

## IRF640NS-VB Datasheet

### N-Channel 200 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
200	0.048 at V <sub>GS</sub> = 10 V	40
	0.060 at V <sub>GS</sub> = 6.5 V	35

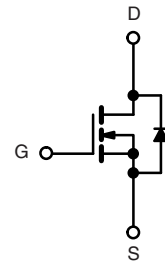
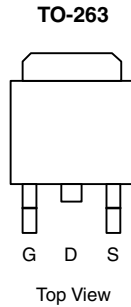
#### FEATURES

- TrenchFET® Power MOSFET
- 175 °C Junction Temperature
- Low Thermal Resistance Package
- PWM Optimized for Fast Switching
- Compliant to RoHS Directive 2002/95/EC



#### APPLICATIONS

- Isolated DC/DC Converters
- Primary-Side Switch



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	200	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 175 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	40
		T <sub>C</sub> = 125 °C	25
Pulsed Drain Current	I <sub>DM</sub>	80	A
Avalanche Current	I <sub>AR</sub>	20	
Repetitive Avalanche Energy <sup>a</sup>	E <sub>AR</sub>	16.2	mJ
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>C</sub> = 25 °C	200 <sup>b</sup>
		T <sub>A</sub> = 25 °C <sup>c</sup>	4.5
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C

THERMAL RESISTANCE RATINGS			
Parameter	Symbol	Limit	Unit
Junction-to-Ambient	R <sub>thJA</sub>	40	°C/W
Junction-to-Case (Drain)	R <sub>thJC</sub>	1	

Notes:

- a. Duty cycle ≤ 1 %.
- b. See SOA curve for voltage derating.
- c. When mounted on 1" square PCB (FR-4 material).

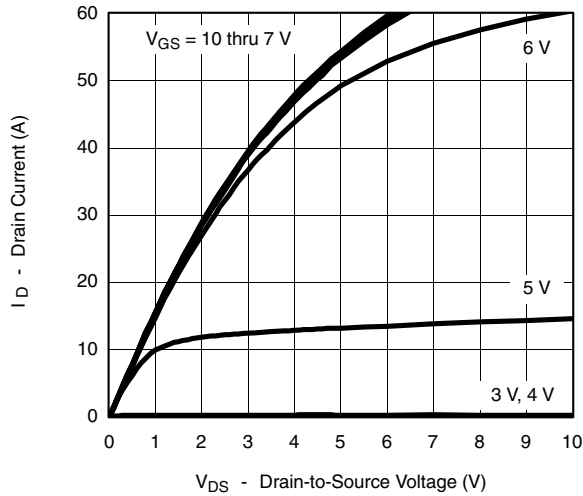
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min .	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	200			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2		4	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			50	
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$			250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 15\text{ V}, V_{GS} = 10\text{ V}$	60			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.048		$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.150		
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 175\text{ }^\circ\text{C}$		0.180		
Drain-Source on State Resistance		$V_{GS} = 6.5\text{ V}, I_D = 15\text{ A}$		0.060		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 30\text{ A}$	15			S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$		2820		$\mu\text{F}$
Output Capacitance	$C_{oss}$			300		
Reverse Transfer Capacitance	$C_{rss}$			120		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		35		nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			11		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			14		
Gate Resistance	$R_G$			2		$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 100\text{ V}, R_L = 5\text{ }\Omega$ $I_D \cong 20\text{ A}, V_{GEN} = 10\text{ V}, R_G = 2.5\text{ }\Omega$		15	25	ns
Rise Time <sup>c</sup>	$t_r$			35	55	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			40	60	
Fall Time <sup>c</sup>	$t_f$			30	45	
<b>Source-Drain Diode Ratings and Characteristics</b> ( $T_C = 25\text{ }^\circ\text{C}$ ) <sup>b</sup>						
Continuous Current	$I_S$				40	A
Pulsed Current	$I_{SM}$				60	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		1	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 50\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		115	170	ns
Peak Reverse Recovery Charge	$I_{RM(REC)}$			7.5	12	A
Reverse Recovery Charge	$Q_{rr}$			0.43	1.02	$\mu\text{C}$

**Notes:**

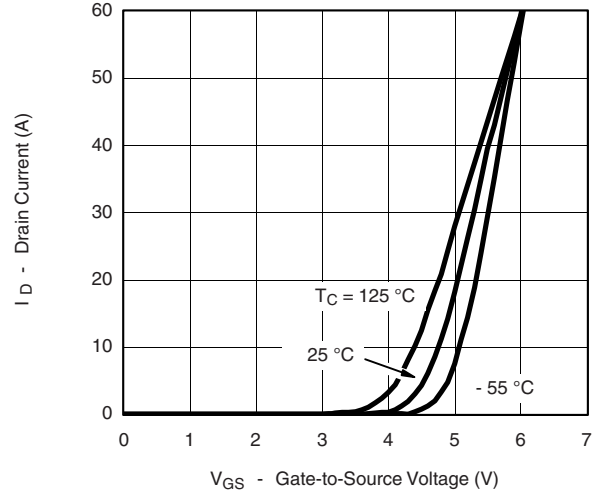
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

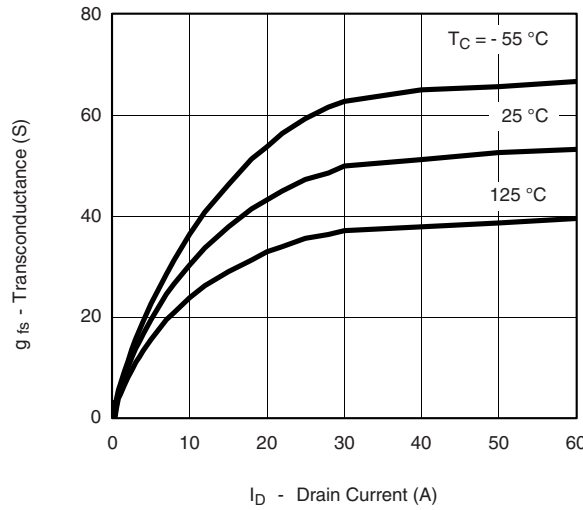
**TYPICAL CHARACTERISTICS** (25 °C unless noted)



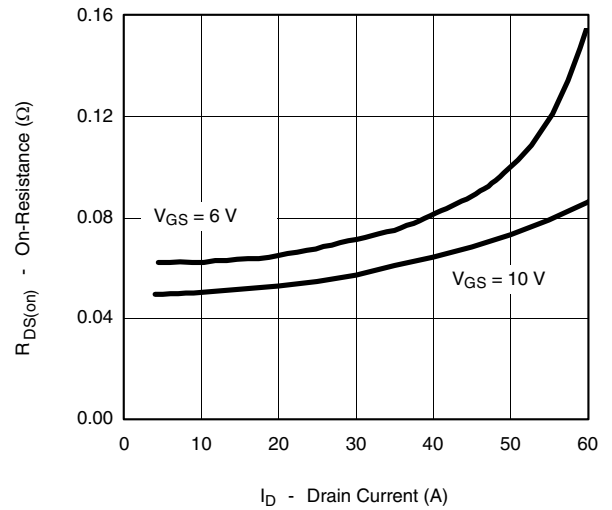
**Output Characteristics**



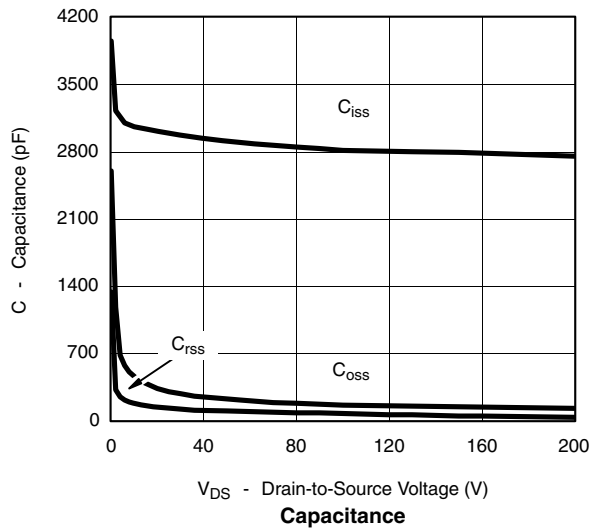
**Transfer Characteristics**



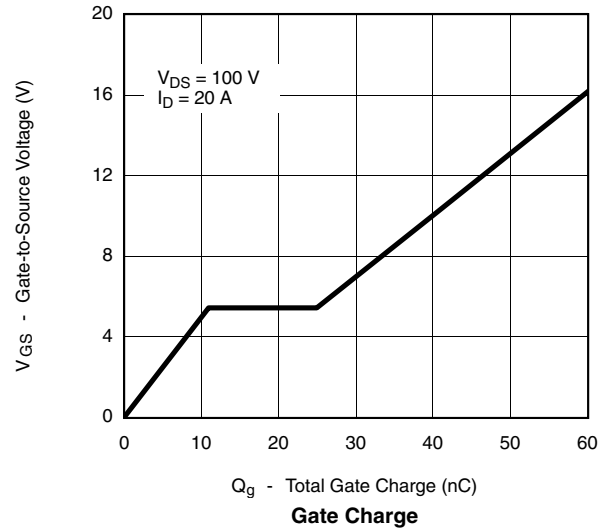
**Transconductance**



**On-Resistance vs. Drain Current**

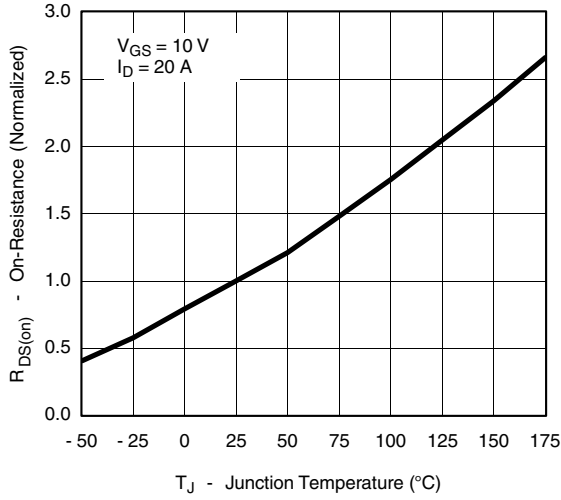


**Capacitance**

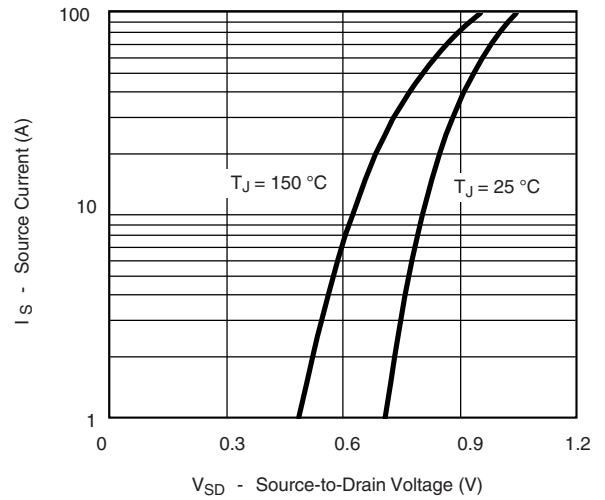


**Gate Charge**

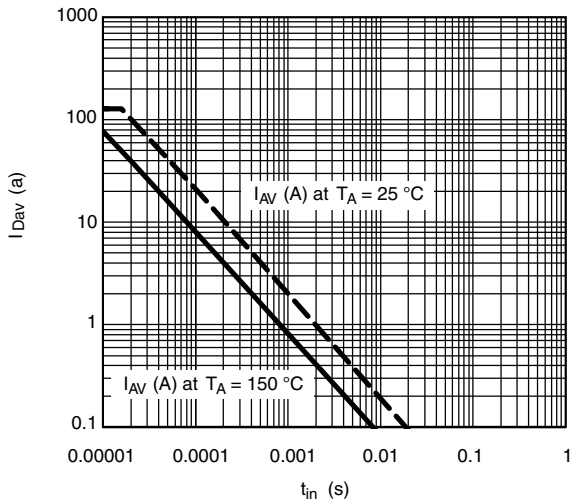
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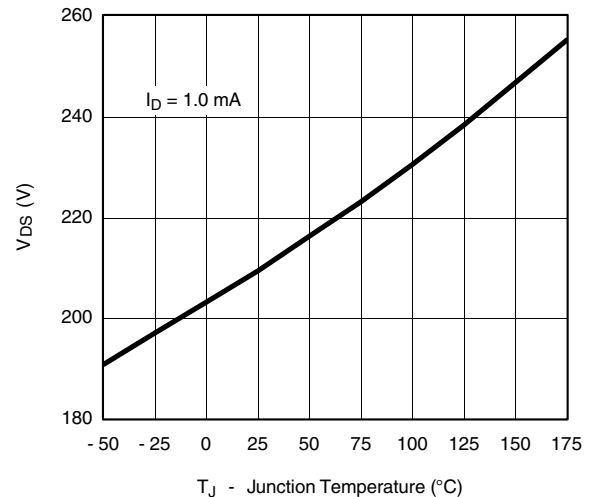
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

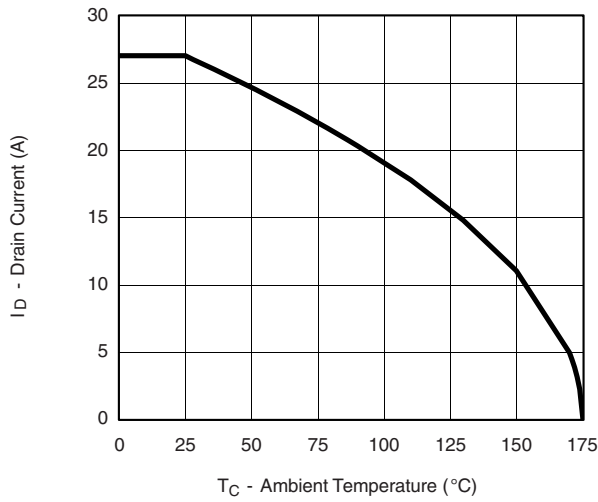


**Avalanche Current vs. Time**

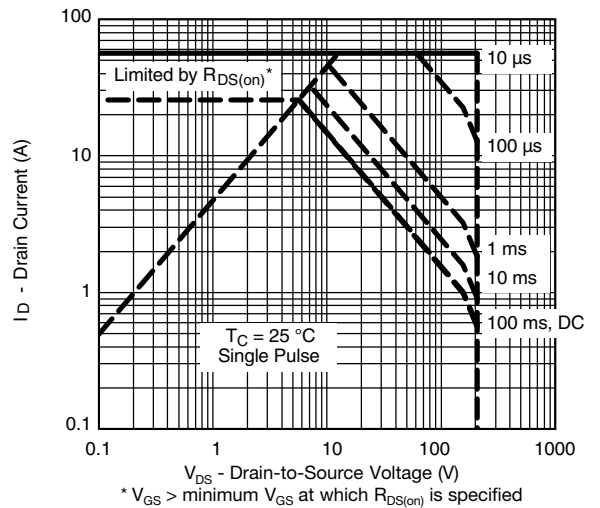


**Drain Source Breakdown vs. Junction Temperature**

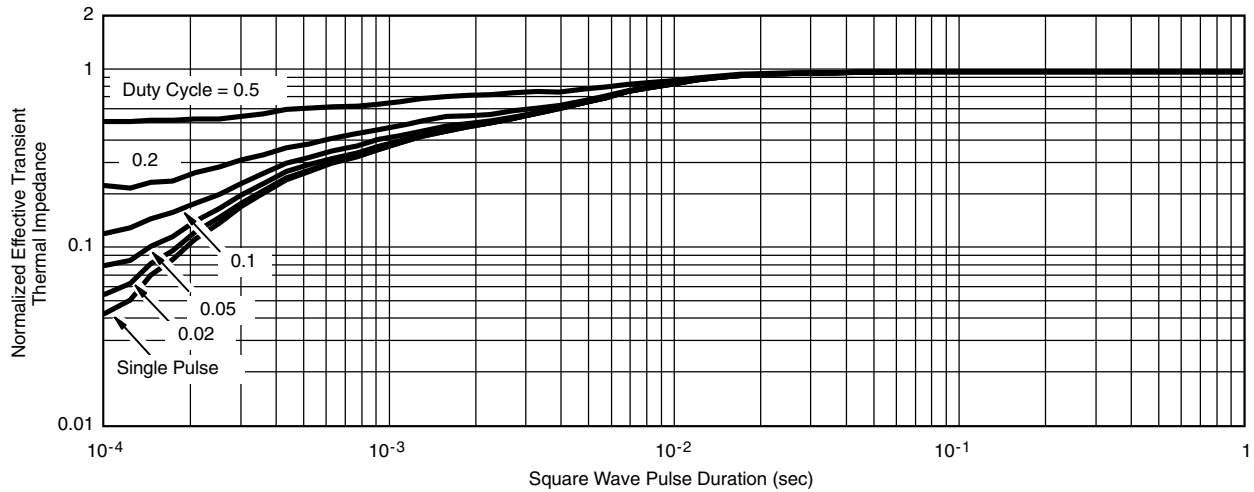
**THERMAL RATINGS**



**Maximum Avalanche and Drain Current vs. Case Temperature**



**Safe Operating Area**  
\*  $V_{GS} > \text{minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$



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

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