MyRIO Expansion Board

(Gamma2d, November 2021)

Name	Value	Package	Description	Part Number
C1, C2, C3	220 uF (50V)	Radial	Buckpuck cap	493-1609-ND
C4	.1 uF	Radial	Vreg output cap	399-4264-ND
C5	.33 uF 50V	Radial	Vreg input cap	399-4299-ND
C6, C7	.1 uF	0805	Lick sensor LP filter	
C8, C9	.1 uF	0805	Comparator bypass cap	
C10, C11	.1uF	0805	Ref pin bypass network to improve stability (optional)	
D1	2A, 200V	Through hole	Input reverse polarity protection diode	RL203-TPCT-ND
D2, D3	3A, 60V	SMB	Fast recovery Schottky diode for coils. MBRS360	MBRS360BT3GOSCT-ND
D4, D5		SOD-123	Protection diode for shock during lick (optional, can be shorted out)	CMHD2003 TR PBFREE
U1	TVS	SOT-143	TVS Protection diode for lick inputs. (Optional component)	CD143A-SR12CT-ND
Q1, Q3, Q5	200mA, 40V	SOT23	2N3906 PNP for Buckpuck ctrl	MMBT3906FSCT-ND
Q2, Q4, Q6	200mA, 40V	SOT23	2N3904 NPN for Buckpuck ctrl	568-4510-1-ND
T1, T2	60V, 4A	SOT-223	Power NFET for soln. Alternate part with better characteristics (protection)	NCV8406ASTT1GOSCT-ND
R1, R2	500	1206	Soln FET gate drive	
R3, R4	50k	1206	Soln FET pull-down	
R5, R23	500	axial	Power LED (red), isolated LED(green)	R5, R23
R6 – R14	5k	0805	Buckpuck control	
R15, R16	10M	0805	Lick sense pull-up resistor	HMC0805JT50M0CT-ND
R17, R18	2.4M	0805	Comparator reference resistor	RMCF0805FT2M40CT-ND
R19, R20	500	0805	Opto-isolator LED current limit	
R21, R22	1k	0805	Lick sensor LP filter. Needs to work correctly with internal pull-up	311-1.00KCRCT-ND
R24, R25	1.5,	0805	Ref pin bypass network to improve stability (optional)	
RH_L, RH_R	106k 1%		Sets fixed hysteresis value if not using the trimmers	

DNP1, DNP2	10k	0805	Comparator output pull-up. Not needed with myRio	
HYST_L, HYST_R	100k	Bourne 3362P	Hysteresis adjust	3362P-104LF-ND
TSH_L, TSH_R	2M	Bourne 3362P	Threshold trimmer	3362P-1-205LF-ND
OK1-OK4	Opto isolator	6-SMD	4N25SM	4N25SM-ND
~~U1~~	~~TVS~~	~~SOT-143~~	~~TVS Protection diode for lick FETs~~	~~CD143A-SR12CT-ND~~
U3, U4	Comparator	8-SOIC	LTC1540	LTC1540CS8#TRPBFCT-ND
U3	5V LDO Regulator	DPAK	MC78M05	497-7255-1-ND
	Right Angle BNC Double			ARF2111-ND ACX2286-ND
	Right Angle BNC			A97553-ND, WM5514-ND
	NI MXP Connector			S9207-ND
	Audio jack			CP1-3525N-ND
	DC Barrel Connector			EJ503A-ND
	Switch SPDT		EG2478	EG2478-ND
	Switch 3PDT		To select battery power.	360-3209-ND
		SIP-7	Buckpuck 350 mA, internal current adjustment pot	788-1098-ND
			9V Battery holder	~~BC9VPC-ND~~ (Poles reversed) BA9VPC-ND
			~~RG-174 thin BNC cable for lick detection~~	~~501-1496-ND~~

Version History:

Gamma 1a (Fabbed 2017)

1. Eliminated the Teensy
2. Replaced Q1, Q3 NPN with BS170 nFETs and BAS40 protection diode array
    a. Upgraded Q1, Q3 to DMN24H3D5L (240V) and upgraded protection diode array to CMPD2004S (240V)
3. Added alternate lick detection topology (Comparator, LP, Schmitt trigger)

Gamma 1b

1. Fixed ground pour overlap
2. Added current limiting resistors to bases of BuckPuck BJTs
3. Added weak pulldown on solenoid driver FETs

Gamma 2a (Fabbed October 2018)

1. Upgraded FET protection to use TVS data line ESD protection via CD143A
2. Alternate lick detection circuit included and opto-isolated
3. Smart power transistors for solenoid actuation
4. Included switch and indicator to select lick circuit power/isolation

Gamma 2b (Fabbed August 2019)

1. Fixed miswired pin 5, 6 on lick B circuit opto-isolators
2. Changed lick circuit selection to a jumper instead of solder pad
3. Using LTC1540 comparator circuit with adjustable hysteresis and separate threshold.
4. Added RC filter on opto output.

Gamma 2c

1. MyRIO has internal 40k pullups on inputs. Eliminated pullups on the board.
2. Eliminated old transistor lick circuit
3. Renumbered components accordingly

Gamma 2d

1. Adding protection diodes and series diodes on lick inputs to make compatible with future shock stim. Added ESD protection on same inputs
2. Added RC bypass network on Ref pin to stabilize the Ref voltage in times of VCC fluctuations.
3. Silkscreen updates

Next version (Gamma 3a)

Maybe the ref comparator input should be from the stable ref pin, instead of using battery voltage. Then lick spout would also need to be pulled up to ref voltage (1.8V). If I keep the shock protection series diodes, the diode drop might not leave enough voltage headroom with this scheme.