

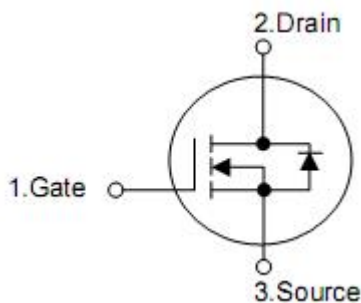
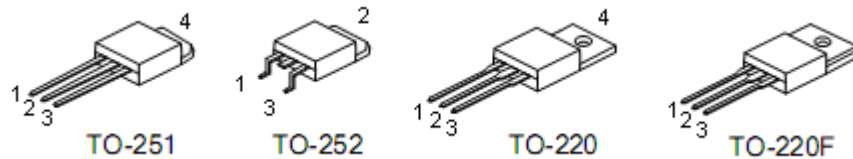
## 1. Description

The 2N60H N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

## 2. Features

- n  $R_{DS(ON)}=4.1\Omega@V_{GS}=10V$ .
- n Low gate charge (typical 9nC)
- n High ruggedness
- n Fast switching capability
- n Avalanche energy specified
- n Improved dv/dt capability

## 3. Pin configuration



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

#### 4. Absolute maximum ratings

| Parameter                         |                       | Symbol           | Rating<br>(T <sub>C</sub> = 25°C, unless otherwise noted) |      |       | Units |
|-----------------------------------|-----------------------|------------------|-----------------------------------------------------------|------|-------|-------|
|                                   |                       |                  | 252/251                                                   | 220  | 220F  |       |
| Drain-source voltage              |                       | V <sub>DSS</sub> | 600                                                       |      |       | V     |
| Gate-source voltage               |                       | V <sub>GSS</sub> | ± 30                                                      |      |       | V     |
| Drain current continuous          | T <sub>C</sub> =25°C  | I <sub>D</sub>   | 2.0*                                                      | 2.0  | 2.0*  | A     |
|                                   | T <sub>C</sub> =100°C |                  | 1.35*                                                     | 1.35 | 1.35* | A     |
| Drain current pulsed (note1)      |                       | I <sub>DP</sub>  | 8*                                                        | 8    | 8*    | A     |
| Avalanche Enlsed                  | Repetitive (note1)    | E <sub>AR</sub>  | 4.4                                                       |      |       | mJ    |
|                                   | Single pulse (note2)  | E <sub>AS</sub>  | 120                                                       |      |       | mJ    |
| Peak diode recovery dv/dt (note3) |                       | dv/dt            | 4.5                                                       |      |       | V/ns  |
| Total power dissipation           | T <sub>C</sub> =25°C  | P <sub>D</sub>   | 44                                                        | 55.5 | 23.6  | W     |
|                                   | Derate above 25°C     |                  | 0.35                                                      | 0.44 | 0.19  | W/ °C |
| Junction temperature              |                       | T <sub>J</sub>   | +150                                                      |      |       | °C    |
| Storage temperature               |                       | T <sub>STG</sub> | -50~+150                                                  |      |       | °C    |

\*Drain current limited by maximum junction temperature.

#### 5. Thermal characteristics

| Parameter                            | Symbol            | Rating  |      |      | Unit |
|--------------------------------------|-------------------|---------|------|------|------|
|                                      |                   | 252/251 | 220  | 220F |      |
| Thermal resistance,Junction-ambient  | R <sub>thJA</sub> | 62.5    | 62.5 | 62.5 | °C/W |
| Thermal resistance,case-to-sink typ. | R <sub>thCS</sub> | --      | 0.5  | --   | °C/W |
| Thermal resistance,Junction-case     | R <sub>thJC</sub> | 2.87    | 2.25 | 5.3  | °C/W |

## 6. Electrical characteristics

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

| Parameter                                 |         | Symbol                               | Test conditions                                                            | Min | Typ | Max  | Unit  |
|-------------------------------------------|---------|--------------------------------------|----------------------------------------------------------------------------|-----|-----|------|-------|
| Off characteristics                       |         |                                      |                                                                            |     |     |      |       |
| Drain-source breakdown voltage            |         | BV <sub>DSS</sub>                    | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                 | 600 | -   | -    | V     |
| Zero gate voltage drain current           |         | I <sub>DSS</sub>                     | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V                                 | -   | -   | 1    | μA    |
|                                           |         |                                      | V <sub>DS</sub> =480V, T <sub>C</sub> =125°C                               | -   | -   | 10   | μA    |
| Gate-body leakage current                 | Forward | I <sub>GSS</sub>                     | V <sub>GS</sub> =30V, V <sub>DS</sub> =0V                                  | -   | -   | 100  | nA    |
|                                           | Reverse |                                      | V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V                                 | -   | -   | -100 | nA    |
| Breakdown voltage temperature coefficient |         | ΔBV <sub>DSS</sub> / ΔT <sub>J</sub> | I <sub>D</sub> =250μA                                                      | -   | 0.7 | -    | V/ °C |
| On characteristics                        |         |                                      |                                                                            |     |     |      |       |
| 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     |
| Static drain-source on- resistance        |         | R <sub>DS(ON)</sub>                  | V <sub>DS</sub> =10V, I <sub>D</sub> =1.0A                                 | -   | 4.1 | 5.0  | Ω     |
| Dynamic characteristics                   |         |                                      |                                                                            |     |     |      |       |
| Input capacitance                         |         | C <sub>ISS</sub>                     | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz                          | -   | 200 | -    | pF    |
| Output capacitance                        |         | C <sub>OSS</sub>                     |                                                                            | -   | 20  | -    | pF    |
| Reverse transfer capacitance              |         | C <sub>RSS</sub>                     |                                                                            | -   | 4   | -    | pF    |
| Switching characteristics                 |         |                                      |                                                                            |     |     |      |       |
| Turn-on delay time                        |         | t <sub>D(ON)</sub>                   | V <sub>DD</sub> =300V, I <sub>D</sub> =2.0A, R <sub>G</sub> =25Ω (note4,5) | -   | 10  | -    | ns    |
| Rise time                                 |         | t <sub>R</sub>                       |                                                                            | -   | 25  | -    | ns    |
| Turn-off delay time                       |         | t <sub>D(OFF)</sub>                  |                                                                            | -   | 25  | -    | ns    |
| Fall time                                 |         | t <sub>F</sub>                       |                                                                            | -   | 30  | -    | ns    |
| Total gate charge                         |         | Q <sub>G</sub>                       | V <sub>DS</sub> =480V, I <sub>D</sub> =2.0A V <sub>GS</sub> =10V (note4,5) | -   | 9   | -    | nC    |
| Gate-source charge                        |         | Q <sub>GS</sub>                      |                                                                            | -   | 1.5 | -    | nC    |
| Gate-drain charge                         |         | Q <sub>GD</sub>                      |                                                                            | -   | 4.0 | -    | nC    |
| Drain-source diode characteristics        |         |                                      |                                                                            |     |     |      |       |
| drain-source diode forward voltage        |         | V <sub>SD</sub>                      | V <sub>GS</sub> =0V, I <sub>SD</sub> =2.0A                                 | -   | -   | 1.4  | V     |
| Continuous drain-source current           |         | I <sub>SD</sub> *                    |                                                                            | -   | -   | 2.0  | A     |
| Pulsed drain-source current               |         | I <sub>SM</sub> *                    |                                                                            |     |     | 8.0  | A     |
| Reverse recovery time                     |         | t <sub>RR</sub>                      | I <sub>SD</sub> =2.0A                                                      |     | 230 | -    | ns    |
| Reverse recovery charge                   |         | Q <sub>RR</sub>                      | dI <sub>SD</sub> /dt=100A/μs (note4)                                       |     | 1.0 | -    | μC    |

Notes:1.repetitive rating:pulse width limited by maximum junction temperature

2.L=60mH, I<sub>AS</sub>=2.0A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=25°C

3.I<sub>SD</sub>≤2.0A, di/dt≤200A/μs, V<sub>DD</sub>≤BV<sub>DSS</sub>, starting T<sub>J</sub>=25°C

4.Pulse test:pulse width≤300μs,duty cycle≤2%

5.Essentially independent of operating temperature

## 7. Typical characteristics

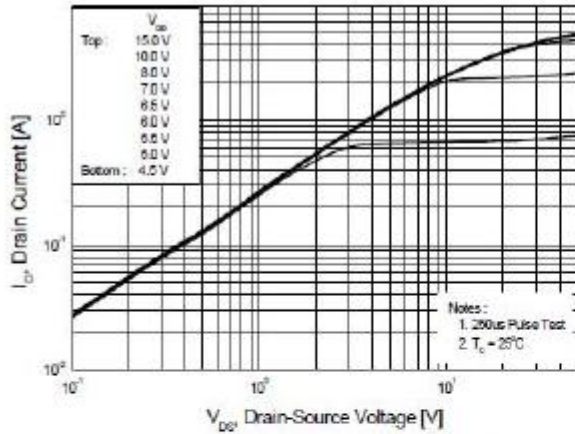


Figure 1. On-Region Characteristics

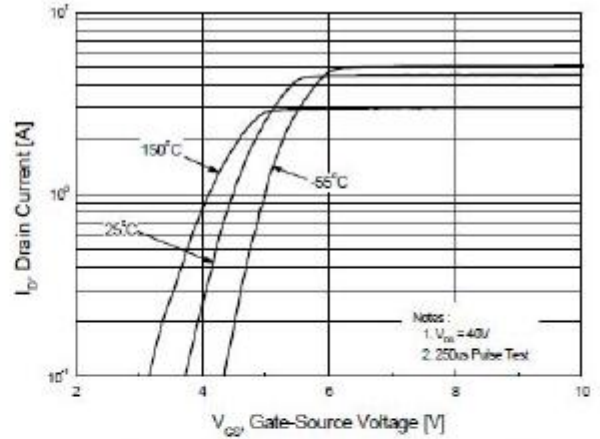


Figure 2. Transfer Characteristics

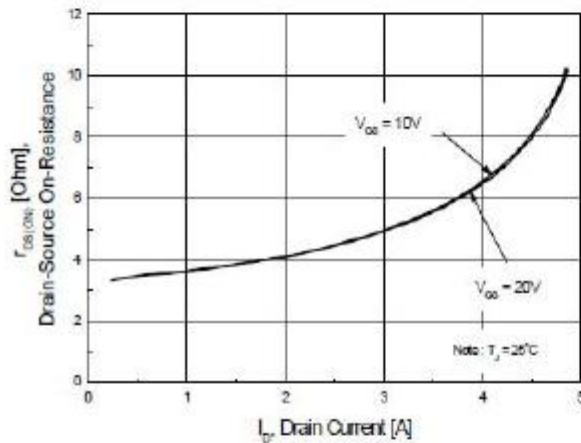


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

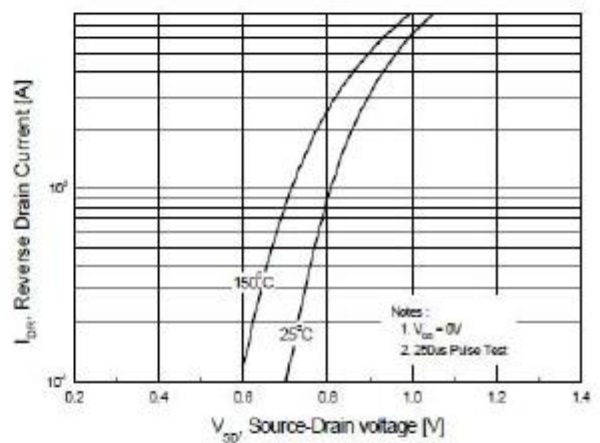


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

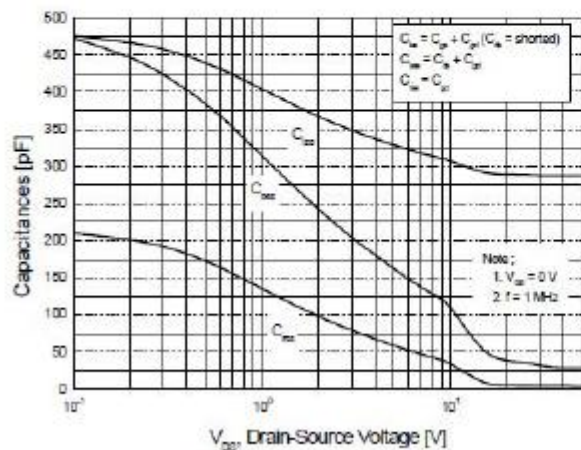


Figure 5. Capacitance Characteristics

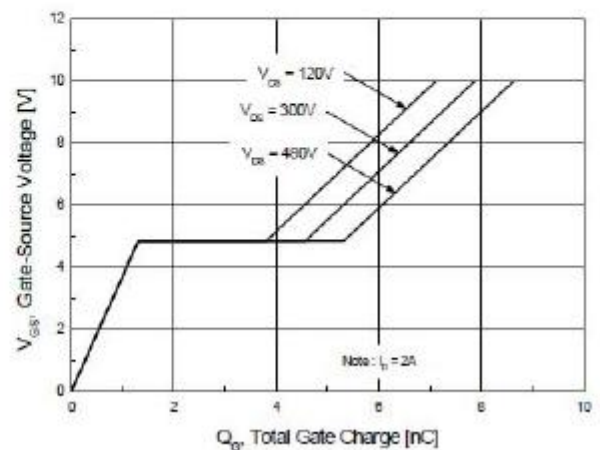


Figure 6. Gate Charge Characteristics

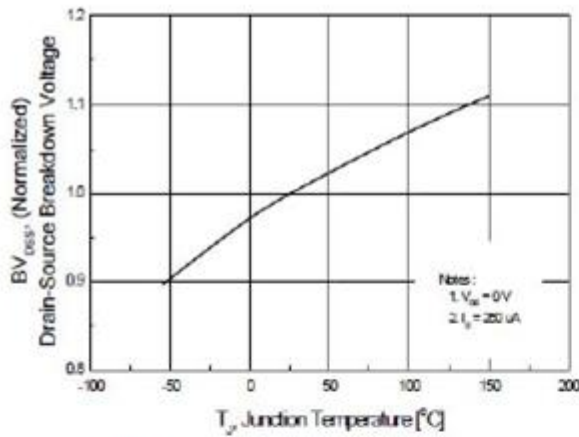


Figure 7. Breakdown Voltage Variation vs Temperature

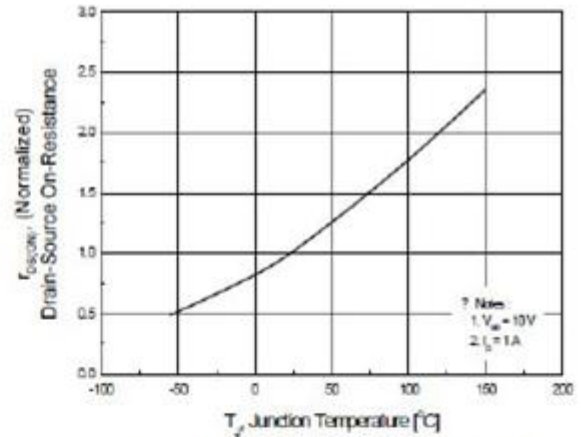


Figure 8. On-Resistance Variation vs Temperature

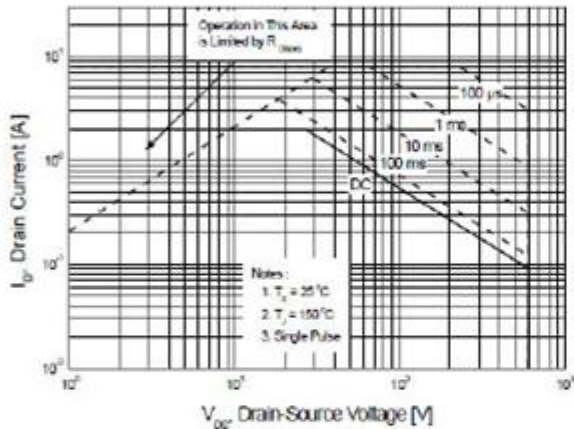


Figure 9. Maximum Safe Operating Area

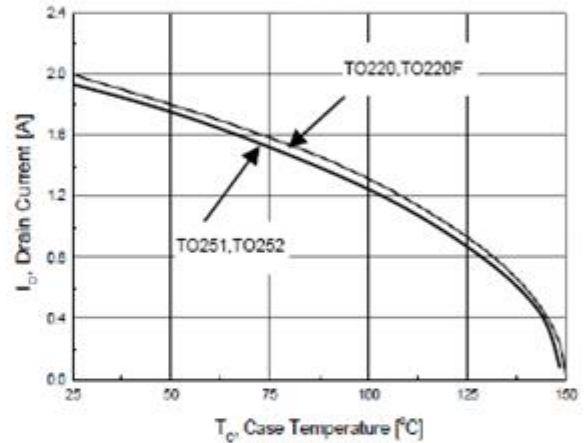


Figure 10. Maximum Drain Current vs Case Temperature

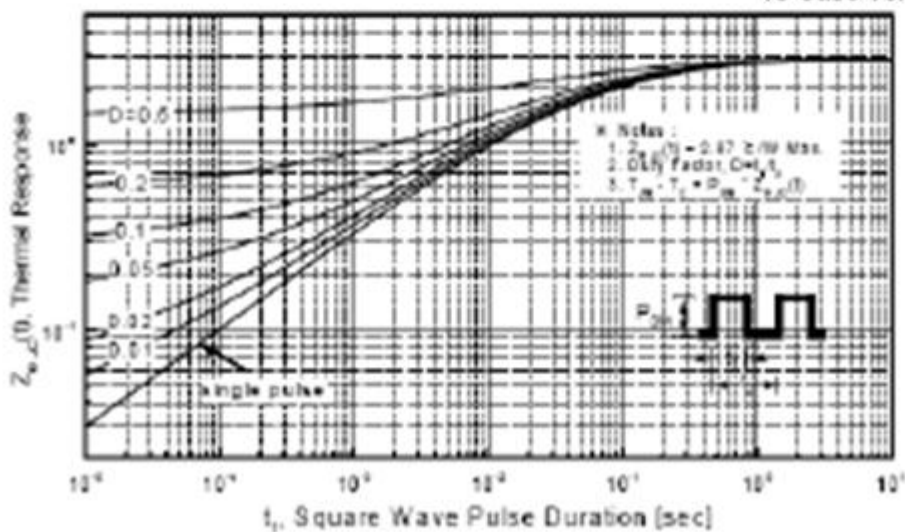


Figure 11. Transient Thermal Response Curve for TO-251/252

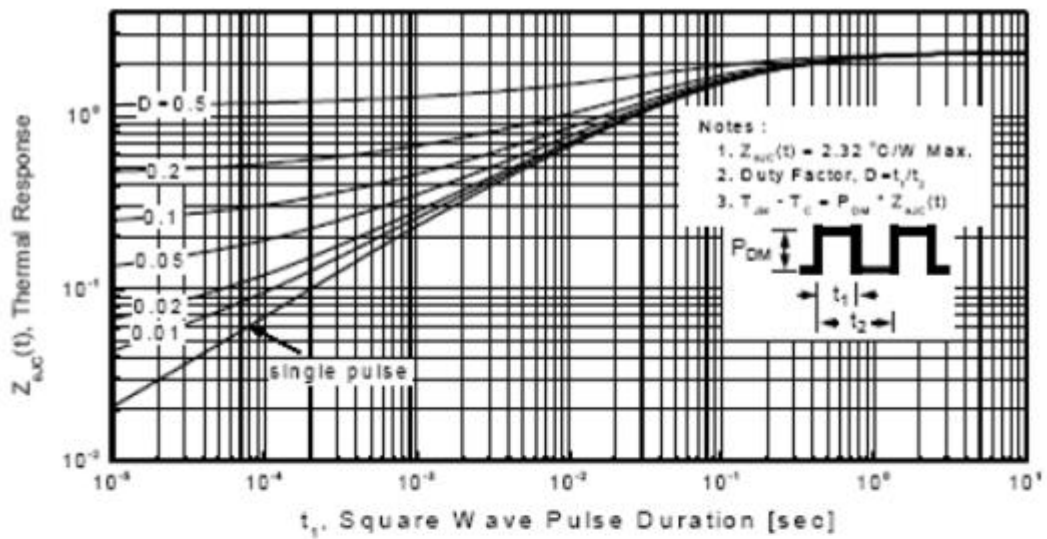


Figure 11-1. Transient Thermal Response Curve  
for TO-220

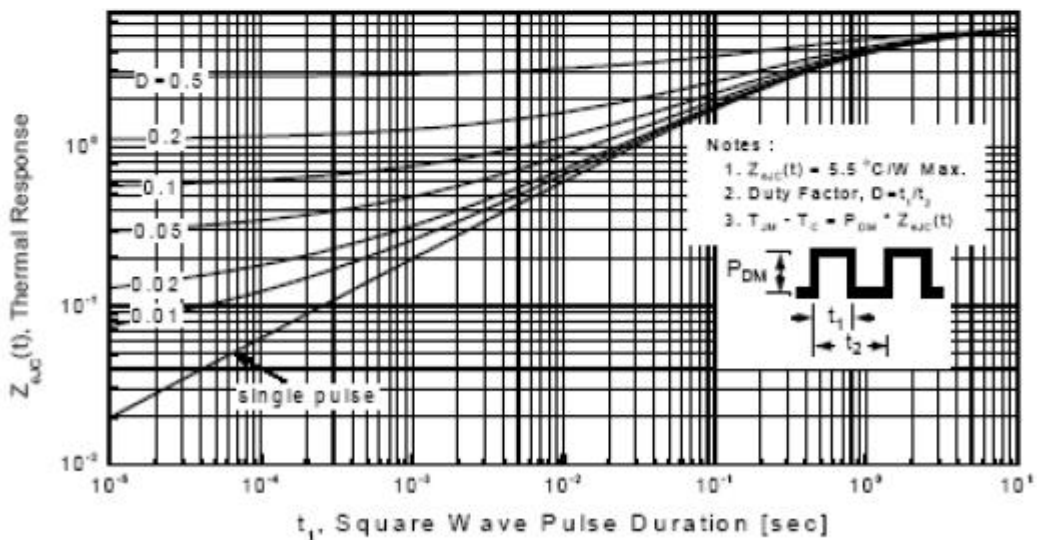


Figure 11-2. Transient Thermal Response Curve  
for TO-220F