

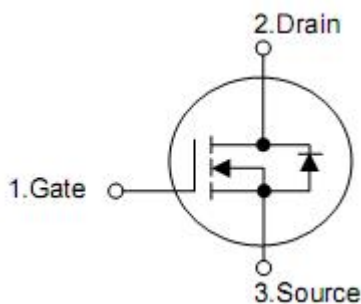
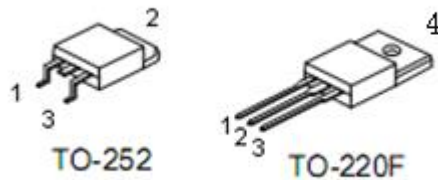
## 1. Features

- n  $R_{DS(ON),typ.}=2.0\Omega$  @  $V_{GS}=10V, I_D=2A$
- n Fast Switching
- n 100% avalanche tested
- n Improved dv/dt capability

## 2. Application

- n High frequency switching mode power supply
- n Uninterruptible Power Supply(UPS)
- n Electronic ballast

## 3. Pin configuration



Pin	Function
1	Gate
2	Drain
3	Source
4	Drain

## 4. Ordering Information

Part Number	Package	Brand
KND4365A	TO-252	KIA
KNF4365A	TO-220F	KIA

## 5. Absolute maximum ratings

(T<sub>C</sub>= 25°C , unless otherwise specified)

Parameter	Symbol	Rating		Units
		TO252	TO220F	
Drain-source voltage	V <sub>DSS</sub>	650		V
Gate-source voltage	V <sub>GSS</sub>	±30		V
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> =25 °C	4*	A
		T <sub>C</sub> =100 °C	2.78*	A
Pulsed Drain Current <sup>note1</sup>	I <sub>DM</sub>	16*	16*	A
Single Pulse Avalanche Energy <sup>note2</sup>	E <sub>AS</sub>	180		mJ
Peak Diode Recovery Energy <sup>note3</sup>	dv/dt	4.8		V/ns
Power Dissipation	P <sub>D</sub>	T <sub>C</sub> =25 °C	55	W
Linear Derating Factor		T <sub>C</sub> > 25 °C	0.46	W/°C
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	2.16	3.75	°C/W
Operating and Storage Temperature Range	T <sub>L</sub> , T <sub>STG</sub>	-55~+150		°C

\*Drain current limited by maximum junction temperature

## 6. Electrical characteristics

(T<sub>J</sub>=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650	-	-	V
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DS}}{\Delta T_J}$	I <sub>D</sub> =250μA, referenced to 25°C	-	0.65	-	V/°C
Zero Gage Voltage Drain Source	I <sub>DSS</sub>	V <sub>DS</sub> =640V, V <sub>GS</sub> =0V	-	-	1	μA
		V <sub>DS</sub> =512V, T <sub>C</sub> =125°C	-	-	10	μA
Gate to Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V	-	-	100	nA
		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	-	-	-100	nA
On characteristics						
Gate threshold voltage <sup>note4</sup>	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2	-	4	V
Static drain-source on-resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2A	-	2.0	2.5	Ω
Forward Transconductance	G <sub>FS</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =2A	-	6	-	S
Dynamic characteristics						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,	-	523	-	pF
Output capacitance	C <sub>OSS</sub>	f=1.0 MHz	-	58.7	-	pF
Reverse transfer capacitance	C <sub>RSS</sub>		-	9.85	-	pF
Total gate charge	Q <sub>G</sub>	V <sub>DD</sub> =512V,	-	15.7	-	nC
Gate-source charge	Q <sub>GS</sub>	I <sub>D</sub> =4.0A	-	2.43	-	nC
Gate-drain charge	Q <sub>GD</sub>	V <sub>GS</sub> =10V	-	6.72	-	nC
Switching characteristics						
Turn-on delay time	t <sub>D(ON)</sub>	V <sub>DD</sub> =320V, I <sub>D</sub> =4.0A,	-	12.1	-	ns
Rise time	t <sub>R</sub>	R <sub>G</sub> =10Ω, V <sub>GS</sub> =10V	-	14.9	-	ns
Turn-off delay time	t <sub>D(OFF)</sub>		-	36.8	-	ns
Fall time	t <sub>F</sub>		-	11.3	-	ns
Switching characteristics						
Drain-source diode forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =4.0A	-	-	1.4	V
Continuous drain-source current	I <sub>S</sub>		-	-	4	A
Pulsed drain-source current	I <sub>SM</sub>		-	-	16	A
Reverse recovery time	t <sub>RR</sub>	V <sub>GS</sub> =0V, I <sub>F</sub> =4A	-	312	-	ns
Reverse recovery charge	Q <sub>RR</sub>	di/dt=100A/μs	-	1.81	-	μC

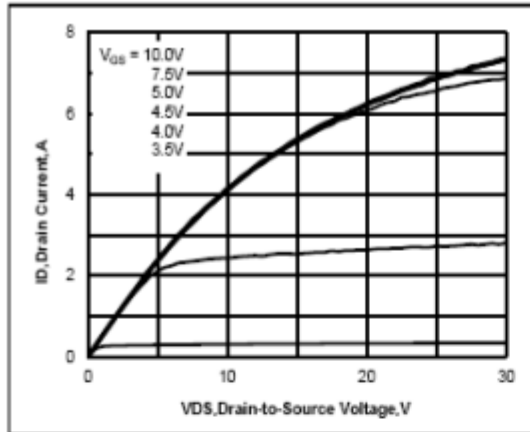
Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. L=10mH, I<sub>AS</sub>=6A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C.

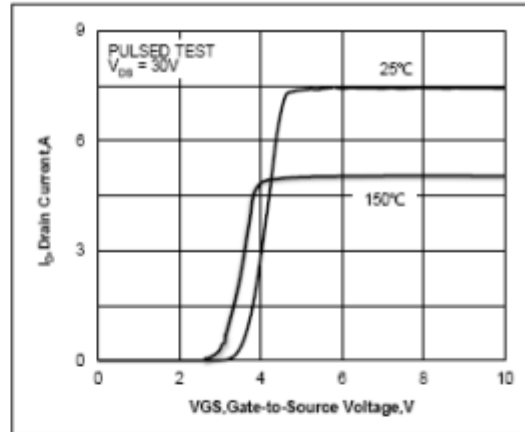
3. I<sub>SD</sub>≤4A, di/dt≤200A/μs, V<sub>DD</sub>≤B<sub>V</sub>DSS, Starting T<sub>J</sub>=25°C.

4. Pulse width≤300μs; duty cycle≤2%

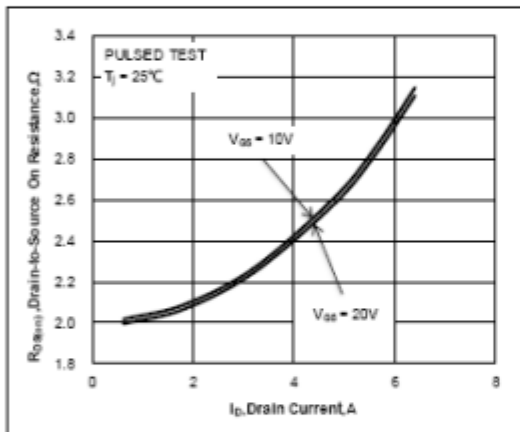
**7. Typical Characteristics**



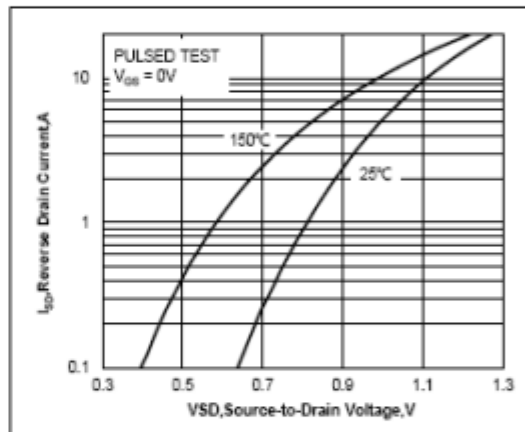
**Figure 1. Output Characteristics**



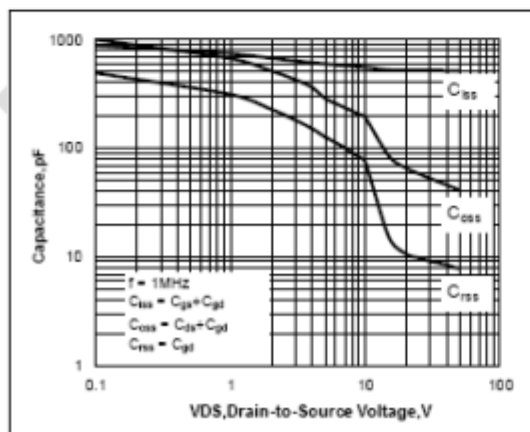
**Figure 2. Transfer Characteristics**



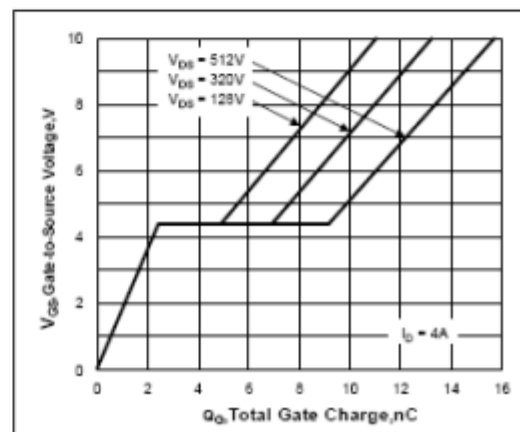
**Figure 3. Drain-to-Source On Resistance vs. Drain Current and Gate Voltage**



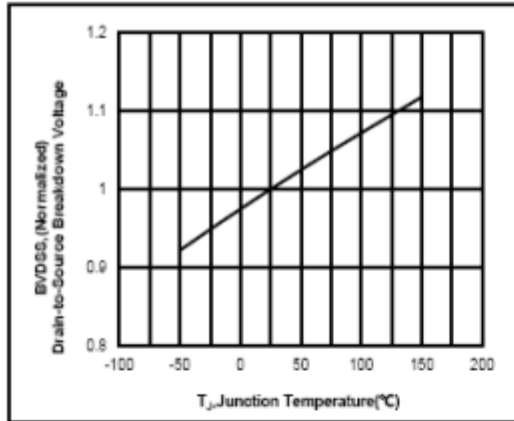
**Figure 4. Body Diode Forward Voltage vs. Source Current and Temperature**



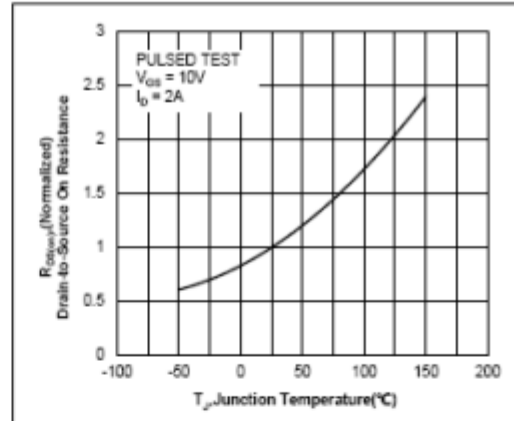
**Figure 5. Capacitance Characteristics**



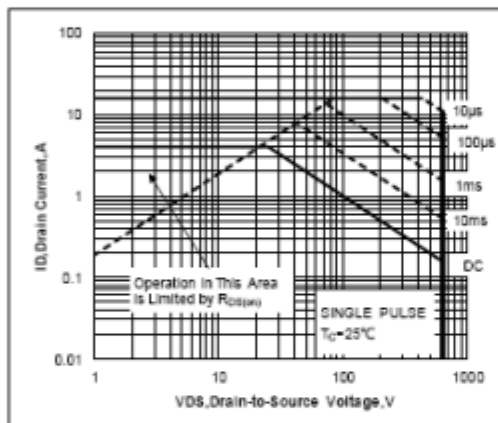
**Figure 6. Gate Charge Characteristics**



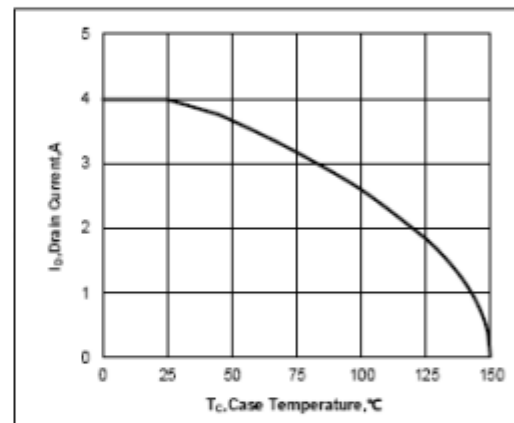
**Figure 7. Normalized Breakdown Voltage vs. Junction Temperature**



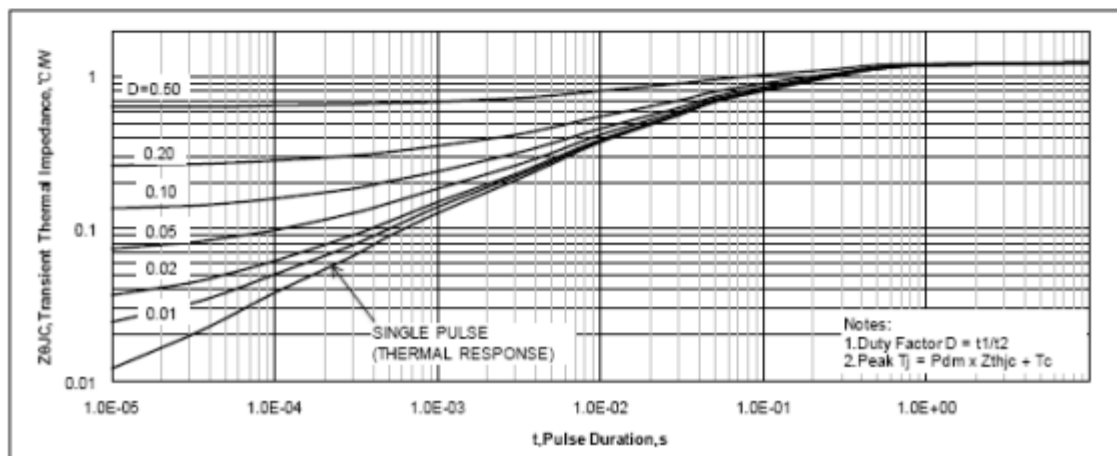
**Figure 8. Normalized On Resistance vs. Junction Temperature**

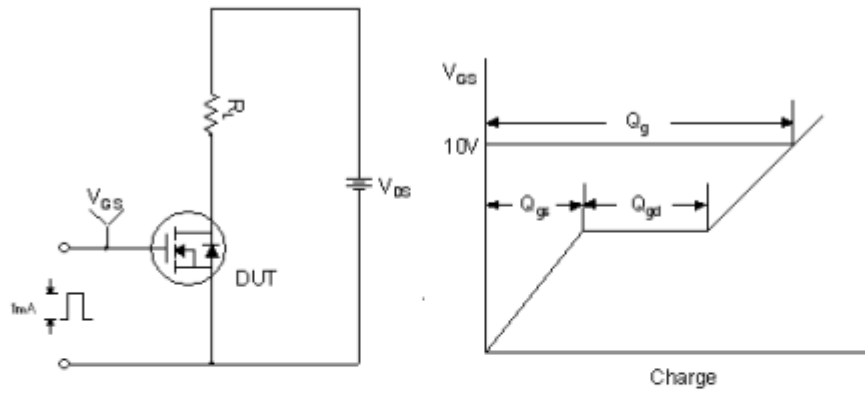


**Figure 9. Maximum Safe Operating Area**

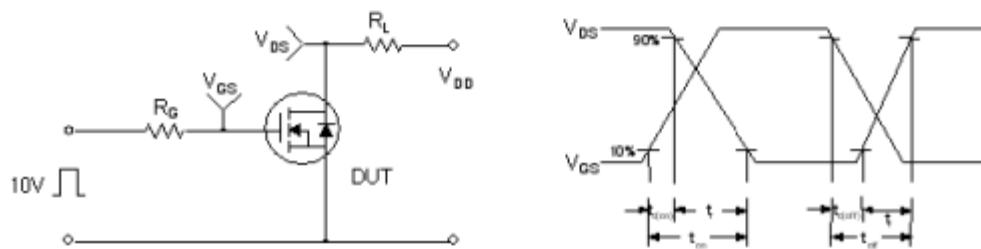


**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

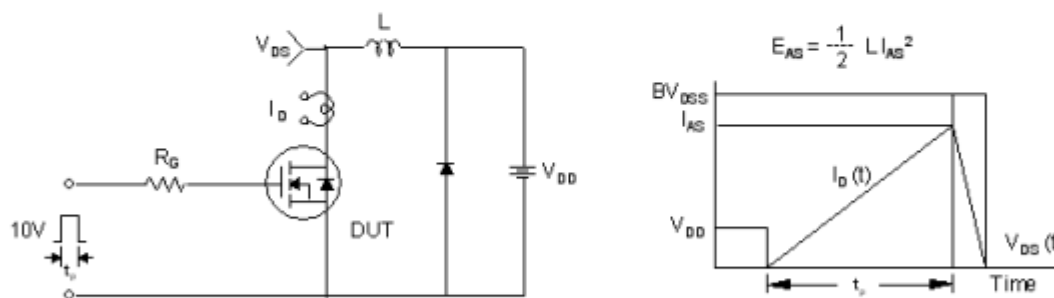




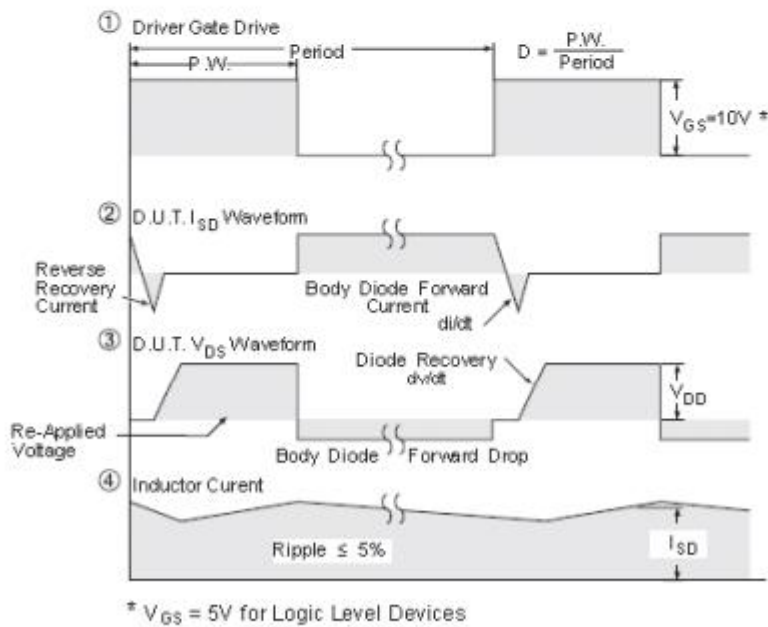
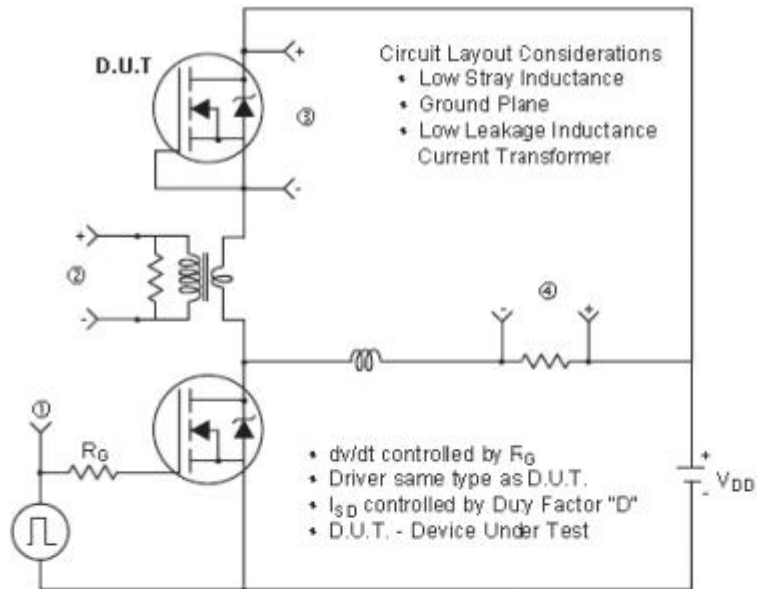
**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**



**Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms (For N-channel)**