

NTHD4508N

Power MOSFET

20 V, 4.1 A, Dual N-Channel ChipFET™

Features

- Low $R_{DS(on)}$ and Fast Switching Speed
- Leadless ChipFET Package has 40% Smaller Footprint than TSOP-6
- Excellent Thermal Capabilities Where Heat Transfer is Required
- Pb-Free Package is Available

Applications

- DC-DC Buck/Boost Converters
- Battery and Low Side Switching in Portable Equipment Such as MP3 Players, Cell Phones, DSCs and PDAs
- Level Shifting

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | | Symbol | Value | Unit | |
|---|-------------------------|--------------------------|------------|------------------|---|
| Drain-to-Source Voltage | | V_{DS} | 20 | V | |
| Gate-to-Source Voltage | | V_{GS} | ± 12 | V | |
| Continuous Drain Current | Steady State | $T_J = 25^\circ\text{C}$ | I_D | 3.0 | A |
| | | $T_J = 85^\circ\text{C}$ | | | |
| | $t \leq 5\text{ s}$ | $T_J = 25^\circ\text{C}$ | 4.1 | | |
| Power Dissipation | Steady State | $T_J = 25^\circ\text{C}$ | P_D | 1.13 | W |
| | | $T_J = 85^\circ\text{C}$ | | | |
| | $t \leq 5\text{ s}$ | $T_J = 25^\circ\text{C}$ | 2.1 | | |
| Pulsed Drain Current | $t_p = 10\ \mu\text{s}$ | I_{DM} | 12 | A | |
| Operating Junction and Storage Temperature | | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ | |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T_L | 260 | $^\circ\text{C}$ | |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|---|-----------------|-----|---------------------------|
| Junction-to-Ambient - Steady State (Note 1) | $R_{\theta JA}$ | 110 | $^\circ\text{C}/\text{W}$ |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

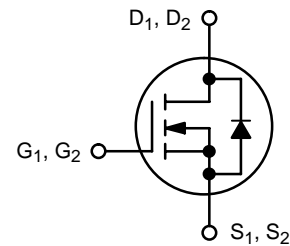
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.27 in sq [1 oz] including traces).



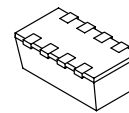
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<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | I_D MAX |
|---------------|-----------------------|-----------|
| 20 V | 60 m Ω @ 4.5 V | 4.1 A |
| | 80 m Ω @ 2.5 V | |

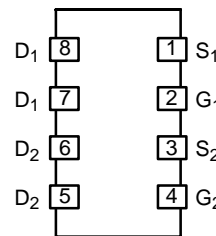


N-Channel MOSFET

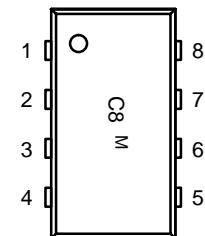


ChipFET
CASE 1206A
STYLE 2

PIN CONNECTIONS



MARKING DIAGRAM



C8 = Specific Device Code
M = Month Code

ORDERING INFORMATION

| Device | Package | Shipping† |
|--------------|-------------------|------------------|
| NTHD4508NT1 | ChipFET | 3000/Tape & Reel |
| NTHD4508NT1G | ChipFET (Pb-Free) | 3000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|-----------|--------|-----------------|-----|-----|-----|-------|
|-----------|--------|-----------------|-----|-----|-----|-------|

OFF CHARACTERISTICS

| | | | | | | |
|-----------------------------------|----------------------|---|----|--|------|----|
| Drain-to-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} = 0 V | 20 | | | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{GS} = 0 V, V _{DS} = 16 V | | | 1.0 | μA |
| | | V _{GS} = 0 V, V _{DS} = 16 V, T _J = 125°C | | | 10 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{DS} = 0 V, V _{GS} = ±12 V | | | ±100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|-------------------------------|---------------------|---|-----|-----|-----|----|
| Gate Threshold Voltage | V _{GS(TH)} | V _{GS} = V _{DS} , I _D = 250 μA | 0.6 | | 1.2 | V |
| Drain-to-Source On-Resistance | R _{DS(on)} | V _{GS} = 4.5 V, I _D = 3.1 A | | 60 | 75 | mΩ |
| | | V _{GS} = 2.5 V, I _D = 2.3 A | | 80 | 115 | |
| Forward Transconductance | g _{FS} | V _{DS} = 10 V, I _D = 3.1 A | | 6.0 | | S |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|---------------------|--|--|-----|-----|----|
| Input Capacitance | C _{ISS} | V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 10 V | | 180 | | pF |
| Output Capacitance | C _{OSS} | | | 80 | | |
| Reverse Transfer Capacitance | C _{RSS} | | | 25 | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.1 A | | 2.6 | 4.0 | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | 0.5 | | |
| Gate-to-Source Charge | Q _{GS} | | | 0.6 | | |
| Gate-to-Drain Charge | Q _{GD} | | | 0.7 | | |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|---------------------|--|--|-----|-----|----|
| Turn-On Delay Time | t _{d(ON)} | V _{GS} = 4.5 V, V _{DS} = 16 V, I _D = 3.1 A, R _G = 2.5 Ω | | 5.0 | 10 | ns |
| Rise Time | t _r | | | 15 | 30 | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 10 | 20 | |
| Fall Time | t _f | | | 3.0 | 6.0 | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-------------------------|-----------------|--|--|------|------|----|
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 3.1 A | | 0.75 | 1.15 | V |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, I _S = 1.5 A, di _S /dt = 100 A/μs | | 12.5 | | ns |
| Charge Time | t _a | | | 9.0 | | |
| Discharge Time | t _b | | | 3.5 | | |
| Reverse Recovery Charge | Q _{RR} | | | 6.0 | | |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperatures.

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

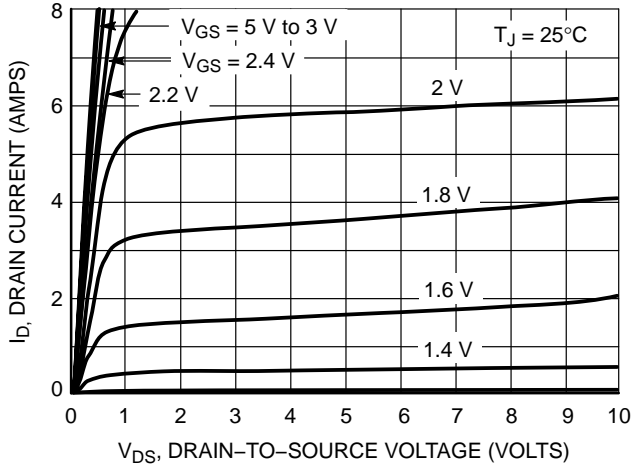


Figure 1. On-Region Characteristics

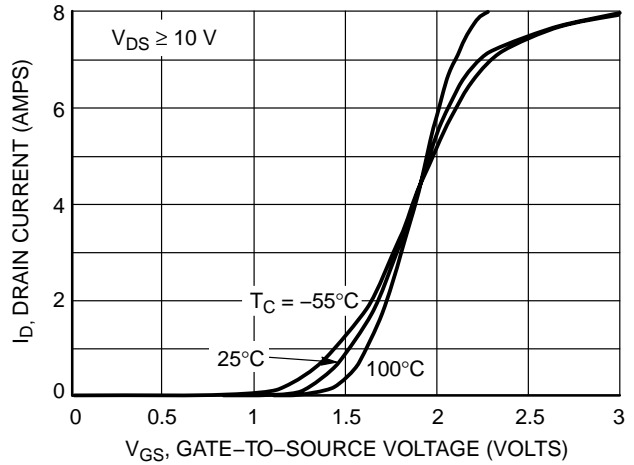


Figure 2. Transfer Characteristics

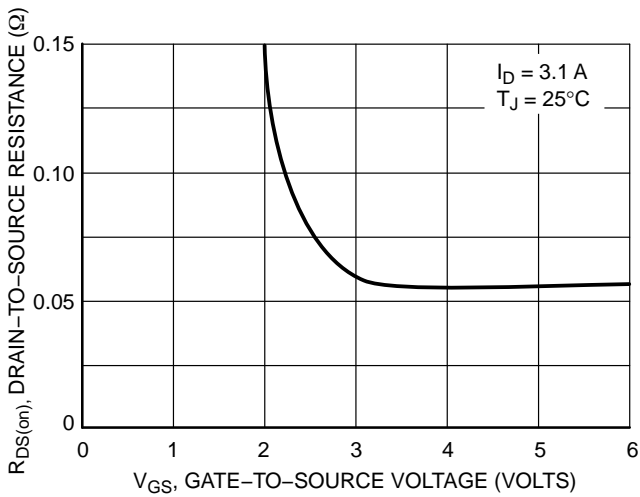


Figure 3. On-Resistance vs. Gate-to-Source Voltage

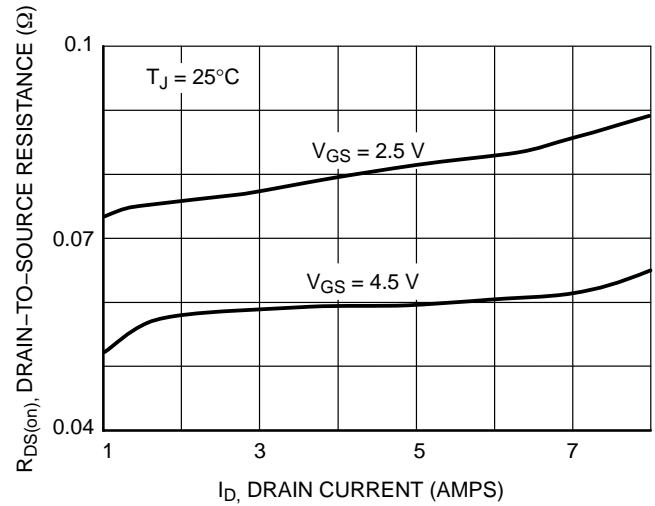


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

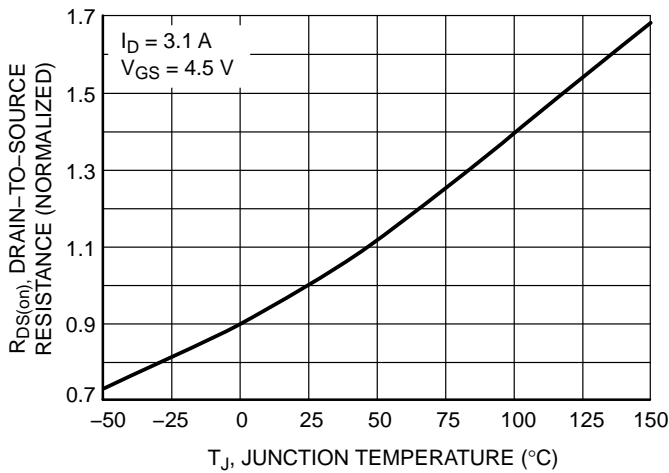


Figure 5. On-Resistance Variation with Temperature

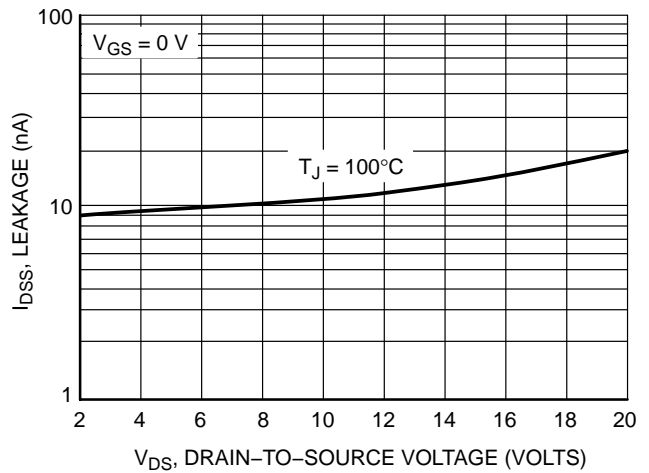


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

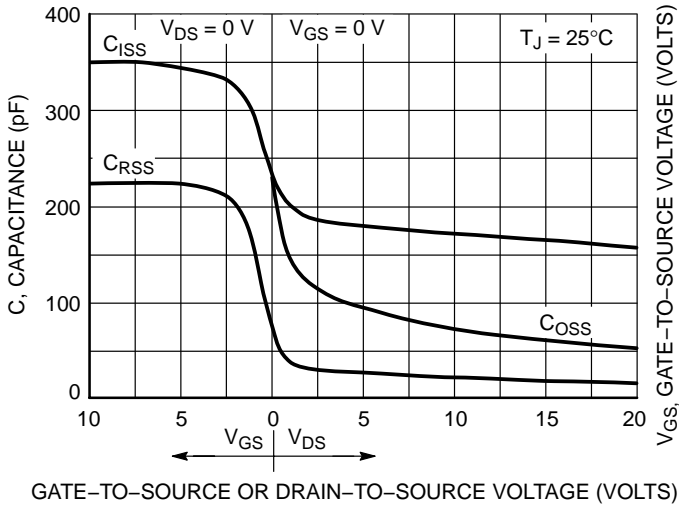


Figure 7. Capacitance Variation

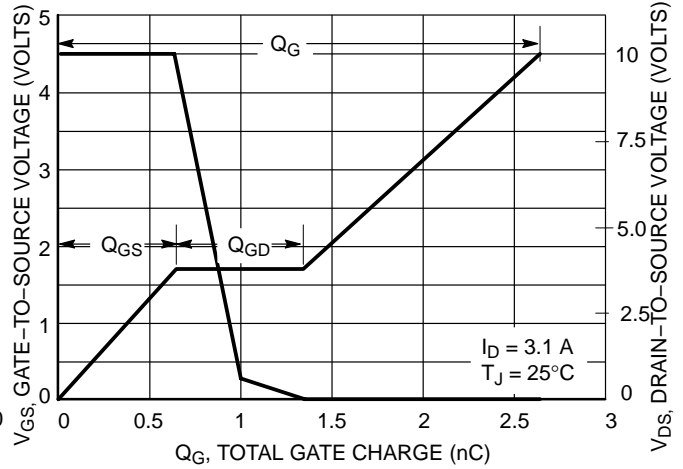


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

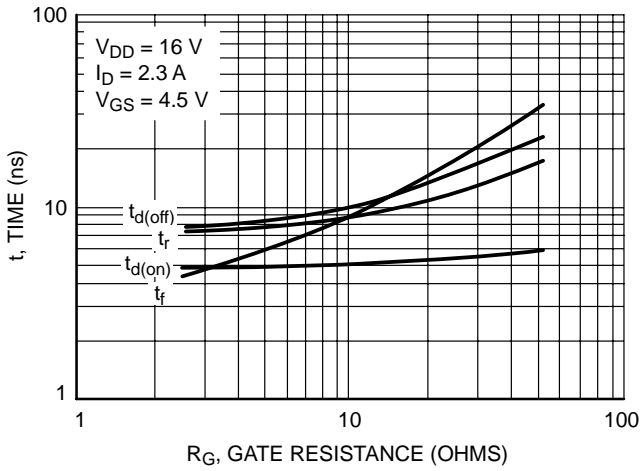


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

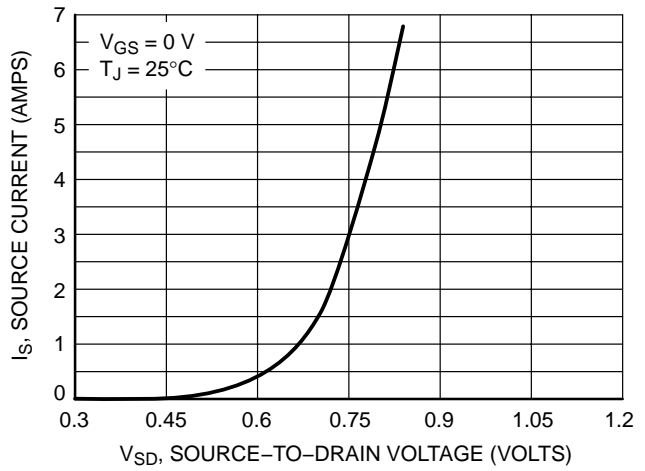


Figure 10. Diode Forward Voltage vs. Current

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SOLDERING FOOTPRINTS*

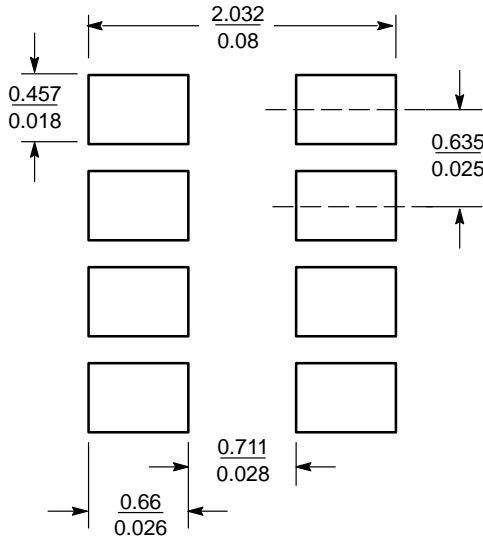


Figure 11. Basic

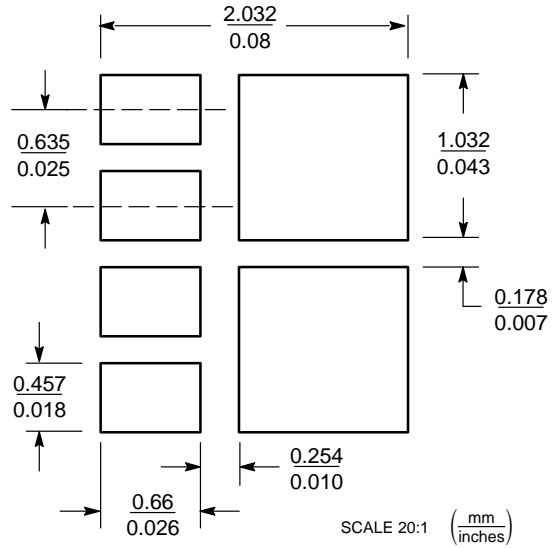


Figure 12. Style 2

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

BASIC PAD PATTERNS

The basic pad layout with dimensions is shown in Figure 11. This is sufficient for low power dissipation MOSFET applications, but power semiconductor performance requires a greater copper pad area, particularly for the drain leads.

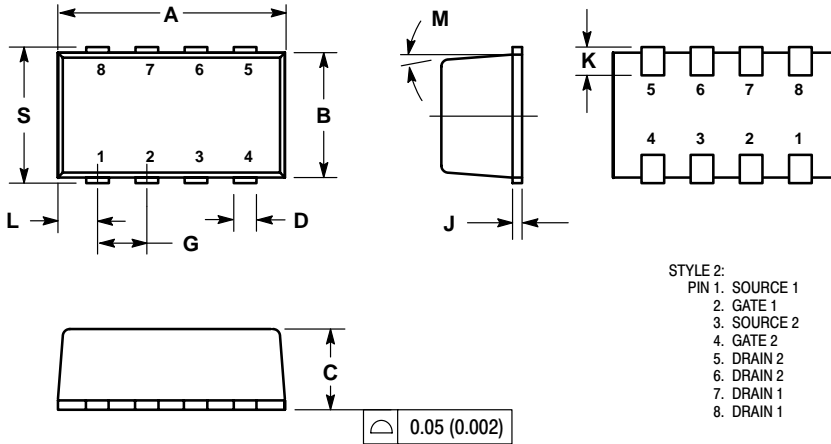
The minimum recommended pad pattern shown in Figure 12 improves the thermal area of the drain connections (pins 5, 6, 7, 8) while remaining within the confines of the basic

footprint. The drain copper area is 0.0019 sq. in. (or 1.22 sq. mm). This will assist the power dissipation path away from the device (through the copper lead-frame) and into the board and exterior chassis (if applicable) for the single device. The addition of a further copper area and/or the addition of vias to other board layers will enhance the performance still further.

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PACKAGE DIMENSIONS

ChipFET CASE 1206A-03 ISSUE E




- STYLE 2:
 PIN 1. SOURCE 1
 2. GATE 1
 3. SOURCE 2
 4. GATE 2
 5. DRAIN 2
 6. DRAIN 2
 7. DRAIN 1
 8. DRAIN 1

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH ALLOWED ON THE TOP AND BOTTOM LEAD SURFACE.
7. 1206A-01 AND 1206A-02 OBSOLETE. NEW STANDARD IS 1206A-03.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.95 | 3.10 | 0.116 | 0.122 |
| B | 1.55 | 1.70 | 0.061 | 0.067 |
| C | 1.00 | 1.10 | 0.039 | 0.043 |
| D | 0.25 | 0.35 | 0.010 | 0.014 |
| G | 0.65 BSC | | 0.025 BSC | |
| J | 0.10 | 0.20 | 0.004 | 0.008 |
| K | 0.28 | 0.42 | 0.011 | 0.017 |
| L | 0.55 BSC | | 0.022 BSC | |
| M | 5° NOM | | 5° NOM | |
| S | 1.80 | 2.00 | 0.072 | 0.080 |

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