1. Features

- $R_{DS(ON)}$=2.5mΩ(typ.)@V_{GS}=10V
- Very Low On-resistance $R_{DS(ON)}$
- Low Crss
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

2. Applications

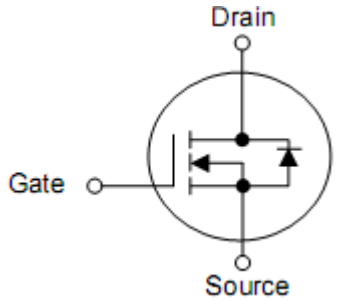
- PWM Application
- Load Switch
- Power Management

3. Symbol

TO-252

TO-263

TO-220



Pin	Function
1	Gate
2	Drain
3	Source

4. Ordering Information

Part Number	Package	Brand
KND2904A	TO-252	KIA
KNB2904A	TO-263	KIA
KNP2904A	TO-220	KIA

5. Absolute maximum ratings

T_C=25°C unless otherwise noted

Parameter		Symbol	Rating		Units
			TO-252	TO-263 TO-220	
Drain-source voltage [1]		V_{DSS}	40		V
Gate-to-Source Voltage		V_{GSS}	±20		V
Continuous drain current [2],[3]	T_C=25°C	I_D	130		A
	T_C=100°C	I_D	84		A
Pulsed Drain Current at V_{GS}=10V [1]		I_{DM}	400		A
Single pulse avalanche energy [2]		E_{AS}	250		mJ
Power dissipation (T_C=25°C)		P_D	130	328	W
Maximum lead temperature for soldering purposes,1/8" from case for 5 seconds		T_L	300		°C
Operating junction and storage temperature range		T_J ,T_{STG}	-55 to150		ºC

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

6. Thermal characteristics

Parameter	Symbol	Rating		Unit
		TO-252	TO-263/TO-220	
Thermal resistance junction-case	$R_{\theta JC}$	0.96	0.38	ºC/W

7. Electrical characteristics

(T_C=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V,I_D=250uA	40	-	-	V
Drain-source leakage current	I_{DSS}	V_{DS}=40V, V_{GS}=0V	-	-	1	uA
Gate-source forward leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
Gate threshold voltage	$V_{GS(TH)}$	V_{DS}=V_{GS},I_D=250uA	1.0	1.5	2.3	V
Drain-source on-resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=20A	-	2.5	3.2	mΩ
		V_{GS}=4.5V,ID=15A	-	3.1	4.2	mΩ
Gate Series Resistance	R_G	f=1MHz	-	1.3	-	Ω
Input capacitance	C_{iss}	V_{DS}=15V,V_{GS}=0V f=1MHz	-	6260	-	pF
Reverse transfer capacitance	C_{oss}		-	580	-	pF
Output capacitance	C_{rss}		-	570	-	pF
Turn-on delay time	$t_{d(on)}$	V_{GS}=10V, V_{DS}=20V, R_L=3Ω, I_D=10A T_J=25°C [3]	-	18	-	ns
Rise time	t_r		-	20	-	ns
Turn-off delay time	$t_{d(off)}$		-	50	-	ns
Fall time	t_f		-	16	-	ns
Total gate charge	Q_g	V_{DS}=15V, I_D=20A V_{GS}=10V [3]	-	135	-	nC
Gate-source charge	Q_{gs}		-	30	-	nC
Gate-drain charge	Q_{gd}		-	19	-	nC
Maximum Continuous Drain-Source Diode Forward Current	I_S	—	-	-	130	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}	—	-	-	400	A
Drain to Source Diode Forward Voltage	V_{SD}	I_{SD}=20A,V_{GS}=0V, T_J=25°C	-	-	1.2	V

Note:
1). Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2). EAS condition: T_J=25°C, V_{DD}=20V, V_G=10V, R_G=25Ω, L=0.5mH.
3). Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

8. Typical operating characteristics

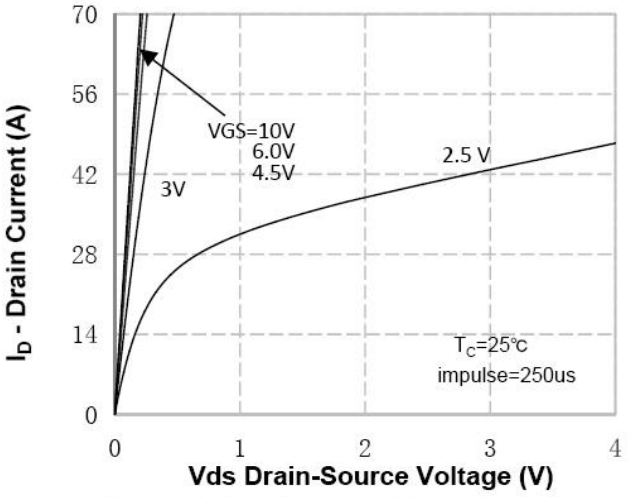


Figure 1. On-Region Characteristics

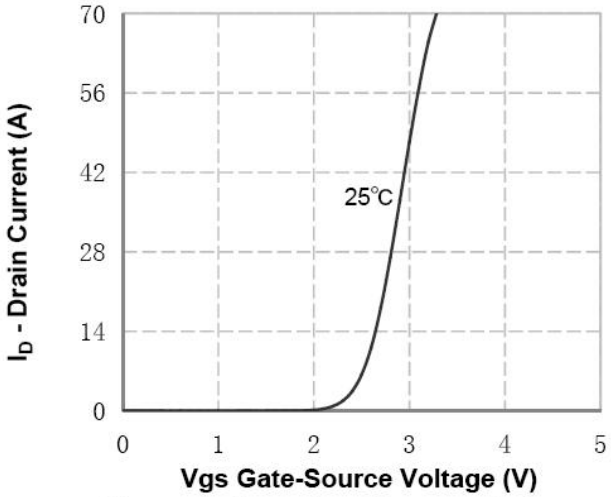


Figure 2. Transfer Characteristics

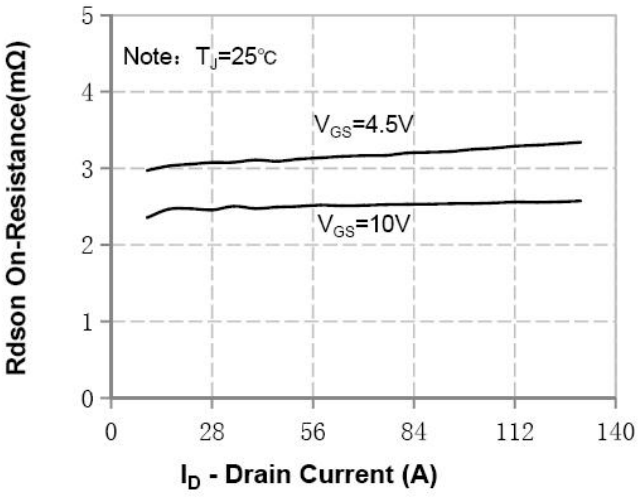


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

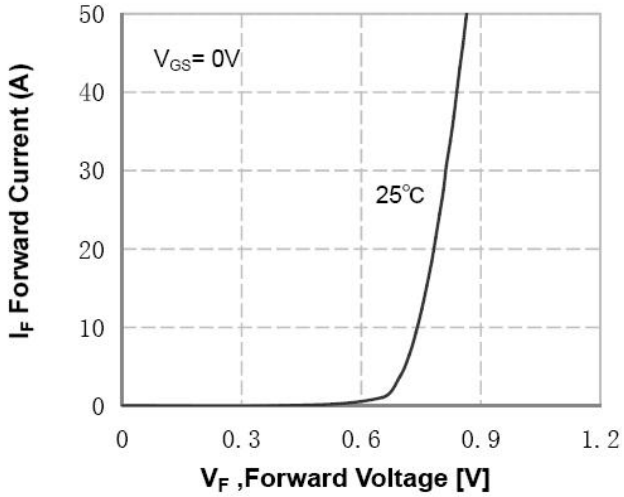


Figure 4. Body Diode Forward Voltage Variation with Source Current

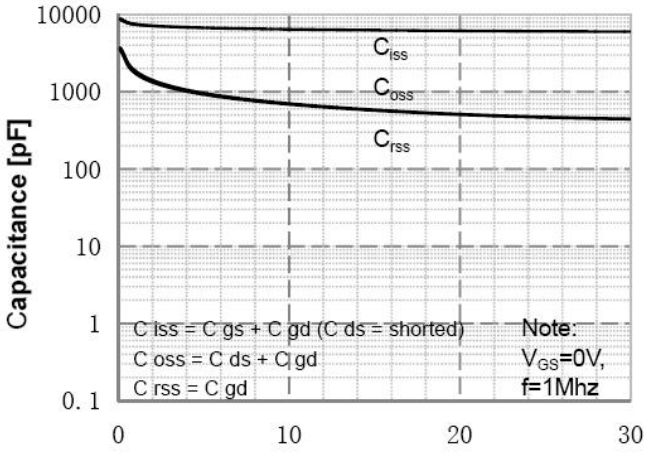


Figure 5. Capacitance Characteristics

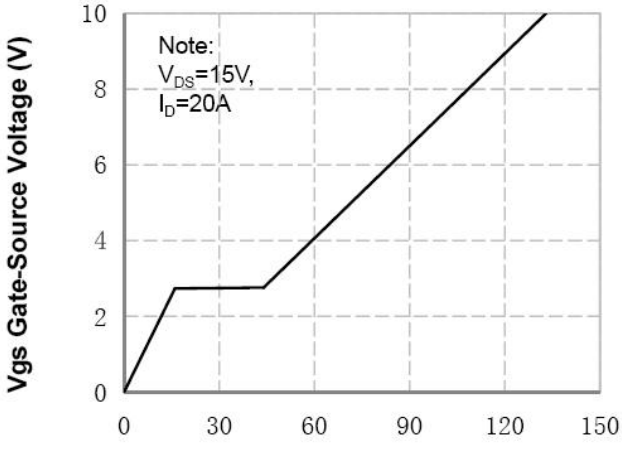


Figure 6. Gate Charge Characteristics

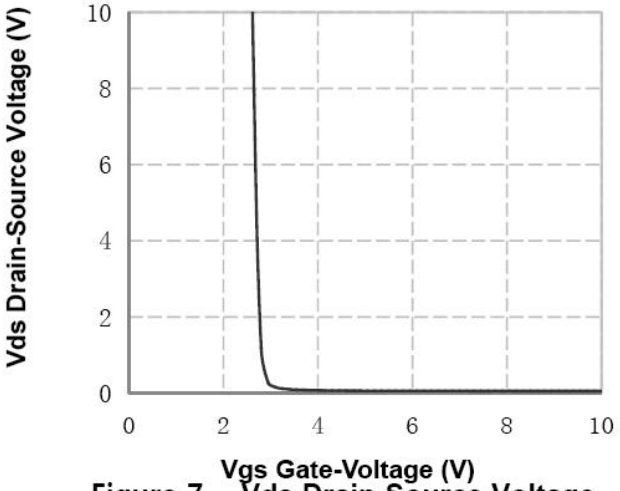


Figure 7. Vds Drain-Source Voltage vs Gate Voltage

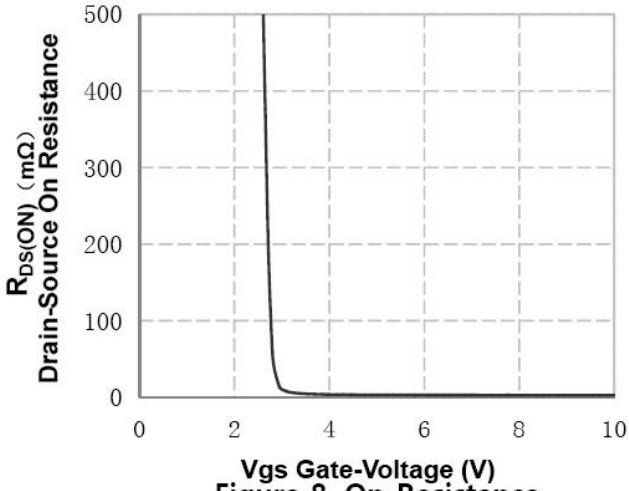


Figure 8. On-Resistance vs Gate Voltage

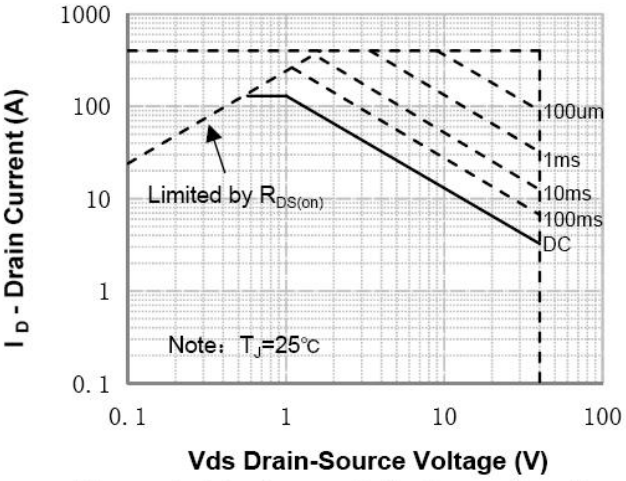


Figure 9. Maximum Safe Operating Area

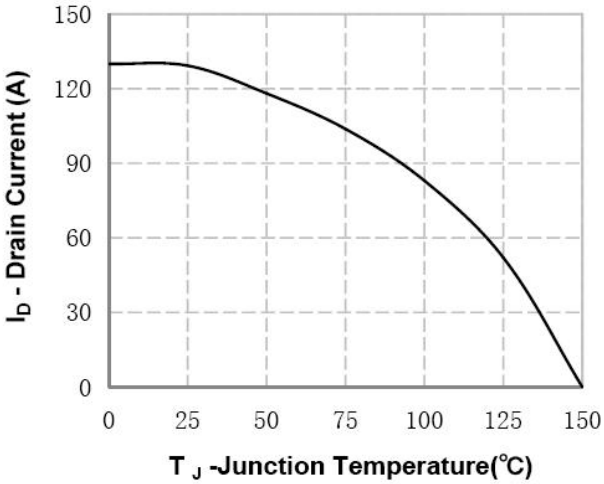


Figure 10. Maximum Continuous Drain Current vs Temperature

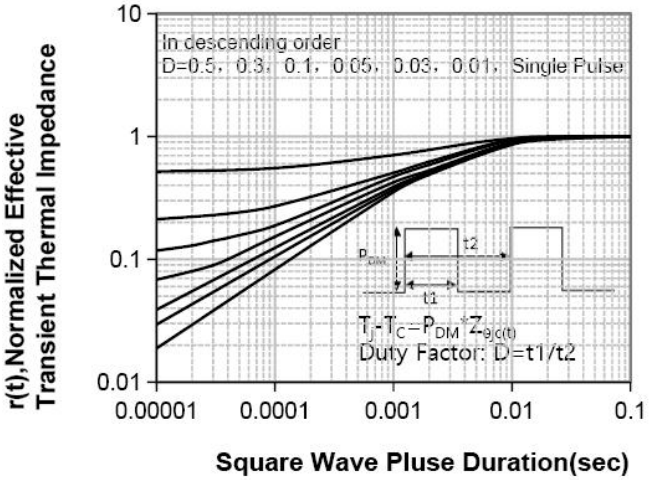
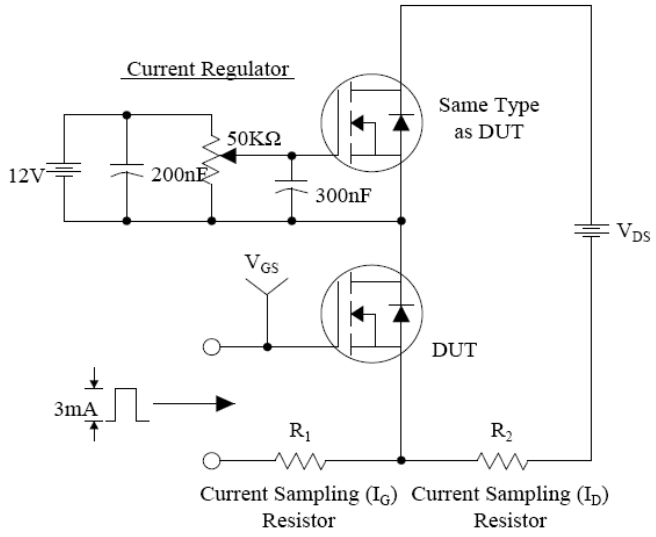
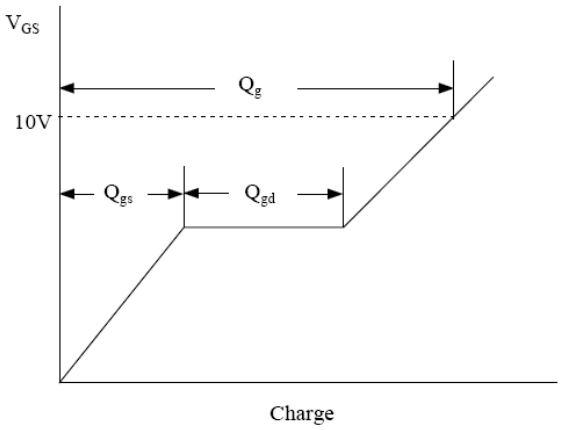


Figure 11. Transient Thermal Response Curve

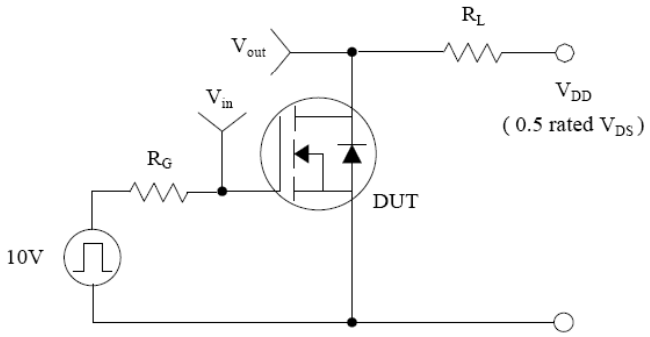
9. Test Circuits and Waveforms

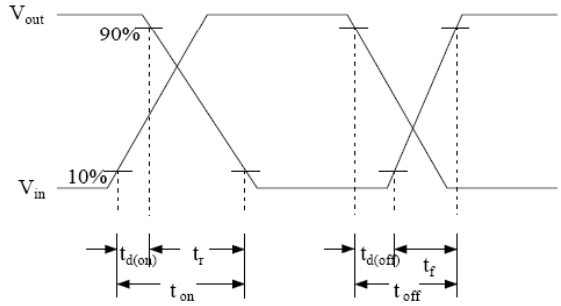
Gate Charge Test Circuit & Waveform



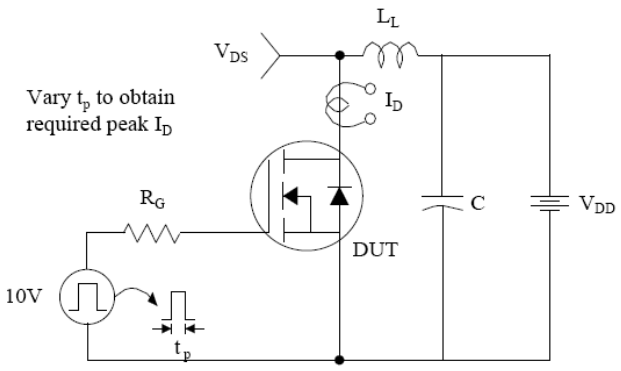


Resistive Switching Test Circuit & Waveforms

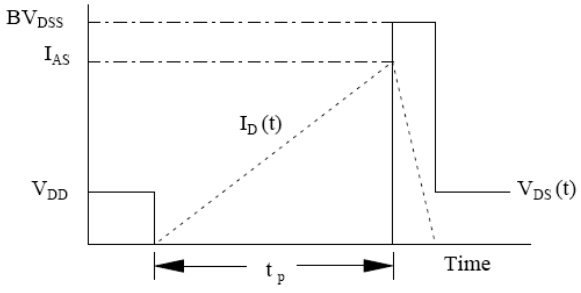




Unclamped Inductive Switching Test Circuit & Waveforms



$$E_{AS} = \frac{1}{2} L_L I_{AS}^2$$



Peak Diode Recovery dv/dt Test Circuit & Waveforms