

## General Description

The WSP6039 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 WSP6039 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

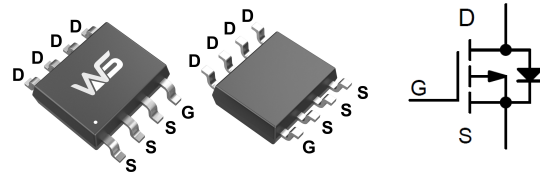
## Product Summary

| BVDSS | RDSON | ID    |
|-------|-------|-------|
| -60V  | 88mΩ  | -3.5A |

## Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- CCFL Back-light Inverter

## SOP-8 Pin Configuration



## Absolute Maximum Ratings

| Symbol               | Parameter                           | Rating     | Units      |
|----------------------|-------------------------------------|------------|------------|
| $V_{DS}$             | Drain-Source Voltage                | -60        | V          |
| $V_{GS}$             | Gate-Source Voltage                 | $\pm 20$   | V          |
| $I_D@T_C=25^\circ C$ | Continuous Drain Current            | -3.5       | A          |
| $I_D@T_C=70^\circ C$ | Continuous Drain Current            | -2.5       | A          |
| $I_{DP}$             | Pulsed Drain Current                | -17.5      | A          |
| $P_D@T_C=25^\circ C$ | Total Power Dissipation             | 2.0        | W          |
| $T_J/T_{STG}$        | Operating/Storage Temperature Range | -55 to 150 | $^\circ C$ |

## Thermal Data

| Symbol          | Parameter                           | Typ. | Max. | Unit         |
|-----------------|-------------------------------------|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient | ---  | 62   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case    | ---  | 4    | $^\circ C/W$ |

**P-Channel Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol       | Parameter                         | Conditions  | Min. | Typ.  | Max.      | Unit       |
|--------------|-----------------------------------|---|------|-------|-----------|------------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage    | $V_{GS}=0V, I_D=-250\mu A$  | -60  | ---   | ---       | V          |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=-10V, I_D=-4A$  | ---  | 88    | 114       | m $\Omega$ |
|              |                                   | $V_{GS}=-4.5V, I_D=-3A$   | ---  | 118   | 153       |            |
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{GS}=V_{DS}, I_D=-250\mu A$                                    | -1.0 | -1.65 | -3.0      | V          |
| $I_{DSS}$    | Drain-Source Leakage Current      | $V_{DS}=-60V, V_{GS}=0V$  | ---  | ---   | -1        | $\mu A$    |
| $I_{GSS}$    | Gate-Source Leakage Current       | $V_{GS}=\pm 20V, V_{DS}=0V$                                       | ---  | ---   | $\pm 100$ | nA         |
| $Q_g$        | Total Gate Charge (-4.5V)         | $V_{DS} = -30V, I_D = -3.7A,$<br>$V_{GS} = -10V$                  | ---  | 17    | ---       | nC         |
| $Q_{gs}$     | Gate-Source Charge                |   | ---  | 2     | ---       |            |
| $Q_{gd}$     | Gate-Drain Charge                 |   | ---  | 4     | ---       |            |
| $T_{d(on)}$  | Turn-On Delay Time                | $V_{DD} = -30V, I_D = -1A,$<br>$V_{GS} = -10V, R_{GEN} = 6\Omega$ | ---  | 11    | ---       | ns         |
| $T_r$        | Rise Time                         |   | ---  | 4.5   | ---       |            |
| $T_{d(off)}$ | Turn-Off Delay Time               |   | ---  | 50    | ---       |            |
| $T_f$        | Fall Time                         |   | ---  | 15    | ---       |            |
| $C_{iss}$    | Input Capacitance                 | $V_{DS} = -30V, V_{GS} = 0V, f = 1.0\text{ MHz}$                  | ---  | 615   | ---       | pF         |
| $C_{oss}$    | Output Capacitance                |   | ---  | 140   | ---       |            |
| $C_{rss}$    | Reverse Transfer Capacitance      |   | ---  | 45    | ---       |            |

**Diode Characteristics**

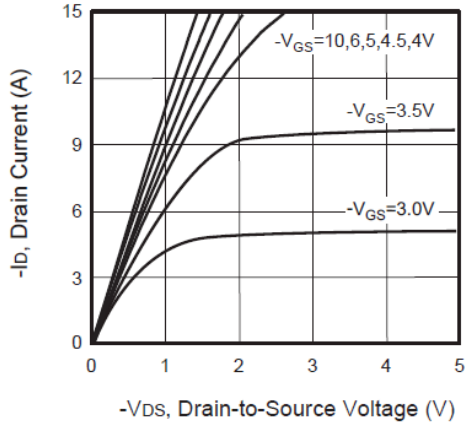
| Symbol   | Parameter                 | Conditions                                 | Min. | Typ. | Max. | Unit |
|----------|---------------------------|--|------|------|------|------|
| $I_S$    | Continuous Source Current | $V_G=V_D=0V$ , Force Current               | ---  | ---  | -3.5 | A    |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$ | ---  | ---  | -1.2 | V    |

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

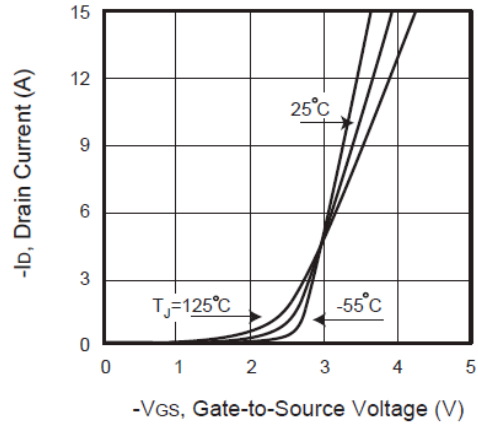
B: Repetitive rating, pulse width limited by junction temperature.

C: The current rating is based on the  $t_s \leq 10s$  junction to ambient thermal resistance rating

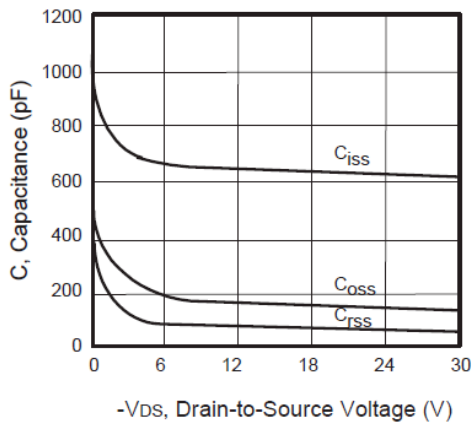
**P-Channel Typical Characteristics**



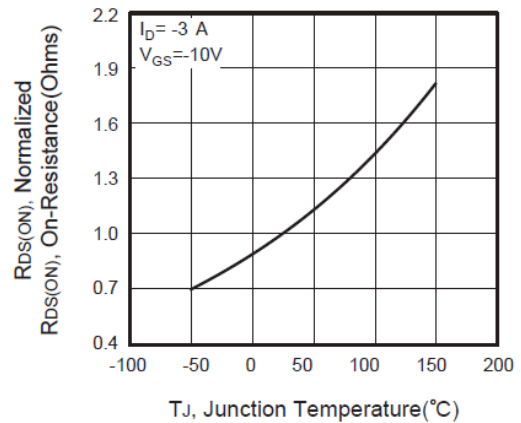
**Figure 1. Output Characteristics**



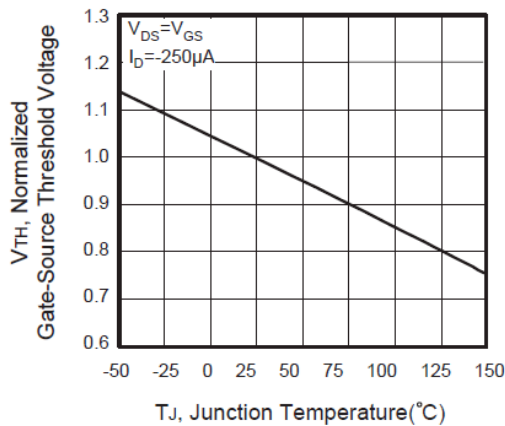
**Figure 2. Transfer Characteristics**



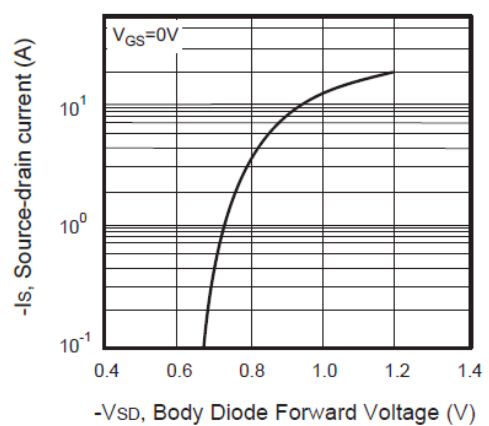
**Figure 3. Capacitance**



**Figure 4. On-Resistance Variation with Temperature**



**Figure 5. Gate Threshold Variation with Temperature**



**Figure 6. Body Diode Forward Voltage Variation with Source Current**

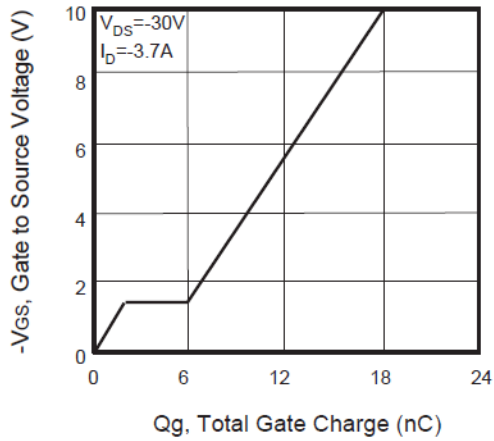


Figure 7. Gate Charge

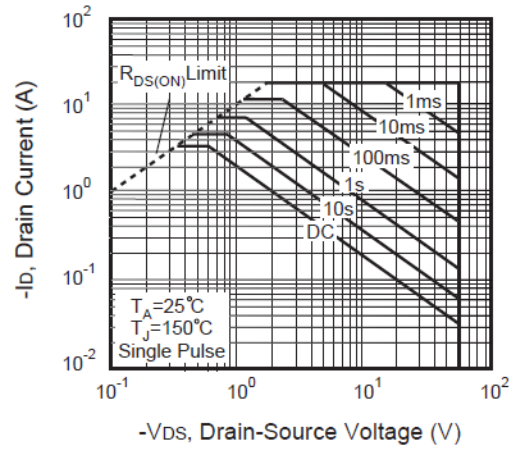


Figure 8. Maximum Safe Operating Area

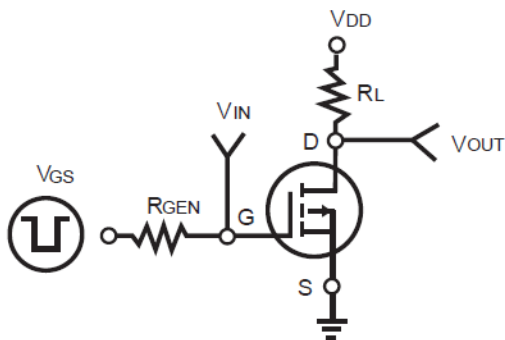


Figure 9. Switching Test Circuit

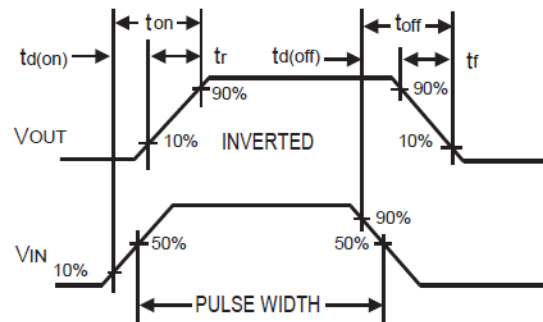


Figure 10. Switching Waveforms

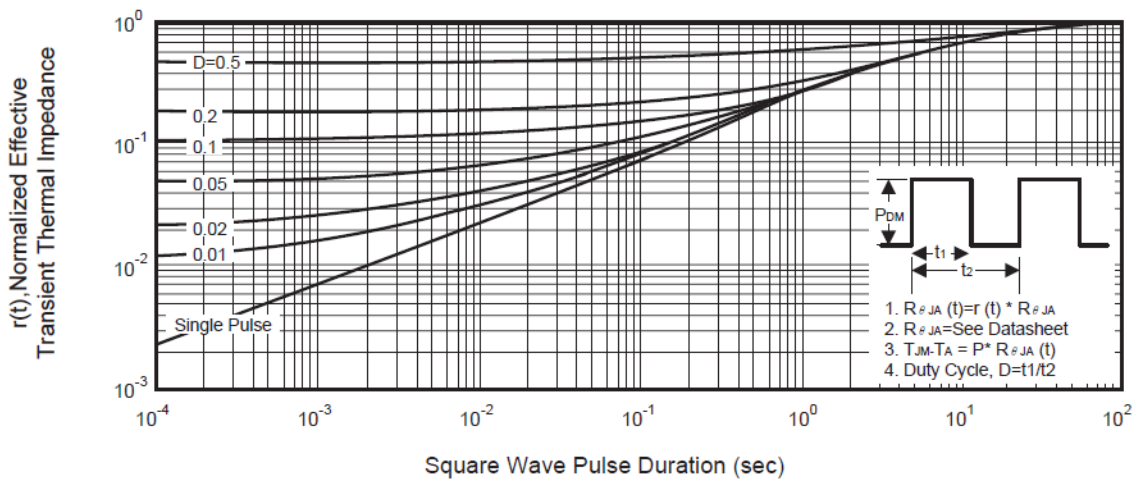


Figure 11. Normalized Thermal Transient Impedance Curve

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