Shenzhen Tuofeng Semiconductor Technology Co., Ltd

**TF3420**

# N-Channel Enhancement Mode Field Effect Transistor

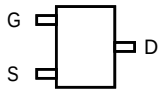
## General Description

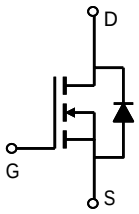
The TF3420 uses advanced trench technology to provide excellent RDS(ON), low gate charge and operation with gate voltages as low as 1.8V while retaining a 12V VGS(MAX) rating. This device is suitable for use as a uni-directional or bi-directional load switch. Standard Product TF3420 is Pb-free

## Features

$V_{DS}$ (V) = 20V
$I_D$ = 6 A ($V_{GS}$ = 10V)
$R_{DS(ON)}$ < 24mΩ ($V_{GS}$ = 10V)
$R_{DS(ON)}$ < 27mΩ ($V_{GS}$ = 4.5V)
$R_{DS(ON)}$ < 42mΩ ($V_{GS}$ = 2.5V)
$R_{DS(ON)}$ < 55mΩ ($V_{GS}$ = 1.8V)

**TO-236**
**(SOT-23)**
**Top View**




**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current [A] | $T_A$=25°C | $I_D$ | 6 | A |
| Pulsed Drain Current [B] | | $I_{DM}$ | 25 | |
| Power Dissipation [A] | $T_A$=25°C | $P_D$ | 1.4 | W |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 70 | 90 | °C/W |
| Maximum Junction-to-Ambient [A] | Steady-State | | 100 | 125 | °C/W |
| Maximum Junction-to-Lead [C] | Steady-State | $R_{\theta JL}$ | 63 | 80 | °C/W |

**Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=250μA, $V_{GS}$=0V | 20 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=16V, $V_{GS}$=0V | | | 1 | μA |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±12V | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250uA | 0.5 | 0.7 | 1 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=4.5V, $V_{DS}$=5V | 25 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=6A | | 19 | 24 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=5A | | 22 | 27 | |
| | | $V_{GS}$=2.5V, $I_D$=4A | | 35 | 42 | |
| | | $V_{GS}$=1.8V, $I_D$=2A | | 45 | 55 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=3.8A | | 24 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.75 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 2 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=10V, f=1MHz | | 630 | | pF |
| $C_{oss}$ | Output Capacitance | | | 164 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 137 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 1.5 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=4.5V, $V_{DS}$=10V, $I_D$=6A | | 8.8 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | 1 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 3.7 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=5V, $V_{DS}$=10V, $R_L$=1.7Ω, $R_{GEN}$=6Ω | | 5.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | 14 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 29 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 10.2 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=6A, dI/dt=100A/μs | | 15.2 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=6A, dI/dt=100A/μs | | 6.3 | | nC |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1$in^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80μs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 $in^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

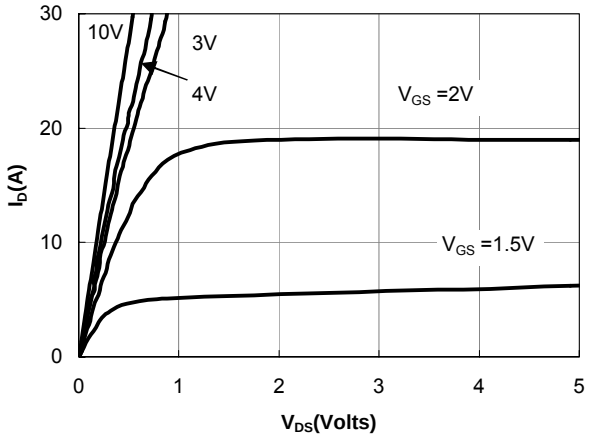


**Figure 1: On-Regions Characteristics**

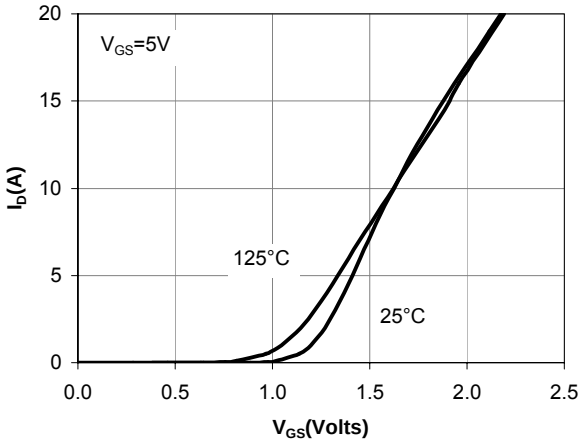


**Figure 2: Transfer Characteristics**

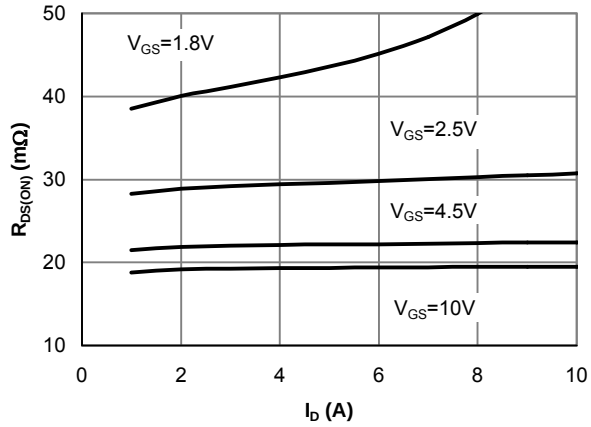


**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

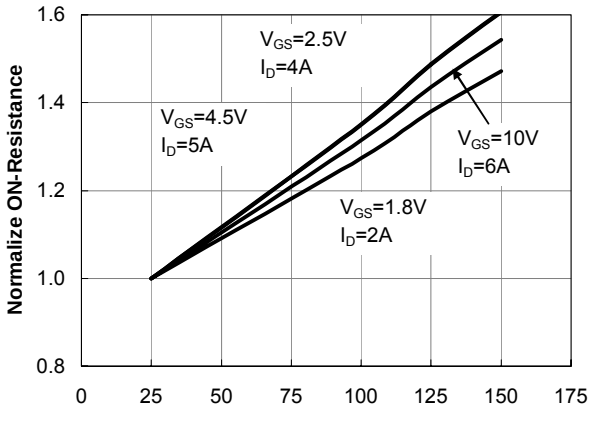


**Figure 4: On-Resistance vs. Junction Temperature**

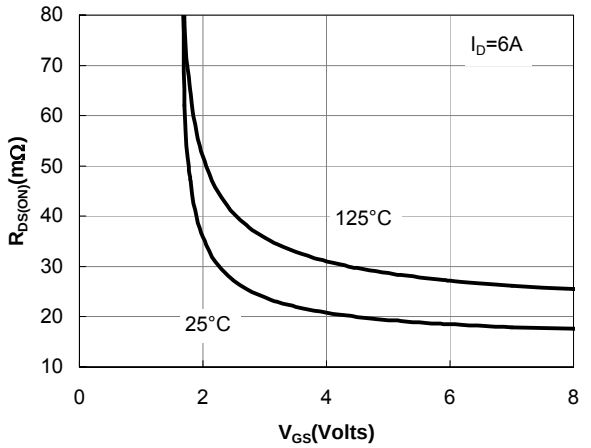


**Figure 5: On-Resistance vs. Gate-Source Voltage**

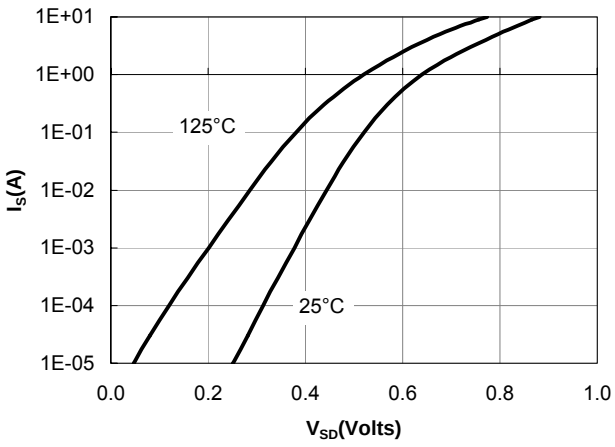


**Figure 6: Body-Diode Characteristics**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

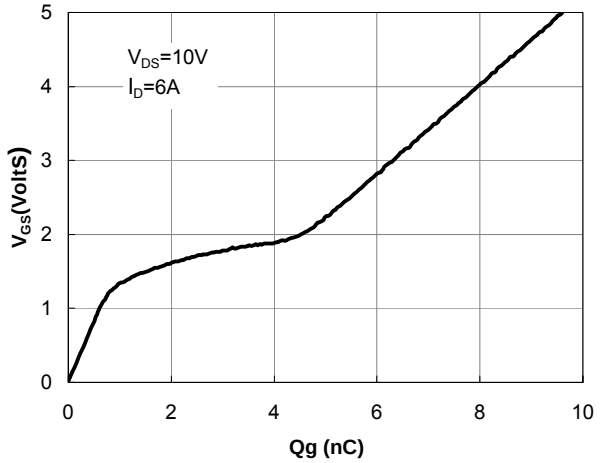


**Figure 7: Gate-Charge Characteristics**

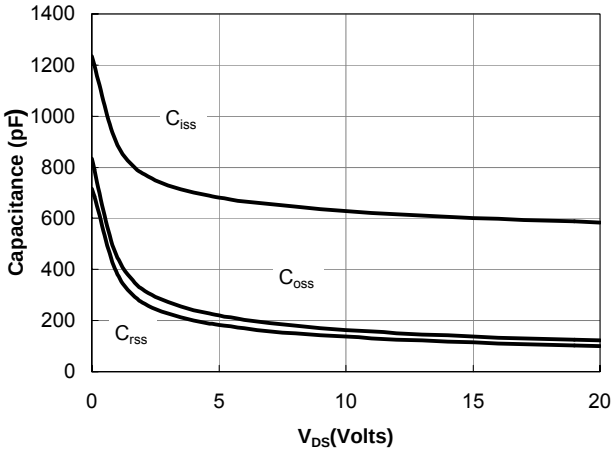


**Figure 8: Capacitance Characteristics**

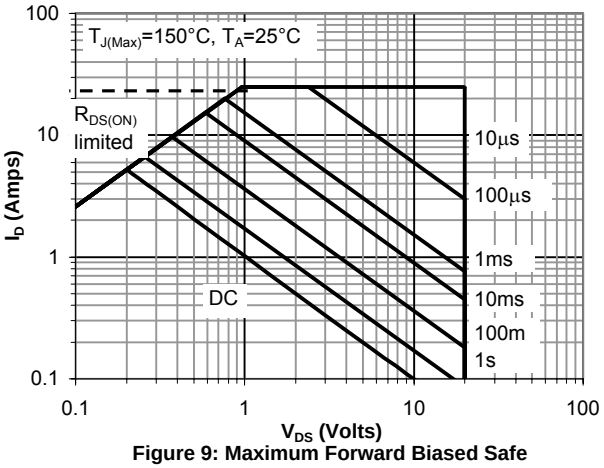


**Figure 9: Maximum Forward Biased Safe Operating Area (Note E)**

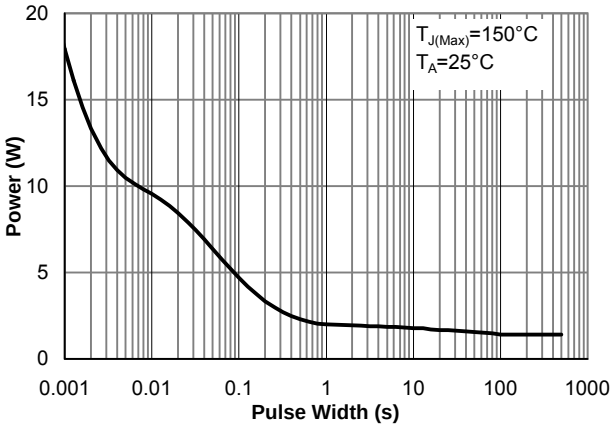


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

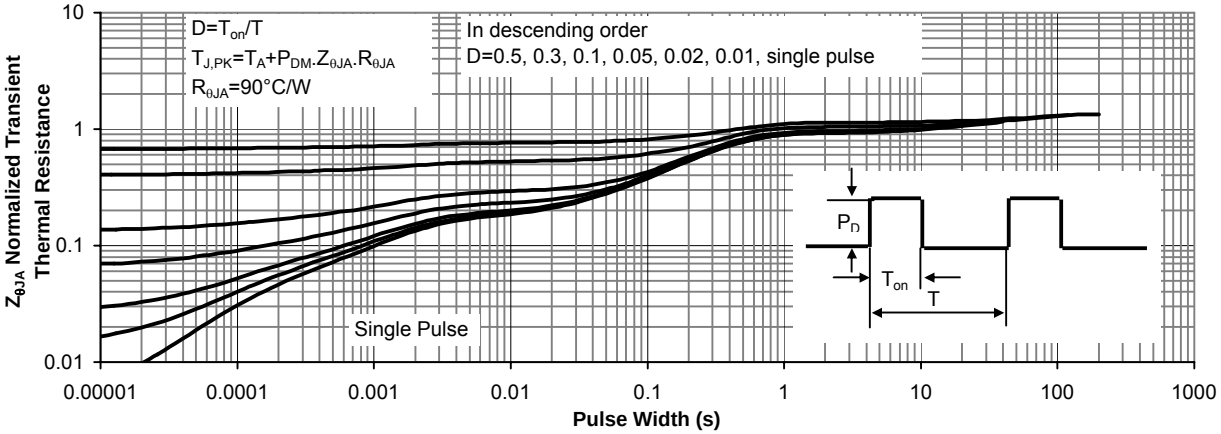


**Figure 11: Normalized Maximum Transient Thermal Impedance**