APPENDIX A: PARTS COUNT RELIABILITY PREDICTION

Parts Count Reliability Prediction - This prediction method is applicable during bid proposal and early design phases when insufficient information is available to use the part stress analysis models shown in the main body of this Handbook. The information needed to apply the method is (1) generic part types (including complexity for microcircuits) and quantities, (2) part quality levels, and (3) equipment environment. The equipment failure rate is obtained by looking up a generic failure rate in one of the following tables, multiplying it by a quality factor, and then summing it with failure rates obtained for other components in the equipment. The general mathematical expression for equipment failure rate with this method is:

$$\lambda_{EQUIP} = \sum_{i=1}^{i=n} N_i (\lambda_g \pi_Q)_i \qquad \text{Equation 1}$$

for a given equipment environment where:

λ_{EQUIP} = Total equipment failure rate (Failures/10^6 Hours)

λ_g = Generic failure rate for the i^{th} generic part (Failures/10^6 Hours)

π_Q = Quality factor for the i^{th} generic part

N_i = Quantity of i^{th} generic part

n = Number of different generic part categories in the equipment

Equation 1 applies if the entire equipment is being used in one environment. If the equipment comprises several units operating in different environments (such as avionics systems with units in airborne inhabited (A_I) and uninhabited (A_U) environments), then Equation 1 should be applied to the portions of the equipment in each environment. These "environment-equipment" failure rates should be added to determine total equipment failure rate. Environmental symbols are defined in Section 3.

The quality factors to be used with each part type are shown with the applicable λ_g tables and are not necessarily the same values that are used in the Part Stress Analysis. Microcircuits have an additional multiplying factor, π_L, which accounts for the maturity of the manufacturing process. For devices in production two years or more, no modification is needed. For those in production less than two years, λ_g should be multiplied by the appropriate π_L factor (See page A-4).

It should be noted that no generic failure rates are shown for hybrid microcircuits. Each hybrid is a fairly unique device. Since none of these devices have been standardized, their complexity cannot be determined from their name or function. Identically or similarly named hybrids can have a wide range of complexity that thwarts categorization for purposes of this prediction method. If hybrids are anticipated for a design, their use and construction should be thoroughly investigated on an individual basis with application of the prediction model in Section 5.

The failure rates shown in this Appendix were calculated by assigning model default values to the failure rate models of Section 5 through 23. The specific default values used for the model parameters are shown with the λ_g Tables for microcircuits. Default parameters for all other part classes are summarized in the tables starting on Page A-12. For parts with characteristics which differ significantly from the assumed defaults, or parts used in large quantities, the underlying models in the main body of this Handbook can be used.

Generic Failure Rate, λ_g (Failures/10^6 Hours) for Microcircuits. See Page A-4 for π_Q Values

(Defaults: π_T Based on Ea Shown, Solder or Weld Seal DIPs/PGAs (No. Pins as Shown Below), π_L = 1 (Device in Production ≥ 2 Yr.))

Section #	Part Type	Environ. → / T_J (°C) →	G_B 50	G_F 60	G_M 65	N_S 60	N_U 65	A_{IC} 75	A_{IF} 75	A_{UC} 90	A_{UF} 90	A_{RW} 75	S_F 50	M_F 65	M_L 75	C_L 60
	Bipolar Technology															
5.1	Gate/Logic Arrays, Digital (Ea = .4)															
	1 - 100 Gates	(16 Pin DIP)	.0036	.012	.024	.024	.035	.025	.030	.032	.049	.047	.0036	.030	.069	1.2
	101 - 1000 Gates	(24 Pin DIP)	.0060	.020	.038	.037	.055	.039	.048	.051	.077	.074	.0060	.046	.11	1.9
	1001 to 3000 Gates	(40 Pin DIP)	.011	.035	.066	.065	.097	.070	.085	.091	.14	.13	.011	.082	.19	3.3
	3001 to 10,000 Gates	(128 Pin PGA)	.033	.12	.22	.22	.33	.23	.28	.30	.46	.44	.033	.28	.65	12
	10,000 to 30,000 Gates	(180 Pin PGA)	.052	.17	.33	.33	.48	.34	.42	.45	.68	.65	.052	.41	.95	17
	30,000 to 60,000 Gates	(224 Pin PGA)	.075	.23	.44	.43	.63	.46	.56	.61	.90	.85	.075	.53	1.2	21
5.1	Linear Microcircuits (Ea = .65)															
	1 - 100 Transistors	(14 Pin DIP)	.0095	.024	.039	.034	.049	.057	.062	.12	.13	.076	.0095	.044	.096	1.1
	101 - 300 Transistors	(18 Pin DIP)	.017	.041	.065	.054	.078	.10	.11	.22	.24	.13	.017	.072	.15	1.4
	301 - 1000 Transistors	(24 Pin DIP)	.033	.074	.11	.092	.13	.19	.19	.41	.44	.22	.033	.12	.26	2.0
	1001 - 10,000 Transistors	(40 Pin DIP)	.050	.12	.18	.15	.21	.29	.30	.63	.67	.35	.050	.19	.41	3.4
5.1	Programmable Logic Arrays (Ea = .4)															
	Up to 200 Gates	(16 Pin DIP)	.0061	.016	.029	.027	.040	.032	.037	.044	.061	.054	.0061	.034	.076	1.2
	201 to 1000 Gates	(24 Pin DIP)	.011	.028	.048	.045	.065	.054	.063	.077	.10	.089	.011	.057	.12	1.9
	1001 to 5000 Gates	(40 Pin DIP)	.022	.052	.087	.082	.12	.099	.11	.14	.19	.16	.022	.10	.22	3.3
	MOS Technology															
5.1	Gate/Logic Arrays, Digital (Ea = .35)															
	1 to 100 Gates	(16 Pin DIP)	.0057	.015	.027	.027	.039	.029	.035	.039	.056	.052	.0057	.033	.074	1.2
	101 to 1000 Gates	(24 Pin DIP)	.010	.026	.045	.043	.062	.049	.057	.066	.092	.083	.010	.053	.12	1.9
	1001 to 3000 Gates	(40 Pin DIP)	.019	.047	.080	.077	.11	.088	.10	.12	.17	.15	.019	.095	.21	3.3
	3001 to 10,000 Gates	(128 Pin PGA)	.049	.14	.25	.24	.36	.27	.32	.36	.51	.48	.049	.30	.69	12
	10,001 to 30,000 Gates	(180 Pin PGA)	.084	.22	.39	.37	.54	.42	.49	.56	.79	.72	.084	.46	1.0	17
	30,000 to 60,000 Gates	(224 Pin PGA)	.13	.31	.53	.51	.73	.59	.69	.82	1.1	.98	.13	.63	1.4	21
5.1	Linear Microcircuits (Ea = .65)															
	1 to 100 Transistors	(14 Pin DIP)	.0095	.024	.039	.034	.049	.057	.062	.12	.13	.076	.0095	.044	.096	1.1
	101 to 300 Transistors	(18 Pin DIP)	.017	.041	.065	.054	.078	.10	.11	.22	.24	.13	.017	.072	.15	1.4
	301 to 1,000 Transistors	(24 Pin DIP)	.033	.074	.11	.092	.13	.19	.19	.41	.44	.22	.033	.12	.26	2.0
	1001 to 10,000 Transistors	(40 Pin DIP)	.05	.12	.18	.15	.21	.29	.30	.63	.67	.35	.05	.19	.41	3.4
5.1	Floating Gate Programmable Logic Array, MOS (Ea =.35)															
	Up to 500 Gates	(24 Pin DIP)	.0046	.018	.035	.035	.052	.035	.044	.044	.070	.070	.0046	.044	.10	1.9
	501 - 2000 Gates	(28 Pin DIP)	.0056	.021	.042	.042	.062	.042	.052	.053	.084	.083	.0056	.052	.12	2.3
	2001 - 5000 Gates	(28 Pin DIP)	.0061	.022	.043	.042	.063	.043	.054	.055	.086	.084	.0061	.053	.13	2.3
	5001 to 20000 Gates	(40 Pin DIP)	.0095	.033	.064	.063	.094	.065	.080	.083	.13	.13	.0095	.079	.19	3.3
5.1	Microprocessors, Bipolar (Ea = .4)															
	Up to 8 Bits	(40 Pin DIP)	.028	.061	.098	.091	.13	.12	.13	.17	.22	.18	.028	.11	.24	3.3
	Up to 16 Bits	(64 Pin PGA)	.052	.11	.18	.16	.23	.21	.24	.32	.39	.31	.052	.20	.41	5.6
	Up to 32 Bits	(128 Pin PGA)	.11	.23	.36	.33	.47	.44	.49	.65	.81	.65	.11	.42	.86	12
5.1	Microprocessors, MOS (Ea = .35)															
	Up to 8 Bits	(40 Pin DIP)	.048	.089	.13	.12	.16	.16	.17	.24	.28	.22	.048	.15	.28	3.4
	Up to 16 Bits	(64 Pin PGA)	.093	.17	.24	.22	.29	.30	.32	.45	.52	.40	.093	.27	.50	5.6
	Up to 32 Bits	(128 Pin PGA)	.19	.34	.49	.45	.60	.61	.66	.90	1.1	.82	.19	.54	1.0	12

Generic Failure Rate, λ_g (Failures/10^6 Hours) for Microcircuits. See Page A-4 for π_Q Values

(Defaults: π_T Based on Ea Shown, Solder or Weld Seal DIPs/PGAs (No. Pins as Shown Below), π_L = 1 (Device in Production ≥ 2 Yr.))

Section #	Part Type	Environ.→ T_J (°C) →	G_B 50	G_F 60	G_M 65	N_S 60	N_U 65	A_{IC} 75	A_{IF} 75	A_{UC} 90	A_{UF} 90	A_{RW} 75	S_F 50	M_F 65	M_L 75	C_L 60
5.2	**MOS Technology**															
	Memories, ROM (Ea = .6)															
	Up to 16K	(24 Pin DIP)	.0047	.018	.036	.035	.053	.037	.045	.048	.074	.071	.0047	.044	.11	1.9
	16K to 64K	(28 Pin DIP)	.0059	.022	.043	.042	.063	.045	.055	.060	.090	.086	.0059	.053	.13	2.3
	64K to 256K	(28 Pin DIP)	.0067	.023	.045	.044	.068	.048	.059	.068	.099	.089	.0067	.055	.13	2.3
	256K to 1 MB	(40 Pin DIP)	.011	.036	.068	.066	.098	.075	.090	.11	.15	.14	.011	.083	.20	3.3
5.2	Memories, PROM, UVEPROM, EEPROM, EAPROM (Ea = .6) (NOTE λ_{cyc} = 0 Assumed for EEPROM)															
	Up to 16K	(24 Pin DIP)	.0049	.018	.036	.036	.053	.037	.046	.049	.075	.072	.0048	.045	.11	1.9
	16K to 64K	(28 Pin DIP)	.0061	.022	.044	.043	.064	.046	.056	.062	.093	.087	.0062	.054	.13	2.3
	64K to 256K	(28 Pin DIP)	.0072	.024	.046	.045	.067	.051	.061	.073	.10	.092	.0072	.057	.13	2.3
	256K to 1 MB	(40 Pin DIP)	.012	.038	.071	.068	.10	.080	.095	.12	.16	.14	.012	.086	.20	3.3
5.2	Memories, DRAM (Ea = 6)															
	Up to 16K	(18 Pin DIP)	.0040	.014	.027	.027	.040	.029	.035	.040	.059	.055	.0040	.034	.080	1.4
	16K to 64K	(22 Pin DIP)	.0055	.019	.036	.034	.051	.039	.047	.056	.079	.070	.0055	.043	.10	1.7
	64K to 256K	(24 Pin DIP)	.0074	.023	.043	.040	.060	.049	.058	.076	.10	.084	.0074	.051	.12	1.9
	256K to 1 MB	(28 Pin DIP)	.011	.032	.057	.053	.077	.070	.080	.12	.15	.11	.011	.067	.15	2.3
5.2	Memories, SRAM, (MOS & BiMOS) (Ea = 6)															
	Up to 16K	(18 Pin DIP)	.0079	.022	.038	.034	.050	.048	.054	.083	.10	.073	.0079	.044	.098	1.4
	16K to 64K	(22 Pin DIP)	.014	.034	.057	.050	.073	.077	.085	.14	.17	.11	.014	.065	.14	1.8
	64K to 256K	(24 Pin DIP)	.023	.053	.084	.071	.10	.12	.13	.25	.27	.16	.023	.092	.19	1.9
	256K to 1 MB	(28 Pin DIP)	.043	.092	.14	.11	.16	.22	.23	.46	.49	.26	.043	.15	.30	2.3
5.2	**Bipolar Technology**															
	Memories, ROM, PROM (Ea = .6)															
	Up to 16K	(24 Pin DIP)	.010	.028	.050	.046	.067	.062	.070	.10	.13	.096	.010	.058	.13	1.9
	16K to 64K	(28 Pin DIP)	.017	.043	.071	.063	.091	.095	.11	.18	.21	.14	.017	.081	.18	2.3
	64K to 256K	(28 Pin DIP)	.028	.065	.10	.085	.12	.15	.16	.30	.33	.19	.028	.11	.23	2.3
	256K to 1 MB	(40 Pin DIP)	.053	.12	.18	.15	.21	.27	.29	.56	.61	.33	.053	.19	.39	3.4
5.2	Memories, SRAM (Ea = .6)															
	Up to 16K	(24 Pin DIP)	.0075	.023	.043	.041	.060	.050	.058	.077	.10	.084	.0075	.052	.12	1.9
	16K to 64K	(28 Pin DIP)	.012	.033	.058	.054	.079	.072	.083	.12	.15	.11	.012	.069	.15	2.3
	64K to 256K	(28 Pin DIP)	.018	.045	.074	.065	.095	.10	.11	.19	.22	.14	.018	.084	.18	2.3
	256K to 1 MB	(40 Pin DIP)	.033	.079	.13	.11	.16	.18	.20	.35	.39	.24	.033	.14	.30	3.4
5.3	VHSIC Microcircuits, CMOS	Refer to Section 5.3, VHSIC CMOS														
5.4	GaAs MMIC (Ea = 1.5)															
	1 to 100 Elements	(8 Pin DIP)	.0013	.0052	.010	.010	.016	.011	.013	.015	.022	.021	.0013	.013	.031	.57
	101 to 1000 Active Elements (Default: Driver and High Power (> 100 mW))	(16 Pin DIP)	.0028	.011	.022	.022	.034	.023	.028	.030	.047	.045	.0028	.028	.068	1.2
5.4	GaAs Digital (Ea = 1.4)															
	1 to 1000 Active Elements	(36 Pin DIP)	.0066	.026	.052	.052	.078	.054	.067	.078	.12	.11	.0066	.065	.16	2.9
	1001 to 10,000 Active Elements	(64 Pin PGA)	.013	.050	.10	.10	.15	.10	.13	.15	.23	.20	.013	.13	.30	5.5

Quality Factors - π_Q

Description	π_Q
Class S Categories: 1. Procured in full accordance with MIL-M-38510, Class S requirements. 2. Procured in full accordance with MIL-I-38535 and Appendix B thereto (Class U). 3. Hybrids: (Procured to Class S requirements (Quality Level K) of MIL-H-38534.	.25
Class B Categories: 1. Procured in full accordance with MIL-M-38510, Class B requirements. 2. Procured in full accordance with MIL-I-38535, (Class Q). 3. Hybrids: Procured to Class B requirements (Quality Level H) of MIL-H-38534.	1.0
Class B-1 Category: Fully compliant with all requirements of paragraph 1.2.1 of MIL-STD-883 and procured to a MIL drawing, DESC drawing or other government approved documentation. (Does not include hybrids). For hybrids use custom screening section below.	2.0

Learning Factor - π_L

Years in Production, Y	π_L
≤ .1	2.0
.5	1.8
1.0	1.5
1.5	1.2
≥ 2.0	1.0

$\pi_L = .01 \exp(5.35 - .35Y)$

Y = Years generic device type has been in production

Quality Factors (cont'd): π_Q Calculation for Custom Screening Programs

Group	MIL-STD-883 Screen/Test (Note 3)	Point Valuation
1*	TM 1010 (Temperature Cycle, Cond B Minimum) and TM 2001 (Constant Acceleration, Cond B Minimum) and TM 5004 (or 5008 for Hybrids) (Final Electricals @ Temp Extremes) and TM 1014 (Seal Test, Cond A, B, or C) and TM 2009 (External Visual)	50
2*	TM 1010 (Temperature Cycle, Cond B Minimum) or TM 2001 (Constant Acceleration, Cond B Minimum) TM 5004 (or 5008 for Hybrids) (Final Electricals @ Temp Extremes) and TM 1014 (Seal Test, Cond A, B, or C) and TM 2009 (External Visual)	37
3	Pre-Burn In Electricals TM 1015 (Burn-In B-Level/S-Level) and TM 5004 (or 5008 for Hybrids) (Post Burn-In Electricals @ Temp Extremes)	30 (B Level) 36 (S Level)
4*	TM 2020 Pind (Particle Impact Noise Detection)	11
5	TM 5004 (or 5008 for Hybrids) (Final Electricals @ Temperature Extremes)	11 (Note 1)
6	TM 2010/17 (Internal Visual)	7
7*	TM 1014 (Seal Test, Cond A, B, or C)	7 (Note 2)
8	TM 2012 (Radiography)	7
9	TM 2009 (External Visual)	7 (Note 2)
10	TM 5007/5013 (GaAs) (Wafer Acceptance)	1
11	TM 2023 (Non-Destructive Bond Pull)	1

$$\pi_Q = 2 + \frac{87}{\Sigma \text{ Point Valuations}}$$

*NOT APPROPRIATE FOR PLASTIC PARTS.

NOTES:
1. Point valuation only assigned if used independent of Groups 1, 2 or 3.
2. Point valuation only assigned if used independent of Groups 1 or 2.
3. Sequencing of tests within groups 1, 2 and 3 must be followed.
4. TM refers to the MIL-STD-883 Test Method.
5. Nonhermetic parts should be used only in controlled environments (i.e., G_B and other temperature/humidity controlled environments).

EXAMPLES:

1. Mfg. performs Group 1 test and Class B burn-in: $\pi_Q = 2 + \frac{87}{50+30} = 3.1$
2. Mfg. performs internal visual test, seal test and final electrical test: $\pi_Q = 2 + \frac{87}{7+7+11} = 5.5$

Other Commercial or Unknown Screening Levels	$\pi_Q = 10$

Generic Failure Rate - λ_g (Failures/10^6 Hours) for Discrete Semiconductors

Section #	Part Type	Env. → T_J (°C) →	G_B 50	G_F 60	G_M 65	N_S 60	N_U 65	A_{IC} 75	A_{IF} 75	A_{UC} 90	A_{UF} 90	A_{RW} 75	S_F 50	M_F 65	M_L 75	C_L 60
	DIODES															
6.1	General Purpose Analog		.0036	.028	.049	.043	.10	.092	.21	.20	.44	.17	.0018	.076	.23	1.5
6.1	Switching		.00094	.0075	.013	.011	.027	.024	.054	.054	.12	.045	.00047	.020	.060	.40
6.1	Fast Recovery Pwr. Rectifier		.023	.19	.32	.28	.68	.61	1.4	1.3	2.9	1.1	.012	.50	1.5	10
6.1	Power Rectifier/ Schottky Pwr.		.0028	.022	.039	.034	.082	.073	.16	.16	.35	.13	.0014	.060	.18	1.2
6.1	Transient Suppressor/Varistor		.0029	.023	.040	.035	.084	.075	.17	.17	.36	.14	.0015	.062	.18	1.2
6.1	Voltage Ref/Reg. (Avalanche and Zener)		.0033	.024	.039	.035	.082	.066	.15	.13	.27	.12	.0016	.060	.16	1.3
6.1	Current Regulator		.0056	.040	.066	.060	.14	.11	.25	.22	.46	.21	.0028	.10	.28	2.1
6.2	Si Impatt (f ≤ 35 GHz)		.86	2.8	8.9	5.6	20	11	14	36	62	44	.43	16	67	350
6.2	Gunn/Bulk Effect		.31	.76	2.1	1.5	4.6	2.0	2.5	4.5	7.6	7.9	.16	3.7	12	94
6.2	Tunnel and Back		.004	.0096	.027	.019	.058	.025	.032	.057	.097	.10	.002	.048	.15	1.2
6.2	PIN		.028	.068	.19	.14	.41	.18	.22	.40	.69	.71	.014	.34	1.1	8.5
6.2	Schottky Barrier and Point Contact (200 MHz ≤ f ≤ 35 GHz)		.047	.11	.31	.23	.68	.30	.37	.67	1.1	1.2	.023	.56	1.8	14
6.2	Varactor		.012	.026	.072	.052	.16	.069	.086	.15	.26	.28	.0054	.13	.41	3.3
6.10	Thyristor/SCR		.0025	.020	.034	.030	.072	.064	.14	.14	.31	.12	.0012	.053	.16	1.1
	TRANSISTORS															
6.3	NPN/PNP (f < 200 MHz)		.00015	.0011	.0017	.0017	.0037	.0030	.0067	.0060	.013	.0056	.000073	.0027	.0074	.056
6.3	Power NPN/PNP (f < 200 MHz)		.0057	.042	.069	.063	.15	.12	.26	.23	.50	.22	.0029	.11	.29	2.2
6.4	Si FET (f ≤ 400 MHz)		.014	.099	.16	.15	.34	.28	.62	.53	1.1	.51	.0069	.25	.68	5.3
6.9	Si FET (f > 400 MHz)		.099	.24	.64	.47	1.4	.61	.76	1.3	2.3	2.4	.049	1.2	3.6	30
6.8	GaAs FET (P < 100 mW)		.17	.51	1.5	1.0	3.4	1.8	2.3	5.4	9.2	7.2	.083	2.8	11	63
6.8	GaAs FET (P ≥ 100 mW)		.42	1.3	3.9	2.5	8.5	4.5	5.6	13	23	18	.21	6.9	27	160
6.5	Unijunction		.016	.12	.20	.18	.42	.36	.80	.74	1.6	.66	.0079	.31	.88	6.4
6.6	RF, Low Noise (f > 200 MHz, P < 1W)		.094	.23	.63	.46	1.4	.60	.75	1.3	2.3	2.4	.047	1.1	3.6	28
6.7	RF, Power (P ≥ 1W)		.045	.091	.23	.18	.50	.18	.23	.32	.55	.73	.023	.41	1.1	11

APPENDIX A: PARTS COUNT

Generic Failure Rate - λ_g (Failures/10^6 Hours) for Discrete Semiconductors (cont'd)

Section #	Part Type	Env.→ G_B	G_F	G_M	N_S	N_U	A_{IC}	A_{IF}	A_{UC}	A_{UF}	A_{RW}	S_F	M_F	M_L	C_L
		T_J(°C)→ 50	60	65	60	65	75	75	90	90	75	50	65	75	60
	OPTO-ELECTRONICS														
6.11	Photodetector	.011	.029	.13	.074	.20	.084	.13	.17	.23	.36	.0057	.15	.51	6.6
6.11	Opto-Isolator	.027	.070	.31	.17	.47	.20	.30	.42	.56	.85	.013	.35	1.2	16
6.11	Emitter	.00047	.0012	.0056	.0031	.0084	.0035	.0053	.0074	.0098	.015	.00024	.0063	.021	28
6.12	Alphanumeric Display	.0062	.016	.073	.040	.11	.046	.069	.096	.13	.20	.0031	.082	.28	3.6
6.13	Laser Diode, GaAs/Al GaAs	5.1	16	78	39	120	58	86	86	110	240	2.6	87	350	3600
6.13	Laser Diode, In GaAs/In GaAsP	9.0	28	135	69	200	100	150	150	200	400	4.5	150	600	6200
7	TUBES	See Section 7 (Includes Receivers, CRTs, Cross Field Amplifiers, Klystrons, TWTs, Magnetrons)													
8	LASERS	See Section 8													

Discrete Semiconductor Quality Factors - π_Q

Section Number	Part Types	JANTXV	JANTX	JAN	Lower	Plastic
6.1, 6.3, 6.4, 6.5, 6.10, 6.11, 6.12	Non-RF Devices/ Opto-Electronics*	.70	1.0	2.4	5.5	8.0
6.2	High Freq Diodes	.50	1.0	5.0	25	50
6.2	Schottky Diodes	.50	1.0	1.8	2.5	----
6.6, 6.7, 6.8, 6.9	RF Transistors	.50	1.0	2.0	5.0	----
6.13	*Laser Diodes	π_Q = 1.0 Hermetic Package = 1.0 Nonhermetic with Facet Coating = 3.3 Nonhermetic without Facet Coating				

Generic Failure Rate, λ_g (Failure/10^6 Hours) For Resistors (Section 9.1)

Part Type	Style	MIL-R-	Env. → G_B / T_A (°C) → 30	G_F 40	G_M 45	N_S 40	N_U 45	A_{IC} 55	A_{IF} 55	A_{UC} 70	A_{UF} 70	A_{RW} 55	S_F 30	M_F 45	M_L 55	C_L 40
Composition	RCR	39008	.0022	.011	.051	.034	.13	.071	.091	.17	.23	.25	.0011	.12	.34	4.9
Composition	RC	11	.0022	.011	.051	.034	.13	.071	.091	.17	.23	.25	.0011	.12	.34	4.9
Film, Insulated	RLR	39017	.0037	.016	.07	.05	.18	.08	.11	.16	.22	.29	.0018	.16	.40	7.0
Film, Insulated	RL	22684	.0037	.016	.07	.05	.18	.08	.11	.16	.22	.29	.0018	.16	.40	7.0
Film, RN (R, C or N)	RNR	55182,	.0037	.016	.07	.05	.18	.08	.11	.16	.22	.29	.0018	.16	.40	7.0
Film, Chip	RM	55342	.0037	.016	.07	.05	.18	.08	.11	.16	.22	.29	.0018	.16	.40	7.0
Film	RN	10509	.0037	.016	.07	.05	.18	.08	.11	.16	.22	.29	.0018	.16	.40	7.0
Film, Power	RD	11804	.010	.041	.16	.12	.43	.18	.24	.32	.44	.65	.0051	.38	.89	18
Film, Network	RZ	83401	.0016	.0084	.038	.025	.10	.053	.068	.12	.17	.19	.00082	.088	.26	3.6
Wirewound, Accurate	RBR	39005	.0024	.010	.044	.031	.11	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Wirewound, Accurate	RB	93	.0024	.010	.044	.031	.11	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Wirewound, Power	RWR	39007	.0085	.038	.16	.11	.41	.19	.25	.38	.52	.68	.0043	.36	.94	16
Wirewound, Power	RW	26	.0085	.038	.16	.11	.41	.19	.25	.38	.52	.68	.0043	.36	.94	16
Wirewound, Power, Chassis Mounted	RER	39009	.016	.070	.29	.21	.77	.36	.46	.71	.98	1.3	.0080	.68	1.8	30
Wirewound, Power, Chassis Mounted	RE	18546	.016	.070	.29	.21	.77	.36	46	.71	.98	1.3	.0080	.68	1.8	30
Thermistor	RTH	23648	.0014	.0058	.023	.017	.061	.026	.033	.045	.062	.091	.0007	.054	.13	2.5
Wirewound, Variable	RTR	39015	.0024	.010	.044	.031	.12	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Wirewound, Variable	RT	27208	.0024	.010	.044	.031	.12	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Wirewound, Variable, Precision	RR	12934	.0024	.010	.044	.031	.12	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Wirewound, Variable, Semiprecision	RA	19	.0026	.013	.059	.037	.15	.083	.11	.19	•	•	.0013	•	•	•
Wirewound, Variable, Semiprecision	RK	39002	.0026	.013	.059	.037	.15	.083	.11	.19	•	•	.0013	•	•	•
Wirewound, Variable, Power	RP	22	0024	.010	.044	.031	.12	.054	.069	.11	.15	.19	.0012	.10	.26	4.5
Nonwirewound, Variable	RJR	39035	.0037	.016	.068	.048	.18	.083	.11	.16	.22	.29	.0018	.16	.40	7.0
Nonwirewound, Variable	RJ	22097	.0037	.016	.068	.048	.18	.083	.11	.16	.22	.29	.0018	.16	.40	7.0
Composition, Variable	RV	94	.0037	.016	.068	.048	.18	.083	.11	.16	.22	.29	.0018	.16	.40	7.0
Nonwirewound, Variable Precision	RQ	39023	.040	.020	.091	.061	.24	.13	.16	.30	.42	.45	.0020	.21	.62	8.7
Film, Variable	RVC	23285	.040	.020	.091	.061	.24	.13	.16	.30	.42	.45	.0020	.21	.62	8.7

NOTES: 1) * Not Normally used in this Environment
2) T_A = Default Component Ambient Temperature (°C)
3) Default Pwr. dissipation .5 watts assumed for all categories except RD, RWR, RW, RER and RE styles. RD, RWR, RW: 8 watts. RER and RE: 40 watts.

Quality	Established Reliability Styles S	R	P	M	MIL-SPEC	Lower
π_Q	.030	.10	.30	1.0	3.0	10

Supersedes page A-7 of Notice 1

Generic Failure Rate, λ_g (Failures/10^6 Hours) for Capacitors (Section 10.1)

Part Type or Dielectric	Style	MIL-C-	Env.→ G_B T_A (°C)→ 30	G_F 40	G_M 45	N_S 40	N_U 45	A_{IC} 55	A_{IF} 55	A_{UC} 70	A_{UF} 70	A_{RW} 55	S_F 30	M_F 45	M_L 55	C_L 40
Paper, By-Pass	CP	25	.00051	.0061	.013	.0043	.010	.0095	.012	.025	.030	.032	.00025	.013	.039	.35
Paper, By-Pass	CA	12889	.00051	.0061	.013	.0043	.010	.0095	.012	.025	.030	.032	.00025	.013	.039	.35
Paper/Plastic, Feed-through	CZ, CZR	11693	.00051	.0061	.013	.0043	.010	.0095	.012	.025	.030	.032	.00025	.013	.039	.35
Paper/Plastic Film	CQ, CQR	19978	.00070	.0084	.018	.0059	.014	.013	.016	.034	.041	.043	.00035	.018	.054	.48
Metallized Plastic/ Plastic	CH	18312	.00051	.0061	.013	.0043	.010	.0095	.012	.025	.030	.032	.00025	.013	.039	.35
Metallized Paper/Plastic	CHR	39022	.00070	.0084	.018	.0059	.014	.013	.016	.034	.041	.043	.00035	.018	.054	.48
Metallized Paper/Plastic	CFR	55514	.00070	.0084	.018	.0059	.014	.013	.016	.034	.041	.043	.00035	.018	.054	.48
Metallized Plastic	CRH	83421	.00070	.0084	.018	.0059	.014	.013	.016	.034	.041	.043	.00035	.018	.054	.48
MICA (Dipped)	CM	5	.00057	.0088	.022	.0062	.016	.019	.024	.069	.082	.064	.00029	.022	.080	.50
MICA (Dipped or Molded)	CMR	39001	.00057	.0088	.022	.0062	.016	.019	.024	.069	.082	.064	.00029	.022	.080	.50
MICA (Button)	CB	10950	.00057	.0088	.022	.0062	.016	.019	.024	.069	.082	.064	.00029	.022	.080	.50
Glass	CYR	23269	.0010	.016	.039	.011	.029	.034	.043	.12	.15	.11	.00051	.039	.14	.90
Glass	CY	11272	.0010	.016	.039	.011	.029	.034	.043	.12	.15	.11	.00051	.039	.14	.90
Ceramic (Gen. Purpose)	CK	11015	.0017	.026	.064	.018	.048	.057	.071	.20	.24	.19	.00086	.064	.24	1.5
Ceramic (Gen. Purpose)	CKR	39014	.0017	.026	.064	.018	.048	.057	.071	.20	.24	.19	.00086	.064	.24	1.5
Ceramic (Temp. Comp.)	CC, CCR	20	.0017	.026	.064	.018	.048	.057	.071	.20	.24	.19	.00086	.064	.24	1.5
Ceramic Chip	CDR	55681	.0035	.053	.13	.037	.098	.12	.14	.41	.49	.38	.0017	.13	.48	3.0
Tantalum, Solid	CSR	39003	.0014	.017	.037	.012	.027	.026	.032	.068	.082	.087	.00070	.037	.11	.96
Tantalum, Chip	CWR	55365	.00014	.0016	.0036	.0011	.0027	.0025	.0031	.0066	.0079	.0084	.000068	.0036	.010	.093
Tantalum, Non-Solid	CLR	39006	.0022	.026	.057	.018	.042	.040	.050	.11	.13	.13	.0011	.057	.17	1.5
Tantalum, Non-Solid	CL	3965	.0022	.026	.057	.018	.042	.040	.050	.11	.13	.13	.0011	.057	.17	1.5
Tantalum, Non-Solid	CRL	83500	.0022	.026	.057	.018	.042	.040	.050	.11	.13	.13	.0011	.057	.17	1.5
Aluminum Oxide	CU, CUR	39018	.0013	.019	.047	.014	.036	.042	.052	.15	.18	.14	.00063	.047	.17	1.1
Aluminum Dry	CE	62	.0013	.019	.047	.014	.036	.042	.052	.15	.18	.14	.00063	.047	.17	1.1
Variable, Ceramic	CV	81	.0055	.066	.14	.046	.11	.10	.13	.27	.32	.34	.0027	.14	.42	3.8
Variable, Piston	PC	14409	.0047	.073	.18	.051	.13	.16	20	.57	.68	.53	.0024	.18	.66	4.1
Variable, Air Trimmer	CT	92	.0000057	.000087	.00021	.000061	.00016	.00019	00024	.00068	.00081	.00063	.0000028	.00021	.00079	0050
Variable, Vacuum	CG	23183	.0042	.050	.11	.035	.082	.077	.097	.20	.24	.26	.0021	.11	.32	2.9

NOTES:
1) * Not Normally used in this Environment
2) T_A = Default Component Ambient Temperature (°C)
3) Voltage stress = .4, π_{SR} = 1
4) Assumed capacitance (µF): CP, CA, CZ, CZR, CQ, CQR, CH, CHR, CFR, CRH: 3.0; CM, CMR, CB: 0.003; CYR, CY, CK, CKR, CC, CCR, CDR: 20; CSR: 150; CWR: 50; CLR, CL, CRL: 1000; CU, CUR, CE: 6000; CV, PC, CT, CG: 0.00006

Quality	Established Reliability Styles D	C	S, B	R	P	M	L	MIL-SPEC	Lower
π_Q	.001	.01	.030	.10	.30	1.0	1.5	3.0	10

Generic Failure Rate, λ_g (Failures/10^6 Hours) for Inductive, Electromechanical and Miscellaneous Parts

Section #	Part Type	MIL-	Env.→ G_B	G_F	G_M	N_S	N_U	A_{IC}	A_{IF}	A_{UC}	A_{UF}	A_{RW}	S_F	M_F	M_L	C_L
			T_A (°C)→ 30	40	45	40	45	55	55	70	70	55	30	45	55	40
	INDUCTIVE DEVICES															
11.1	Transformer, Switching	T-21038	.00061	.0042	.0090	.0035	.012	.0051	.0067	.0070	.0090	.020	.00031	.0097	.029	.43
11.1	Transformer, Flyback	T-27	.0058	.040	.085	.033	.11	.048	.064	.066	.085	.19	.0029	092	.27	4.0
11.1	Transformer, Audio	T-27	.015	.10	.22	.086	.29	.12	.17	.17	.22	.50	.0075	24	.70	10
11.1	Transformer, Power	T-27	.053	.36	.77	.30	1.0	.44	.58	.60	.77	1.7	.026	83	2.5	37
11.1	Transformer, RF	T-55631	.14	.96	2.0	.80	2.7	1.2	1.5	1.6	2.1	4.6	.070	2.2	6.5	97
11.2	Coil, Fixed Inductor or Choke	C-15305, C-39010	.000032	.00022	.00047	.00018	.00063	.00027	.00036	.00037	.00047	.0011	.00002	.00051	0.0015	.022
11.2	Coil, Variable Inductor	C-15305	.00005	.00037	.00079	.00031	.0010	.00044	.00059	.00061	.00079	.0018	.00003	.00085	.0025	.037
	ROTATING DEVICES															
12.1	Motors, General		6.9	6.8	8.3	6.8	8.3	13	13	30	30	13	6.9	•	•	•
12.1	Sensor Motor		27	27	33	27	33	52	52	1.2e+02	1.2e+02	52	27	33	52	27
12.1	Servo Motor		5.4	5.4	6.5	5.4	6.5	10	10	23	23	10	5.4	6.5	10	5.4
12.1	Stepper Motor		1.2	1.2	1.4	1.2	1.4	2.3	2.3	5.3	5.3	2.3	1.2	1.4	2.3	1.2
12.2	Synchros		.031	.071	.47	.25	.70	.19	.28	1.1	1.8	1.2	.016	.54	1.7	24
12.2	Resolvers		.047	.11	.70	.37	1.0	.28	.43	1.7	2.6	1.8	.023	81	2.6	•
	ELAPSED TIME METERS															
12.3	ETM-AC		10	20	120	70	180	50	80	160	250	260	5.0	140	380	•
12.3	ETM-Inverter Driver		15	30	180	105	270	75	120	240	375	390	7.5	210	570	•
13.3	ETM-Commutator DC		40	80	480	280	720	200	320	640	1000	1040	20	560	1520	•
	RELAYS															
13.1	General Purpose (Bal. Arm.)		.049	.12	1.0	.50	1.9	.60	.77	1.3	1.4	3.9	.025	1.7	5.7	•
13.1	Sensitive (Bal. Arm.)		.099	.25	2.1	.99	3.7	1.2	1.5	2.5	2.8	7.9	.049	3.5	11	•
13.1	Dry Reed		.059	.15	1.2	.60	2.2	.72	.93	1.5	1.7	4.7	.030	2.1	6.8	•
13.1	Thermal Bi-metal		.099	.25	2.1	.99	3.7	1.2	1.5	2.5	2.8	7.9	.049	3.5	11	•
13.1	Magnetic Latching, (Bal. Arm.)		.049	.12	1.0	.50	1.9	.60	.77	1.3	1.4	3.9	.025	1.7	5.7	•
13.1	Contactor, High Current (Solenoid)		.049	.12	1.0	.50	1.9	.60	.77	1.3	1.4	3.9	.025	1.7	5.7	•
13.2	Solid State, All		.029	.087	.35	.17	.49	.35	.55	.61	.93	.67	.012	.35	.96	17
	SWITCHES	See 14.1														
14.1	Dual In-line Package		.00012	.00036	.0022	.00096	.0035	.0012	.0022	.0016	.0026	.0055	.00006	.0030	.0080	.14
14.1	Limit		4.3	13	77	34	1.2e+02	43	77	56	95	2.0e+02	2.2	1.1e+02	2.9e+02	5.2e+03
14.1	Microwave		1.7	5.1	31	14	49	17	31	22	37	78	.85	43	1.1e+02	2.0e+03
14.1	Pushbutton		.10	.30	1.8	.80	2.9	1.0	1.8	1.3	2.2	4.6	.050	2.5	6.7	1.2e+02
14.1	Reed		.0010	.0030	.018	.0080	.029	.0100	.018	.013	.022	.046	.00050	.025	.067	1.2
14.1	Rocker		.023	.069	.41	.18	.67	.23	.41	.30	.51	1.1	.012	.57	1.5	28
14.1	Rotary		.11	.33	2.0	.88	3.2	1.1	2.0	1.4	2.4	5.1	.055	2.8	7.4	1.3e+02
14.1	Sensitive		.49	1.5	8.8	3.9	14	4.9	8.8	6.4	11	23	.25	12	33	5.9e+02
14.1	Thermal		.031	.093	.56	.25	.90	.31	.56	.40	.68	1.4	.015	.77	2.1	37
14.1	Thumbwheel		.18	.54	3.2	1.4	5.2	1.8	3.2	2.3	4.0	8.3	.090	4.5	12	2.2e+02
14.1	Toggle		.10	.30	1.8	.80	2.9	1.0	1.8	1.3	2.2	4.6	.050	2.5	6.7	1.2e+02
14.2	Circuit Breaker, All		.68	1.4	10	5.4	18	4.8	6.1	7.5	8.2	31	.34	17	45	•
	CONNECTORS															
15.1	Circular		.0011	.0013	.011	.0065	.018	.0049	.0082	.016	.025	.031	.00055	.014	.044	.64
15.1	PCB Card Edge		.044	.052	.45	.26	.73	.20	.33	.65	.98	1.3	.022	.56	1.8	25
15.1	Hexagonal		.16	.19	1.7	.97	2.7	.74	1.2	2.5	3.7	4.7	.082	2.1	6.7	95
15.1	Rack and Panel		.023	.027	.24	.14	.38	.10	.17	.34	.52	.66	.011	.30	.93	13
15.1	Rectangular		.050	.060	.52	.30	.84	.23	.38	.75	1.1	1.4	.025	.65	2.0	29
15.1	RF Coaxial		.00045	.00053	.0046	.0027	.0075	.0020	.0034	.0067	.0100	.013	.00022	.0058	.018	.26
15.1	Telephone		.0082	.0097	.085	.049	.14	.037	.062	.12	.18	.23	.0041	.11	.33	4.8
15.2	IC Sockets (DIP, SIP, PGA)		.0035	.011	.049	.021	.083	.028	.042	.039	.046	.088	.0018	.049	.13	2.3

Generic Failure Rate, λ_g (Failures/10^6 Hours) for Inductive, Electromechanical and Miscellaneous Parts

Section #	Part Type	MIL-	Env.→ G_B / T_A (°C)→ 30	G_F 40	G_M 45	N_S 40	N_U 45	A_{IC} 55	A_{IF} 55	A_{UC} 70	A_{UF} 70	A_{RW} 55	S_F 30	M_F 45	M_L 55	C_L 40
16.1	Plated Through Hole Circuit Boards		.022	.045	.16	.11	.29	.11	.18	.36	.62	.42	.011	.22	.60	11
16.2	Surface Mount Tech. Circuit Boards		.0025	.37	1.8	1.8	42	6.1	6.1	35	35	6.1	.0025	11	.11	.11
	SINGLE CONNECTIONS															
17.1	Hand Solder, w/o Wrapping		.0013	.0026	.0091	.0052	.014	.0052	.0078	.0078	.0100	.021	.00065	.012	.031	.55
17.1	Hand Solder, w/Wrapping		7.0e-05	.00014	.00049	.00028	.00077	.00028	.00042	.00042	.00056	.0011	3.5e-05	.00063	.0017	.029
*17.1	Crimp		.00026	.00052	.0018	.0010	.0029	.0010	.0016	.0016	.0021	.0042	.00013	.0023	.0062	.11
17.1	Weld		1.5e-05	3.0e-05	1.0e-04	6.0e-05	0.00017	6.0e-05	9.0e-05	9.0e-05	.00012	.00024	7.5e-06	.00013	.00036	.0063
17.1	Solderless Wrap		6.8e-06	1.4e-05	4.8e-05	2.7e-05	7.5e-05	2.7e-05	4.1e-05	4.1e-05	5.4e-05	.00011	3.4e-06	6.1e-05	.00016	.0029
17.1	Clip Termination		.00012	.00024	.00084	.00048	.0013	.00048	.00072	.00072	.00096	.0019	6.0e-05	.0011	.0029	.050
17.1	Reflow Solder		6.9e-05	.00014	.00048	.00028	.00076	.00028	.00041	.00041	.00055	.0011	3.5e-05	.00062	.0017	.029
17.1	Spring Contact		.17	.34	1.2	.68	1.9	.68	1.0	1.0	1.4	2.7	.085	1.5	4.1	71
17.1	Terminal Block		.062	.12	.43	.25	.68	.25	.37	.37	.50	.99	.031	.56	1.5	26
	METERS, PANEL															
*18.1	DC Ammeter or Voltmeter	M-10304	0.09	0.36	2.3	1.1	3.2	2.5	3.8	5.2	6.6	5.4	0.099	5.4	N/A	N/A
*18.1	AC Ammeter or Voltmeter	M-10304	0.15	0.61	3.8	1.8	5.4	4.3	6.4	8.9	11	9.2	0.17	9.2	N/A	N/A
19.1	Quartz Crystals	C-3098	.032	.066	.32	.19	.51	.38	.54	.70	.90	.74	.016	.42	1.0	16
20.1	Lamps, Incandescent, AC		3.9	7.8	12	12	16	16	16	19	23	19	2.7	16	23	100
20.1	Lamps, Incandescent, DC		13	26	38	38	51	51	51	64	77	64	9.0	51	77	350
	ELECTRONIC FILTERS															
21.1	Ceramic-Ferrite	F-15733	.022	.044	.13	.088	.20	.15	.20	.24	.29	.24	.018	.15	.33	2.6
21.1	Discrete LC Comp.	F-15733	.12	.24	.72	.48	1.1	.84	1.1	1.3	1.6	1.3	.096	.84	1.8	14
21.1	Discrete LC & Crystal Comp.	F-18327	.27	.54	1.6	1.1	2.4	1.9	2.4	3.0	3.5	3.0	.22	1.9	4.1	32
22.1	FUSES		.010	.020	.060	.050	.11	.060	.12	.15	.18	.16	.009	.10	.21	2.3

NOTES:
1) * Not normally used in this environment.
2) T_A = Default Component Ambient Temperature (°C), π_T based on T_A shown.
3) Motor assumptions: 10 yr. (87600 hours) design life assumed; Synchros/Resolvers: Size 10-16, 3 brushes; ETMs: π_T = .5.
4) Relay assumptions: Rated Temp. = 125°C, SPST, Resistive Load, S = .5, 10 cycles/hour.
5) Switch assumptions: SPST; Circuit breakers: DPST, not used as a switch.
6) Connector assumptions: π_K = 1; Sockets: 40 pins.
7) Plated through hole circuit board assumptions: 1000 wave solder joints, 3 planes, no hand soldering; SMT circuit board design assumptions are same as those shown in Section 16.2 example using the default ΔT values shown in Section 16.2.
8) Quartz crystal assumptions: 50 MHz
9) Lamp assumptions: utilization rate = .5, 28 volt rating.

π_Q Factor for Use with Section 11-22 Devices

Section #	Part Type	Established Reliability	MIL-SPEC	Non-MIL
11.1, 11.2	Inductive Devices	.25*	1.0	3.0
12.1, 12.2, 12.3	Rotating Devices	N/A	N/A	N/A
13.1	Relays, Mechanical	.60	1.5	2.9
13.2	Relays, Solid State and Time Delay (Hybrid & Solid State)	N/A	1.0	1.9
14.1	Switches, Toggle, Pushbutton, Sensitive	N/A	1.0	2.0
14.2	Circuit Breakers	N/A	1.0	8.4
15.1	Connectors	N/A	1.0	2.0
15.2	Connectors, Sockets	N/A	.3	1.0
16.1	Plated Through Hole Circuit Boards	N/A	1.0	2.0
16.2	Surface Mount Tech. Circuit Boards	N/A	N/A	N/A
17.1	Connections	N/A	N/A	N/A
18.1	Meters, Panel	N/A	1.0	3.4
19.1	Quartz Crystals	N/A	1.0	2.1
20.1	Lamps, Incandescent	N/A	N/A	N/A
21.1	Electronic Filters	N/A	1.0	2.9
22.1	Fuses	N/A	N/A	N/A

* Category applies only to MIL-C-39010 Coils.

Default Parameters for Discrete Semiconductors

Section #	Part Type	λ_b	π_T	π_M	π_S	π_C	π_A	π_R	Comments
5.0	MICROCIRCUITS	All Defaults provided with λ_g Table							
	DIODES								
6.1	General Purpose Analog	.0038			.42	1.0			Voltage Stress = .7, Metallurgically Bonded Contacts
6.1	Switching	.001			.42	1.0			Voltage Stress = .7, Metallurgically Bonded Contacts
6.1	Fast Recovery Power Rectifier	.025			.42	1.0			Voltage Stress = .7, Metallurgically Bonded Contacts
6.1	Transient Suppressor/Varistor	.0031			1.0	1.0			Metallurgically Bonded Contacts
6.1	Power Rectifier	.003			.42	1.0			Voltage Stress = .7, Metallurgically Bonded Contacts
6.1	Voltage Ref/Reg. (Avalanche & Zener)	.002			1.0	1.0			Metallurgically Bonded Contacts
6.1	Current Regulator	.0034			1.0	1.0			Metallurgically Bonded Contacts
6.2	Si Impatt (≤ 35 GHz)	.22					1.0	1.0	
6.2	Gunn/Bulk Effect	.18					1.0	1.0	
6.2	Tunnel and Back	.0023					1.0	1.0	
6.2	PIN	.0081					1.0	2.0	Rated Power = 1000W
6.2	Schottky Barrier and Point Contact (200 MHz ≤ frequency ≤ 35 GHz)	.027			1.0	1.0			
6.2	Varactor	.0025					2.5	1.0	Multiplier Application
6.10	Thyristor/SCR	.0022			.51			1.0	Voltage Stress = .7, Rated Forward Current = 1 Amp
	TRANSISTORS								
6.3	NPN/PNP (f < 200 MHz)	.00074			.21		.70	.77	Voltage Stress = .5, Switching Application, Rated Power = .5W
6.3	Power NPN/PNP (f < 200 MHz)	.00074			.54		1.5	5.5	Voltage Stress = .8, Linear Application, Rated Power = 100W
6.4	Si FET (f ≤ 400 MHz)	.012					.70		MOSFET, Small Signal Switching
6.9	Si FET (f > 400 MHz)	.060							MOSFET
6.8	GaAs FET (P < 100 mW)	.052		1.0			1.0		Low Noise Application, 1 ≤ f ≤ 10 GHz, Input and Output Matching
6.8	GaAs FET (P ≥ 100 mW)	.13		1.0			1.0		Pulsed Application, 5 GHz, 1W Average Output Power, Input and Output Matching
6.5	Unijunction	.0083							
6.6	RF, Low Noise, Bipolar (f > 200 MHz, P < 1W)	.18			.39			.77	Voltage Stress = .7, Rated Power = .5W
6.7	RF, Power (P ≥ 1W)	.08	.36	1.0			1.6		1 GHz, 100W, T_J = 130°C for all Environments, Voltage Stress = .45, Gold Metallization, Pulsed Application, 20% Duty Factor, Input and Output Matching

Default Parameters for Discrete Semiconductors

Section #	Part Type	λ_b	π_T	π_M	π_S	π_C	π_A	π_R	Comments
	OPTO-ELECTRONICS								
6.11	Photodetector	.0055							Phototransistor
6.11	Opto-Isolator	.013							Phototransistor, Single Device
6.11	Emitter	.00023							LED
6.12	Alphanumeric Display	.0030							7 Character Segment Display
6.13	Laser Diode, GaAs/Al GaAs	3.23			1.0 (π_P)		.77		For Environments with T_J > 75°C, assume T_J = 75°C, Forward Peak Current = .5 Amps (π_i = .62), Pulsed Application, Duty Cycle = .6, Pr/Ps = .5 (π_P = 1)
6.13	Laser Diode, In/GaAs/In GaAsP	5.65			1.0 (π_P)		.77		For Environments with T_J > 75°C, assume T_J = 75°C, Forward Peak Current = .5 Amps (π_i = .62), Pulsed Application, Duty Cycle = .6, Pr/Ps = .5 (π_P = 1)