



HVAC Linear Power Module

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard establishes the component performance, design, test, manufacture and acceptance requirements for a Linear Power Module (LPM). The part supplied to this specification shall meet all requirements defined herein unless specifically waived in writing by the GM Blower Motor and Controller Bill of Material Functional Owner (BFO). Components that do not meet the requirements specified herein are subject to rejection. This document specifies minimum requirements; the supplier shall perform additional testing or more stringent testing that the supplier feels is necessary to meet all requirements and ensure a high-quality component in the vehicle environment.

1.2 Applicability. All GM LPMs used in a Heating Ventilation Air Conditioning (HVAC) Module.

1.3 Remarks. The LPM regulates the voltage supplied to a brushed blower motor to control the blower motor's speed, which will provide variable air flow for an automotive HVAC module.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

EWCAP-001	ISO 20653	SAE J1344	SAE J1351
FMVSS 302			

2.2 GM Standards/Specifications.

GMW3059	GMW3172	GMW15634	GMW16044
GMW3097	GMW3191	GMW15635	GMW17625
GMW3103	GMW3235	GMW15760	GMW17626
GMW3116	GMW14780		

2.3 Additional References.

- GM Best Practice HVACPTC-115.
- Yazaki connector dimensions available at www.perfectelectronicparts.com/productdetail.php.

3 Requirements

Note: The part will meet or exceed all requirements stated in this standard. If a supplier has any concerns about meeting any of the requirements as stated herein, they must note those concerns in all quotes or proposals to GM. All exceptions to the content of this standard must be clearly stated, in bold print, at the front of the quote or proposal, and must reference the exact section number of the exception. Design Failure Mode and Effects Analysis (DFMEA) will be baselined for sourced Program and any subsequent changes to the design Fit, Form, or Function will be appropriately communicated to the downstream customer(s).

3.1 Physical Requirements.

3.1.1 Color. All external surfaces visible after installation into the HVAC module which are plastic shall be black.

3.1.2 Materials.

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3.1.2.1 Materials must comply with GMW3059 (see also 7.1), GMW15634, and GMW15635.

3.1.2.2 Supplier is responsible for designing recyclable and recoverable parts using GMW3116.

3.1.2.3 Materials used shall meet specifications per GMW3235 - B - T1, 2 mg maximum.

3.1.2.4 The part must be lead-free.

3.1.2.5 The part must not use rare earth materials unless approved by the GM Blower Motor and Controller BFO.

3.1.2.6 Silicone products (such as mold release) are prohibited in the part and manufacturing process, including at sub-suppliers. Silicone can degrade the brush blower motor's commutator.

3.1.3 Label Requirements. Basic label requirements shall include part number, serial number, manufacture date, and country of origin via a one-dimensional barcode, two-dimensional barcode, or Quick Response (QR) code. GM recommends to use a QR code including the part number, serial number, and any critical values measured by the End of Line (EOL) tester. The HVAC supplier shall ensure the label is legible in their process.

3.1.3.1 Traceability. Parts shall have traceability back to EOL testing based on the serial number, and be retained for a period of 10 years.

3.1.4 Marking of Plastic Parts. Plastic parts shall be marked per SAE J1344 to designate the type of material from which the part was fabricated. Where applicable, cavity number shall be marked.

3.1.5 Finish. Unless specifically defined on the engineering drawings, external surfaces of parts shall conform to good commercial practice (reasonably free of gates, flash, ridges, roughness, tool marks, and mold and tool lubricants and other contaminants).

3.1.6 Cleanliness. All parts and surfaces shall be free from dirt, oil, grease, scale, and other foreign materials that may detrimentally impact appearance, performance, durability, or assembly.

3.1.7 Safe Handling. The LPM and its component parts must be free from flash, burrs or other surface conditions, which could prohibit safe handling of the product. Dropped components or assemblies shall be scrapped and not reworked. The part must withstand reasonable worst case customer handling in the vehicle.

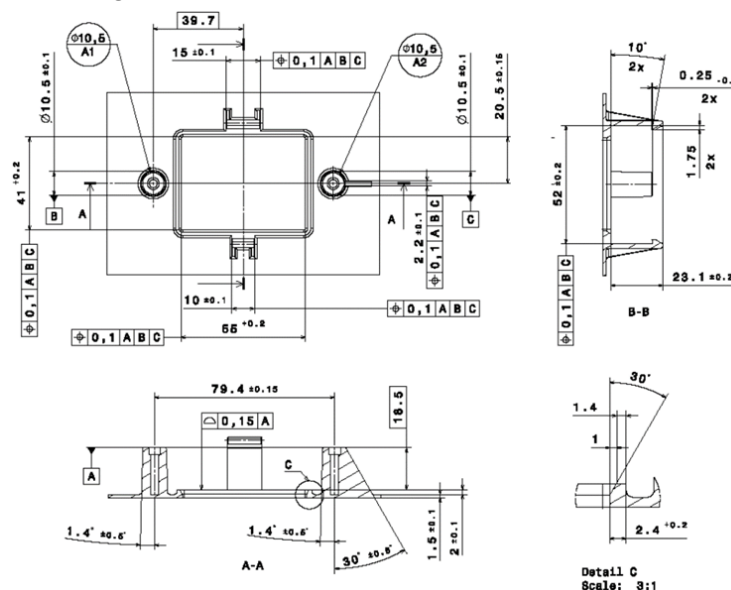
3.2 Mechanical Requirements.

3.2.1 Mass. The mass of the LPM assembly, including foam seal, shall be ≤ 175 g.

3.2.2 Mechanical Interface.

3.2.2.1. Mounting to Scroll. The LPM installs into the HVAC opening as seen in Figure 1. The dimensions are based on a 1.5 mm HVAC case thickness. If the case thickness is different, the interface dimensions must remain as stated in the preceding for the sealing area.

Figure 1: LPM Scroll Interface on HVAC Scroll



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3.2.2.2. Gasket. The LPM is sealed to the module case with a gasket. The gasket compression is controlled by the height of two (2) posts required on the HVAC case. The gasket shall have a compressed dimension of $1.25 \text{ mm} \pm 0.45 \text{ mm}$.

3.2.2.3. Error Proofing. The LPM shall have an error proofing feature to prevent incorrect installation orientation in the HVAC module.

3.2.2.4 Screw-Mounting. For screw-mounting the LPM, the HVAC-opening shall have screw bosses that also provide a limiting-stop to ensure proper compression of the seal.

3.2.2.5 Clip-Mounting. For clip-mounting the LPM, the HVAC-opening shall have posts that provide a limiting-stop to ensure proper fixation of the clip and compression of the seal (the seal must not be used as bearing-element) in addition to the clip features that retain the LPM, per the interface drawing. For clip-mounting, the LPM should not be attached to the HVAC case with the heat sink facing up.

3.2.2.6 Packaging for Cooling. The LPM shall be packaged within the HVAC module in an area to receive sufficient cooling air, but not allow water to pool on the LPM surface (see GM Best Practice HVACPTC-115).

Note: The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

3.3 Environmental Requirements.

3.3.1 Environmental and Durability. The part shall meet all requirements of GMW3172. Any deviation to GMW3172 shall be approved by the GM Blower Motor and Controller BFO.

3.3.2 Operating Temperature Range. The operating temperature range shall be -40°C to $+85^{\circ}\text{C}$ with full performance, and is allowed up to a 50% reduction in output voltage $> +65^{\circ}\text{C}$.

3.3.3 Storage Temperature Range. The storage temperature range shall be -40°C to $+105^{\circ}\text{C}$.

3.3.4 Odor. Materials shall have an odor scale rating of three (3) or less when tested per SAE J1351 and GMW14780.

3.3.5 Fogging. Materials shall meet specifications per GMW3235 - B - T1, 2 mg maximum.

3.3.6 Federal Motor Vehicle Safety Standard (FMVSS) 302. All components shall comply with FMVSS 302 where applicable.

3.4 Electrical Requirements.

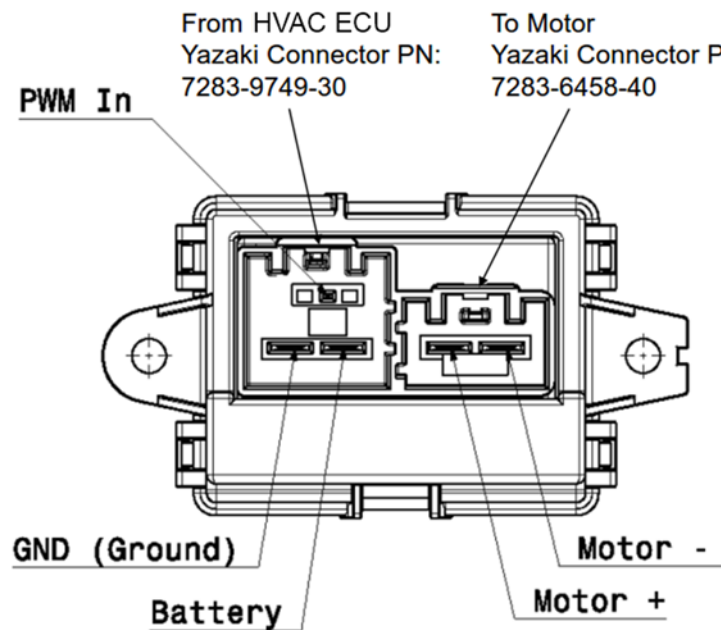
3.4.1 Operating Voltage. The typical GM vehicle provides a direct battery voltage to the LPM through a fuse, but typically not through a relay. The LPM shall operate in a vehicle voltage range of 9.0 Volt Direct Current (VDC) to 16.0 VDC.

3.4.2 Load Point. The HVAC supplier shall use the HVAC total air-side system resistance defined in GMW17625 to determine the worst-case blower motor load point (maximum current draw). The load point shall be determined with 14.0 VDC at the LPM terminals. This maximum current shall be informed from the HVAC supplier to the LPM supplier, and will be used in this specification hereby termed "load point".

3.4.3 Electrical Circuit Diagram. The LPM circuit diagram shall be sent to the GM Blower Motor and Controller BFO for reference.

3.4.4 Connector Requirements. The LPM shall use the connector housings shown in Figure 2, and comply to the dimensions and tolerances provided by Yazaki (see 2.3) for the respective part numbers. The connector housings must meet GMW3191. The recommended pin-outs are shown in Figure 2, but any discrepancies are superseded by the application specific Interface Control Document (ICD). Silver plating shall be applied to the terminals as specified in EWCAP-001, unless the supplier can prove through testing per 4.5.2.2 and 4.5.2.3 that the terminal will never reach $> 120^{\circ}\text{C}$ in the worst-case conditions (ambient, voltage, locked rotor, etc.) If $\leq 120^{\circ}\text{C}$, tin plating may be used.

Figure 2: LPM Connector Requirement and Pin-Out Example



3.4.5 Interfaces. The supplier shall provide all applicable interfaces to complete application specific ICD, at a minimum the electrical circuit, maximum power, and connector pinout.

3.4.5.1 Speed Control. The LPM shall be controlled by the HVAC Engine Control Unit (ECU) via Pulse Width Modulation (PWM). This is typically sent as a low active 35 Hz $\pm$ 5% PWM signal. The generic diagram of electrical interface is shown in Figure 3, but is superseded by the application specific ICD.

Figure 3: Generic Diagram of Electrical Interface

