



## Low Power-Loss Voltage Regulators

### TO-220 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings				Electrical characteristics			Built-in functions						Package	
		Output current I <sub>o</sub> (A)	Input voltage V <sub>in</sub> (V)	Power dissipation (W)		Output voltage V <sub>o</sub> *3 (V) TYP.	Output voltage precision (%)	Dropout voltage V <sub>I-O</sub> *5 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	Lead forming available		
				Pd*1	Pd*2											Package shape type*7
PQxxRD08J00H series	ASO protection function	0.8	20	1.25	10	5, 9, 12	±3	0.5	○	○	○					A
PQ3RD083J00H						3.3			○	○	○					A
PQ6RD083J00H						6.3			○	○	○					A
PQxxRA11J00H series	Low dissipation current at OFF state (I <sub>qs</sub> : 1 μA (MAX.))	1	35	1.5	15	5, 9, 12	±2.5	0.5	○	○	○	○				B
PQ3RD13J000H	ASO protection function		20			3.3			±3	○	○	○			A	
PQxxRD11J00H series	ASO protection function		1.4			5, 9, 12			±3	○	○	○			○	A
PQxxxRDA1SZH series	ASO protection function, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.))	2	20	1.4	15	3.3, 5, 8, 9, 12	±2.5	1.0	○	○	○	○				A
PQxxxRDA2SZH series						3.3, 5, 9, 12			○	○	○	○				A
PQxxxEF01SZH series	Minimum operating input voltage: 2.35 V (4 terminals)	1	10	1.4	15	1.5, 1.8, 2.5, 3.3	±2.5	0.5	○	○	○	○				A
PQxxxEF02SZH series		2				○			○	○	○				A	
PQxxRF11J00H series	General purpose	1	35	1.5	18	5, 9, 12	±2.5	0.5	○	○	○		○			B
PQxxRH11J00H series		1.5				○			○	○					B	
PQ3RD23J000H	ASO protection function	2	20	1.4	15	3.3	±3	0.5	○	○	○					A
PQxxRD21J00H series						5, 9, 12			○	○	○					A
PQxxRF21J00H series	General purpose	3.5	35	1.5	18	3.3	±2.5	0.5	○	○	○		○			B
PQ3RF23J000H	General purpose					○			○	○					B	
PQ3RF33J000H	High output current	1	10	1.4	15	1.5 to 7	±2*4	0.5	○	○			○			B
PQ070XF01SZH	Minimum operating input voltage: 2.35 V (4 terminals)					2			○	○					A	
PQ070XF02SZH	Minimum operating input voltage: 2.35 V (5 terminals)	1	17	1.25	12.5	1.5 to 15	±2*4	0.5	○	○	○	○	○	○		E
PQ070VK01FZH	Minimum operating input voltage: 2.35 V (4 terminals)	2				○			○	○	○	○	○	E		
PQ070VK02FZH	Minimum operating input voltage: 2.35 V (5 terminals)	1	20	1.25	10	3.0 to 15	±2.5*4	1.0	○	○			○			A
PQ15RW08J00H	ASO protection function, minimum operating input voltage: 3.5 V	1		1.4	15	○			○			○			A	
PQ15RW11J00H		2	1.4	15	○	○			○			A				
PQ15RW21J00H	ASO protection function	0.5	24	1.25	10	3.0 to 20	±2.5*4	1.0	○	○	○	○	○	○		A
PQ150RWA2SZH	ASO protection function			1.5	15	○			○	○	○	○	C			
PQ20RX05J00H	Variable output voltage, output ON/OFF control	1	17	1.25	12.5	1.5 to 15	±2*4	0.5		○	○	○	○	○		E
PQ20RX11J00H				2	○	○			○	○	○			E		
PQ150VB01FZH	Overheat shutdown circuit, minimum operating input voltage: 2.35 V (5 terminals)	1	35	1.5	15	1.5 to 30	±2*4	0.5	○	○	△*6		○	○		B
PQ150VB02FZH				2	○	○			△*6		○	○		B		
PQ30RV11J00H	Variable output voltage	3	20	2	20	1.5 to 7	±2*4	0.5	○	○	△*6		○	○		B
PQ30RV21J00H				○	○	△*6				○	○		B			
PQ30RV31J00H				○	○	△*6				○	○		B			
PQ7RV4J0000H		4.6	10	1.8	18	1.5 to 7			○	○	△*6		○			B

\*1 At self-cooling  
 \*2 With infinite heat sink attached  
 \*3 The xx/xxx in the model No. refer to the output voltage values of the model (e.g. 05/050 for 5 V, 12/120 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 53

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## ■ Surface Mount Type Low Power-Loss Voltage Regulators

### ● SOT-23-5 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics				Built-in functions				Package
		Input voltage Vin (V)	Power dissipation Pd*1 (W)	Output current Io (A)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage Vi-o (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	
PQ1Uxx1M2ZPH series	Compact, low output current	16	0.35	0.18	1.8, 2.5, 2.8, 3.0, 3.3, 3.5, 5.0	±2.0 (3.0 V output)	0.26 (Io = 60 mA)	○	○	○	○	SOT-23-5
PQ1Xxx1M2ZPH series	Compact, ceramic capacitor compatible	9			*3			○	○	○	○	

\*1 When mounted on a board

\*2 The xx in the model No. refer to the output voltage values of the model (e.g. 50 for 5.0 V, 18 for 1.8 V).

\*3 1.5, 1.8, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.3, 3.5, 3.7, 4.0, 4.5, 5.0

### ● SOT-23L 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 current Io (A)	Output voltage Vo*2 (V) TYP.	Output voltage precision (%)	Dropout voltage Vi-o (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	
PQ1RxxJ0000H series	Compact, surface mount type, low dissipation current at OFF state (Iqs: 0.1 μA (MAX.))	–	16	0.4	0.18	*3	±2.7 (3.0 V output)	0.26 (Io = 60 mA)	○	○	○	○	SOT-23L
PQ1Kxx3M2ZPH series	Compact, surface mount type, high ripple rejection, output current of up to 300 mA	0.3	9		–	1.8, 2.5, 3.0, 3.3, 3.6, 5.0	±2.0 (3.0 V output)	0.7 (Io = 300 mA)	○	○	○	○	

\*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, 47 for 4.7 V, 50 for 5.0 V).

\*3 1.8, 2.0, 2.3, 2.5, 2.7, 2.8, 2.9, 3.0, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 4.0, 4.2, 4.4, 4.7, 4.9, 5.0, 5.2

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## ● SOT-89 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics			Built-in functions					Package
		Output current I <sub>o</sub> (A)	Input voltage V <sub>in</sub> (V)	Power dissipation P <sub>d</sub> *1 (W)	Output voltage V <sub>o</sub> *2 (V) TYP.	Output voltage precision (%)	Dropout voltage V <sub>l-o</sub> *3 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage	
PQ1Lxx3M2SPQ	Compact, high radiation package, low dissipation current at OFF state (I <sub>qs</sub> : 1 μA (MAX.))	0.3	16	0.9	1.5, 1.8, 2.5, 3.0, 3.2, 3.3, 5.0	±2.0 (3.0 V output)	0.7	○	○	○	○		SOT-89
PQ1LAXx5MSPQ	Compact, high radiation package, ceramic capacitor compatible	0.5	15		1.2, 1.5, 1.8, 2.5, 3.3, 5.0	±2.0		○	○	○	○		
PQ1LAX95MSPQ	Ceramic capacitor compatible, variable output voltage				1.5 to 9.0	±2.0*6		○	○	○	○	○	
PQ1Mxx5M2SPQ	Compact, high output current, ceramic capacitor compatible	0.35	9		1.5, 1.8, 2.5, 3.3, 5.0	±2.0 (5.0 V output)	0.7	○	○	○	○		
PQ1MX55M2SPQ	Ceramic capacitor compatible, variable output voltage				1.3 to 5.0	±2.0*6		○	○	○	○	○	
PQ1Nxx3MxSPQ	Reset signal output function*4, ceramic capacitor compatible				2.5, 3.3	±2.0		○	○				
PQ2Lxxx2MSPQ	Compact, high radiation package, 2 outputs	0.25/ch	9		*5	–	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). [Except PQ2Lxxx2MSPQ]

\*3 Current ratings are defined individually.

\*4 Reset detection voltage: 4.2 V, 3.8 V

\*5 Output voltage combination: 3.3/3.3 V, 3.3/2.5 V, 3.3/1.8 V, 3.3/1.5 V, 2.5/1.8 V, 2.5/1.5 V

\*6 Reference voltage precision

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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 Package shape type <sup>6</sup>				
		Output current I <sub>o</sub> (A)			Input voltage V <sub>in</sub> (V)	Power dissipation Pd <sup>*1</sup> (W)	Output voltage V <sub>o</sub> <sup>*2</sup> (V) TYP.	Output voltage precision (%)	Dropout voltage V <sub>1-o</sub> <sup>*5</sup> (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage		Taped package			
		0.5	1	1.5															
PQ07VR5MAZPH series	Reset signal generation function (input voltage drop detection)	○			10		1.5 to 7	±2.0 <sup>*3</sup>		○	○			○	○	F			
PQ3DZ53J000H	ASO protection function, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.))	○			24	8	3.3	±3.0	0.5	○	○	○	○		○	F			
PQ3DZ13J000H			○											○	○	○	○		○
PQxxDZ51J00H series		○								5, 9, 12			○	○	○	○		○	F
PQxxDZ11J00H series			○										○	○	○	○		○	F
PQxxxDNA1ZPH series	Ceramic capacitor compatible, ASO protection function, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.)), solder dip compatible lead shape			○			3.3, 5, 8, 9, 12	±2.5		○	○	○	○		○	G			
PQxxxDZ01ZPH series	Low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.))		○		9, 10	5	3.3, 5	±3.0		○	○	○	○		○	F			
PQxxxEZ5MZPH series	Minimum operating input voltage: 2.35 V	○			10	8	1.5, 1.8, 2.5, 3.0, 3.3	±2.5 <sup>*4</sup>	0.3	○	○	○	○		○	F			
PQxxxEZ01ZPH series				○										○	○	○	○		○
PQxxxEN01ZPH series	Minimum operating input voltage: 2.35 V, solder dip compatible lead shape			○		5	1.2, 1.5, 1.8, 2.5, 3.3	±2.0	0.9	○	○	○	○		○	G			
PQxxxENA1ZPH series				○									○	○	○	○		○	G
PQxxxENB1ZPH series	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape			○		8	1.5, 1.8, 2.5, 3.0, 3.3	±2.5 <sup>*4</sup>	1.0	○	○	○	○		○	F			
PQxxxENAHZPH series				○									○	○	○	○		○	F
PQxxxEZ1HZPH series	Minimum operating input voltage: 2.35 V			○		8	1.5, 1.8, 2.5	±2.5 <sup>*4</sup>	0.5	○	○	○	○		○	F			
PQxxxEZ02ZPH series				○ (2A)									○	○	○	○		○	F
PQxxxFZ5MZPH series	Minimum operating input voltage: 1.7 V (Dual power supply type)	○			3.7		1.0, 1.2			○	○	○	○		○	F			
PQxxxGN01ZPH series	Minimum operating input voltage: 1.7 V (Dual power supply type), ceramic capacitor compatible, solder dip compatible lead shape			○	5.5	8	0.8, 1.0, 1.2	±30 mV	-	○	○				○	G			
PQxxxGN1HZPH series				○										○	○				○

\*1 With infinite heat sink attached

\*2 The xx/xxx in the model No. refer to the output voltage values of the model (e.g. 033 for 3.3 V, 05/050 for 5 V, 12/120 for 12 V).

\*3 Reference voltage precision

\*4 The value is defined as ±50 mV in some models.

\*5 Current ratings are defined individually.

\*6 Refer to page 53

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### ●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 I <sub>o</sub> (A)			Input voltage V <sub>in</sub> (V)	Power dissipation P <sub>d</sub> *1 (W)	Output voltage V <sub>o</sub> (V) TYP.	Output voltage precision (%)	Dropout voltage V <sub>1-o</sub> *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																																													
PQ070XZ5MZPH	Minimum operating input voltage: 2.35 V	○			10	8	1.5 to 7	±2.0*2	0.5	○	○	○	○	○	○	SC-63	F																														
PQ070XZ01ZPH			○							○	○	○	○	○	○		F																														
PQ070XN01ZPH	Minimum operating input voltage: 2.35 V, solder dip compatible lead shape		○							10	8	1.5 to 7	±2.0*2	0.5	○		○	○	○	○	○	G																									
PQ070XNA1ZPH			○												○		○	○	○	○	G																										
PQ070XNAHZPH	Minimum operating input voltage: 2.35 V, ceramic capacitor compatible, solder dip compatible lead shape			○											10		8	1.5 to 7	±2.0*2	0.9	○	○	○	○	○	○	G																				
PQ070XNA2ZPH				○ (2A)																	10	8	1.5 to 7	±2.0*2	0.5	○	○	○	○	○	○	G															
PQ070XNB1ZPH			○																							10	8	1.5 to 7	±2.0*2	0.3	○	○	○	○	○	○	G										
PQ070XZ1HZPH	Minimum operating input voltage: 2.35 V			○																											10	8	1.5 to 7	±2.0*2	1.0	○	○	○	○	○	○	F					
PQ070XZ02ZPH				○ (2A)																																10	8	1.5 to 7	±2.0*2	0.5	○	○	○	○	○	○	F
PQ015YZ5MZPH	Reference voltage (Vref): 1.0 V, minimum operating input voltage: 1.7 V (Dual power supply type)	○																																							3.7	1.0 to 1.5	±3.0*2	-	○	○	
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	0.8 to 3.5	±30 mV	-	○							○																															G
PQ035ZN1HZPH				○					5.5							0.8 to 3.5																									±30 mV	-	○		○		
PQ20VZ51J00H	Minimum operating input voltage: 4.5 V	○			8	1.5 to 20	±2.0*2			0.5	○	○	○	○																													○		○		F
PQ20VZ11J00H			○						8		1.5 to 20	±2.0*2	0.5	○		○																									○		○		○	○	
PQ20WZ51J00H	Minimum operating input voltage: 3.5 V, ASO protection function, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.))	○												8	3.0 to 20	±2.5*2	0.5	○	○	○																					○		○		○		F
PQ20WZ11J00H			○															8	3.0 to 20	±2.5*2	0.5	○	○	○	○																○		○			F	
PQ200WNA1ZPH	Minimum operating input voltage: 3.5 V, ASO protection function, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.)), ceramic capacitor compatible, solder dip compatible lead shape		○																			24	3.0 to 20	±2.5*2	0.5	○	○	○	○	○											○				G		
PQ200WN3MZPH		Minimum operating input voltage: 5.5 V, low dissipation current at OFF state (I <sub>qs</sub> : 5 μA (MAX.)), ceramic capacitor compatible, current limit: 800 mA	○ (0.3)																								24	3.0 to 20	±2.5*2	0.5	○	○	○	○	○								G				

\*1 With infinite heat sink attached  
 \*2 Reference voltage precision  
 \*3 Current ratings are defined individually.  
 \*4 Refer to page 53

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### ●TO-263 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics			Built-in functions					Taped package	Package
		Output current I <sub>o</sub> (A)	Input voltage V <sub>in</sub> (V)	Power dissipation P <sub>d</sub> *1 (W)	Output voltage V <sub>o</sub> *2 (V) TYP.	Output voltage precision (%)	Dropout voltage V <sub>l-o</sub> *4 (V)	Overheat protection	Overcurrent protection	ON/OFF control	Low dissipation current at OFF state	Variable output voltage		
PQxxxY053ZPH	High output current (minimum operating input voltage: 2.35 V)	5.0	7	35	1.5, 2.5, 3.3	±1.0	0.5	○	○	○		○	TO-263	
PQ05VY053ZPH					1.5 to 5	±1.0*3		○	○	○		○		
PQxxxY3H3ZPH		3.5			1.5, 2.5, 3.3	±1.0		○	○	○		○		
PQ05VY3H3ZPH					1.5 to 5	±1.0*3		○	○	○		○		
PQxxxEH02ZPH	2 A output (minimum operating input voltage: 2.35 V)	2.0	10		1.5, 1.8, 2.5	±2.5*5		○	○	○	○			○
PQ070XH02ZPH					1.5 to 7	±2.0*3		○	○	○	○	○		○
PQ070XHA2ZPH	2 A output (minimum operating input voltage: 2.35 V), ceramic capacitor compatible				1.5 to 7	±2.0*3		○	○	○	○			○
PQxxxEH01ZPH	1 A output (minimum operating input voltage: 2.35 V)	1.0			1.5, 1.8, 2.5	±2.5*5		○	○	○	○			○
PQ070XH01ZPH			1.5 to 7	±2.0*3	○	○	○	○	○	○				

\*1 With infinite heat sink attached

\*2 The xxx in the model No. refer to the output voltage values of the model (e.g. 015 for 1.5 V, 025 for 2.5 V, 033 for 3.3 V).

\*3 Reference voltage precision

\*4 Current ratings are defined individually.

\*5 The value is defined as ±50 mV in some models.

### ●SOP-8 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings			Electrical characteristics		Built-in functions			Taped package	Package
		Output current I <sub>o</sub> (A)	Input voltage V <sub>in</sub> (V)	Power dissipation P <sub>d</sub> *1 (W)	Output voltage V <sub>o</sub> (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 <sub>DD</sub> x 1/2 (V <sub>DDQ</sub> : 1.5 V (MIN.))	±25	○	○	○	SOP-8	
PQ1DX125MZPQ	Built-in sink source function (For DDR memory)				V <sub>DD</sub> x 1/2 (V <sub>DDQ</sub> : 2.3 V (MIN.))	±35	○	○	○		

\*1 When mounted on a board

\*2 Reference voltage precision

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## ■ Surface Mount Type Chopper Regulators (DC-DC Converters) (1)

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current I <sub>sw</sub> (A)	Power dissipation P <sub>d</sub> *1 (W)	Input voltage range V <sub>in</sub> (V)	Output voltage V <sub>o</sub> (V)	Output type	Oscillation frequency f <sub>o</sub> (Hz) TYP.	Output saturation voltage V <sub>sat</sub> (V) TYP.	Outline shape type*6	
PQ6CU12X2APQ	<ul style="list-style-type: none"> <li>High switching voltage: 40 V (MAX.)</li> <li>For tuner power supply</li> <li>Variable oscillation frequency</li> <li>Ceramic capacitor compatible</li> </ul>	0.25	0.35	3.0 to 5.5	up to 36	Step-up	300 k to 800 k	R <sub>on</sub> TYP. 1.7Ω	SOT-23-6W	
PQ1CN38M2ZPH	<ul style="list-style-type: none"> <li>PWM chopper regulator (high oscillation frequency)</li> <li>Output ON/OFF control function</li> <li>Overcurrent/overheat protection circuits</li> <li>For light load</li> </ul>	0.8	8	4.5 to 40	*3 V <sub>REF</sub> to 35 (step-down type)/ -V <sub>REF</sub> to -30 (inverting type)	Step-down	300 k	0.9	SC-63	G
PQ1CN41H2ZPH	<ul style="list-style-type: none"> <li>PWM chopper regulator (high oscillation frequency)</li> <li>Overcurrent/overheat protection circuits</li> </ul>	1.5	8			Step-down	300 k	0.9		G
PQ1CZ21H2ZPH	<ul style="list-style-type: none"> <li>PWM chopper regulator</li> <li>Output ON/OFF control function</li> <li>Overcurrent/overheat protection circuits</li> <li>Low dissipation current at OFF state (Standby current &lt;I<sub>SD</sub>&gt;: 1 μA (MAX.))</li> </ul>		8			Step-down	100 k	0.9		F
PQ1CX12H2ZPQ	<ul style="list-style-type: none"> <li>Bootstrap system for high efficiency (Efficiency 88% (TYP.))</li> <li>Low dissipation current</li> </ul>	2.5	0.9 When mounted on board	4.5 to 30	*3 V <sub>REF</sub> to 24	Step-down	150 k	0.25	SOP-8	
PQ1CX22H2ZPQ	<ul style="list-style-type: none"> <li>Bootstrap system for high efficiency (Efficiency 88% (TYP.))</li> <li>Low dissipation current</li> <li>Low voltage output: 1.2 V (MIN.)</li> </ul>							*4 V <sub>REF</sub> to 24 (step-down type)		
PQ1CX41H2ZPQ	<ul style="list-style-type: none"> <li>Bootstrap system for high efficiency (Efficiency 90% (TYP.))</li> <li>Low voltage output: 0.8 V (MIN.)</li> <li>Ceramic capacitor compatible</li> </ul>	1.5	0.8 When mounted on board	4.75 to 27	0.8 to 20	Step-down	400 k	R <sub>DSon</sub> TYP. 0.45Ω		
☆PQ1CX53H2MPQ	<ul style="list-style-type: none"> <li>Bootstrap system for high efficiency (Efficiency 89% (TYP.))</li> <li>Low voltage output: 0.8 V (MIN.)</li> <li>Ceramic capacitor compatible</li> </ul>	3.5	2 When mounted on board	4.75 to 27	0.8 to 16	Step-down	400 k	R <sub>DSon</sub> TYP. 0.15Ω	USB-8	
☆PQ1CX61H1ZPQ	<ul style="list-style-type: none"> <li>Bootstrap system for high efficiency (Efficiency 88% (TYP.))</li> <li>Low voltage output: 1.0 V (MIN.)</li> <li>Ceramic capacitor compatible</li> </ul>	1.5	0.8 When mounted on board	4.75 to 28	1.0 to 18.9	Step-down	900 k	R <sub>DSon</sub> TYP. 0.55Ω	SOP-8	
PQ1CY1032ZPH	<ul style="list-style-type: none"> <li>PWM chopper regulator</li> <li>Output ON/OFF control function</li> <li>Overheat protection/overcurrent shutdown circuits</li> <li>High output current type</li> </ul>	3.5	35	4.5 to 40	*3 V <sub>REF</sub> to 35 (step-down type)/ -V <sub>REF</sub> to -30 (inverting type)	Step-down	150 k	1.4	TO-263	
PQ1CYxx3HZPH series PQ1CYxx3LZPH series*5	<ul style="list-style-type: none"> <li>PWM chopper regulator</li> <li>Fixed output voltage: 3.3 V or 5 V</li> <li>Overheat protection circuit</li> <li>Output ON/OFF control function</li> </ul>							35		

\*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<sub>REF</sub> nearly equal to 1.26 V

 \*4 V<sub>REF</sub> nearly equal to 1 V

\*5 PQ1CYxx3HZPH series is "H" active, and PQ1CYxx3LZPH series is "L" active.

\*6 Refer to page 53

## ■ Surface Mount Type Chopper Regulators (DC-DC Converters) (2)

Model No.	No. of output circuits	Input voltage range (V)	Output voltage (V)	System	Switching frequency (Hz)	Switching transistor	Switching current (mA) [Built-in SW Tr]	Drive capacity (pF) [External SW Tr]	Package
IR3M58M/U	3	4.5 to 28	External setting	Step-up (MAX. 20 V)/ step-down type PWM	70 k to 500 k	Built-in	400	1 000	P-QFP048-0707/ P-VQFN032-0505
				Step-down type PWM		External	-		
				Step-down, inverting type PWM		External	-		

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## ■ Chopper Regulators (DC-DC Converters)

### ● TO-220 type

(Ta = 25°C)

Model No.	Features	Absolute maximum ratings		Electrical characteristics					Package	
		Switching current I <sub>sw</sub> (A)	Power dissipation P <sub>d</sub> *1 (W)	Input voltage range V <sub>in</sub> (V)	Output voltage V <sub>o</sub> *2 (V)	Output type	Oscillation frequency f <sub>o</sub> (kHz) TYP.	Output saturation voltage V <sub>sat</sub> (V) TYP.	Outline shape type*5	
PQ1CG38M2FZH	<ul style="list-style-type: none"> <li>• PWM chopper regulator (high oscillation frequency)</li> <li>• Built-in overcurrent/overheat protection circuits</li> <li>• For light load</li> <li>• Output ON/OFF control function</li> </ul>	0.8*3					300	0.95	TO-220	E
PQ1CG38M2RZH										D
PQ1CG21H2FZH	<ul style="list-style-type: none"> <li>• PWM chopper regulator</li> <li>• Built-in overcurrent/overheat protection circuits</li> <li>• Output ON/OFF control function</li> </ul>	1.5*3					100	1.0	TO-220	E
PQ1CG21H2RZH										D
PQ1CG41H2FZH	<ul style="list-style-type: none"> <li>• PWM chopper regulator (high oscillation frequency)</li> <li>• Built-in overcurrent/overheat protection circuits</li> <li>• Output ON/OFF control function</li> </ul>	1.5*3	14	40	V <sub>REF</sub> *4 to 35 (step-down type)/ -V <sub>REF</sub> *4 to -30 (inverting type)	Step-down	300	1.0	TO-220	E
PQ1CG41H2RZH										D
PQ1CG2032FZH	<ul style="list-style-type: none"> <li>• PWM chopper regulator</li> <li>• Built-in overcurrent/overheat protection circuits</li> <li>• Output ON/OFF control function</li> </ul>	3.5*3					70	1.4	TO-220	E
PQ1CG2032RZH										D
PQ1CG3032FZH	<ul style="list-style-type: none"> <li>• PWM chopper regulator (high oscillation frequency)</li> <li>• Built-in overcurrent/overheat protection circuits</li> <li>• Output ON/OFF control function</li> </ul>	3.5*3					150	1.4	TO-220	E
PQ1CG3032RZH										D
PQ2CF1J0000H	<ul style="list-style-type: none"> <li>• PWM chopper regulator</li> <li>• Built-in overcurrent/overheat protection circuits</li> </ul>	2.5*3	15	35	4.5 to 35 (step-up type)	Step-up	50	0.6	TO-220	E

\*1 With infinite heat sink attached  
 \*2 Output voltage variable range  
 \*3 Peak current  
 \*4 V<sub>REF</sub> nearly equal to 1.26 V (TYP.)  
 \*5 Refer to page 53

Power Devices/  
Analog ICs

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### ■ Power Supply ICs for CCDs/CCD Camera Modules

Model No.	No. of output circuits	Input voltage range (V)	Output voltage (V)	System	Switching frequency (Hz)	Switching transistor	Switching current (mA) [Built-in SW Tr]	Drive capacity (pF) [External SW Tr]	Package
IR3M63U	4	4.5 to 10	15	Charge pump	200 k	-	12 (DC)	-	P-VQFN032-0505
			-8	Negative charge pump			2.5 (DC)	-	
			3.3	Step-down type PWM + REG	1 M	Built-in	120 (DC)	-	
			1.8	Step-down type PWM + REG			50 (DC)	-	
IR3M59U	3	4.5 to 16	15/12	Charge pump	200 k	-	12/20 (DC)	-	P-VQFN032-0505
			-8/-5	Negative charge pump			2.5/5 (DC)	-	
			3.3	Step-down type PWM + REG	1 M	Built-in	150 (DC)	-	

### ■ Power Supply ICs for TFT-LCDs

Model No.	No. of output circuits	Input voltage range (V)	Output voltage (V)	System	Switching frequency (Hz)	Switching transistor	Switching current (mA) [Built-in SW Tr]	Drive capacity (pF) [External SW Tr]	Package
IR3M58M/U	3	4.5 to 28	External setting	Step-up (MAX. 20 V)/ step-down type PWM	70 k to 500 k	Built-in	400 (for step-up type PWM)	1 000	P-QFP048-0707/ P-VQFN032-0505
				Step-down type PWM		External	-		
				Step-down, inverting type PWM		External	-		

### ■ 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)	<ul style="list-style-type: none"> <li>High voltage CMOS output: 30 V (MAX.)</li> <li>Output ON/OFF control function</li> <li>Overvoltage/overcurrent protection circuits</li> <li>Soft start function</li> </ul>	1	6 (Series connection)	PWM	*1	○	2.7 to 5.5	250*2	1.2 M	USB-6
PQ7L2020BP		<ul style="list-style-type: none"> <li>High voltage CMOS output: 37 V (MAX.)</li> <li>Output ON/OFF control function</li> <li>Overvoltage/overcurrent protection circuits</li> <li>Soft start function</li> <li>Possible to use a low-capacity (0.1 μF) output capacitor</li> </ul>	1	9 (Series connection)		*1	○	2.9 to 5.5	500	1.0 M	USB-6
☆PQ7L3010QPF	White LED driver for flashlight	<ul style="list-style-type: none"> <li>Automatic-switching (between 1x/2x) charge pump system</li> <li>Non-external coil</li> <li>Built-in fail-safe function</li> <li>Short-circuit LED protection function/overheat protection function/soft start function</li> </ul>	1	1	Charge pump	*1	-	2.6 to 4.4	800	0.9 M	16QFN

\*1 LED constant current value can be set by external resistors.

\*2 Peak switching current

\*3 Constant current (MAX.)

\*4 Use this IC within the range of power dissipation.

\*5 Selectable oscillation frequency range

\*6 3.57 mm x 3.57 mm x 0.82 mm (TYP.)

\*7 3.57 mm x 3.57 mm x 0.65 mm (TYP.)

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☆New product  
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### LED Drivers

#### ●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 <sup>*3</sup> current (mA) MAX.	Oscillation frequency (Hz) TYP.	Package
IR2E49U/ IR2E49M	White LED driver for backlight	<ul style="list-style-type: none"> <li>Capable of driving a maximum of 40 LEDs with 8 LEDs (in series) per channel</li> <li>Built-in step-up DC-DC controller</li> <li>Capable of controlling brightness using PWM control</li> <li>Step-up output control according to LED-Vf</li> </ul>	5	40	PWM	○	External	6 to 28	150/ch <sup>*4</sup>	100 k to 1 M <sup>*5</sup>	P-VQFN036-0606/ P-QFP048-0707
IR2E51Y6	LED driver for backlight and call alert display (auto brightness adjustment)	<ul style="list-style-type: none"> <li>Capable of direct connection of ambient light sensor</li> <li>Brightness adjustment by ambient illuminance feedback (16-step ambient illuminance/128-level illuminance) (for main LCDs)</li> <li>Non-external coil thanks to charge pump drive</li> <li>Capable of driving 4 main-LEDs, 2 sub-LEDs, and 3 call alert LEDs with a single device.</li> <li>I<sup>2</sup>C interface-compatible</li> <li>Standby function/power on reset function/soft start function</li> </ul>	9	4 + 2 + 3	Charge pump	○	—	3.0 to 4.5 (for drive)/ 2.3 to 3.2 (for control)	27.4/ch	660 k	35WL-CSP <sup>*6</sup>
IR2E55Yx	LED driver for backlight and call alert display (auto brightness adjustment)	<ul style="list-style-type: none"> <li>Capable of driving 7 main-LEDs (series) and 6 call alert LEDs</li> <li>Auto brightness adjustment and PWM brightness adjustment</li> <li>Power supply for EL panel and LCD controller</li> <li>LDO 2ch</li> <li>Built-in GPIO interface</li> <li>I<sup>2</sup>C/SPI interface-compatible</li> </ul>	7	13	PWM + charge pump	○	○	3 to 4.2 (for drive)/ 2.7 to 3.2 (for control)	Main 25.6/ch Call alert 12.8/ch	1 M	48WL-CSP <sup>*7</sup>
☆IR2E56U6	White LED driver for backlight	<ul style="list-style-type: none"> <li>Capable of driving a maximum of 72 LEDs with 12 LEDs (in series) per channel</li> <li>Built-in step-up DC-DC controller</li> <li>High oscillation frequency (1.5 MHz) makes use of a small coil possible</li> <li>Capable of controlling brightness using PWM control</li> <li>Step-up output control according to LED-Vf</li> <li>Built-in sequential drive mode for output current</li> </ul>	6	72	PWM	○	External	5 to 28	25/ch	200 k to 1.5 M	32VQFN
★IR2E58U		<ul style="list-style-type: none"> <li>Capable of driving a maximum of 96 LEDs with 12 LEDs (in series) per channel</li> <li>Built-in step-up DC-DC converter</li> <li>High oscillation frequency (1.5 MHz) makes use of a small coil possible</li> <li>Capable of controlling brightness using PWM control</li> <li>Step-up output control according to LED-Vf</li> </ul>	8	96		○	○	4.5 to 28	40/ch	500 k to 1.5 M	24HQFN
★IR2E62U		<ul style="list-style-type: none"> <li>Capable of driving a maximum of 96 LEDs with 12 LEDs (in series) per channel</li> <li>Built-in step-up DC-DC converter</li> <li>High oscillation frequency (1.5 MHz) makes use of a small coil possible</li> <li>Capable of controlling brightness using PWM control</li> <li>Step-up output control according to LED-Vf</li> <li>Built-in sequential drive mode for output current</li> <li>Brightness control and operation mode settings carried out using an I<sup>2</sup>C-bus, making use of an internal monitor possible</li> </ul>	8	96		○	○	4.5 to 28	35/ch	500 k to 1.5 M	24HQFN

\*1 LED constant current value can be set by external resistors.

\*2 Peak switching current

\*3 Constant current (MAX.)

\*4 Use this IC within the range of power dissipation.

\*5 Selectable oscillation frequency range

\*6 3.57 mm x 3.57 mm x 0.82 mm (TYP.)

\*7 3.57 mm x 3.57 mm x 0.65 mm (TYP.)

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### ●Built-in step-up circuit (3)

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
☆IR2E65U	White LED driver for backlight	<ul style="list-style-type: none"> <li>Capable of driving a maximum of 120 LEDs with 12 LEDs (in series) per channel</li> <li>Built-in step-up DC-DC controller</li> <li>High oscillation frequency (1.5 MHz) makes use of a small coil possible</li> <li>Wider range of PWM brightness control possible, from simultaneous total output control to local dimming</li> <li>Step-up output control according to LED-Vf</li> </ul>	10	120	PWM	○	External	10 to 28	100/ch	500 k to 1.5 M	52HQFN
★IR2E66M		<ul style="list-style-type: none"> <li>Capable of driving a maximum of 48 LEDs with 12 LEDs (in series) per channel</li> <li>Relationship between input voltage and LED anode voltage sizes not relevant, thanks to built-in DC-DC converter</li> <li>High oscillation frequency (2 MHz) makes use of a small coil possible</li> <li>Capable of controlling brightness using PWM control</li> <li>Step-up output control according to LED-Vf</li> </ul>	4	48		○	○	6 to 28	100/ch	100 k to 2 M	48QFP

- \*1 LED constant current value can be set by external resistors.  
 \*2 Peak switching current  
 \*3 Constant current (MAX.)  
 \*4 Use this IC within the range of power dissipation.  
 \*5 Selectable oscillation frequency range  
 \*6 3.57 mm x 3.57 mm x 0.82 mm (TYP.)  
 \*7 3.57 mm x 3.57 mm x 0.65 mm (TYP.)

### ●External power supply for LEDs

Model No.	Function	Features	Supply voltage (V)	Package
IR2D20U	24-dot LED panel driver with constant-current sink outputs	<ul style="list-style-type: none"> <li>Output current (constant current sink output): 30 mA (MAX.) (setup by external resistor)</li> <li>Gradation function (clock cycle setting or external synchronization)</li> <li>Independent current control for three systems (for RGB LED)</li> <li>LED drive voltage: 15 V</li> <li>Rated output voltage: 20 V (MAX.)</li> <li>fCLK: 20 MHz (MAX.)/16.6 MHz (MAX.) (at cascade connection)</li> </ul>	4.5 to 5.5	P-HQFN052-0707
IR2D071	16-dot LED panel driver with constant current sink outputs	<ul style="list-style-type: none"> <li>Output current (constant-current sink output): 60 mA (MAX.) (setup by external resistor)</li> <li>Rated output voltage: 7 V (MAX.)</li> <li>fCLK: 20 MHz (MAX.)/16.6 MHz (MAX.) (at cascade connection)</li> </ul>	3.0 to 5.5	P-SDIP028-0400

### ■ Power Supply Modules for LED Lighting (AC Direct Drive)

Model No.	Features	Input voltage range Vin (rms)	Input frequency Freq (Hz)	Output voltage range Vo (V)	Output current Iop (mA)	Output power W (W)	Operating temperature range (°C)
★PQ1AS10C1KA	<ul style="list-style-type: none"> <li>Can be connected to the existing light controllers</li> <li>No electrolytic capacitor</li> </ul>	AC100 V±10%	50/60	87 to 113	MAX. 150	8	0 to +60
★PQ1AS10C1KB		AC110 V±10% AC120 V±10%		102 to 116	MAX. 150	8	



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### Power Amplifiers for Wireless LAN

Model No.	Application	Operating frequency (GHz)	Supply voltage Vcc (V) TYP.	Control voltage Vbb (V) TYP.	Linear output power*1 (dBm)	Dissipation current (mA) TYP.	Gain (dB) TYP.	Detection function	Matching circuit	Package (W × D × H mm)	
IRM046U7	For 2.4/5 GHz dual-band wireless LAN (IEEE802.11a/b/g/n)	2.4 to 2.5	3.3	2.8	18	105	30	○	—	P-HQFN024-0404 (4.2 × 4.2 × 1.0)	
		4.9 to 5.9			18	140	25		—		
IRM065U7	For 2.4/5 GHz dual-band wireless LAN (IEEE802.11a/b/g/n)	2.4 to 2.5		2.8	18	130	30	○	Built-in (IN/OUT)	P-HQFN016-0303 (3 × 3 × 0.4)	
		4.9 to 5.9			18	160	30		Built-in (IN/OUT)		
IRM067U6	For 2.4/5 GHz dual-band wireless LAN (IEEE802.11a/b/g/n)	2.4 to 2.5		2.9	17	100	28	○*2	Built-in (IN/OUT)	P-HQFN016-0303 (3 × 3 × 0.4)	
		4.9 to 5.9			17	140	30		Built-in (IN/OUT)		
IRM063U7	For 2.4 GHz single-band wireless LAN (IEEE802.11b/g/n)	2.4 to 2.5		3.3	2.8	18	130	30	○	Built-in (IN/OUT)	P-HQFN010-0202A (2 × 2 × 0.4)
IRM068U7	For 2.4 GHz single-band wireless LAN (IEEE802.11b/g/n)	2.4 to 2.5			2.8	18	115	27	○*2	Built-in (IN)	HSON06-P-1515 (1.5 × 1.5 × 0.4)
IRM053U7	For 5 GHz single-band wireless LAN (IEEE802.11a/n)	4.9 to 5.9	2.8		18	170	30	○	Built-in (IN/OUT)	P-HQFN010-0202A (2 × 2 × 0.4)	

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

\*2 Load fluctuation stabilization and detection output type

### Fail Safe ICs

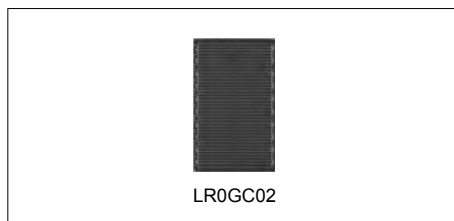
Model No.	Features	Operating voltage			Dissipation current (μA) TYP.	Operating temp. (°C)	Package
		VBAT (V)	VBAC (V)	VIO (V)			
IR3T46U6	<ul style="list-style-type: none"> <li>Malfunction detection</li> <li>Built-in 8-bit ADC</li> <li>Built-in timer circuit</li> <li>Built-in key detection output OR gate</li> </ul>	3.2 to 4.5	3.0 to 3.3	2.6 to 3.0	10	-20 to +85	P-HQFN024-0404
IR3T48Y6	<ul style="list-style-type: none"> <li>Small package</li> <li>Built-in 3-STATE buffer</li> <li>Malfunction detection</li> <li>Built-in 8-bit ADC</li> <li>Built-in timer circuit</li> <li>Built-in key detection output OR gate</li> </ul>			1.6 to 3.0			35WL-CSP*

\* 3.0 (W) × 3.0 (D) × 0.975 (H) mm (TYP.)

### Solar Modules for Mobile Devices

Model No.	Features	Maximum output power* TYP. (mW)	Maximum output voltage* TYP. (V)	Maximum output current* TYP. (mA)	Outline dimensions (mm)
☆LR0GC02	Module thickness: 0.8 mm	300	4.5	67	67.5 × 41.0 × 0.8

\* Measuring conditions: AN 1.5; irradiance: 1000 W/m<sup>2</sup> ± 50 mW; module temperature: at 25°C



#### Notice

In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc. Except where specially indicated, models listed on this page comply with the RoHS Directive\*. For details, please contact SHARP. \*RoHS Directive: Prohibits use of lead, cadmium, hexavalent chromium, mercury and specific brominated flame retardants (PBBs and PBDEs), with certain exceptions. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.