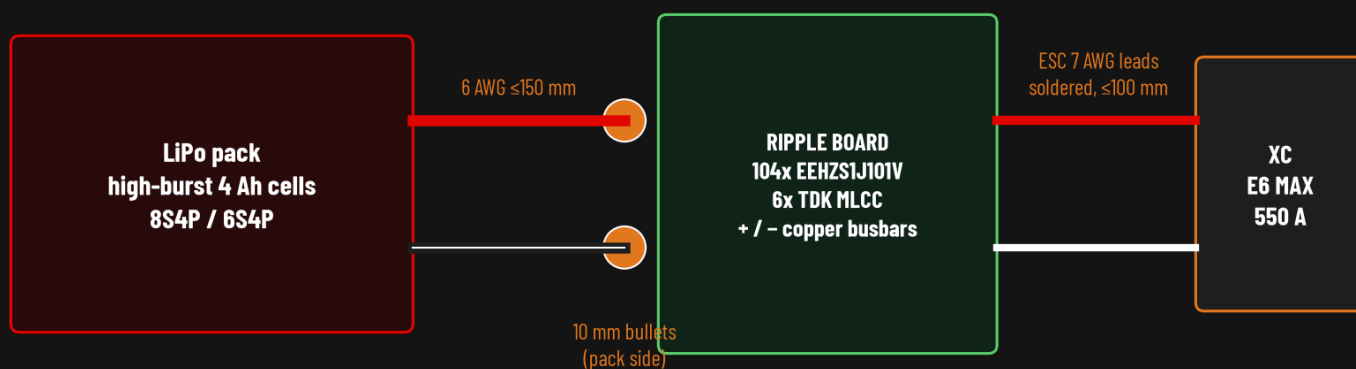


RIPPLE PACK BUILD GUIDE

v2 board · 104 polymer caps · soldered right at the ESC leads · 6S or 8S · up to the E6 MAX 550 A limit

NO ADAPTER · NO 8 mm PLUG IN THE POWER PATH



0.76 V

ripple p-p at 550 A, 20 kHz, duty 0.5

EST

88%

of each cap's rated ripple current (2.64 A vs 3.0 A **RATED**)

194 G

104 × 1.87 g caps **RATED**; PCB, copper and wire extra **EST**

WHAT IT DOES: the ESC chops the battery current thousands of times a second. The ripple board feeds those pulses from right next to the ESC so the pack wiring doesn't have to. It does **not** fix sag; that's the battery's job (see the Sag: Battery First guide).

V2 BILL OF MATERIALS

QTY	PART	WHAT / RATING	MASS
104	Panasonic EEH2S1J101V polymer hybrid	100 μ F · 63 V · 19 m Ω · 3.0 A rms RATED → 10,400 μ F · 0.18 m Ω board EST	194 g RATED
6	TDK C5750X7S2A106K230KB MLCC	10 μ F · 100 V · X7S, at the ESC lead pads RATED	not published
2	Ripple PCB 140 × 46 mm, 2-layer, 4 oz copper	52 caps each, 4 × 13 grid at 10.5 mm pitch EST	≈50 g EST
2	Copper busbar 150 × 10 × 2 mm (+ and -)	M5 bolts to both boards; 10 mm sockets on the pack end EST	≈54 g EST
2	10 mm bullet pairs	pack ↔ ripple board	—
—	6 AWG silicone wire	pack leads, keep them short	—
—	XC E6 MAX 7 AWG leads	8 mm plugs cut off, soldered to the board pads, ≤100 mm EST	—
—	Kapton tape, heat-shrink, foam tape	between the busbars, over the joints, under the board	—

10 mm sockets → PACK

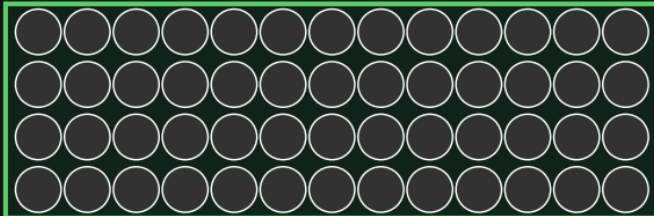
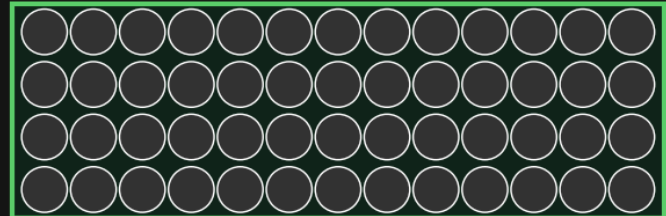
ESC leads soldered →

— COPPER BUSBAR

+ COPPER BUSBAR (both boards bolt here, M5)

BOARD A · 52x EEH2S1J101V (Ø10) · 4 oz Cu, 2-layer

BOARD B · 52x EEH2S1J101V (Ø10) · 4 oz Cu, 2-layer

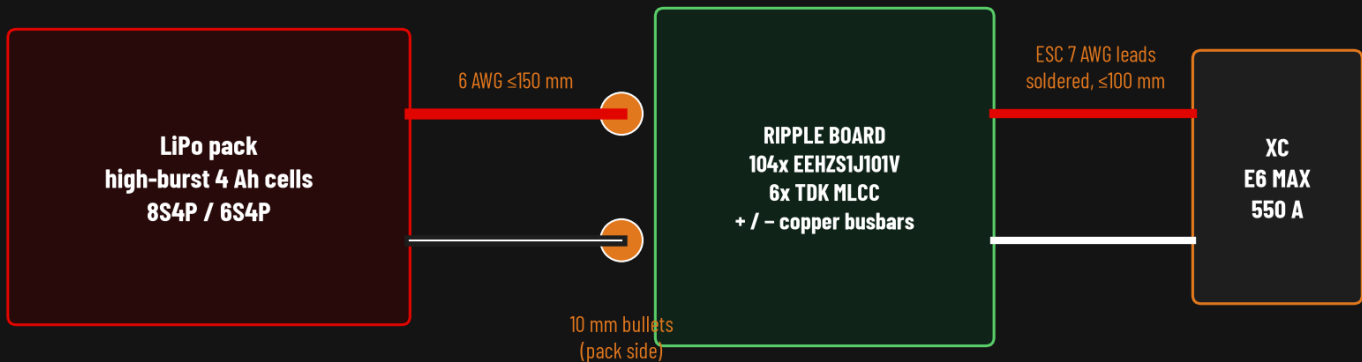

6x TDK C5750X7S2A106K230KB MLCC across the busbars right at the ESC lead pads · boards stack or sit side by side · 140 x 46 mm each **EST**

63 V parts on a 33.6 V (8S) or 25.2 V (6S) pack **RATED**. The E6 MAX's switching frequency and its own input caps aren't published by XC, so ripple numbers in this guide are shown at 10, 20 and 40 kHz **EST**.

LAYOUT THAT WORKS

Ripple current lives in the loop between the caps and the ESC's switches. Make that loop short, flat and wide.

NO ADAPTER · NO 8 mm PLUG IN THE POWER PATH



DO

- Mount the board within 100 mm of the ESC **EST**.
- Stack + over - busbars with Kapton between them.
- Put the 6 MLCCs right at the ESC lead pads.
- Bolt both boards to the same busbars so they share evenly.
- Foam-mount the board against vibration.

DON'T

- No adapter or 8 mm plug between the board and the ESC.
- Don't mix big cans with small polymer caps on one board: the cans hog the current (page 5).
- Don't count the ripple board as sag help.
- Don't leave bare busbar edges: 550 A shorts weld tools.

10 mm sockets → PACK

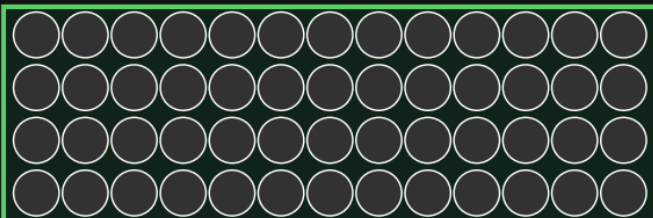
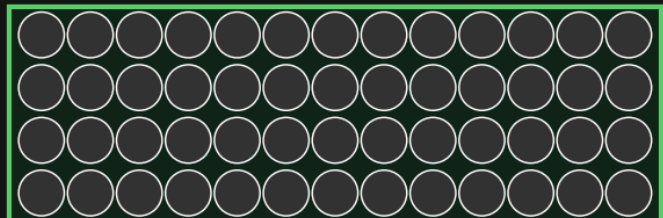
ESC leads soldered →

- COPPER BUSBAR

+ COPPER BUSBAR (both boards bolt here, M5)

BOARD A · 52x EEHVS1J101V (Ø10) · 4 oz Cu, 2-layer

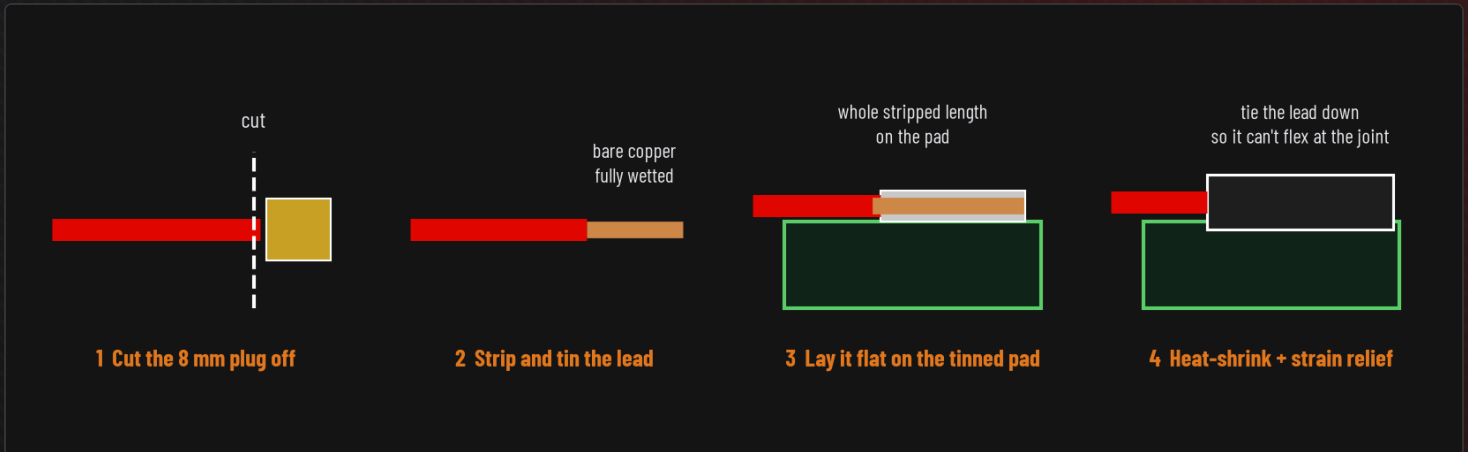
BOARD B · 52x EEHVS1J101V (Ø10) · 4 oz Cu, 2-layer



6x TDK C5750X7S2A106K230KB MLCC across the busbars right at the ESC lead pads · boards stack or sit side by side · 140 x 46 mm each **EST**

SOLDER TO THE ESC LEADS

The ESC's 7 AWG leads go straight onto the board pads. One less connector, less resistance, one less thing to come loose.



STEPS

1. Pack unplugged. ESC disconnected from everything.
2. Cut the 8 mm plugs off the ESC leads, leaving them as short as the layout allows.
3. Strip and tin each lead with a high-wattage iron or station big enough for 7 AWG.
4. Tin the board pad, lay the lead flat along it and flow solder until the whole joint is wetted.
5. Let it cool without moving. Heat-shrink, then tie the lead down so it can't flex at the joint.
6. Check polarity: ESC + to the + busbar side, - to -, before the pack ever goes on.

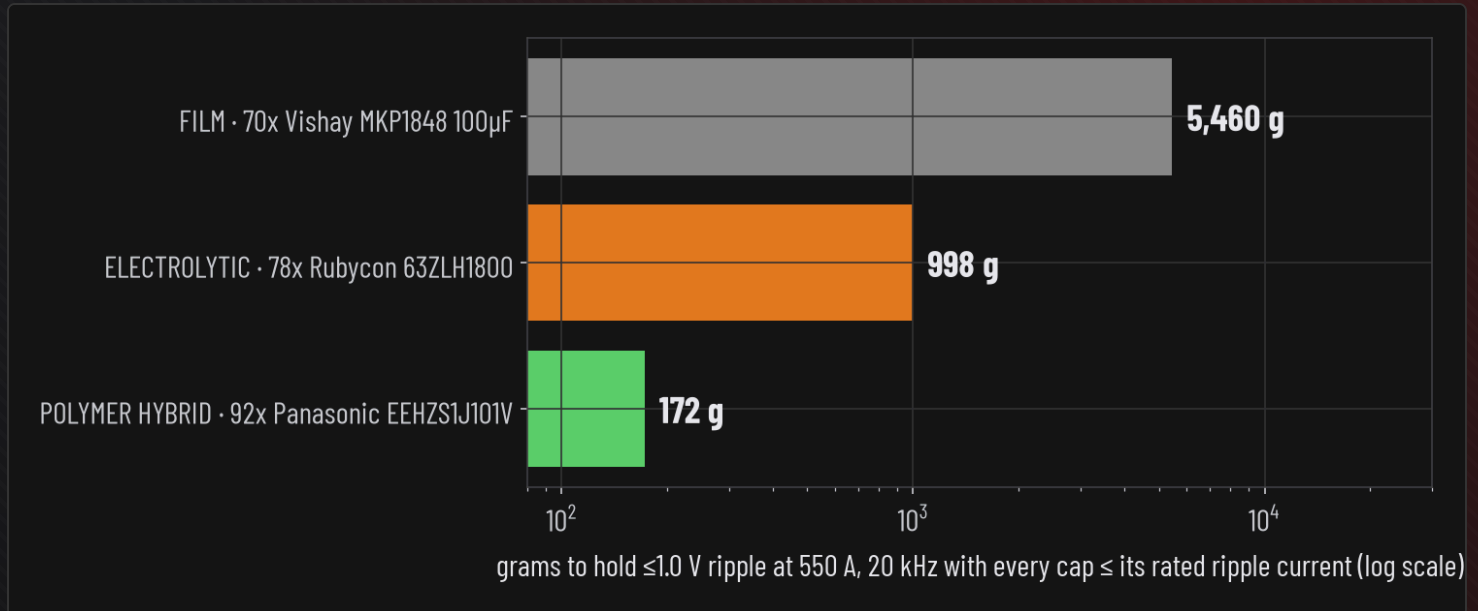
CHECK IT

- Joint shiny and smooth, solder flowed into the strands.
- No caps or MLCCs cooked near the pad (look for discoloured cases).
- Tug test each lead.
- Power up the first time on a current-limited supply if you have one.

WARRANTY: cutting the ESC's plugs is your call and may affect the ESC maker's warranty. Combos are competition gear with no warranty.

POLYMER BEATS FILM PER GRAM

What matters on a race car is how many grams it takes to hold the ripple with every cap inside its rating.



PER GRAM	EST	μ F/G	A RMS/G
Vishay MKP1848 film		1.3	0.28
KEMET C4AQ 15 μ F film		0.5	—
Rubycon 63ZLH1800 (mass EST)		141	0.28
Panasonic EEHXS1J101V		54	1.60

Per gram = rated μ F and rated ripple amps **RATED** $\div$ mass. Film is built for 450–500 V, so it carries far less μ F per gram. Big aluminium cans hold lots of μ F but little ripple current per gram, and their low impedance makes them hog the current: the v1 mix (10 $\times$ 63ZLH820 + 10 $\times$ EEHXS1J101V) runs its cans at about 802% of rating at 550 A, 20 kHz **EST**.

1.42 / 0.76 / 0.43 V

v2 ripple at 550 A, 10 / 20 / 40 kHz **EST**

+0.2 °C

per cap per 3 s pass at 550 A, 20 kHz, no cooling **EST**

CHECK IT IN THE RIPPLE CALCULATOR

evulempire.com/ripple/ · enter cells in series, ESC current, switching frequency and caps; it shows ripple volts, each cap's % of rating, heat, and how many caps hit your target.



[TOOLS](#)
[SAG](#)
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[GUIDES](#)



RIPPLE PACK CALCULATOR

The caps at the ESC · ripple volts, ripple amps per cap, heat, and how many caps you need

RESET

Cap values are **RATED** from the maker's data sheet unless tagged **EST**. The ESC maker doesn't publish its switching frequency or its own input caps, so pick the frequency and treat results as EST.

THIS BOARD WORKS

0.76 V P-P · 88% OF CAP RATING

v2 board at 550 A, 20 kHz: ripple is 2.3% of 33.6 V. For 1 V with Panasonic EEH2S1J101V alone: 92 caps, 172 g. **EST**

<p>RIPPLE</p> <h4>0.76 V P-P</h4> <p>0.66 V from μF + 0.10 V from ESR · EST</p>	<p>WORST CAP VS RATING</p> <h4>88%</h4> <p>2.64 A in each of 104 vs 3 A RATED</p>	<p>HEAT IN THE CAPS</p> <h4>13.8 W</h4> <p>hottest cap +0.2 °C per 3 s pass, no cooling · EST</p>	<p>BOARD</p> <h4>10,400 μF</h4> <p>0.18 mΩ · 194 g of caps · ripple current 275 A rms</p>	<p>VOLTAGE RATING</p> <h4>63 V</h4> <p>vs 33.6 V full pack · OK</p>
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YOUR ESC

<p>CELLS IN SERIES</p> <p>8S</p>	<p>ESC CURRENT (A)</p> <p>550</p>	<p>SWITCHING FREQUENCY EST</p> <p>20 KHZ</p>	<p>DUTY CYCLE EST</p> <p>0.5</p>
<p>TARGET RIPPLE (V PEAK TO PEAK)</p> <p>1.0</p>	<p>PASS LENGTH FOR HEAT (S)</p> <p>3</p>		

XC E6 MAX · 550 A **RATED** 6S 8S

Duty 0.5 is the worst case for input ripple. The target is your call (1.0 V is an example).

YOUR CAPS

BOARD

V2 BOARD · 104 × PANASONIC

RATED (Panasonic data sheet): 100 μF , 63 V, 19 m Ω ESR, 3.0 A rms ripple, 1.87 g

CARE

- The board needs no charging; it follows the pack.
- Inspect joints and busbar bolts every race day.
- Replace any cap with a bulged or discoloured case.
- Plug the pack in last and unplug it first.

Questions: evul@evulempire.com · (724) 338-8557

SAFETY

- Insulate the busbars; 550 A through a dropped tool welds it.
- Charge LiPo in a LiPo bag or box, never unattended.
- Competition gear, no warranty.