# WSP4067B

**N&P-Channel MOSFET**

## General Description

The WSP4067B is the highest performance trench N-ch and P-ch MOSFET with extreme high cell density , which provide excellent RDSON and gate charge for most of the synchronous buck converter applications .

The WSP4067B 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

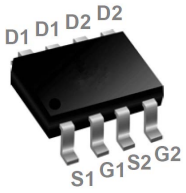
## Product Summery

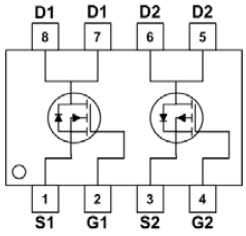
| BVDSS | RDSON | ID |
|---|---|---|
| 40V | 25mΩ | 6.0A |
| -40V | 40mΩ | -5.1A |

## Applications

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

## SOP-8 Pin Configuration




## Absolute Maximum Ratings

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| | | N-Channel | P-Channel | |
| $V_{DS}$ | Drain-Source Voltage | 40 | -40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current | 6.0 | -5.1 | A |
| $I_D$@$T_C$=70℃ | Continuous Drain Current | 3.9 | -3.2 | A |
| $I_{DM}$ | Pulsed Drain Current | 24 | -20 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation | 2 | 2 | W |
| $T_J$/$T_{STG}$ | Operating Temperature /Storage Temperature Range | -55 to 150 | | ℃ |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 62.5 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 50 | ℃/W |

## N-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 40 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.067 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=6A | --- | 25 | 35 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=5A | --- | 40 | 55 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.6 | 2.2 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -5.24 | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=85℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=32V , $V_{GS}$=0V , $T_J$=85℃ | --- | --- | 30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| $Q_g$ | Total Gate Charge | $V_{DS}$=20V , $V_{GS}$=10V , $I_D$=6A | --- | 11 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 2 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 2.2 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$ = 20 V, $V_{GEN}$ = 10 V, $R_G$ = 3.3 Ω, $R_L$ = 3.3 Ω, $I_{DS}$ = 6 A . | --- | 1.9 | --- | ns |
| $T_r$ | Rise Time | | --- | 18.6 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 8.7 | --- | |
| $T_f$ | Fall Time | | --- | 2.6 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=20V , $V_{GS}$=0V , f=1MHz | --- | 600 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 62 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 48 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | TA=25°C. | --- | --- | 2.6 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=1A | --- | --- | 1.3 | V |

A: The value of $R_{\theta JA}$ is measured 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 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≤ 10s junction to ambient thermal resistance rating.

## P-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -40 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.03 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-4A | --- | 40 | 50 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-3A | --- | 55 | 75 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.0 | -1.6 | -2.2 | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=85℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-32V , $V_{GS}$=0V , $T_J$=85℃ | --- | --- | -30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-20V , $V_{GS}$=-10V , $I_D$=-5.1A | --- | 20 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 5.7 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 4.6 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=-20V , $V_{GS}$=-10V , $R_G$=3.3Ω, $I_D$=-5.1A,$R_L$=3.9Ω. | --- | 6.8 | --- | ns |
| $T_r$ | Rise Time | | --- | 33 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 30 | --- | |
| $T_f$ | Fall Time | | --- | 12 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , f=1MHz | --- | 1100 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 100 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 80 | --- | |

## Diode Characteristics

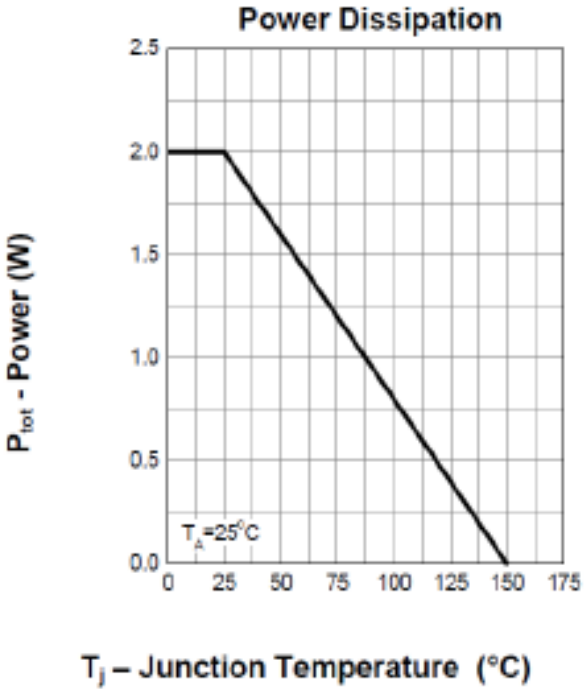
| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | TA=25°C. | --- | --- | -2.6 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-1A . | --- | --- | -1.2 | V |

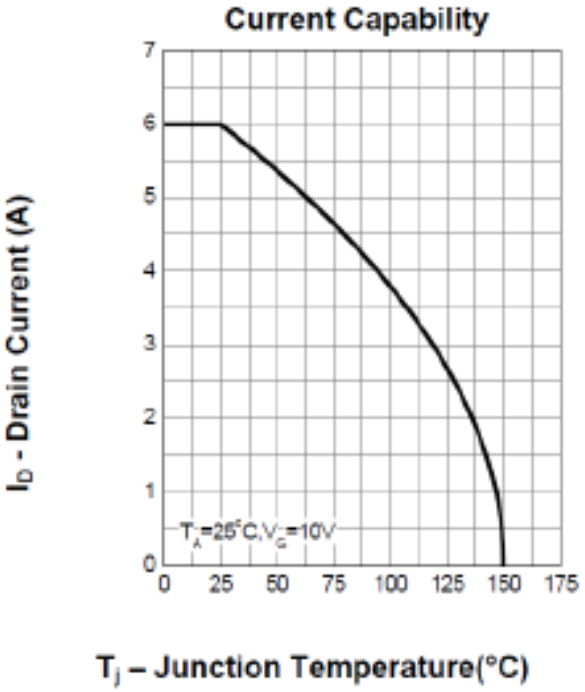
A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The value in any given application depends on the user's specific board design.

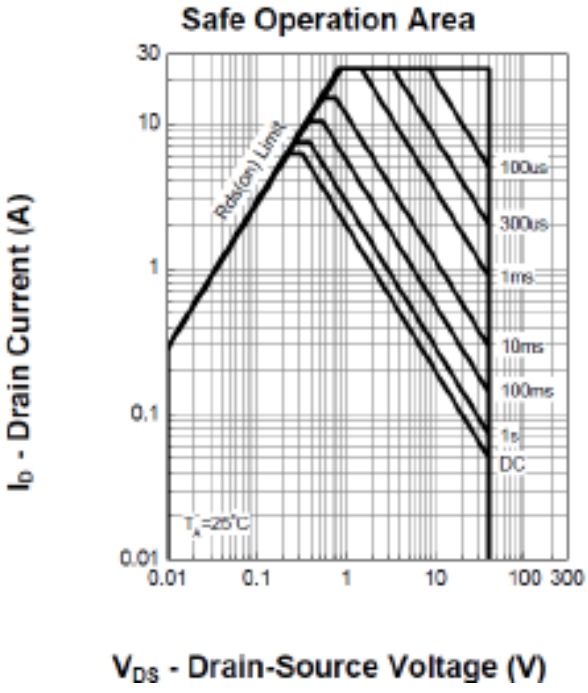
B: Repetitive rating, pulse width limited by junction temperature.

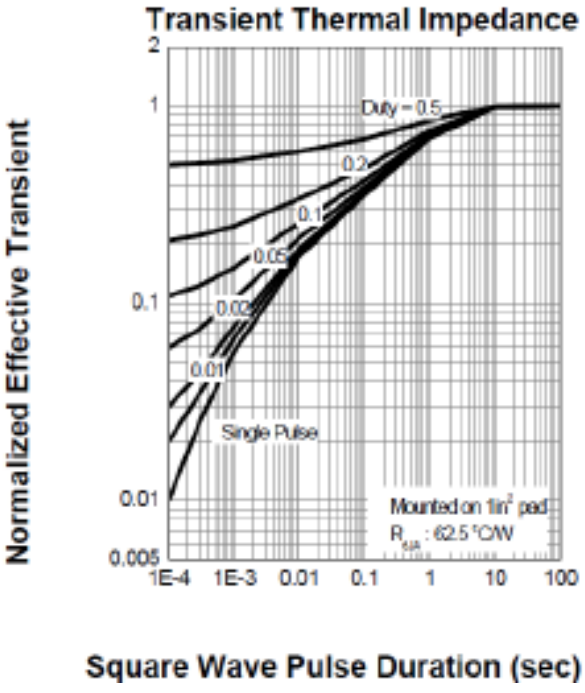
C: The current rating is based on the t≤ 10s junction to ambient thermal resistance rating.

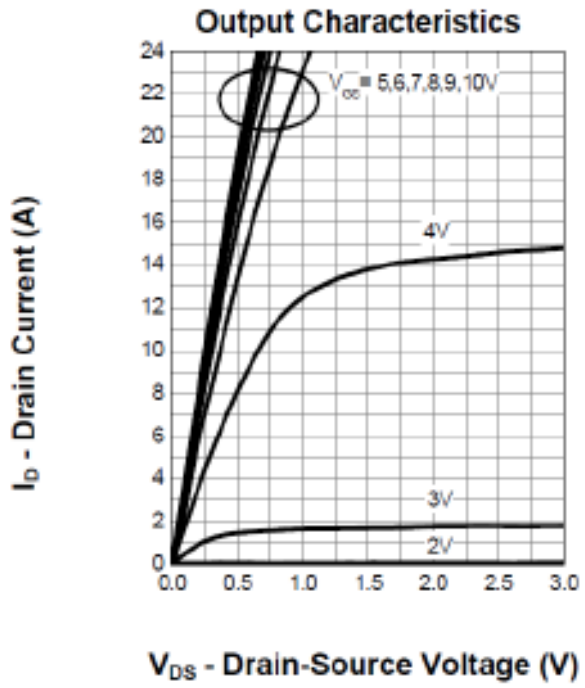
## N-Channel Typical Characteristics

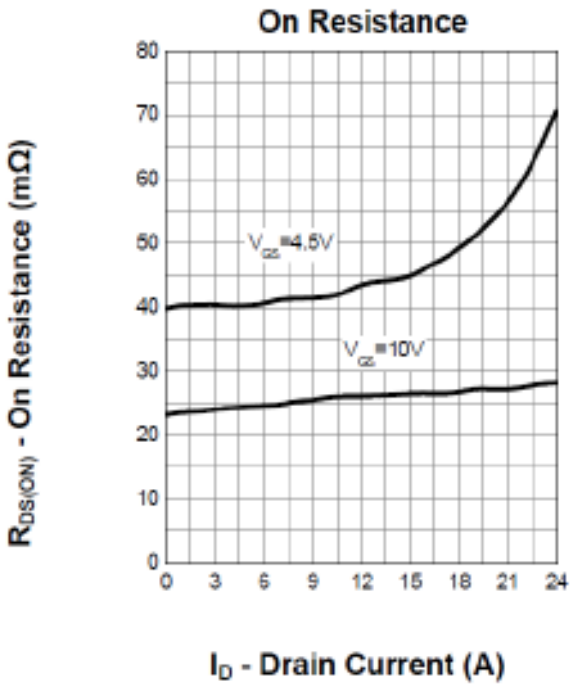


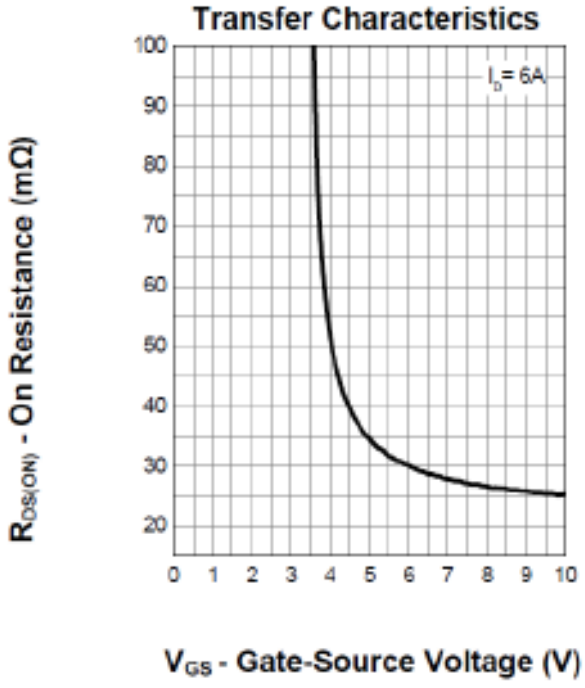



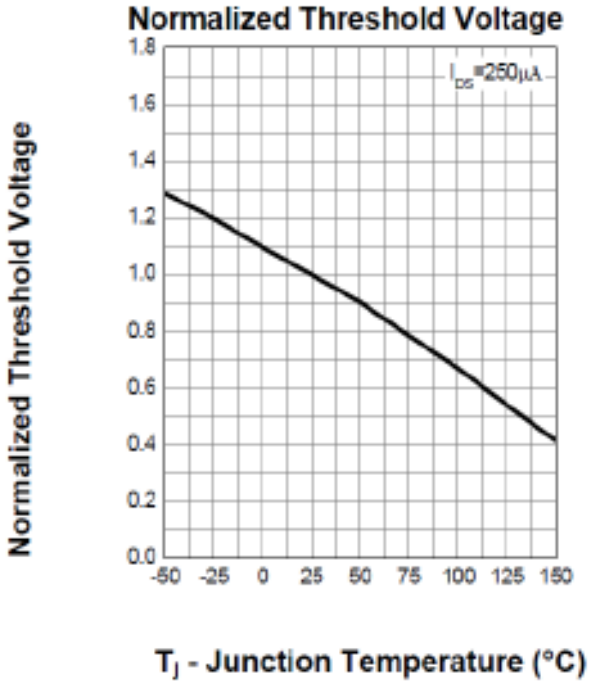



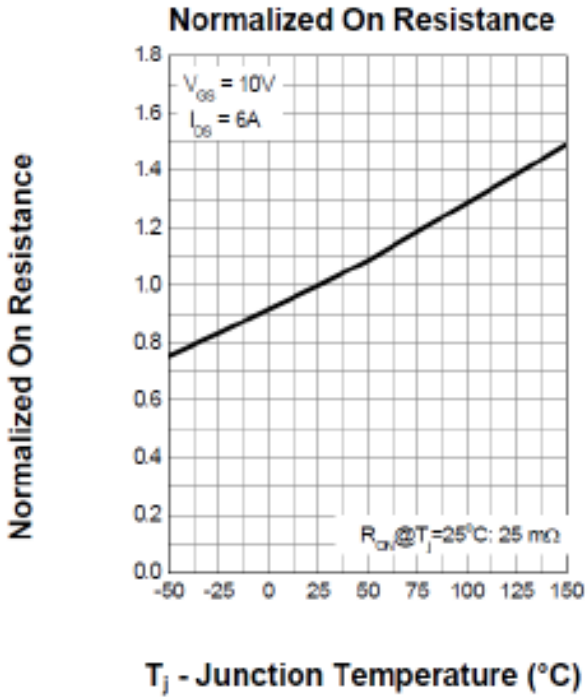



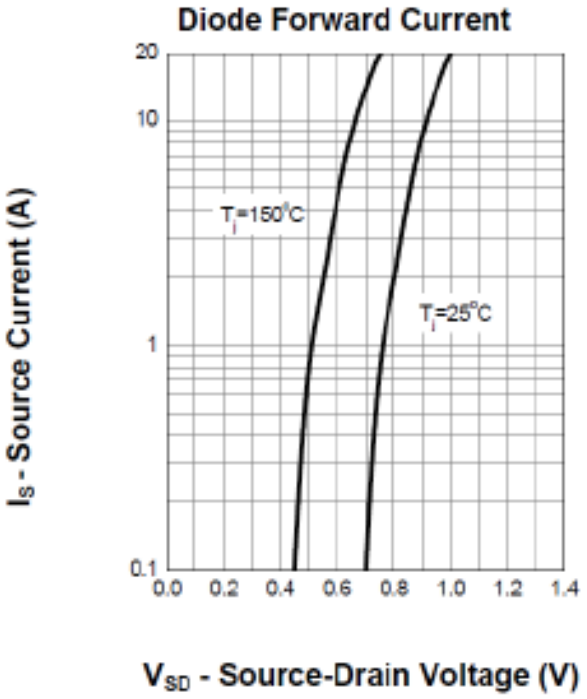

Output Characteristics
$I_D$ - Drain Current (A)
$V_{GS}$= 5,6,7,8,9,10V
4V
3V
2V
$V_{DS}$ - Drain-Source Voltage (V)

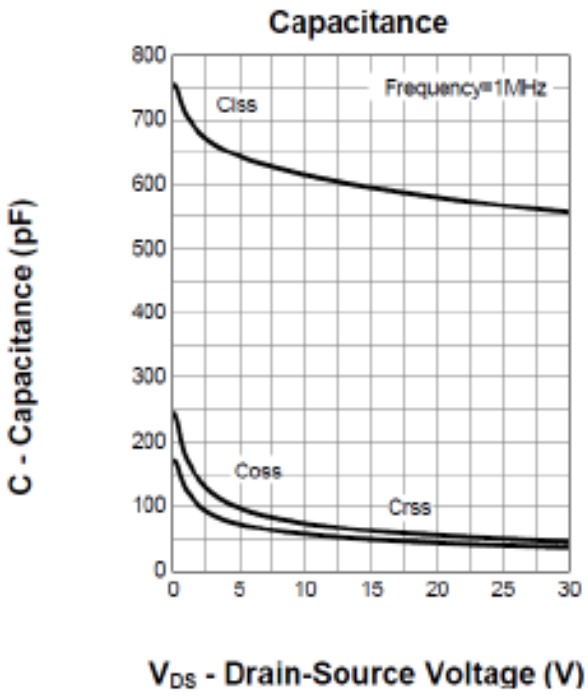

On Resistance
$R_{DS(ON)}$ - On Resistance (mΩ)
$V_{GS}$=4.5V
$V_{GS}$=10V
$I_D$ - Drain Current (A)

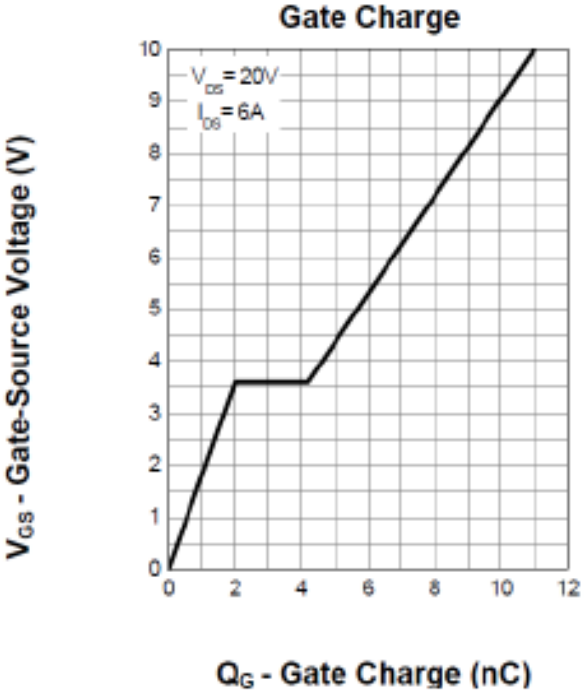

Transfer Characteristics
$R_{DS(ON)}$ - On Resistance (mΩ)
$I_D$= 6A
$V_{GS}$ - Gate-Source Voltage (V)

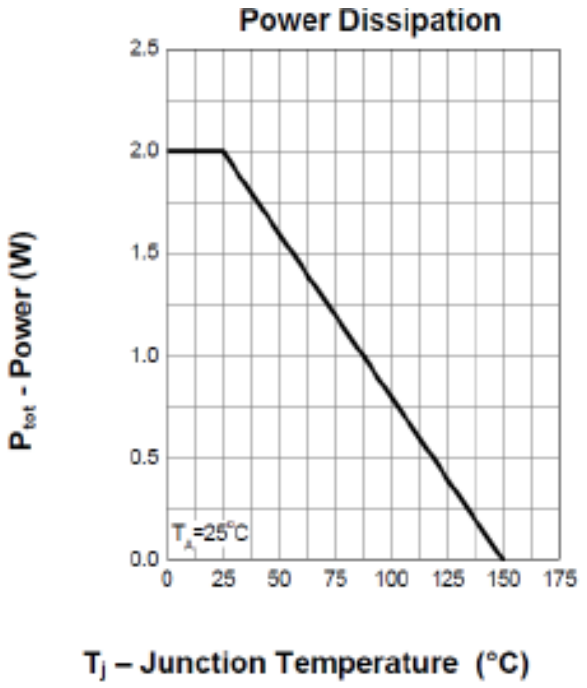

Normalized Threshold Voltage
Normalized Threshold Voltage
$I_{DS}$=250μA
$T_J$ - Junction Temperature (°C)

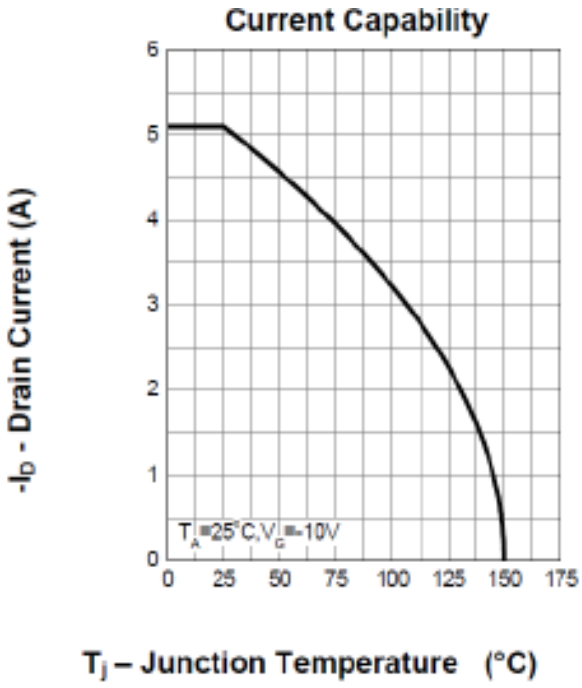

Normalized On Resistance
Normalized On Resistance
$V_{GS}$ = 10V
$I_{DS}$ = 6A
$R_{DS}$@$T_j$=25°C: 25 mΩ
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-50 -25 0 25 50 75 100 125 150
$T_j$ - Junction Temperature (°C)

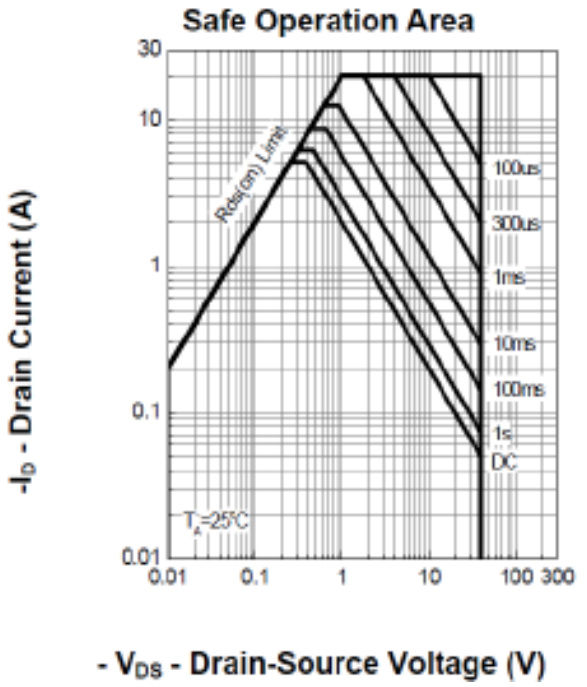

Diode Forward Current
$I_S$ - Source Current (A)
$T_j$=150°C
$T_j$=25°C
20
10
1
0.1
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4
$V_{SD}$ - Source-Drain Voltage (V)

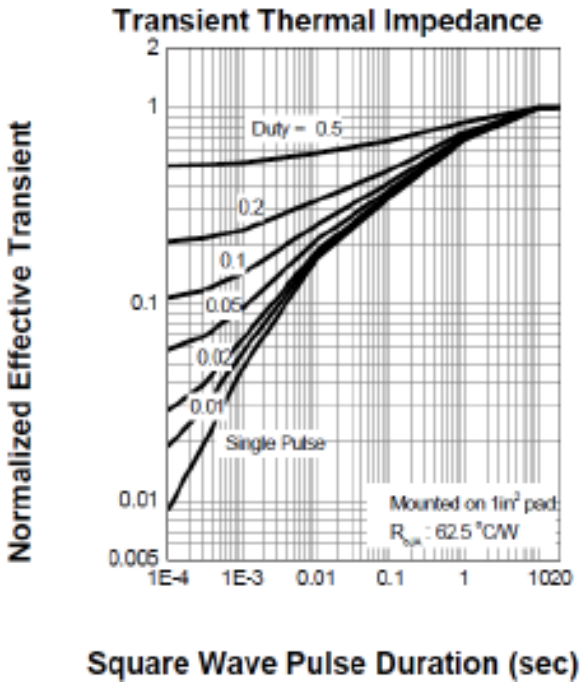

Capacitance
C - Capacitance (pF)
Frequency=1MHz
Ciss
Coss
Crss
800
700
600
500
400
300
200
100
0
0 5 10 15 20 25 30
$V_{DS}$ - Drain-Source Voltage (V)

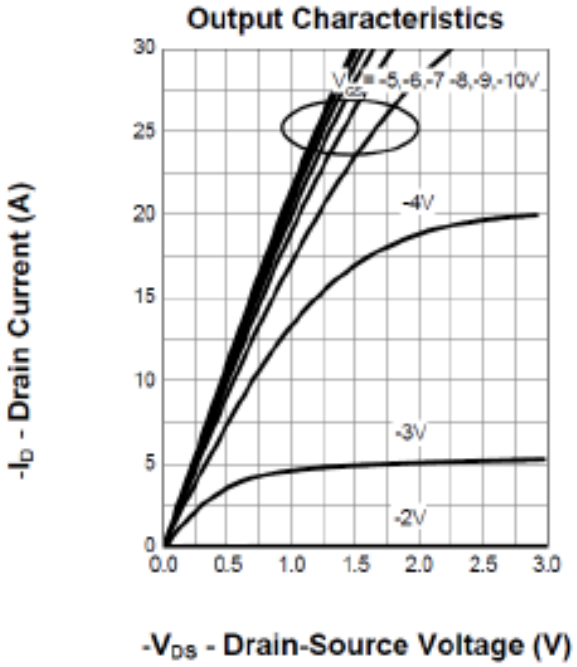

Gate Charge
$V_{GS}$ - Gate-Source Voltage (V)
$V_{DS}$ = 20V
$I_{DS}$ = 6A
10
9
8
7
6
5
4
3
2
1
0
0 2 4 6 8 10 12
$Q_G$ - Gate Charge (nC)

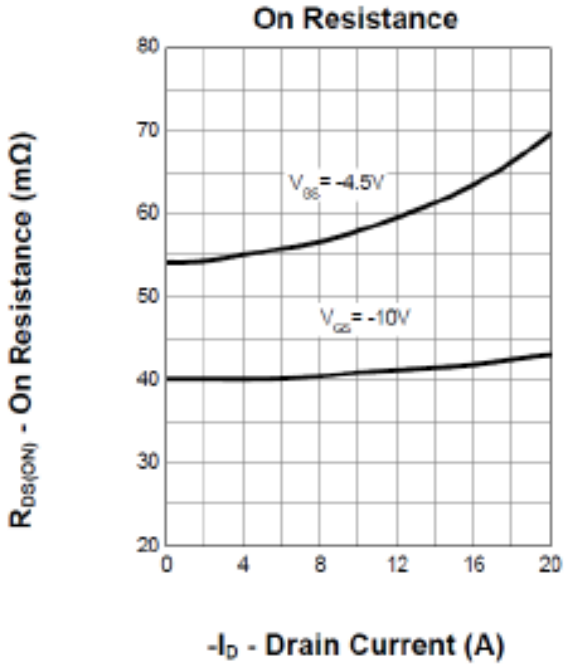

Power Dissipation
$P_{tot}$ - Power (W)
2.5
2.0
1.5
1.0
0.5
0.0
0
25
50
75
100
125
150
175
$T_A$=25°C
$T_J$ – Junction Temperature (°C)

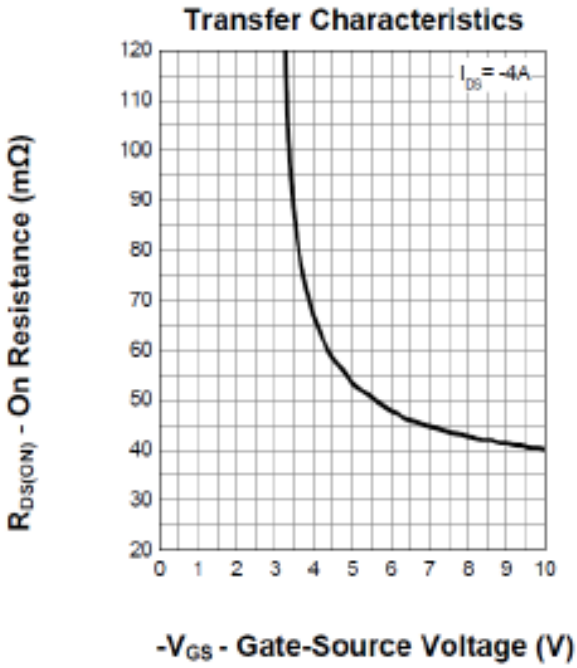

Current Capability
$-I_D$ - Drain Current (A)
6
5
4
3
2
1
0
0
25
50
75
100
125
150
175
$T_A$=25°C,$V_G$=-10V
$T_J$ – Junction Temperature (°C)

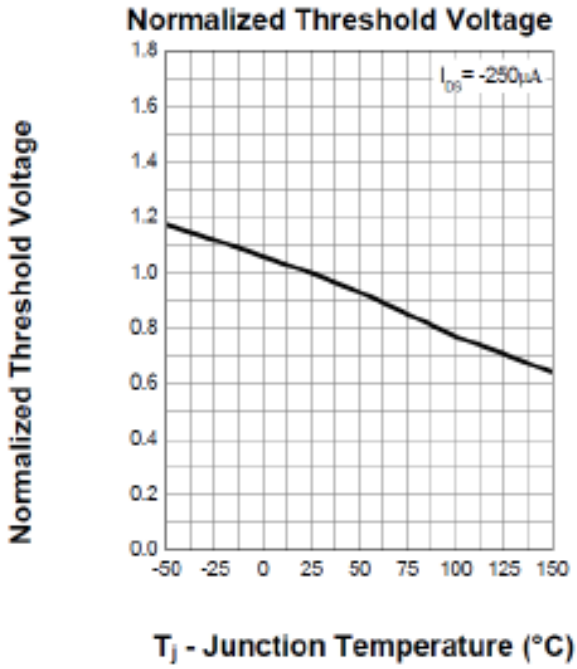

Safe Operation Area
$-I_D$ - Drain Current (A)
30
10
1
0.1
0.01
0.01
0.1
1
10
100
300
$R_{DS(on)}$ Limit
100us
300us
1ms
10ms
100ms
1s
DC
$T_A$=25°C
- $V_{DS}$ - Drain-Source Voltage (V)

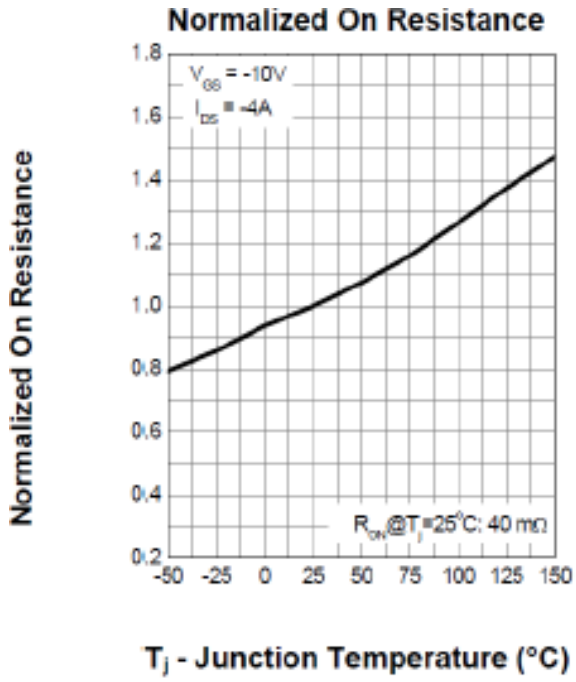

Transient Thermal Impedance
Normalized Effective Transient
2
1
0.1
0.01
0.005
1E-4
1E-3
0.01
0.1
1
10
100
Duty = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Mounted on 1in² pad
$R_{\theta JA}$ : 62.5 °C/W
Square Wave Pulse Duration (sec)

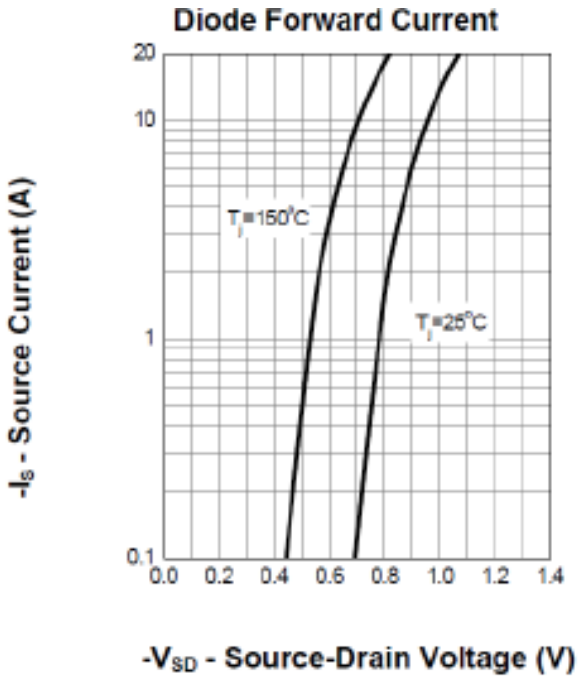

Output Characteristics
-I_D - Drain Current (A)
-V_DS - Drain-Source Voltage (V)
V_GS = -5,-6,-7 -8,-9,-10V
-4V
-3V
-2V
0
5
10
15
20
25
30
0.0
0.5
1.0
1.5
2.0
2.5
3.0

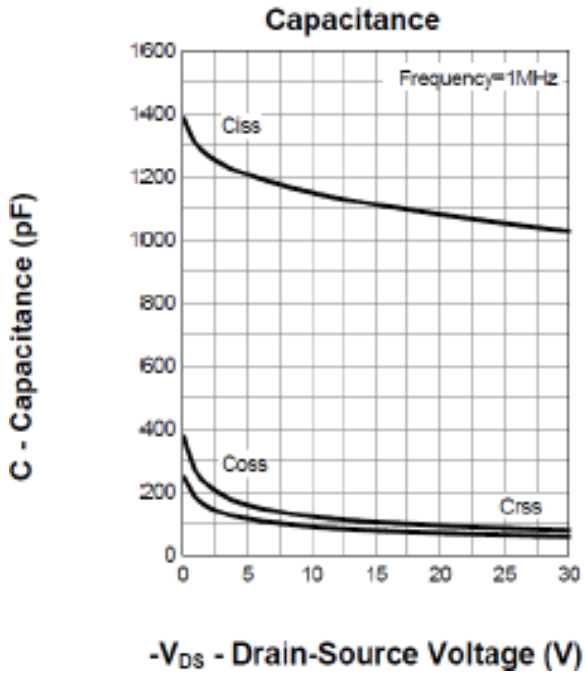

On Resistance
R_DS(ON) - On Resistance (mΩ)
-I_D - Drain Current (A)
V_GS = -4.5V
V_GS = -10V
20
30
40
50
60
70
80
0
4
8
12
16
20

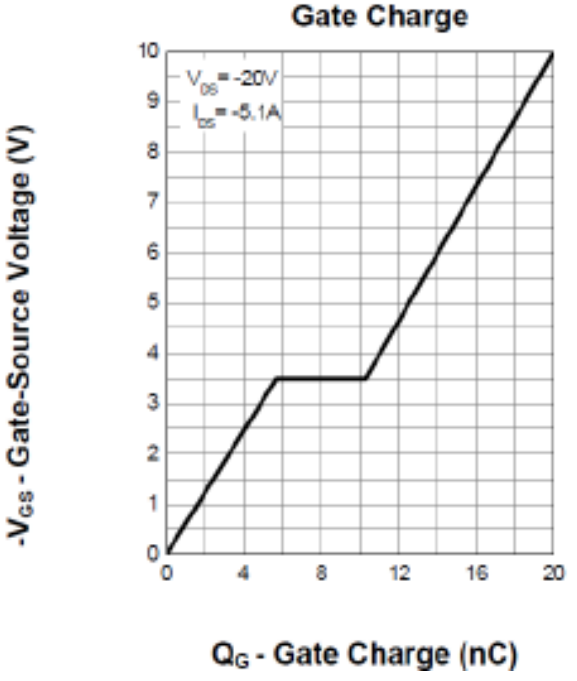

Transfer Characteristics
R_DS(ON) - On Resistance (mΩ)
-V_GS - Gate-Source Voltage (V)
I_DS = -4A
20
30
40
50
60
70
80
90
100
110
120
0
1
2
3
4
5
6
7
8
9
10


Normalized Threshold Voltage
Normalized Threshold Voltage
T_j - Junction Temperature (°C)
I_DS = -250μA
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
-50
-25
0
25
50
75
100
125
150


Normalized On Resistance
Normalized On Resistance
$V_{GS}$ = -10V
$I_{DS}$ = -4A
$R_{ON}$@$T_j$=25°C: 40 mΩ
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-50 -25 0 25 50 75 100 125 150
$T_j$ - Junction Temperature (°C)


Diode Forward Current
$-I_S$ - Source Current (A)
20
10
1
0.1
$T_j$=150°C
$T_j$=25°C
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4
$-V_{SD}$ - Source-Drain Voltage (V)


Capacitance
C - Capacitance (pF)
Frequency=1MHz
Ciss
Coss
Crss
1600
1400
1200
1000
800
600
400
200
0
0 5 10 15 20 25 30
$-V_{DS}$ - Drain-Source Voltage (V)


Gate Charge
$-V_{GS}$ - Gate-Source Voltage (V)
$V_{DS}$ = -20V
$I_{DS}$ = -5.1A
10
9
8
7
6
5
4
3
2
1
0
0 4 8 12 16 20
$Q_G$ - Gate Charge (nC)

# Attention

1, Any and all Winsok power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your Winsok power representative nearest you before using any Winsok power products described or contained herein in such applications.

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