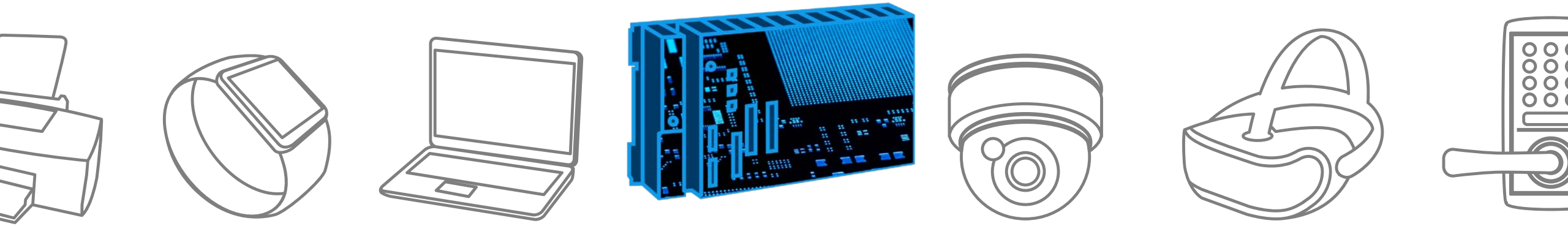
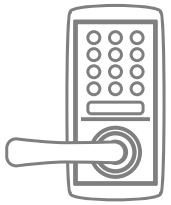
TOSHIBA

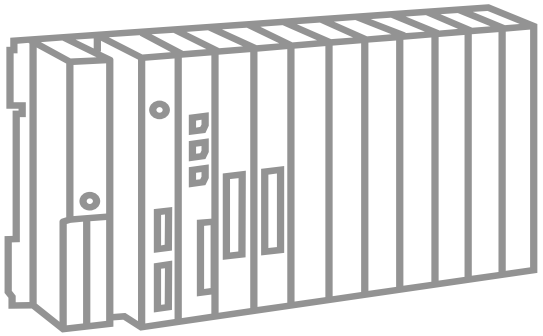
R20

Programmable Logic Controller

Solution Proposal by Toshiba

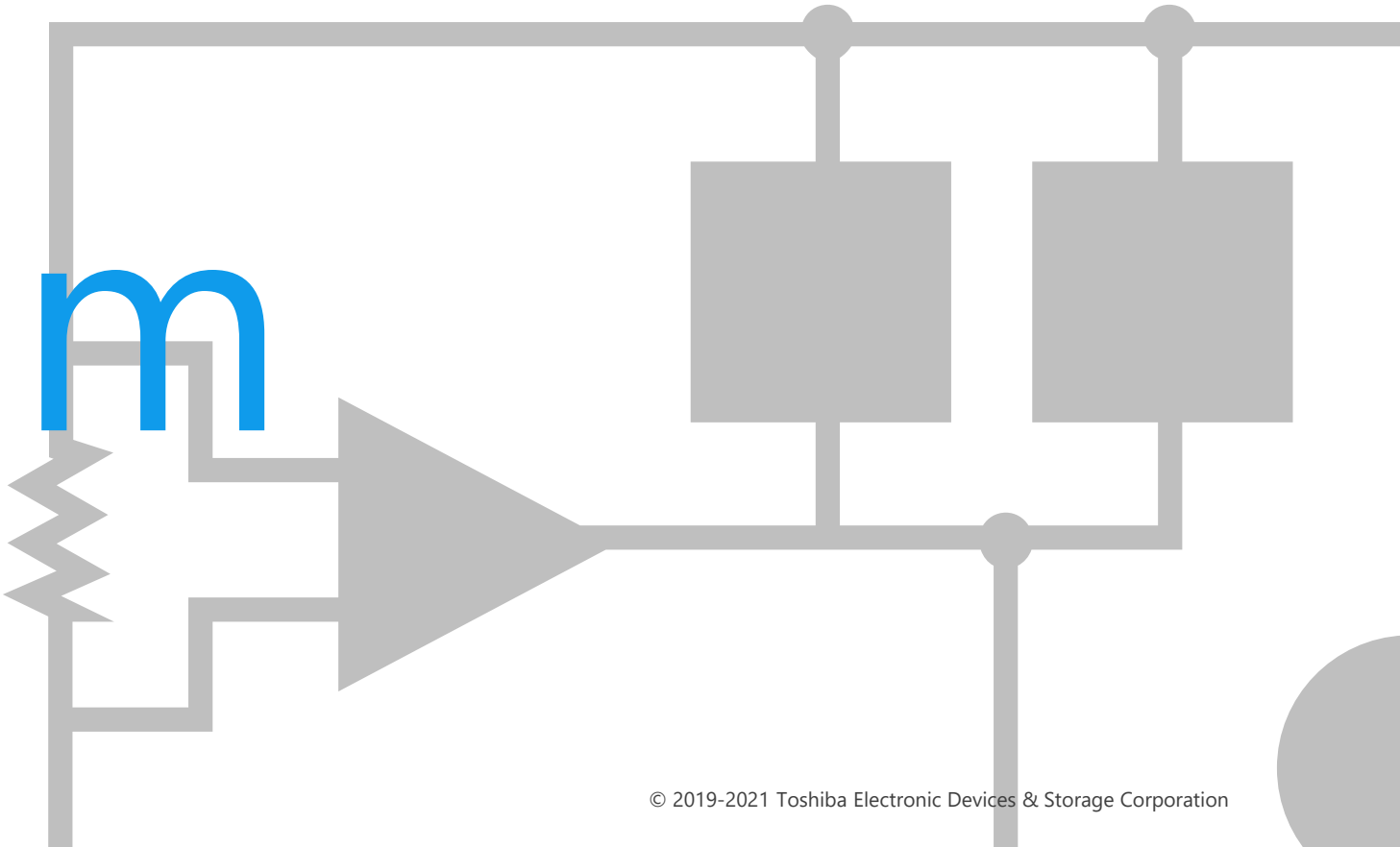




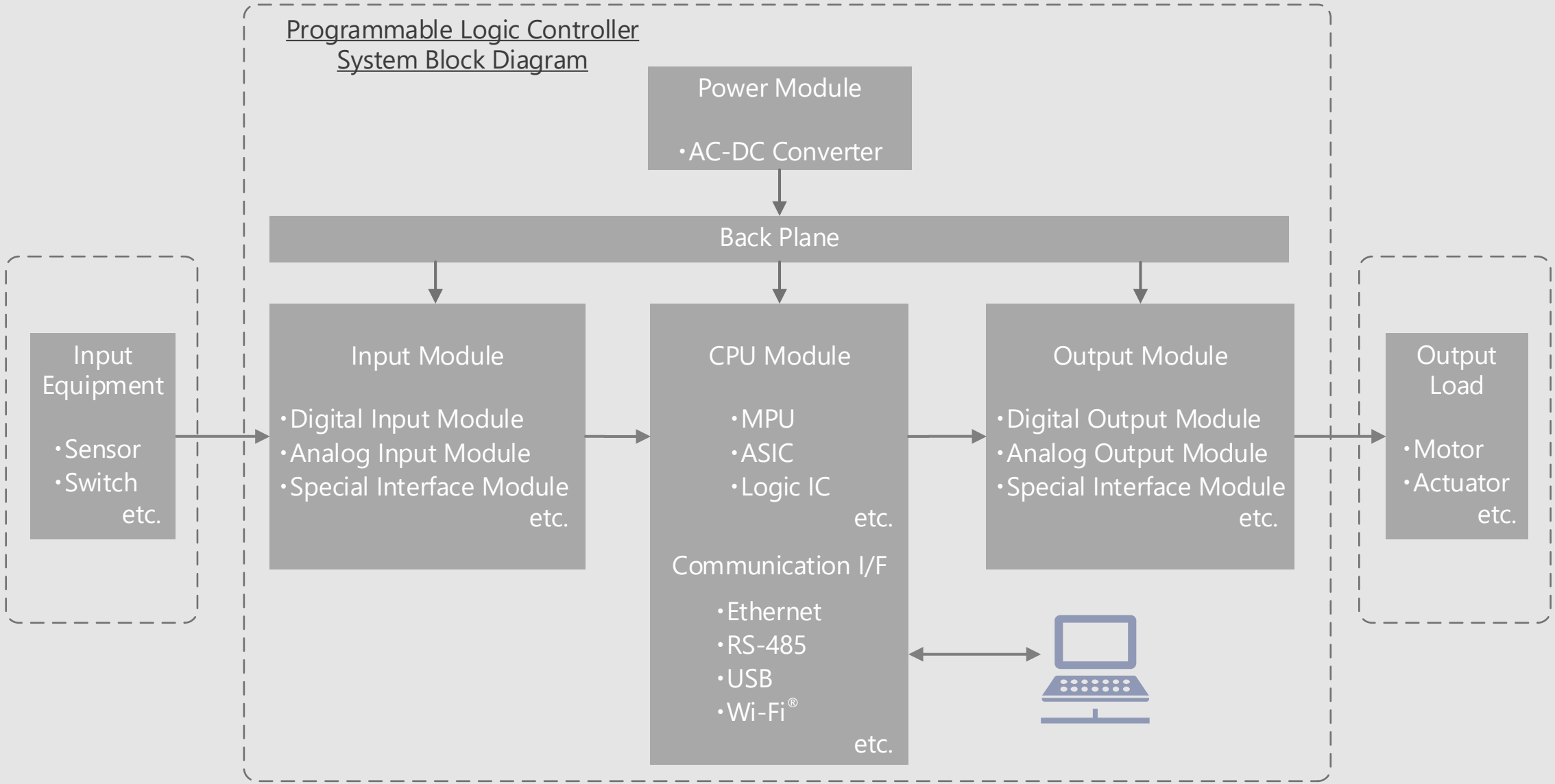


Toshiba Electronic Devices & Storage Corporation provides comprehensive device solutions to customers developing new products by applying its thorough understanding of the systems acquired through the analysis of basic product designs.

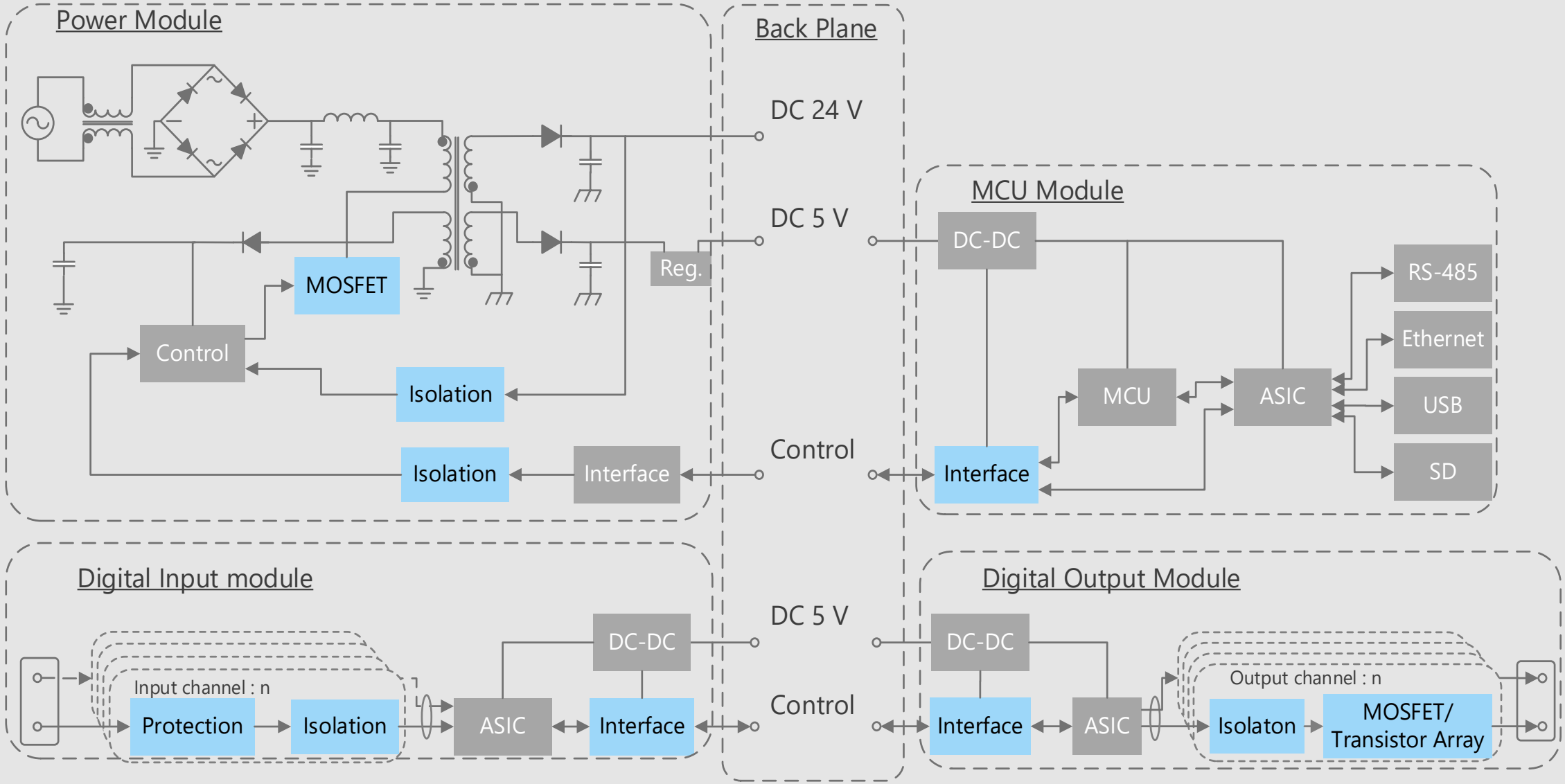
Block Diagram



Programmable Logic Controller　Overall System

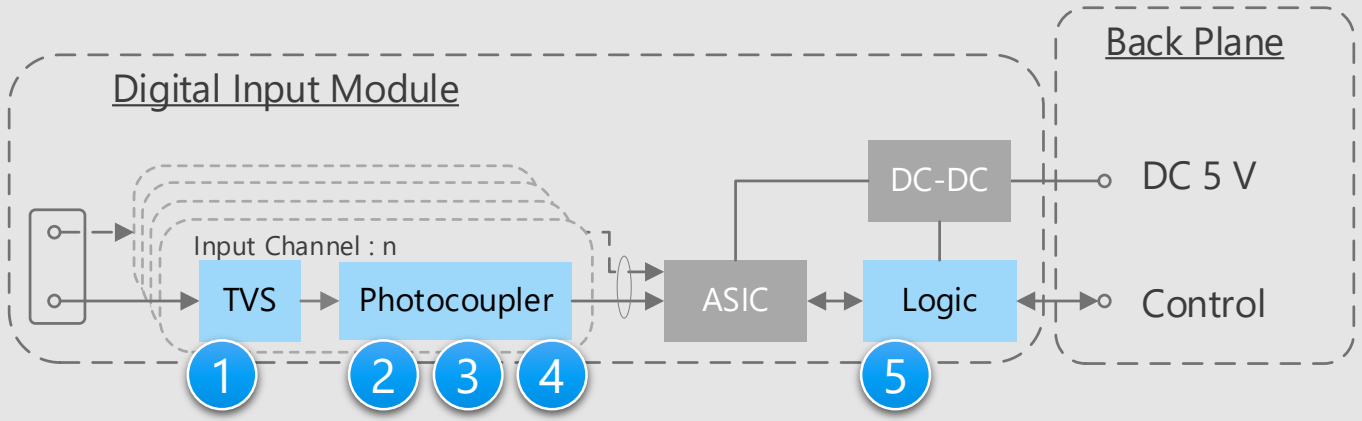


Programmable Logic Controller　Overall block diagram



Programmable Logic Controller　Detail of digital input module section

Digital Input Module Circuit



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

Criteria for device selection

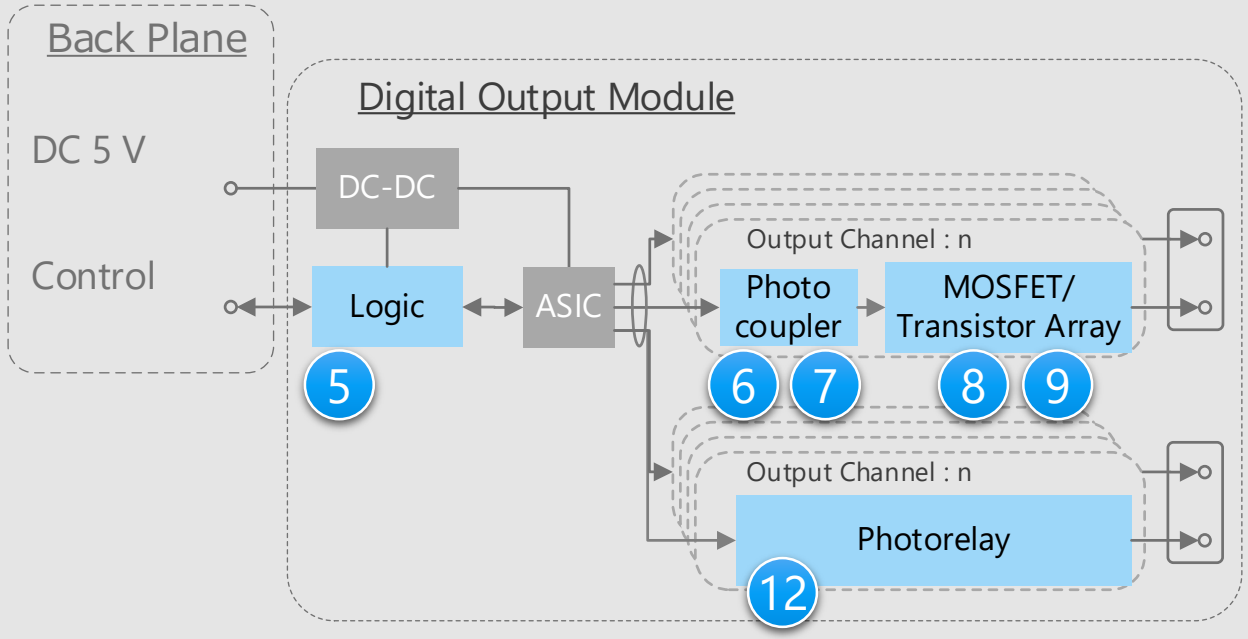
- A TVS for internal protection is required at the signal input.
- Internal circuits need to be galvanically isolated from the external input signal line.

Proposal from Toshiba

- **Prevent circuit malfunctions by absorbing electrostatic discharge (ESD) from external terminals** 1
  TVS diode
- **High light output, high gain, high speed photocoupler** 2 3 4
  Transistor output photocoupler (AC input)
  High speed IC output photocoupler (AC input)
  High speed IC output photocoupler (supports IEC 61131-2)
- **Small and thin package, low voltage and compact surface mounting** 5
  One gate CMOS logic

Programmable Logic Controller　Detail of digital output module section

Digital output module circuit



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

Criteria for device selection

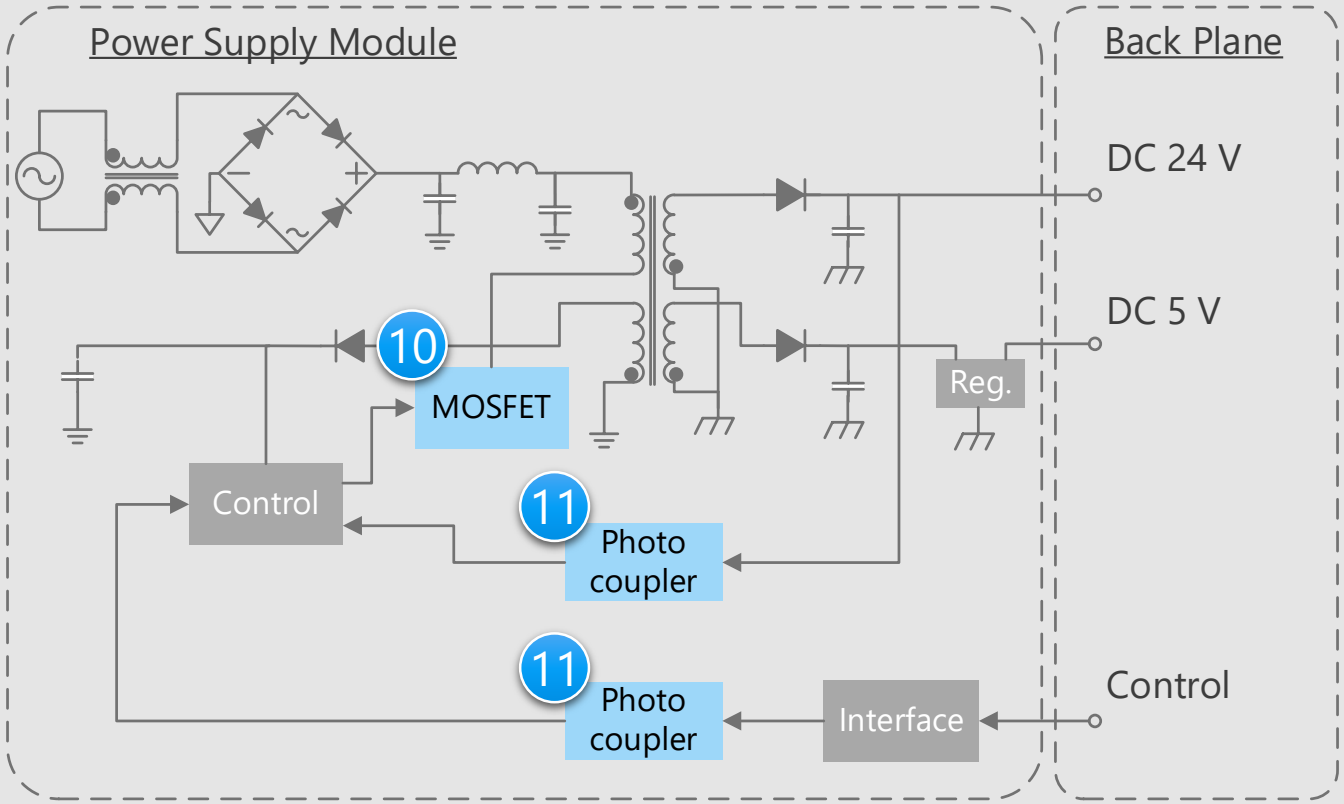
- The external output signal line needs to be galvanically isolated from internal circuits.

Proposal from Toshiba

- **Small and thin package, low voltage and compact surface mounting** 5
  One gate CMOS logic
- **High optical output, high gain and high speed photocoupler** 6
  Transistor output photocoupler (DC input) 7
  High speed IC output photocoupler (DC input)
- **Low on-resistance contributes to realize low power dissipation of the set** 8
  Small signal MOSFET
- **High voltage and high current by output stage DMOS FET** 9
  Transistor array
- **High output current and low on-resistance** 12
  Photorelay

Programmable Logic Controller　Detail of power supply module section

Power Supply Module



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

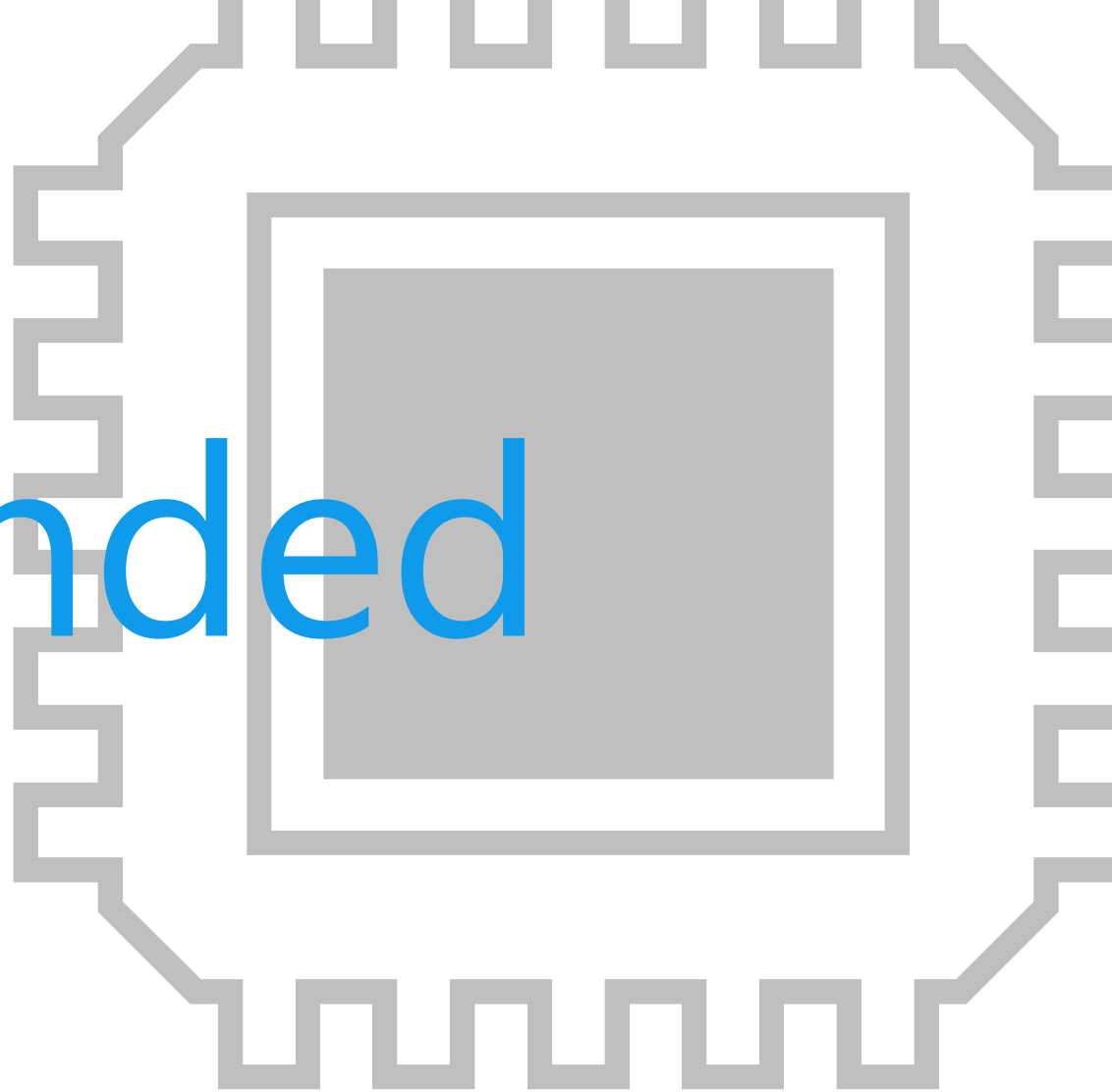
Criteria for device selection

- A low loss MOSFET suitable for switching is required for the efficient AC-DC power supply.
- Galvanic Isolation is required between the primary and secondary side.

Proposal from Toshiba

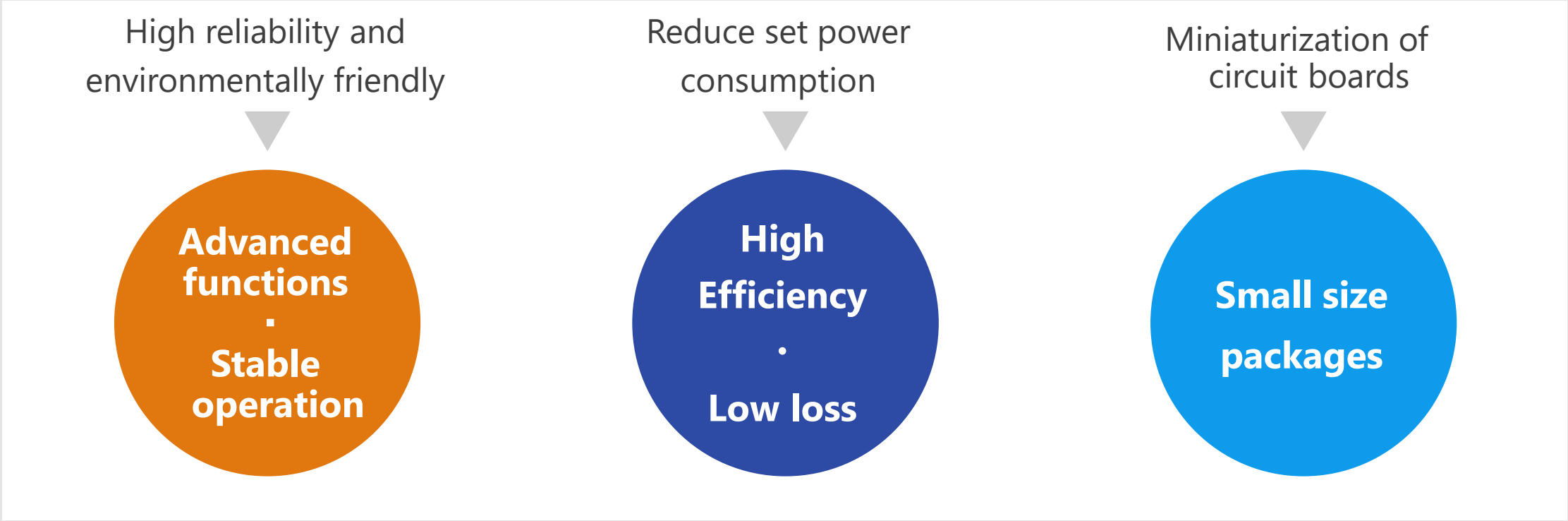
- **Low on-resistance contributes to realize low power dissipation of the set**
  Power MOSFET 10
- **Photocoupler with high isolation voltage** 11
  Transistor output photocoupler (DC input)

Recommended Devices



Device solutions to address customer needs

As described above, in the design of PLC, **“High reliability, environmentally friendly“**, **“Set power consumption reduction”** and **“Miniaturization of circuit boards”** are important factors. Toshiba’s proposals are based on these three solution perspectives.



Device solutions to address customer needs

		Advanced functions · Stable operation	High Efficiency · Low loss	Small size packages
1	TVS diode	●	●	●
2	Transistor output photocoupler (AC input)	●	●	●
3	High speed IC output photocoupler (AC input)	●	●	●
4	High speed IC output photocoupler (supports IEC 61131-2)	●	●	●
5	One gate CMOS logic		●	●
6	Transistor output photocoupler (DC input)	●	●	●
7	High speed IC output photocoupler (DC input)	●	●	●
8	Small signal MOSFET		●	●
9	Transistor array	●	●	●
10	Power MOSFET		●	●
11	Transistor output photocoupler (DC input)	●	●	●
12	Photorelay	●	●	●

1 TVS diode

DF2B7ASL / DF2B7AFS / DF2B7ACT / DF2B7AE / DF2B7AFU

Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

Protects devices and prevents circuit malfunctions by absorbing ESD entering from external terminals.

1 Improved ESD pulse absorption

Compared to our earlier products, ESD absorption is improved (operating resistance reduced by 50 %) .High signal quality and protection are assured by means of low operating resistance and low capacitance.

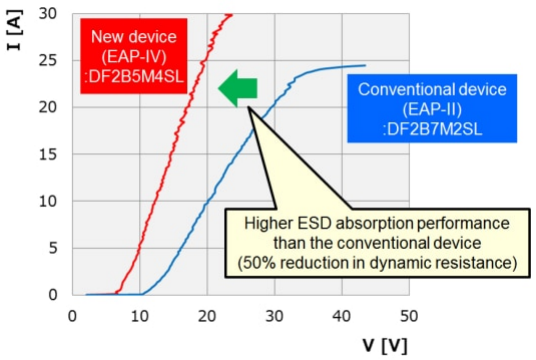
2 Suppress ESD energy by means of low clamp voltage

Using Toshiba original technology, provides full protection for connected circuit components.

3 High density mounting

Wide selection of packages available (single to multi flow-through).

ESD Pulse Absorption Performance (Toshiba internal comparison)



Note: This device is for ESD protection only and cannot be used for other purposes such as, but not limited to, constant voltage source circuits.

Line up

Part number	DF2B7ASL	DF2B7AFS	DF2B7ACT	DF2B7AE	DF2B7AFU
Package	SL2	fSC	CST2	ESC	USC
V_{RWM} (Max) [V]	5.5	5.5	5.5	5.5	5.5
C_t (Typ.) [pF]	8.5	8.5	8.5	8.5	8.5
R_{DYN} (Typ.) [Ω]	0.2	0.2	0.2	0.2	0.2
V_C (Typ.) [V] @I_{PP} = 1 A	8	8	8	8	8

◆Return to Block Diagram TOP

Value provided

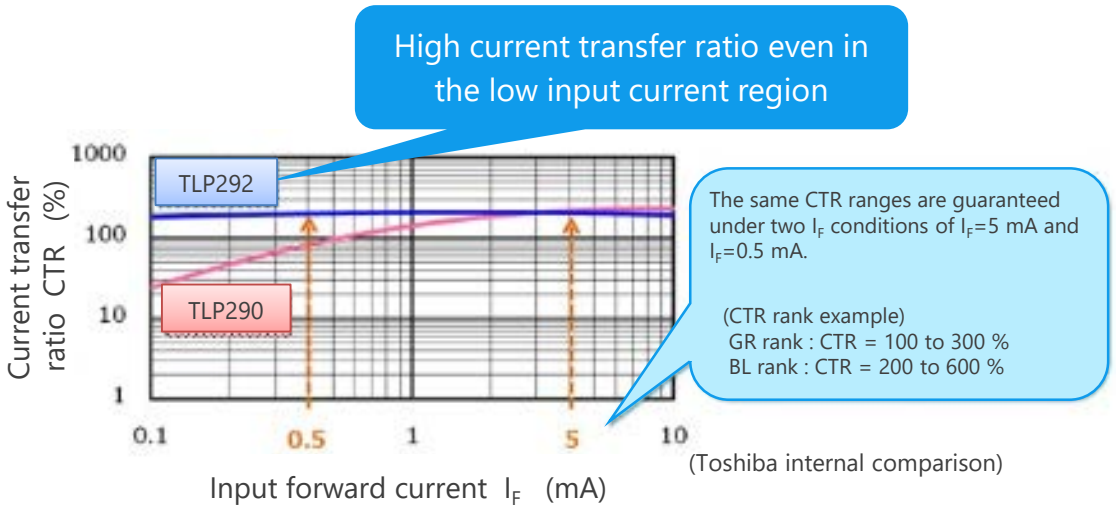
High current transfer ratio even for low input current (I_F = 0.5 mA)

1 High current transfer ratio at low input current (I_F = 0.5 mA) is realized

By adopting a high output LED, high current transfer ratio is realized even in low input current conditions of I_F = 0.5 mA. This allows easy design in the low current region.

2 Operating temperature is expanded to 125 °C

The operating temperature range is expanded (-55 to 125 °C) to ensure operating under severe conditions.



(Toshiba internal comparison)

Line up

Part number	TLP292	TLP292-4
Package	SO4 (4pin) 	SO16 
BV_S (Min) [Vrms]	3750	3750
T_{opr} [°C]	-55 to 125	-55 to 125

◆Return to Block Diagram TOP

3 High speed IC output photocoupler (AC input)

TLP2395 / TLP2398

Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

Input side supports the AC input and output side supports both sink and source logic signal

1 AC input and sink/source logic output

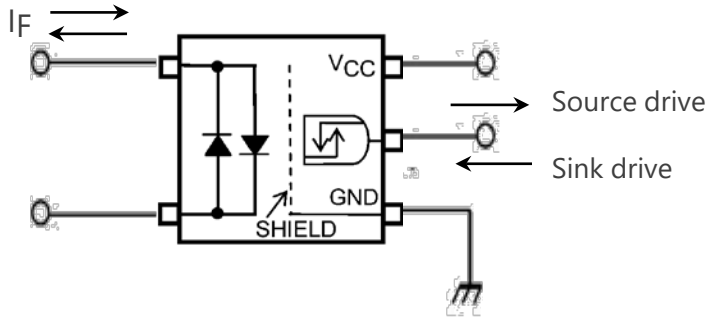
AC input is supported by adding a reverse parallel LED on the LED side of the photocoupler. Output supports both sink and source logic signal without adding a pull-up or pull-down resistor.

2 Operating temperature is expanded to 125 °C

The operating temperature range is expanded (-40 to 125 °C) to ensure operating under severe conditions.

3 Wide supply voltage range from 3.0 to 20 V

Operation with a supply voltage from 3.0 V is possible, enabling the use as common components in mixed 3.3 V / 5.0 V systems.



UL approved : UL1577, File No.E67349
cUL approved : Component Acceptance Service No.5A File No.E67349
VDE approved : EN60747-5-5, EN62368-1 (Note1)
CQC approved : GB4943.1, GB8898 Thailand factory
(Note1): To select a VDE approved type, designate the "Option (V4) ".

Line up

Part number	TLP2395	TLP2398
Package	SO6 (5pin) 	SO6 (5pin) 
BV_S (Min) [Vrms]	3750	3750
T_{opr} [°C]	-40 to 125	-40 to 125
Output type	Buffer logic	Inverter logic

◆Return to Block Diagram TOP

4 High speed IC output photocoupler (supports IEC 61131-2)

TLP2363

Advanced functions · Stable operation

High Efficiency · Low loss

Small size packages

Value provided

Supports the digital input module to compliant to IEC 61131-2 Type 1.

1 Supports IEC 61131-2 Type1 compliant

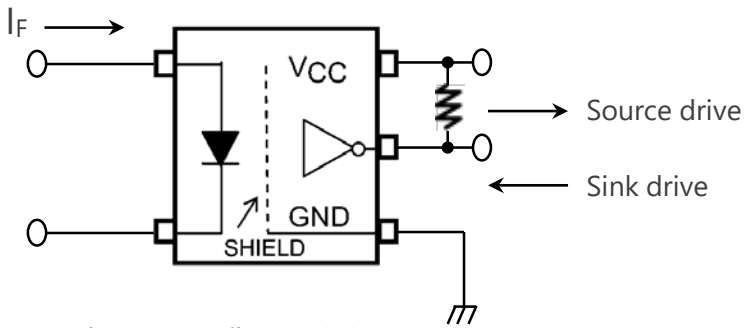
The guaranteed minimum and maximum value of input threshold current supports designing a digital input module to follow the operation range that is defined in IEC 61131-2 Type 1.

2 High immunity to slow inputs

The output without chattering is kept even when the input has gradual rise / fall time until 24 V / 60 s.

3 Supports 3.3 V / 5 V operation

Operation with a supply voltage from 2.7 V to 5.5 V is possible, enabling the use as common components in mixed 3.3 V / 5.0 V systems.



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VDE approved : EN60747-5-5, EN62368-1 (Note1)
CQC approved : GB4943.1, GB8898 Japan factory
(Note1): To select a VDE approved type, designate the "Option (V4) ".

Line up

Part number	TLP2363
Package	SO6 (5pin) 
BV_S (Min) [Vrms]	3750
T_{opr} [°C]	-40 to 105
Output type	Open collector

◆Return to Block Diagram TOP

Value provided

Line-up using small, common packages with low voltage operation offers good ease-of-use

1 Low power and high speed

High speed operation is achieved with the low power of CMOS.

2 Compatible with low voltage systems

The wide operating voltage range of 1.65 V to 5.5 V enables to be used with low voltage systems.

3 Power down protection function

The output terminal has a 5.5 V power-down protection function to protect the device when the power is off.

TC7WZ07FK

TC7WZ00FK

Line up

Part number	TC7WZ07FK	TC7WZ00FK
Package	US8 	US8 
V_{CC} [V]	1.65 to 5.5	1.65 to 5.5
t_{PZL}/t_{PD} (Typ.) [ns] @V_{CC} = 5 V	2.3	2.4
T_{opr} (Max)[°C]	125	125
Function	Non-Inverter (open drain)	2-Input NAND

◆Return to Block Diagram TOP

6 Transistor output photocoupler (DC input)

TLP293 / TLP293-4

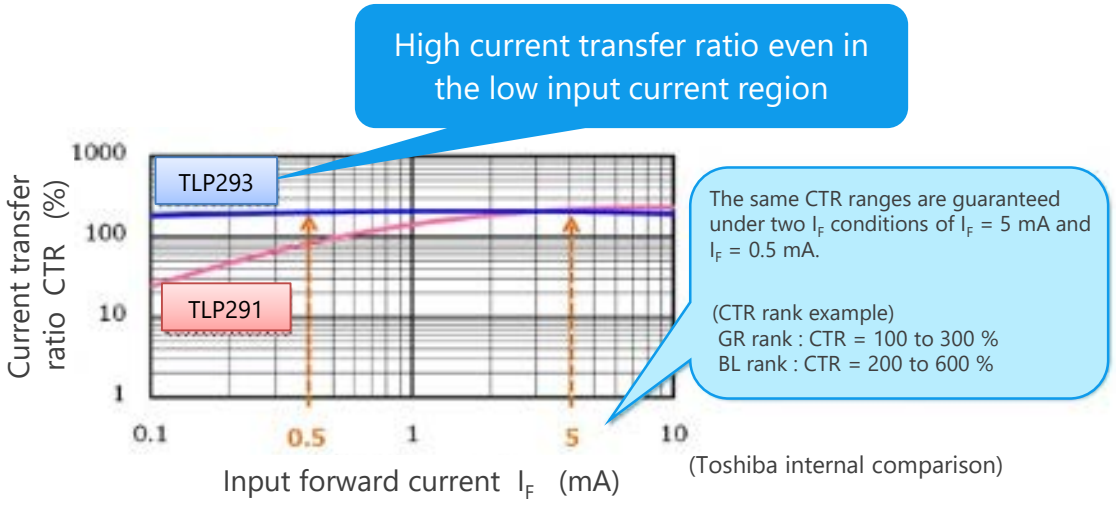
Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

High current transfer ratio even for low input current (I_F = 0.5 mA)

1 High current transfer ratio at low input current (I_F = 0.5 mA) is realized

By adopting a high output LED, high current transfer ratio is realized even in low input current conditions of I_F = 0.5 mA. This allows easy design in the low current region.



(Toshiba internal comparison)

2 Operating temperature is expanded to 125 °C

The operating temperature range is expanded (-55 to 125 °C) to ensure operating under severe conditions.

Line up

Part number	TLP293	TLP293-4
Package	SO4 (4pin) 	SO16 
BV_S (Min) [Vrms]	3750	3750
T_{opr} [°C]	-55 to 125	-55 to 125

◆Return to Block Diagram TOP

7 High speed IC output photocoupler (DC input)

TLP2355 / TLP2358

Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

Supports both sink and source logic signal outputs

1 Sink/source logic output

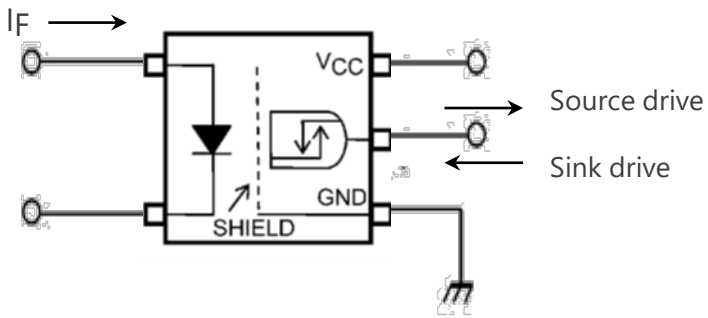
Output supports both sink and source logic signal without adding a pull-up or pull-down resistor.

2 Operating temperature is expanded to 125 °C

The operating temperature range is expanded (-40 to 125 °C) to ensure operating under severe conditions.

3 Wide supply voltage range from 3.0 to 20 V

Operation with a supply voltage from 3.0 V is possible, enabling the use as common components in mixed 3.3 V / 5.0 V systems.



UL approved : UL1577, File No.E67349
cUL approved : Component Acceptance Service No.5A File No.E67349
VDE approved : EN60747-5-5, EN62368-1 (Note1)
CQC approved : GB4943.1, GB8898 Thailand factory
(Note1): To select a VDE approved type, designate the "Option (V4) ".

Line up

Part number	TLP2355	TLP2358
Package	SO6 (5pin) 	SO6 (5pin) 
BV_S (Min) [Vrms]	3750	3750
T_{opr} [°C]	-40 to 125	-40 to 125
Output type	Buffer logic	Inverter logic

◆Return to Block Diagram TOP

8 Small signal MOSFET

SSM3K341R / SSM3K341TU

Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

Suitable for power management switches, contributing to the PCB miniaturization.

1 High temperature operation

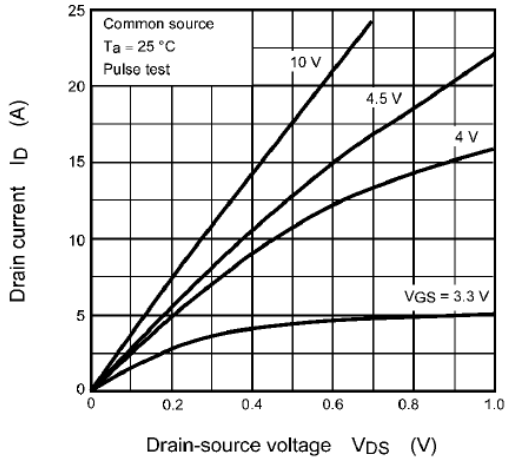
A channel temperature up to 175 °C and storage temperature from -55 to 175 °C are supported to ensure operating under severe conditions.

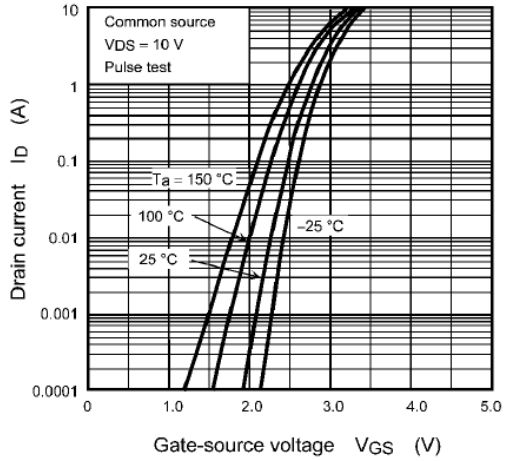
2 Low on-resistance

By reducing the on-resistance between the source and drain, heat generation and power consumption can be reduced, in keeping with the trend of declining system power consumption.

3 Small size package

In addition to the industry standard SOT-23F package, a smaller UFM package is also available with the same level of power consumption, contributing to overall set miniaturization.





Line up

Part number	SSM3K341R	SSM3K341TU
Package	SOT-23F	UFM
Polarity	N-ch	N-ch
$R_{DS(ON)}$ (Typ.) [Ω] @V_{GS} = 10 V	28	28
I_D (Max) [A]	6	6
V_{DSS} (Max) [V]	60	60
V_{GSS} (Max) [V]	±20	±20

◆Return to Block Diagram TOP

Value provided

High voltage and current output using DMOS FET output

1 High voltage and high current

Adoption of the BiCD, which is a high voltage monolithic process, an FET output is possible with an absolute maximum voltage of 50 V and selectable current rating types of 0.3 A, 0.5 A and 1.5 A.

2 Wide line-up

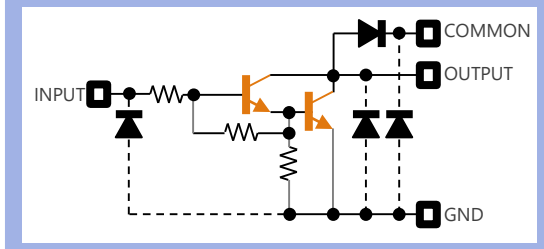
Selections include input type (buffer, inverter), output type (sink, source), number of channels (4 to 8). A total of 55 products are available, including DIP packages and built-in D-FF products.

3 Low loss

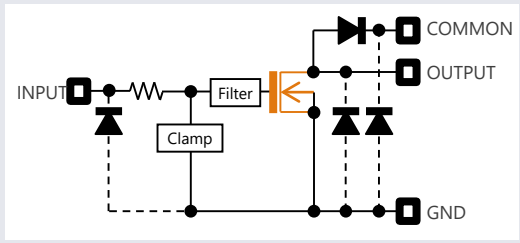
Low loss is achieved by the low Ron of the output circuit. Power loss is reduced by approximately 40 % compared to conventional products.
(Conditions: T_a = 25 °C, I_{OUT} = 200 mA)

TBD62xxx**A** Series

Before Output: **Bipolar transistor**



After Output: **DMOS FET**



DMOS FET：Double-Diffused MOSFET

Line up

Part number	TBD62083AFNG	TBD62783AFNG
Function	Sink output transistor array	Source output transistor array
Outputs	8	8
Ratings	50 V	50 V
	500 mA (Max)	-500 mA (Max)
Output on-resistance	2.0 Ω (Typ.)	1.6 Ω (Typ.)
Clamp diode	yes	yes
Package	SSOP18	SSOP18

◆Return to Block Diagram TOP

Value provided

Suitable for switching regulators, easy to use and contributes to the PCB miniaturization.

1 Low on-resistance

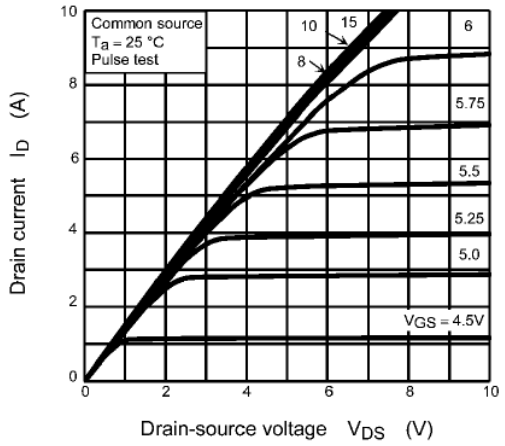
By reducing the on-resistance between the source and drain, heat generation and power dissipation is reduced.

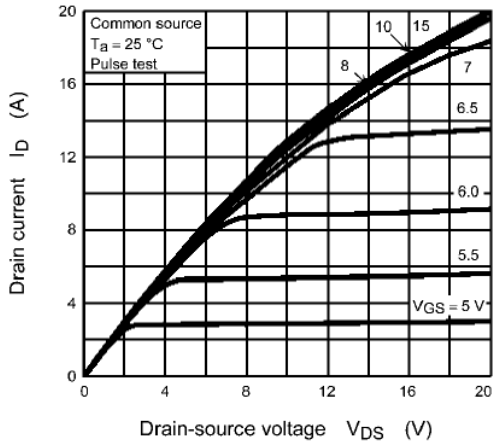
2 Low leak current

Drain cut-off current I_{DSS} = 10 μA (max) (at V_{DS} = 640 V)

3 Enhancement type

Easy to use enhancement type FET, no drain current flows when no gate voltage is applied.





Line up

Part number	TK10A80E
Package	TO-220SIS
V_{DSS} [V]	800
I_D [A]	10
P_D [W]	50
C_{iss} [pF]	2000
$R_{DS(ON)}$ (Max) [Ω]	0.7
Polarity	N-ch

◆Return to Block Diagram TOP

11 Transistor output photocoupler (DC input)

TLP383

Advanced functions · Stable operation | High Efficiency · Low loss | Small size packages

Value provided

Reduced board area, maintenance-free operation and improved reliability

1 High isolation voltage in a small thin package

A high isolation photocoupler with a phototransistor optically coupled to an infrared light emitting, diode with a guaranteed breakdown voltage of 5000 Vrms. Due to the small and thin DIP package, high density board mounting is possible.

2 Operating temperature is expanded to 125 °C

The operating temperature range is expanded (-55 to 125 °C) to ensure operating under severe conditions.

Industrial equipment

Inverters
Servo amps
Robots
FA
High power supplies
Security
Semiconductor testers
PLC

High isolation and noise immunity

Line up

Part number	TLP383
Package	SO6L (4pin) 
BV_S (Min) [Vrms]	5000
T_{opr} [°C]	-55 to 125

◆Return to Block Diagram TOP

Value provided

Photorelay consists of an infrared light emitting diode optically coupled to a photo-MOSFET and is suitable for replacing mechanical relays.

1 Low on-resistance R_{ON}

Low on-resistance contributes to realize low power dissipation.

2 Wide current range I_{ON}

The range of on-state current I_{ON} is wide and suitable for power-line control.

I_{ON} = 2.0 A (Max)

(TLP241B : A connection) [Note 1]

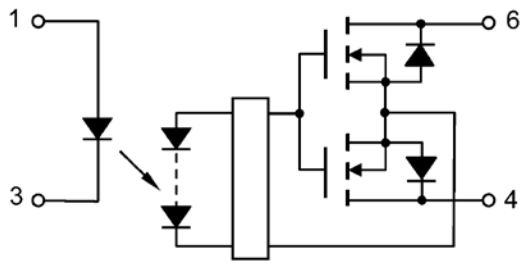
3 Small mounting area

Packages to reduce the size of the set and improve the degree of freedom for design are provided.

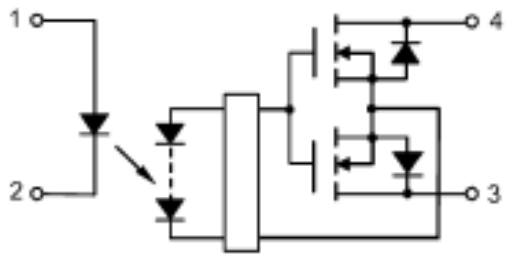
VSON Package size : 1.45 mm x 2.45 mm x 1.3 mm (Typ.)

[Note 1] Please refer to the technical data sheet for connection.

TLP241B
Internal equivalent circuit



TLP3420
Internal equivalent circuit



Line up

Part number	TLP241B	TLP3420
Package	DIP4 	VSON4 
I_{ON} (Max) [A]	2.0	0.1
V_{OFF} (Max) [V]	100	100
R_{ON} (Max) [Ω]	0.2	14
I_{FT} (Max) [mA]	3	3
BV_S (Min) [Vrms]	5000	500

◆Return to Block Diagram TOP

If you are interested in these products and have questions or comments about any of them, please do not hesitate to contact us below:

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