CHP2299

WCDMA

InGaP HBT Amplifier Module

PRELIMINARY DATA SHEET - Rev 1.2

FEATURES

- Small Profile (3 x 3 x 1 mm)
- InGaP HBT Technology
- Low Quiescent Current of 20 mA
- PFT™ 50 Ω Matched Module
- High Linearity of -40 dBc
- High PAE of 40%
- Low V_{REF} of 2.85 V
- Single Positive Supply Voltage
- Single Mode Operation for High and Low Powers
- Optional Analog Gain Control (AGC) & Current Adjust

M12 Package
9 Pin 3 x 3 x 1 mm
Surface Mount Module

APPLICATIONS

- WCDMA Multi-mode handsets
- WLL Subscriber units

PRODUCT DESCRIPTION

CHP2299 is an InGaP HBT amplifier module offering high performance for WCDMA wireless handsets. It consists of a two-stage amplifier, 50 Ω matching network for both input and output, and a bias control circuit. It is packaged in a 3 x 3 x 1 mm package using proprietary Passive-Free Technology (PFT)™. The package excellent electrical stability and low thermal resistance.

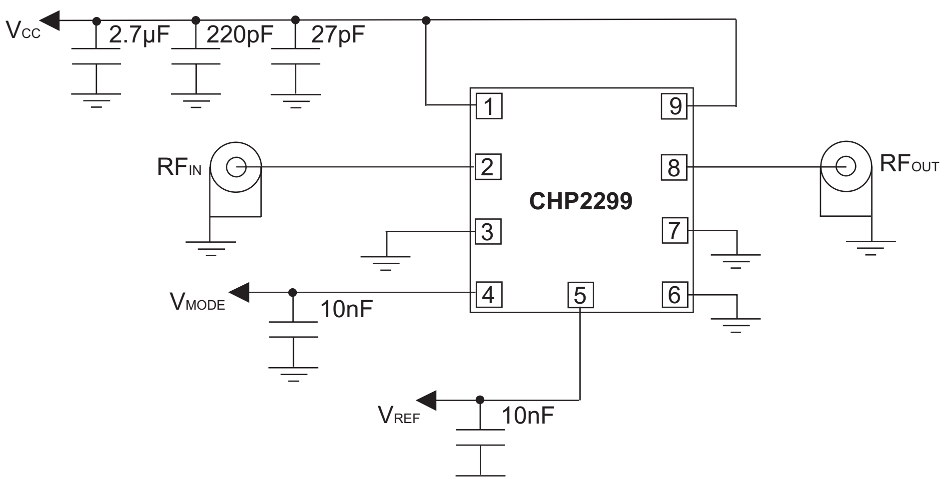


Figure 1: Block Diagram

Table 1: Pad Description

PIN	NAME	DESCRIPTION
1	V_{CC}	Supply Voltage
2	RF_{IN}	RF Input Signal
3	GND	Ground
4	V_{MODE}	Mode Control (AGC voltage)
5	V_{REF}	Reference Voltage
6	GND	Ground
7	GND	Ground
8	RF_{OUT}	RF Output
9	V_{CC}	Supply Voltage

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT	COMMENTS
RF Input Power (P_{IN})	-	10	dBm	
Supply Voltage (V_{CC})	-	6	V	
Reference Voltage (V_{REF})	-	3.4	V	
Mode Control Voltage(V_{MODE})	-	3.4	V	
Case Operating Temperature (T_C)	-25	100	°C	
Storage Temperature (T_{STG})	- 55	125	°C	
Soldering Temperature (T_S)	-	240	°C	5 seconds

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Table 3: Operating Ranges (with NO AGC)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency (f)	1920	-	1980	MHz	
Supply Voltage (V_{CC})	+1.8	+3.4	+4.2	V	
Reference Voltage (V_{REF})	+2.8	+2.85	+2.9	V	
Mode Control Voltage (V_{MODE})	+2.1	+2.85	+3.0	V	with NO AGC option
Operating Temperature (T_C)	-25	+25	+85	°C	

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Notes:

1. *In NO AGC option, V_{MODE} can simply be tied to V_{REF}.*

Table 4: Electrical Specifications (with NO AGC)
(T_C = +25 °C, fo = 1950 MHz, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, (unless otherwise specified))

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain GL G Gh	 22 24 25	 24 26 27	 26 28 29	dB	 V_{CC} = 1.8 V, Po = 0 dBm V_{CC} = 3.4 V, Po = 16 dBm V_{CC} = 3.4 V, Po = 27.5 dBm
Power-Added Efficiency (1) PAE PAEH	 - -	 18 40	 - -	%	 V_{CC} = 1.8 V, Po = 16 dBm V_{CC} = 3.4 V, Po = 27.5 dBm
Adjacent Channel Leakage Ratio(2) 5 MHz Offset ACLR1L ACLR1H 10 MHz Offset ACLR2L ACLR2H	 - - - -	 -43 -40 -62 -50	 -38 -37 -50 -47	dBc	 V_{CC} = 1.8 V, Po = 16 dBm V_{CC} = 3.4 V, Po = 27.5 dBm V_{CC} = 1.8 V, Po = 16 dBm V_{CC} = 3.4 V, Po = 27.5 dBm
Quiescent Current Iqs (Shutdown Mode) Iq(3)	 - 45	 1 50	 5 65	 µA mA	 V_{REF} = 0V, V_{MODE} = 0V, No RF No RF
V_{REF} Current (I_{REF})	-	-	8	mA	Po = 27.5 dBm
V_{MODE} Current (I_{MODE})	-	-	100	µA	V_{MODE} = 2.1 V
Noise in Receive Band(4)	-	-136	-	dBm/Hz	Po = 27.5 dBm
Harmonics 2fo 3fo	 - -	 - -	 -28 -28	dBc	 Po = 27.5 dBm Po = 27.5 dBm
Input Return Loss	-	-18	-12	dB	S11
Spurious Output Level	-	-	-60	dBc	VSWR < 6:1
Ruggedness - no damage(5)	10:1	-	-	VSWR	Po = 27.5 dBm

Notes:
(1) Includes the current at pins 1, 4, 5, and 9.
(2) ACPR is specified per IS95 as the ratio of adjacent power in 30 kHz BW to the total in-band power (1.23 MHz BW).
(3) Includes the current at pins 1 and 9 (Vcc current).
(4) RxBn is measured at 190 MHz above the operating frequency (Fo). (Measurement setup: RBW = 30 kHz, VBW = 30 kHz).
(5) All phases, time equals to 10 seconds.

Table 5: Power Mode Truth Table (with NO AGC)

POWER MODE	V_{CC}	V_{REF}	V_{MODE}	TYPICAL GAIN
Shut Down	3.4	0 V(1)	0 V	<-40 dB
PA ON	3.4	2.85 V	>2.1 V	27 dB
PA ON	1.8	2.85 V	>2.1 V	24 dB

Notes:
1. V_{REF} = 0V forces all currents to zero excluding the current of V_{MODE} pin. To shut down the V_{MODE} current V_{MODE} should be zero as well.

Using the AGC Option

If the analog gain control (AGC) option is needed, then for a typical operation, Vmode can be defined as a linear function of output power:

V_{MODE} = 1.5 V + 0.025* P_{OUT}(dBm)

The following tables list the electrical performance, of CHP2299 with AGC option as well as the power mode truth table.

Table 6: Operating Ranges (with AGC)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency (f)	1920	-	1980	MHz	
Supply Voltage (V_{CC})	+3.2	+3.4	+4.2	V	
Reference Voltage (V_{REF})	+2.8	+2.85	+2.9	V	
Mode Control Voltage (V_{MODE})	+1.1	-	+2.1	V	effective range with AGC(1)
Operating Temperature (T_C)	-25	+25	+85	°C	

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Notes:
(1) Gain and idle current for V_{MODE} less than $V_{MODE_{Min}}$ are the same as that of $V_{MODE} = V_{MODE_{Min}}$. Also the Gain and idle current for V_{MODE} higher than $V_{MODE_{Max}}$ are the same as that of $V_{MODE} = V_{MODE_{Max}}$.

Figure 2: Idle Current vs. V_{MODE}

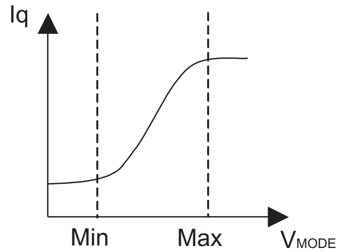


Table 7: Electrical Specifications (with AGC)
(T_C = +25 °C, fo = 1950 MHz, V_{CC} = 3.4 V, V_{REF} = 2.85 V,
V_{MODE} = (1.5 + 0.025*P_{OUT} {dBm}) V, (unless otherwise specified))

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain					
GL	14	16	18	dB	V_{MODE} = 1.25V, Po = -10 dBm
G	24	26	28	dB	V_{MODE} > 1.8 V, Po = 16 dBm
Gh	25	27	29	dB	V_{MODE} > 2.1 V, Po = 27.5 dBm
Power-Added Efficiency [1]					
PAE	-	9	-	%	V_{MODE} > 1.8 V, Po = 16 dBm
PAEH	-	40	-	%	V_{MODE} > 2.1 V, Po = 27.5 dBm
Adjacent Channel Leakage Ratio [2]					
5 MHz Offset					
ACLR1L	-	-43	-38	dBc	V_{MODE} > 1.8 V, Po = 16 dBm
ACLR1H	-	-40	-37	dBc	V_{MODE} > 2.1 V, Po = 28 dBm
10 MHz Offset					
ACLR2L	-	-62	-50	dBc	V_{MODE} > 1.8 V, Po = 16 dBm
ACLR2H	-	-50	-47	dBc	V_{MODE} > 2.1 V, Po = 27.5 dBm
Quiescent Current					
Iqs (Shutdown Mode)	-	1	5	μA	V_{REF} = 0V, V_{MODE} = 0V, No RF
Iq1 [3]	17	20	28	mA	V_{MODE} < 1.0 V, No RF
Iq [3]	45	50	60	mA	V_{MODE} > 2.1 V, No RF
V_{REF} Current (I_{REF})	-	-	8	mA	Po = 27.5 dBm
V_{MODE} Current (I_{MODE})	-	-	100	mA	V_{MODE} = 2.1 V
Noise in Receive Band [4]	-	-136	-	dBm/Hz	Po = 27.5 dBm
Harmonics					
2fo	-	-	-28	dBc	Po = 27.5 dBm
3fo	-	-	-28	dBc	Po = 27.5 dBm
Input Return Loss	-	-18	-12	dB	S11
Spurious Output Level	-	-	-60	dBc	VSWR < 6:1
Ruggedness - no damage [5]	10:1	-	-	VSWR	Po = 27.5 dBm

Notes:
(1) Includes the current at pins 1, 4, 5, and 9.
(2) ACLR is specified per ETSI 3GPP TS 25.101 as the ratio of adjacent power (3.84 MHz BW) to the total in-band power (3.84 MHz BW).
(3) Includes the current at pins 1 and 9 (Vcc current).
(4) RxBn is measured at 80 MHz above the operating frequency (Fo).
(Measurement setup: RBW = 30 kHz, VBW = 30 kHz).
(5) All phases, time equals to 10 seconds.

Table 8: Power Mode Truth Table (with AGC)

POWER MODE	V_{CC}	V_{REF}	V_{MODE}	TYPICAL GAIN
Shut Down	3.4	0 V(1)	0 V	<-40 dB
High Power	3.4	2.85 V	>2.1 V	27 dB
Low Power	3.4	2.85 V	<1.1 V	16 dB

Notes:

1. *V_{REF} = 0V forces all currents to zero excluding the current of V_{MODE} pin. To shut down the V_{MODE} current V_{MODE} should be zero as well.*

PERFORMANCE DATA

Figure 3: ACLR1_U vs P_{OUT} (T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

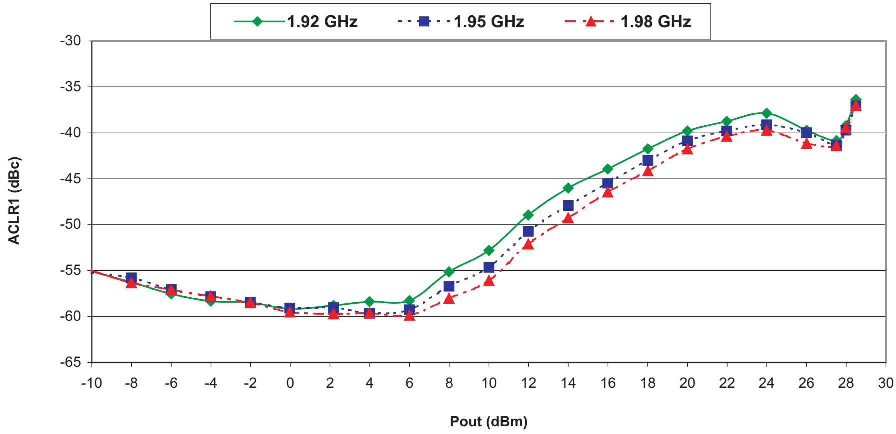


Figure 4: ACLR2_U vs P_{OUT} (T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

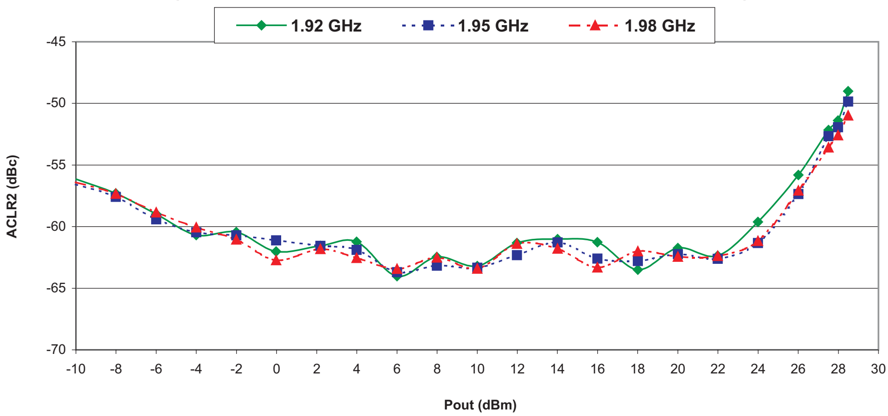


Figure 5: Gain vs P_{OUT} (T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

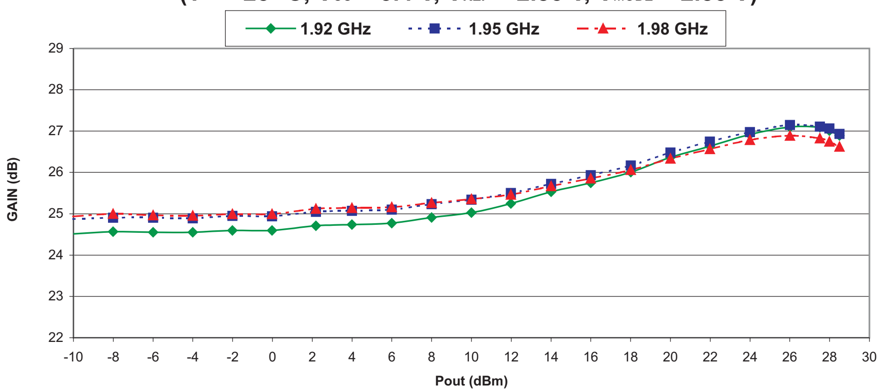


Figure 6: PAE vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

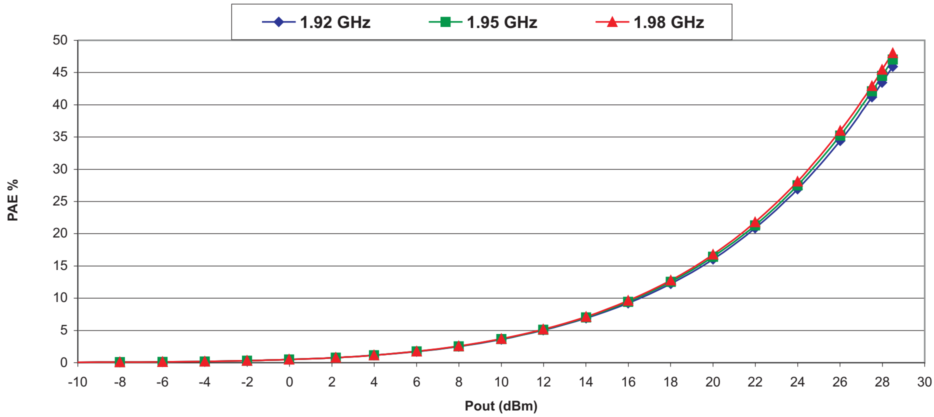


Figure 7: I_{CC} vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

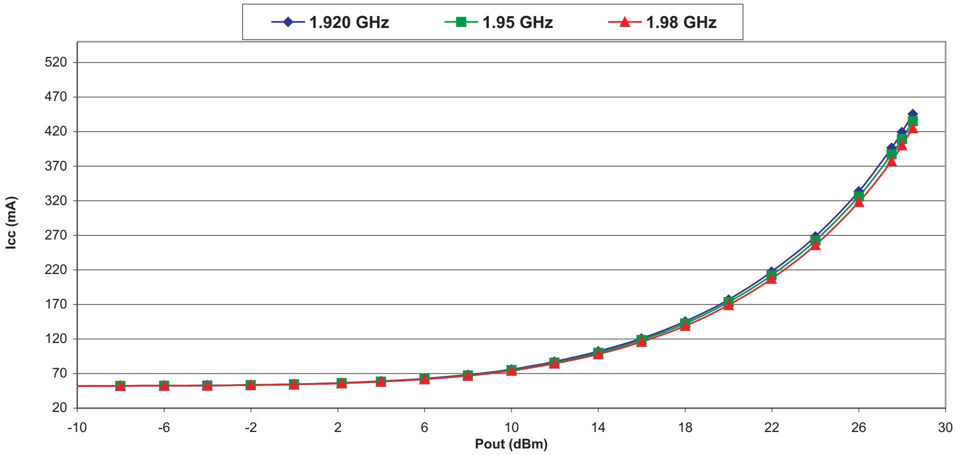


Figure 8: ACLR1_U vs V_{CC}
(P_{OUT} = 27.5 dBm, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

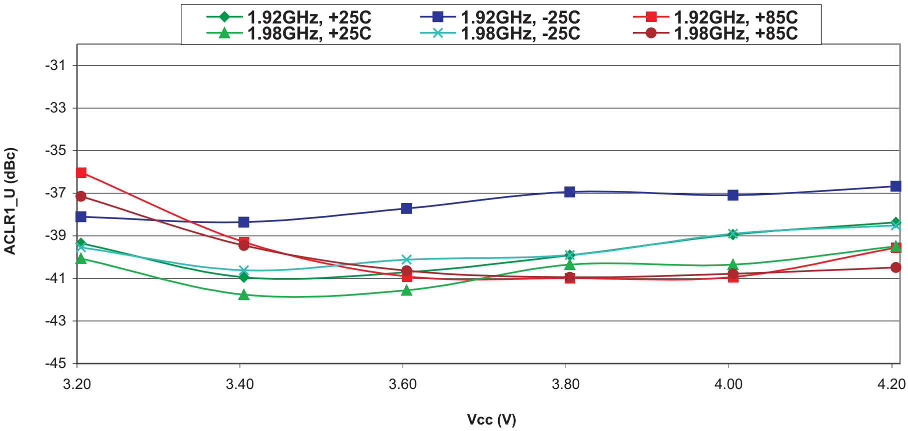


Figure 9: ACLR2_U vs V_{CC}
(P_{OUT} = 27.5 dBm, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

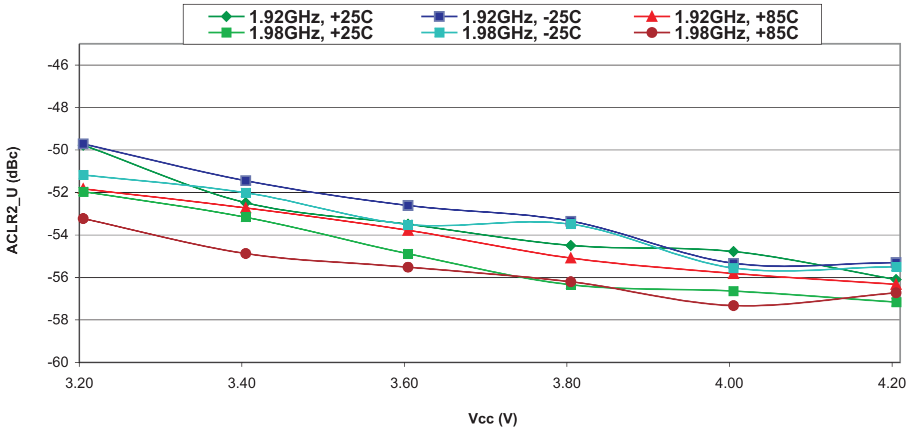


Figure 10: PAE vs V_{CC}
(P_{OUT} = 27.5 dBm, V_{REF} = 2.85 V, V_{MODE} = 2.85 V)

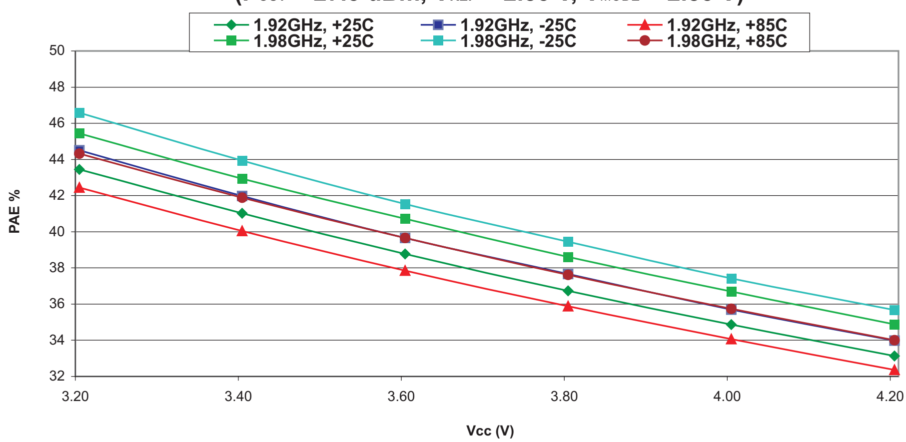


Figure 11: ACLR1_U vs Po
(V_{CC} = 1.8 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, F = 1.95 GHz)

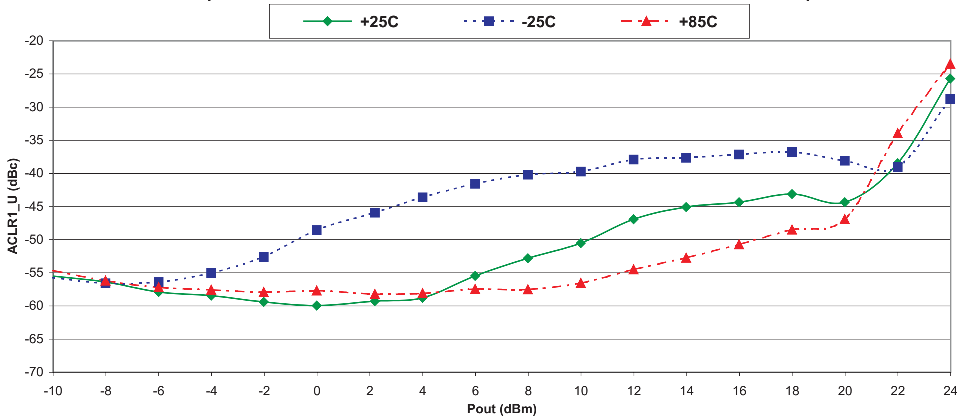


Figure 12: ACLR2_U vs Po
(V_{CC} = 1.8 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, F = 1.95 GHz)

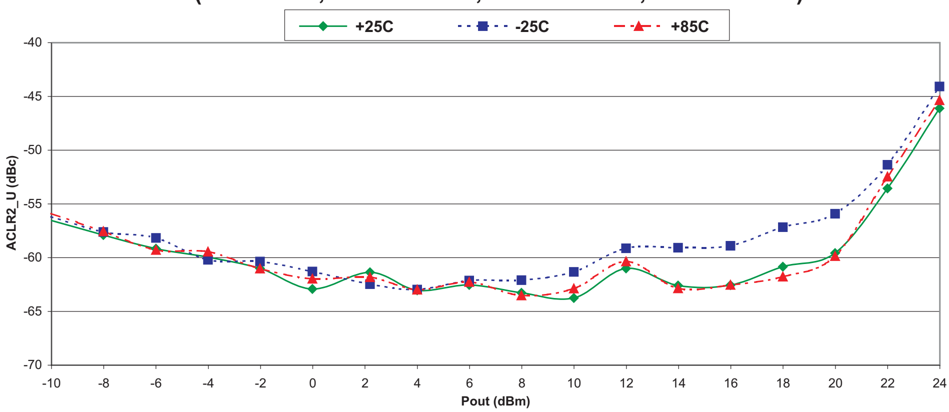


Figure 13: Gain vs P_{OUT}
(V_{CC} = 1.8 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, F = 1.95 GHz)

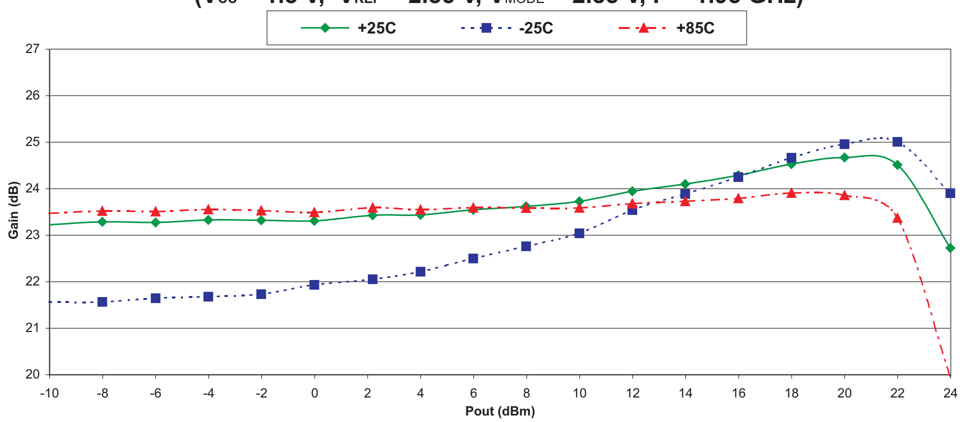


Figure 14: I_{CC} vs P_{OUT}
(V_{CC} = 1.8 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, F = 1.95 GHz)

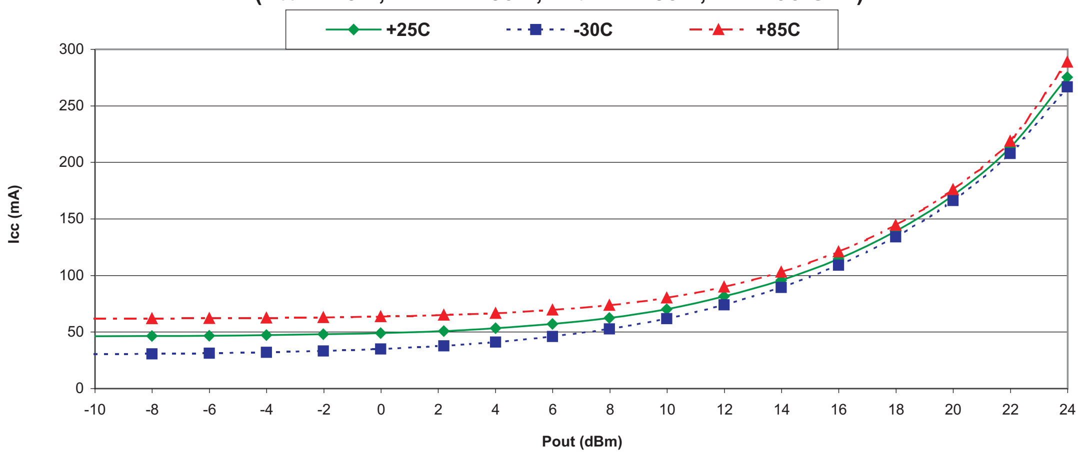


Figure 15: PAE vs P_{OUT}
(V_{CC} = 1.8 V, V_{REF} = 2.85 V, V_{MODE} = 2.85 V, F = 1.95 GHz)

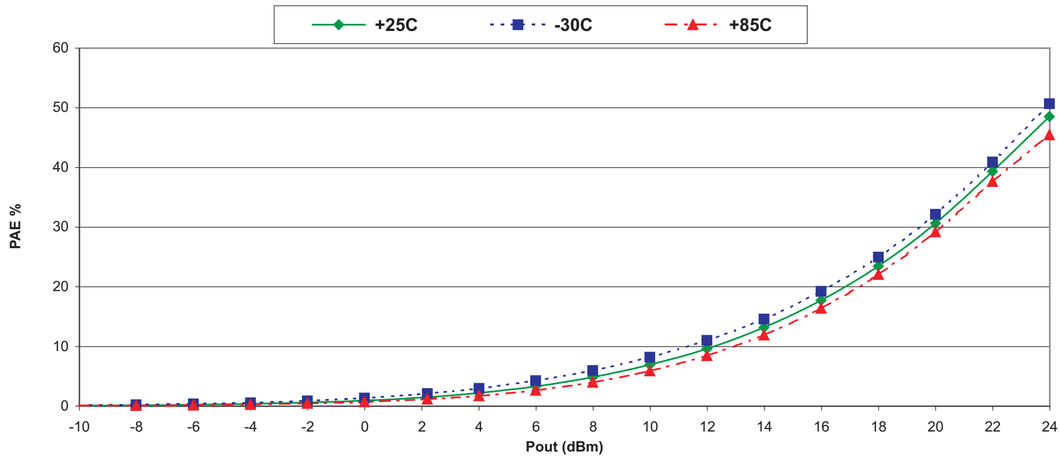


Figure 16: ACLR1_U vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT})

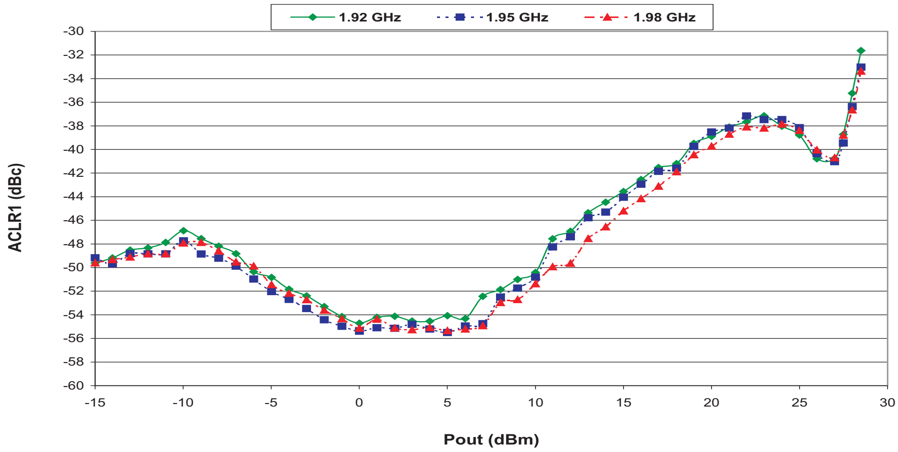


Figure 17: ACLR2_U vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT})

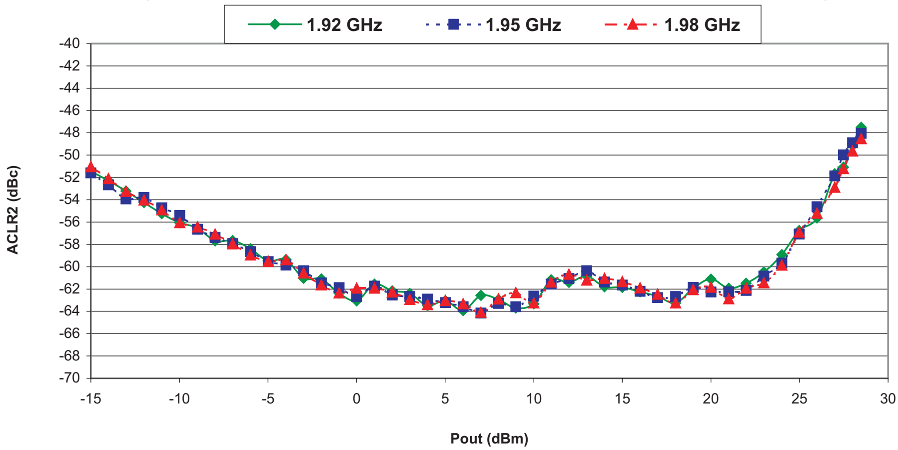


Figure 18: Gain vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT})

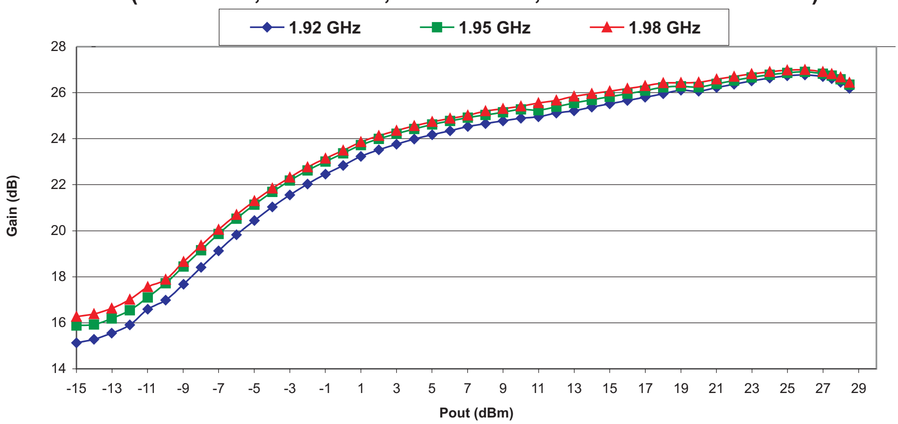


Figure 19: I_{CC} vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT})

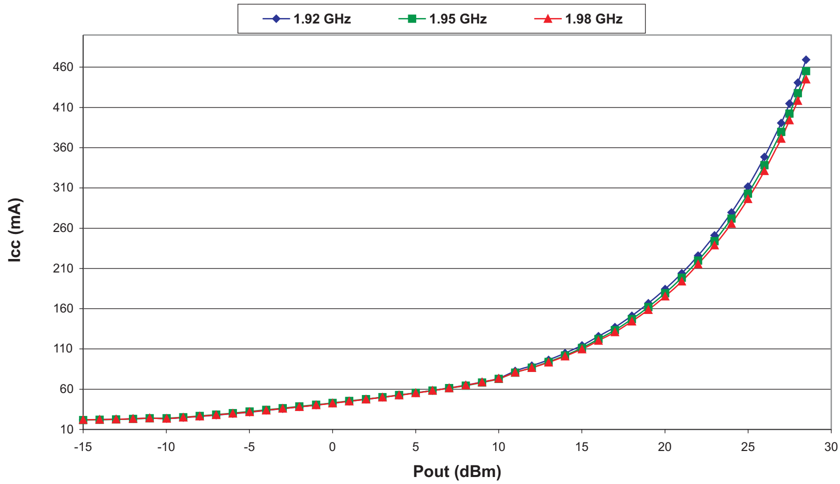


Figure 20: PAE vs P_{OUT}
(T = +25 °C, V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT})

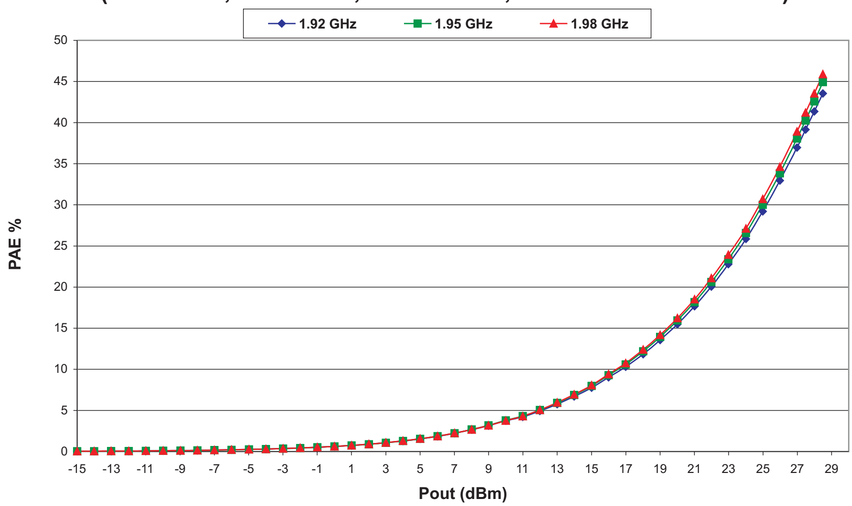


Figure 21: ACLR1_U vs Po
(VCC = 3.4 V, VREF = 2.85 V, VMODE = 1.5 + 0.025* POUT, F = 1.95 GHz)

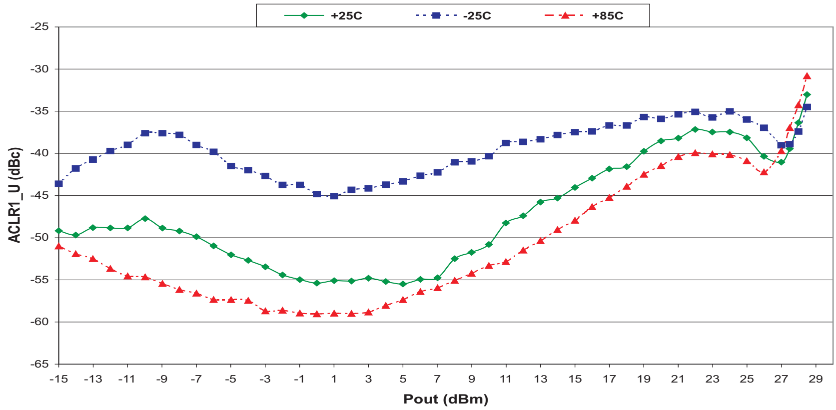


Figure 22: ACLR2_U vs Po
(VCC = 3.4 V, VREF = 2.85 V, VMODE = 1.5 + 0.025* POUT, F = 1.95 GHz)

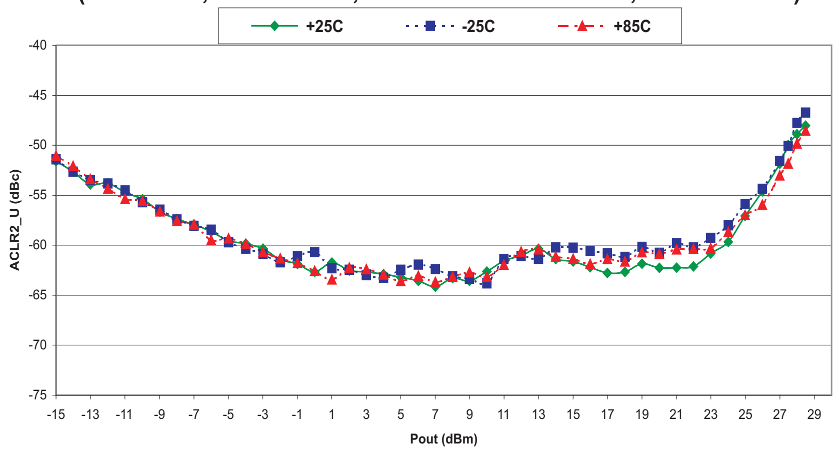


Figure 23: PAE vs POUT
(VCC = 3.4 V, VREF = 2.85 V, VMODE = 1.5 + 0.025* POUT, F = 1.95 GHz)

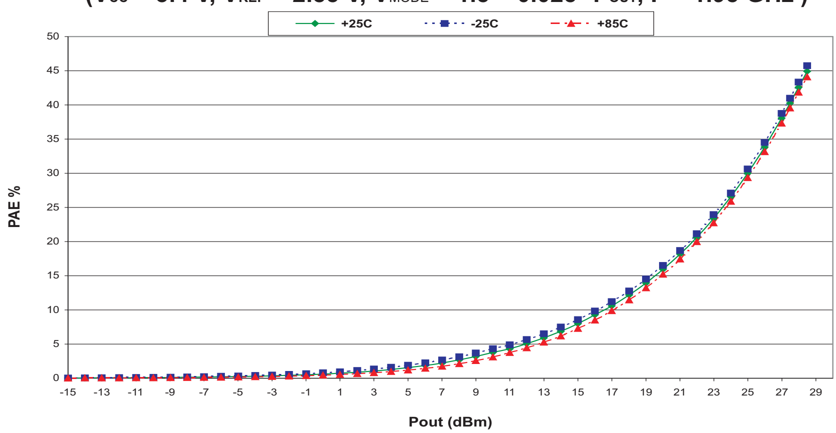


Figure 24: Icc vs Pout
(V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT}, F = 1.95 GHz)

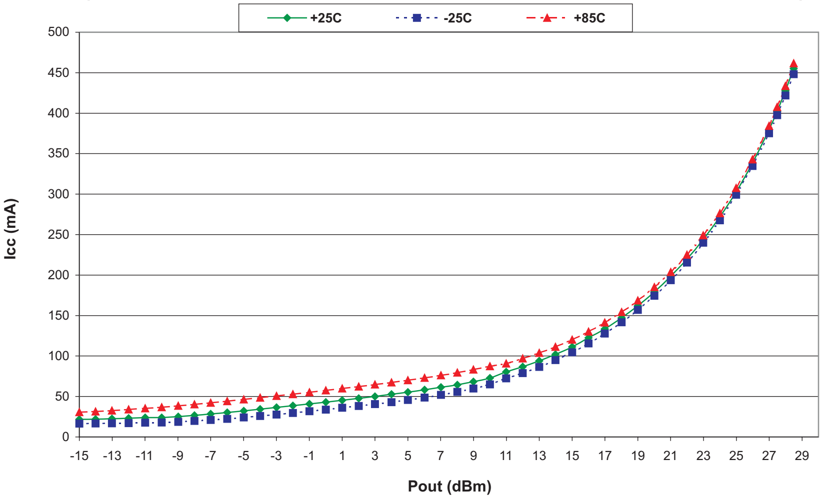
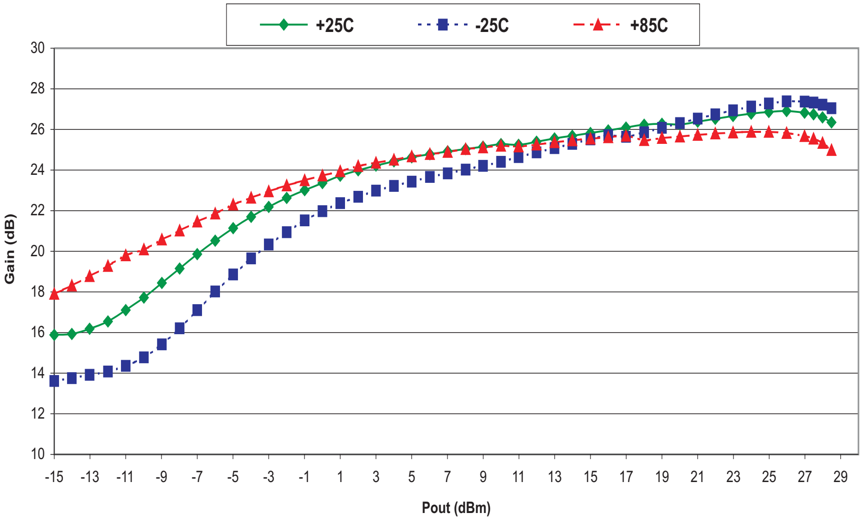
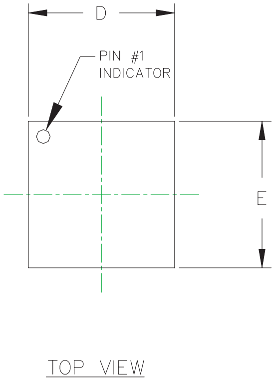
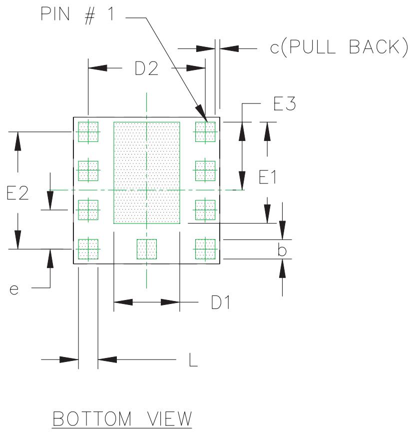


Figure 25: Gain vs Pout
(V_{CC} = 3.4 V, V_{REF} = 2.85 V, V_{MODE} = 1.5 + 0.025* P_{OUT}, F = 1.95 GHz)

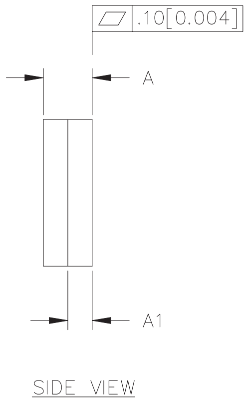


PACKAGE OUTLINES





SYMBOL	MILLIMETER			INCHES		
	MIN	NOM.	MAX	MIN	NOM.	MAX
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.45	0.50	0.55	0.018	0.020	0.022
b	0.40	0.47	0.55	0.016	0.019	0.022
c	–	0.10	–	–	0.004	–
D	2.90	3.00	3.10	0.114	0.118	0.122
D1	–	1.35	–	–	0.053	–
D2	–	2.40	–	–	0.094	–
E	2.90	3.00	3.10	0.114	0.118	0.122
E1	–	2.07	–	–	0.081	–
E2	–	2.40	–	–	0.094	–
E3	–	1.40	–	–	0.055	–
e	0.80 BSC			0.031 BSC		
L	0.40	0.47	0.55	0.016	0.019	0.022



NOTES :

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS
2. UNLESS SPECIFIED TOLERANCE= ±0.076[±0.003].

Figure 26: Package Outline

NOTES

NOTES

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