KIA
SEMICONDUCTORS

60A，500V
**N-CHANNEL MOSFET**

KCX3650A

1. Description

This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

2. Features

- n Robust High Voltage Termination
- n Avalanche Energy Specified
- n Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- n Diode is Characterized for Use in Bridge Circuits
- n I_{DSS} and $V_{DS(ON)}$ Specified at Elevated Temperature
- n Isolated Mounting Hole Reduces Mounting Hardware

3. Pin configuration
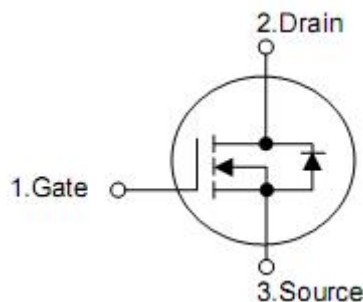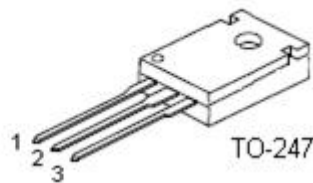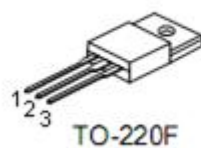
Pin	Function
1	Gate
2	Drain
3	Source

4. Ordering Information

Part Number	Package	Brand
KCF3650A	TO-220F	KIA
KCM3650A	TO-247	KIA

5. Absolute maximum ratings

(T_C= 25 ºC , unless otherwise noted)

Parameter		Symbol	Rating		Units
			220F	247	
Drain current continuous		$I_D{}^1$	60		A
Drain current pulsed		I_{DM}	180		A
Gate-to-Source Voltage Continue		V_{GS}	± 20		V
Single Pulse Drain-to-Source Avalanche Energy T_J=25 ºC (V_{DD}=100V, V_{GS}=10V, I_L=16A, L=10mH, R_G=25Ω)		E_{AS}	1280		mJ
Total power dissipation	T_C=25 ºC	P_D	54	379	W
	derate above 25 ºC		0.43	3.03	W/ºC
Operating and storage temperature range		T_J, T_{STG}	-55~+150		ºC
Maximum lead temperature for soldering purposes, 1/8 ″ from case for 10 seconds		T_L	260		ºC

1. Drain current limited by maximum junction temperature

6. Thermal characteristics

Parameter	Symbol	Rating		Unit
		220F	247	
Thermal resistance, Junction-ambient	R_{thJA}	62.5	40	ºC/W
Thermal resistance, Junction-case	R_{thJC}	2.3	0.33	ºC/W

7. Electrical characteristics

(T_C=25°C,unless otherwise noted)

| Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V,I_D=250µA	500	-	-	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=500V ,V_{GS}=0V	-	-	1	µA
Gate-Source Leakage Current-Forward	I_{GSSF}	V_{GS}=20V,V_{DS}=0V	-	-	100	nA
Gate-Source Leakage Current-Reverse	I_{GSSR}	V_{GS}=-20V,V_{DS}=0V	-	-	-100	nA
On characteristics						
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250µA	2	3	4	V
Static drain-source on-resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=20A*	-	50	56	mΩ
Gate resistance	R_G	f=1MHz, open drain	-	3.9	-	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V, f=1MHz	-	3180	-	pF
Output capacitance	C_{oss}		-	4400	-	pF
Reverse transfer capacitance	C_{rss}		-	80	-	pF
Switching characteristics						
Turn-on delay time	$t_{d(on)}$	V_{DD}=250V,I_D=20A, R_G=25Ω*	-	52	-	ns
Rise time	t_r		-	148	-	ns
Turn-off delay time	$t_{d(off)}$		-	127	-	ns
Fall time	t_f		-	75	-	ns
Total gate charge	Q_g	V_{DS}=400V,I_D=20A , V_{GS}=10V*	-	66	-	nC
Gate-source charge	Q_{gs}		-	24	-	nC
Gate-drain charge	Q_{gd}		-	28	-	nC
Drain-source diode characteristics and maximum ratings						
Drain-source diode forward voltage[1]	V_{SD}	I_S=20A dI_S/dt=100A/µs	-	-	1.5	V
Forward turn-On Time	t_{ON}		-	**	-	ns
Reverse recovery charge	t_{rr}		-	992	-	ns

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

　　　**. Negligible, Dominated by circuit inductance

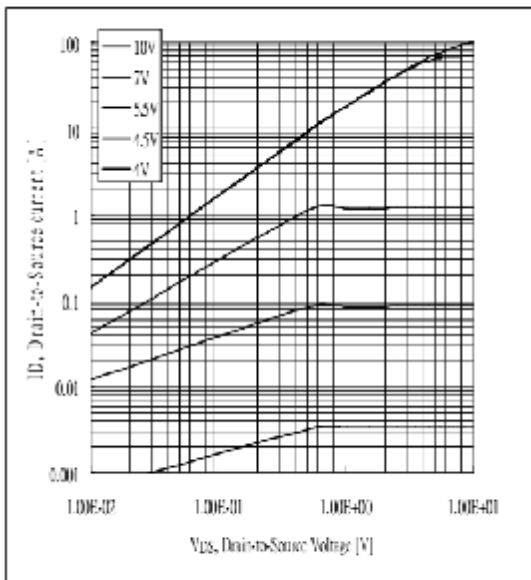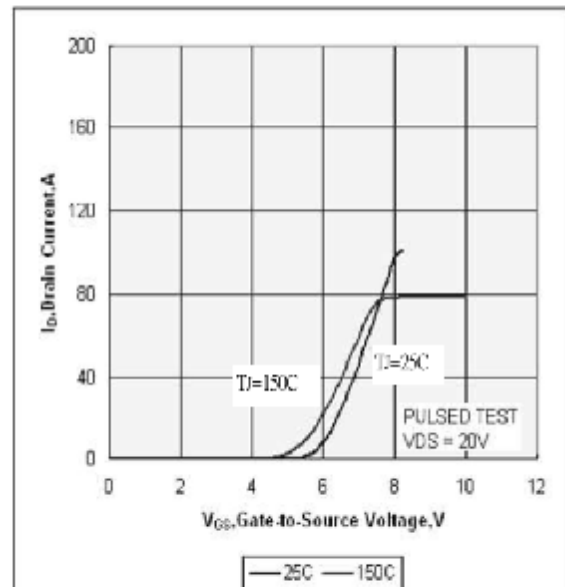## 8. Test circuits and waveforms
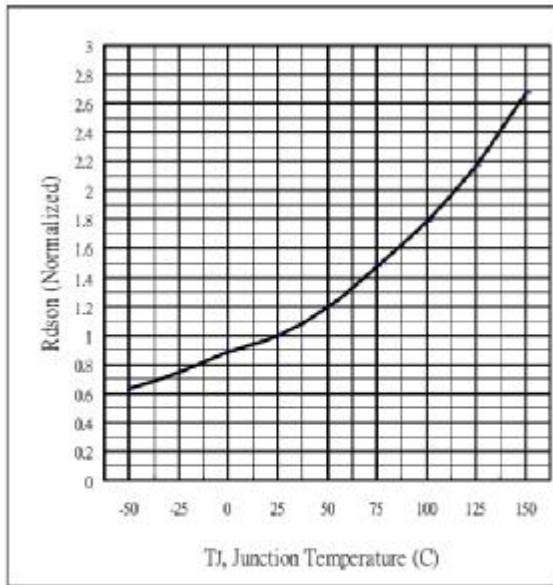
Fig 1. On-Resistance Variation with vs. Temperature
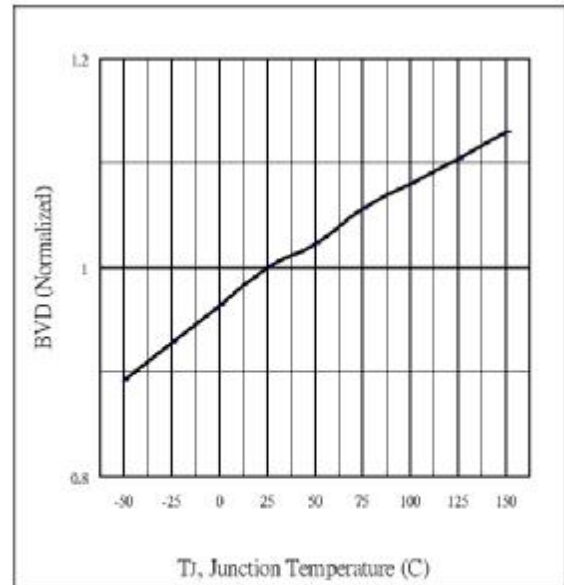
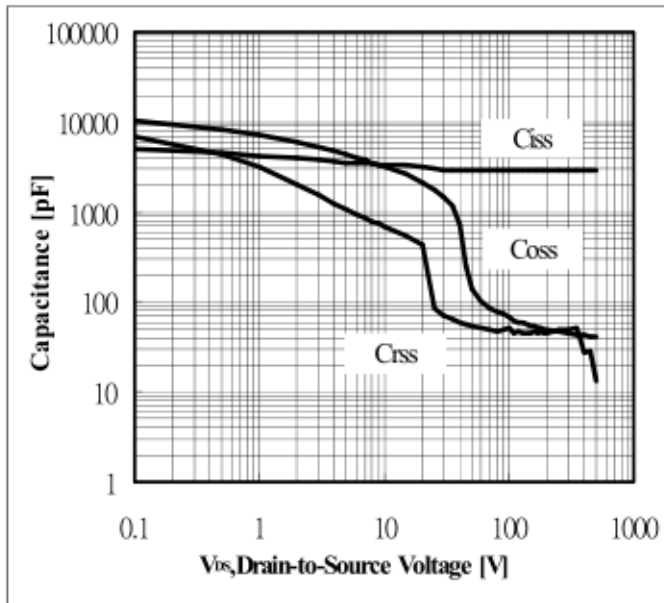Fig.2 Breakdown Voltage Variation vs. Temperature
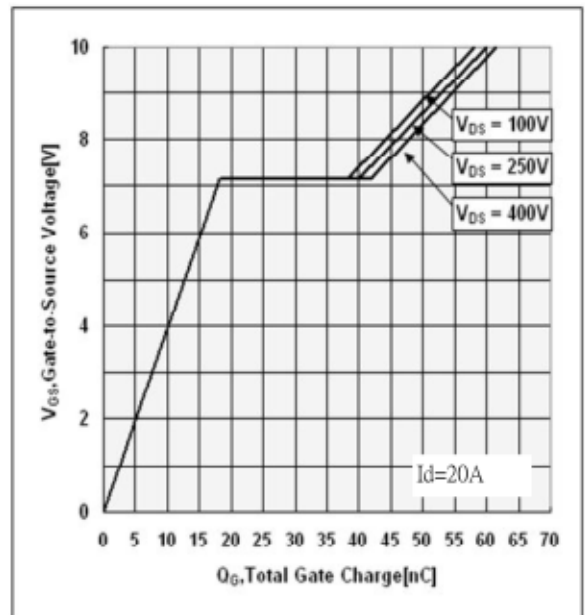

Fig 3. Typical Output Characteristics

Fig 4. Typical Transfer Characteristics

Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage