RoHS

■Low Power-Loss Voltage Regulators

●TO-220 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings				Electrical characteristics			Built-in functions					Lead forming available	Package	
		Output current Io (A)	Input voltage Vin (V)	Power dissipation (W) Pd*1	Power dissipation (W) Pd*2	Output voltage Vo*3 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*5 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage			Package shape type*7
PQxxxRDA1SZH series	ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.))	1	24	1.4	15	3.3, 5, 9, 12	±3	0.5	○	○	○	○			TO-220	A
PQxxxRDA2SZH series		2	20			3.3, 5, 9, 12	±2.5	1.0	○	○	○	○				A
PQ30RV11J00H	Variable output voltage	1	35	1.5	15	1.5 to 30	±2*4	0.5	○	○	△*6		○	○		B
PQ30RV21J00H		2			18				○	○	△*6		○	○		B
PQ30RV31J00H		3		2	20				○	○	△*6		○	○		B

*1 At self-cooling
*2 With infinite heat sink attached
*3 The xxx in the model No. refer to the output voltage values of the model (e.g. 050 for 5 V, 120 for 12 V, 015 for 1.5 V).
*4 Reference voltage precision
*5 Current ratings are defined individually.
*6 △ : Available by adding circuit
*7 Refer to page 35

■Surface Mount Type Low Power-Loss Voltage Regulators

●SOT-89 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics			Built-in functions					Package
		Output current Io (A)	Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	
PQ1LAxx5MSPQ	Compact, high radiation package, ceramic capacitor compatible	0.5	15	0.9	1.2, 1.5, 1.8, 2.5, 3.3, 5.0	±2.0	0.7	○	○	○	○		SOT-89
PQ1LAX95MSPQ	Ceramic capacitor compatible, variable output voltage				1.5 to 9.0	±2.0*4		○	○	○	○	○	

*1 When mounted on a board
*2 The xx in the model No. refer to the output voltage values of the model (e.g. 25 for 2.5 V, 50 for 5.0 V).
*3 Current ratings are defined individually.
*4 Reference voltage precision

SURFACE MOUNT TYPE
LOW POWER-LOSS VOLTAGE REGULATORS

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●SC-63 Type (1) Output Voltage Fixed Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings					Electrical characteristics			Built-in functions						Package	
		Output current Io (A)			Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	Taped package		Package shape type*4
		0.5	1	1.5													
PQxxxDNA1ZPH series	Ceramic capacitor compatible, ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), solder dip compatible lead shape		○		24	8	3.3, 5, 9, 12	±2.5	0.5	○	○	○	○	–	○	SC-63	F
PQxxxENA1ZPH series	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape		○		10	8	1.5, 1.8, 2.5, 3.3	±2.0		○	○	○	○	–	○		F
PQxxxENB1ZPH series			○			5	1.2, 1.5, 1.8, 2.5, 3.3		0.3	○	○	○	○	–	○		F
PQxxxENAHZPH series				○		8	1.5, 1.8, 2.5, 3.3		0.9	○	○	○	○	–	○		F
PQxxxGN01ZPH series	Minimum operating input voltage: 1.7 V (Dual power supply type), ceramic capacitor compatible, solder dip compatible lead shape		○		5.5		1.0, 1.2	±30 mV	–	○	○			–	○		F
PQxxxGN1HZPH series				○						○	○			–	○		F

*1 With infinite heat sink attached
*2 The xxx in the model No. refer to the output voltage values of the model (e.g. 033 for 3.3 V, 050 for 5 V, 120 for 12 V).
*3 Current ratings are defined individually.
*4 Refer to page 35

●SC-63 Type (2) Output Voltage Variable Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings					Electrical characteristics			Built-in functions						Package	
		Output current Io (A)			Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo (V) TYP.	Output voltage precision (%)	Dropout voltage VI-O*3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	Taped package		Package shape type*4
		0.5	1	1.5													
PQ070XNA1ZPH	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape		○		10	8	1.5 to 7	±2.0*2	0.5	○	○	○	○	○	○	SC-63	F
PQ070XNAHZPH				○					0.9	○	○	○	○	○	○		F
PQ070XNA2ZPH				○ (2 A)					0.5	○	○	○	○	○	○		F
PQ070XNB1ZPH			○			5	1.2 to 7		0.3	○	○	○	○	○	○		F
PQ035ZN01ZPH	Reference voltage (Vref): 0.6 V, minimum operating input voltage: 1.7 V (Dual power supply type), ceramic capacitor compatible, solder dip compatible lead shape		○		5.5	8	0.8 to 3.5	±30 mV	–	○	○			○	○		F
PQ035ZN1HZPH				○					–	○	○			○	○		F
PQ200WNA1ZPH	Minimum operating input voltage: 3.5 V, ASO protection function, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), ceramic capacitor compatible, solder dip compatible lead shape		○		24		3.0 to 20	±2.5*2	0.5	○	○	○	○	○	○		F
PQ200WN3MZPH	Minimum operating input voltage: 5.5 V, low dissipation current at OFF state (Iqs: 5 µA (MAX.)), ceramic capacitor compatible, current limit: 800 mA	○ (0.3)				6.8	5.0 to 20			○	○	○	○	○	○		F

*1 With infinite heat sink attached
*2 Reference voltage precision
*3 Current ratings are defined individually.
*4 Refer to page 35

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●SOP-8 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics		Built-in functions		Taped package	Package
		Output current Io (A)	Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output voltage Vo (V) TYP.	Output voltage precision*2 (mV)	Overheat protection	Overcurrent protection		
PQ1DX095MZPQ	Built-in sink source function (For DDR II memory)	±0.8	6	0.6	V_{DD} x 1/2 (V_{DDQ}: 1.5 V (MIN.))	±25	○	○	○	SOP-8

*1 When mounted on a board
*2 Reference voltage precision

■Surface Mount Type Chopper Regulators (DC-DC Converters)

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current Isw (A)	Power dissipation Pd*1 (W)	Input voltage range Vin (V)	Output voltage*2 Vo (V)	Output type	Oscillation frequency fo (Hz) TYP.	Output saturation voltage Vsat (V) TYP.		Outline shape type*4
PQ6CU12X2APQ	• High switching voltage: 40 V (MAX.) • For tuner power supply • Variable oscillation frequency • Ceramic capacitor compatible	0.25	0.35	3.0 to 5.5	up to 36	Step-up	300 k to 800 k	Ron TYP. 1.7Ω	SOT-23-6W	
PQ1CN38M2ZPH	• PWM chopper regulator (high oscillation frequency) • Output ON/OFF control function • Overcurrent/overheat protection circuits • For light load	0.8	8	4.5 to 40	V_{REF}*3 to 35 (step-down type)/ –V_{REF} to –30 (inverting type)	Step-down	300 k	0.9	SC-63	F
PQ1CN41H2ZPH	• PWM chopper regulator (high oscillation frequency) • Overcurrent/overheat protection circuits	1.5	8			Step-down	300 k	0.9		F
PQ1CX41H2ZPQ	• Bootstrap system for high efficiency (Efficiency 90% (TYP.)) • Low voltage output: 0.8 V (MIN.) • Ceramic capacitor compatible	1.5	0.8 When mounted on board	4.75 to 27	0.8 to 20	Step-down	400 k	RDSon TYP. 0.45Ω	SOP-8	
PQ1CX53H2MPQ	• Bootstrap system for high efficiency (Efficiency 89% (TYP.)) • Low voltage output: 0.8 V (MIN.) • Ceramic capacitor compatible	3.5	2 When mounted on board	4.75 to 27	0.8 to 16	Step-down	400 k	RDSon TYP. 0.15Ω	USB-8	
PQ1CX61H1ZPQ	• Bootstrap system for high efficiency (Efficiency 88% (TYP.)) • Low voltage output: 1.0 V (MIN.) • Ceramic capacitor compatible	1.5	0.8 When mounted on board	4.75 to 28	1.0 to 18.9	Step-down	900 k	RDSon TYP. 0.55Ω	SOP-8	

*1 With infinite heat sink attached or when mounted on a board listed in the specification sheets.
*2 Output variable range (step-down/inversion).
*3 V_{REF} nearly equal to 1.26 V
*4 Refer to page 35

RoHS

■Chopper Regulators (DC-DC Converters)

●TO-220 Type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current Isw (A)	Power dissipation Pd*1 (W)	Input voltage range Vin (V)	Output voltage Vo*2 (V)	Output type	Oscillation frequency fo (kHz) TYP.	Output saturation voltage Vsat (V) TYP.		Outline shape type*5
PQ1CG21H2FZH	• PWM chopper regulator • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function	1.5*3	14	40	V_{REF}*4 to 35 (step-down type)/ $-V_{REF}$*4 to –30 (inverting type)	Step-down	100	1.0	TO-220	E
PQ1CG41H2FZH	• PWM chopper regulator (high oscillation frequency) • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function						300	1.0		E
PQ1CG2032FZH	• PWM chopper regulator • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function	3.5*3					70	1.4		E
PQ1CG3032FZH	• PWM chopper regulator (high oscillation frequency) • Built-in overcurrent/overheat protection circuits • Output ON/OFF control function						150			E

*1 With infinite heat sink attached
*2 Output voltage variable range
*3 Peak current
*4 V_{REF} nearly equal to 1.26 V (TYP.)
*5 Refer to page 35

☆New product

RoHS

■LED Drivers

●Built-in Step-up Circuit (1)

Model No.	Function	Features	No. of output circuits	Number of LEDs	Booster method	Constant current circuit	Switching transistor	Input voltage range (V)	Output*3 current (mA) MAX.	Oscillation frequency (Hz) TYP.	Package
PQ6CB11X1CP▲	White LED driver for backlight (for small panels)	• High voltage CMOS output: 30 V (MAX.) • Output ON/OFF control function • Overvoltage/overcurrent protection circuits • Soft start function	1	6 (Series connection)	PWM	*1	○	2.7 to 5.5	250*2	1.2 M	USB-6
PQ7L2020BP▲		• High voltage CMOS output: 37 V (MAX.) • Output ON/OFF control function • Overvoltage/overcurrent protection circuits • Soft start function • Possible to use a low-capacity (0.1 µF) output capacitor	1	9 (Series connection)		*1	○	2.9 to 5.5	500	1.0 M	USB-6
IR2E58U	White LED driver for backlight	• Capable of driving a maximum of 96 LEDs with 12 LEDs (in series) per channel • Built-in step-up DC-DC converter • High oscillation frequency (1.5 MHz) makes use of a small coil possible • Capable of controlling brightness using PWM control • Step-up output control according to LED-Vf	8	96	PWM	○	○	4.5 to 28	40/ch	500 k to 1.5 M	24HQFN
IR2E65U		• Capable of driving a maximum of 120 LEDs with 12 LEDs (in series) per channel • Built-in step-up DC-DC controller • High oscillation frequency (1.5 MHz) makes use of a small coil possible • Wider range of PWM brightness control possible, from simultaneous total output control to local dimming • Step-up output control according to LED-Vf	10	120		○	External	10 to 28	100/ch	500 k to 1.5 M	52HQFN
☆IR2E71Y	LED driver for backlight and call alert display (auto brightness adjustment)	• 2 ch (11 LEDs x 2 ch) LED driver for backlight • Auto brightness adjustment backlight LED • 6 ch RBG LED driver for illumination • Built-in switching regulator for LCD backlight • Built-in LCD controller power supply (+5.8 V / −5.8 V MAX.) • LDO 1 ch • Interface for digital-output proximity sensor with ambient light sensor • Built-in general purpose input/output port (7 ch MAX.)	Backlight 2 RGB 6	Backlight 22 RGB 6	PWM	○	○	3.0 to 4.5	Backlight 25.5/ch RGB 12.7/ch	10 k to 1 M	35WL-CSP

*1 LED constant current value can be set by external resistors.
*2 Peak switching current
*3 Constant current (MAX.)
The model marked with ▲ may not be available in the near future. Contact with SHARP for details before use.

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●Built-in Step-up Circuit (2)

Model No.	Function	Features	No. of output circuits	Number of LEDs	Booster method	Constant current circuit	Switching transistor	Input voltage range (V)	Output*1 current (mA) MAX.	Oscillation frequency (Hz) TYP.	Package
IR2E67M	White LED driver for backlight	• Built-in 10 ch. constant-current control amplifier (external output transistor) • Enables driving LEDs up to external transistor voltage limit • Built-in timing controller for lighting • Wider range of PWM brightness control possible, from simultaneous total output control to local dimming • Step-up output control according to LED-Vf	10	*2	*3	*4	External	4.5 to 5.5	*5	–	80LQFP-1420
IR2E70N	White LED driver for backlight	• Built-in step-up DC-DC controller for 2 ch individual control • Capable of 2 ch individual PWM brightness control • LED current value adjustable by external signal (voltage input / PWM signal) • Brightness control possible at high contrast ratio 3000:1 • Step-up output control according to LED-Vf	2	*2	PWM	*6	External	4.5 to 5.5 8 to 28	*5	100 k to 500 k	24SSOP

*1 Constant current (MAX.)
*2 Determined by external transistor voltage limit.
*3 Built-in feedback voltage-generating circuit for external power supply.
*4 Built-in constant-current control amplifier (external output transistor)
*5 Determined by external resistor.
*6 Constant current can be controlled by LED anode voltage control.

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■AC-DC Conversion Type ICs for LED Lighting

Model No.	Features	Operating temperature range (°C)	Supply voltage range (V)	Dissipation current (mA) TYP.	Switching frequency (kHz)*1 TYP.	Gate driver capacity		System	Package
						Low (Ω)	High (mA)		
IR3M92N4	Overvoltage/overheat/overcurrent circuits, high-speed activation, stand-by feature, PWM brightness control	–30 to +100	10 to 18	1	160	MAX. 15	MIN. 40	Flyback Step-down	SOP-8

*1 When operating a flyback converter

■Power Amplifiers for Wireless LAN

Model No.	Application	Supply voltage Vcc (V) TYP.	Control voltage Vbb (V) TYP.	Linear output power*1 (dBm)	Dissipation current (mA) TYP.	Gain (dB) TYP.	Detection circuit	Matching circuit	Package (mm)
IRM068U7	For 2.4 GHz single-band wireless LAN (IEEE802.11b/g/n)	3.3	2.8	18	115	27	○	Built-in (IN)	HQFN6 pin (1.5 × 1.5 × 0.4 mm)
QM2A1UA003				20	150	28	○	Built-in (IN)	
IRM053U7	For 5 GHz single-band wireless LAN (IEEE802.11a/n)			18	170	30	○	Built-in (IN/OUT)	HQFN10 pin (2 × 2 × 0.4 mm)
QM2A1UA004				20	225	31	○	Built-in (IN/OUT)	
IRM067U6	For 2.4/5 GHz dual-band wireless LAN (IEEE802.11a/b/g/n)		2.9	17	100	28	○	Built-in (IN/OUT)	HQFN16 pin (3 × 3 × 0.4 mm)
				17	140	30			

*1 At time of OFDM 64QAM modulating wave input.

■Front-End Modules for Wireless LAN

Model No.	Application	Features	Supply voltage (V) TYP.	Control voltage (V) TYP.	Transmitter section			Receiver section		Package
					EVM (%)/ Output power (dBm)	Dissipation current (mA)/ Output power (dBm)	Gain (dB) TYP.	Noise figure (dB) TYP.	Gain: Normal/ Bypass (dB) TYP.	
QM2A1UB028/ 032A	Front-end IC for 2.4 GHz wireless LAN (802.11b/g/n/ac) (SP3T SW + PA + LNA)	• Built-in detection circuit, high efficiency / high linear-output power amplifier • .11ac-compliant low EVM design • Low-noise amplifier with bypass mode • Built-in input/output matching circuit • Compact and thin package	3.6	3.3	2/19*1	200/19	27	2	13/-5.5	HQFN16 pin (2.5 × 2.5 × 0.4 mm)
QM2A1UB029/ 033A	Front-end IC for 5 GHz wireless LAN (802.11a/n/ac) (SPDT SW + PA + LNA)				2/18*2	180/18	28	2.5	13/-7	

*1 MCS7 HT20 at 64QAM input
*2 MCS7 HT40 at 64QAM input

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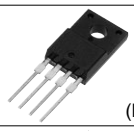
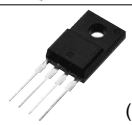
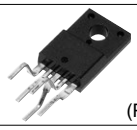
●Lead-Inserting Type Packages [For regulators: PQ series]

Package type	Appearance (Package material)	No. of terminals	Terminal pitch mm	Outline dimensions (Width x Thickness x Height) mm	Lead frame material
A TO-220	 (Plastic)	4	2.54	10.2 (MAX.) x 4.5 x 29.1*2	Cu
B TO-220 (Full mold)	 (Plastic)	4	2.54	10.2 (MAX.) x 4.5 x 29.1*2	Cu
C TO-220 (Full mold) [Lead forming type]	 (Plastic)	5	(1.7)*1	10.2 (MAX.) x 4.5 x 24.6*2	Cu
D TO-220 [Lead forming type]	 (Plastic)	5	(1.7)*1	10.2 (MAX.) x 4.5 x 24.6*2	Cu
E TO-220 [Lead forming type]	 (Plastic)	5	(1.7)*1	10.2 (MAX.) x 4.5 x 24.6*2	Cu

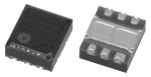
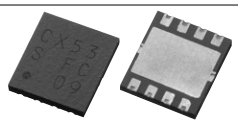
*1 The figure in parentheses indicates reference value.
*2 Including lead length

●Surface-Mount Type Packages [For regulators/LED drivers: PQ series]

Package type	Appearance (Package material)	No. of terminals	Terminal pitch mm	Outline dimensions (Width x Height x Thickness) mm	Lead frame material
F SC-63	 (Plastic)	5 (Heat sink included)	(1.27)*1	6.6 (MAX.) x 9.7 (MAX.)*2 x 2.1	Cu
SOP-8	 (Plastic)	8	1.27	5 x 6.2*2 x 1.55*2	Cu
SOT-89	 (Plastic)	6	1.5	4.5 x 4.3*2 x 1.5	Cu

*1 The figure in parentheses indicates reference value.
*2 Including lead length

●Surface-Mount Type Packages [For regulators/LED drivers: PQ series] (cont'd)

Package type	Appearance (Package material)	No. of terminals	Terminal pitch mm	Outline dimensions (Width x Height x Thickness) mm	Lead frame material
SOT-23-6	 (Plastic)	6	0.95	2.9 x 2.8*2 x 1.3	Cu
SOT-23-6W	 (Plastic)	6	0.95	2.9 x 2.8*2 x 1.3	Cu
SOT-23-L	 (Plastic)	6	(0.95)*1	(3.4)*1 x 3.3*2 x 1.4 (MAX.)	Cu
SOT-23-5	 (Plastic)	5	(0.95)*1	(2.9)*1 x 2.8*2 x 1.3 (MAX.)	Cu
USB-6		6	0.5	2.0 x 1.8 x 0.8	Cu (Terminal material)/ Au plating (Terminal finish)
USB-8		9 (Including radiating fin)	1.0	5.0 x 4.5 x 0.75 (MAX.)	Cu

*1 The figure in parentheses indicates reference value.
*2 Including lead length

Notice
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