



SPECTRUM CONTROL INC.

A Control Products and Systems Company

Decades of advancing interconnections and signal conditioning technology gives Spectrum Control a uniquely effective perspective on EMI and its control. Since the best time to control noise is before it starts, we've developed a simulation capability that helps eliminate EMI problems at your earliest design stage, prior to board fabrication.

Quiet Board Noise Reduction Printed Circuit Boards are another innovative product from Spectrum Control. These shielded printed circuit boards utilize an enhanced Copper Polymer shield to provide the noise filtering effect of discrete bypass capacitors without added inductance. This unique board-coating technology eliminates the frustration of failing emissions certification, without resorting to multi-layer ground planes. All at real cost savings over other board-level fixes.

In combination with our Filtering, Shielding, and TVSS products, Spectrum Control can solve EMI problems while providing you with increased design flexibility, reduced time-to-market and peak system performance.

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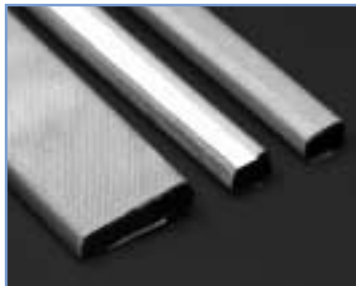
Quietshield™ Shielding Products . . .



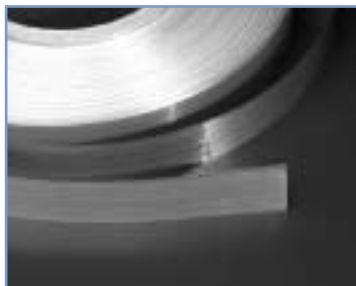
Gaskets



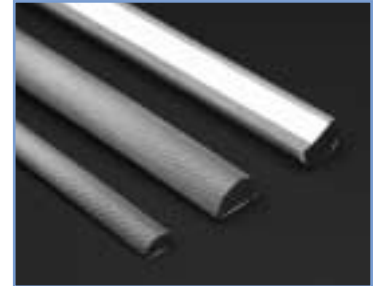
I/O Gaskets - "D"



Quietshield "R" Profile Gaskets



EMI Shielding Tapes



Quietshield "D" Profile Gaskets



Quietshield "P" Profile Gaskets



Quietshield "L" Profile Gaskets

Shielding Theory and Introduction

Shielding Theory

Electromagnetic shielding is used to prevent electromagnetic signals such as radio signals from leaving or entering a box or enclosure. Signals inadvertently emitted by an electronic device can cause distortion or interruption in normal radio communications in a localized area. This is the basis of most laws and regulations concerning electromagnetic interference. In addition, normal radio signals can cause unprotected electronic devices to malfunction. Depending on the devices' function, a malfunction in the device could be a minor inconvenience such as static on a radio, or life threatening such as the malfunction of a life support system at a hospital.

Introduction

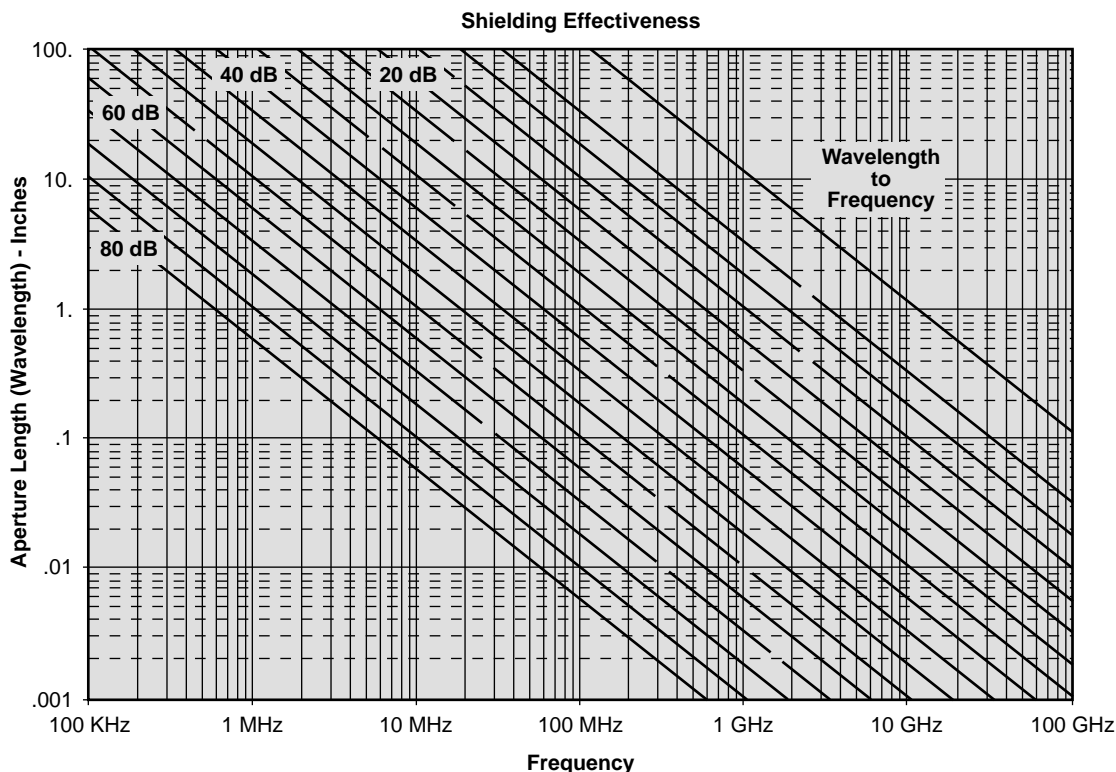
The electromagnetic shield in most cases is the electronic housing itself. The housing/shield forms a metal cage around the electronic circuits in a device. Most of the electromagnetic signal is absorbed with a small portion (3 to 10 dB) of the signal reflected off the metal housing. Most of the absorbed signal creates alternating currents at radio frequencies travels on the surface of metal. This allows the electromagnetic shield to keep signals from outside the enclosure on the outside of the shield and signals from inside signals on the inside of the shield.

The shield will continue to function as long as there are no holes in the electromagnetic shield which would allow the currents to flow from one side of the shield to the other. Holes are a necessity in an electronic enclosure. Connectors, wires, and cables are needed to transmit information to and from electronic devices. Doors and covers are needed to get access to components to maintenance, service, and keypads may also be required. The problem is that all of these items cause openings in the shield which reduce the performance of the shield.

Special devices such as shielding gaskets, shielding ventilation panels, shielded filtered connectors, and shielded switches minimize the effect of a hole in the shield.

The length of the hole and wavelength of the signal that needs to be shielded are the major factors determining the shielding effectiveness of an electronic enclosure. The distance between spotwelds, or screws which hold a metal housing together count as long narrow holes. Higher frequencies (lower wavelengths) flow more easily through smaller holes, and so the highest frequency needed to be shielded is the frequency of concern when designing shielding.

Aperture versus frequency charts can give a rough estimate of the shielding effectiveness of a metallic electronic housing.



Quietshield™ Gaskets



Features

- Maintain shielding effectiveness across seams or gaps
- Shielding Effectiveness (SE) of 70 - 100 dB between 1 MHz to 18 GHz
- Exclusive Quiet Contact provides instantaneous shielding effectiveness upon initial contact of gasket
- Flexible and conformable
- No creasing or tearing
- Lightweight material

Profile Gaskets

Quietshield EMI/RFI Gaskets maintain shielding effectiveness (SE) across a seam or gap in the electronic equipment's shielding material. They consist of metallized fabric wrapped around a neoprene elastomer core. This provides a low cost solution which allows you to utilize many material combinations and product designs never before practical.

Quietshield gaskets provide unique solutions to your most stringent shielding, grounding, ESD and packaging requirements. It's the cost-effective avenue for creativity in design. Profile gaskets are currently available in four shapes: "D", "R", "L", and "P".

Spectrum Control's proprietary manufacturing method for making profile shielding gaskets is also ideally suited to custom profiles. New shapes and sizes can be manufactured with minimal lead times and low tooling costs. Changes can be easily made to the rubber core material, type of fabric or foil covering, and adhesive systems. Shielding specialists are at your disposal to help you with your custom designs. These specialists use design for manufacturability concepts to produce designs which meet your specific requirements at a reasonable cost.

Mounting Styles

The mounting style available for most profile gaskets is pressure sensitive adhesive.

Pressure sensitive adhesives allow simple place and press mounting on smooth and clean metal surfaces. The parts can be cut to the desired length with common scissors or ordered to the exact length required. The adhesive provides high strength with aggressive initial tack, which increases in strength over time or after exposure to elevated temperatures.

I/O Gaskets

Spectrum Control offers a complete line of standard and custom I/O connector Electromagnetic Shielding Gaskets. I/O gaskets are flat gaskets used to provide a ground contact between a metal connector and the electronic enclosure or mating connector. They insure that the shield remains continuous from the input/output cable to the electronic enclosure.

Sample Kit

Quietshield sample kits are available from Spectrum Control Inc. Order number KIT-QSHIELD-57.

Test	ASTM Test	Performance
Shielding Effectiveness, dB		70-100
Compression Set %	D3574	7.9
Compression Load Deflection, PSI	D3574	15
Compression at Max Load		60%
Water Absorption (Foam Only) %	D1667	5.8
Abrasion Resistance, 3,000 Cycles	D3885	Excellent
Ultra Violet Exposure	D750	No Visible Change
Fungus Exposure	G21	Small Growth
Operating Temperature C	D746	-40 to +90
Flammability Rating	UL94	VO
Conductivity, OHMS/SQ		
Unexposed		0.2
Weathered (100 HRS)		0.3
Fungus		0.2
Salt		0.2
DC Conductivity		.2 Ohms/SQ
Tensile Strength		80 lb/in

Quietshield™ “D” and “P” Profile Gaskets

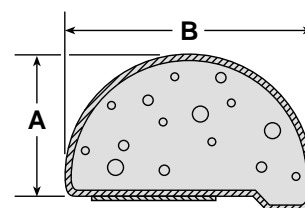


“D” Profile Gasket Features

- Exclusive Quiet Contact provides instantaneous shielding effectiveness upon initial contact
- Provides superior Shielding Effectiveness (SE) of 70 dB between 1 MHz to 18 GHz
- Non-conductive adhesive is standard; conductive adhesive is available
- Ni/Ag metallized nylon fabric wrapped around a foam compression core
- Available in any length, six foot maximum

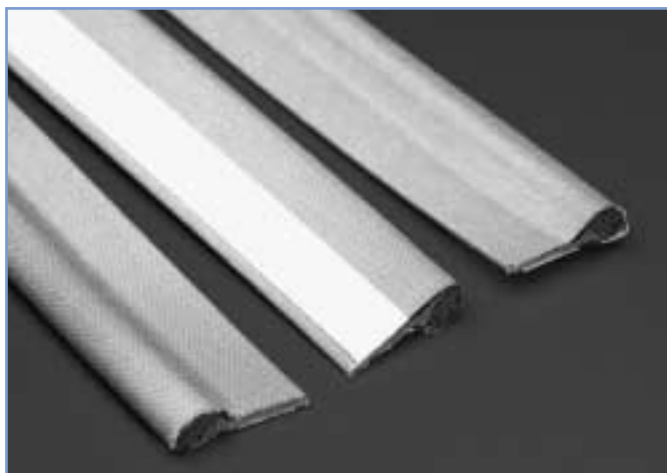
Dimensions		Attachment	Length	Old Part Number	New Catalog Number
A	B				
.060 (1.52)	.150 (3.81)	Non-conductive adhesive	6 ft.	267513-2	57D13-1506-7200
.090 (2.29)	.090 (2.29)	Non-conductive adhesive	6 ft.	93941-2	57D13-0909-7200
.120 (3.05)	.150 (3.81)	Non-conductive adhesive	6 ft.	93942-2	57D13-1512-7200
.120 (3.05)	.250 (6.35)	Non-conductive adhesive	6 ft.	267440-4	57D13-2512-7200
.140 (3.56)	.250 (6.35)	Non-conductive adhesive	6 ft.	93943-2	57D13-2514-7200
.250 (6.35)	.375 (9.53)	Non-conductive adhesive	6 ft.	93944-2	57D13-3725-7200

Dimensions in inches (mm)



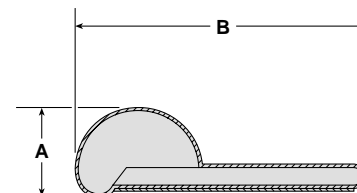
“P” Profile Gasket Features

- Exclusive Quiet Contact provides instantaneous shielding effectiveness upon initial contact
- Provides superior Shielding Effectiveness (SE) of 70 dB at between 1 MHz to 18 GHz
- Dual-durometer core provides consistent part shape and function
- Non-conductive adhesive is standard; conductive adhesive is available
- Nickel/copper metallized polyester fabric wrapped around a low compression set neoprene core
- Ni/Ag metallized nylon fabric wrapped around a foam compression core
- Available in any length, six foot maximum

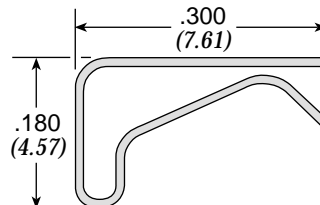
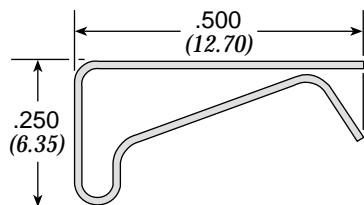


Dimensions		Attachment	Length	Old Part Number	New Catalog Number
A	B				
.160 (4.06)	.520 (13.21)	Non-conductive adhesive	6 ft.	267416-1	57P13-5216-7200
.160 (4.06)	.520 (13.21)	Conductive adhesive	6 ft.	267416D-72	57P12-5216-7200

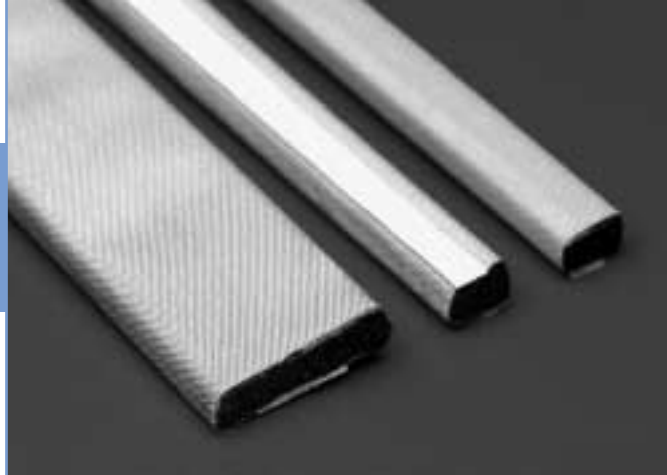
Dimensions in inches (mm)



Clips



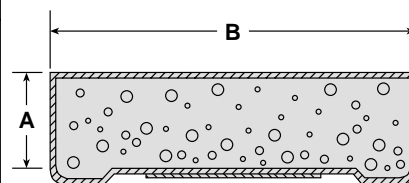
Quietshield™ “R” and “L” Profile Gaskets



“R” Profile Gasket Features

- Exclusive Quiet Contact provides instantaneous shielding effectiveness upon initial contact
- Provides superior Shielding Effectiveness (SE) of 70 dB at between 1 MHz to 18 GHz
- Non-conductive adhesive is standard; conductive adhesive is available
- Nickel/copper metallized polyester fabric wrapped around a low compression set neoprene core
- Ni/Ag metallized nylon fabric wrapped around a foam compression core
- Available in any length, six foot maximum

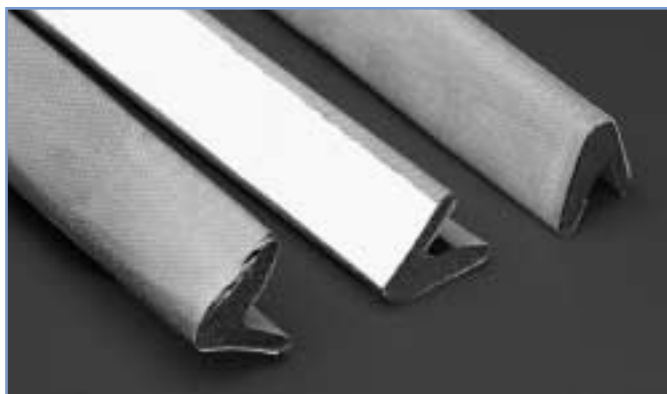
Dimensions		Attachment	Length	Old Part Number	New Catalog Number
A	B				
.040 (1.02)	.400 (10.16)	Non-conductive adhesive	6 ft.	267415-1	57R13-4004-7200
.040 (1.02)	.200 (5.08)	Non-conductive adhesive	6 ft.	267454-1	57R13-2004-7200
.062 (1.57)	.200 (5.08)	Non-conductive adhesive	6 ft.	267517-1	57R13-2006-7200
.080 (2.03)	.160 (4.06)	Non-conductive adhesive	6 ft.	267455-1	57R13-1608-7200
.120 (3.05)	.400 (10.16)	Non-conductive adhesive	6 ft.	267410-1	57R13-4012-7200
.125 (3.18)	.250 (6.35)	Non-conductive adhesive	6 ft.	93946-2	57R13-2512-7200
.130 (3.30)	.190 (4.83)	Non-conductive adhesive	6 ft.	93945-2	57R13-1913-7200
.130 (3.30)	.500 (12.70)	Non-conductive adhesive	6 ft.	93947-2	57R13-5013-7200
.160 (4.06)	.160 (4.06)	Non-conductive adhesive	6 ft.	267414-1	57R13-1616-7200
.200 (5.08)	.200 (5.08)	Non-conductive adhesive	6 ft.	267411-1	57R13-2020-7200
.220 (5.59)	.400 (10.16)	Non-conductive adhesive	6 ft.	267408-1	57R13-4022-7200
.375 (9.53)	.375 (9.53)	Non-conductive adhesive	6 ft.	267413-1	57R13-3737-7200
.400 (10.16)	.510 (12.95)	Non-conductive adhesive	6 ft.	267409-1	57R13-5140-7200
.250 (6.35)	.500 (12.70)	Non-conductive adhesive	6 ft.	267412-1	57R13-5025-7200



Dimensions in inches (mm)

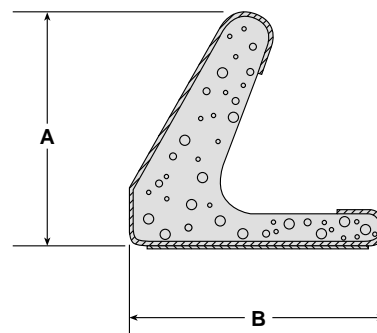
“L” Profile Gasket Features

- Provides superior Shielding Effectiveness (SE) of 70 dB at between 1 MHz to 18 GHz
- Conductive adhesive is standard
- Nickel/copper metallized polyester fabric wrapped around a low compression set neoprene core
- Ni/Ag metallized nylon fabric wrapped around a foam compression core
- Available in any length, six foot maximum



Dimensions		Attachment	Length	Old Part Number	New Catalog Number
A	B				
.395 (10.03)	.430 (10.92)	Conductive adhesive	6 ft.	93949-2	57L12-4339-7200
.673 (17.09)	.578 (14.68)	Conductive adhesive	6 ft.	267205-2	57L12-5767-7200

Dimensions in inches (mm)

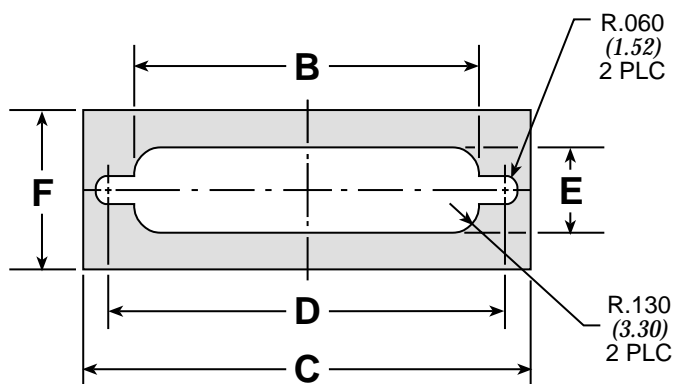


I/O Gaskets - "D"



Features

- Three thickness styles:
 - Die-cut, non-woven Ni/Cu metalized polyester fabric
 - .040" thick woven fabric around neoprene
 - .070" thick woven fabric around neoprene
- Each style available in "D" connector shell sizes 1-5 (9, 15, 25, 37, 50 position)
- Provides superior Shielding Effectiveness (SE) of 70 dB at between 1 MHz to 18 GHz
- Lightweight



Shell Size	Thickness A	Dimensions					Fabric Type	Old Catalog Number	New Catalog Number
		B	C	D	E	F			
1	0.012 (0.30)	0.746 (18.95)	1.213 (30.81)	0.984 (24.99)	0.400 (10.16)	0.750 (19.05)	Non woven	267250-1	57F01-D112-1275
	0.040 (1.02)						Woven	267251-1	57F11-D140-1275
	0.070 (1.78)						Woven	267251-2	57F11-D170-1275
2	0.012 (0.30)	1.074 (27.28)	1.541 (39.14)	1.312 (33.32)	0.400 (10.16)	0.750 (19.05)	Non woven	267250-2	57F01-D212-1575
	0.040 (1.02)						Woven	267252-1	57F11-D240-1575
	0.070 (1.78)						Woven	267252-2	57F11-D270-1575
3	0.012 (0.30)	1.614 (41.00)	2.088 (53.04)	1.852 (47.04)	0.400 (10.16)	0.750 (19.05)	Non woven	267250-3	57F01-D312-2075
	0.040 (1.02)						Woven	267253-1	57F11-D340-2075
	0.070 (1.78)						Woven	267253-2	57F11-D370-2075
4	0.012 (0.30)	2.266 (57.56)	2.720 (69.09)	2.500 (63.50)	0.400 (10.16)	0.750 (19.05)	Non woven	267250-4	57F01-D412-2775
	0.040 (1.02)						Woven	267254-1	57F11-D440-2775
	0.070 (1.78)						Woven	267254-2	57F11-D470-2775
5	0.012 (0.30)	2.158 (54.81)	2.63 (66.80)	2.406 (61.11)	0.500 (12.70)	0.850 (21.59)	Non woven	267250-5	57F01-D512-2685
	0.040 (1.02)						Woven	267255-1	57F11-D540-2685
	0.070 (1.78)						Woven	267255-2	57F11-D570-2685

Dimensions in inches (mm)

Custom Shielding Products

Custom I/O Gaskets

The manufacturing method used to make the standard I/O gaskets can be easily adapted to make custom designs. Various widths and thicknesses can be made with minimal tooling changes. Complicated cutout patterns are not a problem, and in many cases a large I/O gasket with a pattern of cutouts can economically replace several single I/O gaskets. The materials used to construct the I/O gasket can also be changed to suit specific customer requirements of cost, or performance. Spectrum has an experienced design staff available to assist in your custom I/O requirements.

Custom Laminates

QUIETSHIELD™ Custom Laminates from Spectrum are inexpensive shields usually used inside an electronic enclosure to shield an individual circuit board, or even a specific component. In most cases, a simple inexpensive shielding laminate can provide all the shielding required without having to modify or redesign the enclosure. Shielding laminates are also a good way to separate individual circuit boards or components which interfere with each other. Shielding laminates come in all sizes and can be custom made to your specifications, or our skilled shielding design team can create a design to suit your specific requirements.

Laminate Types

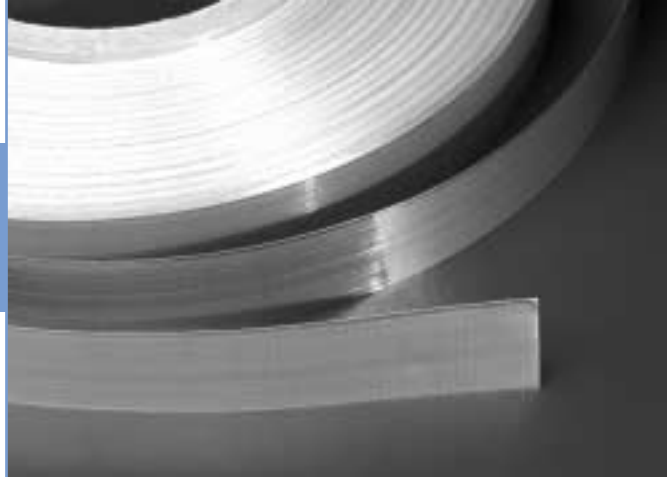
■ **Simple shields** – These laminates consist of a metalized fabric or metal foil, and are usually laminated on one side with PVC film or similar backing to prevent the shield from shorting the circuit board that the laminate is attached to. The laminate is usually placed over a circuit board, and attached to ground with screws or conductive adhesive. These shields usually give shielding performances from 3 to 10 dB. In many cases, this is enough to solve problems between circuit boards.

■ **Shielding patches** – Die cut tapes with the same shape as cutouts in an electronic enclosure. The patches form an easy to remove cover over a hole in an electronic enclosure. Holes can be punched out in an enclosure for connectors, cables, or other components which will be added in future upgrades or versions of a device. The die cut patch covers the hole and provides a dust shield at the hole which can be easily removed in the future.

■ **Shielding envelopes** – Similar to a paper business envelope except that they are made out of a conductive cloth or foil. The envelope is designed so that a circuit board can be slipped inside, and a flap with conductive adhesive closed behind the circuit board. Cutouts in the envelope are strategically placed for connectors, mounting screws, heat sinks, etc. The result is a flexible, low cost electronic enclosure for a circuit board. The main application is for electronic equipment with plastic housings which need to meet higher shielding requirements. In many cases, redesign of the plastic housing to a metal housing with shielding gaskets is expensive and time consuming, while the shielding envelope is inexpensive and quick. Another application is in shielding individual circuit boards from each other with the same electronic enclosure.

■ **Electronic component shields** – Shield laminates can be made into a shield cover for an individual component or circuit on the circuit board. The shield laminate can be screwed in place, or adhered with a conductive adhesive. Spectrum has also developed a special component shield - the hybrid shield. The hybrid shield consists of a flat laminate shield with QUIETSHIELD™ gaskets mounted around its perimeter to form a shield can. The hybrid shield can be placed over a component on a circuit board to form a shield. The lid or cover of the enclosure supplies the force to ensure that the hybrid can also be easily removed to get at the component or circuit being shielded. The hybrid shield is ideal for a small enclosure with limited space which may need frequent adjustment of maintenance to noisy circuits.

EMI Shielding Tapes



Features

- Tin plated copper foil contact tape with tape mask
- Metallized woven fabric with Shielding Effectiveness (SE) of 70 dB; 1 MHz to 18 GHz
- Conductive or non-conductive adhesive
- Standard and custom widths

Shielding Tapes

Shielding tapes are usually used to cover up a seam on an electronic enclosure. Standard tape is available as metallized fabric with conductive adhesive. Options include non-conductive adhesive and/or custom widths. Shield laminates in the form of tapes can be wrapped around a cable to form a custom cable shield. The metallized fabric is ideal for this application due to its inherent flexibility. The shielding tape can be laminated on the inside with a conductive adhesive to hold the wrap in place. A non-conductive or abrasion resistant tape can then be wrapped over the shield to prevent shorting or abrasion damage.

Foil Tape

Spectrum offers a Foil Contact Paint Mask Tape as an accessory to its line of QUIETSHIELD™ profile gaskets. This tape consists of a thin tin plated copper foil with a conductive adhesive on one side and a paint mask on the other. The tape can be applied to the bare metal surface of an electronic enclosure before painting. After painting, the paint mask is removed providing a clean contact surface for mounting and contact with the shielding gaskets. The tape is also useful in providing an interface between reactive metal surfaces such as aluminum or zinc (galvanized) and the shielding gaskets.

EMI Shielding Tapes				
Tape	Width	Length	Part Numbers	Catalog Numbers
Fabric	1 in.	200 ft.	267297-1	57T11-0100-0200
Fabric	2 in.	200 ft.	267297-2	57T11-0200-0200
Fabric	3.625 in.	200 ft.	267297-3	57T11-0362-0200
Fabric	4 in.	200 ft.	267297-4	57T11-0400-0200
Foil	.5 in.	330 ft.	267325-2	57T12-0050-0330
Foil	.75 in.	330 ft.	267325-1	57T12-0075-0330

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267416	57P13-5216-7200	231
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267440	57D13-2512-7200	231
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Note: This part number index lists all cataloged parts by base number only. Complete part numbers (with prefixes and/or suffixes) are shown on the pages indicated.