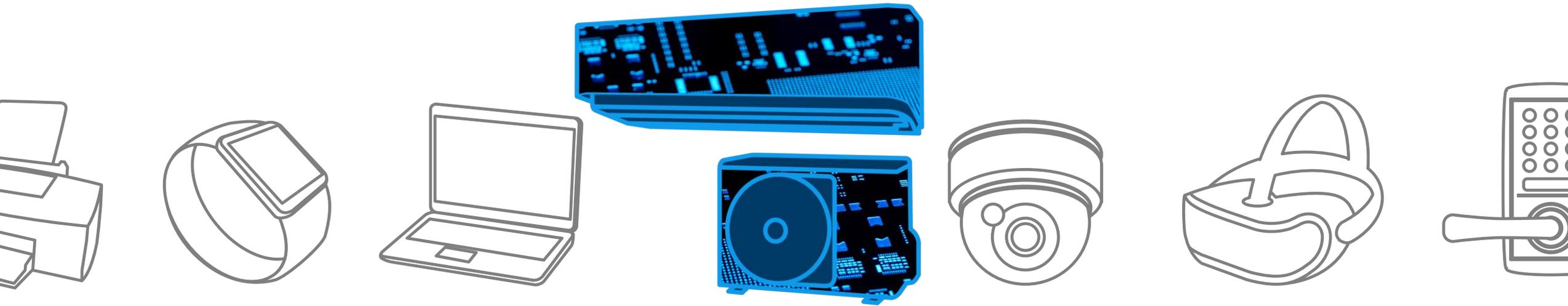
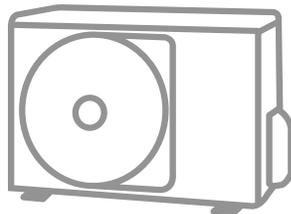
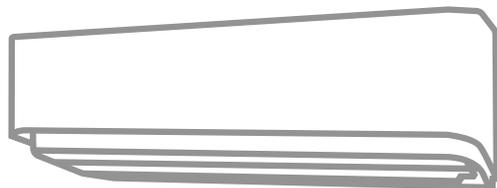
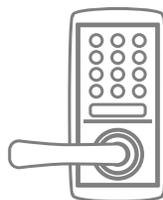


Air Conditioner

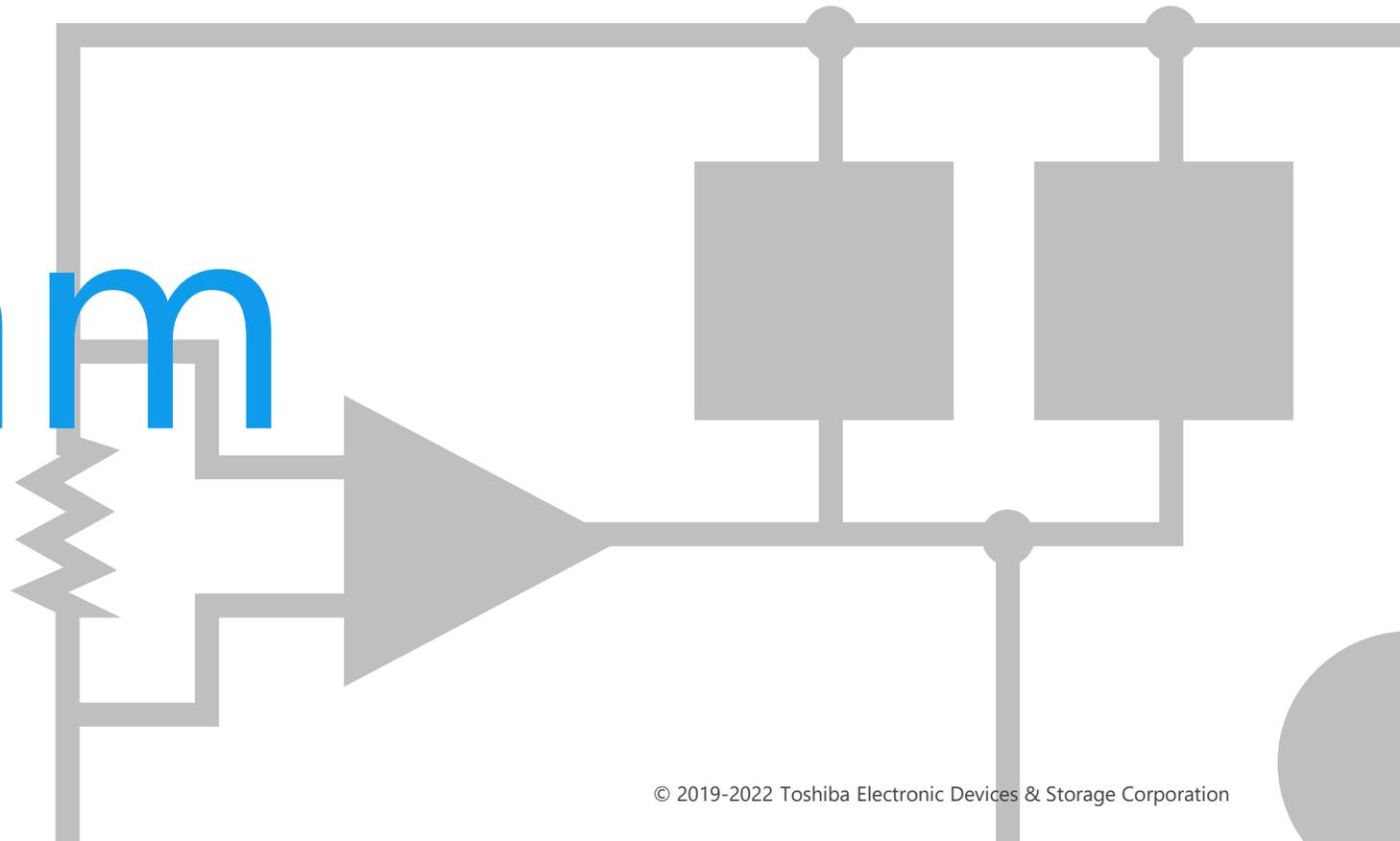
Solution Proposal by Toshiba



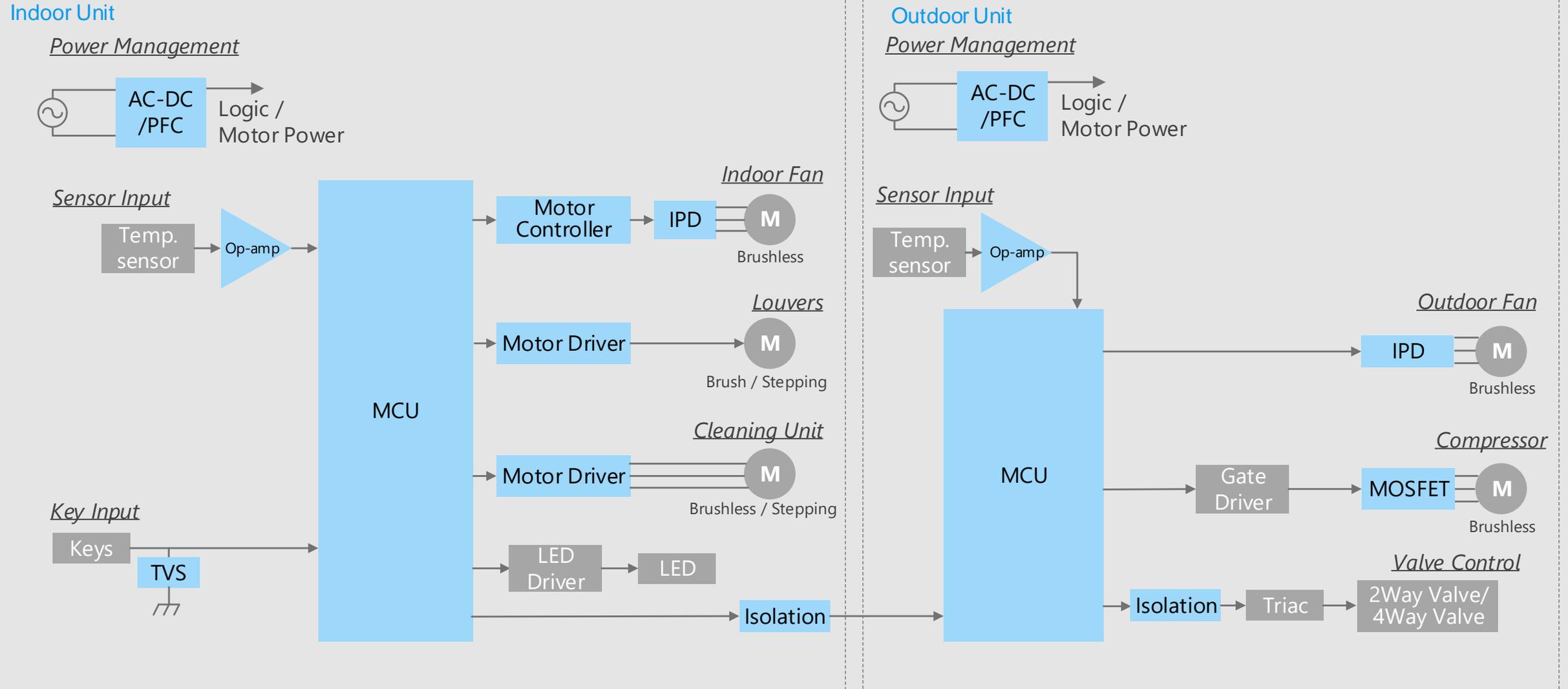


Toshiba Electronic Devices & Storage Corporation provides comprehensive device solutions to customers developing new products by applying its thorough understanding of the systems acquired through the analysis of basic product designs.

Block Diagram

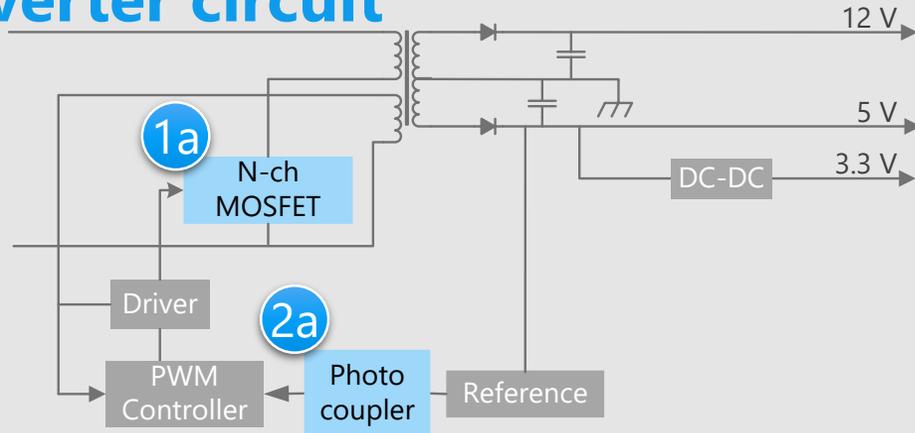


Air Conditioner Overall Block Diagram



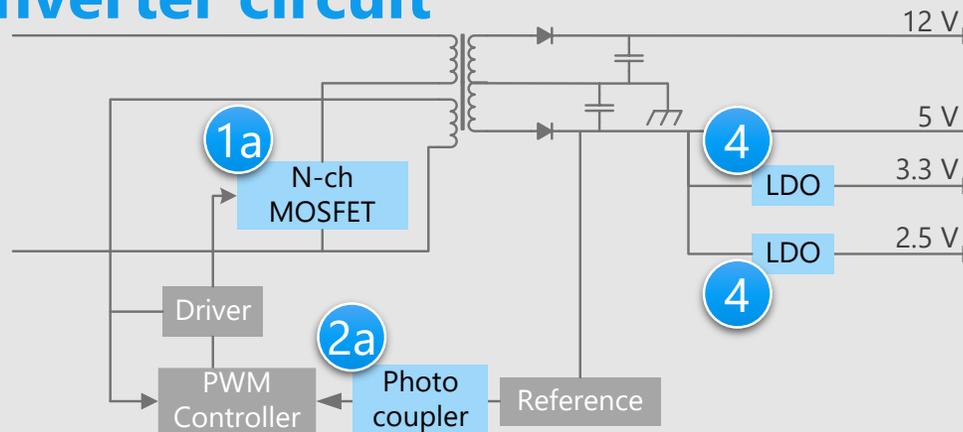
AC-DC converter circuit

Outdoor unit



AC-DC converter circuit

Indoor unit



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

Criteria for device selection

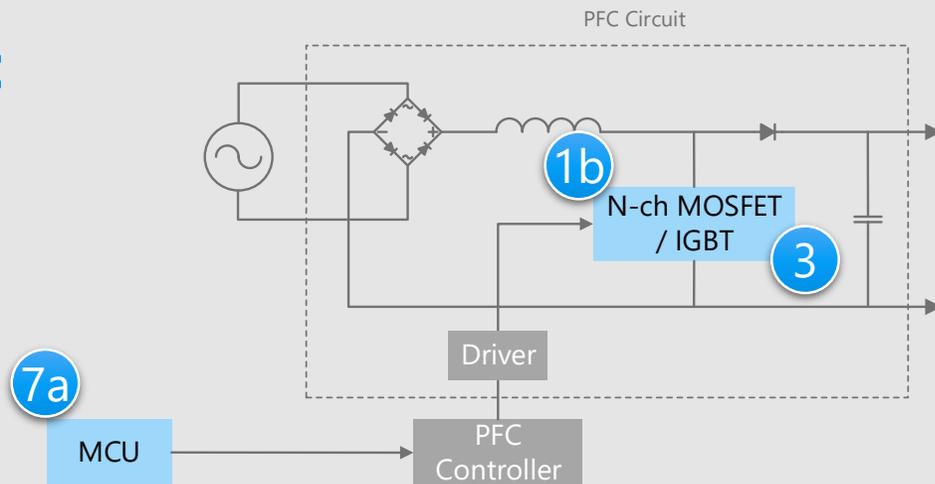
- High voltage MOSFETs are suitable for primary switching of AC-DC converters.
- Photocoupler with high current transfer ratio even in the low input current range contributes to higher power supply efficiency.

Proposal from Toshiba

- **Suitable for high efficiency voltage switching**
π-MOSVIII Series MOSFET 1a
- **High current transfer ratio and high temperature operation makes easy to design.**
Transistor output photocoupler 2a
- **Supply the power with low noise**
Small surface mount LDO regulator 4

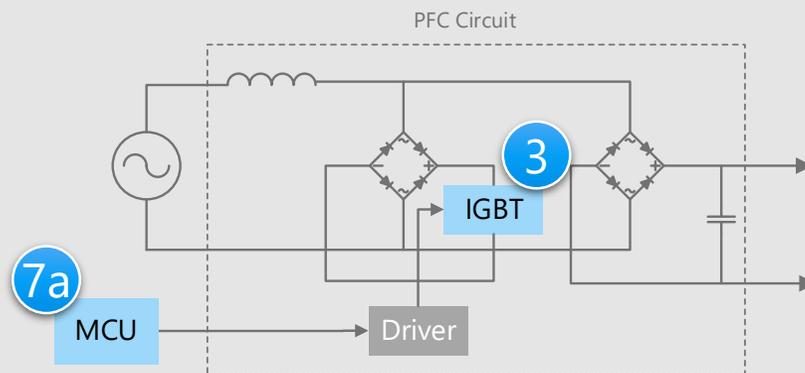
PFC circuit

Active type



PFC circuit

Partial switching type



Criteria for device selection

- MOSFETs with high speed switching and low on-resistance are suitable for active type PFC circuit.
- IGBTs with low collector-emitter saturation voltage are suitable for partial switching type PFC circuit.

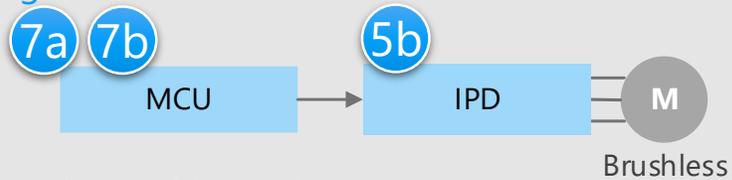
Proposal from Toshiba

- **Suitable for high efficiency power supply switching**
DTMOSVI Series MOSFET (1b)
- **IGBT which is suitable for high voltage and high current system**
Discrete IGBT (3)
- **Suitable for PFC and motor control**
MCU (7a)

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

Fan section (indoor/outdoor units)

High voltage IPD



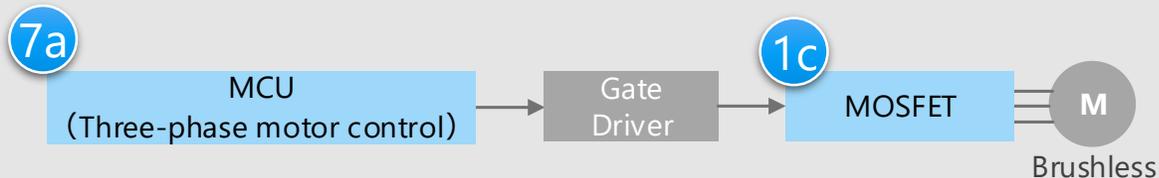
MCD (controller) + high voltage IPD



MCU (Three-phase motor controller) + high voltage IPD



Compressor section



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

Criteria for device selection

- IPDs are suitable for fan motor drive in indoor & outdoor units.
- MOSFET with short reverse recovery time is suitable for compressors.
- By using brushless motor drivers, three-phase brushless DC motors can be controlled easily.

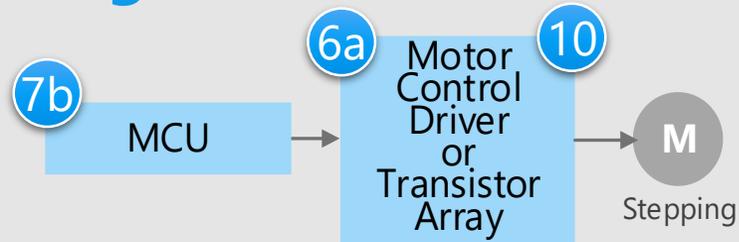
Proposal from Toshiba

- **Suitable for inverter**
DTMOSIV (HSD) [Note] Series MOSFET
- **High voltage motor driver circuit**
High voltage IPD
- **Easy motor drive**
Motor driver
- **Suitable for PFC and motor control**
MCU
- **Easy software development using general purpose CPU cores**
MCU

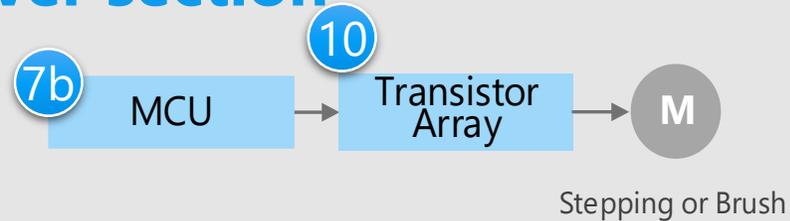


[Note] 4th generation DTMOS with high speed diode

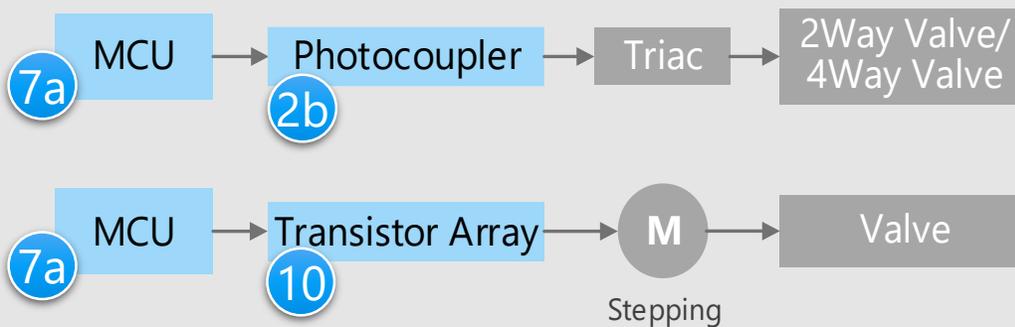
Cleaning section



Louver section



Valve control section



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

Criteria for device selection

- By using brushless DC motor drivers, three-phase brushless DC motors can be controlled easily.
- Stepping motor driver enables efficient motor control by optimizing real-time current to the motor.
- Brushed DC motor driver allows motor driving with low power consumption.

Proposal from Toshiba

- **Easy motor drive**
Motor driver 6a
- **Triac driver for high dv/dt**
Triac output photocoupler 2b
- **Suitable for PFC and motor control**
MCU 7a
- **Easy software development using general purpose CPU cores**
MCU 7b
- **High efficiency and high current driver with built-in low loss DMOS FET**
Transistor array 10

Microcontroller section

Power control block for outdoor unit



Isolation circuit

Compressor block between outdoor / indoor units



Criteria for device selection

- Isolation devices such as transistor output photocouplers are effective when voltage difference exists between outdoor and indoor GNDs.
- MCUs are suitable for system monitoring and control.

Proposal from Toshiba

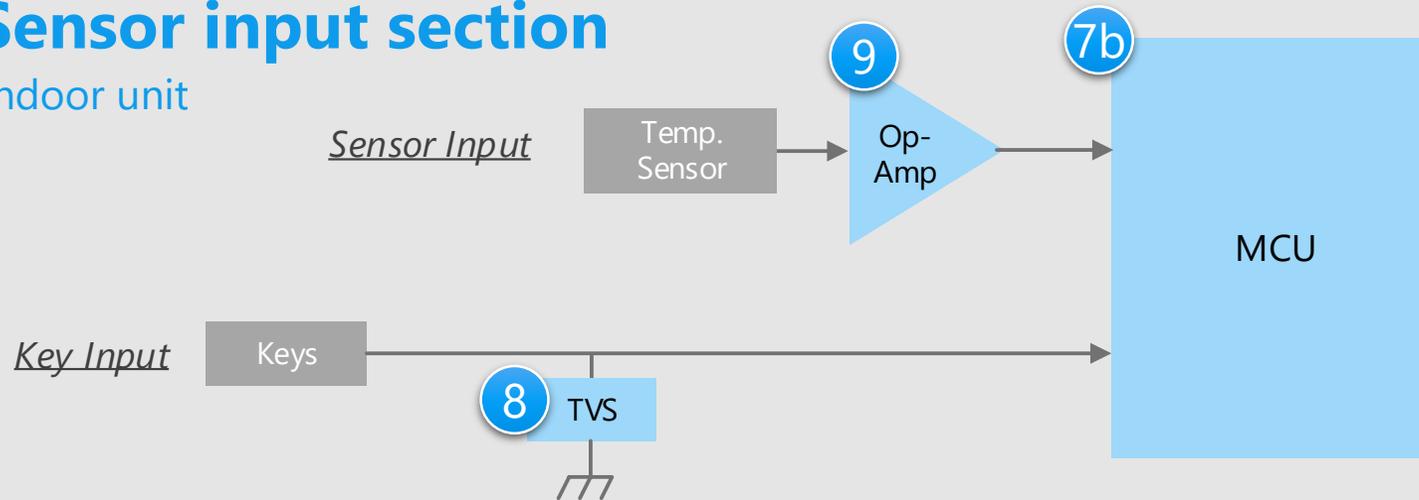
- **High current transfer ratio and high temperature operation makes easy to design.** Transistor output photocoupler
- **Supply the power with low noise** Small surface mount LDO regulator
- **Suitable for PFC and motor control** MCU
- **Easy software development using general purpose CPU cores** MCU

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

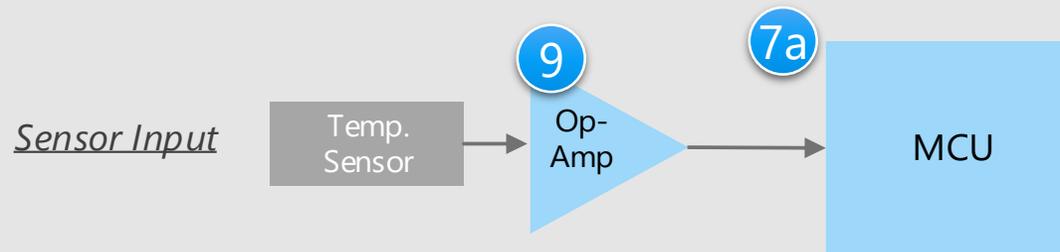
Air Conditioner Details of sensor input unit

Sensor input section

Indoor unit



Outdoor unit



Criteria for device selection

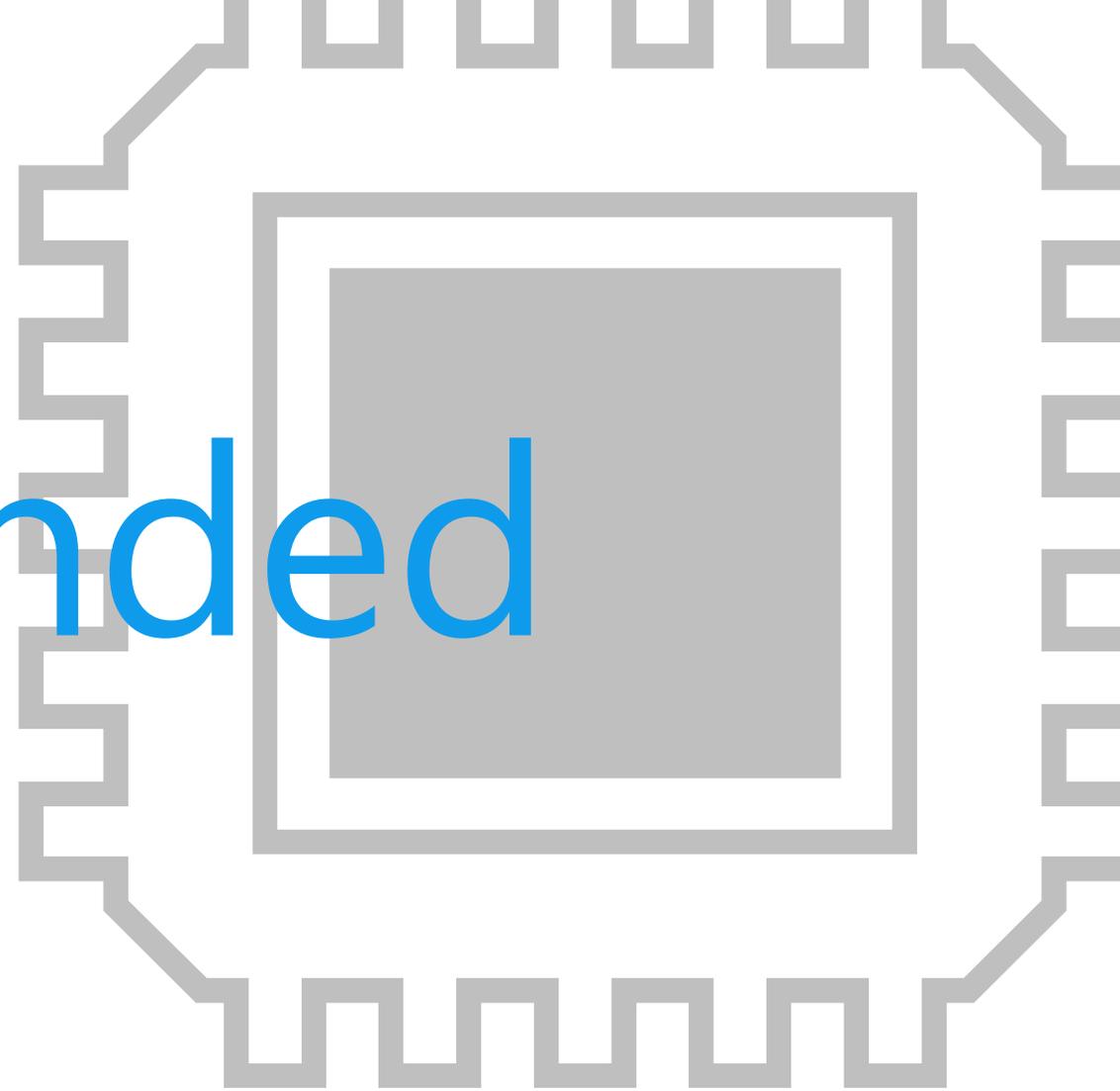
- To achieve good usability, voice commands require fast responses.
- LDO regulators are suitable for power supply circuits with low ripple noise and stable voltage.

Proposal from Toshiba

- **Suitable for PFC and motor control** MCU (7a)
- **Easy software development using general purpose CPU cores** MCU (7b)
- **Absorb static electricity (ESD) to prevent malfunction of the circuit** TVS diode (8)
- **Amplifies signals from various sensors with low noise** Low noise operational amplifier (9)

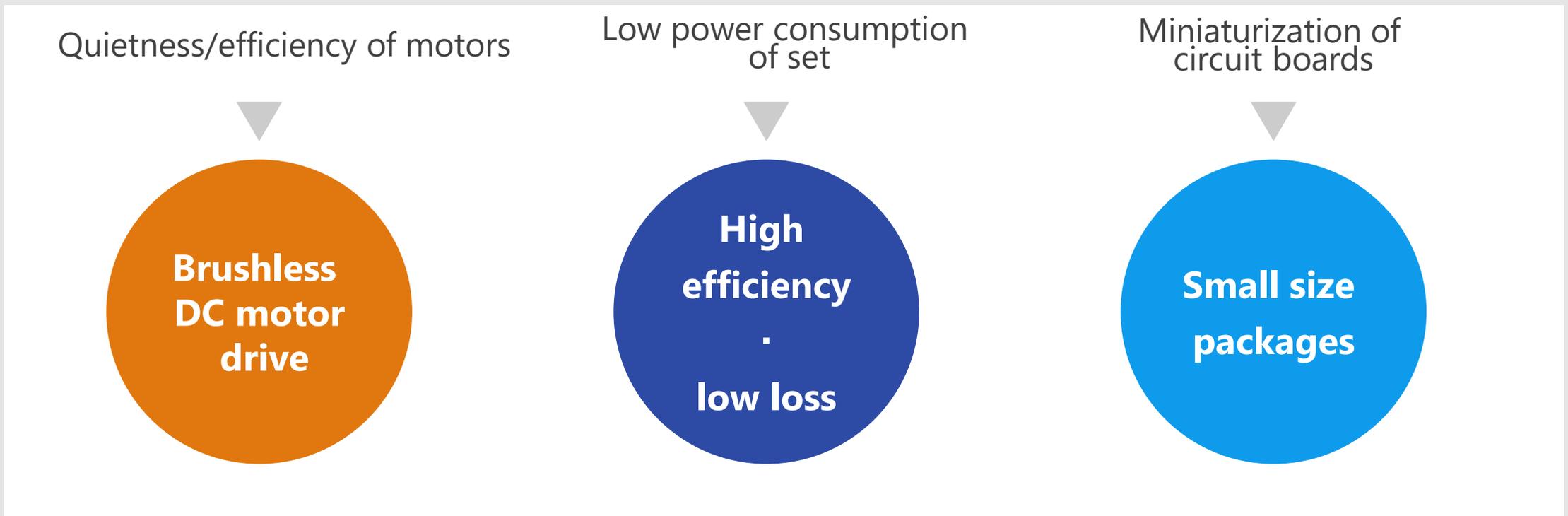
※Click on the blue circled numbers above to view detailed explanations.

Recommended Devices



Device solutions to address customer requirements

As described above, in the design of air conditioner, “**Quietness/efficiency of motors**”, “**Low power consumption of set**” and “**Miniaturization of circuit boards**” are important factors. Toshiba’s proposals are based on these three solution perspectives.



Device solutions to address customer requirements

	Brushless DC motor drive	High efficiency - low loss	Small size packages
1 π -MOS ^{III} / DTMOS ^{VI} / DTMOS ^{IV} (HSD) Series MOSFET	●	●	●
2 Transistor output photocoupler / Triac output photocoupler		●	●
3 Discrete IGBT	●	●	●
4 Small surface mount LDO regulator		●	●
5 High voltage IPD	●	●	●
6 Motor driver	●	●	●
7 MCU	●	●	●
8 TVS diode			●
9 Low noise operational amplifier		●	●
10 Transistor array		●	●

Value provided

Realizes improvement of power supply efficiency by reduction of RonA by 24 % (comparison of Toshiba's conventional products) and contributes miniaturization of set.

1 RonA reduced by 24 %

By using π -MOS^{III} chip design, figure of merit RonA is reduced by 24 % (comparison of Toshiba's π -MOS^{IV} products).

2 Q_g reduced by 23 %

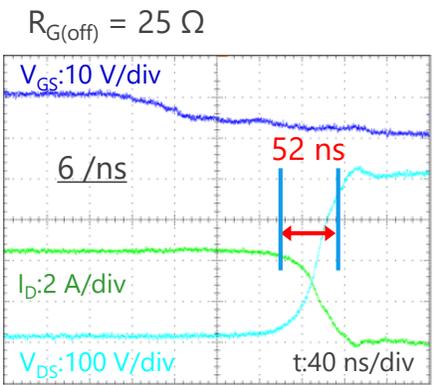
By using π -MOS^{III} chip design, Q_g is reduced by 23 % (comparison of Toshiba's π -MOS^{IV} products).
Reduction of switching loss is expected.

3 C_{oss} reduced by 18 %

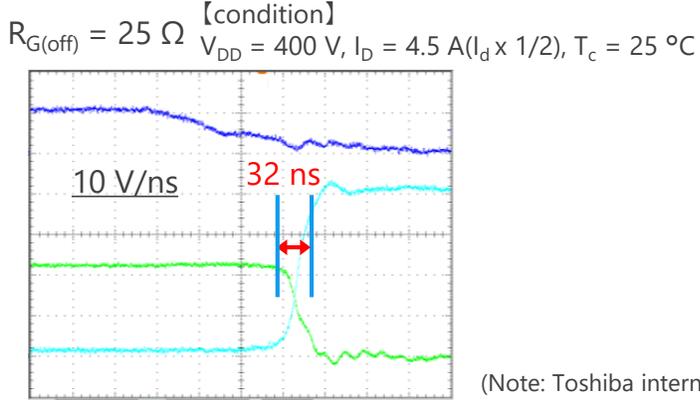
By using π -MOS^{III} chip design, C_{oss} is reduced by 18 % (comparison of Toshiba's π -MOS^{IV} products).
Improvement for light load conditions is expected.

Turn-on waveform

Toshiba's conventional product



TK9J90E



(Note: Toshiba internal comparison)

Lineup			
Part number	TK6A80E	TK10A80E	TK9J90E
Package	TO-220SIS		TO-3P(N)
V _{DSS} [V]	800	800	900
I _D [A]	6	10	9
R _{DS(ON)} [Ω] @V _{GS} = 10 V	Typ.	1.35	0.7
	Max	1.7	1
Polarity	N-ch	N-ch	N-ch

[Return to Block Diagram TOP](#)

Value provided

Realizes improvement of power supply efficiency by 40 % (comparison of Toshiba's conventional products) reduction of $R_{DS(ON)} \times Q_{gd}$ ·

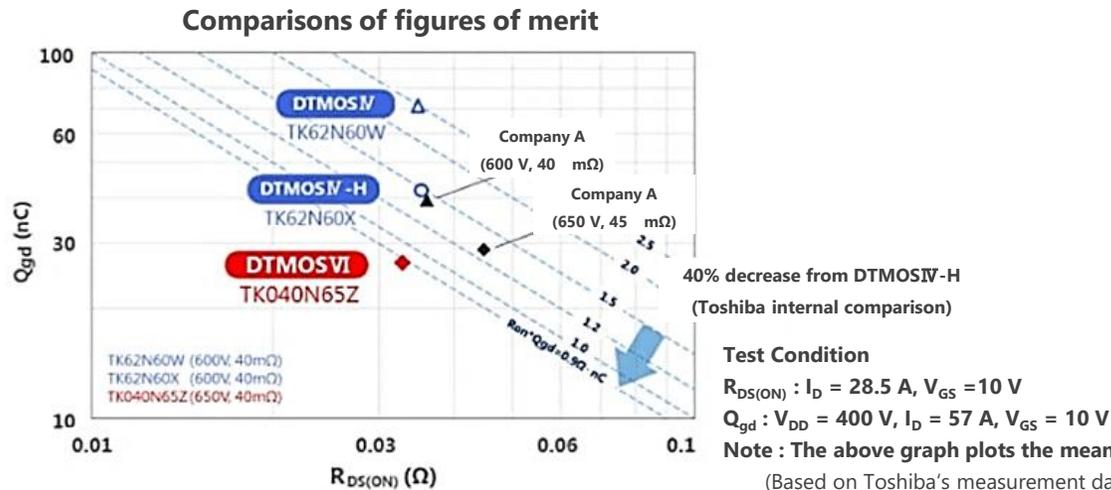
1 $R_{DS(ON)} \times Q_{gd}$ reduced by 40 %

Using a single epitaxial process, the figure of merit $R_{DS(ON)} \times Q_{gd}$ was reduced by 40 % by optimizing the structure (comparison of Toshiba's DTMOS IV-H 600 V products). By realizing low $R_{DS(ON)} \times Q_{gd}$, device switching loss was reduced contributing to improvement in power supply efficiency of equipment.

2 RonA reduced by 18 %

The figure of merit RonA of the latest generation [Note] DTMOS VI has been reduced by 18 % compared with the previous generation (Toshiba's DTMOS IV 650 V products). Achieving low on-resistance while maintaining high voltage contributes to high efficiency of equipment.

[Note] As of August 2021



Lineup

Part number	TK065U65Z	TK040N65Z
Package	TOLL 	TO-247 
V_{DSS} [V]	650	650
I_D [A]	38	57
$R_{DS(ON)}$ [Ω] @ $V_{GS} = 10 \text{ V}$	Typ.	0.051
	Max	0.065
Polarity	N-ch	N-ch

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Value provided

The figure of merit R_{onA} (compared with Toshiba conventional products) has been reduced by 30%, then contribute to improve efficiency of power supply.

1 RonA 30 % reduction

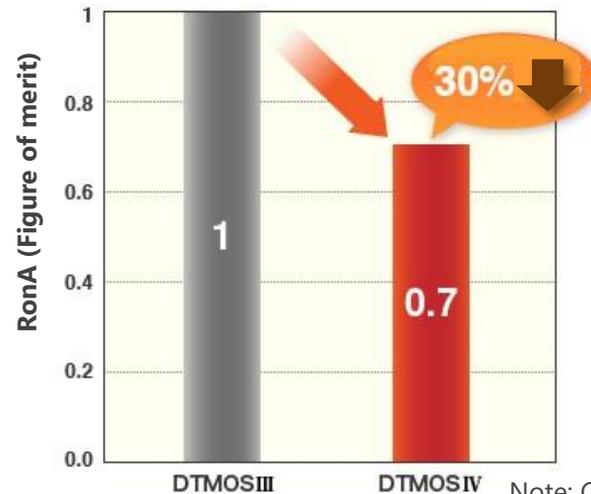
Adoption of newly developed single-epitaxial process to reduce the figure of merit R_{onA} by 30 %.
(Compared with Toshiba DTMOSIII products)

2 Reduction of on-resistance increase at high temperature

The single epitaxial process reduces the on-resistance increase at high temperature.

3 Optimization of switching speed

Optimization of switching speed has been achieved by reduction of C_{OSS} (by 12 %, compared with Toshiba conventional products) and others.



Note: Compared with Toshiba conventional products

Lineup

Part number	TK20A60W5	
Package	TO-220SIS	
V_{DSS} [V]	600	
I_D [A]	20	
$R_{DS(ON)}$ [Ω] @ $V_{GS} = 10$ V	Typ.	0.15
	Max	0.175
Polarity	N-ch	

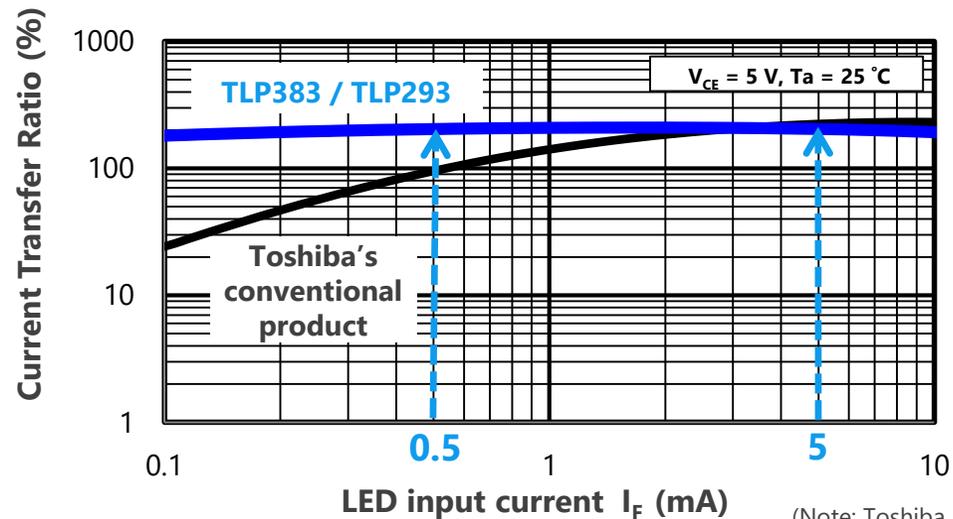
[◆Return to Block Diagram TOP](#)

Value provided

High CTR (Current Transfer Ratio) is realized even in low input current range ($I_F = 0.5 \text{ mA}$).

1 High current transfer ratio

The TLP383 / TLP293 is a high-isolation photocoupler that optically couples a phototransistor and high output infrared LED. Compared to Toshiba's conventional products (TLP385), higher CTR (Current Transfer Ratio) in low input current range (@ $I_F = 0.5 \text{ mA}$) is realized.



(Note: Toshiba internal comparison)

2 High temperature operation

The TLP383 / TLP293 are designed to operate even under severe ambient temperature conditions.

Lineup

Part number	TLP383	TLP293	TLP385
Package	SO6L (4pin) 	SO4 	SO6L (4pin) 
BV_S [Vrms]	5000	3750	5000
T_{opr} [$^\circ\text{C}$]	-55 to 125	-55 to 125	-55 to 110

[◆Return to Block Diagram TOP](#)

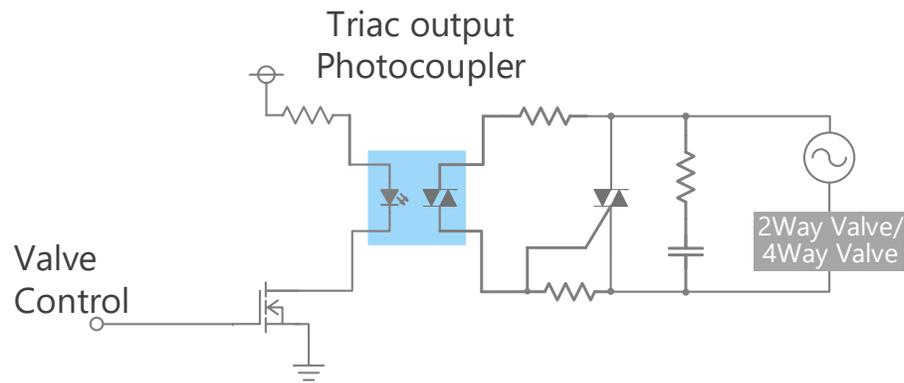
Value provided

Using a triac with high dv/dt pre-driver for solenoid valve control suppresses false turn-on.

1 Low input and zero-crossing input control

This device optically couples a photo triac and a high power infrared LED, providing high isolation equivalent to an electromagnetic relay. Capable of low input operation, the photo coupler can be directly controlled by a microcontroller.

■ Example of AC switch using triac output photocoupler



2 High dv/dt

The TLP 3083 is a triac having a high dv/dt of 2000 V/μs (Typ.). With a high OFF-state voltage of 800 V, it can work with various AC power supplies.

Lineup		
Part number	TLP3083	TLP3073
Package	5pin DIP6 	
Output Type	Zero-crossing functionary (ZC)	Non-zero-crossing functionary (NZC)
BV _S [Vrms]	5000	
T _{opr} [°C]	-40 to 100	

[◆Return to Block Diagram TOP](#)

Value provided

Switching devices for high voltage (600 V or more) and high current (30 A or more) application. Lineup of low $V_{CE(sat)}$ products are effective in reducing conduction loss.

1 High speed, low saturation voltage

By adopting a thin wafer punch-through structure, high speed turn-off characteristics and low $V_{CE(sat)}$ characteristics are realized.

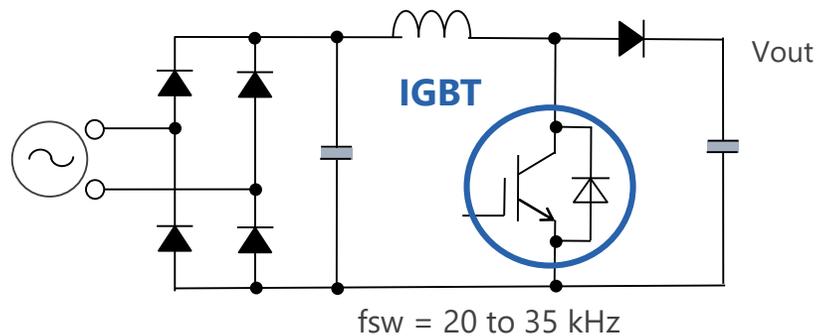
2 High breakdown tolerance

Toshiba has a lineup of products with high breakdown tolerance (short circuit withstand time t_{sc} and reverse bias safe operating area RBSOA).

3 Enhancement type

Since collector current does not flow when gate voltage is not applied for enhancement devices, handling is easy.

Active type PFC circuit example using discrete IGBT (GT50JR22)



Lineup

Part Number	GT50JR22	GT30J122A	GT50J123
Package	TO-3P(N) 		
Built-in FWD	✓ (RC structure)	-	-
V_{CES} [V]	600	600	600
I_C [A]	50	30	59
@ $I_C = 50 \text{ A}$, $V_{GE} = 15 \text{ V}$, $T_a = 25^\circ\text{C}$	Typ.	1.55	1.70
	Max	2.20	2.80
Breakdown tolerance	t_{sc} [μs]	-	5
	RBSOA	-	120 A, 600 V (full square)

[◆Return to Block Diagram TOP](#)

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 originally developed latest process significantly improved the dropout voltage characteristics.

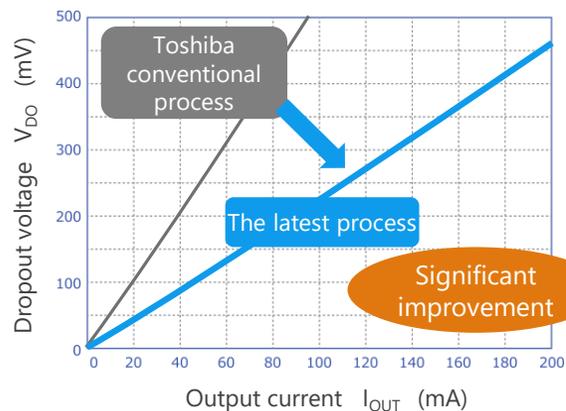
2 High PSRR Low output noise voltage

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

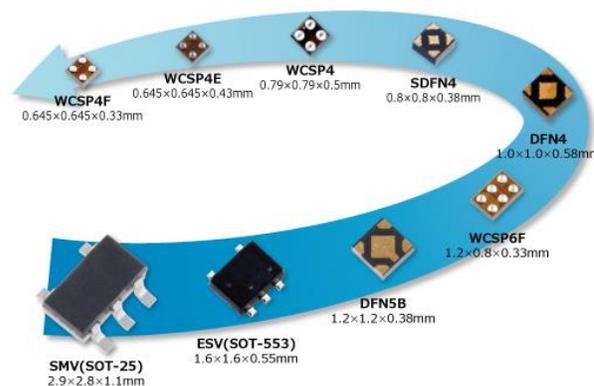
0.34 μA of $I_{B(ON)}$ is realized by utilizing CMOS process and unique circuit technology. (TCR3U Series)

Low dropout voltage



Note: Toshiba internal comparison

Rich package lineup



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		15 V 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

[Return to Block Diagram TOP](#)

Value provided

A brushless DC motor driver with a built-in MOSFET can be driven at a variable speed by control signals from the MCU.

1 Built-in circuitry required to drive the motor

It contains a level shifting high side driver, low side driver and MOSFET.

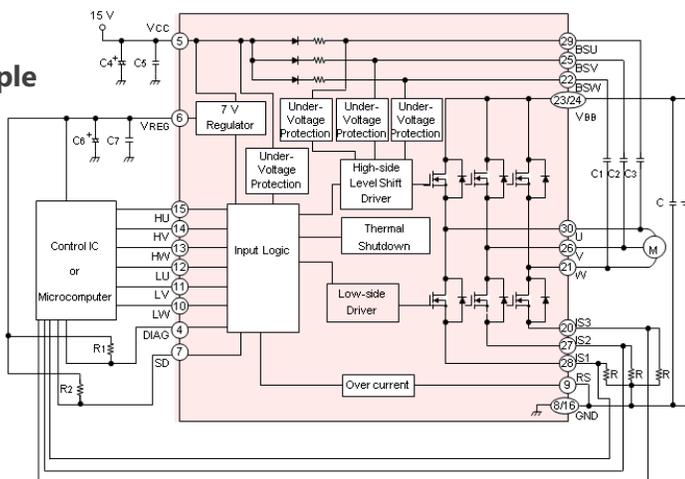
2 Motor drive terminals and control terminals are separated

High voltage/large current terminals and the control terminals are separated on both sides of the package, thereby eliminating the complexity of wiring.

3 Included protection functions

Over current and under voltage protection, shutdown (SD) and thermal shutdown functions are available.

TPD4204F Application Circuit Example



Lineup

Part number	TPD4204F
Package	SSOP30 
V_{BB} [V]	600
I_{out} [A]	2.5
V_{CC} [V]	13.5 to 16.5

[◆Return to Block Diagram TOP](#)

Value provided

This product optimizes for brushless DC motor driving and has the functions required for motor driving into one package.

1 Contributing to low power consumption

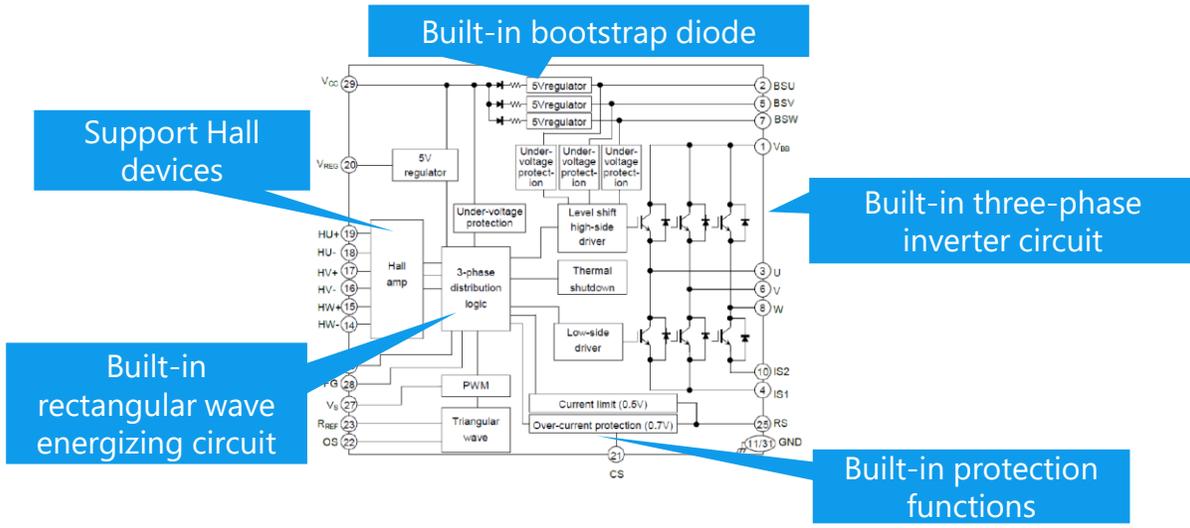
The power consumption can be reduced by replacing from the AC motor to a brushless DC motor.

2 Contributing to reducing the number of parts

Built-in functions and protection functions required for inverter operation can reduce the number of parts.

3 Contributing to reduction of circuit board area

The use of small surface mount packages contributes to the reduction of circuit board area.



Lineup	
Part number	TPD4162F
Package	HSSOP31 
V_{BB} [V]	600
I_{out} [A]	0.7
V_{CC} (Max) [V]	17.5
Protective function	Current limitation, Overcurrent protection, Thermal shutdown, Under voltage protection

[Return to Block Diagram TOP](#)

Value provided

Support low voltage motor drive (2.5 V (Min)) and contributes to the power saving of set.

1 Low voltage operation

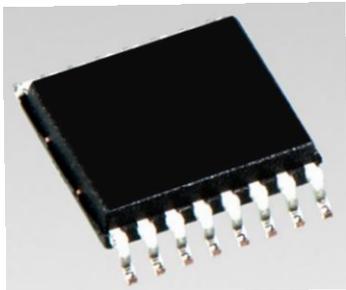
Motor driving voltage is 2.5 V (Min) for low voltage applications such as battery operation devices.

2 Low current consumption

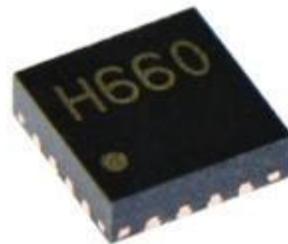
Standby current is 2 μ A or less (IC total) for power saving of devices.

3 Abnormality detection functions

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



TSSOP16 Package (5.0 x 6.4 x 1.2 mm)



VQFN16 Package (3.0 x 3.0 x 0.9 mm)

Lineup

Part Number	TC78H621FNG	TC78H660FNG	TC78H660FTG
V_M [V]	18	18	18
I_{OUT} [A]	1.1	2.0	2.0
$R_{on(upper\ and\ lower\ sum)}$ (Typ.) [Ω]	0.8	0.48	0.48
Control Interface	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)	2.5 V (Min) RS resistor less	2.5 V (Min) RS resistor less
Abnormality detection function	ISD, TSD, UVLO	ISD, TSD, UVLO	ISD, TSD, UVLO
Package	TSSOP16	TSSOP16	VQFN16

[◆Return to Block Diagram TOP](#)

Value provided

Toshiba's proprietary technology eliminates the need for phase adjustment and achieves high efficiency for a wide range of rotation speeds.

1 High efficiency in a wide range of rotation speeds

Toshiba's automatic lead angle control technology realizes a high efficiency drive regardless of motor speed, load torque or power supply voltage.

2 Motor control with low noise, and low vibration

Sine wave drive system with smooth current waveforms contributes to lower motor noise and vibration compared to conventional square wave drive system ^[Note].

3 Small package

VQFN32 package is adopted for TC78B042FTG, which requires small space. SSOP30 package is adopted for TC78B041FNG as conventional Type.

[Note] Comparison with Toshiba products



SSOP30 Package
(10.2 x 7.6 x 1.6 mm)



VQFN32 Package
(5 x 5 x 1 mm)

Lineup

Part Number	TC78B041FNG	TC78B042FTG
Power supply voltage	6 to 16.5 V (operating range)	
Drive Type	Sine wave	
Features	Auto lead angle control for optimizing voltage & current phases	
	Hall element or hall IC input	
	Forward / reverse rotation switch	
	Motor lock detection	
	Selectable pulse number of rotation pulse signal output	
Package	Built-in 5 V regulator (VREF / VREF2 pins)	Built-in 5 V regulator (VREF pin)
	Error detection positive / negative input	Error detection positive input
Package	SSOP30	VQFN32

[◆Return to Block Diagram TOP](#)

Value provided

High voltage and high current brushless DC motor driving can be implemented by external MOSFET.

1 High efficient motor control by automatic phase control

Automatic phase controller by current feedback is integrated adding conventional fixed phase voltage input (32 steps).

2 Motor control with low noise, and low vibration

Sine wave drive system with smooth current waveforms contributes to lower motor noise and vibration compared to conventional square wave drive system ^[Note].

3 Sufficient development support

Various supports such as 3rd party evaluation board and PSpice® data for development and design are prepared.

[Note] Comparison with Toshiba products

TB6584FNG, TB6584AFNG



SSOP30 package (10.2 x 7.6 x 1.6 mm)

Lineup

Part Number	TB6584FNG	TB6584AFNG	TB6634FNG
Supply voltage range	6 to 16.5 V (operating range)		
Output current range	0.002 A (for MOSFET driver) (operating range)		
Drive mode	Sine wave drive system		
Features	Lead angle control: Auto phase control (current feedback) Sensor input: Hall device/ Hall IC compatible Internal regulator: 5 V / 30 mA (max) Error detection: overcurrent protection, abnormal position signal protection, undervoltage lockout, motor restrained detection (TB6634FNG)		

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Value provided

A motor control IC and IGBTs are integrated into one package, contributing to the miniaturization of circuit boards.

1 A motor control IC and IGBTs

A motor control IC with sine wave PWM drive function and IGBTs with 600 V / 2 A characteristics are integrated into one package.

2 Motor control with low noise, and low vibration

Sine wave drive system with smooth current waveforms contributes to lower motor noise and vibration compared to conventional square wave drive system [Note].

3 High heat dissipation

HDIP30 package is adopted for TB67B000AHG, which has high heat dissipation. HSSOP34 package is adopted for TB67B000AFG, which is smaller than HDIP30.

[Note] Comparison with Toshiba products



HDIP30
(32.8 x 13.5 x 3.525 mm)



HSSOP34
(17.5 x 11.93 x 2.2 mm)

Lineup

Part Number	TB67B000AHG	TB67B000AFG
Operating voltage range	Power supply for control: 13.5 to 16.5 V	
	Power supply for motor drive: 50 to 450 V	
Output current	2 A	
Drive Type	Sine wave PWM drive / Wide angle commutation	
Lead angle control	0 to 58 degrees 32 steps / 0 to 28 degrees 16 steps	
Speed command input voltage	Motor operation: 2.1 to 5.4 V	
Features	IGBT Three-phase bridge, Oscillator circuit, Built-in bootstrap diode, Overcurrent protection, Thermal shutdown, Undervoltage lockout, Motor lock detection	
Package	HDIP30	HSSOP34

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Value provided

System cost reduction, higher efficiency and less development work.

1 Equipped with motor control co-processor

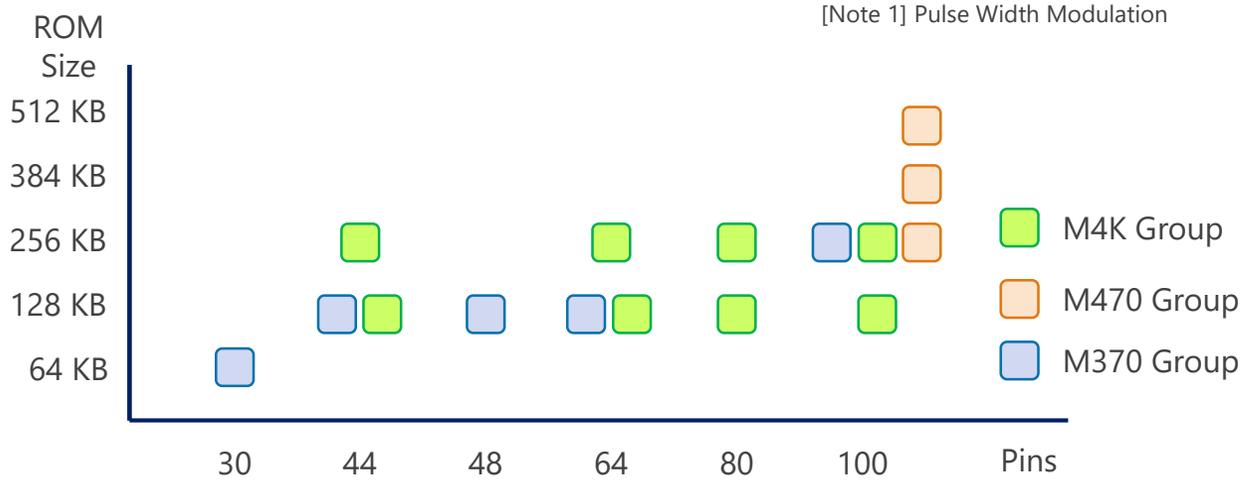
Toshiba's original co-processor vector engine (VE) for motor control reduces CPU load and allows control of multiple motors and peripherals.

2 Equipped with motor control logic circuit

Versatile three phase PWM [Note 1] output and sensing timing make both high efficiency and low noise possible. The advanced encoder reduces CPU load of each PWM processing.

3 Equipped with analog circuit for motor control

Multiple high speed and high accuracy AD converters are integrated, allowing conversion timing and PWM output to be linked. Such as high performance operational amplifier is integrated on-chip. [Note 2]



[Note 1] Pulse Width Modulation

[Note 2] The number of AD converter units and the built-in operational amplifier differ depending on the product.

Lineup		
Series	Group	Function
TXZ+™4A Series	M4K Group	Arm® Cortex®-M4, 160 MHz operation 4.5 to 5.5 V, 3motor control (Max), Data Flash
TX04 Series	M470 Group	Arm® Cortex®-M4, 120 MHz operation 4.5 to 5.5 V, 2motor control (Max)
TX03 Series	M370 Group	Arm® Cortex®-M3, 80 MHz operation 4.5 to 5.5 V, 2motor control (Max)

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Value provided

MCU is equipped with many peripheral functions. MCU contributes to higher functionality as a system control MCU.

1 Built-in Arm® Cortex®-M3 CPU core

MCU is equipped with Arm Cortex-M3 core. Maximum operation frequency is 120 MHz.

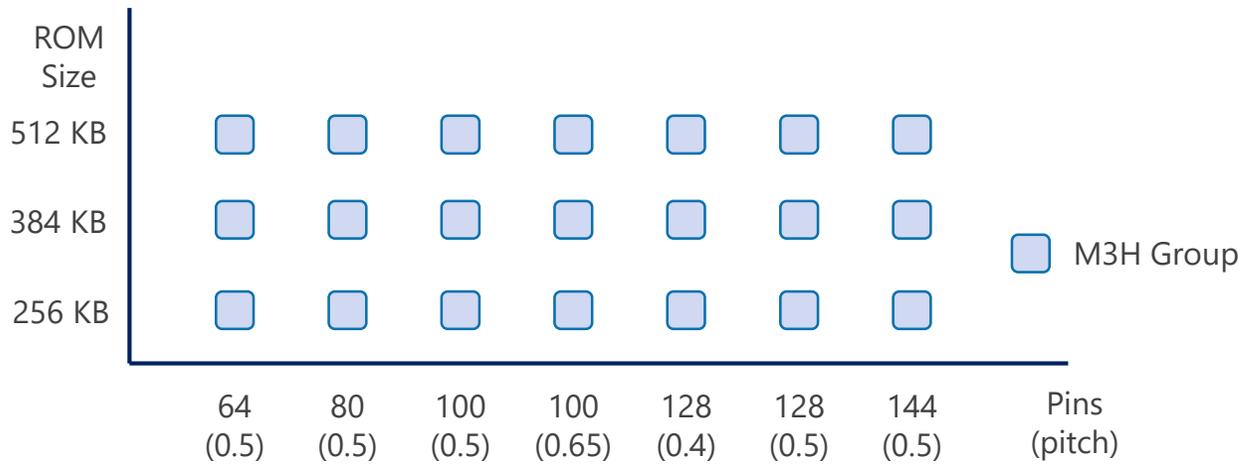
2 Various lineup of built-in memories and packages

M3H group integrates both 512 KB code and 32 KB data flash memories which support 100,000 write cycle endurance, and has a wide lineup of package from 64 to 144 pins.

3 Equipped with many peripheral functions

M3H Group have many peripheral functions such as UART, SPI, I²C, 12bit AD converter, 8 bit DA converter, PMD, ENC and digital LCD driver [Note], etc.

[Note] 64 pins product isn't equipped with digital LCD driver.



Lineup		
Series	Group	Function
TXZ+™3A Series	M3H Group	Arm® Cortex®-M3, 120 MHz operation, 2.7 to 5.5 V

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Value provided

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

1 High ESD pulse absorption performance

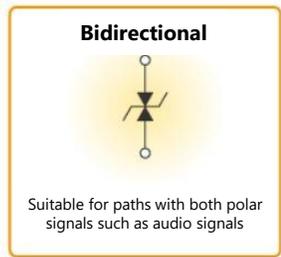
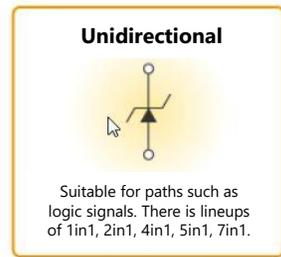
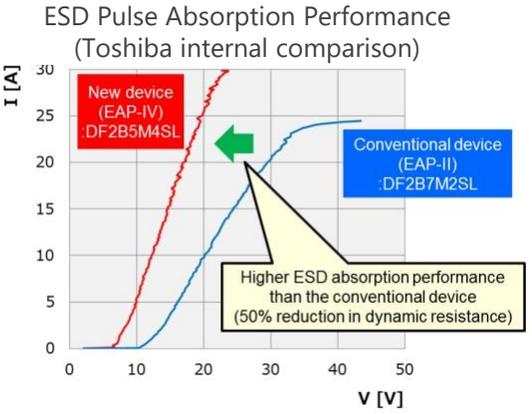
Improved ESD absorption compared to Toshiba's conventional products. (50 % reduction in operating resistance) For some products, both low operating resistance and low capacitance are realized and ensures high signal protection performance and signal quality.

2 Suppress ESD energy by low clamp voltage

Protect the connected circuits/devices using Toshiba own technology.

3 Suitable for high density mounting

A variety of small packages are available.



Lineup			
Part number	DF2B7BSL	DF2B5M4SL	DF2B6M4SL
Package	SL2	SL2	SL2
V_{ESD} [kV]	±30	±20	±20
V_{RWM} (Max) [V]	5.5	3.6	5.5
C_t (Typ.) [pF]	12	0.2	0.2
R_{DYN} (Typ.) [Ω]	0.2	0.5	0.5

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

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Value provided

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

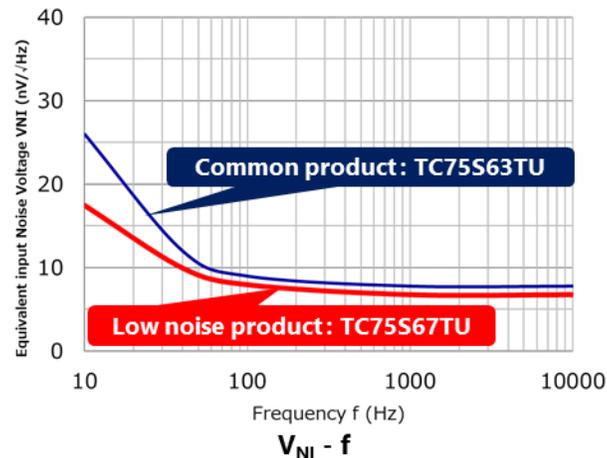
1 Low noise

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

Very small signals detected by various sensors ^[Note] can be amplified with low noise using CMOS operational amplifier by optimizing the processing. We achieved low input equivalent noise voltage.

[Note] Sensor Typ.es: vibration sensor, shock sensor, accelerometer, pressure sensor, infrared sensor, temperature sensor, etc

Noise characteristics
(Toshiba internal comparison)



2 Low dissipation current

$I_{DD} = 430$ [μA] (Typ.)

Low current consumption characteristics are realized by using the CMOS process.

Lineup

Part number	TC75S67TU
Package	UFV 
$V_{DD,SS}$ (Max) [V]	±2.75
$V_{DD,SS}$ (Min) [V]	±1.1
I_{DD} (Typ.) [μA]	430
V_{NI} (Typ.) [nV/√Hz] @f = 1 kHz	6

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Value provided

DMOS FET is used for the output of drive circuit and realizes low loss. And CMOS input can control directly from controller's I/O, etc.

1 Rich product lineup

In addition to the listed products, we have lineup of various packaged products (such as DIP, SOL, SOP, SSOP, etc.) and source output type products.

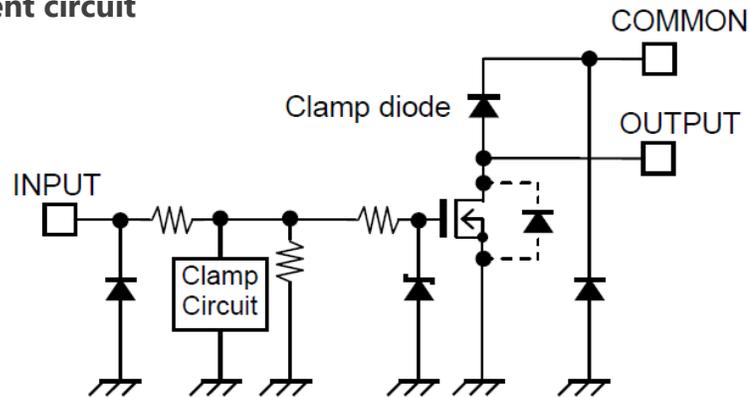
2 Built-in output clamp diode.

Built-in output clamp diodes regenerate the back electromotive force generated by switching of an inductive.

3 Higher current drive is possible.

The load can be driven with higher current by connecting multiple outputs in parallel.

Equivalent circuit



(Note) Equivalent circuit may be simplified for explanatory purpose.

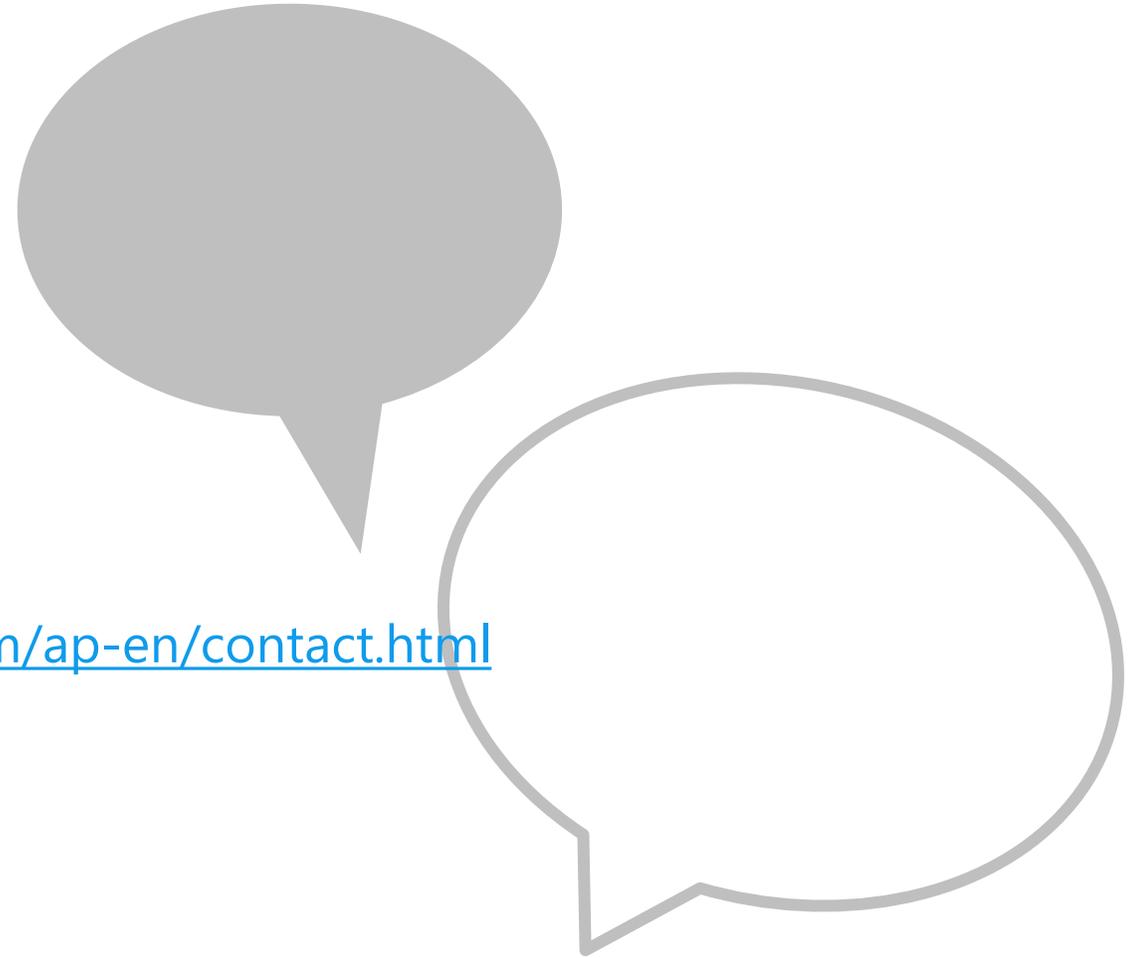
Lineup

Part number	TBD62003AFWG	TBD62083AFG	TBD62064AFAG
Package	P-SOP16-0410-1.27-002	SOP18-P-375-1.27	P-SSOP24-0613-1.00-001
Output type	Sink	Sink	Sink
Number of channels	7ch	8ch	4ch
Input level	H	H	H
I_{OUT} [mA/ch]	500	500	1,500
V_{OUT} [V]	50	50	50

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