

## Apple 3G iPhone

### Quad-band GSM/Tri-band W-CDMA with EDGE/HSDPA Report # 11000-080711-BCg

Weight: 134.8 grams measured  
(1.8 grams more than spec)



#### Product Description:

Accompanied by media frenzy, the July 2008 release of the Apple 3G iPhone proved to be an event of worldwide significance. Retaining the sleek glass-faced bar form and touchscreen interface of its predecessor, the new iPhone builds on an established platform by doubling available memory and adding functionality. Of particular interest is the addition of W-CDMA/HSDPA capability and Assisted GPS, improvements that propel the 3G iPhone into the "World Phone" arena. Both the 8GB and 16GB models were examined for this report. With the exception of memory capacity, the two are essentially identical. The now-familiar feature set, including orientation-sensitive display, 2.0MP camera, 802.11b/g WiFi, Bluetooth, music and video player, and games, is again integrated into a highly intuitive user environment.

#### Report Contents:

- Detailed external & internal photos
- Detailed step-by-step disassembly
- Power measurements
- Block Diagram
- Circuit board & packaging metrics
- Complete parts list & component count
- Manufacturing cost analysis
- Description of most interesting electronic features & packaging concepts

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The July 11<sup>th</sup>, 2008 release of Apple's 3G iPhone was greeted worldwide by lines of motivated customers and the predictable news coverage. By the end of that day, a detailed report of the 8GB 3G iPhone's structure and supply chain was published (see Portelligent "Apple 3G iPhone: Quick Turn Teardown 071108") and the similarities and differences between the new and previous-generation models became clear. The three major differentiators are the addition of W-CDMA/HSDPA cellular protocols, standalone GPS, and up to twice the NAND Flash memory of the original design. The flat back metal/plastic shell of the 2G design has also been replaced with a plastic-only rear casing which is more contoured, perhaps to improve RF performance for the device's more complex array of radio functions. Another welcome change is the elimination of the docking cradle, along with a new, highly compact AC adapter. Major similarities remain, including the touchscreen user interface, sleek form factor, orientation-sensitive display, and highly intuitive operating system. For this report, three units were examined: two 8GB units and one 16GB, confirming the use of multiple vendors for the Main PCB, Battery, and Display Module.

Outside the communications platform, semiconductor content of the 3G iPhone is fairly similar to that of its predecessor, with a central Samsung ARM Processor (Samsung #S5L8900B02) supported by a Package-on-Package (PoP) Samsung 128MB Mobile DDR SDRAM Memory (#K4X1G163PC). For the units we analyzed, the 8GB model used Toshiba NAND Flash Memory (#TH58NVG6D1D, 8GB), while the 16GB model contained a two-TSSOP stacked-package Samsung MLC NAND Flash (#K9MDG08U5M, 16GB total). With the addition of W-CDMA functionality, the RF section becomes heavily reliant on Infineon. The Digital Baseband Processor is a two-chip affair (assumed to be the #PMB8878) which combines a legacy #PMB8877 2G processor and a new device for WCDMA functionality. Similarly, the Infineon RF transceiver - assumed to be the #PMB6952 - combines a 2G and 3G radio chip (#PMB6272/#PMB5701 - both seen previously in Portelligent teardowns) into a single package. Other Infineon silicon in the cellular radio includes the Tri-band HSDPA LNA (#BGA736L16), and Power Management Unit (#PMB6820). TriQuint makes their iPhone debut with a trio of W-CDMA power amplifiers (#TQM676031, #TQM666032, and #TQM616035), while Skyworks returns with the Quad-band GSM Power Amplifier (#SKY77340). Infineon is also behind the iPhone's newly added GPS capability, supplying both the A-GPS Baseband Processor (#PMB2525) and the GPS LNA (#BGA615L7). Also of note are upgraded repeat-vendor components in familiar iPhone sockets, such as the Wolfson Audio CODEC (strongly suspected as the #WM8991 based on die mark and unique package) and the 3-axis Accelerometer from STMicroelectronics (#LIS331DL). The touchscreen capability is again enabled by Broadcom, using the #BCM5974 which first appeared in the iPod Touch and a line driver from TI (#CD3239), shrunk in size compared to the similar device found in the 2G iPhone and iPod Touch. National Semiconductor's serial Mobile Panel link part remains as the LCD interface. Aptina's 2MP CMOS imager and an identical NXP Power Management Unit (#PCF50633?) remain. An upgraded BlueCore6 Bluetooth chip and the same Marvell #88W8686 single-chip WiFi solution are co-located on a dense module manufactured by Murata, one of the few components found on the back of the Main PCB.

With substantial build quality and use of several new-on-the-market components, estimated hardware cost-of-goods-sold (COGS) for the 16GB 3G iPhone is \$182.89 with \$4.55 in supporting materials for the 16GB unit bringing total COGS to \$187.43. Assuming \$15 for 8GB of MLC NAND, a total COGS for the 8GB sister-product of \$172.43 is implied with supporting materials. Note that all cost estimates are sensitive to our assumption for NAND flash and to a similar extent, our estimate for the Touchscreen Glass assembly (\$13.50). This touchscreen is now separate from the LCD panel, an approach first used in the iPod Touch.

With a \$199 (8GB) or \$299.00 (16GB) price from AT&T (exclusive U.S. agent at the time of this writing), cost-of-goods-sold represents about 87% to 63% of the retail price, with higher profits stemming from the 16GB variant. It is widely speculated that the margin here - and then some - belongs to Apple, with AT&T benefiting from the sale of service plans (with an increased data plan fee) but subsidizing the iPhone cost to the consumer. Assuming brisk first-day and early follow-on sales continue without interruption, Apple seems to have (another) potential winner on its hands. Of course one does not have to wait for the expected competitors to launch a response - they have already begun to arrive.

