

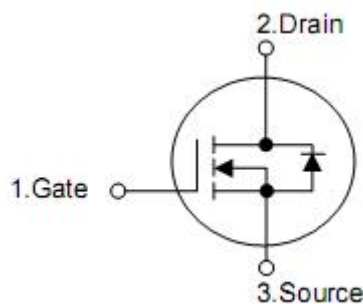
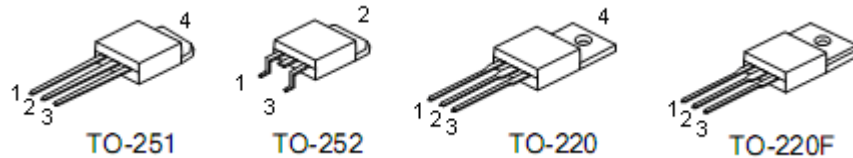
## 1. Description

This Power MOSFET is produced using KIA advanced planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

## 2. Features

- n  $R_{DS(on)}=2.5\Omega$  @  $V_{GS}=10V$
- n Low gate charge (typical 16nC)
- n High ruggedness
- n Fast switching
- n 100% avalanche tested
- n Improved dv/dt capability

## 3. Pin configuration



Pin	Function
1	Gate
2	Drain
3	Source
4	Drain

## 4. Absolute maximum ratings

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

Parameter	Symbol	Rating				Units	
		TO251	TO252	TO220	TO220F		
Drain-source voltage	V <sub>DSS</sub>	650				V	
Drain current continuous	I <sub>D</sub>	T <sub>C</sub> =25°C	3.0	3.0	4.0	4.0*	A
		T <sub>C</sub> =100°C	1.8	1.8	2.4	2.4*	A
Drain current pulsed (note1)	I <sub>DM</sub>	12	12	16	16*	A	
Gate-source voltage	V <sub>GSS</sub>	±30				V	
Single Pulse avalanche energy (note2)	E <sub>AS</sub>	210	210	180	180	mJ	
Repetitive avalanche energy (note1)	E <sub>AR</sub>	5.8	5.8	10	10	mJ	
Peak diode recovery dv/dt (note3)	dv/dt	4.5				V/ns	
Power dissipation	P <sub>D</sub>	T <sub>C</sub> =25°C	58	58	104	34	W
		Derate above 25°C	0.46	0.46	0.83	0.27	W/°C
Operating and storage temperature range	T <sub>J</sub> , T <sub>STG</sub>	-55~+150				°C	
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	T <sub>L</sub>	300				°C	

\*Drain current limited by maximum junction temperature.

## 5. Thermal characteristics

Parameter	Symbol	TO251	TO252	TO220	TO220F	Unit
Thermal resistance junction-case	R <sub>thJC</sub>	2.16	2.16	1.2	3.65	°C/W
Thermal resistance, case-to-sink typ.	R <sub>thJS</sub>	50	50	0.5	0.5	
Thermal resistance junction-ambient	R <sub>thJA</sub>	110	110	62.5	62.5	

## 6. Electrical characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>Off characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	650	-	-	V
Breakdown voltage temperature coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$ , Referenced to $25^{\circ}\text{C}$	-	0.65	-	V/ $^{\circ}\text{C}$
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$	-	-	1	$\mu A$
		$V_{DS}=520V, T_C=125^{\circ}\text{C}$	-	-	10	$\mu A$
Gate-body leakage current	Forward	$V_{GS}=30V, V_{DS}=0V$	-	-	100	nA
	Reverse	$V_{GS}=-30V, V_{DS}=0V$	-	-	-100	nA
<b>On characteristics</b>						
Gate threshold voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	-	4.0	V
Static drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10V$ , $I_D=1.5A$ (TO251, TO252) $I_D=2.0A$ (TO220, TO220F)	-	2.5	3.0	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V$ , $f=1\text{MHz}$	-	560	-	pF
Output capacitance	$C_{OSS}$		-	55	-	pF
Reverse transfer capacitance	$C_{RSS}$		-	7	-	pF
<b>Switching characteristics</b>						
Turn-on delay time	$t_{D(ON)}$	$V_{DD}=300V, I_D=4.5A$ (TO251, TO252), $V_{DD}=325V, I_D=4.0A$ (TO220, TO220F) $R_G=25\Omega$ , (note4,5)	-	10	-	ns
Rise time	$t_R$		-	40	-	ns
Turn-off delay time	$t_{D(OFF)}$		-	40	-	ns
Fall time	$t_F$		-	50	-	ns
Total gate charge	$Q_G$	$V_{DS}=480V, I_D=4.5A$ (TO251, TO252)	-	16	-	nC
Gate-source charge	$Q_{GS}$	$V_{DS}=520V, I_D=4.0A$ (TO220, TO220F)	-	2.5	-	nC
Gate-drain charge	$Q_{GD}$	$V_{GS}=10V$ (note4,5)	-	6.5	-	nC
<b>Drain-source diode characteristics</b>						
Continuous drain-source current	$I_S$	TO251, TO252	-	-	3.0	A
		TO220, TO220F	-	-	4.0	
Pulsed drain-source current	$I_{SM}$	TO251, TO252	-	-	12	A
		TO220, TO220F	-	-	16	
Drain-source diode forward voltage	$V_{SD}$	$V_{GS}=0V$ , $I_S=3.0A$ (TO251, TO252) $I_S=4.0A$ (TO220, TO220F)	-	-	1.4	V
Reverse recovery time	$t_{RR}$	$V_{GS}=0V, di_F/dt=100A/\mu s$ $I_S=4.5A$ , (TO251, TO252)	-	300	-	ns
Reverse recovery charge	$Q_{RR}$	$I_S=4.0A$ (TO220, TO220F) (note 4)	-	2.0	-	$\mu C$

Note:1. Repetitive rating: pulse width limited by maximum junction temperature

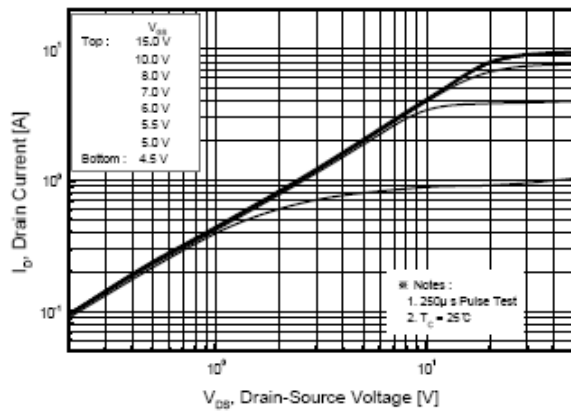
2.  $I_{AS}=4.5A, V_{DD}=50V$ , (TO251, TO252),  $I_{AS}=4.0A, V_{DD}=25V$ (TO220, TO220F),  $R_G=25\Omega$ , starting  $T_J=25^{\circ}\text{C}$

3.  $I_{SD}\leq 4.5A$ , (TO251, TO252),  $I_{SD}\leq 4.0A$ (TO220, TO220F),  $di/dt \leq 200A/\mu s$ ,  $V_{DD}\leq BV_{DSS}$ , starting  $T_J=25^{\circ}\text{C}$

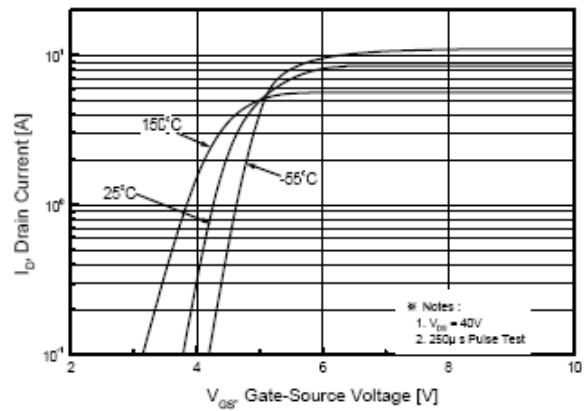
4. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$

5. Essentially independent of operating temperature

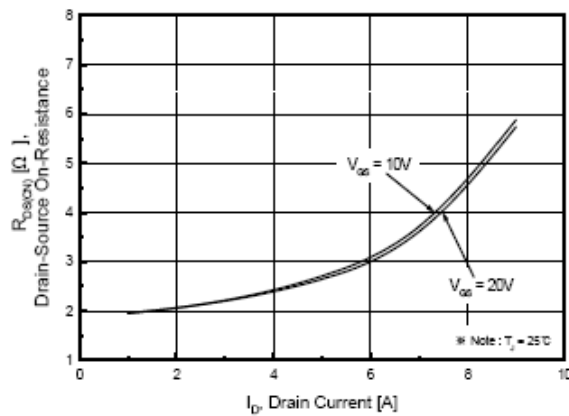
**7. Test circuits and waveforms**



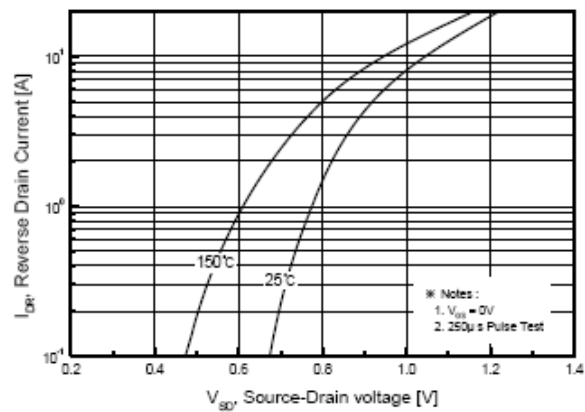
**Figure 1. On-Region Characteristics**



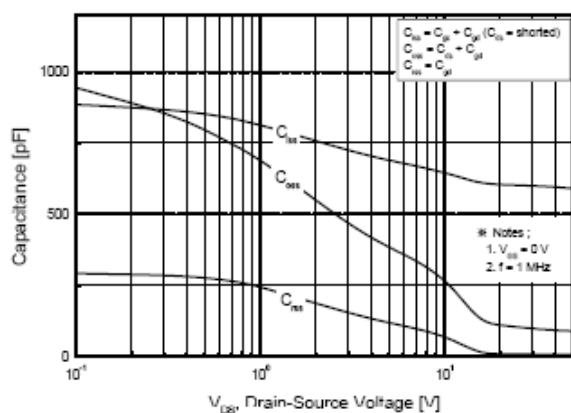
**Figure 2. Transfer Characteristics**



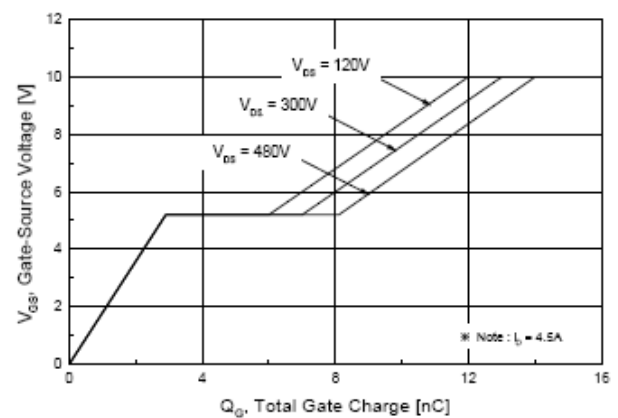
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



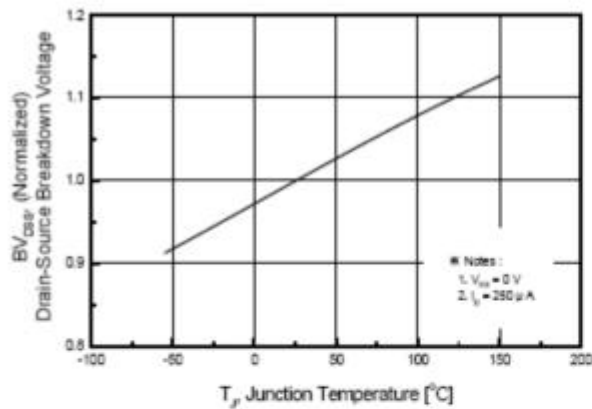
**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**



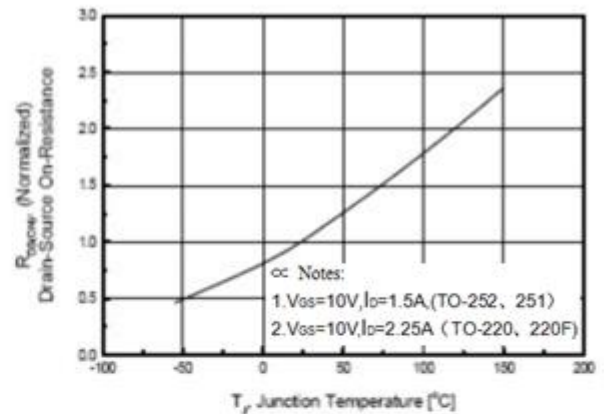
**Figure 5. Capacitance Characteristics**



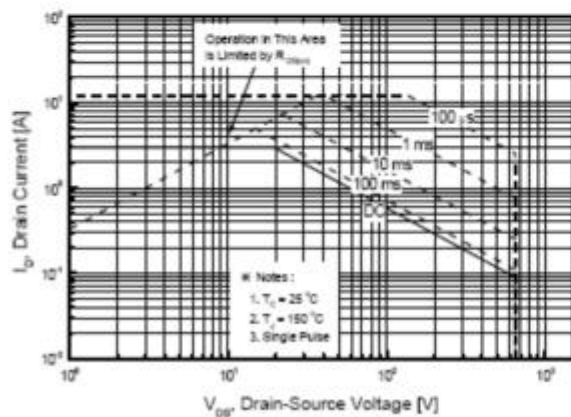
**Figure 6. Gate Charge Characteristics**



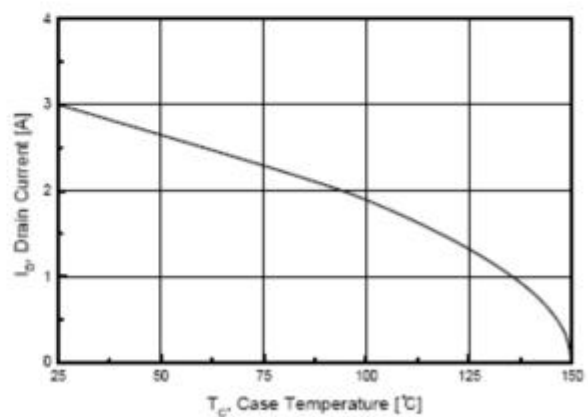
**Figure 7. Breakdown Voltage Variation vs Temperature**



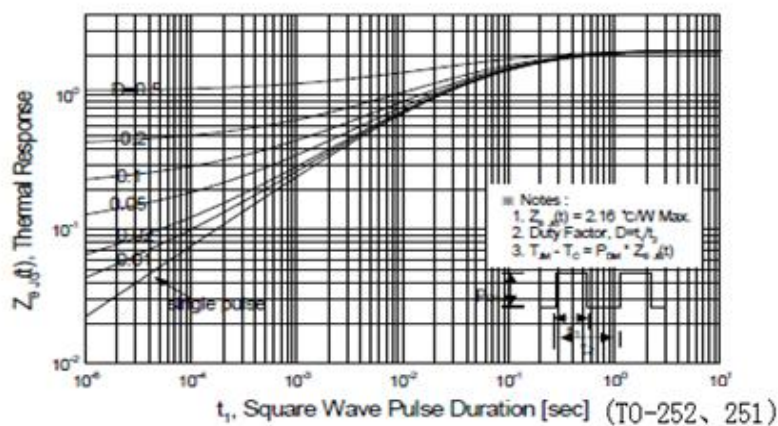
**Figure 8. On-Resistance Variation vs Temperature**



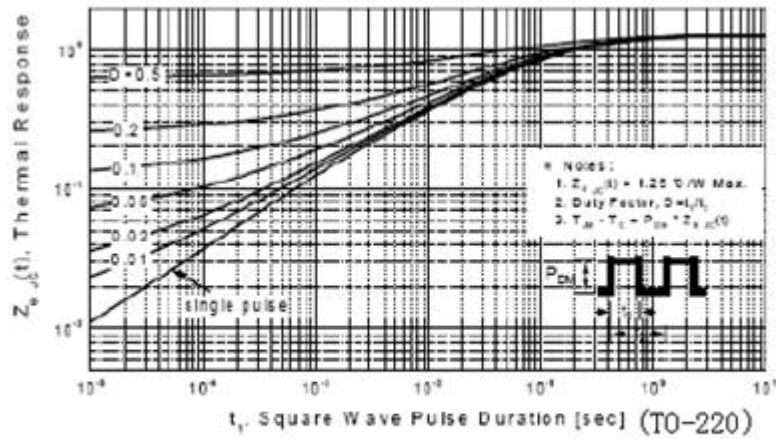
**Figure 9. Maximum Safe Operating Area**



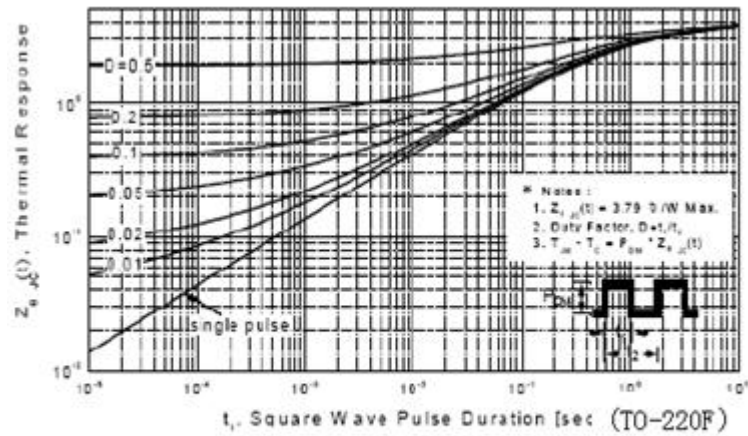
**Figure 10. Maximum Drain Current vs Case Temperature**



**Figure 11. Transient Thermal Response Curve**



**Figure 11-1. Transient Thermal Response Curve**



**Figure 11-2. Transient Thermal Response Curve**