TOSHIBA

R1

Motion Detector

Solution Proposal by Toshiba

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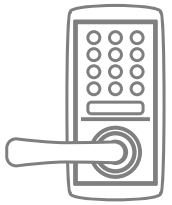

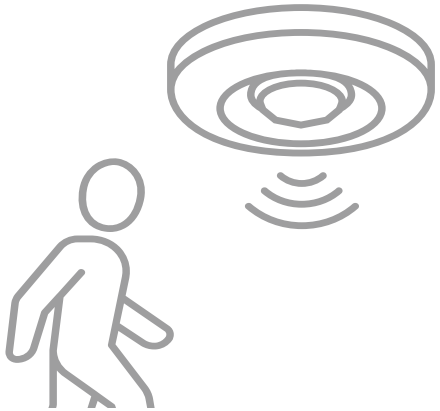

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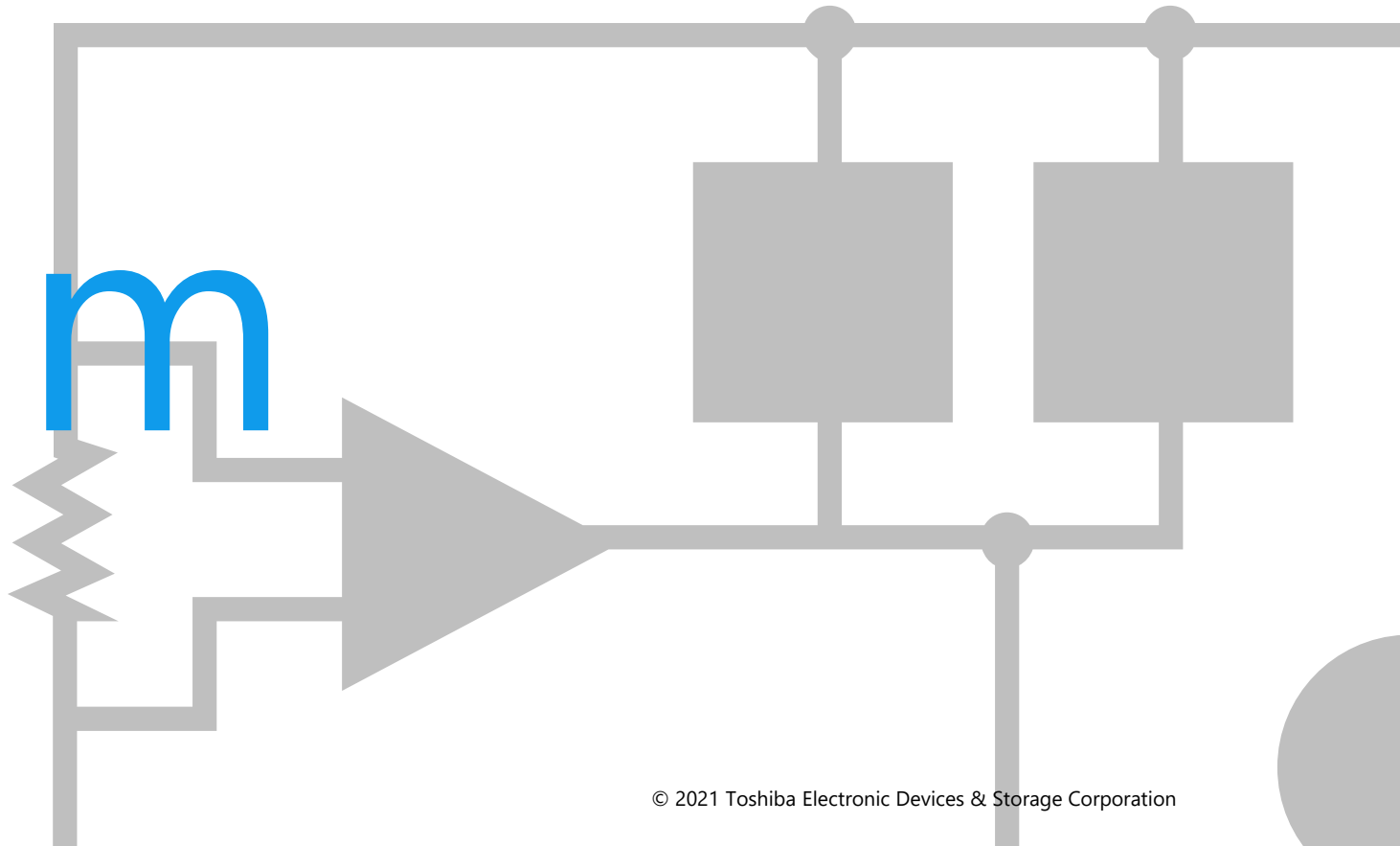
Block Diagram



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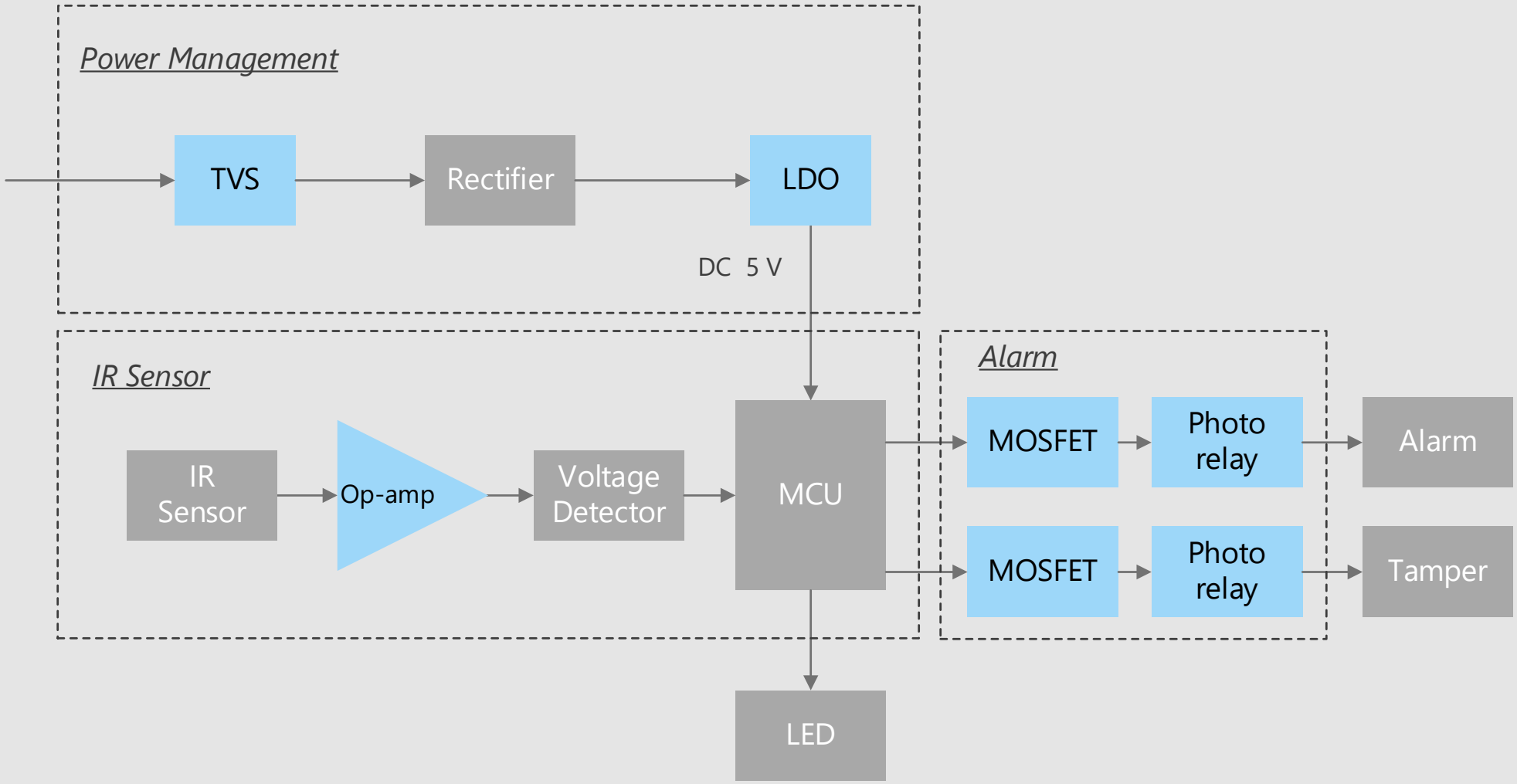
Motion Detector　Overall brock diagram



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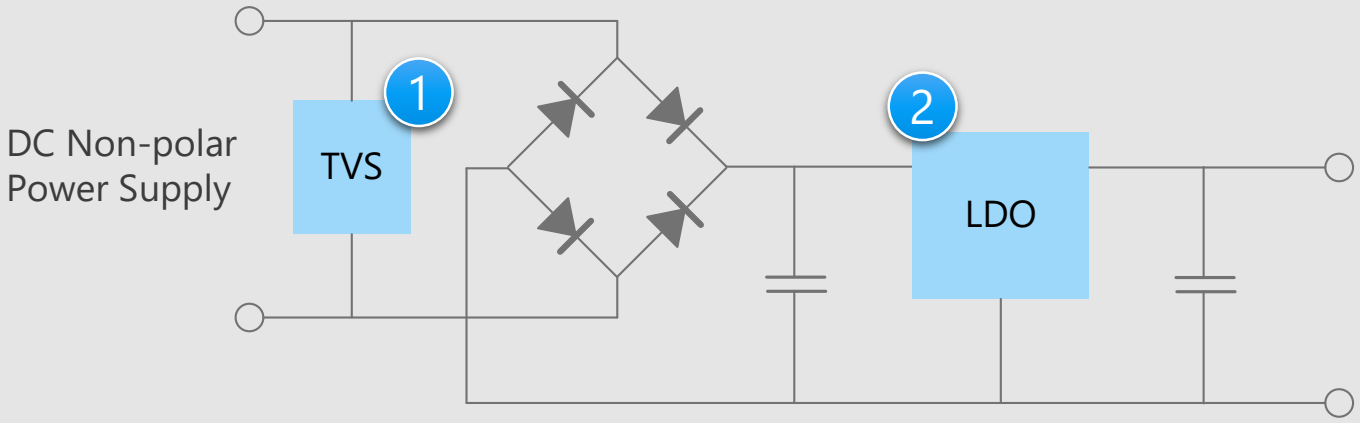
Motion Detector　Detail of power supply circuit

An example of power supply circuit



* Click on the numbers in the circuit diagram to jump to the detailed descriptions page

Criteria for device selection

- Highly ESD resistant and reliable system design is possible.
- The board area can be reduced by adopting a small package product.

Proposal from Toshiba

- **Realizes high ESD tolerance and space saving.** 1
  TVS diode
- **Space saving and low dropout voltage.** 2
  Small surface mount LDO regulator

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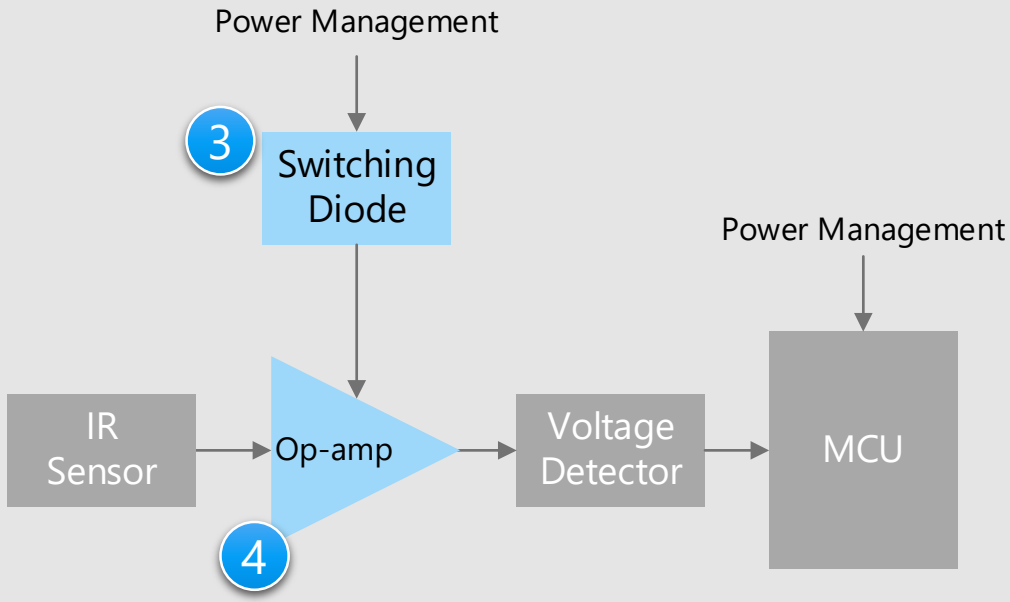
Motion Detector　Detail of sensor circuit

An example of sensor circuit



* Click on the numbers in the circuit diagram to jump to the detailed descriptions page

Criteria for device selection

- High-speed switching characteristic supports high frequency operation.
- Low power consumption is realized by operating at low voltage / current consumption.
- An operational amplifier with low offset characteristics and low noise characteristics is required for high-precision sensing.

Proposal from Toshiba

- **High speed switching**
  Switching diode　3

- **Low noise operational amplifier with low V_{IO}**
  Low current consumption op-amp / Low noise op-amp　4

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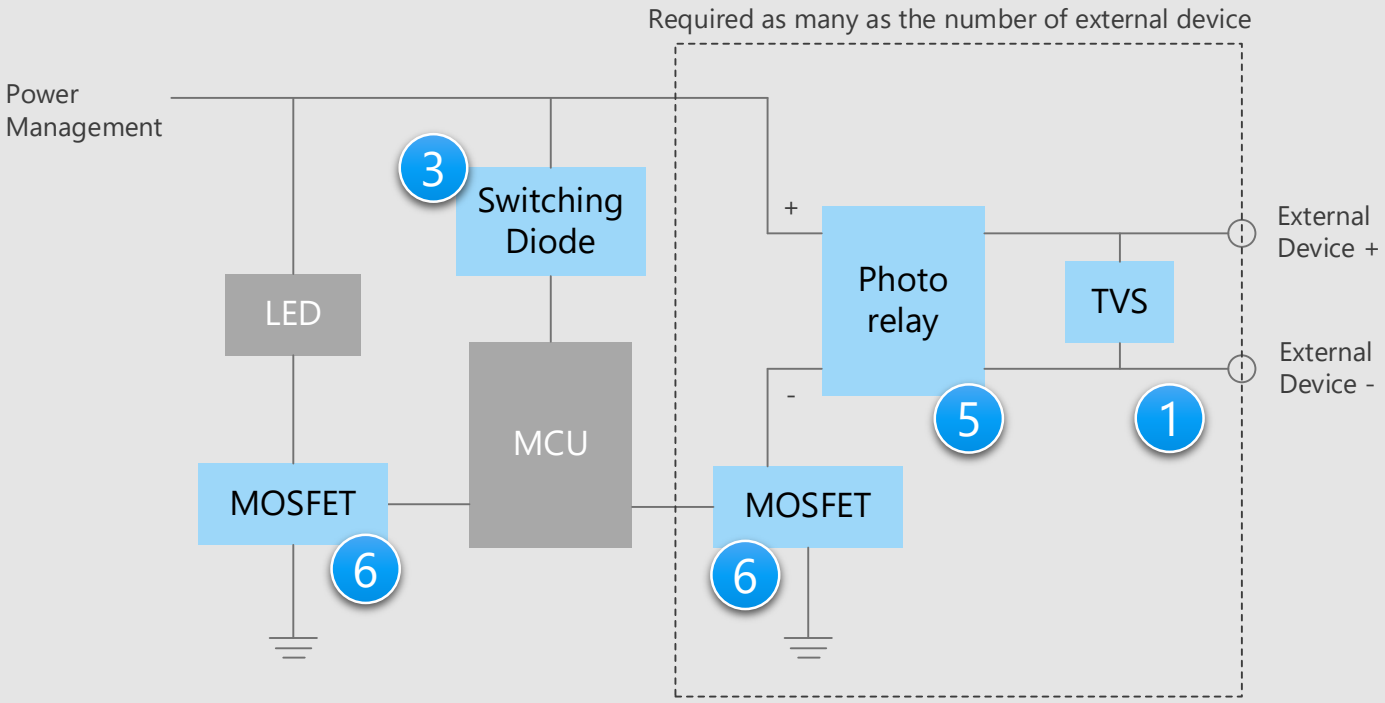
Motion Detector　Detail of alarm circuit

An example of alarm circuit



* Click on the numbers in the circuit diagram to jump to the detailed descriptions page

Criteria for device selection

- By using a photorelay instead of a mechanical relay, the life limit due to wear or welding of the contact portion is eliminated, enabling a longer life and quieter operation.
- In addition, the board area can be reduced by adopting a small package product.

Proposal from Toshiba

- **Realizes high ESD tolerance and space saving.** 1
  TVS diode
- **High speed switching** 3
  Switching diode
- **Suitable for replacement of mechanical relays.** 5
  Photorelay
- **A MOSFET that can be driven at low voltages.** 6
  Small signal MOSFET

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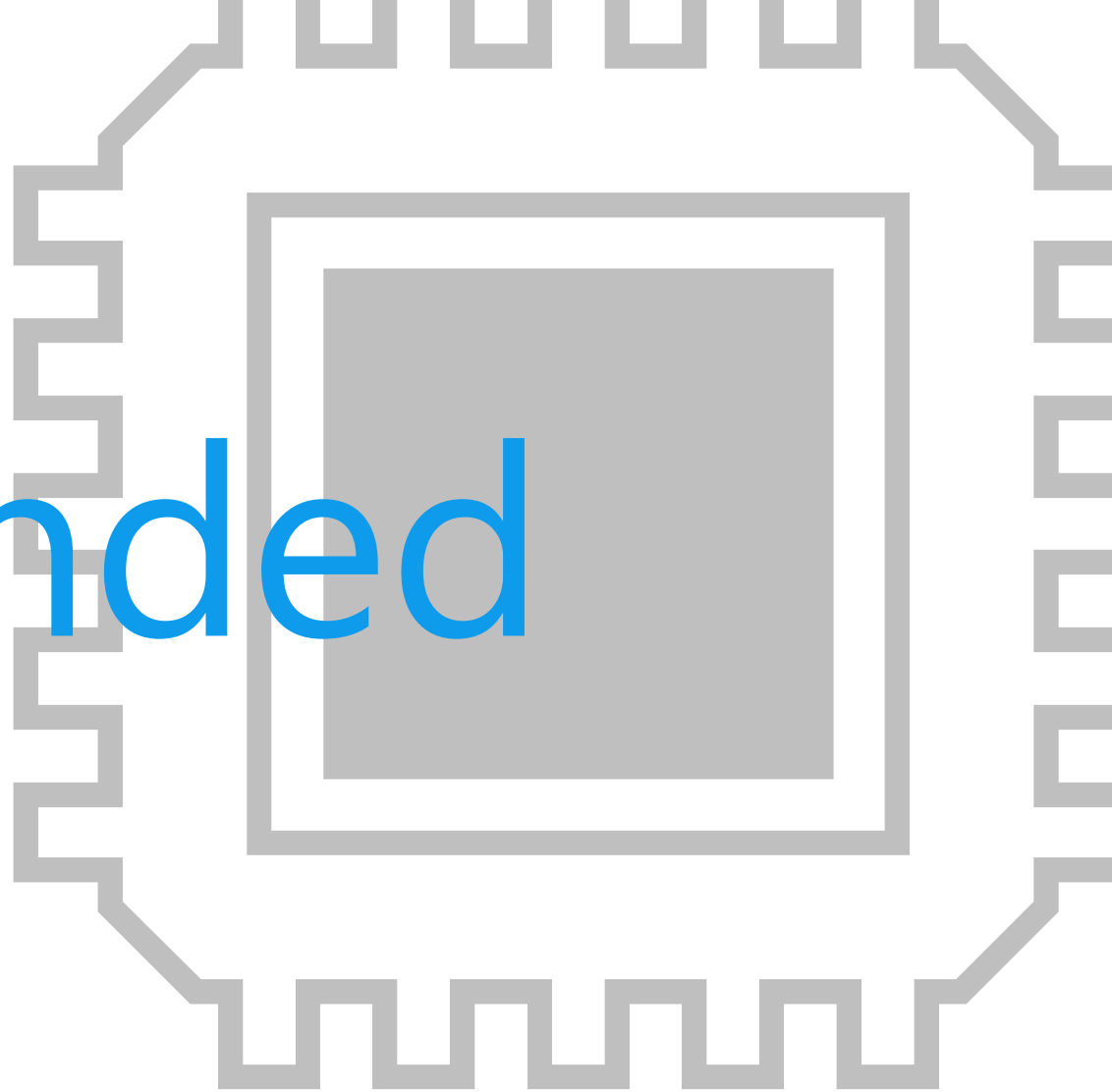
Recommended Devices



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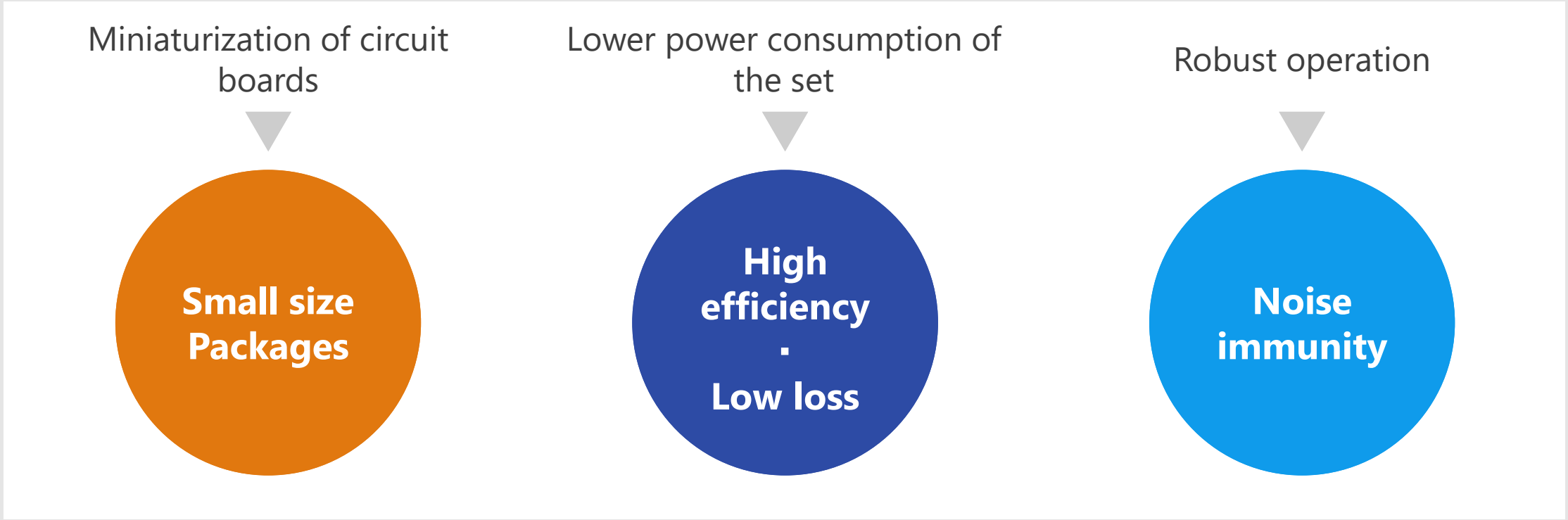
Device solutions to address customer needs

As described above, in the design of motion sensor, **"Miniaturization of circuit boards"**, **"Low power consumption of sets"** and **"Robust operation"** are important factors. Toshiba's proposals are based on these three solution perspectives.



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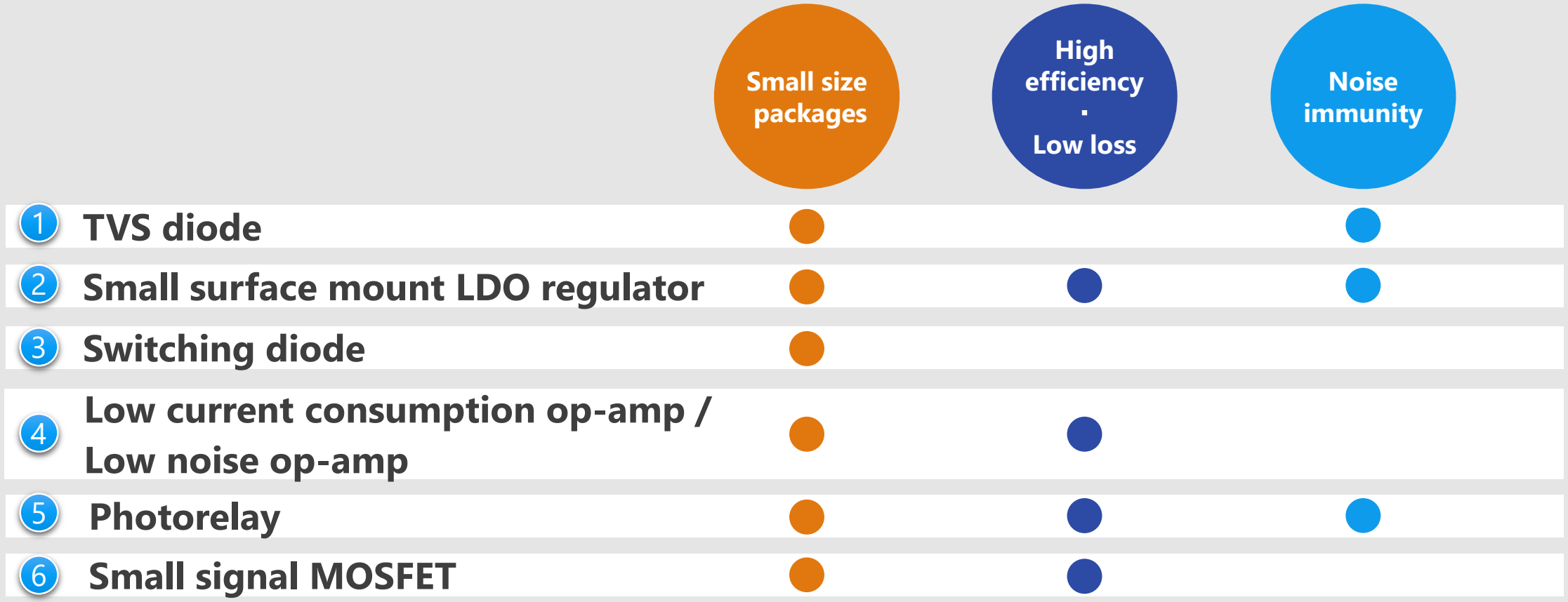
Device solutions to address customer needs



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1 TVS diode

DF2B29FU / DF2S23P2FU / DF2S23P2CTC

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 our 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.

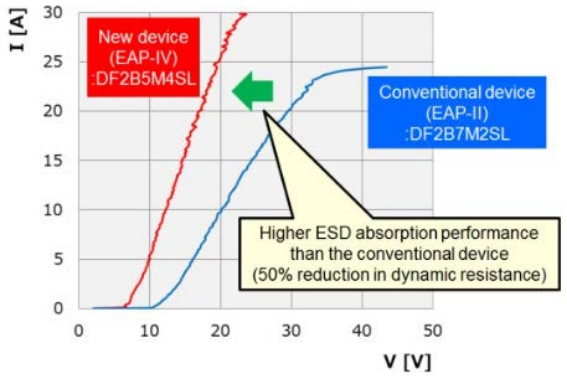
2 Suppress ESD energy by low clamp voltage

Steadily protect the connected circuits/devices using proprietary technology.

3 Suitable for high-density mounting

A variety of compact packages are available.

ESD Pulse Absorption Performance
(Note: 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	DF2B29FU	DF2S23P2FU	DF2S23P2CTC
Package	SOD-323 (USC) 		SOD-963 (CST2C) 
V_{ESD} [kV]	±25	±30	
V_{RWM} (Max) [V]	±24	21	
C_t (Typ.) [pF]	9	160	
R_{DYN} (Typ.) [Ω]	1.1	0.13	

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

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2 Small surface mount LDO regulator

TAR5S50U / TAR5S50 / TAR5SB50

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

Dropout characteristics have been greatly improved by the newly developed process.(50 % improvement : Toshiba comparison)

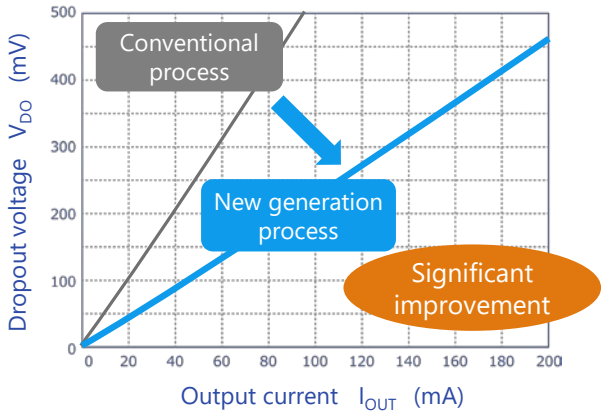
2 High PSRR

With a high PSRR (Power Supply Rejection Ratio), ripple is efficiently removed.

3 Can be used with ceramic capacitors

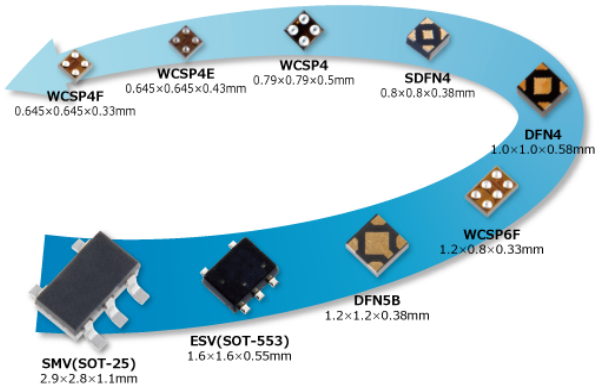
With improved dropout characteristics, it is now possible to use ceramic capacitors for external capacitor functions.

Low dropout voltage



(Note: Toshiba internal comparison)

Rich package line up



Line up

Part number	TAR5S50U	TAR5S50	TAR5SB50
Package	SOT-353F (UFV) 	SOT-25 (SMV) 	
V_{IN} [V]	2.4 to 15		
I_{OUT} (Max) [mA]	200		
V_{DO} (Typ.) [mV]	130		
PSRR (Typ.) [dB]	70		
$I_{B(ON)}$ (Typ.) [μA]	170		

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3 Switching diode

1SS181 / 1SS184 / 1SS352 / 1SS387 / 1SS302A

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

Value provided

Wide range of products are provided, mainly compact package that is suitable for high-density assembly.

1 Surface mount / compact package

Adopting S-mini / USC / ESC / USM package which is lower in height compared to the conventional lead type contributes to the space saving of the equipment.

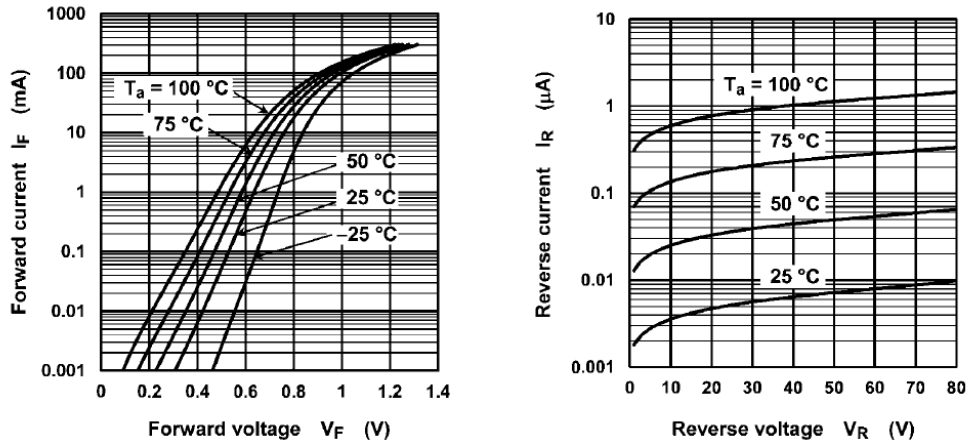
2 Wide product line up (1)

Reverse voltage : 20 to 100 V
Average forward current : 100 mA
Suitable product can be selected according to requirements.

3 Wide product line up (2)

For protection of inductive load of mechanical relay, diodes with low voltage and small package are also provided.

Examples of 1SS302A's characteristics



Line up

Part number	1SS181	1SS184	1SS352	1SS387	1SS302A
Package	S-Mini		USC	ESC	USM
I_O (Max) [mA]	100	100	100	100	100
V_R (Max) [V]	80	80	80	80	80

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4 Low current consumption op-amp / Low noise op-amp

TC75S102F / TC75S67TU

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

Value provided

Low current consumption type and low noise type operational amplifiers maximize the performance of system.

1 Low voltage operation

We have a lineup of low power supply voltage-driven operational amplifiers using CMOS process for low power supply voltage-driven equipment.

2 Low current consumption (TC75S102F) I_{DD} = 0.27 [µA] (Typ.)

CMOS processes have been used to achieve lower current consumption. This contributes to lower power consumption.

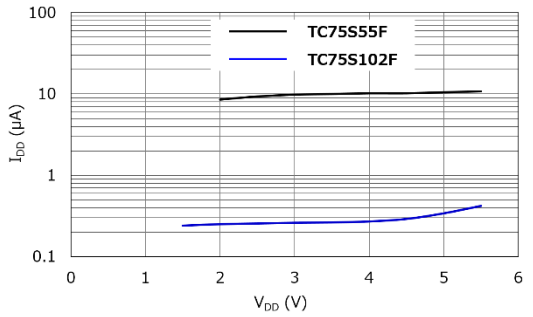
3 Low noise (TC75S67TU) V_{NI}=6.0 [nV/√Hz] (Typ.) @f=1 kHz

This CMOS operational amplifier can amplify minute signals detected by various sensors [1] with very low noises. By optimizing the process, we have achieved the industry's top-level [2] low equivalent input noise voltage.

[Note 1] Sensor types: vibration, shock, acceleration, pressure, infrared, temperature, etc.
[Note 2] As of May 2017

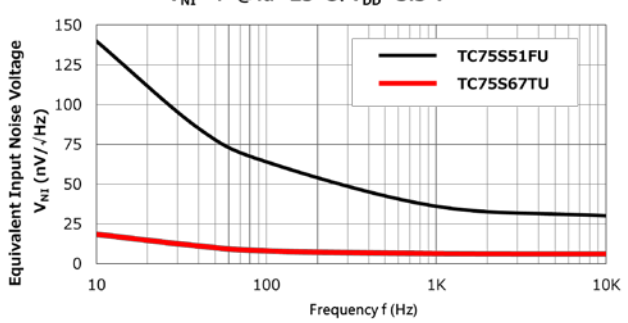
TC75S102F
Current Consumption Characteristic
(Note: Toshiba internal comparison)

Low current consumption product TC75S102F



TC75S67TU
Noise Characteristic
(Note: Toshiba internal comparison)

Reduce 1/f noise (10 Hz) by 86 % from our normal products



Line up

Part number	TC75S102F	TC75S67TU
Package	SMV 	UFV 
V_{DD} - V_{SS} [V]	1.5 to 5.5	2.2 to 5.5
V_{IO} (Max) [mV]	1.3	3
CMV_{IN} (Max) [V]	V_{DD}	1.4 (@V_{DD} = 2.5 V)
I_{DD} (Typ. / Max) [µA]	0.27 / 0.46 (@V_{DD}=1.5 V)	430 / 700 (@V_{DD} = 2.5 V)
V_{NI} (Typ.) [nV/√Hz] @f = 1 kHz	-	6

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5 Photorelay

TLP170AM / TLP171A / TLP240A / TLP241B

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

Value provided

Photorelays are composed of infrared light emitting diodes that are optically coupled to photo MOSFETs, are resistant to noise, and low current consumption, suitable for use in motion detectors.

1 Low on-resistance R_{ON}

Low on-resistance R_{ON} contributes to realize low power consumption of set.

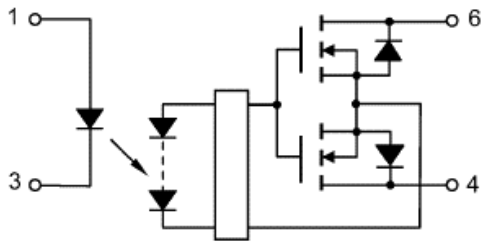
2 Low trigger current I_{FT}

The trigger current I_{FT} of TLP171A is 0.2 mA (Max).
Low I_{FT} contributes to design with low drive current.

3 Many types of package

Many types of package for reducing of size of set and improving freedom of design are provided.

TLP170AM
Internal circuit



1: Anode
3: Cathode
4: Drain
6: Drain

Safety standard
All 4 parts
UL-recognized: UL1577, File No.E67349
cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
VDE-approved: EN 60747-5-5

only for TLP240A
UL-recognized: UL 508, File No.E499232
CQC-approved: GB4943.1, GB8898
VDE-approved: EN 62368-1

Line up

Part number	TLP170AM	TLP171A	TLP240A	TLP241B
Package	4pin SO6 	2.54 SOP4 	DIP4 	
I_{ON} (Max) [A]	0.7	0.4	0.5	2.0
V_{OFF} (Max) [V]	60	60	60	100
R_{ON} (Max) [Ω]	0.3	2	2	0.2
I_{FT} (Max) [mA]	1	0.2	3	3
BV_S (Min) [Vrms]	3750	1500	5000	5000

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6 Small signal MOSFET

SSM3K15ACTC / SSM3K16CTC / SSM3K35AFS / SSM3K35AMFV

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

Value provided

Suitable for high speed switching and greatly contributes to miniaturization.

1 Low voltage operation

Drive at low V_{GS}

SSM3K15ACTC / SSM3K16CTC : 1.5 V drive

SSM3K35AFS / SSM3K35AMFV : 1.2 V drive

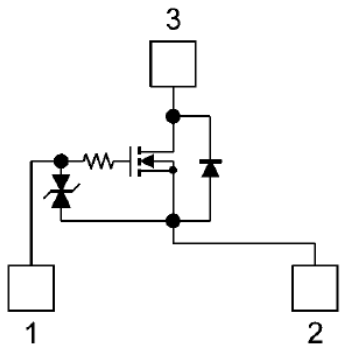
2 Low on-resistance

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

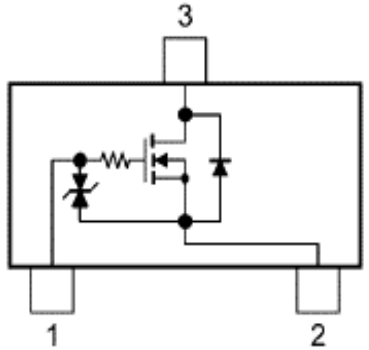
3 Small size packages

Products with small size package such as CST3C, SSM and VESM are provided.

SSM3K15ACTC / SSM3K16CTC
Internal circuit diagram



SSM3K35AFS / SSM3K35AMFV
Internal circuit diagram



1: Gate
2: Source
3: Drain

Line up

Part number	SSM3K15ACTC	SSM3K16CTC	SSM3K35AFS	SSM3K35AMFV
Package	CST3C 		SSM 	VESM 
Polarity	N-ch	N-ch	N-ch	N-ch
V_{DSS} [V]	30	20	20	20
I_D [mA]	100	200	250	250
$R_{DS(ON)}$ (Max) [Ω] @V_{GS} = 2.5 V	6	3	1.6	1.6

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