

# The MRFIC Line

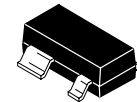
## General Purpose RF Cascode Amplifier

The MRFIC0915 is a cost-effective, high isolation cascode silicon monolithic amplifier in the industry standard SOT-143 surface mount package designed for general purpose RF applications. The device is a lower current version of the MRFIC0916 and is appropriate for VCOs, VCO buffers and amplifiers. On-chip bias circuitry sets the bias point while matching is accomplished off chip affording the maximum in application flexibility.

- Usable Frequency Range = 100 to 2500 MHz
- Good Small Signal Gain at  $V_{CC} = 2.7$  Volts
  - 16.2 dB Typ at 850 MHz
  - 9.6 dB Typ at 1800 MHz
  - 5.8 dB Typ at 2400 MHz
- -4.6 dBm typical Output Power at 1 dB Gain Compression at 850 MHz,  $V_{CC} = 2.7$  Volts
- 38 dB Typical Reverse Isolation at 850 MHz
- 2.5 mA Max Bias Current at  $V_{CC} = 2.7$  Volts
- 2.7 to 5 Volt Supply
- Order MRFIC0915T1 for Tape and Reel.  
T1 Suffix = 3,000 Units per 8 mm, 7 inch Reel.
- Device Marking = 22

# MRFIC0915

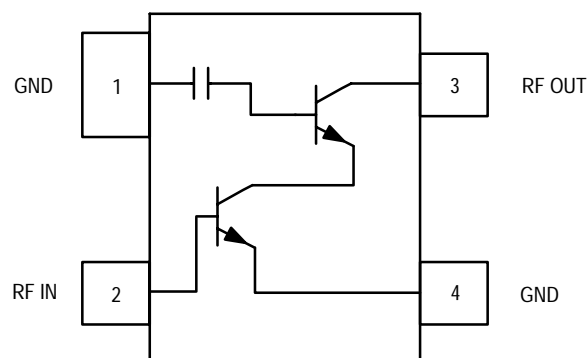
100 to 2500 MHz  
 SILICON GENERAL PURPOSE  
 RF CASCODE AMPLIFIER



CASE 318A-05  
(SOT-143)

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Limit	Unit
Supply Voltage	$V_{CC}$	6	Vdc
RF Input Power	$P_{RF}$	10	dBm
Power Dissipation	$P_{DIS}$	100	mW
Supply Current	$I_{CC}$	10	mA
Thermal Resistance, Junction to Case	$R_{\theta JC}$	250	$^\circ\text{C/W}$
Storage Temperature Range	$T_{stg}$	- 65 to +150	$^\circ\text{C}$
Operating Case Temperature	$T_C$	- 40 to +100	$^\circ\text{C}$



Pin Connections and Functional Block Diagram

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 LAST SHIP 27DEC02  
 LAST ORDER 15JAN02

RECOMMENDED OPERATING RANGES

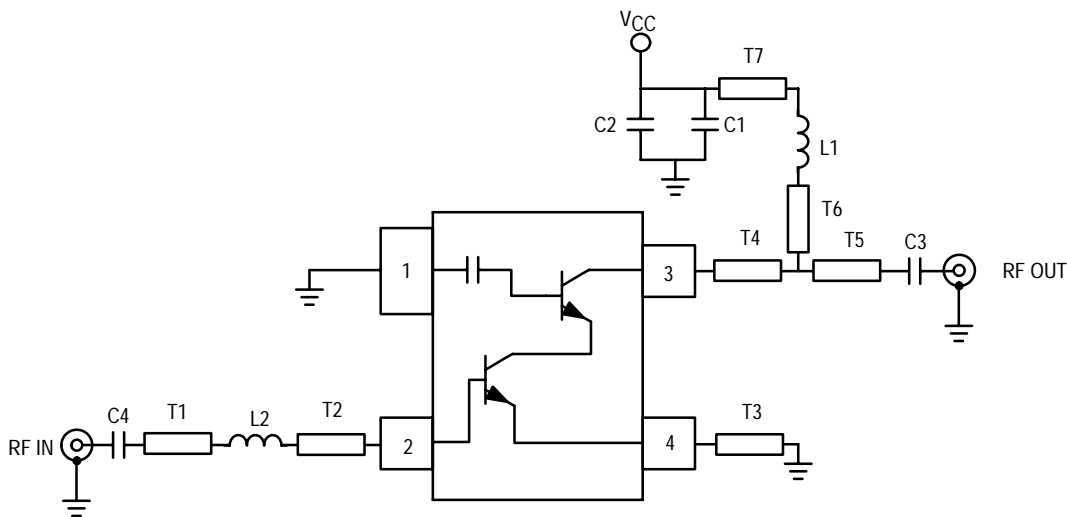
Parameter	Symbol	Value	Unit
RF Frequency	$f_{RF}$	100 to 2500	MHz
Supply Voltage	$V_{CC}$	2.7 to 5	Vdc

ELECTRICAL CHARACTERISTICS ( $V_{CC} = 2.7\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

Characteristic	Min	Typ	Max	Unit
Small Signal Gain				
850 MHz	14.2	16.2	—	dB
1800 MHz	7.4	9.6	—	dB
2400 MHz	5	5.8	—	dB
Noise Figure				
850	—	1.9	—	dB
1800 MHz	—	3.6	—	dB
2400 MHz	—	5.5	—	dB
Power Output at 1dB Gain Compression				
850 MHz	—	-4.6	—	dBm
1800 MHz	—	-7.8	—	dBm
2400 MHz	—	-9.8	—	dBm
Output 3rd Order Intercept Point				
850 MHz	—	4	—	dBm
1800 MHz	—	1	—	dBm
2400 MHz	—	-1	—	dBm
Reverse Isolation				
850 MHz	—	38	—	dB
1800 MHz	—	33	—	dB
2400 MHz	—	29	—	dB
Supply Current	1.5	2.0	2.5	mA

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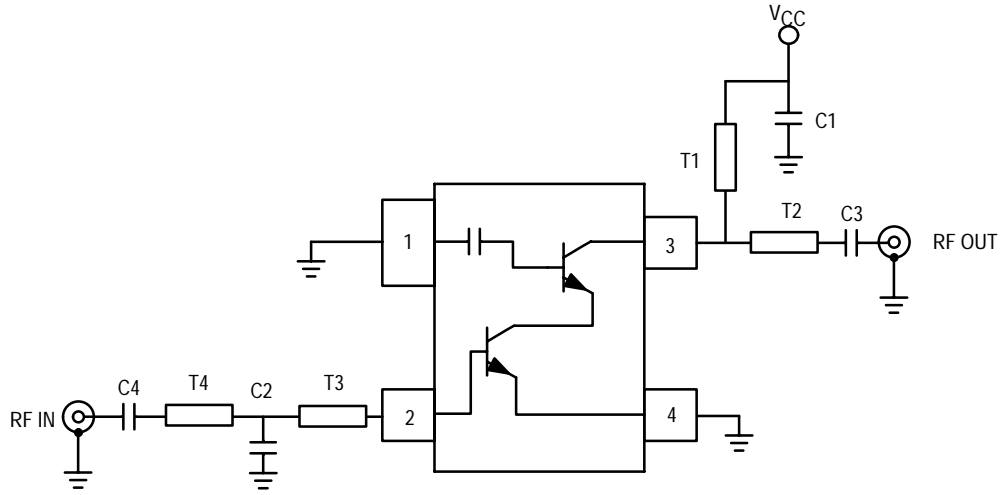
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- |    |                 |    |                          |
|----|-----------------|----|--------------------------|
| C1 | 10 pF, NPO/COG  | T1 | 50 Ω MICROSTRIP, 0.13"   |
| C2 | 0.01 μF         | T2 | 76 Ω MICROSTRIP, 0.072"  |
| C3 | 1.4 pF, NPO/COG | T3 | 100 Ω MICROSTRIP, 0.035" |
| C4 | 12 pF, NPO/COG  | T4 | 50 Ω MICROSTRIP, 0.048"  |
| L1 | 8.2 nH          | T5 | 50 Ω MICROSTRIP, 0.08"   |
| L2 | 10 nH           | T6 | 76 Ω MICROSTRIP, 0.062"  |
|    |                 | T7 | 76 Ω MICROSTRIP, 0.07"   |

BOARD MATERIAL: FR4,  $\epsilon_r = 4.45$ , THICKNESS = 0.014"

Figure 1. 850 MHz Applications Circuit Configuration



1.8 GHz DESCRIPTION

C1	18 pF, NPO/COG
C2	1.0 pF, NPO/COG
C3	0.9 pF, NPO/COG
C4	10 pF, NPO/COG
T1	50 Ω MICROSTRIP, 0.41"
T2	50 Ω MICROSTRIP, 0.076"
T3	50 Ω MICROSTRIP, 0.528"
T7	N/A

2.4 GHz DESCRIPTION

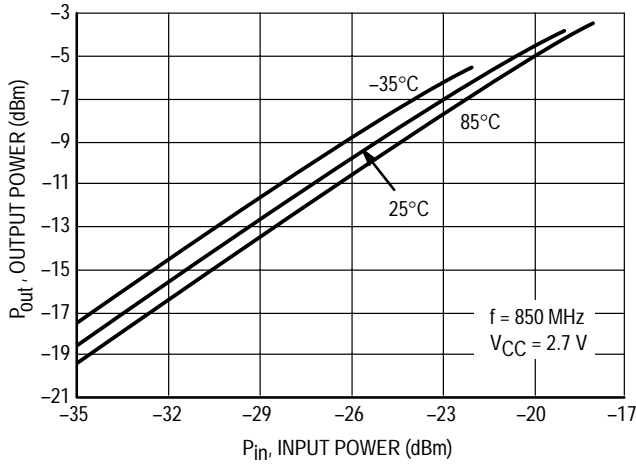
C1	12 pF, NPO/COG
C2	1.2 pF, NPO/COG
C3	0.7 pF, NPO/COG
C4	10 pF, NPO/COG
T1	50 Ω MICROSTRIP, 0.228"
T2	50 Ω MICROSTRIP, 0.076"
T3	50 Ω MICROSTRIP, 0.229"
T4	50 Ω MICROSTRIP, 0.345"

BOARD MATERIAL: FR4,  $\epsilon_r = 4.45$ , THICKNESS = 0.014"

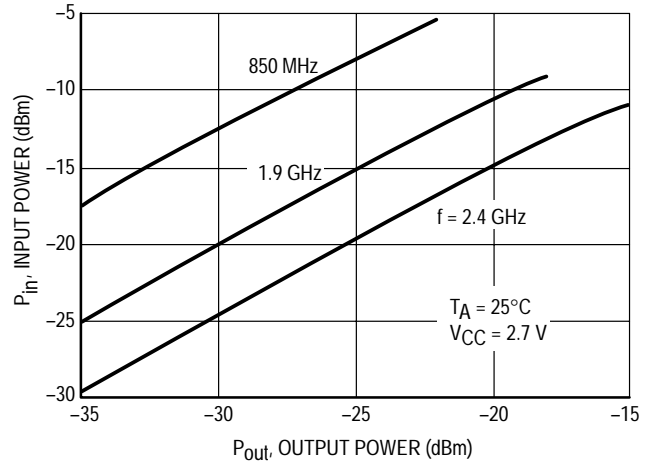
Figure 2. 1800 and 2400 MHz Applications Circuit Configuration

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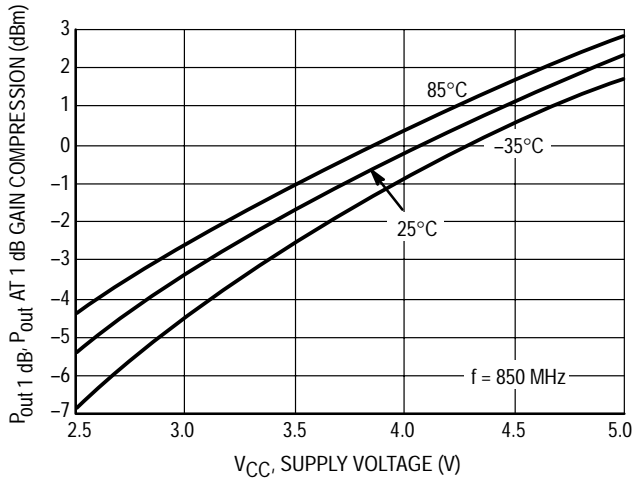
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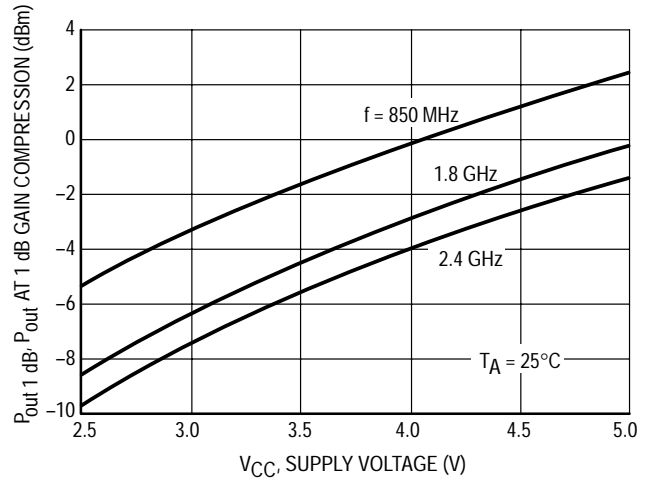
**Figure 3. Output Power versus Input Power**



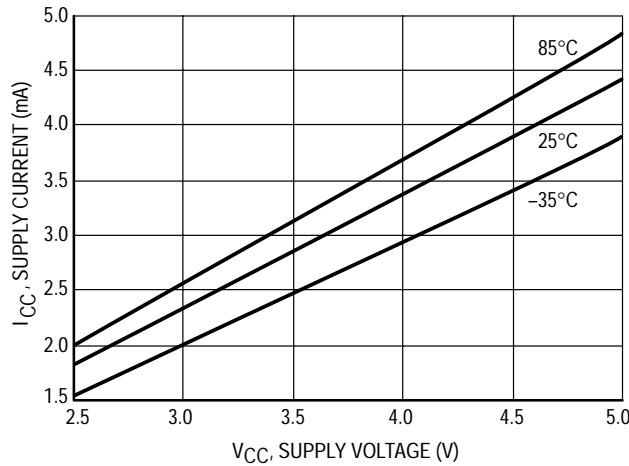
**Figure 4. Output Power versus Input Power**



**Figure 5. Output Power at 1 dB Gain Compression versus Supply Voltage**



**Figure 6. Output Power at 1 dB Gain Compression versus Supply Voltage**



**Figure 7. Supply Current versus Supply Voltage**

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# Freescale Semiconductor, Inc.

f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
100	0.91	-11	5.72	168	0.000	53	0.97	-3
200	0.90	-22	5.50	156	0.001	85	0.97	-7
300	0.86	-32	5.32	145	0.002	80	0.96	-10
400	0.82	-42	5.00	134	0.002	74	0.95	-13
500	0.75	-52	4.72	122	0.002	69	0.94	-16
600	0.70	-60	4.35	113	0.002	67	0.92	-18
700	0.66	-68	4.05	105	0.003	66	0.91	-21
800	0.63	-75	3.65	97	0.003	67	0.90	-24
900	0.57	-83	3.52	89	0.002	69	0.89	-26
1000	0.54	-90	3.28	82	0.002	73	0.87	-29
1100	0.50	-96	3.05	75	0.002	78	0.86	-32
1200	0.48	-103	2.81	69	0.002	92	0.85	-34
1300	0.45	-109	2.71	62	0.002	108	0.84	-37
1400	0.43	-114	2.53	56	0.002	129	0.83	-40
1500	0.41	-120	2.37	51	0.002	147	0.81	-42
1600	0.39	-125	2.28	45	0.003	160	0.80	-45
1700	0.38	-132	2.12	39	0.004	167	0.79	-48
1800	0.37	-137	2.00	34	0.005	113	0.78	-51
1900	0.36	-141	1.88	28	0.006	116	0.77	-53
2000	0.35	-146	1.78	23	0.008	-2	0.76	-56
2100	0.34	-150	1.71	18	0.010	-61	0.75	-59
2200	0.33	-155	1.65	12	0.012	-120	0.74	-62
2300	0.34	-159	1.51	7	0.013	-120	0.73	-65
2400	0.33	-161	1.51	2	0.016	-61	0.72	-69
2500	0.34	-167	1.39	-5	0.019	58	0.71	-73
2600	0.34	-171	1.32	-10	0.022	176	0.70	-77
2700	0.34	-173	1.26	-15	0.025	175	0.69	-80
2800	0.34	-176	1.20	-20	0.028	174	0.68	-83
2900	0.34	-119	1.14	-25	0.032	172	0.67	-86
3000	0.34	118	1.09	-30	0.036	170	0.66	-90

Table 1. S-Parameters (V<sub>CC</sub> = 2.7 V, 50 Ω System)

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f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
100	0.88	-12	8.65	167	0.001	48	0.97	-3
200	0.85	-23	8.23	154	0.001	93	0.97	-6
300	0.80	-34	7.73	142	0.002	82	0.96	-10
400	0.75	-44	7.15	131	0.002	73	0.95	-12
500	0.67	-53	6.56	119	0.002	68	0.93	-15
600	0.62	-60	5.99	111	0.002	66	0.92	-18
700	0.57	-67	5.47	102	0.002	63	0.91	-21
800	0.53	-74	5.02	95	0.002	65	0.90	-23
900	0.48	-80	4.67	88	0.002	66	0.88	-26
1000	0.44	-86	4.31	81	0.002	69	0.87	-29
1100	0.41	-92	3.98	75	0.001	79	0.86	-31
1200	0.38	-97	3.71	69	0.001	101	0.85	-34
1300	0.36	-102	3.49	63	0.001	139	0.84	-36
1400	0.34	-107	3.26	58	0.002	102	0.82	-39
1500	0.32	-111	3.07	53	0.003	-4	0.81	-42
1600	0.30	-116	2.89	49	0.004	-119	0.80	-44
1700	0.29	-122	2.72	43	0.005	-115	0.79	-47
1800	0.28	-126	2.56	38	0.007	-113	0.78	-50
1900	0.28	-130	2.42	33	0.008	-113	0.77	-53
2000	0.27	-134	2.30	29	0.010	-112	0.76	-55
2100	0.26	-137	2.20	24	0.012	-113	0.75	-58
2200	0.25	-141	2.08	19	0.014	-114	0.74	-61
2300	0.26	-146	1.98	14	0.017	-115	0.73	-64
2400	0.25	-147	1.90	10	0.019	-117	0.72	-68
2500	0.26	-153	1.79	5	0.022	-119	0.71	-72
2600	0.26	-157	1.71	0	0.025	59	0.70	-75
2700	0.27	-159	1.63	-5	0.028	177	0.69	-78
2800	0.27	-162	1.55	-9	0.032	175	0.68	-81
2900	0.27	-164	1.48	-14	0.036	173	0.67	-85
3000	0.27	-167	1.41	-18	0.040	171	0.66	-88

Table 2. S-Parameters (V<sub>CC</sub> = 4.0 V, 50 Ω System)



# Freescale Semiconductor, Inc.

f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
100	0.85	-12	11.04	166	0.00	39	0.97	-3
200	0.82	-24	10.44	152	0.00	94	0.97	-6
300	0.77	-35	9.79	140	0.00	82	0.96	-9
400	0.70	-44	8.95	128	0.00	74	0.96	-12
500	0.62	-53	8.16	117	0.00	69	0.94	-15
600	0.57	-59	7.34	109	0.00	64	0.93	-18
700	0.52	-66	6.70	100	0.00	63	0.92	-20
800	0.48	-72	6.02	93	0.00	65	0.90	-23
900	0.43	-77	5.58	86	0.00	68	0.89	-26
1000	0.39	-82	5.11	80	0.00	71	0.88	-28
1100	0.36	-87	4.71	75	0.00	81	0.87	-31
1200	0.34	-92	4.33	69	0.00	114	0.86	-33
1300	0.32	-95	4.08	63	0.00	152	0.84	-36
1400	0.30	-99	3.80	59	0.00	114	0.83	-38
1500	0.28	-104	3.54	54	0.00	-118	0.82	-41
1600	0.26	-108	3.35	49	0.00	-114	0.81	-44
1700	0.25	-113	3.13	44	0.01	-111	0.80	-47
1800	0.25	-117	2.96	40	0.01	-110	0.79	-49
1900	0.24	-120	2.79	35	0.01	-111	0.78	-52
2000	0.23	-123	2.64	31	0.01	-111	0.77	-55
2100	0.22	-126	2.52	26	0.01	-112	0.76	-58
2200	0.22	-130	2.40	22	0.01	-114	0.75	-61
2300	0.23	-135	2.25	18	0.02	-115	0.74	-64
2400	0.23	-136	2.19	13	0.02	-117	0.73	-67
2500	0.23	-142	2.05	8	0.02	-119	0.72	-71
2600	0.23	-146	1.96	4	0.02	-1	0.71	-74
2700	0.24	-149	1.87	0	0.03	177	0.70	-77
2800	0.24	-151	1.78	-4	0.03	175	0.69	-80
2900	0.25	-153	1.70	-9	0.03	173	0.68	-84
3000	0.25	-156	1.62	-13	0.04	171	0.68	-87

Table 3. S-Parameters (V<sub>CC</sub> = 5.0 V, 50 Ω System)

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VCC (Volts)	f (GHz)	NFmin (dB)	$\Gamma_0$		RN ( $\Omega$ )
			MAG	$\angle \phi$	
2.7	0.30	1.26	0.47	18	0.47
	0.50	1.48	0.42	29	0.44
	0.70	1.71	0.38	41	0.42
	0.90	1.96	0.34	53	0.41
	1.00	2.09	0.33	60	0.40
	1.50	2.82	0.27	94	0.38
	2.00	3.67	0.25	132	0.36
	2.40	4.43	0.25	165	0.36
4.0	0.30	1.27	0.37	18	0.37
	0.50	1.41	0.33	29	0.35
	0.70	1.56	0.30	40	0.33
	0.90	1.73	0.27	52	0.32
	1.00	1.82	0.25	59	0.31
	1.50	2.32	0.21	93	0.30
	2.00	2.91	0.20	133	0.29
	2.40	3.44	0.21	168	0.29
4.5	0.30	1.41	0.38	18	0.40
	0.50	1.53	0.34	26	0.38
	0.70	1.67	0.31	36	0.37
	0.90	1.83	0.27	46	0.36
	1.00	1.92	0.26	52	0.35
	1.50	2.42	0.20	85	0.33
	2.00	3.03	0.17	126	0.32
	2.40	3.61	0.16	165	0.34
5.0	0.30	1.36	0.33	18	0.35
	0.50	1.47	0.29	28	0.33
	0.70	1.60	0.26	40	0.32
	0.90	1.74	0.24	52	0.31
	1.00	1.82	0.22	58	0.30
	1.50	2.25	0.18	93	0.29
	2.00	2.78	0.17	133	0.28
	2.40	3.27	0.18	170	0.29

Table 4. Typical Noise Parameters (50  $\Omega$  System)

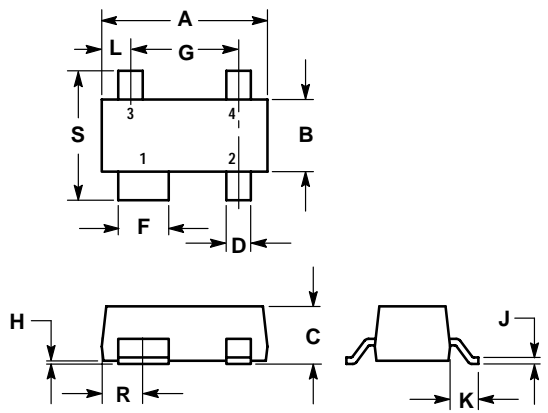
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- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: MILLIMETER.


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.84	1.14	0.033	0.045
D	0.39	0.50	0.015	0.020
F	0.79	0.93	0.031	0.037
G	1.78	2.03	0.070	0.080
H	0.013	0.10	0.0005	0.004
J	0.08	0.15	0.003	0.006
K	0.46	0.60	0.018	0.024
L	0.445	0.60	0.0175	0.024
R	0.72	0.83	0.028	0.033
S	2.11	2.48	0.083	0.098

**CASE 318A-05  
ISSUE R**



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