

**Product Information****March 1996**

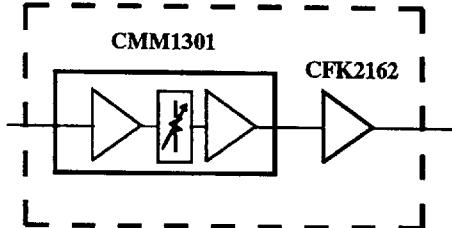
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**1.85 to 2.0 GHz  
2 Watt Amplifier Chip Set****Features**

- High Gain  $\approx$  35 dB**
- +33 dBm Output Power @ 5 Volts**
- >45% Efficiency Achievable**
- Small Size**

**Applications**

- North America PCS Base Stations**
- Japanese PHS Base Stations**
- Industrial Data Communication Networks**

**Functional Block Diagram****Description**

The Celeritek CCS1933 is a two-chip set designed to provide a compact, 2 Watt, RF power amplifier for North American PCS base stations, Japanese PHS base stations, and industrial applications operating in the 1.85 to 2.0 GHz band. The chip set consists of a integrated driver amplifier (CMM1301) and a matched power stage (CFK2162) that operates from a 5 Volt positive supply.

When used with external heat sinking, the chip set implements a very small, high performance, and cost-effective transmit power amplifier that can be operated with high efficiency or backed off for linear operation through adjustment of the input drive level. Off chip matching is limited to just three capacitors and one resistor which further contributes to the compact nature of the product. The driver amplifier includes an

analog level adjustment capability that allows fine tuning of the output power level over a 10 dB range.

The use of the CCS1933 allows the designer to achieve more than the FCC-specified +30 dBm out of the antenna, after making allowances for filter and antenna coupling losses. When used with a Celeritek CSW2102 SPDT switch, transmit/receive switching can be implemented. The use of a second Celeritek CSW2102 SPDT switch in the circuit allows for the implementation of antenna diversity switching.

**Evaluation Board**

The Celeritek PB-CCS1933 evaluation board is available to assist the designer in the testing of this chip set and is useful as an application example. The test data and typical performance shown were taken on this evaluation board.

**Electrical Characteristics**

The following typical specifications are measured at +25°C with  $V_{D1} = V_{D2} = 5$  V. The CMM1301 is biased for  $I_D = 150$  mA and the CFK2162 is biased for  $I_D = 1.2$  A, with no RF applied. Refer to individual device Data Sheets for biasing details.

Parameter	Condition	1.85 GHz	1.95 GHz	2.0 GHz	Units
Power Output	1 dB Gain Compression Point	33.0	33.0	32.5	dBm
Gain	$P_{IN} = -15$ dBm	36.0	35.5	35.0	dB

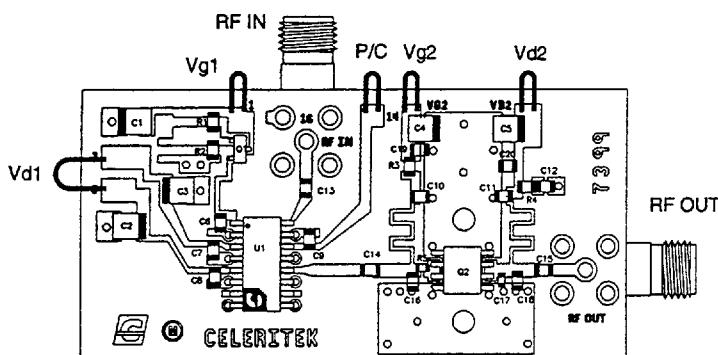
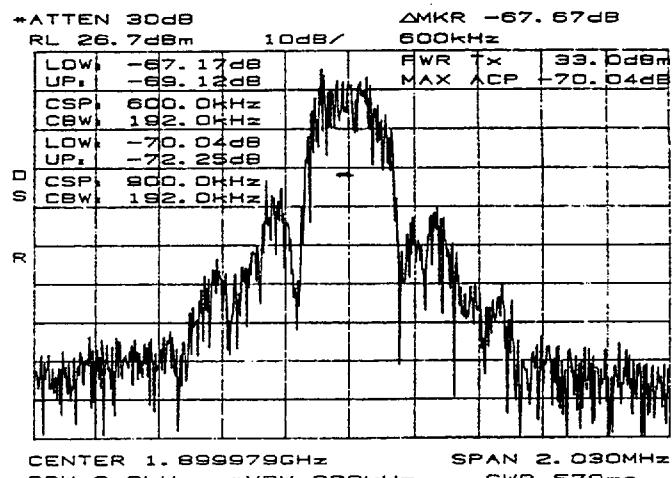
**Ordering Information**

The CCS1933 Amplifier is available as a two-chip set. Both devices can be purchased individually or as a set. Both devices are available in tape and reel. The PB-CCS1933 Evaluation board may also be purchased separately. Ordering part numbers are listed.

Part Number for Ordering	Function	Package
CCS1933	Amplifier Chip Set	CMM1301-AM, CFK2162-P3
PB-CCS1933	Amplifier Evaluation Board	Assembled FR4 PC board with SMA connectors
CMM1301-AM	Driver Amplifier	SOIC-16 surface mount narrow body plastic package
CFK2162-P3	Power Stage	SOIC-8 surface mount power package

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## PB-CCS1933 Evaluation Board

CFK2162 Spectral Regrowth  
5 V, 1.2 A,  $\pi/4$  DQPSK Modulation

## Evaluation Board Parts List

Part Type	Reference Designator	Description	Manufacturer	Part Number
Capacitor	C6-C9, C19, C20	SMD 0805, 0.01 $\mu$ F	AVX	08051C103KAT050
Capacitor	C10-C15	SMD 0805, 100 pF	AVX	08051A101JAT050
Capacitor	C1-C5	SMD tantalum, 2.2 $\mu$ F	Matsuo	267M2002225M
Capacitor	C16	SMD 0805, 3.3 pF	AVX	08055A3R3DAT050
Capacitor	C17	SMD 0805, 2.7 pF	AVX	08055A2R7DAT050
Capacitor	C18	SMD 0805, 2.2 pF	AVX	08055A2R2DAT050
Resistor	R2	SMD 0805, 18k	ROHM	MCR10JW183
Resistor	R1	SMD 0805, 22k	ROHM	MCR10JW223
Resistor	R3, R4	SMD 0805, 51k	ROHM	MCR10JW510
Resistor	R5	SMD 0603, 2.4 $\Omega$	ROHM	MCR03JW024
Transistor	Q1	SMD transistor	Motorola	MMBT5087
Connector	J1, J2	Right angle SMA PC board mount	EF Johnson	142-0701-301
MMIC	U1	Driver amplifier	Celeritek	CMM1301-AM
Power Stage	Q2	Power MESFET	Celeritek	CFK2162-P3

## Evaluation Board Operating Instructions

Handle and test the board in an ESD protected environment. With all power OFF, connect the RF and DC connections. Monitor the drain currents of the CMM1301 and the CFK2162. To experiment with different bias conditions, use four (4) power supplies; one for each bias voltage.

Connect DC ground to any of the ground plane areas of the board. Connect a -5 V supply to Vg1. Connect a -5 V supply to Vg2. Connect a +5 V supply to Vd1. Monitor the Vd1 current and adjust Vg1 until the current (Id1) is 150 mA with no RF power applied. Connect 5.0 V to Vd2. Monitor the Vd2 current and adjust Vg2 until the current (Id2) is 1.2 A. In this configuration the CMM1301 will be operating at 5.0 V and 150 mA. The CFK2162 will be operating at 5 V and 1.2 A. For maximum output power connect P/C to ground. See the CMM1301 Data Sheet for specifications on the power control (P/C) function. Connect a +5 dBm signal to RF IN and measure the output power at RF OUT.

**NOTE: Power Supply Sequencing** The negative voltages (Vg1, Vg2) must be applied first at all times to prevent damage to the CMM1301 and the CFK2162. When turning the chip set off, the positive supply voltages must be turned off before the negative supplies. If this sequencing is not followed the devices will be damaged.

**Thermal Considerations** During evaluation it is suggested that a heat sink (recommended: EG&G Wakefield Engineering, part number: 290-2AB) be mounted on the backside of the board using the two screw holes provided. Refer to the Celeritek CFK2162 device data sheet for further information.

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 3236 Scott Boulevard, Santa Clara, California 95054  
 Phone: (408) 986-5060  
 Fax: (408) 986-5095