CEL

NEC's NPN SiGe RF IC IN A 8-PIN LEAD-LESS MINIMOLD

UPA901TU

FEATURES

- **OUTPUT POWER:**
  P_{out} = 19 dBm @ P_{in} = –3 dBm, V_{CE} = 3.6 V, f = 5.8 GHz
- **LOW POWER:**
  I_C = 90 mA @ P_{in} = –3 dBm, V_{CE} = 3.6 V, f = 5.8 GHz
- **SINGLE POWER SUPPLY OPERATION:**
  V_{CE} = 3.6 V
- **BUILT-IN BIAS CIRCUIT**
- **8-PIN LEAD-LESS MINIMOLD:**
  (2.0 × 2.2 × 0.5 mm)

DESCRIPTION

NEC's UPA901TU is a silicon germanium HBT IC designed for the power amplifier of 5.8 GHz cordless phone and other 5.8 GHz applications. This IC consists of two stage amplifiers and has excellent performance, high efficiency, high gain, low power consumption.

NEC's UPA901TU is packaged in surface mount 8-pin lead-less minimold plastic package.

This device is fabricated with our SiGe HBT process UHS2-HV technology.

APPLICATIONS

- **5.8 GHz Cordless Phones**
- **5.8 GHz Band DSRC (Dedicated Short Range Communication) System**
- **5 GHz Band Video Transmitter**

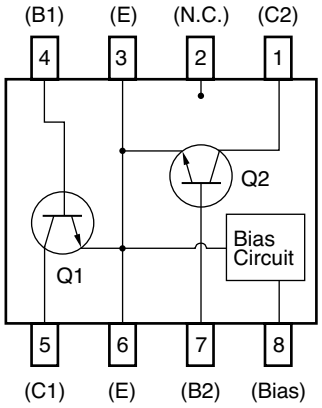
ORDERING INFORMATION

PART NUMBER	ORDER NUMBER	QUANTITY	PACKAGE	MARKING	SUPPLYING FORM
UPA901TU	UPA901TU-A	50 pcs (Non reel)	8-pin lead-less minimold(Pb-Free)	A901	• 8 mm wide embossed taping • Pin 1, Pin 8 face the perforation side of the tape
UPA901TU-T3	UPA901TU-T3-A	5 kpcs/reel			

Remark To order evaluation samples, contact your nearby sales office.
The unit sample quantity is 50 pcs.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

(Top View)



ABSOLUTE MAXIMUM RATINGS (T_A =+25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector to Base Voltage	V_{CBO}	15	V
Collector to Emitter Voltage	V_{CEO}	4.5	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current of Q1	I_{C1}	75	mA
Collector Current of Q2	I_{C2}	250	mA
Bias Current	I_{BIAS}	25	mA
Total Power Dissipation	P_{tot} **Note**	410	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C
Operating Ambient Temperature	T_A	–40 to +85	°C

Note Mounted on 20 × 20 × 0.8 mm (t) glass epoxy PCB (FR-4)

THERMAL RESISTANCE (T_A =+25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	RATINGS	UNIT
Channel to Ambient Resistance	$R_{th\ (j\text{-}a1)}$ **Note**		150	°C/W
	$R_{th\ (j\text{-}a2)}$	Free Air	TBD	°C/W

Note Mounted on 20 × 20 × 0.8 mm (t) glass epoxy PCB (FR-4)

RECOMMENDED OPERATING RANGE (All Parameters)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Collector to Emitter Voltage	V_{CE}	–	3.6	4.5	V
Total Current	I_{total}	–	90	300	mA
Input Power	P_{in}	–	–3	+5	dBm

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

-DC CHARACTERISTICS-

(1) Q1

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 5 V, I_E = 0 mA	–	–	60	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0 mA	–	–	120	nA
DC Current Gain	h_{FE} Note	V_{CE} = 3 V, I_C = 6 mA	80	120	160	–
Current Ratio ($I_{C\ (set)\ 1}/I_{BIAS}$)	CR1	V_{CE} = 3.6 V, V_{BE} = V_{BIAS} = 0.865 V	2	4.5	9	–

(2) Q2

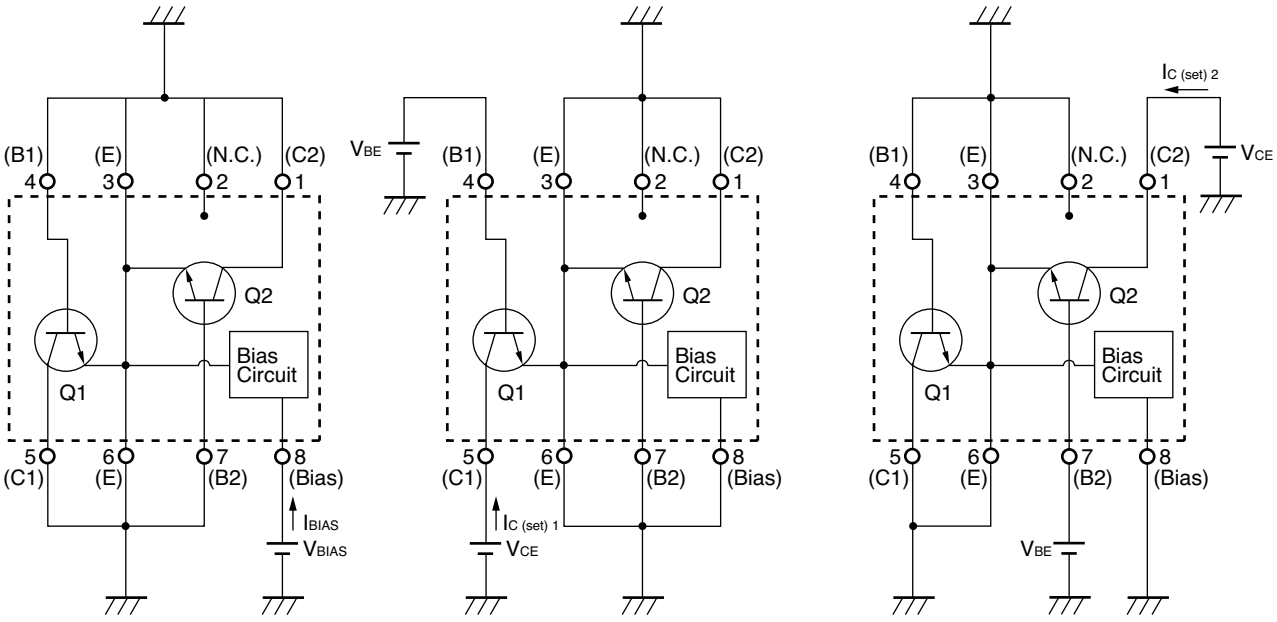
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 5 V, I_E = 0 mA	–	–	200	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0 mA	–	–	400	nA
DC Current Gain	h_{FE} Note	V_{CE} = 3 V, I_C = 20 mA	80	120	160	–
Current Ratio ($I_{C\ (set)\ 2}/I_{BIAS}$)	CR2	V_{CE} = 3.6 V, V_{BE} = V_{BIAS} = 0.865 V	8	10	13	–

(3) Bias Circuit

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Bias Circuit Current	I_{BIAS}	V_{BIAS} = 0.865 V	–	4	–	mA

Note Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

I_{BIAS}, $I_{C\ (set)\ 1}$, $I_{C\ (set)\ 2}$ MEASUREMENT CIRCUIT



I_{BIAS}

$I_{C\ (set)\ 1}$

$I_{C\ (set)\ 1}$ = CR1× I_{BIAS}
= 4.5 × I_{BIAS} (TYP.)

$I_{C\ (set)\ 2}$

$I_{C\ (set)\ 2}$ = CR2 × I_{BIAS}
= 4.5 × I_{BIAS} (TYP.)

The application circuits and their parameters are for reference only and are not intended for actual design-ins.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

-RF CHARACTERISTICS-

(1) Q1

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Insertion Power Gain (Q1)	$\|S_{21e}\|^2$	V_{CE} = 3.6 V, I_C = 12 mA, f = 5.8 GHz	8.5	10.0	11.5	dB
Maximum Available Power Gain (Q1)	MAG1	V_{CE} = 3.6 V, I_C = 12 mA, f = 5.8 GHz	13.5	15.0	–	dB
Output Power (Q1)	$P_{out}1$	V_{CE} = 3.6 V, $I_{C(set)}$ = 12 mA, f = 5.8 GHz, P_{in} = –3 dBm	10.2	11.2	–	dBm
Collector Current (Q1)	$I_{CC}1$	V_{CE} = 3.6 V, $I_{C(set)}$ = 12 mA, f = 5.8 GHz, P_{in} = –3 dBm	–	20	–	mA

(2) Q2

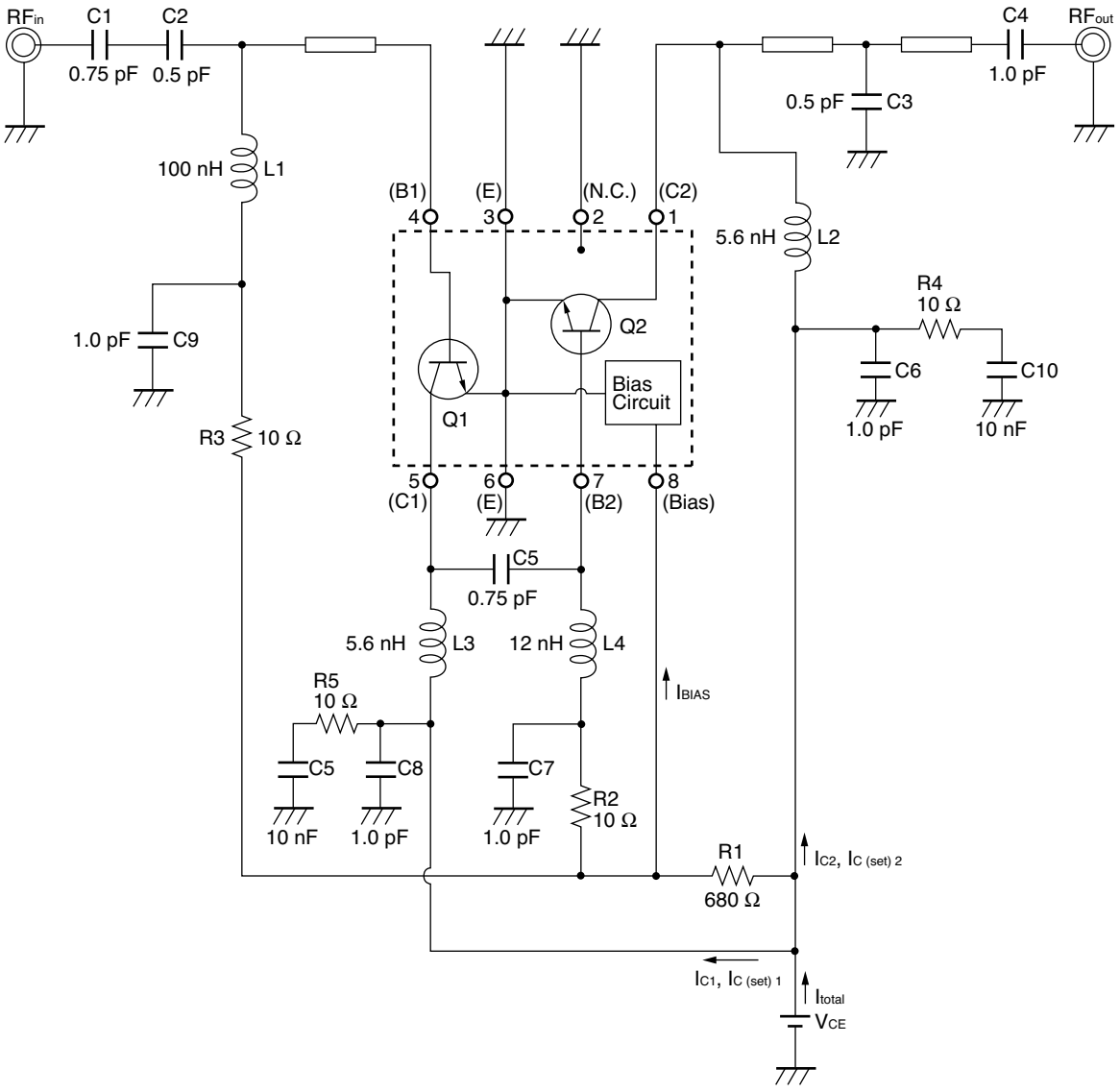
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Insertion Power Gain (Q2)	$\|S_{21e}\|^2$	V_{CE} = 3.6 V, I_C = 40 mA, f = 5.8 GHz	2	3.5	5	dB
Maximum Available Power Gain (Q2)	MAG2	V_{CE} = 3.6 V, I_C = 40 mA, f = 5.8 GHz	8.5	10.0	10.5	dB
Output Power (Q2)	$P_{out}2$	V_{CE} = 3.6 V, $I_{C(set)}$ = 40 mA, f = 5.8 GHz, P_{in} = 11 dBm	17.5	19.0	–	dBm
Collector Current (Q2)	$I_{CC}2$	V_{CE} = 3.6 V, $I_{C(set)}$ = 40 mA, f = 5.8 GHz, P_{in} = 11 dBm	–	70	–	mA

(3) Q1 + Q2, 2 stage Amplifiers

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Power (Q1 + Q2)	P_{out}	V_{CE} = 3.6 V, R_{BIAS} = 680 Ω, f = 5.8 GHz, P_{in} = –3 dBm **Note**	17.5	19.0	–	dBm
Total Current (Q1 + Q2)	I_{total}	V_{CE} = 3.6 V, R_{BIAS} = 680 Ω, f = 5.8 GHz, P_{in} = –3 dBm **Note**	–	90	–	mA

Note by **MEASUREMENT CIRCUIT 1**

MEASUREMENT CIRCUIT 1

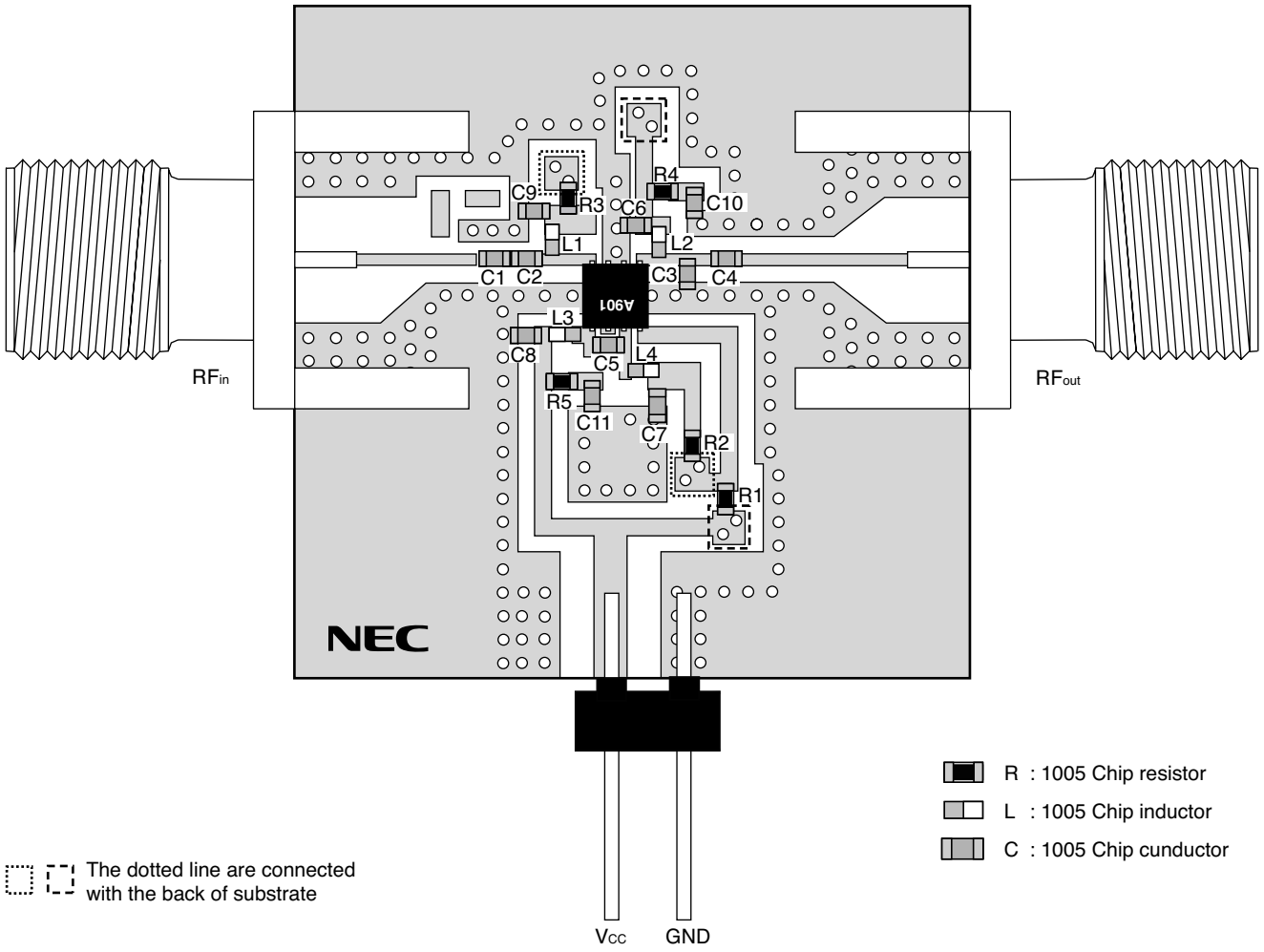


$I_{C\,(set)\,1} = CR1 \times I_{BIAS}$
$= 4.5 \times I_{BIAS}$ (TYP.)

$I_{C\,(set)\,2} = CR2 \times I_{BIAS}$
$= 4.5 \times I_{BIAS}$ (TYP.)

The application circuits and their parameters are for reference only and are not intended for actual design-ins.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



Remarks

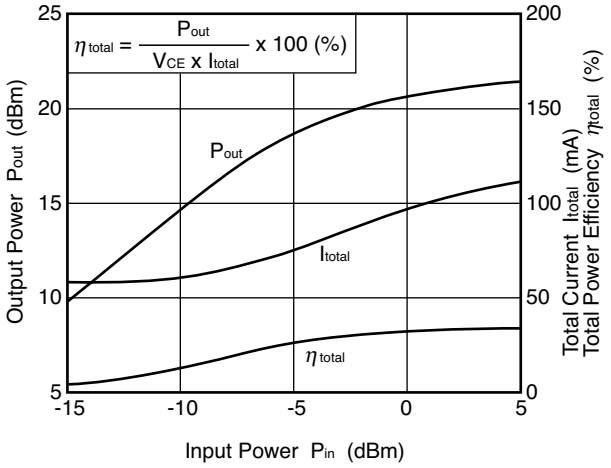
1. Substrate : 20 × 20 × 0.8 (t) mm FR-4 (4 Layer, each thickness 0.2 mm), copper thickness 18 μm, gold flash plating
2. Back side : GND pattern
3. o : Through hole

USING THE NEC EVALUATION BOARD

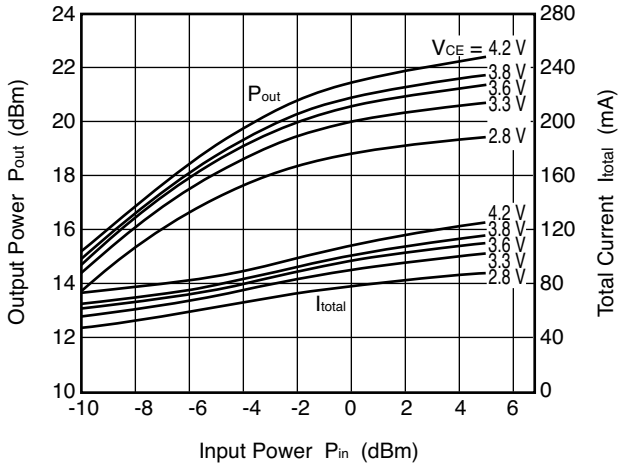
SYMBOL	VALUES	SYMBOL	VALUES
R1	680 Ω	C2	0.5 pF
R2	10 Ω	C3	0.5 pF
R3	10 Ω	C4	1.0 pF
R4	10 Ω	C5	0.75 pF
R5	10 Ω	C6	1.0 pF
L1	100 nH	C7	1.0 pF
L2	5.6 nH	C8	1.0 pF
L3	5.6 nH	C9	1.0 pF
L4	12 nH	C10	10 nF
C1	0.75 pF	C11	10 nF

TYPICAL CHARACTERISTICS (T_A = +25°C , V_{CE} = 3.6 V, R_{BIAS} = 680 Ω, f = 5.8 GHz, unless otherwise specified)

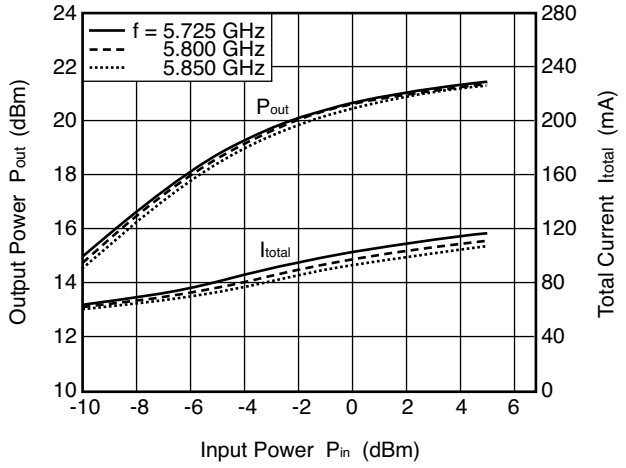
OUTPUT POWER, TOTAL CURRENT,
TOTAL POWER EFFICIENCY vs. INPUT POWER



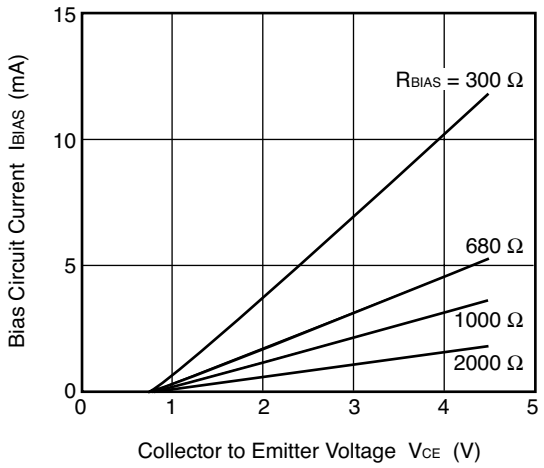
OUTPUT POWER, TOTAL CURRENT,
vs. INPUT POWER



OUTPUT POWER, TOTAL CURRENT,
vs. INPUT POWER



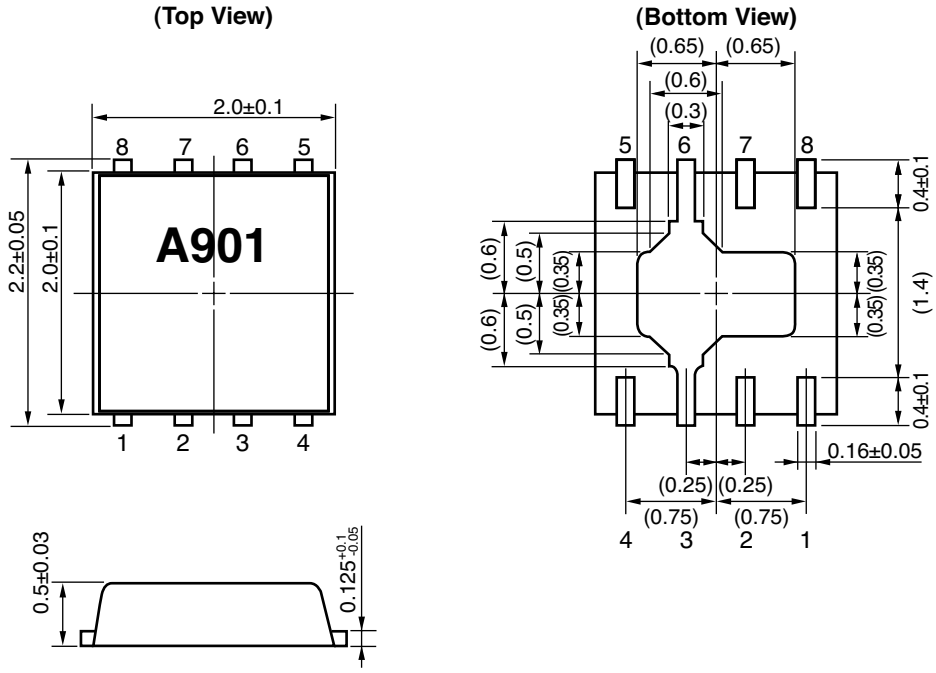
BIAS CIRCUIT CURRENT
vs. COLLECTOR TO EMITTER VOLTAGE



Remark The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

8-PIN LEAD-LESS MINIMOLD (UNIT:mm)



Remark ( ) : Reference value

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Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
Lead (Pb)	< 1000 PPM	-A	-AZ
		Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.