3A Load Switch IC

NO. EA-312-150320

OUTLINE

The R5527K is an N-channel load switch IC with low supply current, Typ. 40µA. By using an Nch transistor as a driver transistor, the features of low on resistance and the reverse current protection at on/off state are realized. The R5527K is an ideal load switch IC to supply power from the battery to the load circuit. The R5527K is available in an ultra-small DFN (PLP)1612-4D package which can achieve high-density mounting on boards.

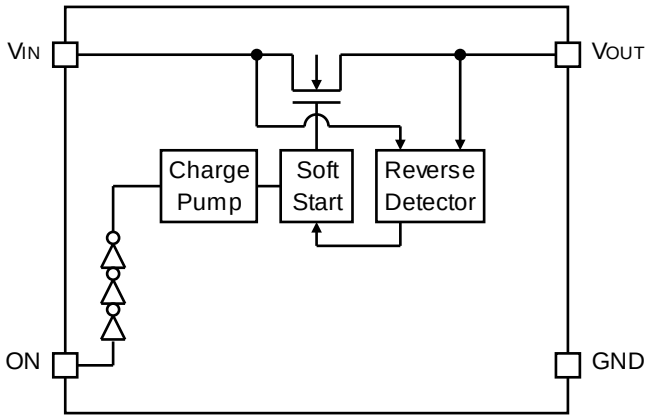
FEATURES

- Input Voltage Range ····· 1.8V to 5.5V
- Typical R_{ON} ····· 48mΩ (V_{IN}=5V)
  46mΩ (V_{IN}=4.5V)
  45mΩ (V_{IN}=3.8V)
  68mΩ (V_{IN}=1.8V)
- Slew Rate/Inrush Control with t_R ····· 1.5ms (Min.)
- 3A Maximum Continuous Current Capability
- Low Off Switch Current····· <1µA (R5527K001B/D), <2µA(R5527K001A/C)
- Reverse Current Blocking (RCB)
- Package····· DFN(PLP)1612-4D

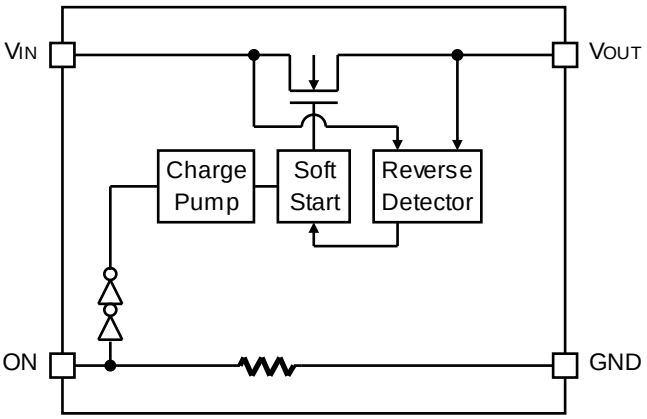
APPLICATION

- Smart Phones, Tablet PCs
- Storage, Portable Devices

BLOCK DIAGRAMS



R5527K001A



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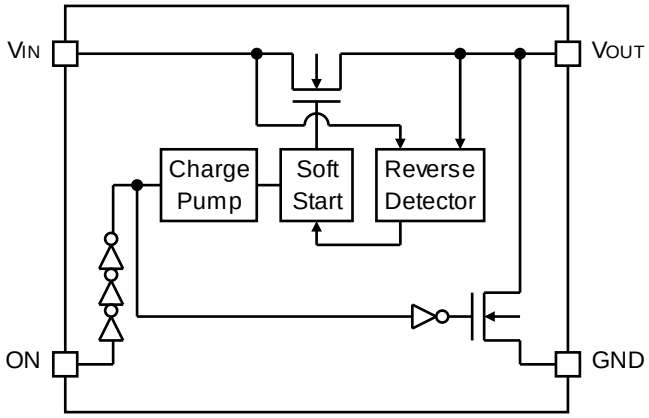

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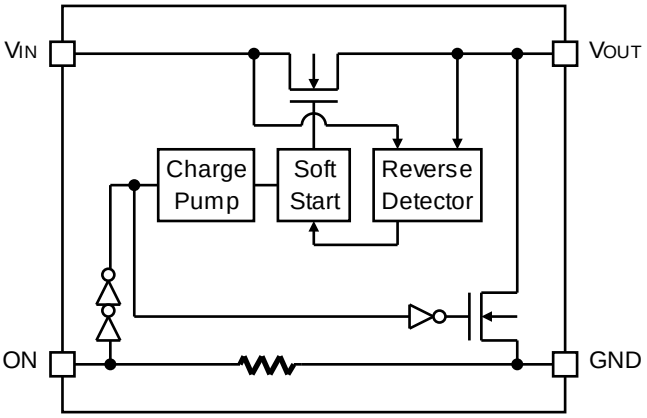
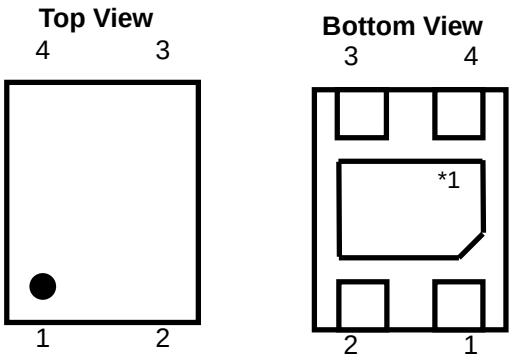


R5527K001D

PIN DESCRIPTION

● **DFN(PLP)1612-4D**



Pin No	Symbol	Pin Description
1	V_{IN}	Supply Input Pin
2	GND	Ground Pin
3	ON	ON/OFF Control Pin, Active High/Low
4	V_{OUT}	Switch Output Pin

*1 The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

SELECTION GUIDE

The ON pin polarity and the auto-discharge function for the ICs are user-selectable options.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R5527K001∗-TR	DFN(PLP)1612-4D	5,000 pcs	Yes	Yes

∗: Specify a combination of the ON pin polarity and the auto-discharge function.
(A) “L” Active, without auto-discharge function at off state
(B) “H” Active, without auto-discharge function at off state
(C) “L” Active, with auto-discharge function at off state
(D) “H” Active, with auto-discharge function at off state

Auto-Discharge function quickly lowers the output voltage to 0V by releasing the electrical charge in the external capacitor when the ON signal is switched from the active mode to the standby mode.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage		-0.3 to 6.0	V
V_{ON}	Input Voltage (ON Pin)		-0.3 to 6.0	V
V_{OUT}	Output Voltage		-0.3 to 6.0	V
I_{OUT}	Output Current		3.0	A
P_D	Power Dissipation (DFN(PLP)1612-4D)*1	Standard Land Pattern	610	mW
Ta	Ambient Tmeprature		-40 to 85	°C
Tstg	Storage Temerature		-55 to 125	°C

*1 Refer to *PACKAGE INFORMATION* 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 are 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} = 1.8 to 5.5V, I_{OUT} = 1mA, C_{IN} = 1µF, C_{OUT} = None, unless otherwise noted.

The specifications surrounded by ☐ are guaranteed by design engineering at -40ºC ≤ Ta ≤ 85ºC.

R5527K001A (Ta=25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.8		5.5	V
$I_{Q(OFF)}$	Off Supply Current	V_{ON}=V_{IN},V_{OUT}=OPEN			1	2	µA
I_{SD}	Shutdown Current	V_{ON}=V_{IN}, V_{OUT}=GND	Ta=25°C		1	2	µA
			Ta=85°C		1	10	µA
I_Q	Quiescent Current	V_{ON}=GND, I_{OUT}=0mA			40	70	µA
R_{ON}	On Resistance	V_{IN}=5V, I_{OUT}=1A			48	65	mΩ
		V_{IN}=4.5V, I_{OUT}=1A			46		
		V_{IN}=3.8V, I_{OUT}=1A			45	60	
		V_{IN}=3.3V, I_{OUT}=500mA			45		
		V_{IN}=2.5V, I_{OUT}=500mA			51		
		V_{IN}=1.8V, I_{OUT}=250mA			68		
V_{IH}	ON Input Logic High Voltage	V_{IN}=1.8V to 5.5V		1.7			V
V_{IL}	ON Input Logic Low Voltage	V_{IN}=1.8V to 5.5V				1.2	V
I_{ON}	ON Input Leakage	V_{ON}=V_{IN}				1	µA
V_{T_RCB}	RCB Protection Trip Point	V_{OUT} - V_{IN}			45		mV
V_{R_RCB}	RCB Protection Release Trip Point	V_{IN} - V_{OUT}			25		mV
	RCB Hysteresis				70		mV
I_{SD_OUT}	V_{OUT} Shutdown Current	V_{ON}=GND, V_{OUT}=5.5V, V_{IN}=Short to GND				10	µA
t_{DON}*1	Turn-On Delay	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="H"→"L" to V_{OUT}=V_{IN} x 10%		0.5		2.5	ms
t_R*1	V_{OUT} Rise Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from V_{OUT}=V_{IN} x 10% to V_{IN} x 90%		1.5		5.0	ms
t_{ON}*1	Turn-On Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="H"→"L" to V_{OUT}=V_{IN} x 90%		2.0		7.5	ms

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition (Tj≈Ta=25ºC) except RCB Protection Trip Point, RCB Protection Release Trip Point, and RCB Hysteresis.

*1 Rise time from V_{OUT}=0V is defined. Refer to the *TIMING CHART* for detailed information.

V_{IN} = 1.8 to 5.5V, I_{OUT} = 1mA, C_{IN} = 1µF, C_{OUT} = None, unless otherwise noted.
The specifications surrounded by ▭ are guaranteed by design engineering at -40ºC ≤ Ta ≤ 85ºC.

R5527K001B (Ta=25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.8		5.5	V
$I_{Q(OFF)}$	Off Supply Current	V_{ON}=GND,V_{OUT}=OPEN			0.5	1	µA
I_{SD}	Shutdown Current	V_{ON}=GND, V_{OUT}=GND	Ta=25°C		0.5	1	µA
			Ta=85°C		0.5	10	µA
I_Q	Quiescent Current	V_{ON}=V_{IN}, I_{OUT}=0mA			40	70	µA
R_{ON}	On Resistance	V_{IN}=5V, I_{OUT}=1A			48	65	mΩ
		V_{IN}=4.5V, I_{OUT}=1A			46		
		V_{IN}=3.8V, I_{OUT}=1A			45	60	
		V_{IN}=3.3V, I_{OUT}=500mA			45		
		V_{IN}=2.5V, I_{OUT}=500mA			51		
		V_{IN}=1.8V, I_{OUT}=250mA			68		
V_{IH}	ON Input Logic High Voltage	V_{IN}=1.8V to 5.5V		1.7			V
V_{IL}	ON Input Logic Low Voltage	V_{IN}=1.8V to 5.5V				1.2	V
I_{ON}	ON Input Leakage	V_{ON}=GND				1	µA
R_{ON_PD}	Pull-Down Resistance at ON Pin	V_{IN}=V_{ON}=1.8V to 5.5V			3		MΩ
V_{T_RCB}	RCB Protection Trip Point	V_{OUT} - V_{IN}			45		mV
V_{R_RCB}	RCB Protection Release Trip Point	V_{IN} - V_{OUT}			25		mV
	RCB Hysteresis				70		mV
I_{SD_OUT}	V_{OUT} Shutdown Current	V_{ON}=GND, V_{OUT}=5.5V, V_{IN}=Short to GND				10	µA
t_{DON}*1	Turn-On Delay	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="L"→"H" to V_{OUT}=V_{IN} x 10%		0.5		2.5	ms
t_R*1	V_{OUT} Rise Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from V_{OUT}=V_{IN} x 10% to V_{IN} x 90%		1.5		5.0	ms
t_{ON}*1	Turn-On Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="L"→"H" to V_{OUT}=V_{IN} x 90%		2.0		7.5	ms

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition (Tj≈Ta=25ºC) except RCB Protection Trip Point, RCB Protection Release Trip Point, and RCB Hysteresis.
*1 Rise time from V_{OUT}=0V is defined. Refer to the *TIMING CHART* for detailed information.

V_{IN} = 1.8 to 5.5V, I_{OUT} = 1mA, C_{IN} = 1µF, C_{OUT} = None, unless otherwise noted.
The specifications surrounded by ▭ are guaranteed by design engineering at -40ºC ≤ Ta ≤ 85ºC.

R5527K001C (Ta=25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.8		5.5	V
I_{SD}	Shutdown Current	V_{ON}=V_{IN}, V_{OUT}=GND	Ta=25°C		1	2	µA
			Ta=85°C		1	10	µA
I_Q	Quiescent Current	V_{ON}=GND, I_{OUT}=0mA			40	70	µA
R_{ON}	On Resistance	V_{IN}=5V, I_{OUT}=1A			48	65	mΩ
		V_{IN}=4.5V, I_{OUT}=1A			46		
		V_{IN}=3.8V, I_{OUT}=1A			45	60	
		V_{IN}=3.3V, I_{OUT}=500mA			45		
		V_{IN}=2.5V, I_{OUT}=500mA			51		
		V_{IN}=1.8V, I_{OUT}=250mA			68		
V_{IH}	ON Input Logic High Voltage	V_{IN}=1.8V to 5.5V		1.7			V
V_{IL}	ON Input Logic Low Voltage	V_{IN}=1.8V to 5.5V				1.2	V
I_{ON}	ON Input Leakage	V_{ON}=V_{IN}				1	µA
V_{T_RCB}	RCB Protection Trip Point	V_{OUT} - V_{IN}			45		mV
V_{R_RCB}	RCB Protection Release Trip Point	V_{IN} - V_{OUT}			25		mV
	RCB Hysteresis				70		mV
I_{SD_OUT}	V_{OUT} Shutdown Current	V_{ON}=GND, V_{OUT}=5.5V, V_{IN}=Short to GND				10	µA
t_{DON}*1	Turn-On Delay	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="H"→"L" to V_{OUT}=V_{IN} x 10%		0.5		2.5	ms
t_R*1	V_{OUT} Rise Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from V_{OUT}=V_{IN} x 10% to V_{IN} x 90%		1.5		5.0	ms
t_{ON}*1	Turn-On Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="H"→"L" to V_{OUT}=V_{IN} x 90%		2.0		7.5	ms
R_{LOW}	Nch. On Resistance for Auto-Discharge	V_{IN}=V_{ON}=5.0V, V_{OUT}=0.1V			20		Ω

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition (Tj≈Ta=25ºC) except RCB Protection Trip Point, RCB Protection Release Trip Point, and RCB Hysteresis.
*1 Refer to the *TIMING CHART* for detailed information.

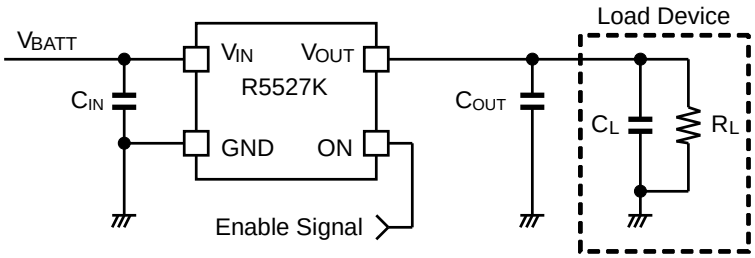
V_{IN} = 1.8 to 5.5V, I_{OUT} = 1mA, C_{IN} = 1µF, C_{OUT} = None, unless otherwise noted.
The specifications surrounded by ▭ are guaranteed by design engineering at -40ºC ≤ Ta ≤ 85ºC.

R5527K001D (Ta=25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.8		5.5	V
I_{SD}	Shutdown Current	V_{ON}=GND, V_{OUT}=GND	Ta=25°C		0.5	1	µA
			Ta=85°C		0.5	10	µA
I_Q	Quiescent Current	V_{ON}=V_{IN}, I_{OUT}=0mA			40	70	µA
R_{ON}	On Resistance	V_{IN}=5V, I_{OUT}=1A			48	65	mΩ
		V_{IN}=4.5V, I_{OUT}=1A			46		
		V_{IN}=3.8V, I_{OUT}=1A			45	60	
		V_{IN}=3.3V, I_{OUT}=500mA			45		
		V_{IN}=2.5V, I_{OUT}=500mA			51		
		V_{IN}=1.8V, I_{OUT}=250mA			68		
V_{IH}	ON Input Logic High Voltage	V_{IN}=1.8V to 5.5V		1.7			V
V_{IL}	ON Input Logic Low Voltage	V_{IN}=1.8V to 5.5V				1.2	V
I_{ON}	ON Input Leakage	V_{ON}=GND				1	µA
R_{ON_PD}	Pull-Down Resistance at ON Pin	V_{IN}=V_{ON}=1.8V to 5.5V			3		MΩ
V_{T_RCB}	RCB Protection Trip Point	V_{OUT} - V_{IN}			45		mV
V_{R_RCB}	RCB Protection Release Trip Point	V_{IN} - V_{OUT}			25		mV
	RCB Hysteresis				70		mV
I_{SD_OUT}	V_{OUT} Shutdown Current	V_{ON}=GND, V_{OUT}=5.5V, V_{IN}=Short to GND				10	µA
t_{DON}*1	Turn-On Delay	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="L"→"H" to V_{OUT}=V_{IN} x 10%		0.5		2.5	ms
t_R*1	V_{OUT} Rise Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from V_{OUT}=V_{IN} x 10% to V_{IN} x 90%		1.5		5.0	ms
t_{ON}*1	Turn-On Time	V_{IN}=3.8V, R_L=150Ω, C_L=100µF Time from ON="L"→"H" to V_{OUT}=V_{IN} x 90%		2.0		7.5	ms
R_{LOW}	Nch. On Resistance for Auto-Discharge	V_{IN}=5.0V, V_{ON}=GND, V_{OUT}=0.1V			20		Ω

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition (Tj≈Ta=25ºC) except RCB Protection Trip Point, RCB Protection Release Trip Point, and RCB Hysteresis.
*1 Refer to the *TIMING CHART* for detailed information.

TYPICAL APPLICATION

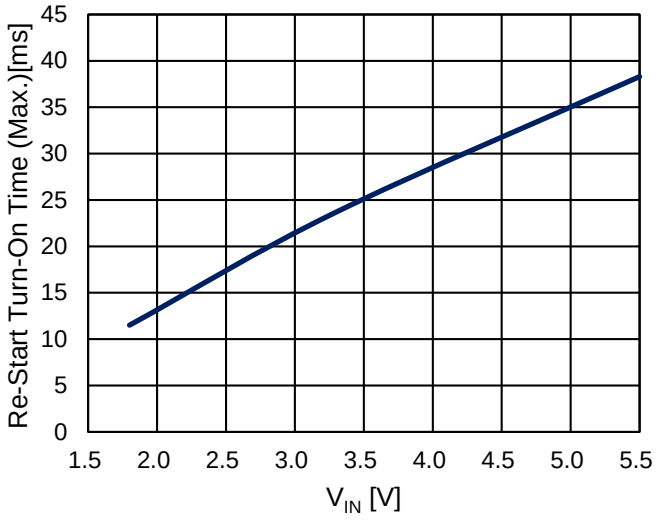


R5527K Typical Application

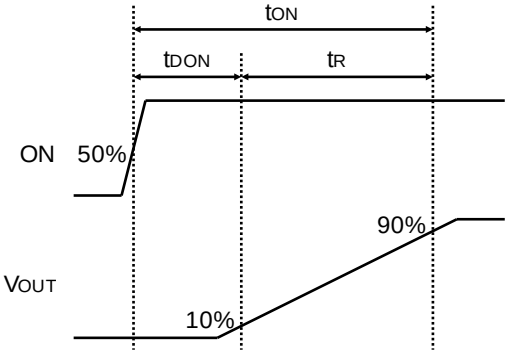
TECHNICAL NOTES

- Basically, the R5527K does not require a bypass capacitor between V_{IN} and GND, however, considering the spike noise, use 0.1μF or more capacitor (1μF [Ceramic] recommended) as a bypass capacitor. More capacitance is also acceptable depending on the application.

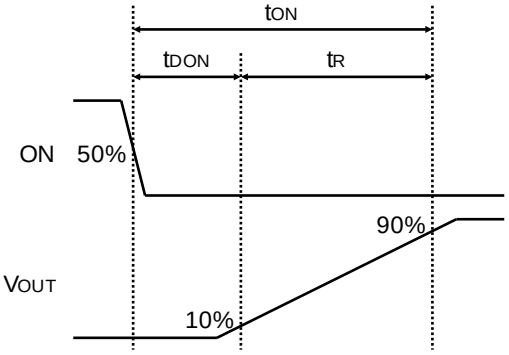
- When a voltage is remained in the output pin at the restart, the startup time (the time until R5527K is able to fully drive the output load from ON signal input) takes longer than the t_{ON} definition. Refer to the following graph for the maximum value of the startup time. When returning from the reverse current blocking (RCB) trip point, the following startup time is necessary based on the RCB protection release trip point.



TIMING CHART



V_{OUT} Timing Chart (R5527K001B/D)



V_{OUT} Timing Chart (R5527K001A/C)

PACKAGE INFORMATION

Power Dissipation (DFN(PLP)1612-4D)

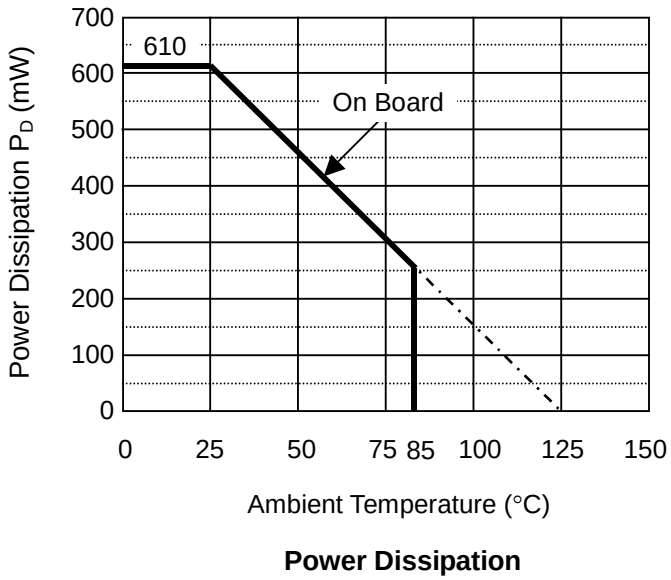
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

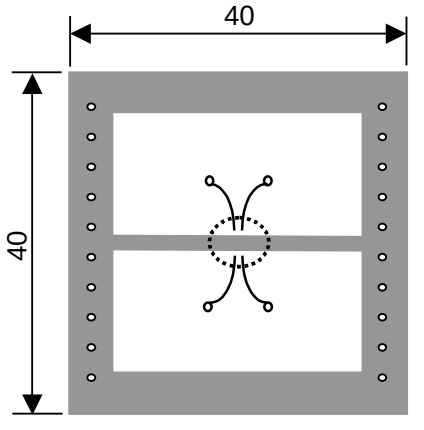
	Standard Test Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm*40mm*1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.54mm * 24pcs

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

	Standard Test Land Pattern
Power Dissipation	610mW
Thermal Resistance	θja = (125-25 °C)/0.61W = 164 °C/W
	θjc = 48 °C/W



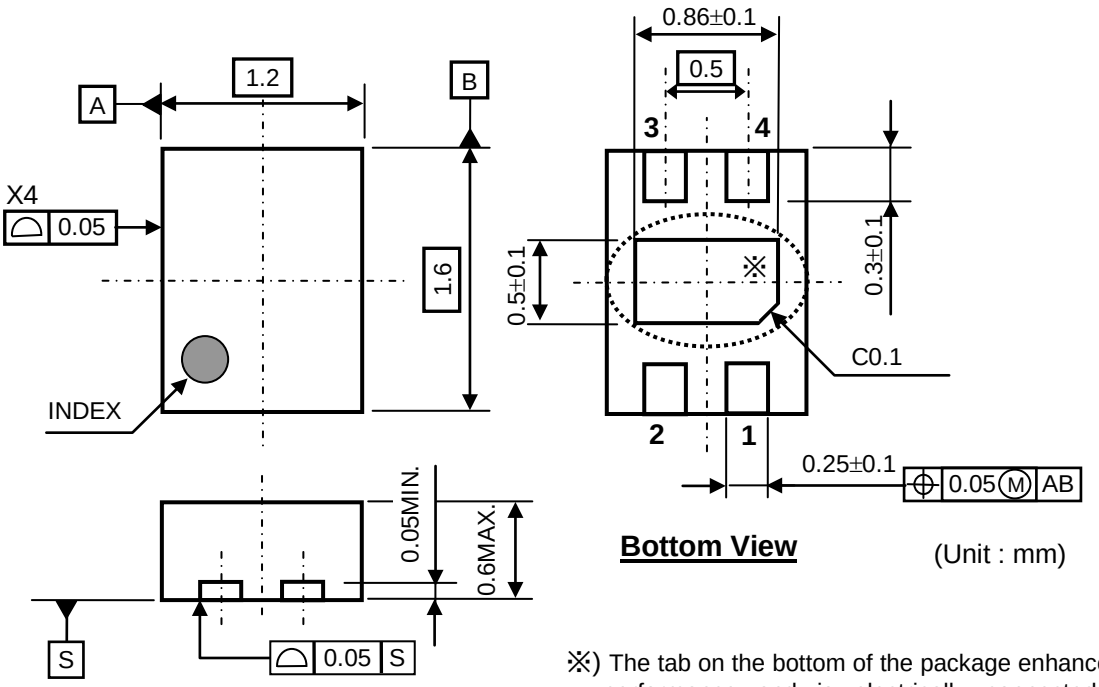
Power Dissipation



Measurement Board Pattern

IC Mount Area (Unit : mm)

Package Dimensions (DFN(PLP)1612-4D)

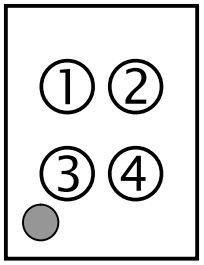


※) The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

Mark Specification (DFN(PLP)1612-4D)

①②: Product Code … ***Refer to "R5527K Mark Specification Table".***

③④: Lot Number … Alphanumeric Serial Number



Mark Specification

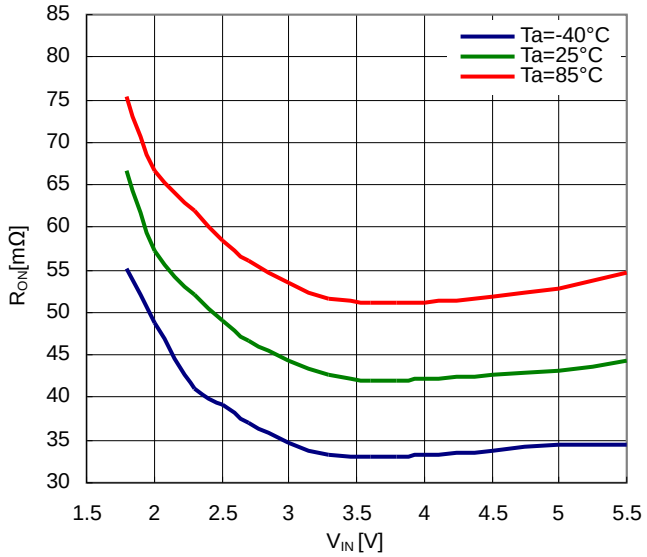
R5527K Mark Specification Table (DFN(PLP)1612-4D)

Product Name	①②
R5527K001B	7A
R5527K001C	7B
R5527K001D	7C
R5527K001A	7D

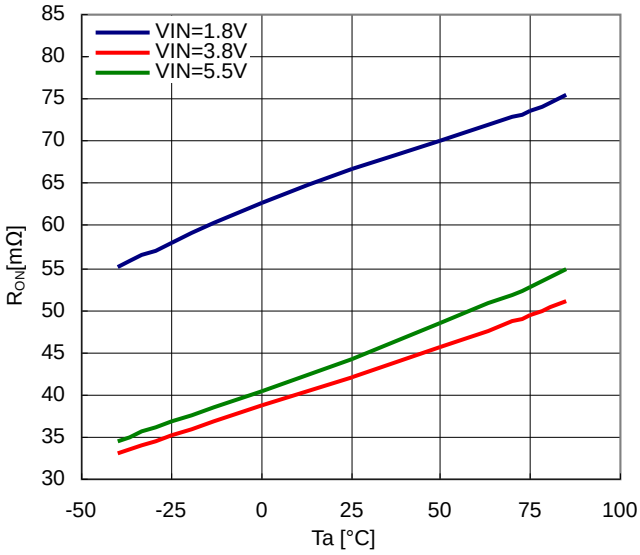
TYPICAL CHARACTERISTICS

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

1) On Resistance vs. Input Voltage

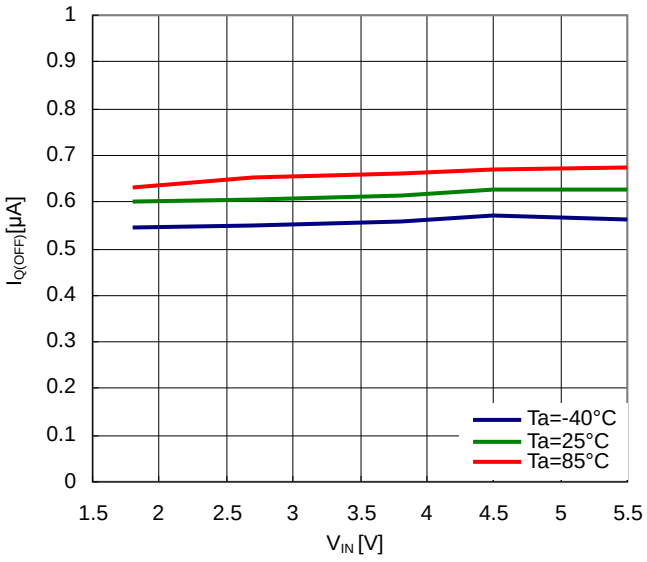


2) On Resistance vs. Temperature



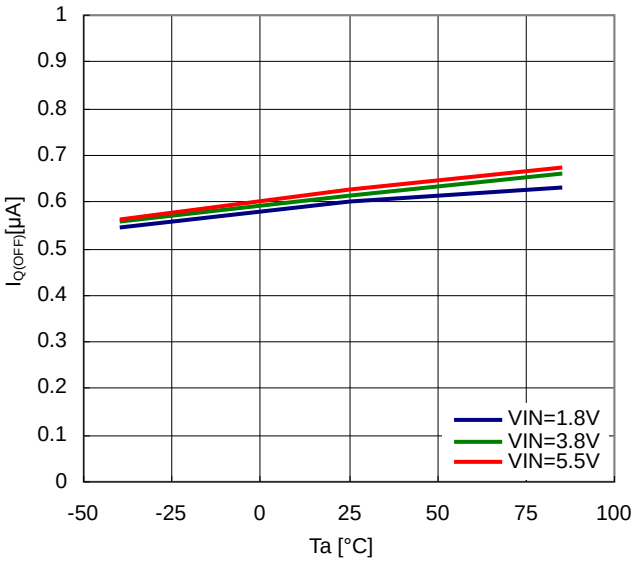
3) Off Supply Current vs. Input Voltage

R5527K001B/R5527K001D



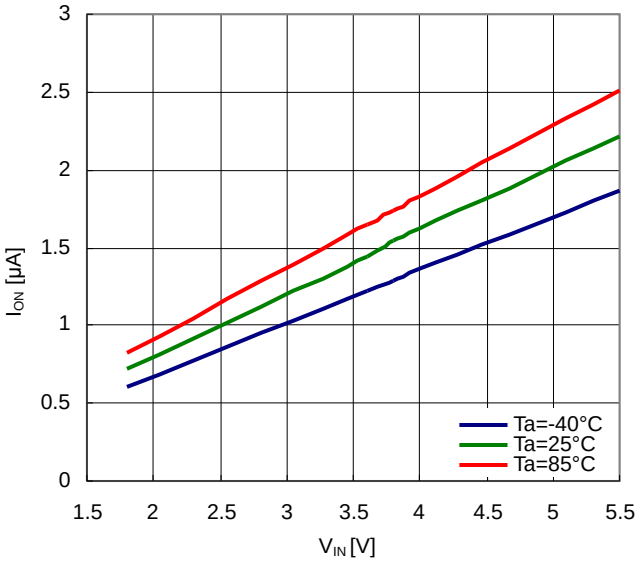
4) Off Supply Current vs. Temperature

R5527K001B/R5527K001D



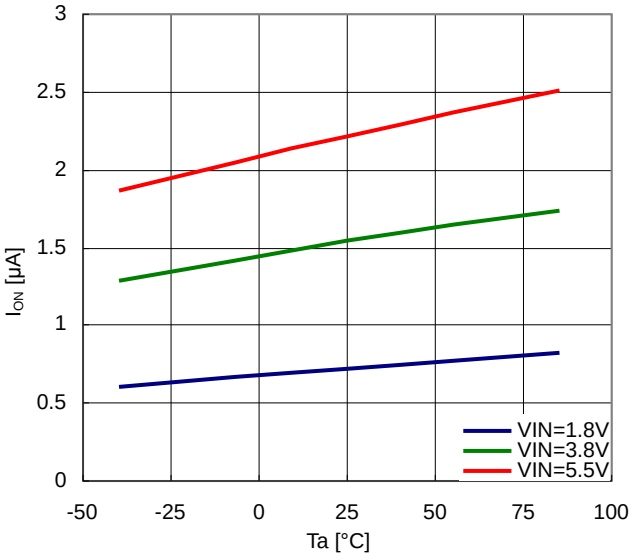
5) ON pin Pull-Down Current vs. Input Voltage

R5527K001B/R5527K001D

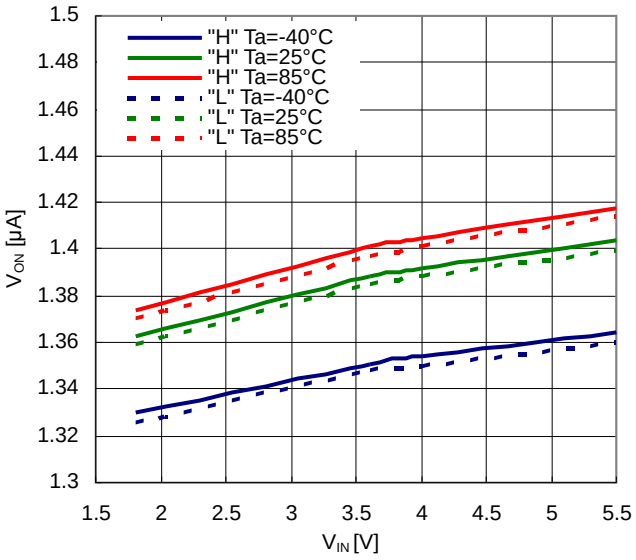


6) ON pin Pull-Down Current vs. Temperature

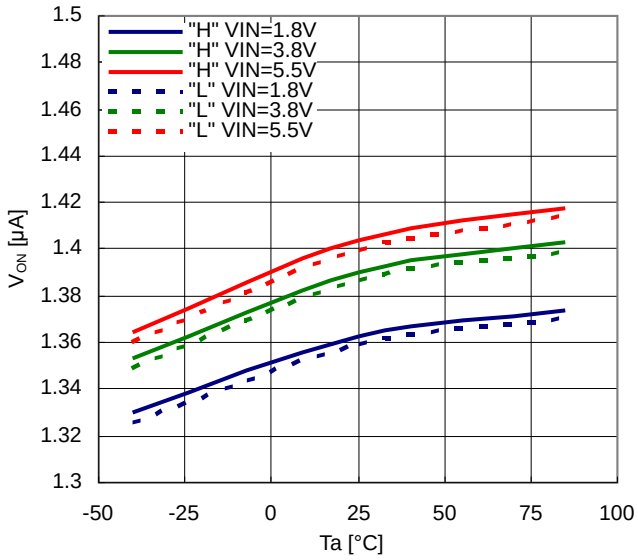
R5527K001B/R5527K001D



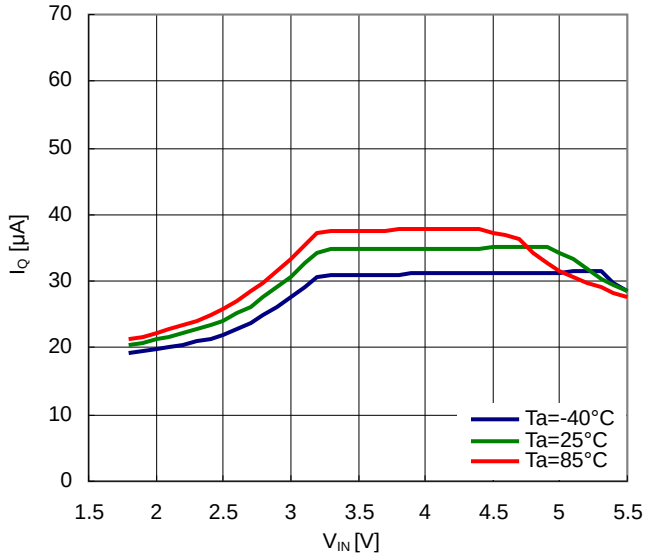
7) ON pin Logic Threshold vs. Input Voltage



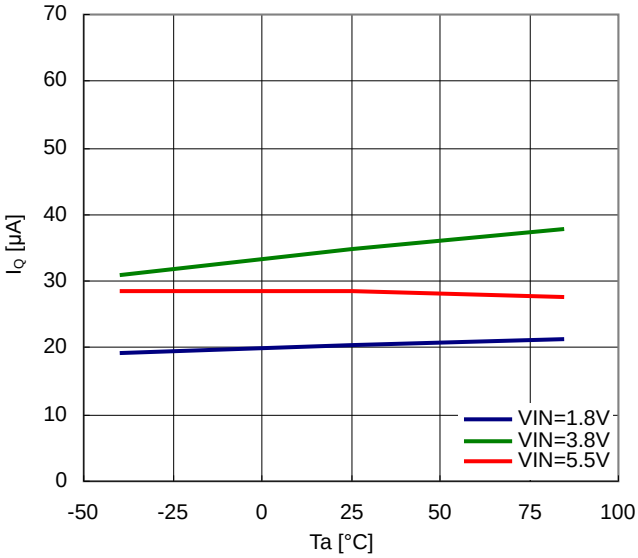
8) ON pin Logic Threshold vs. Input Voltage



9) Quiescent Current vs. Input Voltage

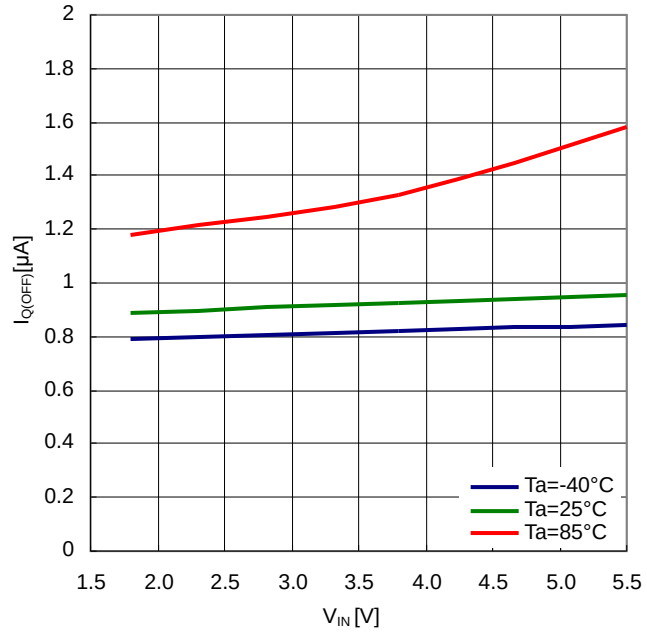


10) Quiescent Current vs. Temperature



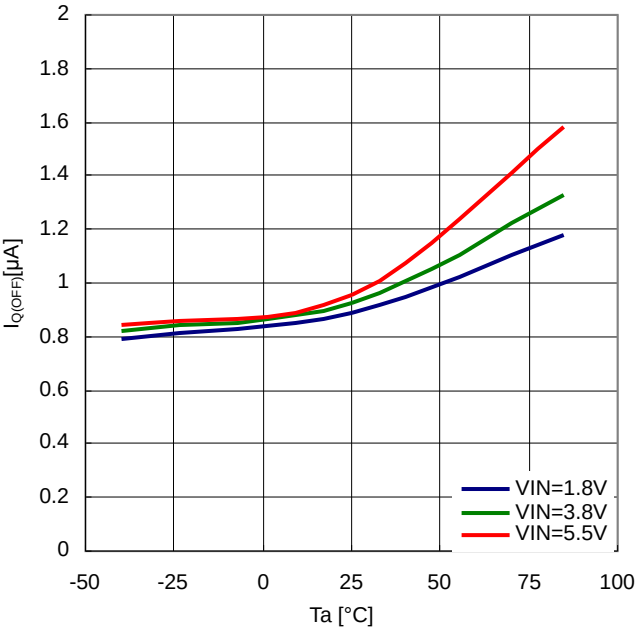
11) Off Supply Current vs. Input Voltage

R5527K001A/R5527K001C



12) Off Supply Current vs. Temperature

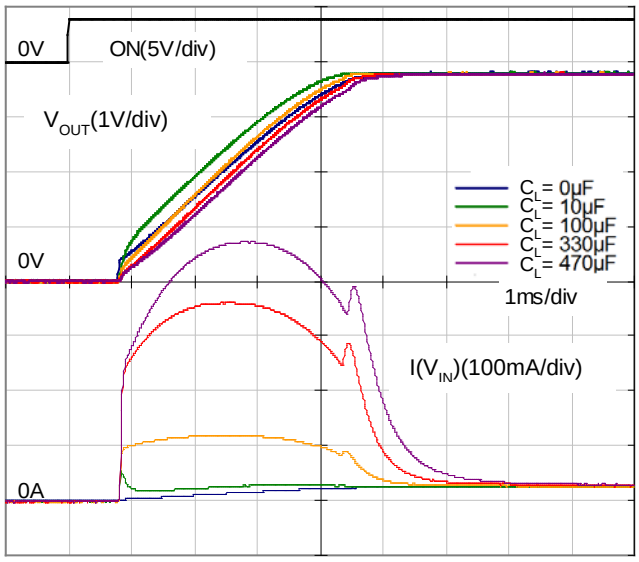
R5527K001A/R5527K001C



13) Inrush Current

R5527K001B

Ta=25°C R_L=150Ω



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