

# IRFS38N20DTRLP-VB Datasheet

## N-Channel 200-V (D-S) MOSFET

### PRODUCT SUMMARY

$V_{(BR)DSS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
200	0.038 at $V_{GS} = 15$ V	45	57
	0.043 at $V_{GS} = 10$ V	40	

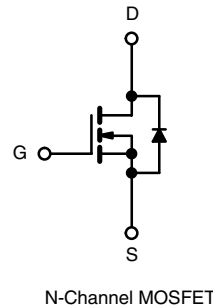
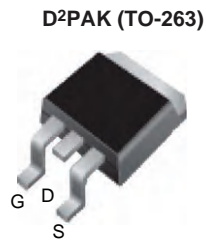
### FEATURES

- Trench Power MOSFETS
- 175 °C Junction Temperature
- 100 %  $R_g$  and UIS Tested


**RoHS**  
 COMPLIANT

### APPLICATIONS

- Power Supply
- Lighting Systems



### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	200	V
Gate-Source Voltage	$V_{GS}$	$\pm 25$	
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	45	A
		26	
Pulsed Drain Current	$I_{DM}$	150	
Single Pulse Avalanche Current	$I_{AS}$	20	
Single Pulse Avalanche Energy <sup>a</sup>	$E_{AS}$	20	mJ
Maximum Power Dissipation <sup>a</sup>	$P_D$	166 <sup>b</sup>	W
		3.12	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient (PCB Mount) <sup>c</sup>	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.75	

Notes:

a. Duty cycle  $\leq 1$  %.

b. See SOA curve for voltage derating.

c. When Mounted on 1" square PCB (FR-4 material).

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	200			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2		4	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			50	
		V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			250	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	40			A
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A		0.048		Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A, T <sub>J</sub> = 125 °C		0.050		
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A, T <sub>J</sub> = 175 °C		0.070		
		V <sub>GS</sub> = 6 V, I <sub>D</sub> = 3 A		0.092		
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 3 A		35		S
Dynamic <sup>a</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, F = 1 MHz		3000		pF
Output Capacitance	C <sub>oss</sub>			180		
Reverse Transfer Capacitance	C <sub>rss</sub>			80		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A		34	51	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			8		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			12		
Gate Resistance	R <sub>g</sub>		0.5		2.9	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V, R <sub>L</sub> = 5.2 Ω I <sub>D</sub> ≅ 3 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω		15	25	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			50	75	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			30	45	
Fall Time <sup>c</sup>	t <sub>f</sub>			60	90	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C)						
Pulsed Current	I <sub>SM</sub>				36	A
Diode Forward Voltage <sup>b</sup>	V <sub>SD</sub>	I <sub>F</sub> = 3 A, V <sub>GS</sub> = 0 V		0.9	1.5	V
Source-Drain Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 3 A, dI/dt = 100 A/μs		180	250	ns

Notes:

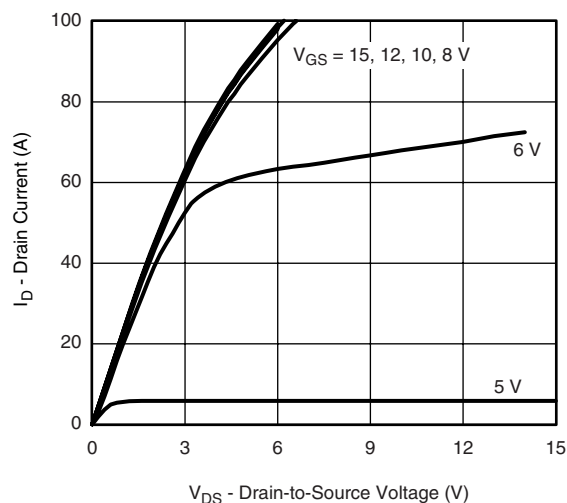
a. Guaranteed by design, not subject to production testing.

b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

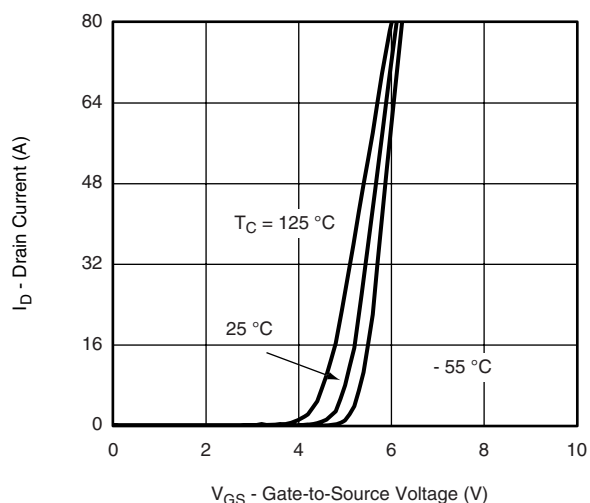
c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

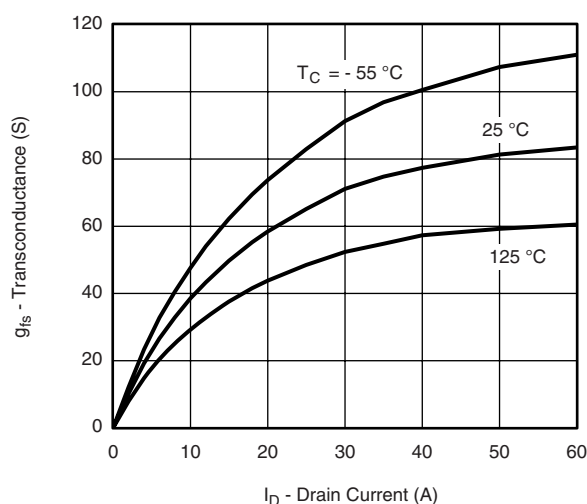
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



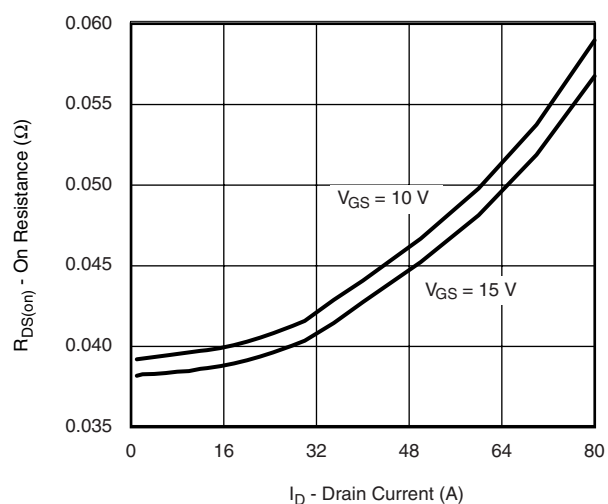
**Output Characteristics**



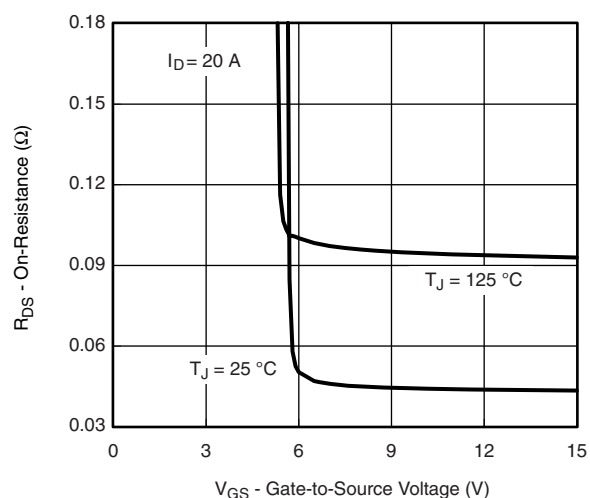
**Transfer Characteristics**



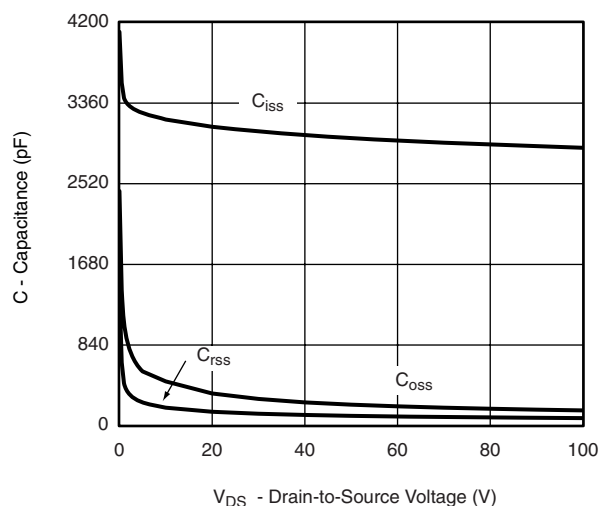
**Transconductance**



**On-Resistance vs. Drain Current**

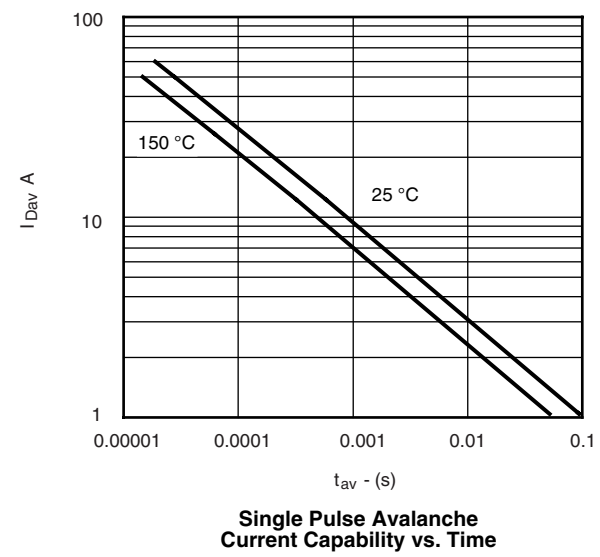
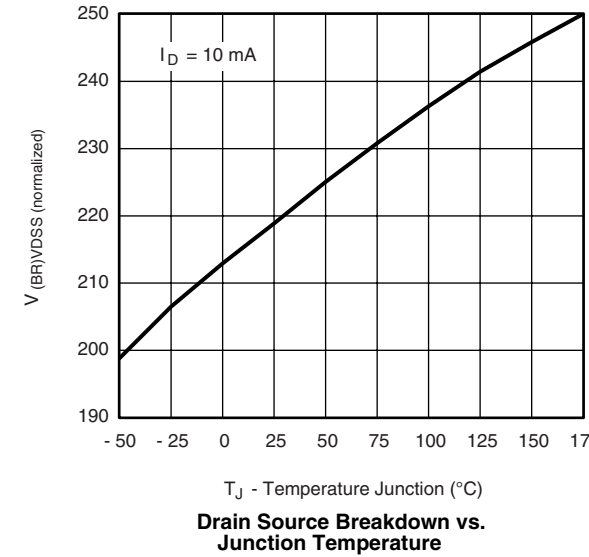
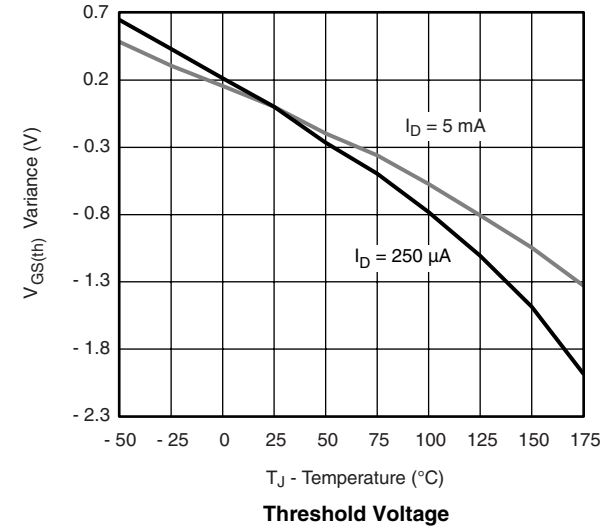
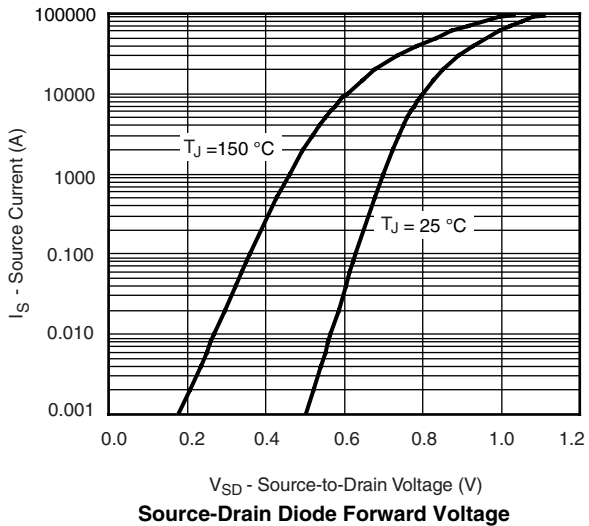
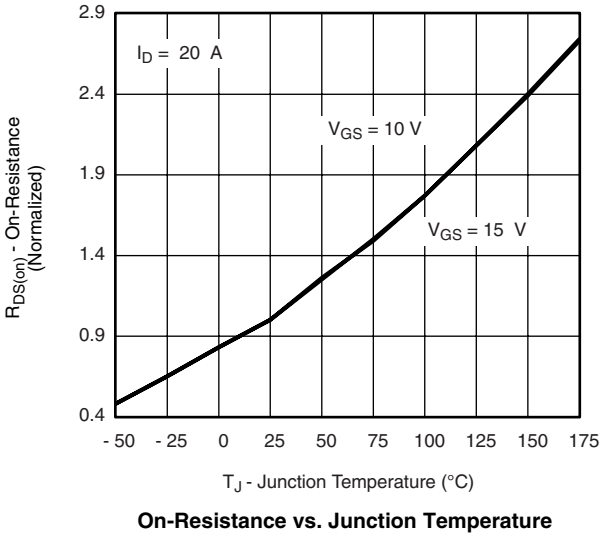
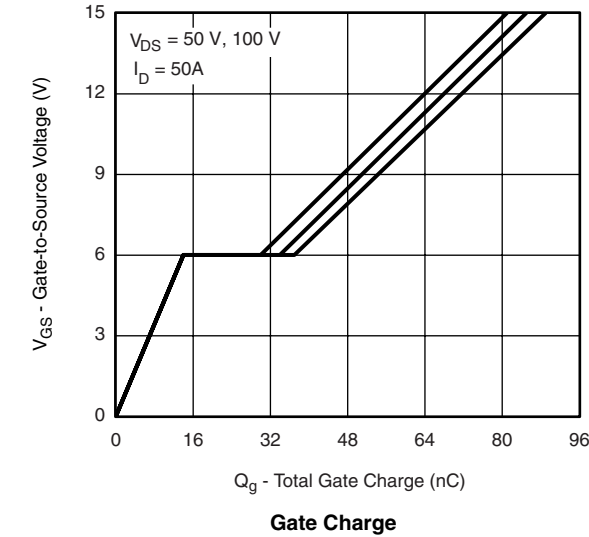


**On-Resistance vs. Gate-to-Source Voltage**

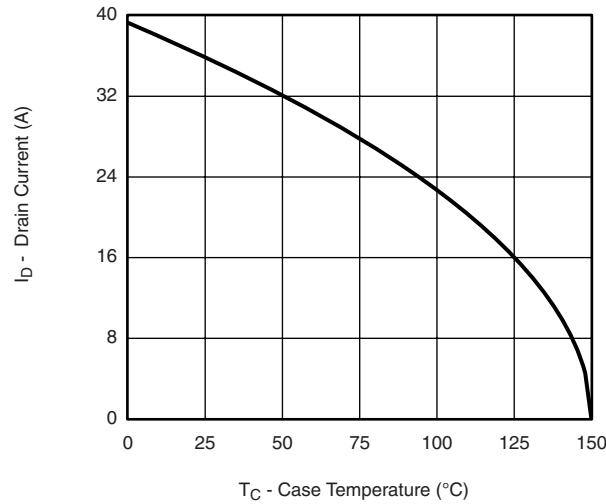


**Capacitance**

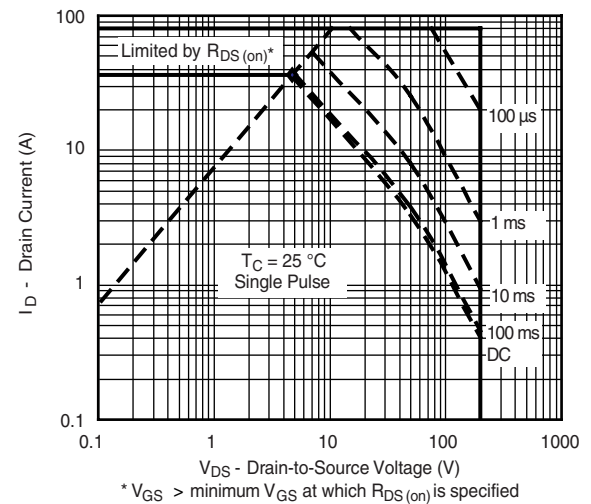
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



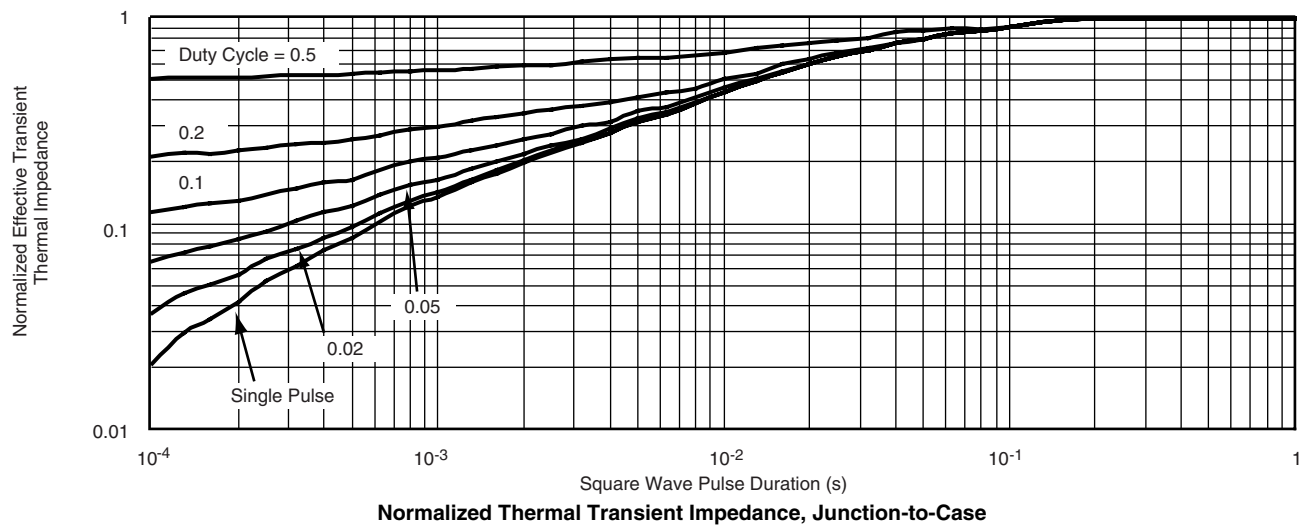
**THERMAL RATINGS**



**Maximum Drain Current vs. Case Temperature**



**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

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