

MC10E452, MC100E452

5V ECL 5-Bit Differential Register

Description

The MC10E/100E452 is a 5-bit differential register with differential data (inputs and outputs) and clock. The registers are triggered by a positive transition of the positive clock (CLK) input. A high on the Master Reset (MR) asynchronously resets all registers so that the Q outputs go LOW.

The differential input structures are clamped so that the inputs of unused registers can be left open without upsetting the bias network of the device. The clamping action will assert the \overline{D} and the \overline{CLK} sides of the inputs. Because of the edge triggered flip-flop nature of the device simultaneously opening both the clock and data inputs will result in an output which reaches an unidentified but valid state. Note that the input clamps only operate when both inputs fall to 2.5 V below V_{CC} .

The fully differential design of the device makes it ideal for very high frequency applications where a registered data path is necessary.

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

The 100 Series contains temperature compensation.

Features

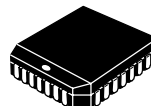
- Differential D, CLK and Q; V_{BB} Reference Available
 - 1100 MHz Min. Toggle Frequency
 - Asynchronous Master Reset
 - PECL Mode Operating Range: $V_{CC} = 4.2$ V to 5.7 V with $V_{EE} = 0$ V
 - NECL Mode Operating Range: $V_{CC} = 0$ V with $V_{EE} = -4.2$ V to -5.7 V
 - Internal Input 50 k Ω Pulldown Resistors, Output \overline{Q}_3 will Default to Low State When Inputs Are Left Open
 - ESD Protection: Human Body Model; > 2 kV
Machine Model; > 200 V
Charged Device Model; > 2 kV
 - Meets or Exceeds JEDEC Spec 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 = 315 devices
 - 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.



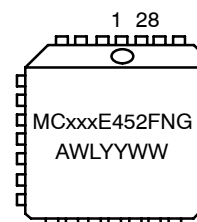
ON Semiconductor®

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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.

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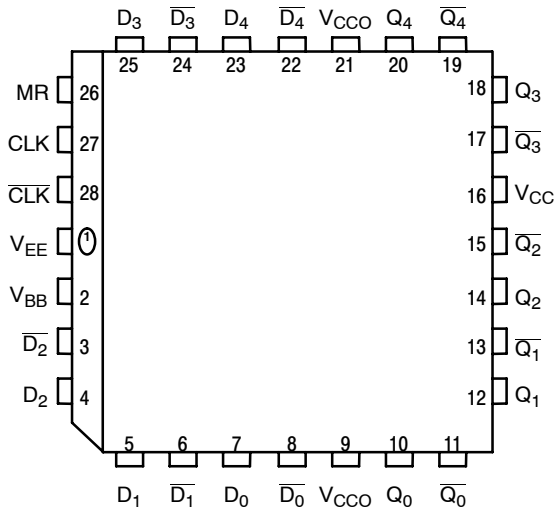


Table 1. PIN DESCRIPTION

| PIN | FUNCTION |
|-----------------------------|-------------------------------|
| $D[0:4], \overline{D}[0:4]$ | ECL Differential Data Inputs |
| MR | ECL Master Reset Input |
| CLK, \overline{CLK} | ECL Differential Clock Input |
| $Q[0:4], \overline{Q}[0:4]$ | ECL Differential Data Outputs |
| V_{BB} | Reference Voltage Output |
| V_{CC}, V_{CCO} | Positive Supply |
| V_{EE} | Negative Supply |

* 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: PLCC-28 (Top View)

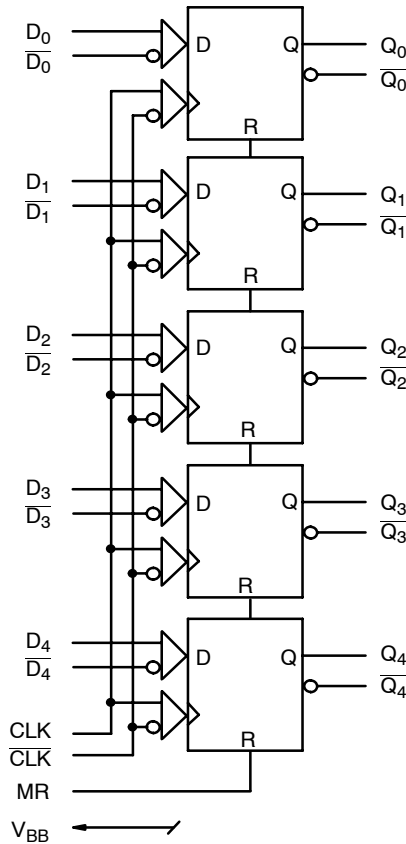


Figure 2. Logic Diagram

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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 V |
| I _{out} | Output Current | Continuous Surge | | 50 100 | mA mA |
| I _{BB} | V _{BB} Sink/Source | | | ± 0.5 | 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 lfpm 500 lfpm | PLCC-28 PLCC-28 | 63.5 43.5 | °C/W °C/W |
| θ _{JC} | Thermal Resistance (Junction-to-Case) | Standard Board | PLCC-28 | 22 to 26 | °C/W |
| T _{sol} | Wave Solder Pb Pb-Free | | | 265 265 | °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 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 | | 74 | 89 | | 74 | 89 | | 74 | 89 | | 74 | 89 | 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 (Single-Ended) | | | | 3830 | 3995 | 4160 | 3870 | 4030 | 4190 | 3940 | 4110 | 4280 | mV |
| V _{IL} | Input LOW Voltage (Single-Ended) | | | | 3050 | 3285 | 3520 | 3050 | 3285 | 3520 | 3050 | 3302 | 3555 | mV |
| V _{BB} | Output Voltage Reference | 3.57 | | 3.7 | 3.62 | | 3.74 | 3.65 | | 3.75 | 3.69 | | 3.81 | V |
| V _{IHCMR} | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 3) | | | | 2.2 | | 4.6 | 2.2 | | 4.6 | 2.2 | | 4.6 | V |
| I _{IH} | Input HIGH Current | | | 150 | | | 150 | | | 150 | | | 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 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 -0.46 V / +0.06 V.
2. Outputs are terminated through a 50 Ω resistor to V_{CC} - 2.0 V.
3. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}.

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

| 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 | | 74 | 89 | | 74 | 89 | | 74 | 89 | | 74 | 89 | mA |
| V_{OH} | Output HIGH Voltage (Note 5) | | | | -1020 | -930 | -840 | -980 | -895 | -810 | -910 | -815 | -720 | mV |
| V_{OL} | Output LOW Voltage (Note 5) | | | | -1950 | -1790 | -1630 | -1950 | -1790 | -1630 | -1950 | -1773 | -1595 | mV |
| V_{IH} | Input HIGH Voltage (Single-Ended) | | | | -1170 | -1005 | -840 | -1130 | -970 | -810 | -1060 | -890 | -720 | mV |
| V_{IL} | Input LOW Voltage (Single-Ended) | | | | -1950 | -1715 | -1480 | -1950 | -1715 | -1480 | -1950 | -1698 | -1445 | mV |
| V_{BB} | Output Voltage Reference | -1.43 | | -1.3 | -1.38 | | -1.27 | -1.35 | | -1.25 | -1.31 | | -1.19 | V |
| V_{IHCMR} | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 6) | | | | -2.8 | | -0.4 | -2.8 | | -0.4 | -2.8 | | -0.4 | V |
| I_{IH} | Input HIGH Current | | | 150 | | | 150 | | | 150 | | | 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 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.

4. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.
5. Outputs are terminated through a $50\ \Omega$ resistor to $V_{CC} - 2.0\text{ V}$.
6. V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

Table 5. 100E SERIES PECL DC CHARACTERISTICS $V_{CCx} = 5.0\text{ V}$; $V_{EE} = 0.0\text{ V}$ (Note 7)

| 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 | | 74 | 89 | | 74 | 89 | | 74 | 89 | | 85 | 102 | mA |
| V_{OH} | Output HIGH Voltage (Note 8) | | | | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | 3975 | 4050 | 4120 | mV |
| V_{OL} | Output LOW Voltage (Note 8) | | | | 3190 | 3295 | 3380 | 3190 | 3255 | 3380 | 3190 | 3260 | 3380 | mV |
| V_{IH} | Input HIGH Voltage (Single-Ended) | | | | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | 3835 | 3975 | 4120 | mV |
| V_{IL} | Input LOW Voltage (Single-Ended) | | | | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | 3190 | 3355 | 3525 | mV |
| V_{BB} | Output Voltage Reference | 3.62 | | 3.74 | 3.62 | | 3.74 | 3.62 | | 3.74 | 3.62 | | 3.74 | V |
| V_{IHCMR} | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 9) | | | | 2.2 | | 4.6 | 2.2 | | 4.6 | 2.2 | | 4.6 | V |
| I_{IH} | Input HIGH Current | | | 150 | | | 150 | | | 150 | | | 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 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.

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 $V_{CC} - 2.0\text{ V}$.
9. V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

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Table 6. 100E SERIES NECL DC CHARACTERISTICS $V_{CCx} = 0.0\text{ V}$; $V_{EE} = -5.0\text{ V}$ (Note 10)

| 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 | | 74 | 89 | | 74 | 89 | | 74 | 89 | | 85 | 102 | mA |
| V_{OH} | Output HIGH Voltage (Note 11) | | | | -1025 | -950 | -880 | -1025 | -950 | -880 | -1025 | -950 | -880 | mV |
| V_{OL} | Output LOW Voltage (Note 11) | | | | -1810 | -1705 | -1620 | -1810 | -1745 | -1620 | -1810 | -1740 | -1620 | mV |
| V_{IH} | Input HIGH Voltage (Single-Ended) | | | | -1165 | -1025 | -880 | -1165 | -1025 | -880 | -1165 | -1025 | -880 | mV |
| V_{IL} | Input LOW Voltage (Single-Ended) | | | | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | -1810 | -1645 | -1475 | mV |
| V_{BB} | Output Voltage Reference | -1.38 | | -1.26 | -1.38 | | -1.26 | -1.38 | | -1.26 | -1.38 | | -1.26 | V |
| V_{IHCMR} | Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 12) | | | | -2.8 | | -0.4 | -2.8 | | -0.4 | -2.8 | | -0.4 | V |
| I_{IH} | Input HIGH Current | | | 150 | | | 150 | | | 150 | | | 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.

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

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

12. V_{IHCMR} min varies 1:1 with V_{EE} , max varies 1:1 with V_{CC} .

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 13)

| Symbol | Characteristic | -40°C | | | 25°C | | | 85°C | | | Unit | |
|------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|----|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | | |
| f_{MAX} | Maximum Toggle Frequency | 1.1 | | | 1.1 | | | 1.1 | | | GHz | |
| t_{PLH} t_{PHL} | Propagation Delay to Output CLK (Diff) CLK (SE) MR | 425 375 375 | 600 600 625 | 850 900 900 | 475 425 425 | 600 600 625 | 800 850 900 | 475 425 425 | 600 600 625 | 800 850 900 | ps | |
| t_S | Setup Time | D | 175 | -50 | 150 | -50 | | 150 | -50 | | ps | |
| t_H | Hold Time | D | 225 | 50 | 200 | 50 | | 200 | 50 | | ps | |
| t_{RR} | Reset Recovery Time | | 750 | 450 | 700 | 450 | | 700 | 450 | | | |
| t_{PW} | Minimum Pulse Width CLK MR | | 400 400 | | 400 400 | | | 400 400 | | | ps | |
| t_{skew} | Within-Device Skew (Note 14) | | 50 | | | | | 50 | | | ps | |
| t_{JITTER} | Random Clock Jitter (RMS) | | < 1.0 | | < 1.0 | | | < 1.0 | | | ps | |
| V_{PP} | Input Voltage Swing (Differential Configuration) | | 150 | | 1000 | 150 | | 1000 | 150 | | 1000 | mV |
| t_r/t_f | Rise/Fall Times 20–80% | | 250 | 475 | 725 | | | 275 | 475 | 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.

13. 10 Series: V_{EE} can vary $-0.46\text{ V} / +0.06\text{ V}$.

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

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

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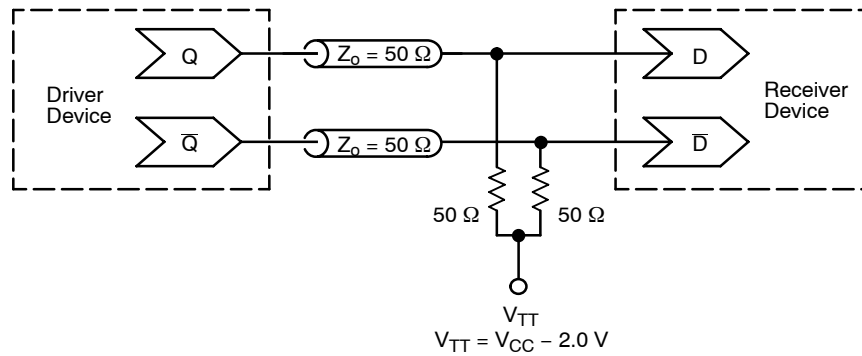


Figure 3. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|----------------|----------------------|-----------------------|
| MC10E452FN | PLCC-28 | 37 Units / Rail |
| MC10E452FNG | PLCC-28 (Pb-Free) | 37 Units / Rail |
| MC10E452FNR2 | PLCC-28 | 500 / Tape & Reel |
| MC10E452FNR2G | PLCC-28 (Pb-Free) | 500 / Tape & Reel |
| MC100E452FN | PLCC-28 | 37 Units / Rail |
| MC100E452FNG | PLCC-28 (Pb-Free) | 37 Units / Rail |
| MC100E452FNR2 | PLCC-28 | 500 / Tape & Reel |
| MC100E452FNR2G | 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.

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

MC10E452, MC100E452

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 | --- |

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