



Mini-Circuits

BALANCED TO UNBALANCED



## RF Transformer

TC1.33-282X-4+

100 to 75Ω 5 to 2800 MHz

## FEATURES

- Suitable for tin/lead and RoHS solder systems
- Wideband, 5 to 2800 MHz
- Balanced transmission line
- Good return loss, 20 dB typ. at 1 dB band
- Excellent amplitude unbalance, 0.3 dB typ.
- Aqueous washable



Generic photo used for illustration purposes only

CASE STYLE: AT1521

**+RoHS Compliant**The +Suffix identifies RoHS Compliance.  
See our website for methodologies and qualifications

| Qorvo Part No. | Description                                        |
|----------------|----------------------------------------------------|
| QPB8896        | 5-700 MHz, 25 dB<br>Balanced Return Path Amplifier |

## ELECTRICAL SPECIFICATIONS AT +25°C

| Parameter                           | Frequency (MHz) | Min. | Typ. | Max. | Unit   |
|-------------------------------------|-----------------|------|------|------|--------|
| Impedance Ratio (secondary/primary) |                 |      | 1.33 |      | Ohm    |
| Frequency Range                     |                 | 5    |      | 2800 | MHz    |
| Insertion Loss*                     | 5 - 2800        |      | 3.0  |      | dB     |
|                                     | 30 - 2000       |      | 2.0  |      |        |
|                                     | 50 - 1500       |      | 1.0  |      |        |
| Amplitude Unbalance                 | 50 - 1500       |      | 0.3  |      | dB     |
|                                     | 30 - 2000       |      | 1.0  |      |        |
| Phase Unbalance                     | 50 - 1500       |      | 6.0  |      | Degree |
|                                     | 30 - 2000       |      | 6.0  |      |        |

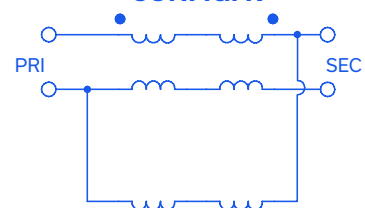
\* Insertion Loss is referenced to mid-band loss, 1.0 dB typ. Measured in 75Ω system.

## MAXIMUM RATINGS

| Parameter             | Ratings        |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power              | 0.25W          |
| DC Current            | 30mA           |

Permanent damage may occur if any of these limits are exceeded.

## CONFIG. K

REV. B  
ECO-021661  
TC1.33-282X-4+  
MCL NY  
240501



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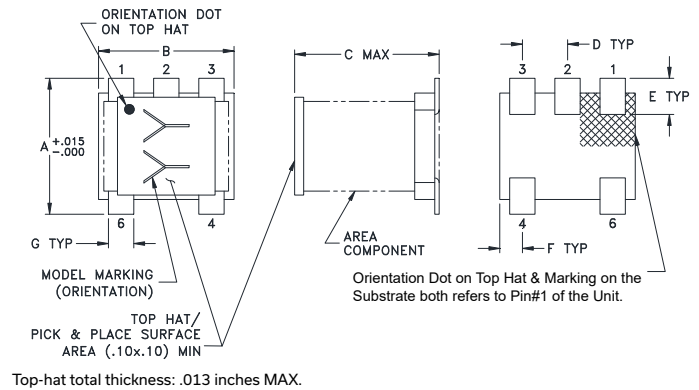
100 to 75Ω 5 to 2800 MHz

## PIN CONNECTIONS

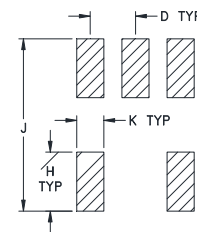
| Function      | Pin Number |
|---------------|------------|
| PRIMARY DOT   | 6          |
| PRIMARY       | 4          |
| SECONDARY DOT | 1          |
| SECONDARY     | 3          |
| NOT USED      | 2          |

PRODUCT MARKING: CM

## OUTLINE DRAWING



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

## OUTLINE DIMENSIONS (Inch/mm)

| A    | B    | C    | D    | E    | F    | G    | H    | J    | K    |
|------|------|------|------|------|------|------|------|------|------|
| .150 | .150 | .160 | .050 | .040 | .025 | .028 | .065 | .190 | .030 |
| 3.81 | 3.81 | 4.06 | 1.27 | 1.02 | 0.64 | 0.71 | 1.65 | 4.83 | 0.76 |

Weight: 0.15 grams

## TAPE & REEL INFORMATION: F17





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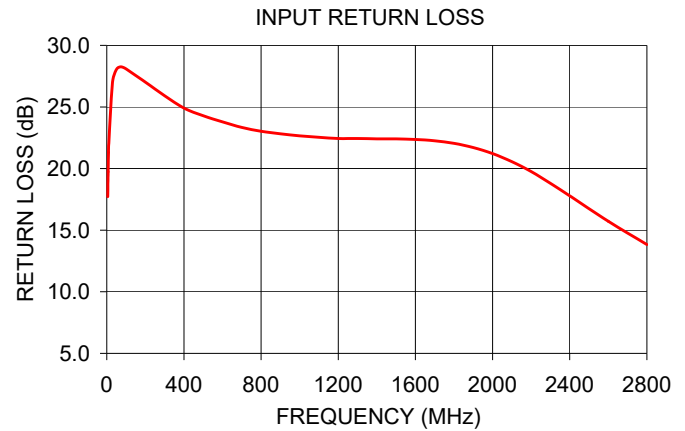
# RF Transformer

TC1.33-282X-4+

100 to 75Ω 5 to 2800 MHz

## TYPICAL PERFORMANCE DATA

| FREQUENCY (MHz) | INSERTION LOSS (dB) | INPUT R. LOSS (dB) | AMPLITUDE UNBALANCE (dB) | PHASE UNBALANCE (Deg.) |
|-----------------|---------------------|--------------------|--------------------------|------------------------|
| 5.00            | 1.48                | 17.72              | 0.38                     | 3.28                   |
| 10.00           | 1.20                | 21.95              | 0.21                     | 2.17                   |
| 30.00           | 1.08                | 27.05              | 0.11                     | 0.55                   |
| 50.00           | 1.08                | 28.04              | 0.09                     | 0.06                   |
| 100.00          | 1.09                | 28.09              | 0.08                     | 1.09                   |
| 500.00          | 0.99                | 24.29              | 0.21                     | 5.00                   |
| 1000.00         | 0.97                | 22.66              | 0.07                     | 6.34                   |
| 1500.00         | 1.20                | 22.41              | 0.71                     | 5.18                   |
| 2000.00         | 1.64                | 21.22              | 1.49                     | 1.64                   |
| 2400.00         | 2.13                | 17.79              | 2.00                     | 3.40                   |
| 2800.00         | 2.76                | 13.83              | 2.31                     | 10.70                  |



### NOTES

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)



# RF Transformer

# TC1.33-282X-4+

## Typical Performance Data

| FREQUENCY<br>MHz | AVERAGE<br>INSERTION<br>LOSS<br>(dB) | INPUT<br>RETURN<br>LOSS<br>(dB) | AMPLITUDE<br>UNBALANCE<br>(dB) | PHASE<br>UNBALANCE<br>(deg.) |
|------------------|--------------------------------------|---------------------------------|--------------------------------|------------------------------|
| 5                | 1.48                                 | 17.72                           | 0.38                           | 3.28                         |
| 7                | 1.32                                 | 19.74                           | 0.30                           | 2.77                         |
| 9                | 1.23                                 | 21.31                           | 0.23                           | 2.35                         |
| 10               | 1.20                                 | 21.95                           | 0.21                           | 2.17                         |
| 30               | 1.08                                 | 27.05                           | 0.11                           | 0.55                         |
| 50               | 1.08                                 | 28.04                           | 0.09                           | 0.06                         |
| 70               | 1.09                                 | 28.26                           | 0.08                           | 0.51                         |
| 90               | 1.09                                 | 28.18                           | 0.08                           | 0.92                         |
| 100              | 1.09                                 | 28.09                           | 0.08                           | 1.09                         |
| 200              | 1.09                                 | 27.01                           | 0.12                           | 2.56                         |
| 300              | 1.06                                 | 25.91                           | 0.17                           | 3.66                         |
| 400              | 1.02                                 | 24.91                           | 0.21                           | 4.42                         |
| 500              | 0.99                                 | 24.29                           | 0.21                           | 5.00                         |
| 600              | 0.97                                 | 23.79                           | 0.19                           | 5.45                         |
| 700              | 0.95                                 | 23.34                           | 0.15                           | 5.84                         |
| 800              | 0.95                                 | 23.03                           | 0.10                           | 6.12                         |
| 900              | 0.96                                 | 22.82                           | 0.02                           | 6.27                         |
| 1000             | 0.97                                 | 22.66                           | 0.07                           | 6.34                         |
| 1100             | 1.00                                 | 22.54                           | 0.18                           | 6.30                         |
| 1200             | 1.04                                 | 22.44                           | 0.30                           | 6.17                         |
| 1300             | 1.08                                 | 22.44                           | 0.43                           | 5.91                         |
| 1400             | 1.14                                 | 22.41                           | 0.57                           | 5.57                         |
| 1500             | 1.20                                 | 22.41                           | 0.71                           | 5.18                         |
| 1600             | 1.27                                 | 22.36                           | 0.86                           | 4.62                         |
| 1700             | 1.35                                 | 22.25                           | 1.02                           | 4.06                         |
| 1800             | 1.44                                 | 22.05                           | 1.18                           | 3.35                         |
| 1900             | 1.54                                 | 21.71                           | 1.34                           | 2.55                         |
| 2000             | 1.64                                 | 21.22                           | 1.49                           | 1.64                         |
| 2100             | 1.75                                 | 20.56                           | 1.63                           | 0.61                         |
| 2200             | 1.87                                 | 19.76                           | 1.76                           | 0.56                         |
| 2300             | 2.00                                 | 18.80                           | 1.89                           | 1.90                         |
| 2400             | 2.13                                 | 17.79                           | 2.00                           | 3.40                         |
| 2600             | 2.43                                 | 15.72                           | 2.20                           | 6.79                         |
| 2800             | 2.76                                 | 13.83                           | 2.31                           | 10.70                        |



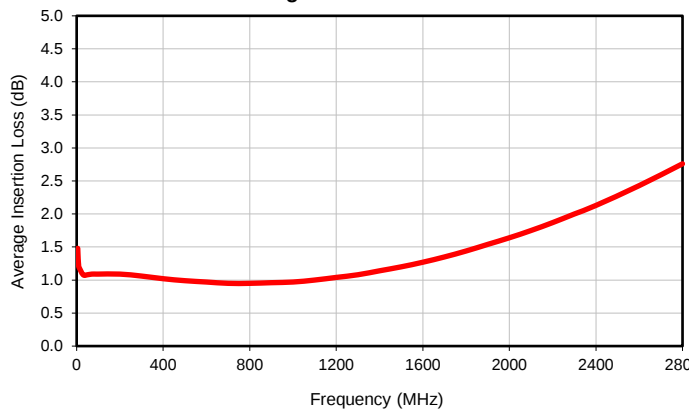
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site  
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IF/RF MICROWAVE COMPONENTS

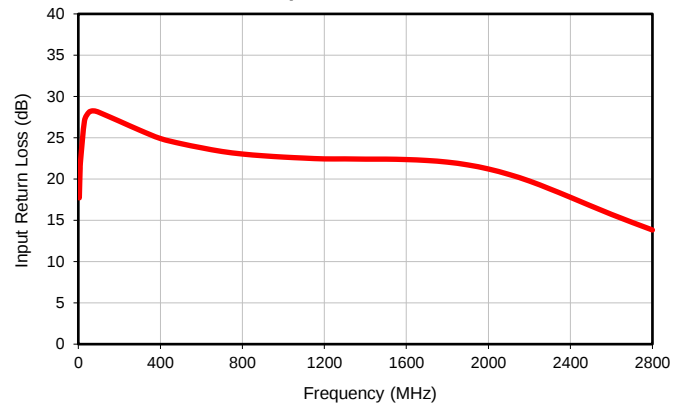
REV. OR  
TC1.33-282X-4+  
2/26/2021  
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## Typical Performance Data

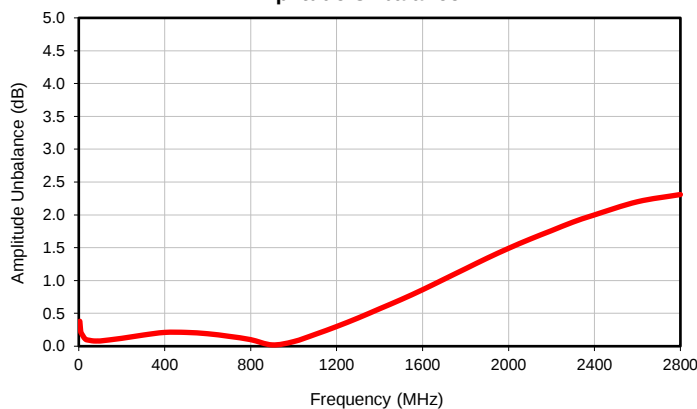
Average Insertion Loss



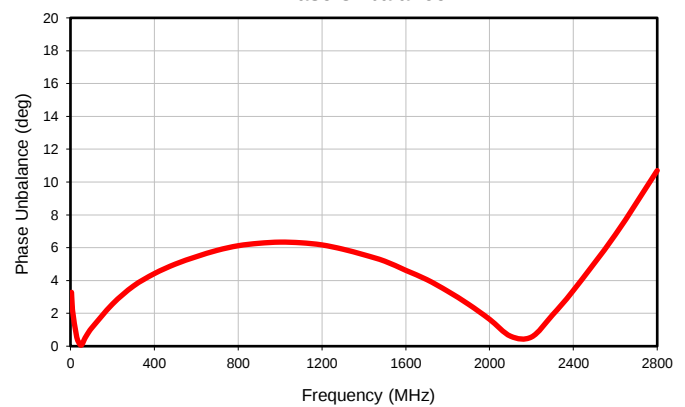
Input Return Loss



Amplitude Unbalance



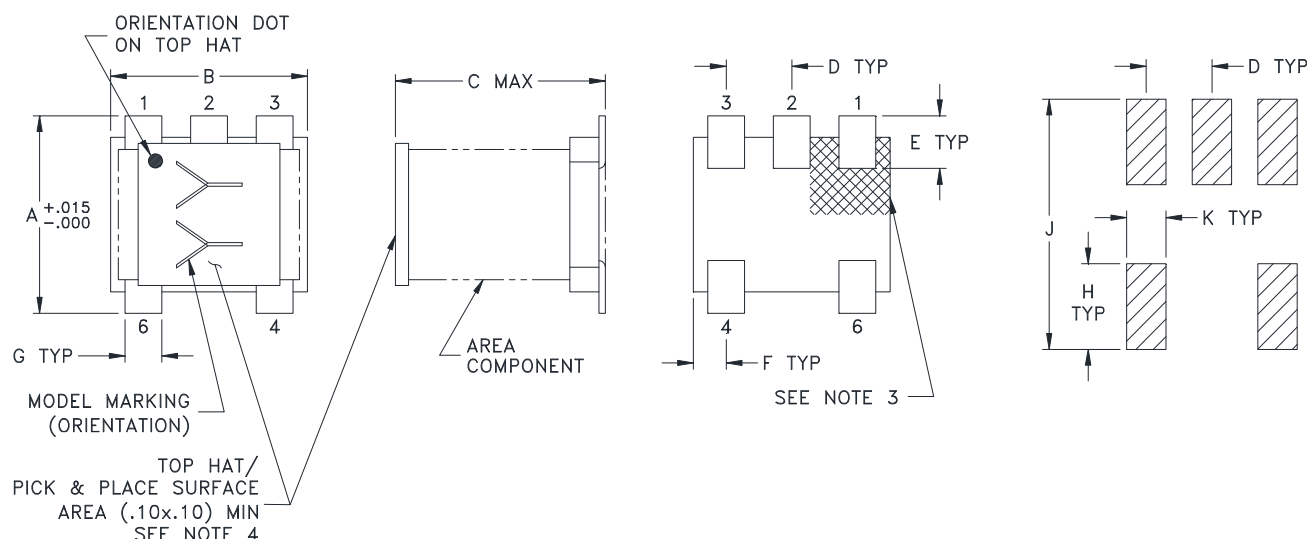
Phase Unbalance



## Outline Dimensions

AT1521

## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

| CASE # | A              | B              | C              | D              | E              | F             | G             | H              | J              | K             | WT. GRAMS |
|--------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|----------------|----------------|---------------|-----------|
| AT1521 | .150<br>(3.81) | .150<br>(3.81) | .160<br>(4.06) | .050<br>(1.27) | .040<br>(1.02) | .025<br>(.64) | .028<br>(.71) | .065<br>(1.65) | .190<br>(4.83) | .030<br>(.76) | .15       |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
- Orientation Dot on Top Hat & Marking on the Substrate both refers to Pin #1 of the Unit.
- Top-Hat total thickness: .013 inches MAX.



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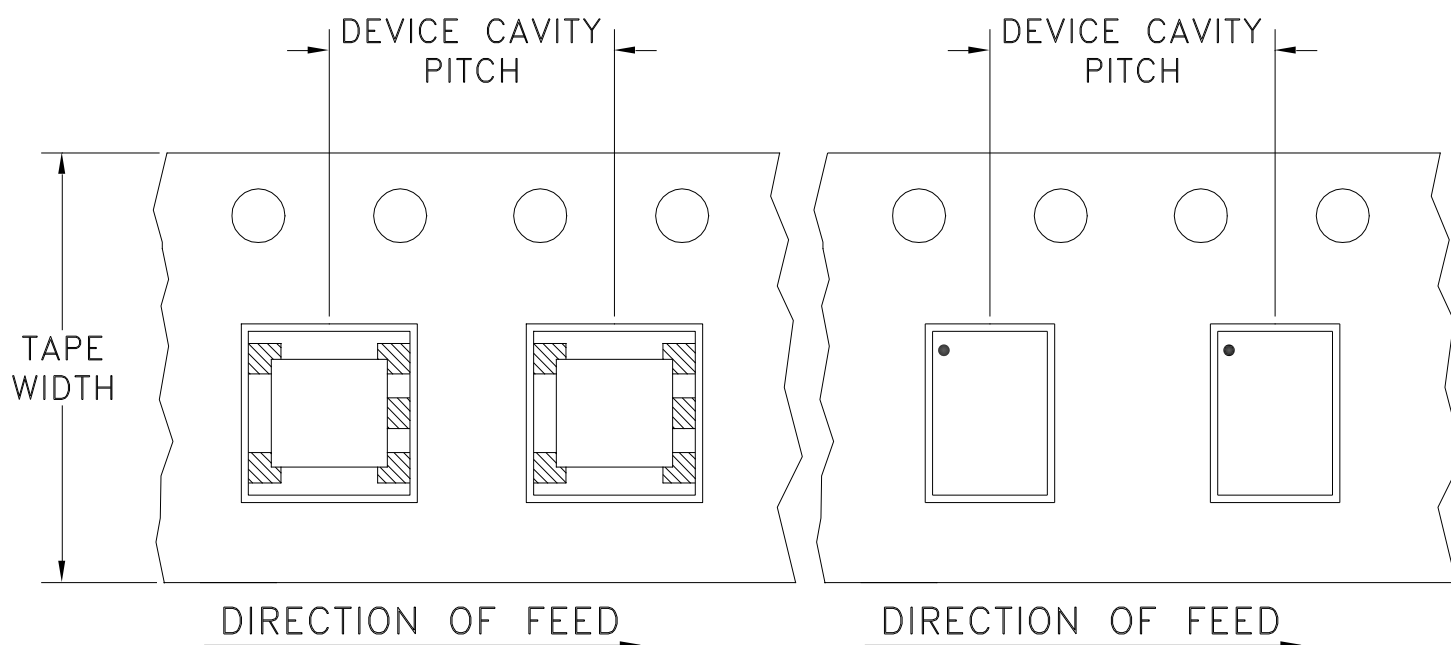


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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F17

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 12             | 8                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         | 13                | Standard                            | 1000 |
|                |                         |                   |                                     | 2000 |

Note: Please Consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



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RF/IF MICROWAVE COMPONENTS



All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition                                                                                                                                       | Reference/Spec                                                                                       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Operating Temperature          | -40° to 85°C<br>Ambient Environment                                                                                                                             | Individual Model Data Sheet                                                                          |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment                                                                                                                           | Individual Model Data Sheet                                                                          |
| Humidity                       | 90 to 95% RH, 240 hours, 50°C                                                                                                                                   | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                                                                                                                       | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| Solder Reflow Heat             | Sn-Pb Eutetic Process: 225°C peak<br>Pb-Free Process 245° - 250°C peak                                                                                          | J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1                                                        |
| Solderability                  | 10X Magnification                                                                                                                                               | J-STD-002, 95% Coverage                                                                              |
| Vibration (High Frequency)     | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)                                                                             | MIL-STD-202, Method 204, Condition D                                                                 |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                                                               | MIL-STD-202, Method 213, Condition A                                                                 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215                                                                              |