

## Advanced Power MOSFET

## IRFS740A

### FEATURES

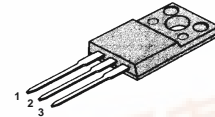
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 400V$
- Lower  $R_{DS(ON)}$  : 0.437  $\Omega$  (Typ.)

$$BV_{DSS} = 400 \text{ V}$$

$$R_{DS(on)} = 0.55 \Omega$$

$$I_D = 5.7 \text{ A}$$

TO-220F



1. Gate 2. Drain 3. Source

### Absolute Maximum Ratings

| Symbol         | Characteristic  | Value        | Units            |
|----------------|---|--------------|------------------|
| $V_{DSS}$      | Drain-to-Source Voltage   | 400          | V                |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ\text{C}$ )                     | 5.7          | A                |
|                | Continuous Drain Current ( $T_C=100^\circ\text{C}$ )                    | 3.6          |                  |
| $I_{DM}$       | Drain Current-Pulsed ①  | 40           | A                |
| $V_{GS}$       | Gate-to-Source Voltage  | $\pm 30$     | V                |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②  | 557          | mJ               |
| $I_{AR}$       | Avalanche Current ①   | 5.7          | A                |
| $E_{AR}$       | Repetitive Avalanche Energy ①   | 4.4          | mJ               |
| dv/dt          | Peak Diode Recovery dv/dt ③   | 4.0          | V/ns             |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ\text{C}$ )                      | 44           | W                |
|                | Linear Derating Factor  | 0.35         |                  |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^\circ\text{C}$ |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300          |                  |

### Thermal Resistance

| Symbol          | Characteristic      | Typ. | Max. | Units              |
|-----------------|---------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case    | --   | 2.86 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 62.5 |                    |

# IRFS740A

## N-CHANNEL POWER MOSFET

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

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units               | Test Condition   |
|------------------------|---|------|------|------|---------------------|--|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 400  | --   | --   | V                   | $V_{GS}=0V, I_D=250\mu\text{A}$  |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.50 | --   | V/ $^\circ\text{C}$ | $I_D=250\mu\text{A}$ <b>See Fig 7</b>  |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 2.0  | --   | 4.0  | V                   | $V_{DS}=5V, I_D=250\mu\text{A}$  |
| $I_{GSS}$              | Gate-Source Leakage, Forward            | --   | --   | 100  | nA                  | $V_{GS}=30V$   |
|                        | Gate-Source Leakage, Reverse            | --   | --   | -100 |                     | $V_{GS}=-30V$  |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | 10   | $\mu\text{A}$       | $V_{DS}=400V$  |
|                        |   | --   | --   | 100  |                     | $V_{DS}=320V, T_C=125^\circ\text{C}$   |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.55 | $\Omega$            | $V_{GS}=10V, I_D=2.85A$ ④  |
| $g_{fs}$               | Forward Transconductance                | --   | 6.21 | --   | $\Omega$            | $V_{DS}=50V, I_D=2.85A$ ④  |
| $C_{iss}$              | Input Capacitance                       | --   | 1180 | 1530 | pF                  | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                   |
| $C_{oss}$              | Output Capacitance                      | --   | 175  | 205  |                     |  |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 80   | 95   |                     |  |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 18   | 50   | ns                  | $V_{DD}=200V, I_D=10A,$<br>$R_G=9.1\Omega$<br><b>See Fig 13</b> ④ ⑤          |
| $t_r$                  | Rise Time                               | --   | 21   | 55   |                     |  |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 78   | 170  |                     |  |
| $t_f$                  | Fall Time                               | --   | 28   | 65   |                     |  |
| $Q_g$                  | Total Gate Charge                       | --   | 58   | 75   | nC                  | $V_{DS}=320V, V_{GS}=10V,$<br>$I_D=10A$<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 8.1  | --   |                     |  |
| $Q_{gd}$               | Gate-Drain( "Miller" ) Charge           | --   | 31.3 | --   |                     |  |

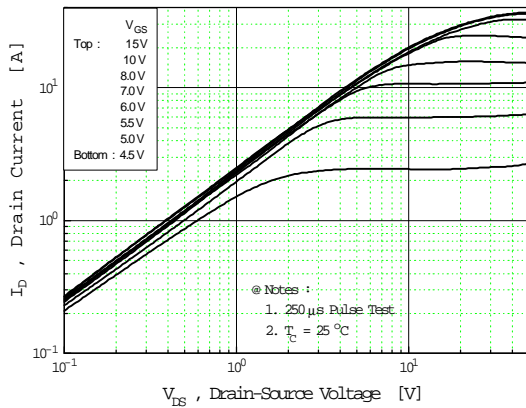
### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units         | Test Condition                              |
|----------|---------------------------|------|------|------|---------------|---|
| $I_S$    | Continuous Source Current | --   | --   | 5.7  | A             | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | 40   |               |   |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | 1.5  | V             | $T_J=25^\circ\text{C}, I_S=5.7A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 315  | --   | ns            | $T_J=25^\circ\text{C}, I_F=10A$             |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 2.84 | --   | $\mu\text{C}$ | $di_F/dt=100A/\mu\text{s}$ ④                |

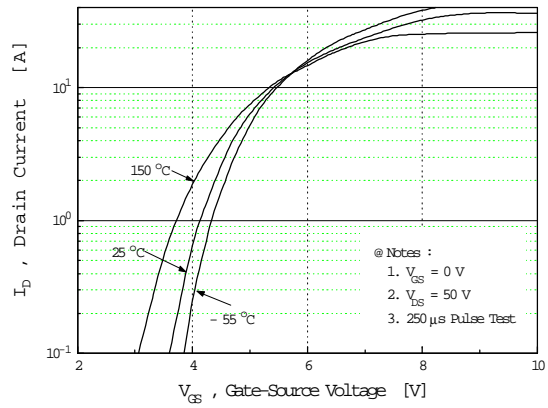
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=30\text{mH}, I_{AS}=5.7A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq 10A, di/dt \leq 170A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width = 250  $\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

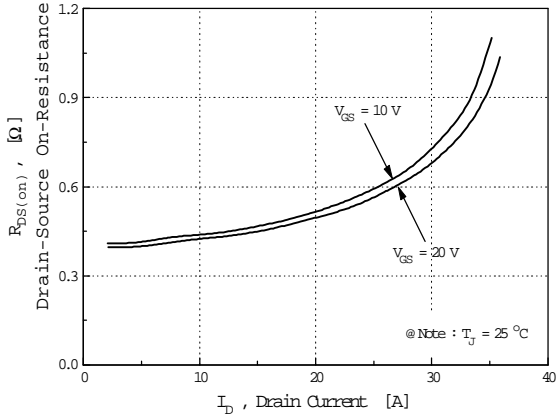
**Fig 1. Output Characteristics**



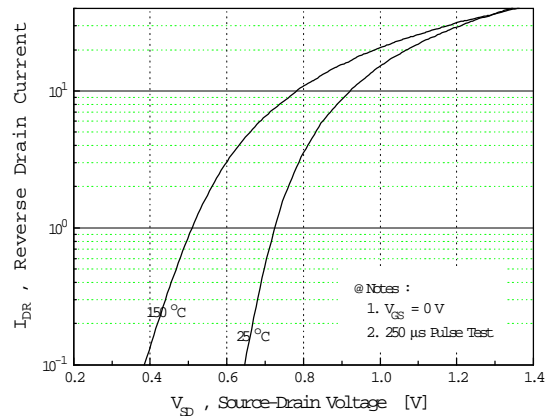
**Fig 2. Transfer Characteristics**



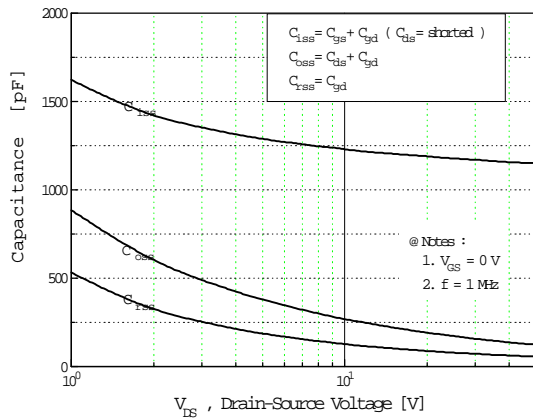
**Fig 3. On-Resistance vs. Drain Current**



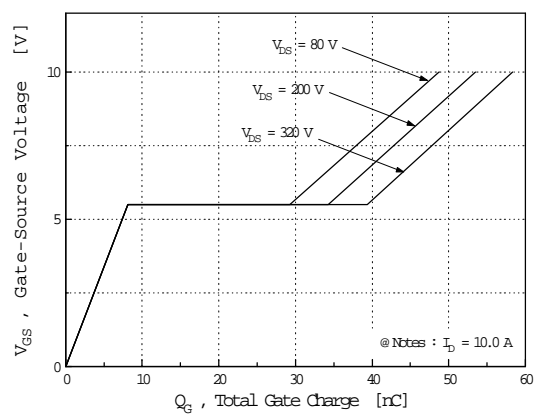
**Fig 4. Source-Drain Diode Forward Voltage**



**Fig 5. Capacitance vs. Drain-Source Voltage**

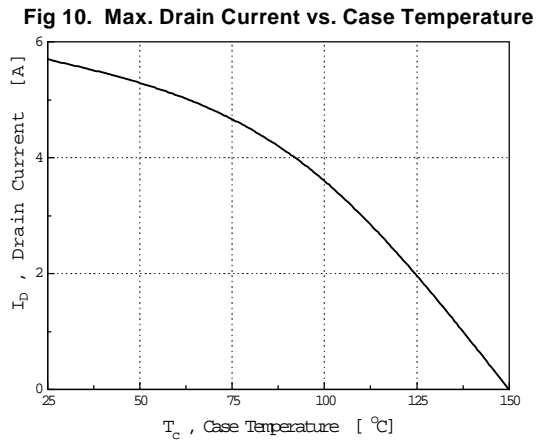
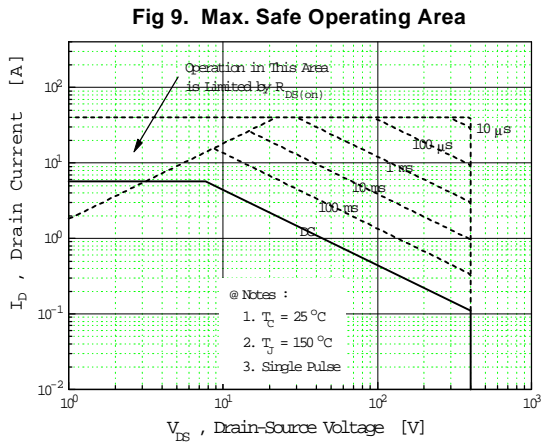
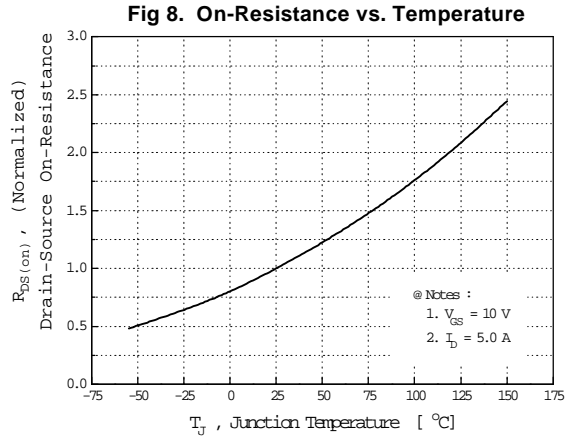
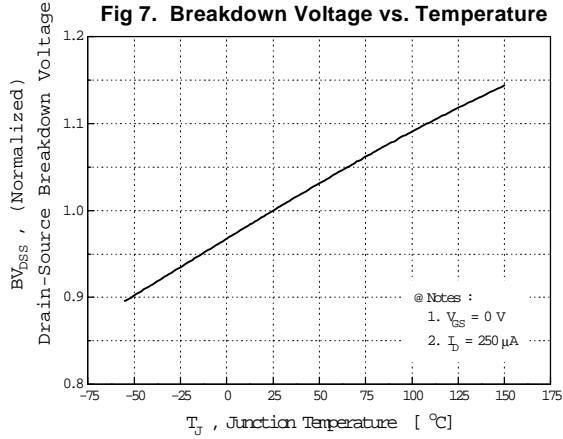


**Fig 6. Gate Charge vs. Gate-Source Voltage**

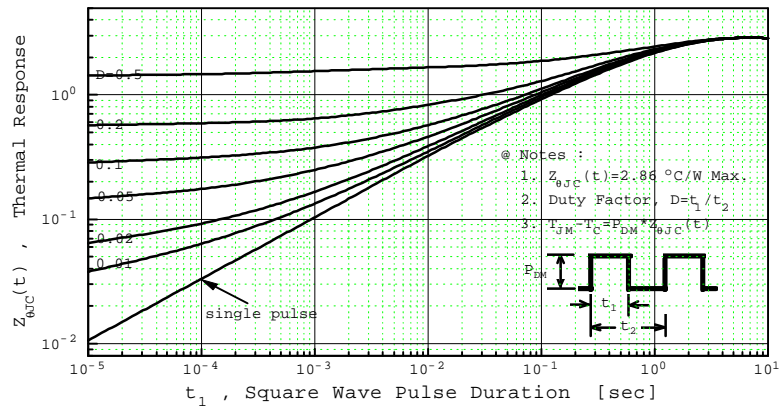


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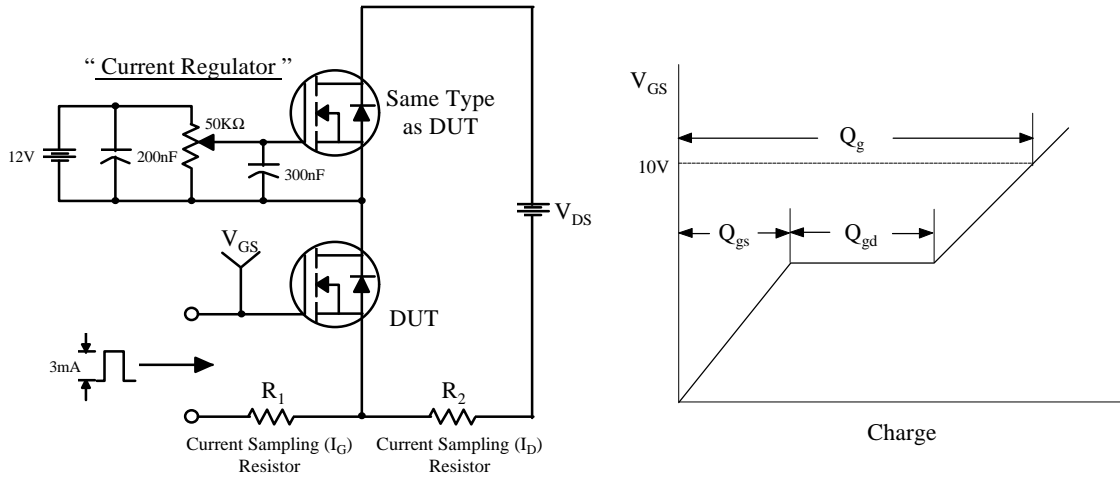
## N-CHANNEL POWER MOSFET



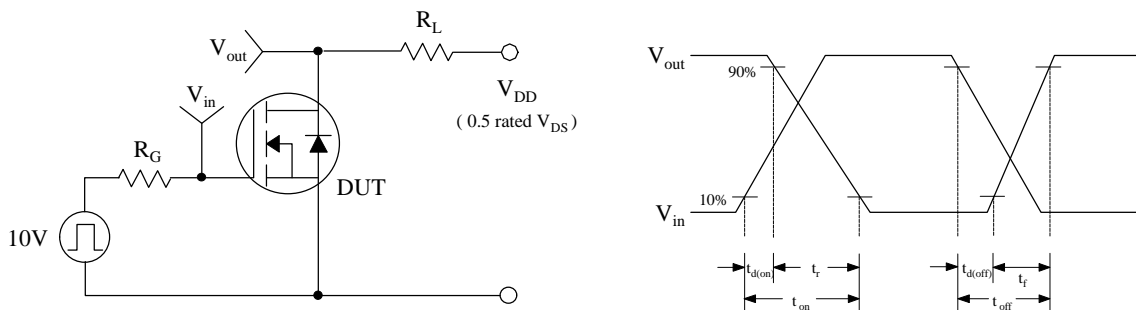
**Fig 11. Thermal Response**



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

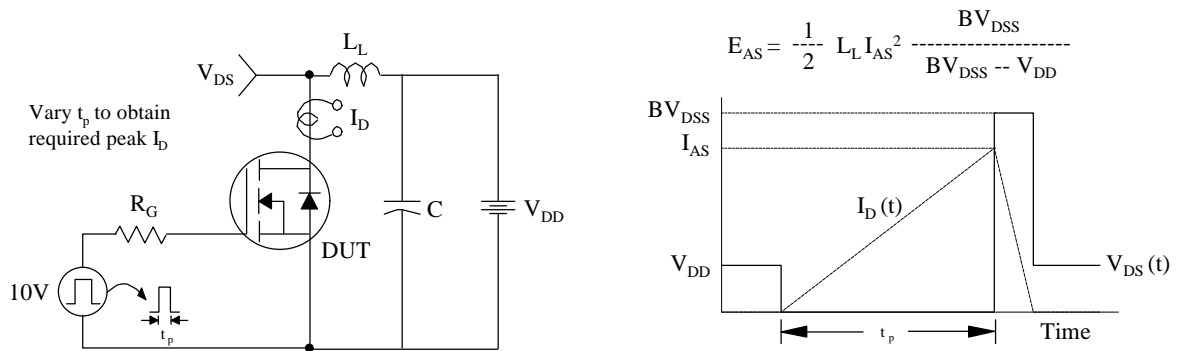
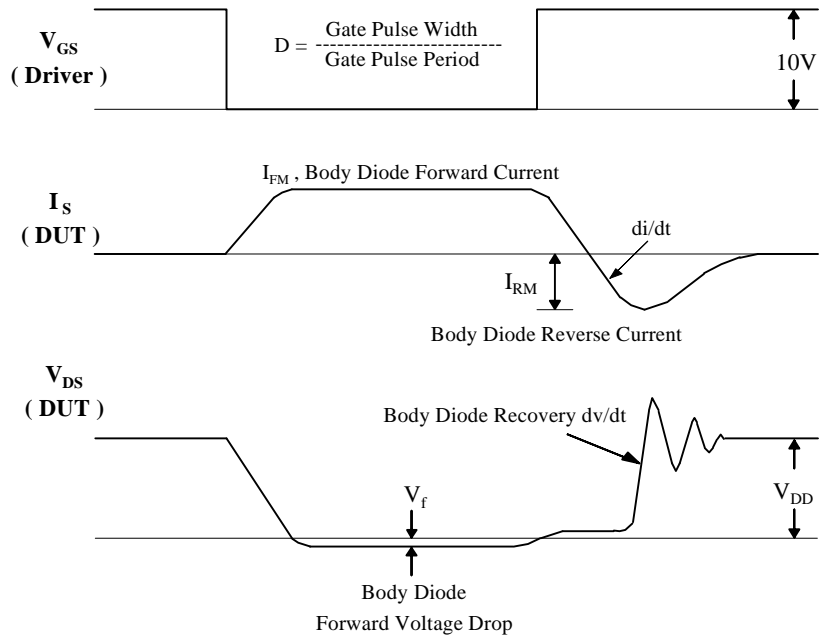
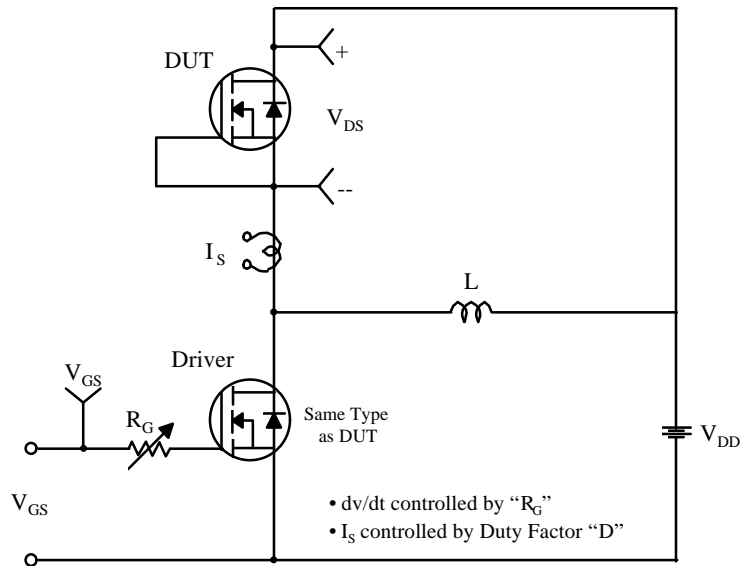


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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