R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PLP)1820-6) is the non-promotional product as of March 2019.

RICOH

STEP-UP DC/DC CONVERTER FOR OLED BACK LIGHT with SHUTDOWN FUNCTION

NO.EA-192-170925

OUTLINE

R1200x series are CMOS-based control type step-up DC/DC converter with low supply current ICs. Each of these ICs consists of a Nch MOSFET, NPN transistor, an oscillator, PWM comparator, a voltage reference unit, an error amplifier, a current limit circuit, an under voltage lockout circuit (UVLO), an over voltage protection circuit (OVP), and a soft start circuit. As the external components, an inductor, resistances or capacitors are necessary to make a constant output voltage of step-up DC/DC converter with the R1200x. At standby mode, the NPN transistor can separate the output from the input. During the situation of that, there are two versions. R1200xxxxA: the output of V_{OUT} is generated to 0V by the low resistance (with the auto discharge function). R1200xxxxB does not generate the output of V_{OUT} (without the auto discharge function).

The soft-start time (Typ. 1.5ms) and the maximum duty cycle (Typ. 91%) are set internally. For the protection functions of R1200x series are the current limit function of the L_X peak current, the OVP function for detection the over voltage of output and the UVLO function for protective miss-operation by the low voltage. (The threshold of OVP is selectable from 17V, 19V or 21V.)

Since the packages for these ICs are DFN1616-6, DFN(PLP)1820-6, SOT-23-6 and WLCSP-6-P1, therefore high density mounting of the ICs on boards is possible.

FEATURES

- Supply Current .... Typ. 500μA
- Standby Current .... Max. 3μA
- Input Voltage Range .... 2.3V to 5.5V
- Feedback Voltage .... 1.0V (Externally adjustable)
- Feedback Voltage Accuracy....................................... ±1.5%
- Temperature-Drift Coefficient of Feedback Voltage ..... ±150ppm/°C
- Oscillator Frequency .... Typ. 1.2MHz
- Maximum Duty Cycle .... Typ. 91%
- Switch ON Resistance .... Typ. 1.35Ω
- UVLO Detector Threshold.. Typ. 2.0V
- Soft-start Time... Typ. 1.5ms
- Lx Current Limit Protection .... Typ. 700mA
- OVP Detector Threshold......................... .... 17V, 19V, 21V
- Switching Control .... PWM
- Built-in a rectifier NPN transistor, at standby mode, complete shutdown is possible.
- Built-in Auto discharge function.................................. A version
- Packages .... DFN1616-6, DFN(PLP)1820-6, SOT-23-6, WLCSP-6-P1
- Ceramic capacitors are recommended....................... 1μF

APPLICATION

- OLED power supply for portable equipment
- White LED Backlight for portable equipment

SELECTION GUIDE

The OVP threshold voltage, auto discharge function, and the package for the ICs can be selected at the user's request.

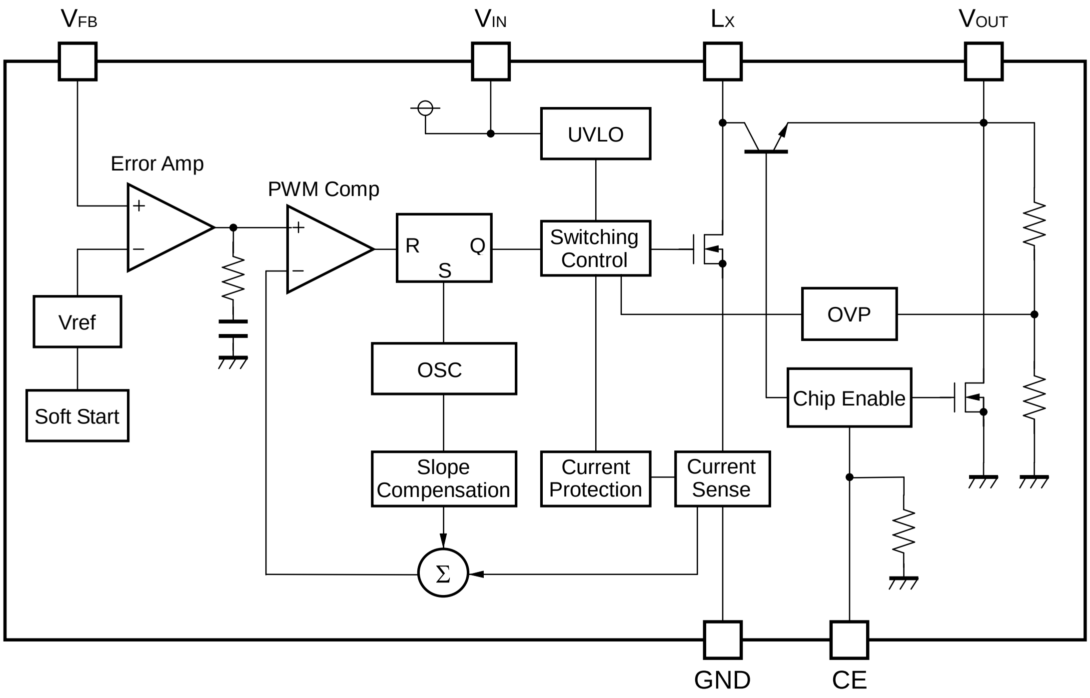
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1200Zxxx∗-E2-F	WLCSP-6-P1	5,000 pcs	Yes	Yes
R1200Lxxx∗-TR	DFN1616-6	5,000 pcs	Yes	Yes
R1200Kxxx∗-TR	DFN(PLP)1820-6	5,000 pcs	Yes	Yes
R1200Nxxx∗-TR-FE	SOT-23-6	3,000 pcs	Yes	Yes

xxx : Designation of OVP detector threshold
(001) 17V threshold of OVP
(002) 19V threshold of OVP
(003) 21V threshold of OVP

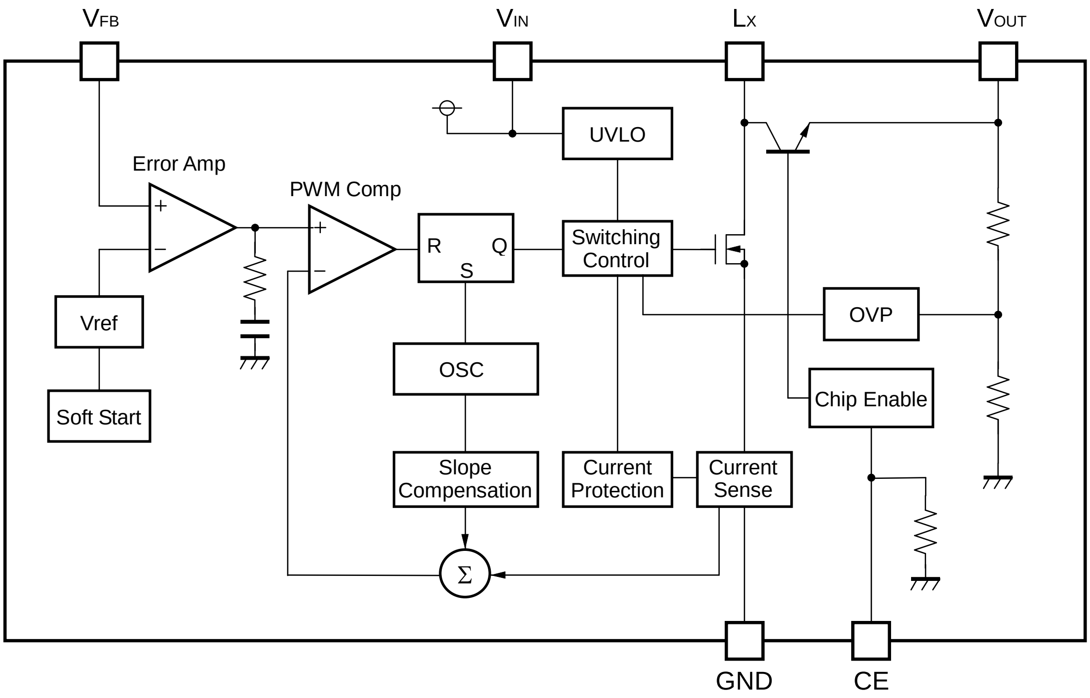
∗ : The auto discharge function at off state are options as follows.
(A) with auto discharge function at off state
(B) without auto discharge function at off state

BLOCK DIAGRAMS

R1200xxxxA

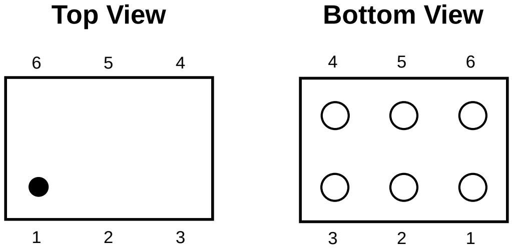


R1200xxxxB

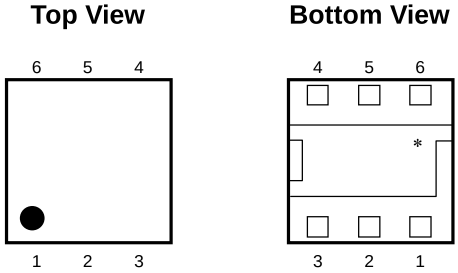


PIN DESCRIPTIONS

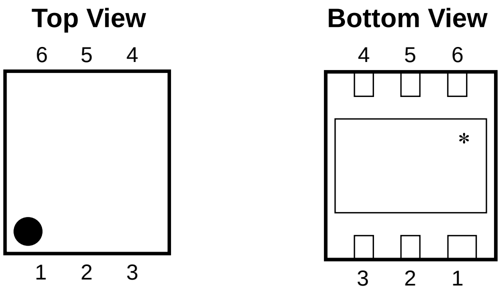
WLCSP-6-P1



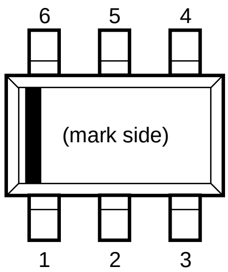
DFN1616-6



DFN(PLP)1820-6



SOT-23-6



- **WLCSP-6-P1**

Pin No	Symbol	Pin Description
1	Lx	Switching Pin (Open Drain Output)
2	V_{IN}	Power Supply Input Pin
3	V_{FB}	Feedback Pin
4	CE	Chip Enable Pin ("H" Active)
5	V_{OUT}	Output Pin
6	GND	Ground Pin

- **DFN1616-6, DFN(PLP)1820-6**

Pin No	Symbol	Pin Description
1	CE	Chip Enable Pin ("H" Active)
2	V_{FB}	Feedback Pin
3	Lx	Switching Pin (Open Drain Output)
4	GND	Ground Pin
5	V_{DD}	Input Pin
6	V_{OUT}	Output Pin

*) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

- **SOT-23-6**

Pin No	Symbol	Pin Description
1	CE	Chip Enable Pin ("H" Active)
2	V_{OUT}	Output Pin
3	V_{DD}	Input Pin
4	Lx	Switching Pin (Open Drain Output)
5	GND	Ground Pin
6	V_{FB}	Feedback Pin

ABSOLUTE MAXIMUM RATINGS

(GND=0V)

<table>
<tr><th>Symbol</th><th colspan="3">Item</th><th>Rating</th><th>Unit</th></tr>
<tr><td>V_{IN}</td><td colspan="3">V_{IN} Pin Voltage</td><td>–0.3 to 6.5</td><td>V</td></tr>
<tr><td>V_{CE}</td><td colspan="3">CE Pin Voltage</td><td>–0.3 to V_{IN}+0.3</td><td>V</td></tr>
<tr><td>V_{FB}</td><td colspan="3">V_{FB} Pin Voltage</td><td>–0.3 to V_{IN}+0.3</td><td>V</td></tr>
<tr><td>V_{OUT}</td><td colspan="3">V_{OUT} Pin Voltage</td><td>–0.3 to 25.0</td><td>V</td></tr>
<tr><td>V_{LX}</td><td colspan="3">L_X Pin Voltage</td><td>–0.3 to 25.0</td><td>V</td></tr>
<tr><td>I_{LX}</td><td colspan="3">L_X Pin Current</td><td>1000</td><td>mA</td></tr>
<tr><td rowspan="4">P_D</td><td rowspan="4">Power Dissipation*</td><td>Standard Test Land Pattern</td><td>WLCSP-6-P1</td><td>633</td><td rowspan="4">mW</td></tr>
<tr><td rowspan="3">JEDEC STD. 51-7 Test Land Pattern</td><td>DFN1616-6</td><td>2400</td></tr>
<tr><td>DFN(PLP)1820-6</td><td>2200</td></tr>
<tr><td>SOT-23-6</td><td>660</td></tr>
<tr><td>Tj</td><td colspan="3">Junction Temperature Range</td><td>–40 to 125</td><td>°C</td></tr>
<tr><td>Tstg</td><td colspan="3">Storage Temperature Range</td><td>–55 to 125</td><td>°C</td></tr>
</table>

*) For Power Dissipation, please refer to *POWER DISSIPATION*.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.3 to 5.5	V
Ta	Operating Temperature Range	−40 to 85	°C

RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such ratings by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PLP)1820-6) is the non-promotional product as of March 2019.

ELECTRICAL CHARACTERISTICS

- **R1200x**

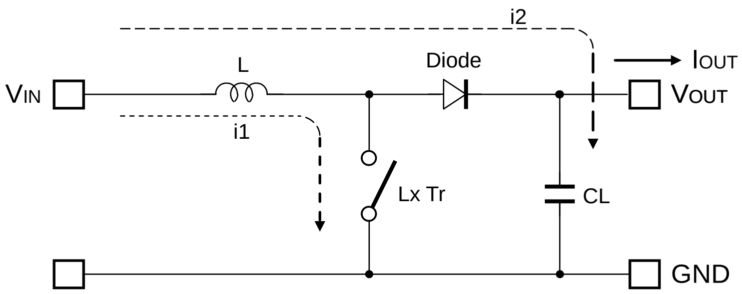
Ta=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
I_{DD}	Supply Current	V_{IN}=5.5V, V_{FB}=0V, Lx at no load		0.5	1.0	mA
Istandby	Standby Current	V_{IN}=5.5V, V_{CE}=0V		0	3.0	µA
V_{UVLO1}	UVLO Detector Threshold	V_{IN} falling	1.9	2.0	2.1	V
V_{UVLO2}	UVLO Released Voltage	V_{IN} rising		V_{UVLO1} +0.10	2.25	V
V_{CEH}	CE Input Voltage "H"	V_{IN}=5.5V	1.5			V
V_{CEL}	CE Input Voltage "L"	V_{IN}=2.3V			0.5	V
R_{CE}	CE Pull Down Resistance	V_{IN}=3.6V	600	1200	2200	kΩ
V_{FB}	V_{FB} Voltage Accuracy	V_{IN}=3.6V	0.985	1.0	1.015	V
$\Delta V_{FB}/\Delta Ta$	V_{FB} Voltage Temperature Coefficient	V_{IN}=3.6V, $-40°C \leq Ta \leq 85°C$		±150		ppm/°C
I_{FB}	V_{FB} Input Current	V_{IN}=5.5V, V_{FB}=0V or 5.5V	−0.1		0.1	µA
tstart	Soft-start Time	V_{IN}=3.6V		1.5		ms
R_{ON}	Switch ON Resistance	V_{IN}=3.6V, I_{SW}=100mA		1.35		Ω
I_{LXleak}	Switch Leakage Current			0	3.0	µA
I_{LXlim}	Switch Current Limit	V_{IN}=3.6V	400	700	1000	mA
V_{NPN}	NPN V_{CE} Voltage	I_{NPN}=100mA		0.8		V
$I_{NPNOFF1}$	NPN Leakage Current 1	V_{OUT}=23V			10	µA
$I_{NPNOFF2}$	NPN Leakage Current 2	V_{OUT}=0V, V_{LX}=5.5V			3.0	µA
fosc	Oscillator Frequency	V_{IN}=3.6V, V_{OUT}=V_{FB}=0V	1.0	1.2	1.4	MHz
Maxduty	Maximum Duty Cycle	V_{IN}=3.6V, V_{OUT}=V_{FB}=0V	86	91		%
V_{OVP1}	OVP Detector Threshold	V_{IN}=3.6V, V_{OUT} rising: R1200x001x	16	17	18	V
		R1200x002x	18	19	20	
		R1200x003x	20	21	22	
V_{OVP2}	OVP Released Voltage	V_{IN}=3.6V, V_{OUT} falling		V_{OVP1} −1.1		V
I_{DISCHG}	V_{OUT} Discharge Current	V_{IN}=3.6V, V_{OUT}=0.1V, R1200xxxxA		0.7		mA
I_{VOUT}	OVP Sense Current	V_{IN}=3.6V, V_{OUT}=23V		6.0		µA

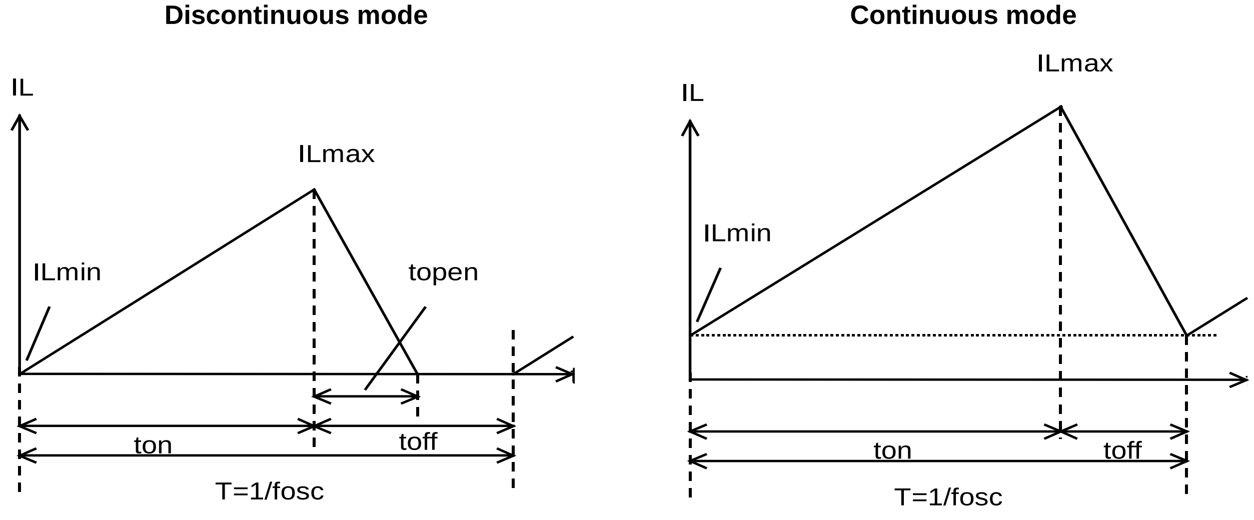
OPERATING DESCRIPTIONS

Operation of Step-Up DC/DC Converter and Output Current

<Basic Circuit>



<Current through L>



There are two operation modes of the step-up PWM control-DC/DC converter. That is the continuous mode and discontinuous mode by the continuousness inductor.

When the transistor turns ON, the voltage of inductor L becomes equal to V_{IN} voltage. The increase value of inductor current (i1) will be

$\Delta i1 = V_{IN} \times ton / L$ .... Formula 1

As the step-up circuit, during the OFF time (when the transistor turns OFF) the voltage is continually supply from the power supply. The decrease value of inductor current (i2) will be

$\Delta i2 = (V_{OUT} - V_{IN}) \times topen / L$ .... Formula 2

At the PWM control-method, the inductor current become continuously when $topen = toff$, the DC/DC converter operate as the continuous mode.

In the continuous mode, the variation of current of i1 and i2 is same at regular condition.

$V_{IN} \times ton / L = (V_{OUT} - V_{IN}) \times toff / L$ .... Formula 3

The duty at continuous mode will be

$duty (\%) = ton / (ton + toff) = (V_{OUT} - V_{IN}) / V_{OUT}$ .... Formula 4

The average of inductor current at $tf = toff$ will be

$IL(Ave.) = V_{IN} \times ton / (2 \times L)$ .... Formula 5

If the input voltage = output voltage, the I_{OUT} will be

$I_{OUT} = V_{IN}^2 \times ton / (2 \times L \times V_{OUT})$ .... Formula 6

If the I_{OUT} value is large than above the calculated value (Formula 6), it will become the continuous mode, at this status, the peak current ($ILmax$) of inductor will be

$ILmax = I_{OUT} \times V_{OUT} / V_{IN} + V_{IN} \times ton / (2 \times L)$ .... Formula 7

$ILmax = I_{OUT} \times V_{OUT} / V_{IN} + V_{IN} \times T \times (V_{OUT} - V_{IN}) / (2 \times L \times V_{OUT})$ .... Formula 8

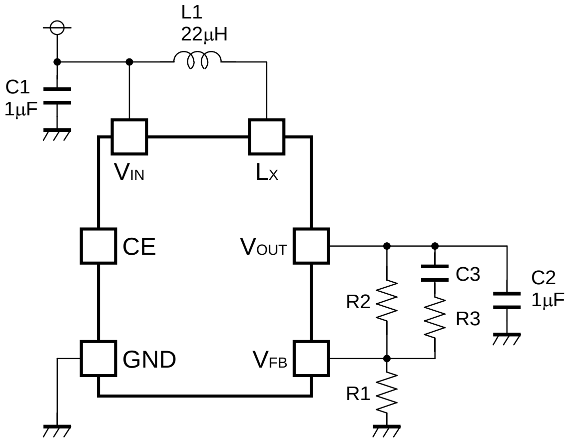
The peak current value is larger than the I_{OUT} value. In case of this, selecting the condition of the input and the output and the external components by considering of $ILmax$ value.
The explanation above is based on the ideal calculation, and the loss caused by L_X switch and the external components are not included.
The actual maximum output current will be between 50% and 80% by the above calculations. Especially, when the IL is large or V_{IN} is low, the loss of V_{IN} is generated with on resistance of the switch. Moreover, it is necessary to consider V_f of the diode (approximately 0.8V) about V_{OUT}.

● **Shutdown**

- At standby mode, the output is completely separated from the input and shutdown by the NPN transistor of internal IC. However, the leakage current is generated when the L_X pin voltage is equal or more than V_{IN} pin voltage at standby mode.
- R1200xxxxA (with auto discharge function): In the term of standby mode, the switch is turned ON between V_{OUT} to GND and the V_{OUT} capacitor is discharged.
- R1200xxxxB (without auto discharge function): The built-in switch for discharge does not turn on, but the OVP sense resistors between V_{OUT} and GND exists as same as A version.
- However, the both version (A/B) has the OVP sense resistance (4 to 5MΩ) between V_{OUT} and GND (refer to OVP sense current (I_{VOUT}) on ELECTRICAL CHARACTERISTICS table) and the current flows through from V_{OUT} to GND.

APPLICATION INFORMATION

● **Typical Applications**



● **Selection of Inductors**

The peak current of the inductor at normal mode can be estimated as the next formula when the efficiency is 80%.

$$ILmax=1.25 \times I_{OUT} \times V_{OUT} / V_{IN} + 0.5 \times V_{IN} \times (V_{OUT} - V_{IN}) / (L \times V_{OUT} \times fosc)$$

In the case of start-up or dimming control by CE pin, inductor transient current flows, and the peak current of it must be equal or less than the current limit of the IC. The peak current should not beyond the rated current of the inductor.
The recommended inductance value is 4.7 µH – 22 µH.

Table 1 Peak current value in each condition

Condition				
V_{IN} (V)	V_{OUT} (V)	I_{OUT} (mA)	L (µH)	ILmax (mA)
3	14	20	10	215
3	14	20	22	160
3	21	20	10	280
3	21	20	22	225

Table 2 Recommended inductors

L (μH)	Part No.	Rated Current (mA)	Size (mm)
10	LQH32CN100K53	450	3.2 x 2.5 x 1.55
10	LQH2MC100K02	225	2.0 x 1.6 x 0.9
10	VLF3010A-100	490	2.8 x 2.6 x 0.9
10	VLS252010-100	520	2.5 x 2.0 x 1.0
22	LQH32CN220K53	250	3.2 x 2.5 x 1.55
22	LQH2MC220K02	185	2.0 x 1.6 x 0.9
22	VLF3010A-220	330	2.8 x 2.6 x 0.9
4.7	LQH32CN4R7M53	650	3.2 x 2.5 x 1.55

● Selection of Capacitors

Set 1μF or more value bypass capacitor C1 between V_{IN} pin and GND pin as close as possible.
Set 1μF – 4.7μF or more capacitor C2 between V_{OUT} and GND pin.

Table 3　Recommended components

	Rated voltage(V)	Part No.
C1	6.3	CM105B105K06
C2	25	GRM21BR11E105K
C3	25	22pF
R1		For V_{OUT} Setting
R2		For V_{OUT} Setting
R3		2kΩ

● External Components Setting

・If the spike noise of V_{OUT} may be large, the spike noise may be picked into V_{FB} pin and make the operation unstable. In this case, use a R3 of the resistance value in the range from 1kΩ to 5kΩ to reduce a noise level of V_{FB}.

● The Method of Output Voltage Setting

・The output voltage can be calculated with divider resistors (R1 and R2) values as the following formula:

$$\text{Output Voltage} = V_{FB} \times (R1 + R2) / R1$$

・The total value of R1 and R2 should be equal or less than 300kΩ. Make the V_{IN} and GND line sufficient. The large current flows through the V_{IN} and GND line due to the switching. If this impedance (V_{IN} and GND line) is high, the internal voltage of the IC may shift by the switching current, and the operating may become unstable. Moreover, when the built-in L_X switch is turn OFF, the spike noise caused by the inductor may be generated. As a result of this, recommendation voltage rating of capacitor (C2) value is equal 1.5 times larger or more than the setting output voltage.

TECHNICAL NOTES

● Current Path on PCB

The current paths in an application circuit are shown in Fig. 1 and 2.
A current flows through the paths shown in Fig. 1 at the time of MOSFET-ON, and shown in Fig. 2 at the time of MOSFET-OFF. In the paths pointed with red arrows in Fig. 2, current flows just in MOSFET-ON period or just in MOSFET-OFF period. Parasitic impedance/inductance and the capacitance of these paths influence stability of the system and cause noise outbreak. So please minimize this side effect. In addition, please shorten the wiring of other current paths shown in Fig. 1 and 2 except for the paths of LED load.

● Layout Guide for PCB

・Please shorten the wiring of the input capacitor (C1) between V_{IN} pin and GND pin of IC. The GND pin should be connected to the strong GND plane.

・The area of L_X land pattern should be smaller.

・Please put output capacitor (C2) close to the V_{OUT} pin.

・Please make the GND side of output capacitor (C2) close to the GND pin of IC.

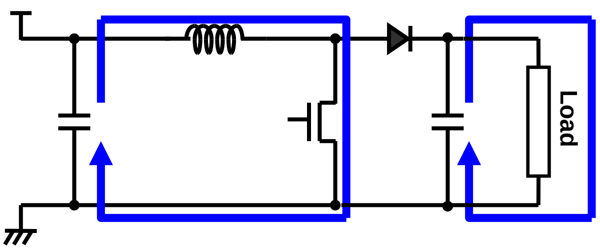


Fig. 1 **MOSFET-ON**

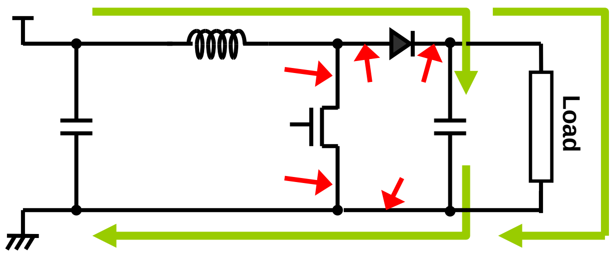
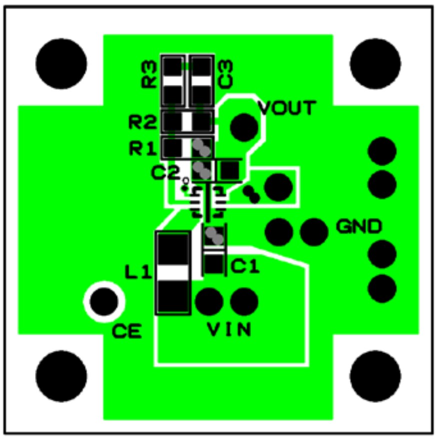
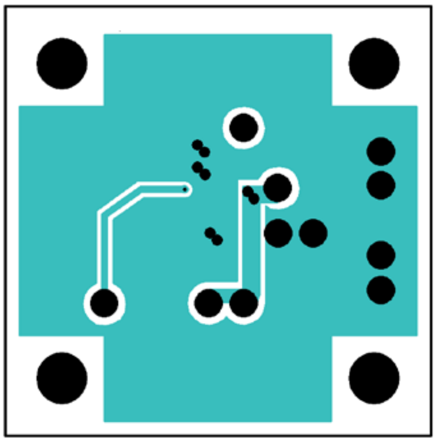


Fig. 2 **MOSFET-OFF**

● PCB Layout

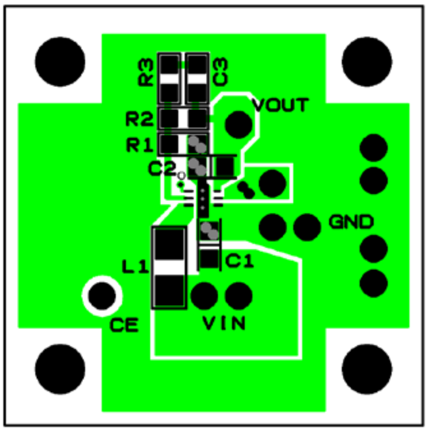
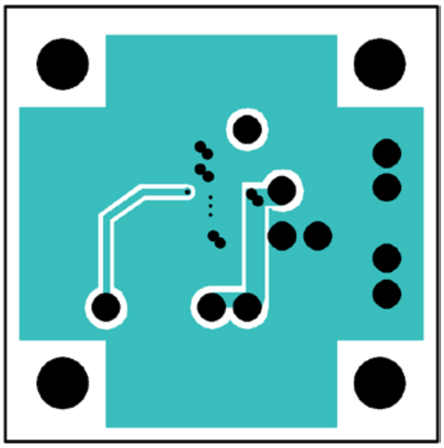
· PKG: DFN1616-6pin

R1200L Typical Board Layout

Topside	Backside
	

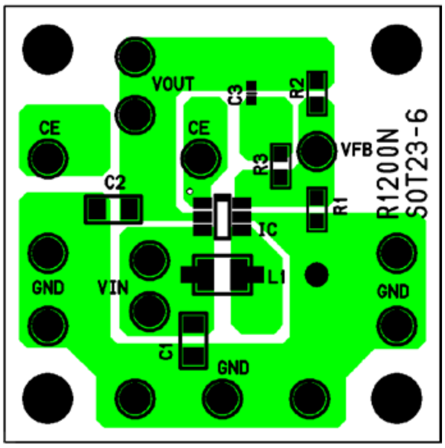
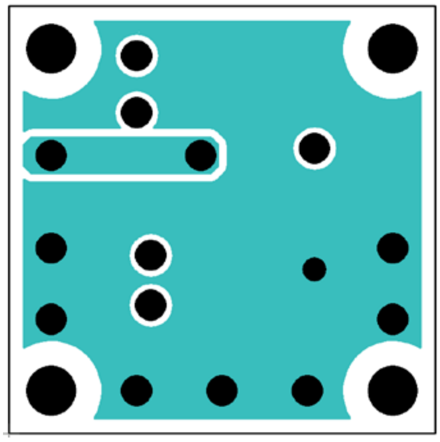
· PKG:DFN(PLP)1820-6pin

R1200K Typical Board Layout

Topside	Backside
	

・**PKG:SOT-23-6pin**

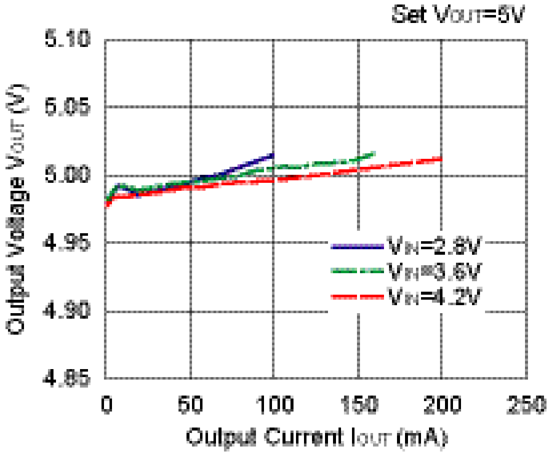
R1200N Typical Board Layout

Topside	Backside
	

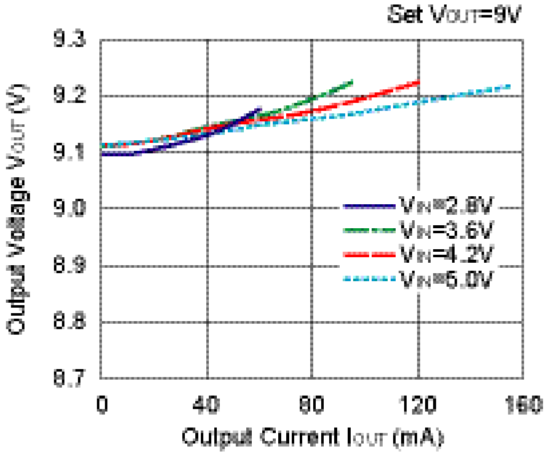
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (L=22μH)

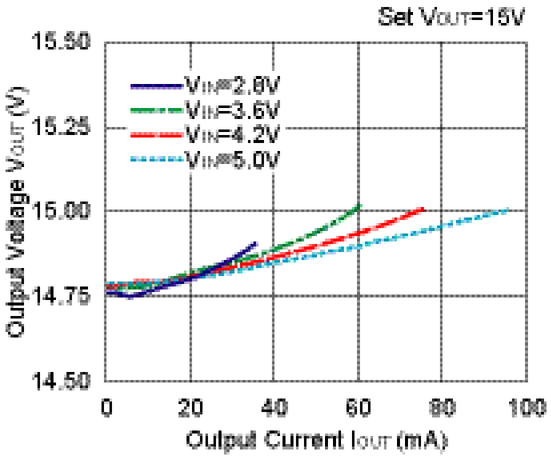
R1200x



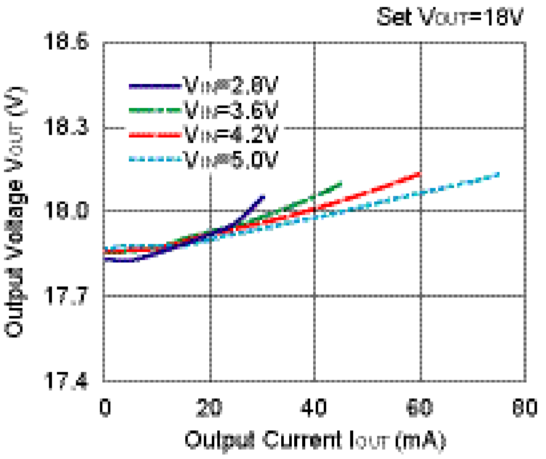
R1200x



R1200x

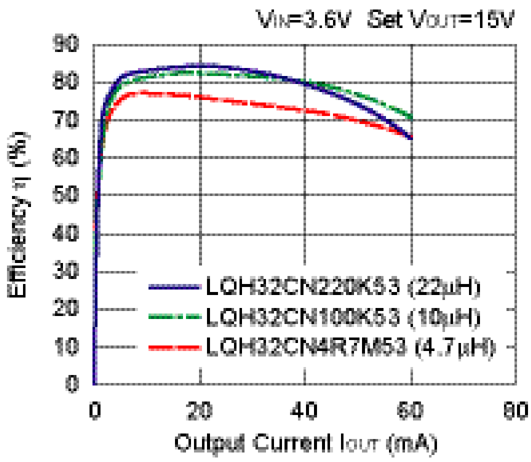


R1200x

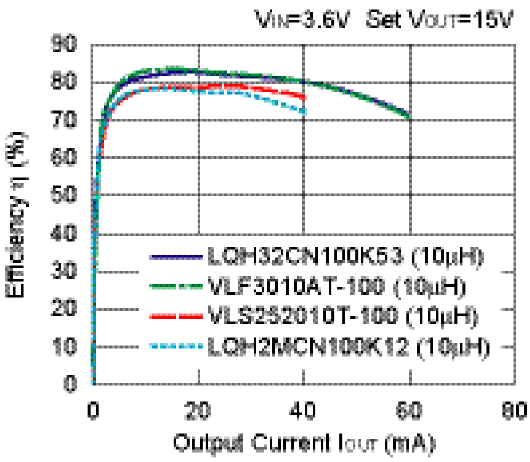


2) Efficiency vs. Output Current

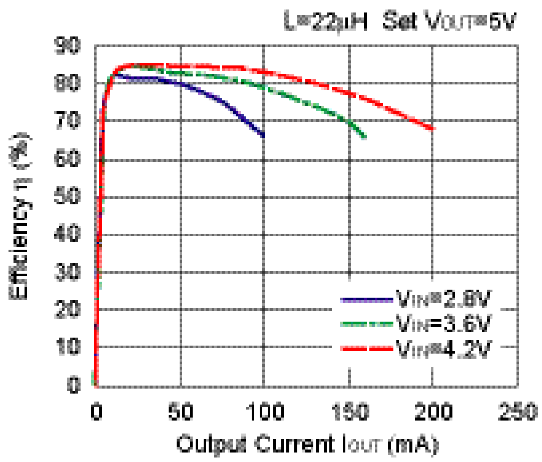
R1200x



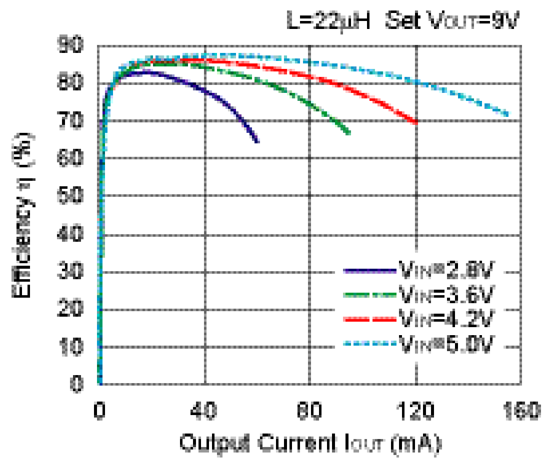
R1200x



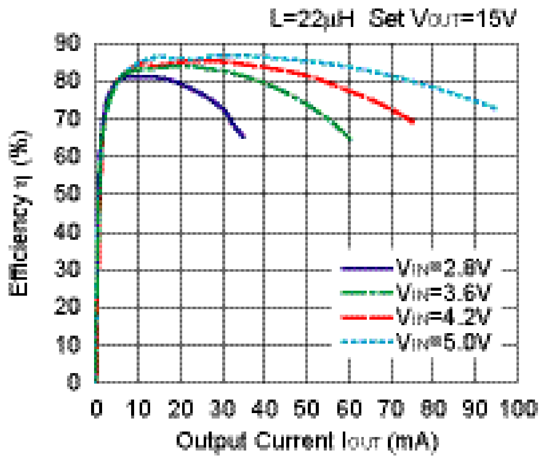
R1200x



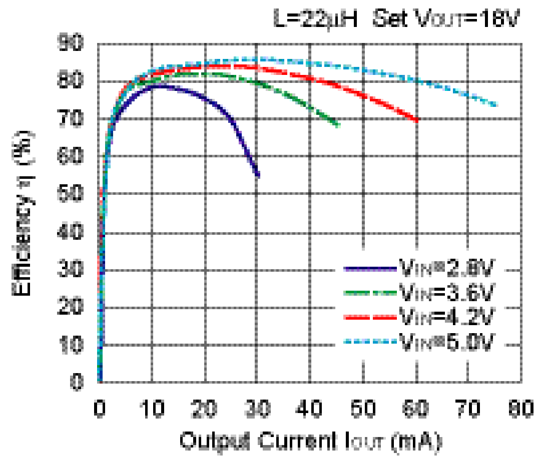
R1200x



R1200x

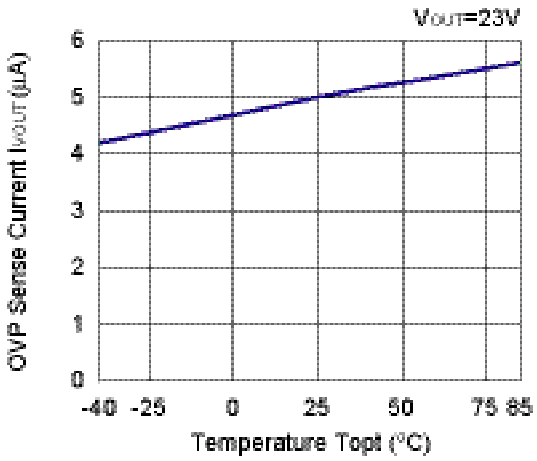


R1200x



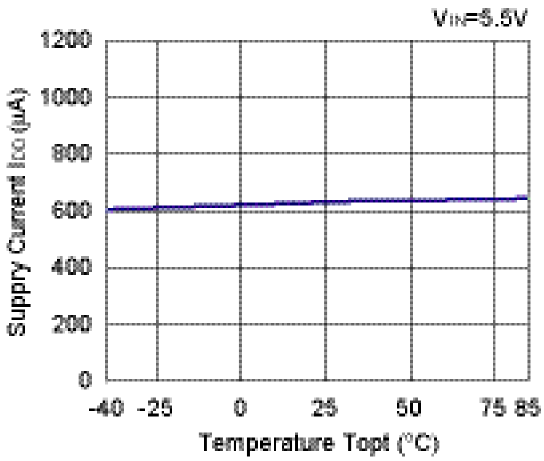
3) OVP Sense Current vs. Temperature

R1200x



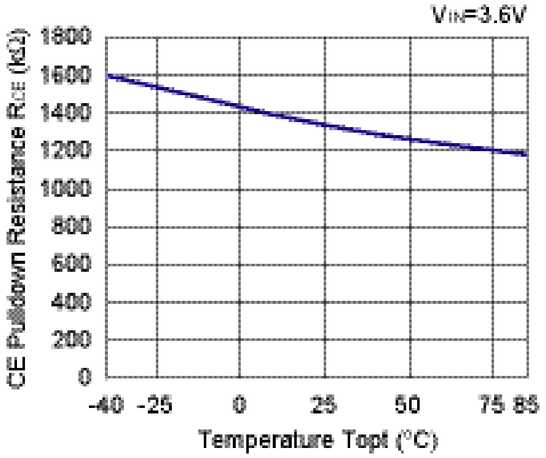
4) Supply Current vs. Temperature

R1200x



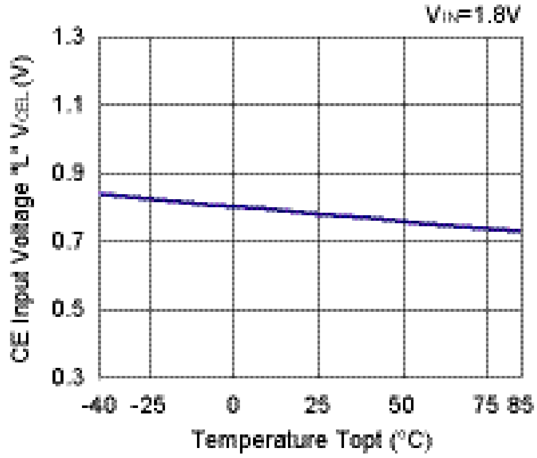
5) CE Pulldown Resistance vs. Temperature

R1200x



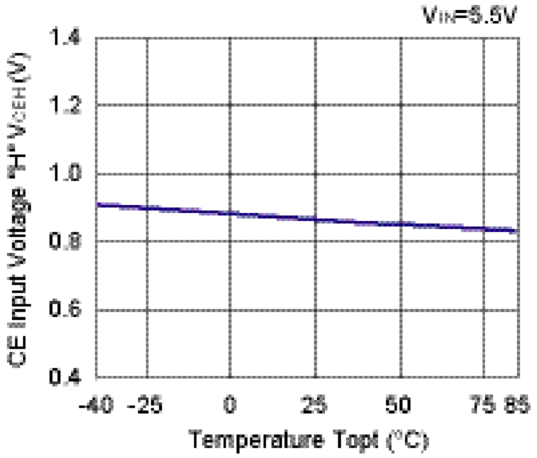
6) CE Input Voltage "L" vs. Temperature

R1200x



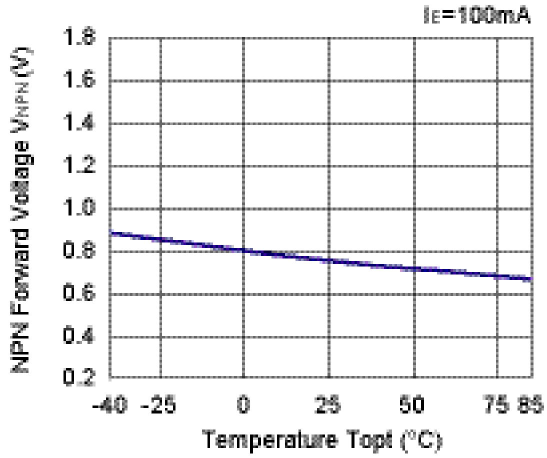
7) CE Input Voltage "H" vs. Temperature

R1200x



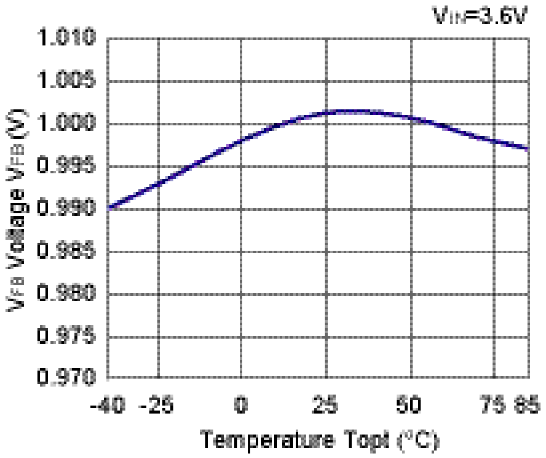
8) NPN V_{CE} Voltage vs. Temperature

R1200x



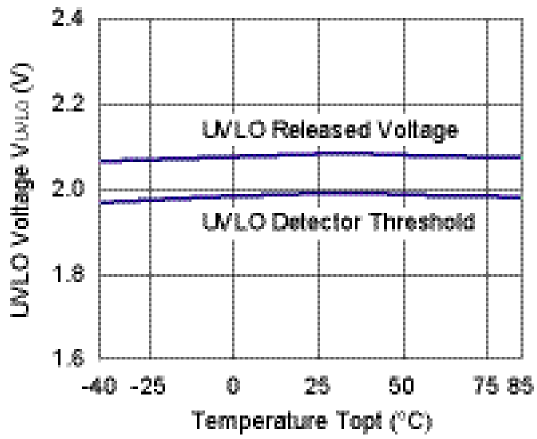
9) V_{FB} Voltage vs. Temperature

R1200x

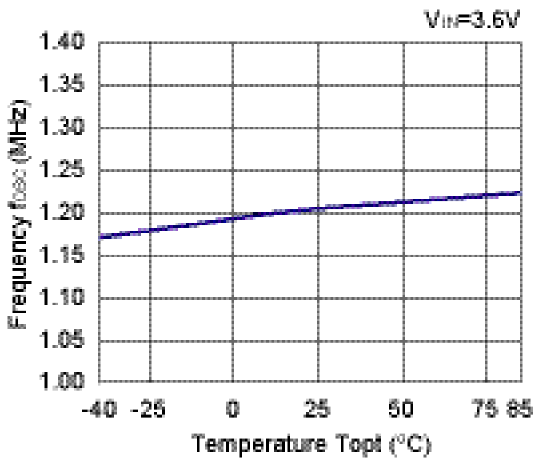


10) UVLO Detect / Released Voltage vs. Temperature

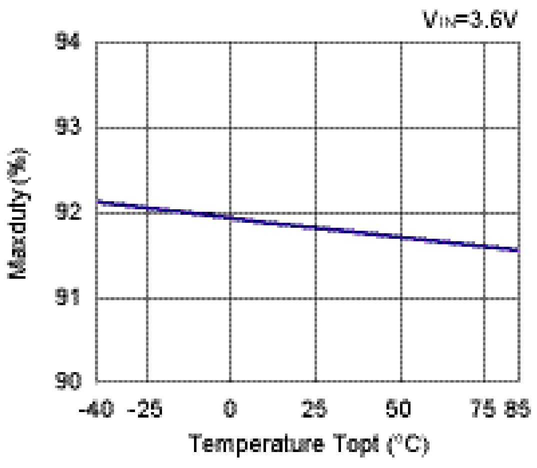
R1200x



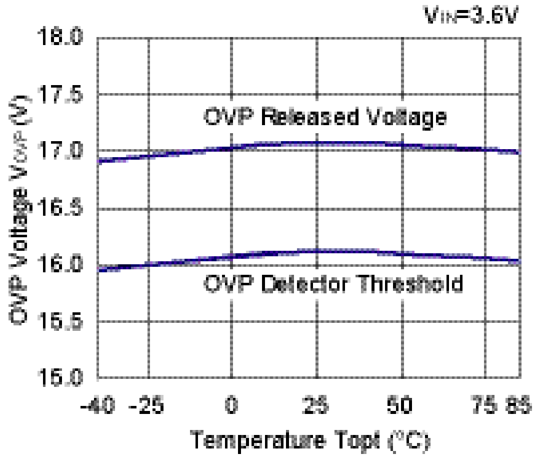
11) Oscillator Frequency vs. Temperature



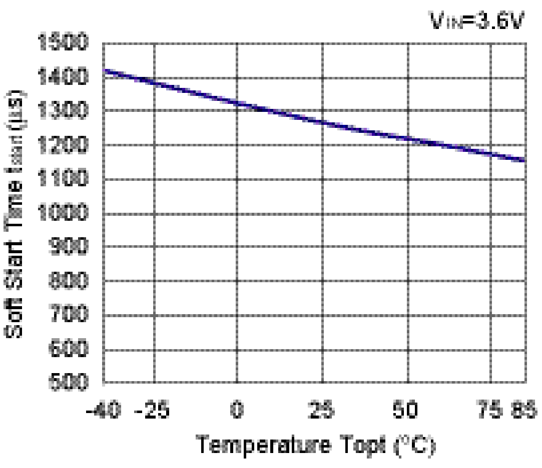
12) Maxduty vs. Temperature



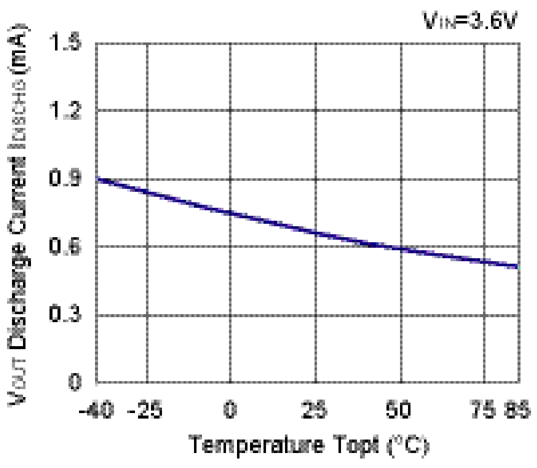
13) OVP Detect / Released Voltage vs. Temperature



14) Soft-start Time vs. Temperature

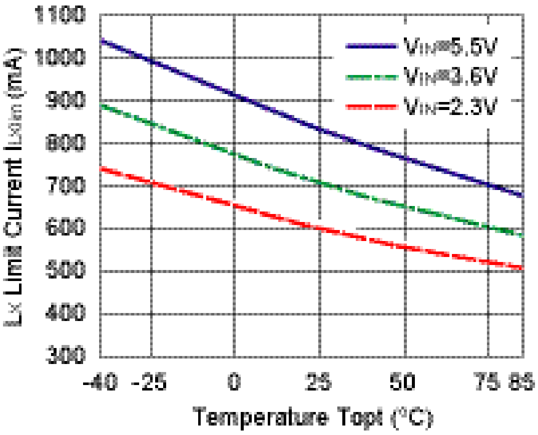


15) V_{OUT} Discharge Current vs. Temperature



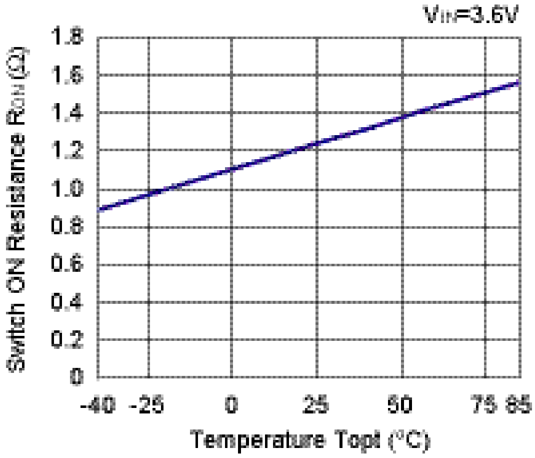
16) Lx Limit Current vs. Temperature

R1200x



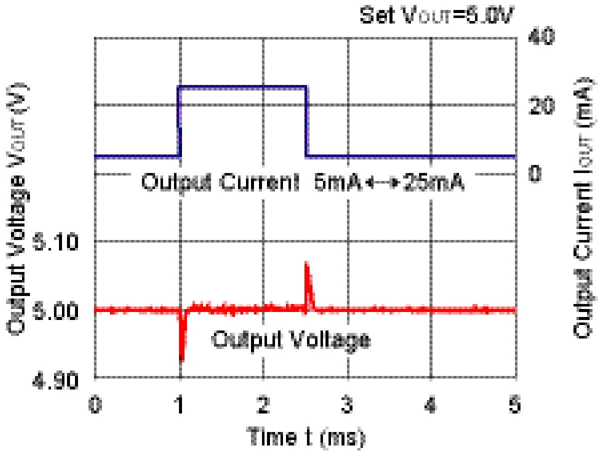
17) Switch ON Resistance vs. Temperature

R1200x

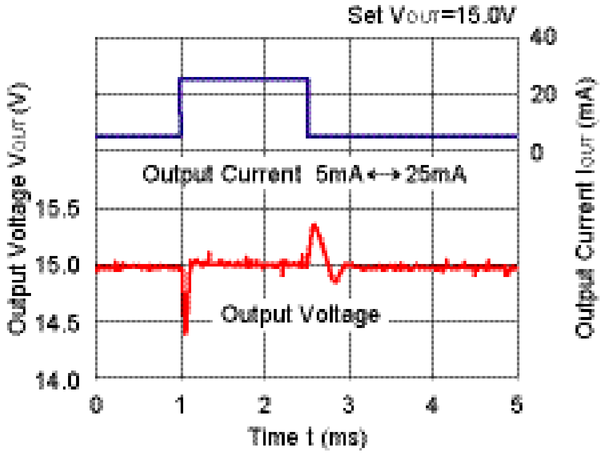


18) Load Transient Response (V_{IN}=3.6V, I_{OUT}=5mA↔25mA, tr=tf=0.5µs)

R1200x

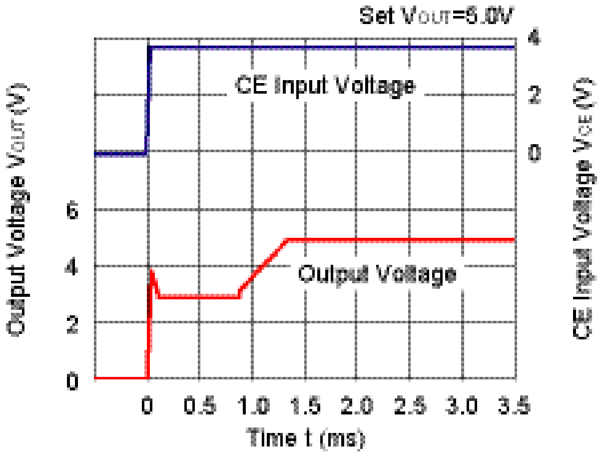


R1200x

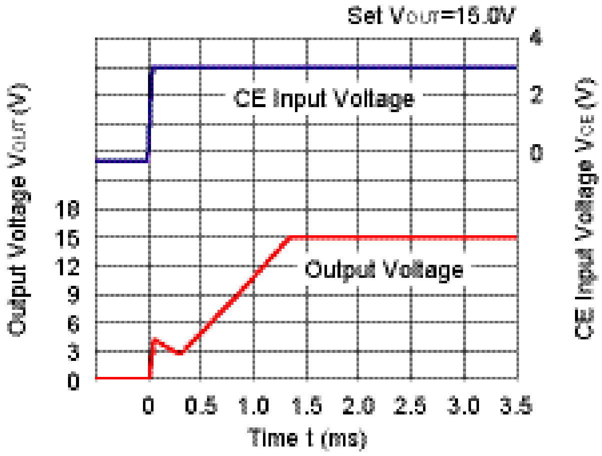


19) Start-up Waveform (V_{IN}=3.6V, I_{OUT}=20mA)

R1200x001A

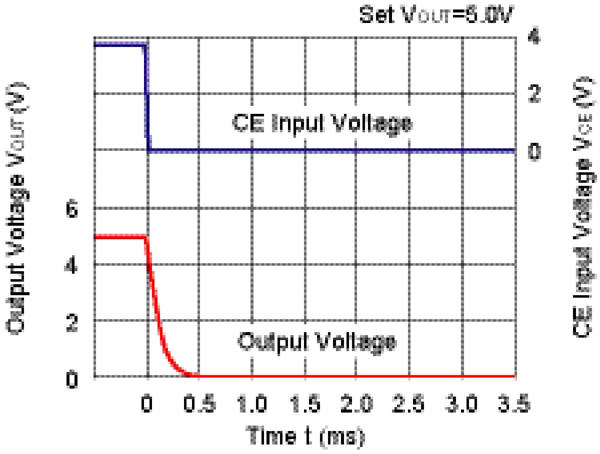


R1200x003A

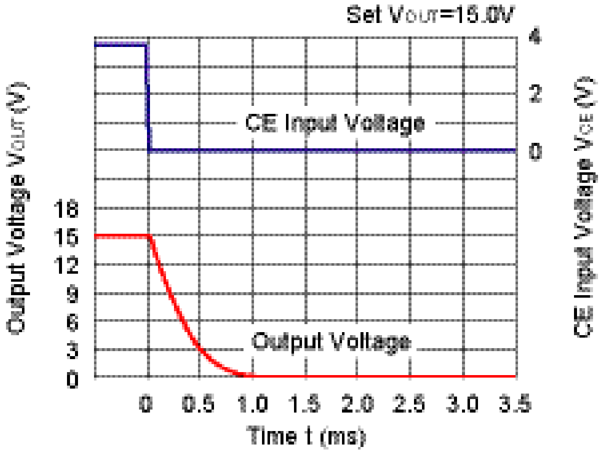


20) Shut-down Waveform (V_{IN}=3.6V, I_{OUT}=20mA)

R1200x001A

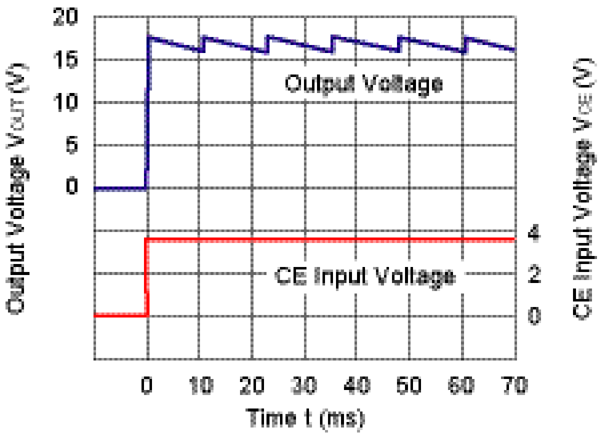


R1200x003A



21) OVP Waveform (V_{FB}=0V)

R1200x001A



POWER DISSIPATION

Ver. A

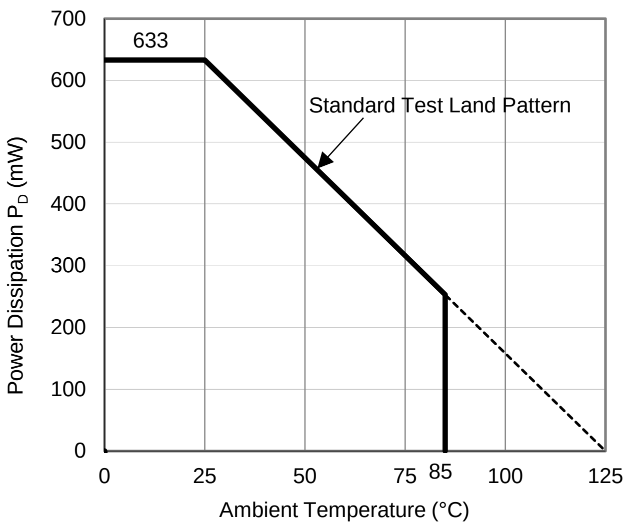
The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

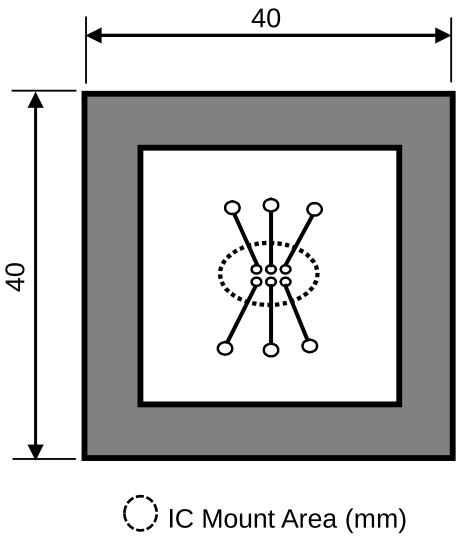
	Standard Test Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-Sided Board)
Board Dimensions	40 mm × 40 mm × 1.6 mm
Copper Ratio	Top Side: Approx. 50% Bottom Side: Approx. 50%
Through-holes	-

Measurement Result (Ta = 25°C, Tjmax = 125°C)

	Standard Test Land Pattern
Power Dissipation	633 mW
Thermal Resistance	θja = (125 − 25°C) / 0.633 W = 158°C/W



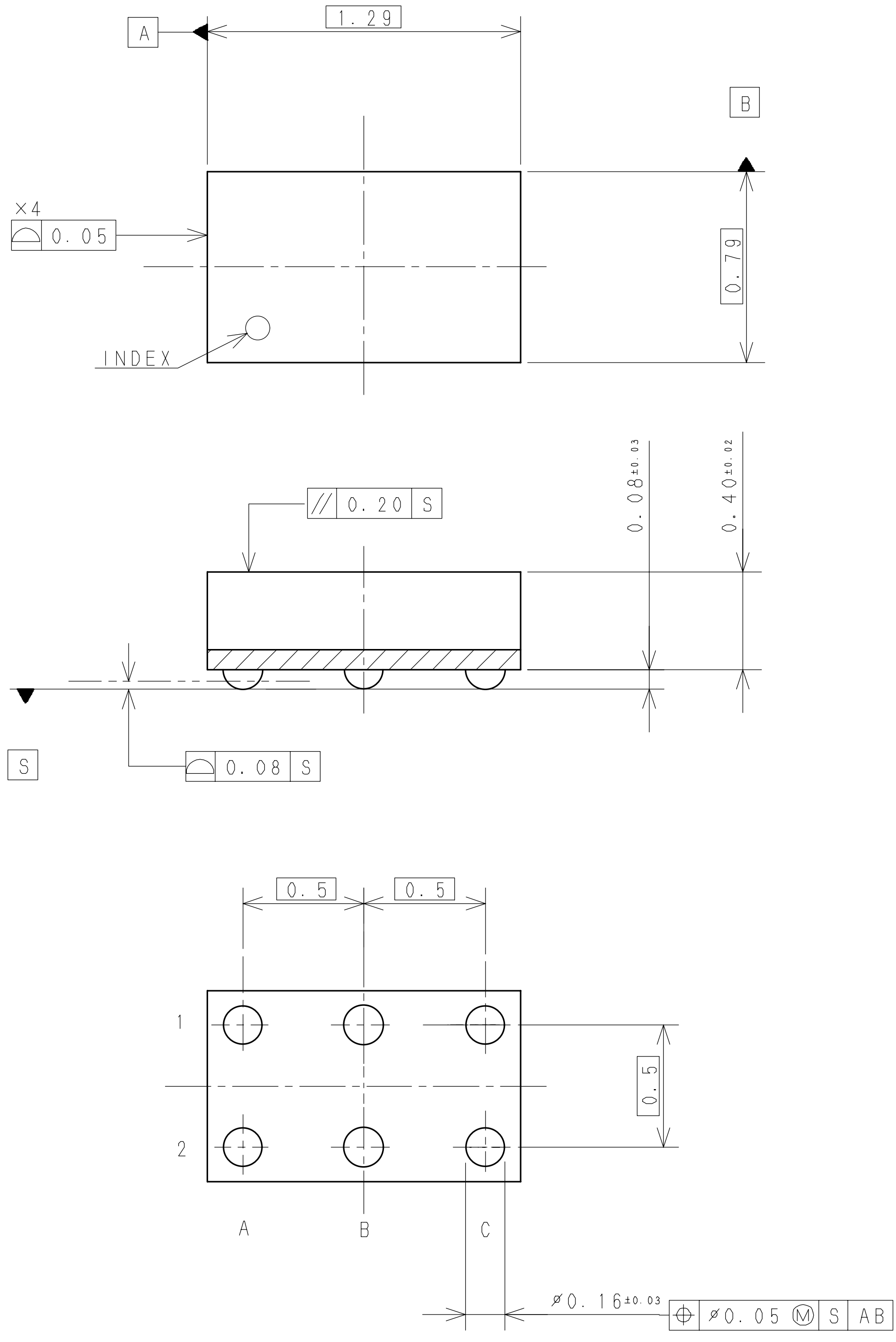
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PLP)1820-6) is the non-promotional product as of March 2019.

Ver. A



WLCSP-6-P1 Package Dimensions (Unit: mm)

RICOH

POWER DISSIPATION DFN1616-6

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

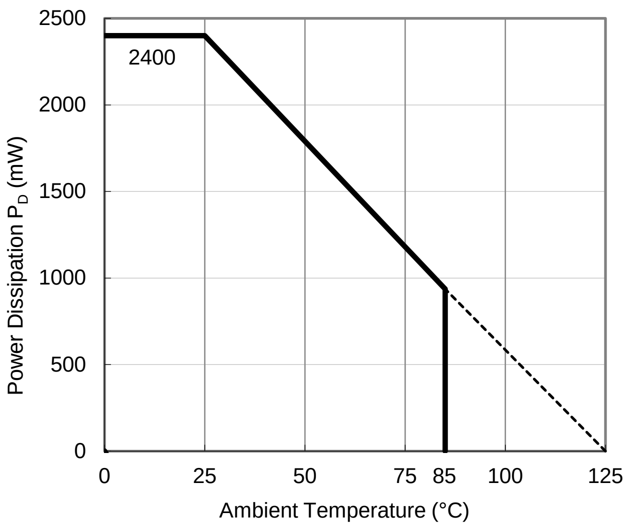
Item	Measurement Conditions (JEDEC STD. 51-7)
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	1st Layer: Less than 95% of 50 mm Square 2nd, 3rd, 4th Layers: Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 15 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

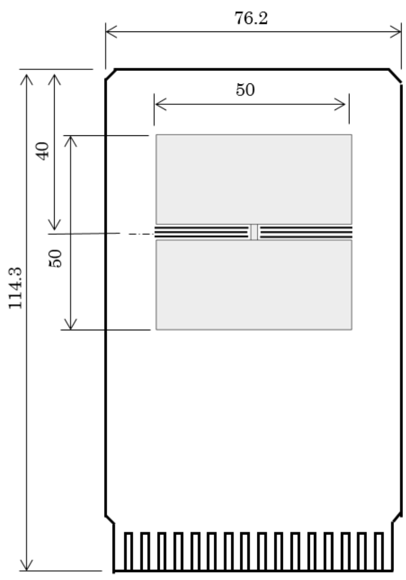
Item	Measurement Result
Power Dissipation	2400 mW
Thermal Resistance (θja)	θja = 41°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 11°C/W

θja: Junction-to–ambient thermal resistance.

ψjt: Junction–to-top of package thermal characterization parameter.



Power Dissipation vs. Ambient Temperature

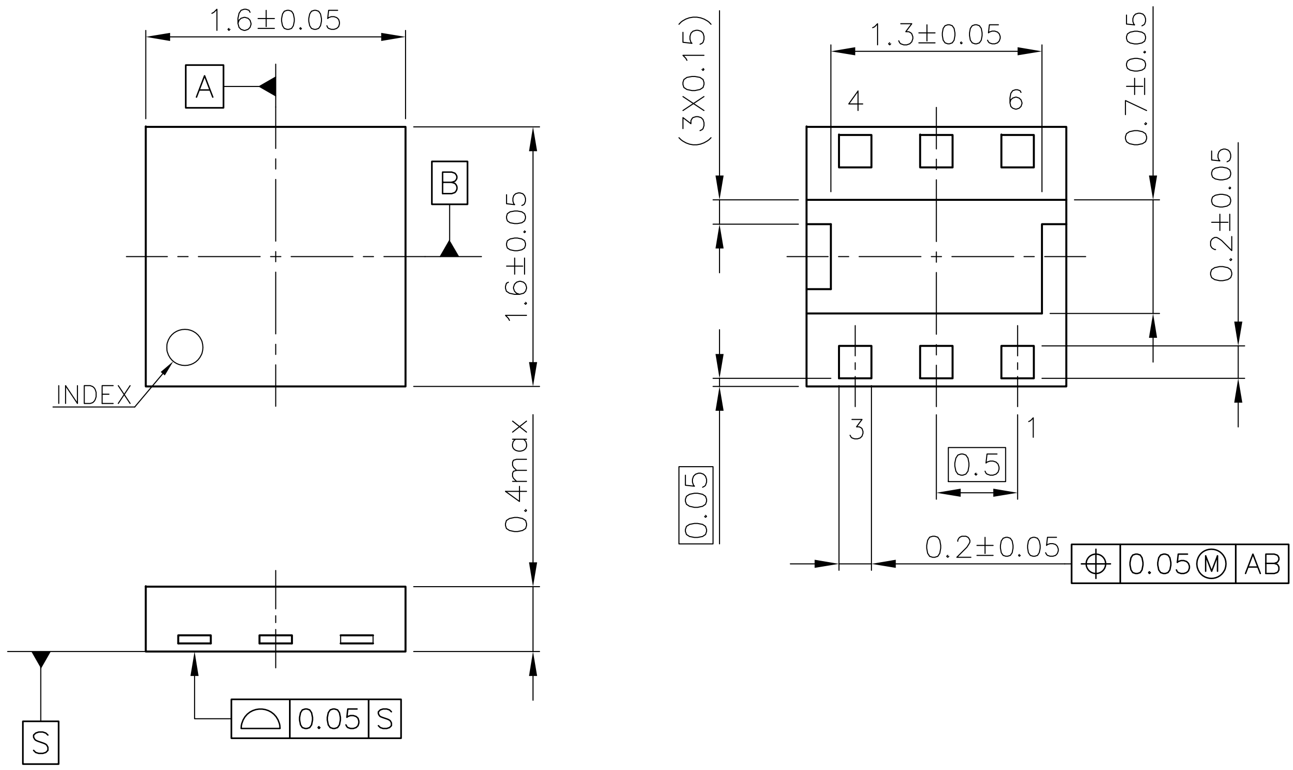


Measurement Board Pattern

RICOH

R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PLP)1820-6) is the non-promotional product as of March 2019.

Ver. A



DFN1616-6 Package Dimensions (Unit: mm)

∗ The tab on the bottom of the package shown by blue circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane on the board but it is possible to leave the tab floating.

POWER DISSIPATION

DFN(PLP)1820-6

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

Item	Measurement Conditions (JEDEC STD. 51-7)
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	1st Layer: Less than 95% of 50 mm Square 2nd, 3rd, 4th Layers: Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 34 pcs

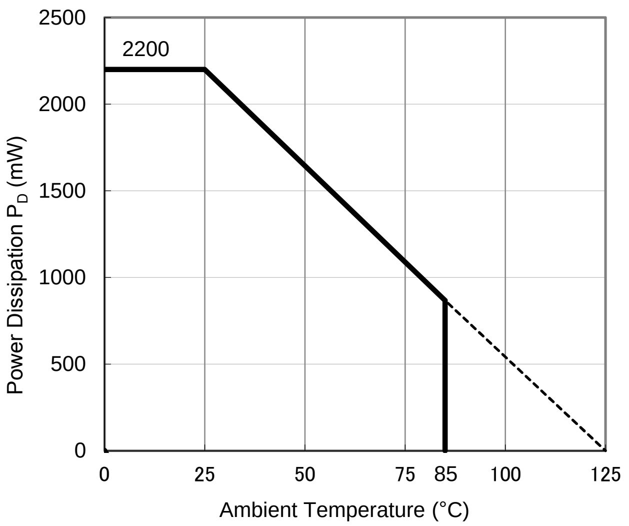
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

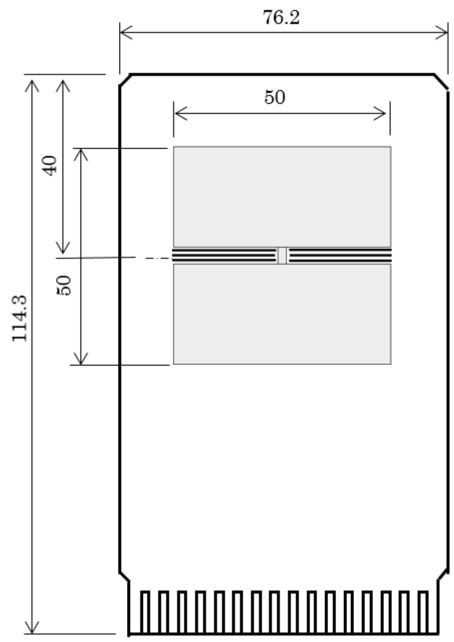
Item	Measurement Result
Power Dissipation	2200 mW
Thermal Resistance (θja)	θja = 45°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 18°C/W

θja: Junction-to–ambient thermal resistance.

ψjt: Junction–to-top of package thermal characterization parameter.



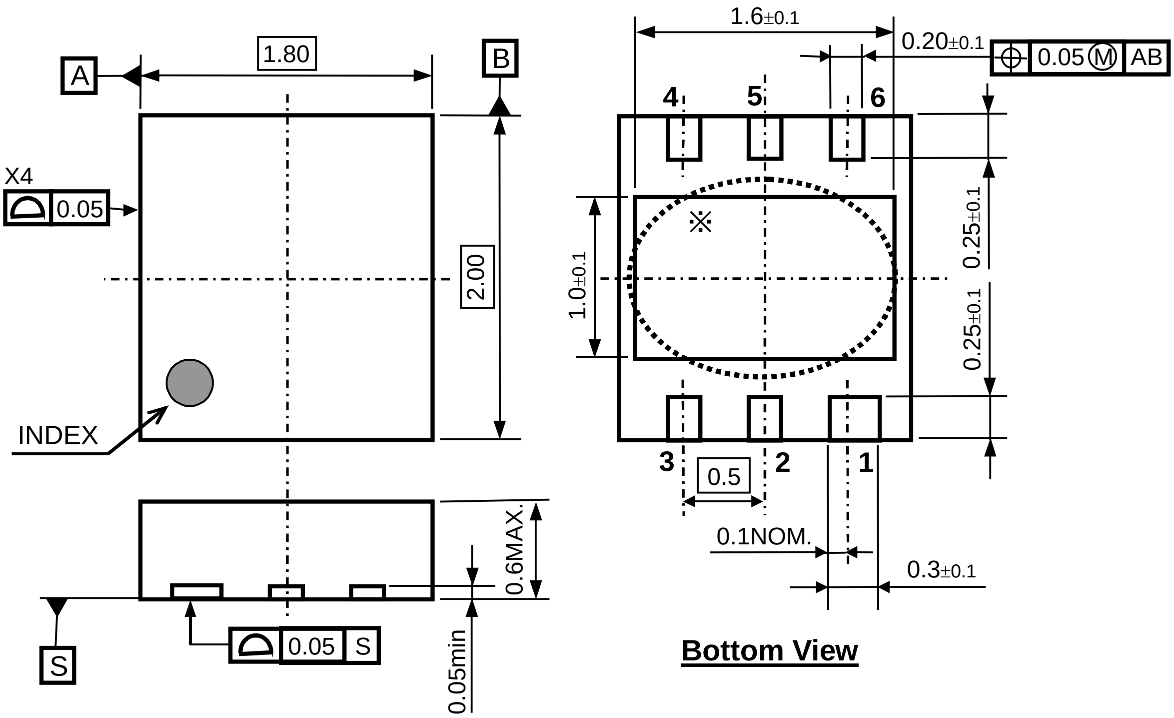
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

RICOH

Ver. A



DFN(PLP)1820-6 Package Dimensions (Unit: mm)

∗ The tab on the bottom of the package is substrate level (GND). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

RICOH

POWER DISSIPATION

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

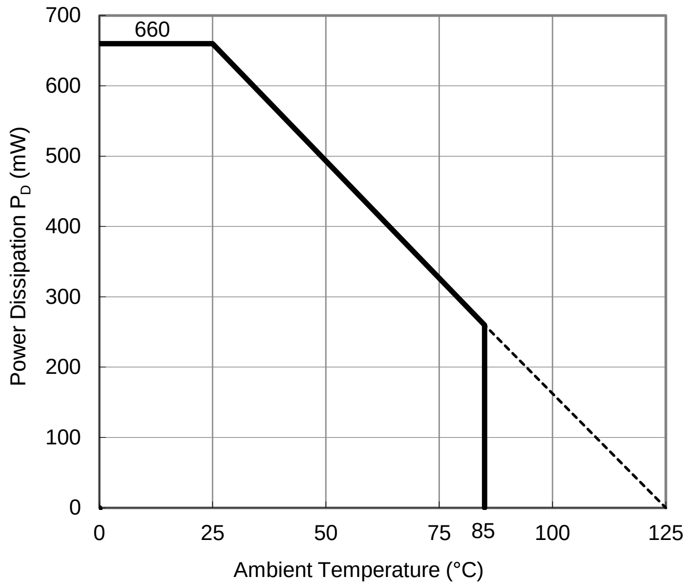
Item	Measurement Conditions (JEDEC STD. 51-7)
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	1st Layer : Less than 95% of 50 mm Square 2nd, 3rd, 4th Layers: Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 7 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

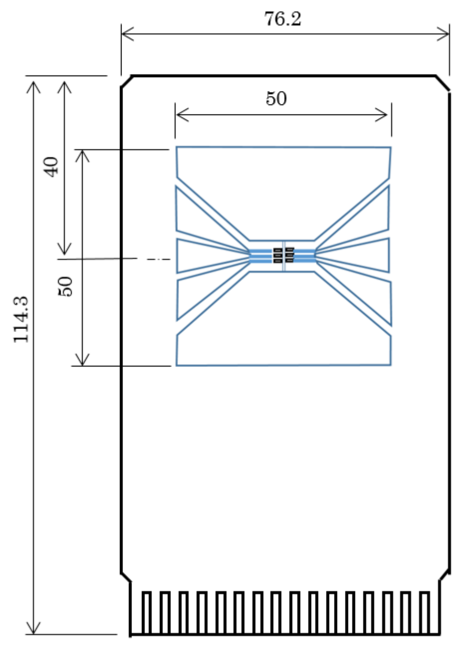
Item	Measurement Result
Power Dissipation	660 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to–ambient thermal resistance.

ψjt: Junction–to-top of package thermal characterization parameter



Power Dissipation vs. Ambient Temperature

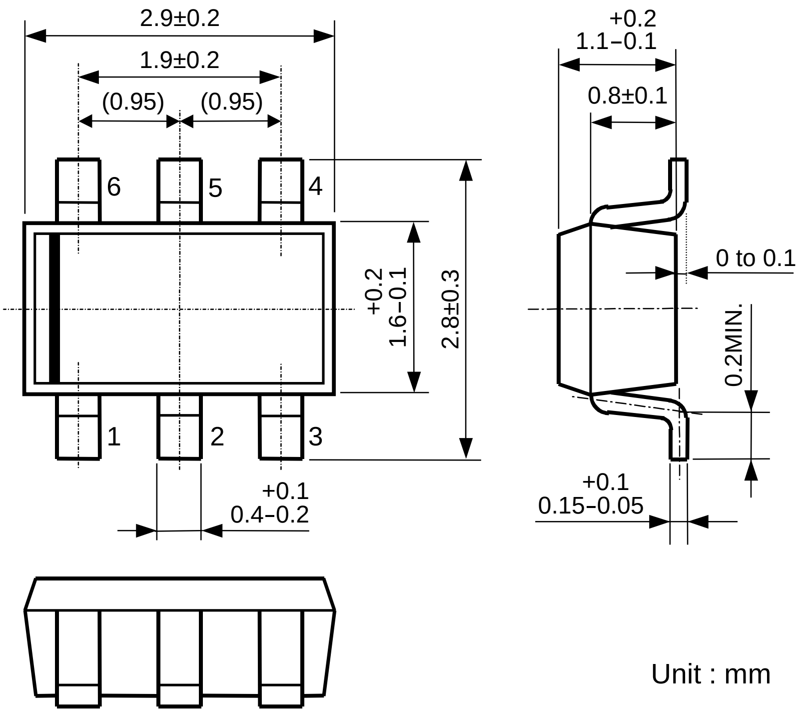


Measurement Board Pattern

RICOH

PACKAGE DIMENSIONS SOT-23-6

Ver. A



Unit : mm

SOT-23-6 Package Dimensions

RoHS Compliant
Halogen Free

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 products since April 1, 2012.

RICOH ELECTRONIC DEVICES CO., LTD.

https://www.e-devices.ricoh.co.jp/en/

Sales & Support Offices

Ricoh Electronic Devices Co., Ltd.
Shin-Yokohama Office (International Sales)
2-3, Shin-Yokohama 3-chome, Kohoku-ku, Yokohama-shi, Kanagawa, 222-8530, Japan
Phone: +81-50-3814-7687 Fax: +81-45-474-0074

Ricoh Americas Holdings, Inc.
675 Campbell Technology Parkway, Suite 200 Campbell, CA 95008, U.S.A.
Phone: +1-408-610-3105

Ricoh Europe (Netherlands) B.V.
Semiconductor Support Centre
Prof. W.H. Keesomlaan 1, 1183 DJ Amstelveen, The Netherlands
Phone: +31-20-5474-309

Ricoh International B.V. - German Branch
Semiconductor Sales and Support Centre
Oberrather Strasse 6, 40472 Düsseldorf, Germany
Phone: +49-211-6546-0

Ricoh Electronic Devices Korea Co., Ltd.
3F, Haesung Bldg, 504, Teheran-ro, Gangnam-gu, Seoul, 135-725, Korea
Phone: +82-2-2135-5700 Fax: +82-2-2051-5713

Ricoh Electronic Devices Shanghai Co., Ltd.
Room 403, No.2 Building, No.690 Bibo Road, Pu Dong New District, Shanghai 201203, People's Republic of China
Phone: +86-21-5027-3200 Fax: +86-21-5027-3299

Ricoh Electronic Devices Shanghai Co., Ltd.
Shenzhen Branch
1205, Block D(Jinlong Building), Kingkey 100, Hongbao Road, Luohu District, Shenzhen, China
Phone: +86-755-8348-7600 Ext 225

Ricoh Electronic Devices Co., Ltd.
Taipei office
Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan
Phone: +886-2-2313-1621/1622 Fax: +886-2-2313-1623