DESCRIPTION

The DV-704A is a combined hybrid EMI filter and voltage spike protection module that is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. The DV-704A EMI filter is designed to be used with VPT/Delta’s DVSA, DVHF, DVTR, and DVFL series DC-DC converters to comply with the surge requirements of MIL-STD-704A, B, C, and D with 40 watts maximum output power. This device also reduces the reflected noise of the DC-DC converters to meet MIL-STD-461C CE03 and MIL-STD-461D CE102 limits. It also protects the DC-DC converters against the voltage spikes specified in MIL-STD-461C CS06 and conducted susceptibility in MIL-STD-461C CS01 and CS02.

These filters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

This product may incorporate one or more of the following U.S. patents:

5,784,266  
5,790,389  
5,963,438  
5,999,433  
6,005,780  
6,084,792  
6,118,673

FEATURES

- High Reliability
- Up to 2.0 Amps Maximum Current
- 45 dB Minimum Attenuation at 500 kHz
- Industry Standard Pinout
- Inrush Current Limit and Soft Start
- Under Voltage Lockout
- Clamps Output Voltage to 45 Volts Maximum
- Precision Seam Welded or Solder Seal Hermetic Package
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-704A, B, C, and D Surge Limits
- Compliant to MIL-STD-461C CE03 and MIL-STD-461D CE102 EMC Requirements
- Protects Against Conducted Susceptibility Specified in MIL-STD-461C, CS01 and CS02 and Against Voltage Spikes Specified in MIL-STD-461C CS06
- MIL-PRF-38534 Element Evaluated Components

Figure 1 – DV-704A EMI Filter  
(Exact marking may differ from that shown)
### DV-704A Series

#### SPECIFICATIONS

(T\text{CASE} = -55°C to +125°C, V\text{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

#### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
</table>
| **Input Voltage** | Continuous No Load | 0 | 28 | 40 | V
| | Continuous 2.0 A Load | 15 | 28 | 40 | V
| | Transient 100 ms, R\text{S} = 0.0 Ω | - | - | 80 | V
| | Transient 60 ms, R\text{S} = 0.5 Ω | - | - | 100 | V
| | Transient 20 μs, R\text{S} = 50 Ω | - | - | 600 | V
| **Output Current** | Continuous No Load | - | - | 10 | mA
| | Inhibited | - | - | 2.0 | mA
| **Input Voltage** | Continuous Open Circuit | 0 | 14 | 16 | V
| | Inhibited | 0 | - | 0.8 | V
| **Inhibit Pin Voltage** | Inhibit Pin Voltage = 0 to 0.8 V | - | - | -300 | μA
| **Undervoltage Lockout** | | 7.0 | - | 14 | V
| **Output Clamp Voltage** | | 43 | - | 47 | V
| **Input Surge Limit** | 2.0 A Load, 80 V | - | - | 100 | ms
| | 2.0 A Load, 100 V | - | - | 80 | ms
| **Input Spike Limit** | 2.0 A Load, 600 V, R\text{S} = 50 Ω | - | - | 20 | μs
| | 2.0 A Load, 400 V, R\text{S} = 0.5 Ω | - | - | 20 | μs
| **Input Inrush Current** | V\text{IN} = 0 – 28V, No Load C\text{L} = 100μF | - | 0.25 | 0.5 | A\text{PK}
| **DC Resistance** | Continuous, T\text{CASE}= 25°C | - | - | 450 | mΩ
| **Power Dissipation** | Continuous | - | - | 15 | W
| | Peak | - | - | 500 | W
| **Noise Rejection** | f = 500 kHz | 45 | - | - | dB
| **Capacitance** | Pin to Case | - | 20 | - | nF
| **Isolation** | Any Pin to Case, 500 V\text{DC} | 100 | - | - | MΩ
| **MTBF (MIL-HDBK-217F)** | AIF @ T\text{C} = 55°C | - | 0.627 | - | MHrs

#### Notes:

1. Derate linearly to 0 at 135°C.
2. Verified by qualification testing.
3. Maximum output power is linearly derated to 0 A from +125°C to +135°C.
4. Rated current applies at any voltage.
**BLOCK DIAGRAM**

Figure 2

**CONNECTION DIAGRAM**

Figure 3 – DV-704A EMI Filter Hookup with Single Converter
Figure 4 – Isolated Inhibit Drive
(Shown with optional capacitor for turn-on delay)
Figure 5 – MIL-STD-461C Measurement Method (Feedthrough Capacitor)

Figure 6 – MIL-STD-461D Measurement Method (LISN)
EMI PERFORMANCE CURVES

(T_{CASE} = 25°C, V_{IN} = +28V ± 5%, Full Load, Unless Otherwise Specified)

**Figure 7** – MIL-STD-461C
DVTR2800S Without EMI Filter

**Figure 8** – MIL-STD-461C
DVTR2800S With DV-704A EMI Filter

**Figure 9** – MIL-STD-461D
DVTR2800S With DV-704A EMI Filter
### PACKAGE SPECIFICATIONS (SOLDER SEAL)

**TOP VIEW**

- **SEAL DISC**
- **PIN 1**

**SIDE VIEW**

- **ø0.162’’ [ø4.11mm]**
- **R0.170’’ [R4.32mm]**
- **0.060’’ [1.52mm]**

**BOTTOM VIEW**

- **6 x PINØ 0.040’’±0.003’’ [1.06mm]**
- **5 x SEALØ 0.090’’±0.002’’ [2.29mm]**
- **0.400’’ [10.16mm]**
- **0.400’’ [10.16mm]**
- **0.475’’ [12.07mm]**
- **1.600’’ [40.64mm]**

**NOTES:**
1. DIMENSIONAL LIMITS ARE ±0.005’’ UNLESS OTHERWISE STATED.
2. CASE TEMPERATURE IS MEASURED ON THE CENTER OF THE BASEPLATE.
3. MOUNTING HOLES ARE NOT THREADED. RECOMMENDED FASTENER IS #6-32 SCREW.
4. MATERIALS:
   - **CASE:** STEEL, FUSED TIN OVER NICKEL PLATED.
   - **COVER:** STEEL, FUSED TIN OVER NICKEL PLATED.
   - **PINS:** COPPER CORED ALLOY 52, FUSED TIN OVER NICKEL PLATED.
   - **PIN SEALS:** GLASS

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28V IN</td>
<td>3</td>
<td>CASE</td>
<td>5</td>
<td>IN COM</td>
</tr>
<tr>
<td>2</td>
<td>28V OUT</td>
<td>4</td>
<td>OUT COM</td>
<td>6</td>
<td>INHIBIT</td>
</tr>
</tbody>
</table>

**Figure 10** – Solder Seal Package and Pinout (Not Used for /HB or Higher Screened Products)
PACKAGE SPECIFICATIONS (SEAM SEAL)

Figure 11 – Seam Seal Package and Pinout

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28V IN</td>
<td>3</td>
<td>CASE</td>
<td>5</td>
<td>IN COM</td>
</tr>
<tr>
<td>2</td>
<td>28V OUT</td>
<td>4</td>
<td>OUT COM</td>
<td>6</td>
<td>INHIBIT</td>
</tr>
</tbody>
</table>
## PACKAGE PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28V IN</td>
<td>Positive Input Voltage Connection</td>
</tr>
<tr>
<td>2</td>
<td>28V OUT</td>
<td>Positive Output Voltage Connection</td>
</tr>
<tr>
<td>3</td>
<td>CASE</td>
<td>Case Connection</td>
</tr>
<tr>
<td>4</td>
<td>OUT COM</td>
<td>Output Common Connection</td>
</tr>
<tr>
<td>5</td>
<td>IN COM</td>
<td>Input Common Connection</td>
</tr>
<tr>
<td>6</td>
<td>INHIBIT</td>
<td>Logic Low = Disabled Output. Connecting the inhibit pin to input common causes filter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.</td>
</tr>
</tbody>
</table>
**ENVIRONMENTAL SCREENING** (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

<table>
<thead>
<tr>
<th>Screening</th>
<th>MIL-STD-883</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Destructive Bond Pull</td>
<td>Method 2023</td>
</tr>
<tr>
<td>Internal Visual</td>
<td>Method 2017, 2032 Internal Procedure</td>
</tr>
<tr>
<td>Temperature Cycling</td>
<td>Method 1010, Condition C</td>
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<tr>
<td>Constant Acceleration</td>
<td>Method 2001, 3000g, Y1 Direction</td>
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<tr>
<td>PIND</td>
<td>Method 2020, Condition A²</td>
</tr>
<tr>
<td>Pre Burn-In Electrical</td>
<td>100% at 25°C</td>
</tr>
<tr>
<td>Burn-In</td>
<td>Method 1015, 320 hours at +125°C</td>
</tr>
<tr>
<td>Final Electrical</td>
<td>MIL-PRF-38534, Group A¹</td>
</tr>
<tr>
<td>Hermeticity</td>
<td>Method 1014, Fine Leak, Condition A</td>
</tr>
<tr>
<td>Radiography</td>
<td>Method 2012³</td>
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<tr>
<td>External Visual</td>
<td>Method 2009</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard (No Suffix)</th>
<th>Extended /ES</th>
<th>HB /HB</th>
<th>Class H /H</th>
<th>Class K /K</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% R&amp;R testing at –55°C, +25°C, and +125°C with all test data included in product shipment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIND test Certificate of Compliance included in product shipment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiographic test Certificate of Compliance and film(s) included in product shipment.</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Product Series</th>
<th>Screening Code(^{1, 2})</th>
<th>Additional Screening Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV-704A</td>
<td>None</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>ES</td>
<td>Extended</td>
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<tr>
<td></td>
<td>HB</td>
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<tr>
<td></td>
<td>H</td>
<td>Class H</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>Class K</td>
</tr>
</tbody>
</table>

Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) or Class K (/K) qualified products.
2. VPT Inc. reserves the right to ship higher screened or SMD products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.

Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing, different input voltage, output voltage, power requirement, source inspection, and/or special element evaluation for space or other higher quality applications.
SMD (STANDARD MICROCIRCUIT DRAWING) NUMBERS

<table>
<thead>
<tr>
<th>Standard Microcircuit Drawing (SMD)</th>
<th>DV-704A Series Similar Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>*T.B.D.</td>
<td>DV-704A/H</td>
</tr>
</tbody>
</table>

Do not use the DV-704A Series similar part number for SMD product acquisition. It is listed for reference only. For exact specifications for the SMD product, refer to the SMD drawing. SMD’s can be downloaded from the DSCC website at [http://www.dscc.dla.mil/programs/smcr/](http://www.dscc.dla.mil/programs/smcr/). The SMD number listed above is for MIL-PRF-38534 Class H screening, standard gold plated lead finish, and no RHA (Radiation Hardness Assurance) level. Please reference the SMD for other screening levels, lead finishes, and radiation levels. All SMD products are marked with a “Q” on the cover as specified by the QML certification mark requirement of MIL-PRF-38534.

CONTACT INFORMATION

To request a quotation or place orders please contact your sales representative or the VPT Inc. Sales Department at:

- **Phone**: (425) 353-3010
- **Fax**: (425) 353-4030
- **E-mail**: vptsales@vpt-inc.com

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