

Assumed Failure Modes

Component	Used in digital circuits	Used in analog circuits
2-port linear (passive) (resistor, capacitor)	stuck short	stuck short
	stuck open	stuck open
		drift of spec. value
2-port nonlinear (active) (diode, diac, mov, zener etc.)	stuck short	stuck short
	stuck open	stuck open
		threshold / operating point drift
2-port crystal	like 2-port plus oscillation on sub- or harmonic	like 2-port plus oscillation on sub- or harmonic
2-port nonlinear (active) (LED, phototransistor, thermocouple, pressure sense.)	stuck short	stuck short
	stuck open	stuck open
		gain drift / linearity error
3-port active (FET, transistor, voltage regulator etc.)	Output/Input stuck high	Output/Input stuck high
	Output/Input stuck low	Output/Input stuck low
	B-E, B-C, E-C short or similar FM	B-E, B-C, E-C short or similar FM
		gain, output drift
Integrated Circuit Low/Medium Scale Integration (OpAmp, Gates,Quardpacks)	Stuck low of any pin	Stuck low of any pin
	Stuck high of any pin	Stuck high of any pin
	Short between any pin	Short between any pin
	Stuck open of any pin	Stuck open of any pin
		Drift of operating characteristics
Integrated Circuit LSI/VLSI (PLA,ASIC,CPU etc.)	Stuck low of any pin	Stuck low of any pin
	Stuck high of any pin	Stuck high of any pin
	Short between any pin	Short between any pin
	Stuck open of any pin	Stuck open of any pin
	Internal logic defect	Drift of operating characteristics

Fault Injection Test Protocol

Type of Equipment
Manufacturer
Test dates
Software Version
Schematic Number / Revision
Serial Number

Test #	Loc	Description	Purpose	Time Status /	Expected Reaction	Tested Reaction	PF	Comments
1.	2B4	U67 P5 Gnd	Clock signal short	AT / CA	undetermined	Error 19	P	Switch / shutdown
2.	2B3	U56 P1 Gnd	Temp sensor dead	AT / CA	Sensor error	Error 32	P	
3.	2C4	U565 P6 Gnd	WD pulse stuck	AT / CA	Module reset	Error 456	P	Module in reset
4.	3D3	R90 1K	5V monitor low	AT / CA	Voltage error	Error2	P	
5.	3D3	R946 1K	12V monitor low	AT / CA	Voltage error	Error 56	P	
6.	3D1	U311 P8 Gnd	Change DAC reference	AT / CA	DAC readback	Error 76	P	
7.	3A4	U454 P2 SC P4	IC short	AT / CA	Error	Error 44	P	
8.	3D2	U314 P4 SC P5	Interchannel short	AT / CA	Mismatch error	Error 65	P	
9.	3D2	U314 P15 SC P16	Mux address short	AT / CA	Mismatch error	Error 543	P	
10.	4D2	U110 P1 SC P2	MUX address short	AT / CA	Mismatch error	Error 45	P	
11.	4B1	U280 P9 SC P10	AD interchannel short	AT / CA	Mismatch error	Error 45	P	
12.	4B1	U23 P4 SC P8	IC short	AT / CA	Mismatch error	Error 45	P	
13.	4C2	R92 1K	Sec. Gain loss	AT / CA	Mismatch error	Error 654	P	
14.	4B2	U202 P6 Gnd	HC11 WD stuck	AT / CA	Communication error	Error125	P	
15.	4B2	U202 P7 Gnd	Reset HC11	AT / CA	Communication error	Error 654	P	
16.	5D4	CR61 SC	Diode short	AT / VE	Short error	Error 54	P	On modified board
17.	8C2	U90 P2 Gnd	OK loop stuck closed	AT / CA	ND	ND	?	See rationale
18.	8B3	U57 P8 Vcc	ME override	AT / CA	Discrepancy error	Error 96	P	

Legend

Column	Abbr.	Explanation
Description	Ux	IC number
	Px	IC pin number
	SC	Short circuit
	OC	Open circuit
	GND	Short to ground
	Vcc	Short to Vcc / Vdd

Column	Abbr.	Explanation
Time / Status	SU	Start up / Power on tests
	AC	active
	ER	Error state
	AT	Any time

Column	Abbr.	Explanation
P/F	P	Pass test
	F	Failed test / reaction not as expected
	?	Further evaluation necessary

Test #	Description	Purpose	Time / Status	Expected Reaction	Tested Reaction	PF	Comments
Test No.	Component designator as found in corresponding schematic SC = short circuit Hi = short to +5V (Vcc) Lo = short to logic ground (GND) SC = short circuit Component pins as commonly known: P - IC pin B - transistor basis	Describes the failure mode of the fault injection. May describe the localized result of a fault and or additional technical explanations	Status of the unit under test during which the fault was injected AT - any time SU - start up RDY - ready STBY - standby	Expected reaction to the injected fault on system level	Observed reaction to the injected fault on system level	P-pass F-fail	Additional comments, criticality assessment