

High-Efficiency Cellular Phone Power Amplifier Module for the Japanese Market cdma One System

CXG1156K

The CDMA2000 1x system went into service in April 2002 and that Japan has now entered the third generation of cellular phone systems.

While Sony is already producing power amplifier modules in volume for the Japanese market cdma One system, Sony has now developed a new high-efficiency low-distortion power amplifier module for the CDMA2000 1x system, the CXG1156K.

- High efficiency, low distortion, and high gain
- Single positive voltage supply operation
- Miniature package
- Built-in temperature compensation circuit

■ High Efficiency, Low Distortion, and High Gain

The CXG1156K adopts a newly-developed JPHEMT*¹ device that provides an even higher gm and an even lower ON resistance than conventional JPHEMT devices. The module matching circuit features a lower loss circuit design achieved by reducing the wiring resistance. This results in the device achieving the low distortion of ACPR1 = -55 dBc and the high efficiency of 40% at an operating voltage of 3.5 V and an output power of 27.5 dBm. It also achieves extremely flat gain characteristics, with a band gain deviation of 0.5 dB and a power gain of 29 dB. Since the cdma system performs output power control during transmission, the

efficiency and distortion of the power amplifier are important not only at maximum output power, but at low power as well. The CXG1156K achieves excellent power amplifier characteristics in this critical low output range as well. In particular, it achieves the high efficiency of 23% at an operating voltage of 1.3 V and an output power of 15 dBm, and also achieves an ACPR1 of -55 dBc at an operating voltage of 1.3 V and an output power of 18 dBm. Thus this device achieves low-distortion characteristics from low to high output power levels at low voltages. (See table 1 and figure 1.) The CXG1156K is also capable of operating at the low operating voltage of 1.0 V if the power amplifier output power is limited to a maximum of 15 dBm in the low power range. In this mode, the efficiency jumps to 30.7% (at an output power of 15 dBm) at the low distortion of an ACPR1 of -55 dBc or lower. Thus this device provides power amplifier specifications that can respond to a wide range of application needs during low power operation.

■ Single Positive Power Supply Operation

Sony's unique JPHEMT device features a high built-in potential, and allows positive power supply operation of the power amplifier module. This obviates the need for the peripheral components associated with a negative power supply circuit, and can contribute to the miniaturization of portable terminals.

■ Miniature Package Adopted

The CXG1156K is provided in a package with a volume of 0.06 cc ($6.2 \times 6.2 \times 1.7$ mm) and can contribute to reduced PWB mounting areas in portable terminals. (See figure 2.)

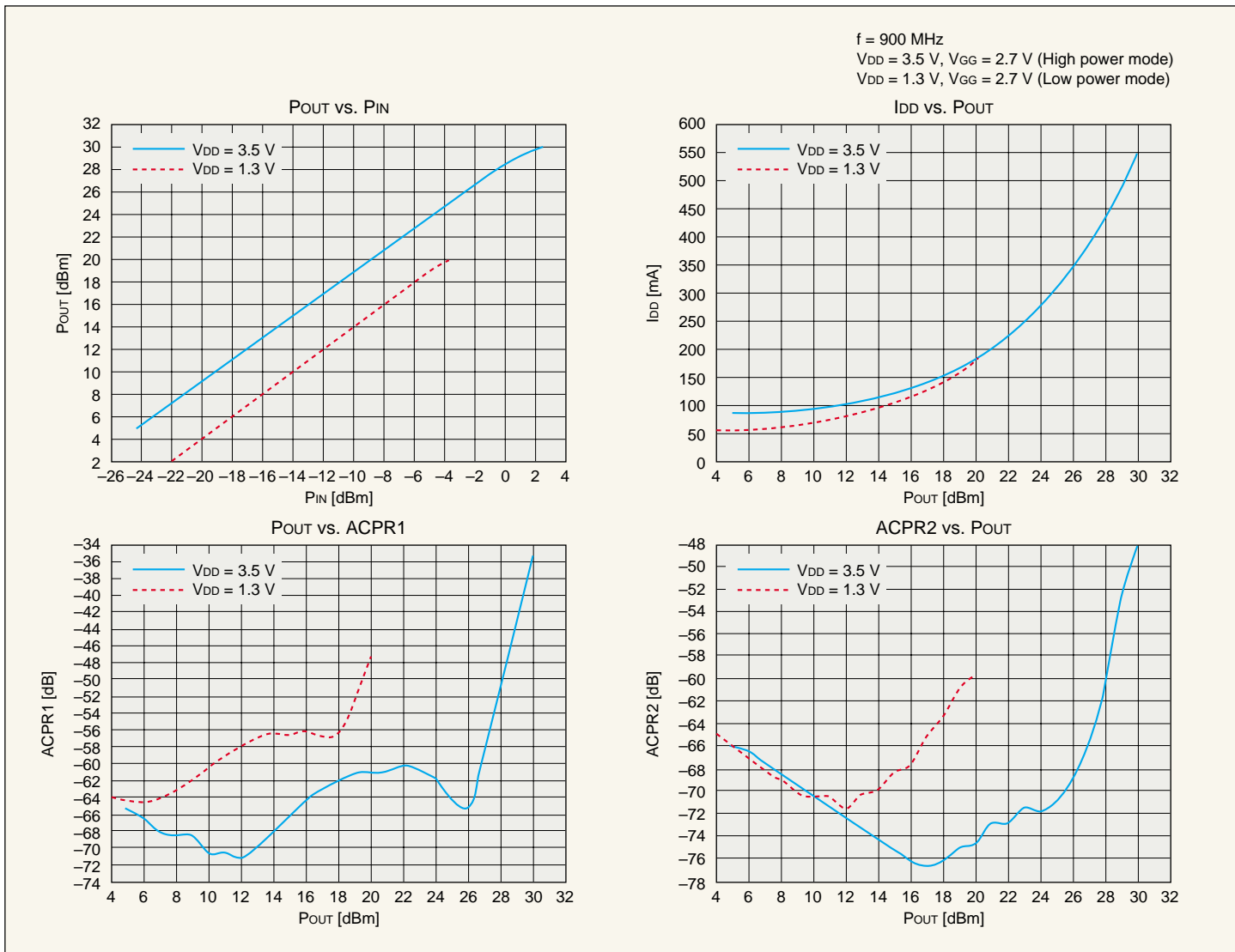
■ Built-in Temperature Compensation Circuit

Since power amplifier bias currents fluctuate widely with changes in temperature, their characteristics degrade with changes in temperature. The CXG1156K includes a built-in temperature compensation circuit that controls the bias current to have an optimal value as the temperature changes, thus preventing degradation of device characteristics at high and low temperatures.

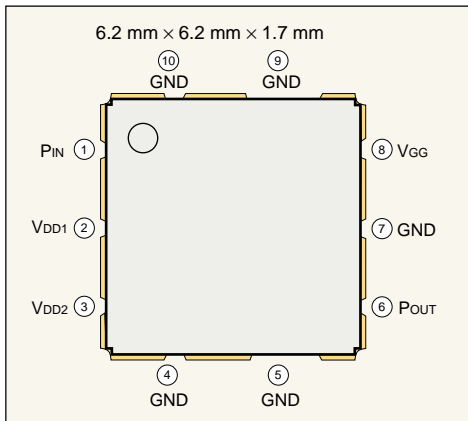
*1 JPHEMT: Junction Pseudomorphic High Electron Mobility Transistor

V O I C E

We developed the CXG1156K with the intent of achieving the highest possible performance. To succeed in this, at the same time as increasing the performance of the individual transistors, we introduced many new techniques and went through many stages of trial and error. Although this was a particularly difficult development project, I am convinced that we achieved the highest possible performance with a superlative overall balance. I strongly recommend that you try this device in your cell phone products.



■ Figure 1 CXG1156K I/O Characteristics



■ Figure 2 CXG1156K Package Dimensions

■ Table 1 CXG1156K Main Characteristics

High Power Mode		Low Power Mode	
Output power	P _{OUT} = 27.5 dBm	Operating voltage	V _{DD} = 1.3 V, V _{GG} = 2.7 V
Operating voltage	V _{DD} = 3.5 V, V _{GG} = 2.7 V	Current consumption	105 mA (Efficiency: 23%)
Current consumption	400 mA (efficiency: 40%)	Gain	@ P _{OUT} = 15 dBm 24 dB @ P _{OUT} = 18 dBm
Gain	29 dB	ACPR1 *1	-56 dBc @ P _{OUT} = 18 dBm
ACPR1 *1	-55 dBc	ACPR2 *2	-63 dBc @ P _{OUT} = 18 dBm
ACPR2 *2	-64 dBc		
Reception band noise	-140 dBm/Hz		

f = 887 to 925 MHz, T_a = 25°C

*1: Conditions: ±900 kHz offset, 30 kHz bandwidth
*2: Conditions: ±1.98 MHz offset, 30 kHz bandwidth