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SEMICONDUCTOR
TECHNICAL DATA

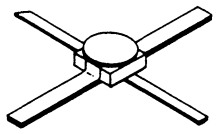
MRF942

The RF Line
NPN Silicon Low Noise, High-Frequency Transistor

I_C = 40 mA
LOW NOISE
HIGH FREQUENCY
TRANSISTOR

. . . designed for use in high gain, low noise small-signal amplifiers. This device features excellent broadband linearity and is offered in a metal-ceramic hermetic package suitable for high-reliability applications.

- Low Noise Figure — 1.3 dB Typ @ f = 1.0 GHz
- Associated Gain — 16 dB Typ @ f = 1.0 GHz
- Fully Implanted Base and Emitter Structure
- 9 Finger, 1.25 Micron Geometry with Gold Top Metal
- High Reliability Processing Available



CASE 303-01

MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	10	Vdc
Collector-Base Voltage	V_{CBO}	20	Vdc
Emitter-Base Voltage	V_{EBO}	1.5	Vdc
Power Dissipation (1) @ T_C = 125°C Derate above 125°C	P_D	300 4.0	mWatts mW/°C
Collector Current — Continuous (2)	I_C	40	mA
Junction Temperature	T_J	200	°C
Storage Temperature	T_{stg}	−65 to +200	°C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	250	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (3)					
Collector-Emitter Breakdown Voltage (I_C = 0.1 mA, I_B = 0)	$V_{(BR)CEO}$	10	13	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mA, I_E = 0)	$V_{(BR)CBO}$	20	25	—	Vdc
Emitter Cutoff Current (V_{EB} = 1.0 V, I_C = 0)	I_{EBO}	—	—	0.1	μAdc
Collector Cutoff Current (V_{CB} = 10 V, I_E = 0)	I_{CBO}	—	—	0.1	μAdc
ON CHARACTERISTICS (3)					
DC Current Gain (V_{CE} = 8.0 V, I_C = 5.0 mA)	h_{FE}	50	—	200	—
DYNAMIC CHARACTERISTICS					
Collector-Base Capacitance (V_{CB} = 10 V, I_E = 0, f = 1.0 MHz)	C_{cb}	—	0.2	—	pF
Current Gain — Bandwidth Product (V_{CE} = 6.0 V, I_C = 15 mA)	f_T	—	8.0	—	GHz

NOTES: 1. Case Temperature is measured on the collector lead where it first contacts the printed circuit board closest to the package. To calculate the junction temperature use $T_J = P_D \times R_{\theta JC} + T_{CASE}$.
2. I_C — Continuous (MTBF ≈ 10 years)
3. Pulse width ≤ 300 μs, duty cycle ≤ 2.0% pulsed.

PERFORMANCE CHARACTERISTICS

Conditions		Symbol	Min	Typ	Max	Units
Insertion Gain		$\|S_{21}\|^2$				dB
$\|S_{21}\|^2$ (V_{CE} = 6.0 V, I_C = 15 mA)	f = 1.0 GHz		—	18	—	
	f = 2.0 GHz		—	12	—	
	f = 4.0 GHz		—	6.0	—	
Output Power		$P_{1\ dB}$	—	16	—	dBm
$P_{1\ dB}$ (V_{CE} = 6.0 V, I_C = 15 mA)	f = 1.0 GHz					
1.0 dB Compressed Gain		$G_{1\ dB}$	—	21	—	dB
$G_{1\ dB}$ (V_{CE} = 6.0 V, I_C = 15 mA)	f = 1.0 GHz					
Minimum Noise Figure		NF_{min}				dB
NF_{min} (V_{CE} = 6.0 V, I_C = 3.0 mA)	f = 1.0 GHz		—	1.3	1.8	
	f = 2.0 GHz		—	2.0	—	
	f = 4.0 GHz		—	2.9	—	
Associated Gain		G_{NF}				dB
G_{NF} (V_{CE} = 8.0 V, I_C = 5.0 mA)	f = 1.0 GHz		14	16	—	
	f = 2.0 GHz		—	11	—	
	f = 4.0 GHz		—	8.0	—	

TYPICAL NOISE PARAMETERS

V_{CE} (Vdc)	I_C (mA)	f (MHz)	NF_{min} (dB)	G_{NF} (dB)	Γ_o (MAG, ANG)	R_N (ohms)	$NF_{50\ \Omega}$ (dB)
6	3	1000	1.3	16	.36 ∠ 94	17.5	1.7
		2000	2.0	11	.37 ∠ −145	15.5	2.6
		4000	2.9	8.0	.50 ∠ −134	21.5	4.3
	15	1000	2.1	19	.25 ∠ 150	13	2.6
		2000	2.7	14	.26 ∠ −173	16.5	3.1
		4000	4.3	9.0	.48 ∠ −96	47	5.4

TYPICAL CHARACTERISTICS

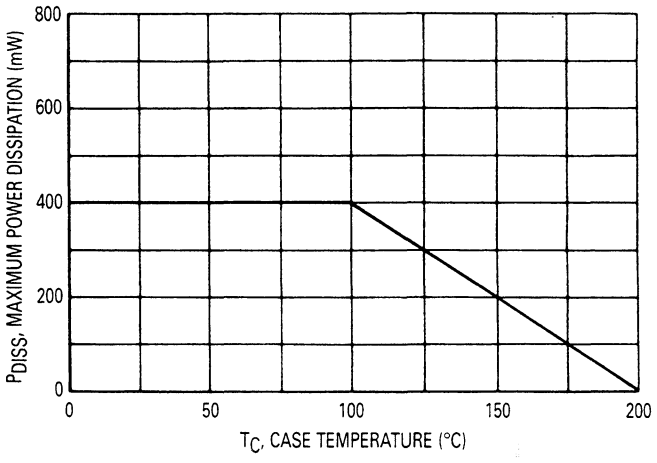


Figure 1. Maximum Power Dissipation versus Case Temperature

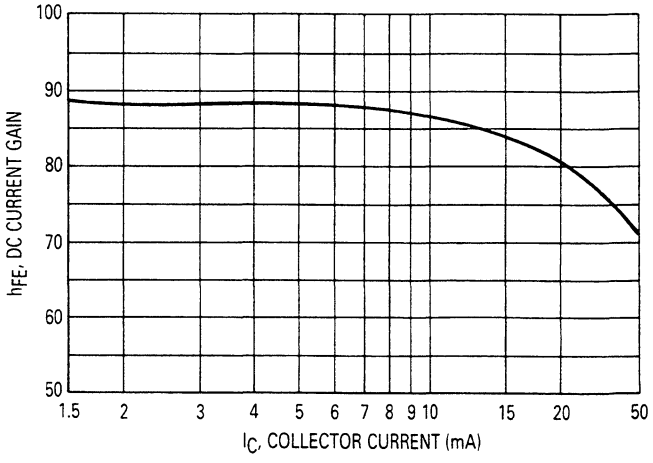


Figure 2. DC Current Gain versus Current

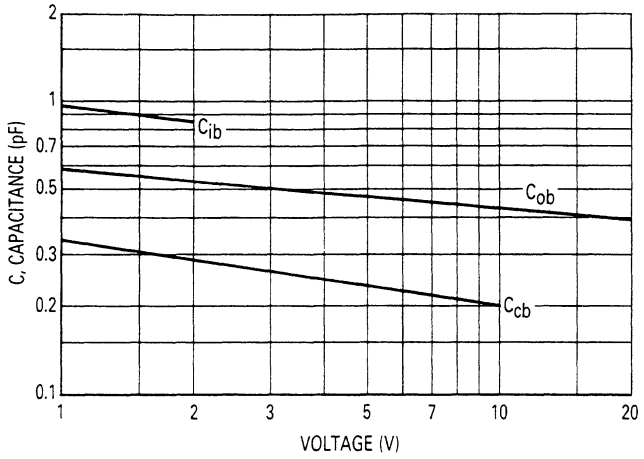


Figure 3. Capacitance versus Voltage

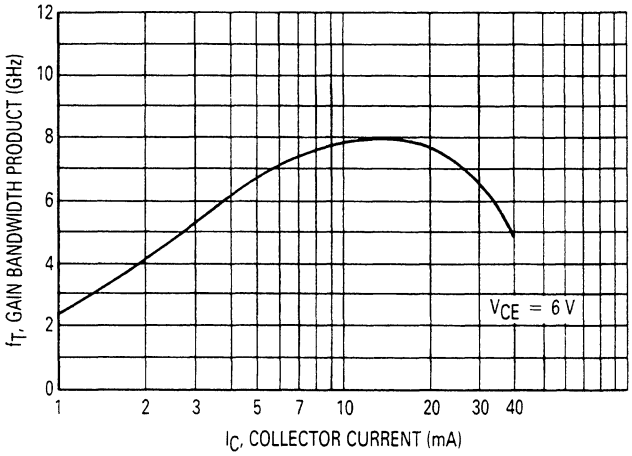


Figure 4. Gain-Bandwidth Product versus Collector Current

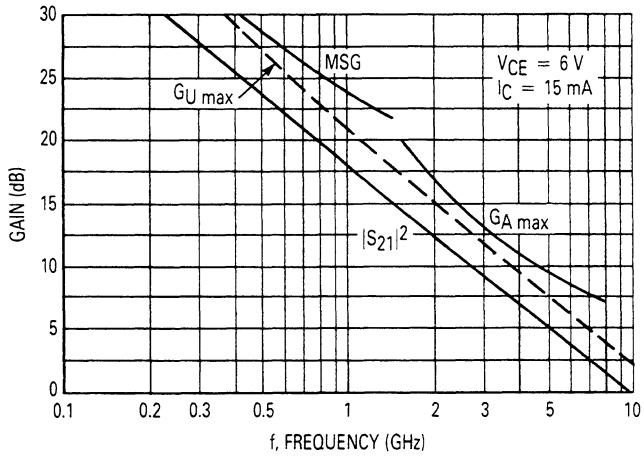


Figure 5. Gain versus Frequency

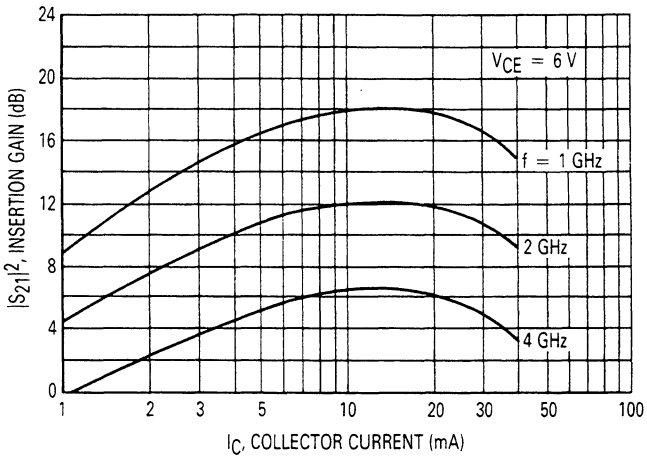


Figure 6. Insertion Gain versus Current

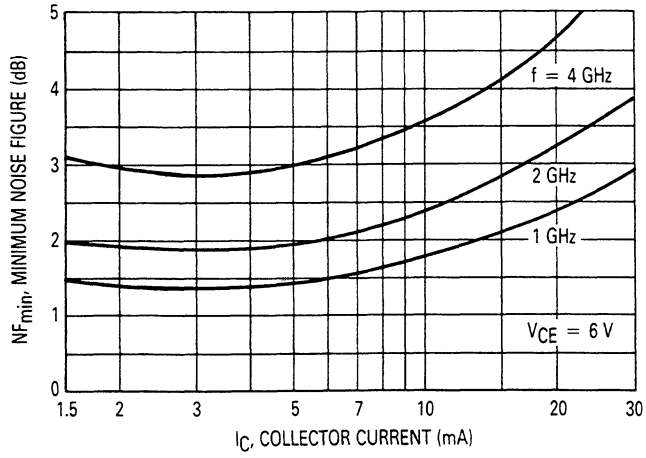


Figure 7. Minimum Noise Figure versus Current

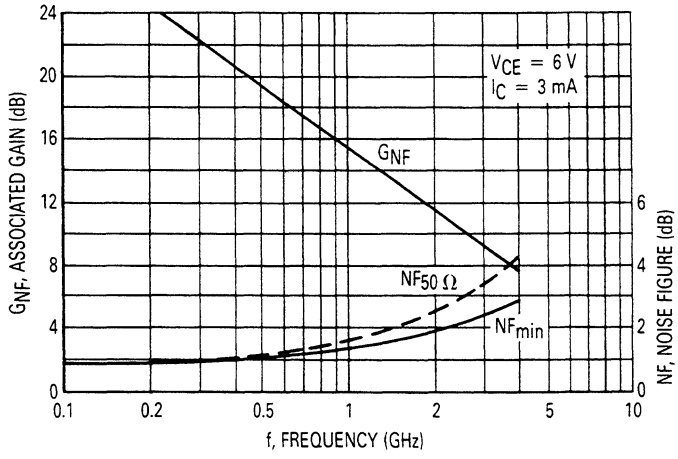


Figure 8. Noise Figure and Associated Gain versus Frequency

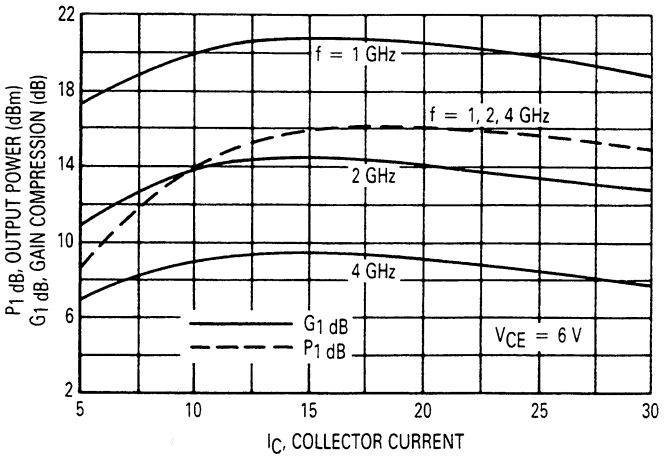


Figure 9. Output Power and 1 dB Gain Compression versus Current

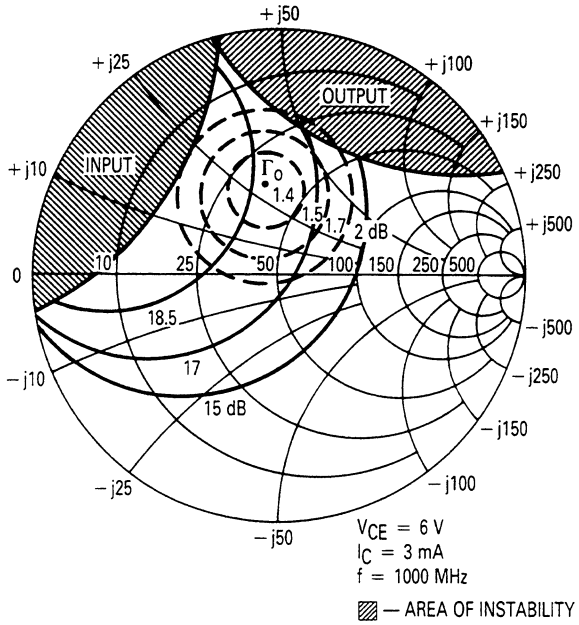


Figure 10. Gain and Noise Figure Contours f = 1 GHz

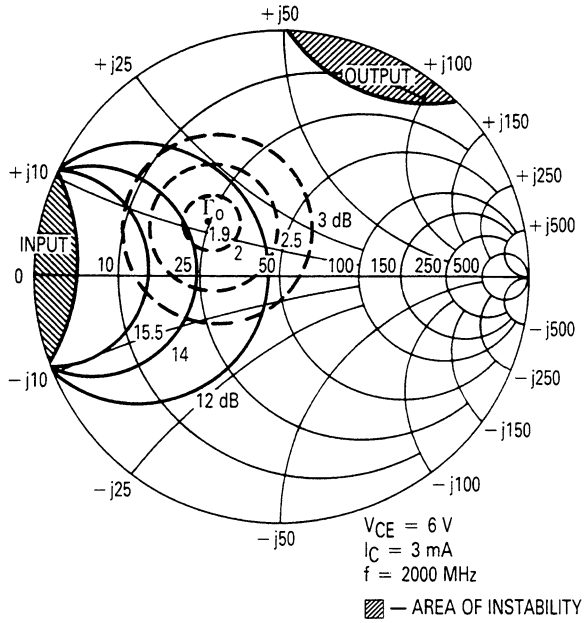


Figure 11. Gain and Noise Figure Contours f = 2 GHz

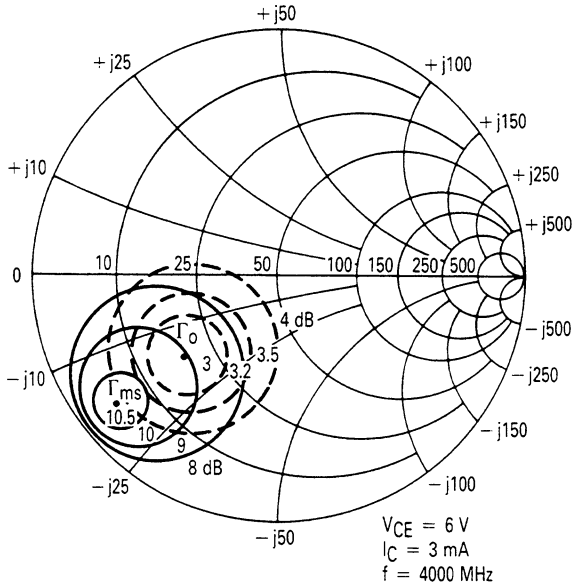


Figure 12. Gain and Noise Figure Contours f = 4 GHz

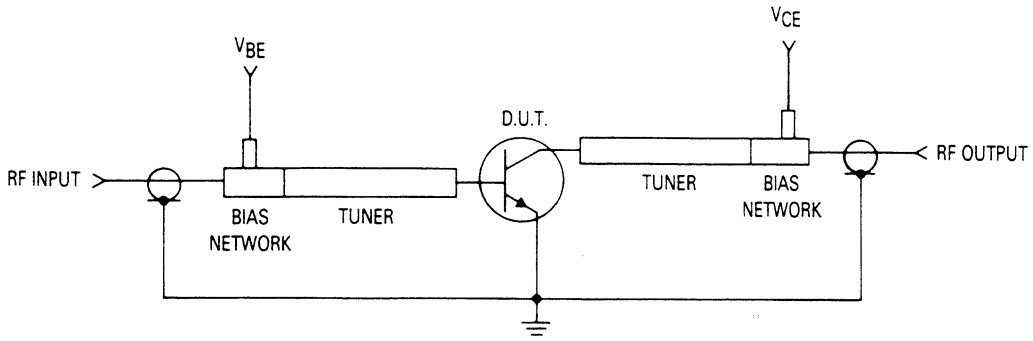


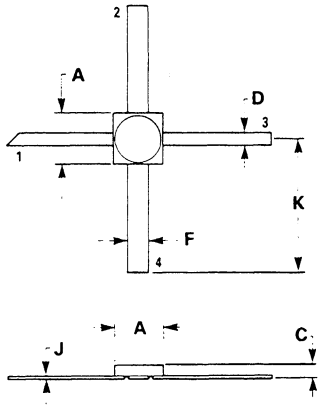
Figure 13. Functional Circuit Schematic

Figure 14. Typical Common Emitter S-Parameters

V_{CE} (Vdc)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
6	3	100	0.89	−17	9.93	171	0.01	84	0.99	−7
		500	0.79	−72	7.71	134	0.05	52	0.86	−29
		1000	0.69	−122	5.31	102	0.07	35	0.72	−42
		1500	0.67	−145	3.96	87	0.07	27	0.66	−52
		2000	0.59	−166	2.90	73	0.08	25	0.65	−58
		3000	0.52	162	2.07	52	0.08	26	0.65	−73
		4000	0.55	135	1.56	32	0.09	30	0.65	−92
		5000	0.60	113	1.28	20	0.10	32	0.63	−112
		6000	0.69	92	1.17	1	0.11	34	0.62	−133
		7000	0.66	73	0.99	−15	0.13	32	0.69	−150
		8000	0.62	57	0.86	−38	0.16	32	0.76	−163
	5	100	0.83	−23	15.04	168	0.01	79	0.98	−9
		500	0.71	−89	10.34	125	0.04	50	0.77	−33
		1000	0.63	−138	6.47	96	0.06	35	0.62	−44
		1500	0.60	−157	4.64	82	0.06	32	0.58	−53
		2000	0.54	−178	3.42	70	0.07	32	0.58	−58
		3000	0.49	152	2.41	50	0.08	37	0.59	−73
		4000	0.53	129	1.83	31	0.09	39	0.60	−90
		5000	0.57	107	1.50	19	0.11	38	0.58	−110
		6000	0.66	85	1.36	0	0.12	36	0.59	−132
		7000	0.64	70	1.13	−15	0.14	32	0.66	−148
		8000	0.60	52	0.99	−37	0.17	31	0.73	−162
	10	100	0.69	−34	24.58	162	0.01	74	0.95	−13
		500	0.60	−116	13.41	114	0.03	45	0.64	−37
		1000	0.56	−157	7.54	89	0.04	42	0.52	−43
		1500	0.55	−173	5.23	77	0.05	45	0.50	−52
		2000	0.52	168	3.90	66	0.06	46	0.51	−56
		3000	0.47	141	2.68	47	0.06	49	0.54	−70
		4000	0.54	121	2.03	30	0.09	48	0.56	−88
		5000	0.57	102	1.68	18	0.12	43	0.54	−108
		6000	0.66	82	1.52	−1	0.13	39	0.55	−130
		7000	0.62	66	1.25	−16	0.15	34	0.63	−147
		8000	0.59	47	1.11	−39	0.17	32	0.70	−161
	15	100	0.61	−45	30.33	157	0.01	71	0.92	−15
		500	0.57	−131	14.35	108	0.03	48	0.58	−37
		1000	0.56	−160	7.77	85	0.03	48	0.49	−41
		1500	0.54	179	5.32	74	0.04	51	0.48	−49
		2000	0.51	161	3.98	64	0.05	54	0.50	−54
		3000	0.48	137	2.72	45	0.07	54	0.54	−69
		4000	0.55	117	2.06	28	0.10	52	0.55	−87
		5000	0.59	99	1.68	16	0.12	46	0.54	−107
		6000	0.67	81	1.52	−2	0.13	41	0.55	−129
		7000	0.63	64	1.25	−18	0.16	36	0.63	−146
		8000	0.63	45	1.10	−40	0.18	33	0.70	−161
	30	100	0.46	−77	36.83	148	0.01	66	0.86	−18
		500	0.57	−156	13.51	100	0.02	53	0.55	−35
		1000	0.58	−180	7.01	81	0.03	59	0.51	−35
		1500	0.55	169	4.76	70	0.04	62	0.51	−45
		2000	0.55	155	3.61	60	0.05	64	0.54	−51
		3000	0.52	131	2.42	42	0.07	63	0.58	−67
		4000	0.58	113	1.82	24	0.10	60	0.60	−86
		5000	0.64	95	1.47	12	0.12	52	0.58	−109
		6000	0.75	76	1.32	−6	0.14	46	0.59	−131
		7000	0.69	57	1.08	−21	0.16	40	0.66	−147
		8000	0.66	39	0.94	−44	0.19	38	0.73	−161

OUTLINE DIMENSIONS

CASE 303-01



STYLE 1:
PIN 1. COLLECTOR
2. EMITTER
3. BASE
4. EMITTER

NOTE:
1. DIMENSION "K" APPLIES TO ALL LEADS.
2. DIRECTION OF 45° CUT ON PIN 1 IS VENDOR OPTION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.29	2.67	0.090	0.105
C	0.89	1.40	0.035	0.055
D	0.41	0.61	0.016	0.024
F	0.89	1.09	0.035	0.043
J	0.08	0.15	0.003	0.006
K	4.45	5.84	0.175	0.230

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