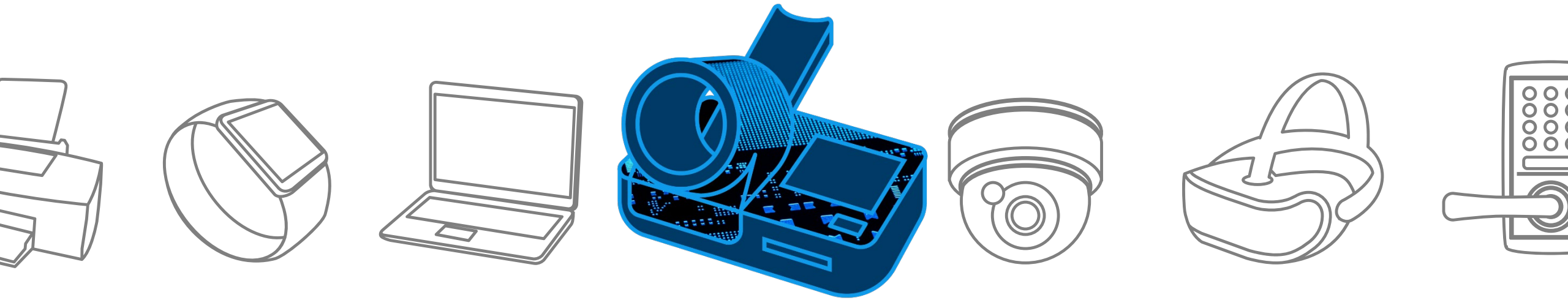
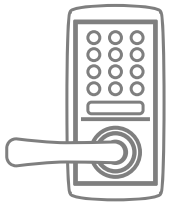
TOSHIBA

R20

Electronic Sphygmomanometer

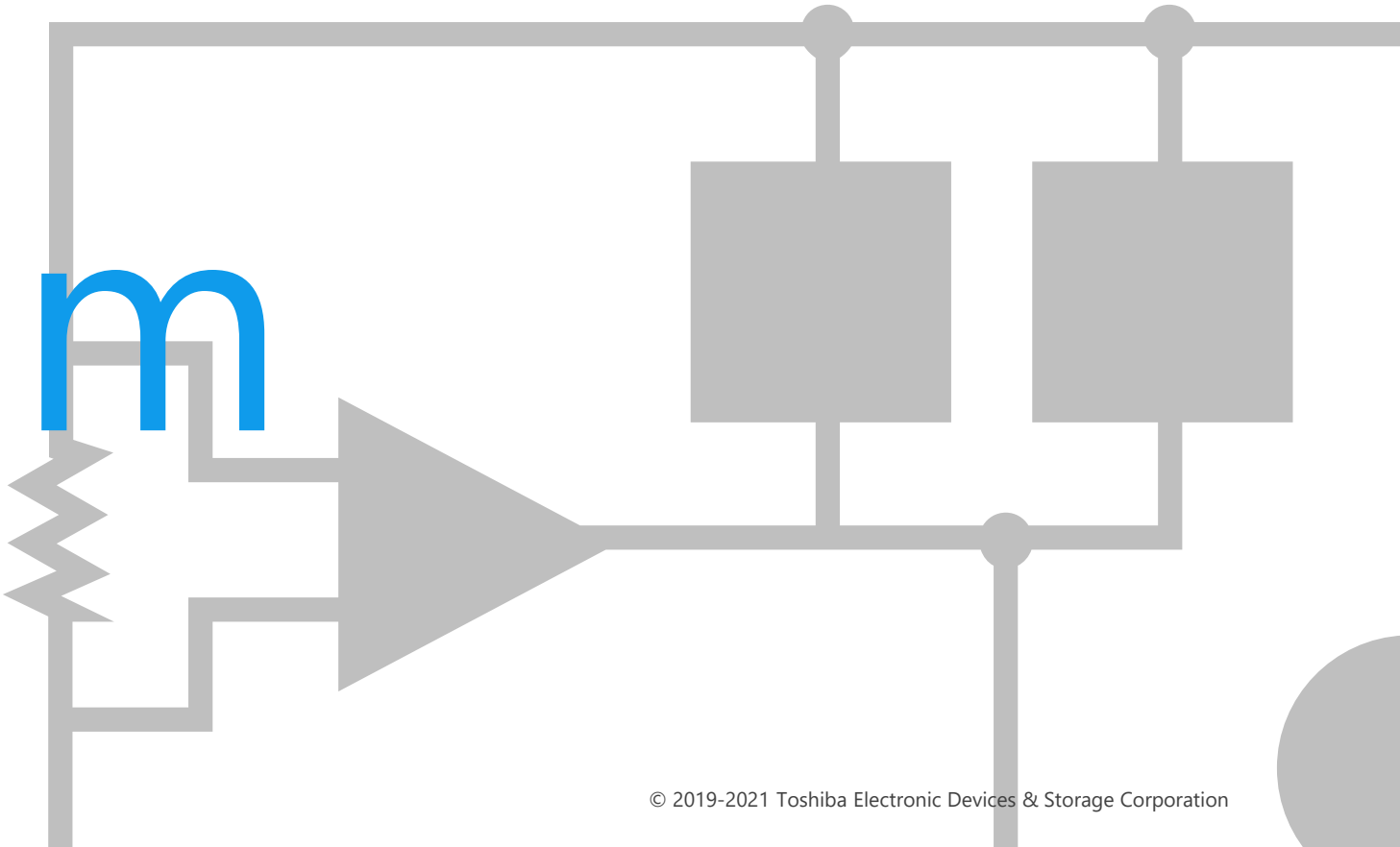
Solution Proposal by Toshiba



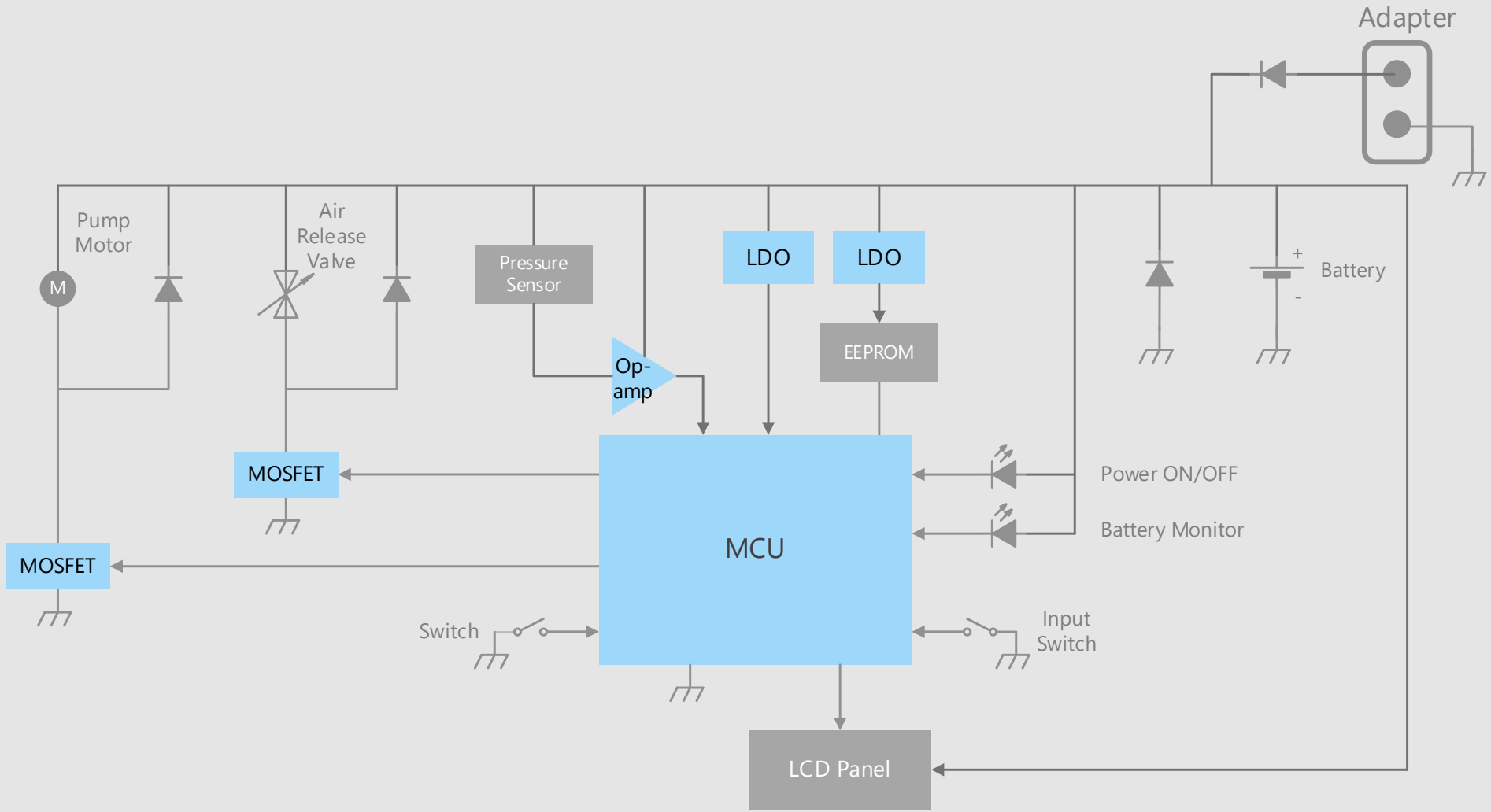


Toshiba Electronic Devices & Storage Corporation provides comprehensive device solutions to customers developing new products by applying its thorough understanding of the systems acquired through the analysis of basic product designs.

Block Diagram

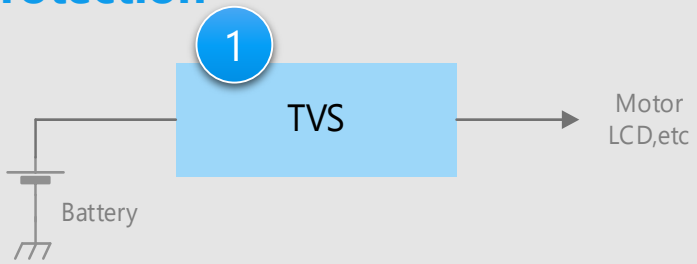


Electronic Sphygmomanometer　Overall block diagram

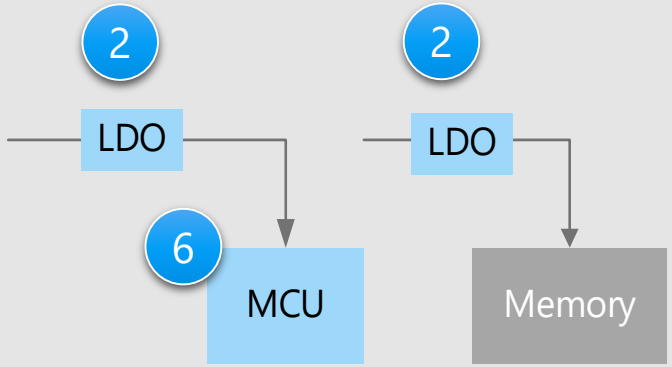


Electronic Sphygmomanometer　Detail of power supply circuits

Surge voltage protection



Control MCU power supply



Constant voltage supply circuit

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

Device selection points

- The power line from the DC adapter must be protected against surge voltage.
- PSRR is a key feature of microcomputers.
- A backflow prevention measure is necessary between the battery and the AC adapter.

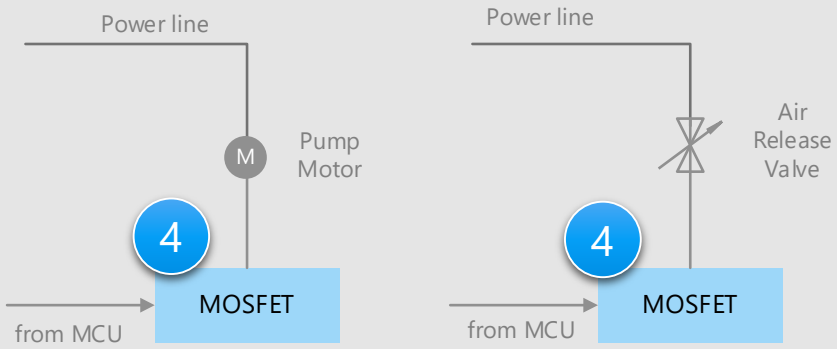
Proposals from Toshiba

- **Static electricity (ESD) from external terminals is absorbed to prevent circuit malfunction and device breakdown.**
  TVS diode (1)
- **Optimum power supply for environments with high power supply noise**
  Small surface mount LDO regulator (2)
- **Low forward voltage / Strong against surge current**
  Schottky barrier diode (3)
- **Built-in LCD driver / controller CPU**
  MCU (6)

Electronic Sphygmomanometer　Detail of motor drive circuits

Motor protection

Motor control



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

Device selection points

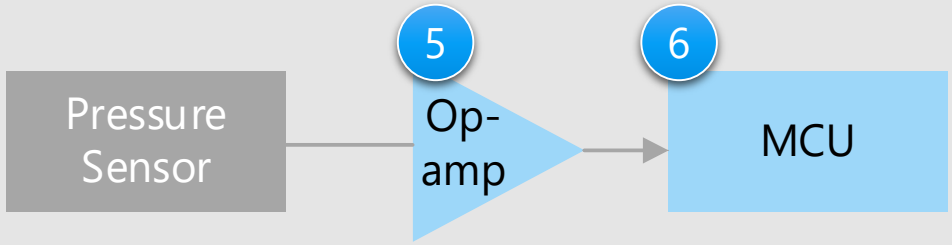
- A small, low on-resistance MOSFET is used to control the motors.
- Protection against flyback current by the motor is necessary.

Proposals from Toshiba

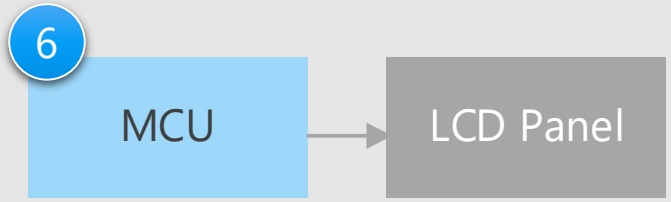
- **Low forward voltage / Strong against surge current**
  Schottky barrier diode　3
- **Setting of low power consumption with low on-resistance**
  Small signal MOSFET　4

Electronic Sphygmomanometer　Detail of sensor signal detection circuit

Pressure sensor



LCD driver / controller



Device selection points

- The voltage and current supplied are important for selecting the operational amplifier.
- The use of small packages reduces the board area.

Proposals from Toshiba

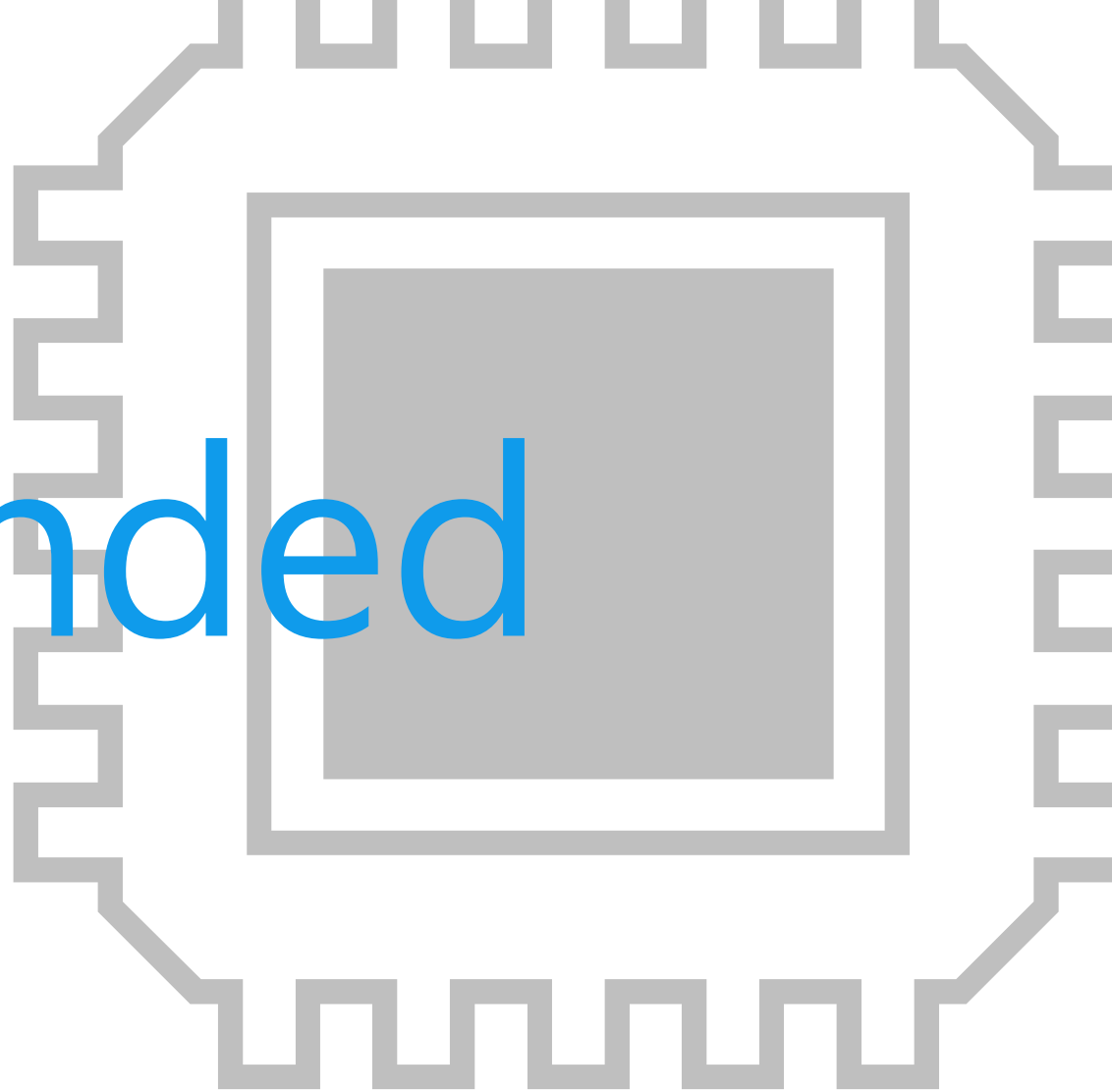
- **Amplify the detected small signal with low noise.**
  Low noise operational amplifier
- **Built-in LCD driver / controller CPU**
  MCU

5

6

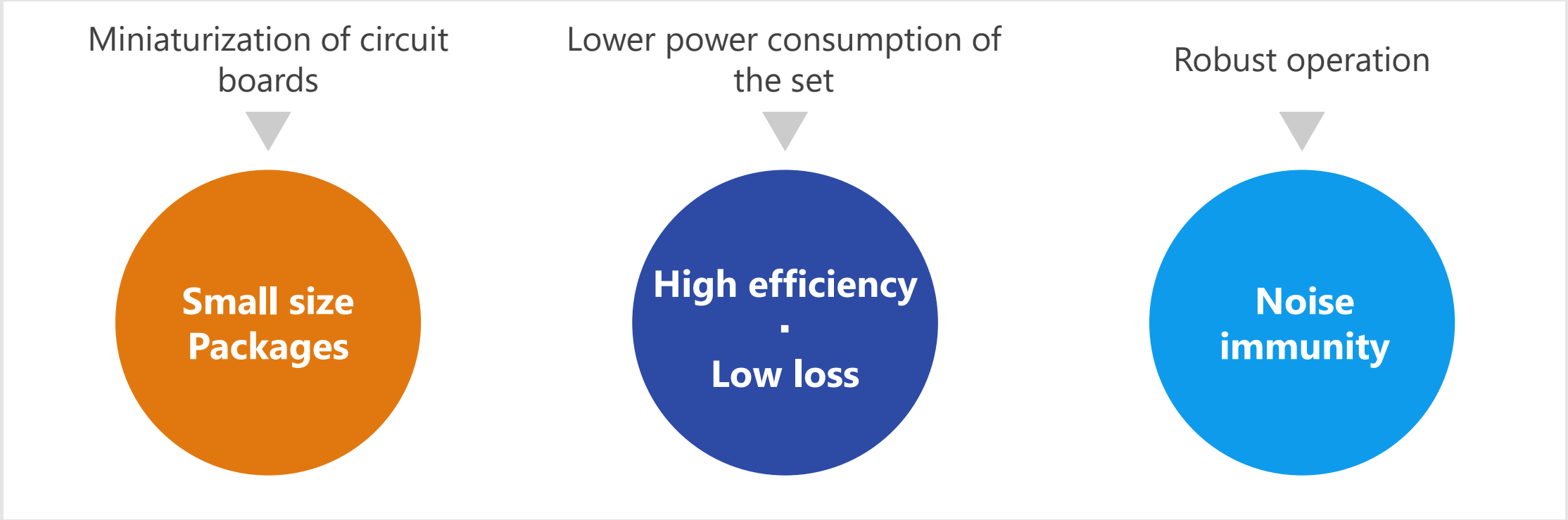
* Click on the numbers in the circuit diagram to jump to the detailed descriptions page

Recommended Devices

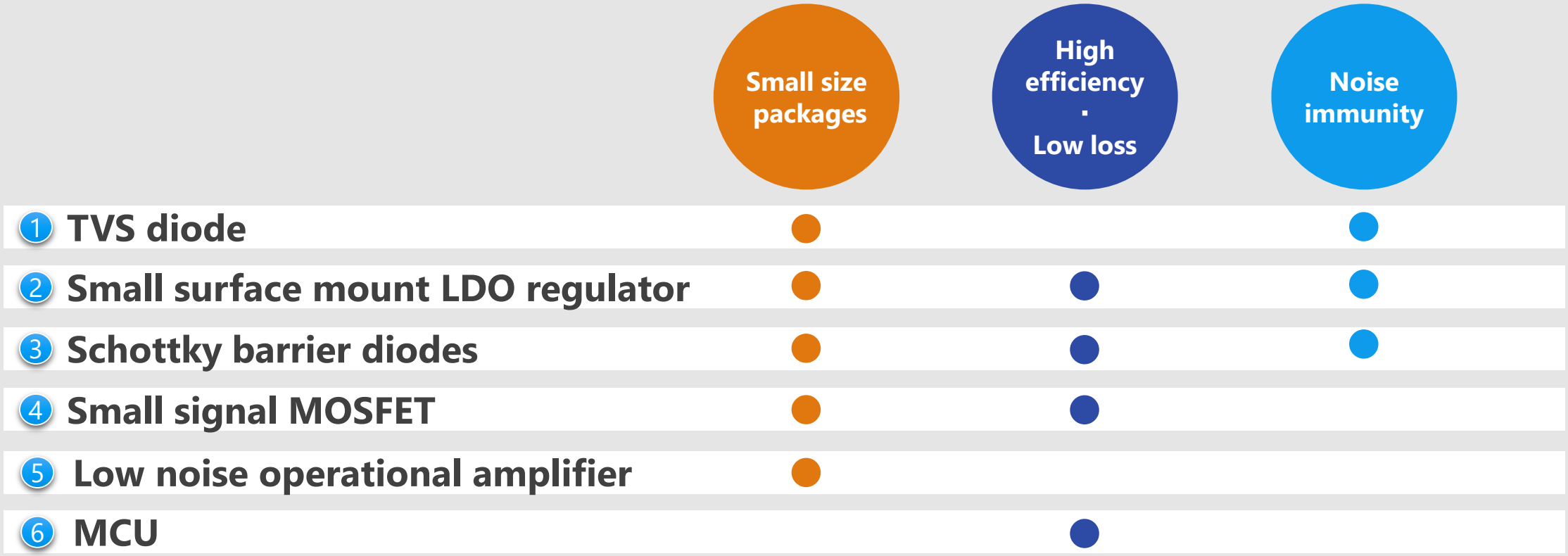


Device Solutions to address customer needs

As described above, in the design of Electronic Sphygmomanometer, **"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.



Device Solutions to address customer needs



1 TVS diode

DF2B7ASL / DF2B20M4SL / DF2B5PCT / DF2B7PCT / DF2S14P2CTC / 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 Improved ESD 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.

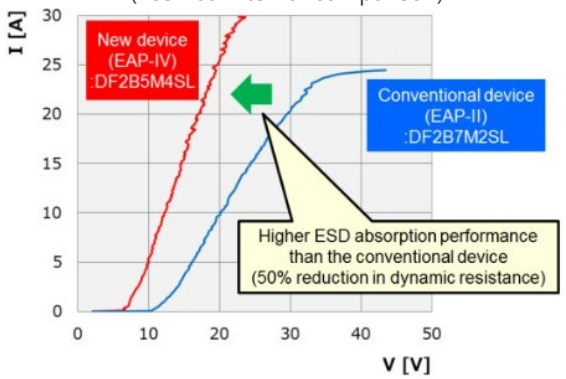
2 Suppress ESD energy by low clamp voltage

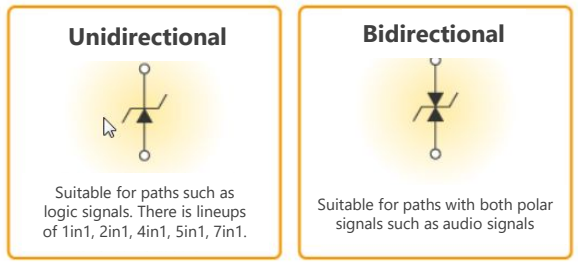
Steadily protect the connected circuits/devices using proprietary technology.

3 Suitable for high-density mounting

A variety of compact packages are available.

ESD Pulse Absorption Performance
(Toshiba internal comparison)





Line up

Part number	DF2B7ASL	DF2B20M4SL	DF2B5PCT	DF2B7PCT	DF2S14P2CTC	DF2B7AFU
Package	SL2 		CST2 			USC 
V_{ESD} [kV]	±30	±15	±30	±30	±30	±30
V_{RWM} (Max) [V]	5.5	18.5	3.6	5.5	12.6	5.5
C_t (Typ.) [pF]	8.5	0.2	41	45	270	8.5
R_{DYN} (Typ.) [Ω]	0.2	0.2	0.1	0.1	0.08	0.2

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

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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 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.

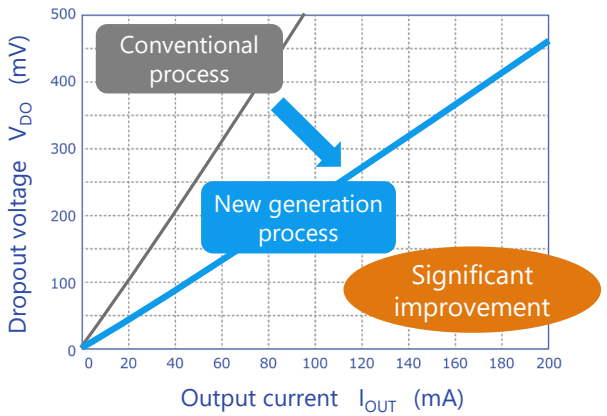
2 High PSRR Low output noise voltage

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

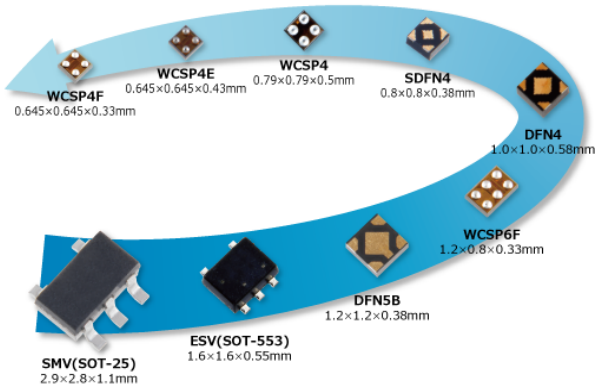
0.34 μA of $I_{B(ON)}$ is realized by utilizing CMOS process and unique circuit technology.

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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3 Schottky barrier diodes

CUS10S40 / CUHS15F40 / CUS10F30 / 1SS424

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

Value provided

Low loss allows it to be applied to various applications, and greatly contributes to miniaturization.

1 Low forward voltage

It is suitable for Backflow prevention with low power loss by low forward voltage.

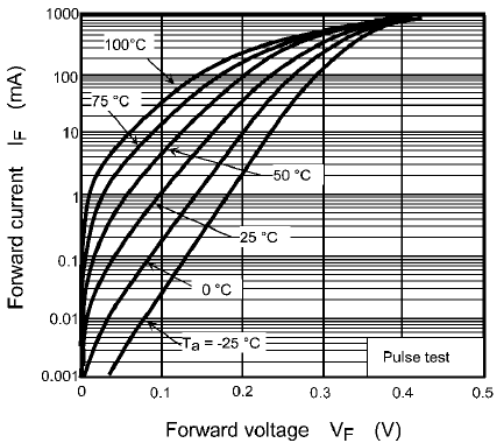
2 Be resistant to reverse voltage

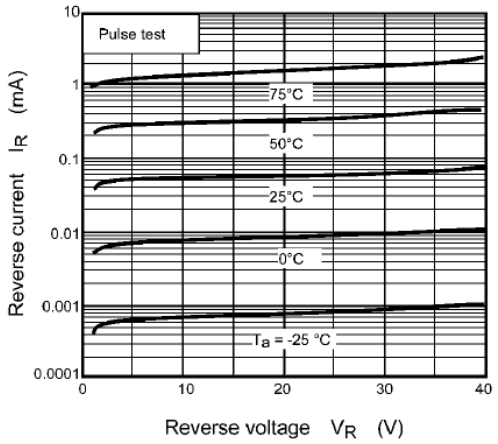
The reverse voltage V_R can be applied up to 40 V.

3 Small package

Small package is suitable for high-density mounting.

CUS10S40 Characteristics Curves





Line up

Part number	CUS10S40	CUHS15F40	CUS10F30	1SS424
Package	USC 	US2H 	USC 	ESC 
I_O (Max) [A]	1.0	1.5	1.0	0.2
V_R (Max) [V]	40	40	30	20
V_F (Typ.) [V]	0.45	0.49	0.43	0.42

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4 Small signal MOSFET

SSM3K329R / SSM3K324R / SSM3K35AMFV

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

Value provided

Suitable for power management switches and greatly contributes to miniaturization.

1 Low voltage drive

Drive at V_{GS} = 1.8 V.

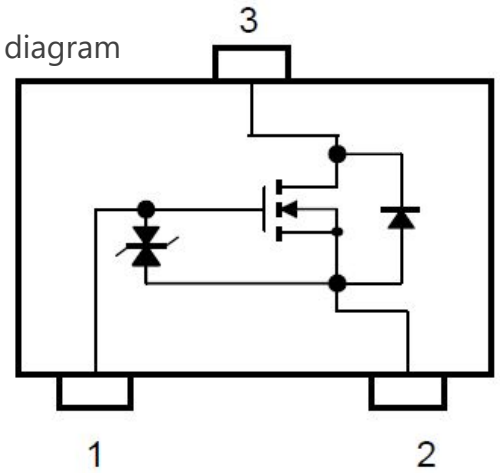
2 Low on-resistance

Heat generation and power consumption can be kept low by keeping the on-resistance between the source and drain low.

3 Small package

Package line-up for SOT-23F / VESM.

SSM3K329R
Internal connection diagram



Line up

Part number	SSM3K329R	SSM3K324R	SSM3K35AMFV
Package	SOT-23F 	SOT-23F 	VESM 
Polarity	N-ch	N-ch	N-ch
V_{DSS} [V]	30	30	20
I_D [A]	3.5	4.0	0.25
$R_{DS(ON)}$ (Max) [Ω] @V_{GS} = 1.5 V	0.289	0.109	3.1

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5 Low noise operational amplifier

TC75S67TU

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

Value provided

Very small 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 Small package

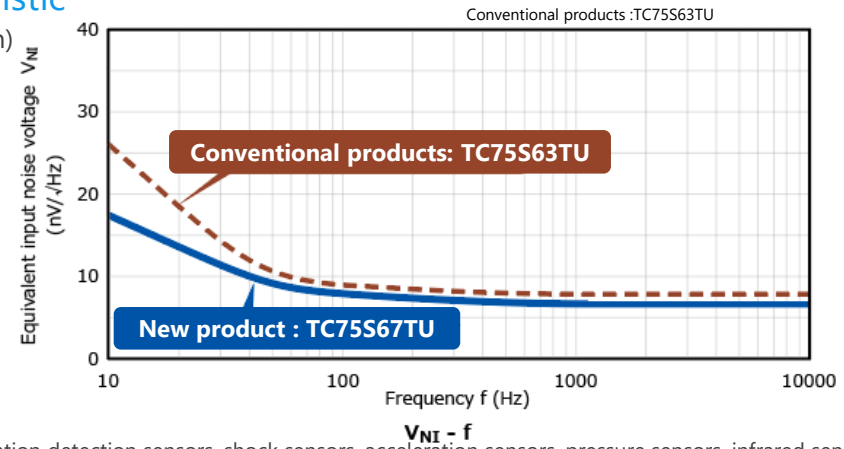
This is a flat lead type compact package, which contributes to the miniaturization and lower height of the printed circuit board. Packaging size: 2.0 x 2.1 x 0.7 mm

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

The adoption of the CMOS process achieves lower current-consumption characteristics than our bipolar process operational amplifier.

Low noise characteristic

(Toshiba internal comparison)



V_{NI} - f

Line up

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

[Note 1] Various sensors: vibration detection sensors, shock sensors, acceleration sensors, pressure sensors, infrared sensors, and temperature sensors, etc.
[Note 2] Based on our survey (as of May 2017).

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Value provided

Built-in LCD driver / controller Toshiba original CPU 8bit MCUs

1 Toshiba Original CPU Core TLCS-870/C1 Series

TLCS-870/C1 Series of 8bit MCUs realizes processing capability equivalent to 16bit MCUs, and achieves high-speed processing at low internal clock frequencies by operating one instruction cycle in a single clock cycle.

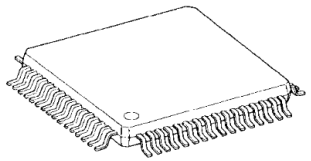
2 Built-in LCD driver / controller

TMP89FW20AUG and TMP89FW24AFG have a built-in LCD driver / controller and can directly drive a segment LCD. 1/4, 1/3, 1/2 duty and static drive can be selected. They also have a built-in bleeder resistor for LCD power supply voltage.

3 Reduction of system cost and development load

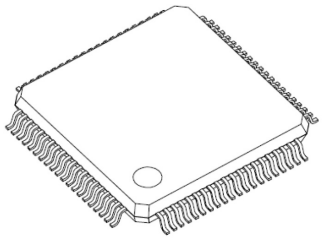
TMP89FW20AUG and TMP89FW24AFG have a built-in high-frequency oscillation circuit (Typ.:10 MHz) and can reduce system cost. In addition, the software development period can be shortened by a built-in Toshiba NANOFLASH™ memory, which allows high-speed rewriting of programs.

TMP89FW20AUG



LQFP64

TMP89FW24AFG



LQFP80

Line up

Part number	TMP89FW20AUG	TMP89FW24AFG
Maximum operation frequency	16 MHz	16 MHz
Instruction ROM	124 KB	124 KB
RAM	3 KB	3 KB
Timer	16bit x 2ch 10bit x 1ch 8bit x 4ch	16bit x 2ch 10bit x 1ch 8bit x 4ch
UART	3ch	3ch
LCDD	32 SEG x 4 COM	40 SEG x 4 COM
ADC	8ch (10bit)	8ch (10bit)

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