

| File Number | Piece Number |
|-------------|--------------|
|             |              |



|             |                  |
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| File Number | TYS-PST3S-H4-IDS |
| Stage Mark  | FM               |
| Version     | V2.3(166)        |

# PST3S-H4 Star Tracker IDS

Signature

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Proofread by: Chai Yin

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Standardization  
Checked by: Dong Pengfei

Approved by: Xiao Mingguo

## IDS 1: Performance Index

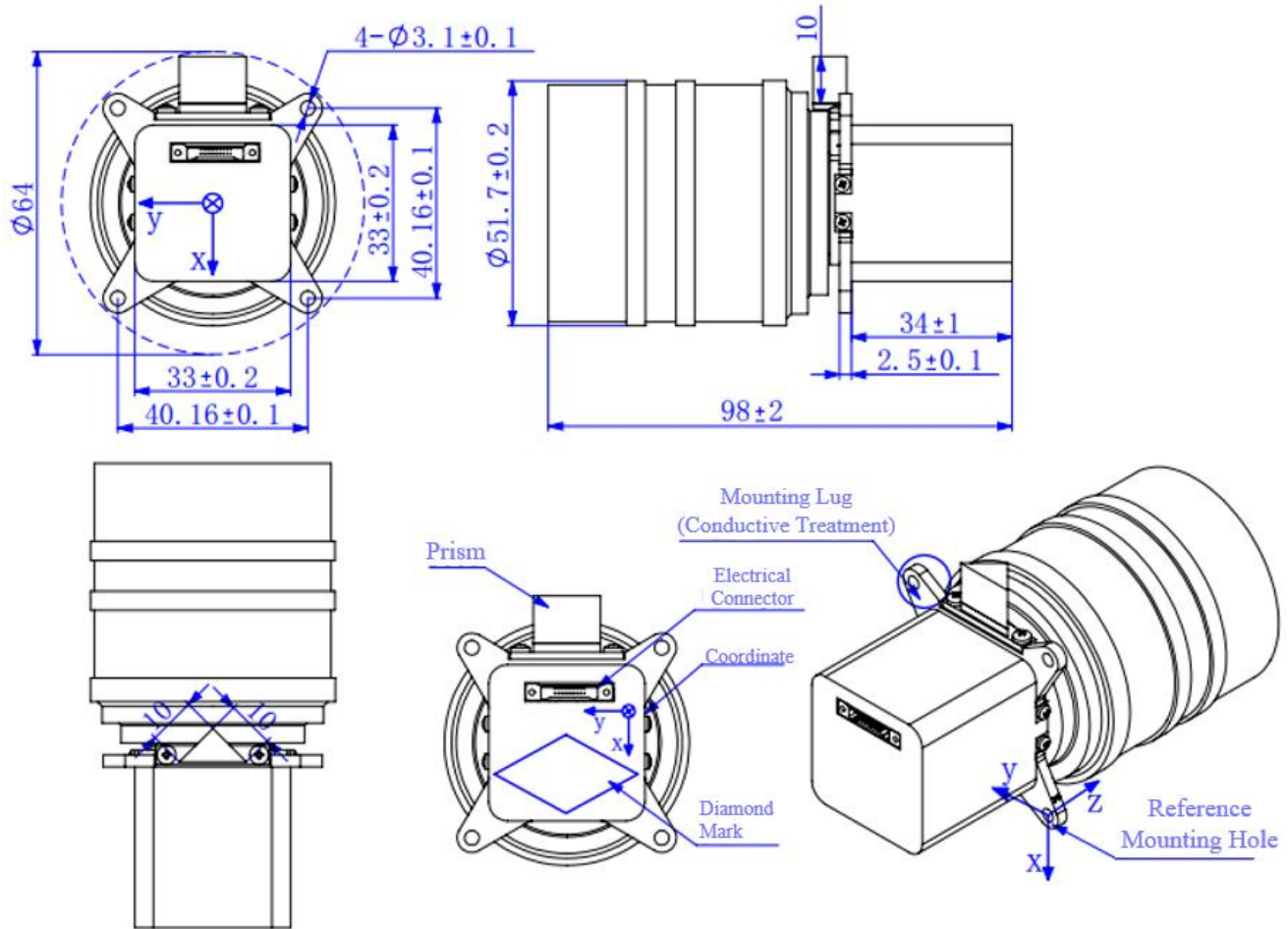
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|                        |                                                                                                                                                                                                                 | File Number     | TYS-PST3S-H4-IDS      |  | Page 1 of 14    |  |
|                        |                                                                                                                                                                                                                 | Sub-System Name |                       |  |                 |  |
|                        |                                                                                                                                                                                                                 | Device Name     | PST3S-H4 Star Tracker |  | Stage Mark      |  |
|                        |                                                                                                                                                                                                                 | Device Code     |                       |  |                 |  |
| Parameters             | Specifications                                                                                                                                                                                                  |                 |                       |  |                 |  |
| Attitude Accuracy      | Pointing: 5" ( $3\sigma$ )<br>Roll: 50" ( $3\sigma$ )                                                                                                                                                           |                 |                       |  |                 |  |
| Dynamic Performance    | @0.1°/s: 5" (Pointing, $3\sigma$ ); 50" (Roll, $3\sigma$ );<br>@0.5°/s: 8" (Pointing, $3\sigma$ ); 60" (Roll, $3\sigma$ );<br>@1.0°/s: 15" (Pointing, $3\sigma$ ); 120" (Roll, $3\sigma$ );<br>@3°/s: Trackable |                 |                       |  |                 |  |
| Data Validity Rate     | >98%@ 0.5°/s; >96%@0.5°/s ~1.5°/s;                                                                                                                                                                              |                 |                       |  |                 |  |
| Update Rate            | ≥10Hz                                                                                                                                                                                                           |                 |                       |  |                 |  |
| Acquisition Rate       | Max. ≤2s                                                                                                                                                                                                        |                 |                       |  |                 |  |
| Start-up Time          | Better than 5s                                                                                                                                                                                                  |                 |                       |  |                 |  |
| Exclusion Angle        | Sun: better than 35°; Earth: better than 25°                                                                                                                                                                    |                 |                       |  |                 |  |
| Time Scale Accuracy    | Better than 0.5ms @ synchronization pulse (SYNC pulse)                                                                                                                                                          |                 |                       |  |                 |  |
| Communication          | RS422                                                                                                                                                                                                           |                 |                       |  |                 |  |
| Quaternions Continuity | The scalar of quaternion: non-negative                                                                                                                                                                          |                 |                       |  |                 |  |
| Life Time              | 3 years @500km Orbit                                                                                                                                                                                            |                 |                       |  |                 |  |
| Reliability            | ≥0.98 @ the end of 3-year running                                                                                                                                                                               |                 |                       |  |                 |  |
| Edited (Date):         |                                                                                                                                                                                                                 |                 |                       |  |                 |  |
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## IDS 2: Mechanical Characteristics

|                                                                                                                                                                                                                                                                                                                                                                           |                                                  |                                                     |  |                                                                                                                                                                          |                       |                          |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|------|
|                                                                                                                                                                                                                                                                                                                                                                           |                                                  | File Number                                         |  | TYS-PST3S-H4-IDS                                                                                                                                                         |                       | Page 2 of 14             |      |
|                                                                                                                                                                                                                                                                                                                                                                           |                                                  | Sub-System Name                                     |  |                                                                                                                                                                          |                       |                          |      |
|                                                                                                                                                                                                                                                                                                                                                                           |                                                  | Device Name                                         |  | PST3S-H4 Star Tracker                                                                                                                                                    |                       | Stage Mark               |      |
|                                                                                                                                                                                                                                                                                                                                                                           |                                                  | Device Code                                         |  |                                                                                                                                                                          |                       |                          | FM   |
| Device Weight: 95±10g                                                                                                                                                                                                                                                                                                                                                     |                                                  | Device Count: 1                                     |  |                                                                                                                                                                          |                       |                          | √    |
| Mechanical Characteristics                                                                                                                                                                                                                                                                                                                                                | Envelope Size (mm)                               | <Φ64                                                |  | Height: 98±2                                                                                                                                                             |                       |                          | √    |
|                                                                                                                                                                                                                                                                                                                                                                           | CM Position (mm)                                 | X: -21±1                                            |  | Y: 20±1                                                                                                                                                                  | Z: 4±1                |                          | √    |
|                                                                                                                                                                                                                                                                                                                                                                           | Inertia at CM (kg.mm <sup>2</sup> )              | P <sub>X</sub> = 79±2                               |  | P <sub>Y</sub> = 80±2                                                                                                                                                    | P <sub>Z</sub> = 33±2 |                          | √    |
|                                                                                                                                                                                                                                                                                                                                                                           |                                                  |                                                     |  |                                                                                                                                                                          |                       | MEAS                     | CALC |
| Mounting Characteristics                                                                                                                                                                                                                                                                                                                                                  | Mounting Hole Count: 4                           | Mounting Hole Dimensions (Tolerance) (mm): Φ3.1±0.1 |  |                                                                                                                                                                          | Material: 2A12-T4     | Determination Method (√) |      |
|                                                                                                                                                                                                                                                                                                                                                                           | Mounting Contact Area (mm <sup>2</sup> ): 200    |                                                     |  | Note: The determination method refers to the way to determine the mechanical characteristics of the device.<br>MEAS: Measurement<br>CALC: Calculation<br>EST: Estimation |                       |                          |      |
|                                                                                                                                                                                                                                                                                                                                                                           | Mounting Surface Flatness: 0.1mm/(100mm×100mm)   |                                                     |  |                                                                                                                                                                          |                       |                          |      |
|                                                                                                                                                                                                                                                                                                                                                                           | Mounting Surface Roughness Ra (μm): 3.2          |                                                     |  |                                                                                                                                                                          |                       |                          |      |
|                                                                                                                                                                                                                                                                                                                                                                           | Mounting Surface Treatment: Conductive Treatment |                                                     |  |                                                                                                                                                                          |                       |                          |      |
| <p>Parameter relationship diagram (should indicate coordinate system relative orientation, CM position, device body dimensions, mounting surface location, etc.):</p> <div style="text-align: center;"> </div> <p>Note: The coordinate origin is located at the center of the reference mounting hole on the mounting surface (see <i>IDS 3: Instrument Diagram</i>).</p> |                                                  |                                                     |  |                                                                                                                                                                          |                       |                          |      |
| Edited (Date):                                                                                                                                                                                                                                                                                                                                                            |                                                  |                                                     |  |                                                                                                                                                                          |                       |                          |      |
| Signed (Date):                                                                                                                                                                                                                                                                                                                                                            |                                                  | Mark                                                |  |                                                                                                                                                                          |                       | Signature, Date          |      |

### IDS 3: Instrument Diagram

|  |                 |                       |              |  |    |  |
|--|-----------------|-----------------------|--------------|--|----|--|
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|  | Sub-System Name |                       |              |  |    |  |
|  | Device Name     | PST3S-H4 Star Tracker | Stage Mark   |  |    |  |
|  | Device Code     |                       |              |  | FM |  |



**Note:** This schematic diagram should include overall dimensions, mounting dimensions, mounting surface, mounting points (hole diameters and their tolerances, center-to-center distance and their tolerances), positional tolerances of guide pins and holes, orientation, position, type and designation of electrical connectors, operation holes required for calibration and testing, bonding jumpers/straps (position and length), and registration measurement datum.

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| Signed (Date): | Mark |  | Signature, Date |

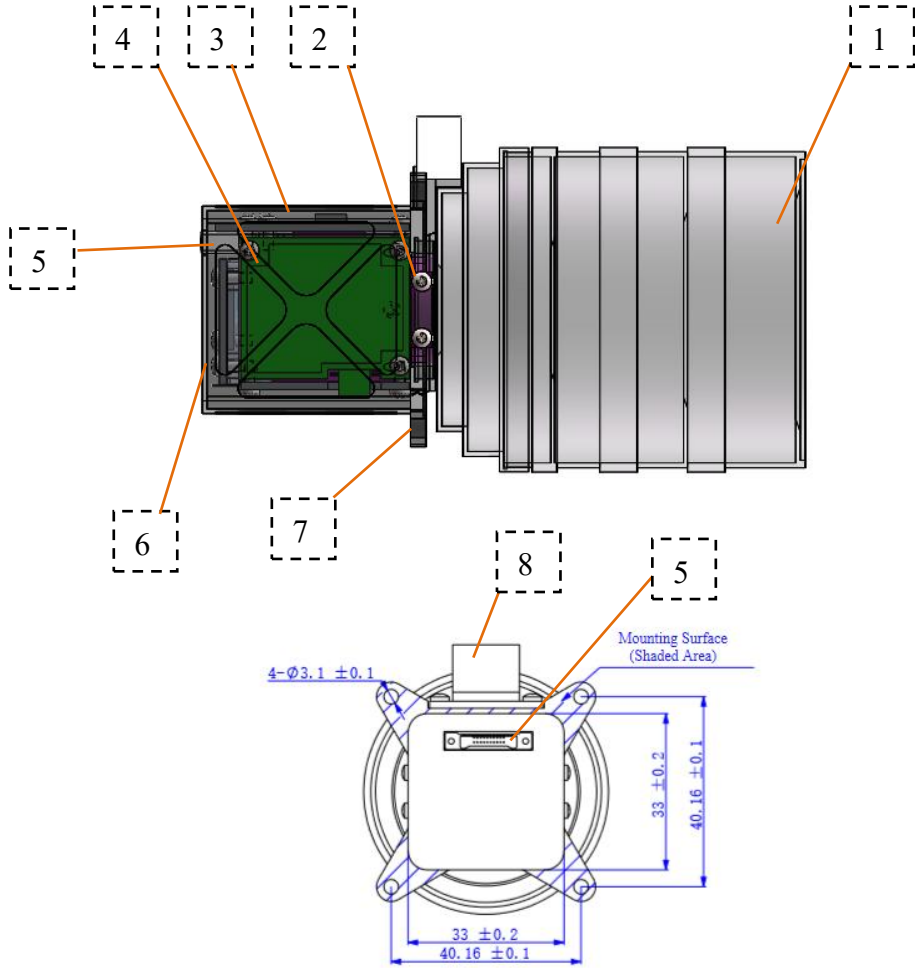
## IDS 4: Thermal Characteristics

|                                                                                |                                                    |                 |                                                                                                                        |  |              |                 |
|--------------------------------------------------------------------------------|----------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------|--|--------------|-----------------|
|                                                                                |                                                    | File Number     | TYS-PST3S-H4-IDS                                                                                                       |  | Page 4 of 14 |                 |
|                                                                                |                                                    | Sub-System Name |                                                                                                                        |  |              |                 |
|                                                                                |                                                    | Device Name     | PST3S-H4 Star Tracker                                                                                                  |  | Stage Mark   |                 |
|                                                                                |                                                    | Device Code     |                                                                                                                        |  |              |                 |
| Surface<br>(Excluding<br>Mounting<br>Surface)                                  | Material: Aluminum alloy (2A12-T4)                 |                 | Note: The inner surface of the baffle is ultra black coating.<br>$\varepsilon_H \geq 0.85, \alpha_S \geq 0.96$         |  |              |                 |
|                                                                                | Outer Surface Treatment: Conductive Treatment      |                 |                                                                                                                        |  |              |                 |
|                                                                                | Outer Surface Emissivity: $\varepsilon_H \geq 0.6$ |                 |                                                                                                                        |  |              |                 |
| Start Temperature °C: -30~+40                                                  |                                                    |                 | Heat Capacity J/K: 90                                                                                                  |  |              |                 |
| Operating Temperature Range °C: -30~+40                                        |                                                    |                 | Operating Relative Humidity Range: $\leq 60\%$                                                                         |  |              |                 |
| Best Operating Temperature Range °C: 20±5                                      |                                                    |                 | Storage Relative Humidity Range: $\leq 70\%$                                                                           |  |              |                 |
| Storage Temperature Range °C: -30~+40                                          |                                                    |                 | Power Consumption @Operating State W: $1 \pm 0.2$ (Per Device)<br>Power Consumption @Preparing State W: 0 (Per Device) |  |              |                 |
| <p>Description:</p> <div style="text-align: center; margin-top: 50px;"> </div> |                                                    |                 |                                                                                                                        |  |              |                 |
| Edited (Date):                                                                 |                                                    |                 |                                                                                                                        |  |              |                 |
| Signed (Date):                                                                 |                                                    |                 | Mark                                                                                                                   |  |              | Signature, Date |

IDS 5: Thermal Diagram

|  |                 |                       |              |  |    |  |
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|  | File Number     | TYS-PST3S-H4-IDS      | Page 5 of 14 |  |    |  |
|  | Sub-System Name |                       |              |  |    |  |
|  | Device Name     | PST3S-H4 Star Tracker | Stage Mark   |  |    |  |
|  | Device Code     |                       |              |  | FM |  |

Diagram:



- 1—Baffle
- 2—Lens
- 3—Circuit Box
- 4—Power Supply & Image Processing Circuit Board
- 5—Connector
- 6—Image Sensor Circuit Board
- 7—Mounting Lug
- 8—Optical Prism

Note: Conductive mounting of Star Tracker Circuit Box and Baffle.

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## IDS 6: Power

|                                                     |                   |                 |  |                                     |                 |                   |    |   |
|-----------------------------------------------------|-------------------|-----------------|--|-------------------------------------|-----------------|-------------------|----|---|
|                                                     |                   | File Number     |  | TYS-PST3S-H4-IDS                    |                 | Page 6 of 14      |    |   |
|                                                     |                   | Sub-System Name |  |                                     |                 |                   |    |   |
|                                                     |                   | Device Name     |  | PST3S-H4 Star Tracker               |                 | Stage Mark        |    |   |
|                                                     |                   | Device Code     |  |                                     |                 |                   | FM |   |
| Operating Mode<br>(Long Term/Short Term / Other)    |                   | Long Term       |  |                                     |                 | Device Count      |    | 1 |
| Voltage                                             | Voltage Stability | Ripple Voltage  |  | Inrush Current<br>(Peak / Duration) |                 | Power Consumption |    |   |
| 5V                                                  | /                 | 100mV (p-p)     |  | 2A/5ms                              |                 | 1±0.2W            |    |   |
| <b>Notes:</b><br>Safe Operating Voltage: 4.8V~5.4V. |                   |                 |  |                                     |                 |                   |    |   |
| Edited (Date):                                      |                   |                 |  |                                     |                 |                   |    |   |
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## IDS 7: Electrical Connector Contact Assignment – Differential PPS

|                                                                       |                               |                                               |                |                       |  |                              |  |    |  |
|-----------------------------------------------------------------------|-------------------------------|-----------------------------------------------|----------------|-----------------------|--|------------------------------|--|----|--|
|                                                                       |                               | File Number                                   |                | TYS-PST3S-H4-IDS      |  | Page 7 of 14                 |  |    |  |
|                                                                       |                               | Sub-System Name                               |                |                       |  |                              |  |    |  |
|                                                                       |                               | Device Name                                   |                | PST3S-H4 Star Tracker |  | Stage Mark                   |  |    |  |
|                                                                       |                               | Device Code                                   |                |                       |  |                              |  | FM |  |
| Name (by Function): X1                                                |                               | Electrical Connector P/N: J70A-2F2-037-431-TH |                |                       |  | Pin / Hole: Hole             |  |    |  |
| Contact Number                                                        | Signal (Function) Description | Voltage/V                                     | Current/A      | Polarity              |  | Remarks (Shielded / Twisted) |  |    |  |
| 13                                                                    | PPS_H                         | RS422 Standard                                | RS422 Standard | PPS Receive+          |  | 13,14 Twisted                |  |    |  |
| 14                                                                    | PPS_L                         |                                               |                | PPS Receive-          |  |                              |  |    |  |
| 20,21                                                                 | VCC5                          | 5V                                            |                | Power                 |  | Two-Point Two-Wire           |  |    |  |
| 32,33                                                                 | GND                           | 0V                                            |                | Power Ground          |  |                              |  |    |  |
| 3,4                                                                   | TXD+                          | RS422 Standard                                | RS422 Standard | 422 Transmit+         |  | 1,3 Twisted, 2,4 Twisted     |  |    |  |
| 1,2                                                                   | TXD-                          |                                               |                | 422 Transmit-         |  |                              |  |    |  |
| 11,12                                                                 | RXD+                          | RS422 Standard                                | RS422 Standard | 422 Receive+          |  | 9,11 Twisted, 10,12 Twisted  |  |    |  |
| 9,10                                                                  | RXD-                          |                                               |                | 422 Receive-          |  |                              |  |    |  |
| 5,6,7,8,15,16, 17,18,19,22, 23,24,25,26, 27,28,29,30, 31,34,35,36, 37 |                               |                                               |                |                       |  | Internal Use                 |  |    |  |

Pinout diagram for connector X1 (J70A-2F2-037-431-TH). The diagram shows a 37-pin connector with pins 1-19 on the left and 20-37 on the right. Signals include TXD-, TXD+, CAN1L, CAN1H, CAN2L, CAN2H, RXD-, RXD+, PPS H, PPS L, FPGA TDI, FPGA TMS, FPGA TDO, FPGA TCK, FPGA nTRST, X3 P, X3 N, X0 P, X0 N, Xclk P, Xclk N, X1 P, X1 N, X2 P, X2 N, CAN2H, CAN2L, CAN1H, CAN1L, VIN, and HOLE GND. It also shows termination resistors AR48, AR49, AR50, AR51 and components USF1206, VC5v5.

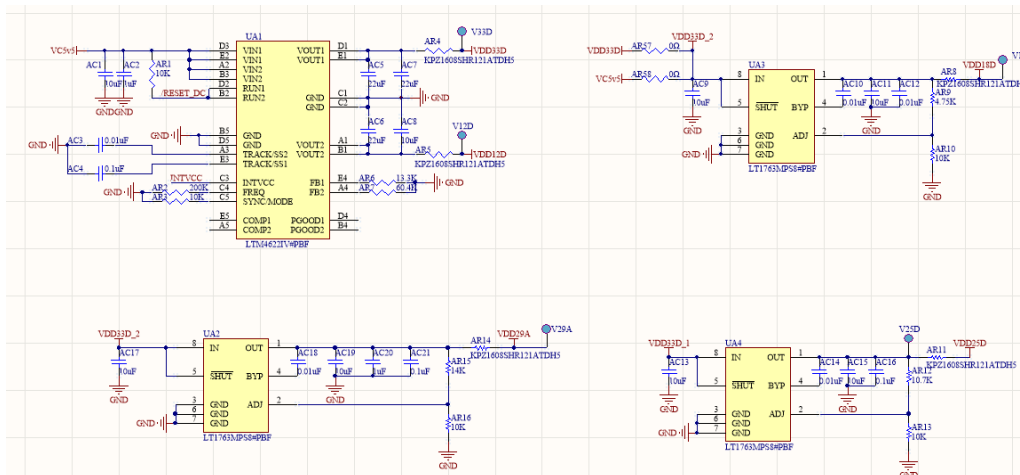
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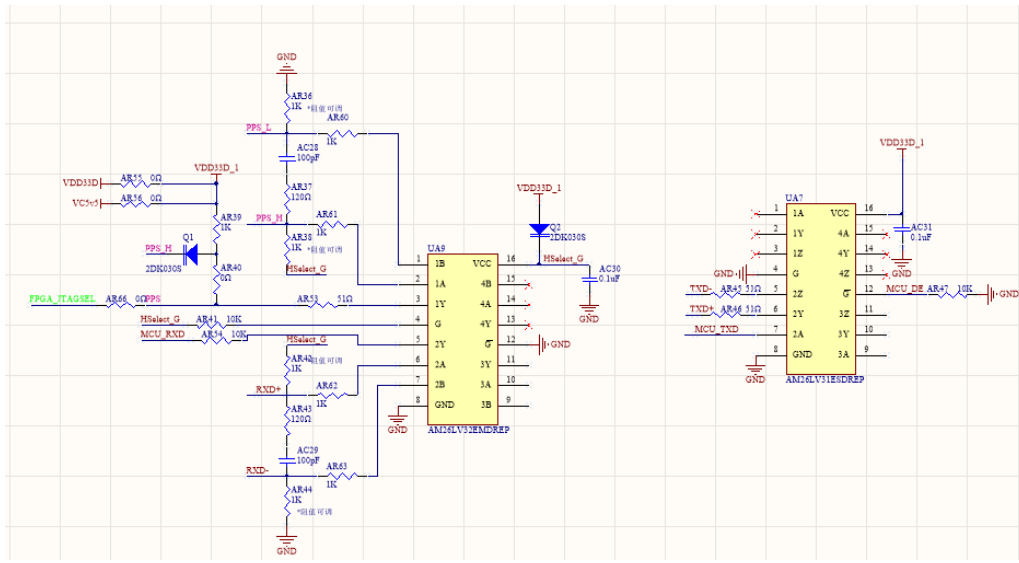
## IDS 8: Electrical Interface Features - Power

|                        |                                                                                                                                                                                                                                                                                                                                                                                                        |                       |              |                 |    |
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|                        | File Number                                                                                                                                                                                                                                                                                                                                                                                            | TYS-PST3S-H4-IDS      | Page 8 of 14 |                 |    |
|                        | Sub-System Name                                                                                                                                                                                                                                                                                                                                                                                        |                       |              |                 |    |
|                        | Device Name                                                                                                                                                                                                                                                                                                                                                                                            | PST3S-H4 Star Tracker | Stage Mark   |                 |    |
|                        | Device Code                                                                                                                                                                                                                                                                                                                                                                                            |                       |              |                 | FM |
| Interface Signal       | Power Supply                                                                                                                                                                                                                                                                                                                                                                                           |                       |              |                 |    |
| Signal Characteristics | 5V power and the ground are two-point two-wire.                                                                                                                                                                                                                                                                                                                                                        |                       |              |                 |    |
| Interface Circuit      | <pre> graph LR     Input[5V Input] --&gt; R1[2.4Ω Resistor]     Input --&gt; R2[2.4Ω Resistor]     R1 --&gt; U1[USF1206]     R2 --&gt; U2[USF1206]     U1 --&gt; DCDC[DCDC]     U2 --&gt; DCDC     DCDC --&gt; V12D[V1.2D]     DCDC --&gt; V33D[V3.3D]     V33D --&gt; V33D     V33D -- VLDO --&gt; V18D[V1.8D]     V33D -- VLDO --&gt; V25D[V2.5D]     V33D -- VLDO --&gt; V29A[V2.9A]         </pre> |                       |              |                 |    |
| Notes                  |                                                                                                                                                                                                                                                                                                                                                                                                        |                       |              |                 |    |
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## IDS 9: Electrical Interface Features - Power

|                        |                                                                                                |                 |                       |  |              |                 |    |
|------------------------|------------------------------------------------------------------------------------------------|-----------------|-----------------------|--|--------------|-----------------|----|
|                        |                                                                                                | File Number     | TYS-PST3S-H4-IDS      |  | Page 9 of 14 |                 |    |
|                        |                                                                                                | Sub-System Name |                       |  |              |                 |    |
|                        |                                                                                                | Device Name     | PST3S-H4 Star Tracker |  | Stage Mark   |                 |    |
|                        |                                                                                                | Device Code     |                       |  |              |                 | FM |
| Interface Signal       | Power Supply                                                                                   |                 |                       |  |              |                 |    |
| Signal Characteristics | 5V power and the ground are two-point two-wire.                                                |                 |                       |  |              |                 |    |
| Interface Circuit      | <div></div> |                 |                       |  |              |                 |    |
| Notes                  | AR58: not soldered.                                                                            |                 |                       |  |              |                 |    |
| Edited (Date):         |                                                                                                |                 |                       |  |              |                 |    |
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## IDS 10: Electrical Interface Features - RS422

|                        |                                                                                       |                 |                       |  |               |                 |    |
|------------------------|---------------------------------------------------------------------------------------|-----------------|-----------------------|--|---------------|-----------------|----|
|                        |                                                                                       | File Number     | TYS-PST3S-H4-IDS      |  | Page 10 of 14 |                 |    |
|                        |                                                                                       | Sub-System Name |                       |  |               |                 |    |
|                        |                                                                                       | Device Name     | PST3S-H4 Star Tracker |  | Stage Mark    |                 |    |
|                        |                                                                                       | Device Code     |                       |  |               |                 | FM |
| Interface Signal       | Digital Signal: RS422                                                                 |                 |                       |  |               |                 |    |
| Signal Characteristics | RS422 Communication Baud Rate: 115200bps;<br>Communication Method: Two-point Two-wire |                 |                       |  |               |                 |    |
| Interface Circuit      |   |                 |                       |  |               |                 |    |
| Notes                  | AR56: not soldered.                                                                   |                 |                       |  |               |                 |    |
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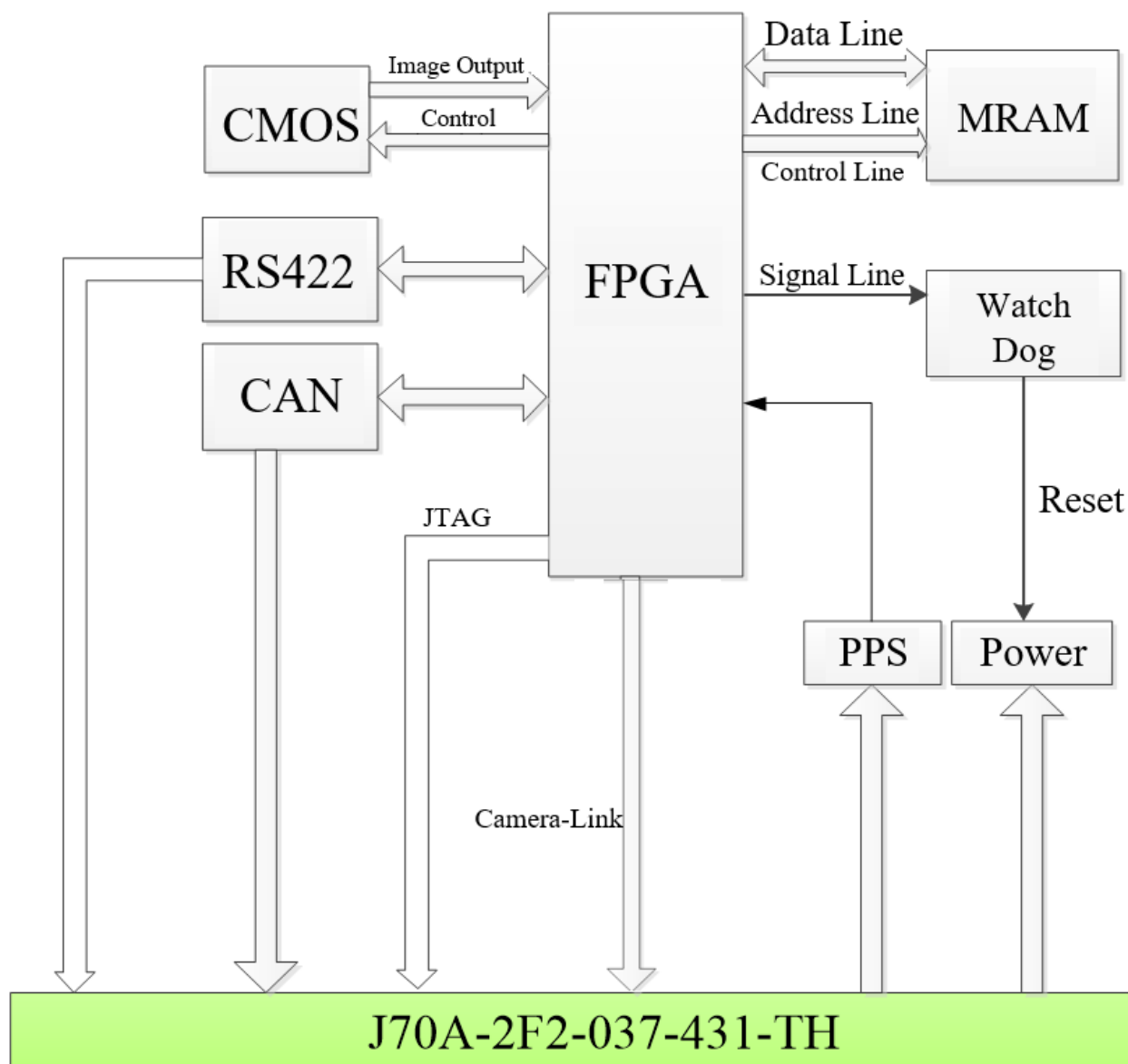
## IDS 11: Electrical Interface Features - Differential PPS

|                        |                                                                                                                   |                 |                       |  |               |                 |    |
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|                        |                                                                                                                   | File Number     | TYS-PST3S-H4-IDS      |  | Page 11 of 14 |                 |    |
|                        |                                                                                                                   | Sub-System Name |                       |  |               |                 |    |
|                        |                                                                                                                   | Device Name     | PST3S-H4 Star Tracker |  | Stage Mark    |                 |    |
|                        |                                                                                                                   | Device Code     |                       |  |               |                 | FM |
| Interface Signal       | Pulse Per Second (PPS)                                                                                            |                 |                       |  |               |                 |    |
| Signal Characteristics | Second Pulse Signal: Differential Input;<br>Falling Edge Aligned to Integer Seconds;<br>Negative Pulse Width 1ms. |                 |                       |  |               |                 |    |
| Interface Circuit      | PPS circuit<br>                                                                                                   |                 |                       |  |               |                 |    |
| Notes                  | AR40, AR39, AR56, Q1: not soldered @Differential PPS                                                              |                 |                       |  |               |                 |    |
| Edited (Date):         |                                                                                                                   |                 |                       |  |               |                 |    |
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## IDS 12: Circuit and Interface Schematics

|  |                 |                       |               |  |    |  |
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|  | Sub-System Name |                       |               |  |    |  |
|  | Device Name     | PST3S-H4 Star Tracker | Stage Mark    |  |    |  |
|  | Device Code     |                       |               |  | FM |  |

Schematic Diagram:



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IDS 13: Mounting Requirements

|  |                 |                       |               |  |    |  |
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|  | Sub-System Name |                       |               |  |    |  |
|  | Device Name     | PST3S-H4 Star Tracker | Stage Mark    |  |    |  |
|  | Device Code     |                       |               |  | FM |  |

Mounting Requirements: Ensure that nothing sheltered in the field of view (no obstructions within the 80° cone from the top of the baffle).

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## IDS 14: Device Description

|                |                 |                       |                 |  |    |
|----------------|-----------------|-----------------------|-----------------|--|----|
|                | File Number     | TYS-PST3S-H4-IDS      | Page 14 of 14   |  |    |
|                | Sub-System Name |                       |                 |  |    |
|                | Device Name     | PST3S-H4 Star Tracker | Stage Mark      |  |    |
|                | Device Code     |                       |                 |  | FM |
| <p>None.</p>   |                 |                       |                 |  |    |
| Edited (Date): |                 |                       |                 |  |    |
| Signed (Date): | Mark            |                       | Signature, Date |  |    |