

August 1991

### Features

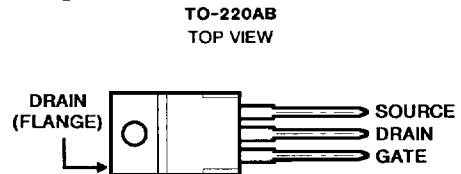
- 50A, 50V and 60V
- $r_{DS(on)} = 0.8\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

### Description

The RFP4N05 and RFP4N06 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.

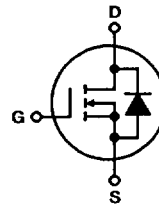
The RFP-series types are supplied in the JEDEC TO-220AB plastic package.

### Package



### Terminal Diagram

#### N-CHANNEL ENHANCEMENT MODE



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

	RFP4N05	RFP4N06	UNITS
Drain-Source Voltage .....	50	60	V
Drain-Gate Voltage ( $R_{GS} = 1\text{M}\Omega$ ) .....	50	60	V
Continuous Drain Current .....	4	4	A
Pulsed Drain Current .....	10	10	A
Gate-Source Voltage .....	$\pm 20$	$\pm 20$	V
Maximum Power Dissipation			
$T_C = +25^\circ\text{C}$ .....	25	25	W
Linear Derating Factor .....	0.2	0.2	W/ $^\circ\text{C}$
Operating and Storage Temperature .....	-55 to +150	-55 to +150	$^\circ\text{C}$

**4**
**N-CHANNEL  
POWER MOSFETS**

## Specifications RFP4N05, RFP4N06

**Electrical Characteristics** ( $T_C = +25^\circ\text{C}$ ), Unless Otherwise Specified

CHARACTERISTIC	SYMBOLS	TEST CONDITIONS	LIMITS				UNITS
			RFP4N05		RFP4N06		
			MIN	MAX	MIN	MAX	
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D = 1\text{ mA}, V_{GS} = 0$	50	-	60	-	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	$I_{DSS}$	$V_{DS} = 40\text{ V}$	-	1	-	-	$\mu\text{A}$
		$V_{DS} = 50\text{ V}$	-	-	-	1	$\mu\text{A}$
		$T_C = +125^\circ\text{C}$ $V_{DS} = 40\text{ V}$	-	50	-	-	$\mu\text{A}$
		$V_{DS} = 50\text{ V}$	-	-	-	50	$\mu\text{A}$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0$	-	100	-	100	nA
Drain-Source On-Voltage	$V_{DS(on)}^*$	$I_D = 1\text{ A}, V_{GS} = 10\text{ V}$	-	0.8	-	0.8	V
		$I_D = 2\text{ A}, V_{GS} = 10\text{ V}$	-	2.0	-	2.0	V
		$I_D = 4\text{ A}, V_{GS} = 10\text{ V}$	-	4.8	-	4.8	V
Static Drain-Source On Resistance	$r_{DS(on)}^*$	$I_D = 1\text{ A}, V_{GS} = 10\text{ V}$	-	0.8	-	0.8	$\Omega$
Forward Transconductance	$g_{fs}^*$	$I_D = 1\text{ A}, V_{DS} = 10\text{ V}$	400	-	400	-	S (S)
Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$	-	200	-	200	pF
Output Capacitance	$C_{OSS}$		-	85	-	85	pF
Reverse-Transfer Capacitance	$C_{RSS}$		-	30	-	30	pF
Turn-On Delay Time	$t_{d(on)}$		$I_D = 1\text{ A}, V_{DD} = 30\text{ V}$ $R_{GEN} = R_{GS} = 50\Omega$ $V_{GS} = 10\text{ V}$	6 (typ)	15	6 (typ)	15
Rise Time	$t_r$		14 (typ)	30	14 (typ)	30	ns
Turn-Off Delay Time	$t_{d(off)}$		16 (typ)	30	16 (typ)	30	ns
Fall Time	$t_f$		14 (typ)	25	14 (typ)	25	ns
Thermal Resistance Junction-to-Case	$R_{\theta JC}$		-	5	-	5	$^\circ\text{C/W}$

\* Pulsed: Pulse duration = 300 $\mu\text{s}$  max., duty cycle = 2%.

### Source-Drain Diode Ratings and Characteristics

CHARACTERISTIC	SYMBOLS	TEST CONDITIONS	LIMITS				UNITS
			RFP4N05		RFP4N06		
			MIN	MAX	MIN	MAX	
Diode Forward Voltage	$V_{SD}^*$	$I_{SD} = 1\text{ A}$	-	1.4	-	1.4	V
Diode Reverse Recovery Time	$t_{rr}$	$I_F = 2\text{ A}$ $dI_F/dt = 50\text{ A}/\mu\text{s}$	100 (typ)	100 (typ)	100 (typ)	100 (typ)	ns

\* Pulsed: Pulse duration  $\leq 300\mu\text{s}$  max., duty cycle  $\leq 2\%$ .

# RFP4N05, RFP4N06

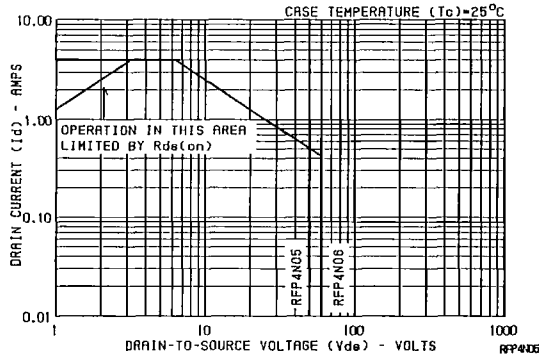


Fig. 1 — Maximum operating areas for all types.

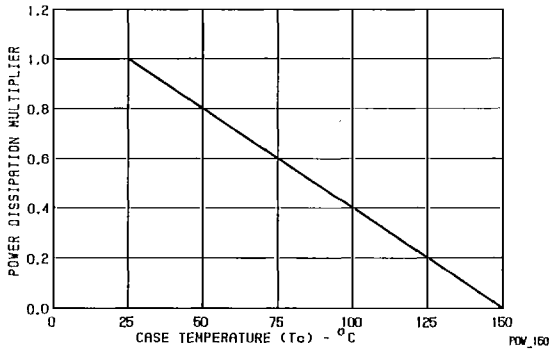


Fig. 2 — Power dissipation vs. case temperature derating curve for all types.

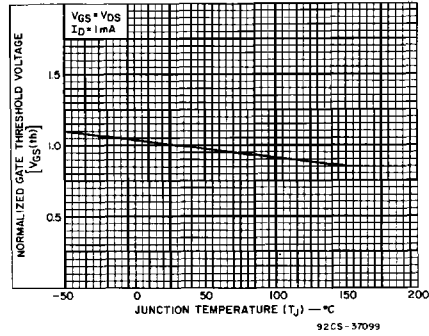


Fig. 3 — Typical normalized gate threshold voltage as a function of junction temperature for all types.

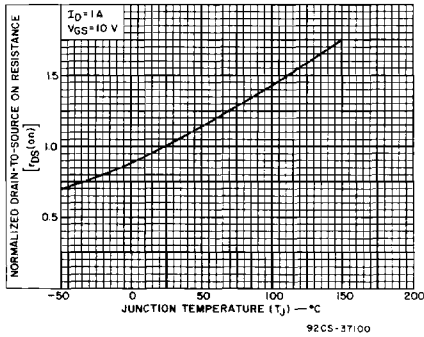


Fig. 4 — Normalized drain-to-source on resistance to junction temperature for all types.

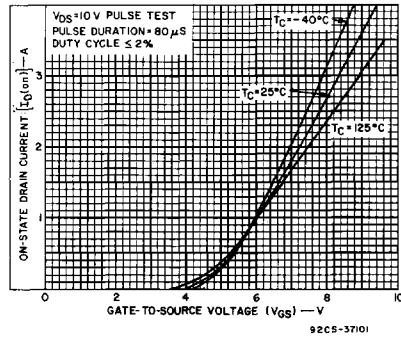


Fig. 5 — Typical transfer characteristics for all types.

4  
N-CHANNEL  
POWER MOSFETS

# RFP4N05, RFP4N06

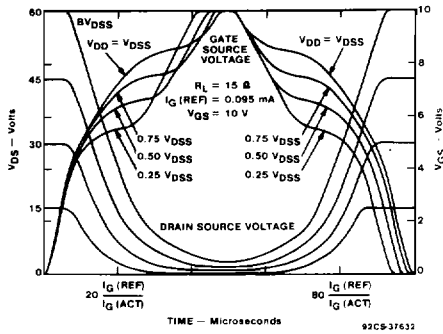


Fig. 6 – Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN-7254 and AN-7260

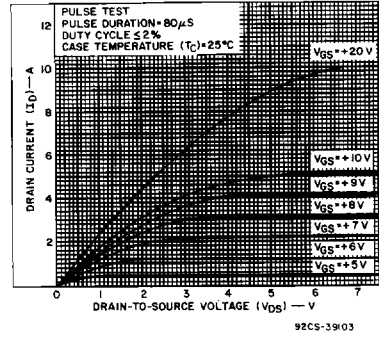


Fig. 7 — Typical saturation characteristics for all types.

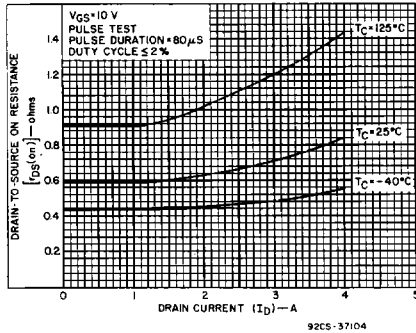


Fig. 8 — Typical drain-to-source on resistance as a function of drain current for all types.

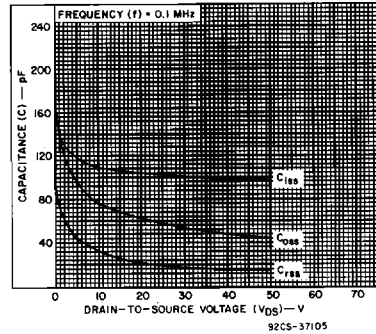


Fig. 9 — Capacitance as a function of drain-to-source voltage for all types

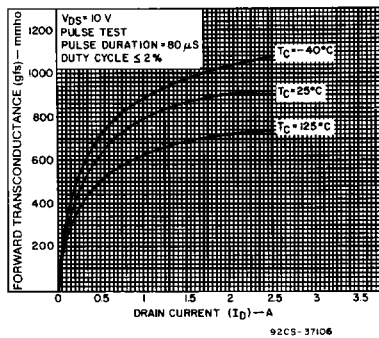


Fig. 10 — Typical forward transconductance as a function of drain current for all types.

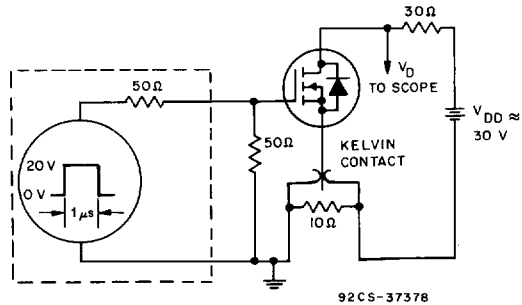


Fig. 11 — Switching Time Test Circuit