

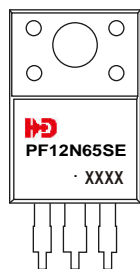
TO-220F Plastic-Encapsulate MOSFETS

N-Channel Power MOSFET

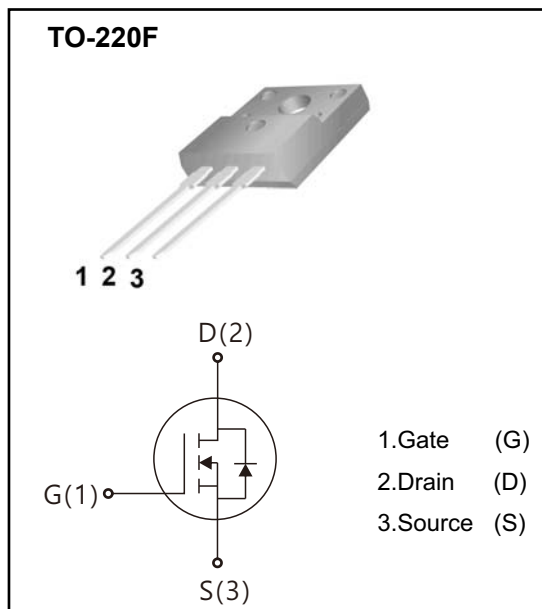
FEATURE

- Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Extended Safe Operating Area
- Unrivalled Gate Charge :Qg= 44nC (Typ.)
- BVDSS=650V, ID=12A
- $R_{DS(on)}$:0.76 Ω (Max) @VG=10V
- 100% Avalanche Tested

MARKING



PF12N65SE= Device code.
Solid dot = Green molding compound device,
if none, the normal device.
XXXX = Code.



Absolute Maximum Ratings (Ta=25°C unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|--------------|---|-------------------------|------------------|
| V_{DSS} | Drain-Source Voltage | 650 | V |
| I_D | Drain Current | $T_j=25^\circ\text{C}$ | 12 |
| | | $T_j=100^\circ\text{C}$ | 7.9 |
| $V_{GS(TH)}$ | Gate Threshold Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy (note1) | 660 | mJ |
| I_{AR} | Avalanche Current (note2) | 12 | A |
| P_D | Power Dissipation ($T_j=25^\circ\text{C}$) | 44 | W |
| T_j | Junction Temperature(Max) | 150 | $^\circ\text{C}$ |
| T_{stg} | Storage Temperature | -55~+150 | $^\circ\text{C}$ |
| TL | Maximum lead temperature for soldering purpose, 1/8 μS from case for 5 seconds | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|---|------|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | - | 2.8 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | - | 62.5 | $^\circ\text{C}/\text{W}$ |

ELECTRICAL CHARACTERISTICS (T_a=25°C unless otherwise specified)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|------|------|------|------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | I _D =250μA , V _{GS} =0 | 650 | - | - | V |
| ΔBV _{DSS} /ΔT _J | Breakdown Voltage Temperature Coefficient | I _D =250μA , Reference to 25°C | - | 0.71 | - | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =650V, V _{GS} =0V | - | - | 10 | μA |
| | | V _{DS} =520V, T _j =125°C | | | 100 | |
| I _{GSSF} | Gate-body leakage Current, Forward | V _{GS} =+30V, V _{DS} =0V | - | - | 100 | nA |
| I _{GSSR} | Gate-body leakage Current, Reverse | V _{GS} =-30V, V _{DS} =0V | - | - | -100 | |
| On Characteristics | | | | | | |
| V _{GS(TH)} | Gate Threshold Voltage | I _D =250μA, V _{DS} =V _{GS} | 2 | - | 4 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | I _D =6.0A, V _{GS} =10V | - | - | 0.76 | Ω |
| Dynamic Characteristics | | | | | | |
| C _{iss} | Input Capacitance | V _{DS} =25V , V _{GS} =0 , f=1.0MHz | - | 1890 | - | pF |
| C _{oss} | Output Capacitance | | - | 150 | - | |
| C _{rss} | Reverse Transfer Capacitance | | - | 18 | - | |
| Switching Characteristics | | | | | | |
| T _{d(on)} | Turn-On Delay Time | V _{DD} =300V , I _D =12A R _G =25Ω (Note 3,4) | - | 30 | 70 | ns |
| T _r | Turn-On Rise Time | | - | 80 | 165 | |
| T _{d(off)} | Turn-Off Delay Time | | - | 144 | 300 | |
| T _f | Turn-Off Rise Time | | - | 77 | 165 | |
| Q _g | Total Gate Charge | V _{DS} =520V, V _{GS} =10V , I _D =12A (Note 3,4) | - | 44 | 47 | nC |
| Q _{gs} | Gate-Source Charge | | - | 6.7 | - | |
| Q _{gd} | Gate-Drain Charge | | - | 18.5 | - | |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I _s | Max. Diode Forward Current | - | - | - | 12 | A |
| I _{SM} | Max. Pulsed Forward Current | - | - | - | 48 | |
| V _{SD} | Diode Forward Voltage | I _D =12A | - | - | 1.4 | V |
| T _{rr} | Reverse Recovery Time | I _S =12A, V _{GS} =0V diF/dt=100A/μs (Note3) | - | 380 | - | nS |
| Q _{rr} | Reverse Recovery Charge | | - | 3.5 | - | μC |

Notes : 1, L=0.5mH, I_{AS}=12A, V_{DD}=50V, R_G=25Ω, Starting T_J =25°C

2, Repetitive Rating : Pulse width limited by maximum junction temperature

3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%

4, Essentially Independent of Operating Temperature

Typical Characteristics

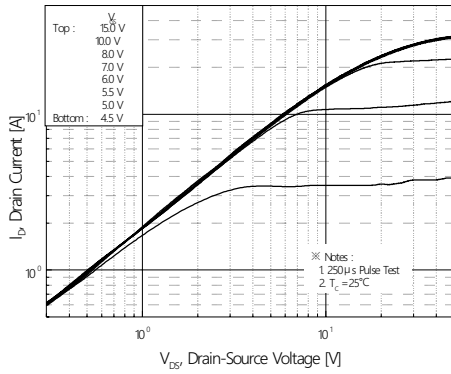


Figure 1. On-Region Characteristics

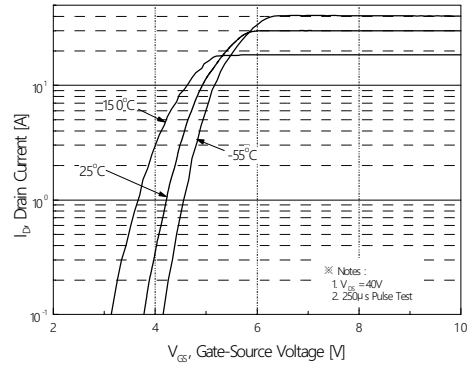


Figure 2. Transfer Characteristics

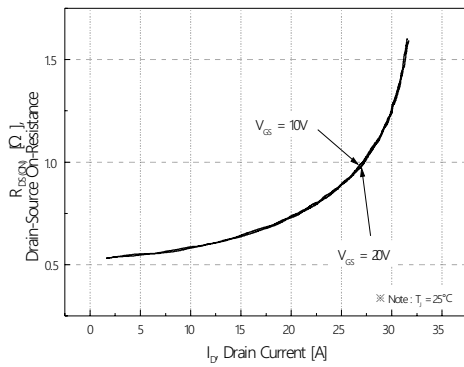


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

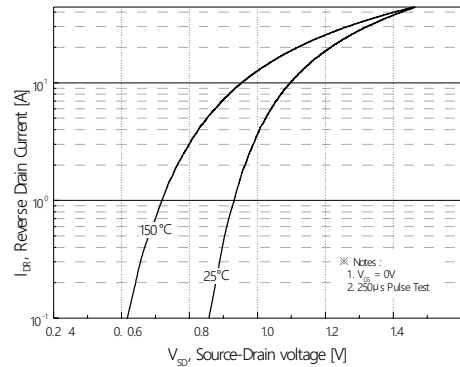


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

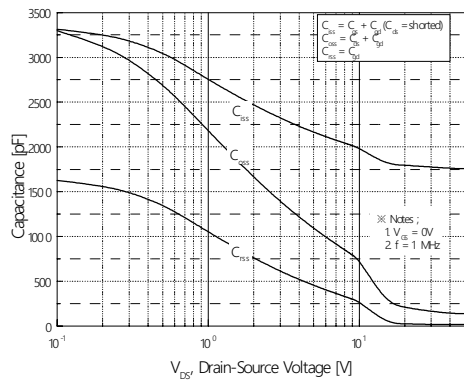


Figure 5. Capacitance Characteristics

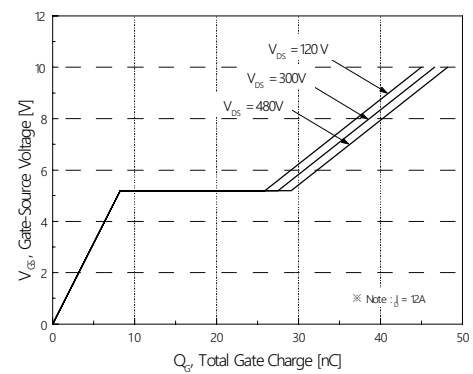


Figure 6. Gate Charge Characteristics

Typical Characteristics

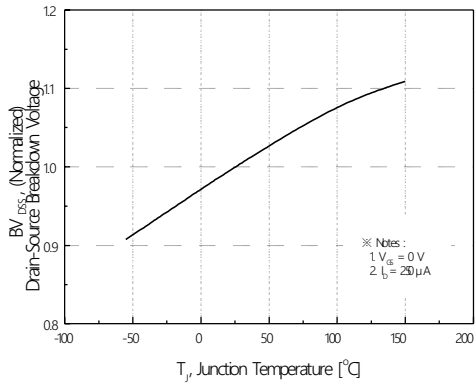


Figure 7. Breakdown Voltage Variation vs Temperature

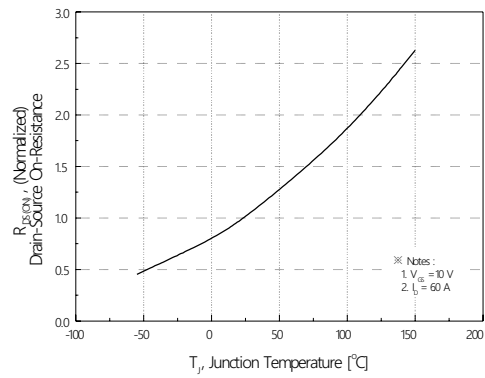


Figure 8. On-Resistance Variation vs Temperature

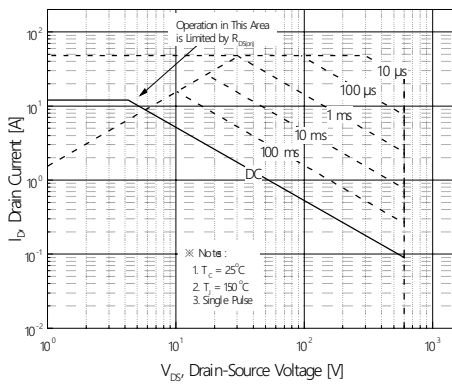


Figure 9-2. Maximum Safe Operating Area

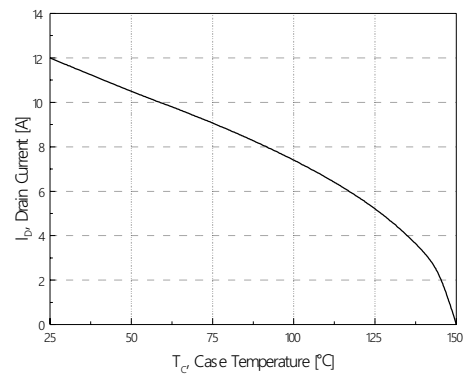


Figure 10. Maximum Drain Current vs Case Temperature

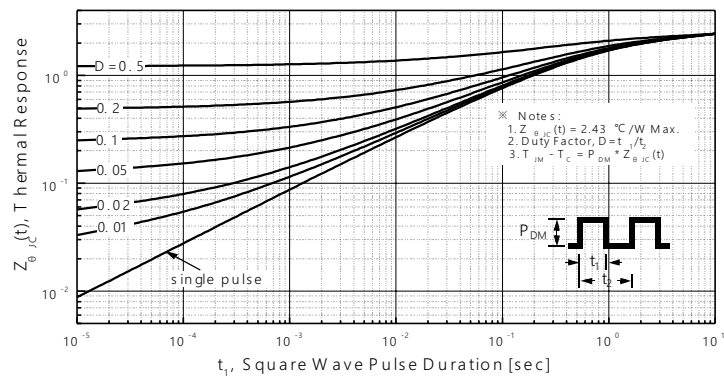
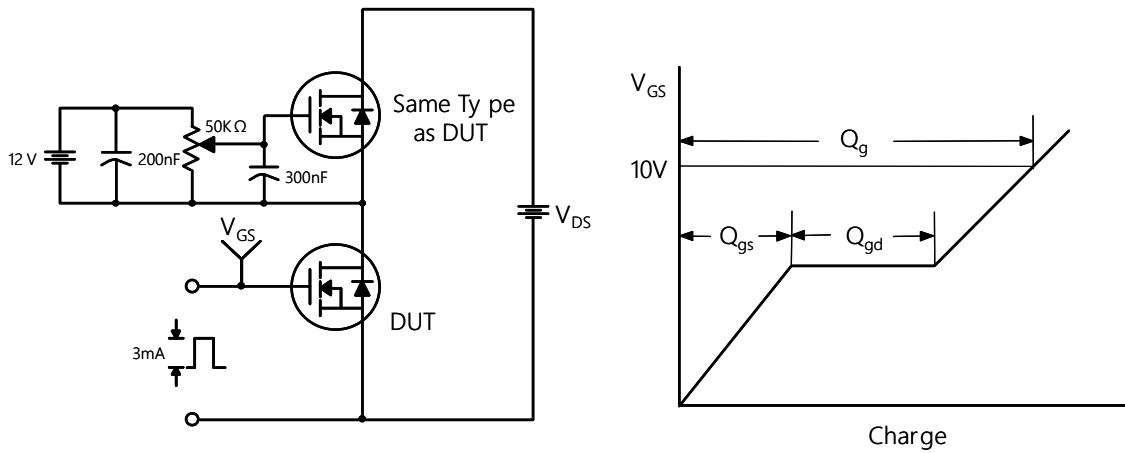


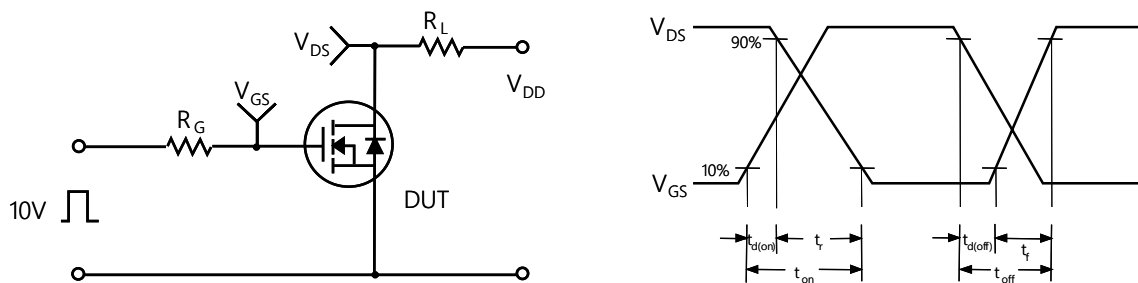
Figure 11-2. Transient Thermal Response Curve

Typical Characteristics

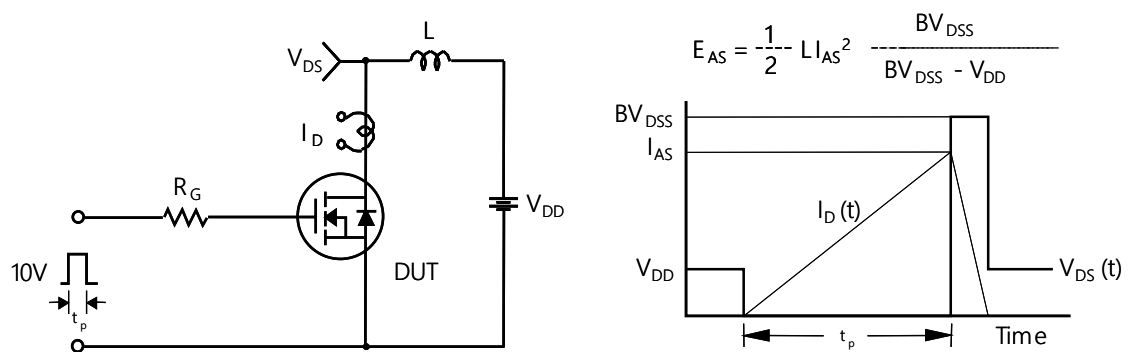
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms

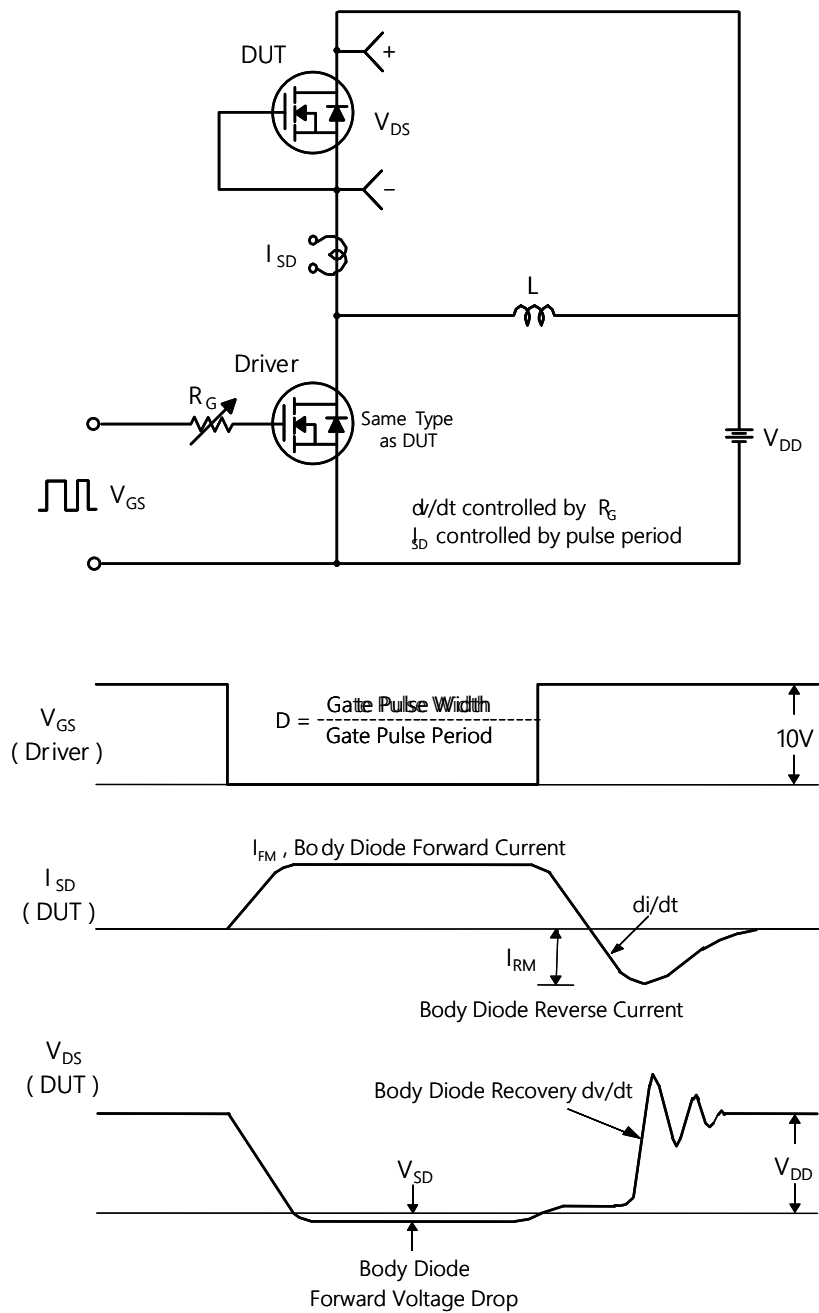


Unclamped Inductive Switching Test Circuit & Waveforms



Typical Characteristics

Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220F Package Outline Dimensions

TO-220F

Unit: mm

