SC0627-766

DESIGN, DEVELOPMENT AND DELIVERY OF ONE (1) BREADBOARD AND THREE (3) PRODUCTION UNITS OF A 75 VA INTEGRATED STATIC INVERTER

MONTHLY REPORT NUMBER 15

JULY 1966

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Contract Number NAS 8-11925

Control Number DCN 1-5-40-56195 (IF) & SI (IF)

Prepared by

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For

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George C. Marshall Space Flight Center

Huntsville, Alabama 35812

CONTRACT NO. NAS 8-11925
BILLINGS SCHEDULE--S/C

SECTION I
INFORMAL COST DATA

T. I. COSTS

Summary No. 15

1911

INCEPTION		Reimbursable costs and fee as specified in contract from thru			CURRENT	TOTAL TO DATE
	1.	**DIRECT CHARGES TO CONTRACT**			2228.77	30733.42
		1A.1. Direct Materials				
		1A.2				
		1B. Direct Labor				
		1B1. Engineering Labor			3049.99	68344.71
		1B2. Manufacturing Labor				
		1B3. Engr. Field Service Labor				
		1B4.				
		1C. Other Costs				
		1D. Charges Other Div.				
		IE. Finished Devices			12.00	3280.00
	2.	**APPORTIONED CHARGES TO CONTRACT**				
		2A.1. Overhead on Direct Materials	%			
		2B. Overhead on Direct Labor				
		2B1. On Engineering Labor	178 %		5428.98	121653.57
		2B2. On Manufacturing Labor	%			
		2B3. On Engr. Field Serv. Labor	%			
		2B4.				
		SUBTOTAL			10719.74	224011.70
		2C. Administrative Expense	3.7 %		396.19	8937.43
		SUBTOTAL			11115.93	222949.13
	3.	**APPARATUS CHARGES**				
		SUBTOTAL				
	4.	**Deduct ________% Cost-Sharing**				
		SUBTOTAL				
	5.	**Deduct Excess of Est. Contract Cost**				
		SUBTOTAL				
	6.	**FIXED FEE DUE**				
		Total Estimated Cost				
		Cost Incurred From Inception				
		thru				
		Percentage of Completion				
		Fixed Fee $ x %				
		AMOUNT CLAIMED THIS BILLING	11115.93			

SECTION II

TECHNICAL DISCUSSION

A. Progress Report for Month of July, 1966

1. Summary

The breadboard version of the inverter was delivered to Huntsville on July 16. A second breadboard with a lay-out similar to that of the final package has been built.

Several lots of new I/C array material are presently in process. These slices incorporate features designed to alleviate the epitaxial stress problems. Also, thicker oxide growths are being used on the emitters.

A modification is being introduced to the 16 pin package lid. (Gold-plated Kovar is to be used for lid material.) Also, stitch welding, rather than one-shot welding, of lid is to be used.

Because the system requires greater quantities of L-163's than L-164, the TI power device fabrication effort for the month was devoted to building L-163's. A sufficient number of both device types was available for completion of the breadboard.

2. Progress Report on Subsections

a. Inverter System

The breadboard was delivered to Huntsville on July 16. It contained all final components except

for the Johnson counter which consisted of four (4) flat packs and twelve (12) resistors instead of the proposed single chip circuit.

A second breadboard has been built. Component placement and wiring are very similar to that of the final production models. Room temperature operation is satisfactory and temperature testing will be completed soon.

The two TXCO's shipped back to Bendix for rework because of failure to operate at high temperature have been received. Both worked satisfactorily over the temperature range of -25 to +125°C.

The potting of components for all production models has been completed.

All system housings have been completed except for anodization. The printed circuit board art work is almost finished.

Optimistically, the first production model inverter should be ready for electrical evaluation the first part of September.

b. I/C Flip-Flop Arrays

A total of 60 slices of new Johnson counter material is at various stages of the diffusion process. An additional 15 slices of the original material have completed diffusions and are presently being metallized. Also, 3 slices of ripple counter and 2 slices of decade counter material are also being metallized.

Approximately 50 of the new packages are scheduled to be received August 1. Further deliveries will follow later.

c. Power Transistors

Thirty-seven L-163's were fabricated during the month. Electrical evaluation showed 26 of these units did not meet specs; the remaining eleven were sent to the QA department for mechanical testing. High thermal impedance, apparently caused by inadequate bonding between the wafer contact and the ceramic metallization, is the primary cause of the loss.

B. Current Problems and Corrective Action

Project running behind schedule, pending delivery of Johnson counter arrays. Corrective action discussed in Part A of the report.

C. Work to be Performed During Next Reporting Period

1. System

a. Complete evaluation of second breadboard.

b. Complete manufacturing of printed circuit board.

c. Complete manufacture of system housing.

d. Start packaging first production model.

2. I/C Flip-Flop Arrays

a. Obtain Johnson counter and ripple counter arrays which meet all specifications.

3. Power Transistors

a. A larger number of L-163's should be built next month and work to improve the yield will continue.

Table A-1 Parts List - 75 VA Integrated Static Inverter

(Originally Issued March 1, 1966)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
Q1-Q7	L-163, Dual Power NPN Darlington Transistor, 6 Pin Stud Package	TI		Developmental Item
Q8	L-164, Dual Power NPN-PNP Transistor, 6 Pin Stud Package	TI		Developmental Item
Q9	2N3838, Dual PNP-NPN Transistors in TO-89 Package	TI		
Q10	2N3044, Dual NPN Transistors in TO-89 Package	TI		
Q11-Q13	2N3038, Transistor in TO-50 Type Package	TI		
N1	L-169, Integrated Circuit Variable Duty Cycle One-Shot; Mask Modification of SN5380	TI		Developmental Item
N2	SN523A, Integrated Circuit Differential Amplifier	TI		
NA1	L-166, Integrated Circuit 8 Stage Ripple Counter Array	TI		Developmental Item
NA2	L-165, Integrated Circuit 6 Stage Johnson Counter and Toggle Flip-Flop Array	TI		Developmental Item

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
NA3	L-168, Integrated Circuit ÷10 Flip-Flop Array	TI		Developmental Item
NA4	L-167, Integrated Circuit ÷12 Flip-Flop Array	TI		Developmental Item
TXCO	2.4576 mc Temperature Compensated Crystal Oscillator	Bendix		Developmental Item; Weight ≈ .71 oz.
C1-C3	K1G205J-H1, 2uf, 100VDC, ±5% Polycarbonate Capacitor	Elpac	4-1-66	
C4-C6	K1G333K-D2, .033uf, 100VDC, ±10% Polycarbonate Capacitor	Elpac	7-1-66	
C7-C8	186P33491T15 .33uf 100VDC, ±10% Metal Clad Capacitor	Sprague	7-1-66	
C9	202D108X0050A5, 50VDC, 1000uf, ±20%, Tantalum Capacitor	Sprague		
C10	202D357X9150A5, 150VDC, 350uf, ±10%, Tantalum Capacitor	Sprague		Weight ≈ 5.5 oz.
C11	202D198X9015A2, 15VDC, 1900uf, ±10%,	Sprague		

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
C11	Tantalum Capacitor			Weight ≈ 3.0 oz.
C12, C16	SCM396BP010C2, 39uf, 10VDC, ±10% Tantalum Capacitor	TI	7-1-66	
C13	SCH06F221M, 220pf, 200VDC, ±20% Ceramic Capacitor	Scionics		

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
C14	K6G563G-G1, .056uf, 600VDC, ±2%, Polycarbonate Capacitor	Elpac	5-1-66	
C15	SCM227HP010D2, 220uf, 10VDC, ±10%, Tantalum Capacitor	TI		
C17	SCM335FP015A4, 3.3uf, 15VDC, ±20%, Tantalum Capacitor	TI	6-1-66	
C18	SCM685BP035D2, 6.8uf, 35VDC, ±10%, Tantalum Capacitor	TI	7-1-66	
Z1	1% 1N753, 6.2V, Breakdown Diode, Moly/G Glass Package	TI	4-1-66	Selected from 1N753 family
Z2, Z5	1% 1N752, 5.6V, Breakdown Diode, Moly/G Glass Package	TI	4-1-66	Selected from 1N752 family
Z3	1N969B, 22V, 5% Breakdown Diode, Moly/G Glass Package	TI		
Z4	Deleted		7-1-66	
D1	1N3890, 100V, 12 AMP Fast Recovery Rectifier, DO-4 Type Package	TI		
D2, D3, D10, D4	TI-252, 50V, 40ma Diffused Silicon Mesa Diode, Micro/G Package	TI	5-1-66	
D5, D6	Deleted		7-1-66	

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
D7, D8	G130 Stabistor, Silicon Forward Conductance Diode, Moly/G Glass Package	TI	4-1-66	
D9	G129 Stabistor, Silicon Forward Conductance Diode, Moly/G Glass Package	TI	4-1-66	
DA1	TIXD29, 30V, Dual 10 Array, TO-84 Type Package	TI	7-1-66	
R1 - R3	RW69V201, 200Ω, 3W, Wirewound Resistor	Spraque		
R4-R6	CR-1/8, 442Ω, 1/8W, 1%, Carbon Film Resistor	TI	5-1-66	
R7	CR-1/8, 143Ω, 1/8W, 1%, Carbon Film Resistor	TI	4-1-66	
R8	CR-1/8, 750Ω, 1/8W, 1%, Carbon Film Resistor	TI		
R9, R10	3260H-1-101, 100Ω, Trimpot	Bourns		

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
R11	CR-1/4, 150Ω, 1/4W, 1%, Carbon Film Resistor	TI		
R12	CR-1/4, 200Ω, 1/4W, 1%, Carbon Film Resistor	TI		
R13	CR-1/8, 100K, 1/8W, 1%, Carbon Film Resistor	TI		
R14	CR-1/8, 150Ω, 1/8W, 1%, Carbon Film Resistor	TI		
R15, R20, R21	CR-1/8, 3.92K, 1/8W, 1%, Carbon Film Resistor	TI		
R16	CR-1/8, 4.99K, 1/8W, 1%, Carbon Film Resistor	TI		
R17	CR-1/8, 2.74K, 1/8W, 1%, Carbon Film Resistor	TI	4-1-66	
R18	CR-1/8, 14.3K, 1/8W, 1%, Carbon Film Resistor	TI		
R19	MC65 T-2, 309Ω, 1/2W, 1%, Metal Film Resistor	TI	5-1-66	

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

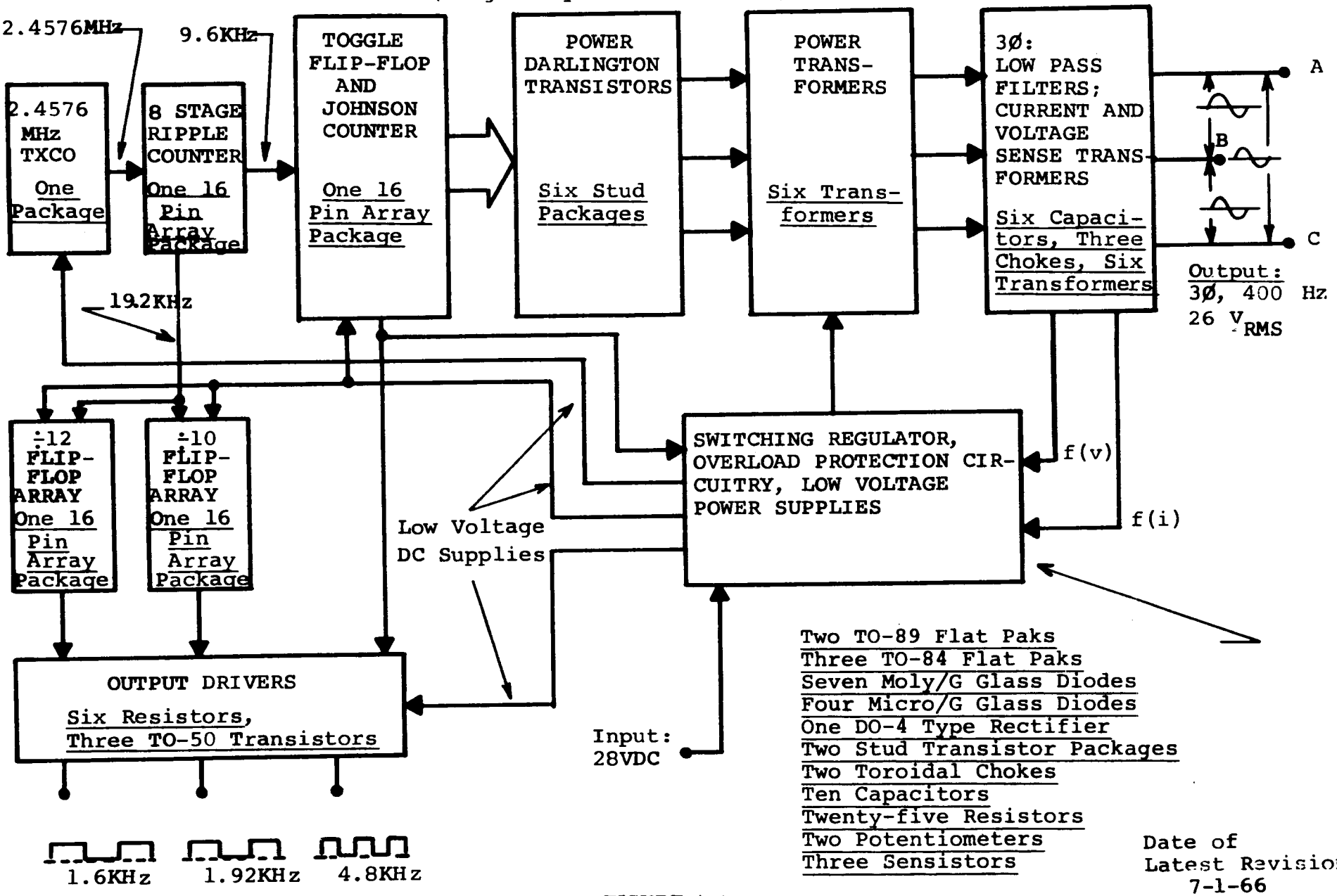
Component Designation	Description of Components	Manufacturer	Date of Change	Comments
R22	MC65 T-2, 953Ω, 1/2W, 1%, Metal Film Resistor	TI	5-1-66	
R23	CR-1/8, 10K, 1/8W, 1%, Carbon Film Resistor	TI		
R24	CR-1/8, 2.05K, 1/8W, 1%, Carbon Film Resistor	TI	7-1-66	
R25	CR-1/2, 5.23K, 1/2W, 1%, Carbon Film Resistor	TI	7-1-66	
R26	RW69V102, 1K, 3W, Wirewound Resistor	Spraque		
R27	CR-1/8, 3.01K, 1/8W, 1%, Carbon Film Resistor	TI		
R28	CR-1/4, 825Ω, 1/4W, 1%, Carbon Film Resistor	TI	7-1-66	
R29	820Ω, ±5%, TM-1/4, Sensistor	TI	7-1-66	
R30	CR-1/8, 121Ω, 1/8W, 1%, Carbon Film Resistor	TI	7-1-66	
R31, R34	CR-1/8, 1.02K, 1/8W, 1%, Carbon Film Resistor	TI	5-1-66	
R32, R33	330Ω, ±5%, TM-1/8, Sensistor	TI	4-1-66	
R35	CR-1/8, 82.5K, 1/8W, 1%, Carbon Film Resistor	TI	6-1-66	
R36	CR-1/4, 750Ω, 1/4W, 1%, Carbon Film Resistor	TI	7-1-66	

Parts List - 75 VA Integrated Static Inverter

Table A-1 (Continued)

Component Designation	Description of Components	Manufacturer	Date of Change	Comments
L1-L3	AC Choke, ≈ 1mh, 63 Turns, #18 H.F. Core: Magnetics 55927-M4 Powdered Iron Toroid	-		Unpotted Weight of Each Choke ≈ 2.0 oz.
L4	DC Choke, ≈ .265mh, 41 Turns, #13 H.F. Core: Arnold W110168-3 Powdered Iron Toroid	-	4-1-66	Unpotted Weight of Choke ≈ 5.5 oz.
L5	DC Choke, ≈ .8mh, 54 Turns, #13 H.F. Core: Arnold W-108281-3 Powdered Iron Toroid	-	4-1-66	Unpotted Weight of Choke ≈ 10.6 oz.
T1-T3	Voltage Sense Transformers, Cores: Magnetics 52176-2A, Tape Wound Toroids, PRl. 900T #36 H.F., SEC. 200T #34 H.F.	-		Unpotted Weight of Each Transformer ≈ .47 oz.
T4-T6	Current Sense Transformers, Cores: Magnetics 52000-2A Tape Wound Toroids, PRl. 2T #16 H.F., SEC. 500T #32 H.F.	-		Unpotted Weight of Each Transformer ≈ .44 oz.
T7-T12	Power Transformers, Cores: Magnetics 52026-2S Tape Wound Toroids, PRl. 180T, SEC. NS1 = 120T, NS2 = 90T, NS3 = 30T. All Wire is #23 H.F.	-		Unpotted Weight of Each Transformer ≈ 4.3 oz.
X1	G-663 Thermistor (NASA Part #50M10346)	FEIC		Not shown or discussed elsewhere in this report.

BLOCK DIAGRAM - 75VA INTEGRATED STATIC INVERTER
(Originally Issued March 1, 1966)



Two TO-89 Flat Paks
Three TO-84 Flat Paks
Seven Moly/G Glass Diodes
Four Micro/G Glass Diodes
One DO-4 Type Rectifier
Two Stud Transistor Packages
Two Toroidal Chokes
Ten Capacitors
Twenty-five Resistors
Two Potentiometers
Three Sensistors

Date of Latest Revision: 7-1-66

FIGURE A-1

SC 02121

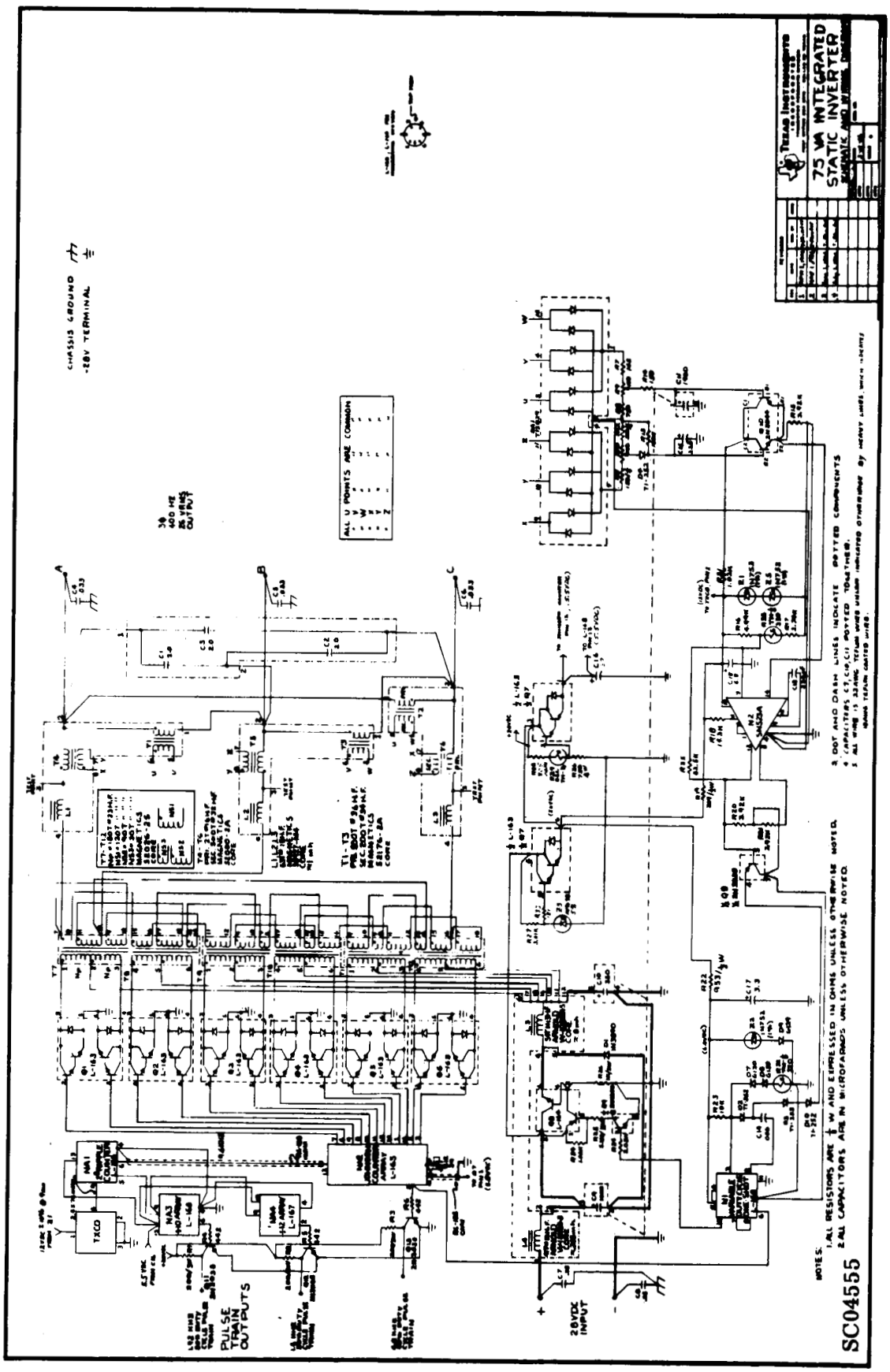


Figure A-2. System Schematic — VA Integrated Static Inverter, Revision No. 4, Dated July 1, 1966