

**GTS9928E****N-CHANNEL ENHANCEMENT MODE POWER MOSFET**

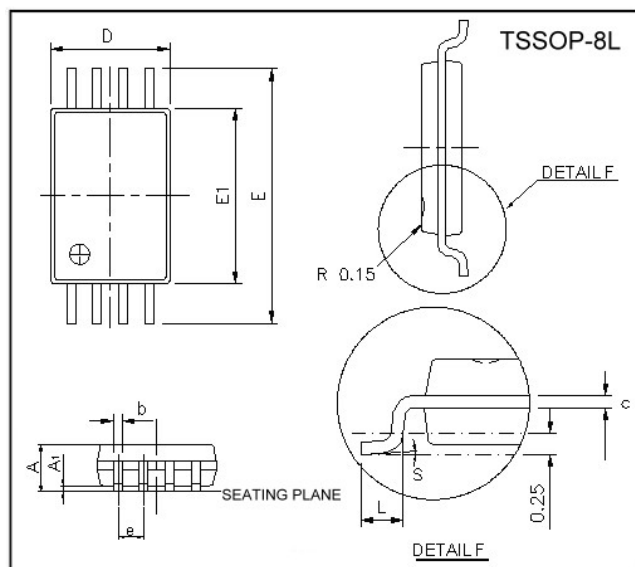
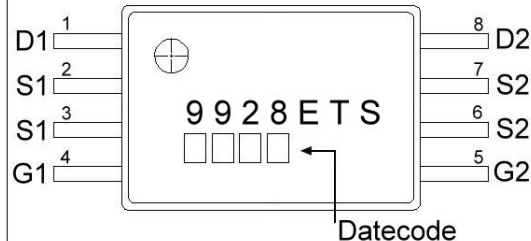
|                     |      |
|---------------------|------|
| BV <sub>DSS</sub>   | 20V  |
| R <sub>DS(ON)</sub> | 22mΩ |
| I <sub>D</sub>      | 5A   |

**Description**

The GTS9928E provides the designer with the best combination of fast switching, ruggedized device design, ultra low on-resistance and cost-effectiveness.

**Features**

- \*Low on-resistance
- \*Capable of 2.5V gate drive
- \*Optimal DC/DC battery application

**Package Dimensions****Marking:**

| REF. | Millimeter |      | REF. | Millimeter |      |
|------|------------|------|------|------------|------|
|      | Min.       | Max. |      | Min.       | Max. |
| A    | -          | 1.20 | E    | 6.20       | 6.60 |
| A1   | 0.05       | 0.15 | E1   | 4.30       | 4.50 |
| b    | 0.19       | 0.30 | e    | 0.65 BSC   |      |
| c    | 0.09       | 0.20 | L    | 0.45       | 0.75 |
| D    | 2.90       | 3.10 | S    | 0°         | 8°   |

**Absolute Maximum Ratings**

| Parameter                                          | Symbol                            | Ratings    | Unit |
|----------------------------------------------------|-----------------------------------|------------|------|
| Drain-Source Voltage                               | V <sub>DS</sub>                   | 20         | V    |
| Gate-Source Voltage                                | V <sub>GS</sub>                   | ±12        | V    |
| Drain Current <sup>3</sup> , V <sub>GS</sub> @4.5V | I <sub>D</sub> @Ta=25°C           | 5.0        | A    |
| Drain Current <sup>3</sup> , V <sub>GS</sub> @4.5V | I <sub>D</sub> @Ta=70°C           | 3.5        | A    |
| Pulsed Drain Current <sup>1</sup>                  | I <sub>DM</sub>                   | 25         | A    |
| Power Dissipation                                  | P <sub>D</sub> @Ta=25°C           | 1          | W    |
| Linear Derating Factor                             |                                   | 0.008      | W/°C |
| Operating Junction and Storage Temperature Range   | T <sub>j</sub> , T <sub>stg</sub> | -55 ~ +150 | °C   |

**Thermal Data**

| Parameter                                             | Symbol             | Ratings | Unit |
|-------------------------------------------------------|--------------------|---------|------|
| Thermal Resistance Junction-ambient <sup>3</sup> Max. | R <sub>thj-a</sub> | 125     | °C/W |

**Electrical Characteristics(T<sub>j</sub> = 25°C Unless otherwise specified)**

| Parameter                                          | Symbol                         | Min. | Typ. | Max. | Unit | Test Conditions                                          |
|----------------------------------------------------|--------------------------------|------|------|------|------|----------------------------------------------------------|
| Drain-Source Breakdown Voltage                     | BV <sub>DSS</sub>              | 20   | -    | -    | V    | V <sub>GS</sub> =0, I <sub>D</sub> =250uA                |
| Breakdown Voltage Temperature Coefficient          | $\Delta BV_{DSS} / \Delta T_j$ | -    | 0.02 | -    | V/°C | Reference to 25°C, I <sub>D</sub> =1mA                   |
| Gate Threshold Voltage                             | V <sub>GS(th)</sub>            | 0.5  | -    | -    | V    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA |
| Forward Transconductance                           | g <sub>fs</sub>                | -    | 21   | -    | S    | V <sub>DS</sub> =10V, I <sub>D</sub> =5A                 |
| Gate-Source Leakage Current                        | I <sub>GSS</sub>               | -    | -    | ±10  | uA   | V <sub>GS</sub> = ±12V                                   |
| Drain-Source Leakage Current(T <sub>j</sub> =25°C) | I <sub>DSS</sub>               | -    | -    | 1    | uA   | V <sub>DS</sub> =20V, V <sub>GS</sub> =0                 |
| Drain-Source Leakage Current(T <sub>j</sub> =70°C) |                                | -    | -    | 25   | uA   | V <sub>DS</sub> =20V, V <sub>GS</sub> =0                 |
| Static Drain-Source On-Resistance <sup>2</sup>     | R <sub>DS(on)</sub>            | -    | -    | 22   | mΩ   | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A                |
|                                                    |                                | -    | -    | 28   |      | V <sub>GS</sub> =2.5V, I <sub>D</sub> =2A,               |
| Total Gate Charge <sup>2</sup>                     | Q <sub>g</sub>                 | -    | 15.9 | -    | nC   | I <sub>D</sub> =5A                                       |
| Gate-Source Charge                                 | Q <sub>gs</sub>                | -    | 1.5  | -    |      | V <sub>DS</sub> =10V                                     |
| Gate-Drain ("Miller") Change                       | Q <sub>gd</sub>                | -    | 7.4  | -    |      | V <sub>GS</sub> =4.5V                                    |
| Turn-on Delay Time <sup>2</sup>                    | T <sub>d(on)</sub>             | -    | 6.2  | -    | ns   | V <sub>DS</sub> =10V                                     |
| Rise Time                                          | T <sub>r</sub>                 | -    | 9    | -    |      | I <sub>D</sub> =1A                                       |
| Turn-off Delay Time                                | T <sub>d(off)</sub>            | -    | 30   | -    |      | V <sub>GS</sub> =4.5V                                    |
| Fall Time                                          | T <sub>f</sub>                 | -    | 11   | -    |      | R <sub>G</sub> =3.3Ω<br>R <sub>D</sub> =10Ω              |
| Input Capacitance                                  | C <sub>iss</sub>               | -    | 530  | -    | pF   | V <sub>GS</sub> =0V                                      |
| Output Capacitance                                 | C <sub>oss</sub>               | -    | 245  | -    |      | V <sub>DS</sub> =20V                                     |
| Reverse Transfer Capacitance                       | C <sub>rss</sub>               | -    | 125  | -    |      | f=1.0MHz                                                 |

**Source-Drain Diode**

| Parameter                             | Symbol          | Min. | Typ. | Max. | Unit | Test Conditions                                              |
|---------------------------------------|-----------------|------|------|------|------|--------------------------------------------------------------|
| Forward On Voltage <sup>2</sup>       | V <sub>SD</sub> | -    | -    | 1.2  | V    | I <sub>S</sub> =5A, V <sub>GS</sub> =0, T <sub>j</sub> =25°C |
| Continuous Source Current(Body Diode) | I <sub>S</sub>  | -    | -    | 0.83 | A    | V <sub>D</sub> =V <sub>G</sub> =0V, V <sub>S</sub> =1.2V     |

Notes: 1. Pulse width limited by Max. junction temperature.

2. Pulse width ≤ 300us, duty cycle ≤ 2%.

3. Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board; 208°C/W when mounted on Min. copper pad.

## Characteristics Curve

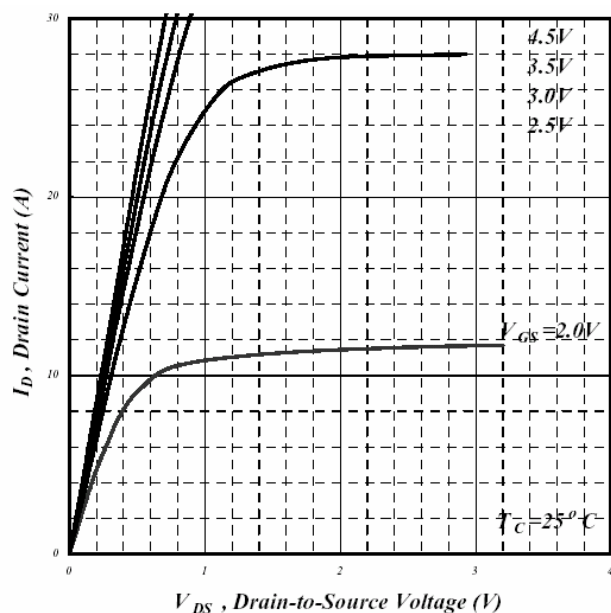


Fig 1. Typical Output Characteristics

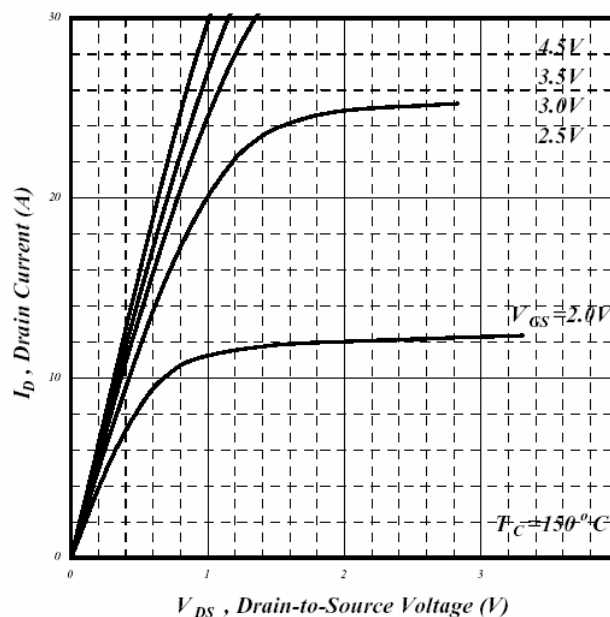


Fig 2. Typical Output Characteristics

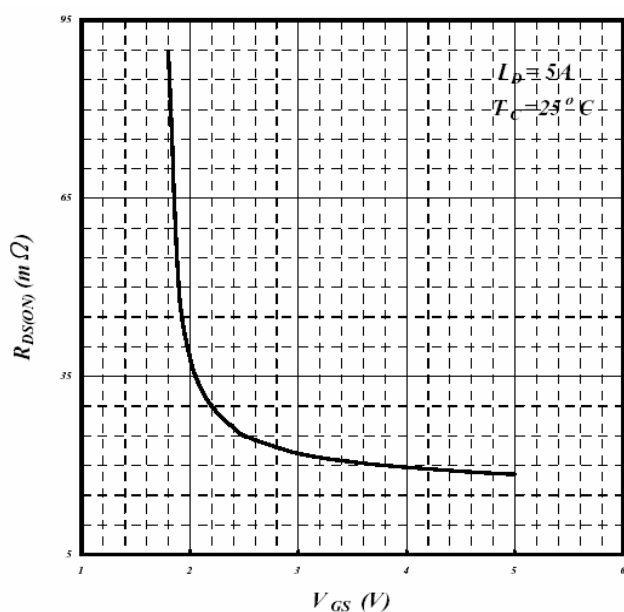


Fig 3. On-Resistance v.s. Gate Voltage

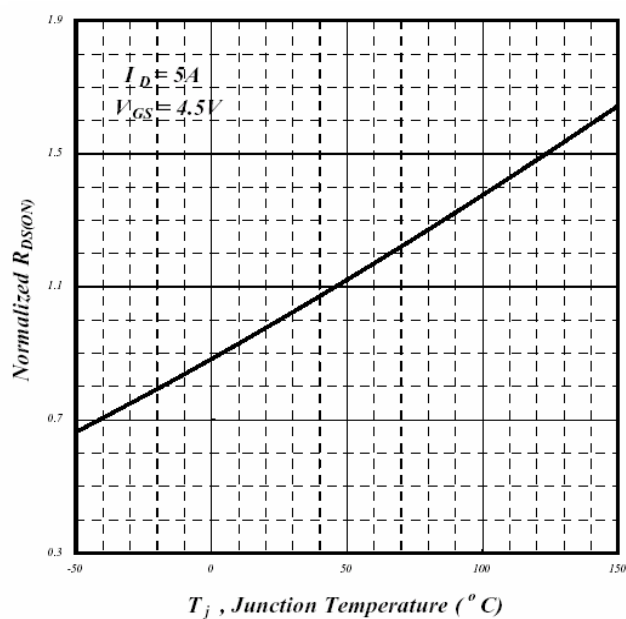
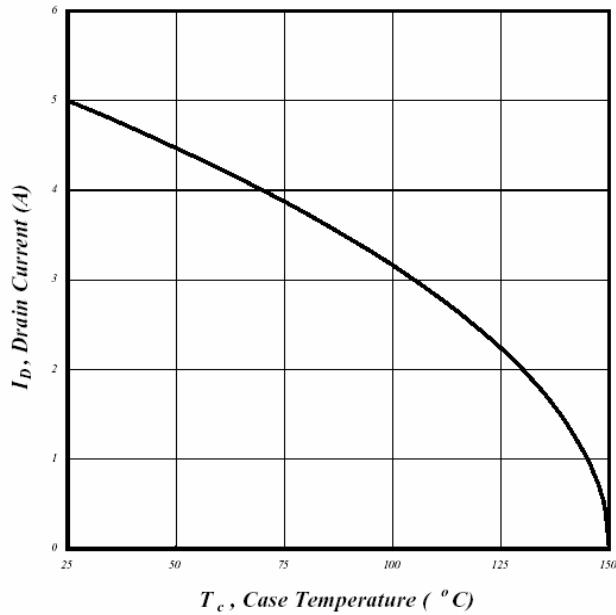
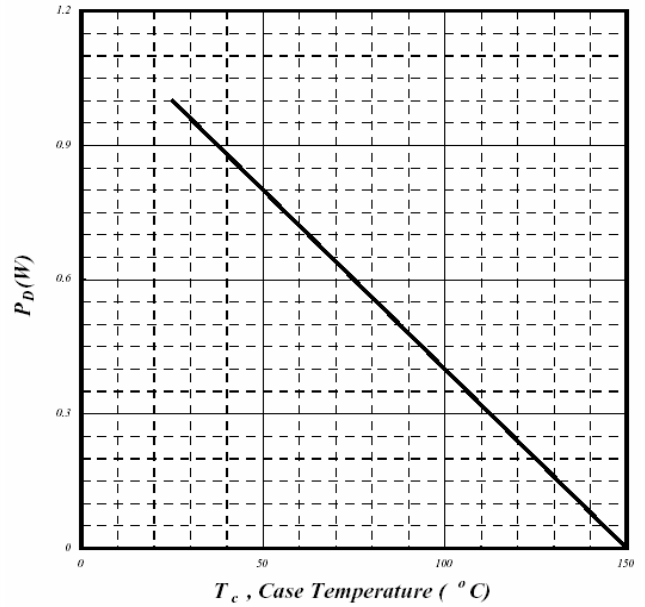


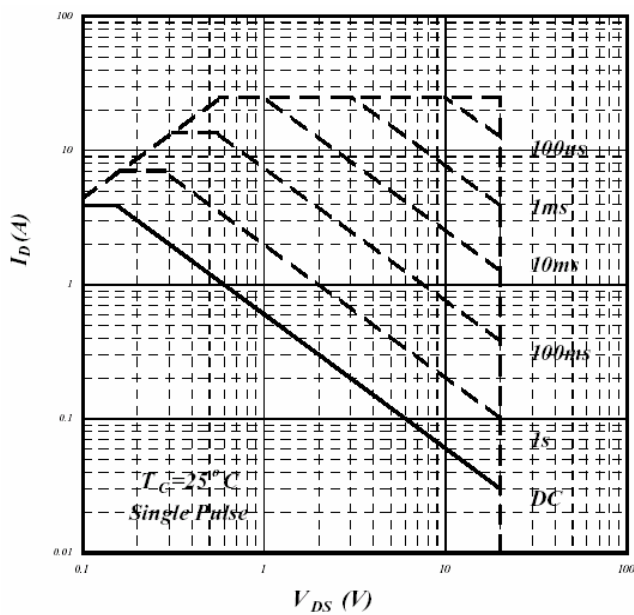
Fig 4. Normalized On-Resistance v.s. Junction Temperature



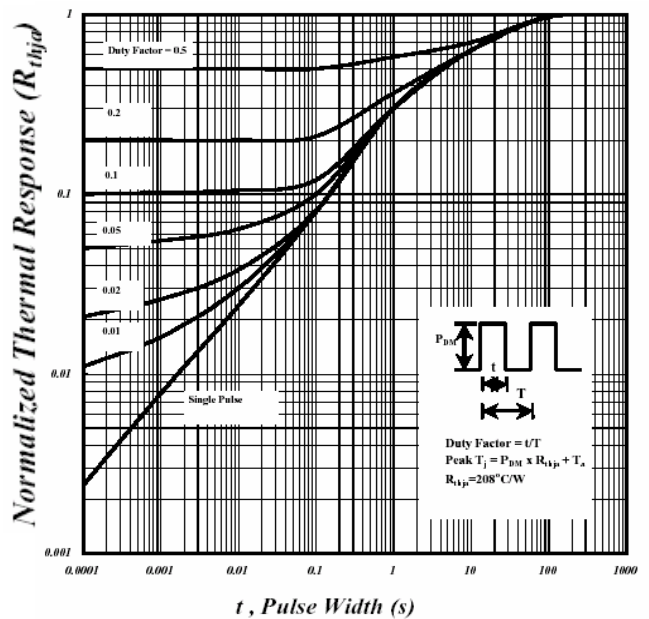
**Fig 5. Maximum Drain Current v.s. Case Temperature**



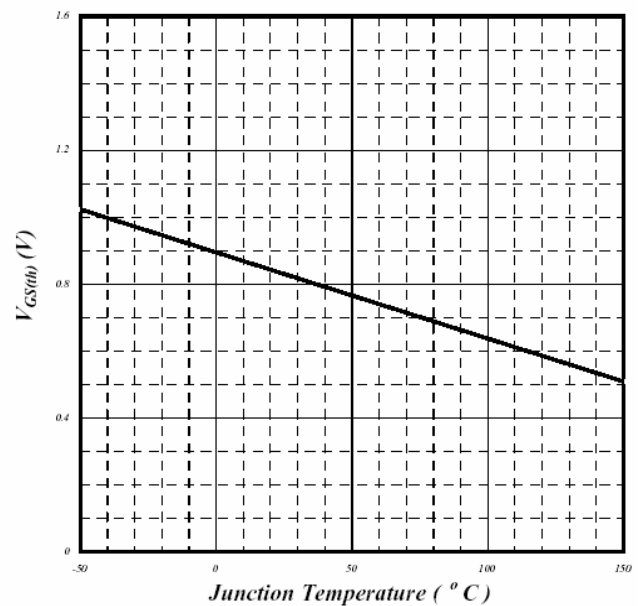
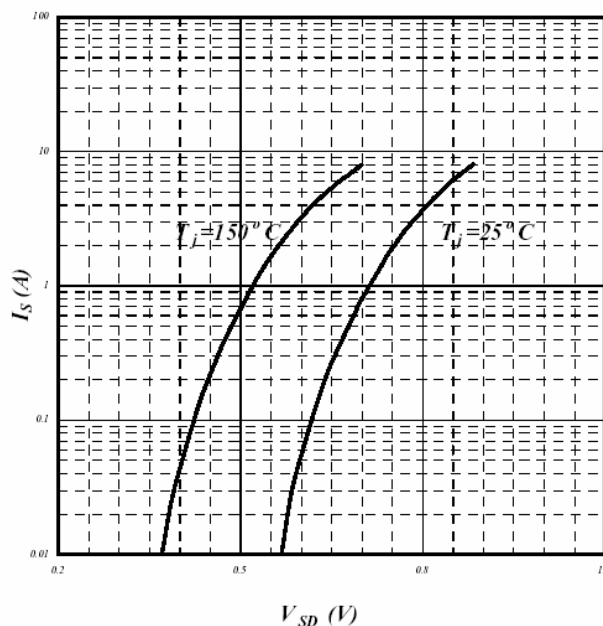
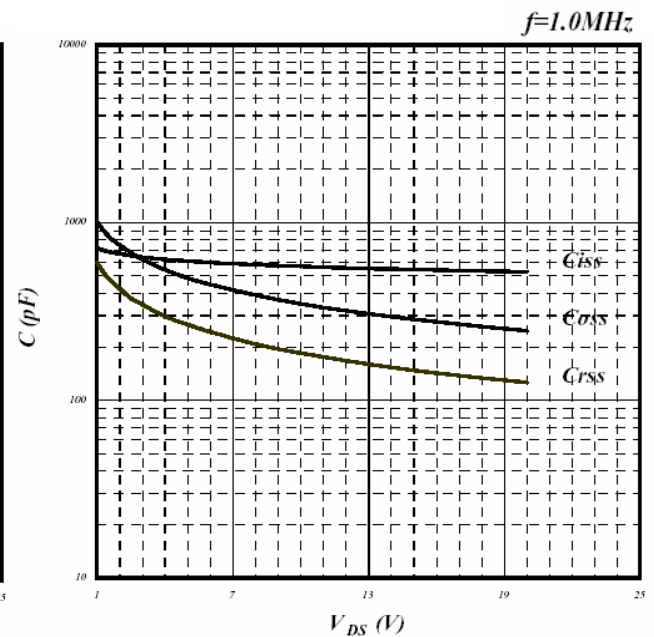
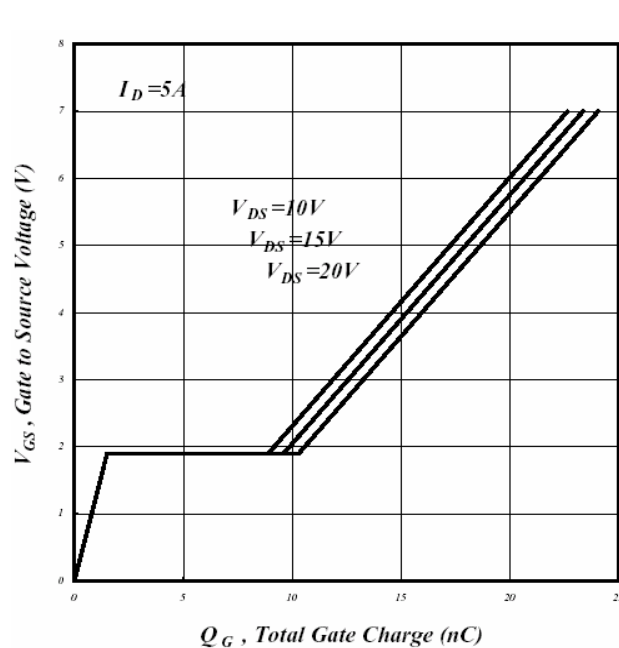
**Fig 6. Typical Power Dissipation**



**Fig 7. Maximum Safe Operating Area**



**Fig 8. Effective Transient Thermal Impedance**



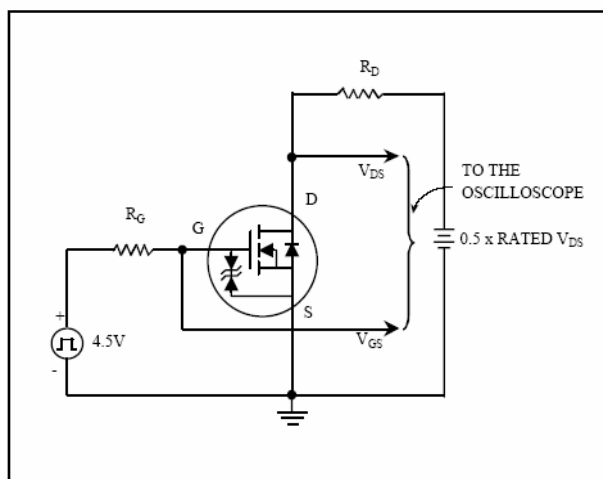


Fig 13. Switching Time Circuit

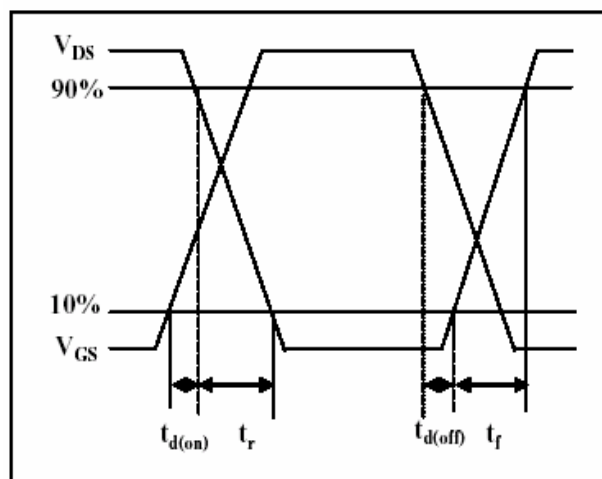


Fig 14. Switching Time Waveform

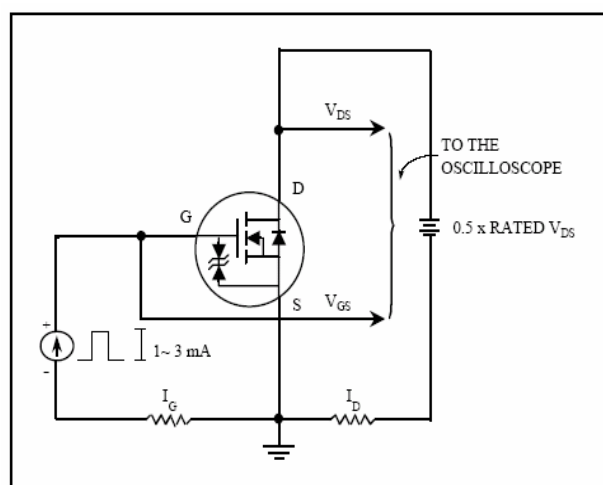


Fig 15. Gate Charge Circuit

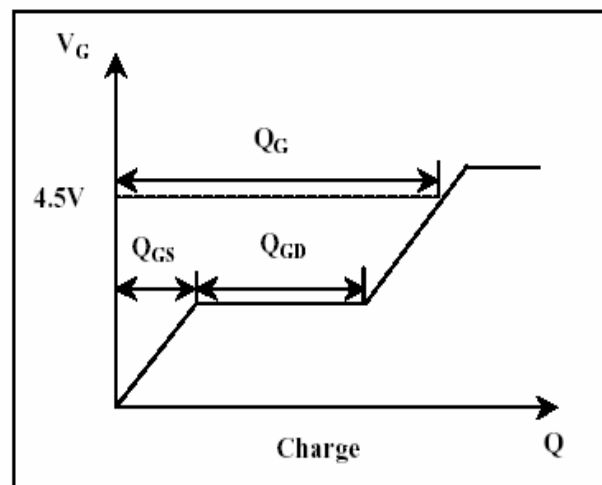


Fig 16. Gate Charge Waveform

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