2008-9

SYSTEM CATALOG

Mobile Solutions

semiconductor

http://www.semicon.toshiba.co.jp/eng

Toshiba Semiconductor Devices for Mobile Applications

Mobile communications via cellular phones and PDAs are changing the way we live.
Toshiba's semiconductor technology supports the hardware of mobile handsets.
We are committed to ensuring the highest quality in both design and production so you can put our best-in-class IC capability to work for you as smoothly as possible.

Pushing the limits of what is possible in mobile electronics, we are seeking a new paradigm of communications.

RF System

RF Analog ICs
Single-chip transceiver ICs for triple-band W-CDMA

RF Devices
Power amplifiers
Buffer amplifiers
LNA transistors
Variable capacitance diodes
Antenna switches

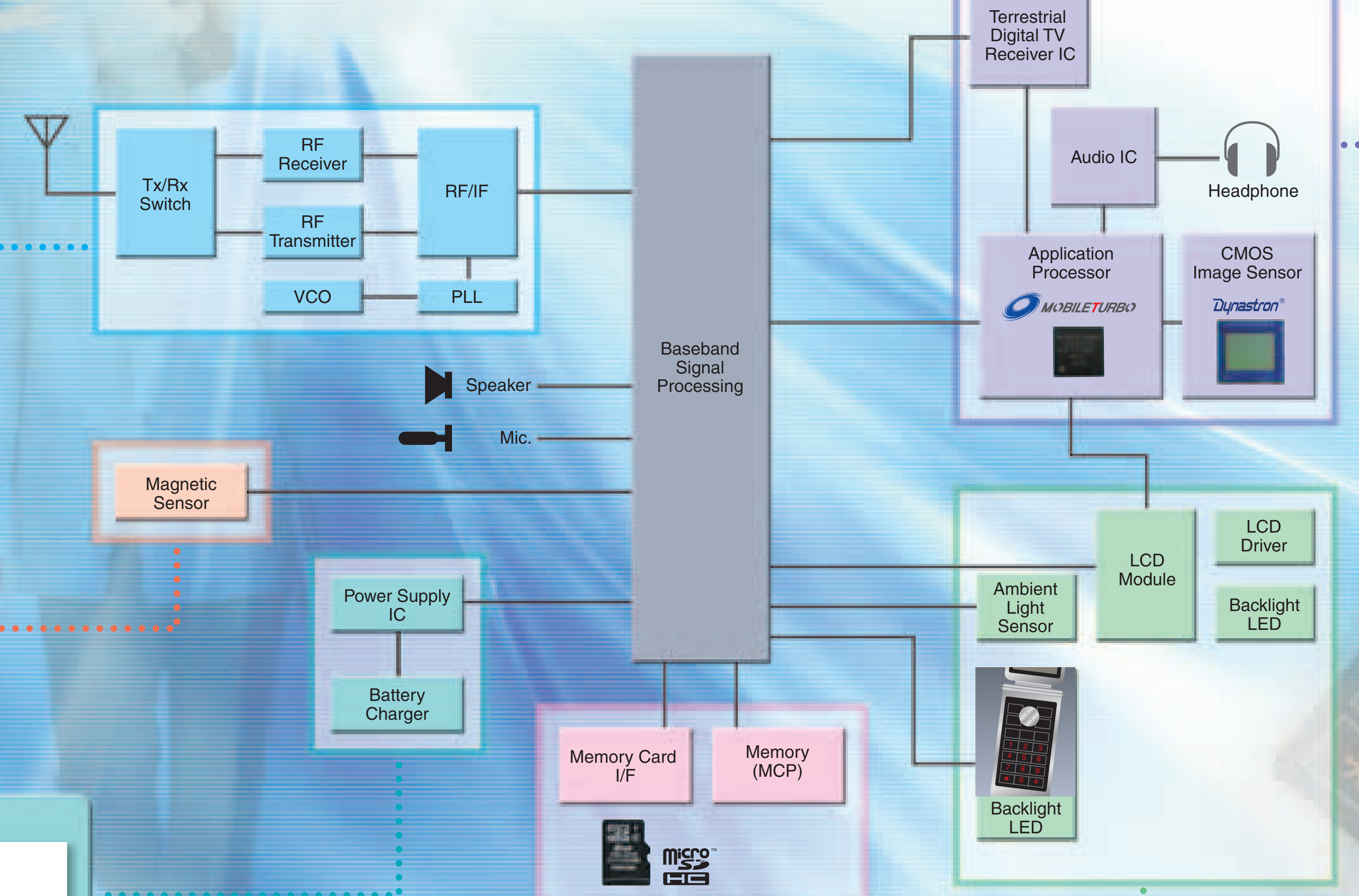
Digital-Output Magnetic Sensor Series
TCS10 and TCS11 Series
Ideal for applications with open/close contacts
Memory (MCP)

Power Supply System

Discrete Devices for Power Supply Systems
Power MOSFETs for power management
Power MOSFETs for lithium-ion battery protection

General-Purpose
Triple switch for power supplies
Power supply ICs with low standby current
Photocouplers

Power Supply ICs for Power Amps (for CDMA)



Memory

Memory: Multi-Chip Packages
mobileLBA-NAND, a high-density NAND flash series, ideal for cellular phone applications

SD Memory Cards
microSD cards

The microSD logo is a trademark.

Display

Backlighting and Key Lighting
Small and high-brightness LED lamps
Schottky barrier diodes
Zener diodes
Level shifters
Ambient light sensors

White LED Drivers
Switching-regulated drivers
Charge-pumped drivers
DC/DC converters
Non-upconvert constant-current drivers

Surface-Mount Photo ICs for Ambient Light Sensors
TPS850 Series
Best suited for use in automatic brightness control of LCD monitors and key backlighting

Applications

CMOS Area Image Sensor
Dynastron™
2M/3.2M/5M/8M Dynastron™

CSCM (Chip Scale Camera Module)

Ultra-Compact Surface-Mount Photointerrupter
TLP848
Ultra-compact surface-mount package

Terrestrial Digital TV Receiver IC
(ISDB-T One-Segment OFDM Demodulator IC)
ETC90521/JBTC90521
Reduces the size of one-segment cellular phones.

Multimedia & 3D Graphics Engine
TC352980XBG <T5GE>
FWVGA video playback/record using H.264

TC35711XBG <TG2>
High-performance 3D graphics engine

Peripheral ICs
High-speed serial image transmission and general capabilities for controlling peripheral functions
MDDI Display Buffer
TC358720XBG, etc.
MIPI Display Buffer
TC358730XBG, etc.
I/O Expander
TC35890XBG, etc.

CONTENTS

CMOS Area Image Sensors Dynastron™ 4 • 5
Multimedia Engines Designed for Cellular Phone Applications 6
Multimedia Engines Designed for Cellular Phone Applications 7
Peripheral ICs 8 • 9
Mobile Memories NAND Flash Memory 10
Memory: Multi-Chip Packages 11
NAND Flash Storage 12
Single-Chip Transceiver IC for Triple-Band W-CDMA 13
Digital TV Receiver IC Compact SMD Type LED Lamps 14
White LED Drivers Power Supply ICs for Cellular Phone (CDMA) Power Amps 15
Surface-Mount Photo-IC for Ambient Light Sensor: TPS856 Ultra-Compact Surface-Mount Photointerrupter: TLP848 16
TCS10/11 Digital-Output Magnetic Sensor Series 17
Ultra-Small, Low ON-Resistance Analog Switches ESD Protection Diodes 18
Devices for Small Power Supplies : MOSFETs and CMOS LDO Regulators 19

Note: The system and product names mentioned herein may be trademarks or registered trademarks of respective companies.

Small Package, Low Power Consumption and High Resolution

CMOS Area Image Sensor Dynastron™

In its pursuit of further miniaturization and higher performance, Toshiba offers a new Dynastron CMOS image sensor with a pixel pitch of 1.75 µm, reduced from 2.2 µm.
The new image sensor is available in pixel counts ranging from 2.0 M to 8 M.
The Dynastron technology provides high-quality imaging, thanks to the use of a microlens and an optimized array of photodiodes.
The new image sensor opens up new possibilities for mobile handsets such as camera phones.

*: Dynastron is a trademark of Toshiba Corporation.

ET8EN2-AS

2-Megapixel Dynastron™: ET8EM0 (under development)

3.2-Megapixel Dynastron™: ET8EM1

5-Megapixel Dynastron™: ET8EM2 (under development)

8-Megapixel Dynastron™: ET8EN2 (under development)

Features

- Dynastron technology provides world-class image quality.
- The integrated PLL provides great flexibility in the selection of input clocks.
- Offers blemish correction, gain control, etc.
- Command controlled via the I²C bus.

General Specifications

Item	Specification			
Part Number	**ET8EN2**	**ET8EM2**	**ET8EM1**	**ET8EM0**
Optical Format	1/2.6 inch	1/3.2 inch	1/4 inch	1/5 inch
Pixel Count	Approx. 8 M (3,280 (H) x 2,464 (V))	Approx. 5 M (2,584 (H) x 1,960 (V))	Approx. 3.2 M (2,060 (H) x 1,548 (V))	Approx. 2 M (1,616 (H) x 1,216 (V))
Cell Size	1.75 µm x 1.75 µm	1.75 µm x 1.75 µm	1.75 µm x 1.75 µm	1.75 µm x 1.75 µm
Output Signaling	RAW	RAW	RAW	YUV/RGB/RAW
Frame Rate	7.5 fps at full resolution	12 fps at full resolution	15 fps at full resolution	UXGA@15 fps VGA@30 fps
Control Bus	I²C	I²C	I²C	I²C
ISP	None	None	None	Integrated

ISP: Image Signal Processor

Dynastron™ Roadmap

Shown in round boxes are optical formats.

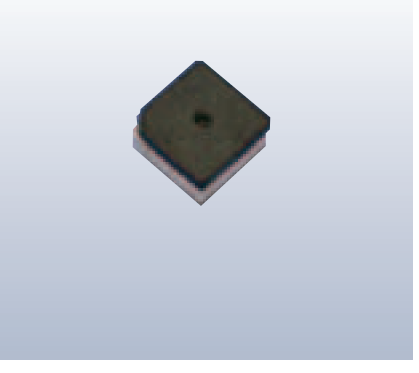
Resolution	3.3 µm	2.7 µm	2.2 µm	1.75 µm
8 M				ET8EN2 1/2.6"
5 M			1/2.5"	ET8EM2 1/3.2"
3.2 M		1/2.6"	1/3.2"	ET8EM1 1/4"
2 M	1/2.7"	1/3.3"	1/4"	ET8EM0 1/5"
1.3 M	1/3.3"	1/4"	1/5"	
0.33 M	1/7"	1/8"	1/10"	

Pixel Count — Finer pitch

CSCM (Chip Scale Camera Module)

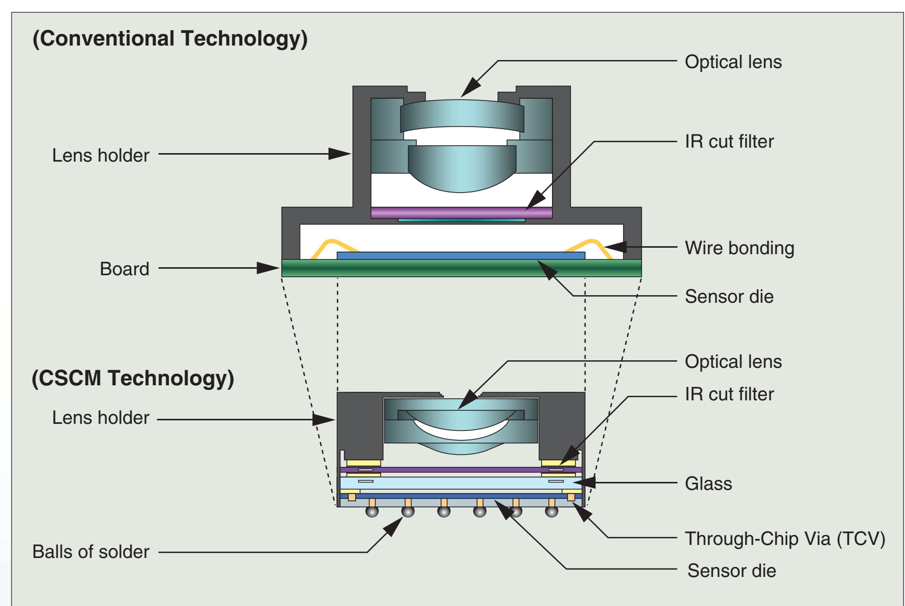
The first camera modules manufactured using Through-Chip Via (TCV) technology

Toshiba now offers a family of chip scale camera module (CSCM[*1]) with a Dynastron™ CMOS image sensor. They are the first[*2] to use TCV[*3] technology.
In the last few years, cellular phones and other mobile devices are coming in smaller and smaller form factors. This is driving the need for smaller, yet higher-quality camera modules to be able to incorporate digital camera functionality into these space-critical applications.
TCV technology uses a chip structure with built-in pass-through electrodes and allows the mounting and assembly of camera modules in the semiconductor wafer. With solder balls on the bottom of the substrate, the CSCM requires no wire bonding space, delivering a 64% reduction[*4] in module size compared to Toshiba's conventional camera modules manufactured with the same VGA sensors.
The use of heat-resistant lenses and solder balls permits reflow soldering[*5] and thus simplifies the pc board mounting of camera modules. This contributes to a reduction in the manufacturing process of surface-mount pc boards.



*1 The chip scale camera module is a ultra-small camera module that allows the mounting and assembly of camera module components at the wafer level.
*2 As of October 1, 2007, according to a survey by Toshiba.
*3 Through-Chip Via, for cutting holes and running electrodes through the wafer.
*4 Comparison with Toshiba's conventional camera modules manufactured with the same sensor chip.
*5 Surface-mount assembly process in which components are temporarily mounted on the pc board using solder paste, after which the board is passed through a temperature-controlled oven in order to solder the joint.

■ Comparison Between the Conventional and CSCM Camera Modules



■ General Specifications

Part Number	TCM9200MD
Module Size	6.31 mm (X) x 6.41 mm (Y) x 4.35 mm (H)
Total Pixel Count	1,648 (H) x 1,216 (V) (UXGA)
Cell Size	2.2 µm (H) x 2.2 µm (V)
Output Signaling	YUV/RGB/RAW
Output Format	8-bit parallel
Frame Rate	15 frames per second (UXGA output) 30 frames per second (VGA output)
Control Signal	I²C bus

Part Number	TCM9000MD
Module Size	4.00 mm (X) x 4.00 mm (Y) x 2.27 mm (H)
Total Pixel Count	648 (H) x 492 (V) (VGA)
Cell Size	2.2 µm (H) x 2.2 µm (V)
Output Signaling	YUV/RAW
Output Format	8-bit parallel
Frame Rate	30 frames per second (VGA output)
Control Signal	I²C bus

※For detailed information, contact your nearest Toshiba sales representative.
※The specifications of the products being developed are subject to change.

Multimedia Engines Designed for Cellular Phone Applications

Toshiba has launched a new multimedia engine specifically designed for cellular phone applications. Designated as the T5GE, the new multimedia engine is a successor to the T5G and contains three hardware accelerators—a video codec, a 3D graphics accelerator and a JPEG codec—for faster execution of video or still image shooting, one-segment TV reception, 3D games and the like. The video codec supports H.264 and MPEG-4 (FWVGA) encoding/decoding. The powerful 3D graphics accelerator expands the possibilities for games and other applications of cellular phones. The JPEG codec supports the shooting of still images having up to 5 megapixels in order to satisfy a demand for a higher resolution; it also offers fast processing that enables continuous shooting. Additionally, the T5GE incorporates an LCD controller that supports LCD display at resolutions up to FWVGA (864 x 480).

T5GE TC352980XBG

■ Features

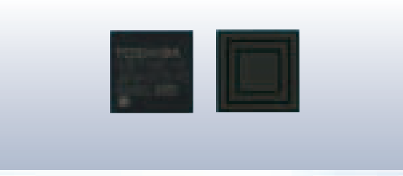
- **Video codec**
  H.264 codec: Supports FWVGA-size (864 x 480) encoding and decoding at a frame rate of 30 fps.
  MPEG-4 codec: Supports up to FWVGA-size (864 x 480) encoding and decoding at a frame rate of 30 fps.
  H.263 video codec, camera input (filtering, zoom-out and rotation) and video output (filtering, zoom-out, zoom-in and rotation).
- **Audio codec**
  AMR-compliant; ITU-T G.726-compliant; MP3 audio encoding/decoding; WMA audio encoding/decoding; PCM input/output; MP4 demultiplexing; bitstream input/output; video phone (ITU-T H.223); MPEG2-TS (ITU-T H.222.0)
- **2D/3D graphics**
- **JPEG codec**
  JFIF-compliant and JPEG Baseline-compliant; JPEG PART 2-compliant (ISO/IEC 10918-2); YUV 4:4:4, YUV 4:2:2 and YUV 4:2:0 input formats
- **LCD controller**
  FWVGA resolution; support for two LCD panels; RGB and YUV output formats; composition of up to four layers; synchronous and asynchronous interfaces; simultaneous display of FWVGA and TV; frame storage
- **Camera interface: Direct connections with two cameras; YUV 4:2:2 camera input**
- **On-chip memories: Graphics eDRAM and mobile DDR SDRAM**

■ General Specifications

Item	Specification
Process	90 nm
Power Supply	1.2 V (core); 2.5 V (core); 1.8 to 3.0 V (I/O)
Package Dimensions	11 mm x 11 mm (358 pins)

TG2 TC35711XBG

■ Features



- The integrated 3D graphics processor delivers 3D rendering performance of 100 mega-polygons* (800 megapixels*) a second.
- Contains three processors to realize graphics performance equivalent to tabletop game consoles: a high-performance 3D graphics processor, a MeP (Media Embedded Processor) suitable for multimedia processing and an ARM1176JZF-S CPU core designed specifically for mobile handsets.
- Compatible with programmable shaders, which bring realistic shading and reflectivity to mobile handsets.
- Incorporates an LCD controller that supports LCD display of WVGA size (480 x 800) and can display WVGA and TV through the video encoder independently and simultaneously.
- Integrates a 512-Mbit DDR memory in a stack-up configuration in an SiP package.
- Different types of external interfaces are available: SD card, serial I/O, NAND flash memory, DDR memory controller and UART.

* Peak performance of the graphics core

■ General Specifications

Item	Specification
Process	90 nm
Functions	CPU; 3D graphics; LCD interface; SD card interface; serial I/O; UART; DDR memory controller
Power Supply	1.2 V (core); 1.8 to 3.3 V (I/O)
Package Dimensions	13 mm x 13 mm, 449-pin BGA

Toshiba MOBILETURBO Application Engine Road Map

Multimedia Engines Designed for Cellular Phone Applications

Specific Product Line

Over 30 times the graphics performance of the predecessor device

TG2
Programmable Shader
3D Graphics
(Equivalent to Open GL-ES)

T6G
H.264 720pEnc/Dec
3D Graphics
(Open GL-ES 2.0)

T5GE
FWVGA
H.264 Enc/Dec
3D Graphics

Recording and playback of high-quality VGA video at 30 fps

T5G
VGA
MPEG4 Enc/Dec
3D Graphics

High Performance Line

T4G
QVGA
MPEG4 Enc/Dec
3D Graphics

T4
QVGA/QCIF

S1G
QVGA/VGA
Low Power Audio
3D Graphics

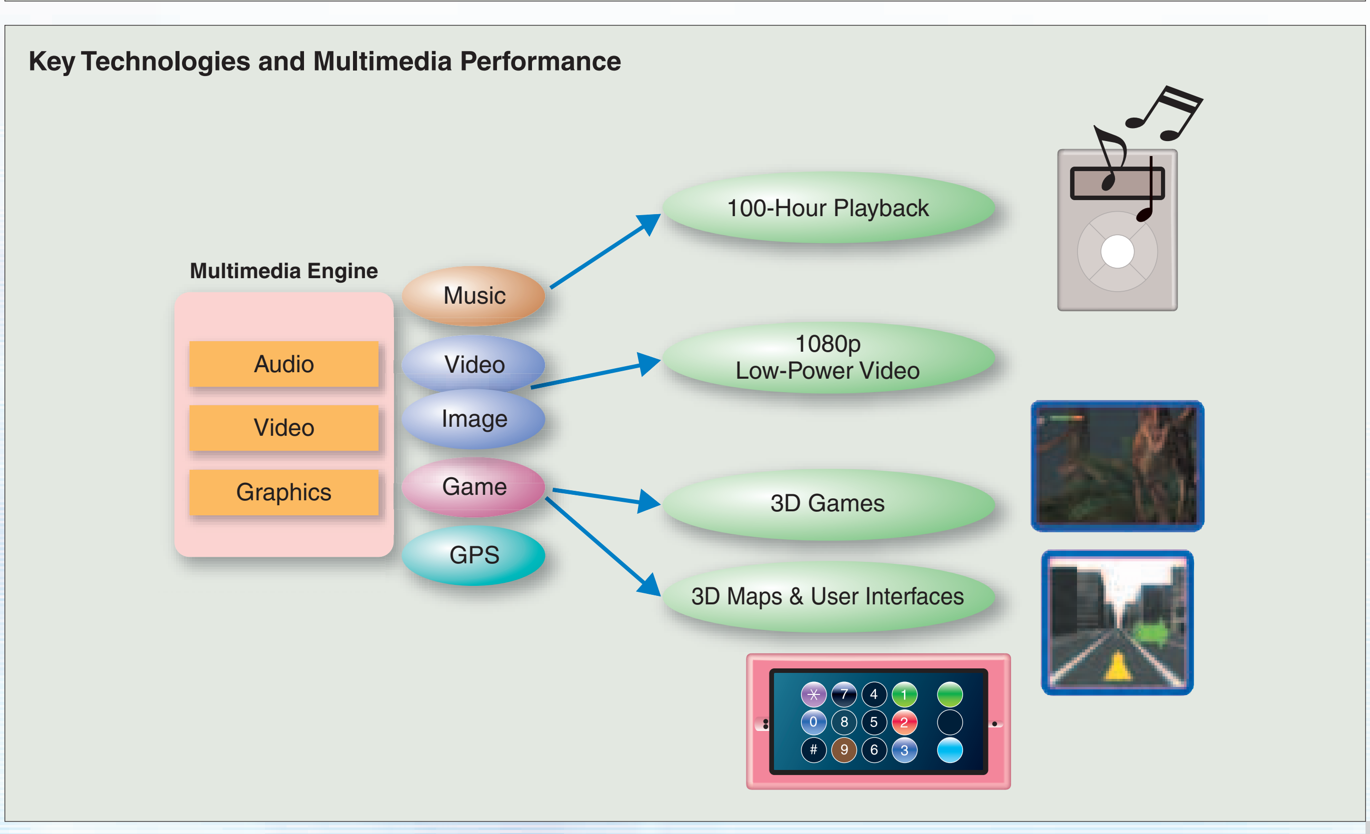
Reception of 1-segment broadcasting, audio playback, and low power consumption

S1
QVGA
Low Power Audio

A1J
Low Power Audio

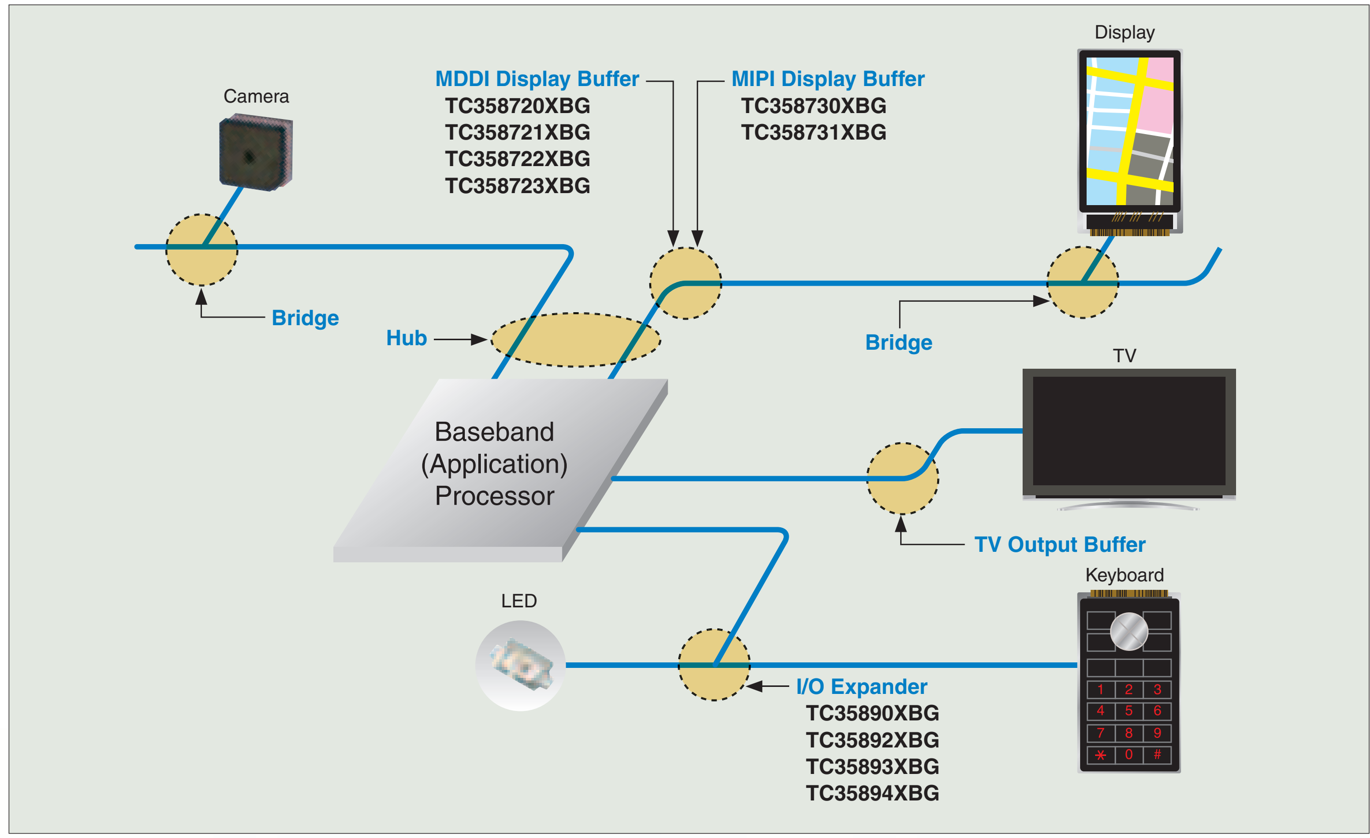
Cost Performance Line

'04 | '05 | '06 | '07 | '08 | '09

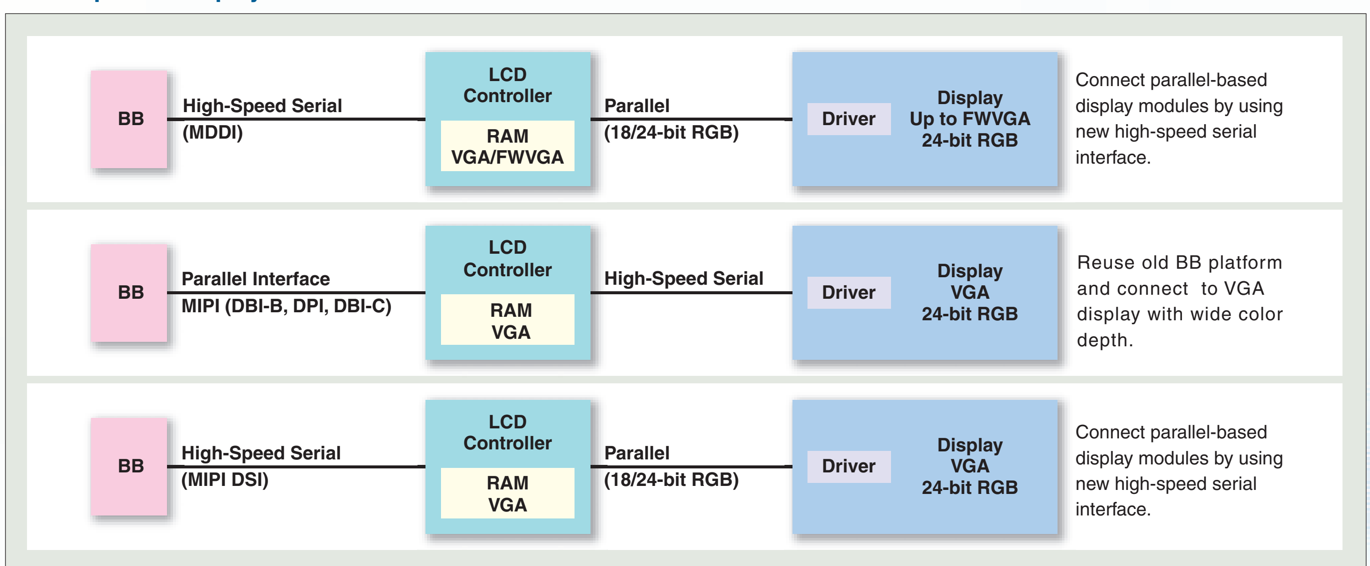


Peripheral ICs

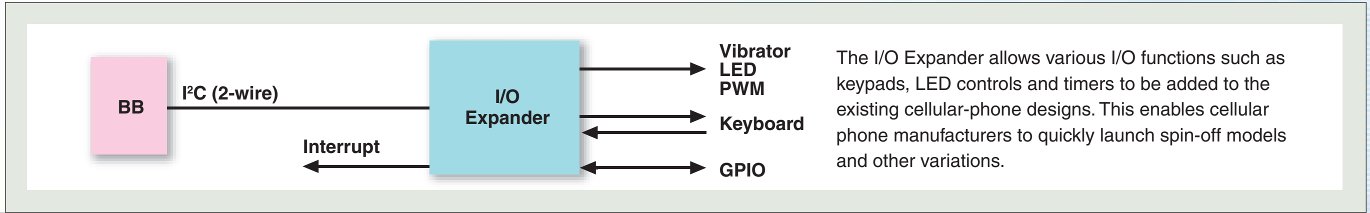
Toshiba offers peripheral ICs that provide flexible connections between the baseband or application processor in a cellular-phone system and various peripheral devices.



■ Examples of Display Buffer Solutions

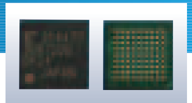


■ I/O Expander Example



Cellular phones, both clamshell and sliding styles, will continue to evolve with a variety of user interfaces. To address their mechanical and electrical challenges, Toshiba offers a family of highly integrated peripheral ICs: the TC358720XBG and TC358721XBG MDDI-based VEGAMagiq display buffers; the TC358730XBG and TC358731XBG MIPI-based display buffers; and the TC35890XBG, TC35892XBG, TC35893XBG and TC35894XBG I/O Expanders. The I/O Expander allows typical baseband or application processor packages to be kept at a minimum pin count by enabling I/O pin expansion at the location where needed. Display buffers support not only high-speed serial interfaces for image data transmission but also traditional interfaces for peripheral device control.

MDDI Display Buffer: VEGAMagiq TC358720XBG, TC358721XBG



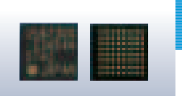
Features

- MDDI Client interface with data rates of up to 400 Mbps
- Support for a VGA-sized primary LCD panel and a QCIF+-sized secondary LCD panel
- Traditional peripheral interfaces: I^2C, SPI, GPIO and PWM
- Input clock frequency range between 32.768 kHz and 20 MHz
- LCD video transfer rate: VGA at 60 fps

General Specifications

Item	Specification
Process	130 nm
Power Supply	1.5 V (core); 2.6 V (eDRAM); 1.8 to 3.3 V (I/O); 1.5 V & 1.8 V (MDDI I/O)
Package Dimensions	6 mm x 6 mm (81 pins)

MIPI Display Buffer TC358730XBG



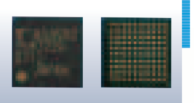
Features

- Support for two interfaces: MIPI™ DBI Type B and MIPI™ DPI
- High-speed serial output interface (T-HSSI: Toshiba High-Speed Serial Interface)
- Full frame buffering of VGA resolution
- PWM for backlight control
- Input clock frequency range between 32.768 kHz and 19.2 MHz

General Specifications

Item	Specification
Process	90 nm
Power Supply	1.8 V (core); 1.8 V (I/O); 2.5 V (eDRAM)
Package Dimensions	5 mm x 5 mm (64 pins)

MDDI Display Buffer: VEGAMagiq-W TC358722XBG, TC358723XBG



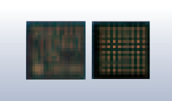
Features

- MDDI Client interface with data rates of up to 400-Mbps
- Support for a FWVGA-sized primary LCD panel and a QCIF+-sized secondary LCD panel
- Traditional peripheral interfaces: I^2C, SPI, GPIO and PWM
- Input clock frequency range between 32.768 kHz and 20 MHz
- LCD video transfer rate: FWVGA at 60 fps

General Specifications

Item	Specification
Process	130 nm
Power Supply	1.5 V (core); 2.6 V (eDRAM); 1.8 to 3.3 V (I/O); 1.5 V & 1.8 V (MDDI I/O)
Package Dimensions	6 mm x 6 mm (100 pins)

MIPI Display Buffer TC358731XBG



Features

- Baseband processor interfaces: MIPI™ DBI Type B, MIPI™ DPI and MIPI™ DBI Type C
- High-speed serial input interface (MIPI™ DSI)
- Full frame buffering of VGA resolution
- PWM for peripheral device control
- Input clock frequency range between 32.768 kHz and 19.2 MHz

General Specifications

Item	Specification
Process	90 nm
Power Supply	1.8 V (core); 1.8 V (I/O); 2.5 V (other)
Package Dimensions	5 mm x 5 mm (64 pins)

I/O Expander TC35890XBG, TC35892BG, TC35893XBG, TC35894XBG

Features

- Low-power operation
- I^2C interface; 2 x 2 to 8 x 12 keypad; PWM timers; general-purpose I/O pins (GPIO)
- Up to 24 general-purpose I/O pins

General Specifications

Item	TC35890XBG	TC35892XBG	TC35893XBG	TC35894XBG
Features	Up to 24 GPIO pins; crystal oscillation; support for dual power supplies	Up to 24 GPIO pins; on-chip RC oscillation; crystal oscillation	Up to 20 GPIO pins; on-chip RC oscillation	Up to 24 GPIO pins; on-chip RC oscillation; crystal oscillation
Power Supply	1.7 to 3.6 V	1.62 to 2.7 V	1.62 to 2.7 V	1.62 to 2.7 V
Package Dimensions	5 mm x 5 mm (36 pins)	3.5 mm x 3.5 mm (36 pins)	3.0 mm x 3.0 mm (25 pins)	3.5 mm x 3.5 mm (36 pins)
Package				

Mobile Memories

■ Well-proven NAND flash

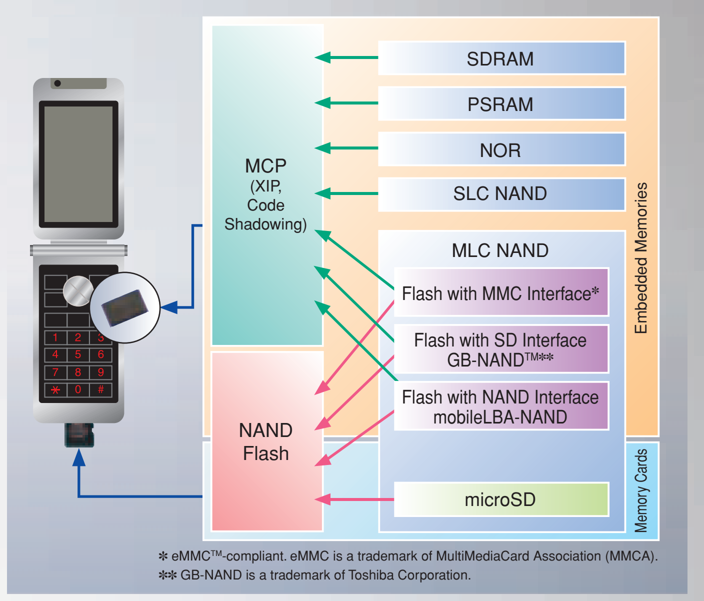
Invented by Toshiba, NAND flash has gained popularity in the cellular phone market. Toshiba manufactures all of its NAND flash products in Japan, which are renowned for their quality and reliability.

■ Available in space-saving configurations like MCP packages and microSD cards

Several memory chips are stacked up vertically in MCP packages to get the maximum space-saving advantage possible. Also, ultra-small microSD cards are designed specifically for cellular phones to allow size reduction. These flash memory products contribute to enabling form-factor miniaturization and feature-rich cellular phones.

■ Wide variety of memory solutions

Embedded memories in MCP packages and microSD cards, especially multi-level cell (MLC) NAND flash products, provide total memory solutions for cellular phone applications.



* eMMC™-compliant. eMMC is a trademark of MultiMediaCard Association (MMCA).
** GB-NAND is a trademark of Toshiba Corporation.

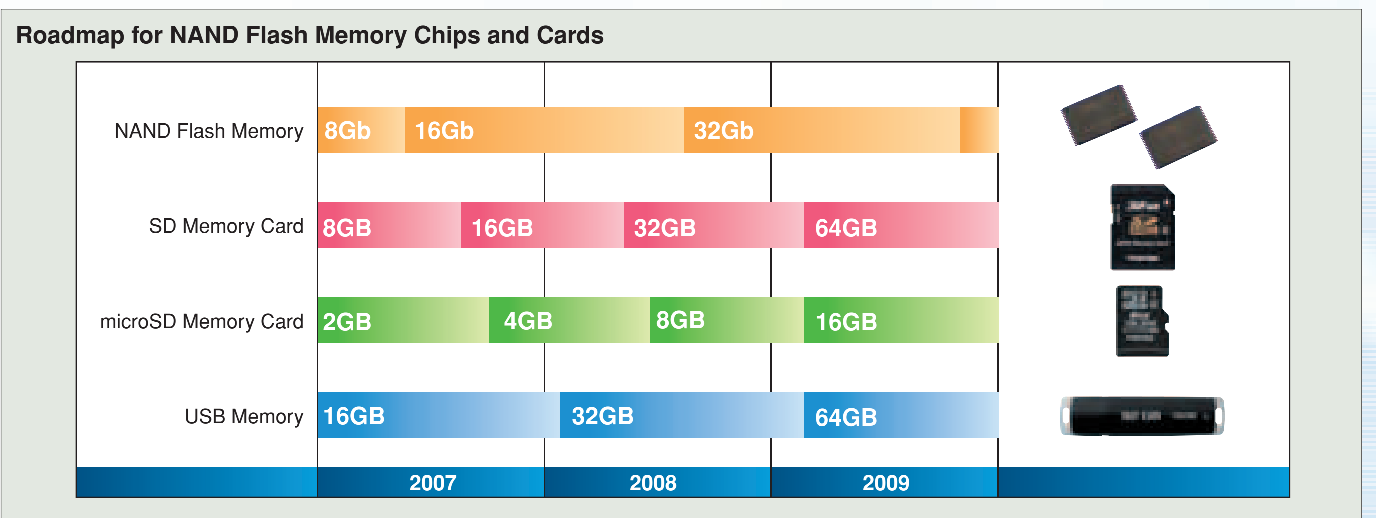
XIP (eXecute-In-Place): A method of executing programs directly from NOR flash memory. Primarily used in GPRS cellular phones in China and Europe.
Code shadowing: A method of copying program code at boot-up from the SLC NAND flash to synchronous dynamic RAM (SDRAM) to run applications. Widely used in high-end cellular phones in Japan and South Korea.

NAND Flash Memory

To meet the rapidly growing demand for high-capacity storage, Toshiba offers the industry's largest 16-Gbit and 32-Gbit NAND flash memories fabricated with the advanced 43-nm process technology.

■ Features

- Advanced 43-nm process and multi-level cell technologies have enabled the product to have a capacity of 16 and 32 Gbits in the same package size as before.
- The new NAND flash memory provides faster write performance by increasing the page size and optimizing the memory cell control system.
- Stacked-die packaging technologies allow large-capacity memory cards.

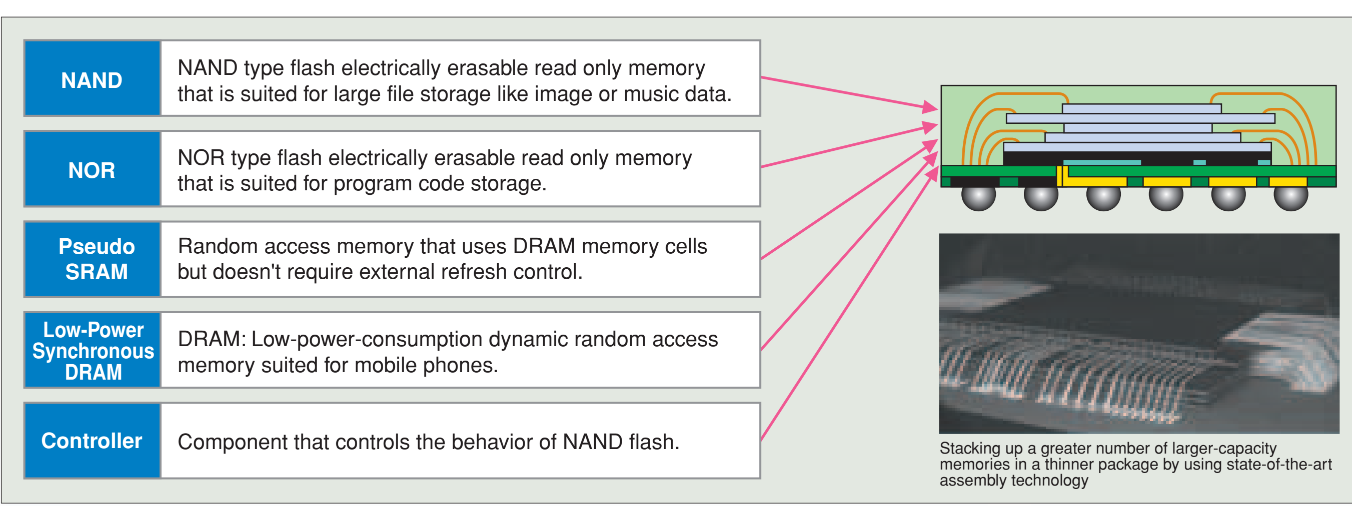


Memory: Multi-Chip Packages

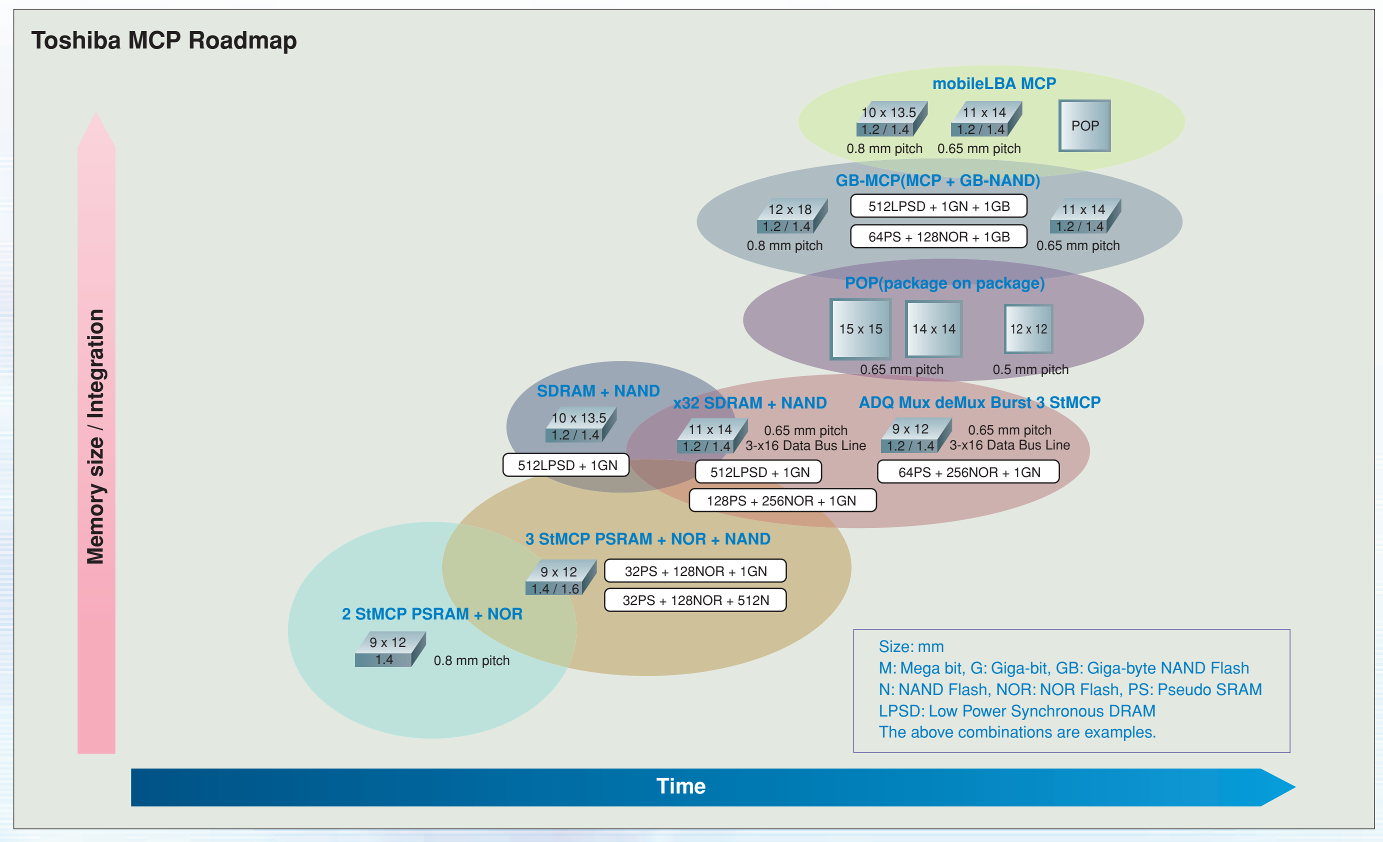
More and more features are being added to mobile devices like cellular phones, such as the storing and playback of still pictures, videos and music, and game playing capabilities. This is driving the need for processing large amounts of data at high speeds. On the other hand, multi-chip packages (MCPs) are becoming increasingly popular for die stacking to save board space.

■ Features

- Various types of memory can be combined in a single package.
- Up to nine layers can be stacked up (including inter-die spacers) in a package with a thickness of 1.4 mm. Up to five layers can be stacked up in a package with a thickness of 1.0 mm.
- Samples of high-density mobileLBA NAND flash memories are now available. The new mobileLBA NAND flash memories reduce the workload of a host controller. Manufacturers can, on the same chip, define an SLC area best suited for high-speed reads and writes, separately from an MLC area optimized for storage of a large amount of data. The 2-Gbit, 4-Gbit and 8-Gbit versions allow their full capacity to be allocated as SLC, while the 16-Gbit and 32-Gbit versions can support up to 8 Gbits of SLC.



Stacking up a greater number of larger-capacity memories in a thinner package by using state-of-the-art assembly technology



SD Memory Card Family

Multipurpose SD Memory Cards also provide high-level copyright protection.

SD Memory Cards

Ultra high-speed CLASS 6

SD Memory Cards

High-speed CLASS 4

SDHC Memory Cards use the FAT32 filesystem to address large memory space.

SDHC Memory Cards

Ultra high-speed CLASS 6

SDHC Memory Cards

High-speed CLASS 4

microSD Memory Cards are the smallest SD Memory Cards.

microSD Memory Cards

High-speed

As digital devices become more sophisticated, they need more data storage capacity.

microSDHC Memory Cards

High-speed CLASS 4

SD Speed Class

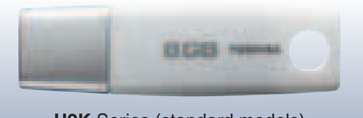
CLASS 2	CLASS 4	CLASS 6

The SD Speed Class indicates the minimum read/write data transfer rate for the SD Memory Card based on the SD Card Association standards.
The minimum data transfer rate of Class 2, Class 4 and Class 6 cards is 2 MB/s, 4 MB/s and 6 MB/s respectively.

USB Flash Memory

TransMemory

Just plug it into a USB port and it is automatically recognized. Whether moving data around the office or sharing photos with a friend, this compact, highly portable USB Flash Memory is your data link.
Windows Vista® and **ReadyBoost™** supported.

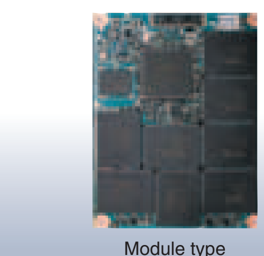


U2K Series (standard models)

U2G Series (high-capacity model)

Solid State Drive (SSD)

High-speed, high capacity
Serial ATA interface
Product offerings: Module, 1.8-inch, 2.5-inch types
Capacity: 32 GB, 64 GB, 128 GB



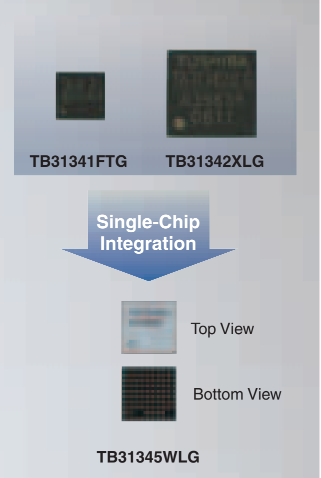
Module type

1.8-inch type

The SD, SDHC, microSD and microSDHC logos are trademarks. TransMemory The TransMemory is a registered trade mark of Toshiba Corporation.
Windows Vista® and ReadyBoost™ are registered trademarks or trademarks of Microsoft Corporation in the USA and other countries.

Single-Chip Transceiver IC for Triple-Band W-CDMA

The market of W-CDMA cellular phones has been rapidly expanding, promoting a movement for greater versatility and use of a wider frequency band. This trend also demands more highly-integrated, smaller RF-LSI chips.
The new RF-LSI chip, TB31345WLG, combines the two previous chips, the TB31341FTG low noise amplifier (LNA) and the TB31342XLG transceiver (TRX). Additionally, the TB31345WLG is housed in the industry's smallest-class wafer-level chip size package (WCSP*).
The TB31345WLG covers the BAND V (800-MHz) area in addition to the BAND I (2-GHz) area for roaming services.
The receiver's built-in lowpass filter (LPF) provides excellent characteristics for reducing the GSM and CDMA2000 interference noise.
The SiGe BiCMOS technology enables the TB31345WLG to operate with low power consumption and low error vector magnitude (EVM), thus providing long standby and talk times.



TB31345WLG

Features

- Low current consumption: TX = 66 mA (@ +4 dBm output power in normal operating mode);
  69 mA (@ +4 dBm output power in Icc-up HSDPA mode)
  RX = 36 mA
- Frequency bands: Band I (2-GHz band), Band V/VI (800-MHz band), Band IX (1.7-GHz band)
- Low EVM: RX = 10%; TX = 3%
- Fast lock & low noise: Built-in fractional-N PLL, VCO and loop filter
- Reduced interference: Receiver's built-in lowpass filter (LPF) for reducing GSM and CDMA2000 interference noise
- Small, thin package: 96-pin S-UFLGA96 (4.13 x 4.16 x 0.6 mm), 0.4-mm ball pitch (WCSP*)

*: WCSP: Wafer-Level Chip Size Package

RF-LSI Block Diagram

TB31345WLG
800 MHz
2 GHz
1.7 GHz
ANT
SW
DPX
DPX
DPX
PA
PA
PA
BPF
DrAMP
QMOD
LPF
LPF
F-PLL
Loop F
VCO
Loop F
VCO
F-PLL
1.7 GHz
2 GHz
800 MHz
LNA
LNA
LNA
BPF
QDEM
QDEM
QDEM
LPF/VGA
SBI
TB31341FTG
TB31342XLG
Analog Baseband IC

ISDB-T 1-Segment OFDM Demodulation IC for Mobile Receivers

Digital TV Receiver IC

Designated the ETC90521 in bare-die form and JBTC90521 in solder-bumped form, an OFDM demodulation IC is available in production quantities, which is specifically designed for the ISDB-T 1-segment of Japanese digital TV broadcasting for mobile receivers.

■ Features

- Can receive terrestrial digital broadcasting and ISDB-T 1-segment broadcasting.
- Fabricated using the 90-nm technology and offered in package-less forms (bare-die or solder-bumped) to minimize system size.
- Contains all hardware necessary for OFDM demodulation such as memory and an A/D converter, eliminating the need for external components.
- The self-contained ETC90521/JBTC90521 can run on its own (except for initialization, channel selection, etc.), reducing the workload of the host CPU.
- Provides improved mobile reception performance and channel switching times than the predecessor, TC90501FLG.

The successor to this IC is now being developed: TC90541 (single chip RF-CMOS 1-segment receiver/ tuner).

Offers High Brightness with Low Current Drive

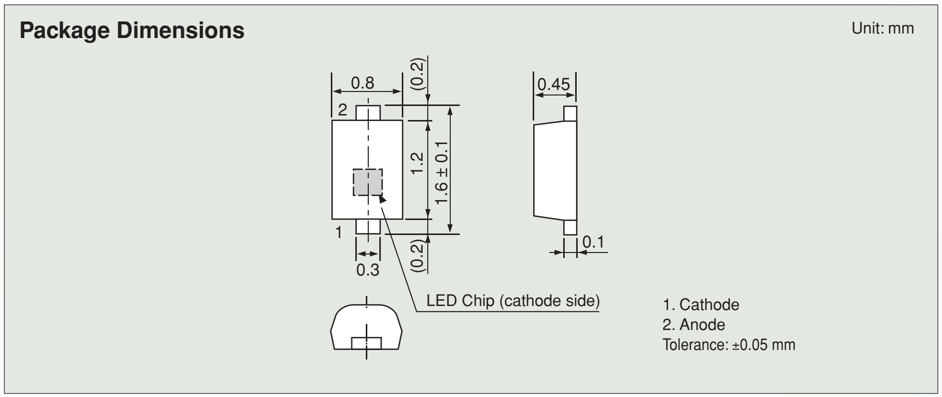
Compact SMD Type LED Lamps

■ Features

- Package dimensions: 1.6 (L) x 0.8 (W) x 0.45 (H) mm (Including lead length)
- New LED chip structure achieving high-brightness and low-current drive (TLxV1022 Series).
- Can be used as a replacement for the predecessor high-brightness LED (TLxV1022 Series).
- ROHS compatible

TL✻V1022

Package Dimensions Unit: mm



■ Product Offerings

@Ta = 25˚C

Series Name	Part Number	Color	Dominant Wavelength λd Typ. (nm) @IF = 5 mA	DC Forward Voltage VF (V) @IF = 5 mA		Reverse Current IR (μA) @VR = 4 V	Luminous Intensity IV (mcd) @IF = 5 mA		Available Bins
				Typ.	Max	Max	Min	Typ.	
TL✻V Series (InGaAℓP)	*TLRV1022(T14, F)/(T15, F)	Red	630	1.8	2.1	10	4.76	15	# JK
	*TLRMV1022(T14, F)/(T15, F)	Red	626	1.8	2.1	10	4.76	20	# JK
	*TLSV1022(T14, F)/(T15, F)	Red	613	2.0	2.3	10	8.5	30	# KL
	*TLOV1022(T14, F)/(T15, F)	Orange	605	2.0	2.3	10	8.5	38	# KL
	*TLAV1022(T14, F)/(T15, F)	Amber	592	2.0	2.3	10	8.5	25	# KL
	*TLYV1022(T14, F)/(T15, F)	Yellow	587	2.0	2.3	10	8.5	25	# KL
	*TLGV1022(T14, F)/(T15, F)	Green	571	2.0	2.3	10	4.76	14	# JK
	*TLPGV1022(T14, F)/(T15, F)	Pure green	561	2.0	2.3	10	1.53	3.5	# FG

*: Sealed in a moisture-proof bag.
#: For the available luminous intensity bins and further details, contact your nearest Toshiba sales representative.

Drives White LEDs for LCD Backlight at High Efficiency

White LED Drivers

The family of white LED drivers features high brightness with low power consumption, helping to reduce product size. It is ideal for LCD backlight and secondary camera flash applications. Both switching and charge-pump DC/DC converters are available.

■ Features

- Small packaging: SOT23-6, VQON24, PLP
- High efficiency: >85% (switching-regulated type)
- Low noise: No inductors required (charge-pumped type)
- Analog dimming control
- Multiple output capability for system integration (charge-pumped type)
- High quality: Protection circuitry (OVD)
- High accuracy: ±5% output current

■ Product Offerings

Switching-Regulated Drivers

Part Number	Features	Status
TB62731FUG	Temperature compensation circuit	Available
TB62732FUG	Small form factor	Available
TB62734FUG	Analog dimming; OVD	Available
TB62736FUG	High efficiency; analog dimming	Available
TB62737FUG/FPG	OVD; high efficiency	Available
TB62756FUG	PWM dimming; high efficiency	Available
TB62757FUG/FPG	PWM dimming; OVD; high efficiency	Available
TB62750FTG	High current (up to 800 mA)	Under development
TB62752AFUG/TB62755FPG	Multiple output lines (up to 8 LEDs)	Available
TB62752BFUG	OVD threshold = 31.5 V (typ.)	Available
TB62754AFNG	Medium-sized LCD backlighting	Available

Charge-Pumped Drivers

Part Number	Features	Status
TCA62753FUG	5-V constant-voltage output	Available

Non-step-up-type constant-current drivers are also available.

Optimizes Power Amplifier Efficiency

Power Supply ICs for Cellular Phone (CDMA) Power Amps

The power supply ICs for cellular phone power amps combine bypass MOSFET with a small, high-efficiency, synchronous-current-mode step-down regulator. They are ideal for optimizing the efficiency of CDMA and W-CDMA power amps to increase battery life.

■ Features

- Small packaging
- High efficiency: >80%
- Low Ron bypass MOSFET
- Variable output voltage
- High quality: Protection circuitry

■ Product Offerings

Part Number	Features	Status
TB62504FMG	Small voltage reference	Available

Ideal for Automatic Brightness Adjustment for LCD Monitors and Keypad Backlights

Surface-Mount Photo-IC for Ambient Light Sensor: TPS856

The TPS856 is a photo-IC that incorporates a photodiode, a current amplifier and a luminous-efficiency correction function in a single chip. This device has high sensitivity and excellent output linearity relative to change in the ambient brightness of the operating environment. The device also features little variation in light current ratio between light sources and so supports operation at a lower voltage than the previous series. Moreover, the power dissipation of this photo-IC is reduced even in standby mode through the use of a newly added standby pin. As a power-saving device with further enhanced functionality, the TPS856 contributes to power saving in various display devices.

■ Features

- Small and thin surface-mount package: 1.6 x 1.6 x 0.55 mm (typ.)
- Current linear output type: incorporating a photodiode and a current amplifier in a single chip
- High sensitivity: light current (I_L) = 40 to 80 µA @Ev = 100 lx using fluorescent light
- Light current ratio (I_L@ incandescent light / I_L@ fluorescent): 1.0 x (typ.)
- Low supply voltage: V_{CC} = 1.8 to 5.5 V
- Built-in standby function
- Silicon is used as the chip material. This product can be used in place of a CdS cell.

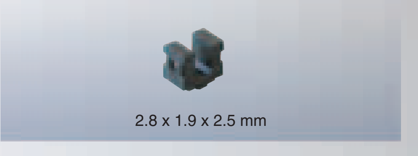
■ Comparisons of the New TPS856 to the Conventional TPS852 and TPS853

Part Number	Package Dimensions (mm)	Power Supply (V)	Light Current (µA) @ Ev = 100 lx using Fluorescent Light	Light Source Ratio (Incandescent Light to Fluorescent Light)	Standby Function	Output Logic (Dark → Bright)
TPS852	1.6 x 1.6 x 0.55(t)	2.7 to 5.5	27 to 54	1.2 x (typ.)	No	Low → High
TPS853	2.1 x 2.0 x 0.7(t)	2.2 to 5.5	37 to 74	1.2 x (typ.)	Yes	Low → High
TPS856	1.6 x 1.6 x 0.55(t)	1.8 to 5.5	40 to 80	1.0 x (typ.)	Yes	High → Low

Ultla Compact Package Suitable for Control of Optical Zoom and AF Lens on Cellular Phones

Ultra-Compact Surface-Mount Photointerrupter: TLP848

Ideal for optical zooming and AF lens position detection in digital cameras, digital video cameras and cellular phone cameras.


2.8 x 1.9 x 2.5 mm

■ Features

- Ultra-compact surface-mount package
  - Size: 2.8 x 1.9 x 2.5 mm ⇒ 50% in volume as compared with TLP846 (Toshiba existing product)
  - Detection gap with: 1.2 mm⇒ Same as TLP846 (Toshiba existing product)
- High current transfer ratio: I_C/I_F = 3 to 24 %

TCS10/11 Digital-Output Magnetic Sensor Series

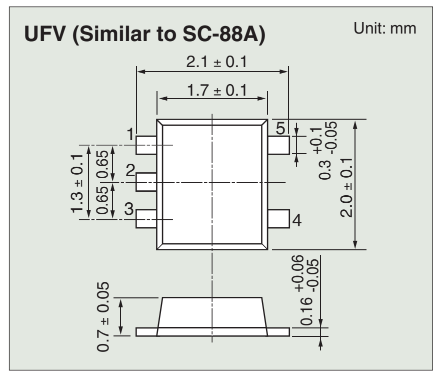
Ideal for applications with open/close contacts

- Senses the magnetic flux density in the longitudinal field.
- Provides a digital output.
- Senses the S, N or both poles.

Dual-Pole (S and N) Magnetic Sensors

Item	Specification **(TCS10DPU, TCS10DLU, TCS11DLU)**
Power Supply	V_{CC} = 2.3 to 3.6 V
Magnetic Flux Density	B_{ON} = 1.8 mT (typ.) B_{OFF} = 0.8 mT (typ.) Hysteresis (BH) = 1.0 mT (typ.)
Current Consumption (V_{CC} = 2.3 to 2.7 V)	Average = 8.5 μA (typ.)
Output Configuration	Push-pull, open-drain (5-V-tolerant)

UFV (Similar to SC-88A) Unit: mm



Part Naming Schemes

TCS 10 D P U
a b c d e

a: Toshiba magnetic sensors

b: Sensor characteristics
- 10: Highly sensitive
- 11: Highly sensitive and inverted output

C: Polarity
- S: S-pole sensing
- N: N-pole sensing
- D: S and N pole sensing

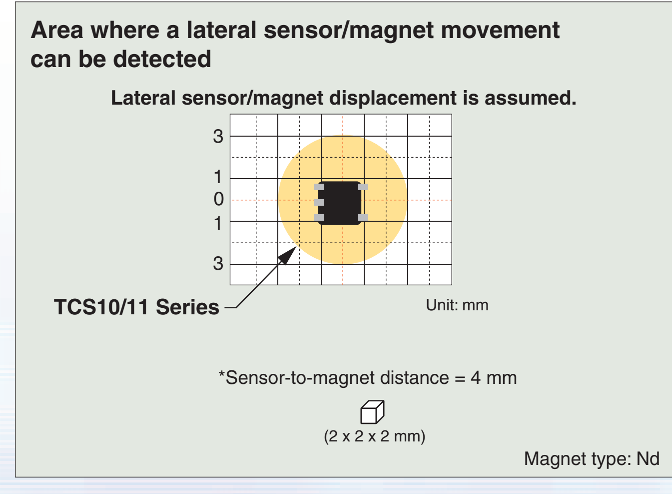
d: Output configuration
- P: Push-pull
- L: Open-drain

e: Packaging
- U: UFV (Similar to SC-88A)

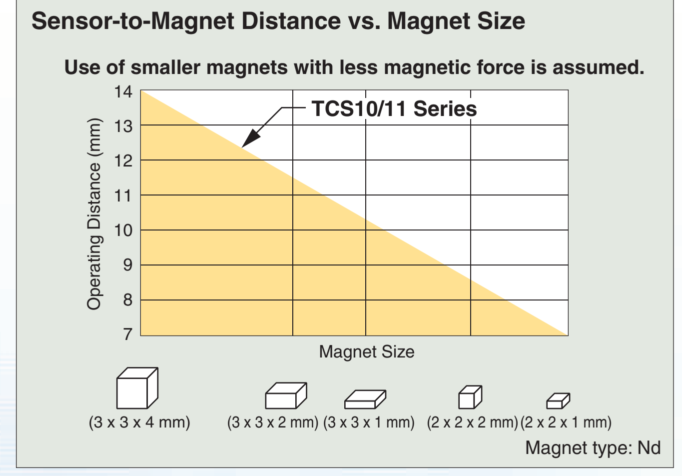
Application Data

Toshiba's magnetic sensors help improve system design flexibility due to their high sensitivity.

Area where a lateral sensor/magnet movement can be detected



Sensor-to-Magnet Distance vs. Magnet Size



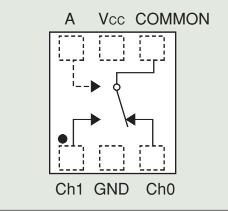
Product Offerings

Part Number	Sensed Pole	Output Configuration	Package
TCS10SPU	S	Push-pull	UFV (2.0 x 2.1 x 0.7 mm*) *Similar to SC-88A.
TCS10SLU		Open-drain	
TCS11SLU		Inverted output; open-drain	
TCS10NPU	N	Push-pull	
TCS10NLU		Open-drain	
TCS11NLU		Inverted output; open-drain	
TCS10DPU	S and N	Push-pull	
TCS10DLU		Open-drain	
TCS11DLU		Inverted output; open-drain	

Ultra-Small, Low ON-Resistance Analog Switches

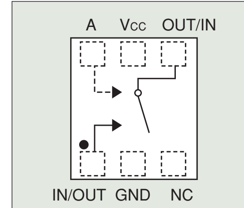
TCFS201FC SPDT

- ON-resistance flatness:
  $R_{ON\text{-}flatness}$ = 0.5 Ω (typ.) @ V_{CC} = 3.6 V
- ON-resistance: R_{ON} = 1.9 Ω (typ.) @ V_{CC} = 3.6 V
- Supply voltage: V_{CC} = 1.65 to 3.6 V
- Small package: CST6C 1.15 x 1.5 x 0.38 mm

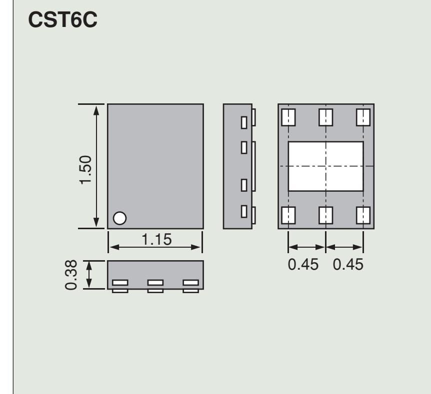


TCFS101FC SPST

- ON-resistance flatness:
  $R_{ON\text{-}flatness}$ = 0.3 Ω (typ.) @ V_{CC} = 3.6 V
- ON-resistance: R_{ON} = 0.8 Ω (typ.) @ V_{CC} = 3.6 V
- Supply voltage: V_{CC} = 1.65 to 3.6 V
- Small package: CST6C 1.15 x 1.5 x 0.38 mm

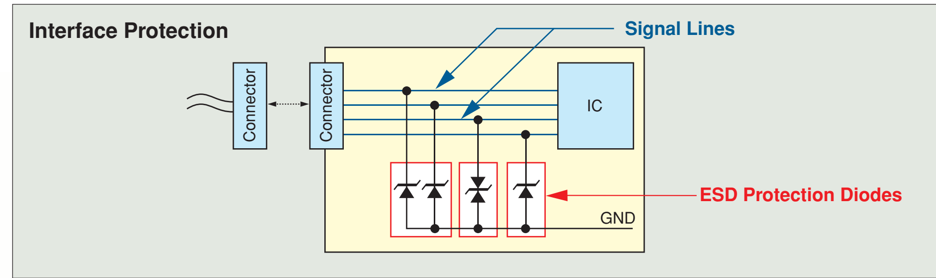


■ Package Dimensions



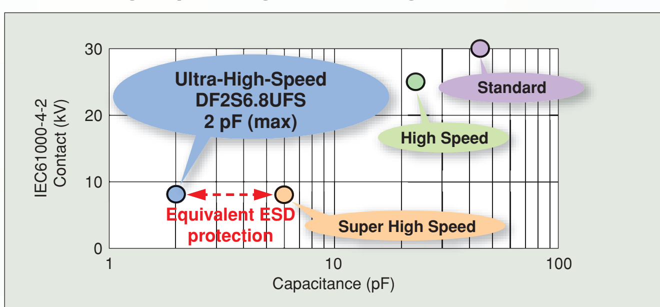
ESD Protection Diodes

■ Application Example



■ DF2S6.8UFS: Low capacitance and high ESD protection

Ideal for high-speed signal lines (e.g., USB 2.0)

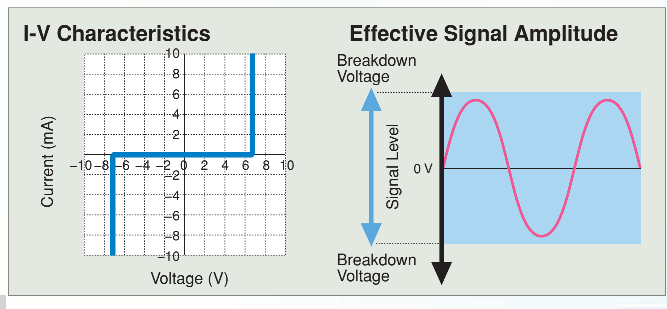


■ General Specification

Characteristics (Symbol)	Rating (Test Condition)
Reverse stand-off voltage (V_{RWM})	5.0 V (max)
Reverse voltage (V_R)	6.8 V (typ.) @I_R = 1 mA
Reverse current (I_R)	0.5 µA (max) @V_{RWM} = 5 V
Diode capacitance (CT)	2 pF (max) @V_R = 0 V, f = 1 MHz
Forward breakdown voltage	25 V (typ.)
ESD immunity	≥ ±8 kV @IEC61000-4-2 (contact)
Package	fSC: 1.0 x 0.6 x 0.48 mm

■ DF2B6.8FS: Bidirectional ESD protection diode

Ideal for audio signal line protection



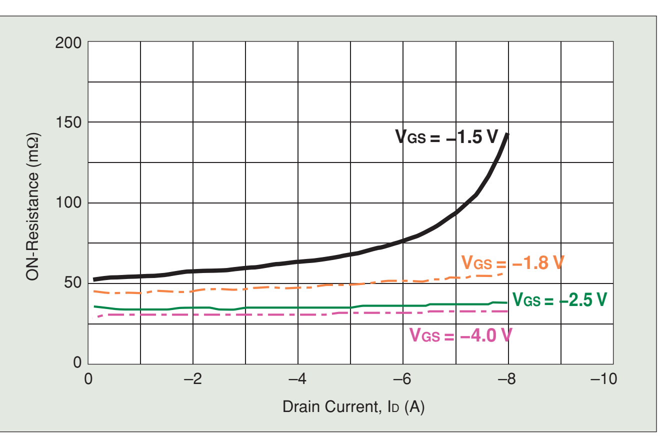
■ General Specifications

Characteristics	Rating (Test Condition)
Breakdown voltage	6.8 V (typ.) @I_R = 5 mA
Reverse current	0.5 µA (max) @V_R = 5 V
ESD immunity	≥ ±8 kV @IEC61000-4-2 (contact)
Diode capacitance	15 pF (typ.) @V_R = 0 V, f = 1 MHz
Package	fSC: 1.0 X 0.6 X 0.48 mm

Devices for Small Power Supplies: MOSFETs and CMOS LDO Regulators

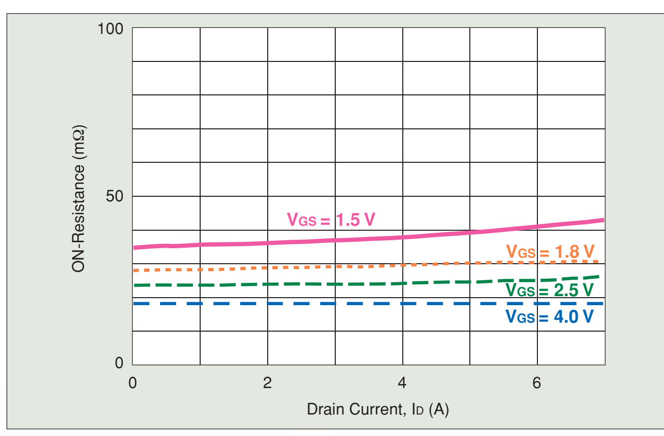
P-Channel MOSFET for Load Switch: SSM3J120TU

- 1.5-V operative
- Ultra-low ON-resistance P-channel MOSFET
- Absolute Maximum ratings
  - V_{DSS} = –20 V
  - V_{GSS} = ±8 V
  - I_D = –4 A
- Main characteristics
  - Ron = 38 mΩ max @V_{GS} = –4.0 V
  - Ron = 49 mΩ max @V_{GS} = –2.5 V
  - Ron = 140 mΩ max @V_{GS} = –1.5 V
  - Ciss = 1484 pF typ. @V_{DS} = –20 V
- Small-Power UFM package: 2.0 x 2.1 x 0.7 mm



N-Channel MOSFET for Load Switch: SSM3K123TU

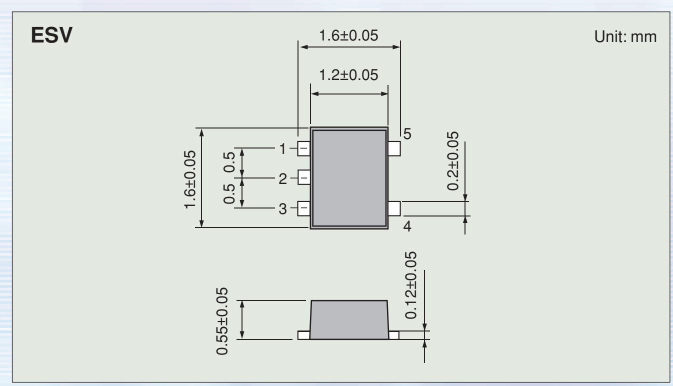
- 1.5-V operative
- Ultra-low ON-resistance N-channel MOSFET
- Absolute Maximum ratings
  - V_{DSS} = 20 V
  - V_{GSS} = ±10 V
  - I_D = 4.2 A
- Main characteristics
  - Ron = 28 mΩ max @V_{GS} = 4.0 V
  - Ron = 32 mΩ max @V_{GS} = 2.5 V
  - Ron = 66 mΩ max @V_{GS} = 1.5 V
  - Ciss = 1010 pF typ. @V_{DS} = 10 V
- Small-power UFM package: 2.0 x 2.1 x 0.7 mm



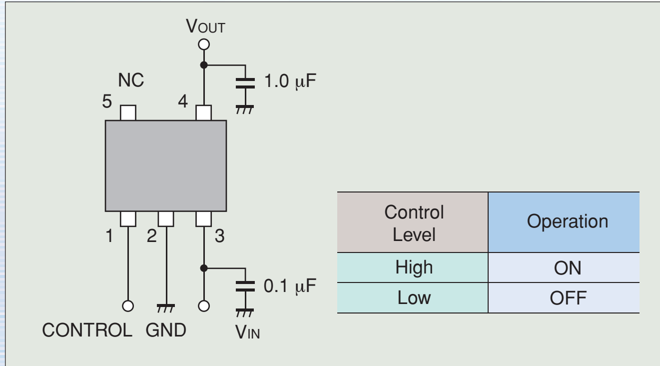
CMOS LDO Regulators in a Tiny Package: TCR5SCxxFE

- Output current: I_{OUT} (max) = 150 mA
- Low dropout voltage: V_{drop} = 90 mV (typ.) @ I_{OUT} = 50 mA, TCR5SC25FE
- Base current: I_B (typ.) = 32 µA @ I_{OUT} = 0 mA
- Ripple rejection: R.R. (typ.) = 70 dB @ f = 1 kHz
- Output noise voltage: V_{NO} (typ.) = 100 µVrms @ I_{OUT} = 10 mA
- Available with an output voltage of 1.5 V to 3.6 V in 0.1-V steps
- Overcurrent protection
- Small package: ESV

■ Package



■ Pin Configuration



Control Level	Operation
High	ON
Low	OFF

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(As of April 01, 2008)

2008-9

SCE0008H

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