# WSP4099

**Dual P-Channel MOSFET**

## General Description

The WSP4099 is the highest performance trench P-ch MOSFETs with extreme high cell density , which provide excellent RDSON and gate charge for most of the synchronous buck converter applications .

The WSP4099 meet the RoHS and Green Product requirement , 100% EAS guaranteed with full function reliability approved.

## Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

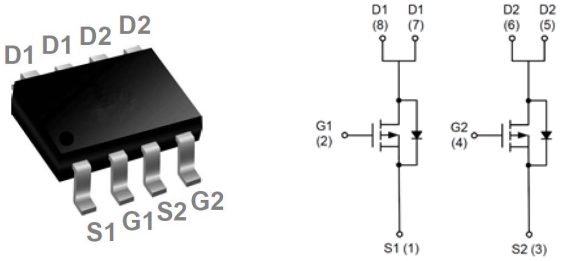
## Product Summery

| BVDSS | RDSON | ID |
|---|---|---|
| -40V | 30mΩ | -6.5A |

## Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

## SOP-8 Pin Configuration




## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, -$V_{GS}$ @ -10V[1] | -6.5 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, -$V_{GS}$ @ -10V[1] | -4.5 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | -22 | A |
| EAS | Single Pulse Avalanche Energy[3] | 25 | mJ |
| $I_{AS}$ | Avalanche Current | -10 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 2.0 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 110 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 50 | ℃/W |

## Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -40 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.02 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V , $I_D$=-6.5A | --- | 30 | 38 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-4.5A | --- | 46 | 62 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.5 | -2.0 | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 3.72 | --- | V/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=-5V , $I_D$=-4A | --- | 8 | --- | S |
| $Q_g$ | Total Gate Charge (-4.5V) | $V_{DS}$=-20V , $V_{GS}$=-4.5V , $I_D$=-6.5A | --- | 7.5 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 2.4 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 3.5 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=-15V , $V_{GS}$=-10V , $R_G$=6Ω, $I_D$=-1A ,$R_L$=20Ω | --- | 8.7 | --- | ns |
| $T_r$ | Rise Time | | --- | 7 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 31 | --- | |
| $T_f$ | Fall Time | | --- | 17 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , f=1MHz | --- | 668 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 98 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 72 | --- | |

## Guaranteed Avalanche Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| EAS | Single Pulse Avalanche Energy[5] | $V_{DD}$=-25V , L=0.5mH , $I_{AS}$=-10A | 20 | --- | --- | mJ |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,6] | $V_G$=$V_D$=0V , Force Current | --- | --- | -2 | A |
| $I_{SM}$ | Pulsed Source Current[2,6] | | --- | --- | -22 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1.0 | V |

Note :
1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper,t<10sec.
2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3.The EAS data shows Max. rating . The test condition is VDD=-25V,VGS=-10V,L=0.5mH,IAS=-10A
4.The power dissipation is limited by 150℃ junction temperature
5.The Min. value is 100% EAS tested guarantee.
6.The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## Typical Characteristics

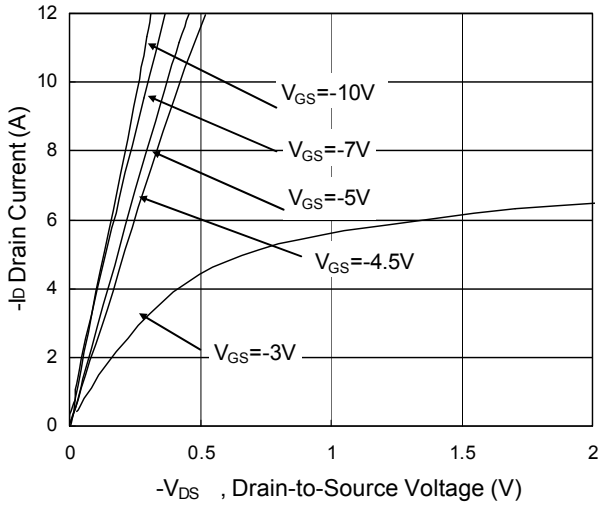



Fig.1 Typical Output Characteristics

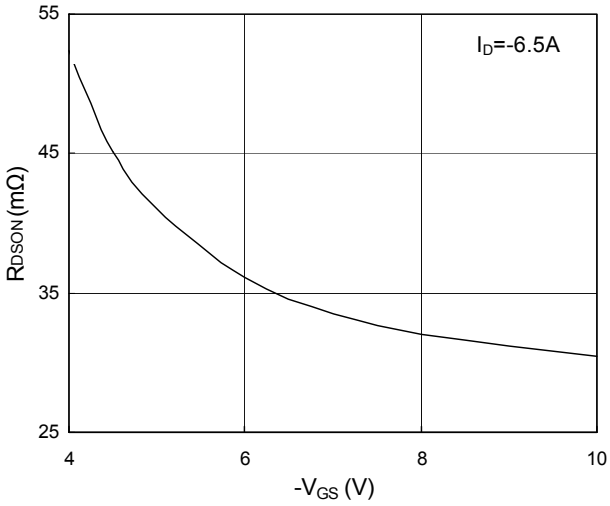



Fig.2 On-Resistance v.s Gate-Source

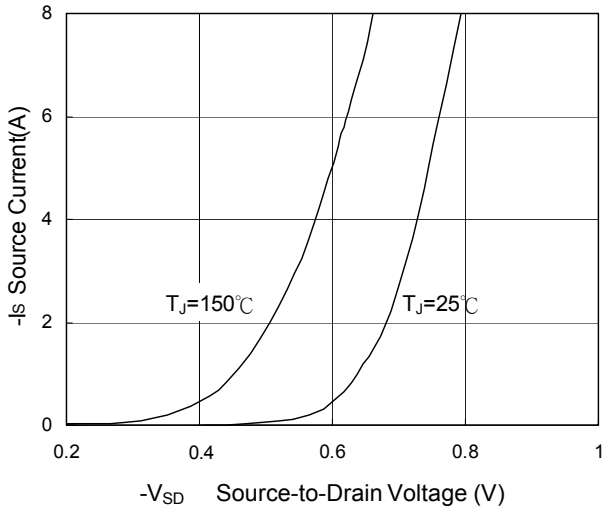



Fig.3 Forward Characteristics Of Reverse

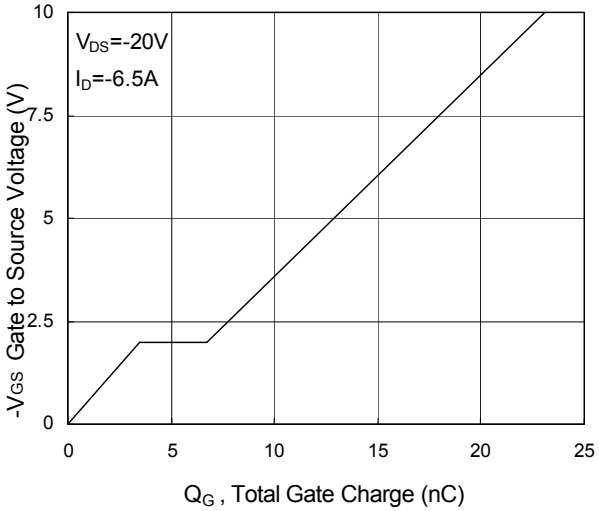



Fig.4 Gate Charge Characteristics

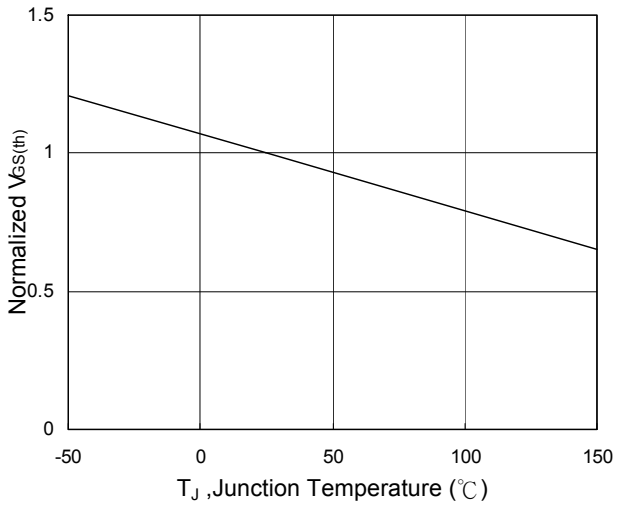



Fig.5 Normalized $V_{GS(th)}$ v.s $T_J$

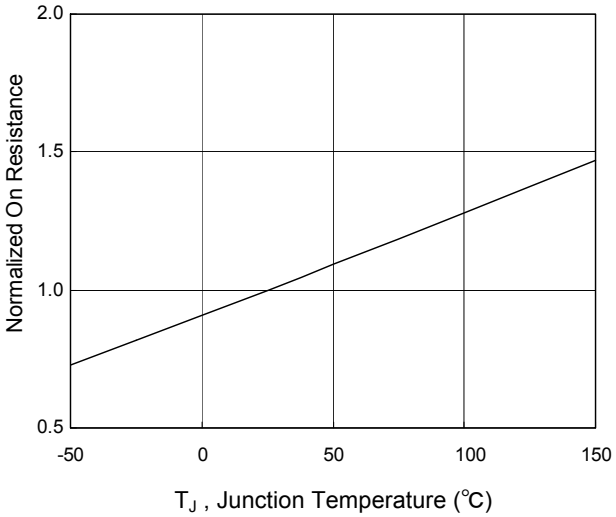



Fig.6 Normalized $R_{DSON}$ v.s $T_J$

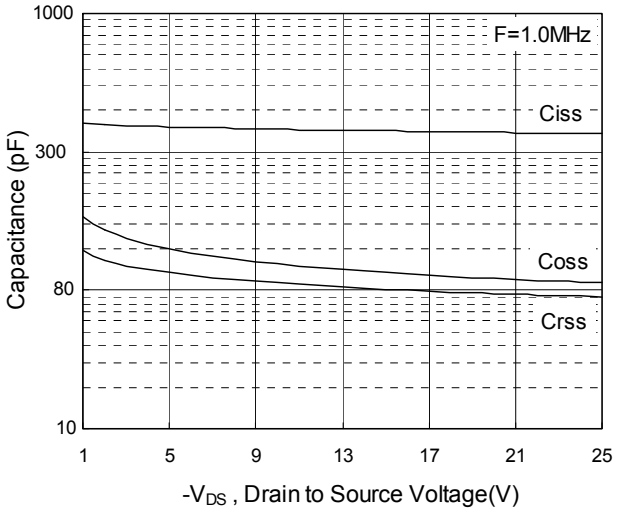



Fig.7 Capacitance

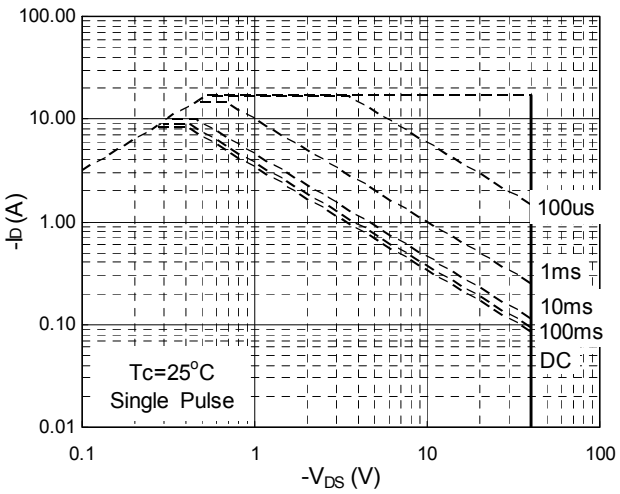



Fig.8 Safe Operating Area

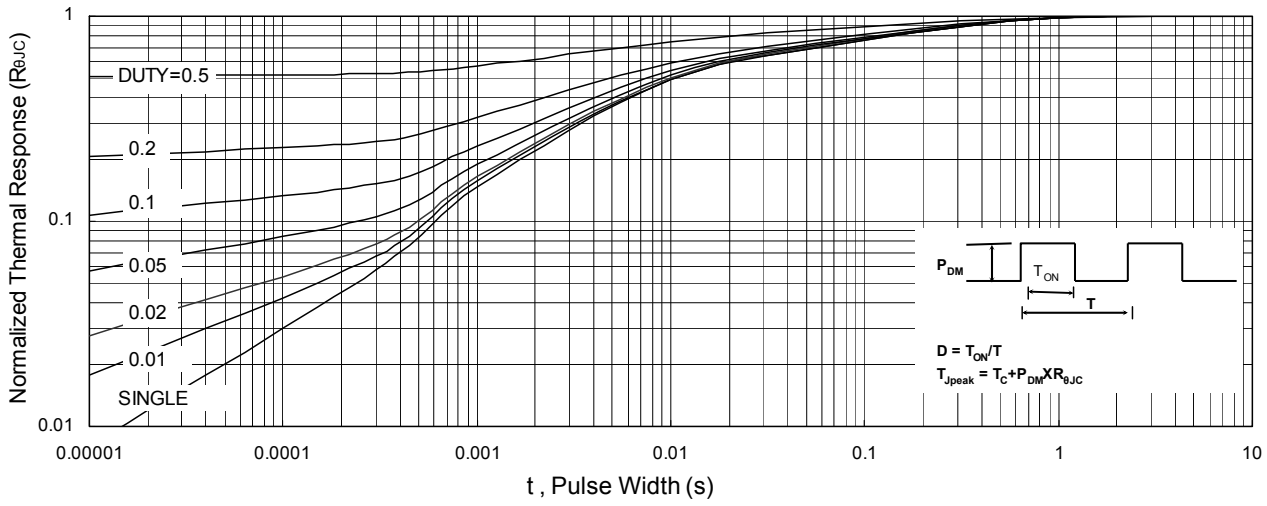



Fig.9 Normalized Maximum Transient Thermal Impedance

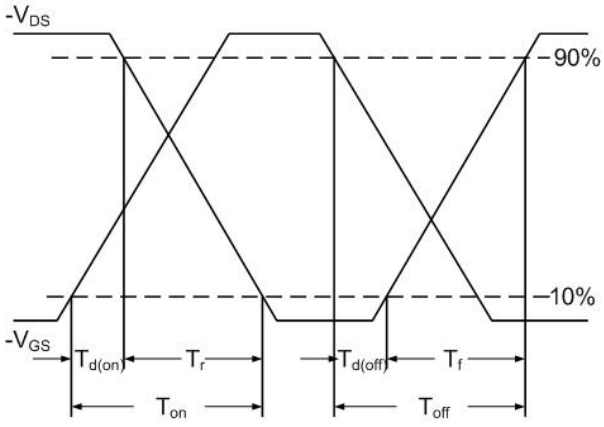



Fig.10 Switching Time Waveform

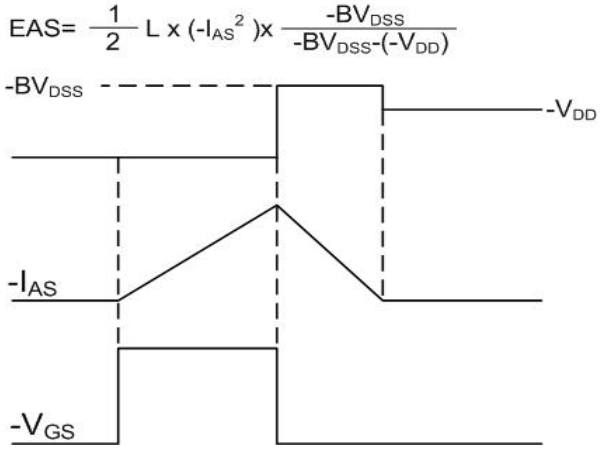



Fig.11 Unclamped Inductive Waveform

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