1 Device Overview

1.1 General Description

The MEQX-20ACH family of passive MMIC equalizer die are an ideal solution for compensating for low pass filtering effects in RF/microwave and high speed digital systems. They provide positive slope from DC to 20GHz with DC attenuation options between 3 and 11dB. The unique design offers superior return loss to competitors. GaAs MMIC technology provides consistent unit-to-unit performance in a small, low cost form factor.

Die

1.2 Features

- DC attenuation options from 3 to 11dB
- Typical Insertion Loss 0.4dB at 20GHz
- VSWR < 1.3:1 Over Entire Band
- S2P data: MEQX-ACH.zip

1.3 Applications

- RF Transceivers
- High-Speed Data
- Telecom
- Cable Loss Compensation
- Amplifier Compensation

1.4 Functional Block Diagram

1.5 Part Ordering Options[1]

Part Number	Loss at DC (dB)	Description	Package	Green Status	Product Lifecycle	Export Classification
MEQ3-20ACH	3	Wire bondable die	CH	RoHS	Active	EAR99
MEQ5-20ACH	5					
MEQ6-20ACH	6					
MEQ7-20ACH	7.5					
MEQ10-20ACH	10					
MEQ11-20ACH	11					
MEQ20CH-KIT	Evaluation Kit contains 5x of each model: MEQ3-20ACH, MEQ5-20ACH, MEQ6-20ACH, MEQ7-20ACH, MEQ10-20ACH, MEQ11-20ACH. Contact info@markimicrowave.com for pricing and availability.					

[1] Refer to our website for a list of definitions for terminology presented in this table.

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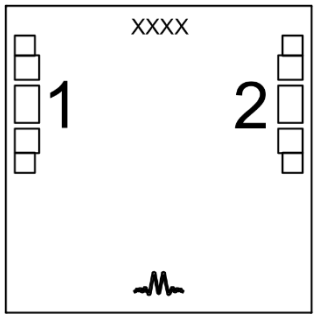
Revision History

Revision Code	Revision Date	Comment
-	November 2017	Datasheet Initial Release
A	August 2018	Evaluation Kit: **MEQ20CH-KIT**
B	March 2019	Updated ESD Rating
C	May 2019	Added Chip Dimension Tolerance Spec

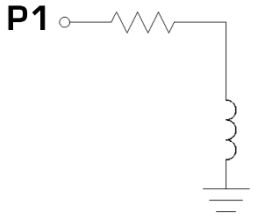
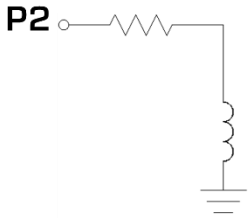
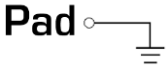
2 Port Configurations and Functions

2.1 Port Diagram

A top-down view of the MEQX-20A CH package outline drawing is shown below. The MEQ equalizers are symmetrical allowing Port 1 or Port 2 to be used as the input.



2.2 Port Functions

Port	Function	Description	Equivalent Circuit
Port 1	Input/Output	Port 1 is DC connected to ground through a resistor. DC block is required if voltage present.	
Port 2	Input/Output	Port 2 is DC connected to ground through a resistor. DC block is required if voltage present.	
Pad	Ground	CH package ground path is provided through the substrate and ground bond pads.	

3 Specifications

3.1 Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Units
Port 1 DC Current	40	mA
Port 2 DC Current	40	mA
Power Handling, at any Port	+30	dBm
Operating Temperature	-55 to +100	°C
Storage Temperature	-65 to +125	°C

3.2 Package Information

Parameter	Details	Rating
ESD	Human Body Model (HBM), per MIL-STD-750, Method 1020	1A

3.3 Electrical Specifications[2]

The electrical specifications apply at T_A=+25°C in a 50Ω system. Typical data shown is for the equalizer in a CH package with a sine wave input applied to port 1.

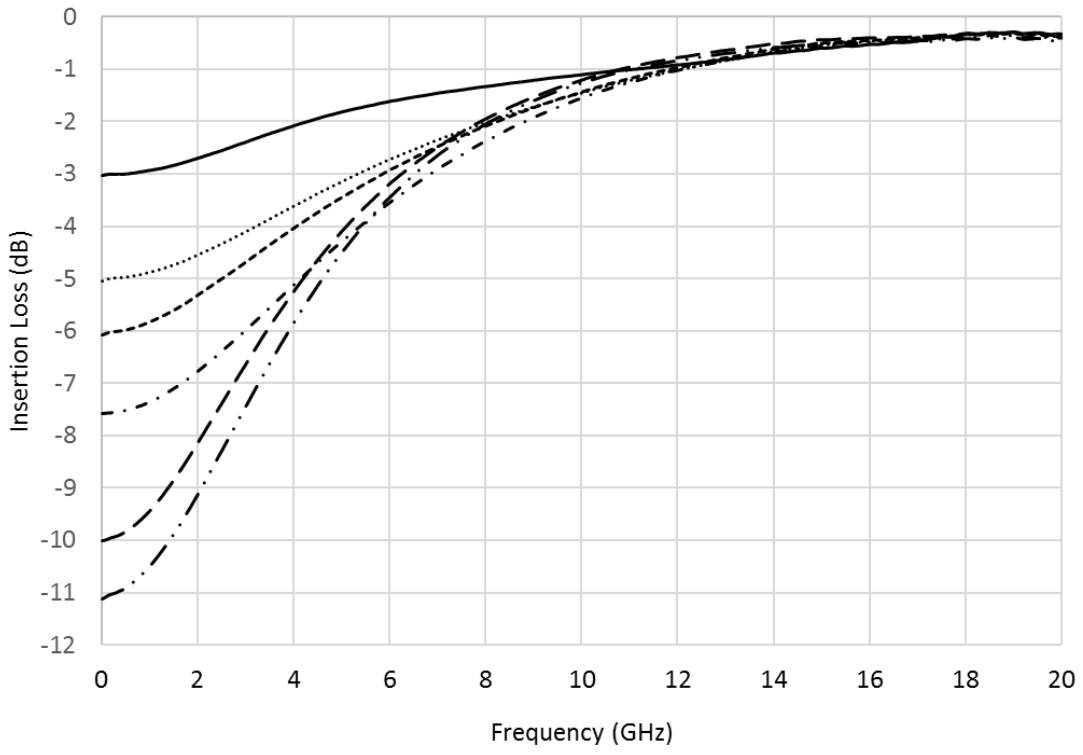
Min and Max limits are guaranteed at T_A=+25°C. All bare die are 100% DC tested and visually inspected.

Part Number	Typical Insertion Loss		Typical Return Loss	Units
	DC	20 GHz	DC - 20 GHz	
MEQ3-20ACH	3	0.3	21	dB
MEQ5-20ACH	5	0.3	22	dB
MEQ6-20ACH	6	0.3	21	dB
MEQ7-20ACH	7.5	0.4	23	dB
MEQ10-20ACH	10	0.4	25	dB
MEQ11-20ACH	11	0.4	23	dB

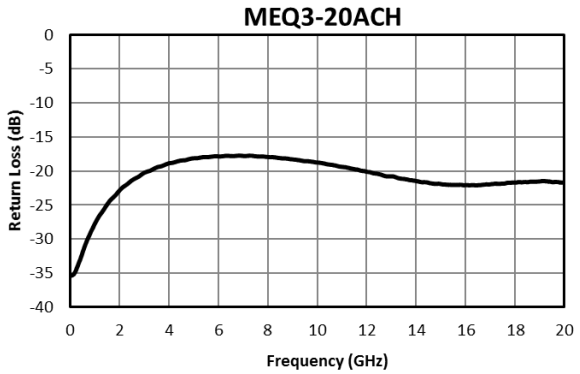
[2] Equalizer is symmetrical. Reverse measurement is equivalent to forward measurement.

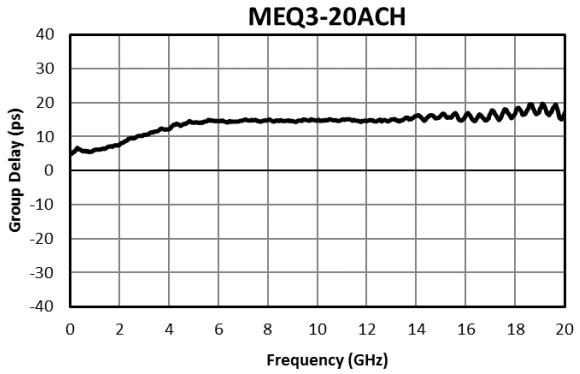
3.4 Typical Performance Plots

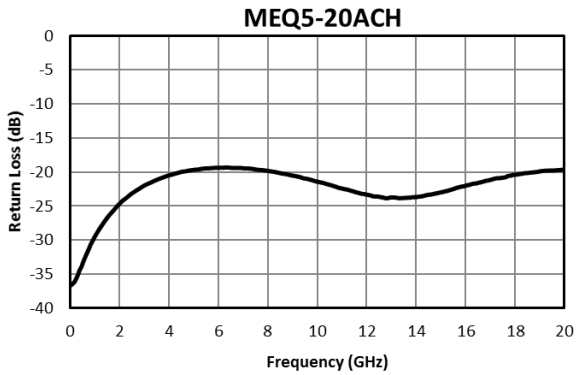
3.4.1 Insertion Loss

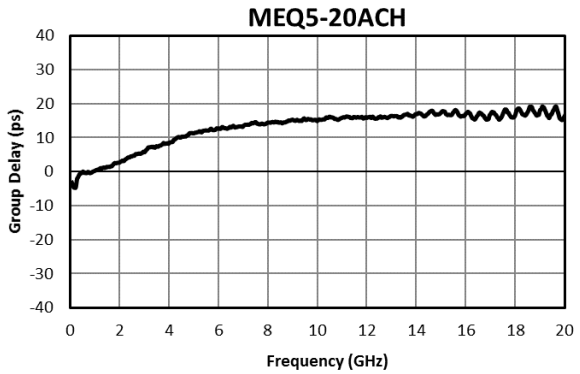


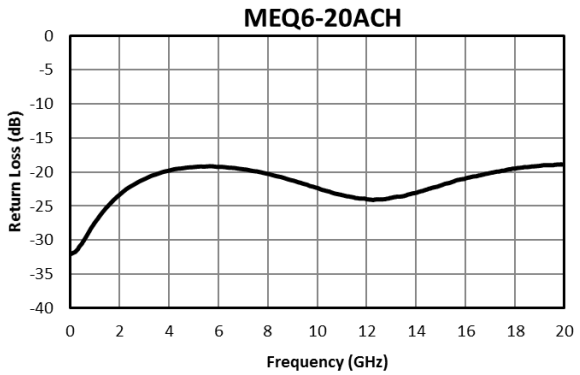
3.4.2 Return Loss & Group Delay[3]

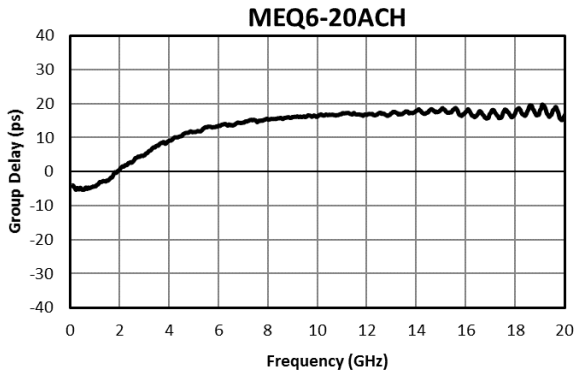




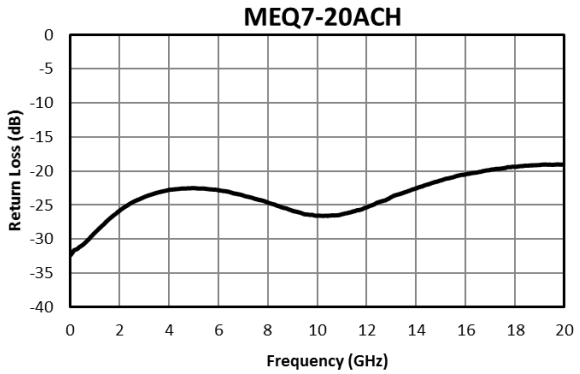


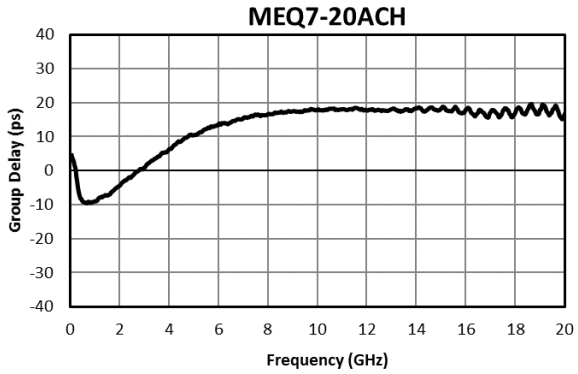


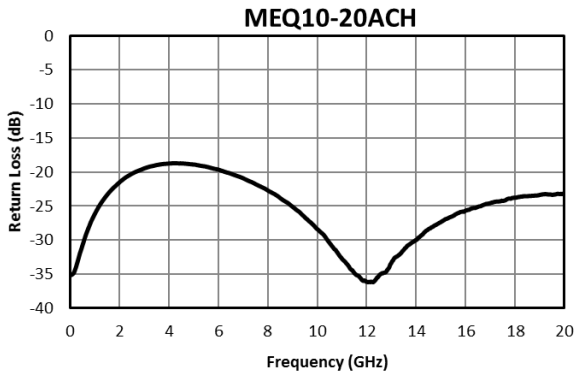


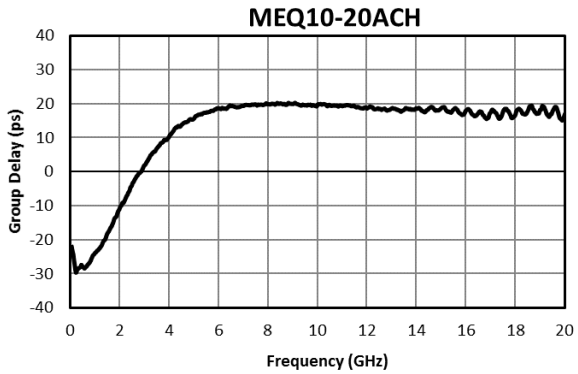


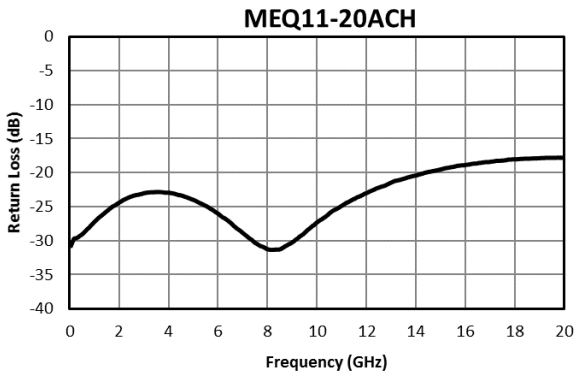
[3] Group delay calculated using wrapped phase response.

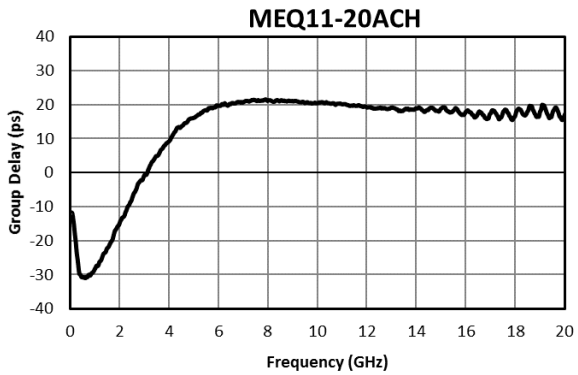












4 Die Mounting Recommendations

4.1 Mounting and Bonding Recommendations

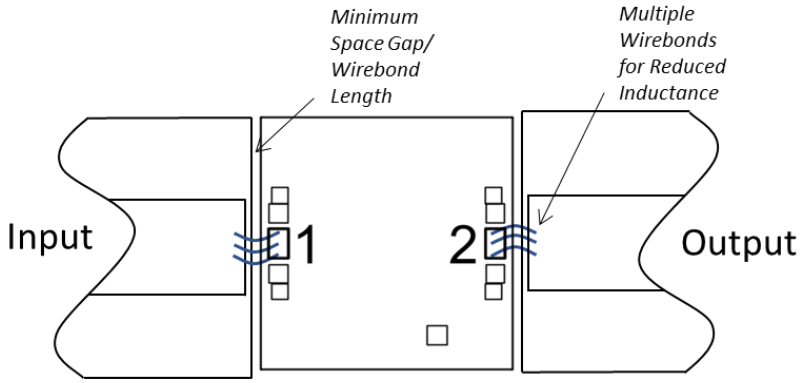
Marki MMICs should be attached directly to a ground plane with conductive epoxy. The ground plane electrical impedance should be as low as practically possible. This will prevent resonances and permit the best possible electrical performance. Datasheet performance is only guaranteed in an environment with a low electrical impedance ground.

Mounting - To epoxy the chip, apply a minimum amount of conductive epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip. Cure epoxy according to manufacturer instructions.

Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).

Circuit Considerations – 50 Ω transmission lines should be used for all high frequency connections in and out of the chip. Wirebonds should be kept as short as possible, with multiple wirebonds recommended for higher frequency connections to reduce parasitic inductance. In circumstances where the chip more than .001" thinner than the substrate, a heat spreading spacer tab is optional to further reduce bondwire length and parasitic inductance.

4.2 Bonding Diagram



4.3 Handling Precautions

General Handling

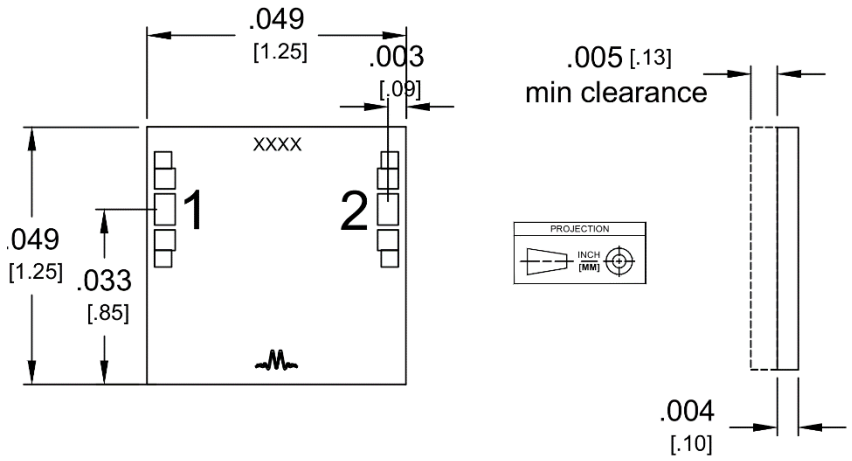
Chips should be handled with care using tweezers or a vacuum collet. Users should take precautions to protect chips from direct human contact that can deposit contaminants, like perspiration and skin oils on any of the chip's surfaces.

Static Sensitivity
GaAs MMIC devices are sensitive to ESD and should be handled, assembled, tested, and transported only in static protected environments.

Cleaning and Storage: Do not attempt to clean the chip with a liquid cleaning system or expose the bare chips to liquid. Once the ESD sensitive bags the chips are stored in are opened, chips should be stored in a dry nitrogen atmosphere.

5 Mechanical Data

5.1 CH Package Outline Drawing



Unless otherwise specified, dimensions are in inches. Tolerances are:

.XX	±.01
.XXX	±.002

1. CH Substrate material is 0.004 in thick GaAs.
2. I/O trace finish is 4.2 microns Au. Ground plane finish is 5 microns Au.
3. XXXX denotes circuit number

Part Number	Circuit Number
MEQ3-20ACH	6339
MEQ5-20ACH	6342
MEQ6-20ACH	6340
MEQ7-20ACH	6343
MEQ10-20ACH	6341
MEQ11-20ACH	6345