Nixie Transistor Clock — my version 5 board build

Bill of materials · KABtronics Nixie-Transistor Clock, bare PCB version 5, six IN-12A tubes, no ICs

Revision: A **Date:** 2026-11-03 **Lines:** 44 **Source:** clocks.fubsypoly.com/nixie-transistor-clock/vol-5/

Every part for building the clock on a bare version 5 board, in the order of Volume 5's parts list, which starts from the KABtronics manual (document 1.7, BOM updated 2015). For each line: the part to buy now, the original it replaces, and the tag. Where I have already bought a part (Volume 3, build log), the part number is the one I bought. Stock and prices change daily; other part numbers are examples that meet the specification. Check each footprint's lead spacing on the board before ordering, especially for capacitors. This board carries up to about 180 V: read the high-voltage safety notes 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 The original part is still a standard catalog item; buy it as listed. **EOL** The original is obsolete; buy the replacement given.

Spec The original BOM line does not say enough (no voltage rating, no part number) or the part is under-rated. **Conflict** The schematic and the BOM disagree; the BOM (newer) wins unless noted.

Choice A change I chose for this build.

ORD	HAVE	FIT	QTY	REF. DES.	PART / SPECIFICATION	PART NUMBER	ALTERNATES / SUBSTITUTES	WHERE TO BUY	TAG	NOTES
Semiconductors										
☐	☐	☐	**150**	Flip-flops, gates, decoders	**2N3904 NPN** TO-92	2N3904		Digi-Key www.digikey.com Mouser www.mouser.com	**Same**	Still made by several manufacturers.
☐	☐	☐	**30**	Logic	**2N3906 PNP** TO-92	2N3906		Digi-Key Mouser	**Same**	
☐	☐	☐	**46 (BOM: 50)**	45 cathode drivers + Q129 (AM/PM neon); 4 spares	**HV NPN, 400 V, TO-92, pins 1-2-3 = E-C-B** Original ST STX13003G (obsolete)	JSCJ 3DD13003B (LCSC C22739)	**Taiwan Semiconductor TS13003CT (same E-C-B order; hard to find in stock). Not the MPSA42 (E-B-C) and not the plain 3DD13003 (B-C-E).**	LCSC www.lcsc.com/product-detail/C22739.html	**EOL**	Order the B (TO-92) part. Ohmmeter-check one footprint first (Vol 5 §5.5); positions: Vol 3 Fig 3.4.
☐	☐	☐	**1**	Q139, HV power switch	**NPN Darlington, 400 V, 8 A, TO-220** BOM: 'Transistor, NPN Power, TO-220'; must be high-voltage	onsemi MJE5742G	ST ST901T (350 V, 4 A, TO-220; check lead order). Not TIP120, not BU806, not ST901TFP.	Digi-Key www.digikey.com/en/products/detail/onsemi/MJ…	**Spec**	The one I bought. Buy a spare.
☐	☐	☐	**1**	Q69, switch driver	**MPSA56 PNP, 80 V** TO-92	MPSA56	2N5401 (150 V PNP) if it disappears; check pinout	Digi-Key Mouser	**Same**	
☐	☐	☐	**~500**	Gates, decoders, diode matrix	**1N4148 small-signal diode** DO-35	1N4148		Digi-Key Mouser	**Same**	Buy the full 500: the kit page counts 518 diodes.
☐	☐	☐	**4**	Bridge rectifier	**1N5818 Schottky** Schematic shows 1N4002; 30 V reverse is enough on 12 VAC	1N5818		Digi-Key Mouser	**Conflict**	
☐	☐	☐	**1**	D99, HV rectifier	**Ultrafast rectifier 400 V, 3 A, 50 ns, DO-201AD** Original onsemi MR854 (obsolete)	UF5404	**Any 400 V or higher, 3 A, ultrafast DO-201AD rectifier (untested)**	Jameco www.jameco.com Digi-Key	**EOL**	About six times faster recovery than the MR854.

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☐	☐	☐	**2**	HV reference; hourly shut-off	**Zener 4.7 V, 0.5 W** DO-35	1N5230B		Digi-Key Mouser	Same	
☐	☐	☐	**16**	Counter test LEDs	**Red 3 mm LED** Any			Digi-Key Tayda www.taydaelectronics.com	Same	For watching the counters during the build.
☐	☐	☐	**5**	Colons NE1–NE4, NE5	**NE-2 type neon lamp** About 70 V, 0.5 mA	NE-2		Digi-Key Jameco	Same	

The display

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☐	☐	☐	**6**	Tubes	**IN-12A nixie tube** Soviet top-view tube, new old stock	IN-12A (ИН-12А)	**IN-12B (adds an unused decimal point), also NOS. No IN-12 is made today: new old stock only. Buy 1–2 spares from one batch.**	eBay Specialist nixie sellers	EOL	No longer made; plentiful as new old stock.
☐	☐	☐	**6**	Tube sockets	**IN-12 floating-pin socket with solder lugs** Lugs wired by hookup wire, not soldered to the PCB (Vol 3 §3.5)			eBay Specialist nixie sellers	Same	
☐	☐	☐	**22 ft**	Tube wiring	**Stranded hookup wire, insulation 300 V or more** Every cathode lead sees up to the HV			Digi-Key Mouser	Spec	

Resistors 1% metal film, 1/4 W unless noted

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☐	☐	☐	**180**	Logic	**10 kΩ**				Same	
☐	☐	☐	**180**	Logic	**100 kΩ**				Same	
☐	☐	☐	**75**	Logic	**1 kΩ**				Same	
☐	☐	☐	**50**	45 cathode resistors + others	**22 kΩ** About 0.9 mA per digit at 165 V (Vol 2 §2.6)				Same	
☐	☐	☐	**5**		**220 kΩ**				Same	
☐	☐	☐	**3**	Comparator hysteresis	**1 MΩ**				Same	
☐	☐	☐	**2**	R332 (Q139 base); FUSE stand-in	**22 Ω**				Same	One is the temporary FUSE stand-in for HV bring-up.
☐	☐	☐	**1**	PWR stand-in	**10 Ω**				Same	Temporary, for HV bring-up.
☐	☐	☐	**1**		**100 Ω**				Same	

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☐	☐	☐	**1**	SNS stand-in	**47 kΩ** Sets about 25.5 V for the first power-up				Same	
☐	☐	☐	**1 set**	SNS, sets the HV	**348 kΩ, 357 kΩ and 390 kΩ, 1%** Schematic shows 380 kΩ				Conflict	Buy all three; the right one depends on the zener (Vol 2 §2.2). Set in hand.
☐	☐	☐	**1**	R333, PWR current sense	**0.47 Ω, 1/2 W or more** Schematic shows 0.5 Ω	Vishay PAC10000470FA1000 (0.47 Ω 1%, 1 W)	Any 0.47 Ω 1/2 W metal film or metal oxide	Digi-Key Mouser	Conflict	The one I bought: 1 W because it was in stock; it fits.
☐	☐	☐	**1**	Bleeder across C73	**150 kΩ, 1 W, rated 350 V or more** Not on the original BOM	TE H4P150KFCA (1%, rated 500 V)	Two 75 kΩ 1/2 W in series	Digi-Key Mouser	Choice	The one I bought. Bleed-down about 90 s → 25 s; ~0.22 W at 180 V.
Capacitors and inductor										
☐	☐	☐	**1**	C73, HV reservoir	**120 µF, 250 V or more, 105 °C, long-life radial** BOM gives no voltage; it holds 165–180 V	Nichicon UCY2E121MHD3		Digi-Key Mouser	Spec	The one I bought. Lies down, tie-wrapped: check diameter.
☐	☐	☐	**2**	C1 logic reservoir; C72 HV input	**6,800 µF, 25 V, 105 °C** BOM gives no voltage; rail reaches ~18 V. Outline 16–18 mm dia. × ≤35.5 mm	Rubycon 25PX6800MEFC16X31.5		Digi-Key Mouser	Spec	The ones I bought (16 × 31.5 mm).
☐	☐	☐	**1**	C59, Q69 supply	**10 µF 25 V aluminium electrolytic** Original 10 µF 16 V tantalum on an ~18 V rail		A 35 V tantalum		Spec	
☐	☐	☐	**90**	Flip-flop speed-up and trigger	**220 pF C0G (NP0), 50 V**				Same	
☐	☐	☐	**2 + spares**	HV oscillator timing	**470 pF and 1,000 pF C0G** PCB marks one 470 pF, one 0.001 µF				Same	Swap to tune the oscillator to about 22 kHz.
☐	☐	☐	**2**		**0.001 µF C0G, 50 V**				Same	
☐	☐	☐	**3**	Incl. the HV pulser capacitor	**0.01 µF X7R, 50 V**				Same	
☐	☐	☐	**13**	Bypass	**0.1 µF X7R, 50 V**				Same	
☐	☐	☐	**1**	L1, boost inductor	**220 µH vertical toroid, 3.6 A** Original 220 µH 2 A toroid; 125.6 µH at 3.6 A (Bourns)	Bourns 2216-V-RC		Digi-Key www.digikey.com	Spec	The one I bought. Scope the peak at bring-up; >2.8 A → 0.56 Ω PWR.
Power, protection and hardware										
☐	☐	☐	**1**	F1, FUSE	**Pico II fuse, 3 A fast** Schematic shows 2 A	Littelfuse 0251003 (.MXL, .NAT1L…)		Digi-Key Mouser	Conflict	A 2 A fuse would sit at the ~2 A peak.

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☐	☐	☐	**1**	Q139 heatsink	**TO-220 heatsink matching the board's pad and hole** Schematic note: Digi-Key 294-1080-ND			Digi-Key	Same	
☐	☐	☐	**1**	Power	**12 VAC wall transformer, 2 A (24 VA) or more, AC output** Clock draws about 1.2 A; counts the 60 Hz				Choice	Must be an AC adapter.
☐	☐	☐	**1**	Power input	**2-position terminal block** Pitch to match the board				Same	
☐	☐	☐	**3**	H, M, S	**Momentary push button** BOM gives no type; match the footprint				Same	
☐	☐	☐	**13**	Mounting	**4-40 × 0.5 in screws, nuts, washers**				Same	
☐	☐	☐	**10**	HV capacitor, wiring	**Small nylon tie wraps**				Same	
☐	☐	☐	**6 ft**	Power cord	**2-conductor cable**				Same	

Orders

VENDOR	ORDER NO.	DATE	TOTAL	RECEIVED	LINES / NOTES

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

Notes