

# EVVOSEMI<sup>®</sup>

THINK CHANGE DO



ESD



TVS



MOS



LDO



Diode



Sensor



DC-DC

## Product Specification

|              |             |                |
|--------------|-------------|----------------|
| ▶ Domestic   | Part Number | EV-IRF9540N-T3 |
| ▶ Overseas   | Part Number | IRF9540N       |
| ▶ Equivalent | Part Number | IRF9540N       |

"T3" means TO-220

EV is the abbreviation of name EVVO

## P-Channel MOSFET

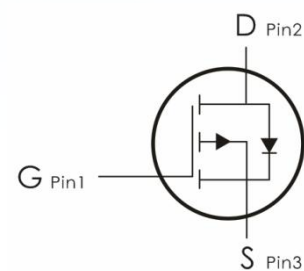
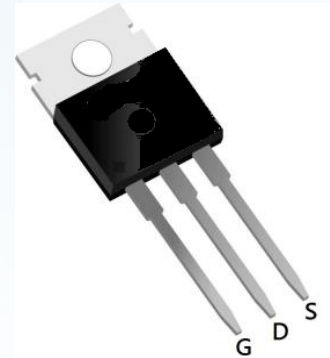
### Description:

This P-Channel MOSFET uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge.

It can be used in a wide variety of applications.

### Features:

- 1)  $V_{DS}=-100V, I_D=-20A, R_{DS(on)}<90m\ \Omega$  @  $V_{GS}=-10V$
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra low  $R_{DS(on)}$ .
- 5) Excellent package for good heat dissipation.



### Absolute Maximum Ratings: ( $T_C=25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter                                         | Ratings     | Units            |
|----------------|---------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain-Source Voltage                              | -100        | V                |
| $V_{GS}$       | Gate-Source Voltage                               | $\pm 20$    | V                |
| $I_D$          | Continuous Drain Current- $T_C=25^\circ\text{C}$  | -20         | A                |
|                | Continuous Drain Current- $T_C=100^\circ\text{C}$ | -14         | A                |
| $I_{DM}$       | Pulsed Drain Current <sup>1</sup>                 | -85         | A                |
| $P_D$          | Total Power Dissipation                           | 58          | W                |
| $E_{AS}$       | Single Pulsed Avalanche Energy                    | 177         | mJ               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range  | -55 to +150 | $^\circ\text{C}$ |

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## Thermal Characteristics:

| Symbol          | Parameter                            | Max  | Units                       |
|-----------------|--------------------------------------|------|-----------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 2.15 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient  | 62   | $^{\circ}\text{C}/\text{W}$ |

Electrical Characteristics: ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

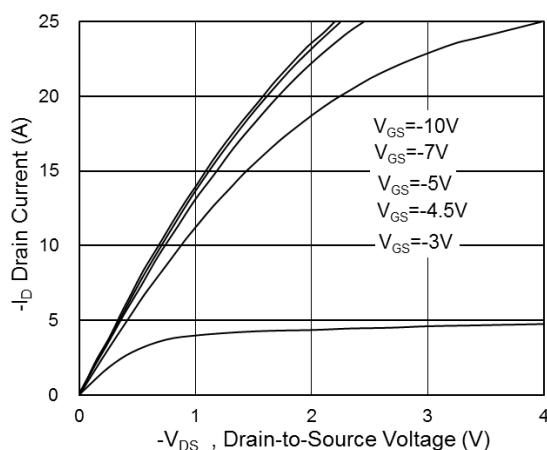
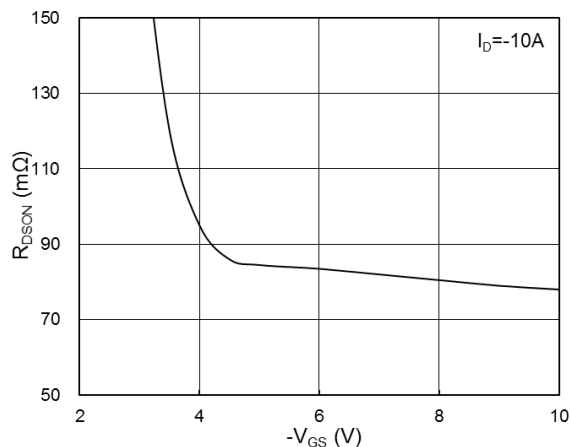
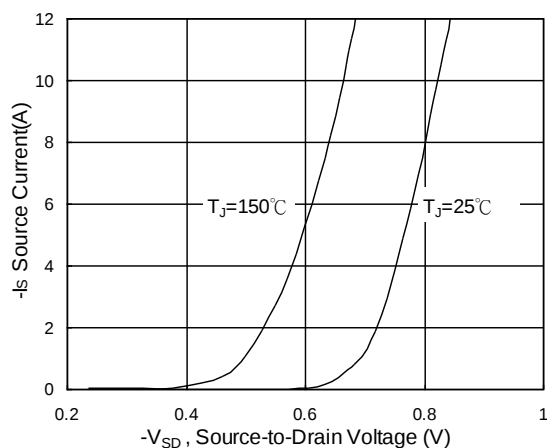
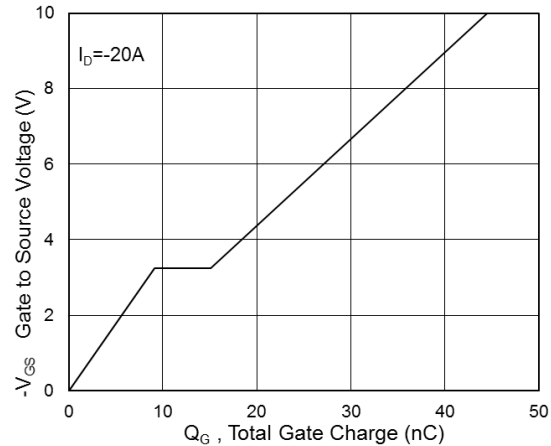
| Symbol                    | Parameter                          | Conditions                                                                                   | Min  | Typ  | Max   | Units |
|---------------------------|------------------------------------|----------------------------------------------------------------------------------------------|------|------|-------|-------|
| Off Characteristics       |                                    |                                                                                              |      |      |       |       |
| BV <sub>DSS</sub>         | Drain-Sourctce Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>D</sub> =-250 μ A                                                | -100 | ---  | ---   | V     |
| I <sub>DSS</sub>          | Zero Gate Voltage Drain Current    | V <sub>GS</sub> =0V, V <sub>DS</sub> =-100V                                                  | ---  | ---  | -50   | μ A   |
| I <sub>GSS</sub>          | Gate-Source Leakage Current        | V <sub>GS</sub> = ± 20V, V <sub>DS</sub> =0A                                                 | ---  | ---  | ± 100 | nA    |
| On Characteristics        |                                    |                                                                                              |      |      |       |       |
| V <sub>GS(th)</sub>       | GATE-Source Threshold Voltage      | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250 μ A                                  | -1.2 | -1.7 | -2.5  | V     |
| R <sub>DS(on)</sub>       | Static Drain-Source On-Resistance  | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                                  | ---  | 78   | 90    | m Ω   |
|                           |                                    | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-8A                                                  | ---  | 86   | 110   |       |
| Dynamic Characteristics   |                                    |                                                                                              |      |      |       |       |
| C <sub>iss</sub>          | Input Capacitance                  | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz                                           | ---  | 3020 | ---   | pF    |
| C <sub>oss</sub>          | Output Capacitance                 |                                                                                              | ---  | 120  | ---   |       |
| C <sub>rss</sub>          | Reverse Transfer Capacitance       |                                                                                              | ---  | 73   | ---   |       |
| Switching Characteristics |                                    |                                                                                              |      |      |       |       |
| t <sub>d(on)</sub>        | Turn-On Delay Time <sup>2,3</sup>  | V <sub>DD</sub> =-50V, I <sub>D</sub> =-10A,<br>V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3 Ω | ---  | 11   | ---   | ns    |
| t <sub>r</sub>            | Rise Time <sup>2,3</sup>           |                                                                                              | ---  | 27   | ---   | ns    |
| t <sub>d(off)</sub>       | Turn-Off Delay Time <sup>2,3</sup> |                                                                                              | ---  | 78   | ---   | ns    |
| t <sub>f</sub>            | Fall Time <sup>2,3</sup>           |                                                                                              | ---  | 53   | ---   | ns    |
| Q <sub>g</sub>            | Total Gate Charge <sup>2,3</sup>   | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-50V,                                                | ---  | 44   | ---   | nC    |

## P-Channel MOSFET

|                                    |                                           |                                                               |     |      |      |    |
|------------------------------------|-------------------------------------------|---------------------------------------------------------------|-----|------|------|----|
| <b>Q<sub>gs</sub></b>              | Gate-Source Charge <sup>2,3</sup>         | I <sub>D</sub> =-20A                                          | --- | 9    | ---  | nC |
| <b>Q<sub>gd</sub></b>              | Gate-Drain “Miller” Charge <sup>2,3</sup> |                                                               | --- | 5.5  | ---  | nC |
| Drain-Source Diode Characteristics |                                           |                                                               |     |      |      |    |
| <b>V<sub>sD</sub></b>              | Drain Diode Forward Voltage <sup>2</sup>  | V <sub>GS</sub> =0V,I <sub>S</sub> =-1A                       | --- | ---  | -1.2 | V  |
| <b>I<sub>S</sub></b>               | Continuous Source Current <sup>1,5</sup>  | V <sub>G</sub> =V <sub>D</sub> =0V , Force Current            | --- | ---  | -20  | A  |
| <b>T<sub>rr</sub></b>              | Reverse Recovery Time                     | I <sub>F</sub> =-8A , di/dt=-100A/μs ,<br>T <sub>J</sub> =25℃ | --- | 38.7 | ---  | nS |
| <b>Q<sub>rr</sub></b>              | Reverse Recovery Charge                   |                                                               | --- | 22.4 | ---  | nC |

**Notes:**

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is  $V_{DD}=-25V, V_{GS}=-10V, L=0.88mH, I_{AS}=-18.9A$
4. The power dissipation is limited by 150°C junction temperature
5. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

**Typical Characteristics:** ( $T_C=25^\circ C$  unless otherwise noted)**Fig.1 Typical Output Characteristics****Fig.2 On-Resistance vs G-S Voltage****Fig.3 Typical S-D Diode Forward Voltage****Fig.4 Gate-Charge Characteristics**

## P-Channel MOSFET

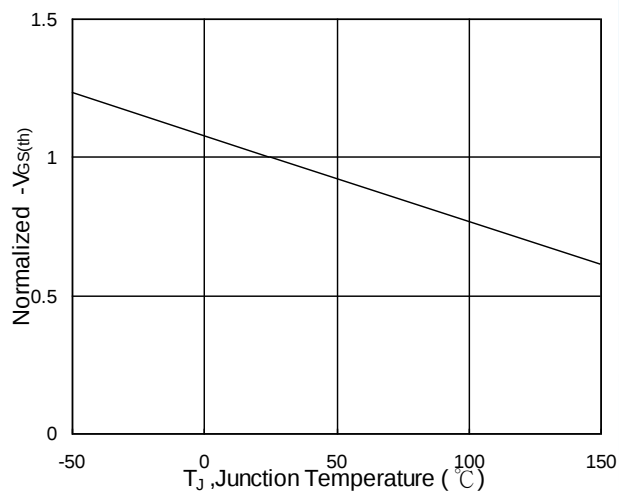
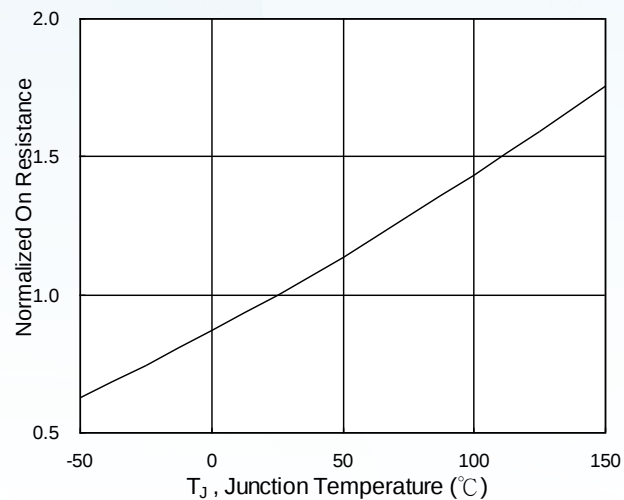
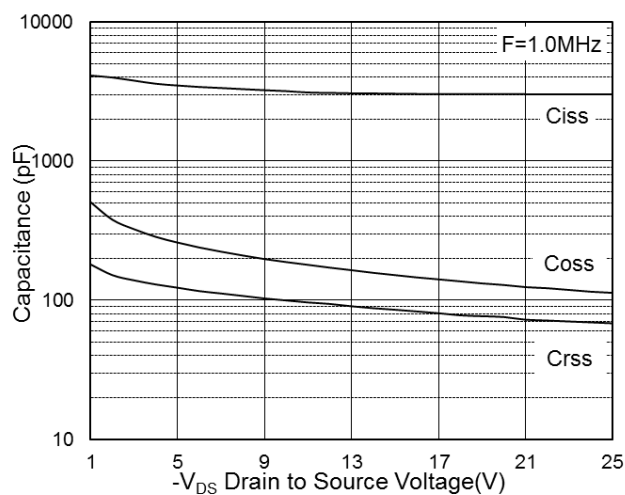
Fig.5 Normalized  $V_{GS(th)}$  vs  $T_J$ Fig.6 Normalized  $R_{DS(on)}$  vs  $T_J$ 

Fig.7 Capacitance

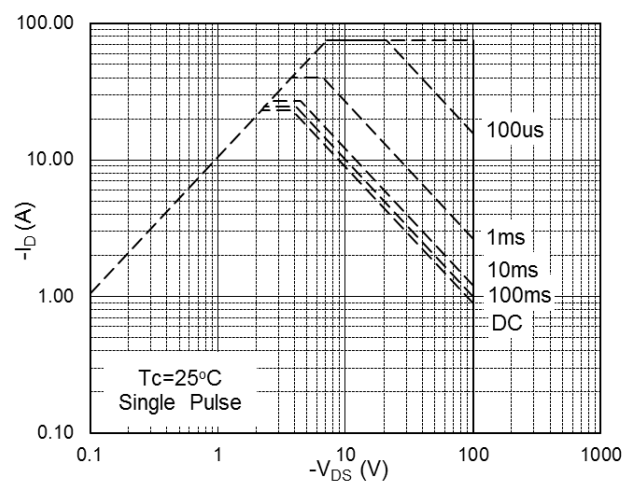


Fig.8 Safe Operating Area

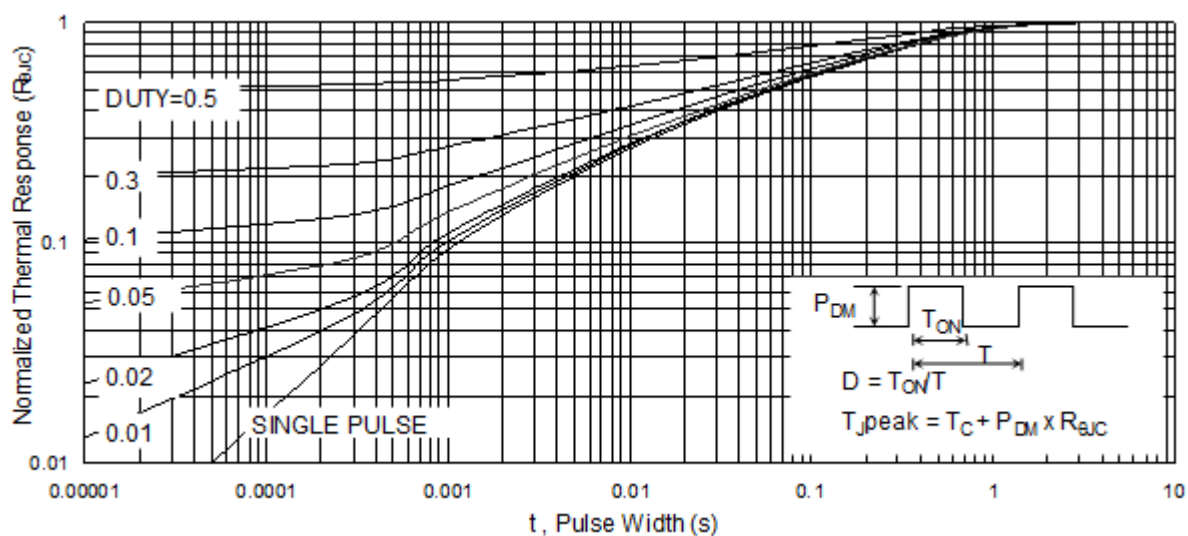


Fig.9 Normalized Maximum Transient Thermal Impedance

## P-Channel MOSFET

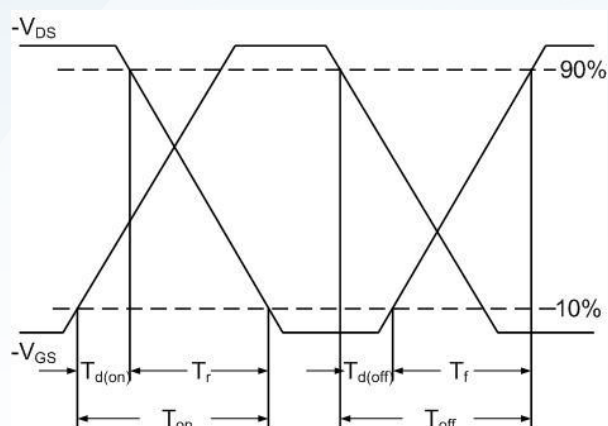


Fig.10 Switching Time Waveform

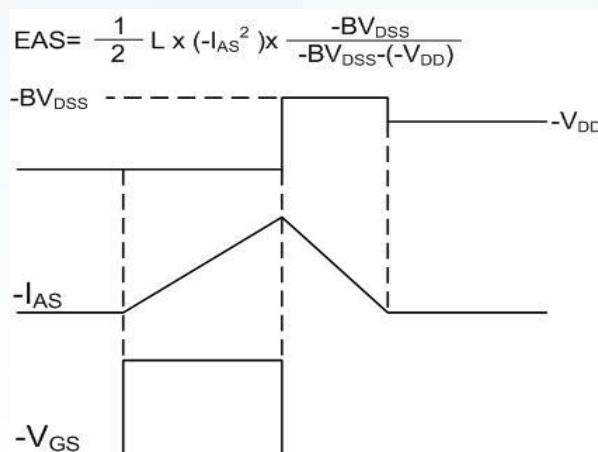
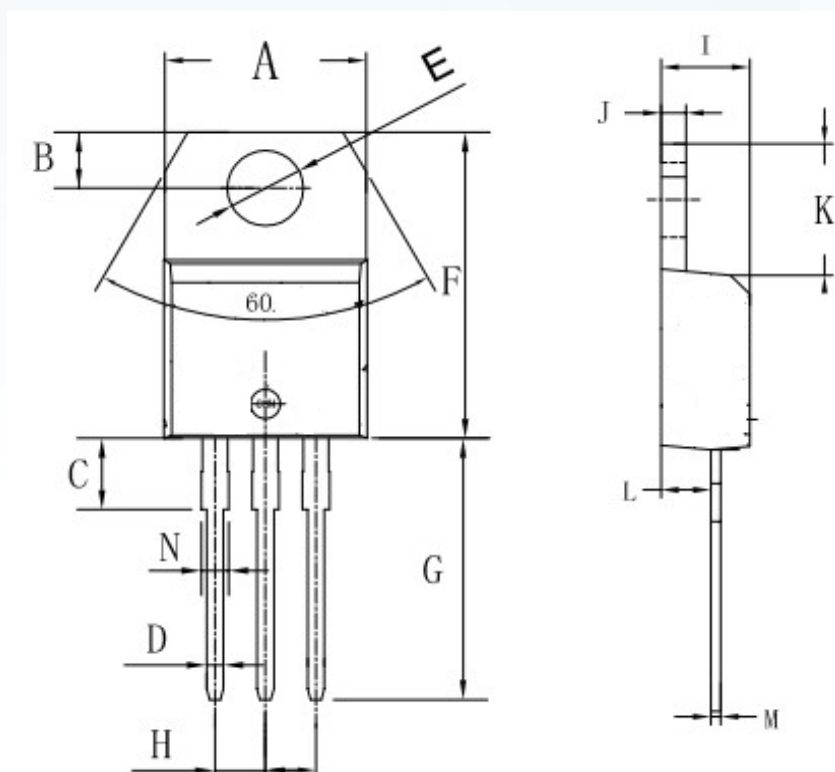


Fig.11 Unclamped Inductive Waveform

## P-Channel MOSFET

## Package Dimensions



| Symbol | Dimensions In Millimeters |      | Dimensions In Inches |       |
|--------|---------------------------|------|----------------------|-------|
|        | Min                       | Max  | Min                  | Max   |
| A      | 9.8                       | 10.4 | 0.385                | 0.409 |
| B      | 2.65                      | 3.1  | 0.104                | 0.122 |
| C      | 2.8                       | 4.2  | 0.110                | 0.165 |
| D      | 0.7                       | 0.92 | 0.027                | 0.036 |
| E      | 3.75                      | 3.95 | 0.147                | 0.155 |
| F      | 14.8                      | 16.1 | 0.582                | 0.633 |
| G      | 13.05                     | 13.6 | 0.513                | 0.535 |
| H      | 2.4                       | 2.7  | 0.094                | 0.106 |
| I      | 4.38                      | 4.61 | 0.172                | 0.181 |
| J      | 1.15                      | 1.36 | 0.045                | 0.053 |
| K      | 5.85                      | 6.82 | 0.230                | 0.268 |
| L      | 2.35                      | 2.75 | 0.092                | 0.108 |
| M      | 0.35                      | 0.65 | 0.013                | 0.025 |
| N      | 1.18                      | 1.42 | 0.046                | 0.055 |

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