RELIABILITY AND QUALITY ASSURANCE

QUALITY LEVELS

RF Products are available from Motorola in three quality levels:

1. Industrial/commercial grade, identified by a prefix such as 2N, MRF, or MHW on the part number and tested to a published Corporate, JEDEC, or Proelectron specification.
2. Military grade, built and tested per MIL-S-19500 and identified by a 2N prefix and JAN, JTX, or JTXV suffix.
3. Customer-specified grade with screening, testing, and marking determined by the customer to meet his particular requirements. These may range from a custom-marked industrial/commercial grade product to a product which is subjected to the most stringent tests required for space or submarine applications.

POST-ASSEMBLY PROCESSING

After assembly, a production lot is first sent to Final Test, then is transferred to Quality Assurance.

Final Test Processing

In Final Test, 100% of a lot is processed. This processing may be as simple as electrical testing to a data sheet specification or as complex as a series of mechanical and environmental screening tests preceded and followed by electrical tests. In Final Test all lots, whether commercial or high-rel, receive a minimum of an eight-hour storage bake at 150 or 200°C.

Quality Assurance Processing

Once in QA, high-rel lots may undergo additional 100% screening prior to testing. Using the popular 2N3866* family as an example, Table 1 compares the varying degrees of preconditioning and screening that are done on the 2N3866, 2N3866JAN, 2N3866JANTX and the 2N3866JTXV transistors. For testing, QA uses test sample groups A, B, and C as defined in MIL-STD 19500. Individual tests are defined in MIL-STD-202, 750, and 883. All lots, including industrial/commercial, receive Group A testing, usually to the same specification which is used by Final Test. In addition to the Group A tests, military and customer-specified high-rel specifications usually require Group B and C tests. Table 2 lists the standard LTPD, sample size and lot acceptance number used for Group A testing of standard products at Motorola. Military and high-rel specifications may call for a tighter Group A sample plan. Tables 3 and 4 list the Group B and C test requirements of the 2N3866JAN and 2N3866-JANTXV specifications

Special Processing

Three additional tests that may be specified at extra cost by a high-rel customer are:

1. Scanning electron microscope inspection of a wafer.
2. X-ray examination of metal can transistors.
3. Particle Inclusion Noise Detection (PIND) test to detect loose particles trapped in a package.

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*The 2N3866 is a 400 MHz, 1.0 Watt NPN silicon transistor mounted in a TO-39 metal can.

TABLE 1 — 100% PRECONDITIONING AND SCREENING (2N3866 Family)

Test	MIL-S-750 Method	Condition	2N3866/JAN	2N3866JTX/V
Final Test				
1. Electrical Tests (Same as Group A)		Go/No Go Remove Rejects	100%	100%
2. High Temperature Storage		200°C, 24 hours	Omit	100%
3. Temperature Cycling	1051	C, 10 cycles	Omit	100%
4. Constant Acceleration	2006	20,000 G Y_1	Omit	100%
5. Hermetic Seal	1071		Omit	100%
Fine Leak		G or H		
Gross Leak		A, B, C, D or F		
6. HT R B		150°C, 48 hr, 24 V	Omit	100%
7. Electrical Tests (Similar to Group A)			Omit	100%
QA				
8. Electrical Tests		Go/No Go	Omit	100%
9. Establish Identity			Omit	100%
10. Electrical Tests	I_{CBO} and h_{FE} with Deltas		Omit	100%
11. Burn In		168 hr, 1.0 W	Omit	100%
12. Electrical Tests		PDA = 10%	Omit	100%

TABLE 2 — STANDARD GROUP A SAMPLING PLANS* (Discrete Products)

Characteristic (By Subgroup)	LTPD	Sample Size	Accept Number
Discrete Devices			
Visual and Mechanical	3.0	129	1
DC Parameters	3.0	129	1
AC and Temperature Parameters	7.0	55	1
Opens/Shorts	1.75	129	0
Discrete Wafers and Dice			
Visual and Mechanical			
Multipack and Decca Pack (100% Sorted)	10	52	2
Wafer Sales and Vial Package (no 100% Sort)	20	69	9
DC Parameters	10	38	1
AC and Temperature Parameters	20	25	2

*Extracted from Motorola Specification 12MRBO2952A Issue D.

TABLE 3 – GROUP B TESTS (2N3866 Family)

Inspection or Test	MIL-S-750 Method	Condition	LT P D (Accept No.)	
			2N3866JAN	2N3866JTX/V
Subgroup B-1			20(1)	20(1)
Physical Dimensions	2066			
Subgroup B-2			15(1)	15(1)
Solderability	2026			
Temperature Cycling	1051	C		
Thermal Shock	1056	B		
Hermeticity	1071			
Fine Leak		IIIa G or H		
Gross Leak		A, B, C, D or F		
Moisture Resistance	1021			
Subgroup B-3			15(1)	15(1)
Shock	2016	1500 G		
Variable Freq. Vib	2056			
Constant Acceleration	2006	20,000 G		
Subgroup B-4			20(1)	20(1)
Lead Fatigue	2036	E		
Subgroup B-5			20(1)	20(1)
Salt Atmosphere	1041			
Subgroup B-6 High Temperature Storage Life	1031	200°C	7(1) (340 hours)	5(1) (1000 hours)
Subgroup B-7 Steady State Operating Life	1026	$T_A = 25°C$ $V_{CB} = 25$ V $P_T = 1$ W	7(1) (340 hours)	5(1) (1000 hours)

TABLE 4 – GROUP C TESTS (2N3866 Family)

Inspection or Test	MIL-S-750 Method	Condition	LTPD (Accept No.)	
			2N3866JAN	2N3866JTX/V
Subgroup C-1			10(1)	10(1)
Barometric Pressure	1001			
Thermal Resistance	3151			
Subgroup C-2 Burnout by Pulsing	3005		10(1)	10(1)
Subgroup C-3 High Temperature Storage Life	1031	Extension of B-6 to 1000 hrs	10(1)	–
Subgroup C-4 Steady State Operating Life	1026	Extension of B-7 to 1000 hrs	10(1)	–