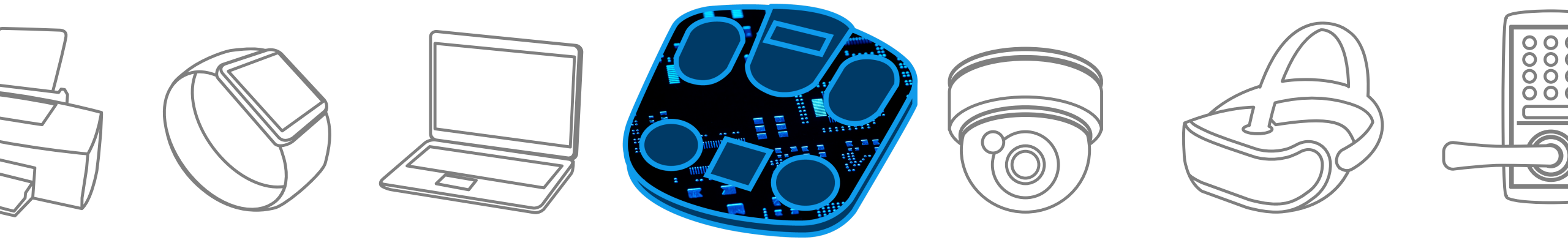
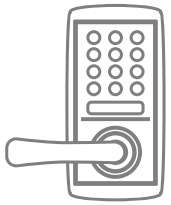
TOSHIBA

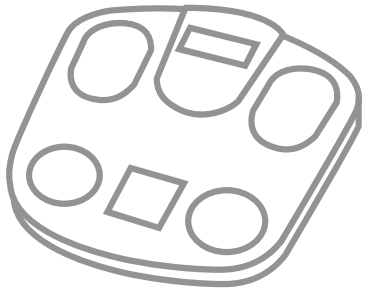
R20

Body Composition Analyzer

Solution Proposal by Toshiba







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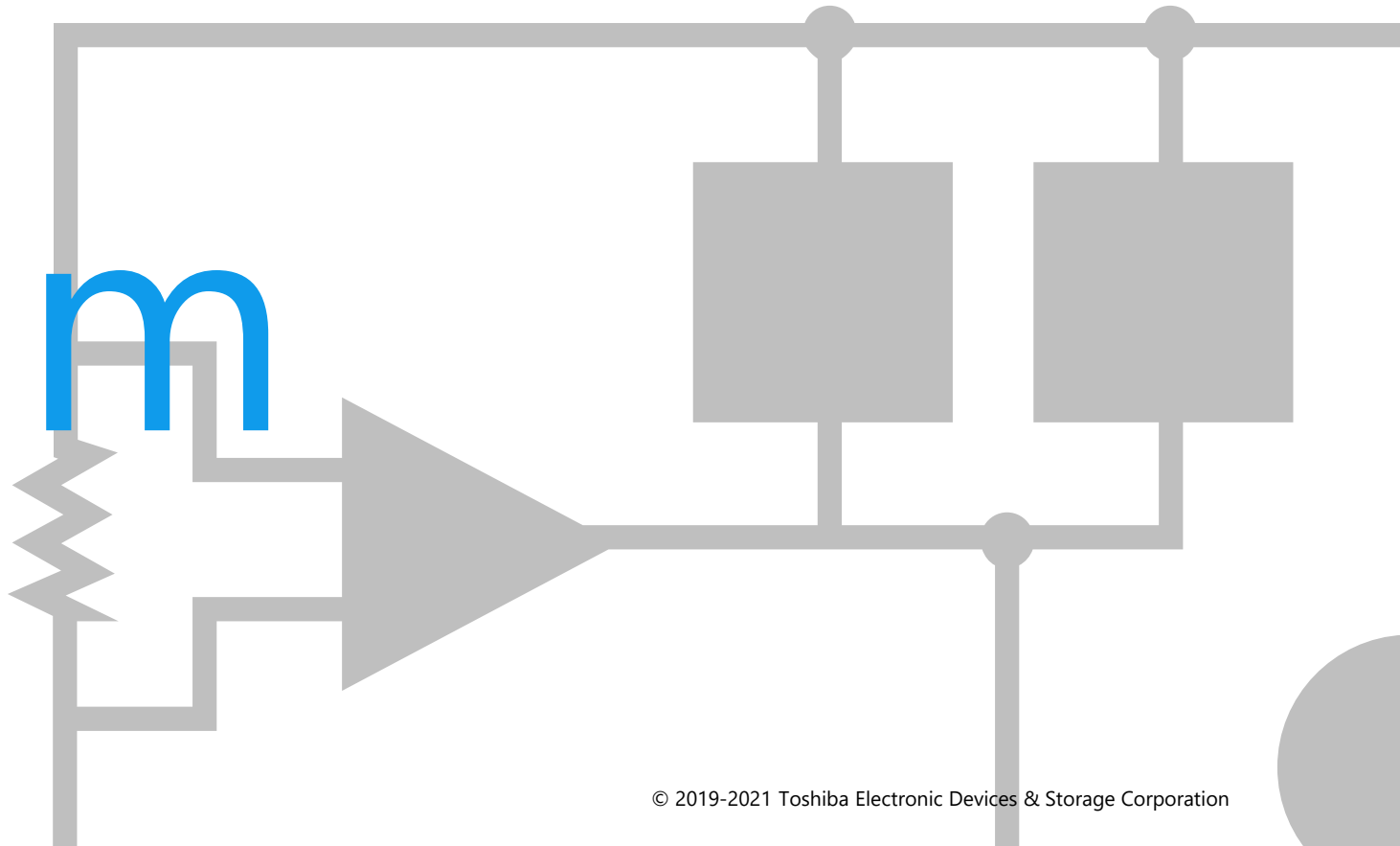
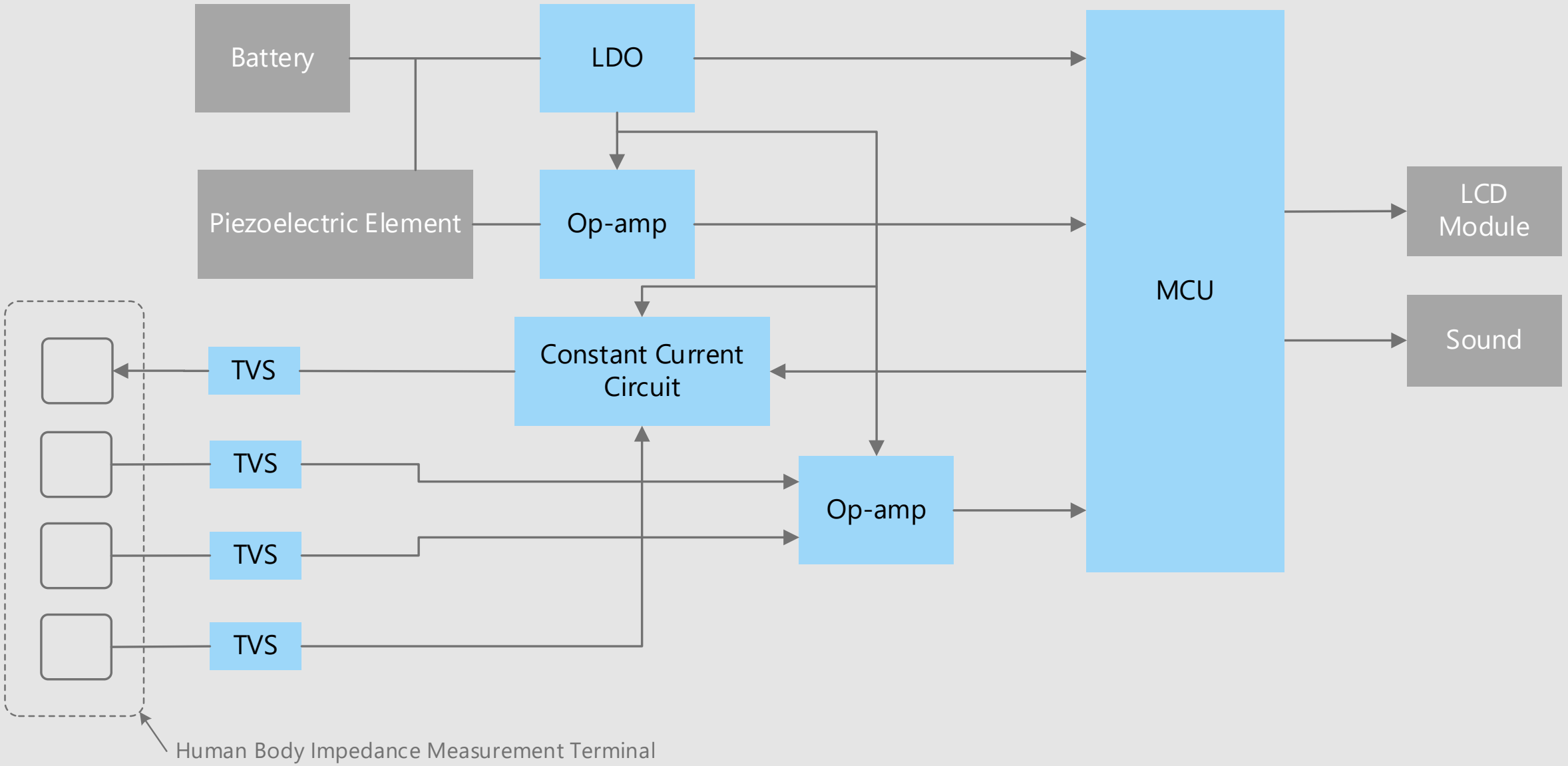
Block Diagram

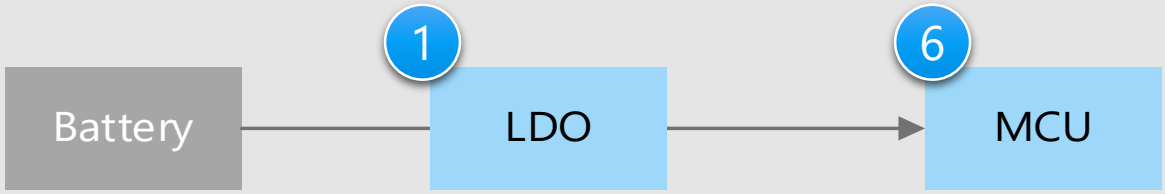


Body Composition Analyzer　Overall block diagram

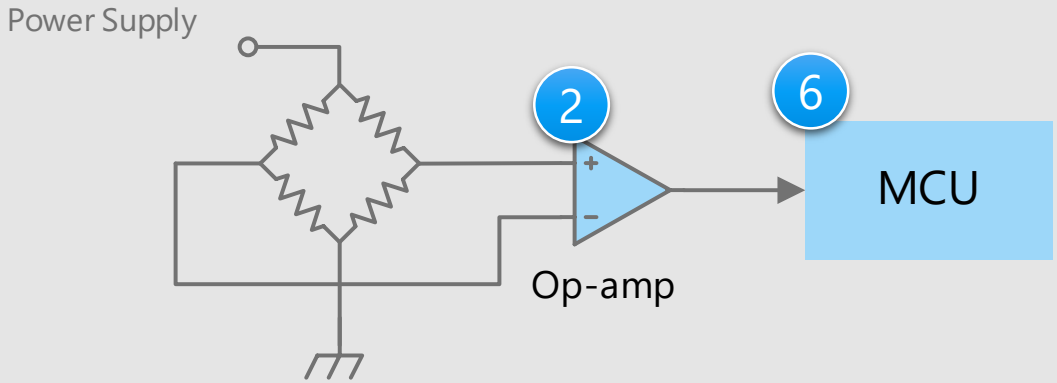


Body Composition Analyzer　Details of analog signal line (1)

Power supply



Piezoelectric element



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

Criteria for device selection

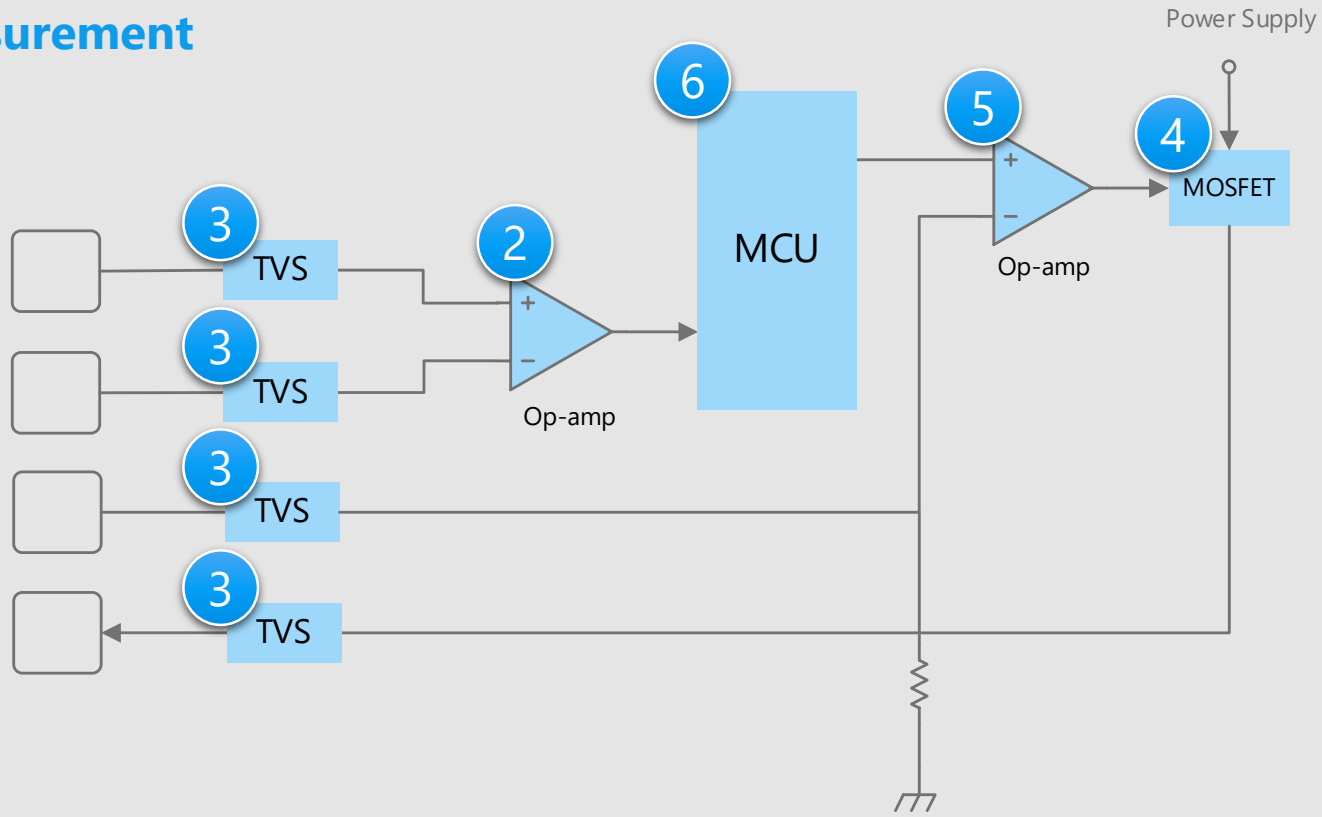
- PSRR (Power Supply Rejection Ratio) is a key characteristic for microcomputer.
- The use of small packages reduces the circuit board area.

Proposals from Toshiba

- **Optimum power supply for environments with high power supply noise**
  Small surface mount LDO regulator 1
- **Amplify the detected weak signal with low noise.**
  Low noise operational amplifier 2
- **Built-in analog input interface at low power consumption and efficient software development**
  MCU 6

Body Composition Analyzer　Details of analog signal line (2)

Human body impedance measurement



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

Criteria for device selection

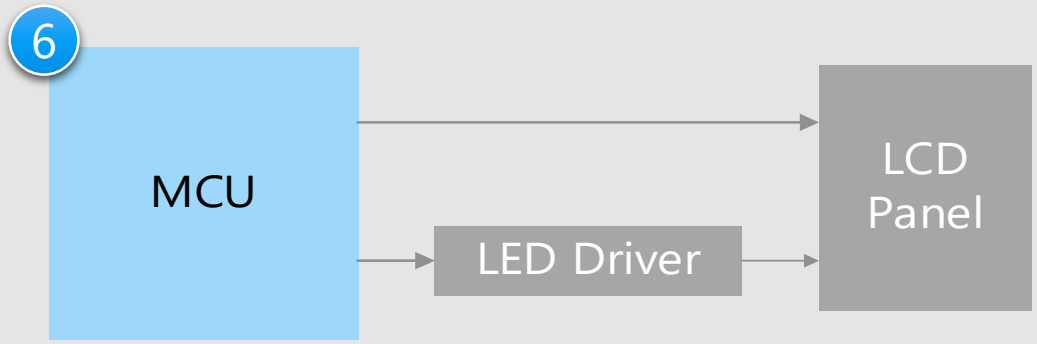
- MCU output voltage, base-emitter voltage and transistor DC current are important factors in selecting transistors.
- The use of small packages reduces the circuit board area.

Proposals from Toshiba

- **Amplify the detected small signal with low noise.**
  Low noise operational amplifier 2
- **Static electricity (ESD) from external terminals is absorbed to prevent circuit malfunction and device breakdown.**
  TVS diode 3
- **Realize a set with low power consumption by low on-resistance**
  Small signal MOSFET 4
- **Amplify the detected small signal .**
  Low current consumption operational amplifier 5
- **Built-in analog input interface at low power consumption and efficient software development**
  MCU 6

Body Composition Analyzer　Details of Main operation unit

Panel display system



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

Criteria for device selection

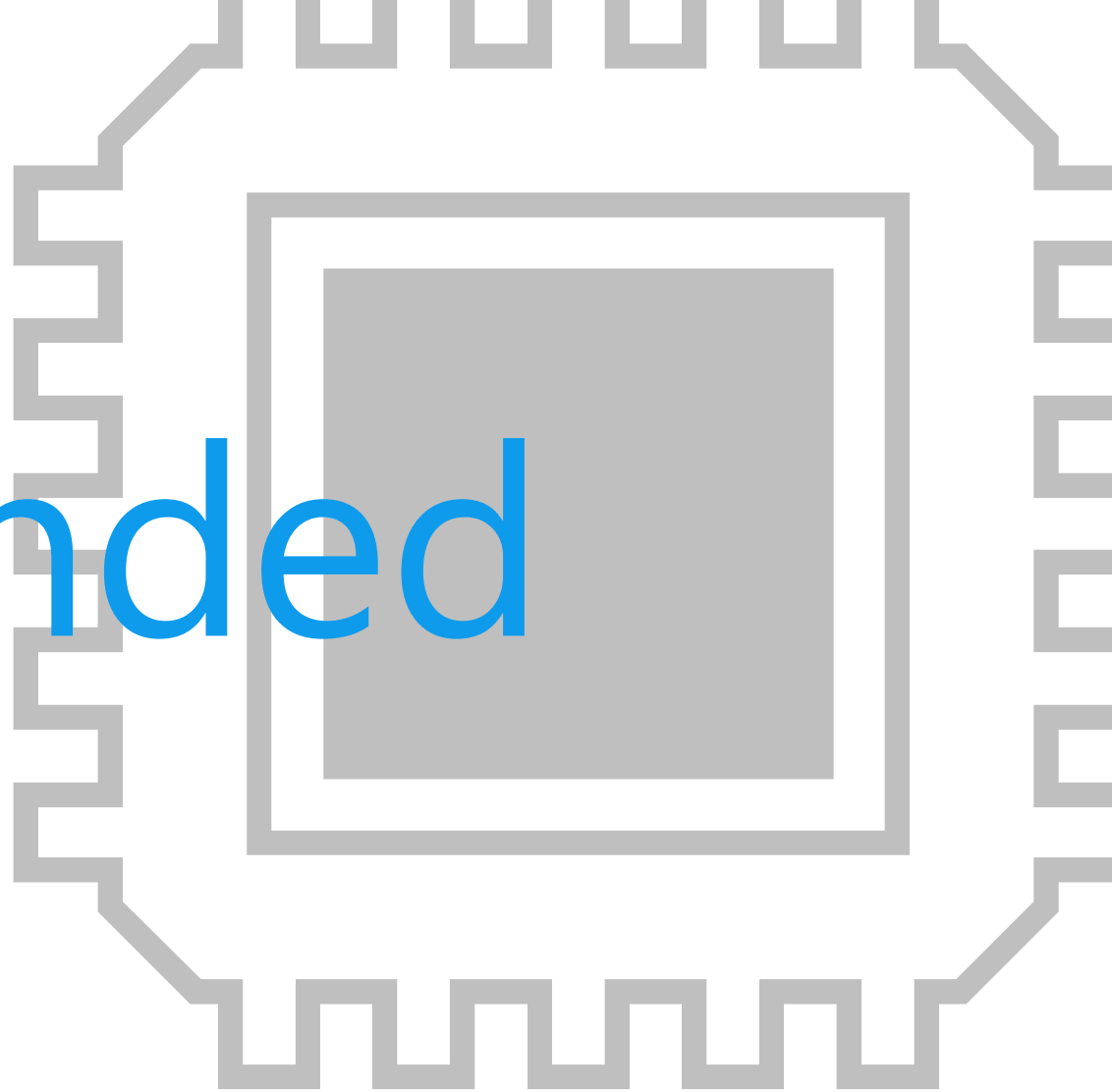
- Data processing of various sensing data and its analyzation within very short time period

Proposals from Toshiba

- **Built-in analog input interface at low power consumption and efficient software development**

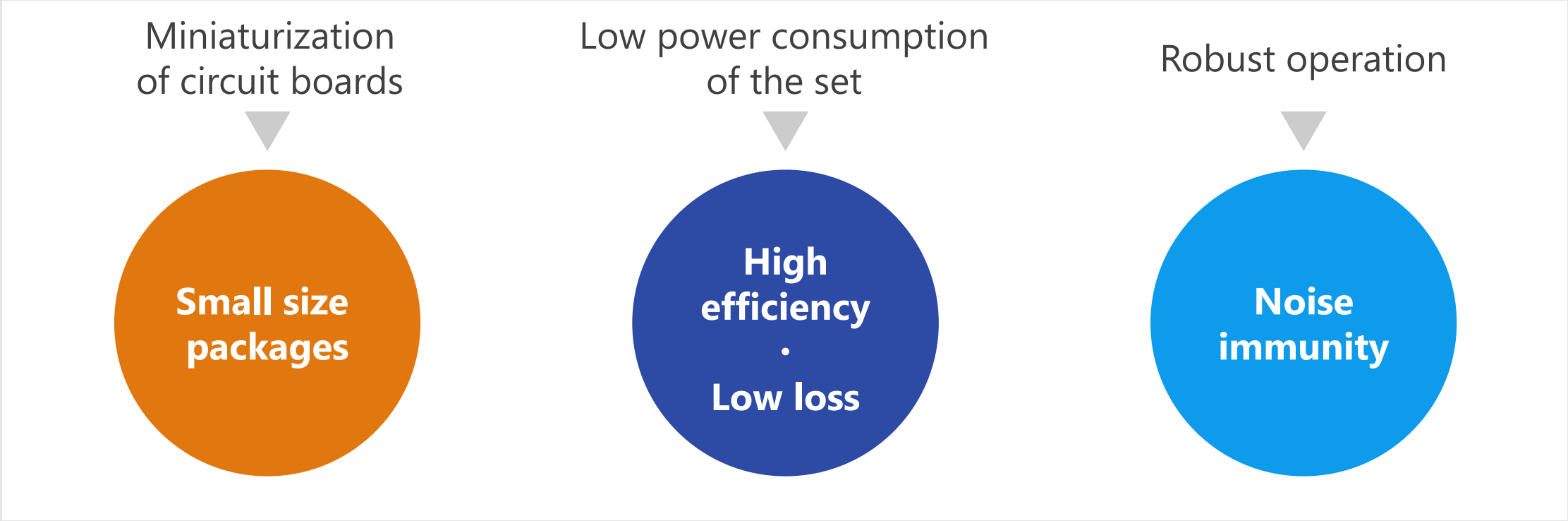
MCU 6

Recommended Devices



Device solutions to address customer needs

As described above, in the design of body composition analyzer, **“Miniaturization of circuit boards“**, **“Low power consumption of the 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 Small surface mount LDO regulator	●	●	●
② Low noise operational amplifier	●	●	
③ TVS diode	●	●	●
④ Small signal MOSFET	●	●	
⑤ Low current consumption operational amplifier	●	●	
⑥ MCU	●	●	

1 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.

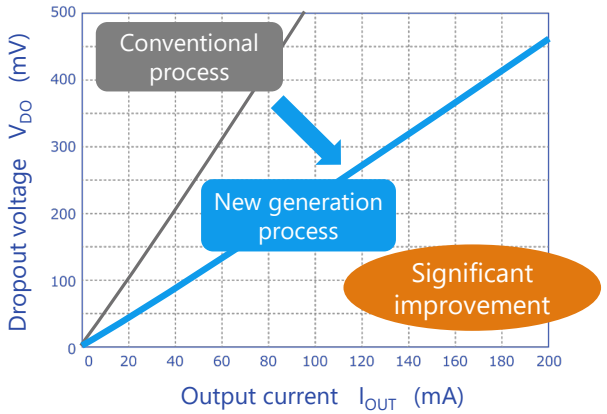
2 High PSRR Low output noise voltage

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

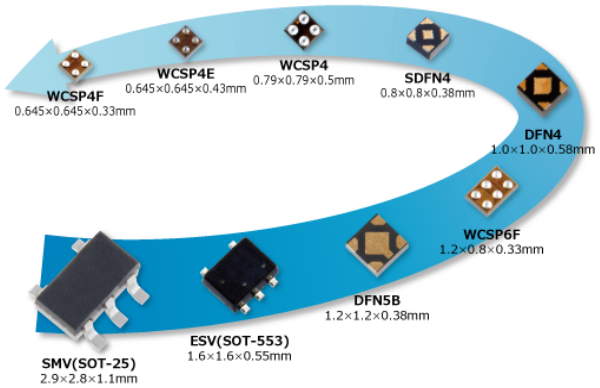
0.34 μA of $I_{B(ON)}$ is realized by utilizing CMOS process and unique circuit technology.

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

◆Return to Block Diagram TOP

2 Low noise operational amplifier
TC75S67TU

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

Value provided

Very weak signals detected by various sensors can be amplified with very low noise.

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

Very small signals detected by various sensors [Note 1] can be amplify with low noise using CMOS operational amplifier by optimizing the processing. We achieved one of the industry's lowest [Note 2] input equivalent noise voltage.

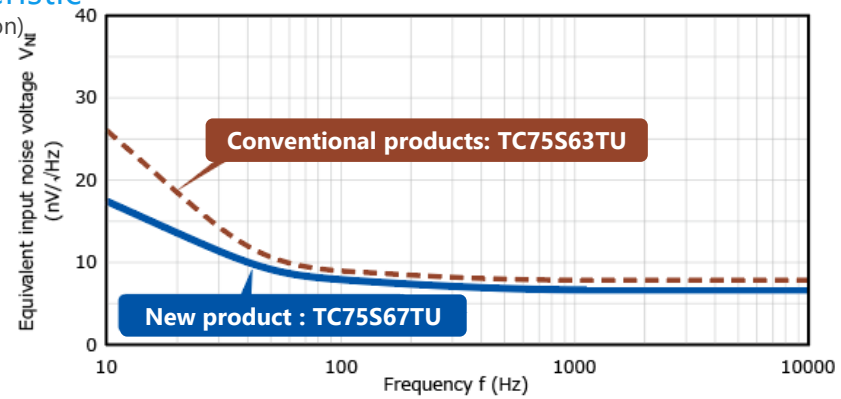
2 Low current consumption
I_{DD} = 430 [μA] (Typ.)

The low current consumption characteristics of CMOS processing contributes to the extension of battery life of the compact IoT devices.

3 Enhancement type

It is easy to handle because it is an enhancement type in which no drain current flows when no gate voltage is applied.

Low noise characteristic
(Toshiba internal comparison)



Line up

Part number	TC75S67TU
Package	UFV 
V_{DD}, V_{SS} (Max) [V]	±2.75
V_{DD}, V_{SS} (Min) [V]	±1.1
I_{DD} (Max) [μA]	700
V_{NI} (Typ.) [nV/√Hz] @f = 1 kHz	6

[Note 1] Sensor types: vibration detection sensor, shock sensor, accelerometer, pressure sensor, infrared sensor, and temperature sensor, etc.
[Note 2] Based on Toshiba data (as of May 2017)

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3 TVS diode
DF2B7AFU

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 High ESD pulse absorption performance

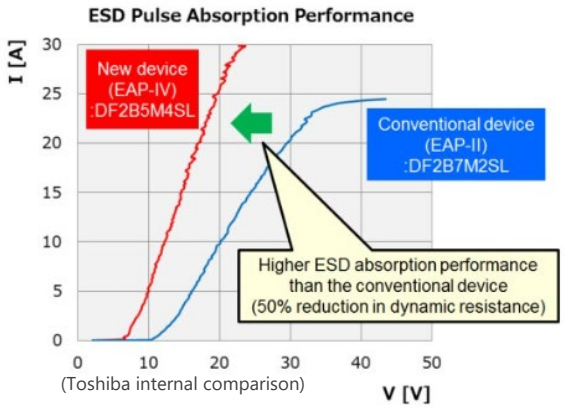
For some products, both low operating resistance and low capacitance are realized and ensures high signal protection performance and signal quality.

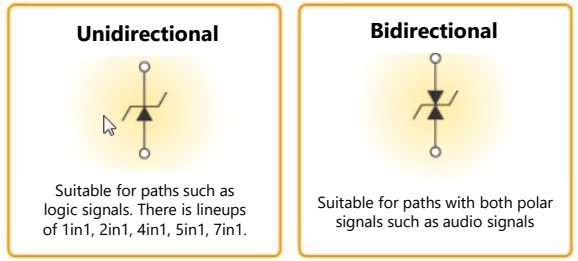
2 Suppress ESD energy by low clamp voltage

Steadily protect the connected circuits/devices using proprietary technology.

3 Suitable for high-density mounting

A variety of compact packages are available.





Line up

Part number	DF2B7AFU
Package	USC 
V_{ESD} (Max) [kV]	±30
V_{RWM} (Max) [V]	5.5
C_t (Max) [pF]	10.0
R_{DYN} (Typ.) [Ω]	0.2

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

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4 Small signal MOSFET
SSM3K15AMFV

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

Value provided

Suitable for the load switch with partial power-down and greatly contributes to miniaturization.

1 Low voltage drive

Drive at V_{GS}=2.5 V.

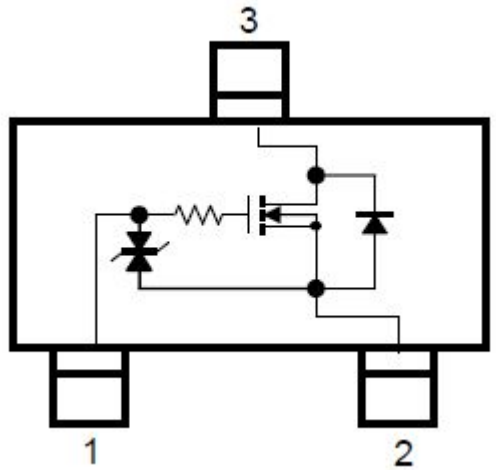
2 Low on-resistance

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

3 Small package

SOT-723 / VESM package.

SSM3K15AMFV
Internal connection



Line up

Part number		SSM3K15AMFV
Package		VESM 
V_{DSS} (Max) [V]		30
I_D (Max) [mA]		100
$R_{DS(ON)}$ [Ω] @V_{GS} = 2.5 V	Typ.	3.5
	Max	6.0
Polarity		N-ch

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5 Low current consumption operational amplifier

TC75S102F / TC75S103F

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

Value provided

Low current consumption 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 body composition analyzer.

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

CMOS processes have been used to achieve lower current consumption. This contributes to lower power consumption and longer life of wearable equipment.

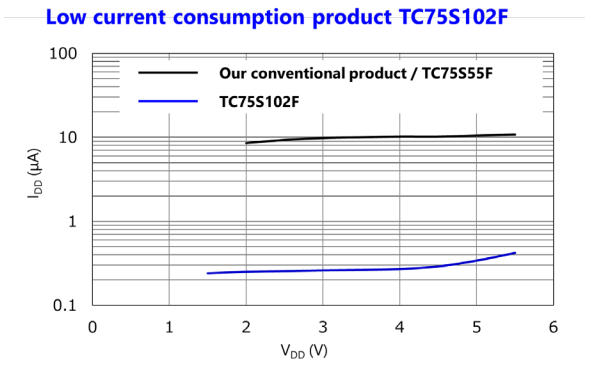
3 I/O full range (I/O Rail to Rail)

It is possible to amplify and process a wide range of input signals from GND voltage to power supply voltage at low power supply voltage.

TC75S102F

Current Consumption Characteristic

(Toshiba internal comparison)



Line up

Part number	TC75S102F	TC75S103F
Package	SMV 	SMV 
V_{DD} - V_{SS} (Max) [V]	1.5 to 5.5	1.8 to 5.5
V_{IO} (Max) [mV]	1.3	1.5
CMV_{IN} (Max) [V]	V_{DD}	V_{DD}
I_{DD} (Typ. / Max) [µA]	0.27 / 0.46 (@V_{DD}=1.5 V)	100 / 165 (@V_{DD}=1.8 V)
f_T (Typ.) [kHz]	0.5	300

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Value provided

System cost down, high efficiency system, development efficiency improvement.

1 Built-in Arm® Cortex®-M0 CPU core

Built-in Cortex-M0 core with Thumb instruction set improves energy efficiency. Various development tool and their partners allow users many options.

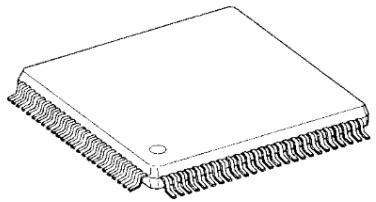
2 Suitable for sensing analog signal

Built-in multi-channel ADC and CPU system executes sensing data processing efficiently at low cost.

3 Small package and very low power consumption

Cortex-M0 and original NANOFLASH™ technology bring to the small package and low power consumption. They contribute foot print and power consumption reduction.

TMPM061FWFG



LQFP100

Line up

Part number	TMPM061FWFG
Maximum operation frequency	16 MHz
Instruction ROM	128 KB
RAM	8 KB
Timer	9ch
UART/SIO	4ch
ADC	1ch(10bits), 3ch(24bits)
LCDD	40 seg x 4 com

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