# International **TOR** Rectifier

# Specifications

 $\rm T_{CASE}$  = -55°C to +85°C,  $\rm ~V_{_{IN}}$  = +28V  $\pm$  5% unless otherwise specified

| Absolute Maximum Ratings       |                                   |                 |  |  |
|--------------------------------|-----------------------------------|-----------------|--|--|
| Input voltage                  | -0.5V to +50VDC                   |                 |  |  |
| Power Output                   | Internally limited, 17.5W typical |                 |  |  |
| Soldering temperature          | 300°C for 10 seconds              |                 |  |  |
| Temperature Range <sup>6</sup> | Operating case temperature        | -55°C to +115°C |  |  |
|                                | Storage case temperature          | -65°C to +135°C |  |  |

|                                     |                    | Condition  |                        |               |                |               |                  |        |  |  |  |  |  |
|-------------------------------------|--------------------|--|------------------------|---------------|----------------|---------------|------------------|--------|--|--|--|--|--|
| TEST                                | SYMBOL             | $-55^{\circ}C \leq T_C \leq +85^{\circ}C, V_{IN} = 28 \ V_{DC}$                            | ±5%, CL=0              | ATO           | 2812T          | ATO2          | 2815T            |        |  |  |  |  |  |
|                                     |                    | unless otherwise specified   |                        | Min           | Max            | Min           | Max              | Units  |  |  |  |  |  |
| STATIC<br>CHARACTERISTICS<br>OUTPUT |                    |  |                        |               |                |               |                  |        |  |  |  |  |  |
| Voltage 1                           | Vout               | $I_{OUT} = 0$ (main)   | TC = 25°C              | 4.95          | 5.05           | 4.95          | 5.05             | V      |  |  |  |  |  |
|                                     |                    | 1  | Over Temp              | 4.90          | 5.10           | 4.90          | 5.10             | V      |  |  |  |  |  |
|                                     |                    | I <sub>OUT</sub> = 0 (dual) <sup>1</sup>   | TC = 25°C<br>Over Temp | ±11.88        | ±12.12         | ±14.85        | ±15.15<br>+15.30 | V<br>V |  |  |  |  |  |
| Current 1,2,3                       | IOUT               | V <sub>IN</sub> = 16, 28, and 40 VDC (main)  | Over remp              | ±11.76<br>0.0 | ±12.24<br>2000 | ±14.70<br>0.0 | ±15.30<br>2000   | mA     |  |  |  |  |  |
| Current                             | 1001               | $V_{IN} = 16, 28, and 40 VDC (mail)^{1}$   |                        | 0.0           | ±2000          | 0.0           | ±167             | mA     |  |  |  |  |  |
|                                     |                    | $V_{IN} = 16, 28, and 40 VDC (dual)$   |                        |               | 80             |               | 80               | mVp-p  |  |  |  |  |  |
| Ripple Voltage 1,4                  | V <sub>RIP</sub>   | BW = DC to 2 MHz (main)  |                        |               |                |               |                  |        |  |  |  |  |  |
|                                     |                    | V <sub>IN</sub> = 16, 28, and 40 VDC   |                        |               | 40             |               | 40               | mVp-p  |  |  |  |  |  |
| Power 1,2,3                         | Pout               | BW = DC to 2 MHz (dual))<br>$V_{IN} = 16, 28, and 40 VDC (main)$                           |                        | 10            |                | 10            |                  | w      |  |  |  |  |  |
| FOWEI                               | FOUT               | $V_{\rm IN} = 10, 20, and 40 VDC (main) (+dual)$   |                        | 2.5           |                | 2.5           |                  | Ŵ      |  |  |  |  |  |
|                                     |                    | (-dual)  |                        | 2.5           |                | 2.5           |                  | Ŵ      |  |  |  |  |  |
|                                     |                    | (total)  |                        | 15            |                | 15            |                  | W      |  |  |  |  |  |
| REGULATION<br>Line <sup>1,3</sup>   |                    |  |                        |               |                |               |                  |        |  |  |  |  |  |
| Line "                              | VR <sub>LINE</sub> | V <sub>IN</sub> = 16, 28, and 40 VDC<br>I <sub>OUT</sub> = 0, 1000, 2000mA (main)          |                        |               | 25             |               | 25               |        |  |  |  |  |  |
|                                     |                    | $V_{IN} = 16, 28, and 40 VDC (dual)$   | TC = 25°C              |               | ±30            |               | ±35              |        |  |  |  |  |  |
|                                     |                    | $I_{OUT} = 0, \pm 84, \pm 167 \text{mA} \text{ (dual)}$                                    | Over Temp              |               | ±60            |               | ±75              | mV     |  |  |  |  |  |
| Load 1,3                            | VRLOAD             | V <sub>IN</sub> = 16, 28, and 40 VDC   |                        |               | 50             |               | 50               |        |  |  |  |  |  |
|                                     |                    | $I_{OUT} = 0, 1000, 2000 \text{mA} \text{(main)}$  |                        |               |                |               |                  |        |  |  |  |  |  |
|                                     |                    | V <sub>IN</sub> = 16, 28, and 40 VDC<br>I <sub>OUT</sub> = 0, ±84, ±167mA (dual)           |                        |               | ±60            |               | ±75              |        |  |  |  |  |  |
| INPUT                               |                    | 1001 - 0, ±01, ±1071117 (ddd)  |                        |               |                |               |                  |        |  |  |  |  |  |
| Current                             | I <sub>IN</sub>    | I <sub>OUT</sub> = 0, Inhibit (pin 8)  |                        |               | 15             |               | 15               | mA     |  |  |  |  |  |
|                                     |                    | Tied to input return (pin 10)  |                        |               |                |               |                  |        |  |  |  |  |  |
| Ripple Current <sup>4</sup>         |                    | $I_{OUT} = 0$ , inhibit (pin 2) = open   |                        |               | 40             |               | 40               | mA     |  |  |  |  |  |
|                                     | I <sub>RIP</sub>   | $I_{OUT} = 2000 \text{ mA} \text{ (main)}$<br>$I_{OUT} = \pm 167 \text{mA} \text{ (dual)}$ |                        |               | 50             |               | 50               | mAp-p  |  |  |  |  |  |
|                                     |                    | BW = DC to 2MHz  |                        |               |                |               |                  |        |  |  |  |  |  |
| EFFICIENCY                          | E <sub>FF</sub>    | $I_{OUT} = 2000 \text{mA} \text{ (main)}$  | TC = 25°C              | 76            |                | 76            |                  | %      |  |  |  |  |  |
|                                     |                    | $I_{OUT} = \pm 167 \text{mA} \text{ (dual)}$   |                        |               |                |               |                  |        |  |  |  |  |  |
| ISOLATION                           | ISO                | Input to output or any pin to  | TC = 25°C              | 100           |                | 100           |                  | MΩ     |  |  |  |  |  |
| Load Fault                          | Po                 | case (except pin 7) at 500 VDC<br>Overload   | TC = 25°C              |               | 8.0            |               | 8.0              | w      |  |  |  |  |  |
| Power Dissipation <sup>3</sup>      | 10                 | Short Circuit  | 10 = 25'0              |               | 6.0            |               | 6.0              | vv     |  |  |  |  |  |
| Switching Frequency                 | Fs                 | I <sub>OUT</sub> = 2000mA (main)   |                        | 225           | 275            | 225           | 275              | KHz    |  |  |  |  |  |
| • • •                               | -                  | $I_{OUT} = \pm 167 \text{mA} \text{ (dual)}$   |                        |               |                |               |                  |        |  |  |  |  |  |
| Inhibit Open Circuit                | Voi                |  |                        | 9.0           | 13             | 9.0           | 13               | V      |  |  |  |  |  |
| Voltage                             |                    | L  |                        | ļ             |                |               |                  |        |  |  |  |  |  |

#### Notes to Specifications

Tested at each output. 1.

Parameter guaranteed by line and load regulation tests. 2.

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4.

At least 20 percent of the total output power should be taken from the (+5V) main output. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit 5. protection and is the condition of maximum power dissipation.

6. Above  $85^{\circ}C$  case temperature, derate output power linearly to 0 at  $115^{\circ}C$  case.

# International **TOR** Rectifier Specifications

# $\rm T_{CASE}$ = -55°C to +105°C, $\rm ~V_{IN}$ = +28V ± 5% unless otherwise specified

| Absolute Maximum Ratings       |                                   |                 |  |  |
|--------------------------------|-----------------------------------|-----------------|--|--|
| Input voltage                  | -0.5V to +50VDC                   |                 |  |  |
| Power Output                   | Internally limited, 17.5W typical |                 |  |  |
| Soldering temperature          | 300°C for 10 seconds              |                 |  |  |
| Temperature Range <sup>6</sup> | Operating case temperature        | -55°C to +125°C |  |  |
|                                | Storage case temperature          | -65°C to +135°C |  |  |

| TEST   | SYMBOL             | Condition<br>-55°C $\leq$ T <sub>C</sub> $\leq$ +105°C, V <sub>IN</sub> = 28 V <sub>DC</sub> ±5%, C <sub>L</sub> =0                             |                        | ATO2812T/ES            |                  | ATO2815T/ES            |                  |             |
|--|--------------------|---|------------------------|------------------------|------------------|------------------------|------------------|-------------|
|  |                    | unless otherwise specif   |                        |                        |                  |                        |                  |             |
| STATIC                                       |                    |   |                        | Min                    | Max              | Min                    | Max              | Units       |
| CHARACTERISTICS                              |                    |   |                        |                        |                  |                        |                  |             |
| Voltage <sup>1</sup>                         | V <sub>OUT</sub>   | I <sub>OUT</sub> = 0 (main)   | TC = 25°C<br>Over Temp | 4.95<br>4.90           | 5.05<br>5.10     | 4.95<br>4.90           | 5.05<br>5.10     | V<br>V      |
|  |                    | $I_{OUT} = 0 (dual)^1$  | TC = 25°C<br>Over Temp | ±11.88<br>±11.76       | ±12.12<br>±12.24 | ±14.85<br>±14.70       | ±15.15<br>±15.30 | V<br>V      |
| Current <sup>1,2,3</sup>                     | I <sub>OUT</sub>   | $V_{IN}$ = 16, 28, and 40 VDC (main)<br>$V_{IN}$ = 16, 28, and 40 VDC (dual) <sup>1</sup>   |                        | 0.0<br>0.0             | 2000<br>±208     | 0.0<br>0.0             | 2000<br>±167     | mA<br>mA    |
| Ripple Voltage <sup>1,4</sup>                | V <sub>RIP</sub>   | $V_{IN}$ = 16, 28, and 40 VDC<br>BW = DC to 2 MHz (main)  |                        |                        | 80               |                        | 80               | mVp-p       |
|  |                    | V <sub>IN</sub> = 16, 28, and 40 VDC<br>BW = DC to 2 MHz (dual))  |                        |                        | 40               |                        | 40               | mVp-p       |
| Power <sup>1,2,3</sup>                       | Pout               | V <sub>IN</sub> = 16, 28, and 40 VDC (main)<br>(+dual)<br>(-dual)<br>(total)  |                        | 10<br>2.5<br>2.5<br>15 |                  | 10<br>2.5<br>2.5<br>15 |                  | W<br>W<br>W |
| REGULATION<br>Line <sup>1,3</sup>            | VRLINE             | V <sub>IN</sub> = 16, 28, and 40 VDC  |                        | 10                     | 25               |                        | 25               |             |
|  |                    | $I_{OUT} = 0, 1000, 2000mA (main)$<br>$V_{IN} = 16, 28, and 40 VDC (dual)$<br>$I_{OUT} = 0, \pm 84, \pm 167mA (dual)$                           | TC = 25°C<br>Over Temp |                        | ±30<br>±60       |                        | ±35<br>±75       | mV          |
| Load <sup>1,3</sup>                          | VR <sub>LOAD</sub> | $V_{IN} = 16, 28, and 40 VDC$<br>$I_{OUT} = 0, 1000, 2000mA (main)$<br>$V_{IN} = 16, 28, and 40 VDC$<br>$I_{OUT} = 0, \pm 84, \pm 167mA (dual)$ |                        |                        | 50<br>±60        |                        | 50<br>±75        |             |
| INPUT  |                    | $1007 = 0, \pm 04, \pm 107 \text{ mA (dual)}$   |                        |                        |                  |                        |                  |             |
| Current                                      | I <sub>IN</sub>    | I <sub>OUT</sub> = 0, Inhibit (pin 8)<br>Tied to input return (pin 10)  |                        |                        | 15               |                        | 15               | mA          |
| Ripple Current <sup>4</sup>                  | I <sub>RIP</sub>   | $I_{OUT} = 0$ , inhibit (pin 2) = open<br>$I_{OUT} = 2000 \text{ mA} \text{ (main)}$<br>$I_{OUT} = \pm 167\text{ mA} \text{ (dual)}$            |                        |                        | 40<br>50         |                        | 40<br>50         | mA<br>mAp-p |
| EFFICIENCY                                   | E <sub>FF</sub>    | $BW = DC \text{ to } 2MHz$ $I_{OUT} = 2000\text{mA} \text{ (main)}$ $I_{OUT} = \pm 167\text{mA} \text{ (dual)}$ $TC = \pm 25^{\circ}C$          | TC = 25°C              | 76                     |                  | 76                     |                  | %           |
| ISOLATION                                    | ISO                | Input to output or any pin to<br>case (except pin 7) at 500 VDC   | TC = 25°C              | 100                    |                  | 100                    |                  | MΩ          |
| Load Fault<br>Power Dissipation <sup>3</sup> | P <sub>D</sub>     | Overload, TC = $+25^{\circ}C^{5}$<br>Short Circuit, TC = $+25^{\circ}C$   | TC = 25°C              |                        | 8.0<br>6.0       |                        | 8.0<br>6.0       | w           |
| Switching Frequency                          | Fs                 | $I_{OUT} = 2000$ mA (main)<br>$I_{OUT} = \pm 167$ mA (dual)   |                        | 225                    | 275              | 225                    | 275              | KHz         |
| Inhibit Open Circuit<br>Voltage              | V <sub>OI</sub>    |   |                        | 9.0                    | 13               | 9.0                    | 13               | v           |

#### Notes to Specifications

1. Tested at each output.

Parameter guaranteed by line and load regulation tests. 2.

3. At least 20 percent of the total output power should be taken from the (+5V) main output.

4.

Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit 5. protection and is the condition of maximum power dissipation.

6. Above 105°C case temperature, derate output power linearly to 0 at 125°C case

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# International **TOR** Rectifier

# **ATO28XXT Series**

#### **Specifications**

 $\rm T_{CASE}$  = -55°C to +125°C,  $\rm ~V_{_{IN}}$  = +28V ± 5% unless otherwise specified

| Absolute Maximum Rating        | S                                 |                                   |  |  |  |
|--------------------------------|-----------------------------------|-----------------------------------|--|--|--|
| Input voltage                  | -0.5V to +50VDC                   |                                   |  |  |  |
| Power Output                   | Internally limited, 17.5W typical | Internally limited, 17.5W typical |  |  |  |
| Soldering temperature          | 300°C for 10 seconds              | 300°C for 10 seconds              |  |  |  |
| Temperature Range <sup>6</sup> | Operating case temperature        | -55°C to +135°C                   |  |  |  |
|                                | Storage case temperature          | -65°C to +135°C                   |  |  |  |

|   |                                     | Condition   |                                     |                        |                         |                        |                         | 1                 |
|---|-------------------------------------|---|-------------------------------------|------------------------|-------------------------|------------------------|-------------------------|-------------------|
| TEST  | SYMBOL                              | $\text{-55}^{\circ}\text{C} \leq \text{T}_{C} \leq \text{+125}^{\circ}\text{C}, \ \text{V}_{\text{IN}} = 28 \ \text{V}_{\text{DC}} \pm 5\%, \ \text{C}_{\text{L}} = 0$  |                                     | ATO2812T/HB            |                         | ATO2815T/HB            |                         |                   |
|   |                                     | unless otherwise specified  |                                     | Min Max                |                         | Min Max                |                         | Units             |
| STATIC<br>CHARACTERISTICS<br>OUTPUT<br>Voltage <sup>1</sup> | V <sub>OUT</sub>                    | I <sub>ουτ</sub> = 0 (main)<br>I <sub>ουτ</sub> = 0 (dual) <sup>1</sup>   | TC = 25°C<br>Over Temp<br>TC = 25°C | 4.95<br>4.90<br>±11.88 | 5.05<br>5.10<br>±12.12  | 4.95<br>4.90<br>±14.85 | 5.05<br>5.10<br>±15.15  | V<br>V<br>V       |
| Current <sup>1,2,3</sup>                                    | Ι <sub>ουτ</sub>                    | $V_{IN} = 16, 28, and 40 VDC (main)$<br>$V_{IN} = 16, 28, and 40 VDC (dual)^{1}$  | Over Temp                           | ±11.76<br>0.0<br>0.0   | ±12.24<br>2000<br>±208  | ±14.70<br>0.0<br>0.0   | ±15.30<br>2000<br>±167  | V<br>mA<br>mA     |
| Ripple Voltage <sup>1,4</sup>                               | V <sub>RIP</sub>                    | $V_{IN} = 16, 28, and 40 VDC$<br>BW = DC to 2 MHz (main)<br>$V_{IN} = 16, 28, and 40 VDC$   |                                     |                        | 80<br>40                |                        | 80<br>40                | mVp-p<br>mVp-p    |
| Power <sup>1,2,3</sup>                                      | Pout                                | BW = DC  to  2  MHz (dual))<br>$V_{ N } = 16, 28, \text{ and } 40 \text{ VDC (main)}$<br>(+dual)<br>(-dual)<br>(total)  |                                     | 10<br>2.5<br>2.5<br>15 |                         | 10<br>2.5<br>2.5<br>15 |                         | W<br>W<br>W<br>W  |
| REGULATION<br>Line <sup>1,3</sup>                           | VR <sub>LINE</sub>                  | V <sub>IN</sub> = 16, 28, and 40 VDC<br>I <sub>OUT</sub> = 0, 1000, 2000mA (main)<br>V <sub>IN</sub> = 16, 28, and 40 VDC (dual)  | TC = 25°C                           |                        | 25<br>±30               |                        | 25<br>±35               |                   |
| Load <sup>1,3</sup>   | VR <sub>LOAD</sub>                  |   | Over Temp                           |                        | ±30<br>±60<br>50<br>±60 |                        | ±35<br>±75<br>50<br>±75 | mV                |
| INPUT   |                                     |   |                                     |                        |                         |                        |                         |                   |
| Current<br>Ripple Current <sup>4</sup>                      | I <sub>IN</sub><br>I <sub>RIP</sub> | $\begin{split} &I_{OUT} = 0, \text{ Inhibit (pin 8)} \\ &\text{Tied to input return (pin 10)} \\ &I_{OUT} = 0, \text{ inhibit (pin 2) = open} \\ &I_{OUT} = 2000 \text{ mA (main)} \\ &I_{OUT} = \pm 167\text{mA (dual)} \\ &\text{BW} = \text{DC to 2MHz} \end{split}$ |                                     |                        | 15<br>40<br>50          |                        | 15<br>40<br>50          | mA<br>mA<br>mAp-p |
| EFFICIENCY  | E <sub>FF</sub>                     | $I_{OUT} = 2000 \text{mA} \text{ (main)}$<br>$I_{OUT} = \pm 167 \text{mA} \text{ (dual)}$<br>TC = $\pm 25^{\circ}\text{C}$  | TC = 25°C                           | 76                     |                         | 76                     |                         | %                 |
| ISOLATION   | ISO                                 | Input to output or any pin to case (except pin 7) at 500 VDC  | TC = 25°C                           | 100                    |                         | 100                    |                         | MΩ                |
| Load Fault<br>Power Dissipation <sup>3</sup>                | P <sub>D</sub>                      | Overload, TC = $+25^{\circ}C^{5}$<br>Short Circuit, TC = $+25^{\circ}C$   | TC = 25°C                           |                        | 8.0<br>6.0              |                        | 8.0<br>6.0              | w                 |
| Switching Frequency   | Fs                                  | I <sub>OUT</sub> = 2000mA (main)<br>I <sub>OUT</sub> = ±167mA (dual)  |                                     | 225                    | 275                     | 225                    | 275                     | KHz               |
| Inhibit Open Circuit<br>Voltage                             | V <sub>OI</sub>                     |   |                                     | 9.0                    | 13                      | 9.0                    | 13                      | V                 |

Notes to Specifications

Tested at each output. 1.

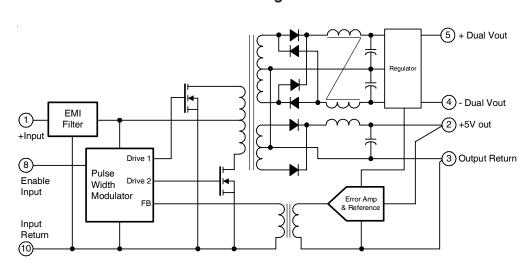
Parameter guaranteed by line and load regulation tests. 2.

At least 20 percent of the total output power should be taken from the (+5V) main output. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz. 3.

4.

An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation. Above 125°C case temperature, derate output power linearly to 0 at 135°C case 5.

6.



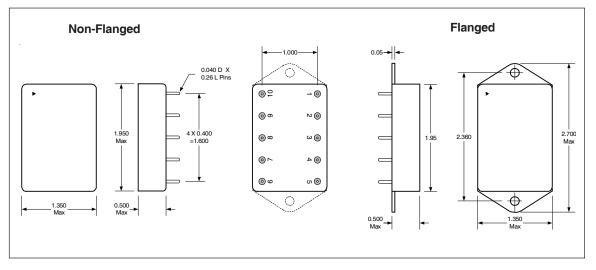
# **Block Diagram**

# Standard Microcircuit Drawing Equivalence Table

| Standard Microcircuit<br>Drawing Number | Vendor Cage<br>Code | IR Standard<br>Part Number |
|---|---------------------|----------------------------|
| 5962-90954                              | 52467               | ATO2815T                   |
| 5962-91602                              | 52467               | ATO2812T                   |

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#### **Mechanical Outlines**

# Pin Designation

| Pin # | Designation   |  |
|-------|---------------|--|
| 1     | + Input       |  |
| 2     | +5V Output    |  |
| 3     | Output Return |  |
| 4     | - Dual Output |  |
| 5     | + Dual Output |  |
| 6     | NC            |  |
| 7     | Case Ground   |  |
| 8     | Enable Input  |  |
| 9     | NC            |  |
| 10    | Input Return  |  |

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### **Device Screening**

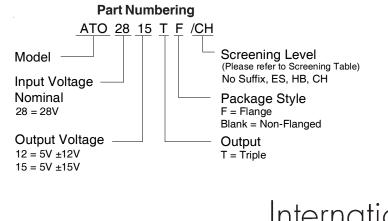
| Requirement                  | MIL-STD-883 Method | No Suffix      | ES ©              | HB              | СН              |
|------------------------------|--------------------|----------------|-------------------|-----------------|-----------------|
| Temperature Range            |                    | -20°C to +85°C | -55°C to +125°C ③ | -55°C to +125°C | -55°C to +125°C |
| Element Evaluation           | MIL-PRF-38534      | N/A            | N/A               | N/A             | Class H         |
| Non-Destructive<br>Bond Pull | 2023               | N/A            | N/A               | N/A             | N/A             |
| Internal Visual              | 2017               | 0              | Yes               | Yes             | Yes             |
| Temperature Cycle            | 1010               | N/A            | Cond B            | Cond C          | Cond C          |
| Constant Acceleration        | 2001, Y1 Axis      | N/A            | 500 Gs            | 3000 Gs         | 3000 Gs         |
| PIND                         | 2020               | N/A            | N/A               | N/A             | N/A             |
| Burn-In                      | 1015               | N/A            | 48 hrs@hi temp    | 160 hrs@125°C   | 160 hrs@125°C   |
| Final Electrical             | MIL-PRF-38534      | 25°C           | 25°C ©            | -55°C, +25°C,   | -55°C, +25°C,   |
| (Group A)                    | & Specification    |                |                   | +125°C          | +125°C          |
| PDA                          | MIL-PRF-38534      | N/A            | N/A               | N/A             | 10%             |
| Seal, Fine and Gross         | 1014               | Cond A         | Cond A, C         | Cond A, C       | Cond A, C       |
| Radiographic                 | 2012               | N/A            | N/A               | N/A             | N/A             |
| External Visual              | 2009               | 0              | Yes               | Yes             | Yes             |

Notes:

① Best commercial practice

② Sample tests at low and high temperatures

3 -55°C to +105°C for AHE, ATO, ATW



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