INSTRUCTIONS

MULTIPLIER/DIVIDER, 193X541A_G01–G04

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to General Electric Company.

GENERAL ELECTRIC

INSTRUCTIONS

MULTIPLIER/DIVIDER, 193X541A_G01–G04

1.0 GENERAL

This instruction provides basic information regarding the subject card. Refer to the system elementary diagrams for information relating to the overall system operation.

2.0 DESCRIPTION

The card contains either one or two integrated circuit multiplier chips with the following group arrangements:

G01 and G03 one channel
G02 and G04 two channels

The G01 and G03, and the G02 and G04 are both mechanically and functionally interchangeable. Different groups for the equivalent functions identify use of different electronic devices.

PERFORMANCE

The card will have the following characteristics while exposed to the conditions indicated:

2.1 Multiplication
With ±20V and COM applied to tabs 31, 2 and 15 respectively, and with Z connected to OP (Z1 to OP1 for G01, Z1 to OP1 and Z2 to OP2 for G02), the card will generate an output voltage.

OP = 0.1 • X • Y where X and Y are voltages applied to the respective inputs.

2.11 Accuracy – (multiplication)
Total error (25°C): ± .27% max. of ± .027V max. with a 10K ohm or less output load.

(All accuracy is % of 10V full output)
Total error vs. temp.: ± .01%/°C or .001V/°C
Warm–up time to rated performance: 5 minutes

2.12 Individual errors (contributing to the total errors in 2.11)
Output offset: ± .015V max at 25°C with X = Y = 0
Scale factor: ± .1% or .01V at 25°C
Feedthrough: X = 0, Y = 20V p–p, 10Hz – .02V p–p
Y = 0, X = 20V p–p, 10 Hz – .02V p–p
Non–linearity: X(Y) = ± 10V, Y(X) = 20V p–p – ± .1% or ± .01V

2.2 Division
With ±20V and COM applied to tabs 31, 2 and 15 respectively and with Y connected to OP, the card will generate an output voltage.

OP = 10 • Z/X where the applied voltages X and Z are within the following ranges:

$$-10V \leq X \leq -.1V$$
$$-10V \leq Z \leq +10V$$

2.21 Accuracy – Division
Total divider error: 10 x Em/X where Em is the total error previously specified for the multiplier operation.

NOTE: A 10.1 denominator (X) range is a practical limit for the dividing mode.

2.3 Output
Max. output voltage: ± 10V
Max. output current: ± 5mA
Output Impedance: 1 Ohm

2.4 Input
Max. rated input voltage: ± 10V
Max. safe input voltage: ± 15V
Input impedance, X, Y, (X): 25K ohms, (70K ohm)

2.5 Temperature
Rated performance: 0 to 70°C
Max Operating: –25°C to +85°C

2.6 Power Supply
Range: +15V ±0.15V at tab 26, –15V ±0.15V at tab 8
Quiscent current: +15mA, –8.5mA at ±15V and +31mA, –25mA at ±20V
Drift: 0.02% per °C

3.0 ADJUSTMENTS

There are no adjustments on this card.

4.0 TROUBLESHOOTING

4.1 Check for +15 ± 1 volts at tab 26, –15 ± 1 volts at tab 8.

4.2 As a multiplier:
With +20 volts, –20 volts and Com applied to tabs 31, 2 and 15 respectively and with Z connected to OP (Z1 to OP1 for G01, Z1 to OP1 and Z2 to OP2 for G02), apply 10 volts to either X1 and Y1 or X2 and Y2. Card output for this condition should be 10 volts $\pm$0.27% at OP1 or OP2 respectively.

If the output does not fall within this value, the card should be replaced.

4.3 As a divider:
With +20 volts, –20 volts, and Com applied to tabs 31, 2 and 15 respectively and with Y connected to OP (Y1 to OP1 for G01, Y1 to OP1 and Y2 to OP2 for G02), apply –10 volts to either Z1 and X1 or Z2 and X2. Card output for this condition should be 10 volts $\pm$0.27% at OP1 or OP2 respectively.

If the output does not fall within this value, the card should be replaced.

4.4 Use an oscilloscope to determine if excessive noise on any of the input signals causes a distortion of the output signal during system operation. Filtering of the input signal(s) may be necessary to improve operation.

GENERAL ELECTRIC

36B590243AD
CONT ON SHEET SH NO.

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING.

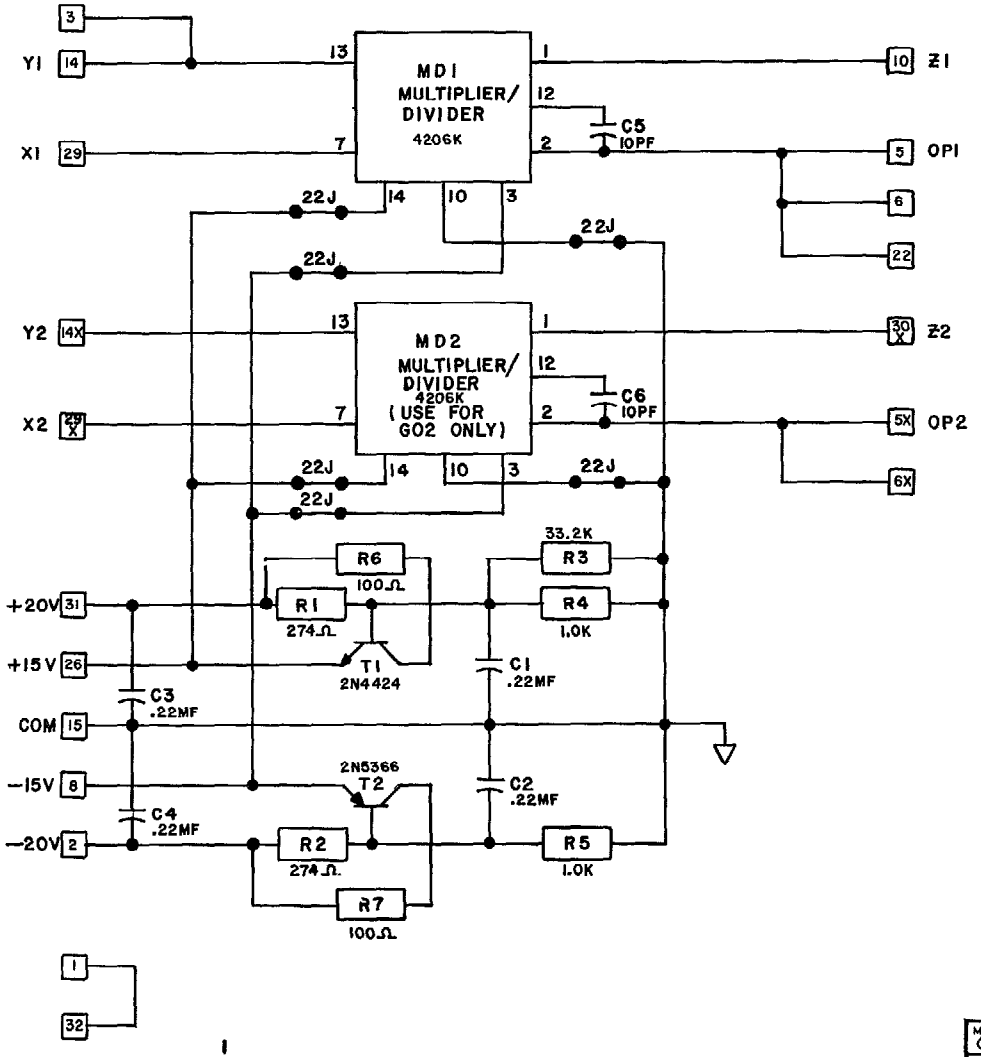
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
		FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

REV NO 0

CONT ON SHEET SH NO.

TITLE ELEMENTARY DIAGRAM
MULTIPLIER CARD

FIRST MADE FOR STANDARD LINE
193X541ADG01 & G02



NOTES:

1. MULTIPLIER

   $OP = \frac{X \cdot Y}{10}$ WITH Z CONNECTED TO OP.

   DIVIDER

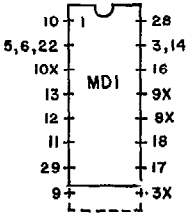
   $OP = \frac{10 \cdot Z}{X}$ WITH Y CONNECTED TO OP.

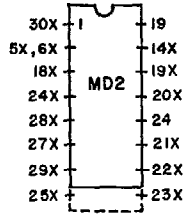
   $-10V \leq X \leq -.1V$

   $-10V \leq Z \leq +10V$

2. MULTIPLIER/DIVIDER 435J CAN BE USED INSTEAD OF 4206K.

IC CHIP POINTS RUN DIRECTLY TO TABS BUT ARE NOT SHOWN ON ELEM.





REVISIONS

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department

PRINTS TO	
5B(8)M	5J(BW)
5R(2)BW	
5L(2)BW	
AW(BW)	
5D(CD)	
JA(CD)	

MADE BY J.R. Baker OCT. 10, 1977

ISSUED Paul Mark FEB. 16, 1978

APPROVALS

SPEED VARIATOR — DIV OR DEPT

ERIE, PA. — LOCATION

36B590243AD
CONT ON SHEET SH NO.

FF 806-F(1 77)

GENERAL ELECTRIC

36C764177AD

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
710A815	✓	±	±	±

TITLE PRINTED CIRCUIT DIAGRAM
MULTIPLIER CARD

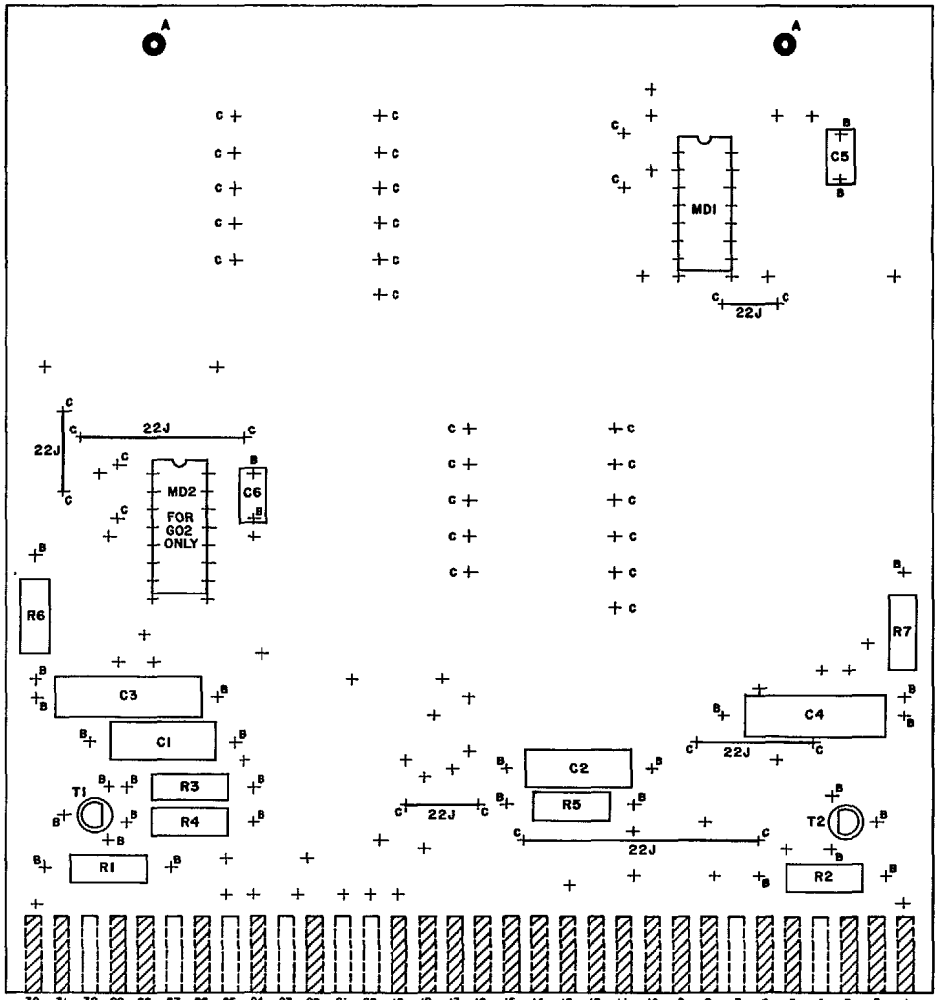
FIRST MADE FOR STANDARD LINE

193X541AD601, G02

HOLE TABULATION

ALL HOLES 032 DIA. EXCEPT THE HOLES TABULATED BELOW

LOC	DIA.	QUAN
A	.157	2
B	.040	32
C	.052	38



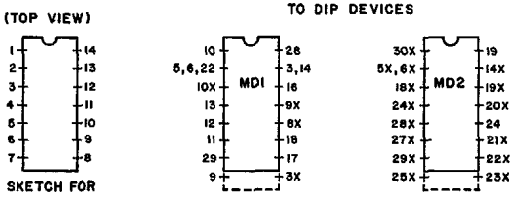
SEE NOTE 1 & 2

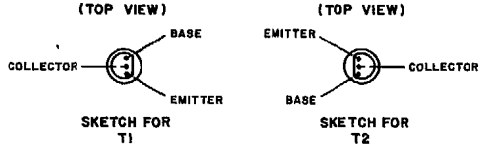
SEE NOTE 4

NOTES

1. INDICATED TAB NUMBERS CORRESPOND TO MATCHING RECEPTACLE NUMBERS
2. CROSS HATCHED TABS INDICATES TABS USED.
3. CARD SIZE, $5.500^{+.000}_{-.015} \times 5.130^{+.002}_{-.008}$
4. THIS CARD HAS GOLD PLATED TABS ON BOTH SIDES. TABS 1 THRU 32 ARE LOCATED ON THE REVERSE SIDE. TABS 1X THRU 32X ARE LOCATED ON THE COMPONENT SIDE OF THE CARD. TAB 1X IS OPPOSITE TAB 1 AND ETC. THE TAB NUMBERS SHOWN ARE THOSE USED ON THIS CARD.

TAB CONNECTIONS TO DIP DEVICES





GROUP	KEY LOCATION			
G01	12–13	21–22	30–31	
G02	12–13	16–17	21–22	30–31

2X	36A358055AC005	36A358056AC005	1	—
SCALE	REAR ETCHED BOARD DWG.	FRONT ETCHED BOARD DWG.	FRONT SPACE	BACK UNIT REQUIREMENT

REVISIONS

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department

REV NO 0

PRINTS TO

5B(6)M	5J(BW)
5R(2)BW	
5L(2)BW	
AW(BW)	
5D(CD)	
JA(CD)	

MADE BY J.R. Baker JAN. 20, 1978
ISSUED Carl Nook FEB. 16, 1978
APPROVALS

speed variator — DIV. OR DEPT
ERIE, PA. — LOCATION

36C764177AD — CONT ON SHEET — SH NO

DRAWING NO

CONT ON SHEET SH NO

FOLD

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
		FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

REV NO 0

CONT ON SHEET SH NO

GENERAL ELECTRIC

36B590248AA

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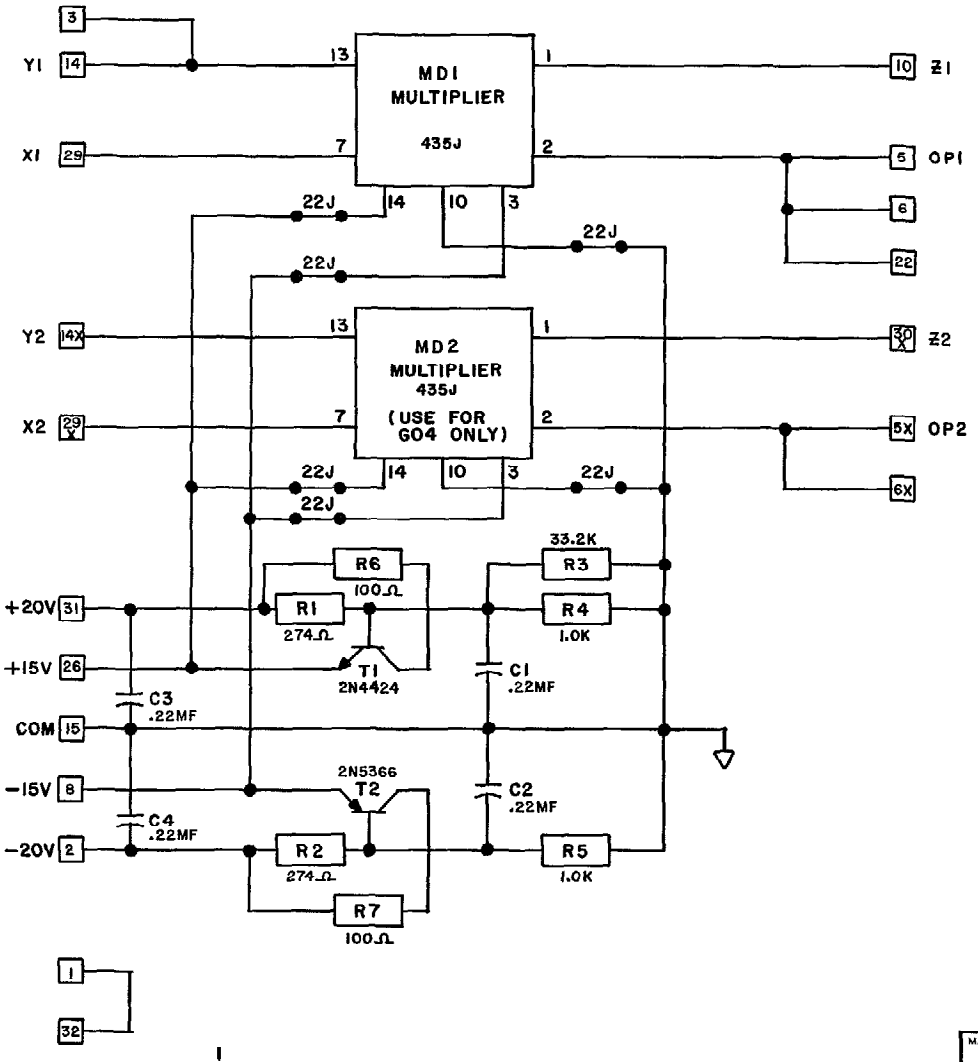
TITLE ELEMENTARY DIAGRAM
MULTIPLIER CARD

FIRST MADE FOR STANDARD LINE
193X541ADG03 & G04

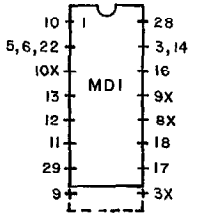


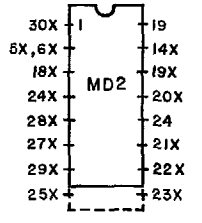
NOTES:

1. MULTIPLIER

$$OP = \frac{X \cdot Y}{10}$$ WITH Z CONNECTED TO OP.

IC CHIP POINTS RUN DIRECTLY TO TABS BUT ARE NOT SHOWN ON ELEM.





REVISIONS

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department

PRINTS TO	
5B(8)M	5J(BW)
5R(2)BW	
5L(2)BW	
AW(BW)	
5D(CD)	
JA(CD)	

MADE BY G.R. Baker FEB. 15, 1978

ISSUED Paul Marek FEB 16, 1978

APPROVALS

SPEED VARIATOR DIV OR DEPT

ERIE, PA. LOCATION

36B590248AA

CONT ON SHEET SH NO

FF 806 F(1 77)

FOLD

GENERAL ELECTRIC

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING				
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
		FRACTIONS	DECIMALS	ANGLES
718A515	✓	±	±	±

TITLE PRINTED CIRCUIT DIAGRAM
MULTIPLIER CARD

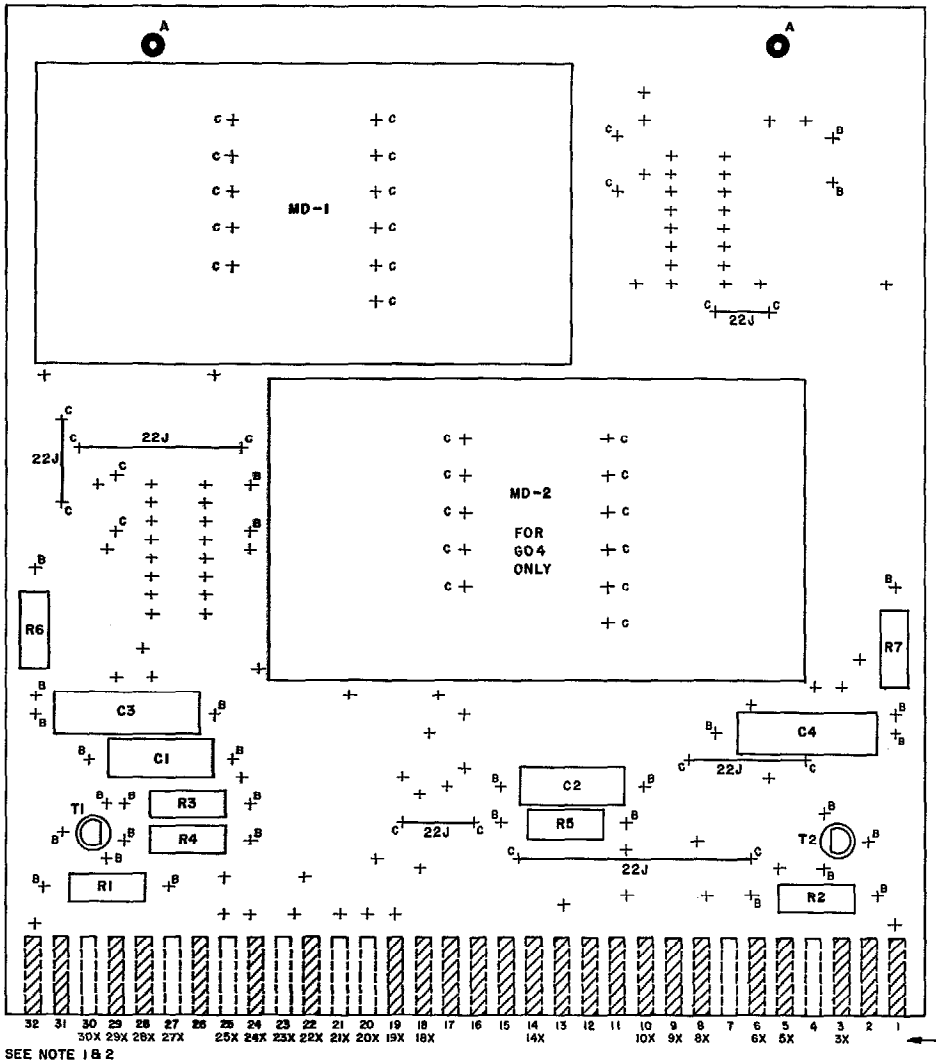
FIRST MADE FOR STANDARD LINE
193X541AD603,604

36C764185AA
CONT ON SHEET — SH NO

HOLE TABULATION

ALL HOLES .032 DIA. EXCEPT THE HOLES TABULATED BELOW

LOC.	DIA.	QUAN.
A	.157	2
B	.040	32
C	.052	38



SEE NOTE 1 & 2

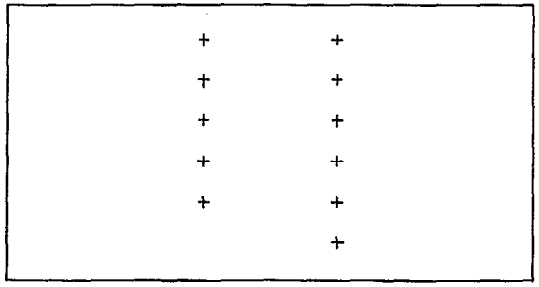
SEE NOTE 4

GROUP	KEY LOCATION				
G03	12—13	21—22	30—31		
G04	12—13	16—17	21—22	30—31	

NOTES

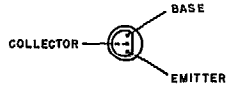
1. INDICATED TAB NUMBERS CORRESPOND TO MATCHING RECEPTACLE NUMBERS.
2. CROSS HATCHED TABS INDICATES TABS USED.
3. CARD SIZE, $5.500^{+.000}_{-.015}$ X $5.130^{+.002}_{-.008}$
4. THIS CARD HAS GOLD PLATED TABS ON BOTH SIDES. TABS I THRU 32 ARE LOCATED ON THE REVERSE SIDE. TABS IX THRU 32X ARE LOCATED ON THE COMPONENT SIDE OF THE CARD. TAB IX IS OPPOSITE TAB I AND ETC. THE TAB NUMBERS SHOWN ARE THOSE USED ON THIS CARD.

(TOP VIEW)



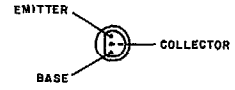
SKETCH FOR MD-1, MD-2

(TOP VIEW)



SKETCH FOR T1

(TOP VIEW)



SKETCH FOR T2

2X	36A358055AC005	36A358056AC005	1	—
SCALE	REAR ETCHED BOARD DWG.	FRONT ETCHED BOARD DWG.	FRONT	BACK
			SPACE UNIT REQUIREMENT	

REVISIONS

REV NO. 0

PRINTS TO

5B(8)M	5J(BW)
5R(2)BW	
5L(2)BW	
AW(BW)	
5D(CO)	
JA(CO)	

MADE BY O.R. Baker JAN. 23, 1978
ISSUED Paul Novak FEB. 16, 1978
APPROVALS

Speed variator — DIV. OR DEPT
ERIE, PA. — LOCATION

36C764185AA
CONT ON SHEET — SH NO

SPEED VARIATOR PRODUCTS OPERATION
GENERAL ELECTRIC COMPANY – DIRECT CURRENT MOTOR & GENERATOR DEPARTMENT
ERIE, PENNSYLVANIA 16531

GENERAL ELECTRIC

GEK–24961 (4–78) 1.5M(F)