DOCUMENT NO.	MLB-AL-D27
DATE	04.29.2007

WRITTEN	CHECKED	APPROVED
/	/	/

QUALITY REPORT

FAILURE RATE AND MTBF DATA

1206 MULTI LAYER CERAMIC CHIP CAPACITOR

(NP0, X7R & Y5V)

TESTED PRODUCT:

–NP0: C1206C0G500-102JNE
–X7R: C1206X7R500-104KNE
–Y5V: C1206Y5V160-105ZNE

VENKEL LTD.

5900 SHEPHERD MOUNTAIN COVE
AUSTIN, TEXAS 78730

Phone: 512 / 794-0081
Fax: 512 / 794-0087
Toll Free: 800 / 950-8365
email: sales@venkel.com
www.venkel.com

HALT MODEL

MTBF (mean time between failure) after HALT test is transformed to that of rated condition (operating condition) by using the following HALT model, and assurance time in normal condition can be predicted.

$$A_L = L_1/L_2$$

$$= \{V_2/V_1\}^n.\exp\{Ea/k(1/T_1 - 1/T_2)\}$$

$$= A_V \cdot A_T$$

A_L, A_V, A_T: acceleration factor, voltage acceleration factor, temperature acceleration factor

n: voltage index
Ea: activation energy (eV)
V: applied voltage (volt)
T: absolute temperature (°K)
k: BOLTZMANN constant (8.625×10^{-5} eV/°K)

	Ea	n	Test Condition		Rated Voltage
			Temperature (°C)	Voltage (V)	
NP0	1.15	2.9	140	400	V_{dc}
X7R				Rated voltage*8	
Y5V	1.07	2.4			

5900 Shepherd Mountain Cove • Austin, TX 78730
Phone: 512 / 794-0081 • Fax: 512 / 794-0087 • Toll Free: 800 / 950-8365
e-mail: sales@venkel.com • www.venkel.com

VENKEL LTD.

1. USER'S REQUEST

Failure rates and MTBFs data for 1206 (NP0, X7R, Y5V)

2. TEST DATA (For MLCC only)

HALT model was adopted for the calculation of Failure rates and MTBFs.

For the technical data and procedure, see page 4

Test results are as follows

2.1 Basic Conditions

	Temperature	Voltage	Test Hour
Field condition	50°C	Rated Voltage	500 Hr
Test condition	140°C	Rated Voltage*8	

2.2 Basic Quantities

	Acceleration Factor
NP0, X7R	3.35 E6
Z5U	6.33 E5

2.3 Test Results (Failure Mode: IR short)

Size	Item	Failure Quantity	MTBF (year)	Failure Rate (λ in FIT)
1206	NP0	7/40	951,293	0.12
	X7R	11/40	600,817	0.19
	Y5V	14/40	78,189	1.46

5900 Shepherd Mountain Cove • Austin, TX 78730
Phone: 512 / 794-0081 • Fax: 512 / 794-0087 • Toll Free: 800 / 950-8365
e-mail: sales@venkel.com • www.venkel.com

MLCC HALT

MLCC HALT DATA (Test Condition: 140°C Rated Voltage x 8)

PART NO: C1206C0G500-102JNE					
LOT NO: AK127CR					
				INITIAL	AFTER
				IR(MΩ)	IR(MΩ)
SPEC				MIN	MIN
NO.		Hr		1.0E+04	
1				5.0E+06	4.4E+06
2				8.7E+06	1.1E+07
3				7.0E+06	1.7E+07
4				7.6E+06	2.2E+06
5				6.2E+06	2.3E+06
6				6.8E+06	5.5E+06
7				1.1E+06	2.6E+06
8				6.1E+06	1.8E+06
9				6.5E+06	1.3E+06
10		156.00		6.6E+06	OVLD
11				2.5E+07	5.8E+05
12				7.4E+06	7.6E+05
13				4.1E+06	1.0E+06
14				5.5E+06	5.5E+05
15				6.3E+06	9.3E+05
16		249.00		1.5E+06	OVLD
17				2.2E+06	1.3E+06
18				7.6E+06	1.4E+06
19				1.7E+06	1.6E+06
20				1.1E+06	7.7E+05
21		82.00		8.7E+05	8.1E+05
22				7.7E+05	5.4E+02
23				2.3E+06	1.0E+06
24				1.2E+06	2.2E+07
25				1.6E+06	8.2E+04
26		229.00		9.7E+05	OVLD
27		86.00		1.6E+06	OVLD
28				1.3E+06	1.5E+05
29				1.5E+06	2.6E+05
30				1.3E+06	6.2E+04
31		184.00		1.9E+06	OVLD
32				6.4E+06	2.3E+05
33				1.2E+06	7.0E+04
34				1.0E+06	3.4E+05
35		49.00		1.7E+06	OVLD
36				1.8E+05	1.6E+05
37				9.1E+05	3.3E+05
38				2.3E+05	1.4E+05
39				3.7E+05	1.3E+06
40		411.00		8.1E+05	OVLD
TEST HOUR		500			
FAILURE HOUR		1035			
FAILURE QUANTITY		7			
GOOD QUANTITY		33			
TOTAL TEST HOUR		17535			
Fit		0.12			

PART NO: C1206X7R500-104KNE					
LOT NO: AK8CKFF					
				INITIAL	AFTER
				IR(MΩ)	IR(MΩ)
SPEC				MIN	MIN
NO.		Hr		5.0E+03	
1				3.1E+04	2.8E+04
2				3.2E+04	2.5E+04
3		414.00		6.3E+04	OVLD
4				3.9E+04	2.9E+04
5				2.5E+04	2.4E+04
6				7.0E+04	4.2E+04
7				3.0E+04	2.5E+04
8				3.8E+04	2.6E+04
9		91.00		3.1E+04	OVLD
10				2.7E+04	2.5E+04
11				2.8E+04	2.7E+04
12				3.2E+04	2.7E+04
13		163.00		1.0E+05	OVLD
14		475.00		3.0E+04	OVLD
15				3.0E+04	2.6E+04
16				3.7E+04	2.8E+04
17				2.9E+04	2.0E+04
18				2.8E+04	2.5E+04
19				4.4E+04	2.2E+04
20				3.1E+04	2.4E+04
21				4.0E+04	2.6E+04
22		369.00		2.7E+04	OVLD
23				3.8E+04	3.7E+04
24				2.8E+04	2.3E+04
25		327.00		1.1E+05	OVLD
26				3.1E+04	2.8E+04
27		177.00		2.7E+04	OVLD
28				2.8E+04	2.2E+04
29				2.9E+04	2.1E+05
30				3.0E+04	1.9E+04
31				3.1E+04	1.0E+05
32		92.00		2.9E+04	OVLD
33		133.00		2.7E+04	OVLD
34		282.00		2.8E+04	OVLD
35				3.7E+04	2.1E+04
36				3.2E+04	3.1E+04
37		79.00		3.0E+04	OVLD
38				3.0E+04	2.6E+04
39				2.9E+04	2.8E+04
40				2.5E+04	2.1E+04
TEST HOUR		500			
FAILURE HOUR		2602			
FAILURE QUANTITY		11			
GOOD QUANTITY		29			
TOTAL TEST HOUR		17102			
Fit		0.19			

PART NO: C1206Y5V160-105ZNE					
LOT NO: AK518HC					
				INITIAL	AFTER
				IR(MΩ)	IR(MΩ)
SPEC				MIN	MIN
NO.		Hr		5.0E+02	
1		75.00		2.8E+04	OVLD
2				3.2E+04	3.1E+04
3				3.0E+05	3.0E+05
4				2.9E+04	2.3E+04
5				2.4E+04	1.9E+04
6		48.00		4.2E+04	OVLD
7				3.0E+04	2.6E+04
8		165.00		3.8E+04	OVLD
9				3.1E+04	3.1E+04
10				2.7E+05	2.6E+05
11				2.7E+04	2.3E+04
12		239.00		2.7E+04	OVLD
13				2.5E+04	2.3E+04
14				3.0E+04	2.5E+04
15				2.6E+04	2.5E+04
16				2.8E+04	2.6E+04
17				2.9E+04	2.7E+04
18		442.00		2.5E+04	OVLD
19		359.00		2.2E+04	OVLD
20		121.00		2.4E+04	OVLD
21				4.0E+04	3.7E+04
22		47.00		2.4E+05	OVLD
23				3.8E+04	3.3E+04
24				2.8E+04	2.4E+04
25				3.4E+04	2.6E+04
26		98.00		2.8E+04	OVLD
27		106.00		2.7E+04	OVLD
28				2.2E+05	2.2E+05
29		381.00		2.9E+04	OVLD
30				3.0E+04	2.9E+04
31				3.1E+04	2.7E+04
32		30.23		2.6E+04	OVLD
33				2.4E+04	1.5E+04
34				2.8E+04	2.7E+04
35				3.7E+04	3.3E+04
36				3.1E+05	2.7E+05
37				3.0E+04	2.9E+04
38		34.64		2.6E+04	OVLD
39		10.15		2.8E+04	OVLD
40				2.5E+04	1.9E+04
TEST HOUR		500			
FAILURE HOUR		2156			
FAILURE QUANTITY		14			
GOOD QUANTITY		26			
TOTAL TEST HOUR		15156			
Fit		1.46			

5900 Shepherd Mountain Cove • Austin, TX 78730
Phone: 512 / 794-0081 • Fax: 512 / 794-0087 • Toll Free: 800 / 950-8365
e-mail: sales@venkel.com • www.venkel.com

VENKEL LTD.