

**Philips Components–Signetics**

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ECL Products	

# 10135 Flip-Flop

## Dual J-K Master-Slave Flip-Flop

**FEATURES**

- Typical propagation delay: 3.0ns
- Typical supply current ( $-I_{EE}$ ): 54mA

**DESCRIPTION**

The 10135 is a Dual Master-Slave DC coupled J-K Flip-Flop. It contains a common clock and separate J-K inputs which do not affect the output when the Clock is static. The outputs of the 10135 register a change on the J or K inputs with a positive transition of the Clock. Asynchronous Set (S) and Reset (R) inputs are provided which override the Clock. Unused inputs must be tied Low to  $V_{IL}$  or  $V_{EE}$ .

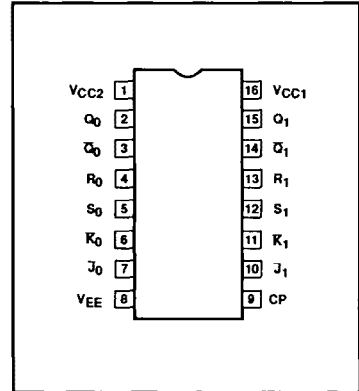
**ORDERING INFORMATION**

DESCRIPTION	ORDER CODE
16-Pin Plastic DIP	10135N
16-Pin Ceramic DIP	10135F

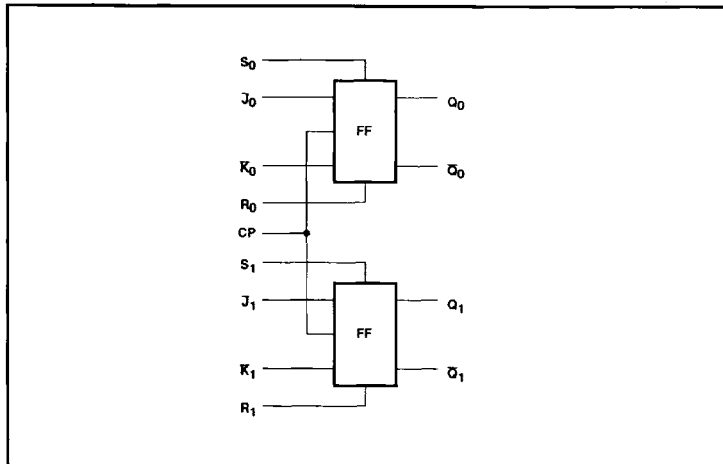
**PIN DESCRIPTION**

PINS	DESCRIPTION
$J_n, K_n$	J, K Inputs
CP	Clock Input
$S_n, R_n$	Set and Reset Inputs
$Q_n, \bar{Q}_n$	Data Outputs

**PIN CONFIGURATION**



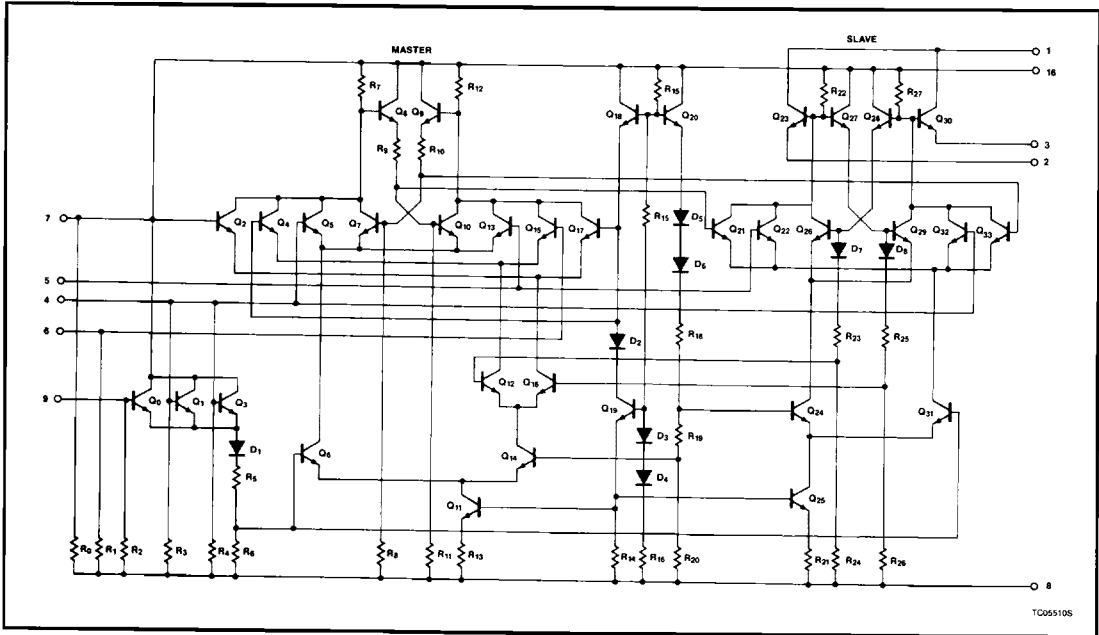
**LOGIC DIAGRAM**



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## SIMPLIFIED SCHEMATIC



TC055105

## FUNCTION TABLES

INPUTS		OUTPUT
R	S	$Q_{n+1}$
L	L	$Q_n$
L	H	H
H	L	L
H	H	.

\* Not allowed.  
R and S must be Low.

INPUTS		OUTPUT
J	K	$Q_{n+1}$
L	L	$Q_n$
H	L	L
L	H	H
H	H	$Q_n$

H = High Voltage Level  
L = Low Voltage Level

## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	LIMITS	UNIT
$V_{EE}$	Supply voltage	-8.0	V
$V_{IN}$	Input voltage ( $V_{IN}$ should never be more negative than $V_{EE}$ )	0 to $V_{EE}$	V
$I_O$	Output source current (continuous)	-50	mA
$T_S$	Storage temperature range	-55 to +150	°C
$T_J$	Maximum junction temperature	Ceramic Package	+165
		Plastic Package	+150

### NOTE:

Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted, these limits are specified over the operating ambient temperature range.

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## DC OPERATING CONDITIONS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN.	NOM.	MAX.	
$V_{CC1}, V_{CC2}$	Circuit ground		0	0	0	V
$V_{EE}$	Supply voltage (negative)			-5.2		V
$V_{IH}$	High level input voltage	$T_A = -30^\circ\text{C}$			-890	mV
		$T_A = +25^\circ\text{C}$			-810	mV
		$T_A = +85^\circ\text{C}$			-700	mV
$V_{IHT}$	High level input threshold voltage	$T_A = -30^\circ\text{C}$	-1205			mV
		$T_A = +25^\circ\text{C}$	-1105			mV
		$T_A = +85^\circ\text{C}$	-1035			mV
$V_{ILT}$	Low level input threshold voltage	$T_A = -30^\circ\text{C}$			-1500	mV
		$T_A = +25^\circ\text{C}$			-1475	mV
		$T_A = +85^\circ\text{C}$			-1440	mV
$V_{IL}$	Low level input voltage	$T_A = -30^\circ\text{C}$	-1890			mV
		$T_A = +25^\circ\text{C}$	-1850			mV
		$T_A = +85^\circ\text{C}$	-1825			mV
$T_A$	Operating ambient temperature range		-30	+25	+85	$^\circ\text{C}$

## NOTE:

When operating at other than the specified  $V_{EE}$  voltage (-5.2V), the DC and AC Electrical Characteristics will vary slightly from specified values.

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**DC ELECTRICAL CHARACTERISTICS**  $V_{CC1} = V_{CC2} = \text{ground}$ ,  $V_{EE} = -5.2V \pm 0.010V$ ,  $T_A = -30^\circ\text{C}$  to  $+85^\circ\text{C}$  output loading  $50\Omega$  to  $-2.0V \pm 0.010V$  unless otherwise specified<sup>1,3</sup>

SYMBOL	PARAMETER	TEST CONDITIONS <sup>2</sup>		LIMITS			UNIT	
				MIN.	TYP.	MAX.		
$V_{OH}$	High level output voltage	$T_A = -30^\circ\text{C}$	For $Q_n$ outputs, apply $V_{IHMAX}$ to S input with $V_{ILMIN}$ applied to R input and all other inputs. For $\bar{Q}_n$ outputs, apply $V_{IHMAX}$ to R input with $V_{ILMIN}$ applied to S input and all other inputs.	-1060		-890	mV	
		$T_A = +25^\circ\text{C}$		-960		-810	mV	
		$T_A = +85^\circ\text{C}$		-890		-700	mV	
$V_{OHT}$	High level output threshold voltage	$T_A = -30^\circ\text{C}$	For $Q_n$ outputs, apply $V_{IHT}$ to S input with $V_{ILMIN}$ applied to R input and all other inputs. For $\bar{Q}_n$ outputs, apply $V_{IHT}$ to S input with $V_{ILMIN}$ applied to R input and all other inputs.	-1080			mV	
		$T_A = +25^\circ\text{C}$		-980			mV	
		$T_A = +85^\circ\text{C}$		-910			mV	
$V_{OLT}$	Low level output threshold voltage	$T_A = -30^\circ\text{C}$	For $Q_n$ outputs, apply $V_{IHT}$ to R input with $V_{ILMIN}$ applied to S input and all other inputs. For $\bar{Q}_n$ outputs, apply $V_{IHT}$ to S input with $V_{ILMIN}$ applied to R input and all other inputs.			-1655	mV	
		$T_A = +25^\circ\text{C}$				-1630	mV	
		$T_A = +85^\circ\text{C}$				-1595	mV	
$V_{OL}$	Low level output voltage	$T_A = -30^\circ\text{C}$	For $Q_n$ outputs, apply $V_{IHMAX}$ to R input with $V_{ILMIN}$ applied to S input and all other inputs. For $\bar{Q}_n$ outputs, apply $V_{IHMAX}$ to S input with $V_{ILMIN}$ applied to R input and all other inputs.	-1890		-1675	mV	
		$T_A = +25^\circ\text{C}$		-1850		-1650	mV	
		$T_A = +85^\circ\text{C}$		-1825		-1615	mV	
$I_{IH}$	High level input current	S, R inputs	$T_A = -30^\circ\text{C}$	Apply $V_{IHMAX}$ to each input, under test, one at a time, with $V_{ILMIN}$ applied to all other inputs.			620	$\mu\text{A}$
			$T_A = +25^\circ\text{C}$				390	$\mu\text{A}$
			$T_A = +85^\circ\text{C}$				390	$\mu\text{A}$
		J, K inputs	$T_A = -30^\circ\text{C}$	Apply $V_{IHMAX}$ to each input, under test, one at a time, with $V_{ILMIN}$ applied to all other inputs.			425	$\mu\text{A}$
			$T_A = +25^\circ\text{C}$				265	$\mu\text{A}$
			$T_A = +85^\circ\text{C}$				265	$\mu\text{A}$
$I_{IL}$	Low level input current	$T_A = -30^\circ\text{C}$	Apply $V_{ILMIN}$ to each input under test, one at a time, with $V_{IHMAX}$ applied to all other inputs.	0.5			$\mu\text{A}$	
		$T_A = +25^\circ\text{C}$		0.5			$\mu\text{A}$	
		$T_A = +85^\circ\text{C}$		0.3			$\mu\text{A}$	
$-I_{EE}$	$V_{EE}$ supply current	$T_A = -30^\circ\text{C}$				75	mA	
		$T_A = +25^\circ\text{C}$			54	68	mA	
		$T_A = +85^\circ\text{C}$				75	mA	
$\frac{\Delta V_{OH}}{\Delta V_{EE}}$	High level output voltage compensation	$T_A = +25^\circ\text{C}$			0.016		V/V	
$\frac{\Delta V_{OL}}{\Delta V_{EE}}$	Low level output voltage compensation				0.250		V/V	
$\frac{\Delta V_{BB}}{\Delta V_{EE}}$	Reference bias voltage compensation				0.148		V/V	

**NOTES:**

- The specified limits represent the worst case values for the parameter. Since these worst case values normally occur at the supply voltage and temperature extremes, additional noise immunity can be achieved by decreasing the allowable operating condition ranges.
- Conditions for testing shown in the tables are not necessarily worst case. For worst case testing guidelines, refer to DC Testing, Chapter 1, Section 3.
- The specified limits shown in the DC Electrical Characteristics table can be met only after thermal equilibrium has been established. Thermal equilibrium is established by applying power for at least 2 minutes, while maintaining transverse airflow of 2.5 meters/sec (500 linear feet/min) over the device, mounted either in a test socket or on a printed circuit board. Test voltage values are given in the DC Operating Conditions table.

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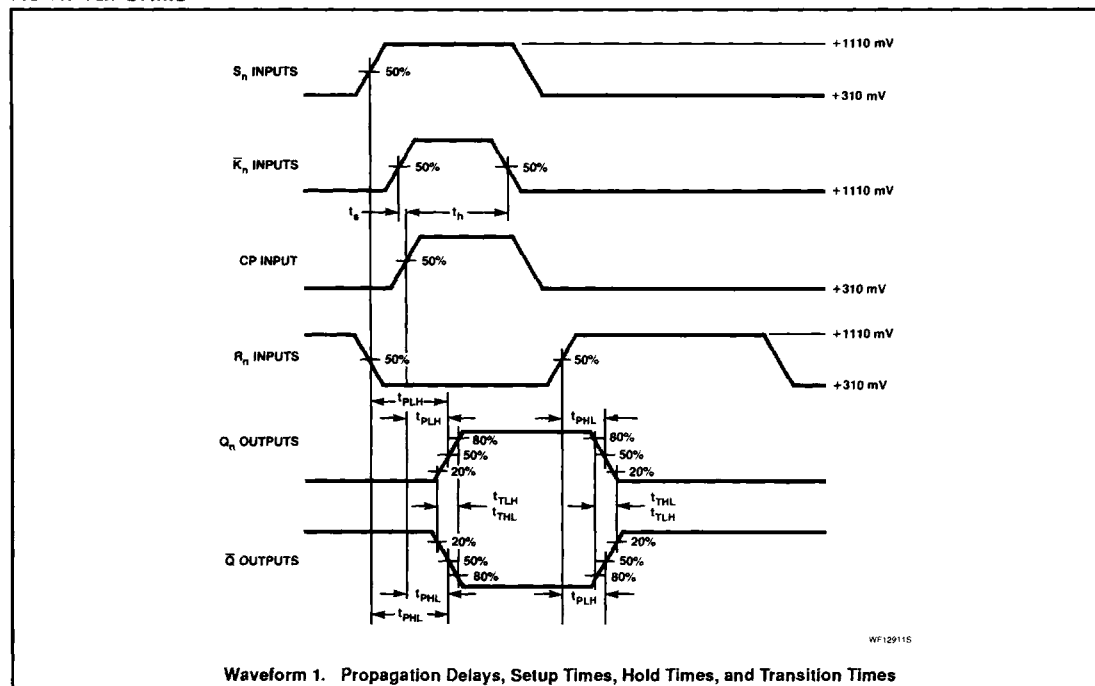
## AC ELECTRICAL CHARACTERISTICS $V_{CC1} = V_{CC2} = \text{ground}, V_{EE} = -5.2V \pm 0.010V$

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS						UNIT	
			$T_A = -30^\circ\text{C}$		$T_A = +25^\circ\text{C}$			$T_A = +85^\circ\text{C}$		
			MIN.	MAX.	MIN.	TYP.	MAX.	MIN.		MAX.
$f_{MAX}$	Maximum clock frequency	Waveform 1	125		125	140		125		MHz
$t_{PLH}$ $t_{PHL}$	Propagation delay CP to $Q_n, \bar{Q}_n$		1.80	5.00	1.80	3.00	4.50	1.80	4.60	ns
$t_{PLH}$ $t_{PHL}$	Propagation delay $S_n$ to $Q_n, \bar{Q}_n$		1.80	5.60	1.80	3.00	5.00	1.80	5.20	ns
$t_{PLH}$ $t_{PHL}$	Propagation delay $R_n$ to $Q_n, \bar{Q}_n$		1.80	5.60	1.80	3.00	5.00	1.80	5.20	ns
$t_s$	Setup time $J_n, \bar{K}_n$ to CP		2.50		2.50	1.00		2.50		ns
$t_h$	Hold time $J_n, \bar{K}_n$ to CP		1.50		1.50	1.00		1.50		ns
$t_{TLH}$ $t_{THL}$	Transition time 20% to 80%, 80% to 20%		1.10	4.80	1.10	2.00	4.50	1.10	4.70	ns
$t_{TLH}$ $t_{THL}$	Transition time 20% to 80%, 80% to 20%		1.10	4.80	1.10	2.00	4.50	1.10	4.70	ns

**NOTE:**

For AC test setup information, see AC Testing, Chapter 2, Section 3.

## AC WAVEFORMS



Waveform 1. Propagation Delays, Setup Times, Hold Times, and Transition Times