

IRFU9014NPBF-VB Datasheet

P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
- 60	0.066 at $V_{GS} = - 10$ V	- 20	40 nC
	0.080 at $V_{GS} = - 4.5$ V	- 18	

FEATURES

- Trench Power MOSFET
- 100 % UIS Tested

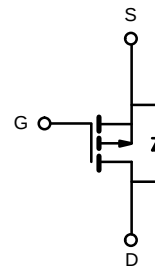
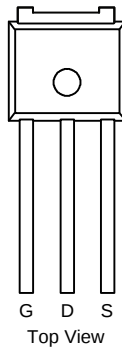
APPLICATIONS

- Load Switch



RoHS
COMPLIANT
HALOGEN
FREE

TO-251



P-Channel MOSFET

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

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	- 60	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	I_D	- 20 ^a	A
	$T_C = 70$ °C		- 16	
	$T_A = 25$ °C		- 11 ^b	
	$T_A = 70$ °C		- 9 ^b	
Pulsed Drain Current		I_{DM}	- 100	
Avalanche Current Pulse		I_{AS}	- 35	mJ
Single Pulse Avalanche Energy		E_{AS}	101	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	- 29 ^a	A
	$T_A = 25$ °C		- 2.1 ^b	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	35 ^a	W
	$T_C = 70$ °C		20 ^a	
	$T_A = 25$ °C		3.0 ^b	
	$T_A = 70$ °C		2 ^b	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^b	Steady State	R_{thJA}	33	40	°C/W
	Steady State	R_{thJC}	0.98	1.2	

Notes:

a. Based on $T_C = 25$ °C.

b. Surface mounted on 1" x 1" FR4 board.

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = - 250 μA	- 60			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = - 250 μA		68		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 5.2		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA	- 1.0		- 2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = - 60 V, V _{GS} = 0 V			- 1	μA
		V _{DS} = - 60 V, V _{GS} = 0 V, T _J = 55 °C			- 10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} = - 5 V, V _{GS} = - 10 V	- 120			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = - 10 V, I _D = - 30 A		0.066		Ω
		V _{GS} = - 4.5 V, I _D = - 20 A		0.080		
Forward Transconductance ^a	g _{fs}	V _{DS} = - 15 V, I _D = - 50 A	20			S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = - 25 V, V _{GS} = 0 V, f = 1 MHz		1200		pF
Output Capacitance	C _{oss}			200		
Reverse Transfer Capacitance	C _{rss}			150		
Total Gate Charge	Q _g	V _{DS} = - 30 V, V _{GS} = - 10 V, I _D = - 55 A		40		nC
		V _{DS} = - 30 V, V _{GS} = - 4.5 V, I _D = - 55 A		38		
Q _{gs}			16			
Q _{gd}			19			
Gate Resistance	R _g	f = 1 MHz		5.2		Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = - 2 V, R _L = 2 Ω I _D ≡ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω		10	15	ns
Rise Time	t _r			7	15	
Turn-Off Delay Time	t _{d(off)}			70	110	
Fall Time	t _f			40	60	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			- 66	A
Pulse Diode Forward Current ^a	I _{SM}				- 150	
Body Diode Voltage	V _{SD}	I _S = - 30 A		- 1	- 1.5	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = - 50 A, di/dt = 100 A/μs, T _J = 25 °C		45	68	ns
Body Diode Reverse Recovery Charge	Q _{rr}			59	120	nC
Reverse Recovery Fall Time	t _a			29		ns
Reverse Recovery Rise Time	t _b			16		

Notes:

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

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

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



Transconductance



Transfer Characteristics



Transconductance

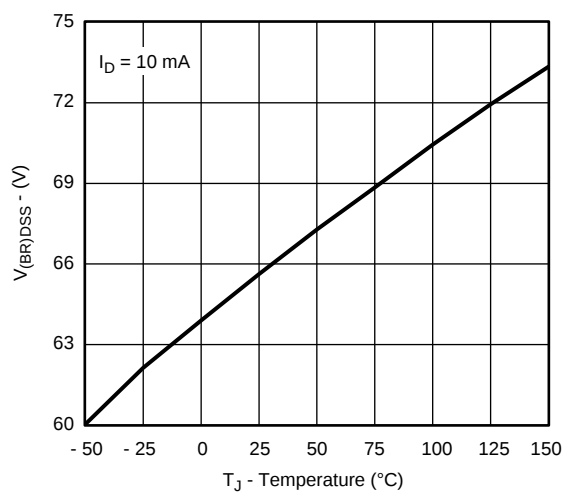
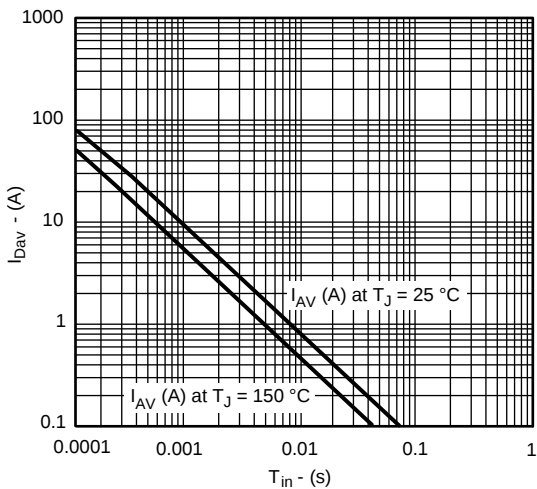
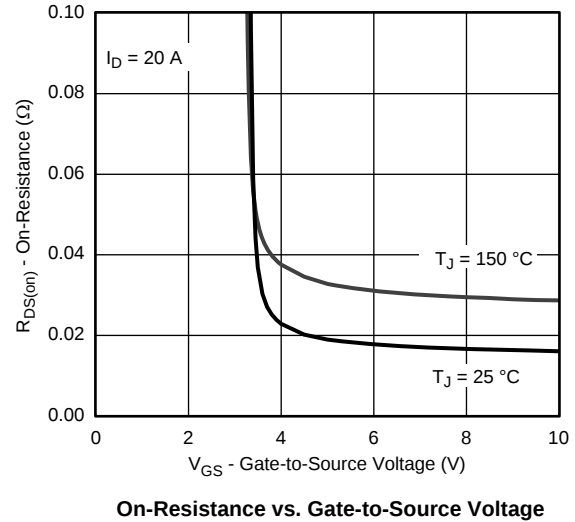
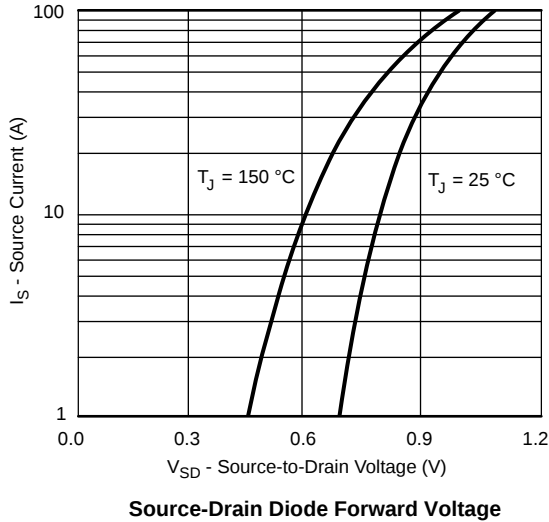
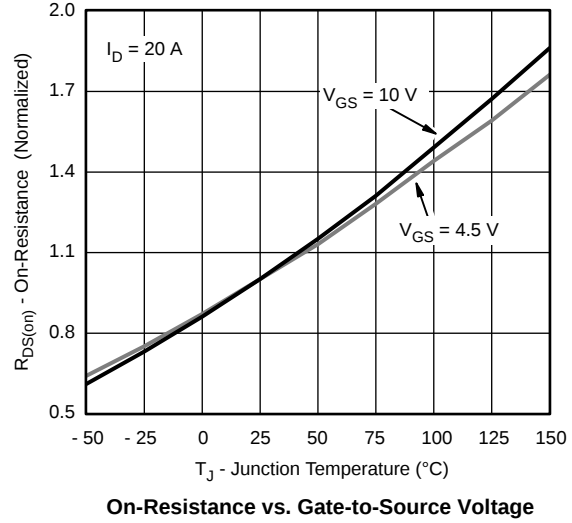
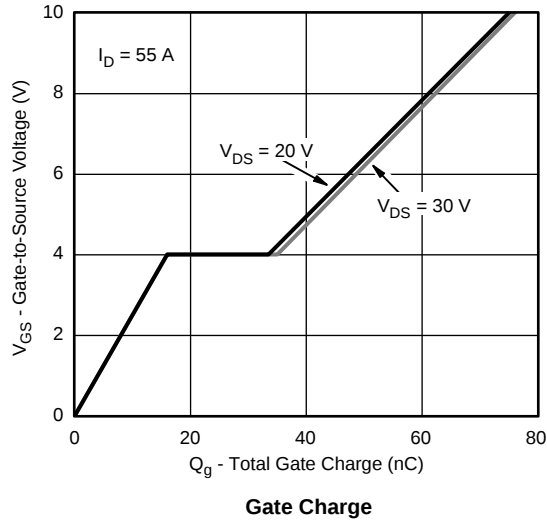


On-Resistance vs. Drain Current



Capacitance

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Single Pulse Avalanche Current Capability vs. Time

Drain-Source Breakdown Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Threshold Voltage



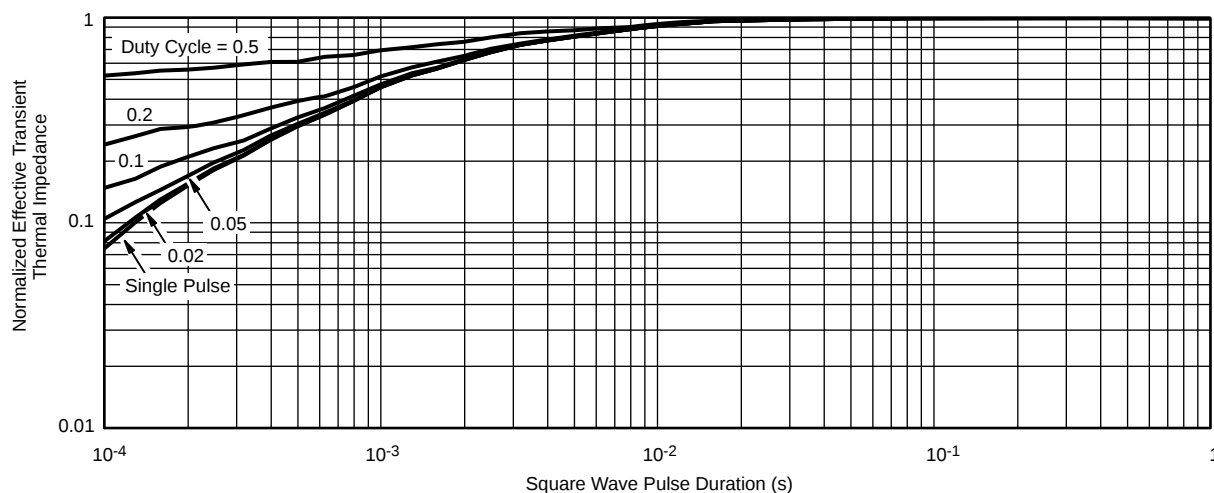
Max. Drain Current vs. Case Temperature



Power Derating, Junction-to-Case



Safe Operating Area, Junction-to-Case



Normalized Thermal Transient Impedance, Junction-to-Case

TO-251AA (DPAK)



Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	2.21	2.38	0.087	0.094
A1	0.89	1.14	0.035	0.045
b	0.71	0.89	0.028	0.035
b1	0.76	1.14	0.030	0.045
b2	5.23	5.43	0.206	0.214
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
E	6.48	6.73	0.255	0.265
e	2.28 BSC		0.090 BSC	
L	8.89	9.53	0.350	0.375
L1	1.91	2.28	0.075	0.090
L2	0.89	1.27	0.035	0.050
L3	1.15	1.52	0.045	0.060
ECN: S-03946—Rev. E, 09-Jul-01				
DWG: 5346				

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