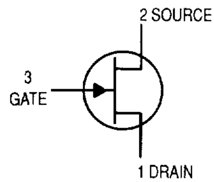
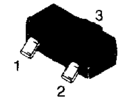
JFET VHF/UHF Amplifier Transistor
N–Channel

MMBFJ309LT1
MMBFJ310LT1





CASE 318–08, STYLE 10
SOT–23 (TO–236AB)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DS}	25	Vdc
Gate–Source Voltage	V_{GS}	25	Vdc
Gate Current	I_G	10	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR–5 Board(1) T_A = 25°C Derate above 25°C	P_D	225 1.8	mW mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	°C/W
Junction and Storage Temperature	T_J, T_{stg}	–55 to +150	°C

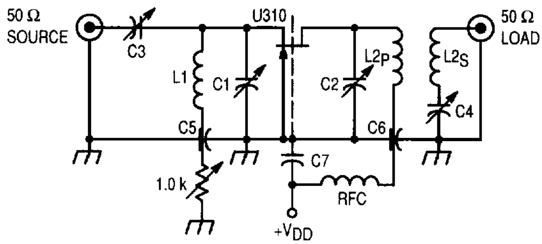
DEVICE MARKING

MMBFJ309LT1 = 6U; MMBFJ310LT1 = 6T

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)		$V_{(BR)GSS}$	–25	—	—	Vdc
Gate Reverse Current (V_{GS} = –15 Vdc) (V_{GS} = –15 Vdc, T_A = 125°C)		I_{GSS}	— —	— —	–1.0 –1.0	nAdc µAdc
Gate Source Cutoff Voltage (V_{DS} = 10 Vdc, I_D = 1.0 nAdc)	MMBFJ309 MMBFJ310	$V_{GS(off)}$	–1.0 –2.0	— —	–4.0 –6.5	Vdc
ON CHARACTERISTICS						
Zero–Gate–Voltage Drain Current (V_{DS} = 10 Vdc, V_{GS} = 0)	MMBFJ309 MMBFJ310	I_{DSS}	12 24	— —	30 60	mAdc
Gate–Source Forward Voltage (I_G = 1.0 mAdc, V_{DS} = 0)		$V_{GS(f)}$	—	—	1.0	Vdc
SMALL–SIGNAL CHARACTERISTICS						
Forward Transfer Admittance (V_{DS} = 10 Vdc, I_D = 10 mAdc, f = 1.0 kHz)		$\|Y_{fs}\|$	8.0	—	18	mmhos
Output Admittance (V_{DS} = 10 Vdc, I_D = 10 mAdc, f = 1.0 kHz)		$\|y_{os}\|$	—	—	250	µmhos
Input Capacitance (V_{GS} = –10 Vdc, V_{DS} = 0 Vdc, f = 1.0 MHz)		C_{iss}	—	—	5.0	pF
Reverse Transfer Capacitance (V_{GS} = –10 Vdc, V_{DS} = 0 Vdc, f = 1.0 MHz)		C_{rss}	—	—	2.5	pF
Equivalent Short–Circuit Input Noise Voltage (V_{DS} = 10 Vdc, I_D = 10 mAdc, f = 100 Hz)		$\bar{e}_n$	—	10	—	$nV/\sqrt{Hz}$

1. FR–5 = 1.0 × 0.75 × 0.062 in.



C1 = C2 = 0.8 – 10 pF, JFD #MVM010W.
C3 = C4 = 8.35 pF Erie #539–002D.
C5 = C6 = 5000 pF Erie (2443–000).
C7 = 1000 pF, Allen Bradley #FA5C.
RFC = 0.33 μH Miller #9230–30.
L1 = One Turn #16 Cu, 1/4″ I.D. (Air Core).
L2p = One Turn #16 Cu, 1/4″ I.D. (Air Core).
$L2_S$ = One Turn #16 Cu, 1/4″ I.D. (Air Core).

Figure 1. 450 MHz Common–Gate Amplifier Test Circuit

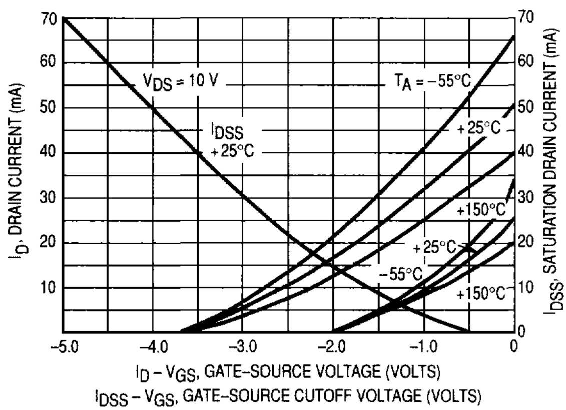


Figure 2. Drain Current and Transfer Characteristics versus Gate–Source Voltage

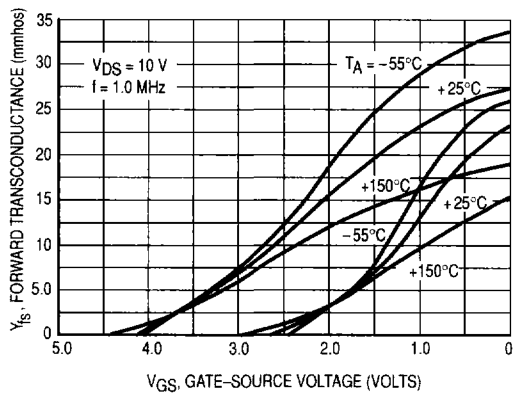


Figure 3. Forward Transconductance versus Gate–Source Voltage

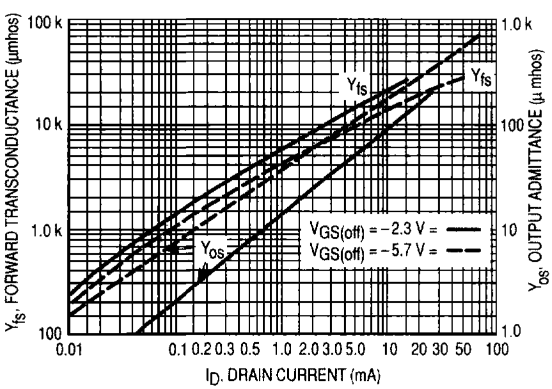


Figure 4. Common–Source Output Admittance and Forward Transconductance versus Drain Current

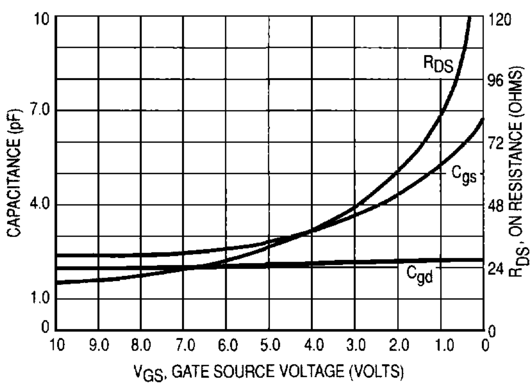


Figure 5. On Resistance and Junction Capacitance versus Gate–Source Voltage

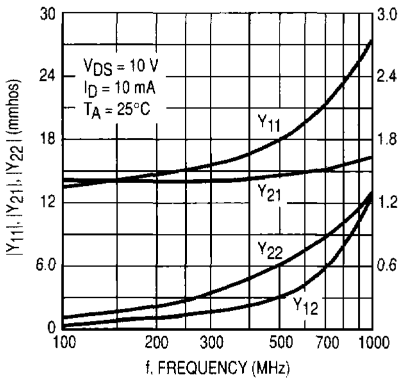


Figure 6. Common–Gate Y Parameter Magnitude versus Frequency

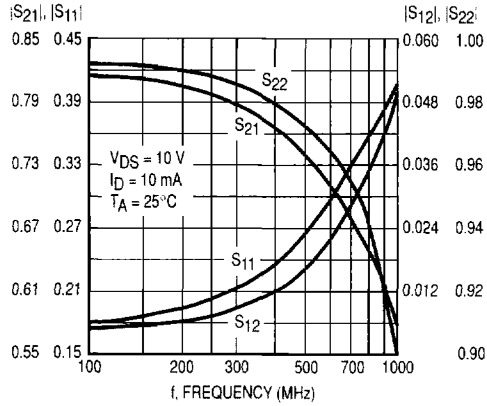


Figure 7. Common–Gate S Parameter Magnitude versus Frequency

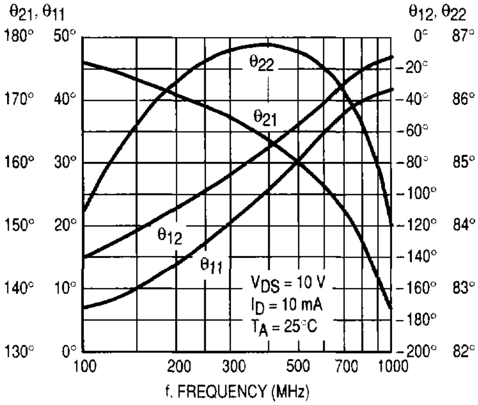


Figure 8. Common–Gate Y Parameter Phase–Angle versus Frequency

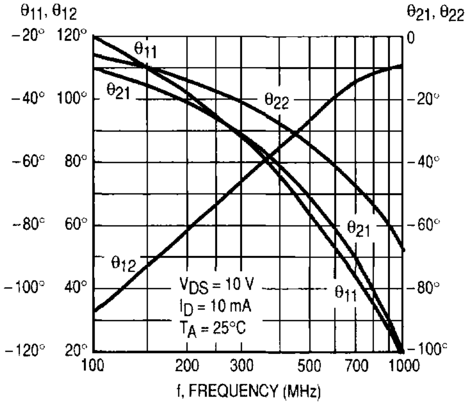


Figure 9. S Parameter Phase–Angle versus Frequency

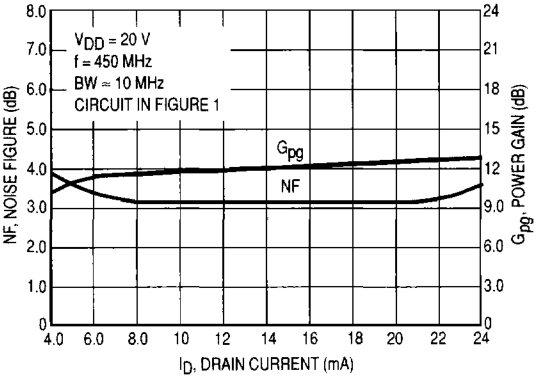


Figure 10. Noise Figure and Power Gain versus Drain Current

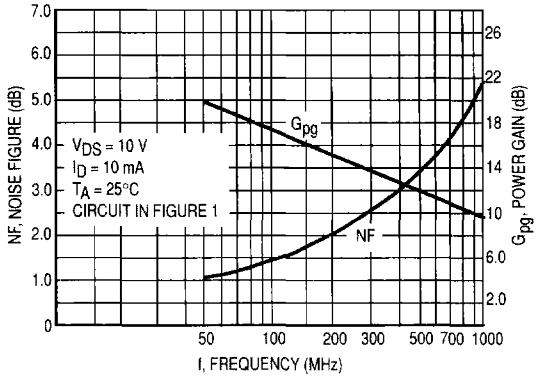
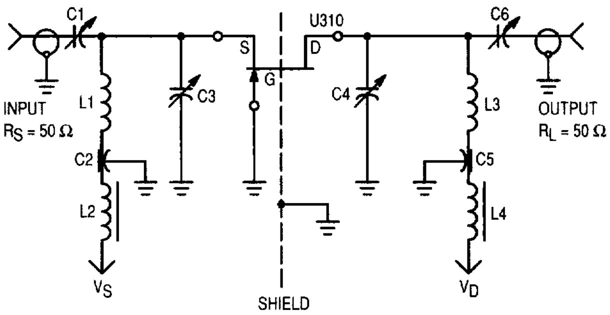


Figure 11. Noise Figure and Power Gain versus Frequency



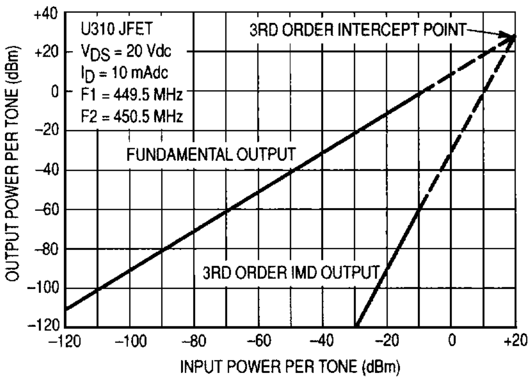
B_W (3 dB) – 36.5 MHz
I_D – 10 mAdc
V_{DS} – 20 Vdc
Device case grounded
IM test tones – f1 = 449.5 MHz, f2 = 450.5 MHz

C1 = 1–10 pF Johanson Air variable trimmer.
C2, C5 = 100 pF feed thru button capacitor.
C3, C4, C6 = 0.5–6 pF Johanson Air variable trimmer.

L1 = 1/8″ x 1/32″ x 1–5/8″ copper bar.
L2, L4 = Ferroxcube Vk200 choke.
L3 = 1/8″ x 1/32″ x 1–7/8″ copper bar.

Figure 12. 450 MHz IMD Evaluation Amplifier

Amplifier power gain and IMD products are a function of the load impedance. For the amplifier design shown above with C4 and C6 adjusted to reflect a load to the drain resulting in a nominal power gain of 9 dB, the 3rd order intercept point (IP) value is 29 dBm. Adjusting C4, C6 to provide larger load values will result in higher gain, smaller bandwidth and lower IP values. For example, a nominal gain of 13 dB can be achieved with an intercept point of 19 dBm.



Example of intercept point plot use:
Assume two in–band signals of –20 dBm at the amplifier input. They will result in a 3rd order IMD signal at the output of –90 dBm. Also, each signal level at the output will be –11 dBm, showing an amplifier gain of 9.0 dB and an intermodulation ratio (IMR) capability of 79 dB. The gain and IMR values apply only for signal levels below comparison.

Figure 13. Two Tone 3rd Order Intercept Point