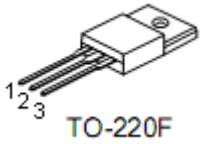
## 1. Features

- Advanced Planar Process
- $R_{DS(ON),(typ.)}$=170mΩ@$V_{GS}$=10V
- Low Gate Charge Minimize Switching Loss
- Rugged Poly silicon Gate Structure

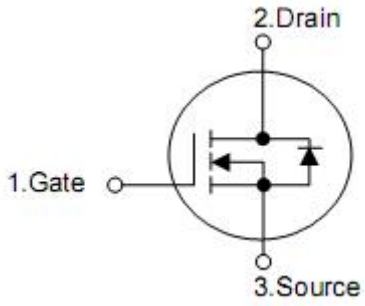
## 2. Features

- BLDC Motor Driver
- Electric Welder
- High Efficiency SMPS

## 3. Pin configuration



TO-220F




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

## 4. Ordering Information

| Part Number | Package | Brand |
|---|---|---|
| KNF7650A | TO-220F | KIA |

## 5. Absolute maximum ratings

TC=25 ºC unless otherwise specified

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | 500 | V |
| Gate-to-Source Voltage | $V_{GSS}$ | ±30 | |
| Continuous Drain Current | $I_D$ | 25 | A |
| Continuous Drain Current @ Tc=100 ºC | | 16 | |
| Pulsed Drain Current at $V_{GS}$=10V [2,4] | $I_{DM}$ | 100 | |
| Single Pulse Avalanche Energy | $E_{AS}$ | 1800 | mJ |
| Peak Diode Recovery dv/dt[3] | dv/dt | 5.0 | |
| Power Dissipation | $P_D$ | 105 | W |
| Derating Factor above 25 ºC | | 0.84 | W/ ºC |
| Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds | $T_L$<br>$T_{PAK}$ | 300<br>260 | ºC |
| Operating and Storage Temperature Range | $T_J$& $T_{STG}$ | -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 |
|---|---|---|---|
| Thermal resistance, junction-ambient | $R_{\theta JA}$ | 100 | ºC/W |
| Thermal resistance, Junction-case | $R_{\theta JC}$ | 1.19 | |

## 7. Electrical characteristics

($T_J$=25°C,unless otherwise notes)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Off characteristics | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | $V_{GS}$=0V,$I_D$=250μA | 500 | - | - | V |
| Drain-to-source Leakage Current | $I_{DSS}$ | $V_{DS}$=500V ,$V_{GS}$=0V | - | - | 1 | μA |
| | | $V_{DS}$=400V , $V_{GS}$=0V $T_C$=125℃, | - | - | 125 | μA |
| Gate-body leakage current | $I_{GSS}$ | $V_{GS}$=30V,$V_{DS}$=0V | - | - | +100 | nA |
| | | $V_{GS}$=-30V,$V_{DS}$=0V | - | - | -100 | nA |
| On characteristics | | | | | | |
| Static drain-source on-resistance | $R_{DS(on)}$ | $V_{GS}$=10V,$I_D$=14A | - | 170 | 210 | Ω |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | - | 4.0 | V |
| Forward Transconductance | gfs | $V_{DS}$=30V,$I_D$=14A | - | 30 | - | S |
| Dynamic characteristics | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{DS}$=25V,$V_{GS}$=0V, f=1MHz | - | 4280 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 1400 | - | pF |
| Reverse transfer capacitance | $C_{rss}$ | | - | 185 | - | pF |
| Total gate charge | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=250V,$I_D$=14A, $V_{GS}$=10V,$R_G$=10Ω | - | 24 | - | ns |
| Rise time | $t_r$ | | - | 40 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 100 | - | ns |
| Fall time | $t_f$ | | - | 35 | - | ns |
| Total gate charge | $Q_g$ | $V_{DS}$=250V,$I_D$=28A , $V_{GS}$=0 to10V | - | 76 | - | nC |
| Gate-source charge | $Q_{gs}$ | | - | 20 | - | nC |
| Gate-drain charge | $Q_{gd}$ | | - | 19 | - | nC |
| Drain-source diode characteristics | | | | | | |
| Drain-source diode forward voltage | $V_{SD}$ | $V_{GS}$=0V,$I_S$=18A | - | - | 1.5 | V |
| Continuous drain-source current [2] | $I_{SD}$ | Integral pn-diode In MOSFET | - | - | 25 | A |
| Pulsed drain-source current[2] | $I_{SM}$ | | - | - | 100 | A |
| Reverse recovery time | $t_{rr}$ | $V_{GS}$=0V,$I_F$=28A $DI_F/dt$=100A/μs | - | 530 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 4.5 | - | μC |

Note: 1.TJ=+25°C to +150°C
2.Silicon limited current only.
3.Package limited current
4.Repetitive rating; pulse width by maximum junction temperature
5.Pulse width≤380μs; duty cycle≤2%

## 8. Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

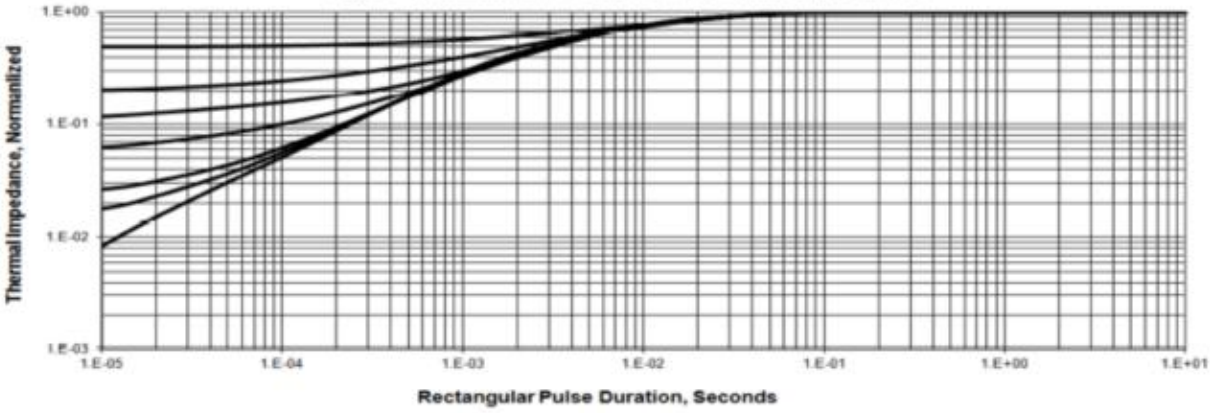



Figure 2 . Max. Power Dissipation vs Case Temperature

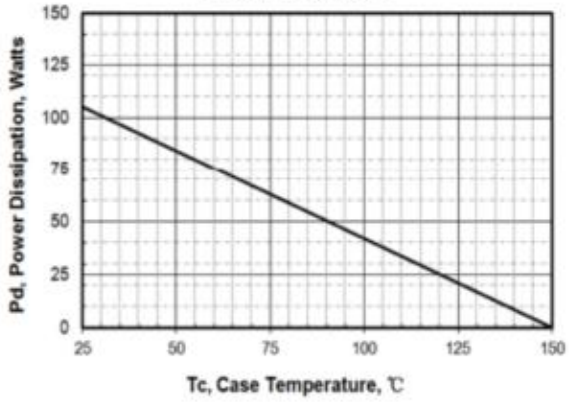



Figure 3 .Maximum Continuous Drain Current vs Tc

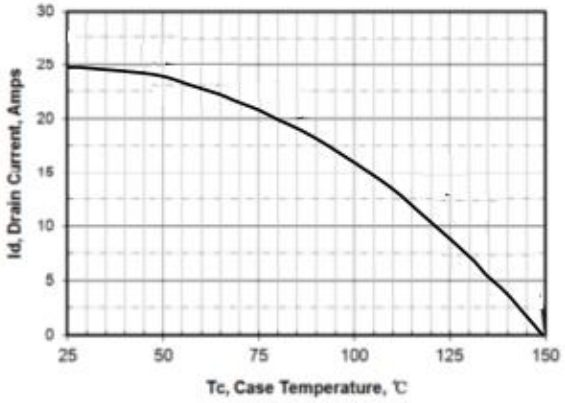



Figure 4. Output Characteristics

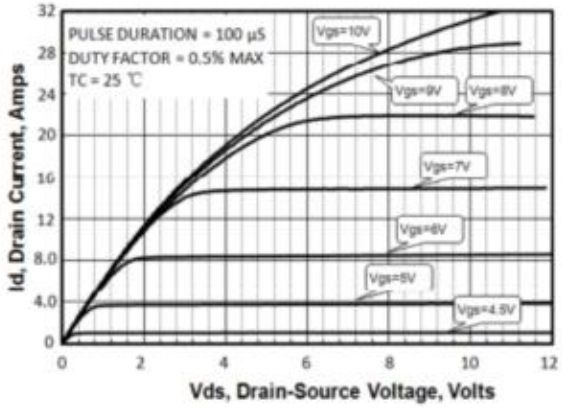
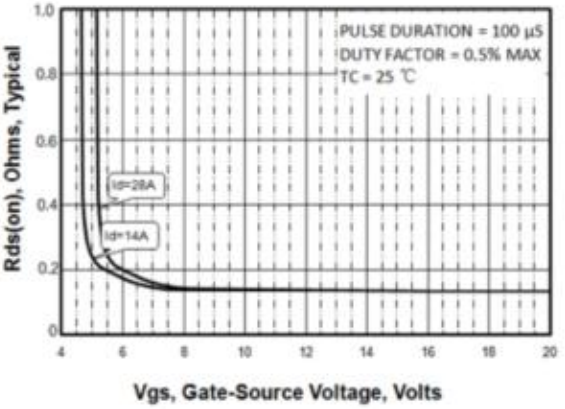
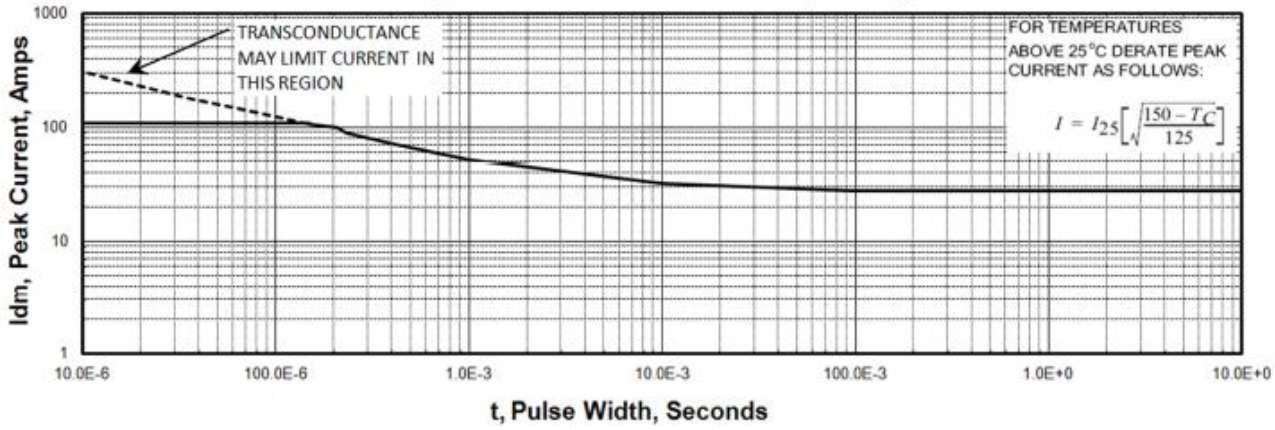


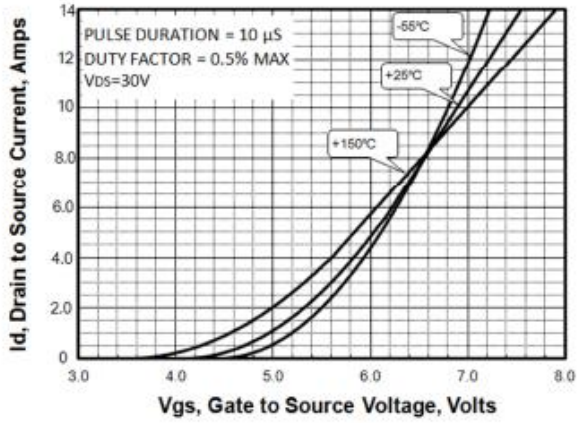

Figure 5. Rdson vs Gate Voltage



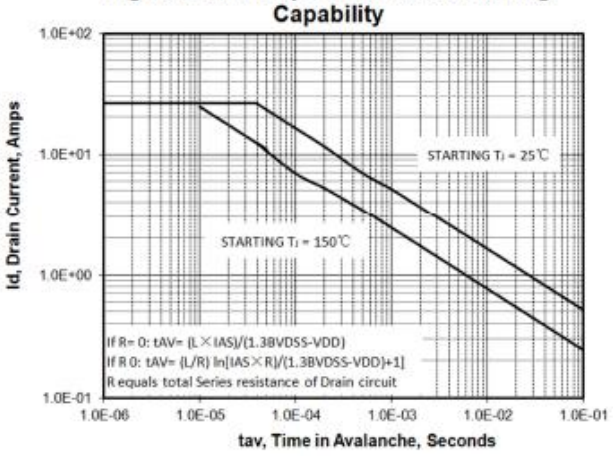
## Figure 6. Peak Current Capability



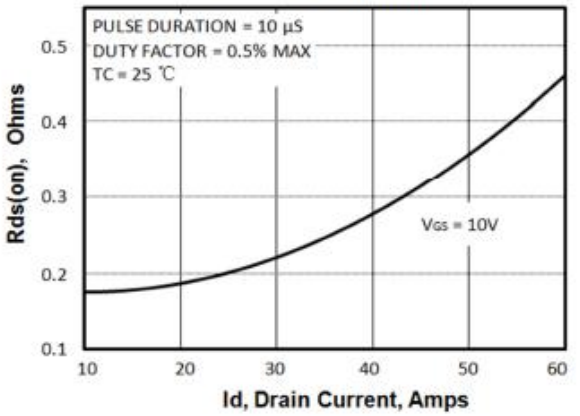

## Figure 7. Transfer Characteristics




## Figure 8. Unclamped Inductive Switching Capability




## Figure 9. Drain to Source ON Resistance vs Drain Current




## Figure 10. Rdson vs Junction Temperature

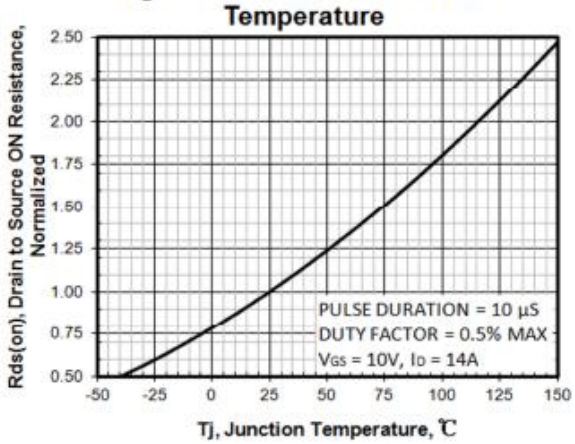


Figure 11.Breakdown Voltage vs Temperature

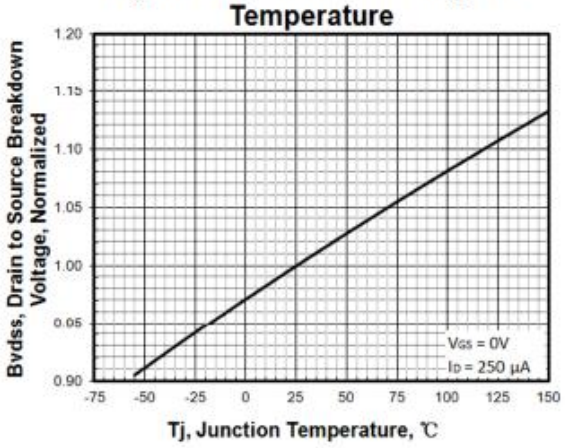



Figure 12.Threshold Voltage vs Temperature

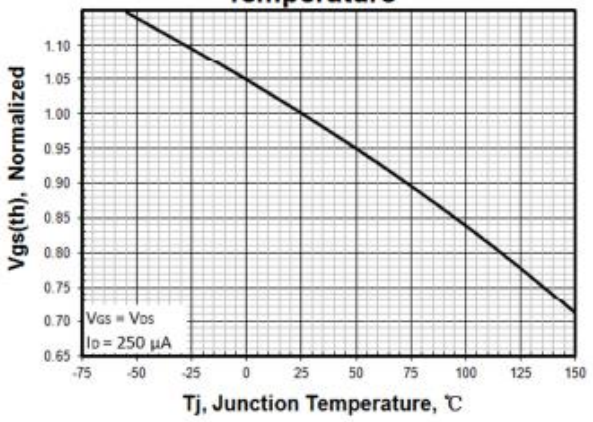



Figure 13 . Maximum Safe Operating Area

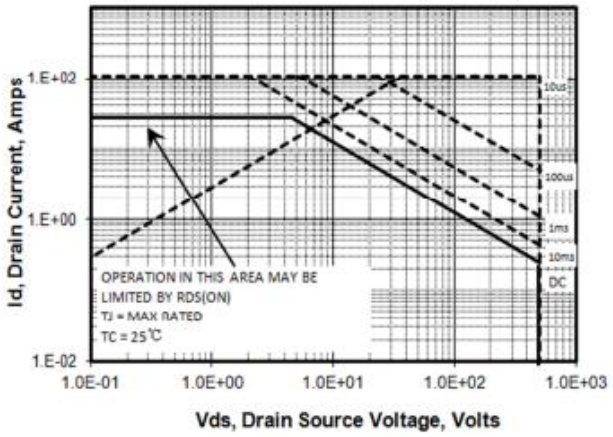



Figure 14. Capacitance vs Vds

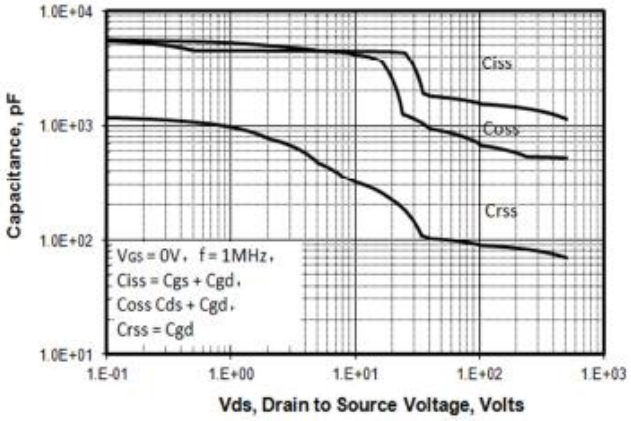



Figure 15 .Typical Gate Charge

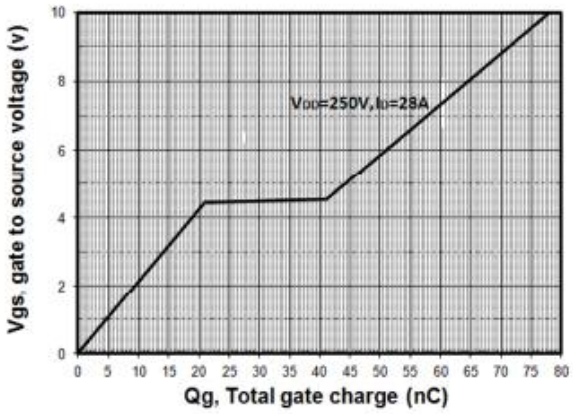
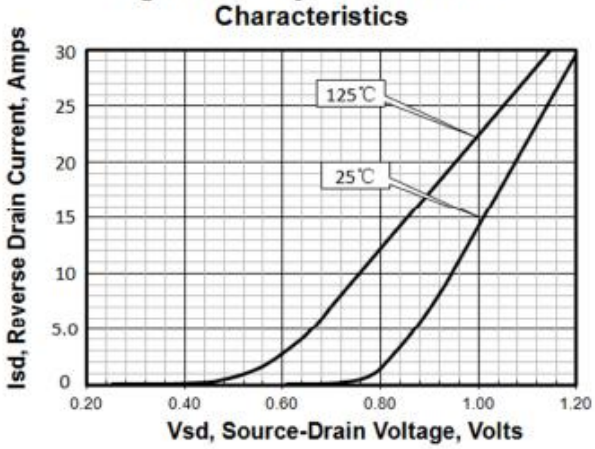



Figure 16.Body Diode Transfer Characteristics



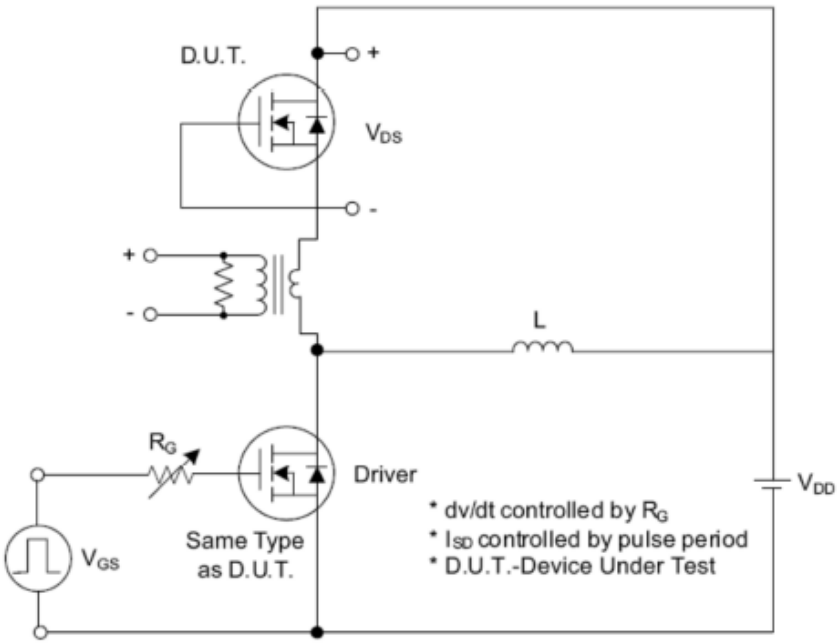



Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

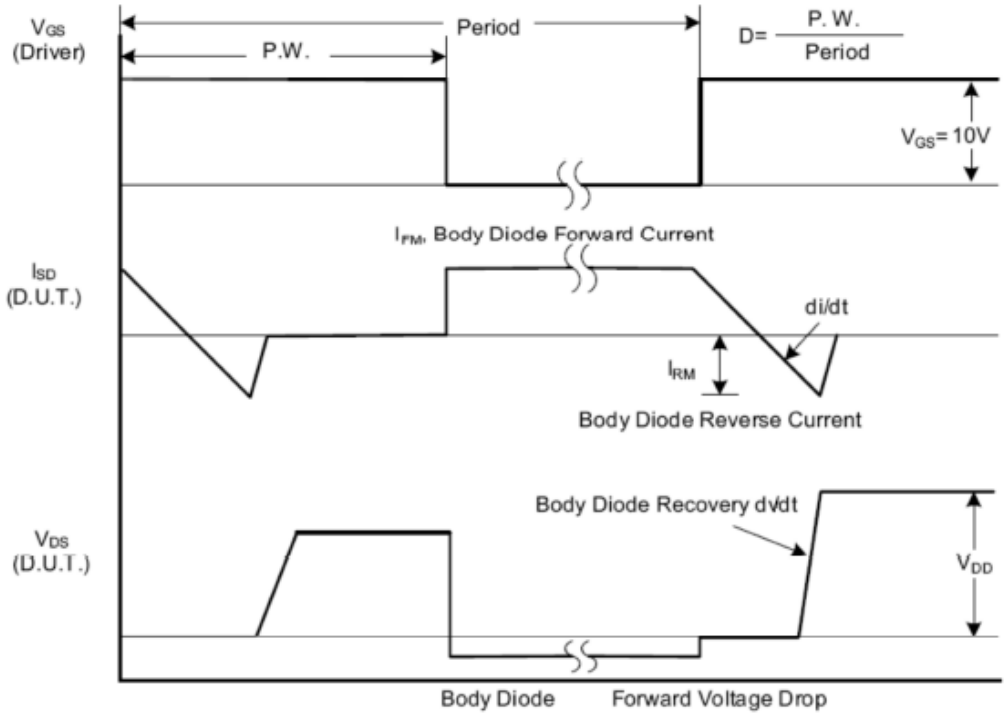



Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

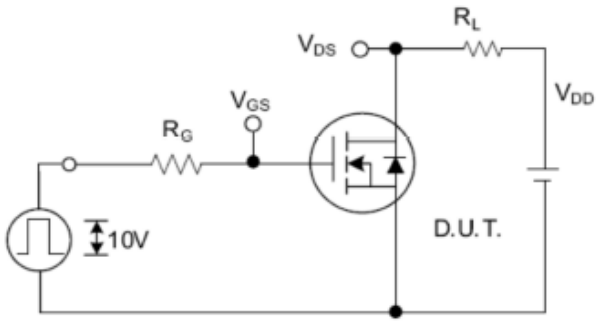



Fig. 2.1 Switching Test Circuit

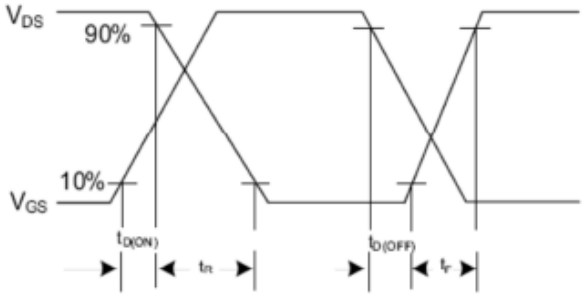



Fig. 2.2 Switching Waveforms

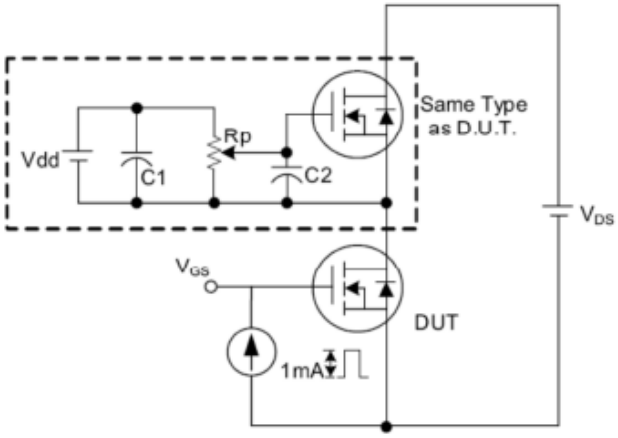



Fig. 3 . 1 Gate Charge Test Circuit

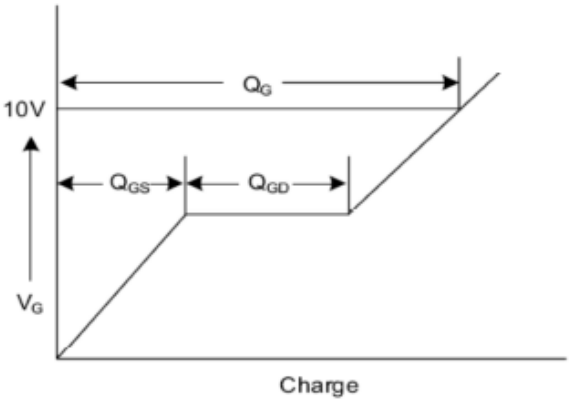



Fig. 3 . 2 Gate Charge Waveform

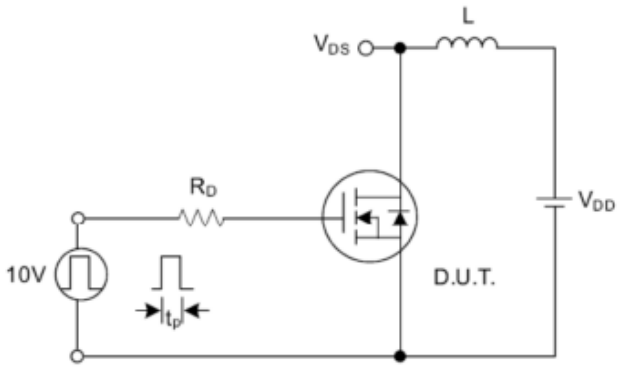



Fig. 4.1 Unclamped Inductive Switching Test Circuit

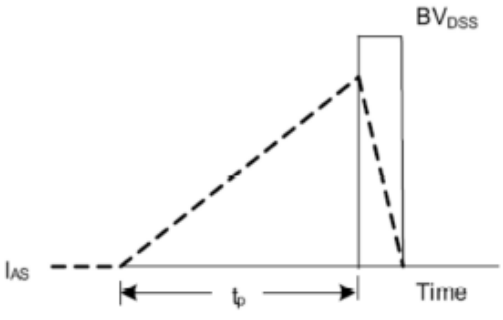



Fig. 4.2 Unclamped Inductive Switching Waveforms