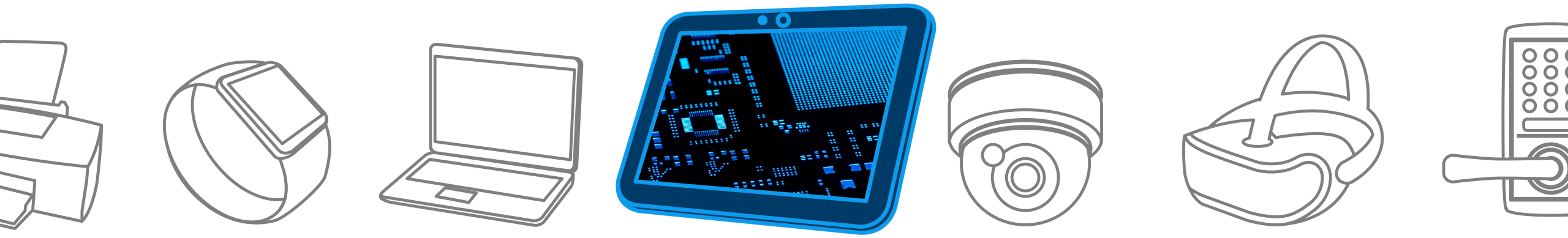
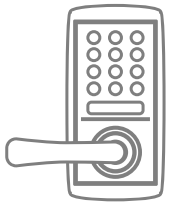
TOSHIBA

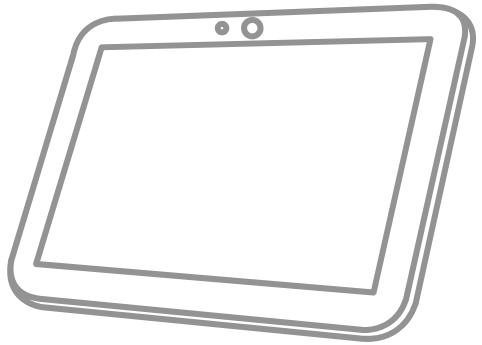
R20

Tablet Device

Solution Proposal by Toshiba

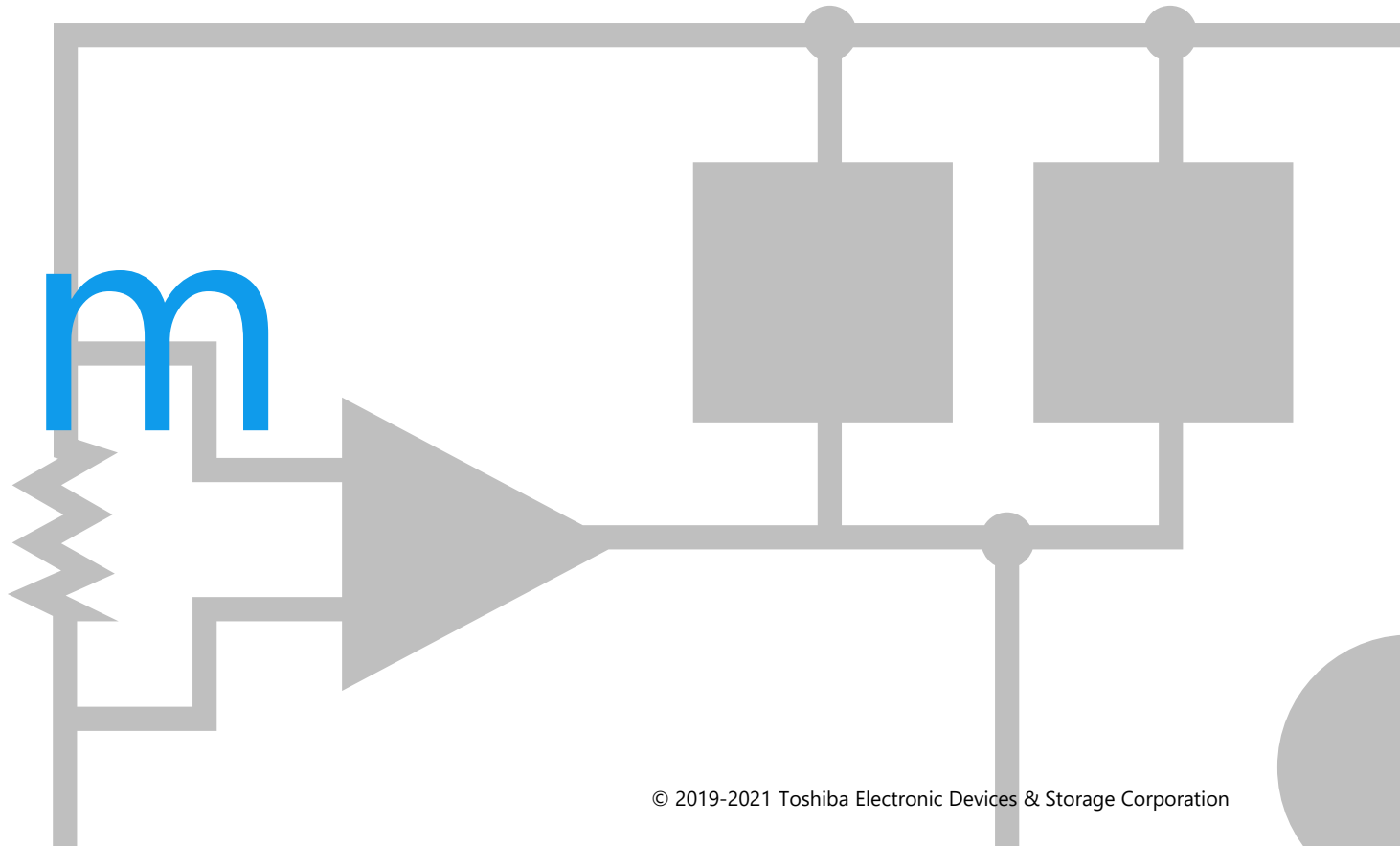




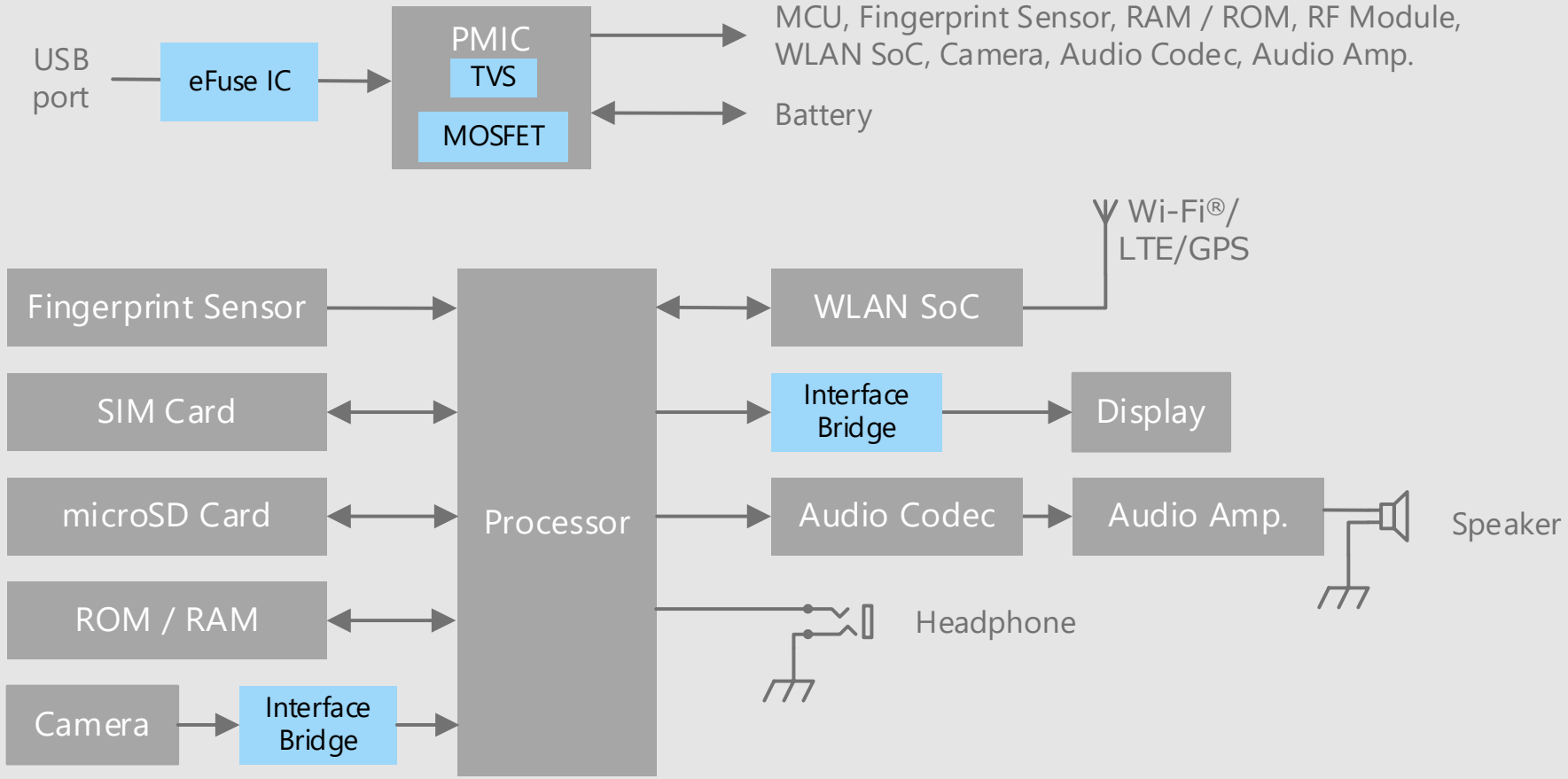


Toshiba Electronic Devices & Storage Corporation provides comprehensive device solutions to customers developing new products by applying its thorough understanding of the systems acquired through the analysis of basic product designs.

Block Diagram



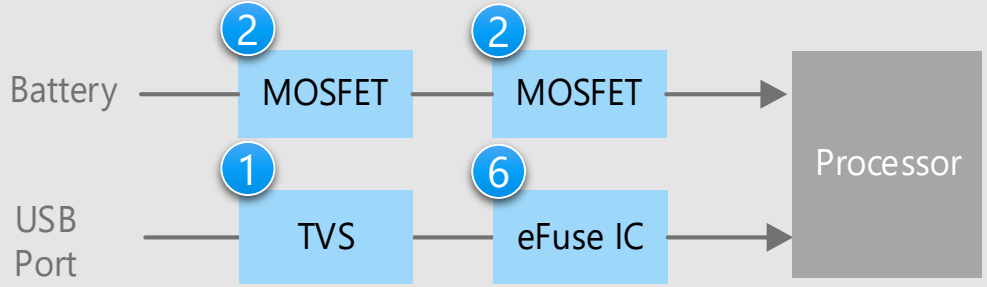
Tablet Device　Overall block diagram



System power circuit

Method using power controller

Method without power controller



※ Click on the blue circled numbers above to view detailed descriptions.

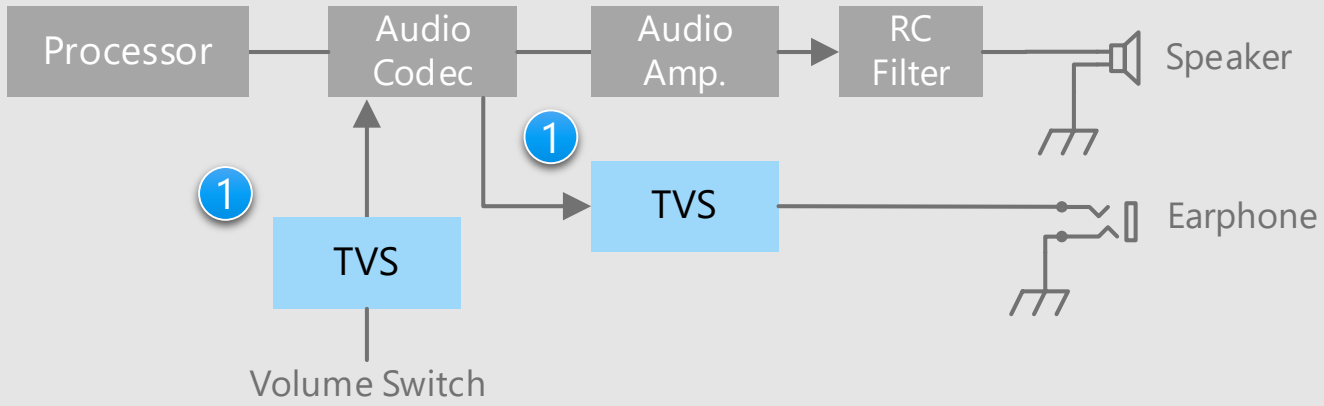
Criteria for device selection

- A low R_{DYN} of an electrostatic protection diode (TVS) is important parameter of protection performance.
- MOSFETs are suitable for control of USB power circuits.
- Board area reduction is possible by using small packages.

Proposal from Toshiba

- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals**
  TVS diode (1)
- **Low power dissipation sets possible by means of low ON resistance**
  Small signal MOSFET (2)
- **Robust protection function**
  Electronic fuse (eFuse IC) (6)

Audio circuit



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Criteria for device selection

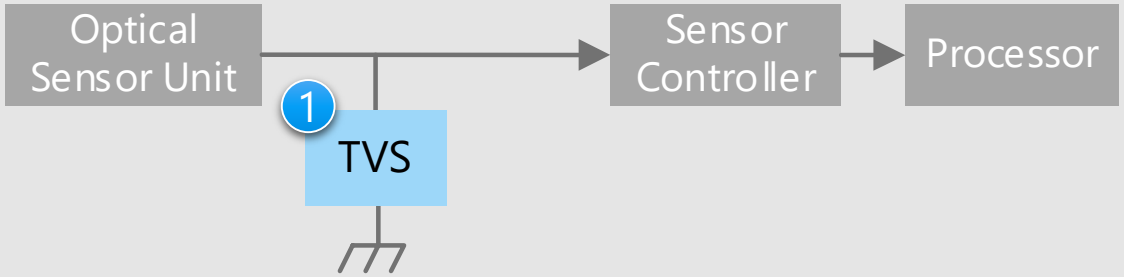
- A low R_{DYN} of an electrostatic protection diode (TVS) is important parameter of protection performance.
- Board area reduction is possible by using small packages.

Proposal from Toshiba

- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals**
  TVS diode 1

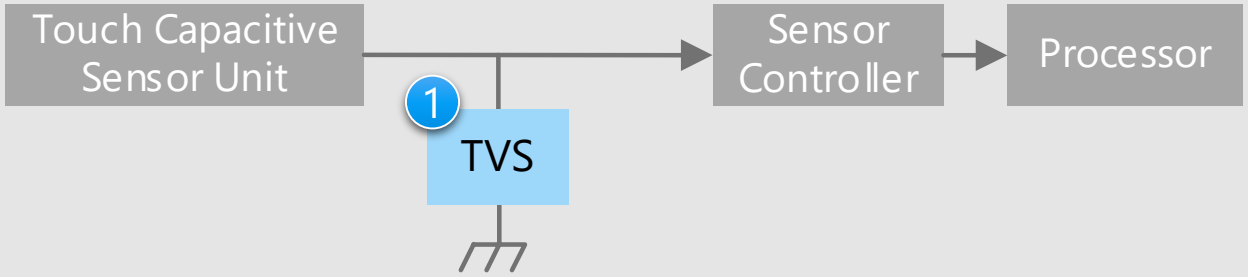
Touch sensor circuit

Optical type



Touch sensor circuit

Capacitive type



※ Click on the blue circled numbers above to view detailed descriptions.

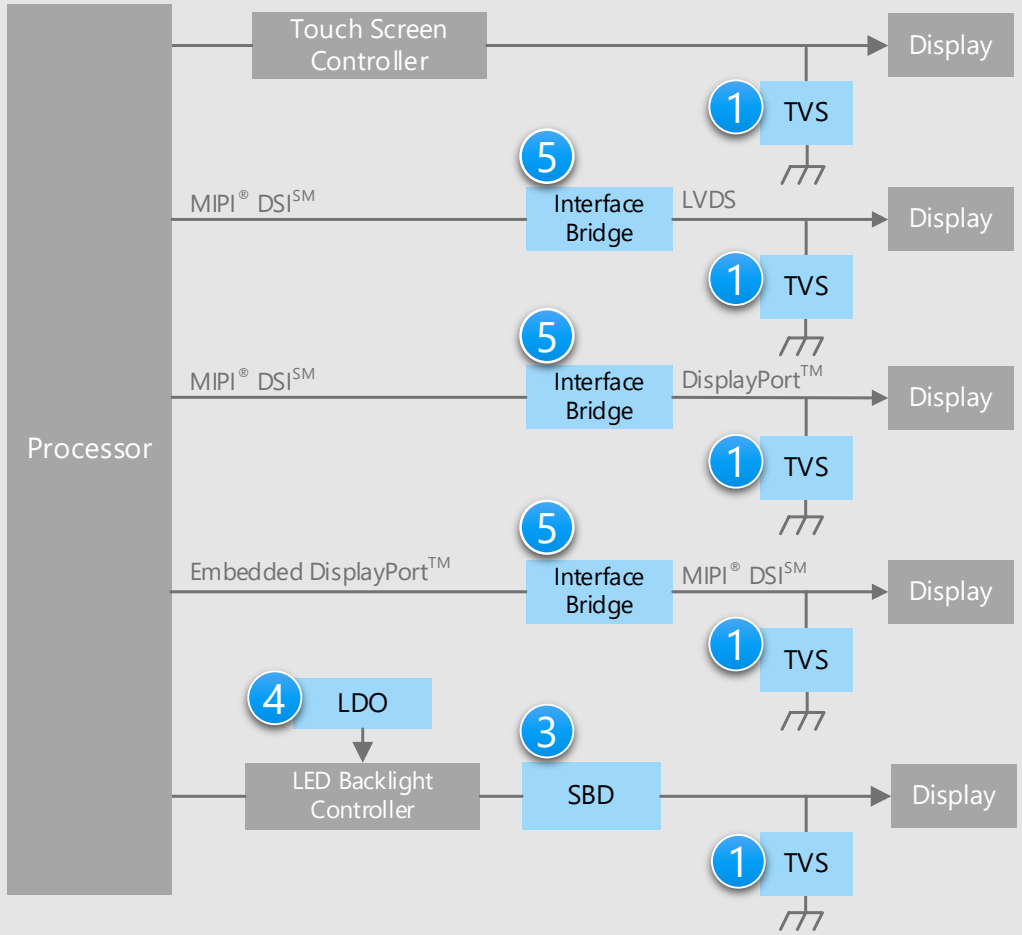
Criteria for device selection

- A low R_{DYN} of an electrostatic protection diode (TVS) is important parameter of protection performance.
- Board area reduction is possible by using small packages.

Proposal from Toshiba

- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals**
  TVS diode ①

Display circuit



※ Click on the blue circled numbers above to view detailed descriptions.

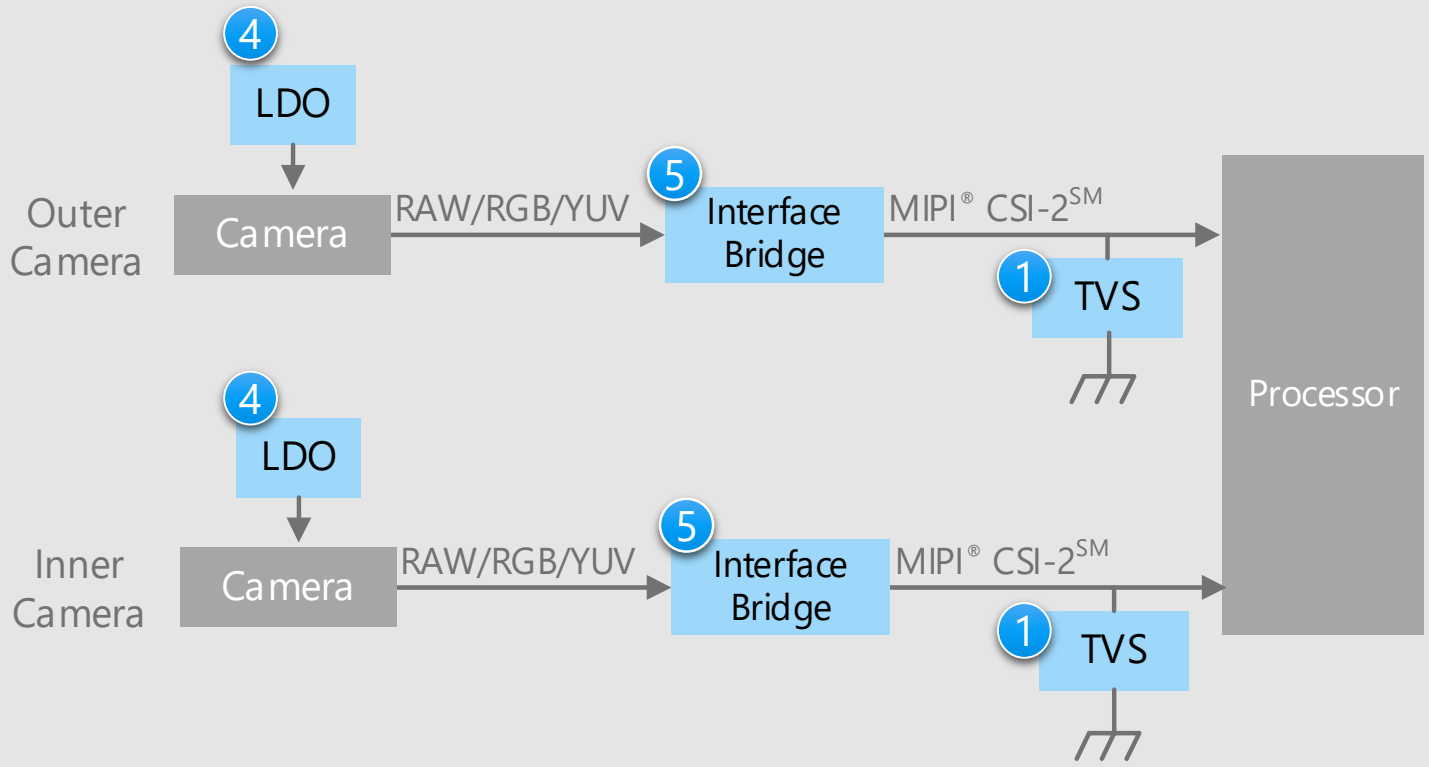
Criteria for device selection

- A low R_{DYN} of an electrostatic protection diode (TVS) is important parameter of protection performance.
- Low V_F & low I_R are essential for SBDs.
- Board area reduction is possible by using small packages.
- Display components can be selected without concern for interface standards.

Proposal from Toshiba

- **Prevent malfunctions by absorbing external electrostatic discharge (ESD)**
  TVS diode (1)
- **High speed, low power**
  Schottky barrier diode (3)
- **Resistant to power supply noise**
  Small surface mount LDO regulator (4)
- **Absorb differences in interfaces**
  Interface bridge (5)

Camera unit circuit



※ Click on the blue circled numbers above to view detailed descriptions.

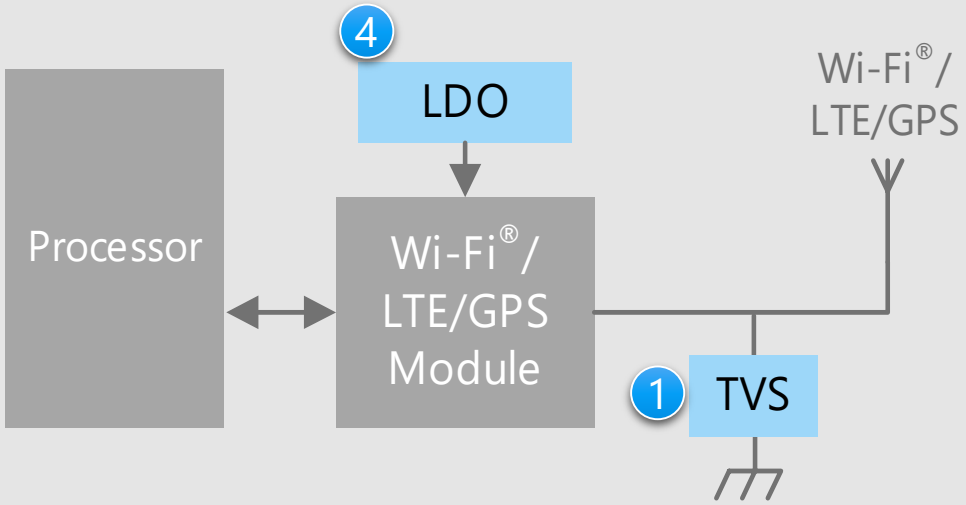
Criteria for device selection

- PSRR (Power Supply Rejection Ratio) is an important parameter for camera modules.
- Small, low C_t TVS diodes are suited for ESD protection.
- Board area reduction is possible by using small packages.
- Camera components can be selected without concern for interface standards.

Proposal from Toshiba

- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals**
  TVS diode 1
- **Resistant to power supply noise**
  Small surface mount LDO regulator 4
- **Absorb differences in interfaces**
  Interface bridge 5

Wireless circuit



※ Click on the blue circled numbers above to view detailed descriptions.

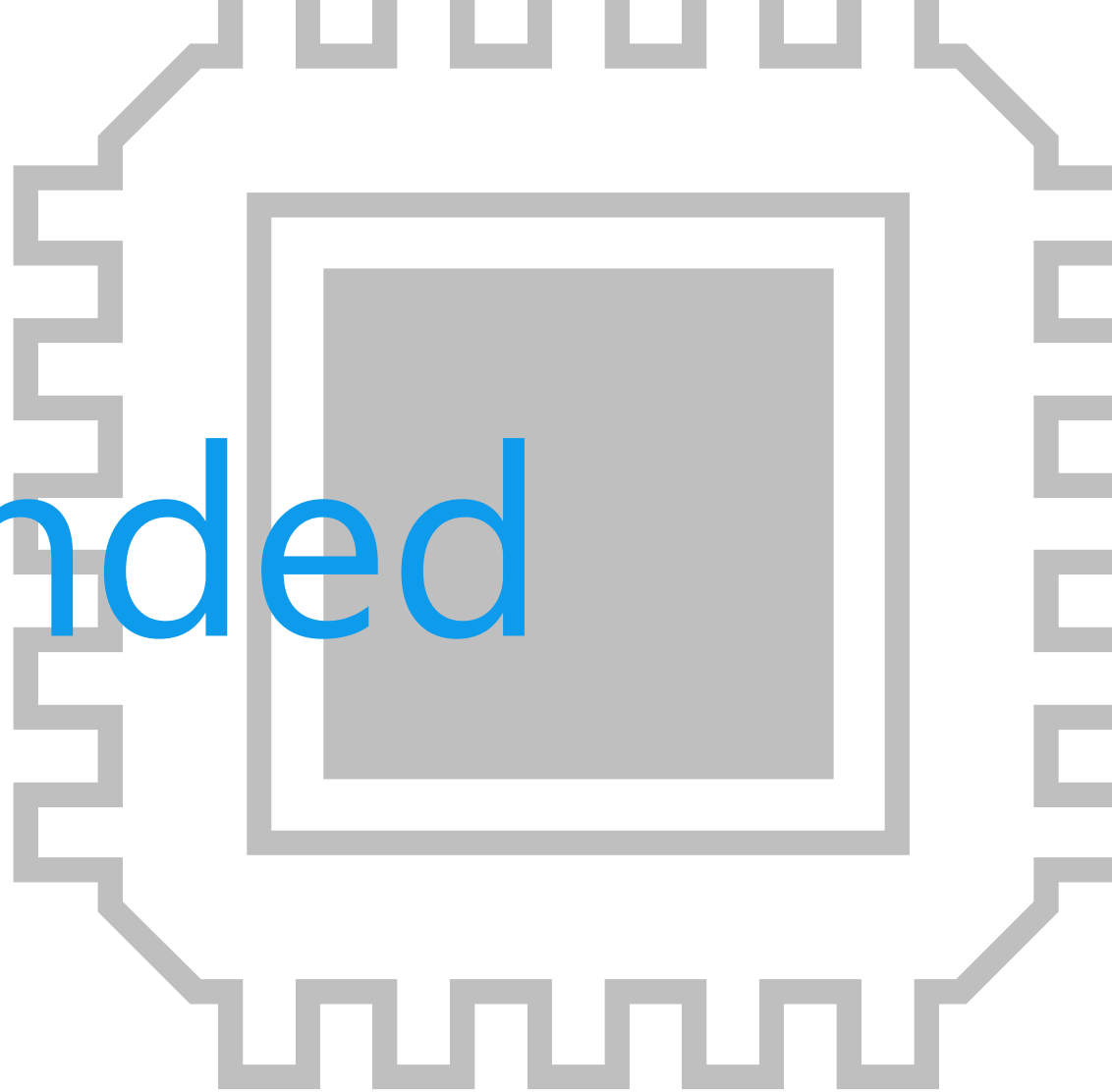
Criteria for device selection

- Due to small device size, small components are required.
- Wi-Fi® system requires power supply with large current capability.

Proposal from Toshiba

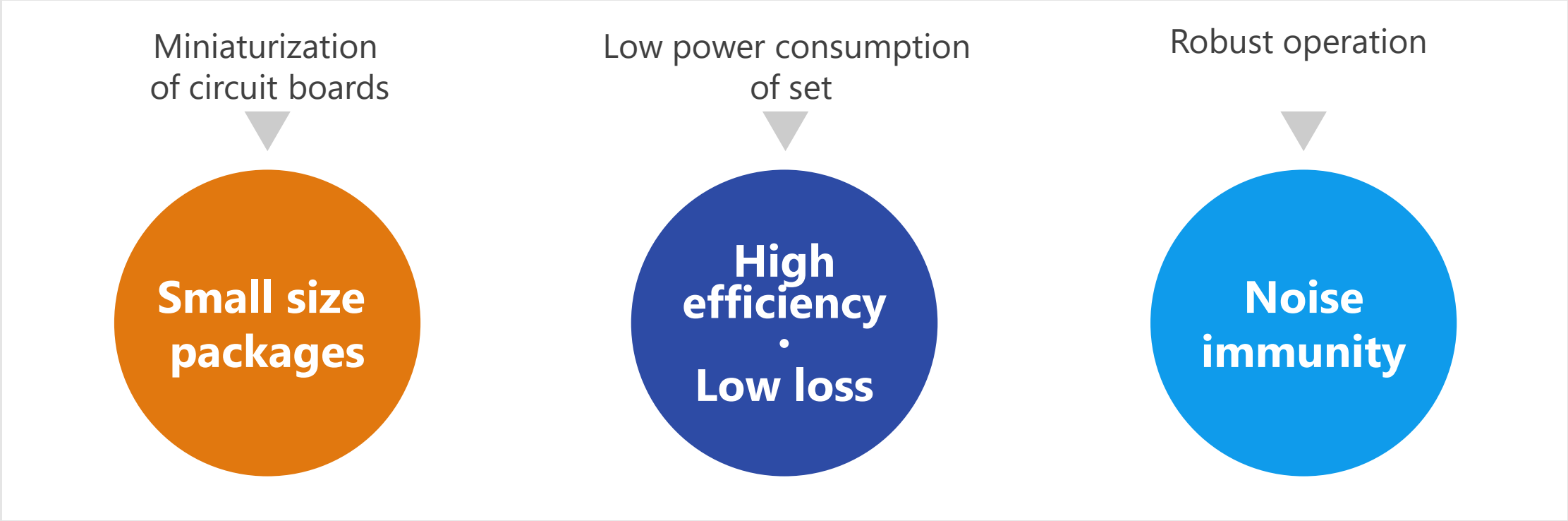
- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals**
  TVS diode　1
- **Resistant to power supply noise**
  Small surface mount LDO regulator　4

Recommended Devices



Device solutions to address customer needs

As described above, in the design of tablet device, **“Miniaturization of circuit boards”**, **“Low power consumption of set”** and **“Robust operation”** are important factors. Toshiba’s proposals are based on these three solution perspectives.



Device solutions to address customer needs

	Small size packages	High efficiency • Low loss	Noise immunity
1 TVS diode	●	●	●
2 Small signal MOSFET	●	●	
3 Schottky barrier diode	●	●	●
4 Small surface mount LDO regulator	●	●	●
5 Interface bridge	●		●
6 Electronic fuse (eFuse IC)	●	●	

1 TVS diode

DF2B7ASL / DF2S14P1CT / DF2B5M4ASL / DF2B6M4ASL

Small size packages | High efficiency · Low loss | Noise immunity

Value provided

Absorbs static electricity (ESD) from external terminals, prevents circuit malfunction, and protects devices.

1 Improved ESD pulse absorption

Improved ESD absorption compared to conventional products. (50 % reduction in operating resistance) For some products, both low operating resistance and low capacitance are realized and ensures high signal protection performance and signal quality.

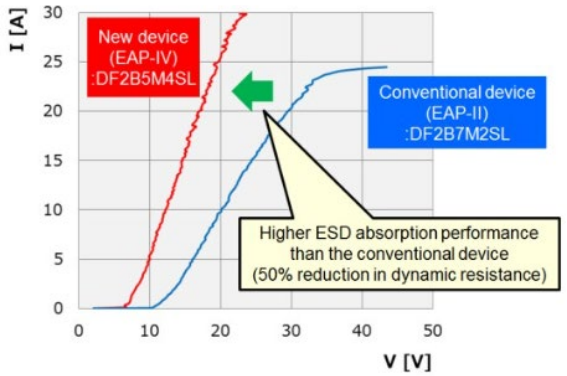
2 Suppress ESD energy by low clamp voltage

Steadily protect the connected circuits/devices using proprietary technology.

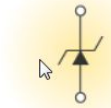
3 Optimal for high-density mounting

A variety of compact packages are available.

ESD Pulse Absorption Performance (Toshiba internal comparison)



Unidirectional



Suitable for paths such as logic signals. There is lineups of 1in1, 2in1, 4in1, 5in1, 7in1.

Bidirectional

Suitable for paths with both polar signals such as audio signals

Line up

Part number	DF2B7ASL	DF2S14P1CT	DF2B5M4SL	DF2B6M4SL
Package	SL2 	CST2 	SL2 	SL2 
V_{ESD} (Max) [kV]	±30	±30	±16	±15
V_{RWM} (Max) [V]	5.5	12.6	3.6	5.5
C_t (Typ.) [pF]	8.5	40	0.15	0.15
R_{DYN} (Typ.) [Ω]	0.2	0.5	0.7	0.7

(NOTE) : This product is designed for ESD protection purpose and cannot be used for purposes other than ESD protection (including but not limited to voltage regulation applications).

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Value provided

Suitable for power management, contributes to miniaturization

1 Low voltage operation

Operates at V_{DS} = 4.5 V

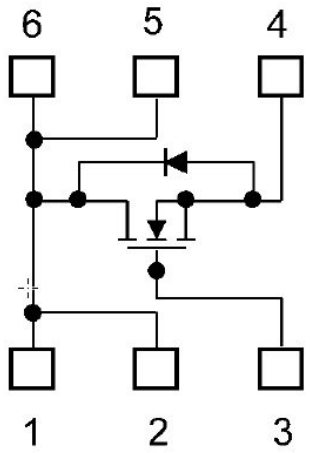
2 Low on-resistance

By reducing source-drain on-resistance, heat radiation and power dissipation is minimized.

3 Small package

Encapsulated in SOT-1220 (2.0 x 2.0 mm)

SSM6K513NU equivalent circuit



Line up

Part number		SSM6K513NU	SSM6N55NU	SSM6J507NU
Package		UDFN6B	UDFN6B	UDFN6B
V_{DSS} (Max) [V]		30	30	-30
I_D (Max) [A]		15	4	-10
$R_{DS(ON)}$ [mΩ] @V_{GS} = 4.5 V	Typ.	8.0	48	19
	Max	12	64	28
Polarity		N-ch	N-ch x 2	P-ch

◆Return to Block Diagram TOP

3 Schottky barrier diode

CUHS20F40 / CTS05F40

Small size packages | High efficiency · Low loss | Noise immunity

Value provided

Fast, low-loss, small package and ideal for many applications

1 Fast switching

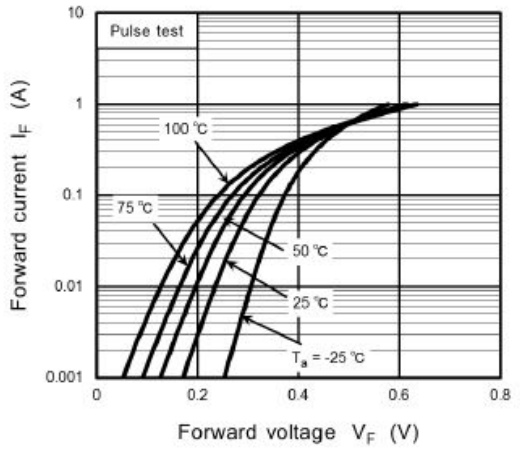
For fast switching applications.

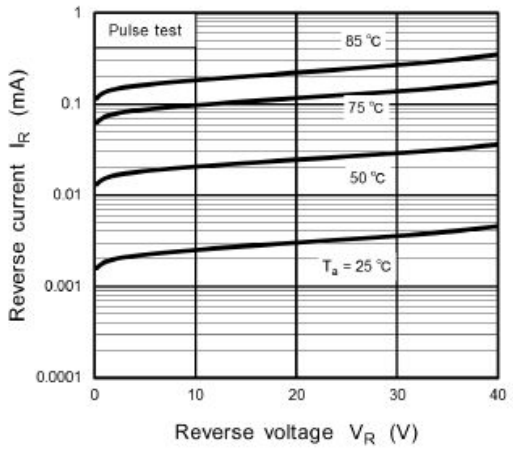
2 High reverse voltage

Reverse voltage V_R can be applied up to 40 V maximum.

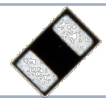
3 Small package

Small surface-mount packages for high-density assembly:
US2H : 2.5 x 1.4 x 0.6 mm
CST2 : 1.0 x 0.6 x 0.38 mm





Line up

Part number	CUHS20F40	CTS05F40
Package	US2H 	CST2 
I_O (Max) [A]	2.0	0.5
V_R (Max) [V]	40	40
V_F (Typ.) [V]	0.39 @I_F = 1.0 A	0.74 @I_F = 0.5 A
I_R (Max) [μA] @V_R = 40 V	60	15

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4 Small surface mount LDO regulator

TCR15AG / TCR13AG / TCR8BM / TCR5BM / TCR5RG / TCR3RM / TCR3U / TCR2L / TAR5 Series

Small size packages | High efficiency · Low loss | Noise immunity

Value provided

Wide line up from general-purpose type to small package type are provided. Contribute to realize a stable power supply not affected by fluctuation of battery.

1 Low dropout voltage

The newly developed new-generation process significantly improved the drop-out voltage characteristics.

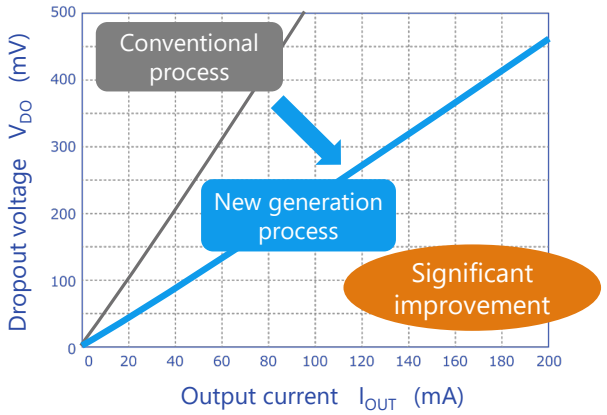
2 High PSRR Low output noise voltage

Many product series that realize both high PSRR (Power Supply Rejection Ratio) and low output noise voltage characteristics are provided. They are suitable for stable power supply for analog circuit.

3 Low current consumption

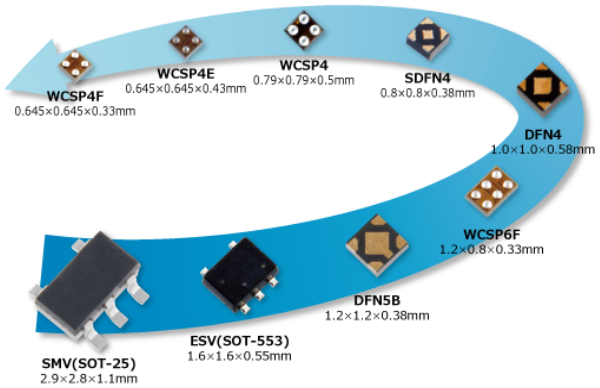
0.34 μA of $I_{B(ON)}$ is realized by utilizing CMOS process and unique circuit technology.

Low dropout voltage



Note: Toshiba internal comparison

Rich package line up



Line up

Part number	TCR15AG Series	TCR13AG Series	TCR8BM Series	TCR5BM Series	TCR5RG Series	TCR3RM Series	TCR3U Series	TCR2L Series	TAR5 Series
Features	Low dropout voltage High PSRR				High PSRR Low noise Low current consumption		Low current consumption		15V Input voltage Bipolar type
I_{OUT} (Max) [A]	1.5	1.3	0.8	0.5		0.3		0.2	
PSRR (Typ.) [dB] @f=1 kHz	95	90	98	98	100	100	70	-	70
I_B (Typ.) [μA]	25	52	20	19	7	7	0.34	1	170

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5 Interface bridge

TC358775XBG / TC358767AXBG / TC358860XBG / TC358746AXBG

Small size packages | High efficiency · Low loss | Noise immunity

Value provided

Eliminating the interface gap between host and display/camera allows more freedom of component selection

1 Wider component selection

Conversion of the interface allows shared procurement with other products as well as adoption of less inexpensive parts.

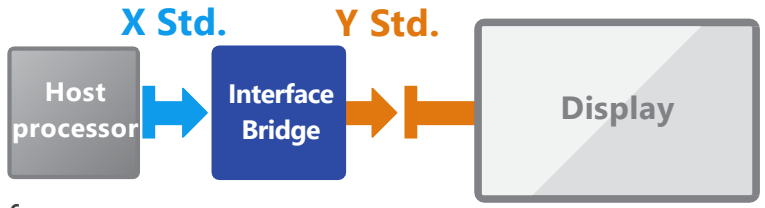
2 Noise immunity

Converting parallel communication to serial improves noise immunity and suppresses noise generation to the surroundings.

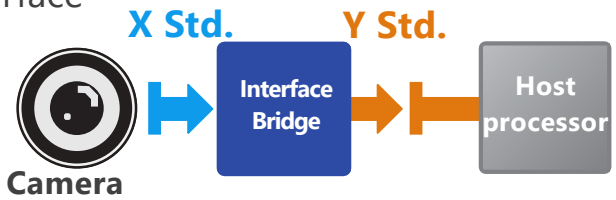
3 Less cabling

Converting from parallel communication to serial reduces total wiring the risks of wire breakage.

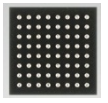
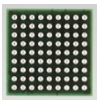
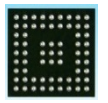
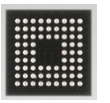
■ Display interface



■ Camera interface



Line up

Part number	TC358775XBG	TC358767AXBG	TC358860XBG	TC358746AXBG
Package	BGA64 	BGA81 	BGA65 	BGA72 
Input	MIPI® DSI℠1.01	(1)MIPI® DSI℠1.01 (2)MIPI® DPI℠2.0	VESA Embedded DisplayPort™ (eDP)	(1) MIPI® CSI-2℠ (2) Parallel 24bit
Output	LVDS Dual Link (5 pairs / link)	VESA DisplayPort™ 1.1a	MIPI® DSI℠1.02	(1) Parallel 24bit (2) MIPI® CSI-2℠

◆Return to Block Diagram TOP

6 Electronic fuse (eFuse IC)

TCKE8 Series / TCKE7 Series

Small size packages | High efficiency · Low loss | Noise immunity

Value provided

Electronic fuse (eFuse IC) can be used repeatedly to protect circuits from abnormal conditions such as overcurrent and overvoltage.

1 Can be used repeatedly

When overcurrent flows through the electronic fuse (eFuse IC), the internal detection circuit operates and switches off the internal MOSFET. It is not destroyed by a single overcurrent and can be used repeatedly.

2 IEC62368-1 certified

Toshiba's eFuse ICs are certified to the international safety standard IEC62368-1 (G9: Integrated circuit (IC) current limiters) and contribute to robust protection and simplification of circuit design.

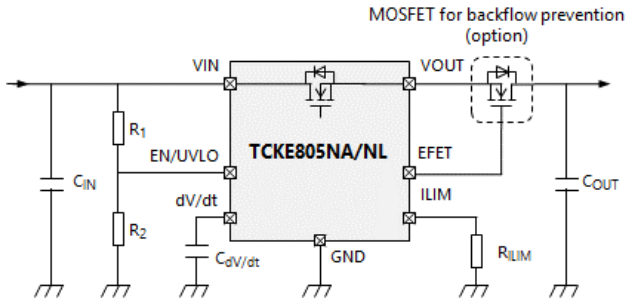
Note: TCKE712BNL is scheduled to be certified in Sep. 2021.

3 Rich protection functions

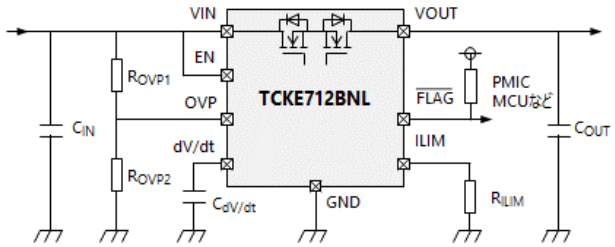
TCKE8 Series: short-circuit protection, overcurrent protection, overcurrent clamp function, overvoltage clamp function, thermal shut down, inrush current suppression, backflow prevention (optional), etc.

TCKE7 Series: short-circuit protection, overcurrent protection, overvoltage protection, thermal shut down, FLAG signal output, backflow prevention (built-in), etc.

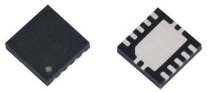
Reference circuit example of TCKE8 Series



Reference circuit example of TCKE7 Series



Line up

Part number	TCKE800NA/NL	TCKE805NA/NL	TCKE812NA/NL	TCKE712BNL
Package	WSON10B 3.0 x 3.0 x 0.75 mm 			WSON10 3.0 x 3.0 x 0.75 mm 
V_{IN} [V]	4.4 to 18			4.4 to 13.2
R_{ON} (Typ.) [mΩ]	28			53
Return function	NA: Automatic return NL: Latch type (external signal control)			Latch type (external signal control)
V_{OVC} (Typ.) [V]	-	6.04	15.0	Adjustable

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have questions or comments about any of them,
please do not hesitate to contact us below:

Contact address: https://toshiba.semicon-storage.com/ap-en/contact.html

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