

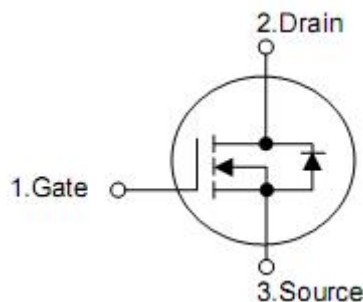
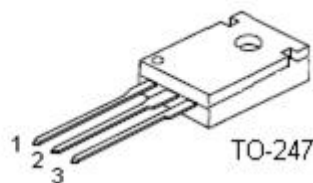
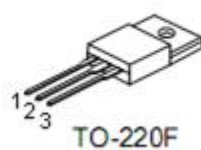
1. Description

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

($T_C = 25\text{ }^\circ\text{C}$, 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 $T_J=25\text{ }^\circ\text{C}$ ($V_{DD}=100\text{V}$, $V_{GS}=10\text{V}$, $I_L=16\text{A}$, $L=10\text{mH}$, $R_G=25\Omega$) | E_{AS} | 1280 | | mJ | |
| Total power dissipation | P_D | $T_C=25\text{ }^\circ\text{C}$ | 54 | 379 | W |
| | | derate above $25\text{ }^\circ\text{C}$ | 0.43 | 3.03 | W/ $^\circ\text{C}$ |
| Operating and storage temperature range | T_J, T_{STG} | -55~+150 | | $^\circ\text{C}$ | |
| Maximum lead temperature for soldering purposes, 1/8 " from case for 10 seconds | T_L | 260 | | $^\circ\text{C}$ | |

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 | $^\circ\text{C/W}$ |
| Thermal resistance, Junction-case | R_{thJC} | 2.3 | 0.33 | $^\circ\text{C/W}$ |

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 d _I /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

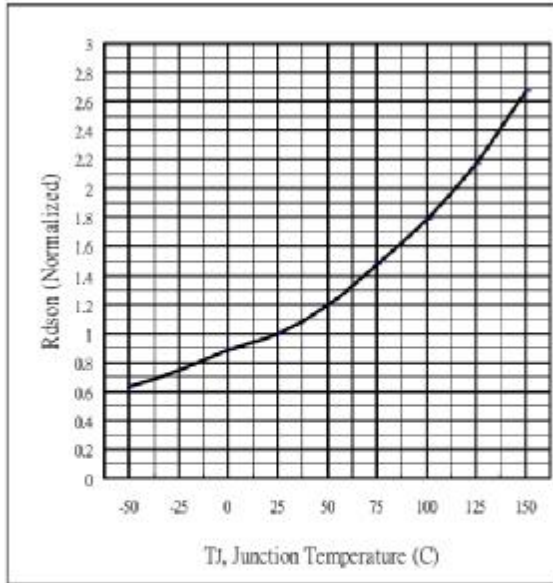


Fig 1. On-Resistance Variation with vs. Temperature

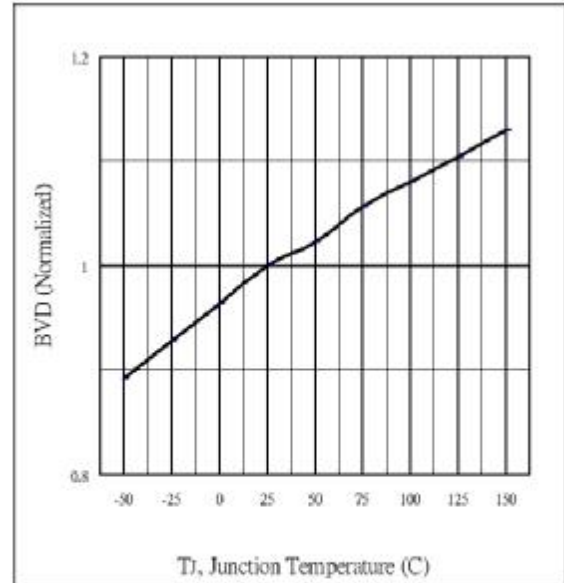


Fig.2 Breakdown Voltage Variation vs. Temperature

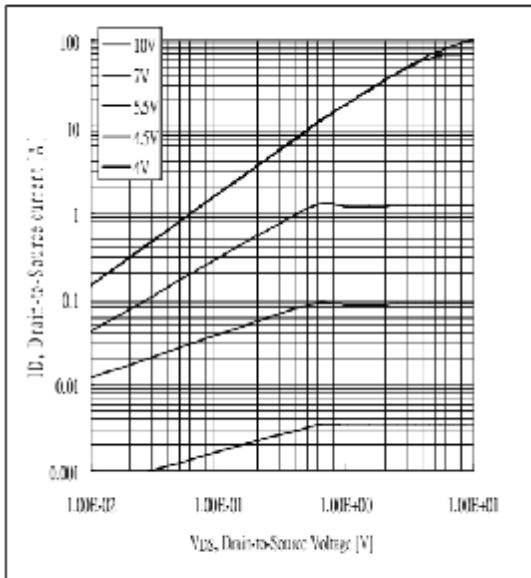


Fig 3. Typical Output Characteristics

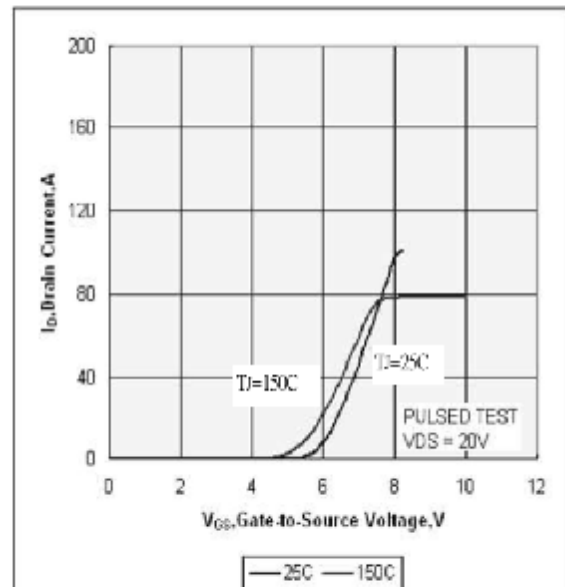


Fig 4. Typical Transfer Characteristics

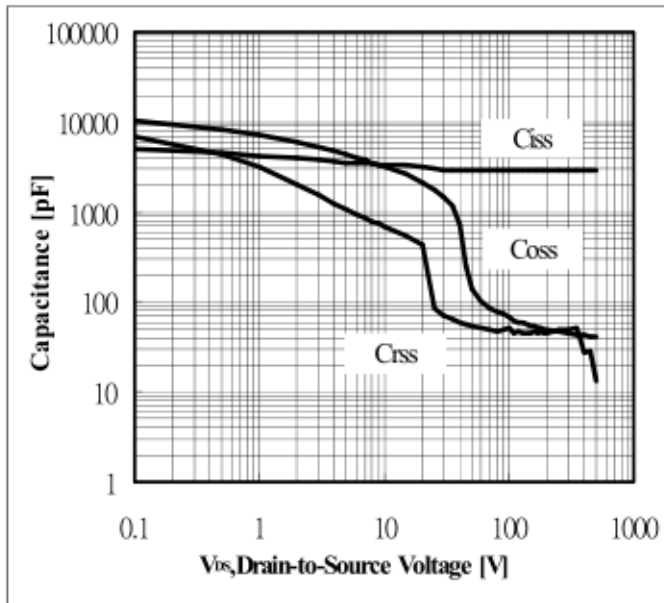


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

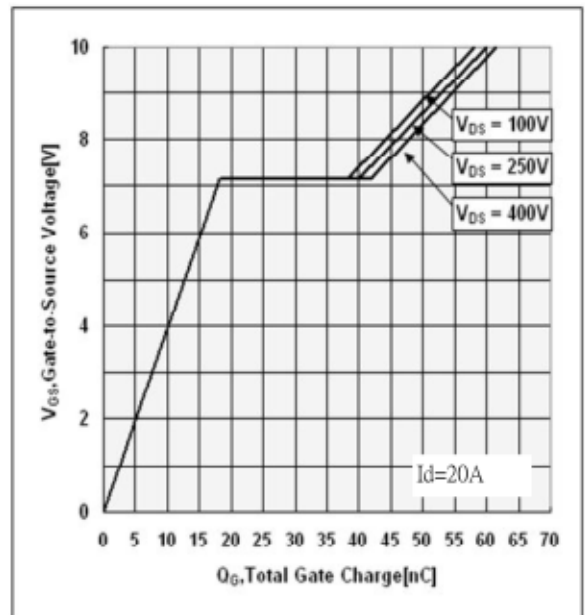


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage