

Readiness report — SMD Nixie Clock

Checked 2026-09-03 00:02 · 26 searches, 9 pages fetched

Readiness: SMD Nixie Clock

Verdict: Ready with caveats · 2026-09-02 · est. parts cost \$190–\$260 (excludes PCB fabrication and the enclosure) **Cybersecurity — software & network: Could not check**

Every part on this board that has a manufacturer part number is Active and in stock at an authorized distributor, and both blocking problems from the 2026-07-09 report have cleared: the 78L05 regulator line is no longer obsolete (the snapshot's LM78L05ACZ/NOPB is Active with 17,228 in stock) and the P2 power header is no longer out of stock (68000-103HLF, 41,026 in stock). The verdict is unchanged at Ready with caveats, but for different reasons than in July: those were sourcing failures, and this run's caveats are verification gaps. Six vintage 1N-14 tubes remain secondary-market only and still dominate the bill of materials at \$105–\$150; the crystal the snapshot names as its example is a surface-mount part that will not fit the board's through-hole footprint, so that line needs a decision before anyone orders; and three ratings on the high-voltage side (resistor working voltage, jumper-wire insulation, the HV5622 supply rail) are asserted by the snapshot but were not confirmed by this run's evidence.

Action required

Part	Problem	Recommended action
Y1: ABLS-16.000MHZ-B4-T	New since the previous report. DigiKey's parametrics list this crystal as Surface Mount (HC-49/US, 11.40 mm × 4.70 mm); the board footprint is a through-hole HC-49/U vertical pattern with 4.88 mm pin pitch. Footprint mismatch.	Decide first whether Y1 is populated at all — the snapshot records that the firmware pins F_CPU=1000000UL (the 1 MHz internal RC). If it is populated, order a through-hole HC-49/U crystal and match its load capacitance to C2/C3; no through-hole part was checked this run (all 23 DigiKey alternates are also SMD).
U1: DS3231SN#	Priced \$18.77 at DigiKey, up 7.3% since 2026-07-09, and the single most expensive line apart from the tubes.	Buy the identical part at Mouser, \$17.46 (3,119 in stock per the ECIA inventory check) or take the reel variant DS3231SN#T&R at \$17.69 .
U2, U3: HV5622PG-G	DigiKey holds 90 units and each clock needs two — thin for a class order, as flagged in July (96 then).	Spread the order across authorized distributors: Spirit Electronics 960, Mouser 487 @ \$9.04 , Newark 89 @ \$8.63. Do not fall back to HV5522PG-G — it is out of stock at every distributor checked.

Part	Problem	Recommended action
N1-N3, N5-N7: IN-14 tubes	Out of production since the Soviet era; secondary market only. Unchanged from July.	Buy tested or NOS lots — six with bases, \$120 or seven new, \$118 — and order spares.

Cybersecurity — software & network

Could not check — Nothing in the project was checkable - the firmware and both vendored libraries are unpinned AVR C source with no advisory database, and the IDE has no endoflife.date entry - while the single recorded item is a build-trust note on a device with no network interface.

Component	Version	How known	Support status
NixieCode firmware (njeff/nixie-clock)	not determined	not determined (The repository root, NixieCode/ and NixieCode/NixieCode/ were listed this run and contain no manifest, tag file or version string; the fetched NixieCode.cproj records only project settings (avrdevice ATmega328P, F_CPU=1000000UL, ToolchainName com.Atmel.AVRGCC8.C).)	—
AVR-GCC toolchain (com.Atmel.AVRGCC8.C)	not determined	unpinned (NixieCode.cproj names the toolchain (ToolchainName com.Atmel.AVRGCC8.C, ToolchainFlavour Native) and links only libm, but pins no compiler version - the build uses whatever version the installed IDE ships.)	—
Atmel Studio / Microchip Studio (IDE)	not determined	not determined (The snapshot names Atmel Studio 6.2 / 7.0 without saying which; the fetched NixieCode.cproj carries ProjectVersion 6.1, which is the project-file schema version, not an IDE version.)	—
millis (Zak Kemble AVR millis library, vendored)	not determined	not determined (Vendored as loose millis.c / millis.h in NixieCode/NixieCode (repository listing this run) with no tag or release; the upstream repository github.com/zkemble/millis was listed this run and has no manifest either.)	—
ds_rtc_lib (akafugu DS3231 RTC / TWI driver, vendored)	not determined	not determined (Vendored as loose rtc.c, rtc.h, twi.c, twi-lowlevel.c in NixieCode/NixieCode (repository listing this run); the upstream repository github.com/akafugu/ds_rtc_lib was listed this run and has no manifest.)	—
avrdude (ISP flashing utility)	not determined	not determined (Invoked by program_328p.bat, which the repository listing of NixieCode/NixieCode/Debug shows is committed alongside the firmware; no version is pinned and the utility is installed locally by the student.)	—

Component	Finding	Severity	Fix available?
NixieCode firmware (njeff/nixie-clock)	The repository ships a prebuilt firmware binary (NixieCode.hex, NixieCode.elf) next to the flashing script program_328p.bat, and the snapshot's flashing command writes that committed .hex to the chip, so students program a binary that nothing ties back to the C source in the same repository.	posture	Mitigation only - rebuild NixieCode.hex from the included source in the IDE and flash the locally built file rather than the committed binary.

What this means for your lab

This clock has no network hardware at all - no Wi-Fi, Ethernet or Bluetooth, no listening ports and no accounts or passwords - so there is nothing here for someone else on the school network to reach, and no networking precautions are needed. The software question is instead one of trust in what gets programmed onto the chip: the project's repository contains a ready-made firmware file and the supplied flashing script writes that file straight to the microcontroller, so the safest habit is to open the included source in the IDE, build it yourself, and flash your own build. Be aware that none of this software could actually be checked for known vulnerabilities: firmware written in C for AVR chips, and the two helper libraries copied into the project, are not tracked in any security database, and the copies carry no version numbers. That is an unknown rather than a clean bill of health - though with no network connection, the practical risk to a classroom is very low.

Not checked

- NixieCode firmware (AVR C source): Embedded AVR C project in no package registry; OSV has no ecosystem covering it, so no vulnerability check was possible. Absence of advisories here is not evidence of safety.
- millis and ds_rtc_lib (vendored C libraries): Copied into the project as loose source files with no tag, release or manifest - there is no version to check, and no advisory database covers these libraries.
- avr-gcc / avr-libc toolchain: The project pins no compiler version and there is no advisory database or endoflife.date entry for the AVR toolchain.
- Atmel Studio / Microchip Studio (IDE): No advisory database tracks the IDE, and the support lookup this run found no endoflife.date product for it, so its support state is unknown.
- avrdude: Version not stated anywhere in the project; a locally installed utility, so nothing concrete could be looked up.
- microchip-studio 7.0: support status: endoflife.date has no such product

Parts

Active Integrated Circuits and Regulators

Part	Spec/Package	Status	Stock	Price	Source	Drift
IC1: ATMEGA328P-AU	32-TQFP (7×7), 1.8–5.5 V	Active	29,655	\$2.66	DigiKey	Price flat; stock 10,288 → 29,655
U1: DS3231SN#	16-SOIC (0.295", 7.50 mm), 2.3–5.5 V	Active	2,992	\$18.77	DigiKey (Mouser \$17.46)	\$17.49 → \$18.77 (+7.3%); stock 3,220 → 2,992
U2, U3: HV5622PG-G (×2)	44-PQFP (10×10)	Active	90 (≈1,600 across 6 distributors)	\$8.81	DigiKey	Price flat; DigiKey stock 96 → 90
U4: LM78L05ACZ/ NOPB	TO-92-3, Vin ≤ 35 V, 5 V/ 100 mA	Active	17,228	\$0.67	DigiKey	July checked MC78L05ABPX (Obsolete, 0 stock) — problem resolved

Cold-Cathode Display Tubes and Indicator Lamps

Part	Spec/Package	Status	Stock	Price	Source	Drift
N1–N3, N5–N7: IN-14 (×6)	Soviet side-view Nixie, ~170 V strike	Hard to obtain (vintage, secondary market)	Multiple lots listed	\$120.00 / six with bases	eBay (also Etsy \$118/seven new, gra-afch \$24.95/tube)	~\$20/tube in July; flat
N4, N8: IN-3 (×2)	2-lead subminiature neon, 60–90 V firing	Available (NOS)	Lots of 2 to 200	\$2.42 / two NOS	Etsy (bulk: 100 pcs \$20.00 , eBay)	\$1.75/three in July; immaterial rise

Resistors

Part	Spec/Package	Status	Stock	Price	Source	Drift
R1, R4, R5, R6, R9, R10: 27 kΩ — CFR-25JR-52-27K	Axial 2.40 × 6.30 mm, 0.25 W, ±5%	Active	10,753	\$0.10	DigiKey	Different MPN in July at the same \$0.10
R2, R7: 100 kΩ — CFR-25JR-52-100K	Axial 2.40 × 6.30 mm, 0.25 W, ±5%	Active	73,486	\$0.10	DigiKey	July priced the 120 kΩ variant at \$0.10; board netlist value is 100 kΩ

Part	Spec/Package	Status	Stock	Price	Source	Drift
R3, R8: 4.7 kΩ — CFR-25JR-52-4K7	Axial 2.40 × 6.30 mm, 0.25 W, ±5%	Active	87,945	\$0.10	DigiKey	Flat at \$0.10
R11: 10 kΩ — CFR-25JR-52-10K	Axial 2.40 × 6.30 mm, 0.25 W, ±5%	Active	93,327	\$0.10	DigiKey	Flat at \$0.10

The 0.25 W rating meets the snapshot's requirement, but DigiKey's parameters for this series do not state a maximum working voltage, so the ≥ 200 V requirement for the six 27 kΩ and two 100 kΩ resistors sitting on the ~170 V HT rail is **not verified** — check the YAGEO datasheet before ordering.

Capacitors

Part	Spec/Package	Status	Stock	Price	Source	Drift
C1, C4, C5: 0.1 μF — K104K15X7RF53L2	Radial TH, 50 V X7R, lead spacing 2.50 mm	Active	32,552	\$0.27	DigiKey	Price flat; stock 35,451 → 32,552
C2, C3: 22 pF — C315C220J5G5TA	Radial TH, 50 V C0G/NP0, lead spacing 2.54 mm	Active	1,546	\$0.53	DigiKey	July priced a different part (TDK, \$0.37, 390 in stock) — new baseline, and the low-stock warning is gone

Frequency Reference & Battery

Part	Spec/Package	Status	Stock	Price	Source	Drift
Y1: ABL5-16.000MHZ-B4-T	HC-49/US, Surface Mount per DigiKey — board needs through-hole HC-49/U, 4.88 mm pitch	Available but footprint mismatch	13,646	\$0.24	DigiKey	New issue this run; July priced CTS ATS16B at \$0.28 without flagging the footprint
BT1: BAT-HLD-001 (holder)	PCB surface mount, 4.20 mm above board	Active	22,164	\$0.38	DigiKey	Price flat; stock 14,260 → 22,164
BT1: CR2032 cell (3 V)	20 mm lithium coin cell	not checked	—	—	—	—

Connectors, Switches, and Hardware

Part	Spec/Package	Status	Stock	Price	Source	Drift
CON1: PJ-102A	TH right-angle barrel jack, 24 VDC / 2.5 A	Active	43,403	\$0.68	DigiKey	July priced sibling PJ-102AH at \$0.72 (now \$0.77)
P1: 67997-206HLF	2×03 male pin header, 2.54 mm pitch and row spacing	Active	77,481	\$0.53	DigiKey	July checked 67996-206HLF at \$0.56 — different MPN
P2: 68000-103HLF	1×03 male pin header, 2.54 mm pitch	Active	41,026	\$0.34	DigiKey	July's 67996-103HLF had zero stock — problem resolved
SW1–SW3: PTS645VL39-2 LFS (×3)	TH right-angle, side-actuated 3.85 mm, 0.05 A @ 12 VDC	Active	12,445	\$0.42	DigiKey	July used an unnamed SparkFun button at \$0.60
Mounting hardware: 4× 4-40 screws + nuts	#4-40 machine screws and nuts	Available (commodity)	High	\$1.57 / 12 nuts	Home Depot (screws \$1.98 , Lowe's)	"not checked" in July — checked now

Off-Board Hardware, External Modules, and Enclosure

Part	Spec/Package	Status	Stock	Price	Source	Drift
NCH6100HV boost module	12 V in, adjustable 85–235 V out	Available	Listed	\$11.29	eBay	\$11.58 → \$11.29 (–2.5%)
Machined female socket pins (60)	2.54 mm round SIP receptacle strip	Available	High	\$1.29 / 40-pin strip	Etsy (also \$5.99 / 5 strips , eBay)	~\$2.00 Pololu in July; comparable
12 V DC wall adapter (≥ 1 A, 2.1 mm)	Centre-positive barrel plug	Available	High	\$6.99	Tinkersphere	\$6.49 → \$6.99 (+8%)
Interconnect wires (3-way F-F Dupont)	22–26 AWG, snapshot wants ≥ 300 V insulation	Available; insulation rating not verified	High	\$1.89 / 3-pin	elliotttelectronicssupply.com	Not priced in July

Part	Spec/Package	Status	Stock	Price	Source	Drift
Custom enclosure materials	Student-fabricated chassis	not checked	—	—	—	Same as July

Substitutes

For part	Substitute	Differences	Verified	Judgment
U2, U3: HV5622PG-G	HV5522PG-G — \$6.96, DigiKey stock 0 (6-week factory lead)	Same manufacturer, same 44-QFP / 44-PQFP (10×10) package, same "Voltage - Supply" 10.8–13.2 V; the snapshot explicitly allows an HV5522. Cheaper by \$1.85, but every distributor checked shows zero stock and ECIA rates it Med lifecycle / Med supply-chain risk.	Verified: package/case and supplier device package match, supply range matches (DigiKey parametrics on both parts). Not verified: pinout, output polarity, the 220 V output rating (no datasheet fetched).	Not usable today — out of stock everywhere. Stay with HV5622PG-G.
U2, U3: HV5622PG-G	HV5222PG-G (\$7.34, 92), HV5122PG-G (\$7.81, 34), HV5530PG-G (\$9.08, stock not given) — DigiKey "Parametric Equivalent" suggestions	All described "IC SR OPEN DRAIN 32BIT 44-PQFP", but the suggestion entries carry no parameters block, and the snapshot restricts substitution to HV5522/HV5622.	Not verified: nothing — no package, supply or output-rating data in evidence.	Not recommended without a datasheet comparison of logic levels and the 220 V output rating.
U1: DS3231SN#	DS3231SN#T&R — \$17.69, stock 6,359	Same manufacturer, same 16-SOIC (0.295", 7.50 mm) package, same 2.3–5.5 V supply; differs only in the "T&R" suffix, assumed to denote tape-and-reel packaging. \$1.08 cheaper.	Verified: package/case and supply range (DigiKey parametrics). Not verified: what the "T&R" suffix encodes (assumed packaging).	Acceptable if reel-packaged parts are convenient to handle.

For part	Substitute	Differences	Verified	Judgment
U4: LM78L05ACZ/ NOPB	L78L05ACZ (STMicroelectronics) — \$0.27, stock 16,837, from DigiKey's suggested list for LM78L05ACZ/NOPB	Described "IC REG LINEAR 5V 100MA TO92-3": same output, same current, same package family, \$0.40 cheaper. The snapshot requires pin 1 VOUT / pin 2 GND / pin 3 VIN.	Verified: 5 V output, 100 mA, TO-92 — from the DigiKey description line only. Not verified: pin order and maximum input voltage (no parameters block returned).	Plausible cost saving at class scale; confirm the datasheet pinout before ordering — 78L05 pin assignment differs between vendors.
U4: LM78L05ACZ/ NOPB	MC78L05ACPG (onsemi) — \$0.34, stock 10,051, same suggested list	Described "IC REG LINEAR 5V 100MA TO92". Note the same list also contains MC79L05ABPRAG / MC79L05ABPRMG, which are negative –5 V regulators — not substitutes.	Verified: 5 V output, 100 mA, TO-92 — description line only. Not verified: pin order, maximum input voltage.	Plausible; the same datasheet- pinout check applies.
C2, C3: C315C220J5G5TA	C315C220J5G5TA7303 — \$0.11, stock not given	Identical parametrics: 22 pF, $\pm 5\%$, 50 V, C0G/ NP0, radial through- hole, 2.54 mm lead spacing. Differs only in the "7303" suffix, assumed a packaging code.	Verified: capacitance, dielectric, voltage rating, lead spacing (DigiKey parametrics on both). Not verified: what "7303" encodes; single-quantity availability.	Acceptable if DigiKey shows stock when you order.
NCH6100HV module	NCH8200HV — \$16.99, Elecrow	Successor module in the same family, within the snapshot's "any compact 12 V → 160– 180 V, ≥ 20 mA module" latitude; \$5.70 dearer.	Not verified: input voltage, output range and output current — no product page could be fetched (the shopping result gives only a redirect link).	Plausible, unverified. Only needed if the NCH6100HV listing disappears; confirm 12 V in and ≥ 20 mA at 170 V on the seller's page first.

Verify any substitute against its datasheet before ordering.

Other dependencies

- **PCB fabrication** — the repository ships 8 RS-274X Gerbers plus an Excellon drill file (PCB/ Gerber/); 2-layer FR4, 1.6 mm, 1 oz copper, board outline 148.08 mm × 37.08 mm, 0.2 mm clearance, 0.4 mm drill vias, lead-free HASL or ENIG recommended for the 0.8 mm pitch QFPs. No fabrication quote was obtained: **not checked**. (The July report quoted 101.60 mm × 38.10 mm; the snapshot's 148.08 mm × 37.08 mm is the outline to send a fab house.)
- **GitHub project repository** — <https://github.com/njeff/nixie-clock>, the download source for the board files and design sources; its directory listings responded normally this run. **Live**.
- **OSHPark shared project** — https://oshpark.com/shared_projects/nlSfLdLr; the fetch returned no readable text this run, so the shared board could not be confirmed. **Not confirmed** — order from the Gerbers if it will not open.
- **Instructables build log** — <https://www.instructables.com/id/SMD-Nixie-Clock/>; the page downloaded but no readable text could be extracted (the site renders in JavaScript). **Reachable, content not verified**.
- **eBay listing URLs quoted in the lab documentation** (the IN-14, IN-3 and NCH6100HV ebay.com/itm/... links) — **not checked**; they are dated marketplace listings, and the current sellers and prices in the Parts tables supersede them.
- **Custom enclosure** — student-fabricated from wood, 3D print, CNC or laser-cut acrylic; no purchasable specification, so **not checked**.

Watch list

- **IN-14 tubes** — out of production and secondary-market only; prices and lot sizes drift, and quality varies. Buy tested/NOS, order spares, and re-price before each cohort.
- **HV5622PG-G** — DigiKey is down to 90 units (two per clock). The wider authorized channel holds roughly 1,600, but the one alternative the snapshot sanctions, HV5522PG-G, is currently at zero stock everywhere with Med lifecycle risk. Watch the two as a pair.
- **DS3231SN#** — up 7.3% since July against a single manufacturer (ADI/Maxim); it is the costliest non-tube line, so compare Mouser and Newark pricing at order time.
- **High-voltage ratings not verified this run** — the CFR-25 resistors' ≥ 200 V working voltage, the Dupont HT jumper's ≥ 300 V insulation, and the disagreement between the snapshot's stated +5 V VDD for the HV5622 and DigiKey's "Voltage - Supply 10.8–13.2 V". Resolve all three against datasheets before the next build; they are safety-relevant, not just sourcing detail.
- **Y1 crystal** — the footprint decision above is unresolved, and no through-hole HC-49/U part has a price baseline yet.