MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

Order number: MC100ES6014
Rev 2, 5/2004

MC100ES6014

2.5V / 3.3V 1:5 Differential ECL/PECL/HSTL/LVDS Clock Driver

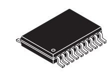
The MC100ES6014 is a low skew 1-to-5 differential driver, designed with clock distribution in mind, accepting two clock sources into an input multiplexer. The ECL/PECL input signals can be either differential or single-ended (if the V_{BB} output is used). HSTL and LVDS inputs can be used when the ES6014 is operating under PECL conditions.

The ES6014 specifically guarantees low output-to-output skew. Optimal design, layout, and processing minimize skew within a device and from device to device.

To ensure that the tight skew specification is realized, both sides of any differential output need to be terminated identically into 50 Ω even if only one output is being used. If an output pair is unused, both outputs may be left open (unterminated) without affecting skew.

The common enable ($\overline{EN}$) is synchronous, outputs are enabled/disabled in the LOW state. This avoids a runt clock pulse when the device is enabled/disabled as can happen with an asynchronous control. The internal 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.

The MC100ES6014, as with most other ECL devices, can be operated from a positive V_{CC} supply in PECL mode. This allows the ES6014 to be used for high performance clock distribution in +3.3 V or +2.5 V systems. Single ended CLK input pin operation is limited to a $V_{CC} \geq 3.0$ V in PECL mode, or $V_{EE} \leq -3.0$ V in ECL mode. Designers can take advantage of the ES6014's performance to distribute low skew clocks across the backplane or the board.



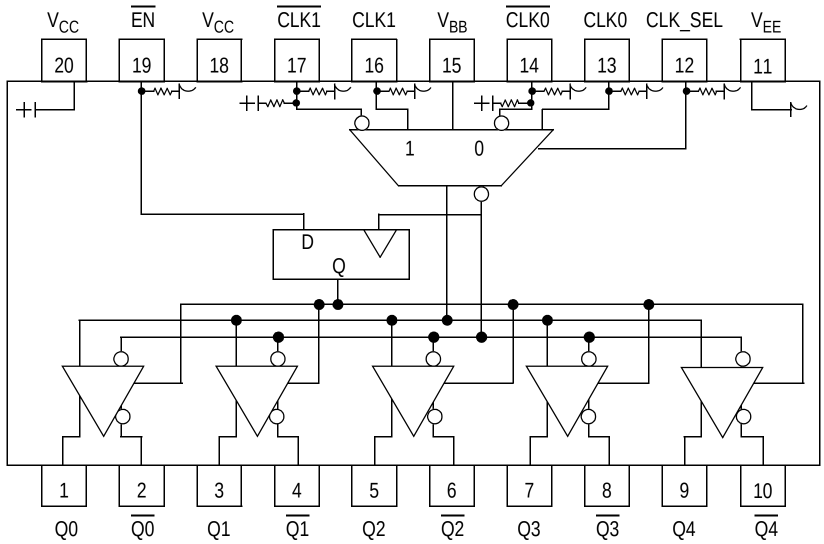
DT SUFFIX
20 LEAD TSSOP PACKAGE
CASE 948E

ORDERING INFORMATION

Device	Package
MC100ES6014DT	TSSOP-20
MC100ES6014DTR2	TSSOP-20

Features

- 25 ps Within Device Skew
- 400 ps Typical Propagation Delay
- Maximum Frequency > 2 GHz Typical
- The 100 Series Contains Temperature Compensation
- PECL and HSTL Mode: V_{CC} = 2.375 V to 3.8 V with V_{EE} = 0 V
- ECL Mode: V_{CC} = 0 V with V_{EE} = –2.375 V to –3.8 V
- LVDS and HSTL Input Compatible
- Open Input Default State



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

Figure 1. 20-Lead Pinout (Top View) **and Logic Diagram**

Table 1. Pin Description

Pin	Function
CLK0*, $\overline{\text{CLK0}}$**	ECL/PECL/HSTL CLK Input
CLK1*, $\overline{\text{CLK1}}$**	ECL/PECL/HSTL CLK Input
Q0:4, $\overline{\text{Q0:4}}$	ECL/PECL Outputs
CLK_SEL*	ECL/PECL Active Clock Select Input
$\overline{\text{EN}}$*	ECL Sync Enable
V_{BB}	Reference Voltage Output
V_{CC}	Positive Supply
V_{EE}	Negative Supply

* Pins will default LOW when left open.
** Pins will default to V_{CC}/2 when left open.

Table 2. Function Table

CLK0	CLK1	CLK_SEL	$\overline{\text{EN}}$	Q
L	X	L	L	L
H	X	L	L	H
X	L	H	L	L
X	H	H	L	H
X	X	X	H	L*

* On next negative transition of CLK0 or CLK1

Table 3. General specifications

Characteristics		Value
Internal Input Pulldown Resistor		75 kΩ
Internal Input Pullup Resistor		75 kΩ
ESD Protection	Human Body Model Machine Model Charged Device Model	> 2000 V > 200 V > 1500 V
Thermal Resistance (Junction-to-Ambient)	0 LFPM, 20 TSSOP 500 LFPM, 20 TSSOP	140°C/W 100°C/W
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test		

Table 4. Absolute Maximum Ratings[1]

Symbol	Characteristic	Conditions	Rating	Units
V_{SUPPLY}	Power Supply Voltage	Difference between V_{CC} & V_{EE}	3.9	V
V_{IN}	Input Voltage	$V_{CC} - V_{EE} \leq 3.6$ V	V_{CC} + 0.3 V_{EE} – 0.3	V
I_{OUT}	Output Current	Continuous Surge	50 100	mA mA
I_{BB}	V_{BB} Sink/Source Current		±0.5	°C
T_A	Operating Temperature Range		–40 to +85	°C
T_{STG}	Storage Temperature Range		–65 to +150	°C

1. Absolute maximum continuous ratings are those maximum values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation at absolute-maximum-rated conditions is not implied.

Table 5. DC Characteristics (V_{CC} = 0 V, V_{EE} = –2.5 V±5% or V_{CC} = 2.5 V±5%, V_{EE} = 0 V)

Symbol	Characteristics	–40°C			0°C to 85°C			Unit
		Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		30	60		30	60	mA
V_{OH}	Output HIGH Voltage[1]	V_{CC}–1250	V_{CC}–990	V_{CC}–800	V_{CC}–1200	V_{CC}–960	V_{CC}–750	mV
V_{OL}	Output LOW Voltage[1]	V_{CC}–2000	V_{CC}–1550	V_{CC}–1150	V_{CC}–1925	V_{CC}–1630	V_{CC}–1200	mV
V_{outPP}	Output Peak-to-Peak Voltage	200			200			mV
V_{IH}	Input HIGH Voltage	V_{CC}–1165		V_{CC}–880	V_{CC}–1165		V_{CC}–880	mV
V_{IL}	Input LOW Voltage	V_{CC}–1810		V_{CC}–1475	V_{CC}–1810		V_{CC}–1475	mV
V_{BB}	Output Reference Voltage I_{BB} = 200 µA	V_{CC}–1400		V_{CC}–1200	V_{CC}–1400		V_{CC}–1200	mV
V_{PP}	Differential Input Voltage[2]	0.12		1.3	0.12		1.3	mV
V_{CMR}	Differential Cross Point Voltage[3]	V_{EE}+0.2		V_{CC}–1.0	V_{EE}+0.2		V_{CC}–1.0	mV
I_{IN}	Input Current			±150			±150	µA

1. Output termination voltage V_{TT} = 0V for V_{CC} = 2.5V operation is supported but the power consumption of the device will increase.
2. V_{PP} (DC) is the minimum differential input voltage swing required to maintain device functionality.
3. V_{CMR} (DC) is the crosspoint of the differential input signal. Functional operation is obtained when the crosspoint is within the V_{CMR} (DC) range and the input swing lies within the V_{PP} (DC) specification.

Table 6. DC Characteristics (V_{CC} = 0 V, V_{EE} = –3.8 V to –3.135 V or V_{CC} = 3.135 V to 3.8 V, V_{EE} = 0 V)

Symbol	Characteristics	–40°C			0°C to 85°C			Unit
		Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		30	60		30	60	mA
V_{OH}	Output HIGH Voltage[1]	V_{CC}–1150	V_{CC}–1020	V_{CC}–800	V_{CC}–1200	V_{CC}–970	V_{CC}–750	mV
V_{OL}	Output LOW Voltage[1]	V_{CC}–1950	V_{CC}–1620	V_{CC}–1250	V_{CC}–2000	V_{CC}–1680	V_{CC}–1300	mV
V_{outPP}	Output Peak-to-Peak Voltage	200			200			mV
V_{IH}	Input HIGH Voltage	V_{CC}–1165		V_{CC}–880	V_{CC}–1165		V_{CC}–880	mV
V_{IL}	Input LOW Voltage	V_{CC}–1810		V_{CC}–1475	V_{CC}–1810		V_{CC}–1475	mV
V_{BB}	Output Reference Voltage I_{BB} = 200 µA	V_{CC}–1400		V_{CC}–1200	V_{CC}–1400		V_{CC}–1200	mV
V_{PP}	Differential Input Voltage[2]	0.12		1.3	0.12		1.3	V
V_{CMR}	Differential Cross Point Voltage[3]	V_{EE}+0.2		V_{CC}–1.1	V_{EE}+0.2		V_{CC}–1.1	V
I_{IN}	Input Current			±150			±150	µA

1. Output termination voltage V_{TT} = 0V for V_{CC} = 2.5V operation is supported but the power consumption of the device will increase.
2. V_{PP} (DC) is the minimum differential input voltage swing required to maintain device functionality.
3. V_{CMR} (DC) is the crosspoint of the differential input signal. Functional operation is obtained when the crosspoint is within the V_{CMR} (DC) range and the input swing lies within the V_{PP} (DC) specification.

Table 7. AC Characteristics (V_{CC} = 0 V, V_{EE} = –3.8 V to –3.135 V or V_{CC} = 3.135 V to 3.8 V, V_{EE} = 0 V)[1]

Symbol	Characteristics	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Output Frequency	2			2			2			GHz
t_{PLH} t_{PHL}	Propagation Delay (Differential) CLK to Q, $\overline{Q}$	300	355	425	300	375	475	300	400	525	ps
t_{SKEW}	Within Device Skew[2] Q, $\overline{Q}$ Device-to-Device Skew[2]		23	45 125		23	45 175		23	45 225	ps ps
t_{JITTER}	Cycle-to-Cycle Jitter RMS (1σ)			1			1			1	ps
V_{PP}	Input Peak-to-Peak Voltage Swing (Differential)	200		1200	200		1200	200		1200	mV
V_{CMR}	Differential Cross Point Voltage	V_{EE}+0.2		V_{CC}–1.2	V_{EE}+0.2		V_{CC}–1.2	V_{EE}+0.2		V_{CC}–1.2	V
t_r/t_f	Output Rise/Fall Time (20%–80%)	70		225	70		250	70		275	ps

1. Measured using a 750 mV source, 50% duty cycle clock source. All loading with 50 ohms to V_{CC}–2.0 V.
2. Skew is measured between outputs under identical transitions.

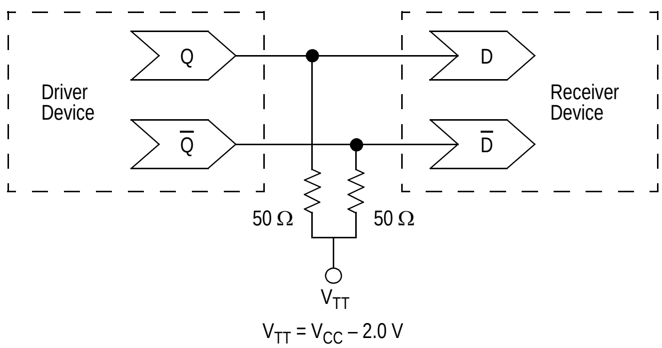


Figure 2. Typical Termination for Output Driver and Device Evaluation

Marking Notes:

Device Nomenclature	20-Lead TSSOP Marking
MC100ES6014DT	6014

Trace Code Identification for 20 TSSOP: ALYW

"A" – The First character indicates the Assembly location.
"L" – The Second character indicates the Source Wafer Lot Tracking Code.
"Y" – The Third character indicates the "ALPHA CODE" of the year device was assembled.
"W" – The Fourth character indicates the "ALPHA CODE" of the Work Week device was assembled.

The "Y" Year ALPHA CODES

Year	Month	Work Week Code
A = 2003	FIRST 6 MONTHS	WW01 – WW26
B = 2003	SECOND 6 MONTHS	WW27 – WW52
C = 2004	FIRST 6 MONTHS	WW01 – WW26
D = 2004	SECOND 6 MONTHS	WW27 – WW52
E = 2005	FIRST 6 MONTHS	WW01 – WW26
F = 2005	SECOND 6 MONTHS	WW27 – WW52
G = 2006	FIRST 6 MONTHS	WW01 – WW26
H = 2006	SECOND 6 MONTHS	WW27 – WW52
I = 2007	FIRST 6 MONTHS	WW01 – WW26
J = 2007	SECOND 6 MONTHS	WW27 – WW52
K = 2008	FIRST 6 MONTHS	WW01 – WW26
L = 2008	SECOND 6 MONTHS	WW27 – WW52
M = 2009	FIRST 6 MONTHS	WW01 – WW26
N = 2009	SECOND 6 MONTHS	WW27 – WW52
O = 2010	FIRST 6 MONTHS	WW01 – WW26
P = 2010	SECOND 6 MONTHS	WW27 – WW52
Q = 2011	FIRST 6 MONTHS	WW01 – WW26
R = 2011	SECOND 6 MONTHS	WW27 – WW52
S = 2012	FIRST 6 MONTHS	WW01 – WW26
T = 2012	SECOND 6 MONTHS	WW27 – WW52
U = 2013	FIRST 6 MONTHS	WW01 – WW26
V = 2013	SECOND 6 MONTHS	WW27 – WW52
W = 2014	FIRST 6 MONTHS	WW01 – WW26
X = 2014	SECOND 6 MONTHS	WW27 – WW52
Y = 2015	FIRST 6 MONTHS	WW01 – WW26
Z = 2015	SECOND 6 MONTHS	WW27 – WW52

The "W" Work Week ALPHA CODES

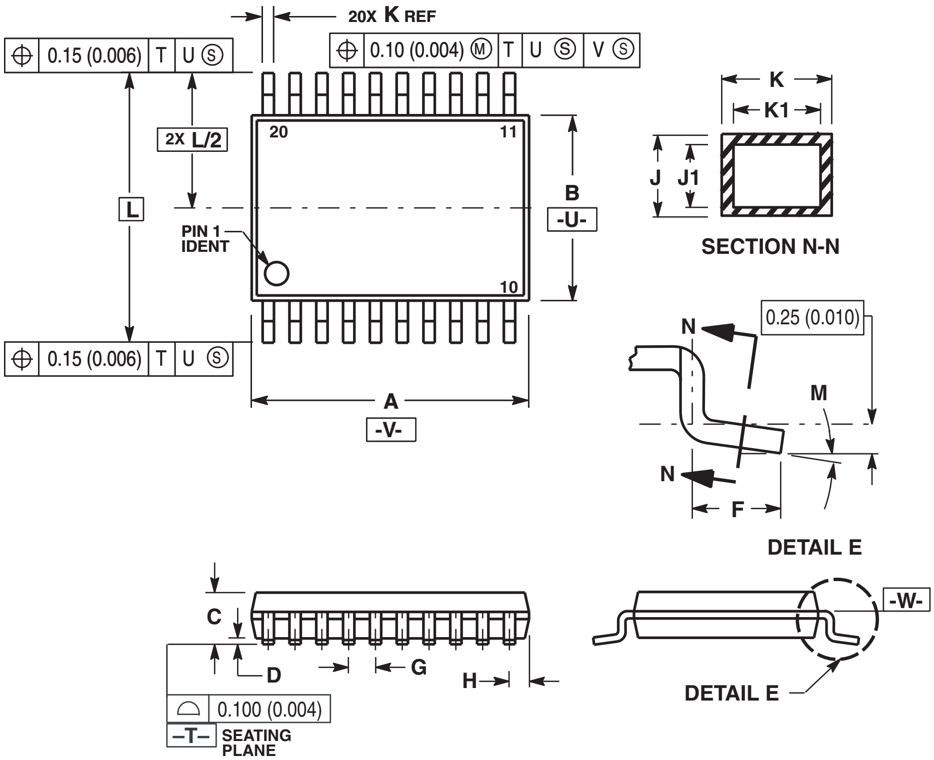
1st 6 Months (WW01 – WW26)	2nd 6 Months (WW27 – WW52)
A = WW01	A = WW27
B = WW02	B = WW28
C = WW03	C = WW29
D = WW04	D = WW30
E = WW05	E = WW31
F = WW06	F = WW32
G = WW07	G = WW33
H = WW08	H = WW34
I = WW09	I = WW35
J = WW10	J = WW36
K = WW11	K = WW37
L = WW12	L = WW38
M = WW13	M = WW39
N = WW14	N = WW40
O = WW15	O = WW41
P = WW16	P = WW42
Q = WW17	Q = WW43
R = WW18	R = WW44
S = WW19	S = WW45
T = WW20	T = WW46
U = WW21	U = WW47
V = WW22	V = WW48
W = WW23	W = WW49
X = WW24	X = WW50
Y = WW25	Y = WW51
Z = WW26	Z = WW52

20 TSSOP Tracecode Marking Example:

```
5ABR
| | | |
5 | | | = Assembly Location
  | | |
  A | | = First Lot Assembled of this device in the designated Work Week
    | |
    B | = 2003 Second 6 Months, WW27 – WW52
      |
      R = WW44 of 2003
```

PACKAGE DIMENSIONS

DT SUFFIX
20 LEAD TSSOP PACKAGE
CASE 948E-02
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. 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.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND BE ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

NOTES

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