DM4011
12.5 Gb/sec XOR gate
(Preliminary Information)

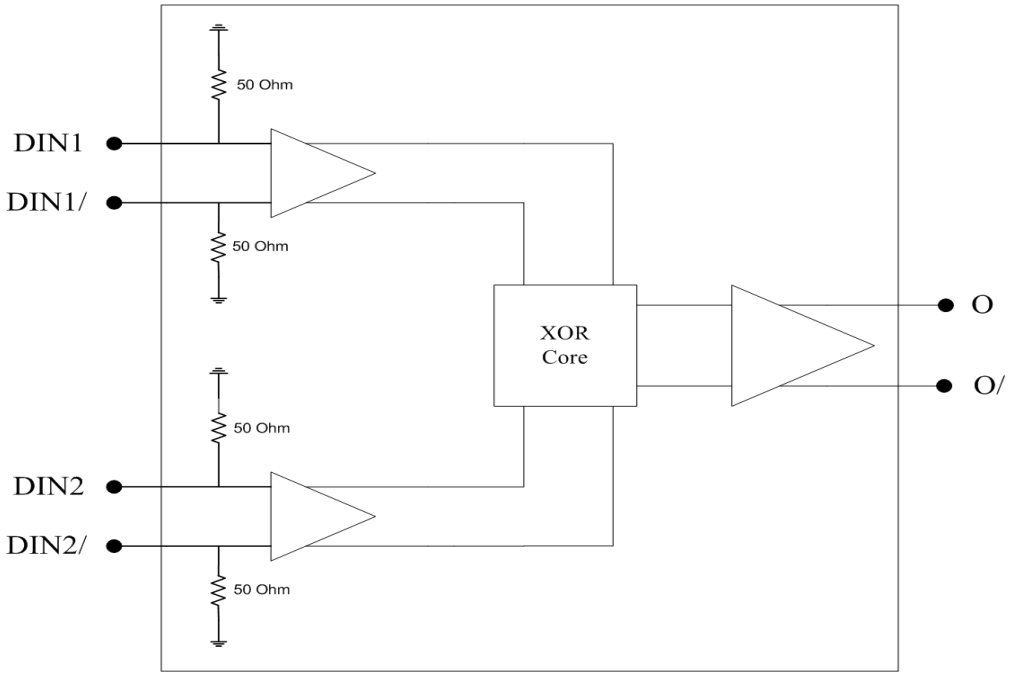
Description

The DM4011 is a high-speed logic exclusive OR (XOR) device fabricated using 1-µm GaAs HBT technology. It features high output voltage, fast rise and fall times, and excellent eye diagram at data rates up to 12.5 Gb/s. Applications include XOR logic up to 12.5 Gb/s, edge detection and Manchester encoding up to 10.709 Gb/s, and X2 clock multiplication with inputs up to 6.25 GHz. The DM4011 employs an ECL topology to guarantee high-speed operation. Data inputs and output are DC coupled, and internal 50-ohm resistors at the input eliminate the need for external impedance matching terminations. Inputs can be either single-ended or differential, and a high-performance output buffer ensure superior eye diagram performance.

Features

- Data rate range: DC to 12.5 Gb/s
- Typical single-ended output : 800 mVpp
- Input sensitivity: >300 mV (single-ended)
- Jitter RMS < 1.8 ps
- Output rise time (20% to 80%): < 22 ps
- Output fall time (20% to 80%): < 19 ps
- 50-ohm matched DC-coupled inputs and outputs
- Differential or single-ended I/O
- Power consumption: 750 mW
- 4mm Plastic QFN Package or Die

Device Diagram



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Absolute Maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only. Functional operation of the device at these or any other conditions above those indicated in the operational section of this document is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameters/Conditions	Min.	Max.	Units
Vee	Power supply voltage	-5.5	0	V
Vih	Data/clock input voltage level, high level	-1.2	1.2	V
Vil	Data/clock input voltage level, low level	-1.2	1.2	V
Ta	Operating temperature range – die	-15	125	°C
Tstg	Storage temperature	-65	150	°C

Recommended Operating Conditions

Symbol	Parameters/conditions	Min.	Typ.	Max.	Units
Ta	Operating temperature range – die	0		85	°C
Vee	Power supply voltage		-5		V
Vih	Data input voltage level, high level (single-ended)		0		V
Vil	Data input voltage level, low level (single-ended)		-0.9		V
Vindc	DC input voltage (with DC-coupled input)		-0.45		V

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Electrical Characteristics[1]

Symbol	Parameters		Min	Typ	Max	Units
V_{ee}	Power supply voltage		-5.25	-5.0	-4.75	V
V_{ih}	Data input voltage level, high level (single-ended)		-0.5	0.0	0.5	V
V_{il}	Data input voltage level, low level (single-ended)		-1	-0.9	0.0	V
V_{INpp}	Data input amplitude	Differential peak-to-peak	0.3	1.8	2.0	V
		Single-ended peak-to-peak	0.3	0.9	1.0	V
V_{indc}	DC input voltage (with DC-coupled input) [2]		-0.75	-0.45	0.25	V
V_{out}	Data output voltage amplidude (O,Ob) single-ended, peak-to-peak		0.7	0.8	0.85	V
V_{OH}	Data output voltage high level (O, Ob) [3]		-0.1	0	--	V
V_{outc}	Data output voltage, common mode (O, Ob) single-ended [3]		-0.4	-0.35	-0.3	V
Tr	Output rise time (20% to 80%)			20	24	ps
Tf	Output fall time (20% to 80%)			17	21	ps
Td	Data in to data out delay [4]			80		ps
RLin	Input return loss (up to 15 GHz) [4]			15		dB
RLout	Output return loss (up to 15 GHz) [4,5]			5		dB
Jpp	Peak to peak jitter		4	7.7	10	ps
Jrms	RMS jitter		0.82	1.3	1.8	ps
Ic	Power supply current		137	150	162	mA
Pd	Power dissipation		0.65	0.75	0.85	W

1. At ambient temperature

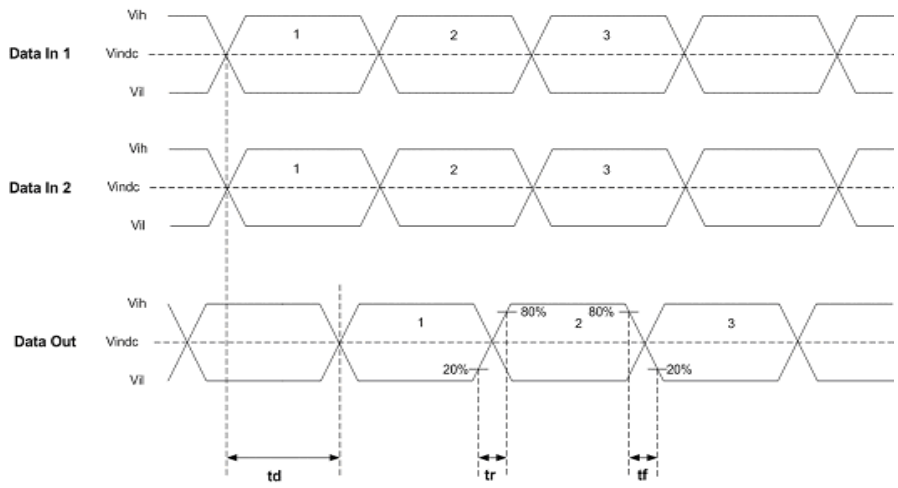
2. In the case of single-ended inputs, the unused one must be tied to Vindc. In the case of single-ended outputs, the unused one must be terminated with 50 ohms to ground.

3. The output common mode is application dependent. The figures in the table do not apply when the DM4011 is used as an edge detector.

4. Simulated data.

5. RLout increases up to 9.5 dB by inserting a 10-ohm series resistor on the outputs.

Timing Diagram



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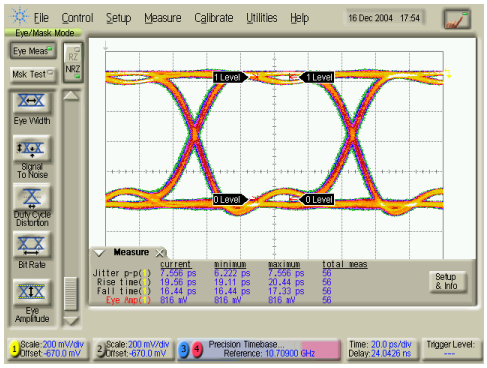
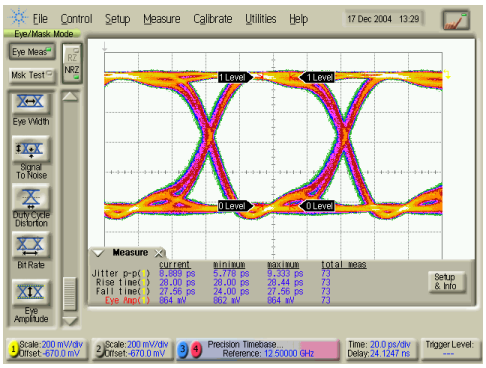
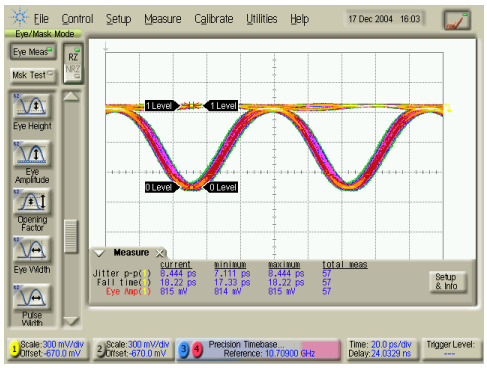
Eye Diagram Performance



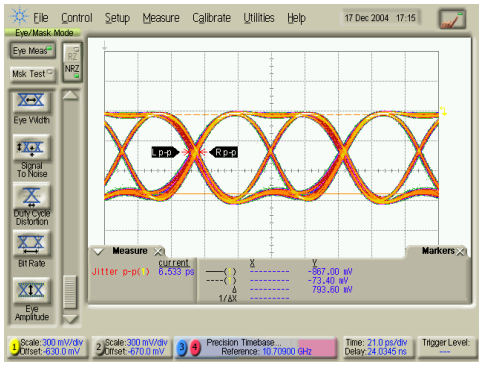
DM4011 used as XOR gate.
10.709 Gb/s NRZ inputs,
1.8 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame



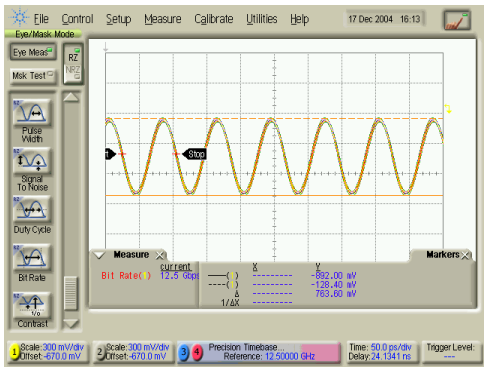
DM4011 used as XOR gate.
12.5 Gb/s NRZ inputs,
1.8 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame



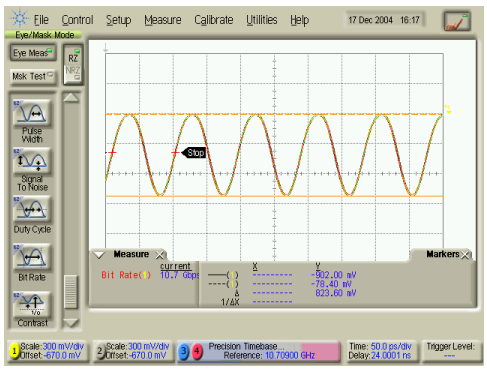
DM4011 used as edge detector.
10.709 Gb/s NRZ inputs,
1.8 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame



DM4011 used as Manchester encoder.
10.709 Gb/s NRZ inputs,
1.8 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame



DM4011 used as X2 clock multiplier.
6.25 GHz clock inputs, 1.8 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame



DM4011 used as X2 clock multiplier.
5.36 GHz clock inputs, 1.8 Vpp Differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame

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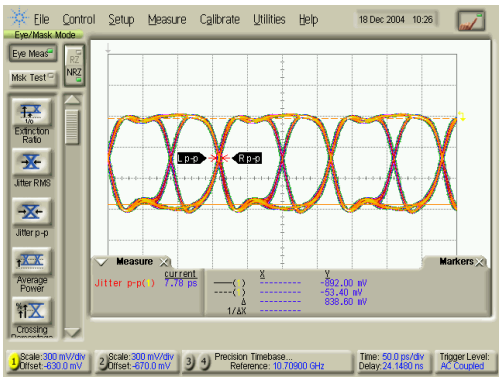
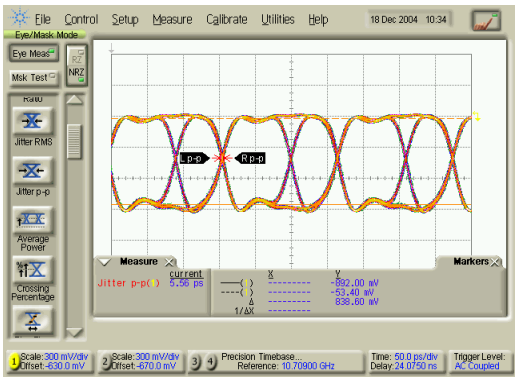
Eye Diagram Performance (cont.)



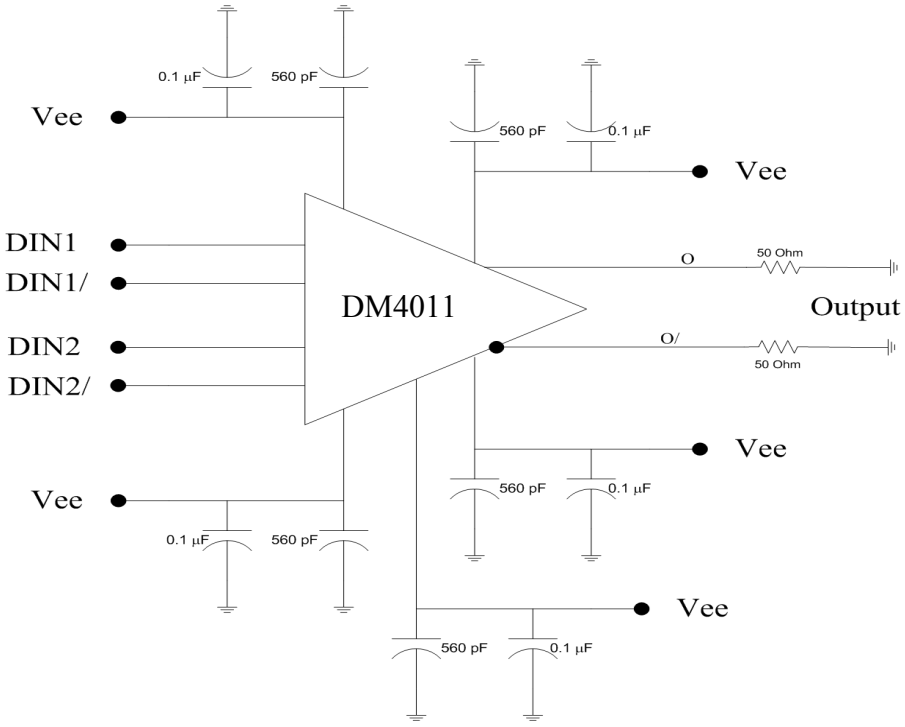
A.



B.

DM4011 used as Manchester encoder with different input amplitudes, 6.25 Gb/s NRZ inputs.
A. 1.8 Vpp differential on DIN1 and DIN2.
B. 0.6 Vpp differential on DIN1 and DIN2.
Power supply voltage: -5 V
Power supply current: 150 mA
Open frame

Recommended Operational Setup



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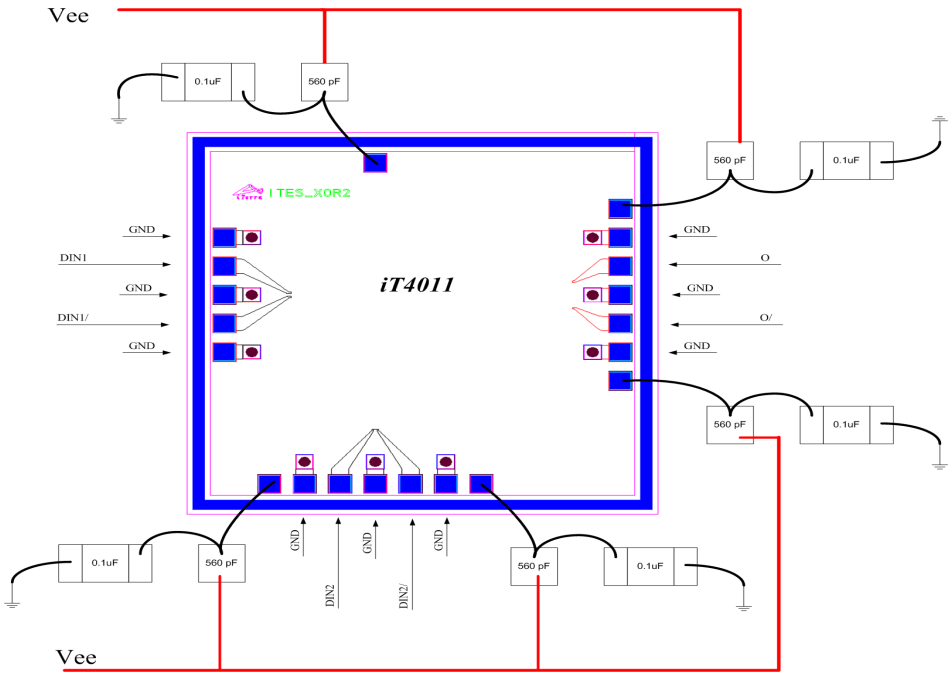
Recommended Chip Assembly



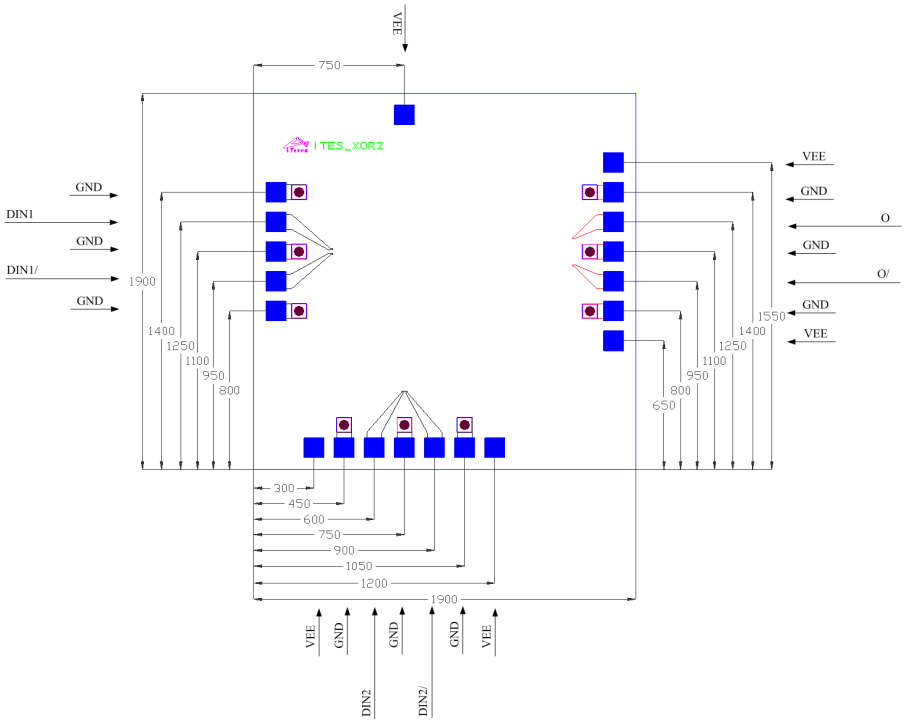
Pads positions and chip dimension (µm)

Chip size:
1900 µm +/-10 µm
x 1900 m +/-10 µm

Chip thickness:
104 µm +/-3 µm

Pad size:
100 µm x 100 µm

RF pad pitch:
150 µm



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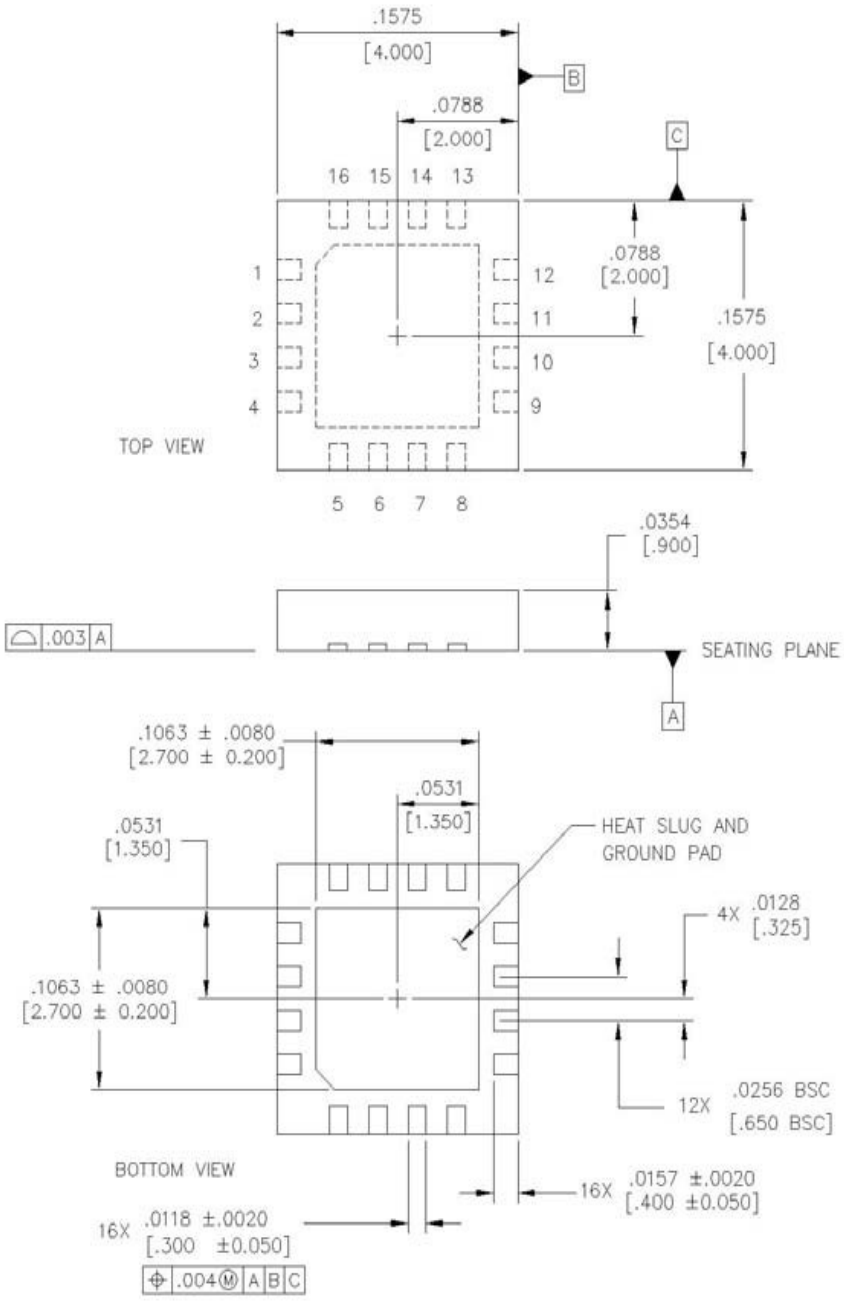
Package Drawing and Pinouts

Dimension: Inches [mm]
Name equivalencies
A = DIn1
B = Din2
Dout = Output
VEE=Power Supply



Pinouts

P1: A	**P9: Vee**
P2: N/C	**P10: Dout**
P3: A/	**P11: N/C**
P4: Vee	**P12: Dout/**
P5: B	**P13: Vee**
P6: N/C	**P14: N/C**
P7: B/	**P15: N/C**
P8: N/C	**P16: Vee**

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Application Information

CAUTION: THIS IS AN ESD SENSITIVE DEVICE

Chip carrier material should be selected to have GaAs compatible thermal coefficient of expansion and high thermal conductivity such as copper molybdenum or copper tungsten. The chip carrier should be machined, finished flat, plated with gold over nickel and should be capable of withstanding 325°C for 15 minutes.

Die attachment for power devices should utilize Gold/Tin (80/20) eutectic alloy solder and should avoid hydrogen environment for HBT devices. Note that the backside of the chip is gold plated and it is connected to RF and DC Ground.

These GaAs devices should be handled with care and stored in dry nitrogen environment to prevent contamination of bonding surfaces. These are ESD sensitive devices and should be handled with appropriate precaution including the use of wrist-grounding straps. All die attach and wire/ribbon bond equipment must be well grounded to prevent static discharges through the device.

Recommended wire bonding: for Signal input / output connections, use either 3 mils wide and 0.5 mil thick gold ribbon or a pair of 1mil diameter wires with lengths as short as practical allowing for appropriate stress relief (typically 400 +/- 100 um long). For all other connections, a single 1 mil dia wire of appropriate minimum length may be used.

Product Status Definitions

Datasheet Identification	Product Status	Definition
Advanced Information	Formative or or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. DIGIMIMIC reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. DIGIMIMIC reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not in Production	This datasheet contains specifications on a product that has been discontinued by DIGIMIMIC. The datasheet is printed for reference information only.

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