

Tesla Model 3 Disassembly

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Introduction

Outstanding performance of Tesla Model 3 has been fueling tremendous interest in EV/HEV engineering community. Thanks to Engineerix's videos, we are able to see the beauty underneath now! To take a closer look at the technologies used, we have extracted the most relevant frames from the videos. All key components mentioned in the videos are labeled on the pictures. The videos didn't point out the circuit topologies used. The following topologies are listed based on our best understanding,

1. Inverter : SiC-based three-half-bridge traditional inverter (not a 3-level one)
2. Traction Motor: Permanent magnet switched reluctance motor
3. PFC of OBC: SiC-based three independent totem-pole PFC converters (Not a Vienna rectifier, since the output caps were not arranged in a voltage divider. The input can be either a single-phase AC or a three-phase AC)
4. DC/DC of OBC: three-phase LLC (with very little output caps)
5. 12V battery charger: single-phase LLC

Tesla Model 3 Main Spec and Devices Used

The inverter is part of the drive unit and it takes up to 500 amps of 400 volt DC power from the battery and makes 3-phase AC power for the motor. Maximum output power: 300kW. Battery: 80kWh

Here is the list of major components:

SiC FETS: ST GK026 (24)

Gate Drivers: STGAP1AS (6)

MCU: TI TMS320F28377DPTPQ

Resolver Amp: ON Semi TCA0372BDW

Temp Amp: TI LMV844

EEPROM: Microchip 25LC256E

CAN Transceiver: TI SN65HVD1040A (2)

LIN Transceiver: NXP TJA1021

HV Sense: Broadcom ACPL-C87BT-000E

DC-DC Power: Infineon TLF35584QVVS2

DC-DC Transformer: TDK VGT22EPC-222S6A12

Here is an image showing how the SiC MOSFETs are mounted to the cold plate and how they are connected:

<https://ibb.co/dfvktz>

Here is the internal structure:

<https://ibb.co/cphemK>

Engineerix videos:

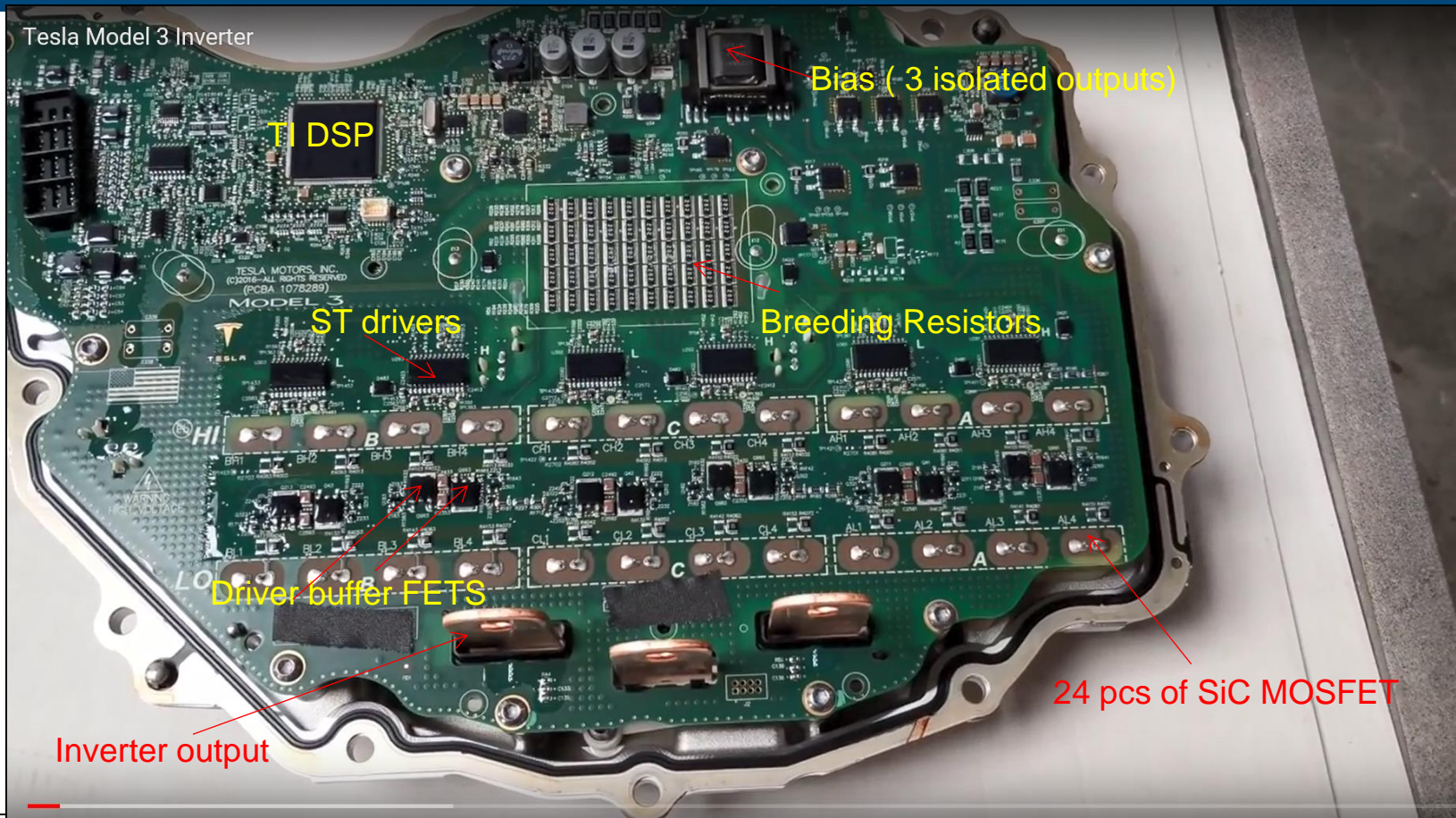
<https://www.youtube.com/watch?v=l6dV2re3rtM>

https://www.youtube.com/watch?v=m4eQ7nN_Lwo

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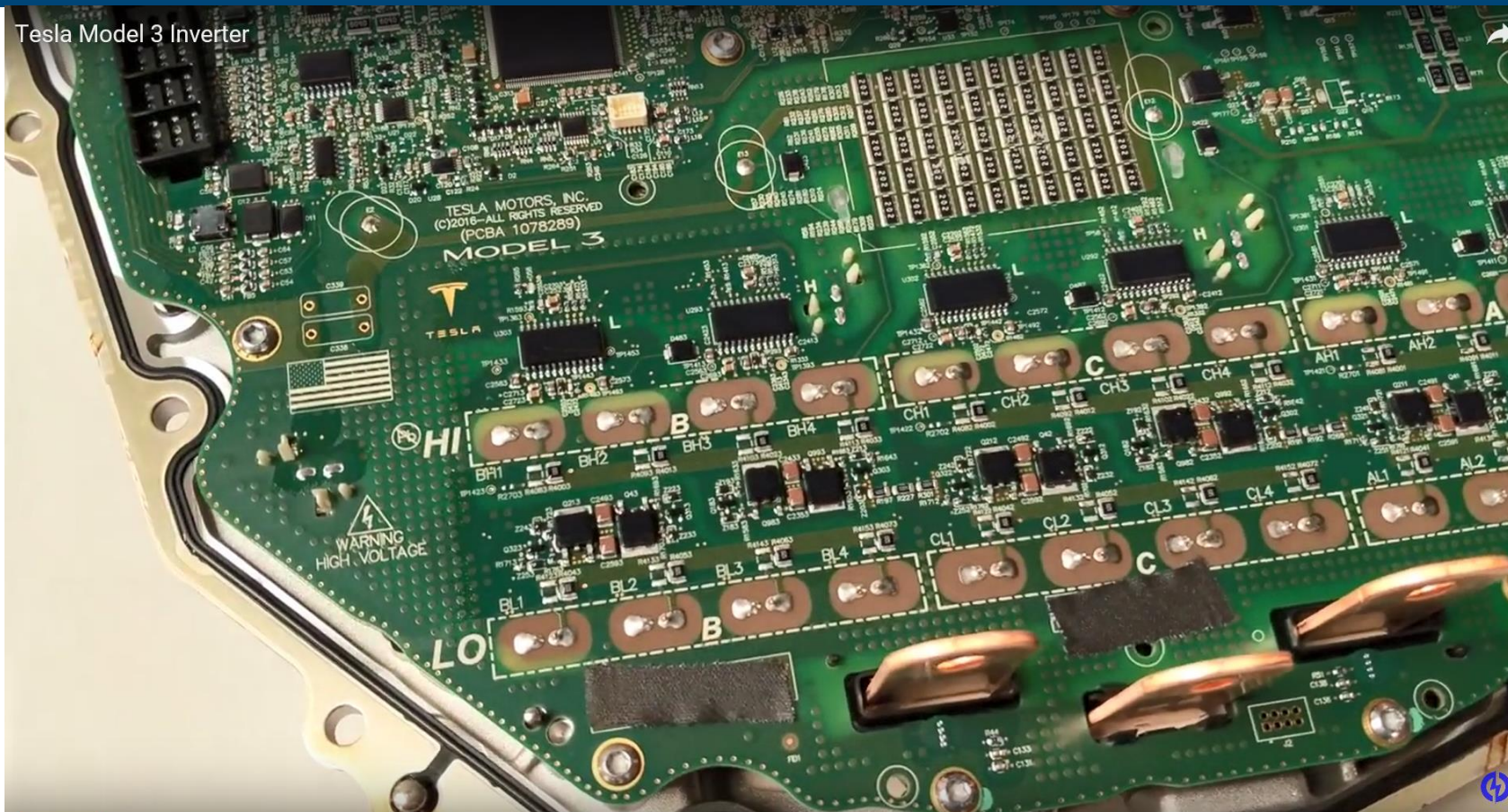
<https://www.youtube.com/watch?v=ANLPPKRwiyQ>

Tesla Model 3 - Inverter



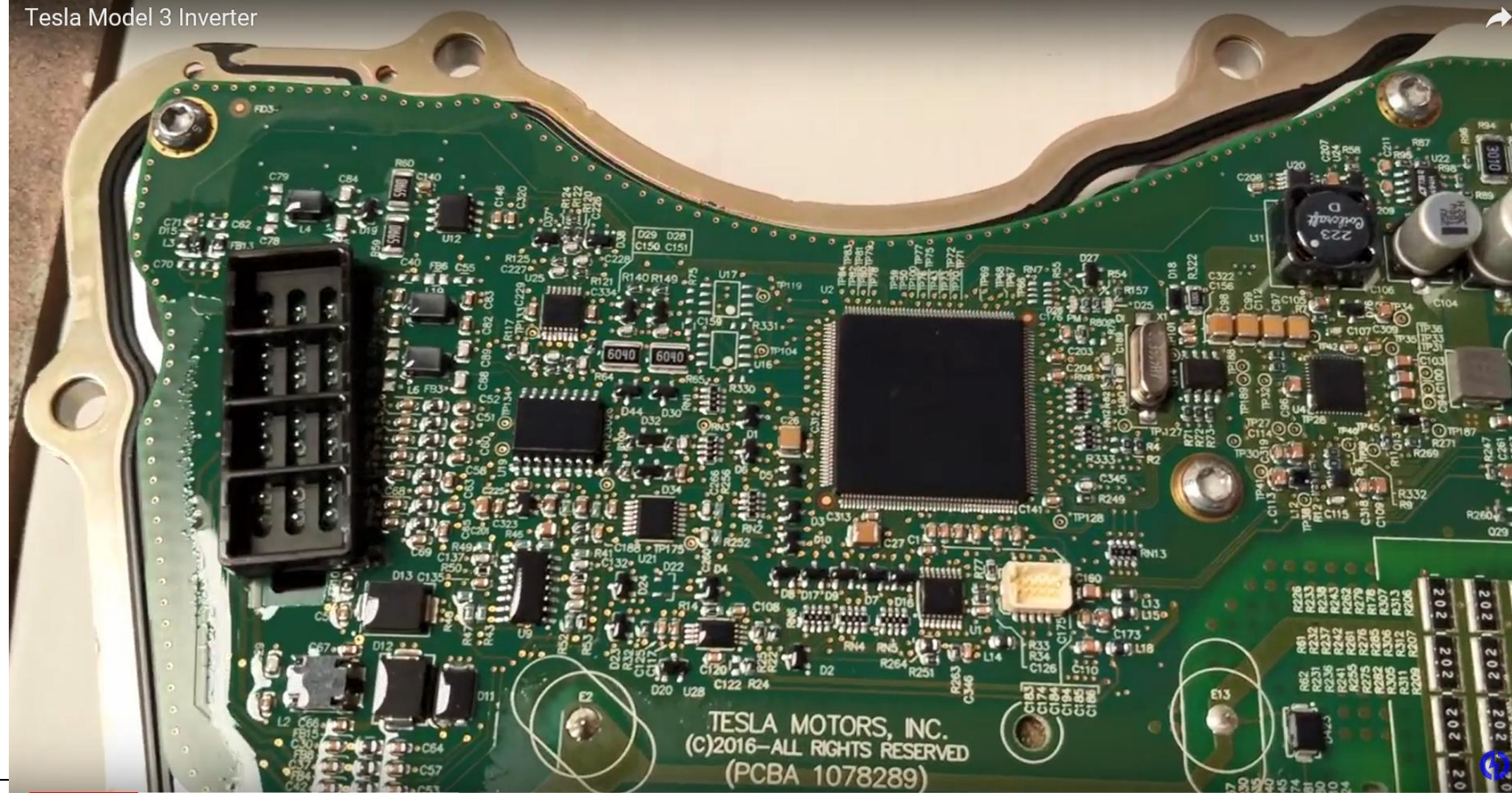
Tesla Model 3 - Inverter

Tesla Model 3 Inverter



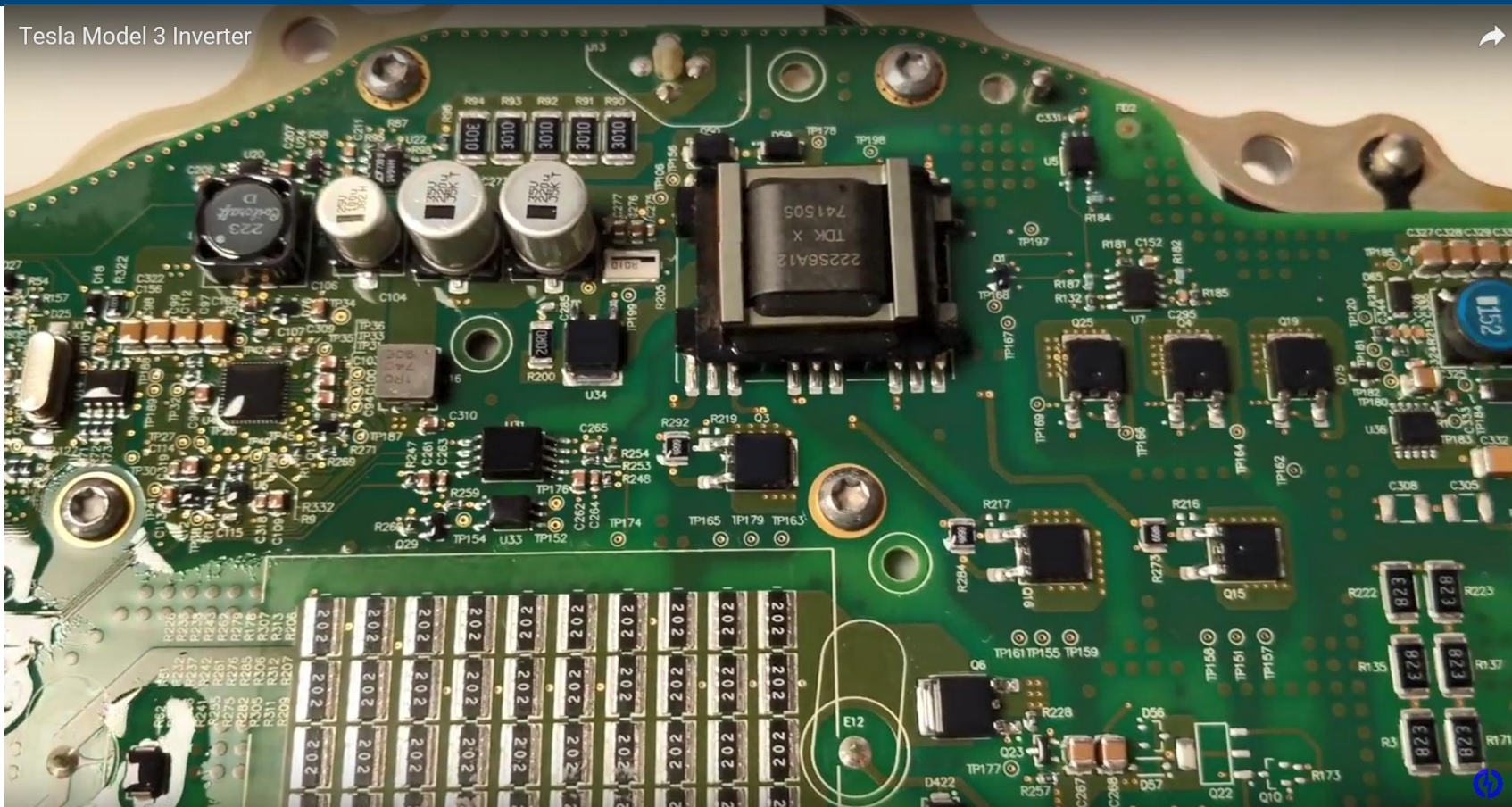
Tesla Model 3 - Inverter

Tesla Model 3 Inverter



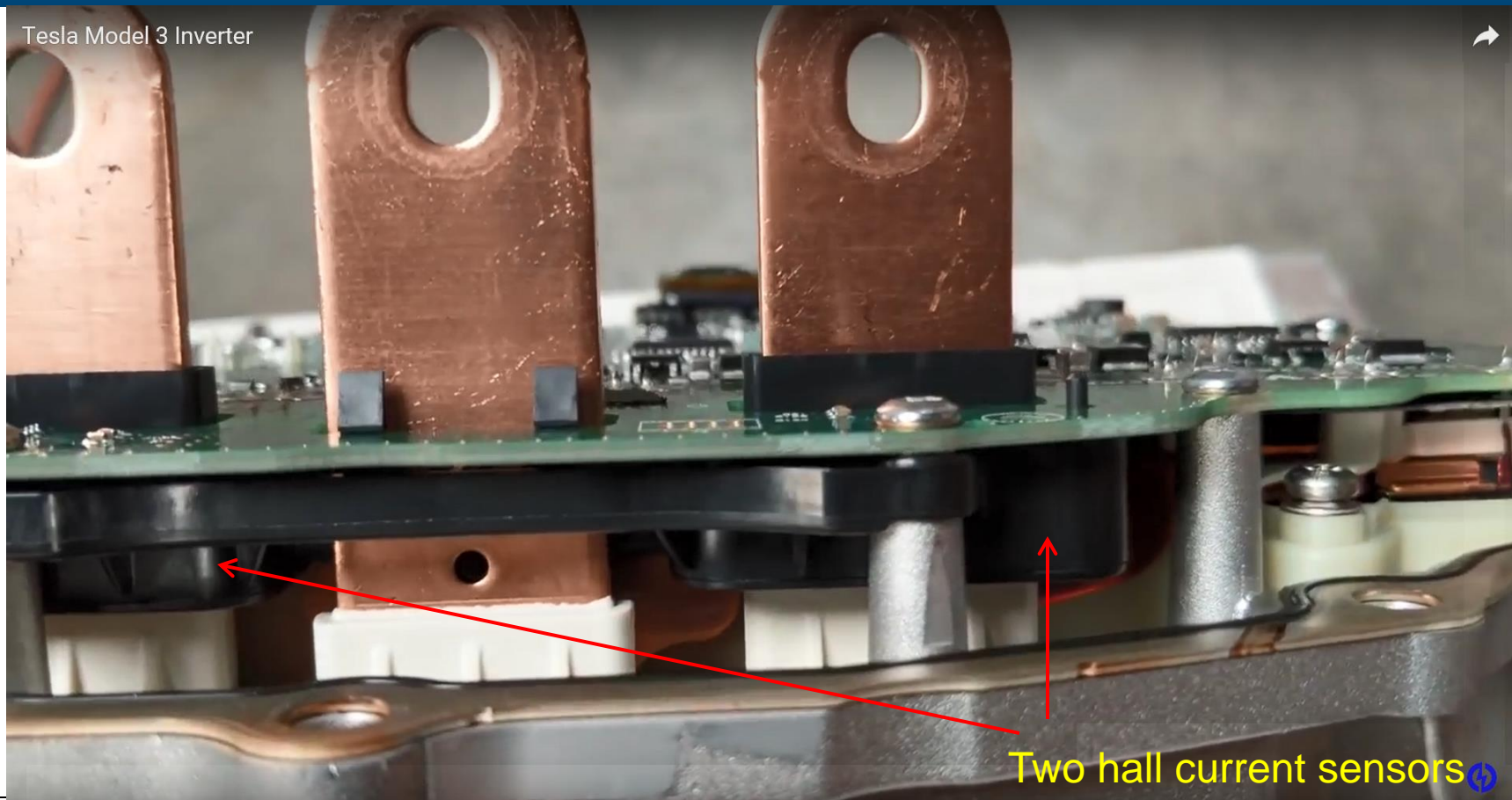
Tesla Model 3 - Inverter

Tesla Model 3 Inverter



Tesla Model 3 - Inverter

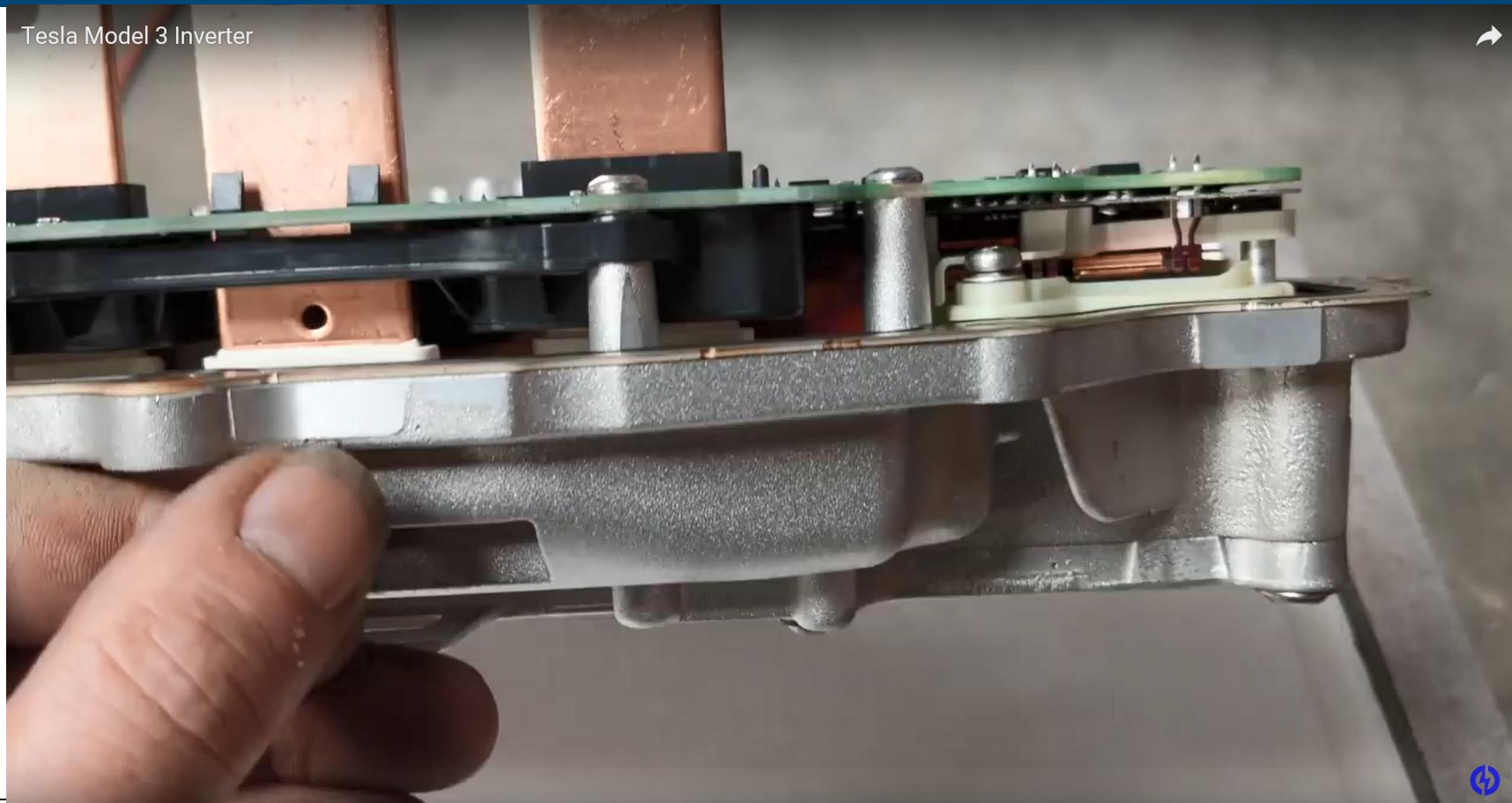
Tesla Model 3 Inverter



Two hall current sensors

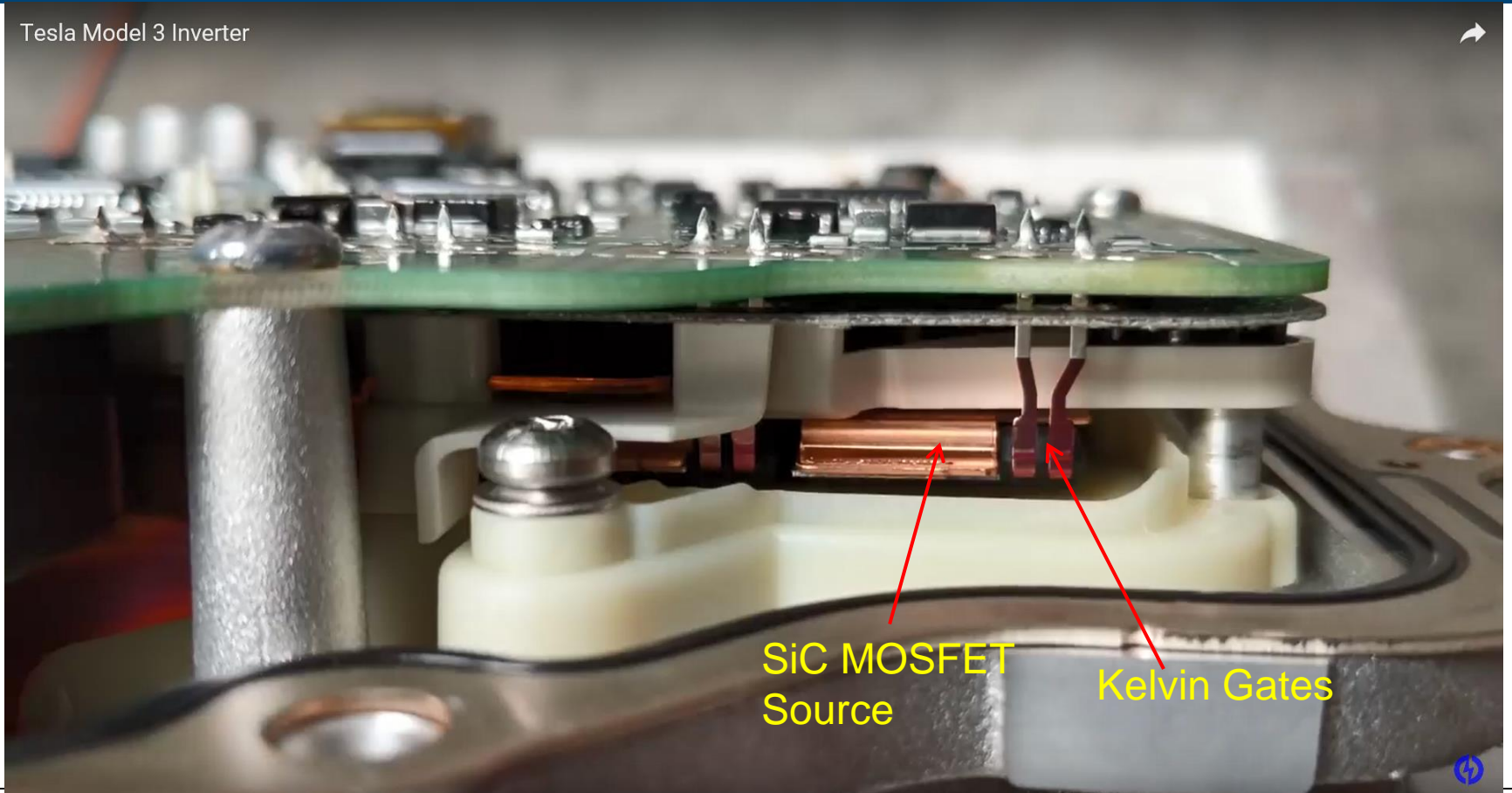
Tesla Model 3 - Inverter

Tesla Model 3 Inverter



Tesla Model 3 - Inverter

Tesla Model 3 Inverter



SiC MOSFET
Source

Kelvin Gates

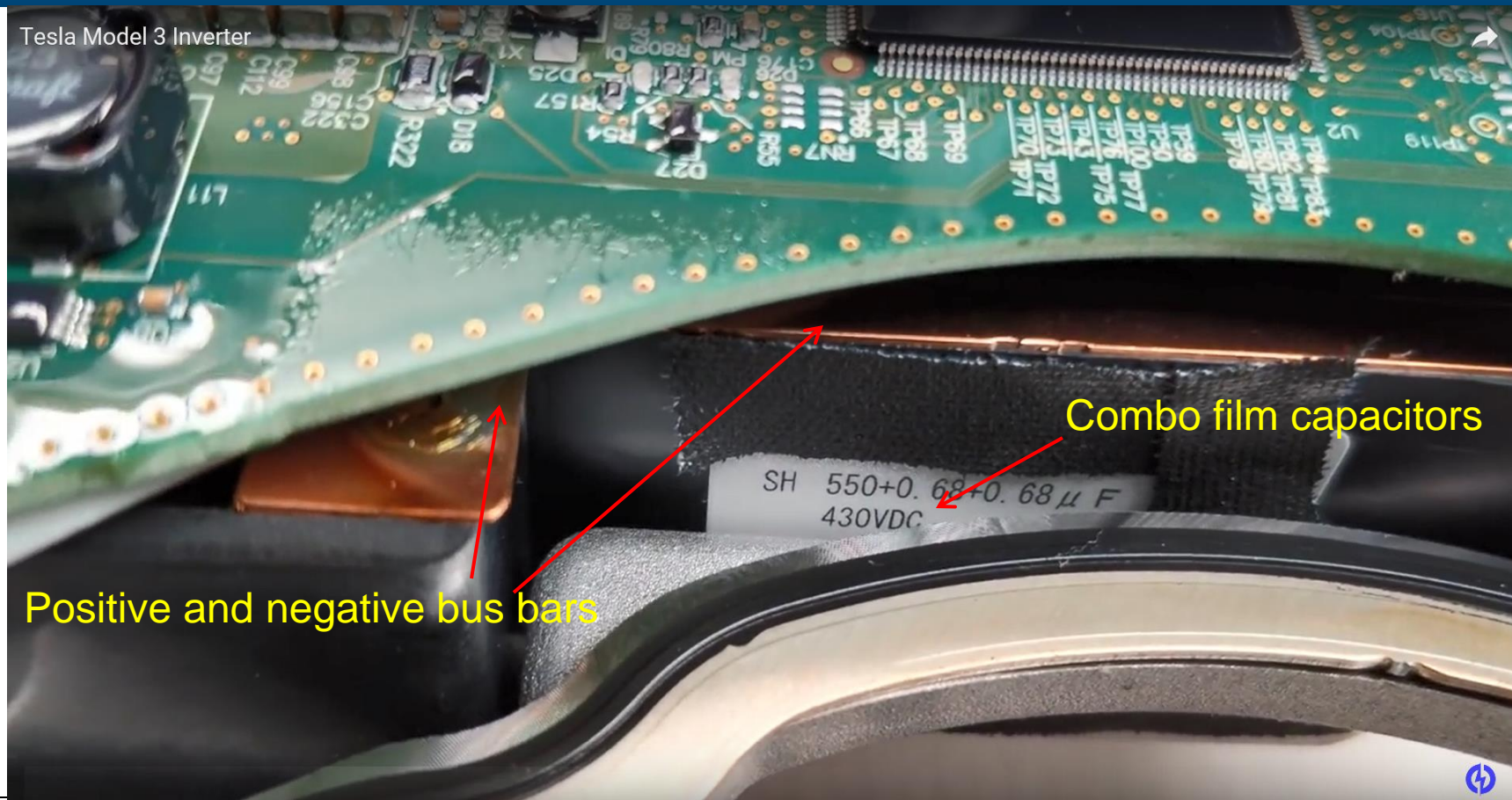
Tesla Model 3 - Inverter



Tesla Model 3 - Inverter

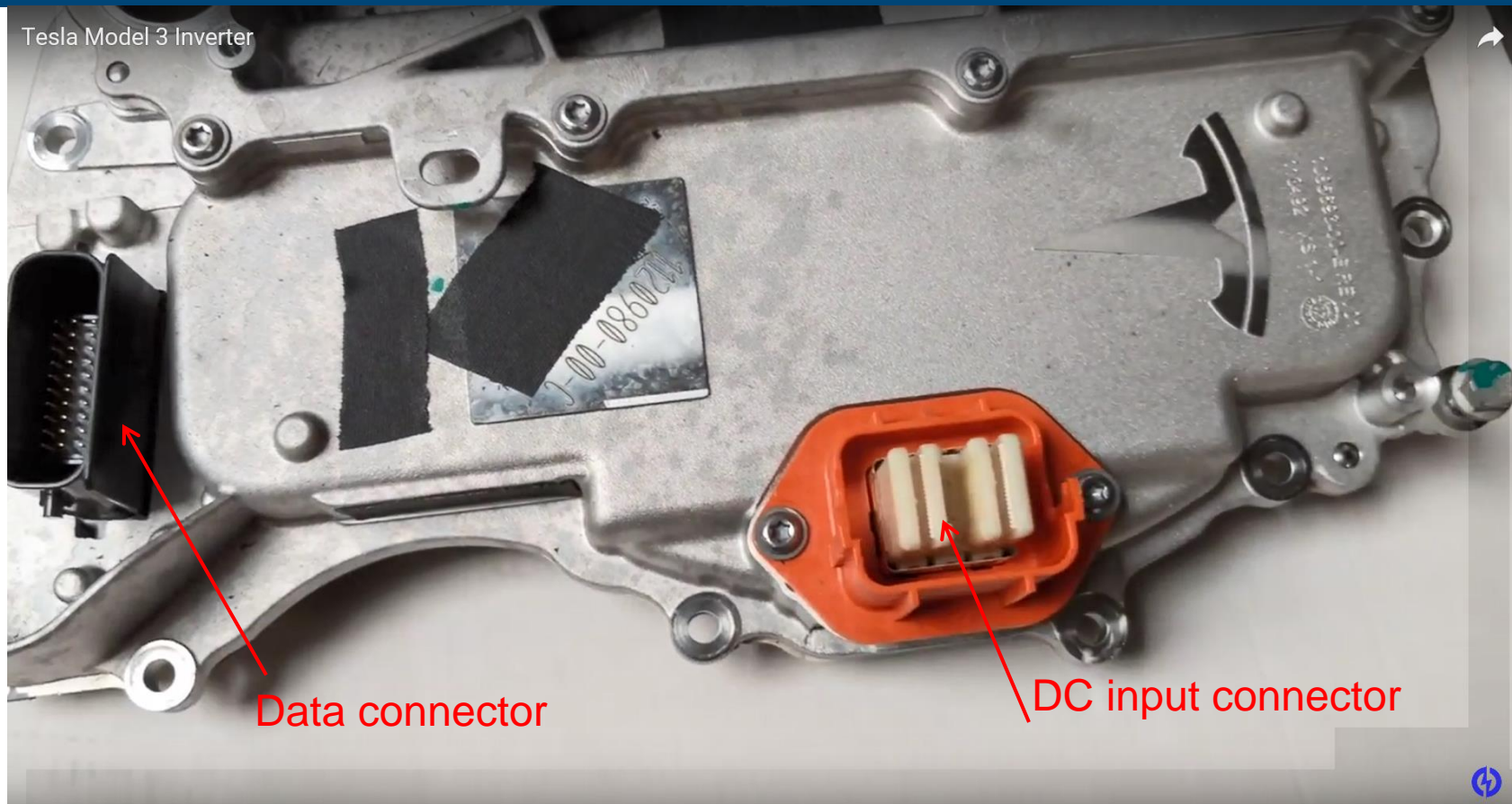


Tesla Model 3 - Inverter



Tesla Model 3 - Inverter

Tesla Model 3 Inverter



Data connector

DC input connector

Tesla Model 3 - Inverter



Tesla Model 3 - Inverter

Tesla Model 3 Inverter



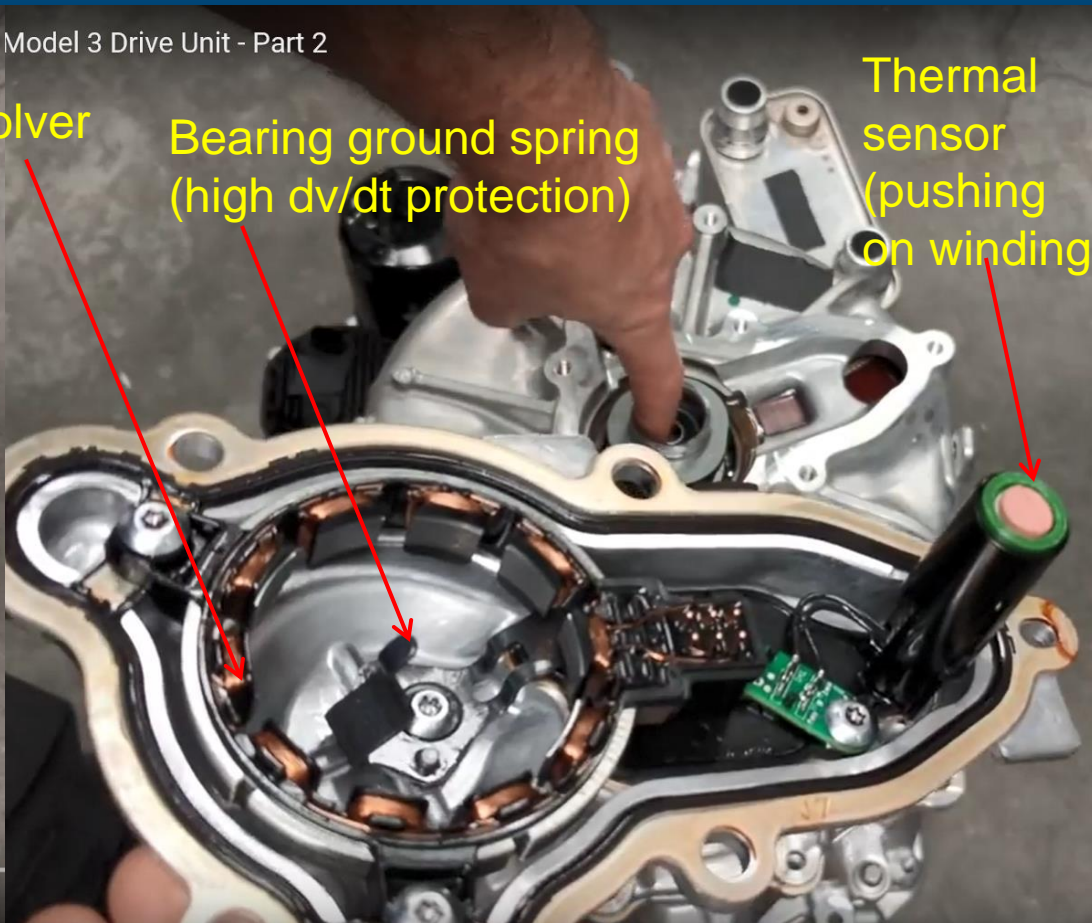
Heatsink fins

Tesla Model 3- Driver Unit

- Part 2



Model 3 Drive Unit - Part 2



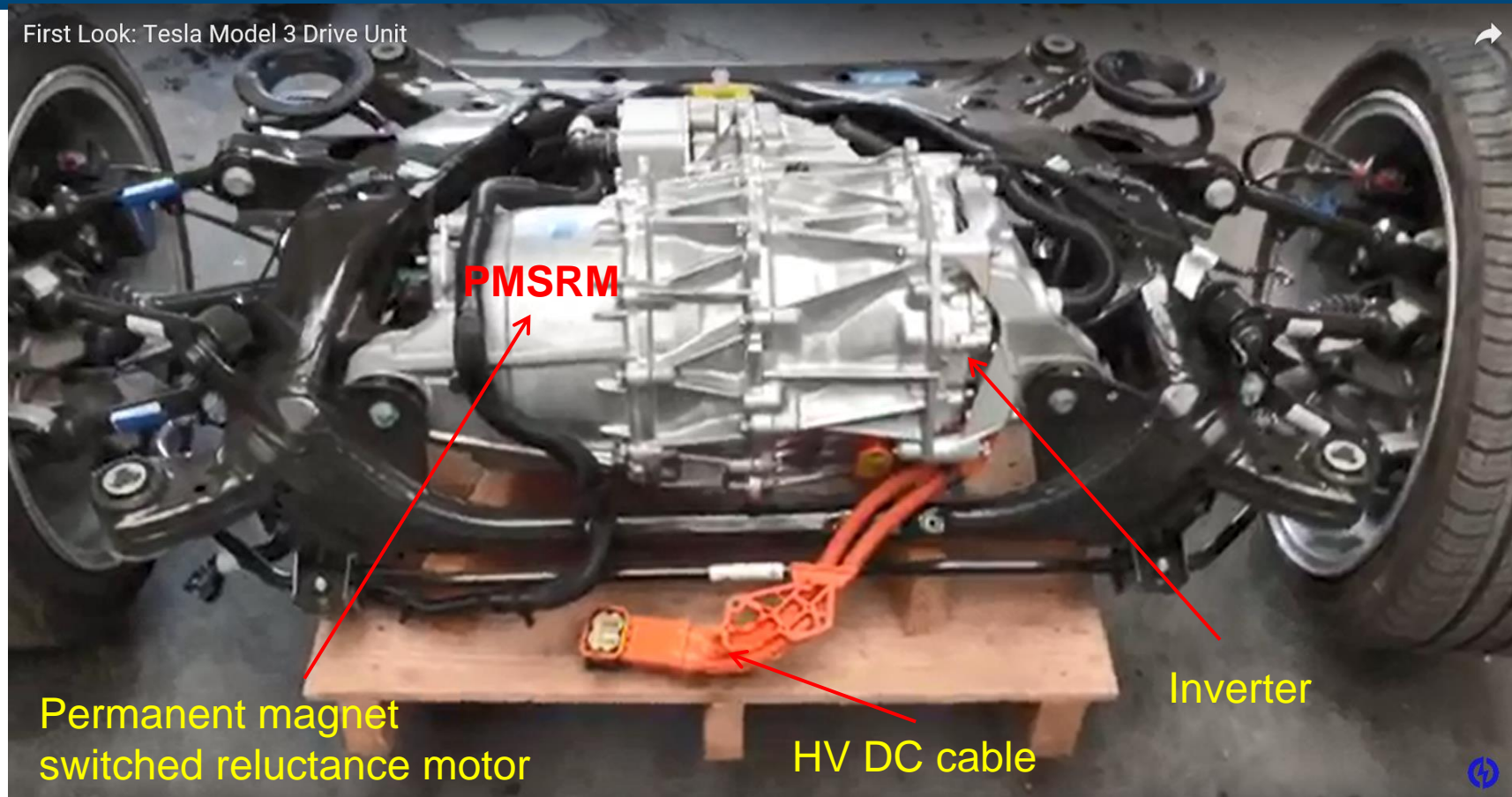
Resolver

Bearing ground spring
(high dv/dt protection)

Thermal
sensor
(pushing
on winding)

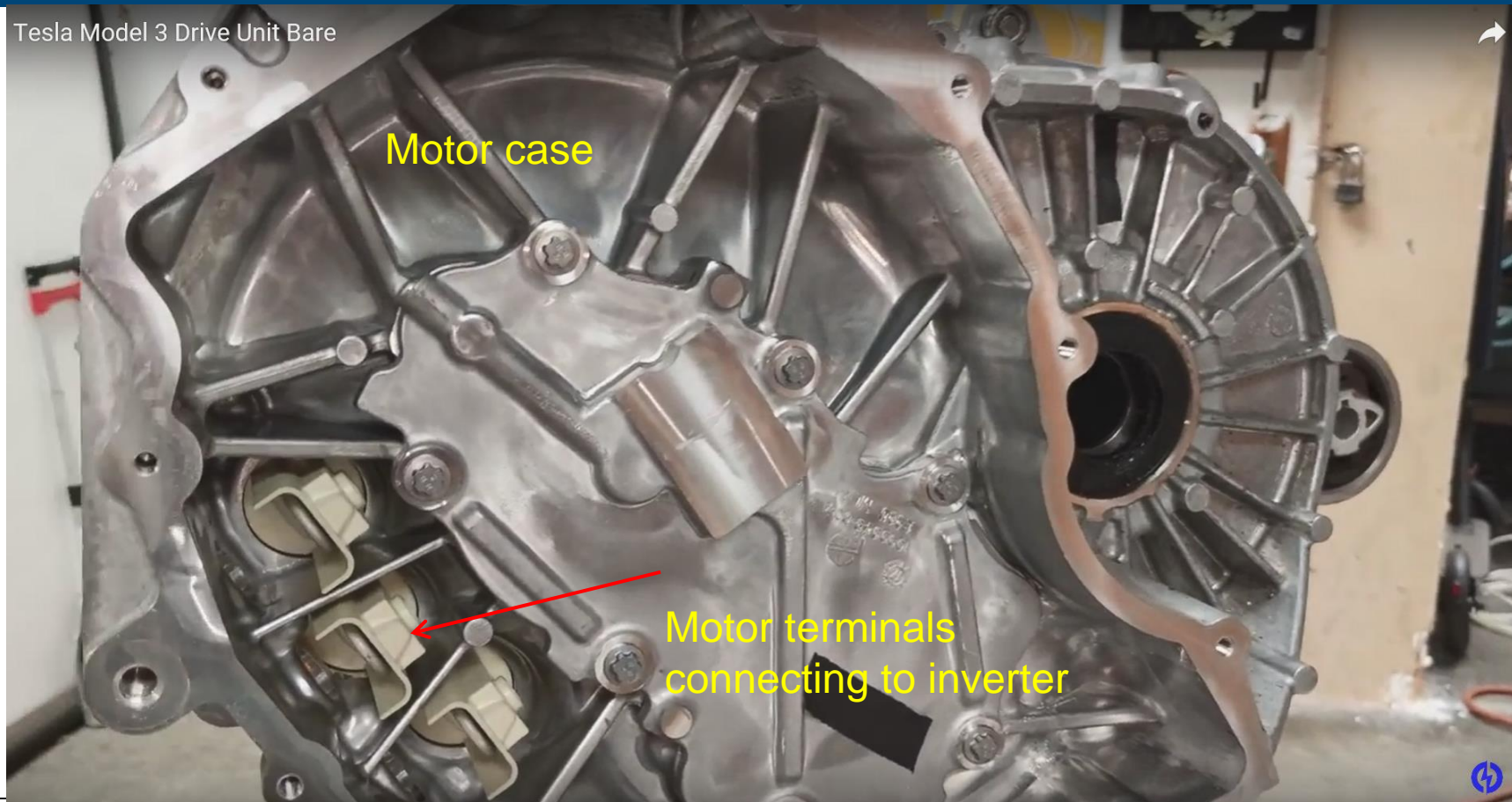
Tesla Model 3- Driver Unit

First Look: Tesla Model 3 Drive Unit



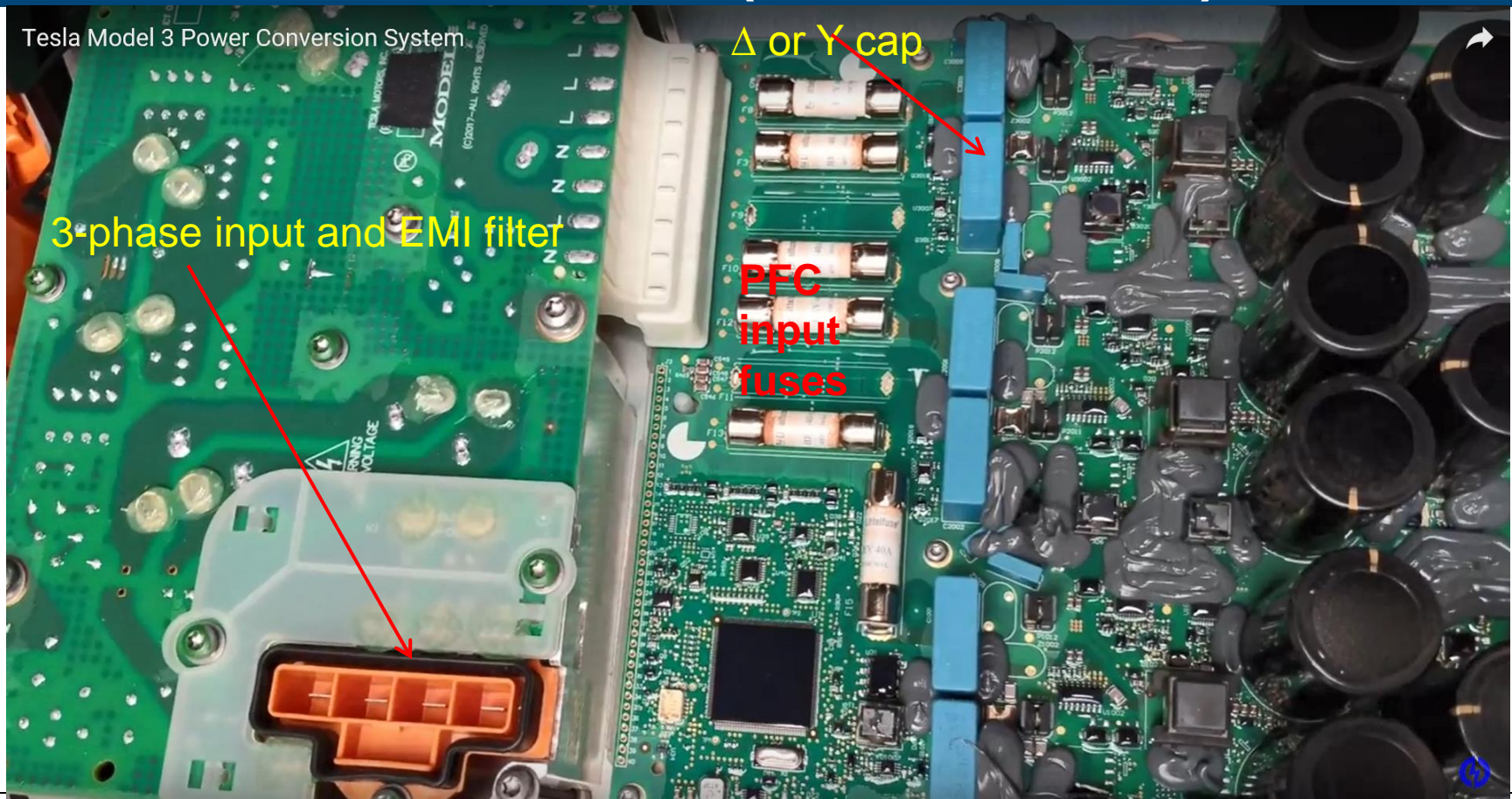
Tesla Model 3- Driver Unit

Tesla Model 3 Drive Unit Bare



Tesla Model 3 – PCS (OBC + DC/DC) 20kW

Tesla Model 3 Power Conversion System

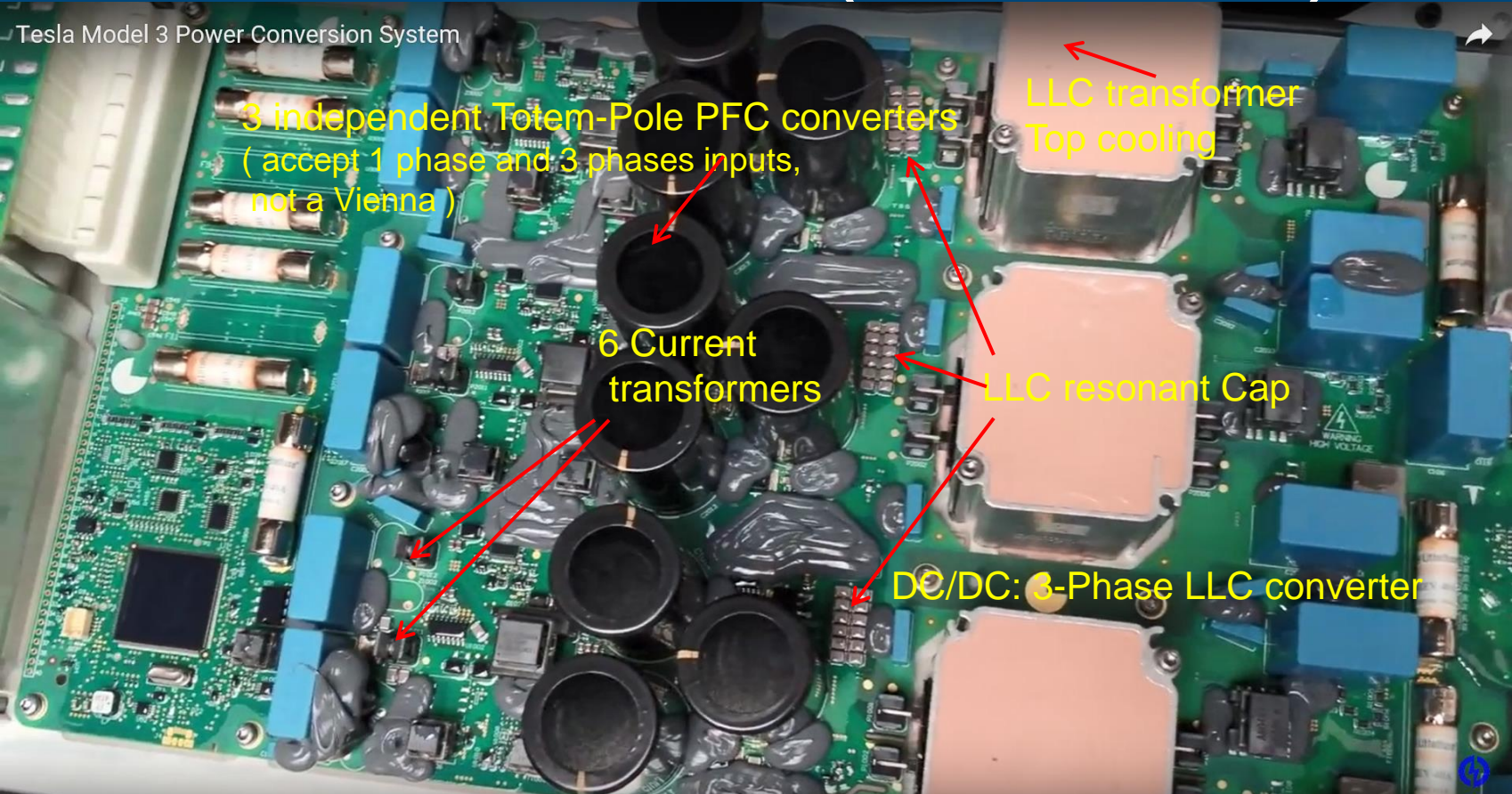


3-phase input and EMI filter

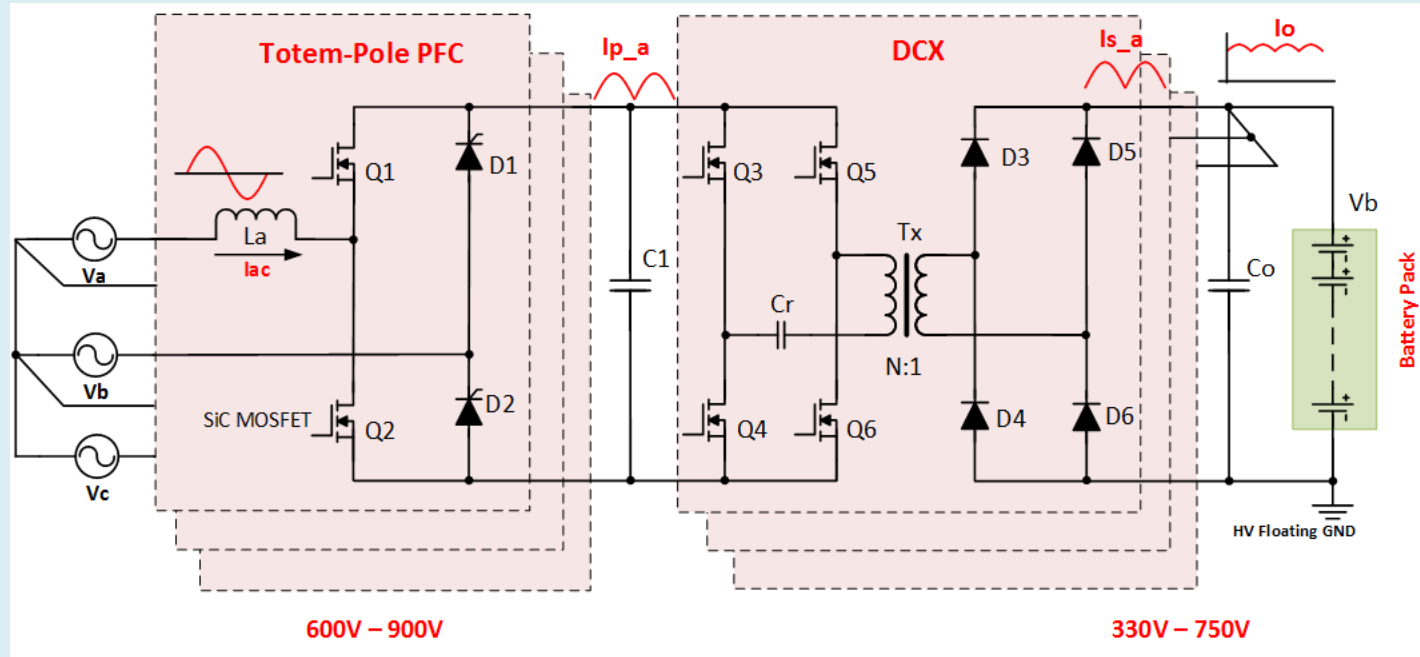
Δ or Y cap

PFC
input
fuses

Tesla Model 3 – PCS (OBC + DC/DC)

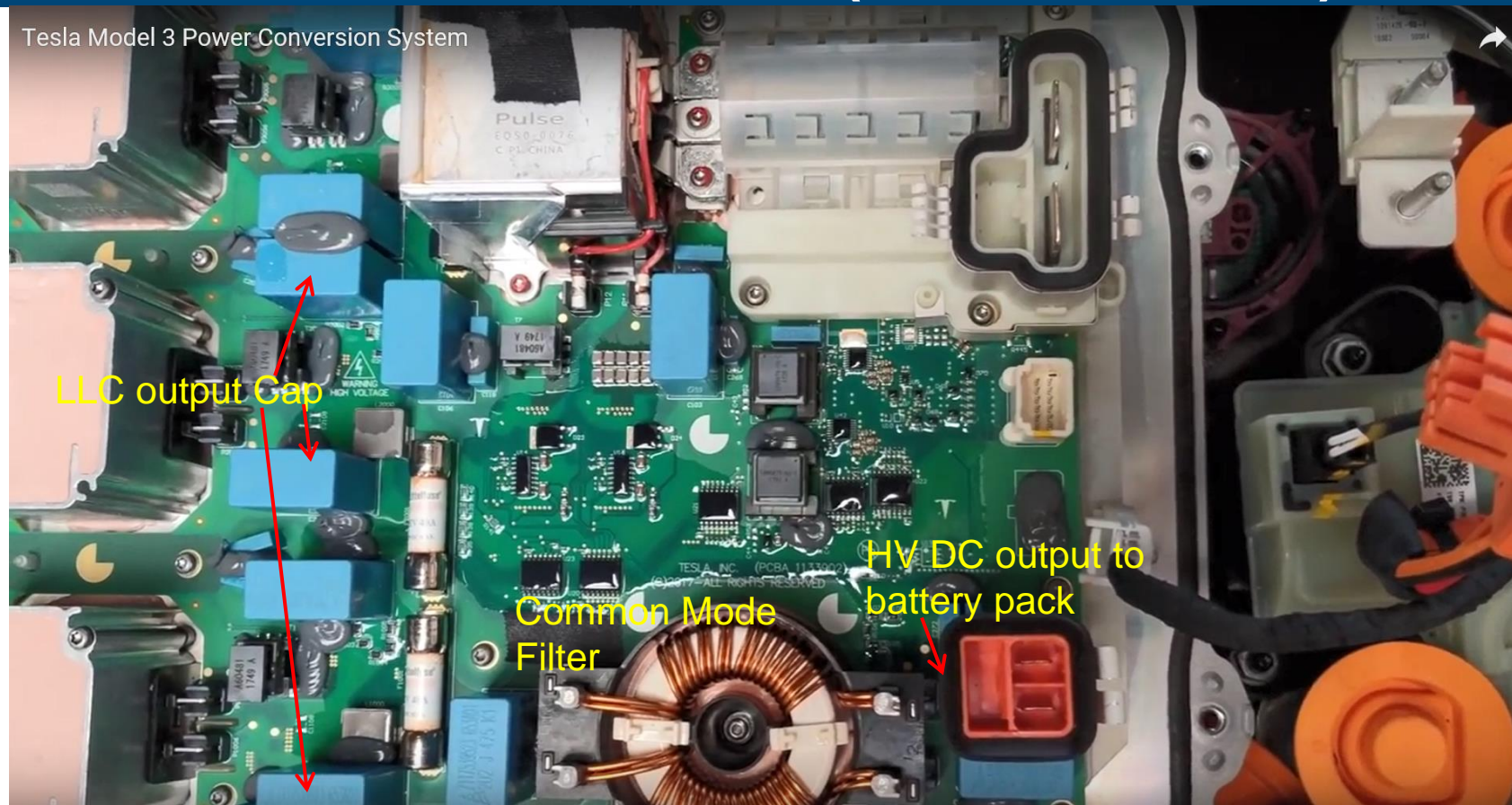


Tesla 20kW OBC



Tesla Model 3 – PCS (OBC + DC/DC)

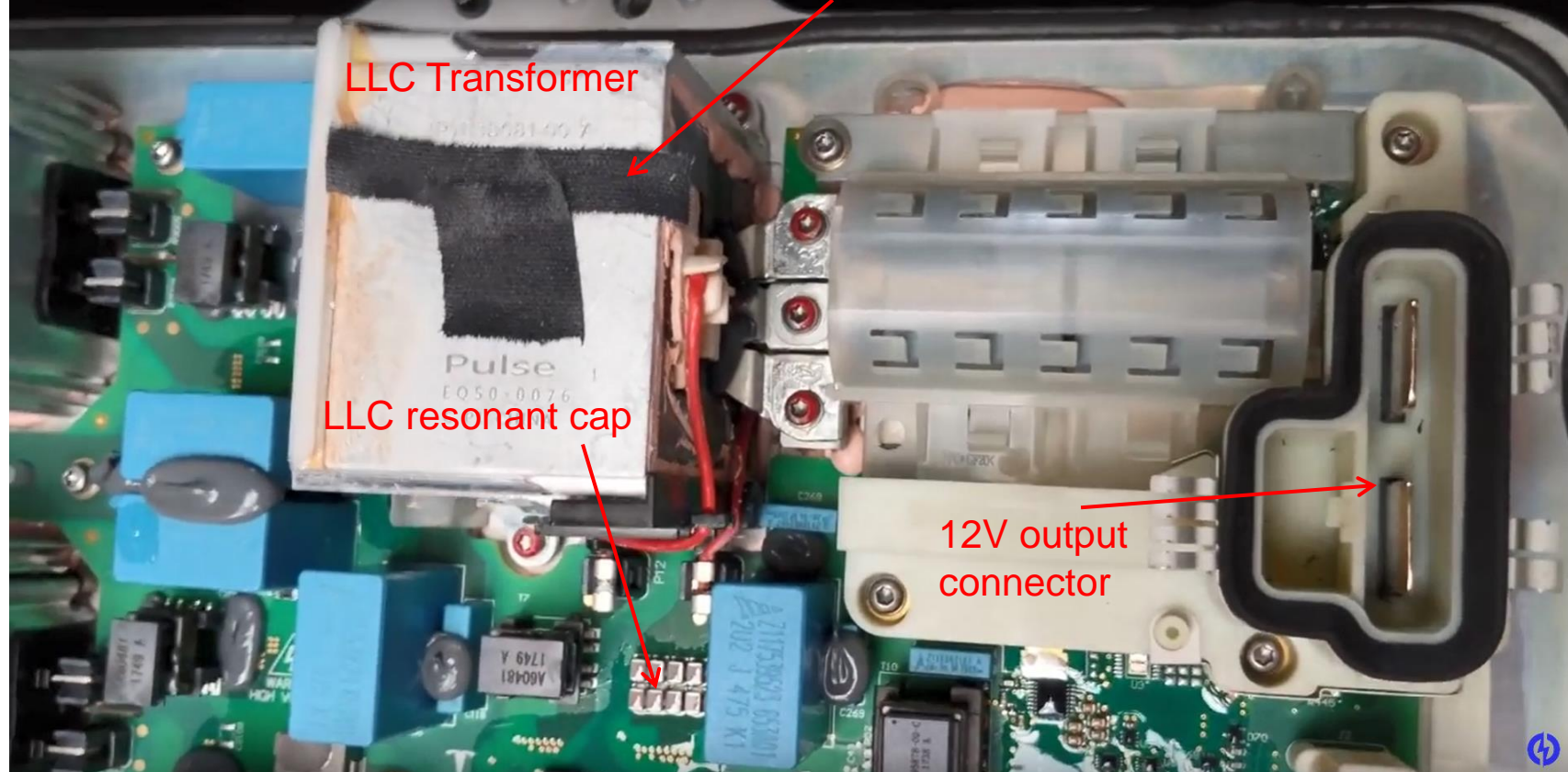
Tesla Model 3 Power Conversion System



Tesla Model 3 – PCS (OBC + DC/DC)

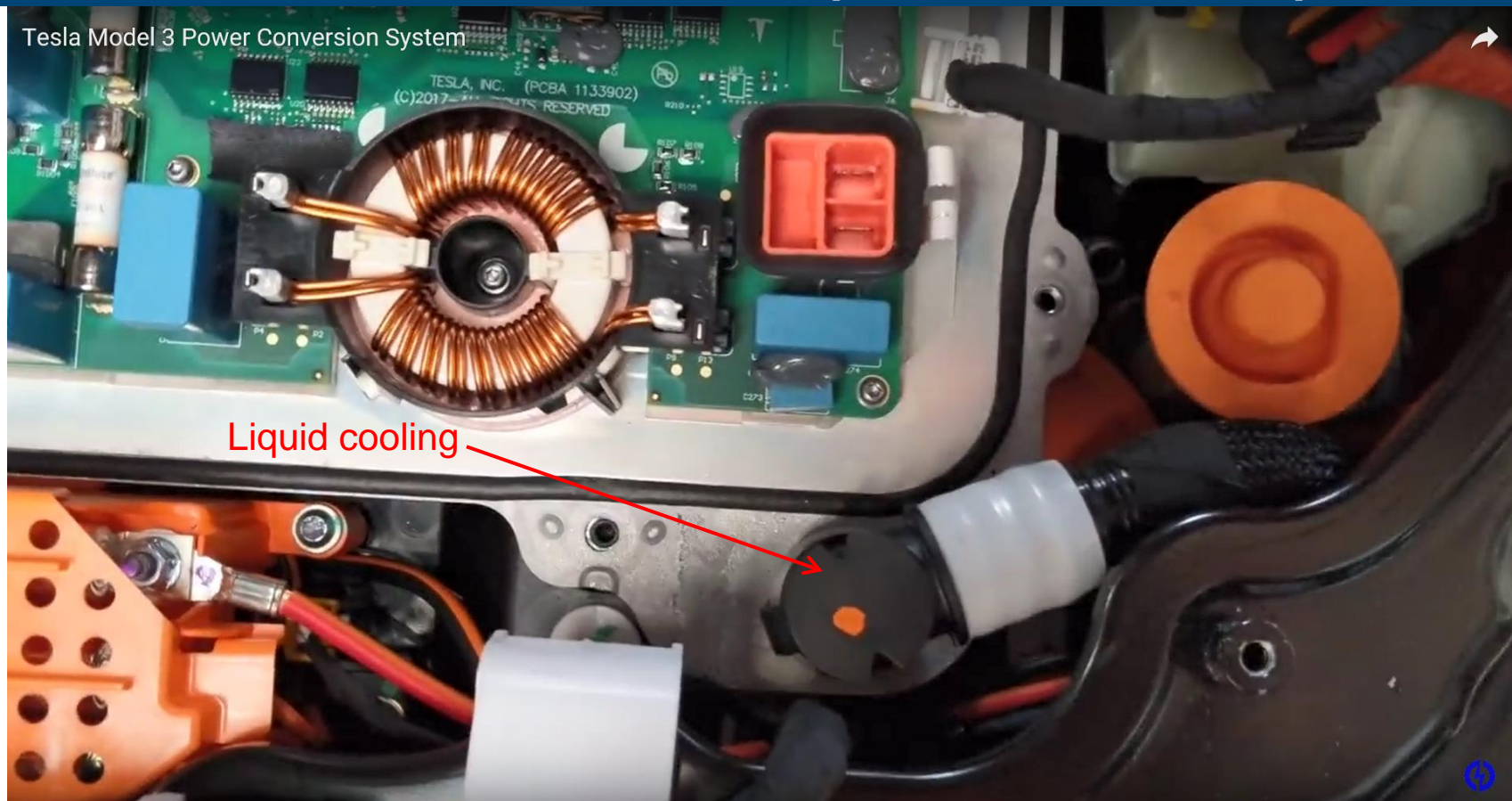
Tesla Model 3 Power Conversion System

LLC DC/DC for 12V batter charging



Tesla Model 3 – PCS (OBC + DC/DC)

Tesla Model 3 Power Conversion System



Tesla Model 3 Disassembly

Thank You !

Shanghai Lingang (上海 临港)