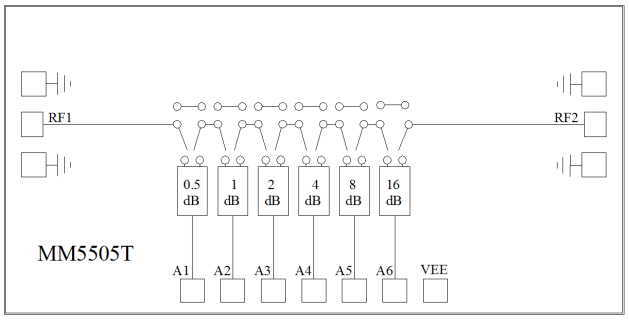
Features

- 0.5 dB LSB Steps to 31.5 dB
- Insertion Loss : 6.0 dB Typical
- High Input IP3: +36 dBm
- ±0.6 dB Typical Bit Error
- TTL Control : Low(0 to 0.8V)
  High (2 to 5V)
- Power Supply: -5V
- Chip Size: 2.294 x 1.144 x 0.1mm

Functional Block Diagram



Typical Applications

- Test Instrumentation
- Microwave Radio & VSAT
- Military & Space
- Telecom Infrastructure
- Fiber Optics

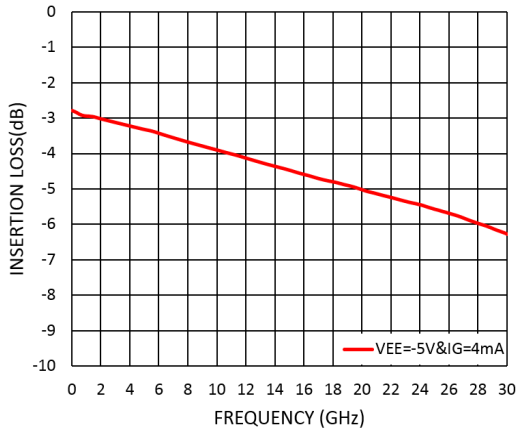
Electrical Specifications

TA = +25°C, VEE = -5V, VCTL = 0/ +5V

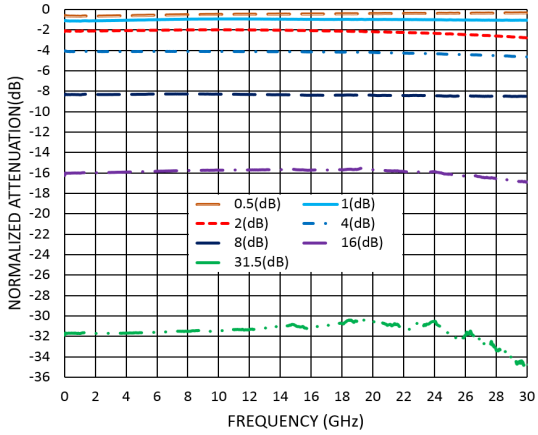
Parameters		Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency			DC - 20			20 - 30		GHz
Insertion Loss			5.0	5.5		6.3	6.8	dB
Attenuation Range			31.5			32		dB
Attenuation accuracy (Referenced to Insertion Loss)			±0.6			±1.5		dB
Input Return Loss (RF1 & RF2, All Atten States)			-14			-13		dB
Output Return Loss (RF1 & RF2, All Atten States)			-15			-16		dB
Input Power for 1 dB Compression			23			24		dBm
Input Third Order Intercept Point			35			36		dBm
Switching Characteristics	tRISE, tFALL (10/90% RF)		60			60		ns
	tON/tOFF (50% CTL to 10/90% RF)		90			90		

MM5505T
0.5 dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR DC – 30GHz

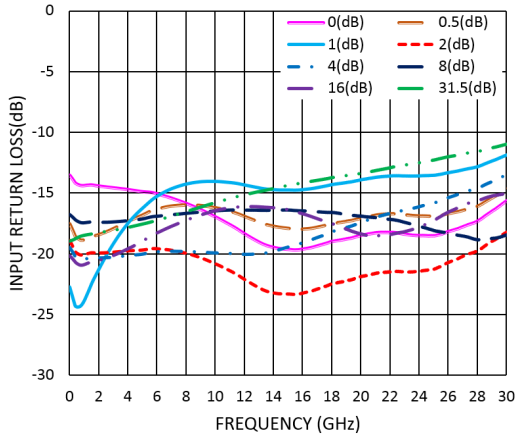
Insertion Loss vs. Frequency
TA = +25°C



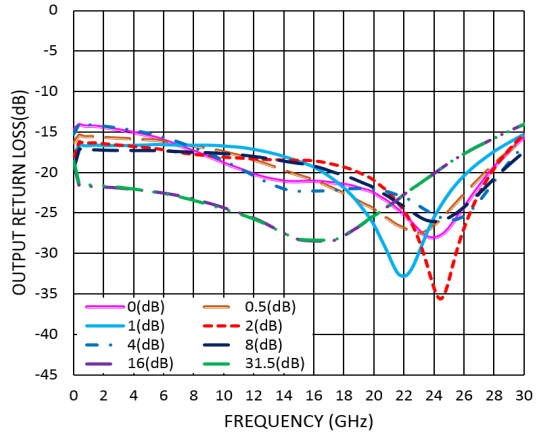
Normalized Attenuation vs. Frequency
TA = +25°C



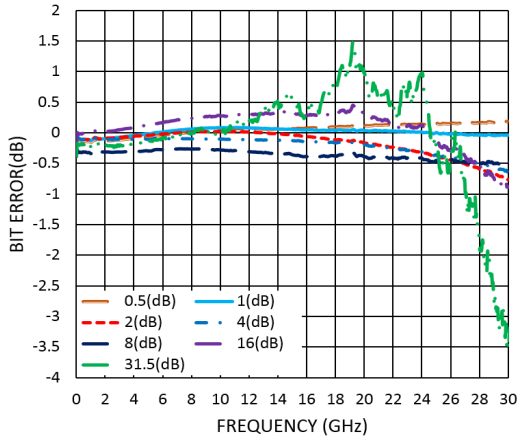
Input Return Loss vs. Frequency
TA = +25°C



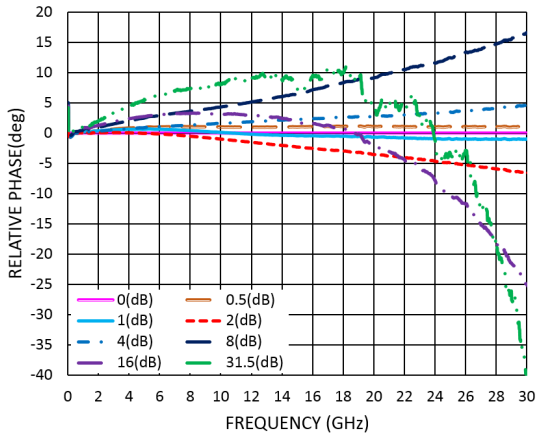
Output Return Loss vs. Frequency
TA = +25°C



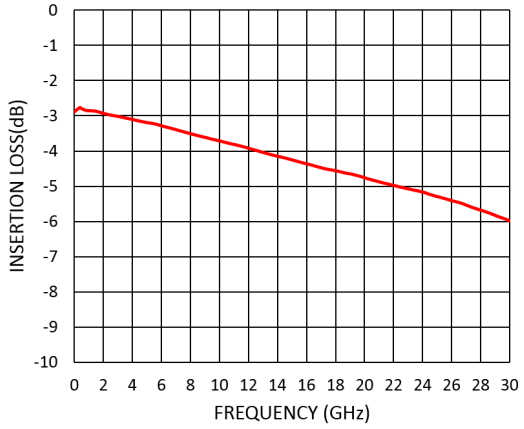
Bit Error vs. Frequency
TA = +25°C



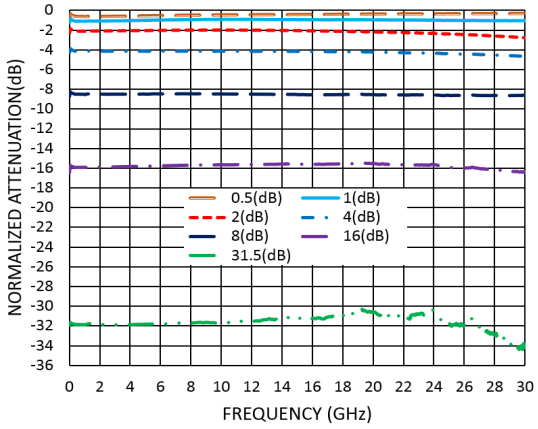
Relative Phase vs. Frequency
TA = +25°C



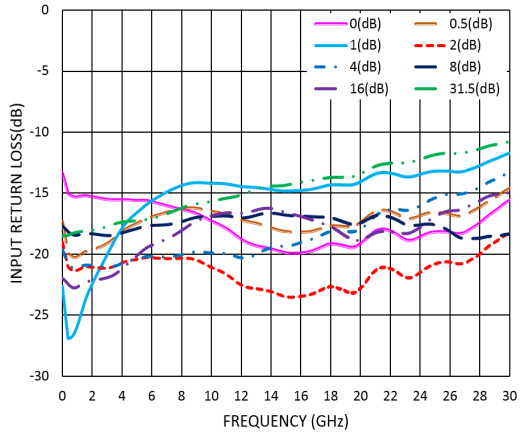
Insertion Loss vs. Frequency
TA = -40°C



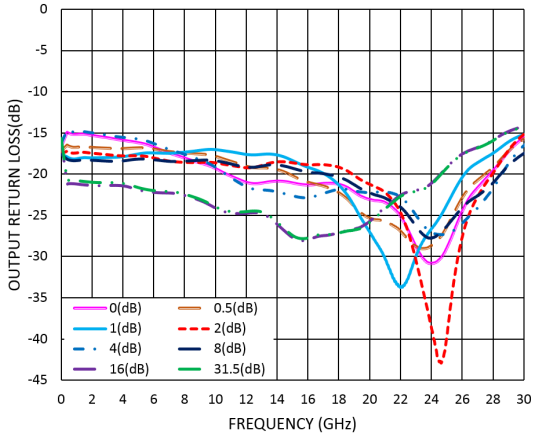
Normalized Attenuation vs. Frequency
TA = -40°C



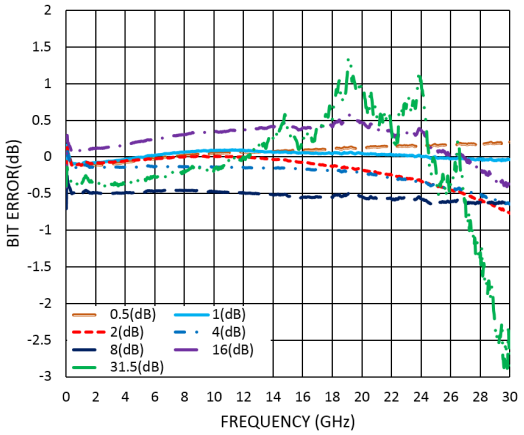
Input Return Loss vs. Frequency
TA = -40°C



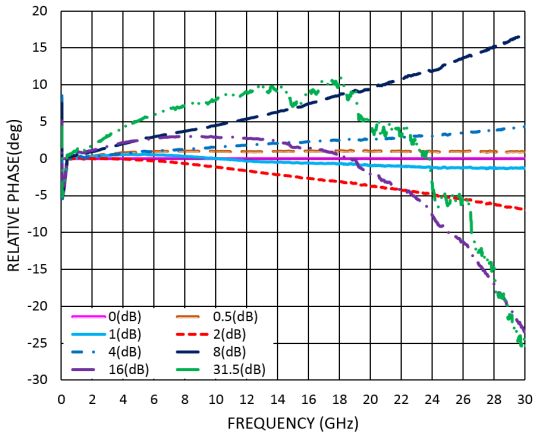
Output Return Loss vs. Frequency
TA = -40°C



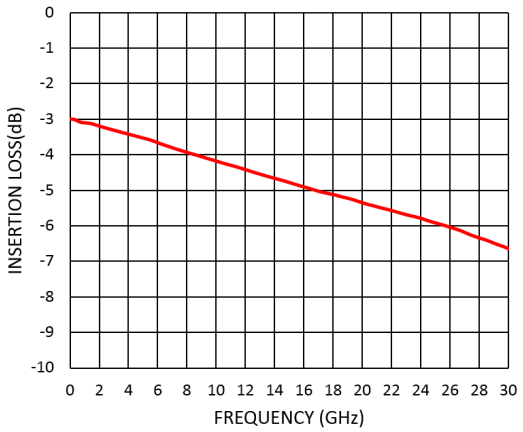
Bit Error vs. Frequency
TA = -40°C



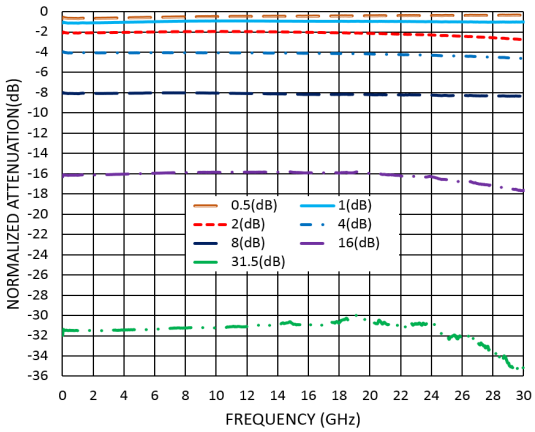
Relative Phase vs. Frequency
TA = -40°C



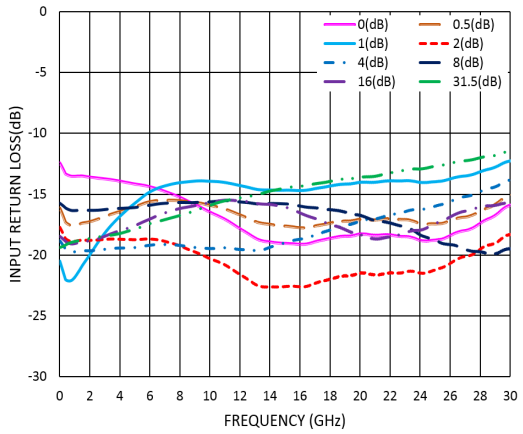
Insertion Loss vs. Frequency
TA = +85°C



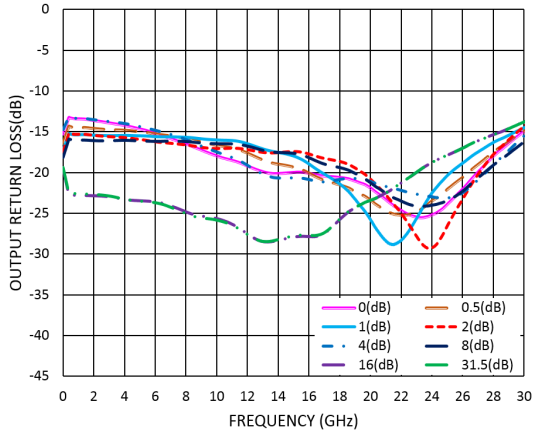
Normalized Attenuation vs. Frequency
TA = +85°C



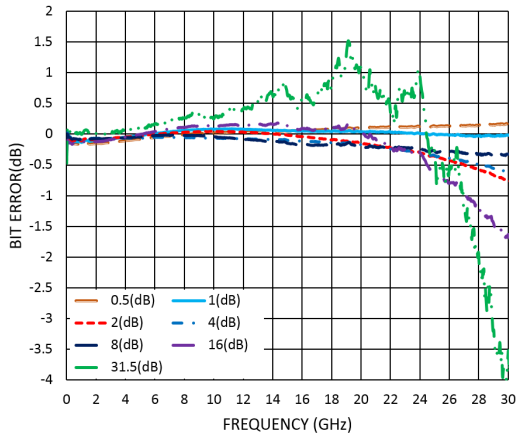
Input Return Loss vs. Frequency
TA = +85°C



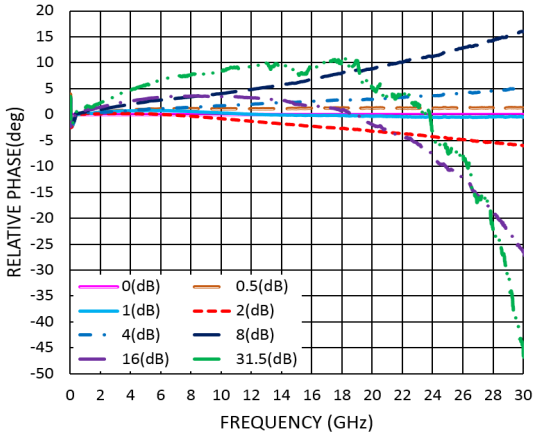
Output Return Loss vs. Frequency
TA = +85°C



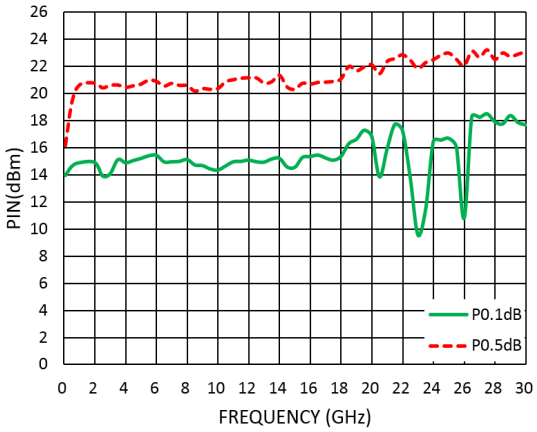
Bit Error vs. Frequency
TA = +85°C



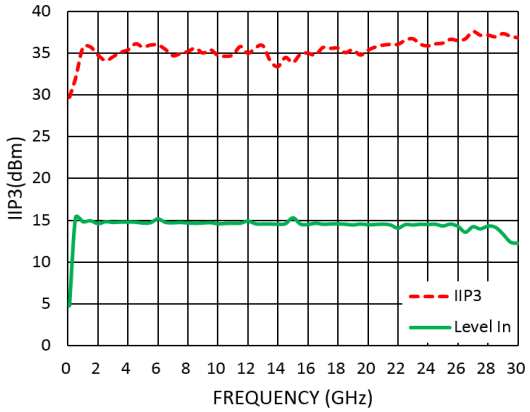
Relative Phase vs. Frequency
TA = +85°C



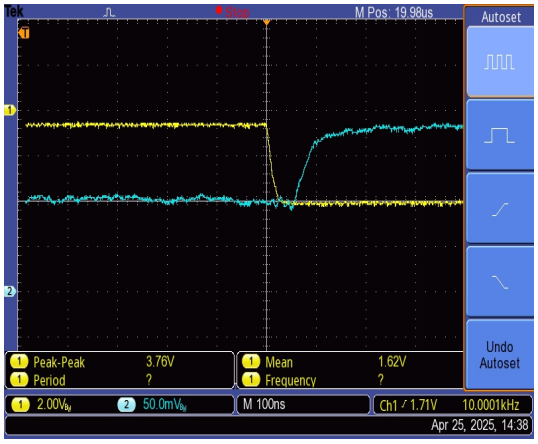
Pin vs. Frequency
TA = +25°C



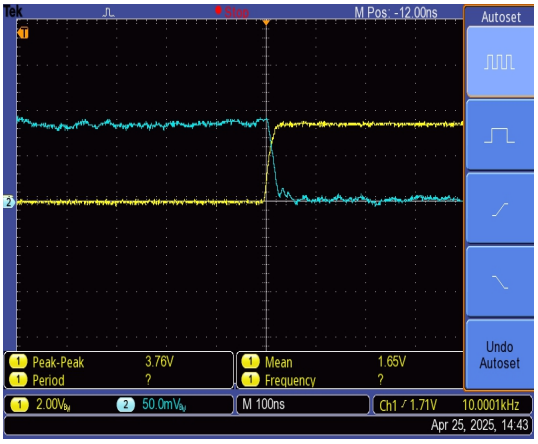
IIP3 vs. Frequency
TA = +25°C



Switching Rise Time
TA = +25°C

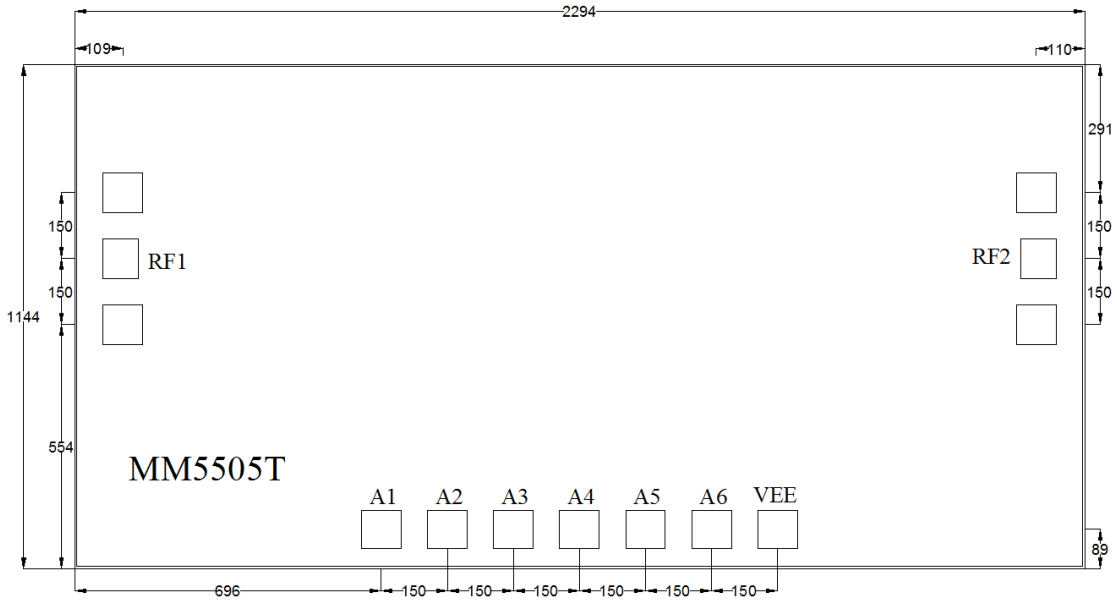


Switching Fall Time
TA = +25°C



Outline Drawing:

All Dimensions in µm



Truth Table

Control Voltage Input							Attenuation State RF1-RF2
A1	A2	A3	A4	A5	A6	VEE	
0	0	0	0	0	0	-5V	Reference IL
1	0	0	0	0	0	-5V	0.5dB
0	1	0	0	0	0	-5V	1dB
0	0	1	0	0	0	-5V	2dB
0	0	0	1	0	0	-5V	4dB
0	0	0	0	1	0	-5V	8dB
0	0	0	0	0	1	-5V	16dB
1	1	1	1	1	1	-5V	31.5dB

Notes:

1. **Die thickness: 100µm**
2. **DC bond pad is 90*90µm²**
3. **RF bond pad is 80*90µm²**
4. **Bond pad metalization: Gold**
5. **Backside metalization: Gold**

Bias Voltages & Currents

VEE	**-5V @ 4mA (Typ)**

Control Voltage

State	Bias Condition
Low(0)	**0 to 0.8V @ 1 µA (Typ)**
High(1)	**2 to 5V @ 1 µA (Typ)**

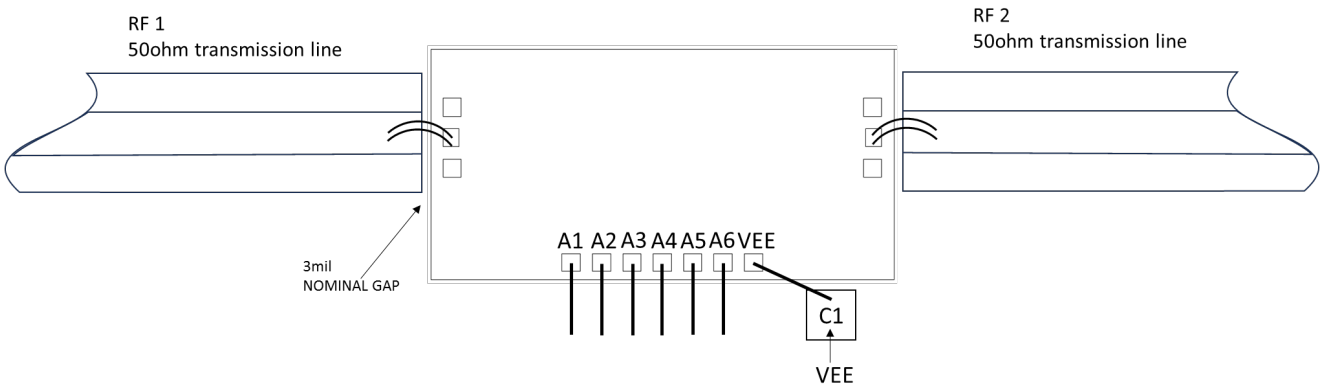
Absolute Maximum Ratings

RF Input Power (RFIN)	**+24dBm**
VEE	**-6 Vdc**
Channel Temperature	**150 °C**
Operating Temperature	**-55°C to +85 °C**
Storage Temperature	**-65°C to +150 °C**
ESD Sensitivity (HBM)	**Class 1A**

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

MM5505T
0.5 dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR DC – 30GHz

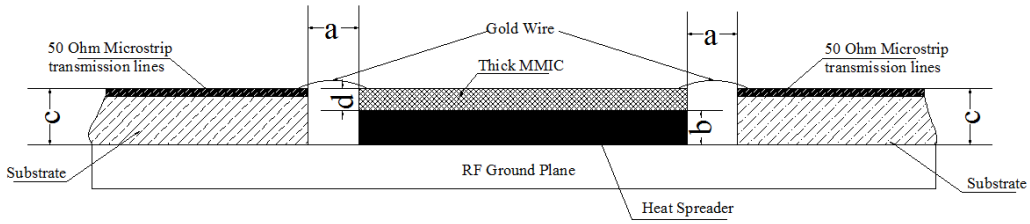
Assembly Drawing



Item	Description
C1	100pF Example: Skyworks Part: SC10002430

No	Function	Description
1	RF1, RF2	This pad is DC coupled and matched to 50 Ohm. Blocking capacitors are required if RF line potential is not equal to 0V.
2	A1、A2、A3、A4、A5、A6	Control pad, see truth table and control voltage table.
3	VEE	Negative bias -5V.
4	Die Bottom	Die bottom must be connected to RF and dc ground.

Mounting & Bonding Technigues for MMICs



Direct Mounting

1.Typically, the die is mounted directly on the ground plane.
2.If the thickness difference between the substrate (thickness c) and the die (thickness d) exceeds 0.05 mm (i.e., c – d > 0.05 mm), it is recommended to first mount the die on a heat spreader, then attach the heat spreader to the ground plane.
3.Heat Spreader Material: Molybdenum-copper (MoCu) alloy is commonly used.
4.Heat Sink Thickness (b): Should be within the range of (c – d – 0.05 mm) to (c – d + 0.05 mm).
5.Spacing (a): The gap between the bare die and the 50Ω transmission line should typically be 0.05 mm to 0.1 mm. If the application frequency is higher than 40GHz, then this gap is recommended to be 0.05mm

Wire Bonding Interconnection

The connection between the die and the 50Ω transmission line is usually made using 25 µm diameter gold (Au) wires, bonded via wedge bonding or ball bonding processes.

Die Attachment Methods

1.Conductive Epoxy:

After adhesive application, cure according to the manufacturer's recommended temperature profile.

2.Au-Sn80/20 Eutectic Bonding:

Use preformed Au-Sn80/20 solder preforms.
Perform bonding in an inert atmosphere (N_2 or forming gas: 90% N_2 + 10% H_2).
Keep the time above 320°C to less than 20 seconds to prevent excessive intermetallic formation.