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 device's 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.

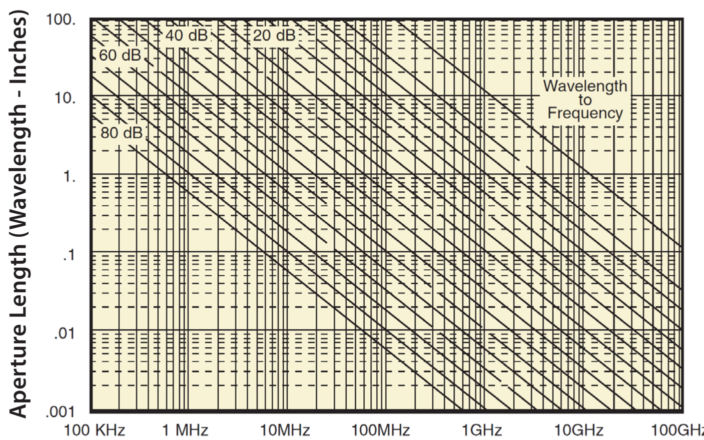
Shielding Theory

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 which 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.

Shielding Effectiveness

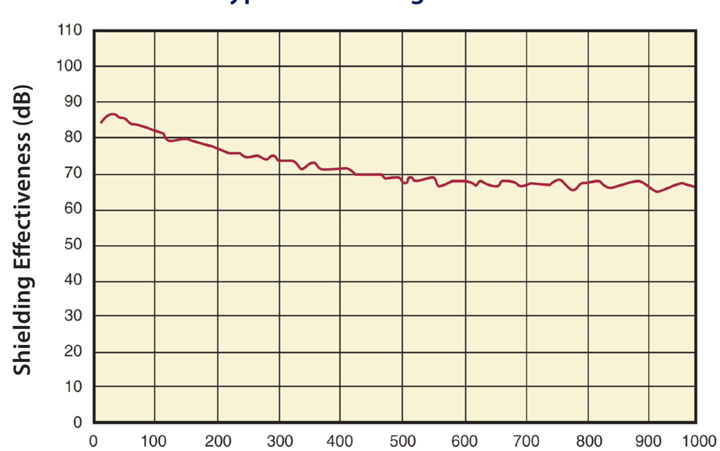


Frequency (MHz)

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.

Typical Shielding Effectiveness



Frequency (MHz)
Test Methods: ASTM D-4935-89
Test Fixture: Flanged coaxial transmission line

Quietshield™ Fabric-over-Foam I/O & Waved Metal Gaskets

Specifications

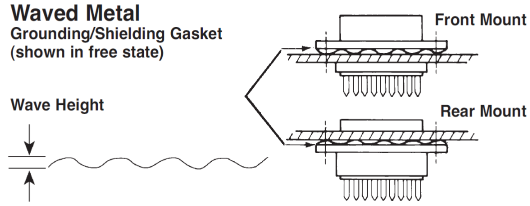
Material: Beryllium Copper, CA 174 (per QQ-C-533)

Finish: STD: Electro tin plate, 100 micro inches (per MIL-T-10727)
For RoHS: Nickel - Change last 2 p/n digits - NI
For Hi-Rel: Gold - Change last 2 p/n digits - AU

Material Thickness: .005" (.13mm) compressed

Weight Height: .030"+.020/-.015 (.76+.51/-.38mm)

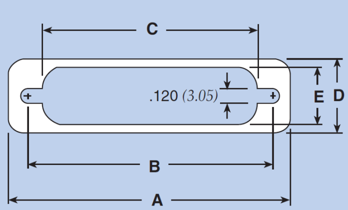
Length increase when flattened: 0.008" (.20mm) per inch



Waved Metal Gaskets *(Select part number by filling in "xxx": 572019-00xxx-70)*

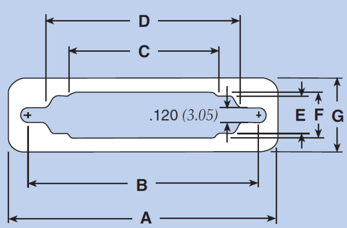
Mounting: Front mounted pin or socket connector, rear mounted pin connector.

Shell Size	A ±.020 (0.51)	B ±.020 (0.51)	C ±.020 (0.51)	D ±.020 (0.51)	E ±.005 (0.13)	"xxx"
9	1.213 (30.81)	.984 (24.99)	.777 (19.74)	.600 (15.24)	.440 (11.18)	100
15	1.541 (39.14)	1.312 (33.32)	1.105 (28.07)	.600 (15.24)	.440 (11.18)	101
25	2.088 (53.04)	1.852 (47.04)	1.645 (41.78)	.600 (15.24)	.440 (11.18)	102
37	2.729 (69.32)	2.500 (63.50)	2.293 (58.24)	.600 (15.24)	.440 (11.18)	103
50	2.635 (66.93)	2.406 (61.11)	2.190 (55.63)	.710 (18.03)	.550 (13.97)	104



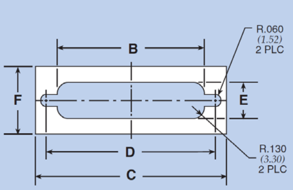
Mounting: Rear mounted socket connectors only.

Shell Size	A ±.020 (0.51)	B ±.020 (0.51)	C ±.020 (0.51)	D ±.020 (0.51)	E ±.005 (0.13)	F ±.005 (0.13)	G ±.020 (0.51)	"xxx"
9	1.213 (30.81)	.984 (24.99)	.450 (11.43)	.660 (16.76)	.324 (8.23)	.360 (9.14)	.600 (15.24)	105
15	1.541 (39.14)	1.312 (33.32)	.670 (17.02)	.988 (25.10)	.324 (8.23)	.360 (9.14)	.600 (15.24)	106
25	2.088 (53.04)	1.852 (47.04)	1.110 (28.19)	1.528 (38.81)	.324 (8.23)	.360 (9.14)	.600 (15.24)	107
37	2.729 (69.32)	2.500 (63.50)	1.550 (39.37)	2.176 (55.27)	.324 (8.23)	.360 (9.14)	.600 (15.24)	108
50	2.635 (66.93)	2.406 (61.11)	1.550 (39.37)	2.082 (52.88)	.436 (11.07)	.470 (11.94)	.710 (18.03)	109



Fabric-over-Foam I/O Gaskets

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



Dimensions in inches (mm)