

AMT128503

1.25 Gb/s Integrated 850 nm MSM-TIA

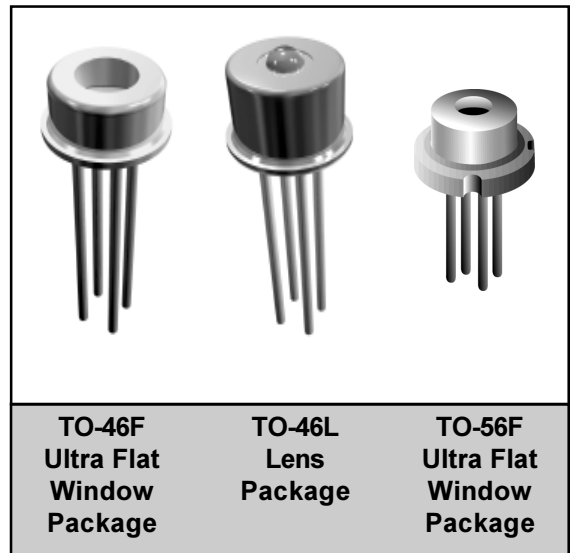
Data Sheet - Rev 1

FEATURES

- 1.25 Gb/s Differential Output TIA
- 3.3V Operation
- Automatic Gain Control
- 850nm Photodetector with 100 μm x 100 μm Active Area
- Integrated MSM detector & TIA
- TO-46 Ultra Flat Window or Lens Package
- TO-56 Ultra Flat Window Package

APPLICATIONS

- Gigabit Ethernet (1.250Gb/s)
- Fibre Channel (1.0625 Gb/s)



PRODUCT DESCRIPTION

The ANADIGICS AMT128503 is a 3.3V monolithically integrated Metal-Semiconductor-Metal (MSM) photodetector and transimpedance amplifier (TIA) used to convert an 850nm input optical signal into a differential output voltage, and is manufactured in ANADIGICS' 6" GaAs wafer fabrication facility. The integrated MSM and TIA receiver maximizes the receiver performance by minimizing the photodetector input parasitics to the TIA and

internally biasing the photodetector to achieve high sensitivity, bandwidth and overload performance. As an integrated product the reliability is inherently better than a discrete solution, and both the MSM-TIA integrated circuit and TO46 flat window, TO46 lens and TO56 flat window packaged receiver pass stringent reliability requirements. These products are readily designed into receivers and transceivers for Gigabit Ethernet and Fibre Channel applications.

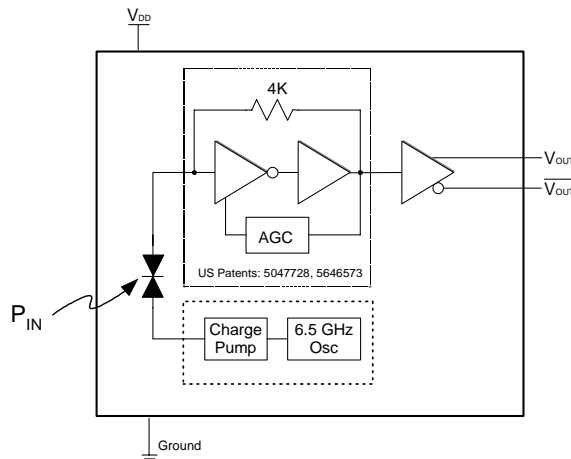


Figure 1: AMT128503 Equivalent Circuit

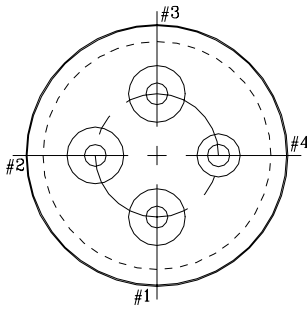


Figure 2: T46F/T46L Pin Outline (Bottom View)

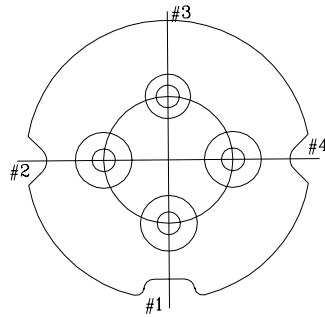


Figure 3: T56 Pin Outline (Bottom View)

Table 1: Package Pin Description

| PIN | T46F/T46L Description | T56F Description |
|-----|--|--|
| 1 | VOUT - TIA Output Voltage (non-inverted) Logical '1' with optical input | VDD - Positive Supply Voltage |
| 2 | VDD - Positive Supply Voltage | $\overline{\text{VOUT}}$ - TIA Output Voltage (inverted) Logical "1" with optical input |
| 3 | $\overline{\text{VOUT}}$ - TIA Output Voltage (inverted) Logical '0' with optical input | Ground (case is grounded) |
| 4 | Ground (case is grounded) | VOUT - TIA Output Voltage (non-inverted) Logical "1" with optical input |

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Maximum Ratings

| | |
|----------|---------------------------------|
| V_{DD} | 6.0 V |
| P_{IN} | + 5 dBm |
| T_S | Storage Temp. - 65 °C to 125 °C |

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Table 3: Electrical Characteristics

| PARAMETER | MIN | TYP | MAX | UNIT |
|--|-------|-----------|------|--------------------|
| Wavelength (λ) | 770 | 850 | 860 | nm |
| Detector Active Area | | 100 x 100 | | μm |
| Small Signal Differential Responsivity ⁽¹⁾ (@ 50 MHz) | 1000 | | | V / W |
| Bandwidth ⁽¹⁾ | 1000 | | 1500 | MHz |
| Low Frequency Cutoff | | 300 | 1000 | kHz |
| Output Resistance | 25 | 40 | 60 | Ω |
| Optical Overload ⁽²⁾ | 0 | | | dBm |
| Optical Sensitivity ⁽²⁾ | -20 | - 22 | | dBm |
| Differential Output Voltage ^{(3), (4)} | | 700 | | mV |
| T _{RISE} & T _{FALL} (20 - 80%) ^{(3), (4)} | | 260 | | ps |
| Duty Cycle Distortion ^{(3), (5)} | | 4 | 10 | % |
| RMS Jitter ^{(3), (5), (6)} | | 15 | | ps |
| Total Jitter (pk-pk) ^{(3), (5), (7)} | | 90 | | ps |
| Supply Current | | | 55 | mA |
| Operating Voltage Range | + 3.0 | +3.3 | +3.6 | V |
| Operating Ambient Temperature Range | 0 | | 70 | $^{\circ}\text{C}$ |

Notes:

- (1) Measured at -14 dBm optical input power with output connected into $R_L = 100\Omega$ (differential)
- (2) Measured at 10^{-10} BER with a 2^7-1 PRBS at 1.25 GB/s
- (3) Input optical power = -3 dBm, $R_L = 100 \Omega$ (differential).
- (4) Measured with a 625 MHz, 50% duty cycle square wave.
- (5) Measured with a 1.25 Gb/s, 2^7-1 PRBS.
- (6) 1σ about the center eye crossing.
- (7) 6σ about the center eye crossing.

PERFORMANCE DATA

Figure 4: Eye Diagram with an Optical Input Power of -17dBm

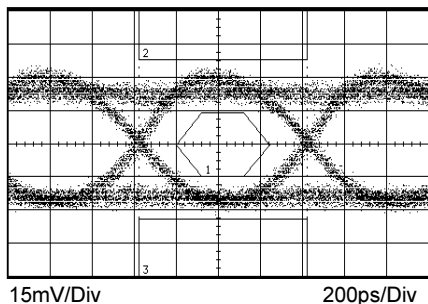


Figure 5: Eye Diagram with an Optical Input Power of -1.0dBm

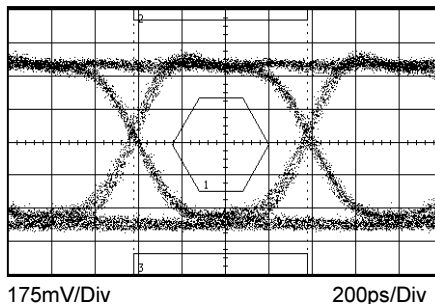


Figure 6: Supply Current vs Temperature

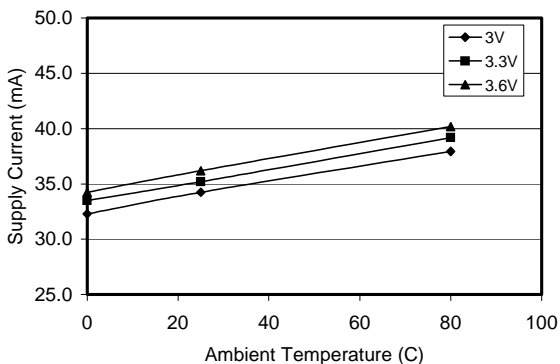


Figure 7: Bandwidth vs. Temperature

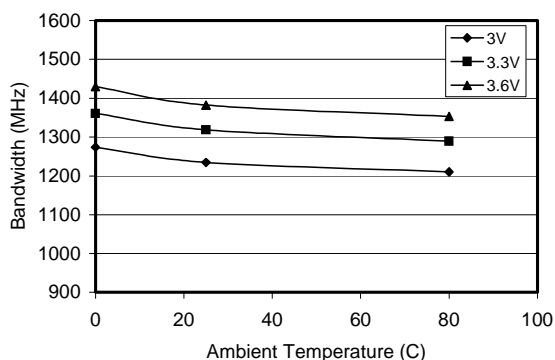


Figure 8: Differential Responsivity vs Temperature

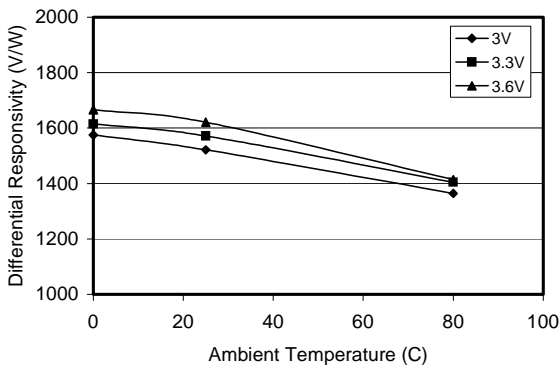
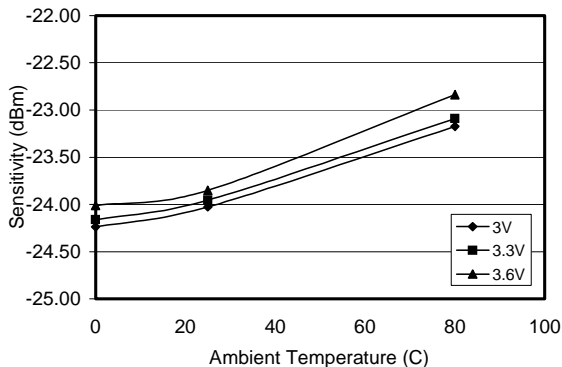


Figure 9: Sensitivity vs Temperature



MEASUREMENT METHODS

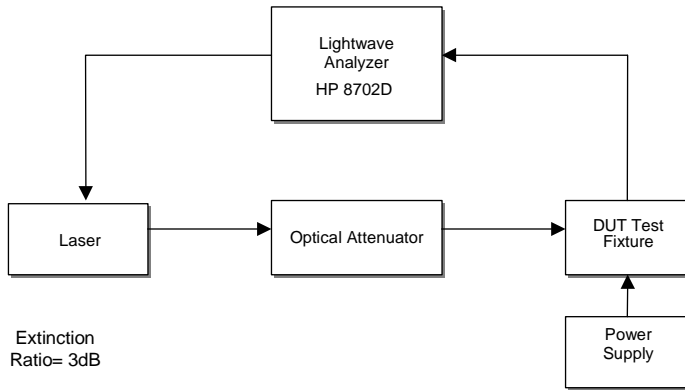


Figure 10: Test Setup for Frequency Response

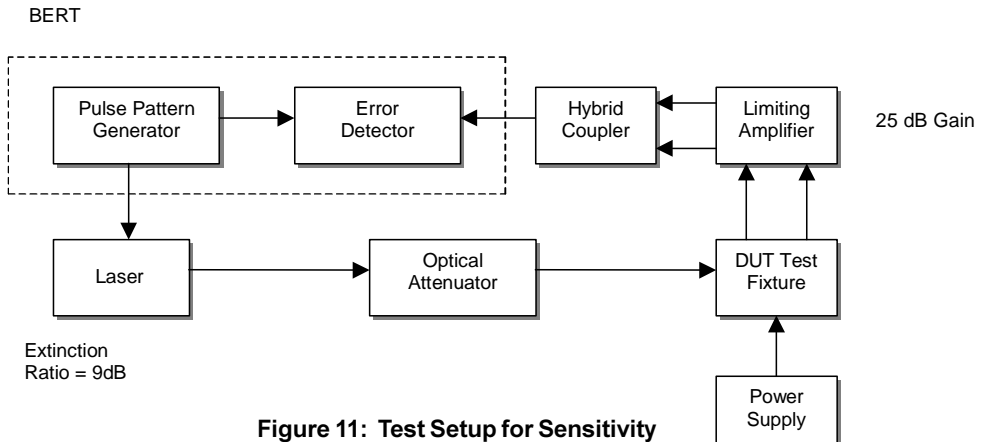


Figure 11: Test Setup for Sensitivity

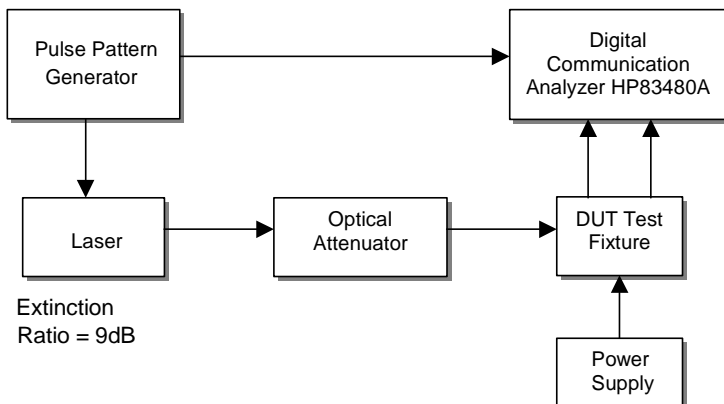


Figure 12: Test Setup for Eye Measurements

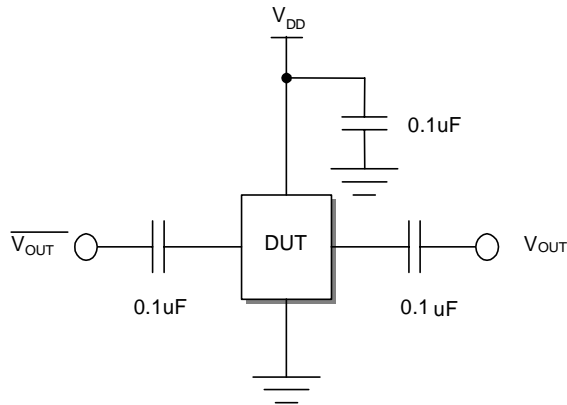


Figure 13: DUT Test Fixture Schematic

APPLICATION INFORMATION

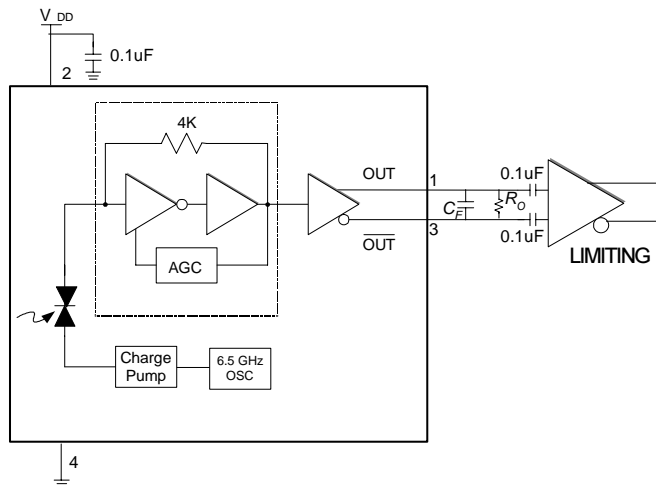


Figure 14: Application Schematic

C_F is an optional single pole noise filter

$$C_F = \frac{1}{2\pi f_c R}$$

f_c is the desired cutoff frequency

$$R = 50 \Omega$$

R_O is required with high input resistance limiting amplifiers

$$R_O = 100 \Omega$$

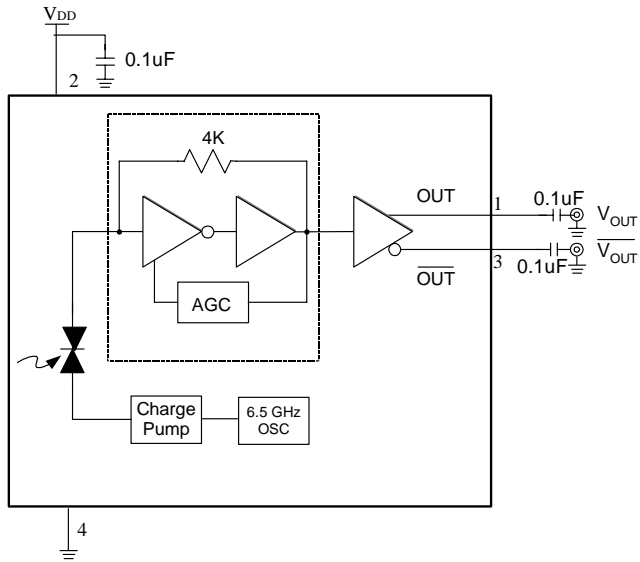


Figure 15: Evaluation Board Schematic

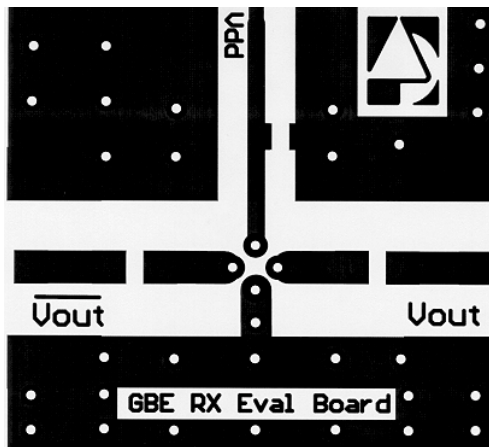
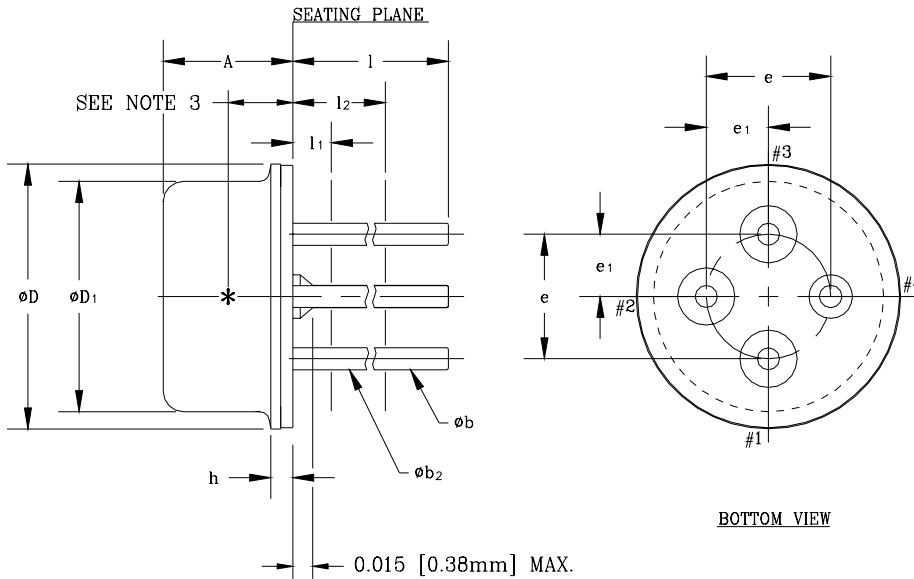


Figure 16: Evaluation Board Layout

PACKAGE OUTLINE



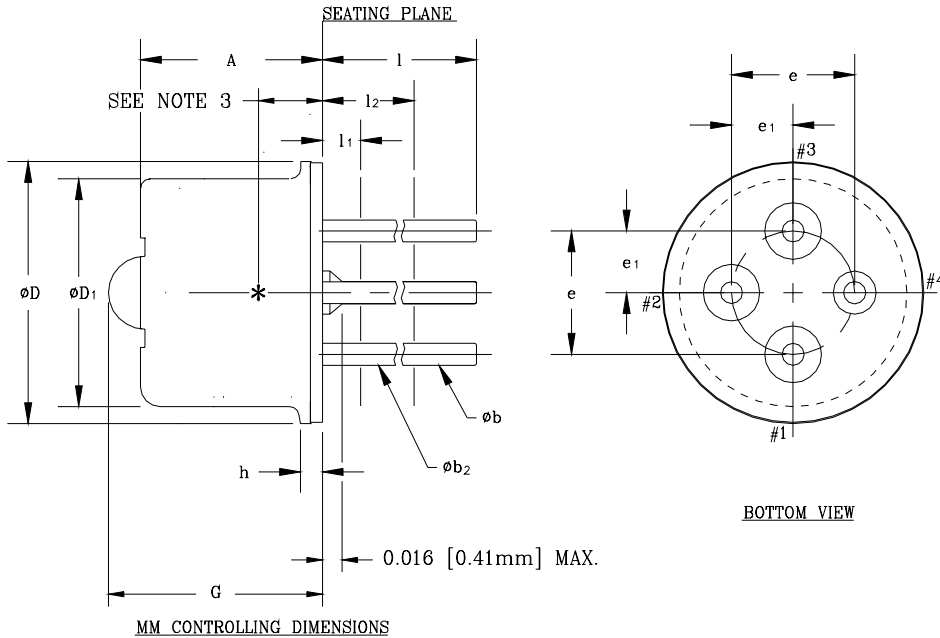
MM CONTROLLING DIMENSIONS

| S _M B _{OL} | INCHES | | MILLIMETERS | | NOTE |
|--------------------------------|------------|-------|-------------|-------|------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 0.098 | 0.110 | 2.50 | 2.80 | |
| øb | 0.016 | 0.020 | 0.41 | 0.51 | 1 |
| øb ₂ | 0.012 | 0.019 | 0.30 | 0.48 | 1 |
| øD | 0.212 | 0.218 | 5.38 | 5.54 | |
| øD ₁ | 0.181 | 0.187 | 4.60 | 4.75 | |
| e | 0.100 T.P. | | 2.54 T.P. | | 2 |
| e ₁ | 0.050 T.P. | | 1.27 T.P. | | 2 |
| h | 0.014 | 0.022 | 0.36 | 0.56 | |
| l | 0.500 | 0.540 | 12.70 | 13.70 | 1 |
| l ₁ | - | 0.050 | - | 1.27 | 1 |
| l ₂ | 0.250 | - | 6.35 | - | 1 |

NOTES:

1. (FOUR LEADS) øb₂ APPLIES BETWEEN l₁ AND l₂. øb APPLIES BETWEEN l₂ AND 0.5 [12.70mm] FROM SEATING PLANE. DIAMETER IS UNCONTROLLED IN l₁ AND BEYOND 0.5 [12.70mm] TO END OF PIN.
2. MAXIMUM DIAMETER LEADS AT A GAGING PLANE 0.054 [1.37mm]+0.001 [0.025mm] -0.000 [0.000mm] BELOW SEATING PLANE TO BE WITHIN 0.007 [0.178mm] OF THEIR TRUE POSITION RELATIVE TO MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.212 [5.40mm] DIAMETER MEASURED WITH A SUITABLE GAGE. WHEN GAGE IS NOT USED, MEASUREMENT WILL BE MADE AT 0.250 [6.35mm] FROM SEATING PLANE.
3. INTERNAL OPTICAL HEIGHT = 0.052±0.003[1.31±.08]
4. BENT LEADS SHOULD NOT EXTEND OUTSIDE DIAMETER (øD) OF CAP OR TOUCH EACH OTHER.
5. ALL DIMENSIONS ARE REFERENCE ONLY-EXCEPT A, D & h.
6. DETECTOR DIODE PLACEMENT ACCURACY: ⊕0.15MM[0.006] WITH RESPECT TO CENTER OF HEADER.(REF.ONLY)

Figure 17: T46F Package Outline Diagram

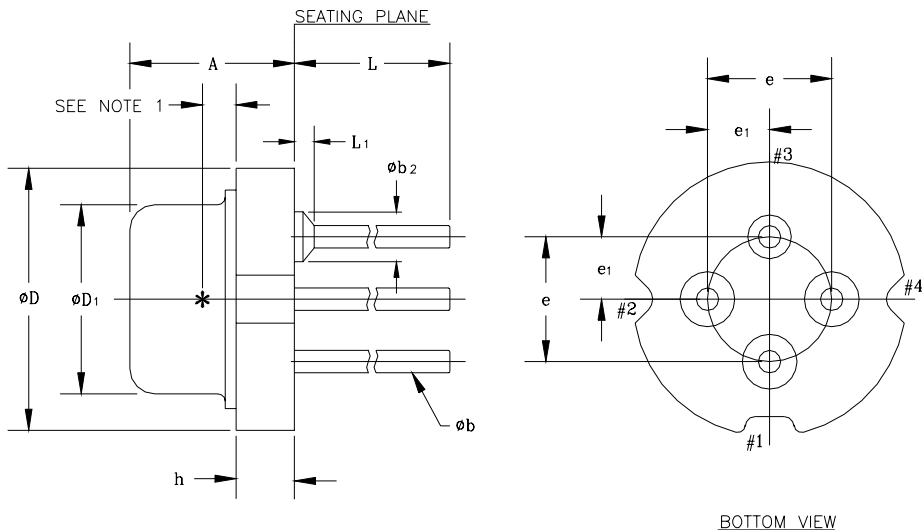


| SYMBOL | INCHES | | MILLIMETERS | | NOTE |
|--------|------------|-------|-------------|-------|------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | -- | 0.160 | -- | 4.00 | |
| øb | 0.016 | 0.020 | 0.41 | 0.51 | 1 |
| øb2 | 0.012 | 0.019 | 0.30 | 0.48 | 1 |
| øD | 0.212 | 0.218 | 5.38 | 5.54 | |
| øD1 | 0.181 | 0.187 | 4.60 | 4.75 | |
| e | 0.100 T.P. | | 2.54 T.P. | | 2 |
| e1 | 0.050 T.P. | | 1.27 T.P. | | 2 |
| h | 0.014 | 0.022 | 0.36 | 0.56 | |
| l | 0.500 | 0.540 | 12.70 | 13.70 | 1 |
| l1 | -- | 0.050 | -- | 1.27 | 1 |
| l2 | 0.250 | -- | 6.35 | -- | 1 |
| G | -- | 0.190 | -- | 4.66 | 7 |

NOTES:

1. (FOUR LEADS) øb2 APPLIES BETWEEN l1 AND l2. øb APPLIES BETWEEN l2 AND 0.5 [12.70mm] FROM SEATING PLANE. DIAMETER IS UNCONTROLLED IN l1 AND BEYOND 0.5 [12.70mm] TO END OF PIN.
2. MAXIMUM DIAMETER LEADS AT A GAGING PLANE 0.054 [1.37mm]+0.001 [0.025mm] -0.000 [0.000mm] BELOW SEATING PLANE TO BE WITHIN 0.007 [0.178mm] OF THEIR TRUE POSITION RELATIVE TO MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.212 [5.40mm] DIAMETER MEASURED WITH A SUITABLE GAGE. WHEN GAGE IS NOT USED, MEASUREMENT WILL BE MADE AT 0.250 [6.35mm] FROM SEATING PLANE.
3. INTERNAL OPTICAL HEIGHT = 0.052±0.003[1.32±0.08] DIE PLACEMENT ACCURACY FOR REF. ONLY.
4. BENT LEADS SHOULD NOT EXTEND OUTSIDE DIAMETER (øD) OF CAP OR TOUCH EACH OTHER.
5. ALL DIMENSIONS ARE REFERENCE ONLY-EXCEPT A, D & h.
6. DETECTOR DIODE PLACEMENT ACCURACY: ±0.15MM[0.006] ALL DIRECTIONS
7. LENS HEIGHT = 0.65±0.1 [0.026±0.004]

Figure 18: T46L Package Outline Diagram



MM CONTROLLING DIMENSIONS

| S _M B _{OL} | MILLIMETERS | | INCHES | | NOTE |
|--------------------------------|-------------|------|------------|-------|------|
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.10 | 3.50 | 0.122 | 0.138 | |
| ϕb | 0.41 | 0.48 | 0.016 | 0.019 | |
| ϕb_2 | - | 0.89 | - | 0.035 | |
| ϕD | 5.57 | 5.60 | 0.219 | 0.221 | |
| ϕD_1 | 3.80 | 3.90 | 0.150 | 0.154 | |
| e | 2.54 T.P. | | 0.100 T.P. | | |
| e ₁ | 1.27 T.P. | | 0.050 T.P. | | |
| h | 1.10 | 1.30 | 0.043 | 0.051 | |
| L | 6.00 | 7.00 | 0.236 | 0.276 | |
| L ₁ | - | 0.38 | - | 0.015 | |

NOTES:

- INTERNAL OPTICAL HEIGHT = $0.70 \pm 0.04 [0.028 \pm 0.0015]$
- BENT LEADS SHOULD NOT EXTEND OUTSIDE DIAMETER (ϕD) OF CAP OR TOUCH EACH OTHER.
- ALL DIMENSIONS ARE REFERENCE ONLY, EXCEPT A, ϕD & h.
- DETECTOR DIODE PLACEMENT ACCURACY: $\pm 0.15\text{MM} [0.006]$ WITH RESPECT TO CENTER OF HEADER: REFERENCE ONLY.
- CAN PLACEMENT ACCURACY: $\pm 0.2\text{MM} [0.008]$ WITH RESPECT TO CENTER OF HEADER: REFERENCE ONLY.

Figure 19: T56F Package Outline Diagram

NOTES

ORDERING INFORMATION

| Part Number | Package Option | Package Description |
|---------------|----------------|---------------------|
| AMT128503T46F | TO-46F | Ultra Flat Window |
| AMT128503T46L | TO-46L | Lens |
| AMT128503T56F | TO-56F | Ultra Flat Window |

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