All values reported here are results of experiments in our laboratories intended to illustrate product performance potential with a given experimental design. They are not intended to represent the product’s specifications, details of which are available upon demand.

**PRODUCT DESCRIPTION**

DuPont 17G-Series screen printable resistor compositions are specially formulated and tested for use on gold conductor terminations. These compositions range from 3 Ω/sq to 1 MΩ/sq. Each member is blendable with the adjacent members. There are no blend breaks. The length effects have been characterized for very small resistors.

**PRODUCT BENEFITS**

- Qualified and tested on Au conductor
- Excellent encapsulated and unencapsulated post laser trim stability after laser trimming and long term storage
- Optimised for 60 minute 850°C firing profile
- Fully blendable resistor series
- Phthalate, Cadmium, Nickel oxide free*

* Phthalate, Cadmium and Nickel oxide ‘free’ as used herein means that cadmium, phthalate and nickel oxide are not intentional ingredients in and are not intentionally added to the referenced product. Trace amounts however may be present.

**PROCESSING SUMMARY**

**Screen Type**

- 200 mesh stainless steel screen with a 12-18 µm emulsion build up. Nylon or polyester screens may be used in some applications. A 150-175 mesh screen will usually be required to achieve equivalent print thickness.
- Recommended dried thickness 25+/-3 µm.

**Drying**

- Allow prints to level for over 10 minutes at room temperature, then dry for ≥ 10 -15 minutes at 150°C

**Firing**

- 850°C peak held for 10 minutes on 60 minute cycle in an air atmosphere. DuPont 17G-Series resistivity and TCR specifications are based on a 60-min firing cycle with a 10 min peak at 850°C, 20 min above 800°C and 30 min above 600°C (see Chart 1).

**COMPATIBILITY**

Whilst DuPont has tested this composition with the materials specified above and the recommended processing conditions, it is impossible or impractical to cover every combination of materials, customer processing conditions and circuit layouts. It is therefore essential that customers thoroughly evaluate the material in their specific situations in order to completely satisfy themselves with the overall quality and suitability of the composition for its intended application(s).

**Table 1-Typical Physical Properties**

<table>
<thead>
<tr>
<th>Test</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity (Pa.s.) Brookfield HBT, utility cup and spindle, (SC4-14/6R), 10 rpm, 25°C±0.2°C</td>
<td>145-210</td>
</tr>
<tr>
<td>Coverage [cm²/g] Based on wet thickness of 50µm</td>
<td>80-110</td>
</tr>
<tr>
<td>Thinner</td>
<td>4036 or 8250 or 4553</td>
</tr>
<tr>
<td>Shelf Life (months)</td>
<td>6</td>
</tr>
</tbody>
</table>

**TERMINATIONS**

Use of a different termination material may cause a shift of TCR and resistivity values from those stated.

**RESISTOR GEOMETRY**

17G-Series compositions are quality Assured tested using a 1.5mm x 1.5mm resistor with prefired DuPont Au termination. Variations in resistor geometry will result in slight variations of resistivity and TCR values. Length effect curves are presented in figure 3, with data based on tests of 0.5-1.5 mm wide resistors varying in aspect ration from 0.4—4.0sq.

**BLENDING ADJACENT MEMBERS**

Adjacent members of 17G-Series are blendable. See figure 2.
**DUPONT 17G-SERIES**

**STORAGE AND SHELF LIFE**
Containers may be stored in a clean, stable environment at room temperature (between 5°C – 30°C) with their lids tightly sealed. Storage in high temperature (<30°C) or in freezers (temperature <0° C) is NOT recommended as this could cause irreversible changes in the material. The shelf life of compositions in factory-sealed (unopened) containers between (5°C – 30°C) is 6 months from date of shipment.

**SUBSTRATES**
Substrates of different compositions and from various manufacturers may result in variations in performance properties.

**THINNER**
17G-Series compositions are optimized for screen printing and thinning is not normally required. Use the DuPont recommended thinner for slight adjustments to viscosity or to replace evaporation losses. The use of too much thinner or the use of a non-recommended thinner may affect the rheological behaviour of the material and its printing characteristics. Please refer to table 1.

**PRINTING**
The composition should be thoroughly mixed before use. This is best achieved by slow, gentle hand stirring with a clean burr-free spatula (flexible plastic or stainless steel) for about 1-2 minutes. Care must be taken to avoid air entrapment. Printing should be performed in a well ventilated area. Additional information on requirements for printing areas is contained in DuPont Technical Guide EUT 7.3 ‘Processing-Screen Printing Rooms’ available on request. Note: optimum printing characteristics are generally achieved in the room temperature range of 20°C-23°C. It is therefore important that the material, in its container, is at the temperature prior to commencement of printing. Class 10,000 printing area is recommended for building complex hybrids and multilayer circuits, otherwise severe yield losses could occur. Refer to ‘Processing Summary’.

**DRYING**
Allow prints to level at room temperature, then dry in a well ventilated oven or conveyor dryer. Refer to ‘Processing Summary’.

**FIRING**
Fire in well ventilated belt, conveyor furnace or static furnace. Air flows and extraction rates should be optimized to ensure that oxidizing conditions exist within the muffle and that no exhaust gases enter the room.

Full information on requirements for firing is contained in DuPont Technical Guide EUT 7.4 ‘Process Guide-Firing’. Refer to ‘Processing Summary’.

**ENCAPSULATION**
In general, glass encapsulation is not required. However, in applications which require mechanical protection or protection from extreme environments such as high temperature nitrogen or forming gas, DuPont encapsulant compositions QQ550 and QQ620 are recommended.

**GENERAL**
Performance will depend to a large degree on care exercised in screen printing. Scrupulous care should be taken to keep the composition, printing screens and other tools free of metal contamination. Dust, lint and other particulate matter may also contribute to poor yields.

**SAFETY AND HANDLING**
DuPont thick film compositions are intended for use in an industrial environment by trained personnel. All appropriate health/ safety regulations regarding storage, handling and processing of such materials should be complied with. For information on health / safety regulations please refer to the specific product MSDS and to the DuPont Safety Guide EUT 7.1 ‘Practical Safe Handling of Thick Film Compositions’.
Table 2-Typical Fired Properties

<table>
<thead>
<tr>
<th></th>
<th>1703H</th>
<th>1708H</th>
<th>1718H</th>
<th>1728</th>
<th>1738R</th>
<th>1748R</th>
<th>1758</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistivity¹ (Ωsq, %)</td>
<td>3 ± 10</td>
<td>10 ± 10</td>
<td>100 ± 10</td>
<td>1k ± 10</td>
<td>10k ± 10</td>
<td>100k ± 10</td>
<td>1M ± 10</td>
</tr>
<tr>
<td>Temperature Coefficient of Resistance (TCR) ppm/°C</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
<td>0 ± 100</td>
</tr>
<tr>
<td>Short Term Overload Voltage², V/mm</td>
<td>5</td>
<td>9</td>
<td>30</td>
<td>75</td>
<td>250</td>
<td>280</td>
<td>–</td>
</tr>
<tr>
<td>Standard Working Voltage³, V/mm</td>
<td>2</td>
<td>4</td>
<td>12</td>
<td>30</td>
<td>100</td>
<td>110</td>
<td>–</td>
</tr>
<tr>
<td>Maximum Rated Power Dissipation⁴, mW/mm²</td>
<td>888</td>
<td>864</td>
<td>900</td>
<td>562</td>
<td>1000</td>
<td>120</td>
<td>–</td>
</tr>
<tr>
<td>Quan Tech Noise⁵, dB</td>
<td>-31</td>
<td>-24</td>
<td>-16</td>
<td>-13</td>
<td>-6</td>
<td>2</td>
<td>–</td>
</tr>
</tbody>
</table>

¹ Shipping specifications: reported to Dried thickness 25 μm. Fired on 5715 Au prefired termination.

² Resistor geometry: 1.5 mm x 1.5 mm. Temperature coefficient of resistance: –55 to 25°C and 25 to 125°C

³ All tests performed on 96% alumina substrate

⁴ Short term overload voltage — voltage required (5-sec duration) to induce a resistance change of 0.25% in a 1 mm x 1 mm trimmed resistor at 25°C

⁵ Standard working voltage: 0.4 x short term overload voltage.

⁶ Maximum rated power = (Standard Working Voltage)² / Resistance

⁷ Resistor geometry: 1 mm x 1 mm; Firing cycle: 60-min cycle to peak temperature of 850°C for 10 min.

Chart 1. Firing Profile
Figure 2. Blending Characteristics
Adjacent members of 17G-Series are blendable. Resistivities and TCRs blend smoothly and predictably for all blend ratios.

The data required in these curves were generated using resistors terminated with prefired 5715 Au Conductor.
**DUPONT 17G-SERIES**

**Figure 3. Length Effect Curves for Resistivity**

Data for the 0.5–4.0 sq resistors are reported for resistor widths of 0.5mm–1.5 mm. The 1.5 mm x 1.5 mm resistor was controlled to a dried thickness of 25µm. All of the resistivity data have been referenced to this resistor. Terminations are prefired 5715 Gold Conductor.