Cost Estimate

This document aims to estimate all the costs involved in producing the Tiny Scarab board, its enclosure and graphical overlay membrane.

1. PCB Circuit

1.1 Component Cost

I purchase all components – except for one – directly at the circuit manufacturer JLC PCB. I typically buy the components before ordering the PCB itself. They are stored in my personal inventory in the JLC PCB factory (each client has an account and a personal inventory tied to that account, where you can pre-order components).

These are the components I order for one board:

Designators	JLCPCB Part #	Qty	$/part	$/board
C1, C2, C4, C5, C6, C7, C8, C9, C10, C15, C16, C17, C23, C24, C25, C26, C27, C30, C31, C37, C38, C39, C40, C41	C307331	24	0.004500	0.108000
C3, C20, C21, C22, C32, C33, C34, C35, C36	C15850	9	0.008100	0.072900
C11, C13, C14, C18	C52923	4	0.003600	0.014400
C12, C19	C15525	2	0.004700	0.009400
C28, C29, C42, C43	C1555	4	0.000900	0.003600
D1	C2943833	1	0.021000	0.021000
D2	C397613	1	0.016400	0.016400
F1	C1972777	1	0.086600	0.086600
J1	C2927038	1	0.037800	0.037800
J3, J4	C84004	2	0.048200	0.096400
LED1, LED5	C7115899	2	0.320900	0.641800
LED2	C5579175	1	0.398200	0.398200
LED3, LED4	C6538602	2	0.531400	1.062800
Q1, Q2, Q6	C156390	3	0.017700	0.053100
Q3, Q4, Q5	C177033	3	0.077600	0.232800
R1, R27	C25117	2	0.000500	0.001000
R2	C25087	1	0.000500	0.000500
R4, R13, R19, R29, R31	C11702	5	0.000500	0.002500
R5, R6	C25905	2	0.000500	0.001000
R7, R15, R17	C25076	3	0.000500	0.001500
R8, R10	C25091	2	0.000500	0.001000
R14, R25, R26, R32	C25741	4	0.000500	0.002000
R16, R18	C25092	2	0.000500	0.001000
R20, R21, R28	C25744	3	0.000500	0.001500
R22, R23, R24	C17168	3	0.000500	0.001500
SW1, SW2, SW3	C92581	3	0.064500	0.193500
SW4	C2884764	1	0.076500	0.076500
SW5	C146695	1	0.057200	0.057200
TVS1, TVS2	C840637	2	0.352500	0.705000
TVS3	C83329	1	0.082400	0.082400
TVS4, TVS5, TVS6, TVS7, TVS8, TVS9, TVS10, TVS11, TVS12, TVS13, TVS14, TVS15, TVS16, TVS17, TVS18, TVS19, TVS20, TVS21, TVS22, TVS23, TVS24, TVS25, TVS26, TVS27, TVS28, TVS29, TVS30, TVS31, TVS32, TVS33, TVS34, TVS35	C126836	32	0.052100	1.667200
U1	C500761	1	0.152400	0.152400
U2	C145411	1	1.024500	1.024500
U3	C5123443	1	1.542000	1.542000
XTAL1	C2901629	1	0.192300	0.192300
XTAL2	C279615	1	0.103700	0.103700

The $/part column is filled in in the assumption that I purchase a large enough quantity of parts to fill 100 PCBs. In other words, the “bulk discount” is already integrated in the price.

Adding all the component prices from the aforementioned table results in $8.6654 component cost per board.

Add to that the CH32V003F4P6 10-cent microcontroller that I cannot order at JLC PCB. Only distribution channel for this chip is AliExpress. The microcontroller itself is dirt cheap, but I need to pay of course the transport and transaction costs. So the eventual component cost is:

$9.00 component cost per board, if order quantity is > 100

1.2 PCB Production and Assembly Cost

I’ve listed the PCB production and assembly (parts placement and soldering) costs in the table below. Please note that these costs are under the assumption that >100 PCBs are ordered:

	$/board	Notes
PCB Production	0.6703	
Board clean service	0.1650	
PCB Assembly	1.3622	
Additional solder cost	0.2950	I’m not entirely sure what the “additional solder cost” refers to. I believe it’s related to some manual actions needed to prepare the machines etc.
Shipping cost	1.3559	Shipping cost per board can decrease for larger quantities.
Customs duties & taxes	1.9201	Not sure how JLCPCB computed this. I’ve sent a mail to request further info. I think it’s the 21% VAT cost for both the board production as well as the component purchases.

The total cost per board:

$5.7685 board production cost :

- Includes component assembly
- Excludes component purchase (that’s already accounted for in previous section)
- Includes shipping and taxes
- Assume order quantity > 100

The shipping cost goes slightly up for larger quantities, but not linearly. So the shipping cost per board can be reduced by ordering larger quantities that are shipped in one batch.

2. Enclosure

The following table lists the costs for the enclosures, provided that the order quantity > 100:

	$/unit	Notes
Box	3.2862	
Lid	0.9431	
Shipping	2.1536	
Customs duties & taxes	1.3405	Seems to be 21% VAT tax

$7.7234 enclosure production cost :

- Includes shipping and taxes
- Assume order quantity > 100

Again, the shipping cost goes slightly up for larger quantities, but not linearly. So the shipping cost per unit can be reduced by ordering larger quantities.

3. Graphical Membrane

The graphical membrane costs $1.45 per unit, for >100. The shipping fee is not given separately.

$1.45 graphical membrane cost :

- Includes shipping
- Includes taxes (?)
- Assume order quantity > 100

4. Miscellaneous Costs

The finished product has 5 light pipes to funnel the LED lights to the surface. Four screws need to be inserted to fasten the enclosure. Last but not least – I place a small iron block in each enclosure to give the product extra weight, such that it sits stable on the desk when attached to wires.

	$/unit	Notes
Light Pipes	0.31 x 5 = 1.55 (excl. VAT) 1.55 x 1.21 = 1.8755 (incl. VAT)	12 weeks delivery time, so I have to order them from a more expensive source at 0.80$ a piece if needed faster
Screws	0.02 x 4 = 0.08	
Iron block	1.198 (incl. VAT)	Includes shipping cost and VAT tax

$3.1535 miscellaneous costs :

- Includes shipping and taxes
- Assume order quantity > 100

TOTAL

Let's compute the total cost per unit (incl shipping and taxes):

	$/unit (incl shipping and taxes)
PCB components	9.0000
Board Production	5.7685
Enclosure	7.7234
Graphical Membrane	1.4500
Miscellaneous	3.1535
TOTAL	27.0954

The total cost per unit, if produced in > 100 quantities, is $27.0954. This includes all shipping and taxes. Without shipping and taxes, the total cost per unit would be $19.5942.