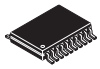
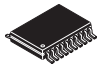
3.3 V ECL/PECL/HSTL/LVDS ÷2/4, ÷4/5/6 Clock Generation Chip

MC100ES6139



DT SUFFIX
20-LEAD TSSOP PACKAGE
CASE 948E-03



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Pb-FREE PACKAGE
CASE 948E-03

The MC100ES6139 is a low skew ÷2/4, ÷4/5/6 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 device can be driven by either a differential or single-ended ECL or, if positive power supplies are used, LVPECL input signals. In addition, by using the V_{BB} output, a sinusoidal source can be AC coupled into the device. If a single-ended input is to be used, the V_{BB} output should be connected to the $\overline{CLK}$ input and bypassed to ground via a 0.01 μF capacitor.

The common enable ($\overline{EN}$) 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. 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; therefore, for systems which utilize multiple ES6139s, the master reset (MR) input must be asserted to ensure synchronization. For systems which only use one ES6139, the MR pin need not be exercised as the internal divider design ensures synchronization between the ÷2/4 and the ÷4/5/6 outputs of a single device. All V_{CC} and V_{EE} pins must be externally connected to power supply to guarantee proper operation.

The 100ES Series contains temperature compensation.

ORDERING INFORMATION	
Device	**Package**
MC100ES6139DT	TSSOP-20
MC100ES6139DTR2	TSSOP-20
MC100ES6139EJ	TSSOP-20 (Pb-Free)
MC100ES6139EJR2	TSSOP-20 (Pb-Free)

Features

- Maximum Frequency >1.0 GHz Typical
- 50 ps Output-to-Output Skew
- PECL Mode Operating Range: V_{CC} = 3.135 V to 3.8 V with V_{EE} = 0 V
- ECL Mode Operating Range: V_{CC} = 0 V with V_{EE} = –3.135 V to –3.8 V
- Open Input Default State
- Synchronous Enable/Disable
- Master Reset for Synchronization of Multiple Chips
- V_{BB} Output
- LVDS and HSTL Input Compatible
- 20-Lead Pb-Free Package Available

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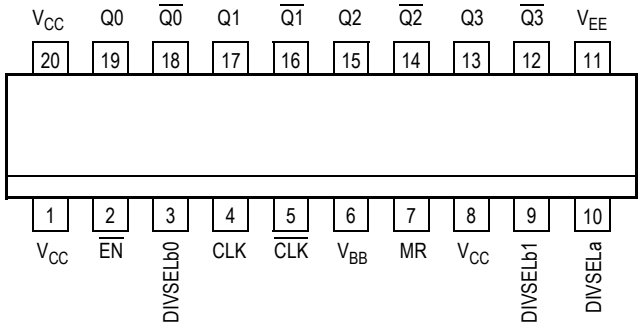


Warning: All V_{CC} and V_{EE} pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. 20-Lead Pinout (Top View)

Table 1. Pin Description

Pin	Function
CLK(1), $\overline{CLK}$(1)	ECL Diff Clock Inputs
$\overline{EN}$(1)	ECL Sync Enable
MR(1)	ECL Master Reset
V_{BB}	ECL Reference Output
Q0, Q1, $\overline{Q0}$, $\overline{Q1}$	ECL Diff ÷2/4 Outputs
Q2, Q3, $\overline{Q2}$, $\overline{Q3}$	ECL Diff ÷4/5/6 Outputs
DIVSELa(1)	ECL Freq. Select Input ÷2/4
DIVSELb0(1)	ECL Freq. Select Input ÷4/5/6
DIVSELb1(1)	ECL Freq. Select Input ÷4/5/6
V_{CC}	ECL Positive Supply
V_{EE}	ECL Negative Supply

1. Pins will default low when left open.

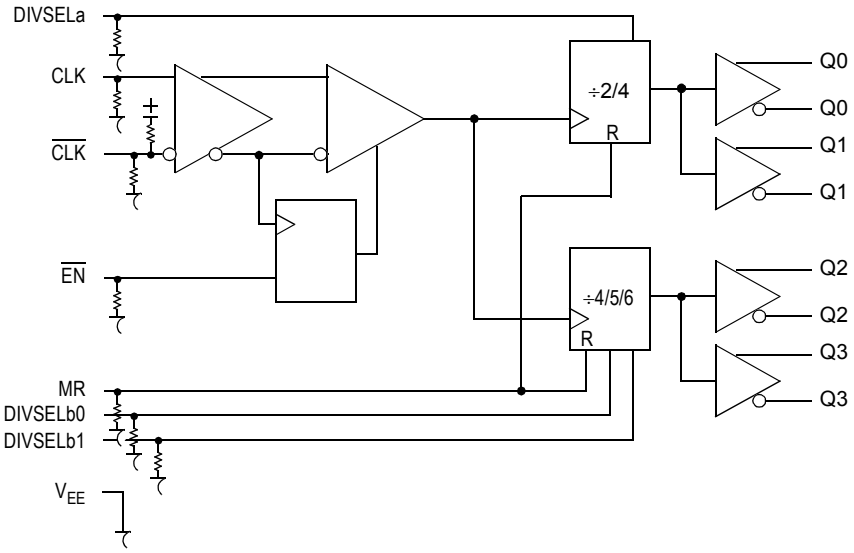


Figure 2. Logic Diagram

Table 2. Function Tables

CLK	$\overline{EN}$	MR	Function
Z	L	L	Divide
ZZ	H	L	Hold Q0:3
X	X	H	Reset Q0:3

X = Don't Care
Z = Low-to-High Transition
ZZ = High-to-Low Transition

DIVSELa		Q0:1 Outputs
L		Divide by 2
H		Divide by 4
DIVSELb0	DIVSELb1	Q2:3 Outputs
L	L	Divide by 4
H	L	Divide by 6
L	H	Divide by 5
H	H	Divide by 5

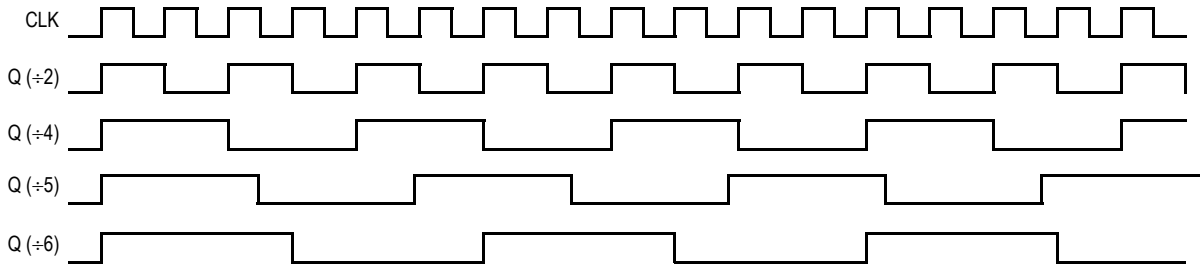


Figure 3. Timing Diagram

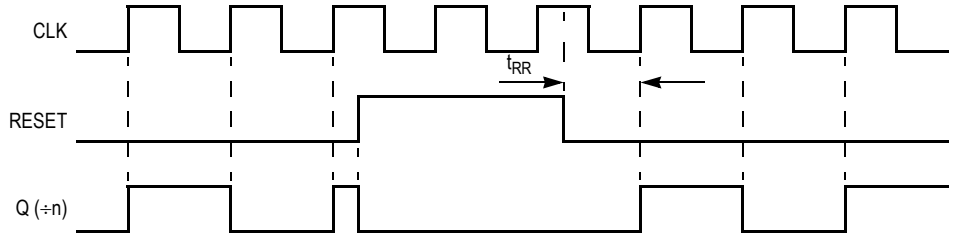


Figure 4. Timing Diagram

Table 3. Attributes

Characteristics		Value
Internal Input Pulldown Resistor		75 kΩ
Internal Input Pullup Resistor		75 kΩ
ESD Protection	Human Body Model Machine Model Charged Device Model	> 4 kV > 200 V > 2 kV

Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test

Table 4. Maximum Ratings[1]

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V_{CC}	PECL Mode Power Supply	V_{EE} = 0 V		3.9	V
V_{EE}	ECL Mode Power Supply	V_{CC} = 0 V		–3.9	V
V_I	PECL Mode Input Voltage ECL Mode Input Voltage	V_{EE} = 0 V V_{CC} = 0 V	$V_I \le V_{CC}$ $V_I \ge V_{EE}$	3.9 –3.9	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
I_{BB}	V_{BB} Sink/Source			± 0.5	mA
TA	Operating Temperature Range			–40 to +85	°C
T_{stg}	Storage Temperature Range			–65 to +150	°C
θ_{JA}	Thermal Resistance (Junction-to-Ambient)	0 LFPM 500 LFPM	20 TSSOP 20 TSSOP	74 64	°C/W °C/W

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

Table 5. 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)[1]

Symbol	Characteristic	–40°C			0°C to 85°C			Unit
		Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		35	60		35	60	mA
V_{OH}	Output HIGH Voltage[2]	V_{CC} –1150	V_{CC} –1020	V_{CC} –800	V_{CC} –1200	V_{CC} –970	V_{CC} –750	mV
V_{OL}	Output LOW Voltage[2]	V_{CC} –1950	V_{CC} –1620	V_{CC} –1250	V_{CC} –2000	V_{CC} –1680	V_{CC} –1300	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	V_{CC} –1165		V_{CC} –880	V_{CC} –1165		V_{CC} –880	mV
V_{IL}	Input LOW Voltage (Single-Ended)	V_{CC} –1810		V_{CC} –1475	V_{CC} –1810		V_{CC} –1475	mV
V_{BB}	Output Reference Voltage	V_{CC} –1400		V_{CC} –1200	V_{CC} –1400		V_{CC} –1200	mV
V_{PP}	Differential Input Voltage[3]	0.12		1.3	0.12		1.3	V
V_{CMR}	Differential Cross Point Voltage[4]	V_{EE} +0.2		V_{CC} –1.1	V_{EE} +0.2		V_{CC} –1.1	V
I_{IH}	Input HIGH Current			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			μA

1. MC100ES6139 circuits 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 airflow greater than 500 lfpm is maintained.
2. All loading with 50 Ω to V_{CC}–2.0 volts.
3. V_{PP} (DC) is the minimum differential input voltage swing required to maintain device functionality.
4. 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. 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	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Frequency		> 1			> 1			> 1		GHz
t_{PLH}, t_{PHL}	Propagation Delay CLK, Q (Diff) MR, Q	550 400		850 850	550 400		850 850	550 400		850 850	ps
t_{RR}	Reset Recovery	200	100		200	100		200	100		ps
t_s	Setup Time $\overline{EN}$, $\overline{CLK}$ DIVSEL, CLK	200 400	120 180		200 400	120 180		200 400	120 180		ps
t_h	Hold Time $\overline{CLK}$, $\overline{EN}$ CLK, DIVSEL	100 200	50 140		100 200	50 140		100 200	50 140		ps
t_{PW}	Minimum Pulse Width MR	550	450		550	450		550	450		ps
t_{SKEW}	Within Device Skew Q, $\overline{Q}$ Q, $\overline{Q}$ @ Same Frequency Device-to-Device Skew[2]			100 50 300			100 50 300			100 50 300	ps
t_{JITTER}	Cycle-to-Cycle Jitter (RSM 1σ)			1			1			1	ps
V_{PP}	Input 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 Times Q, $\overline{Q}$ (20% – 80%)	50		300	50		300	50		300	ps

1. Measured using a 750 mV source, 50% duty cycle clock source. All loading with 50 Ω to V_{CC} –2.0 V.
2. Skew is measured between outputs under identical transitions. Duty cycle skew is defined only for differential operation when the delays are measured from the cross point of the inputs to the cross point of the outputs.

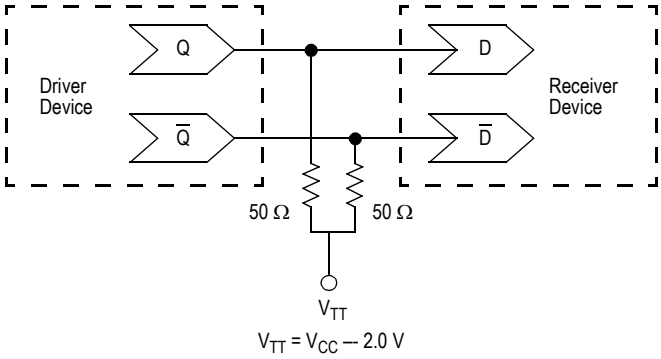
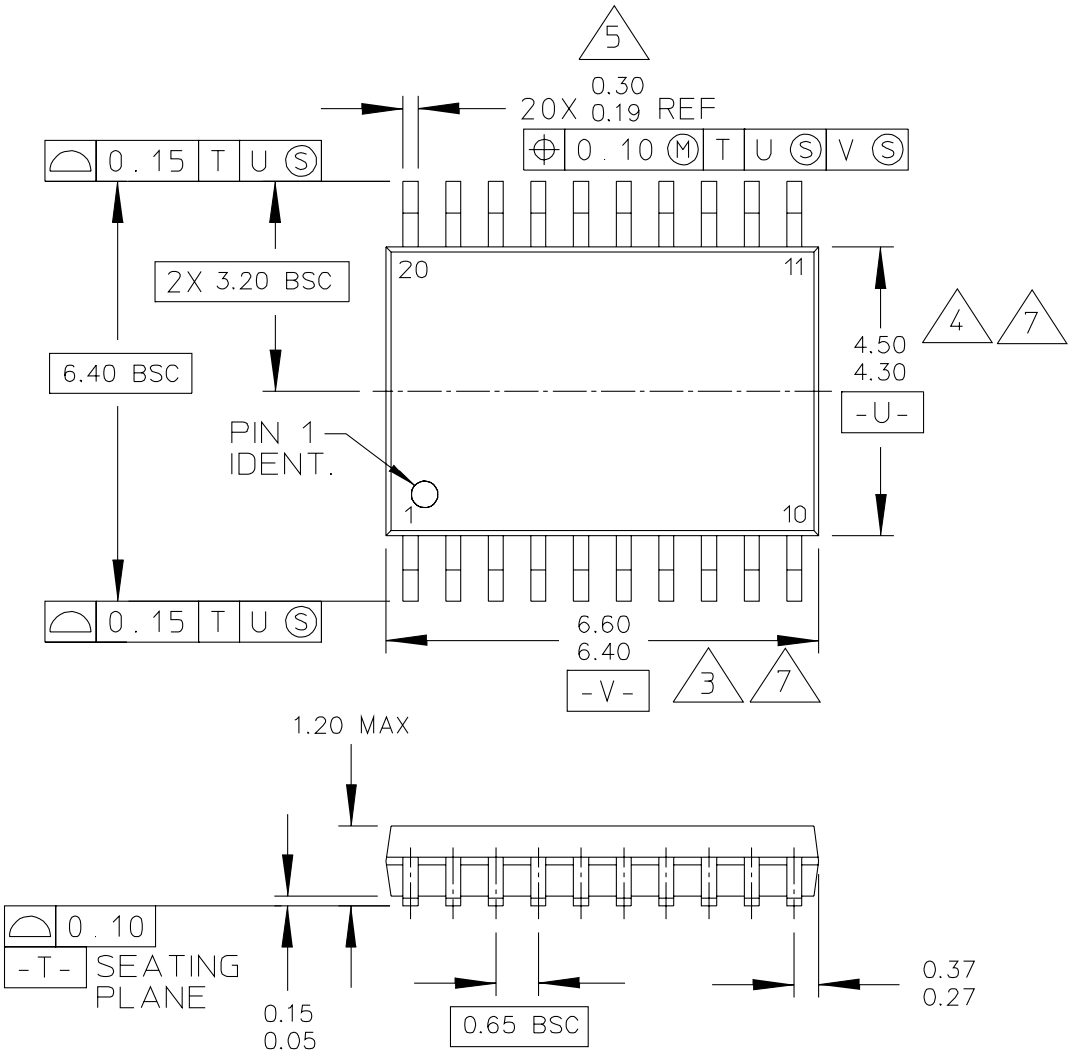


Figure 5. Typical Termination for Output Driver and Device Evaluation

PACKAGE DIMENSIONS



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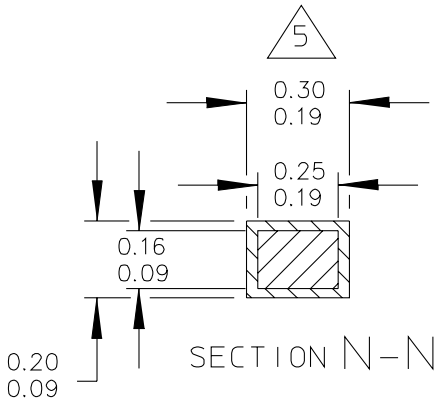
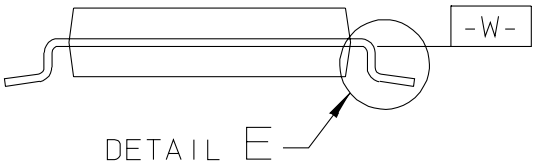
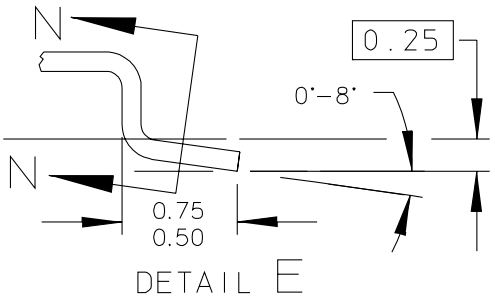
CASE 948E-03
ISSUE B
20-LEAD TSSOP PACKAGE

PACKAGE DIMENSIONS







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4. DIMENSION DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
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6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSIONS ARE TO BE DETERMINED AT DATUM PLANE -W-.

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