Overvoltage Protector IC with Reverse Current Protection

NO.EA-313-181010

OUTLINE

The R5528Z001A is a CMOS-based overvoltage protector IC with reverse current protection that use an NMOS pass transistor to achieve ultra-low on resistance (Typ. 54mΩ). Overvoltage protection threshold is as high as 6.8V±3%. Also, continuous current capability is as high as 3A.

Internally, the R5528Z001A consists of a reverse current protection circuit, a soft-start circuit, a startup debounce circuit, an undervoltage lockout (UVLO) circuit, and a thermal shutdown circuit.

The R5528Z001A is offered in a small and thin WLCSP-9-P1 package which achieves the smallest possible footprint solution on boards where area is limited.

FEATURES

- Input Voltage Range (V_{IN}) ····· 2.3V to 36V
- Output Current (I_{OUT}) ····· Max. DC 3A
- Switch On Resistance (R_{ON}) ····· 54mΩ (V_{IN} = 5.0V, I_{OUT} = 100mA)
- OVP Threshold Accuracy ····· 6.8V±3%
- PG Function
- Reverse Current Protection Circuit
- Soft-start Circuit
- Startup Debounce Circuit ····· 15ms
- Thermal Shutdown Circuit
- Package ····· WLCSP-9-P1 (1.27 mm x 1.27 mm x 0.64 mm)

APPLICATIONS

- Smartphones, Tablet PCs
- Portable devices

BLOCK DIAGRAMS

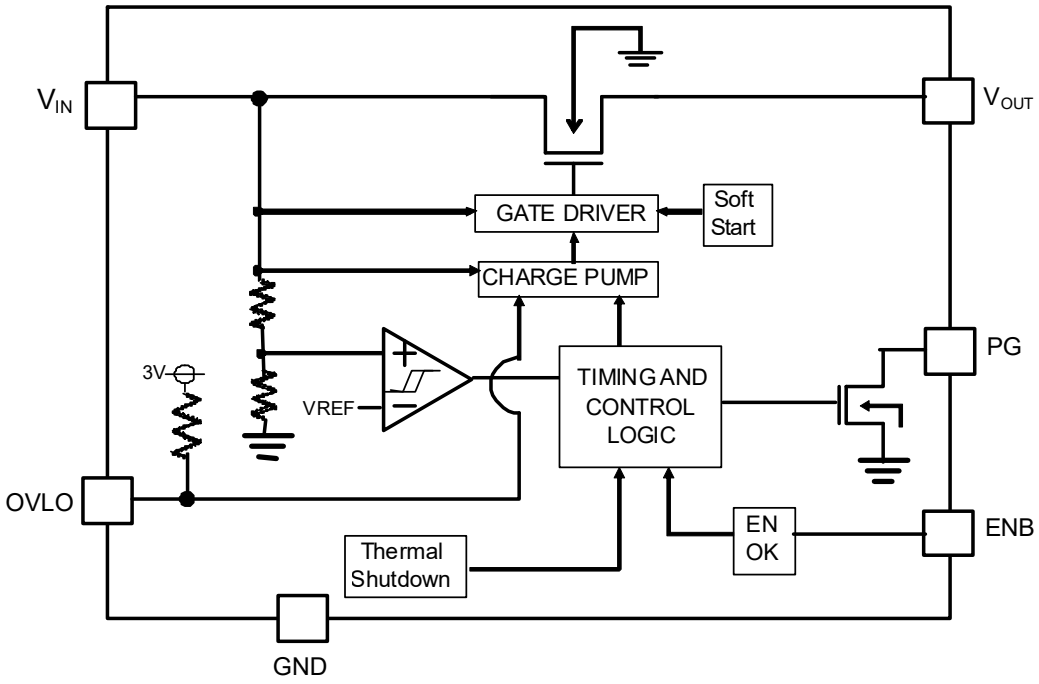


Figure 1. R5528Z001A

SELECTION GUIDE

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R5528Z001A-E2-F	WLCSP-9-P1	5,000pcs	Yes	Yes

PIN CONFIGULATIONS

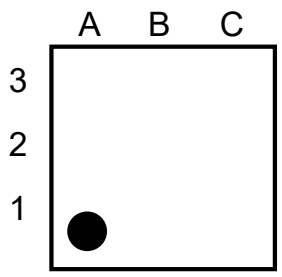


Figure 2. Top View

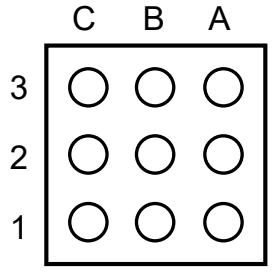


Figure 3. Bottom View

PIN DESCRIPTION

Pin No.	Symbol	Pin Description
A1	PG	Open Drain Flag Output Pin PG is driven low after input voltage is stable between minimum V_{IN} and $V_{IN\text{-}OVLO}$ after debounce (delay).
A2	OVLO	Overvoltage Lockout Input Pin Applying a voltage less than OVLO threshold (V_{OVLO_TH}) to the overvoltage lockout input pin can turn off a switch. When the overvoltage lockout input pin is Open, it outputs an OVLO open voltage (V_{OVLO_OP}).
A3	ENB	Active-Low ENB Input Pin
B1, C1	V_{IN}	Input Pin
B2	I.C	Internally Connected to Ground Unconnected or connected to GND
B3, C3	V_{OUT}	Output Pin
C2	GND	Ground Pin

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	-0.3 to 40	V
V_{OUT}	Output Voltage	-0.3 to 8.0	V
V_{ENB}	ENB Pin Input Voltage	-0.3 to 6.5	V
V_{PG}	PG Pin Voltage	-0.3 to 6.5	V
V_{OVLO}	OVLO Pin Input Voltage	-0.3 to 6.5	V
I_{PG}	PG Pin Current	14	mA
I_{OUT}	Output Current	3.0	A
P_D	Power Dissipation (High Wattage Land Pattern)*1	1190	mW
Topt	Operating Temperature Range	-40 to +85	°C
Tstg	Storage Temerature	-55 to +125	°C

*1 Refer to *POWER DISSIPATION* for detailed information.

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 (ELECTRICAL CHARACTERISTICS)

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 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

V_{IN} = 2.3V to 36V, I_{OUT} = 1mA, C_{IN} = 1μF, C_{OUT} =1μF, unless otherwise noted. Typical values are V_{IN} = 5V and Ta = 25°C.
The specifications surrounded by ☐ are guaranteed by Design Engineering at - 40ºC ≤ Ta ≤ 85ºC.

(Ta=25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage		2.3		36	V
I_{IN}	Input Supply Current	V_{ENB} = 0V, V_{IN} = 5V, I_{OUT} = 0mA		50	120	μA
I_{IN_DIS}	Input Disable Current	V_{ENB} = 0V, V_{IN} = 5V, V_{OVLO} = 0V		40	120	μA
I_{IN_Q}	Input Shutdown Current	V_{ENB} = 5V, V_{IN} = 5V, V_{OUT} = 0V		1.0	12	μA
$I_{OUT-DIS}$	Output Disable Current	V_{ENB} = 0V, V_{OUT} = 5V, V_{IN} = 5V, V_{OVLO} < $V_{OVLO-TH}$			3	μA
		V_{ENB} = 0V, V_{OUT} = 5V, V_{IN} > $V_{IN-OVLO}$				
I_{OUT-SD}	Output Shutdown Current	V_{ENB} = 5V, V_{OUT} = 5V, V_{IN} = 5V			5.5	μA
R_{ON}	On Resistance	V_{IN} = 5V, I_{OUT} = 100mA		54	100	mΩ
$V_{IN-OVLO}$	Overvoltage Protection Threshold	V_{IN} rising	6.6	6.8	7.0	V
		V_{IN} falling	6.4			V
C_{OUT}	OUT Load Capacitance				1000	μF
V_{OVLO_OP}	OVLO Open voltage	V_{ENB} = 0V, V_{IN} = 5.0V		3.0	3.6	V
R_{OVLO_PU}	OVLO Pull-up Resistance			500		kΩ
V_{OVLO_TH}	OVLO Force Off Voltage		0.6	1.0	1.4	V
V_{IH}	ENB Input High Voltage		1.4			V
V_{IL}	ENB Input Low Voltage				0.4	V
I_{ENB}	ENB Input Leakage		-1		1	μA
V_{OL}	PG Output Low Voltage	I_{SINK} = 1mA			0.4	V
V_{PG_LEAK}	PG Leakage Current	V_{IO} = 3.3V*2	-1		1	μA
t_{DEB}	IN Debounce Time	starts when 2.3V < V_{IN}(5V) < $V_{IN-OVLO}$ and ends when charge-pump is turned on*3	10	15	35	ms
t_{SS}	Soft-start Time	starts when 2.3V < V_{IN} < $V_{IN-OVLO}$ and ends when V_{OUT} = 90% of V_{IN}		30		ms
t_{ON}	Turn-on Time During Soft-start	V_{IN} = 5V, R_L = 50Ω, C_L = 10uF, starts when V_{OUT} = 20% of V_{IN} and ends when V_{OUT} = 80% of V_{IN}*3	1.5	-		ms
t_{OFF}	Turn-off Time	R_L = 50Ω, starts when V_{IN} > $V_{IN-OVLO}$ (2V/μs) and ends when V_{OUT} = 80% of V_{IN}		1.5		μs
		starts when V_{ENB} is switched from “L” to “H”, ends when V_{OUT} = 80% of V_{IN}, R_L = 50Ω		84		
T_{SHDN}	Thermal Shut Down			150		°C
T_{HYST}	Thermal Hysteresis			20		°C
V_{UVREL}	UVLO Release Voltage	V_{IN} rising		2.05	2.3	V
V_{UVHYS}	UVLO Hysteresis	V_{IN} falling		0.15		V

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition (Tj≈Ta=25ºC) except Soft-Start Time and Turn-off Time and UVLO Hysteresis.

*2 Refer to *TYPICAL APPLICATION AND TECHNICAL NOTES.*

*3 Refer to *TIMING CHART*.

TIMING CHART

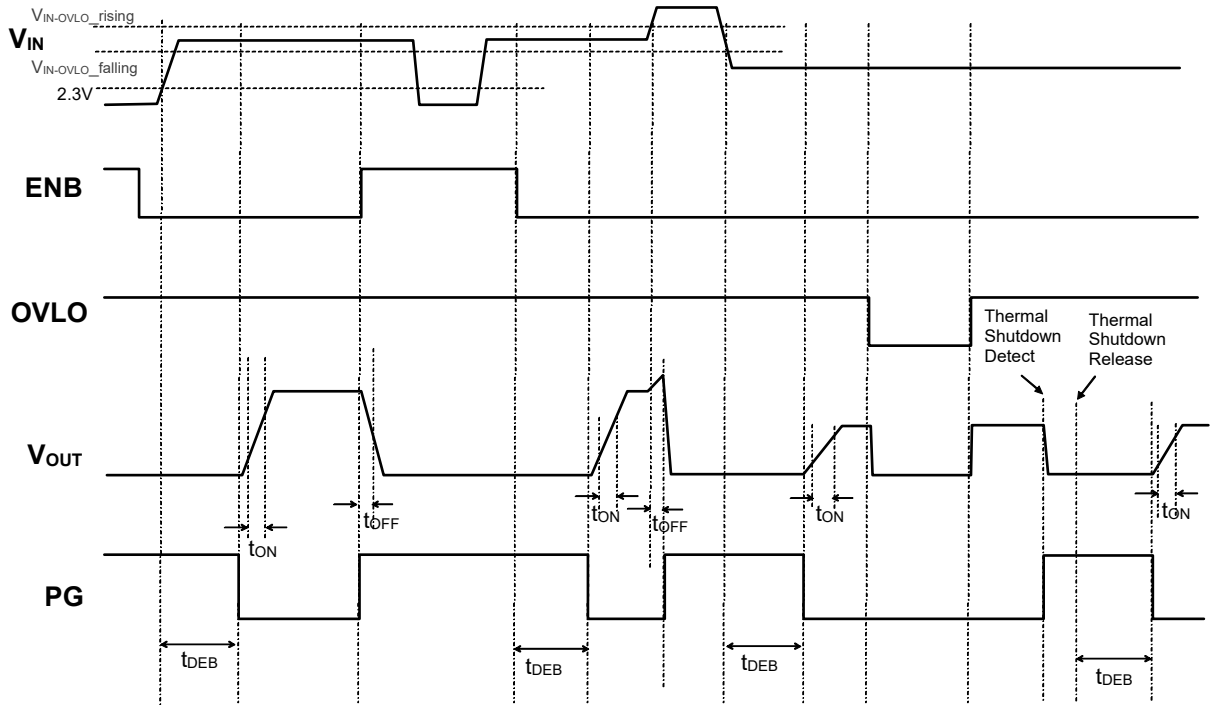


Figure 4. Timing Chart

TYPICAL APPLICATIONS AND TECHNICAL NOTES

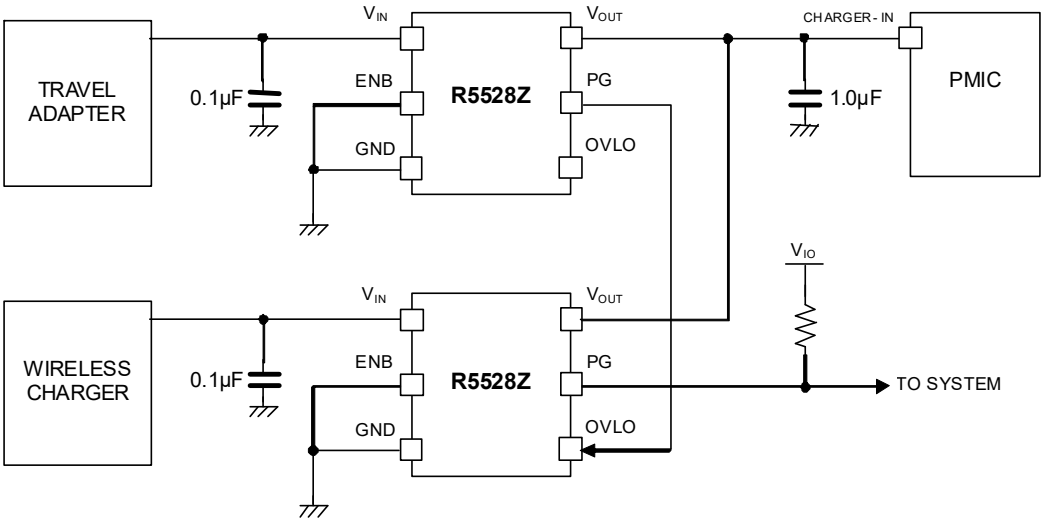


Figure 5. Typical Applications

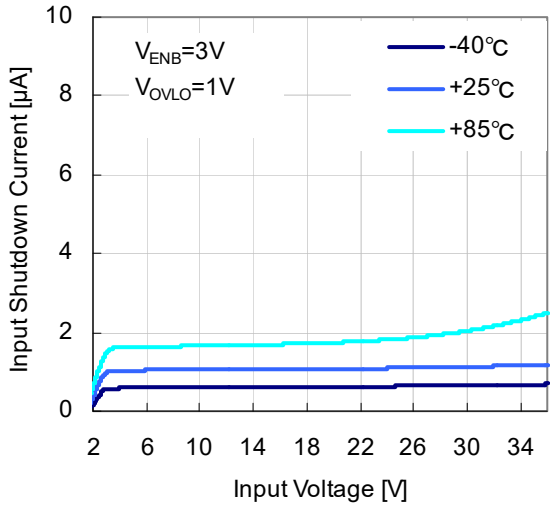
Technical Notes

The R5528Z001A does not require any bypass capacitor between V_{IN} and GND. However, connecting a 0.1µF or more capacitor between V_{IN} and GND may improve the performance against the noise.

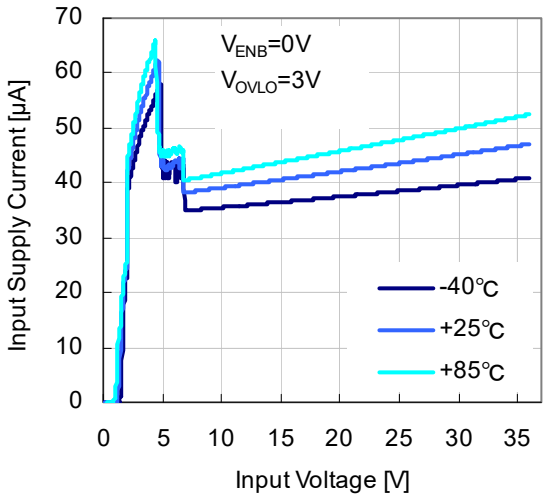
If there's any possibility of generating spike noise due to the parasitic element (inductance) of V_{IN}, connect an appropriate-sized capacitor between V_{IN} and GND.

TYPICAL CHARACTERISTIC

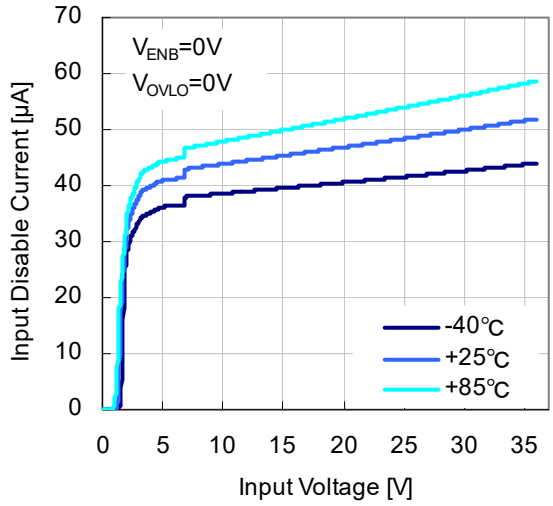
1) Input Shutdown Current VS. Input Voltage
R5528Z001A



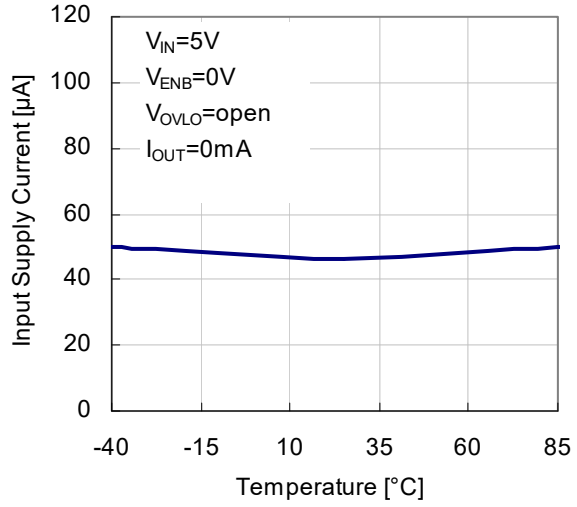
2) Input Supply Current VS. Input Voltage
R5528Z001A



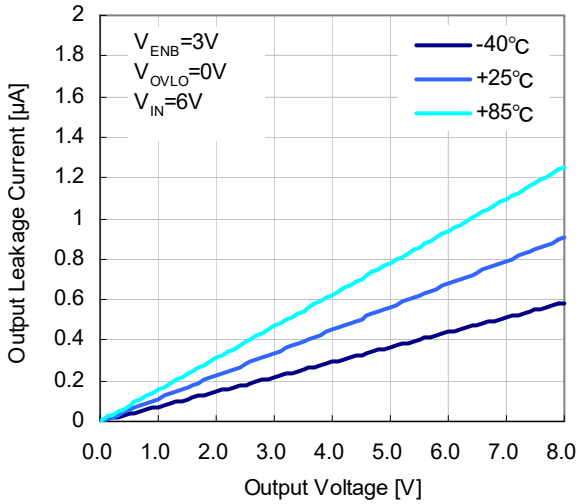
3) Input Disable Current VS. Input Voltage
R5528Z001A



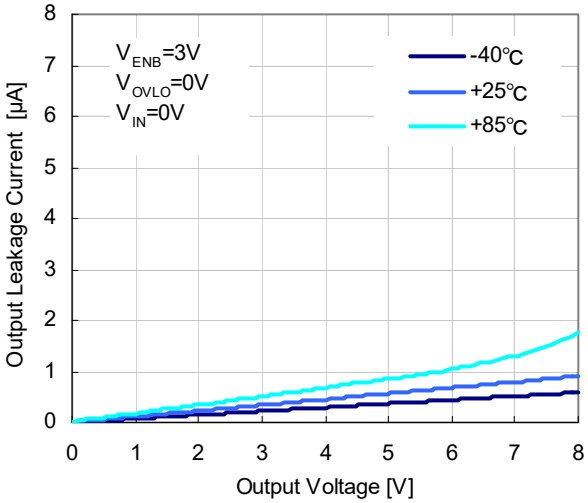
4) Input Supply Current VS. Temperature
R5528Z001A



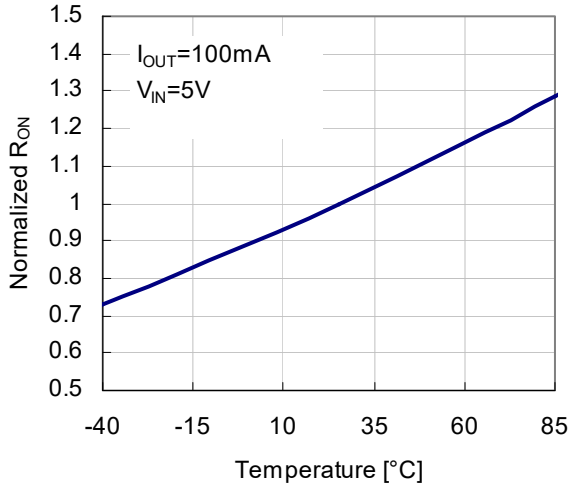
5) Output Leakage Current (6V) VS. Output Voltage
R5528Z001A



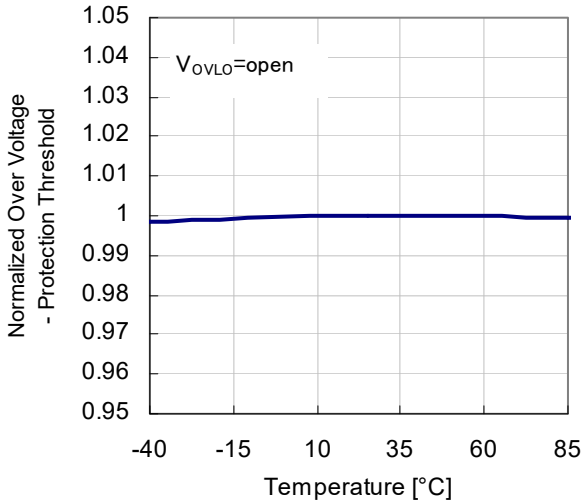
6) Output Leakage Current (0V) VS. Output Voltage
R5528Z001A



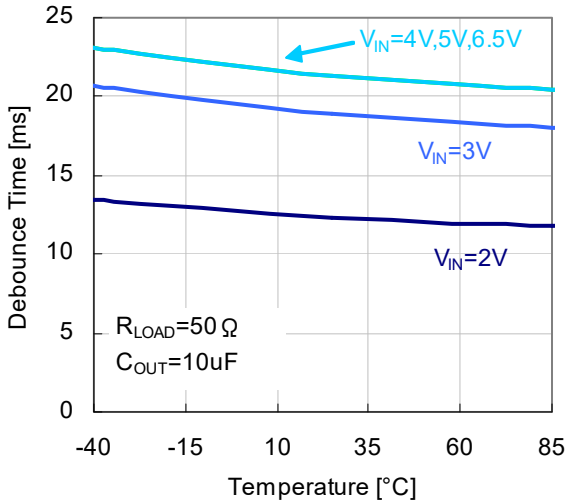
7) Normalized On-Resistance VS. Temperature
R5528Z001A



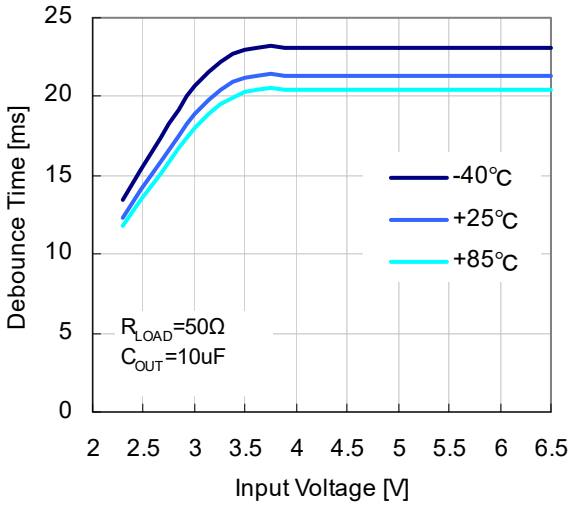
8) Normalized Overvoltage Protection Threshold (IN rising) VS. Temperature
R5528Z001A



9) Debounce Time VS. Temperature
R5528Z001A

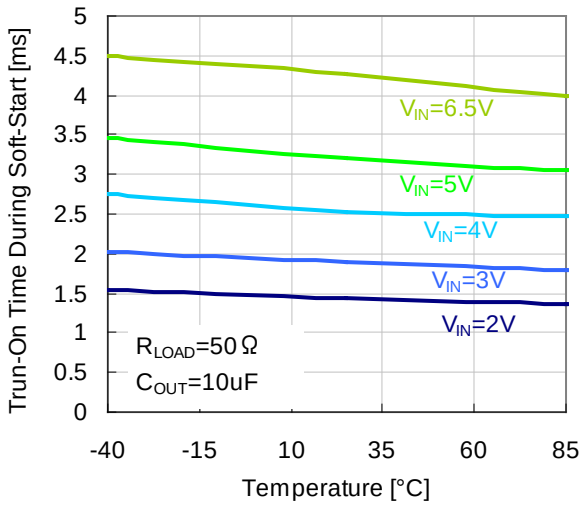


10) Debounce Time VS. Input Voltage
R5528Z001A



11) Trun-On Time VS. Temperature

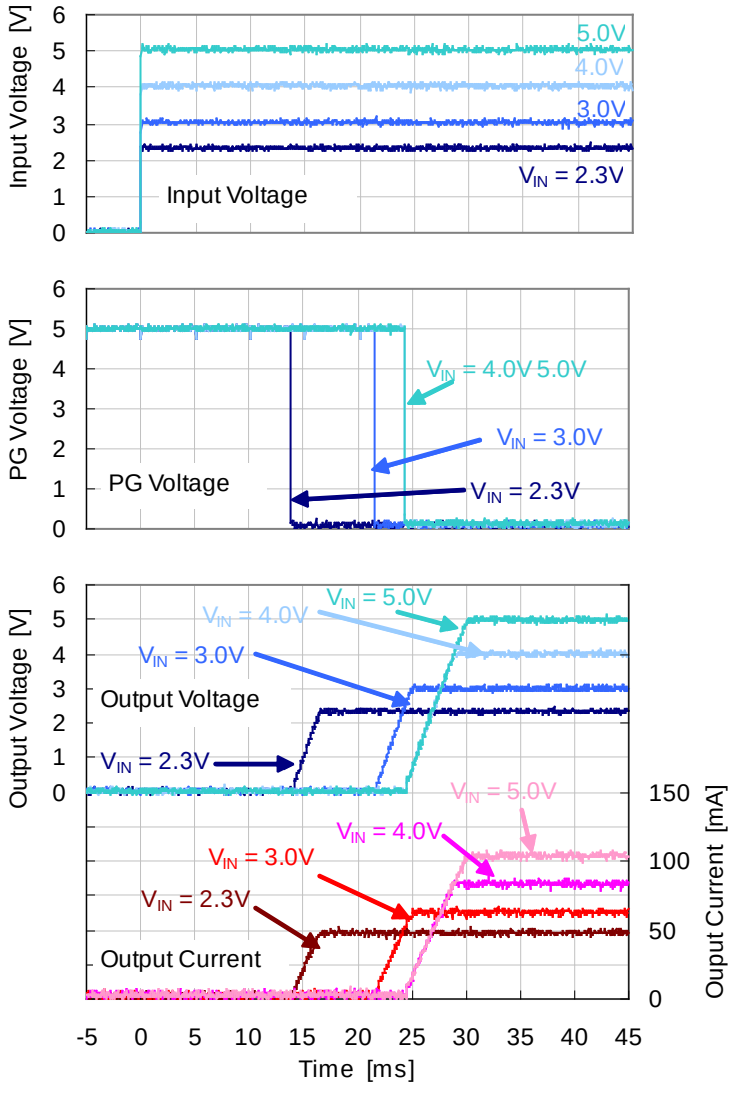
R5528Z001A



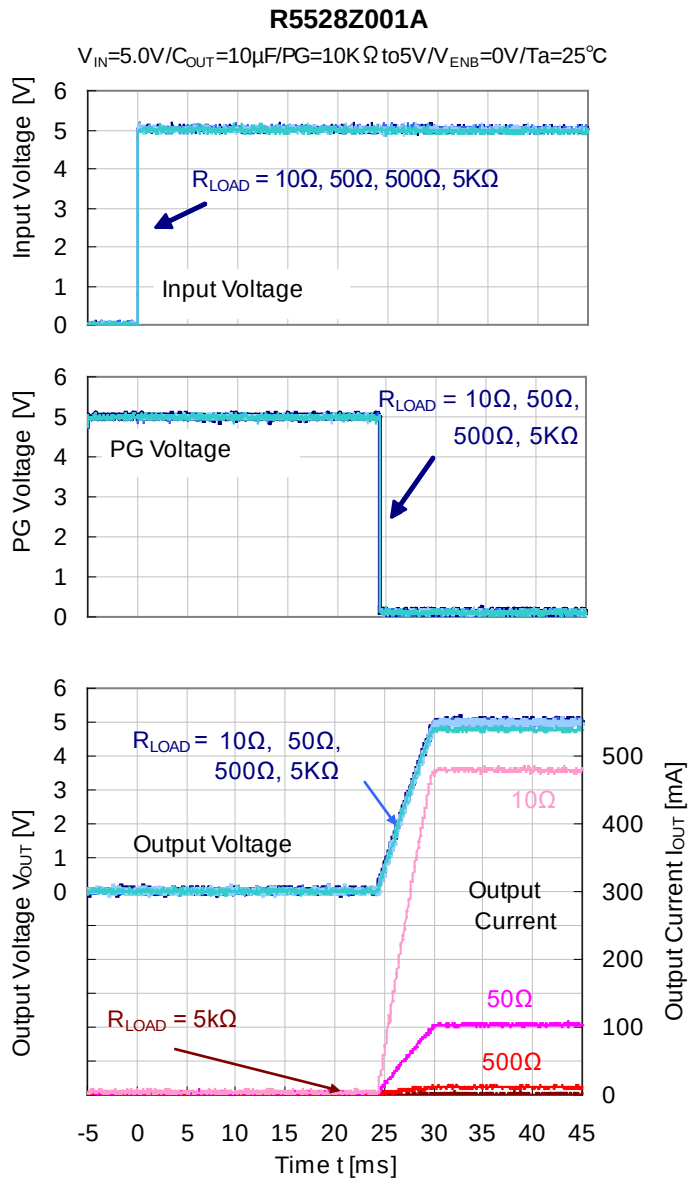
12) Power-Up Responce (V_{IN} = 2.3V/ 3.0V/ 4.0V/ 5.0V)

R5528Z001A

R_{LOAD}=50Ω/C_{OUT}=10µF/PG=10KΩ to5V/V_{ENB}=0V/Ta=25°C



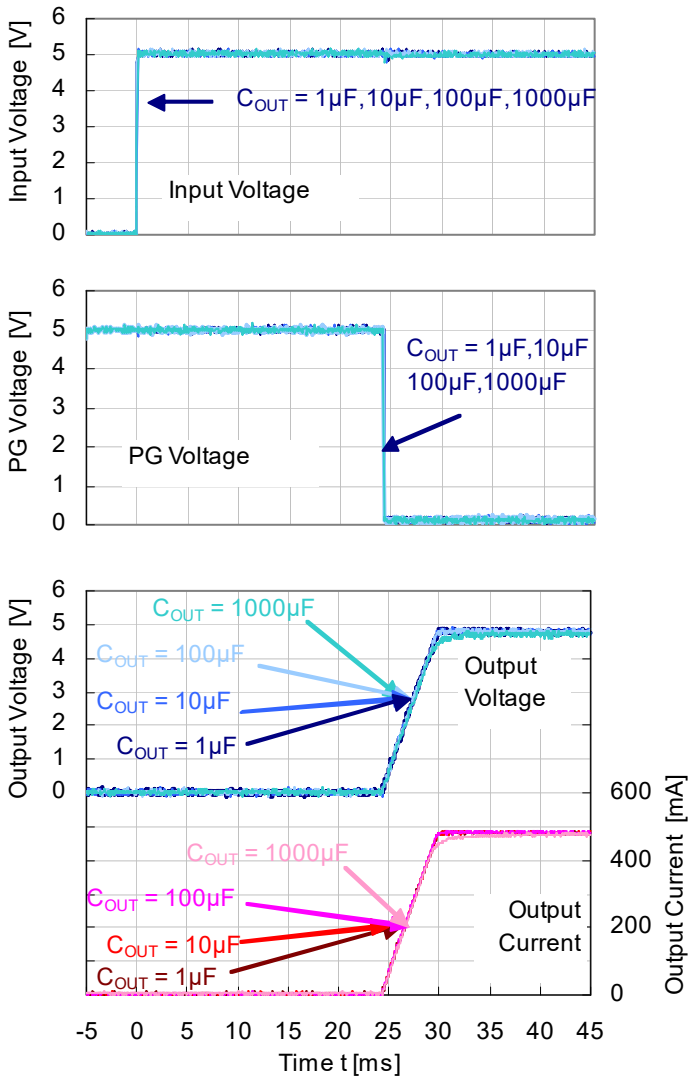
13) Power-Up Responce (R_{LOAD} = 10Ω/ 50Ω/ 500Ω/ 5KΩ)



14) Power-Up Responce (C_{OUT} = 1µF/ 10µF/ 100µF/ 1000µF)

R5528Z001A

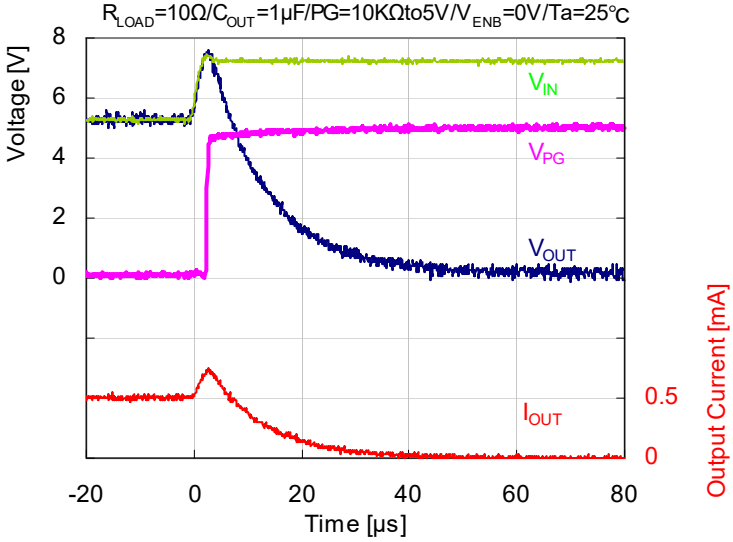
V_{IN}=5V/R_{LOAD}=10Ω/PG=10KΩ to5V/V_{ENB}=0V/Ta=25°C



15) Overvoltage Fault Response

R5528Z001A

R_{LOAD}=10Ω/C_{OUT}=1µF/PG=10KΩto5V/V_{ENB}=0V/Ta=25°C



Ver. A

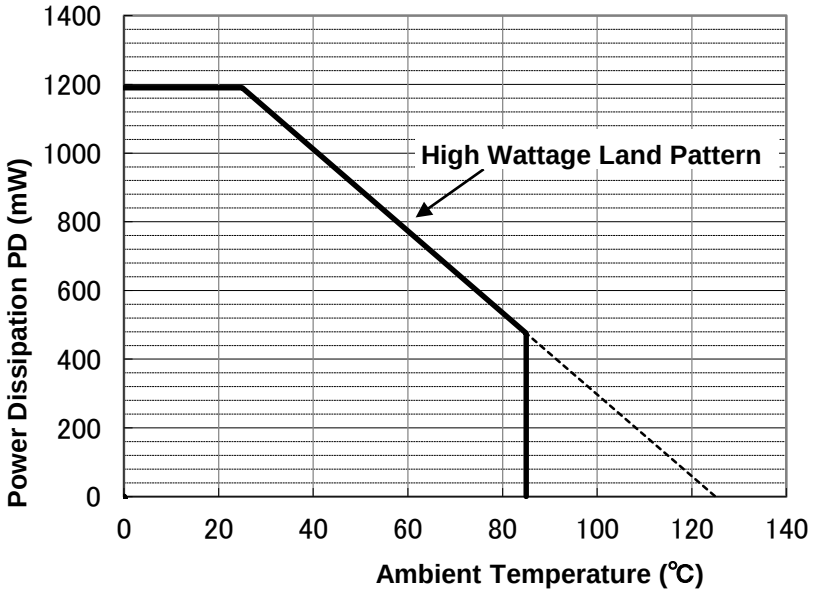
The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

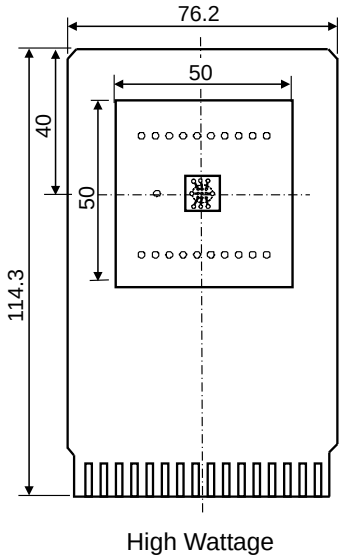
	High Wattage Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-layers)
Board Dimensions	76.2 mm × 114.3 mm × 1.6 mm
Copper Ratio	Outer Layers (First and Fourth Layers): Approx. 60% Inner Layers (Second and Third Layers): 100%

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

	High Wattage Land Pattern
Power Dissipation	1190 mW
Thermal Resistance	θja = (125 − 25°C) / 1.19 W = 84°C/W



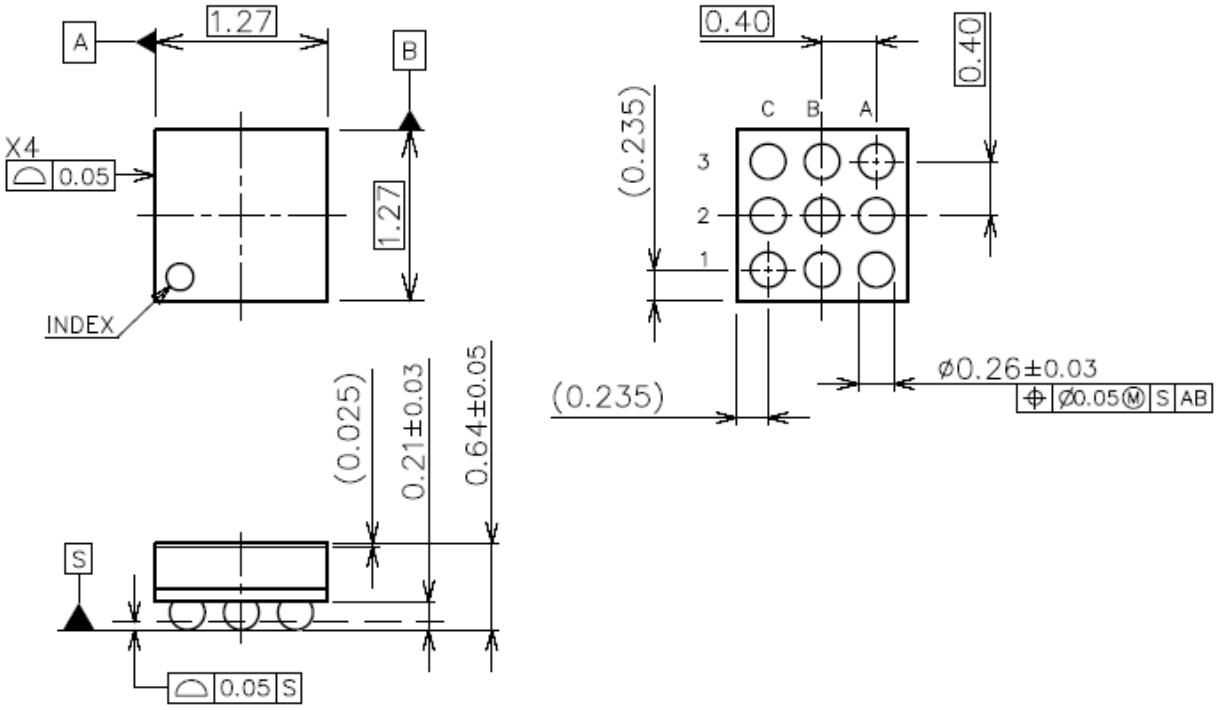
Power Dissipation vs. Ambient Temperature



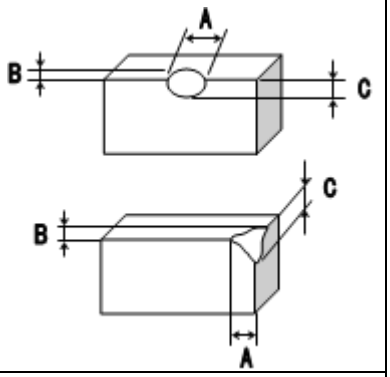
IC Mount Area (mm)

Measurement Board Pattern

RICOH



WLCSP-9-P1 Package Dimensions (Unit: mm)

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)	

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 Ricoh 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 prior written consent of Ricoh.
3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.
4. The technical information described in this document shows typical characteristics of 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 Ricoh's 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 (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.
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. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. 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 Ricoh sales or our distributor before attempting to use AOI.
11. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.

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 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

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Power Switch ICs - Power Distribution ***category:***

Click to view products by Nisshinbo ***manufacturer:***

Other Similar products are found below :

TCK111G,LF(S FPF1018 DS1222 TCK2065G,LF SZNCP3712ASNT3G MIC2033-05BYMT-T5 MIC2033-12AYMT-T5 MIC2033-05BYM6-T5 SLG5NT1437VTR SZNCP3712ASNT1G DML1008LDS-7 KTS1670EDA-TR KTS1640QGDV-TR KTS1641QGDV-TR NCV459MNWTBG FPF2260ATMX U6513A U6119S NCP45780IMN24RTWG MAX14919ATP+ MC33882PEP TPS2021IDRQ1 TPS2104DBVR MIC2098-1YMT-TR MIC94062YMT TR MP6231DN-LF MIC2075-2YM MIC94068YML-TR SIP32461DB-T2-GE1 NCP335FCT2G TCK105G,LF(S AP2151DSG-13 MIC94094YC6-TR MIC94064YC6-TR MIC2505-1YM MIC94042YFL-TR MIC94041YFL-TR MIC2005-1.2YM6-TR TPS2032QDRQ1 SIP32510DT-T1-GE3 NCP333FCT2G NCP331SNT1G TPS2092DR TPS2063DR TPS2042P MIC2008YML-TR MIC2040-1YMM TPS22810DRVR MIC2043-2YTS MIC2041-2YMM