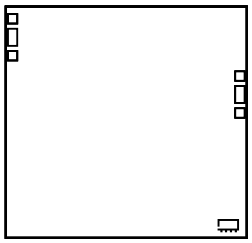
MMIC DIE

X3 Frequency Multiplier CY3-453-D+

50Ω Output 20 to 45 GHz

THE BIG DEAL

- Ultra-wideband, output from 20 to 45 GHz
- Wide input power range, +12 to +17 dBm
- Low Conversion Loss, 20 dB Typ.
- Good Fundamental and Harmonic Suppression: F1 > +40 dBc; F2 > +25 dBc; F4 > +35 dBc.



+RoHS Compliant
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

SEE ORDERING INFORMATION ON THE LAST PAGE

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

Mini-Circuits' CY3-453-D+ is an ultra-wideband MMIC Frequency Tripler, converting input frequencies from 6.66 to 15 GHz into output frequencies from 20 to 45 GHz. Its wide output range makes this model suitable for broadband systems as well as a wide variety of narrow-band applications. The CY3-453-D+ die utilizes GaAs HBT technology and is suitable for chip and wire assemblies.

KEY FEATURES

Feature	Advantages
Broadband, 20 to 45 GHz output	With an output frequency range spanning 20 to 45 GHz, this multiplier supports broadband applications such as defense and instrumentation as well as a wide range of narrowband system requirements including 5G.
Excellent fundamental and harmonic suppression: • F1, +40 dBc • F2, +25 dBc • F4, +35 dBc	Reduces spurious signals and the need for additional filtering.
Unpackaged Die	Enable user to integrate it directly into hybrid chip and wire assemblies.
Wide input power range, +12 to +17 dBm	Wide input power signal range accommodates different input signal levels while still maintaining a low Conversion Loss.

REV. OR
ECO-015292
CY3-453-D+
MCL NY
221006

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ELECTRICAL SPECIFICATIONS[1] AT 25°C AND Zo = 50Ω, UNLESS NOTED OTHERWISE

Parameter		Condition (GHz)	RF Input = +16 dBm Min.	Typ.	Max.	Unit
Multiplication Factor				3		
Frequency Range, Input (F1)			6.66	-	15	GHz
Frequency Range, Output (F2)			20	-	45	GHz
Input Power			15		17	dBm
Conversion Loss		6.66-8		20.0		dB
		8-10		19.3		
		10-12		19.0		
		12-15		20.3		
Harmonic Output[2]	F1	6.66-8		48		dBc
		8-10		44		
		10-12		42		
		12-15		37		
	F2	6.66-8		72		dBc
		8-10		38		
		10-12		29		
		12-15		25		
	F4	6.66-8		35		dBc
		8-10		33		
		10-12		31		
		12-15		36		

1. Electrical specifications are measured by soldering the die on Mini-Circuits Die Characterization Test Board and de-embedded to the bond wires
2. Harmonics of input frequency below the power of F3

MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
RF Input Power	+22 dBm (5 minute max) +19 dBm (Continuous)

3. Permanent damage may occur if any of these limits are exceeded.

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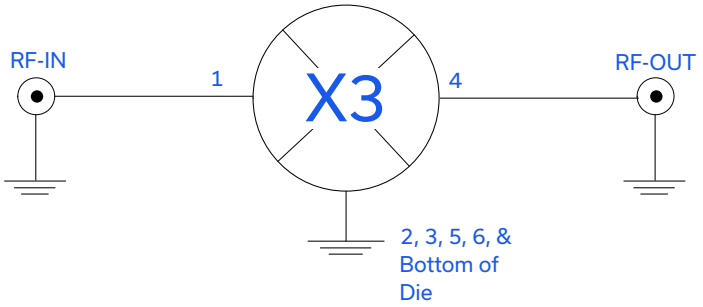
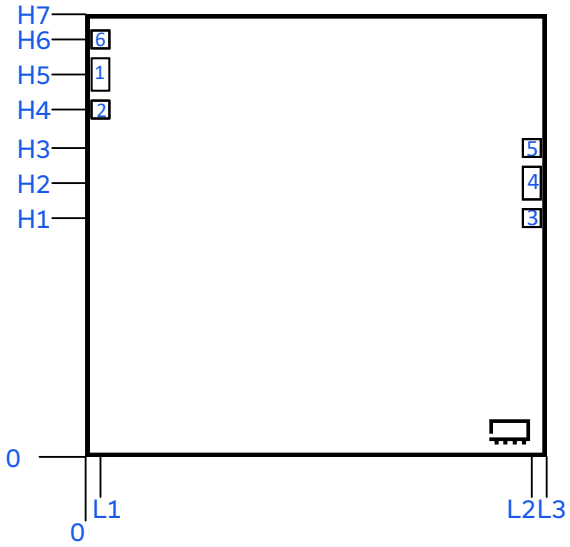
SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	1	RF-Input Pad.
RF-OUT	4	RF-Output Pad.
Ground	2, 3, 5, 6 & Bottom of Die	The bond pads are connected to back-side through vias and do not require wire-bond connections to ground.

BONDING PAD POSITION



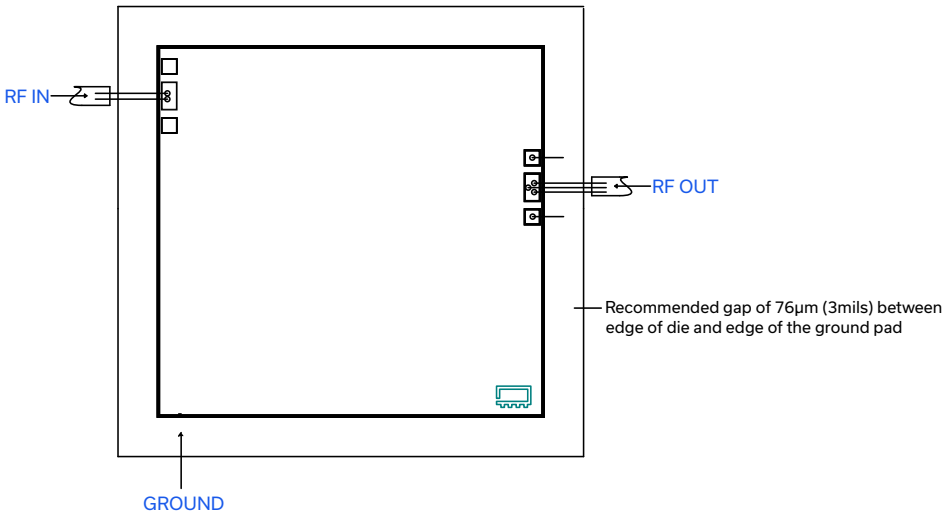
DIMENSIONS IN µM, TYPICAL

L1	L2	L3
81.0	2419.0	2500.0

H1	H2	H3	H4	H5	H6	H7
1295.0	1485.0	1675.0	1884.0	2074.0	2264.0	2400.0

Thickness	Die Size	Pad Size 1 & 4	Pad Size 2, 3, 5, & 6
100	2500 x 2400	92 x 172	92 x 92

ASSEMBLY DIAGRAM



Note: bond wires should be as short as possible

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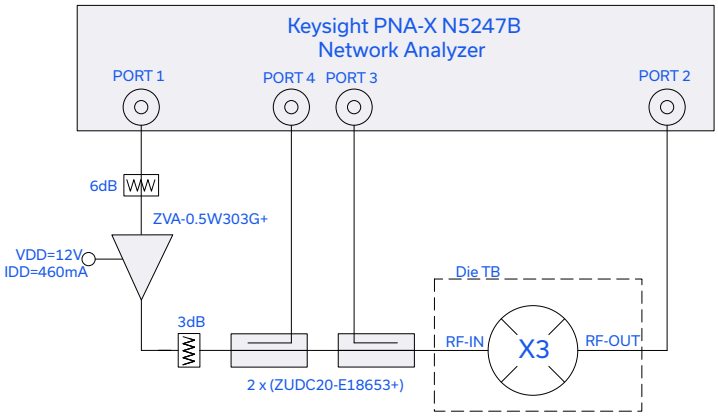
APPLICATION AND CHARACTERIZATION CIRCUIT



6 dB attenuator P/N BW-E6-1W653+
3 dB attenuator P/N BW-E3-1W653+

Figure 1: Block diagram of test circuit used for characterization
Note: DUT is soldered onto a Mini-Circuits Die Characterization Test Board and de-embedded to the bond wires. Conversion Loss and Harmonic Output are measured using PNA-X N5247B Network Analyzer

ASSEMBLY PROCEDURE

1. Storage
   Die should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC HBT Multiplier die are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
3. Die Handling and Attachment
   Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition.
4. Wire Bonding
   Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the die gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wire length and bond wire height should be kept as short as possible unless specified by the Assembly Drawing to minimize performance degradation due to undesirable series inductance

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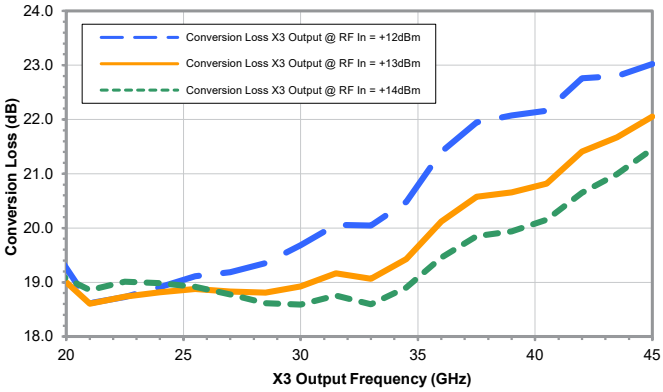
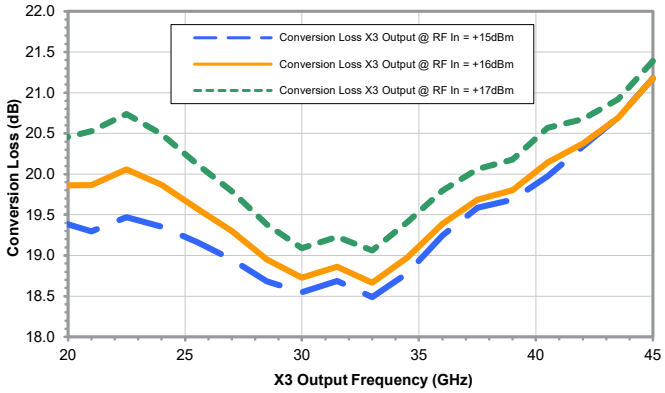
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

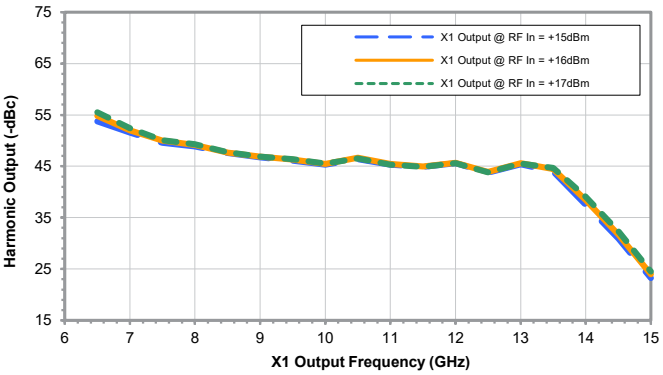
Conversion Loss X3 Output Vs Pin
Temperature = +25°C



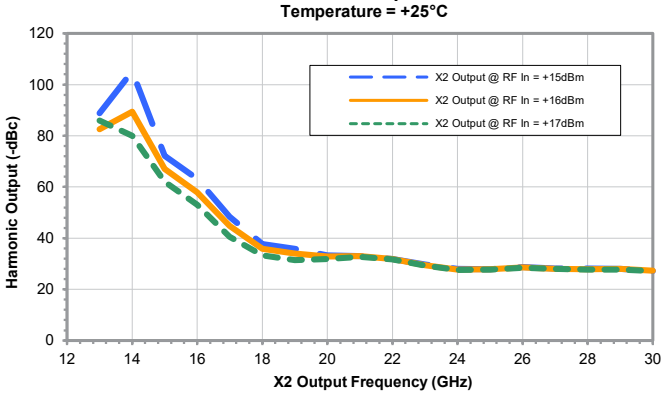
Conversion Loss X3 Output Vs Pin
Temperature = +25°C



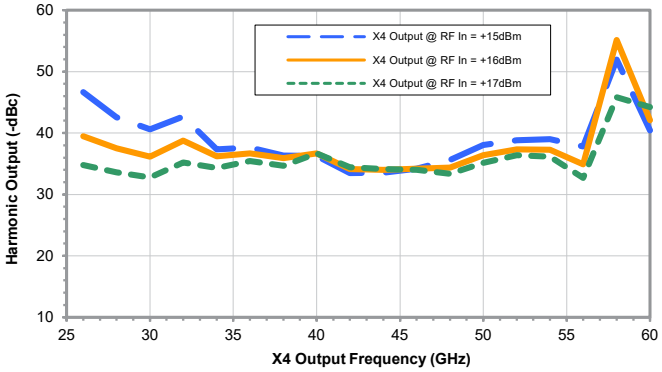
Harmonic X1 Output Vs Pin
Temperature = +25°C



Harmonic X2 Output Vs Pin
Temperature = +25°C



Harmonic X4 Output Vs Pin
Temperature = +25°C



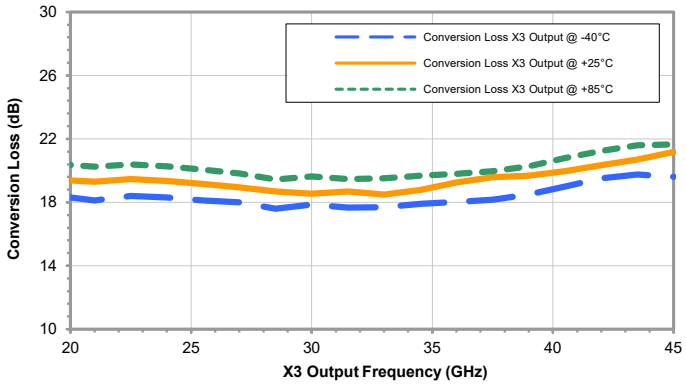
X3 Frequency Multiplier CY3-453-D+

50Ω Output 20 to 45 GHz

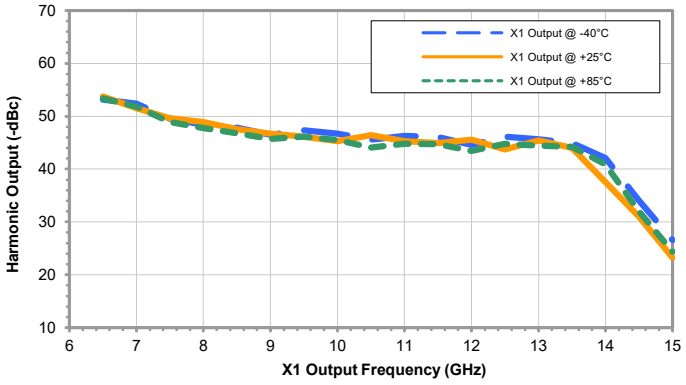
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

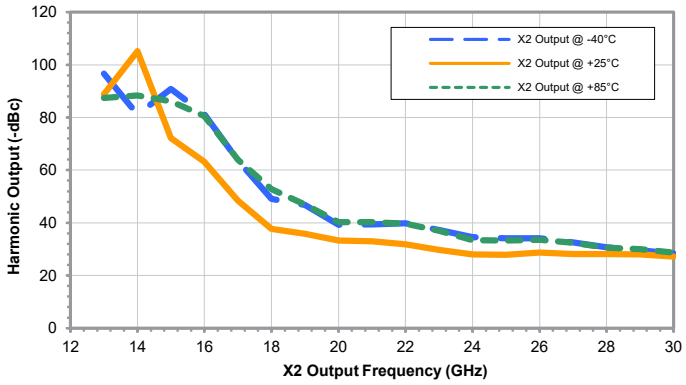
Conversion Loss X3 Output Vs Temperature
RF In = +15dBm



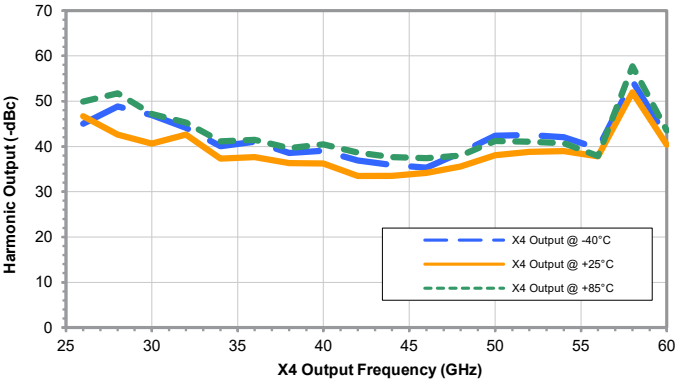
Harmonic X1 Output Vs Temperature
RF In = +15dBm



Harmonic X2 Output Vs Temperature
RF In = +15dBm



Harmonic X4 Output Vs Temperature
RF In = +15dBm



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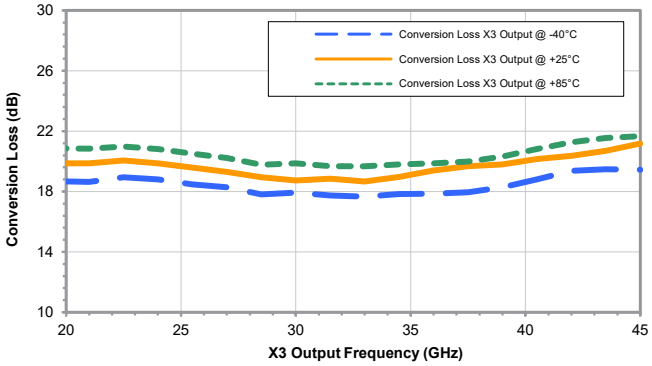
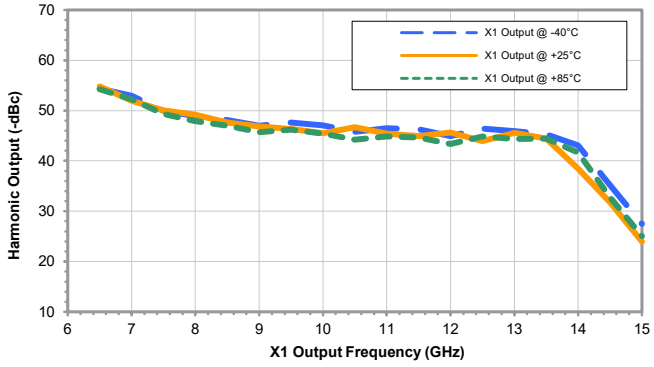
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

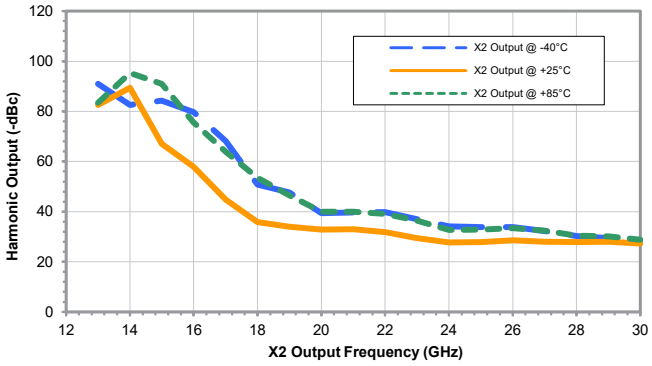
Conversion Loss X3 Output Vs Temperature
RF In = +16dBm



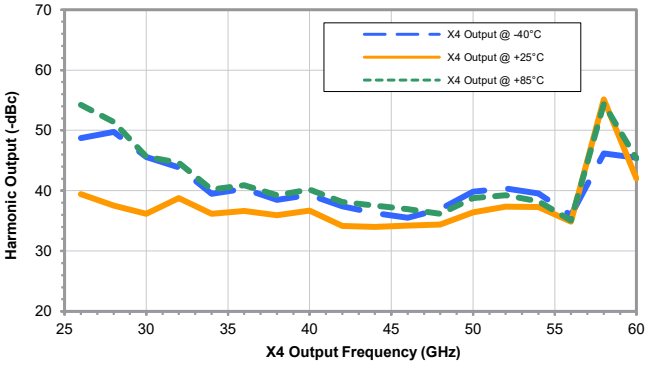
Harmonic X1 Output Vs Temperature
RF In = +16dBm



Harmonic X2 Output Vs Temperature
RF In = +16dBm



Harmonic X4 Output Vs Temperature
RF In = +16dBm



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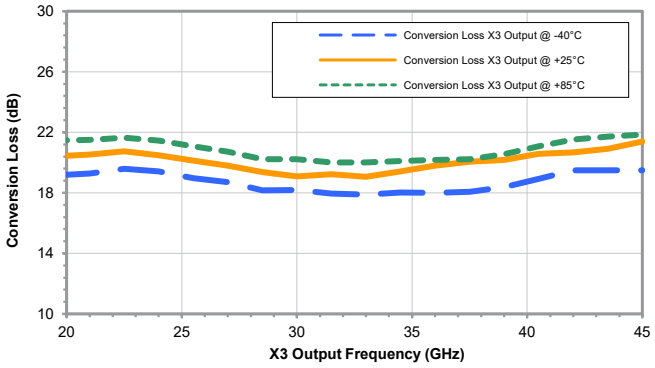
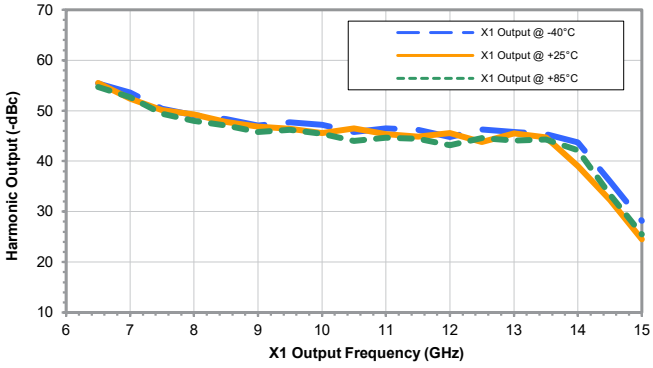
TYPICAL PERFORMANCE CURVES

Note: Harmonics data is presented as the harmonic of input frequency below the power of F3

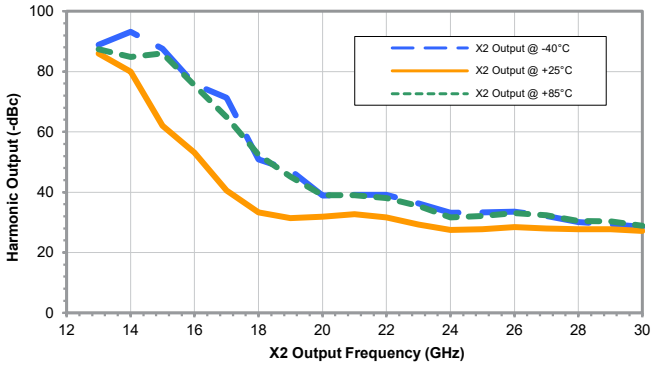
Conversion Loss X3 Output Vs Temperature
RF In = +17dBm



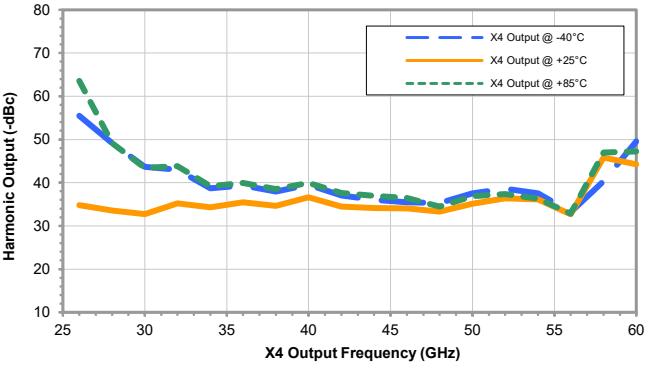
Harmonic X1 Output Vs Temperature
RF In = +17dBm



Harmonic X2 Output Vs Temperature
RF In = +17dBm



Harmonic X4 Output Vs Temperature
RF In = +17dBm



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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set with and without port extension (.zip file)	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package Gel – Pak: 5, 10, 50 Medium†, Partial wafer: <400 Full Wafer	Model No. CY3-453-DG+ CY3-453-DP+ CY3-453-DF+
Die Marking	EL-MUL-3	
Environmental Ratings	ENV80	

NOTES

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