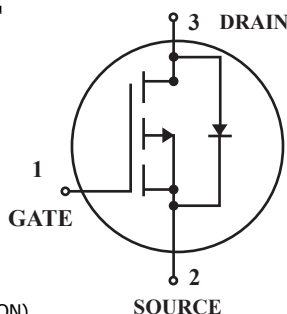


### Surface Mount P-Channel Enhancement Mode MOSFET

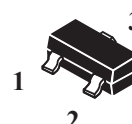
**(Pb)** Lead(Pb)-Free



**DRAIN CURRENT**  
-550m AMPERES  
**DRAIN SOURCE VOLTAGE**  
-20 VOLTAGE

#### Features:

- \*Super High Dense Cell Design For Low  $R_{DS(ON)}$   
 $R_{DS(ON)} < 600m\Omega @ V_{GS} = -10V$
- \*Simple Gate Drive
- \*Small package Outline
- \*Fast Switching Speed
- \*SOT-23 Package



**SOT-23**

#### Description

- \*Designer with best combination of fast switching
- \*Low on-resistance
- \*Cost-effectiveness

#### Maximum Ratings ( $T_A = 25^\circ C$ Unless Otherwise Specified)

| Rating                                                                                   | Symbol          | Value     | Unit         |
|------------------------------------------------------------------------------------------|-----------------|-----------|--------------|
| Drain-Source Voltage                                                                     | $V_{DS}$        | -20       | V            |
| Gate-Source Voltage                                                                      | $V_{GS}$        | $\pm 12$  |              |
| Continuous Drain Current <sup>3</sup> , ( $T_A = 25^\circ C$ )<br>( $T_A = 70^\circ C$ ) | $I_D$           | -550      | mA           |
|                                                                                          |                 | -440      |              |
| Pulsed Drain Current <sup>1,2</sup>                                                      | $I_{DM}$        | 2.5       |              |
| Total Power Dissipation ( $T_A = 25^\circ C$ )                                           | $P_D$           | 1.0       | W            |
| Maximum Thermal Resistace Junction-ambient                                               | $R_{\theta JA}$ | 125       | $^\circ C/W$ |
| Operating Junction and Storage Temperature Range                                         | $T_J, T_{stg}$  | - 55~+150 | $^\circ C$   |

#### Device Marking

WTC1333=1333

## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ Unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### Static

|                                                                                                                                                               |              |             |             |                    |                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|-------------|--------------------|------------------|
| Drain-Source Breakdown Voltage<br>$V_{GS}=0, I_D=-250\mu\text{A}$                                                                                             | $BV_{DSS}$   | -20         | -           | -                  | V                |
| Gate-Source Threshold Voltage<br>$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$                                                                                         | $V_{GS(Th)}$ | -0.5        | -           | -1.2               |                  |
| Gate-Source Leakage current<br>$V_{GS}=\pm 12\text{V}$                                                                                                        | $I_{GSS}$    | -           | -           | $\pm 100$          | nA               |
| Drain-Source Leakage Current ( $T_j=25^\circ\text{C}$ )<br>$V_{DS}=-20\text{V}, V_{GS}=0$                                                                     | $I_{DSS}$    | -           | -           | -1                 | $\mu\text{A}$    |
| Drain-Source Leakage Current ( $T_j=70^\circ\text{C}$ )<br>$V_{DS}=-16\text{V}, V_{GS}=0$                                                                     |              | -           | -           | -10                |                  |
| Drain-Source On-Resistance<br>$V_{GS}=-10\text{V}, I_D=-550\text{mA}$<br>$V_{GS}=-4.5\text{V}, I_D=-500\text{mA}$<br>$V_{GS}=-2.5\text{V}, I_D=-300\text{mA}$ | $R_{DS(on)}$ | -<br>-<br>- | -<br>-<br>- | 600<br>800<br>1000 | $\text{m}\Omega$ |
| Forward Transconductance<br>$V_{DS}=-5\text{V}, I_D=-550\text{mA}$                                                                                            | $g_{fs}$     | -           | 1           | -                  | S                |

### Dynamic

|                                                                                         |           |   |    |       |             |
|-----------------------------------------------------------------------------------------|-----------|---|----|-------|-------------|
| Input Capacitance<br>$V_{GS}=0\text{V}, V_{DS}=-10\text{V}, f=1.0\text{MHz}$            | $C_{iss}$ | - | 66 | 105.6 | $\text{pF}$ |
| Output Capacitance<br>$V_{GS}=0\text{V}, V_{DS}=-10\text{V}, f=1.0\text{MHz}$           | $C_{oss}$ | - | 25 | -     |             |
| Reverse Transfer Capacitance<br>$V_{GS}=0\text{V}, V_{DS}=-10\text{V}, f=1.0\text{MHz}$ | $C_{rss}$ | - | 20 | -     |             |

## Switching

|                                                                                                       |              |   |     |     |    |
|-------------------------------------------------------------------------------------------------------|--------------|---|-----|-----|----|
| Turn-on Delay Time <sup>2</sup><br>$V_{DS}=-10V, V_{GS}=-5V, I_D=-500mA, R_D=20\Omega, R_G=3.3\Omega$ | $t_{d(on)}$  | - | 5   | -   | ns |
| Rise Time<br>$V_{DS}=-10V, V_{GS}=-5V, I_D=-500mA, R_D=20\Omega, R_G=3.3\Omega$                       | $t_r$        | - | 8   | -   |    |
| Turn-off Delay Time<br>$V_{DS}=-10V, V_{GS}=-5V, I_D=-500mA, R_D=20\Omega, R_G=3.3\Omega$             | $t_{d(off)}$ | - | 10  | -   |    |
| Fall Time<br>$V_{DS}=-10V, V_{GS}=-5V, I_D=-500mA, R_D=20\Omega, R_G=3.3\Omega$                       | $t_f$        | - | 2   | -   |    |
| Total Gate Charge <sup>2</sup><br>$V_{DS}=-16V, V_{GS}=-4.5V, I_D=-500mA$                             | $Q_g$        | - | 1.7 | 2.7 | nC |
| Gate-Source Charge<br>$V_{DS}=-16V, V_{GS}=-4.5V, I_D=-500mA$                                         | $Q_{gs}$     | - | 0.3 | -   |    |
| Gate-Source Change<br>$V_{DS}=-16V, V_{GS}=-4.5V, I_D=-500mA$                                         | $Q_{gd}$     | - | 0.4 | -   |    |

## Source-Drain Diode Characteristics

|                                                            |          |   |   |     |   |
|------------------------------------------------------------|----------|---|---|-----|---|
| Forward On Voltage <sup>2</sup><br>$V_{GS}=0V, I_S=-300mA$ | $V_{SD}$ | - | - | -12 | V |
|------------------------------------------------------------|----------|---|---|-----|---|

Note: 1. Pulse width limited by Max, junction temperature.  
 2. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .  
 3. Surface mounted on FR4 board,  $t \leq 10sec$ .

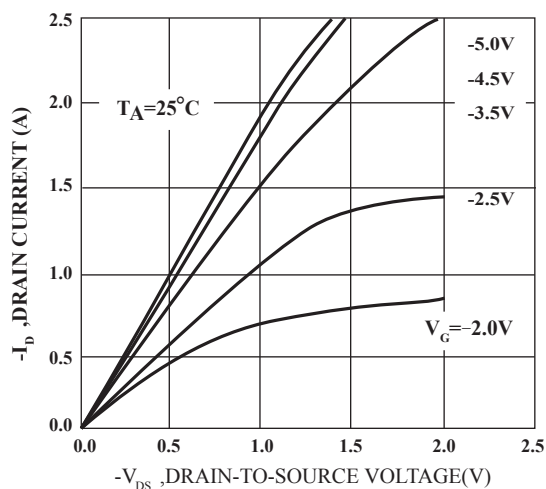


FIG.1 Typical Output Characteristics

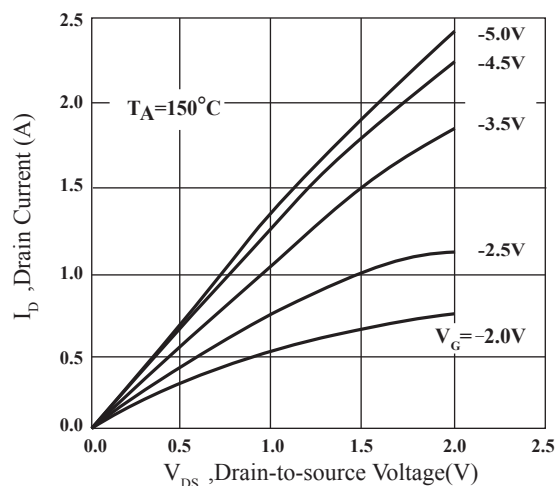


Fig.2 Typical Output Characteristics

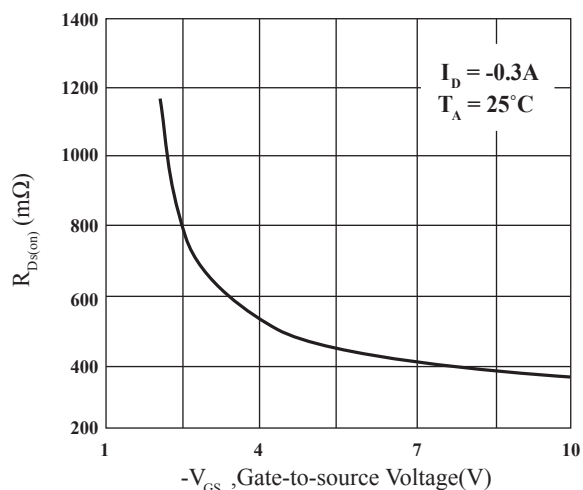


Fig.3 On-Resistance v.s. Gate Voltage

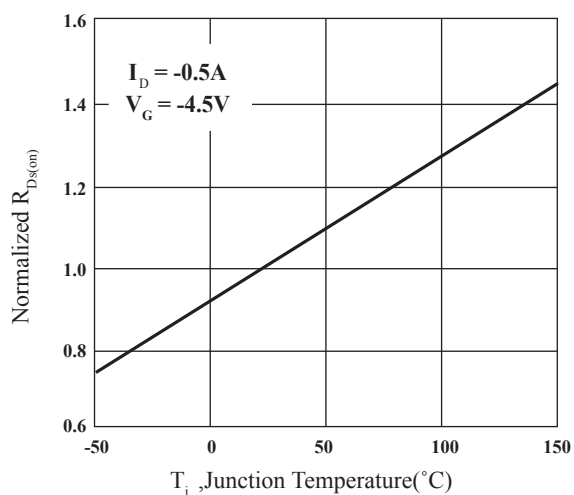


Fig.4 Normalized OnResistance

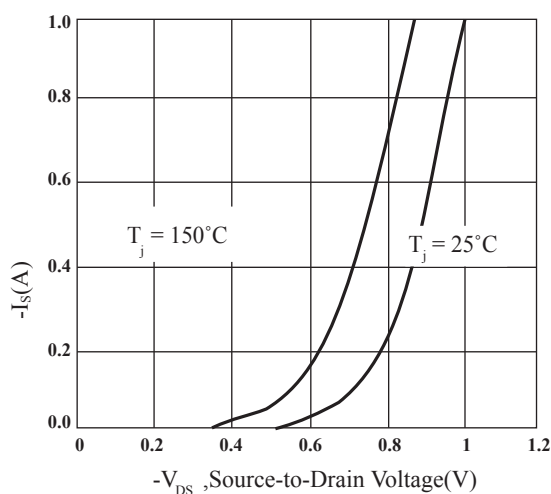


Fig.5 Forward Characteristics of Reverse Diode

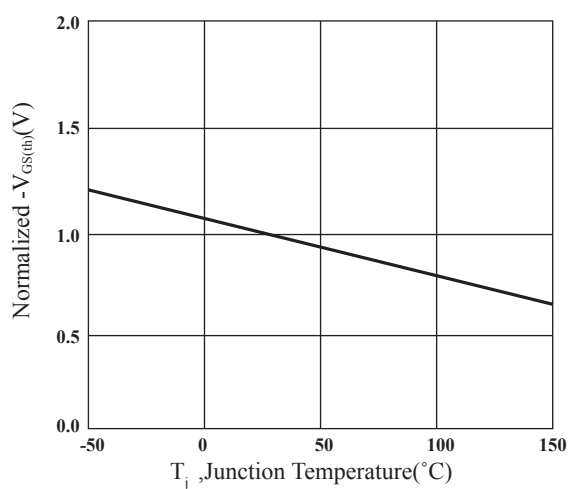


Fig.6 Gate Threshold Voltage v.s. Junction Temperature

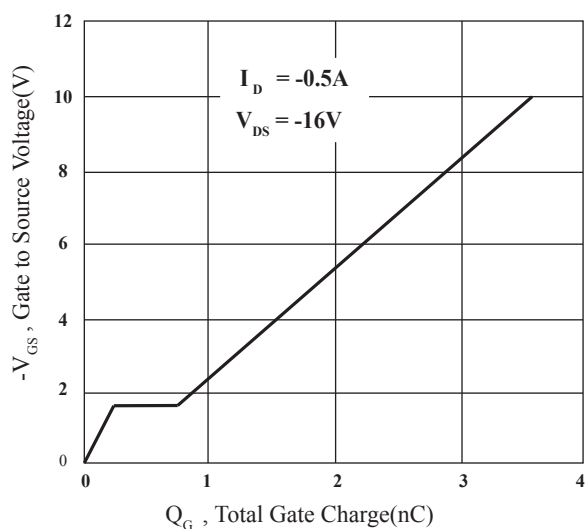


Fig 7. Gate Charge Characteristics

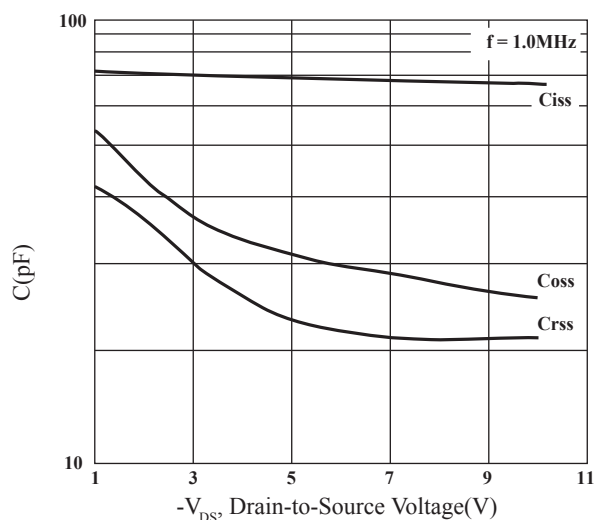


Fig 8. Typical Capacitance Characteristics

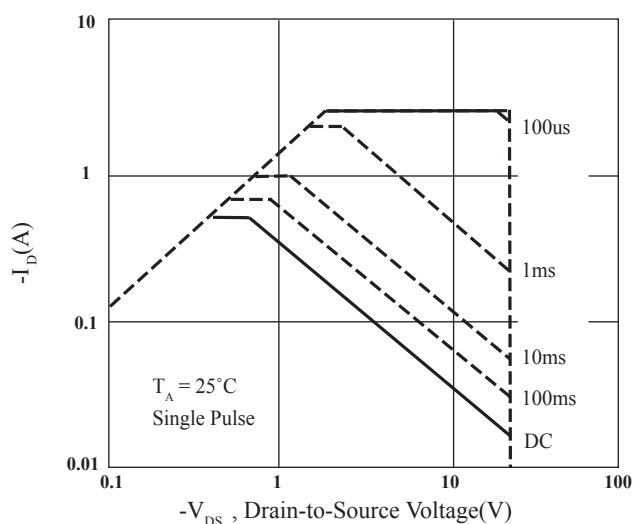


Fig 9. Maximum Safe Operation Area

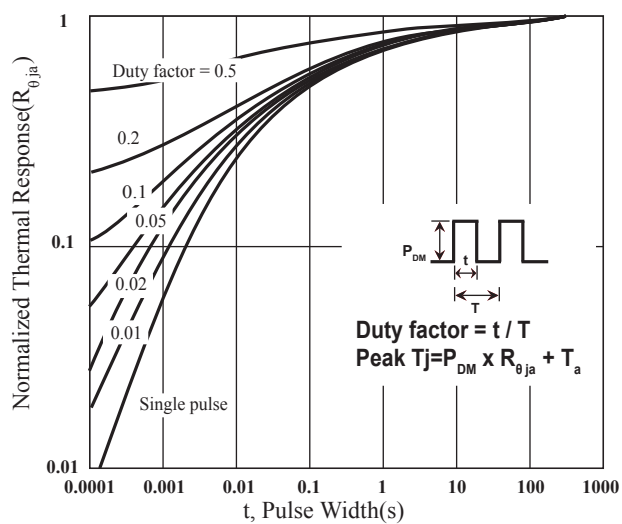


Fig 10. Effective Transient Thermal Impedance

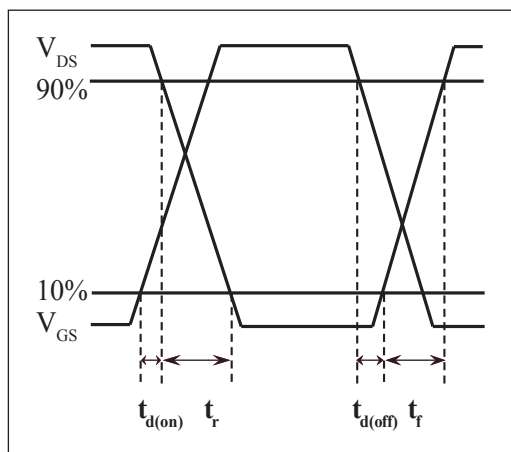


Fig 11. Switching Time Circuit

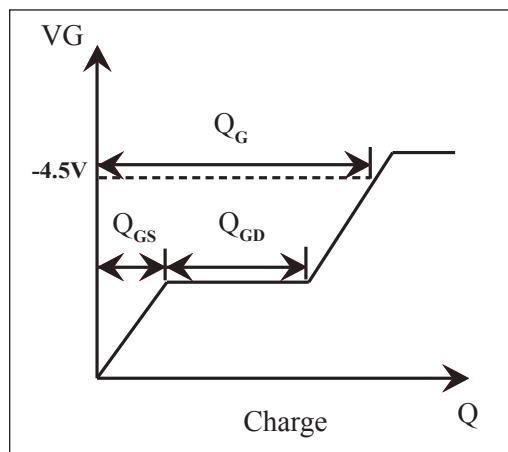
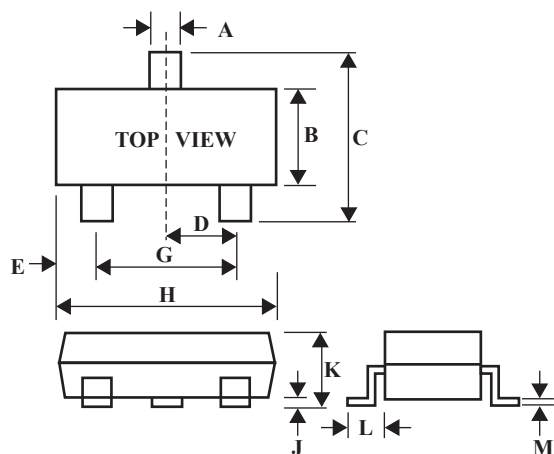


Fig.12 Gate Charge Waveform

## SOT-23 Outline Dimension

Unit:mm



| SOT-23 |       |      |
|--------|-------|------|
| Dim    | Min   | Max  |
| A      | 0.35  | 0.51 |
| B      | 1.19  | 1.40 |
| C      | 2.10  | 3.00 |
| D      | 0.85  | 1.05 |
| E      | 0.46  | 1.00 |
| G      | 1.70  | 2.10 |
| H      | 2.70  | 3.10 |
| J      | 0.01  | 0.13 |
| K      | 0.89  | 1.10 |
| L      | 0.30  | 0.61 |
| M      | 0.076 | 0.25 |