

# MC10EL31, MC100EL31

## 5V ECL D Flip-Flop With Set and Reset

The MC10EL/100EL31 is a D flip-flop with set and reset. The device is functionally equivalent to the E131 device with higher performance capabilities. With propagation delays and output transition times significantly faster than the E131, the EL31 is ideally suited for those applications which require the ultimate in AC performance.

Both set and reset inputs are asynchronous, level triggered signals. Data enters the master portion of the flip-flop when clock is LOW and is transferred to the slave, and thus the outputs, upon a positive transition of the clock.

The 100 Series contains temperature compensation.

- 475 ps Propagation Delay
- 2.8 GHz Toggle Frequency
- ESD Protection: > 1 KV HBM, > 100 V MM
- 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 Pulldown Resistors on D, CLK, S, and R
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity Level 1  
For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL-94 code V-0 @ 1/8",  
Oxygen Index 28 to 34
- Metastability 125 ps (see Application Note AN1504)
- Transistor Count = 79 devices



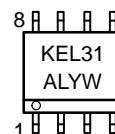
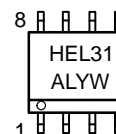
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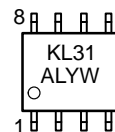
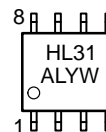
### MARKING DIAGRAMS\*



**SO-8  
D SUFFIX  
CASE 751**



**TSSOP-8  
DT SUFFIX  
CASE 948R**



H = MC10  
K = MC100  
A = Assembly Location

L = Wafer Lot  
Y = Year  
W = Work Week

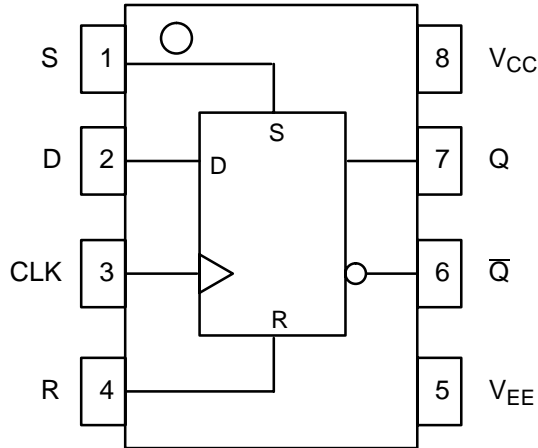
\*For additional information, see Application Note AND8002/D

### ORDERING INFORMATION

Device	Package	Shipping
MC10EL31D	SO-8	98 Units/Rail
MC10EL31DR2	SO-8	2500 Tape & Reel
MC100EL31D	SO-8	98 Units/Rail
MC100EL31DR2	SO-8	2500 Tape & Reel
MC10EL31DT	TSSOP-8	98 Units/Rail
MC10EL31DTR2	TSSOP-8	2500 Tape & Reel
MC100EL31DT	TSSOP-8	98 Units/Rail
MC100EL31DTR2	TSSOP-8	2500 Tape & Reel

# MC10EL31, MC100EL31

## LOGIC DIAGRAM AND PINOUT ASSIGNMENT



TRUTH TABLE

D	S*	R*	CLK	Q
L	L	L	Z	L
H	L	L	Z	H
X	H	L	X	H
X	L	H	X	L
X	H	H	X	Undef

Z = LOW to HIGH Transition

\* Pins will default low when left open.

PIN DESCRIPTION

PIN	FUNCTION
S	ECL Set Input
D	ECL Data Input
R	ECL Reset Input
CLK	ECL Clock Input
Q, $\bar{Q}$	ECL Data Outputs
V <sub>CC</sub>	Positive Supply
V <sub>EE</sub>	Negative Supply

## MAXIMUM RATINGS (Note 1.)

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
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		50	mA
		Surge		100	mA
T <sub>A</sub>	Operating Temperature Range			-40 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	8 SOIC	190	°C/W
		500 LFPM	8 SOIC	130	°C/W
θ <sub>JC</sub>	Thermal Resistance (Junction to Case)	std bd	8 SOIC	41 to 44	°C/W
θ <sub>JA</sub>	Thermal Resistance (Junction to Ambient)	0 LFPM	8 TSSOP	185	°C/W
		500 LFPM	8 TSSOP	140	°C/W
θ <sub>JC</sub>	Thermal Resistance (Junction to Case)	std bd	8 TSSOP	41 to 44 ± 5%	°C/W
T <sub>sol</sub>	Wave Solder	<2 to 3 sec @ 248°C		265	°C

1. Maximum Ratings are those values beyond which device damage may occur.

# MC10EL31, MC100EL31

## 10EL SERIES PECL DC CHARACTERISTICS $V_{CC}=5.0\text{ V}$ ; $V_{EE}=0.0\text{ V}$ (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		27	32		27	32		27	32	mA
$V_{OH}$	Output HIGH Voltage (Note 2.)	3920	4010	4110	4020	4105	4190	4090	4185	4280	mV
$V_{OL}$	Output LOW Voltage (Note 2.)	3050	3200	3350	3050	3210	3370	3050	3227	3405	mV
$V_{IH}$	Input HIGH Voltage	3770		4110	3870		4190	3940		4280	mV
$V_{IL}$	Input LOW Voltage	3050		3500	3050		3520	3050		3555	mV
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.3			$\mu\text{A}$

NOTE: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lfpm is maintained.

1. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.25 V / -0.5 V.

2. Outputs are terminated through a 50 ohm resistor to  $V_{CC}$ -2 volts.

## 10EL 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		27	32		27	32		27	32	mA
$V_{OH}$	Output HIGH Voltage (Note 2.)	-1080	-990	-890	-980	-895	-810	-910	-815	-720	mV
$V_{OL}$	Output LOW Voltage (Note 2.)	-1950	-1800	-1650	-1950	-1790	-1630	-1950	-1773	-1595	mV
$V_{IH}$	Input HIGH Voltage	-1230		-890	-1130		-810	-1060		-720	mV
$V_{IL}$	Input LOW Voltage	-1950		-1500	-1950		-1480	-1950		-1445	mV
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.3			$\mu\text{A}$

NOTE: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lfpm is maintained.

1. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.25 V / -0.5 V.

2. Outputs are terminated through a 50 ohm resistor to  $V_{CC}$ -2 volts.

## 100EL SERIES PECL DC CHARACTERISTICS $V_{CC}=5.0\text{ V}$ ; $V_{EE}=0.0\text{ V}$ (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		27	32		27	32		31	37	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	3835		4120	3835		4120	3835		4120	mV
$V_{IL}$	Input LOW Voltage	3190		3525	3190		3525	3190		3525	mV
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

NOTE: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lfpm is maintained.

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 ohm resistor to  $V_{CC}$ -2 volts.

## 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		27	32		27	32		31	37	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	-1165		-880	-1165		-880	-1165		-880	mV
$V_{IL}$	Input LOW Voltage	-1810		-1475	-1810		-1475	-1810		-1475	mV
$I_{IH}$	Input HIGH Current			150			150			150	$\mu\text{A}$
$I_{IL}$	Input LOW Current	0.5			0.5			0.5			$\mu\text{A}$

NOTE: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lfpm is maintained.

1. Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.8 V / -0.5 V.

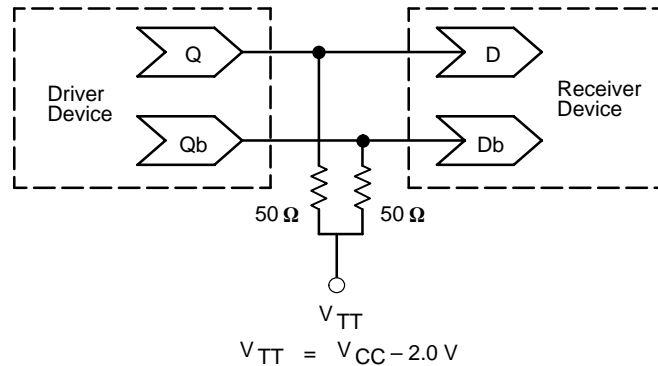
2. Outputs are terminated through a 50 ohm resistor to  $V_{CC}$ -2 volts.

# MC10EL31, MC100EL31

**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	2.0	2.5		2.2	2.8		2.2	2.8		GHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay to Output CLK S, R	315 295	465 455	630 630	375 355	475 465	590 590	430 400	530 510	645 645	ps
$t_S$ $t_H$	Setup Time Hold Time	150 250	0 100		150 250	0 100		150 250	0 100		ps
$t_{RR}$	Set/Reset Recovery	400	200		400	200		400	200		ps
$t_{PW}$	Minimum Pulse Width CLK, Set, Reset	400			400			400			ps
$t_{JITTER}$	Cycle-to-Cycle Jitter		TBD			TBD			TBD		ps
$t_r$ $t_f$	Output Rise/Fall Times Q (20% – 80%)	100	225	350	100	225	350	100	225	350	ps

1. 10 Series:  $V_{EE}$  can vary +0.25 V / -0.5 V.  
100 Series:  $V_{EE}$  can vary +0.8 V / -0.5 V.



**Figure 1. Typical Termination for Output Driver and Device Evaluation**  
(See Application Note AND8020 – Termination of ECL Logic Devices.)

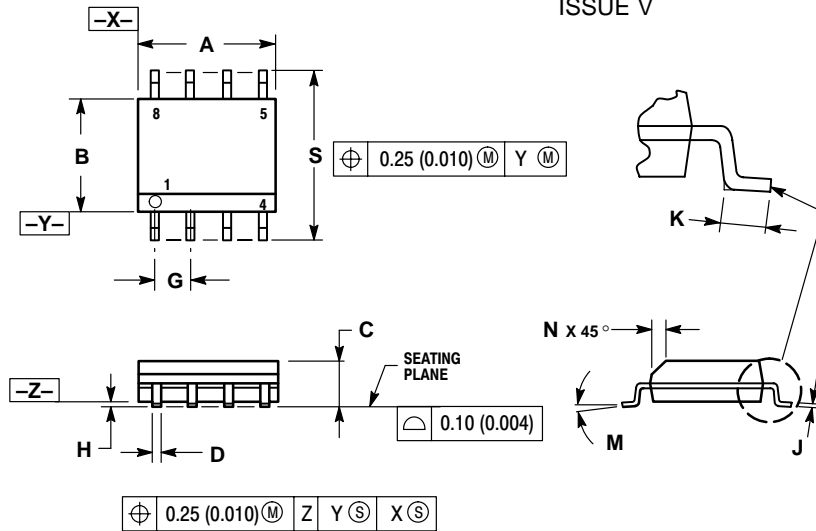
**Resource Reference of Application Notes**

- AN1404** – ECLinPS Circuit Performance at Non–Standard  $V_{IH}$  Levels
- AN1405** – ECL Clock Distribution Techniques
- AN1406** – Designing with PECL (ECL at +5.0 V)
- AN1503** – ECLinPS I/O SPICE Modeling Kit
- AN1504** – Metastability and the ECLinPS Family
- AN1560** – Low Voltage ECLinPS SPICE Modeling Kit
- AN1568** – Interfacing Between LVDS and ECL
- AN1596** – ECLinPS Lite Translator ELT Family SPICE I/O Model Kit
- AN1650** – Using Wire–OR Ties in ECLinPS Designs
- AN1672** – The ECL Translator Guide
- AND8001** – Odd Number Counters Design
- AND8002** – Marking and Date Codes
- AND8020** – Termination of ECL Logic Devices

# MC10EL31, MC100EL31

## PACKAGE DIMENSIONS

SO-8  
D SUFFIX  
PLASTIC SOIC PACKAGE  
CASE 751-07  
ISSUE V



### NOTES:

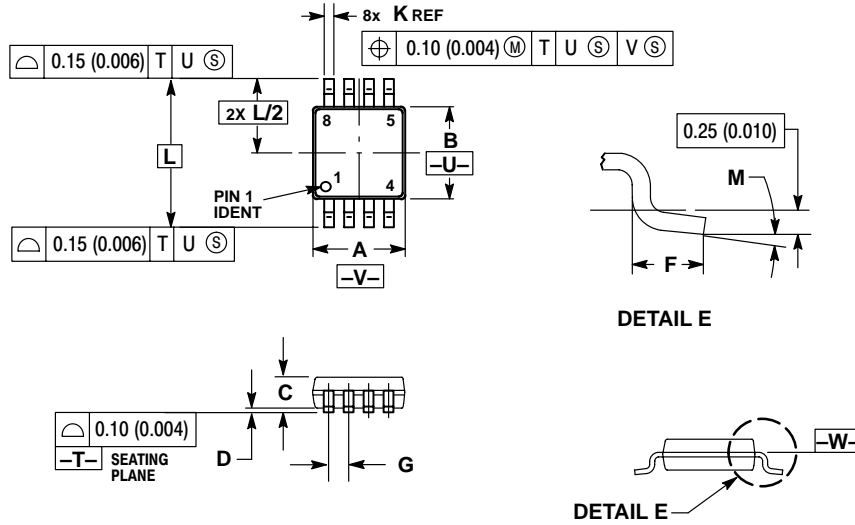
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

# MC10EL31, MC100EL31

## PACKAGE DIMENSIONS

**TSSOP-8**  
**DT SUFFIX**  
 PLASTIC TSSOP PACKAGE  
 CASE 948R-02  
 ISSUE A



### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED  $0.15 (0.006)$  PER SIDE.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED  $0.25 (0.010)$  PER SIDE.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.80	1.10	0.031	0.043
D	0.05	0.15	0.002	0.006
F	0.40	0.70	0.016	0.028
G	0.65 BSC		0.026 BSC	
K	0.25	0.40	0.010	0.016
L	4.90 BSC		0.193 BSC	
M	$0^\circ$	$6^\circ$	$0^\circ$	$6^\circ$

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