

# RFL4N12 RFL4N15

## N-Channel Enhancement-Mode Power Field-Effect Transistors

August 1991

### Features

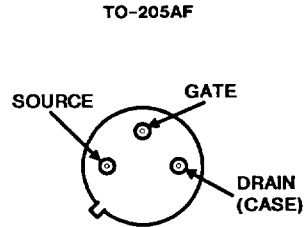
- 4A, 120V and 150V
- $r_{DS(on)} = 0.4\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

### Description

The RFL4N12 and RFL4N15 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.

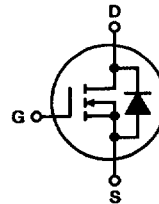
The RFL-series types are supplied in the JEDEC TO-205AF metal package.

### Package



### Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



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

	RFL4N12	RFL4N15	UNITS	
Drain-Source Voltage .....	$V_{DSS}$	120	150	V
Drain-Gate Voltage ( $R_{GS} = 1\text{M}\Omega$ ) .....	$V_{DGR}$	120	150	V
Continuous Drain Current				
$T_C = +25^\circ\text{C}$ .....	$I_D$	4	4	A
Pulsed Drain Current .....	$I_{DM}$	15	15	A
Gate-Source Voltage .....	$V_{GS}$	$\pm 20$	$\pm 20$	V
Maximum Power Dissipation				
$T_C = +25^\circ\text{C}$ .....	$P_D$	8.33	8.33	W
Linear Derating Factor .....		0.0667	0.0667	W/ $^\circ\text{C}$
Operating and Storage Temperature .....	$T_J, T_{STG}$	-55 to +150	-55 to +150	$^\circ\text{C}$

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N-CHANNEL  
POWER MOSFETS

## Specifications RFL4N12, RFL4N15

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFL4N12		RFL4N15		
			Min.	Max.	Min.	Max.	
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D=1\text{ mA}$ $V_{GS}=0$	120	—	150	—	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	$I_{DSS}$	$V_{DS}=100\text{ V}$ $V_{GS}=120\text{ V}$	—	1	—	—	$\mu\text{A}$
		$T_C=125^\circ\text{ C}$ $V_{DS}=100\text{ V}$ $V_{GS}=120\text{ V}$	—	50	—	50	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20\text{ V}$ $V_{DS}=0$	—	100	—	100	nA
Drain-Source On Voltage	$V_{DS(on)}^{\text{a}}$	$I_D=2\text{ A}$ $V_{GS}=10\text{ V}$	—	0.8	—	0.8	V
		$I_D=4\text{ A}$ $V_{GS}=10\text{ V}$	—	3	—	3	
Static Drain-Source On Resistance	$r_{DS(on)}^{\text{a}}$	$I_D=2\text{ A}$ $V_{GS}=10\text{ V}$	—	0.40	—	0.40	$\Omega$
Forward Transconductance	$g_{fs}^{\text{a}}$	$V_{DS}=10\text{ V}$ $I_D=2\text{ A}$	1.5	—	1.5	—	mho
Input Capacitance	$C_{iss}$	$V_{DS}=25\text{ V}$	—	850	—	850	pF
Output Capacitance	$C_{oss}$	$V_{GS}=0\text{ V}$	—	230	—	230	
Reverse-Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$	—	100	—	100	
Turn-On Delay Time	$t_d(on)$	$V_{DD} = 75\text{ V}$ $I_D=2\text{ A}$ $R_{\theta en}=R_{\theta cs}=50\ \Omega$ $V_{GS}=10\text{ V}$	40(typ)	60	40(typ)	60	ns
Rise Time	$t_r$		165(typ)	250	165(typ)	250	
Turn-Off Delay Time	$t_d(off)$		90(typ)	135	90(typ)	135	
Fall Time	$t_f$		90(typ)	135	90(typ)	135	
Thermal Resistance Junction-to-Case	$R_{\theta jc}$		RFL4N12, RFL4N15	—	15	—	

### SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFL4N12		RFL4N15		
			Min.	Max.	Min.	Max.	
Diode Forward Voltage	$V_{SD}^{\text{a}}$	$I_{SD} = 2\text{ A}$	—	1.4	—	1.4	V
Reverse Recovery Time	$t_{rr}$	$I_F = 4\text{ A}$ $dI_F/dt = 100\text{ A}/\mu\text{s}$	200(typ.)		200(typ.)		ns

<sup>a</sup>Pulsed: Pulse duration=300  $\mu\text{s}$  max., duty cycle=2%.

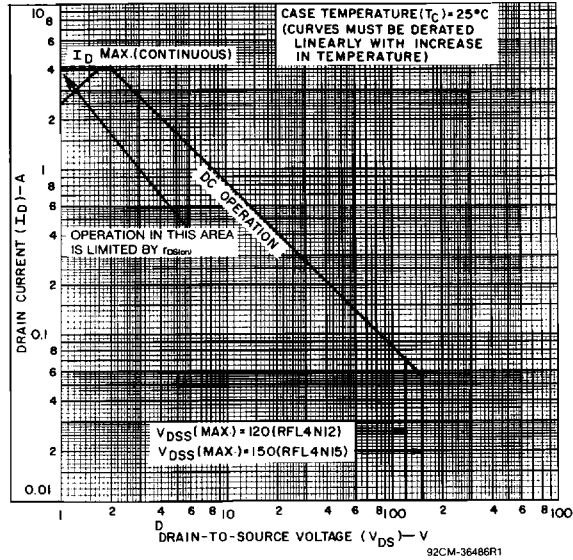


Fig. 1 - Maximum safe operating areas for all types.

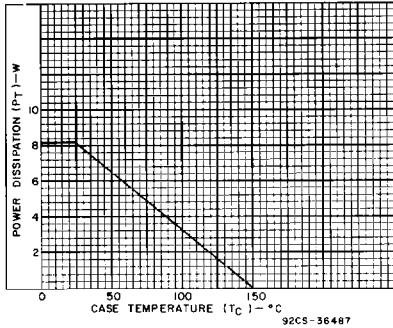


Fig. 2 - Power vs. temperature derating curve for all types.

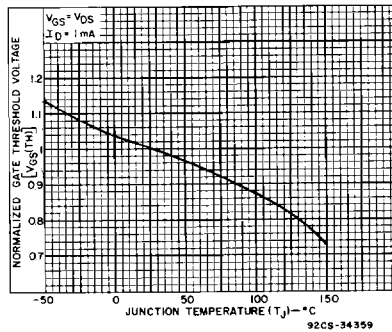


Fig. 3 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

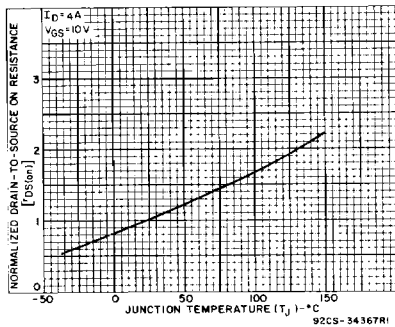


Fig. 4 - Normalized drain-to-source on resistance as a function of junction temperature for all types.

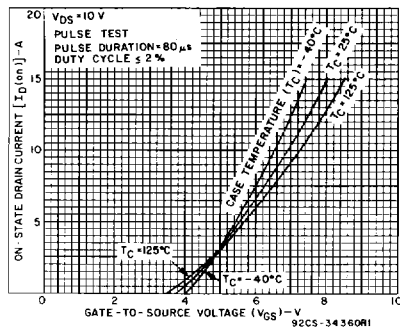


Fig. 5 - Typical transfer characteristics for all types.

# RFL4N12, RFL4N15

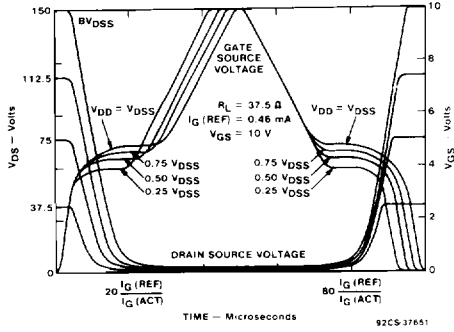


Fig. 6 - Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN-7254 and AN-7260

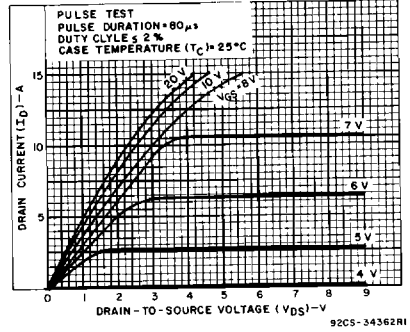


Fig. 7 - Typical saturation characteristics for all types.

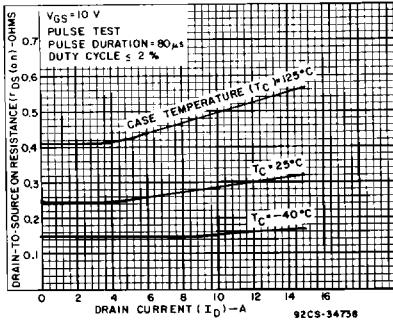


Fig. 8 - Typical drain-to-source on resistance as a function of drain current for all types.

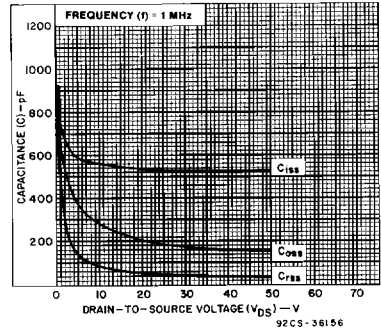


Fig. 9 - Capacitance as a function of drain-to-source voltage for all types.

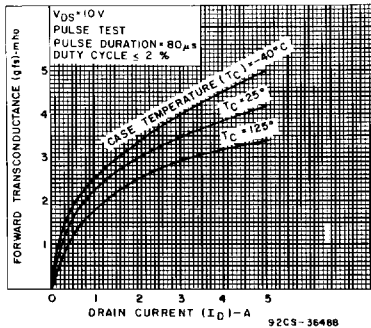


Fig. 10 - Typical forward transconductance as a function of drain current for all types.

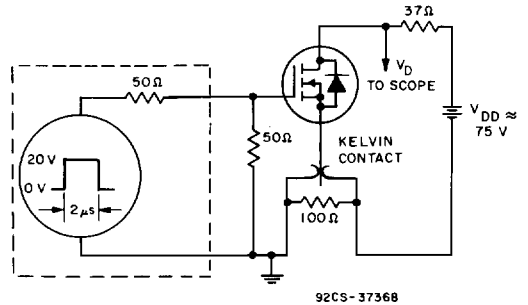


Fig. 11 - Switching Time Test Circuit.