The ERM Driver With Brake And Discharge Function

Features

- Drives a erm
- Rdson HS + LS: 770mΩ(Typ)
- Supply Voltage Range 2V to 7V
- Standby current: 0.1μA
- 1A Maximum Drive Current
- Brake function integrated
- Discharge function integrated
- WBDFN 2mm×2mm×0.75mm-8L package
- Over-Current Protection
- Over-Temperature Protection
- Under-Voltage Protection

Applications

- Wearable Devices
- Mobile phones

General Description

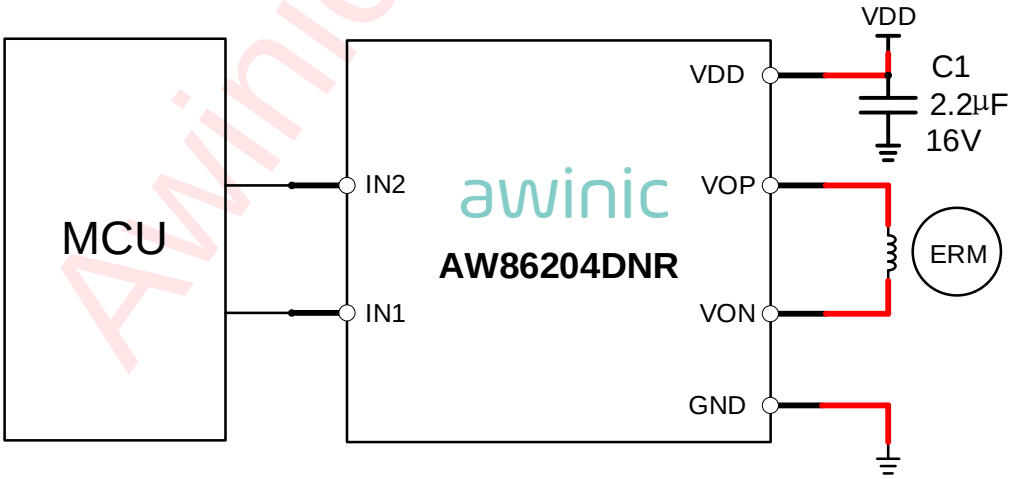
The AW86204 is a low cost ERM actuator driver for mobile phone and wearable devices, the brake function can reduce the fall time of actuator significantly. And the discharge function can protecting chips from the impact of overshoot caused by inductive current storage.

The AW86204 has a PWM(IN1 and IN2) input interface, which is compatible with industry standard devices.

The AW86204 integrate a H-driver to control the output.

Internal shutdown functions are provided for Over-current protection, Over-temperature protection and Under-voltage Protection.

Typical Application Circuit



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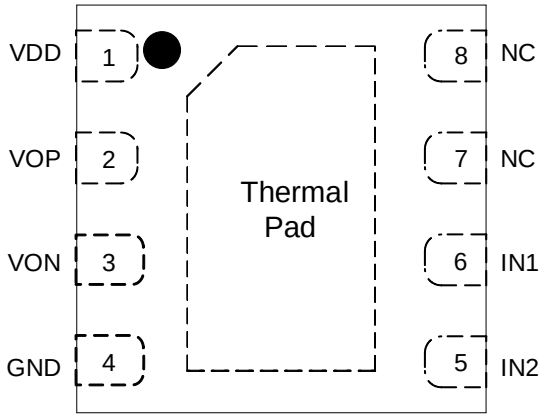
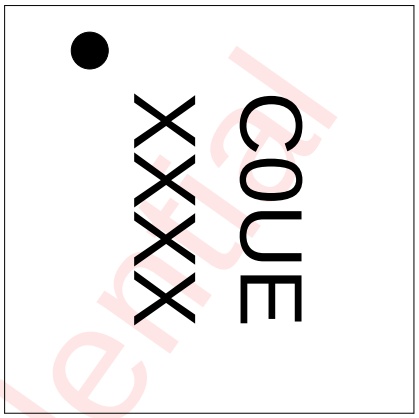
Pin Configuration And Top Mark

AW86204DNR
(Top view)



AW86204DNR Marking
(Top view)



C0UE- AW86204 DNR
XXXX- Production Tracing Code

Pin Definition

No.	NAME	DESCRIPTION
1	VDD	Power supply.
2	VOP	H-bridge output. Connect these pins to the motor winding.
3	VON	H-bridge output. Connect these pins to the motor winding.
4	GND	Device ground. This pin must be connected to ground.
5	IN2	Logic inputs. Controls the H-bridge output. Has internal pulldowns.
6	IN1	Logic inputs. Controls the H-bridge output. Has internal pulldowns.
7、8	NC	-
	Thermal Pad	Beneath the IC for heat dissipation. Always solder to the PCB ground for high-current power converter.

Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW86204DNR	-40°C~125°C	DFN 2mm×2mm -8L(0.75mm)	C0UE	MSL1	ROHS+HF	3000 units/ Tape and Reel

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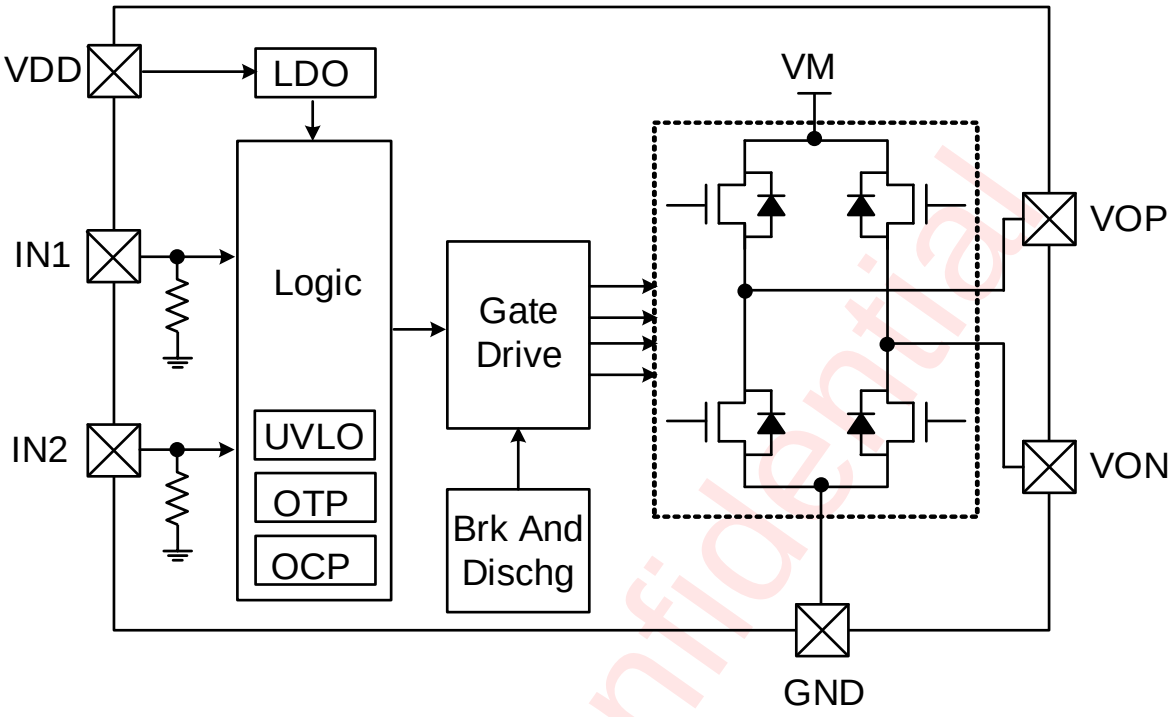
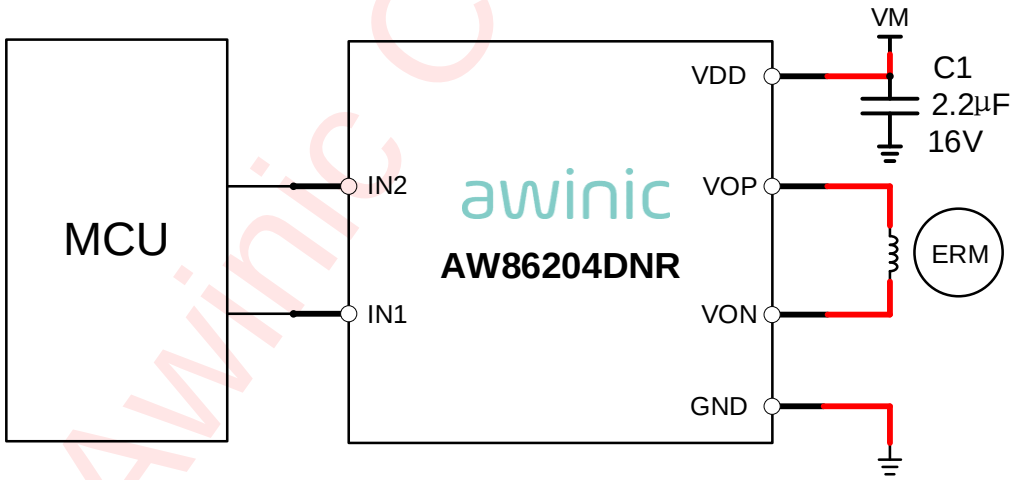
Functional Block Diagram



Typical Application Circuits



- Notice for Typical Application Circuits:

1. Please place C1 as close to the chip as possible.
2. **Table 1** lists the recommended external components for the device.

Table 1 External Components

COMPONENT	PIN 1	PIN 2	RECOMMENDED
C1	VDD	GND	16V, 2.2µF ceramic capacitor rated for VDD

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Absolute Maximum Ratings(NOTE1)

PARAMETERS	RANGE
Motor power-supply voltage (VDD)	-0.3V to 9V
Control pin voltage (IN1, IN2)	-0.5V to 7V
Peak drive current (OUT1, OUT2)	Internally limited
Junction-to-ambient thermal resistance θ_{JA}	94.4°C/W
Operating free-air temperature range	-40°C to 125°C
Maximum operating junction temperature T_{JMAX}	160°C
Storage temperature TSTG	-65°C to 150°C
Lead temperature (soldering 10 seconds)	260°C
ESD(Including HBM CDM)(NOTE 2)	
HBM(Human Body Model)	±4000V
CDM(Charge Device Model)	±1000V
Latch-Up	
Test Condition: JEDEC STANDARD NO.78E	+IT：200mA -IT：-200mA

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: The human body model is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin. HBM method: ESDA/IEDEC JS-001-2017. CDM method: ESDA/JEDEC JS-002-2018.

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

PARAMETERS		Range	Unit
VDD	Power supply voltage	2 to 7	V
Vin	Logic input voltage (IN1, IN2)	1.8 to 7	V
f_{PWM}	Logic input PWM frequency (IN1, IN2)	0 to 300(1)	kHz
I_{peak}	Peak output current(2)	0 to 1	A
T_A	Operating ambient temperature	-40 to 125	°C

(1) The voltages applied to the inputs should have at least 1500ns of pulse width to ensure detection.

(2) Power dissipation and thermal limits must be observed.

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Electrical Characteristics

T_A=25°C,VDD=5V for typical values (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLIES (VDD)						
VDD	VDD operating voltage		2		7	V
I_{VDD}	VDD operating supply current	IN1 = 5V; IN2 = 0V No load		165	210	μA
I_{STBY}	VDD standby mode supply current	IN1 = IN2 = 0V		50	100	nA
LOGIC-LEVEL INPUTS (IN1, IN2)						
V_{IL}	Input logic-low voltage	VDD = 2V~7V			0.6	V
V_{IH}	Input logic-high voltage	VDD = 2V~7V	1.6			V
V_{HYS}	Input logic hysteresis			160		mV
I_{IL}	Input logic low current	V_{IN} = 0V	-1		1	μA
I_{IH}	Input logic high current	V_{IN} = 3.3V		25	70	μA
t_{SLEEP}	Time to sleep	Inputs low to sleep		1.5	2	ms
MOTOR DRIVER OUTPUTS (VOP, VON)						
$R_{DS(on)}$	HS + LS FET on-resistance	I_{OUT} = 200mA		770		mΩ
I_{OFF}	Off-state leakage current	V_{OUT} = 0V	-200		200	nA
t_{DEAD}	Dead Time			200		ns
PROTECTION CIRCUITS						
V_{UVLO}	VDD undervoltage lockout	VDD falling		1.65	1.85	V
		VDD rising		1.75	1.95	V
V_{UVHYS}	VDD undervoltage hysteresis	Rising to falling threshold		100		mV
I_{OCP}	Overcurrent protection trip level			1.5		A
t_{DEG}	Overcurrent deglitch time			1.5		μs
t_{RETRY}	Overcurrent retry time			2		ms
T_{SD}	Thermal shutdown temperature	Die temperature T_J	145	155	165	°C
T_{HYS}	Thermal shutdown hysteresis			30		°C

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Typical Characteristics

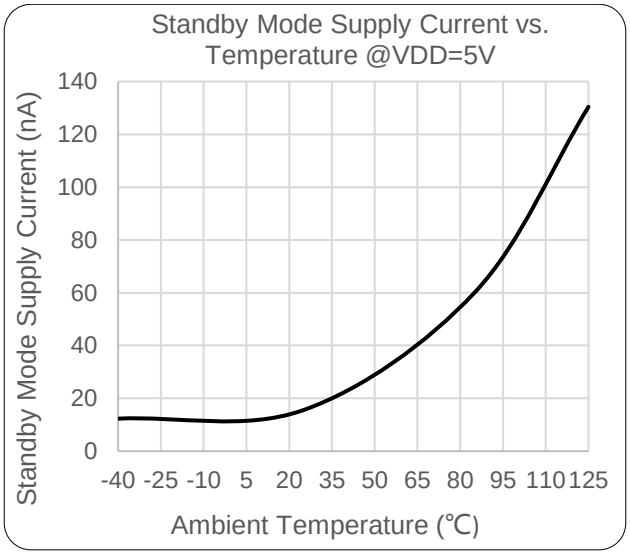

Figure 1

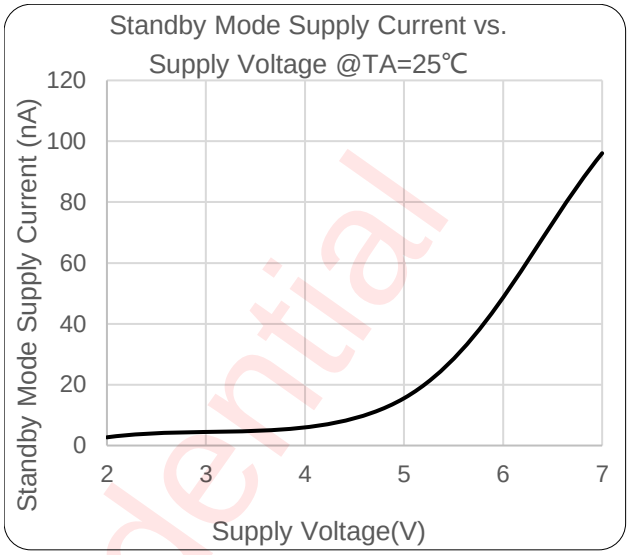

Figure 2

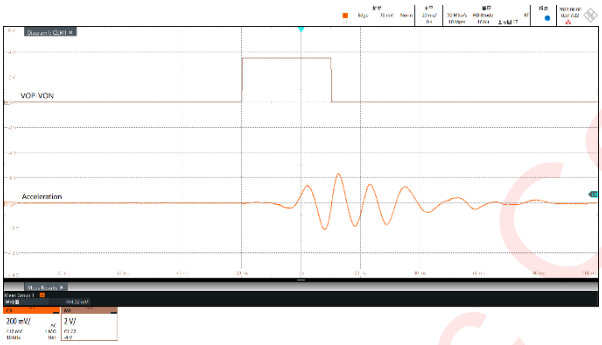

Figure 3 Output without brake

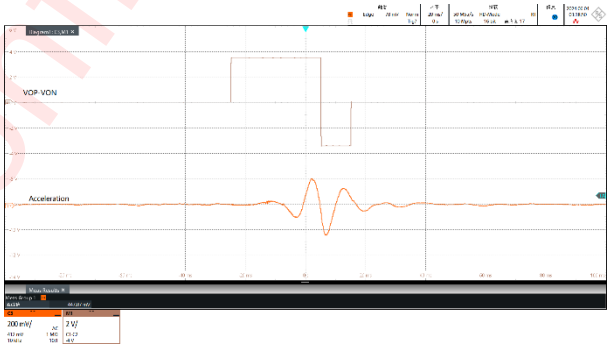

Figure 4 Output with brake

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Detailed Functional Description

OVERVIEW

The AW86204 is a dedicated ERM driver integrating brake and discharge function. The outputs are controlled by two logic inputs IN1 and IN2 interface on the AW86204 device. When the inputs are all low, the chip enters low power sleep mode after t_{SLEEP} time. In addition, the AW86204 adds protection features beyond traditional discrete implementations: under-voltage lockout, overcurrent protection, and thermal shutdown.

FEATURE DESCRIPTION

SLEEP MODE

When the IN1 and IN2 Pins are both low for time t_{SLEEP}(typically 1.5 ms), the AW86204 device enter a low-Power sleep mode, where the outputs remain High-Z and the device uses I_{VDDQ} (μA) of current.

OVERCURRENT PROTECTION

An analog current-limit circuit on each FET limits the current through the FET by removing the gate drive. If this analog current limit persists for longer than t_{DEG}, all FETs in the H-bridge are disabled. Operation resumes automatically after t_{RETRY} has elapsed. Overcurrent conditions are detected on both the high-side and low side FETs. A short to the VDD pin, GND, or from the VOP pin to the VON pin results in an overcurrent condition.

UNDERVOLTAGE LOCKOUT

If at any time the voltage on the VDD pin falls below the under-voltage lockout threshold voltage, all FETs in the H-bridge are disabled. Operation resumes when the VDD pin voltage rises above the UVLO threshold.

THERMAL SHUTDOWN

If the die temperature exceeds safe limits, all FETs in the H-bridge are disabled. After the die temperature falls to a safe level, operation automatically resumes.

Table 2 Fault Behavior

FAULT	CONDITION	H-BRIDGE	RECOVERY
VDD under-voltage (UVLO)	$VDD < V_{UVLO}$	Disabled	$VDD > V_{UVLO} + V_{HYS}$
Overcurrent (OCP)	$I_{OUT} > I_{OCP}$	Disabled	t_{RETRY} elapses
Thermal Shutdown (TSD)	$T_J > T_{SD}$	Disabled	$T_J < T_{SD} - T_{HYS}$

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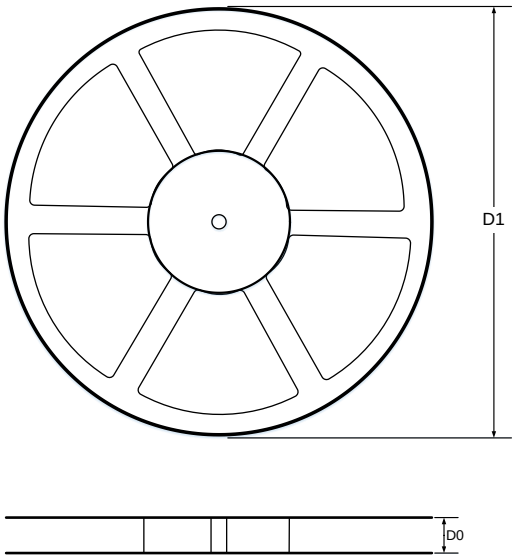
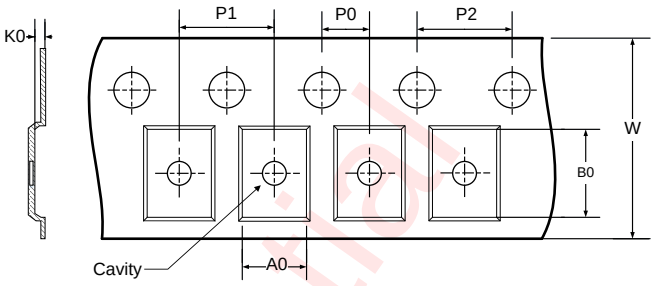
Tape And Reel Information

REEL DIMENSIONS

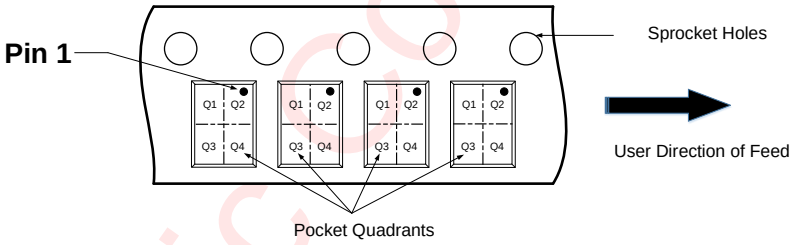


TAPE DIMENSIONS



A0：Dimension designed to accommodate the component width
B0：Dimension designed to accommodate the component length
K0：Dimension designed to accommodate the component thickness
W：Overall width of the carrier tape
P0：Pitch between successive cavity centers and sprocket hole
P1：Pitch between successive cavity centers
P2：Pitch between sprocket hole
D1：Reel Diameter
D0：Reel Width

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178.0	8.40	2.30	2.30	1.00	2.00	4.00	4.00	8.00	Q2

All dimensions are nominal

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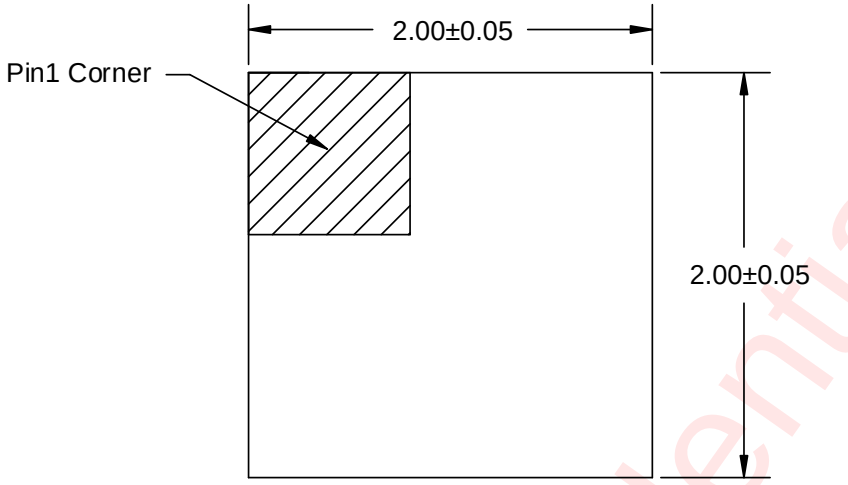
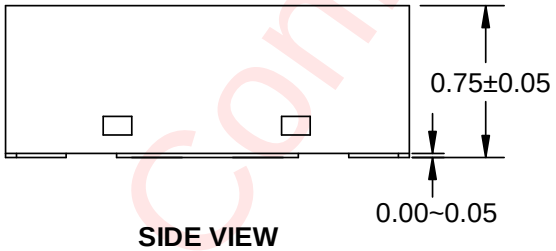
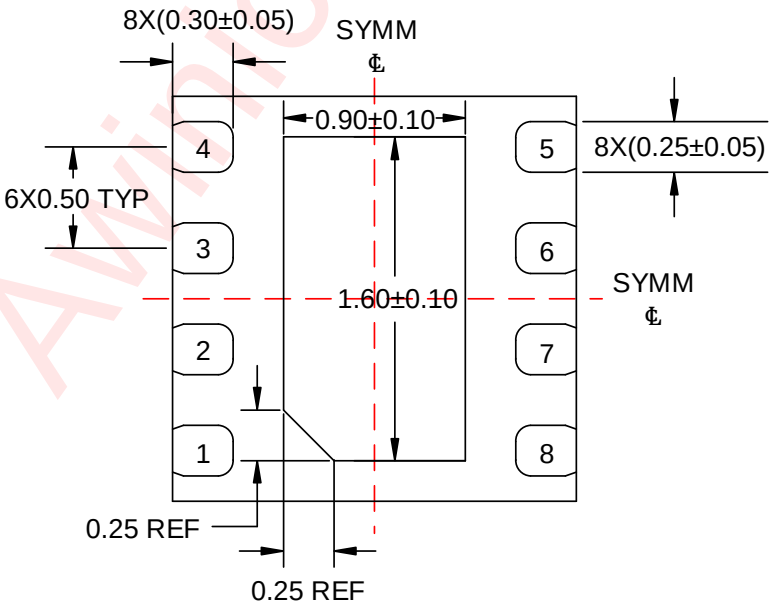
Package Description



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Unit: mm

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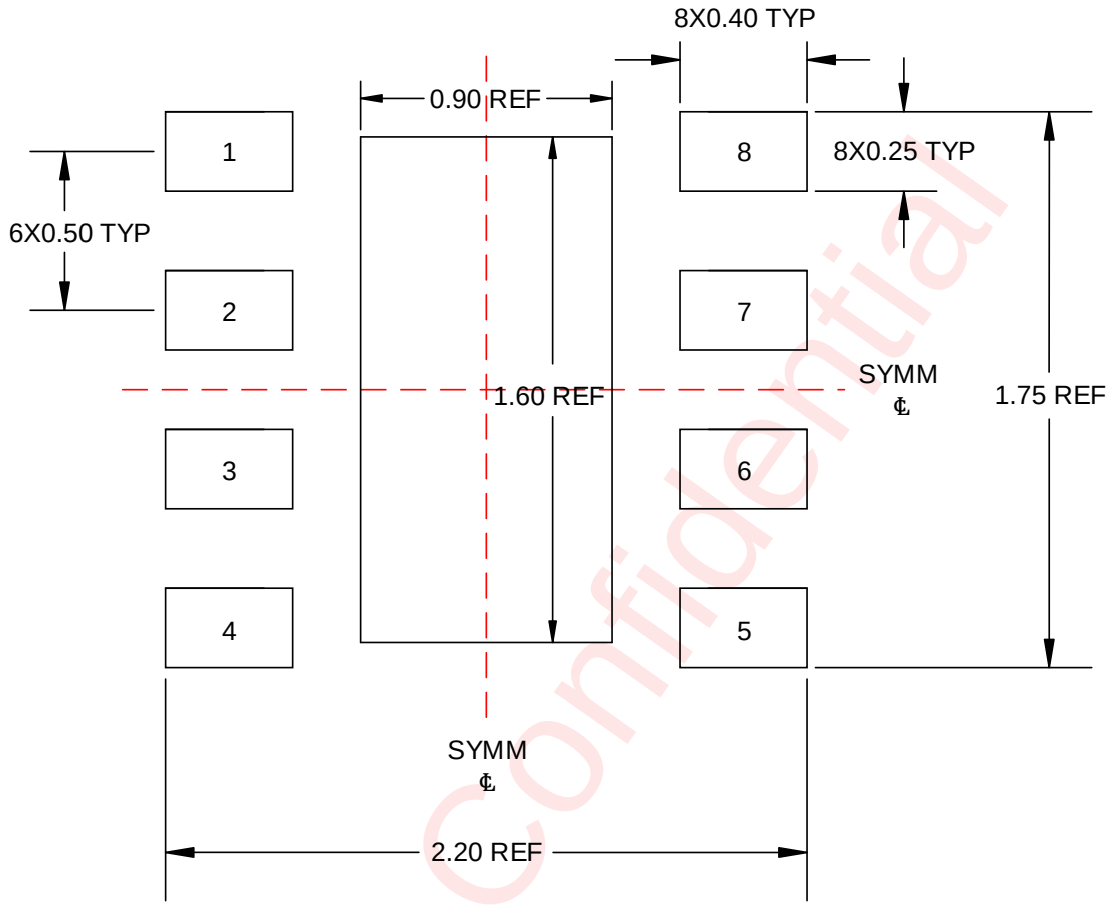
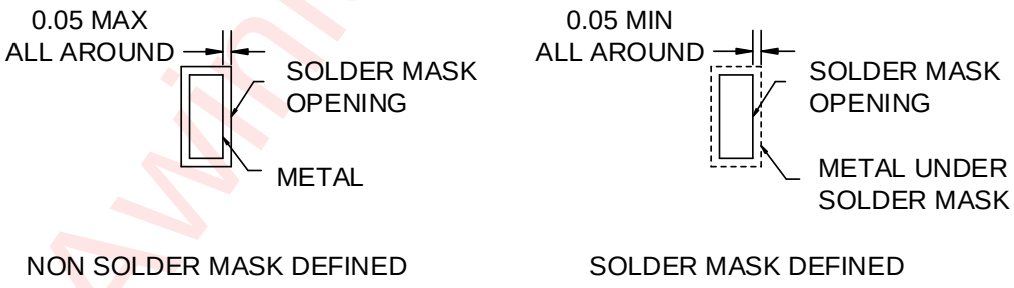
Land Pattern Data





Unit: mm

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Revision History

Version	Date	Change Record
V1.0	Jun. 2024	Initial release
V1.1	Dec. 2024	Change Iocp value to TYP 1.5A

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