Test CIC0623   P. Kind 12.6.2023

Preface

The new version of the MOPSHUB-CIC has significant changes in controling the output voltage. Now all 8 Bits of the register chip MCP23S08 are used:

Version:	OLD CIC versions	NEW CIC version 0622
Set VCAN = 0 (Power disable)	Set Bit 0 = 0 (Bits 1 to 7 = dont care)	Set Bit 0 or Bit 1 (or both Bits) to 0
Set VCAN to the selected value (Power enable)	Set Bit 0 = 1 (Bits 1 to 7 = dont care)	Set Bit 0 AND Bit 1 to 1
Setting of VCAN voltage	By trimmpotentiometer	8 fixed values Defined by 8 SMD resistors selected by multiplexer (see tables below)

Bitpattern definition

Bit	7	6	5	4	3	2	1	0
function	Dual bit C for voltage selection (MSB)		Dual bit B for voltage selection		Dual bit A for voltage selection (LSB)		Dual bit P for POWER ENABLE	

C = Bit 7 AND Bit 6; B = Bit 5 AND Bit 4; A = Bit 3 AND Bit 2; P = Bit 1 AND Bit 0;

Logic table

C	B	A	P	VCAN (Volt)	R_set (kOhm)
X	X	X	0	0	(dont care)
Voltage setting resistor disabled by DIL switch			1	1,25	(infinity)
0	0	0	1	1,9	90,9
0	0	1	1	2,0	78,7
0	1	0	1	2,4	51,1
0	1	1	1	2,6	44,2
1	0	0	1	2,8	38,3
1	0	1	1	3,5	26,1
1	1	0	1	4,2	19,6
1	1	1	1	4,6	16,9

Note 1: Voltages are defined by fix resistors, the formula is:

VCAN = 1,257 V x (Rset + 47 kOhm) / Rset = 1,257 V x (1 + 47 kOhm / Rset)

Note 2: On the CIC card is (for each VCAN channel A and B) an 8-bit DIL-switch.
Each of the 8 resistors Rset has in series a switch to disable it. Setting this switch to OFF changes Rset to „infinity" and the corresponding VCAN to the minimum value of 1.257 V. So for security the maximum VCAN can be selected by the switch („by hardware").

Note 3: The formular in Note 1 results from the used voltage regulator (MAX8880) with internal reference of typ. 1,257 V. The output voltage is feed back by a voltage divider with 47 kOhm (Tolerance 1%) from output to feedback input, and Rset from feedback input to GND. Rset are selected (switched) by an analog multiplexer (MAX4581).

Measurement for all bitpaterns with on board ADC (values in Volt, rounded)

byte	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F
0-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
1-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
2-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
3-	0	0	0	2,4	0	0	0	2,4	0	0	0	2,4	0	0	0	2,6
4-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
5-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
6-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
7-	0	0	0	2,4	0	0	0	2,4	0	0	0	2,4	0	0	0	2,6
8-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
9-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
A-	0	0	0	1,9	0	0	0	1,9	0	0	0	1,9	0	0	0	2,0
B-	0	0	0	2,4	0	0	0	2,4	0	0	0	2,4	0	0	0	2,6
C-	0	0	0	2,8	0	0	0	2,8	0	0	0	2,8	0	0	0	3,5
D-	0	0	0	2,8	0	0	0	2,8	0	0	0	2,8	0	0	0	3,5
E-	0	0	0	2,8	0	0	0	2,8	0	0	0	2,8	0	0	0	3,5
F-	0	0	0	4,2	0	0	0	4,2	0	0	0	4,2	0	0	0	4,6

What if one bit flips?   (hexadecimal pattern = VCAN in Volt)

normal >>>	FF = 4,6	F3 = 4,2	CF = 3,5	C3 = 2,8	3F = 2,6	33 = 2,4	0F = 2,0	03 = 1,9
Flip Bit 7	7F = 2,6	73 = 2,4	4F = 2,0	43 = 1,9	BF = 2,6	B3 = 2,4	8F = 2,0	83 = 1,9
Flip Bit 6	BF = 2,6	B3 = 2,4	8F = 2,0	83 = 1,9	7F = 2,6	73 = 2,4	4F = 2,0	43 = 1,9
Flip Bit 5	DF = 3,5	D3 = 2,8	EF = 3,5	E3 = 2,8	1F = 2,0	13 = 1,9	2F = 2,0	23 = 1,9
Flip Bit 4	EF = 3,5	E3 = 2,8	DF = 3,5	D3 = 2,8	2F = 2,0	23 = 1,9	1F = 2,0	13 = 1,9
Flip Bit 3	F7 = 4,2	FB = 4,2	C7 = 2,8	CB = 2,8	37 = 2,4	3B = 2,4	07 = 1,9	0B = 1,9
Flip Bit 2	FB = 4,2	F7 = 4,2	CB = 2,8	C7 = 2,8	3B = 2,4	37 = 2,4	0B = 1,9	07 = 1,9
Flip Bit 1	FD = 0	F1 = 0	CD = 0	C1 = 0	3D = 0	31 = 0	0D = 0	01 = 0
Flip Bit 0	FE = 0	F2 = 0	CE = 0	C2 = 0	3E = 0	32 = 0	0E = 0	02 = 0

Conclusion: one bitflip means:
voltage is equal or lower than the normal value, but never higher

Measuring the VCAN voltages with Digitalvoltmeter

Select Rset from E48-values				register	measured		Diff. To VCAN_theo	
VCAN (ideal)	Rset (theo)	Rset (E48)	VCAN (theo)	Setting byte	Ch A (V)	Ch B (V)	delta ch A	delta ch B
1,9	91,88	90,9	1,907	x03	1,896	1,893	-0,011	-0,014
2	79,51	78,7	2,008	x0f	1,997	1,994	-0,011	-0,014
2,4	51,69	51,1	2,413	x33	2,39	2,39	-0,023	-0,023
2,6	43,99	44,2	2,594	x3f	2,57	2,56	-0,024	-0,034
2,8	38,29	38,3	2,800	xc3	2,77	2,77	-0,030	-0,030
3,5	26,34	26,1	3,521	xcf	3,48	3,48	-0,041	-0,041
4,3	19,41	19,6	4,271	xf3	4,22	4,22	-0,051	-0,051
4,7	17,16	16,9	4,753	xff	4,64	4,56	-0,113	-0,193
	inf.	inf.	1,257	disable	1,252	1,25	-0,005	-0,007