

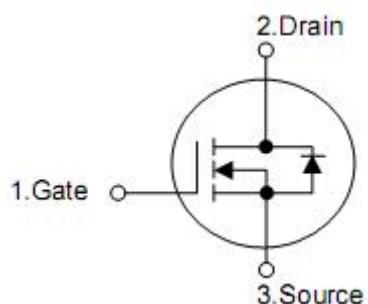
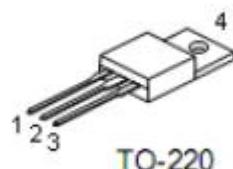
1. Features

- $R_{DS(on)}(TYP) = 2.2\text{m}\Omega$ @ $V_{GS} = 10\text{ V}$
- Lead free and green device available
- Low Rds-on to minimize conductive loss
- High avalanche current

2. Applications

- Power supply
- DC-DC converters

3. Pin configuration



Pin	Function
1	Gate
2	Drain
3	Source
4	Drain

4. Ordering Information

Part Number	Package	Brand
KNP2404A	TO-220	KIA

5. Absolute maximum ratings

Parameter		Symbol	Maximum	Units
Drain-to-source voltage		V _{DSS}	40	V
Gate-to-source voltage		V _{GSS}	± 25	V
Continuous drain current	T _C =25°C(Silicon limited)	I _D	190	A
	T _C =25°C(Package limited)		120	
	T _C =100°C (Silicon limited)		109	
Pulsed drain current	T _C =25 °C	I _{DP}	480	A
Avalanche current(L=0.5mH)		I _{AS}	46	A
Avalanche energy(L=0.5mH)		E _{AS}	529	mJ
Maximum power dissipation	T _C =25 °C	P _D	123	W
	T _C =100 °C		82	W
Junction & storage temperature range		T _J , T _{STG}	-55~150	°C

*Drain current limited by maximum junction temperature.

6. Thermal characteristics

Parameter	Symbol	Typical	Units
Thermal resistance-junction to case	R _{θjc}	1.02	°C/W
Thermal resistance-junction to ambient	R _{θja}	80	

7. Electrical characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Static characteristics						
Drain-source breakdown voltage	BV_{DSS}	$V_{\text{GS}}=0\text{V}, I_{\text{DS}}=250\mu\text{A}$	40	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{\text{DS}}=64\text{V}, V_{\text{GS}}=0\text{V}$	-	-	1	μA
Gate threshold voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}}=V_{\text{GS}}, I_{\text{DS}}=250\mu\text{A}$	2	-	4	V
Gate leakage current	I_{GSS}	$V_{\text{GS}}=\pm 25\text{V}, V_{\text{DS}}=0\text{V}$	-	-	± 100	nA
Drain-source on-state resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}}=10\text{V}, I_{\text{DS}}=30\text{A}$	-	2.2	3.5	$\text{m}\Omega$
Forward Transconductance	G_{fs}	$V_{\text{DS}}=5\text{V}, I_{\text{D}}=40\text{A}$	-	135	-	S
Diode characteristics						
Diode forward voltage	V_{SD}	$I_{\text{SD}}=40\text{A}, V_{\text{GS}}=0\text{V}$	-	0.9	1.3	V
Diode continuous forward current	I_{s}		-	-	190	A
Reverse recovery time	t_{rr}	$I_{\text{s}}=40\text{A}, dI/dt=100\text{A}/\mu\text{s}$	-	55	-	nS
Reverse recovery charge	Q_{rr}		-	70	-	nC
Dynamic characteristics²						
Gate resistance	R_{G}	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=0\text{V}, F=1\text{MHz}$	-	2.0	-	Ω
Input capacitance	C_{iss}	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=25\text{V}, F=1.0\text{MHz}$	-	6010	-	pF
Output capacitance	C_{oss}		-	1400	-	
Reverse transfer capacitance	C_{rss}		-	675	-	
Turn-on delay time	$t_{\text{d}(\text{ON})}$	$V_{\text{DD}}=25\text{V}, I_{\text{D}}=90\text{A}, V_{\text{GS}}=10\text{V}, R_{\text{G}}=2.7\Omega$	-	25	-	nS
Turn-on rise time	t_{r}		-	102	-	
Turn-off delay time	$t_{\text{d}(\text{OFF})}$		-	62	-	
Turn-off fall time	t_{f}		-	84	-	
Gate charge characteristics²						
Total gate charge	Q_{g}	$V_{\text{DS}}=40\text{V}, V_{\text{GS}}=10\text{V}, I_{\text{D}}=32\text{A}, F=1.0\text{MHz}$	-	150	-	nC
Gate-to-source charge	Q_{gs}		-	32	-	
Gate-to-drain charge	Q_{gd}		-	70	-	

8. Test circuits and waveforms

Fig 1: Output Characteristics

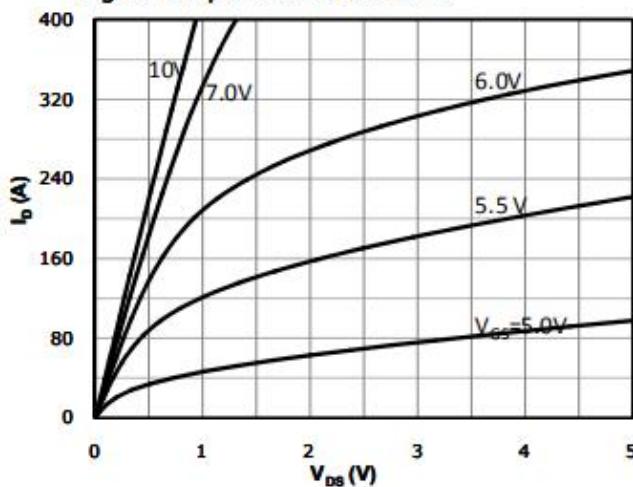


Fig 2: Transfer Characteristics

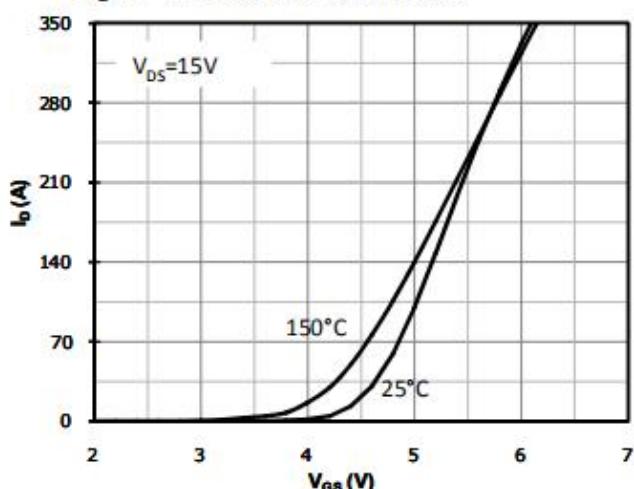


Fig 3: $R_{DS(on)}$ vs Drain Current and Gate Voltage

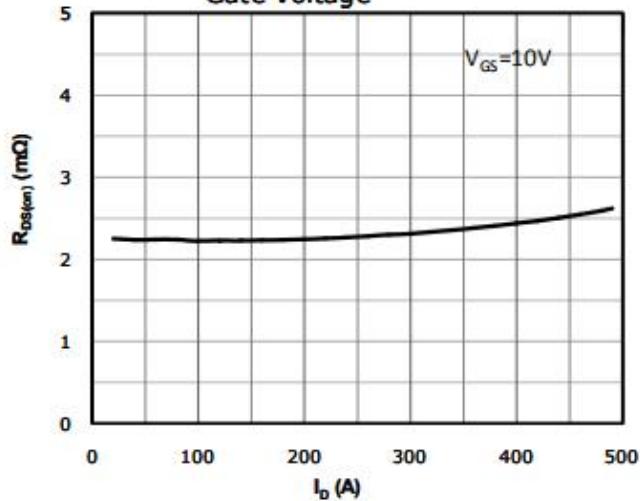


Fig 4: $R_{DS(on)}$ vs Gate Voltage

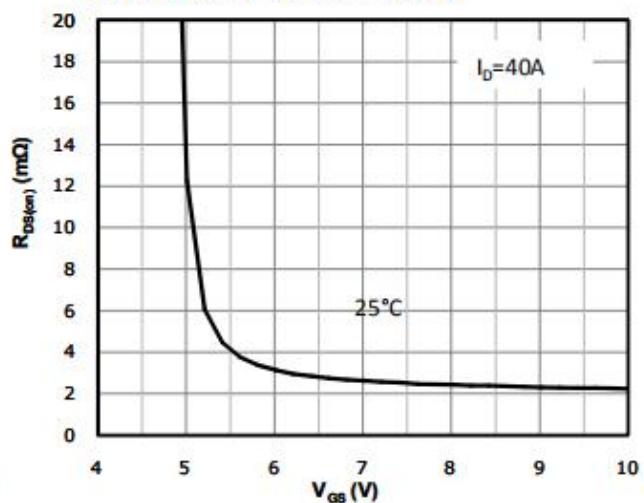


Fig 5: $R_{DS(on)}$ vs. Temperature

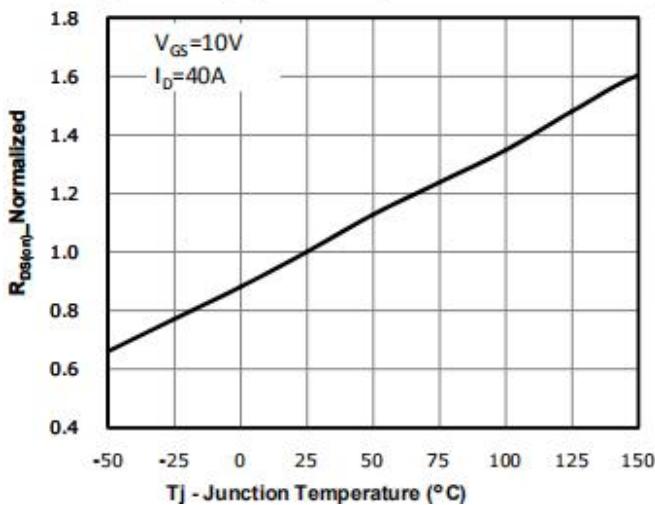


Fig 6: Capacitance Characteristics

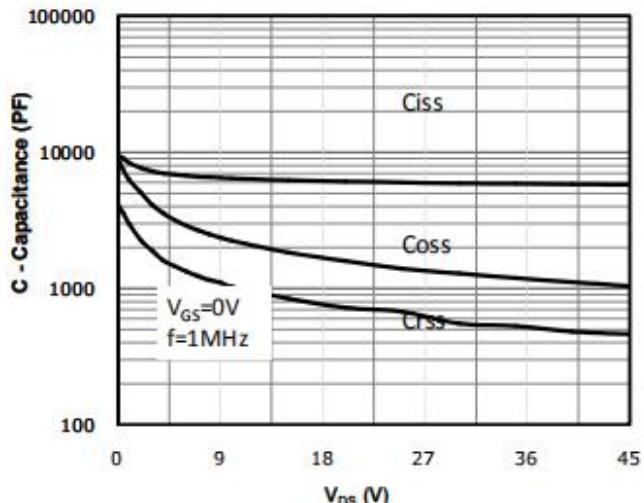


Fig 7: Gate Charge Characteristics

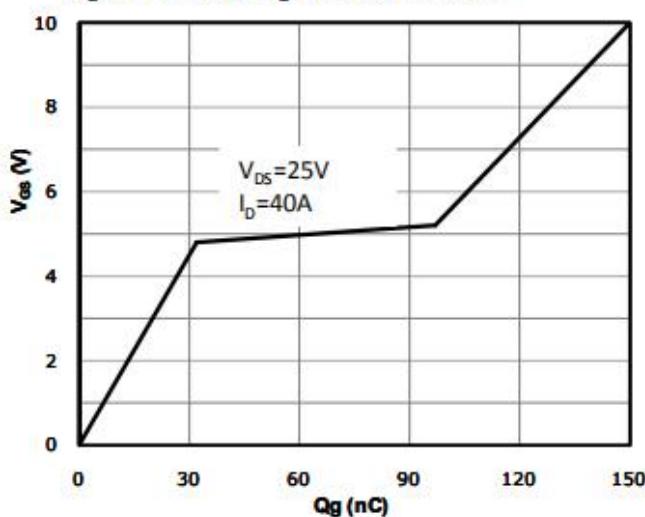


Fig 8: Body-diode Forward Characteristics

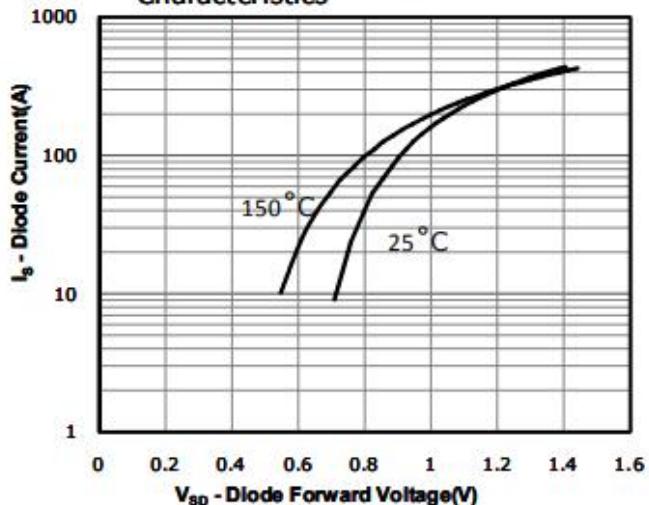


Fig 9: Power Dissipation

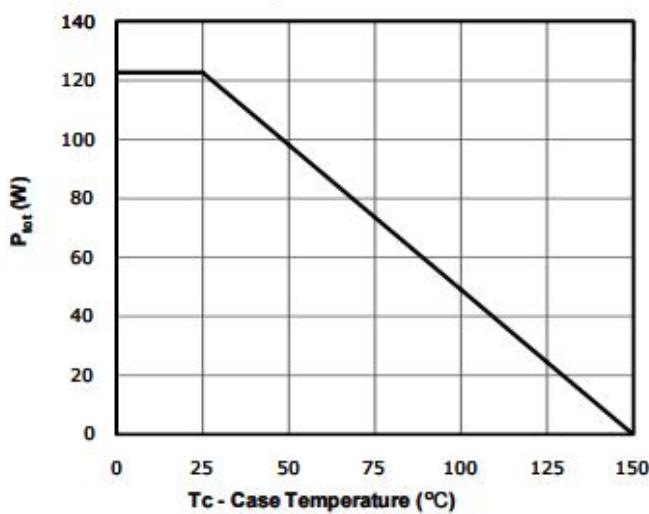


Fig 10: Drain Current Derating

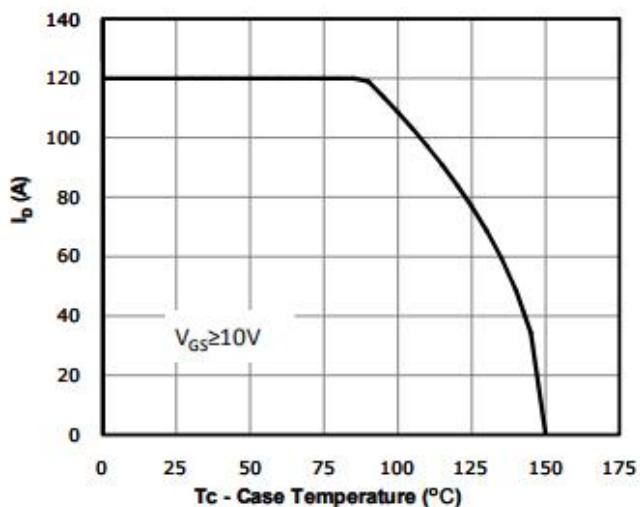


Fig 11: Safe Operating Area

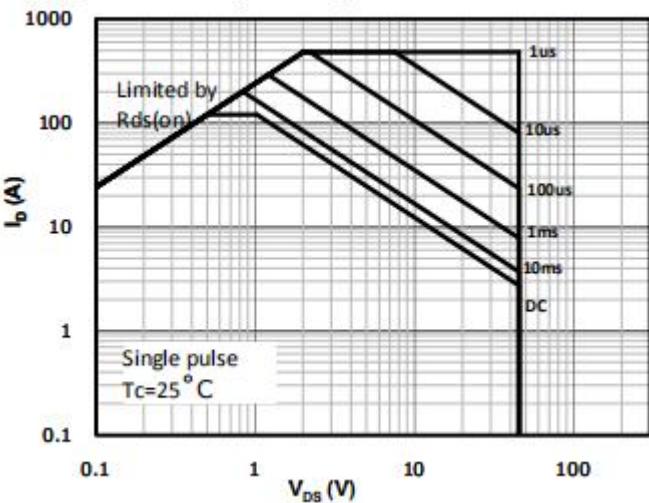


Fig 12: Max. Transient Thermal Impedance

