SILICON MOS TRANSISTOR N-Channel Depletion Type

For Audio, Video, and RF Amplifier Applications in Communications, Instrumentation and Control Circuits

RCA 3N139 is a silicon, insulated-gate field-effect transistor of the N-channel depletion type, utilizing the MOS* construction. It is a general purpose transistor especially suited for audio, video, and rf applications, and for wide-band amplifier designs. The insulated gate provides a very high input resistance (10^{14} Ω typ.) which is relatively insensitive to temperature and is independent of gate-bias conditions (positive, negative, or zero bias). The 3N139 also has a high transconductance, a low value of input capacitance (3 pF typ.), and a very low feedback capacitance (0.19 pF typ.).

The 3N139 is hermetically sealed in the standard 4-lead JEDEC TO-72 package.

Maximum Ratings, *Absolute-Maximum Values:*

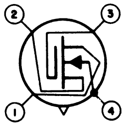
DRAIN-TO-SOURCE VOLTAGE, V_{DS}	+35 max.	V
DRAIN-TO-SUBSTRATE VOLTAGE, V_{DB}	+35, -0.3 max.	V
SOURCE-TO-SUBSTRATE VOLTAGE, V_{SB}	+35, -0.3 max.	V
DC GATE-TO-SOURCE VOLTAGE, V_{GS}	±10 max.	V
PEAK GATE-TO-SOURCE VOLTAGE, V_{GS}	±14 max.	V
PEAK VOLTAGE, GATE-TO-ALL OTHER TERMINALS; V_{GS}, V_{GD}, V_{GB}, non-repetitive	±42 max.	V
DRAIN CURRENT, I_D	50 max.	mA
TRANSISTOR DISSIPATION, P_T:		
At ambient temperatures up to 25°C	330	mW
above 25°C	Derate linearly at 2.2 mW/°C	
AMBIENT TEMPERATURE RANGE:		
Storage	-65 to +175	°C
Operating	-65 to +175	°C
LEAD TEMPERATURE (During Soldering):		
At distance not closer than 1/32 inch to seating surface for 10 seconds max.	265 max.	°C

* Metal-Oxide-Semiconductor

FEATURES

- **high input resistance** $R_{GS} = 10^{14}$ Ω typ.
- **low input capacitance** C_{iss} = 3 pF typ.
- **low feed back capacitance** C_{rss} = 0.2 pF typ.
- **low gate leakage current** I_{GSS} = 0.1 nA typ.
- **high drain-to-source voltage:** +35 max. V

TERMINAL ARRANGEMENT



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

ELECTRICAL CHARACTERISTICS, at T_A = 25° C Unless Otherwise Specified. Bulk (Substrate) Connected to Source

CHARACTERISTICS	SYMBOLS	TEST CONDITIONS: FREQUENCY f (MHz)	DC DRAIN-TO-SOURCE VOLTAGE V_{DS} (V)	DC GATE-TO-SOURCE VOLTAGE V_{GS} (V)	DC DRAIN CURRENT I_D (mA)	LIMITS Min.	Typ.	Max.	UNITS
Drain-to-Source Cutoff Current	$I_{D(OFF)}$		15	−8		—	—	50	μA
Zero-Bias Drain Current*	I_{DSS}		15	0		5	15	25	mA
Gate Reverse Current	I_{GSS}	T_A = 25°C	0	±10		—	—	1	nA
		T_A = 100°C	0	±10		—	—	100	nA
Gate-to-Source Cutoff Voltage	$V_{GS(OFF)}$		15		0.05	−2	−4	−6	V
Small-Signal, Short-Circuit Reverse-Transfer Capacitance (Drain-to-Gate)	C_{rss}	1	15		5	0.05	0.2	0.4	pF
Input Resistance	r_{is}	100	15		5		12	—	kΩ
Input Capacitance	C_{iss}	100	15		5	—	3	10	pF
Output Resistance	r_{os}	100	15		5		6	—	kΩ
Output Capacitance	C_{oss}	100	15		5	—	1.4	—	pF
Forward Transconductance	g_{fs}	1 kHz	15		5		5	—	mmho

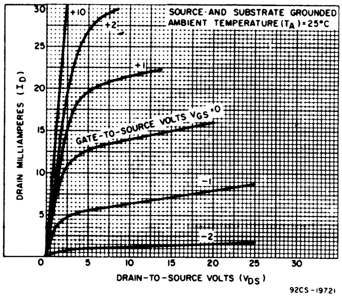


Fig. 1 – Drain Current vs Drain Voltage

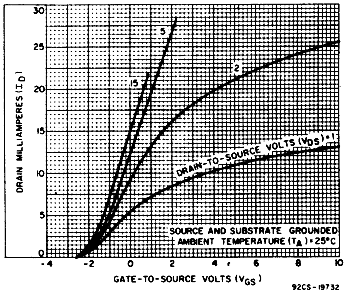


Fig. 2 – Drain Current vs Gate-to-Source Voltage

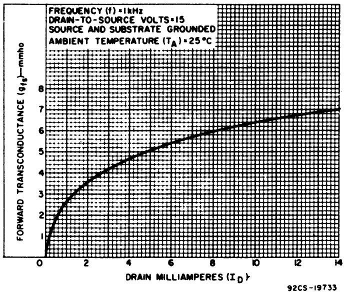


Fig. 3 – 1 KHz forward transconductance vs drain current

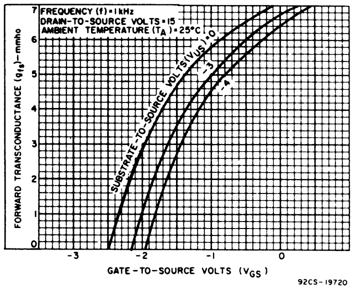


Fig. 4 – 1 KHz forward transconductance vs gate-to-source voltage

40467A

Silicon MOS Transistor N-Channel Depletion Type

For VHF Tuners and Other VHF Amplifier
Applications in Industrial & Commercial Electronic Equipment
Operating up to 220 MHz

RCA-40467A is an n-channel depletion-type silicon insulated-gate field-effect transistor utilizing the MOS■ construction. It is intended primarily for vhf-amplifier applications in industrial and commercial electronic equipment.

The 40467A is useful in vhf applications requiring devices capable of providing high useful power gains at frequencies up to approximately 220 MHz.

The 40467A features high forward transconductance, high dc gate-to-source resistance, and low feedback capacitance. Because of the improved transfer characteristic and increased dynamic range, the 40467A provides substantially better cross-modulation performance in linear-amplifier applications than conventional (bipolar) transistors and is free from diode-current loading, a problem that exists in junction type FET s. This device is hermetically sealed in the TO-72 metal case and utilizes full-gate construction.

■ Metal-Oxide Semiconductor

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

DRAIN-TO-SOURCE VOLTAGE, V_{DS} .... +20 V
DRAIN-TO-GATE VOLTAGE, V_{DG} .... +20 V
GATE-TO-SOURCE VOLTAGE, V_{GS}:
CONTINUOUS (dc) .... +1, −8 V
PEAK ac .... +15 V
DRAIN CURRENT, I_D .... 50 mA
TRANSISTOR DISSIPATION:
At ambient temperatures { up to 25°C .... 330 mW
{ above 25°C .... derate at 2.2 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

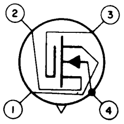
Device Features:

- **Low feedback capacitance - C_{rss} = 0.25 pF typ.**
- **High forward transconductance - g_{fs} = 7500 µmho typ.**
- **High vhf power gain - G_{PS} = 16 dB typ at 200 MHz**
- **Low vhf noise figure - NF = 3.5 dB typ at 200 MHz**
- **Exceptionally good cross-modulation characteristics**

Performance 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**

TERMINAL DIAGRAM



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

ELECTRICAL CHARACTERISTICS AT T_C = 25°C WITH BULK (SUBSTRATE) CONNECTED TO SOURCE

CHARACTERISTICS	SYMBOLS	TEST CONDITIONS: FREQUENCY f	DC DRAIN-TO-SOURCE VOLTAGE V_{DS}	DC DRAIN CURRENT I_D	LIMITS RCA 40467A			UNITS
		MHz	V	mA	Min	Typ.	Max.	
Gate-to-Source Cutoff Voltage	V_{GS}(off)		12	0.1	-	-	-8	V
Gate Leakage Current	I_{GSS}		0	V_{GS} = +1V	-	-	1	nA
			0	V_{GS} = -8V	-	-	1	nA
Zero-Bias Drain Current	I_{DSS}		15	V_{GS} = 0	5	15	30	mA
Small-Signal, Short-Circuit Forward Transconductance	g_{fs}	1 KHz	15	5	4000	7500	-	µmho
Small-Signal, Short-Circuit Reverse-Transfer Capacitance (Drain-to-Gate)	C_{rss}	1	15	5	0.12	0.25	0.35	pF
Small Signal Short-Circuit Input Capacitance	C_{iss}	1	15	5	-	5.5	-	pF
Input Admittance	Y_{is}	Common Source Configuration f = 200 mHz V_{DS} = 15V I_D = 5 mA			-	0.4 + j7.3	-	
Forward Transfer Admittance	Y_{fs}				-	7 - J2	-	
Output Admittance	Y_{os}				-	0.28 + J1.8	-	
Maximum Available Power Gain	MAG	200	15	5	-	21	-	dB
Maximum Usable Power Gain (unneutralized)	MUG	200	15	5	-	12	-	dB
Maximum Usable Power Gain (neutralization)	MUG	200	15	5	12	16	-	dB
Noise Figure	NF	200	15	5	-	3.5	5	dB

For characteristics curves, refer to types 3N128 and 3N143.

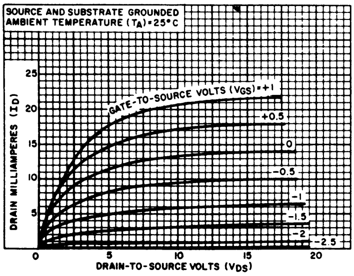


Fig. 4 - Drain current vs. drain-to-source voltage

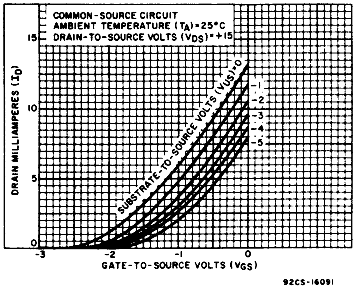


Fig. 5 - Drain current vs. gate-to-source voltage (V_{GS})

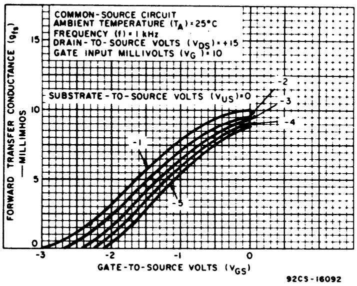


Fig. 6 - Forward transconductance vs. gate bias voltage

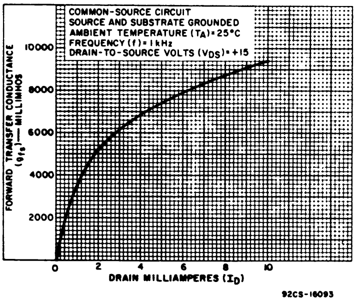


Fig. 7 - Forward transconductance vs. drain current

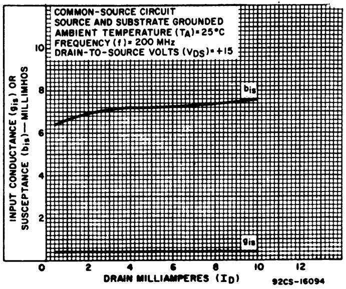


Fig. 8 - Input admittance vs. drain current

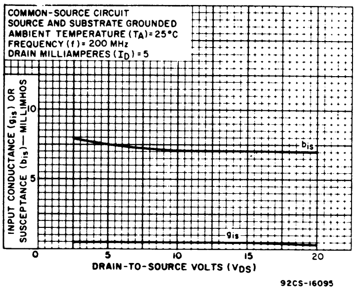


Fig. 9 - Input admittance vs. drain-to-source voltage

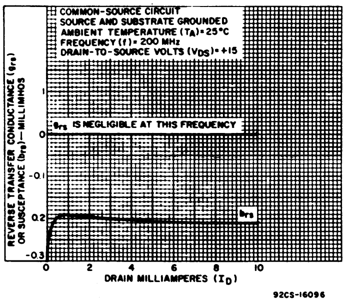


Fig. 10 - Reverse transadmittance vs. drain current

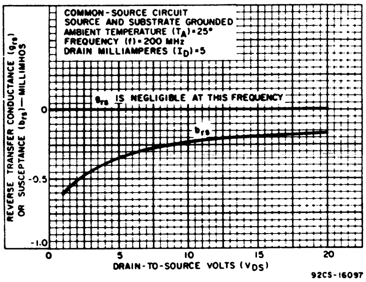


Fig. 11 - Reverse transadmittance vs. drain-to-source voltage

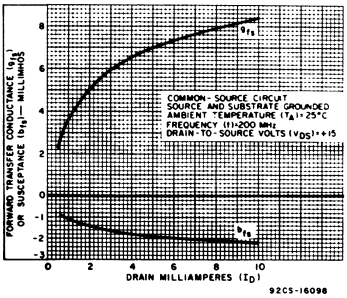


Fig. 12 - Forward transadmittance vs. drain current

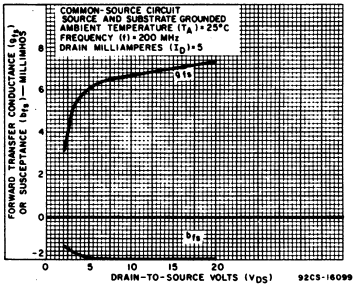


Fig. 13 - Forward transadmittance vs. drain-to-source voltage

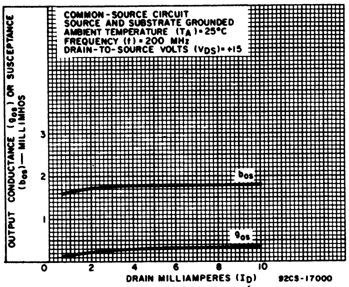


Fig. 14 - Output admittance vs. drain current

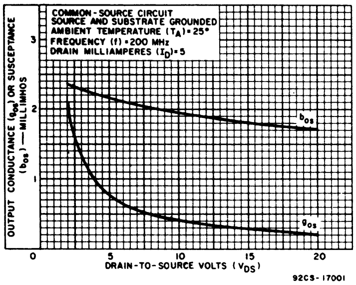


Fig. 15 - Output admittance vs. drain-to-source voltage