## General Description

The WSP4636 is the highest performance trench N+P-Channel MOSFET with extreme high cell density, which provide excellent $R_{DS(ON)}$ and gate charge for most of the synchronous buck converter applications.

The WSP4636 meet the RoHS and Green Product requirement, 100% $E_{AS}$ guaranteed with full function reliability approved.

## Product Summery

| $BV_{DSS}$ | $R_{DS(ON)}$ | $I_D$ |
|---|---|---|
| 30V | 18.7mΩ | 8A |
| -30V | 22mΩ | -7A |

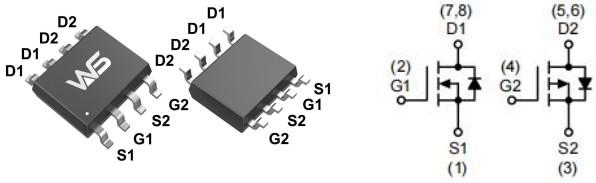
## Features

- 100% UIS Tested.
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

## Applications

- Synchronous Rectification.
- Motor control.

## SOP-8L Pin Configuration




## Absolute Maximum Ratings ($T_A$=25°C, Unless Otherwise Noted)

| Symbol | Parameter | | Rating | | Units |
|---|---|---|---|---|---|
| | | | N-Ch | P-Ch | |
| $V_{DS}$ | Drain-Source Voltage | | 30 | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±20 | ±20 | |
| $I_D$ [7] | Continuous Drain Current | $T_C$=25°C | 8 | -7 | A |
| | | $T_C$=100°C | 6.3 | -5.6 | |
| $I_{DM}$ [3] | Pulse Drain Current | | 32 | -28 | |
| $P_D$ [2] | Power Dissipation | $T_C$=25°C | 2.08 | 2.08 | W |
| | | $T_C$=100°C | 1.33 | 1.33 | |
| $I_{AS}$ [3] | Single pulse Avalanche Current | | 7.2 | 11 | A |
| $E_{AS}$ [3] | Single pulse Avalanche Energy | L=0.3mH | 13 | 30 | mJ |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | | -55 to 150 | -55 to 150 | |
| $R_{\theta JA}$ [1,4] | Thermal Resistance-Junction to Ambient | t≤10s | 60 | 60 | °C/W |
| | | Steady State | 100 | 100 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | | 36 | 36 | |

## Electrical Characteristics ($T_J$=25°C, Unless Otherwise Noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250μA | 30 | --- | --- | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=8A | --- | 18.7 | 24 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=5A | --- | 25 | 36 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$=250μA | 1.0 | 1.8 | 2.6 | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=24V , $V_{GS}$=0V | --- | --- | 1.0 | μA |
| | | $T_J$=55°C | --- | --- | 30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{DS}$=0V , $V_{GS}$=±20V | --- | --- | ±100 | nA |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=5V , $I_D$=20A | --- | 30 | --- | S |
| $R_G$ | Gate Resistance | $f$=1.0MHz | 1.0 | 1.8 | 3.1 | Ω |
| $Q_g$ | Total Gate Charge (10V) | $V_{DS}$=15V , $V_{GS}$=10V , $I_D$=8A | --- | 8.3 | 12 | nC |
| $Q_g$ | Total Gate Charge (4.5V) | | --- | 3.9 | 6 | |
| $Q_{gs}$ | Gate-Source Charge | | --- | 1.6 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 1.4 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=15V , $V_{GS}$=10V , $I_D$=1A , $R_L$=15Ω , $R_{GEN}$=6Ω | --- | 5.2 | --- | ns |
| $T_r$ | Rise Time | | --- | 8.6 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 13.5 | --- | |
| $T_f$ | Fall Time | | --- | 3.4 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , $f$=1.0MHz | --- | 408 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 72 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 40 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_S$ [7] | Continuous Source Current | | --- | --- | 8 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=8A | --- | 0.7 | 1.0 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=8A , di/dt=500A/μs | --- | 12 | --- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 3.5 | --- | nC |

Note:

1. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The Power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ t≤ 10s and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
2. The power dissipation $P_D$ is based on $T_{J(MAX)}$=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
3. Single pulse width limited by junction temperature $T_{J(MAX)}$=150°C.
4. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
5. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
6. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.
7. The maximum current rating is package limited.
8. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C.
9. The maximum current rating is silicon limited

## Electrical Characteristics ($T_J$=25°C, Unless Otherwise Noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250μA | -30 | --- | --- | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-7A | --- | 22 | 32 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-5A | --- | 32 | 45 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$=-250μA | -1.0 | -1.5 | -2.4 | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=24V , $V_{GS}$=0V | --- | --- | -1.0 | μA |
| | | $T_J$=55°C | --- | --- | -30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{DS}$=0V , $V_{GS}$=±20V | --- | --- | ±100 | nA |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=-5V , $I_D$=-20A | --- | 30 | --- | S |
| $R_G$ | Gate Resistance | $f$=1.0MHz | --- | 12 | --- | Ω |
| $Q_g$ | Total Gate Charge (10V) | $V_{DS}$=-15V , $V_{GS}$=-10V , $I_D$=-7A | --- | 17 | --- | nC |
| $Q_g$ | Total Gate Charge (4.5V) | | --- | 8 | --- | |
| $Q_{gs}$ | Gate-Source Charge | | --- | 2 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 4 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=-15V , $V_{GS}$=-10V , $I_D$=-1A , $R_L$=15Ω , $R_{GEN}$=6Ω | --- | 9 | --- | ns |
| $T_r$ | Rise Time | | --- | 11 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 55 | --- | |
| $T_f$ | Fall Time | | --- | 34 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , $f$=1.0MHz | --- | 750 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 142 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 102 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_S$ [7] | Continuous Source Current | | --- | --- | -7 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-8A | --- | -0.7 | -1.0 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=-8A , di/dt=500A/μs | --- | 14 | --- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 7 | --- | nC |

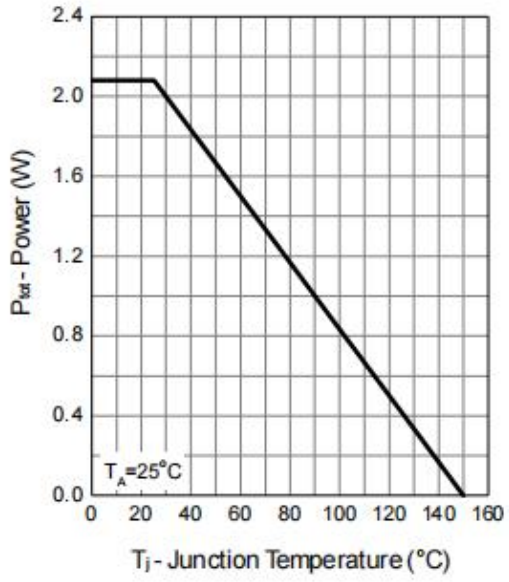
Note:

10. The value of $R_{\theta JA}$ is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The Power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ t≤ 10s and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
11. The power dissipation $P_D$ is based on $T_{J(MAX)}$=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
12. Single pulse width limited by junction temperature $T_{J(MAX)}$=150°C.
13. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
14. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
15. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.
16. The maximum current rating is package limited.
17. These tests are performed with the device mounted on 1 in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C.

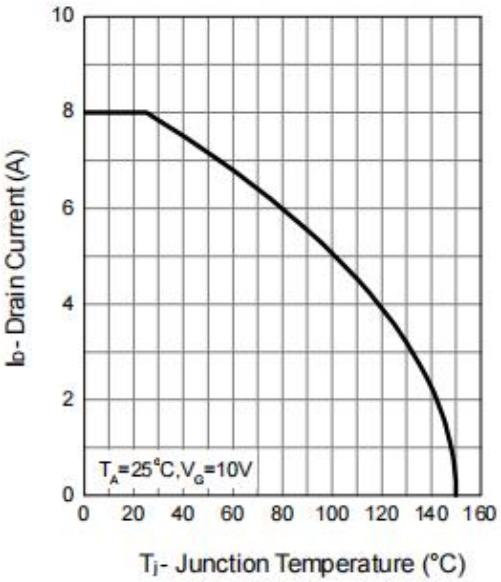
The maximum current rating is silicon limited

## N Channel Typical Operating Characteristics

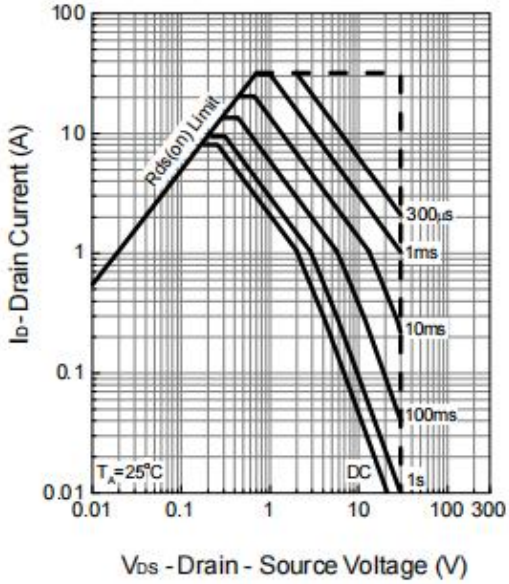
**Power Dissipation**



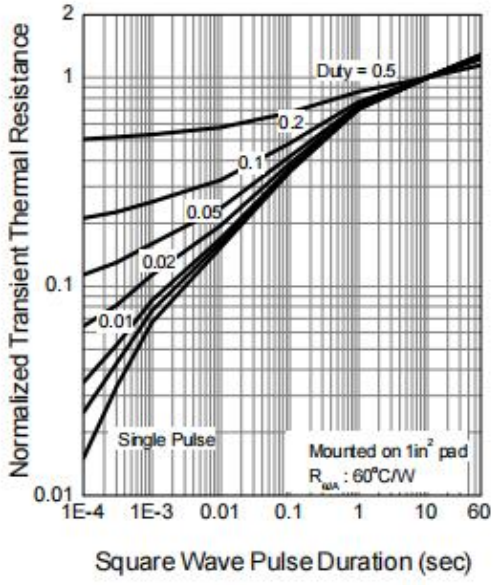

**Drain Current**




**Safe Operation Area**

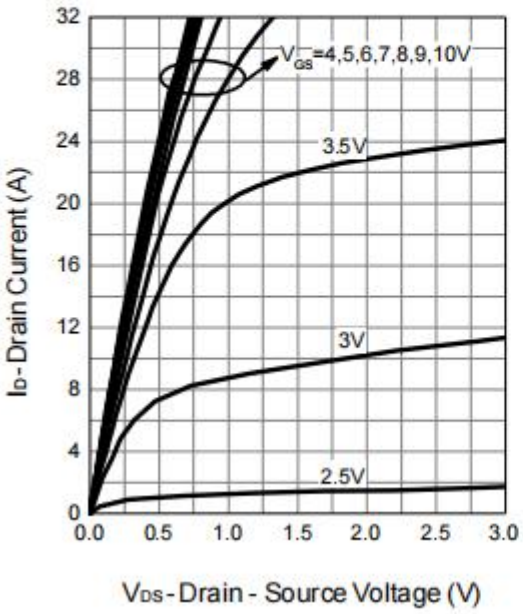



**Thermal Transient Impedance**

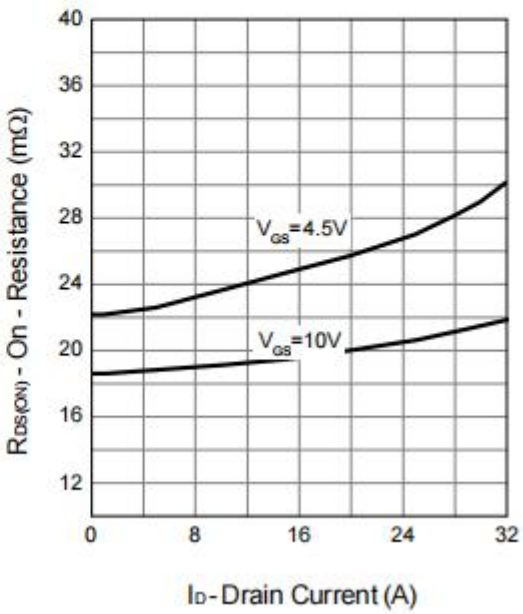


## N Channel Typical Operating Characteristics (Cont.)

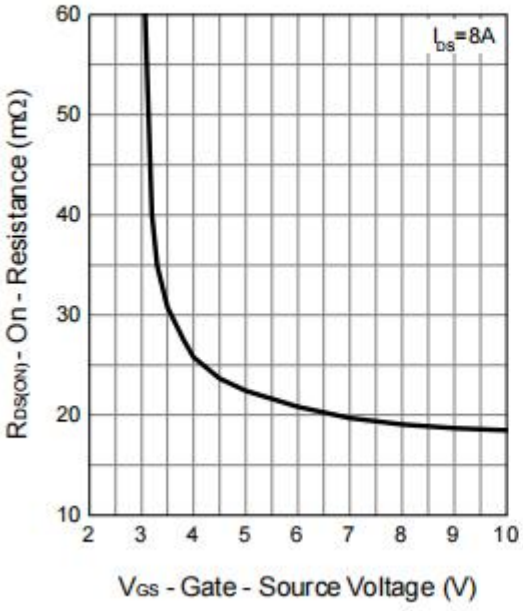
**Output Characteristics**



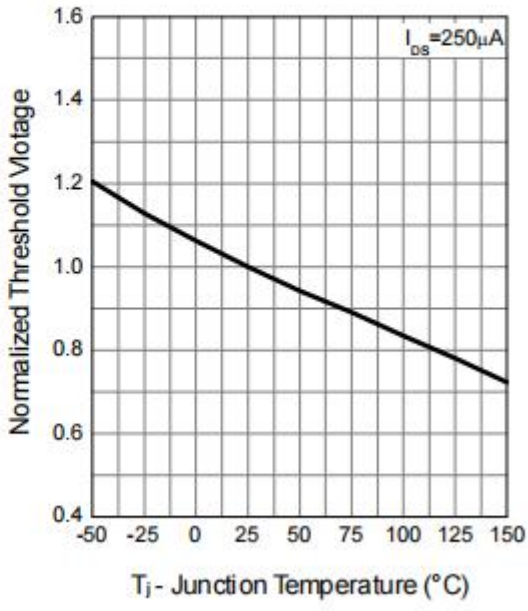

**Drain-Source On Resistance**




**Gate-Source On Resistance**

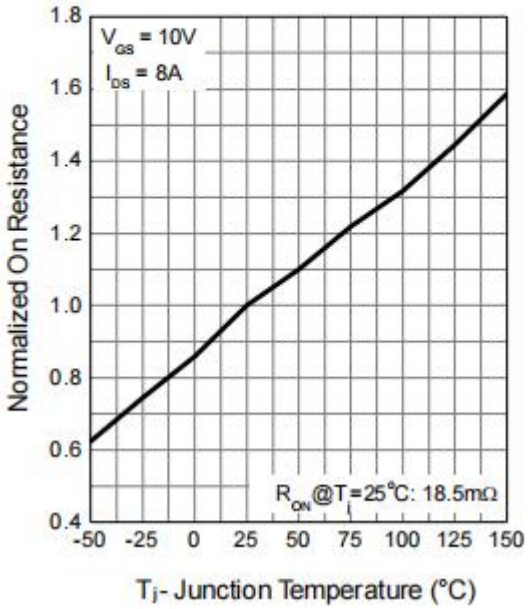



**Gate Threshold Voltage**

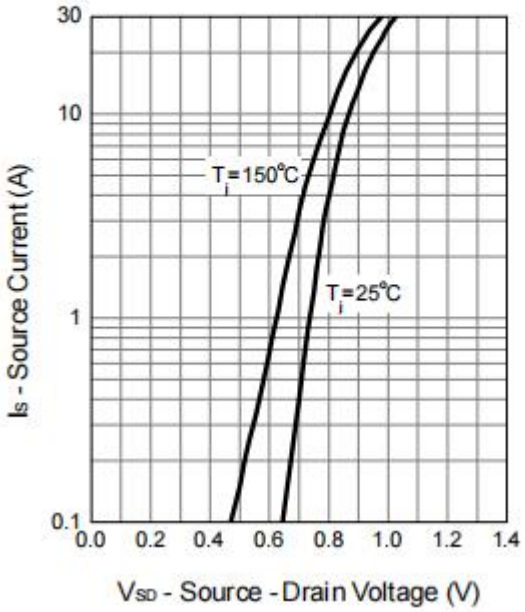


## N Channel Typical Operating Characteristics (Cont.)

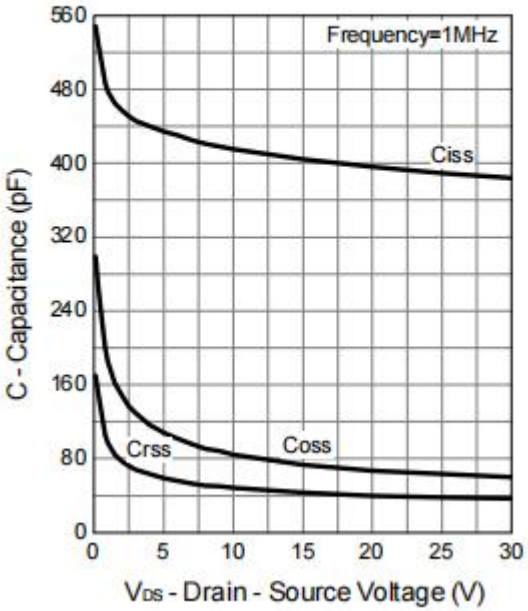
**Drain-Source On Resistance**



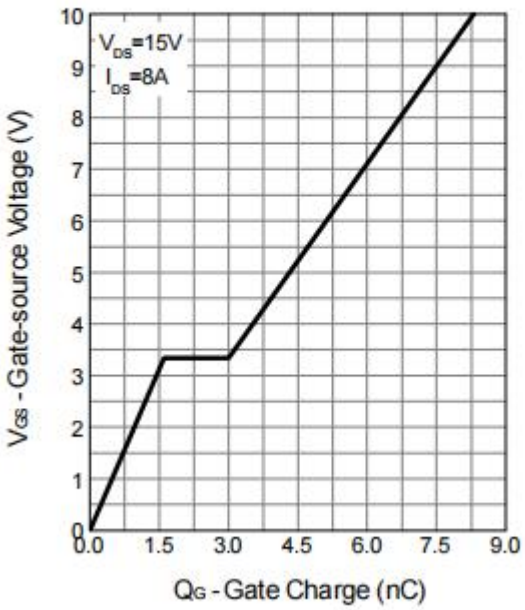

**Source-Drain Diode Forward**



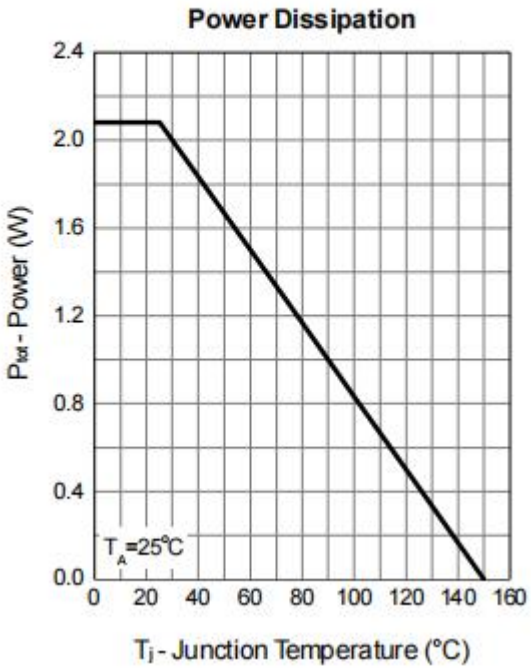

**Capacitance**

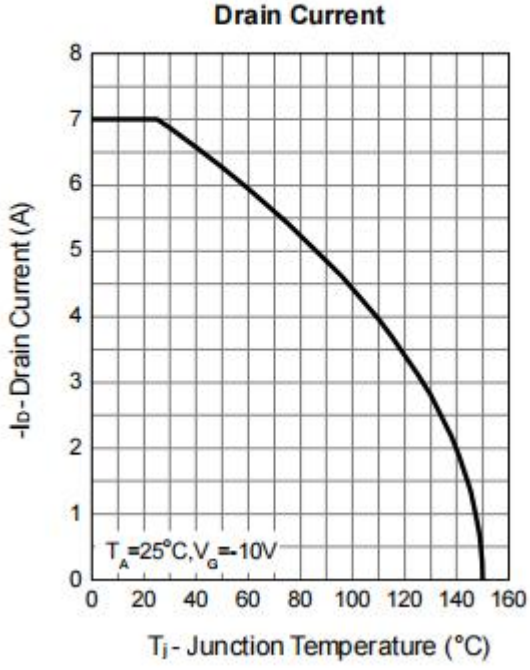


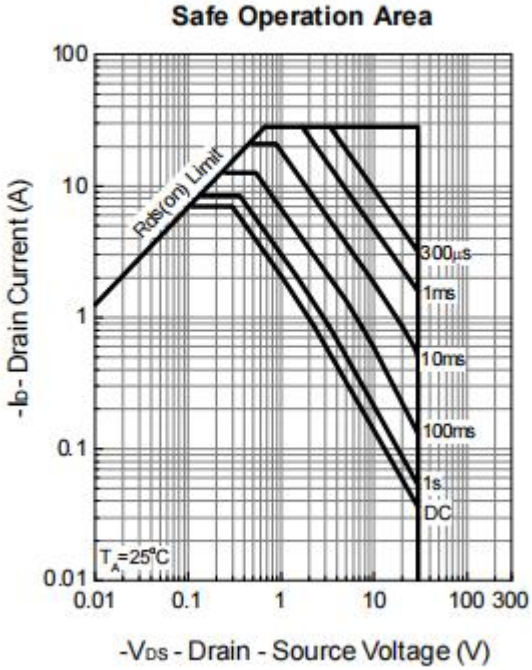

**Gate Charge**

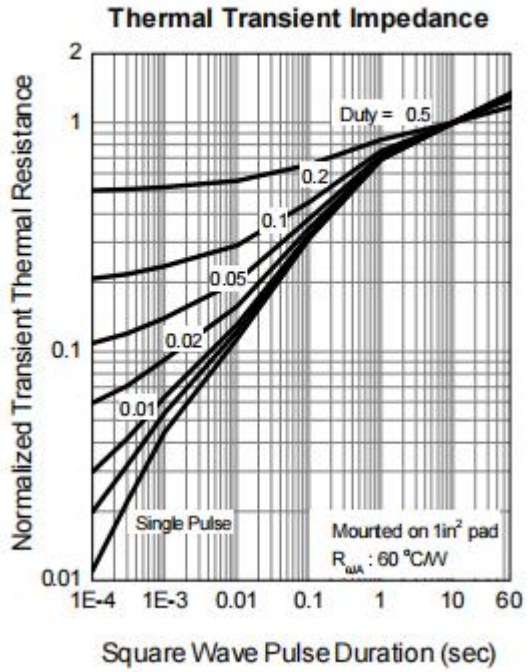


## P Channel Typical Operating Characteristics

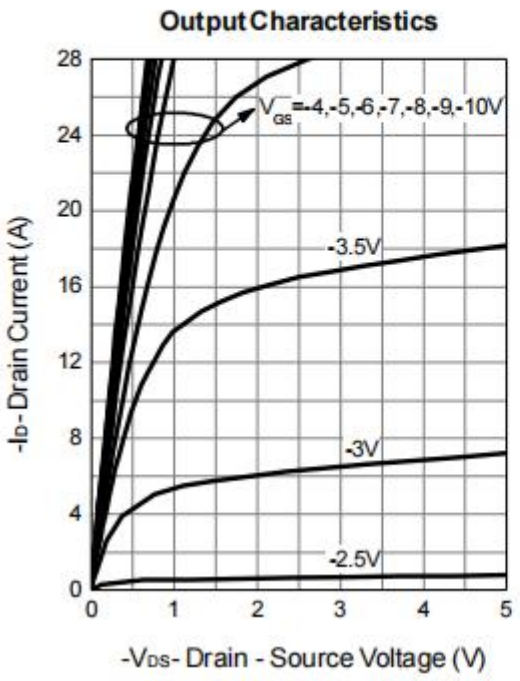


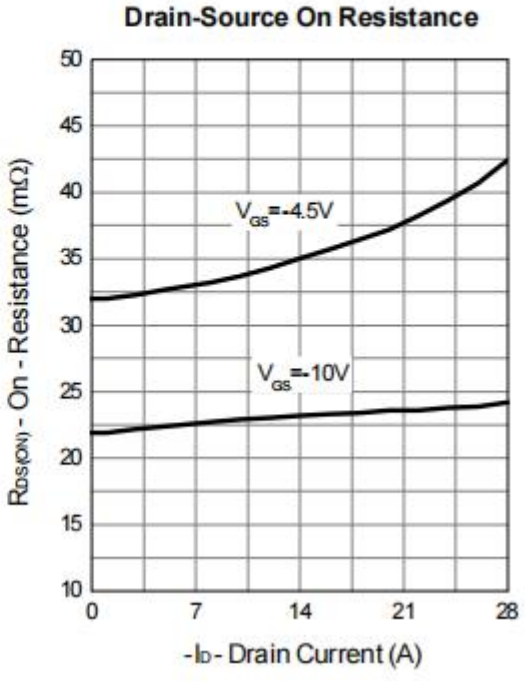



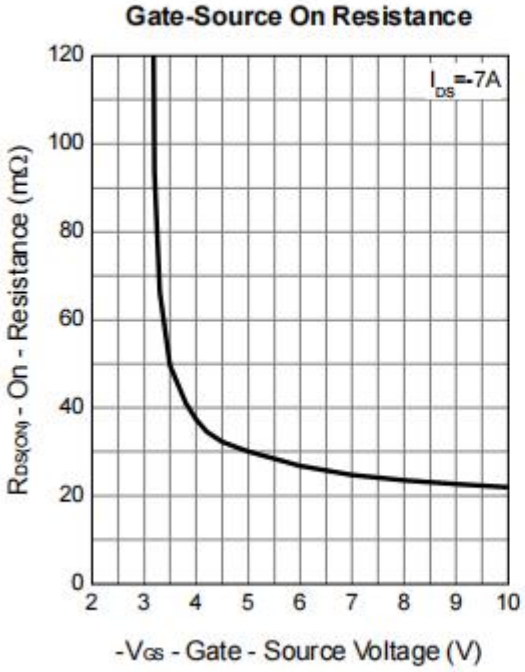



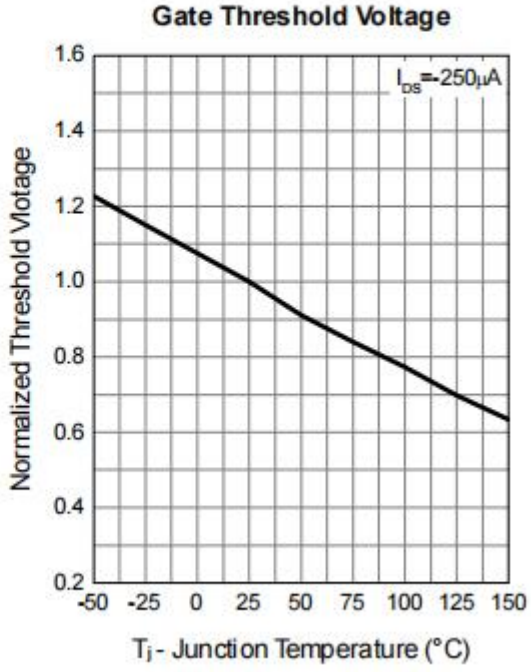



## P Channel Typical Operating Characteristics (Cont.)

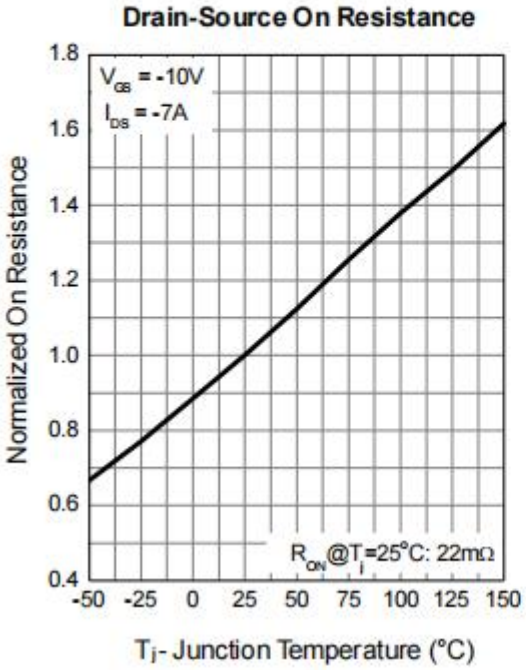


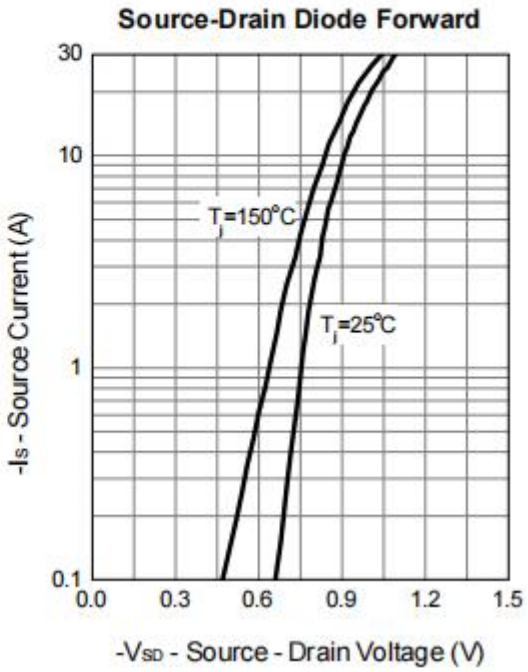



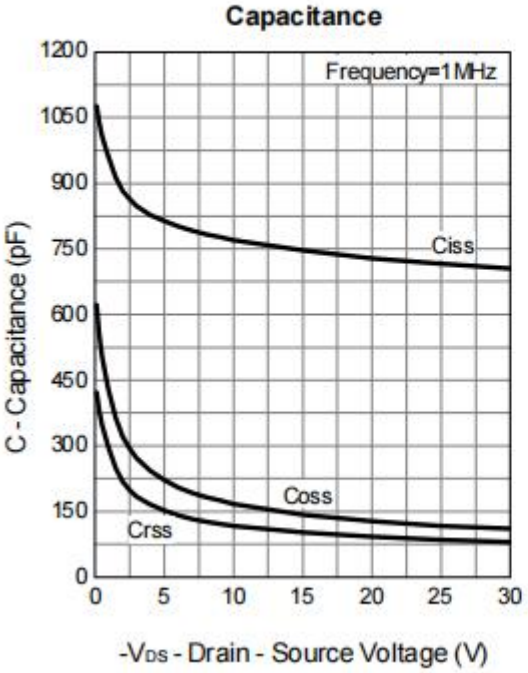



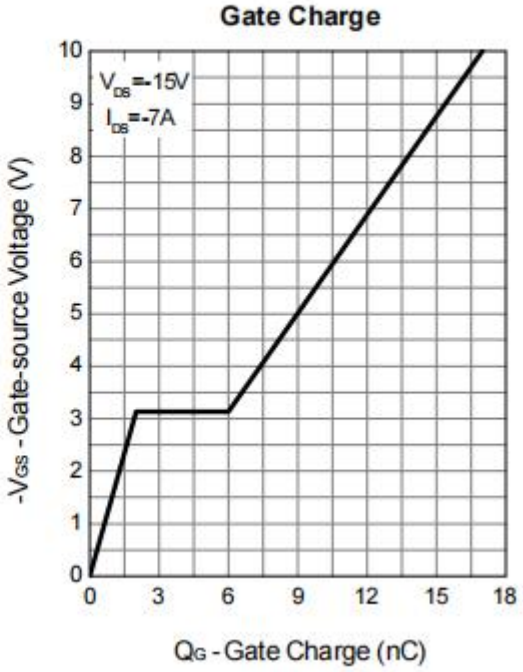



## P Channel Typical Operating Characteristics (Cont.)



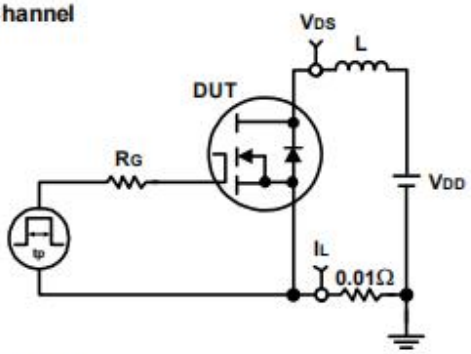



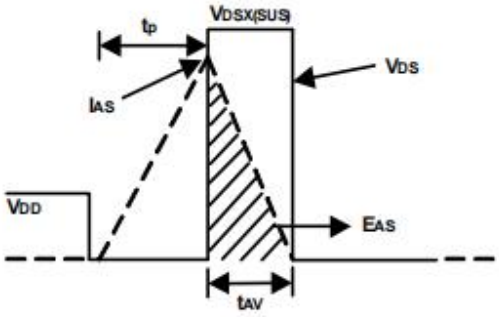



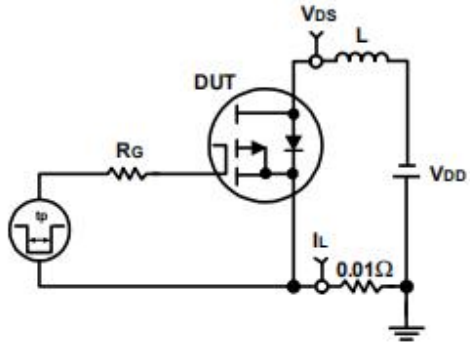
## Avalanche Test Circuit and Waveforms

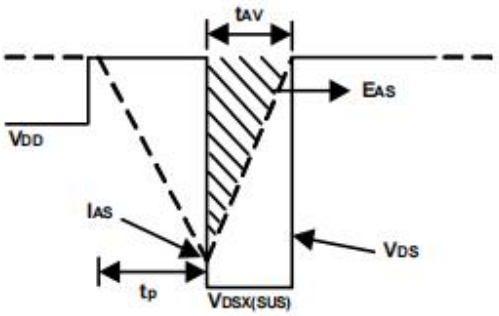
N Channel



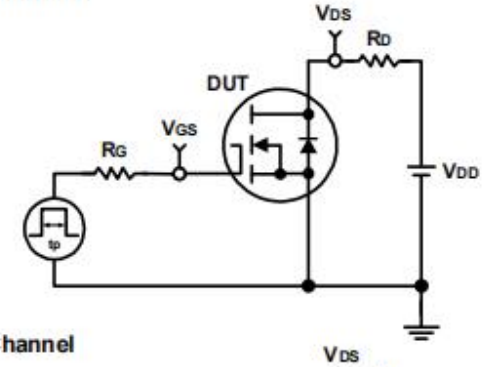

P Channel

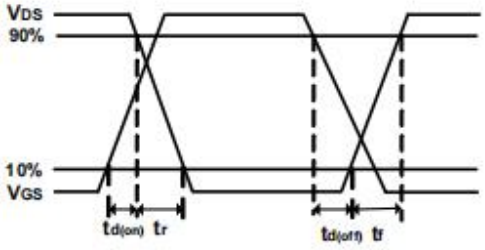


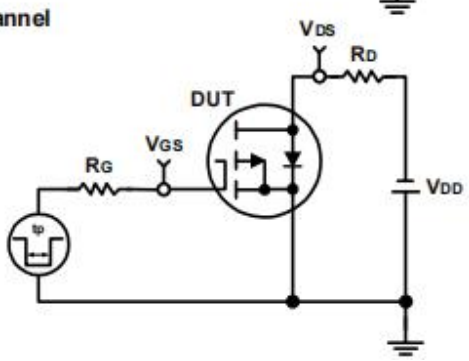

## Switching Time Test Circuit and Waveforms

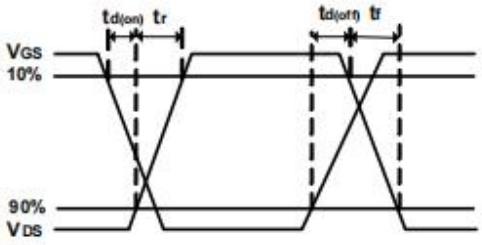
N Channel



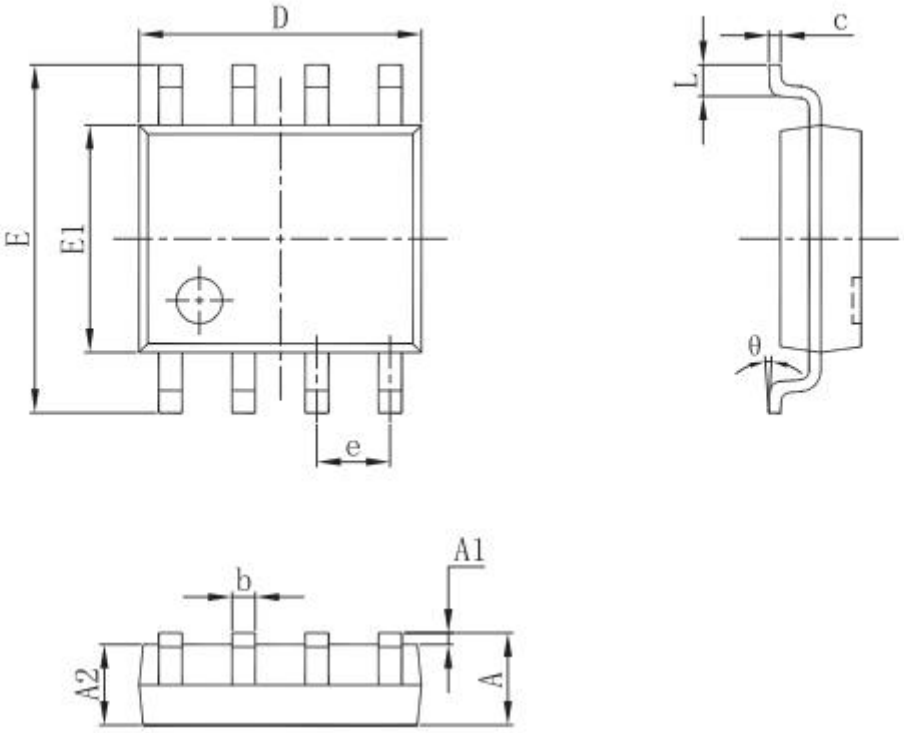




P Channel



## Packaging information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | **Min** | **Max** | **Min** | **Max** |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.800 | 5.000 | 0.189 | 0.197 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

# Attention

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