

Low On-Resistance Load Switch with Controlled Slew Rate

■ General Description

The OCP9211 features a low-Ron internal FET and an operating range of 1.2V to 5.5V. The switch is controlled by an on/off input which is compatible with standard CMOS GPIO. The low shut-off current allows power designs to meet standby and off-power drain specifications. On-chip discharge resistance is integrated for quick output discharge when switch is turned off. Slew-rate control prevents inrush current during switch turn-on.

The OCP9211 is available in a fully “green” compliant 0.87mm * 0.87mm WLCSP-4B Package.

■ Features

- Supply Voltage Range: 1.2V to 5.5V
- Typical Ron:
 - Ron=37mΩ at VIN=5.5V
 - Ron=47mΩ at VIN=3.3V
 - Ron=80mΩ at VIN=1.8V
 - Ron=105mΩ at VIN=1.5V
 - Ron=185mΩ at VIN=1.2V
- Slew Rate Control
- Low Quiescent Current
- Integrated Discharge Function
- 4-Bump, WLCSP 0.87 mm x 0.87 mm, 0.5mm Pitch

■ Applications

- Portable Media Players
- Cell Phones or Smart Phones
- PDAs
- Mobile Handsets
- Tablet PCs and Laptops/Net books



Pin Configuration

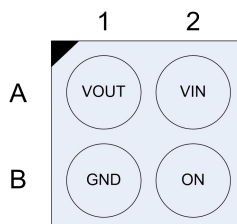


Figure 1, Pin Assignments of OCP9211 (Top View)

Pin Name	Pin No.	Pin Function
VOUT	A1	Switch output
VIN	A2	Switch input
GND	B1	Ground
ON	B2	ON/OFF Control, active HIGH

Typical Application Circuit

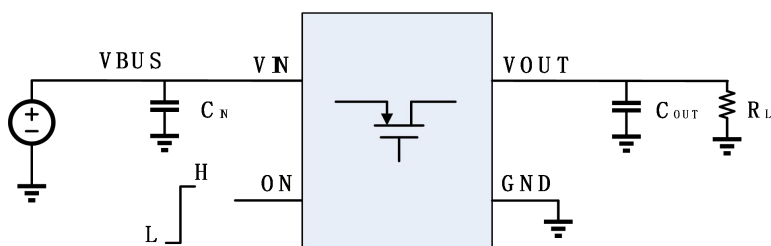


Figure 2 Typical Application of OCP9211

Block Diagram

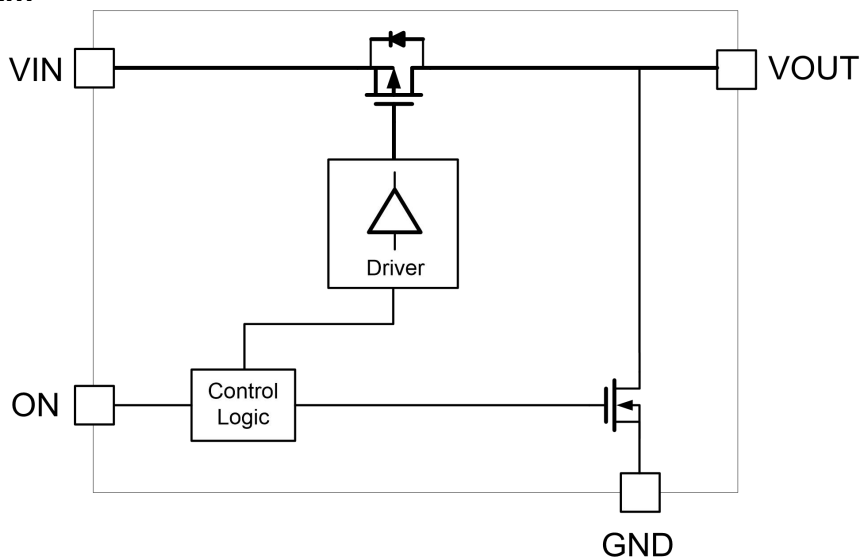


Figure 3, Block Diagram of OCP9211



■ Ordering Information

Part Number	Package Type	Marking	Package Qty	Temperature	Eco Plan	Lead Finish
OCP9211WPAD	WLCSP-4	L	7-in reel 3000pcs/reel	-40~85℃	Green	Cu/Ag/Sn

■ Absolute Maximum Ratings¹ (T_A=25℃, unless otherwise noted)

Parameter	Symbol	Rating	Unit
V _{IN} Pin to GND	V _{IN}	-0.3 to +6	V
V _{OUT} Pin to GND	V _{OUT}	-0.3 to +6	V
ON Pin to GND	V _{ON}	-0.3 to +6	V
Maximum Continuous Switch Current at Ambient Operating Temperature	I _{SW}	2	A
Human Body Model (HBM)	ESD	4	kV
Charged Device Model (CDM)		2	
Storage Temperature Range	T _S	-55 to +150	℃
Operating Junction Temperature Range	T _J	-40 to +150	℃

■ Recommended Operating Conditions²

Parameter	Symbol	Rating	Unit
V _{IN} Pin Voltage to GND	V _{IN}	+1.2 to +5.5	V
Thermal Resistance	R _{θJA}	110	℃/W
Operating Temperature Range	T _{OP}	-40 to +85	℃

Note1: Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at these conditions or other operating conditions exceeding those specified is not implied. Only one absolute maximum rating should be applied at any one time.

Note2: The device is not guaranteed to function outside of its operating conditions.

■ Electrical Characteristics

(Unless otherwise noted, T_A=-40℃ to +85℃ and V_{IN}=1.2V to 5.5V. Typical values are at T_A=25℃, V_{IN}=3.3V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Basic Operation						
I _Q	Quiescent Current	V _{ON} =5.5V, V _{IN} =5.5V, I _{OUT} =0mA		0.1	1.5	μA
I _{SD}	Off Supply Current	V _{ON} =0V, V _{IN} =5.5V, V _{OUT} =0V		0.1	1.0	μA
I _{Q(OFF)}	Shutdown Current	V _{ON} =0V, V _{IN} =5.5V, V _{OUT} =Open		0.1	1.0	μA
I _{ON}	On Input Leakage Current	V _{ON} =V _{IN} or 0V			2.0	μA
R _{on}	Switch On Resistance	V _{IN} =5.5V, I _{OUT} =200mA, T _A =25℃		37	55 ³	mΩ
		V _{IN} =3.3V, I _{OUT} =200mA, T _A =25℃		47	65 ³	
		V _{IN} =1.8V, I _{OUT} =200mA, T _A =25℃		80	100 ³	
		V _{IN} =1.5V, I _{OUT} =200mA, T _A =25℃		105	150 ³	



		$V_{IN}=1.2V, I_{OUT}=200mA, T_A=25^{\circ}C$		185	220 ³	
R_{PD}	Output Discharge Resistance	$V_{IN}=3.3V, I_{OUT}=20mA, V_{OUT}=OFF, T_A=25^{\circ}C$		130		Ω
V_{IH}	ON input high level	/EN Rising	1.15			V
V_{IL}	ON input low level	/EN Falling			0.65	V
R_{ON_PD}	Pull Down Resistance at ON Pin			5.3		M Ω
Timing Characteristics						
T_{DON}	Switch Turn-on Delay Time	$V_{IN}=3.3V, R_L=10\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		86		μs
T_R	V_{OUT} Rise Time			130		μs
T_{ON}	Switch Turn-on Time			216		μs
T_{DOFF}	Switch Turn-off Delay Time ⁴	$V_{IN}=3.3V, R_L=10\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		8.6		μs
		$V_{IN}=3.3V, R_L=500\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		9.8		
T_F	V_{OUT} Fall Time ⁴	$V_{IN}=3.3V, R_L=10\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		2.5		μs
		$V_{IN}=3.3V, R_L=500\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		27		
T_{OFF}	Switch Turn-off Time ⁴	$V_{IN}=3.3V, R_L=10\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		11		μs
		$V_{IN}=3.3V, R_L=500\Omega, C_L=0.1\mu F, T_A=25^{\circ}C$		36		

Note3: This parameter is guaranteed by design and characterization; not production tested.

Note4: Output discharge enable during off-state.



■ Timing Diagrams

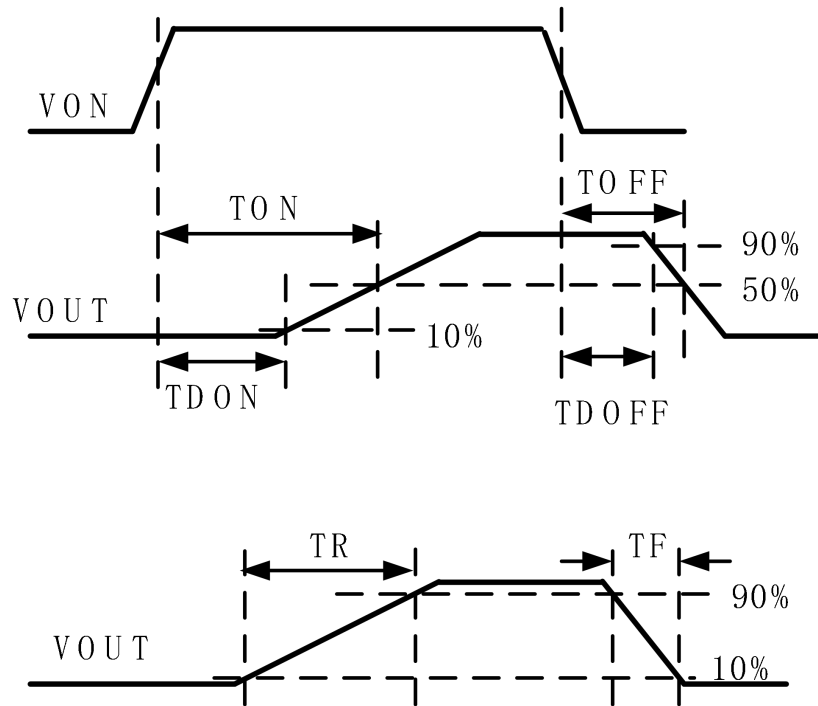


Figure 4, Timing Diagram



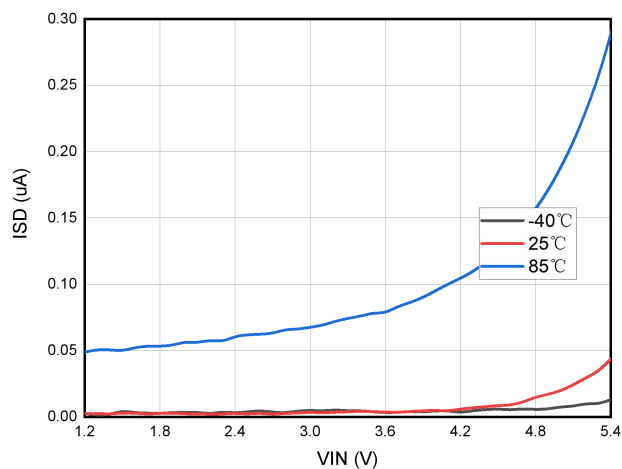
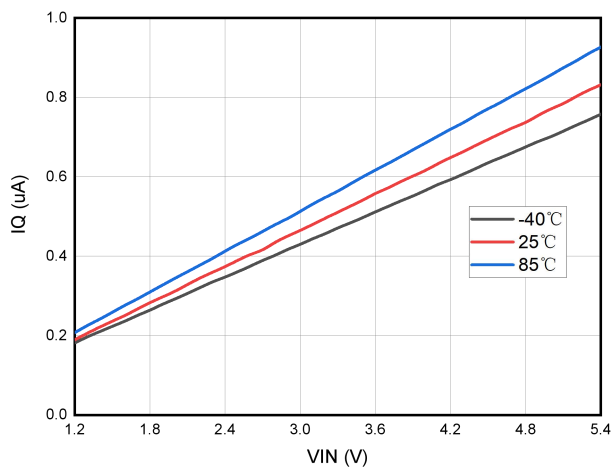
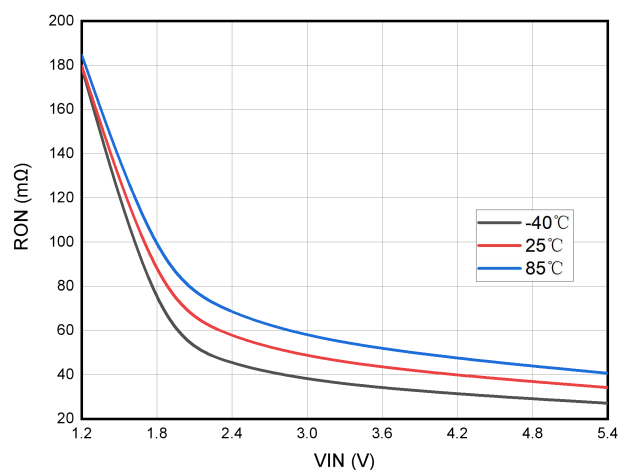
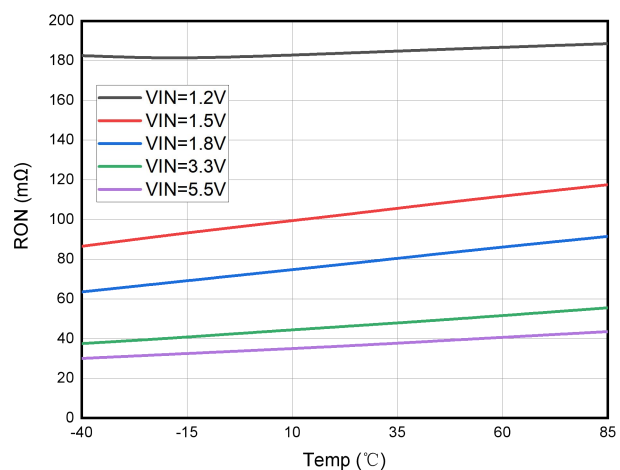
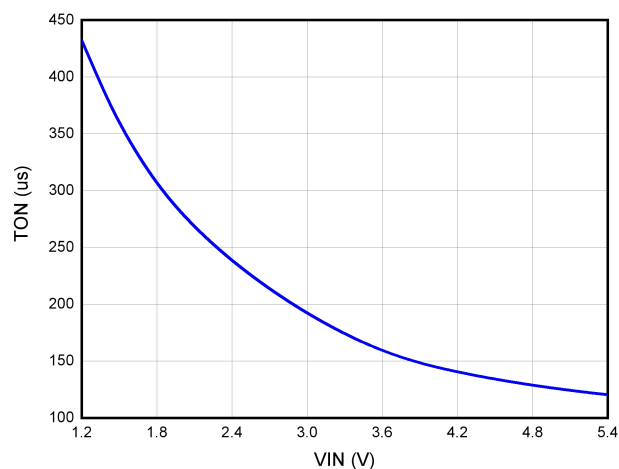
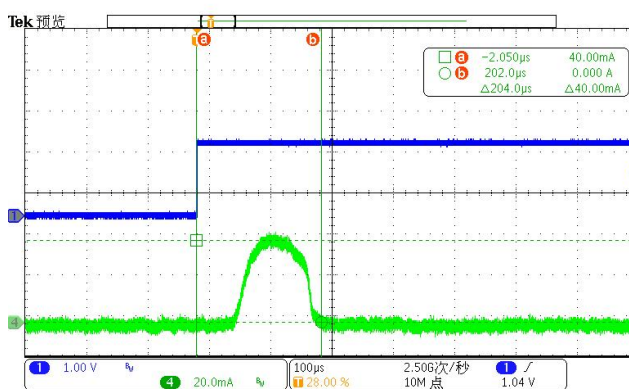
■ Typical Performance Characteristics ($C_{IN}=1\mu F$, $C_{OUT}=0.1\mu F$, unless otherwise specified.)

Figure 5-1 Shutdown Current

Figure 5-2 Quiescent Current ($V_{IN}=ON$)Figure 5-3 On-Resistance ($I_{OUT}=200mA$)Figure 5-4 On-Resistance ($I_{OUT}=200mA$)Figure 5-5 T_R ($E_N=V_{IN}$)Figure 5-6 Inrush Current
 $V_{IN}=3.3V$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$

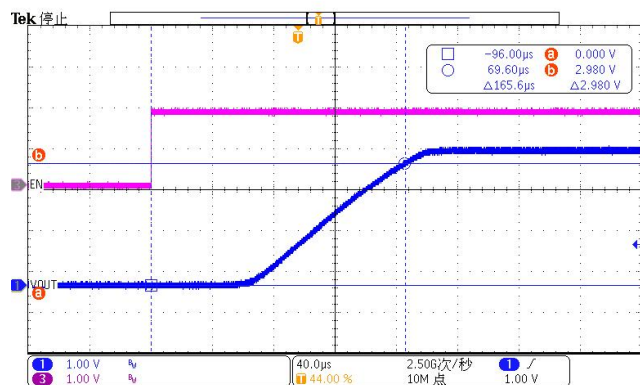


Figure 5-7 Turn-On Response
VIN=3.3V, CIN=1uF, COUT=0.1uF, RL=500Ω

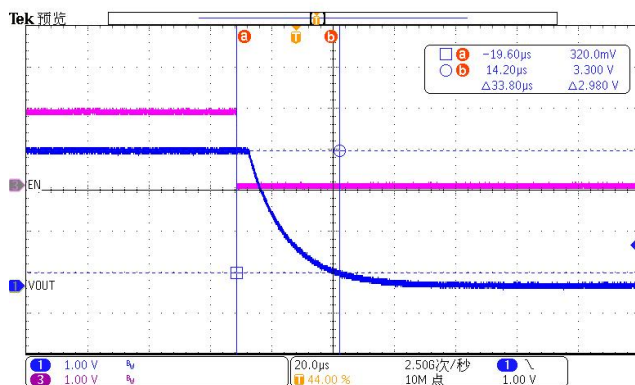


Figure 5-8 Turn-Off Response
VIN=3.3V, CIN=1uF, COUT=0.1uF, RL=500Ω

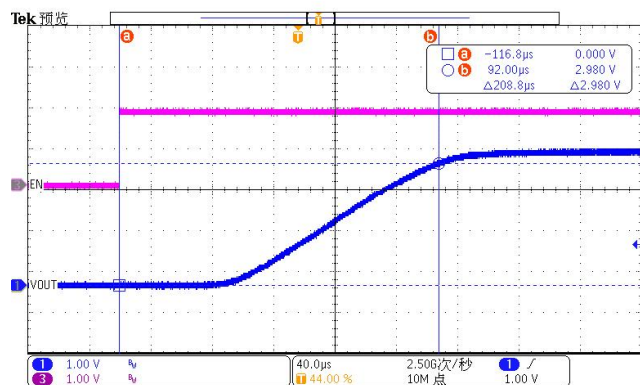


Figure 5-9 Turn-On Response
VIN=3.3V, CIN=1uF, COUT=0.1uF, RL=10Ω

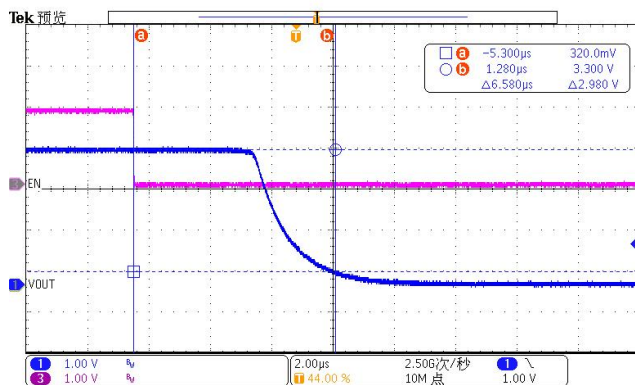


Figure 5-10 Turn-Off Response
VIN=3.3V, CIN=1uF, COUT=0.1uF, RL=10Ω



■ Detailed Functional Description

Device Operation

The OCP9211 is low- R_{ON} P-channel load switch in 4-pin WLCSP package. The slew turn-on control is integrated to limited inrush current. The device is designed to have very low leakage current during off state for low power-saving system.

Input Capacitor

To limit the voltage-drop on the input supply caused by transient inrush currents when the switch turns on into a discharged load capacitor or short-circuit, a capacitor needs to be placed between V_{IN} and GND. A $1\mu F$ ceramic capacitor, C_{IN} , placed close to the pins, is usually sufficient. Higher values of C_{IN} can be used to further reduce the voltage drop during high current applications. When switching heavy loads, it is recommended to have an input capacitor about 10 times higher than the output capacitor to avoid excessive voltage drop.

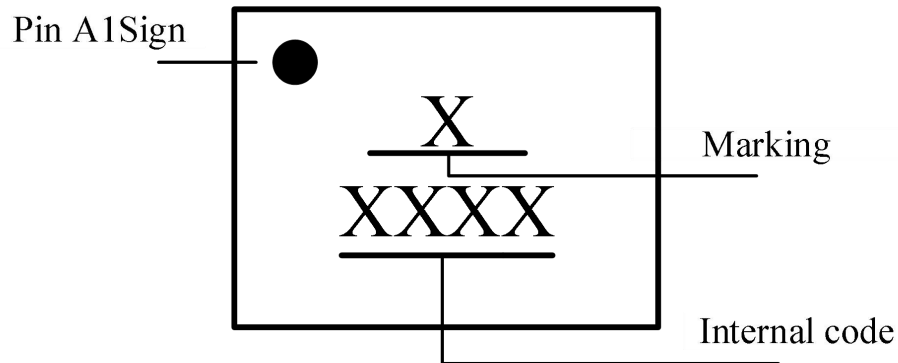
Output Capacitor

Due to the integrated body diode in the PMOS switch, a C_{IN} greater than C_L is highly recommended. A C_L greater than C_{IN} can cause V_{OUT} to exceed V_{IN} when the system supply is removed. This could result in current flow through the body diode from V_{OUT} to V_{IN} .

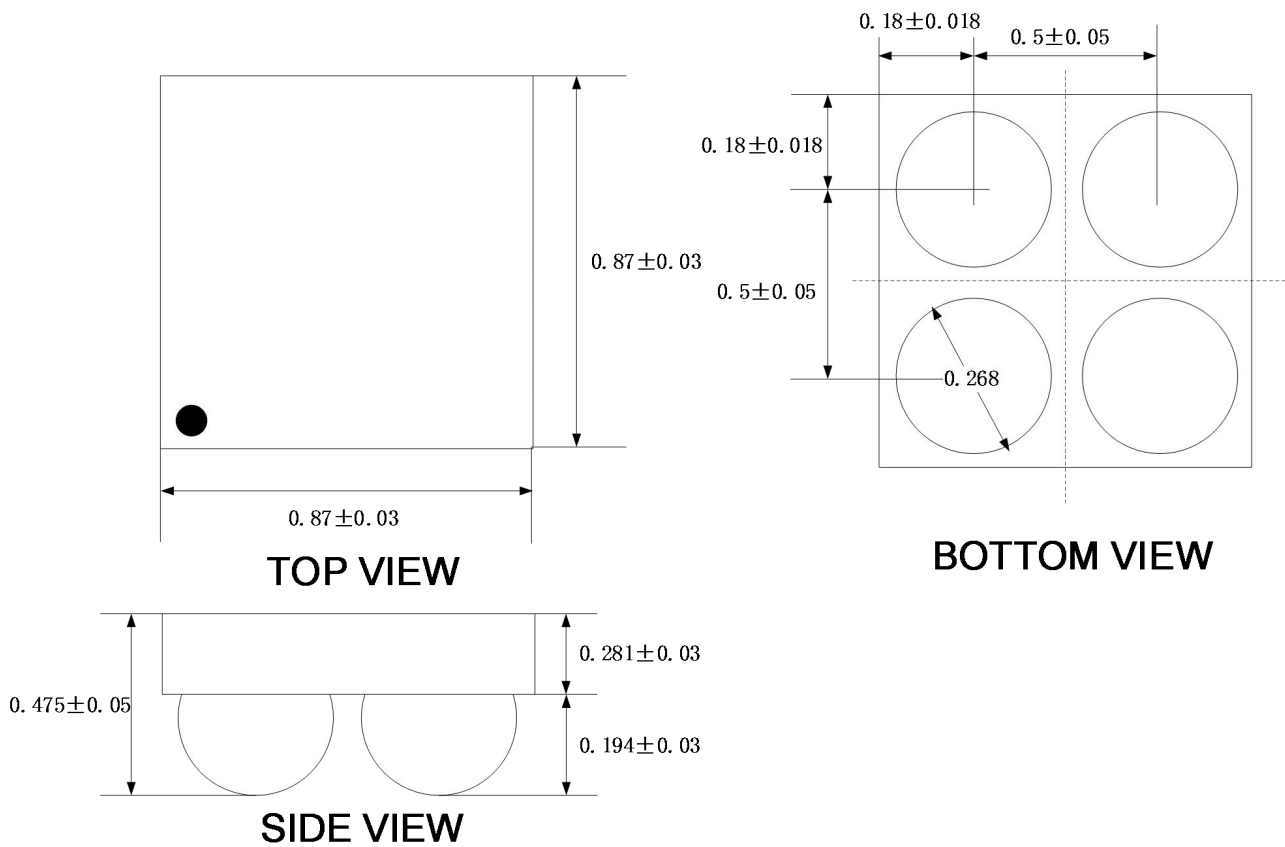


■ Marking Information

WLCSP-4B



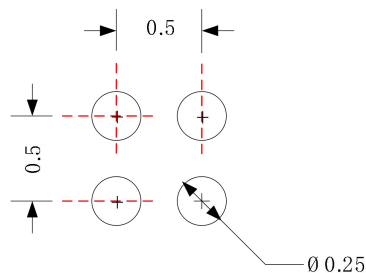
■ Package Information



NOTE : ALL dimensions are in millimeters



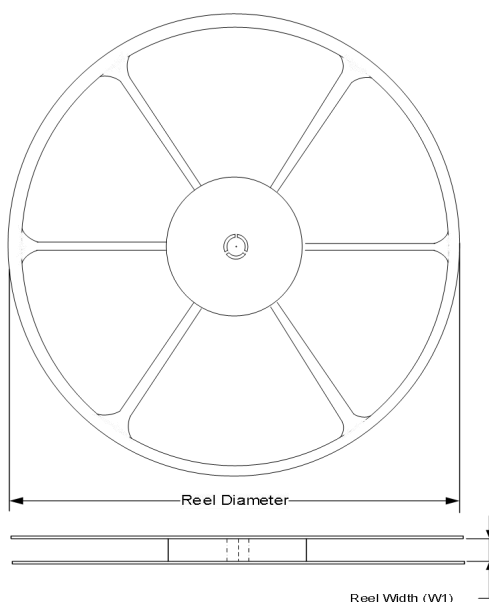
Recommended Land Pattern



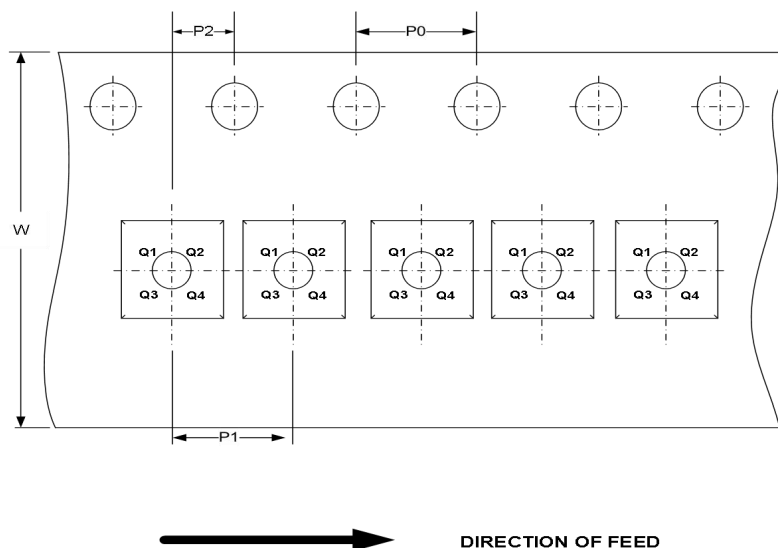
Recommended Land Pattern

Packing Information

REEL DIMENSIONS



TAPE DIMENSIONS



Package type	SPQ (PCS)	Reel Diameter (mm)	Reel Width W1(mm)	W (mm)	P0 (mm)	P1 (mm)	P2 (mm)	MSL	PIN A1 Quadrant
4-Ball WLCSP (WLCSP-4B)	3000	180	8.6	8.0	4.0	4.0	2.0	Level-1-260℃	Q1



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