

## 3.3 V ECL/PECL/HSTL/LVDS $\div 2/4$ , $\div 4/6$ Clock Generation Chip

The MC100ES6039 is a low skew  $\div 2/4$ ,  $\div 4/6$  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.

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.

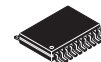
Upon startup, the internal flip-flops will attain a random state; therefore, for systems which utilize multiple ES6039s, the master reset (MR) input must be asserted to ensure synchronization. For systems which only use one ES6039, the MR pin need not be exercised as the internal divider design ensures synchronization between the  $\div 2/4$  and the  $\div 4/6$  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.

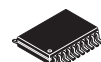
### Features

- Maximum Frequency >1.0 GHz Typical
- 50 ps Output-to-Output Skew
- PECL Mode Operating Range:  $V_{CC} = 3.135\text{ V to }3.8\text{ V}$  with  $V_{EE} = 0\text{ V}$
- ECL Mode Operating Range:  $V_{CC} = 0\text{ V}$  with  $V_{EE} = -3.135\text{ V to }-3.8\text{ V}$
- 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

## MC100ES6039



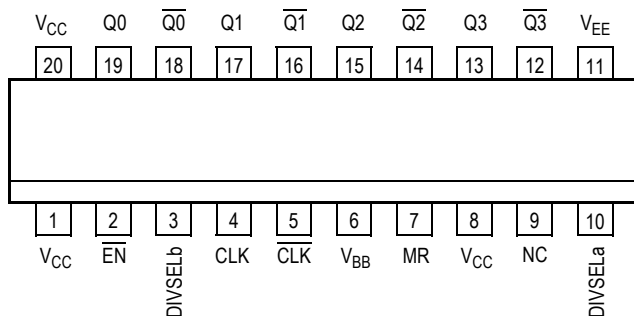
DW SUFFIX  
20-LEAD SOIC PACKAGE  
CASE 751D-07



EG SUFFIX  
20-LEAD TSSOP PACKAGE  
Pb-FREE PACKAGE  
CASE 751D-07

### ORDERING INFORMATION

Device	Package
MC100ES6039DW	SO-20
MC100ES6039DWR2	SO-20
MC100ES6039EG	SO-20 (Pb-Free)
MC100ES6039EGR2	SO-20 (Pb-Free)



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

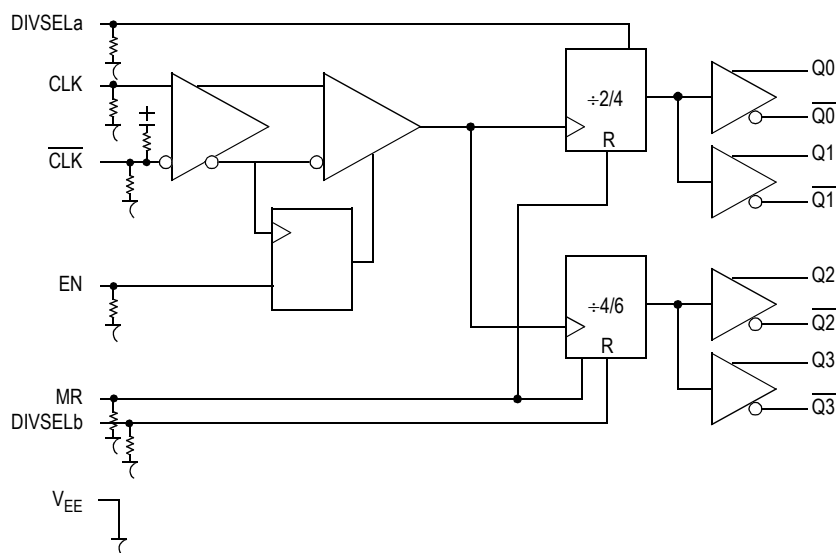
**Figure 1. 20-Lead Pinout (Top View)**

**Table 1. Pin Description**

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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 $\div 2/4$ Outputs
$Q2, Q3, \overline{Q2}, \overline{Q3}$	ECL Diff $\div 4/6$ Outputs
$DIVSELa^{(1)}$	ECL Freq. Select Input $\div 2/4$
$DIVSELb^{(1)}$	ECL Freq. Select Input $\div 4/6$
$V_{CC}$	ECL Positive Supply
$V_{EE}$	ECL Negative Supply
NC	No Connect

1. Pins will default low when left open.



**Figure 2. Logic Diagram**

**Table 2. Function Tables**

CLK	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
$DIVSELb$	Q2:3 Outputs
L	Divide by 4
H	Divide by 6

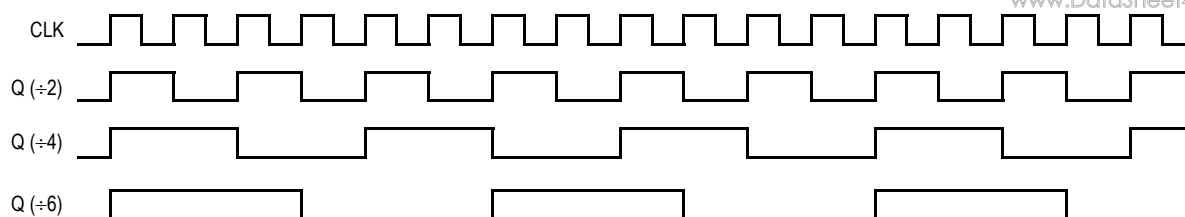


Figure 3. Timing Diagram

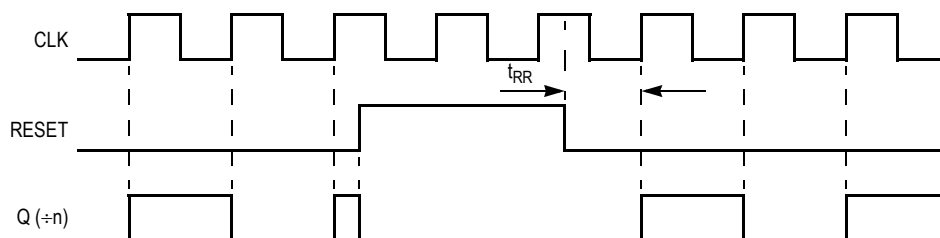


Figure 4. Timing Diagram

Table 3. Attributes

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

Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test

**Table 4. Maximum Ratings<sup>(1)</sup>**

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Symbol	Parameter	Condition 1	Condition 2	Rating	Units
$V_{CC}$	PECL Mode Power Supply	$V_{EE} = 0\text{ V}$		3.9	V
$V_{EE}$	ECL Mode Power Supply	$V_{CC} = 0\text{ V}$		-3.9	V
$V_I$	PECL Mode Input Voltage ECL Mode Input Voltage	$V_{EE} = 0\text{ V}$ $V_{CC} = 0\text{ V}$	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	3.9 -3.9	V V
$I_{out}$	Output Current	Continuous Surge		50 100	mA mA
$I_{BB}$	$V_{BB}$ Sink/Source			$\pm 0.5$	mA
$T_A$	Operating Temperature Range			-40 to +85	°C
$T_{stg}$	Storage Temperature Range			-65 to +150	°C
$\theta_{JA}$	Thermal Resistance (Junction-to-Ambient)	0 LFPM 500 LFPM	20 SOIC 20 SOIC	TBD TBD	°C/W °C/W

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

**Table 5. DC Characteristics** ( $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -3.8\text{ V}$  to  $-3.135\text{ V}$  or  $V_{CC} = 3.135\text{ V}$  to  $3.8\text{ V}$ ,  $V_{EE} = 0\text{ V}$ )<sup>(1)</sup>

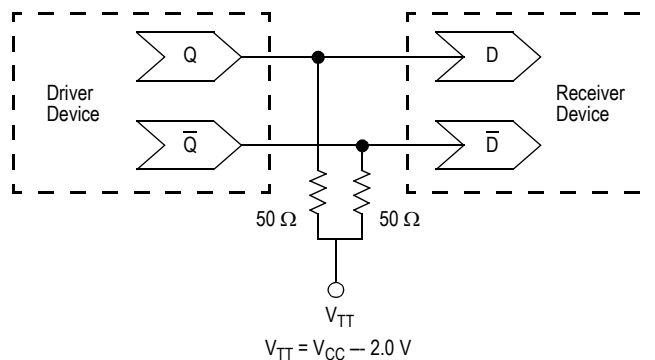
Symbol	Characteristic	-40°C			0°C to 85°C			Unit
		Min	Typ	Max	Min	Typ	Max	
$I_{EE}$	Power Supply Current		35	60		35	60	mA
$V_{OH}$	Output HIGH Voltage <sup>(2)</sup>	$V_{CC} - 1150$	$V_{CC} - 1020$	$V_{CC} - 800$	$V_{CC} - 1200$	$V_{CC} - 970$	$V_{CC} - 750$	mV
$V_{OL}$	Output LOW Voltage <sup>(2)</sup>	$V_{CC} - 1950$	$V_{CC} - 1620$	$V_{CC} - 1250$	$V_{CC} - 2000$	$V_{CC} - 1680$	$V_{CC} - 1300$	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 <sup>(3)</sup>	0.12		1.4	0.12		1.4	V
$V_{CMR}$	Differential Cross Point Voltage <sup>(4)</sup>	$V_{EE} + 0.2$		$V_{CC} - 0.7$	$V_{EE} + 0.2$		$V_{CC} - 0.7$	V
$I_{IH}$	Input HIGH Current			150			150	μA
$I_{IL}$	Input LOW Current	0.5			0.5			μA

- 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.
- All loading with  $50\ \Omega$  to  $V_{CC} - 2.0$  volts.
- $V_{PP}$  (DC) is the minimum differential input voltage swing required to maintain device functionality.
- $V_{CMR}$  (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** ( $V_{CC} = 0\text{ V}$ ,  $V_{EE} = -3.8\text{ V}$  to  $-3.135\text{ V}$  or  $V_{CC} = 3.135\text{ V}$  to  $3.8\text{ V}$ ,  $V_{EE} = 0\text{ V}$ )<sup>(1)</sup>

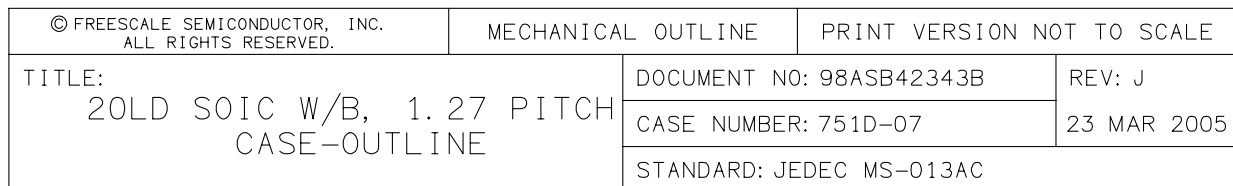
Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{\max}$	Maximum Frequency		> 1			> 1			> 1		GHz
$t_{PLH}$ , $t_{PHL}$	Propagation Delay CLK, Q (Diff) MR, Q	575 500		875 850	575 500		875 850	575 500		875 850	ps ps
$t_{RR}$	Reset Recovery	200	100		200	100		200	100		ps
$t_s$	Setup Time $\overline{EN}$ , CLK	200	120		200	120		200	120		ps
	DIVSEL, CLK	400	180		400	180		400	180		ps
$t_h$	Hold Time $\overline{CLK}$ , $\overline{EN}$	100	50		100	50		100	50		ps
	CLK, DIVSEL	200	140		200	140		200	140		ps
$t_{PW}$	Minimum Pulse Width MR	550	450		550	450		550	450		ps
$t_{SKEW}$	Within Device Skew Q, $\overline{Q}$			80			80			80	ps
	Q, $\overline{Q}$ @ Same Frequency			50			50			50	ps
	Device-to-Device Skew <sup>(2)</sup>			300			300			300	ps
$t_{JITTER}$	Cycle-to-Cycle Jitter (RMS 1 $\sigma$ )			1			1			1	ps
$V_{PP}$	Input Voltage Swing (Differential)	150		1400	150		1400	150		1400	mV
$V_{CMR}$	Differential Cross Point Voltage	$V_{EE}+0.2$		$V_{CC}-1.1$	$V_{EE}+0.2$		$V_{CC}-1.1$	$V_{EE}+0.2$		$V_{CC}-1.1$	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  $50\ \Omega$  to  $V_{CC} - 2.0\text{ V}$ .
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**

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**CASE 751D-07  
ISSUE J  
20-LEAD SOIC PACKAGE**

## PACKAGE DIMENSIONS

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### NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. DATUMS A AND B TO BE DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
4. THIS DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSION OR GATE BURRS SHALL NOT EXCEED 0.15 MM PER SIDE. THIS DIMENSION IS DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
5. THIS DIMENSION DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.25 MM PER SIDE. THIS DIMENSION IS DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
6. THIS DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED 0.62 mm.

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TITLE: 20LD SOIC W/B, 1.27 PITCH, CASE OUTLINE			DOCUMENT NO: 98ASB42343B		REV: J
			CASE NUMBER: 751D-07		23 MAR 2005
			STANDARD: JEDEC MS-013AC		

PAGE 2 OF 2

### CASE 751D-07 ISSUE J 20-LEAD SOIC PACKAGE

MC100ES6039

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