RENESAS

Renesas General-Purpose ICs

Power Management Linear ICs / General-Purpose Linear ICs / General-Purpose Logic ICs

General Catalog

Linear&Logic

Renesas Electronics

Innovation for a beautiful planet…

Both here and there.

EVERY WHERE

The beauty of solutions from Renesas. Achieving reduced power consumption in advanced applications.

Logic IC

Analog IC

Power Management

20134
OK4
6000

GSS

Green Stream Solution

© Green Stream Solution
These solutions control the flow of power (energy) and contribute to reduced power consumption overall.

The new Renesas offers a broad range of product lineups that contribute to an eco-friendly society.

Power Management
Linear ICs

Peripheral ICs for MCUs

Standard Logic ICs

General-Purpose ASSPs

Applications

Package Dimensions

Product Numbers

Packing

Product category map

General-Purpose Linear ICs

Power Management Linear ICs

Power Management ICs

Power Management ICs for Insulated Switching Power Supplies···05	Converts AC to DC.
Power Management ICs for PFC···07	Improves the power factor when converting from AC to DC.
LED Drivers for Lighting Fixtures···09	Convert Ac to DC for LED Lamp
SiPs with Integrated MOSFETs···10 ICs for DC/DC Power Supplies···11 ICs for strobe capacitor charger···13	Converts one DC voltage to another DC voltage.
Shunt Regulators···14	Generates a reference voltage.
Series Regulators (3-Pin Regulators)···16	Convenient local low-voltage power source.

Battery ICs

Charge Control ICs···18	Controls battery charging functions.
Battery Protection ICs···19	Controls battery protection functions.

Peripheral ICs for MCUs and SoCs

Detector ICs/System Organizers

Special Reset ICs···20	Controls the power supply sequence.
Single-Function Reset ICs···20 Multifunction Reset ICs···20	Monitors the power supply.

Data Converters

D/A Converters···21	Store various settings.

Standard Linear ICs

Operational Amplifiers/Comparators···23	Boosts weak signals from sensors, etc., performs external drive by amplifying output, and so on.

General-Purpose Logic ICs

Standard Logic ICs

Low-Voltage Logic ICs

HD/RD74LVC Series···31 HD74LV-A Series···32 HD74SSTV Series···33	Logic ICs with a low operating voltage for reduced power consumption.

5V Standard Logic ICs

HD74LS Series HD74BC Series HD74AC Series HD74HC Series	Logic circuits supporting conventional-level logic operations.

Unilogic ICs

74LV-A LVT-A 1G/1GW/2G···30 74LVC 1G/2G/3G···30 74ALVC 1G/2G···30 74HC 1G/2G···30	For adding logic circuits not included in an SoC.

High-Voltage Logic ICs

RD74HV1G···32 RD74HV8T···32 High-Voltage Logic Drivers···32	Drives external actuators using logic output from an MCU.

LED Drivers

Display/Illumination LED Drivers···26	Illuminates LEDs.

General-Purpose ASSPs

I/O Expanders···35	Expands the I/O ports of an MCU.
Level Shifters···26	Converts the peripheral circuit logic level to the operation level of the MCU or SoC.
Clock Generators for SSCGs···33	Spread the emission spectrum and suppresses interference.
HD74LVCZ Series···31	Enables removal or insertion of boards while the power is on.
IGBT Drivers···41	Illuminates a camera flash unit.
High-Speed Bus Switches···35	

Interface ICs

ICs for RS422/433, IEEE 485/488 Interface ICs···34 CCD/MOS Drivers···34	Drives an external bus.

•For details, see the following URL.

Power Management Linear ICs

Power Management Linear ICs
(Insulated Switching Regulator Controllers)

Typical Power Supply Circuit

Primary Side   Secondary Side

AC Input

Rush Current Protection Circuit

Filter Circuit

Di Current Circuit

PFC

AC/DC Converter

DC/DC Converter

5V

Battery Charger

Secondary Battery

PFC
Suppresses high-frequency current to improve the power factor.

DC/DC Converter
Converts one DC voltage to another DC voltage (step-down, step-up, inversion).

Isolated DC/DC converter
Low-voltage step-down function, isolated from high-voltage line.

Battery Charger
Controls charging of the secondary battery,

Renesas introduce various power supply applications.
http://www.renesas.com/en/vp
Please access and look for optimum solutions.

Insulated Switching Regulator Controllers

Part No.	Application	PFC Function	DTC Function	1 Overcurrent Protection Function	2 Overvoltage Protection Function	3 Remote On/Off	4 Soft Start	5 Adjustable Delay Timer fmax [MHz]	Fmax (MHz)
R2A20121	Full bridge control, for high-efficiency applications	–	–	pulse by pulse			yes	yes	2.0
R2A20124A	Full bridge/for high-efficiency applications, support for light-load mode	–	–	pulse by pulse		yes	yes	yes	1.0
M51995/6/8	V-mode, forward, for low-power applications	–	–	pulse by pulse/ Timer Latch/v	yes	–	–		0.5
M62213/281	Local power supply for DC/DC converters, etc.	–	–	pulse by pulse/ Timer Latch/v	yes		yes		0.7
M62235	Flyback regulator			yes	yes				

Description of Functions

1 Overcurrent Protection Function

Pulse by pulse: The PWM pulse width is limited one pulse at a time to provide protection.

Timer Latch: A function that stops pulse output when an overcurrent state has continued for a long period under the assumption that the boost diode has failed.

One shot: When an overcurrent state is ongoing, protection operation continues for a fixed period of time, followed by automatic recovery.

2 Overvoltage Protection Function

When the voltage is excessively large due to a problem such as a multifunction in the load, the overvoltage protection function operates to protect the power supply circuit.

3 Remote ON/OFF

Enables the power supply to be turned on and off remotely. Output is started and stopped according to a control signal from the system controller.

4 Soft Start

A system that gradually increases the PWM output pulse width after power-on to prevent overshooting due to a sudden rise in the DC/DC converter output. This function can be enabled by adding a CST to the DB pin.

5 Adjustable Delay Timer

Enables zero voltage switching (ZVS) by adjusting output time delay TD1 and TD2 by means of external resistors.
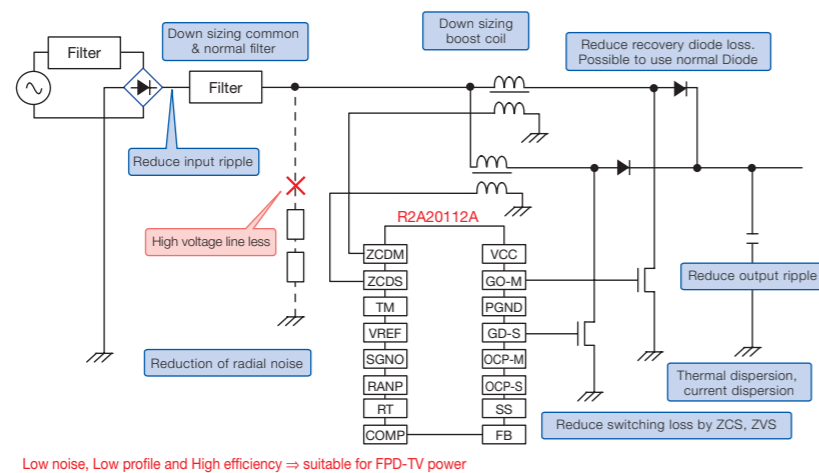
Low-Noise, High-Efficiency Interleaved PFC ICs

Features of Renesas PFC IC's

Part No.	1 Mode	Interleave Technology	ZCD winding less	4 ZCD open detector	5 Current limiter timer latch	Constant Power Limiter	Multi input less	3 Dynamic OVP	6 Brown Out	7 OVP2,	Vref acuracy		Light Load Efficiency	Soft Start	OVP / OCP, UVLO	Package
R2A20114A	CCM	Yes			Yes			Yes	Yes	Yes	1.6%	Yes	Phase drop	Yes	Yes	SOP20 LQFP40
R2A20104	CCM	Yes			Yes			Yes	Yes	Yes	1.6%	Yes	Phase drop	Yes	Yes	SOP20 LQFP40
R2A20115	CCM					Yes		Yes	Yes		1.6%	Yes			Yes	Yes	SOP-16
R2A20131	CCM							Yes	Yes		1.5%	Yes	LTB	Yes	Yes	SOP-16
R2A20112A	CRM	Yes		Yes			Yes	Yes			4.0%	Yes			Yes	Yes	SOP-16
R2A20118A	CRM	Yes			Yes		Yes	Yes	Yes	Yes	1.5%	Yes			Yes	Yes	SOP-20
R2A20132	CRM	Yes		Yes	Yes		Yes		Yes	Yes	1.5%	Yes	Slave drop LTB		Yes	SOP-20
R2A20113A	CRM		Yes				Yes	Yes			3.0%	Yes			Yes	SOP-8
R2A20133A R2A20133B	CRM		Yes				Yes	Yes		Yes	1.5%	Yes			Yes	SOP-8

Block diagrams & System merits

1 System merits of CRM Interleave PFC IC

Filter
Down sizing common & normal filter
Down sizing boost coil
Reduce recovery diode loss. Possible to use normal Diode
Filter
Reduce input ripple
High voltage line less
R2A20112A
ZCDM VCC
ZCDS GO-M
TM PGND
VREF GD-S
SGNO OCP-M
RANP OCP-S
RT SS
COMP FB
Reduce output ripple
Reduction of radial noise
Thermal dispersion, current dispersion
Reduce switching loss by ZCS, ZVS

Low noise, Low profile and High efficiency ⇒ suitable for FPD-TV power

Evaluation results

1 Ripple current comparison (CRM single vs. Interleave)

Ripple current of input filter capacitor

- single 80V
- single 100V
- single 200V
- single 250V
- Int 80V
- Int 100V
- Int 200V
- Int 250V
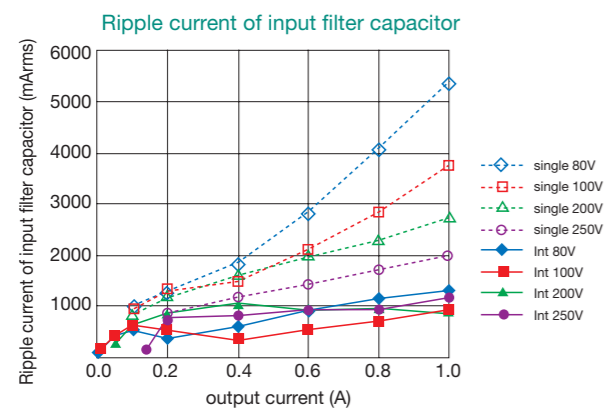
1 Efficiency comparison (CCM single vs. CRM Interleave)

efficiency

- DCM interleave Vin=100V
- DCM interleave Vin=220V
- CCM single Vin=100V
- CCM single Vin=220V
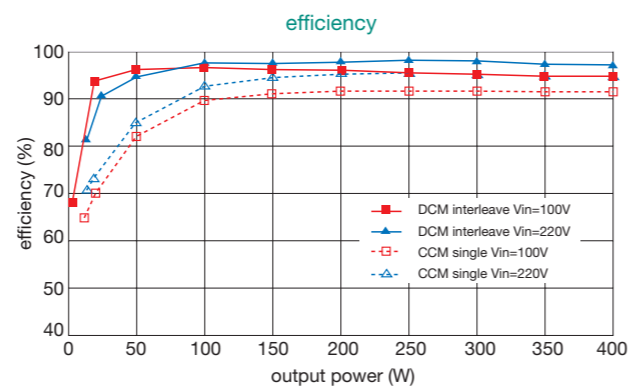
1 Switching noise comparison (CCM single vs. CRM Interleave)

Vin=100VAC/Po=200W

Noise Terminal Voltage Measurement
Equipment name: HA16174P
Part No.:
Serial No.: 01
Measurement bands: 4 bands
Detection mode: Peak
Line mode: VA
Standard 1: [VCCI] Class B (QP)
Standard 2: [VCCI] Class B (mean value) (-10dB)
Temperature: deg C
Humidity: %
Measuring device: R3261C
Measurement date/time: 10-24-2006/20:49
Comment: PFC

Noise Terminal Voltage Measurement
Equipment name: R2A20112
Part No.:
Serial No.: 01
Measurement bands: 4 bands
Detection mode: Peak
Line mode: VA
Standard 1: [VCCI] Class B (QP)
Standard 2: [VCCI] Class B (mean value) (-10dB)
Temperature: deg C
Humidity: %
Measuring device: R3261C
Measurement date/time: 10-24-2006/19:45
Comment: PFC
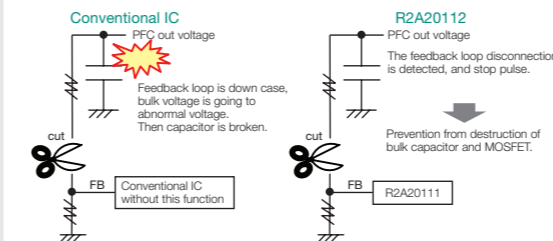

CCM Single

CRM Interleave

Functions for protecting systems & IC's

2 Feedback loop open detection

Built over voltage protection. And lose feedback loop detection can stop Output pulse. Therefore, bulk capacitor & MOSFET are not broken.

Conventional IC
PFC out voltage
Feedback loop is down case, bulk voltage is going to abnormal voltage. Then capacitor is broken.
cut
FB Conventional IC without this function

R2A20112
PFC out voltage
The feedback loop disconnection is detected, and stop pulse.
cut
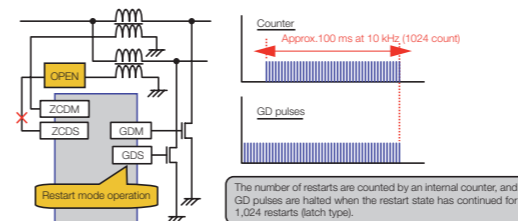Prevention from destruction of bulk capacitor and MOSFET.
FB R2A20111

3 Dynamic over voltage protection

R2A20112 has "Dynamic" and "Static" OVP. Dynamic OVP is doing discharge error AMP voltage gradually when over voltage happened. Because of this, it is possible to void audible noise caused by suddenly pulse stop.
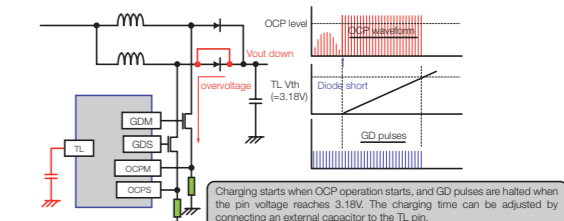

Reduce of a potential of Audible noise.
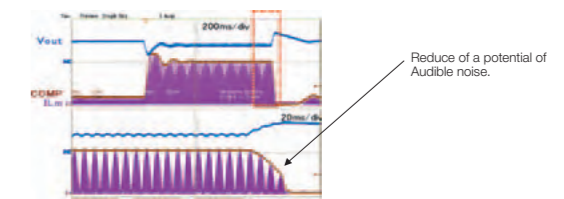
4 Slave ZCD Signal Open/Short Protection Function

Halts GD pulses when slave restart mode operation continues for a long time under the assumption that the ZCD line is in an abnormal state.

OPEN
ZCDM
ZCDS GDM
GDS
Restart mode operation
Counter
Approx.100 ms at 10 kHz (1024 count)
GD pulses
The number of restarts are counted by an internal counter, and GD pulses are halted when the restart state has continued for 1,024 restarts (latch type).

5 OCP Timer Latch

Halts GD pulses when OCP operation continues for a long time under the assumption that the boost diode is in an abnormal state.

OCP level
OCP waveform
Vout down
overvoltage TL Vth (=3.18V) Diode short
TL GDM
GDS
OCPM
OCPS
GD pulses
Charging starts when OCP operation starts, and GD pulses are halted when the pin voltage reaches 3.18V. The charging time can be adjusted by connecting an external capacitor to the TL pin.
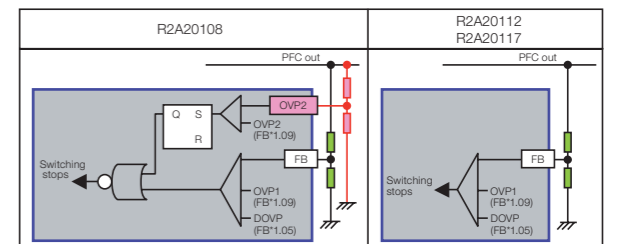
6 Brownout Function

The AC input voltage is divided and smoothed before being input to the BO pin, preventing switching from occurring when the AC input voltage falls below the specified voltage.

Filter
BO
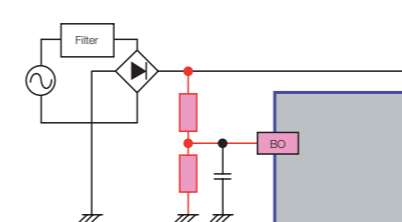
7 OVP2 Function

The FB pin and OVP2 pin are equipped with two OVP functions to provide enhanced safety in case of overvoltage.

R2A20108
PFC out
Q S
R
OVP2 (FB*1.09)
FB
Switching stops
OVP1 (FB*1.09)
DOVP (FB*1.05)

R2A20112 R2A20117
PFC out
OVP2
FB
Switching stops
OVP1 (FB*1.09)
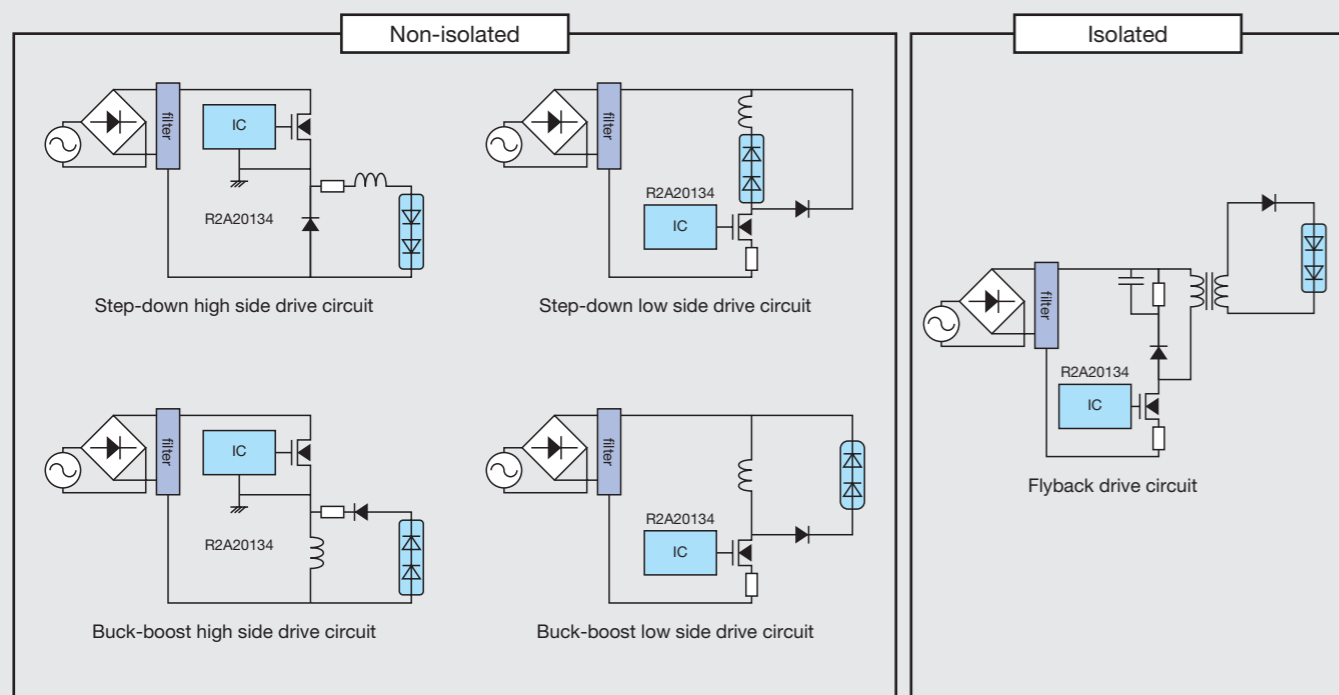DOVP (FB*1.05)

Power Management Linear ICs

Features of R2A20134 LED Driver IC for LED Lighting
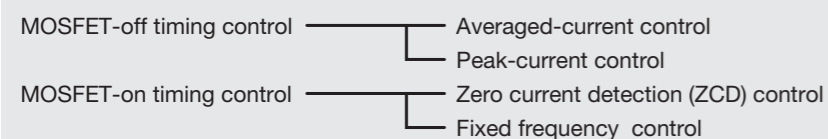
POL

Features of R2A20134

Provides compatibility with a variety of circuit configurations and control methods to support a wide range of market requirements.

• Non-isolated topology and step-down high-side drive for high efficiency (92%) and high power factor (0.94) (Renesas evaluation board).

• Enables reduced BOM cost through use of simple circuit configuration and MOSFETs with low voltage tolerance rating.
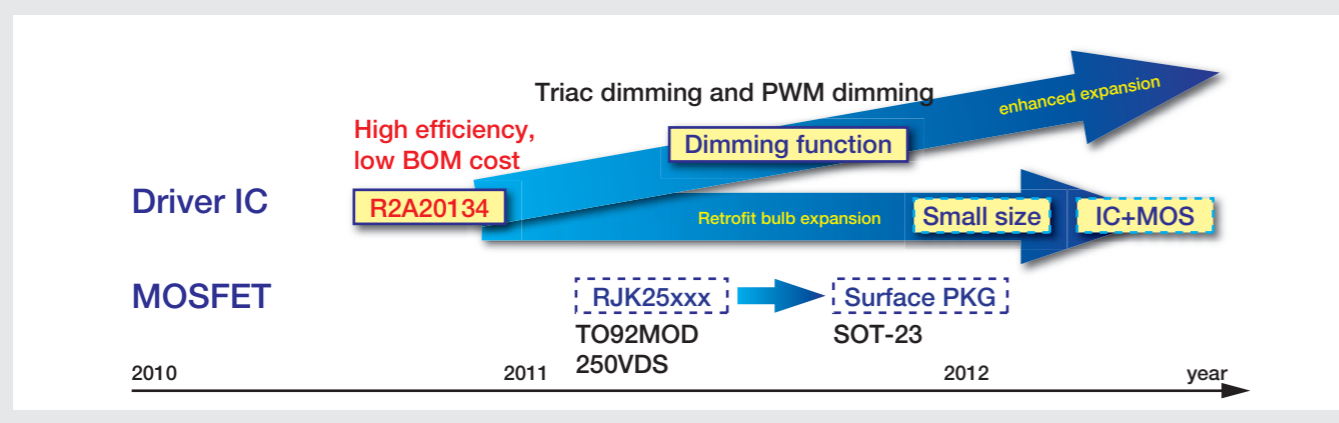
Covering various circuit configurations

Non-isolated

Isolated

Step-down high side drive circuit

Step-down low side drive circuit

Buck-boost high side drive circuit

Buck-boost low side drive circuit

Flyback drive circuit

Covering various control methods

MOSFET-off timing control —— Averaged-current control
—— Peak-current control

MOSFET-on timing control —— Zero current detection (ZCD) control
—— Fixed frequency control

Technology roadmap

Triac dimming and PWM dimming

enhanced expansion

High efficiency, low BOM cost

Dimming function

Driver IC — R2A20134 — Retrofit bulb expansion — Small size — IC+MOS

MOSFET — RJK25xxx → Surface PKG
TO92MOD — SOT-23
250VDS

2010   2011   2012   year

### Power Management Linear ICs (POL Converters)

There is a trend in high-performance equipment toward placement of a local power supply close to the load to improve power supply quality and reduce noise emission. Renesas Electronics offers a lineup of devices for such applications, including switching regulator controller ICs for use in combination with switching elements as POL converters and the R2J20702, a SiP with integrated MOS.

R2J20702NP PWM Controller SiP with Integrated MOSSFET (POL-SiP) PWM

• Integrates mutually optimized synchronous rectification PWM controller and power MOSFETs for high efficiency and reduced size
• Recommended input voltage range: 8V to 14V (supports control circuit operation at 5V)
• Support for large-current output: Max. 40A
• Integrated 0.6V reference voltage generator with 1% accuracy
• Wide operating frequency setting range: 200kHz to 1MHz
• Peak current control for high responsiveness
• Current sharing function (parallel operation of up to 5 devices)
• Support for single operation, 2-phase operation, and multichannel operation (tracking startup function)
• Integrated bootstrap SBD
• Integrated on/off control and overvoltage momentary cutoff function (hiccup circuit)
• Design support tools and evaluation boards available
• Compact package: OFN 56-pin (8mm × 8mm)
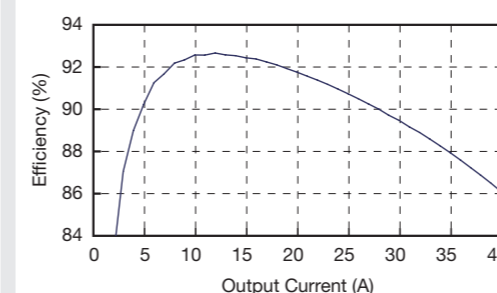
Conditions
Vin=12V, Vout=1.8V, fsw=500kHz,
L=0.32uH, Cout=600uF, No Air-Flow
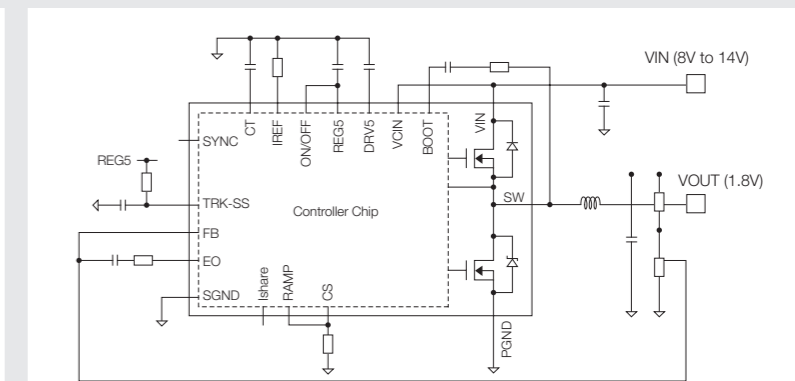
POL Converters/Controllers

Part No.	Configuration	Conversion Type	Operating Voltage Range	Rectification Type	Output Voltage	Oscillation Frequency	Output MOSFET	Other Functions	Package		
									TSSOP	QFN	CSP
R2J20702NP	POL SiP	Voltage step-down	7.4~16V	Synchronous rectification	40A 0.8 to 5.0V	to 1MHz	Yes	1 On/off control, 2 OCP hiccup function	–	NP (56)	–

1 On/Off Control

On/off control allows stopping IC function and turning off the MOSFETs when in the low-level or open state.

2 OCP Hiccup Function

When the CS pin voltage exceeds 1.5V, the OCP hiccup function shuts off the IC and the MOSFETs. Also, the TRK-SS pin is pulled down to SGND by an internal circuit. The RESsignal continues for 1,024 times[?] while the ICis off, then switching operation starts from the soft start state.

Power Management Linear ICs

Description of Power Management Linear IC (DC/DC) Functions

Multi Purpose DC/DC Converters

Part No.	Application	Operating Voltage Range	Current Consumption	Output Type	Output Voltage	Output Current	Oscillation Frequency	Max. On Duty	Other Functions	Package DIP	Package SOP	Package SSOP
M5291	Voltage step-up, voltage step-down, polarity reversal	2.5~40V	1.4mA			200mA	100Hz~100kHz	85.7%	**1** peak current limiter circuit	P (8)	FP (10)	—
M62212		2.5~18V	1.3mA	Open collector		~300kHz	0~100% (Set by DTC pin)		**2** output short protection **4** DTC **3** on/off control **5** soft start, external input synchronous operation			GP (8)
M62211	Voltage step-up, voltage step-down, polarity reversal, backlight control	2.5~35V				150mA			2-input priority control **4** DTC **3** on/off control **5** soft start, external input **2** output short protection synchronous operation	P (14)	FP (8)	—
M62215		8.6~25V	9.5mA	Totem pole		±1A	~500kHz	90%	2-input priority control **5** soft start, external input **3** on/off control synchronous operation **2** output short protection **6** Pulse by Pulse CLM **4** DTC		—	
M62216	Voltage step-up, voltage step-down	0.9~15V	850μA	Open collector	Variable	100mA	~155kHz	87%	**3** on/off control	—	FP (8)	GP (8)
HA16114	Voltage step-down, polarity reversal									P (16)	FP (16)	—
HA16120	Voltage step-up								**3** on/off control **6** Pulse by pulse CLM **7** timer-controlled intermittent operation function, external input synchronous operation, (HA16114/120) **5** soft start, external input synchronous operation **8** quick shut function **9** Vref overvoltage protection function		—	
HA16116	CH1: Voltage step-down, polarity reversal CH2: Voltage step-down	3.9~40V	8.5mA	Totem pole		±1A	~600kHz	0~100% (Set by DB pin)			FP (20)	
HA16121	CH1: Voltage step-down, polarity reversal CH2: Voltage step-up											

Fixed-Output-Voltage DC/DC Converters

Part No.	Application	Operating Voltage Range	Current Consumption	Output Type	Output Voltage	Output Current	Oscillation Frequency	Max. On Duty	Other Functions	Package SIP	Package SOP	Package SOT
M62220		4~15V	660mA		220: 3.3V		110kHz			L (5)	FP (8)	—
M62270			500mA		270: 3.3V					—	—	GP (5)
M62290	Voltage step-down	6~15V	780mA	Open collector	5.0V	100mA	120kHz	90%	Overcurrent protection circuit	L (5)	FP (8)	—
M62291			570mA							—	—	GP (5)
M62292 M62293		4~15V	1.0mA		292: 3.3/1.8V 293: 3.3/2.5V	30mA	110kHz		Dual-voltage (input voltage and 3.3V output) detection function	—	FP (8)	—

Multi DC/DC Converters

Part No.	Ch. No.	Conversion Type	Operating Range	Output Voltage (Typ.)	Output Current (max.) 1LI-ion	Output Current (max.) 2AA	Rectification Type	Integrated Parts MOS FET	Integrated Parts Load SW	Integrated Parts Phase Compensator	Oscillation Frequency (max.)	Max. On Duty	Application	Other Functions	Package QFN
R2A20016	CH1	Voltage step-up	1.5 to 5.5V	5.0V	600mA	400mA	Synchronous rectification	Yes	Yes	Yes	2MHz	90%	Motor	**3** on/off control **5** soft start **2** output short protection **10** overvoltage protection **11** overcurrent protection backlight brightness adjustment voltage detector PFM/PWM switching	NP (40)
	CH2	Voltage step-down		1.8V	600mA	400mA	Synchronous rectification	Yes	—	Yes		100%	SDRAM		
	CH3	Voltage step-down		1.0V	600mA	400mA	Synchronous rectification	Yes	—	Yes			SOC		
	CH4	Voltage step-up/ step-down		3.3V	500mA	350mA	Synchronous rectification	Yes	—	Yes	1MHz	95%	I/O,AFE		
	CH5	Voltage step-up		13V	50mA	30mA	Di rectification	Yes	Yes	Yes			CCD (+)		
	CH6	Polarity reversal		-7.5V	100mA	100mA	Di rectification	Yes	—	Yes	500kHz	90%	CCD (-)		
	CH7	Voltage step-up		4LEDs (20mA)	35mA	30mA	Di rectification	Yes	Yes	Yes		95%	LCD BL		

1 Peak Current Limiter Circuit

Peak current detection is accomplished by connecting a resistor (RSC) between designated pins. When an overcurrent condition causes the RSC voltage to drop more than 0.3V (standard), the charge current to the oscillation capacitor increases suddenly, minimizing the output switch's on period and turning off output.

2 Output Short Protection

The output pin voltage is monitored, and the power supply is shut down when it drops below a specified value.

3 On/Off Control

Enables the power supply to be turned on and off remotely. Output is started and stopped according to a control signal from the system controller.

4 DTC (Dead Time Control)

At startup, a delay circuit prevents the output from rising until the input power supply stabilizes.

5 Soft Start

A system that gradually increases the PWM output pulse width after power-on to prevent overshooting due to a sudden rise in the DC/DC converter output. This function can be enabled by adding a CST to the DB pin.

6 Pulse by pulse CLM

The PWM pulse width is limited one pulse at a time to provide protection.

7 Timer-Controlled Intermittent Operation Function

When a continuing overcurrent condition exists, the TM and ON/OFF pins are used to make the IC operate intermittently. This makes it possible to configure a power supply with sharp drop-off characteristics.

8 Quick Shut Function

The quick shut function resets the pin voltages when the IC is turned off, causing PWM pulse output to halt immediately.

9 Vref Overvoltage Protection Function

The Vref input also has an on-chip overvoltage protection circuit that prevents excessive voltage from entering via the Vref pin and damaging the device internally.

10 Overvoltage Protection Function

When the voltage is excessively large due to a problem such as a multifunction in the load, the overvoltage protection function operates to protect the power supply circuit.

11 Overcurrent Protection

This function limits the output current to prevent it from becoming excessive. There are two types: one with a with vertical drop-off characteristics and one with "hook-back" drop-off characteristics.

Power Good Function

This is a pin that indicates when the converter is supplying the normal output voltage. It is driven low in cases where it is necessary to indicate the possibility that the power supply output is outside the regulation range.
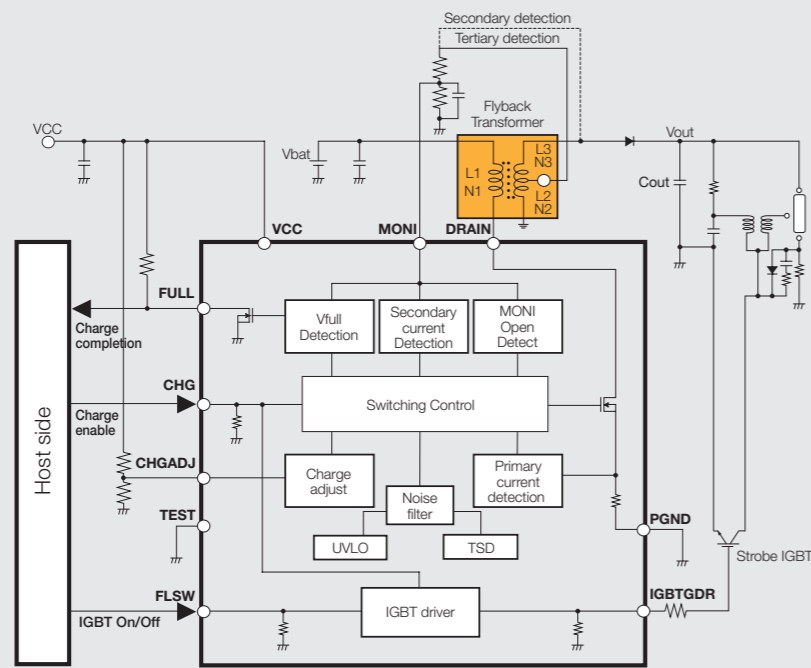
Photoflash capacitor charger IC with IGBT driver R2J20071BNS

Shunt Type

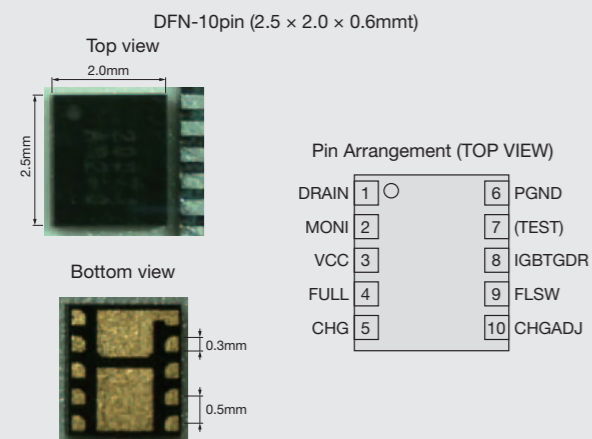# Photoflash capacitor charger IC with IGBT driver R2J20071BNS

Features

- Self-oscillation method with fly-back transformer.
- The charge completion is detected by indirect detection method with tertiary-winding or direct detection method with secondary-winding.
- High precision charge completion detection voltage 1.0V+/-1.0%
- Small package :DFN-10 (2.5 × 2.0 × 0.6mmt)
- Built-in high voltage (60V) and Low Ron (0.2ohm) Nch MOSFET for Power Switch.
- Various protect functions
  - Low voltage protection
  - Thermal shutdown
  - Maximum off time limitation for Nch MOSFET
  - Overcharge protection for open winding
- Primary side current is adjustable by inputting the DC voltage to CHGADJ terminal.
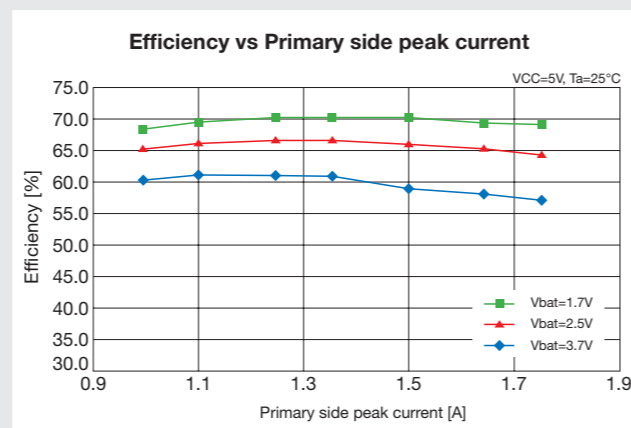- IGBT driver is adjusted to Renesas's strobe IGBT.

Application Circuit Example

Package

DFN-10pin (2.5 × 2.0 × 0.6mmt)

Top view

2.0mm

2.5mm

Bottom view

0.3mm

0.5mm

Pin Arrangement (TOP VIEW)

DRAIN	1	6	PGND
MONI	2	7	(TEST)
VCC	3	8	IGBTGDR
FULL	4	9	FLSW
CHG	5	10	CHGADJ

Efficiency

Efficiency vs Primary side peak current

VCC=5V, Ta=25°C

Efficiency [%]

Primary side peak current [A]
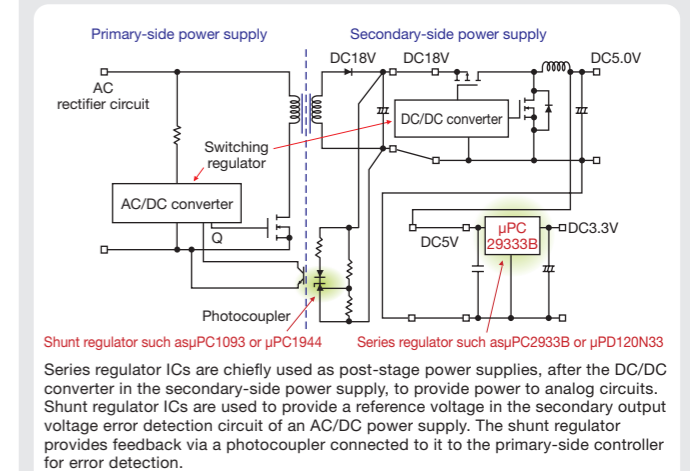
- Vbat=1.7V
- Vbat=2.5V
- Vbat=3.7V

New Shunt Regulator IC Lineup

For applications such as output voltage detection in all sorts of electronic devices and as reference voltage sources for A/D input, Renesas Electronics supplies a variety of shunt regulator ICs, including the HA17431 Series and the µPC1093, µPC1943, µPC1944, and µPC1945 Series. The HA17431G Series delivers high-voltage and high-precision characteristics in a compact package, while the µPC1093, µPC1943, µPC1944, and µPC1945 Series include compact-package and low-voltage models.

Renesas HA17431G Series Features

- Achieve both high voltage and high accuracy compared to conventional product.
  - Max. cathode voltage (Vkmax): 40V
  - Reference voltage (Vref at 25°C)
    - : 2.500V ±0.5%(A type)
    - : 2.500V±1.0% (Standard type)
- Abundant variations in packages including small surface mounting package for equipment downsizing.
  - Surface mounting type: MPAKV, MPAK-5V, UPAK
  - Through hole type: TO-92
  - K-REF pin reversed type: HA17432G (UPAK)

Example Power Supply Circui

Primary-side power supply

Secondary-side power supply

DC18V   DC18V   DC5.0V

AC rectifier circuit

Switching regulator

AC/DC converter

DC/DC converter

Q

DC5V

µPC 29333B

DC3.3V

Photocoupler

Shunt regulator such asµPC1093 or µPC1944   Series regulator such asµPC2933B or µPD120N33

Series regulator ICs are chiefly used as post-stage power supplies, after the DC/DC converter in the secondary-side power supply, to provide power to analog circuits. Shunt regulator ICs are used to provide a reference voltage in the secondary output voltage error detection circuit of an AC/DC power supply. The shunt regulator provides feedback via a photocoupler connected to it to the primary-side controller for error detection.

- Reference voltage generation circuits
- Switching power management error amplification circuits, etc.

Product Lineup

| Item		Low voltage type (1.25V)		Standard voltage type (2.5V)				
		HA17L431A	HA17L431	HA17431V	HA17431H	HA17431A	HA17431GA	HA17431G
Reference voltage	Vref (V)	1.240	1.240	2.500	2.500	2.495	2.500	2.500
Maximum cathode voltage	VKA (V)	16	16	16	36	40	40	40
Continuous cathode current	IK (mA)	-30~+50	-30~+50	-50~+50	-50~+50	-100~+150	-50~+100	-50~+100
Reference voltage accuracy	(%)	±1	±1.5	±1	±1	±2.2	±0.5	±1.0
Operating temperature range	Topr (°C)	-20~+85	-20~+85	-20~+85	-20~+85	-20~+85	-40~+85	-40~+85
Package	MPAK	HA17L431ALTP HA17L432ALTP	—	HA17431VLTP HA17432VLTP	HA17431HLTP HA17432HLTP	—	HA17431GLTPA	HA17431GLTP
	MPAK-5	HA17L431ALP	—	HA17431VLP	HA17431HLP	—	HA17431GLPA	HA17431GLP
	TO-92	HA17L431AP	—	HA17431VP	HA17431HP	HA17431PNA	HA17431GPA	HA17431GP
	TO-92MOD	—	—	—	—	HA17431PA	—	—
	UPAK	—	HA17L431UP HA17L432UP	HA17431VUP HA17432VUP	HA17431HUP HA17432HUP	HA17431UA HA17432UA	—	HA17431GUP HA17432GUP

Power Management Linear ICs

Shunt Type

External Package Dimensions and Pin Arrangement

Package	MPAKV		MPAK-5V			UPAK	
Pin Arrangement (Top view) *1	A / R K	A / K R	NC NC / R A K	NC PS / R A K	A R / NC NC K	A / R A K	A / K A R
Part No.	HA17431GLTP HA17431GLTPA HA17431HLTP HA17431VLTP HA17L431ALTP	HA17432HLTP HA17432VLTP HA17L432ALTP	HA17431GLP HA17431GLPA HA17431HLP	HA17L431VLP	HA17L431ALP	HA17431GUP HA17431UA HA17431HUP HA17431VUP HA17L431UP	HA17432GUP HA17432UA HA17432HUP HA17432VUP HA17L432UP

Package	TO-92	TO-92MOD
Pin Arrangement (Top view) *1	R A K	R A K
Part No.	HA17431GP HA17431GPA HA17431PNA HA17431HP HA17431VP HA17L431AP	HA17431PA

*1 R : Reference
A : Anode
K : Cathode
NC: No Connection
PS : Built-in Photocoupler Bypass Resistor (2kΩ)

Package	Size (mm)	Pin pitch (mm)	Power dissipation (mW)	Abbreviation
MPAKV	1.5 × 2.95 × 1.1	(0.95)	150	LTP
MPAK-5V	1.6 × 2.9 × 1.1	0.95	150	LP
UPAK	2.5 × 4.5 × 1.5	1.5	385	UP
TO-92	5.0 × 4.8 × 3.8	1.27	500	P, PN
TO-92MOD	8.0 × 4.8 × 3.8	1.27	800	P

K ○ 2kΩ ○ PS
○ REF
○ A
Symbol (HA17431VLP)
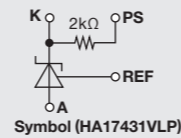
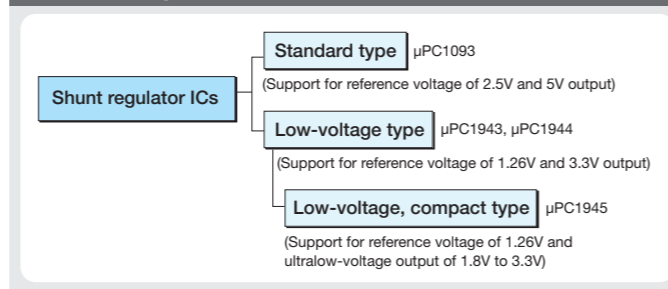## Other shunt regulator ICs

Shunt regulator ICs are widely used as feedback circuits in switching power supplies and as reference voltage sources.

Features of µPC1093, µPC1943, µPC1944, and µPC1945 Series

• The product lineup includes the µPC1093 with a standard 2.5V reference voltage (equivalent to 431 from other vendors) and models with a low reference voltage of 1.26V.

Shunt Regulator IC Lineup

Shunt regulator ICs

— Standard type µPC1093
(Support for reference voltage of 2.5V and 5V output)

— Low-voltage type µPC1943, µPC1944
(Support for reference voltage of 1.26V and 3.3V output)

— Low-voltage, compact type µPC1945
(Support for reference voltage of 1.26V and ultralow-voltage output of 1.8V to 3.3V)

Shunt Regulator ICs

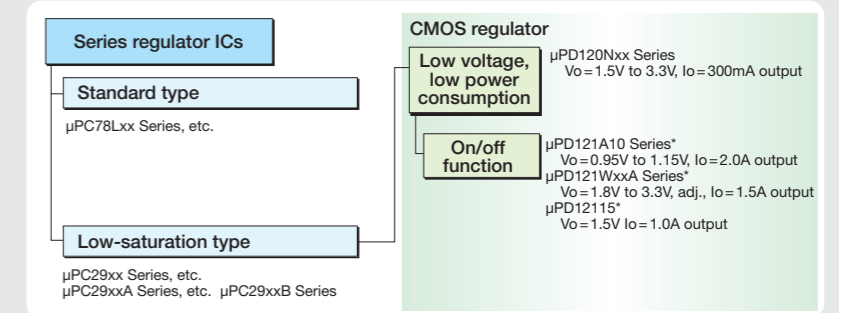| Product Name	Output Current (A)	Reference Voltage (V)	Accuracy (%)	Output Voltage Variable Range (V)	Absolute Maximum Characteristics		Package	Remarks
					Input Voltage (V)	Total Loss (W)		
µPC1093	0.15	2.495	±2	2.5~36	37	0.48	8-pin SOP	—
						2*1	SOT-89	
						0.51*2	SC-74A	
µPC1943	0.05	1.26	±2.6	1.26~24	25	1.6*1	SC-62	For 3V power supplies
µPC1944	0.05	1.26	±2.6	1.26~24	25	0.385	8-pin SOP	For 3V power supplies (pin-compatible with µPC1093)
						1.6*1	SOT-89	
µPC1945	0.015	1.26	±2	1.26~5	6	0.09	SC-74A	For 1.8V power supplies

*1: When mounted on 16cm² × 0.7mm ceramic substrate   *2: When mounted on 75mm² × 0.7mm ceramic substrate

Series Regulator ICs

Series regulator ICs require few external elements and are widely used as simple power supplies. Due to their excellent noise characteristics, series regulator ICs are suitable for supplying power to analog circuits that are sensitive to noise.

Series Regulator Lineup

• In addition to standard type regulators, low-saturation type (LDO) products with minimal input-output voltage difference and low-power CMOS type products are available.
• Wide range of output current specifications, from 0.1A to 2A
• Wide range of output voltage specifications, from 1V to 1.5V

Series regulator ICs

— Standard type
µPC78Lxx Series, etc.

— Low-saturation type
µPC29xx Series, etc.
µPC29xxA Series, etc. µPC29xxB Series

CMOS regulator

— Low voltage, low power consumption
µPD120Nxx Series
Vo = 1.5V to 3.3V, Io = 300mA output

— On/off function
µPD121A10 Series*
Vo = 0.95V to 1.15V, Io = 2.0A output
µPD121WxxA Series*
Vo = 1.8V to 3.3V, adj., Io = 1.5A output
µPD12115*
Vo = 1.5V Io = 1.0A output

Standard Type Three-Pin Regulators

Type	Product Name	Output Current (A)	Output Voltage (V)												Absolute Maximum Characteristics		Package
			3.3	4	5	6	7	8	9	10	12	15	18	24	Input Voltage (V)	Total Loss (W)*2	
Positive voltage	µPC78Lxx	0.1		○	○	○	○		○	○	○				30*1	2*3	SOT-89
	µPC305	0.05	Output voltage variable range: 4.5V to 30V												40	0.44	8-pin SOP

*1: The input voltage (absolute maximum) is 35V for products with 10V, 12V, or 15V output.
*2: Limited by internal circuit characteristics.
*3: When mounted on 16cm² (0.7mm thick) ceramic substrate

CMOS Regulators

Product Name	Output Current (A)	Output Voltage (V)							Absolute Maximum Characteristics		Package	Features
		1.0	1.5	1.8	2.5	3.3	5.0	ADJ	Input Voltage (V)	Total Loss (W)*1		
µPD120Nxx	0.3		○	○	○	○			6	2*2	SOT-89	—
										0.51*3	SC-74A	
µPD121A10	2.0	○							6	10	TO-252 5pin	On/off function
µPD121WxxA	1.5			○	○	○		○	6	10	TO-252 5pin	On/off function
µPD12115	1.0	○							6	10	TO-252 5pin	On/off function

*1: Limited by internal circuit characteristics.   *2: When mounted on 16cm² × 0.7mm ceramic substrate   *3: When mounted on 75mm² × 0.7mm ceramic substrate

3-Pin Type

Low-Saturation Regulators

Product Name	Output Current (A)	1.8	2.5	2.6	3	3.3	4	5	6	7	7.8	8	9	10	12	15	18	24	Absolute Maximum Characteristics Input Voltage (V)	Total Loss (W)*1	Package	Features
μPC29Lxx	0.1				○	○	○	○											16	2*2	SOT-89	Low-saturation, 3-pin
μPC29Mxx	0.5			○					○	○		○	○	○	○				20	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
μPC29M33A μPC29M05A	0.5				○		○												20	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
μPC29xx	1.0			○					○	○		○	○	○	○				20	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
μPC2918 μPC2925 μPC2926	1.0	○	○	○															20	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
μPC2933A μPC2905A	1.0				○		○												20	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
μPC29xxB	1.0	○	○		○		○												16	10	SC-64	Low-saturation, 3-pin
																				10	SC-63	
																				10	TO-252	
μPC29Sxx	0.1							○				○							20	0.48	8-pin SOP	On/off function
μPC3033/05	1				○		○												8	12.5	TO-126	On/off function

*1: Limited by internal circuit characteristics.　*2: When mounted on 16 cm² × 0.7 mm ceramic substrate

HA17 Series Three-Pin Regulator ICs

These 3-Pin Regulators IC Lineup always supply a stable output voltage, unaffected by fluctuations in the input voltage. They are suitable for use in audio equipment power supplies, for stabilization of unstable voltages of multi-output switching regulators, and for power supplies of various kinds of control devices.

Features

- Variety of output voltage grades
- Various built-in protection circuits: current limiting circuit, chip junction temperature limiting circuit, internal power dissipation limiting circuit
- Wide operating temperature range:Ta=–40 to +85°C

Series Regulators
- Suitable for precision, high-stability, low-capacity power supplies (up to 20W)
- Extremely low noise generation
- Facilitate circuit design

Example of Fixed-Output Regulator Circuit

AC100V　HA178LXXUA　Vout
0.33μF　0.1μF
Common

Circuit　　　　Lineup
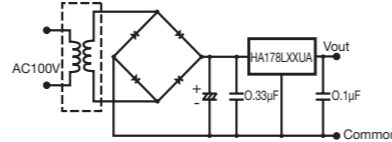
Output voltage (V)	Current (mA)	Package	
		UPAK(SOT89)	TO-92MOD
5.0	100	HA178L05UA	HA178L05/A/P/PA
8	100	HA178L08UA	HA178L08/A/P/PA
12	100	HA178L12UA	HA178L12/A/PA
15	100	HA178L15UA	HA178L15/A/P
-5	100	HA179L05U	HA179L05/P
-8	100	HA179L08U	HA179L08/P
-12	100	HA179L12U	HA179L12/P
-15	100	HA179L15U	HA179L15/P

Circuit

Grade	HA178Lxx Series	HA179Lxx Series
Standard	±8%	±4%
A Grade	±5%	–

Battery

Power Management Linear ICs (for Battery Chargers)

Charge Control IC Roadmap

Functionality

For integrated charger applications

R2A20050ANS
- Compact package DFN-10 (2.7 × 2.5mm)

R2J20052NS
- Power path control
- Suitable for USB chargers
- I²C control

- Suitable for USB adapters
- Ultra-compact package
- I²C control
- Integrated JEITA profile support

For charger applications (with primary-side control)

R2A20035SP
- Integrated JEITA profile support (control of charging voltage and current according to battery temperature)

- Multi-cell support
- Switching charger control

~2009　　　2010　　　2011~

Charge Control IC Lineup

Part No.	Li-ion	Ni-MH	Vcc(V)	Charge control voltage (V)	On-chip MOS FET	On-chip current sense resistor	Primary control	MCU I/F	LED driving output	Battery identification	AC adaptor detection	Settable charge termination	Trickle charge	Re-charge	Over-discharge detection	Over-voltage detection	Over current detection	Battery temperature detection	Safety timer	Thermal protection	Compulsory charge stop	Package
M62237	○	○	2.5-15	1.25																		SOP8
R2S20035	○		2.8-5.5	4.20	○	○	○		2		○	○	○		○	○	○	○	○	○		SSOP20
M62244	○		3.0-6.5	4.20					2		○		○	○	○	○	○	○	○		○	SSOP20
M62245	○		3.0-6.5	4.20					2		○		○	○	○	○		○	○			SSOP16
M62249	○		4.75-6.1	4.20	○				1		○		○	○		○	○	○			○	QFN28
M62253A	○		5.0-15	4.10/4.20					2			○	○	○	○				○			SSOP16
R2S20030	○		4.75-6	4.20	○	○			1			○	○	○		○			○	○	○	QFN28
R2A20050A	○		4.0-5.8	4.20	○	○			1		○		○	○	○			○	○	○		DFN10
M62242	○		5.3-15	4.10/4.20				○		○			○	○	Realized with MCU							SSOP16

Description of Functions

1 Battery Connection Detection Function

Outputs the TH pin voltage. The TH pin is used for both battery connection detection and battery temperature detection, and the MCU determines from the output whether or not a battery is connected and, if so, its temperature.

2 AC Adaptor Connection Detection Function

The Adpt SW pin is used for AC adaptor detection. An adaptor is determined to be connected when this pin is driven high. Note that adaptor mode has priority, so if the Adpt SW pin goes high when charging is in progress, charging stops and operation switches to adaptor mode.

3 Temperature Detection Function

The voltage divided by an externally connected pull-up resistor (to Vcref) and an external thermistor resistance is input to the Tdet pin. This voltage is used to determine the temperature.

4 Forced Charge Stop

This function enables charging to be forcibly stopped by driving the STP pin low. At this time an LED goes dark and the timers are initialized.

Battery

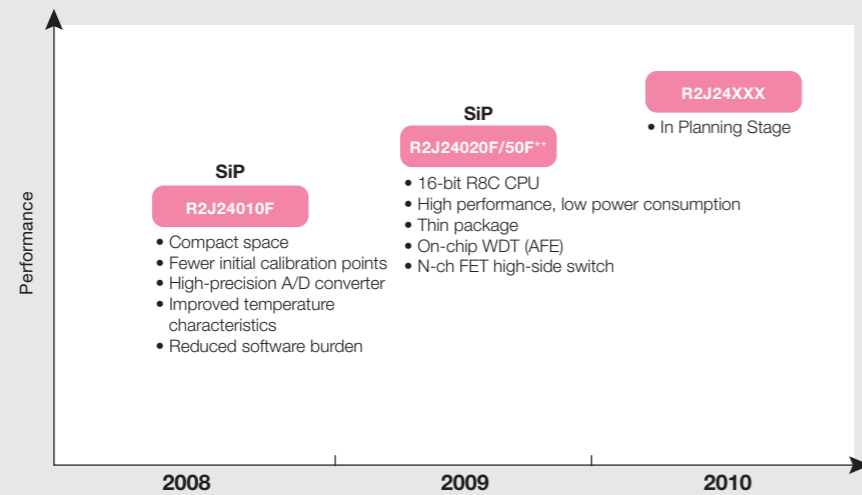# Smart Battery System for Notebook PC "R2J24020F/50F**"

High-precision battery charge remaining management and battery
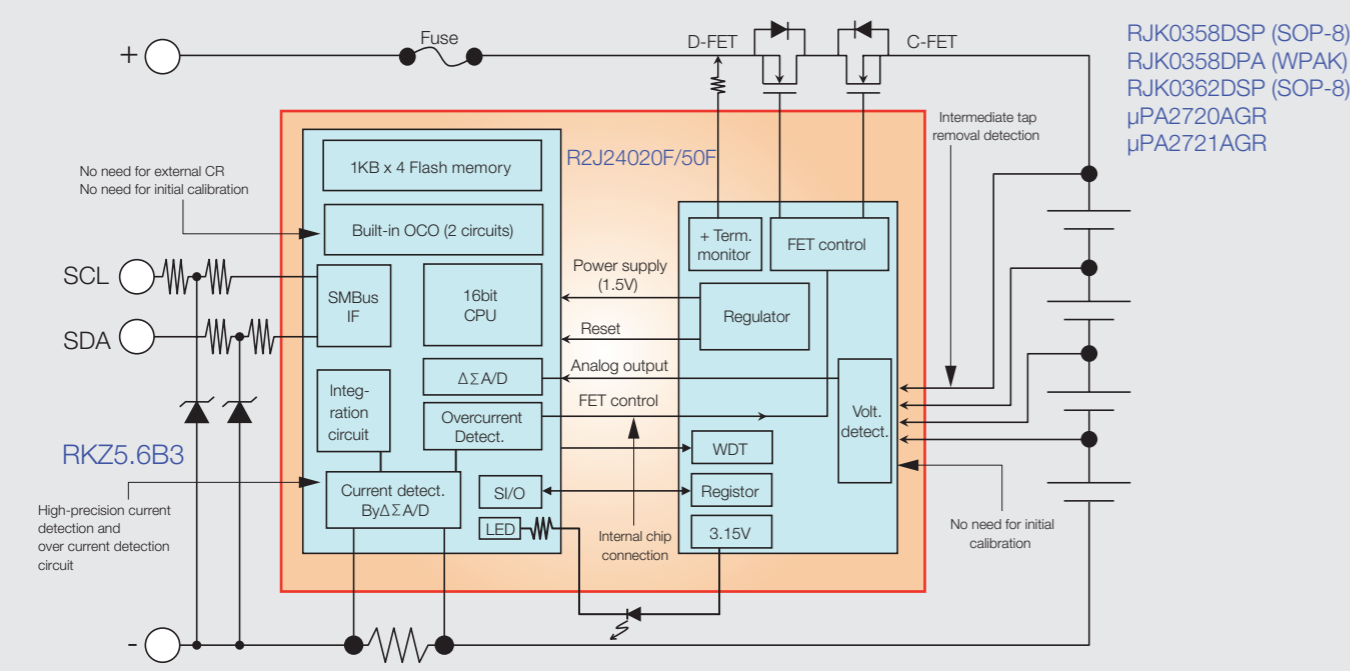protection functions in a single package

Features

- 16Bit R8C CPU core→Low power consumption
- High Precision A/D converter for more exact battery remaining detection and reduction of power consumption
- Smaller and Thinner package→TSSOP48 (R2J24050F**)

Battery Solution Roadmap

R2J24XXX
- In Planning Stage

SiP
R2J24020F/50F**
- 16-bit R8C CPU
- High performance, low power consumption
- Thin package
- On-chip WDT (AFE)
- N-ch FET high-side switch

SiP
R2J24010F
- Compact space
- Fewer initial calibration points
- High-precision A/D converter
- Improved temperature characteristics
- Reduced software burden

Performance

2008   2009   2010

Example PC Battery Implementation Using SiP (R2J24010F)

+
Fuse
D-FET   C-FET

RJK0358DSP (SOP-8)
RJK0358DPA (WPAK)
RJK0362DSP (SOP-8)
μPA2720AGR
μPA2721AGR

Intermediate tap removal detection

No need for external CR
No need for initial calibration

1KB x 4 Flash memory
R2J24020F/50F

Built-in OCO (2 circuits)

+ Term. monitor   FET control

SCL
SDA

Power supply (1.5V)

SMBus IF   16bit CPU

Regulator

Reset

Integ-ration circuit   ΔΣ A/D   Analog output

Overcurrent Detect.   FET control

RKZ5.6B3

Volt. detect.

WDT

Current detect. ByΔΣ A/D   SI/O

Registor

High-precision current detection and over current detection circuit

LED   3.15V

Internal chip connection

No need for initial calibration

-

**: Under Development

Reset ICs

Power Supply Monitoring

Renesas Electronics produces a variety of peripheral ICs in response to a range of customer requirements, including single-function CMOS type devices with a voltage detection accuracy of ±1% and low current consumption, single-function bipolar type devices supporting high power supply voltages, and multifunction type devices such as sequencers for controlling the power-on sequence of multiple power supplies.

Reset ICs

- Single-Function Devices Supporting High Power Supply Voltages

Category	Part No.*2	Package	Detection Voltage (Vs (V))*1
		FP	
Power supply voltage detection (variable delay time)	RNA51953AFP	○	
	RNA51953BFP	○	
Input voltage detection (variable delay time)	RNA51957AFP	○	Variable by using external resistor
	RNA51957BFP	○	
	RNA51958AFP	○	
	RNA51958BFP	○	

*1: The detection may be set within a range of 2V to 15V.
*2: A (constant-voltage output), B (open collector)

- Single-Function Devices with ±1% Voltage Detection Accuracy and Low Current Consumption

Detection Voltage (Vs (V))	Open Drain	CMOS	Package
			LP
5.0		RNA51B50FLP	○
4.6	RNA51A46FLP		○
4.5	RNA51A45FLP		○
4.4	RNA51A44FLP		○
3.1	RNA51A31FLP		○
3.0	RNA51A30FLP		○
2.9	RNA51A29FLP		○
2.8	RNA51A28FLP		○
2.7	RNA51A27FLP	RNA51B27FLP	○
2.6	RNA51A26FLP		○
1.4		RNA51B14FLP	○

- Multifunction Devices Such as Sequencers for Multiple Power Supplies

Category	Part No.	Function	Package	
			MM	US
2-channel CMOS reset	RNA52A10	Reference voltage: 1.00V Variable detection voltage	○	
Power supply sequence controller	RNA50C27A	Power supply sequence: Startup: 3.3V → 1.8V Shutdown: 1.8V → 3.3V	○	○

- ASSPs for Memory Backup

Category	Part No.	Function	Package
			US
Standby controller	RD3ST24	Puts MCU into standby state	○

Package Codes
FP: PRSP0008DE-C   **LP**: MPAK-5V   **MM**: MMPAK-8   **US**: SSOP-8

Reset IC Usage Example

AC 100V commercial power supply

AC/DC unit

DC 12V

RNA51957B

Monitoring --------- Output

Power good signal

RNA52A10

DC/DC   5V
DC/DC   3.3V
DC/DC   1.8V

MCU or ASIC

DC/DC   Control board

MCU with on-chip reset function

M
DC motor

Interrupt signal

Supports voltage detection for two power supplies.

Sequence signals

Reset signal

Main board   RNA52A10   RNA51957B
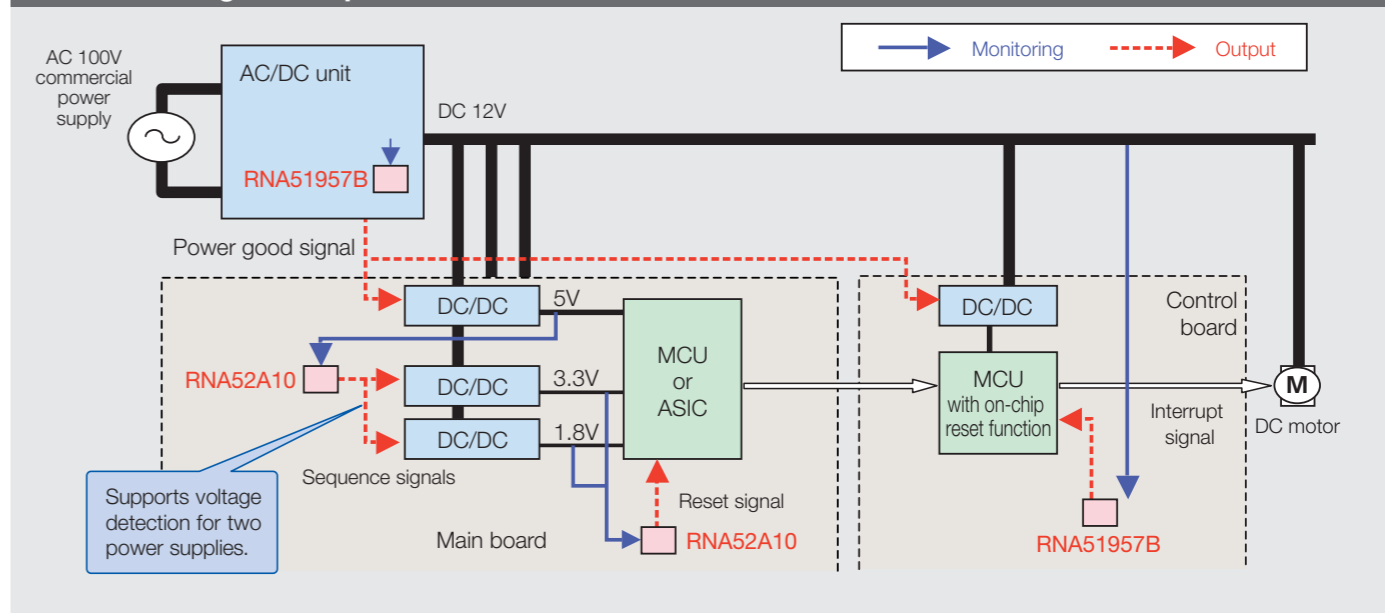
Data Converters

Mixed digital/analog capability: the dicisive factor in automatic adjustment and high-speed, high-precision control

These are D/A converters for trimming applications with 2 to 36 channels incorporated in one package, operating at low/medium speeds of 100kHz to 1MHz. The use of CMOS analog circuitry and pattern design employing patented technologies enables high precision to be achieved without using special processes, trimming, etc.
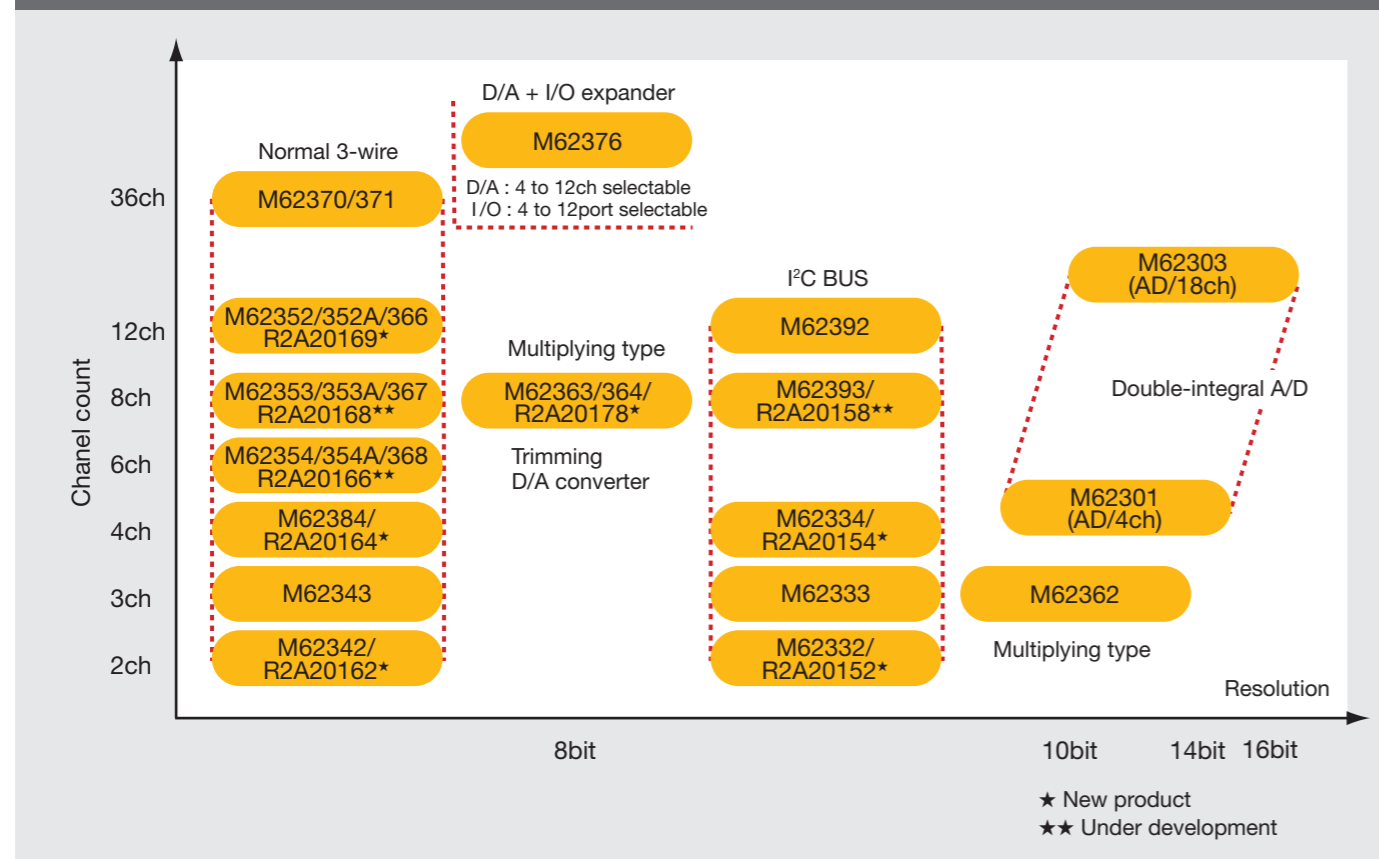
Features

- World's top runner in trimming D/A converter market
- Wide selection of variations (DAC)
  - Number of channels: 2 to 36
  - Resolution: 8 to 12 bits
  - Bus type: Three-wire, I²C
  - Power supply voltage: 3V, 5V systems available
- Fewer channel D/A converter lineup available

Applicable Market Areas

- Mobile phone, DVCs, DSCs, monitors, TVs,printers, CD-R, etc.

Data Converter Series

Peripheral ICs for MCUs (D/A Converters)

List of D/A Converters

Part No.	Power Supply Voltage (V)	Resolution (Bits)	D/A Output Channels	Serial Bus	D/A Buffer Amplifier	Settling Time (μs (Max.))	Offset (LSB)	SOP (FP/SP)	TSSOP (SA)/ LSSOP (GP)	LQFP (GP)	VSP (HP)	DIP (P)	SON (NA)/ QFN (NS)	Remarks
M62332/M62337	2.7-5.5	8	2	I²C	Yes	(300)*1	1	8	—	—	—	8	—	
M62333/M62338	2.7-5.5	8	3	I²C	Yes	(300)*1	1	8	—	—	—	8	—	
M62334/M62339	2.7-5.5	8	4	I²C	Yes	(300)*1	1	8	—	—	—	8	—	
R2A20152	2.7-5.5	8	2	I²C	Yes	(300)*1	1	8	—	—	—	—	8	Under development
R2A20154	2.7-5.5	8	4	I²C	Yes	(300)*1	1	8	—	—	—	—	8	New product
M62342	2.7-5.5	8	2	3-line	Yes	300	1	8	8	—	8	8	—	
R2A20162	2.7-5.5	8	2	3-line	Yes	150	1	8	8	—	—	—	8	New product
M62343	2.7-5.5	8	3	3-line	Yes	300	1	8	8	—	—	8	—	
M62352/M62352A*2	4.5-5.5	8	12	3-line	Yes	300	1	20	20	—	—	20	—	
M62353/M62353A*2	4.5-5.5	8	8	3-line	Yes	300	1	16	16	—	—	16	—	
M62354/M62354A*2	4.5-5.5	8	6	3-line	Yes	300	1	14	16	—	—	14	—	
R2A20169	2.7-5.5	8	12	3-line	Yes	150	1	20	20	—	—	—	20	New product
R2A20168	2.7-5.5	8	8	3-line	Yes	150	1	16	16	—	—	—	16	Under development
R2A20166	2.7-5.5	8	6	3-line	Yes	150	1	—	16	—	—	—	16	Under development
R2A20164	2.7-5.5	8	4	3-line	Yes	150	1	—	16	—	—	—	16	New product
M62362	4.5-5.5	10	3	3-line	Yes	20	0	16	—	—	—	14	—	Multiplier type
M62363	4.5-5.5	8	8	3-line	Yes	5	0	24	—	—	—	—	—	Multiplier type
M62364	2.7-5.5	8	8	3-line	Yes	300	0	24	24	—	—	—	—	Multiplier type
R2A20178	2.7-5.5	8	8	3-line	Yes	300	0	24	—	—	—	—	24	Multiplier type, under development
M62366	2.7-3.6	8	12	3-line	Yes	300	1	—	20	—	—	—	—	
M62367	2.7-3.6	8	8	3-line	Yes	300	1	16	16	—	—	—	—	
M62368	2.7-3.6	8	6	3-line	Yes	300	1	—	16	—	—	—	—	
M62370	2.7-5.5	8	36	3-line	Yes	300	1	—	—	48	—	—	—	
M62371	2.7-5.5	8	36	3-line	Yes	300	1	—	—	48	—	—	—	
M62383	4.5-5.5	8	2ch × 2	3-line	Yes	20	0	24	—	—	—	—	—	
M62384	2.7-5.5	8	4	3-line	Yes	10	0	16	—	—	—	—	—	
M62392	4.5-5.5	8	12	I²C	Yes	(300)*1	1	24	—	—	—	24	—	
M62393	4.5-5.5	8	8	I²C	Yes	(300)*1	1	20	—	—	—	20	—	
R2A20158	2.7-5.5	8	8	I²C	Yes	(300)*1	1	—	—	—	—	—	20	Under development

*1: I²C bus type D/A converters have no LD signal (a signal transferred from the shift register of the serial interface to the D/A converter), so no settling time is stipulated. They are designed such that the duration from the falling edge of the 8th clock pulse of the final data transfer to the establishment of the analog output voltage is 300μs (as a reference value).

*2: Items with a product No. ending in A (TTL level input) are available in an LSSOP package only.

General-Purpose CMOS, Op-Amp. and Comparator ICs Series

Products Concept

We offer a lineup of products combining low-voltage operation, low power consumption, and compact size.

Applications

- Portable device (DSC, etc.)
- Amplification and detection of sensor signal (health machine, etc.)
- Signal controlling switch
- Detection of overvoltage of low-power electric source (monitor)

Features

- Ultra-small package saves you space (CMPAK-5, MPAK-5, MMPAK-8, TSSOP-14)
- Low-voltage operation and low current dissipation most suitable for battery-use device (VDD=1.8 to 5.5V, IDD: 15 to 800mA, The high output type supports 2.7 to 5.5V.)
  - Output full swing (operational amplifier) VOH=2.9Vmin (at VDD=3V)
  - Low input offset voltage (operational amplifier) VIO=4mVmax
  - Low input bias current IIB=1pA (typ.)
  - Operating temperature range Topr=−40 to +85°C
  - 15mA typ./30mA typ. (HA1630S/D07.08) high-current-output versions available.

Series Evolution
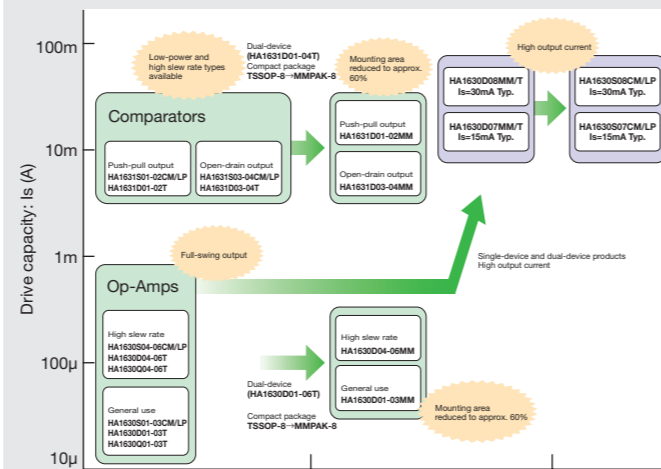
Lineup

• Op-Amps

Power supply voltage	Input offset voltage	Power supply current	Slew rate	Output drive current	Part No.		
VDD (V)	Vio max. (mV)	IDD typ. (µA)	SR typ. (V/µs)	Is typ. (mA)	No. of channels		
					Single	Dual	Quad
General-Purpose 1.8 to 5.5	4	15 /ch	0.125	0.01	HA1630S01	HA1630D01	HA1630Q01
		50 /ch	0.5	0.05	HA1630S02	HA1630D02	HA1630Q02
		100 /ch	1	0.1	HA1630S03	HA1630D03	HA1630Q03
		200 /ch	2	0.2	HA1630S04	HA1630D04	HA1630Q04
		400 /ch	4	0.4	HA1630S05	HA1630D05	HA1630Q05
		800 /ch	8	0.8	HA1630S06	HA1630D06	HA1630Q06
High-power 2.7 to 5.5	6	60 /ch	1.0	15	HA1630S07	HA1630D07	
		170 /ch	1.5	30	HA1630S08	HA1630D08	
Package					CMPAK-5V & MPAK-5V	MMPAK-8	TSSOP-14

• Comparators

Power supply voltage	Input offset voltage	Power supply current	Response time	Output configuration	Output current	Part No.	
VDD (V)	Vio max. (mV)	IDD typ. (µA)	TPHL/TPLH typ. (µs)		Io@VDD=3V (mA)	No. of channels	
						Single	Dual
1.8 to 5.5	5	5 /ch	1.2 / 0.6	Push-pull	14 / 13	HA1631S01	HA1631D01
		50 /ch	0.3 / 0.2			HA1631S02	HA1631D02
		5 /ch	− / 0.6	Open drain	14 / −	HA1631S03	HA1631D03
		50 /ch	− / 0.2			HA1631S04	HA1631D04
Package						CMPAK-5V & MPAK-5V	TSSOP-8 & MMPAK-8

General-Purpose Bipolar Op-Amp and Comparator ICs

µPC Series Product Lineup

Product Type		8pin		14pin	Package Type	Operating Temperature min/max (°C)	Power Supply Voltage min/max (V)	Input Offset Voltage Vio max. (mV) note1.	Input Bias Current Ib max. (nA) note1.	SR typ.(V/µs) or Response Time typ. (µs) note1, 2.
		Single (1ch)	Dual (2ch)	Quad (4ch)						
Op-Amp	Single power supply	µPC1251MP-KAA			TSSOP(2.8×2.9)	-40/+125°C	3/30	7	250	0.25
		µPC1251GR-9LG	µPC451GR-9LG		TSSOP	-40/+125°C	3/30	7	250	0.25
		µPC1251G2	µPC451G2		SOP	-40/+85°C	3/30	7	250	0.25
		µPC358GR-9LG	µPC324GR-9LG		TSSOP	-40/+85°C	3/30	7	250	0.25
		µPC358G2	µPC324G2		SOP	-20/+80°C	3/30	7	250	0.25
	High-speed single power supply	µPC842GR-9LG	µPC844GR-9LG		TSSOP	-40/+125°C	3/32	5	500	7
		µPC842G2	µPC844G2		SOP	-40/+85°C	3/32	5	500	7
		µPC4742GR-9LG	µPC4744GR-9LG		TSSOP	-40/+85°C	3/32	5	500	7
		µPC4742G2	µPC4744G2		SOP	-20/+80°C	3/32	5	500	7
			µPC452G2		SOP	-40/+85°C	3/32	7	250	0.8
			µPC3403G2		SOP	-20/+80°C	3/32	7	250	0.8
	Low-noise	µPC4570GR-9LG	µPC4574GR-9LG		TSSOP	-40/+85°C	±4/±16	5	400/1000	7/6
		µPC4570G2	µPC4574G2		SOP	-20/+80°C	±4/±16	5	400/1000	7/6
		µPC258G2	µPC458G2		SOP	-40/+85°C	±4/±16	6/5	500/300	1/1.6
		µPC4558G2	µPC4741G2		SOP	-20/+80°C	±4/±16	6/5	500/300	1/1.6
		µPC259G2			SOP	-40/+85°C	±4/±16	6	500	2.8
		µPC4560G2			SOP	-20/+80°C	±4/±16	6	500	2.8
		µPC4572G2			SOP	-20/+80°C	±2/±7	5	400	6
	J-FET input	µPC803G2	µPC804G2		SOP	-40/+85°C	±5/±16	15	0.4	13
		µPC4081G2	µPC4082G2	µPC4084G2	SOP	-20/+80°C	±5/±16	15	0.4	13
		µPC821G2	µPC822G2	µPC824G2	SOP	-40/+85°C	±5/±16	10	0.2	13
		µPC4071G2	µPC4072G2	µPC4074G2	SOP	-20/+80°C	±5/±16	10	0.2	13
		µPC831G2	µPC832G2	µPC834G2	SOP	-40/+85°C	±2/±16	10	0.1	3
		µPC4061G2	µPC4062G2	µPC4064G2	SOP	-20/+80°C	±2/±16	10	0.1	3
		µPC811G2	µPC812G2		SOP	-40/+85°C	±5/±16	2.5/3	0.2	15
		µPC4091G2	µPC4092G2		SOP	-20/+80°C	±5/±16	2.5/3	0.2	15
		µPC813G2	µPC814G2		SOP	-40/+85°C	±5/±16	2.5/3	0.2	25
		µPC4093G2	µPC4094G2		SOP	-20/+80°C	±5/±16	2.5/3	0.2	25
			µPC835MN-KAA		TSSOP(3×3)	-40/+85°C	±5/±16	3	0.2	5.5
	General-purpose	µPC151G2	µPC251G2		SOP	-40/+85°C	±7.5/±16	6	200	0.5
		µPC741G2	µPC1458G2		SOP	-20/+80°C	±7.5/±16	6	200	0.5
Comparator	Single power supply	µPC277MP-KAA			TSSOP(2.8×2.9)	-40/+125°C	2/32	5	250	1.8
		µPC277GR-9LG	µPC177GR-9LG		TSSOP	-40/+125°C	2/32	5	250	1.8/1.6
		µPC277G2	µPC177G2		SOP	-40/+85°C	2/32	5	250	1.3
		µPC393GR-9LG	µPC339GR-9LG		TSSOP	-40/+125°C	2/32	5	250	1.8/1.6
		µPC393G2	µPC339G2		SOP	-40/+85°C	2/32	5	250	1.3
	High-speed	µPC271G2			SOP	-40/+85°C	±4/±16	7.5	250	0.2
		µPC311G2			SOP	-20/+80°C	±4/±16	7.5	250	0.2

note1. When multiple values are listed, the figure on the left applies to products with fewer channels and that on the right to products with more channels.
note2. "SR" indicates the slew rate of an op-amp, and "response time" refers to the pulse response time of a comparator.

Operational Amplif iers

LED Drivers

HA17 Series General-Purpose Bipolar Op-Amp and Comparator ICs

Features

- Lineup of world standard compatible products
- Variety of packages (DP-8/14, SOP-8/14, TSSOP-8/14)

Specifications

	Op-Amps		Comparators	
	HA17358A (Dual)	HA17324A (Quad)	HA17393A (Dual)	HA17339A (Quad)
Input offset voltage	Vio typ.=3mV		Vio typ.=2mV	
Power supply voltage	Vcc max=32V		Vcc max=36V	
Dissipation current	Icc typ.=0.8mA			
In-phase input voltage	Vin=-0.3~+Vcc			
Sink current	Iosink typ=20mA	Iosink typ=20mA	Iosink typ=16mA	
Source current	Iosource typ=40mA	Iosource typ=40mA	*Iosink (VOL=2.5V), Iosource (VOH=10V)	
Operating temperature	-40°C~+85°C			

*HA17901A, 902A, 903A and 904A models for communications industry use are also available.

Product Lineup

• Op-Amps

Number of Channels	Part No.	Package
Dual (2ch)	HA17358A	DIP-8
	HA17358AF	JEITA SOP-8
	HA17358ARP	JEDEC SOP-8
	HA17358AT	TSSOP-8
Quad (4ch)	HA17324A	DIP-14
	HA17324AF	JEITA SOP-14
	HA17324ARP	JEDEC SOP-14
	HA17324AT	TSSOP-14

• Comparators

| Number of Channels	Part No.	Package
Dual (2ch)	HA17393A	DIP-8
	HA17393AF	JEITA SOP-8
	HA17393ARP	JEDEC SOP-8
	HA17393AT	TSSOP-8
Quad (4ch)	HA17339A	DIP-14
	HA17339AF	JEITA SOP-14
	HA17339ARP	JEDEC SOP-14
	HA17339AT	TSSOP-14

Peripheral ICs for MCUs (LED Drivers)

In addition to scan-type displays such as LCD panels, LEDs and other light emitting elements are an important means for indicating output from control systems such as MCUs. Two types of devices are used to drive LEDs: constant-voltage drivers (simple switches) and constant-current drivers. Output varies with the power supply voltage when constant-voltage drive is used, but this method is widely used in low-cost applications due to its simplicity. In contrast, constant-current drive has the advantage of unvarying brightness regardless of fluctuations in the power supply voltage, making it suitable for applications (such as game machines) where subtle color changes would cause problems.

Either series or parallel connection can be used to drive multiple LEDs. Since white LEDs have a voltage drop of 3V to nearly 3.6V, high voltage is necessary when they are connected in series, and the driver used must have a high voltage tolerance. When the LEDs are connected in parallel, a drive capacity of 10mA to 20mA per LED is necessary.

Renesas Electronics offers a wide-ranging lineup of LED driver ICs, including high-output devices that can also accommodate parallel connection of many LEDs, devices with latch input, devices with a serial-parallel function using a shift register, and newly developed SpAS* devices.

Note: With an SpAS type LED driver, an SCI interface is used to illuminate multiple LEDs. Each LED is assigned an address, allowing for fine-grained control focusing on specific points. (SpAS stands for "SCI protocol with address selected.")

Figure 1 Driver with Vcc=3.3V, Voltage output standing =3.3V
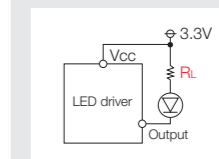
The applied voltage is 3.3V, which is not sufficient to illuminate a white LED. (Also difficult for a driver with Vcc=5V.)

**Figure 2 Driver with Vcc=3.3V, Voltage output standing =24V**
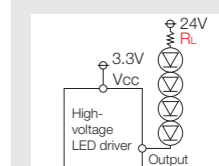
Drives four white LEDs connected in series with power to spare.

Vf: The Vf of red, green, and yellow LEDs is genellary about 1.8V, and that blue and White LEDs about 3V to 3.6V. The Vf of Infrared LEDs is about 1.3V.

RL: The rated current of a typical display LED is around 20mA, and the resistance value is determined so as to produce a current of about 5mA to 20mA (RL=(VDD-Vf × n)/ 0.02 (at 20mA)). For game machine or outdoor display applications requiring high blightness, RL is determined so as produce sufficient blightness with LEDs having a high voltage rating or in a parallel connection.

Development Roadmap
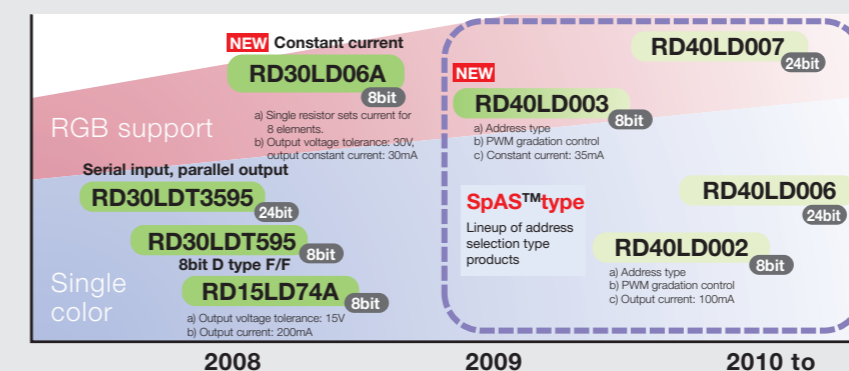
RD40LD003FP Specifications 8-bit, releases constant current

- SpAS (SCI + general ports)
- Operating speed: 5Mbps
- Power supply voltage: 3.0V to 5.5V
- Output voltage tolerance: 40V
- Constant current output: 35mA (max.)
- Constant current accuracy: ±4% between pins, ±10% between ICs
- TTL level input
- Hysteresis: ⌀0.9V (Vcc=4.5V)
- PWM: 256 gradations
- Specification temperature: –40°C to 85°C
- Package: SOP-20 (7.8 × 12.6 [mm], 835mW)

LEDs connected in series

B,G: 3.7×5=18.5V
R : 3.7×5=18.5V
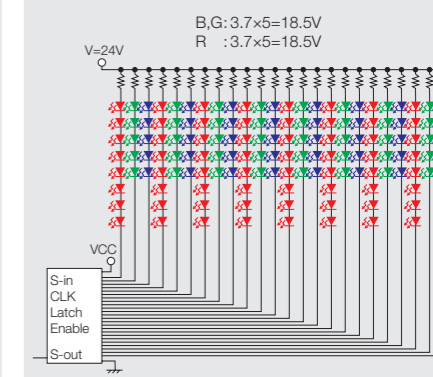
In game machines a large number of LEDs are typically mounted on a board with a large area. Using conventional serial-parallel conversion employing shift registers requires a large number of control lines and is very susceptible to noise. An SpAS type LED driver, which provides stable drive by means of SCI-based address selection, is ideal in such cases.

LED Drivers

### Main High-Functionality ICs

Part No.	bit	Function	Burst Transfer	4 Power Up/Down Protection	5 Gradation Control	Drive Type	Transfer Speed	Pull-Up/Down Resistors	Supported Input Signal Levels	Output Voltage Tolerance (Max.)	Output Current	PKG
RD15LD74A	8	Data protection by latch with clear	No	–	No	Constant voltage	–	–	3.3/5.0	15V	200mA	SDIP-20, DIP-20, TSSOP-20
RD30LD06A	8	Data protection by D-type F/F with clear	No	–	No	6 Constant current	–	–	3.3/5.0	30V	30mA	SOP-20
RD30LDT595	8	1 Shift register serial-parallel function	No	○	No	Constant voltage	12.5Mbps	Yes	3.3/5.0	30V	100mA	DIP-16 SOP-16
RD30LDT3595	24	Shift register serial-parallel function	No	○	No	Constant voltage	12.5Mbps	Yes	3.3/5.0	30V	100mA	SSOP-36
RD40LD003FP	8	2 SpAS serial-parallel function	3 DMAC	Power On Reset	On-chip PWM (256)	Constant current	5Mbps	–	3.3/5.0	40V	35mA	SOP-20

### 1 Shift Register Serial-Parallel Function
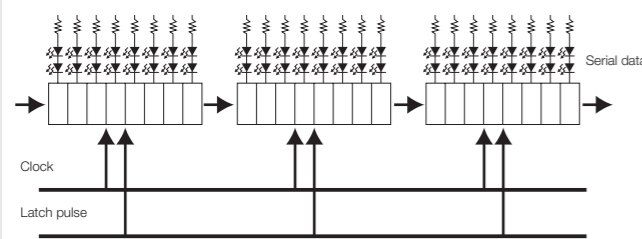
Serial-parallel conversion using shift resisters is widely used because it allows easy extension using cascade connections and its operating principle is simple. Nevertheless, in cases where a many LEDs are arranged over a large area, mounting can become complex and care must be taken to avoid malfunction. (Since the serial data must pass through a single line of sequential connections, delays and skews in the clock and latch pulses must be taken into account in the layout in order to avoid malfunction.) The RD30LDT595 and RD30LDT3595 pass the input data through a Schmitt circuit to reduce the effects of noise.

2 SpAS:SCI protocol with Address Selected system,
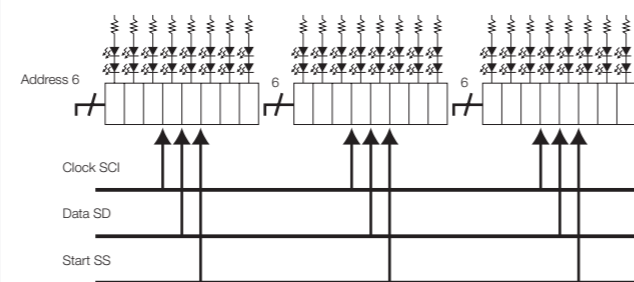
Basically, in an SpAS system the data and clock signals are connected in parallel, so it is easy to ensure that they are the same length and thereby eliminate concerns about the effect of delays and skews. The lack of restrictions on connections allows for a simple mounting layout even when many LEDs are arranged over a large area. If expansion is required, up to 64 SpAS LED drivers may be connected in parallel. The widely used clock synchronous serial format simplifies connections to the MCU.

3 DMAC
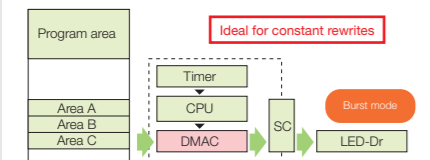
By using the direct memory access controller (DMAC), which is a standard function of most MCUs, programs can be simplified by combining memory areas for data transfer operations. Using the DMAC of a standard MCU, data rewrites can be simplified by transferring the data in burst mode.

4 Power Up/Down Protection

Malfunction during the power-on or power-off period can cause LEDs to illuminate erroneously. The power up/down protection function prevents this by keeping output in the high-impedance state when VCC is low, regardless of whether or not an enable signal is being input.

5 Gradation Control
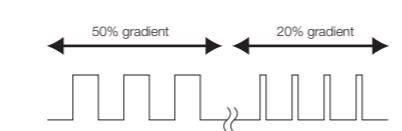
Constant-current drive 6 maintains the correct brightness while PWM allows adjustment in 256 gradations. The correct relative brightness is maintained, allowing for accurate expression of shadows and pale colors.

Level Converters

A wide range of products are available, including high-speed level shifters, clock generators that reduce emission noise, and world standard interface ICs.

Level Shifting Use in Personal Computer,etc.
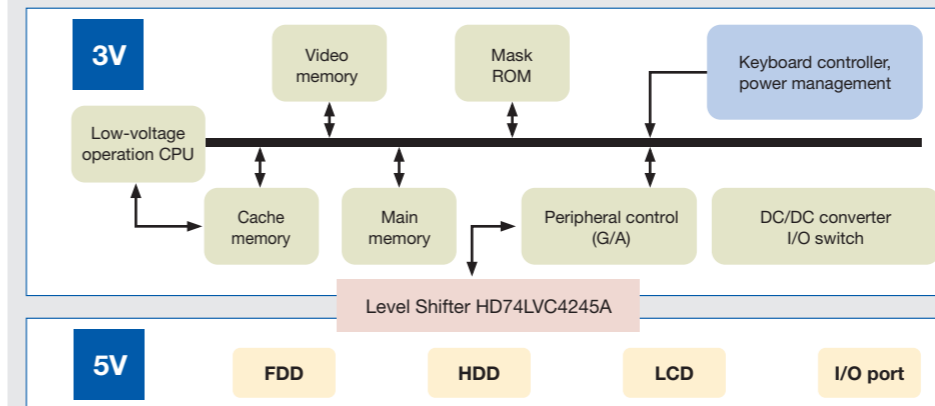
This IC performs signal level conversion when two power supply voltages are used on the same board. It can also implement power management that cuts the subclock power supply and reduces power dissipation when the system is in standby mode. (74LVC4245A)

Support for high-speed two-way conversion between different voltages, plus provision of a tolerant function for all input/output

Ex. Memory		Level Shifters (for Level Transfer)		Ex. CPU
Vcc=1.2~2.7V	1.2~2.7V	HD74ALVC166245A (VccA=1.2~2.7V,VccB=1.4~3.6V) 1.2V ⇔ 3.6V conversion capability	1.4~3.6V	Vcc=1.4~3.6V
Vcc=1.4~3.6V	1.4~3.6V	HD74ALVC165245A (VccA=1.4~3.6V,VccB=1.2~2.7V) 1.2V ⇔ 3.6V conversion capability	1.2~2.7V	Vcc=1.2~2.7V
Vcc=5V	5V	HD74LVC4245A (VccA=5V, VccB=3.3V)	3.3V	Vcc=3.3V
Vcc=5V	5V	HD74LVCC4245A (VccA=5V, VccB=3.3V)	3.3V	Vcc=3.3V
Vcc=2.3~3.6V	2.3~3.6V	HD74LVCC3245A (VccA=2.3~3.6V,VccB=3~5.5V)	3~5.5V	Vcc=3~5.5V

High-Speed Level Shifter Lineup

| Part No.	Bits	Input/Output Tolerant	VccA*	VccB	Tpd(max)	Drive Capability	Package
HD74ALVC166245A	16	○	2.5V	3.3V	4.4ns	24mA	TSSOP-48
			1.8V	3.3V	6.2ns	24mA	
			1.5V	2.5V	6.0ns	18mA	
			1.2V	1.5V	5.0ns (Typ)	4mA	
HD74ALVC165245A	16	○	3.3V	2.5V	4.4ns	24mA	
			3.3V	1.8V	6.2ns	24mA	
			2.5V	1.5V	6.0ns	18mA	
			1.5V	1.2V	5.5ns (Typ)	4mA	
HD74LVC4245A	8	○	5+/-0.5V	2.7 to 3.6V	7ns	24mA	TSSOP-24
HD74LVCC4245A	8	○	5+/-0.5V	2.7 to 5.5V	7ns	24mA	
HD74LVCC3245A	8	○	2.5+/-0.2V	3.3+/-0.3V	11ns	8mA	
			2.7 to 3.6V**	3.3+/-0.3V**	8ns	12mA	
			2.7 to 3.6V	5+/-0.5V	7ns	24mA	
HD151015	9	×	3V	5V	10ns	12mA	
			2.7V	4.5V	12ns	12mA	

Note *: Control pins (DIR, OE) are VccA on the LVC Series and HD15015, and VccB on the ALVC Series.   **: VccA ≤ VccB.

memo

Uni-Logic

One to Three Gates in Ultra-Small, Lightweight Packages.

As portable electronic products become ever more compact, there is a constant demand for smaller and lighter logic ICs. The solution to this demand is provided by Uni-Logic ICs, containing from one to three logic gates in a package with a mounting area approximately 1/20 that of an SOP. As well as making efficient use of on-board space, these devices facilitate wiring design. And board modifications can be achieved simply by adding logic.

Package Comparison

Eliminates wasted space by reducing the mounting area.

Uni-Logic Family

	Uni-Logic	
5V Medium Speed	3.3V High Speed	2.5V Ultra High Speed
HC Series	LV-A Series	ALVC Series
CMPAK-5	CMPAK-5,VSON-5	VSON-5
HC1G Series 9 models HCT1G Series 8 models	LV1G-A Series 11 models LV1GT-A Series 10 models CMPAK-6 LV1GW-A Series 12 models SSOP-8 LV2G-A Series 18 models LV2GT-A Series 18 models	ALVC1G Series 15 models SSOP-8 ALVC2G Series 19 models

HD74HC1G/HCT1G

Power supply voltage
Guaranteed at 2.0/4.5/6.0 V

Same speed as LS-TTL
Vcc=4.5V   CL=50pF
Ta=25°C   tpd=12ns (Typ)

Output current
IOL/IOH=±2mA (Vcc=4.5V)

TTL input level product lineup
HD74HCT1G Series

Operation temperature range
Ta=−40~85°C

HD74LV1G-A/1GT-A/ 2G-A/2GT-A/1GW-A

Power supply voltage
Guaranteed at 1.8/2.5/3.3/5.0 V

Low Voltage,
High-speed Operation
Vcc=3.3V   CL=50pF
Ta=25°C   tpd=7.5ns (Typ)

Output current
IOL/IOH=±6mA (Vcc=3.3V)

5V input/output tolerant
Vin (Max)=5.5V (Vcc=0~5.5V)
Vo (Max)=5.5V (Output: Z or Vcc=0V)

Leakage prevention
when Vcc = off
Ioff=5µA(Max)
(Vin or Vo=0~5.5V)

Hysteresis input
VH=0.35V @Vcc=3.3V
(Excluding analog and unbuffered inputs)

TTL input level product lineup
HD74LV1GT-A/2GT-A Series

Operation temperature range
Ta=−40~85°C

HD74ALVC1G/2G

Power supply voltage
Guaranteed at 1.2/1.5/1.8/2.5/3.3 V

Low Voltage,
High-speed Operation
Vcc=3.3V   CL=30pF
Ta=25°C   tpd=3.0ns (Max)

Output current
IOL/IOH=±24mA (Vcc=3.3V)

3.6 V input/output tolerant
Vin (Max)=3.6V (Vcc=0~3.6V)
Vo (Max)=3.6V (Vcc=0V)

Leakage prevention
when Vcc = off
Ioff=5µA(Max)
(Vin or Vo=0~3.6V)

Operation temperature range
Ta=−40~85°C

Unidirectional Level Shifting Using Uni-Logic IC

Input ╲ Output Vcc	5.0V	3.3V	2.5V	1.8V	1.5V	1.2V
5.0V		LV-A	LV-A	LV-A		
3.3V	HCT,LV-AT*		LV-A,ALVC	LV-A,ALVC	ALVC	ALVC
2.5V	HCT,LV-AT*	HC,LV-A,LV-AT* ALVC		LV-A,ALVC	ALVC	ALVC
1.8V		LV-AT*	LV-A,ALVC		ALVC	ALVC
1.5V				LV-A,ALVC		ALVC
1.2V						ALVC

HC: HD74HC1G Series, HCT: HD74HCT1G Series,
LV-AT*: HD74LV1GT/2GT-A Series
LV-A: HD74LV1G/1GW/2G-A Series
ALVC: HD74ALVC1G/2G Series

Vcc

Input → Uni-Logic → Output

Configurable Multiple Function Gate

One product realizes various logic functions by changing connection of input pins.

Cover various gate functions by one IC
Convenient when a specification change is made suddenly.

The gate where one input turned into an inverted input among 2 inputs.
Inverted input enables one space saving from two pieces.

Applicable Function

| Lineup	Applicable function (CMPAK-6pin)
HD74LV1GW57ACM	
HD74LV1GW58ACM	
HD74LV1GW97ACM	
HD74LV1GW98ACM	

Standard Logic ICs

Low-Voltage Products Offering a Variety of System Benefits.

These low-voltage standard logic ICs meet the demands of portable systems for small size and low power dissipation together with high performance. These devices offer such user-friendly features as performance equivalent to or exceeding that of 5V standard logic ICs on a drive voltage of only 3V, good noise characteristics, and usability in mixed 5V/3V systems.
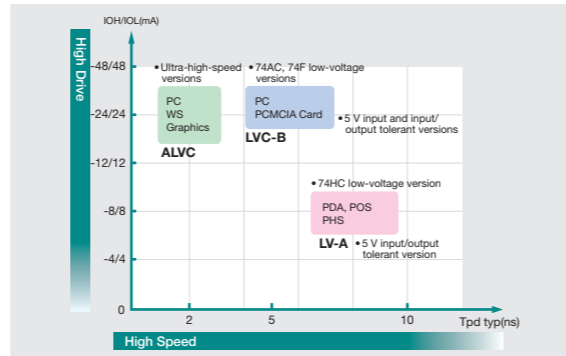
High-Speed Type LVC Series

RD74LVC-B Series / HD74LVC Series
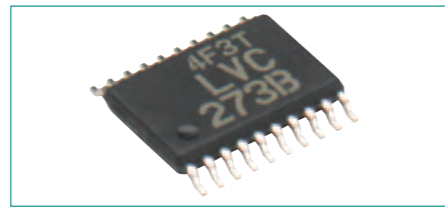
Performance

RD74LVC-B and HD74LVC series products combine high-speed operation with reduced power and voltage requirements.

Features

Suitable for low-voltage operation
Vcc=1.65V to 5.5V

High-speed operation
tpd=4ns (typ)
[Vcc=3.3V, Ta=25°C]

Low leakage and low current consumption
Iin, Ioff=5mA (max)

All models support insertion output tolerant

Lineup

Function	Part No.	LVC-B Package SOP(E)	LVC-B Package TSSOP	Pin
Gate	00B	○	○	14
	02B	○	○	14
	04B	○	○	14
	08B	○	○	14
	14B	○	○	14
	32B	○	○	14
Decoder/Selector/Multiplexer	138B	○	○	16
	139B	○	○	16
Flip-Flop/Latch	74B	○	○	14
	273B	○	○	20
	373B	○	○	20
	374B	○	○	20
	573B	○	○	20
	574B	○	○	20
	16373B	—	○	48
	16374B	—	○	48
Buffer	125B	○	○	14
	126B	○	○	14
	240B	○	○	20
	244B	○	○	20
	245B	○	○	20
	540B	○	○	20
	541B	○	○	20
	16240B	—	○	48
	16244B	—	○	48
	16245B	—	○	48

SOP (E): JEITA specification

LVCZxxxA Products CMOS Logic ICs Supporting Hot Swapping

These ICs support hot swapping, with output being driven to the high- impedance state when IC power is turned ON or OFF. HD74LVCZxxxA products employ a Power Up/Down protection function that prevents erroneous system operation by driving output to the Hi-Z state in a power supply voltage range of 0V to 2V. In addition to hot swapping, this is also useful for systems whose operation is to be guaranteed when power is turned ON or OFF.

Schematic Drawing of Boards

Main system (power on)

Board removal/insertion (hot swapping)

Product Lineup

	Part No.	Function	Package Pin	Package *Type
8-bit Products	HD74LVCZ240A	Line driver/receiver	20	FP/T
	HD74LVCZ244A	Line driver/receiver	20	FP/T
	HD74LVCZ245A	Transceiver	20	FP/T
16-bit Products	HD74LVCZ16240A	Line driver/receiver	48	T
	HD74LVCZ16244A	Line driver/receiver	48	T
	HD74LVCZ16245A	Transceiver	48	T

*FP: SOP (JEITA)   T: TSSOP

LVC2244A Products with Built-In Output Damping Resistance for Reducing Reflection Noise

Input — Output

Output damping resistance
LVC2244A: 45Ω incorporated
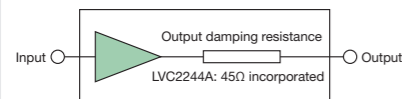
Output damping resistance:
A resistance incorporated into the IC output that enables line impedance matching to be achieved and reduces reflection noise.
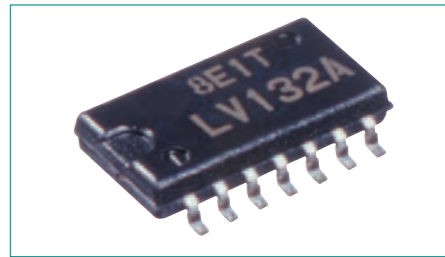
Product Lineup

	Part No.	Function	Package Pin	Package *Type
8-bit Products	HD74LVC2244A	Line driver/receiver	20	FP/T

*FP:SOP(JEITA)   T:TSSOP

LV-A Series

The LV-A Series comprises LV Series based and upward-compatible devices offering improved switching speed and functions, available in an extended lineup.

Performance

Characteristics guaranteed voltage
3-point guarantee: Vcc=2.5V, 3.3V, 5.0V

Switching performance
tpd=7ns(typ) [Vcc=3.3V, Ta=25°C]

Drive capability
IOH/IOH=-8/8mA
IOH/IOL=-16/16mA [Vcc=5V] output current

Low current dissipation
Standby current dissipation: Icc=20µA

IOFF, output skew guaranteed

Features

Low noise
VOLP<0.8V (Typ) [Vcc=3.3V,Ta=25°C]
VOHV>2.0V (Typ) [Vcc=3.3V,Ta=25°C]

5V input/output tolerant

Electrostatic withstand voltage, latchup resistance
Same as HC Series

HD74LV-A Series

Function	Part No.	Package SOP(E)	Package TSSOP	Pin
Gate	00A	○	○	14
	02A	○	○	14
	04A	○	○	14
	U04A	○	○	14
	05A	○	○	14
	06A	○	○	14
	07A	○	○	14
	08A	○	○	14
	10A	○	○	14
	11A	○	○	14
	14A	○	○	14
	20A	○	○	14
	21A	○	○	14
	27A	○	○	14
	32A	○	○	14
	86A	○	○	14
	132A	○	○	14
Decoder/Selector/Multiplexer	138A	○	○	16
	139A	○	○	16
	157A	○	○	16
Analog Switch	4051A	○	○	16
	4053A	○	○	16
	4066A	○	○	14

| Function	Part No.	Package SOP(E)	Package TSSOP	Pin
Flip-Flop/Latch	74A	○	○	14
	273A	○	○	20
	373A	○	○	20
	374A	○	○	20
	573A	○	○	20
	574A	○	○	20
Shift Register	166A	○	○	16
	595A	○	○	16
Counter	161A	○	○	16
	163A	○	○	16
	393A	○	○	14
	4040A	○	○	16
Multivibrator	123A	○	○	16
	221A	○	○	16
Bus Buffer/Transceiver	125A	○	○	14
	126A	○	○	14
	240A	○	○	20
	244A	○	○	20
	245A	○	○	20
	540A	○	○	20
	541A	○	○	20

SOP (E): JEITA specification

High-Voltage Logic IC RD74HV1G Series/RD74HV8T Series

Example Illustration of Level Conversion (Conversion from 5V to 30V)

Conversion of 5V Amplitude to 30V Amplitude
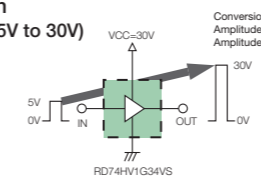
Example Illustration of Level Conversion (Conversion from 3.3V to 30V)

Conversion of 3.3V Amplitude to 30V Amplitude
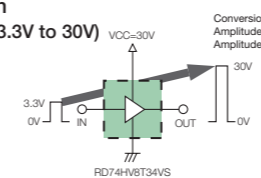
Part No.	Function	Circuits/Package	Power Supply (Vcc) Voltage Range	Input Logic Level	Package	Allowable Loss (W)	Output Format
RD74HV1G00VS	High-Voltage 2-input NAND Gate	1	10 to 30V	5.0V	VSON-5	0.2	CMOS Output
RD74HV1G02VS	High-Voltage 2-input NOR Gate	1	10 to 30V	5.0V	VSON-5	0.2	
RD74HV1G04VS	High-Voltage Inverter Gate	1	10 to 30V	5.0V	VSON-5	0.2	
RD74HV1G08VS	High-Voltage 2-input AND Gate	1	10 to 30V	5.0V	VSON-5	0.2	
RD74HV1G32VS	High-Voltage 2-input OR Gate	1	10 to 30V	5.0V	VSON-5	0.2	
RD74HV1G34VS	High-Voltage Buffer Gate	1	10 to 30V	5.0V	VSON-5	0.2	
RD74HV8T04	High-Voltage 8-bit Inverter Buffer	8	10 to 30V	3.3V	SOP-20	0.8	Open-Drain Output
RD74HV8T34	High-Voltage 8-bit Buffer Gates	8	10 to 30V	3.3V	SOP-20	0.8	
RD74HV8T06	High-Voltage 8-bit Inverter Buffer	8	10 to 30V	3.3V	SOP-20	0.8	
RD74HV8T07	High-Voltage 8-bit Buffer Gates	8	10 to 30V	3.3V	SOP-20	0.8	

Standard Logic ICs

General-Purpose ASSPs

EMI Noise Solutions are Urgently Needed.

- EMI noise is becoming an increasingly severe problem due to the higher system operating frequencies used in the latest equipment.
- EMI noise is generally thought to adversely affect other electronic equipment, and recently, the regulations limiting EMI emissions have become increasingly strict in many countries around the world. (USA: FCC, Europe: CE, Japan: VCCI)
- Renesas is releasing the SSCG Series that adopts spread spectrum technology to reduce EMI noise.
- This spread spectrum technology modulates the output frequency slightly and thus diffuses the energy to improve the EMI characteristics.

* SSCG:Spread Spectrum Clock Generator   EMI:Electro Magnetic Interference

Advantages of SSCG

Conventional EMI Solutions
- Improved metal shielding
- Tuning the resistor and capacitor component values
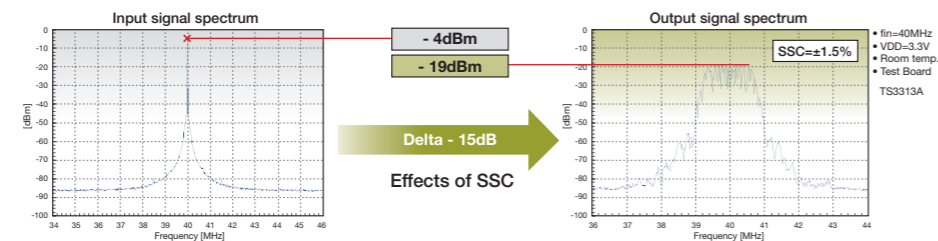- Changing the circuit board design

Advantages of Using SSCG
- No circuit board design changes, and no new components, are required.
- Stable EMI performance that does not depend on the skill and experience of system engineers.
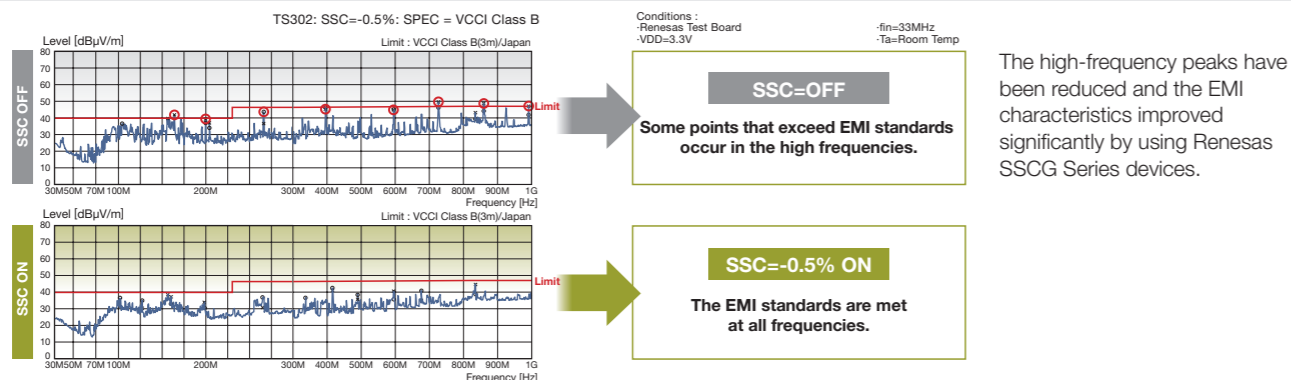- Significant reductions in the system development period.

EASY to REDUCE

EMI can be reduced easily by using SSCG.
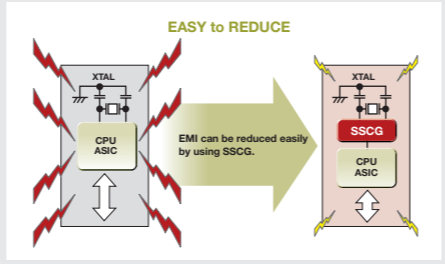
Spread Spectrum Technology

The height of the peak in the energy spectrum is reduced when the output is modulated.

- fin=40MHz
- VDD=3.3V
- Room temp.
- Test Board

SSC=±1.5%

TS3313A

- 4dBm
- 19dBm

Delta - 15dB

Effects of SSC

Effects of SSCG

Actual EMI Test Results

TS302: SSC=-0.5%: SPEC = VCCI Class B

Conditions :
· Renesas Test Board
· VDD=3.3V
· fin=33MHz
· Ta=Room Temp

SSC=OFF

Some points that exceed EMI standards occur in the high frequencies.

SSC=-0.5% ON

The EMI standards are met at all frequencies.

The high-frequency peaks have been reduced and the EMI characteristics improved significantly by using Renesas SSCG Series devices.

The high-frequency peaks have been reduced and the EMI characteristics improved significantly by using Renesas SSCG Series devices.

### RD151TS33XXA Series Lineup

Output frequency: Covering a wide range of frequencies from 10MHz to160MHz, and providing respective center/down spread modulation. Most suitable products for application can be selected.

Central spread Product part no.	RD151 TS3312A	RD151 TS3313A	RD151 TS3314A	RD151 TS3315A	RD151 TS3316A
Down spread Product part no.	RD151 TS3322A	RD151 TS3323A	RD151 TS3324A	RD151 TS3325A	RD151 TS3326A
Output frequency	10 - 20MHz	20 - 40MHz	40 - 80MHz	80 - 160MHz	40 - 80MHz
Input frequency	10 - 20MHz	20 - 40MHz	20 - 40MHz	20 - 40MHz	40 - 80MHz
Multiplication (input: output)	1 : 1	1 : 1	1 : 2	1 : 4	1 : 1
Power supply voltage	3.3V typ.				
SSC% (Center)	OFF, ±0.5%, ±1.5%				
SSC% (Down)	OFF, -1.0%, -3.0%				
Cycle to Cycle Jitter	|100| ps typ.				
Slew Rate	0.7 V/ns @15pF	0.8 V/ns @15pF	2.0 V/ns @15pF	0.8 V/ns @15pF	

Serial Interface

PC   PC   Telephone line   ISDN

LAN (RS-422A/485)

Printer
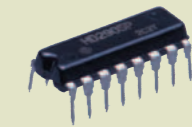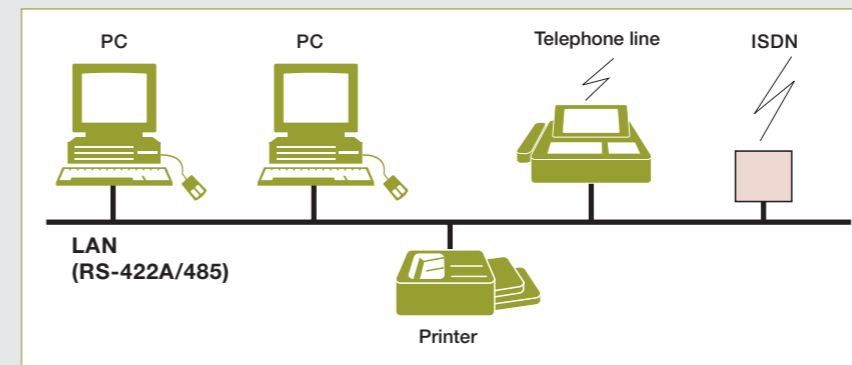
Also the power-saving CMOS edition that is compatible with the high-function RS-485, and the interface IC based on the RS-422A, which is suitable for high-speed, long-distance interfaces between PCs are lined up. (HD 26/29 series)

HD151 Series

Function	Part No.	Package		Pin
		SOP (E)	TSSOP	
Liquid Crystal Panel Alternation Signal Counter	151011	—	○	20
Centronics Interface	151005	○	—	20

SOP (E): JEITA specification

HD26/29 Series

Function	Part No.	Package		Pin
		DIP	SOP (E)	
RS-422A/423A Standard	26C31	—	○	16
	26C32A	○	○	16
	26LS31	○	—	16
	26LS32	○	○	16
	26LS32A	○	—	16
	29050	○	—	16
	29051	○	—	16

Function	Part No.	Package	Pin
		SOP (E)	
CCD/MOS Driver	29026A	○	8
	29027	○	8
	29029	○	8

General-Purpose ASSPs

I/O Expanders

I/O expanders are a convenient way to extend the ports of an MCU. Our lineup includes products with I²C bus and parallel bus support.

Serial Type I/O Expanders

R8A66154SP	R8A66152SP	R8A66155SP	R8A66156SP
(16mA) M66014FP	R8A66150SP		R8A66151SP
(8mA) M66013FP	(3mA)		(5mA)

Original BUS

I²C BUS Interface (5mA) M62320FP/P

Output bit counts: 8 12 16 24 [bit]

BUS Type I/O Expanders

Original Internal BUS — R8A66153FP (High voltage output port: 25mA, Other: 5mA)

Z80 family BUS — M64620P/FP

68 family BUS — M64621P/FP

Output bit counts: 8 12 16 24 [bit]

High-Speed Bus Switches

250 ps Switching Speed. Ultra-High 8-Fold Speed at a Stroke.
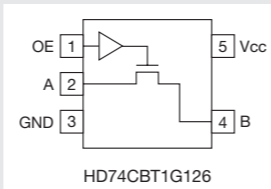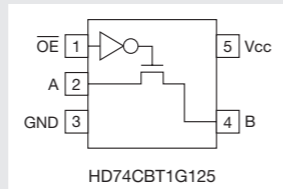
Bus Switch

- 250 ps delay time enabling the construction of high-speed bus systems
- Almost no power is consumed within the circuit, for low power dissipation
- Structure providing on/off linkage between input and output eliminates the need for direction switching in input/output switching
- 5V => 3.3V level transfer, partial power-down support

Input/Output Characteristics Supporting Partial Power-Down

The HD74CBT Series supports partial power-down operation (partial power supply stoppage). As there is no leakage current at the time of NMOS switch-off, the Vcc = OFF and Vcc = ON systems are totally isolated in partial power-down mode. Functions remain unchanged when HD74CBT power is turned off.
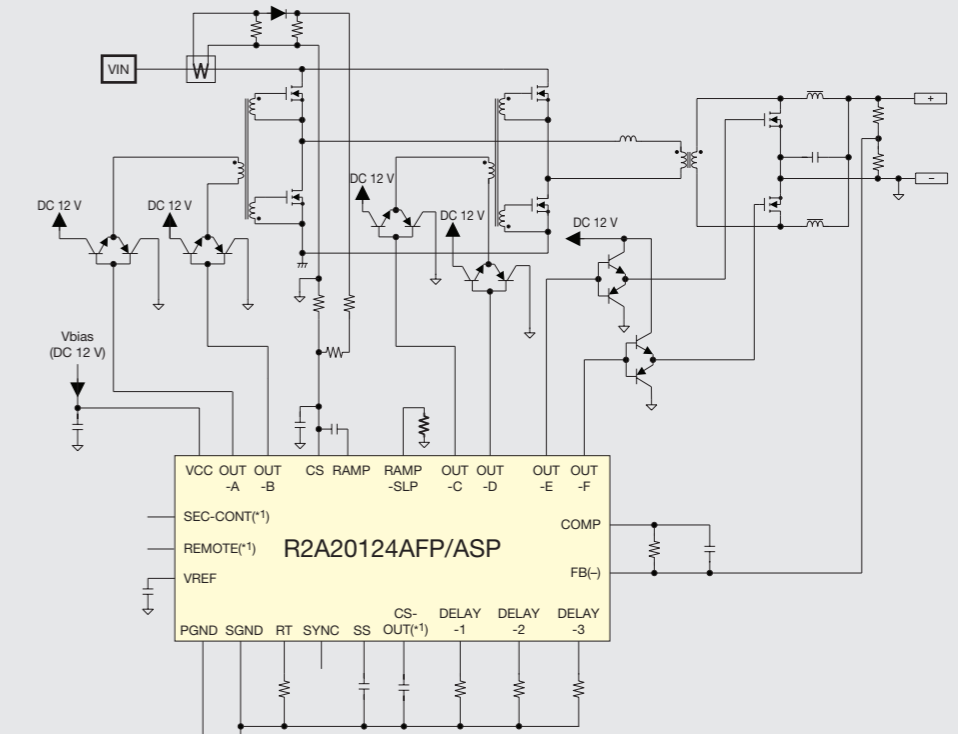
Bus Switch Series (HD74CBT1G125/126CM)

Signal on/off
(Low on-resistance: 5W (typ), ultra-high speed: 250ps)

Partial power-down support SW:
High impedance at off or power-off

Small CMPAK-5 package

HD74CBT1G125

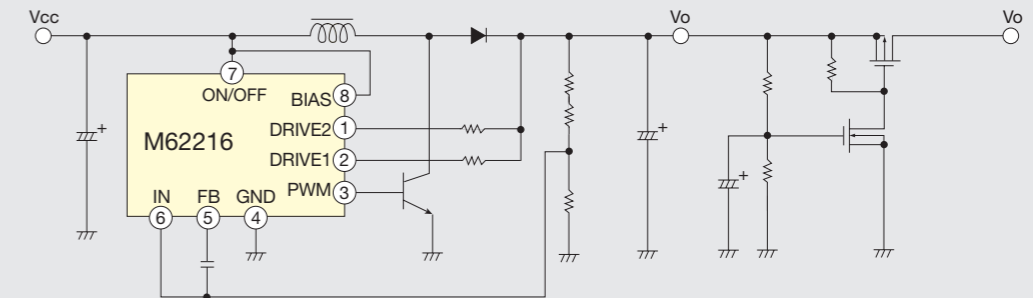HD74CBT1G126

Isolated DC/DC converter (full-bridge, phase shift)

R2A20124AFP/ASP

Note: *1. Only R2A20124AFP

Low-Voltage DC/DC Converter

M62216

Uninsulated On-Board DC/DC Converter

M62292FP

Application Circuit Example

MCU SH2A Series

Flash memory

Applications

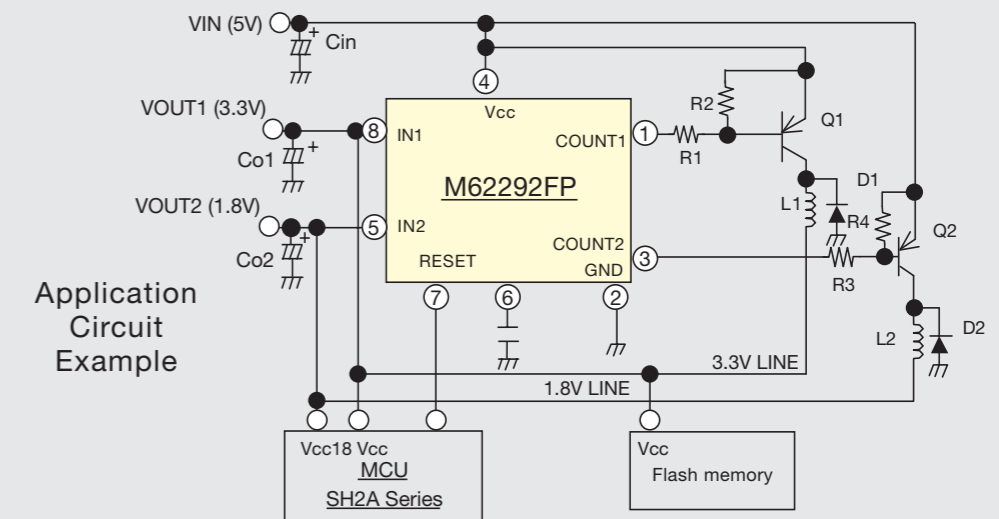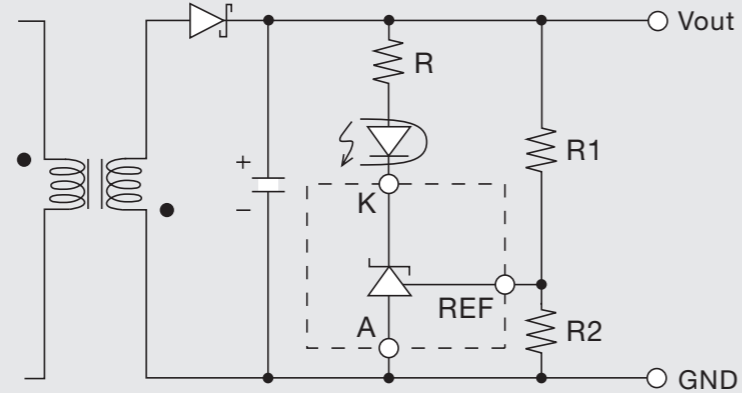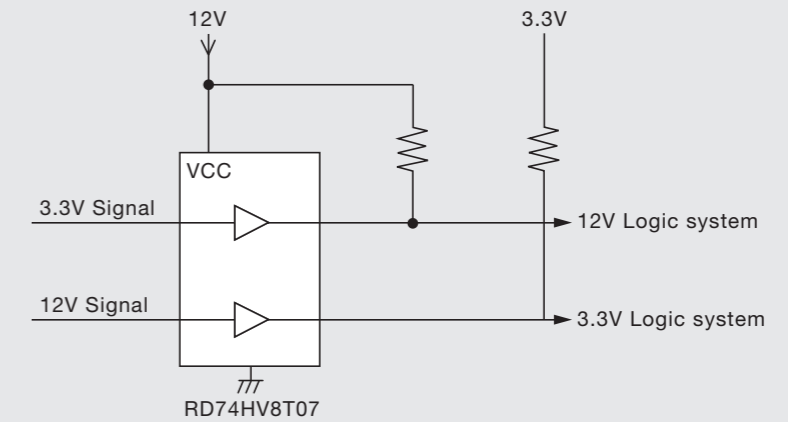## PWM Power Supply with PFC Function, Low-Voltage DC/DC Converter, Uninsulated On-Board DC/DC Converter

Generating the reference voltage for the secondary side error amplification circuit of a switching power supply.
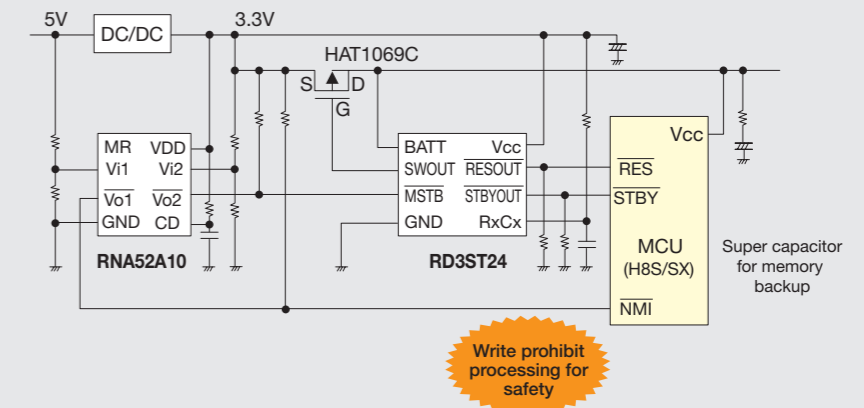

Vout
R
R1
K
REF
A
R2
GND

Power Supply Reference Voltage, Standby Control, Reset

Interface between 3.3V LOGIC system to 12V LOGIC system.

12V   3.3V
VCC
3.3V Signal → 12V Logic system
12V Signal → 3.3V Logic system
RD74HV8T07

Controlling the hardware standby mode of an MCU.

Circuit Example Using a Multifunction Reset IC for Memory Write Prohibit Processing Before Hardware Standby

5V   DC/DC   3.3V
HAT1069C
S D
G
MR   VDD
Vi1   Vi2
Vo1   Vo2
GND   CD
RNA52A10

BATT   Vcc
SWOUT RESOUT
MSTB   STBYOUT
GND   RxCx
RD3ST24

Vcc
RES
STBY
MCU (H8S/SX)
NMI

Super capacitor for memory backup
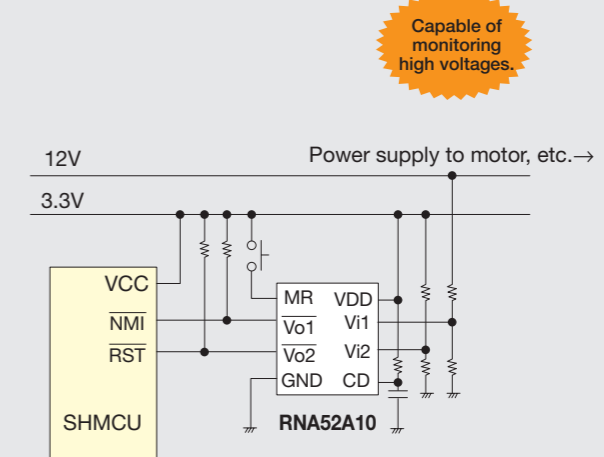
Write prohibit processing for safety

The hardware standby function of the H8S/SX can be used to maintain data in on-chip memory.
Using a standby controller (RD3ST24) in combination enables a simpler circuit design.
When the RNA52A10 in used, data can be maintained in memory with a higher degree of safety because the transition to standby mode can be mad after write prohibit processing.

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design in a system.

Monitoring the power supply voltage.

Multiple Power Supply Application Example of Multifunction Reset IC

Capable of monitoring high voltages.

12V   Power supply to motor, etc.→
3.3V
VCC   MR   VDD
NMI   Vo1   Vi1
RST   Vo2   Vi2
                 GND   CD
SHMCU   RNA52A10

The power supply to the RNA52A10MM enables monitoring of a separate voltage.
For example, it is possible to monitor a motor drive power supply and have a warning lamp light when a voltage drop occurs.
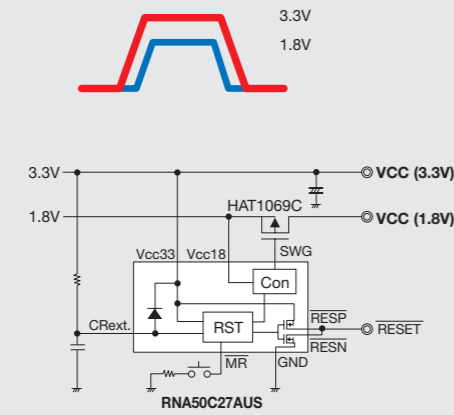
Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design in a system.

Applications

Applications

Power Supply Reference Voltage, Standby Control, Reset
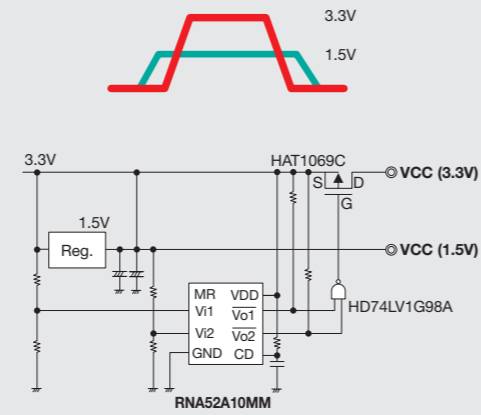
Controlling the power-on sequence of power supplies.

Example of power supply sequence control using a multifunction reset IC and an MCU with two power supplies

For Dual Power Supplies MPU/MCU

3.3V
1.8V

3.3V
1.8V

VCC (3.3V)
VCC (1.8V)

HAT1069C

Vcc33 Vcc18
Con
SWG
CRext.
RST
RESP
RESN
MR
GND
RESET

RNA50C27AUS

For Triple Power Supplies MPU/MCU

3.3V
1.5V

3.3V

VCC (3.3V)
VCC (1.5V)

HAT1069C
S D
G

1.5V
Reg.

MR VDD
Vi1 Vo1
Vi2 Vo2
GND CD

HD74LV1G98A

RNA52A10MM

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design in a system.

Controlling the power-on sequence of power supplies.

Example of simultaneously starting two power supplies using a multifunction reset IC

[Required waveform example]

3.3V
1.8V

When attempting to start two power supplies simultaneously, strictly speaking there is always a certain gap in the timing. This configuration example is designed to make that gap as small as possible.

[Circuit example]

3.3V
1.8V

HAT1069C × 2
S D
G
S D
G

VCC (3.3V)
HRV103A
VCC (1.8V)

MR VDD
Vi1 Vo1
Vi2 Vo2
GND CD

HD74LV2G14A

RES

RNA52A10MM

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design in a system.

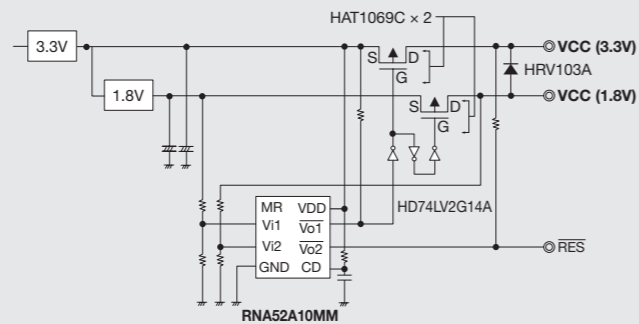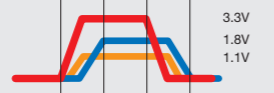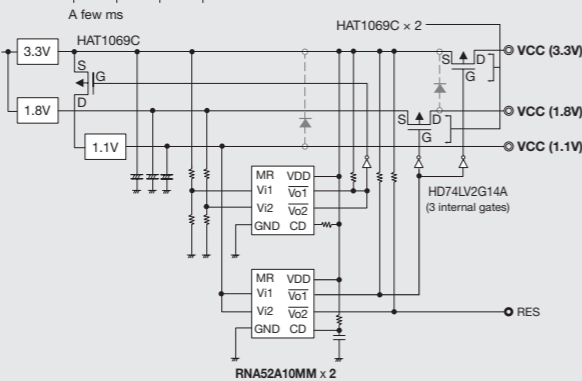### Controlling the power-on sequence of power supplies.

Example of simultaneously starting multiple power supplies using a multifunction reset IC

[Required waveform example]

3.3V
1.8V
1.1V

A few ms

Note: Simultaneous startup of SH7785 MCUs, etc.

In this case an external power supply unit must be used due to the large current requirements.
Simultaneous power supply startup can be difficult under these circumstances.
This configuration example is designed to deal with this problem.

[Circuit example]

3.3V
1.8V
1.1V

HAT1069C
S
G
D

HAT1069C × 2
S D
G
S D
G

VCC (3.3V)
VCC (1.8V)
VCC (1.1V)

MR VDD
Vi1 Vo1
Vi2 Vo2
GND CD

HD74LV2G14A
(3 internal gates)

MR VDD
Vi1 Vo1
Vi2 Vo2
GND CD

RES

RNA52A10MM × 2

Note: This circuit diagram is intended for reference only. Careful verification should be performed before actually using this design in a system.

Power-On Sequence Controller, LCD Backlight Controller, Level Shifter

Controlling an LCD backlight.

Sample Backlight Control Application Circuit Using M62215FP Dual-Input Type DC/DC Converter

Vcc
VREF
COSC
IN1
IN2
Reference voltage source
Oscillation circuit
UVLO VTHON :8.6V VTHOFF:7.6V
OP Amp1
PWM Comp
OP Amp2
Short-circuit protection circuit
CLM
FB SCP (SOFT) GND
RCLM
Load
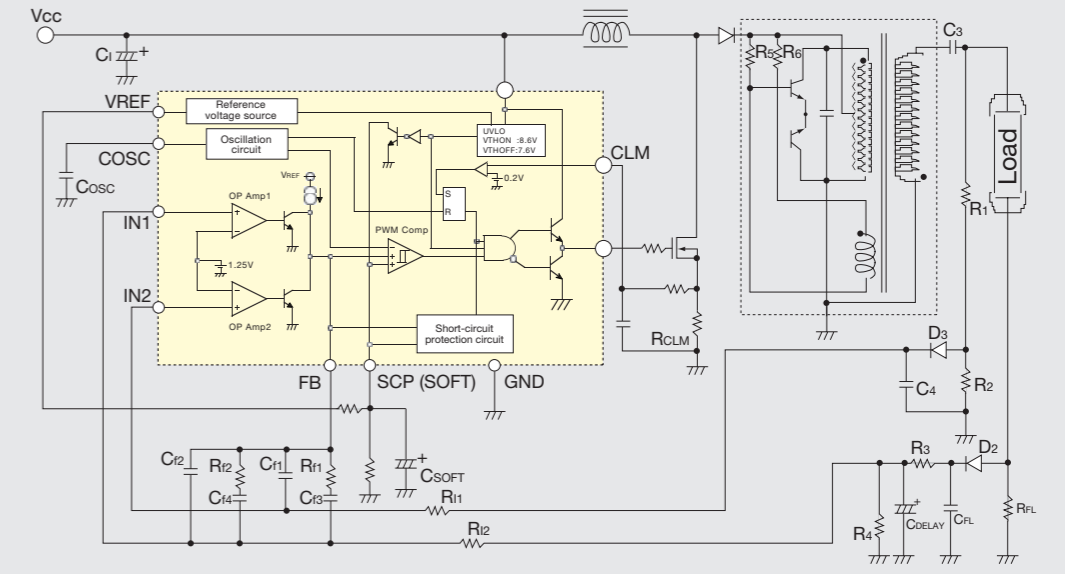
Converting between different logical levels.

Easy Implementation of 5V => 3.3V Level Conversion Using External Diode

5V → 3.3V level transfer can be achieved easily and at low cost by dropping the Vcc power supply of an HD74CBT Series device by 0.7V with an external diode and providing a voltage drop of approximately 1V between the gate and source of the NMOS structure.

5V/3.3V Level Transfer between Devices with the Use of Bus Switch

Vcc=5V
HVD133
OE
A
Vcc=4.3V
GND
B
3V Bus line
5V Bus line

3.3V signal ← 5V signal
3.3V signal → 3.3V signal
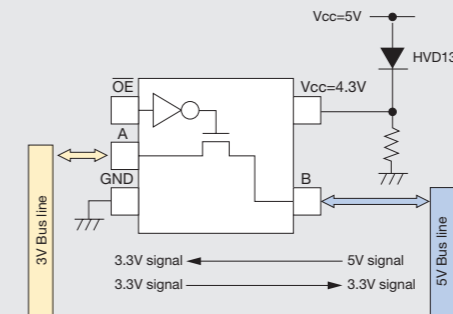
To transfer a 5V signal to 3.3V, insert a diode into the power pin and change the power voltage to 4.3V.

Vcc (V) vs. Vout

VOUT (V)
5
4
3.3V
3
2
1
0
3.0 3.5 4.0 4.3V 4.5 5.0 5.5
Vcc (V)

about 1 V lower output voltage than Vcc
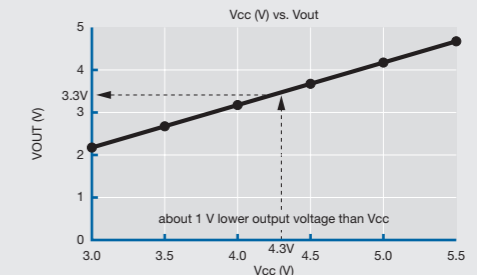
Extending the output ports of an MCU.

+5V
SDA
SCL

SDA
SCL

I²C BUS

Applications

Port Extension, Weak Signal Handling, Battery Monitoring, Camera Flash

LED Driver
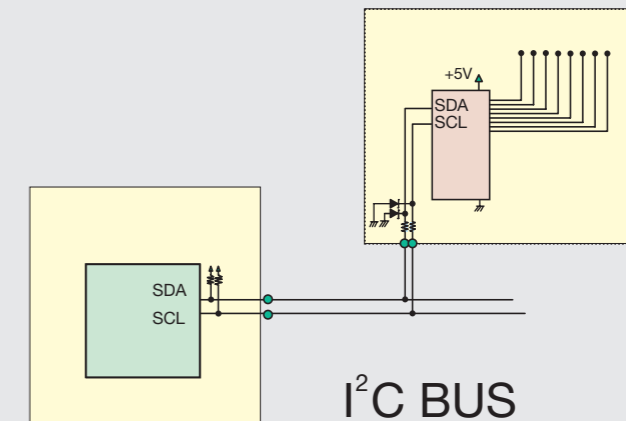
Handling weak signals. Driving an actuator.

Power supply line

MCU

Reset IC — RESET

CMOS opamp

DAout

CMOS opamp

Sensor

Analog signal of 3.3V or less

ADin

Relay, lamp, solenoid, etc.

High-precision A/D converter

CMOS opamp

Sensor, analog IC, etc.

Analog signal of 3.3V or more

ADin

SIO

ADin
Dout
ADJ

Shunt regulator

Monitoring the charge current of a battery charger.
ex. (Power supply circuit)

Mini Disc

014 : Fighting
L :
R :

MD player

Battery charger

OP-AMP

HA1630Sxx

Charging current monitoring

Driving a camera flash unit.
Sample Strobe Circuit

Xe tube

Trigger Transformer

Power MOSFET

C_M

Thyristor

IGBT

Driver

IGBT Type

Xe tube

Trigger Transformer

Thyristor Type

Illuminating LEDs using an SpAS system.

+5V

+5V

SDA
SCL
SS
Add
REXT

+5V

+5V

SDA
SCL
SS
Add
REXT

RD40LD003A,005,007

RD40LD002,006,008

MCU
(R8C/3X Series etc.)

+3.3V

TxD1
SCK1

LVC
244B

P27(SS)

Illuminating LEDs using serial-parallel conversion.

VCC

VCC

RD30LDT3595/595

RD30LDT3595/595

MCU
(R8C/3X Series etc.)

S-in
CLK
Latch
Enable

S-out

S-in
CLK
Latch
Enable

S-out

Illuminating 7-segment LEDs.

V=9V

V=9V

RD30LDT3595

VCC

RD30LDT595

VCC

MCU
(R8C/3X Series etc.)

S-in
CLK
Latch
Enable
S-out

MCU
(R8C/3X Series etc.)

S-in
CLK
Latch
Enable
S-out

LED Illumination

Package Dimensions 1
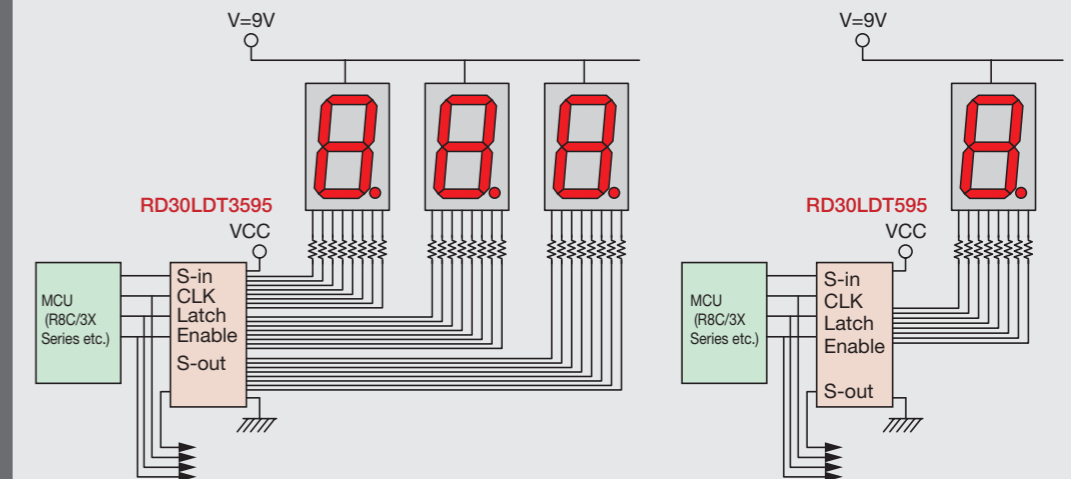
Lowering the voltage for LED illumination.

Application Circuit Example (Voltage Step-Down Mode)

9V to 38V

Vout

CH0

High → MODE

LED drive Max. 1.5A

Vout ＜ Vin

Current control

2SK3377

*Nch MOSFETs, which offer cost advantages and many options, may be used for step-down configurations as well.

78K0 Series MCU

CH1
CH2
CH3

4-channel product μPD168804 only

μPD16804,830
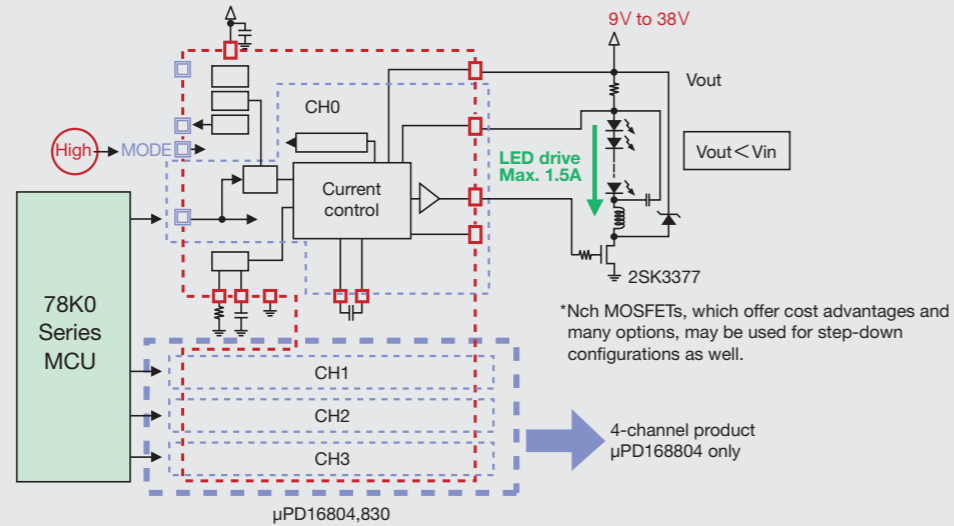
Raising the voltage for LED illumination.

Application Circuit Example (Voltage Step-Up Mode)

9V to 38V Vin

Vout ＞ Vin

CH0

Low → MODE

Current control

Vout

LED drive Max. 1.5A

2SK3377 etc

78K0 Series MCU

CH1
CH2
CH3

4-channel product μPD168804 only

μPD16804,830

Package Name
Package Code   (Units: mm)

DIP — DP-8B — PRDP0008AF-A

DIP — DP-8FV — PRDP0008AF-B

(Ni/Pd/Au plating)

DIP — 8P4 — PRDP0008AA-A

DIP — DP-14AV — PRDP0014AB-B

DIP — 14P4 — —

DIP — DP-16E — PRDP0016AE-A

DIP — DP-16FV — PRDP0016AE-B

(Ni/Pd/Au plating)

DIP — 16P4 — PRDP0016AA-A

Package Dimensions 2

Package Name
Package Code   (Units: mm)

DIP — 18P4 / —

0.27 +0.07 -0.05
6.3±0.15
7.62
0° to 15°
24.0±0.2
4.5MAX
3.0MIN
3.3
0.51MIN
2.54
1.5 +0.3 -0.1
0.5±0.1

DIP — DP-20NEV / PRDP0020AC-B

24.50
25.40 Max
20   11
6.30
7.00 Max
1   10
0.89   1.30
1.27 Max
0.51 Min
2.54 Min
5.08 Max
7.62
0.25 +0.11 -0.05
0°-15°
2.54 ± 0.25   0.48 ± 0.10

DIP — 22P4H / —

0.25 +0.07 -0.05
6.6±0.15
7.62
0° to 15°
2.70±0.2
3.0MIN 4.7MAX
3.65
0.51MIN
2.54
1.2 +0.3 -0.1
0.5±0.1
1.0 +0.3 -0.1

DIP — 24P4D / PRDP0024AA-A

0.27 +0.07 -0.05
6.3±0.15
7.62
0° to 15°
29.2±0.2
3.0MIN 4.5MAX
3.3
0.51MIN
2.54
1.5 +0.3 -0.1
0.5±0.1
1.0 +0.3 -0.1

SDIP — 20P4B / PRDP0020BA-A

20   11
1   10
6.3 ± 0.15 +1°
7.62 ± 0.3
0.27 +0.1° -15°
19.0 ± 0.2 -2
4.5 Min
3.3
3.0 Min
0.51 Min
1.778 ± 0.25
1.0 +1 -3
0.48 ± 0.1
Notes) 1. Dimensions "*1" and "*2" do not include mold flash.
2. Dimension "*3" does not include trim offset.

HSDIP — DP-24TS / —

27.10
28.10 Max
24   13
8.8
10.0 Max
1   12
1.0
1.5 Max
0.51 Min
2.54 Min
5.06 Max
10.16
0.25 +0.10 -0.05
0° -13°
1.78 ± 0.25   4.04 ± 0.20   0.48 ± 0.10

SIP — 5P5T / —

11.7 ± 0.2
1.97 ± 0.2
4.0 Nom
6.1 Max
1.4 Min
3.0 Min
0.5 ± 0.1
1.2 +0.5 -0.1
0.85 +0.1 -0.05
0.27 +0.05
0.7 ± 0.1
2.54 Nom
SEATING PLANE

SIP — 8P5 / —

19.0±0.2
2.8±0.2
6.4
8.3MAX
1.2MIN
3.0MIN
1.2±0.1
2.54
0.5±0.1
0.85 +0.3 -0.1
0.27 +0.07 -0.05
1.2 +0.3 -0.1

Package Dimensions 3

Package Name
Package Code   (Units: mm)

SOP — 5pin Power Package / —

9.52 MAX
9.14 MAX
6.50 BSC
1.27 MAX
8.13 MAX
8.03 MAX
10.67 MAX
1.14 MAX
0.25 BSC
0.79 BSC
1.70 BSC
2.03 MAX
0.25 BSC
0.25 BSC
DETAIL "A"
0.13 MAX
1.04 MAX
0° -6°
A

SOP — FP-8DCV (JEDEC) / PRSP0008DD-C

4.90
5.3 Max
8   5
3.95
1   4
0.75 Max
1.27
1.75 Max
*0.42 ± 0.08
0.40 ± 0.06
0.14 +0.1 -0.05
6.10 +0.10 -0.30
*0.22 ± 0.03
0.20 ± 0.03
1.08
0.60 +0.67 -0.20
0° -8°
0.15
0.25
*Dimension including the plating thickness
Base material dimension

SOP — 8P2S-A / PRSP0008DA-A

6.2±0.3
4.4±0.2
5.0±0.3
1.27
1.9 MAX
1.5
0.9
0.05MIN
0.4±0.2
0.15 +0.05 -0.02
0° to 10°
Detail F
F

SOP — 10P2-C / —

8.1±0.3
5.3±0.2
6.13±0.2
0.45 +0.1 -0.05
1.27
1.75
0.05MIN
0.5±0.2
0.15 +0.05 -0.02
2.15MAX
0° to 10°
Detail F
F

SOP — FP-8DGV (JEITA) / PRSP0008DE-B

4.85
5.25 Max
8   5
4.4
1   4
0.75 Max
2.03 Max
1.27
1.05
*0.22 ± 0.05
0.20 ± 0.04
6.50 +0.10 -0.20
0.10 ± 0.10
0.60 +0.10 -0.05
0° -8°
*0.42 ± 0.08
0.40 ± 0.06
0.15
0.12
*Dimension including the plating thickness
Base material dimension

SOP — — / PRSP0008DE-C

4.85 ± 0.2
8   5
4.4 ± 0.2
6.2 +0.1 -0.3
1   4
Index mark
0.75 Max 1.27 ± 0.15 0.4 ± 0.06
0.12 Max
2.03 Max
0.4 ± 0.06
0.20 ± 0.05
0.90
1.85
0.1 ± 0.1
0.45 ± 0.2
0° to 8°
Terminal cross section
(Ni/Pd/Au plating)
Detail F
F

SOP — 10P2N-A / PRSP0010DB-A

8.1±0.3
5.7±0.1
6.8±0.1
0.4 +0.1 -0.05
1.27
1.8
0.1±0.1
1.21
0.5±0.2
0.2 +0.05 -0.02
2.1MAX
0° to 8°
Detail F
F

SOP — FP-14DAV (JEITA) / PRSP0014DF-B

10.06
10.5 Max
14   8
5.5
1   7
1.42 Max
2.20 Max
1.27
7.80 +0.10 -0.20
1.15
*0.22 ± 0.05
0.20 ± 0.04
0.10 ± 0.10
0.70 ± 0.20
0° -8°
*0.42 ± 0.08
0.40 ± 0.06
0.15
0.12
*Dimension including the plating thickness
Base material dimension

Package Dimensions

Package Dimensions

Package Dimensions 4

Package Name	
Package Code	(Units: mm)

SOP — FP-14DNV (JEDEC) / PRSP0014DE-A
*Ni/Pd/Au plating

SOP — 14P2P-A / —

SOP — 14P2N-A / PRSP0014DD-A

SOP — FP-16DAV (JEITA) / PRSP0016DH-B
*Dimension including the plating thickness
Base material dimension

SOP — FP-16DNV(JEDEC) / PRSP0016DG-A
*Ni/Pd/Au plating

SOP — 16P2S-A / —

SOP — 16P2N-A / PRSP0016DE-A

SOP — FP-20DAV (JEITA) / PRSP0020DD-B
*Dimension including the plating thickness
Base material dimension

Package Dimensions 5

Package Name	
Package Code	(Units: mm)

SOP — FP-20DBV(JEDEC) / PRSP0020DC-A
*Ni/Pd/Au plating

SOP — 20P2X-A / —

SOP — 20P2N-A / PRSP0020DA-A

SOP — 24P2E-A / PLSP0024JA-A

SOP — 24P2Q-A / PRSP0024GA-A

SOP — 24P2N-B / —

SOP — 24P2V-A / —

HSOP — FP-26DT (JEITA) / —
*Dimension including the plating thickness
Base material dimension

Package Dimensions

Package Name

Package Code　　(Units: mm)

HSOP	MMPAK-8 / PLSP0008JC-A

SSOP	8P2J-A / PTSP0008JA-A

Detail G　　Detail F

SSOP	8P2X-A / —

Detail A

SSOP	TTP-8DBV / PVSP0008KA-A

SSOP	16P2E-A / PLSP0016JA-A

Detail F

SSOP	20P2E-A / —

Detail F

SSOP	20P2F-A / PLSP0020JB-A

Detail F

SSOP	36P2R-A / PRSP0036GA-A

Notes) 1. Dimensions "*1" and "*2" do not include mold flash.
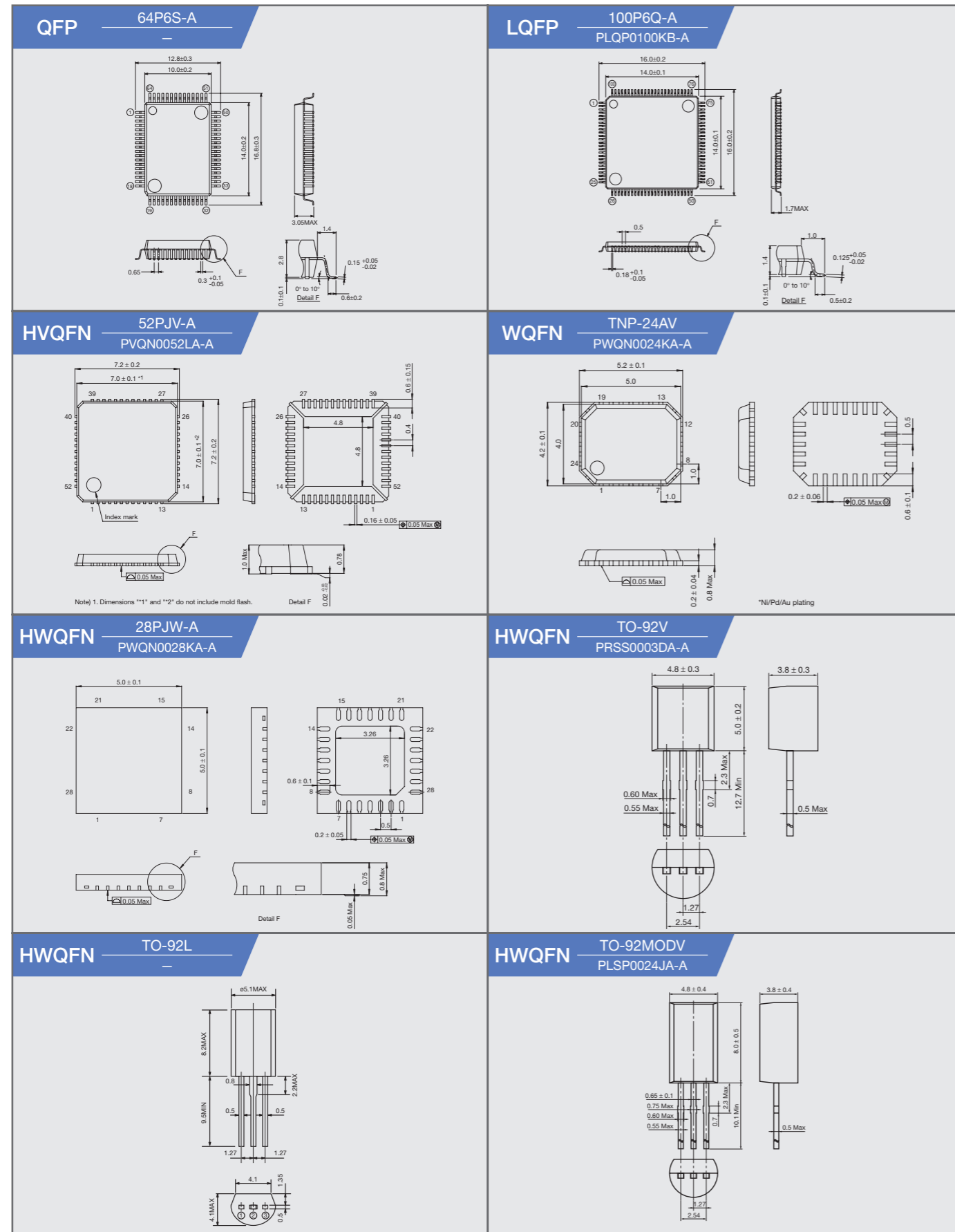2. Dimension "*3" does not include trim offset.

Index mark

Detail F

Package Name

Package Code　　(Units: mm)

SSOP	36P2R-D / PRSP0036GA-B

Index mark

Detail F

TSSOP	TTP-8DAV / PTSP0008JC-B

*Dimension including the plating thickness
Base material dimension

TSSOP	TTP-14DV / PTSP0014JA-B

*Dimension including the plating thickness
Base material dimension

TSSOP	TTP-16DAV / PTSP0016JB-A

*Dimension including the plating thickness
Base material dimension

TSSOP	TTP-20DAV / PTSP0020JB-A

*Ni/Pd/Au plating

TSSOP	TTP-24DBV(JEITA) / PTSP0024JB-A

*Ni/Pd/Au plating

TSSOP	TTP-48DBV(JEITA) / PTSP0048KA-A

*Ni/Pd/Au plating

QFP	48P6D-A / —

Detail F

Package Dimensions

Package Name
Package Code (Units: mm)

QFP	64P6S-A / –
LQFP	100P6Q-A / PLQP0100KB-A
HVQFN	52PJV-A / PVQN0052LA-A
WQFN	TNP-24AV / PWQN0024KA-A
HWQFN	28PJW-A / PWQN0028KA-A
HWQFN	TO-92V / PRSS0003DA-A
HWQFN	TO-92L / –
HWQFN	TO-92MODV / PLSP0024JA-A

HWQFN	MPAKV / PLSP0003ZB-A
HWQFN	SOT-25 / PLSP0005ZA-A
HWQFN	MPAK-5V / PLSP0005ZB-A
HWQFN	CMPAK-5V / PTSP0005ZA-A
HWQFN	UPAKV / PLZZ0004CA-A
HWQFN	SOT-89 / PLZZ0004CB-A
VSON	TNP-5DV / PUSN0005KA-A
CMPAK	CMPAK-5V / PTSP0005ZC-A
CMPAK	CMPAK-6V / PTSP0006JA-A

Package Dimensions

Package Dimensions

Package Name

Package Code　(Units: mm)

Package Name

Package Code　(Units: mm)

SOT-89　3Pin POMM(SOT-89)　PKG3C4-212-0432

4.5±0.1
1.6±0.2
1.5±0.1
2.5±0.1
4.0±0.25
0.8 MIN.
0.42 ±0.06
0.47 ±0.06
0.42±0.06
1.5
3.0
0.41$^{+0.03}_{-0.05}$

SOT-457　5Pin MM(SOT-457)　PKG5C3-121-0412

detail of lead end

ITEM	MILLIMETERS
A	2.9±0.2
B	0.3
C	0.95 (T.P.)
D	0.32$^{+0.05}_{-0.05}$
E	0.05±0.05
F	1.4 MAX.
G	1.1$^{+0.2}_{-0.1}$
H	2.8±0.2
I	1.5$^{+0.2}_{-0.1}$
J	0.65$^{+0.1}_{-0.15}$
K	0.16$^{+0.1}_{-0.06}$
L	0.4±0.2
M	0.19
N	0.1
R	5°±5°

SSTA-95-15A

TO-252　5Pin MP-3ZK(TO-252)　PKG5J5-313-0422

(UNIT:mm)

ITEM	DIMENSIONS
D	6.10±0.20
D1	4.4TYP(4.0MIN)
E	6.50±0.20
E1	4.4TYP(4.3MIN)
H	9.8TYP(10.3MAX)
A	2.30±0.10
A1	0 to 0.25
b	0.60±0.10
b1	5.0
c	0.50±0.10
c1	0.50±0.10
c2	0.508
e	1.14
L	1.52±0.12
L1	1.0
L2	0.80

P5T1F-114-1

NOTE
1. ▨ No Plating area

TO-251　MP-3(TO-251)　PKG3J5-112-0431

6.5±0.2
5.0±0.3
1.5±0.2
2.3±0.2
0.5±0.1
1.6±0.2
5.5±0.2
13.7 MIN.
7.0 MIN.
1.1±0.1
0.5$^{+0.1}_{-0.1}$
0.5$^{+0.1}_{-0.1}$
2.3　2.3
0.75

TO-252　MP-3Z(TO-252)　PKG3J5-212-0431

6.5±0.2
5.0±0.2
4.4±0.2
2.3±0.2
1.5±0.2
0.5±0.1
NOTE
NOTE
5.5±0.2
5.6±0.3
9.5±0.5
1.0±0.5
0.4 MIN.
0.5 TYP.
2.5±0.5
0.5±0.1
0.5±0.1
2.3±0.3
2.3±0.3
0.15±0.15

TO-252　MP-3ZK(TO-252)　PKG3J5-312-0431

6.5±0.2
5.1 TYP.
4.3 MIN.
2.3±0.1
1.0 TYP.
0.5±0.1
4.0 MIN.
6.1±0.2
10.4 MAX. (9.8 TYP.)
0.51 MIN.
0.8
1.14 MAX.
0.76±0.12
2.3　2.3
0 to 0.25
0.5±0.1
1.0

SOP　8Pin SOP(3.1×4.9)　PKG8MF-PAA-0408

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
D	4.80 to 5.00
E	3.80 to 4.00
HE	5.80 to 6.20
e	1.27
bp	0.85 to 0.49
A	1.35 to 1.75
A1	0.10 to 0.25
A3	0.25
c	0.19 to 0.25
Lp	0.40 to 1.25
h	0.25 to 0.50
Lp	0.25
w	0.25
x	0.25
y	0.10
θ	0° to 7°

SOP　16Pin SOP(300ml)　PKG16GS-0403

detail of lead end

3°

10.2±0.2
1.65±0.15
1.55
7.7±0.3
5.6±0.3
1.1±0.2
0.78 MAX.
0.6±0.2
0.22$^{+0.05}_{-0.05}$
0.1±0.1
0.42$^{+0.08}_{-0.05}$
0.12

P16GM-50-300B-6

SOP　16Pin SOP(375ml)　PKG16GT-0106

detail of lead end

3°

10.2±0.26
10.3±0.3
7.2±0.2
1.6±0.2
2.9 MAX.
2.50±0.2
1.27
0.805 MAX.
0.8±0.2
0.42$^{+0.08}_{-0.05}$
0.12
0.125±0.075
0.17$^{+0.03}_{-0.03}$

P16GT-50-375B-2

SOP　14Pin SOP(225ml)　PKG14GR-AND-0103

detail of lead end

3°

10.2±0.26
1.59$^{+0.1}_{-0.1}$
1.49
6.5±0.2
4.4±0.1
1.1 to 0.16
0.6±0.2
1.27
1.42 MAX.
0.42$^{+0.08}_{-0.05}$
0.17$^{+0.03}_{-0.03}$
0.1±0.1

TSSOP　14Pin TSSOP(225ml)　PKG14GR-9LG-0405

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
D	5.15±0.15
D1	5.00±0.10
E	4.40±0.10
HE	6.40±0.20
A	1.20 MAX.
A1	0.10±0.05
A2	1.00±0.05
A3	0.25
b	0.24$^{+0.06}_{-0.05}$
c	0.145±0.055
L	0.50
Lp	0.60±0.15
L1	1.00±0.20
θ	3$^{+5°}_{-3}$
e	0.65
x	0.10
y	0.10
ZD	0.625

P14GR-65-9LG

NOTE
Each lead centerline is located within 0.10mm of its true position at maximum material condition.

TSSOP　8Pin TSSOP(2.8×2.9)　PKG8MP-KAA-0405

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
D	2.90
D1	3.00±0.20
E	2.80
HE	4.00±0.20
e	0.65
b	0.22±0.05
A	1.03 MAX.
A1	0.08±0.08
A2	0.85±0.05
A3	0.25
L1	0.60±0.20
c	0.145$^{+0.05}_{-0.03}$
Lp	0.37±0.10
x	0.10
y	0.10
θ	3$^{+5°}_{-3}$
ZD	0.525

P8MP-65-KAA

NOTE
Each lead centerline is located within 0.10 mm of its true position at maximum material condition.

TSSOP　8Pin TSSOP(225ml)　PKG8GR-9JG-0405

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
D	3.15±0.15
D1	3.00±0.10
E	4.40±0.10
HE	6.40±0.20
A	1.20 MAX.
A1	0.10±0.05
A2	1.00±0.05
A3	0.25
b	0.24$^{+0.06}_{-0.05}$
c	0.145±0.055
L	0.50
Lp	0.60±0.15
L1	1.00±0.20
θ	3$^{+5°}_{-3}$
e	0.65
x	0.10
y	0.10
ZD	0.60

P8GR-65-9LG

NOTE
Each lead centerline is located within 0.10mm of its true position at maximum material condition.

TSSOP　8Pin TSSOP(3×3)　PKG8MN-KAA-0405

detail of lead end

(UNIT:mm)

ITEM	DIMENSIONS
D	3.00
E	3.00
f	0.20
HE	4.90
t	0.20
e	0.65
bp	0.25 to 0.38
A1	0.10±0.05
A	1.10 MAX.
A2	0.85±0.10
A3	0.25
L1	0.95
c	0.13 to 0.23
Lp	0.55/0.15
x	0.10
y	0.10
θ	3$^{+5°}_{-3}$

P8MN-65-KAA

0.15 MAX.
0.15 MAX.
0.15 MAX.

Renesas New Package Code Destination

P R DP 0008 A F - A

- **Auxiliary appearance code**
  (1 alphanumeric character; sequential)
  *No general common rules; this code is used to identify lead shape and the like.

- **Appearance identification code**
  (1 alphanumeric character; sequential)
  *No general common rules; this code is used to identify body shape and the like.

- **Pin pitch code (1 alphanumeric character)**

Code	Pin pitch	Code	Pin pitch	Code	Pin pitch
A	2.54	B	1.778	C	1.50
D	1.27	E	1.25	F	1.00
G	0.80	H	0.75	J	0.65
K	0.50	L	0.40	M	0.30
Z	Others				

- **Number of pins (4-digit number)**

Display	No. Pins	Display	No. Pins
0000	Contact-less	0008	8 pin
Display	No. Pins	Display	No. Pins
0208	208 pin	0848	1848 pin

- **Package appearance code (2 alphanumeric characters)**

Code	Appearance	Code	Appearance	Code	Appearance
BG	BGA				
CA	Card with connector	CB	No-contact card	CC	Card with surface-contact pin
DP	DIP	DT	DTP		
LG	LGA			PG	PGA
QF	QFF	QJ	QFJ	QN	QFN
QP	QFP	QT	QTP	QW	QFI
SA	TSOP(1)	SB	TSOP(2)	SF	SOF
SJ	SOJ	SN	SON	SP	SOP
SS	SIP	SV	SVP	SW	SOI
TP	Asymmetric DTP				
ZP	ZIP	ZZ	Special		

- **Package mounting height code (1 alphanumeric character)**

Code	Description	Code	Description	Code	Description
R	1.70＜R	L	1.20＜L ≦1.70	T	1.00＜T ≦1.20
V	0.80＜V ≦1.00	W	0.65＜W ≦0.80	U	0.50＜U ≦0.65
X	X≦0.50				

- **Package structure code (1 alphanumeric character)**

Code	Description	Code	Description
C	Ceramic (Laminated ceramic)	G	Ceramic (Glass sealed)
M	Package consisting of metal	P	Package consisting of plastic
S	Package using wafer process	T	Package consisting of tape
W	Light transmissive package		

Part No. Composition

M51943 ML - D F 0J

- Internal code
- Lead plating specification ►
- Taping and packing specification ►
- Package type ►
- Product type number ►

► **Lead plating specifications**

6	General product
F	Lead-free product

► **Taping and packing specifications**

D	Embossed tape (see the figure at right)
C	Embossed tape (see the figure at right)
A	Paper tape (TO-92L)
T	Tube (SIP)

► **Package types**

ML	SOT-89
SL	TO-92L
FP	SOP
GP	SOT-23, SSOP
HP	SOT-23

► **Product type number (Base series)**

HA1630	CMOS Operational Amplifier
HA1631	CMOS Comparator
HA17	Standard Linear IC
HA16	Standard Linear IC (for industry)
RNA5	Reset IC
RNB	Overseas Sales Only

HA1630 S01 CM EL

RNA5 2A10 MM EL

- Taping and packing specification ►
- Package type ►
- Internal code
- Product type number ►

► **Taping and packing specifications**

E	Embossed tape CMPAK, VSON, SSOP
EL	Embossed tape, left-winded SOP, TSSOP (24 or more pins)
ELL	Embossed tape, left-winded, large diameter TSSOP (20 or less pins)

► **Package types**

P	DIP, TO-92, TO-92MOD
F, FP	JEITA SOP
RP	JEDEC SOP
T	TSSOP, TVSOP-80
LP	MPAK-5
CM	CMPAK
LTP	MPAK
US	SSOP-8
U	UPAK
MM	MMPAK-8
PS	DIP-8
–	DIP

Standard Logic Part No. Composition

HD74HC T 1G 04 CM E

■ Base Series

HD74HC	HD74HC Series
HD74AC	HD74AC Series
HD74LV-A	HD74LV-A Series
HD74ALVC	HD74ALVC Series
HD74CBT	HD74CBT Series
HD26	HD26 Series
HD29	HD29 Series
HD151	HD151 Series
RD74LVC-B	RD74LVC-B Series
RD3CYD	RD3CYD Series
RD5CYD	RD5CYD Series
RD74HV	RD74HV Series

■ Taping Abbreviation

E	Embossed	CMPAK, VSON, SSOP
EL	Embossed, left-reel	SOP, TSSOP (24 or more pins)
ELL	Embossed, left-reel, large	TSSOP (20 or less pins)

■ Package Abbreviation

P	DIP
FP	JEITA SOP
RP	JEDEC SOP (Overseas sales only)
T	TSSOP
SS	SSOP (Without 8 pins)
CM	CMPAK
VS	VSON
US	SSOP-8

■ Product Name Number (Function)

■ Package

1G	5-pin / 6-pin device
1GW	6-pin device
2G	6-pin / 8-pin device
No code	Other

■ TTL Input Level Product

Note: TTL input versions of the HD74LV1G/2G are the LV1GT/2GT.

Part No. Destination of Series Regulators

µPC 29 M 33 A T
  1   2   4   5   6   7

µPC 12 1 W 18 A T1F
  1   2 3   4   5   6   7

1 Product category
C: Bipolar integrated circuits
D: CMOS integrated circuits

2 Series
[Bipolar type]
78: Standard positive voltage
29: Low-power LDO positive voltage
[CMOS type]
12: CMOS positive voltage

3 Additional functions
0: None
1: ON/OFF

4 Output Current
L: 100mA
N: 300mA
M: 500mA
No representation: 1A
A: 2A
W: 1.5A

5 Output voltage
00: Variable
10: 1.0V or 10V
15: 1.5V or 15V
18: 1.8V or 18V
25: 2.5V
33: 3.3V
05: 5.0V

6 Version

7 Package
T: SC-63 or SOT-89
T1D: TO-252 (Pin 3)
HB: SC-64
TA: SC-74A
T1B: SOT-89
T1F: TO-252 (Pin 5)

Part No. Destination of Switching Regulators

µPC 1933 GR
  1   2   3

1 Product category
C: Bipolar integrated circuits
D: CMOS integrated circuits

2 Product serial number

3 Package
C, CX: DIP
G, GR, GS: SOP
W: wafer

Part No. Destination of Op Amp & Comparators

µPC 358 GR-9LG
  1   2   3

1 Product category
Bipolar integrated circuits

2 Product serial number
• Teperature spec expanding products
or industrial use products apply particular
products serial number.
(Example) 1251, 451, 258 etc.
• General use products apply those of
first source manufacturers
(Example) 358, 324, 4558 etc.

3 Package
GR-9LG: TSSOP
MN-KAA: TSSOP(3×3)
MP-KAA: TSSOP(2.8×2.9)
G2:   SOP(225mil)
C: DIP(300mil)

Package		Packing Unit (pcs/reel)	Symbol	Appearance	Magazine	
					(pcs/Stick)	(pcs/Inner Box)
SOP (JEITA)	FP-8DGV	2,500	-EL		100	1,000
	FP14DAV/ 16DAV	2,000			50	1,000
	FP-20DAV				40	1,000
SOP (JEDEC)	FP-8DCV	2,500	-EL		–	–
	FP-14DNV	2,500			–	2,500
TSSOP	TTP-8DAV	3,000	EL		–	–
	TTP-14DV	2,000	ELL		–	2,000
MMPAK-8		3,000	EL		–	–
UPAKV		1,000 or 1,000×4	-TL		25	2,500
MPAK-5V MPAKV CMPAK-5V		3,000	-EL		–	–
TO-92/ TO-92MODV		2,500 (pcs/BOX)	-TZ	an enlargement (Part No.) + (-TZ) (EIAJ-RC-1008B) Zigzag Box	–	–
DIP	DP-8	–	–	–	50	1,000
	DP-14/16				25	1,000
	DP-20				20	1,000

Products with "-EL" and "-TL" (UPAKV) are the counterclockwise-reeled emboss-tape type.
Please order the products in multiples of 1000 in magazines.
Please order the products in packing units for shipment in reel.
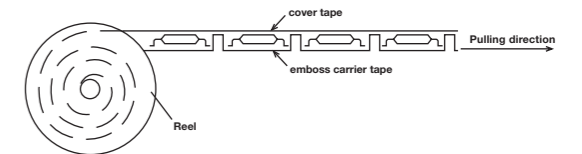
Package		Emboss Taping (pcs/reel)		Tube (pcs/stick)		Tube (pcs/inner box)		Tray (pcs/tray)		Tray (pcs/inner box)	
		Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof	Normal	Moisture-proof
SIP	5P5P			45		4950					
	8P5			25		2500					
DIP	8P4			50		2250 or 2000					
	14P4			25		1125 or 1000					
	16P4			25		1125 or 1000					
	18P4			20		900 or 800					
	20P4			20		900 or 800 or 720					
	22P4H			17		765 or 680					
				19							
	24P4D			16		720 or 640					
SDIP	20P4B			25		1125 or 1000					
SOP	8P2S-A			100		15000					
	10P2-C	2000	2000	80	80	8000 or 4800	1920 or 2560				
	10P2N-A		2000	70	70	7000	2240 or 4200				
	14P2P-A		3000	60	60	9000	1800				
	14P2N-A		2000	50	50	5000	1600 or 3000				
	16P2S-A		3000	50		7500					
	16P2N-A		1000	50	50	5000	1600 or 3000				
	20P2N-A		2000	40	40	4000	1280 or 2400				
	24P2N-B		2000	35	35	3500	1120 or 2100				
	24P2V-A		1000	30	30	2400	1800				
SSOP	8P2J-A										
	16P2E-A		3000 or 2500	90	90	2160	900				
	20P2E-A		4000 or 2500 or 500	70	70	1680	4000				
				80	80	7680	4000				
	24P2E-A		2500	60	60	5760	600				
					65		6240				
	24P2Q-A		2000	50	50	5000	1600 or 3000				
	36P2R-A		1000	35	35	2100	350 or 980	250		1250	
LQFP	48P6D-A		1000					144		720	

C
Indicates T1 direction

D
Indicates T2 direction
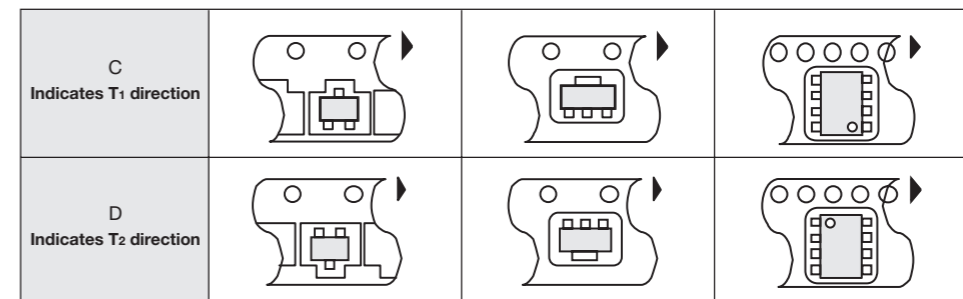
Packing 2

General-Purpose Logic Taping Specifications

Package		Packing Configurations	Packing Unit (pcs/reel)	Symbol	Appearance
SOP (JEITA)	SOP-8* (FP)	Magazines (Multiples of 1000) Taping	2500	EL	
	SOP-14* (FP)		2000		
	SOP-16* (FP)				
	SOP-20* (FP)				
SOP (JEDEC)	SOP-8 (RP)	Magazines (Multiples of 1000) Taping	2500	EL	
	SOP-14* (RP)				
	SOP-16* (RP)				
	SOP-20* (RP)		1000		
TSSOP (JEITA)	TSSOP-14 (T)	Taping	2000	ELL	
	TSSOP-16 (T)				
	TSSOP-20 (T)				
	TSSOP-24 (T)	Taping	1000	EL	
	TSSOP-48 (T)				
CMPAK VSON	CMPAK-5,6(CM)	Taping	3000	E	
	VSON-5(VS)				
SSOP	SSOP-8 (US)	Taping	3000	E	
	SSOP-36 (FP)		1000	HO	

EL/ELL is the counterclockwise-reeled emboss-tape type.

Products in DIP will be shipped in magazines only, and products in TSSOP, CMPAK, VSON, SSOP will be shipped in taping only, and products in SOP will be shipped in both magazines and taping.

*: Please order the products in multiples of 1000 for shipment in magazines (applicable only to " * " and DIP).

Packaging

Environmental Considerations for Renesas Electronics Products

Renesas Electronics is working actively to improve product environmental quality in all aspects of its business operations, including product design, materials procurement, manufacturing, and shipping.

Design
- **Development of environmentally compliant products through product environmental assessment**
  Making products more resource and energy efficient (more compact, higher integration, reduced power consumption, extended service life)
  Reducing environmental load due to chemicals (management of chemical content of products)
- **Compliance with domestic and international product environmental regulations**
  EU RoHS Directive, China RoHS, ELV Directive, REACH Regulation

< Renesas Product Environmental Quality Management Sequence >

Global environmental preservation
Resource conservation / Health effects

Regulations
RoHS Directive
WEEE Directive
ELV Directive
REACH Regulation
China RoHS   etc.

Customers
Requirement to eliminate restricted substances
Requirement to report chemical substances content

Renesas Electronics

Requirement to eliminate restricted substances
Requirement to report chemical substances content

Suppliers

Development, design
Design of environmentally compliant products (development and design operations)

Procurement
Green procurement (materials procurement and product environmental management operations)
Conformance assessment (quality assurance, development, and design operations)

Manufacturing
Production management (manufacturing operations)

Shipment of environmentally compliant products

Management of chemical substances

Procurement
- **Thoroughgoing green procurement activities**
- **Investigation and confirmation of chemical content of procured parts and materials**

Manufacturing
- **Prevention of inclusion or contamination by prohibited chemicals in products (process management)**
- **Reduction of CO_2 emissions (reduction of PFC output and energy usage), reduction of environmental load from chemicals used in manufacturing, reduction of waste materials**

Shipping
- **Reduction of volume of packing materials (expanding reuse of plastic packaging materials)**
- **Reduction of energy consumption in transport (improving overall efficiency of distribution)**

Compliance with customer requirements	Transmission of information such as chemical content of products

RoHS: Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
WEEE: Waste Electrical and Electronic Equipment
ELV: End of Life Vehicles
REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals

Renesas Green Device Accreditation System

Renesas green device definitions:
Renesas Electronics defines green devices as products that reduce environmental impact by more than a specified amount over their life cycle, which includes procurement, production, distribution, use, and disposal, as determined at the R&D and design stage according to the company's internal environmental standards. Renesas Electronics recognizes three green device ranks for each fiscal year.

a) Green devices:
Products having a "FactorX" score of 1 or higher after completion of a product environmental assessment (at completion of development) and an improvement ratio of 10% or greater.

b) Supergreen devices:
Products that have been assigned a "FactorX" score after completion of a product environmental assessment (at completion of development) and an improvement ratio that place them among the top 20 products.

c) Ultragreen devices:
Products selected from among the supergreen devices as having environmental performance that is No. 1 in the industry or extremely high, or products that combine high environmental performance with excellence in another aspect such that they are considered to contribute substantially to boosting the presence of Renesas Electronics.

RoHS: Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
WEEE: Waste Electrical and Electronic Equipment
ELV: End of Life Vehicles
REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals

Visit www.renesas.com for comprehensive support for your development work.

Searching by Application

The selection of application examples on the Renesas Electronics website has been further enhanced. You can search for product examples among the following categories.
- Mobile/networking
- PCs and PC peripherals
- Consumer electronics
- Healthcare
- Automotive
- Industrial/building management
- Elemental technologies

Searching by Category

From the standard IC top page you can search for content arranged by product series from among categories such as power ICs, op-amps and comparators for use with MCUs, converter ICs, and logic ICs. In addition, you can use the navigation panel on the left to locate documentation related to standard ICs.

Searching by Product Name

By using the search function on the top page you can go directly to the content that interests you.

❶ Keyword/Part No. Search

You can search the contents of the website by entering keywords or enter a part number to view a listing of product specifications. On the results page you can switch to the information you need by clicking the corresponding tab. (Click on the tabs in the back to display the product pages from which datasheets, etc., can be obtained.)

❷ Parametric Search

You can display custom listings of product specs by narrowing the range of functions or specifications to search for. The search results can then be downloaded as a CSV file.

❸ Document Search

You can search for documents by document type or document number.

❹ Obsolete/Discontinued Product Search

You can search for information on products that have been discontinued or are no longer being actively promoted.

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We aim to offer a total support package to meet customers' needs through the provision of simulation data, FAQ, seminars, inquiries via the Web, and so on.

Renesas VP
The Buck Designer section of Renesas VP enables you to enter your usage conditions to obtain a listing of the optimal power MOSFETs for your buck converter and a graphical display of its simulated characteristics.

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http://www.renesas.com

Overseas   http://www.renesas.com/en/gpsp

memo

Renesas General-Purpose ICs (Power Management Linear ICs/ General-Purpose Linear ICs/ General-Purpose Logic ICs) General Catalog

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