MSM6025™ CHIPSET SOLUTION

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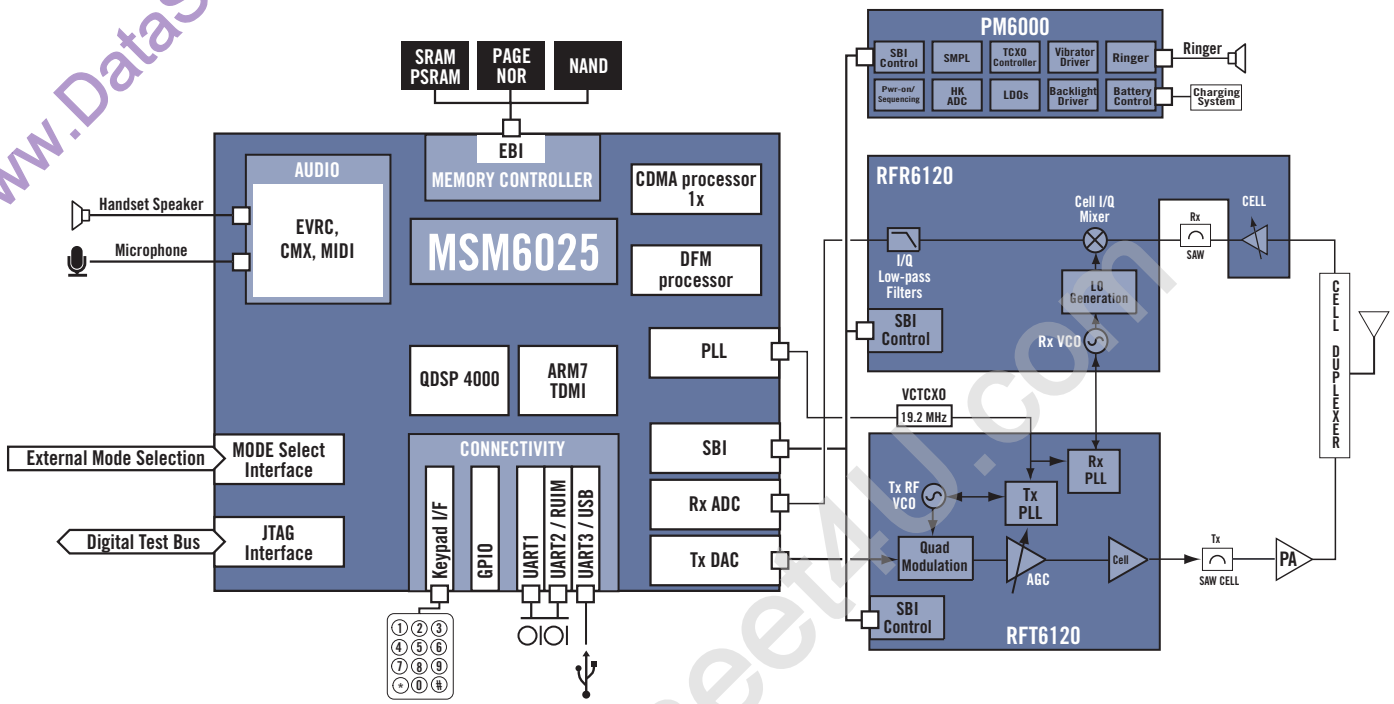

MSM6025 Chipset Architecture Using QCT's radioOne Zero Intermediate Frequency (ZIF) — Single-Band

MSM6025 Chipset Solution

QUALCOMM CDMA Technologies (QCT) developed the MSM6025™ Mobile Station Modem™ (MSM™) chipset to address the global demand for data-enabled, entry-level devices and to help drive CDMA2000® 1X adoption in emerging markets worldwide.

The MSM6025 solution supports entry-level data services, in addition to voice service, to create immediate opportunity for increased revenues from mainstream consumers. With increased processing power and flexible memory capabilities, the MSM6025 chipset and system software combines the most cost-effective external memories with the lowest system costs to result in a solution that enables cost reduction of entry-level, data-enabled devices for emerging markets worldwide.

To enable handset design reutilization and seamless network migration paths, the MSM6025 solution includes pin compatibility with QUALCOMM's GPS-enabled MSM6050™ chipset solution. This flexibility gives manufacturers a development platform that reuses existing design resources for different market segments — ensuring reduced development and bill-of-materials (BOM) costs, accelerated time to market, and improved handset standby and talk times.

Compliant with CDMA2000 1X Revision 0, MSM6025-based terminals provide operators up to twice the voice capacity over 2G IS-95A/B solutions, with data rates of up to 153 kbps.

MSM6025 Chipset Solution Benefits

- Provides pin compatibility with QUALCOMM's MSM6050 solution to provide re-use of existing MSM6050-based design platforms, accelerating time-to-market and reducing BOM costs
- Provides a CDMA2000 1X Revision 0 solution that enables 153 kbps data rate support on both the forward link (FL) and reverse link (RL) in entry-level devices from a proven platform
- Supports low-cost, high density external memories, lowering system costs
- Affords immediate opportunity for increased revenues from today's mainstream consumers with support for entry-level data services in addition to voice and SMS services
- Enables additional segmentation strategy by allowing manufacturers and operators to cost-effectively define their own products and service offerings based on market needs
- Enables cost-effective, multiband, multimode handsets in smaller form factors

MSM6025 Device Description

The MSM6025 CDMA2000 1X Revision 0 solution is optimized to support voice and key data capabilities while enabling CDMA2000 network benefits. This solution provides a seamless migration path from 2G to 3G services and applications with the increased voice capacity of a CDMA2000 network. The MSM6025 chipset enables manufacturers to quickly develop handset solutions that meet specifications for worldwide cdmaOne™ (IS-95 A/B) and CDMA2000 1X systems.

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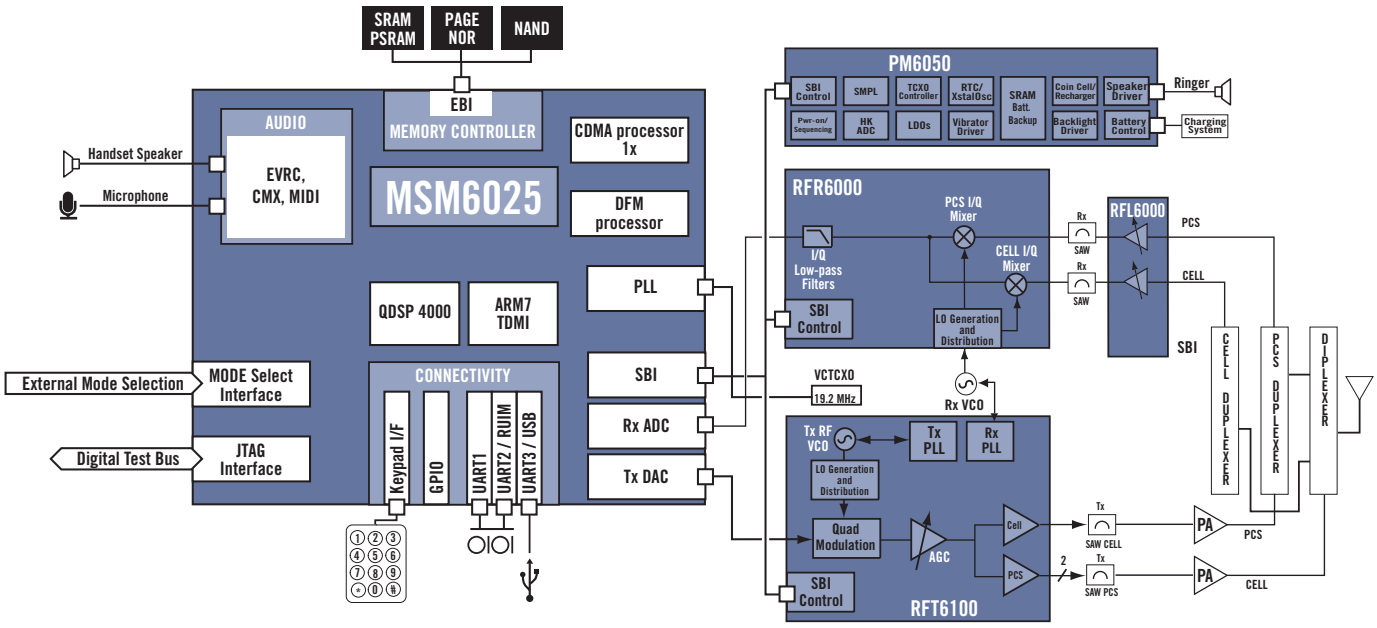

MSM6025 Chipset Architecture Using QCT's radioOne Zero Intermediate Frequency (ZIF) — Tri-Band

The MSM6025 solution consists of the MSM6025 baseband processor and radio frequency (RF) systems solutions to support multiple configurations, including tri-mode (cellular CDMA, PCS CDMA, cellular FM), single mode, cellular frequency band only (cellular CDMA) and 450 MHz single band for CDMA2000 1X. The MSM6025 solution interfaces with proven QUALCOMM RF solutions to support these configurations:

- The direct conversion RFL6000™, RFR6000™, RFR6120™ and RFR6175™ receive devices
- The direct conversion RFT6100™, RFT6120™ and RFT6170™ transmit devices

The baseband and RF chipsets are supported by QUALCOMM's PM6000™ and PM6050™ power management devices and a compatible power amplifier.

The MSM6025 device is supported by a complete software suite, Dual-Mode Subscriber Software™ (DMSS™), for building handsets around the MSM6025 chipset. DMSS software is designed to run on a Subscriber Unit Reference (SURF™) phone platform, an optional development platform optimized to assist in evaluating, testing and debugging DMSS software.

MSM6025 Device Features

- CDMA2000 1X Revision 0 support, offering data rates of up to 153 kbps on both FL and RL
- Multiple modes supported including tri-mode and single-mode cellular
- 450 MHz frequency band support for CDMA2000 1X
- Vocoder support (EVRC)
- PureVoice® advanced voice recognition (VR) software
- Compact Media Extensions™ (CMX™) multimedia software
- Standard MIDI ringer
- Universal serial bus (USB)
- Removable universal identity module (R-UIM) card interface
- JPEG encoder/encoder
- AFLT position location
- Integrated wideband mono voice CODEC
- Enhanced memory support
  - 1.8 V compatible
  - Page mode NOR Flash
  - NAND flash memory interface
  - Pseudo SRAM
- 208-pin FBGA package

radioOne Technology

As with all members of the MSM6xxx™ family of chipset solutions, the MSM6025 solution features QUALCOMM's radioOne® Zero Intermediate Frequency (ZIF) architecture, which eliminates the need for Intermediate Frequency (IF) components. With radioOne technology, the MSM6025 chipset requires less printed-circuit-board area than previous generations and reduces time-to-market development and BOM costs.

RFL6000 Device Description

Integrated into the RFL6000 device are two low noise amplifiers (LNAs): a cellular LNA and PCS LNA. Operating modes — Sleep, Rx and Rx/Tx — as well as LNA bias currents, are all automatically adjusted via software to minimize DC power consumption. Depending on handset status, the LNA bias current adjusts automatically to meet RF performance requirements with minimal power consumption.

The device is fabricated using a SiGe BiCMOS process, which is suited for high performance RF circuits. The RFL6000 device is packaged in a very small 16-pin bump chip carrier (16-pin BCC++).

RFL6000 Device Features

- radioOne chipset eliminates receiver and transmitter IF, reducing component count, space and cost
- Two integrated LNAs with programmable gain steps
  - Cellular LNA supports CDMA and AMPS
  - Operates in cellular bands in China, Japan, Korea, Latin America and the United States
  - Individual gain setting for CDMA and AMPS modes
  - PCS LNA supports PCS CDMA operation
  - PCS bands of operation in China, Korea, Latin America and the United States
- Programmable mode control to reduce DC power consumption
- High-reverse isolation
- Efficient three-line QCT serial bus interface (SBI)
- Low power consumption
- Fabricated in SiGe BiCMOS process
- Small package: 16-pin BCC++ (4 mm x 4 mm)

RFR6000 Device Description

The RFR6000 device is the radioOne Zero IF (ZIF) down converter. The device has three mixers which, when combined with the RFL6000 device, provide full RF-to-baseband down conversion for the cellular, PCS and GPS bands. The local oscillator (LO) generation block produces all LO signals so that only one external single-band voltage control oscillator (VCO) is required for all CDMA frequency bands of operation.

Included on chip is the GPS LNA as well as the entire GPS VCO including resonant components. The Rx PLL, which resides on the transmit companion IC, the transmit device, is switched between the GPS VCO and the external Rx VCO.

Extension of standby time is achieved by selective circuit power-down, gain control and bias current. These features along with all of radioOne chipset functionalities are controlled by QUALCOMM's MSM device.

The device is designed to operate with 2.7 to 3.0 V power supplies and is compatible with single-cell Li-Ion batteries. Compatibility to the digital reference voltage (1.8 to 3.0 V) is assured when the VDDM is connected to the MSM pad voltage.

The RFR6000 device is fabricated using a SiGe BiCMOS process, which provides high-frequency, high-precision analog circuits as well as low-power CMOS functions. Package type is a 40-pin BCC++, which includes a large ground slug for improved grounding, mechanical strength and thermal conductivity.

RFR6000 Device Features

- Compatibility with QUALCOMM's radioOne ZIF chipset that eliminates the entire IF, reducing component count and space
- Single- or multiband operation: cellular, PCS and GPS
- Single- or multimode operation: cellular CDMA, PCS CDMA, cellular FM and GPS
- Full downconversion — RF to baseband
- Receive path circuitry
  - GPS LNA
  - Stepped gain control
  - Three sets of quadrature downconverters
  - Band-specific low-pass filter
  - Baseband amplifiers with DC offset adjustment
- Only one single-band external VCO (Rx VCO) is needed for all CDMA bands of operation for entire radioOne chipset.
- Includes entire on-chip GPS VCO-including resonant circuit
- Individual circuit power on/off controls
- Power reduction feature control extends handset standby time
  - Selective circuit power-down
  - Gain and bias controls
- Low-power supply voltage (2.7 to 3.0 V), low-power dissipation
  - Digital reference voltage is compatible with lower MSM voltage (1.8 to 3.0 Vdd)
- Available in small, thermally efficient package (40-pin BCC++)

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RFR6120 Device Description

The RFR6120 chip, optimized specifically for single-band cellular receive operation, includes an integrated CDMA LNA/mixer and UHF VCO. The integrated UHF VCO covers both cellular and J-CDMA bands and is controlled by the receive (Rx) PLL integrated in the RFT6120 chip. The RFR6120 chip is offered in a 6 mm x 6 mm 40-pin Quad Flat No-Lead (QFN40) package.

RFR6120 Device Features

- Compatibility with all CDMA2000 1X members of the QUALCOMM MSM6xxx family of MSM chipsets
- Full direct downconversion — RF to baseband
- Supports full-international cellular band operation such as for Japan, China, India, Latin America, Korea and the United States
  - Supports CDMA and AMPS modes
- Supports full international CDMA2000 1X cellular band
- Receive path circuitry includes:
  - High dynamic range baseband filter
  - Cellular LNA and mixer
  - On-chip UHF VCO
- Integrated LNA with programmable gain steps
  - Two LNA AMPS gain settings
  - High-reverse isolation
- Individual circuit power on/off controls
- Power reduction feature control extends handset standby time
  - Selective circuit power-down
  - Gain and bias controls
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Compatible with lower MSM voltage (1.8 to 3.0 Vdd)
- Available in small, thermally efficient package (QFN40)

RFR6175 Device Description

The RFR6175, tailored for the 450 MHz frequency band, includes an LNA, UHF VCOs and Phase Lock Loops (PLLs). The RFR6175 is offered in a 6mm x 6mm, 40-pin, Quad Flat No-Lead (QFN40) package

RFR6175 Device Features

- Support for the CDMA 450 MHz band
- Receive path circuitry includes:
  - High dynamic range baseband filter
  - Cellular 450 MHz LNA and mixer
  - On-chip UHF VCO
- Integrated LNA with programmable gain steps
  - LNA gain setting
  - High-reverse isolation
- Individual circuit power on/off controls
- Power reduction feature control extends handset standby time
  - Selective circuit power-down
  - Gain and bias controls
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Compatible with lower MSM voltage (1.8 to 3.0 Vdd)
- Available in small, thermally efficient package (QFN40)

RFT6100 Device Description

The RFT6100 device is a direct conversion chipset that integrates all the upconversion and modulation functionality necessary for AMPS- and CDMA-mode phones operating in cellular and PCS bands. This transmit chip consists of two I/Q modulators, one for cellular and one for the PCS band. The baseband I/Q input from the MSM directly modulates the cellular or PCS carrier derived from the respective LO generation circuit.

Both the cellular and PCS output drive their own variable gain amplifier (VGA) with a gain control range of 85 dB. A final cellular driver amplifier provides a modulated RF output.

To accommodate split-band and filtering, the PCS VGA drives two output amplifiers that can be selected independently or simultaneously via an input selectable switch. All RF outputs have fully integrated 50-ohm matching networks. Integrated on the RFT6100 is the receiver PLL, the transmit PLL and the entire transmit VCO including resonant components. The VCO drives the LO generation block, which in turn generates the required local oscillator signal for all CDMA bands of operation.

RFT6100 Device Features

- Reduction in component count, space and cost via radioOne chipset eliminates receiver and transmitter IF
- Single- or dual-band operation: cellular and PCS
- Single- or multimode operation:
  - Cellular CDMA and AMPS
  - PCS CDMA
- Full direct upconversion from analog baseband to RF
- Transmit signal path:
  - Baseband amplifier
  - Two sets of quadrature modulators/upconverters
  - RF AGC amplifier, switch network, driver amplifier
- Integration of LO generation circuit
- Requirement of only one external VCO for all CDMA bands of operation
- Entire transmit synthesizer on chip (transmitter PLL and VCO)
- Receiver PLL on chip

- Greater than 85 dB transmit power control range
- Power-reduction feature via MSM control extends handset talk time
  - Optimized for low DC power consumption versus RF output level
  - Transmit puncturing
  - Selective circuit power-down
- Efficient three-line QCT SBI
- Power supply voltage (2.7 to 3.0 V)
- Small thermally efficient package (40-pin BCC++)

RFT6120 Device Description

The RFT6120 chip, tailored specifically for single-band cellular transmit operation, consumes lower current than its quad-mode predecessor, the RFT6100 device, and is offered in a 5 mm x 5 mm 32-pin Quad Flat No-Lead (QFN32) package.

RFT6120 Device Features

- Compatibility with all CDMA2000 1X members of the QUALCOMM MSM6xxx family of Mobile Station Modem (MSM) chips
- Full direct upconversion — baseband to RF
- Supports full-international cellular band operation such as for Japan, China, India, Latin America and the United States
- Supports full international CDMA2000 1X cellular band*
- Transmit path circuitry includes:
  - Baseband amplifier
  - One set of quadrature modulators/upconverters
  - RF AGC amplifier
  - Driver amplifer with on chip RF matching
- Integration of LO generation circuit
- Entire transmit synthesizer on chip (transmitter PLL and VCO)
- On chip receiver PLL to control UHF VCO
- Greater than 85 dB transmit power control range
- Power reduction feature via MSM control extends handset talk time
  - Optimized for low DC power consumption versus RF output level
  - Transmit puncturing
  - Selective circuit power-down
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Available in small, thermally efficient package (QFN32)

RFT6170 Device Description

The RFT6170, tailored for the 450 MHz frequency band, includes integrated UHF VCOs and Phase Lock Loops (PLLs).

The RFT6170 is offered in a 5mm x 5mm, 32-pin, Quad Flat No Lead (QFN32) package.

RFT6170 Device Features

- Support for the 450 MHz band
- Transmit path circuitry includes:
  - Baseband amplifier
  - One set of quadrature modulators/upconverters
  - RF AGC amplifier
  - Driver amplifier with on chip RF matching
- Integration of LO generation circuit
- Entire transmit synthesizer on chip (transmitter PLL and VCO)
- On-chip receiver PLL to control UHF VCO
- Power reduction feature via MSM control extends handset talk time
  - Optimized for low DC power consumption versus RF output level
  - Selective circuit power-down
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Available in small, thermally efficient package (QFN32)

MSM6025™ CHIPSET SOLUTION

PM6000 Device Description

The MSM6025 device interfaces directly with QCT's power management chip, the PM6000 device, which provides battery management and charging functions, general housekeeping and various functions supporting user interfaces. The PM6000 is optimized for handset system control with the MSM6025 system software and includes generation of all the regulated voltages for the MSM and radioOne chipset. The PM6000 chip contains all of the primary power management functions, making it ideal for basic terminals.

PM6000 Features

- Complete power management, housekeeping and user interface functions for CDMA terminals
- Fully compatible with QUALCOMM's radioOne ZIF chipset
- Valid external supply attachment and removal detection
- Supports unregulated and regulated charging systems
- Supports lithium-ion and nickel-based main batteries
- Trickle, constant current, constant voltage and pulsed charging of the main battery
- Current monitoring for over-current protection
- Voltage and current control loops to support unregulated external supplies
- Automated recovery from sudden momentary power loss (SMPL)
- Seven low-dropout regulator circuits with programmable output voltages
- Six of seven regulators can be individually enabled/disabled for power savings
- 10-bit ADC for precise voltage and current measurements
- 10:1 analog multiplexer selects the ADC input signal (five wired internally, five accessible)
- Dual oscillators — 32.768 kHz off-chip crystal and on chip RC assures MSM sleep clock
- TCXO circuits control TCXO warm-up and synchronize and buffer the TCXO signal
- Two programmable current sinks for driving backlights and LEDs
- Driver circuit compatible with 1.3 or 3.0 V vibrator motors
- Ringer/buzzer driver
- MSM-compatible three-line SBI for efficient initialization, status and control
- Ten functions monitored and reported through real-time and interrupt status signals
- Dedicated circuits for controlled power-on sequencing, including the MSM's reset signal
- Supports and orchestrates soft resets

PM6050 Device Description

The MSM6025 device also interfaces directly with another of QCT's power management chips, the PM6050 device, which provides battery management and charging functions, general housekeeping and various functions supporting user interfaces. This device is optimized for handset system control with the MSM6025 system software and generates all the regulated voltages for the MSM and radioOne chipsets.

The PM6050 integrates power management functions for CDMA terminals, affording further savings in size and BOM for the handset design. The PM6050 chip supports many additional handset features, such as real-time clock and speakerphone applications, making it the ideal power management solution for feature-rich terminals.

PM6050 Key Features

- Complete power management, housekeeping and user interface functions for CDMA terminals
- Fully compatible with QUALCOMM's radioOne ZIF chipset
- Valid external supply attachment and removal detection
- Supports unregulated and regulated charging systems
- Supports lithium-ion and nickel-based main batteries
- Trickle, constant current, constant voltage and pulsed charging of the main battery
- Supports coin cell back-up battery (including charging)
- Current monitoring for over-current protection
- Voltage and current control loops to support unregulated external supplies
- Automated recovery from SMPL
- Eight low dropout regulator circuits with programmable output voltages
- Seven of eight regulators can be individually enabled/disabled for power savings
- 10-bit ADC for precise voltage and current measurements
- 10:1 analog multiplexer selects the ADC input signal (five wired internally, five accessible)
- Dual oscillators — 32.768 kHz off chip crystal and on chip RC assures MSM sleep clock
- Real-time clock for tracking time, calendar functions and programmed durations and generating associated alarms
- On chip adjustments minimize crystal oscillator frequency errors
- TCXO circuits control TCXO warm-up and synchronize and buffer the TCXO signal
- Four programmable current sinks for driving backlights and LEDs
- Driver circuit compatible with 1.3 or 3.0 V vibrator motors
- Ringer/buzzer driver
- Speaker driver with programmable gain, turn-on time and muting; single-ended or differential operation (drives external 8-ohm speakers with volume controlled 500 mW)
- MSM-compatible three-line SBI for efficient initialization, status and control
- 13 functions monitored and reported through real-time and interrupt status signals
- Dedicated circuits for controlled power-on sequencing, including the MSM's reset signal
- Supports and orchestrates soft resets

The Launchpad Suite of Technologies

The Launchpad™ suite of applications technologies offers wireless operators and manufacturers a cost-effective, scalable and timely solution for providing advanced wireless data services. This seamlessly integrated solution enables advanced next-generation applications and services that incorporate multimedia, position location, connectivity, customized user interface and storage capabilities. Launchpad features are available for each QUALCOMM chipset, closely matching the specific functionality and cost-target objectives agreed upon in joint product planning with manufacturers and wireless service operators worldwide.

The MSM6025 solution supports a select feature set of QUALCOMM's Launchpad suite of technologies, including advanced CMX audio and graphic animation features and still-image JPEG encoding and decoding.

QUALCOMM's BREW Solution

The MSM6025 includes support for QUALCOMM's BREW® solution. BREW is a complete product and business system for the development and over-the-air deployment of data services on wireless devices. The BREW system provides the necessary tools and value-added services to developers, device manufacturers and wireless operators for application development and distribution, device configuration and billing and payment.

QUALCOMM's Complete Solution — Our Commitment to Our Partners

QUALCOMM CDMA Technologies is enabling the future of communications. We work closely with our manufacturer and operator partners to develop solutions that meet market needs today and provide the technology foundation for the wireless communications of tomorrow. Our world-class CDMA engineers create detailed reference designs to accelerate testing and deployment for our partners. And our chipsets and system software are fully integrated and able to bring advanced features and functionality to today's wireless devices. With QUALCOMM CDMA Technologies, manufacturers and operators can offer sophisticated wireless solutions that succeed in the global marketplace.

*For CDMA with AMPS requirements, the RFT6100 is recommended.

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