

# IRFR4510TR-VB Datasheet

## N-Channel 100-V (D-S) MOSFET

| PRODUCT SUMMARY |                            |           |
|-----------------|----------------------------|-----------|
| $V_{DS}$ (V)    | $R_{DS(on)}$ ( $\Omega$ )  | $I_D$ (A) |
| 100             | 0.0085 at $V_{GS} = 10$ V  | 85        |
|                 | 0.0105 at $V_{GS} = 4.5$ V | 70        |

### FEATURES

- Trench Power MOSFET
- 100 % R9 Tested
- 100 % UIS Tested

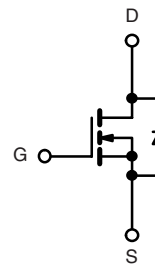
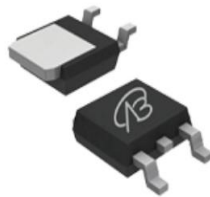


**RoHS**  
COMPLIANT

### APPLICATIONS

- Primary Side Switch
- Isolated DC/DC Converter

TO-252



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted |                |                 |      |
|----------------------------------------------------------------|----------------|-----------------|------|
| Parameter                                                      | Symbol         | Limit           | Unit |
| Drain-Source Voltage                                           | $V_{DS}$       | 100             | V    |
| Gate-Source Voltage                                            | $V_{GS}$       | $\pm 20$        |      |
| Continuous Drain Current ( $T_J = 150$ °C)                     | $I_D$          | 85              | A    |
|                                                                |                | 75 <sup>a</sup> |      |
| Pulsed Drain Current                                           | $I_{DM}$       | 300             |      |
| Avalanche Current                                              | $I_{AS}$       | 75              |      |
| Single Pulse Avalanche Energy <sup>b</sup>                     | $E_{AS}$       | 280             | mJ   |
| Maximum Power Dissipation <sup>b</sup>                         | $P_D$          | 176             | W    |
|                                                                |                | 3.75            |      |
| Operating Junction and Storage Temperature Range               | $T_J, T_{stg}$ | - 55 to 175     | °C   |

| THERMAL RESISTANCE RATINGS               |            |         |         |      |  |
|------------------------------------------|------------|---------|---------|------|--|
| Parameter                                | Symbol     | Typical | Maximum | Unit |  |
| Maximum Junction-to-Ambient <sup>b</sup> | $R_{thJA}$ | 40      | 50      | °C/W |  |
| Maximum Junction-to-Case                 | $R_{thJC}$ | 0.85    | 1.1     |      |  |

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

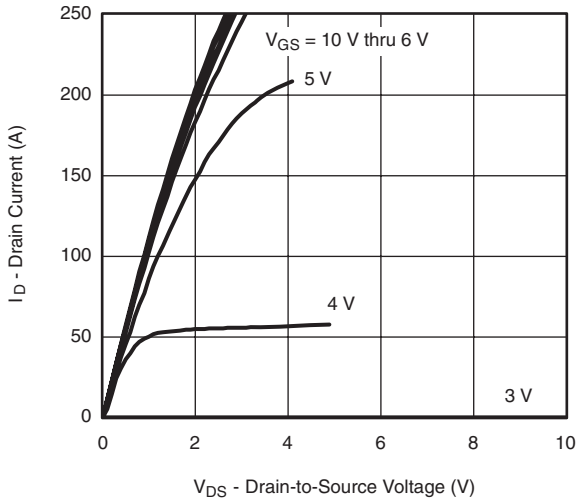
| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted                     |               |                                                                                                                                     |      |        |           |               |
|------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------|------|--------|-----------|---------------|
| Parameter                                                                                      | Symbol        | Test Conditions                                                                                                                     | Min. | Typ.   | Max.      | Unit          |
| Static                                                                                         |               |                                                                                                                                     |      |        |           |               |
| Drain-Source Breakdown Voltage                                                                 | $V_{DS}$      | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                              | 100  |        |           | V             |
| Gate-Threshold Voltage                                                                         | $V_{GS(th)}$  | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                  | 1    |        | 4         |               |
| Gate-Body Leakage                                                                              | $I_{GSS}$     | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$                                                                                  |      |        | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                                | $I_{DSS}$     | $V_{DS} = 100\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                     |      |        | 1         | $\mu\text{A}$ |
|                                                                                                |               | $V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                                |      |        | 50        |               |
|                                                                                                |               | $V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 175^{\circ}\text{C}$                                                        |      |        | 250       |               |
| On-State Drain Current <sup>a</sup>                                                            | $I_{D(on)}$   | $V_{DS} = \geq 5\text{ V}$ , $V_{GS} = 10\text{ V}$                                                                                 | 50   |        |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                                  | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$                                                                                        |      | 0.0085 |           | $\Omega$      |
|                                                                                                |               | $V_{GS} = 4.5\text{ V}$ , $I_D = 20\text{ A}$                                                                                       |      | 0.0105 |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                                  |      | 0.017  |           |               |
|                                                                                                |               | $V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$                                                  |      | 0.022  |           |               |
| Forward Transconductance <sup>a</sup>                                                          | $g_{fs}$      | $V_{DS} = 15\text{ V}$ , $I_D = 20\text{ A}$                                                                                        | 25   |        |           | S             |
| Dynamic <sup>b</sup>                                                                           |               |                                                                                                                                     |      |        |           |               |
| Input Capacitance                                                                              | $C_{iss}$     | $V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                                                 |      | 4000   |           | pF            |
| Output Capacitance                                                                             | $C_{oss}$     |                                                                                                                                     |      | 565    |           |               |
| Reverse Transfer Capacitance                                                                   | $C_{rss}$     |                                                                                                                                     |      | 205    |           |               |
| Total Gate Charge <sup>c</sup>                                                                 | $Q_g$         | $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 45\text{ A}$                                                               |      | 105    | 160       | nC            |
| Gate-Source Charge <sup>c</sup>                                                                | $Q_{gs}$      |                                                                                                                                     |      | 17     |           |               |
| Gate-Drain Charge <sup>c</sup>                                                                 | $Q_{gd}$      |                                                                                                                                     |      | 23     |           |               |
| Turn-On Delay Time <sup>c</sup>                                                                | $t_{d(on)}$   | $V_{DD} = 20\text{ V}$ , $R_L = 0.6\text{ }\Omega$<br>$I_D \cong 45\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 2.5\text{ }\Omega$ |      | 12     | 25        | ns            |
| Rise Time <sup>c</sup>                                                                         | $t_r$         |                                                                                                                                     |      | 90     | 135       |               |
| Turn-Off DelayTime <sup>c</sup>                                                                | $t_{d(off)}$  |                                                                                                                                     |      | 55     | 85        |               |
| Fall Time <sup>c</sup>                                                                         | $t_f$         |                                                                                                                                     |      | 130    | 195       |               |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup> |               |                                                                                                                                     |      |        |           |               |
| Continuous Current                                                                             | $I_S$         |                                                                                                                                     |      |        | 85        | A             |
| Pulsed Current                                                                                 | $I_{SM}$      |                                                                                                                                     |      |        | 140       |               |
| Forward Voltage <sup>a</sup>                                                                   | $V_{SD}$      | $I_F = 45\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                         |      | 1.0    | 1.5       | V             |
| Reverse Recovery Time                                                                          | $t_{rr}$      | $I_F = 50\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$                                                                            |      | 85     | 140       | ns            |
| Peak Reverse Recovery Current                                                                  | $I_{RM(REC)}$ |                                                                                                                                     |      | 4.5    | 7         | A             |
| Reverse Recovery Charge                                                                        | $Q_{rr}$      |                                                                                                                                     |      | 0.17   | 0.35      | $\mu\text{C}$ |

Notes:

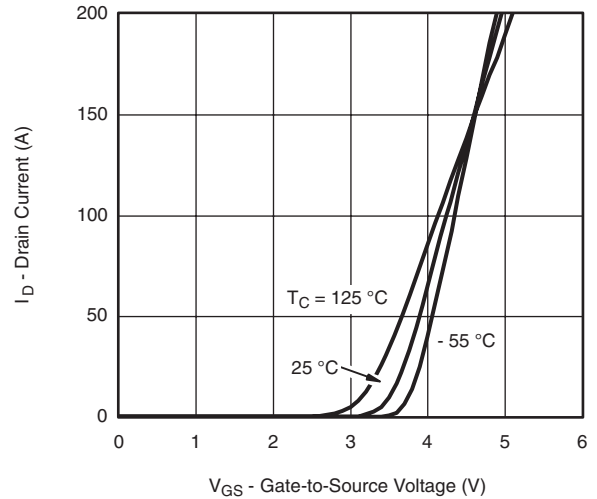
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.  
 c. Independent of operating temperature.

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**TYPICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$ , unless otherwise noted



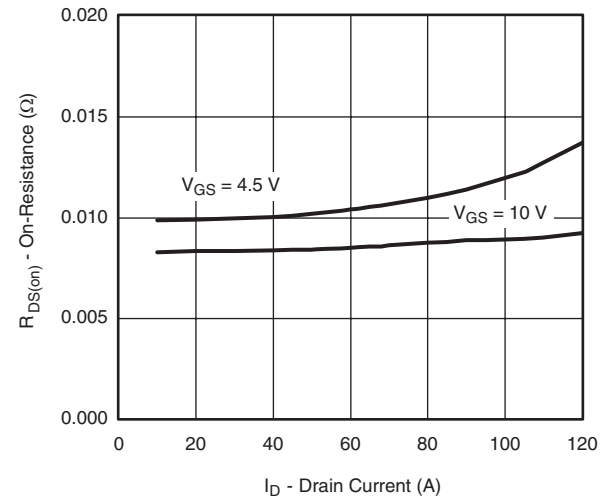
**Output Characteristics**



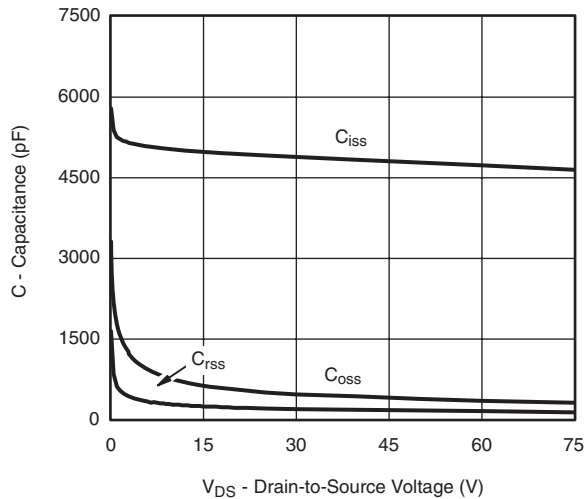
**Transfer Characteristics**



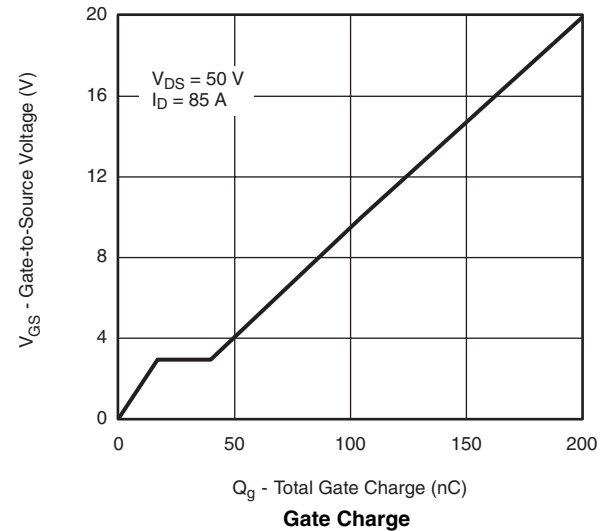
**Transconductance**



**On-Resistance vs. Drain Current**



**Capacitance**

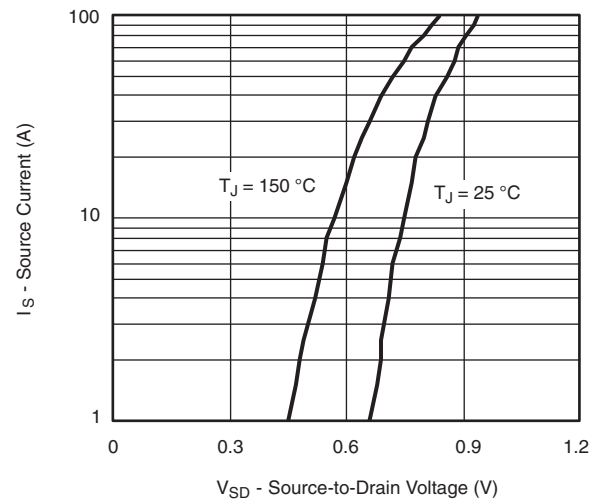


**Gate Charge**

**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted



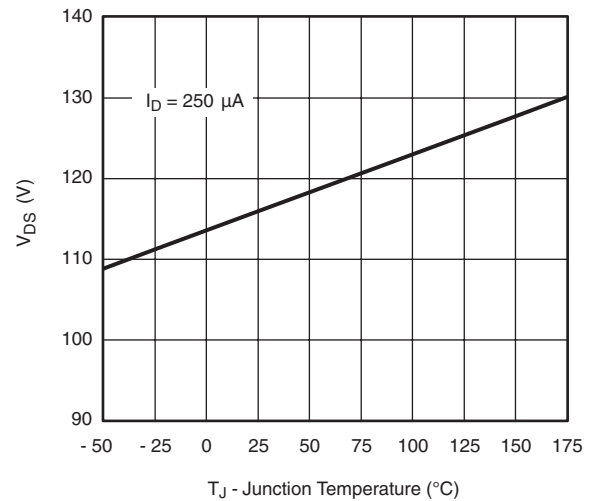
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

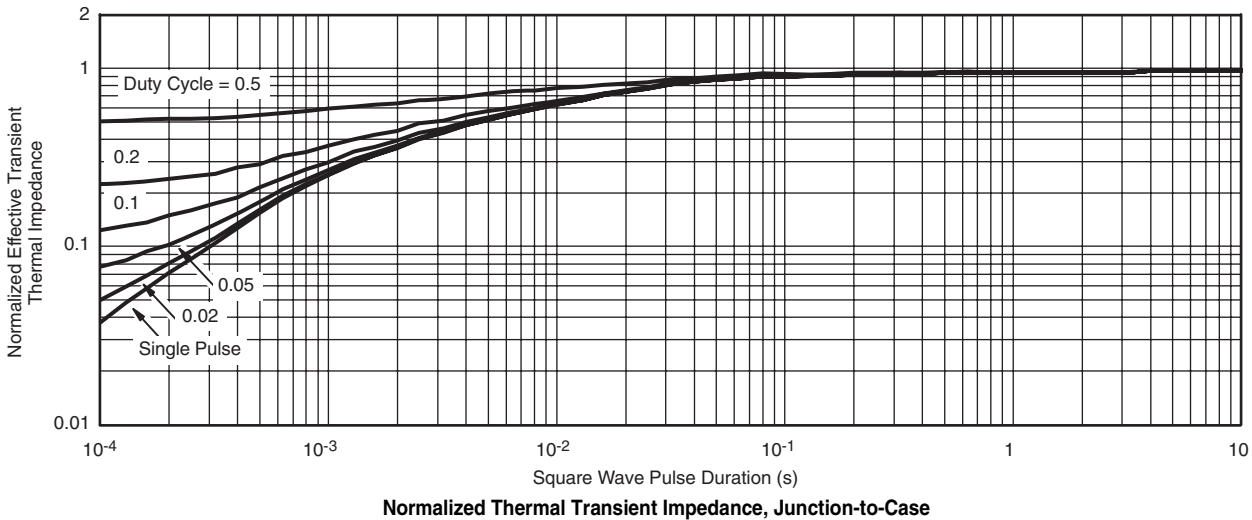


**Avalanche Current vs. Time**

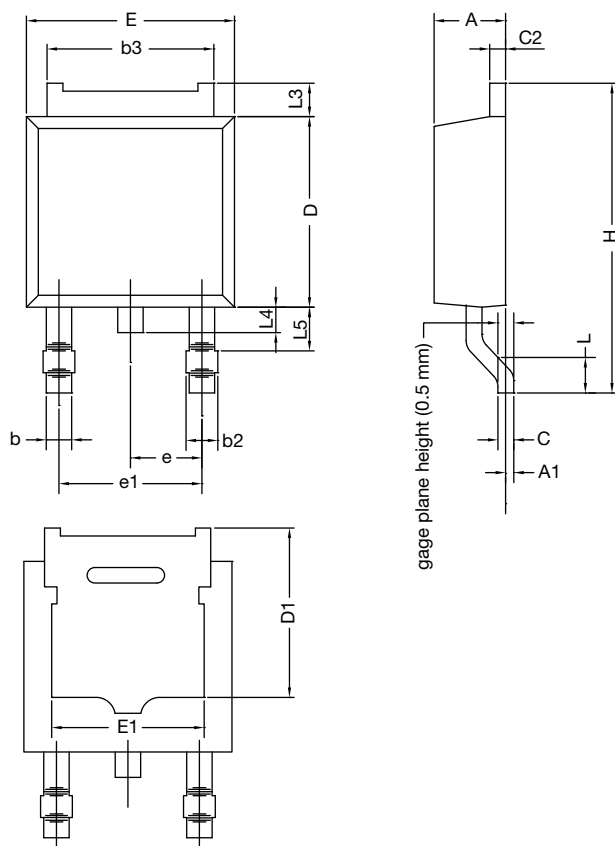


**$T_J$  - Drain-Source Breakdown vs. Junction-Temperature**

**THERMAL RATINGS**



## TO-252AA CASE OUTLINE

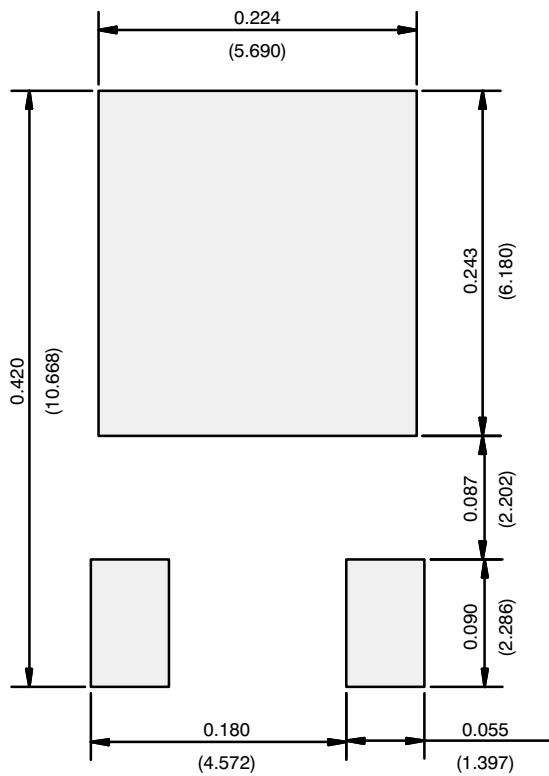


| DIM.                            | MILLIMETERS |       | INCHES    |       |
|---------------------------------|-------------|-------|-----------|-------|
|                                 | MIN.        | MAX.  | MIN.      | MAX.  |
| A                               | 2.18        | 2.38  | 0.086     | 0.094 |
| A1                              | -           | 0.127 | -         | 0.005 |
| b                               | 0.64        | 0.88  | 0.025     | 0.035 |
| b2                              | 0.76        | 1.14  | 0.030     | 0.045 |
| b3                              | 4.95        | 5.46  | 0.195     | 0.215 |
| C                               | 0.46        | 0.61  | 0.018     | 0.024 |
| C2                              | 0.46        | 0.89  | 0.018     | 0.035 |
| D                               | 5.97        | 6.22  | 0.235     | 0.245 |
| D1                              | 5.21        | -     | 0.205     | -     |
| E                               | 6.35        | 6.73  | 0.250     | 0.265 |
| E1                              | 4.32        | -     | 0.170     | -     |
| H                               | 9.40        | 10.41 | 0.370     | 0.410 |
| e                               | 2.28 BSC    |       | 0.090 BSC |       |
| e1                              | 4.56 BSC    |       | 0.180 BSC |       |
| L                               | 1.40        | 1.78  | 0.055     | 0.070 |
| L3                              | 0.89        | 1.27  | 0.035     | 0.050 |
| L4                              | -           | 1.02  | -         | 0.040 |
| L5                              | 1.14        | 1.52  | 0.045     | 0.060 |
| ECN: X12-0247-Rev. M, 24-Dec-12 |             |       |           |       |
| DWG: 5347                       |             |       |           |       |

### Note

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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