# PFU65R540G / PFD65R540G

## N-Channel Super Junction MOSFET

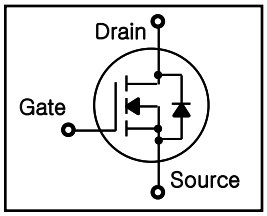
### FEATURES

- New technology for high voltage device
- Low $R_{DS(on)}$ low conduction losses
- Small package
- Ultra low gate charge cause lower driving requirement
- 100% avalanche tested
- Halogen Free

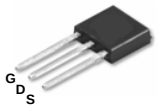
**$BV_{DSS}$ = 650 V**

**$R_{DS(on)}$= 0.48 Ω**

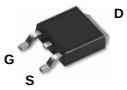
**$I_D$ = 8.0 A**




**I-PAK(TO-251)**




**D-PAK(TO-252)**




### APPLICATION

- Power Factor Correction(PFC)
- Switch mode power supply (SMPS)
- Uninterruptible Power Supply (UPS)

## Absolute Maximum Ratings

$T_C$=25℃ unless otherwise specified

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage ($V_{GS}$=0V) | 650 | V |
| $I_D$ | Drain Current – Continuous ($T_C$ = 25℃) | 8.0 | A |
| | Drain Current – Continuous ($T_C$ = 100℃) | 5.2 | A |
| $I_{DM(pulse)}$ | Drain Current – Pulsed * Note 1 | 24 | A |
| $V_{GS}$ | Gate-Source Voltage ($V_{DS}$=0V) | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy * Note 2 | 185 | mJ |
| $I_{AR}$ | Avalanche Current * Note 1 | 4.0 | A |
| $E_{AR}$ | Repetitive Avalanche Energy * Note 1 | 0.4 | mJ |
| dv/dt | Drain Source Voltage Slope, $V_{DS}$ ≤ 480V | 50 | V/ns |
| | Reverse Diode dv/dt, $V_{DS}$ ≤ 480V | 15 | V/ns |
| $P_D$ | Maximum Power Dissipation ($T_C$ = 25℃) | 80 | W |
| | Derate above 25℃ | 0.64 | W/℃ |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | ℃ |

* Limited by maximum junction temperature

## Thermal Resistance Characteristics

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case (Maximum) | 1.56 | ℃/W |
| $R_{\theta JA}$ | Junction-to-Ambient (Maximum) | 62 | |

## Electrical Characteristics $T_A$=25 °C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 uA | 2.5 | 3.0 | 3.5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 4.0 A | -- | 480 | 540 | m.ohm |
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 uA | 650 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 650 V, $V_{GS}$ = 0 V | -- | -- | 1 | uA |
| | | $V_{DS}$ = 650 V, $T_C$=125 ℃ | -- | -- | 100 | uA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = 30 V, $V_{DS}$ = 0 V | -- | -- | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = -30 V, $V_{DS}$ = 0 V | -- | -- | -100 | nA |
| **Dynamic Characteristics** | | | | | | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20V, $I_D$ = 4.0A | -- | 5.5 | -- | S |
| $R_G$ | Intrinsic Gate Resistance | f = 1.0 MHz, open drain | -- | 2 | -- | ohm |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 50 V, $V_{GS}$ = 0 V, f = 1.0 MHz | -- | 680 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 58 | -- | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 4 | -- | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 480 V, $I_D$ = 8.0 A, $V_{GS}$ = 10 V | -- | 14.5 | 22 | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 2.8 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 5.5 | -- | nC |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 380 V, $I_D$ = 4.0 A, $R_G$ = 12 Ω, $V_{GS}$ = 10V | -- | 5.5 | -- | ns |
| $t_r$ | Turn-On Rise Time | | -- | 3.5 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 55 | 75 | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 6.5 | 10 | ns |
| **Source-Drain Diode Maximum Ratings and Characteristics** | | | | | | |
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 8.0 | A |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current | | -- | -- | 23.4 | A |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 8.0 A, $V_{GS}$ = 0 V | -- | 0.9 | 1.2 | V |
| trr | Reverse Recovery Time | $I_S$ = 8.0 A di/dt = 100 A/μs | -- | 220 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 2.2 | -- | μC |

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $V_{DD}$=50V, $R_G$=25Ω, Starting $T_J$=25°C

## Typical Characteristics

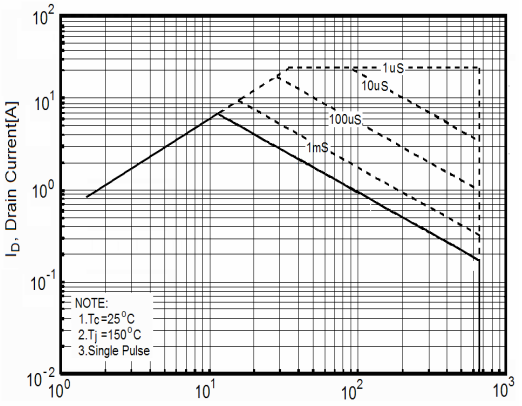



**Figure 1. Safe Operating Area**

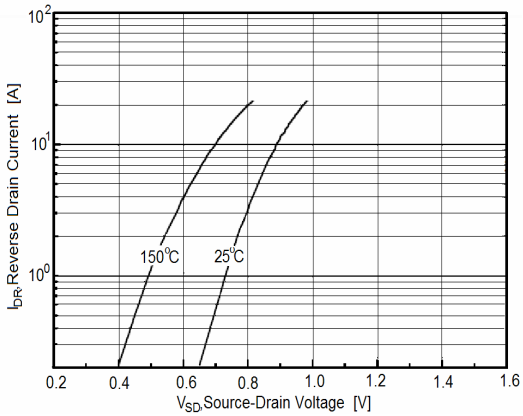



**Figure 2. Source-Drain Diode Forward Voltage**

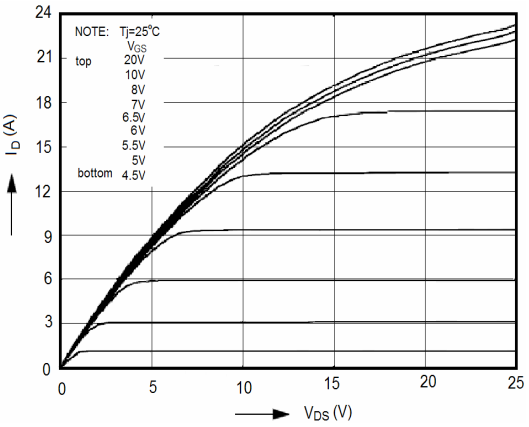



**Figure 3. Output Characteristics**

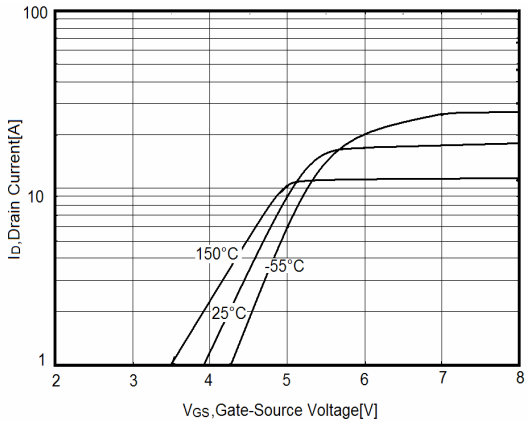



**Figure 4. Transfer Characteristics**

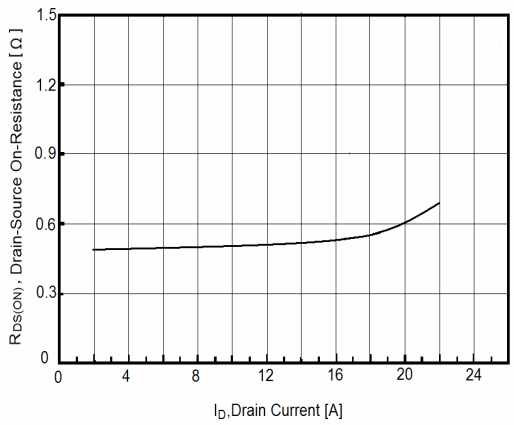



**Figure 5. Static Drain-Source On Resistance**

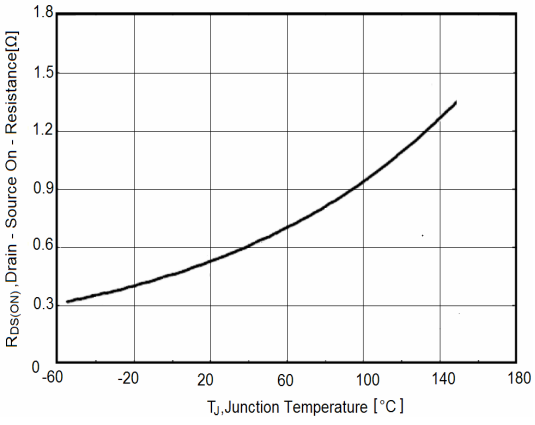



**Figure 6. Rds(on) vs. Junction Temperature**

## Typical Characteristics (continued)

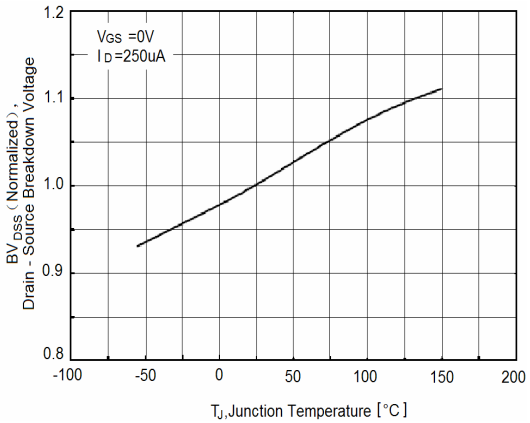



**Figure 7. BVdss vs. Junction Temperature**

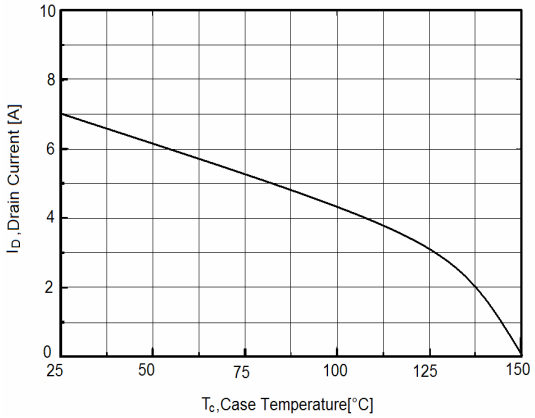



**Figure 8. Maximum ID vs. Junction Temperature**

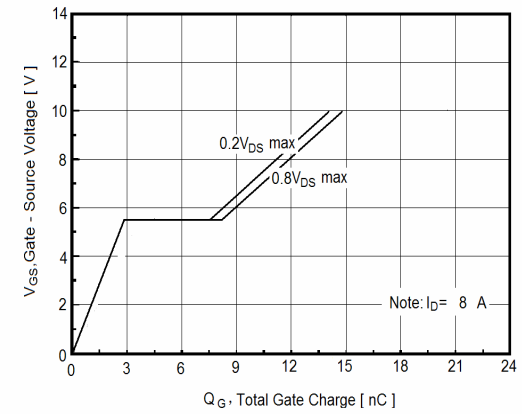



**Figure 9. Gate Charge Waveforms**

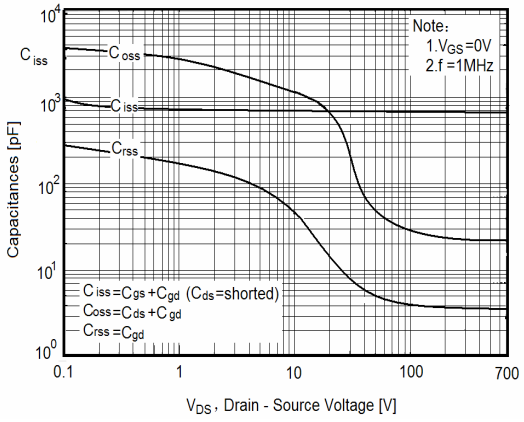



**Figure 10. Capacitance**

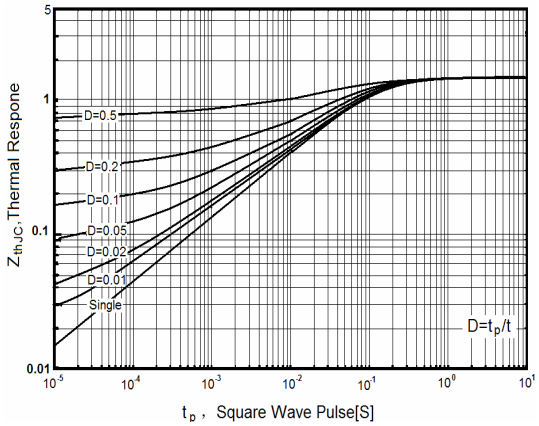
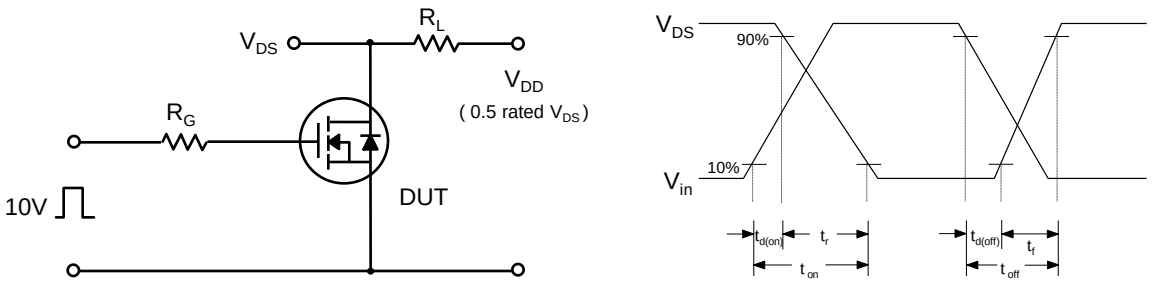
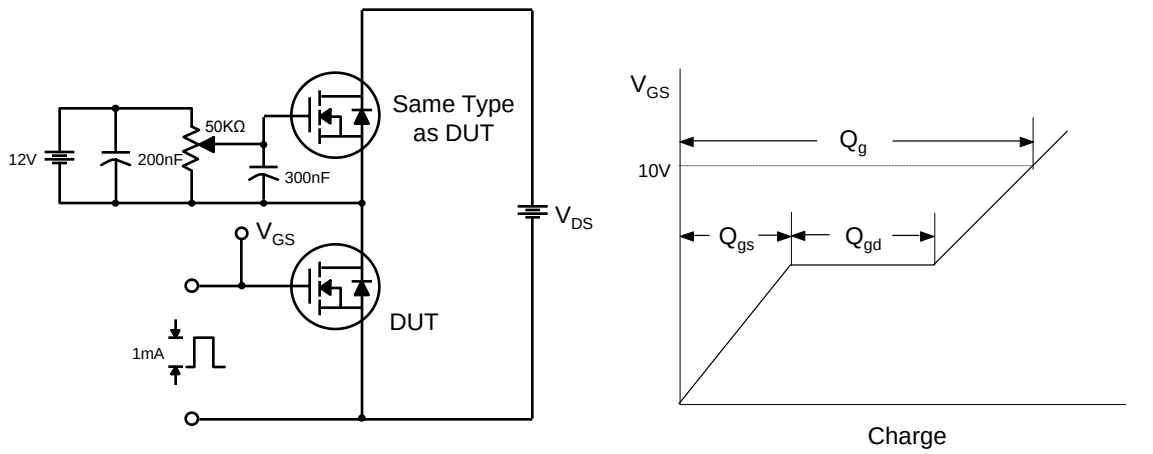



**Figure 11. Transient Thermal Response Curve**

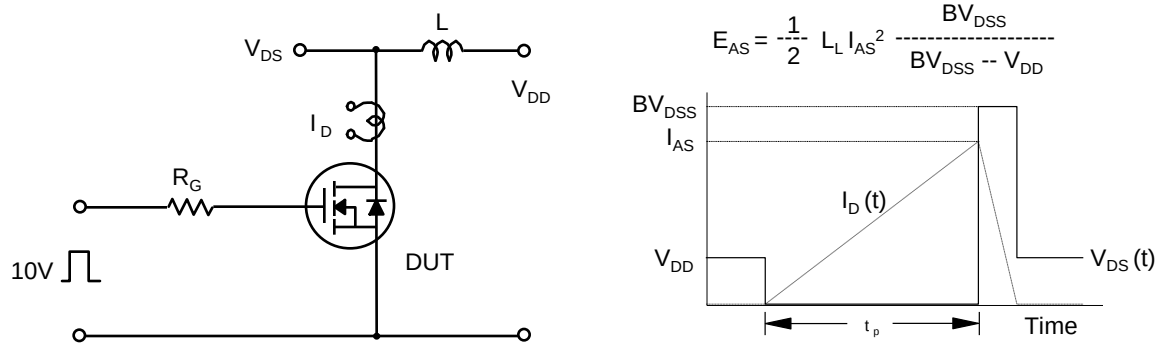
## Characteristics Test Circuit & Waveform




**Switching Time Test Circuit & Waveforms**

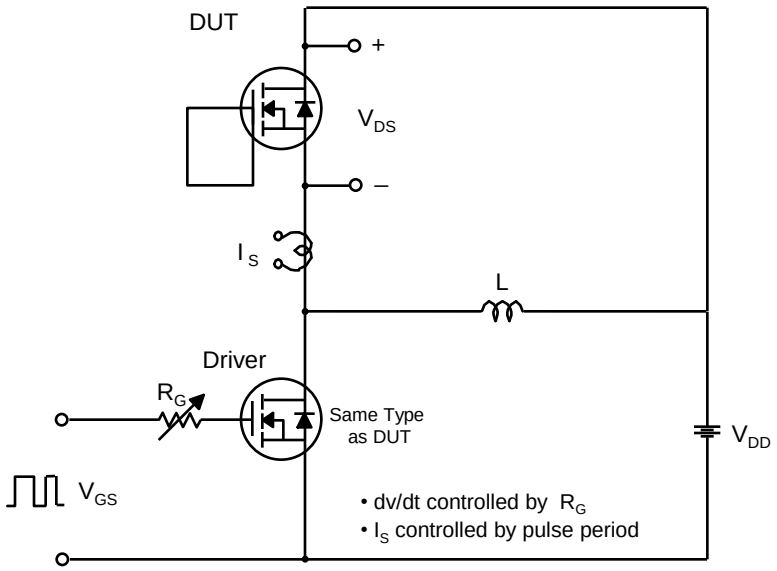


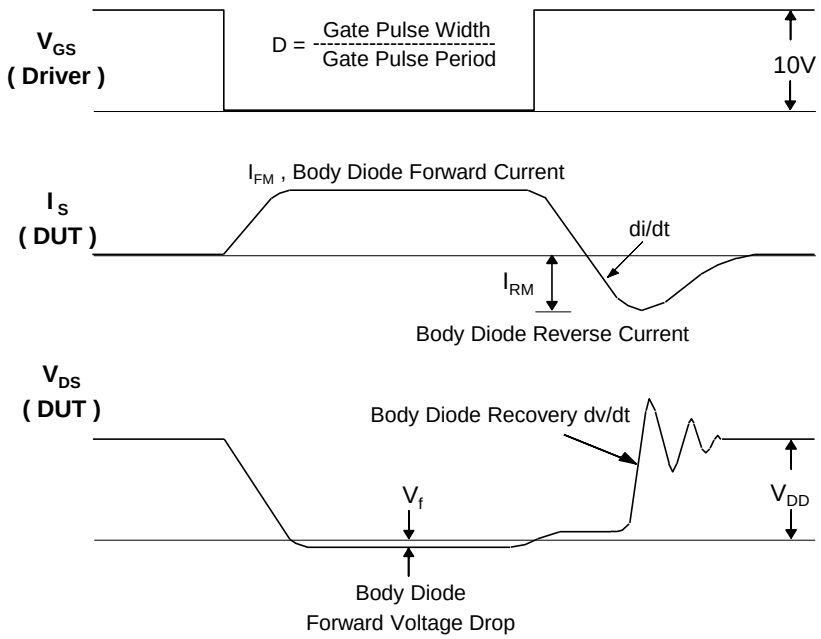

**Gate Charge Test Circuit & Waveform**




**Unclamped Inductive Switching Test Circuit & Waveforms**

## Characteristics Test Circuit & Waveform (continued)




**Peak Diode Recovery dv/dt Test Circuit & Waveforms**