DIO7195B

5.5 V, Full-Function, 2.5 A DC Load Switch with Adjustable Current Limit

Features

- Input voltage: 1.8 V ~ 5.5 V
- Quiescent supply current: Maximum 95 μA
- Turn-on controlled
- Current limit : Maximum 2.5 A
- 0.045 A ~ 2.5 A current
- P-channel MOSFET current-limited architecture
- Undervoltage lockout
- Overvoltage lockout
- Low shutdown current
- Fast current limit response
- Thermal shutdown protection
- Reverse current blocking
- Package: six ball advanced 0.98 x 1.48 mm WLCSP-6

Applications

- Handheld electronic devices
- Portable enterprise / industrial devices
- Digital cameras
- Peripheral ports and accessories
- Medical equipment
- Hot swap

Descriptions

The DIO7195B is a load switch that provides full protection to systems and loads that may encounter large current conditions.

A P-channel MOSFET current-limit stops the current when the MOSFET is off and the output voltage is higher than input. The perfect thermal shutdown protection shuts off the switch to prevent damage to the part when a continuous over-current condition causes excessive heating.

When the switch current reaches the current limit, the parts operate in a constant-current mode to prohibit excessive currents from causing damage.

The DIO7195B does not turn off after a current limit fault, but remains in the constant-current mode indefinitely.

Block Diagram

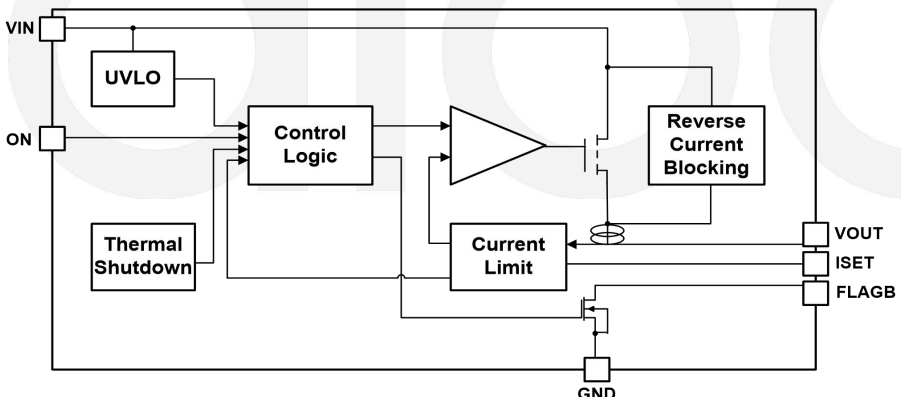


Figure 1. Functional block diagram

Ordering Information

Part Number	Top Marking	RoHS	T_A	Package	
DIO7195BWL6	D795	Green	-40 to 85°C	WLCSP-6	Tape & Reel,3000

Pin Assignment

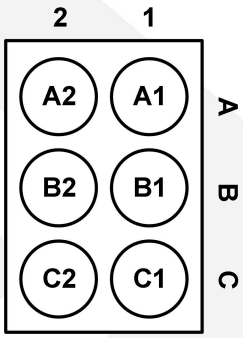


Figure 2. Pin assignment (Bottom view)

Pin Definitions

Pin Code	Name	Pin Description
A1	FLAGB	Fault output. Active low, open-drain output that indicates an over-current supply, under-voltage, or over-temperature state.
B1	VOUT	Switch output. Output of the power switch.
C1	ISET	Current limit set input. A resistor from ISET to ground sets the current limit for the switch.
C2	GND	Ground.
B2	VIN	Supply input. Input to the power switch and the supply voltage.
A2	ON	Active high, ON control input.

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Rating	Unit
	All pins	-0.3 to 6	V
θ_{JA}	Package thermal resistance	85	°C/W
T_J	Junction temperature range	150	°C
T_L	Lead temperature (soldering, 10 s.)	260	°C
T_{STG}	Storage temperature range	-65 to 150	°C
ESD	HBM (human body mode)	7	kV

Note: Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating	Unit
	VIN	1.8 to 5.5	V
	All other pins	0 to 5.5	V
T_J	Junction temperature range	-40 to 125	°C
T_A	Ambient temperature range	-40 to 85	°C

Electrical Characteristics

T_A = 25°C, V_{IN} = 3.3 V, unless otherwise noted.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{IN}	Input voltage range			1.8		5.5	V
I_Q	Quiescent supply current	I_{OUT} = 0 mA, V_{ON} = V_{IN}	V_{IN} = 1.8 V		50	85	μA
			V_{IN} = 5.5 V		65	95	μA
$R_{DS(ON)}$	On-resistance	T_A = 25°C, I_{OUT} = 200 mA			55	80	mΩ
		T_A = -40 to 85°C, I_{OUT} = 200 mA				135	
V_{IH}	On input logic high voltage on	V_{IN} = 1.8 V		0.8			V
		V_{IN} = 5.5 V		1.4			
V_{IL}	On input logic low voltage	V_{IN} =1.8 V				0.5	V
		V_{IN} = 5.5 V				1.0	
I_{IN}	On input leakage	V_{ON} = V_{IN} or GND		-1	0	1	μA
I_{VIN_SD}	VIN shutdown current	V_{ON} = 0 V, V_{IN} = 5.5 V, V_{OUT} = short to GND		-2		2	μA
V_{FLB_L}	FLAGB output logic low voltage	V_{IN} = 5 V, I_{SINK} = 2 mA			0.05	0.20	V
		V_{IN} = 1.8 V, I_{SINK} = 2 mA			0.12	0.30	V
I_{FLB_H}	FLAGB output logic high leakage current	V_{IN} = 5 V, switch on				1	μA
I_{VOUT_SD}	VOUT shutdown current	V_{ON} = 0 V, V_{OUT} = 5.5 V, V_{IN} = short-to-GND		-2		2	μA
$V_{BREAKDOWN}$	Reverse breakdown voltage	V_{IN} = V_{ON} = 0 V, I_{OUT} = 200 μA			8		V
I_{LIM}	Current limit	V_{IN} = 5 V	R_{SET} = 430 Ω		1.6		A
			R_{SET} = 840 Ω		1		A
			R_{SET} = 1 kΩ		815		mA
			R_{SET} = 1.5 kΩ		525		mA
T_{SD}	Thermal shutdown temperature	Shutdown threshold			140		°C
		Return from shutdown			130		°C
	Thermal shutdown hysteresis				10		°C
V_{OVLO}	Over-voltage lockout	V_{IN} increasing		5.6	5.8	6.1	V
V_{OVLO_HYST}	Over-voltage lockout hysteresis				200		mV
TF_D	Delay time	From current limit to FLAGB			3		ms

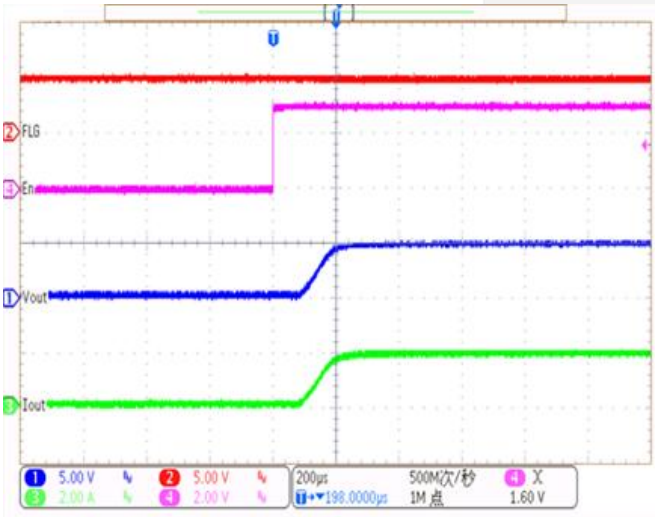
V_{UVLO}	Under-voltage lockout	V_{IN} increasing	1.55	1.65	1.75	V
V_{UVLO_HYST}	Under-voltage lockout hysteresis			50		mV
td_{ON}	Delay on time	R_L = 500 Ω, C_L = 0.1 μF		80		μs
t_R	V_{OUT} rise time	R_L = 500 Ω, C_L = 0.1 μF		80		μs
t_{ON}	Turn on time	R_L = 500 Ω, C_L = 0.1 μF		160		μs
td_{OFF}	Delay off time	R_L = 500 Ω, C_L = 0.1 μF		7		μs
t_F	V_{OUT} fall time	R_L = 500 Ω, C_L = 0.1 μF		140		μs
t_{OFF}	Turn off time	R_L = 500 Ω, C_L = 0.1 μF		146		μs
t_{SC}	Short-circuit response time	V_{IN} = V_{OUT} = 3.3 V		5		μs

Typical Performance Characteristics

Typical value: V_{IN} = 3.3 V, C_{IN} = 1 uF, C_{OUT} = 1 uF, T_A = 25°C, unless otherwise specified.

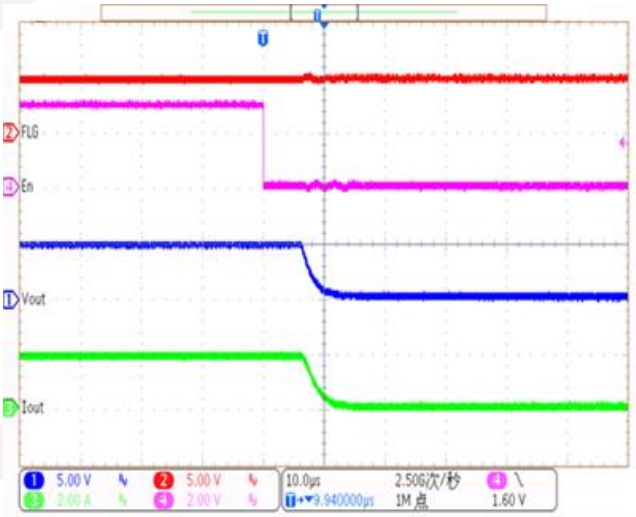
Enable Start Up

(V_{IN} = 5 V, R_{Load} = 2.5 Ω)

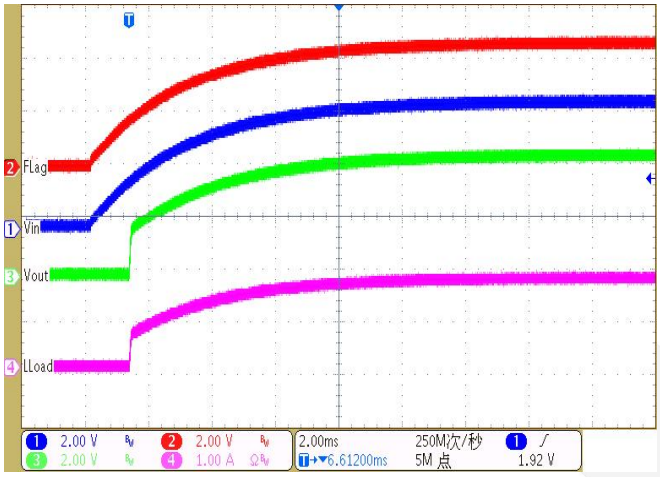


Enable Shut Down

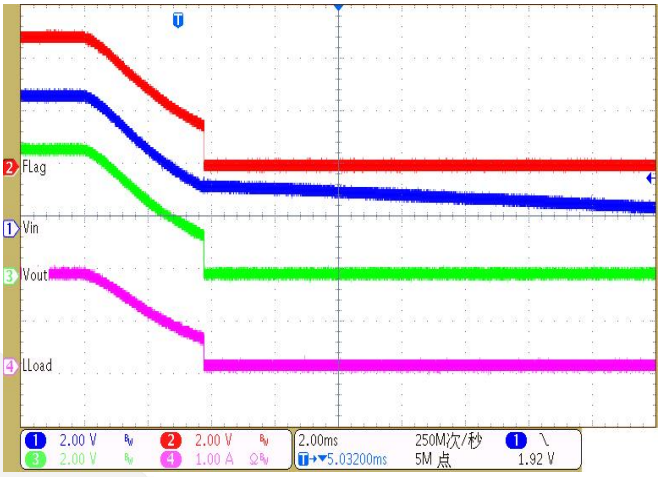
(V_{IN} = 5 V, R_{Load} = 2.5 Ω)



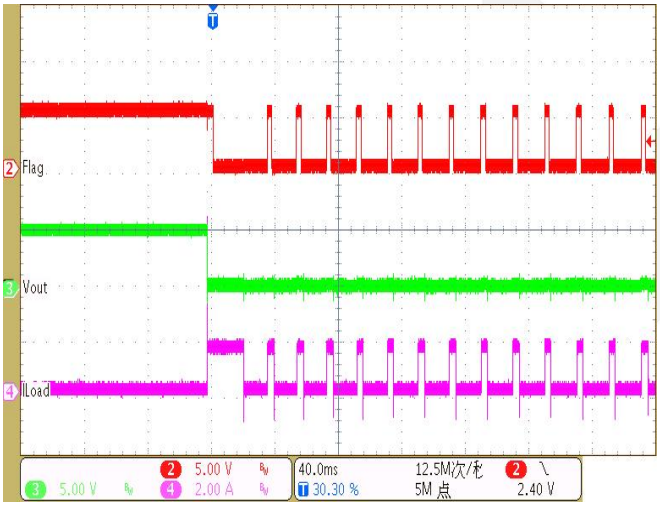
Power On (V_{IN} = 5 V, R_{Load} = 2.5 Ω)



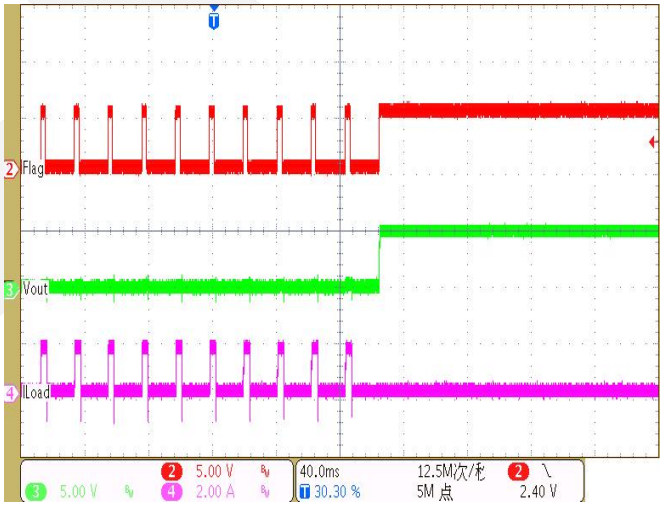
Power Off (V_{IN} = 5 V, R_{Load} = 2.5 Ω)



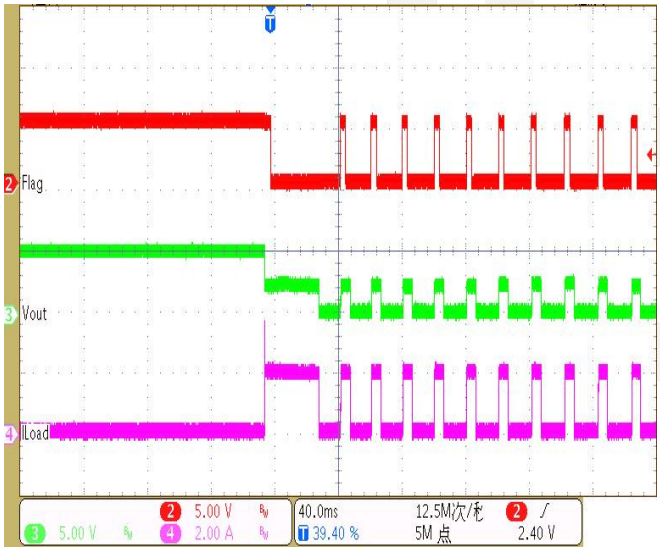
Short Circuit Protection



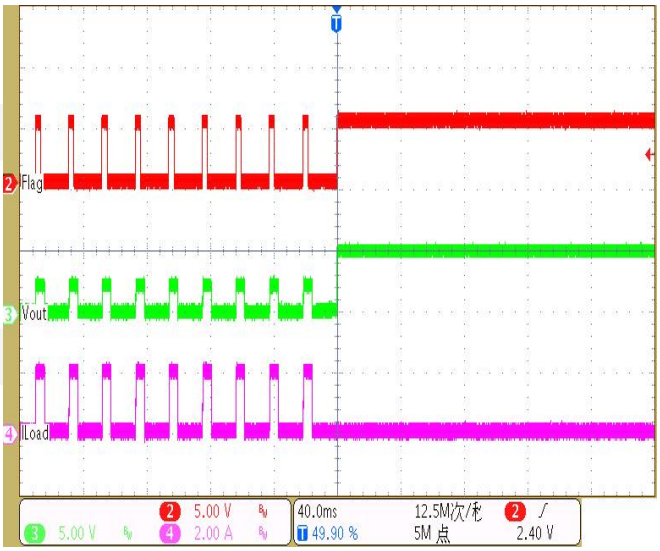
Short Circuit Protection Recovery



Over Load (No Load to 1 Ω Response)



Over Load (1 Ω to No Load Response)



Application Information

The DIO7195B is a current-limit switch that protects the system and load from being damaged or disrupted by the application of high currents. The controller protects against system malfunctions through current limiting, under-voltage lockout, and thermal shutdown.

Current Limiting

The current limiting ensures the current through the switch does not exceed the maximum value. The DIO7195B does not include limit blanking period, so it remains in a constant current state until the ON pin is deactivated or the thermal shutdown turns off the switch. The current limit is set with an external resistor connected between the ISET and GND.

R_{SET} (Ω)	Current Limit (A)
430	1.6
840	1
1000	0.815
15000	0.525

A short-circuit detection feature is introduced to preventing the switch from large power dissipation during heavy load. The switch is put into short-circuit current-limiting mode if the switch is loaded with a heavy load.

The DIO7195B has no current limit blanking period. When the output voltage drops below 1.1 V, which is the short-circuit detection threshold voltage, the current limit value is re-conditioned and the short-circuit current-limit value is decreased to about 60% of the typical current limit. This keeps the power dissipation of the part below a certain limit even at dead-short conditions at 5.5 V input voltage.

On/Off Control

The ON pin controls the state of the switch. The DIO7195B does not turn off in response to an over-current condition but remains operating inconstant-current mode as long as ON is active and the thermal shutdown or under-voltage lockout is not activated.

Fault Report

FLAGB signals the fault mode by activating low as soon as the device detects an over-current, input under-voltage, over-voltage or over-temperature condition. The FLAGB goes low at the end of the blanking time, remains low during the faults and immediately returns high at the end of the fault condition. FLAGB is an open-drain MOSFET that requires a pull-up resistor between the VIN and FLAGB. During shutdown, the pull-down on FLAGB is disabled to reduce current drawn from the supply.

Undervoltage Lockout (UVLO)

The undervoltage lockout turns the switch off if the input voltage drops below the under-voltage lockout threshold. With the ON pin active, the input voltage rising above the under-voltage lockout threshold causes a controlled turn-on of the switch, which limits current over shoot.

Thermal Shutdown

The thermal shutdown protects the die from internally or externally generated excessive temperatures. During an over-temperature condition, FLAGB is activated and the switch is turned off. The switch automatically turns on again if the temperature of the die drops below 130°C.

Reverse-Current Blocking

The reverse-current blocking feature protects the input source against the current flow from output to input. For a standard USB power design, this is an important feature to protect the USB host from being damaged due to reverse current flow on V_{BUS}.

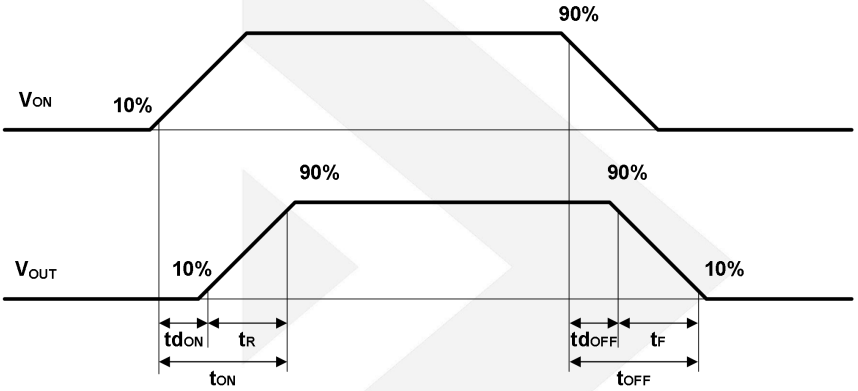


Figure 3. Timing diagram

td_{ON} = Delay On time; t_R = V_{OUT} rise time; t_{ON} = Turn-on time.
td_{OFF} = Delay off time; t_F = V_{OUT} fall time.
t_{OFF} = Turn-off time.

Typical Application

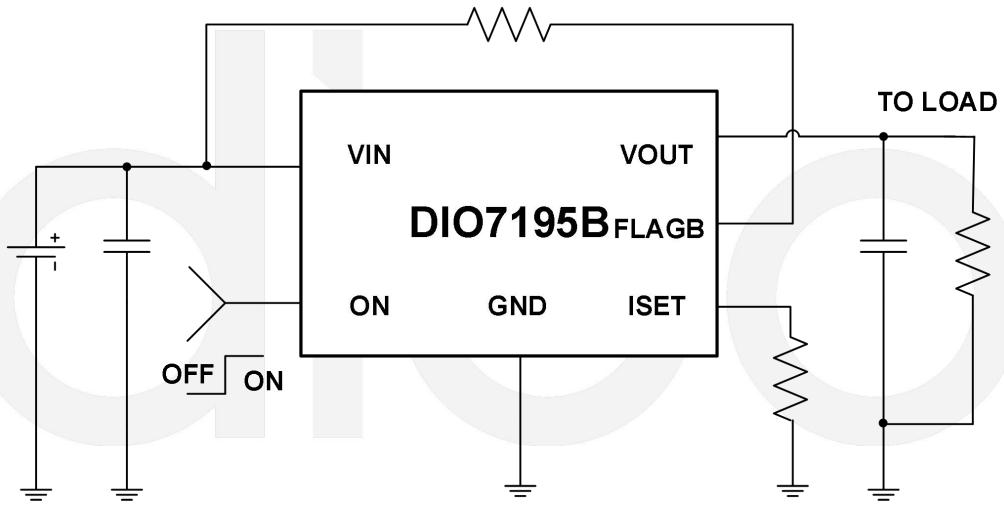
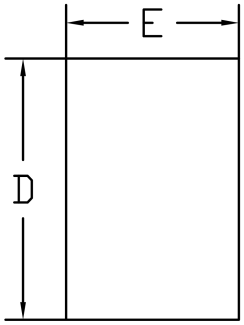
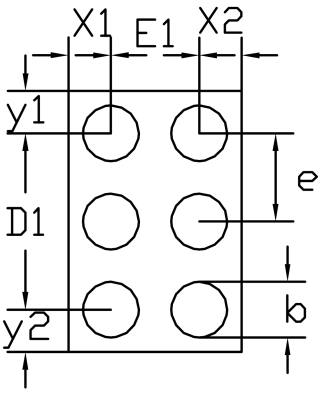


Figure 4. Typical application

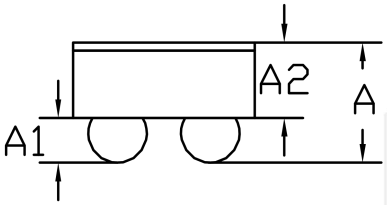
Physical Dimensions: WLCSP-6



TOP VIEW
(MARK SIDE)

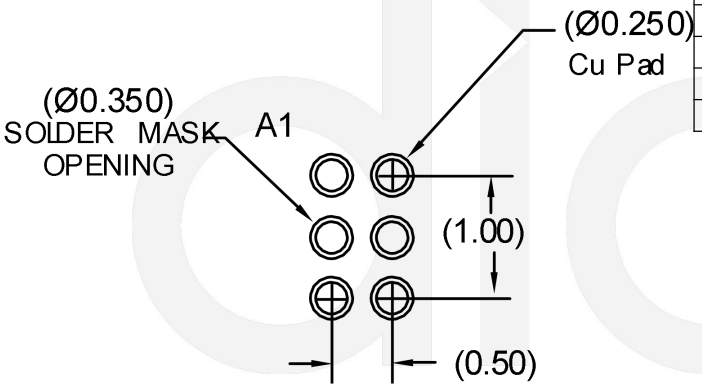


BOTTOM VIEW
(BALL SIDE)



SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.535	0.580	0.625
A1	0.223	0.248	0.273
A2	0.312	0.332	0.352
D	1.450	1.480	1.510
D1		1.000 BSC	
E	0.950	0.980	1.010
E1		0.500 BSC	
b	0.285	0.310	0.335
e		0.500 BSC	
x1		0.240 REF	
x2		0.240 REF	
y1		0.240 REF	
y2		0.240 REF	



RECOMMENDED LAND PATTERN

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