

5 V ECL +2, +4, +8 Clock Generation Chip MC10EL34, MC100EL34

Description

The MC10/100EL34 is a low skew $\div 2$, $\div 4$, $\div 8$ 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 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 μF capacitor and limit current sourcing or sinking to 0.5 mA. When not used, V_{BB} should be left open.

The common enable $(\overline{\text{EN}})$ 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.

Upon startup, the internal flip-flops will attain a random state; the master reset (MR) input allows for the synchronization of the internal dividers, as well as multiple EL34s in a system.

The 100 Series contains temperature compensation.

Features

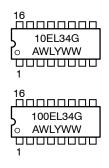
- 50 ps Output-to-Output Skew
- Synchronous Enable/Disable
- Master Reset for Synchronization
- PECL Mode Operating Range:
 - $V_{CC} = 4.2 \text{ V to } 5.7 \text{ V with } V_{EE} = 0 \text{ V}$
- NECL Mode Operating Range:
 - $V_{CC} = 0 \text{ V}$ with $V_{EE} = -4.2 \text{ V}$ to -5.7 V
- Internal Input 75 k Ω Pulldown Resistors on CLK(s), \overline{EN} , and MR
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

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SOIC-16 D SUFFIX CASE 751B-05

MARKING DIAGRAMS*



A = Assembly Location

WL = Wafer Lot
 YY = Year
 WW = Work Week
 G = Pb-Free Package

ORDERING INFORMATION

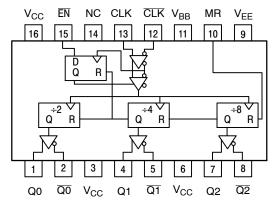
Device	Package	Shipping		
MC10EL34DG	SOIC-16 Pb-Free)	48 Units/Tube		

DISCONTINUED (Note 1)

Device	Package	Shipping
MC100EL34DG	SOIC-16	48 Units/Tube
	Pb-Free)	

DISCONTINUED: This device is not recommended for new design. Please contact your onsemi representative for information.
 The most current information on this device may be available on www.onsemi.com.

^{*}For additional marking information, refer to Application Note <u>AND8002/D</u>.



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

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

Figure 1. Logic Diagram and Pinout Assignment

Table 1. FUNCTION TABLE

CLK*	EN*	MR*	Function
Z	L	L	Divide
ZZ	H	L	Hold Q ₀₋₃
X	X	H	Reset Q ₀₋₃

^{*}Pins will default low when left open.

Table 2. PIN DESCRIPTION

Pin	Function
CLK, CLK	ECL Diff Clock Inputs
EN	ECL Sync Enable
MR	ECL Master Reset
Q0, Q0	ECL Diff ÷2 Outputs
Q1, Q1	ECL Diff ÷4 Outputs
Q2, Q 2	ECL Diff ÷8 Outputs
V _{BB}	Reference Voltage Output
V _{CC}	Positive Supply
V _{EE}	Negative Supply
NC	No Connect

Table 3. ATTRIBUTES

Characteristics	Value
Internal Input Pulldown Resistor	75 KΩ
Internal Input Pullup Resistor	N/A
ESD Protection Human Body Model Machine Model Charge Device Model	> 1 KV > 100 V > 2 KV
Moisture Sensitivity (Note 1)	Level 1
Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
Transistor Count	191 Devices
Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

^{1.} For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

Z = Low-to-High Transition

ZZ = High-to-Low Transition

Table 4. 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
VI	PECL Mode Input Voltage NECL Mode Input Voltage	V _{EE} = 0 V V _{CC} = 0 V	$\begin{array}{c} V_I \leq V_{CC} \\ V_I \geq V_{EE} \end{array}$	6 -6	V
l _{out}	Output Current	Continuous Surge		50 100	mA
I _{BB}	V _{BB} Sink/Source			± 0.5	mA
T _A	Operating Temperature Range			-40 to +85	°C
T _{stg}	Storage Temperature Range			-65 to +150	°C
$\theta_{\sf JA}$	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	SOIC-16	130 75	°C/W
$\theta_{\sf JC}$	Thermal Resistance (Junction-to-Case)	Standard Board	SOIC-16	33 to 36	°C/W
T _{sol}	Wave Solder (Pb-Free)	<2 to 3 sec @ 260°C		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 5. 10EL SERIES PECL DC CHARACTERISTICS ($V_{CC} = 5.0 \text{ V}$; $V_{EE} = 0 \text{ V}$ (Note 1))

		-40°C			25°C			85°C			
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
I _{EE}	Power Supply Current			39			39			39	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 (Single-Ended)	3770		4110	3870		4190	3940		4280	mV
V _{IL}	Input LOW Voltage (Single-Ended)	3050		3500	3050		3520	3050		3555	mV
V _{BB}	Output Voltage Reference	3.57		3.7	3.65		3.75	3.69		3.81	V
V _{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 3)	3.0		4.6	3.0		4.6	3.0		4.6	V
I _{IH}	Input HIGH Current			150			150			150	μΑ
I _{IL}	Input LOW Current	0.5			0.5			0.3			μΑ

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.
 Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.06 V / -0.5 V.
 Outputs are terminated through a 50 Ω resistor to V_{CC} 2.0 V.
 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_{PP}min and 1 V.

Table 6. 10EL SERIES NECL DC CHARACTERISTICS (V_{CC} = 0 V; V_{EE} = -5.0 V (Note 1))

			-40°C			25°C			85°C		
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
I _{EE}	Power Supply Current			39			39			39	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 (Single-Ended)	-1230		-890	-1130		-810	-1060		-720	mV
V _{IL}	Input LOW Voltage (Single-Ended)	-1950		-1500	-1950		-1480	-1950		-1445	mV
V _{BB}	Output Voltage Reference	-1.43		-1.30	-1.35		-1.25	-1.31		-1.19	V
V _{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 3)	-2.0		-0.4	-2.0		-0.4	-2.0		-0.4	V
I _{IH}	Input HIGH Current			150			150			150	μΑ
I _{IL}	Input LOW Current	0.5			0.5			0.3			μΑ

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.

- Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.06 V / -0.5 V.
 Outputs are terminated through a 50 Ω resistor to V_{CC} 2.0 V.
 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_{PP}min and 1 V.

Table 7. 100EL SERIES PECL DC CHARACTERISTICS ($V_{CC} = 5.0 \text{ V}$; $V_{EE} = 0 \text{ V}$ (Note 1))

		-40°C		25°C			85°C				
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
I _{EE}	Power Supply Current			39			39			42	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 Configuration) (Note 3)	2.2		4.6	2.2		4.6	2.2		4.6	٧
I _{IH}	Input HIGH Current			150			150			150	μΑ
I _{IL}	Input LOW Current	0.5			0.5			0.5			μΑ

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.

- 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 Ω resistor to V_{CC} 2.0 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_{PP}min and 1 V.

Table 8. 100EL SERIES NECL DC CHARACTERISTICS (V_{CC} = 0 V; V_{EE} = -5.0 V (Note 1))

		-40°C			25°C		85°C				
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
I _{EE}	Power Supply Current			39			39			42	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 Configuration) (Note 3)	-2.8		-0.4	-2.8		-0.4	-2.8		-0.4	V
I _{IH}	Input HIGH Current			150			150			150	μА
I _{IL}	Input LOW Current	0.5			0.5			0.5			μА

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.

- Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.8 V / -0.5 V.
 Outputs are terminated through a 50 Ω resistor to V_{CC} 2.0 V.
 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_{PP}min and 1 V.

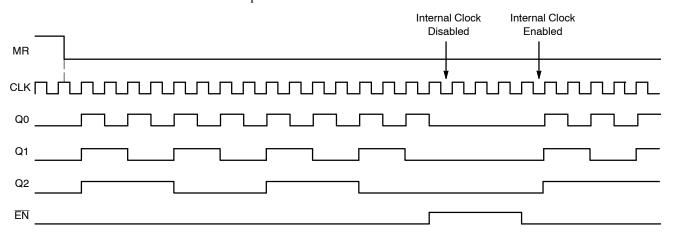
Table 9. AC CHARACTERISTICS ($V_{CC} = 5.0 \text{ V}$; $V_{EE} = 0.0 \text{ V}$ or $V_{CC} = 0.0 \text{ V}$; $V_{EE} = -5.0 \text{ V}$ (Note 1))

			-40°C			25°C			85°C		
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
fmax	Maximum Toggle Frequency	1.1			1.1			1.1			GHz
t _{PLH} t _{PHL}	Propagation CLK to Q0 Delay to	960		1200	960		1200	970		1210	ps
	CLK to Q1,2 Output MR to Q	900 750		1140 1060	900 750		1140 1060	910 790		1150 1090	
t _{SKEW}	Within-Device Skew (Note 2)		100			100			100		ps
t _{JITTER}	Cycle-to-Cycle Jitter		1.0			1.0			1.0		ps
t _S	Setup Time EN	400			400			400			ps
t _H	Hold Time EN	250			250			250			ps
t _{RR}	Set/Reset Recovery	400	200		400	200		400	200		ps
V _{PP}	Input Swing (Note 3)	150		1000	150		1000	150		1000	mV
t _r	Output Rise/Fall Times Q (20% – 80%)	225		475	225		475	225		475	ps

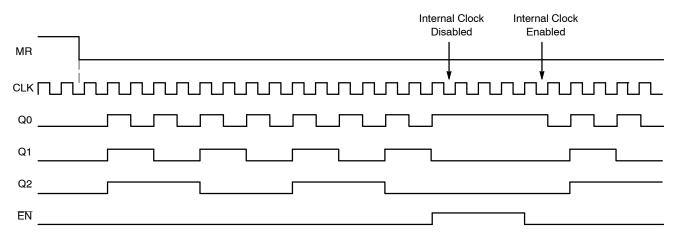
NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm.

- 1. 10 Series: V_{EE} can vary +0.06 V / -0.5 V. 100 Series: \overline{V}_{EE} can vary +0.8 V / -0.5 V.
- 2. Within-device skew is defined as identical transitions on similar paths through a device.
- 3. V_{PP}min is minimum input swing for which AC parameters guaranteed. The device has a DC gain of ≈40.

There are two distinct functional relationships between the Master Reset and Clock:



CASE 1: If the MR is De-asserted (H-L), While the Clock is Still High, the Outputs will Follow the First Ensuing Clock Rising Edge.



CASE 2: If the MR is De-asserted (H-L), After the Clock has Transitioned Low, the Outputs will Follow the Second Ensuing Clock Rising Edge.

Figure 2. Timing Diagrams

The \overline{EN} signal will "freeze" the internal divider flip-flops on the first falling edge of CLK after its assertion. The internal divider flip-flops will maintain their state during the freeze. The \overline{EN} is deasserted (LOW), and after the next falling edge of CLK, then the internal divider flip-flops will "unfreeze" and continue to their next state count with proper phase relationships.

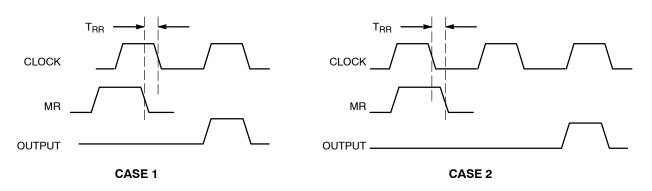


Figure 3. Reset Recovery Time

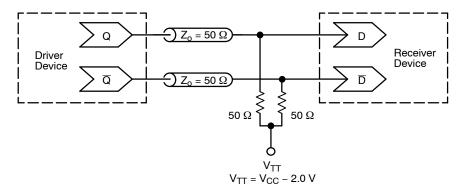


Figure 4. Typical Termination for Output Driver and Device Evaluation (See Application Note <u>AND8020/D</u> – Termination of ECL Logic Devices.)

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

AND8001/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



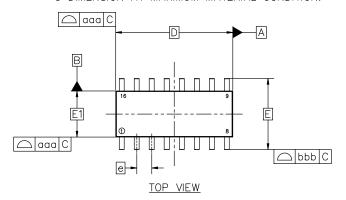


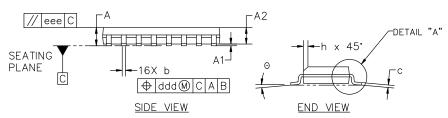
SOIC-16 9.90x3.90x1.37 1.27P CASE 751B ISSUE M

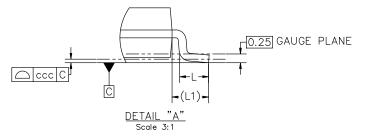
DATE 18 OCT 2024

NOTES:

- 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
- 2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
- 3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
- 4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
- 5. DIMENSION 6 DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE 6 DIMENSION AT MAXIMUM MATERIAL CONDITION.







MILLIMETERS										
DIM	MIN	NOM	MAX							
А	1.35	1.55	1.75							
A1	0.10	0.18	0.25							
A2	1.25	1.37	1.50							
b	0.35	0.42	0.49							
С	0.19	0.22	0.25							
D		9.90 BSC								
E	6.00 BSC									
E1	3.90 BSC									
е		1.27 BSC								
h	0.25		0.50							
L	0.40	0.83	1.25							
L1		1.05 REF								
Θ	0.		7.							
TOLERAN	CE OF FC	RM AND	POSITION							
aaa		0.10								
bbb		0.20								
ccc	0.10									
ddd		0.25	·							
eee		0.10								



RECOMMENDED MOUNTING FOOTPRINT

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D

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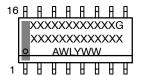
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ISSUE M

DATE 18 OCT 2024

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code A = Assembly Location

WL = Wafer Lot
 Y = 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. Some products may not follow the Generic Marking.

STYLE 1:		STYLE 2:		STYLE 3:	S	TYLE 4:	
	COLLECTOR	PIN 1.	CATHODE	PIN 1.	COLLECTOR, DYE #1	PIN 1.	COLLECTOR, DYE #1
	BASE	2.	ANODE	2.	BASE. #1	2.	
3.	EMITTER	3.	NO CONNECTION	3.	EMITTER. #1	3.	
4.	NO CONNECTION	4.	CATHODE	4.	COLLECTOR, #1	4.	COLLECTOR, #2
5.	EMITTER	5.	CATHODE	5.	COLLECTOR, #2	5.	COLLECTOR, #3
6.	BASE	6.	NO CONNECTION	6.	BASE, #2	6.	COLLECTOR, #3
7.	COLLECTOR	7.	ANODE	7.	EMITTER, #2	7.	COLLECTOR, #4
8.	COLLECTOR	8.	CATHODE	8.	COLLECTOR, #2	8.	COLLECTOR, #4
9.	BASE	9.	CATHODE	9.	COLLECTOR, #3	9.	BASE, #4
10.	EMITTER	10.	ANODE	10.	BASE, #3	10.	EMITTER, #4
11.	NO CONNECTION	11.	NO CONNECTION	11.	EMITTER, #3	11.	
	EMITTER	12.	CATHODE	12.		12.	
13.	BASE	13.		13.	COLLECTOR, #4	13.	BASE, #2
14.	COLLECTOR	14.	NO CONNECTION	14.	BASE, #4	14.	
15.	EMITTER	15.	ANODE	15.	EMITTER, #4	15.	
16.	COLLECTOR	16.	CATHODE	16.	COLLECTOR, #4	16.	EMITTER, #1
STYLE 5:		STYLE 6:		STYLE 7:			
PIN 1.	DRAIN, DYE #1	PIN 1.	CATHODE	PIN 1.	SOURCE N-CH		
2.	DRAIN, #1	2.	CATHODE	2.	COMMON DRAIN (OUTPUT)		
3.	DRAIN. #2				COMMON DOMINI (OLITOLIT)		
	שוויאווי, דב	3.	CATHODE	3.	COMMON DRAIN (OUTPUT)		
4.		3. 4.	CATHODE	3. 4.			
4. 5.	DRAIN, #2 DRAIN, #3		CATHODE CATHODE		GATE P-CH COMMON DRAIN (OUTPUT)		
5. 6.	DRAIN, #2 DRAIN, #3 DRAIN, #3	4. 5. 6.	CATHODE CATHODE CATHODE	4. 5. 6.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT)		
5.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4	4. 5. 6. 7.	CATHODE CATHODE CATHODE CATHODE	4. 5. 6. 7.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT)		
5. 6. 7. 8.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4	4. 5. 6. 7.	CATHODE CATHODE CATHODE CATHODE CATHODE	4. 5. 6. 7. 8.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH		
5. 6. 7. 8.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4	4. 5. 6. 7. 8.	CATHODE CATHODE CATHODE CATHODE CATHODE ANODE	4. 5. 6. 7. 8. 9.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH		
5. 6. 7. 8. 9.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 SOURCE, #4	4. 5. 6. 7. 8. 9.	CATHODE CATHODE CATHODE CATHODE CATHODE ANODE ANODE	4. 5. 6. 7. 8. 9.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT)		
5. 6. 7. 8. 9. 10.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 SOURCE, #4 GATE, #3	4. 5. 6. 7. 8. 9. 10.	CATHODE CATHODE CATHODE CATHODE CATHODE ANODE ANODE ANODE	4. 5. 6. 7. 8. 9. 10.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT)		
5. 6. 7. 8. 9. 10. 11.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 SOURCE, #4 GATE, #3 SOURCE, #3	4. 5. 6. 7. 8. 9. 10. 11.	CATHODE CATHODE CATHODE CATHODE CATHODE ANODE ANODE ANODE ANODE ANODE ANODE	4. 5. 6. 7. 8. 9. 10. 11.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT)		
5. 6. 7. 8. 9. 10. 11. 12.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 SOURCE, #4 GATE, #3 SOURCE, #3 GATE, #2	4. 5. 6. 7. 8. 9. 10. 11. 12.	CATHODE CATHODE CATHODE CATHODE CATHODE CATHODE ANODE ANODE ANODE ANODE ANODE ANODE ANODE	4. 5. 6. 7. 8. 9. 10. 11. 12.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) GATE N-CH		
5. 6. 7. 8. 9. 10. 11. 12. 13.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 GATE, #4 GATE, #3 SOURCE, #3 GOURCE, #3 GOURCE, #2 SOURCE, #2	4. 5. 6. 7. 8. 9. 10. 11. 12. 13.	CATHODE CATHODE CATHODE CATHODE CATHODE CATHODE ANODE	4. 5. 6. 7. 8. 9. 10. 11. 12. 13.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) CATE N-CH COMMON DRAIN (OUTPUT)		
5. 6. 7. 8. 9. 10. 11. 12. 13. 14.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 SOURCE, #4 GATE, #3 SOURCE, #3 GATE, #2 SOURCE, #2 GATE, #1	4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14.	CATHODE CATHODE CATHODE CATHODE CATHODE ANODE	4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) GATE N-CH COMMON DRAIN (OUTPUT) GATE N-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT)		
5. 6. 7. 8. 9. 10. 11. 12. 13.	DRAIN, #2 DRAIN, #3 DRAIN, #3 DRAIN, #4 DRAIN, #4 GATE, #4 GATE, #4 GATE, #3 SOURCE, #3 GOURCE, #3 GOURCE, #2 SOURCE, #2	4. 5. 6. 7. 8. 9. 10. 11. 12. 13.	CATHODE CATHODE CATHODE CATHODE CATHODE CATHODE ANODE	4. 5. 6. 7. 8. 9. 10. 11. 12. 13.	GATE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) SOURCE P-CH SOURCE P-CH COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) COMMON DRAIN (OUTPUT) CATE N-CH COMMON DRAIN (OUTPUT)		

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