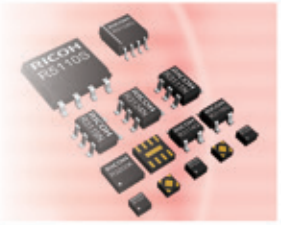
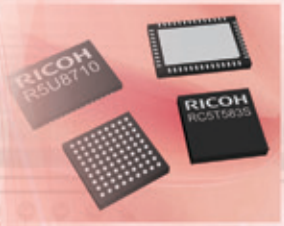
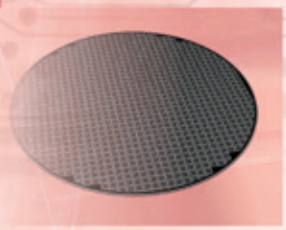
RICOH

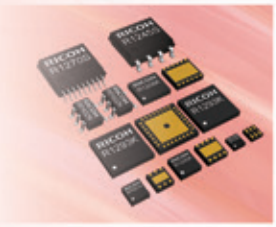
imagine. change.

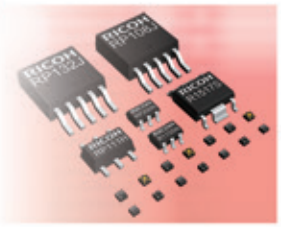




Electronic Device Product Selection Guide 2016







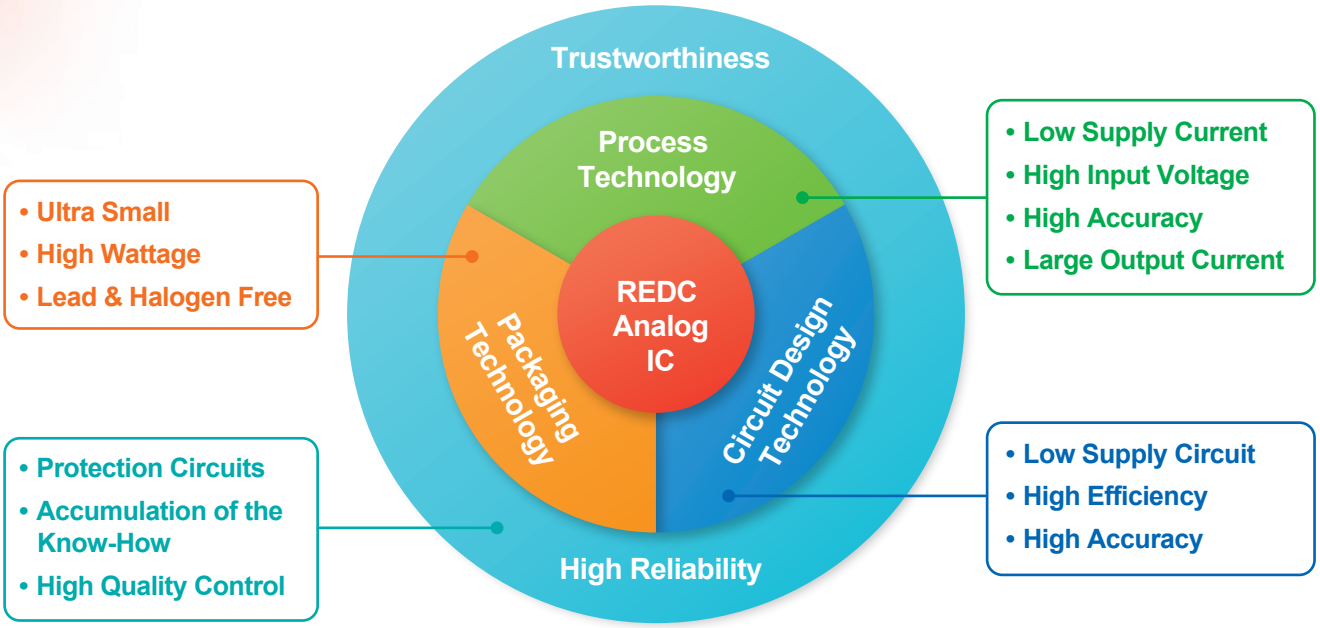
RoHS Compliant

Halogen Free

Electronic Devices Selection Guide

Introduction

Ricoh Electronic Devices Co., LTD. (REDC) offers safe and trusted high-performance CMOS analog devices developed by using our unique manufacturing process and circuitry technologies as well as the latest mounting technology. We promise that our devices can contribute to creating power-saving, small-sizing, high-precision and high-reliability products.



Definition of Marks

These are the definition of marks used in this selection guide.

: Products Newly Released

: Products in Development

H/F : Halogen-free

Rxxxx : Succeeding Products, The performance is improved without any change in pin positioning.

Automatic : Automatic Shift to ECO Mode

Manual : Manual Shift to ECO Mode

Manu/Auto : Manual/Automatic Shift to ECO Mode

Seamless : Seamless Shift to ECO Mode

Thermal : Thermal Shutdown Circuit

Constant : Constant Slope Circuit

Reverse : Reverse Current Protection Circuit

Soft-Start : Soft-start Circuit

Inrush : Inrush Current Limit Circuit

OVLO : Overvoltage Lockout Circuit

UVLO : Undervoltage Lockout Circuit

OVP : Overvoltage Protection Circuit

Shutdown : Shutdown Function

Discharge : Auto-discharge Function

Anti-Ringing : Anti-ringing Switch

Phase : Internal or External Phase Compensation

● : Automotive Products Available

■ : High Temperature Products Available

◆ : Automotive Products Only

◆ : JEDEC-Compliant

Sequencing : Start-up Sequencing Control

Maxduty : Maximum Duty Cycle

LED Adjust : High-speed LED Adjustment

Single-Wire : Single Wire Interface

Diode : Diode Rectification

Synchro : Synchronous Rectification

TempCo : Output Voltage Temperature Coefficient

Ripple : Ripple Rejection, Frequency = 1 kHz

Load Reg : Load Regulation

TempChar : Temperature Characteristics

Peak : Peak Voltage, Application Time = 200 ms or less

SSCG : Spectrum Diffusion Type Oscillator

PG : Power Good Function

Tantalum : Tantalum Capacitor

Index

Power Management

Package Information

Real Time Clocks

LD Driver LSI

Multiple-PMU

High Temperature Products

Overview

REDC offers a wide range of semiconductor devices that are designed for the use in high-temperature environment. We provide high temperature products for consumer applications with maximum operating temperatures of 105°C and 125°C, and for industrial applications that have passed both the screening at high temperature and the reliability test with extended hours. For the high temperature products for industrial applications, "-Y" is added to the end of the product name.

Quality Class		Operating Temp. Range	Screening 25°C	Screening High Temp.	Reliability Test	Applications	Product Name Ex.
High Temperature	Industrial Applications	−40°C to 105°C −40°C to 125°C	●	●	2000 Hrs.	Equipments used under high-temperature conditions, Equipments accompanied by self-heating	R1524x-Y
	Consumer Applications	−40°C to 105°C −40°C to 125°C	●		1000 Hrs.	Portable Equipment, Power source for home appliances	R1524x

: Products Newly Released : Products in Development

Voltage Regulators

Product Name	Operating Temperature Range (°C)	Output Current (mA)	Input Voltage Range (V)	Absolute Max. Ratings (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Dropout Voltage*1(V) Max.	Dropout Voltage*1(V) Condition	Supply Current (μA) Typ.	Capacitor Capacitance (μF)	Other Features	Package
R1515x	-40 to 105	50	4.0 to **36.0**	50.0	2.0 to 12.0	±2	0.20	0.35	IOUT=20mA VSET=5.0V	9	0.1 to 10	Peak Thermal	SOT-89-5 HSOP-6J
RP130x-Y	-40 to 105	150	1.7 to 6.5	7.0	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 3.6, 5.0	±1	0.32	0.51	IOUT=150mA VSET=2.8V	38	0.47 or more	TempCo : ±20ppm/°C Ripple : 80dB Discharge : Ver.D	DFN(PLP)1010-4 SOT-23-5
RP171N-Y	-40 to 105	150	2.6 to 10.0	12.0	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0, 6.0	±1	0.400	0.600	IOUT=150mA VSET=2.8V	23	1 or more	Thermal Discharge : Ver.D Constant Ripple : 70dB	SOT-23-5
R1154x	-40 to 105	150	Max. **24.0**	26.0	2.5 to 12.0 2.5 to 24.0, Ext.Adjustable	±2 ±50mV	0.20	0.40	IOUT=20mA	5	0.1 to 2.2	Thermal	DFN1616-6 SOT-23-5 SOT-89-5
R1155x	-40 to 105	150	3.5 to **24.0**	26.0	2.5 to 12.0 2.5 to 23.0, Ext.Adjustable	±2 ±50mV	0.55*2	1.7*2	IOUT=150mA VSET=5.0V	65*2 7.5*3	4.7 or more	Automatic Thermal Reverse	SOT-23-5 SOT-89-5
R1180x-Y	-40 to 105	150	1.7 to 6.0	6.5	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.4	±2	0.25	0.40	IOUT=150mA VSET=2.8V	**1**	**0.1 or more**		SON1612-6 SOT-23-5
R1514x **R1514x-Y**	-40 to 105	150	4.0 to **36.0**	50.0	2.0 to 12.0 Y: 2.5, 2.8, 3.0, 3.4, 5.0, 6.0, 8.0, 8.5, 9.0, 12.0	±2	0.20	0.35	IOUT=20mA VSET=5.0V	9	0.1 to 10	Peak Thermal	SOT-89-5 HSOP-6J
R1516x	-40 to 105	150	4.0 to **36.0**	50.0	1.8 to 6.2	±1	—	0.60	IOUT=20mA VSET=5.0V	29	0.1 to 20	Thermal	SOT-89-5 HSOP-6J
R5112S +VD **R5112S-Y** +VD	-40 to 105	200	3.5 to **42.0**	50.0	1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0 B: 1.6 to 4.8, D: 2.9 to 4.8, Detector Threshold Range	**±0.6** VD: ±0.6	0.6	1.7	IOUT=200mA VSET=5.0V	3.8	**0.1 or more**	Peak Thermal	HSOP-8E
R1524x **R1524x-Y**	-40 to 105 Y: -40 to **125**	200	3.5 to **36.0**	50.0	1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0, 6.0, 8.0, 8.5, 9.0	**±0.6**	0.6	1.7	IOUT=200mA VSET=5.0V	**2.2**	**0.1 or more**	Thermal	DFN(PLP)1820-6 SOT-23-5 SOT-89-5 HSOP-6J
RP170x-Y	-40 to 105	300	2.6 to 10.0	12.0	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0, 6.0	±1	0.770	1.185	IOUT=300mA VSET=2.8V	23	1 or more	Ripple : 70dB Thermal Constant Discharge : Ver.D	SOT-23-5 SOT-89-5
R1510S +VD	-40 to 105	300	3.5 to **36.0**	50.0	2.5 to 12.0 Ver.A,B,C: 2.3 to 12.0, Ver.D: 2.3 to 10.6, Detector Threshold Range	±1.6 VD: ±1.9	1.0*2	2.0*2	IOUT=300mA VSET=5.0V	110*2 12.5*3	6.8 or more	Automatic Thermal	HSOP-8E
R1511x **R1511x-Y**	-40 to 105	300	3.5 to **36.0**	50.0	3.0 to 9.0 Y: 3.0, 3.3, 3.4, 5.0, 6.0, 8.0, 8.5, 9.0 3.0 to 12.0, Ext.Adjustable	±1 ±30mV	0.64	1.0	IOUT=300mA VSET=5.0V	100	6.8 or more	Peak Thermal	HSOP-6J TO-252-5-P2
R1513S **R1513S-Y**	-40 to **125**	300	3.5 to **36.0**	50.0	1.2, 1.5, 1.8, 3.3, 3.4, 5.0 1.2 to 18.0, Ext.Adjustable	**±0.8**	0.32	0.60	IOUT=300mA VSET=5.0V	75	4.7 or more	Thermal Ripple : 70dB Discharge : Ver.D	HSOP-6J
RP111x-Y	-40 to 105	500	1.4 to 5.25	6.0	**0.7**, 1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.4 0.7 to 3.6, Ext.Adjustable	**±0.8**	0.23	0.34	IOUT=500mA VSET=2.8V	80	1 or more	Load Reg : Typ. 1mV Thermal Inrush response accuracy*4: Typ.-75mV/+45mV Discharge : Ver.D	DFN1212-6 SOT-23-5 SOT-89-5
R1500H	-40 to 105	500	4.0 to **24.0**	36.0	3.0 to 12.0	±2	0.115	0.180	IOUT=200mA VSET=5.0V	70	10 or more	Thermal	SOT-89-5
R1517x	-40 to 105	500	3.5 to **36.0**	50.0	2.5, 3.3, 3.4, 5.0, 8.5 2.5 to 12.0, Ext.Adjustable	**±0.8** ±20mV	0.35	0.62	IOUT=500mA VSET=5.0V	18	**0.1 or more**	Constant : Ext.Adjustable Thermal Discharge : Ver.D/F	HSOP-6J TO-252-5-P2

Product Name	Operating Temperature Range (°C)	Output Current (mA)	Input Voltage Range (V)	Absolute Max. Ratings (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Max.	Condition	Supply Current (μA) Typ.	Capacitor Capacitance (μF)	Other Features	Package
RP115x-Y	-40 to 105	1A (500)	1.4 to 5.25	6	**0.7** to 4.3	±1	0.13	0.18	IOUT=1A	110	1 or more	Ripple : 80dB (VSET≤1.8V) Thermal Reverse Constant Inrush Load Reg : Typ.1mV TempChar : Typ.±30ppm/°C Discharge : Ver.D	DFN1216-8 SOT-89-5
RP132x-Y	-40 to 105	1A	1.4 to 6.5	7.0	**0.8**, 1.2, 1.5, 1.8, 2.5, 3.0, 3.3, 5.0 0.8 to 5.5, Ext.Adjustable	±1 ±15mV	0.52	0.72	IOUT=1A VSET=2.8V	65	2.2 to 4.7 or more	Load Reg : Typ.5mV Ripple : 70dB Thermal Inrush Discharge : Ver.D	DFN(PLP)1820-6 SOT-89-5 HSOP-6J TO-252-5-P2
R1501x	-40 to 105	1A	3.0 to **24.0**	36.0	3.0 to 18.0	±2	0.575	0.900	IOUT=1A VSET=5.0V	70	10 or more	Thermal	HSOP-6J TO-252-5-P2
R1518x	-40 to 105	1A	3.5 to **36.0**	50.0	2.5, 3.3, 3.4, 5.0, 6.0, 8.5 2.5 to 12.0, Ext.Adjustable	**±0.8** ±20mV	0.70	1.30	IOUT=1A VSET=5.0V	18	**0.1 or more**	Constant : Ext.Adjustable Thermal Discharge : Ver.D/F	HSOP-6J TO-252-5-P2
RP108J-Y	-40 to 105	3A	1.6 to 5.25	6.0	**0.8**, 1.2, 1.5, 1.8, 2.5, 3.0, 3.3 0.8 to 4.2, Ext.Adjustable	±1	0.51	0.67	IOUT=3A VSET=2.8V	350	10 or more	Load Reg : Typ.3mV Thermal Reverse Constant Discharge : Ver.D/F	TO-252-5-P2

*1 Set Output Voltage (VSET) = 2.8 V or close to 2.8 V unless otherwise noted. *2 Fast Mode *3 Low Power Mode *4 1 mA ⇔ 250 mA

Voltage Detectors

Product Name	Operating Temperature Range (°C)	Operating Voltage Range (V)	Absolute Max. Ratings (V)	Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Reset Signal	SENSE Pin	Adjustable Release Output Delay Time	Output Delay Time Accuracy (%)	Supply Current*1 (μA)	Hysteresis	Package
R3116x-Y	-40 to 105	0.5 to 6.0	7.0	0.7 to 5.0	±0.8	L	N	Ext.Capacitor	±15	0.35	Y	DFN(PLP)1010-4 SOT-23-5
R3117x	-40 to 105	1.0 to 6.0	7.0	0.7 to 5.0	±1.0	L	Y	—	—	0.29	Y	DFN(PLP)1010-4 SC-88A SOT-23-5
R3119xxxxA R3119xxxxA-Y	-40 to 105	1.2 to 36.0	50.0	2.3 to 12.0	±1.5	L	N	Ext.Capacitor	-50/+80	3.3	Y	DFN(PLP)1820-6 SOT-23-5
R3119xxxxE R3119xxxxE-Y		2.1 to 6.0*2	7.0				Y	—	—			
R3150NxxxA R3150NxxxA-Y R3150NxxxB R3150NxxxB-Y	-40 to 105	1.4 to 36.0	50.0	Detector Threshold Range: 5.0 to 10.0, Release Threshold Range: 5.3 to 11.0	Detector Threshold Accuracy: ±1.5, Release Threshold Accuracy: ±1.5	L H	N	Ext.Capacitor, Release Output Delay Time and Detector Output Delay Time are Adjustable	Output Delay Time Accuracy: -35/+40, Detector Output Delay Time Accuracy: -35/+40	3.8	Y	SOT-23-6
R3150NxxxE R3150NxxxE-Y R3150NxxxF R3150NxxxF-Y		3.6 to 6.0*2	7.0			L H	Y			3.5		

*1 Detector Threshold (-VDET) = 1.5 V, Detection released *2 Input Voltage Range of SENSE Pin: 0 V to 36.0 V

Watchdog Timers

Watchdog Timer with Voltage Detector and Voltage Regulator

Product Name	Operating Temperature Range (°C)	Operating Voltage Range (V)	Absolute Max. Ratings (V)	Voltage Detector Section: Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Release Delay Time*1 (ms) Min.	Typ.	Max.	Watchdog Timer Section: WDT Timeout Period*2 (ms) Min.	Typ.	Max.	Inhibit Pin	Voltage Regulator Section: Output Voltage Range (V)	Output Voltage Accuracy (%)	Output Current (mA)	Supply Current (μA) Typ.	Package
R5110Sxx1A R5110Sxx1B*3	-40 to 105	3.5 to 36.0	50.0	1.6 to 5.5	±1.8*4	194	242	290	14.4	18.0	21.6	N	1.8 to 5.0	±1.5*4	500	25	HSOP-8E
R5110Sxx2C R5110Sxx2D*3												Y					HSOP-18
R5111Sxx1A-Y R5111Sxx1B-Y*3	-40 to 105	3.5 to 36.0	50.0	1.6 to 5.5	±1.8*4	194	242	290	14.4	18.0	21.6	N	1.8 to 5.0	±1.5*4	300	25	HSOP-8E
R5111Sxx2C-Y R5111Sxx2D-Y*3												Y					HSOP-18

*1 R5110S/R5111S: CD = 0.22 μF *2 R5110S/R5111S: CTW = 0.01 μF *3 Window watchdog timer. Window watchdog timer monitors microprocessor activity and asserts a reset signal if the watchdog pulse does not occur within the defined time window (open window) or if the watchdog pulse occurs within the other defined time window (close window).
*4 Detector threshold accuracy in operating temperature range.

Watchdog Timer with Voltage Detector

Product Name	Operating Temperature Range (°C)	Operating Voltage Range (V)	Absolute Max. Ratings (V)	Voltage Detector Section: Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Release Delay Time Accuracy (%)	Watchdog Timer Section: WDT Timeout Period Accuracy (%)	Inhibit pin	Supply Current (μA) Typ.	Other Features	Package
R5106N	-40 to 105	0.9 to 6.0	7.0	1.5 to 5.5	±1.0	±16	±33	Y	11	CD Pin and CTW Pin are combined.	SOT-23-6
R5107G										MR Pin is included.	SSOP-8G
R5108G		1.5 to 6.0								SENSE Pin is included.	
R5109G		0.9 to 6.0							11.5	2 Clock Input Type	

High Temperature Products

DC/DC Converters

High Voltage Step-down DC/DC Converters

Product Name	Version	Operating Temperature Range (°C)	Control	Input Voltage Range (V)	Absolute Max. Ratings (V)	Output Voltage Range (V)	V_{FB} Voltage Accuracy (%)	Switching Frequency (kHz)	Output Current*1 (A)	Protection Circuit Type	Other Features	Package
R1245x	00xA/C/E/G 00xB/D/F/H	-40 to 105	PWM	4.5 to 30.0	32.0	0.8 to 27.6, Ext.Adjustable	0.8V±1	330: xxxA/B 500: xxxC/D 1000: xxxE/F 2400: xxxG/H	1.2	Latch Fold-back	Diode UVLO Soft-Start Thermal	DFN(PLP)2020-8 SOT-23-6W HSOP-8E
R1270S	001A 001B	-40 to 105	PWM, PWM/VFM Auto-Switching	3.6 to 34.0	36.0	0.8 to 31.6, Ext.Adjustable	0.8V±1	300 to 2400: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	3	Fold-back Latch Fold-back	Diode UVLO OVLO Soft-Start : Ext.Adjustable Thermal FLG pin	HSOP-18
R1272S R1272S-Y	xxxA	-40 to 105	Forced PWM, PWM/VFM Auto-Switching	4.0 to 34.0	36.0	0.7 to 5.3, Ext.Adjustable	0.64V±1	250 to 1000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	External	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP	HSOP-18
R1273L R1273L-Y	xxxA	-40 to 105	Forced PWM, PWM/VFM Auto-Switching	4.0 to 34.0	36.0	0.7 to 5.3, Ext.Adjustable	0.64V±1	250 to 1000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	14	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP	QFN0505-32B
R1275S R1275S-Y	003x	-40 to 105	Forced PWM, PWM/VFM Auto Switching	3.6~34.0	36	3.3 to 5.0, Ext.Adjustable	0.64V±1	2000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit (1800 to 2200)	2	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP OVLO	HSOP-18

*1 Output Current (I_{OUT}) can be affected by environmental conditions or external components. This is an approximate value.

Low Voltage Step-down DC/DC Converters

Product Name	Version	Operating Temperature Range (°C)	Control	MODE Pin	Input Voltage Range (V)	Absolute Max. Ratings (V)	Output Voltage Range (V)	V_{FB} Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Current*2 (A)	Protection Circuit Type	Other Features	Package
RP506L-Y	xx1G/K xx1H/L 001N 001M	-40 to 105	Forced PWM, PWM/ VFM Auto Switching	Y	2.5 to 5.5 or 2.5 to 4.5	6.5	0.8, 1.0, 1.1, 1.2, 1.3, 1.5, 1.8, 1.85, 3.0, 3.3 0.8 to 4.0, Ext.Adjustable 0.6 to 4.0, Ext.Adjustable	±1.5% 0.6V±9 0.6V±9	1200: xxxK/L/M 2300: xxxG/H/N	2	Latch	Synchro Soft-Start : Ext.Adjustable UVLO Thermal Discharge PG	DFN3030-12
RP510L-Y	xx1/4G xx1/4H 001/4J 001/4N	-40 to 105	Forced PWM	N	2.5 to 5.5	6.5	0.8, 1.0, 1.1, 1.2, 1.3, 1.5, 1.8, 3.0, 3.3 0.8 to 3.3, Ext.Adjustable	±1.0 0.6V±6	2300	4	xx1/001: Latch xx4/004: Fold-back	Synchro Soft-Start : Ext.Adjustable UVLO Thermal Discharge PG	DFN3030-12

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Output Current (I_{OUT}) can be affected by environmental conditions or external components. This is an approximate value.

● **Step-up DC/DC Converter with Charge Pumps for TFT/LCD**

Product Name	Control	Operating Temperature Range (°C)	Input Voltage Range (V)	Absolute Max. Ratings (V)	Output Voltage Range (V)	Output Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Tr.	Lx Current Limit*2 (A)	Protection Circuit Type	Other Features	Package
R1294L-Y	CH1: PWM, Step-up	-40 to 105	2.0 to 5.5 : 101A 2.5 to 5.5 : 102A 3.3 to 5.5 : 103A	6.5	CH1: Ext.Adjustable, up to 20.0	1.0V-40/+25	210 to 1400, Ext.Adjustable, 800-10%/+14%*3	Internal	CH1: 2	Latch	The charge pump operates at 1/4th operating frequency. Soft-Start : Ext.Adjustable Sequencing UVLO Phase : Ext. Maxduty : Ext.Adjustable	QFN0404-24B
	CH2: Charge pump, Positive				CH2/3: Ext.Adjustable	1.5V-50/+35						
	CH3: Charge pump, Negative					0V±35						

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Lx Current Limit is not Output Current. *3 This specification is guaranteed by design engineering at -40°C to 105°C.

REDC Products and Website Information

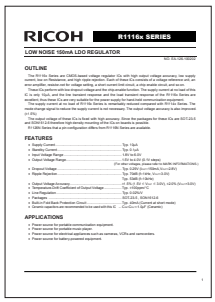
SELECTION GUIDE 2016

Corporate Information - PDF

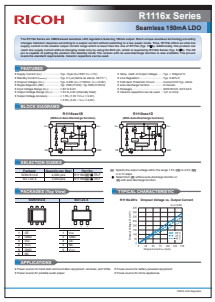
October, 2015 Edition

Product Information - PDF

Datasheet



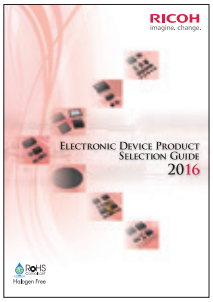
Product News



Design guide for DC/DC converter is also available for referring typical applications, recommended parts and board layouts.

Product Information - Catalog

● Electronic Device Selection Guide

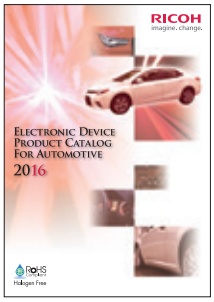


March, 2016 Edition

● PMIC Catalog English

October, 2014 Edition

● PMIC Catalog for Automotive Application



December, 2015 Edition

Website Information - http://www.e-evices.ricoh.co.jp/en/

Latest product information and datasheets are available. We provide useful information. We hope our website helps you.

Voltage Regulators

Grey-out Products : The successors of these products are indicated in Other Features

● : Automotive Products Available ■ : High Temperature Products Available : Products Newly Released : Products in Development

Maximum Input Voltage and Output Current Chart

Product Type		Max. Input Voltage (V)	Output Current: Up to 150mA Single	Up to 150mA Dual	Up to 200mA	Up to 300mA Single	Up to 300mA Dual	Up to 400mA	Up to 500mA	Up to 800mA	Up to 1A	Up to 3A
High-performance		5.25	RP112x			RP102x	RP150K		RP111x			
		6									R1172x R1173x	
		6.5	RP130x									
Standard		-10~-2.5	RP117x: ~100mA									
		3.6						RP106x RP116Z				
		5.25	RP109x	RP152x RP153L	RP100x RP155Z	RP101x RP114x	RP154x	RP105x	RP115L*1		RP115x*1	RP108J
		6								R1170x		R1171S: Up to 1.5A R1171J: Up to 2A
		6.5									RP131x RP132x	
		8	R1111N R1121N			R1130H						
		10	RP171x			RP170x						
		16									R1190x	
		24							R1500H		R1501x	
		36	R1516x			R1511x R1513S						
Low Supply Current		5.25	RP110x									
		6	R1180x									
		8	Rx5RW: Up to 80mA Rx5RZ: Up to 100mA									
		10	Rx5RL: Up to 80mA									
		11	RP173x*2									
		24	R1150H +VD R1154x									
		36	R1515x: 50mA R1514x		R5112S +VD R1524x				R1517x		R1518x	
ECO Functions	Automatic Mode Shifting	5.25	RP118x: ~100mA (5.5V)		RP202x							
		6		R5326K								
		24	R1155x									
		36				R1510S +VD						
	Manual/Automatic Mode Shifting	5.25	RP201x			RP200x						
	Seamless	6	R1116x									
	Manual Mode Shifting	6	R1163x	R5328K	R1160N							
		16				R1191x						
Ext. PNP Tr. Type		10									RN5RF	

*1 Output Current (I_{OUT}) is switchable between 500 mA and 1 A using the LCON pin of DFN1216-8. *2 RP173x: V_{SET} + 6.5 V ≤ 11.0 V

25 mA to 120 mA Voltage Regulators

Product Name	Output Current (mA)	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Max.	Condition	Supply Current (µA) Typ.	RR@1kHz (dB) Typ.	Capacitor Capacitance (µF)	Other Features	Package
Rx5RL	25 to 80	Max.10.0	2.0 to 6.0	±2.5	0.04	0.06	I_{OUT}=1mA	**1**	—	0.1 to 2.2		SOT-23-5 SOT-89
Rx5RW	35 to 80	Max.8.0	1.5 to 6.0	±2	0.04	0.06	I_{OUT}=1mA	**1.5**	—	0.1 to 2		SON1612-6 SC-82AB
R1100D	35 to 100	Max.6.0	0.9 to 4.0	±2	0.025	0.050	I_{OUT}=1mA	**1.5**	—	**0.1 or more**		SON1408-3
RN5RT	40 to 100	Max.8.0	2.0 to 6.0	±2	0.3	0.5	I_{OUT}=40mA	**4**	—	0.1 to 2.2		SOT-23-5
R1515x ● ■	50	4.0 to **36.0**	2.0 to 12.0	±2	0.20	0.35	I_{OUT}=20mA V_{SET}=5.0V	9	—	0.1 to 10	Operating Temp.: -40 to 105°C Thermal	SOT-89-5 HSOP-6J
RH5RE	60 to 120	Max.10.0	2.0 to 6.0	±2.5	0.5	0.7	I_{OUT}=30mA	**1.1**	—	0.1 to 2.2		SOT-89
RP117x	100	-2.5 to -10.0	-1.0 to -5.5	±1.0	0.23		I_{OUT}=100mA V_{SET}=-3V	75	**80**	2.2 or more	Negative LDO Thermal Discharge : Ver.D	DFN(PLP)1212-6 SC-88A
RP118x	100	1.7 to 5.5	1.2 to 3.6	±1.0	0.15		I_{OUT}=100mA	40*2 **0.2***3	—	1 or more	Automatic Discharge : Ver.D/G	WLCSP-4-P8 DFN(PLP)1010-4 SOT-23-5
Rx5RZ	100	Max.8.0	2.0 to 6.0	±2	0.2	0.3	I_{OUT}=60mA	20	55	10 or more	Tantalum	SOT-23-5 SOT-89
R1141Q	120	2.2 to 6.0	1.5 to 4.0	±1.5	0.18	0.28	I_{OUT}=120mA	90	70	1 to 2.2 or more	⇒RP109x Discharge : Ver.D	SC-82AB

150 mA to 200 mA Voltage Regulators

Product Name	Output Current (mA)	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V)			Supply Current (µA)	RR@1kHz (dB)	Capacitor Capacitance (µF)	Other Features	Package
					Typ.	Max.	Condition	Typ.	Typ.			
RP103x	150	1.7 to 5.25	1.2 to 3.3	±1	0.21	0.27	IOUT=150mA	36	**75**	0.47 or more	TempChar :Typ.±30ppm/°C ⇒RP109x Discharge : Ver.D	DFN(PLP)1010-4 SC-82AB SOT-23-5
RP104x	150	1.7 to 5.25	1.2 to 3.3	**±0.8**	0.24	0.32	IOUT=150mA	**1**	—	**0.1 or more**	TempChar : **Typ.±40ppm/°C** ⇒RP110x Discharge : Ver.D	DFN(PLP)1010-4 SOT-23-5
RP109x	150	1.4 to 5.25	**0.8** to 3.6	±1	0.25	0.35	IOUT=150mA	50	**75**	**0.1 or more**	Load Reg : Typ.5mV TempChar : **Typ.±30ppm/°C** Discharge : Ver.D	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
RP110x	150	1.4 to 5.25	**0.8** to 3.6	±1	0.28	0.40	IOUT=150mA	**1**	—	**0.1 or more**	Constant Discharge : Ver.D	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
RP112x	150	2.0 to 5.25	1.2 to 4.8	±1	0.20	0.28	IOUT=150mA	75	**80** **65***4	1 or more	Output noise : 10µVrms TempChar : **Typ.±30ppm/°C** Discharge : Ver.D	DFN(PLP)1010-4 SC-88A SOT-23-5
RP130x ● ■	150	1.7 to 6.5	1.2 to 5.3	±1	0.32	0.51	IOUT=150mA	38	**80**	0.47 or more	TempChar : **Typ.±20ppm/°C** Discharge : Ver.D	DFN(PLP)1010-4 SC-82AB SOT-23-5
RP171x ● ■	150	2.6 to 10.0	1.2 to 6.0	±1	0.400	0.580	IOUT=150mA	23	70	1 or more	Thermal Discharge : Ver.D Constant	SC-88A SOT-23-5
RP173x	150	2.5 to 11.0*5	1.2 to 5.5	±1	0.90	1.47	IOUT=150mA	**2**	—	**0.1 or more**	Reverse Discharge : Ver.D	DFN(PLP)1010-4 SC-88A SOT-23-5
RP201x	150	1.4 to 5.25	**0.8** to 4.0	±1*2	0.12*2	0.18*2	IOUT=150mA	55*2 **1.5***3	70*2	1 or more	Manu/Auto Discharge : Ver.D	WLCSP-4-P5 DFN(PLP)1212-6
R1111N	150	2.0 to 8.0	1.5 to 5.0	±2	0.20	0.30	IOUT=100mA	35	70	1 or more	Tantalum Replaceable with LP2980/2985	SOT-23-5
R1114x ●	150	2.0 to 6.0	1.5 to 4.0	±2	0.22	0.35	IOUT=150mA	75	70	0.47 to 1 or more	⇒RP109x, RP130x Discharge : Ver.D	SON1612-6 SC-82AB SOT-23-5
R1116x	150	1.8 to 6.0	1.5 to 4.0	±1.5	0.29	0.46	IOUT=150mA	10	70	1 or more	Seamless Discharge : Ver.D	SON1612-6 SOT-23-5
R1121N	150	2.0 to 8.0	1.5 to 5.0	±2	0.20	0.30	IOUT=100mA	35	70	1 or more	Tantalum Replaceable with TK111/112/113	SOT-23-5
R1122N	150	2.0 to 6.0	1.5 to 5.0	±2	0.19	0.26	IOUT=100mA	100	**80**	2.2 to 4.7 or more	Replaceable with TK111/112/113 ⇒RP112x, RP130x	SOT-23-5
R1150H +VD ●	150	**Max.24.0**	2.1 to 14.0 Ver.A: 2.3 to 15.0, Ver.B,C,D: 2.0 to 15.0, Detector Threshold Range	±2 VD: ±2.5	0.30	0.40	IOUT=20mA	7	—	**0.1 or more**	Thermal	SOT-89-5
R1154x ■	150	**Max.24.0**	2.5 to 12.0 2.5 to 24.0, Ext.Adjustable	±2 ±50mV	0.20	0.40	IOUT=20mA	5	—	0.1 to 2.2	Operating Temp.: -40 to 105°C Thermal	DFN1616-6 SOT-23-5 SOT-89-5
R1155x ■	150	3.5 to **24.0**	2.5 to 12.0 2.5 to 23.0, Ext.Adjustable	±2 ±50mV	0.55*2	1.70*2	IOUT=150mA VSET=5.0V	65*2 7.5*3	60*2	4.7 or more	Operating Temp.: -40 to 105°C Automatic Thermal Reverse	SOT-23-5 SOT-89-5
R1163x ●	150	2.0 to 6.0	1.5 to 5.0	±1.5*2	0.25*2	0.35*2	IOUT=150mA	70*2 6*3	70*2	0.47 or more	Manual Reverse Discharge : Ver.D	DFN(PLP)1616-6 SON-6 SOT-23-5
R1180x ● ■	150	1.7 to 6.0	1.2 to 3.6	±2	0.25	0.40	IOUT=150mA	**1**	—	**0.1 or more**		SON1612-6 SC-82AB SOT-23-5
R1514x ● ■	150	4.0 to **36.0**	2.0 to 12.0	±2	0.20	0.35	IOUT=20mA VSET=5.0V	9	—	0.1 to 10	Operating Temp.: -40 to 105°C Thermal	SOT-89-5 HSOP-6J
R1516x ● ■	150	4.0 to **36.0**	1.8 to 6.2	±1	—	0.60	IOUT=20mA VSET=5.0V	29	—	0.1 to 20	Operating Temp.: -40 to 105°C Thermal	SOT-89-5 HSOP-6J
RP100x	200	1.7 to 5.25	1.2 to 3.3	**±0.6**	0.13	0.23	IOUT=150mA	18	**75**	1 or more	TempChar : **Typ.±30ppm/°C** Discharge : Ver.D	DFN(PLP)1612-4 SOT-23-5
RP107x	200	1.4 to 5.25	1.0 to 4.2	±1	0.27	0.36	IOUT=200mA	9.5	60	Output Capacitor-less (CIN=0.1 or more)	Constant Discharge : Ver.D	WLCSP-4-P5 DFN(PLP)1212-6 SC-88A

*1 Set Output Voltage (VSET) = 2.8 V or close to 2.8 V unless otherwise noted. *2 Fast Mode *3 Low Power Mode *4 RR@f = 100 kHz *5 VSET + 6.5 V ≤ 11.0 V

Voltage Regulators

200 mA to 800 mA Voltage Regulators

Product Name	Output Current (mA)	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Max.	Condition	Supply Current (µA) Typ.	RR@1kHz (dB) Typ.	Capacitor Capacitance (µF)	Other Features	Package
RP202x	200	1.4 to 5.25	**0.8 to** 4.0	±1*2	0.20*2	0.29*2	IOUT=200mA	50*2 **2.5***3	70*2	0.47 or more	Automatic Constant Discharge : Ver.D	DFN(PLP)1010-4 SC-88A SOT-23-5
R1160N	200	1.4 to 6.0	**0.8** to 3.3	±2*2	0.14*2	0.2*2 0.25*3	IOUT=200mA	40*2 4.5*3	70*2	2.2 or more	Tantalum Manual	SOT-23-5
RP155Z	200	1.9 to 5.25	1.8 to 3.6	±1	0.085	0.117	IOUT=200mA VSET=2.85V	80	**75**	1 or more	TempChar : **Typ.±30ppm/°C** Thermal Inrush Discharge : Ver.B Dual Output voltage switchable.	WLCSP-5-P1
R5112S +VD	200	3.5 to **42.0**	1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0 B: 1.9 to 4.8, D: 2.9 to 4.8 Detector Threshold Range	**±0.6** VD: ±0.6	0.6	1.7	IOUT=200mA VSET=5.0V	**3.8**	—	**0.1 or more**	Operating Temp.: -40 to 105°C Thermal	HSOP-8E
R1524x	200	3.5 to **36.0**	1.8, 2.5, 2.8, 3.0, 3.3, 3.4, 5.0, 6.0, 8.0, 8.5, 9.0	**±0.6**	0.6	1.7	IOUT=200mA VSET=5.0V	**2.2**	—	**0.1 or more**	Operating Temp.: -40 to 105°C Thermal	DFN(PLP)1820-6 SOT-23-5 SOT-89-5 HSOP-6J
RP101x	300	1.7 to 5.25	1.2 to 3.3	**±0.6**	0.13	0.23	IOUT=150mA	18	**75**	1 or more	TempChar : **Typ.±30ppm/°C** Discharge : Ver.D	DFN(PLP)1612-4 DFN(PLP)1612-4B SOT-23-5
RP102x	300	1.7 to 5.25	1.2 to 3.3	**±0.8**	0.120	0.190	IOUT=300mA	50	**80**	1 or more	TempChar : **Typ.±20ppm/°C** Discharge : Ver.D	WLCSP-4-P2 DFN(PLP)1820-6 SOT-23-5
RP114x	300	1.4 to 5.25	**0.8** to 3.6	±1	0.25	0.30	IOUT=300mA	50	**75**	1 or more	Discharge : Ver.D	DFN(PLP)1010-4 SC-88A SOT-23-5
RP170x	300	2.6 to 10.0	1.2 to 6.0	±1	0.77	1.08	IOUT=300mA	23	70	1 or more	Thermal Constant Discharge : Ver.D	SOT-23-5 SOT-89-5
RP200x	300	1.4 to 5.25	**0.8** to 4.0	±1*2	0.23*2	0.35*2	IOUT=300mA	55*2 **1.5***3	70*2	1 or more	Manu/Auto Discharge : Ver.D	WLCSP-4-P5 DFN(PLP)1212-6 SOT-23-5
R1130H	300	2.5 to 8.0	1.5 to 5.0 1.5 to 5.0, Ext.Adjustable	±2 ±36mV	0.25	0.34	IOUT=100mA	50	60	0.1 or more		SOT-89-5
R1131N	300	1.4 to 6.0	**0.8** to 3.3	±2	0.23	0.35	IOUT=300mA	60	65	1 or more (VSET≥1.0V)	⇒RP101N Discharge : Ver.D	SOT-23-5
R1131Dxx1	300	1.4 to 6.0	**0.8** to 3.3	±2	0.23	0.35	IOUT=300mA	60	65	1 or more (VSET≥1.0V)	Discharge : Ver.D	SON-6
R1161N	300	1.4 to 6.0	**0.8** to 3.3	±2*2	0.23*2	0.35*2	IOUT=300mA	60*2 4.5*3	65*2	1 or more (VSET≥1.0V)	Manual Discharge : Ver.D ⇒RP200N	SOT-23-5
R1191x	300	3.5 to 16.0 (VSET≥3.0)	2.0 to 15.0	±1.5*2	0.55*2	0.75*2	IOUT=300mA VSET=5.0V	50*2 6*3	70*2	4.7 or more	Manual Thermal Reverse Discharge : Ver.D	DFN1616-6 SOT-23-5 SOT-89-5
R1510S +VD	300	3.5 to **36.0**	2.5 to 12.0 Ver.A,B,C: 2.3 to 12.0, Ver.D: 2.3 to 10.6, Detector Threshold Range	±1.6 VD: ±1.9	1.0*2	2.0*2	IOUT=300mA VSET=5.0V	110*2 12.5*3	—	6.8 or more	Operating Temp.: -40 to 105°C Automatic Thermal	HSOP-8E
R1511x	300	3.5 to **36.0**	3.0 to 9.0 3.0 to 12.0, Ext.Adjustable	±1 ±30mV	0.64	1.0	IOUT=300mA VSET=5.0V	100	65	6.8 or more	Operating Temp.: -40 to 105°C Thermal	HSOP-6J TO-252-5-P2
R1513S	300	3.5 to **36.0**	1.2, 1.5, 1.8, 3.3, 3.4, 5.0 1.2 to 18.0, Ext.Adjustable	**±0.8**	0.32	0.60	IOUT=300mA VSET=5.0V	75	70*4	4.7 or more	Operating Temp.: -40 to **125°C** Thermal Discharge : Ver.D	HSOP-6J
RP105x	400	2.4 to 5.25 (VIN=from 0.9)	**0.6** to 1.5	±15mV	0.180	0.260	IOUT=400mA VSET=1.5V VBIAS=3.6V	28	**80***5	2.2 or more	Dual power supply Discharge : Ver.D/F	DFN1212-5 DFN(PLP)1212-6 SOT-23-5
RP106x	400	1.0 to 3.6	**0.7** to 1.8	**±0.8**	0.22	0.31	IOUT=400mA VSET=1.5V	48	60*6	1 or more	Constant Discharge : Ver.D	WLCSP-4-P5 DFN(PLP)1212-6 SC-88A
RP116Z	400	1.0 to 3.6	**0.7** to 1.8	**±0.8**	0.22	0.31	IOUT=400mA VSET=1.5V	48	60*6	1 or more	Constant Discharge : Ver.D Thinner than RP106Z (t=0.36mm)	WLCSP-4-P7
RP111x	500	1.4 to 5.25	**0.7** to 3.6 0.7 to 3.6, Ext.Adjustable	**±0.8**	0.23	0.34	IOUT=500mA	80	**75**	1 or more	Load Reg : Typ.1mV Thermal Inrush Discharge : Ver.D Load transient response accuracy*7: Typ.-75mV/+45mV	DFN1212-6 SOT-23-5 SOT-89-5
RP115L	500*8	1.4 to 5.25	**0.7** to 4.3	±1	0.065	0.090	IOUT=500mA	110	**80** (VSET≤ 1.8V)	1 or more	Load Reg : Typ.1mV TempChar : **Typ.±30ppm/°C** Thermal Reverse Constant Inrush Discharge : Ver.D	DFN1216-8
R1500H	500	4.0 to **24.0**	3.0 to 12.0	±2	0.115	0.180	IOUT=200mA VSET=5.0V	70	60	10 or more	Operating Temp.: -40 to 105°C Thermal	SOT-89-5
R1517x	500	3.5 to **36.0**	2.5, 3.3, 3.4, 5.0, 8.5 2.5 to 12.0, Ext.Adjustable	**±0.8** ±20mV	0.35	0.62	IOUT=500mA VSET=5.0V	18	—	**0.1 or more**	Operating Temp.: -40 to 105°C Constant : Ext.Adjustable Thermal Discharge : Ver.D/F	HSOP-6J TO-252-5-P2
R1170x	800	Max.6.0	1.5 to 5.0	±2	0.12	0.18	IOUT=300mA	80	50	10 or more	Thermal	HSON-6 SOT-89-5 HSOP-6J

*1 Set Output Voltage (VSET) = 2.8 V or close to 2.8 V unless otherwise noted. *2 Fast Mode *3 Low Power Mode *4 RR@f = 100 Hz *5 VIN = Ripple *6 RR@f = 10 kHz *7 1 mA ⇔ 250 mA
*8 Output Current (IOUT) is switchable between 500 mA or 1 A using the LCON pin of DFN1216-8.

1 A to 3 A Voltage Regulators

Product Name	Output Current (A)	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Max.	Condition	Supply Current (μA) Typ.	RR@1kHz (dB) Typ.	Capacitor Capacitance (μF)	Other Features	Package
RP115x ● ■	1*2	1.4 to 5.25	**0.7** to 4.3	±1	0.13	0.18	IOUT=1A	110	**80** (VSET≤ 1.8V)	1 or more	Load Reg : Typ.1mV TempChar **: Typ.±30ppm/°C** Thermal Reverse Constant Inrush Discharge : Ver.D	DFN1216-8 SOT-89-5
RP131x	1	1.6 to 6.5	**0.8** to 5.5	±1	0.500	0.750	IOUT=1A	65	70	2.2 to 4.7 or more	Thermal Inrush Discharge : Ver.D	DFN1616-6B DFN(PLP)1820-6 SOT-89-5 HSOP-6J TO-252-5-P2
RP132x ● ■	1	1.4 to 6.5	**0.8** to 5.5 0.8 to 5.5, Ext.Adjustable	±1 ±15mV	0.52	0.72	IOUT=1A	65	70	2.2 to 4.7 or more	Load Reg : Typ.5mV Thermal Inrush : Ext.Adjustable Discharge : Ver.D/F	DFN(PLP)1820-6 SOT-89-5 HSOP-6J TO-252-5-P2
R1172x ●	1	1.4 to 6.0	**0.8** to 5.0	±2	0.05	0.10	IOUT=300mA	60	70	4.7 or more (VSET≥1.0V)	Thermal Inrush Discharge : Ver.D	SOT-23-5 SOT-89-5 HSON-6 HSOP-6J
R1173x	1	1.4 to 6.0	**0.8** to 5.0 1.0 to VIN, Ext.Adjustable	±2 ±30mV	0.05	0.10	IOUT=300mA	60	70	4.7 or more (VSET≥1.0V)	Load Reg : Typ.-3mV Thermal Inrush Discharge : Ver.D	SOT-89-5 HSON-6 HSOP-6J
R1190x ●	1	3.5 to 16.0	2.0 to 12.0	±1.5	1.1	1.85	IOUT=1A VSET=5.0V	150	60	4.7 or more	Thermal Discharge : Ver.D Inrush : Ext.Adjustable	SOT-89-5 HSOP-6J TO-252-5-P2
R1501x ● ■	1	3.0 to **24.0**	3.0 to 18.0	±2	0.575	0.900	IOUT=1A VSET=5.0V	70	60	10 or more	Operating Temp.: -40 to 105°C Thermal	HSOP-6J TO-252-5-P2
R1518x ● ■	1	3.5 to **36.0**	2.5, 3.3, 3.4, 5.0, 6.0, 8.5 2.5 to 12.0, Ext.Adjustable	**±0.8** ±20mV	0.70	1.30	IOUT=1A VSET=5.0V	18	—	**0.1 or more**	Operating Temp.: -40 to 105°C Constant : Ext.Adjustable Thermal Discharge : Ver.D/F	HSOP-6J TO-252-5-P2
R1171S ●	1.5	2.1 to 6.0	1.5 to 5.0	±2	0.09	0.18	IOUT=300mA	130	50	4.7 to 10 or more	Thermal	HSOP-6J
R1171J	2		1.8 to 5.0									TO-252-5-P1
RP108J ● ■	3	1.6 to 5.25	**0.8** to 4.2 0.8 to 4.2, Ext.Adjustable	±1	0.51	0.60	IOUT=3A	350	65	10 or more	Load Reg : Typ.3mV Thermal Reverse Constant Discharge : Ver.D/F	TO-252-5-P2
RN5RF	Ext.Tr.	1.8 to 10.0	1.2 to 6.0	±2	0.1*3	0.2	IOUT=100mA	30	60	10 or more	Tantalum	SOT-23-5

*1 Set Output Voltage (VSET) = 2.8 V or close to 2.8 V unless otherwise noted. *2 Output Current (IOUT) is switchable between 500 mA or 1 A using the LCON pin of DFN1216-8.
*3 Dropout Voltage (VDIF) is dependent on the external transistor.

Multi-Channel Voltage Regulators

Product Name	Output Current (mA)	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy (%)	Dropout Voltage*1(V) Typ.	Max.	Condition	Supply Current*2 (μA) Typ.	RR@1kHz (dB) Typ.	Capacitor Capacitance (μF)	Other Features	Package
RP152x 2ch	150	1.4 to 5.25	**0.8** to 3.6	±1	0.20	0.35	IOUT=150mA	40	70	0.22 or more	Start-up sequence controllable: xxxC Discharge : Ver.B/C	DFN1212-6 SOT-23-6
RP153L 2ch	150	1.4 to 5.25	**0.8** to 3.6	±1	0.20	0.35	IOUT=150mA	40 85*5	70	0.22 or more	Dual Input Type Enhanced Load Transient Response: xxxD/E Discharge : Ver.B/E	DFN1216-8
R5326K 2ch	150	1.4 to 6.0	**0.8** to 4.2	±1*3	0.19*3	0.27*3	IOUT=150mA	50*3 5.5*4	70*3	1 to 3.3	Automatic Discharge : Ver.B	DFN(PLP)1820-6
R5328K 2ch	150	1.4 to 6.0	**0.8** to 4.0	±1*3	0.25*3	0.35*3	IOUT=150mA	65*3 **2.5***4	70*3	1 or more	Manual Discharge : Ver.B	DFN(PLP)2020-8
RP150K 2ch	300	2.5 to 5.25	1.5 to 3.3	±1	0.21	0.34	IOUT=300mA	24	**80**	1 or more	TempChar **: Typ.±30ppm/°C** Discharge : Ver.B	DFN(PLP)2020-8
RP154x 2ch ●	300	1.4 to 5.25	**0.8** to 3.7	±1	0.25	0.30	IOUT=300mA	50	**75**	1 or more	Dual Input Type available: only DFN Discharge : Ver.B	DFN1216-8 SOT-23-6
R5324K 3ch	100	2.0 to 6.0	1.5 to 4.0	±2	0.15	0.25	IOUT=100mA	90	70	1 or more	Discharge : Ver.B	DFN(PLP)2527-10
	150				0.22	0.33	IOUT=150mA					
	200				0.23	0.35	IOUT=200mA					

*1 Set Output Voltage (VSET) = 2.8 V or close to 2.8 V unless otherwise noted. *2 Supply Current (ISS) per channel. *3 Fast Mode *4 Low Power Mode
*5 Enhanced Load Transient Response Type (xxxD/E)

Voltage Detectors/Watchdog Timers/Reset Timers

● : Automotive Products Available ■ : High Temperature Products Available ◆ : Automotive Products Only : Products in Development

Microcontroller Supervisor Features

Max. Operating Voltage (V)	Release Output Delay Time	Supervisor Configuration:	VD		VD with WDT		VD with VR and WDT		VD with VR		
		VD Monitors:	VIN	VSENSE	VIN	VSENSE	VOUT	VSENSE	VIN	VOUT	VSENSE
5.5	Y	Int. Counter	RP300x								
6.0	N	—	R3114x	R3117x	—						
	Y	Ext. Capacitor	R3112x R3116x	R3118x	R5106N R5107G R5109G	R5108G					
		Int. Counter	R3130N R3132x R3133D R3134N								
10.0	N	—	R3111x		—						
	Y	Ext. Capacitor	RN5VD				R5101G				
24.0	N	—			—				R1150HxxxA		R1150HxxxB
	Y	Ext. Capacitor							R1150HxxxC	R1150HxxxD	
36.0	N	—		R3119xxxxE	—				R1510SxxxA		R1510SxxxB
	Y	Ext. Capacitor	R3119xxxxA R3150NxxxA/B	R3150NxxxE/F			R5104V R5110Sxx1A/B R5111Sxx1A/B	R5110Sxx2C/D R5111Sxx2C/D	R1510SxxxC	R1510SxxxD R5112SxxxD	R5112SxxxB

Voltage Detectors

Product Name	Operating Voltage Range (V)	Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Reset Signal	SENSE Pin	MR Pin*1	Adjustable Release Output Delay Time	Output Delay Time Accuracy (%)	Supply Current*2 (µA)	Hysteresis	Package
RP300x	0.72 to 5.50	1.1, 2.32, 2.63, 2.7, 2.8, 2.93, 3.08, 3.4, 4.38, 4.6	±0.8	L	N	Y	Int. Counter	50ms±5 200ms±5	0.95	N	DFN(PLP)1010-4B SOT-23-5
R3114x	0.5 to 6.0	0.7 to 5.0	±0.8	L	N	N	—	—	0.35	Y	DFN(PLP)1010-4 SC-82AB SOT-23-5
R3112x	0.7 to 6.0	0.9 to 5.0	±2.0	L	N	N	Ext. Capacitor	Not specified	0.5	Y	SON1612-6 SC-82AB SOT-23-5
R3116x ● ■	0.5 to 6.0	0.7 to 5.0	±0.8	L	N	N	Ext. Capacitor	±15	0.35	Y	DFN(PLP)1010-4 SC-82AB SOT-23-5
R3130N	1.0 to 6.0	1.6 to 4.8	±1.5	L	N	N	Int. Counter	50ms±10 240ms±10	1.4	N	SOT-23-3
R3132x	0.75 to 6.0	1.0 to 5.0	±2.0	L	N	Y	Int. Counter	240ms±15	0.8	N	SON1612-6 SC-82AB
R3133D	0.8 to 6.0	1.0 to 5.0	±2.0	H	N	Y	Int. Counter	240ms±15	0.8	N	SON1612-6
R3134N ●	0.75 to 6.0	1.0 to 5.0	±1.8	L	N	Y	Int. Counter	240ms±15	0.8	N	SOT-23-5
R3117x ● ■	1.0 to 6.0	0.7 to 5.0	±1.0	L	Y	N	—	—	0.29	Y	DFN(PLP)1010-4 SC-88A SOT-23-5
R3118x ●	1.0 to 6.0	0.6 to 5.0	±1.5	L	Y	N	Ext. Capacitor	±30	0.4	Y	DFN(PLP)1212-6 SC-88A SOT-23-5
R3111x	0.7 to 10.0	0.9 to 6.0	±2.0	L/H*3	N	N	—	—	1.0	Y	SON1612-6 SC-82AB SC-88A SOT-23-3 SOT-23-5 SOT-89
RN5VD	0.7 to 10.0	0.9 to 6.0	±2.5	L	N	N	Ext. Capacitor	Not specified	1.0	Y	SOT-23-5
R3119xxxxA ● ■	1.2 to 36.0	2.3 to 12.0	±1.5	L	N	N	Ext. Capacitor	-50/+80	3.3	Y	DFN(PLP)1820-6 SOT-23-5
R3119xxxxE ● ■	2.1 to 6.0*4	2.3 to 12.0	±1.5	L	Y	N	—	—	3.3	Y	DFN(PLP)1820-6 SOT-23-5
R3150NxxxA ● ■	1.4 to 36.0	Detector Threshold Range: 5.0 to 10.0, Release Threshold Range: 5.3 to 11.0	Detector Threshold Accuracy: ±1.5, Release Threshold Accuracy: ±1.5	L	N	N	Ext. Capacitor, Detector Output Delay Time and Release Output Delay Time are also adjustable using external capacitors.	Output Delay Time Accuracy: -35/+40, Detector Output Delay Time Accuracy: -35/+40	3.8	Y	SOT-23-6
R3150NxxxB ● ■				H							
R3150NxxxE ● ■	3.6 to 6.0*4			L	Y				3.5		
R3150NxxxF ● ■				H							

*1 Manual Reset Pin *2 Detector Threshold (-VDET) = 1.5 V, Detection released *3 SON1612-6, SC-82AB and SC-88A generates a high reset signal. *4 Input Voltage of SENSE Pin: 0V to 36.0V

Watchdog Timers

● Watchdog Timer with Voltage Detector and Voltage Regulator

Product Name	Operating Voltage Range (V)	Voltage Detector Section					Watchdog Timer Section				Voltage Regulator Section			Supply Current (µA)	Package
		Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Output Delay Time*1 (ms)			WDT Timeout Period*2 (ms)			Inhibit Pin	Output Voltage Range (V)	Output Voltage Accuracy (%)	Output Current (mA)		
				Min.	Typ.	Max.	Min.	Typ.	Max.					Typ.	
R5101G	1.5 to 10.0	1.7 to 4.5	±2.5	7	14	35	50	120	250	Y	1.8 to 5.0	±2.5	50	5	SSOP-8G
R5104V ◆	Max.36.0	2.8 to 4.0	±2.0	Not specified			200	300	510	Y xxxA	3.3 to 5.0	±2.0	Depending on external Tr.	60	SSOP-10
R5110Sxx1A ● R5110Sxx1B*3 ■	3.5 to 36.0	1.6 to 5.5	±1.8*4	194	242	290	14.4	18	21.6	N	1.8 to 5.0	±1.5*4	500	25	HSOP-8E
R5110Sxx2C ● R5110Sxx2D*3 ■										Y					HSOP-18
R5111Sxx1A ● R5111Sxx1B*3 ■*5	3.5 to 36.0	1.6 to 5.5	±1.8*4	194	242	290	14.4	18	21.6	N	1.8 to 5.0	±1.5*4	300	25	HSOP-8E
R5111Sxx2C ● R5111Sxx2D*3 ■*5										Y					HSOP-18

*1 R5101G: C_D = 0.001 µF, R5110S/ R5111S: C_D = 0.22 µF *2 R5101G: C_W = 0.01 µF, R5104V: C_{TW} = 0.1 µF, R5110S/R5111S: C_{TW} = 0.01 µF *3 Window Watchdog Timer. Window watchdog timer monitors microprocessor activity and asserts a reset signal if the watchdog pulse does not occur witin the defined time window (open window) or if the watchdog pulse occurs within the defined time widown (close window). *4 Detector Threshold Accuracy in all temperature range. *5 The R5111S for consumer application are high temperature products.

● Watchdog Timer with Voltage Detector

Product Name	Operating Voltage Range (V)	Voltage Detector Section			Watchdog Timer Section		Supply Current (µA)	Remarks	Package
		Detector Threshold Range (V)	Detector Threshold Accuracy (%)	Output Delay Time Accuracy (%)	WDT Timeout Period Accuracy (%)	Inhibit Pin	Typ.		
R5105N ◆	0.9 to 6.0	1.5 to 5.5	±1.0	±16	±33	N	11		SOT-23-6
R5106N ● ■						Y		CD Pin and CTW Pin are combined.	
R5107G ● ■								MR Pin is included.	SSOP-8G
R5108G ● ■	1.5 to 6.0							SENSE Pin is included.	
R5109G ● ■	0.9 to 6.0						11.5	2 Clock Input Type	

Reset Timers

A reset timer is designed for a mobile equipment, such as a smartphone and a tablet, with a fixed internal battery which cannot be removed to initiate a reset sequence.

Product Name	Operating Voltage Range (V)	Reset Input	Reset Output	Supply Current (µA)	Output Delay Time (s)	Output Release Time (s)	Package
R3200x001x	1.65 to 5.5	$\overline{SR0}$, $\overline{SR1}$	xxxA: $\overline{RST}$ xxxB: $\overline{RST}$, RST2	0.28	7.5, 11.25	—	DFN(PLP)2020-8B
R3200x002x					7.5	0.234	DFN1216-8
R3200L052B					10	0.313	DFN1216-8
R3200L053B					10	0.078	DFN1216-8
R3200L064A					3	0.1875	DFN1216-8

Lead (Pb) Free/ Halogen Free Information

Ricoh is committed to reducing the environmental loading materials in electrical devices with a view to contributing to the protection of human health and the environment. Ricoh has been providing RoHS compliant products since April 1, 2006 and Halogen-free & Antimony-free products since April 1, 2012.

Definition of Halogen-free According to "IEC 61249-2-21" Standard
- 900 ppm of chlorine or
- 900 ppm of bromine or
- a combined total of 1,500 ppm of chlorine and bromine

Definition of Antimony-free
- 1,000 ppm of antimony trioxide

The performance and reliability of the Ricoh's halogen-free products are comparable to conventional products. Please contact our sales representatives for details.

DC/DC Converters

Grey-out Products : The successors of these products are indicated in Product Name.

● : Automotive Products Available ■ : High Temperature Products Available : Products Newly Released : Products in Development

Input Voltage Level and DC/DC Converter Type Chart

Major products are classified by input voltage and function. This chart does not include all products.

	Step-down		Step-up		Step-up/down, Multi Power Supply	
40V						
High Voltage	1.2 A Output	R1245x	For PMOLED, General Use	R1204xxxxB/C/E/F		
	2 A Output	R1243x R1275S	For White LED, External Diode	R1204xxxxA/D R1204xxxxG/H		
	3 A Output	R1242S R1270S	For White LED, External Diode, 2 Strings/4 Strings	R1214Z R1208K		
	External	R1272S				
	14 A Output	R1273L				
20V						
Middle Voltage	18.5 V, Reset Protection	R1224N	For White LED, Internal Diode	R1202xxxxD	Step-up and Inverting	R1280D R1283K
	18.5 V, Latch Protection	R1225N	For White LED, External Diode	R1203x071B R1206N071B	Step-up and Charge pump	R1290K R1294L
			For PMOLED, General Use	R1202xxxxA/B	Step-up, LDO and Amplifier	R1293K
			For General Use	R1213K001B	Step-up, LDO and Step-down	R1282D
6V						
Low Voltage	50 mA/ 300 mA Output	RP512x	For General Use	RP401x	Step-up/down	RP601Z RP602Z RP604x
	600 mA Output	RP504x	For General Use, Synchronous Rectifier	RP402x	Step-up and Inverting	R1286K R1287x
	600 mA Output, VOUT Ext. Adjustable	RP507K	For General Use	R1213K001A	Step-down and Bypass Switch	RP904Z
	600 mA Output, 6 MHz	RP508K			Step-up, LDO and VD	RP600K
	1 A Output	RP505K RP509Z/N				
	1 A Dual Output	RP550K				
	2 A Output	RP506K				

High Voltage Step-down DC/DC Converters

Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range (V)	VFB Voltage Accuracy (mV)	Switching Frequency (kHz)	Output Current*1 (A)	Protection Circuit Type	Other Features	Package
R1240x	00xA 00xB	PWM	4.5 to 30.0	0.8 to 15.0, Ext.Adjustable	0.8V±12	1250	1.2	Latch Fold-back	Diode UVLO Soft-Start Thermal	SOT-23-6W*2 DFN(PLP)2527-10
R1244N	001B	PWM	4.5 to 30.0	0.8 to 15.0, Ext.Adjustable	0.8V±12	1250	1.2	Fold-back	Diode UVLO Soft-Start Thermal	SOT-23-6W*2
R1245x ● ■	00xA/C/E/G 00xB/D/F/H	PWM	4.5 to 30.0	0.8 to 27.6, Ext.Adjustable	0.8V±8	330: xxxA/B, 500: xxxC/D, 1000: xxxE/F, 2400: xxxG/H	1.2	Latch Fold-back	Diode UVLO Soft-Start Thermal	DFN(PLP)2020-8 SOT-23-6W HSOP-8E
R1243x	001A/C 001B/D 001E	PWM	4.5 to 30.0	0.8 to 18.0, Ext.Adjustable	0.5V±7	330: xxxC/D, 1000: xxxA/B/E	2	Latch Fold-back Latch	Diode UVLO Soft-Start : Ext.Adjustable Thermal FLG Pin	DFN(PLP)2527-10 HSOP-8E HSOP-8E
R1242S	001A/C/E/G 001B/D/F/H	PWM	5.0 to 30.0	0.8 to 15.0, Ext.Adjustable	0.8V±12	330: xxxC/D, 500: xxxE/F, 1000: xxxG/H, 330 to 1000: xxxA/B, Ext.Adjustable	3	Latch Fold-back	Synchro : with external low side transistor UVLO Soft-Start Thermal	HSOP-8E
R1270S ● ■	001A 001B	PWM, PWM/VFM Auto-Switching	3.6 to 34.0	0.8 to 31.6, Ext.Adjustable	0.8V±8	300 to 2400: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	3	Fold-back Latch Fold-back	Diode UVLO Soft-Start : Ext.Adjustable Thermal FLG Pin OVLO	HSOP-18
R1272S ● ■	xxxA	Forced PWM, PWM/VFM Auto-Switching	4.0 to 34.0	0.7 to 5.3, Ext.Adjustable	0.64V±1%	250 to 1000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	External	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP	HSOP-18
R1273L ● ■	xxxA	Forced PWM, PWM/VFM Auto-Switching	4.0 to 34.0	0.7 to 5.3, Ext.Adjustable	0.64V±1%	250 to 1000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit	14	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP	QFN0505-32B
R1275S ● ■	003x	Forced PWM, PWM/VFM Auto-Switching	3.6 to 34.0	3.3 to 5.0, Ext.Adjustable	0.64V±1%	2000: Ext.Adjustable, Ext.Synchronizable with PLL Circuit (1800 to 2200)	2	Latch or Hiccup	Synchro SSCG PG UVLO Soft-Start : Ext.Adjustable Thermal OVP OVLO	HSOP-18

*1 Output Current (IOUT) can be affected by environmental conditions or external components. This is an approximate value. *2 The pin-layout of R1240N and that of R1244N is upside down.

Middle Voltage Step-down DC/DC Controllers

These products are middle voltage step-down DC/DC controllers with an external output transistor.

Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy*1	Switching Frequency (kHz)	Output Tr.	Output Current	Protection Circuit Type	Other Features	Package
R1223N	xx2A/B	PWM/VFM Auto Switching	2.3 to 13.2	1.5 to 5.0	±2	300: xxxA/C/E/G, 500: xxxB/D/F/H	External	Depending on external MOSFET	Latch	Diode	SOT-23-5
	xx2C/D	PWM							Reset	Soft-Start	
	xx2E/F	PWM/VFM Auto Switching									
	xx2G/H	PWM									
R1224N	xx2E/F/L	PWM/VFM Auto Switching	2.3 to 18.5	1.2 to 6.0	±2	180: xxxL/M, 300: xxxE/G, 500: xxxF/H	External	Depending on external MOSFET	Reset	Diode	SOT-23-5
	xx2G/H/M	PWM		1.0 to VIN, Ext.Adjustable						Soft-Start	
	102G/H/M									UVLO	
R1225N	xx2C/D/K	PWM	2.3 to 18.5	1.2 to 6.0	±2	180: xxxJ/K, 300: xxxA/C, 500: xxxB/D	External	Depending on external MOSFET	Latch	Diode	SOT-23-6W
	xx2A/B/J	PWM/VFM Auto Switching								Soft-Start	
										UVLO	

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy.

Low Voltage Step-down DC/DC Converters

Product Name	Version	Control	MODE Pin	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy*1 (%)	Switching Frequency (MHz)	Output Current*2 (mA)	Protection Circuit Type	Other Features	Package
RP512x	xx1A	VFM	N	2.0 to 5.5	1.0 to 4.0	±1.5	*3	50: xxxA/B	—	Synchro, UVLO, Soft-Start, Discharge : xxxB/D	WLCSP-8-P1, DFN(PLP)2527-10, SOT-89-5
	xx1B							300: xxxC/D			
	xx1C										
	xx1D										
RP500x	xx1A	PWM/VFM Auto Switching	N	2.55 to 5.5	1.1 to 3.3	±1.5	1.2	600	Latch	Synchro, UVLO, Soft-Start, Discharge : xx3A/xx4A	DFN1616-6, DFN(PLP)1820-6, SOT-23-6W
	xx2A	PWM									
	xx3A	PWM/VFM Auto Switching									
	xx4A	PWM									
RP503x	xx1A	PWM/VFM Auto Switching	N	2.5 to 5.5	0.8 to 2.5	±1.5	2	600	Latch	Synchro, UVLO, Soft-Start, Discharge : xx2A	DFN1616-6, SOT-23-5
	xx2A										
RP507K	001B	PWM/VFM Auto Switching	N	2.3 to 5.5	0.7 to 5.5, Ext.Adjustable	0.6V±9mV	2	600	—	Synchro, UVLO, Soft-Start, Thermal, Discharge	DFN(PLP)1616-6D
RP504x	xx1A	Forced PWM, PWM/VFM Auto Switching	Y	2.3 to 5.5 (VOUT≥1.0)	0.8 to 3.3	±1.5	2.25	600	Latch	Synchro, UVLO, Soft-Start, Discharge : xx1D	DFN(PLP)1216-6F, DFN1616-6B
	xx1B	PWM/VFM Auto Switching	N								SOT-23-5
	xx1C	Forced PWM									
	xx1D	Forced PWM, PWM/VFM Auto Switching	Y								DFN(PLP)1216-6F, DFN1616-6B
RP508K	xx1A	Forced PWM, PWM/VFM Auto Switching	Y	2.3 to 5.5	0.8 to 3.3	±1.5	6	600	—	Synchro, UVLO, Soft-Start, Thermal, Discharge : xx1B	DFN(PLP)1212-6F
	xx1B										
RP502x	xx1B	PWM/VFM Auto Switching	N	2.5 to 5.5	0.8 to 3.3	±1.5	3.3	600	Latch	Synchro, UVLO, Soft-Start, Discharge : xx3B/xx4B	WLCSP-6-P2, DFN1616-6
	xx2B	PWM									
	xx3B	PWM/VFM Auto Switching									
	xx4B	PWM									
R1232D	xx1A/B	PWM	N	2.6 to 5.5	0.9 to 3.3	±2	1: xxxA/C, 2.25: xxxB/D	1000	Latch	Synchro, UVLO, Soft-Start	SON-8
	001C/D				0.8 to VIN, Ext.Adjustable	0.8V±16mV					
RP501K	xx1A	PWM, PWM/VFM Auto Switching	Y	2.5 to 5.5	1.0 to 3.3	±1.5	2.25	1000	Latch	Synchro, UVLO, Soft-Start, Discharge : xx1B	DFN(PLP)2527-10
	xx1B										
RP505K	xx1A	Forced PWM, PWM/VFM Auto Switching	Y	2.3 to 5.5 (VOUT≥0.8)	0.6 to 3.3	±1.5	2.25	1000	Latch	Synchro, UVLO, Soft-Start, Thermal, Discharge : xx1B	DFN(PLP)2020-8
	xx1B										
	001C			2.3 to 5.5	0.8 to 3.3, Ext.Adjustable	0.6V±9mV					
RP509Z, RP509N	xxxA/B	Forced PWM, PWM/VFM Auto Switching	Y	2.3 to 5.5	0.6 to 3.3	±1.5 (VOUT≥1.2V)	6	1000 or 500	—	Synchro, UVLO, Soft-Start, Thermal, Discharge : xxxB/00xD	WLCSP-6-P6, SOT-23-6
	00xC/D				0.6 to 5.5, Ext.Adjustable	0.6V±9mV					
RP506K ● ■	xx1A/D	Forced PWM, PWM/VFM Auto Switching	Y	2.5 to 5.5 or 2.5 to 4.5	0.8 to 3.3: xx1A/B, 0.6 to 3.3: xx1D/E	±1.5	1.2: xxx1D/E/F, 2.25: xxxA/B/C	2000	Latch	Synchro, UVLO, Soft-Start : Ext.Adjustable, Thermal, Discharge : xx1B/E, PG	DFN(PLP)2527-10
	xx1B/E										
	001C				0.8 to 4.0, Ext.Adjustable	0.6V±9mV					
	001F				0.6 to 4.0, Ext.Adjustable						

● Dual Channel

RP550K Dual ●	001A	Forced PWM, PWM/VFM Auto Switching	Y	2.3 to 5.5 (VOUT≥0.8)	0.6 to 3.3, Ext. Adjustable	0.6V±9mV	2.25	1000×2	Latch	Synchro, UVLO, Soft-Start, Thermal	DFN(PLP)2730-12

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Output Current (IOUT) can be affected by environmental conditions or external components. This is an approximate value. *3 Switching frequency is depending on the conditions of Input, Output Voltage, and Output Current.

DC/DC Converters

Step-up DC/DC Converters for White LEDs/PMOLEDs/General Use

These products are PWM step-up DC/DC converters, which are optimized to drive white LEDs for background illumination or passive matrix OLED display with constant current. These products include an under-voltage lockout circuit (UVLO), and a soft-start circuit. These are also able to be used in a general step-up power supply.

● For White LEDs

Diode	Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range*1 (V)	VFB Voltage Accuracy (mV)	Switching Frequency (kHz)	Lx Current Limit*2 (mA)	OVP Voltage (Typ.) (V)	Other Features	Package
Internal	R1201N	021/023	PWM	1.8 to 5.5	Up to 20, Ext.Adjustable	0.2V±10	1000: 0x1/2, 1200: 0x3/4	700	9.5	UVLO Soft-Start LED Adjust	SOT-23-6
		031/033							14		
		041/043							18.5		
		051/053							20.6		
		052/054		1.8 to 4.5	Up to 21, Ext.Adjustable				21.6		
	R1202x	3xxD	PWM	1.8 to 5.5	Up to 22.2, Ext.Adjustable	0.2V±10	1200	350	14	UVLO Soft-Start Thermal Shutdown LED Adjust	DFN1616-6B TSOT-23-6
		7xxD						700	23		
	R1205L	8x1B	PWM	1.8 to 5.5	Up to 24.2, Ext.Adjustable	0.2V±10	1200	350	25	UVLO Soft-Start Thermal LED Adjust	DFN1616-6B
		8x1C				0.4V±10		700			
	R1205N ⇒R1207N	8x3B	PWM	1.8 to 5.5	Up to 24.2, Ext.Adjustable	0.2V±10	1200	350 700	25	UVLO Soft-Start Thermal LED Adjust	TSOT-23-6*3
	R1207N	8x3B	PWM	1.8 to 5.5	Up to 24.2, Ext.Adjustable	0.2V±10	1200	350	25	UVLO Soft-Start Thermal LED Adjust	TSOT-23-6*3
		8x3C				0.4V±10		700			
	R1218N	021A	PWM	1.8 to 5.5	Up to 17, Ext.Adjustable	0.2V±10	1200	700	9.5	UVLO Soft-Start	SOT-23-6
		031A							14		
		041A							18.5		
External	R1203L	071B	PWM	1.8 to 5.5	Up to 28.7, Ext.Adjustable	0.2V±10	1200	700	29.5	UVLO Soft-Start LED Adjust	DFN1616-6B
	R1203N ⇒R1206N	071B	PWM	1.8 to 5.5	Up to 28.7, Ext.Adjustable	0.2V±10	1200	700	29.5	UVLO Soft-Start LED Adjust	SOT-23-6*3
	R1206N	071B	PWM	1.8 to 5.5	Up to 28.7, Ext.Adjustable	0.2V±10	1200	700	29.5	UVLO Soft-Start LED Adjust	SOT-23-6*3
	R1204x ●	11xA/D	PWM	2.3 to 5.5	Up to 40.2, Ext.Adjustable	0.2V±10	1000: xxxA, 750: xxxD	900	23	UVLO Soft-Start Thermal LED Adjust	DFN(PLP)1820-6 TSOT-23-6
		21xA/D							33		
		31xA/D							42		
		11xG/H				0.4V±10	1000: xxxG, 750: xxxH		23		
		21xG/H							33		
		31xG/H							42		
	R1218N	052A	PWM	1.8 to 5.5	Up to 30, Ext.Adjustable	0.2V±10	1200	700	23	UVLO Soft-Start	SOT-23-6
		062A							27.5		
		072A							31.5		

*1 Output voltage is different by version. *2 Lx current limit is different from output current. *3 The pin-layout of R1205N and that of R1207N are different by 180 degrees. Also, the pin-layout of R1203N and that of R1206N are different by 180 degrees.

● For 2 or 4 Strings of White LEDs

Diode	Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range*1 (V)	Max LED Current (mA)	LED Current Accuracy (%)	Switching Frequency (kHz)	Lx Current Limit*2 (A)	OVP Voltage (Typ.) (V)	Other Features	Package
External	R1214Z	211A/C	PWM/VFM Auto Switching	2.7 to 5.5	Up to 29, Ext. Adjustable	40x2	±2: xx1A/B, ±1.5: xx1C/D	750: 221A/C, 450: 211A/B/C/D	1.9	35	UVLO Soft-Start Thermal LED Adjust 2 strings	WLCSP-9-P1
		221A/C										
		211B	PWM									
		211D										
	R1208K	112A/B	PWM	2.7 to 22.0	Up to 42, Ext. Adjustable	80x4	±3	750: xxxA, 450: xxxB	2	23	UVLO Soft-Start Thermal LED Adjust 4 strings	DFN(PLP)2730-12
		212A/B								33		
		312A/B								43.5		

*1 Output voltage is different by version. *2 Lx current limit is different from output current.

For PMOLEDs and General Use

Diode	Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range*1 (V)	VFB Voltage Accuracy (mV)	Switching Frequency (kHz)	Lx Current Limit*2 (mA)	OVP Voltage (Typ.) (V)	Other Features	Package
Internal	R1200x	001x 002x 003x	PWM	2.3 to 5.5	Up to 20, Ext.Adjustable	1.0V±15	1200	700	17 19 21	UVLO Soft-Start Shutdown Discharge : xxxA	DFN1616-6 DFN(PLP)1820-6 SOT-23-6
	R1202x	3xxA/B 4xxA/B 5xxA/B 6xxA/B 7xxA/B	PWM	2.3 to 5.5	Up to 22.2, Ext.Adjustable	1.0V±15	1200	350 700	14 17 19 21 23	UVLO Soft-Start Thermal Shutdown Discharge : xxxA	DFN1616-6B TSOT-23-6
	R1205L	8x1A	PWM	2.3 to 5.5	Up to 24.2, Ext.Adjustable	1.0V±15	1200	350 700	25	UVLO Soft-Start Thermal	DFN1616-6B
	R1205N ⇒R1207N	8x3A	PWM	2.3 to 5.5	Up to 24.2, Ext.Adjustable	1.0V±15	1200	350 700	25	UVLO Soft-Start Thermal	TSOT-23-6*3
	R1207N	8x3A	PWM	2.3 to 5.5	Up to 24.2, Ext.Adjustable	1.0V±15	1200	350 700	25	UVLO Soft-Start Thermal	TSOT-23-6*3
External	R1204x ●	11xB/C/E/F 21xB/C/E/F 31xB/C/E/F	PWM: xxxB/E PWM/VFM Auto Switching: xxxC/F	2.3 to 5.5	Up to 40.2, Ext.Adjustable	1.0V±15	1000: xxxB/C, 750: xxxE/F	900	23 33 42	UVLO Soft-Start Thermal	DFN(PLP)1820-6 TSOT-23-6

*1 Output voltage is different by version. *2 Lx current limit is different from output current. *3 The pin-layout of R1205N and that of R1207N are different by 180 degrees.

Step-up DC/DC Converters for General Use

Product Name	Version	Control	Input Voltage Range (V)	Output Voltage Range (V)	Output Voltage Accuracy*1 (%)	Frequency (kHz)	Output Tr.	Lx Current Limit*2 (A)	Protection Circuit Type	Other Features	Package
RN5RK	xx1x xx2A	VFM	0.75 to 8.0 0.7 to 8.0	2.0 to 5.5	±2.5	Max.100	Internal External	—	—	Diode	SOT-23-5
R1210N	xx1A/C/D xx2C/D	PWM	0.9 to 8.0 0.8 to 8.0	2.2 to 6.0: xxxC/D 2.2 to 3.5: xx1A	±2.5	100: xxxA/C 180: xxxD	Internal External	—	—	Diode xx1A: with frequency change-over circuit Soft-Start*3	SOT-23-5
R1213K	001A 001B	PWM	2.3 to 5.5	3.0 to 6.0, Ext.Adjustable 6.0 to 15.0, Ext.Adjustable	0.8V±8mV	1000	Internal	3	Latch	Diode Phase : Ext. Shutdown : FLAG pin Soft-Start : Ext. Adjustable UVLO Thermal	DFN(PLP)2730-12
RP400x	xx1A xx1B xx1C	PWM/VFM Auto Switching	0.8 to 5.5 0.7 to 5.5 1.2 to 5.5	1.8 to 5.0 or 1.8 to 5.0, Ext.Adjustable : only DFN	±2	700	Internal	0.6*4	—	Diode Soft-Start Anti-Ringing	DFN(PLP)1820-6 SOT-23-5
RP401x	xx1A	PWM, PWM/VFM Auto Switching	0.6 to 5.5	1.8 to 5.5	±2	1200	Internal	1*4	Latch	Diode Soft-Start	DFN(PLP)1820-6
	xx1B								—		
	xx1C	PWM/VFM Auto Switching		1.8 to 5.5 or 1.8 to 5.5, Ext.Adjustable : only DFN					—		DFN(PLP)1820-6 SOT-23-5
	xx1D	PWM							—		
RP402x	xx1A/C	PWM, PWM/VFM Auto Switching	0.6 to 4.8 or 0.6 to 4.6: 001	1.8 to 5.5 or 1.8 to 5.5, Ext.Adjustable	±1.5	1200	Internal	1.5*4	Latch	Synchro Soft-Start OVP OVLO Anti-Ringing : xx1/001 Regulation available at VIN>VOUT Reverse current protection at VIN=0V or open	DFN(PLP)2020-8
	xx2A	Forced PWM				1000					
	xx1B/D	PWM, PWM/VFM Auto Switching				1200			—		
	xx2B	Forced PWM				1000					
	xx1E/G	PWM/VFM Auto Switching	0.6 to 4.8	1.8 to 5.5		1200			Latch	Input and output cut off completely at standby: xxxA/B/E/F	SOT-23-5
	xx1F/H								—	Input and output bypass at standby: xxxC/D/G/H	

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Lx current limit is different from output current. *3 Soft-start includes a function that detects a sudden fluctuation of voltage to prevent overshoot and undershoot. *4 Lx Limit Current fluctuates depending on Duty.

DC/DC Converters

DC/DC Converters for LCDs/OLEDs/CCDs

These products are suitable for the power management of LCDs, OLEDs and CCDs. Many variations are available such as step-up DC/DC controller, step-up and step-down dual output converter and step-up and positive/negative charge pump triple output converter. These products include an under-voltage lockout circuit (UVLO), and a latch type protection circuit. The products with a built-in sequence control circuit option are able to control a start-up sequence and a shutdown sequence.

Step-up DC/DC Controllers

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Tr.	Lx Current Limit*2 (A)	Protection Circuit Type	Other Features	Package
R1211x ●	PWM	2.5 to 6.0	Ext.Adjustable	1.0V±15	700: xxxA/B 300: xxxC/D	External	N	Latch	Soft-Start UVLO Diode Phase : Ext., xxxA/C Phase : Int., xxxB/D, with stand-by	SON-6 SOT-23-6W
R1212D	PWM	2.2 to 5.5	Ext.Adjustable	1.0V±15	300: xxxC 700: xxxA 1400: xxxB	External	N	Latch	Soft-Start : Ext.Adjustable UVLO Diode Phase : Ext. Maxduty : Ext.Adjustable	SON-8
R1215D	PWM	1.8 to 5.5	Ext.Adjustable	1.0V±15	700: xxxA/E 1400: xxxB/F	External	N	Latch	Soft-Start : Ext.Adjustable UVLO Diode Phase : Ext. Maxduty : Ext.Adjustable	SON-8

Step-up and Inverting DC/DC Converters

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Tr.	Lx Current Limit*2 (A)	Protection Circuit Type	Timer Latch Delay Time (ms)	Other Features	Package
R1280D	CH1: PWM, Step-up CH2: PWM, Inverting	2.5 to 5.5	Ext.Adjustable	1.0V±15	200: xxxC, 700: xxxA/B	External	—	Latch	100	Soft-Start : Ext.Adjustable UVLO Diode Phase : Ext., xxxA/C Phase : Int., xxxB, with stand-by	SON-10
R1283K	CH1: PWM, Step-up CH2: PWM, Inverting	2.5 to 5.5	Up to 20.0, Ext.Adjustable Up to VDD-20.0, Ext.Adjustable	1.0V±15 0V±25	300: xxxA, 700: xxxB, 1400: xxxC	Internal	1.5 1.5	Latch	50	Soft-Start UVLO Discharge : Inverting output only Sequencing Diode	DFN(PLP)2730-12
R1286K	CH1: PWM, Step-up CH2: PWM, Inverting	2.5 to 5.5	4.5 to 5.8: xxxA/C to G 4.5 to 5.8, Ext.Adjustable, 001B -2.0 to -6.0: xxxA/C to G -2.0 to -6.0, Ext.Adjustable, 001B	±0.9% 1.0V±15 ±70 0V±25	1750	Internal	1.0: 0xxx, 1.1: 1xxx 1.5: 0xxx, 1.8: 1xxx	Latch	16: 0xxx/001B, 40: 1xxx	Synchro Soft-Start UVLO Sequencing Discharge Thermal Single-Wire : xxxA/C to G, Inverting output can be dynamically changed by S-wire control.	DFN(PLP)2730-12
R1287x ● CH1: Step-up / CH2: Inverting	PWM/VFM Auto Switching: xxxB/F, PWM: xxxC/D/G/H	2.5 to 5.5	4.5 to 5.8: xxx 4.5 to 5.8: Ext.Adjustable, 001 -4.5 to -5.8: xxx -4.5 to -6.0: Ext.Adjustable, 001	±0.9% 1.0V±15 ±1.0% 0V±30	900: xxxB/F, 300: xxxC/G, 1000: xxxD/H 1100: xxxB/F, 300: xxxC/G, 1000: xxxD/H	Internal	1.1 1.5	Latch	30	Synchro Soft-Start UVLO Sequencing Discharge Thermal xxxF/G/H: only WLCSP-12-P1	WLCSP-12-P1 DFN3030-12

Step-up and Step-down Type DC/DC Controller

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Tr.	Protection Circuit Type	Other Features	Package
R1282D	CH1: PWM, Step-up CH2: PWM, Step-down	2.5 to 5.5	Ext.Adjustable	1.0V±15	700	External	Latch	UVLO Diode Soft-Start : Ext.Adjustable Phase : Ext.	SON-10

Step-up and Charge Pump Type DC/DC Converters

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy*1 (mV)	Switching Frequency (kHz)	Output Tr.	Lx Current Limit*2 (A)	Protection Circuit Type	Other Features	Package
R1293K	PWM, Step-up	2.2 to 5.5	Up to 16.0, Ext.Adjustable	1.0V±15	300 to 1000, Ext.Adjustable	Internal	2	Latch	DC/DC output with noise reduction function, VCOM amplifier 1 channel, GAMMA amplifier 6 channel Thermal Diode Soft-Start : Ext.Adjustable Phase : Ext. Maxduty : Ext.Adjustable	QFN(PLP)0404-32
	LDO		1.8 to 2.5	±1%		Internal	IOUT= 350mA			
	Amplifier	5.0 to 16.0	—	—		—	—			
R1290K ●	CH1: PWM, Step-up	2.0 to 5.5 : 101A 2.5 to 5.5 : 102A 3.3 to 5.5 : 103A	CH1: Up to 20.0, Ext.Adjustable	1.0V±15	180 to 1400, Ext.Adjustable	Internal	CH1: 2	Latch	The charge pump operates at 1/4th operating frequency. Soft-Start : Ext.Adjustable Sequencing UVLO Diode Phase : Ext. Maxduty : Ext.Adjustable	QFN0404-24
	CH2: Charge pump,Positive		CH2/3: Ext.Adjustable	1.5V±25						
	CH3: Charge pump, Negative			0V±30						
R1294L ● ■	CH1: PWM, Step-up	2.0 to 5.5 : 101A 2.5 to 5.5 : 102A 3.3 to 5.5 : 103A	CH1: Up to 20.0, Ext.Adjustable	1.0V±15	210 to 1400, Ext.Adjustable, 800±8%	Internal	CH1: 2	Latch	The charge pump operates at 1/4th operating frequency. Soft-Start : Ext.Adjustable Sequencing UVLO Diode Phase : Ext. Maxduty : Ext.Adjustable	QFN0404-24B
	CH2: Charge pump,Positive		CH2/3: Ext.Adjustable	1.5V±25						
	CH3: Charge pump, Negative			0V±30						

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Lx current limit is different from output current.

Step-up DC/DC Converter with VD and VR

Product Name	DC/DC Converter Part							Other Features	Package
	Control	Input Voltage Range (V)	Output Voltage Range*1 (V)	CE	Switching Frequency (MHz)	Output Tr.	Lx Current Limit*2 (A)		
RP600K0xxA	PWM, PWM/VFM Auto switching	0.8 to 5.5	2.3 to 5.5, Accuracy: ±2%	CE	1.2	Internal	1.4	Diode, Soft-Start, Thermal, Sequencing : Except xxC	DFN(PLP)2527-10
RP600K0xxB				CE1					
RP600K2xxC				CE					
RP600K1xxD			2.3 to 5.5, Ext.Adjustable, Accuracy: ±12mV	CE					

Product Name	LDO Regulator Part						Voltage Detector Part			
	Output Current (mA)	Input Voltage Range (V)	Output Voltage Range (V)	CE	ECO Function	Input	Operating Voltage Range (V)	Detector Threshold Range (V)	Output Delay Time	Hysteresis Range (%)
RP600K0xxA	500	2.0 to 5.5	1.5 to 5.0, Accuracy: ±1%	CE	Fast Response Mode	DC/DC output	0.8 to 5.5	1.0 to 4.5, Accuracy: ±2%, Monitor VSENSE	Y	5
RP600K0xxB	300			CE2	DC/DC Enabled: Fast Response Mode DC/DC Disabled: Automatic/Manual Shift Mode	VIN			Y	5
RP600K2xxC	150			—		DC/DC output			N	30 to 80, 10% steps
RP600K1xxD	500			CE	Fast Response Mode				Y	5

*1 For the externally adjustable output voltage type, this is a feedback voltage accuracy. *2 Lx current limit is different from output current.

Step-down DC/DC Converter with VD and VR

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy (%)	Switching Frequency (MHz)	Output Tr.	Output Current *1 (mA)	Protection Circuit Type	Other Features	Package
R5220K	PWM	2.8 to 5.5	1.0 to 3.3	±2	1.2	Internal	400: DC/DC, 50: VR	Latch	Synchro, Soft-Start, UVLO, Built-in DC/DC and VR Alternative Circuit	DFN(PLP)2514-6
RP901K	PWM, PWM/VFM Auto Switching	4.5 to 5.5	1.2 to 1.8: DC/DC	±2	1.2	Internal	800: xxxA/B/C, 900: xxxD	Reset	Synchro, Soft-Start, UVLO, Thermal, Sequencing, Built-in VD and VR, for DVD drive	DFN(PLP)2527-10
			2.5 to 3.3: VR	±1			600			
			2.0 to 3.0: VD, xxxA 3.0 to 5.0: VD, xxxB/C/D	±2			—			
RP904Z	PWM/VFM Manual switching	2.5 to 5.5	1.2 to 3.3 (DC/DC1)	±2	2	Internal	1000	Latch	Synchro, Soft-Start, UVLO, Built-in Bypass switch, Output Voltage selectable from DC/DC1 or DC/DC2	WLCSP-11-P2
			1.0 to 1.5 (DC/DC2)	±30mV						

*1 Output Current (IOUT) can be affected by environmental conditions or external components. This is an approximate value.

Step-up/down DC/DC Converters

Product Name	Control	Input Voltage Range (V)	Output Voltage Range (V)	Voltage Accuracy (%)	Switching Frequency (MHz)	Output Tr.	Output Current *1 (A)	Protection Circuit Type	Other Features	Package
RP601Z	Forced PWM, PWM/VFM Auto Switching	2.3 to 5.5	2.75 to 4.2	±2	2.4	Internal	1	—	Synchro, UVLO, Soft-Start, Discharge, Thermal, PG, Single-Wire : Dynamic Control of Output Voltage Using S-Wire, Forced Bypass Mode, DVS: 50mV	WLCSP-16-P1
RP602Z	Forced PWM, PWM/VFM Auto Switching	2.3 to 5.5	2.7 to 4.2	±1.5	2.6	Internal	1.5	Latch or Reset	Synchro, OVP, UVLO, Soft-Start, Discharge, Thermal	WLCSP-20-P1
RP604x	VFM	2.0 to 5.5*2	1.6 to 5.2*2	±1.5	*3	Internal	0.2	—	Synchro, UVLO, Soft-Start, Discharge	WLCSP (Underdevelopment)

*1 Output Current (IOUT) can be affected by environmental conditions or external components. This is an approximate value. *2 The actual input/output voltage range can be changed due to using conditions. *3 Switching frequency is depending on the conditions of Input, Output Voltage, and Output Current.

Li-ion Polymer Battery Protections/ Li-ion Polymer Secondary Battery Protections/ Analog Front Ends

REDC's Li-ion polymer battery protections and Li-ion polymer secondary battery protections have been released to the market since 1995, when the Li-ion rechargeable batteries became available. REDC has over 20 years of experience developing these products. These protections protect batteries provide features like over-charge/discharge voltage, excess charge/discharge current and short circuit.
REDC has a wide product portfolio of 1-cell protections for smartphones and tablets, 2-cell protections for DSLR and portable DVD players, multi-cell protections for electrical power tools and E-bike and Li-ion polymer secondary battery protections for notebook PCs and electrical power tools.

: Products Newly Released : Products in Development

1-Cell Li-ion Polymer Battery Protections

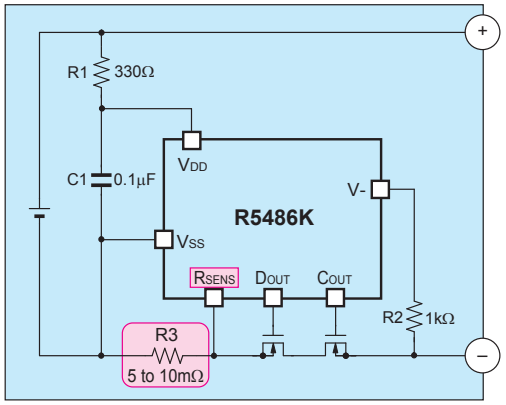
REDC's 1-cell Li-ion polymer battery protections are high precision devices. Not only the over-charge detector threshold, for example, the R5486K Series have an ultra high accuracy excess discharge current detector of ±8% accuracy. (If V_{D3} is less than 38 mV, ±3.1 mV accuracy is guaranteed.) Due to using external sensing resistance solution, R5472x/R5480x/R5486K/R5494x Series can detect more precise excess charge/discharge current than conventional solution of using FET's on resistance. FET's on resistance is unstable depending on the condition such as gate voltage, temperature, and FET part number. Besides, the R5471L Series have high precision over-charge voltage detector with ±10 mV accuracy in the temperature range from 0°C to 50°C.

Product Name		R540xx	R5471L	R5475N R5478N	R5472x	R5480x	R5486K	R5487L R5497L	R5494K R5494L
Supply Current (µA)	Typ.	3.5 or 4.0	4.0	3.0	4.0	←	←	3.0	←
Standby Current (µA)	Max.	0.1 or 2.0	0.1	0.1 or 2.0	0.1	←	←	0.1 or 0.5	0.5
Overcharge									
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		4.0 to 4.5, ±25	4.1 to 4.5*1, ±10	4.2 to 4.5, 3.65 or 3.9, ±25	4.1 to 4.5, ±20	←	←	4.2 to 4.6, ±20	4.1 to 4.5, ±20
Output Delay Time (s)	Typ.	0.250 or 0.275 or 1.0 or 1.1	1.0	←	←	←	←	←	←
Protection Circuit Type		Latch or Auto Release	Latch	Latch or Auto Release	Latch	←	←	Latch or Auto Release	Auto Release
Overdischarge									
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		2.0 to 3.0, ±2.5%	←	1.9 to 3.0, ±2.5%	2.1 to 3.0, ±35	←	←	2.0 to 3.0, ±35	2.1 to 3.0, ±35
Output Delay Time (ms)	Typ.	20	←	←	←	20 or 128	20	20	128
Protection Circuit Type		Latch or Auto Release	Latch	Latch or Auto Release	Latch	←	←	Latch or Auto Release	Auto Release
Excess Discharge Current									
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		0.05 to 0.20, ±15	0.05 to 0.13, ±10	0.05 to 0.20, ±15	0.050 to 0.080, ±10 0.081 to 0.100, ±15	0.030 to 0.048, ±15%	V_{D3-1}: 0.015 to 0.046, ±8% or ±3.1, V_{D3-2}: 0.030 to 0.080, ±8% or ±3.1	0.025 to 0.15, ±10 or ±10% or ±5	0.021 to 0.048, ±10% or ±4
Output Delay Time (ms)	Typ.	6 or 12 or 16	36	6 or 12	12	12 or 16	tV_{D3-1}: 3s or 4s or 5s tV_{D3-2}: 12	12	8
Excess Charge Current									
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		-0.2 to -0.05, ±30	-0.17 to -0.05, ±20	—	-0.100 to -0.081, ±15, -0.080 to -0.050, ±10	-0.030 to -0.020, ±15%	-0.060 to -0.015, ±15% or ±3	-0.150 to -0.020, ±10% or ±5	-0.035 to -0.020, ±15%
Output Delay Time (ms)	Typ.	8 or 16	16	—	16	8 or 16	16	8	9
Short Protection									
Detector Threshold (V)	Typ.	0.8 or 1.3	0.6	0.75	0.5	0.18 or 0.5	0.15 to 0.3	0.15 to 0.40	V_{DET3}×3 or V_{DET3}×4
Output Delay Time (µs)	Typ.	200 or 300 or 400	600	200 or 300	250	←	←	←	200
0V charge		Selectable	←	←	Prohibited	←	←	Selectable	←
Other Features			High Precision: ±10mV		Excess Current Sensing by External Resistor with R_{SENS} Pin		Excess Current Sensing by External Resistor with R_{SENS} Pin, Excess Discharging Sensing by Two-steps Detection of V_{D3}		Exccess Current Sensing by External Resistor with RSENS Pin
Package		DFN(PLP)1616-6 DFN1814-6 DFN(PLP)1820-6 SOT-23-5 SOT-23-6	DFN1814-6	**R5475N Series** SOT-23-5 **R5478N Series** SOT-23-6	DFN(PLP)1414-6 DFN1414-6	DFN(PLP)1414-6 DFN1814-6	DFN(PLP)1414-6	**R5487L Series** DFN1814-6B DFN1414-6B **R5497L Series** DFN1414-6B	DFN(PLP)1414-6 DFN1814-6C

*1 Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however, this specification is guaranteed by design, not mass production tested.

■ Typical Application

Battery Pack



R_{SENS}: Over-current detector input pin
Due to using external resistance R3, R5472x/R5480x/R5486K/R5494x Series can detect more precise excess charge/discharge current than conventional solution of using FET's on resistance. FET's on resistance is unstable depending on the condition such as gate voltage, temperature, and FET part number.
(Excess current threshold of R5486K is ±8% accuracy. If V_{D3} is less than 38 mV, ±3.1 mV accuracy is guaranteed.)
Products built-in the R_{SENS} pin: R5472x, R5480x, R5486K, R5494x

2-Cell Li-ion Polymer Battery Protections

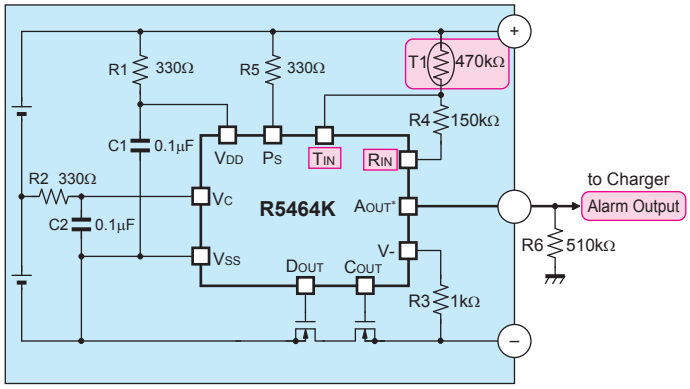
REDC's 2-cell Li-ion polymer battery protections have a high accuracy. Especially R5461K and R5464K Series have an ultra high accuracy over-charge detection of +10 mV and -15 mV in a temperature range from 0°C to 50°C.

Product Name		R5460x	R5461K	R5462K	R5463K	R5464K	R5466K
Supply Current (µA)	Typ.	4.0	4.0 or 5.0	4.0	←	5.0 or 6.0	5.0
Standby Current (µA)	Max.	0.1 or 2.0	0.1	0.1 or 2.0	0.1	←	←
Overcharge							
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		4.2 to 4.5 or 3.5 to 4.0, ±25	3.60 to 4.35*1, +10/-15	3.65 to 4.32*1, ±10	3.65 to 4.32, ±20	4.0 to 4.3*1, +10/-15	4.0 to 4.3, +20/-25
Output Delay Time (s)	Typ.	1.0	←	←	←	←	←
Protection Circuit Type		Auto Release	←	←	←	←	←
Overdischarge							
Detector Threshold Range (V) Detector Threshold Accuracy (%)		2.0 to 3.0, ±2.5	←	2.0 to 3.2, ±1	←	2.0 to 3.0, ±2.5	←
Output Delay Time (ms)	Typ.	128	←	←	←	←	←
Protection Circuit Type		Latch or Auto Release	Latch	Latch or Auto Release	Latch	←	←
Excess Discharge Current							
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		0.05 to 0.20, ±15	0.05 to 0.24, ±15	0.05 to 0.20, ±10	0.05 to 0.20, ±10 or 0.20 to 0.40, ±10%	0.05 to 0.24, ±15	←
Output Delay Time (ms)	Typ.	12	12 or 24	12	←	12 or 16	16
Excess Charge Current							
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		-0.1, -0.2, -0.4 ±30, ±30, ±40	-0.22 to -0.1, ±30	-0.2 to -0.1, ±20	←	-0.22 to -0.1, ±20	←
Output Delay Time (ms)	Typ.	8	←	←	←	←	←
Short Protection							
Detector Threshold (V)	Typ.	1	←	←	←	←	←
Output Delay Time (µs)	Typ.	300	←	←	←	←	←
0V Charge		Acceptable	Selectable	←	Prohibited	Selectable	←
Other Features			with Alarm Function	High Precision		with Alarm Function	with Alarm Function
Package		DFN(PLP)1820-6 SOT-23-6	DFN(PLP)2527-10	DFN(PLP)1820-6B	DFN(PLP)1820-6B	DFN(PLP)2527-10	DFN(PLP)2527-10

*1 Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however, this specification is guaranteed by design, not mass production tested.

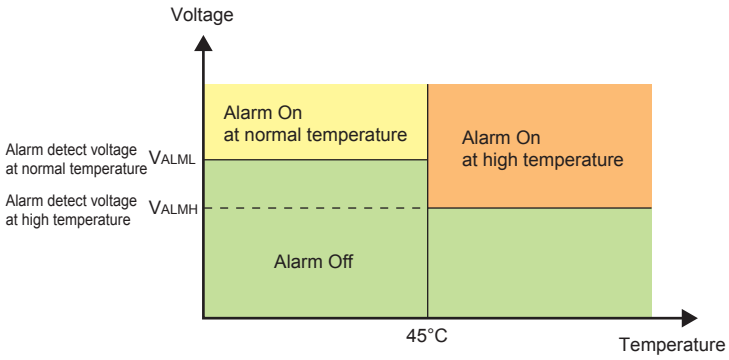
■ Typical Application

Battery Pack



TIN: External thermistor connection pin.
RIN: External resistor connection pin.
PS: P-channel source pin for over-charge alarm output*
* Alarm output pin (AOUT) is a P-channel open drain output.
In the R5464K, the source of AOUT is Ps pin, not VDD pin. Therefore, the external pull-down resistor, R6 does not have an impact on the drop out between a plus terminal of a battery pack and a VDD pin.
Thus, R6 value range is wide enough to choose.
* Products built-in the Alarm output pin (AOUT): R5461K, R5464K, R5466K

■ Alarm Function



When 1-cell voltage or 2-cell voltage exceeds the alarm threshold voltage (VALML), an alarm signal will be present at the AOUT pin. If the detection temperature of thermistor exceeds 45°C, the alarm detect voltage threshold changes to VALMH. (The detection temperature can be changed)

Products with alarm output controlled by an external thermistor: R5461K, R5464K, R5466K

Multi-Cell Li-ion Polymer Battery Protections

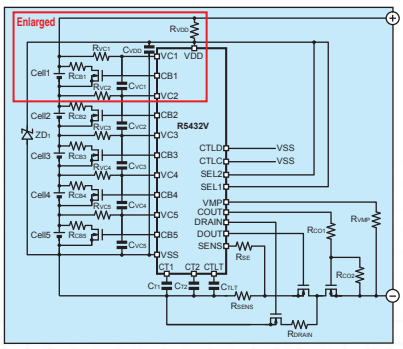
REDC's multi-cell Li-ion polymer battery protection have several advanced features such as Cell Balance Function, Cascade Connection and Breaking Wire Detection.

Product Name		R5431V	R5432V	R5433V	R5436T	R5650T
Supply Current (µA)	Typ.	12.0	←	6.0	12.0	←
Standby Current (µA)	Typ.	6.0	—	—	6.0	←
Overcharge						
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		3.6 to 4.5, ±25	←	←	←	←
Output Delay Time (s)	Typ.	1.0	←	←	←	←
Protection Circuit Type		Auto Release	←	←	←	←
Overdischarge						
Detector Threshold Range (V) Detector Threshold Accuracy (%)		2.0 to 3.0, ±2.5	←	←	2.0 to 3.2, ±2.5	← ±50mV
Output Delay Time (s)	Typ.	0.128 or 1.2	Settable by C_{T1}	←	←	←
Protection Circuit Type		Auto Release	←	←	Latch or Auto Release	←
Excess Discharge Current						
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		V_{D3-1}: V_{DD}-0.2, V_{D3-2}: V_{DD}-0.6, ±20	V_{D3-1} 0.1 to 0.3, ±20 V_{D3-2} BA: 0.45 or 0.60, ±100 BB/BC: 0.25 to 0.40, ±70 BD: 0.25 or 0.30, ±55 ($V_{D3-2} \geq V_{D3-1}$ + 0.1V)	—	V_{D3-1}: 0.05 to 0.25, ±20 V_{D3-2}: 3×V_{D3-1}, ±50	V_{D3-1}: 0.03 to 0.05, ±5, 0.05 to 0.1, ±10 V_{D3-2}: 2 or 2.5 or 3×V_{D3-1}, ±12.5
Output Delay Time (ms)	Typ.	tV_{D3-1}: 12 or 1.0s tV_{D3-2}: 2 or 10	tV_{D3-1}: Settable by C_{T2} tV_{D3-2}: tV_{D3-1}×1/100 or 1/6	—	tV_{D3-1}: Settable by C_{T2} tV_{D3-2}: tV_{D3-1}×1/100 or 1/6	← tV_{D3-2}: Settable by C_{T3}
Excess Charge Current						
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		V_{D4}: V_{DD}+0.2, ±30	-0.05, -0.1, -0.2, -0.4 ±30, ±30, ±30, ±40	—	-0.05, -0.1, -0.2 ±30, ±30, ±30	-0.015, -0.05 ±7.5, ±10
Output Delay Time (ms)	Typ.	8	←	—	8	←
Short Protection						
Detector Threshold (V)	Typ.	V_{DD}-1.2	BA: 1.0 BB/BC: 0.75 BD: V_{D3-2}×1.67	—	0.25 to 1.0	0.1 to 0.6
Output Delay Time (µs)	Typ.	300	←	—	330	500
0V charge		Prohibited	Selectable	Acceptable	←	Selectable
Other Features		For 3-cell to 4-cell Protection, High Side Protection FET	For 3-cell to 5-cell Protection*1, Built-in Cell Balance Function, Built-in Breaking Wire Detection	Over-charge/-discharge is controlled by sending a signal to MCU from the COUT/DOUT pin, Signal Output Type, Built-in Breaking Wire Detection	For 3-cell to 5-cell Protection*1, Built-in Cell Balance Function, Built-in Breaking Wire Detection*2, External NTC Temperature Protection Function	For 3-cell to 5-cell Protection, External NTC Temperature Protection Function
Package		SSOP-16	SSOP-24	SSOP-16	TSSOP-28	TSSOP-20

*1 Cascadable for 6-cell, or higher cell protections. *2 Only BA version.

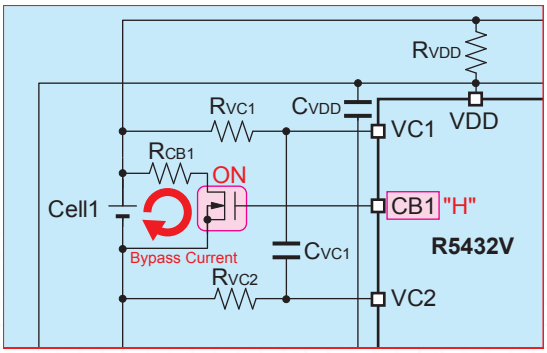
■ Typical Application

Battery Pack

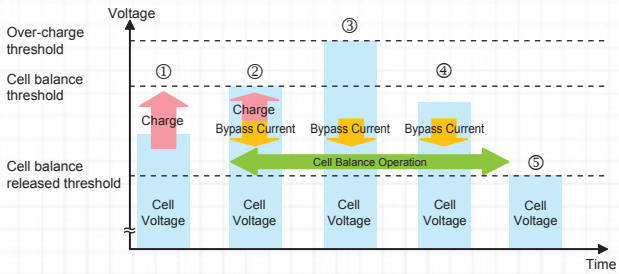


Enlarged Figure

Battery Pack



■ Cell Balance Operation



① When a cell voltage is lower than the cell balance threshold, a cell is charged.
② When a cell voltage becomes higher than the cell balance threshold, CB1 pin becomes "H" and N-channel transistor turns on, and then the cell balance operation starts. Then a bypass current flows to the direction of a arrow and a charge current becomes suppressed by the bypass current.
③ When a cell voltage reaches to the over-charge threshold, cell charging stops after the output delay time.
④ If charging to a cell stops, the cell balance operation continues until a cell voltage becomes lower than the cell balance released threshold. The bypass current continues to flow decreasing the cell voltage.
⑤ When a cell voltage reaches to the cell balance released voltage, CB1 pin becomes "L" and N-channel transistor turns off, and then cell balance operation stops.

■ Breaking Wire Detection

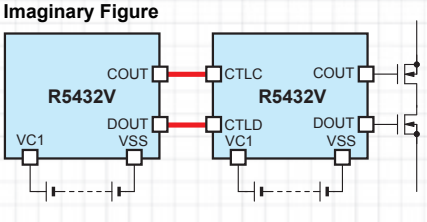
In case of using a battery pack in electric power tools exposed to heavy vibrations, there is a risk that the protection circuit fails due to a breaking wire condition between battery cells and protection circuit board.

The Breaking Wire Detection circuit performs a test at fixed intervals, depending on the capacitance connected to CTLT pin. When a breaking wire event occurs, it results in interrupting the charge or discharge condition.

■ Cascade Connection

Multi cell Li-ion/polymer battery protection ICs can protect over 6 cells by cascade connection.

Imaginary Figure

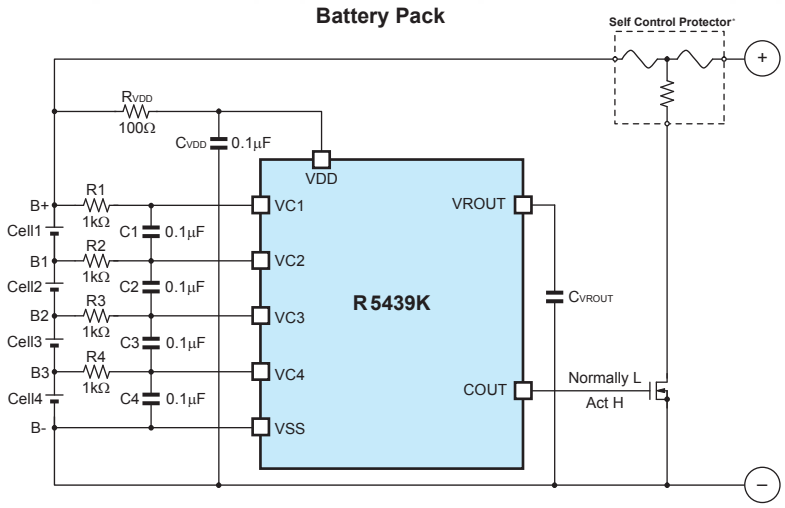


Li-ion Polymer Secondary Battery Protections

REDC's Li-ion polymer secondary battery protections support over-charge voltage protection only. These are suitable from 1-cell to 5-cell battery packs.

Product Name		R5434D	R5435x	R5437L R5438L	R5439K	R5458L
Supply Current (µA)	Typ.	3.0	←	0.85	4.0: V_{CELLn}=4.15V (n=1, 2, 3, 4) 2.5: V_{CELLn}=3.1V (n=1, 2, 3, 4)	1.5
Standby Current (µA)	Max.	—	0.1	←	0.2	0.5
Overcharge						
Detector Threshold Range (V) Detector Threshold Accuracy (mV)		3.6 to 4.6, ±25	4.10 to 4.55, ±20	4.10 to 4.60, ±20	4.20 to 4.60, ±20	4.00 to 4.70, ±20
Output Delay Time (s)	Typ.	1.5	2.0 or 4.0 or 6.0	←	←	2
C_{OUT} Output "H" Voltage (V)	Typ.	3.7	4.7	←	←	VDD
Shutdown Detector Threshold (V)	Typ.	—	3.5	←	Shutdown1 detector threshold: 3.8, Shutdown2 detector threshold: 2.3 to 2.8	—
Other Features		2-cell to 5-cell	2-cell to 3-cell	1-cell to 3-cell	2-cell to 4-cell Voltage Regulator Function: 2.9V to 3.7V	1-cell
Package		SON-8	DFN(PLP)1616-6B TSOT-23-6	DFN1814-6, The pin-layout of R5437L and that of R5438L is different.	DFN(PLP)2020-8	DFN1814-6C

Typical Application



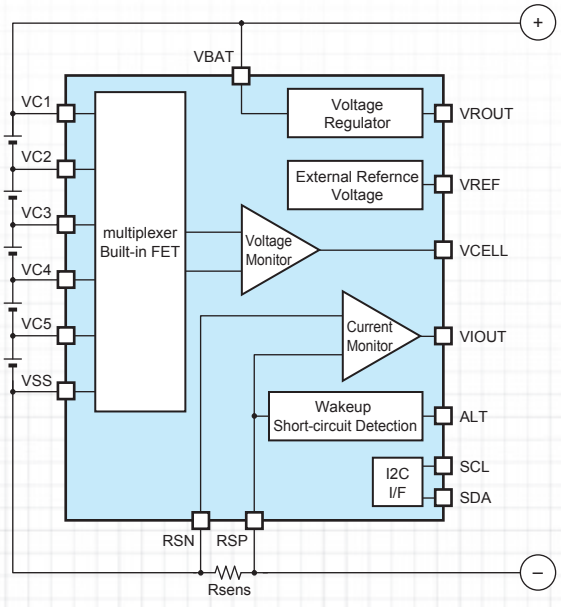
In terms of the order of connecting terminals, Connect sequences must be used as following:
B-→B3→B2→B1→B+.
Otherwise, COUT may output "H" tentatively, and the fuse may be fused.
Please contact Dexerials Corporation regarding Self-control Protector.

Analog Front-ends for Li-ion Polymer Battery Protections

CMOS-based analog front-ends monitor up to five cell voltage levels of Li-ion polymer secondary battery.

analog front-ends		R5601T
Supply Current (µA)	Typ.	36
Low Supply Current Mode (µA)	Typ.	6.5
Standby Current (µA)	Max.	2.0
Voltage Monitoring Accuracy (mV)		Input-referred Voltage Error: ±9
Current Monitoring Gain Accuracy H		AA: 40±2.0% AC: 10±1.0%
Current Monitoring Gain Accuracy L		AA: 10±1.0% AC: 5±0.8%
External Reference Voltage (mV)		±3.5
Voltage Regulator Output Voltage (V)		3.3±1.0%
Voltage Regulator Output Current (mA)		30
Communication		I²C
Other Features		For 3-cell to 5-cell Wakeup Function Short-circuit Current Detection
Package		TSSOP-16

Block Diagram



Switches

● : Automotive Products Available : Products in Development

Introduction

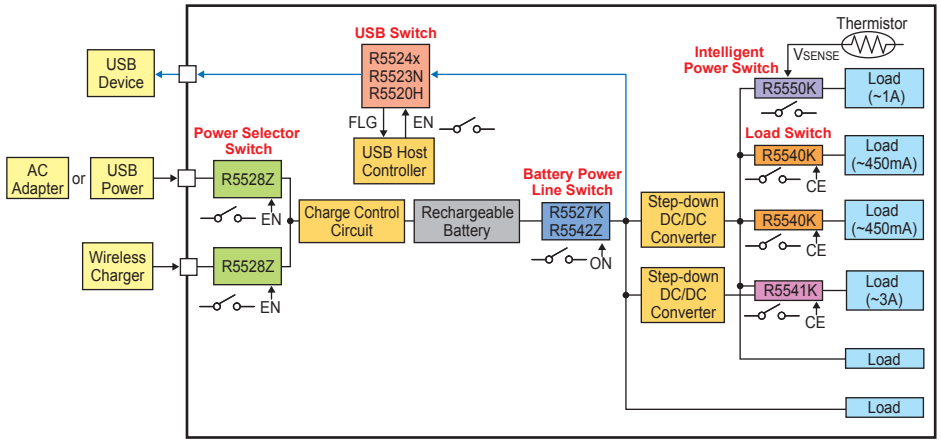
Aiming at saving energy, not only the battery-powered application, but all electronic equipment is required to consumption power limit according to each local standard. To save energy, instead of using LDO, switch IC for each circuit block is used after DC/DC converter. Simple MOSFET can play the role as a switch, but load switch IC can include protection circuits, discharge function at off state, and a slew rate control circuit. As a result, saving space and intensive function realization are possible. REDC provides wide variety lineup of switch ICs with low on resistance MOSFET and protection circuits in one chip.

Switch Features

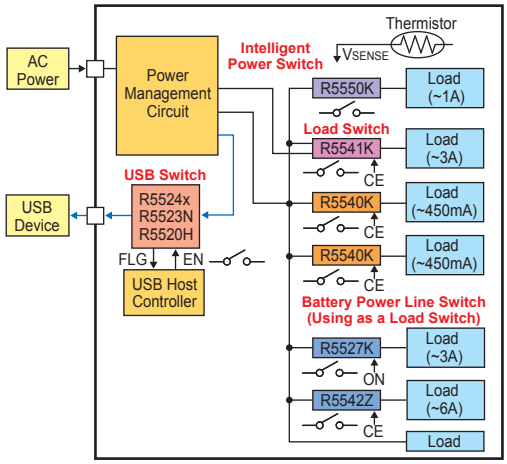
Product Category	Product Description	Typical Applications	Product Name
USB Switch	USB Power Line Protection USB Power Line ON/OFF Control	USB Powered Application: PCs, PC Peripherals, Digital TVs, STBs, Printers, Smartphones	R5520H R5523N R5524x
Rectifier Switch	Output Rectifier Regardless of Input Polarity	Toy and Healthcare Product Powered by Dry Cell	R5590D/N
Load Switch	Power Line ON/OFF Control and Distribution; Secondary Power Supply Switch	Power-saving Required Equipment during Standby/ Sleep Mode: Portable Communication Equipment, DSCs, DSVCs, PCs, MFPs	R5527K R5540K R5541K
Battery Power Line Switch	Battery Line Protection; Primary Power Supply Switch or Load Switch	Secondary Battery Powered Equipment: Smartphones, Tablet PCs, PNDs, Notebook PCs It can be used as a load switch for any electronic equipment.	R5527K R5542Z
Intelligent Power Switch	Power Line's Systematic Protection; Secondary Power Supply Switch	Power-saving with High Protection Required Equipment during Standby/ Sleep Mode: Portable Communication Equipment, DSCs, DSVCs, PCs, MFPs	R5550K
External Power Switch	Several Power Line Switchover Control	Power Selection Required Equipment: AC Adapters, USB Chargers, Wireless Charger	R5528Z
OVP Switch	Overvoltage Protection for Input Pin	Charger Protection for Secondary Battery-Powered Equipment	R5560Z R5528Z
PC Card & Express Card Power Switch	ON/OFF Control of PC Card Power Line	PC Card Bus Slot, PC Card Reader Writer	R5533V
	ON/OFF Control of Express Card Power Line	Express Card Slot	R5538D

Typical Application

For Portable Equipment



For Non-Portable Equipment



USB Switches

There are two main roles of USB. Recently, USB switch IC is used as a load switch with protections.

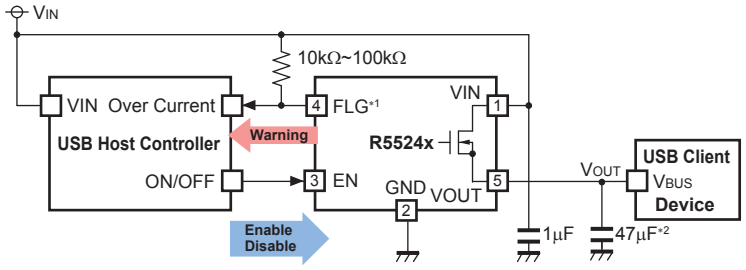
1. USB Power Line's ON/OFF Control

By the enable signal from another device such as a USB Host Controller, the USB switch turn on the USB power line with suppressing inrush current with soft-start function. On the contrary, by the disable signal, the USB switch cut off the power line with or without auto-discharge function (Option).

2. USB Power Line Protection

There is protection capability against the abnormal heating in the USB switch, and if preset over-current is detected, output current is limited or power is cut off and latched for protection.

R5524x Typical Application



*1 FLG pin has N-channel open drain output, therefore pull-up resistance is necessary when it is used. The output of FLG pin becomes "L" when the thermal shutdown or over-current limit-function works.

*2 According to the USB standard, 120uF or more capacitor attachment is recommended, however, as an IC, changing capacitor is acceptable considering other usage.

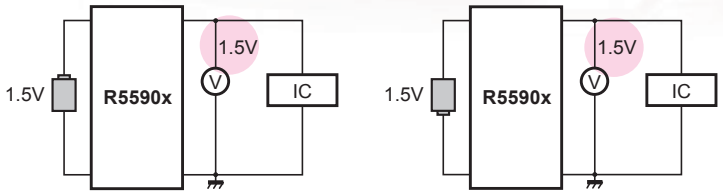
USB High-side Switches

Product Name	ON Resistance (mΩ)	Supply Current (μA)	Operating Voltage Range (V)	UVLO Detect Voltage (V)	Current Limit Threshold (mA)		Short Current Limit (mA)		Internal FET	EN	Protection Type	Other Features	Package
		Typ.		Typ.	Min.	Typ.	Min.	Typ.					
R5520H	100	20	4.0 to 5.5	2.2	—	1200	500	750	Pch	H/L	Constant Current	Thermal Soft-Start	SOT-89-5
R5523N ●	130	20	2.2 to 5.5	1.8	—	1000	500	750	Pch	H/L	Constant Current	Thermal Soft-Start	SOT-23-5
R5524x001A/B ●	100	110	2.7 to 5.5	2.4	650	800	550	650	Nch	H	Latch-Off/ Constant Current	Thermal Soft-Start	DFN(PLP)1820-6
R5524x002A/B ●												Reverse : OFF	SOT-23-5
R5524N004A ●					1250	1550					Constant Current	Discharge : xxxA	SOT-23-5

■ Rectifier Switches

Protection against reverse insertion of a dry cell, generally, mechanically or using diode method is common. These method limits operation if reverse insertion happens. REDC offers direction free insertion of a dry cell with the R5590. The R5590 reduces the energy loss of Vf by a diode and rectifies and realizes dry cell direction free insertion.

R5590x Typical Application



The R5590x allows batteries to be placed in any direction without regard to positive or negative polarity.

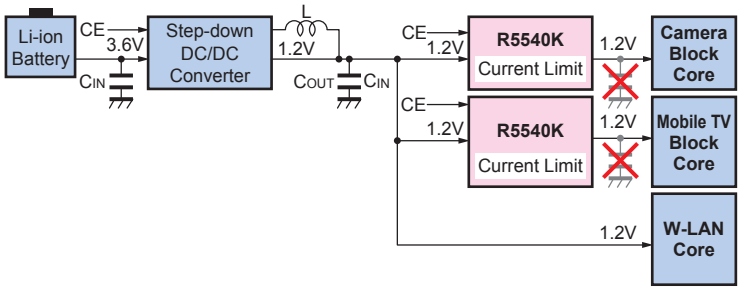
■ Rectifier Switches

Product Name	ON Resistance (Ω) Typ.	Supply Current (μA) Typ.	Operating Voltage Range (V)	Package
R5590N R5590D	0.6: SOT-23-5, VIN=1.5V 0.52: SON1612-6, VIN=1.5V	0.05: VIN=1.5V	0.9 to 5.25	SOT-23-5 SON1612-6

■ Load Switches

Same voltage is necessary for different function blocks. In that case, to make a power tree, a higher than required voltage is generated by DC/DC converter and distributed the appropriate voltage to each function block via LDO. In another case, the same voltage is generated by DC/DC converter directly, and distributed the voltage via load switch. In using LDO method, a certain dropout voltage between input and output is necessary, therefore, power loss should be bigger than using load switch method. Not only that, to secure the phase compensation of an LDO, external capacitors are often necessary, therefore more space is required. On the other hand, load switches do not have the regulation function, however, internal output transistor's on resistance is very small, therefore dropout voltage can be minimized and suppression of the power loss is possible. External capacitors are unnecessary.

R5540K Typical Application



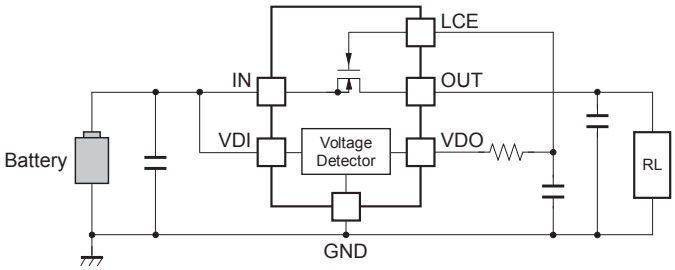
■ Load Switches

Product Name	ON Resistance (mΩ)	Supply Current (μA) Typ.	Operating Voltage Range (V)	Output Current (mA)	Current Limit Threshold (mA) Typ.	Current Limit Threshold (mA) Max.	Internal FET	CE	Other Features	Package
R5540K002	120	9	0.75 to 3.6	200	350	500	Nch	H/L	Discharge : xxxC/D Soft-Start Reverse : OFF	DFN(PLP)1010-4F
R5540K004			0.8 to 3.6	450	700	1000				
R5541K	18	25	VIN: 0.6 to 4.8 VBIAS: 2.5 to 5.5	3000	—	—	Nch	H	Thermal Reverse : OFF Discharge : xxxD Soft-Start : Ext.Adjustable	DFN(PLP)1216-6G

■ Battery Power Line Switches

Battery line switch IC can suppress inrush current at start-up by its soft-start circuit. Due to the reverse current protection function during off state or for always, unlike a simple MOSFET, space saving is possible to realize intensive functions. They are used as load switches. To use a battery line switch as a load switch, discharge function can be selected as an option. Further, the R5542 Series have another voltage detector inside.

R5542Z Typical Application



The R5542Z detects a voltage drop of battery and cuts the switch off.

■ Battery Power Line Switches

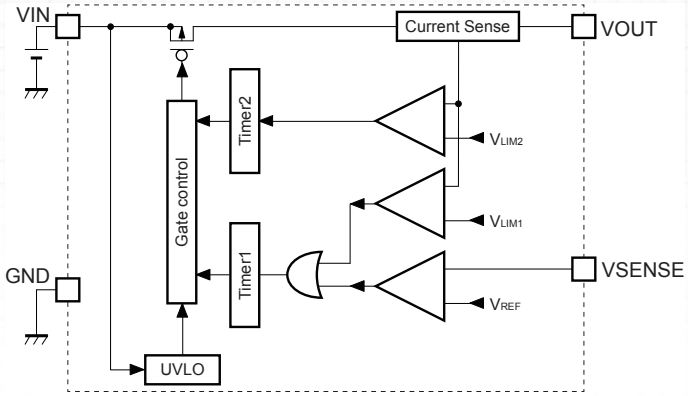
Product Name	ON Resistance (mΩ)	Supply Current (μA) Typ.	Operating Voltage Range (V)	Output Current (A)	Internal FET	ON/CE	Other Features	Package
R5527K	45	40	1.8 to 5.5	3	Nch	H/L	Reverse : ON/OFF Soft-Start Discharge : xxxC/D	DFN(PLP)1612-4D
R5542Z	9	Switch: 10 VD: 1	Switch: 2.3 to 5.5 VD: 1.2 to 5.5	6	Nch	H	Soft-Start UVLO Reverse : OFF Built-in Voltage Detector (CMOS Output) Detector Threshold: 2.0V to 5.0V Detector Threshold Accuracy: ±2.0%	WLCSP-12-P3

Switches

■ Intelligent Power Switches

Intelligent power switch protects a battery line. For example, each IC of the R5550K series has two steps abnormal current detectors and an abnormal voltage detector. In the R5550KxxxA, the first step abnormal current detector for lower current, detecting counter delay is set long, but second step abnormal current detector for higher current, the counter delay is set short.
Therefore, recognition of the momentum permissible current is possible. Not only that, if the preset detector delay time has passed, the switch turns off. But after a certain time, automatically resumed and checking the current again and the same operation repeats until the abnormal cause is removed.

R5550K Block Diagram



■ Intelligent Power Switches

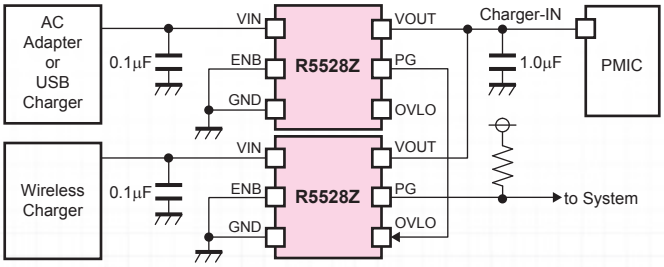
Product Name	ON Resistance (mΩ)	Supply Current (µA)	Operating Voltage Range (V)	UVLO Detect Voltage (V)	Output Current (A)	Current Limit Threshold (mA)			Output Current Limit (mA)			Internal FET
		Typ.		Typ.		Min.	Typ.	Max.	Min.	Typ.	Max.	
R5550K001A	180	2.6	2.3 to 5.25	1.9	1	300	460	624	1130	1470	1790	Pch

Product Name	Detector Threshold (V)	Current Limit/Under Voltage Detection (ms)			Output Current Limit (ms)			Protection	Package
	Typ.	Delay Time	OFF Time	ON Time	Delay Time	OFF Time	ON Time		
R5550K001A	0.5	10	80	2.5	1.33	80	1.33	Auto Release	DFN(PLP)1010-4F

■ External Power Switches/ OVP Switches

Handheld equipment such as smartphones and tablet PCs, charging via AC adapter or USB cable, wireless charging is also possible. Therefore selector switch is necessary. Further, if abnormal voltage adapter is connected, over voltage must be detected to prevent from destruction of the system. The switch is called an OVP switch. The R5528 has both of the functions, switch-over and OVP. The R5560 does not have the function of switch-over, however, OVP voltage can be set by user with divider resisters.
The circuit shown below is an example of input voltage switch-over circuit.
In this example, when the AC Adapter or USB Charger input is in the appropriate range, PG pin becomes "L", then Wireless Charger side switch turns off by the OVLO pin, as a result, input power source can be switched over. In this example, the AC Adapter or USB Charger side becomes primary input.

R5528Z Typical Application



■ External Power Switches/ OVP Switches

Product Name	ON Resistance (mΩ)	Supply Current (µA)	Operating Voltage Range (V)	OVP Detect Voltage (V)	UVLO Detect Voltage (V)	Output Current (A)	Internal FET	EN	Other Features	Package
		Typ.		Typ.	Typ.		FET			
R5528Z001A	54	50	2.3 to 36.0	6.8 ±3%	1.9	3	Nch	L	Thermal Soft-Start Reverse : OFF PG Debounce Time Delay Circuit	WLCSP-9-P1
R5560Zxx1A	38	19	2.5 to 28.0	6.8 ±3%	—	4.5	Nch	—	Thermal Soft-Start Adjustable OVLO Threshold Surge Clamp Circuit: 80V Debounce Time Delay Circuit PG	WLCSP-12-P2

■ PC Card & Express Card Power Switch Products Lineup

Product Name	Function	Feature	Package
R5533V	Single Slot Power Switch for PC Card	Corresponding to Standard-type PCMCIA Power Controller, Nch MOSFET	SSOP-16
R5538D	Power Switch for Express Card	For Total Power Management for Express Card	QFN0404-20

: Products in Development

Power Management ICs for LED Lighting

REDC offers power management ICs for LED lighting in 'Smart Society' that help our customers to add a new value to their products.

■ Constant Current LED Controller

We provide a new constant current LED controller that can achieve human-friendly LED lightings. This controller can be used for LED lightings for FA equipment or various facilities that are directly driven by DC current. It also can be used for illumination for brightening surroundings or illumination for amusement that requires a large current or a wide dimming range. Also, it can be used for illumination for image recognition system that requires flicker-free lighting at photographing. This controller also can be used as a constant current controller for various equipments that require constant current.

■ Constant Current LED Controller

Version	Dimming Control	Efficiency	Standby Current	Signal Input Circuit	Feature
R1580N001A	○ (1%-100%)	○ Feedback Voltage=0.4V (Max.)	○ 140μA (Typ.)	Comparator Input, H=1.2V, L=1.1V	If a 0.5% dimming is not required, 001A is recommended.
R1580N002A	◎ (0.5%-100%)	△ Feedback Voltage=0.8V (Max.)	○ 140μA (Typ.)	Comparator Input, H=1.2V, L=1.1V	High Accuracy Dimming, Min. Dimming 0.5%
R1580N003A	○ (1%-100%)	○ Feedback Voltage=0.4V (Max.)	◎ 28μA (Typ.)	Inverter Input, H=1.2V, L=0.4V	Low Standby Current Type

For more details, please refer to the Package Information on the REDC web site.

: Products Newly Released : Products in Development H/F : Halogen Free ◆ : JEDEC-Compliant

WLCSP Package

Pin	Symbol	Package	Halogen Free	Actual Size	Bottom View	Dimensions (mm)					Power Dissipation (mW) Standard Condition / High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Solder Ball ϕ	Tjmax=125°C	Tjmax=150°C*1		
4	Z	WLCSP-4-P2	H/F			0.79×0.79	0.79×0.79	0.48	0.5	0.16	530	662	TR	5,000
4	Z	WLCSP-4-P5	H/F			0.69×0.69	0.69×0.69	0.48	0.4	0.16	278	348	TR	5,000
4	Z	WLCSP-4-P7	H/F			0.69×0.69	0.69×0.69	0.36	0.4	0.16	278		TR	5,000
4	Z	WLCSP-4-P8	H/F											
5	Z	WLCSP-5-P1	H/F			1.346×0.98	1.346×0.98	0.56	0.5	0.25	770 ◆		E2	5,000
6	Z	WLCSP-6-P2	H/F			1.29×0.87	1.29×0.87	0.48	0.5	0.16	650		E2	5,000
6	Z	WLCSP-6-P6	H/F			1.28×0.88	1.28×0.88	0.64	0.4	0.26	910 ◆		E2	5,000
8	Z	WLCSP-8-P1	H/F											
9	Z	WLCSP-9-P1	H/F			1.27×1.27	1.27×1.27	0.64	0.4	0.26	1190		E2	5,000
11	Z	WLCSP-11-P2	H/F			2.37×1.47	2.37×1.47	0.78	0.5	0.16	1000		E2	4,000
12	Z	WLCSP-12-P1	H/F			1.97×1.47	1.97×1.47	0.81	0.4	0.26	760 ◆		E2	4,000
12	Z	WLCSP-12-P2	H/F			1.288×1.828	1.288×1.828	0.64	0.4	0.27	760 ◆		TL	5,000
12	Z	WLCSP-12-P3	H/F			1.68×1.28	1.68×1.28	0.65	0.4	0.26	1000 ◆		E2	4,000
16	Z	WLCSP-16-P1	H/F			1.95×1.95	1.95×1.95	0.64	0.4	0.26	1400 ◆		E2	5,000
20	Z	WLCSP-20-P1	H/F			2.305×1.70	2.305×1.70	0.54	0.4	0.265	1400 ◆		E2	5,000

DFN(PLP) Package

Pin	Symbol	Package	Halogen Free	Actual Size	Bottom View	Dimensions (mm)				Power Dissipation (mW) Standard Condition / High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
4	K	DFN(PLP)0808-4	H/F			0.8×0.8	0.8×0.8	0.4	0.48	286	358	TR	10,000
4	K	DFN(PLP)1010-4	H/F			1.0×1.0	1.0×1.0	0.6	0.65	400	500	TR	10,000
4	K	DFN(PLP)1010-4B	H/F			1.0×1.0	1.0×1.0	0.6	0.65	400		TR	10,000
4	K	DFN(PLP)1010-4F	H/F			1.0×1.0	1.0×1.0	0.4	0.5	300		TR	10,000
4	K	DFN(PLP)1612-4	H/F			1.2×1.6	1.2×1.6	0.6	0.6	610	762	TR	5,000
4	K	DFN(PLP)1612-4B	H/F			1.2×1.6	1.2×1.6	0.4	0.6	580	725	TR	5,000
4	K	DFN(PLP)1612-4D	H/F			1.2×1.6	1.2×1.6	0.6	0.5	610		TR	5,000
4	K	DFN(PLP)2114-4B	H/F			1.4×2.1	1.4×2.1	0.6	0.65	714		TR	5,000

Package Information

Pin	Symbol	Package	Halogen Free	Actual Size	Bottom View	Dimensions (mm)				Power Dissipation (mW) Standard Condition High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
6	K	DFN(PLP)1212-6	H/F			1.2×1.2	1.2×1.2	0.4	0.4	400	500	TR	5,000
6	K	DFN(PLP)1212-6F	H/F			1.2×1.2	1.2×1.2	0.4	0.4	**666 ◆**		TR	5,000
6	K	DFN(PLP)1216-6F	H/F			1.6×1.2	1.6×1.2	0.4	0.5	385		E2	5,000
6	K	DFN(PLP)1216-6G	H/F			1.6×1.2	1.6×1.2	0.4	0.6	**714 ◆**		E2	5,000
6	K	DFN(PLP)1414-6	H/F			1.4×1.4	1.4×1.4	0.4	0.5			TR	5,000
6	K	DFN(PLP)1616-6	H/F			1.6×1.6	1.6×1.6	0.6	0.5	640	800	TR	5,000
6	K	DFN(PLP)1616-6B	H/F			1.6×1.6	1.6×1.6	0.6	0.5	640		TR	5,000
6	K	DFN(PLP)1616-6D	H/F			1.6×1.6	1.6×1.6	0.6	0.5	640		TR	5,000
6	K	DFN(PLP)1820-6	H/F			1.8×2.0	1.8×2.0	0.6	0.5	880	1096	TR	5,000
6	K	DFN(PLP)1820-6B	H/F			1.8×2.0	1.8×2.0	0.6	0.55	880	1096	TR	5,000
6	K	DFN(PLP)2514-6	H/F			1.4×2.5	1.4×2.5	0.6	0.5	730		TR	5,000
8	K	DFN(PLP)2020-8	H/F			2.0×2.0	2.0×2.0	0.6	0.5	880	1100	TR	5,000
8	K	DFN(PLP)2020-8B	H/F			2.0×2.0	2.0×2.0	0.6	0.5	880	1100	TR	5,000
10	K	DFN(PLP)2527-10	H/F			2.7×2.5	2.7×2.5	0.6	0.5	910 **1400**	1138 **1700**	TR	5,000
12	K	DFN(PLP)2730-12	H/F			3.0×2.7	3.0×2.7	0.6	0.5	1000 **1950 ◆**		TR	5,000

DFN Package

Pin	Symbol	Package	Halogen Free	Actual Size	Bottom View	Dimensions (mm)				Power Dissipation (mW) Standard Condition High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
4	L	DFN1010-4	H/F			1.0×1.0	1.0×1.0	0.4	0.65	400	500	TR	10,000
5	L	**DFN1212-5**	H/F			1.2×1.2	1.2×1.2	0.4	0.8	650		TR	5,000
6	L	DFN1212-6	H/F			1.2×1.2	1.2×1.2	0.4	0.4	600	750	TR	5,000
6	L	DFN1414-6	H/F			1.4×1.4	1.4×1.4	0.4	0.5	600		TR	5,000
6	L	**DFN1414-6B**	H/F			1.4×1.4	1.4×1.4	0.6	0.5			TR	5,000
6	L	DFN1616-6	H/F			1.6×1.6	1.6×1.6	0.4	0.5	640		TR	5,000
6	L	DFN1616-6B	H/F			1.6×1.6	1.6×1.6	0.4	0.5	640	800	TR	5,000
6	L	DFN1814-6	H/F			1.4×1.8	1.4×1.8	0.4	0.5			TR	5,000
6	L	**DFN1814-6B**	H/F			1.4×1.8	1.4×1.8	0.4	0.5			TR	5,000
6	L	**DFN1814-6C**	H/F			1.4×1.8	1.4×1.8	0.4	0.5			TR	5,000
8	L	DFN1216-8	H/F			1.6×1.2	1.6×1.2	0.4	0.4	625	781	E2	5,000
12	L	DFN3030-12	H/F			3.0×3.0	3.0×3.0	0.8	0.5	**1950 ◆**	**2440 ◆**	TR	3,000

SC Package

Pin	Symbol	Package	Halogen Free	Actual Size	Top View	Dimensions (mm)				Power Dissipation (mW) Standard Condition Ultra High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
4	Q	SC-82AB	H/F			2.0×1.25	2.0×2.1	1	1.3	380		TR	3,000
5	Q	SC-88A	H/F			2.0×1.25	2.0×2.1	1.1	0.65	380	475	TR	3,000

SOT Package

3	N	SOT-23-3 (SC-59A)	H/F			2.9×1.6	2.9×2.8	1.4	0.95	420		TR	3,000
5	N	SOT-23-5 (SC-74A)	H/F			2.9×1.6	2.9×2.8	1.2	0.95	420	525	TR	3,000
6	N	SOT-23-6 (SC-74)	H/F			2.9×1.6	2.9×2.8	1.2	0.95	420		TR	3,000
6	N	SOT-23-6W	H/F			2.9×1.8	2.9×2.8	1.2	0.95	430		TR	3,000
6	N	TSOT-23-6	H/F			2.9×1.6	2.9×2.8	0.95	0.95	460		TR	3,000
3	H	SOT-89 (SC-62)	H/F			4.5×2.5	4.5×4.0	1.5	1.5	900		T1	1,000
5	H	SOT-89-5	H/F			4.5×2.5	4.5×4.35	1.5	1.5	900 **2200**	1120 **2700**	T1	1,000

SON Package

3	D	SON1408-3	H/F			1.4×0.8	1.4×1.2	0.6	0.45	250		TR	9,000
6	D	SON1612-6	H/F			1.6×1.2	1.6×1.6	0.6	0.5	500		TR	4,000
6	D	SON-6	H/F			1.6×2.6	1.6×3.0	0.85	0.5	500	625	TR	3,000
6	D	HSON-6	H/F			2.9×2.8	2.9×3.0	0.9	0.95	900		TR	3,000
8	D	SON-8	H/F			2.9×2.8	2.9×3.0	0.9	0.65	480		TR	3,000
10	D	SON-10	H/F			2.9×2.8	2.9×3.0	0.9	0.5	480		TR	3,000

SOP/TO Package

Pin	Symbol	Package	Halogen Free	Actual Size	Top View	Dimensions (mm)				Power Dissipation (mW) Standard Condition / Ultra High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
8	G	SSOP-8G	H/F			2.9×2.8	2.9×4.0	1.3	0.65	380	475	TR	3,000
10	V	SSOP-10	H/F			3.1×4.4	3.1×6.4	1.25	0.5	450		E2	2,000
16	V	SSOP-16	H/F			5.1×4.4	5.1×6.4	1.45	0.65	685		E2	2,000
24	V	SSOP-24	H/F			7.9×5.6	7.9×7.6	1.4	0.65	770		E2	3,000
6	S	HSOP-6J	H/F			5.02×3.9	5.02×6.0	1.65	1.905	1700 **2700**	2100 **3400**	E2	1,000
8	S	HSOP-8E	H/F			5.2×4.4	5.2×6.2	1.5	1.27	**2900**	**3600**	E2	1,000
18	S	HSOP-18	H/F			5.2×4.4	5.2×6.2	1.5	0.5	**2500** ◆	**3125** ◆	E2	1,000
16	T	TSSOP-16	H/F			5.0×4.4	5.0×6.4	1.2	0.65	**850** ◆		E2	2,500
20	T	TSSOP-20	H/F			6.5×4.4	6.5×6.4	1.2	0.65				
28	T	TSSOP-28	H/F			9.7×4.4	9.7×6.4	1.2	0.65	**1250** ◆		E2	3,000
5	J	TO-252-5-P1	—			6.54×6.04	6.54×9.68	2.54	1.27	1900 **3800**	2350 **4800**	T1	3,000
5	J	TO-252-5-P2	H/F			6.6×6.1	6.6×9.9	2.427	1.27	1900 **3800**	2350 **4800**	T1	3,000

QFN Package

Pin	Symbol	Package	Halogen Free	Actual Size	Bottom View	Dimensions (mm)				Power Dissipation (mW) Standard Condition / High Wattage Condition		Taping Direction	Quantity/ Reel (pcs)
						Body	Mount Area	Thickness	Pitch	Tjmax=125°C	Tjmax=150°C*1		
20	D	QFN0404-20	H/F			4.0×4.0	4.0×4.0	0.85	0.5			TR	2,000
24	K	QFN0404-24	H/F			4.0×4.0	4.0×4.0	0.75	0.5	670 **1500**	830 **1860**	E2	1,000
24	L	QFN0404-24B	H/F			4.0×4.0	4.0×4.0	0.75	0.5	670 **1500**	830 **1860**	E2	1,000
32	K	QFN(PLP)0404-32	H/F			4.0×4.0	4.0×4.0	0.6	0.4	670 **1500**	830 **1860**	E2	2,000
32	L	QFN0505-32B	H/F			5.0×5.0	5.0×5.0	0.85	0.5	**1600** ◆	**2000** ◆	E2	1,000

*1 Tjmax = 150°C does not apply to all products.

Real Time Clocks

4-wire Serial Interface (SPI Bus)

Product Name	Package	Time Keeping Current Typ. (µA)	Time Keeping Voltage (V)	Alarm Function	Perodic Interupt Function	32kHz Clock Output	Battery Checker (V)	Clock Adjust Function	OSC Halt Sensing	Back-up Battery Switch-over Circuit	VD with Delay Function	Other Features
R2043x	QFN023023-16 TSSOP10G	0.45, at 3V	Typ. 0.66 to 5.50 Worst. 1.0 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	Nch Open Drain Output, Controllable by Command	1.6 or 1.3	Y	Y	N	N	
R2045S	SOP14	0.48, at 3V	1.15 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	Nch Open Drain Output, Controllable by Command	2.1 or 1.3	Y	Y	N	N	Built-in Crystal Unit, Frequency Deviation: 0±5ppm
Rx5C348A	SSOP10 SSOP10G	0.35, at 3V	1.45 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	Nch Open Drain Output, Controllable by Command	2.1 or 1.6	Y	Y	N	N	
RV5C348B	SSOP10G	0.55, at 3V				Nch Open Drain Output, Keeping Output Enable						

3-wire Serial Interface

Product Name	Package	Time Keeping Current Typ. (µA)	Time Keeping Voltage (V)	Alarm Function	Perodic Interupt Function	32kHz Clock Output	Battery Checker (V)	Clock Adjust Function	OSC Halt Sensing	Back-up Battery Switch-over Circuit	VD with Delay Function	Switch-over/ Detector Threshold
R2033x	QFN023023-16 TSSOP10G	0.45, at 3V	Typ. 0.66 to 5.50 Worst. 1.0 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS Output with Control Pin	1.6 or 1.3	Y	Y	N	N	
R2061x	QFN023023-16 SSOP16	0.4, at 3V	Typ. 0.75 to 5.50 Worst. 1.0 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	—	2.10 or 1.35	Y	Y	Y	Y	1.7V, 2.8V 2.4V
R2062L	QFN023023-16	0.4, at 3V	Typ. 0.75 to 5.50 Worst. 1.0 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS Output with Level Shifter	2.10 or 1.35	Y	Y	Y*1	Y	2.7V, 2.9V
R2262x	QFN0202-18 TSSOP10G	0.3, at 3V	Typ. 0.6 to 5.5 Worst. 0.9 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS Output with Level Shifter	1.35	Y	Y	Y*2	Y	2.7V
Rx5C338A	SSOP10 SSOP10G	0.35, at 3V	1.45 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS Output with Control Pin	2.1 or 1.6	Y	Y	N	N	

2-wire Serial Interface (I^2C Bus)

Product Name	Package	Time Keeping Current Typ. (µA)	Time Keeping Voltage (V)	Alarm Function	Perodic Interupt Function	32kHz Clock Output	Battery Checker (V)	Clock Adjust Function	OSC Halt Sensing	Back-up Battery Switch-over Circuit	VD with Delay Function	Others Switch-over/ Detector Threshold
R2023x	QFN023023-16 TSSOP10G	0.45, at 3V	Typ. 0.66 to 5.50 Worst. 1.0 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS output with control pin	1.6 or 1.3	Y	Y	N	N	
R2025x	SOP14 SON22	0.48, at 3V	1.15 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS output with control pin	2.1 or 1.3	Y	Y	N	N	Built-in crystal unit. Frequency Deviation : 0±5ppm
R2051x	QFN023023-16 SSOP16 TSSOP10G	0.4, at 3V	Typ. 0.75 to 5.50 Worst.1.0 to 5.5	2set W/H/M, H/M Register only, No INTR pin	0.5s to 1Month Register only, No INTR pin	CMOS output with level shifter	2.10 or 1.35	Y	Y	Y	Y — —	2.4V, 2.8V 2.4V, 2.8V, 4.0V 2.4V
R2221x	QFN018018-12 TSSOP10G	0.3*3, at 3V	Typ. 0.6 to 5.5 Worst. 0.9 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS output with control pin	1.35	Y	Y	N	N	ECO mode is set by ECO Pin.
R2223x	QFN018018-12 TSSOP10G	0.3*3, at 3V	Typ. 0.6 to 5.5 Worst. 0.9 to 5.5	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS output with control pin	1.35	Y	Y	N	N	ECO Mode is set by a Register.
RS5C372A RS5C372B	SSOP8	0.5, at 3V	1.3 to 6.0 1.45 to 6.00	2 Sets, W/H/M×2	0.5s to 1Month	Nch open drain output (Controllable by command) CMOS output (Controllable by command)	–	Y	Y	N	N	32768Hz/32000Hz Crystal is Selectable
RV5C386A	SSOP10G	0.35, at 3V	1.45 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	CMOS output with control pin	2.1 or 1.6	Y	Y	N	N	
RV5C387A	SSOP10G	0.35, at 3V	1.45 to 5.50	2 Sets, W/H/M, H/M	0.5s to 1Month	Nch open drain output (Controllable by command)	2.1 or 1.6	Y	Y	N	N	

*1 For secondary battery or capacitor *2 For secondary battery or capacitor, built-in VR for charger *3 Time keeping current can be reduced in ECO mode.

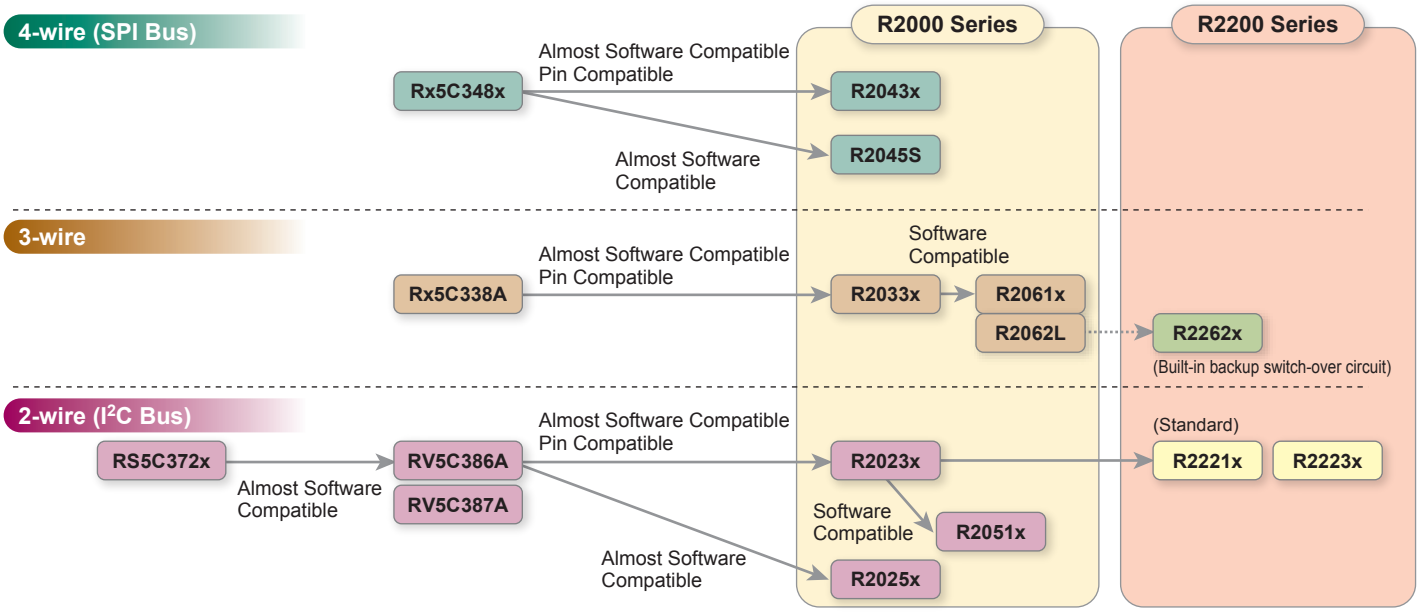
Glossary

Time Keeping Current	The consumption current which operates only clock and calendar without accessing CPU.
Time Keeping Voltage	The voltage which operates only clock and calendar without accessing CPU. The operating voltage to access CPU is specified in the other specification.
Alarm Function	The function which outputs the interrupt signal at the setting time.
Periodic Interrupt Function	The interrupt function which outputs at constant period such as every second, every minute, every hour and every month. It is useful when indicating clock and calendar by using the RTC clock data.
32kHz Clock Output	It is possible to output same clocks of crystal frequency which is used in RTC. There are four types of selectable outputs such as Open drain controllable by pin, Open drain keeping output enable, CMOS controllable by pin, and CMOS with level shifter. It is suitable for CPU sub-clock.
Clock Adjustment Circuit	The circuit which adjusts time gain or loss by the software. It is useful to compensate the crystal frequency deviation.
OSC Halt Sensing Circuit	The circuit which records past oscillation halt to internal register. It can be used to judge the validity of internal data in such events as power-on.
Battery Checker	It records them as Flag when detecting voltage threshold of backup battery. It is useful as checker of the output voltage for backup battery.
32768Hz/32000Hz Crystal Selectable	RTC generally use 32768Hz crystal oscillator. But RS5C372A/B can select 32000Hz crystal oscillator as well as 32768Hz crystal oscillator. 32KOUT pin outputs 32000Hz clock pulses when 32000Hz crystal oscillator is used.
Battery Backup Switch-over Function	R2051x, R2061x, R2062L, R2262x, incorporate the automatic switch-over circuit which can switch between a main power supply and a backup battery. Primary battery, secondary battery, electric double layered capacitor or aluminum electrolytic capacitor are selectable as backup battery in R2051x, R2061x. Secondary battery, electric double layered capacitor or aluminum electrolytic capacitor are selectable as backup battery in R2062L and R2262x. R2262x includes VR for charger.
Frequency Deviation (0±5ppm)	R2025S/D and R2045S incorporates 32768Hz crystal unit. The oscillation frequency is adjusted to high precision (0±5ppm: at 25°C). The deviation corresponds to ±13 seconds per month. By using the clock adjustment circuit, time deviation also can be calibrated to 3 or 6 or 9±5ppm.
ECO Mode	In the case that equivalent series resistance of crystal oscillator is low, (approximately equal or less than 45kΩ) time keeping current can be reduced, if ECO mode is active. There are a register setting type such as R2223x and a pin setting type such as R2221x and in the setting ECO mode.

Lineup

	Standard	Built-in Backup Battery Switch-over Circuit	Built-in Crystal, Real Time Clock Module
4-Wire (SPI Bus)	**R2043x** Rx5C348x	–	**R2045S**
3-Wire	**R2033x** Rx5C338A	**R2262x** **R2061x** **R2062L**	–
2-Wire (I^2C Bus)	**R2221x** **R2223x** **R2023x** RS5C372x RV5C386A RV5C387A	**R2051x**	**R2025x**

Functional Map



Merits of Using a Real Time Clock

1. Low Power Consumption

Clock functions often have a backup power circuit, so they can continue to keep time while the primary source of power is off or unavailable. Although keeping time can be done without an RTC, using RTC has benefits of reducing the size and the cost of developing a backup circuit board since it only requires extremely low consumption current and very low input voltage.

2. Facilitates a Software Development

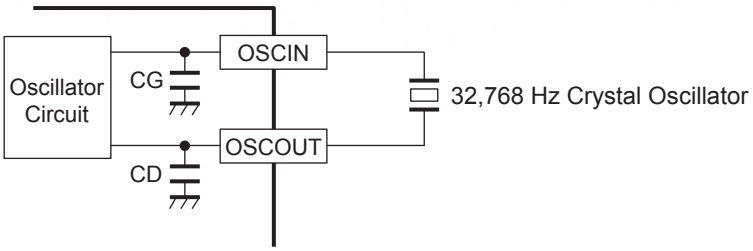
RTCs are specifically designed for keeping track of the current time and calendar. The clock function of RTCs tracks hours, minutes and seconds. The calendar function of RTCs tracks year, month, date, day-of-the-week and is accurate through 2099, with automatic leap year/ long month/ short month correction. By integrating RTCs, the need of developing a complicated software for tracking time and calendar can be omitted.

3. Facilitates a Oscillation Circuit Design

RTCs have peripheral components for the oscillator circuit built in, so an oscillator circuit can be easily configured by only adding a crystal resonator as an external component. Using RTCs can facilitate a layout design of oscillator circuit which is susceptible to noises.

Back-up Time Measurement **(R2051S01)**

Backup Device	Backup Time	
	Backup Starting Voltage: 5V	Backup Starting Voltage: 3V
Coin Cell Primary Battery (CR2032)	–	10 Years or more (Calculated Value)
Electric Double Layered Capacitor (1F)	130 Days	116 Days
Electric Double Layered Capacitor (0.1F)	21 Days	15 Days
Aluminum Electrolytic Capacitor (4700µF)	20 Hrs	12 Hrs 30 Min
Aluminum Electrolytic Capacitor (470µF)	2 Hrs	1 Hr 15 Min
Aluminum Electrolytic Capacitor (47µF)	12 Min	7 Min 30 Sec



1. Key Features of REDC Real Time Clocks

1. Programmable Calibration Adjustment

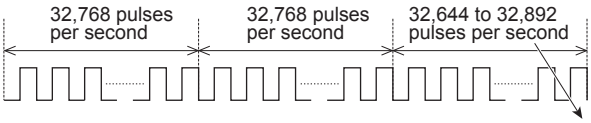
REDC RTCs have a programmable calibration adjustment from −189 ppm to +189 ppm or −63 ppm to +63 ppm.

The crystal oscillator used in REDC RTCs provides 32,644 to 32,892 pulses per 20 seconds or 60 seconds while a normal crystal oscillator provides exactly 32,768 pulses per second.

Tuning fork crystal provides highly stable natural oscillation frequency; however, environmental changes of temperature, humidity, pressure, vibration or a capacitance formed on a substrate can change the resonant frequency of a crystal oscillator.

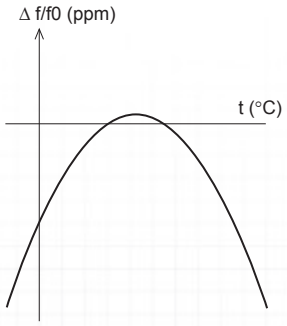
When performing a capacitor matching evaluation using a PCB for mass production, those influences need to be considered. REDC RTCs have a programmable time register to adjust a timekeeping glitch without the need of additional capacitors, which makes the capacitor matching evaluation easier.

A tuning fork crystal is usually cut such that its frequency over temperature is a parabolic curve centered around 25°C. REDC's programmable calibration circuit have an external temperature sensor to compensate this deviation.

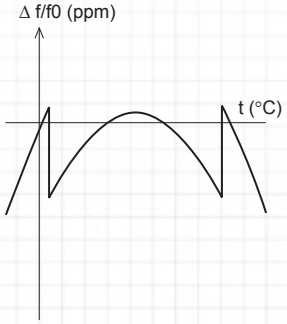


REDC RTCs perform this calibration adjustment every 20 or 60 seconds.
Notes: R2025x/R2045S performs a calibration adjustment evey 20 seconds.

Uncompensated Crystal Drift



REDC RTCs Compensated Crystal Drift



2. Key Features of REDC Real Time Clocks

1. Clock Data Validation

4-Wire (SPI Bus): R2043x
3-Wire: R2033x/R2061x/R2062L/R2262x
2-Wire (I^2C Bus): R2023x/R2051x/R2221x/R2223x

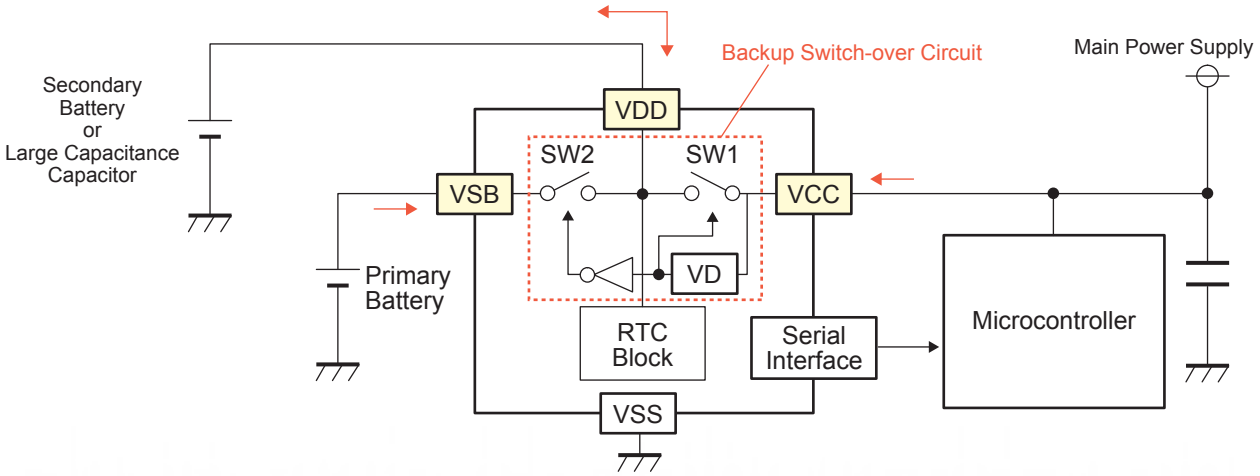
These RTCs provide a power-on reset function, an oscillation halt sensing function and a supply voltage monitoring function. These functions can be applied to judge a clock data validity.

- **Power-on Reset Function**
  Power-on reset circuit is configured to reset a control register and store the status as a flag after initial power on from 0 V without backup battery.
- **Oscillation Halt Sensing Function**
  Oscillation halt sensing circuit is equipped with internal registers configured to record any past oscillation halt as a flag.
- **Supply Voltage Monitoring Function**
  Supply voltage monitoring circuit is configured to record a drop in supply voltage below supply voltage monitoring thresholds.

2. Battery Backup Switch-over Circuit

3-Wire: R2061x/R2062L/R2262x
2-Wire (I^2C Bus): R2051x

These RTCs have a backup battery switch-over circuit which detects power failures and automatically switches to the battery supply when a power failure occurs. They are also equipped with two or three power supply pins so there is no need of adding a diode.



Notes: R2062L does not have the SW2 switch or the VSB pin. R2262x has the SW2 switch and the BAT pin instead of the VSB pin. The SW2 switch is constantly turned on unless it is turned off by a register setting.

3. High-precision Real Time Clock Module

4-Wire (SPI Bus): R2045S
2-Wire (I^2C Bus): R2025x

These RTCs have a built-in crystal oscillator that is adjusted to 0±5 ppm at 25°C at the time of factory shipping. This means ±13 seconds per month at 25°C.

Package Informaiton

H/F : Halogen-free

Pin	Symbol	Package	Halogen Free	Actual Size	Top View/ Bottom View	Dimensions (mm)				Taping Direction	Quantity/Reel	Product Name
						Body Size	Mount Area	Thickness	Pitch			
8	S	SSOP8	H/F			3.5×4.4	3.5×6.4	1.25	0.65	E2	2,000	RS5C372A RS5C372B
10	S	SSOP10	H/F			3.5×4.4	3.5×6.4	1.25	0.5	E2	2,000	RS5C338A RS5C348A
10	V	SSOP10G	H/F			2.9×2.8	2.9×4.0	1.2	0.5	E2	2,000	RV5C338A RV5C348A RV5C348B RV5C386A RV5C387A
10	T	TSSOP10G	H/F			2.9×2.8	2.9×4.0	0.85	0.5	E2	2,000	R2023T R2033T R2043T R2051T R2221T R2223T R2262T
12	L	QFN018018-12	H/F			1.8×1.8	1.8×1.8	0.43	0.4	E2	3,000	R2221L R2223L
16	L	QFN023023-16	H/F			2.3×2.3	2.3×2.3	0.43	0.4	E2	3,000	R2023L R2033L R2043L R2051L R2061L R2062L
18	L	QFN0202-18	H/F			2.0×2.0	2.0×2.0	0.43	0.4	E2	3,000	R2262L
14	S	SOP14 (RTC Module)	H/F			10.1×5.0	10.1×7.4	3.2	1.27	E2	1,000	R2025S R2045S
16	S	SSOP16	H/F			5.0×4.4	5.0×6.4	1.25	0.65	E2	2,000	R2051S R2061S
22	D	SON22 (RTC Module)	H/F			6.1×4.7	6.1×5.0	1.3	0.5	E2	1,000	R2025D

LD Driver LSI

: Products in Development H/F : Halogen Free

LD Driver LSI

This LD driver LSI achieves highly accurate printing. It is offered in a cathode type or an anode type. It provides a small package solution.

Product Name	LD	CH	Supply Voltage (V)	Max. Operating Frequency (MHz)	LED Current Min. Pulse Width (ns)	Drive Current Setting (mA)			Package	Halogen Free	Other
						Threshold Current	LED Current	Operating Current			
RN5C713	Cathode	2CH	5.0	400	1.25	50	50	70	QFN0606-48	H/F	Need no VR, Digital method
RN5C719	Anode	1CH	5.0	200	2.5	70	50	100	QFN0505-36	H/F	
RN5C711	Cathode	2CH	3.3 or 5.0	200	2.5	—	—	70	QFN0505-36	H/F	Include APC (Automatic Power Control), LVDS (Low Voltage Differential Signal) format data
RN5C716	Anode	1CH	3.3 or 5.0	200	2.5	—	—	80	QFN0303-20	H/F	
RN5C512	Cathode	2CH	5.0	400	1.25	70	50	100	QFN0506-32		
RS5C516	Anode	1CH	5.0	200	2.5	70	50	100	TSSOP20	H/F	
RS5C517	Anode	1CH	3.3	200	2.5	50	50	70	TSSOP20	H/F	

Multiple-PMU

H/F : Halogen Free

Multiple-PMU Products

REDC Multiple-PMU is a high integrated power management system IC, which is perfect optimum for the application which uses single Li-ion battery and needs multiple channels of power conversion. It is also optimum in case of needing an accurate control function as multiple core application processors.

Multiple-PMU Products Lineup

Product Name	Package	Input Voltage Range (V)	Interface	Main Function								
				Step-down DC/DC	LDO	VD	Charger	Battery-Gauge (Fuel-Gauge)	WDT	ADC	RTC	GPIO
RN5T566	QFN0606-36	2.7 to 5.5	PIN	2	5	2	—	—	—	—	—	—
RN5T567	QFN0606-48	2.7 to 5.5	I²C	4 DVS*1	7	4	—	—	1	—	—	4
RN5T568	QFN0707-48	2.7 to 5.5	I²C	4 DVS*1	7	4	—	—	1	—	—	4
RN5T614	QFN0606-48	3.1 to 5.5	I²C	3 DVS*1	8	2	Wall USB	—	—	—	—	—
RN5T618	QFN0606-48	2.7 to 5.5	I²C	3 DVS*1	7	4	Wall USB	1	1	1	—	4
RC5T619	CSP0606-85	2.7 to 5.5	I²C	5 DVS*1	12	4	Wall USB	1	1	1	1	5
RC5T619x	CSP0608-80											

*1 DVS (Dynamic Voltage Scaling) allows the output voltages to be programmed through I²C.

Multiple-PMU Package Information

Pin	Symbol	Package	Halogen Free	Dimensions			Taping Direction	Quantity /Reel	Product Name
				Body Size	Thickness	Pitch			
36	N	QFN0606-36	H/F	6.0×6.0	0.9	0.5	E4	5,000	RN5T566
48	N	QFN0606-48	H/F	6.0×6.0	0.9	0.4	E4	2,000	RN5T567 RN5T614
								5,000	RN5T618
		QFN0707-48	H/F	7.0×7.0	0.9	0.5	E4	2,000	RN5T568
80	C	CSP0608-80	H/F	6.0×8.0	1.2	0.65	E4	2,000	RC5T619x
85	C	CSP0606-85	H/F	6.0×6.0	1.07	0.5	E4	2,000	RC5T619

Product Index

Non-Promotion/Limited/Discontinued Products

■ Non-Promotion Products: These products will be discontinued in the future. New adoption is not recommended.
■ Limited Products: These products are already discontinued. Providing only for the customer under present adoption with stock.
■ Discontinued Products: These products are already discontinued.

The lists below do not include some of our old products. The alternative products are not fully compatible with the non-promotion/ limited/ discontinued products. The function of alternative products are similar to these products, but the electrical characteristics and the pin-layout may differ.

Category	Product Name	Sub Category	Package	Status	Termination Date	Alternative Product			
						Same Spec with Different Package	Package	Succeeding Product	Package
Voltage Regulator	RN5RG	External transisitor type	SOT-23-5	Discontinued	Already	—	—	RN5RF	SOT-23-5
	R1110N	Low supply current type	SOT-23-5	Discontinued	Already	—	—	R1111N	SOT-23-5
	R1112N	High-performance type	SOT-23-5	Discontinued	Already	—	—	RP112N	SOT-23-5
	R1113Z	High-performance type	WLCSP-4-P1	Limited	Already	R1122N	SOT-23-5	RP112N	SOT-23-5
	R1115Z	Standard type	WLCSP-4-P4	Discontinued	Already	R1114D R1114N R1114Q	SON1612-6 SOT-23-5 SC-82AB	RP130K RP130N RP130Q	DFN(PLP)1010-4 SOT-23-5 SC-82AB
	R1118K	With ECO function	DFN(PLP)1612-4B	Non-promotion		—	—	RP201K RP201Z	DFN(PLP)1212-6 WLCSP-4-P5
	R1118N	With ECO function	SOT-23-5	Discontinued	Already	—	—	RP201K RP201Z	DFN(PLP)1212-6 WLCSP-4-P5
	R1120N	Standard type	SOT-23-5	Discontinued	Already	—	—	R1121N	SOT-23-5
	R1124N	Standard type	SOT-23-5	Discontinued	Already	R1114N	SOT-23-5	RP130N	SOT-23-5
	R1126N	With ECO function	SOT-23-5	Discontinued	Already	R1116N	SOT-23-5	RP201K RP201Z	DFN(PLP)1212-6 WLCSP-4-P5
	R1130D	Standard type	HSON-6	Discontinued	Already	R1130H	SOT-89-5	RP170H RP170N	SOT-89-5 SOT-23-5
	R1131Dxx2	Standard type	HSON-6	Discontinued	Already	R1131N	SOT-23-5	RP101Kxx1 RP101Kxx2 RP101N	DFN(PLP)1612-4 DFN(PLP)1612-4B SOT-23-5
	R1140Q	Standard type	SC-82AB	Discontinued	Already	—	—	R1141Q RP109K RP109L RP109Q RP109N	SC-82AB DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
	R1151N	External transistor type+VD	SOT-23-6	Limited	Already	—	—	—	—
	R1152N	External transistor type	SOT-23-5	Limited	Already	—	—	—	—
	R1160D	With ECO function	SON-6	Discontinued	Already	R1160N	SOT-23-5	RP202K RP202Q RP202N	DFN(PLP)1010-4 SC-88A SOT-23-5
	R1161Dxx1	With ECO function	SON-6	Limited	Already	R1161N	SOT-23-5	RP200K RP200N RP200Z	DFN(PLP)1212-6 SOT-23-5 WLCSP-4-P5
	R1161Dxx2		HSON-6	Discontinued					
	R1162D R1162N	With ECO function	SON1612-6 SOT-23-5	Discontinued	Already	—	—	R1163D R1163N RP201K RP201Z	SON-6 SOT-23-5 DFN(PLP)1212-6 WLCSP-4-P5
	R1182K R1182N	With ECO function	DFN(PLP)1616-6 SOT-23-5	Discontinued	Already	—	—	R1116N	SOT-23-5
	R1183Z	Low supply current type	WLCSP-4-P2	Limited	Already	R1180D R1180N R1180Q	SON1612-6 SOT-23-5 SC-82AB	RP110K RP110L RP110Q RP110N	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
	R1500J	Standard type	TO-252-5-P2	Discontinued	Already	R1500H	SOT-89-5	R1501J	TO-252-5-P2
	RP103Qxx2	Standard type	SC-88A	Discontinued	Already	RP103K RP103N RP103Qxx1	DFN(PLP)1010-4 SOT-23-5 SC-82AB	RP109K RP109L RP109Q RP109N	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
	RP104Q	Low supply current type	SC-82AB	Limited	Already	RP104K RP104N	DFN(PLP)1010-4 SOT-23-5	RP110K RP110L RP110Q RP110N	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
	RP105Q	Ultra low voltage	SC-88A	Discontinued	Already	RP105K RP105N	DFN(PLP)1212-6 SOT-23-5	—	—
	RP106N	Standard type	SOT-23-5	Non-promotion		RP106Z RP106K RP106Qxx2	WLCSP-4-P5 DFN(PLP)1212-6 SC-88A	—	—
	RP107N	Standard type	SOT-23-5	Non-promotion		RP107K RP107Q RP107Z	DFN(PLP)1212-6 SC-88A WLCSP-4-P5	—	—
	RP113Q	Standard type	SC-88A	Discontinued	Already	RP103K RP103N RP103Qxx1	DFN(PLP)1010-4 SOT-23-5 SC-82AB	RP109K RP109L RP109Q RP109N	DFN(PLP)0808-4 DFN1010-4 SC-88A SOT-23-5
	RP170Q	Standard type	SC-88A	Discontinued	Already	RP170H RP170N	SOT-89-5 SOT-23-5	—	—
	RP200Q	With ECO function	SC-88A	Discontinued	Already	RP200K RP200N RP200Z	DFN(PLP)1212-6 SOT-23-5 WLCSP-4-P5	—	—
	RP201N	With ECO function	SOT-23-5	Discontinued	Already	RP201K RP201Z	DFN(PLP)1212-6 WLCSP-4-P5	—	—
	RP201Q		SC-88A						
Voltage Regulator: Multiple Output	R5320D R5320G	3ch.	SON-8 SSOP-8G	Discontinued	Already	—	—	R5324K	DFN(PLP)2527-10
	R5321D	2ch.	SON-8	Discontinued	Already	—	—	RP152L RP152N RP153L	DFN1212-6 SOT-23-6 DFN1216-8
	R5322N	2ch.	SOT-23-6W	Discontinued	Already	—	—	RP152L RP152N RP153L	DFN1212-6 SOT-23-6 DFN1216-8
	R5323K R5323N R5323Z	2ch.	DFN(PLP)1820-6 SOT-23-6 WLCSP-6-P1	Discontinued	Already	—	—	RP152L RP152N RP153L	DFN1212-6 SOT-23-6 DFN1216-8
	R5324D	3ch.	SON-8	Discontinued	Already	R5324K	DFN(PLP)2527-10	—	—
	R5325K	2ch., With ECO function	DFN(PLP)1820-6	Discontinued	Already	—	—	—	—
	R5325N		SOT-23-6						
	R5326N R5326Z	2ch., With ECO function	SOT-23-6 WLCSP-6-P1	Discontinued	Already	R5326K	DFN(PLP)1820-6	—	—
	RP151K	2ch.+VD	DFN(PLP)2020-8	Discontinued	Already	—	—	—	—

Category	Product Name	Sub Category	Package	Status	Termination Date	Alternative Product			
						Same Spec with Different Package	Package	Succeeding Product	Package
Voltage Detector	R3111E	Normal type	TO-92	Discontinued	Already	R3111H R3111Nxx1 R3111Nxx2 R3111Qxx1 R3111Qxx2	SOT-89 SOT-23-5 SOT-23-3 SC-82AB SC-88A	—	—
	R3112Qxx2	With delay function (External capacitor type)	SC-88A	Non-promotion		R3112D R3112Qxx1 R3112N	SON1612-6 SC-82AB SOT-23-5	R3116K R3116Q R3116N	DFN(PLP)1010-4 SC-82AB SOT-23-5
	R3113D	Normal type	SON1408-3	Discontinued	Already	—	—	R3114K R3114N R3114Q	DFN(PLP)1010-4 SOT-23-5 SC-82AB
	R3115Z	With delay function (External capacitor type)	WLCSP-4-P2	Discontinued	Already	R3112D R3112N R3112Qxx1	SON1612-6 SOT-23-5 SC-82AB	R3116K R3116N R3116Q	DFN(PLP)1010-4 SOT-23-5 SC-82AB
	R3131N	With delay function (Internal counter type)	SOT-23-3	Discontinued	Already	—	—	R3133D RP300K RP300N	SON1612-6 DFN(PLP)1010-4B SOT-23-5
	R3133Q	With delay function (Internal counter type)	SC-82AB	Discontinued	Already	R3133D	SON1612-6	RP300K RP300N	DFN(PLP)1010-4B SOT-23-5
	R3134K R3134Q	With delay function (Internal counter type)	DFN(PLP)1212-6 SC-88A	Discontinued	Already	R3134N	SOT-23-5	RP300K RP300N	DFN(PLP)1010-4B SOT-23-5
Watchdog Timer Switch	R5102V	WDT with Dual output VR	SSOP-10	Discontinued	Already	—	—	—	—
	R5521V	For pay on-demand	SSOP-16	Discontinued	Already	—	—	—	—
	R5522V	For pay on-demand	SSOP-20	Discontinued	Already	—	—	—	—
	R5531V	For PCMCIA 1slot	SSOP-16	Discontinued	Already	—	—	R5533V	SSOP-16
	R5532V	For PCMCIA 2slot	SSOP-28	Discontinued	Already	—	—	R5533V	SSOP-16
	R5534V	For PCMCIA 2slot	SSOP-20	Discontinued	Already	—	—	R5533V	SSOP-16
	R5535V	For Express Card	SSOP-20	Discontinued	Already	—	—	R5538D	QFN0404-20
DC/DC Converter	RN5RYxx1/202	Step-up	SOT-23-5	Discontinued	Already	—	—	RP401K RP401N	DFN(PLP)1820-6 SOT-23-5
	R1200Z	For PMOLED and general step-up use	WLCSP-6-P1	Discontinued	Already	R1200K R1200L R1200N	DFN(PLP)1820-6 DFN1616-6 SOT-23-6	R1202LxxxA/B R1202NxxxA/B	DFN1616-6B TSOT-23-6
	R1201L	For white LED backlight	DFN1616-6	Discontinued	Already	R1201N	SOT-23-6	R1202LxxxD R1202NxxxD	DFN1616-6B TSOT-23-6
	R1218K	For white LED backlight	DFN(PLP)1820-6	Non-promotion		R1218N	SOT-23-6	R1202LxxxD R1202NxxxD R1204KxxxA/D R1204NxxxA/D	DFN1616-6B TSOT-23-6 DFN(PLP)1820-6 TSOT-23-6
	R1221N	Step-down with VD (Middle voltage)	SOT-23-6W	Discontinued	Already	—	—	R1224N R1225N	SOT-23-5 SOT-23-6W
	R1230D	Step-down (Low voltage)	SON-8	Discontinued	Already	—	—	RP504K RP504L RP504N	DFN(PLP)1216-6F DFN1616-6B SOT-23-5
	R1234D	Step-down (Low voltage)	SON-8	Discontinued	Already	—	—	RP504K RP504L RP504N	DFN(PLP)1216-6F DFN1616-6B SOT-23-5
	R1250V	Charge pump inverting	TSOP-8	Discontinued	Already	—	—	—	—
	R1283Z	Step-up/Inverting	WLCSP-11-P2	Discontinued	Already	R1283K	DFN(PLP)2730-12	R1286K R1287Z	DFN(PLP)2730-12 WLCSP-12-P1
	R1285L	Step-up/Inverting	DFN2730-12	Discontinued	Already	—	—	R1283K R1286K R1287Z	DFN(PLP)2730-12 DFN(PLP)2730-12 WLCSP-12-P1
	RP500Z	Step-down (Low voltage)	WLCSP-6-P2	Non-promotion		RP500L RP500K RP500N	DFN1616-6 DFN(PLP)1820-6 SOT-23-6W	RP504K RP504L RP504N	DFN(PLP)1216-6F DFN1616-6B SOT-23-5
	RP503Z	Step-down (Low voltage)	WLCSP-6-P2	Discontinued	Already	RP503L RP503N	DFN1616-6 SOT-23-5	RP504K RP504L RP504N	DFN(PLP)1216-6F DFN1616-6B SOT-23-5
Li-ion/ Polymer Battery Protection	R5400D	For 1cell battery	SON1612-6	Discontinued	Already	R5400N	SOT-23-5	—	—
	R5401N	For 1cell battery	SOT-23-5	Discontinued	Already	R5401K	DFN(PLP)1820-6	—	—
	R5404K	For 1cell battery	DFN(PLP)1616-6	Discontinued	Already	—	—	—	—
	R5406K	For 1cell battery	DFN(PLP)1616-6B	Discontinued	Already	—	—	—	—
	R5407K	For 1cell battery	DFN(PLP)1820-6B	Discontinued	Already	—	—	R5403K	DFN(PLP)1820-6
	R5407N		SOT-23-5	Non-promotion					
	R5408K	For 1cell battery	DFN(PLP)1616-6	Discontinued	Already	R5408L R5408N	DFN1414-6 SOT-23-6	R5405K	DFN(PLP)1616-6
	R5408L R5408D		DFN1414-6 SON1612-6	Non-promotion					
	R5409K	For 1cell battery	DFN(PLP)2114-4	Discontinued	Already	—	—	—	—
	R5421N	For 1cell battery	SOT-23-6	Discontinued	Already	—	—	R5405N	SOT-23-6
	R5425N	For 1cell battery	SOT-23-6	Discontinued	Already	—	—	R5405N	SOT-23-6
	R5426N	For 1cell battery	SOT-23-6	Non-promotion	Already	R5426D	SON-6	R5405N	SOT-23-6
	R5429D	For 1cell battery	SON-6	Discontinued	Already	—	—	R5401K	DFN(PLP)1820-6
	R5429N		SOT-23-6						
	R5451K	For 1cell battery	DFN(PLP)1616-6B	Discontinued	Already	—	—	R5450N	SOT-23-5
	R5454K	For 1cell battery	DFN(PLP)1820-6B	Discontinued		—	—	—	—
	R5455K	For 1cell battery	DFN(PLP)2114-4	Discontinued	Already	—	—	—	—
	R5456K	For 1cell battery	DFN(PLP)1616-6	Discontinued	Already	—	—	—	—
	R5470K	For 1cell battery	DFN(PLP)2114-4B	Discontinued	Already	R5471L	DFN1814-6	—	—
	R5471K		DFN(PLP)1616-6B						
	R5476K	For 1cell battery	DFN(PLP)1616-6B	Discontinued	Already	—	—	—	—
Multi Power Supply	R5210D R5210N	For optical disk drive	HSON-6 SOT-23-6W	Discontinued	Already	—	—	RP901K	DFN(PLP)2527-10
	R5212D	For optical disk drive	HSON-6	Discontinued	Already	—	—	RP901K	DFN(PLP)2527-10
	R5220D	For general use	SON-6	Non-promotion		R5220K	DFN(PLP)2514-6	—	—
	R5310L	For mobile phone	LQFP0505-32	Discontinued	Already	—	—	—	—
	R5312L	For mobile phone	LQFP0505-32	Discontinued	Already	—	—	—	—
	R5314D	For mobile phone	QFN0404-20	Discontinued	Already	—	—	—	—
	R5315B	Wireless Modules for M2M	CSP0605-49	Non-promotion		—	—	—	—
	R5510H	For optical disk drive	SOT-89-5	Limited	Already	—	—	RP901K	DFN(PLP)2527-10
	R5511D	For optical disk drive	SON-6	Discontinued	Already	—	—	RP901K	DFN(PLP)2527-10
	R5511H	For optical disk drive	SOT-89-5	Discontinued	Already	—	—	RP901K	DFN(PLP)2527-10
	R5511N		SOT-23-5						
	RP902K	For optical disk drive	QFN0404-20	Discontinued	Already	—	—	—	—

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