

## General Description

The WSP6039 is the highest performance trench P-ch MOSFETs with extreme high cell density, which provide excellent R<sub>DS(on)</sub> 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

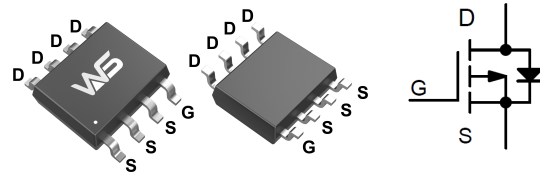
## Product Summary

| BVDSS | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------|---------------------|----------------|
| -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 <sub>DS</sub>                      | Drain-Source Voltage                | -60        | V     |
| V <sub>GS</sub>                      | Gate-Source Voltage                 | ±20        | V     |
| I <sub>D</sub> @T <sub>C</sub> =25°C | Continuous Drain Current            | -3.5       | A     |
| I <sub>D</sub> @T <sub>C</sub> =70°C | Continuous Drain Current            | -2.5       | A     |
| I <sub>DP</sub>                      | Pulsed Drain Current                | -17.5      | A     |
| P <sub>D</sub> @T <sub>C</sub> =25°C | Total Power Dissipation             | 2.0        | W     |
| T <sub>J</sub> /T <sub>STG</sub>     | Operating/Storage Temperature Range | -55 to 150 | °C    |

## Thermal Data

| Symbol           | Parameter                           | Typ. | Max. | Unit |
|------------------|-------------------------------------|------|------|------|
| R <sub>θJA</sub> | Thermal Resistance Junction-Ambient | ---  | 62   | °C/W |
| R <sub>θJC</sub> | Thermal Resistance Junction-Case    | ---  | 4    | °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**

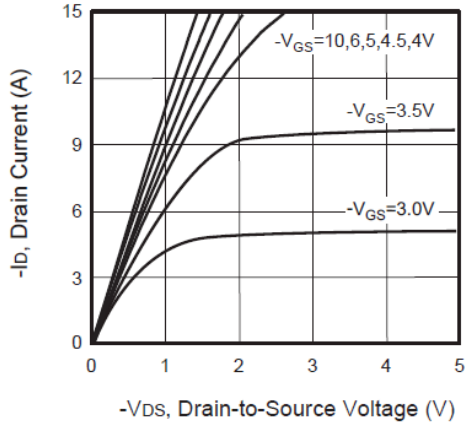
| Symbol   | Parameter                 | Conditions                                 | Min. | Typ. | Max. | Unit |
|----------|---------------------------|--|------|------|------|------|
| $I_S$    | Continuous Source Current | $V_G=V_D=0V$ , Force Current               | ---  | ---  | -3.5 | A    |
| $V_{SD}$ | 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.

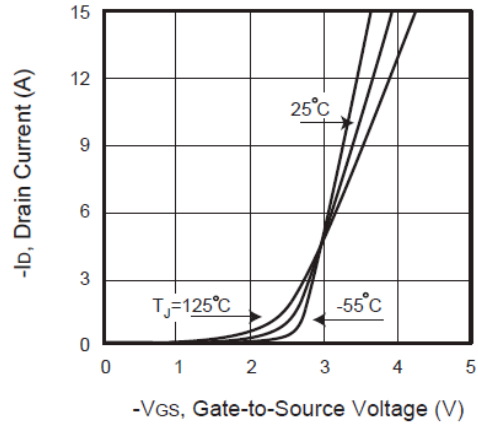
B: Repetitive rating, pulse width limited by junction temperature.

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

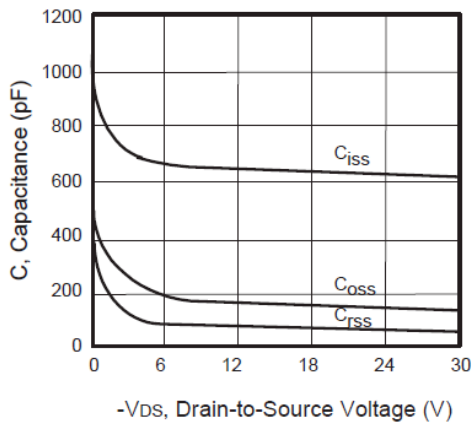
**P-Channel Typical Characteristics**



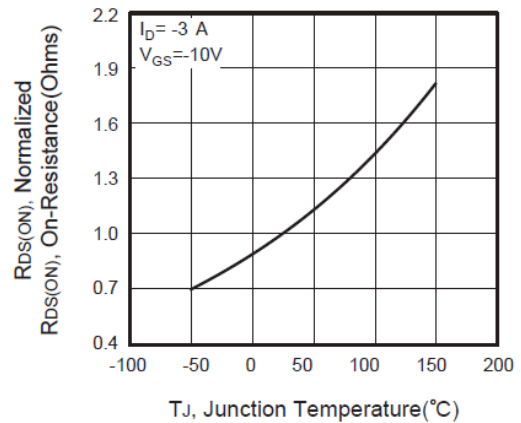
**Figure 1. Output Characteristics**



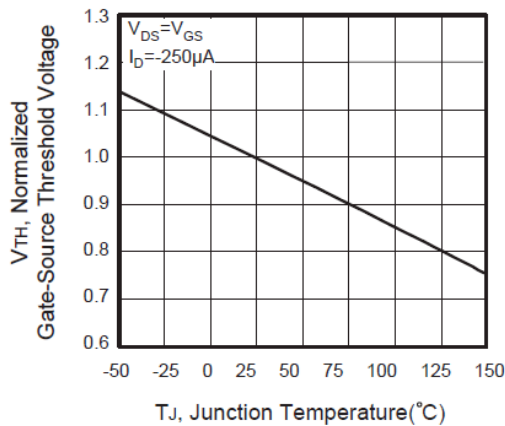
**Figure 2. Transfer Characteristics**



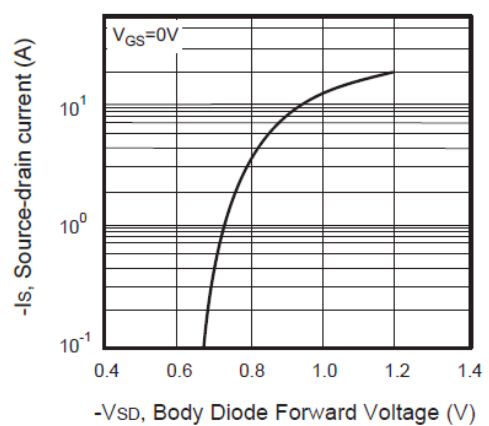
**Figure 3. Capacitance**



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



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



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

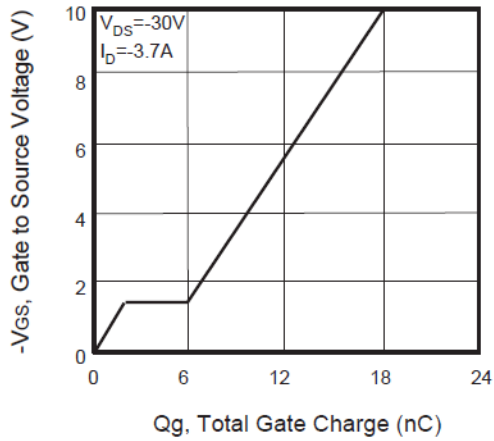


Figure 7. Gate Charge

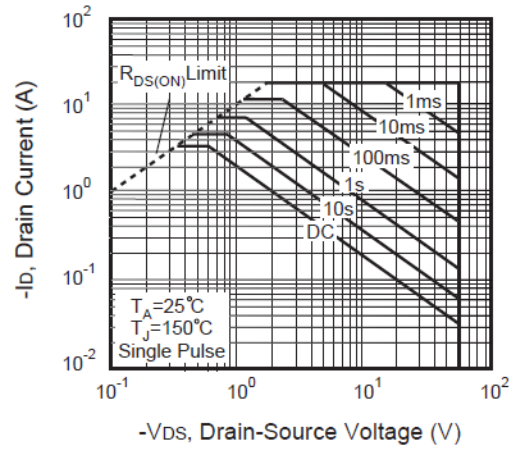


Figure 8. Maximum Safe Operating Area

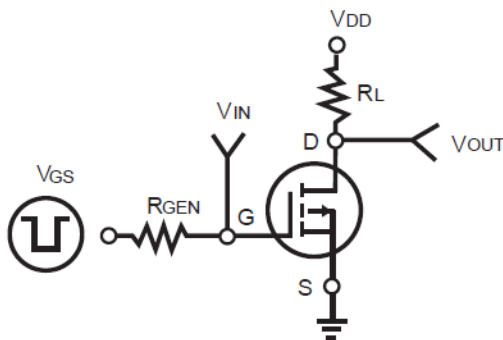


Figure 9. Switching Test Circuit

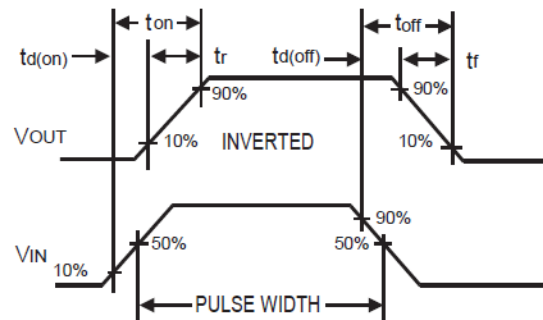


Figure 10. Switching Waveforms

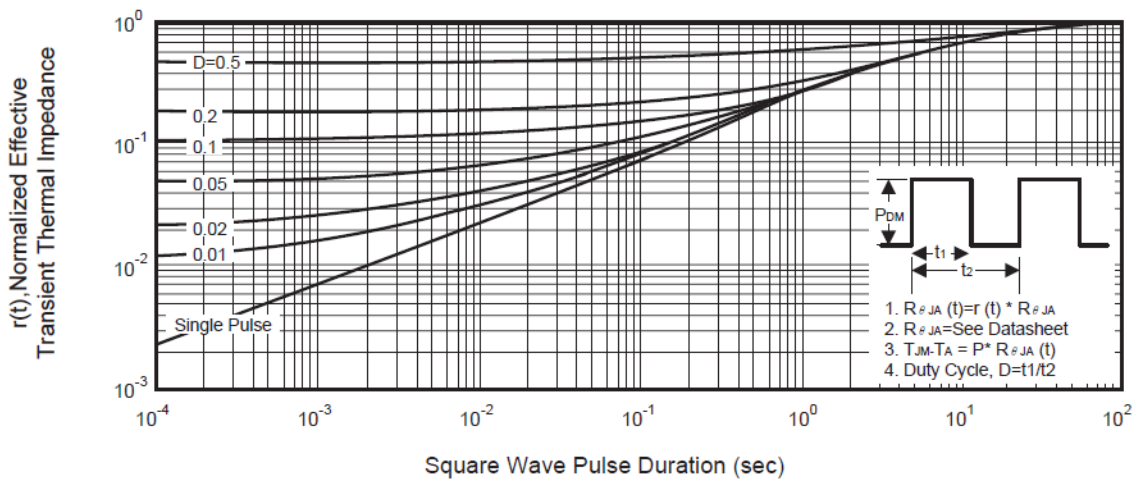


Figure 11. Normalized Thermal Transient Impedance Curve



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