Application and Cable Integration Guide:

Native High-Frequency Size 16 Coaxial Contacts (CPX™ Series) for 2M805 Connectors

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Abstract

For SWaP-optimized, high-bandwidth data links such as microsatellite communication terminals and automotive millimeter-wave radars, compact 2M805 connector shells are widely specified to replace traditional, larger-footprint MIL-DTL-38999 series connectors. Within the traditional 38999 platform, the baseline standard for high-frequency coaxial transmission has historically relied on Size 12 cavities. However, as system envelopes compress down to the 2M805 footprint, the Size 16 cavity configuration has emerged as the optimal physical architecture, delivering the ideal compromise between channel packing density and mechanical ruggedness. For high-frequency transmission from DC to 67 GHz, the standard SMPS blind-mate interface is inherently the definitive, commercially off-the-shelf solution dimensioned for Size 16 cavities. It natively guarantees 50Ω impedance continuity while delivering the critical radial and axial float tolerances required for ruggedized blind-mating, representing the golden standard for this platform.

However, standard COTS high-frequency Size 16 SMPS contacts (specifically the male configuration) are historically engineered with an axial length matched to D38999 cavity depths. Direct integration into the more compact 2M805 cavities results in severe axial interference, preventing the internal tooth spring of the connector from closing and latching properly. Due to the lack of shortened, native high-frequency contacts optimized for 2M805 Size 16 cavities in the generic commercial off-the-shelf (COTS) ecosystem, designers are frequently forced to compromise on a full Size 20 sub-miniature cavity layout. This constraint limits the backend coaxial cable diameter strictly to 0.047", which introduces catastrophic insertion loss (IL) in extended-length links and drastically downgrades the continuous-wave (CW) power handling capacity. Furthermore, the shrunken contact-and-pin envelope degrades axial and radial blind-mate alignment tolerances, introducing risks of center pin mechanical fatigue and intermittent signal jitter under prolonged, high-vibration profiles.

The Anoison CPX™ (Coaxial Contact Cable Components) series resolves this axial packaging mismatch through structural reconfiguration of the SMPS Size 16 body, realigning its retention shoulder to interface perfectly with the internal tooth spring architecture of standard 2M805 cavities for seamless in-situ insertion and positive locking. By opening up the 2M805 Size 16 platform, the CPX™ series eliminates legacy cable diameter bottlenecks, offering dual termination capabilities for both 0.047" and 0.086" coax lines to allow flexible configuration based on link length and loss budgets.

01 Traditional RF Contacts in 2M805 Shells:
Physical Interference and Performance Constraints

1 Axial Mismatch and Latching Failure

Within standard 2M805 shells, contact retention relies on internal metallic tooth springs capturing the positioning shoulder of the barrel. However, standard COTS high-frequency Size 16 SMPS contacts are axially dimensioned for legacy D38999 cavity depths (Fig 1). When integrated into the compressed envelope of a 2M805 cavity, this excessive axial length prevents the locking shoulder from reaching the retention zone. Consequently, the tooth spring remains splayed open without dropping into its designated detent, causing total mechanical retention failure.

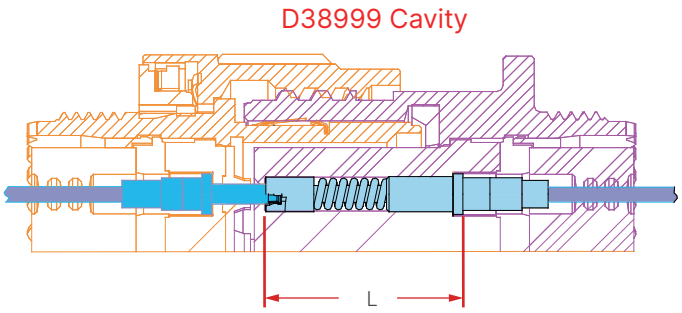

Fig 1 SMPS (size16) in D38999 cavity

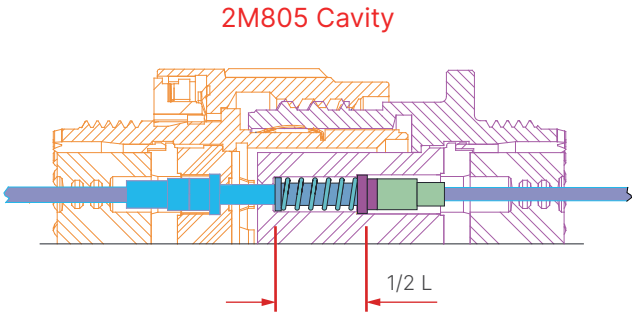

Fig 2 CPX (size 16) in 2M805 cavity

2 Technical Trade-offs and System Impacts of Compromising on Size 20 Layouts

Because the existing component ecosystem primarily confines high-frequency blind-mate solutions to the shrunken Size 20 cavity platform—lacking natively shortened Size 16 variants—system architects utilizing 2M805 shells are routinely forced to compromise on a full Size 20 layout. This fallback configuration introduces severe performance bottlenecks across multiple parameters:

- The backend cable size is locked into 0.047": While absolute attenuation remains manageable for short pigtails under 1 foot, the cumulative per-foot attenuation becomes unacceptable for cross-chassis run lengths, causing total link budget failure.
- Due to the sub-miniature core diameter of the 0.047" center conductor, the continuous-wave (CW) power handling capability drops significantly at high frequencies, exposing the dielectric core to localized thermal stress and structural deformation under high RF drive levels.
- The micro-scale physical envelope of a Size 20 platform utilizes extremely fragile pin geometries. During frequent mating cycles or blind-mate engagement under low-visibility field conditions, minor angular or radial offsets easily cause irreversible plastic deformation or catastrophic pin breakage.

- 0.047" cable assemblies exhibit low structural rigidity. When exposed to relentless mechanical vibration or high-g shock profiles, the center conductor is highly susceptible to micro-fatigue wear, manifesting as intermittent signal dropouts and phase/amplitude jitter during testing.

02 Technical Approach:
CPX™ Dimensional Re-engineering and Platform Compatibility

1 Axial Realignment and Direct Drop-In Integration

While preserving the exact mechanical and RF interfaces of the standard SMPS profile, the CPX™ series features a completely re-engineered internal locking shoulder with a compressed axial envelope. When seated into a standard 2M805 Size 16 cavity, the shoulder precisely clears and engages the internal tooth springs to ensure standard positive retention (Fig 2).

- The interface conforms fully to standard SMPS specifications, guaranteeing 100% intermateability with the user's legacy pool of COTS blind-mate test cables and adapters.
- By establishing native Size 16 compatibility, backend diameter restrictions are eliminated. Designers can dynamically optimize layouts by transitioning between high-flex 0.047" lines and ultra-low-loss 0.085"/0.086" semi-flexible or flexible coax cables based on run length and power parameters.

2 High-Density Layout Integration and Insert Flex

Within the physical constraints of a Size 16 cavity, the CPX™ profile is precision-engineered to integrate seamlessly into standard 2M805 high-density insert arrangements, such as the prominent 18-12 configuration (Shell Size 18, 12 fully loaded channels). This layout maximizes routing density while strictly maintaining electrical isolation and mechanical clearance limits between adjacent channels. Once consolidated, the multi-core cable bundle preserves high flexural compliance, effectively isolating the blind-mate interface from severe lateral side loads that could induce centerline eccentricity and pin wear. Furthermore, leveraging its modular, discrete contact geometry, the CPX™ functions as a versatile building block, enabling direct drop-in implementation into asymmetric hybrid configurations or low pin-count application-specific custom inserts without requiring structural modifications to the cavity retention mechanism.

03 Length-Based Cable Selection and Attenuation Budgeting

Because the CPX™ architecture unlocks the backend envelope, cable selection should be analytically driven by the total routing length (benchmarked at 40 GHz: 0.047" coax exhibits ~2.7 dB/ft attenuation; 0.086" coax exhibits ~1.7 dB/ft attenuation):

1 Short-Run Routing Scenarios (Under 1.5 Feet)

For ultra-confined, intra-chassis routing, 0.047" cables provide a superior tight bend radius. Given that the absolute path length is restricted (typically under 1 foot), the cumulative insertion loss and localized thermal dissipation remain well within acceptable system margins. In this scenario, running the CPX™ in a 2M805 Size 16 cavity leverages the superior blind-mate alignment window and extended mating cycle life of the ruggedized SMPS interface.

2 Extended-Length Cable Runs (Over 1.5 Feet)

For extended cross-chassis or bay-to-bay system links, 0.086" coax configurations are heavily recommended. For a baseline 4-foot (~1.2m) link operational at 40 GHz, routing with standard 0.047" lines incurs a crippling 10.7 dB insertion loss. Upgrading to a CPX™ terminated with 0.086" coax limits the total attenuation to roughly 7.0 dB, instantly reclaiming a 3.7 dB margin for the RF frontend. When pushed to the 67 GHz upper limit (where 0.047" hits 3.5 dB/ft and 0.086" stays at 2.2 dB/ft), the 0.086" architecture saves 5.2 dB of critical system power across that same 4-foot link. This substantial recovery in link budget directly cascades into system-level SWaP (Size, Weight, and Power) returns: it reduces the gain/power draw required from peripheral Power Amplifiers (PAs), shrinks thermal heatsink volumes, and drives meaningful weight reductions across the primary platform.

04 Delivery Modes and Engineering Configurations

Anoison offers two flexible delivery configurations tailored to streamline field integration and simplify quality tracking:

- **Mode 1:** Terminated Contact Cable Assemblies: Coaxial lines are factory-terminated to the CPX™ contacts and RF-tested to your exact drawing lengths. Anoison delivers these standalone pre-terminated contact cable runs directly to your facility, allowing technicians to push-fit them into existing warehouse inventories of standard 2M805 shells for seamless integration and flexible routing.
- **Mode 2:** Complete Harness Integration: Anoison executes the multi-channel contact populating, channel matrix bundling, and external protective looming within the connector shells. The user receives a fully integrated, turn-key multichannel RF harness assembly ready for immediate panel deployment.
- **Optional Variations & Data Delivery:** Phase Matching & Data: Standard intra-run phase matching (skew tolerance within ±1 ps) and full VNA test documentation are available upon customer drawing or purchase order specifications.

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