# TSM12N02

## N-Channel Enhancement Mode MOSFET

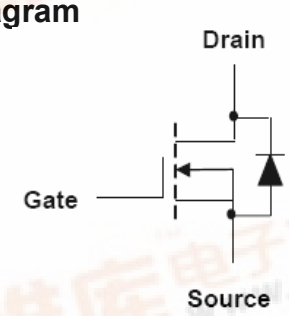

Pin assignment:
1. Gate
2. Drain
3. Source

$V_{DS}$ = 20V
$I_D$ = 12A
$R_{DS\ (on)}$, Vgs @ 10V, Ids@8A = 30mΩ
$R_{DS\ (on)}$, Vgs @ 4.5V, Ids@6A = 40mΩ

## Features

- ✧ Advanced trench process technology
- ✧ Low gate charge
- ✧ High Density Cell Design for Ultra Low On-Resistance
- ✧ Fully Characterized Avalanche Voltage and Current
- ✧ High performance technology for low $R_{DS(ON)}$
- ✧ Fast switching speed

## Block Diagram




## Ordering Information

| Part No. | Packing | Package |
|---|---|---|
| TSM12N02CP | Tape & Reel | TO-252 |

## Absolute Maximum Rating ($T_A$ = 25 °C unless otherwise noted)

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current | | $I_D$ | 12 | A |
| Pulsed Drain Current | | $I_{DM}$ | 30 | |
| Maximum Power Dissipation | $T_A$ = 25 °C | $P_D$ | 1.3 | W |
| | $T_A$ = 100 °C | | 2 | W/°C |
| Operating Junction Temperature | | $T_J$ | +150 | °C |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Thermal Performance

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Lead Temperature (1/8" from case) | $T_L$ | 10 | S |
| Junction-to-case Thermal Resistance | Rθjc | 2.2 | °C/W |
| Junction to Ambient Thermal Resistance (PCB mounted) | Rθja | 50 | |

Note: 1. Maximum DC current limited by the package
2. 1-in$^2$ 2oz Cu PCB board

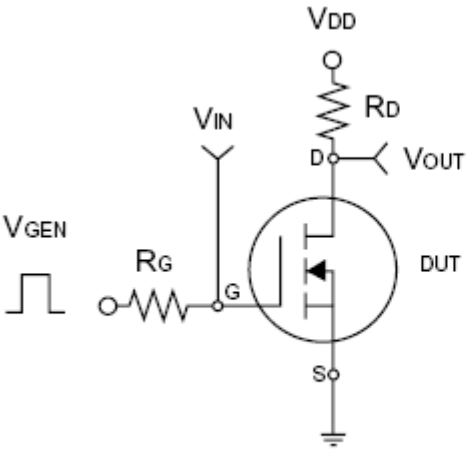
## Electrical Characteristics

$T_J$ = 25 °C, unless otherwise noted

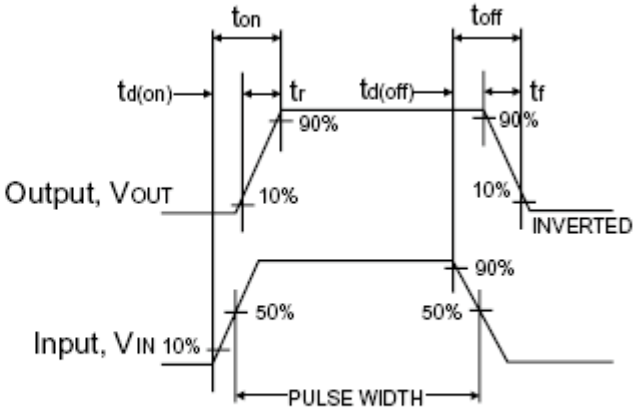
| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250uA | $BV_{DSS}$ | 20 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS}$ = 10V, $I_D$ = 8A | $R_{DS(ON)}$ | -- | 21 | 30 | mΩ |
| Drain-Source On-State Resistance | $V_{GS}$ = 4.5V, $I_D$ = 6A | $R_{DS(ON)}$ | -- | 30 | 40 | mΩ |
| Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250uA | $V_{GS(TH)}$ | 0.6 | -- | -- | V |
| Zero Gate Voltage Drain Current | $V_{DS}$ = 20V, $V_{GS}$ = 0V | $I_{DSS}$ | -- | -- | 1.0 | uA |
| Gate Body Leakage | $V_{GS}$ = ±12V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Forward Transconductance | $V_{DS}$ =10V, $I_D$ = 6A | $g_{fs}$ | 7 | 13 | -- | S |
| **Dynamic** | | | | | | |
| Total Gate Charge | $V_{DS}$ = 10V, $I_D$ = 6A, $V_{GS}$ = 4.5V | $Q_g$ | -- | 7.1 | -- | nC |
| Gate-Source Charge | | $Q_{gs}$ | -- | 1.96 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 2.94 | -- | |
| Turn-On Delay Time | $V_{DD}$ = 10V, $R_L$ = 10Ω, $I_D$ = 1A, $V_{GEN}$ = 4.5V, $R_G$ = 6Ω | $t_{d(on)}$ | -- | 4.9 | -- | nS |
| Turn-On Rise Time | | $t_r$ | -- | 2.6 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 15.7 | -- | |
| Turn-Off Fall Time | | $t_f$ | -- | 14 | -- | |
| Input Capacitance | $V_{DS}$ = 10V, $V_{GS}$ = 0V, f = 1.0MHz | $C_{iss}$ | -- | 620 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 124 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 95 | -- | |
| **Source-Drain Diode** | | | | | | |
| Max. Diode Forward Current | | $I_S$ | -- | -- | 1.7 | A |
| Diode Forward Voltage | $I_S$ = 1.7A, $V_{GS}$ = 0V | $V_{SD}$ | -- | -- | 1.2 | V |

Note: 1. pulse test: pulse width <=300uS, duty cycle <=2%

2. Negligible, Dominated by circuit inductance.

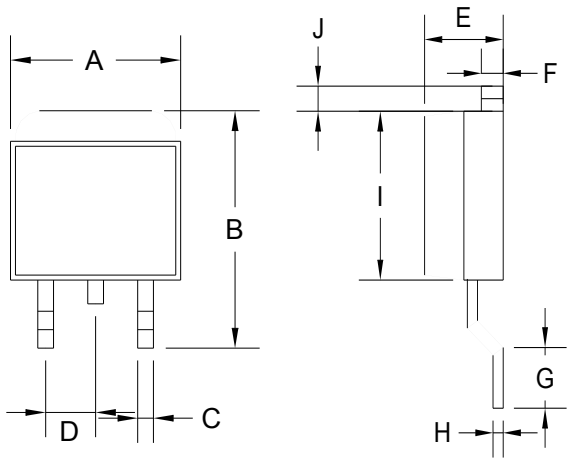



Switching Test Circuit




Switchin Waveforms

# TO-252 Mechanical Drawing




| TO-252 DIMENSION | | | | |
|---|---|---|---|---|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| A | 6.570 | 6.840 | 0.259 | 0.269 |
| B | 9.250 | 10.400 | 0.364 | 0.409 |
| C | 0.550 | 0.700 | 0.022 | 0.028 |
| D | 2.560 | 2.670 | 0.101 | 0.105 |
| E | 2.300 | 2.390 | 0.090 | 0.094 |
| F | 0.490 | 0.570 | 0.019 | 0.022 |
| G | 1.460 | 1.580 | 0.057 | 0.062 |
| H | 0.520 | 0.570 | 0.020 | 0.022 |
| I | 5.340 | 5.550 | 0.210 | 0.219 |
| J | 1.460 | 1.640 | 0.057 | 0.065 |