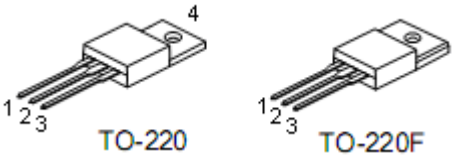
## 1.Description

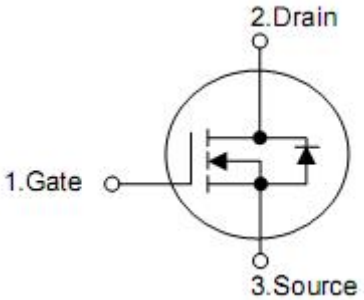
The KIA12N60H N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

## 2. Features

- $R_{DS(on)}$= 0.53Ω @ $V_{GS}$= 10 V
- Low gate charge ( typical 52nC)
- Fast switching capability
- avalanche energy specified
- Improved dv/dt capability

## 3. Pin configuration




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

## 4. Absolute maximum ratings

(TC= 25 ºC , unless otherwise specified)

| Parameter | | Symbol | Rating | | Units |
|---|---|---|---|---|---|
| | | | TO-220 | TO-220F | |
| Drain-source voltage | | $V_{DSS}$ | 600 | | V |
| Drain-source voltage | | $V_{GSS}$ | ±30 | | V |
| Drain current continuous | $T_C$=25 ºC | $I_D$ | 12.0 | 12.0* | A |
| | $T_C$=100 ºC | | 7.4 | 7.4* | A |
| Drain current pulsed (note 1) | | $I_{DP}$ | 48.0 | 48* | A |
| Avalanche energy | Repetitive (note 1) | $E_{AR}$ | 23.1 | | mJ |
| | Single pulse (note 2) | $E_{AS}$ | 865 | | mJ |
| Peak diode recovery dv/dt (note 3) | | dv/dt | 4.5 | | V/ns |
| Total power dissipation | $T_C$=25 ºC | $P_D$ | 231 | 54 | W |
| | derate above 25 ºC | | 1.85 | 0.43 | W/ºC |
| Junction temperature | | $T_J$ | +150 | | ºC |
| Storage temperature | | $T_{STG}$ | -55~+150 | | ºC |

*Drain current limited by maximum junction temperature.

## 5. Thermal characteristics

| Parameter | Symbol | Rating | | Unit |
|---|---|---|---|---|
| | | TO-220 | TO-220F | |
| Thermal resistance,Junction--ambient | $R_{thJA}$ | 62.5 | | ºC/W |
| Thermal resistance,case-to-sink typ. | $R_{thCS}$ | 0.5 | - | ºC/W |
| Thermal resistance,Junction-case | $R_{thJC}$ | 0.54 | 2.33 | ºC/W |

## 6. Electrical characteristics

($T_J$=25°C,unless otherwise notes)

| Parameter | | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Off characteristics | | | | | | | |
| Drain-source breakdown voltage | | $BV_{DSS}$ | $V_{GS}$=0V,$I_D$=250μA | 600 | - | - | V |
| Zero gate voltage drain current | | $I_{DSS}$ | $V_{DS}$=600V ,$V_{GS}$=0V | - | - | 1 | μA |
| | | | $V_{DS}$=480V ,$T_C$=125ºC | - | - | 10 | μA |
| Gate-body leakage current | Forward | $I_{GSS}$ | $V_{GS}$=30V,$V_{DS}$=0V | - | - | 100 | nA |
| | Reverse | | $V_{GS}$=-30V,$V_{DS}$=0V | - | - | -100 | nA |
| Breakdown voltage temperature coefficient | | △$BV_{DSS}$/△$T_J$ | $I_D$=250μA | - | 0.7 | - | V/°C |
| On characteristics | | | | | | | |
| Gate threshold voltage | | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | - | 4.0 | V |
| Static drain-source on-resistance | | $R_{DS(on)}$ | $V_{GS}$=10V,$I_D$=6.0A | - | 0.53 | 0.65 | Ω |
| Dynamic characteristics | | | | | | | |
| Input capacitance | | $C_{iss}$ | $V_{DS}$=25V,$V_{GS}$=0V, f=1MHz | - | 1850 | - | pF |
| Output capacitance | | $C_{oss}$ | | - | 180 | - | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | - | 20 | - | pF |
| Switching characteristics | | | | | | | |
| Turn-on delay time | | $t_{d(on)}$ | $V_{DD}$=300V,$I_D$=12.0A, $R_G$=25Ω(note4,5) | - | 30 | - | ns |
| Rise time | | $t_r$ | | - | 90 | - | ns |
| Turn-off delay time | | $t_{d(off)}$ | | - | 140 | - | ns |
| fall time | | $t_f$ | | - | 90 | - | ns |
| Total gate charge | | $Q_g$ | $V_{DS}$=480V,$I_D$=12.0A $V_{GS}$=10V,(note4,5) | - | 52 | - | nC |
| Gate-source charge | | $Q_{gs}$ | | - | 8.5 | - | nC |
| Gate-drain charge | | $Q_{gd}$ | | - | 20 | - | nC |
| Drain-source diode characteristics | | | | | | | |
| Drain-source diode forward voltage | | $V_{SD}$ | $V_{GS}$=0V,$I_{SD}$=12.0A | - | - | 1.4 | V |
| Continuous drain-source current | | $I_{SD}$ | | - | - | 12.0 | A |
| Pulsed drain-source current | | $I_{SM}$ | | - | - | 48.0 | A |
| Reverse recovery time | | $t_{rr}$ | $I_{SD}$=12.0A dI$_{SD}$/dt=100A/μs (note4) | - | 430 | - | ns |
| Reverse recovery charge | | $Q_{rr}$ | | - | 5.0 | - | μC |

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

2.L=11mH,$I_{AS}$=12.0A,$V_{DD}$=50V,$R_G$=25Ω,staring $T_J$=25ºC

3.$I_{SD}$≤12.0A,di/dt≤200A/μs,$V_{DD}$≤$BV_{DSS}$,staring $T_J$=25 ºC

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

5.Essentially independent of operating temperature

## 7.Test circuits and waveforms

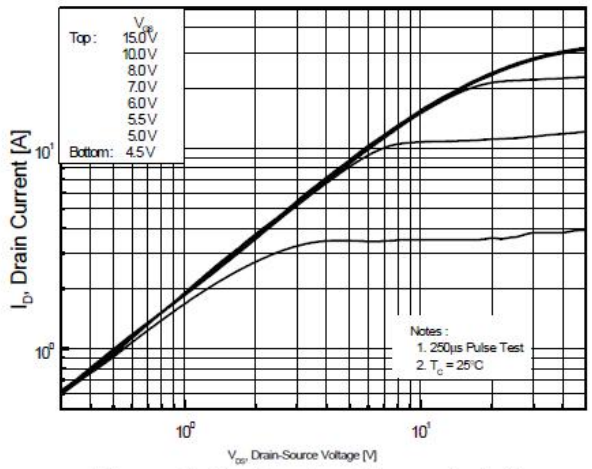



Figure 1. On-Region Characteristics

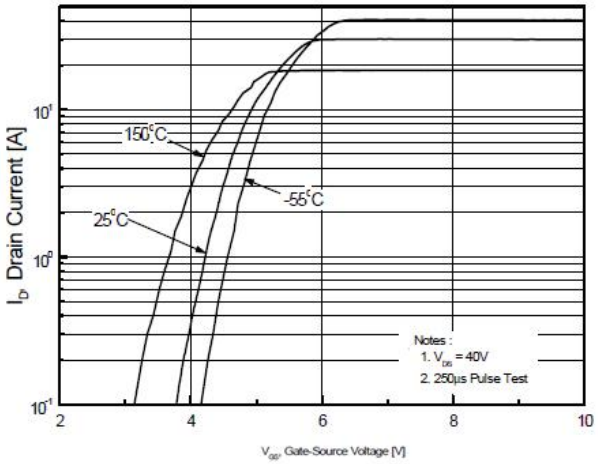



Figure 2. Transfer Characteristics

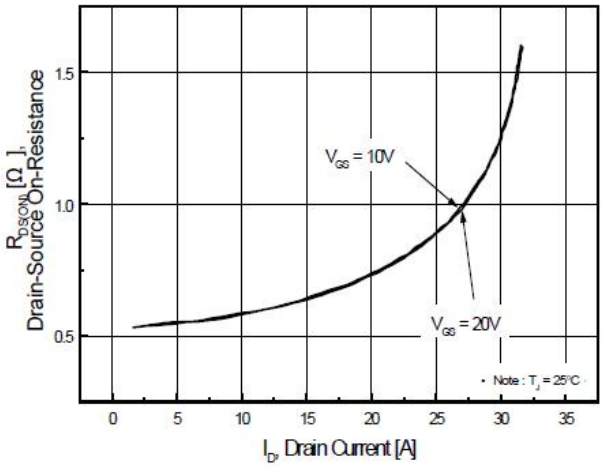



Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

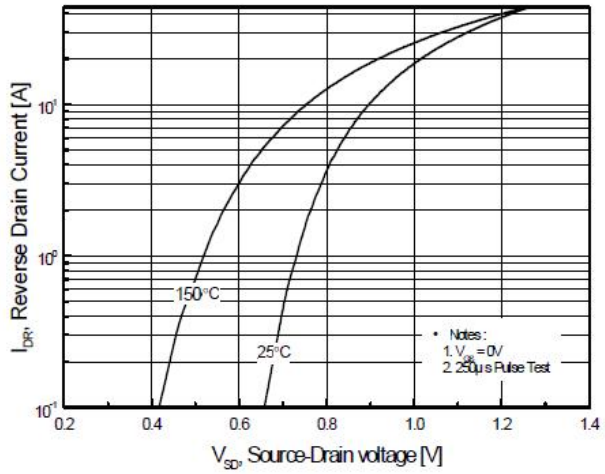



Figure 4. Body Diode Forward Voltage Variation with Source Currentand Temperature

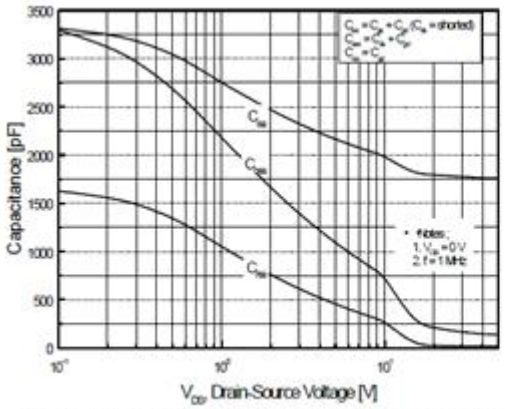



Figure 5. Capacitance Characteristics

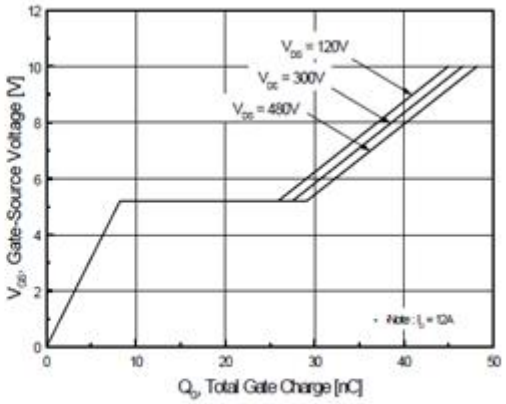



Figure 6. Gate Charge Characteristics

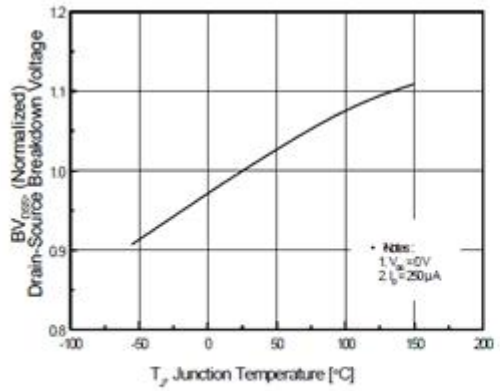



Figure 7. Breakdown Voltage Variation vs Temperature

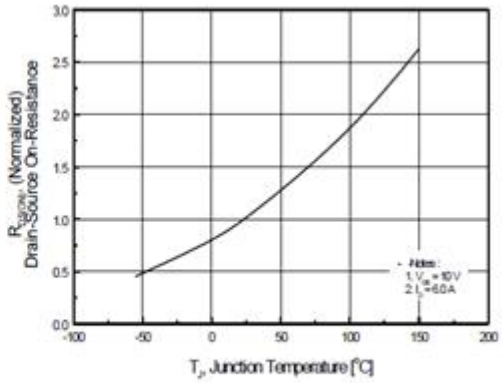



Figure 2. Transfer Characteristics

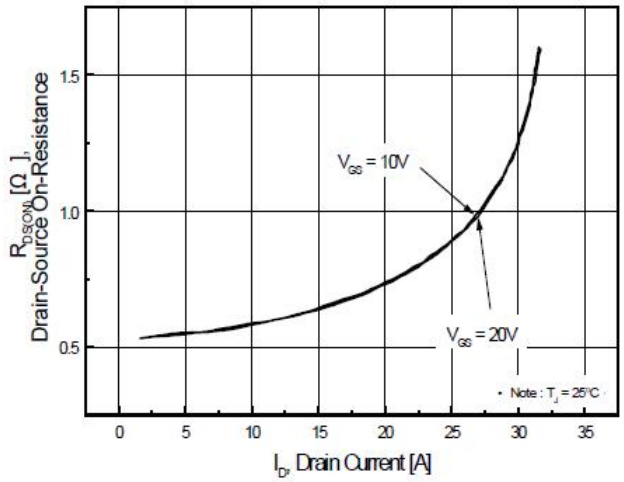



Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

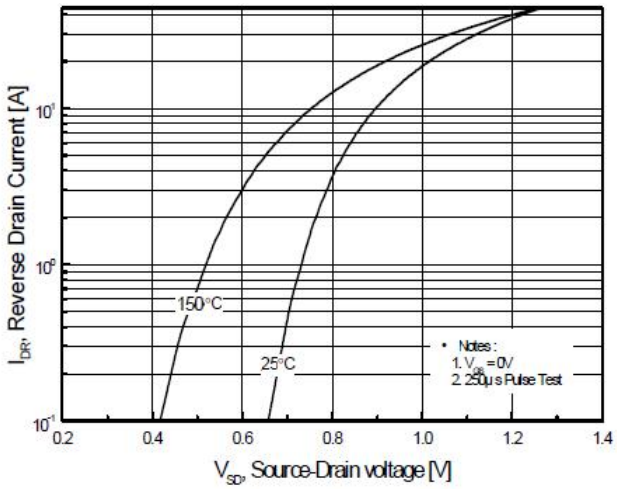



Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

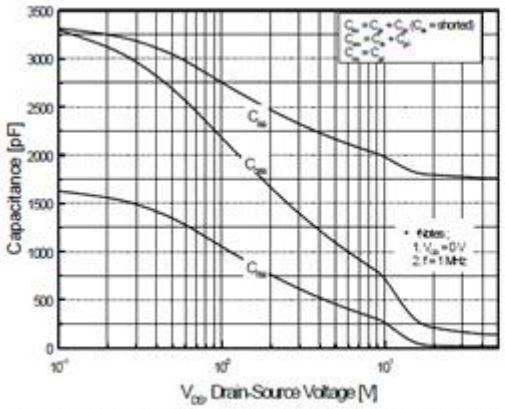



Figure 5. Capacitance Characteristics

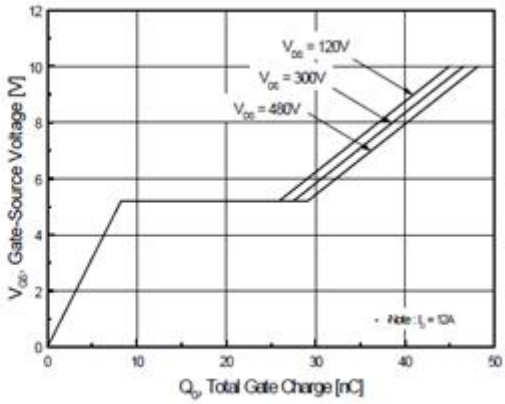



Figure 6. Gate Charge Characteristics

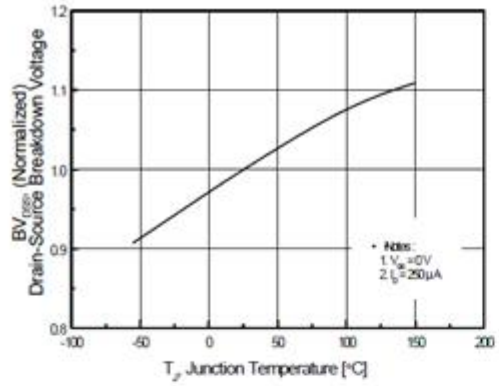



Figure 7. Breakdown Voltage Variation vs Temperature

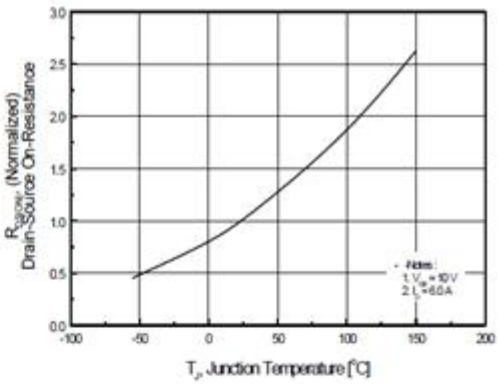



Figure 8. On-Resistance Variation vs Temperature

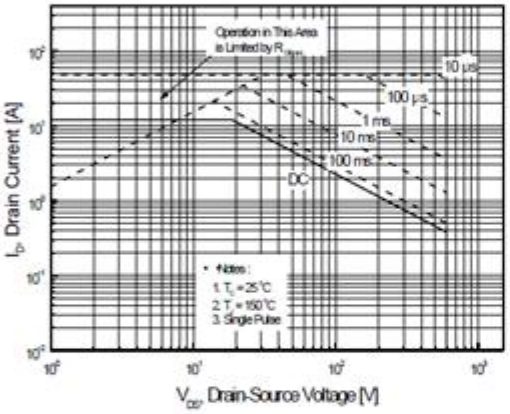



Figure 9-1. Maximum Safe Operating Area for TO220

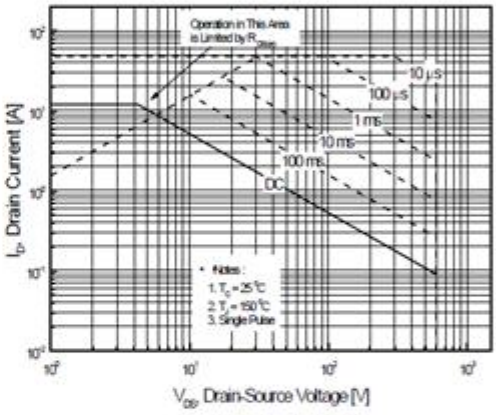



Figure 9-2. Maximum Safe Operating Area for TO220F

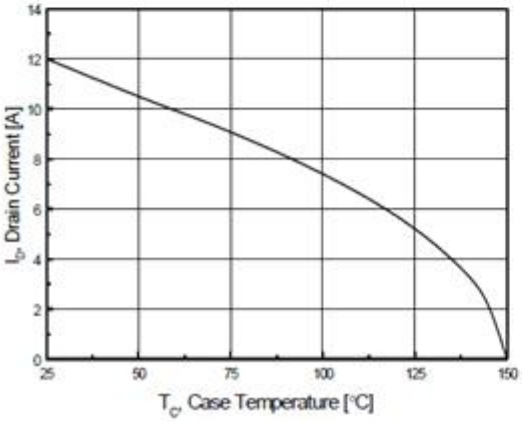



Figure 10. Maximum Drain Current vs Case Temperature

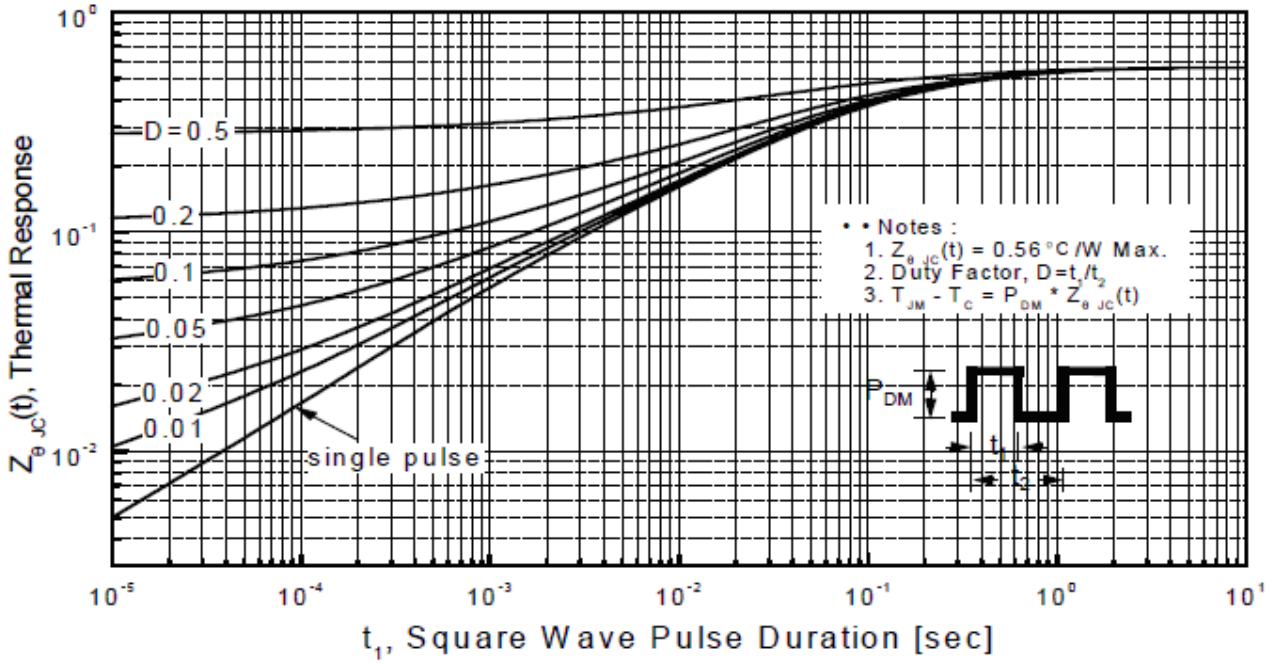



Figure 11-1. Transient Thermal Response Curve for TO220

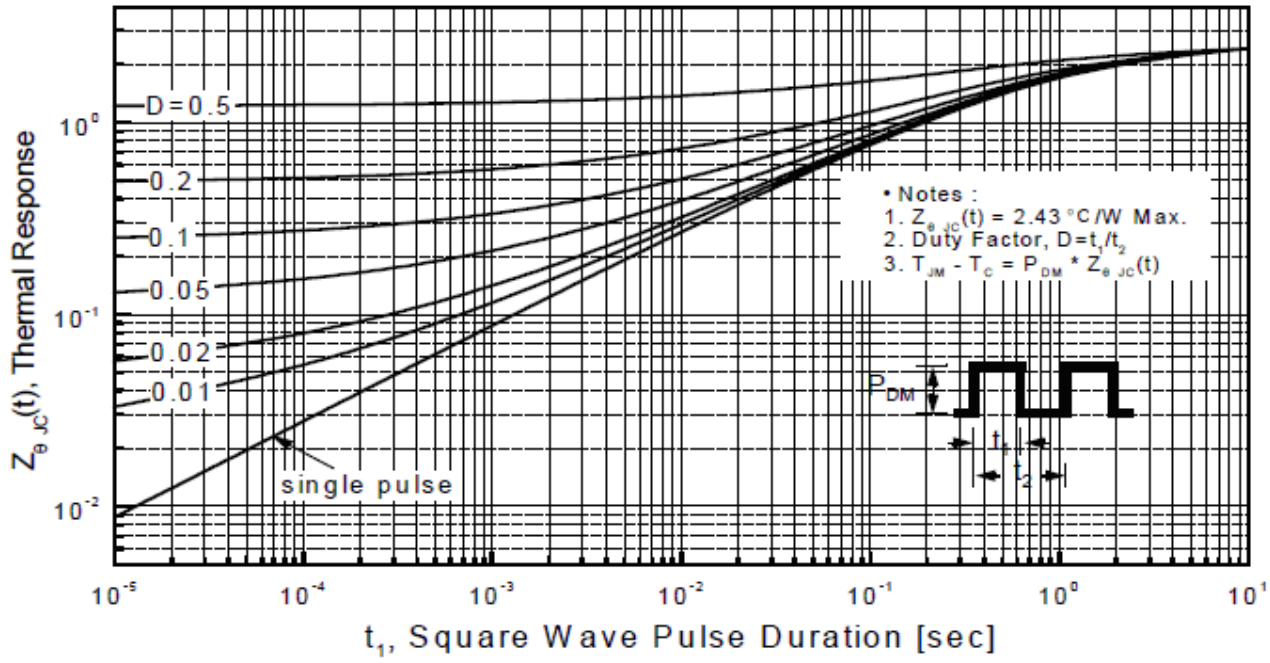



Figure 11-2. Transient Thermal Response Curve for TO220F