

RFM4N35/4N40 RFP4N35/4N40

N-Channel Enhancement Mode
Power Field Effect Transistors

August 1991

Features

- 4A, 350V and 400V
- $r_{DS(on)} = 2\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

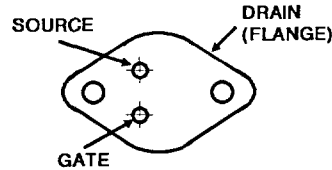
Description

The RFM4N35 and RFM4N40 and the RFP4N35 and RFP4N40 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.

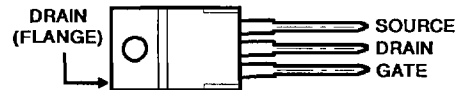
The RFM-series types are supplied in the JEDEC TO-204AA steel package and the RFP-series types in the JEDEC TO-220AB plastic package.

Packages

TO-204AA

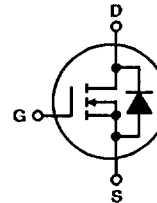


TO-220AB
TOP VIEW



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



4
N-CHANNEL
POWER MOSFETS

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

	RFM4N35	RFM4N40	RFP4N35	RFP4N40	UNITS
Drain-Source Voltage	350	400	350	400	V
Drain-Gate Voltage ($R_{GS} = 1\text{m}\Omega$)	350	400	350	400	V
Continuous Drain Current					
RMS Continuous	4	4	4	4	A
Pulsed Drain Current	8	8	8	8	A
Gate-Source Voltage	± 20	± 20	± 20	± 20	V
Maximum Power Dissipation					
$T_C = +25^\circ\text{C}$	75	75	60	60	W
Above $T_C = +25^\circ\text{C}$, Derate Linearly	0.6	0.6	0.48	0.48	W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	-55 to +150	-55 to +150	-55 to +150	-55 to +150	$^\circ\text{C}$

Specifications RFM4N35, RFM4N40, RFP4N35, RFP4N40

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

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFM4N35 RFP4N35		RFM4N40 RFP4N40		
			MIN.	MAX.	MIN.	MAX.	
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D=1\text{ mA}$ $V_{GS}=0$	350	—	400	—	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}	$V_{DS}=280\text{ V}$ $V_{GS}=320\text{ V}$	—	10	—	—	μA
		$T_c=125^\circ\text{C}$ $V_{DS}=280\text{ V}$ $V_{GS}=320\text{ V}$	—	100	—	100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20\text{ V}$ $V_{DS}=0$	—	100	—	100	nA
Drain-Source On Voltage	$V_{DS(on)}^a$	$I_D=2\text{ A}$ $V_{GS}=10\text{ V}$	—	4	—	4	V
		$I_D=4\text{ A}$ $V_{GS}=10\text{ V}$	—	12	—	12	
Static Drain-Source On Resistance	$r_{DS(on)}^a$	$I_D=2\text{ A}$ $V_{GS}=10\text{ V}$	—	2	—	2	Ω
Forward Transconductance	g_{fs}^a	$V_{DS}=10\text{ V}$ $I_D=2\text{ A}$	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	$t_d(on)$	$V_{DD}=200\text{ V}$ $I_D=2\text{ A}$ $R_{gen}=R_{gs}=50\ \Omega$	12(typ)	45	12(typ)	45	ns
Rise Time	t_r		42(typ)	60	42(typ)	60	
Turn-Off Delay Time	$t_d(off)$		130(typ)	200	130(typ)	200	
Fall Time	t_f		62(typ)	100	62(typ)	100	
Thermal Resistance Junction-to-Case	$R\theta_{JC}$	RFM4N35, RFM4N40	—	1.67	—	1.67	$^\circ\text{C/W}$
		RFP4N35, RFP4N40	—	2.083	—	2.083	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFM4N35 RFP4N35		RFM4N40 RFP4N40		
			MIN.	MAX.	MIN.	MAX.	
Diode Forward Voltage	V_{SD}^a	$I_{SD}=2\text{ A}$	—	1.4	—	1.4	V
Reverse Recovery Time	t_{rr}	$I_F=4\text{ A}$ $dI_F/dt=100\text{ A}/\mu\text{s}$	800(typ)		800(typ)		ns

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

RFM4N35, RFM4N40, RFP4N35, RFP4N40

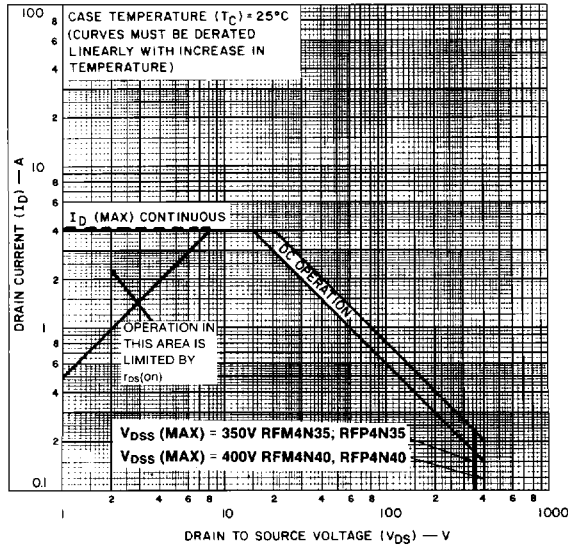


Fig. 1 — Maximum operating areas for all types.

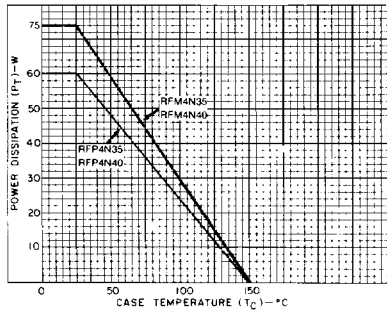


Fig. 2 — Power dissipation vs. temperature derating curve for all types.

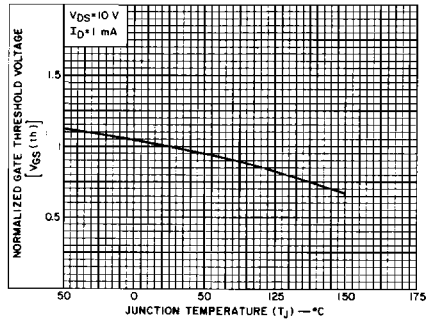


Fig. 3 — Typical normalized gate threshold voltage as a function of junction temperature for all types.

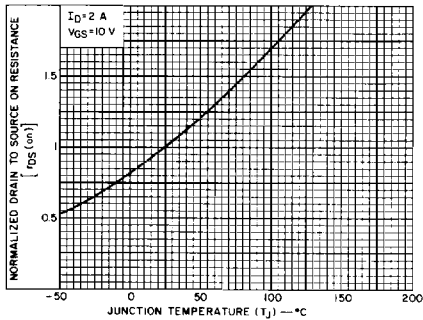


Fig. 4 — Normalized drain-to-source resistance to junction temperature for all types.

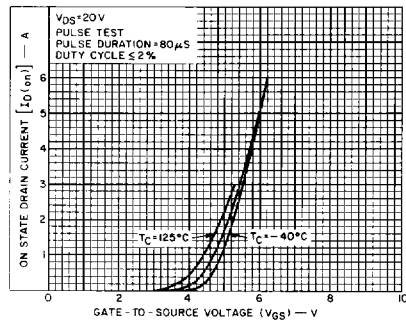


Fig. 5 — Typical transfer characteristics for all types.

RFM4N35, RFM4N40, RFP4N35, RFP4N40

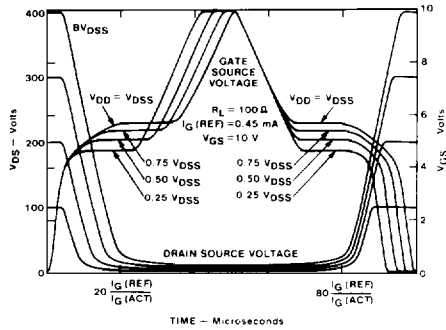


Fig. 6 - Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN-7254 and AN-7260

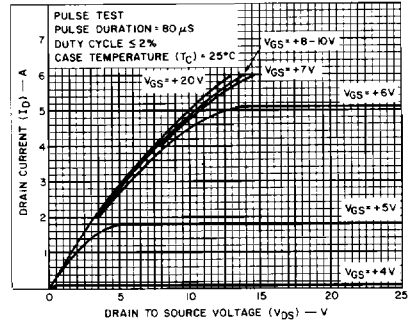


Fig. 7 - Typical saturation characteristics for all types.

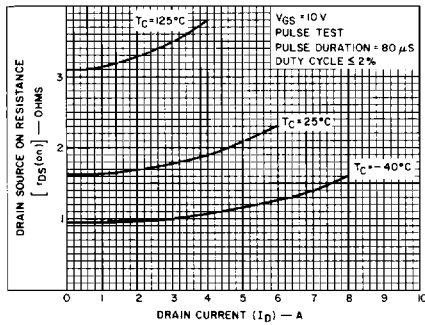


Fig. 8 - Typical drain-to-source on resistance as a function of drain current for all types.

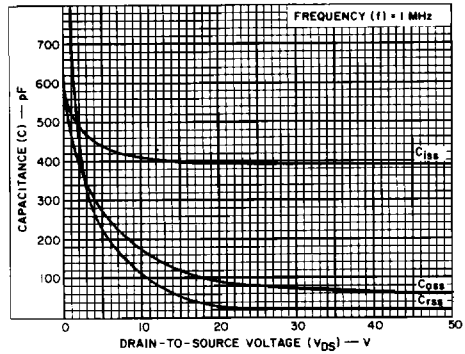


Fig. 9 - Capacitance as a function of drain-to-source voltage for all types.

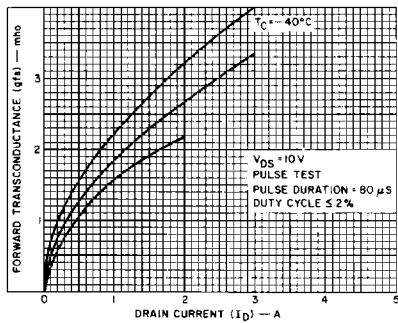


Fig. 10 - Typical forward transconductance as a function of drain current for all types.

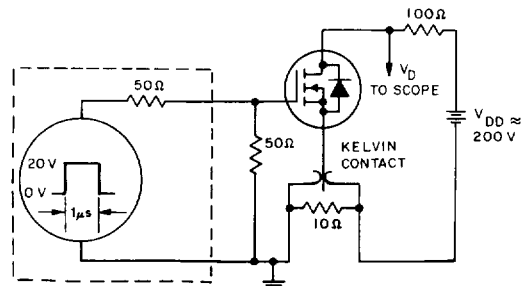


Fig. 11 - Switching Time Test Circuit