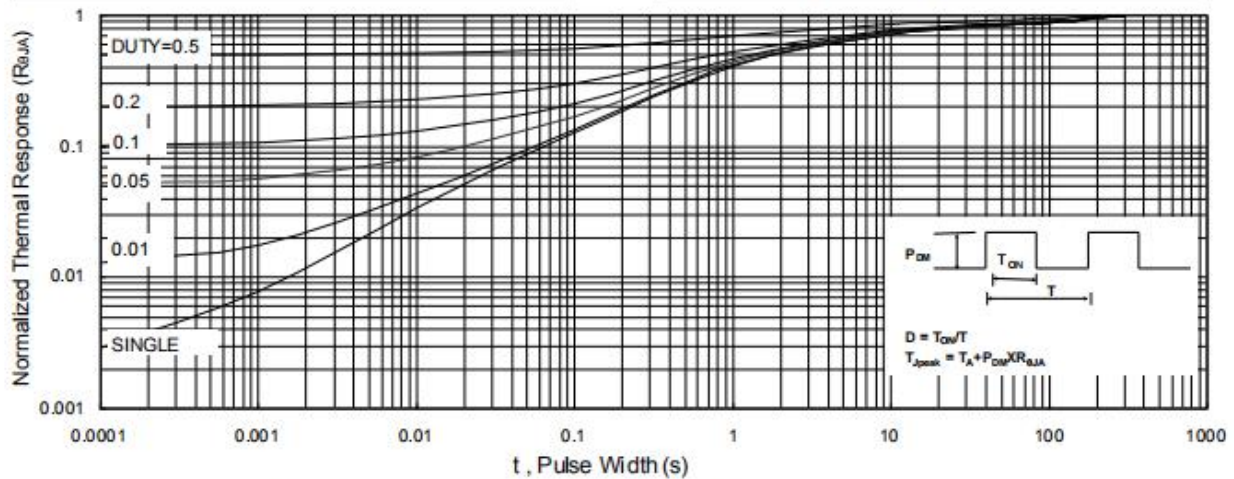
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



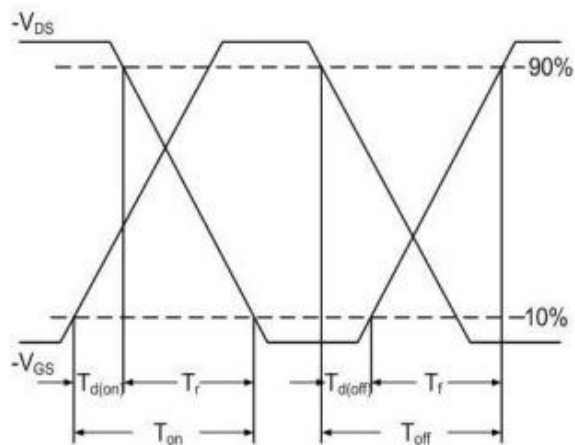
**Fig.7 Capacitance**



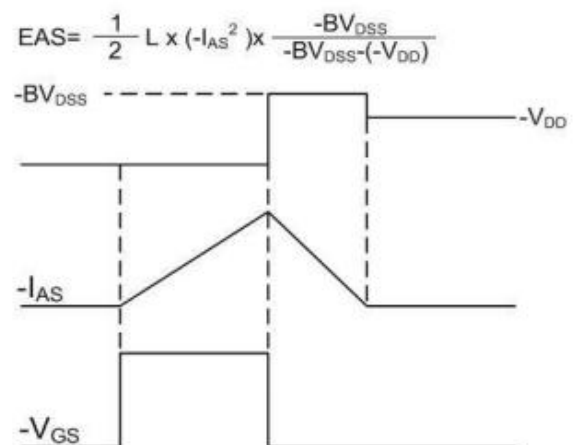
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

$$EAS = \frac{1}{2} L \times (-I_{AS}^2) \times \frac{-BV_{DSS}}{-BV_{DSS} - (-V_{DD})}$$

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