



Datasheet – MSI2006 6A Bi-directional Load Switch for Tablet

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General Description

The MSI2006 is a low R_{on} P-channel MOSFET controlled by a soft-start sequence of 2ms for Mobile applications.

Bi-directional switching allows reverse current from V_{OUT} to V_{IN} . The switching is controlled by active-LOW logic input the ENB pin.

The input voltage range operates from 2.3V to 5.5VDC to support a wide range of applications in consumer, optical, storage, portable and industrial device power management.

The device is packaged 1.235mm x 1.625mm, Wafer-Level Chip-Scale Package (WLCSP).

Features

- Wide Input Voltage : 2.3V to 5.5V
- Low $R_{DS(ON)}$: 7 m Ω (Typ.)
- Slew Rate/Inrush Control : 2.0ms(Typ.)
- 6A Maximum Continuous Current
- Low Off Switch Current : < 1uA
- Reverse Current Blocking (RCB) during OFF
- ESD Protected
 - Human Body Model : > 8.0kV
 - Charged Device Model : > 2.0kV

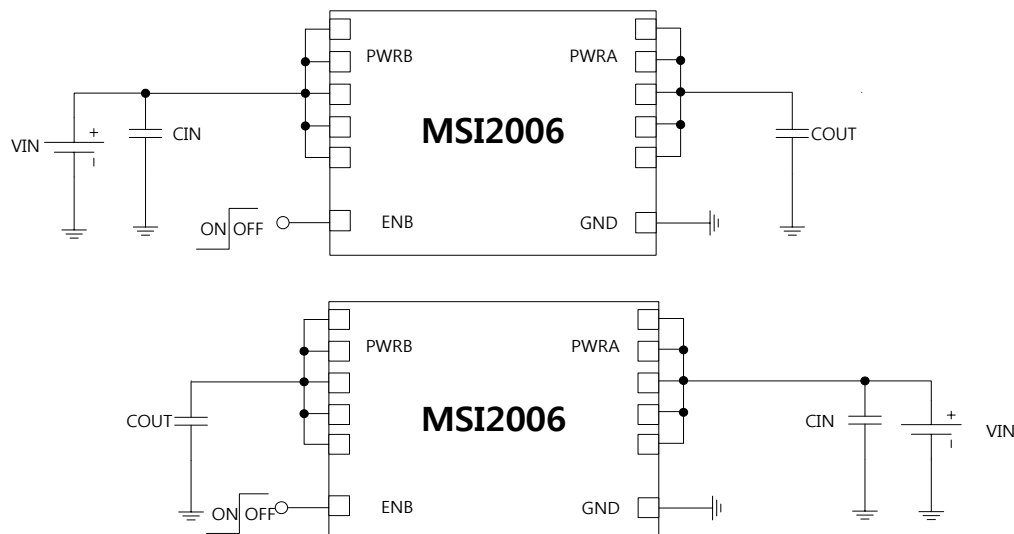
Applications

- Tablet
- Storage, DSLR, portable Devices

Ordering Information

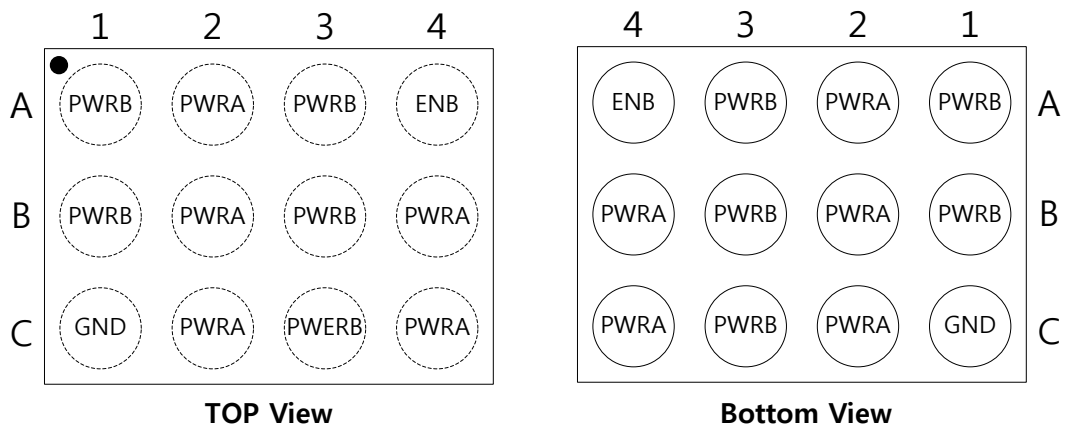
Part Number	Top Marking	Ambient Temperature Range	Package	RoHS Status
MSI2006WCRH	M06	-40°C to +85 °C	1.235 mm X 1.625 mm WLCSP-12Ball	Halogen Free Pb-Free

Typical Application



Pin Configuration

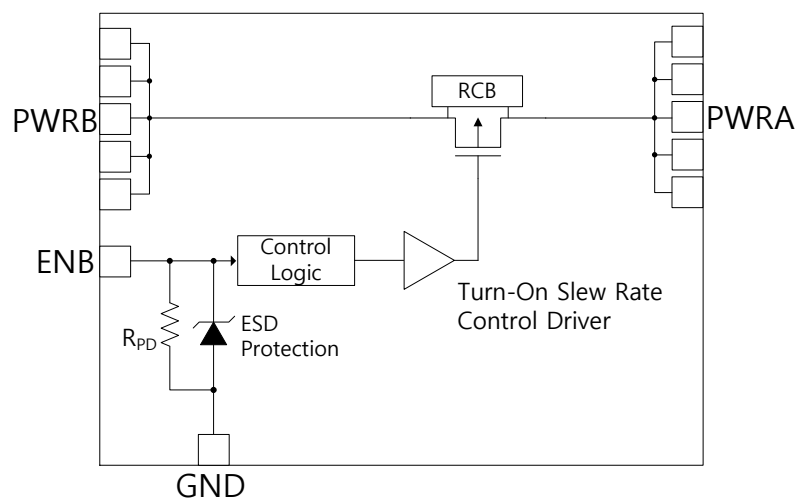
Top View and Bottom View



Pin Description

Name	No.	Description
PWRA	A2, B2, B4, C2, C4	Power Input / Output : Bi-directional power path
PWRB	A1, A3, B1, B3, C3	Power Input / Output : Bi-directional power path
GND	C1	Ground
ENB	A4	ON/OFF control, Active Low

Functional Block Diagram



Absolute Maximum Ratings ^(Note 1)

Symbol	Parameter	Min	Max	Unit
V_{VIN}	PWRA, PWRB, ENB to GND	-0.3	6.0	V
I_{SW}	Maximum Continuous Switch Current		6.0	A
P_D	Power Dissipation at $T_A = 25^{\circ}\text{C}$ (Derate 7.22 mW/ $^{\circ}\text{C}$ above 25°C)		902	mW
T_{STG}	Storage Junction Temperature	-65	+150	$^{\circ}\text{C}$
T_A	Operating Temperature Range	-40	+85	$^{\circ}\text{C}$
ESD	HBM on All Pins (Note 2)	8.0		kV
	CDM on All Pins (Note 3)	2.0		

Note 1: Stresses beyond the above listed maximum ratings may damage the device permanently. Operating above the recommended conditions for extended time may stress the device and affect device reliability. Also the device may not operate normally above the recommended operating conditions. These are stress ratings only.

Note 2: ESD tested per JESD22-A114C.

Note 3: ESD tested per JESD22-C101E

Recommended Operating Conditions ^(Note 1)

Symbol	Parameter	Min	Max	Unit
PWRA, PWRB	Supply Input (or Output) Voltage	2.3	5.5	V
ENB	Enable Logic High Voltage	1.6	5.5	V
	Enable Logic Low Voltage	0	0.4	V
C_{PWRA}, C_{PWRB}	Input / Output Capacitor	0.1		μF
T_A	Ambient Temperature ^(Note 2)	-40	85	$^{\circ}\text{C}$

Note 1: Normal Operation of the device is not guaranteed if operating the device over outside range of recommended conditions.

Note 2: The ambient temperature may have to be de-rated if used in high power dissipation and poor thermal resistance conditions.

Package Thermal Resistance

Parameter	Value	Unit
θ_{JA} , 1.235 mm X 1.625 mm WLCSP-12Ball	138.6	$^{\circ}\text{C/W}$

Electrical Characteristics

Min & Max Limits apply for $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ and for $2.3\text{V} \leq V_{IN} \leq 5.5\text{V}$ (Unless otherwise noted).

Typical values are at $V_{IN} = 4.2\text{V}$ and $T_A = 25^{\circ}\text{C}$ (Unless otherwise noted). (Note 1)

Parameter		Test Condition	Min	Typ.	Max	Unit
SUPPLY OPERATION						
V_{PWRA} V_{PWRB}	Input voltage range		2.3		5.5	V
I_{PWRA} I_{PWRB}	Quiescent Current	$V_{EN/} = \text{Low}, T_A=25^{\circ}\text{C}$			1	uA
I_{SHDN}	Shutdown Current	$V_{EN/} = 5.5\text{V}, (V_{PWRA} = 5.5\text{V}, V_{PWRB} = \text{open})$ or $(V_{PWRB} = 5.5\text{V}, V_{PWRA} = \text{open}), T_A=25^{\circ}\text{C}$			1	uA
INTERNAL FET						
R_{ON}	On-Resistance Between PWRA and PWRB	$T_A = +25^{\circ}\text{C}, I_{LOAD} = 100\text{mA}, V_{PWRA/B} = 2.3\text{V}$		10.0	16.0	mΩ
		$T_A = +25^{\circ}\text{C}, I_{LOAD} = 100\text{mA}, V_{PWRA/B} = 3.3\text{V}$		7.0	10.0	
ENABLE INPUT						
V_{IH}	Enable Input Logic-High Voltage		1.6			V
V_{IL}	Enable Input Logic-Low Voltage				0.4	V
R_{PD}	Enable Internal Pull down Resistor			500	700	kΩ
DYNAMIC						
t_{ON}	Turn-On Time	$V_{IN}=4.2\text{V}, R_L=100\Omega, C_L=0.1\mu\text{F}, T_A=25^{\circ}\text{C}$		3		ms
t_{OFF}	Turn-Off Time	$V_{IN}=4.2\text{V}, R_L=100\Omega, C_L=0.1\mu\text{F}, T_A=25^{\circ}\text{C}$		3		ms

Note 1: All devices under mass production are tested at $T_C = +25^{\circ}\text{C}$. Specifications over the operating temperature range are not guaranteed.

Typical Operating Characteristics

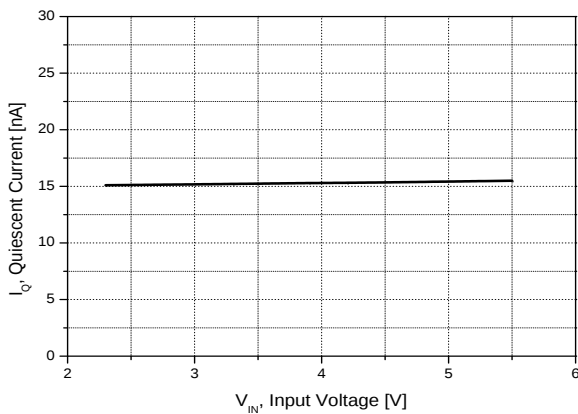


Figure 1. Quiescent Current vs. Input Voltage

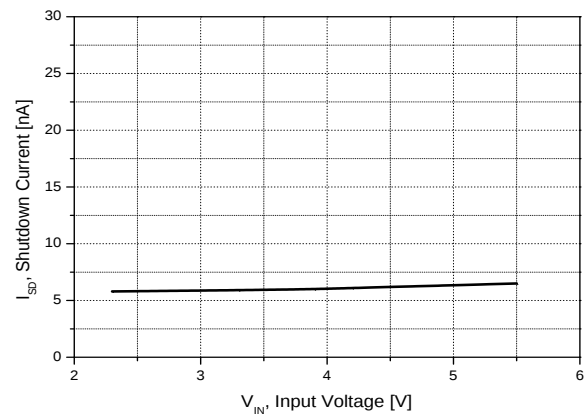


Figure 2. Shutdown Current vs. Input Voltage

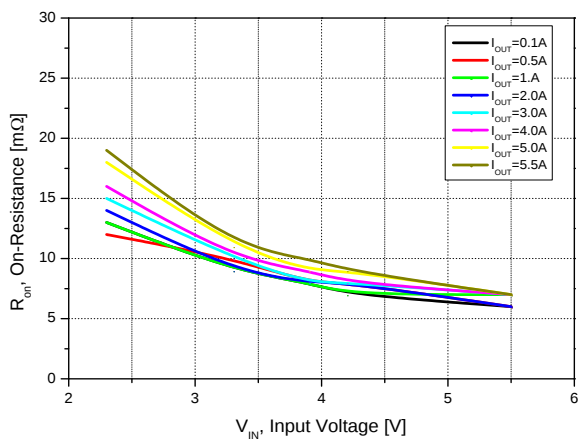


Figure 3. On-Resistance vs. Input Voltage

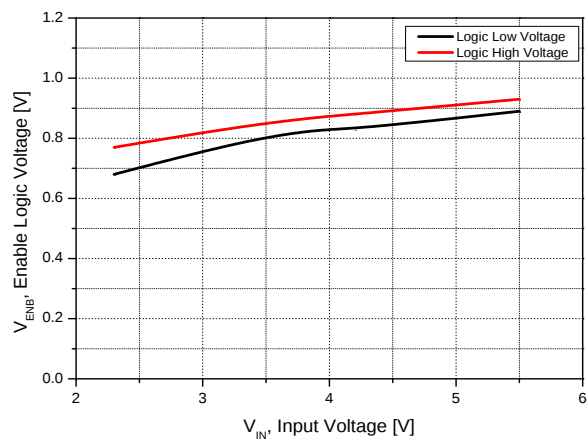


Figure 4. Enable Logic Voltage vs. Input Voltage

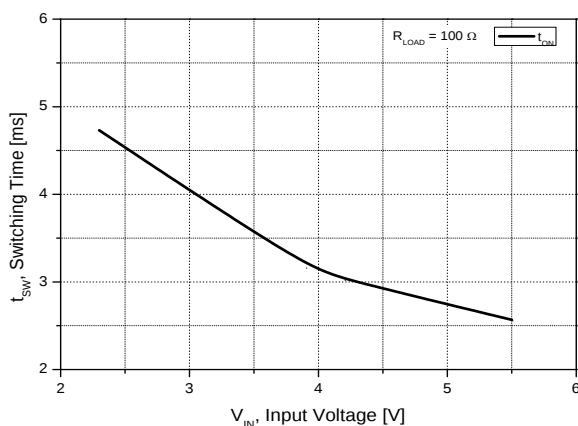


Figure 5. Turn-On Time vs. Input Voltage

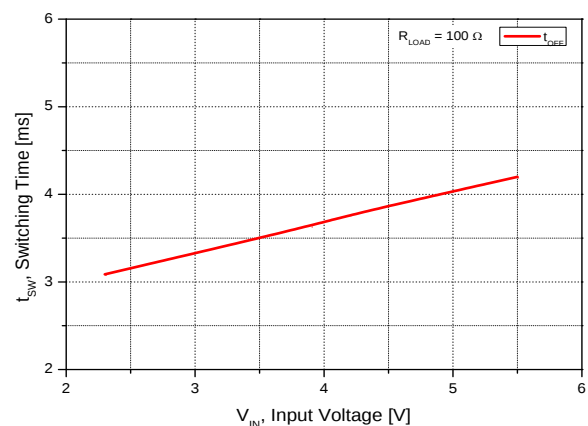


Figure 6. Turn-Off Time vs. Input Voltage

Typical Operating Characteristics

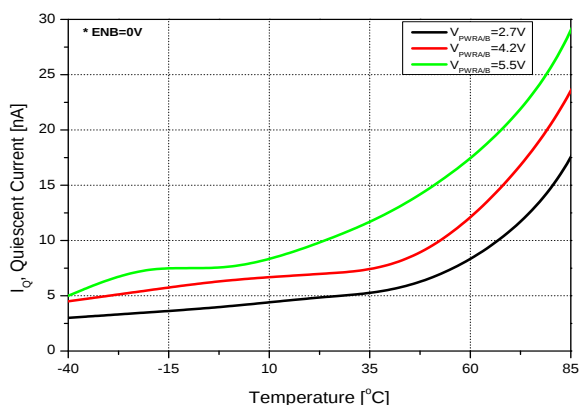


Figure 7. Quiescent Current vs. Temperature

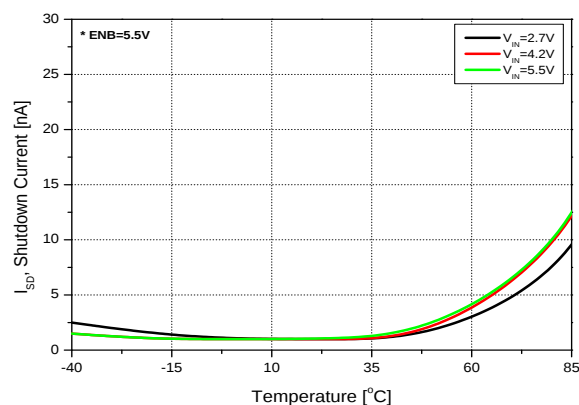


Figure 8. Shutdown Current vs. Temperature

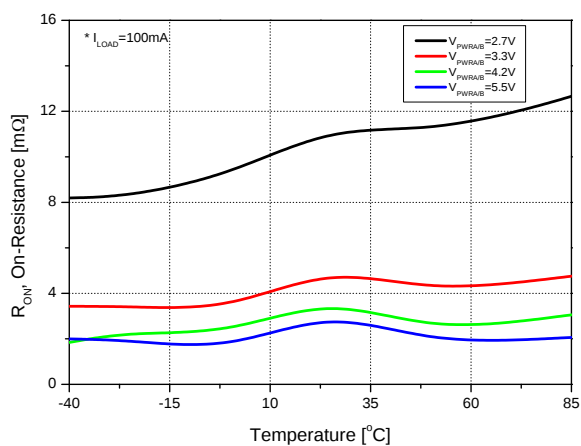


Figure 9. On-Resistance vs. Temperature

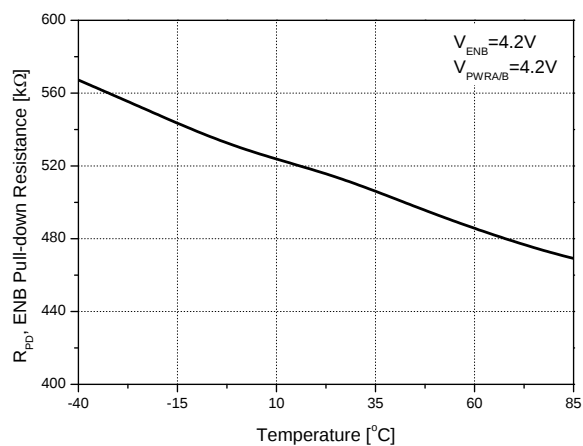


Figure 10. ENB Pull-down Resistance vs. Temperature

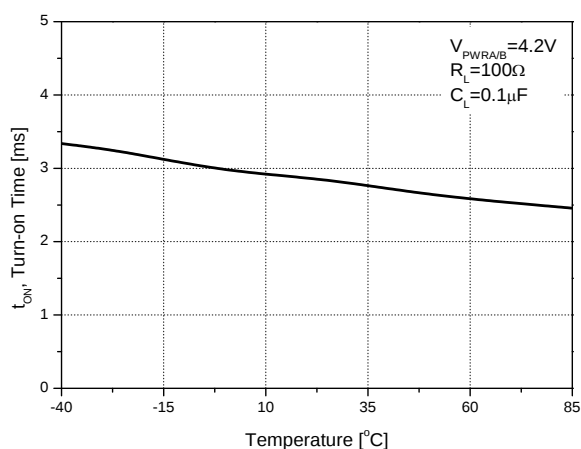


Figure 11. Turn-On Time vs. Temperature

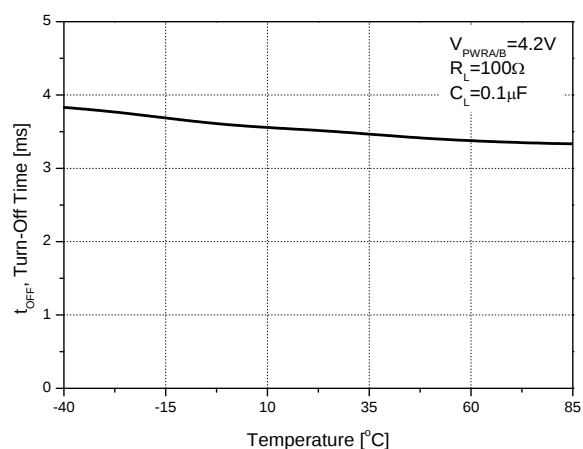


Figure 12. Turn-Off Time vs. Temperature

Overview

The MSI2006 is a low R_{on} P-channel MOSFET controlled by a soft-start sequence of 2ms for Mobile applications.

Bi-directional switching allows reverse current from V_{OUT} to V_{IN} . The switching is controlled by active-LOW logic input the ENB pin.

The input voltage range operates from 2.3V to 5.5VDC to support a wide range of applications in consumer, optical, storage, portable and industrial device power management.

The device is packaged 1.235mm x 1.625mm, Wafer-Level Chip-Scale Package (WLCSPP).

Reverse Current Blocking

The MSI2006 bi-directional switch prevents current flowing from either port to the other when device is disabled.

ENB Input

The MSI 2006's switch position is controlled by an ENB active low logic input. The switch is on when ENB is logic low and off when ENB is logic high. ENB is internally pulled down to ground by R_{PD} .

Switch On and Off Performance

The MSI2006 has slew rate control. This minimizes the inrush current and provides a soft turn on. ($C_{PWRA/B}=0.1\mu F$, $V_{PWRA}=4.2V$, $R_{LOAD}=10\Omega$)

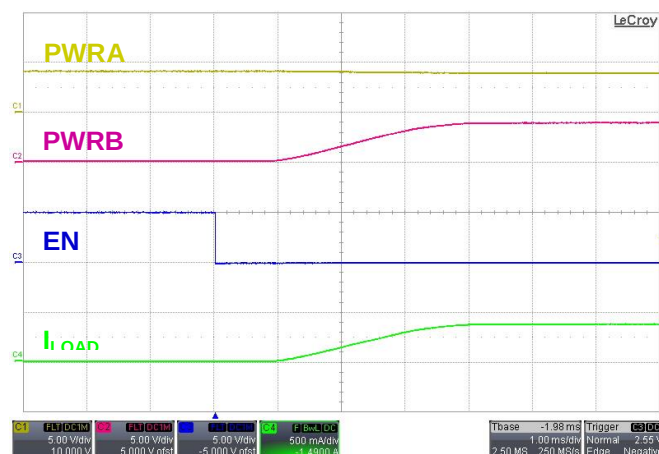


Figure 14. PWRB Turn-On Waveform

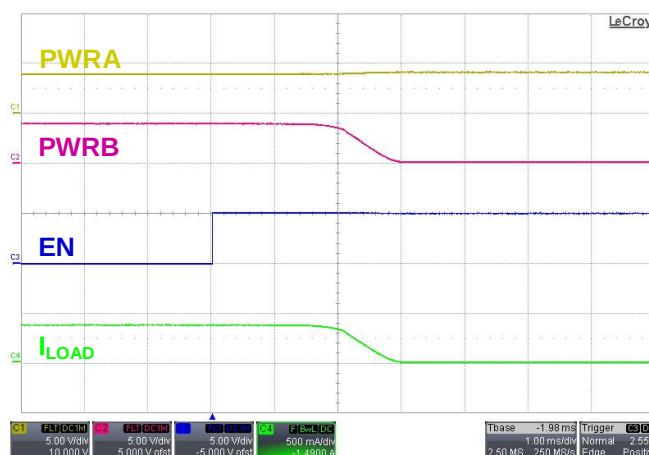
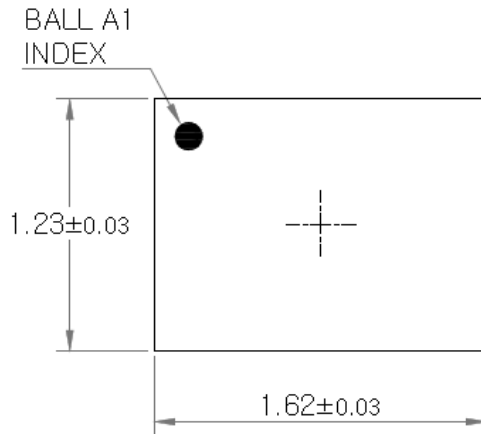


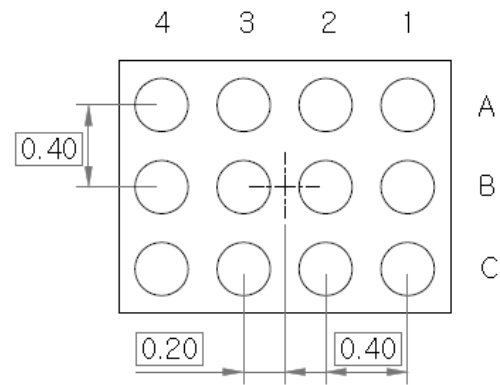
Figure 15. PWRB Turn-Off Waveform

Physical Dimensions

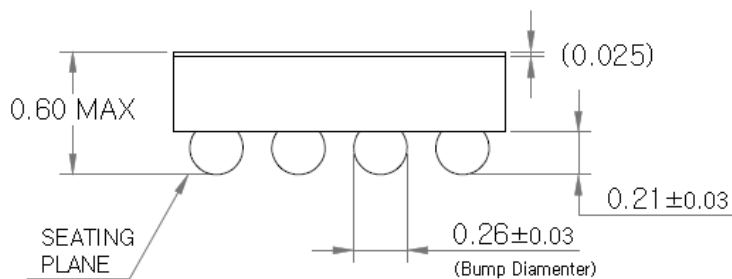
1.235 mm X 1.625 mm WLCSP-12Ball



TOP VIEW



BOTTOM VIEW



SIDE VIEW

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