

# Thick Film Chip Resistors



## Features:

- Small size and light weight.
- Suitable for both flow and reflow soldering.
- Reduction of assembly costs and matching with placement machines.

## Performance Specifications:

|                                 |   |
|---------------------------------|---|
| Temperature coefficient         | : $\pm 5\%$ : $1\Omega \sim 10\Omega \leq \pm 200\text{PPM}/^\circ\text{C}$<br>$\pm 1\%$ : $10\Omega \sim 100\Omega \leq \pm 200\text{PPM}/^\circ\text{C}$ ; $101\Omega \sim 1\text{M}\Omega \leq \pm 100\text{PPM}/^\circ\text{C}$ . |
| Short-time overload             | : $\pm 5\%$ : $\pm(2.0\% + 0.1\Omega)$ Maximum<br>$\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Maximum.   |
| Minimum Insulation resistance   | : 1000 Megaohm.   |
| Dielectric withstanding voltage | : No evidence of flashover, mechanical damage, arcing or insulation breakdown.  |
| Terminal bending                | : $\pm(1.0\% + 0.05\Omega)$ Maximum .   |
| Soldering heat                  | : $\pm(1.0\% + 0.05\Omega)$ Maximum.  |
| Minimum solderability           | : 95% coverage.   |
| Temperature cycling             | : $\pm 5\%$ : $\pm(1.0\% + 0.05\Omega)$ Maximum<br>$\pm 1\%$ : $\pm(0.5\% + 0.05\Omega)$ Maximum.   |
| Humidity (Steady state)         | : $\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Maximum<br>$\pm 1\%$ : $\pm(0.5\% + 0.1\Omega)$ Maximum.   |
| Load life in humidity           | : $\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Maximum<br>$\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Maximum.   |
| Load life                       | : $\pm 5\%$ : $\pm(3.0\% + 0.1\Omega)$ Maximum<br>$\pm 1\%$ : $\pm(1.0\% + 0.1\Omega)$ Maximum.   |

\*The values which are not of standard E-24 series (2% & 5%) and not of E-96 series (1%) could be offered on a case to case basis.

## Specification Table

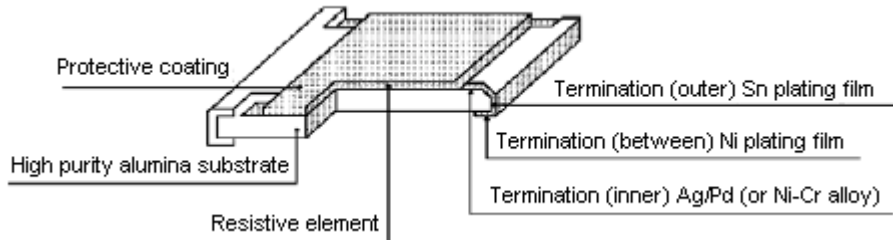
| Type | Power Rating at 70°C (W) | Maximum Working Voltage (V) | Maximum Overload Voltage (V) | Operating Temperature (°C) | Tolerance (%)                 | Resistance Range                    | Standard Series   |
|------|--------------------------|-----------------------------|------------------------------|----------------------------|-------------------------------|-------------------------------------|-------------------|
| 0402 | 1/16                     | 1A                          | 2A                           | -55 to +155                | Jumper                        | <50mΩ                               | E96<br>E24<br>E24 |
|      |                          | 50                          | 100                          |                            | $\pm 1$<br>$\pm 2$<br>$\pm 5$ | 10Ω - 1MΩ<br>1Ω - 10MΩ<br>1Ω - 10MΩ |                   |



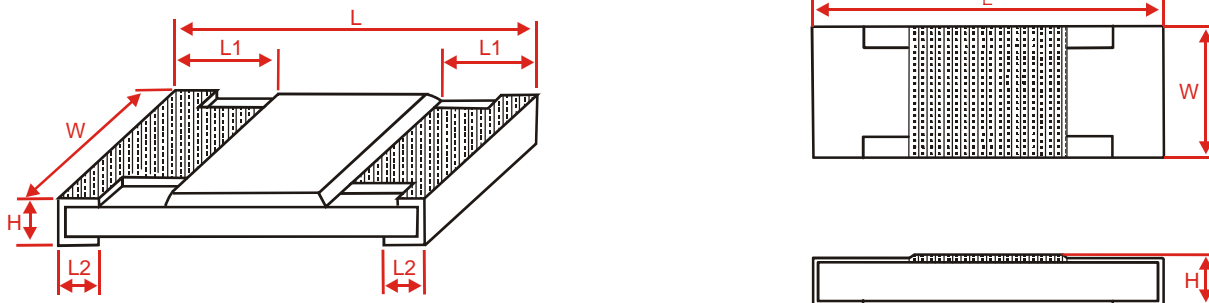
# Thick Film Chip Resistors



## Construction:



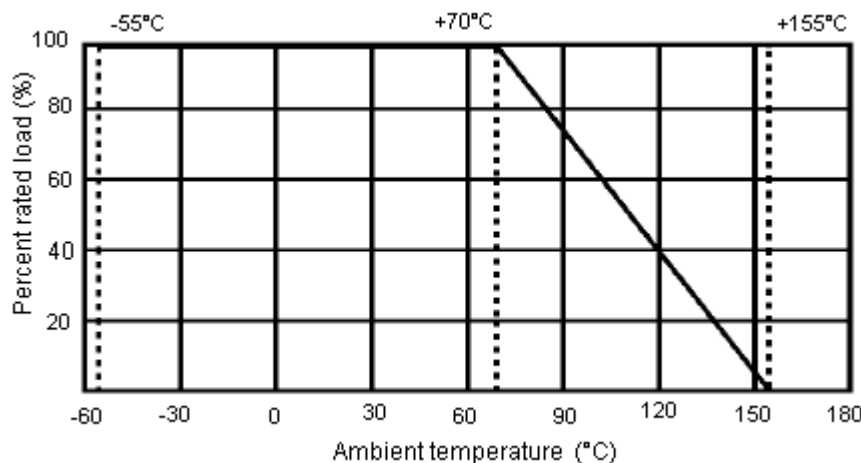
## Power Rating and Dimension:



| Series | Dimension             |                      |                       |                        |                        |
|--------|-----------------------|----------------------|-----------------------|------------------------|------------------------|
|        | Length (L) $\pm 0.10$ | Width (W) $\pm 0.05$ | Height (H) $\pm 0.05$ | Length (L1) $\pm 0.10$ | Length (L2) $\pm 0.10$ |
| 0402   | 1.00                  | 0.50                 | 0.35                  | 0.20                   | 0.25                   |

Dimensions : Millimetres

## Derating Curve



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## Marking on the Resistors Body

- For 0402 size, no marking on the body due to the small size of resistor.
- $\pm 5\%$  tolerance product. (Including resistance values less than  $1\Omega$ ; both 1% and 5%) The marking is 3 digits, the first 2 digits are the significant figures of the resistance and the 3rd digit denotes number of zeros.

153 =  $15000\Omega = 15K\Omega$ ; 120 =  $12\Omega$

Below  $10\Omega$  shown as this: 6R8 =  $6.8\Omega$

|  |     |  |
|--|-----|--|
|  | 153 |  |
|--|-----|--|

|  |     |  |
|--|-----|--|
|  | 6R8 |  |
|--|-----|--|

## Resistance Preferred Value Range

| E6 | E12 | E24 | E96  | E6 | E12 | E24 | E96  | E6 | E12 | E24 | E96  |
|----|-----|-----|------|----|-----|-----|------|----|-----|-----|------|
| 10 | 10  | 10  | 10.0 |    |     |     | 21.5 |    |     |     | 46.4 |
|    |     |     | 10.2 | 22 | 22  | 22  | 22.1 | 47 | 47  | 47  | 47.5 |
|    |     |     | 10.5 |    |     |     | 22.6 |    |     |     | 48.7 |
|    |     |     | 10.7 |    |     |     | 23.2 |    |     |     | 49.9 |
|    |     | 11  | 11.0 |    |     |     | 23.7 |    |     | 51  | 51.1 |
|    |     |     | 11.3 |    |     | 24  | 24.3 |    |     |     | 52.3 |
|    |     |     | 11.5 |    |     |     | 24.9 |    |     |     | 53.6 |
|    |     |     | 11.8 |    |     |     | 25.5 |    |     |     | 54.9 |
|    | 12  | 12  | 12.1 |    |     |     | 26.1 |    | 56  | 56  | 56.2 |
|    |     |     | 12.4 |    |     |     | 27.7 |    |     |     | 57.6 |
|    |     |     | 12.7 |    |     | 27  | 27.4 |    |     |     | 59.0 |
|    |     | 13  | 13.0 |    |     |     | 28.0 |    |     |     | 60.4 |
|    |     |     | 13.3 |    |     |     | 28.7 |    |     | 62  | 61.9 |
|    |     |     | 13.7 |    |     |     | 29.4 |    |     |     | 63.4 |
|    |     |     | 14.0 |    |     | 30  | 30.1 |    |     |     | 64.9 |
|    |     |     | 14.3 |    |     |     | 30.9 |    |     |     | 66.5 |
|    |     |     | 14.7 |    |     |     | 31.6 | 68 | 68  | 68  | 68.1 |
| 15 | 15  | 15  | 15.0 |    |     |     | 32.4 |    |     |     | 69.8 |
|    |     |     | 15.4 | 33 | 33  | 33  | 33.2 |    |     |     | 71.5 |
|    |     |     | 15.8 |    |     |     | 34.0 |    |     |     | 73.2 |
|    |     | 16  | 16.2 |    |     |     | 34.8 |    |     | 75  | 75.0 |
|    |     |     | 16.5 |    |     |     | 35.7 |    |     |     | 76.8 |
|    |     |     | 16.9 |    |     | 36  | 36.5 |    |     |     | 78.7 |
|    |     |     | 17.4 |    |     |     | 37.4 |    |     |     | 80.6 |
|    |     |     | 17.8 |    |     |     | 38.3 |    | 82  | 82  | 82.5 |
|    | 18  | 18  | 18.2 |    | 39  | 39  | 39.2 |    |     |     | 84.5 |
|    |     |     | 18.7 |    |     |     | 40.2 |    |     |     | 86.6 |
|    |     |     | 19.1 |    |     |     | 41.2 |    |     |     | 88.7 |
|    |     |     | 19.6 |    |     |     | 42.2 |    |     | 91  | 90.9 |
|    |     | 20  | 20.0 |    |     | 43  | 43.2 |    |     |     | 93.1 |
|    |     |     | 20.5 |    |     |     | 44.2 |    |     |     | 95.3 |
|    |     |     | 21.0 |    |     |     | 45.3 |    |     |     | 97.6 |

Above values in accordance with IEC Publication 63 (1963) and BS2488



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## Part Number Table

| Resistance Value | Part Number    |
|------------------|----------------|
| 0R               | 0402WGF0000TCE |
| 1R5              | 0402WGF150KTCE |
| 2R2              | 0402WGF220KTCE |
| 3R3              | 0402WGF330KTCE |
| 4R7              | 0402WGF470KTCE |
| 6R8              | 0402WGF680KTCE |
| 10R              | 0402WGF100JTCE |
| 11R              | 0402WGF110JTCE |
| 12R              | 0402WGF120JTCE |
| 13R              | 0402WGF130JTCE |
| 15R              | 0402WGF150JTCE |
| 16R              | 0402WGF160JTCE |
| 18R              | 0402WGF180JTCE |
| 20R              | 0402WGF200JTCE |
| 22R              | 0402WGF220JTCE |
| 24R              | 0402WGF240JTCE |
| 27R              | 0402WGF270JTCE |
| 30R              | 0402WGF300JTCE |
| 33R              | 0402WGF330JTCE |
| 36R              | 0402WGF360JTCE |
| 39R              | 0402WGF390JTCE |
| 43R              | 0402WGF430JTCE |
| 47R              | 0402WGF470JTCE |
| 51R              | 0402WGF510JTCE |
| 56R              | 0402WGF560JTCE |
| 62R              | 0402WGF620JTCE |
| 68R              | 0402WGF680JTCE |
| 75R              | 0402WGF750JTCE |
| 82R              | 0402WGF820JTCE |
| 91R              | 0402WGF910JTCE |
| 100R             | 0402WGF1000TCE |



# Thick Film Chip Resistors



## Part Number Table

| Resistance Value | Part Number    |
|------------------|----------------|
| 110R             | 0402WGF1100TCE |
| 120R             | 0402WGF1200TCE |
| 130R             | 0402WGF1300TCE |
| 150R             | 0402WGF1500TCE |
| 160R             | 0402WGF1600TCE |
| 180R             | 0402WGF1800TCE |
| 200R             | 0402WGF2000TCE |
| 220R             | 0402WGF2200TCE |
| 240R             | 0402WGF2400TCE |
| 270R             | 0402WGF2700TCE |
| 300R             | 0402WGF3000TCE |
| 330R             | 0402WGF3300TCE |
| 360R             | 0402WGF3600TCE |
| 390R             | 0402WGF3900TCE |
| 430R             | 0402WGF4300TCE |
| 470R             | 0402WGF4700TCE |
| 510R             | 0402WGF5100TCE |
| 560R             | 0402WGF5600TCE |
| 620R             | 0402WGF6200TCE |
| 680R             | 0402WGF6800TCE |
| 750R             | 0402WGF7500TCE |
| 820R             | 0402WGF8200TCE |
| 910R             | 0402WGF9100TCE |
| 1K               | 0402WGF1001TCE |
| 1K1              | 0402WGF1101TCE |
| 1K2              | 0402WGF1201TCE |
| 1K3              | 0402WGF1301TCE |
| 1K5              | 0402WGF1501TCE |
| 1K6              | 0402WGF1601TCE |
| 1K8              | 0402WGF1801TCE |
| 2K               | 0402WGF2001TCE |



# Thick Film Chip Resistors



## Part Number Table

| Resistance Value | Part Number    |
|------------------|----------------|
| 2K2              | 0402WGF2201TCE |
| 2K4              | 0402WGF2401TCE |
| 2K7              | 0402WGF2701TCE |
| 3K               | 0402WGF3001TCE |
| 3K3              | 0402WGF3301TCE |
| 3K6              | 0402WGF3601TCE |
| 3K9              | 0402WGF3901TCE |
| 4K3              | 0402WGF4301TCE |
| 4K7              | 0402WGF4701TCE |
| 5K1              | 0402WGF5101TCE |
| 5K6              | 0402WGF5601TCE |
| 6K2              | 0402WGF6201TCE |
| 6K8              | 0402WGF6801TCE |
| 7K5              | 0402WGF7501TCE |
| 8K2              | 0402WGF8201TCE |
| 9K1              | 0402WGF9101TCE |
| 10K              | 0402WGF1002TCE |
| 11K              | 0402WGF1102TCE |
| 12K              | 0402WGF1202TCE |
| 13K              | 0402WGF1302TCE |
| 15K              | 0402WGF1502TCE |
| 16K              | 0402WGF1602TCE |
| 18K              | 0402WGF1802TCE |
| 20K              | 0402WGF2002TCE |
| 22K              | 0402WGF2202TCE |
| 24K              | 0402WGF2402TCE |
| 27K              | 0402WGF2702TCE |
| 30K              | 0402WGF3002TCE |
| 33K              | 0402WGF3302TCE |
| 36K              | 0402WGF3602TCE |
| 39K              | 0402WGF3902TCE |



# Thick Film Chip Resistors



## Part Number Table

| Resistance Value | Part Number    |
|------------------|----------------|
| 43K              | 0402WGF4302TCE |
| 47K              | 0402WGF4702TCE |
| 51K              | 0402WGF5102TCE |
| 56K              | 0402WGF5602TCE |
| 62K              | 0402WGF6202TCE |
| 68K              | 0402WGF6802TCE |
| 75K              | 0402WGF7502TCE |
| 82K              | 0402WGF8202TCE |
| 91K              | 0402WGF9102TCE |
| 100K             | 0402WGF1003TCE |
| 110K             | 0402WGF1103TCE |
| 120K             | 0402WGF1203TCE |
| 130K             | 0402WGF1303TCE |
| 150K             | 0402WGF1503TCE |
| 160K             | 0402WGF1603TCE |
| 180K             | 0402WGF1803TCE |
| 200K             | 0402WGF2003TCE |
| 220K             | 0402WGF2203TCE |
| 240K             | 0402WGF2403TCE |
| 270K             | 0402WGF2703TCE |
| 300K             | 0402WGF3003TCE |
| 330K             | 0402WGF3303TCE |
| 360K             | 0402WGF3603TCE |
| 390K             | 0402WGF3903TCE |
| 430K             | 0402WGF4303TCE |
| 470K             | 0402WGF4703TCE |
| 510K             | 0402WGF5103TCE |
| 560K             | 0402WGF5603TCE |
| 620K             | 0402WGF6203TCE |
| 680K             | 0402WGF6803TCE |
| 750K             | 0402WGF7503TCE |
| 820K             | 0402WGF8203TCE |
| 910K             | 0402WGF9103TCE |
| 1M               | 0402WGF1004TCE |



# Thick Film Chip Resistors



## Multiplier Code (for 0402 1% Marking)

| Code       | A      | B      | C      | D      | E      | F      | G      | H      | X         | Y         | Z         |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|-----------|-----------|
| Multiplier | $10^0$ | $10^1$ | $10^2$ | $10^3$ | $10^4$ | $10^5$ | $10^6$ | $10^7$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ |

## Standard E-96 Series Resistance Value Code (for 0402 1% Marking)

| Value | Code | Value | Code | Value | Code | Value | Code | Value | Code |
|-------|------|-------|------|-------|------|-------|------|-------|------|
| 100   | 01   | 162   | 21   | 261   | 41   | 422   | 61   | 681   | 81   |
| 102   | 02   | 165   | 22   | 267   | 42   | 432   | 62   | 698   | 82   |
| 105   | 03   | 169   | 23   | 274   | 43   | 442   | 63   | 715   | 83   |
| 107   | 04   | 174   | 24   | 280   | 44   | 453   | 64   | 732   | 84   |
| 110   | 05   | 178   | 25   | 287   | 45   | 464   | 65   | 750   | 85   |
| 113   | 06   | 182   | 26   | 294   | 46   | 475   | 66   | 768   | 86   |
| 115   | 07   | 187   | 27   | 301   | 47   | 487   | 67   | 787   | 87   |
| 118   | 08   | 191   | 28   | 309   | 48   | 499   | 68   | 806   | 88   |
| 121   | 09   | 196   | 29   | 316   | 49   | 511   | 69   | 825   | 89   |
| 124   | 10   | 200   | 30   | 324   | 50   | 523   | 70   | 845   | 90   |
| 127   | 11   | 205   | 31   | 332   | 51   | 536   | 71   | 866   | 91   |
| 130   | 12   | 210   | 32   | 340   | 52   | 549   | 72   | 887   | 92   |
| 133   | 13   | 215   | 33   | 348   | 53   | 562   | 73   | 909   | 93   |
| 137   | 14   | 221   | 34   | 357   | 54   | 576   | 74   | 931   | 94   |
| 140   | 15   | 226   | 35   | 365   | 55   | 590   | 75   | 953   | 95   |
| 143   | 16   | 232   | 36   | 374   | 56   | 604   | 76   | 976   | 96   |
| 147   | 17   | 237   | 37   | 383   | 57   | 619   | 77   | -     | -    |
| 150   | 18   | 243   | 38   | 392   | 58   | 634   | 78   | -     | -    |
| 154   | 19   | 249   | 39   | 402   | 59   | 649   | 79   | -     | -    |
| 158   | 20   | 255   | 40   | 412   | 60   | 665   | 80   | -     | -    |

## Stocked Values

| Tolerance | Wattage | Preferred Value Range | Range Value |
|-----------|---------|-----------------------|-------------|
| 1%        | 0.06W   | E96                   | 0R - 1M     |
| 1%        | 0.1W    | E24                   | 0R - 1M     |
| 1%        | 0.125W  | E24                   | 0R - 1M     |





















# Thick Film Chip Resistors



## Notes:

## International Sales Offices:

|  |   |   |   |   |  |   |   |
|--|---|---|---|---|--|---|---|
|    | <b>AUSTRALIA - Farnell</b><br>Tel No: ++61 1300 361 005<br>Fax No: ++61 1300 361 225        |    | <b>FINLAND - Farnell</b><br>Tel No: ++ 358 9 560 7780<br>Fax No: ++ 358 9 345 5411        |    | <b>ITALY - Farnell</b><br>Tel No: ++ 39 02 93 995 200<br>Fax No: ++ 39 02 93 995 300       |    | <b>SPAIN - Farnell</b><br>Tel No: 901 20 20 80<br>Fax No: 901 20 20 90  |
|   | <b>AUSTRIA - Farnell</b><br>Tel No: ++ 43 662 2180 680<br>Fax No: ++ 43 662 2180 670        |   | <b>FRANCE - Farnell</b><br>Tel No: ++ 33 474 68 99 99<br>Fax No: ++ 33 474 68 99 90       |   | <b>MALAYSIA - Farnell-Newark</b><br>Tel No: ++ 60 3 7873 8000<br>Fax No: ++ 60 3 7873 7000 |   | <b>SWEDEN - Farnell</b><br>Tel No: ++ 46 8 730 50 00<br>Fax No: ++ 46 8 83 52 62  |
|  | <b>BELGIUM - Farnell</b><br>Tel No: ++ 32 3 475 2810<br>Fax No: ++ 32 3 227 3648            |  | <b>GERMANY - Farnell</b><br>Tel No: ++ 49 89 61 39 39 39<br>Fax No: ++ 49 89 613 59 01    |  | <b>NETHERLANDS - Farnell</b><br>Tel No: ++ 31 30 241 7373<br>Fax No: ++ 31 30 241 7333     |    | <b>SWITZERLAND - Farnell</b><br>Tel No: ++ 44 204 64 64<br>Fax No: ++ 44 204 64 54  |
|  | <b>BRAZIL - Farnell-Newark</b><br>Tel No: ++ 55 11 4066 9400<br>Fax No: ++ 55 11 4066 9410  |  | <b>HONG KONG - Farnell-Newark</b><br>Tel No: ++ 852 2268 9888<br>Fax No: ++ 852 2268 9899 |  | <b>NEW ZEALAND - Farnell</b><br>Tel No: 0800 90 80 80<br>Fax No: 0800 90 80 81             |    | <b>UK - Farnell</b><br>Tel No: ++ 44 8701 200 200<br>Fax No: ++ 44 8701 200 201   |
|  | <b>CHINA - Farnell-Newark</b><br>Tel No: ++86 10 6238 5152<br>Fax No: ++86 10 6238 5022     |  | <b>HUNGARY - Farnell</b><br>Tel No: ++ 44 870 1200 208<br>Fax No: ++ 44 870 1200 209      |  | <b>NORWAY - Farnell</b><br>Tel No: 800 146 70<br>Fax No: 800 146 76                        |    | <b>UK - CPC</b><br>++ 44 8701 202 530<br>++ 44 8701 202 531   |
|  | <b>CZECH REPUBLIC - Farnell</b><br>Tel No: ++ 44 870 1200 208<br>Fax No: ++ 44 870 1200 209 |  | <b>INDIA - Farnell</b><br>Tel No: ++ 44 870 1200 208<br>Fax No: ++ 44 870 1200 209        |  | <b>PORTUGAL - Farnell</b><br>Tel No: ++ 34 93 475 8804<br>Fax No: ++ 34 93 474 5288        |    | <b>USA - Newark</b><br>Tel No: 800 463 9275   |
|  | <b>DENMARK - Farnell</b><br>Tel No: ++ 45 44 53 66 44<br>Fax No: ++ 45 44 53 66 06          |  | <b>IRELAND - Farnell</b><br>Tel No: ++ 353 1 830 9277<br>Fax No: ++ 353 1 830 9016        |  | <b>RUSSIA - Farnell</b><br>Tel No: ++ 44 870 1200 208<br>Fax No: ++ 44 870 1200 209        |    | <b>EXPORT - Farnell</b><br>Tel No: ++ 44 8701 200 208<br>Fax No: ++ 44 8701 200 209<br>For enquiries from all other markets |
|  | <b>ESTONIA - Farnell</b><br>Tel No: ++ 358 9 560 7780<br>Fax No: ++ 358 9 345 5411          |  | <b>ISRAEL - Farnell</b><br>Tel No: ++ 180 937 0015<br>Fax No: ++ 180 937 0014             |  | <b>SINGAPORE - Farnell-Newark</b><br>Tel No: ++ 65 6788 0200<br>Fax No: ++ 65 6788 0300    | <a href="http://www.farnell.com">http://www.farnell.com</a><br><a href="http://www.newark.com">http://www.newark.com</a><br><a href="http://www.cpc.co.uk">http://www.cpc.co.uk</a> |   |

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