3N154

Silicon MOS Transistor

For Critical Amplifier Applications in Military & Industrial VHF Communications Equipment Operating up to 250 MHz

Features:

- *Large dynamic range*
- *Greatly reduced spurious responses*
- *Permits use of vacuum-tube biasing techniques*
- *Excellent thermal stability*
- *Superior cross-modulation performance and greater dynamic range than bipolar transistors*

RCA 3N154• is an n-channel depletion-type silicon field-effect transistor utilizing the MOS construction. It is intended primarily for vhf amplifier applications up to 250 MHz in military and industrial equipment.

Because of its improved transfer characteristic and exceptionally wide dynamic range, the 3N154 can provide substantially better crossmodulation performance in linear amplifier applications than conventional bipolar transistors. The extremely low gate leakage current eliminates diode-current loading of the input circuit under strong input conditions, a problem which is common to junction-type FET's. These features, in addition to low feedback capacitance, permit the design of circuits providing superior high-frequency operation and high gain without neutralization. The 3N154 utilizes full-gate construction and is hermetically sealed in a JEDEC TO-72 metal package.

• Formerly Developmental No.TA7375.

Maximum Ratings, *Absolute-Maximum Values at T_A = 25°:*

DRAIN-TO-SOURCE VOLTAGE, V_{DS}	+20 V
GATE-TO-SOURCE VOLTAGE, V_{GS}:	
Continuous (dc)	+1, −8 V
Peak ac	±15 V
DRAIN-TO-GATE VOLTAGE, V_{DG}	20 V
DRAIN CURRENT, I_D▲	50 mA
TRANSISTOR DISSIPATION:	
At ambient temperatures up to 25°C	400 mW
At ambient temperatures above 25°C	derate at 2.67 mW/°C
AMBIENT TEMPERATURE RANGE:	
Storage	−65 to +175°C
Operating	−65 to +175°C
LEAD TEMPERATURE (During Soldering):	
At distances not closer than 1/32 inch to seating surface for 10 seconds maximum	265°C

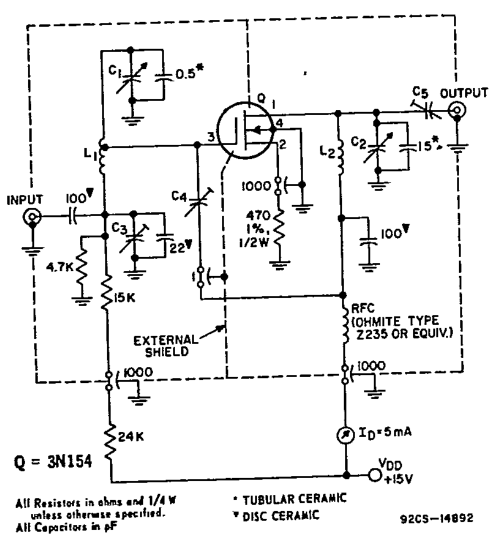
▲Pulsed:
Pulse duration ≤ 20 ms
Duty factor ≤ 0.15

ELECTRICAL CHARACTERISTICS: (At $T_A = 25°$ C)

Measured with Substrate Connected to Source Unless Otherwise Specified.

CHARACTERISTICS	SYMBOLS	CONDITIONS	LIMITS 3N154 Min.	Typ.	Max.	UNITS
Gate-to-Source Cutoff Voltage	$V_{GS}(off)$	V_{DS} = 15 V, I_D = 50 μA	-2	-3.5	-8	V
Drain-to-Source Cutoff Current	$I_D(off)$	V_{DS} = 20 V, V_{GS} = -8 V	-	-	50	μA
Zero-Bias Drain Current**	I_{DSS}	V_{DS} = 15 V, V_{GS} = 0	10	15	25	mA
Gate Leakage Current	I_{GSS}	V_{DS} = 0, V_{GS} = -8 V, T_A = 25° C	-	0.0001	0.05	nA
		V_{DS} = 0, V_{GS} = -8 V, T_A = 125° C	-	-	5	nA
		V_{DS} = 0, V_{GS} = +1, T_A = 25° C	-	0.0001	0.05	nA
		V_{DS} = 0, V_{GS} = +1, T_A = 125° C	-	-	5	nA
Magnitude of Forward Transadmittance	y_{fs}	V_{DS} = 15 V, I_D = 5 mA, f = 200 MHz	5000	7500	-	μmho
Forward Transsconductance	g_{fs}	V_{DS} = 15 V, I_D = 5 mA, f = 1 kHz	5000	7500	12,000	μmho
Small-Signal Short-Circuit Input Capacitance	C_{iss}	V_{DS} = 15 V, I_D = 5 mA, f = 0.1 to 1 MHz	-	5.5	7	pF
Small-Signal Short-Circuit Reverse Transfer Capacitance*	C_{rss}	V_{DS} = 15 V, I_D = 5 mA, f = 0.1 to 1 MHz	0.03	0.12	0.2	pF
Small-Signal Short-Circuit Output Capacitance	C_{oss}	V_{DS} = 15 V, I_D = 5 mA, f = 0.1 to 1 MHz	-	1.4	-	pF
Gate Leakage Current Resistance	R_{GS}	V_{DS} = 0, V_{GS} = -8 V	-	10^{14}	-	Ω
Drain-to-Source Channel Resistance	$r_{DS}(on)$	V_{DS} = 0, V_{GS} = 0, f = 1 kHz	-	200	-	Ω
Input Conductance	g_{is}	V_{DS} = 15 V, I_D = 5 mA, f = 200 MHz	-	500	-	μmho
Output Conductance	g_{os}	V_{DS} = 15 V, I_D = 5 mA, f = 200 MHz	-	275	-	μmho
Power Gain Maximum Available Gain	G_{PS}	V_{DS} = 15 V, I_D = 5 mA, f = 200 MHz	-	20	-	dB
Maximum Usable Gain (Neutralized) see Fig.1			13.5	16	-	dB
Noise Figure (see Figs.1 & 10)	NF	V_{DS} = 15 V, I_D = 5 mA, f = 200 MHz	-	3.5	5	dB

* Three-Terminal Measurement: Source Returned to Guard Terminal ** Pulse Test: Pulse Duration ≤ 20 ms Duty Factor ≤ 0.15.



C_1, C_2: 1.5-5 pF variable air capacitor: E. F. Johnson Type 160-102 or equivalent

C_3: 1-10 pF piston-type variable air capacitor: JFD Type VAM-010, Johanson Type 4335, or equivalent

C_4, C_5: 0.3-3 pF piston-type variable air capacitor: Roanwell Type MH-13 or equivalent

Q = 3N154

L_1: 5 turns silver-plated 0.02" thick, 0.07"-0.08" wide copper ribbon. Internal diameter of winding = 0.25"; winding length approx. 0.65". Tapped at 1-1/2 turns from C_1 end of winding

L_2: Same as L_1 except winding length approx. 0.7"; no tap.

Fig.1 - Test Circuit used to Measure 200-MHz Maximum Usable Power Gain and Noise Figure.

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TYPICAL CHARACTERISTICS

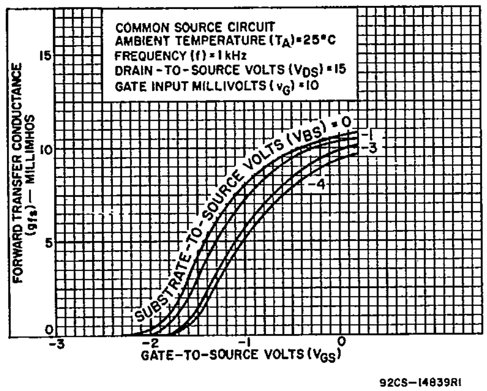

Fig.2 - Forward transconductance vs gate-bias voltage.

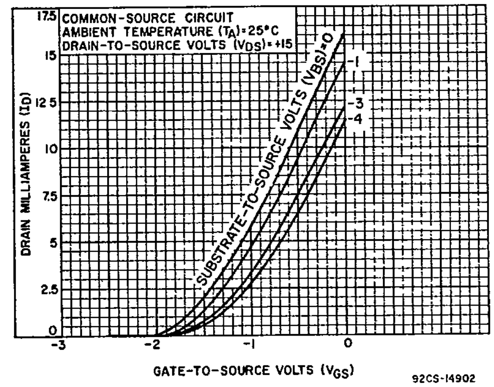

Fig.3 - Drain current vs gate-to-source voltage.

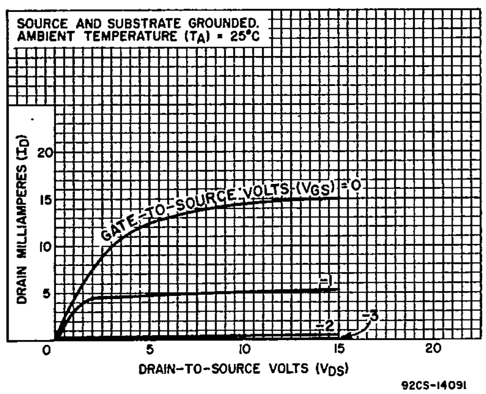

Fig.4 - Drain current vs drain-to-source voltage.

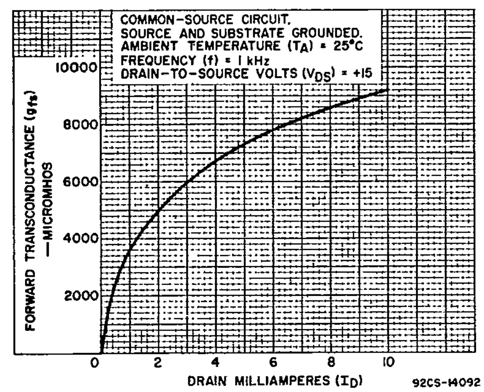

Fig.5 - 1-kHz forward transconductance vs drain current.

TYPICAL 200-MHz COMMON-SOURCE ADMITTANCE (Y) COMPONENTS vs DRAIN CURRENT

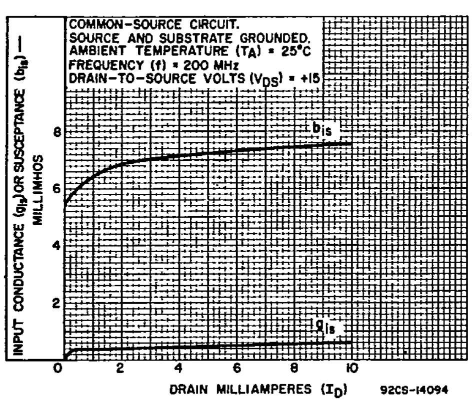

Fig.6 - Input admittance (Y_{is}) components.

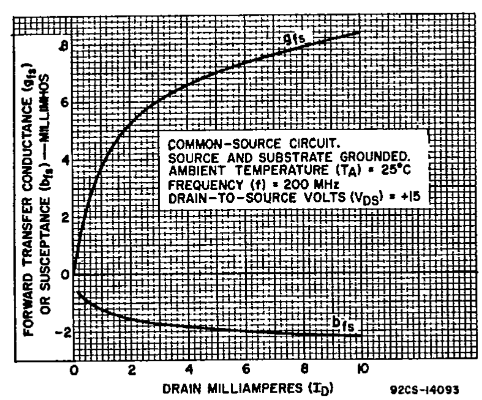

Fig.7 - Forward transadmittance (Y_{fs}) components.

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TYPICAL 200-MHz COMMON-SOURCE ADMITTANCE (Y) COMPONENTS vs DRAIN CURRENT

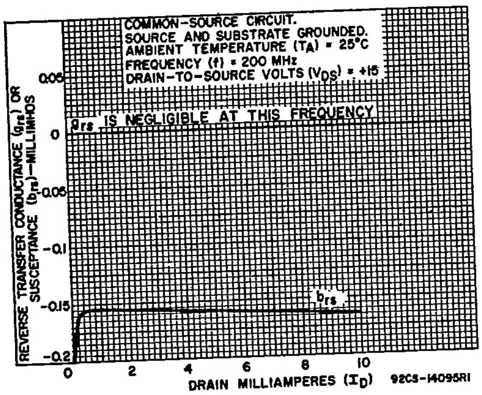


Fig.8 - Reverse transadmittance (Y_{rs}) components.

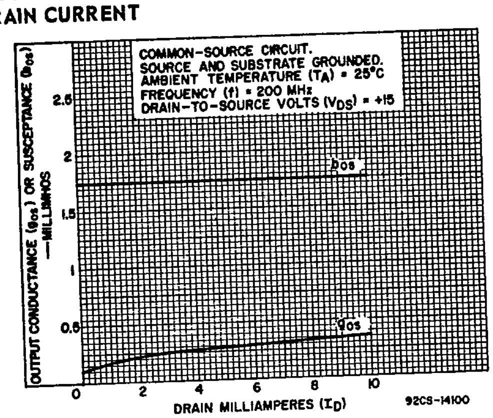
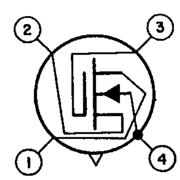
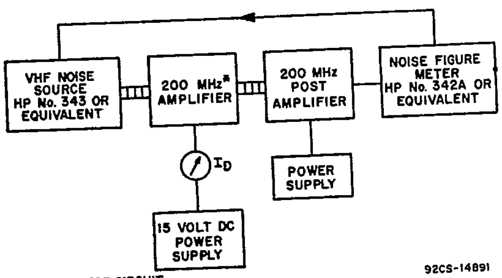


Fig.9 - Output admittance (Y_{os}) components.

TERMINAL DIAGRAM



1 - Drain
2 - Source
3 - Insulated Gate
4 - Bulk (Substrate) and Case



* SEE FIG 1 FOR CIRCUIT

Fig.10 - Noise figure measurement setup.

OPERATING CONSIDERATIONS

The flexible leads of the 3N154 are usually soldered to the circuit elements. As in the case of any high-frequency semiconductor device, the tips of soldering irons should be grounded, and appropriate precautions should be taken to protect the devices against high electric fields.

This device should not be connected into or disconnected from circuits with the power on because high transient voltages may cause permanent damage to the device.