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TESTING AND VERIFICATION OF DESIGN SPECIFICATIONS FOR SQUID FEEDBACK TRANSFORMER

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Note: Feedback transformer is not ESD sensitive.

Superconductive Feedback Transformer Specification

Primary Coil

Resistance < 10 ohms

Inductance sufficient to achieve mutual inductance given below

Secondary Coil

Inductance less than or equal to 0.2 μH

Resistance $< 10^{-12}$ ohms

Mutual Inductance = 0.4 μH +/- 30%

Capacitance between Primary and Secondary < 10 nF

Substrate Size < 0.2" by 0.3" max.

Magnetics: Part must pass zone 2B requirement.

Interface to SQUID Wiring:
Located at Periphery of
Transformer Die

solderable (gold over
niobium for example)
2 Ea.
for Primary; 0.040" x 0.040"
minimum size
2 Ea.
for Secondary; 0.040" x 0.040"
minimum size
Transformer should be corrosion
resistant

<u>Testing of Completed Feedback
Transformer</u>
MATERIALS AND EQUIPMENT
Feedback Transformer
Plexiglas Rod 1/4" X 1/4"
X 6'
Sapphire Carrier 3/8" X 1-
7/8" X .025" with 4 gold bond pads
separately interconnected to
copper solder pads over Niobium
metalization.
Kapton Tape
60/40 PbSn Solder
Soldering iron
2 - 10 foot twisted pairs
formed from 30 gauge insulated
stranded hookup wire, each
wire of a different color
Super Glue
Westbond Ultrasonic
Wedge Bonder
Tanaka's Superconductive
wire 2 mil
Dewar with at least 6" of
liquid helium
HP 4277A LCZ meter with
16047A test fixture
Fluke 77 Ohm meter
Acetone

PROCEDURE

Record transformer's serial number in Table 1.

Turn on the LCZ meter. Allow at least 30 minutes warm up prior to making measurements.

Attach the transformer to be tested to the sapphire carrier with a single drop of super glue.

Using the ultrasonic bonder attach fly wires between each of the transformer's bond pads and the carrier's bond pads using the superconductive wire.

Solder twisted pair wires to the primary's solder pads on the carrier. Solder twisted pair wires to the secondary's solder pads on the carrier. Make note of which twisted pair goes to the primary and which pair goes to the secondary.

Attach the sapphire carrier to one end of the Plexiglas rod using Kapton tape. Secure the two twisted pairs along the length of the rod with Kapton tape.

Immerse the carrier in liquid helium. Measure the resistances at the free ends of each of the two twisted pairs with the ohm meter. Verify that the resistance of

both primary and secondary circuits are less than 1 ohm when the transformer is immersed in liquid helium_____(Y/N).

Measure the resistance between one wire each of the twisted pairs from the primary and secondary of the transformer. Verify that the primary to secondary resistance exceeds 20 MΩ_____(Y/N).

Set up the LCZ meter as follows:
CKT MODE in AUTO
LC|Z| RANGE in AUTO
TEST SIGNAL in LOW
DISPLAY in L
FREQ at 100kHz

Measure and record in Table 1 the primary and secondary inductances.

Connect one wire from the primary to one input terminal. Connect one wire from the secondary to the other input terminal. Connect the remaining wires from the primary and secondary together. Record in Table 1 the displayed value of the primary secondary inductance (Lps). Now reverse the wires from the primary, connecting the one that was previously connected to the input of the meter to the free wire from the secondary and the

wire from the primary that was previously connected to the secondary to the input of the meter. Record in Table 1 this second primary - secondary series inductance L(sp). The mutual inductance M of the transformer is found by dividing the difference of the above two series inductance values by 4. Record M in Table 1.

Change the display setting on the LCZ meter to C. Connect one wire from the primary to one input terminal and one wire from the secondary to the other input terminal. Leave the other two wires floating. Record in Table 1 the displayed value of the primary to secondary capacitance (C).

Table 1

Parameter	Measure
serial number	
Lp	
Ls	
Lps	
Lsp	
M (|Lps-Lsp| /4)	
C	

LCZ meter serial # 00008646231
Cal. Date_____
Database #_____

Fluke Ohmmeter serial #66970626
Cal. Date_____
Database #_____

Remove transformer from dewar and test probe. Store part in container marked with part number and serial number.

Procedure Complete

_____ QA Rep.
_____ MIP Signoff
_____ Barry Muhlfelder
_____ Date