

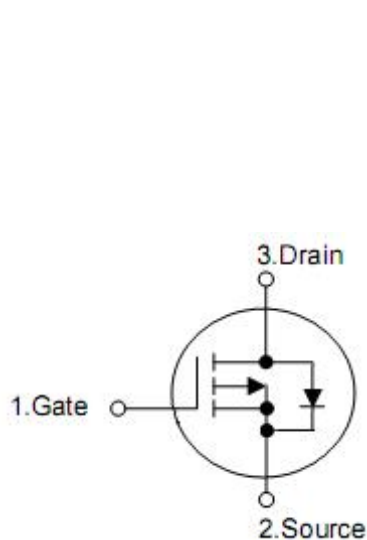
## 1. Description

The KIA3415 uses advanced trench technology to provide excellent  $R_{DS(on)}$ , low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications. Standard Product KIA3415 is Pb-free (meets ROHS & Sony 259 specifications). KIA3415 is a Green Product ordering option. KIA3415 is electrically identical.

## 2. Features

- n  $V_{DS}(V) = -20V$
- n  $I_D = -4.0A$
- n  $R_{DS(on)} < 45m\Omega (V_{GS} = -4.5V, I_D = -4.0A)$
- n  $R_{DS(on)} < 54m\Omega (V_{GS} = -2.5V, I_D = -4.0A)$
- n  $R_{DS(on)} < 75m\Omega (V_{GS} = -1.8V, I_D = -2.0A)$

## 3. Symbol



| Pin | Function |
|-----|----------|
| 1   | Gate     |
| 2   | Source   |
| 3   | Drain    |

#### 4. Absolute maximum ratings

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

| Parameter                              | Symbol                            | Rating                | Units |
|----------------------------------------|-----------------------------------|-----------------------|-------|
| Drain-source voltage                   | V <sub>DS</sub>                   | -20                   | V     |
| Gate-source voltage                    | V <sub>GS</sub>                   | ±8                    | V     |
| Continuous drain current <sup>A</sup>  | I <sub>D</sub>                    | T <sub>A</sub> =25°C  | -4.0  |
|                                        |                                   | T <sub>A</sub> =70°C  | -3.5  |
| Pulsed drain current <sup>B</sup>      | I <sub>DM</sub>                   | -30                   | A     |
| Total power dissipation <sup>A</sup>   | P <sub>D</sub>                    | T <sub>A</sub> =25 °C | 1.4   |
|                                        |                                   | T <sub>A</sub> =70°C  | 0.9   |
| Junction and storage temperature range | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150            | °C    |

#### 5. Thermal characteristics

| Parameter                                     | Symbol           | Typ | Max | Unit |
|-----------------------------------------------|------------------|-----|-----|------|
| Maximum junction-ambient <sup>A</sup> (t≤10s) | R <sub>θJA</sub> | 65  | 90  | °C/W |
| Maximum junction-ambient <sup>A</sup>         | R <sub>θJA</sub> | 85  | 125 | °C/W |
| Maximum junction-Lead <sup>C</sup>            | R <sub>θJL</sub> | 43  | 60  | °C/W |

## 6. Electrical characteristics

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

| Parameter                             | Symbol       | Test Conditions                                              | Min  | Typ   | Max       | Units      |
|---------------------------------------|--------------|--------------------------------------------------------------|------|-------|-----------|------------|
| Drain-source breakdown voltage        | $BV_{DSS}$   | $V_{GS}=0V, I_D=-250\mu A$                                   | -20  | -     | -         | V          |
| Zero gate voltage drain current       | $I_{DSS}$    | $V_{DS}=-16V, V_{GS}=0V$                                     | -    | -     | -50       | nA         |
| Gate- body leakage current            | $I_{GSS}$    | $V_{GS}=\pm 8V, V_{DS}=0V$                                   | -    | -     | $\pm 100$ | nA         |
| Gate threshold voltage                | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$                               | -0.4 | -0.55 | -0.8      | V          |
| On state drain current                | $I_{D(on)}$  | $V_{GS}=-4.5V, V_{DS}=-5V$                                   | -25  | -     | -         | A          |
| Static drain-source on-resistance     | $R_{DS(on)}$ | $V_{GS}=-4.5V, I_D=-4.0A$                                    | -    | 40    | 45        | m $\Omega$ |
|                                       |              | $V_{GS}=-2.5V, I_D=-4.0A$                                    | -    | 50    | 54        |            |
|                                       |              | $V_{GS}=-1.8V, I_D=-2.0A$                                    | -    | 70    | 75        |            |
| Forward transconductance              | $g_{fs}$     | $V_{DS}=-5.0V, I_D=-4A$                                      | 8    | 16    | -         | S          |
| Diode forward voltage                 | $V_{SD}$     | $V_{GS}=0V, I_S=-1A$                                         | -    | -0.78 | -1.28     | V          |
| Maximum body-diode continuous current | $I_S$        |                                                              | -    | -     | -2.2      | A          |
| Input capacitance                     | $C_{iss}$    | $V_{DS}=-10V, V_{GS}=0V,$<br>$f=1MHz$                        | -    | 1450  | -         | pF         |
| Output capacitance                    | $C_{oss}$    |                                                              | -    | 205   | -         |            |
| Reverse transfer capacitance          | $C_{rss}$    |                                                              | -    | 160   | -         |            |
| Gate resistance                       | $R_g$        | $V_{DS}=0V,$<br>$V_{GS}=0V, f=1MHz$                          | -    | 6.5   | -         | $\Omega$   |
| Total gate charge                     | $Q_g$        | $V_{DS}=-10V, V_{GS}=-4.5V$<br>$I_D=-4.0A$                   | -    | 17.2  | -         | nC         |
| Gate-source charge                    | $Q_{gs}$     |                                                              | -    | 1.3   | -         |            |
| Gate-drain charge                     | $Q_{gd}$     |                                                              | -    | 4.5   | -         |            |
| Turn-on delay time                    | $t_{d(on)}$  | $V_{DS}=-10V, R_L=2.5\Omega,$<br>$R_G=3\Omega, V_{GS}=-4.5V$ | -    | 9.5   | -         | ns         |
| Rise time                             | $t_r$        |                                                              | -    | 17    | -         |            |
| Turn-off delay time                   | $t_{d(off)}$ |                                                              | -    | 94    | -         |            |
| Fall time                             | $t_f$        |                                                              | -    | 35    | -         |            |
| Reverse recovery time                 | $t_{rr}$     | $I_F=-4A, di/dt=100A/\mu s,$                                 | -    | 31    | -         | nS         |
| Reverse recovery charge               | $Q_{rr}$     |                                                              | -    | 13.8  | -         | nC         |

Note: A. The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $t_{\leq 10s}$  thermal resistance rating.

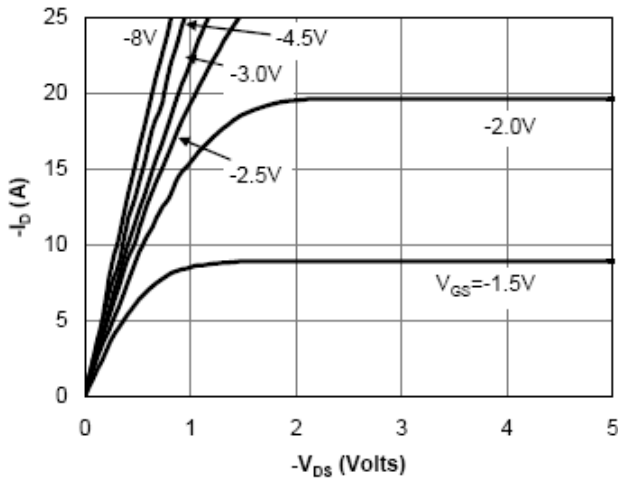
B. Repetitive rating, pulse width limited by junction temperature.

C. The  $R_{\theta JA}$  the sum of the thermal impedance from junction to lead  $R_{\theta JA}$  and lead to ambient.

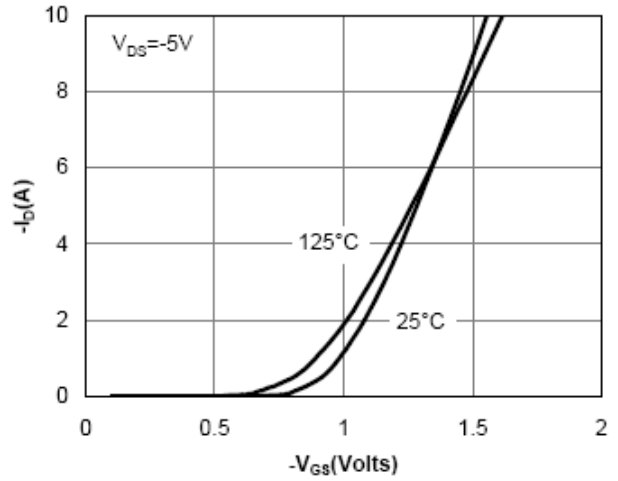
D. The static characteristics in Figures 1 to 6, 12, 14 are obtained using 80 $\mu s$  pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

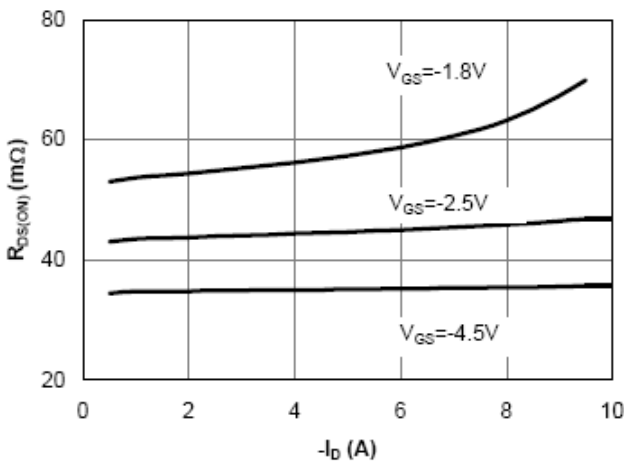
**7. Test circuits and waveforms**



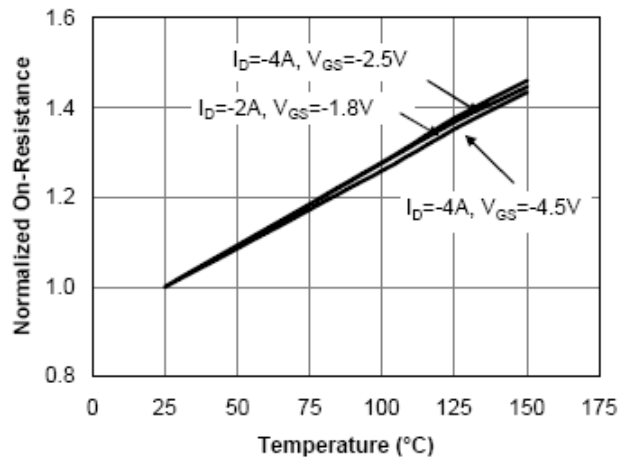
**Fig 1: On-Region Characteristics**



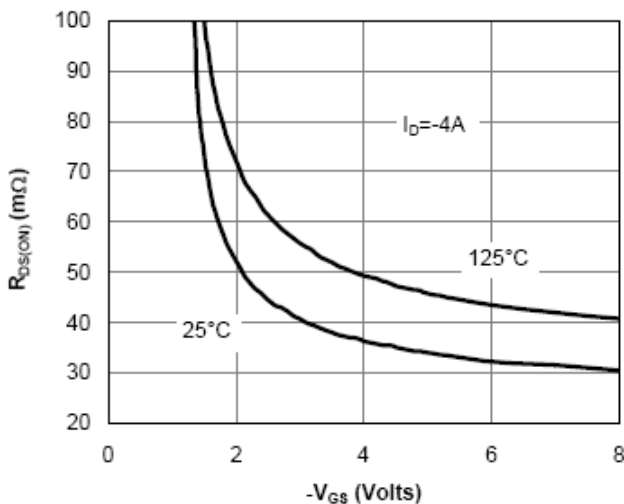
**Figure 2: Transfer Characteristics**



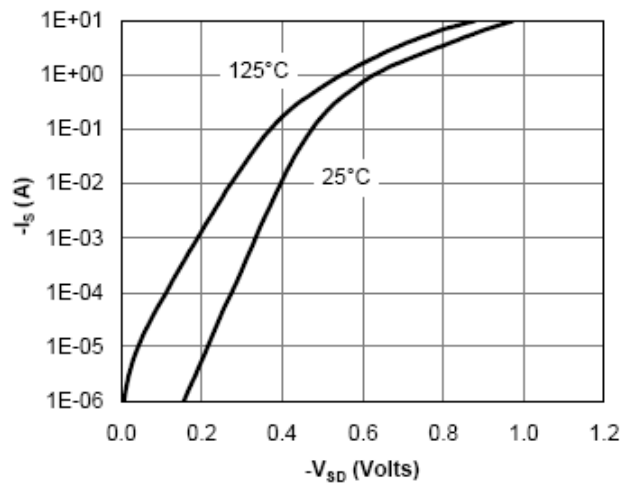
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**



**Figure 5: On-Resistance vs. Gate-Source Voltage**



**Figure 6: Body-Diode Characteristics**

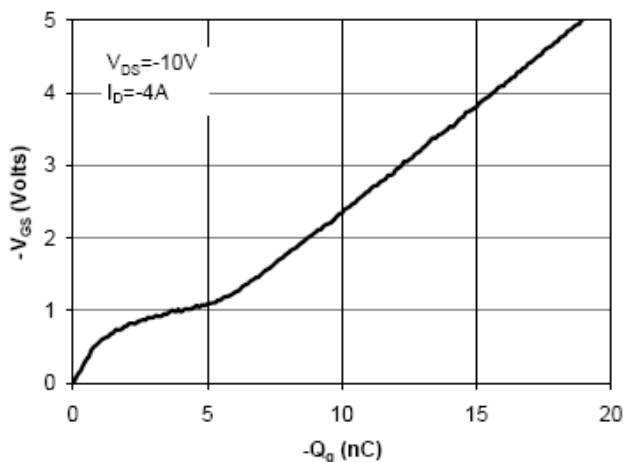


Figure 7: Gate-Charge Characteristics

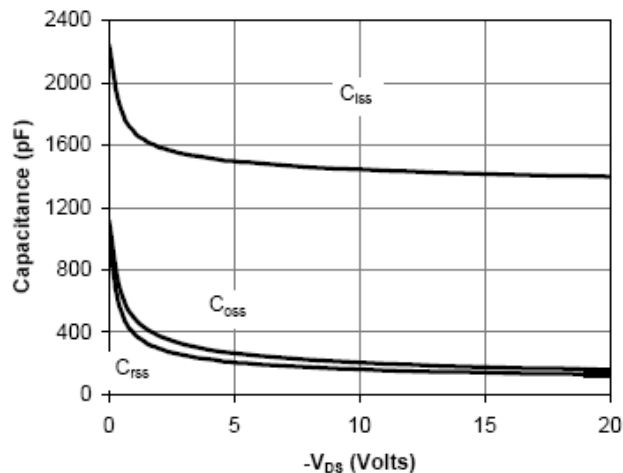


Figure 8: Capacitance Characteristics

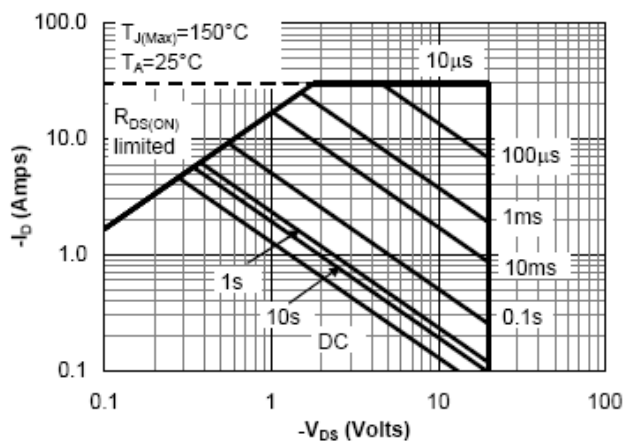


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

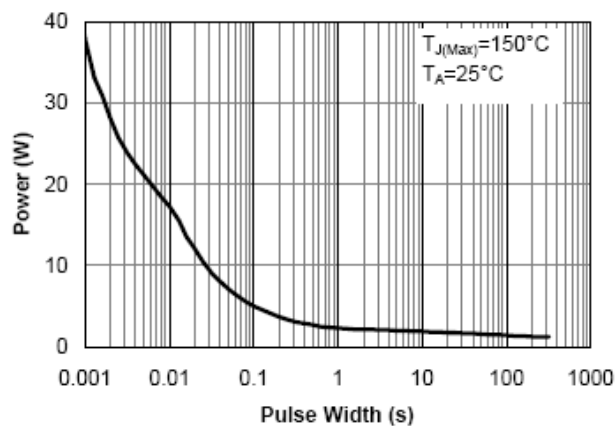


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

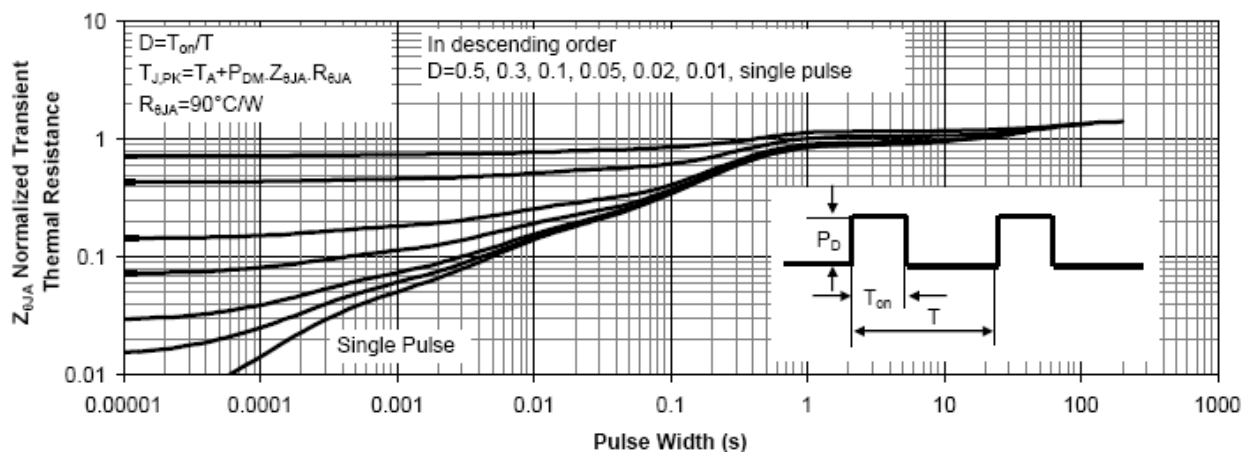


Figure 11: Normalized Maximum Transient Thermal Impedance