# digiLO – A Wideband PLL Synthesizer

**Features:**

The **digiLO** is a wideband Fractional-N / Integer-N PLL Synthesizer capable of generating signals from 23.5MHz to 6GHz. Measuring only 2” x 3”, it's primarily designed for use as a transverter's local oscillator. But it can also be used as a low-level signal source. It comes pre-programmed with over a hundred popular frequencies. Connection to an external 10MHz reference is recommended. But the **digiLO** automatically switches to its on-board TCXO reference when its 10MHz external reference is not detected. A “LOCK” indicator for direct connection to a LED is also provided.

**Operation:**

The recommended supply voltage is 9V. But reliable operation is possible down to 7V. The **digiLO** is tolerant of supply voltages up to 15V. But operation beyond 9V results in excessive heating of the voltage regulator. If 12V operation is desired, it is recommended to use a 25 Ohm 2-Watt resistor in series with the power connection. This should drop the voltage to the **digiLO** to a safer level.

The required supply current decreases as output frequency increases. Below 47MHz, supply current is a maximum of 200mA. And above 3GHz, the supply current drops to 130mA.

The 10MHz External Reference should be from a clean & stable source. Keep in mind that the **digiLO**'s output is directly affected by the quality of this reference source. The recommended input range for “REF IN” is 0dBm to +13dBm. At levels below 0dBm, the **digiLO** automatically switches over to its internal TCXO reference.

When the **digiLO** is locked to its external 10MHz reference, the “LOCK” output switches from 0V to 5V through a 200 Ohm resistor. This output can serve as a simple indication of which reference (external or internal) is sourcing the **digiLO**. Up to 20mA can be safely sourced from this connection. Therefore, a LED can be connected directly from the “LOCK” output to ground.

The RF output of the **digiLO** appears on the “RF OUT” connection. The output level is virtually flat from 23.5MHz up to 2GHz. And it maintains a level of +2dBm ±2dB up to 3GHz. Beyond 3GHz, the output gradually falls to -10dBm at 6GHz.

Refer to the supplied Frequency Table to select the desired frequency with jumpers or solder bridges. Or install a DIP switch or an external switch. Frequencies can be changed on the fly.

| digiLO Frequency Table for Firmware v17.10.2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INDEX | FREQ | FREQ SELECT JUMPERS | | | | | | | | SUGGESTED APPLICATION |
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0 | 116.000 | | | | | | | | | 144-28 |
| 1 | 194.000 | | | | | | | | X | 222-28 |
| 2 | 404.000 | | | | | | | X | | 432-28 |
| 3 | 758.000 | | | | | | | X | X | 902-144 |
| 4 | 874.000 | | | | | | X | | | 902-28 |
| 5 | 759.000 | | | | | | X | | X | 903-144 |
| 6 | 875.000 | | | | | | X | X | | 903-28 |
| 7 | 1152.000 | | | | | | X | X | X | 1296-144 |
| 8 | 1268.000 | | | | | X | | | | 1296-28 |
| 9 | 2160.000 | | | | | X | | | X | 2304-144 |
| 10 | 2276.000 | | | | | X | | X | | 2304-28 |
| 11 | 3312.000 | | | | | X | | X | X | 3456-144 |
| 12 | 3428.000 | | | | | X | X | | | 3456-28 |
| 13 | 5616.000 | | | | | X | X | | X | 5760-144 |
| 14 | 5732.000 | | | | | X | X | X | | 5760-28 |
| | | | | | | | | | | |
| 32 | 50.100 | | | X | | | | | | 50 MHz WSS |
| 33 | 70.100 | | | X | | | | | X | 70 MHz WSS |
| 34 | 144.100 | | | X | | | | X | | 144 MHz WSS |
| 35 | 222.100 | | | X | | | | X | X | 222 MHz WSS |
| 36 | 432.100 | | | X | | | X | | | 432 MHz WSS |
| 37 | 435.100 | | | X | | | X | | X | 435 MHz WSS |
| 38 | 902.100 | | | X | | | X | X | | 902 MHz WSS |
| 39 | 903.100 | | | X | | | X | X | X | 903 MHz WSS |
| 40 | 915.100 | | | X | | X | | | | 915 MHz WSS |
| 41 | 1275.100 | | | X | | X | | | X | 1275 MHz WSS |
| 42 | 1296.100 | | | X | | X | | X | | 1296 MHz WSS |
| 43 | 2304.100 | | | X | | X | | X | X | 2304 MHz WSS |
| 44 | 3456.100 | | | X | | X | X | | | 3456 MHz WSS |
| 45 | 5760.100 | | | X | | X | X | | X | 5760 MHz WSS |
| 46 | 3456.033 | | | X | | X | X | X | | 10368 MHz WSS / 3 |

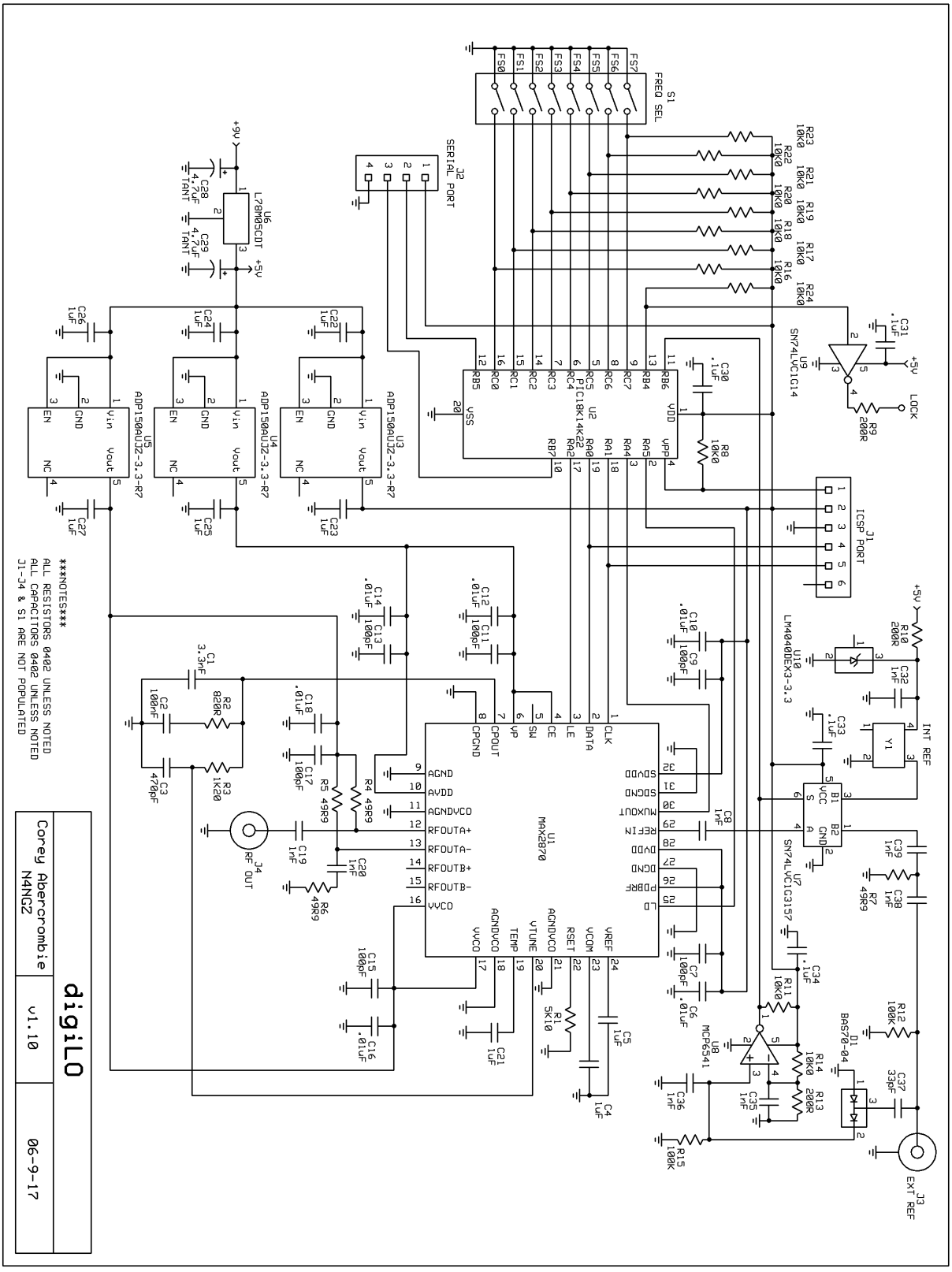
| INDEX | FREQ | FREQ SELECT JUMPERS | | | | | | | | SUGGESTED APPLICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 128 | 42.000 | X | | | | | | | | 70-28 & (50-29) x 2 |
| 129 | 44.000 | X | | | | | | | X | (50-28) x 2 |
| 130 | 77.000 | X | | | | | | X | | 222-145 |
| 131 | 78.000 | X | | | | | | X | X | 222-144 |
| 132 | 79.000 | X | | | | | X | | | 223-144 |
| 133 | 84.000 | X | | | | | X | | X | (50-29) x 4 |
| 134 | 88.000 | X | | | | | X | X | | (50-28) x 4 |
| 135 | 95.000 | X | | | | | X | X | X | (220-30) / 2 |
| 136 | 95.250 | X | | | | X | | | | (220-29.5) / 2 |
| 137 | 95.500 | X | | | | X | | | X | (220-29) / 2 |
| 138 | 96.000 | X | | | | X | | X | | (220-28) / 2 |
| 139 | 96.250 | X | | | | X | | X | X | (222-29.5) / 2 |
| 140 | 96.500 | X | | | | X | X | | | (222-29) / 2 |
| 141 | 96.750 | X | | | | X | X | | X | (222-28.5) / 2 |
| 142 | 97.000 | X | | | | X | X | X | | (222-28) / 2 |
| 143 | 97.500 | X | | | | X | X | X | X | (222-27) / 2 |
| 144 | 98.000 | X | | | X | | | | | (222-26) / 2 |
| 145 | 100.625 | X | | | X | | | | X | (432-29.5) / 4 |
| 146 | 100.875 | X | | | X | | | X | | (432-28.5) / 4 |
| 147 | 100.750 | X | | | X | | | X | X | (432-29) / 4 |
| 148 | 101.000 | X | | | X | | X | | | (432-28) / 4 |
| 149 | 101.250 | X | | | X | | X | | X | (432-27) / 4 |
| 150 | 101.500 | X | | | X | | X | X | | (432-26) / 4 |
| 151 | 101.750 | X | | | X | | X | X | X | (435-28) / 4 |
| 152 | 102.000 | X | | | X | X | | | | (435-27) / 4 |
| 153 | 102.250 | X | | | X | X | | | X | (435-26) / 4 |
| 154 | 114.000 | X | | | X | X | | X | | 144-30 |
| 155 | 114.500 | X | | | X | X | | X | X | 144-29.5 |
| 156 | 115.000 | X | | | X | X | X | | | 144-29 |
| 157 | 115.500 | X | | | X | X | X | | X | 144.28.5 |
| 158 | 117.000 | X | | | X | X | X | X | | 144-27 |
| 159 | 118.000 | X | | | X | X | X | X | X | 144-26 |
| 160 | 119.000 | X | | X | | | | | | 144-25 |
| 161 | 120.000 | X | | X | | | | | X | 144-24 |
| 162 | 170.000 | X | | X | | | | X | | 220-50 |
| 163 | 171.000 | X | | X | | | | X | X | 222-51 |
| 164 | 172.000 | X | | X | | | X | | | 222-50 |
| 165 | 190.000 | X | | X | | | X | | X | 220-30 |
| 166 | 191.000 | X | | X | | | X | X | | 220-29 |
| 167 | 192.000 | X | | X | | | X | X | X | 220-28 |
| 168 | 192.500 | X | | X | | X | | | | 222-29.5 |
| 169 | 193.000 | X | | X | | X | | | X | 222-29 |
| 170 | 193.500 | X | | X | | X | | X | | 222-28.5 |
| 171 | 195.000 | X | | X | | X | | X | X | 222-27 |
| 172 | 196.000 | X | | X | | X | X | | | 222-26 |

| INDEX | FREQ | FREQ SELECT JUMPERS | | | | | | | | SUGGESTED APPLICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 173 | 381.000 | X | | X | | X | X | | X | 432-51 |
| 174 | 382.000 | X | | X | | X | X | X | | 432-50 |
| 175 | 383.000 | X | | X | | X | X | X | X | 435-52 |
| 176 | 384.000 | X | | X | X | | | | | 435-51 |
| 177 | 385.000 | X | | X | X | | | | X | 435-50 |
| 178 | 402.000 | X | | X | X | | | X | | 432-30 |
| 179 | 402.500 | X | | X | X | | | X | X | 432-29.5 |
| 180 | 403.000 | X | | X | X | | X | | | 432-29 |
| 181 | 403.500 | X | | X | X | | X | | X | 432-28.5 |
| 182 | 405.000 | X | | X | X | | X | X | | 432-27 |
| 183 | 406.000 | X | | X | X | | X | X | X | 435-29 |
| 184 | 407.000 | X | | X | X | X | | | | 435-28 |
| 185 | 408.000 | X | | X | X | X | | | X | 435-27 |
| 186 | 409.000 | X | | X | X | X | | X | | 435-26 |
| 187 | 850.000 | X | | X | X | X | | X | X | 902-52 |
| 188 | 852.000 | X | | X | X | X | X | | | 902-50 |
| 189 | 1244.000 | X | | X | X | X | X | | X | 1296-52 |
| | | | | | | | | | | |
| 192 | 984.000 | X | X | | | | | | | (24048-432) / 24 |
| 193 | 990.000 | X | X | | | | | | X | (24192-432) / 24 |
| 194 | 996.000 | X | X | | | | | X | | (24048-144) / 24 |
| 195 | 1002.000 | X | X | | | | | X | X | (24192-144) / 24 |
| 196 | 1008.000 | X | X | | | | X | | | (10368-1296) / 9 |
| 197 | 1022.400 | X | X | | | | X | | X | (10368-144) / 10 |
| 198 | 1065.000 | X | X | | | | X | X | | (5760-435) / 5 |
| 199 | 1065.600 | X | X | | | | X | X | X | (5760-432) / 5 |
| 200 | 1080.000 | X | X | | | X | | | | (2304-144) / 2 |
| 201 | 1079.000 | X | X | | | X | | | X | (2304-146) / 2 |
| 202 | 1078.000 | X | X | | | X | | X | | (2300-144) / 2 |
| 203 | 1088.000 | X | X | | | X | | X | X | (2320-144) / 2 |
| 204 | 1104.000 | X | X | | | X | X | | | (3456-144) / 3 & (10368-432) / 9 |
| 205 | 1116.000 | X | X | | | X | X | | X | (5760-1296) / 4 |
| 206 | 1122.600 | X | X | | | X | X | X | | (5760-147) / 5 |
| 207 | 1123.000 | X | X | | | X | X | X | X | (5760-145) / 5 |
| 208 | 1123.200 | X | X | | X | | | | | (5760-144) / 5 |
| 209 | 1127.000 | X | X | | X | | | | X | (2304-50) / 2 |
| 210 | 1128.000 | X | X | | X | | | X | | (2400-144) / 2 |
| 211 | 1135.000 | X | X | | X | | | X | X | (3456-51) / 3 |
| 212 | 1136.000 | X | X | | X | | X | | | (10368-144) / 9 |
| 213 | 1140.000 | X | X | | X | | X | | X | (2424-144) / 2 |
| 214 | 1142.000 | X | X | | X | | X | X | | (5760-50) / 5 |
| 215 | 1242.000 | X | X | | X | | X | X | X | (10368-432) / 8 |
| 216 | 1246.000 | X | X | | X | X | | | | 1296-50 |
| 217 | 1267.000 | X | X | | X | X | | | X | 1296-29 |
| 218 | 1276.000 | X | X | | X | X | | X | | 1420-144 |
| 219 | 1278.000 | X | X | | X | X | | X | X | (10368-144) / 8 |

| INDEX | FREQ | FREQ SELECT JUMPERS | | | | | | | | SUGGESTED APPLICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 220 | 1656.000 | X | X | | X | X | X | | | (10368-432) / 6 |
| 221 | 1704.000 | X | X | | X | X | X | | X | (10368-144) / 6 |
| 222 | 1987.200 | X | X | | X | X | X | X | | (10368-432) / 5 |
| 223 | 2044.800 | X | X | | X | X | X | X | X | (10368-144) / 5 |
| 223 | 2044.800 | X | X | | X | X | X | X | X | (10368-144) / 5 |
| 224 | 2176.000 | X | X | X | | | | | | 2320-144 |
| 225 | 2254.000 | X | X | X | | | | | X | 2304-50 |
| 226 | 2256.000 | X | X | X | | | | X | | 2400-144 |
| 227 | 2280.000 | X | X | X | | | | X | X | 2424-144 |
| 228 | 2484.000 | X | X | X | | | X | | | (10368-432) / 4 |
| 229 | 2556.000 | X | X | X | | | X | | X | (10368-144) / 4 |
| 230 | 2624.000 | X | X | X | | | X | X | | (24048-432) / 9 |
| 231 | 2640.000 | X | X | X | | | X | X | X | (24192-432) / 9 |
| 232 | 2656.000 | X | X | X | | X | | | | (24048-144) / 9 |
| 233 | 2672.000 | X | X | X | | X | | | X | (24192-144) / 9 |
| 234 | 2952.000 | X | X | X | | X | | X | | (24048-432) / 8 |
| 235 | 2970.000 | X | X | X | | X | | X | X | (24192-432) / 8 |
| 236 | 2988.000 | X | X | X | | X | X | | | (24048-144) / 8 |
| 237 | 3024.000 | X | X | X | | X | X | | X | 3456-432 |
| 238 | 3256.000 | X | X | X | | X | X | X | | 3400-144 |
| 239 | 3408.000 | X | X | X | | X | X | X | X | (10368-144) / 3 |
| 240 | 3936.000 | X | X | X | X | | | | | (24048-432) / 6 |
| 241 | 3960.000 | X | X | X | X | | | | X | (24192-432) / 6 |
| 242 | 3984.000 | X | X | X | X | | | X | | (24048-144) / 6 |
| 243 | 4008.000 | X | X | X | X | | | X | X | (24192-144) / 6 |
| 244 | 4464.000 | X | X | X | X | | X | | | 5760-1296 |
| 245 | 4752.000 | X | X | X | X | | X | | X | (24192-432) / 5 |
| 246 | 4780.800 | X | X | X | X | | X | X | | (24048-144) / 5 |
| 247 | 4809.600 | X | X | X | X | | X | X | X | (24192-144) / 5 |
| 248 | 4968.000 | X | X | X | X | X | | | | (10368-432) / 2 |
| 249 | 5112.000 | X | X | X | X | X | | | X | (10368-144) / 2 |
| 250 | 5328.000 | X | X | X | X | X | | X | | 5760-432 |
| 251 | 5904.000 | X | X | X | X | X | | X | X | (24048-432) / 4 |
| 252 | 5940.000 | X | X | X | X | X | X | | | (24192-432) / 4 |
| 253 | 5976.000 | X | X | X | X | X | X | | X | (24048-144) / 4 |
| | | | | | | | | | | |
| 255 | 1000.000 | X | X | X | X | X | X | X | X | TEST |

| digiLO Measured Phase Noise at Various Frequencies and Offsets | | | | | |
|---|---|---|---|---|---|
| Frequency | Reference | dBc/Hz @ 100Hz | dBc/Hz @ 1KHz | dBc/Hz @ 10KHz | dBc/Hz @ 100KHz |
| 116MHz | INT | -93 | -100 | -109 | -125 |
| | EXT | -90 | -101 | -111 | -125 |
| 194MHz | INT | -94 | -99 | -105 | -125 |
| | EXT | -90 | -100 | -107 | -122 |
| 404MHz | INT | -92 | -90 | -99 | -120 |
| | EXT | -85 | -94 | -102 | -122 |
| 758MHz | INT | -88 | -89 | -92 | -115 |
| | EXT | -85 | -91 | -95 | -118 |
| 874MHz | INT | -88 | -86 | -89 | -116 |
| | EXT | -92 | -92 | -97 | -116 |
| 1152MHz | INT | -83 | -83 | -87 | -113 |
| | EXT | -84 | -86 | -90 | -115 |
| 1268MHz | INT | -83 | -82 | -86 | -110 |
| | EXT | -83 | -82 | -88 | -112 |
| 2160MHz | INT | -78 | -80 | -82 | -105 |
| | EXT | -76 | -78 | -84 | -107 |
| 3312MHz | INT | -78 | -78 | -77 | -99 |
| | EXT | -81 | -83 | -83 | -105 |
| 5760MHz | INT | -65 | -63 | -70 | -100 |

| digiLO Bill of Materials | | |
|---|---|---|
| DESIGNATOR | QTY | DESCRIPTION |
| C1 | 1 | 3.3nF 10% 50V X7R 0402 |
| C2,C30,C31,C33,C34 | 5 | 0.1uF 10% 16V X7R 0402 |
| C3 | 1 | 470pF 5% 50V NP0 0402 |
| C4,C5,C21,C22,C23,C24,C25,C26,C27 | 9 | 1uF 10% 10v X5R 0402 |
| C6,C10,C12,C14,C16,C18 | 6 | 10nF 10% 16V X7R 0402 |
| C7,C9,C11,C13,C15,C17 | 6 | 100pF 5% 50V NP0 0402 |
| C8,C19,C20,C32,C35,C36,C38,C39 | 8 | 1nF 10% 50VX7R 0402 |
| C28,C29 | 2 | 4.7uF 10% 16V SIZE B TANT |
| C37 | 1 | 33pF 5% 50V NP0 0402 |
| D1 | 1 | BAS70-04 SOT-23 |
| J1 | 0 | DO NOT INSTALL |
| J2 | 0 | DO NOT INSTALL |
| J3,J4 | 0 | DO NOT INSTALL |
| R1 | 1 | 5K10 1% 0402 |
| R2 | 1 | 820R 1% 0402 |
| R3 | 1 | 1K20 1% 0402 |
| R4,R5,R6,R7 | 4 | 49R9 1% 0402 |
| R8,R11,R14,R16,R17,R18,R19,R20,R21,R22,R23,R24 | 12 | 10K0 1% 0402 |
| R9,R10,R13 | 3 | 200R 1% 0402 |
| R12,R15 | 2 | 100K 1% 0402 |
| S1 | 0 | DO NOT INSTALL |
| U1 | 1 | MAX2870ETJ+ |
| U2 | 1 | PIC18F14K22-I/SS |
| U3,U4,U5 | 3 | ADP150AUJZ-3.3-R7 |
| U6 | 1 | L78M05CDT |
| U7 | 1 | SN74LVC1G3157DBVR |
| U8 | 1 | MCP6546T-I/OT |
| U9 | 1 | 74LVC1G14GV,125 (NXP) |
| U10 | 1 | LM4040DEX3-3.3 |
| Y1 | 0 | DO NOT INSTALL |


digiLO
Corey Abercrombie
N4NGZ
v1.10
06-9-17
***NOTES***
ALL RESISTORS 0402 UNLESS NOTED
ALL CAPACITORS 0402 UNLESS NOTED
J1-J4 & S1 ARE NOT POPULATED
FREQ SEL
SERIAL PORT
ICSP PORT
INT REF
EXT REF
LOCK
RF OUT
MAX2870
PIC18K14K22
SN74LVC1G14
SN74LVC1G157
LM4040DEX3-3.3
MCP6541
BAS70-04
ADP150AUJZ-3.3-R7
L78M05CDT
+9V
+5V