mmTron
Unleashing the mmWave Frontier

TMC192
6-8 GHz Active Frequency Tripler

Product Features

- LO Output frequency: 6 to 8 GHz
- Conversion Gain: 20 dB
- Die Size: X=2.5, Y=2.8, Z=0.1 mm
- Package Size: X=5 mm, Y=5 mm, Z=2mm
- DC Power: 5 VDC, 400 mA

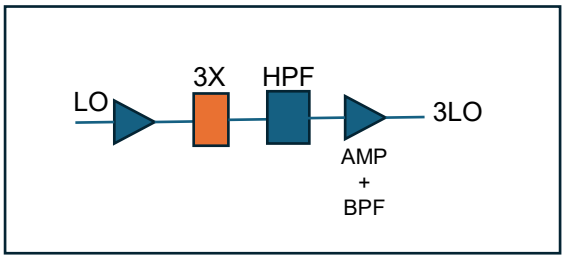
Application

- Point-to-Point Radios and VSATs
- Test instrumentation
- Fiber Optics
- Military, EW and Space

Product Description

The TMC192 GaAs PHEMT is an Active Frequency Tripler, designed for use in Radios, Test instrumentation, Military, EW and Space applications. The TMC192 is a 50 Ω matched design with input and output buffer amplifiers and built-in filter and eliminates the need for RF port matching. TMC192 is exceptionally robust with minimal variation over temperature. Both bond pad and backside metallization are Au-based that is compatible with ribbon and wedge bonding and epoxy and die attach methods. TMC192-P5 is the 5x5 packaged version.

Functional Block Diagram



*Add off chip bypassing for VD pad 100pF

Ordering Information

Part No.	Description
TMC192-D	Bare Die
TMC192-P5	Packaged Version

	min	Typ	Max	Units
LO Input Frequency	6	7	8	GHz
LO Output Frequency	18	21	24	GHz
LO Input Drive	-5	0	+5	dBm
Conversion Gain		20		dB
LO Input Return Loss		-10		dB
LO Output Return Loss		-10		dB
Bias Voltage	4	5	6	V
Bias Current		400		mA

	min	Typ	Max	Units
LO Tripler fundamental Rejection		-50		dBc
LO Tripler Second Harmonic Rejection		-30		dBc

Recommended Biasing

The TMC192 is operated with one positive supply VDD and one negative supply voltage VGG. The positive supply must be connected to the output pad through a bias-T. The negative voltage VGG should be connected to VG1 pad on the die. The VGG is biased to -1V first, then VDD is gradually biased to +10V and finally, VG1 is adjusted to around -0.5V for IDD=500mA DC current.

Reverse the sequence during power down, i.e. bring the VGG to -1V, lower VDD to 0V, and then VGG to 0.

Assembly Techniques

The TMC192 is fabricated using a GaAs-based semiconductor material structure. All bare die are placed Gel based ESD protective containers and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a humidity-controlled dry nitrogen environment.

Use a vacuum collet sized to handle the chip along the edges to avoid touching the air bridges. The die is back-metalized and can be mounted with standard AuSn eutectic or conductive epoxy assembly techniques. The mounting surface should be clean and flat.

Eutectic Die Attach

The most common eutectic alloy used in die attach is the gold-tin (AuSn) alloy. With a melting point of 280°C, it provides a strong, reliable bond without requiring excessively high temperatures that could potentially damage the die or the substrate. Eutectic die attach is generally performed in a two-step process. First, the eutectic alloy is deposited onto the die or substrate, often by a process such as electroplating or sputtering. This forms what is known as the "preform". Next, the die is placed onto the preform, and the assembly is heated to the melting point of the alloy. This causes the alloy to reflow, spreading out to cover the entire interface between the die and the substrate. Once cooled, the alloy solidifies, creating a robust bond between the die and the substrate. A 80/20 AuSn preform with a work surface temperature of 255 °C is recommended. The tool temperature of 265 °should be used. The chip should not be exposed to a temperature greater than 300 °C for more than 45 seconds. A maximum 3 seconds of scrubbing should be sufficient for die attachment.

Epoxy Die Attach

Apply a minimum amount of epoxy such as Ablestick 84-1LMI m(0.25-0.75mil) to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule. The epoxy fillet around the die should be approximately half-way up the side of the 4-mil thick MMIC. Too little epoxy may lead to voids, too much epoxy may lead to stringers and shorts to the front-side metal.

Wire Bonding

RF wadge bonds made with two 1 mil wires are recommended for RF ports. A single 1mil wire can be used for DC pads. Ensure the bonding tool is grounded. These bonds could be bonded thermosonically with a force of 50 grams and a stage temperature of 150 °C. Use a shim under the die to bring the top surface of the die level with the RF input and output transmission line to shorten wirebonds to < 10mil.



Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. mmTron Inc. recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications. 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 Compliant

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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