ESTONE TECHNOLOGY MDK-100

EXPERIENCED US-BASED OEM/ODM MAKES AVAILABLE TECHNOLOGICALLY UP-TO-DATE VERSATILE, CUSTOMIZABLE HARD HANDLE TABLETS FOR VARIOUS MARKETS

by Conrad H. Blickenstorfer; photography by Carol Cotton

In this review we're taking a detailed look at Estone Technology's MDK-100 rugged hard handle Windows tablet. The review is a little different because the MDK-100, and in fact all of Estone's computing products are OEM designs, and not branded products that will directly go to end user customers. In other words, in addition to making available products like the rugged MDK-100 tablet that's the subject of this review, Estone Technology can design and manufacture products per customer specifications.

Longtime readers of RuggedPCReview.com may remember the Norco PPC-3308/Habey R8, one of the earliest rugged tablets available with Android. Chinese Norco Intelligent Technology goes back to 1991 as a designer and manufacturer of embedded and industrial boards and PCs. In 2008 they set up their Habey USA subsidiary, and then spun off Estone Technology in Toledo, Ohio, as a provider of OEM/ODM solutions focussing on tablet and Panel PC products. Today, Estone offers about a dozen different tablet platforms of various sizes, some targeted at medical markets, others as general purpose rugged tablets for various industrial and vertical markets.

The role of OEMs/ODMs

In the past, most products were made where a company was located. They might get a few parts here and there, but almost everthing was designed, manufactured and assembled in one place. A prime example of that approach was Henry Ford's Rouge factory in Detroit. Iron ore and other raw materials went into the complex on one side, cars came out on the other.

Today, making everything in one place is no longer feasible. Parts are procured and assembled depending on cost and logistics. This gave rise to OEMs (Original Equipment Manufacturers) and ODMs (Original Design Manufactures). OEMs make a product per design and specifications of the customer. ODMs design and manufacture a product, and then sell it to companies who put their own name and brand on it.

How important are OEMs and ODMs today? Very. Most consumer electronics products are not made by the companies that sell them. An example of a major OEM is Hon Hai Precision Industry, better known as Foxconn. Hoi Han had 2017 revenues of US$158 billion. That's more than General Motors, and far more than the revenues of IBM, Dell or Hewlett Packard.

Does all of this affect the rugged mobile computer market? It does. Many rugged handhelds, tablets, laptops and panels are made by OEMs and ODMs, and then sold under other names. The relationships between OEMs/ODMs and the final sellers can assume many different forms. An OEM may manufacture a product to very precise specifications for one customer only, and that customer has an absolute exclusive. An ODM may sell the exact product to many customers who then may only put their brand label on it and nothing more. In between are many shades of gray.

What does all of that have to do with Estone Technology and the MDK-100 hard handle tablet? Well, Estone is both an ODM and an OEM, and one that specializes in rugged computing products. Estone's customers are companies that provide rugged technology to their own end user customers. The rugged computing market is much smaller than the consumer technology market, and Estone is much smaller than Foxconn. But it's essentially the same thing.

Estone's customers are companies that built their own businesses on catering to their own special markets. They sell rugged computing equipment to their own customers, together with expertise, software, turnkey solutions, service, and consulting arrangements. Estone customers may be large, well established names in the rugged computing market. Such customers may have precise customization requirements, their own color schemes, and their own brand names. But Estone's customers might also be resellers, large end users, system integrators, and more.

Why go to Estone instead of one of the rapidly growing Chinese or Korean rugged computing hardware OEMs and ODMs? Because Estone is right here in the US, in Toledo, Ohio, and in Walnut, California.

The hard handle tablet platform

How did the unique form factor with the integrated hard handle came about. This goes back well over a decade when Intel researchers came up with a reference platform they called MCA, "Mobile Clinical Assistant." Intel described it as a light and handy electronic clipboard with an integrated handle for easy carrying around during a shift. Loaded with suitable software, such a unique tablet would allow healthcare workers easy access to patient records during their rounds and quickly document a patient's condition. This would result in fewer errors, a better workflow, and quicker and safer patient care. Some of the thoughts that went into the MCA design:

- **Easy cleaning**: Frequent disinfection prevents the spread of disease, so the case a) has to be sealed, b) has to be easy to clean and wipe without any holes and hard-to-reach places where grime might accumulate, and c) the case had to be made of chemical-resistant and perhaps anti-microbial resin.
- **Ruggedness**: Mobility, even with an integrated handle, means the tablet will get dropped at times, and this necessitated strong, rugged construction.
- **Data collection**: The Intel reference design called for an onboard camera for documentation, WiFi and Bluetooth for communication, an RFID read-

er, as well as an integrated 1D/2D barcode scanner for rapid data capture. While this is common now, it wasn't back in 2005, and the reference design helped popularizing all of those features.

- **Memory and storage**: The Intel reference design called for an onboard camera for documentation, WiFi and Bluetooth for communication, an RFID reader, as well as an integrated 1D/2D barcode scanner for rapid data capture. While this is common now, it wasn't back in 2005, and the reference design helped popularizing all of those features.2D integrated scanner located in the hard handle.

In addition, since MCAs weren't likely be used away from their docks for extended periods of time, battery life should be good, but not come at the expense of a large power pack that would make the device too thick and heavy. And the device would include both touch and digital ink to allow annotations.

Intel presented the reference design to hardware manufacturers, and Motion Computing was the first to introduce an MCA February 2007. Others soon followed with their own versions. It soon became obvious that the inherently rugged multi-function design was equally well suited for use in the field. The hard handle design remains popular today, with most major rugged hardware vendors offering a version.

Estone's OEM implementation of the hard handle tablet platform

Working with an OEM/ODM like Estone makes sense. An OEM/ODM offers a cost advantage. OEM/ODM designs are easily customizable to meet the needs of customers, including personalizing a product with labels, colors, and materials. OEM/ODMs are also more likely to offer variable I/O and support different technologies, standards, and performance envelopes.

How did Estone go about creating its own version of this smart and functional concept? Our review unit was the rugged market version of the tablet with the popular dark-gray/black color scheme.

A challenge tablet designers run into a lot is how to make a tablet that doesn't look like every other tablet. That's less of a problem with the Intel MCA reference design because the basic design is large enough to allow some leeway in making an implementation unique. Estone came up with a clean, elegant design that adds function buttons along the right side of the display, offers ample wired connectivity options, and includes perimeter and corner protection.

The 11 x 10 x 0.87 inch package makes the MDK-100 larger than your typical 10-inch tablet. But this isn't your standard tablet. It is a tool for the job that offers far more functionality. Our fully equipped tester came in at 3.4 pounds, still manageable for what is a remarkably solid and rugged device.

Another indication that Estone created a multi-purpose implementation of the original MCA that's equally at home in the field as it is indoors is the careful sealing and protection of all external I/O ports.

Due to size and weight considerations, tablets don't generally have a lot of wired onboard I/O, for a multi-purpose tablet platform, but it's good to cover the basics. Estone did that with equipping the MDK-100 with a USB 3.0 port, HDMI, a standard 3.5mm audio-in/out jack, and an RJ45 LAN jack. And since security is ever more important, the device has both a fingerprint scanner as well as a CAC Card reader.

Scaleable performance options

OEM customers have widely differing priorities, ranging from lowest cost to highest possible performance. To address that, Estone offers the platform as a low end (MD-100) and a high end (MDK-100) version.

MDK-100 models are available with three different Intel 7th gen "Kaby Lake" Core processors. These are dual core/quad thread designs tuned for low power consumption but also provide high performance in "turbo" mode. MD-100 models offer the choice of two Intel Atom based "Apollo Lake" chips. These are considerably simpler designs, albeit plenty powerful enough for many tasks. The table shows specifics of the five available processors.

Which processor makes the most sense? That depends on customer priority. As far as performance goes, our review unit came with the Core i5-7Y54. The table shows our estimate at relative CPU-only performance of the five processor options, based on the RuggedPCReview benchmark database. Performance always comes at a price. Intel charges almost four times as much for the Core i7-7Y75 as for the Celeron N3350, and such component prices affect the price of MD-100/MDK-100 configurations.

Estone MD-100/MDK-100: Processor Options

PROCESSOR OPTIONS	Core i7	Core i5	Core m3	Pentium	Celeron
Model	7Y75	7Y54	7Y30	N4200	N3350
Gen	7th gen Core (Kaby Lake Y)	7th gen Core (Kaby Lake Y)	7th gen Core (Kaby Lake M)	Apollo Lake	Apollo Lake
Cores/Threads	2/4	2/4	2/4	4/4	2/4
Base Clock Speed	1.30 GHz	1.20 GHz	1.00 GHz	1.10 GHz	1.10 GHz
Turbo/Burst Speed	3.60 GHz	3.20 GHz	2.60 GHz	2.50 GHz	2.40 GHz
Cache	4MB SmartCache	4MB SmartCache	4MB SmartCache	2MB L2 Cache	2MB L2 Cache
Thermal Design Power (TDP)	4.5 watts	4.5 watts	4.5 watts	6.0 watts	6.0 watts
Graphics	HD Graphics 615	HD Graphics 615	HD Graphics 615	HD Graphics 505	HD Graphics 500
Graphics base speed	300 MHz	300 MHz	300 MHz	200 MHz	200 MHz
Graphics max speed	1.05 GHz	0.95 GHz	0.90 GHz	0.75 GHz	0.65 GHz
Estimated CPU performance	2.7 X	2.4 X	2.0 X	1.5 X	1.0 X
Intel vPro	Yes	No	No	No	No
Intel TSX-NI	Yes	No	No	No	No
Intel SIPP	Yes	No	No	No	No
Intel Trusted Execution	Yes	No	No	No	No

Estone's design and construction

OEM products must be designed to be flexible from the ground upand allow as many configurations as possible. They must also be as easy and simple to maintain, upgrade, and repair. How does the Estone MDK-100 score in all those areas, including clinical issues?

Small rubber plugs sit flush in the screw holes to keep grime out and make cleaning/disinfecting easy. Undo small Philips screws to separate the two halves of the tablet's housing. The speaker wire between the halves disconnects easily. A single, long, replaceable square-profile rubber pressure O-ring seal sits in a groove. We prefer seals to be of contrasting color.

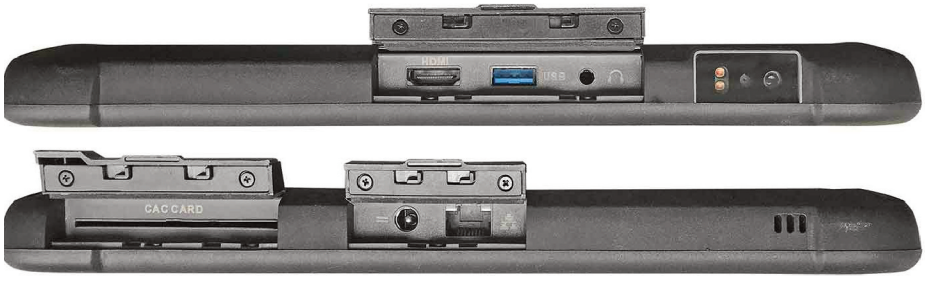
The MDK-100 has polycarbonate front and backs. The polycarbonate front bezel has a thick magnesium chassis screwed onto it. All electronics are mounted onto this chassis on one side and the display on the outside. The back of the MDK-100 is gray polymer, coffered for strength, with black polymer fused onto it along the perimeter. That adds visual distinction and extra protection. The black protective areas have a slightly rubberized feel. While the protective cladding is fused on, the tablet's hinged I/O doors are screwed on and replaceable. Each of the doors has a soft foam rubber seal and a locking slider.

The 11.1V, 3,700mAH rechargeable Li-Polymer battery fits flush into the back of the tablet. Its 41 watt-hours is more than the Getac RX10 (32 whr) and the Zebra/Xplore L10 (36 whr). An internal 3.25 watt-hour backup battery allows for hot-swapping of the battery.

The inside of the MDK-100 is uncrowded. The motherboard is covered by aluminum shielding that also acts as a heat sink and heat spreader for the electronics. I/O is split between motherboard and daughterboard. Separating I/O makes it easier to offer custom configurations for special needs and applications.

A Newland EM3296 CMOS-based 1D/2D imager is integrated into the side of the tablet at the height of the hard handle for ergonomic reasons. It supports batch, trigger, sense, and continuous modes.

WiFi and and optional mobile broadband modules sit on the motherboard. Their antennae are placed along the perimeter of the tablet for best wireless per-



formance. The daughterboard and all modules and connectors (camera, scanner, pogo pin docking, etc.) are via precision-cut, plasticized ribbon cables. Each is marked "MD100" — along with its purpose. While components and connectors are miniaturized, they are easily accessible and large enough for easy maintenance. In an era of almost impossible to repair electronics, Estone certainly got it right.

Contemporary display

The Estone hard handle tablets all have a 10.1-inch capacitive multi-touch IPS display with 1920 x 1200 pixel resolution. That makes 224 pixels per inch — sharp enough for the intended applications. The basic display offers 400 nits luminance, an optional 1,000 nits version is available for outdoor/sunlight use, and Estone can provide screens with anti-glare, anti-reflection, and anti-smudge coatings. Since this is an IPS screen, there are perfect viewing angles and no color or contrast shifts when viewed from any angle.

The MDK-100 default display's 400 nits luminance is more than a laptop, and roughly the same as that of an iPad Air. That is plenty enough for indoor use in healthcare or general office settings. For outdoor use we'd recommend the optional sunlight-readable display our review came with. With that display, we measured 1245 nits luminance in our testing.

Estone's sunlight-readable display earned high marks. It doesn't wash out at maximum brightness. It offers very wide viewing angles from all directions. There aren't any contrast shifts or color aberrations when viewing the display from an angle. One caveat is that leaving the display in maximum brightness will drain the battery considerably more quickly.

Estone MDK-100 Power Draws (at idle)			
Backlight level	Lowest (0%)	50%	Maximum (100%)
Power Saver	5.4 watts (7.8 hrs)	6.3 watts (6.7 hrs)	11.0 watts (3.8 hrs)
Max Performance	5.4 watts (7.8 hrs.)	7.1 watts (5.9 hrs.)	14.7 watts (2.9 hrs.)

We used the BatteryMon utility to measure battery drawdown under different power mode and brightness settings. In "Power Saver" mode we saw 5.4, 6.3, and 11 watts for lowest, 50%, and full backlight. In "Max Performance" mode, those numbers rose to 5.4, 7.1 and 14.7 watts, respectively.

Optional active pen

For deployments where an active pen is needed, Estone offers the EETI eGalax Pen. It does need a battery, a tiny AAAA one. There's a garage for the pen on the backside of the MDK-100 handle, and there's a spiral tether for the pen that extends two to three feet. The pen comes on automatically when it senses the screen. Once the pen is sensed, there's also "palm rejection," i.e. the tablet knows you're using the pen and will ignore finger or palm touch.

The eGalax Pen has two buttons and the tip is pressure sensitive. While basic pen functionality is supported by every application, button and pressure sensitivity support depends on the application. As is the case with all active pens, this one has a learning curve.

Desktop and Wall/Vehicle Docks

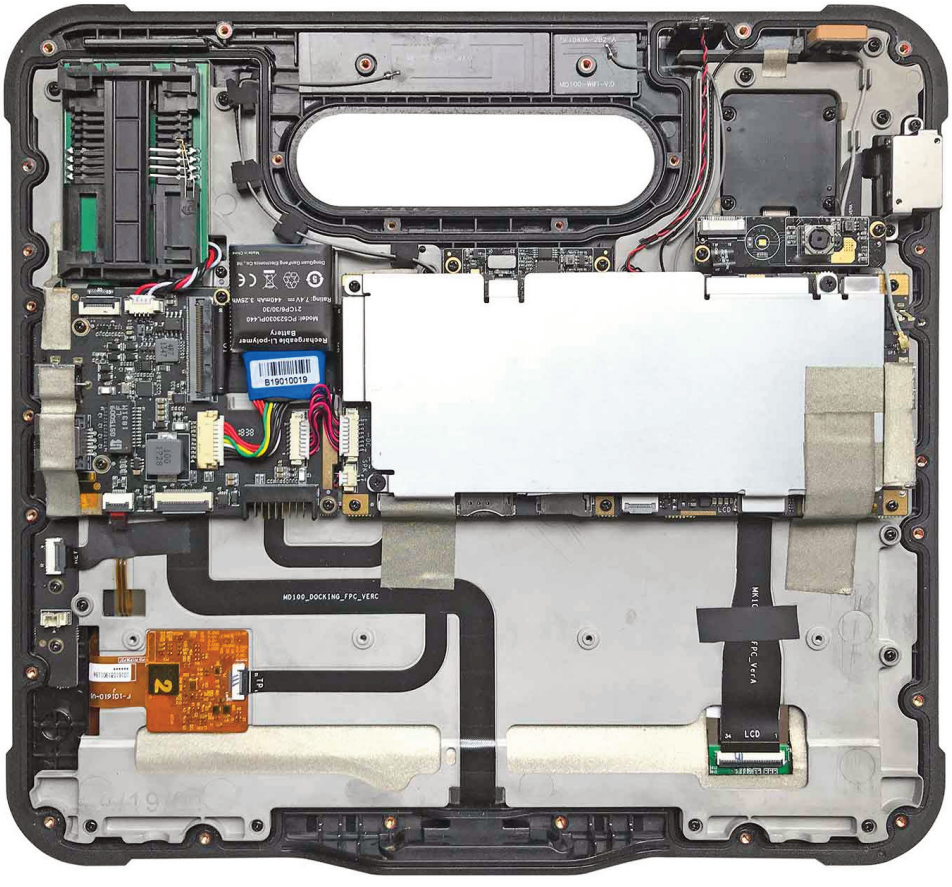
Even the most mobile computer will often be used in an office, on a desk. Or in a vehicle. Or it may be mounted on a wall. For that Estone offers three different docks, shown below:

On the left is the office dock. It offers two extra USB 2.0 ports, an RJ45 LAN jack, and a 9-pin legacy RS232 serial port. The office dock includes a charging slot for an additional battery. On the right is the vehicle/wall dock. It provides the same extra ports, and has VESA 75mm and 100mm mounting screw hole cutouts in its back plate. Both docks are made of white plastic and powder-coated aluminium.

Cameras

Like virtually every tablet these days, the Estone MDK-100 has both a front and a rear camera. The front one is primarily for WiFi video calls and conferencing, and offers 2 megapixel resolution. The more powerful one in the rear is for documentation and general photography and comes standard with a 5 megapixel imager. An 8 megapixel rear camera is optional.

The onboard camera app in our review unit could go as high as 8mp stills (2592 x 1944 pixels) and 1920 x 1080 pixel FHD video. For video the camera tops out at 1080p/30fps. The Microsoft Windows Camera app is very limited in its settings and options, offering only time delay, auto/manual focus, and exposure com-



pensation. The cameras can undoubtedly do more, but tapping that potential requires additional imaging software. Given the incredible imaging quality of today's smartphones, users have come to expect a lot from their mobile device cameras. We'd encourage Estone to source or create their own camera app, optimized for onboard imaging hardware.

Tough and durable

Unlike smartphones and consumer tablets that are increasingly fashion statements, OEM/ODM tablets are tools for the job. The MDK-100 makes it clear from the start that you can use it without worries. No screen protector needed, because the screen itself is of chemically hardened cover glass. There's no glossy metal that easily scratches, only polycarbonate plastic.

How tough is this tablet? The MDK-100 carries IP65 sealing where the "6" means it's dustproof, and the "5" that it is protected from low-pressure water jets from all directions. It can handle a spill or a bit of rain.

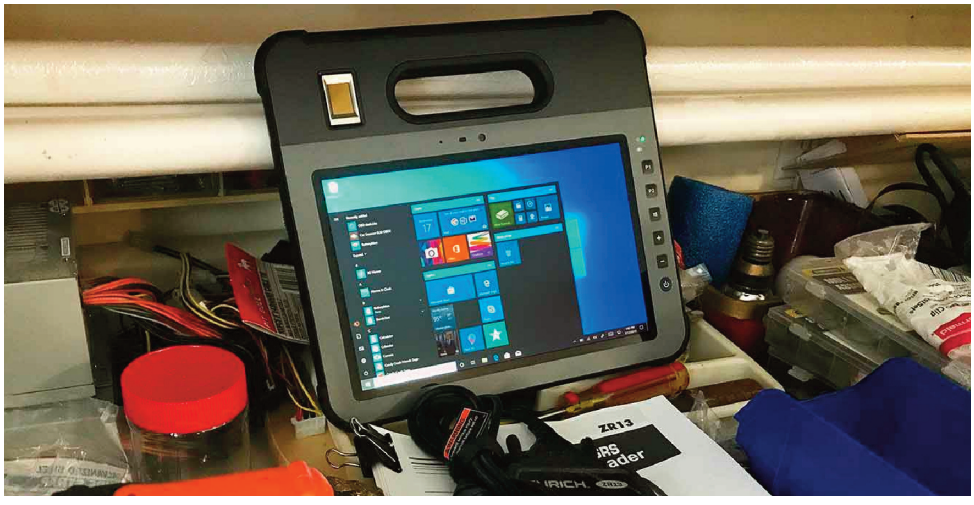
The device can also handle drops from four feet. That means it can survive falling off a desk or a cart. Four feet is also the distance a tablet falls if it slips out of one"s hands while using it in a standing position.

The stated operating temperature range of 32 to 113 degrees Fahrenheit seems conservative. While it won't get colder or hotter than that in healthcare settings, outdoors is a different story. There, the temperature range should be considerably broader.

Estone's info materials highlight ruggedness testing. These tests include aging, immunity to power line variation, liquids resistance, battery stress, thermal testing, temperature and humidity (both storage and operating), drop test, package drop, vibration, ESD, and moisture & salinity. The list of testing performed on a particular device, of course, depends on the product and its intended purpose.

Note that Estone offers product certification services both for governmental as well as for private technical commissions and software/standards licensing.

Estone MDK-100: Summary



With the MDK-100, Toledo, Ohio based OEM/ODM Estone Technology makes available a contemporary implementation of what started as an Intel reference design for a hard handle tablet several years ago. Initially termed MCA (Mobile Clinical Assistant) by Intel, the platform proved suitable and popular for field use as well. Estone offers the platform in different configurations and color schemes, suitable for all sorts of rebranding, reselling requirements, and well as for turn-key projects and solutions.

Depending on equipment level, the MDK-100 weighs around three pounds, its polymer over magnesium chassis design won't scratch or break, and its 10.1-inch capacitive multi-touch display with excellent viewing angles is crisp and sharp. The very bright optional daylight-viewable display on our review unit allowed easy viewing in sunlight. Thanks to a bridge battery, the 42 watt-hour main battery is hot-swappable.

Estone offers five different Intel processor options, covering a wide range of performance. An integrated industrial-grade scanner does 1D/2D barcode reading. NFC, RFID, GPS, CAC card and fingerprint readers, and mobile broadband are all optionally available. The device is available with up to 1TB of solid state storage (and there is a micro SD card slot in the battery compartment).

The tablet's nternal design is rugged, logical, rational and should be easy to repair/maintain. Layout and organization suggest easy customization. Overall, the Estone MDK-100 is a practical, cost-efficient multi-purpose hard handle tablet platform that can fit into many tablet lineups.

-- Conrad H. Blickenstorfer, July 2019

Estone MDK-100

Type: Rugged OEM hard handle Tablet PC

Processors:
Intel Core i7-7Y75: 1.30GHz/3.60GHz
Intel Core i5-7Y54: 1.20GHz/3.20GHz (tested)
Intel Core m3-7Y30: 1.00GHz/2.60GHz
Intel Pentium N4200: 1.10GHz/2.50GHz
Intel Celeron N3350: 1.10GHz/2.40GHz

OS: Windows 10 Pro/home/LTSB, Linux

Memory:
MD-100: 4GB or 8GB LPDDR3
MDK-100: 8GB or 16GB LPDDR3

Graphics: Kaby Lake versions: Intel HD Graphics 615
Apollo Lake versions: Intel HD Graphics 500/505

Display: 10.1-inch/1920 x 1200 pixel, 220 ppi), AG, AR, AF coatings available, 400 or 1,000 nits

Digitizer: Capacitive multi-touch with wet support; optional active pen

Keyboard/keys: Power, volume up/down, 2 programmable, optional scan button

Storage: 128GB up to 1TB M.2 SSD

Expansion slots: 1 x micro SD, 1 x micro SIM card

Housing: Thermoplastic polyurethane with magnesium chassis; anti-microbial option

Operating temperature: 32° to 122°F (0° to 50°C)

Ingress protection: IP65 (IEC 60529)

Humidity: 10-90% - non condensing, operating

Drop: Operating: 4-foot drops per MIL-STD-810G

Vibration: MIL-STD-810G, Method 514,6, Procedure I, Category 4 and 20

ESD: Connect ±8KV for all metal outside. Air ±15KV for all metal outside and touch panel

Sensors: Ambient light, gyro, compass, atmosphere

Size: 11.0 x 10.1 x 0.87 inches (280 x 256 x 22 mm)

Weight: Starting at 2.43 pounds (1.1 kg); 3.4 lbs 1.53 kg as tested with dual batteries, pen, scanner

Power: Hot-swappable 11V, 3,800mAH, 42 watt-hour rechargeable Li-Ion battery, 3.25 watt-hour bridge battery

Cameras: Front: 2-megapixel; rear: 5 or 8-megapixel AF

Security: Optional fingerprint reader

Communication: Dual-band 802.11a/b/g/n/ac, BT 4.2

Interface: 1 x USB 3.0 Type A, 1 x HDMI out Type A, 1 x 3.5mm audio, 1 x gigabit RJ45, power, dock

Price: Inquire

Regulatory: FCC, IATA for International Shipping, IEC62133, IEC60601-1

Contact:
Estone Technology
www.estonetech.com
info@estonetech.com
Phone: 1-888-653-3346