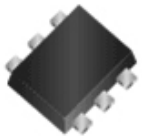
# WPMD2013

**Dual P-Channel, -20V, -0.64A, Small Signal MOSFET**

**Http//:www.willsemi.com**

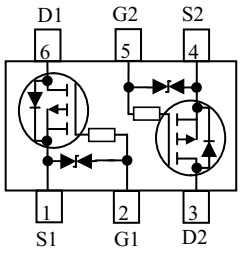
| $V_{DS}$ (V) | Rds(on) (Ω) |
|---|---|
| -20 | 0.550@ $V_{GS}$=-4.5V |
| | 0.740@ $V_{GS}$=-2.5V |
| | 0.860@ $V_{GS}$=-1.8V |



**SOT-563**

## Descriptions

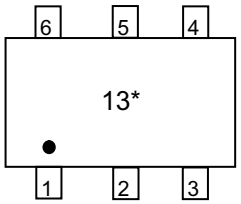
The WPMD2013 is P-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent $R_{DS\ (ON)}$ with low gate charge. This device is suitable for use in DC-DC conversion, load switch and level shift. Standard Product WPMD2013 is Pb-free.




**Pin configuration (Top view)**

## Features

- Trench Technology
- Supper high density cell design
- Excellent ON resistance
- Extremely Low Threshold Voltage
- Small package SOT-563




13 = Device Code
* = Month (A~Z)

**Marking**

## Applications

- DC-DC converter circuit
- Small Signal Switch
- Load Switch
- Level Shift

## Order information

| Device | Package | Shipping |
|---|---|---|
| WPMD2013-6/TR | SOT-563 | 3000/Reel&Tape |

## Absolute Maximum ratings

| Parameter | | Symbol | 10 S | Steady State | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -20 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±6 | | |
| Continuous Drain Current [a] | $T_A$=25°C | $I_D$ | -0.64 | -0.56 | A |
| | $T_A$=70°C | | -0.51 | -0.45 | |
| Maximum Power Dissipation [a] | $T_A$=25°C | $P_D$ | 0.37 | 0.29 | W |
| | $T_A$=70°C | | 0.23 | 0.18 | |
| Continuous Drain Current [b] | $T_A$=25°C | $I_D$ | -0.54 | -0.50 | A |
| | $T_A$=70°C | | -0.43 | -0.40 | |
| Maximum Power Dissipation [b] | $T_A$=25°C | $P_D$ | 0.27 | 0.22 | W |
| | $T_A$=70°C | | 0.17 | 0.14 | |
| Pulsed Drain Current [c] | | $I_{DM}$ | -1.0 | | A |
| Operating Junction Temperature | | $T_J$ | 150 | | °C |
| Storage Temperature Range | | $T_{stg}$ | -55 to 150 | | °C |

## Thermal resistance ratings

| **Single Operation** | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Junction-to-Ambient Thermal Resistance [a] | t ≤ 10 s | $R_{\theta JA}$ | 285 | 335 | °C/W |
| | Steady State | | 350 | 430 | |
| Junction-to-Ambient Thermal Resistance [b] | t ≤ 10 s | $R_{\theta JA}$ | 380 | 460 | |
| | Steady State | | 465 | 555 | |
| Junction-to-Case Thermal Resistance | Steady State | $R_{\theta JC}$ | 280 | 320 | |
| **Dual Operation** | | | | | |
| Junction-to-Ambient Thermal Resistance [a] | t ≤ 10 s | $R_{\theta JA}$ | 317 | 370 | °C/W |
| | Steady State | | 375 | 445 | |
| Junction-to-Ambient Thermal Resistance [b] | t ≤ 10 s | $R_{\theta JA}$ | 425 | 492 | |
| | Steady State | | 505 | 590 | |
| Junction-to-Case Thermal Resistance | Steady State | $R_{\theta JC}$ | 285 | 325 | |

a. Surface mounted on FR4 Board using 1 in sq pad size, 1oz Cu.

b. Surface mounted on FR4 board using the minimum recommended pad size, 1oz Cu.

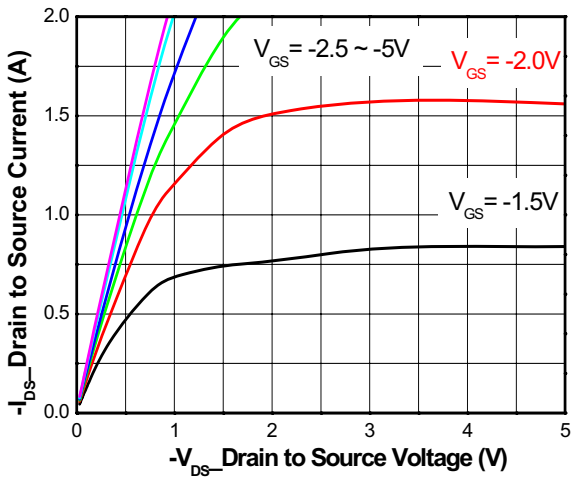
c. Repetitive rating, pulse width limited by junction temperature, tp=10μs, Duty Cycle=1%

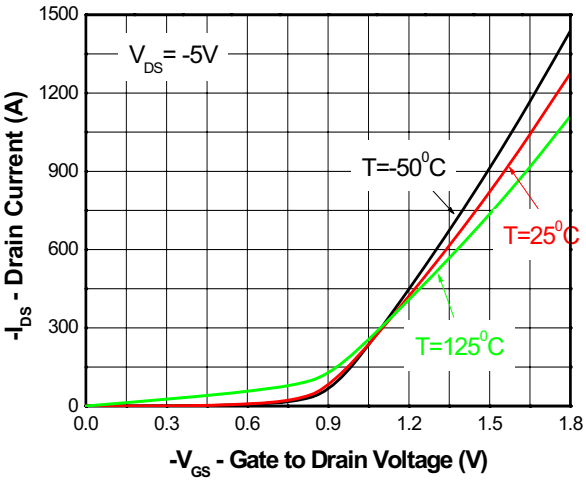
d. Repetitive rating, pulse width limited by junction temperature $T_J$(MAX)=150°C

## Electronics Characteristics (Ta=25°C, unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-to-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ = 0 V, $I_D$ = −250uA | -20 | | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ =-20 V, $V_{GS}$ = 0V | | | -1 | uA |
| Gate-to-source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ =±5V | | | -5 | uA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = -250uA | -0.40 | -0.65 | -0.90 | V |
| Drain-to-source On-resistance | $R_{DS(on)}$ | VGS = −4.5V, ID =−0.45A | | 550 | 810 | mΩ |
| | | VGS = −2.5V, ID = −0. 35A | | 740 | 1050 | |
| | | VGS = −1.8V, ID = −0. 25A | | 860 | 1300 | |
| Forward Transconductance | $g_{FS}$ | VDS = −5 V, ID = -0.45A | | 1.25 | | S |
| **CHARGES, CAPACITANCES AND GATE RESISTANCE** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 100KHz, $V_{DS}$ = −10 V | | 74.5 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 10.8 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 10.2 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = −4.5 V, $V_{DS}$ = −10 V, $I_D$ = -0.45A | | 1.8 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.12 | | |
| Gate-to-Source Charge | $Q_{GS}$ | | | 0.18 | | |
| Gate-to-Drain Charge | $Q_{GD}$ | | | 0.74 | | |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | td(ON) | $V_{GS}$ = -4.5 V, $V_{DS}$ = -10 V, $I_D$=-0.45A, $R_G$=6 Ω | | 45 | | ns |
| Rise Time | tr | | | 140 | | |
| Turn-Off Delay Time | td(OFF) | | | 1500 | | |
| Fall Time | tf | | | 2100 | | |
| **BODY DIODE CHARACTERISTICS** | | | | | | |
| Forward Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = -0.15A | -0.50 | -0.65 | -1.50 | V |

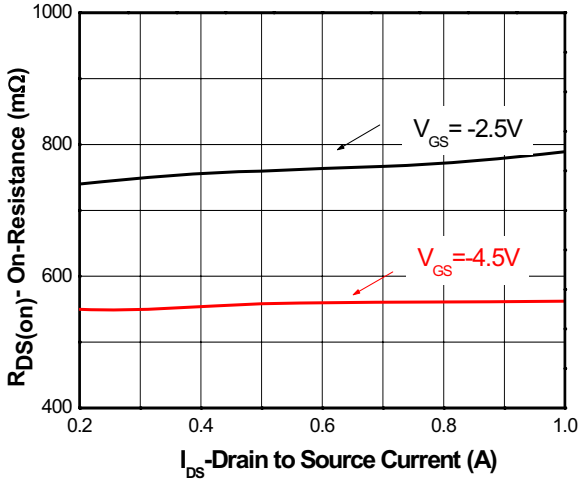
## Typical Characteristics (Ta=25°C, unless otherwise noted)

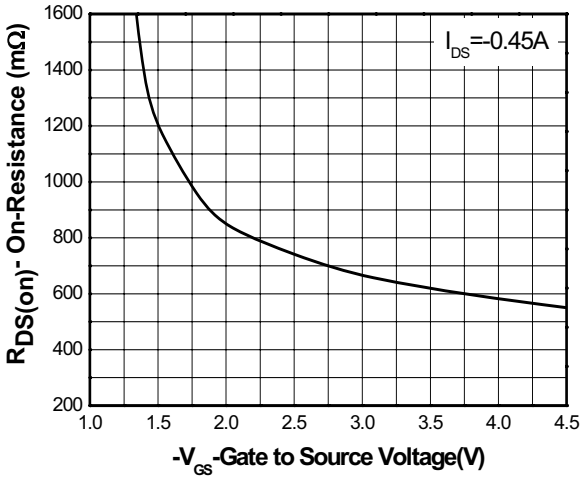



**Output characteristics**

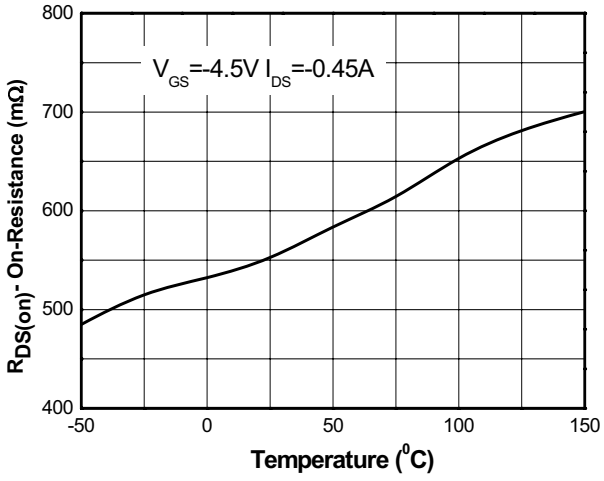
**Transfer characteristics**

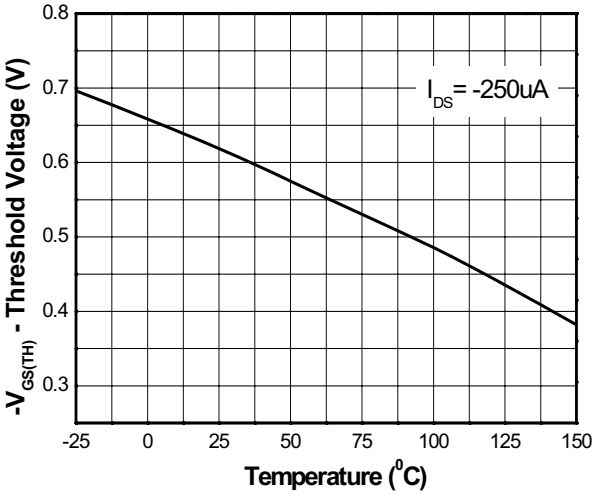



**On-Resistance vs. Drain current**

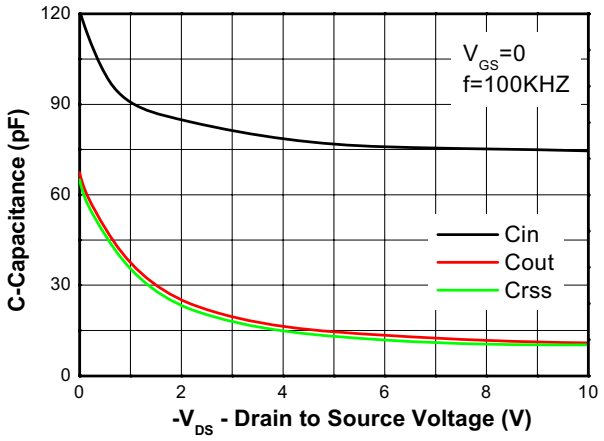
**On-Resistance vs. Gate-to-Source voltage**



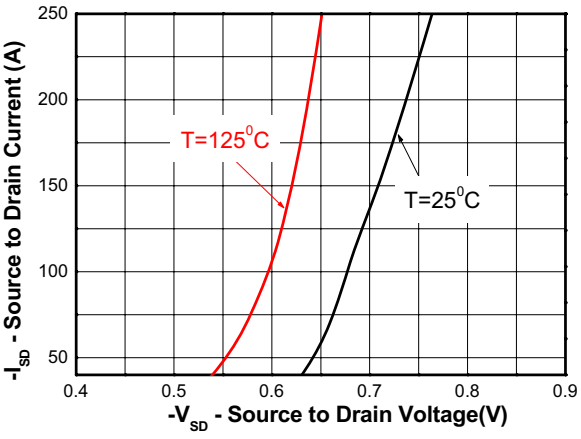




**On-Resistance vs. Junction temperature**

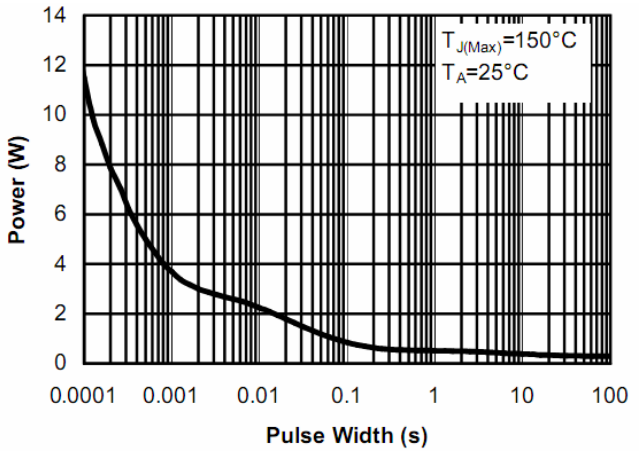
**Threshold voltage vs. Temperature**



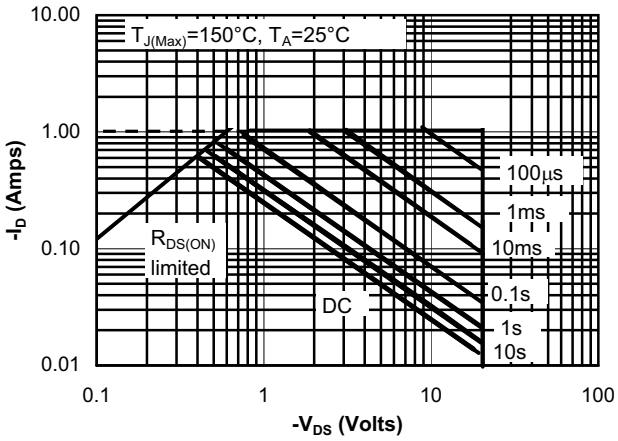

**Capacitance**



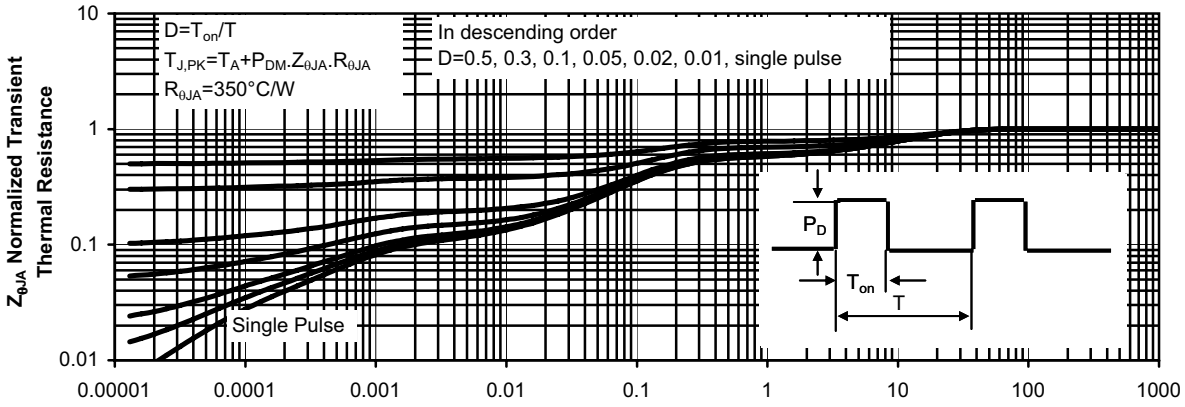

**Body diode forward voltage**




**Single pulse power**



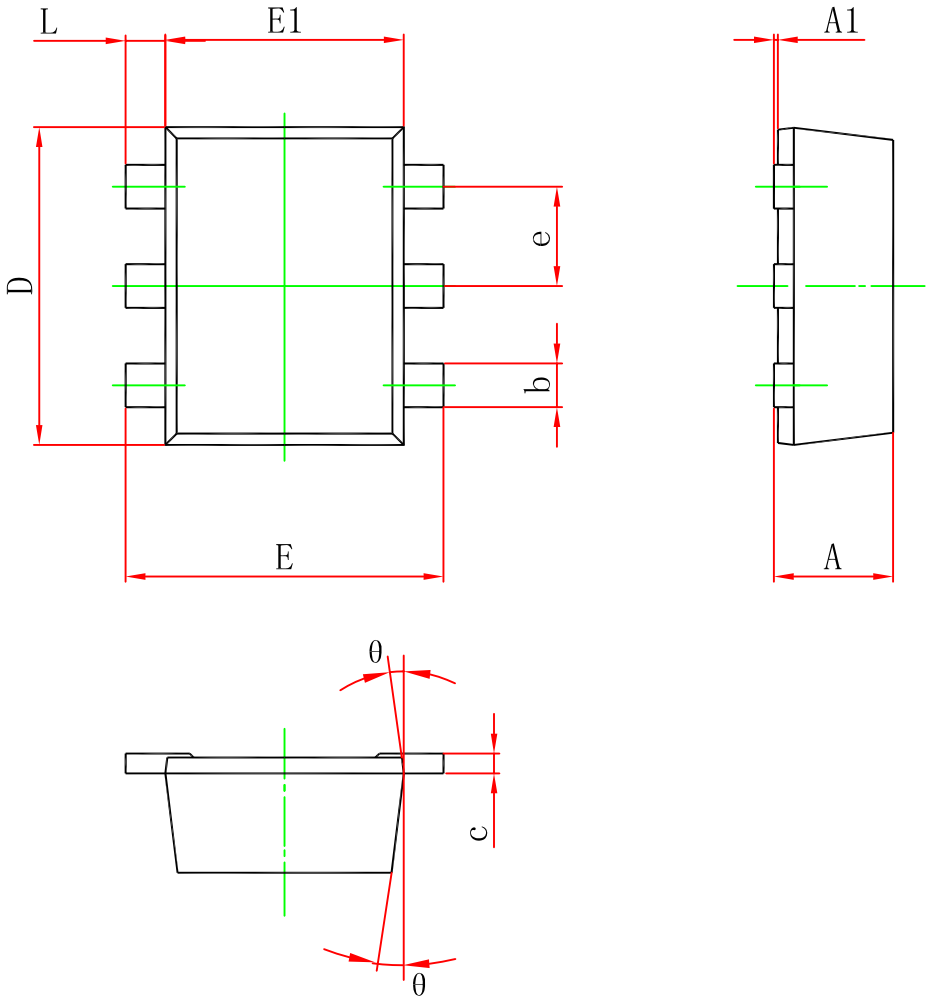

**Safe operating power**




**Transient thermal response (Junction-to-Ambient)**

## Package Outline Dimension

SOT-563




| Symbol | Dimensions in millimeter | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 0.525 | 0.563 | 0.600 |
| A1 | 0.000 | 0.025 | 0.050 |
| e | 0.450 | 0.500 | 0.550 |
| c | 0.090 | 0.125 | 0.160 |
| D | 1.500 | 1.600 | 1.700 |
| b | 0.170 | 0.22 | 0.270 |
| E1 | 1.100 | 1.200 | 1.300 |
| E | 1.500 | 1.600 | 1.700 |
| L | 0.100 | 0.200 | 0.300 |
| θ | 7° REF | | |