

# MC100EL14

## 5V ECL 1:5 Clock Distribution Chip

The MC100EL14 is a low skew 1:5 clock distribution chip designed explicitly for low skew clock distribution applications. The  $V_{BB}$  pin, an internally generated voltage supply, is available to this device only. For single-ended input conditions, the unused differential input is connected to  $V_{BB}$  as a switching reference voltage.  $V_{BB}$  may also rebias AC coupled inputs. When used, decouple  $V_{BB}$  and  $V_{CC}$  via a 0.01  $\mu\text{F}$  capacitor and limit current sourcing or sinking to 0.5 mA. When not used,  $V_{BB}$  should be left open.

The EL14 features a multiplexed clock input to allow for the distribution of a lower speed scan or test clock along with the high speed system clock. When LOW (or left open and pulled LOW by the input pulldown resistor) the SEL pin will select the differential clock input.

The common enable ( $\overline{\text{EN}}$ ) is synchronous so that the outputs will only be enabled/disabled when they are already in the LOW state. This avoids any chance of generating a runt clock pulse when the device is enabled/disabled as can happen with an asynchronous control. The internal flip flop is clocked on the falling edge of the input clock, therefore all associated specification limits are referenced to the negative edge of the clock input.

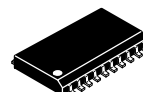
### Features

- 50 ps Output-to-Output Skew
- Synchronous Enable/Disable
- Multiplexed Clock Input
- The 100 Series Contains Temperature Compensation
- PECL Mode Operating Range:  $V_{CC} = 4.2 \text{ V}$  to  $5.7 \text{ V}$  with  $V_{EE} = 0 \text{ V}$
- NECL Mode Operating Range:  $V_{CC} = 0 \text{ V}$  with  $V_{EE} = -4.2 \text{ V}$  to  $-5.7 \text{ V}$
- Q Output will Default LOW with Inputs Open or at  $V_{EE}$
- Internal Input Pull-down Resistors on All Inputs, Pull-up Resistors on Inverted Inputs



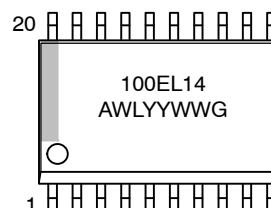
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<http://onsemi.com>



SOIC-20L  
DW SUFFIX  
CASE 751D

### MARKING DIAGRAM



A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

\*For additional marking information, refer to Application Note AND8002/D.

### ORDERING INFORMATION

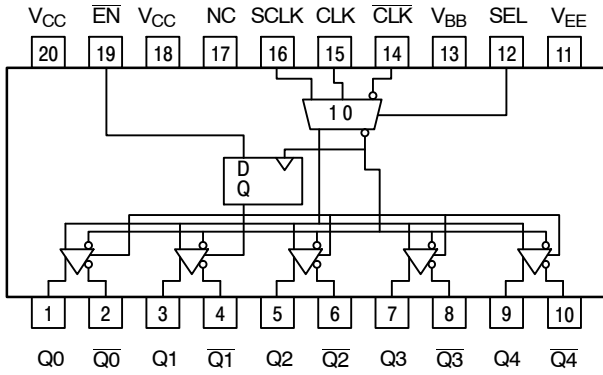
See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

## MC100EL14

- Pb-Free Packages are Available\*

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

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\* All V<sub>CC</sub> pins are tied together on the die.

Warning: All V<sub>CC</sub> and V<sub>EE</sub> pins must be externally connected to Power Supply to guarantee proper operation.

**Figure 1. Logic Diagram and Pinout Assignment**

**Table 1. PIN DESCRIPTION**

| PIN  | FUNCTION                 |
|--|--------------------------|
| CLK, $\overline{\text{CLK}}$                   | ECL Diff Clock Inputs    |
| SCLK   | ECL Scan Clock Input     |
| EN   | ECL Sync Enable          |
| SEL  | ECL Clock Select Input   |
| Q <sub>0-4</sub> , $\overline{\text{Q}}_{0-4}$ | ECL Diff Clock Outputs   |
| V <sub>BB</sub>                                | Reference Voltage Output |
| V <sub>CC</sub>                                | Positive Supply          |
| V <sub>EE</sub>                                | Negative Supply          |
| NC   | No Connect               |

**Table 2. FUNCTION TABLE**

| CLK* | SCLK* | SEL* | $\overline{\text{EN}}^*$ | Q       |
|------|-------|------|--------------------------|---------|
| L    | X     | L    | L                        | L       |
| H    | X     | L    | L                        | H       |
| X    | L     | H    | L                        | L       |
| X    | H     | H    | L                        | H       |
| X    | X     | X    | H                        | L       |
|      |       |      |                          | (Note ) |

1. On next negative transition of CLK or SCLK

\*\*Pins will default low when left open.

**Table 3. ATTRIBUTES**

| Characteristics  | Value  |
|--|--|
| Internal Input Pulldown Resistor                       | 75 k $\Omega$  |
| Internal Input Pullup Resistor                         | 75 k $\Omega$  |
| ESD Protection   | Human Body Model > 2 kV<br>Machine Model > 200 V<br>Charge Device Model > 4 kV |
| Moisture Sensitivity (Note 2)                          | Pb Level 1<br>Pb-Free Level 3  |
| Flammability Rating                                    | Oxygen Index: 28 to 34<br>UL 94 V-0 @ 0.125 in                                 |
| Transistor Count                                       | 303 Devices  |
| Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test |  |

2. For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

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**Table 4. MAXIMUM RATINGS**

| Symbol        | Parameter                                | Condition 1                          | Condition 2       | Rating      | Unit                        |
|---------------|--|--------------------------------------|-------------------|-------------|-----------------------------|
| $V_{CC}$      | PECL Mode Power Supply                   | $V_{EE} = 0\text{ V}$                |                   | 8           | V                           |
| $V_{EE}$      | NECL Mode Power Supply                   | $V_{CC} = 0\text{ V}$                |                   | -8          | V                           |
| $V_I$         | PECL Mode Input Voltage                  | $V_{EE} = 0\text{ V}$                | $V_I \leq V_{CC}$ | 6           | V                           |
|               | NECL Mode Input Voltage                  | $V_{CC} = 0\text{ V}$                | $V_I \geq V_{EE}$ | -6          | V                           |
| $I_{out}$     | Output Current                           | Continuous<br>Surge                  |                   | 50          | mA                          |
|               |  |                                      |                   | 100         | mA                          |
| $I_{BB}$      | $V_{BB}$ Sink/Source                     |                                      |                   | $\pm 0.5$   | mA                          |
| $T_A$         | Operating Temperature Range              |                                      |                   | -40 to +85  | $^{\circ}\text{C}$          |
| $T_{stg}$     | Storage Temperature Range                |                                      |                   | -65 to +150 | $^{\circ}\text{C}$          |
| $\theta_{JA}$ | Thermal Resistance (Junction-to-Ambient) | 0 lfpm                               | SOIC-20L          | 90          | $^{\circ}\text{C}/\text{W}$ |
|               |  | 500 lfpm                             | SOIC-20L          | 60          | $^{\circ}\text{C}/\text{W}$ |
| $\theta_{JC}$ | Thermal Resistance (Junction-to-Case)    | Standard Board                       | SOIC-20L          | 30 to 35    | $^{\circ}\text{C}/\text{W}$ |
| $T_{sol}$     | Wave Solder                              | Pb                                   |                   | 265         | $^{\circ}\text{C}$          |
|               |  | Pb-Free                              |                   | 265         |                             |
|               |  | <2 to 3 sec @ 248 $^{\circ}\text{C}$ |                   |             |                             |
|               |  | <2 to 3 sec @ 260 $^{\circ}\text{C}$ |                   |             |                             |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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**Table 5. 100EL SERIES PECL DC CHARACTERISTICS**  $V_{CC} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  (Note 3)

| Symbol      | Characteristic   | -40°C      |      |            | 25°C       |      |            | 85°C       |      |            | Unit          |
|-------------|--|------------|------|------------|------------|------|------------|------------|------|------------|---------------|
|             |  | Min        | Typ  | Max        | Min        | Typ  | Max        | Min        | Typ  | Max        |               |
| $I_{EE}$    | Power Supply Current   |            | 32   | 40         |            | 32   | 40         |            | 34   | 42         | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 4)   | 3915       | 3995 | 4120       | 3975       | 4045 | 4120       | 3975       | 4050 | 4120       | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 4)  | 3170       | 3305 | 3445       | 3190       | 3295 | 3380       | 3190       | 3295 | 3380       | mV            |
| $V_{IH}$    | Input HIGH Voltage (Single-Ended)  | 3835       |      | 4120       | 3835       |      | 4120       | 3835       |      | 4120       | mV            |
| $V_{IL}$    | Input LOW Voltage (Single-Ended)   | 3190       |      | 3525       | 3190       |      | 3525       | 3190       |      | 3525       | mV            |
| $V_{BB}$    | Output Voltage Reference   | 3.62       |      | 3.74       | 3.62       |      | 3.74       | 3.62       |      | 3.74       | V             |
| $V_{IHCMR}$ | Common Mode Range<br>(Differential Configuration)<br>(Note 5)<br>$V_{PP} < 500\text{ mV}$<br>$V_{PP} \geq 500\text{ mV}$ | 1.3<br>1.5 |      | 4.6<br>4.6 | 1.2<br>1.4 |      | 4.6<br>4.6 | 1.2<br>1.4 |      | 4.6<br>4.6 | V             |
| $I_{IH}$    | Input HIGH Current   |            |      | 150        |            |      | 150        |            |      | 150        | $\mu\text{A}$ |
| $I_{IL}$    | Input LOW Current  | 0.5        |      |            | 0.5        |      |            | 0.5        |      |            | $\mu\text{A}$ |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

- Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $+0.8\text{ V} / -0.5\text{ V}$ .
- Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
- $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ .  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between  $V_{PP}(\text{min})$  and  $1\text{ V}$ .

**Table 6. 100EL SERIES NECL DC CHARACTERISTICS**  $V_{CC} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 6)

| Symbol      | Characteristic   | -40°C        |       |              | 25°C         |       |              | 85°C         |       |              | Unit          |
|-------------|--|--------------|-------|--------------|--------------|-------|--------------|--------------|-------|--------------|---------------|
|             |  | Min          | Typ   | Max          | Min          | Typ   | Max          | Min          | Typ   | Max          |               |
| $I_{EE}$    | Power Supply Current   |              | 32    | 40           |              | 32    | 40           |              | 34    | 42           | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 7)   | -1085        | -1005 | -880         | -1025        | -955  | -880         | -1025        | -955  | -880         | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 7)  | -1830        | -1695 | -1555        | -1810        | -1705 | -1620        | -1810        | -1705 | -1620        | mV            |
| $V_{IH}$    | Input HIGH Voltage (Single-Ended)  | -1165        |       | -880         | -1165        |       | -880         | -1165        |       | -880         | mV            |
| $V_{IL}$    | Input LOW Voltage (Single-Ended)   | -1810        |       | -1475        | -1810        |       | -1475        | -1810        |       | -1475        | mV            |
| $V_{BB}$    | Output Voltage Reference   | -1.38        |       | -1.26        | -1.38        |       | -1.26        | -1.38        |       | -1.26        | V             |
| $V_{IHCMR}$ | Common Mode Range<br>(Differential Configuration)<br>(Note 8)<br>$V_{PP} < 500\text{ mV}$<br>$V_{PP} \geq 500\text{ mV}$ | -3.7<br>-3.5 |       | -0.4<br>-0.4 | -3.8<br>-3.6 |       | -0.4<br>-0.4 | -3.8<br>-3.6 |       | -0.4<br>-0.4 | V             |
| $I_{IH}$    | Input HIGH Current   |              |       | 150          |              |       | 150          |              |       | 150          | $\mu\text{A}$ |
| $I_{IL}$    | Input LOW Current  | 0.5          |       |              | 0.5          |       |              | 0.5          |       |              | $\mu\text{A}$ |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

- Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $+0.8\text{ V} / -0.5\text{ V}$ .
- Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
- $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ .  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between  $V_{PP}(\text{min})$  and  $1\text{ V}$ .

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**Table 7. AC CHARACTERISTICS**  $V_{CC} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  or  $V_{CC} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 9)

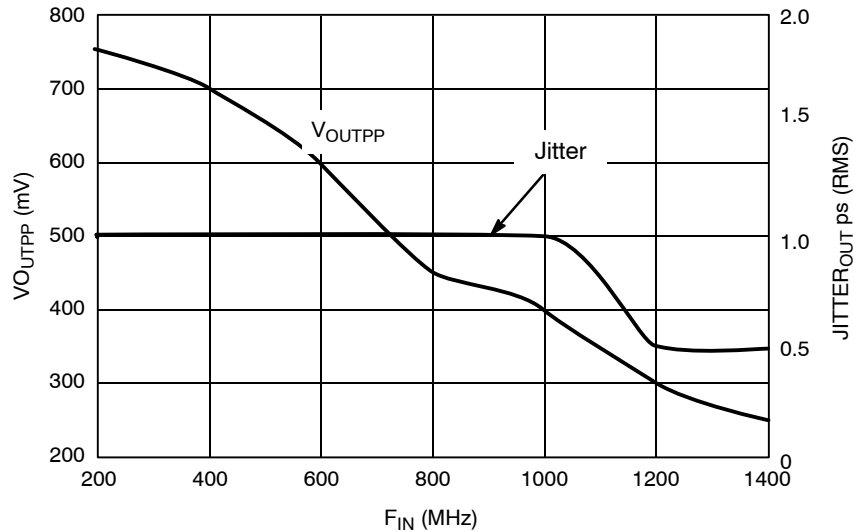
| Symbol                 | Characteristic  | -40°C             |     |                   | 25°C              |                   |                   | 85°C              |     |                   | Unit |
|------------------------|---|-------------------|-----|-------------------|-------------------|-------------------|-------------------|-------------------|-----|-------------------|------|
|                        |   | Min               | Typ | Max               | Min               | Typ               | Max               | Min               | Typ | Max               |      |
| $f_{max}$              | Maximum Toggle Frequency<br>(See Figure 2, $f_{MAX}/\text{Jitter}$ )          |                   | 1   |                   |                   | 1                 |                   |                   | 1   |                   | GHz  |
| $t_{PLH}$<br>$t_{PHL}$ | Prop Delay<br>CLK to Q (Diff)<br>CLK to Q (SE)<br>SCLK to Q                   | 520<br>470<br>470 |     | 720<br>770<br>770 | 580<br>530<br>530 | 680<br>680<br>680 | 780<br>830<br>830 | 630<br>580<br>580 |     | 830<br>880<br>880 | ps   |
| $t_{SKEW}$             | Part-to-Part Skew<br>Within-Device Skew (Note 10)                             |                   |     | 200<br>50         |                   |                   | 200<br>50         |                   |     | 200<br>50         | ps   |
| $t_{JITTER}$           | Random Clock Jitter (RMS) @ 1 GHz<br>(See Figure 2, $f_{MAX}/\text{Jitter}$ ) |                   | 1   |                   |                   | 1                 |                   |                   | 1   |                   | ps   |
| $t_S$                  | Setup Time $\overline{EN}$  | 0                 |     |                   | 0                 | -133              |                   | 0                 |     |                   | ps   |
| $t_H$                  | Hold Time $\overline{EN}$   | 250               |     |                   | 250               | 140               |                   | 250               |     |                   | ps   |
| $V_{PP}$               | Input Swing (Note 11)   | 150               |     | 1000              | 150               |                   | 1000              | 150               |     | 1000              | mV   |
| $t_r$<br>$t_f$         | Output Rise/Fall Times Q<br>(20% - 80%)                                       | 230               |     | 500               | 230               |                   | 500               | 230               |     | 500               | ps   |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

9.  $V_{EE}$  can vary +0.8 V / -0.5 V. Outputs are terminated through a 50  $\Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .

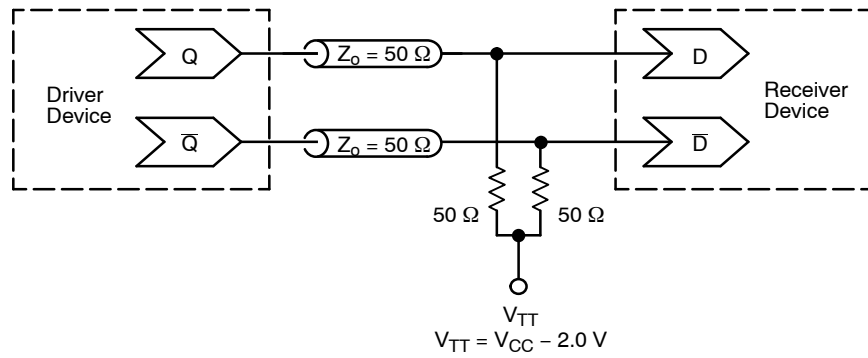
10. Skews are specified for identical LOW-to-HIGH or HIGH-to-LOW transitions.

11.  $V_{PP}(\text{min})$  is the minimum input swing for which AC parameters guaranteed. The device has a DC gain of  $\approx 40$ .



**Figure 2. Output Voltage Amplitude / RMS Jitter vs. Input Frequency at Ambient Temperature (Typical)**

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**Figure 3. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)**

### ORDERING INFORMATION<sup>4</sup>

| Device         | Package               | Shipping <sup>†</sup> |
|----------------|-----------------------|-----------------------|
| MC100EL14DW    | SOIC-20L              | 38 Units / Rail       |
| MC100EL14DWG   | SOIC-20L<br>(Pb-Free) | 38 Units / Rail       |
| MC100EL14DWR2  | SOIC-20L              | 1000 / Tape & Reel    |
| MC100EL14DWR2G | SOIC-20L<br>(Pb-Free) | 1000 / Tape & Reel    |

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

## MC100EL14

### Resource Reference of Application Notes

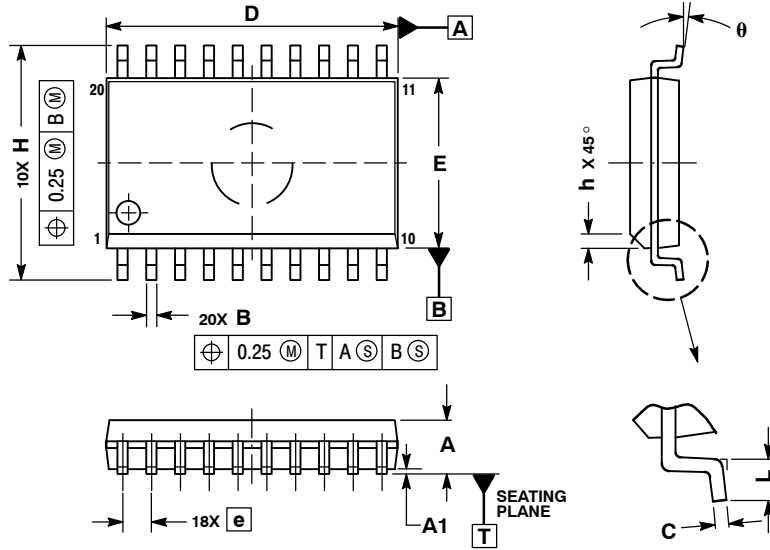
- AN1405/D** – ECL Clock Distribution Techniques
- AN1406/D** – Designing with PECL (ECL at +5.0 V)
- AN1503/D** – ECLinPS™ I/O SPICE Modeling Kit
- AN1504/D** – Metastability and the ECLinPS Family
- AN1568/D** – Interfacing Between LVDS and ECL
- AN1672/D** – The ECL Translator Guide
- AND8001/D** – Odd Number Counters Design
- AND8002/D** – Marking and Date Codes
- AND8020/D** – Termination of ECL Logic Devices
- AND8066/D** – Interfacing with ECLinPS
- AND8090/D** – AC Characteristics of ECL Devices



# MC100EL14

## PACKAGE DIMENSIONS

SO-20 WB  
CASE 751D-05  
ISSUE G



### NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM   | MILLIMETERS |       |
|-------|-------------|-------|
|       | MIN         | MAX   |
| A     | 2.35        | 2.65  |
| A1    | 0.10        | 0.25  |
| B     | 0.35        | 0.49  |
| C     | 0.23        | 0.32  |
| D     | 12.65       | 12.95 |
| E     | 7.40        | 7.60  |
| e     | 1.27 BSC    |       |
| H     | 10.05       | 10.55 |
| h     | 0.25        | 0.75  |
| L     | 0.50        | 0.90  |
| theta | 0°          | 7°    |

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