

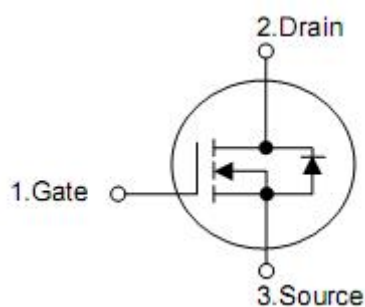
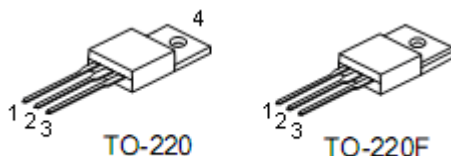
## 1. Description

The KNX6650A-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology

## 2. Features

- n** Proprietary New Planar Technology
- n**  $R_{DS(ON),typ.}=0.33\ \Omega @V_{GS}=10V$
- n** Low Gate Charge Minimize Switching Loss
- n** Fast Recovery Body Diode

## 3. Pin configuration



| Pin | Function |
|-----|----------|
| 1   | Gate     |
| 2   | Drain    |
| 3   | Source   |
| 4   | Drain    |

## 4. Ordering Information

| Part Number | Package | Brand |
|-------------|---------|-------|
| KNF6650A    | TO-220F | KIA   |
| KNP6650A    | TO-220  | KIA   |

## 5. Absolute maximum ratings

TC=25 °C unless otherwise specified

| Parameter                                                                                                        | Symbol                             | Ratings    |       | Unit  |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|------------|-------|-------|
|                                                                                                                  |                                    | TO220      | TO22F |       |
| Drain-to-Source Voltage <sup>[1]</sup>                                                                           | V <sub>DSS</sub>                   | 500        |       | V     |
| Gate-to-Source Voltage                                                                                           | V <sub>GSS</sub>                   | ±30        |       |       |
| Continuous Drain Current                                                                                         | I <sub>D</sub>                     | 15         |       | A     |
| Continuous Drain Current @ T <sub>C</sub> =100 °C                                                                |                                    | Figure3    |       |       |
| Pulsed Drain Current at V <sub>GS</sub> =10V <sup>[2]</sup>                                                      | I <sub>DM</sub>                    | Figure6    |       |       |
| Single Pulse Avalanche Energy                                                                                    | E <sub>AS</sub>                    | 1000       |       | mJ    |
| Peak Diode Recovery dv/dt <sup>[3]</sup>                                                                         | dv/dt                              | 5.0        |       | V/ns  |
| Power Dissipation                                                                                                | P <sub>D</sub>                     | 140        | 60    | W     |
| Derating Factor above 25 °C                                                                                      |                                    | 1.12       | 0.48  | W/ °C |
| Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds | T <sub>L</sub><br>T <sub>PAK</sub> | 300<br>260 |       | °C    |
| Operating and StorageTemperatureRange                                                                            | T <sub>J</sub> & T <sub>STG</sub>  | -55 to 150 |       |       |

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

## 6. Thermal characteristics

| Parameter                            | Symbol           | Ratings |        | Units |
|--------------------------------------|------------------|---------|--------|-------|
|                                      |                  | TO220   | TO220F |       |
| Thermal resistance, junction-ambient | R <sub>θJA</sub> | 62      | 100    | °C/W  |
| Thermal resistance, Junction-case    | R <sub>θJC</sub> | 0.9     | 2.1    |       |

## 7. Electrical characteristics

(T<sub>J</sub>=25°C, unless otherwise notes)

| Parameter                                      | Symbol              | Conditions                                                                              | Min | Typ  | Max  | Units |
|------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------|-----|------|------|-------|
| Off characteristics                            |                     |                                                                                         |     |      |      |       |
| Drain-source breakdown voltage                 | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V,I <sub>D</sub> =250μA                                               | 500 | -    | -    | V     |
| Drain-to-source Leakage Current                | I <sub>DSS</sub>    | V <sub>DS</sub> =500V , V <sub>GS</sub> =0V                                             | -   | -    | 1    | μA    |
|                                                |                     | V <sub>DS</sub> =400V , V <sub>GS</sub> =0V<br>T <sub>C</sub> =125°C,                   | -   | -    | 100  | μA    |
| Gate-body leakage current                      | I <sub>GSS</sub>    | V <sub>GS</sub> =30V,V <sub>DS</sub> =0V                                                | -   | -    | +100 | nA    |
|                                                |                     | V <sub>GS</sub> =-30V,V <sub>DS</sub> =0V                                               | -   | -    | -100 | nA    |
| On characteristics                             |                     |                                                                                         |     |      |      |       |
| Static drain-source on-resistance              | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V,I <sub>D</sub> =7.5A                                               | -   | 0.33 | 0.45 | Ω     |
| Gate threshold voltage                         | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 2.0 | -    | 4.0  | V     |
| Forward Transconductance                       | g <sub>fs</sub>     | V <sub>DS</sub> =30V,I <sub>D</sub> =15A                                                | -   | 15   | -    | S     |
| Dynamic characteristics                        |                     |                                                                                         |     |      |      |       |
| Input capacitance                              | C <sub>iss</sub>    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,<br>f=1MHz                                     | -   | 2148 | -    | pF    |
| Output capacitance                             | C <sub>oss</sub>    |                                                                                         | -   | 208  | -    | pF    |
| Reverse transfer capacitance                   | C <sub>rss</sub>    |                                                                                         | -   | 22   | -    | pF    |
| Total gate charge                              |                     |                                                                                         |     |      |      |       |
| Turn-on delay time                             | t <sub>d(on)</sub>  | V <sub>DD</sub> =250V,I <sub>D</sub> =15A,<br>V <sub>GS</sub> =10V,R <sub>G</sub> =6.1Ω | -   | 13   | -    | ns    |
| Rise time                                      | t <sub>r</sub>      |                                                                                         | -   | 28   | -    | ns    |
| Turn-off delay time                            | t <sub>d(off)</sub> |                                                                                         | -   | 44   | -    | ns    |
| Fall time                                      | t <sub>f</sub>      |                                                                                         | -   | 35   | -    | ns    |
| Total gate charge                              | Q <sub>g</sub>      | V <sub>DD</sub> =250V,I <sub>D</sub> =15A ,<br>V <sub>GS</sub> =0 to10V                 | -   | 46   | -    | nC    |
| Gate-source charge                             | Q <sub>gs</sub>     |                                                                                         | -   | 12   | -    | nC    |
| Gate-drain charge                              | Q <sub>gd</sub>     |                                                                                         | -   | 17   | -    | nC    |
| Drain-source diode characteristics             |                     |                                                                                         |     |      |      |       |
| Drain-source diode forward voltage             | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =15.0A                                               | -   | -    | 1.5  | V     |
| Continuous drain-source current <sup>[4]</sup> | I <sub>SD</sub>     | Integral pn-diode<br>In MOSFET                                                          | -   | -    | 15   | A     |
| Pulsed drain-source current <sup>[4]</sup>     | I <sub>SM</sub>     |                                                                                         | -   | -    | 60   | A     |
| Reverse recovery time                          | t <sub>rr</sub>     | V <sub>GS</sub> =0V,I <sub>F</sub> =15.0A                                               | -   | 520  | -    | ns    |
| Reverse recovery charge                        | Q <sub>rr</sub>     | dI <sub>F</sub> /dt=100A/μs                                                             | -   | 4.5  | -    | μC    |

Note:

[1] T<sub>J</sub> = +25 °C to +150 °C

[2] Repetitive rating; pulse width limited by maximum junction temperature.

[3] I<sub>SD</sub> = 15A di/dt < 100 A/μs, V<sub>DD</sub> < BV<sub>DSS</sub>, T<sub>J</sub> = +150 °C.

[4] Pulse width ≤ 380μs; duty cycle ≤ 2%.

## 8. Typical Characteristics

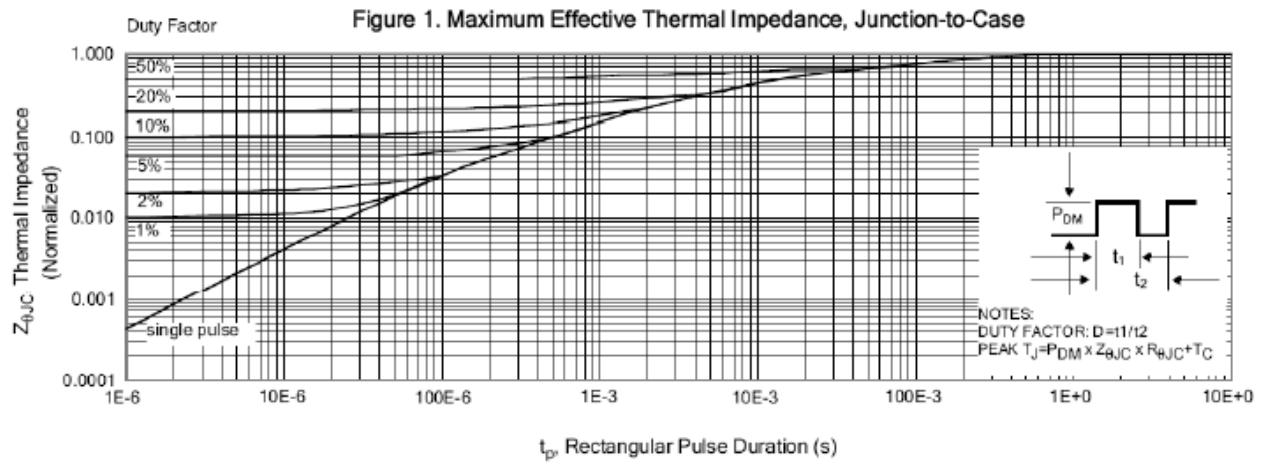


**Figure 2. Maximum Power Dissipation vs Case Temperature**

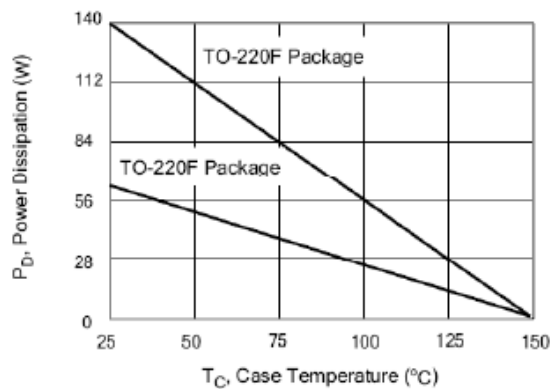


**Figure 3. Maximum Continuous Drain Current vs Case Temperature**

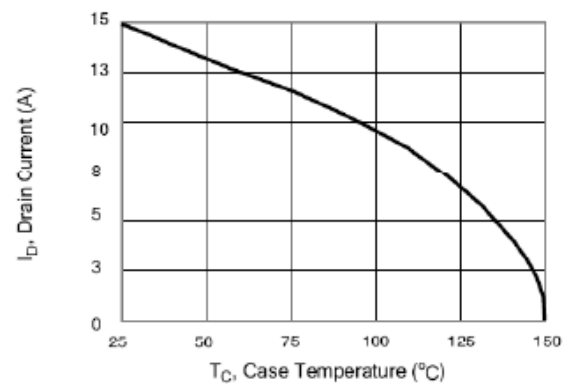


**Figure 4. Typical Output Characteristics**

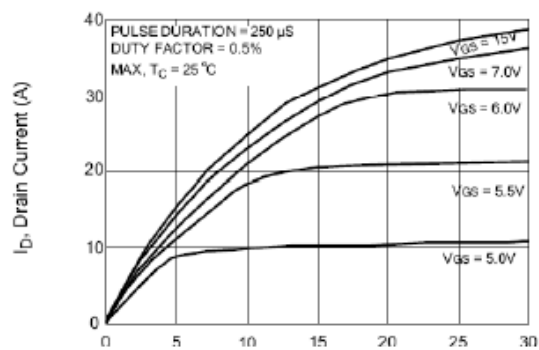


**Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current**

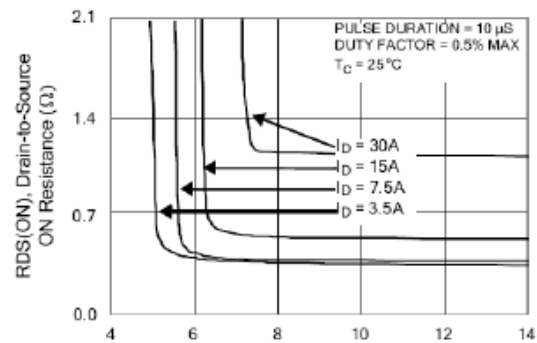


Figure 6. Maximum Peak Current Capability

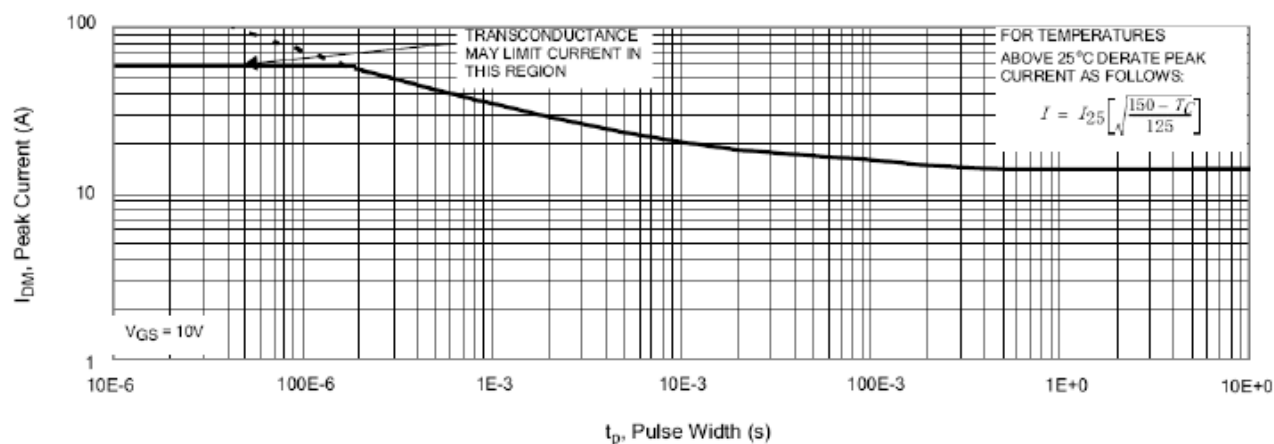


Figure 7. Typical Transfer Characteristics

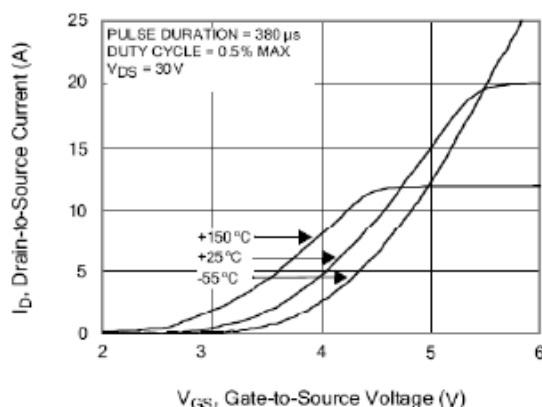


Figure 8. Unclamped Inductive Switching Capability

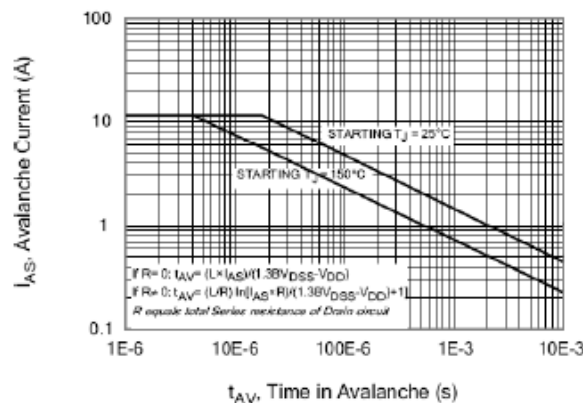


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

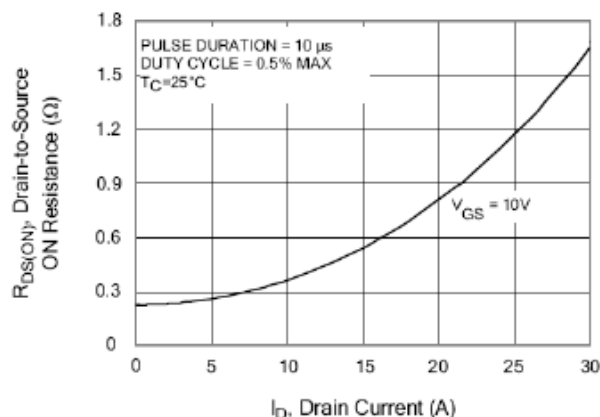


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature

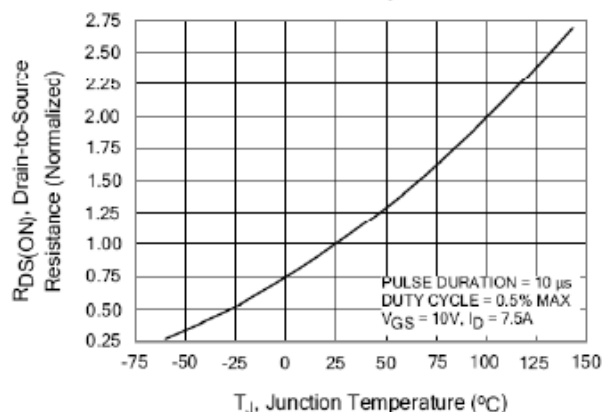


**Figure 11. Typical Breakdown Voltage vs Junction Temperature**

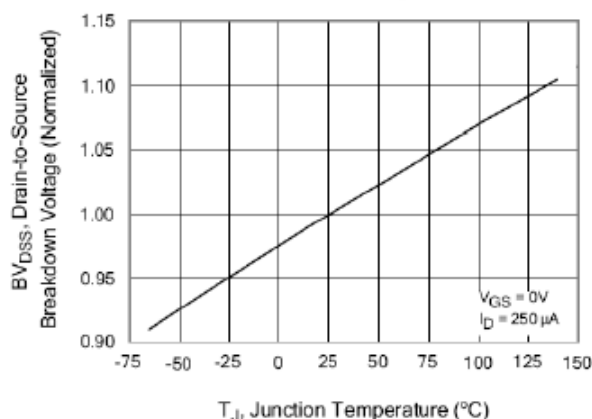


**Figure 12. Typical Threshold Voltage vs Junction Temperature**

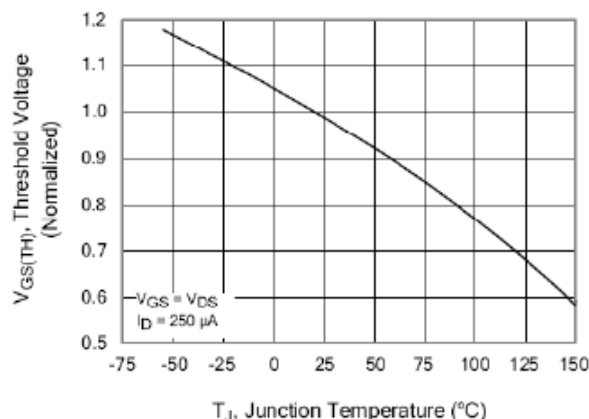


**Figure 13. Maximum Forward Bias Safe Operating Area**

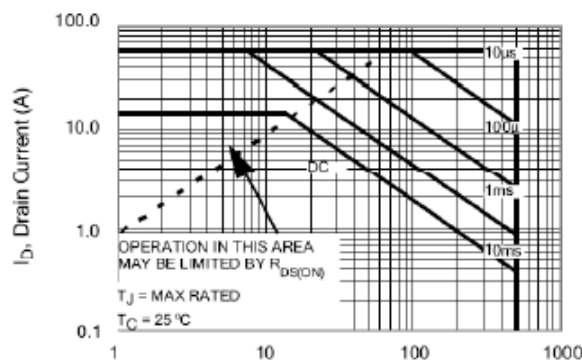


**Figure 14. Typical Capacitance vs Drain-to-Source Voltage**

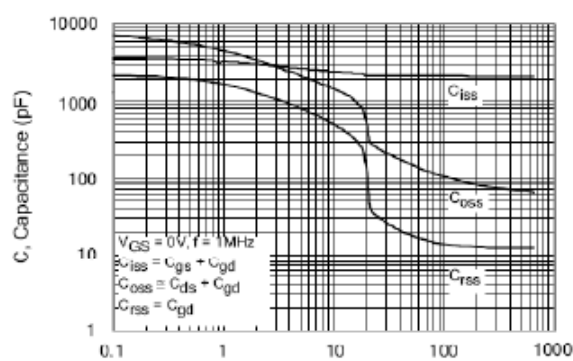


**Figure 15. Typical Gate Charge vs Gate-to-Source Voltage**

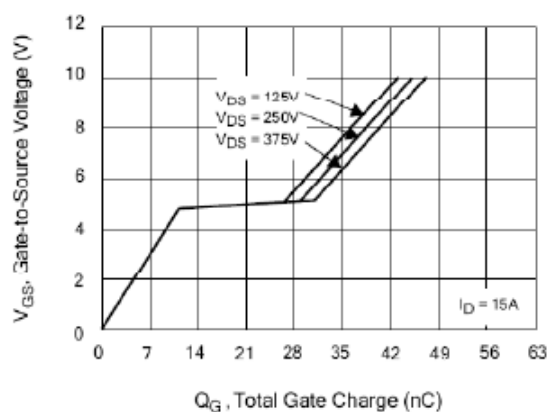
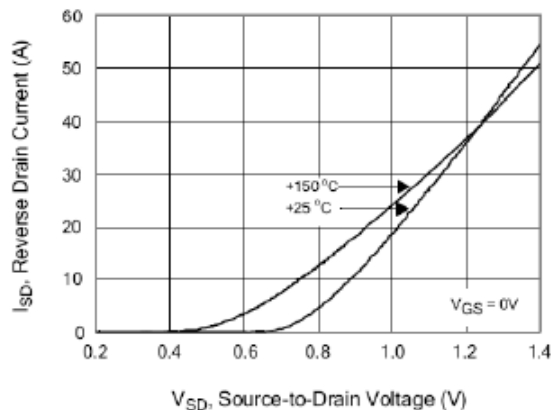


**Figure 16. Typical Body Diode Transfer Characteristics**



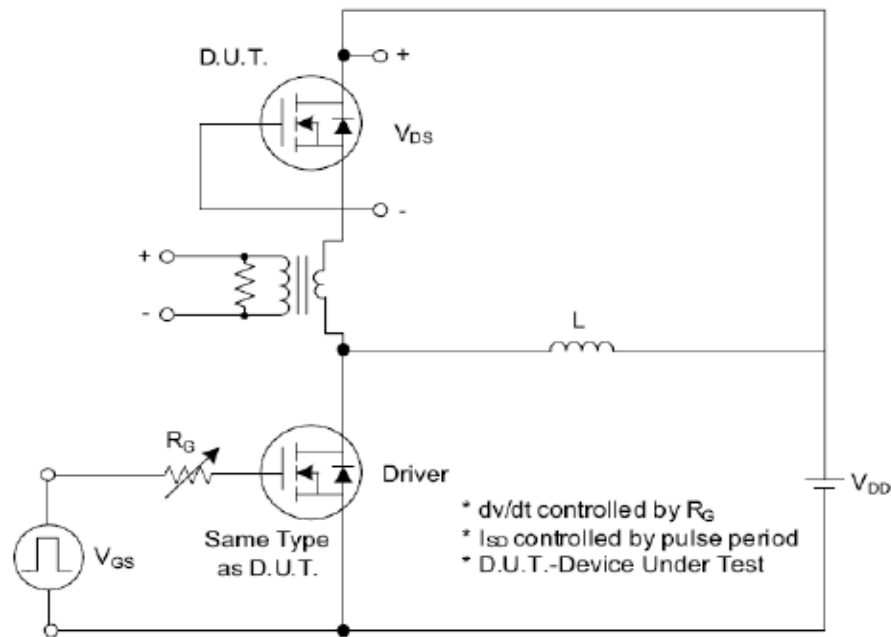


Fig. 1.1 Peak Diode Recovery  $dv/dt$  Test Circuit

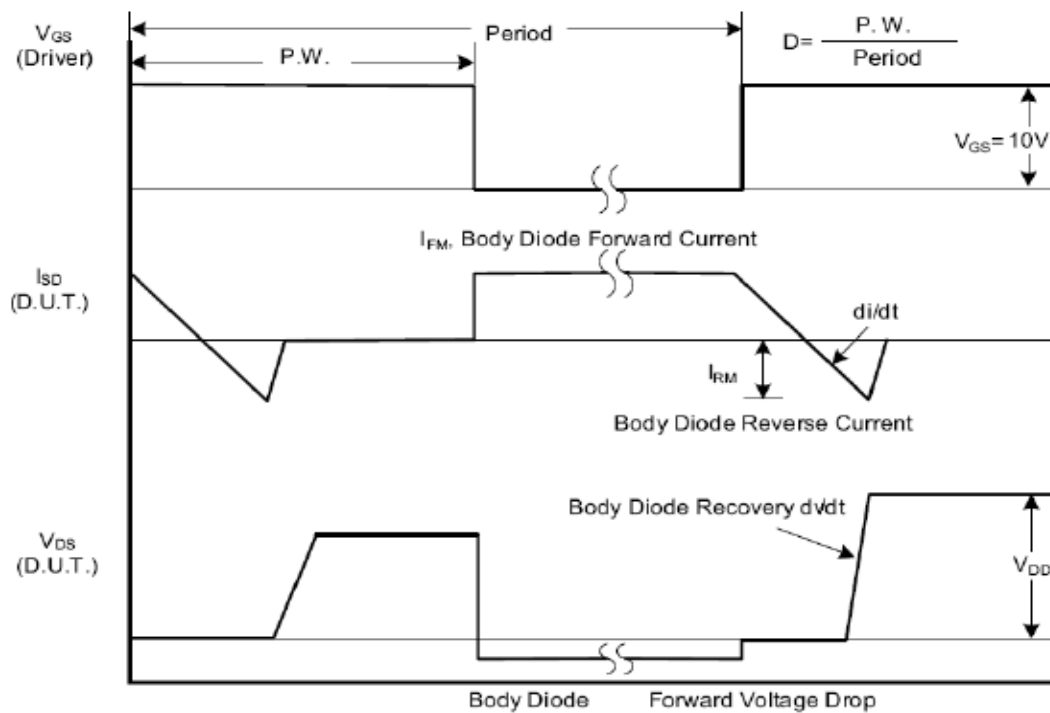


Fig. 1.2 Peak Diode Recovery  $dv/dt$  Waveforms