mmTron
Unleashing the mmWave Frontier

TMC216
25-29 GHz 25-45 W Linear Power Amplifier

Product Description

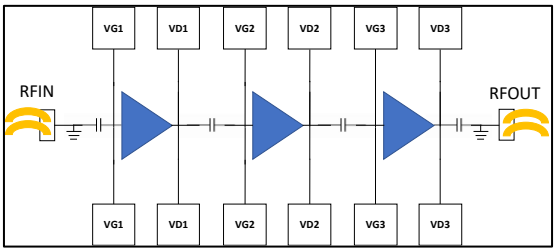
The TMC216-D is a 25-29 GHz, Ultra linear power amplifier die product with high power-added efficiency. TMC216-D is designed for use in SATCOM, Instrumentation, Military Radar, and EW applications. The TMC216-D is a 50Ω matched design with built-in DC blocking and ESD protection on both input and output RF ports. To ensure rugged and reliable operation and moisture protection, the TMC216-D is designed for maximum reliability. TMC216-D typical input operating max saturation power is 25dBm but it can handle bursts of pulsed input power levels of 35 dBm.

Both bond pad and backside metallization are Au-based that is compatible with ribbon and wedge bonding and high conductivity epoxy and eutectic die attach methods. TMC216-D can be biased from 18V to 28V to adjust P1dB output power levels in the 25W to 45W range while maintaining excellent PAE and NPR.
TMC216-T is the bare die on a Cu/CuMo/Cu tab. (CuW and Diamond-based, optional) shims are available with both silver epoxy and AuSn eutectic die attach.
Please contact mmTron for the 15x15 mm packaged version TMC216-P15.

Product Features

- RF frequency: 25 to 29 GHz
- Linear Gain: 23 dB
- P_{sat}: 46.5 dBm
- Die Size: X=4.9, Y=4.0, Z=0.1 mm
- Package Size: X=15.2, Y=15.2, Z=5.2 mm
- DC Bias Point: 28 VDC, 3000 mA
  (VG1 = VG2 = VG3 ~ -4.1V)

Functional Block Diagram *



*Add off chip bypassing for each supply pad 100pF. Decades of capacitance from 100pF to 10uF for best linearity. Device should have DC applied from both top and bottom on all pads. Number of 1-mil bond wires per pad is as follows:
VG1, VG2 and VG3: 1,
VD1: 1, VD2: 2, VD3: 3.

Applications

- SSPA
- SATCOM
- Military Radar, EW

Ordering Information

Part No.	Description
TMC216-D	Bare Die
TMC216-T[1]	Bare Die on a Tab with Bypass Capacitors and Wire bonds
TMC216-T1[1]	Bare Die on a Tab
TMC216-P15[2]	Packaged Version

1- Available in Cu/CuMo/Cu shims.

2- Contact mmTron for further information

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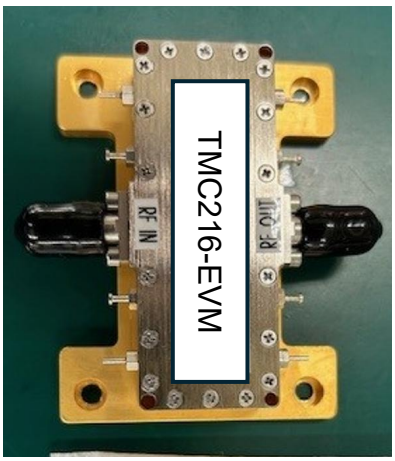
Typical Operating Conditions

	Min	Typ	Max	
Frequency	25		29	GHz
Small Signal Gain		23		dB
Pout @ 19dBc NPR		22		W
Pout @ -32dBc spectral regrowth		23		W
PAE @ P1dB		24		%
Pout @ P1dB		45		W
Return Loss		15		dB
Drain Voltage	18	28	28	V
Drain Bias Current	2000	3000	4000	mA

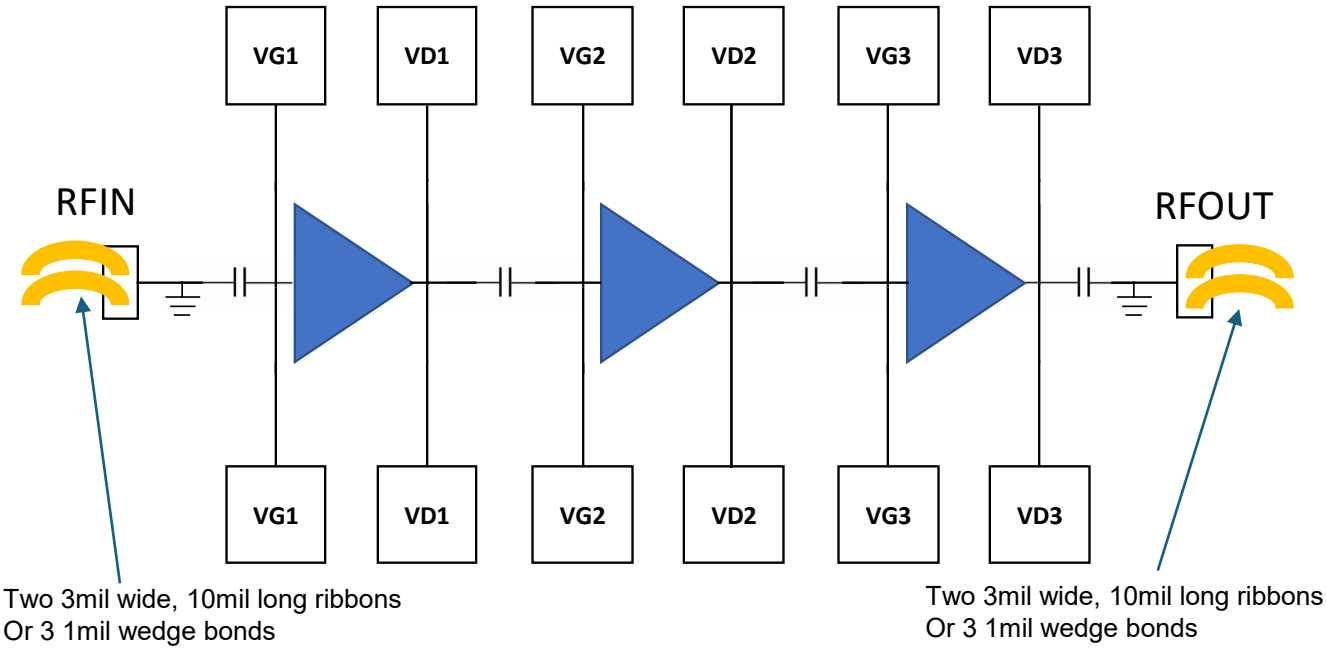
Evaluation Module [1]



1: Contact mmTron, Inc. for mechanical and electrical model information

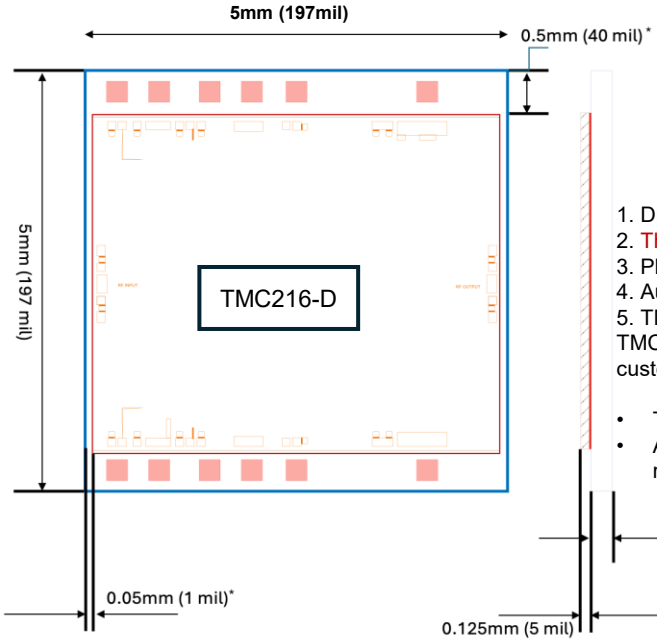
Connecting Instructions

*Off chip bypassing for each supply pad 100pF to minimize components. Decades of capacitance from 100pF to 10uF for best linearity. Device should have DC applied from both top and bottom on all pads. Minimum number of 1-mil bond wires per DC pad is as follows. VG1, VG2 and VG3: 1 wire, VD1: 1 wire, VD2: 2 wires, VD3: 4 wires per side.



Bias Sequencing: To turn ON the device, VG1, VG2 and VG3 are first set at -6V. Then set VD1, VD2 and VD3 to 28V. Finally, adjust VG1 = VG2 = VG3 to achieve ID_total = 3000mA. To turn OFF the device, you set VG1, VG2 and VG3 to -6V, then turn off the VD1, VD2 and VD3 followed by turning off VG1, VG2 and VG3.

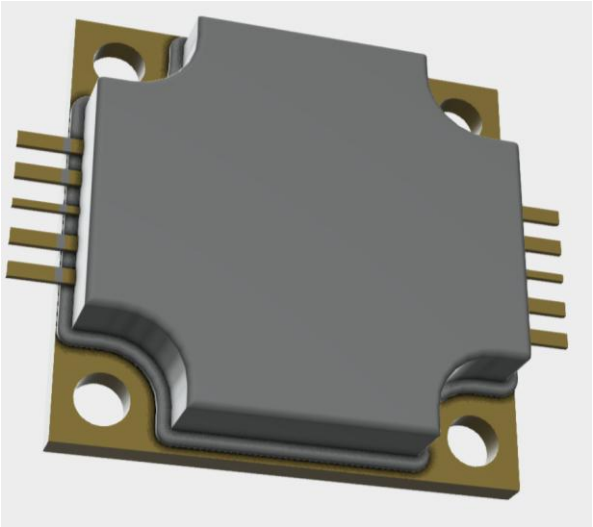
TMC216-T Drawing



1. Dimensions are in mm(mil), +/- 1mil X-Y Tolerance
2. Thermal spreader TAB material: CuMoCu
3. Plating: Ni/Gold
4. AuSn die attach (Ag Epoxy is also available)
5. TMC216-T has bypass capacitors with wirebonds whereas TMC216-T1 is TMC216-D on CuMoCu shim leaving the space for customers to add the capacitors and wirebonds.

- Tolerances are +/- 1mil
- AutoCAD drawings and PCB layout are available upon request

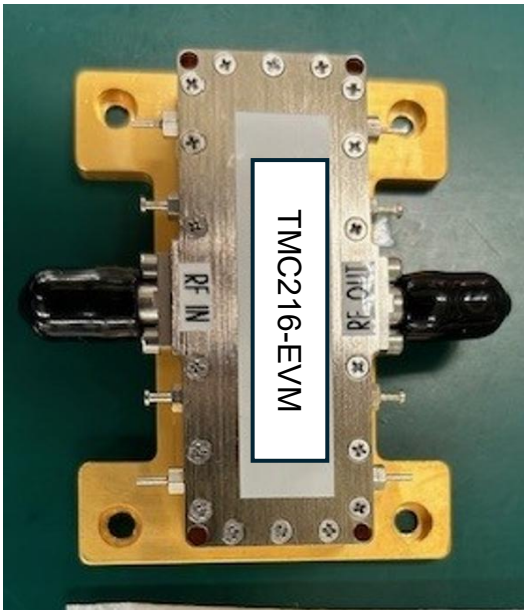
TMC216-P15*

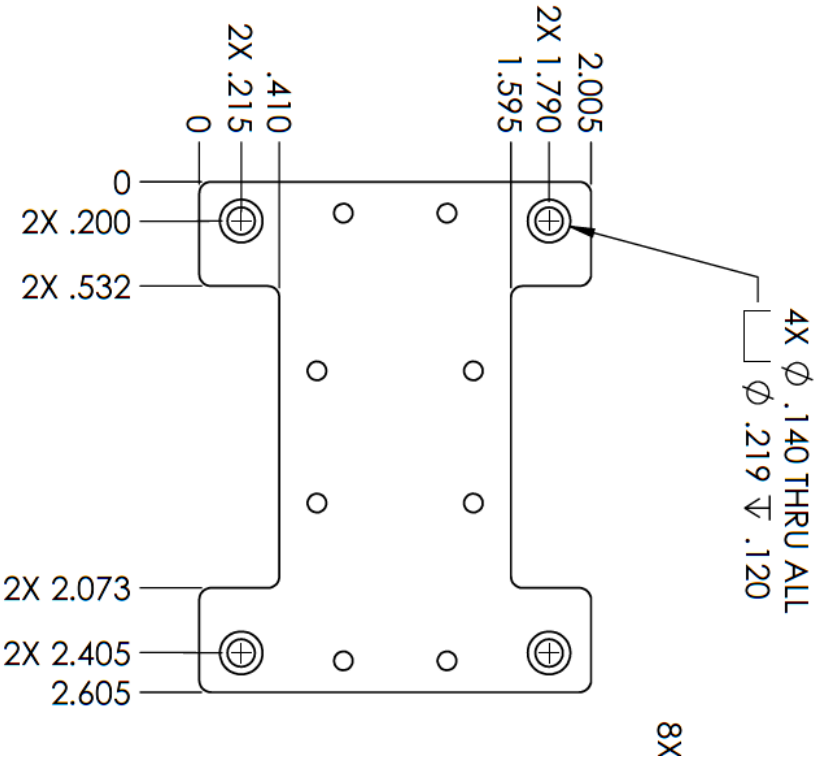


1. Package Size: X=15.2, Y=15.2, Z=5.2 mm
2. AutoCAD drawings and PCB layout are available upon request
3. The packaged TMC216–P15 version has 2-2.5dB less gain and 1-1.5dB less output power than the TMC216–D or TMC216–T versions

* Contact mmTron for further information

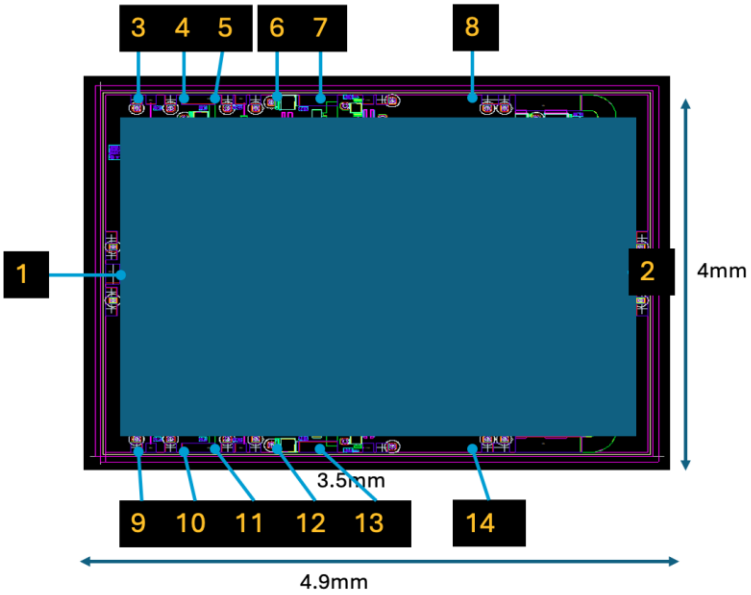
TMC216-EVM Evaluation Module





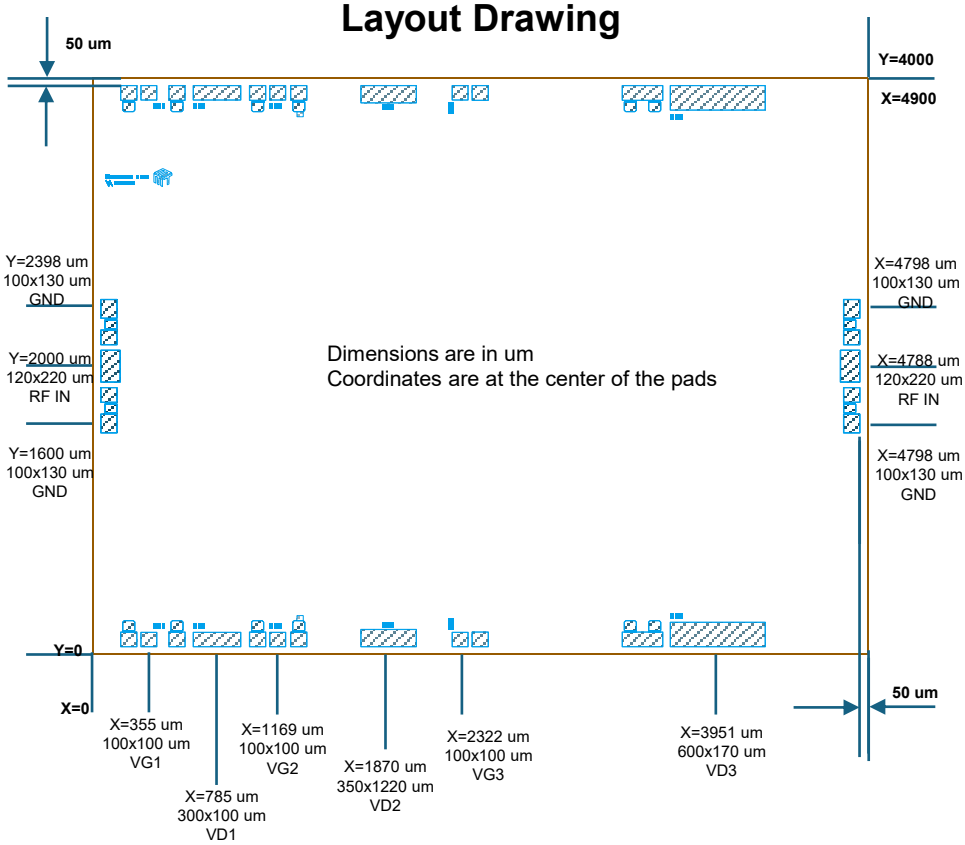
Heatsink top-side (mounting details):
Material is 0.160 +/- 0.002 thick made of copper.

Pad Location and Description

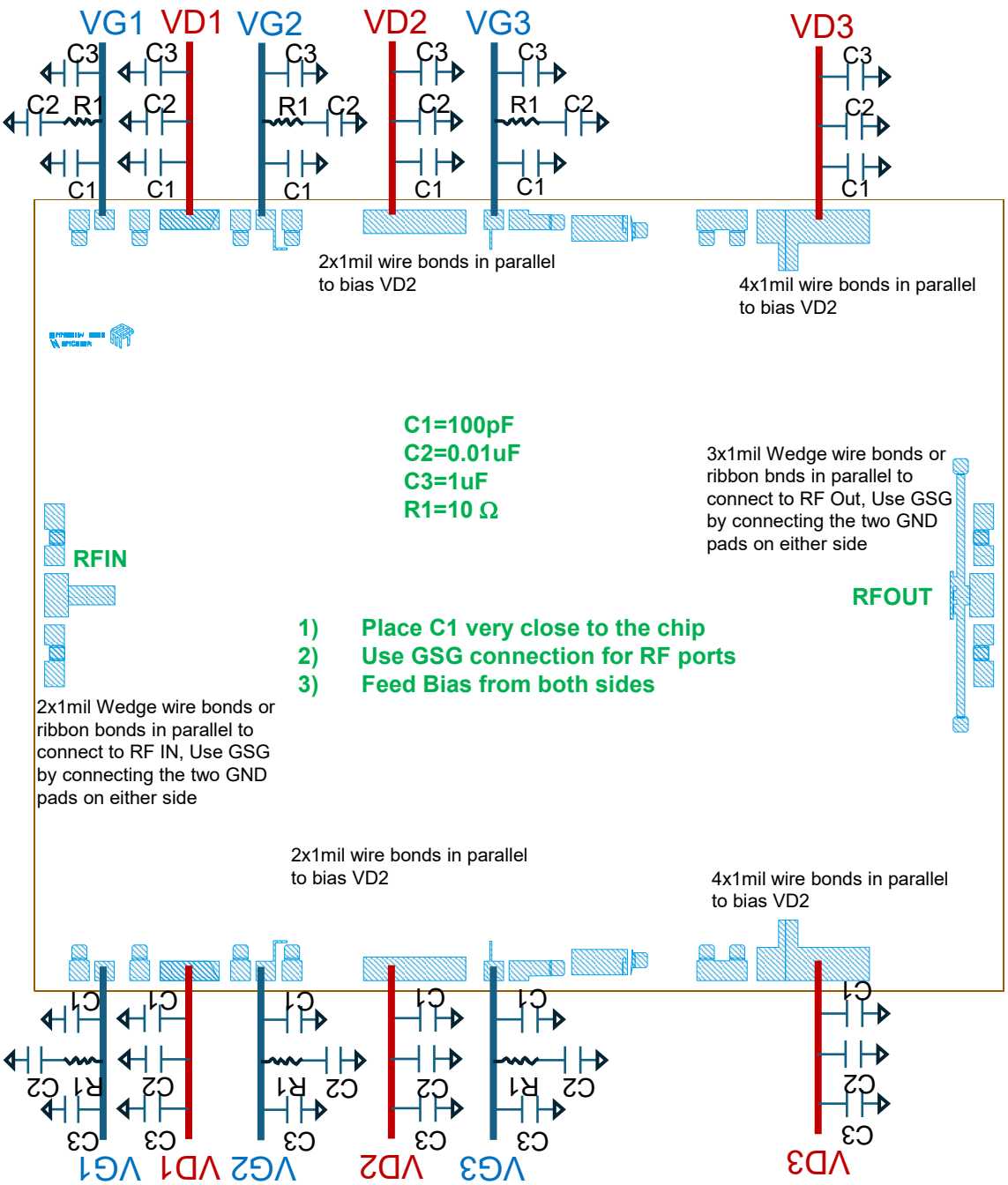


Pad #	Function
1	RFIN
2	RFOUT
3, 9	VG1
4, 10	VD1
5, 11	VG2
6, 12	VD2
7, 13	VG3
8, 14	VD3

Layout Drawing



Recommended Biasing



Recommended Biasing

The TMC216-D is operated with one positive supply VDD (VD1=VD2=VD3) and one negative supply VGG (VG1 = VG2 = VG3). The positive supply must be connected to the VD1, VD2 and VD3 pads on the die. The negative supply must be connected to the VG1, VG2 and VG3 pads on the die. VGG is biased to -6V first, then VDD is gradually biased to +28V and finally, VGG is adjusted to around -4V for ID_total = 3000mA DC current.
Reverse the sequence during power down, i.e. bring VGG to -6V, lower VDD to 0V, and then VGG to 0V.
Note that VG1, VG2 and VG3 can be separated and controlled independently in order to further improve linearity.

Assembly Techniques

The TMC216 is fabricated using a GaN-based semiconductor material structure and may be packaged in a flange-mount package or used as a die. The die is designed to allow either high conductivity epoxy or AuSn eutectic attach.
A High-Density Polysynthetic Silver Thermal Compound such as Arctic Silver® 5 can be used for thermal interface of the package to the housing floor.

ESD Warning

III-V MMICs are ESD-sensitive. Preventative ESD measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, and die-attach and bonding methods are critical factors in successful III-V MMIC performance and reliability.

RoHS Compliance

This part is RoHS compliant, meeting the requirements of the EU Restriction of Hazardous Substances Directive 2002/95/EC, commonly known as RoHS. Six substances are regulated: lead, mercury, cadmium, chromium VI (hexavalent chromium), polybrominated biphenyls (PBB), and polybrominated biphenyl ethers (PBDE). RoHS compliance requires that any residual concentration of these substances is below the Directive's maximum concentration values (MCV): cadmium 100ppm by weight and all others 1000ppm by weight.

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