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Innovative Service Around the Globe **YAGEO**

DATA SHEET

**SURFACE-MOUNT CERAMIC
MULTILAYER CAPACITORS**

Class 2, Y5V

16/25/50 V



Product Specification – Jul 08, 2003 V.7



Phicom

Surface-mount ceramic multilayer capacitors

Class 2, Y5V
16/25/50 V

FEATURES

- Five standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- NiSn terminations.

APPLICATIONS

- Consumer electronics, for example:
 - Tuners
 - Television receivers
 - Video recorders
 - All types of cameras
 - Mobile telephones.

DESCRIPTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two terminations and finally covered with a layer of plated tin (NiSn). A cross section of the structure is shown in Fig.1.

QUICK REFERENCE DATA

| DESCRIPTION | VALUE |
|---------------------------------|--|
| Rated voltage U_R (DC) | 16 V, 25 V, 50 V |
| Capacitance range (E6 series) | 10 nF to 10 μ F; note 1 |
| Tolerance on capacitance | $\pm 20\%$ (M); -20% to $+80\%$ (Z) |
| Test voltage (DC) for 1 minute: | $2.5 \times U_R$ |
| Sectional specifications | IEC 60384-10, second edition 1989-04 |
| Detailed specification | based on IEC 60384-10-1 |
| End terminations | NiSn |
| Climatic category (IEC 60068) | 30/85/21 |

Note

1. Measured at 25 °C, 1 V and 1 kHz, using a four-gauge method.

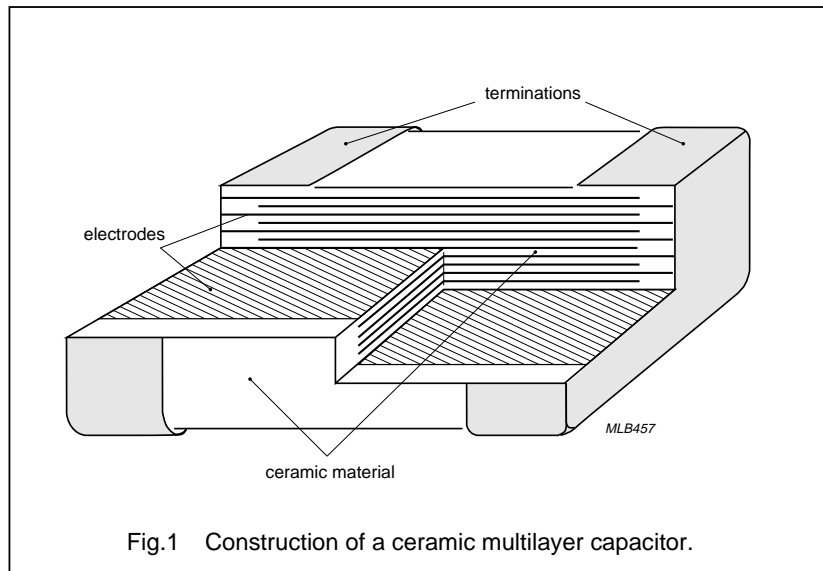
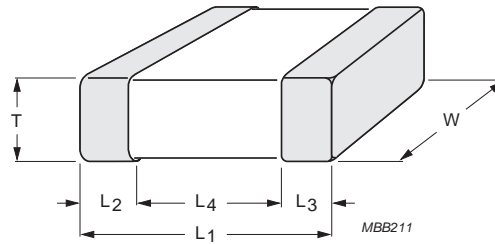


Fig.1 Construction of a ceramic multilayer capacitor.

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MECHANICAL DATA



For dimensions see Table 1.

Fig.2. Component outline.

Physical dimensions

Table 1 Capacitor dimensions; see Fig.2

| CASE SIZE | L ₁ | W | T | | L ₂ and L ₃ . | | L ₄ MIN. |
|----------------------------------|----------------|--------------|-------|-------|-------------------------------------|-------|------------------------|
| | | | MIN. | MAX. | MIN. | MAX. | |
| Dimensions in millimetres | | | | | | | |
| 0402 | 1.0 ±0.05 | 0.5 ±0.05 | 0.45 | 0.55 | 0.15 | 0.30 | 0.40 |
| 0603 | 1.6 ±0.10 | 0.8 ±0.07 | 0.73 | 0.87 | 0.25 | 0.65 | 0.40 |
| 0805 | 2.0 ±0.10 | 1.25 ±0.10 | 0.50 | 1.35 | 0.25 | 0.75 | 0.55 |
| 1206 | 3.2 ±0.15 | 1.6 ±0.15 | 0.50 | 1.75 | 0.25 | 0.75 | 1.40 |
| 1210 | 3.2 ±0.20 | 2.5 ±0.20 | 1.40 | 1.60 | 0.25 | 0.75 | 1.40 |
| Dimensions in inches | | | | | | | |
| 0402 | 0.040 ±0.002 | 0.020 ±0.002 | 0.018 | 0.022 | 0.008 | 0.012 | 0.016 |
| 0603 | 0.063 ±0.004 | 0.032 ±0.003 | 0.029 | 0.035 | 0.010 | 0.026 | 0.016 |
| 0805 | 0.079 ±0.004 | 0.049 ±0.004 | 0.020 | 0.053 | 0.010 | 0.030 | 0.022 |
| 1206 | 0.126 ±0.006 | 0.063 ±0.006 | 0.020 | 0.069 | 0.010 | 0.030 | 0.056 |
| 1210 | 0.126 ±0.008 | 0.098 ±0.008 | 0.047 | 0.069 | 0.010 | 0.030 | 0.056 |

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SELECTION CHART FOR 16 V AND 25 V

| C (nF) | LAST TWO DIGITS OF 12NC | 16 V | | | | | 25 V | | | |
|-----------|-------------------------------------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|----------|
| | | 0402 | 0603 | 0805 | 1206 | 1210 | 0603 | 0805 | 1206 | 1210 |
| 1 | 23 | | | | | | | | | |
| 1.5 | 25 | | | | | | | | | |
| 2.2 | 27 | | | | | | | | | |
| 3.3 | 29 | | | | | | | | | |
| 4.7 | 32 | | | | | | | | | |
| 6.8 | 34 | | | | | | | | | |
| 10 | 36 | | | | | | | | | |
| 15 | 38 | | | | | | | | | |
| 22 | 41 | | | | | | 0.8 ±0.07 | | | |
| 33 | 43 | 0.5 ±0.05 | | | | | | | | |
| 47 | 45 | | | | | | | | | |
| 68 | 47 | | | | | | | | | |
| 100 | 49 | | | | | | | 0.6 ±0.1 | | |
| 150 | 52 | | | | | | | 0.85 ±0.1 | | |
| 220 | 54 | | 0.8 ±0.07 | | | | | | 0.6 ±0.1 | |
| 330 | 56 | | | | | | | | | |
| 470 | 58 | | | 0.85 ±0.1 | | | | | 0.85 ±0.1 | |
| 680 | 61 | | | | | | | 1.25 ±0.1 | | |
| 1 000 | 63 | | | | 0.85 ±0.1 | | | | 1.15 ±0.1 | |
| 1 500 | 65 | | | 1.25 ±0.1 | | | | | | |
| 2 200 | 67 | | | | | | | | | |
| 3 300 | 69 | | | | 1.15 ±0.1 | | | | | |
| 4 700 | 72 | | | | | | | | | |
| 10 000 | 76 | | | | | 1.5 ±0.1 | | | | 1.5 ±0.1 |

Note

1. Values in shaded cells indicate thickness class in mm.

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SELECTION CHART FOR 50 V

| C (nF) | LAST TWO DIGITS OF 12NC | 50 V | | |
|-----------|-------------------------------------|-----------|-----------|-----------|
| | | 0603 | 0805 | 1206 |
| 10 | 05 | | | |
| 15 | 06 | | | |
| 22 | 07 | | | |
| 33 | 08 | 0.8 ±0.07 | 0.6 ±0.1 | |
| 47 | 09 | | | |
| 68 | 11 | | | |
| 100 | 12 | | | |
| 150 | 13 | | 0.85 ±0.1 | 0.6 ±0.1 |
| 220 | 14 | | | |
| 330 | 15 | | 1.25 ±0.1 | |
| 470 | 16 | | | 0.85 ±0.1 |
| 680 | 17 | | | |
| 1 000 | 18 | | | 1.15 ±0.1 |

Note

1. Values in shaded cells indicate thickness class in mm.

Thickness classification and packing quantities

| THICKNESS CLASSIFICATION (mm) | 8 mm TAPE WIDTH QUANTITY PER REEL | | | | QUANTITY PER BULK CASE | | |
|-------------------------------------|-----------------------------------|---------|--------------|---------|------------------------|--------|--------|
| | Ø180 mm; 7" | | Ø330 mm; 13" | | 0402 | 0603 | 0805 |
| | PAPER | BLISTER | PAPER | BLISTER | | | |
| 0.5 ±0.05 | 10 000 | – | 50 000 | – | 50 000 | – | – |
| 0.6 ±0.10 | 4 000 | – | 20 000 | – | – | – | 10 000 |
| 0.8 ±0.07 | 4 000 | – | 15 000 | – | – | 15 000 | – |
| 0.85 ±0.10 | 4 000 | – | 15 000 | – | – | 15 000 | 8 000 |
| 1.15 ±0.10 | – | 3 000 | – | 10 000 | – | – | – |
| 1.25 ±0.10 | – | 3 000 | – | 1 000 | – | – | 5 000 |
| 1.5 ±0.10 | – | 3 000 | – | – | – | – | – |

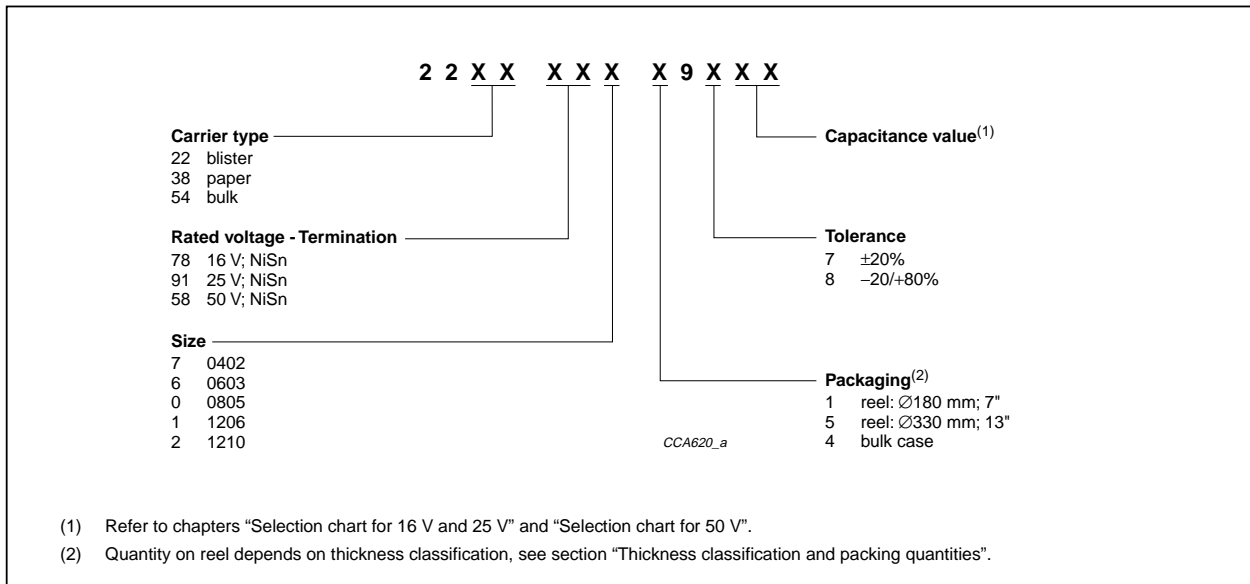
Surface-mount ceramic multilayer capacitors

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ORDERING INFORMATION

Components may be ordered by using either a Phycomp's unique 12NC or simple 15-digit clear text code.

Ordering code 12NC (preferred)



Phycomp Clear text code

EXAMPLE: 12062F105M8BB0D

| Size Code | Temp. Char. | Capacitance | Tol. | Vol. | Termination | Packing | Marking | Series |
|--------------------------------------|-------------|--|-----------------------------|----------------------------------|-------------|---|----------------|---------|
| 0402 0603 0805 1206 1210 | 2F = Y5V | 105 = 1000000 pF; the third digit signifies the multiplying factor: 2 = x 100 3 = x 1000 4 = x 10 000 5 = x 100 000 6 = x 1 000 000 | M = ±20% Z = -20% / +80% | 7 = 16 V 8 = 25 V 9 = 50 V | B = NiSn | 2 = 180 mm; 7" paper 3 = 330 mm; 13" paper B = 180 mm; 7" blister F = 330 mm; 13" blister P = bulk case | 0 = no marking | D = BME |

Surface-mount ceramic multilayer capacitors

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ELECTRICAL CHARACTERISTICS

Class 2 capacitors; Y5V dielectric; NiSn terminations

Unless otherwise stated all electrical values apply at an ambient temperature of 25 ± 1 °C, an atmospheric pressure of 86 to 105 kPa, and a relative humidity of 63 to 67%.

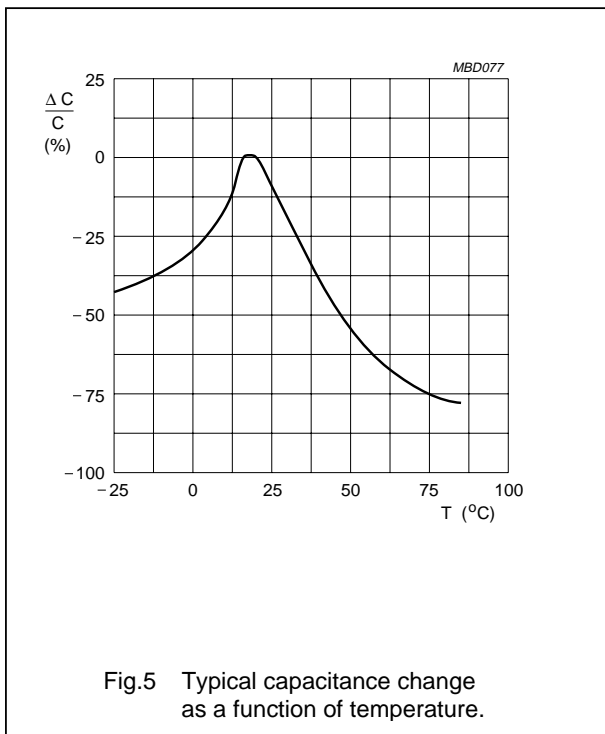
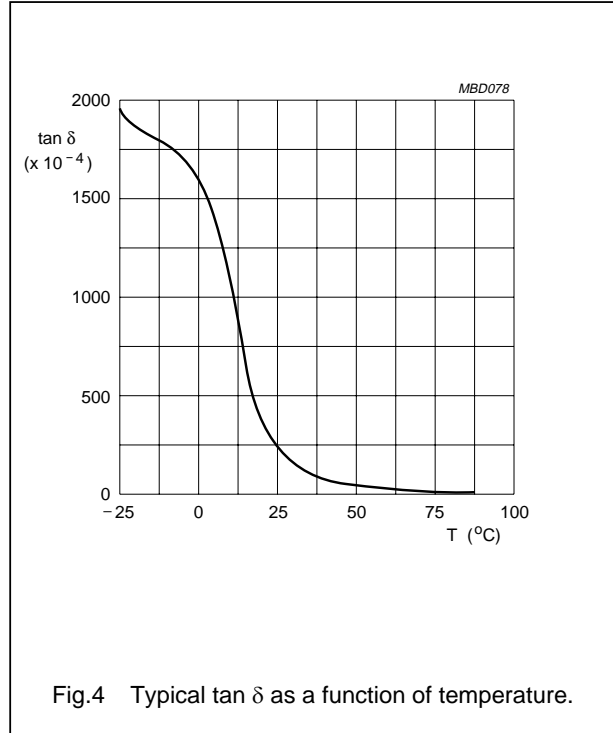
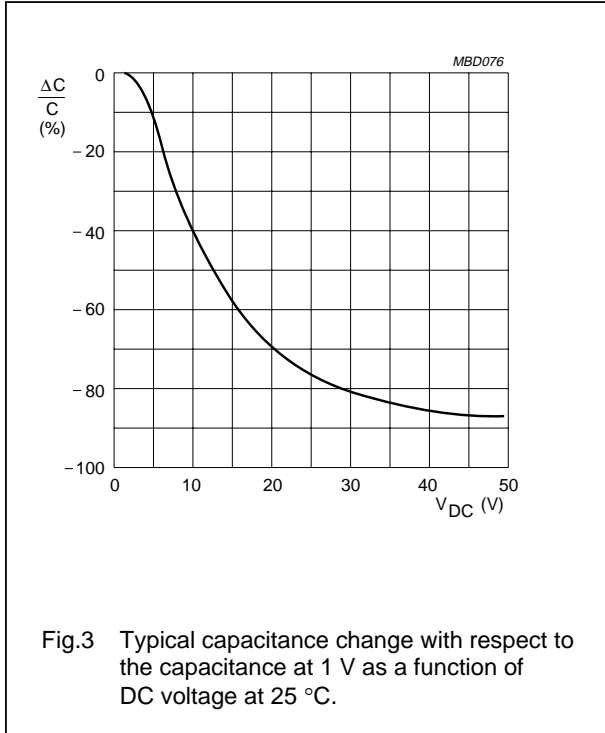
| DESCRIPTION | VALUE |
|---|--|
| Capacitance range (E6 series); note 1 | 10 nF to 10 μ F |
| Tolerance on capacitance after 1000 hours | $\pm 20\%$ (M); -20% to $+80\%$ (Z) |
| Tan δ ; note 1: all 25 V and 50 V except 0805 \geq 330 nF; 0603 /100 nF; 1206 /1 μ F; 1210 /10 μ F sizes 0805 / 330 nF; 0603 / 100 nF; 1206 /1 μ F 25 V 0805 \geq 470 nF 1210 /10 μ F all 16 V except 0402; 0603 \geq 330 nF; 0805 \geq 1.5 μ F; 1206 \geq 3.3 μ F; 1210 /10 μ F sizes 0402; 0603 \geq 330 nF; 0805 \geq 1.5 μ F; 1206 \geq 3.3 μ F; 1210 /10 μ F | $\leq 5\%$ $\leq 7\%$ $\leq 9\%$ $\leq 12.5\%$ $\leq 9\%$ $\leq 12.5\%$ |
| Insulation resistance after 1 minute at U_R (DC): | $R_{ins} > 10$ G Ω or $R_{ins} \times C \geq 500$ seconds whichever is less |
| Maximum capacitance change with respect to capacitance at 25 °C (for typical values see Fig.5) | $+22\%$ to -82% |
| Ageing | typical 7% per time decade |
| Resistance to soldering heat | 260 °C; 10 seconds |

Note

1. Measured at 25 °C, 1 V, 1 kHz, using a four-gauge method.

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TESTS AND REQUIREMENTS

Table 2 Test procedures and requirements

| IEC 60384-10/ CECC 32 100 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS |
|---|----------------------------------|---------------------------------------|--|---|
| 4.4 | | mounting | the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering, reflow soldering (including vapour phase soldering) or conductive adhesive | no visible damage |
| 4.5 | | visual inspection and dimension check | any applicable method using $\times 10$ magnification | in accordance with specification |
| 4.6.1 | | capacitance | $f = 1 \text{ kHz}$; Y5V measuring voltage $1 V_{\text{rms}}$ at $25 \text{ }^\circ\text{C}$ | within specified tolerance |
| 4.6.2 | | $\tan \delta$ | $f = 1 \text{ kHz}$; Y5V measuring voltage $1 V_{\text{rms}}$ at $25 \text{ }^\circ\text{C}$ | in accordance with specification |
| 4.6.3 | | insulation resistance | at U_R (DC) for 1 minute | $R_i C_R \geq 500 \text{ s}$ |
| 4.6.4 | | voltage proof | $2.5 \times U_R$ for 1 minute | no breakdown or flashover |
| 4.7.1 | | temperature coefficient | between minimum and maximum temperature | in accordance with specification |
| 4.8 | | adhesion | a force of 5 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate | no visible damage |
| 4.9 | | bond strength of plating on end face | mounted in accordance with IEC 60384-1, paragraph 4.35 | no visible damage |
| | | | conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm | $\Delta C/C: \leq 30\%$ |
| 4.10 | Tb | resistance to soldering heat | preconditioning: 120 to 150 $^\circ\text{C}$ during 1 minute; 260 $\pm 5 \text{ }^\circ\text{C}$ for 10 $\pm 0.5 \text{ s}$ in a static solder bath | the terminations shall be well tinned after recovery $\Delta C/C: \pm 20\%$ $\tan \delta$: original specification R_{ins} : original specification |
| | | resistance to leaching | 260 $\pm 5 \text{ }^\circ\text{C}$ for 30 $\pm 1 \text{ s}$ in a static solder bath | using visual enlargement of $\times 10$, dissolution of the terminations shall not exceed 10% |

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| IEC 60384-10/ CECC 32 100 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS |
|---|----------------------------------|-----------------------------|---|---|
| 4.11 | Ta | solderability | zero hour test, and test after storage (20 to 24 months) in original packing in normal atmosphere; unmounted chips completely immersed for 2 ± 0.5 s in a solder bath at 235 ± 5 °C | the terminations shall be well tinned |
| 4.12 | Na | rapid change of temperature | preconditioning: between minimum and maximum temperature, 5 cycles | no visible damage after 48 hours recovery: $\Delta^{\circ}\text{C}/\text{C}: \leq \pm 20\%$ |
| 4.14 | Ca | damp heat, steady state | initialization: 48 ± 4 hours after U_R at 40 °C for 1 hour (for initial value measurement); 500 ± 12 hours at 40 °C; 90 to 95% RH; U_R applied | no visible damage after 48 hours recovery: $\Delta^{\circ}\text{C}/\text{C}: +30\%/-40\%$ $\tan \delta: \leq 15\%$ $R_{\text{ins}}: 500 \text{ M}\Omega$ or $R_i C_R \geq 100 \text{ s}$, whichever is less |
| | | damp heat; with U_R load | initialization: 48 hours after U_R at 40 °C; for 1 hour (for initial value measurement); 500 ± 12 hours at 40 °C; 90 to 95% RH; U_R applied | preconditioning: U_R at 40 °C for 1 hour, after 48 hours recovery: $\Delta^{\circ}\text{C}/\text{C}: +30\%/-40\%$ $\tan \delta: \leq 15\%$ $R_{\text{ins}}: 500 \text{ M}\Omega$ or $R_i C_R \geq 25 \text{ s}$, whichever is less |
| 4.15 | | endurance | initialization: $2 \times U_R$ at 85 °C for 1 hour, (initial value measurement after 48 ± 4 hours); $2 \times U_R$ at 85 °C for 1000 hours recovery 48 ± 4 hours at room temperature | after 48 hours recovery: $\Delta^{\circ}\text{C}/\text{C}: +30\%/-40\%$ $\tan \delta: \leq 15\%$ $R_{\text{ins}}: 1000 \text{ M}\Omega$ or $R_i C_R \geq 50 \text{ s}$, whichever is less |

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REVISION HISTORY

| Revision | Date | Change Notification | Description |
|----------|-------------|---------------------|------------------------|
| Rev.7 | 2003 Jul 08 | - | - Updated company logo |