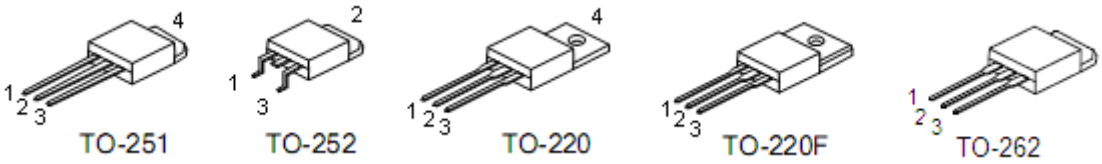
1. Description

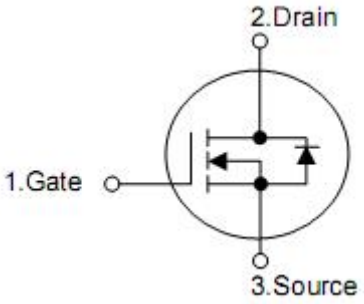
The KIA4N60H N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

2. Features

- $R_{DS(ON)}$ =2.3Ω@ V_{GS}=10V
- Low gate charge (typical 13.5nC)
- High ruggedness
- Fast switching capability
- Avalanche energy specified
- Improved dv/dt capability

3. Pin configuration





Pin	Function
1	Gate
2	Drain
3	Source
4	Drain

4. Absolute maximum ratings

(T_C= 25ºC , unless otherwise specified)

Parameter		Symbol	Rating				Units
			TO220 TO262	TO220F	TO251	TO252	
Drain-source voltage		V_{DSS}	600				V
Gate-source voltage		V_{GSS}	±30				V
Drain current continuous	T_C=25ºC	I_D	4.0	4.0*	2.8		A
	T_C=100ºC		2.4	2.4*	1.8		A
Drain current pulsed (note1)		I_{DM}	16	16*	12		A
Avalanche energy	Repetitive (note1)	E_{AR}	9.3		5.5		mJ
	Single pulse (note2)	E_{AS}	180				mJ
Peak diode recovery dv/dt (note3)		dv/dt	4.5				V/ns
Total power dissipation	T_C=25ºC	P_D	93	31	55		W
	Derate above 25ºC		0.74	0.24	0.44		W/ºC
Junction temperature		T_J	+150				ºC
Storage temperature		T_{STG}	-55~+150				ºC

*Drain current limited by maximum junction temperature.

5. Thermal characteristics

Parameter	Symbol	Rating				Unit
		TO220 TO262	TO220F	TO251	TO252	
Thermal resistance,junction-ambient	R_{thJA}	62.5		110		ºC/W
Thermal resistance,case-to-sink typ	R_{thJS}	0.5	--	50		
Thermal resistance junction-case	R_{thJC}	1.35	4.05	2.25		

6. Electrical characteristics

(T_J=25°C,unless otherwise notes)

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics							
Drain-source breakdown voltage		BV_{DSS}	V_{GS}=0V,I_D=250μA	600	-	-	V
Zero gate voltage drain current		I_{DSS}	V_{DS}=600V ,V_{GS}=0V	-	-	1	μA
			V_{DS}=480V ,T_C=125 ºC	-	-	10	μA
Gate-body leakage current	Forward	I_{GSS}	V_{GS}=30V,V_{DS}=0V	-	-	100	nA
	Reverse		V_{GS}=-30V,V_{DS}=0V	-	-	-100	nA
Breakdown voltage temperature coefficient		$\triangle Bv_{DSS}/\triangle T_J$	I_D=250μA	-	0.6	-	V/ºC
On characteristics							
Gate threshold voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	2.0	-	4.0	V
Static drain-source on-resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=2.0A(TO220,TO262、TO220F) I_D=1.4A(TO251,TO252)	-	2.3	2.7	Ω
Dynamic characteristics							
Input capacitance		C_{ISS}	V_{DS}=25V,V_{GS}=0V, f=1MHz	-	500	-	pF
Output capacitance		C_{OSS}		-	45	-	pF
Reverse transfer capacitance		C_{RSS}		-	4.5	-	pF
Switching characteristics							
Turn-on delay time		$t_{D(ON)}$	V_{DD}=300V, I_D=4.0A(TO220,TO262,TO220F) I_D=2.8A(TO251,TO252) R_G=25Ω (note4,5)	-	10	-	ns
Rise time		t_R		-	32	-	ns
Turn-off delay time		$t_{D(OFF)}$		-	32	-	ns
Fall time		t_F		-	40	-	ns
Total gate charge		Q_G	V_{DS}=480V, I_D=4.0A(TO220,TO262,TO220F) I_D=2.8A(TO251,TO252) V_{GS}=10V (note4,5)	-	13.5	-	nC
Gate-source charge		Q_{GS}		-	2.2	-	nC
Gate-drain charge		Q_{GD}		-	5.4	-	nC
Drain-source diode characteristics							
Drain-source diode forward voltage		V_{SD}	V_{GS}=0V,I_{SD}=4.0A(TO220,TO262,TO220F) I_{SD}=2.8A(TO251,TO252)	-	-	1.4	V
Continuous drain-source current		I_{SD}	TO220,TO262,TO220F	-	-	4.0	A
			TO251,TO252	-	-	2.8	
Pulsed drain-source current		I_{SM}	TO220,TO262,TO220F	-	-	16.0	A
			TO251,TO252	-	-	12	
Reverse recovery time		t_{RR}	I_{SD}=4.0A(TO220,TO262,TO220F) I_{SD}=2.8A(TO251,TO252) dI_{SD}/dt=100A/μs (note 4)	-	250	-	ns
Reverse recovery charge		Q_{RR}		-	1.8	-	μC

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

2. L=20mH, I_{AS}=4.0A, V_{DD}=50V, R_G=25Ω, starting T_J=25ºC

3. I_{SD}≤4.0A,di/dt≤200A/μs , V_{DD}≤BV_{DSS}, starting T_J=25 ºC

4. Pulse test : pulse width≤300μs,duty cycle≤2%

5. Essentially independent of operating temperature

7. Test circuits and waveforms

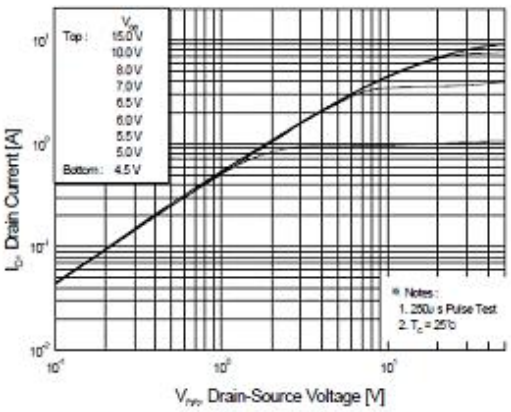


Figure 1. On-Region Characteristics

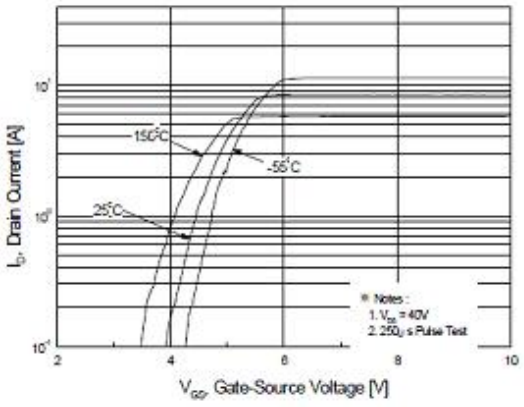


Figure 2. Transfer Characteristics

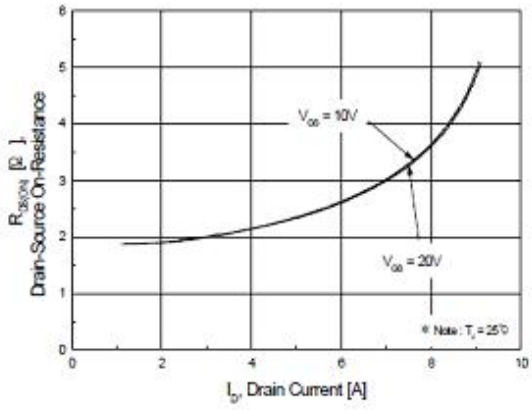


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

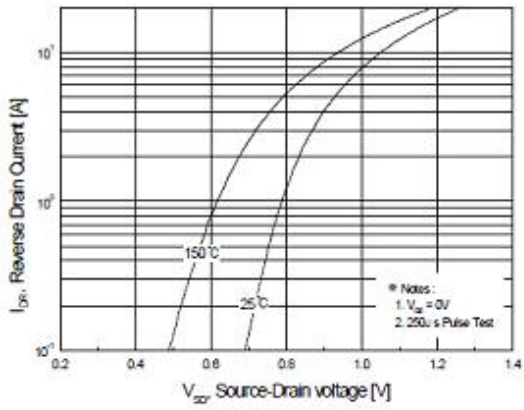


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

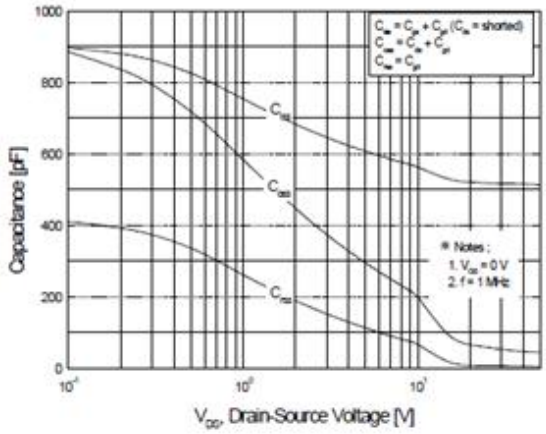


Figure 5. Capacitance Characteristics

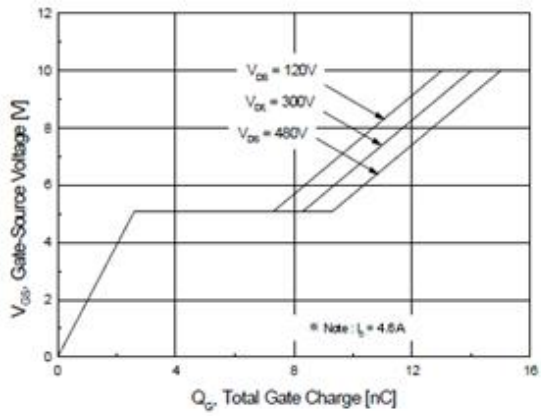


Figure 6. Gate Charge Characteristics

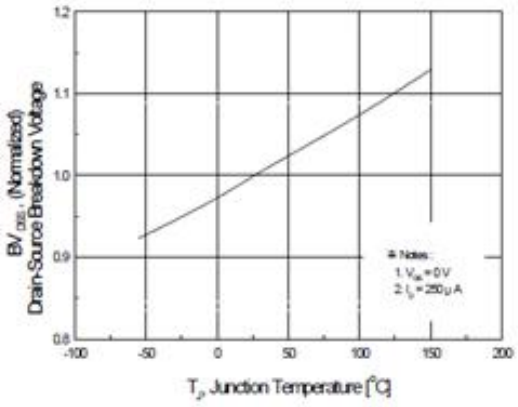


Figure 7. Breakdown Voltage Variation vs Temperature

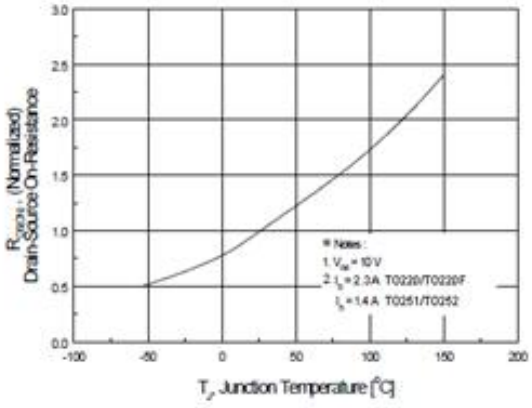


Figure 8. On-Resistance Variation vs Temperature

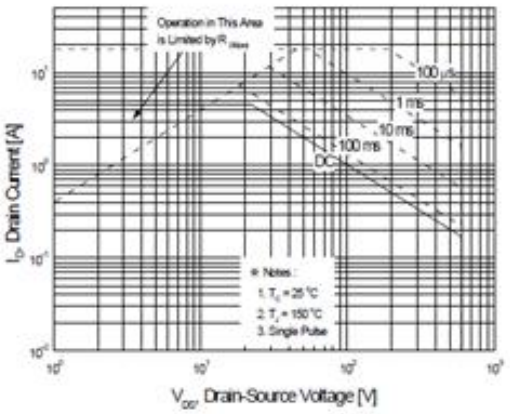


Figure 9-1. Maximum Safe Operating Area for TO220

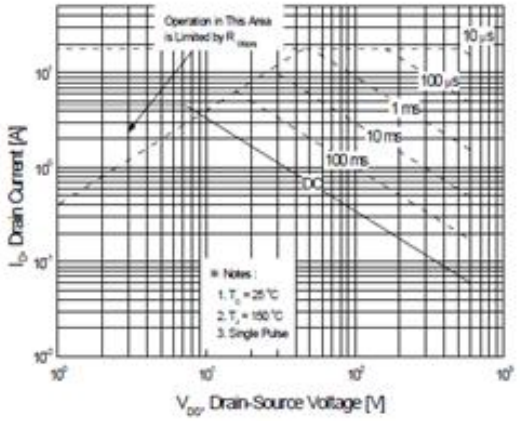


Figure 9-2. Maximum Safe Operating Area for TO220F

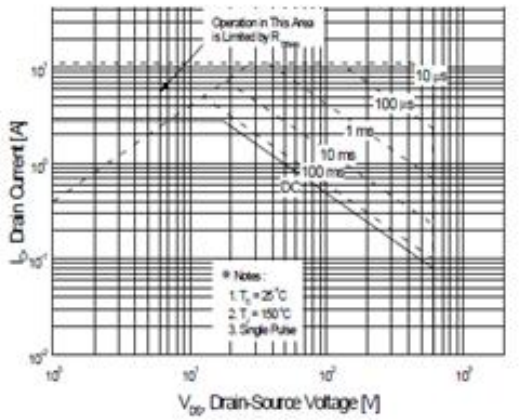


Figure 9-3. Maximum Safe Operating Area for TO251, TO252

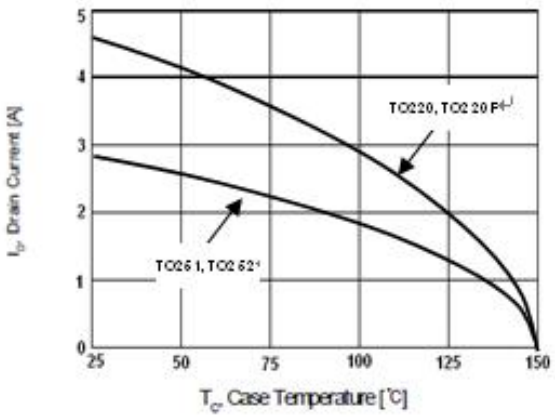


Figure 10. Maximum Drain Current vs Case Temperature

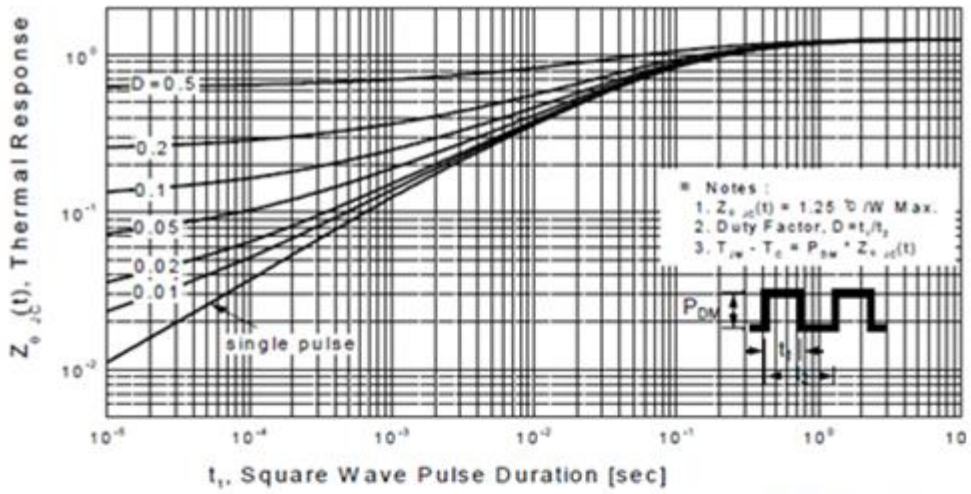


Figure 11-1. Transient Thermal Response Curve for TO220/TO262

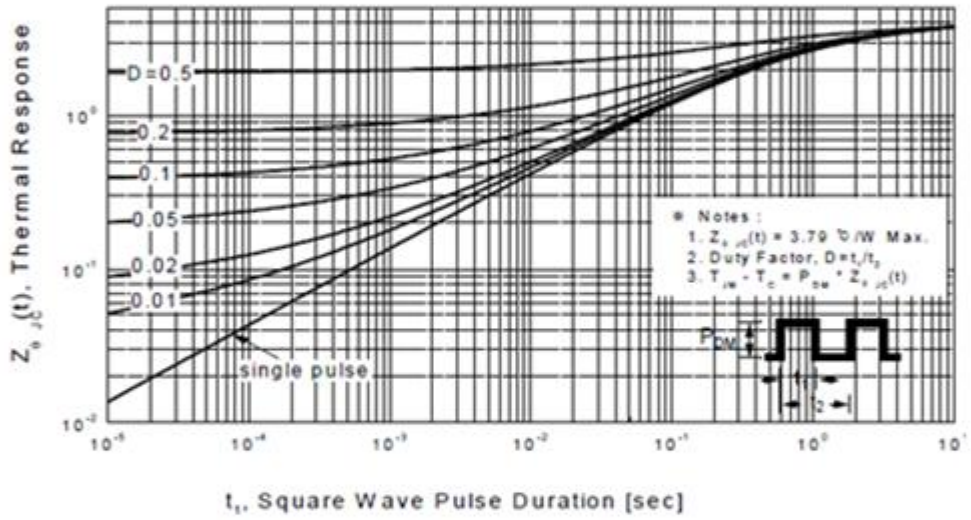


Figure 11-2. Transient Thermal Response Curve for TO220F

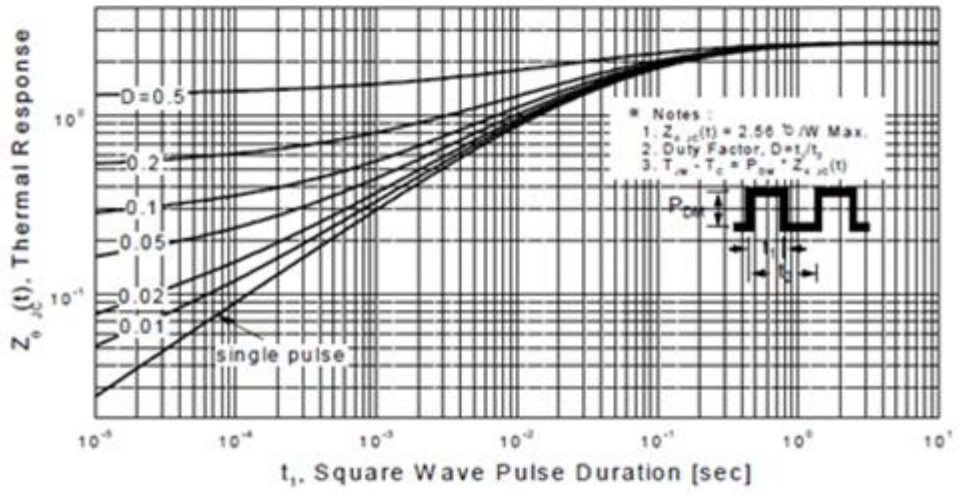


Figure 11-3. Transient Thermal Response Curve for TO251/ TO252