

# MC100EL38

## 5 V ECL ÷2, ÷4/6 Clock Generation Chip

### Description

The MC100EL38 is a low skew  $\pm 2$ ,  $\pm 4/6$  clock generation chip designed explicitly for low skew clock generation applications. The internal dividers are synchronous to each other, therefore, the common output edges are all precisely aligned. The device can be driven by either a differential or single-ended ECL or, if positive power supplies are used, PECL input signal.

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  $\mu$ F capacitor and limit current sourcing or sinking to 0.5 mA. When not used,  $V_{BB}$  should be left open.

The common enable ( $\overline{EN}$ ) is synchronous so that the internal dividers will only be enabled/disabled when the internal clock is already in the LOW state. This avoids any chance of generating a runt clock pulse on the internal clock when the device is enabled/disabled as can happen with an asynchronous control. An internal runt pulse could lead to losing synchronization between the internal divider stages. The internal enable 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.

The Phase\_Out output will go HIGH for one clock cycle whenever the  $\pm 2$  and the  $\pm 4/6$  outputs are both transitioning from a LOW to a HIGH. This output allows for clock synchronization within the system.

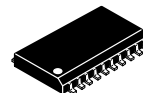
Upon startup, the internal flip-flops will attain a random state; therefore, for systems which utilize multiple EL38s, the master reset (MR) input must be asserted to ensure synchronization. For systems which only use one EL38, the MR pin need not be exercised as the internal divider design ensures synchronization between the  $\pm 2$  and the  $\pm 4/6$  outputs of a single device.

- 50 ps Output-to-Output Skew
- Synchronous Enable/Disable
- Master Reset for Synchronization
- ESD Protection:
  - ♦ 2 kV Human Body Model
  - ♦ 100 V Machine Model
- The 100 Series Contains Temperature Compensation
- PECL Mode Operating Range:
  - ♦  $V_{CC} = 4.2$  V to 5.7 V with  $V_{EE} = 0$  V
- NECL Mode Operating Range:
  - ♦  $V_{CC} = 0$  V with  $V_{EE} = -4.2$  V to  $-5.7$  V
- Internal 75 k $\Omega$  Input Pulldown Resistors on CLK,  $\overline{EN}$ , MR, and DIVSEL
- Q Output will Default LOW with Inputs Open or at  $V_{EE}$
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test



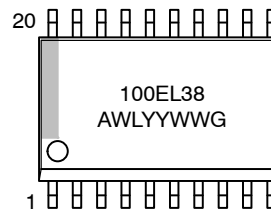
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SOIC-20 WB  
DW SUFFIX  
CASE 751D-05

### 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](#).

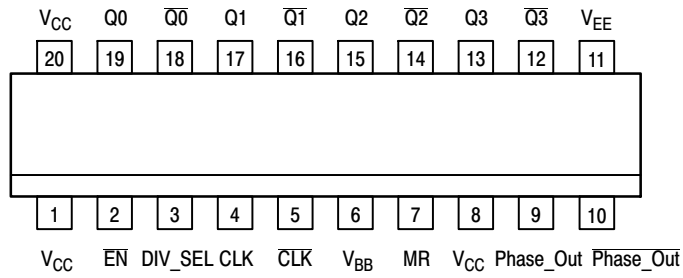
### ORDERING INFORMATION

| Device         | Package                 | Shipping†        |
|----------------|-------------------------|------------------|
| MC100EL38DWR2G | SOIC-20 WB<br>(Pb-Free) | 1000/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](#).

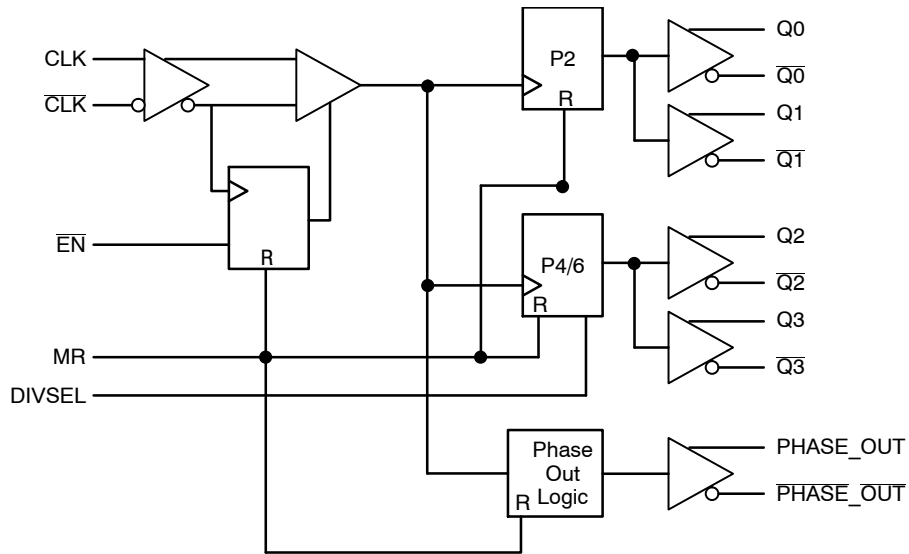
- Moisture Sensitivity Level: 3 (Pb-Free)
  - ♦ For Additional Information, see Application Note [AND8003/D](#)
- Flammability Rating:
  - ♦ UL 94 V-0 @ 0.125 in, Oxygen Index: 28 to 34
- Transistor Count = 388 devices
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

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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. Pinout Assignment (Top View)**



**Figure 2. Logic Diagram**

**Table 1. PIN DESCRIPTION**

| Pin   | Function                           |
|---|------------------------------------|
| CLK, $\overline{\text{CLK}}$  | ECL Diff Clock Inputs              |
| Q <sub>0</sub> , Q <sub>1</sub> ; $\overline{\text{Q}}_0$ , $\overline{\text{Q}}_1$ | ECL Diff $\div 2$ Outputs          |
| Q <sub>2</sub> , Q <sub>3</sub> ; $\overline{\text{Q}}_2$ , $\overline{\text{Q}}_3$ | ECL Diff $\div 4/6$ Outputs        |
| $\overline{\text{EN}}$  | ECL Sync Enable Input              |
| MR  | ECL Master Reset Input             |
| DIVSEL  | ECL Frequency Select Input         |
| Phase_Out, $\overline{\text{Phase\_Out}}$   | ECL Phase Sync Diff. Signal Output |
| V <sub>BB</sub>   | Reference Voltage Output           |
| V <sub>CC</sub>   | Positive Supply                    |
| V <sub>EE</sub>   | Negative Supply                    |

**Table 2. FUNCTION TABLE**

| CLK | EN | MR | Function               |
|-----|----|----|------------------------|
| Z   | L  | L  | Divide                 |
| ZZ  | H  | L  | Hold Q <sub>0-3</sub>  |
| X   | X  | H  | Reset Q <sub>0-3</sub> |

Z = Low-to-High Transition  
 ZZ = High-to-Low Transition  
 X = Don't Care

| DIVSEL | Q <sub>2</sub> , Q <sub>3</sub> OUTPUTS |
|--------|---|
| L      | Divide by 4                             |
| H      | Divide by 6                             |

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**Table 3. 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<br>NECL Mode Input Voltage | $V_{EE} = 0\text{ V}$<br>$V_{CC} = 0\text{ V}$ | $V_I \leq V_{CC}$<br>$V_I \geq V_{EE}$ | 6<br>-6     | V                           |
| $I_{out}$     | Output Current                                     | Continuous<br>Surge                            |  | 50<br>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<br>500 lfpm                             | SOIC-20 WB                             | 90<br>60    | $^{\circ}\text{C}/\text{W}$ |
| $\theta_{JC}$ | Thermal Resistance (Junction-to-Case)              | Standard Board                                 | SOIC-20 WB                             | 30 to 35    | $^{\circ}\text{C}/\text{W}$ |
| $T_{sol}$     | Wave Solder (Pb-Free)                              | <2 to 3 sec @ 260 $^{\circ}\text{C}$           |  | 265         | $^{\circ}\text{C}$          |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**Table 4. 100EL SERIES PECL DC CHARACTERISTICS** ( $V_{CC} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  (Note 1))

| Symbol      | Characteristic   | -40 $^{\circ}\text{C}$ |      |      | 25 $^{\circ}\text{C}$ |      |      | 85 $^{\circ}\text{C}$ |      |      | Unit          |
|-------------|--|------------------------|------|------|-----------------------|------|------|-----------------------|------|------|---------------|
|             |  | Min                    | Typ  | Max  | Min                   | Typ  | Max  | Min                   | Typ  | Max  |               |
| $I_{EE}$    | Power Supply Current   |                        | 50   | 60   |                       | 50   | 60   |                       | 54   | 65   | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 2)                                 | 3915                   | 3995 | 4120 | 3975                  | 4045 | 4120 | 3975                  | 4050 | 4120 | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 2)                                  | 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             |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential) (Note 3) | 1.65                   |      | 4.45 | 1.65                  |      | 4.45 | 1.65                  |      | 4.45 | 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 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  $V_{CC}$ .  $V_{EE}$  can vary +0.8 V / -0.5 V.
2. Outputs are terminated through a 50  $\Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
3.  $V_{IHCMR}$  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  $V_{ppmin}$  and 1 V.

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**Table 5. 100EL SERIES NECL DC CHARACTERISTICS** ( $V_{CC} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 1))

| Symbol      | Characteristic   | -40°C |       |       | 25°C  |       |       | 85°C  |       |       | Unit          |
|-------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------|
|             |  | Min   | Typ   | Max   | Min   | Typ   | Max   | Min   | Typ   | Max   |               |
| $I_{EE}$    | Power Supply Current   |       | 50    | 60    |       | 50    | 60    |       | 54    | 65    | mA            |
| $V_{OH}$    | Output HIGH Voltage (Note 2)                                 | -1085 | -1005 | -880  | -1025 | -955  | -880  | -1025 | -955  | -880  | mV            |
| $V_{OL}$    | Output LOW Voltage (Note 2)                                  | -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             |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range (Differential) (Note 3) | -3.35 |       | -0.55 | -3.35 |       | -0.55 | -3.35 |       | -0.55 | 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.

1. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.8 V / -0.5 V.
2. Outputs are terminated through a 50  $\Omega$  resistor to  $V_{CC} - 2.0\text{ V}$ .
3.  $V_{IHCMR}$  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  $V_{PPmin}$  and 1 V.

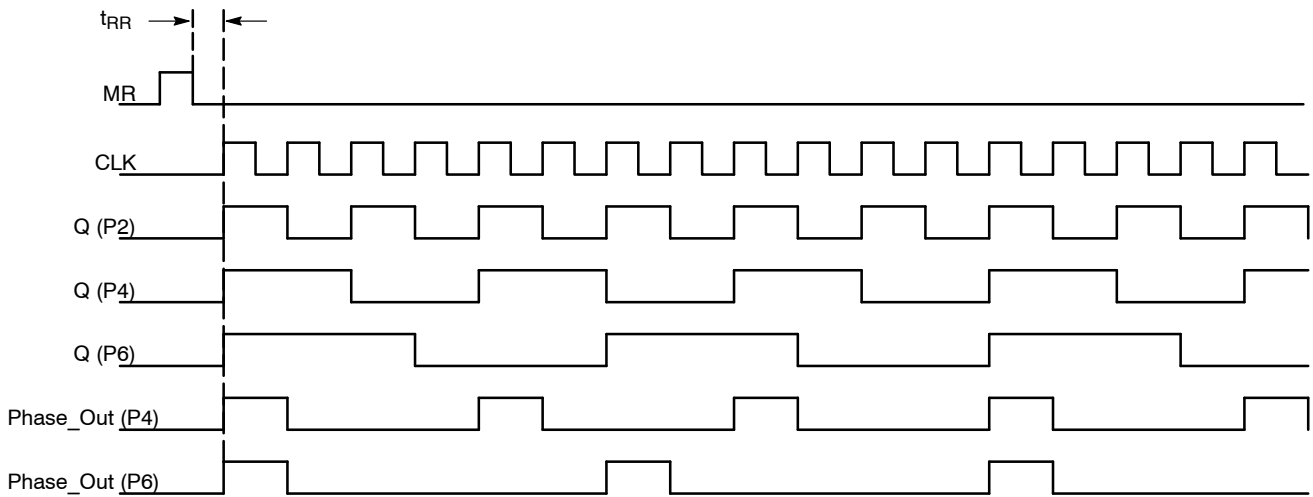
**Table 6. AC CHARACTERISTICS** ( $V_{CC} = 5.0\text{ V}$ ;  $V_{EE} = 0.0\text{ V}$  or  $V_{CC} = 0.0\text{ V}$ ;  $V_{EE} = -5.0\text{ V}$  (Note 1))

| Symbol                 | Characteristic  | -40°C                           |            |                                     | 25°C                            |            |                                     | 85°C                            |            |                                     | Unit |
|------------------------|---|---------------------------------|------------|-------------------------------------|---------------------------------|------------|-------------------------------------|---------------------------------|------------|-------------------------------------|------|
|                        |   | Min                             | Typ        | Max                                 | Min                             | Typ        | Max                                 | Min                             | Typ        | Max                                 |      |
| $f_{max}$              | Maximum Toggle Frequency  |                                 | TBD        |                                     |                                 | TBD        |                                     |                                 | TBD        |                                     | GHz  |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay to Output<br>CLK → Q (Differential)<br>CLK → Q (Single-Ended)<br>CLK → Phase_Out (Differential)<br>CLK → Phase_Out (Single-Ended)<br>MR → Q | 810<br>710<br>800<br>750<br>510 |            | 1010<br>1010<br>1000<br>1050<br>810 | 850<br>750<br>840<br>790<br>540 |            | 1050<br>1050<br>1040<br>1090<br>840 | 900<br>800<br>890<br>840<br>570 |            | 1100<br>1100<br>1090<br>1140<br>870 | ps   |
| $t_{SKEW}$             | Within-Device Skew (Note 2)<br>$Q_0 - Q_3$<br>All   |                                 |            | 50<br>75                            |                                 |            | 50<br>75                            |                                 |            | 50<br>75                            | ps   |
| $t_{JITTER}$           | Cycle-to-Cycle Jitter   |                                 | TBD        |                                     |                                 | TBD        |                                     | TBD                             |            |                                     | ps   |
|                        | Part-to-Part<br>$Q_0 - Q_3$ (Differential)<br>All   |                                 |            | 200<br>240                          |                                 |            | 200<br>240                          |                                 |            | 200<br>240                          |      |
| $t_S$                  | Setup Time<br>EN → CLK<br>DIVSEL → CLK  |                                 | 150        |                                     |                                 | 150        |                                     |                                 | 150        |                                     | ps   |
| $t_H$                  | Hold Time<br>$\overline{\text{CLK}} \rightarrow \text{EN}$<br>CLK → Div_Sel   |                                 | 150<br>200 |                                     |                                 | 150<br>200 |                                     |                                 | 150<br>200 |                                     | ps   |
| $V_{PP}$               | Input Swing (Note 3)  | 150                             |            | 1000                                | 150                             |            | 1000                                | 150                             |            | 1000                                | mV   |
| $t_{RR}$               | Reset Recovery Time   |                                 |            | 100                                 |                                 |            | 100                                 |                                 |            | 100                                 | ps   |
| $t_{PW}$               | Minimum Pulse Width   |                                 |            |                                     |                                 |            |                                     |                                 |            |                                     | ps   |
|                        | CLK<br>MR   | 800<br>700                      |            |                                     | 800<br>700                      |            |                                     | 800<br>700                      |            |                                     |      |
| $t_r, t_f$             | Output Rise/Fall Times Q (20% – 80%)  | 280                             |            | 550                                 | 280                             |            | 550                                 | 280                             |            | 550                                 | ps   |

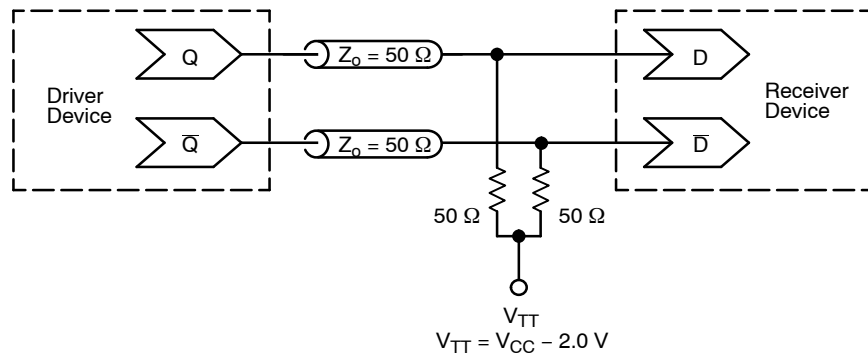
NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional 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.

1.  $V_{EE}$  can vary +0.8 V / -0.5 V.
2. Skew is measured between outputs under identical transitions.
3.  $V_{PP(min)}$  is minimum input swing for which AC parameters guaranteed. The device has a DC gain of  $\approx 40$ .

# MC100EL38



**Figure 3. Timing Diagram**



**Figure 4. Typical Termination for Output Driver and Device Evaluation**  
(See Application Note [AND8020/D](#) – Termination of ECL Logic Devices.)

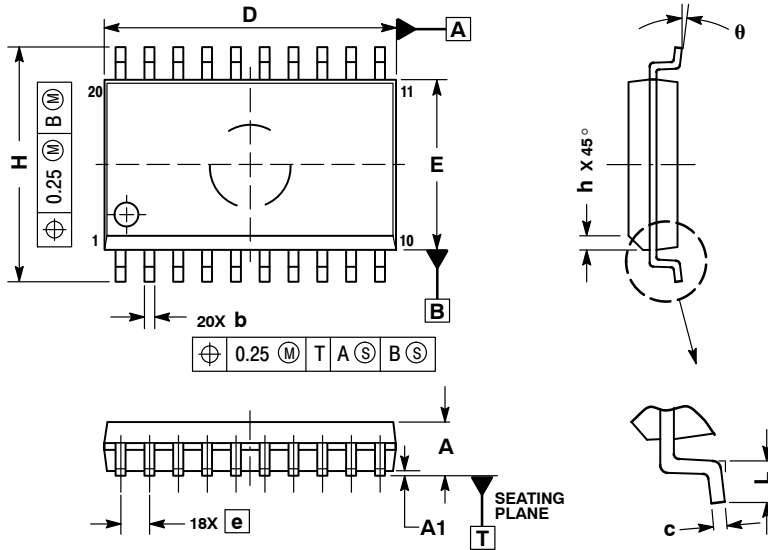
## Resource Reference of Application Notes

- 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

# MC100EL38

## PACKAGE DIMENSIONS

SOIC-20 WB  
CASE 751D-05  
ISSUE H

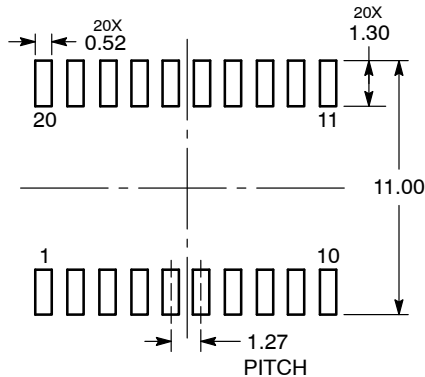


**NOTES:**

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.

| MILLIMETERS |          |       |
|-------------|----------|-------|
| DIM         | 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  |
| θ           | 0°       | 7°    |

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*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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