NISSHINBO

RP605x Series

300mA Ultra-low Power Buck Boost DC/DC Converter with Battery Monitor

No. EA-516-241204

OVERVIEW

RP605x is an ultra-low power DC/DC converter with a Battery Monitor (BM). The battery monitor divides the input voltage (V_{IN}) into 1/3 or 1/4 and directly provides the buffered voltage to a low-voltage AD converter in MCU, it monitors the remaining quantity of the battery.

KEY BENEFITS

- Long-time operation of battery powered equipment and downsizing of battery due to the ultra-low consumption current (I_Q = 0.3 µA).
- Reducing components and saving space by combining DC/DC and BM into a single chip.
- Suitable for coin batteries and USB ports due to its wide input voltage range from 1.8 V to 5.5 V

KEY SPECIFICATIONS

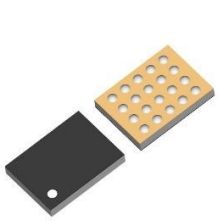
DC/DC Section

- Supply Current: Typ. 0.3 µA
- Output Current: 300 mA
- Input Voltage Range: 1.8 V to 5.5 V
- Output Voltage Range: 1.6 V to 5.2 V
- Output Voltage Accuracy: ±1.5%

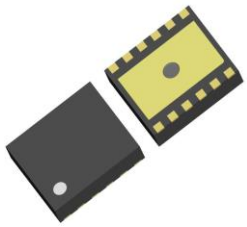
Battery Monitor Section

- Output Voltage: V_{IN}/3 (RP605xxx3x)
  V_{IN}/4 (RP605xxx4x)
- Supply Current: Typ. 0.1 µA

PACKAGES (unit: mm)

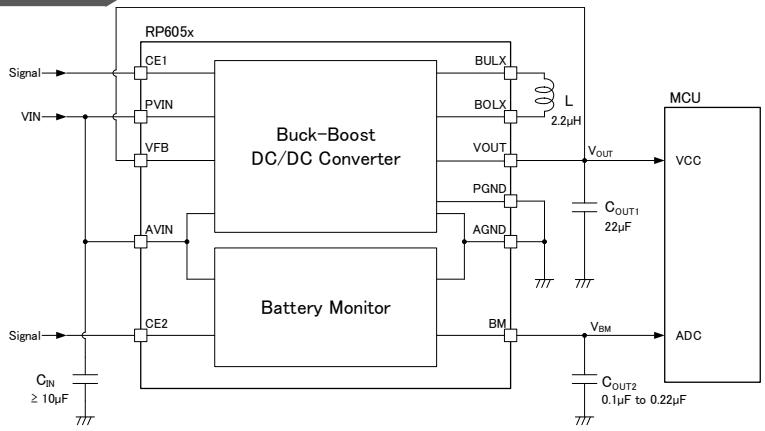


WLCSP-20-P3
2.315 x 1.71 x 0.36



DFN(PL)2730-12
3.00 x 2.70 x 0.6

TYPICAL APPLICATIONS



APPLICATIONS

- Devices with Coin Cell Battery and Lithium Ion Battery
- Wearable devises including Smart watch, Smart band, and Health monitor
- Low power RF Modules including: *Bluetooth*® LE, Zigbee, WiSun and ANT
- Low power CPUs, Memory, Sensor device and Energy harvester

SELECTION GUIDE

The DC/DC set output voltage, the division ratio of BM output, the DC/DC auto-discharge function [1], and the package are user-selectable options.

Selection Guide

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP605Zxx#$-E2-F	WLCSP-20-P3	5,000 pcs	Yes	Yes
RP605Zxx#$-E2-T	WLCSP-20-P3	5,000 pcs	Yes	Yes
RP605Kxx#$-TR	DFN(PL)2730-12	5,000 pcs	Yes	Yes

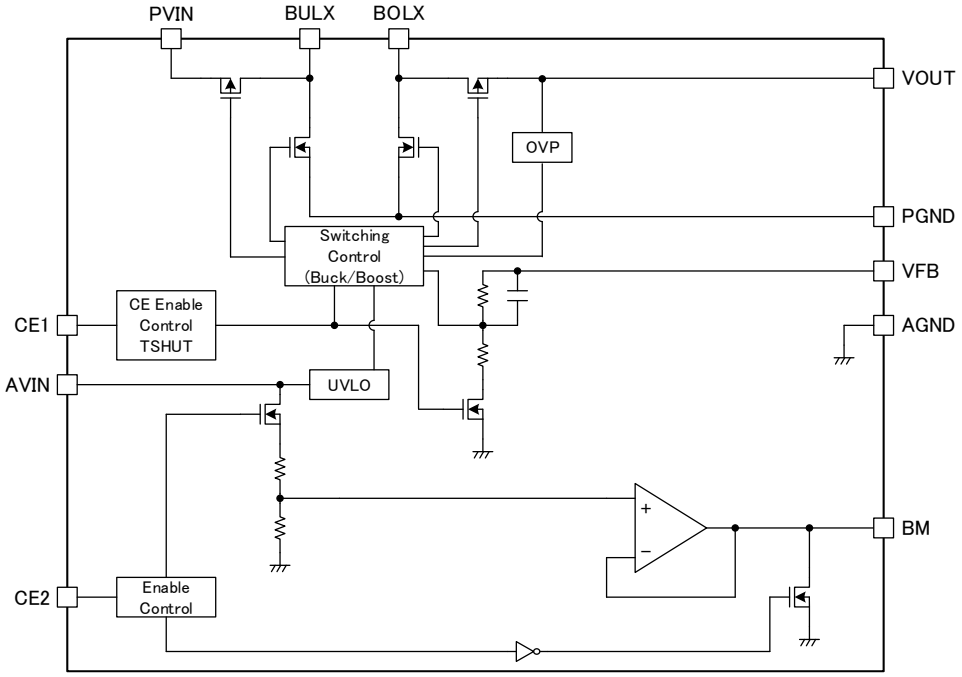
xx: Specify the DC/DC set output voltage (V_{SET})
Fixed output voltage type: 1.6 V (16) to 5.2 V (52) in 0.1 V step
Refer to the *Product-specific Electrical Characteristics* for detail information

#: Specify the division ratio of BM output
3 : $V_{IN}/3$
4 : $V_{IN}/4$

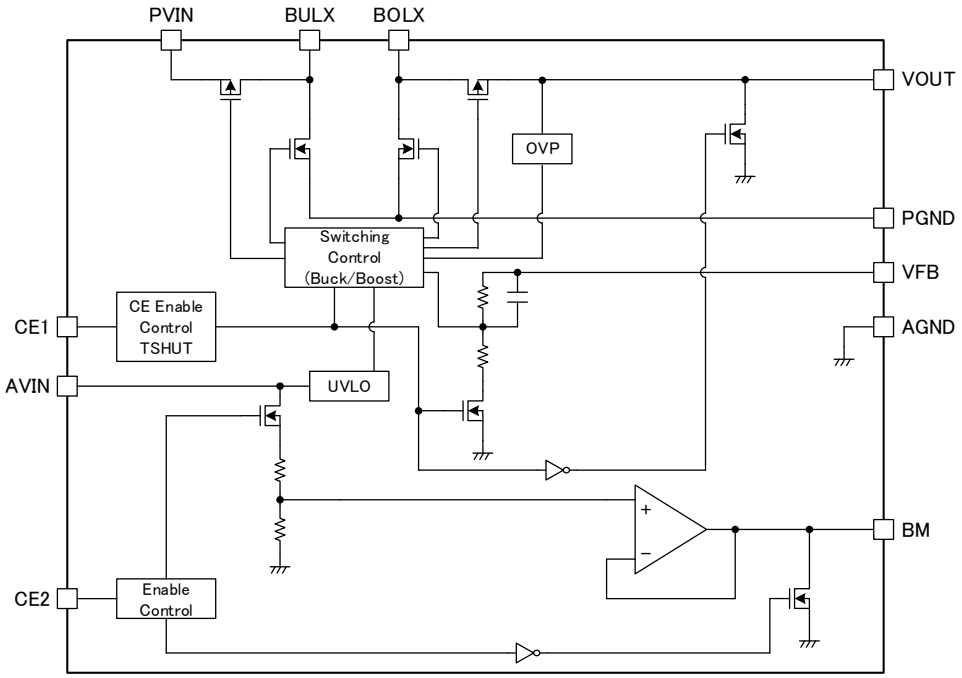
$: Specify the DC/DC auto-discharge option.
A: DC/DC auto-discharge is not included
B: DC/DC auto-discharge is included

[1] Auto-discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge accumulated in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

BLOCK DIAGRAMS

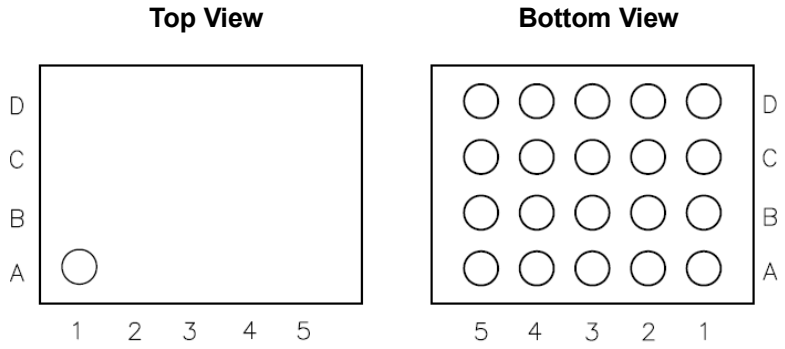


RP605xxxxA Block Diagram: DC/DC auto-discharge is not included



RP605xxxxB Block Diagram: DC/DC auto-discharge is included

PIN DESCRIPTIONS



RP605Z (WLCSP-20-P3) Pin Configuration

RP605Z Pin Description

Pin No.	Symbol	Description
A5, B5	VOUT	DC/DC Output Pin
A4, B4, C4	BOLX	Boost Switching Output LX Pin
A3, B3, C3	PGND	Power Ground Pin
A2, B2, C2	BULX	Buck Switching Output LX Pin
A1, B1, C1	PVIN	Power Source Input Pin
C5	VFB	Feedback Pin
D1	AVIN	Analog Power Supply Pin
D2	CE1	DC/DC Enable Pin (Active-high)
D3	AGND	Analog Ground Pin
D4	CE2	Battery Monitor Enable Pin (Active-high)
D5	BM	Battery Monitor Output Pin

RP605K [DFN(PL)2730-12] Pin Configuration

RP605K Pin Description

Pin No.	Symbol	Description
1	AVIN	Analog Power Supply Pin
2	CE1	DC/DC Enable Pin (Active-high)
3	AGND	Analog Ground Pin
4	CE2	Battery Monitor Enable Pin (Active-high)
5	BM	Battery Monitor Output Pin
6	VFB	Feedback Pin
7	VOUT	DC/DC Output Pin
8	BOLX	Boost Switching Output LX Pin
9	PGND	Power Ground Pin
10	PGND	Power Ground Pin
11	BULX	Buck Switching Output LX Pin
12	PVIN	Power Source Input Pin

* 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.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	−0.3 to 6.5	V
V_{BULX}	BULX Pin Voltage	−0.3 to V_{IN} + 0.3	V
V_{BOLX}	BOLX Pin Voltage	−0.3 to V_{OUT} + 0.3	V
V_{CE1}	CE1 Pin Voltage	−0.3 to 6.5	V
V_{CE2}	CE2 Pin Voltage	−0.3 to 6.5	V
V_{OUT}	VOUT Pin Voltage	-0.3 to 6.5	V
V_{FB}	VFB Pin Voltage	−0.3 to 6.5	V
V_{BM}	BM Pin Voltage	−0.3 to V_{IN} + 0.3	V
P_D	Power Dissipation	Refer to Appendix *"POWER DISSIPATION"*	
Tj	Junction Temperature Range	−40 to 125	°C
Tstg	Storage Temperature Range	−55 to 125	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage 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

Recommended Operating Conditions

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage	RP605xxx3x	1.8 to 5.5	V
		RP605xxx4x	2.4 to 5.5	
Ta	Operating Temperature		−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 they are used over such conditions 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

The specifications surrounded by [ ] are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

RP605x Electrical Characteristics: DC/DC Section (Ta = 25°C)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output voltage	V_{IN} = V_{CE1} = 3.6 V		x 0.985		x 1.015	V
I_Q	Operating quiescent current	V_{IN} = V_{CE1} = V_{OUT} = 3.6 V, V_{SET} = 3.3V, at rest			0.3		µA
$I_{STANDBY}$	Standby current	V_{IN} = 5.5 V, V_{CE1} = 0 V			0.01	1	µA
I_{CE1H}	CE1 pin input current, high	V_{IN} = V_{CE1} = 5.5 V		[−0.025]	0	[0.025]	µA
I_{CE1L}	CE1 pin input current, low	V_{IN} = 5.5 V, V_{CE1} = 0 V		[−0.025]	0	[0.025]	µA
I_{VFBH}	VFB pin input current, high	V_{IN} = V_{FB} = 5.5 V, V_{CE1} = 0 V		[−0.025]	0	[0.025]	µA
I_{VFBL}	VFB pin input current, low	V_{IN} = 5.5 V, V_{CE1} = V_{FB} = 0 V		[−0.025]	0	[0.025]	µA
V_{OVP}	Overvoltage Protection (OVP) Threshold	V_{IN} = 3.6 V , Rising (Detection)			6.0		V
		V_{IN} = 3.6 V , Falling (Release)			5.5		V
R_{DISN}	Auto-discharge NMOS on-resistance	V_{IN} = 3.6 V, V_{CE1} = 0 V RP605xxxxB only			100		Ω
V_{CE1H}	CE1 pin input voltage, high	V_{IN} = 5.5 V		[1.0]			V
V_{CE1L}	CE1 pin input voltage, low	V_{IN} = 1.8 V				[0.4]	V
R_{ONP}	PMOS on-resistance	RP605Z	V_{IN} = 3.6 V, I_{LX} = −100 mA		0.12		Ω
		RP605K	V_{IN} = 3.6 V, I_{LX} = −100 mA		0.15		Ω
R_{ONN}	NMOS on-resistance	RP605Z	V_{IN} = 3.6 V, I_{LX} = −100 mA		0.12		Ω
		RP605K	V_{IN} = 3.6 V, I_{LX} = −100 mA		0.15		Ω
T_{TSD}	Thermal Shutdown Threshold Temperature	Tj, Rising (Detection)			140		°C
T_{TSR}		Tj, Falling (Release)			100		°C
t_{START}	Soft-start time	V_{IN} = V_{CE1} = 3.6 V			20		ms
I_{LXLIM}	BULX Limiting current	V_{IN} = V_{CE1} = 3.6 V		[600]	900		mA
V_{UVLOF}	Undervoltage Lockout (UVLO) Threshold	V_{IN} = V_{CE1}, Falling (Detection)		[1.40]	1.50	[1.65]	V
V_{UVLOR}		V_{IN} = V_{CE1}, Rising (Release)		[1.55]	1.65	[1.80]	V

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C).

Test circuit is operated under condition of “Open Loop Control” (GND = 0 V), unless otherwise specified.

ELECTRICAL CHARACTERISTICS (Continued)

The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

RP605x Electrical Characteristics: Battery Monitor Section (Ta = 25°C)

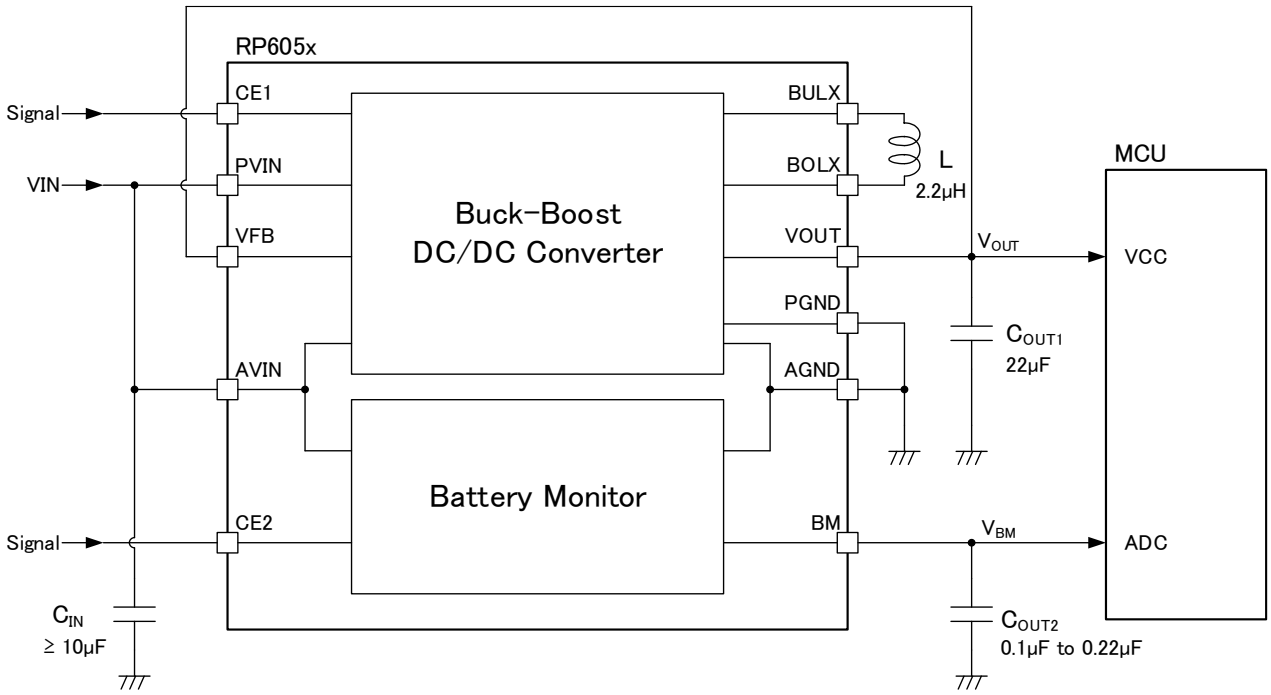
Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{BM}	Output voltage	V_{IN} = 3.6 V, −10μA≤ I_{BM}≤10μA	RP605xxx3x	V_{IN}/3-30	V_{IN}/3	V_{IN}/3+30	mV
			RP605xxx4x	V_{IN}/4-30	V_{IN}/4	V_{IN}/4+30	
I_{BM}	Output current	V_{IN} = 3.6 V		−10		10	μA
I_{SSBM}	Supply current	I_{BM} = 0 μA			0.1		μA
V_{CE2H}	CE2 input voltage, high	V_{IN} = 5.5 V		1.0			V
V_{CE2L}	CE2 input voltage, low	V_{IN} = 1.8 V				0.4	V
R_{DISNBM}	Auto-discharge NMOS. on-resistance	V_{IN} = 4.0 V, V_{CE2} = 0 V			50		Ω

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj ≈ Ta = 25°C)

Product-specific Electrical Characteristics **(Ta = 25° C)**

Product Name	V_{OUT} [V]		
	Min.	Typ.	Max.
RP605x16xx	1.576	1.600	1.624
RP605x18xx	1.773	1.800	1.827
RP605x20xx	1.970	2.000	2.030
RP605x24xx	2.364	2.400	2.436
RP605x25xx	2.463	2.500	2.537
RP605x28xx	2.758	2.800	2.842
RP605x30xx	2.955	3.000	3.045
RP605x31xx	3.054	3.100	3.146
RP605x33xx	3.251	3.300	3.349
RP605x36xx	3.546	3.600	3.654
RP605x40xx	3.940	4.000	4.060
RP605x50xx	4.925	5.000	5.075
RP605x52xx	5.122	5.200	5.278

TYPICAL APPLICATION CIRCUIT



RP605x Typical Application Circuit

TECHNICAL NOTES

The performance of a power source circuit using this device is highly dependent on the peripheral circuit. A peripheral component or the device mounted on PCB should not exceed a rated voltage, a rated current or a rated power. When designing a peripheral circuit, please be fully aware of the following points.

- Use carefully with the distance between the VFB pin and the wiring that causes noise.
- Noise reduction is possible by adding a filter component such as a resistor to the VFB pin
- Use ceramic capacitors with a low equivalent series resistance (ESR), considering the bias characteristics and input/output voltages.
- When the built-in switches are turned off, the inductor may generate a spike-shaped high voltage. Use the high-breakdown voltage capacitor (C_{OUT1}) which output voltage is 1.5 times or more than the set output voltage.
- Use an inductor that has a low DC resistance, has an enough tolerable current and is less likely to cause magnetic saturation.
- The CE1 and CE2 pins are neither pulled up nor pulled down, therefore an operation is not stable at open.
- The thermal shutdown function protects the IC from fuming and ignition but does not ensure the IC's reliability or keep the IC below the absolute maximum ratings. The thermal shutdown function only works on the heat generated by normal IC operation such as latch-up and overvoltage application.
- The thermal shutdown function operates in a state over the absolute maximum ratings, therefore the thermal shutdown function should not be used for a system design.

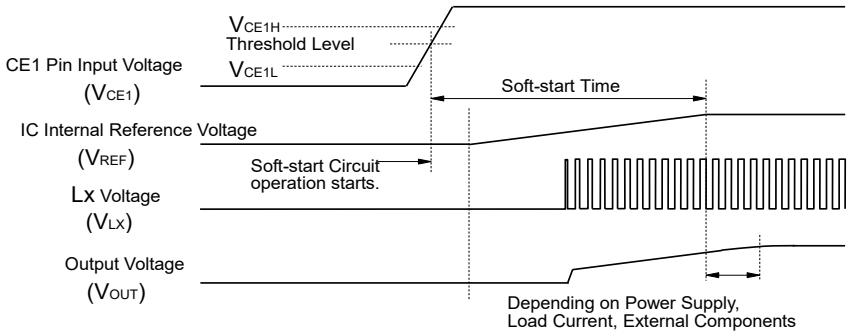
THEORY OF OPERATION

DC/DC Section

Soft-start Time

Starting-up with CE1 Pin

The IC starts to operate when the CE1 pin voltage (V_{CE1}) exceeds the threshold voltage. The threshold voltage is preset between CE1 "High" input voltage (V_{CE1H}) and CE1 "Low" input voltage (V_{CE1L}). After the start-up of the IC, soft-start circuit starts to operate. Then, after a certain period, the reference voltage (V_{REF}) in the IC gradually increases up to the specified value. Switching starts when V_{REF} reaches the preset voltage, and after that the output voltage rises as V_{REF} increases. Soft-start time (t_{START}) indicates the period from the time soft-start circuit gets activated to the time V_{REF} reaches the specified voltage. t_{START} is not always equal to the turn-on speed of the DC/DC converter. Note that the turn-on speed could be affected by the power supply capacity, the output current (I_{OUT}), the inductance and the output capacitor value (C_{OUT1}).

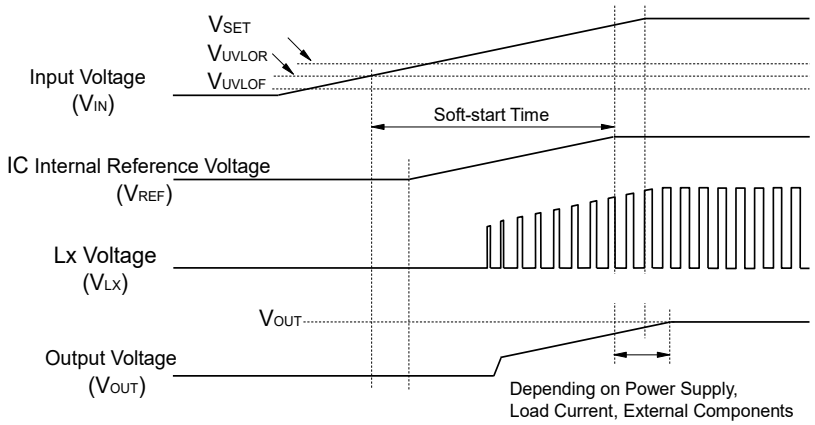


Timing Chart: Starting-up with CE1 Pin

Starting-up with Power Supply

After the power-on, when V_{IN} exceeds the UVLO release voltage (V_{UVLOR}), the IC starts to operate. Then, soft-start circuit starts to operate and after a certain period, V_{REF} gradually increases up to the specified value. Switching starts when V_{REF} reaches the preset voltage, and after that the output voltage rises as V_{REF} increases. The turn-on speed of V_{OUT} could be affected by following conditions:

1. The V_{IN} turn-on speed determined by the power supply to the IC and the C_{IN}
2. The output capacitor value (C_{OUT1}) and the output current (I_{OUT})



Timing Chart: Starting-up with Power Supply

Undervoltage Lockout (UVLO) Circuit

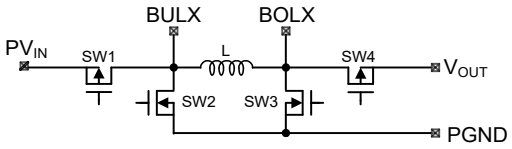
If the V_{IN} becomes lower than the UVLO detector threshold (V_{UVLOF}), the UVLO circuit starts to operate, V_{REF} stops, and PMOS and NMOS built-in switch transistors turn “OFF”. To restart the operation, V_{IN} needs to be higher than V_{UVLOR}.

Overvoltage Protection (OVP) Circuit

If the V_{OUT} becomes higher than the OVP detector threshold (V_{OVP}), the OVP circuit starts to operate and turs off the built-in switch transistors. As a result, V_{OUT} drops according to the C_{OUT} capacitance value and the load.

Overcurrent Protection Circuit

Overcurrent protection circuit supervises the inductor peak current (the peak current flowing through PMOS Tr (SW1) in each switching cycle, and if the current exceeds the BULX current limit (I_{LXLIM}), it turns off PMOS Tr (SW1). I_{LXLIM} of the RP605x is set to Typ. 0.9 A.



Simplified Diagram of Output Switches

Thermal Shutdown Circuit

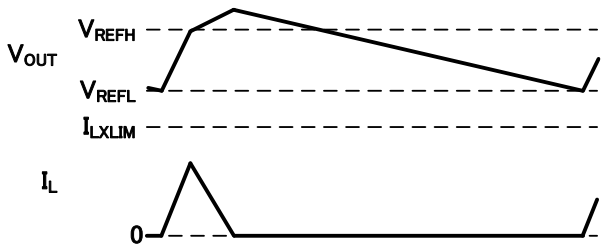
When the junction temperature exceeds the thermal shutdown detector threshold T_{TSD} (Typ.140°C), the output of the DC/DC section is shut off and self-heating is suppressed. The DC/DC restarts when the junction temperature falls below the thermal shutdown release threshold T_{TSR} (Typ.100°C), and the soft-start function is operated like as CE1’s start-up.

VFM Mode

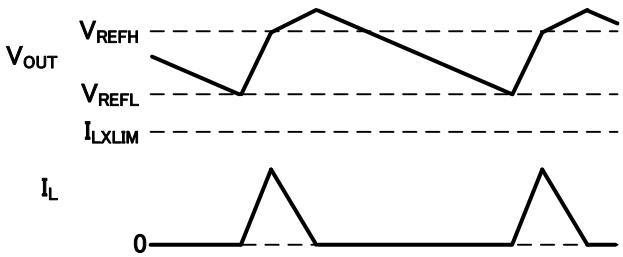
The VFM (Variable Frequency Modulation) mode is adopted as a switching method to achieve a high efficiency under light load conditions. A switching frequency varies depending on values of input voltage (V_{IN}), output voltage (V_{OUT}), and output current (I_{OUT}). Check the actual characteristics to avoid the switching noise.

A switching starts when V_{OUT} drops below the lower-limit reference voltage (V_{REFL}). When V_{OUT} exceeds the upper-limit reference voltage (V_{REFH}), a constant voltage is output by a hysteresis control which stops the switching.

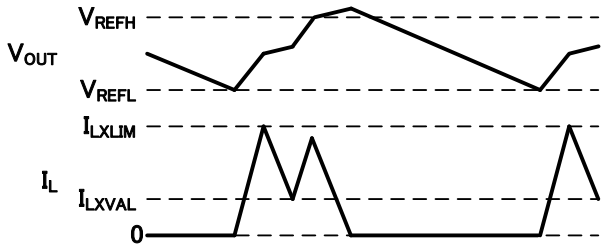
In order to operate within the rated characteristic of inductor and avoid the deteriorated band frequency of DC superimposed characteristics, when the inductor current (I_L) exceeds LX current limit (I_{LXLIM}), the operation shifts to off-cycle. And when I_L drops below the valley current limit (I_{LXVAL}), the operation shifts to on-cycle.



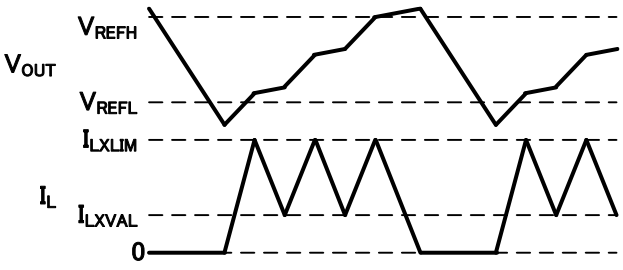
No Load



Light Load



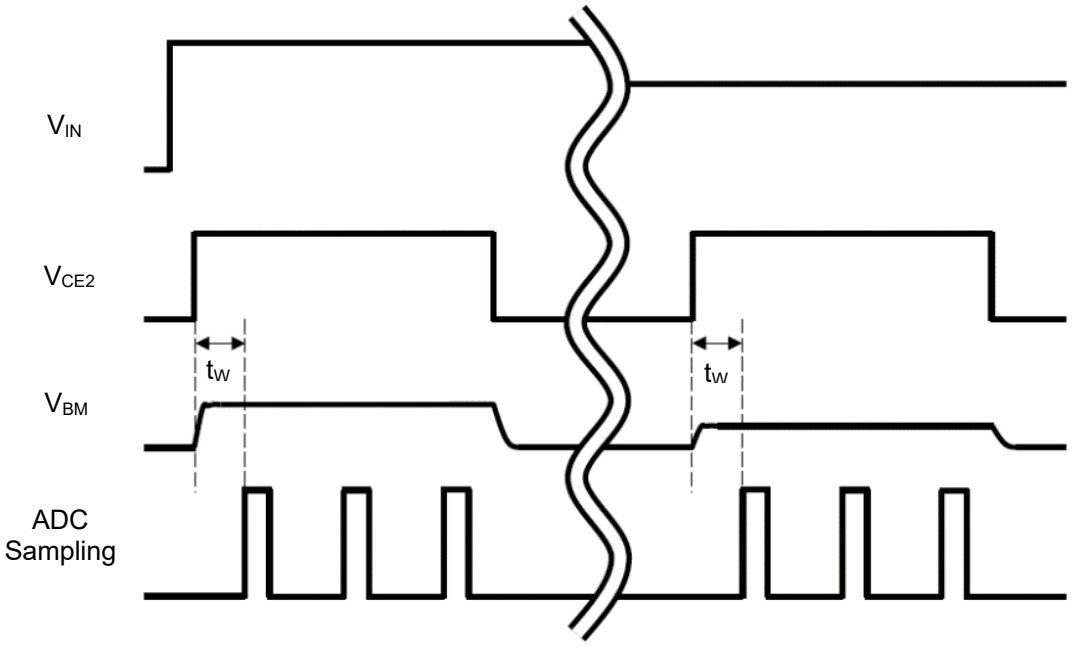
Medium Load



Heavy Load

Battery Monitor Section

Timing Chart of Typical Application Circuit



RP605x Timing Chart of Typical Application Circuit

The RP605x can monitor the battery voltage by connecting BM pin with ADC input pin in MCU. The RP605x allows the CE2 pin to control the battery monitor's start and stop according to the sampling cycle from the ADC, reducing the power consumption of the entire system.

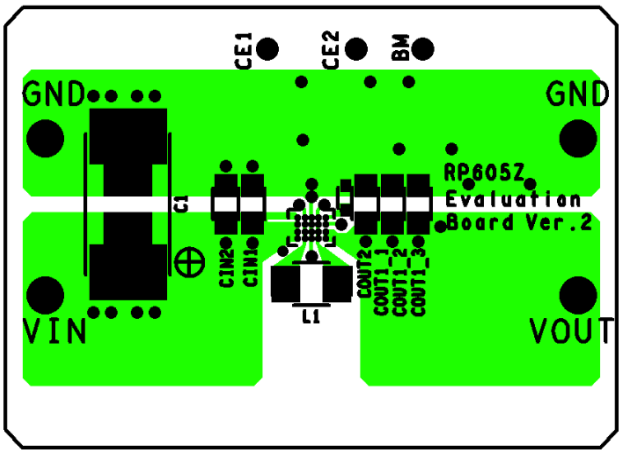
During the battery voltage monitoring, waiting time (tw) is needed, recommended tw ≥ 10ms, for the CE2 pin to gain stable V_{BM}.

APPLICATION INFORMATION

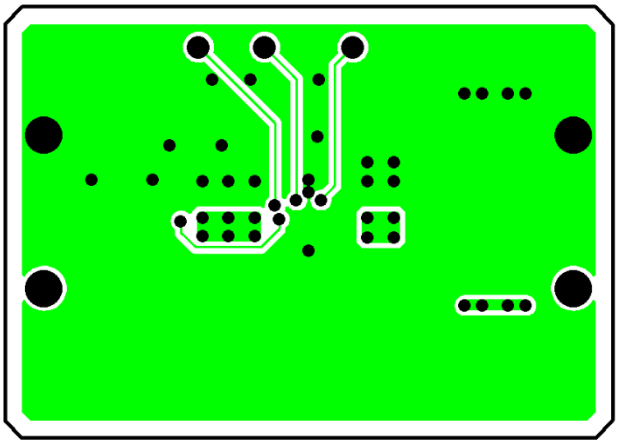
PCB Layout

RP605Z (Package: WLCSP-20-P3) PCB Layout

Top Layer

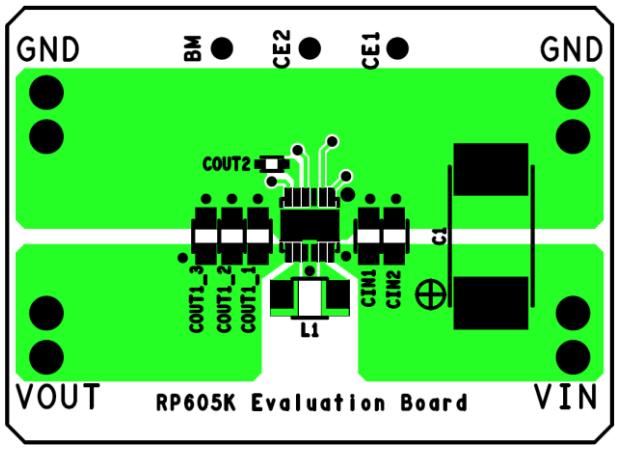


Bottom Layer

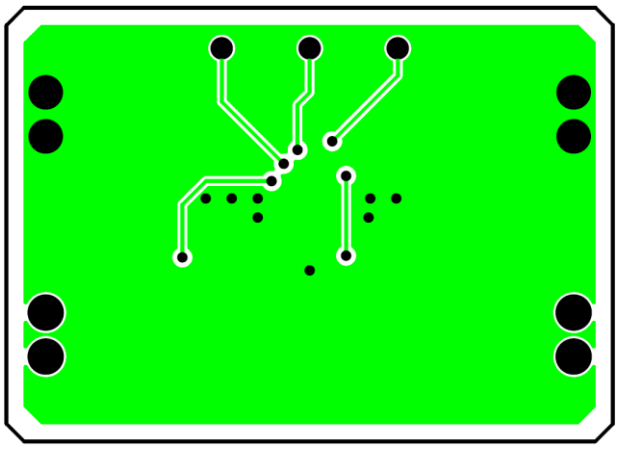


RP605K (Package: DFN(PL)2730-12) PCB Layout

Top Layer



Bottom Layer



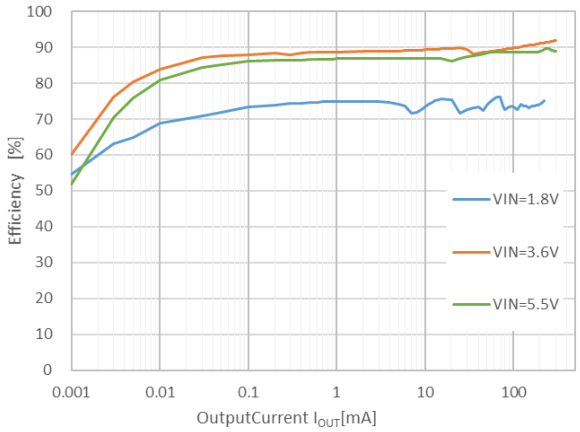
TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

DC/DC Section

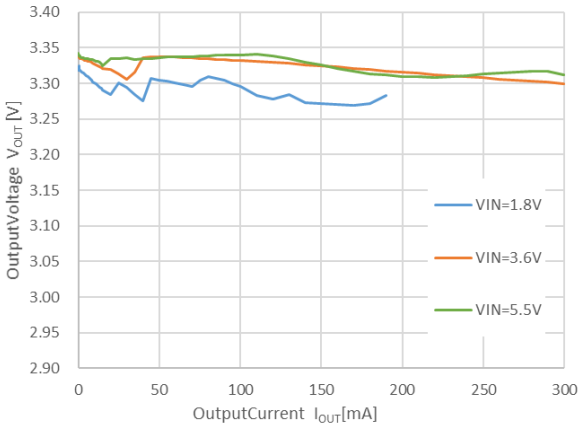
1) Efficiency vs. Output Current

RP605x33xx, Ta = 25°C



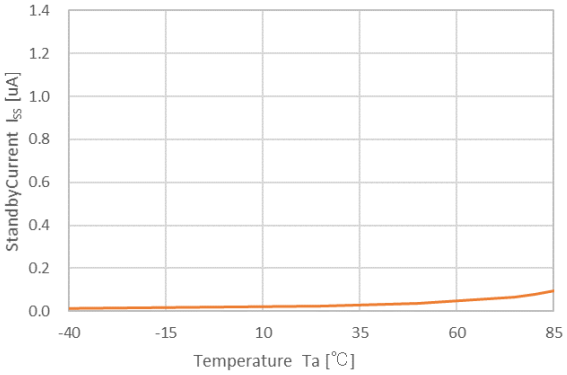
2) Output Voltage vs. Output Current

RP605x33xx, Ta = 25°C



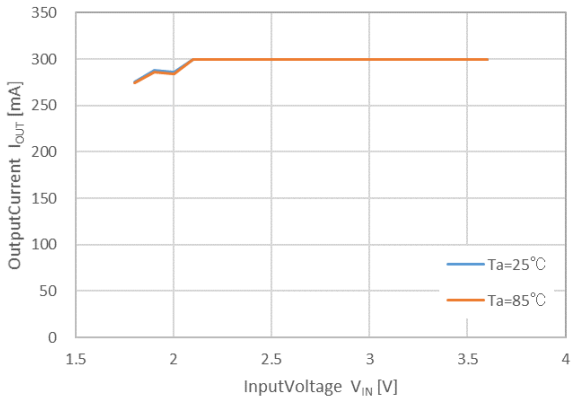
3) Standby Current vs. Temperature

RP605x33xx, V_{IN} = 5.5V

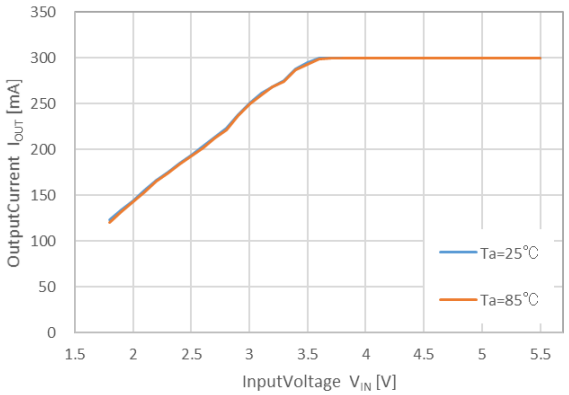


4) Output Current vs. Input Voltage

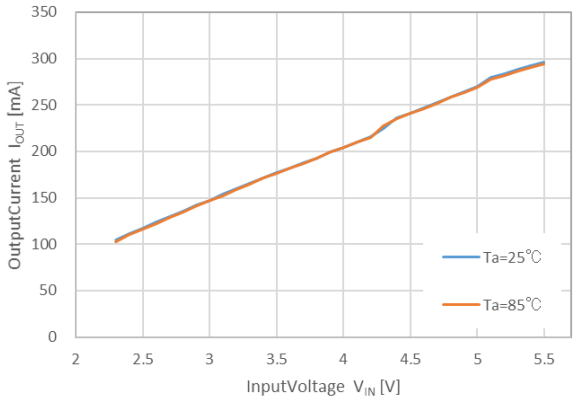
RP605x16xx, V_{IN} = 1.8 to 3.6V, I_{OUT} = (I_{IN} = 300mA)



RP605x33xx, V_{IN} = 1.8 to 5.5V, I_{OUT} = (I_{IN} = 300mA)

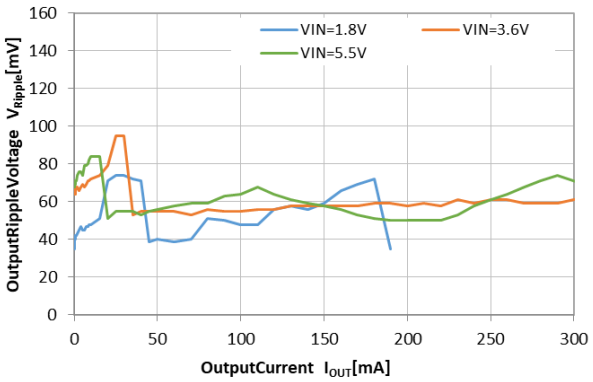


RP605x52xx, V_{IN} = 2.3 to 5.5V, I_{OUT} = (I_{IN} = 300mA)



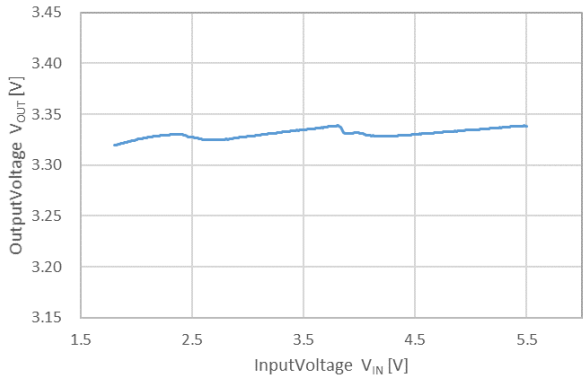
5) Output Ripple vs. Output Current

RP605x33xx, Ta = 25°C

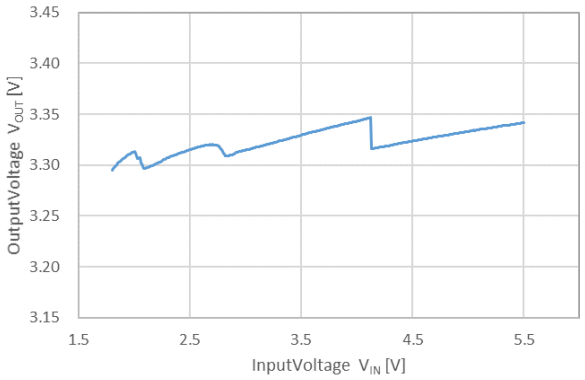


6) Output Voltage vs. Input Voltage

RP605x33xx, I_{OUT} = 1mA, Ta = 25°C



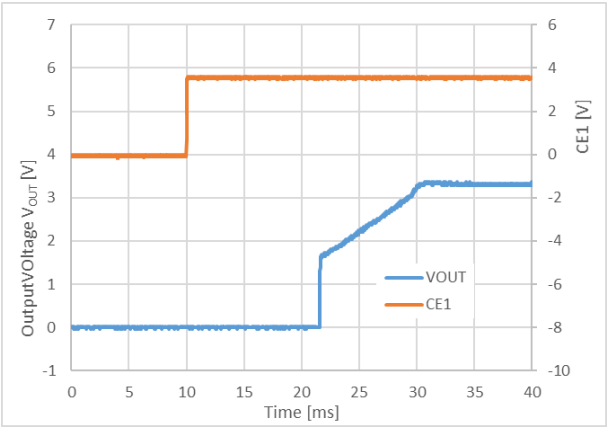
RP605x33xx, I_{OUT} = 100mA, Ta = 25°C



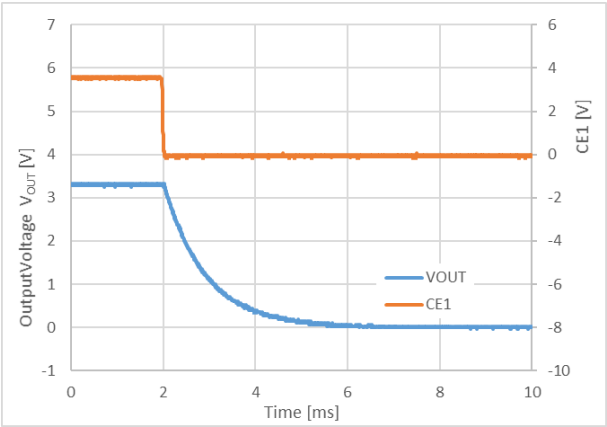
7) Starting-up/ Shutting-down Waveform with CE1 Pin

RP605x33xB, V_{IN} = 3.6V, CE1 = 0V ↔ 3.6V, I_{OUT} = 0mA, Ta = 25°C

(at Starting-up)

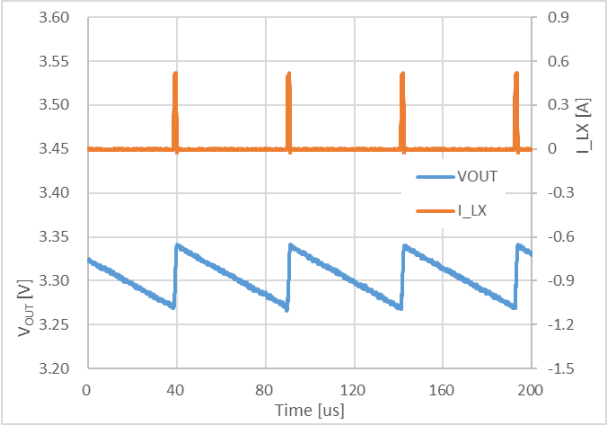


(at Shutting-down)

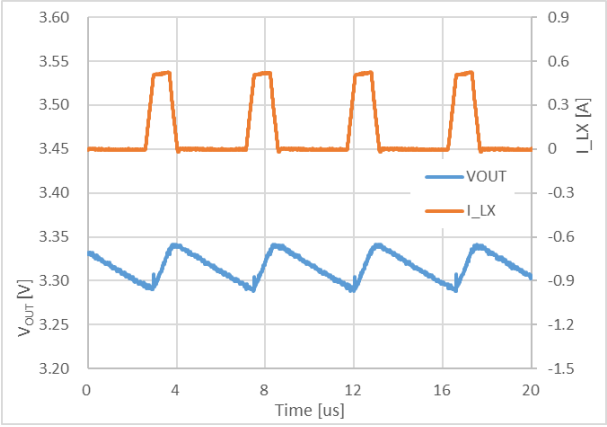


8) VOUT Pin Waveform

RP605x33xx, V_{IN} = 3.6V, I_{OUT} = 10mA, Ta = 25°C

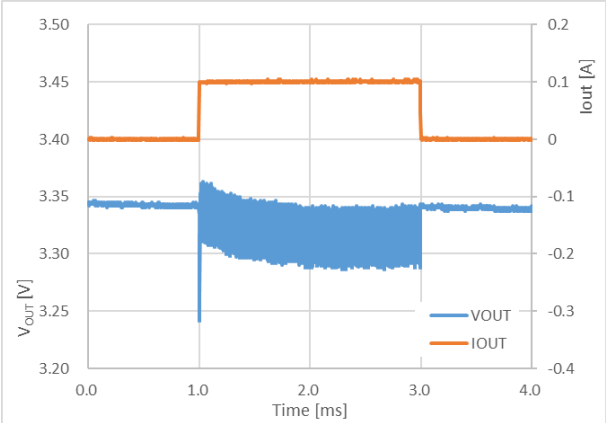


RP605x33xx, V_{IN} = 3.6V, I_{OUT} = 100mA, Ta = 25°C



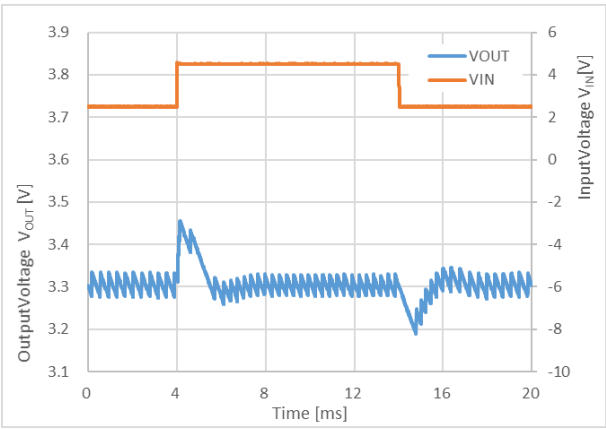
9) Load Transient Response

RP605x33xx, V_{IN} = 3.6V, I_{OUT} = 0.01mA ↔ 100mA, Ta = 25°C

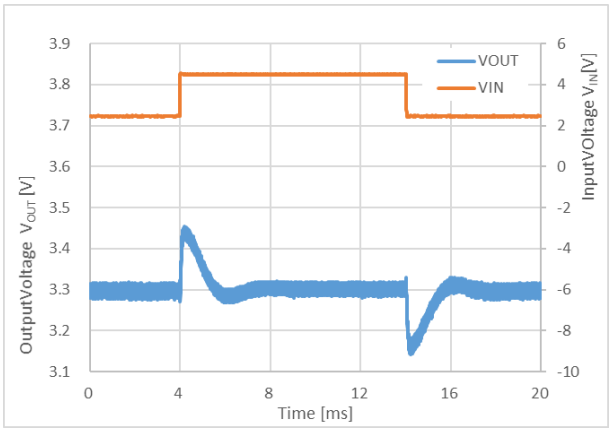


10) Input Transient Response

RP605x33xx, V_{IN} = 2.5V ↔ 4.5V, I_{OUT} = 1mA, Ta = 25°C

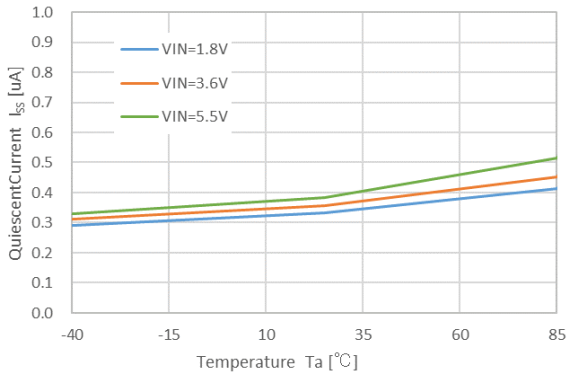


RP605x33xx, V_{IN} = 2.5V ↔ 4.5V, I_{OUT} = 100mA, Ta = 25°C



11) Supply Current vs. Temperature

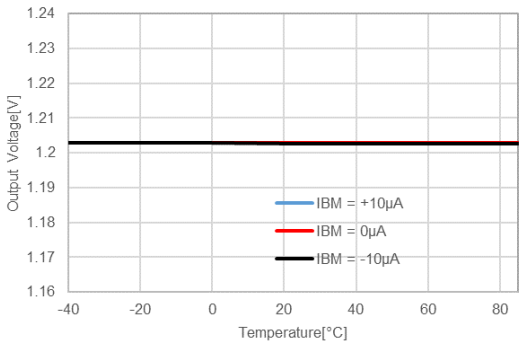
RP605x33xx



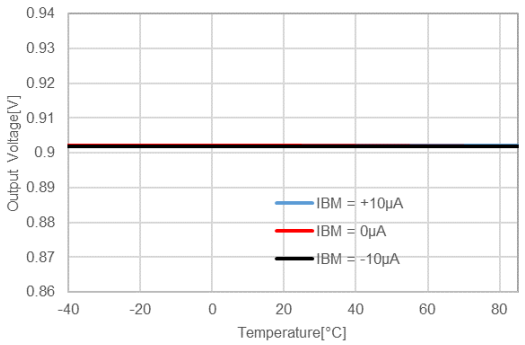
Battery Monitor Section

12) Output Voltage vs. Temperature

RP605xxx3x, V_{IN} = 3.6V

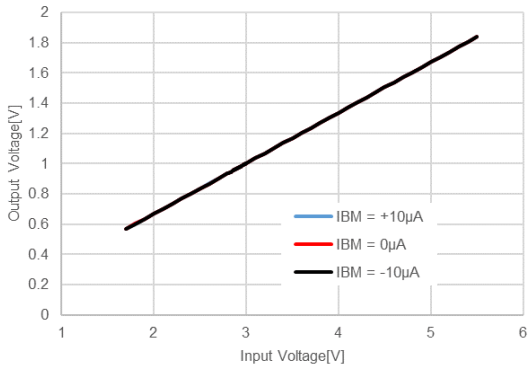


RP605xxx4x, V_{IN} = 3.6V

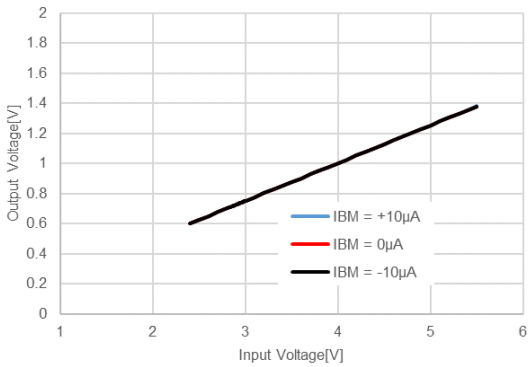


13) Output Voltage vs. Input Voltage

RP605xxx3x, V_{IN} = 5.5V to Minimum Voltage, Ta = 25°C

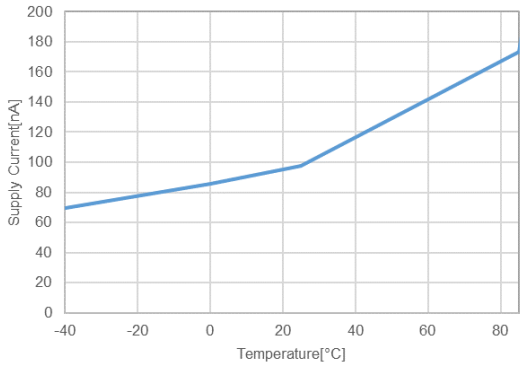


RP605xxx4x, V_{IN} = 5.5V to Minimum Voltage, Ta = 25°C

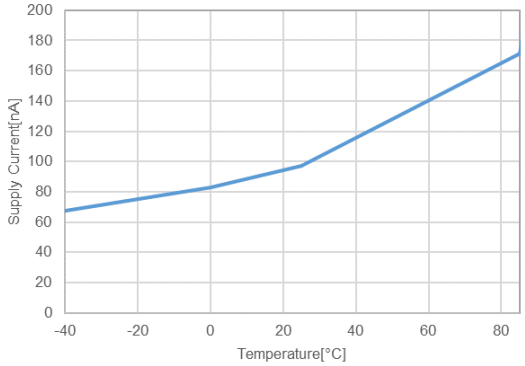


14) Supply Current vs. Temperature

RP605xxx3x, V_{IN} = 3.6V

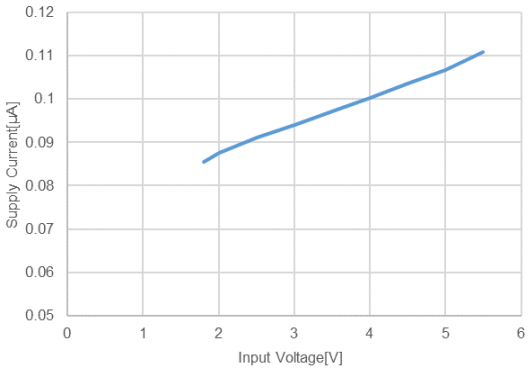


RP605xxx4x, V_{IN} = 3.6V

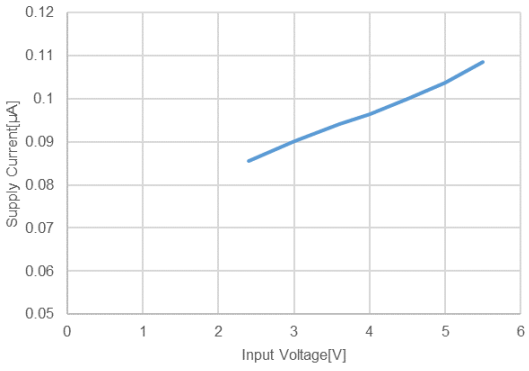


15) Supply Current vs. Input Voltage

RP605xxx3x, V_{IN} = 5.5V to Minimum Voltage, Ta = 25°C

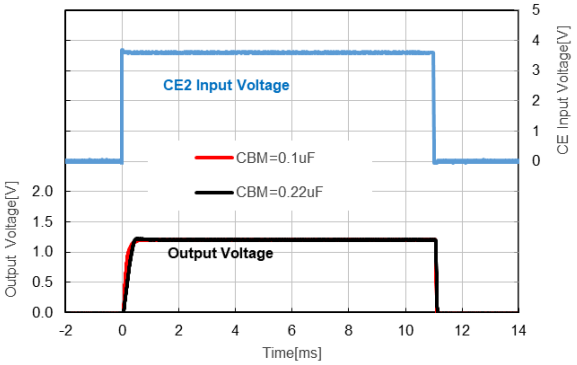


RP605xxx4x, V_{IN} = 5.5V to Minimum Voltage, Ta = 25°C

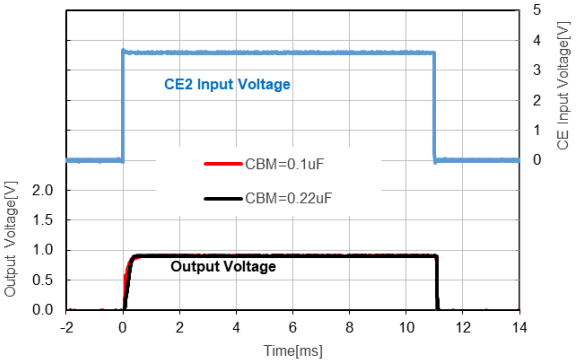


16) Starting-up/ Shutting-down Waveform with CE2 Pin

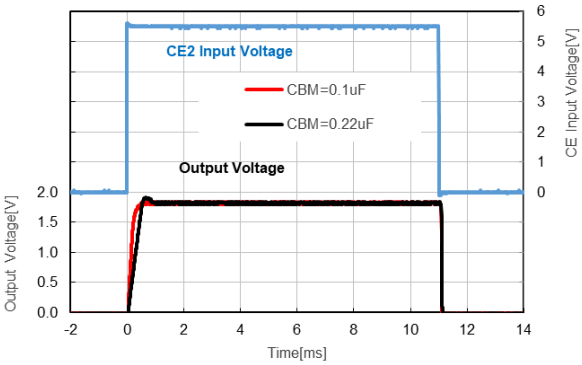
RP605xxx3x, V_{IN} = 3.6V, Ta = 25°C



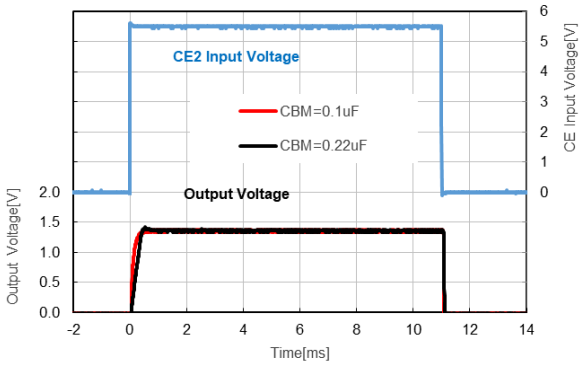
RP605xxx4x, V_{IN} = 3.6V, Ta = 25°C



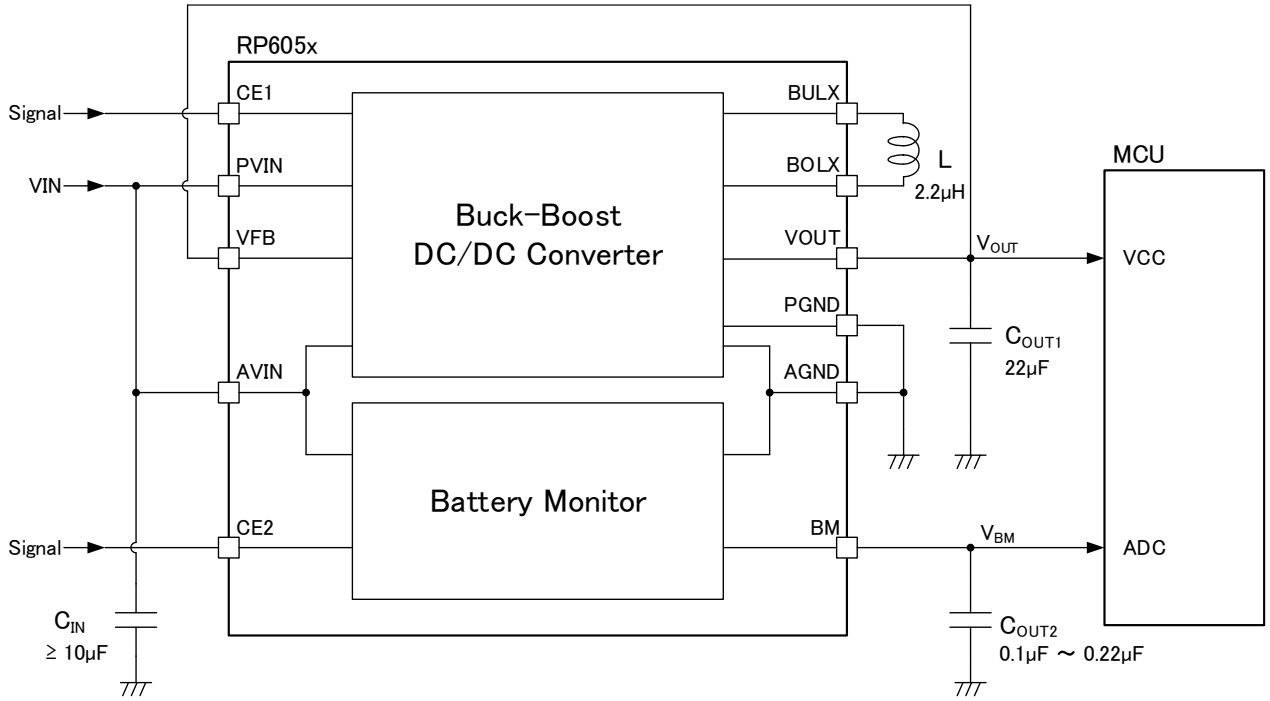
RP605xxx3x, V_{IN} = 5.5V, Ta = 25°C



RP605xxx4x, V_{IN} = 5.5V, Ta = 25°C



Test Circuit



Test Circuit for Typical Characteristics

Measurement Components

Symbol	Capacitance	Manufacture	Parts number
C_{IN}	10µF	Murata	GRM155R60J106M
C_{OUT1}	22µF	Taiyo Yuden	JMK107BBJ226MA
C_{OUT2}	0.1µF	Murata	GRM155R61A104K
L	2.2µH	TDK	MLP2520H2R2ST0S1

Measurement Components for Typical Characteristics

PD-WLCSP-20-P3-(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.

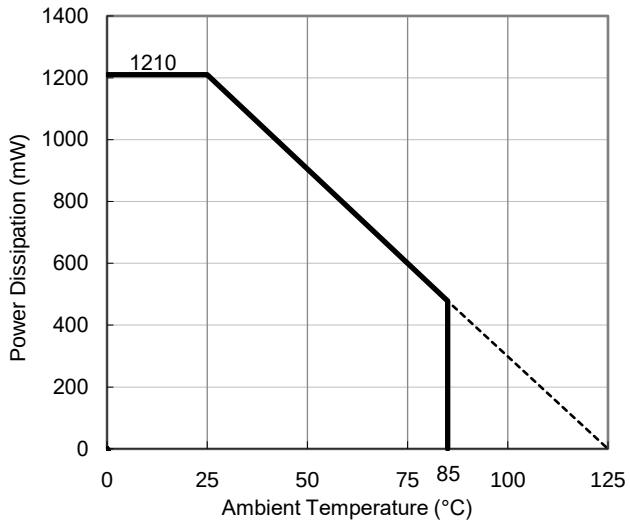
Measurement Conditions

Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	101.5 mm x 114.5 mm x 1.6 mm
Copper Ratio	Outer Layer (First Layer): 10% Inner Layers (Second and Third Layers): 99.5 x 99.5mm 100% Outer Layer (Fourth Layer): 10%

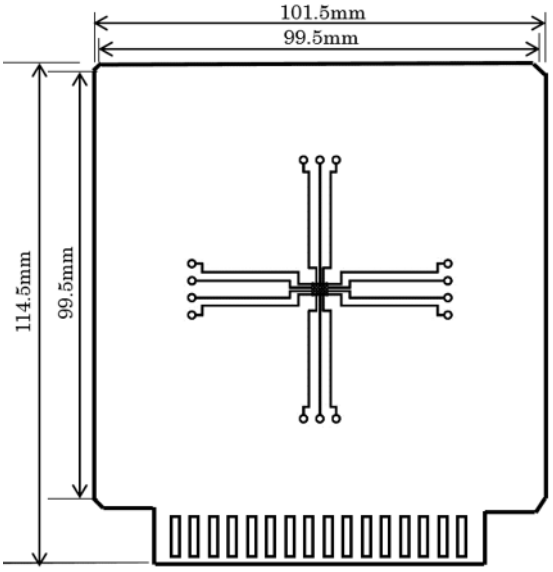
Measurement Result (Ta = 25°C, Tjmax = 125°C)

Item	Measurement Result
Power Dissipation	1210 mW
Thermal Resistance (θja)	θja = 82°C/W

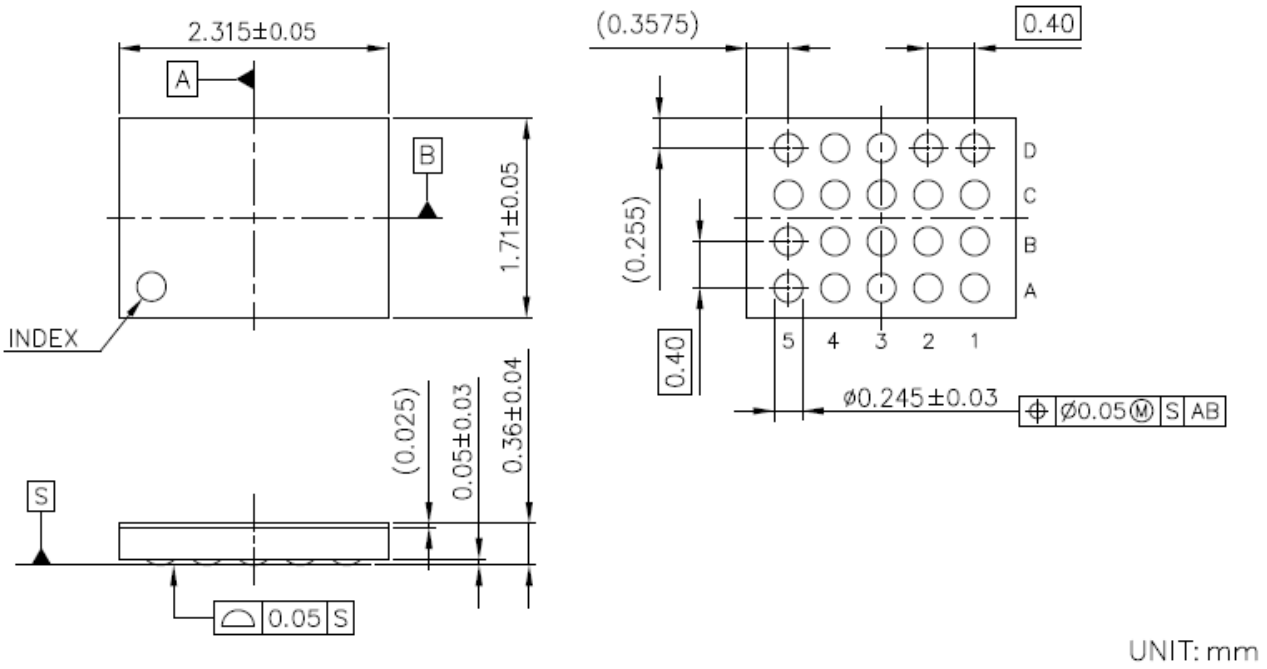
θja: Junction-to-Ambient Thermal Resistance



Power Dissipation vs. Ambient Temperature

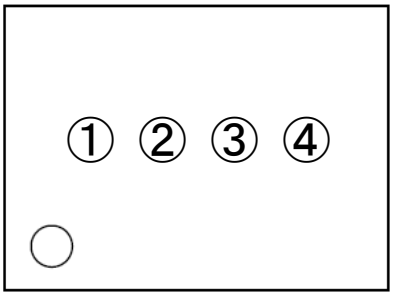


Measurement Board Pattern



WLCSP-20-P3 Package Dimensions

①②: Product Code ⋯ Refer to *Part Marking List*
③④: Lot Number ⋯ Alphanumeric Serial Number



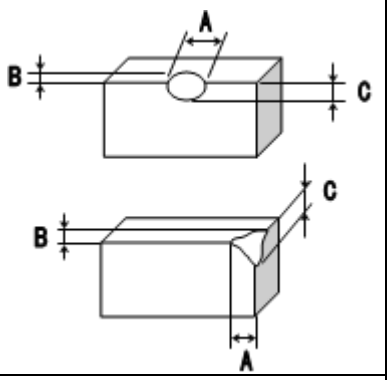
WLCSP-20-P3 Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

RP605Z Part Marking List

Product Name	① ②	V_{OUT}
RP605Z163A	N A	1.6 V
RP605Z183A	N C	1.8 V
RP605Z203A	N E	2.0 V
RP605Z243A	N F	2.4 V
RP605Z253A	N G	2.5 V
RP605Z283A	N H	2.8 V
RP605Z303A	N J	3.0 V
RP605Z313A	N K	3.1 V
RP605Z333A	N L	3.3 V
RP605Z363A	N N	3.6 V
RP605Z403A	N P	4.0 V
RP605Z503A	P K	5.0 V
RP605Z523A	N R	5.2 V
RP605Z164A	N T	1.6 V
RP605Z184A	N U	1.8 V
RP605Z204A	N V	2.0 V
RP605Z244A	N X	2.4 V
RP605Z254A	N Y	2.5 V
RP605Z284A	P A	2.8 V
RP605Z304A	P C	3.0 V
RP605Z314A	P E	3.1 V
RP605Z334A	P F	3.3 V
RP605Z364A	P G	3.6 V
RP605Z404A	P H	4.0 V
RP605Z504A	P L	5.0 V
RP605Z524A	P J	5.2 V

Product Name	① ②	V_{OUT}
RP605Z163B	R A	1.6 V
RP605Z183B	R C	1.8 V
RP605Z203B	R E	2.0 V
RP605Z243B	R F	2.4 V
RP605Z253B	R G	2.5 V
RP605Z283B	R H	2.8 V
RP605Z303B	R J	3.0 V
RP605Z313B	R K	3.1 V
RP605Z333B	R L	3.3 V
RP605Z363B	R N	3.6 V
RP605Z403B	R P	4.0 V
RP605Z503B	T L	5.0 V
RP605Z523B	R R	5.2 V
RP605Z164B	R T	1.6 V
RP605Z184B	R U	1.8 V
RP605Z204B	R V	2.0 V
RP605Z244B	R X	2.4 V
RP605Z254B	R Y	2.5 V
RP605Z284B	T A	2.8 V
RP605Z304B	T C	3.0 V
RP605Z314B	T E	3.1 V
RP605Z334B	T F	3.3 V
RP605Z364B	T G	3.6 V
RP605Z404B	T H	4.0 V
RP605Z504B	T K	5.0 V
RP605Z524B	T J	5.2 V

No.	Inspection Items	Inspection Criteria	Figure
1	Package chipping	A≥0.2mm is rejected B≥0.2mm is rejected C≥0.2mm is rejected And, Package chipping to Si surface and to bump is rejected.	
2	Si surface chipping	A≥0.2mm is rejected B≥0.2mm is rejected C≥0.2mm is rejected But, even if A≥0.2mm, B≤0.1mm is acceptable.	
3	No bump	No bump is rejected.	
4	Marking miss	To reject incorrect marking, such as another product name marking or another lot No. marking.	
5	No marking	To reject no marking on the package.	
6	Reverse direction of marking	To reject reverse direction of marking character.	
7	Defective marking	To reject unreadable marking. (Microscope: X15/ White LED/ Viewed from vertical direction)	
8	Scratch	To reject unreadable marking character by scratch. (Microscope: X15/ White LED/ Viewed from vertical direction)	
9	Stain and Foreign material	To reject unreadable marking character by stain and foreign material. (Microscope: X15/ White LED/ Viewed from vertical direction)	

PD-DFN(PL)2730-12-(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.

Measurement Conditions

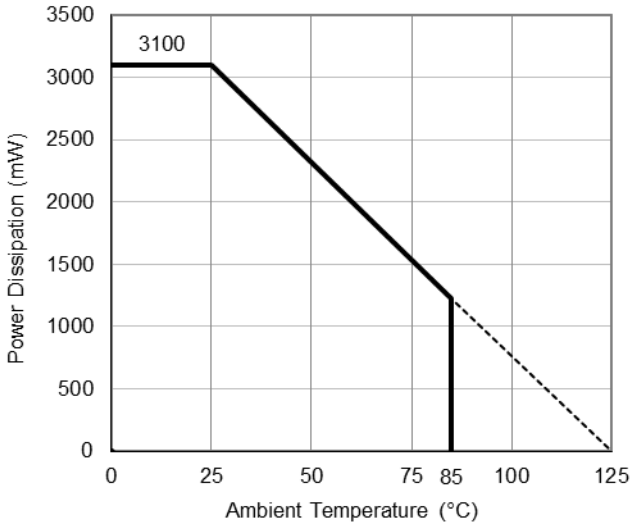
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 32 pcs

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

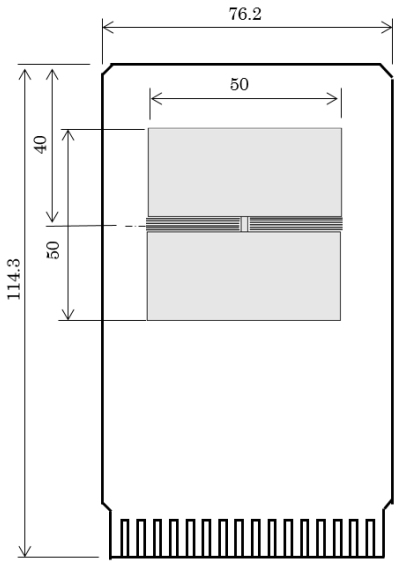
Item	Measurement Result
Power Dissipation	3100 mW
Thermal Resistance (θja)	θja = 32°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 8°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter

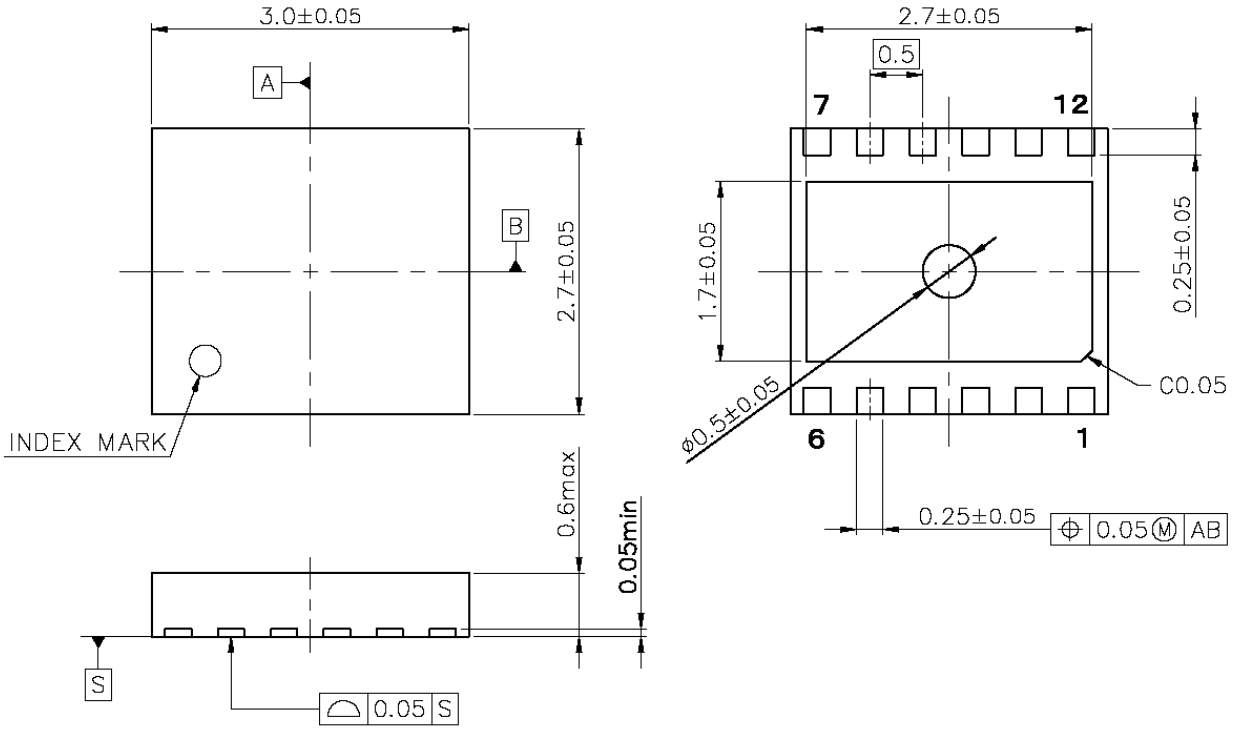


Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

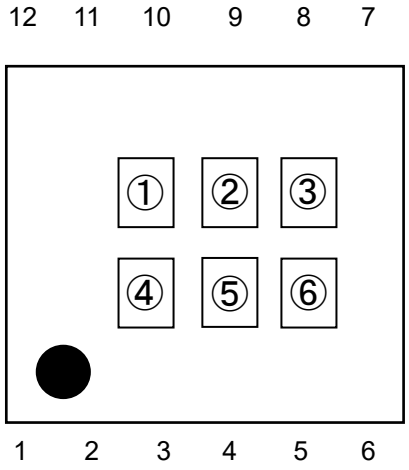
DM-DFN(PL)2730-12-JE-B



DFN(PL)2730-12 Package Dimensions (Unit: mm)

①②③④: Product Code ⋯ Refer to *Part Marking List*

⑤⑥: Lot Number ⋯ Alphanumeric Serial Number



DFN(PL)2730-12 Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

RP605K Part Marking List

Product Name	①②③④	V_{OUT}
RP605K163A	GR00	1.6 V
RP605K183A	GR01	1.8 V
RP605K203A	GR02	2.0 V
RP605K243A	GR03	2.4 V
RP605K253A	GR04	2.5 V
RP605K283A	GR05	2.8 V
RP605K303A	GR06	3.0 V
RP605K313A	GR07	3.1 V
RP605K333A	GR08	3.3 V
RP605K363A	GR09	3.6 V
RP605K403A	GR10	4.0 V
RP605K503A	GR12	5.0 V
RP605K523A	GR11	5.2 V
RP605K164A	GS00	1.6 V
RP605K184A	GS01	1.8 V
RP605K204A	GS02	2.0 V
RP605K244A	GS03	2.4 V
RP605K254A	GS04	2.5 V
RP605K284A	GS05	2.8 V
RP605K304A	GS06	3.0 V
RP605K314A	GS07	3.1 V
RP605K334A	GS08	3.3 V
RP605K364A	GS09	3.6 V
RP605K404A	GS10	4.0 V
RP605K504A	GS12	5.0 V
RP605K524A	GS11	5.2 V

Product Name	①②③④	V_{OUT}
RP605K163B	GT00	1.6 V
RP605K183B	GT01	1.8 V
RP605K203B	GT02	2.0 V
RP605K243B	GT03	2.4 V
RP605K253B	GT04	2.5 V
RP605K283B	GT05	2.8 V
RP605K303B	GT06	3.0 V
RP605K313B	GT07	3.1 V
RP605K333B	GT08	3.3 V
RP605K363B	GT09	3.6 V
RP605K403B	GT10	4.0 V
RP605K503B	GT12	5.0 V
RP605K523B	GT11	5.2 V
RP605K164B	GU00	1.6 V
RP605K184B	GU01	1.8 V
RP605K204B	GU02	2.0 V
RP605K244B	GU03	2.4 V
RP605K254B	GU04	2.5 V
RP605K284B	GU05	2.8 V
RP605K304B	GU06	3.0 V
RP605K314B	GU07	3.1 V
RP605K334B	GU08	3.3 V
RP605K364B	GU09	3.6 V
RP605K404B	GU10	4.0 V
RP605K504B	GU12	5.0 V
RP605K524B	GU11	5.2 V

1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
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.

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Nisshinbo Micro Devices Inc.

Official website
https://www.nisshinbo-microdevices.co.jp/en/

Purchase information
https://www.nisshinbo-microdevices.co.jp/en/buy/