INCH-POUND

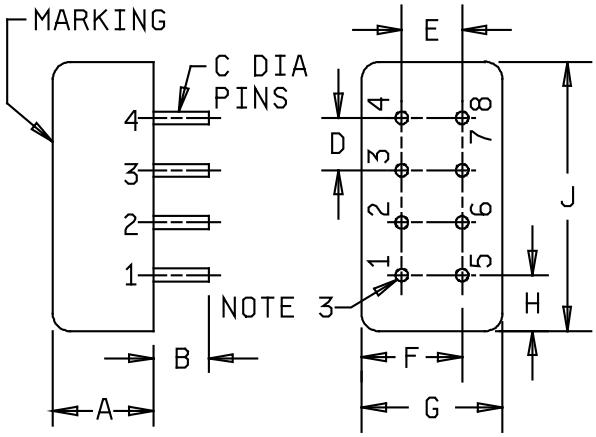
MIL-DTL-28837/1D
5 July 2012
SUPERSEDING
MIL-DTL-28837/1C
30 October 2001

DETAIL SPECIFICATION SHEET

MIXER STAGES, RADIO FREQUENCY, DOUBLE BALANCED, PIN PLUG-IN TERMINATION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification and MIL-DTL-28837.

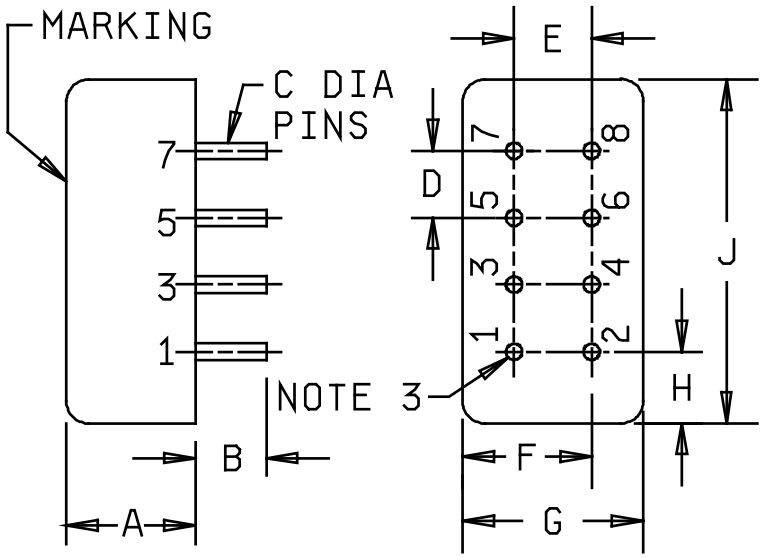


Ltr	Dimension			
	Inches		mm	
	Min	Max	Min	Max
A	.190	.210	4.83	5.33
B	.165	.205	4.19	5.21
C	.028 DIA	.032 DIA	0.71 DIA	0.81 DIA
D	.195	.205	4.95	5.21
E	.195	.205	4.95	5.21
F	.080	.110	2.03	2.79
G	.370	.400	9.40	10.16
H	.080	.110	2.03	2.79
J	.770	.800	19.60	20.32

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin number 1 shall have a contrasting color insulator, all pin numbers are to be marked on sides of case adjacent to the pins. The marking on the header is for reference only.

Termination for PIN M28837/01-01 and M28837/01-13	Termination for PIN M28837/01-02 and M28837/1-14
LO - Pins 1 and 5 RF - Pins 4 and 8 IF is formed by externally connecting pins 2 and 6 together and 3 and 7 together	LO - 1 and 5 RF - Pins 4 and 8 Pins 2, 4, and 6 are internally connected to case. IF is formed by externally connecting pins 3 and 7 together and using the case for reference.

FIGURE 1. Outline drawing for mixers PIN M28837/1-01, M28837/1-02, M28837/1-13, and M28837/1-14.

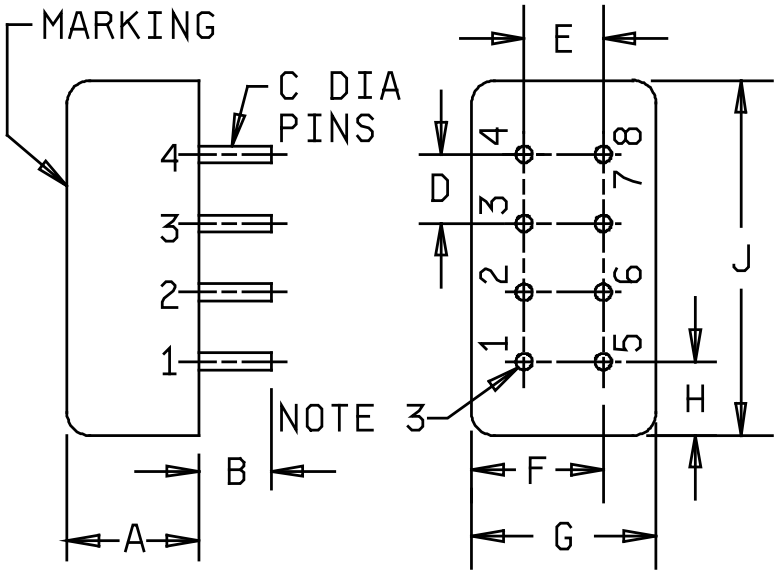


Ltr	Dimension			
	Inches		mm	
	Min	Max	Min	Max
A	---	.400	---	10.16
B	.165	.205	4.19	5.21
C	.028 DIA	.032 DIA	0.71 DIA	0.81 DIA
D	.195	.205	4.95	5.21
E	.195	.205	4.95	5.21
F	.080	.110	2.03	2.79
G	.370	.400	9.40	10.16
H	.080	.110	2.03	2.79
J	.770	.800	19.60	20.32

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin number 1 shall have a contrasting color insulator, all pin numbers are to be marked on sides of case adjacent to the pins. The marking on the header is for reference only.

Termination for PIN M28837/01-03, -
M28837/01-08, and M28837/01-09
LO - Pins 7 and 8
RF - Pins 1 and 2
IF is formed by externally
connecting pins 3 and 4 together
for the grounded side.

FIGURE 2. Outline drawing for mixers PIN M28837/1-03, M28837/1-08, and M28837/1-09.

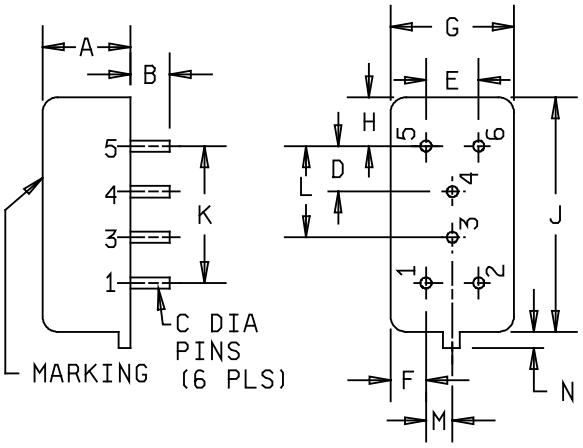


Ltr	Dimension			
	Inches		mm	
	Min	Max	Min	Max
A	.400	.425	10.16	10.80
B	.165	.205	4.19	5.21
C	.028 DIA	.032 DIA	0.71 DIA	0.81 DIA
D	.195	.205	4.95	5.21
E	.195	.205	4.95	5.21
F	.080	.110	2.03	2.79
G	.370	.400	9.40	10.16
H	.080	.110	2.03	2.79
J	.770	.800	19.60	20.32

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin number 1 shall have a contrasting color insulator, all pin numbers are to be marked on sides of case adjacent to the pins. The marking on the header is for reference only.

Termination for PIN M28837/01-04
and M28837/01-12
LO - Pins 1 and 5
RF - Pins 4 and 8
IF is formed by externally
connecting pins 3 and 7 together
for the grounded side and using
pins 2 and 6 for the ground side.

FIGURE 3. Outline drawing for mixers PIN M28837/1-04 and M28837/1-12.

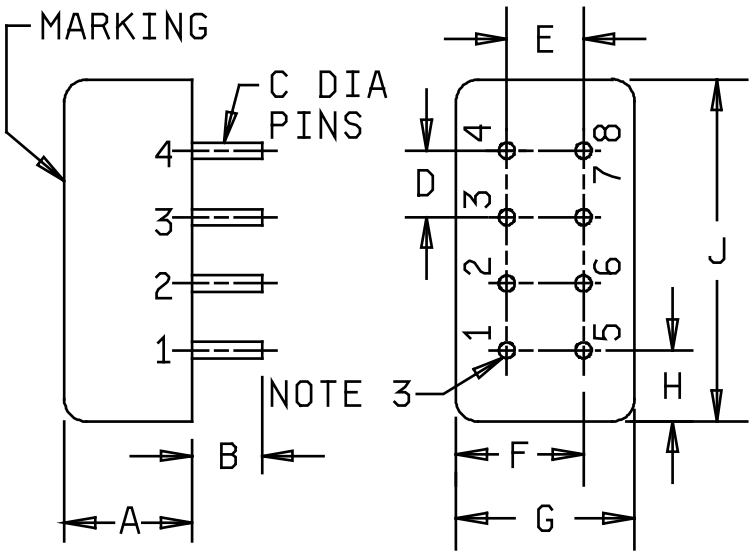


Dimension				
Ltr	Inches		mm	
	Min	Max	Min	Max
A	.390	.430	9.91	10.92
B	.100	.130	2.54	3.30
C	.023 DIA	.027 DIA	0.58 DIA	0.69 DIA
D	.295	.305	7.49	7.75
E	.295	.305	7.49	7.75
F	.090	.130	2.29	3.30
G	.500	.525	12.7	13.34
H	.090	.130	2.29	3.30
J	1.000	1.025	25.4	26.04
K	.795	.805	20.19	20.45
L	.495	.505	12.57	12.83
M	.145	.155	3.68	3.94
N	---	.040	---	1.02

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin number 1 shall have a contrasting color insulator, all pin numbers are to be marked on sides of case adjacent to the pins. The marking on the header is for reference only.

Termination for PIN 28837/1-05,
M28837/1-06, M28837/1-07 and
M28837/1-10
LO - Pins 1 and 2
RF - Pins 5 and 6
IF - Pins 3 and 4.

FIGURE 4. Outline drawing for mixers PIN M28837/1-05, M28837/1-06, M28837/1-07 and M28837/1-10.



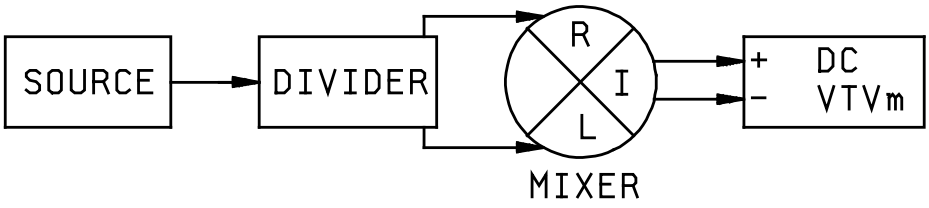
Ltr	Dimension			
	Inches		mm	
	Min	Max	Min	Max
A	.297	.327	7.54	8.31
B	.188	.218	4.78	5.54
C	.028 DIA	.032 DIA	0.71 DIA	0.81 DIA
D	.195	.205	4.95	5.21
E	.195	.205	4.95	5.21
F	.080	.110	2.03	2.79
G	.370	.400	9.40	10.16
H	.080	.110	2.03	2.79
J	.775	.805	19.69	20.45

Termination for PIN M28837/1-11
LO - Pins 4 and 8
RF - Pins 1 and 5
IF - Pins 3 and 7
Pins 2, 4, and 6 are grounded

Termination for PIN M28837/1-15
and M28837/1-16
LO - Pin 5
RF - Pin 8
IF - Pins 3 and 7
All other pins are grounded.

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Pin number 1 shall have a contrasting color insulator, all pin numbers are to be marked on sides of case adjacent to the pins. The marking on the header is for reference only.

FIGURE 4. Outline drawing for mixers PIN M28837/1-11, M28837/1-15, and M28837/1-16.



NOTE: The phase balance test shall be performed in accordance with figure 6. When any difference from the mean reading (approximately -0.35 volts) on the VTVM is greater than 0.05 volts, the mixer fails this test.

FIGURE 6. Phase balance test setup for PIN M28837/1-01 and M28837/1-02.

REQUIREMENTS:

Design and construction:

Dimensions and configuration: See figures 1 through 6.

Electrical characteristics:

Operating frequency range: See table I.

LO drive power: See table I.

Conversion loss (max): See table I.

Noise figure (SSB): See table I.

Isolation (minimum): See table I.

Maximum input power (rms): See table I.

Conversion compression (max): See table I.

Desensitization (max): See table I.

DC relative polarity: See table I.

VSWR: See table I.

Third order two-tone intermodulation: See table I.

Impedance: 50 ohms.

Physical and environmental characteristics:

Weight: See table II.

Temperature range: See table II.

Mechanical shock: See table II.

Hermetic seal: See table II.

Terminal strength: See table II.

Life: See table II.

Part or Identifying Number (PIN)
Space flight mixers shall be marked with “T”, M28837/1- 01 T

TABLE I. Physical and environmental characteristics. 1/

Dash no.	Operating frequency range (MHz)	LO input drive power in dBm 2/	Maximum conversion loss (SSB) dB MHz	Noise figure (SSB) dB MHz	Isolation Minimum LO-RF dB	Isolation Minimum LO-IF dB	Isolation Minimum RF-IF dB	Frequency MHz
01N	LO .05-200	minimum +4 TV +7 maximum +13	6.5 at f_L and f_R 0.2-50 f_I DC-50	6.5 at f_L and f_R 1-50 f_I 0.4-50	45	40	N/A	.05-30
01S	RF .05-200		8.0 at f_L and f_R 50-200 f_I DC-200	8.0 at f_L and f_R 50-200 f_I 0.4-200	35	30	N/A	30-200
	IF DC-200		8.5 at f_L and f_R 0.05-0.2 f_I DC-0.4	N/A				
02N	LO 5-500	minimum +4 TV +7 maximum +13	7.0 at f_L and f_R 5-150 f_I 0.4-150	7.0 at f_L and f_R 10-100 f_I 0.4-100	45	40	N/A	5-50
02S	RF 5-500 IF DC-500		9.0 at f_L and f_R 150-500 f_I 0.4-500	9.0 at f_L and f_R 100-500 f_I 0.4-500	30	25	N/A	50-500
03N	LO .5-500	TV +7	7.5 at f_L and f_R 1-250 f_I DC-250	N/A	35	30	N/A	0.5-1
03S	RF .5-500 IF DC-500		8.5 at f_L and f_R 0.5-500 f_I DC-500		30 25	25 20	N/A N/A	1-250 250-500

See footnotes at end of table.

TABLE I. Electrical characteristics - Continued. 1/

Dash no.	RF and LO 4/ maximum power input (rms)	Conversion compression (maximum)	Desensitization (maximum)	Relative dc polarity 5/	VSWR (maximum)			Third order, two tone intermodulation	
					LO	IF	RF	dBm	Frequencies
01N 01S	50 mW	N/A	N/A	Negative					
02N 02S	400 mW	N/A	N/A	Negative					
03N 03S	350 mW	1.0 dB at P_R level of 0 dBm	1.0 dB at P_{R2} level of -2 dBm	Negative					

See footnotes at end of table.

TABLE I. Physical and environmental characteristics - Continued. 1/

Dash no.	Operating frequency range (MHz)	LO input drive power in dBm 2/	Maximum conversion loss (SSB) dB	Maximum conversion loss (SSB) MHz	Noise figure (SSB) dB	Noise figure (SSB) MHz	Isolation Minimum LO-RF dB	Isolation Minimum LO-IF dB	Isolation Minimum RF-IF dB	Isolation Frequency MHz
04N 04S	LO 2-500 RF 2-400 IF DC-800	minimum +10 TV +20 maximum +23		f_L 5-200 f_R 20-80	3/	f_L 5-200 f_R 20-80	40	40	N/A	2-32
			6.5 at 7.0 at	f_I 5-80 f_I .4-120	6.5 at 7.0 at	f_I 5-80 f_I DC-120				
				f_L 5-300 f_R 5-300	3/	f_L 5-300 f_R 5-300	35	35	N/A	32-100
			7.0 at 8.0 at	f_I 5-80 f_I DC-300	7.0 at 8.0 at	f_I 5-80 f_I 2-120				
				f_L 5-470 f_R 5-400	3/	f_L 5-470 f_R 5-400	25	25	N/A	100-500
			7.5 at	f_I 5-80	8.0 at	f_I 5-80				
				f_L 2-500 f_R 2-400	3/	f_L 2-500 f_R 2-400	N/A	N/A	17	2-400
			9.0 at	f_I DC-800	9.5 at	f_I 5-800				
05N	LO .05-200	minimum +7	7.5 at f_L and f_R 0.2-50	f_I DC-50	7.5 at f_L and f_R 1-50	f_I 0.4-50	45 30	40 25	N/A N/A	.05-30 30-200
05S	RF .05-200 IF DC-200	TV +13 maximum +17	9.0 at f_L and f_R .05-200	f_I DC-200	9.0 at f_L and f_R 50-200	f_I 0.4-200	N/A	N/A	24	.05-3
06N 06S	LO .5-500 RF .5-500 IF DC-500	minimum +7 TV +17 maximum +20	7.0 at f_L and f_R 0.5-30	f_I DC-30	7.0 at f_L and f_R 1-30	f_I 0.4-30	55	45	N/A	0.5-30
			7.5 at f_L and f_R 30-100	f_I DC-100	7.5 at f_L and f_R 30-100	f_I 0.4-100	45	35	N/A	30-100
			9.0 at f_L and f_R 100-500	f_I DC-500	9.0 at f_L and f_R 100-500	f_I 0.4-500	35 N/A	25 N/A	N/A 20	100-500 0.5-500

See footnotes at end of table.

TABLE I. Electrical characteristics - Continued. 1/

Dash no.	RF and LO 4/ maximum power input (rms)	Conversion compression (maximum)	Desensitization (maximum)	Relative dc polarity 5/	VSWR (maximum)			Third order, two tone intermodulation	
					LO	IF	RF	dBm	Frequencies
04N 04S	200 mW	1.0 dB at P_R +15 dBm P_L +23 dBm	1.0 dB at P_{R2} +13 dBm P_L +23 dBm	Positive					
05N 05S	70 mW	1.0 dB at P_R +10 dBm P_L +17 dBm	1.0 dB at P_{R2} +7 dBm P_L +17 dBm	Negative					
06N 06S	140 mW	1.0 dB at P_R +8 dBm P_L +17 dBm	1.0 dB at P_{R2} +7 dBm P_L +17 dBm	Negative					

See footnotes at end of table.

TABLE I. Physical and environmental characteristics - Continued. 1/

Dash no.	Operating frequency range (MHz)	LO input drive power in dBm 2/	Maximum conversion loss (SSB) dB MHz	Noise figure (SSB) dB MHz	Isolation Minimum LO-RF dB	Isolation Minimum LO-IF dB	Isolation Minimum RF-IF dB	Isolation Frequency MHz
07N	LO 5-400 RF 5-400	TV +17	7.5 at f_L and f_R 5-200 f_I DC-200	N/A	35	30	N/A	5-100
07S	IF DC-400		9.0 at f_L and f_R 200-400 f_I DC-400		25	20	N/A	100-400
08N	LO 0.5-500		7.5 at f_L and f_R 0.5-5		45	35	N/A	0.5-5
08S	RF 0.5-500 IF DC-500	TV +17	8.5 at f_L and f_R 5-500 f_I DC-500	N/A	30 25	30 20	N/A N/A	5-250 250-500
09N	LO 1-750		7.5 at f_L and f_R 2-375 f_I DC-375		45 30	30 25	N/A N/A	1-2 2-375
09S	RF 1-750 IF DC-750	TV +7	8.5 at f_L and f_R 1-750 f_I DC-750	N/A	25	20	N/A	375-750
10N	LO .4-500	minimum +7	7.5 at f_L and f_R 1-50 f_I 0.4-50	7.5 at f_L and f_R 1-50 f_I 0.4-50	45 25	40 25	N/A N/A	0.4-50 50-500
10S	RF .4-500 IF DC-500	TV +13 maximum +17	9.0 at f_L and f_R 0.4-500 f_I 0.4-500	9.0 at f_L and f_R 50-500 f_I 0.4-500				

See footnotes at end of table.

TABLE I. Electrical characteristics - Continued. 1/

Dash no.	RF and LO 4/ maximum power input (rms)	Conversion compression (maximum)	Desensitization (maximum)	Relative dc polarity 5/	VSWR (maximum)			Third order, two tone intermodulation	
					LO	IF	RF	dBm	Frequencies
07N 07S	35 mW	N/A	N/A	Negative					
08N 08S	350 mW	1.0 dB at P_R +10 dBm	N/A	Negative					
09N 09S	350 mW	1.0 dB at P_R +0 dBm	1.0 dB at P_{R2} -2 dBm	Negative					
10N 10S	70 mW	1.0 dB at P_R +10 dBm P_L +17 dBm	1.0 dB at P_{R2} +7 dBm P_L +17 dBm	Negative					

See footnotes at end of table.

TABLE I. Physical and environmental characteristics - Continued. 1/

Dash no.	Operating frequency range (MHz)	LO input drive power in dBm 2/	Maximum conversion loss (SSB) dB MHz	Noise figure (SSB) dB MHz	Isolation Minimum LO-RF dB	Isolation Minimum LO-IF dB	Isolation Minimum RF-IF dB	Isolation Frequency MHz
11N 11S	LO 1-500 RF 1-500 IF DC-500	TV +23	8.5 at f_L and f_R 2-400 f_I DC-400	Within 1 dB of conversion loss	50 40 30 20	40 30 20 20	25 20 20 20	1-100 100-200 200-300 300-500
			9.5 at f_L and f_R 1-500 f_I DC-500					
12N 12S	LO .002-12 RF .002-12 IF DC-12	minimum +4 TV +7 maximum +13	6.0 at f_L and f_R .01-5 f_I 0.4-5	6.0 at f_L and f_R .01-5 f_I 0.4-5	45	40	N/A	.002-5 5-12
			8.0 at f_L and f_R .002-12 f_I 0.4-12	8.0 at f_L and f_R 5-12 f_I 0.4-12	40	30	N/A	
13N 13S	LO .05-200 RF .05-200 IF DC-200	minimum -2 TV 0.0 maximum +13	6.5 at f_L and f_R 0.2-50 f_I DC-50	6.5 at f_L and f_R 0.2-50 f_I 0.4-50	45	40	N/A	.05-30
			8.0 at f_L and f_R 50-200 f_I DC-200	8.0 at f_L and f_R 50-200 f_I 0.4-200	35	30	N/A	30-200
			8.5 at f_L and f_R 0.05-0.2 f_I DC-0.2					

See footnotes at end of table.

TABLE I. Electrical characteristics - Continued. 1/

Dash no.	RF and LO 4/ maximum power input (rms)	Conversion compression (maximum)	Desensitization (maximum)	Relative dc polarity 5/	VSWR (maximum)			Third order, two tone intermodulation	
					LO	IF	RF	dBm	Frequencies
11N 11S	425 mW	1.0 dB at P_R +14 dBm P_L +23 dBm	1.0 dB at P_{R2} +12 dBm P_L +23 dBm	Negative					
12N 12S	35 mW	N/A	N/A	Negative					
13N 13S	50 mW	N/A	N/A	Negative	2.5:1	2.0:1	2.5:1	6/ +5 +3	f_{L0}: 200 MHz f_{R1}: 150 MHz f_{R2}: 155 MHz at -10 dBm -15 dBm

See footnotes at end of table.

TABLE I. Physical and environmental characteristics - Continued. 1/

Dash no.	Operating frequency range (MHz)	LO input drive power in dBm 2/	Maximum conversion loss (SSB) dB MHz	Noise figure (SSB) dB MHz	Isolation Minimum LO-RF dB	Isolation Minimum LO-IF dB	Isolation Minimum RF-IF dB	Isolation Frequency MHz
14N 14S	LO 5-500 RF 5-500 IF DC-500	minimum -2 TV 0.0 maximum +13	7.0 at f_L and f_R 10-100 f_I 10-100	7.0 at f_L and f_R 10-100 f_I 10-100	45	40	N/A	5-50
			8.0 at f_L and f_R 100-200 f_I 10-200	8.0 at f_L and f_R 100-200 f_I 10-200	30	25	N/A	50-500
			9.5 at f_L and f_R 5-500 f_I .5-500	9.5 at f_L and f_R 5-500 f_I .5-500				
15N 15S	LO 1-500 RF 1-500 IF DC-500	minimum +3 TV +7 maximum +10	7.0 at f_L and f_R 1-400 f_I DC-400	Within 1 dB of conversion loss	40	35	N/A	1-100
			8.0 at f_L and f_R 1-500 f_I DC-500		30	25	N/A	100-500
16N 16S	LO 1-500 RF 1-500 IF DC-500	minimum +13 TV +15 maximum +20	7.0 at f_L and f_R 1-400 f_I DC-400	Within 1 dB of conversion loss	40	40	N/A	1-100
			8.0 at f_L and f_R 400-500 f_I DC-500		30	25	N/A	100-500

See footnotes at end of table.

TABLE I. Electrical characteristics - Continued. 1/

Dash no.	RF and LO 4/ maximum power input (rms)	Conversion compression (maximum)	Desensitization (maximum)	Relative dc polarity 5/	VSWR (maximum)			Third order, two tone intermodulation	
					LO	IF	RF	dBm	Frequencies
14N 14S	400 mW	N/A	N/A	Negative	2.5:1	2.0:1	2.5:1	6/ +4 +2	f_{L0}: 500 MHz f_{R1}: 400 MHz f_{R2}: 405 MHz at -10 dBm -15 dBm
15N 15S	300 mW	1.0 dB at P_R +3 dBm	1.0 dB at P_R +1 dBm	Positive	2.0:1	1.5:1	1.5:1	+12 7/	f_{L0}: 500 MHz f_{R1}: 400 MHz at -10 dBm f_{R2}: 401 MHz at -10 dBm
16N 16S	300 mW	1.0 dB at P_R +8 dBm	1.0 dB at P_R +1 dBm	Positive	2.0:1	2.0:1	2.0:1	+18 7/	f_{L0}: 500 MHz f_{R1}: 400 MHz at -10 dBm f_{R2}: 401 MHz at -10 dBm

1/ Where data does not appear in the table, the requirement does not apply.
2/ Unless otherwise specified, TV is the test value of the LO power for the electrical characteristics.
3/ Noise figure values apply over a temperature range of -54°C to 85°C. For a temperature range of 85°C to 100°C, the noise figure over the specified frequency band will be allowed an additional 0.5 dB tolerance.
4/ These values are for +25°C and are derated linearly to +125°C.
5/ With two-in phase signals applied to the LO and RF ports and unused pins grounded.
6/ Input intercept point.
7/ Output intercept point.

TABLE II. Physical and environmental characteristics. 1/

Dash number	Weight	Temperature range in celsius (operating on top nonoperating on bottom)	Mechanical shock (method 213) 2/	Hermetic seal (method 112) 2/	Terminal strength (method 211) 2/	Life
01N 01S	0.18 oz. (5.0 g)	-54° to +100° -65° to +100°	---	Yes	---	---
02N 02S	0.18 oz. (5.0 g)	-54° to +100° -65° to +100°	---	Yes	---	---
03N 03S	0.18 oz. (5.0 g)	-55° to +100° -55° to +100°	---	Yes	---	---
04N 04S	0.21 oz. (6.0 g)	-54° to +100° -65° to +100°	C	Yes	---	---
05N 05S	0.24 oz. (6.7 g)	-54° to +100° -65° to +100°	---	Yes	---	Storage 2 years minimum
06N 06S	0.25 oz. (7.2 g)	-54° to +100° -65° to +100°	C	Yes	---	100,000 hours
07N 07S	0.23 oz. (6.5 g)	-54° to +100° -65° to +100°	C	Yes	C	---
08N 08S	0.18 oz. (5.0 g)	-55° to +100° -55° to +100°	---	Yes	C	10 years with 300,000 hours continuous
09N 09S	0.18 oz. (5.0 g)	-55° to +100° -55° to +100°	---	Yes	---	---
10N 10S	0.24 oz. (6.7 g)	-54° to +100° -65° to +100°	C	Yes	C	50,000 hours
11N 11S	0.25 oz. (7.0 g)	-55° to +85° -55° to +85°	---	No	---	---
12N 12S	0.18 oz. (5.0 g)	-54° to +100° -65° to +100°	---	Yes	C	50,000 hours
13N 13S	0.18 oz. (5.0 g)	-54° to +100° -65° to +100°	C	Yes	C	---
14N 14S	0.18 oz. (5.0 g)	-54° to +100° -65° to +100°	C	Yes	C	---
15N 15S	0.25 oz. (7.0 g)	-54° to +100° -65° to +100°	C	Yes	---	50,000 hours
16N 16S	0.25 oz. (7.0 g)	-54° to +100° -65° to +100°	C	Yes	---	50,000 hours

1/ Where --- is indicated, reference requirements as set forth in MIL-DTL-28837.
2/ Reference MIL-STD-202.

Referenced documents: In addition to MIL-DTL-28837, this document references the following MIL-STD-202

Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

(Project 5895-2012-002)

Review activities:
Army - AR, MI
Navy - AS, CG, MC, OS
Air Force - 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.