ATMega Cool Nixie Clock — static-drive ZM1210 build

Bill of materials · four Telefunken ZM1210 tubes (HH:MM), one 74141 per tube, AVR controller, onboard ~180 V boost supply

Revision: A **Date:** 2026-11-03 **Lines:** 21 **Source:** clocks.fubsypoly.com/nixie/vol-6/

Every part for the recommended static-drive 4-digit build, in the order of Volume 6's bill of materials (§6.3). Six tubes and six anode resistors make the HH:MM:SS version (the seconds.pdf add-on). The tubes and the 74141 drivers are no longer made: find them first. Part numbers are examples that meet the specification; the design files (zm1210-display-atm-7.sch, nixiepcb.zip) are authoritative. Everything past the boost inductor runs at about 180 V: read Volume 10 before power-up.

Tick **Ord** when ordered, **Have** when it is in hand and checked against the part number, **Fit** when it is installed. Write the vendor, order number and price on the last page. Alternates for obsolete (EOL) parts are in **bold**.

Same A standard current part; buy it as listed. **EOL** Obsolete: buy new old stock or the alternate given. **Spec** The list gives a value, not a part: buy any part meeting the specification.

Conflict The design files disagree; the resolution is given. **Choice** An option the builder chooses.

ORD	HAVE	FIT	QTY	REF. DES.	PART / SPECIFICATION	PART NUMBER	ALTERNATES / SUBSTITUTES	WHERE TO BUY	TAG	NOTES
Display and drivers the hard parts: find them first										
☐	☐	☐	**4 (6)**	V1–V4	**ZM1210 nixie tube** Telefunken, 15.5 mm digit; ~180 V strike / ~140 V maintain	`ZM1210, new old stock only`	**NONE in production. Radiomuseum lists the ZM1212 as the same tube in another quality grade (unconfirmed; untested). Any other tube type means a new footprint and new anode resistors.**	eBay Specialist nixie sellers	**EOL**	Buy a spare. Test each tube on the bench supply.
☐	☐	☐	**4 (6)**	IC1–IC4	**74141 BCD-to-decimal nixie driver** DIP-16; high-voltage open-collector outputs	`K155ID1 (К155ИД1), new old stock`	**SN74141 new old stock (same pinout). No part in production: an HV5622 shift register or MPSA42 discrete drivers work only with a redesigned board (Vol 4).**	eBay Specialist nixie sellers	**EOL**	Buy spares.
☐	☐	☐	**2**	IC5–IC6	**74HC595 8-bit shift register** DIP-16; drives 16 BCD lines from 3 MCU pins	`SN74HC595N`		Digi-Key www.digikey.com Mouser www.mouser.com	**Same**	
Controller and timebase										
☐	☐	☐	**1**	IC7	**ATmega48 AVR (or AT90S4433-class)** 8-bit AVR; nix-in-17 firmware targets the ATmega48	`ATmega48PA-PU (DIP-28)`	**The original ATmega48 and the AT90S4433 are retired. ATmega48PA is Microchip's drop-in successor (untested with nix-in-17: check fuses and device signature).**	Digi-Key Mouser	**EOL**	The static schematic shows an AT90S4433; the working firmware is for the ATmega48.
☐	☐	☐	**1**	IC8	**7805 +5 V 1 A regulator** TO-220; logic rail from 12 V	`L7805CV`		Digi-Key Mouser	**Same**	
☐	☐	☐	**1**	Optional RTC	**DS3231 RTC (or DS1307)** I²C, 3 V coin-cell backup	`DS3231`	DS1307; or leave it out and use the software RTC	Digi-Key Mouser	**Choice**	
☐	☐	☐	**1**	X1	**Watch crystal 32.768 kHz** Software-RTC timebase (Timer2 async)				**Same**	

ORD	HAVE	FIT	QTY	REF. DES.	PART / SPECIFICATION	PART NUMBER	ALTERNATES / SUBSTITUTES	WHERE TO BUY	TAG	NOTES
☐	☐	☐	**1**	X2	**Crystal 4.096 MHz** MCU clock; or the internal 8 MHz RC				Same	
High-voltage boost supply ~180 V: discharge before touching										
☐	☐	☐	**1**	L1	**Power inductor 100 µH** ≥0.5 A saturation				Spec	
☐	☐	☐	**1**	Q1	**IRFR320 N-MOSFET** ~400 V, 3.1 A, DPAK; logic-tolerant gate	`Vishay IRFR320PbF`		Digi-Key Mouser	Same	
☐	☐	☐	**1**	D1	**BYV27-200 fast-recovery rectifier** ≥200 V, 2 A, SOD-57	`Vishay BYV27-200-TAP`	A 400 V ultrafast rectifier gives more margin over the ~180 V rail (e.g. BYV27-400; untested)	Digi-Key Mouser	Same	
☐	☐	☐	**1**	C_res	**Electrolytic 22 µF / 250 V** ≥250 V, not 200 V; 105 °C				Spec	
☐	☐	☐	**2**	R_top, R_bot	**HV divider** 1 MΩ top + lower leg sized for ~3 V at the ADC				Spec	Use a resistor rated for the voltage across it.
☐	☐	☐	**1**	R_bleed	**Bleeder 220 kΩ–1 MΩ, ≥0.5 W** Self-discharge of the HV rail				Spec	Mandatory.
☐	☐	☐	**1**	R_sense	**Current sense ~1 Ω** In the MOSFET source; optional				Spec	
☐	☐	☐	**4 (6)**	Ra1–Ra4	**Anode resistor 15–22 kΩ, ≥0.5 W** R_a = (V_supply − V_maintain) / I_k ≈ 18 kΩ at 2.2 mA				Spec	Multiplexed build: size for the peak current (Vol 6 §6.3).
Controls, passives and board										
☐	☐	☐	**2**	S1, S2	**Tactile switch, momentary** MODE/set and INC				Same	
☐	☐	☐	**1**	J1	**DC barrel jack** 12 V, centre-positive				Same	
☐	☐	☐	**—**	Bypass; X2 load	**0.1 µF ceramics; 2 × 22 pF for the crystal** Decoupling, crystal load				Same	
☐	☐	☐	**4**	MCU, 74141s	**28/16-pin DIP sockets**				Same	Count as listed; one per socketed chip (MCU, four 74141s, two 595s) is seven.
☐	☐	☐	**1**	Board	**PCB** From the nixiepcb.zip gerbers			Any PCB board house		

Orders

VENDOR	ORDER NO.	DATE	TOTAL	RECEIVED	LINES / NOTES

Build total: _____ **Started:** _____ **First power-up:** _____

Notes