HBT Product Qualification Report

TGC4702-FC, TGV2204-FC

Abstract

This report summarizes the reliability testing that was completed to qualify TriQuint's TGC4702-FC and TGV2204-FC.

These products are fabricated at TriQuint Oregon, on the HBT GaAs process flow K50A. The products are sold as bumped die for flip chip applications. The primary customer is automotive electronics, in support of automotive radar applications. The products are general market offerings.

The Qualification Plan was based on Automotive AECQ100 Specification for grade 3 automotive products.

Process Description

TriQuint's K50A HBT process flow is a proven Gallium Arsenide (GaAs) semiconductor process fabricated at TriQuint's Oregon facility. The products also use the front-side Cu / Sn pillar technology for flip-chip applications.

Mask Set K8421 – TGC4702-FC Mask Set K429 – TGV2204-FC

Product Description

TQNT Part #	Description	Process
TGC4702-FC	Mixer	HBT – K50A
TGV2204-FC	19 GHz VCO	HBT – K50A

Product Description

TGC4702-FC

The TriQuint TGC4702-FC is a down converting IQ mixer designed to cover the automotive radar frequency band. The TGC4702-FC typically provides 12 dB conversion loss from 75 – 82 GHz to an IF frequency band of DC – 100 MHz. The TGC4702-FC is designed using TriQuint's proven HBT process and front-side Cu / Sn pillar technology for simplified assembly and low interconnect inductance. Die

reliability is enhanced by using TriQuint's SiN passivation process. Lead-free and RoHS compliant.

TGV2204-FC

The TriQuint TGV2204-FC is a flip-chip voltage controlled oscillator (VCO) designed to operate at frequencies that target the automotive Radar market. The TGV2204-FC is designed using TriQuint's proven HBT3 process and front-side Cu / Sn pillar technology for simplified assembly and low interconnect inductance. The TGV2204-FC is a VCO that typically provides 7 dBm output power at 19 GHz with < -105 dBc/Hz phase noise at 1 MHz offset. The integrated divide-by-8 pre-scalar eases PLL design. The TGV2204-FC is a excellent choice for applications requiring frequency stability in transmit chain architectures. The TGV2204-FC has a protective surface passivation layer providing environmental robustness. Lead-free and RoHS compliant.

Reliability Test Plan

The table below lists the qualification plan for the TGC4702 and TGV2204 devices. The plan is based on the AEC Q100 specification for grade 3 automotive products.

Test:	Device:	Conditions:	Sample Size	# of Lots	Total Units
HAST	TGV2204 (VCO)	121C/85%/15psig, 96hr Vcc = -5V, Vtune = 5V	77	1	77
TEMP CYCLE	TGC4702 (Mixer)	-50C/125C, 500 cycles	77	1	77
HTOL	TGV2204 (VCO)	TA=66C, Tj=224C, Vcc = 5V, Vtune = GND, 408 hr	77	1	77
HBM ESD	TGC4702, TGV2204	EIA/JESD22-A114	3	1	3
MM ESD	TGC4702, TGV2204	EIA/JESD22-A115	3	1	3

* Note the HTOL ambient temperature condition (66C) was negotiated with Delphi to achieve the highest, safe, junction temperature (Tj=224C), given the parts self-heating characteristics. Calculations indicate a 119C "back-of-die" temperature was achieved.

* Note that not all devices were used for all reliability tests. Parts not stressed were qualified by similarity.

Reliability Testing

TGV2204 Pre and Post HTOL Test Conditions

Temperatures 25C and 85C

Vcc = 5 V, Vtune = 3 V
Measure Prescalar Output power and frequency
Measure VCO Output power and frequency
Measure Itotal

TGV2204 Pre and Post HAST Test Condition

Temperatures 25C
Vtune = 5V; Vcc = Swept from 0 to -5V
Measure leakage at Vcc = -5V

TGC4702 Pre and Post Temp Cycle Test Condition

Temperatures 25C

Vd = 1.5V	Vd = -3.0V
Measure Total Id.	Measure Total Id.

Summary of Results

Acceptance criteria based on the product meeting customer specification. The parts were serialized such that the "Delta" data calculated pre and post stress.

Test:	Device:	Results (Total/Fail)
HAST	TGV2204 (VCO)	77/0
TEMP CYCLE	TGC4702 (Mixer)	77/0
HTOL	TGV2204 (VCO)	77/0
HBM ESD	TGC4702 (Mixer)	50 V
MM ESD	TGC4702 (Mixer)	<50 V
HBM ESD	TGV2204 (VCO)	250V
MM ESD	TGV2204 (VCO)	<50V