# D7185

## FRONT END MODULE for QUAD-BAND GSM/GPRS With DUAL-BAND 3G TRX PORTS for W-CDMA

## PRELIMINARY DATA SHEET

**Version 0.1**

## Features

- **Ultra-Small 6mm×6mm Package Size**
- **Low Profile**
- **Complete Power Control Solution**
- **No External Components or Routing**

**Typical Applications**

- **3V Dual-Mode GSM/W-CDMA Handsets**
- **Commercial and Consumer Systems**
- **Portable Battery-Powered Equipments**

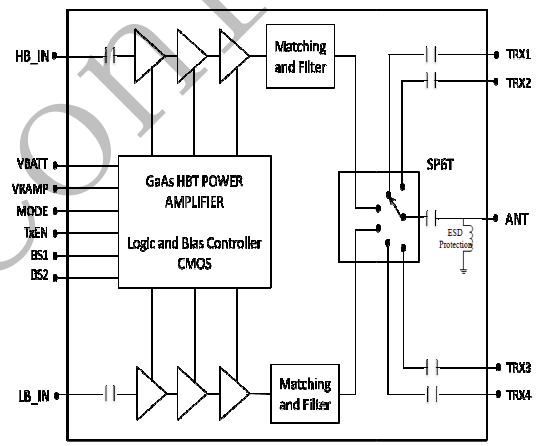
## Product Description

The D7185 is a high-power， high-efficiency quad-band FEM for GSM/GPRS, with dual-band 3G W-CDMA TRx Switch. The module is a self-contained 6mm×6mm module with 50Ω input and output terminals. The module consists of quad-band GSM/GPRS power amplifiers and a SP6T antenna switch, which can provide two GSM Rx ports and two 3G TRx ports. The module is designed for use as the final portion of the transmitter section in GSM/GPRS and W-CDMA handheld digital cellular equipment and other applications in the 824MHz to 915MHz, 1710MHz to 1910MHz bands. It eliminates the need for separate antenna switch and matching network. The D7185 simplifies layout design and reduces board space.

**Optimum Process Technology Applied**

√GaAs HBT
√GaAs pHEMT
√Si CMOS

### Functional Block Diagram




### Pin Assignment

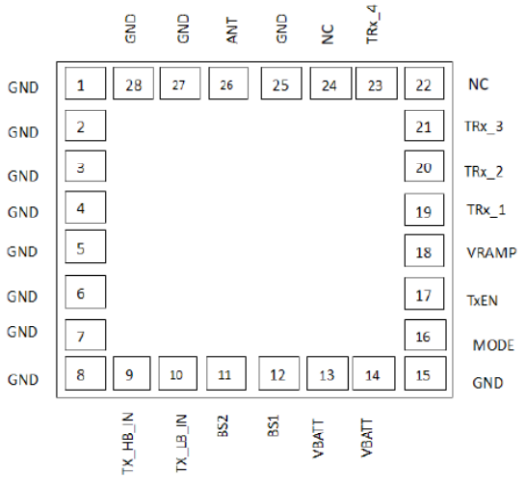


**Table 1: Pin Description**

| Pin No | Definition | Description |
|---|---|---|
| 9 | TX_HB_IN | High band RF input,1710-1910MHz,50Ω input |
| 10 | TX_LB_IN | Low band RF input,824-915MHz,50Ω input |
| 11 | BS2 | Band select |
| 12 | BS1 | Band select |
| 13,14 | VBATT | Battery input voltage , 3.2-4.5V,Trace should be as wide as possible. |
| 16 | MODE | Control logic level selection/Standby control. |
| 17 | TxEN | Tx/Rx mode control. Enables the PA module for Tx mode with a logic high. |
| 18 | VRAMP | Analog power control voltage input, A RC filter outside is preferred. |
| 19-21,23 | TRx | TRx（1-4） 824MHz to 2170MHz ,50Ω output |
| 26 | ANT | RF IN/OUT to Antenna,50Ω |
| 22,24 | NC | Not Connected |
| 1-8,15,25,27, 28 | GND | RF and DC Ground |
| GROUND GRID | | GND PAD, must be connected to main GND |

**Table2: Control Logic Tables**

| Control Logic | TxEN | MODE | BS1 | BS2 |
|---|---|---|---|---|
| Power Down(Standby) | 0 | 0 | 0 | 0 |
| LB_Tx | 1 | 0 | 0 | 1 |
| HB_Tx | 1 | 0 | 1 | 1 |
| TRx_1 | 0 | 1 | 0 | 0 |
| TRx_2 | 0 | 1 | 1 | 0 |
| TRx_3 | 0 | 1 | 0 | 1 |
| TRx_4 | 0 | 0 | 1 | 0 |

## Table 3: Absolute Maximum Ratings

| PARAMETER | MIN | MAX | UNIT |
|---|---|---|---|
| Supply Voltage | -0.3 | +5.0 | V |
| Power Control Voltage (VRAMP) | -0.3 | +1.65 | V |
| RF Input Power | | +10 | dBm |
| Max Duty Cycle | | 50 | % |
| Output Load VSWR | | 20:1 | |
| Operating Case Temperature | -20 | +85 | ℃ |
| Storage Temperature | -55 | +150 | ℃ |

## Table 4: Electrical Characteristics

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| **Overall Power Control VRAMP** | | | | | |
| Power Control "ON" | | | 1.65 | V | |
| Power Control "OFF" | | 0.27 | | V | |
| VRAMP Input Capacitance | | 2 | 20 | pF | DC to 2MHz |
| VRAMP Input Current | | | 30 | μA | VRAMP=1.65V |
| Power Control Range | | 50 | | dB | VRAMP=0.27V to 1.65V |
| **Overall Power Supply** | | | | | |
| Power Supply Voltage | | 3.5 | | V | Specifications |
| | 3.2 | | 4.5 | V | Nominal operating limits |
| Power Supply Current | | 1 | | μA | PIN<-30dBm, TxEN =Low, |
| | | | | | Temp=-20℃ to +85℃ |
| | | | 15 | mA | VRAMP=0.27V, TxEN =High |
| **Overall Control Signals** | | | | | |
| BS2/BS1 /MODE "Low" | 0 | 0 | 0.5 | V | |
| BS2/BS1 /MODE "High" | 1.6 | 2.0 | 3.0 | V | |
| BS2/BS1 /MODE "High" Current | | 10 | 20 | μA | |
| TxEN "Low" | 0 | 0 | 0.5 | V | |
| TxEN "High" | 1.6 | 2.0 | 3.0 | V | |
| TxEN "High" Current | | 10 | 20 | μA | |

## Table 5: Electrical Specification for GSM850 Tx

| PARAMETER | SPECIFICATION | | | UNIT | CONDITION |
|---|---|---|---|---|---|
| | MIN | TYP | MAX | | |
| **Overall** | | | | | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V, TX_LB_IN=3dBm, Freq=824MHz to 849MHz, 25%Duty Cycle, Pulse Width=1154us |
| Operating Frequency Range | 824 | | 849 | MHz | |
| Maximum Output Power 1 | | 33.2 | | dBm | Temp=+25℃, VBATT=3.5V, VRAMP =1.65V |
| Maximum Output Power 2 | 30.5 | | | dBm | Temp=+85℃, VBATT=3.5V, VRAMP =1.65V |
| Total Efficiency | | 38 | | % | At $P_{OUT\ MAX}$ |
| Input Power Range | 0 | +3 | +6 | dBm | |
| Output Noise Power | | | -82 | dBm | RBW=100kHz, 869 MHz to 894MHz, $P_{OUT} \leqslant$ +33dBm |
| | | | -74 | dBm | RBW=100kHz, 1930 MHz to 1990MHz, $P_{OUT} \leqslant$ +33dBm |
| Forward Isolation 1 | | -60 | -40 | dBm | TxEN =Low, TX_LB_IN=+5dBm |
| Forward Isolation 2 | | -40 | -15 | dBm | TxEN =High, TX_LB_IN=+5dBm, VRAMP =0.27V |
| Second Harmonic | | -40 | -30 | dBm | VRAMP =0.27V to 1.65V |
| Third Harmonic | | -40 | -35 | dBm | VRAMP =0.27V to 1.65V |
| All other Non-Harmonic Spurious | | | -36 | dBm | VRAMP =0.27V to 1.65V |
| Input Impedance | | 50 | | Ω | |
| Input VSWR | | | 2.5:1 | | |
| Output Load VSWR stability (Spurious emission) | | | -36 | dBm | VSWR=12:1 |
| Output Load VSWR Ruggedness | No damage or permanent degradation | | | | VSWR=20:1 |
| Output Load impedance | | 50 | | Ω | Load impedance presented at RF OUT pad |
| Switch Leakage Pout at Rx Port GSM850,ANT-GSM850_Rx | | 3 | | dBm | LB_Tx Mode, Freq=824 to 849MHz Pout=33dBm at ANT Port. |

## Table 6: Electrical Specification for EGSM900 Tx

| PARAMETER | SPECIFICATION | | | UNIT | CONDITION |
|---|---|---|---|---|---|
| | MIN | TYP | MAX | | |
| **Overall** | | | | | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V, TX_LB_IN=3dBm, Freq=880MHz to 915MHz, 25%Duty Cycle, Pulse Width=1154us |
| Operating Frequency Range | 880 | | 915 | MHz | |
| Maximum Output Power 1 | | 33.2 | | dBm | Temp=+25℃, VBATT=3.5V, VRAMP =1.65V |
| Maximum Output Power 2 | 30.5 | | | dBm | Temp=+85℃, VBATT=3.5V, VRAMP =1.65V |
| Total Efficiency | | 36 | | % | At $P_{OUT\,MAX}$ |
| Input Power Range | 0 | +3 | +6 | dBm | |
| Output Noise Power | | | -77 | dBm | RBW=100kHz, 925 MHz to 935MHz, $P_{OUT} \leqslant$ +33dBm |
| | | | -80 | dBm | RBW=100kHz, 935 MHz to 960MHz, $P_{OUT} \leqslant$ +33dBm |
| | | | -84 | dBm | RBW=100kHz, 1805 MHz to 1880MHz, $P_{OUT} \leqslant$ +33dBm |
| Forward Isolation 1 | | -60 | -40 | dBm | TxEN =Low, TX_LB_IN=+5dBm |
| Forward Isolation 2 | | -40 | -15 | dBm | TxEN =High, TX_LB_IN=+5dBm, VRAMP =0.27V |
| Second Harmonic | | -40 | -30 | dBm | VRAMP =0.27V to 1.65V |
| Third Harmonic | | -40 | -35 | dBm | VRAMP =0.27V to 1.65V |
| All other Non-Harmonic Spurious | | | -36 | dBm | VRAMP =0.27V to 1.65V |
| Input Impedance | | 50 | | Ω | |
| Input VSWR | | | 2.5:1 | | |
| Output Load VSWR stability (Spurious emission) | | | -36 | dBm | VSWR=12:1 |
| Output Load VSWR Ruggedness | No damage or permanent degradation | | | | VSWR=20:1 |
| Output Load impedance | | 50 | | Ω | Load impedance presented at RF OUT pad |
| Switch Leakage Pout at Rx Port EGSM900,ANT-EGSM900_Rx | | 3 | | dBm | LB_Tx Mode, Freq=880 to 915MHz Pout=33dBm at ANT Port. |

## Table 7: Electrical Specification for DCS Tx

| PARAMETER | SPECIFICATION | | | UNIT | CONDITION |
|---|---|---|---|---|---|
| | MIN | TYP | MAX | | |
| **Overall** | | | | | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V,TX_HB_IN=3dBm, Freq=1710MHz to1785MHz, 25%Duty Cycle, Pulse Width=1154us |
| Operating Frequency Range | 1710 | | 1785 | MHz | |
| Maximum Output Power 1 | | 30.5 | | dBm | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V |
| Maximum Output Power 2 | 28.0 | | | dBm | Temp=+85℃,VBATT=3.0V, VRAMP =1.65V |
| Total Efficiency | | 33 | | % | At $P_{OUT\ MAX}$ |
| Input Power Range | 0 | +3 | +6 | dBm | |
| Output Noise Power | | -85 | -77 | dBm | RBW=100kHz, 925MHz to 935MHz, $P_{OUT}\leqslant$+30dBm |
| | | | -83 | dBm | RBW=100kHz, 935 MHz to 960MHz, $P_{OUT}\leqslant$+30dBm |
| | | | -79 | dBm | RBW=100kHz,1805 MHz to 1880MHz, $P_{OUT}\leqslant$+30dBm |
| Forward Isolation 1 | | -60 | -53 | dBm | TxEN =Low, TX_HB_IN=+5dBm |
| Forward Isolation 2 | | -45 | -15 | dBm | TxEN =High, TX_HB_IN=+5dBm, VRAMP =0.27V |
| Second Harmonic | | -40 | -33 | dBm | VRAMP =0.27V to 1.65V |
| Third Harmonic | | -40 | -35 | dBm | VRAMP =0.27V to 1.65V |
| All other Non-Harmonic Spurious | | | -36 | dBm | VRAMP =0.27V to 1.65V |
| Input Impedance | | 50 | | Ω | |
| Input VSWR | | | 2.5:1 | | |
| Output Load VSWR Stability (Spurious emission) | | | -36 | dBm | VSWR=12:1 |
| Output Load VSWR Ruggedness | No damage or permanent degradation | | | | VSWR=20:1 |
| Output Load impedance | | 50 | | Ω | Load impedance presented at RF OUT pad |
| Switch Leakage Pout at Rx Port DCS1800,ANT-DCS_Rx | | 5 | | dBm | HB_Tx Mode, Freq=1710 to 1785MHz Pout=30dBm at ANT Port. |

## Table8: Electrical Specification for PCS Tx

| PARAMETER | SPECIFICATION | | | UNIT | CONDITION |
|---|---|---|---|---|---|
| | MIN | TYP | MAX | | |
| **Overall** | | | | | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V,TX_HB_IN=3dBm, Freq=1850MHz to1910MHz, 25%Duty Cycle, Pulse Width=1154us |
| Operating Frequency Range | 1850 | | 1910 | MHz | |
| Maximum Output Power 1 | | 30.2 | | dBm | Temp=+25℃,VBATT=3.5V, VRAMP =1.65V |
| Maximum Output Power 2 | 28.0 | | | dBm | Temp=+85℃,VBATT=3.0V, VRAMP =1.65V |
| Total Efficiency | | 32 | | % | At $P_{OUT\ MAX}$ |
| Input Power Range | +1 | +3 | +6 | dBm | |
| Output Noise Power | | -85 | -80 | dBm | RBW=100kHz,869 MHz to 894MHz, $P_{OUT}\leqslant$+30dBm |
| | | | -74 | dBm | RBW=100kHz,1930 MHz to1990MHz, $P_{OUT}\leqslant$+30dBm |
| Forward Isolation 1 | | -60 | -53 | dBm | TxEN =Low, TX_HB_IN=+5dBm |
| Forward Isolation 2 | | -45 | -15 | dBm | TxEN =High, TX_HB_IN=+5dBm, VRAMP =0.27V |
| Second Harmonic | | -40 | -33 | dBm | VRAMP =0.27V to 1.65V |
| Third Harmonic | | -40 | -35 | dBm | VRAMP =0.27V to 1.65V |
| All other Non-Harmonic Spurious | | | -36 | dBm | VRAMP =0.27V to 1.65V |
| Input Impedance | | 50 | | Ω | |
| Input VSWR | | | 2.5:1 | | |
| Output Load VSWR Stability (Spurious emission) | | | -36 | dBm | VSWR=12:1 |
| Output Load VSWR Ruggedness | No damage or permanent degradation | | | | VSWR=20:1 |
| Output Load impedance | | 50 | | Ω | Load impedance presented at RF OUT pad |
| Switch Leakage Pout at Rx Port PCS1900,ANT-PCS_Rx | | 5 | | dBm | HB_Tx Mode, Freq=1850 to 1910MHz Pout=30dBm at ANT Port. |

**Table 9: Electrical Specification for TRx**

| PARAMETER | SPECIFICATION | | | UNIT | CONDITION |
|---|---|---|---|---|---|
| | MIN | TYP | MAX | | |
| **Overall** | | | | | Temp=+25℃,VBATT=3.5V,<br>VRAMP =1.65V,TX_HB_IN=3dBm,<br>TxEN =0,<br>TRx Freq=824MHz to 960MHz<br>TRx Freq=1710MHz to 2170MHz |
| Insertion Loss, ANT- TRx | | 1.0 | 1.2 | dB | TRx Freq=824MHz to 960MHz |
| Insertion Loss, ANT- TRx | | 1.1 | 1.3 | dB | TRx Freq=1710MHz to 2170MHz |
| Isolation from TRX | 20 | | | dB | All TRx ports |
| IMD2 $f$RX–$f$TX | | -103 | -100 | dBm | Tx Output Power = 20 dBm |
| IMD2 $f$RX+$f$TX | | -103 | -100 | dBm | Blocker Power = –15 dBm |
| IMD3 $f$RX–$f$TX | | -100 | -97 | dBm | Blocker freq. swept over all phase angles at TRx port |
| IMD3 $f$RX+$f$TX | | -100 | -97 | dBm | |
| Harmonic 2f | | | -39 | dBm | Tx Output Power = 26 dBm |
| Harmonic 3f | | | -39 | dBm | |
| VSWR @ ANT | | | 1.7:1 | 2:1 | |
| | | | | | |
| | | | | | |
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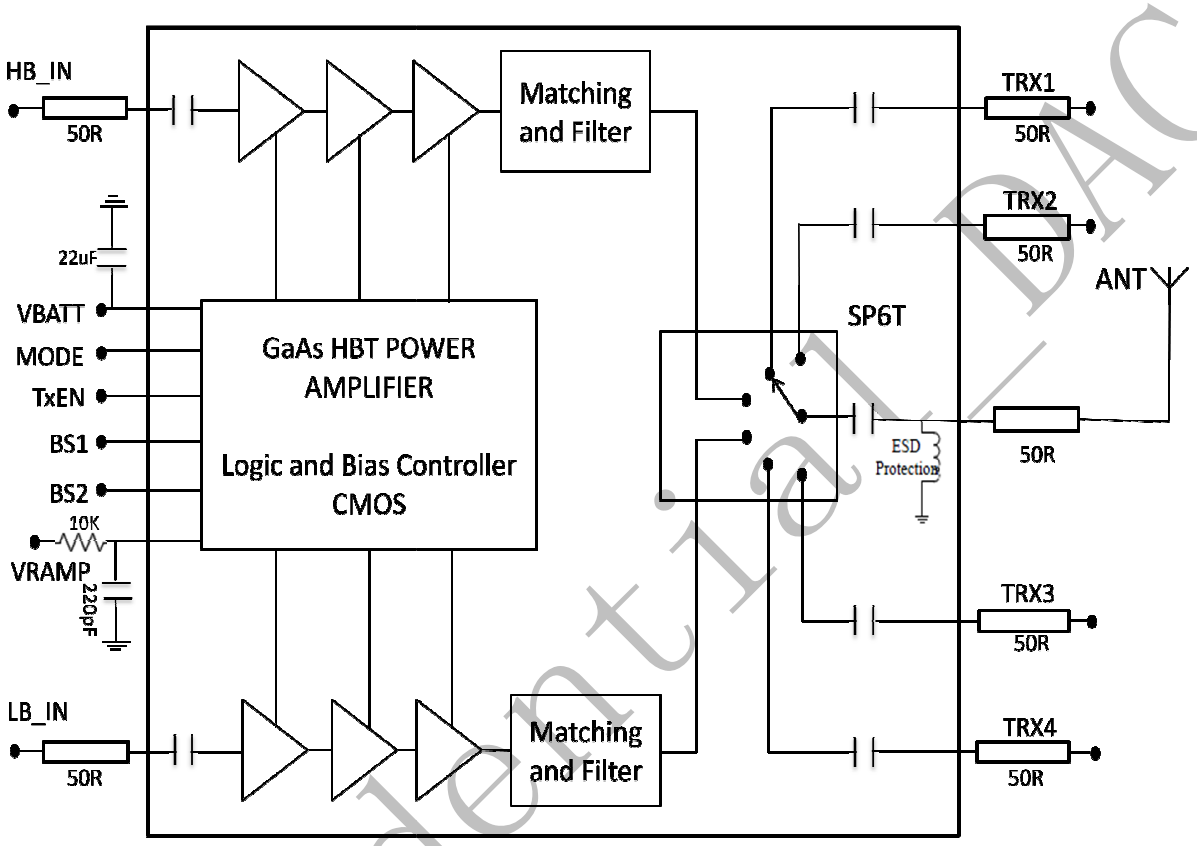
## Application Schematic






Please pay attention to the following notes before your new design.

1) A RC filter is preferred at VRAMP and the 22uF bypass capacitor at VBATT may be changed on applications.

2) RF ports are all 50Ω, including TX_HB_IN, TX_LB_IN, ALL TRx and Antenna port.

3) DC-blocking capacitors are included in all TRx ports, in TX_HB_IN&TX_LB_IN and Antenna ports.

The ESD protection is with the Antenna port.

## ORDERING INFORMATION

| ORDER NUMBER | TEMPERATURE RANGE | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|---|---|---|---|
| D7185 | -20℃ to +85℃ | 6mm×6mm×1mm LGA | Tape and Reel, 3000 per reel |

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