

### General Description

This planar stripe MOSFET has better characteristics, such as fast switching time, low on resistance, low gate charge and excellent avalanche characteristics. It is mainly suitable for electronic ballast and switching mode power supplies.

### FEATURES

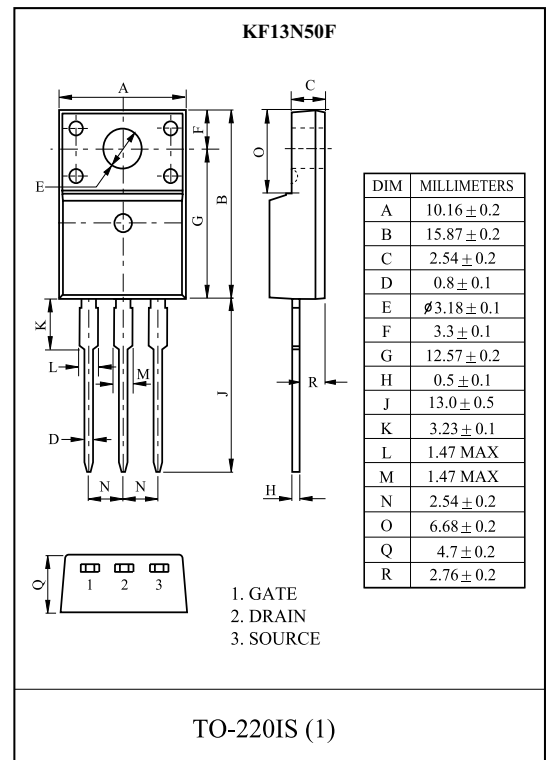
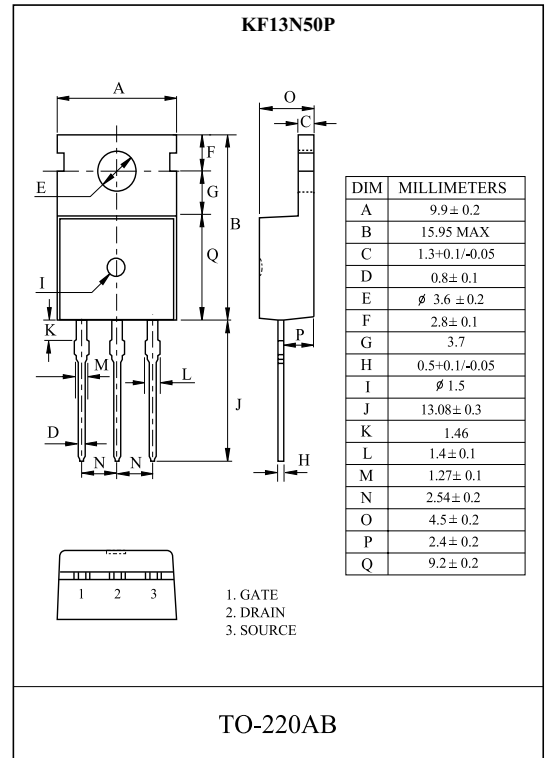
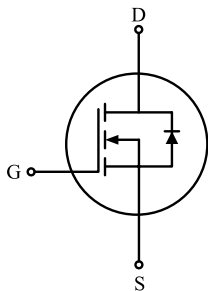
- $V_{DSS} = 500V$ ,  $I_D = 13A$
- Drain-Source ON Resistance :  
 $R_{DS(ON)} = 0.44$  (Max) @  $V_{GS} = 10V$
- $Q_g$ (typ.) = 35nC

### MAXIMUM RATING (Tc=25 °C)

| CHARACTERISTIC                          | SYMBOL          | RATING   |          | UNIT |
|---|-----------------|----------|----------|------|
|   |                 | KF13N50P | KF13N50F |      |
| Drain-Source Voltage                    | $V_{DSS}$       | 500      |          | V    |
| Gate-Source Voltage                     | $V_{GSS}$       | ± 30     |          | V    |
| Drain Current                           | @Tc=25          | 13       | 13*      | A    |
|   | @Tc=100         | 8        | 8*       |      |
|   | Pulsed (Note1)  | $I_{DP}$ | 40       |      |
| Single Pulsed Avalanche Energy (Note 2) | $E_{AS}$        | 860      |          | mJ   |
| Repetitive Avalanche Energy (Note 1)    | $E_{AR}$        | 19.5     |          | mJ   |
| Peak Diode Recovery dv/dt (Note 3)      | dv/dt           | 4.5      |          | V/ns |
| Drain Power Dissipation                 | Tc=25           | 208      | 49.8     | W    |
|   | Derate above 25 | 1.66     | 0.4      | W/   |
| Maximum Junction Temperature            | $T_j$           | 150      |          |      |
| Storage Temperature Range               | $T_{stg}$       | -55 150  |          |      |
| <b>Thermal Characteristics</b>          |                 |          |          |      |
| Thermal Resistance, Junction-to-Case    | $R_{thJC}$      | 0.6      | 2.51     | /W   |
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$      | 62.5     | 62.5     | /W   |

\* : Drain current limited by maximum junction temperature.

### EQUIVALENT CIRCUIT



# KF13N50P/F

## ELECTRICAL CHARACTERISTICS (T<sub>c</sub>=25 °C)

| CHARACTERISTIC                            | SYMBOL                             | TEST CONDITION   | MIN. | TYP. | MAX.  | UNIT |
|---|------------------------------------|--|------|------|-------|------|
| <b>Static</b>                             |                                    |  |      |      |       |      |
| Drain-Source Breakdown Voltage            | BV <sub>DSS</sub>                  | I <sub>D</sub> =250 μA, V <sub>GS</sub> =0V                                  | 500  | -    | -     | V    |
| Breakdown Voltage Temperature Coefficient | BV <sub>DSS</sub> / T <sub>j</sub> | I <sub>D</sub> =250 μA, Referenced to 25                                     | -    | 0.63 | -     | V/°C |
| Drain Cut-off Current                     | I <sub>DSS</sub>                   | V <sub>DS</sub> =500V, V <sub>GS</sub> =0V,                                  | -    | -    | 10    | μA   |
| Gate Threshold Voltage                    | V <sub>th</sub>                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250 μA                    | 2.5  | -    | 4.5   | V    |
| Gate Leakage Current                      | I <sub>GSS</sub>                   | V <sub>GS</sub> = ± 30V, V <sub>DS</sub> =0V                                 | -    | -    | ± 100 | nA   |
| Drain-Source ON Resistance                | R <sub>DS(ON)</sub>                | V <sub>GS</sub> =10V, I <sub>D</sub> =6.5A                                   | -    | 0.35 | 0.44  |      |
| <b>Dynamic</b>                            |                                    |  |      |      |       |      |
| Total Gate Charge                         | Q <sub>g</sub>                     | V <sub>DS</sub> =400V, I <sub>D</sub> =13A<br>V <sub>GS</sub> =10V (Note4,5) | -    | 35   | -     | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                    |  | -    | 9    | -     |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                    |  | -    | 13   | -     |      |
| Turn-on Delay time                        | t <sub>d(on)</sub>                 | V <sub>DD</sub> =250V<br>I <sub>D</sub> =13A<br>R <sub>G</sub> =25 (Note4,5) | -    | 28   | -     | ns   |
| Turn-on Rise time                         | t <sub>r</sub>                     |  | -    | 45   | -     |      |
| Turn-off Delay time                       | t <sub>d(off)</sub>                |  | -    | 105  | -     |      |
| Turn-off Fall time                        | t <sub>f</sub>                     |  | -    | 55   | -     |      |
| Input Capacitance                         | C <sub>iss</sub>                   | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz                          | -    | 1700 | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                   |  | -    | 210  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                   |  | -    | 15   | -     |      |
| <b>Source-Drain Diode Ratings</b>         |                                    |  |      |      |       |      |
| Continuous Source Current                 | I <sub>S</sub>                     | V <sub>GS</sub> <V <sub>th</sub>   | -    | -    | 13    | A    |
| Pulsed Source Current                     | I <sub>SP</sub>                    |  | -    | -    | 52    |      |
| Diode Forward Voltage                     | V <sub>SD</sub>                    | I <sub>S</sub> =13A, V <sub>GS</sub> =0V                                     | -    | -    | 1.4   | V    |
| Reverse Recovery Time                     | t <sub>rr</sub>                    | I <sub>S</sub> =13A, V <sub>GS</sub> =0V,<br>dI <sub>S</sub> /dt=100A/μs     | -    | 360  | -     | ns   |
| Reverse Recovery Charge                   | Q <sub>rr</sub>                    |  | -    | 4.4  | -     | μC   |

Note 1) Repetivity rating : Pulse width limited by junction temperature.

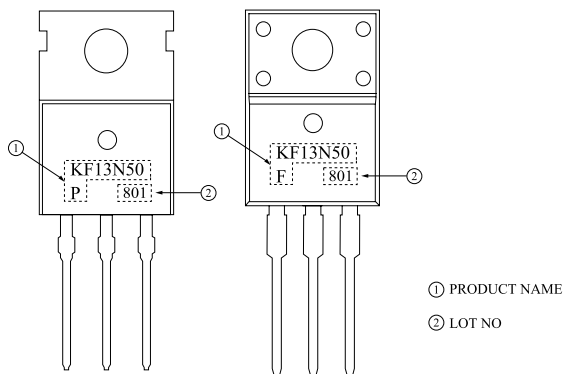
Note 2) L=6.0mH, I<sub>S</sub>=13A, V<sub>DD</sub>=50V, R<sub>G</sub>=25 Ω, Starting T<sub>j</sub>=25 °C.

Note 3) I<sub>S</sub> 13A, dI/dt 200A/μs, V<sub>DD</sub> BV<sub>DSS</sub>, Starting T<sub>j</sub>=25 °C.

Note 4) Pulse Test : Pulse width 300 μs, Duty Cycle 2%.

Note 5) Essentially independent of operating temperature.

### Marking



# KF13N50P/F

Fig1.  $I_D - V_{DS}$

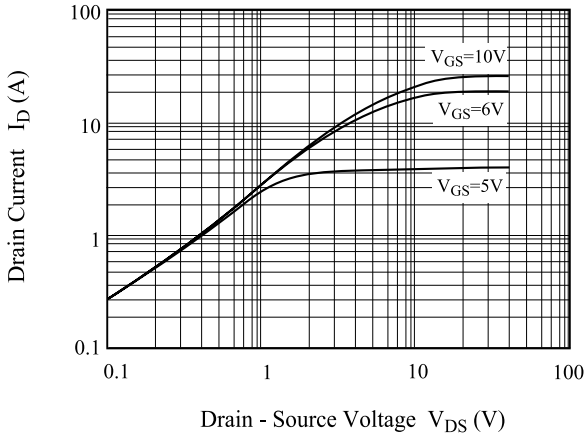


Fig2.  $I_D - V_{GS}$

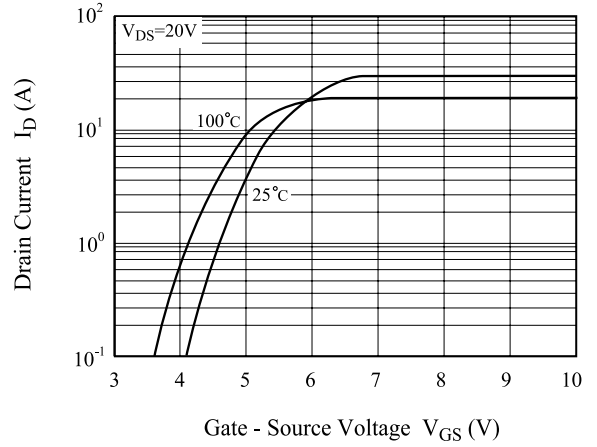


Fig3.  $BV_{DSS} - T_j$

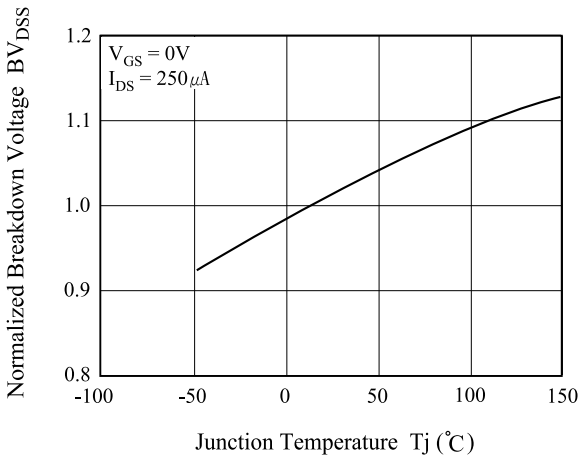


Fig4.  $R_{DS(ON)} - I_D$

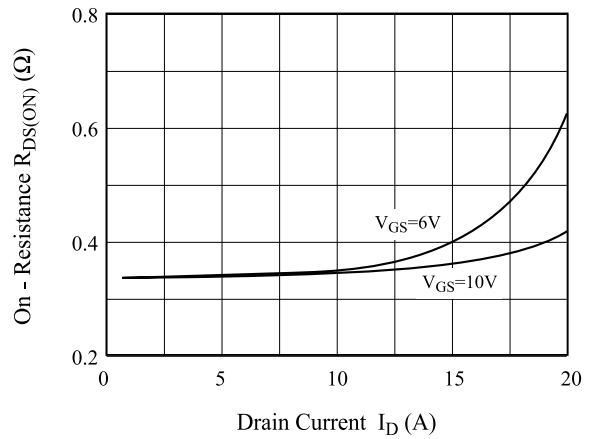


Fig5.  $I_S - V_{SD}$

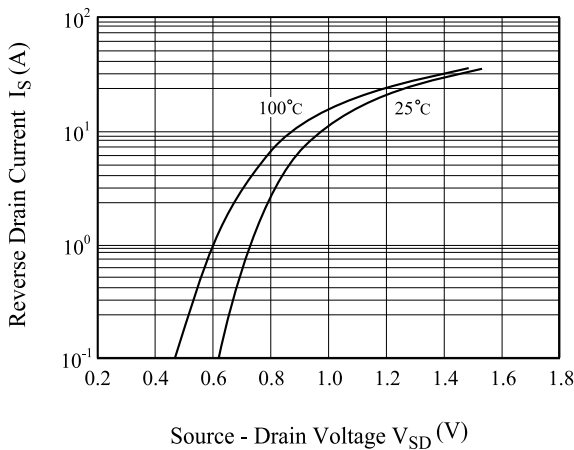
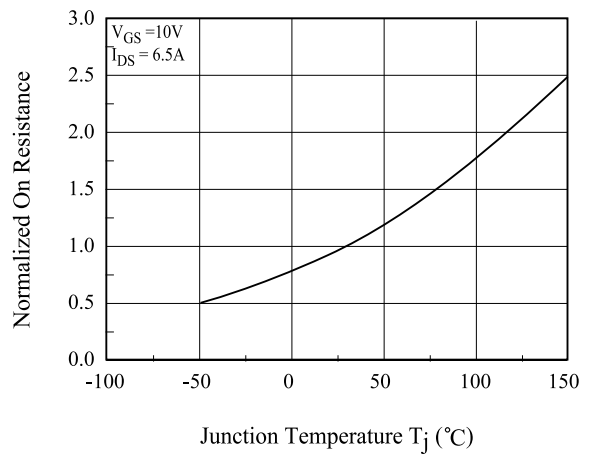


Fig6.  $R_{DS(ON)} - T_j$



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Fig 7. C - V<sub>DS</sub>

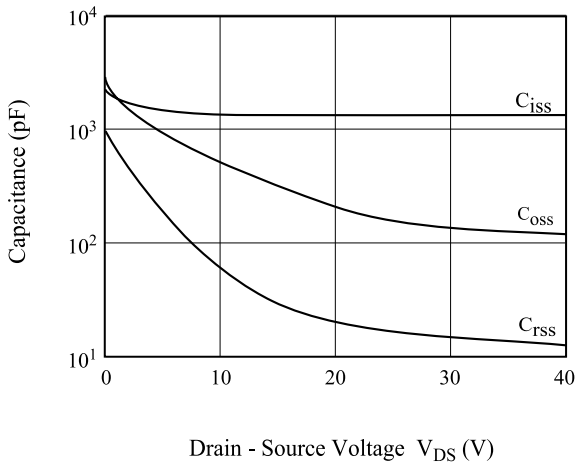


Fig8. Q<sub>g</sub>- V<sub>GS</sub>

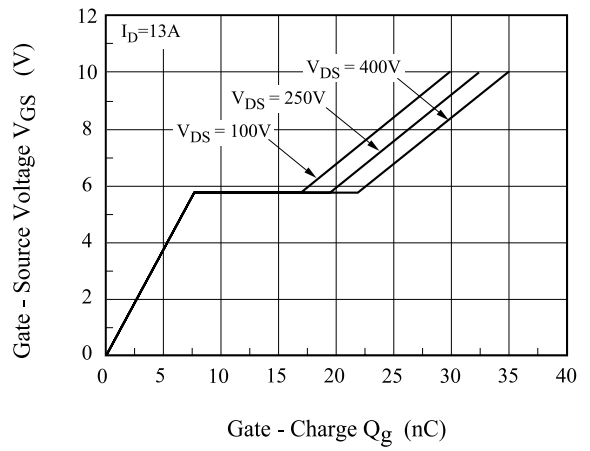


Fig9. Safe Operation Area

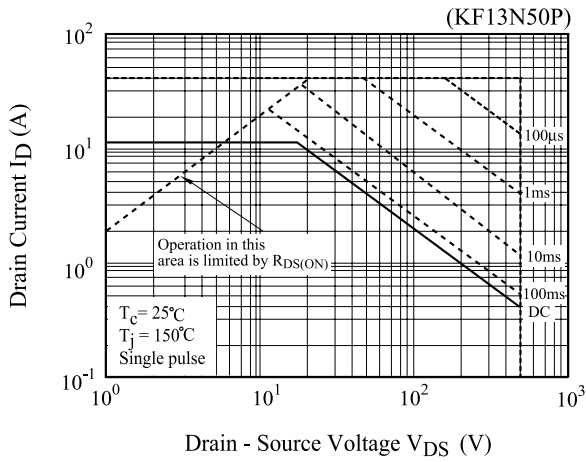


Fig10. Safe Operation Area

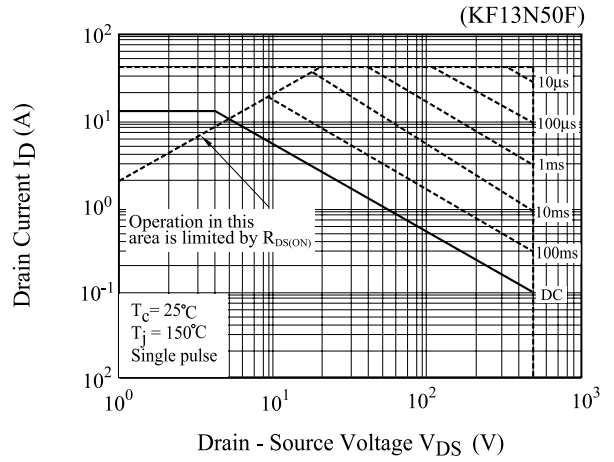
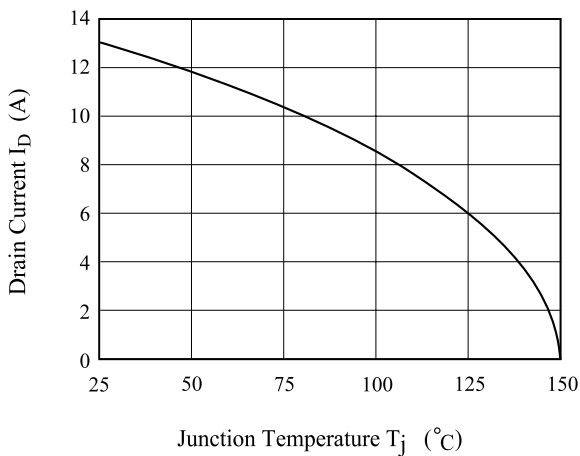


Fig11. ID - T<sub>j</sub>



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Fig12. Transient Thermal Response Curve

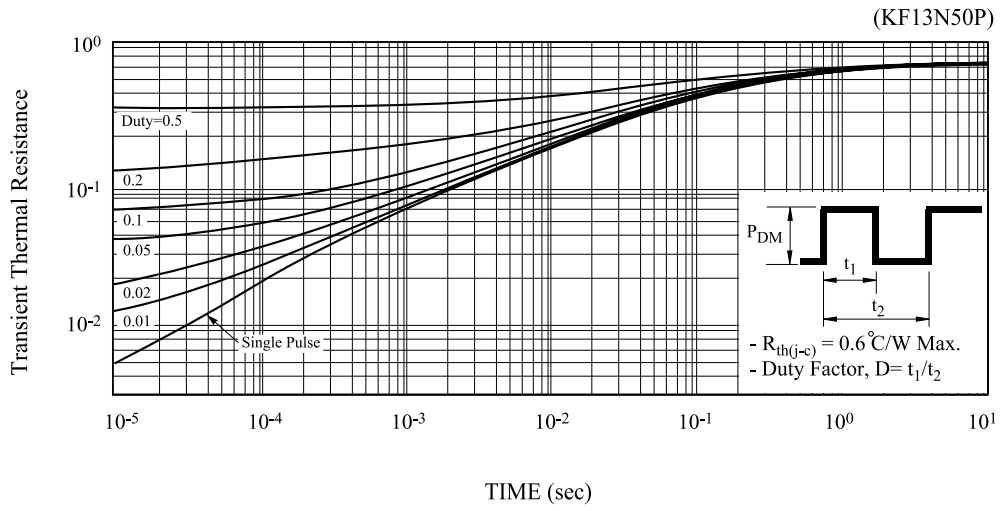


Fig13. Transient Thermal Response Curve

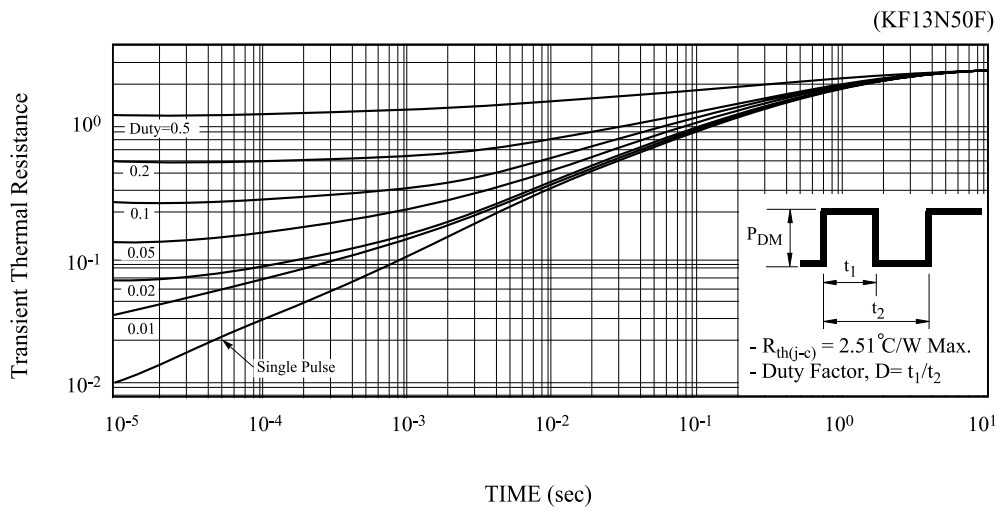


Fig14. Gate Charge

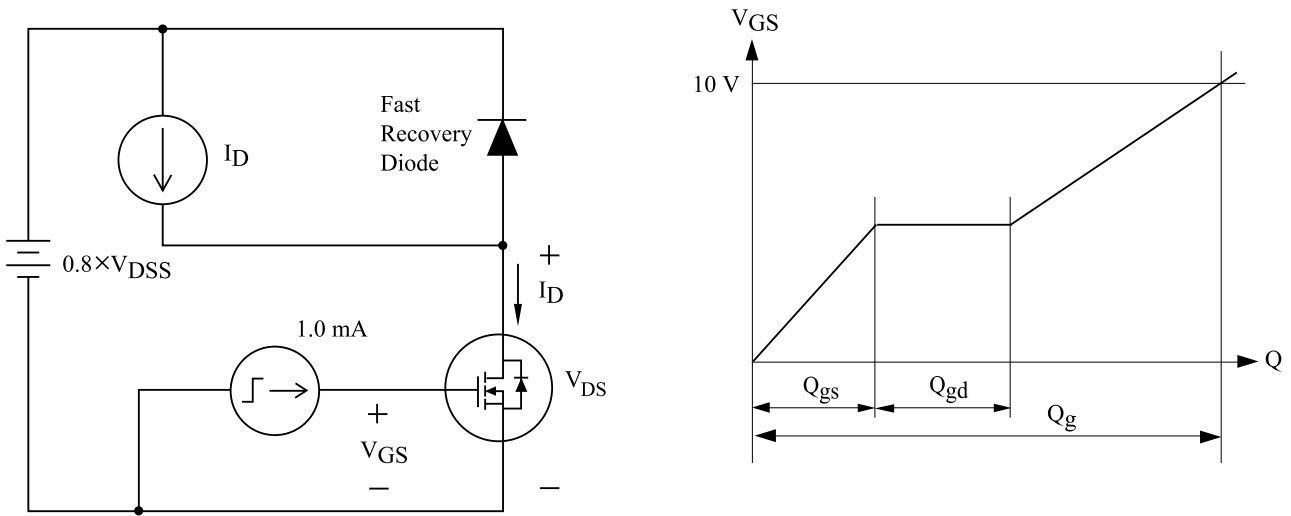


Fig15. Single Pulsed Avalanche Energy

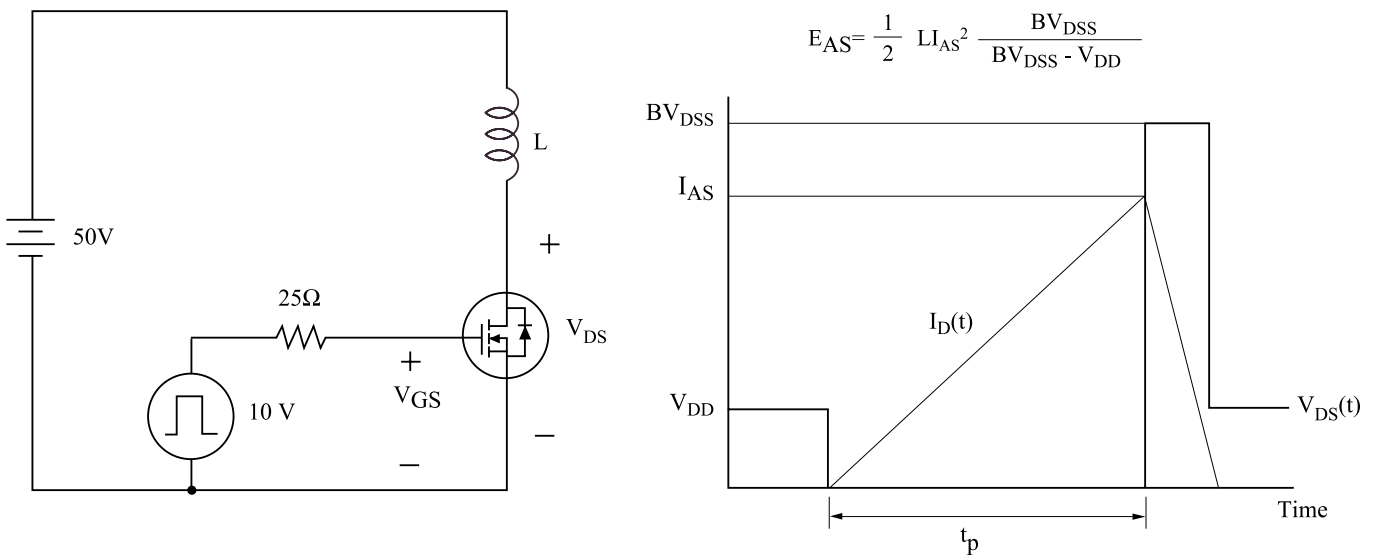


Fig16. Resistive Load Switching

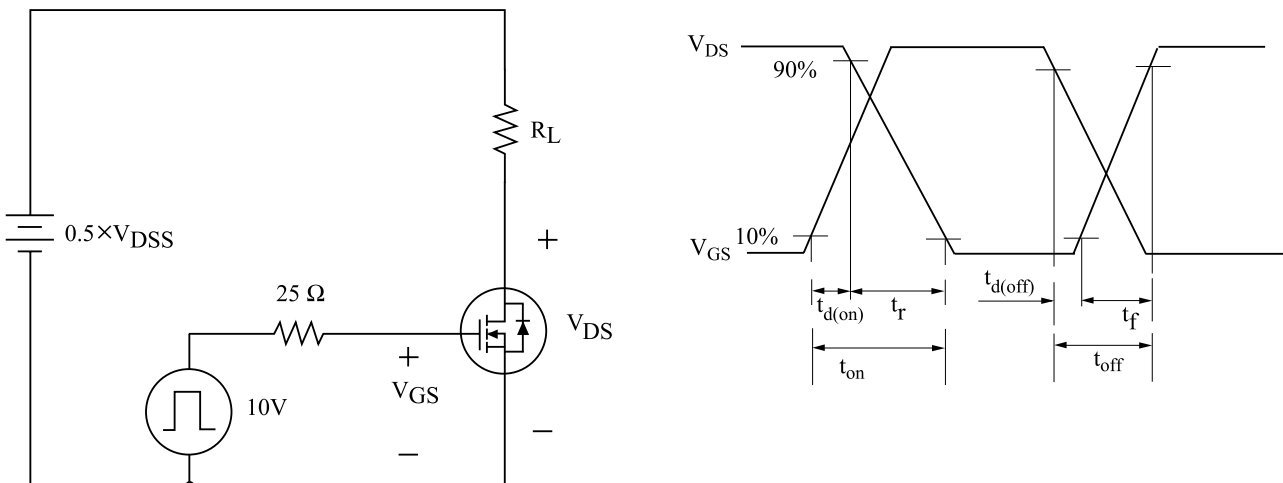


Fig17. Source - Drain Diode Reverse Recovery and  $dv/dt$

