

## Advanced Power MOSFET

## IRFS250A

### FEATURES

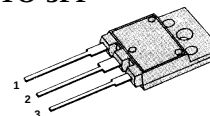
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 200V$
- Low  $R_{DS(on)}$  : 0.071  $\Omega$ (Typ.)

$$BV_{DSS} = 200 V$$

$$R_{DS(on)} = 0.085 \Omega$$

$$I_D = 21.3 A$$

### TO-3PF



1.Gate 2. Drain 3. Source

### Absolute Maximum Ratings

| Symbol         | Characteristic                                                           | Value        | Units      |
|----------------|--------------------------------------------------------------------------|--------------|------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                  | 200          | V          |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                            | 21.3         | A          |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                           | 13.5         |            |
| $I_{DM}$       | Drain Current-Pulsed ①                                                   | 130          | A          |
| $V_{GS}$       | Gate-to-Source Voltage                                                   | $\pm 30$     | V          |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                         | 605          | mJ         |
| $I_{AR}$       | Avalanche Current ①                                                      | 21.3         | A          |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                            | 9            | mJ         |
| dv/dt          | Peak Diode Recovery dv/dt ③                                              | 5.0          | V/ns       |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                             | 90           | W          |
|                | Linear Derating Factor                                                   | 0.72         |            |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                         | - 55 to +150 | $^\circ C$ |
| $T_L$          | 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    | --   | 1.38 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 40   |              |

### Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise specified)

| Symbol              | Characteristic                          | Min. | Typ.  | Max.  | Units | Test Condition                                                                                           |
|---------------------|-----------------------------------------|------|-------|-------|-------|----------------------------------------------------------------------------------------------------------|
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage          | 200  | --    | --    | V     | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                                               |
| ΔBV/ΔT <sub>J</sub> | Breakdown Voltage Temp. Coeff.          | --   | 0.24  | --    | V/°C  | I <sub>D</sub> =250μA <b>See Fig 7</b>                                                                   |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                  | 2.0  | --    | 4.0   | V     | V <sub>DS</sub> =5V, I <sub>D</sub> =250μA                                                               |
| I <sub>GSS</sub>    | Gate-Source Leakage , Forward           | --   | --    | 100   | nA    | V <sub>GS</sub> =30V                                                                                     |
|                     | Gate-Source Leakage , Reverse           | --   | --    | -100  |       | V <sub>GS</sub> =-30V                                                                                    |
| I <sub>DSS</sub>    | Drain-to-Source Leakage Current         | --   | --    | 10    | μA    | V <sub>DS</sub> =200V                                                                                    |
|                     |                                         | --   | --    | 100   |       | V <sub>DS</sub> =160V, T <sub>C</sub> =125 °C                                                            |
| R <sub>DS(on)</sub> | Static Drain-Source On-State Resistance | --   | --    | 0.085 | Ω     | V <sub>GS</sub> =10V, I <sub>D</sub> =10.65A ④                                                           |
| g <sub>fs</sub>     | Forward Transconductance                | --   | 16.64 | --    | Ω     | V <sub>DS</sub> =40V, I <sub>D</sub> =10.65A ④                                                           |
| C <sub>iss</sub>    | Input Capacitance                       | --   | 2300  | 3000  | pF    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz<br><b>See Fig 5</b>                                    |
| C <sub>oss</sub>    | Output Capacitance                      | --   | 410   | 475   |       |                                                                                                          |
| C <sub>rss</sub>    | Reverse Transfer Capacitance            | --   | 200   | 230   |       |                                                                                                          |
| t <sub>d(on)</sub>  | Turn-On Delay Time                      | --   | 21    | 50    | ns    | V <sub>DD</sub> =100V, I <sub>D</sub> =32A,<br>R <sub>G</sub> =6.2 Ω<br><b>See Fig 13</b> ④ ⑤            |
| t <sub>r</sub>      | Rise Time                               | --   | 20    | 50    |       |                                                                                                          |
| t <sub>d(off)</sub> | Turn-Off Delay Time                     | --   | 77    | 160   |       |                                                                                                          |
| t <sub>f</sub>      | Fall Time                               | --   | 38    | 90    |       |                                                                                                          |
| Q <sub>g</sub>      | Total Gate Charge                       | --   | 95    | 123   | nC    | V <sub>DS</sub> =160V, V <sub>GS</sub> =10V,<br>I <sub>D</sub> =32A<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| Q <sub>gs</sub>     | Gate-Source Charge                      | --   | 18    | --    |       |                                                                                                          |
| Q <sub>gd</sub>     | Gate-Drain("Miller") Charge             | --   | 45.3  | --    |       |                                                                                                          |

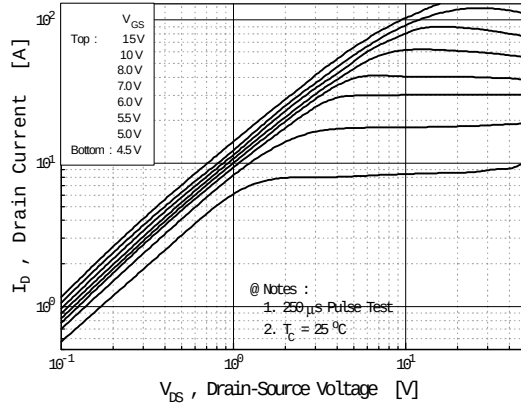
### Source-Drain Diode Ratings and Characteristics

| Symbol          | Characteristic            | Min. | Typ. | Max. | Units | Test Condition                                                   |
|-----------------|---------------------------|------|------|------|-------|------------------------------------------------------------------|
| I <sub>S</sub>  | Continuous Source Current | --   | --   | 21.3 | A     | Integral reverse pn-diode in the MOSFET                          |
| I <sub>SM</sub> | Pulsed-Source Current ①   | --   | --   | 130  |       |                                                                  |
| V <sub>SD</sub> | Diode Forward Voltage ④   | --   | --   | 1.5  | V     | T <sub>J</sub> =25°C, I <sub>S</sub> =21.3A, V <sub>GS</sub> =0V |
| t <sub>rr</sub> | Reverse Recovery Time     | --   | 203  | --   | ns    | T <sub>J</sub> =25°C, I <sub>F</sub> =32A                        |
| Q <sub>rr</sub> | Reverse Recovery Charge   | --   | 1.52 | --   | μC    | di <sub>F</sub> /dt=100A/μs ④                                    |

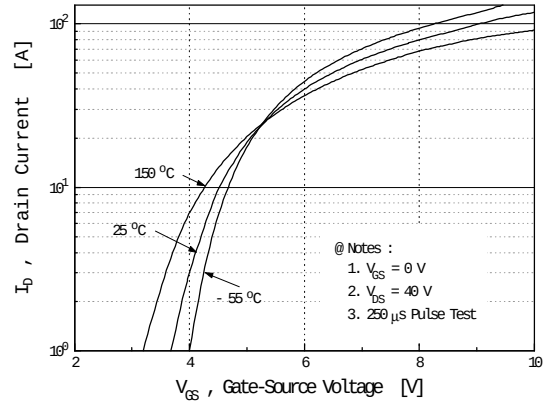
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ② L=2mH, I<sub>AS</sub>=21.3A, V<sub>DD</sub>=50V, R<sub>G</sub>=27Ω, Starting T<sub>J</sub>=25 °C
- ③ I<sub>SD</sub>≤32A, di/dt ≤20A/μs, V<sub>DD</sub>≤BV<sub>DSS</sub>, Starting T<sub>J</sub>=25°C
- ④ Pulse Test : Pulse Width = 250μs, Duty Cycle ≤2%
- ⑤ Essentially Independent of Operating Temperature

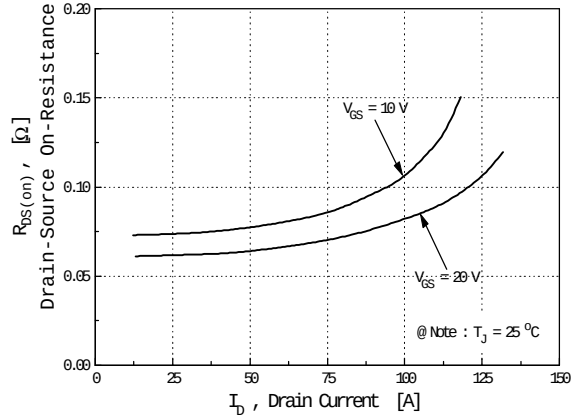
**Fig 1. Output Characteristics**



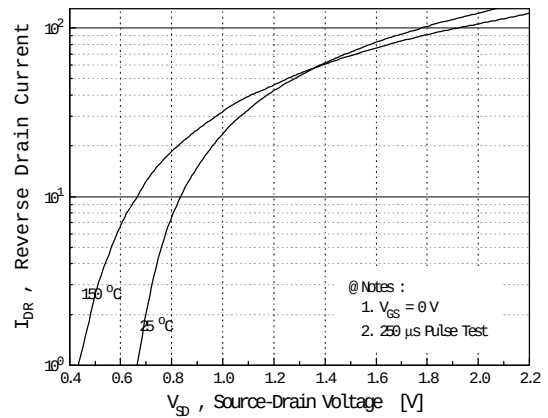
**Fig 2. Transfer Characteristics**



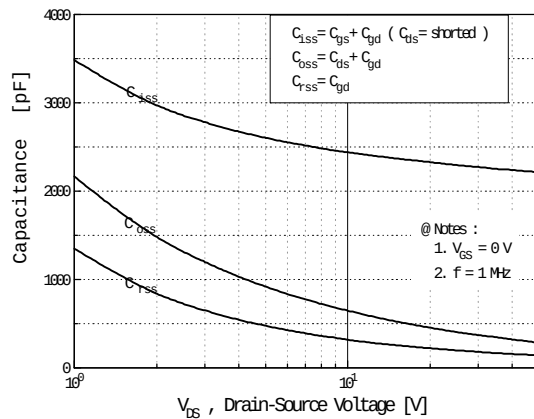
**Fig 3. On-Resistance vs. Drain Current**



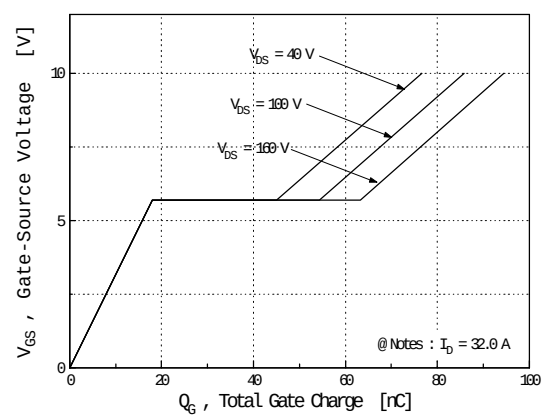
**Fig 4. Source-Drain Diode Forward Voltage**



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

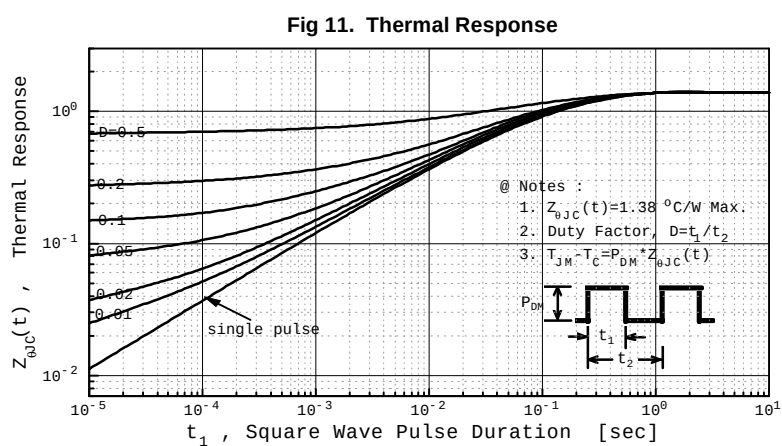
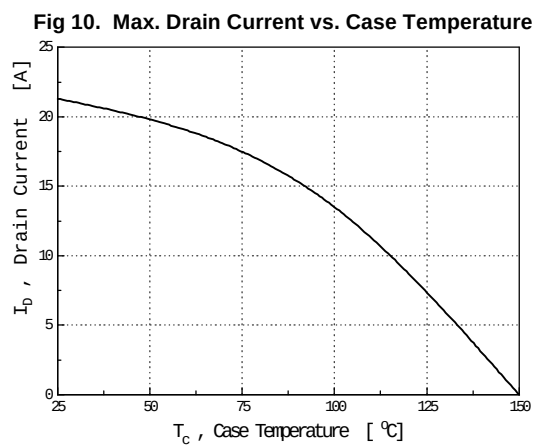
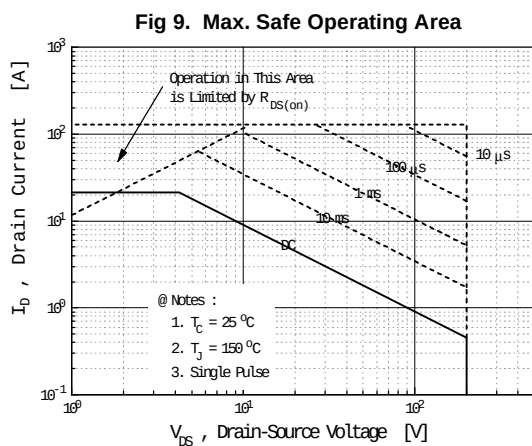
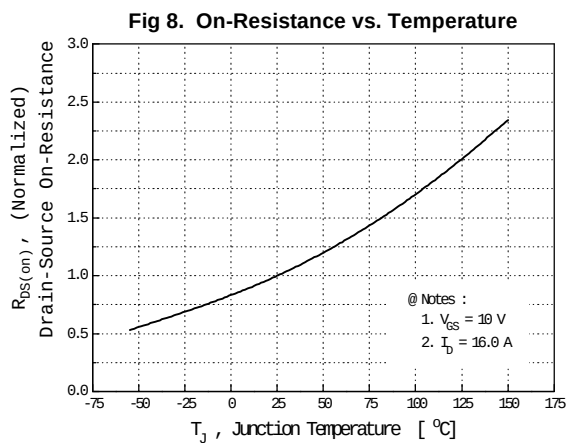
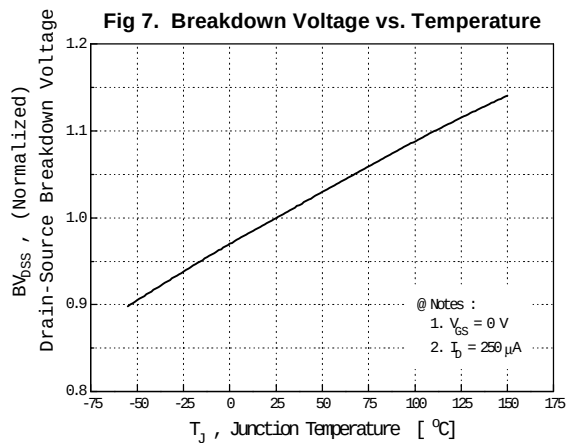


**Fig 6. Gate Charge vs. Gate-Source Voltage**

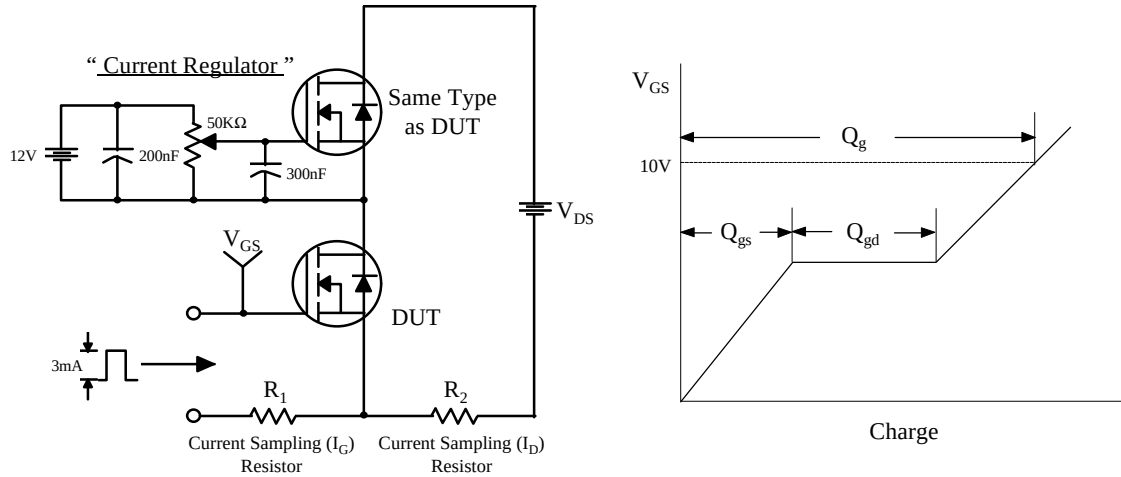


# IRFS250A

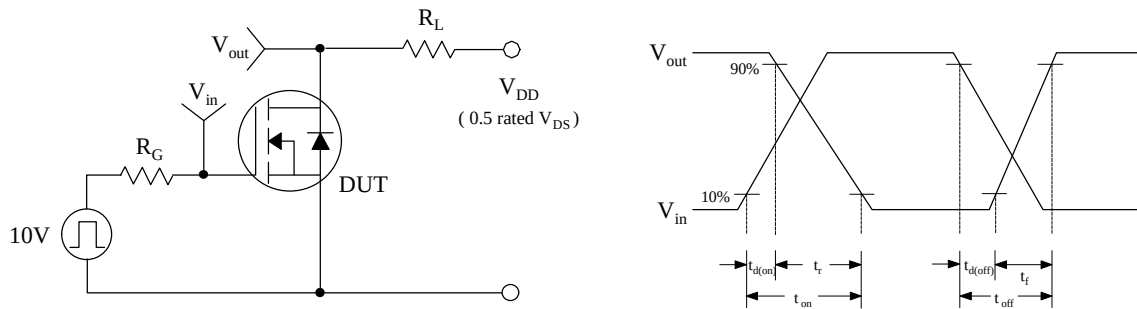
## N-CHANNEL POWER MOSFET



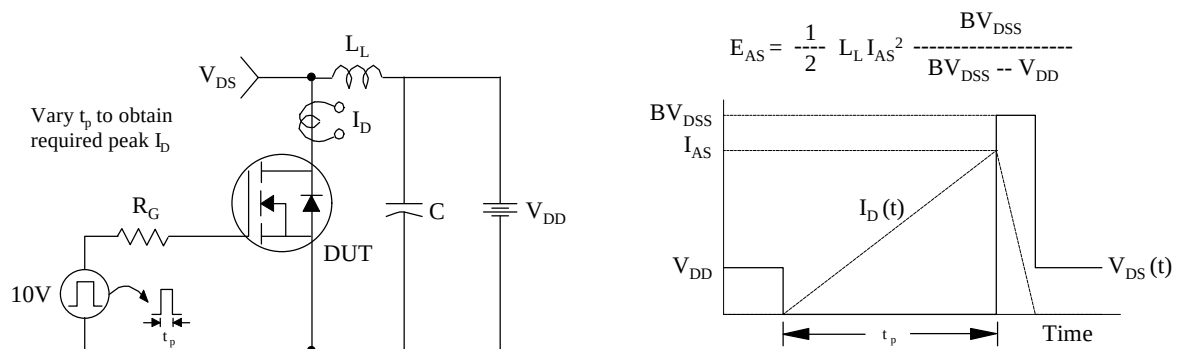
**Fig 12. Gate Charge Test Circuit & Waveform**



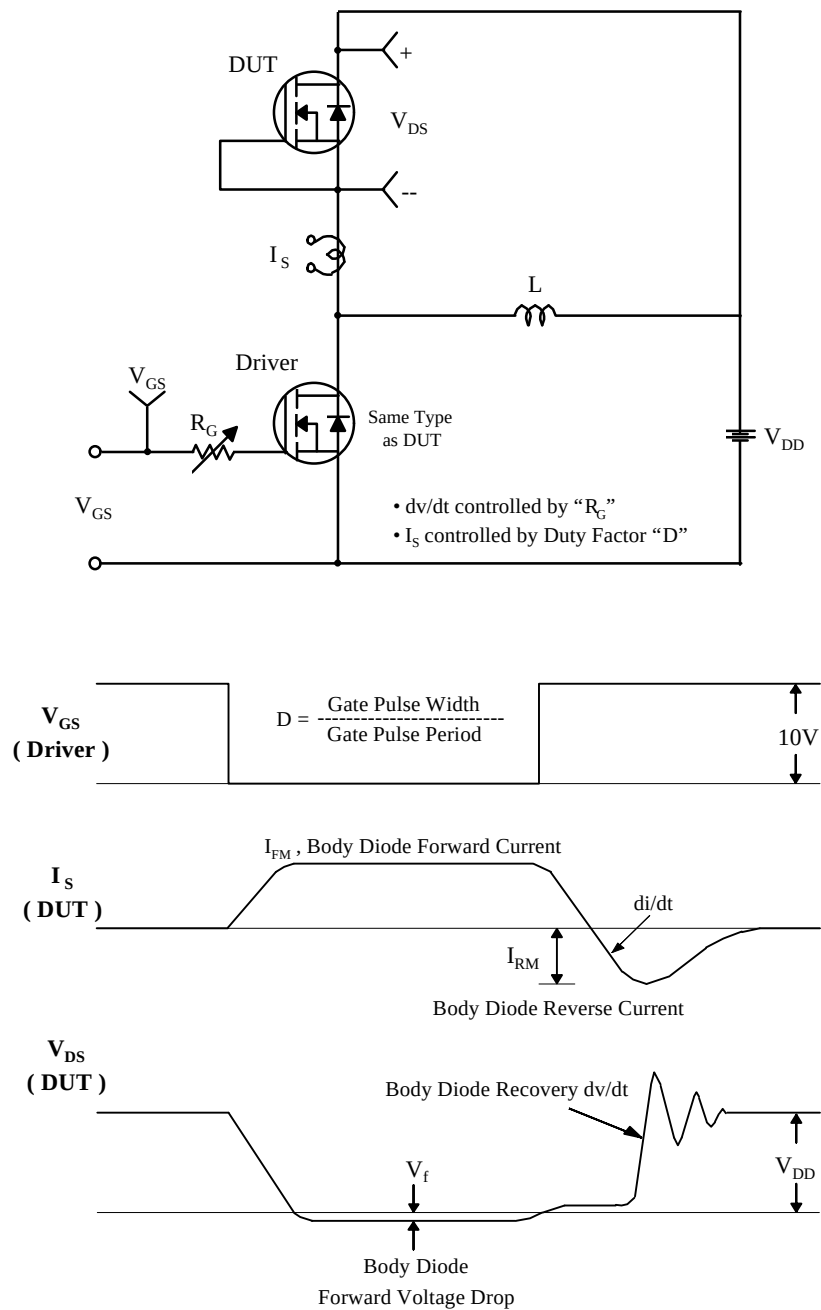
**Fig 13. Resistive Switching Test Circuit & Waveforms**



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



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



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