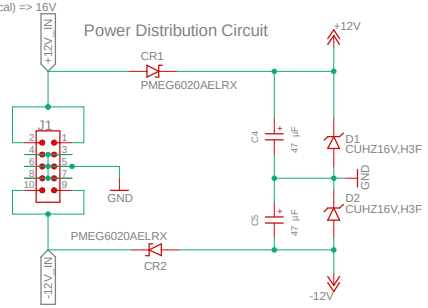
Selecting TVS Diode:

Operating voltage => 12V
20% Tolerance Overhead => 12V * 1.2 = 14.4V

CUHZ16V,H3F =>
V(reverse standoff Typical) => 16V
Vbr => 15.3V-17V
Vc(Typical) => 17V

865080645012
CAP ALUM 47UF 20% 50V SMD

CUHZ16V,H3F
16 V ZENER DIODE, SOD-323HE



45V MAX INPUT

Vset = 1.235V
R2 <= 100kOhm

Vout = Vset * (1 + R1/R2)
R1 = 120k
R2 = 71.5k

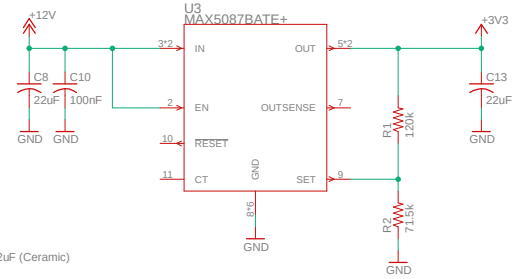
Iout = PD / (Vin - Vout)
306mA = 2.666W / (12V - 3.3V)

RC0402FR-0771K5L
RES 71.5K OHM 1% 1/16W 0402

RC0402FR-07120KL
RES 120K OHM 1% 1/16W 0402

CL21A226MAYNNNE
MLCC22UF25V 20 X5R0805

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402



47uF Minimum Input Capacitance (Electrolytic)
47uF Selected Input Capacitance (Electrolytic) and 22uF (Ceramic)

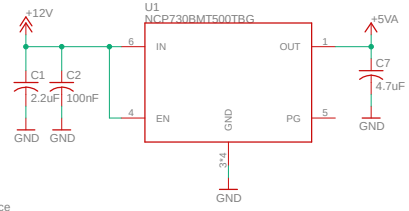
15uF Minimum Output Capacitance
22uF Selected Output Capacitance

38V MAX INPUT

C2012X7R1H475K125AC
CAP CER 4.7UF 50V X7R 0805

CL21B225KAFNFNE
CAP CER 2.2UF 25V X7R 0805

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402



1uF Minimum Input Capacitance
2.2uF Selected Input Capacitance

1uF Minimum Output Capacitance
4.7uF Selected Output Capacitance

38V MAX INPUT

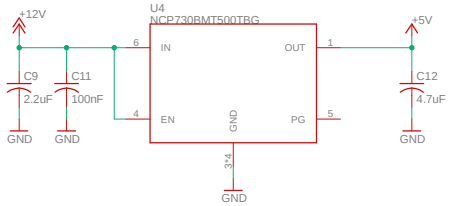
CL21B225KAFNFNE
CAP CER 2.2UF 25V X7R 0805

C2012X7R1H475K125AC
CAP CER 4.7UF 50V X7R 0805

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

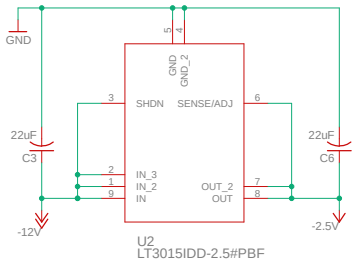
1uF Minimum Input Capacitance
2.2uF Selected Input Capacitance

1uF Minimum Output Capacitance
4.7uF Selected Output Capacitance



-30V MAX INPUT

CL21A226MAYNNNE
MLCC22UF25V 20 X5R0805



10uF Minimum Input Capacitance
22uF Selected Input Capacitance

10uF Minimum Output Capacitance
22uF Selected Output Capacitance

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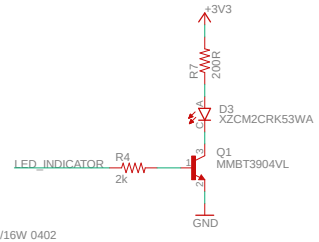
LED Indicator



Per Nexperia MMBT3904 Datasheet:
- Fig. 5: V_be(sat) = 700mV @ I_C = 2mA
- Fig. 6: V_ce(sat) = 800mV @ I_C = 2mA

Calculate Collector Resistor
VDD - V_ce(sat) - V_LED = V_R
3.3V - 0.8V - 2.1V = 0.4V

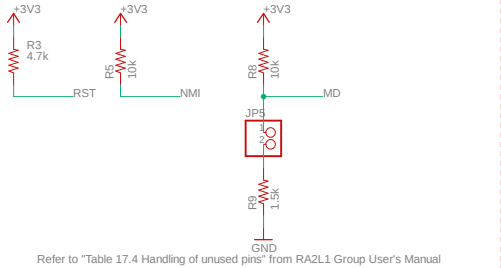
0.4V / 2mA = 200 ohm = R

Calculate Base Resistor
VDD - V_be(sat) = V_R
3.3V - 0.7V = 2.6V

Selected 2k for base resistor

RT0402FRE072KL
RES SMD 2K OHM 1% 1/16W 0402

RMCF0402FT200R
RES 200 OHM 1% 1/16W 0402



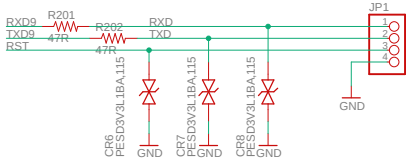
Refer to "Table 17.4 Handling of unused pins" from RA2L1 Group User's Manual

RT0402FRD0710KL
RES SMD 10K OHM 1% 1/16W 0402

RT0402FRE071K5L
RES SMD 1.5K OHM 1% 1/16W 0402

RC0402JR-074K7L
RES SMD 4.7K OHM 5% 1/16W 0402

SCI Flash Programming Interface (UART)

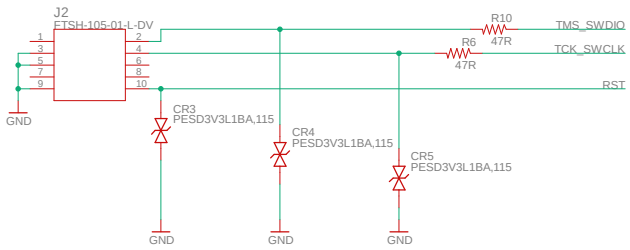


Refer to Section 37.10 - Serial Programming Mode:
Serial programming is done through Boot mode with SCI9.
These will be pins P110/RXD9 and P109/TXD9.

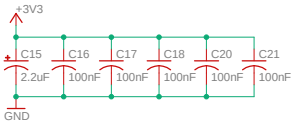
CRGCQ0402F47R
CRGCQ 0402 47R 1%

Jumper for SWD

Use with FFSD-05-S-04.00-01-N cable



CRGCQ0402F47R
CRGCQ 0402 47R 1%



CRGCQ0402F47R
CRGCQ 0402 47R 1%

RT0402FRE071KL
RES SMD 1K OHM 1% 1/16W 0402

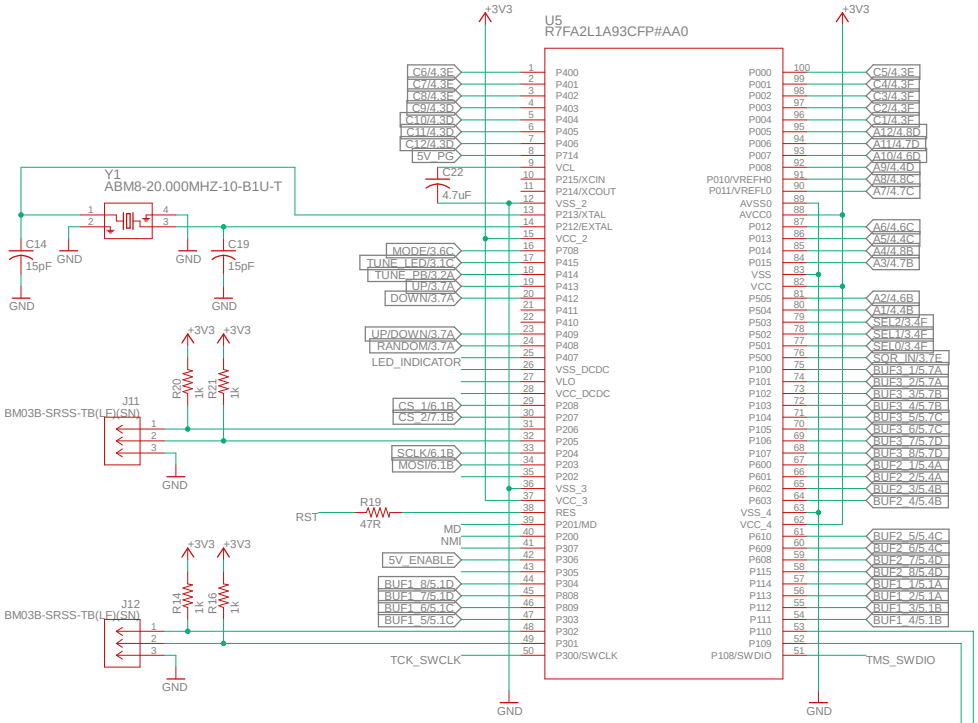
RC0402JR-074K7L
RES SMD 4.7K OHM 5% 1/16W 0402

T491A225K016AT
CAP TANT 2.2UF 10% 16V 1206

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

CC0805KKX7R7BB475
CAP CER 4.7UF 16V X7R 0805

CC0402JRNPO9BN150
CAP CER 15PF 50V C0G/NPO 0402



I2C Connectors - Polyphonic Voice Cards

I2C bus connectors for tuning calibration of on-board Polyphonic Voice Card DACs.
Each connector provides I2C communication for 4 polyphonic voice cards.

Use JST Sales America Cable A03SR03SR30K102B or some equivalent of varying length.

Cab = (pi * epsilon_0 * l) / log_e(d/r)

(pi*epsilon_0*12 inches)/ln(1 mm /(0.3759 mm /2))

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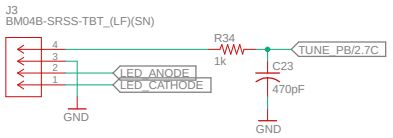
Pinout Header that connects to Tuning PB and Tuning LED Indicator (6071112110F)

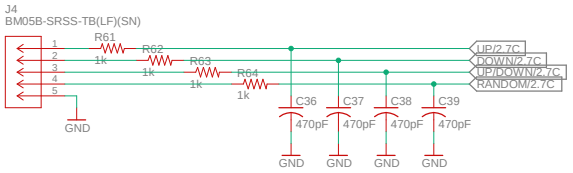


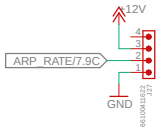
C1005C0G1H471J050BA
CAP CER 470PF 50V C0G 0402

RT0402FRE071KL
RES SMD 1K OHM 1% 1/16W 0402

Pins 3 and 4 are connect to a SPST PB.
The "TUNE_PB" input is connected to an MCU input with an internal pull-up resistor around 10k-20k.
When the SPST PB is pressed, pins 3 and 4 will short together and ground the MCU input.

Pinout Header that wires to G-141S-3011 selector switch



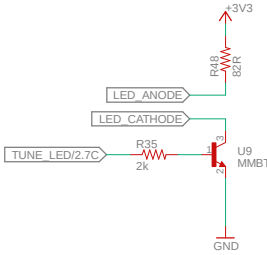


C1005C0G1H471J050BA
CAP CER 470PF 50V C0G 0402

RT0402FRE071KL
RES SMD 1K OHM 1% 1/16W 0402

"UP", "DOWN", "UP/DOWN", and "RANDOM" are each connected to MCU inputs with internal pull-up resistors.
Pins 1, 2, 3, and 4 connect to a single pole of a DP4T selector switch. Each pin is shorted to pin 5 or ground individually when selected.

The Tuning LED Indicator Driver Circuit



RT0402FRE072KL
RES SMD 2K OHM 1% 1/16W 0402

RC0402FR-0782RL
RES 82 OHM 1% 1/16W 0402

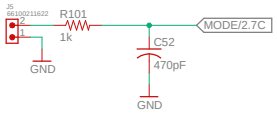
6071112110F Specs: 15mA @ 2V

Vce(sat)<:= 0.1V

Choose a collector resisotr that produces a saturation current at about 15mA:
(3.3V - 0.1V - 2V) / 15mA = 1.2V / 15mA => 80R
Chosen := 82R

Choose base resistor that produces a base current that is about 1/10th the collector saturation current:
(3.3V - 0.7V) / 2k = 1.3mA
Chosen: 2k

Pinout Header that wires to SPST switch



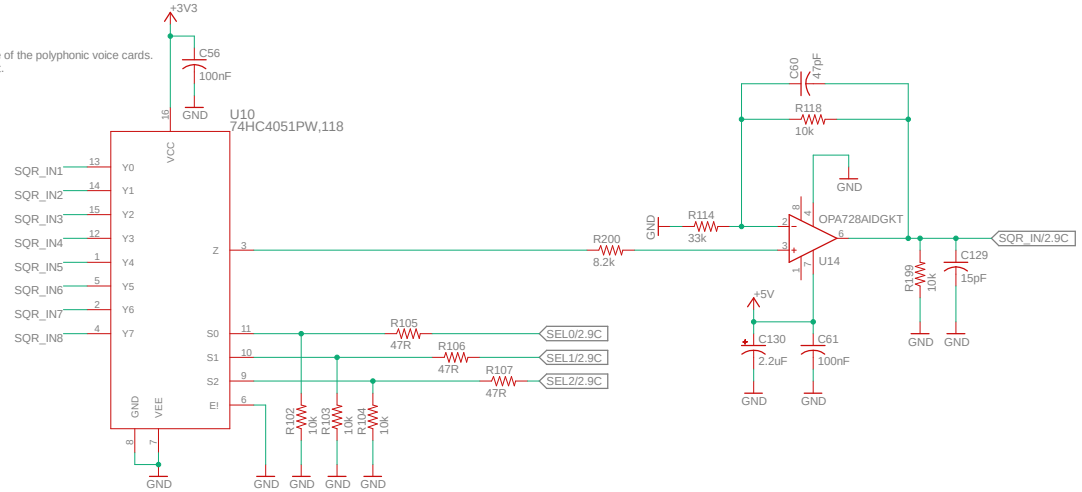
C1005C0G1H471J050BA
CAP CER 470PF 50V C0G 0402

RT0402FRE071KL
RES SMD 1K OHM 1% 1/16W 0402

"MODE" is connected to an MCU input with an internal pull-up resistor.
Pins 1 and 2 are shorted together when the SPST switch is in the ON position, thus grounding the Mode pin of the MCU input.

Square Wave Input Circuit

This circuit individually selects a square wave signal from one of the polyphonic voice cards.
It then produces a readable signal as input into an MCU input.



RT0402FRE078K2L
RES SMD 8.2K OHM 1% 1/16W 0402

RT0805FRE0733KL
RES SMD 33K OHM 1% 1/8W 0805

RT0402FRD0710KL
RES SMD 10K OHM 1% 1/16W 0402

CRGCQ0402F47R
CRGCQ 0402 47R 1%

T491A225K016AT
CAP TANT 2.2UF 10% 16V 1206

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

CC0402JRNPO9BN150
CAP CER 15PF 50V C0G/NPO 0402

C1005C0G1H470J050BA
CAP CER 47PF 50V C0G 0402

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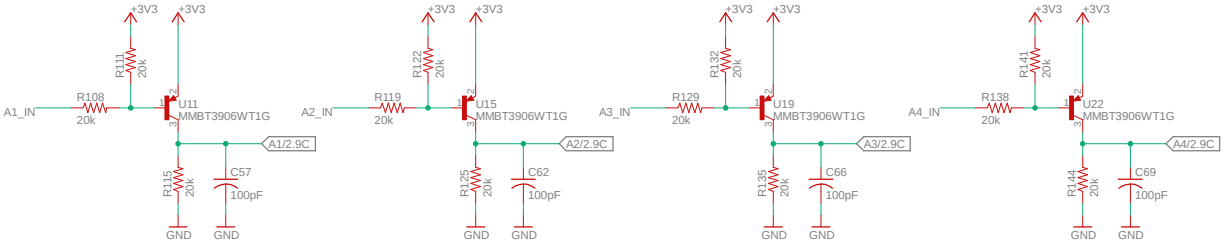
Keybed Interface Circuit

This circuit is used to connect to and interface with the keybed internal circuitry.
The transistor circuits allow for the MCU to properly read voltage levels.

C1005C0G1H101J050BA
CAP CER 100PF 50V C0G 0402

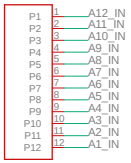
RT0402FRE0720KL
RES SMD 20K OHM 1% 1/16W 0402

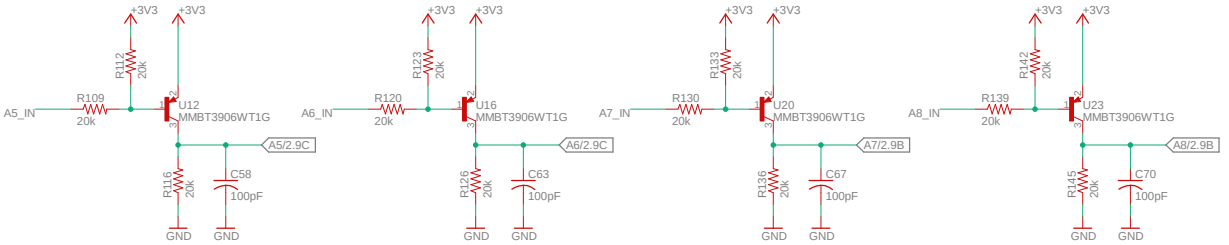


Connects to Keybed Interface PCB.
This connects to the anodes on each diode in the keybed circuit.

Use JST Sales America cable A12KR12KR26E102A.

J6
B12B-PH-K-S(LF)(SN)

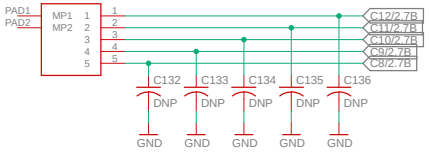


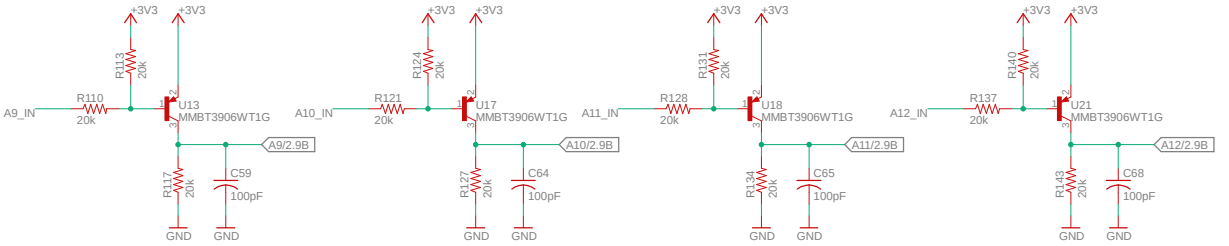


Connects to Keybed Interface PCB.
This connects to the cathodes on each diode in the keybed circuit.

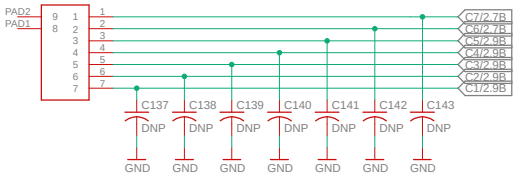
Use JST Sales America cable A05KR05KR26E102A and A07KR07KR26E102A.

J7
B5B-ZR-SM4-TF(LF)(SN)





J8
B7B-PH-SM4-TB(LF)(SN)



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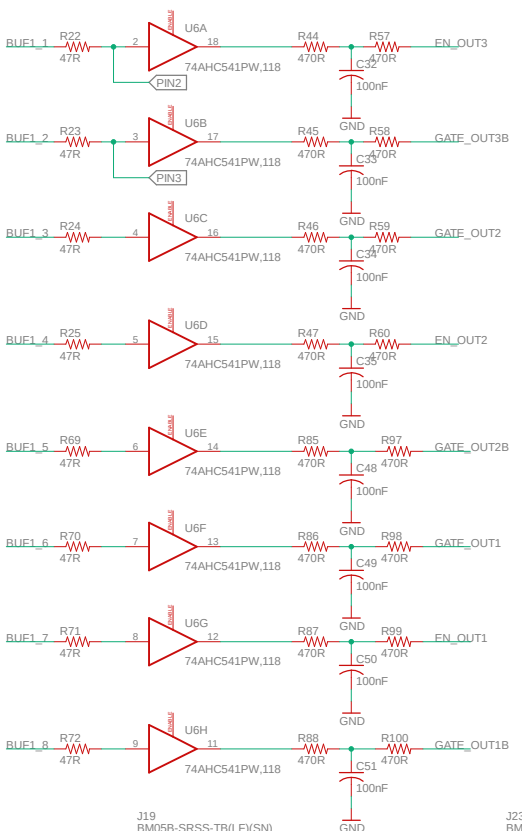
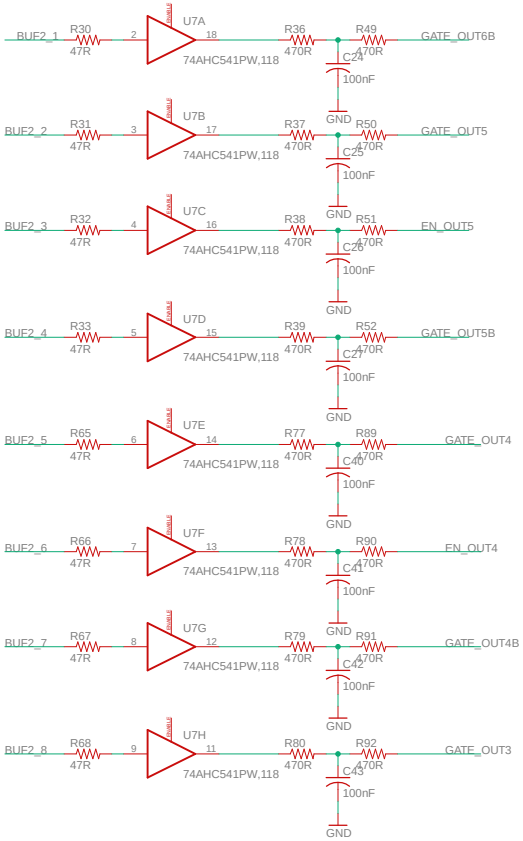
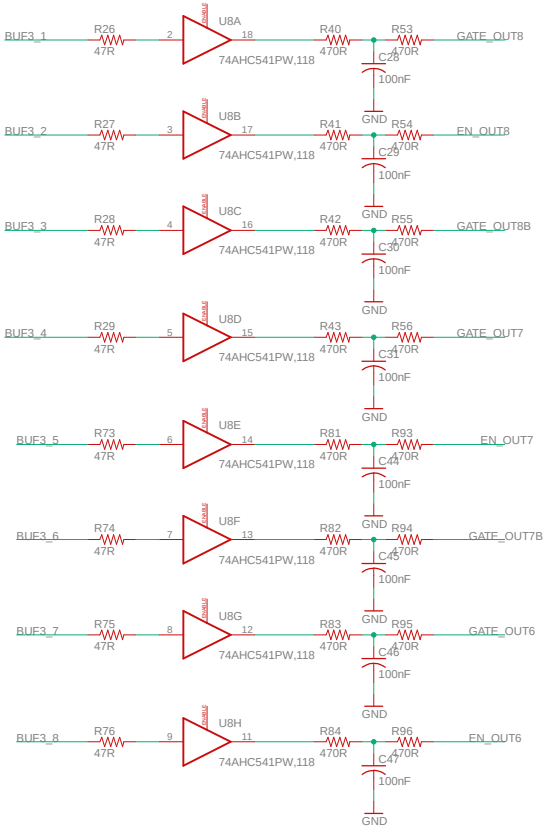
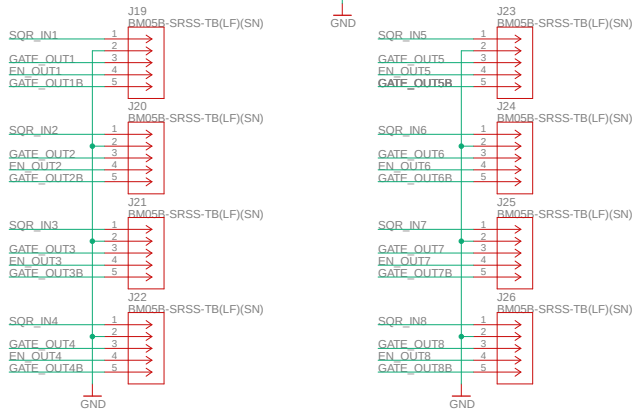
Buffer Circuits

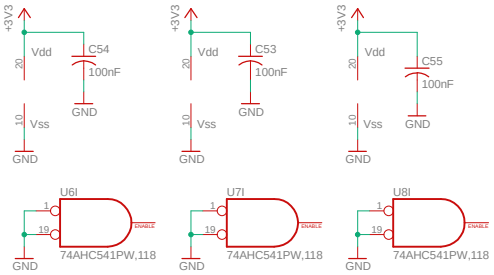
These circuits provide a buffer between the digital output pins of the MCU and the output connectors that connect to the polyphonic voice cards.











Digital Voltage Signal Connectors - Polyphonic Voice Cards

Each digital signal connector provides a gate voltage signal for both VCO A and VCO B on each polyphonic voice card.
Another digital output signal is provided for enabling the audio signal for each polyphonic voice card.
This is provided as an active low signal. When the EN_OUT# signal is high,
the audio signal is shutoff and a square wave will be present on the SQR_IN# input signal for tuning purposes.

Use JST Sales America Cable A05SR05SR30K102B or some equivalent of varying length.

RT0402FRE07470RL
RES SMD 470 OHM 1% 1/16W 0402

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

CRGCQ0402F47R
CRGCQ 0402 47R 1%

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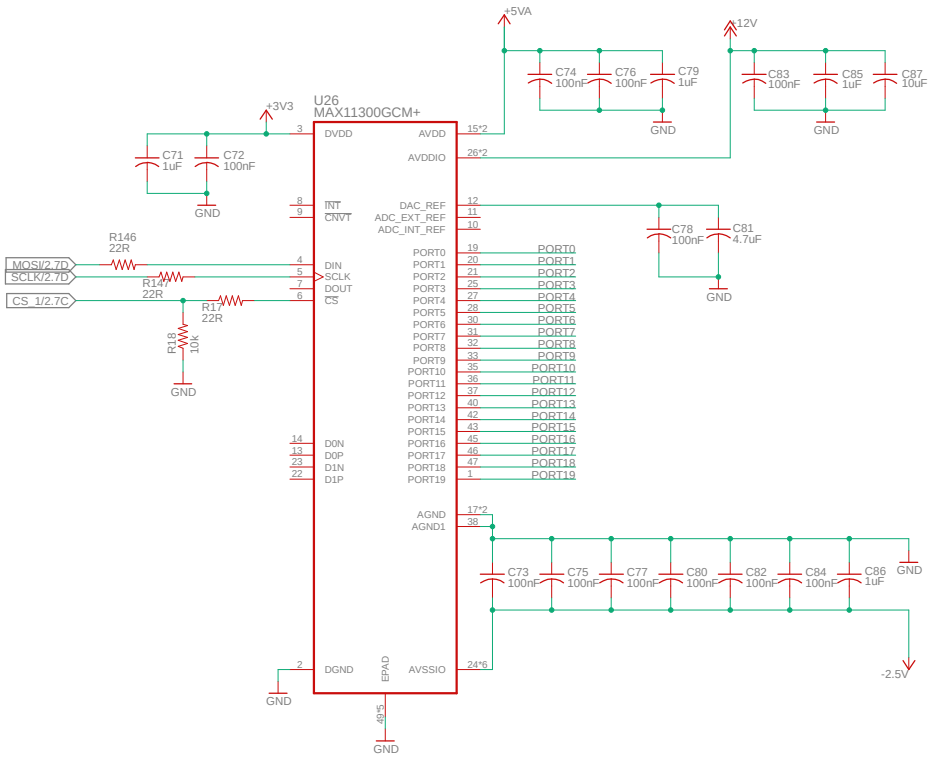
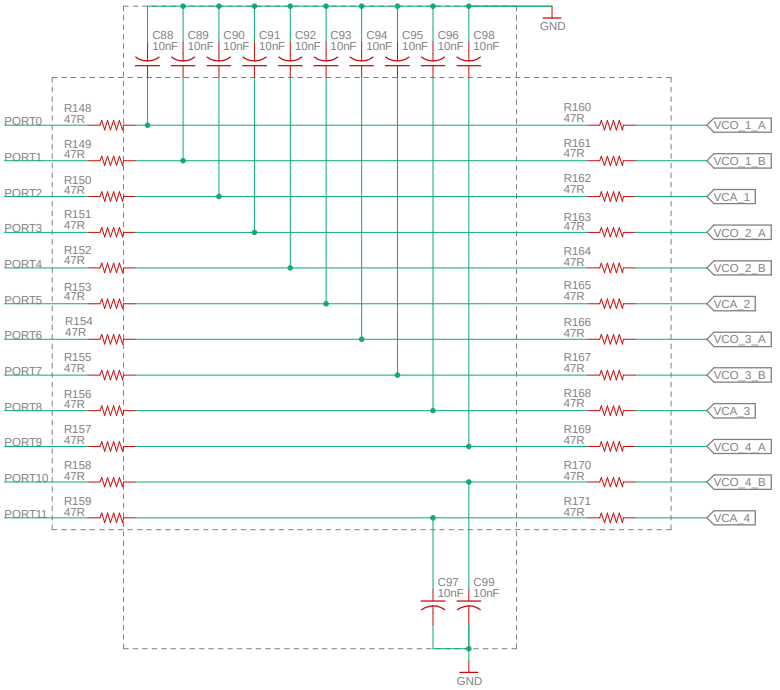
Control Voltage Generator Circuit

This circuit generates analog control using a 20-channel digital-to-analog converter IC.

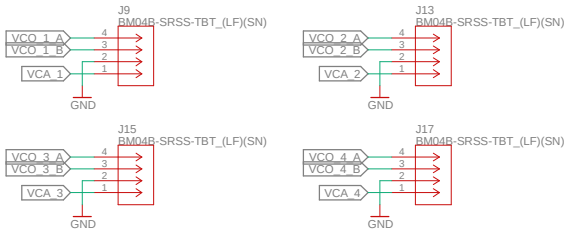




Control Voltage Connectors - Polyphonic Voice Cards

Each control voltage connector has a control voltage for both VCO A and B that are present on each polyphonic voice card.
These are designated as VCO_#_A and VCO_#_B.
Another control voltage output is provided for the VCA on each polyphonic voice card.

Use JST Sales America Cable A04SR04SR30K102B or some equivalent of varying length.



RT0402FRD0710KL
RES SMD 10K OHM 1% 1/16W 0402

RC0402JR-0722RL
RES SMD 22 OHM 5% 1/16W 0402

CRGCQ0402F47R
CRGCQ 0402 47R 1%

C2012X5R1C475K125AC
CAP CER 4.7UF 16V X5R 0805

C3216JB1E106M085AC
CAP CER 10UF 25V JB 1206

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

C1608X5R1E105K080AC
CAP CER 1UF 25V X5R 0603

C1608X7R1H103K080AA
CAP CER 10000PF 50V X7R 0603

MAX11300 - Digital to Analog Converter Circuit

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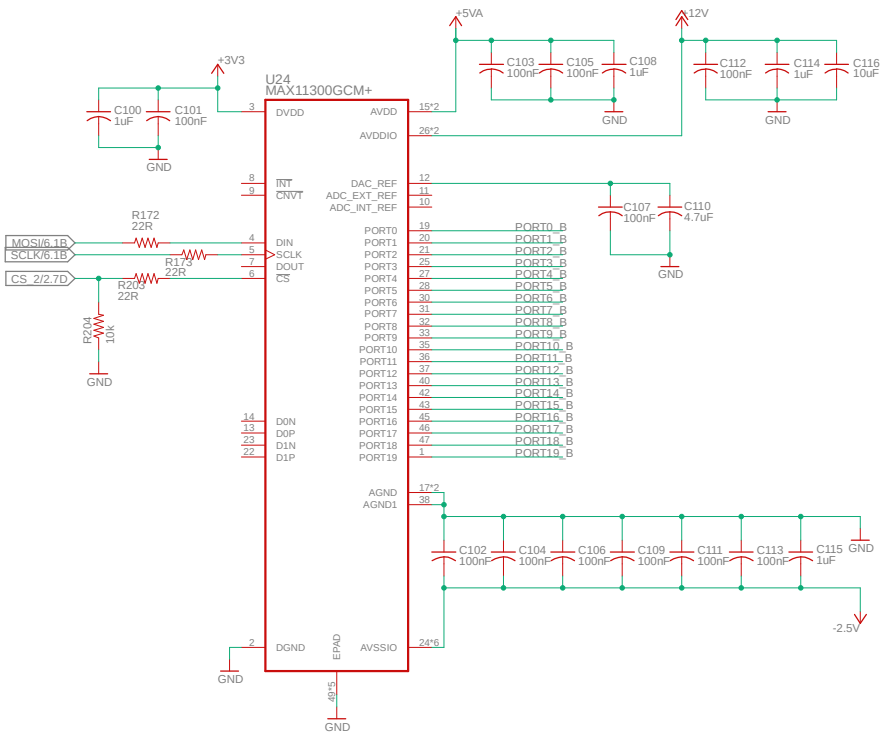
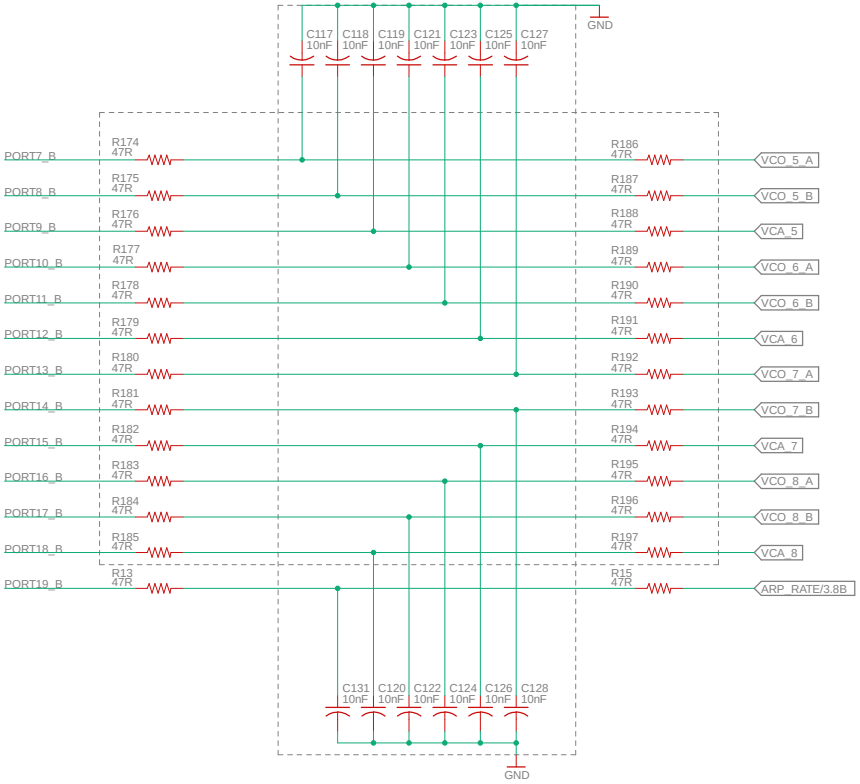
Control Voltage Generator Circuit

This circuit generates analog control using a 20-channel digital-to-analog converter IC.

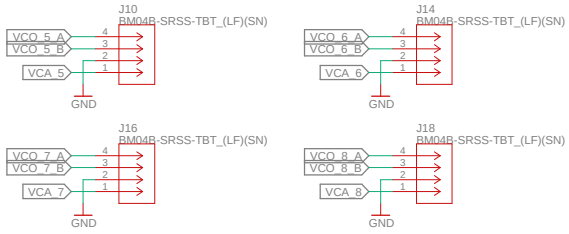




Control Voltage Connectors - Polyphonic Voice Cards

Each control voltage connector has a control voltage for both VCO A and B that are present on each polyphonic voice card.
These are designated as VCO_#_A and VCO_#_B.
Another control voltage output is provided for the VCA on each polyphonic voice card.

Use JST Sales America Cable A04SR04SR30K102B or some equivalent of varying length.



RC0402JR-0710KL
RES SMD 10K OHM 5% 1/16W 0402

RC0402JR-0722RL
RES SMD 22 OHM 5% 1/16W 0402

CRGCQ0402F47R
CRGCQ 0402 47R 1%

C2012X5R1C475K125AC
CAP CER 4.7UF 16V X5R 0805

C3216JB1E106M085AC
CAP CER 10UF 25V JB 1206

C1005X7R1E104K050BB
CAP CER 0.1UF 25V X7R 0402

C1608X5R1E105K080AC
CAP CER 1UF 25V X5R 0603

C1608X7R1H103K080AA
CAP CER 10000PF 50V X7R 0603

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