

MC10E131, MC100E131

5 V ECL 4-Bit D Flip-Flop

Description

The MC10E/100E131 is a quad master-slave D-type flip-flop with differential outputs. Each flip-flop may be clocked separately by holding Common Clock (C_C) LOW and using the Clock Enable (\overline{CE}) inputs for clocking. Common clocking is achieved by holding the \overline{CE} inputs LOW and using C_C to clock all four flip-flops. In this case, the \overline{CE} inputs perform the function of controlling the common clock, to each flip-flop.

Individual asynchronous resets are provided (R). Asynchronous set controls (S) are ganged together in pairs, with the pairing chosen to reflect physical chip symmetry.

Data enters the master when both C_C and \overline{CE} are LOW, and transfers to the slave when either C_C or \overline{CE} (or both) go HIGH.

The 100 Series contains temperature compensation.

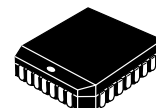
Features

- 1100 MHz Min. Toggle Frequency
- Differential Outputs
- Individual and Common Clocks
- Individual Resets (asynchronous)
- Paired Sets (asynchronous)
- 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 $V_{EE} = -4.2\text{ V to }-5.7\text{ V}$
- Metastability Time Constant is 200 ps.
- Internal Input 50 k Ω Pulldown Resistors
- ESD Protection:
 - ♦ Human Body Model; > 2 kV
 - ♦ Machine Model; > 200 V
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- 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 = 240 devices
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant



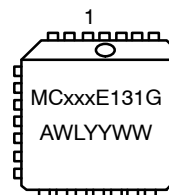
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PLCC-28
FN SUFFIX
CASE 776-02

MARKING DIAGRAM*



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

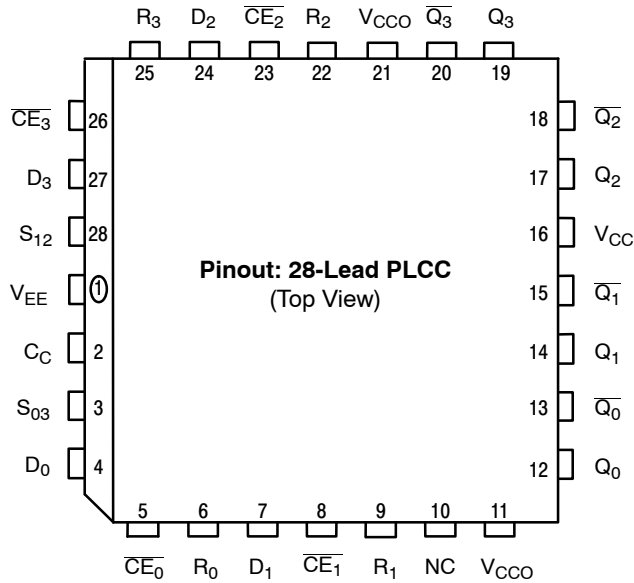
*For additional marking information, refer to Application Note [AND8002/D](#).

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------|-----------------|
| MC10E131FNG | PLCC-28 (Pb-Free) | 37 Units/Tube |
| MC10E131FNR2G | PLCC-28 (Pb-Free) | 500/Tape & Reel |
| MC100E131FNG | PLCC-28 (Pb-Free) | 37 Units/Tube |
| MC100E131FNR2G | PLCC-28 (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](#).

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* All V_{CC} and V_{CCO} pins are tied together on the die.

Warning: All V_{CC} , V_{CCO} , and V_{EE} pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. Pinout Diagram

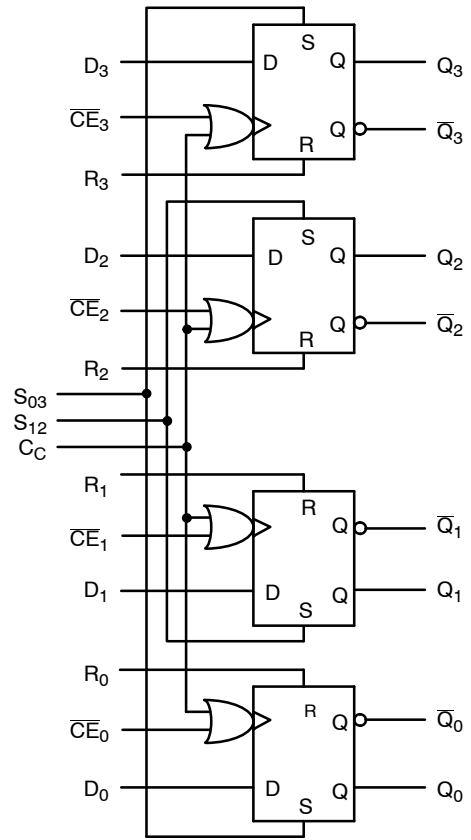


Figure 2. Logic Diagram

Table 1. PIN DESCRIPTION

| PIN | FUNCTION |
|--|--------------------------------|
| $D_0 - D_3$ | ECL Data Inputs |
| $\overline{CE}_0 - \overline{CE}_3$ | ECL Clock Enables (Individual) |
| $R_0 - R_3$ | ECL Resets |
| C_C | ECL Common Clock |
| S_{03}, S_{12} | ECL Sets (paired) |
| $Q_0 - Q_3, \overline{Q}_0 - \overline{Q}_3$ | ECL Differential Outputs |
| V_{CC}, V_{CCO} | Positive Supply |
| V_{EE} | Negative Supply |
| NC | No Connect |

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Table 2. MAXIMUM RATINGS

| Symbol | Parameter | Condition 1 | Condition 2 | Rating | Unit |
|------------------|--|--|--|--------------|------|
| V _{CC} | PECL Mode Power Supply | V _{EE} = 0 V | | 8 | V |
| V _{EE} | NECL Mode Power Supply | V _{CC} = 0 V | | -8 | V |
| V _I | PECL Mode Input Voltage NECL Mode Input Voltage | V _{EE} = 0 V V _{CC} = 0 V | V _I ≤ V _{CC} V _I ≥ V _{EE} | 6 -6 | V |
| I _{out} | Output Current | Continuous Surge | | 50 100 | mA |
| T _A | Operating Temperature Range | | | 0 to +85 | °C |
| T _{stg} | Storage Temperature Range | | | -65 to +150 | °C |
| θ _{JA} | Thermal Resistance (Junction-to-Ambient) | 0 lfp 500 lfp | PLCC-28 | 63.5 43.5 | °C/W |
| θ _{JC} | Thermal Resistance (Junction-to-Case) | Standard Board | PLCC-28 | 22 to 26 | °C/W |
| T _{sol} | Wave Solder (Pb-Free) | | | 265 | °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 3. 10E SERIES PECL DC CHARACTERISTICS (V_{CCx} = 5.0 V; V_{EE} = 0.0 V (Note 1))

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|-----------------|--|-------|-----|--------------------------|------|------|--------------------------|------|------|--------------------------|------|------|--------------------------|------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| I _{EE} | Power Supply Current | | 58 | 70 | | 58 | 70 | | 58 | 70 | | 58 | 70 | mA |
| V _{OH} | Output HIGH Voltage (Note 2) | | | | 3980 | 4070 | 4160 | 4020 | 4105 | 4190 | 4090 | 4185 | 4280 | mV |
| V _{OL} | Output LOW Voltage (Note 2) | | | | 3050 | 3210 | 3370 | 3050 | 3210 | 3370 | 3050 | 3227 | 3405 | mV |
| V _{IH} | Input HIGH Voltage | | | | 3830 | 3995 | 4160 | 3870 | 4030 | 4190 | 3940 | 4110 | 4280 | mV |
| V _{IL} | Input LOW Voltage | | | | 3050 | 3285 | 3520 | 3050 | 3285 | 3520 | 3050 | 3302 | 3555 | mV |
| I _{IH} | Input HIGH Current C S R, CE D | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | μA |
| I _{IL} | 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 lfp. 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 -0.46 V / +0.06 V.
2. Outputs are terminated through a 50 Ω resistor to V_{CC} - 2.0 V.

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Table 4. 10E SERIES NECL DC CHARACTERISTICS ($V_{CCx} = 0.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 1))

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|----------|---|-------|-----|--------------------------|-------|-------|--------------------------|-------|-------|--------------------------|-------|-------|--------------------------|---------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| I_{EE} | Power Supply Current | | 58 | 70 | | 58 | 70 | | 58 | 70 | | 58 | 70 | mA |
| V_{OH} | Output HIGH Voltage (Note 2) | | | | -1020 | -930 | -840 | -980 | -895 | -810 | -910 | -815 | -720 | mV |
| V_{OL} | Output LOW Voltage (Note 2) | | | | -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 C S R, \overline{CE} D | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | μA |
| I_{IL} | Input LOW Current | | | | 0.5 | 0.3 | | 0.5 | 0.065 | | 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 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.

1. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
2. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.

Table 5. 100E SERIES PECL DC CHARACTERISTICS ($V_{CCx} = 5.0\text{ V}$; $V_{EE} = 0.0\text{ V}$ (Note 1))

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|----------|---|-------|------|--------------------------|------|------|--------------------------|------|------|--------------------------|------|------|--------------------------|---------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| I_{EE} | Power Supply Current | | 58 | 70 | | 58 | 70 | | 58 | 70 | | 67 | 81 | mA |
| V_{OH} | Output HIGH Voltage (Note 2) | | | | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | mV |
| V_{OL} | Output LOW Voltage (Note 2) | | | | 3190 | 3295 | 3380 | 3190 | 3255 | 3380 | 3190 | 3260 | 3380 | mV |
| V_{IH} | Input HIGH Voltage | | 3975 | | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | mV |
| V_{IL} | Input LOW Voltage | | 3355 | | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | mV |
| I_{IH} | Input HIGH Current C S R, \overline{CE} D | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | μA |
| I_{IL} | Input LOW Current | | | | 0.5 | 0.3 | | 0.5 | 0.25 | | 0.5 | 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 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.

1. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.
2. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.

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Table 6. 100E SERIES NECL DC CHARACTERISTICS ($V_{CCx} = 0.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 1))

| Symbol | Characteristic | -40°C | | | 0°C | | | 25°C | | | 85°C | | | Unit |
|----------|--|-------|-------|--------------------------|-------|-------|--------------------------|-------|-------|--------------------------|-------|-------|--------------------------|---------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| I_{EE} | Power Supply Current | | 58 | 70 | | 58 | 70 | | 58 | 70 | | 67 | 81 | mA |
| V_{OH} | Output HIGH Voltage (Note 2) | | | | -1025 | -950 | -880 | -1025 | -950 | -880 | -1025 | -950 | -880 | mV |
| V_{OL} | Output LOW Voltage (Note 2) | | | | -1810 | -1705 | -1620 | -1810 | -1745 | -1620 | -1810 | -1740 | -1620 | mV |
| V_{IH} | Input HIGH Voltage | | -1025 | | -1165 | -1025 | -880 | -1165 | -1025 | -880 | -1165 | -1025 | -880 | mV |
| V_{IL} | Input LOW Voltage | | -1645 | | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | mV |
| I_{IH} | Input HIGH Current C _C S R, \overline{CE} D | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | | | 350 450 300 150 | μA |
| I_{IL} | Input LOW Current | | | | 0.5 | 0.3 | | 0.5 | 0.25 | | 0.5 | 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 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 $-0.46\text{ V} / +0.8\text{ V}$.
2. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.

Table 7. 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 1))

| Symbol | Characteristic | -40°C | | | 25°C | | | 85°C | | | Unit |
|------------------------|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| f_{MAX} | Maximum Toggle Frequency | 1100 | 1400 | | 1100 | 1400 | | 1100 | 1400 | | MHz |
| t_{PLH} t_{PHL} | Propagation Delay to Output CE C _C R S | 310 275 400 300 | 600 600 635 550 | 750 725 875 775 | 360 325 450 350 | 500 500 640 550 | 700 675 825 725 | 360 325 450 350 | 500 500 640 550 | 700 675 825 725 | ps |
| t_S | Setup Time (Note 2) D | 200 | 20 | | 150 | 20 | | 150 | 20 | | ps |
| t_H | Hold Time (Note 2) D | 225 | -20 | | 175 | -20 | | 175 | -20 | | ps |
| t_{RR} | Reset Recovery Time | 450 | 150 | | 400 | 150 | | 400 | 150 | | ps |
| t_{PW} | Minimum Pulse Width CLK R, S | 400 400 | | | 400 400 | | | 400 400 | | | ps |
| t_{SKEW} | Within-Device Skew (Note 3) | | 60 | | | 60 | | | 60 | | ps |
| t_{JITTER} | Random Clock Jitter | | < 1 | | | < 1 | | | < 1 | | ps |
| t_r/t_f | Rise/Fall Time (20–80%) | 275 | 460 | 725 | 300 | 480 | | 300 | 480 | 675 | 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. 10 Series: V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
100 Series: V_{EE} can vary $-0.46\text{ V} / +0.8\text{ V}$.
2. Setup/hold times guaranteed for both C_C and \overline{CE} .
3. Within-device skew is defined as identical transitions on similar paths through a device.

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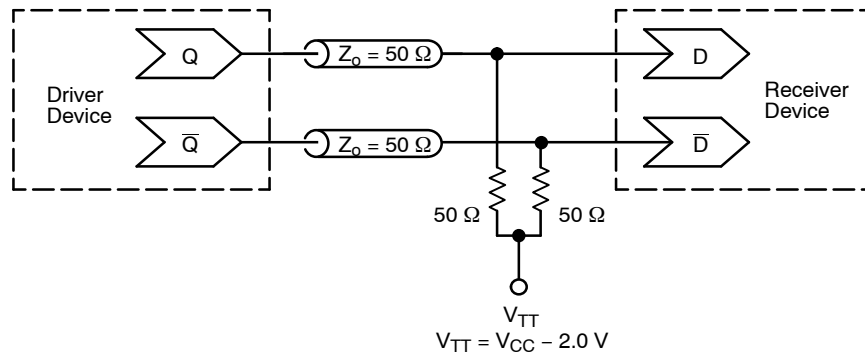


Figure 3. Typical Termination for Output Driver and Device Evaluation
(See Application Note [AND8020/D](#) – Termination of ECL Logic Devices.)

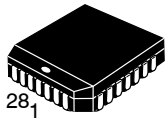
Resource Reference of Application Notes

- 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

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

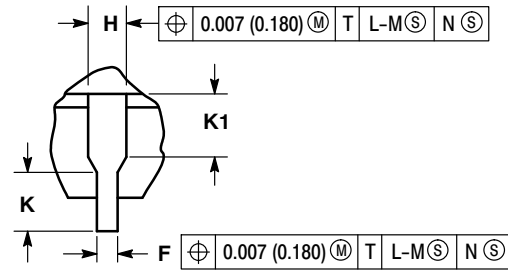
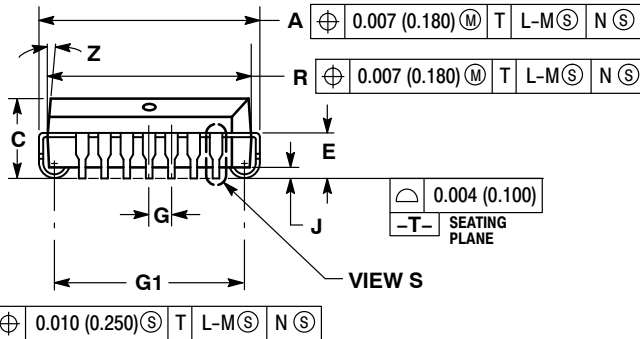
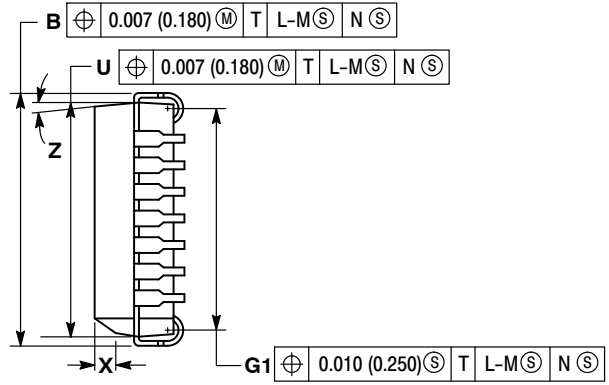
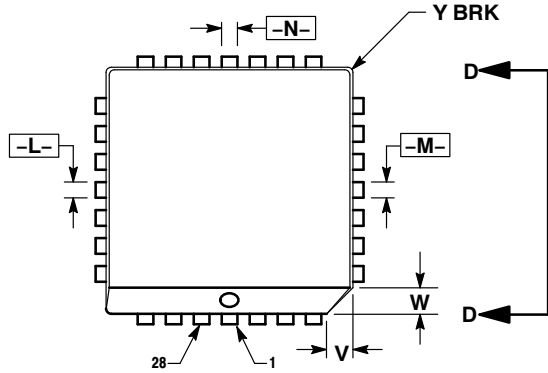
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SCALE 1:1

28 LEAD PLCC
CASE 776-02
ISSUE G

DATE 06 APR 2021

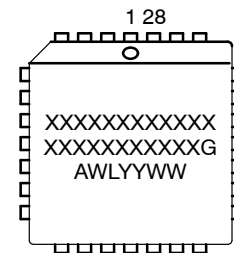


NOTES:

- 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 TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM 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 | 0.021 | 0.33 | 0.53 |
| 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° | | 2° 10° | |
| G1 | 0.410 | 0.430 | 10.42 | 10.92 |
| K1 | 0.040 | --- | 1.02 | --- |

GENERIC MARKING DIAGRAM*



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

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

| | | |
|------------------|--------------|--|
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| DESCRIPTION: | 28 LEAD PLCC | PAGE 1 OF 1 |

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