

# 2-Bit Multiplier scratch work / design

## Truth Table

On the instructions

K-map

		$B_1 B_0$		$P_0$	
		00	01	11	10
$A_1 A_0$	00	0	0	0	0
	01	0	1	1 <sub>S</sub>	1 <sub>S</sub>
	11	0	1 <sub>S</sub>	1 <sub>S</sub>	1 <sub>S</sub>
	10	0	1 <sub>S</sub>	1 <sub>S</sub>	1 <sub>S</sub>

Labels:  $S_1, S_2, Z_1, C_1$  (under 01, 11, 10 columns)  
 $S_3, S_4, Z_2$  (next to 1<sub>S</sub> cells)

Key:

1  $P_0 = A_0 B_0$

S  $P_1 = \overline{B_1} B_0 A_1 + A_1 \overline{A_0} B_0 + \overline{A_1} A_0 B_1 + B_1 \overline{B_0} A_0$   
 $S_1, S_2, S_3, S_4$

□  $P_2 = A_1 \overline{A_0} B_1 + B_1 \overline{B_0} A_1$   
 $Z_1, Z_2$

○  $P_3 = A_1 A_0 B_1 B_0$   
 $C_1$

01 10  
 $a_1 a_0 \cdot b_1 b_0$  first bit, either 0 or 1  
 $= a_1 b_1, a_1 b_0, a_0 b_1, a_0 b_0$   
 already  $10 \cdot 10 = 100$   
 3rd bit can add second and 1st, but if 2nd carries into 3rd bit,  $1+1=10$  so we go to  
 second bit  $P_0$  0 or 1  
 if both 1, make 0 bit + carry to  $P_2$

+  
 $P_3$ , with carry from 2nd bit