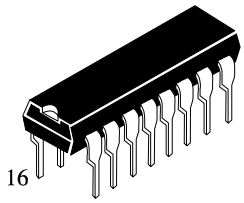
KK4520B

Dual Up-Counter
High-Voltage Silicon-Gate CMOS

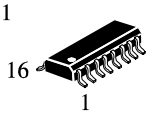
The KK4520B Dual Binary Up-Counter consists two identical, internally synchronous 4-stage counters. The counter stages are D-type flip-flops having interchangeable CLOCK and ENABLE lines for incrementing on either the positive-going or negative-going transition. For single-unit operation the ENABLE input is maintained high and the counter advances on each positive-going transition of the CLOCK. The counters are cleared by high levels on their RESET lines.

The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the CLOCK input of the latter is held low.

- Operating Voltage Range: 3.0 to 18 V
- Maximum input current of 1 μA 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 @ 5.0 V supply
  2.0 V min @ 10.0 V supply
  2.5 V min @ 15.0 V supply



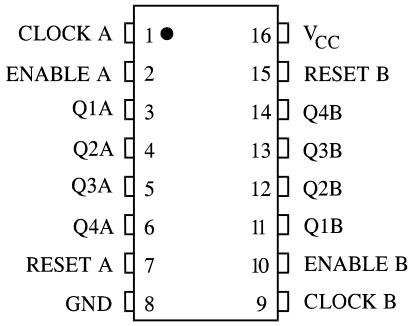
N SUFFIX
PLASTIC



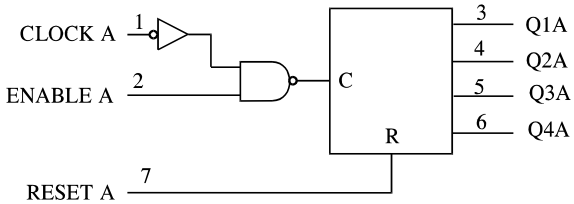
D SUFFIX
SOIC

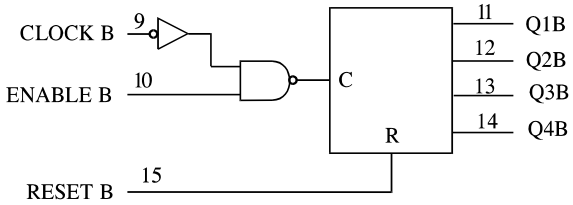
ORDERING INFORMATION
KK4520BN Plastic
KK4520BD SOIC
T_A = -55° to 125° C for all packages

PIN ASSIGNMENT



LOGIC DIAGRAM





PIN 16=V_{CC}
PIN 8= GND

FUNCTION TABLE

Inputs			Outputs
CLOCK	ENABLE	RESET	Mode
⌐	H	L	Increment Counter
L	¬	L	Increment Counter
¬	X	L	No Change
X	⌐	L	No Change
⌐	L	L	No Change
H	¬	L	No Change
X	X	H	Q1 thru Q4=L

X = don't care

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 Still Air, Plastic DIP+ SOIC Package+	750 500	mW
P_D	Power Dissipation per Output Transistor	100	mW
Tstg	Storage Temperature	-65 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.
+Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C
SOIC Package: : - 7 mW/°C from 65° to 125°C

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	-55	+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≤(V_{IN} or V_{OUT})≤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 ≥-55°C	Guaranteed Limit 25°C	Guaranteed Limit ≤125 °C	Unit
V_{IH}	Minimum High-Level Input Voltage	V_{OUT}= 0.5 V or V_{CC} - 0.5V V_{OUT}= 1.0 V or V_{CC} - 1.0 V V_{OUT}= 1.5 V or V_{CC} - 1.5V	5.0 10 15	3.5 7 11	3.5 7 11	3.5 7 11	V
V_{IL}	Maximum Low - Level Input Voltage	V_{OUT}= 0.5 V or V_{CC} - 0.5V V_{OUT}= 1.0 V or V_{CC} - 1.0 V V_{OUT}= 1.5 V or V_{CC} - 1.5V	5.0 10 15	1.5 3 4	1.5 3 4	1.5 3 4	V
V_{OH}	Minimum High-Level Output Voltage	V_{IN}=GND or V_{CC}	5.0 10 15	4.95 9.95 14.95	4.95 9.95 14.95	4.95 9.95 14.95	V
V_{OL}	Maximum Low-Level Output Voltage	V_{IN}=GND or V_{CC}	5.0 10 15	0.05 0.05 0.05	0.05 0.05 0.05	0.05 0.05 0.05	V
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 10 15 20	5 10 20 100	5 10 20 100	150 300 600 3000	µA
I_{OL}	Minimum Output Low (Sink) Current	V_{IN}= GND or V_{CC} U_{OL}=0.4 V U_{OL}=0.5 V U_{OL}=1.5 V	 5.0 10 15	 0.64 1.6 4.2	 0.51 1.3 3.4	 0.36 0.9 2.4	mA
I_{OH}	Minimum Output High (Source) Current	V_{IN}= GND or V_{CC} U_{OH}=2.5 V U_{OH}=4.6 V U_{OH}=9.5 V U_{OH}=13.5 V	 5.0 5.0 10 15	 -2 -0.64 -1.6 -4.2	 -1.6 -0.51 -1.3 -3.4	 -1.15 -0.36 -0.9 -2.4	mA

AC ELECTRICAL CHARACTERISTICS (C_L=50pF, R_L=200kΩ, Input t_r=t_f=20 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit ≥-55°C	Guaranteed Limit 25°C	Guaranteed Limit ≤125°C	Unit
f_{max}	Maximum ClockFrequency, (Figure 1)	5.0 10 15	1.5 3 4	1.5 3 4	0.75 1.5 2	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock or Enable to Output (Figures 1,3)	5.0 10 15	560 230 160	560 230 160	1120 460 320	ns
t_{PHL}	Maximum Propagation Delay, Reset to Output (Figure 2)	5.0 10 15	650 225 170	650 225 170	1300 450 340	ns
t_{THL}, t_{TLH}	Maximum Output Transition Time, Any Output (Figure 1)	5.0 10 15	200 100 80	200 100 80	400 200 160	ns
C_{IN}	Maximum Input Capacitance	-		7.5		pF

TIMING REQUIREMENTS (C_L=50pF, R_L=200 kΩ, Input t_r=t_f=20 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit ≥-55°C	Guaranteed Limit 25°C	Guaranteed Limit ≤125°C	Unit
t_w	Minimum Pulse Width, Clock (Figure 1)	5.0 10 15	200 100 70	200 100 70	400 200 140	ns
t_w	Minimum Pulse Width, Reset (Figure 2)	5.0 10 15	250 110 80	250 110 80	500 220 160	ns
t_w	Minimum Pulse Width, Enable (Figure 3)	5.0 10 15	400 200 140	400 200 140	800 400 280	ns
t_r, t_f	Maximum Input Rise and Fall Times (Figure 1)	5.0 10 15	15 5 5	15 5 5	15 5 5	μs

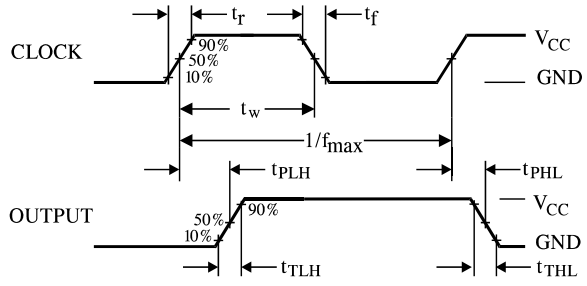


Figure 1. Switching Waveforms

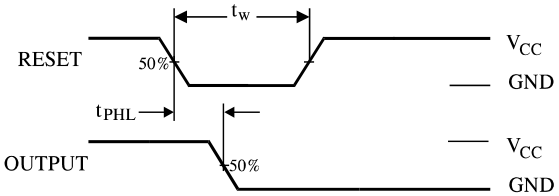


Figure 2. Switching Waveforms

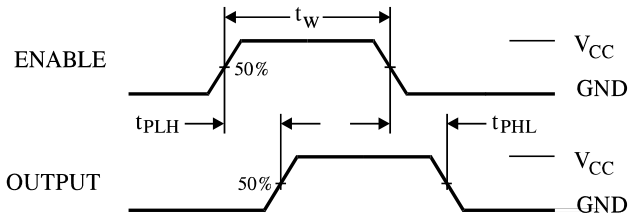
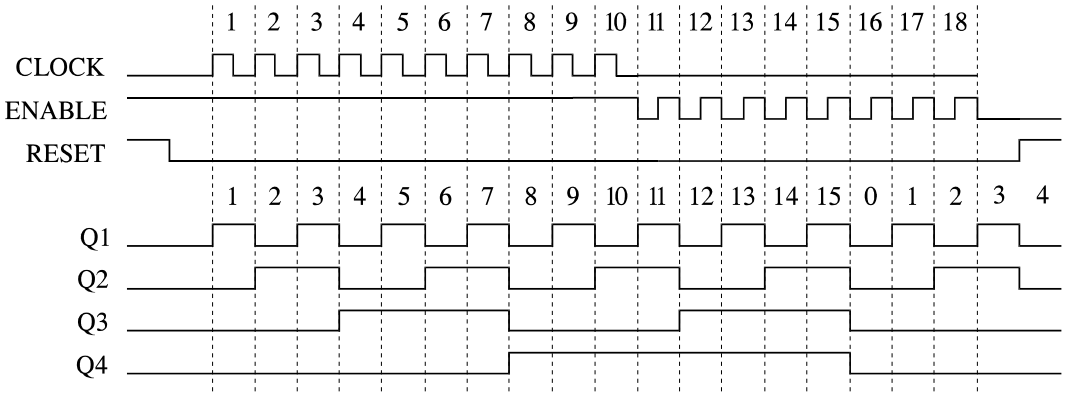
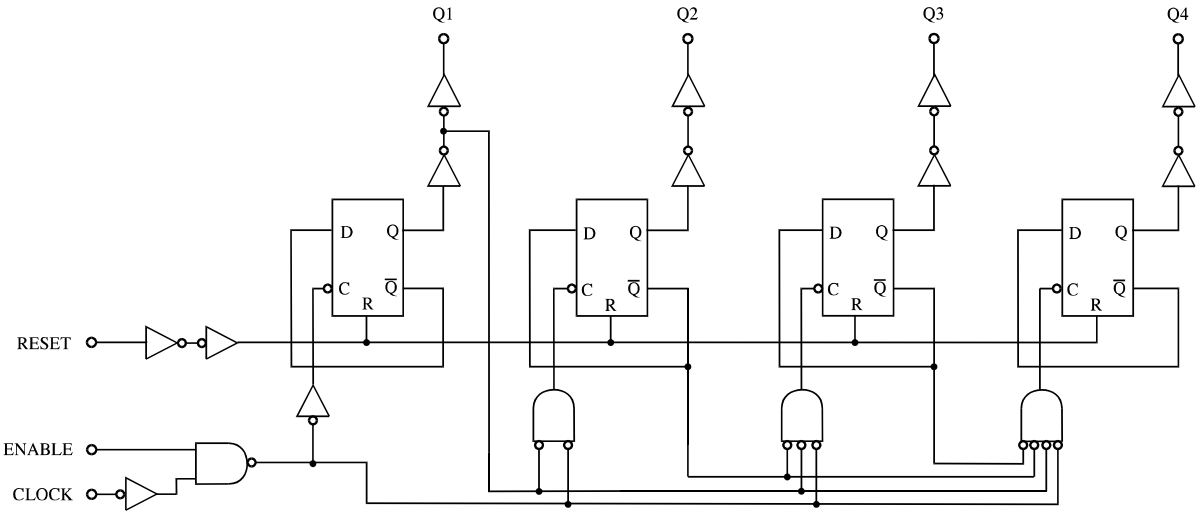


Figure 3. Switching Waveforms

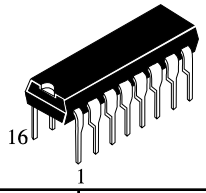
TIMING DIAGRAM

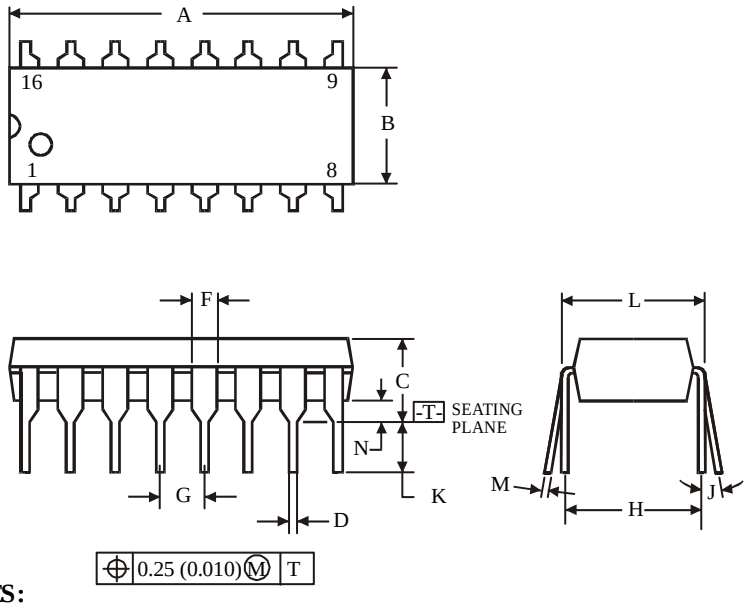


EXPANDED LOGIC DIAGRAM
(1/2 of the Device)



N SUFFIX PLASTIC DIP
(MS - 001BB)



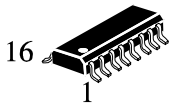


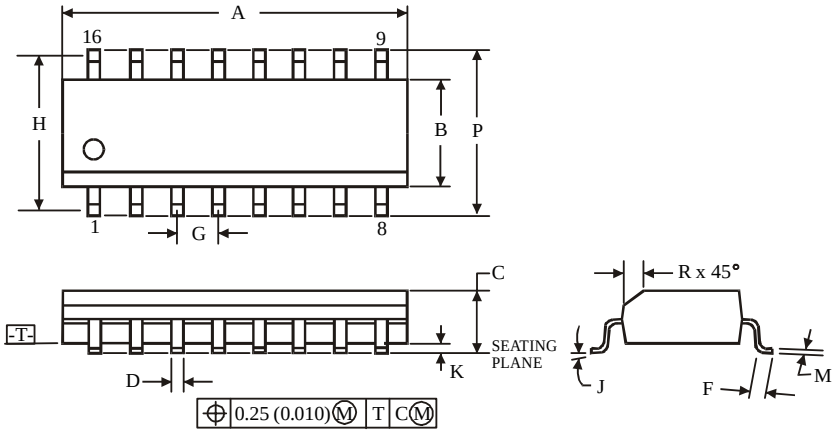
	Dimension, mm	
Symbol	**MIN**	**MAX**
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

1. 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)





	Dimension, mm	
Symbol	**MIN**	**MAX**
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.