National Semiconductor

CD4015BM/CD4015BC DUAL 4-BIT Static Shift Register

General Description

The CD4015BM/CD4015BC contains two identical, 4-stage, serial-input/parallel-output registers with independent "Data," "Clock," and "Reset" inputs. The logic level present at the input of each stage is transferred to the output of that stage at each positive-going clock transition. A logic high on the "Reset" input resets all four stages covered by that input. All inputs are protected from static discharge by a series resistor and diode clamps to V_{DD} and V_{SS}.

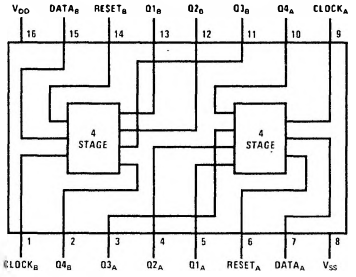
Features

■ Wide supply voltage range	3.0V to 18V
■ High noise immunity	0.45V_{DD} (typ.)
■ Low power TTL compatibility	fan out of 2 driving 74L or 1 driving 74LS
■ Medium speed operation	8MHz (typ) clock rate
■ Fully static design	@$V_{DD} - V_{SS}$ = 10 Volts

Applications

- Seriai-input/parallel-output data queueing
- Serial to parallel data conversion
- General purpose register

Connection Diagram and Truth Table

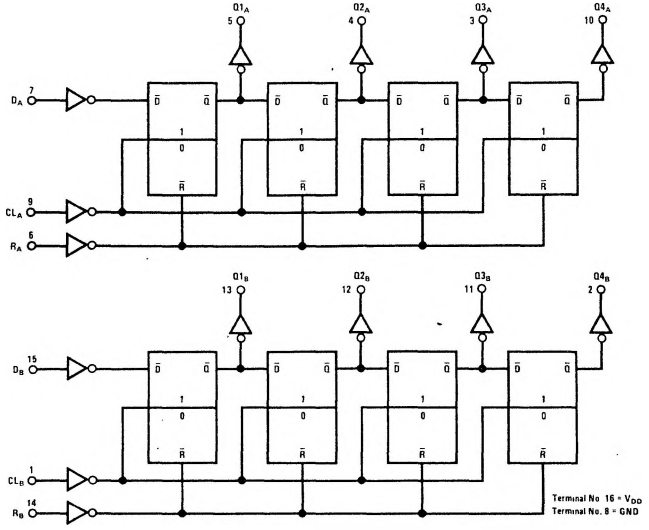


CL▲	D	R	Q_1	Q_n	
⌐	0	0	0	Q_{n-1}	
⌐	1	0	1	Q_{n-1}	
⌐	X	0	Q_1	Q_n	(No change)
X	X	1	0	0	

▲ Level change

X Don't care case.

Logic Diagrams



Absolute Maximum Ratings (Notes 1 and 2)

V_{DD}	DC Supply Voltage	−0.5 to +18 V_{DC}
V_{IN}	Input Voltage	−0.5 to V_{DD} + 0.5 V_{DC}
T_S	Storage Temperature Range	−65 to +150 °C
P_D	Package Dissipation	500 mW
T_L	Lead Temperature (Soldering, 10 seconds)	300 °C

Recommended Operating Conditions

V_{DD}	DC Supply Voltage	+3 to +15 V_{DC}
V_{IN}	Input Voltage	0 to V_{DD} V_{DC}
T_A	Operating Temperature Range	
	CD4015BM	−55 °C to +125 °C
	CD4015BC	−40 °C to +85 °C

DC Electrical Characteristics (Note 2) — CD4015BM

Parameter		Conditions	−55°C		25°C			125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V		5		0.005	5		150	μA
		V_{DD} = 10V		10		0.010	10		300	μA
		V_{DD} = 15V		20		0.015	20		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V		0.05		0	0.05		0.05	V
		V_{DD} = 10V		0.05		0	0.05		0.05	V
		V_{DD} = 15V		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V	4.95		4.95	5		4.95		V
		V_{DD} = 10V	9.95		9.95	10		9.95		V
		V_{DD} = 15V	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V; or 4.5V	3.5		3.5	2.75		3.5		V
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I_{OL}	Low Level Output Current	V_{DD} = 5V, V_O = 0.4V	0.64		0.51	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.6		1.3	2.25		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	4.2		3.4	8.8		2.4		mA
I_{OH}	High Level Output Current	V_{DD} = 5V, V_O = 4.6V	−0.64		−0.51	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.6		−1.3	−2.25		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−4.2		−3.4	−8.8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.1		-10^{-5}	−0.1		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.1		10^{-5}	0.1		1.0	μA

DC Electrical Characteristics (Note 2) — CD4015BC

Parameter		Conditions	−40°C		25°C			85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD} = 5V		20		0.005	20		150	μA
		V_{DD} = 10V		40		0.010	40		300	μA
		V_{DD} = 15V		80		0.015	80		600	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5V		0.05		0	0.05		0.05	V
		V_{DD} = 10V		0.05		0	0.05		0.05	V
		V_{DD} = 15V		0.05		0	0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5V	4.95		4.95	5		4.95		V
		V_{DD} = 10V	9.95		9.95	10		9.95		V
		V_{DD} = 15V	14.95		14.95	15		14.95		V
V_{IL}	Low Level Input Voltage	V_{DD} = 5V, V_O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
		V_{DD} = 10V, V_O = 1.0V or 9.0V		3.0		4.50	3.0		3.0	V
		V_{DD} = 15V, V_O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V_{IH}	High Level Input Voltage	V_{DD} = 5V, V_O = 0.5V; or 4.5V	3.5		3.5	2.75		3.5		V
		V_{DD} = 10V, V_O = 1.0V or 9.0V	7.0		7.0	5.50		7.0		V
		V_{DD} = 15V, V_O = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I_{OL}	Low Level Output Current	V_{DD} = 5V, V_O = 0.4V	0.52		0.44	0.88		0.36		mA
		V_{DD} = 10V, V_O = 0.5V	1.3		1.1	2.25		0.9		mA
		V_{DD} = 15V, V_O = 1.5V	3.6		3.0	8.8		2.4		mA
I_{OH}	High Level Output Current	V_{DD} = 5V, V_O = 4.6V	−0.52		−0.44	−0.88		−0.36		mA
		V_{DD} = 10V, V_O = 9.5V	−1.3		−1.1	−2.25		−0.9		mA
		V_{DD} = 15V, V_O = 13.5V	−3.6		−3.0	−8.8		−2.4		mA
I_{IN}	Input Current	V_{DD} = 15V, V_{IN} = 0V		−0.3		-10^{-5}	−0.3		−1.0	μA
		V_{DD} = 15V, V_{IN} = 15V		0.3		10^{-5}	0.3		1.0	μA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed, they are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions" and "Electrical Characteristics" provide conditions for actual device operation.

Note 2: V_{SS} = OV unless otherwise specified.

AC Electrical Characteristics

$T_A = 25°C$, $C_L = 50pF$, $R_L = 200K$, $t_r = t_f \approx 20ns$, unless otherwise specified.

Clocked Operation	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}, t_{PLH}	Propogation Delay Time	$V_{DD} = 5V$		230	350	ns
		$V_{DD} = 10V$		80	160	ns
		$V_{DD} = 15V$		60	120	ns
t_{THL}, t_{TLH}	Transition Time	$V_{DD} = 5V$		100	200	ns
		$V_{DD} = 10V$		50	100	ns
		$V_{DD} = 15V$		40	40	ns
t_{WL}, t_{WM}	Minimum Clock Pulse-Width	$V_{DD} = 5V$		160	250	ns
		$V_{DD} = 10V$		60	110	ns
		$V_{DD} = 15V$		50	100	ns
t_{rCL}, t_{fCL}	Clock Rise and Fall Time	$V_{DD} = 5V$			15	μS
		$V_{DD} = 10V$			15	μS
		$V_{DD} = 15V$			15	μS
t_{SU}	Minimum Data Set-Up Time	$V_{DD} = 5V$		50	100	ns
		$V_{DD} = 10V$		20	40	ns
		$V_{DD} = 15V$		15	30	ns
f_{CL}	Maximum Clock Frequency	$V_{DD} = 5V$	2	3.5		MHz
		$V_{DD} = 10V$	4.5	8		MHz
		$V_{DD} = 15V$	6	11		MHz
C_{IN}	Input Capacitance	Clock Input		7.5	10	pF
		Other Inputs		5	7.5	pF
Reset Operation						
$t_{PHL(R)}$	Propogation Delay Time	$V_{DD} = 5V$		200	400	ns
		$V_{DD} = 10V$		100	200	ns
		$V_{DD} = 15V$		80	160	ns
$t_{WH(R)}$	Minimum Reset Pulse Width	$V_{DD} = 5V$		135	250	ns
		$V_{DD} = 10V$		40	80	ns
		$V_{DD} = 15V$		30	60	ns