

RFM3N45/3N50 RFP3N45/3N50

N-Channel Enhancement Mode
Power Field Effect Transistors

August 1991

Features

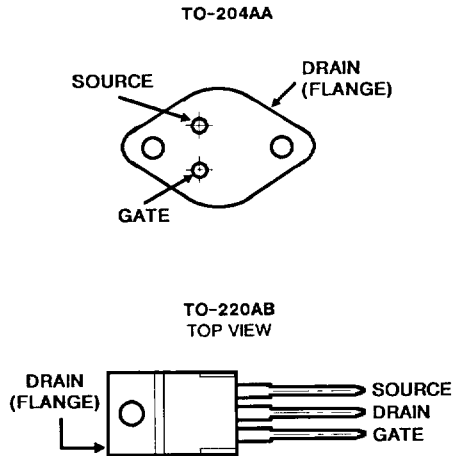
- 3A, 450V and 500V
- $r_{DS(on)} = 3\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

Description

The RFM3N45 and RFM3N50 and the RFP3N45 and RFP3N50 are n-channel enhancement-mode silicon-gate power field-effect transistors designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. These types can be operated directly from integrated circuits.

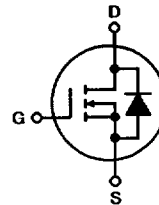
The RFM-series types are supplied in the JEDEC TO-204AA steel package and the RFP-series types in the JEDEC TO-220AB plastic package.

Packages



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$), Unless Otherwise Specified

	RFM3N45	RFM3N50	RFP3N45	RFP3N50	UNITS	
Drain-Source Voltage	V_{DS}	450	500	450	500	V
Drain-Gate Voltage ($R_{GS} = 1\text{m}\Omega$)	V_{DGR}	450	500	450	500	V
Continuous Drain Current						
RMS Continuous	I_D	3	3	3	3	A
Pulsed Drain Current	I_{DM}	5	5	5	5	A
Gate-Source Voltage	V_{GS}	± 20	± 20	± 20	± 20	V
Maximum Power Dissipation						
$T_C = +25^\circ\text{C}$	P_D	75	75	60	60	W
Above $T_C = +25^\circ\text{C}$, Derate Linearly	P_D	0.6	0.6	0.48	0.48	W/ $^\circ\text{C}$
Operating and Storage Junction	T_J, T_{STG}	-55 to +150	-55 to +150	-55 to +150	-55 to +150	$^\circ\text{C}$
Temperature Range						

Specifications RFM3N45, RFM3N50, RFP3N45, RFP3N50

ELECTRICAL CHARACTERISTICS, At Case Temperature (T_c)=25°C unless otherwise specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFM3N45 RFP3N45		RFM3N50 RFP3N50		
			Min.	Max.	Min.	Max.	
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 1 \text{ mA}$ $V_{GS} = 0$	450	—	500	—	V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$ $I_D = 1 \text{ mA}$	2	4	2	4	V
Zero-Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 360 \text{ V}$	—	10	—	—	μA
		$V_{DS} = 400 \text{ V}$	—	—	—	10	
		$T_C = 125^\circ\text{C}$ $V_{DS} = 360 \text{ V}$ $V_{DS} = 400 \text{ V}$	—	50	—	—	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20 \text{ V}$ $V_{DS} = 0$	—	100	—	100	nA
Drain-Source On Voltage	$V_{DS(on)}^a$	$I_D = 1.5 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	4.5	—	4.5	V
		$I_D = 3 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	10.5	—	10.5	
Static Drain-Source On Resistance	$r_{DS(on)}^a$	$I_D = 1.5 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	3	—	3	Ω
Forward Transconductance	g_{fs}^a	$V_{DS} = 10 \text{ V}$ $I_D = 1.5 \text{ A}$	1	—	1	—	mho
Input Capacitance	C_{iss}	$V_{DS} = 25 \text{ V}$	—	750	—	750	pF
Output Capacitance	C_{oss}	$V_{GS} = 0 \text{ V}$	—	150	—	150	
Reverse-Transfer Capacitance	C_{rss}	$f = 1 \text{ MHz}$	—	100	—	100	
Turn-On Delay Time	$t_d(on)$	$V_{DD} = 250 \text{ V}$ $I_D = 1.5 \text{ A}$ $R_{gen} = R_{gs} = 50 \Omega$ $V_{GS} = 10 \text{ V}$	30(Typ)	45	30(Typ)	45	ns
Rise Time	t_r		40(Typ)	60	40(Typ)	60	
Turn-Off Delay Time	$t_d(off)$		90(Typ)	135	90(Typ)	135	
Fall Time	t_f		50(Typ)	75	50(Typ)	75	
Thermal Resistance Junction-to-Case	$R_{\theta JC}$		RFM3N45, RFM3N50	—	1.67	—	
		RFP3N45, RFP3N50	—	2.083	—	2.083	

^a Pulsed: Pulse duration=300 μs max., duty cycle=2%.

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFM3N45 RFP3N45		RFM3N50 RFP3N50		
			MIN.	MAX.	MIN.	MAX.	
Diode Forward Voltage	V_{SD}	$I_{SD} = 1.5 \text{ A}$	—	1.4	—	1.4	V
Reverse Recovery Time	t_{rr}	$I_F = 4 \text{ A}$ $d_f/d_r = 100 \text{ A}/\mu\text{s}$	800(typ)		800(typ)		ns

*Pulse Test: Width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.

RFM3N45, RFM3N50, RFP3N45, RFP3N50

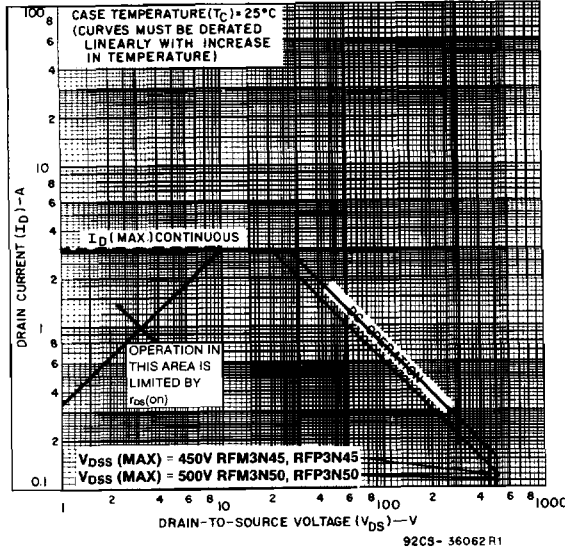


Fig. 1 - Maximum operating areas for all types.

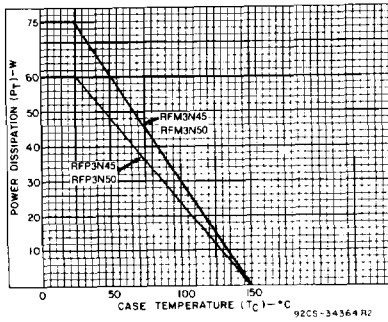


Fig. 2 - Power dissipation vs. temperature derating curve for all types.

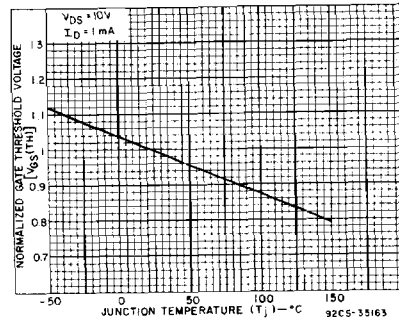


Fig. 3 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

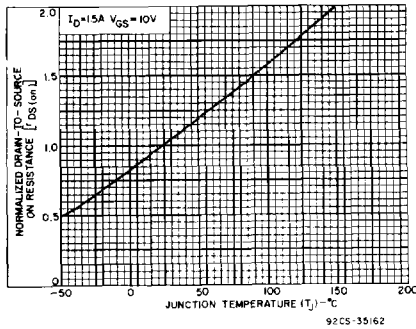


Fig. 4 - Normalized drain-to-source on resistance to junction temperature for all types.

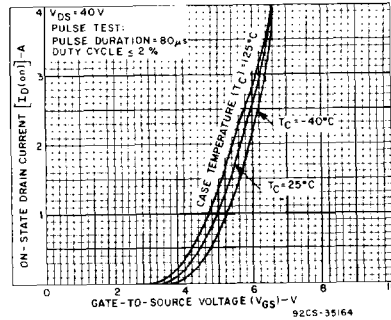


Fig. 5 - Typical transfer characteristics for all types.

RFM3N45, RFM3N50, RFP3N45, RFP3N50

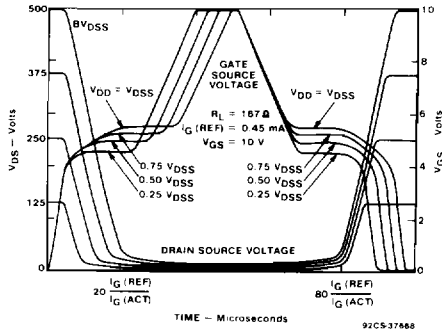


Fig. 6 - Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN-7254 and AN-7260

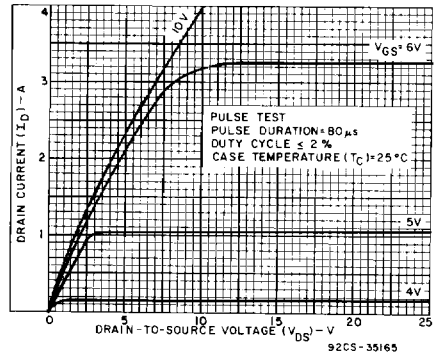


Fig. 7 - Typical saturation characteristics for all types.

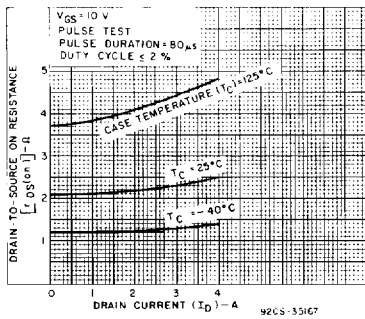


Fig. 8 - Typical drain-to-source on resistance as a function of drain current for all types.

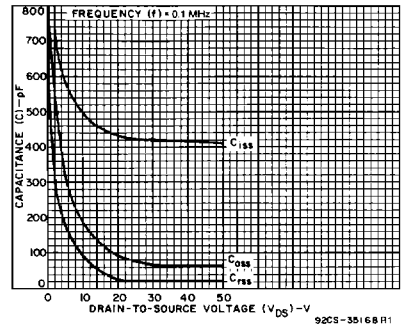


Fig. 9 - Capacitance as a function of drain-to-source voltage for all types.

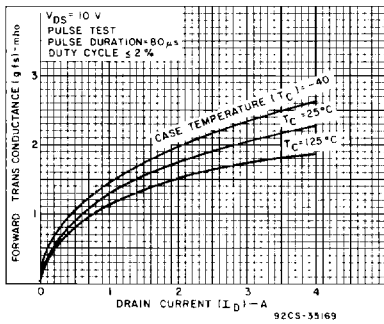


Fig. 10 - Typical forward transconductance as a function of drain current for all types.

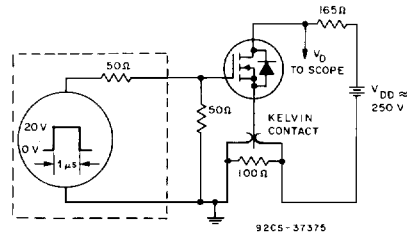


Fig. 11 - Switching Time Test Circuit