# Surveillance Camera

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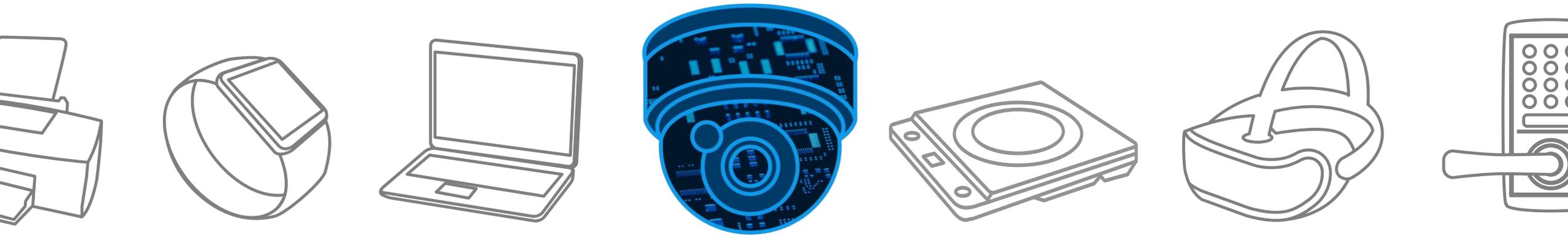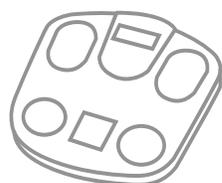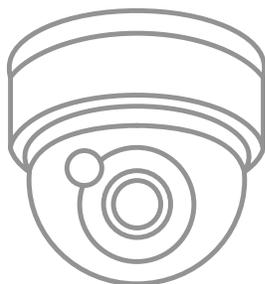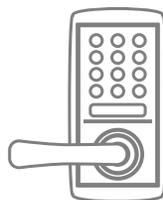
Toshiba Electronic Devices & Storage Corporation provides comprehensive device solutions to customers developing new products by applying its thorough understanding of the systems acquired through the analysis of basic product designs.

Block Diagram
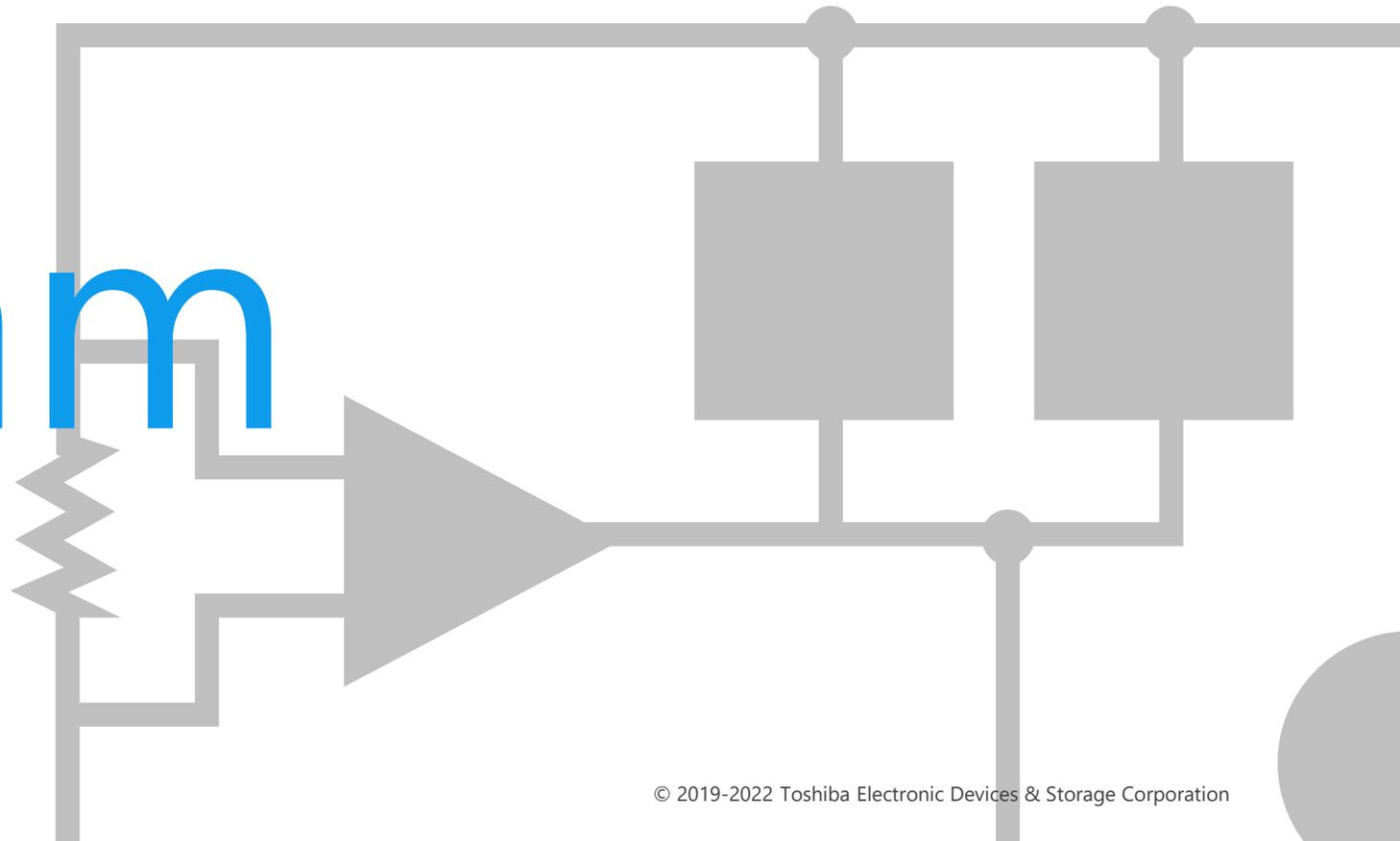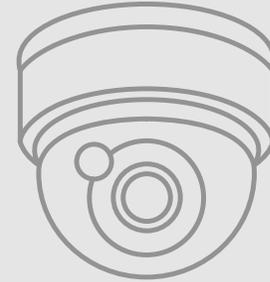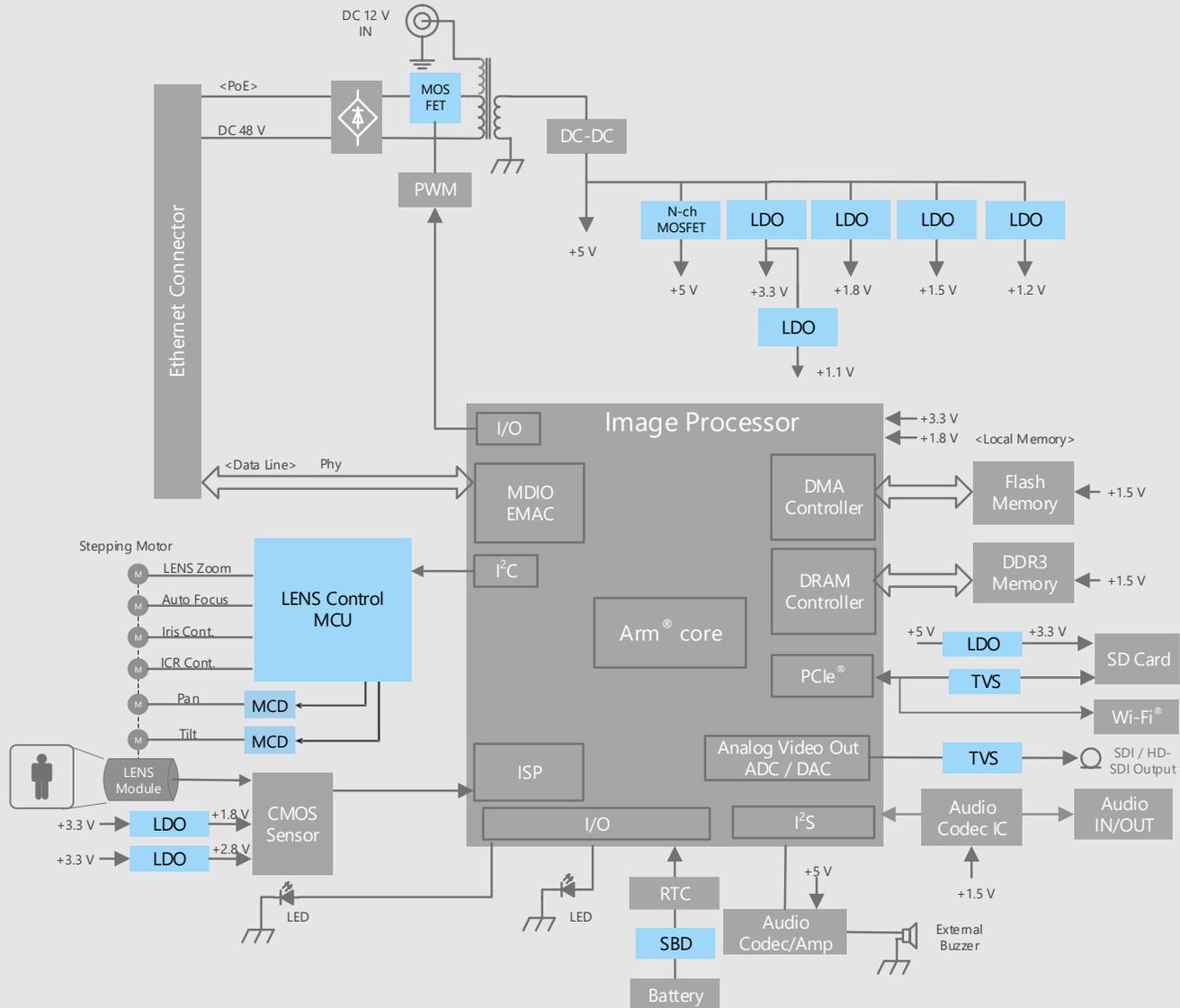
Power supply

DC 12 V
IN

③

<PoE>

MOS
FET

DC 48 V

Ethernet Connector

PWM

DC-DC

+5 V

① ② ② ② ②

N-ch
MOSFET | LDO | LDO | LDO | LDO

+5 V　+3.3 V　+1.8 V　+1.5 V　+1.2 V

② LDO

+1.1 V
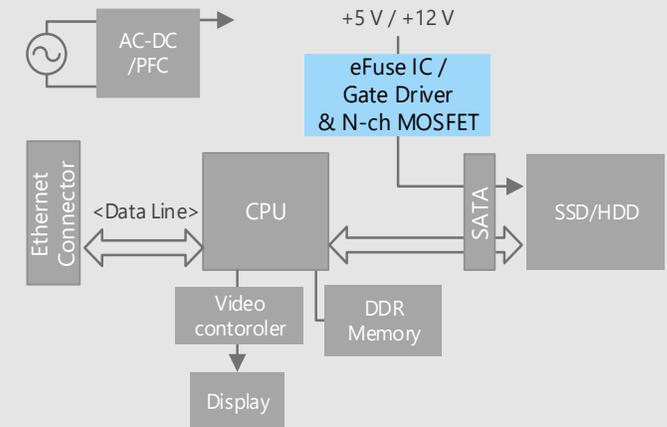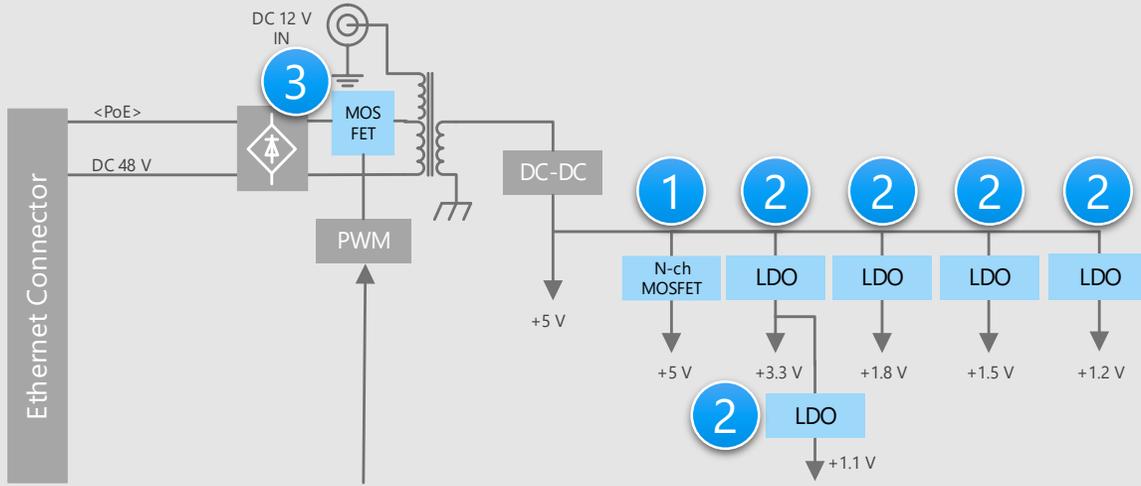
Power supply circuit of storage
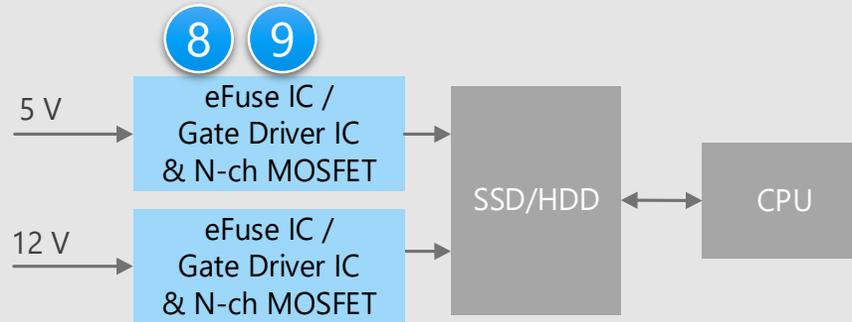
⑧ ⑨

5 V → eFuse IC /
Gate Driver IC
& N-ch MOSFET

12 V → eFuse IC /
Gate Driver IC
& N-ch MOSFET

SSD/HDD ↔ CPU

※ Click the number in the circuit diagram to jump to the detailed description page

Criteria for device selection

- MOSFETs with High speed and low on-resistance are suitable for the primary side of switching power supplies.
- MOSFETs with low on-resistance are suitable for load switches.

Proposals from Toshiba

- **Realize the set with low power consumption by low on-resistance**
  Small signal MOSFET　①
- **Supply the power with low noise**
  Small surface mount LDO regulator　②
- **Suitable for high efficiency power supply switching**
  U-MOS Series N-ch MOSFET　③
- **Built-in protection function against short circuit, over current, over voltage, etc.**
  Electronic fuse (eFuse IC)　⑧
- **Small package and built-in over voltage protection function**
  N-ch MOSFET gate driver IC　⑨

SD card section

LDO ②

PCIe® Bus

PCIe®

SD Express

Image Processor

④a

TVS

SD Card

SDI / HD-SDI

SDI / HD-SDI Output

④b

TVS

Power supply

SBD : Schottky barrier diode

SBD ⑤

RTC

Image Processor
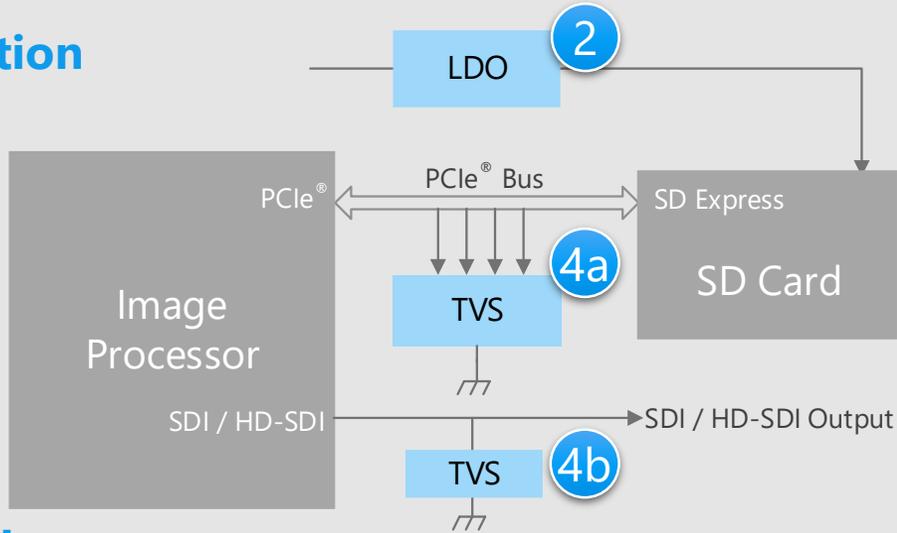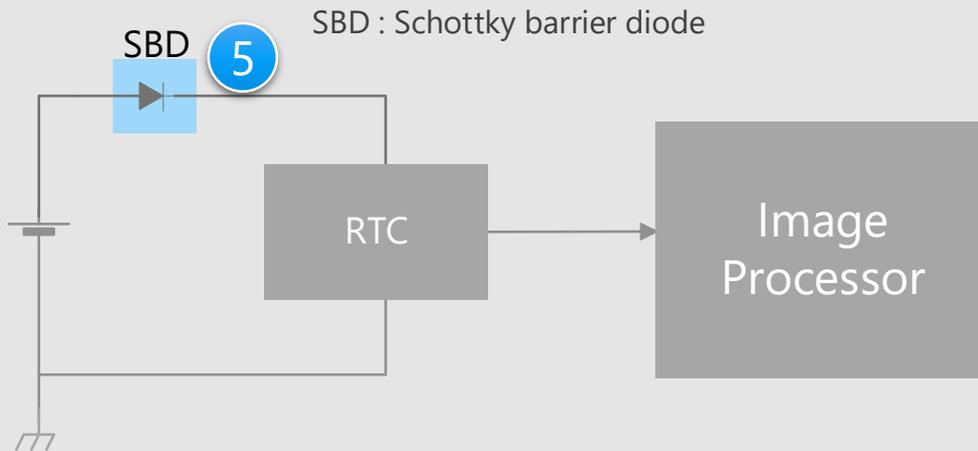
※ Click the number in the circuit diagram to jump to the detailed description page

Criteria for device selection

- The PSRR (Power Supply Rejection Ratio) of LDO regulator is important for SD memory card I/F.
- TVS diodes are suitable for ESD protection of high speed signal lines.
- Schottky barrier diodes with low loss are suitable for preventing current backflow.

Proposals from Toshiba

- **Supply the power with low noise**
  Small surface mount LDO regulator ②
- **Suitable for ESD protection**
  TVS diode ④a ④b
- **High speed, low loss, compact surface mounting**
  Schottky barrier diode ⑤

Detail of camera motion section

LENS Zoom
Auto Focus
Iris Cont
ICR Cont
Pan
Tilt

6

LENS Control MCU

I^2C

MCD
MCD

7a **7b**
7c **7d**

Image Processor

3.3 V
1.8 V
1.1 V

Power Supply

Ethernet Connector

Phy

LENS Module

CMOS Sensor
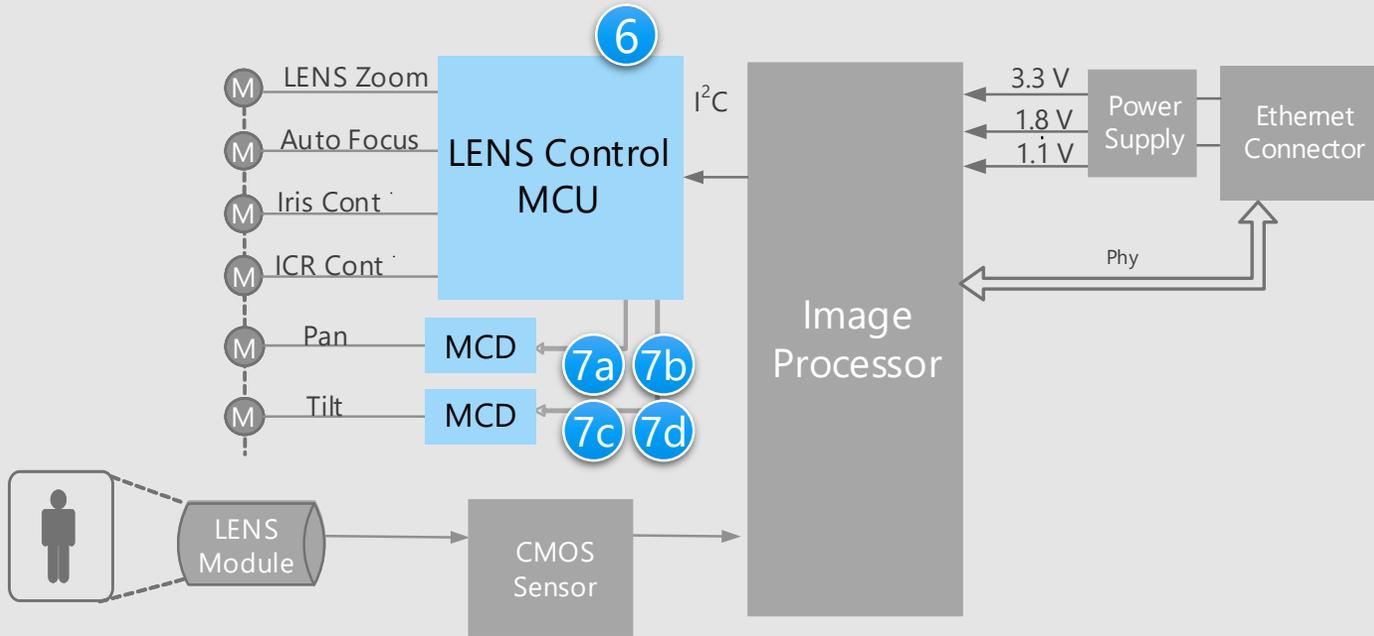
Criteria for device selection

- MCUs that can control multiple motors is suitable for controlling the lens.
- Small package products contribute to the reduction of circuit board area.

Proposals from Toshiba

-Low power consumption LENS motor control MCU
LENS control MCU   **6**

-Low on-resistance and high efficient stepping motor control
Motor control driver   **7a** **7b** **7c** **7d**

※ Click the number in the circuit diagram to jump to the detailed description page

Recommended Devices
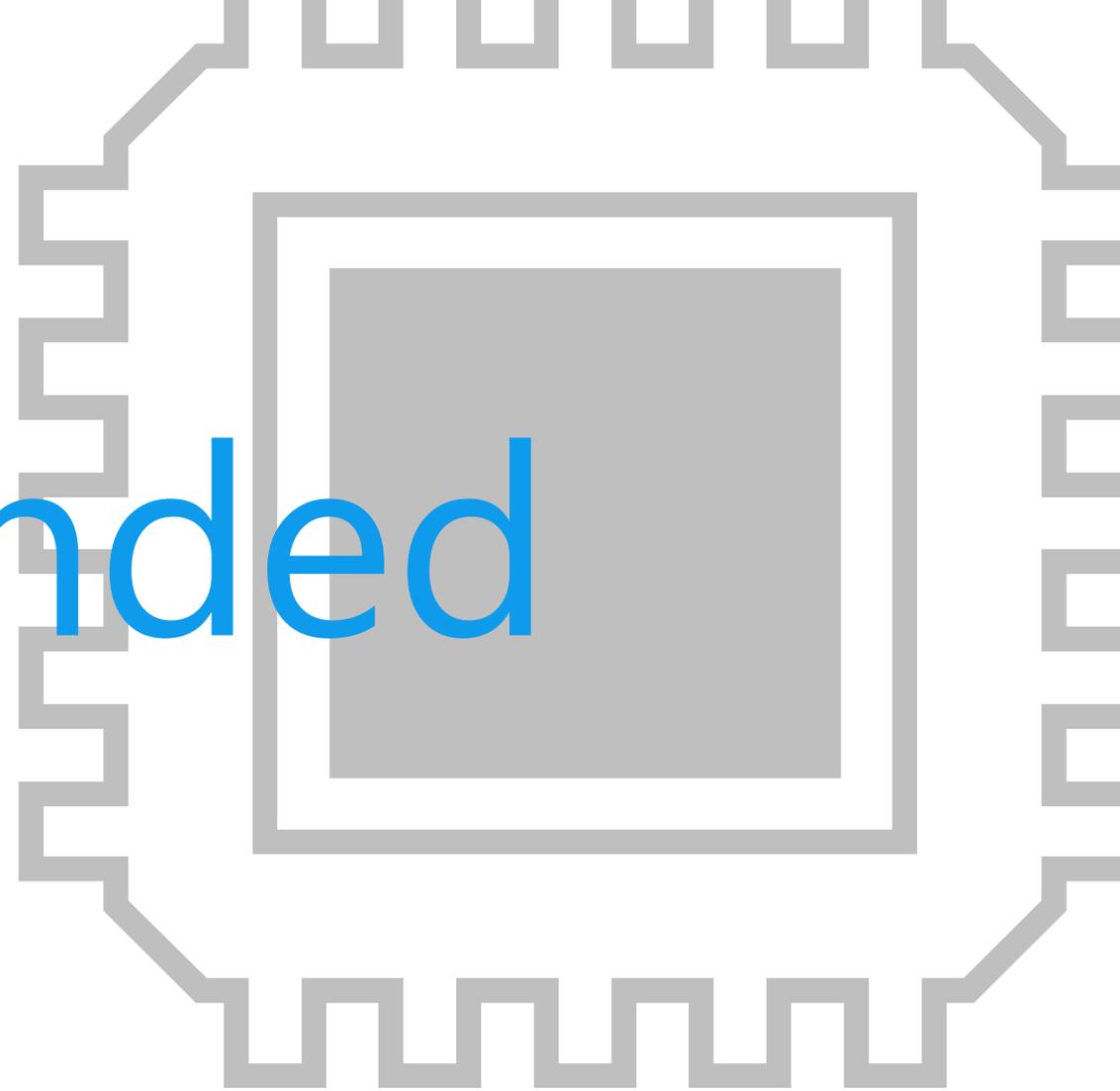
Device solutions to address customer needs

As described above, in the design of surveillance cameras, **"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.

Miniaturization
of circuit boards

Lower power
consumption of set

Robust operation

Small size packages

High efficiency · Low loss
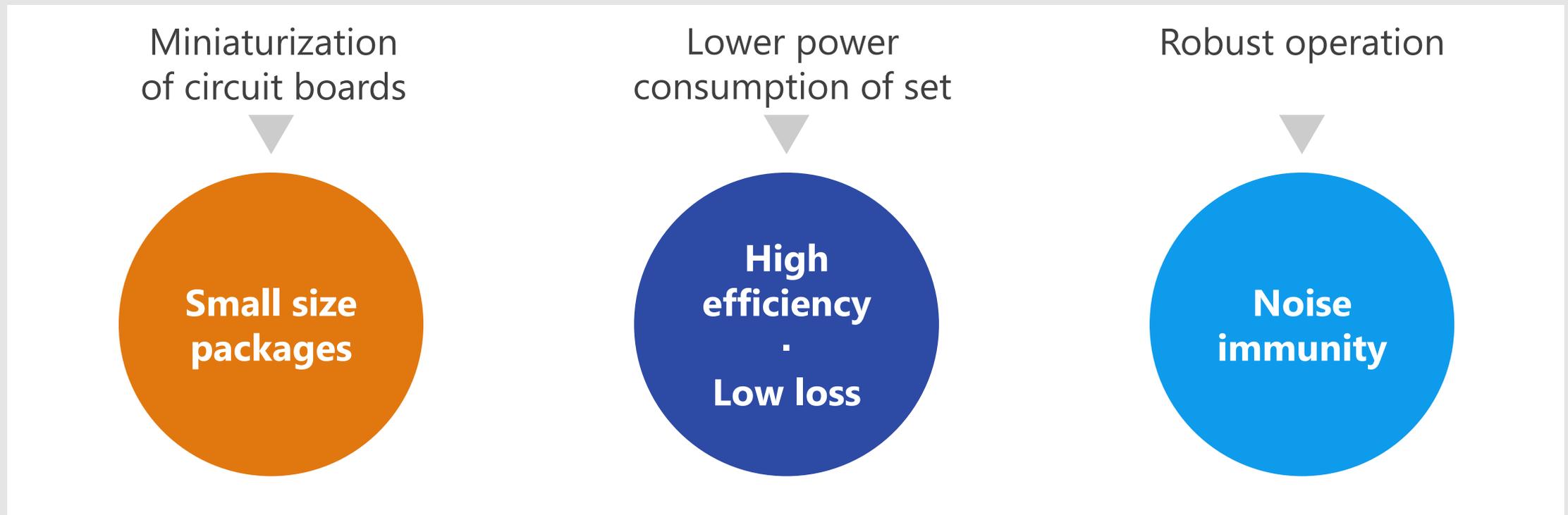
Noise immunity

Device solutions to address customer needs

	Small size packages	High efficiency . Low loss	Noise immunity
① Small signal MOSFET	●	●	
② Small surface mount LDO regulator	●	●	●
③ U-MOS Series N-ch MOSFET	●	●	●
④ TVS diode	●	●	●
⑤ Schottky barrier diode	●	●	
⑥ LENS control MCU	●	●	
⑦ Motor control driver	●	●	
⑧ Electronic fuse (eFuse IC)	●	●	
⑨ N-ch MOSFET gate driver IC	●	●	

Value provided

Suitable for power management switches and greatly contributes to miniaturization.

1 Low voltage operation	**2** Low on-resistance	**3** Small package
Operates down to V_{GS} = 1.8 V	By reducing on-resistance between the drain and source, heat generation and power consumption can be kept low.	Sealed in SOT-23F type package.

SSM3K376R
Internal connection diagram
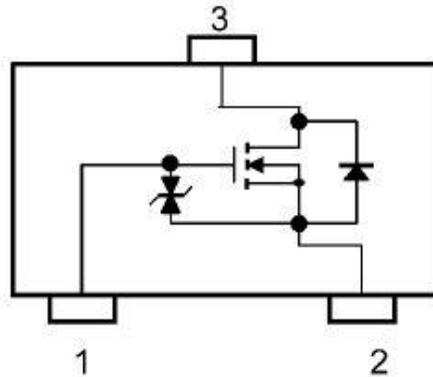
Lineup	
Part number	SSM3K376R
Package	SOT-23F
Polarity	N-ch
V_{DSS} [V]	30
I_D [A]	4
P_D [W]	1
$R_{DS(ON)}$ (Max) [mΩ] @V_{GS} = 4.5 V	56

② 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 lineup 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 originally developed latest process significantly improved the dropout 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.
(TCR3U Series)

Low dropout voltage

Dropout voltage V_{DO} (mV)

Output current I_{OUT} (mA)

Toshiba conventional process

The latest process

Significant improvement
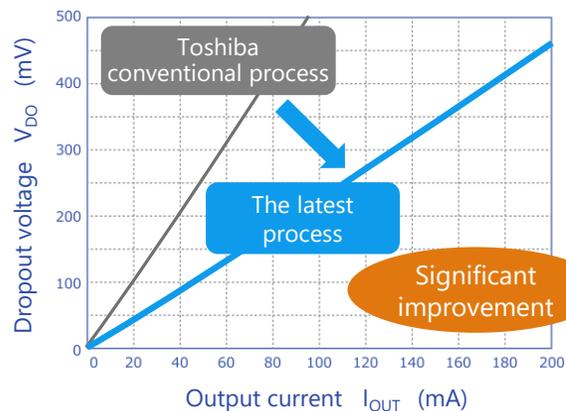
Note: Toshiba internal comparison

Rich package lineup

WCSP4F 0.645×0.645×0.33mm
WCSP4E 0.645×0.645×0.43mm
WCSP4 0.79×0.79×0.5mm
SDFN4 0.8×0.8×0.38mm
DFN4 1.0×1.0×0.58mm
WCSP6F 1.2×0.8×0.33mm
DFN5B 1.2×1.2×0.38mm
ESV(SOT-553) 1.6×1.6×0.55mm
SMV(SOT-25) 2.9×2.8×1.1mm
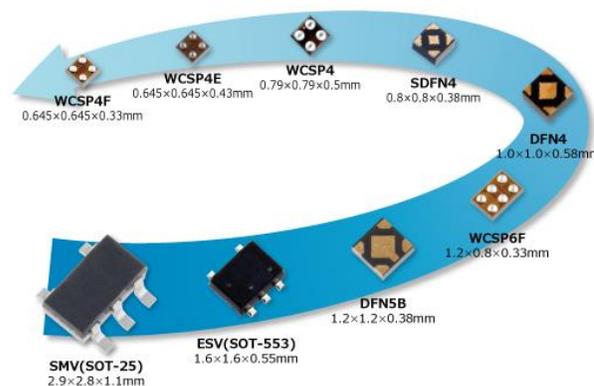
Lineup

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	56	20	19	7	7	0.34	1	170

Value provided

Suitable for switching regulators and greatly contributes to miniaturization.

1 Fast switching speed

t_{on} (Typ.) = 14 [ns]
t_{off} (Typ.) = 19 [ns]

### 2 Low on-resistance

By reducing on-resistance between the drain and source, heat generation and power consumption can be kept low.

3 Enhancement

Enhancement MOSFET for easy handle

TPH5900CNH
Internal connection diagram
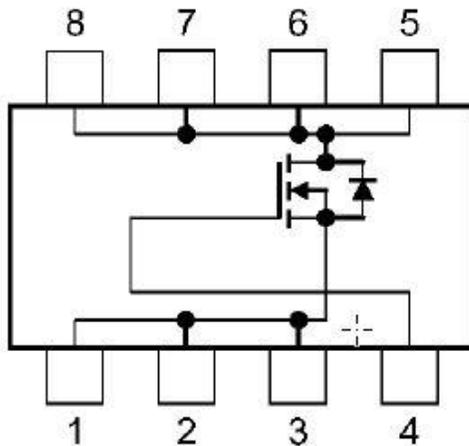
Lineup

Part number	TPH5900CNH
Package	SOP Advance
Polarity	N-ch
V_{DSS} [V]	150
I_D [A]	9
P_D [W]	42
$R_{DS(ON)}$ (Max) [mΩ] @V_{GS} = 10 V	59

TVS diode
DF10G5M4N / DF10G6M4N

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 to our conventional products. (50 % reduction in operating resistance) 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

Protection of connected circuits/devices was realized by using proprietary technology.

3 Suitable for high density mounting

A variety of compact packages are available.

ESD pulse absorption ability (Toshiba internal comparison)

New Generation process

Conventional process

Improved ESD absorption (50% reduction of operating resistance)

I/O1 I/O2 I/O3 I/O4
GND
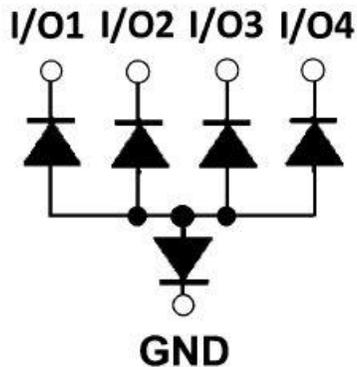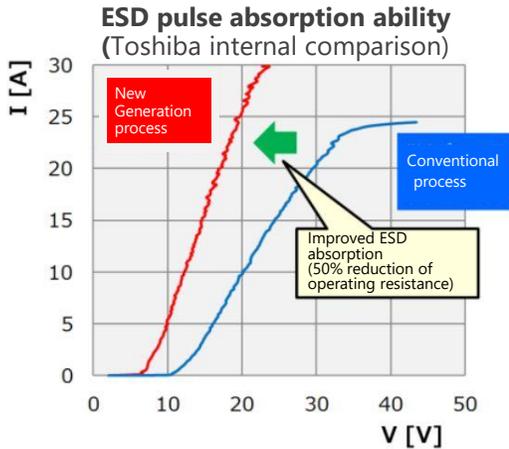
Lineup

Part number	DF10G5M4N	DF10G6M4N
Package	DFN10	DFN10
V_{ESD} [kV]	±20	±20
V_{RWM} (Max) [V]	3.6	5.5
C_t (Typ.) [pF]	0.2	0.2
R_{DYN} (Typ.) [Ω]	0.5	0.5

(Note) This product is designed for ESD protection purpose and cannot be used for purposes other than ESD protection.

TVS diode
DF2B5M4ASL / DF2B6M4ASL / DF2B6M4BSL

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 to our conventional products. Both low operating resistance and low capacitance can realize and ensure high signal protection performance and signal quality.

**2 Suppress ESD energy by low clamp voltage**

Protection of connected circuits/devices was realized by using proprietary technology.

3 Suitable for high density mounting

A variety of compact packages are available.

8KV ESD — Surge voltage — Clump voltage — ESD — 1st peak — I/O — IC — TVS — Damage
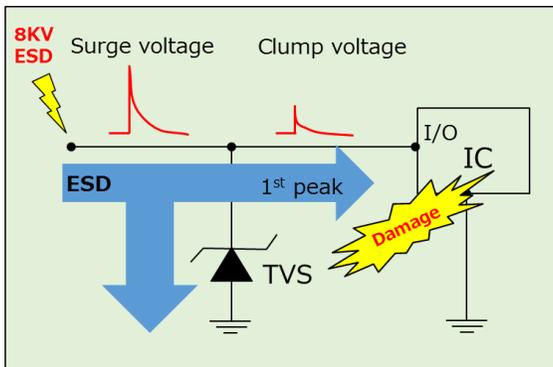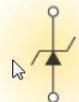
Unidirectional

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

Lineup

Part number	DF2B5M4ASL	DF2B6M4ASL	DF2B6M4BSL
Package	SL2		
V_{ESD} [kV]	±16	±15	±8
V_{RWM} (Max) [V]	3.6	5.5	5.5
C_t (Typ.) [pF]	0.15	0.15	0.12
R_{DYN} (Typ.) [Ω]	0.7	0.7	1.05

(Note) This product is designed for ESD protection purpose and cannot be used for purposes other than ESD protection.

◆Return to Block Diagram TOP

Value provided

Can be applied to various applications which requires high speed and low loss, and greatly contributes to miniaturization.

1 Fast switching

Suitable for fast switching applications.

## 2 Small package

Sealed in USC/CST2 type package.

CUS10F30 Characteristics
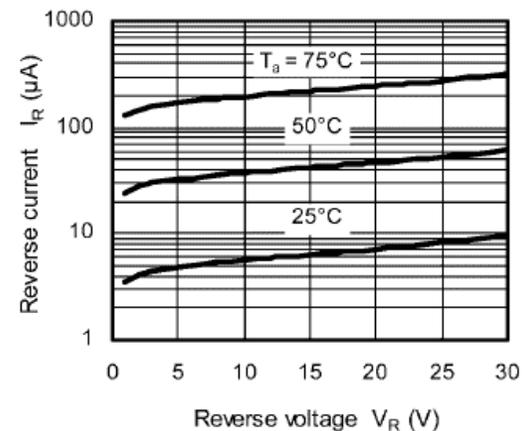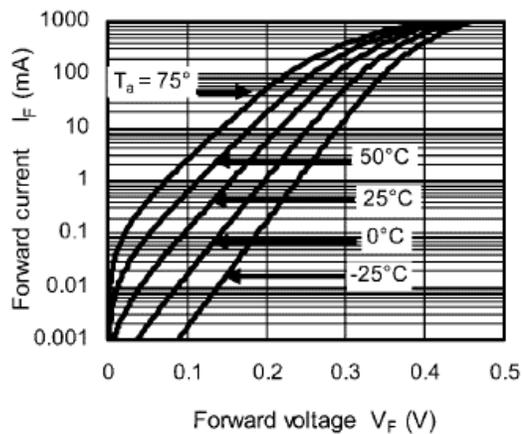
Lineup

Part number	CUS10F30	CTS05F40
Package	USC	CST2
I_O [A]	1.0	0.5
V_R [V]	30	40
V_F (Typ.) [V] @ I_F = 0.1 A	0.28	0.40
I_R (Max) [μA] @ V_R = 10 V	50	15

LENS control MCU
TMPM342FYXBG / TMPM343FDXBG / TMPM343F10XBG

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

Value provided

LENS control specialized MCU at small package and low power consumption

1 All in one solution for LENS control

Silent & high speed multi-channel motor control is possible.
Minimizing board area and number of components can be realized.

2 Low power consumption

Built-in Arm® Cortex®-M3 and PSC [Note 1] co-processor
Operation frequency reduction by distributed processing is realized.

3 High quality OIS control

OIS [Note 2] supports over 20 Hz.
User friendly sample software and evaluation board are available.

[Note 1] Programmable Servo Controller

[Note 2] Optical Image Stabilizer

Pan

Tilt

All in one!

MCU
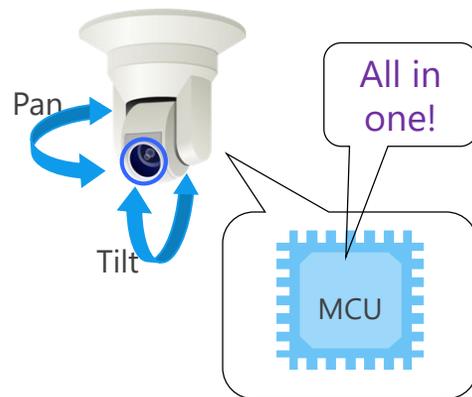
Lineup

Part number	TMPM342FYXBG	TMPM343FDXBG	TMPM343F10XBG
Package	VFBGA142	VBGA162	
Package size	7 x 7 mm, 0.5 mm pitch		
CPU	Arm® Cortex®-M3, Max operation 40 MHz	Arm® Cortex®-M3, Max operation 50 MHz	
Memory	Flash ROM 256 KB SRAM 32 KB	Flash ROM 512 KB SRAM 48 KB+32 KB	Flash ROM 1024 KB SRAM 64 KB+32 KB
Functions	7bit resolution micro step function, PSC (342: 1 unit, 343: 4 unit), 2-phase pulse counter (342: 2ch, 343: 3ch), H-SW driver (342: 7.5ch, 343: 8ch), Micro step unit (342: 2 unit, 343: 3 unit)		

◆Return to Block Diagram TOP

Value provided

It is possible to drive two stepping motor or four brushed DC motor.

1 Four products lineup

There are two control types , clock input and phase signal input as the I/F. Also there are two package type, SSOP and QFN, respectively.

2 Abnormality detection

It is equipped with various abnormality detection functions such as over current detection (ISD), thermal shutdown (TSD) and power on reset (POR).

3 Three selectable drive modes

Three selectable H bridge combination according to motor type and required current as follows: 1) two stepping motor drive, 2) four brushed DC motor drive, 3) two large current brushed DC motor drive

■3 selectable drive modes

1) Two stepping motor drive
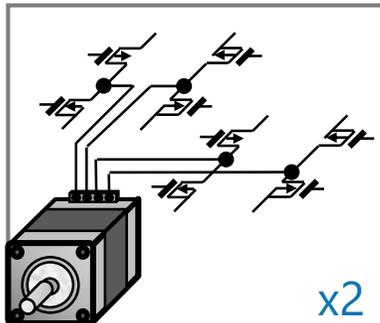
2) Four brushed DC motor drive

3) Two large current brushed DC motor drive

x2

x2

Parallel control x2
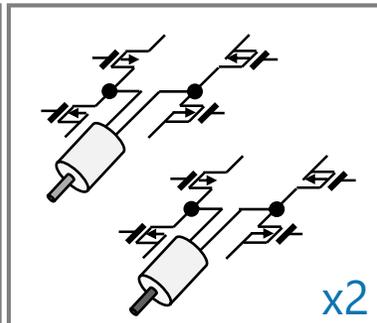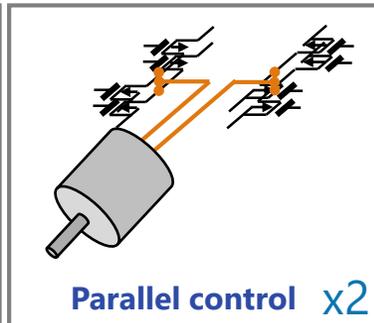
Lineup

Part number	TC78S121FNG/FTG	TC78S122FNG/FTG
Package	HTSSOP48 / QFN48	
Package size	12. 5 x 8.1 x 1.2 mm / 7 x 7 x 0.9 mm	
Maximun ratings	40 V / 2.0 A	
Low on resistor output (sum of 2 Tr)	0.6 Ω	
Functions	- Over limit current detection, over heat detection and power on reset - 2 lineup supports clock input for stepping motor control and phase input - Single power supply without 5 V input	

◆Return to Block Diagram TOP

Stepping motor & Brushed DC motor driver
TC78H670FTG / TC78H660FNG / TC78H660FTG

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

Value provided

Support for low voltage motor driving (2.5 V (Min)) with low power consumption.

1 Low voltage operation

Motor driving voltage is 2.5 V (Min) for low voltage applications such as battery operation devices.

2 Low current consumption

Stand-by current is below 2 µA (IC total) for power saving of devices.

3 Abnormality detection functions

Over current detection (ISD), thermal shutdown (TSD) and under voltage lockout (UVLO) are available.
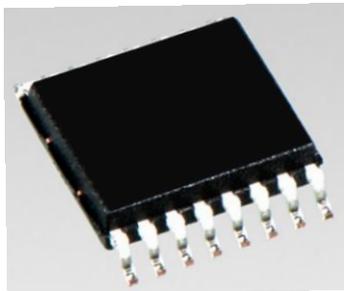
TSSOP16 Package
（5.0 × 6.4 ×1.2 mm）
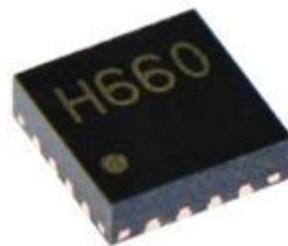
VQFN16 Package
（3.0 × 3.0 × 0.9 mm）

Lineup

Part Number	TC78H670FTG	TC78H660FNG	TC78H660FTG
V_M (Max. Rating) [V]	18	18	18
I_{OUT} (Max. Rating) [A]	2.0	2.0	2.0
$R_{on(upper\ and\ lower\ sum)}$ (Typ.) [Ω]	0.48	0.48	0.48
Control Interface	IN/PHASE inputs	IN/PHASE inputs	IN/PHASE inputs
Step	2phase/1-2phase excitation	2phase/1-2phase excitation	2phase/1-2phase excitation
Motor driving voltage	2.5 V (Min) RS resister less	2.5 V (Min) RS resister less	2.5 V (Min) RS resister less
Abnormality detection function	Thermal shutdown, Over current, Under voltage lockout, load open	Thermal shutdown, Over current, Under voltage lockout	Thermal shutdown, Over current, Under voltage lockout
Package	VQFN16	TSSOP16	VQFN16

Stepping motor driver
TB67S539FTG

Value provided

The maximum voltage rating of 40 V. Standard stepping motor drivers with a small package.

1 High withstand voltage and current

Supports a maximum rated voltage of 40 V and a maximum rated current of 2 A.
The low output on-resistance realizes low power consumption, which reduces heat generation.

2 Small size and high heat dissipation

Adopted QFN package which has a high heat dissipation with an E-Pad. As per connecting the E-Pad, achieve high heat dissipation. The mounting space can be reduced to 5 x 5 mm.

3 Abnormality detection functions

Over current detection (ISD), thermal shutdown (TSD) and under voltage lockout (UVLO) are available.

package
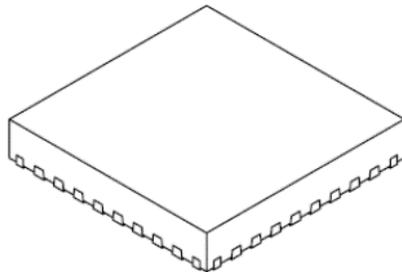
VQFN32 (5 x 5 mm)

Lineup

Part number		TB67S539FTG
Absolute Maximum Ratings	Output withstand voltage	40 V
	Output current	2.0 A
Output on-resistance (H+L)		0.8 Ω
Driving type		PWM constant current drive
Excitation mode		full, half, quarter, 1/8, 1/16 and 1/32 step resolutions
Features		Clock type
Error detection function		TSD, ISD, UVLO
Package		VQFN32

◆Return to Block Diagram TOP

Stepping motor & Brushed DC motor driver
TC78H653FTG

Small size packages

High efficiency · Low loss

Noise immunity

Value provided

It is possible to drive one stepping motor or two brushed DC motor.

1 **Small package**

The VQFN16 package contributes to reduce foot print areas.

2 **Protection and abnormality detection**

It is equipped with a through current prevention function and various abnormality detection functions such as over current detection (ISD), thermal shutdown (TSD), and under voltage lockout (UVLO).

3 **Two selectable drive modes**

Two selectable H bridge combination according to motor type and required current as follows: 1) one stepping motor drive, 2) two brushed DC motor drive

■2 selectable drive modes

1) One stepping motor drive 2) Two brushed DC motor drive
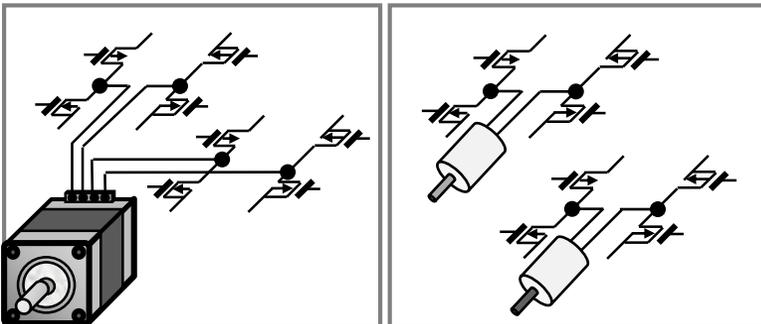
Lineup

Part number	TC78H653FTG
Package	VQFN16
Package size	3.0 x 3.0 x 0.9 mm
Maximum ratings	8 V / 4.0 A
Low on register output (Total Tr)	0.22 Ω
Functions	• Through current preventing function • Over current detection (ISD), thermal shutdown (TSD) and under voltage lockout (UVLO)

◆Return to Block Diagram TOP

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 IEC 62368-1 certified

Toshiba's eFuse ICs are certified to the international safety standard IEC 62368-1 (G9: Integrated circuit (IC) current limiters) and contribute to robust protection and simplification of circuit design.

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
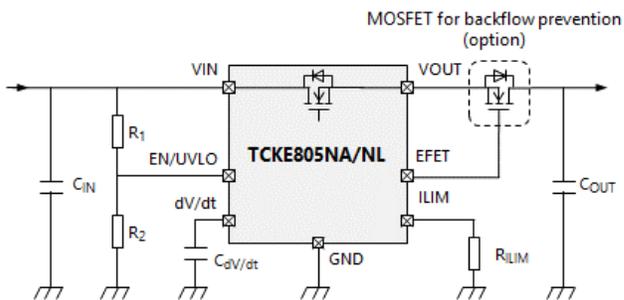
Reference circuit example of TCKE7 Series
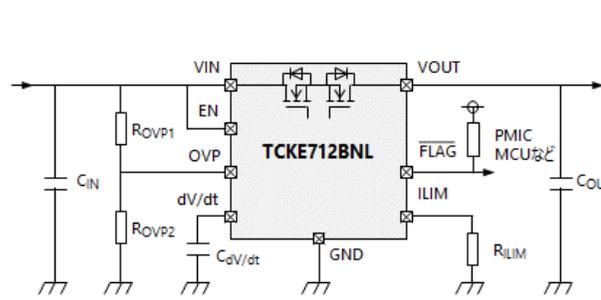
Line up

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	15.1	Adjustable

Value provided

It is N-ch MOSFET gate driver IC with OVP [Note 1] function. It contributes to reduction of power consumption and miniaturization of load switch circuit.

[Note 1]   OVP : Over Voltage Protection

1 **3 types of N-ch MOSFET can be driven**

The following types of MOSFET can be driven :
  TCK40xG : Single high side connection
            Common source connection
  TCK42xG : Single high side connection
            Common drain connection

2 **Wide operating voltage range and various OVLO [Note 2] threshold voltage**

Operating voltage V_{opr} : 2.7 to 28 V
Maximum input voltage : 40 V
V_{IN_OVLO} [Note 3] lineups suitable for 5 to 24 V power supply line.

[Note 2]   OVLO : Over Voltage Lock Out
[Note 3] V_{IN_OVLO} : V_{IN} OVLO threshold

3 **Small packages**

It contributes to reduction of the mounting area and miniaturization of the circuit board :

  WCSP6E : 1.2 x 0.8 mm, t : 0.55 mm
  WCSP6G : 1.2 x 0.8 mm, t : 0.35 mm

Circuit example of TCK42xG with N-ch common drain connection MOSFET

Five variations of threshold voltage

Gate voltage 5.6 V or 10 V
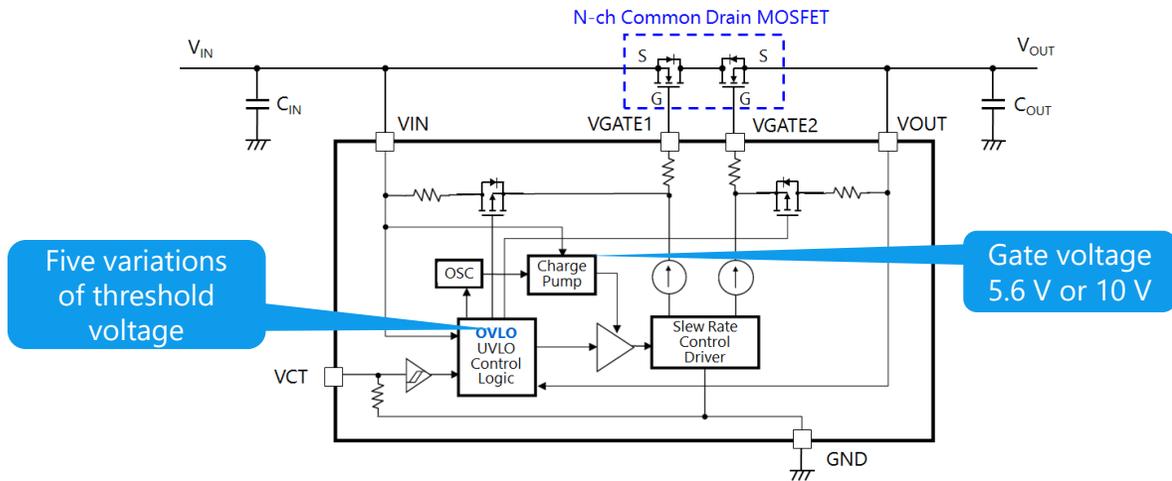
Lineup

Part number	V_{IN_OVLO} Min / Max [V]	V_{GS} Typ. / Max [V]	N-ch MOSFET type can be driven	Package
TCK401G	Over 28	Max 10 ($V_{IN} \geq 12$ V)	Single high side Common Source	WCSP6E
TCK402G				
TCK420G	26.50 / 28.50	10 / 11 ($V_{IN} \geq 5$ V)	Single high side Common Drain	WCSP6G
TCK421G	22.34 / 24.05			
TCK422G	13.61 / 14.91			
TCK423G	13.61 / 14.91	5.6 / 6.3		
TCK424G	10.35 / 11.47			
TCK425G	5.76 / 6.87			

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

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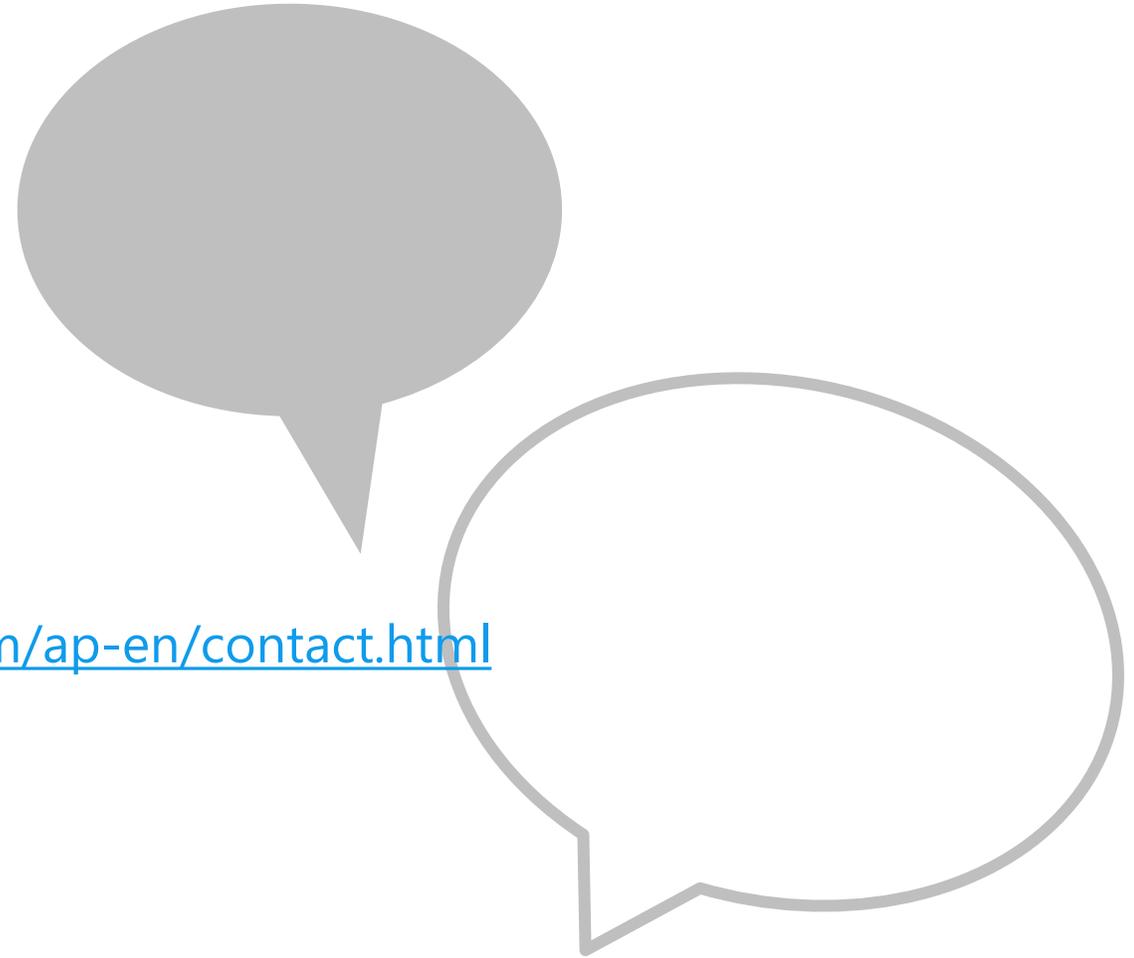
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