

MEMORANDUM

DATE: January 31, 2018

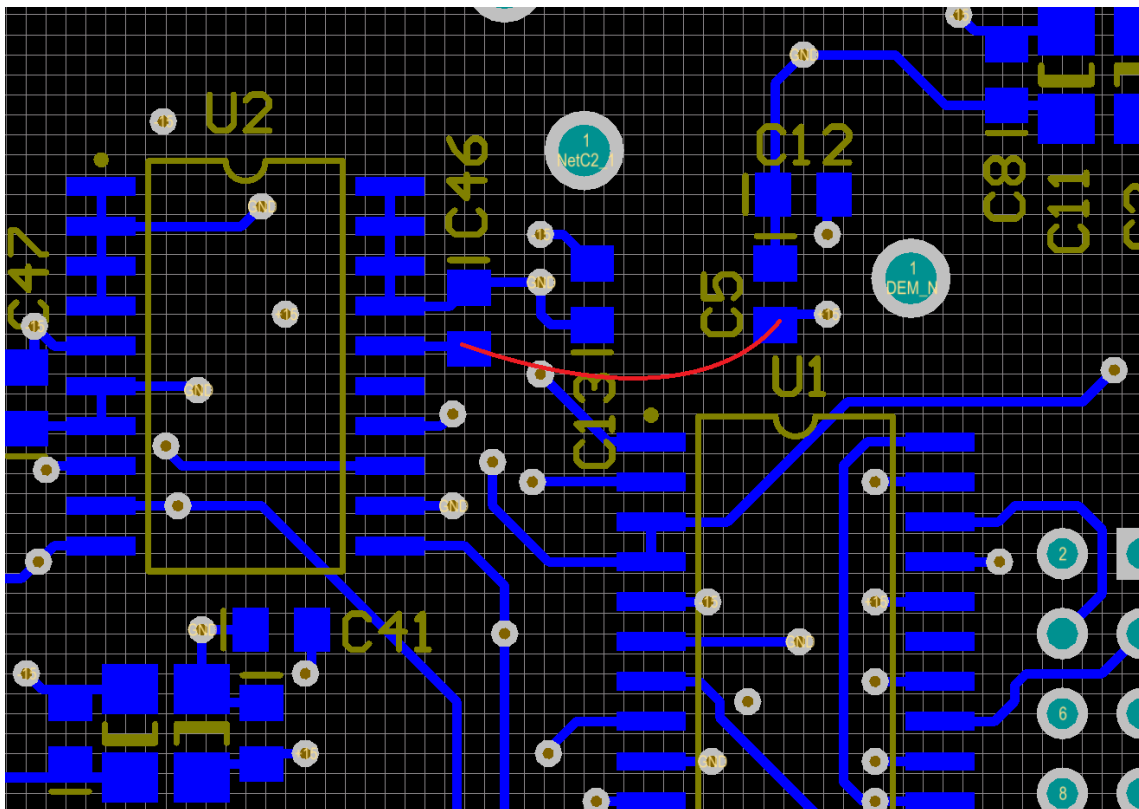
TO: SQZ team
FROM: Daniel Sigg, Marc Pirello
SUBJECT: Modifications to the TTFSS V4
Refer to: LIGO-E1700364-v2

This document lists the modifications to the 4th generation TTFSS, based on PCB D1700346-v1 and on schematics [D1700077](#), [D1700076](#) and [D1700078](#).

Board modifications

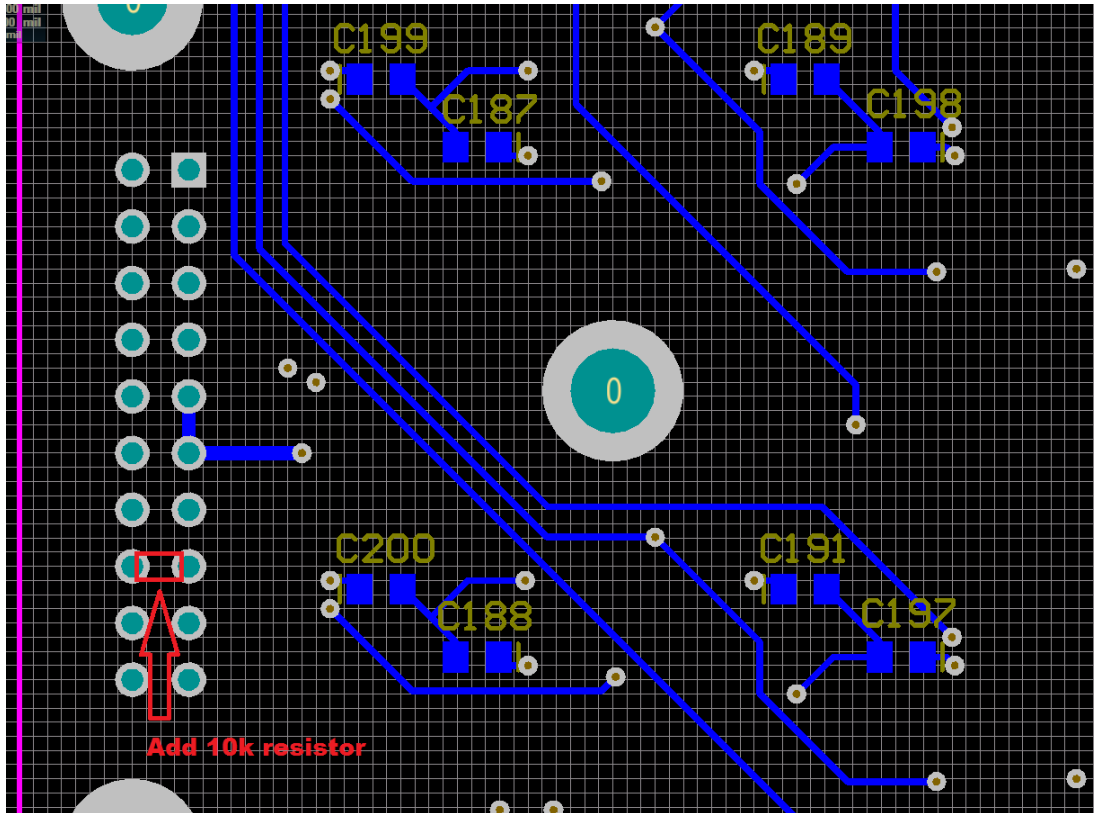
Change 1:

U2 is missing the +15V rail. Add a jumper wire between the C5 pad towards U1 and the C46 pad towards U1 (Servo board, D1700077, bottom).



Change 2:

Input to U26 is floating when OPT4 is selected without an option board. Add a 10 k Ω resistor (R174) between pins 8 and 18 of header JP1 (Servo board, D1700077, bottom).



Part modifications:

Change 3:

A couple of AD829 operational amplifiers are missing a small capacitor in the feedback path to make them stable (Servo board, D1700077, top).

- C66 → 4.7 pF
- C52 → 27 pF
- C53 → 27 pF
- C101 → 10 pF
- C153 → 4.7 pF

Change 4:

The output of the EOM high voltage stage needs a higher output impedance to limit the maximum current drive (HV board, D1700076, top).

R99 → 470 Ω (350V)
C63 → 100 pF (500V)

Change 5:

The common boost filter knee changed to 480 Hz (Servo board, D1700077, top).

R55 → 1 k Ω
R63 → 1 k Ω

Change 6:

The gain in the fast path that is used together with the EOM needs to be increased by 4 (Servo board, D1700077, top).

R65 → 499 Ω
R66 → 499 Ω

Change 7:

The gain in the EOM path is too low and needs to be increased by a factor 10. By increasing R112 we also need to adjust the compensation of OpAmp U33 to stay at a high bandwidth (Servo board, D1700077, top/bottom).

R112 → 10 k Ω
C152 → NL
C165 → NL

Change 8:

A lead compensation is needed in the EOM path to restore a decent phase margin (Servo board, D1700077, top).

R107 → 2 k Ω
C144 → 100 pF (1% or 2%)

Change 9:

Remove pointless EOM path diodes (Servo board, D1700077, top).

D1 → NL
D2 → NL

Change 10:

Add a fourth notch filter in the fast patch to address resonances below 100kHz (Servo board, D1700077, top).

- U29 → AD829
- R91 → 100 Ω
- R95 → NL
- R99 → 249 Ω
- R103 → 0 Ω
- C141 → 10 nF (NP0, 1% or 2%)

BOM (for 6 units, changes 1 through 4):

Qty	Item	Distributor	Description
10	P10KDACT-ND	Digi-Key	Change 2; 10 kΩ
20	478-1300-1-ND	Digi-Key	C66,153; 4.7 pF
10	311-1099-1-ND	Digi-Key	C101; 10pF
20	311-1104-1-ND	Digi-Key	C52,53; 27pF
10	1135-1606-ND	Digi-Key	R99; 470 Ω
10	80-C1206C101FBG	Mouser	C63; 100 pF

BOM (for 6 units, changes 5 through 11):

Qty	Item	Distributor	Description
10	P10KDACT-ND	Digi-Key	R112; 10 kΩ
20	P1.0KDACT-ND	Digi-Key	R55, R63; 1 kΩ
10	P2.0KDACT-ND	Digi-Key	R107; 2 kΩ
20	P499DACT-ND	Digi-Key	R65, R66; 499 Ω
10	311-3379-1-ND	Digi-Key	C144; 100pF
10	P100DACT-ND	Digi-Key	R91; 100 Ω
10	P249DACT-ND	Digi-Key	R99; 249 Ω
10	A110380CT-ND	Digi-Key	R103; 0 Ω
10	490-8295-1-ND	Digi-Key	C141; 10 nF, 1%
7	AD829ARZ-ND	Digi-Key	U29; OpAmp