

## General Description

The WSF40N10 is the highest performance trench N-Ch MOSFET 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 WSF40N10 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 C<sub>dv/dt</sub> effect decline
- Green Device Available

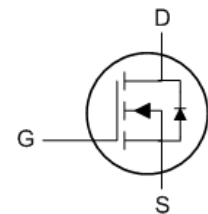
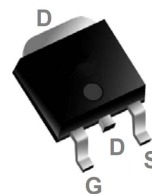
## Product Summary

| BVDSS | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------|---------------------|----------------|
| 100V  | 32mΩ                | 40A            |

## Applications

- High Frequency Point-of-Load Synchronous Buck Converter
- Networking DC-DC Power System
- Load Switch

## TO-252 Pin Configuration



## Absolute Maximum Ratings

| Symbol                                | Parameter  | Rating     | Units |
|---------------------------------------|--|------------|-------|
| V <sub>DS</sub>                       | Drain-Source Voltage   | 100        | V     |
| V <sub>GS</sub>                       | Gate-Source Voltage  | ±20        | V     |
| I <sub>D</sub> @T <sub>C</sub> =25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 40         | A     |
| I <sub>D</sub> @T <sub>C</sub> =100°C | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 30         | A     |
| I <sub>D</sub> @T <sub>A</sub> =25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 4.2        | A     |
| I <sub>D</sub> @T <sub>A</sub> =70°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup> | 3.4        | A     |
| I <sub>DM</sub>                       | Pulsed Drain Current <sup>2</sup>                            | 45         | A     |
| EAS                                   | Single Pulse Avalanche Energy <sup>3</sup>                   | 43.3       | mJ    |
| I <sub>AS</sub>                       | Avalanche Current  | 27         | A     |
| P <sub>D</sub> @T <sub>C</sub> =25°C  | Total Power Dissipation <sup>4</sup>                         | 52.1       | W     |
| P <sub>D</sub> @T <sub>A</sub> =25°C  | Total Power Dissipation <sup>4</sup>                         | 2          | W     |
| T <sub>STG</sub>                      | Storage Temperature Range                                    | -55 to 150 | °C    |
| T <sub>J</sub>                        | Operating Junction Temperature Range                         | -55 to 150 | °C    |

## Thermal Data

| Symbol           | Parameter  | Typ. | Max. | Unit |
|------------------|--|------|------|------|
| R <sub>θJA</sub> | Thermal Resistance Junction-ambient <sup>1</sup> | ---  | 62   | °C/W |
| R <sub>θJC</sub> | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 2.4  | °C/W |

**Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

| Symbol                              | Parameter                                      | Conditions  | Min. | Typ.  | Max. | Unit  |
|-------------------------------------|--|---|------|-------|------|-------|
| BV <sub>DSS</sub>                   | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA  | 100  | ---   | ---  | V     |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | BVDSS Temperature Coefficient                  | Reference to 25°C, I <sub>D</sub> =1mA  | ---  | 0.098 | ---  | V/°C  |
| R <sub>DS(ON)</sub>                 | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A   | ---  | 32    | 38   | mΩ    |
|                                     |  | V <sub>GS</sub> =6.0V, I <sub>D</sub> =15A  | ---  | 40    | 58   |       |
| V <sub>GS(th)</sub>                 | Gate Threshold Voltage                         | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                                | 2.0  | 3.0   | 4.0  | V     |
| ΔV <sub>GS(th)</sub>                | V <sub>GS(th)</sub> Temperature Coefficient    |   | ---  | -5.52 | ---  | mV/°C |
| I <sub>DSS</sub>                    | Drain-Source Leakage Current                   | V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                         | ---  | ---   | 10   | uA    |
|                                     |  | V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C                         | ---  | ---   | 100  |       |
| I <sub>GSS</sub>                    | Gate-Source Leakage Current                    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  | ---  | ---   | ±100 | nA    |
| g <sub>fs</sub>                     | Forward Transconductance                       | V <sub>DS</sub> =5V, I <sub>D</sub> =20A  | ---  | 28.7  | ---  | S     |
| R <sub>g</sub>                      | Gate Resistance                                | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz  | ---  | 1.6   | 3.2  | Ω     |
| Q <sub>g</sub>                      | Total Gate Charge (10V)                        | V <sub>DS</sub> =80V, V <sub>GS</sub> =10V, I <sub>D</sub> =20A                         | ---  | 60    | 84   | nC    |
| Q <sub>gs</sub>                     | Gate-Source Charge                             |   | ---  | 9.7   | 14   |       |
| Q <sub>gd</sub>                     | Gate-Drain Charge                              |   | ---  | 11.8  | 16.5 |       |
| T <sub>d(on)</sub>                  | Turn-On Delay Time                             | V <sub>DD</sub> =50V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω<br>I <sub>D</sub> =20A | ---  | 10.4  | 21   | ns    |
| T <sub>r</sub>                      | Rise Time                                      |   | ---  | 46    | 83   |       |
| T <sub>d(off)</sub>                 | Turn-Off Delay Time                            |   | ---  | 54    | 108  |       |
| T <sub>f</sub>                      | Fall Time                                      |   | ---  | 10    | 20   |       |
| C <sub>iss</sub>                    | Input Capacitance                              | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz                                       | ---  | 3848  | ---  | pF    |
| C <sub>oss</sub>                    | Output Capacitance                             |   | ---  | 137   | ---  |       |
| C <sub>riss</sub>                   | Reverse Transfer Capacitance                   |   | ---  | 82    | ---  |       |

**Guaranteed Avalanche Characteristics**

| Symbol | Parameter                                  | Conditions  | Min. | Typ. | Max. | Unit |
|--------|--|---|------|------|------|------|
| EAS    | Single Pulse Avalanche Energy <sup>5</sup> | V <sub>DD</sub> =25V, L=0.1mH, I <sub>AS</sub> =15A | 13.4 | ---  | ---  | mJ   |

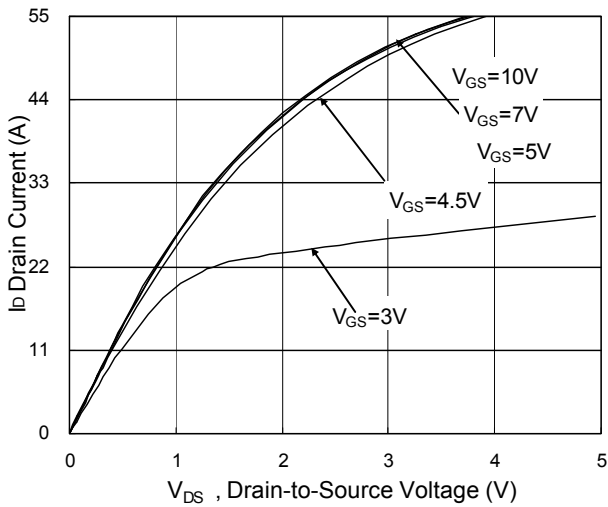
**Diode Characteristics**

| Symbol          | Parameter                                | Conditions  | Min. | Typ. | Max. | Unit |
|-----------------|--|---|------|------|------|------|
| I <sub>S</sub>  | Continuous Source Current <sup>1,6</sup> | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current             | ---  | ---  | 12   | A    |
| I <sub>SM</sub> | Pulsed Source Current <sup>2,6</sup>     |   | ---  | ---  | 45   | A    |
| V <sub>SD</sub> | Diode Forward Voltage <sup>2</sup>       | V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C | ---  | ---  | 1.2  | V    |
| t <sub>rr</sub> | Reverse Recovery Time                    | I <sub>F</sub> =20A, dI/dt=100A/μs, T <sub>J</sub> =25°C      | ---  | 30   | ---  | nS   |
| Q <sub>rr</sub> | Reverse Recovery Charge                  |   | ---  | 37   | ---  | nC   |

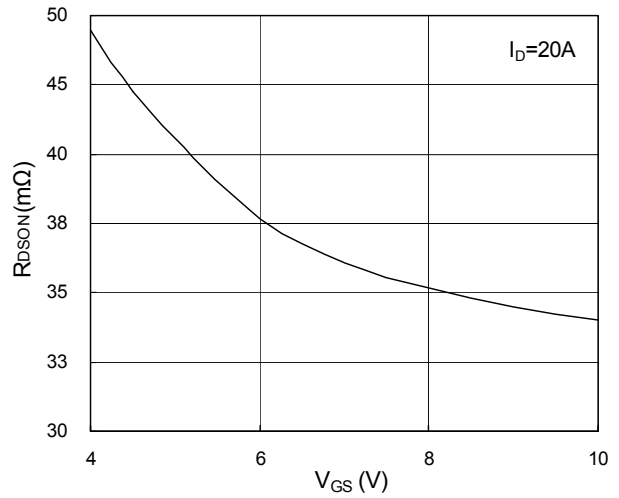
Note :

- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper, t<10sec.
- The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=25V, V<sub>GS</sub>=10V, L=0.1mH, I<sub>AS</sub>=15A
- The power dissipation is limited by 150°C junction temperature
- The Min. value is 100% EAS tested guarantee.
- The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

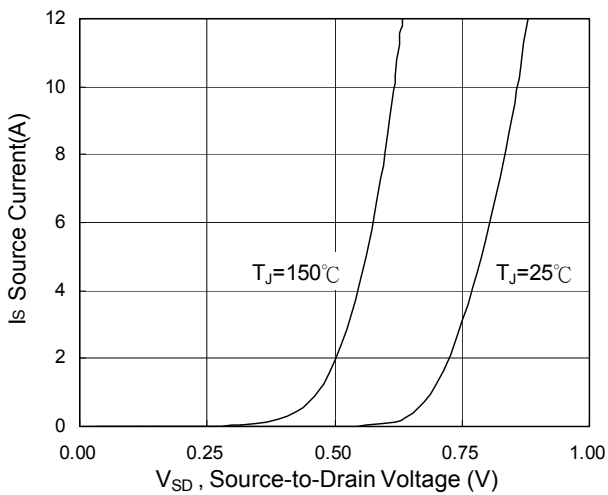
**Typical Characteristics**



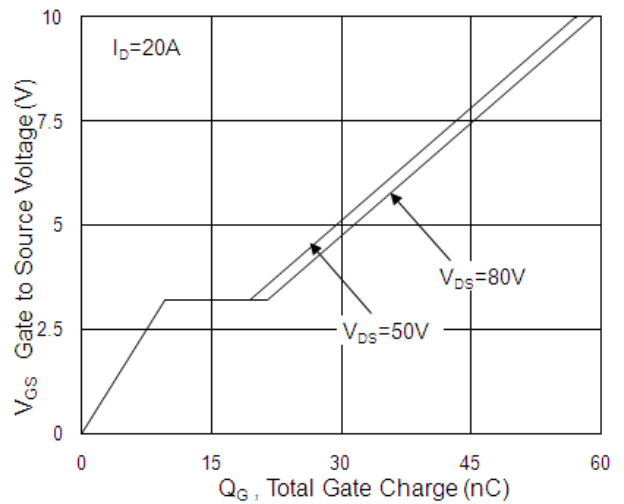
**Fig.1 Typical Output Characteristics**



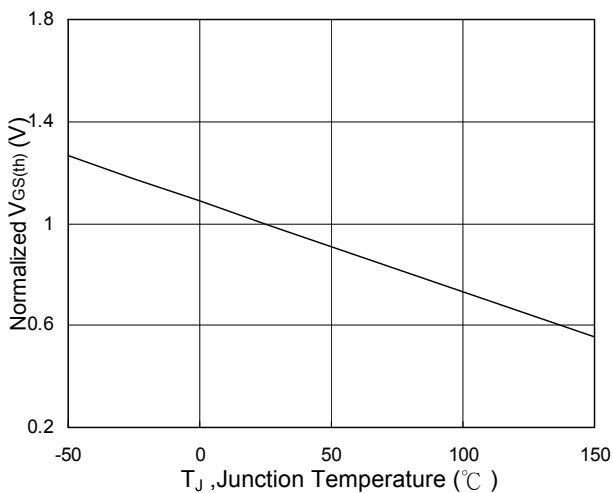
**Fig.2 On-Resistance vs. Gate-Source**



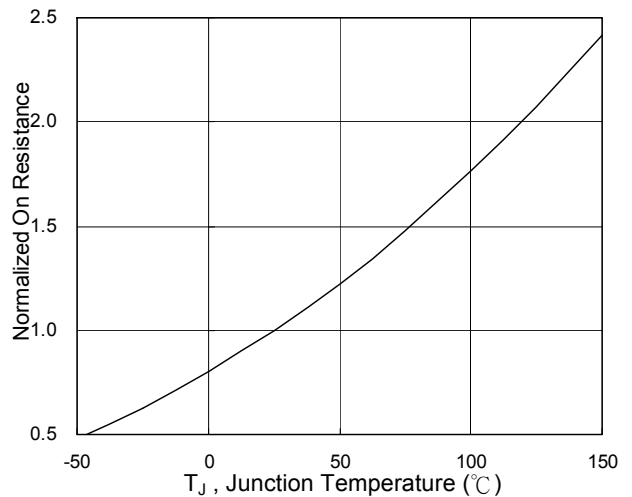
**Fig.3 Forward Characteristics Of Reverse**



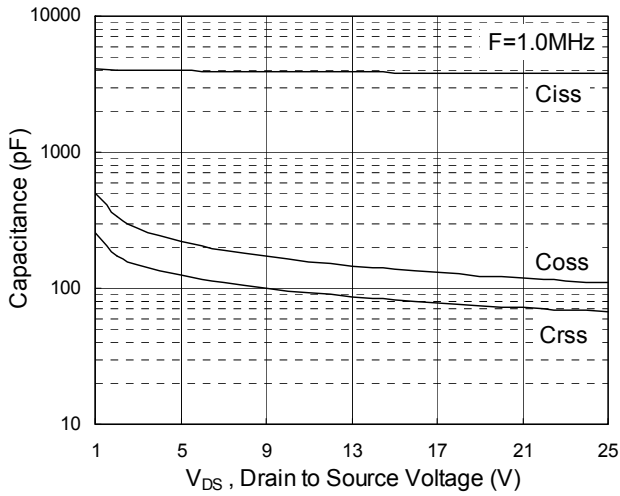
**Fig.4 Gate-Charge Characteristics**



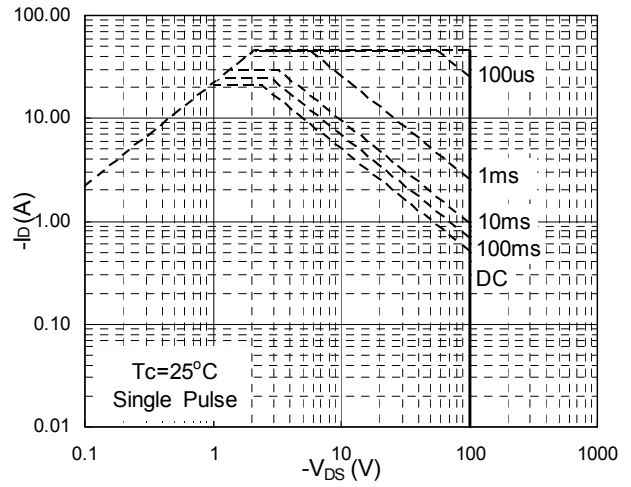
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



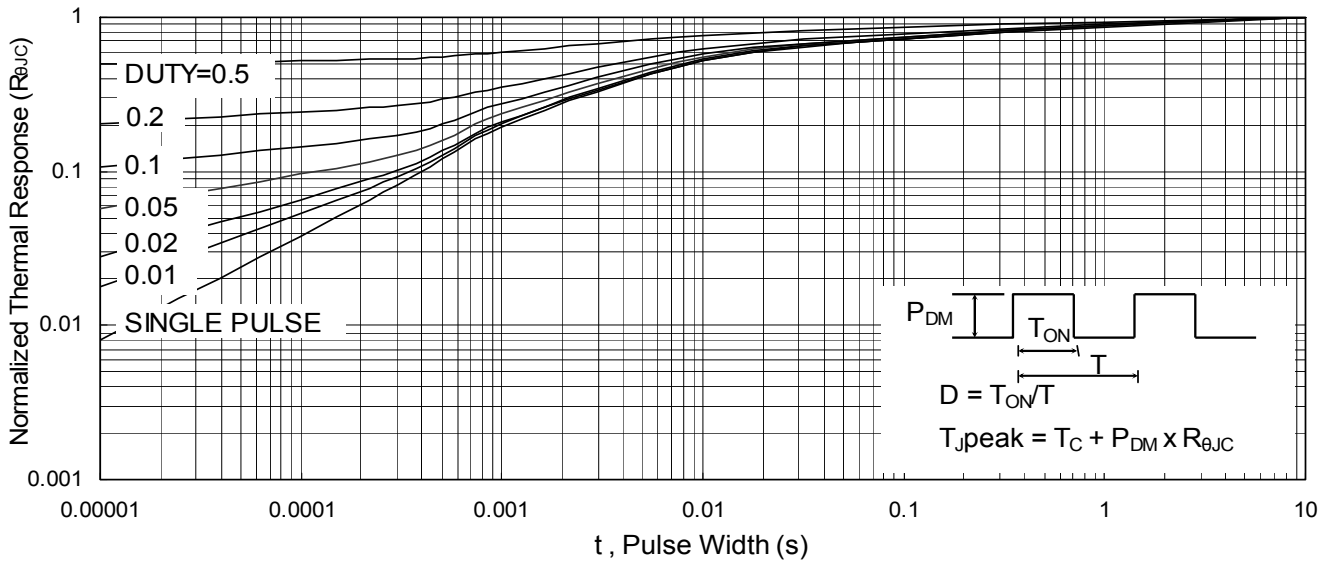
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



**Fig.7 Capacitance**



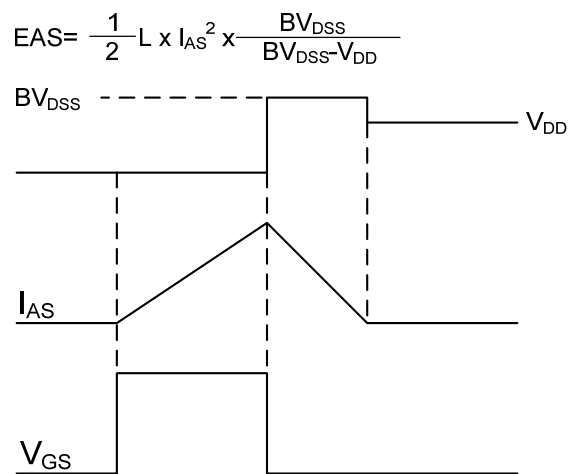
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**



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