



# Syn Shop DefCon 2026 Type 3 Badge

## Assembly Instructions

These instructions are for the DC2026\_Type3 Syn Shop badge. This badge uses mostly through-hole devices. The builder should have some experience soldering ¼ watt resistors the 0.1" pitch DIP packages. There is one SMD, a USB-C connector, that has had its solder pads enlarged to the extent possible to make hand-soldering easier.

The micro-controller has been pre-programmed with the social IR and die rolling system. J7 and Jumper are used to select the mode of operation for the badge. Install the jumper to select Dice Roller during power-up, else the badge will power-up in Social IR mode. The badge can be reprogrammed through the eight pin connector (J2) and a suitable UPDI programmer. This is discussed in Appendix I.

The micro-controller serial port is available through a FTDI six pin connector (J3) and unused micro-controller pins are also available.

The Type3 badge is powered with the USB-C connector and uses a 3.3v linear LDO regulator for power. There is also a SAO sink connector that can supply power.

The SAO connectors I2C lines (SDA & SCL) are attached to the I2C lines of the micro-controller should the user wish to 'hack' the device to control it through this interface.

To Start

Insure that you have all of the parts required. Refer to the parts list below.

DC2026\_Type3 rev3

| Reference                                     | Value            | Description                      | Qty |
|-----------------------------------------------|------------------|----------------------------------|-----|
| BZ1                                           | PS1240P02BT      | BUZZER PIEZO 3V 12.2MM TH        | 1   |
| C1                                            | 0.1 uF           | CAP CER 0.1UF 50V X7R RADIAL     | 1   |
| C2                                            | 10uF             | CAP ALUM 10UF 20% 50V RADIAL TH  | 1   |
| D1                                            | SFH 4545         | EMITTER IR 950NM 100MA RADIAL    | 1   |
| DL1,DL2                                       | LSHD-5503        | 7SEG 0.56" SGL RED 10DIP         | 2   |
| J1                                            | USB4125          | CONN RCPT TYPE C 6P SMD RA       | 1   |
| J2                                            | Conn_01x08       | CONN HEADER R/A 8POS 2.54MM      | 1   |
| J3                                            | Conn_01x06       | CONN HEADER R/A 6POS 2.54MM      | 1   |
| J4                                            | SAO-2x3          | CONN HEADER VERT 6POS 2.54MM     | 1   |
| J5                                            | Conn_01x04       | CONN HDR 4POS 0.1 TIN PCB        | 1   |
| J7                                            | Conn_01x02       | CONN HEADER VERT 2POS 2.54MM     | 1   |
| Q1,Q2,Q3                                      | 2N3904           | TRANS NPN 40V 0.2A TO-92         | 3   |
| R1                                            | 10k              | RES 10K OHM 5% 1/4W AXIAL        | 1   |
| R2,R12,R13                                    | 2k               | RES 2K OHM 5% 1/4W AXIAL         | 3   |
| R3                                            | 15               | RES 15 OHM 5% 1/4W AXIAL         | 1   |
| R4,R5,R6,R7,R8,<br>R9,R10,R11,R14,<br>R15,R16 | 150              | RES 150 OHM 5% 1/4W AXIAL        | 11  |
| U1                                            | MCP1700x-120xxTO | IC REG LINEAR 3.3V 250MA TO92-3  | 1   |
| U3                                            | TSOP38238        | SENSOR REMOTE REC 38.0KHZ 45M    | 1   |
| U4                                            | AVR128DA28x-xSP  | 8BIT 128KB FLASH 28SPDIP         | 1   |
| JP1                                           | Jumper           | JUMPER W/TEST PNT 1X2PINS 2.54MM | 1   |
| PCB                                           | DC2026_Type3     |                                  | 1   |



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### Part Orientation

The 7-segment LEDs pin out is shown in the figure below.

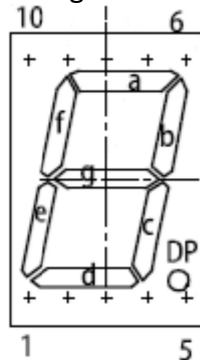


Figure 1

The DIP package should have a silver dot near pin 1. There may also be a recessed dot at pin 1.

The emitter LED (D1) has a flat edge that indicates the Cathode (negative) pin as shown in the figure below.

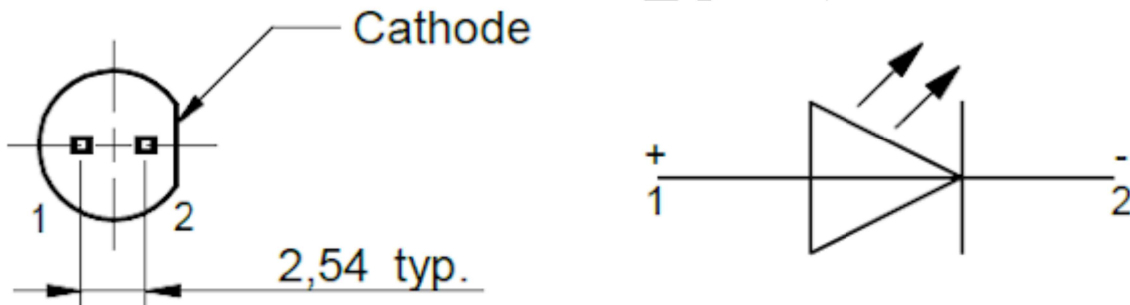


Figure 2

### Assembly Suggestions

The general strategy is to install the low profile components first the build up from there.

Install all resistor. Bend the leads to match the spacing on the PCB and slide the resistor leads into it holes from the top of the board. A piece of blue painters tape can be used to hold the resistors in place when the PCB is turned over to access the bottom side. Through-hole devices are generally inserted from the top side and soldered on the bottom side.

Install C1.

Install J1 (USB-C connector). Solder the four mounting pins first, then the six connector pins. Use a solder braid to remove any excess solder from the pins.

Install the right angle connectors J2 and J3.

Install the IR detector U3. Bend the lead to a right angle so that the sensor has its flat side against the board within the space provided. The curved side is the sensor window.



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Install U4 (28 pin DIP). When soldering a multi-pin device, it is a good idea to NOT solder adjacent pins if possible. This distributes the heat being applied to the device and reduces the chance of heat damage.

Install the buzzer BZ1.

Install J5 and J7.

Install DL1 and DL2. The decimal point should be near Q2 and Q3. (see also Figure 1)

Install Q1, Q2, Q3, C2, D1, and U1 (MCP1700). For D1, see Figure 2 for orientation.

Install J4 on the back side of the board. Solder its pins from the front side. There is a small arrowhead indicating pin 1 on the connector housing.

**HACKERS ONLY:** If using the serial connector J3 to power the board or using a FTDI Bluetooth module, install a wire across JP1 to deliver power.

With the Jumper installed on J7, apply power to bring the badge up in Dice Roller mode to test.

With the Jumper removed from J7, apply power to bring the badge up in Social IR mode and bring the badge to the Host station to have it assigned an ID. A four character User name can also be assigned at the Host station to be displayed on the connections network with the ID.

## References

ref1: DC2026\_Type3\_SCH.pdf – Schematic drawing

ref2: DC2026\_Type3\_PCB.pdf – Printed circuit board layout



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## Appendix I – Reprogramming the Micro-controller

The AVR128DA28 micro-controller can be reprogrammed through use of the Microchip MPLAB X IDE and a SNAP or other suitable UPDI programmer. The MPLAB X project can be downloaded from SYN Shop web site. <insert url link here>.

1. Install the J2 connector to provide access to the SNAP pins.
2. Attach the SNAP programmer pins 1-8 to J2 pins 1-8 respectively.
3. Load the project into the IDE and make desired changes.
4. Compile and download the new code through the programmer.

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