R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PL)1820-6) is the NRND Product as of April 2023.

NISSHINBO

R1200x SERIES

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

NO.EA-192-230529

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(PL)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(PL)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(PL)1820-6	5,000 pcs	Yes	Yes
R1200Nxxx∗-TR-FE	SOT-23-6	3,000 pcs	Yes	Yes

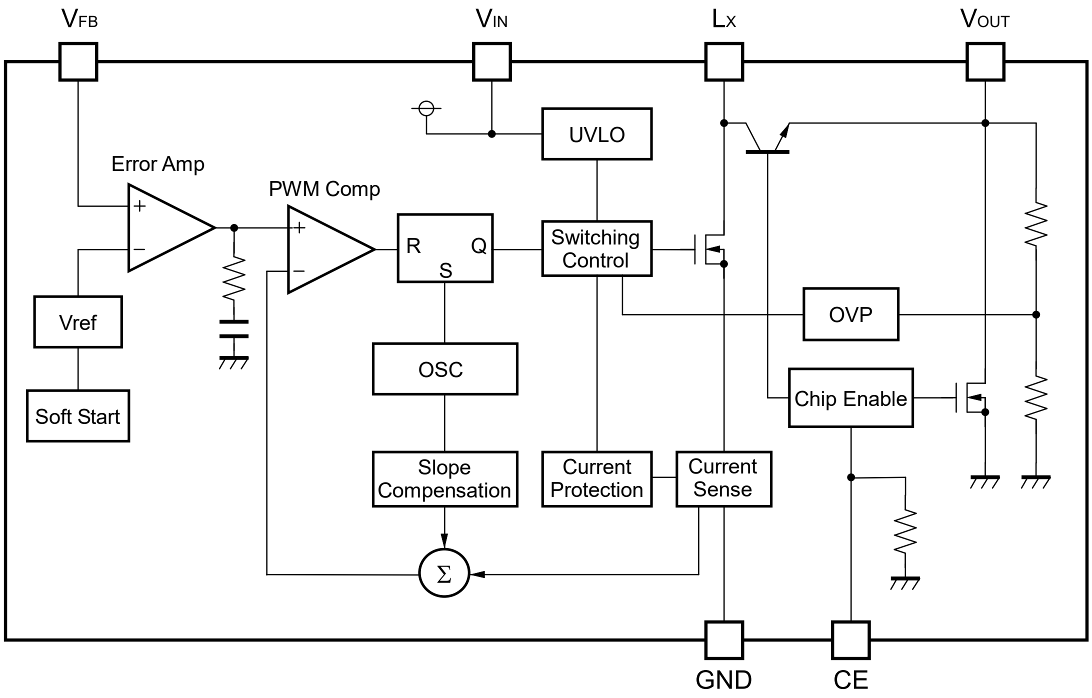
xxx : Designation of OVP detector threshold
(001) 17V threshold of OVP
(002) 19V threshold of OVP
(003) 21V threshold of OVP

∗ : 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

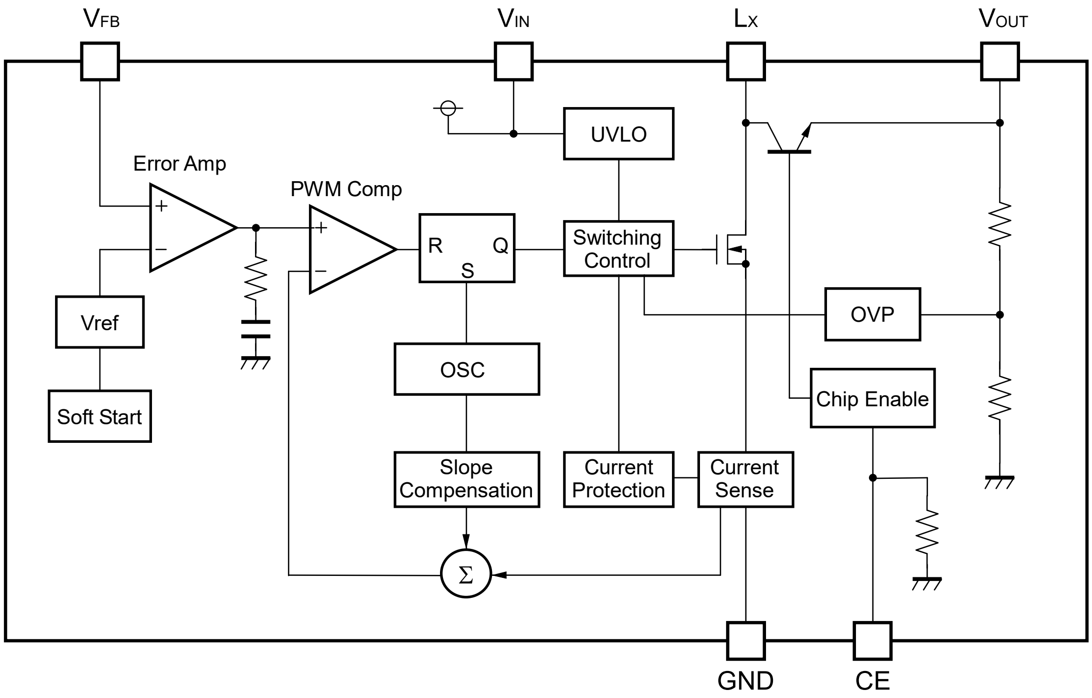
R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PL)1820-6) is the NRND Product as of April 2023.

BLOCK DIAGRAMS

R1200xxxxA

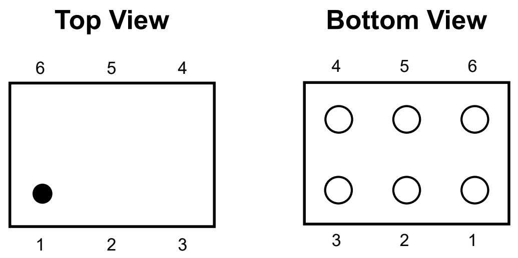


R1200xxxxB

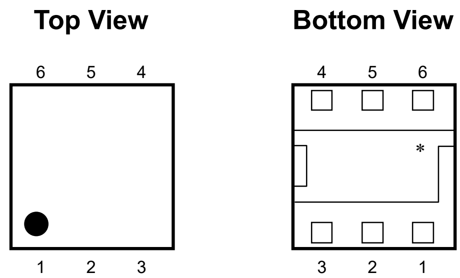


PIN DESCRIPTIONS

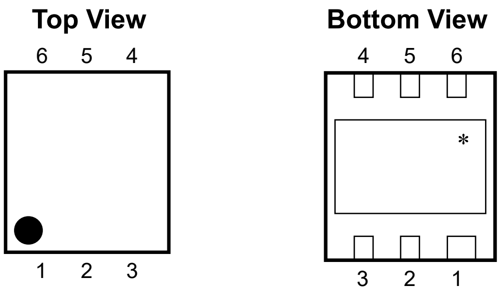
WLCSP-6-P1



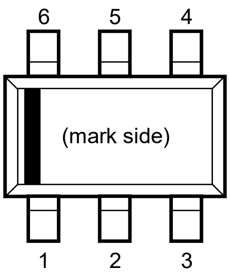
DFN1616-6



DFN(PL)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(PL)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(PL)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.

ELECTRICAL CHARACTERISTICS

- **R1200x**

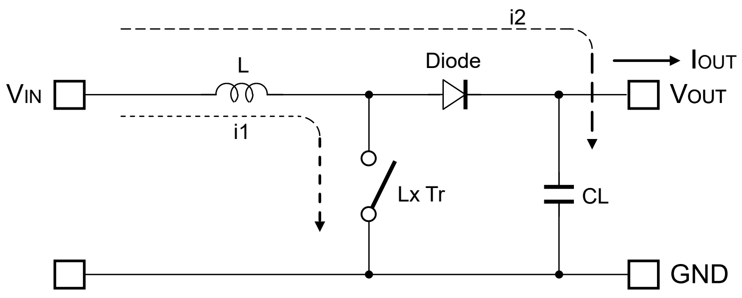
Ta=25°C

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
$I_{standby}$	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 ≤ Ta ≤ 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
t_{start}	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

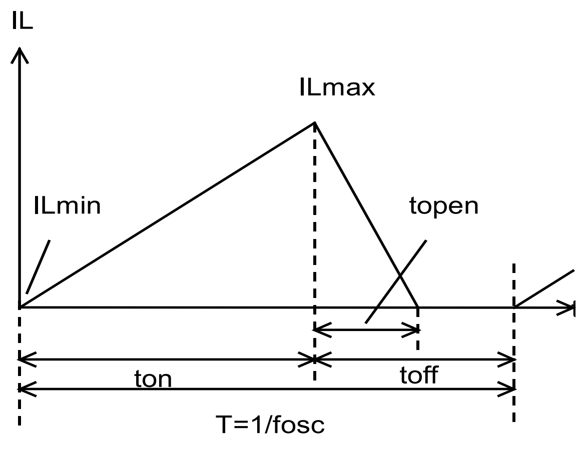
Operation of Step-Up DC/DC Converter and Output Current

<Basic Circuit>

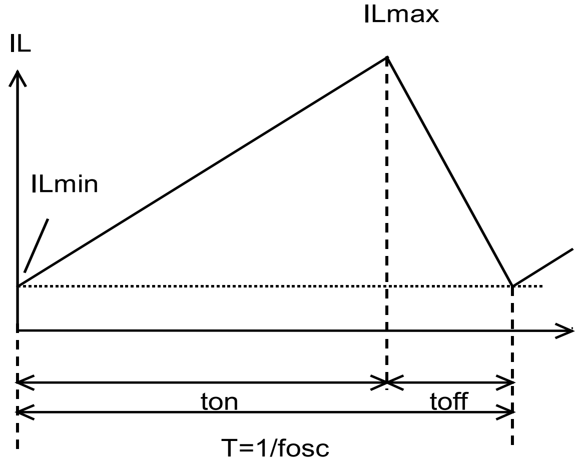


<Current through L>

Discontinuous mode



Continuous mode



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

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

At the PWM control-method, the inductor current become continuously when $t_{open}=t_{off}$, 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.

$V_{IN} \times t_{on} / L = (V_{OUT} - V_{IN}) \times t_{off} / L$ .... Formula 3

The duty at continuous mode will be

$duty\ (\%) = t_{on} / (t_{on} + t_{off}) = (V_{OUT} - V_{IN}) / V_{OUT}$ .... Formula 4

The average of inductor current at tf = t_{off} will be

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

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

$I_{OUT} = V_{IN}^2 \times t_{on} / (2 \times L \times V_{OUT})$ .... 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 (IL_{max}) of inductor will be

$IL_{max} = I_{OUT} \times V_{OUT} / V_{IN} + V_{IN} \times t_{on} / (2 \times L)$ .... Formula 7

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

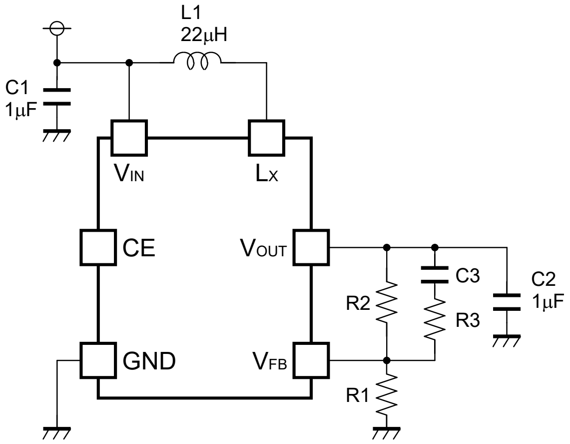
The peak current value is larger than the I_{OUT} value. In case of this, selecting the condition of the input and the output and the external components by considering of IL_{max} value.
The explanation above is based on the ideal calculation, and the loss caused by L_X switch and the external components 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%.

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

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)	I_{Lmax} (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.

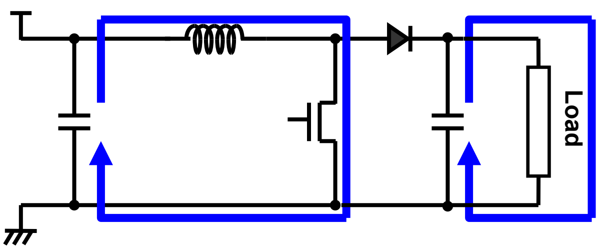


Fig. 1 MOSFET-ON

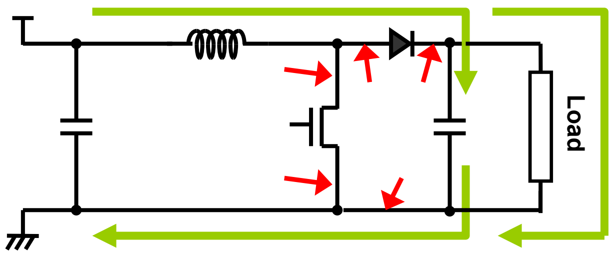


Fig. 2 MOSFET-OFF

● PCB Layout

・PKG: DFN1616-6pin

R1200L Typical Board Layout

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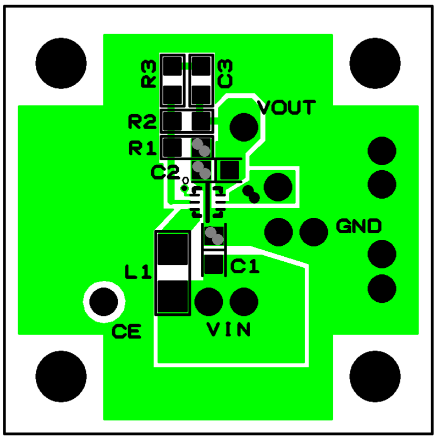
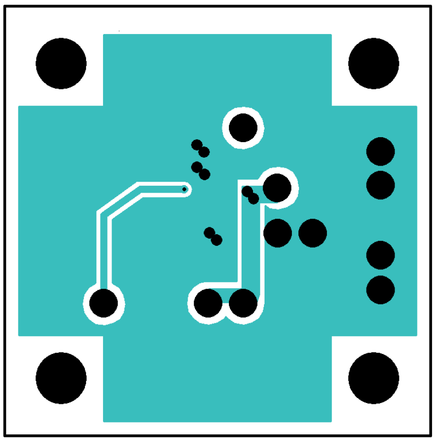
<tr><td>
</td><td></td></tr>
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・PKG:DFN(PL)1820-6pin

R1200K Typical Board Layout

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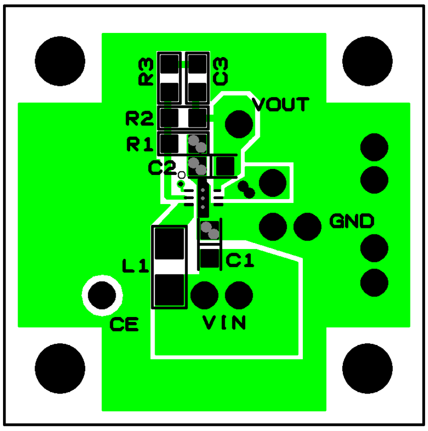
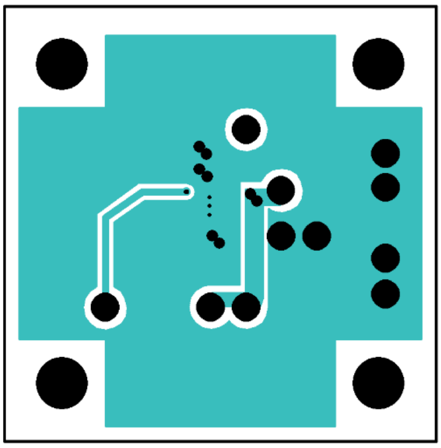
<tr><td>
</td><td></td></tr>
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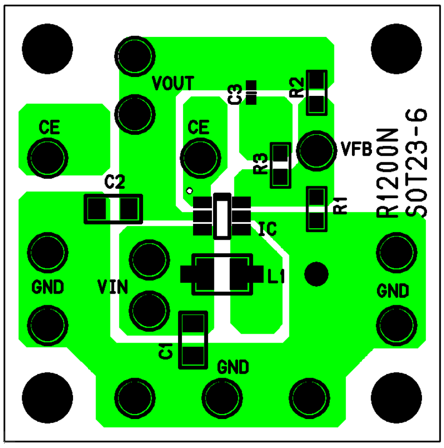
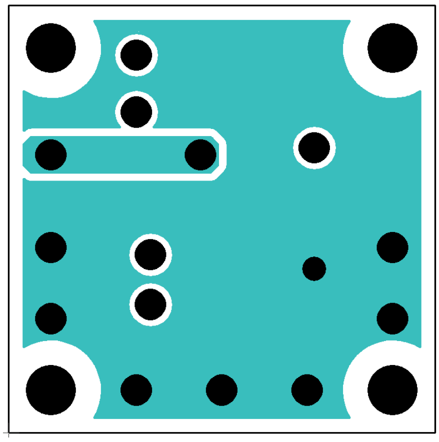
・**PKG:SOT-23-6pin**

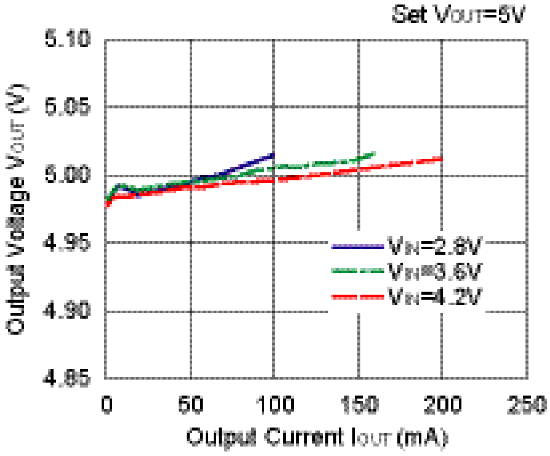
R1200N Typical Board Layout

Topside	Backside
	

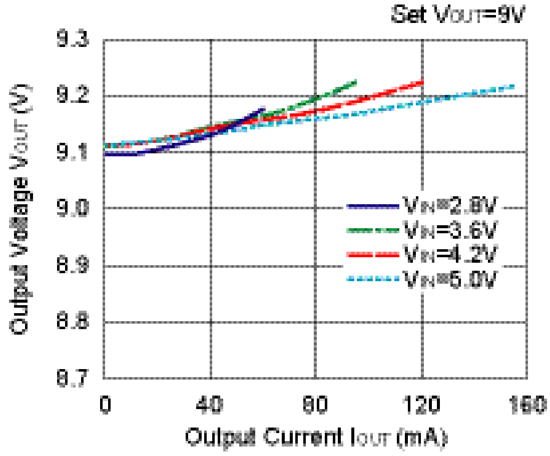
TYPICAL CHARACTERISTICS

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

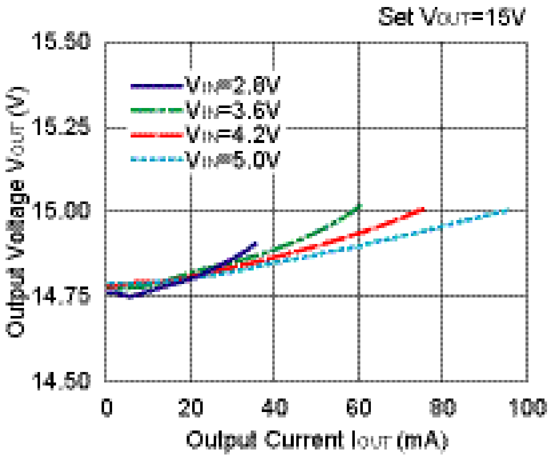
R1200x



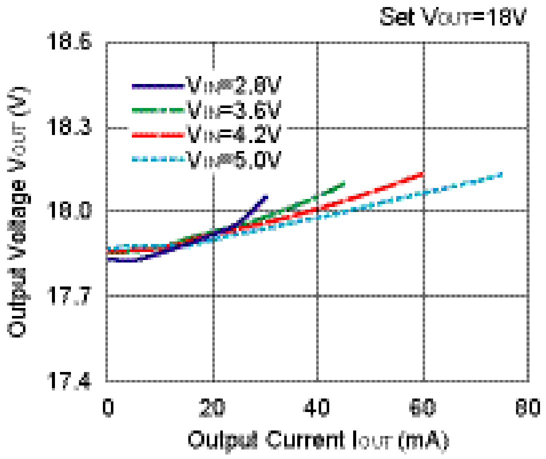
R1200x



R1200x

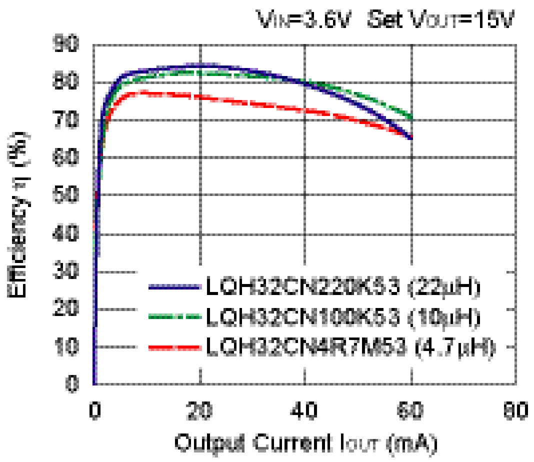


R1200x

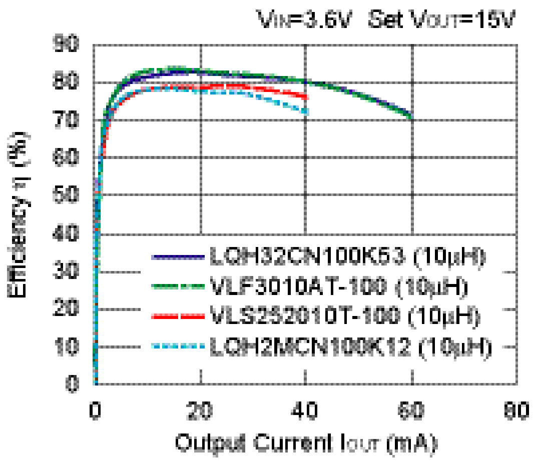


2) Efficiency vs. Output Current

R1200x

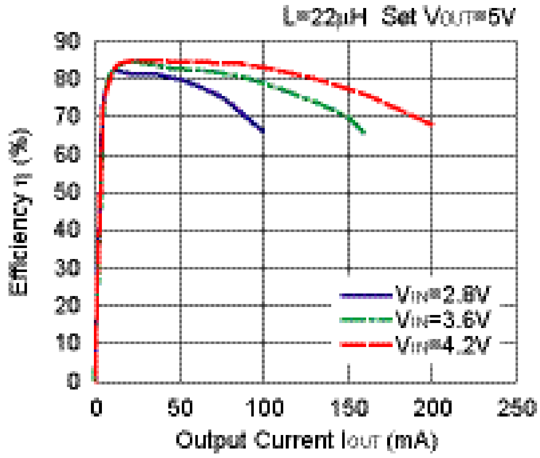


R1200x

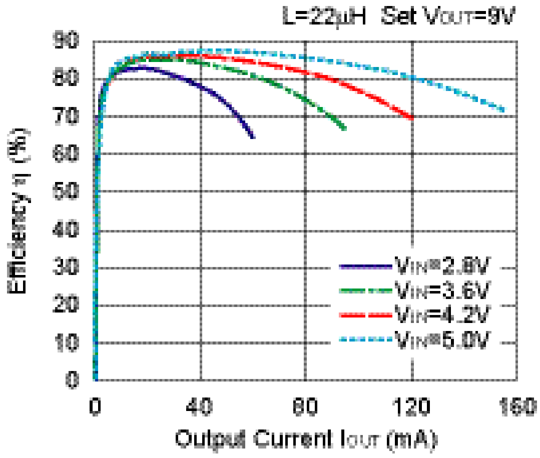


R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PL)1820-6) is the NRND Product as of April 2023.

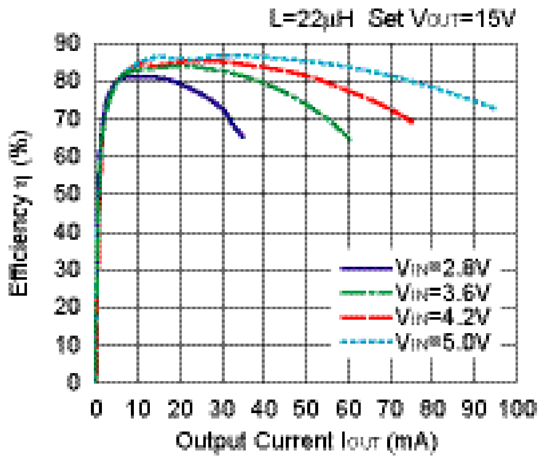
R1200x



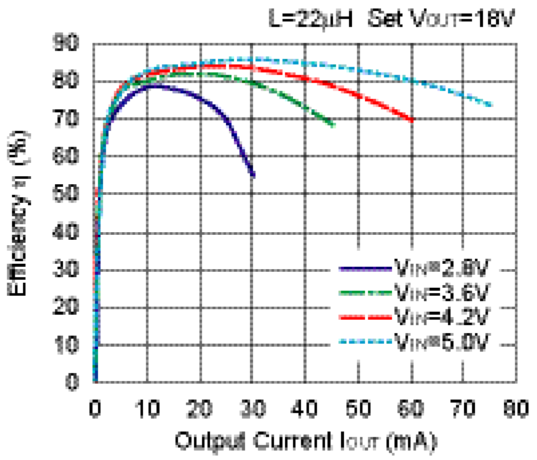
R1200x



R1200x

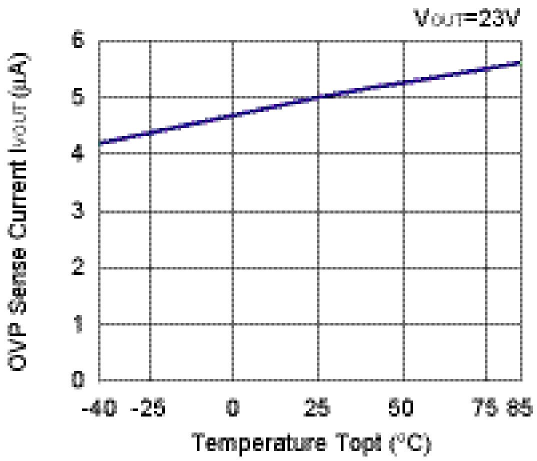


R1200x



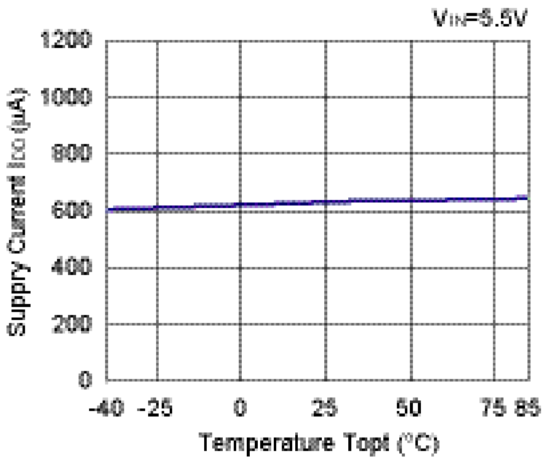
3) OVP Sense Current vs. Temperature

R1200x



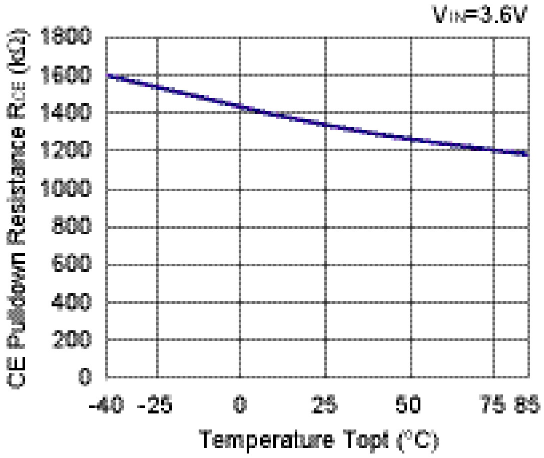
4) Supply Current vs. Temperature

R1200x



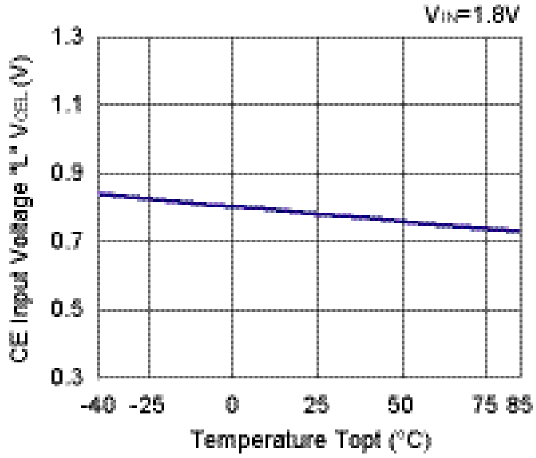
5) CE Pulldown Resistance vs. Temperature

R1200x



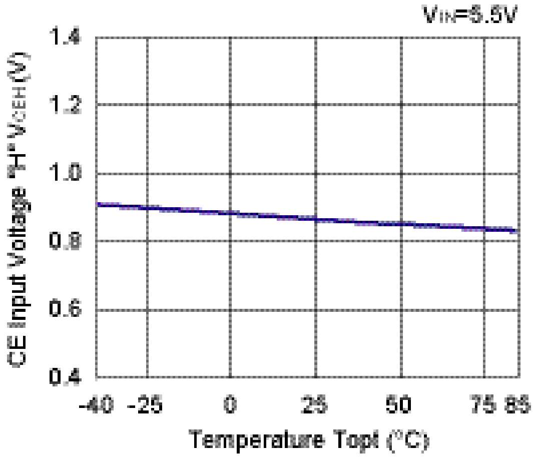
6) CE Input Voltage "L" vs. Temperature

R1200x



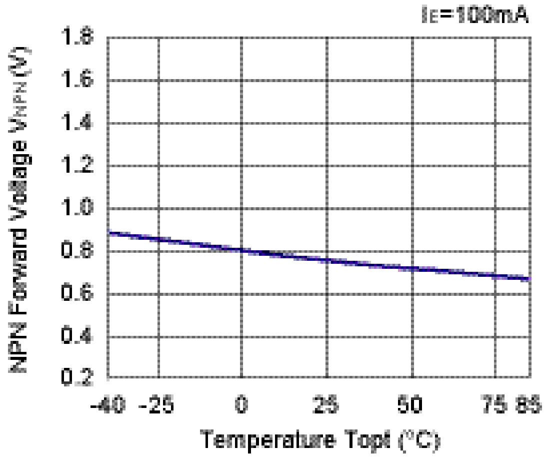
7) CE Input Voltage "H" vs. Temperature

R1200x



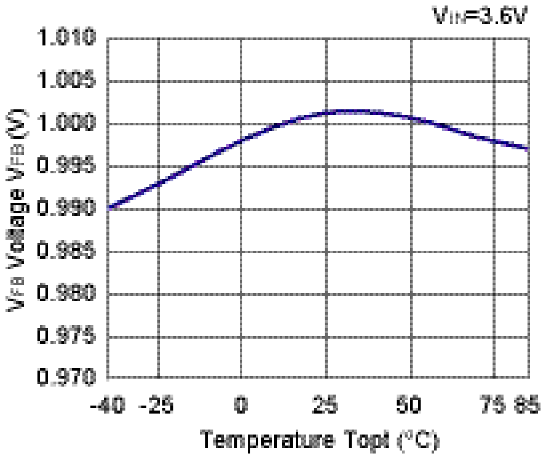
8) NPN V_{CE} Voltage vs. Temperature

R1200x



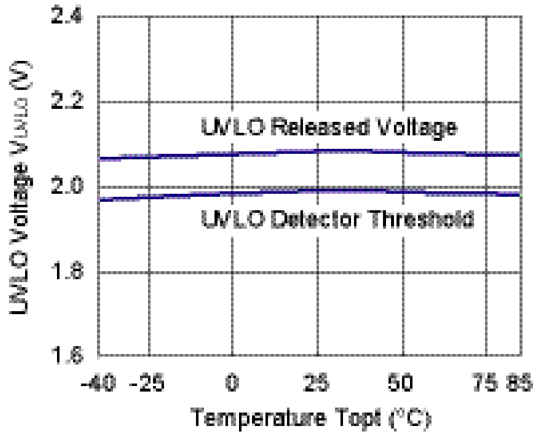
9) V_{FB} Voltage vs. Temperature

R1200x



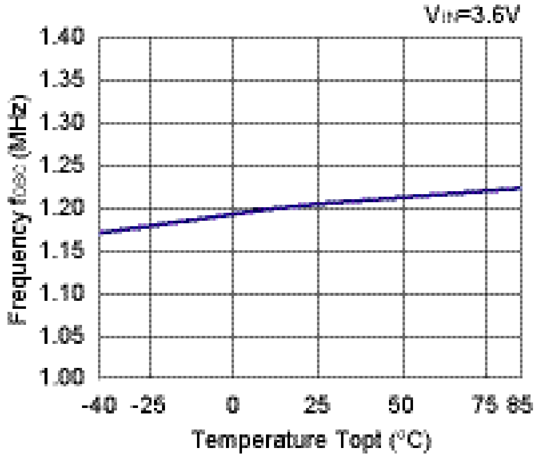
10) UVLO Detect / Released Voltage vs. Temperature

R1200x



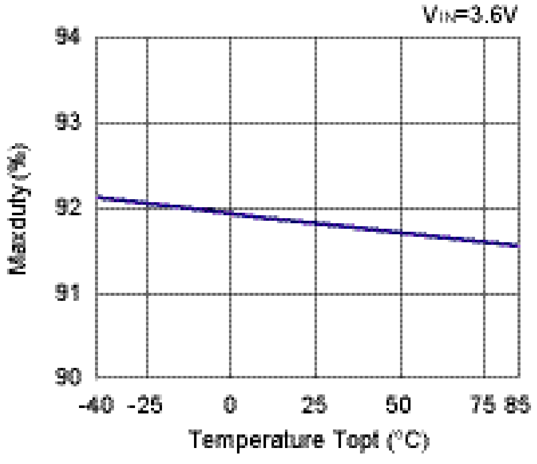
11) Oscillator Frequency vs. Temperature

R1200x



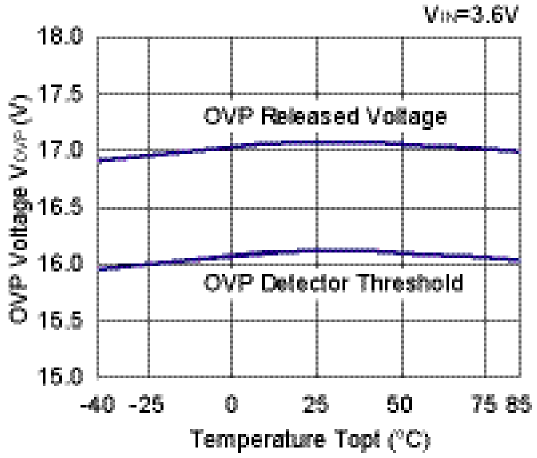
12) Maxduty vs. Temperature

R1200x



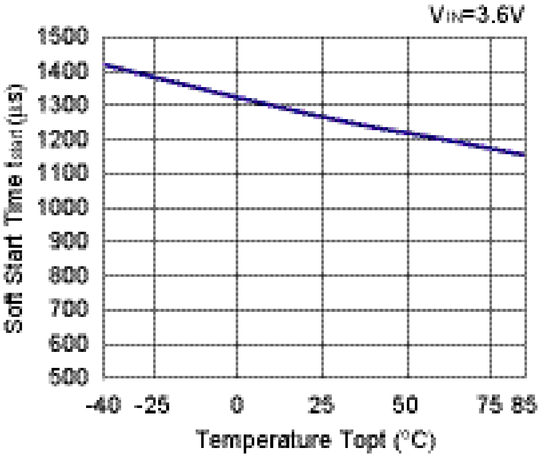
13) OVP Detect / Released Voltage vs. Temperature

R1200x001x



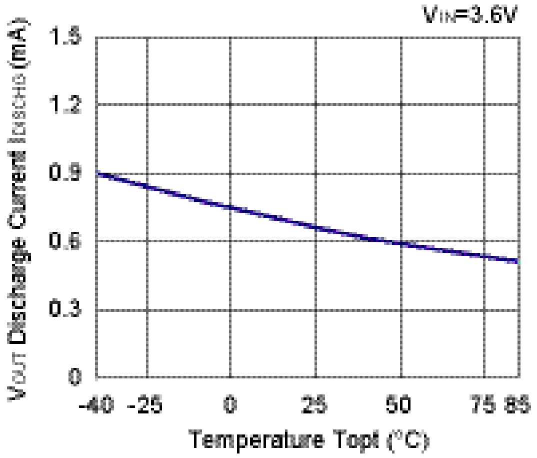
14) Soft-start Time vs. Temperature

R1200x



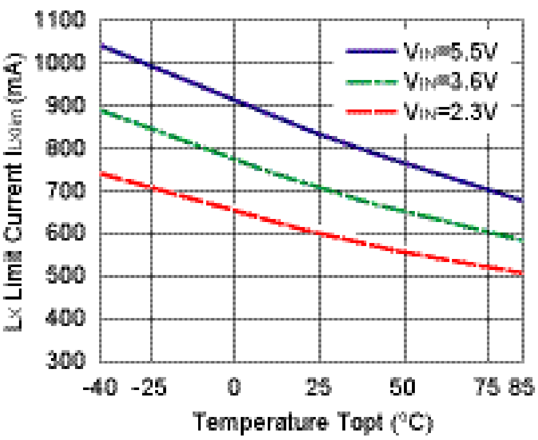
15) V_{OUT} Discharge Current vs. Temperature

R1200x



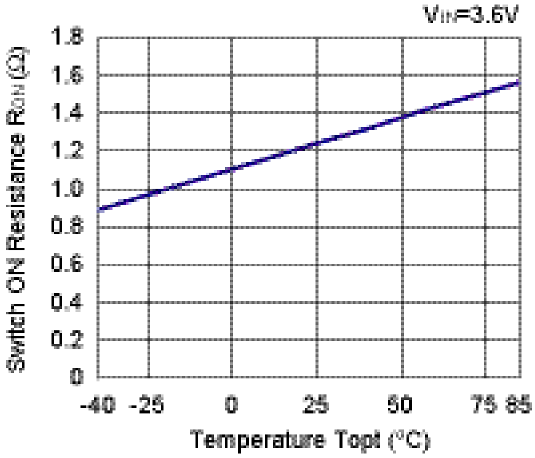
16) Lx Limit Current vs. Temperature

R1200x



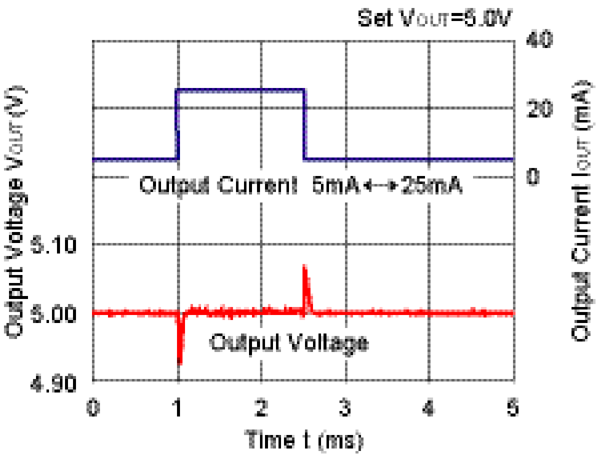
17) Switch ON Resistance vs. Temperature

R1200x

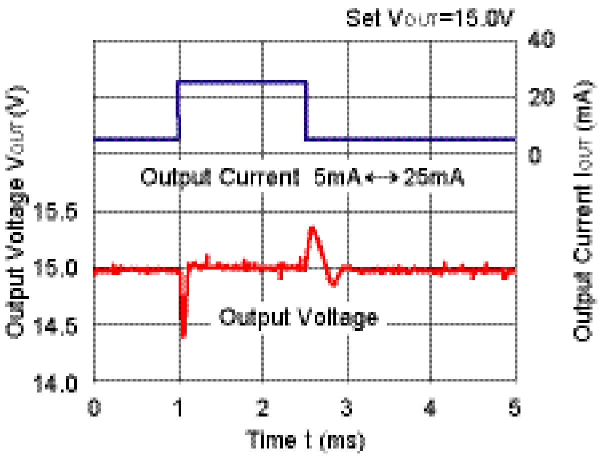


18) Load Transient Response (VIN=3.6V, IOUT=5mA↔25mA, tr=tf=0.5µs)

R1200x

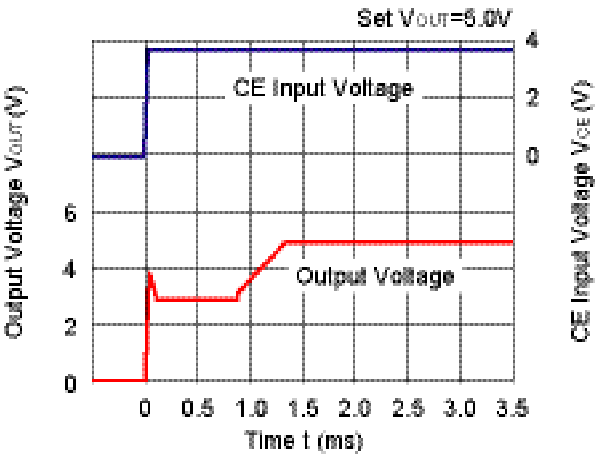


R1200x

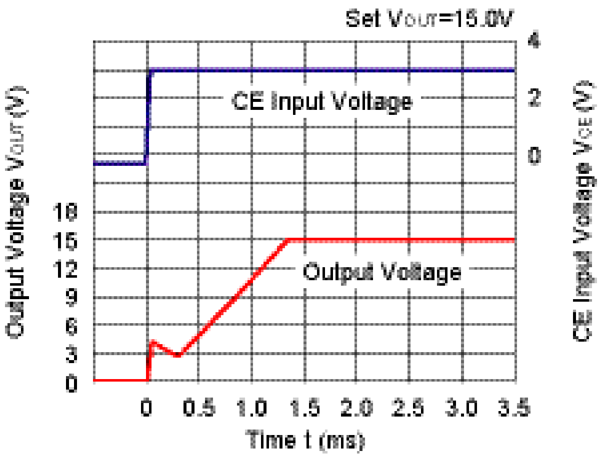


19) Start-up Waveform (VIN=3.6V, IOUT=20mA)

R1200x001A

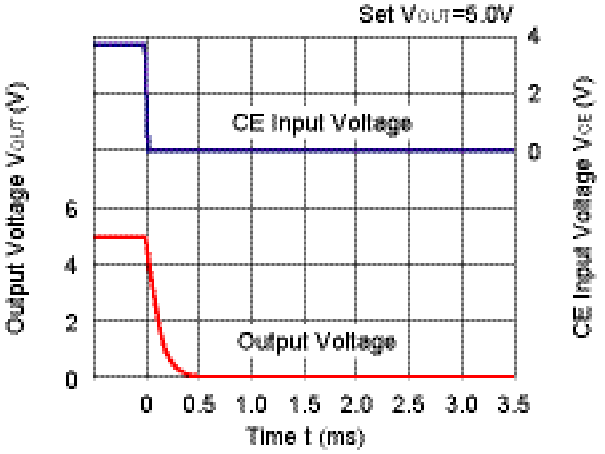


R1200x003A

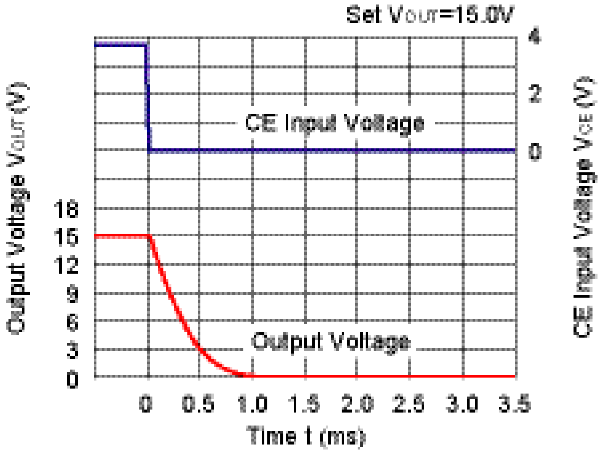


20) Shut-down Waveform (V_{IN}=3.6V, I_{OUT}=20mA)

R1200x001A

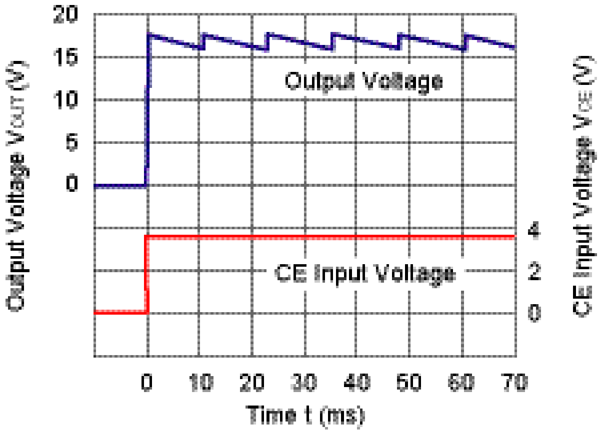


R1200x003A



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

R1200x001A



POWER DISSIPATION WLCSP-6-P1

Ver. A

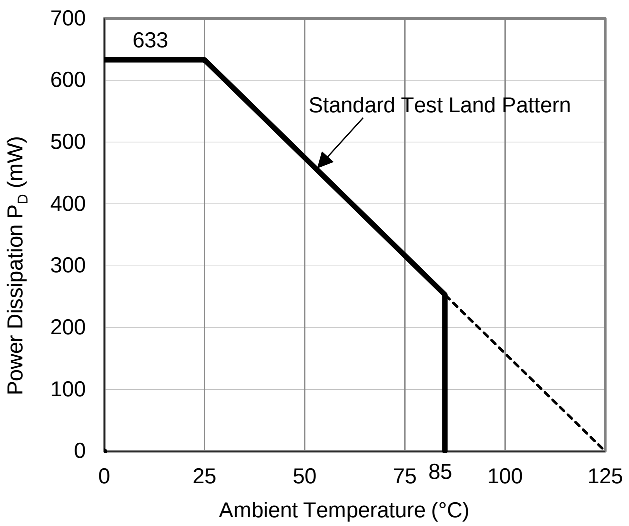
The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

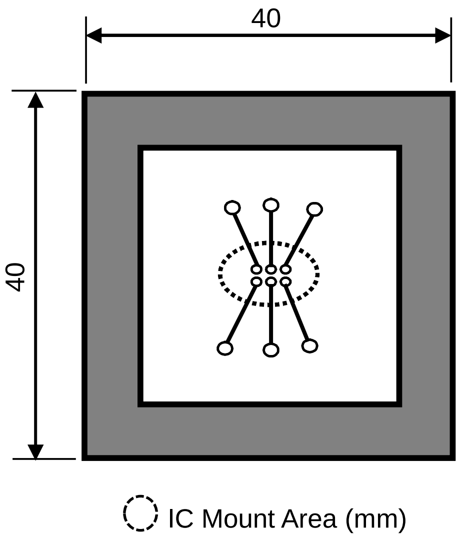
	Standard Test Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-Sided Board)
Board Dimensions	40 mm × 40 mm × 1.6 mm
Copper Ratio	Top Side: Approx. 50% Bottom Side: Approx. 50%
Through-holes	-

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

	Standard Test Land Pattern
Power Dissipation	633 mW
Thermal Resistance	$\theta ja = (125 - 25°C) / 0.633\ W = 158°C/W$



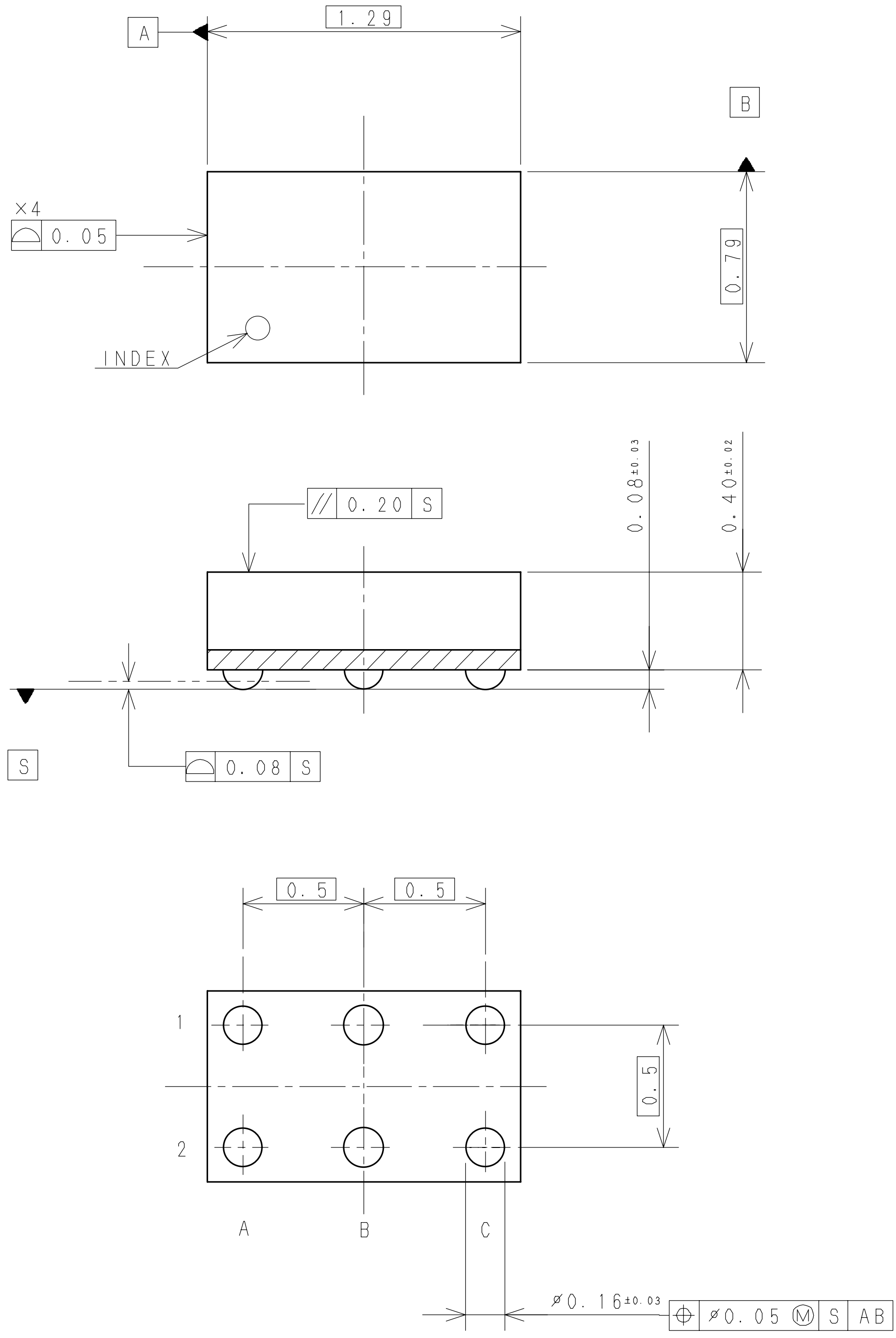
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

R1200Z (WLCSP-6-P1) is the discontinued product as of September 2017.
R1200K (DFN(PL)1820-6) is the NRND Product as of April 2023.

Ver. A



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

POWER DISSIPATION DFN1616-6

PD-DFN1616-6-(85125)-JE-B

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

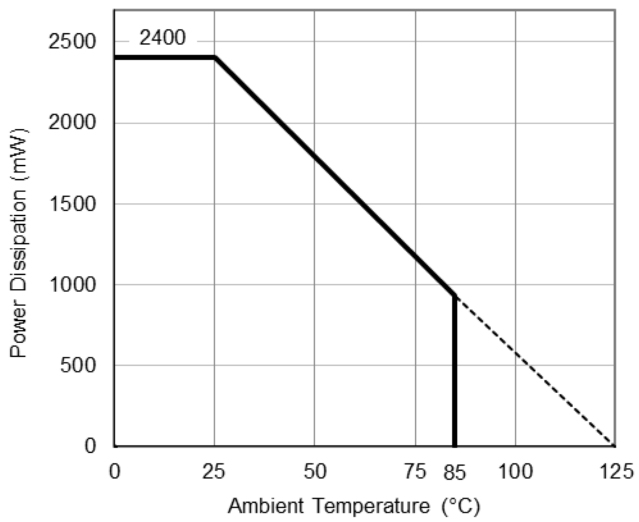
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 25 pcs

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

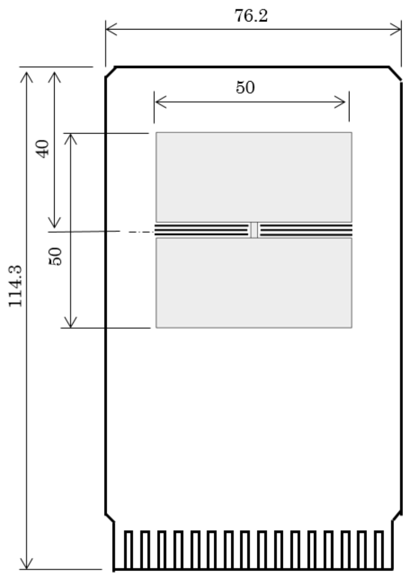
Item	Measurement Result
Power Dissipation	2400 mW
Thermal Resistance (θja)	θja = 41°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 11°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



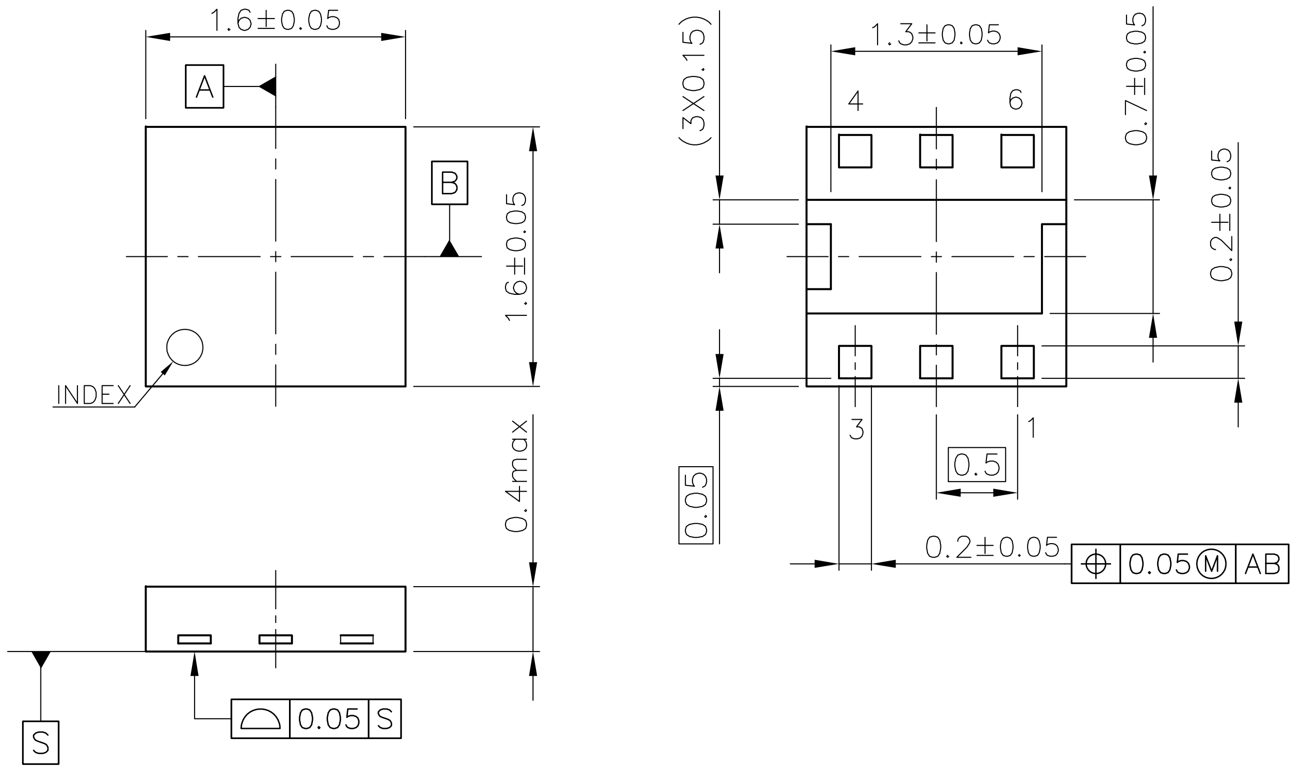
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

PACKAGE DIMENSIONS DFN1616-6

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(PL)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

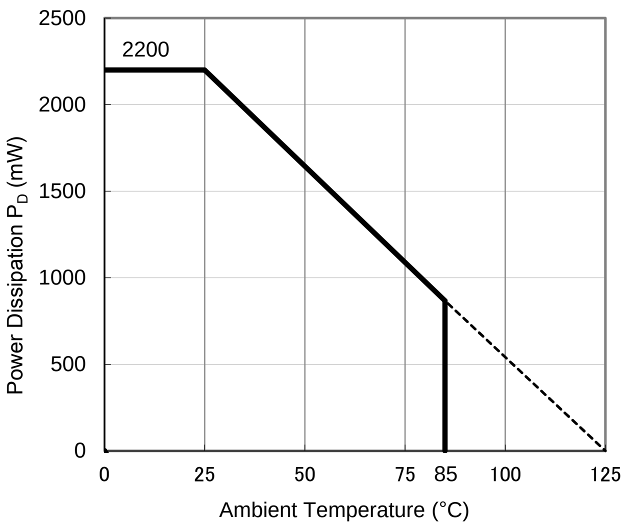
Item	Measurement Conditions (JEDEC STD. 51-7)
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	1st Layer: Less than 95% of 50 mm Square 2nd, 3rd, 4th Layers: Approx. 100% of 50 mm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

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

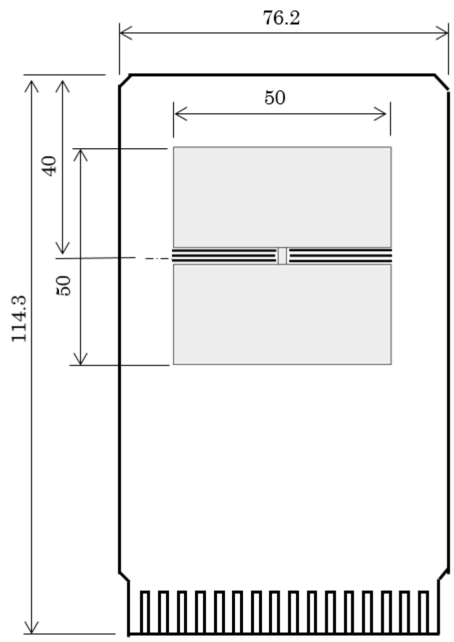
Item	Measurement Result
Power Dissipation	2200 mW
Thermal Resistance (θja)	θja = 45°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 18°C/W

θja: Junction-to–ambient thermal resistance.

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



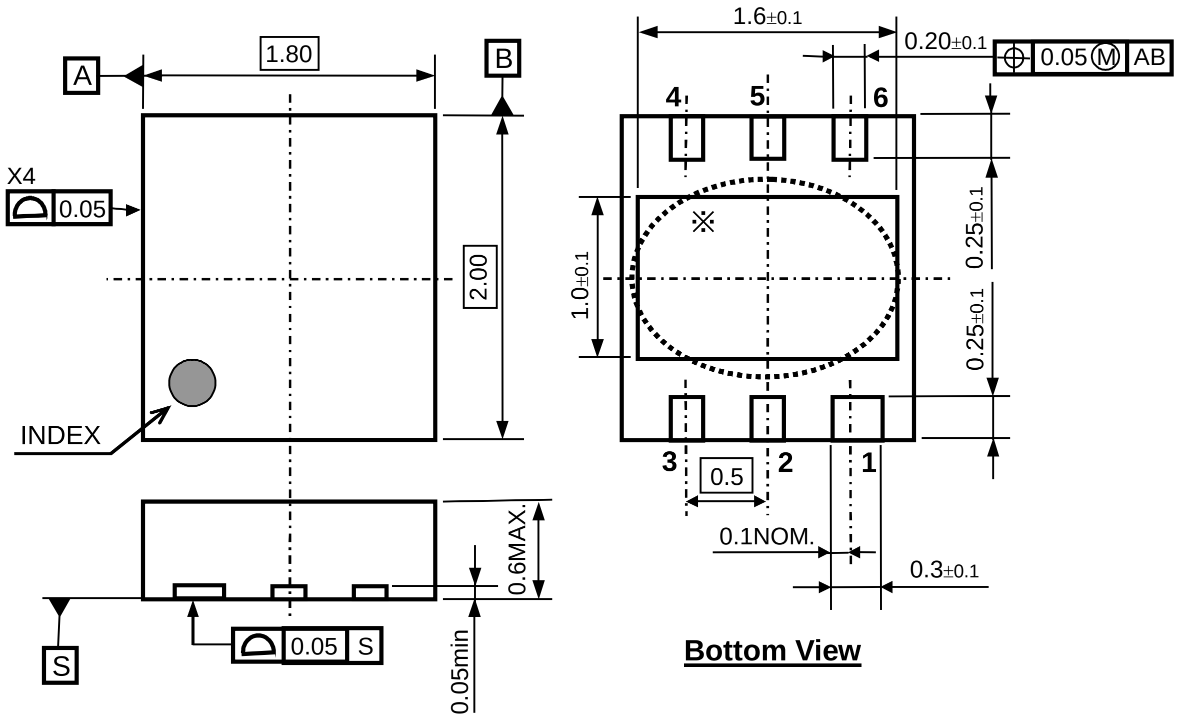
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

PACKAGE DIMENSIONS DFN(PL)1820-6

Ver. A



DFN(PL)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.

POWER DISSIPATION SOT-23-6

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

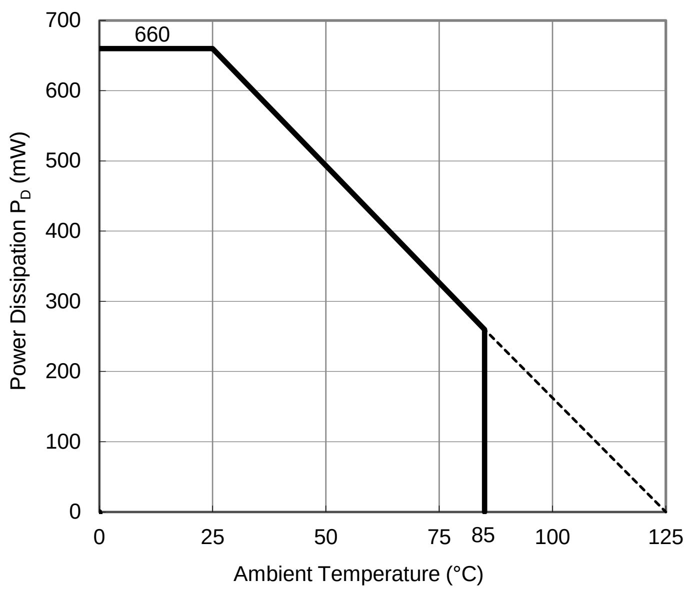
Item	Measurement Conditions (JEDEC STD. 51-7)
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	1st Layer : Less than 95% of 50 mm Square 2nd, 3rd, 4th Layers: Approx. 100% of 50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

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

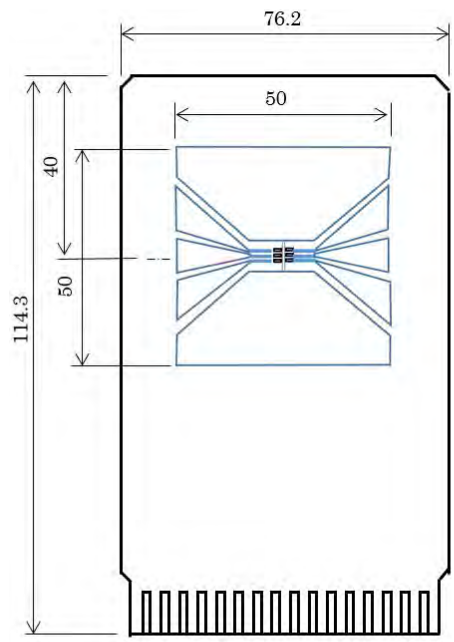
Item	Measurement Result
Power Dissipation	660 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to–ambient thermal resistance.

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



Power Dissipation vs. Ambient Temperature

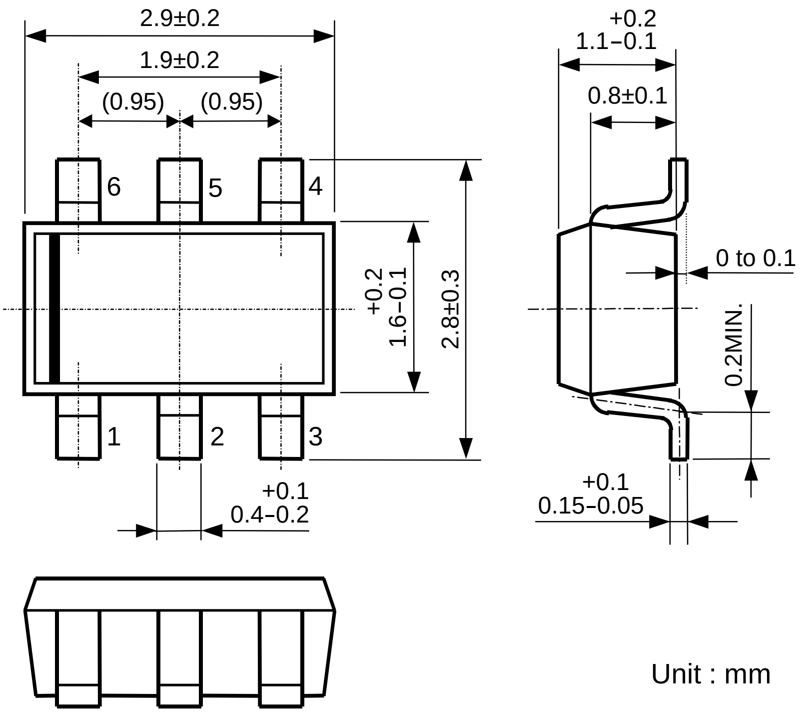


Measurement Board Pattern

Nisshinbo Micro Devices Inc.

PACKAGE DIMENSIONS SOT-23-6

Ver. A



Unit : mm

SOT-23-6 Package Dimensions

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2. The materials in this document may not be copied or otherwise reproduced in whole or in part without the prior written consent of us.
3. This product and any technical information relating thereto are subject to complementary export controls (so-called KNOW controls) under the Foreign Exchange and Foreign Trade Law, and related politics ministerial ordinance of the law. (Note that the complementary export controls are inapplicable to any application-specific products, except rockets and pilotless aircraft, that are insusceptible to design or program changes.) Accordingly, when exporting or carrying abroad this product, follow the Foreign Exchange and Foreign Trade Control Law and its related regulations with respect to the complementary export controls.
4. The technical information described in this document shows typical characteristics and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our or any third party's intellectual property rights or any other rights.
5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
    - Aerospace Equipment
    - Equipment Used in the Deep Sea
    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
    - Fire Alarms / Intruder Detectors
    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

    In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. Quality Warranty

    8-1. Quality Warranty Period

    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.

    8-2. Quality Warranty Remedies

    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.

    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.

    8-3. Remedies after Quality Warranty Period

    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.