MOSFET on Resistance – Rds on mosfet and how to choose it in datasheet

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MOSFET Rds on

Rds on stands for resistance (R), drain (D), and source (S) means resistance between the drain and source of the mosfet but still it is not clear resistance when. That is why on is used at the end to symbolize that it is resistance when mosfet is on.

when voltage at gate pin is available than Resistance between the drain and source is called mosfet on resistance

when voltage at gate pin is not available than resistance between the drain and source is called Mosfet Rds off or Mosfet off resistance.

Lets understand with an example of what is the Rds in mosfet and how to select it from Onsemi datasheet.

NVBLS0D5N04M8

MOSFET – Power, Single, N-Channel

40 V, 300 A, 0.57 mΩ

Features

- Typical $R_{DS(on)}$ = 0.46 mΩ at V_{GS} = 10 V, I_D = 80 A
- Typical $Q_{g(tot)}$ = 220 nC at V_{GS} = 10 V, I_D = 80 A
- UIS Capability
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

MAXIMUM RATINGS T_J = 25°C unless otherwise noted

Parameter	Symbol	Ratings	Units
Drain−to−Source Voltage	V_{DSS}	40	V
Gate−to−Source Voltage	V_{GS}	±20	V
Drain Current − Continuous (V_{GS} = 10) (Note 1) T_C = 25°C	I_D	300	A
Pulsed Drain Current T_C = 25°C		See Figure 4	
Single Pulse Avalanche Energy (Note 2)	E_{AS}	1064	mJ
Power Dissipation	P_D	429	W
Derate Above 25°C		2.86	W/°C
Operating and Storage Temperature	T_J, T_{STG}	−55 to +175	°C
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	0.35	°C/W
Maximum Thermal Resistance, Junction−to−Ambient (Note 3)	$R_{\theta JA}$	43	°C/W

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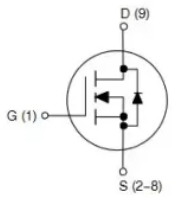


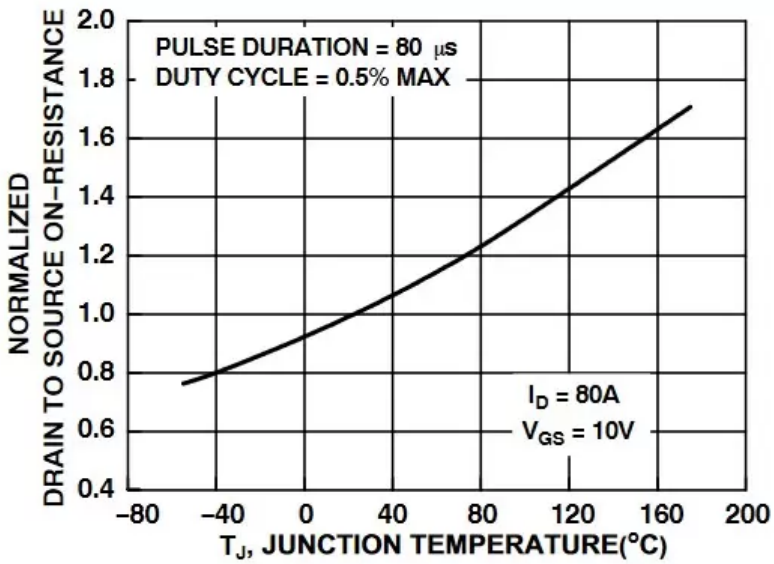
ORDERING INFORMATION

Device	Package	Marking

If you see the datasheet of any MOSFET lets say 40V, 300Amps **NVBLS0D5N04M8** Onsemi MOSFET, on going through the datasheet you will see two values of on resistance one is typical and other is maximum, the question is which value you should choose for your design to be robust.

when you run 300Amps through the MOSFET its junction temperature will increase because of the power dissipation I^2*R.

So here in the above expression what you see R is on resistance of mosfet.



If you choose the wrong Rds on then you may get wrong power dissipation and FET could probably burn.

The Rds on mentioned below is at 25degC, when the current flows through it Junction temperature rises,

Therefore it is recommended to always choose Rds on at maximum Tj which 175 degC in this case.

Also Read How to choose mosfet threshold voltage

So at 175 degC for this case is 1.7 then on resistance at 175degC = 1.7*0.57mohm = 0.969mohm, Now as you see the picture is clearly different, so for your designing you should consider Mosfet Rds on as 0.969mohm always.

Conclusion:

So now how to find Rds on at 175degC, first step is to find normalization factor at 175 degC then multiply it with max Rds on.

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