

# Cable: Competitive Landscape

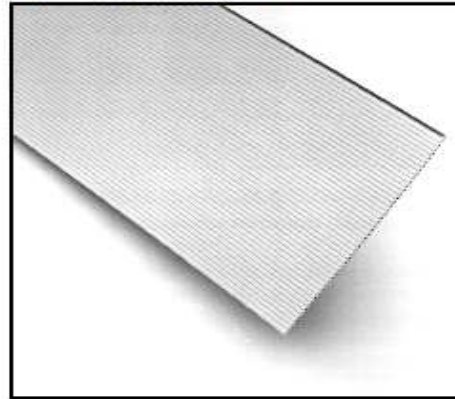


*Mike Giesler - Global Product Marketing Manager*  
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# 3M™ Round Conductor Flat Cable

.050" 28 AWG Stranded, PVC

3365 Series



- 28 AWG wire on .050 inch centers permits mass termination to a broad line of IDC connectors
- Stranded wire provides flexibility and extended product life
- Zippable for branching or discrete termination
- Available in Gray or Black
- RoHS\* compliant

Date Modified: December 12, 2006

TS-0080-15  
Sheet 1 of 2

## Physical

### Insulation

Material: Polyvinyl Chloride (PVC)

Color: Gray Standard or Black (see ordering information)

### Marking

Standard: None

Canadian Option: **PA** AWM 2651 105C 300V VW1 3M NU C **PA** AWM IA 105C 300V FT1 EU <50V

Conductors: 28 AWG, 7 x 36 [ 7 x ø 0.127 ] Tinned Stranded Copper (89% Conductivity)

## Electrical

Voltage Rating: USA: 300V

Canada: 300V

EU: <50V

Insulation Resistance: >1 x 10<sup>10</sup> Ω /10ft [3m]

### Unbalanced

### Balanced

Characteristic Impedance: 102 Ω

172 Ω

Capacitance: 14.47 pF/ft [ 47.5 pF/m ]

8.14 pF/ft [ 26.7 pF/m ]

Inductance: 0.15 µH/ft [ 0.49 µH/m ]

0.24 µH/ft [ 0.79 µH/m ]

Propagation Delay: 1.47 ns/ft [ 4.86 ns/m ]

1.4 ns/ft [ 4.59 ns/m ]

Velocity of Propagation: 69%

73%

Note: Unbalanced is measured between ground-signal -ground conductors. Balanced is measured between conductors within a pair.

## Environmental

Temperature Rating: -20°C to +105°C

Flammability Rating: USA: VW-1

Canada: FT1

\*RoHS compliant\* means that the product or part does not contain any of the following substances in excess of the following maximum concentration values in any homogeneous material, unless the substance is in an application that is exempt under RoHS: (a) 0.1% (by weight) for lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers; or (b) 0.01% (by weight) for cadmium. Unless otherwise stated by 3M in writing, this information represents 3M's knowledge and belief based upon information provided by third party suppliers to 3M.

UL File No.: E42769, Style No.: 2651

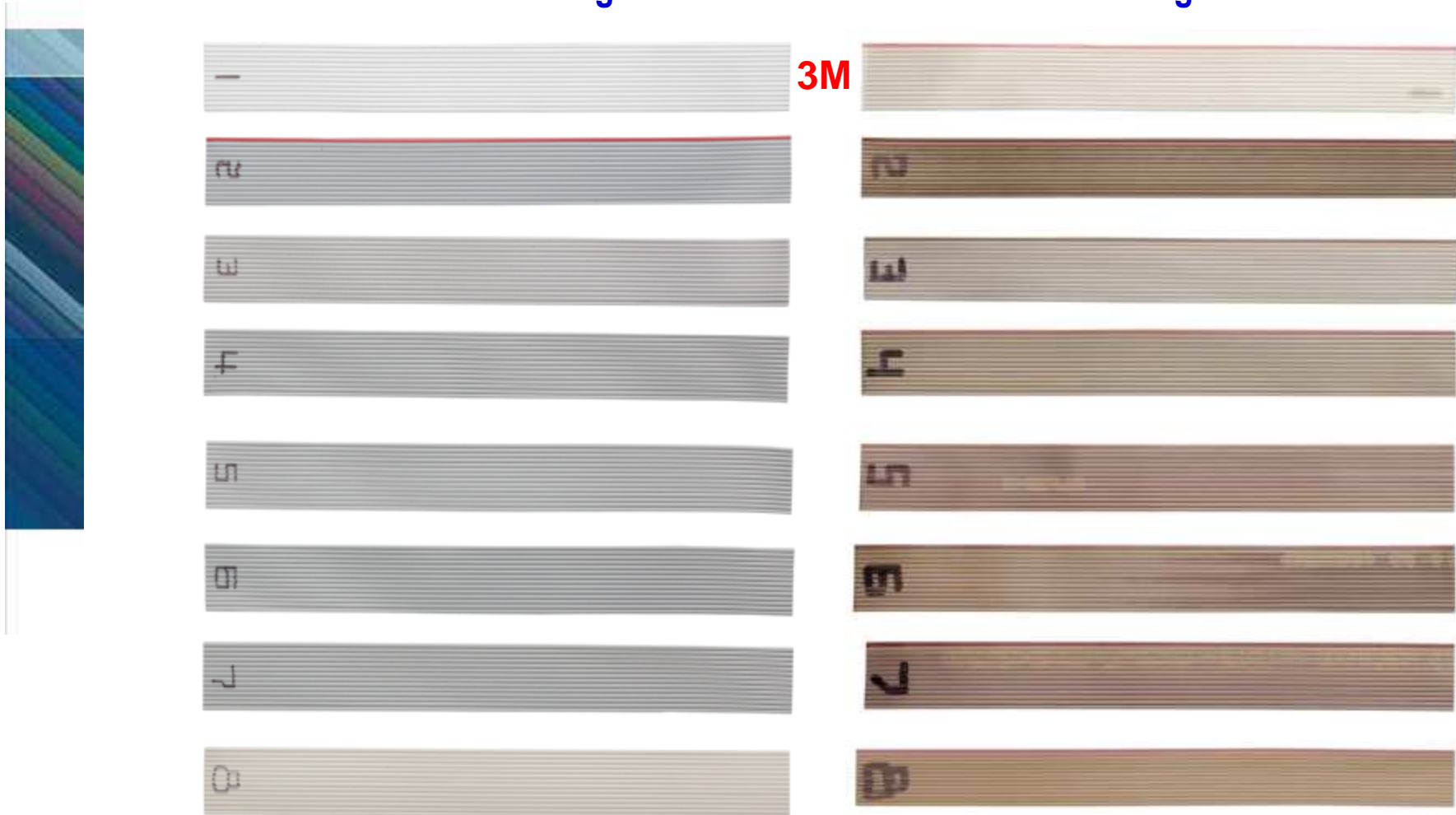
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# Discoloration Testing of Competitive 3365 Offerings

Before Testing

After Testing



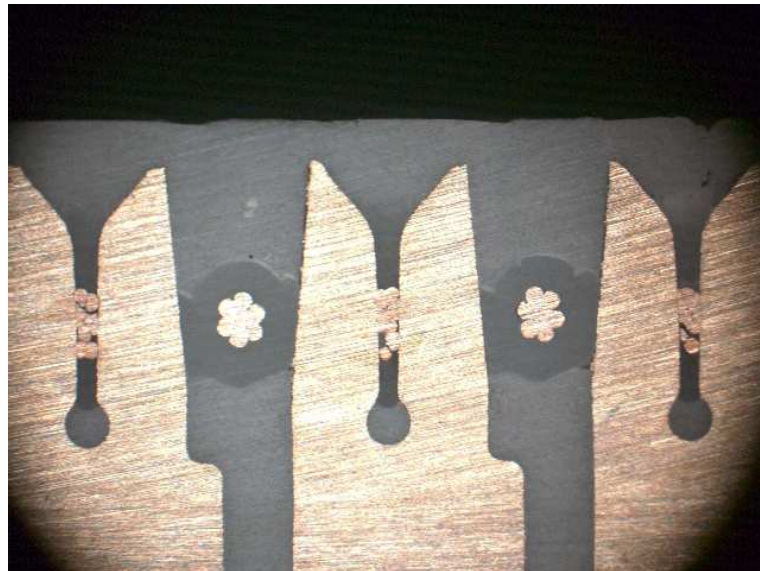
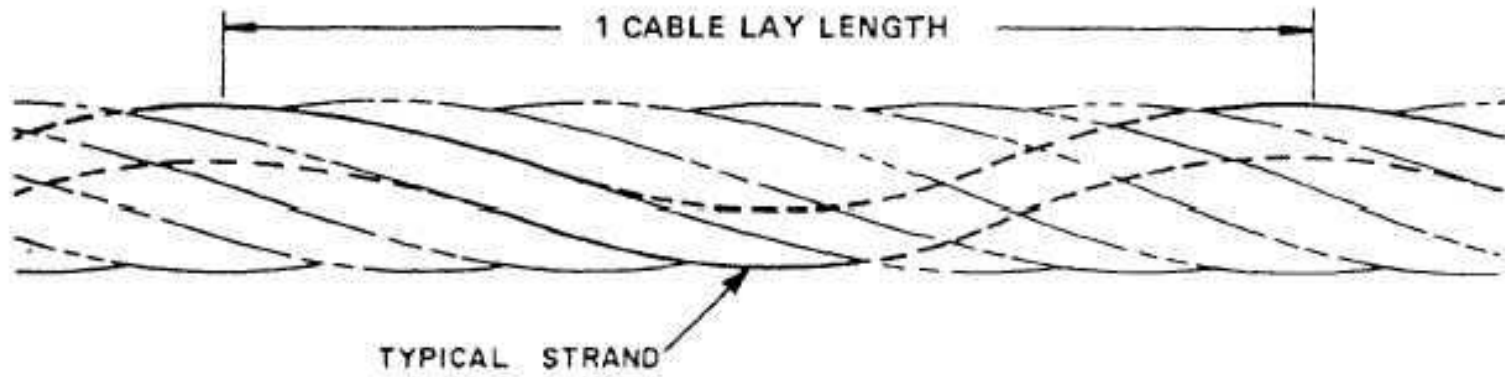
Heat Aged 168hrs @136°C (Based on the UL 1581 Test)

\*Shows impact of deterioration of any heat stabilizers in chemistry

3M Confidential.



# Wire Lay and IDC Termination Compatibility



# Summary of Evaluation Results

## ➤ Results

- *Typical Components In Insulator – PVC, Plasticizer, Heat Stabilizer, Fillers*
  - *PVC – Commodity Resin*
  - *Plasticizer – Provides Flexibility For PVC*
  - *Heat Stabilizer – Prevents Breakdown When Heating*
- *Blending Of Components Into Specialized “Engineering Grade” Resin Costs Extra Money*
- *Competitive product*
  - *Plasticizers That Evaporate Away - Brittleness*
  - *Heat Stabilizers – Poor or Non existent - Discoloration*

***Some PVC Compounds Look Good As Formed Into Cable  
but Show Serious Deterioration During Aging Test***

# 3365 Cable

## Are All Competitive Suppliers the Same?

### ➤ Centerline of Conductors

- *Not all on .050 centers - As bad as .048*
  - *Result - Poor termination of the Conductor to IDC*
  - *Result - Long Term may not be reliable.*

### ➤ Wire Lay - like a loose twisted rope

- *Result - Poor termination of the Conductor to IDC*
- *Result - Long Term may not be reliable.*

### ➤ Lack Proper Plasticizers/Stabilizer adders in Cable Resin

- *Leads to Discoloration*
  - *Indication that the proper stabilizers and plasticizers are missing*
- *Leads to Shrinkage/Dimensional Instability*
  - *Results - Stress on the IDC termination*
- *Leads to Brittleness of Dielectric*
  - *Voltage Breakdown, Shorts, etc.*
- *Leads to Ink Bleeding*

# Cable Solutions – Quality Parameters

*The Difference is in the Materials and Cable Lay!*

*3M manufactures many cable types in house for enhanced quality assurance. By controlling critical parameters, 3M cable stands out from the competition.*

Critical Parameter	Issues if Uncontrolled	Performance Impact
Materials <ul style="list-style-type: none"> <li>▪ PVC</li> <li>▪ Plasticizer (flexibility)</li> <li>▪ Heat Stabilizer</li> </ul>	<ul style="list-style-type: none"> <li>▪ Some plasticizers evaporate when heated</li> <li>▪ Discoloration due to Poor or Lack of stabilizers</li> <li>▪ Cable “shrinks” causing stress on IDC termination</li> </ul>	<ul style="list-style-type: none"> <li>▪ Aesthetics</li> <li>▪ Brittleness/Exposed Conductors</li> <li>▪ IDC Reliability – Increase in opens/intermittent failures</li> </ul>
Pitch Control <ul style="list-style-type: none"> <li>▪ Tolerance of cable pitch (conductor to conductor)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Termination misalignment                             <ul style="list-style-type: none"> <li>❖ <i>High conductor counts</i></li> <li>❖ <i>Tighter cable pitches</i></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Assembly efficiency</li> <li>▪ Quality costs (scrap)</li> <li>▪ IDC Reliability – Increase in opens/intermittent failures</li> </ul>
Lay Length <ul style="list-style-type: none"> <li>▪ Tightness of bundle of wires in a stranded cable construction</li> </ul>	<ul style="list-style-type: none"> <li>▪ Longer lay length means a looser bundle, allowing the wires to align in the IDC slot, reducing normal force</li> </ul>	<ul style="list-style-type: none"> <li>▪ IDC Reliability – Increase in opens/intermittent failures</li> <li>▪ Worse when combined with poor contact materials</li> </ul>