**AME, Inc.**

**AME5131**

## ■ General Description

The AME5131 is a high-frequency boost converter dedicated for LCD bias supply and white LED applications for cellular phone backlighting, PDAs, and other hand-held devices. The part can also be used to generate standard 3.3 V/5 V to 12 V power conversions.

The AME5131 has an internal 400mA switch current limit, offering lower output voltage ripple. The 32μA low quiescent current together with an optimized control scheme, allows device operation at high efficiencies and maintains long battery lifetime. AME5131 uses SOT-25 package and gives a small size solution.
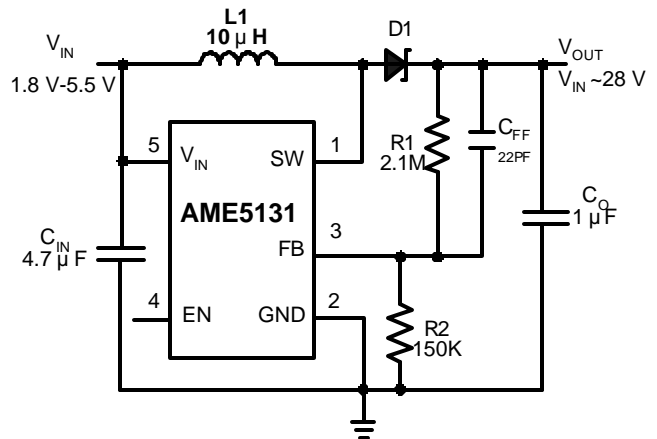
## ■ Features
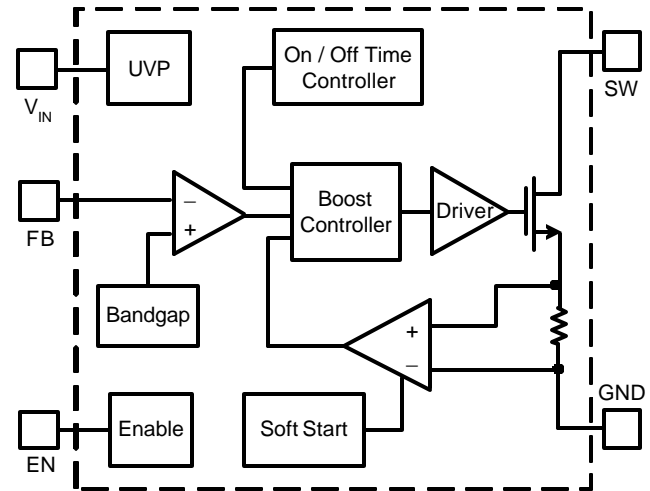
- 0.6Ω Internal Switch
- 1.8V to 5.5V Input Range
- Adjustable Output Voltage Up to 28V
- Input Under Voltage Protection
- 32μA Typical No Load Quiescent Current
- 1μA Shutdown Current
- SOT-25 Package
- All AME's Lead Free Products Meet RoHS Standards
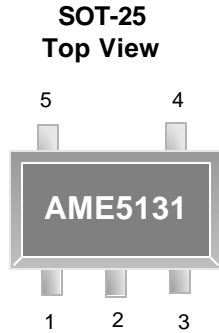
## ■ Applications

- White LED Back-Lighting
- Hand-held Devices
- Digital Cameras
- Portable Applications
- Internet Audio Player
- LCD Bias Power
- Standard 3.3 V/5 V to 12 V Conversions

## ■ Function Block Diagram



## ■ Typical Application

**AME, Inc.**

**Low Power
DC/DC Boost Converter**

# ■ Pin Configuration

**SOT-25
Top View**

5    4

**AME5131**

1    2    3

**AME5131AEEV**

1.  SW
2.  GND
3.  FB
4.  EN
5.  $V_{IN}$

**\* Die Attach:
   Conductive Epoxy**

# ■ Pin Description

| Pin Number | Pin Name | Pin Description |
|:---:|:---:|:---|
| 1 | SW | This is the switch pin and is connected to the drain of the internal NMOS power switch. Minimize the metal trace area connected to this pin to minimize EMI. |
| 2 | GND | Ground Pin. |
| 3 | FB | Feedback Input Pin.<br>Connect this pin to the external voltage divider to program the desired output voltage. |
| 4 | EN | Enable Control Input Pin. (Active High) |
| 5 | $V_{IN}$ | Input Supply Pin.<br>Place bypass capacitor as close to $V_{IN}$ as possible. |

# ■ Ordering Information

**AME5131  x  x  x  x  xxx  x**

- Special Feature
- Output Voltage
- Number of Pins
- Package Type
- Operating Ambient Temperature Range
- Pin Configuration
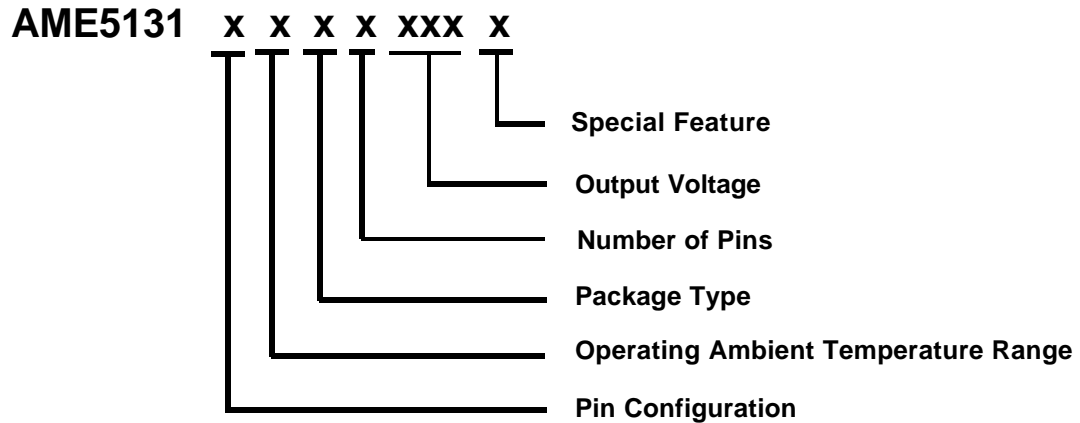
| Pin Configuration | Operating Ambient Temperature Range | Package Type | Number of Pins | Output Voltage | Special Feature |
|---|---|---|---|---|---|
| A (SOT-25)  1. SW  2. GND  3. FB  4. EN  5. $V_{IN}$ | E:  -40$^O$C to +85$^O$C | E:  SOT-2X | V:  5 | ADJ:  Adjustable | Z:  Lead free |

# ■ Ordering Information

| Part Number | Marking* | Output Voltage | Package | Operating Ambient Temperture Range |
|---|---|---|---|---|
| AME5131AEEVADJZ | BEFww | ADJ | SOT-25 | -40$^O$C to +85$^O$C |

Note: ww represents the date code and pls refer to Date Code Rule page on Package Dimension.
    * A line on top of the first letter represents lead free plating such as BEFww.
Please consult AME sales office or authorized Rep./Distributor for the availability of package type.

# ■ Absolute Maximum Ratings

| Parameter | Symbol | Maximum | Unit |
|---|---|---|---|
| Input Supply Voltage | $V_{IN}$ | 6 | |
| EN, FB Voltages | $V_{EN}$, $V_{FB}$ | $V_{IN}$ | V |
| SW Voltage | $V_{SW}$ | 30 | |
| ESD Classification | C* | | |

Caution: Stree above the listed absolute maximum rating may cause permanent damage to the device.
HBM C: 4000V+

# ■ Recommended Operating Conditions

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Ambient Temperature Range | $T_A$ | -40 to +85 | $^oC$ |
| Junction Temperature Range | $T_J$ | -40 to +125 | |

# ■ Thermal Information

| Parameter | Package | Die Attach | Symbol | Maximum | Unit |
|---|---|---|---|---|---|
| Thermal Resistance* (Junction to Case) | | | $\theta_{JC}$ | 81 | $^oC$ / W |
| Thermal Resistance (Junction to Ambient) | SOT-25 | Conductive Epoxy | $\theta_{JA}$ | 260 | $^oC$ / W |
| Internal Power Dissipation | | | $P_D$ | 400 | mW |
| Maximum Junction Temperature | | | | 150 | $^oC$ |
| Solder Iron (10 Sec)** | | | | 350 | $^oC$ |

* Measure $\theta_{JC}$ on center of molding compound if IC has no tab.
** MIL-STD-202G210F

# ■ Electrical Specifications

$V_{IN}$ = 2.4V, EN = $V_{IN}$, $T_A$ = -40°C to 85°C, typical values are at $T_A$ = 25°C

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | 1.8 | | 5.5 | V |
| Quiescent Current | $I_Q$ | $I_{OUT}$ = 0mA, not switching, $V_{FB}$ = 1.3V | | 32 | 50 | μA |
| Shutdown Current | $I_{SD}$ | EN = GND | | 0.1 | 1 | |
| FB Pin Bias Current | $I_{FB}$ | $V_{FB}$ = 1.3V | | | 1 | |
| Feedback Trip Point | $V_{FB}$ | 1.8V  $V_{IN}$  5.5V | 1.187 | 1.212 | 1.237 | V |
| UVP Voltage | UVP | | | 1.5 | 1.7 | V |
| Switch Current Limit | $I_{CL}$ | $V_{OUT}$ = 18V, $I_{OUT}$ = 10mA, $T_A$=25°C | 350 | 400 | 450 | mA |
| Switch $R_{DSON}$ | $R_{DSON}$ | $V_{IN}$ = 2.4V; $I_{SW}$ = 200mA | | 0.6 | 1 | Ω |
| SW leakage current | $I_{SW}$ | $V_{SW}$ = 28V | | 1 | 10 | μA |
| Switch Off Time | $t_{OFF}$ | | | 400 | | ns |
| Switch On Time | $t_{ON}$ | | | 6 | | μs |
| EN Input Current | $I_{EN}$ | EN = GND or $V_{IN}$ | | 0.1 | 1 | μA |
| EN Input Threshold (High) | $V_{EH}$ | Device Active | 1.3 | | | V |
| EN Input Threshold (Low) | $V_{EL}$ | Device Shutdown | | | 0.4 | V |
| Line Regulation | $REG_{LINE}$ | 1.8  $V_{IN}$  5.5V; $V_{OUT}$ =18V; $I_{LOAD}$ =10mA; Cff = not connected | | 0.3 | | %/V |
| Load Regulation | $REG_{LOAD}$ | $V_{IN}$ =2.4V; $V_{OUT}$ =18V; 0mA  $I_{OUT}$  30mA | | 0.15 | | %/mA |

# ■ Detailed Description

### Operation

The AME5131 is a boost converter with a smart control scheme that operates in a pulse frequency modulation (PFM) with constant peak current control.
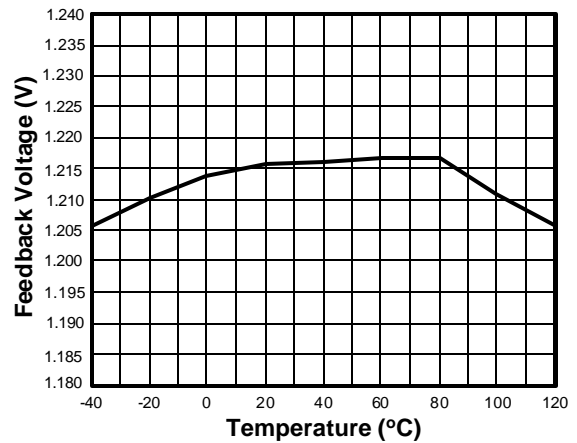
The smart control schemes utilize a reference voltage, minimum off-time, maximum on-time and current-limited control scheme. The switch turns off as the inductor current reaches the internally set peak current of 400mA (typical). The second criteria that turns off the switch is the maximum on-time of 6μs (typical). As the switch is turned off the external Schottky diode is forward biased delivering the current to the output. The switch remains off for a minimum of 400 ns (typical), or until the feedback voltage drops below the reference voltage.

Using this PFM peak current control scheme the converter operates in discontinuous conduction mode (DCM) where the switching frequency depends on the output current, which results in high efficiency over the entire load current range. This regulation scheme is inherently stable, allowing a wider selection range for the inductor and output capacitor.

### Soft-start

Soft-start is provided on the AME5131 to minimize inrush current. All inductive boost converters exhibit high inrush current during start-up if no special precaution is made. This can cause voltage drops at the input rail during start up and may result in an unwanted or early system shut down.

The soft-start time is set by increasing the current limit in two steps starting from 100mA for 256 cycles to 200mA for the next 256 cycles, and then full current limit.
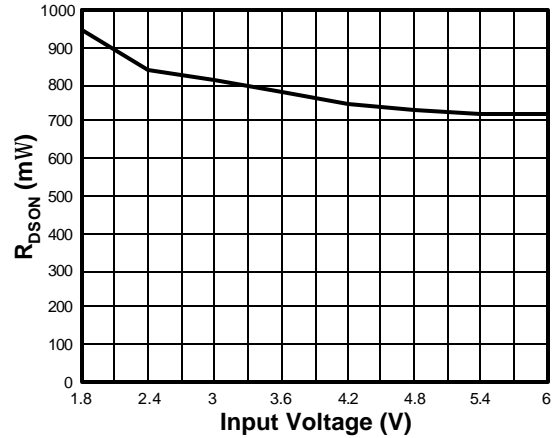
## Efficiency vs Output Current
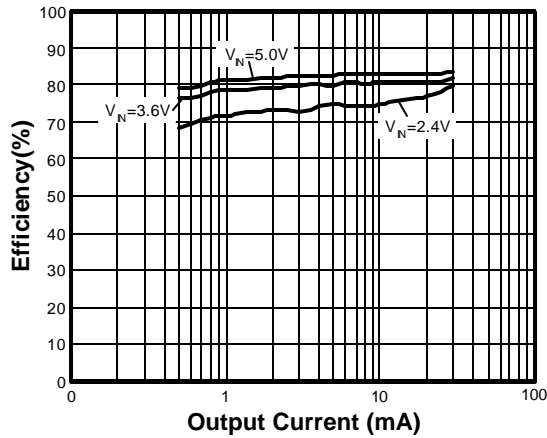


## Efficiency vs Input Voltage
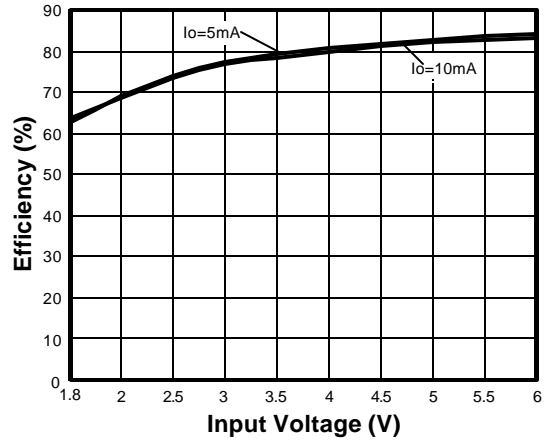


## $V_{OUT}$ vs $I_{OUT}$
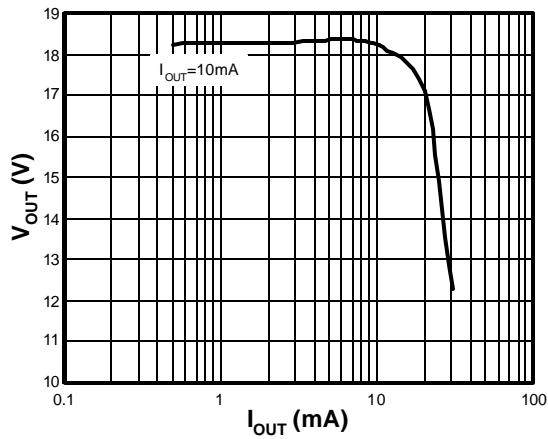


## $V_{OUT}$ vs $V_{IN}$
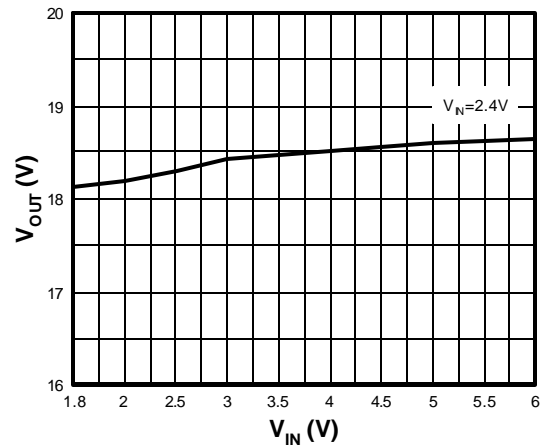


## Quiescent Current vs Input Voltage
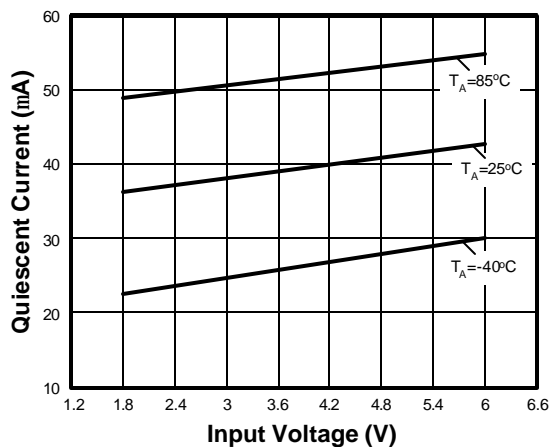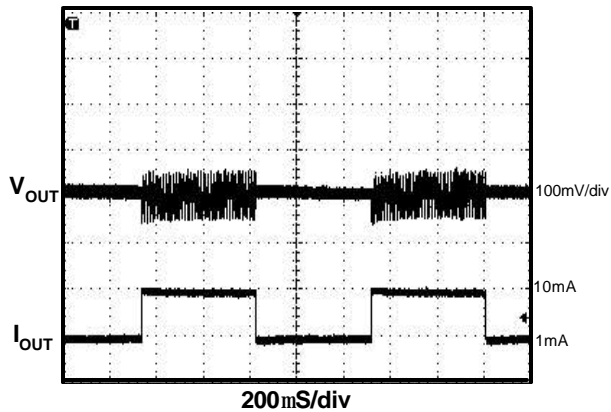


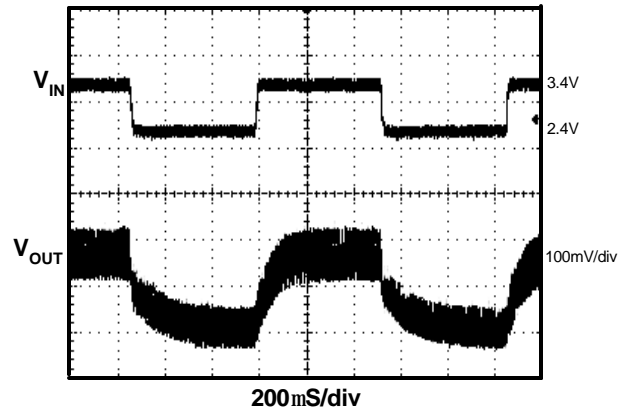## Feedback Voltage vs Temperature

**R$_{DSON}$ vs Temperture**
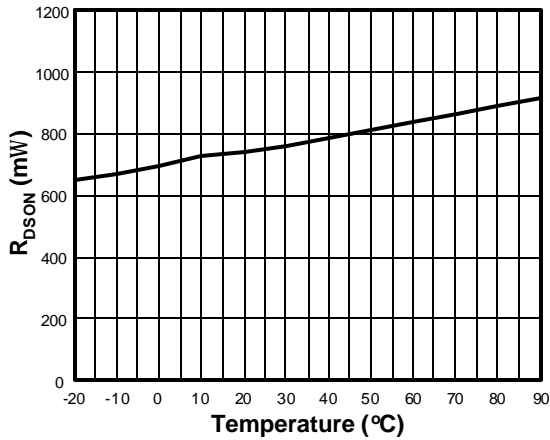


**R$_{DSON}$ vs Input Voltage**



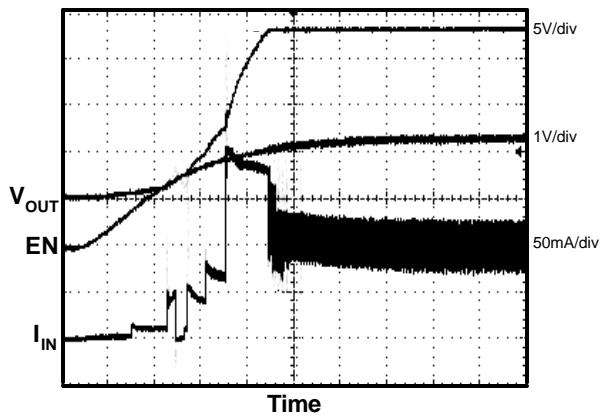**Load Transient Response**



**Line Transient Response**



**Start Up Behavior**

# ■ Date Code Rule

| Marking | | | Date Code | | Year |
|---|---|---|---|---|---|
| A | A | A | W | W | xxx0 |
| A | A | A | W | <u>W</u> | xxx1 |
| A | A | A | <u>W</u> | W | xxx2 |
| A | A | A | <u>W</u> | <u>W</u> | xxx3 |
| A | A | <u>A</u> | W | W | xxx4 |
| A | A | <u>A</u> | W | <u>W</u> | xxx5 |
| A | A | <u>A</u> | <u>W</u> | W | xxx6 |
| A | A | <u>A</u> | <u>W</u> | <u>W</u> | xxx7 |
| A | <u>A</u> | A | W | W | xxx8 |
| A | <u>A</u> | A | W | <u>W</u> | xxx9 |

# ■ Tape and Reel Dimension

**SOT-25**
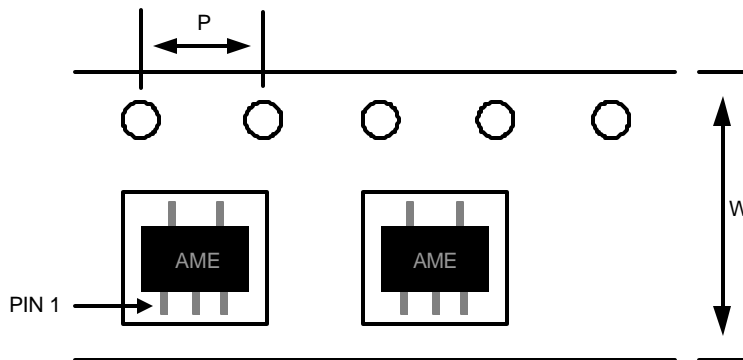


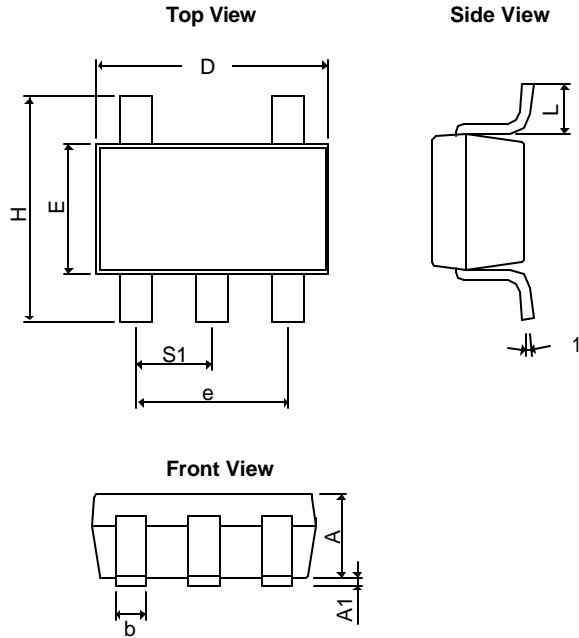**Carrier Tape, Number of Components Per Reel and Reel Size**

| Package | Carrier Width (W) | Pitch (P) | Part Per Full Reel | Reel Size |
|---|---|---|---|---|
| SOT-25 | 8.0±0.1 mm | 4.0±0.1 mm | 3000pcs | 180±1 mm |

# ■ Package Dimension

### SOT-25

**Top View**

**Side View**

**Front View**

| SYMBOLS | MILLIMETERS | | INCHES | |
|:---:|:---:|:---:|:---:|:---:|
| | **MIN** | **MAX** | **MIN** | **MAX** |
| **A** | 1.20REF | | 0.0472REF | |
| **A₁** | 0.00 | 0.15 | 0.0000 | 0.0059 |
| **b** | 0.30 | 0.55 | 0.0118 | 0.0217 |
| **D** | 2.70 | 3.10 | 0.1063 | 0.1220 |
| **E** | 1.40 | 1.80 | 0.0551 | 0.0709 |
| **e** | 1.90 BSC | | 0.07480 BSC | |
| **H** | 2.60 | 3.00 | 0.10236 | 0.11811 |
| **L** | 0.37BSC | | 0.0146BSC | |
| **q1** | 0° | 10° | 0° | 10° |
| **S₁** | 0.95BSC | | 0.0374BSC | |

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