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MOTOROLA

MRFIC1808

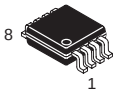
1.9 GHz GaAs Low Noise Amplifier

Designed primarily for use in wireless Personal Communication Systems (PCS) applications such as Digital European Cordless Telephone (DECT), Japan's Personal Handy System (PHS) and the emerging North American systems as a preamp for discrete or integrated downmixers. The MRFIC1808DM is a two–stage low noise amplifier in a low–cost Micro–8 package. The amplifier can be matched to optimize gain or noise figure with simple off–chip input matching. The design employs a novel stacked MESFET design which reuses bias current for the highest gain at minimal current. A CMOS compatible Rx Enable pin allows for very low standby current while the system is in transmit mode.

- Usable Frequency Range = 1.7 to 2.1 GHz
- 18 dB Typ Gain
- 1.6 dB Typ Noise Figure
- Simple Off–chip Matching for Maximum Gain/Noise Figure Flexibility
- High Reverse Isolation = 32 dB (Typ)
- Single Bias Supply = 2.7 to 4.5 V
- Low Standby Current = 8 μA (Typ)
- Low Cost Surface Mount Plastic Package
- Device Marking = M1808

1.9 GHz GaAs
LOW NOISE AMPLIFIER

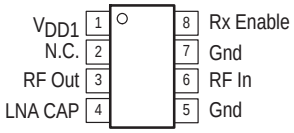
SEMICONDUCTOR
TECHNICAL DATA



(Scale 2:1)

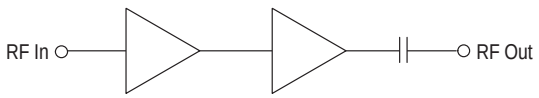
DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro–8, Tape & Reel Only)

PIN CONNECTIONS



(Top View)

Simplified Block Diagram



This device contains 5 active transistors.

ORDERING INFORMATION

Device	Operating Temp Range	Package
MRFIC1808DMR2	T_A = –30 to 85°C	Micro–8

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Symbol	Value	Unit
Supply Voltage	V_{DD}	5.5	Vdc
RF Input Power	P_{RF}	3.0	dBm
Enable Voltage	Rx Enable	5.5	Vdc
Storage Temperature Range	T_{stg}	–65 to 150	°C
Operating Ambient Temperature	T_A	–30 to 85	°C

NOTES: 1. Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the limits in the Recommended Operating Conditions or Electrical Characteristics tables.
2. Meets Human Body Model (HBM) ≤500 V and Machine Model (MM) ≤200 V.
3. ESD data available upon request.

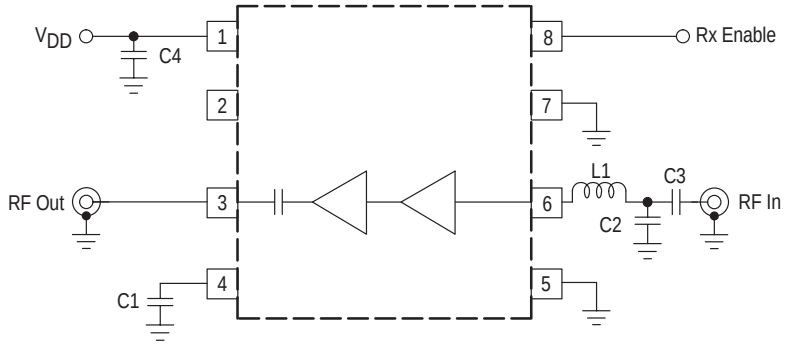
RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
RF Frequency	f_{RF}	1.7	–	2.1	GHz
Supply Voltage	V_{DD}	2.7	–	4.5	Vdc
Rx Enable Voltage, ON	Rx Enable	2.7	–	V_{DD}	Vdc
Rx Enable Voltage, OFF	Rx Enable	0	–	0.2	Vdc

ELECTRICAL CHARACTERISTICS (V_{DD} = 3.0 V, T_A = 25°C, RF = –30 dBm @ 1.9 GHz, Rx Enable = 3.0 V, unless otherwise noted. Tested in Circuit Shown in Figure 1)

Characteristic	Symbol	Min	Typ	Max	Unit
RF Gain	–	16	18	–	dB
SSB Noise Figure	–	–	1.6	–	dB
RF Output 3rd Order Intercept Point	–	–	13	–	dBm
Output 1 dB Gain Compression	–	–3.0	1.0	–	dBm
Reverse Isolation (s_{12})	–	–	–34	–	dB
Input Return Loss	–	–	–12	–	dB
Output Return Loss	–	–	–15	–	dB
Supply Current, Rx Mode	–	–	5.0	7.5	mA
Supply Current, Standby Mode (Rx Enable = 0 V)	–	–	–	50	μA

Figure 1. Applications Circuit Configuration



C1 1.4 pF
C2 1.4 pF
C3, C4 22 pF
L1 4.7 nH

TYPICAL CHARACTERISTICS

Figure 2. Supply Current versus Voltage

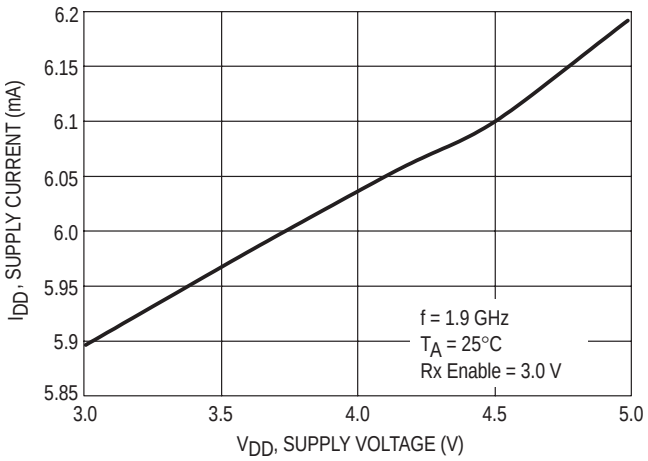


Figure 3. Output Power versus Input Power

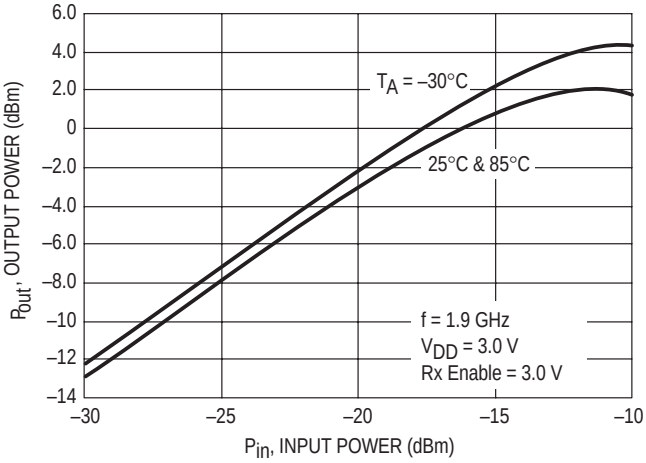


Figure 4. Output Power versus Input Power

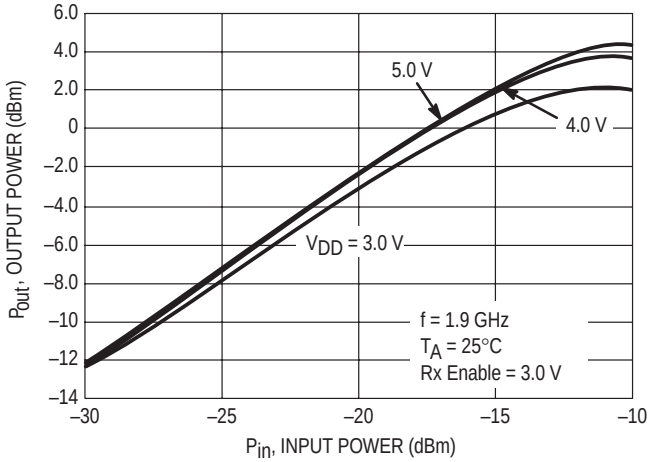


Figure 5. Gain versus Frequency

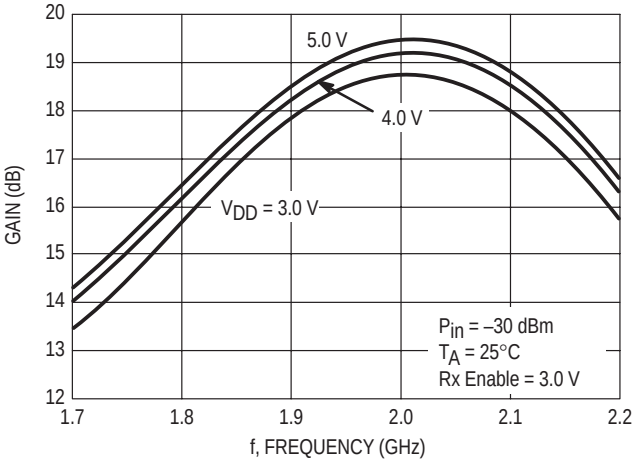


Figure 6. Gain versus Frequency

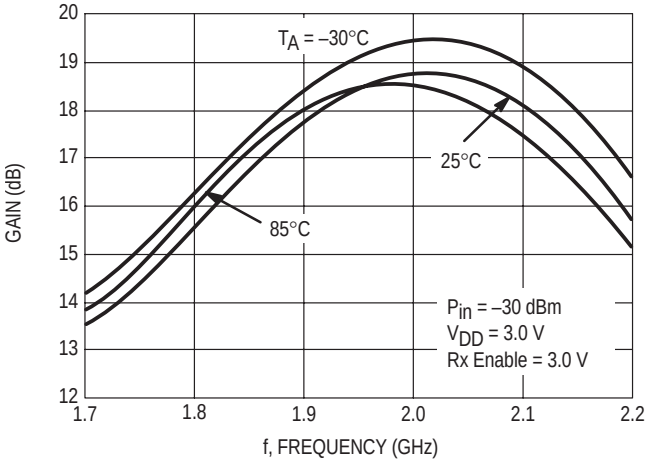
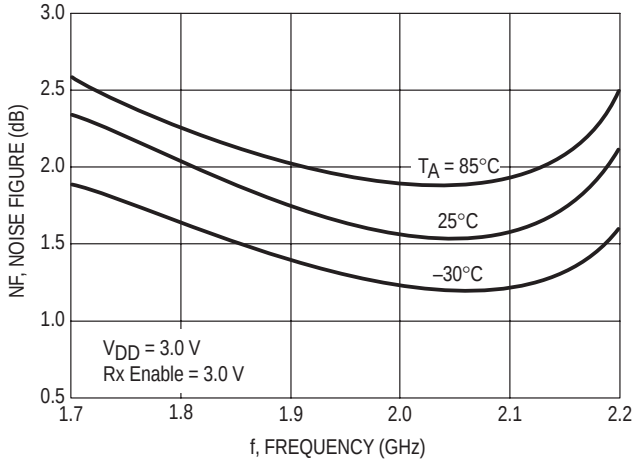


Figure 7. Noise Figure versus Frequency



TYPICAL CHARACTERISTICS

Figure 8. Reverse Isolation versus Frequency

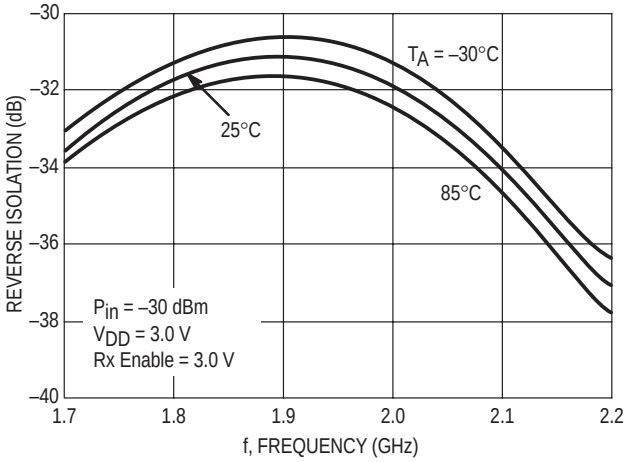


Figure 9. Reverse Isolation versus Frequency

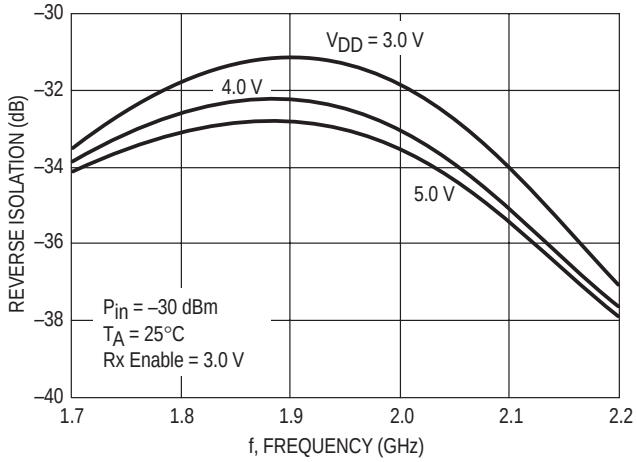


Table 1. Scattering Parameters

(V_{DD} = 3.0 V, T_A = 25°C, Rx Enable = 3.0 V, 50 Ω System)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
1500	0.907	–42	2.91	153	0.012	87	0.793	–60
1530	0.913	–43	3.11	148	0.012	85	0.765	–62
1560	0.920	–44	3.32	144	0.013	83	0.735	–64
1590	0.927	–45	3.55	139	0.013	80	0.701	–66
1620	0.935	–46	3.78	135	0.013	76	0.665	–67
1650	0.943	–47	4.02	130	0.013	73	0.627	–69
1680	0.951	–48	4.26	125	0.013	70	0.586	–70
1710	0.959	–49	4.49	119	0.012	67	0.544	–70
1740	0.967	–50	4.72	114	0.012	63	0.500	–70
1770	0.975	–52	4.94	109	0.012	59	0.458	–70
1800	0.982	–53	5.17	104	0.011	56	0.418	–68
1830	0.988	–55	5.38	98	0.011	52	0.382	–65
1860	0.993	–56	5.58	93	0.011	48	0.351	–60
1890	0.997	–58	5.76	87	0.010	44	0.329	–54
1920	0.999	–59	5.92	82	0.009	40	0.317	–48
1950	1.002	–61	6.07	76	0.008	35	0.317	–40
1980	1.004	–62	6.19	71	0.008	30	0.327	–34
2010	1.004	–64	6.29	65	0.007	25	0.346	–28
2040	1.003	–65	6.37	60	0.006	19	0.371	–24
2070	1.002	–67	6.43	55	0.005	11	0.401	–21
2100	0.999	–68	6.50	50	0.004	2	0.433	–20
2130	0.996	–70	6.55	45	0.004	–10	0.467	–19
2160	0.994	–71	6.61	40	0.003	–29	0.499	–19
2190	0.991	–73	6.67	35	0.003	–52	0.530	–19
2220	0.989	–74	6.70	31	0.003	–80	0.560	–20
2250	0.984	–76	6.70	26	0.003	–100	0.589	–21
2280	0.981	–77	6.66	21	0.004	–113	0.615	–22
2310	0.975	–79	6.59	16	0.005	–122	0.639	–23
2340	0.968	–80	6.51	13	0.006	–130	0.661	–25
2370	0.960	–82	6.48	9	0.007	–135	0.681	–26
2400	0.953	–83	6.47	5	0.008	–140	0.698	–28
2430	0.944	–84	6.48	2	0.009	–145	0.714	–30
2460	0.937	–86	6.50	–2	0.011	–149	0.727	–31
2490	0.929	–87	6.52	–7	0.012	–154	0.739	–33
2520	0.922	–88	6.49	–11	0.013	–158	0.750	–34
2550	0.915	–90	6.43	–15	0.014	–161	0.758	–36
2580	0.908	–91	6.33	–19	0.015	–163	0.766	–38

Table 2. Scattering Parameters

(V_{DD} = 4.0 V, T_A = 25°C, Rx Enable = 3.0 V, 50 Ω System)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
1500	0.893	–42	3.20	151	0.012	87	0.797	–60
1530	0.899	–43	3.42	147	0.012	85	0.770	–62
1560	0.906	–44	3.65	143	0.012	82	0.740	–64
1590	0.914	–45	3.90	138	0.012	80	0.707	–65
1620	0.921	–46	4.15	134	0.013	77	0.671	–67
1650	0.929	–47	4.41	129	0.013	73	0.633	–68
1680	0.936	–48	4.67	124	0.013	70	0.593	–70
1710	0.945	–49	4.93	119	0.012	67	0.551	–70
1740	0.953	–50	5.18	113	0.012	63	0.507	–71
1770	0.960	–52	5.43	108	0.012	60	0.465	–70
1800	0.967	–53	5.66	103	0.011	57	0.424	–68
1830	0.973	–55	5.89	97	0.011	53	0.387	–66
1860	0.979	–56	6.11	92	0.011	50	0.355	–61
1890	0.982	–58	6.32	87	0.010	46	0.330	–56
1920	0.985	–59	6.51	81	0.009	43	0.317	–49
1950	0.987	–61	6.68	75	0.008	39	0.314	–42
1980	0.988	–62	6.81	70	0.008	32	0.322	–35
2010	0.989	–64	6.92	65	0.007	26	0.339	–29
2040	0.988	–65	7.02	60	0.006	20	0.364	–25
2070	0.986	–67	7.09	54	0.005	13	0.394	–22
2100	0.984	–68	7.17	49	0.005	4	0.425	–20
2130	0.980	–70	7.23	44	0.004	–7	0.459	–19
2160	0.978	–71	7.30	40	0.003	–21	0.491	–18
2190	0.975	–73	7.35	35	0.003	–39	0.524	–19
2220	0.972	–74	7.39	30	0.002	–69	0.554	–19
2250	0.968	–76	7.38	25	0.003	–93	0.584	–20
2280	0.964	–77	7.34	20	0.004	–109	0.611	–21
2310	0.958	–79	7.26	16	0.004	–118	0.635	–23
2340	0.950	–80	7.18	12	0.005	–126	0.658	–24
2370	0.942	–82	7.14	8	0.007	–133	0.678	–26
2400	0.934	–83	7.14	4	0.008	–138	0.695	–28
2430	0.927	–84	7.15	1	0.009	–145	0.712	–29
2460	0.920	–85	7.16	–3	0.010	–150	0.726	–31
2490	0.912	–87	7.17	–8	0.011	–154	0.738	–33
2520	0.905	–88	7.14	–12	0.012	–158	0.749	–34
2550	0.897	–89	7.07	–16	0.013	–161	0.758	–36
2580	0.891	–91	6.95	–20	0.014	–163	0.766	–38

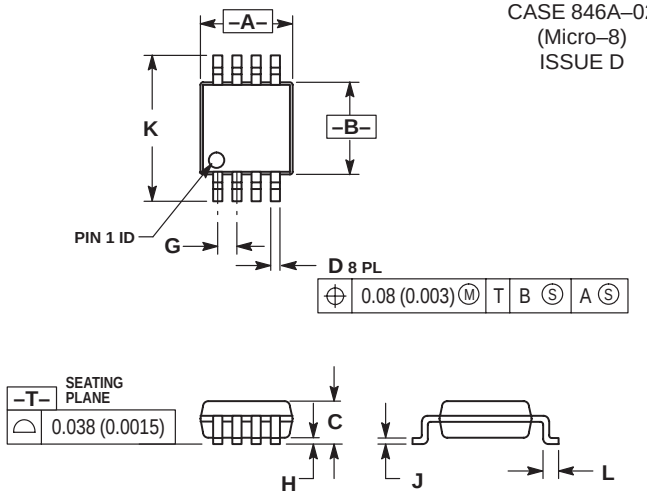
Table 3. Scattering Parameters

(V_{DD} = 5.0 V, T_A = 25°C, Rx Enable = 3.0 V, 50 Ω System)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
1500	0.876	–42	3.50	150	0.012	87	0.799	–59
1530	0.883	–43	3.73	146	0.012	85	0.773	–61
1560	0.891	–44	3.98	141	0.012	83	0.744	–63
1590	0.898	–45	4.25	137	0.012	80	0.712	–65
1620	0.906	–46	4.52	132	0.012	77	0.677	–67
1650	0.914	–47	4.80	127	0.012	74	0.640	–68
1680	0.921	–48	5.08	122	0.012	71	0.600	–69
1710	0.928	–49	5.36	117	0.012	67	0.559	–70
1740	0.936	–51	5.63	112	0.012	64	0.517	–70
1770	0.944	–52	5.90	107	0.012	60	0.475	–70
1800	0.950	–53	6.16	102	0.011	57	0.435	–69
1830	0.956	–55	6.41	96	0.011	54	0.397	–66
1860	0.961	–56	6.66	91	0.010	50	0.365	–62
1890	0.965	–58	6.89	85	0.010	47	0.339	–57
1920	0.967	–59	7.10	80	0.009	43	0.323	–51
1950	0.968	–61	7.29	74	0.009	39	0.318	–44
1980	0.969	–62	7.44	69	0.008	35	0.323	–37
2010	0.970	–64	7.56	64	0.007	29	0.338	–31
2040	0.969	–66	7.66	58	0.006	24	0.361	–26
2070	0.966	–67	7.75	53	0.006	18	0.389	–23
2100	0.963	–69	7.84	48	0.005	10	0.420	–21
2130	0.960	–70	7.91	43	0.004	0	0.453	–19
2160	0.957	–72	7.98	38	0.003	–15	0.485	–19
2190	0.954	–73	8.04	34	0.003	–34	0.517	–19
2220	0.951	–75	8.08	29	0.002	–59	0.547	–20
2250	0.946	–76	8.07	24	0.003	–83	0.576	–21
2280	0.942	–78	8.02	19	0.003	–104	0.603	–22
2310	0.936	–79	7.93	14	0.004	–116	0.629	–23
2340	0.928	–81	7.84	10	0.005	–125	0.652	–24
2370	0.920	–82	7.80	7	0.006	–132	0.672	–26
2400	0.912	–83	7.79	3	0.007	–138	0.690	–28
2430	0.904	–84	7.79	–1	0.008	–143	0.707	–29
2460	0.896	–86	7.81	–5	0.009	–148	0.720	–31
2490	0.889	–87	7.81	–9	0.010	–152	0.733	–33
2520	0.882	–88	7.78	–13	0.011	–155	0.744	–34
2550	0.874	–89	7.69	–17	0.012	–158	0.754	–36
2580	0.869	–91	7.56	–21	0.013	–161	0.762	–38

OUTLINE DIMENSIONS

PLASTIC PACKAGE
CASE 846A–02
(Micro–8)
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	—	1.10	—	0.043
D	0.25	0.40	0.010	0.016
G	0.65 BSC		0.026 BSC	
H	0.05	0.15	0.002	0.006
J	0.13	0.23	0.005	0.009
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

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