# 3-Bit Differential Flip-Flop

**MC10E431**
**MC100E431**

**3-BIT DIFFERENTIAL FLIP-FLOP**

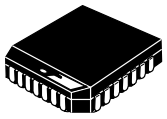
The MC10E/100E431 is a 3-bit flip-flop with differential clock, data input and data output.

The asynchronous Set and Reset controls are edge-triggered rather than level controlled. This allows the user to rapidly set or reset the flip-flop and then continue clocking at the next clock edge, without the necessity of de-asserting the set/reset signal (as would be the case with a level controlled set/reset).

The E431 is also designed with larger internal swings, an approach intended to minimize the time spent crossing the threshold region and thus reduce the metastability susceptibility window.

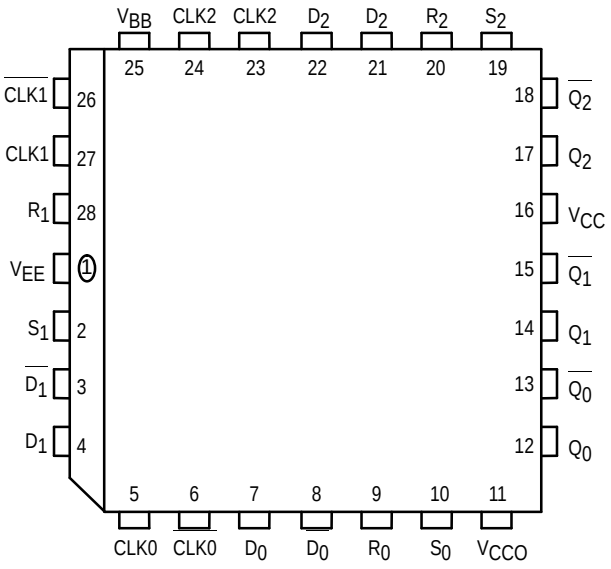
The differential input structures are clamped so that the inputs of unused registers can be left open without upsetting the bias network of the device. The clamping action will assert the D and the CLK sides of the inputs. Because of the edge triggered flip-flop nature of the device simultaneously opening 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 2.5V below $V_{CC}$.

- Edge-Triggered Asynchronous Set and Reset
- Differential D, CLK and Q; $V_{BB}$ Reference Available
- 1100MHz Min. Toggle Frequency
- Extended 100E $V_{EE}$ Range of – 4.2V to – 5.46V



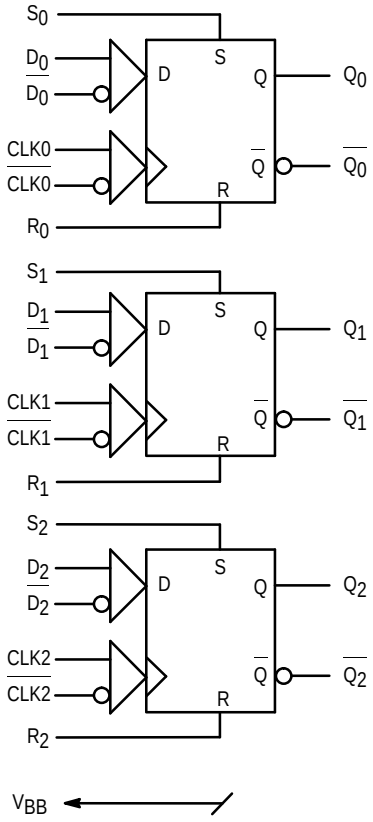
**FN SUFFIX**
PLASTIC PACKAGE
CASE 776-02

**Pinout: 28-Lead PLCC** (Top View)




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

**LOGIC DIAGRAM**




**PIN NAMES**

| Pin | Function |
|---|---|
| D[0:2], $\overline{D[0:2]}$ | Differential Data Inputs |
| CLK[0:2], $\overline{CLK[0:2]}$ | Differential Clock |
| S[0:2] | Edge Triggered Set Inputs |
| R[0:2] | Edge Triggered Reset Input |
| $V_{BB}$ | $V_{BB}$ Reference Output |
| Q[0:2], $\overline{Q[0:2]}$ | Differential Data Outputs |







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**FUNCTION TABLE**

| Dn | CLKn | Rn | Sn | Qn |
|---|---|---|---|---|
| L | Z | L | L | L |
| H | Z | L | L | H |
| X | X | Z | L | L |
| X | X | L | Z | H |

Z = Low to high transition
X = Don't Care

**DC CHARACTERISTICS** ($V_{EE}$ = $V_{EE}$(min) to $V_{EE}$(max); $V_{CC}$ = $V_{CCO}$ = GND)

| | | –40°C | | | 0°C | | | 25°C | | | 85°C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | Characteristic | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Unit | Cond |
| $V_{BB}$ | Output Reference Voltage 10E | –1.43 | | –1.30 | –1.38 | | –1.27 | –1.35 | | –1.25 | –1.31 | | –1.19 | V | |
| | 100E | –1.38 | | –1.26 | –1.38 | | –1.26 | –1.38 | | –1.26 | –1.38 | | –1.26 | | |
| $I_{IH}$ | Input HIGH Current | | | 150 | | | 150 | | | 150 | 150 | | | µA | |
| $I_{EE}$ | Power Supply Current 10E | | 110 | 132 | 110 | 132 | | 110 | 132 | | 110 | 132 | | mA | |
| | 100E | | 110 | 132 | 110 | 132 | | 110 | 132 | | 127 | 152 | | | |
| $V_{CMR}$ | Common Mode Range | –1.5 | | 0 | –1.5 | | 0 | –1.5 | | 0 | –1.5 | | 0 | V | 1 |

1. $V_{CMR}$ is referenced to the most positive side of the differential input signal. Normal specified operation is obtained when the input signals are within the $V_{CMR}$ range and the input swing is greater than $V_{PP}$.

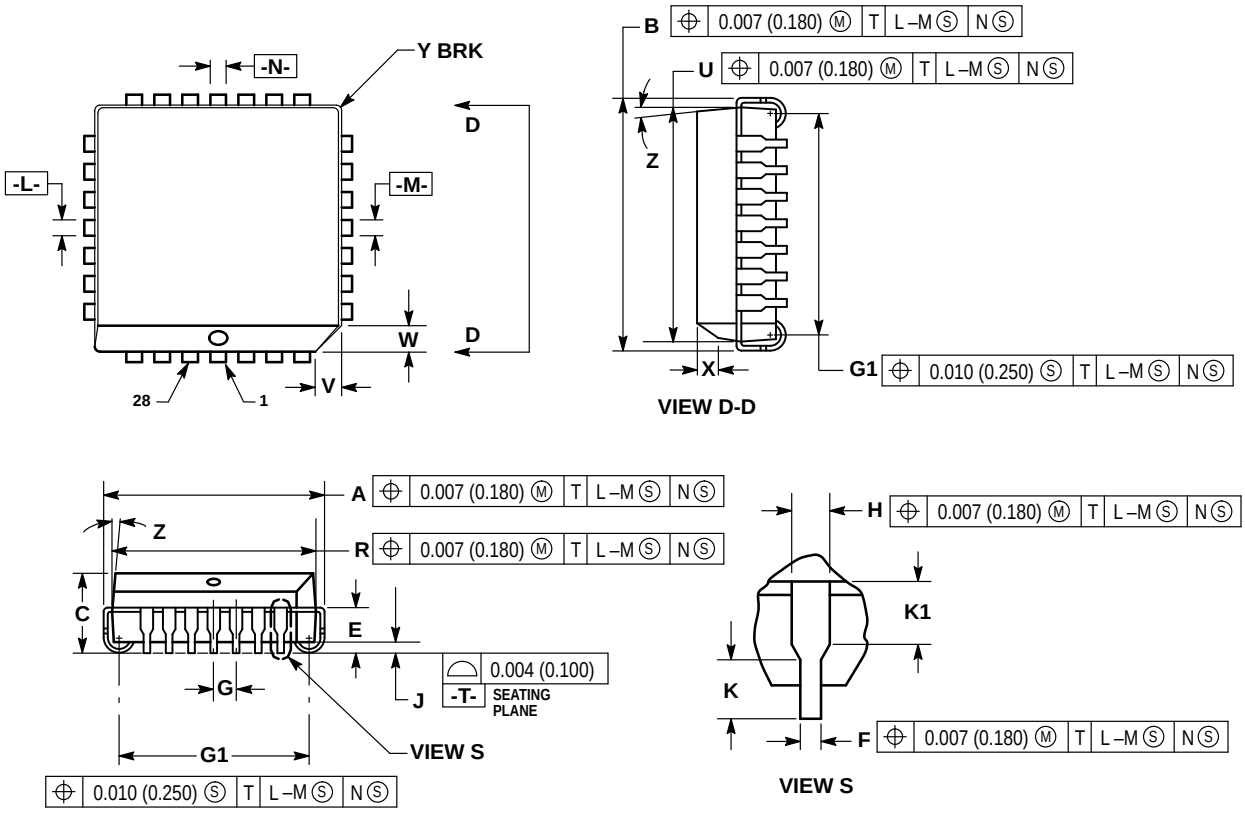
**AC CHARACTERISTICS** ($V_{EE}$ = $V_{EE}$(min) to $V_{EE}$(max); $V_{CC}$ = $V_{CCO}$ = GND)

| | | | –40°C | | | 0°C to 85°C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | Characteristic | | Min | Typ | Max | Min | Typ | Max | Unit | Condition |
| $f_{MAX}$ | Maximum Toggle Frequency | | 1000 | 1400 | | 1100 | 1400 | | MHz | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay to Output | CLK (Diff) | 410 | 600 | 790 | 450 | 600 | 750 | ps | |
| | | CLK (SE) | 460 | 600 | 840 | 400 | 600 | 800 | | |
| | | R | 500 | 725 | 975 | 550 | 725 | 925 | | |
| | | S | 500 | 725 | 975 | 550 | 725 | 925 | | |
| $t_S$ | Setup Time | D | 250 | 0 | | 200 | 0 | | ps | |
| | | R | 1100 | 700 | | 1000 | 700 | | | 1 |
| | | S | 1100 | 700 | | 1000 | 700 | | | 1 |
| $t_H$ | Hold Time | D | 250 | 0 | | 200 | 0 | | ps | |
| $t_{PW}$ | Minimum Pulse Width | CLK | 400 | | | 400 | | | ps | |
| $t_{skew}$ | Within-Device Skew | | | 50 | | | 50 | | ps | 2 |
| $V_{PP}$ | Minimum Input Swing | | 150 | | | 150 | | | mV | 3 |
| $t_r/t_f$ | Rise/Fall Times | | 250 | 450 | 700 | 275 | 450 | 650 | ps | 20–80% |

1. These setup times define the minimum time the CLK or SET/RESET input must wait after the assertion of the RESET/SET input to assure the proper operation of the flip-flop.
2. Within-device skew is defined as identical transitions on similar paths through a device.
3. Minimum input swing for which AC parameters are guaranteed.

## OUTLINE DIMENSIONS

**FN SUFFIX**
PLASTIC PLCC PACKAGE
CASE 776–02
ISSUE D




NOTES:
1. DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
2. DIM G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
3. DIM R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. 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.
7. 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).

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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° | 2° | 10° |
| G1 | 0.410 | 0.430 | 10.42 | 10.92 |
| K1 | 0.040 | — | 1.02 | — |

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