MPF970
MPF971

CASE 29-02, STYLE 5
TO-92 (TO-226AA)

JFET
SWITCHING

P-CHANNEL — DEPLETION

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	25	Vdc
Drain-Gate Voltage	V_{DG}	30	Vdc
Reverse Gate-Source Voltage	V_{GSR}	30	Vdc
Forward Gate Current	$I_{G(f)}$	10	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	350 2.8	mW mW/°C
Storage Channel Temperature Range	T_{stg}	−65 to +150	°C
Operating Temperature Range	$T_{channel}$	−65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Gate-Source Breakdown Voltage (I_G = 1.0 μAdc, V_{DS} = 0)		$V_{(BR)GSS}$	30	—	—	Vdc
Gate Reverse Current		I_{GSS}				
(V_{GS} = 15 Vdc, V_{DS} = 0)			—	—	1.0	nAdc
(V_{GS} = 15 Vdc, V_{DS} = 0, T_A = 150°C)			—	—	1.0	μAdc
Drain-Cutoff Current		$I_{D(off)}$				
(V_{DS} = 15 Vdc, V_{GS} = 12 Vdc)	MPF970		—	—	10	nAdc
(V_{DS} = 15 Vdc, V_{GS} = 12 Vdc, T_A = 150°C)	MPF970		—	—	10	μAdc
(V_{DS} = 15 Vdc, V_{GS} = 7.0 Vdc)	MPF971		—	—	10	nAdc
(V_{DS} = 15 Vdc, V_{GS} = 7.0 Vdc, T_A = 150°C)	MPF971		—	—	10	μAdc
Gate Source Cutoff Voltage		$V_{GS(off)}$				Vdc
(V_{DS} = 15 Vdc, I_D = 10 nAdc)	MPF970		5.0	—	12	
	MPF971		1.0	—	7.0	
ON CHARACTERISTICS						
Zero-Gate-Voltage Drain Current(1)		I_{DSS}				mAdc
(V_{DS} = 20 Vdc, V_{GS} = 0)	MPF970		15	—	100	
	MPF971		2.0	—	50	
Drain-Source On-Voltage		$V_{DS(on)}$				Vdc
(I_D = 10 mAdc, V_{GS} = 0)			—	—	1.5	
(I_D = 1.5 mAdc, V_{GS} = 0)			—	—	1.5	
Static Drain-Source On Resistance		$r_{DS(on)}$				Ohms
(I_D = 1.0 mAdc, V_{GS} = 0)	MPF970		—	—	100	
	MPF971		—	—	250	
SMALL-SIGNAL CHARACTERISTICS						
Drain-Source "ON" Resistance		$r_{ds(on)}$				Ohms
(V_{GS} = 0, I_D = 0, f = 1.0 kHz)	MPF970		—	—	100	
	MPF971		—	—	250	
Input Capacitance		C_{iss}				pF
(V_{GS} = 12 Vdc, V_{DS} = 0, f = 1.0 MHz)	MPF970		—	—	12	
(V_{GS} = 7.0 Vdc, V_{DS} = 0, f = 1.0 MHz)	MPF971		—	—	12	
Reverse Transfer Capacitance		C_{rss}				pF
(V_{GS} = 12 Vdc, V_{DS} = 0, f = 1.0 MHz)	MPF970		—	—	5.0	
(V_{GS} = 7.0 Vdc, V_{DS} = 0, f = 1.0 MHz)	MPF971		—	—	5.0	

ELECTRICAL CHARACTERISTICS (continued) (T_A = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (See Figure 6, R_K = 0) (1)						
Rise Time		t_r				ns
($I_{D(on)}$ = 10 mAdc, $V_{GS(off)}$ = 12 Vdc)	MPF970		—	2.0	5.0	
($I_{D(on)}$ = 1.5 mAdc, $V_{GS(off)}$ = 7.0 Vdc)	MPF971		—	3.0	5.0	
Fall Time		t_f				ns
($I_{D(on)}$ = 10 mAdc, $V_{GS(off)}$ = 12 Vdc)	MPF970		—	9.0	15	
($I_{D(on)}$ = 1.5 mAdc, $V_{GS(off)}$ = 7.0 Vdc)	MPF971		—	68	80	
Turn-On Time		t_{on}				ns
($I_{D(on)}$ = 10 mAdc, $V_{GS(off)}$ = 12 Vdc)	MPF970		—	3.5	8.0	
($I_{D(on)}$ = 1.5 mAdc, $V_{GS(off)}$ = 7.0 Vdc)	MPF971		—	5.0	10	
Turn-Off Time		t_{off}				ns
($I_{D(on)}$ = 10 mAdc, $V_{GS(off)}$ = 12 Vdc)	MPF970		—	13	25	
($I_{D(on)}$ = 1.5 mAdc, $V_{GS(off)}$ = 7.0 Vdc)	MPF971		—	88	120	

(1) Pulse Test: Pulse Width ≤ 100 μs, Duty Cycle ≤ 1.0%.

FIGURE 1 – EFFECT OF I_{DSS} ON DRAIN-SOURCE RESISTANCE AND GATE-SOURCE VOLTAGE

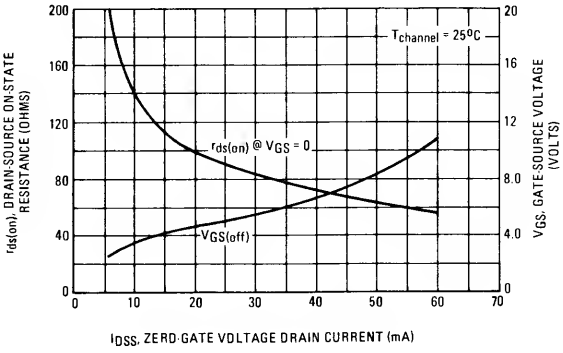


FIGURE 2 – TURN-ON DELAY TIME

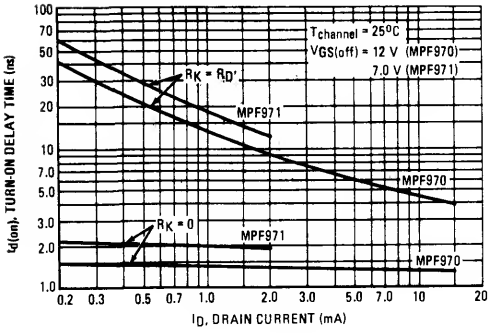


FIGURE 3 – RISE TIME

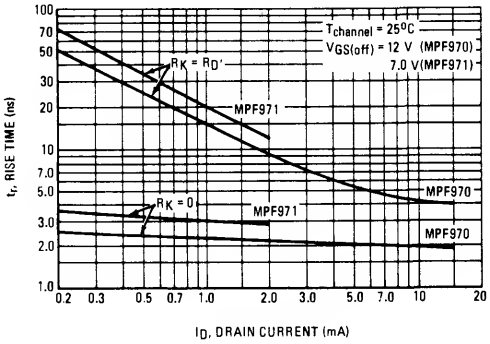


FIGURE 4 – TURN-OFF DELAY TIME

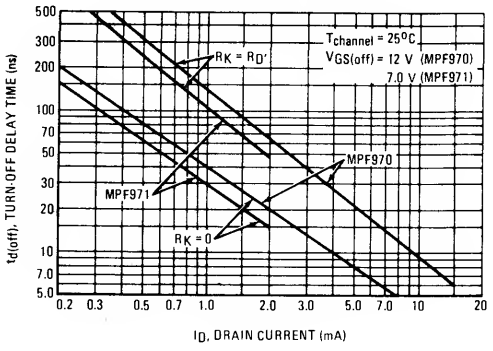


FIGURE 5 – FALL TIME

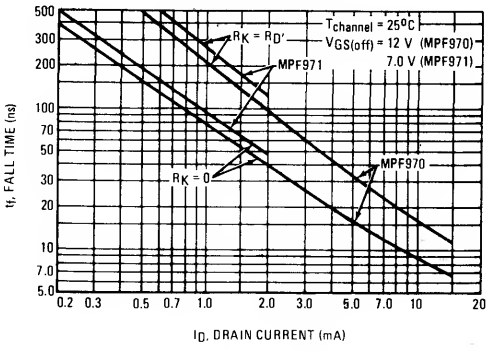
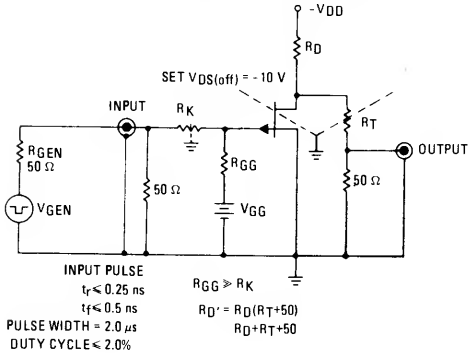


FIGURE 6 – SWITCHING TIME TEST CIRCUIT



NOTE 1

The switching characteristics shown above were measured using a test circuit similar to Figure 6. At the beginning of the switching interval, the gate voltage is at Gate Supply Voltage ($+V_{GG}$). The Drain-Source Voltage (V_{DS}) is slightly lower than Drain Supply Voltage (V_{DD}) due to the voltage divider. Thus Reverse Transfer Capacitance (C_{rss}) or Gate-Drain Capacitance (C_{gd}) is charged to $V_{GG} + V_{DS}$.

During the turn-on interval, Gate-Source Capacitance (C_{gs}) discharges through the series combination of R_{Gen} and R_K. C_{gd} must discharge to $V_{DS(on)}$ through R_G and R_K in series with the parallel combination of effective load impedance (R'_D) and Drain-Source Resistance (r_{ds}). During the turn-off, this charge flow is reversed.

Predicting turn-on time is somewhat difficult as the channel resistance r_{ds} is a function of the gate-source voltage. While C_{gs} discharges, V_{GS} approaches zero and r_{ds} decreases. Since C_{gd} discharges through r_{ds}, turn-on time is non-linear. During turn-off, the situation is reversed with r_{ds} increasing as C_{gd} charges.

The above switching curves show two impedance conditions; 1) R_K is equal to R_D, which simulates the switching behavior of cascaded stages where the driving source impedance is normally the load impedance of the previous stage, and 2) R_K = 0 (low impedance) the driving source impedance is that of the generator.

FIGURE 7 – TYPICAL FORWARD TRANSFER ADMITTANCE

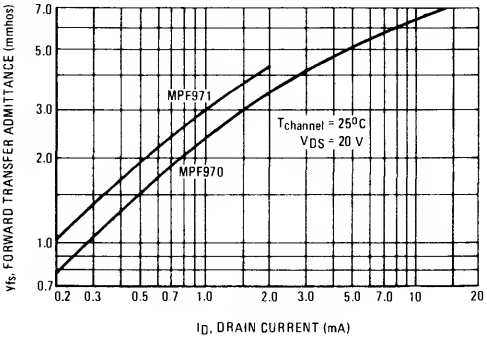


FIGURE 8 – TYPICAL CAPACITANCE

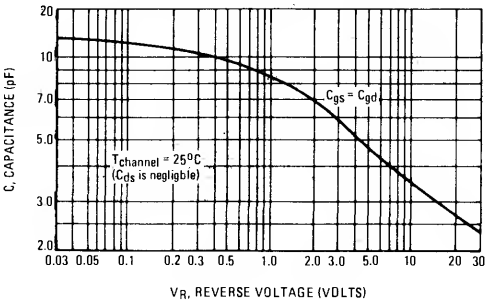


FIGURE 9 – EFFECT OF GATE-SOURCE VOLTAGE ON DRAIN-SOURCE RESISTANCE

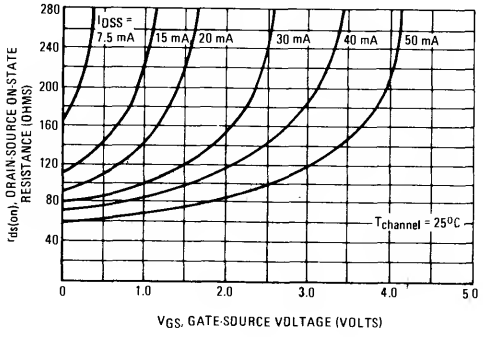


FIGURE 10 – EFFECT OF TEMPERATURE ON DRAIN-SOURCE ON-STATE RESISTANCE

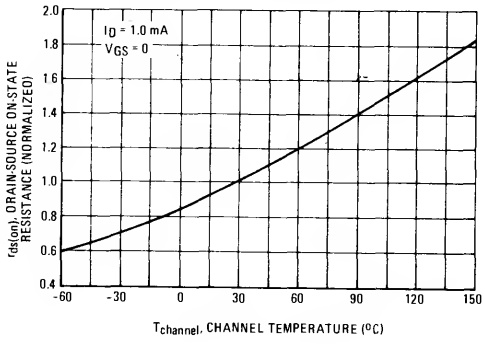


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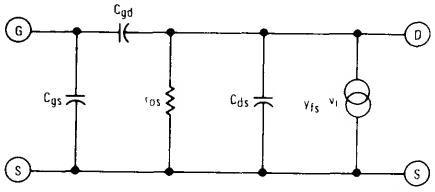
FIGURE 11 – LOW FREQUENCY CIRCUIT MODEL



$Y_{is} = j\omega C_{iss}$
$Y_{os} = 1 / r_{oss} + j\omega C_{oss}$
$Y_{fs} = Y_{fs}$
$Y_{rs} = -j\omega C_{rss}$

$C_{iss} = C_{gd} + C_{gs}$
$C_{rss} = C_{gd}$
$C_{oss} = C_{gd} + C_{ds}$, $C_{ds} \sim 0$