

Dual 4-Stage Static Shift Register

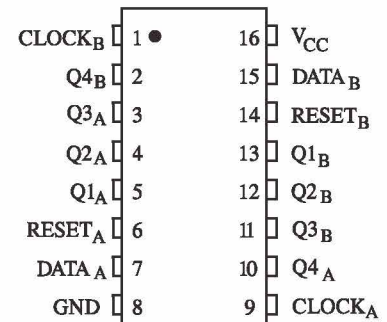
DESCRIPTION

The TK4015 is dual 4-Stage Static Shift Register, it consists of two identical but independent 4-stage serial input and parallel output registers. Each register has independent CLOCK and RESET inputs as well as a single serial DATA input.

All register stages are D-type, master-slave flip-flops. "Q" outputs are available from each of the four stages on both registers. The logic level present at the DATA input is transferred into the first register stage and shifted over one stage at each positive-going clock transition.

Resetting of all stages is accomplished by a high level on the reset line. Register expansion to 8 stages using our DATA.

PIN ASSIGNMENT



FEATURES

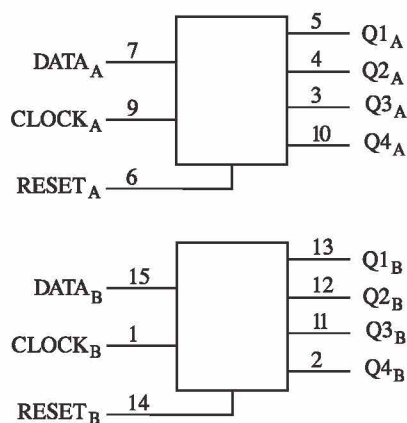
- Operating Voltage Range: 3 to 18 V
- Maximum input current of 1 μ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package temperature range):
 1.0 V min @ 5 V supply
 2.0 V min @ 10V supply
 2.5 V min @ 15 V supply
- Two identical but independent registers
- TA = -40° to 125° C for all packages

FUNCTION TABLE

Inputs			Outputs	
Clock	Data	Reset	Q1	Q _n
	L	L	L	Q _{n-1}
	H	L	H	Q _{n-1}
	X	L	No change	
X	X	H	L	L

X = don't care

LOGIC DIAGRAM



PIN 16=V_{CC} PIN 8= GND

Ordering information

Part Number	Package	Packing	Operating Temperature	Standard Package
TK4015BM	SOIC-16	Reel	-40°C ~ 125°C	2500
TK4015BP	TSSOP-16	Reel	-40°C ~ 125°C	2500
TK4015BE	DIP-16	Tube	-40°C ~ 125°C	1000

■ MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to 20	V
V_{IN}	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} 0.5$	V
V_{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} 0.5$	V
I_{IN}	DC Input Current, per Pin	± 10	mA
P_D	Power Dissipation in Plastic DIP+ SOIC Package+	750 500	mW
P_D	Power Dissipation per Output Transistor	100	mW
Tstg	Storage Temperature	-55 to 150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	°C

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

Functional operation should be restricted to the Recommended Operating Conditions

■ RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	3.0	18	V
V_{IN}, V_{OUT}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V_{CC}	V
T_A	Operating Temperature, All Package Types	-40	125	°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range $GND \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

■ DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				≥-55°C	25°C	≤125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} =0.5 V or V _{CC} - 0.5 V	5.0	3.5	3.5	3.5	V
		V _{OUT} =1.0 V or V _{CC} - 1.0 V	10	7	7	7	
		V _{OUT} =1.5 V or V _{CC} - 1.5 V	15	11	11	11	
V _{IL}	Maximum Low - Level Input Voltage	V _{OUT} =0.5 V or V _{CC} - 0.5 V	5.0	1.5	1.5	1.5	V
		V _{OUT} =1.0 V or V _{CC} - 1.0 V	10	3	3	3	
		V _{OUT} =1.5 V or V _{CC} - 1.5 V	15	4	4	4	
V _{OH}	Minimum High-Level Output Voltage	V _{IN} =GND or V _{CC}	5.0	4.95	4.95	4.95	V
			10	9.95	9.95	9.95	
			15	14.95	14.95	14.95	
		V _{IL} =1.5V, V _{IH} =3.5V, I _O =-1μA	5.0	4.5	4.5	4.5	
		V _{IL} =3.0V, V _{IH} =7.0V, I _O =-1μA	10	9.0	9.0	9.0	
V _{IL} =4.0V, V _{IH} =11V, I _O =-1μA	15	13.5	13.5	13.5			
V _{OL}	Maximum Low-Level Output Voltage	V _{IN} =GND or V _{CC}	5.0	0.05	0.05	0.05	V
			10	0.05	0.05	0.05	
			15	0.05	0.05	0.05	
		V _{IL} =1.5V, V _{IH} =3.5V, I _O =1μA	5.0	0.5	0.5	0.5	
		V _{IL} =3.0V, V _{IH} =7.0V, I _O =1μA	10	1.0	1.0	1.0	
V _{IL} =4.0V, V _{IH} =11V, I _O =1μA	15	1.5	1.5	1.5			
I _{IN}	Maximum Input Leakage Current	V _{IN} = GND or V _{CC}	18	±0.1	±0.1	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{IN} = GND or V _{CC}	5.0	1.0	1.0	30	μA
			10	2.0	2.0	60	
			15	4.0	4.0	120	
			20	20	20	600	
I _{OL}	Minimum Output Low (Sink) Current	V _{IN} = GND or V _{CC}					mA
		V _{OL} =0.4 V	5.0	0.64	0.51	0.36	
		V _{OL} =0.5 V	10	1.6	1.3	0.9	
	V _{OL} =1.5 V	15	4.2	3.4	2.4		
I _{OH}	Minimum Output High (Source) Current	V _{IN} = GND or V _{CC}					mA
		V _{OH} =4.6 V	5.0	-0.64	-0.51	-0.36	
		V _{OH} =2.5 V	5.0	-2.0	-1.6	-1.15	
		V _{OH} =9.5 V	10	-1.8	-1.3	-0.9	
	V _{OH} =13.5 V	15	-4.2	-3.4	-2.4		

■ AC ELECTRICAL CHARACTERISTICS ($C_L=50\text{pF}$, $R_L=200\text{k}\Omega$, Input $t_r=t_f=20\text{ ns}$)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			$\geq -55^\circ\text{C}$	25°C	$\leq 125^\circ\text{C}$	
t_{max}	Maximum Clock Frequency (Figure 1)	5.0	3	3	1.5	MHz
		10	6	6	3	
		15	8.5	8.5	4.25	
$t_{\text{PHL}}, t_{\text{PLH}}$	Maximum Propagation Delay, Clock to Q (Figure 1)	5.0	320	320	640	ns
		10	160	160	320	
		15	120	120	240	
t_{PHL}	Maximum Propagation Delay, Reset to Q (Figure 2)	5.0	400	400	800	ns
		10	200	200	400	
		15	160	160	320	
$t_{\text{THL}}, t_{\text{TLH}}$	Maximum Output Transition Time, Any Output (Figure 1)	5.0	200	200	400	ns
		10	100	100	200	
		15	80	80	160	
C_{IN}	Maximum Input Capacitance	-		7.5		pF

■ TIMING REQUIREMENTS($C_L=50\text{pF}$, $R_L=200\text{ k}\Omega$, Input $t_r=t_f=20\text{ ns}$)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			$\geq -55^\circ\text{C}$	25°C	$\leq 125^\circ\text{C}$	
t_w	Minimum Pulse Width, Clock (Figure 1)	5.0	180	180	360	ns
		10	80	80	160	
		15	50	50	100	
t_w	Minimum Pulse Width, Reset (Figure 2)	5.0	200	200	400	ns
		10	80	80	160	
		15	60	60	120	
t_{su}	Minimum Setup Time, Data to Clock (Figure 3)	5.0	70	70	140	ns
		10	40	40	80	
		15	30	30	60	
t_h	Minimum Hold Time, Clock to Data (Figure 3)	5.0	0	0	0	ns
		10	0	0	0	
		15	0	0	0	
t_r, t_f	Maximum Input Rise and Fall Time (Figure 1)	5.0	15	15	30	μs
		10	6	6	12	
		15	2	2	4	

■ Switching Waveform

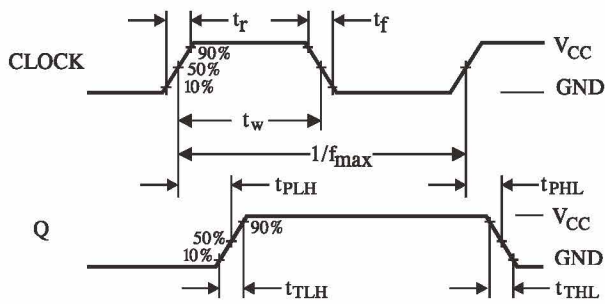


Figure 1. Switching Waveforms

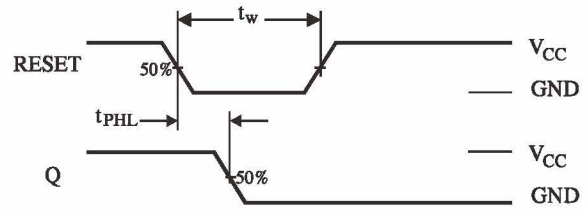


Figure 2. Switching Waveforms

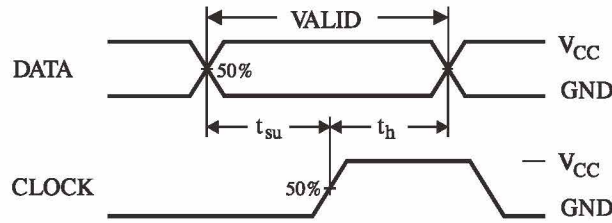
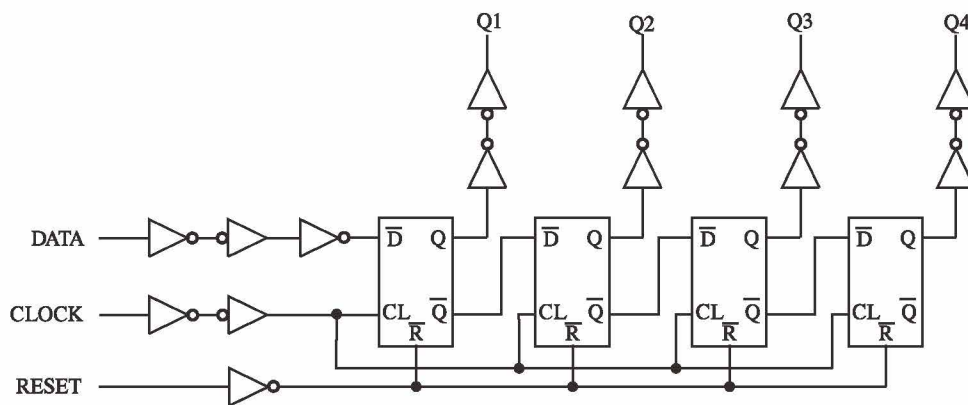
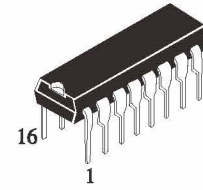
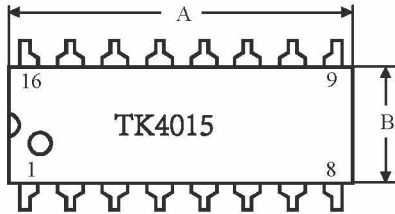


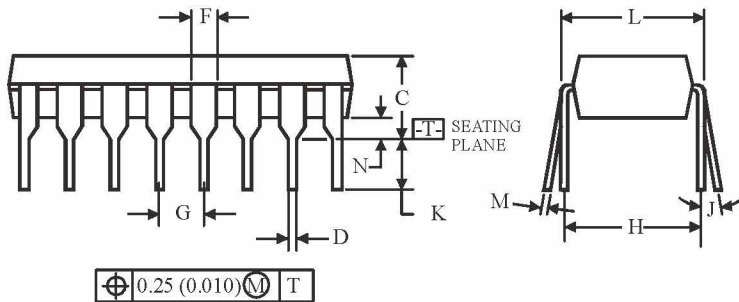
Figure 3. Switching Waveforms

**EXPANDED LOGIC DIAGRAM
(1/2 of the Device)**

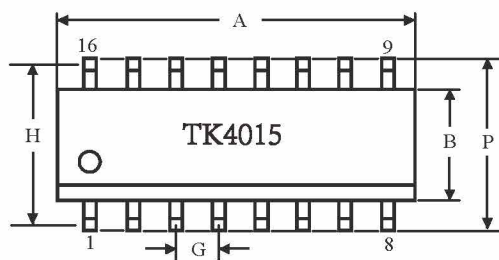
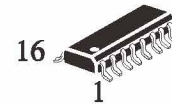


N SUFFIX PLASTIC
(MS - 001BB)


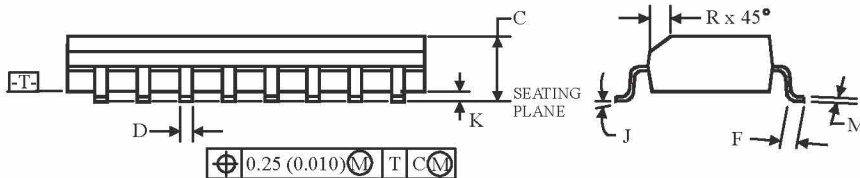
Symbol	Dimensions, mm	
	MIN	MAX
A	18.67	19.69
B	6.10	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.20	0.36
N	0.38	


NOTES:

- Dimensions "A", "B" do not include mold flash or protrusions. Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AC)


Symbol.	Dimensions, mm	
	MIN	MAX
A	9.80	10.0
B	3.80	4.00
C	1.35	1.75
D	0.33	0.51
F	0.40	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.10	0.25
M	0.19	0.25
P	5.80	6.20
R	0.25	0.50


NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A, for B - 0.25 mm (0.010) per side.