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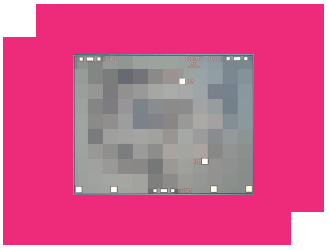
MSW2-00002CH

4-50 GHz MMIC GaAs PIN SPDT Switch

DEVICE OVERVIEW

General Description

The MSW2-00002CH is a reflective, single-pole double throw (SPDT) switch. The switch operates from 4 GHz to 50 GHz with average insertion loss and isolation of 1.0 dB and 48 dB respectively. The MSW2-00002CH requires positive and negative 5V supply inputs to control switch states. This switch has a 50-Ohm characteristic impedance. The MSW2-00002CH is available as a wire-bondable die.



Download s-parameters here

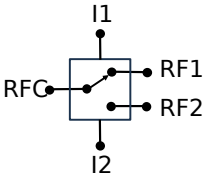
Features

- 1 dB Insertion loss
- 48 dB Isolation
- 4 ns switching time
- +41 dBm Input IP3
- Low Power Consumption

Applications

- Mobile test and measurement equipment
- Radar
- SATCOM
- Electronic Warfare

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MSW2-00002CH	4-50 GHz MMIC GaAs PIN SPDT Switch	CH	REACH RoHS	Released	EAR99

Table Of Contents

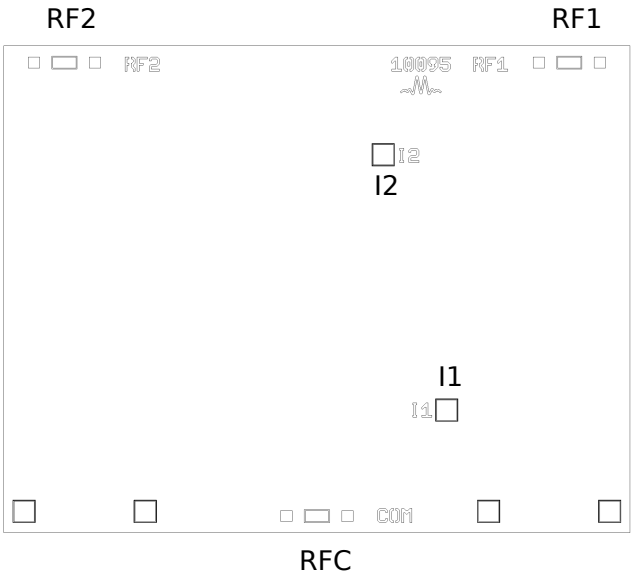
Revision History

Revision Code	Revision Date	Comment
-	2025-05-23	Initial Release
A	2025-06-02	Updated IP3 and P1dB plots frequency range.

Port Configuration and Functions

Port Diagram

A top-down view of the MSW2-00002CH die is show below.



Port Functions

Port	Function	Description	DC Equivalent Circuit
GND	Ground	DC and RF ground is provided through the backside of the die. The die should be connected to a DC/RF ground with high thermal and electrical conductivity.	-
I1	VCTRL1	I1 is the control input pad for port RF1. Control voltages applied to this pad and the I2 pad will result in the active switch path being turned ON or OFF as described in the Application Information section of the datasheet. Nominal positive and negative control voltage for this port are +5V and -5V respectively. The bias circuit attached to this pad should be capable of sourcing or sinking at least 10mA of DC control current.	-
I2	VCTRL2	I2 is the control input pad for port RF2. Control voltages applied to this pad and the I1 pad will result in the active switch path being turned ON or OFF as described in the Application Information section of the datasheet. Nominal positive and negative control voltage for this port are +5V and -5V respectively. The bias circuit attached to this pad should be capable of sourcing or sinking at least 10mA of DC control current.	-
RF1	Input/Output 1	RF port 1 of the device, impedance looking into this port matches RFC load impedance in the ON state. This port is reflective and shorted to GND in the OFF state. This port is internally DC shorted to GND and should have an external DC block installed if DC exists on the RF1 line.	-
RF2	Input/Output 2	RF port 2 of the device, impedance looking into this port matches RFC load impedance in the ON state. This port is reflective and shorted to GND in the OFF state. This port is internally DC shorted to GND and should have an external DC block installed if DC exists on the RF2 line.	-
RFC	Common	RF common port of the device. The input impedance of this port is determined by the RF output port terminations. Output ports should be connected to a 50 Ohm load for normal operation. This port is internally DC shorted to GND and should have an external DC block installed if DC exists on the RFC line.	-

Specifications

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 become inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Max DC on any RF port [1]	0	V
Maximum Operating Temperature	100	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-55	°C
Minimum Storage Temperature	-65	°C
Negative Supply Voltage	-10	V
Positive Supply Voltage	10	V

[1] RF ports are internally shorted to GND and should not have DC voltage applied.

Package Information

Parameter	Details	Rating
Dimensions	-	3.10 x 2.40 mm

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications. Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Control Voltage Low, VINL	-8	-5	-3	V
Ta Ambient Temperature	-55	25	100	°C
Control Current, IINL	-5	-10	-15	mA
Control Voltage High, VINH	3	5	8	V
Control Current, IINH	5	10	15	mA

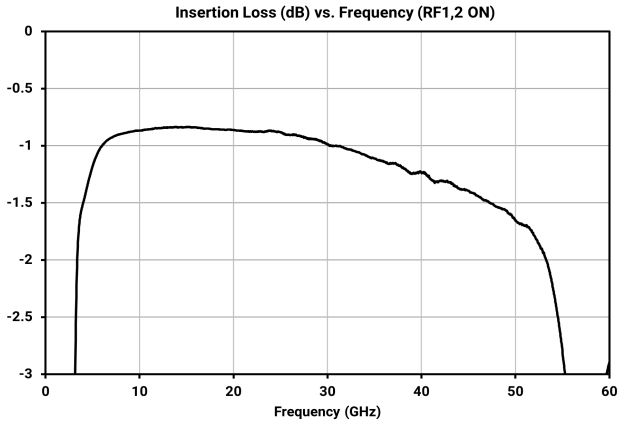
Electrical Specifications

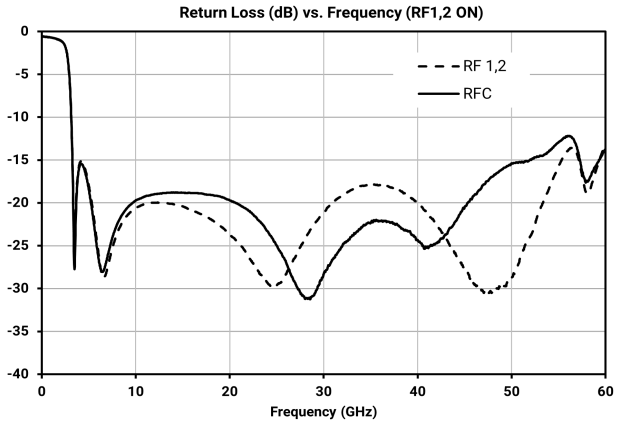
The electrical specifications apply at TA=+25 °C in a 50 Ω system. Unless otherwise noted, all specifications are for I1=±10mA, I2=±10mA and V1 and V2 = ±5V (both switch paths) with all ports terminated into 50 Ω loads.

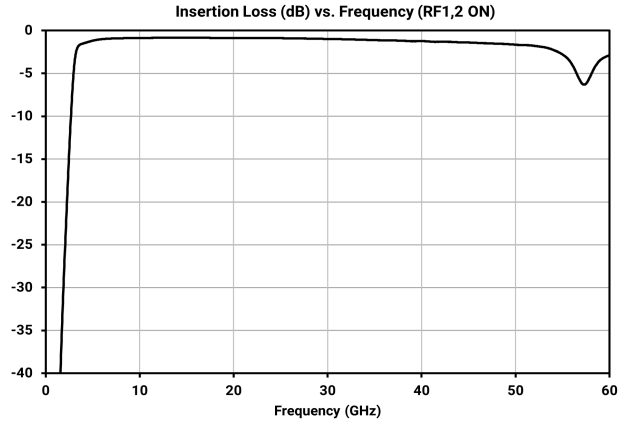
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Insertion Loss	I1=±10mA, I2=±10mA, V1 and V2=±5V	4	50	-	1	-	dB
Return Loss	I1=±10mA, I2=±10mA, V1 and V2=±5V	4	50	-	22	-	dB
Isolation, RF1 to RF2	I1=±10mA, I2=±10mA, V1 and V2=±5V	4	50	-	53	-	dB
Isolation, RFC to any non-active Port	I1=±10mA, I2=±10mA, V1 and V2=±5V	4	50	-	48	-	dB
Input P1dB	I1=±10mA, I2=±10mA, V1 and V2=±5V	4	18	-	26	-	dBm
Input IP3	Two Tones @ +12dBm, dF=1 MHz, I1=±10mA, I2=±10mA, V1 and V2=±5V	2	20	-	41	-	dBm
RF Settling Time	50% V1 and V2 to 0.1dB final RF output	4	50	-	19	-	ns
Risetime/Falltime	10-90% of RF output	4	50	-	4	-	ns
On-Time	50% V1 and V2 to 90% RF output	4	50	-	17	-	ns
Nominal RF Impedance	I1=±10mA, I2=±10mA, V1 and V2=±5V	-	-	-	50	-	Ω

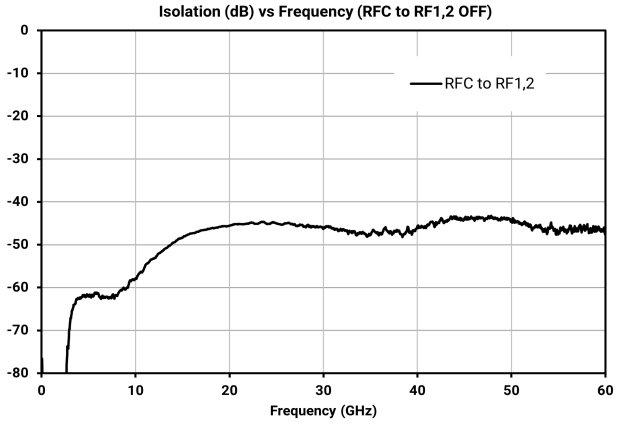
Typical Performance Plots

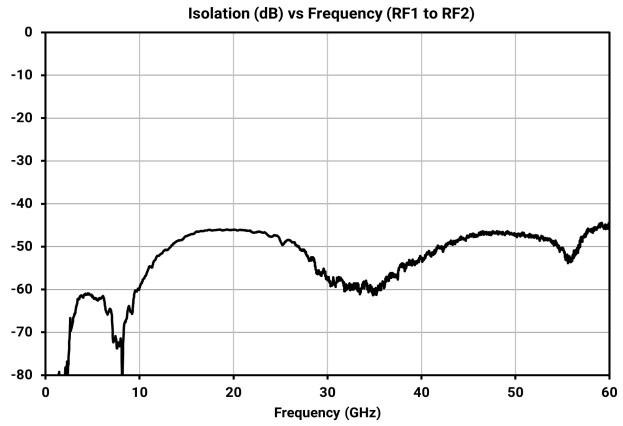
Unless otherwise noted, plotted data is for I1=±10mA, I2=±10mA and V1 and V2 = ±5V (both switch paths) with all ports terminated into 50 Ω loads.

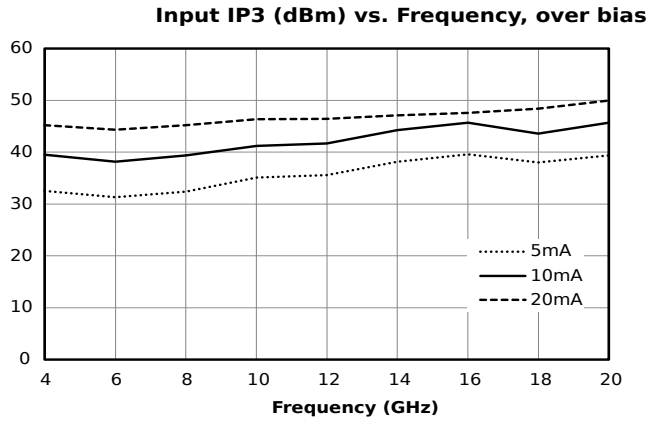




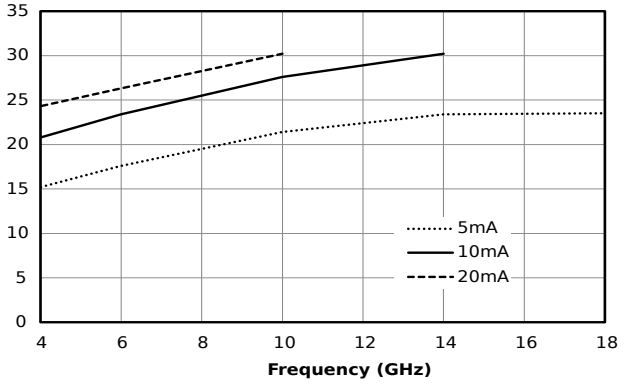








Input P1dB vs. Frequency, over bias



Application Information

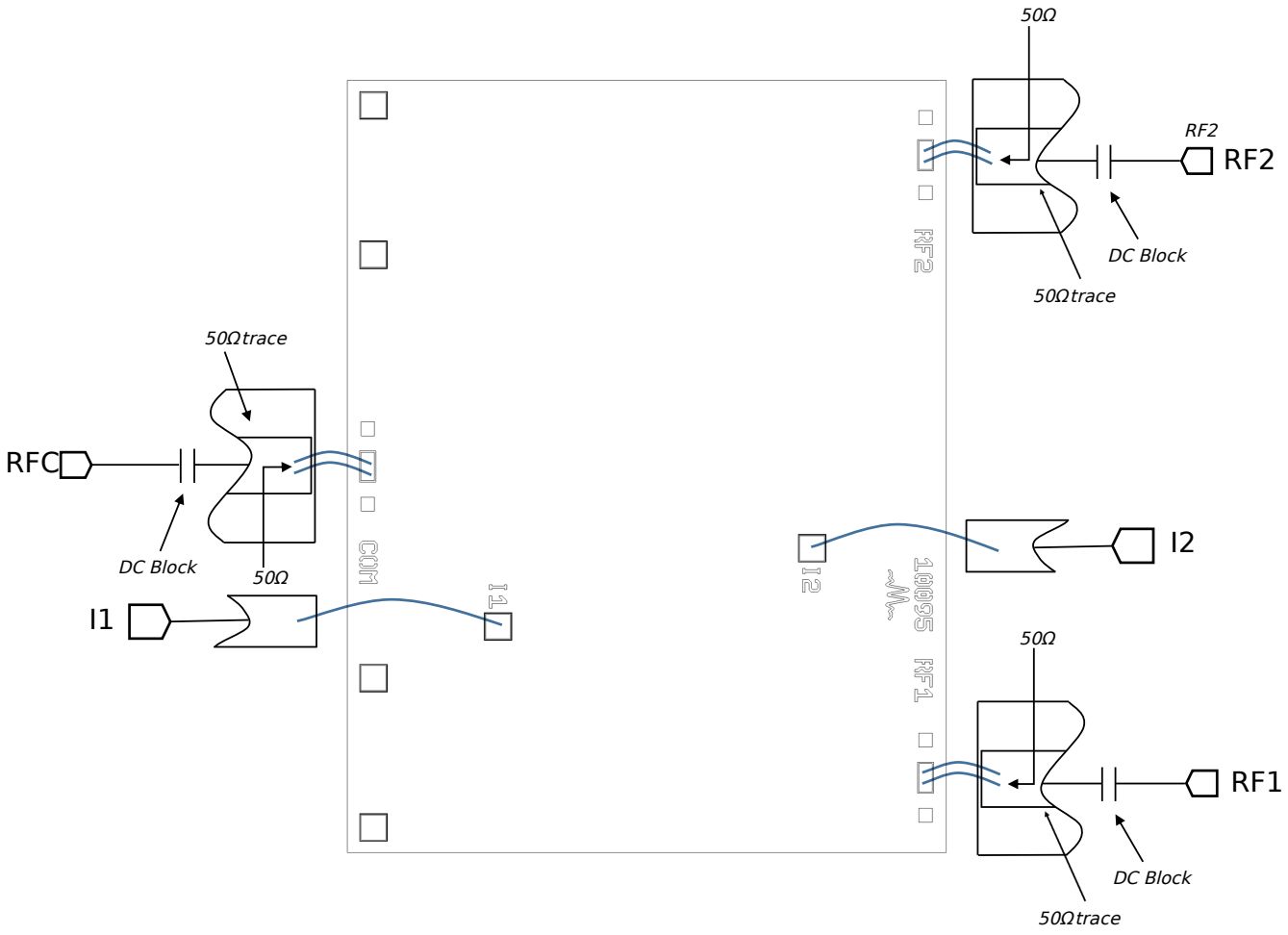
The MSW2-00002CH is an RF SPDT switch. This switch is a reflective design at the RF outputs, meaning these ports will appear reflective in the OFF state. All RF ports are internally DC shorted to GND and should have external DC blocks installed if DC exists on the RF lines.

The MSW2-00002CH requires both positive and negative 5V control/supply voltages, which are applied directly to the I1 and I2 pads of the die. The I1 and I2 inputs are internally bypassed, so no external bypassing is needed. The I1 and I2 inputs control the switch state as specified in the Switch Logic Table. Depending on the polarity of the applied control voltage, the DC supply must be capable of sourcing or sinking at least 10mA of control current. The control current is determined by the voltage on the I1 and I2 pins. While the nominal control voltage is ±5V, higher control voltages will result in increased control currents, which in turn improve switch linearity. Further details can be found in the performance plots.

I1	I2	Active Switch Path
-5V@-10mA	+5V@+10mA	RFC to RF1
+5V@+10mA	-5V@-10mA	RFC to RF2

Switch Logic Table

Application Circuit



Die Mounting Recommendations

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 willprevent resonances and permit the best possible electrical performance. Datasheetperformance 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 themounting surface so that a thin epoxy fillet is observed around the perimeter of the chip.Cure epoxy according to manufacturer instructions.

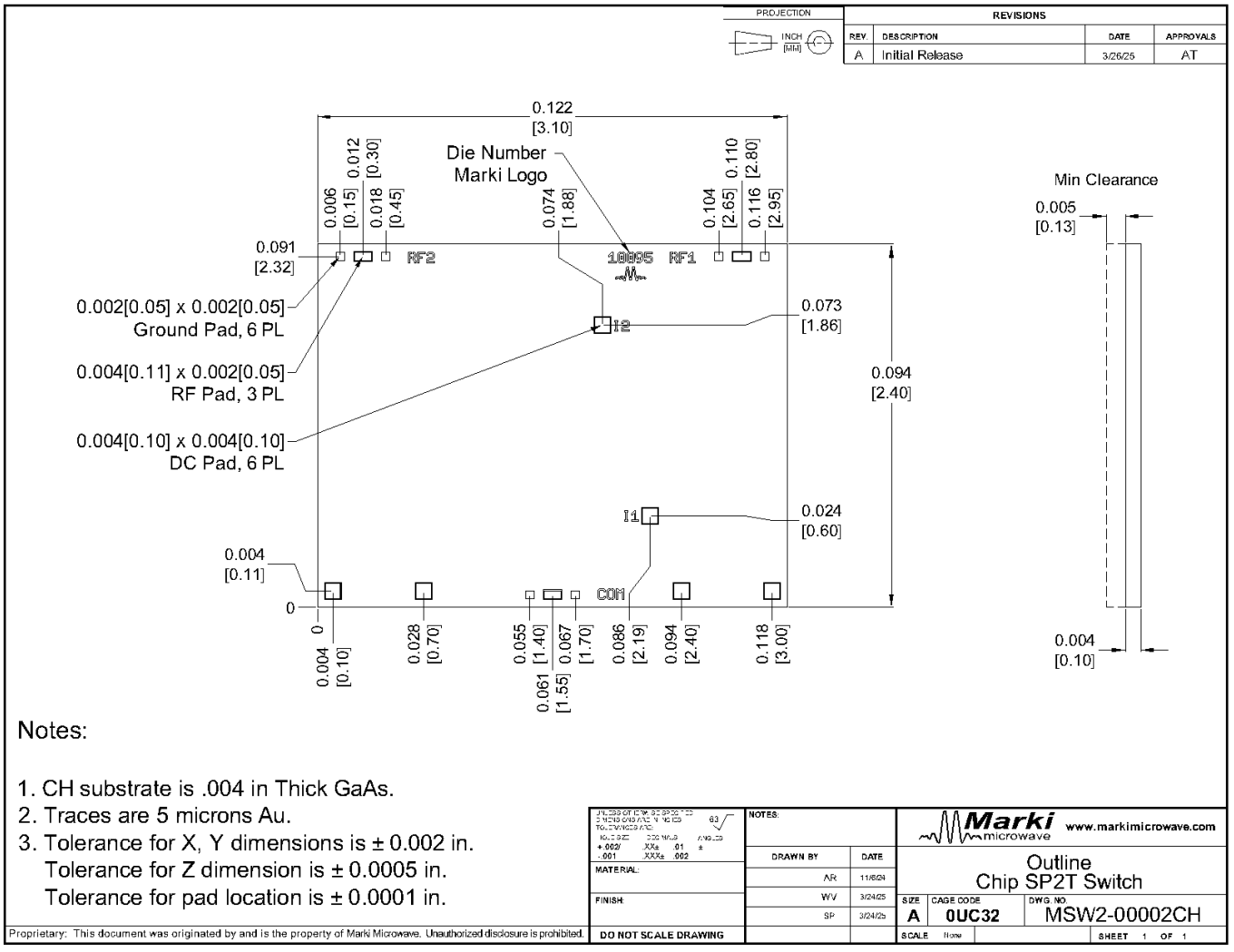
Wire Bonding - Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire.Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bondingforce of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Usethe minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should bestarted on the chip and terminated on the package or substrate. Bond wire inductancewill improve return loss. Bondwire inductance in the range of 30pH to 200pH will improveperformance.

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

Mechanical Data

Outline Drawing

Download : Outline 2D Drawing



1. CH substrate is .004 in Thick GaAs.
2. Traces are 5 microns Au.
3. Tolerance for X, Y dimensions is ± 0.002 in.
Tolerance for Z dimension is ± 0.0005 in.
Tolerance for pad location is ± 0.0001 in.

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