Bendix

Aerospace Systems Division

RSST

Failure Mode Summary

NO.	REV. NO.
ATM 880	

PAGE 1 OF 10

DATE 5/28/70

ATM 880 releases the Failure Mode Summary into the Bendix documentation system for the Resettable Solid State Timer. The basic failure rates for the parts covered by this document were taken from ATM 879 which is the Failure Modes Effect and Criticality Analysis for the RSST. The major changes between this document and corresponding documents as released by Gulton are as follows:

(a) A change has been made in the RSST - Transmitter Power Off Interface. With the addition of a diode, a resistor and a capacitor in the harness, all ALSEP single point failure modes have been eliminated from the RSST. In the event of a timer early time-out, downlink can now be re-established by ground command. Failure modes denoted with asterisks in the Failure Mode Summary Chart were ALSEP System Single Point Failure Modes before this modification. The Probability Criticality Column and Rank columns of this document are based on the relative probability of failure for each part and should not be misenterpretated to reflect system effect.

(b) The basic failure rate used in this ATM for the RCA CD 4000 family of COS/MOS Fets is considerably higher (approximately 40 times in magnitude) than the basic failure rate used by Gulton in preparing corresponding documents. Bendix Reliability arrived at this more realistic failure rate in view of test data received from RCA from two separate tests. The major effect that this failure rate change has upon all related documentation is that the COS/MOS counters now have the highest ranking of failure probability of any part used in the RSST.

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Date: 5/28/70

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
VR4	CK 13877-001	Short	32000	2	Single thread failure Loss of oscillator
VR5	CK 13877-001	Short	32000	2	Single thread failure Loss of oscillator
VR1	CK 13877-001	Short	32000	2	*System may time out early if reference voltage is lost for initial reset
Q15	CK 13877-001	Short, D-S	23200	3	Single thread failure Loss of oscillator
Q8	CK 13877-001	Short, D-S	23200	3	*System may time out early if counters cannot be reset
Q22	CK 13877-001	Short, C-E	23200	3	*System may time out early if counters cannot be reset
K1	CK 13877-001	Open	18000	4	Transmitter cannot be turned off using RSST.
VR2	CK 13877-001	Open	8000	5	Single thread failure Relay K1 cannot be set
VR3	CK 13877-001	Open	8000	5	Single thread failure Relay K1 cannot be set
Q17	CK 13877-001	Short C-E	7200	6	Single thread failure Loss of oscillator
Q19	CK 13877-001	Short C-E	7200	6	Single thread failure Loss of oscillator
Q21	CK 13877-001	Short C-E	7200	6	Single thread failure Loss of oscillator
Q5	CK 13877-001	Short C-E	7200	6	Timer cannot time out Counters will be constantly reset
Q6	CK 13877-001	Short C-E	7200	6	Reset is present at all times RSST will not time out
Q7	CK 13877-001	Short C-E	7200	6	*Loss of initial reset RSST may time out early

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
Q23	CK 13877-001	Short C-E	7200	6	*Loss of reset on slow power application. Possible early RSST time out.
A2	CK 13877-001	High, Low		6	Loss of frequency divider. RSST inoperable
A3	CK 13877-001	High, Low	240000	1	Loss of frequency divider. RSST inoperable
A4	CK 13877-001	High, Low	240000	1	Loss of all timer outputs
A5	CK 13877-001	High, Low	240000	1	Loss of 18 hr. and 3 month outputs
A6	CK 13877-001	High, Low	240000	1	Loss of 18 hr. and 3 month outputs
A7	CK 13877-001	Low	240000	1	If fails low, three month output will be lost.
A8	CK 13877-001	High, Low	240000	1	Loss of 3 month output
A9	CK 13877-001	High, Low	240000	1	Loss of 3 month output
A10	CK 13877-001	High, Low	240000	1	Loss of 3 month output
A11	CK 13877-001	Low	240000	1	If fails low three month output will be lost.
CR26	CK 13877-001	Short	4000	7	One minute output will occur at intervals up to 1 sec. A4 counter may speed up or stop. 18 hr. output will occur early.
CR27	CK 13877-001	Short	4000	7	
CR28	CK 13877-001	Short	4000	7	
CR29	CK 13877-001	Short	4000	7	

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT PROD. x 10^{13}	RANK	NOTES AND COMMENTS
CR30	CK 13877-001	Short	4000	7	1 minute output will occur at intervals up to 1 second. A4 counter may speed up or stop. 18 hr. output will occur early.
CR31	CK 13877-001	Short	4000	7	
CR32	CK 13877-001	Short	4000	7	
CR33	CK 13877-001	Short	4000	7	
CR34	CK 13877-001	Short	4000	7	
CR35	CK 13877-001	Short	4000	7	
CR36	CK 13877-001	Short	4000	7	
CR37	CK 13877-001	Short	4000	7	18 hr. output may occur early or counters A5 and A6 may stop. If counter stops 3 month output may not occur.
CR38	CK 13877-001	Short	4000	7	
CR39	CK 13877-001	Short	4000	7	
CR40	CK 13877-001	Short	4000	7	
CR41	CK 13877-001	Short	4000	7	
CR21	CK 13877-001	Short	4000	7	Oscillator may stop. If oscillator stops RSST will be inoperative.
CR22	CK 13877-001	Short	4000	7	
CR5	CK 13877-001	Short	4000	7	Counter A7 may stop. 3 month output would not be lost.

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
CR4	CK 13877-001	Short	4000	7	*Loss of initial reset RSST may time out early
CR8	CK 13877-001	Short	4000	7	*Loss of reset capability RSST may time out early
CR42	CK 13877-001	Short	4000	7	Loss of RSST
CR16	CK 13877-001	Short	4000	7	Relay K1 will not set. Loss of RSST.
Q15	CK 13877-001	D-S Open G-D Open	2900	8	Loss of oscillator therefore loss of RSST.
Q8	CK 13877-001	G-D Open	2900	8	*Loss of counter reset capability. RSST may time out early.
Q22	CK 13877-001	B-E Open	2900	8	*Lossof counter, reset capability. RSST may time out early.
C5	CK 13877-001	Short	2070	9	*Loss of counter reset capability RSST may time out early.
K1	CK 13877-001	Short	2000	10	*Early three month output.
C7	CK 13877-001	Short	1840	11	Loss of oscillator therefore loss of RSST.
C8	CK 13877-001	Short	1840	11	Loss of oscillator therefore loss of RSST.
CR21	CK 13877-001	Open	1000	12	Loss of oscillator therefore loss of RSST.
CR22	CK 13877-001	Open	1000	12	Loss of oscillator therefore loss of RSST.
CR20	CK 13877-001	Open	1000	12	Loss of oscillator therefore loss of RSST.

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
CR23	CK 13877-001	Open	1000	12	Loss of oscillator therefore loss of RSST.
CR1	CK 13877-001	Open	1000	12	Reduction in power off register retention.
CR4	CK 13877-001	Open	1000	12	*Loss of initial reset. RSST may time out early.
CR8	CK 13877-001	Open	1000	12	Reset will be on continously. Loss of RSST outputs.
CR9	Deleted				
CR50	CK 13877-001	Open	1000	12	*Loss of initial reset. RSST may time out early.
Q16	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q17	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q19	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q21	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q18	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q20	CK 13877-001	C-E Open B-E Open	900	13	Loss of oscillator and all outputs.
Q2	CK 13877-001	C-E Open B-E Open	900	13	Loss of three month output.
Q4	CK 13877-001	C-E Open B-E Open	900	13	Loss of three month output.
Q3	CK 13877-001	C-E Open B-E Open	900	13	Loss of three month output.

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
Q1	CK 13877-001	C-E Open B-E Open	900	13	Loss of three month output.
Q5	CK 13877-001	C-E Open B-E Open	900	13	*Loss of initial reset. RSST may time out early.
Q6	CK 13877-001	C-E Open B-E Open	900	13	*Loss of reset. RSST may time out early.
Q7	CK 13877-001	C-E Open B-E Open	900	13	Reset on at all times. Loss of all RSST outputs.
R51	CK 13877-001	Open	720	14	Loss of oscillator and all outputs.
R58	CK 13877-001	Open	720	14	Loss of oscillator and all outputs.
R52	CK 13877-001	Open	720	14	Loss of oscillator and all outputs.
R54	CK 13877-001	Open	720	14	Loss of oscillator and all outputs.
C3	CK 13877-001	Short	640	15	Loss of three month output.
C4	CK 13877-001	Short	640	15	Loss of three month output.
C1	CK 13877-001	Short	640	15	Loss of all outputs.
C2	CK 13877-001	Short	640	15	Loss of all outputs.
R1	CK 13877-001	Open	630	16	Loss of all outputs.
C7	CK 13877-001	Open	460	17	Loss of oscillator and all outputs.
C8	CK 13877-001	Open	460	17	Loss of oscillator and all outputs.

FAILURE MODE SUMMARY CHART

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
R44	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R49	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R47	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R48	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R42	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R43	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R59	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R57	CK 13877-001	Open	450	18	Loss of 1 second clock and all outputs.
R60	CK 13877-001	Open	450	18	Loss of oscillator and all outputs.
R2	CK 13877-001	Open	450	18	Possible turn on of relay driver.
R3	CK 13877-001	Open	450	18	Possible turn on of relay driver.
R4	CK 13877-001	Open	450	18	Possible turn on of relay driver.
R5	CK 13877-001	Open	450	18	Possible turn on of relay driver.
R13	CK 13877-001	Open	450	18	Loss of three month output.
R15	CK 13877-001	Open	450	18	Loss of three month output.

FAILURE MODE SUMMARY

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
R14	CK 13877-001	Open	450	18	Loss of three month output.
R16	CK 13877-001	Open	450	18	Loss of three month ouput.
R6	CK 13877-001	Open	450	18	Logic counters will generate 5 volts.
R7	CK 13877-001	Open	450	18	*Possible loss of initial reset. Three month ouput may be early.
R17	CK 13877-001	Open	450	18	May reset counters prematurely.
R18	CK 13877-001	Open	450	18	Reset present at all times. Loss of all outputs.
R19	CK 13877-001	Open	450	18	Reset present at all times. Loss of all outputs.
R22	CK 13877-001	Open	450	18	*Loss of reset. Three month counter may go early.
R23	CK 13877-001	Open	450	18	*Loss of reset. Three month counters may go early.
C9	CK 13877-001	Short	450	18	Loss of some noise immunity on reset line.
R51	CK 13877-001	Short	80	19	Increase in oscillator frequency. Outputs may come early.
R52	CK 13877-001	Short	80	19	Increase in oscillator frequency. Outputs may come early.
R54	CK 13877-001	Short	80	19	Increase in oscillator frequency. Outputs may come early.
R58	CK 13877-001	Short	80	19	Increase in oscillator frequency. Outputs may come early.
R60	CK 13877-001	Short	50	20	Loss of oscillator and all outputs.

FAILURE MODE SUMMARY

REF. DES.	DWG. NUMBER	FAILURE MODE	PROB. CRIT. PROD. x 10^{13}	RANK	NOTES AND COMMENTS
R2	CK 13877-001	Short	50	20	Loss of three month output.
R3	CK 13877-001	Short	50	20	Loss of three month output.
R4	CK 13877-001	Short	50	20	Loss of three month output.
R5	CK 13877-001	Short	50	20	Loss of three month output.
R13	CK 13877-001	Short	50	20	Loss of some noise immunity on relay driver line.
R15	CK 13877-001	Short	50	20	Loss of some noise immunity on relay driver line.