

# MC10E151, MC100E151

## 5V ECL 6-Bit D Register

### Description

The MC10E/100E151 contains 6 D-type, edge-triggered, master-slave flip-flops with differential outputs. Data enters the master when both CLK1 and CLK2 are LOW, and is transferred to the slave when CLK1 or CLK2 (or both) go HIGH. The asynchronous Master Reset (MR) makes all Q outputs go LOW.

The 100 Series contains temperature compensation.

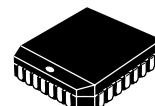
### Features

- 1100 MHz Min. Toggle Frequency
  - Differential Outputs
  - Asynchronous Master Reset
  - Dual Clocks
  - 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  $-5.7\text{ V}$
  - Internal Input  $50\text{ k}\Omega$  Pulldown Resistors
  - ESD Protection: Human Body Model;  $> 2\text{ kV}$ , Machine Model;  $> 200\text{ V}$
  - Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test
  - Moisture Sensitivity Level:  
Pb = 1  
Pb-Free = 3
- For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL 94 V-0 @ 0.125 in, Oxygen Index: 28 to 34
  - Transistor Count = 304 devices
  - Pb-Free Packages are Available\*



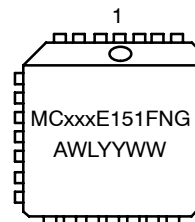
**ON Semiconductor®**

<http://onsemi.com>



PLCC-28  
FN SUFFIX  
CASE 776

### MARKING DIAGRAM\*



xxx = 10 or 100  
A = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

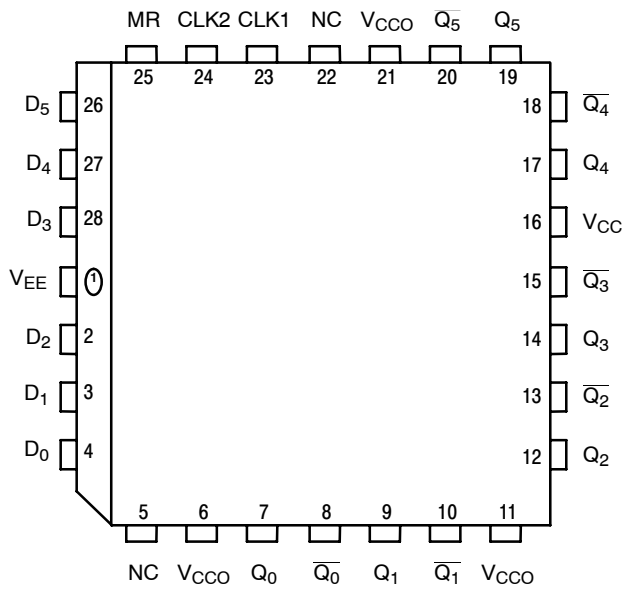
\*For additional marking information, refer to Application Note AND8002/D.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

\*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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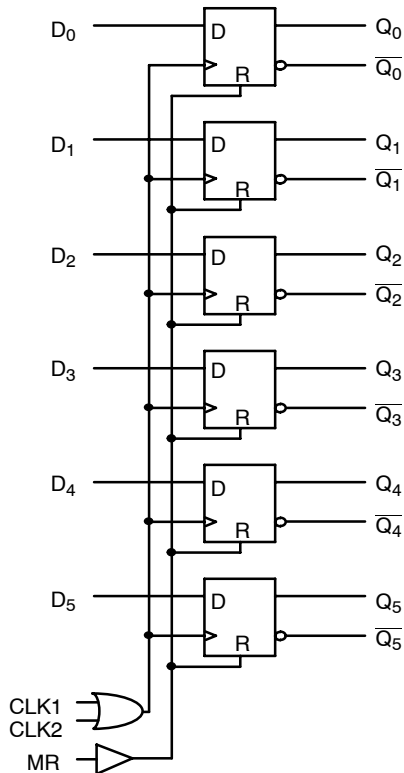
**Table 1. PIN DESCRIPTION**

| PIN   | FUNCTION                 |
|---|--------------------------|
| D <sub>0</sub> - D <sub>5</sub>                                       | ECL Data Inputs          |
| CLK1, CLK2  | ECL Clock Inputs         |
| MR  | ECL Master Reset         |
| Q <sub>0</sub> - Q <sub>5</sub> , $\overline{Q_0}$ - $\overline{Q_5}$ | ECL Differential Outputs |
| V <sub>CC</sub> , V <sub>CCO</sub>                                    | Positive Supply          |
| V <sub>EE</sub>   | Negative Supply          |
| NC  | No Connect               |

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

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

**Figure 1. Pinout: PLCC-28 (Top View)**



**Figure 2. Logic Diagram**

**Table 2. FUNCTION TABLE**

| MR |             | Q <sub>n</sub> |
|----|-------------|----------------|
| 1  | Reset       | L              |
| 0  | Operational | H              |

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**Table 3. MAXIMUM RATINGS**

| Symbol           | Parameter                                | Condition 1           | Condition 2                      | Rating       | Unit |
|------------------|--|-----------------------|----------------------------------|--------------|------|
| V <sub>CC</sub>  | PECL Mode Power Supply                   | V <sub>EE</sub> = 0 V |                                  | 8            | V    |
| V <sub>EE</sub>  | NECL Mode Power Supply                   | V <sub>CC</sub> = 0 V |                                  | -8           | V    |
| V <sub>I</sub>   | PECL Mode Input Voltage                  | V <sub>EE</sub> = 0 V | V <sub>I</sub> ≤ V <sub>CC</sub> | 6            | V    |
|                  | NECL Mode Input Voltage                  | V <sub>CC</sub> = 0 V | V <sub>I</sub> ≥ V <sub>EE</sub> | -6           | V    |
| I <sub>out</sub> | Output Current                           | Continuous<br>Surge   |                                  | 50           | mA   |
|                  |  |                       |                                  | 100          | mA   |
| T <sub>A</sub>   | Operating Temperature Range              |                       |                                  | 0 to +85     | °C   |
| T <sub>stg</sub> | Storage Temperature Range                |                       |                                  | -65 to +150  | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Junction-to-Ambient) | 0 lfpm                | PLCC-28                          | 63.5         | °C/W |
|                  |  | 500 lfpm              | PLCC-28                          | 43.5         | °C/W |
| θ <sub>JC</sub>  | Thermal Resistance (Junction-to-Case)    | Standard Board        | PLCC-28                          | 22 to 26     | °C/W |
| V <sub>EE</sub>  | PECL Operating Range                     |                       |                                  | 4.2 to 5.7   | V    |
|                  | NECL Operating Range                     |                       |                                  | -5.7 to -4.2 | V    |
| T <sub>sol</sub> | Wave Solder                              | Pb<br>Pb-Free         |                                  | 265          | °C   |
|                  |  |                       |                                  | 265          | °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.

**Table 4. 10E SERIES PECL DC CHARACTERISTICS** V<sub>CC</sub> = 5.0 V, V<sub>EE</sub> = 0.0 V (Note 1)

| Symbol          | Characteristic               | 0°C  |      |      | 25°C |      |      | 85°C |      |      | Unit |
|-----------------|------------------------------|------|------|------|------|------|------|------|------|------|------|
|                 |                              | Min  | Typ  | Max  | Min  | Typ  | Max  | Min  | Typ  | Max  |      |
| I <sub>EE</sub> | Power Supply Current         |      |      |      |      |      |      |      |      |      | mA   |
| V <sub>OH</sub> | Output HIGH Voltage (Note 2) | 3980 | 4070 | 4160 | 4020 | 4105 | 4190 | 4090 | 4185 | 4280 | mV   |
| V <sub>OL</sub> | Output LOW Voltage (Note 2)  | 3050 | 3210 | 3370 | 3050 | 3210 | 3370 | 3050 | 3227 | 3405 | mV   |
| V <sub>IH</sub> | Input HIGH Voltage           | 3830 | 3995 | 4160 | 3870 | 4030 | 4190 | 3940 | 4110 | 4280 | mV   |
| V <sub>IL</sub> | Input LOW Voltage            | 3050 | 3285 | 3520 | 3050 | 3285 | 3520 | 3050 | 3302 | 3555 | mV   |
| I <sub>IH</sub> | Input HIGH Current           |      |      |      |      |      |      |      |      |      | μA   |
| I <sub>IL</sub> | Input LOW Current            | 0.5  | 0.3  |      | 0.5  | 0.25 |      | 0.3  | 0.2  |      | μA   |

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 lfpm. 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.

1. Input and output parameters vary 1:1 with V<sub>CC</sub>. V<sub>EE</sub> can vary -0.46 V / +0.06 V.
2. Outputs are terminated through a 50 Ω resistor to V<sub>CC</sub> - 2.0 V.

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**Table 5. 10E SERIES NECL DC CHARACTERISTICS**  $V_{CCx} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 3)

| Symbol   | Characteristic               | 0°C   |       |       | 25°C  |       |       | 85°C  |       |       | Unit          |
|----------|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------|
|          |                              | Min   | Typ   | Max   | Min   | Typ   | Max   | Min   | Typ   | Max   |               |
| $I_{EE}$ | Power Supply Current         |       |       |       |       |       |       |       |       |       | mA            |
| $V_{OH}$ | Output HIGH Voltage (Note 4) | -1020 | -930  | -840  | -980  | -895  | -810  | -910  | -815  | -720  | mV            |
| $V_{OL}$ | Output LOW Voltage (Note 4)  | -1950 | -1790 | -1630 | -1950 | -1790 | -1630 | -1950 | -1773 | -1595 | mV            |
| $V_{IH}$ | Input HIGH Voltage           | -1170 | -1005 | -840  | -1130 | -970  | -810  | -1060 | -890  | -720  | mV            |
| $V_{IL}$ | Input LOW Voltage            | -1950 | -1715 | -1480 | -1950 | -1715 | -1480 | -1950 | -1698 | -1445 | mV            |
| $I_{IH}$ | Input HIGH Current           |       |       |       |       |       |       |       |       |       | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current            | 0.5   | 0.3   |       | 0.5   | 0.065 |       | 0.3   | 0.2   |       | $\mu\text{A}$ |

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.

3. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $-0.46\text{ V} / +0.06\text{ V}$ .

4. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .

**Table 6. 100E SERIES PECL DC CHARACTERISTICS**  $V_{CCx} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  (Note 5)

| Symbol   | Characteristic               | 0°C  |      |      | 25°C |      |      | 85°C |      |      | Unit          |
|----------|------------------------------|------|------|------|------|------|------|------|------|------|---------------|
|          |                              | Min  | Typ  | Max  | Min  | Typ  | Max  | Min  | Typ  | Max  |               |
| $I_{EE}$ | Power Supply Current         |      | 65   | 78   |      | 65   | 78   |      | 75   | 90   | mA            |
| $V_{OH}$ | Output HIGH Voltage (Note 6) | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | mV            |
| $V_{OL}$ | Output LOW Voltage (Note 6)  | 3190 | 3295 | 3380 | 3190 | 3255 | 3380 | 3190 | 3260 | 3380 | mV            |
| $V_{IH}$ | Input HIGH Voltage           | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | mV            |
| $V_{IL}$ | Input LOW Voltage            | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | mV            |
| $I_{IH}$ | Input HIGH Current           |      |      | 150  |      |      | 150  |      |      | 150  | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current            | 0.5  | 0.3  |      | 0.5  | 0.25 |      | 0.5  | 0.2  |      | $\mu\text{A}$ |

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.

5. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $-0.46\text{ V} / +0.8\text{ V}$ .

6. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2\text{ volts}$ .

**Table 7. 100E SERIES NECL DC CHARACTERISTICS**  $V_{CCx} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 7)

| Symbol   | Characteristic               | 0°C   |       |       | 25°C  |       |       | 85°C  |       |       | Unit          |
|----------|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------|
|          |                              | Min   | Typ   | Max   | Min   | Typ   | Max   | Min   | Typ   | Max   |               |
| $I_{EE}$ | Power Supply Current         |       | 65    | 78    |       | 65    | 78    |       | 75    | 90    | mA            |
| $V_{OH}$ | Output HIGH Voltage (Note 8) | -1025 | -950  | -880  | -1025 | -950  | -880  | -1025 | -950  | -880  | mV            |
| $V_{OL}$ | Output LOW Voltage (Note 8)  | -1810 | -1705 | -1620 | -1810 | -1745 | -1620 | -1810 | -1740 | -1620 | mV            |
| $V_{IH}$ | Input HIGH Voltage           | -1165 | -1025 | -880  | -1165 | -1025 | -880  | -1165 | -1025 | -880  | mV            |
| $V_{IL}$ | Input LOW Voltage            | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | mV            |
| $I_{IH}$ | Input HIGH Current           |       |       | 150   |       |       | 150   |       |       | 150   | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current            | 0.5   | 0.3   |       | 0.5   | 0.25  |       | 0.5   | 0.2   |       | $\mu\text{A}$ |

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.

7. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $-0.46\text{ V} / +0.8\text{ V}$ .

8. Outputs are terminated through a  $50\ \Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .

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**Table 8. AC CHARACTERISTICS**  $V_{CCx} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  or  $V_{CCx} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 9)

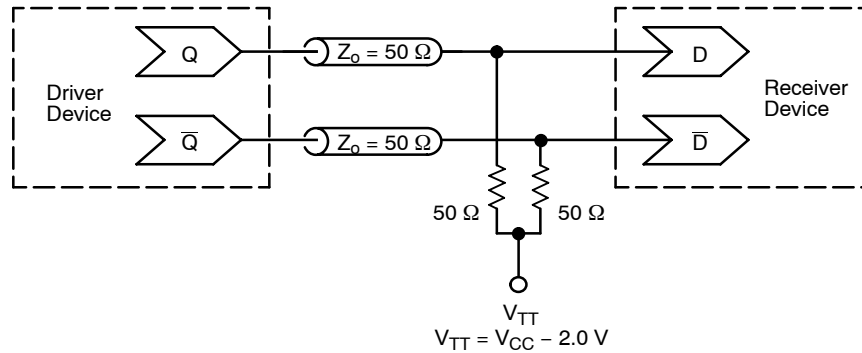
| Symbol                 | Characteristic                      | 0°C |      |     | 25°C |      |     | 85°C |      |     | Unit |
|------------------------|-------------------------------------|-----|------|-----|------|------|-----|------|------|-----|------|
|                        |                                     | Min | Typ  | Max | Min  | Typ  | Max | Min  | Typ  | Max |      |
| $f_{MAX}$              | Maximum Toggle Frequency            | 900 | 1100 |     | 900  | 1100 |     | 900  | 1100 |     | MHz  |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay to Output CLK, MR | 575 | 650  | 900 | 575  | 650  | 900 | 575  | 650  | 900 | ps   |
| $t_s$                  | Setup Time D                        | 0   | -175 |     | 0    | -175 |     | 0    | -175 |     | ps   |
| $t_h$                  | Hold Time D                         | 350 | 175  |     | 350  | 175  |     | 350  | 175  |     | ps   |
| $t_{RR}$               | Reset Recovery Time                 | 750 | 550  |     | 750  | 550  |     | 750  | 550  |     |      |
| $t_{PW}$               | Minimum Pulse Width CLK, MR         | 400 |      |     | 400  |      |     | 400  |      |     | ps   |
| $t_{SKEW}$             | Within-Device Skew (Note 10)        |     | 65   |     |      | 65   |     |      | 65   |     | ps   |
| $t_{JITTER}$           | Random Clock Jitter (RMS)           |     | < 1  |     |      | < 1  |     |      | < 1  |     | ps   |
| $t_r, t_f$             | Rise/Fall Times (20 - 80%)          | 300 | 450  | 700 | 300  | 450  | 700 | 300  | 450  | 700 | 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 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.

9. 10 Series:  $V_{EE}$  can vary  $-0.46\text{ V} / +0.06\text{ V}$ .

100 Series:  $V_{EE}$  can vary  $-0.46\text{ V} / +0.8\text{ V}$ .

10. Within-device skew is defined as identical transitions on similar paths through a device.



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

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## ORDERING INFORMATION

| Device         | Package              | Shipping†         |
|----------------|----------------------|-------------------|
| MC10E151FN     | PLCC-28              | 37 Units / Rail   |
| MC10E151FNG    | PLCC-28<br>(Pb-Free) | 37 Units / Rail   |
| MC10E151FNR2   | PLCC-28              | 500 / Tape & Reel |
| MC10E151FNR2G  | PLCC-28<br>(Pb-Free) | 500 / Tape & Reel |
| MC100E151FN    | PLCC-28              | 37 Units / Rail   |
| MC100E151FNG   | PLCC-28<br>(Pb-Free) | 37 Units / Rail   |
| MC100E151FNR2  | PLCC-28              | 500 / Tape & Reel |
| MC100E151FNR2G | PLCC-28<br>(Pb-Free) | 500 / Tape & Reel |

†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.

### 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

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## PACKAGE DIMENSIONS

PLCC-28  
FN SUFFIX  
PLASTIC PLCC PACKAGE  
CASE 776-02  
ISSUE E



**NOTES:**

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE BOTTOM MAY BE SMALLER THAN THE PACKAGE TOP BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.485     | 0.495 | 12.32       | 12.57 |
| B   | 0.485     | 0.495 | 12.32       | 12.57 |
| C   | 0.165     | 0.180 | 4.20        | 4.57  |
| E   | 0.090     | 0.110 | 2.29        | 2.79  |
| F   | 0.013     | 0.019 | 0.33        | 0.48  |
| G   | 0.050 BSC |       | 1.27 BSC    |       |
| H   | 0.026     | 0.032 | 0.66        | 0.81  |
| J   | 0.020     | ---   | 0.51        | ---   |
| K   | 0.025     | ---   | 0.64        | ---   |
| R   | 0.450     | 0.456 | 11.43       | 11.58 |
| U   | 0.450     | 0.456 | 11.43       | 11.58 |
| V   | 0.042     | 0.048 | 1.07        | 1.21  |
| W   | 0.042     | 0.048 | 1.07        | 1.21  |
| X   | 0.042     | 0.056 | 1.07        | 1.42  |
| Y   | ---       | 0.020 | ---         | 0.50  |
| Z   | 2°        |       | 10°         |       |
| G1  | 0.410     | 0.430 | 10.42       | 10.92 |
| K1  | 0.040     | ---   | 1.02        | ---   |

# MC10E151, MC100E151

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[74VHCV374FT\(BJ\)](#) [74VHCV574FT\(BJ\)](#) [SNJ54ALS574BJ](#) [SN74LVC74ADR](#) [SN74HC574PWR](#) [SN74HC374AN](#) [SN74AS574DWR](#)  
[SN74ALS175NSR](#) [SN74HC175D](#) [SN74AC74D](#) [74AHC1G79GV.125](#) [74AHC74D.112](#) [74HC112D.652](#) [74HC574D.652](#) [74HCT173D.652](#)  
[74HCT374D.652](#) [74AHC574D.118](#) [74AHCT1G79GW.125](#) [74HC273D.652](#) [74HC74D.653](#) [74HC107D.652](#) [74HC574D.653](#)