

## QIAOXIN N-Channel Enhancement Mode Power MOSFET

### Description

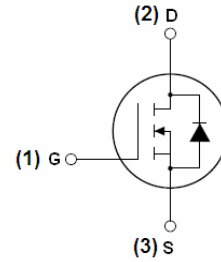
The VCRR0115AK uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

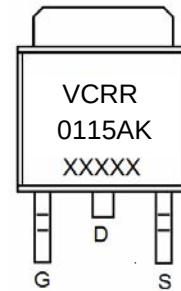
- $V_{DS} = 100V, I_D = 15A$   
 $R_{DS(ON)} < 90m\Omega @ V_{GS}=10V$  (Typ:75m $\Omega$ )  
 $R_{DS(ON)} < 100m\Omega @ V_{GS}=4.5V$  (Typ:80m $\Omega$ )
- High density cell design for ultra low  $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

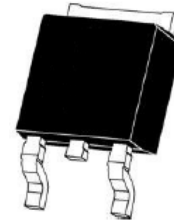
- Power switching application
- Hard switched and high frequency circuits



Schematic diagram



Marking and pin assignment



TO-252-2L top view

### Package Marking and Ordering Information

| Device Marking | Device | Device Package |
|----------------|--------|----------------|
| VCRR0115AK     |        | TO-252-2L      |

### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

| Parameter                                           | Symbol                   | Limit      | Unit             |
|-----------------------------------------------------|--------------------------|------------|------------------|
| Drain-Source Voltage                                | $V_{DS}$                 | 100        | V                |
| Gate-Source Voltage                                 | $V_{GS}$                 | $\pm 20$   | V                |
| Drain Current-Continuous                            | $I_D$                    | 15         | A                |
| Drain Current-Continuous( $T_C=100^\circ\text{C}$ ) | $I_D(100^\circ\text{C})$ | 10.6       | A                |
| Pulsed Drain Current                                | $I_{DM}$                 | 60         | A                |
| Maximum Power Dissipation                           | $P_D$                    | 50         | W                |
| Single pulse avalanche energy <sup>(Note 5)</sup>   | $E_{AS}$                 | 16         | mJ               |
| Operating Junction and Storage Temperature Range    | $T_J, T_{STG}$           | -55 To 175 | $^\circ\text{C}$ |

## Thermal Characteristic

|                                                          |                 |   |                      |
|----------------------------------------------------------|-----------------|---|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 3 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|---|----------------------|

## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

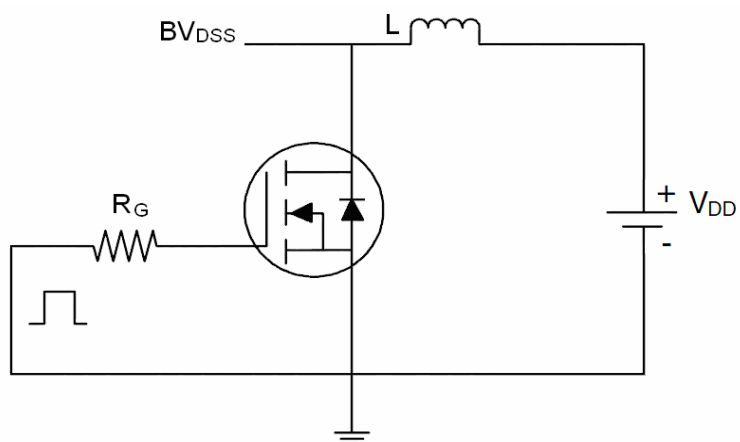
| Parameter                                     | Symbol              | Condition                                                                               | Min | Typ  | Max  | Unit |
|-----------------------------------------------|---------------------|-----------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                           |                     |                                                                                         |     |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                               | 100 | 110  | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                              | -   | -    | 1    | μA   |
| Gate-Body Leakage Current                     | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                              | -   | -    | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |                     |                                                                                         |     |      |      |      |
| Gate Threshold Voltage                        | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0 | 1.6  | 2.5  | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =10A                                               | -   | 75   | 90   | mΩ   |
|                                               |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A                                              | -   | 80   | 100  |      |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =10A                                                | -   | 10   | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                         |     |      |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                  | -   | 830  | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |                                                                                         | -   | 44.2 | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                         | -   | 30.1 | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                         |     |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V, R <sub>L</sub> =6. 4Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω | -   | 15   | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                         | -   | 5    | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                         | -   | 25   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                         | -   | 7    | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =50V, I <sub>D</sub> =10A,<br>V <sub>GS</sub> =10V                      | -   | 22.3 |      | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                         | -   | 2.87 | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                         | -   | 6.14 | -    | nC   |
| Drain-Source Diode Characteristics            |                     |                                                                                         |     |      |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =15A                                                | -   | -    | 1.2  | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                         | -   | -    | 15   | A    |

### Notes:

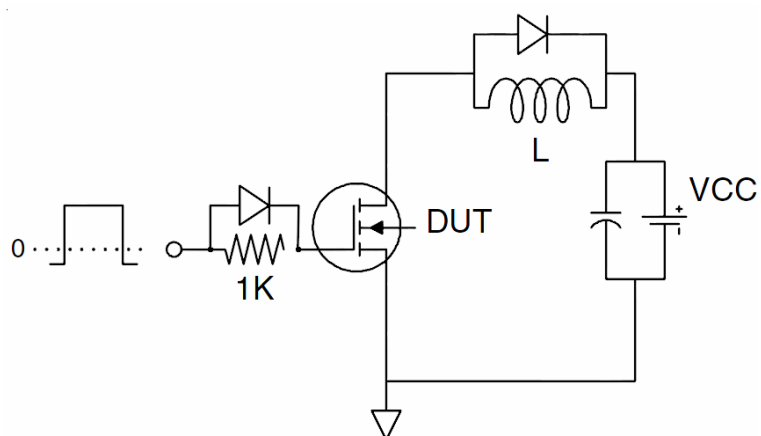
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_j=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## Test Circuit

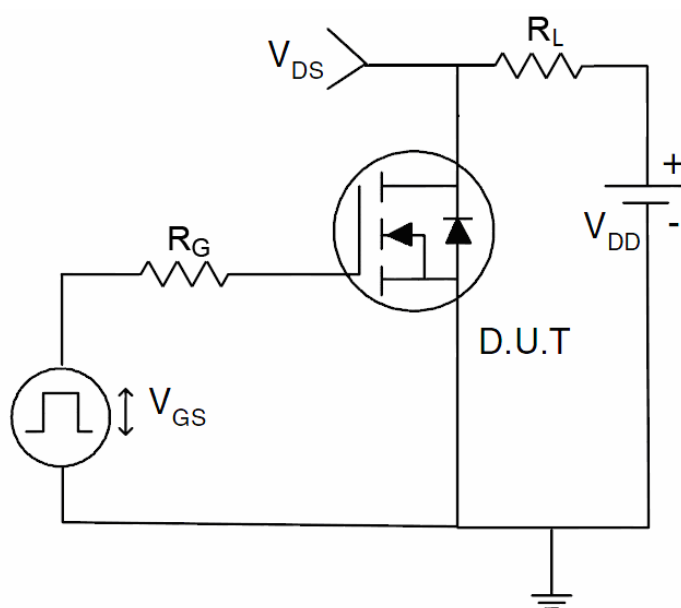
### 1) $E_{AS}$ test Circuit



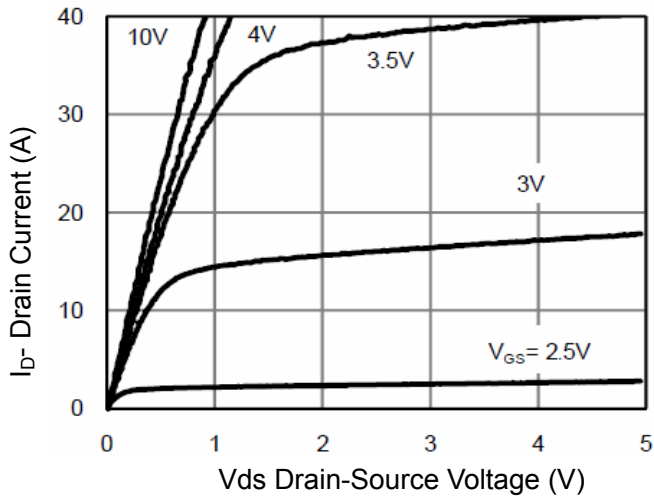
### 2) Gate charge test Circuit



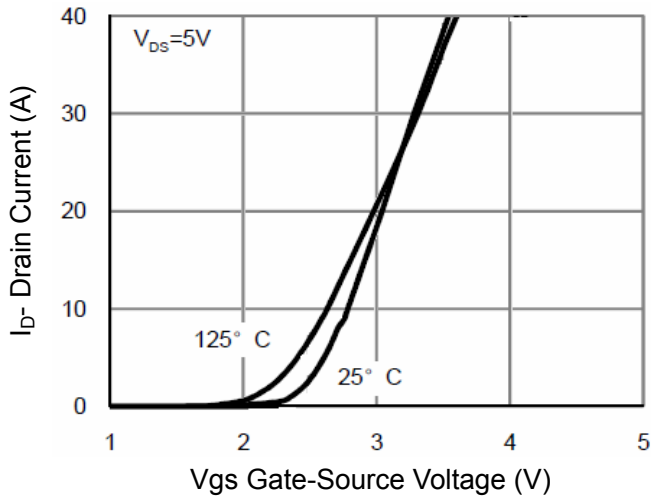
### 3) Switch Time Test Circuit



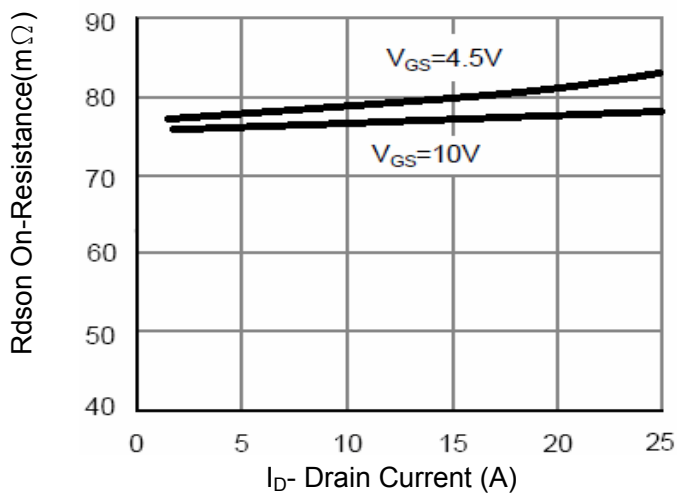
## Typical Electrical and Thermal Characteristics (Curves)



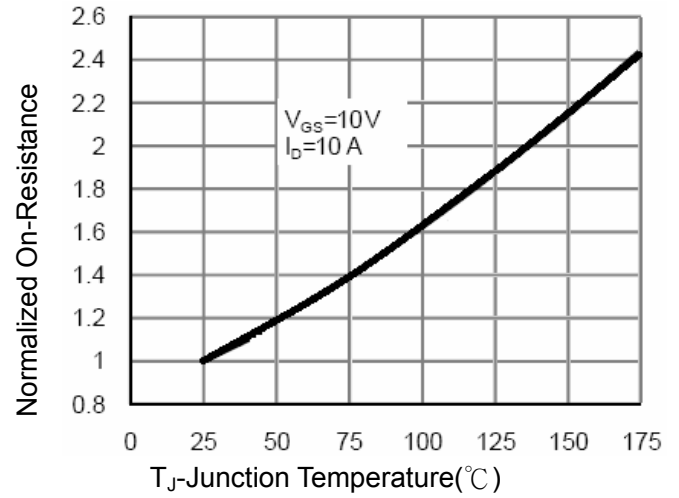
**Figure 1 Output Characteristics**



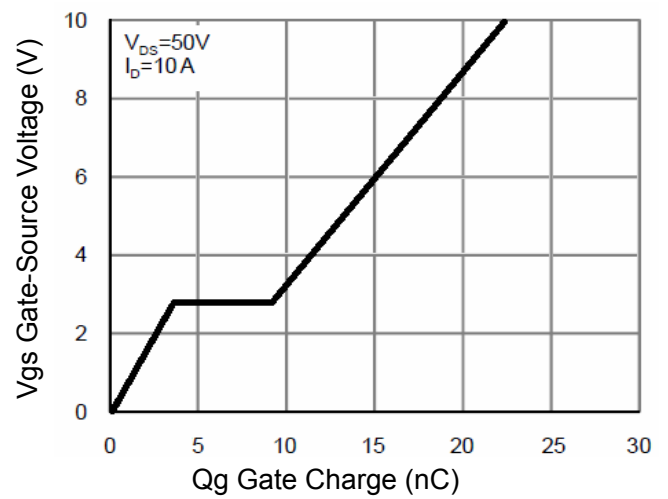
**Figure 2 Transfer Characteristics**



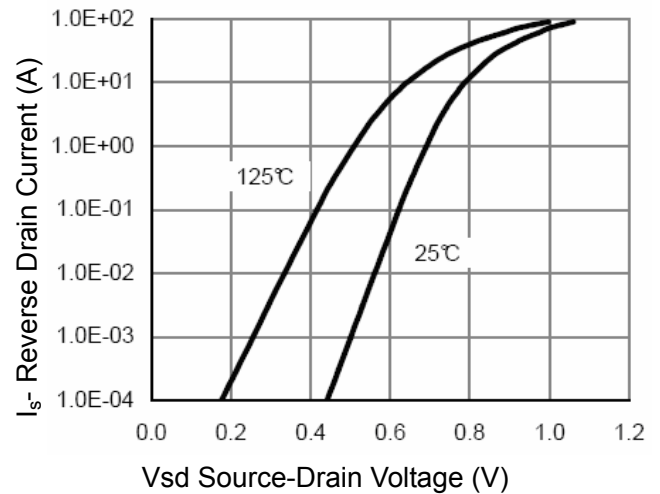
**Figure 3 Rdson- Drain Current**



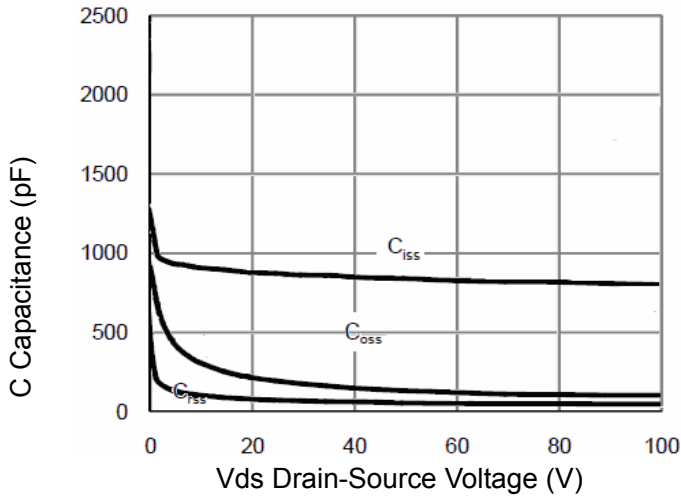
**Figure 4 Rdson-Junction Temperature**



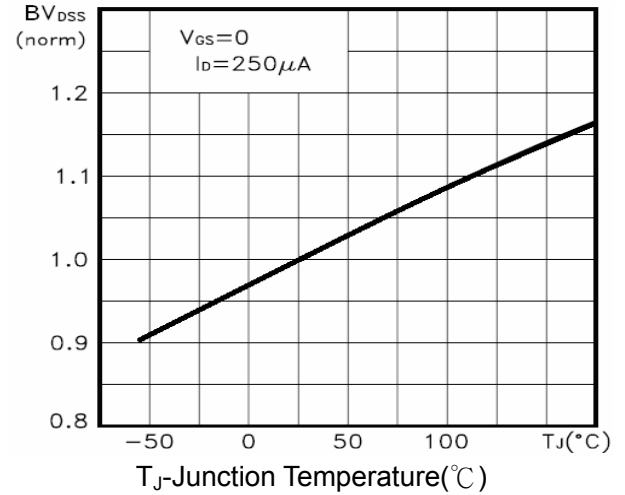
**Figure 5 Gate Charge**



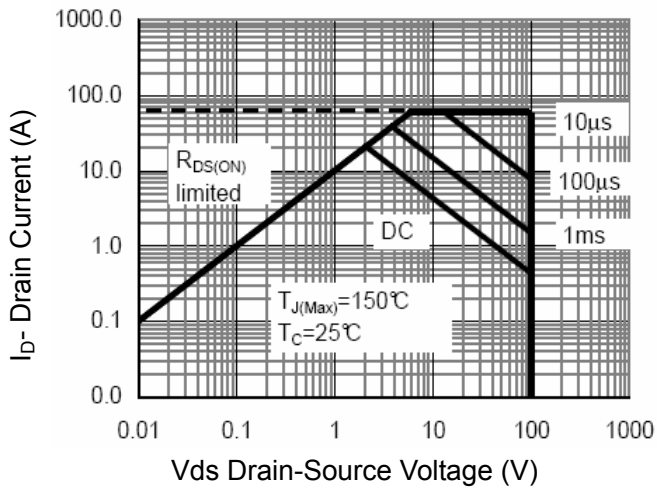
**Figure 6 Source- Drain Diode Forward**



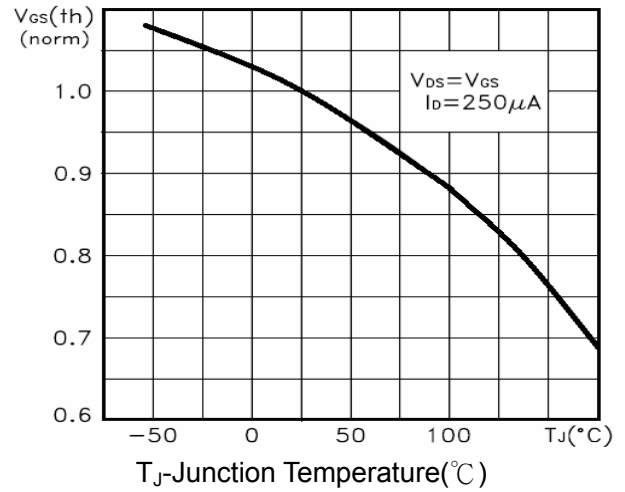
**Figure 7 Capacitance vs Vds**



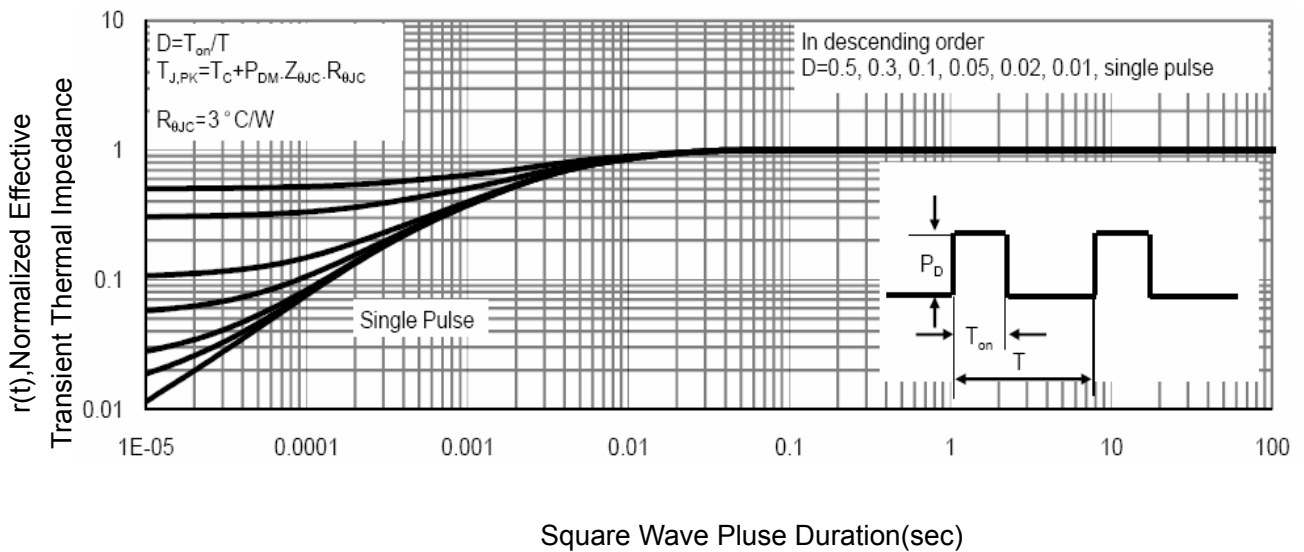
**Figure 9  $BV_{DSS}$  vs Junction Temperature**



**Figure 8 Safe Operation Area**

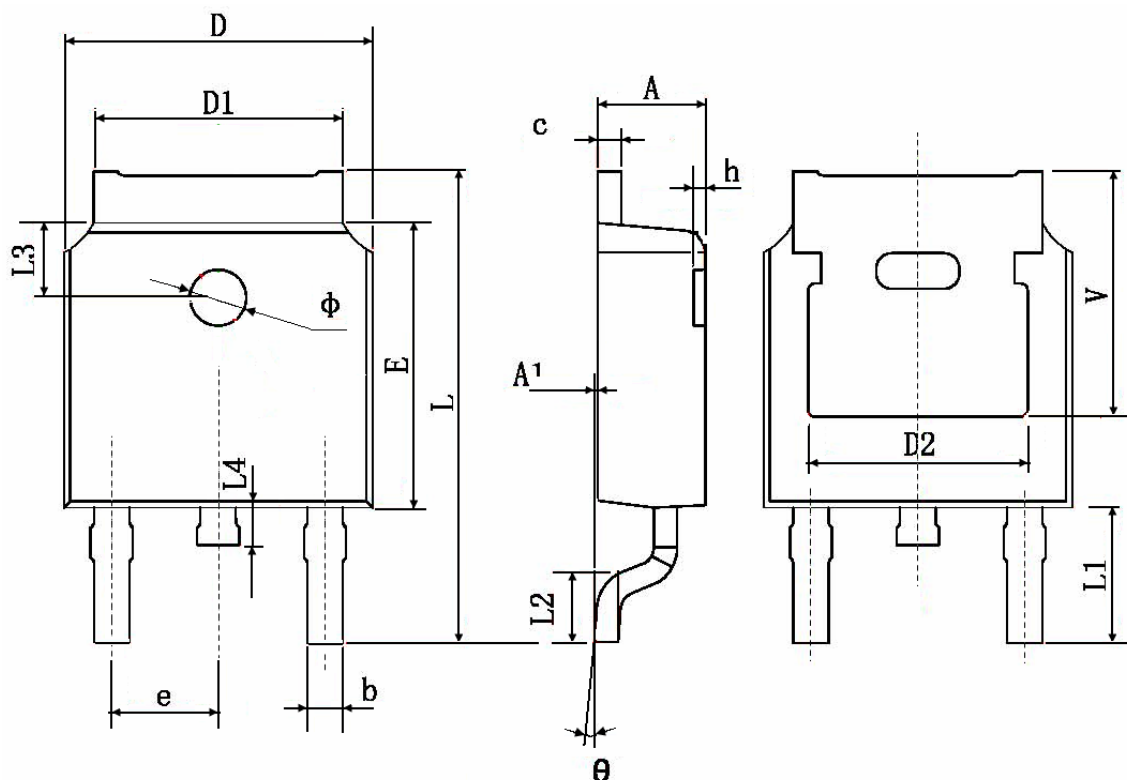


**Figure 10  $V_{GS(th)}$  vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-252 Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 2.200                     | 2.400  | 0.087                | 0.094 |
| A1     | 0.000                     | 0.127  | 0.000                | 0.005 |
| b      | 0.660                     | 0.860  | 0.026                | 0.034 |
| c      | 0.460                     | 0.580  | 0.018                | 0.023 |
| D      | 6.500                     | 6.700  | 0.256                | 0.264 |
| D1     | 5.100                     | 5.460  | 0.201                | 0.215 |
| D2     | 4.830 TYP.                |        | 0.190 TYP.           |       |
| E      | 6.000                     | 6.200  | 0.236                | 0.244 |
| e      | 2.186                     | 2.386  | 0.086                | 0.094 |
| L      | 9.800                     | 10.400 | 0.386                | 0.409 |
| L1     | 2.900 TYP.                |        | 0.114 TYP.           |       |
| L2     | 1.400                     | 1.700  | 0.055                | 0.067 |
| L3     | 1.600 TYP.                |        | 0.063 TYP.           |       |
| L4     | 0.600                     | 1.000  | 0.024                | 0.039 |
| Φ      | 1.100                     | 1.300  | 0.043                | 0.051 |
| θ      | 0°                        | 8°     | 0°                   | 8°    |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| V      | 5.350 TYP.                |        | 0.211 TYP.           |       |

### Attention

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