Low Noise Amplifier for GNSS

Features

- Operation bands: L1, L2 and L5
- Supply voltage: 1.08V to 3.3V
- Require only one input matching inductor
- Low noise figure:
  0.65dB@L1
  0.6dB@L2 and L5
- High linearity $IIP3_{ib}$:
  4dBm@L1
  2dBm@L2
  1.5dBm@L5
- High input 1dB compression point:
  -2.5dBm@L1
  -6dBm@L2 and L5
- High input power: 30dBm
- 2kV HBM ESD protection (all pins)
- DFN 1.1X0.7-6L package

Applications

Mobile Phones
Tablet PCs
Personal Navigation Devices
RF Front End Modules

General Description

AW15745DNR is a Low Noise Amplifier designed for Global Navigation Satellite Systems (GNSS) as GPS, BDS, GLONASS and Galileo. AW15745DNR requires only one external input matching inductor, and reduces assembly complexity and the PCB area, enabling a cost-effective solution.

AW15745DNR with patented Smart Linearity Technology (SLT) achieves ultra-low noise figure, high linearity, high gain, over a wide range of supply voltages from 1.08V to 3.3V. These features make AW15745DNR an excellent choice for GNSS LNA as it improves sensitivity with low noise figure and high gain, provide better immunity against out-of-band jammer signals with high linearity, reduces filtering requirement of preceding stage and hence reduces the overall cost of the GNSS receiver.

AW15745DNR is available in a small lead-free, RoHS-Compliant, DFN 1.1X0.7-6L package.

Typical Application Circuit

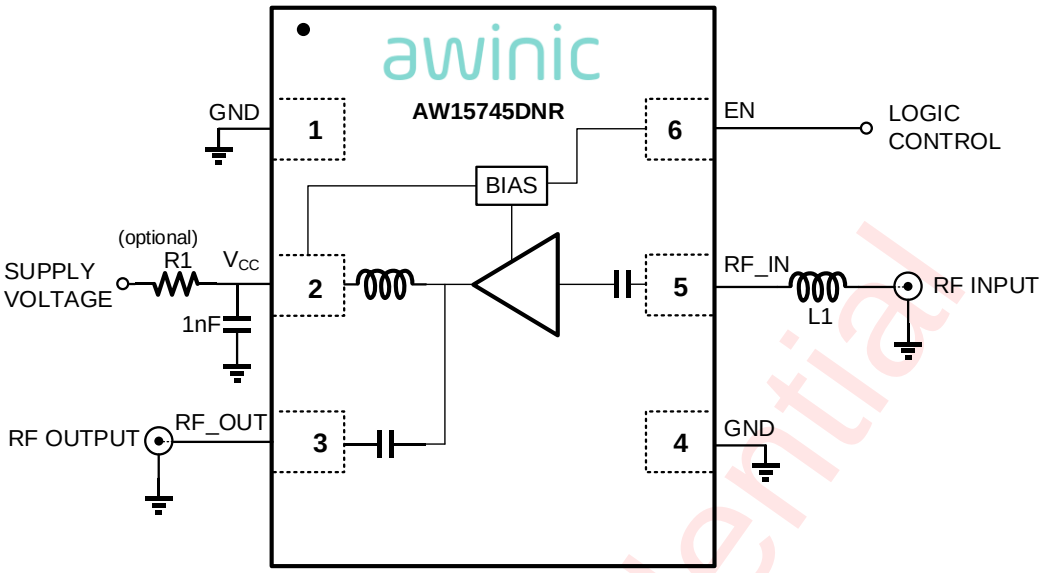


Figure 1. typical application circuit of AW15745DNR

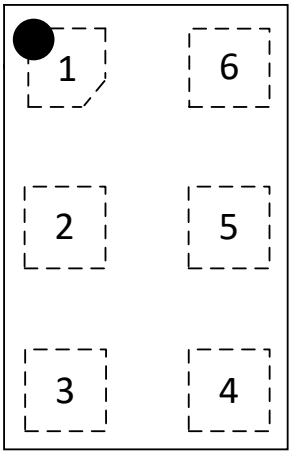
Recommended Components List

Table 1. list of components for GNSS

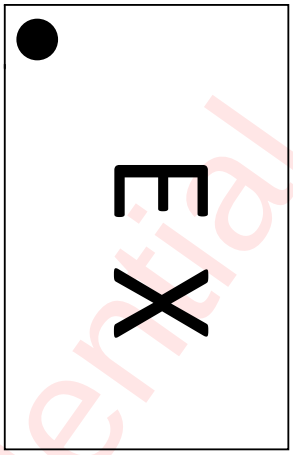
Component	Frequencies Range	Part Number	Inductance	Supplier	Size
L1	1160MHz to 1300MHz	LQW15A	16nH	Murata	0402
L1	1550MHz to 1615MHz	LQW15A	9.5nH	Murata	0402

Pin Configuration And Top Mark

AW15745DNR
(Top View)



AW15745DNR Marking
(Top View)

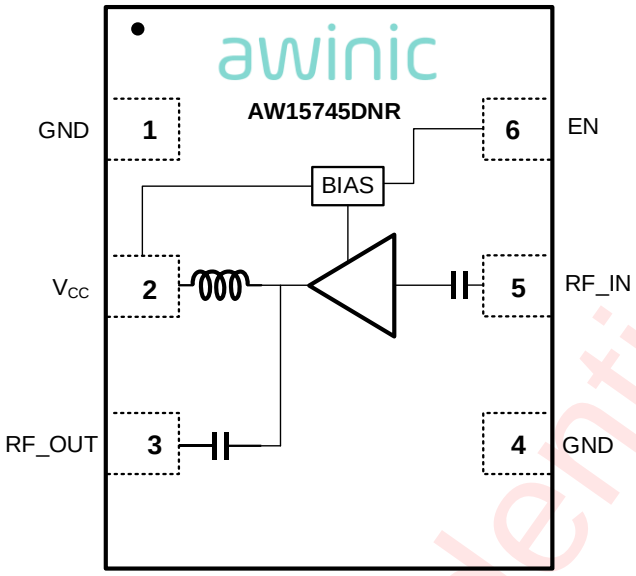


E – AW15745DNR
X – Production Tracing Code

Pin Definition

No.	NAME	DESCRIPTION
1	GND	Ground
2	V_{CC}	DC Supply
3	RF_OUT	LNA output
4	GND	Ground
5	RF_IN	LNA input
6	EN	Logic control

Functional Block Diagram



Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW15745DNR	-40ºC~105ºC	DFN 1.1X0.7-6L	E	MSL1	ROHS+HF	9000 units/ Tape and Reel

Absolute Maximum Ratings[1]

PARAMETERS	RANGE
Supply voltage range V_{CC}	-0.3V to 3.6V
V_{EN}[2]	-0.3V to VCC
RF input power[3]	30dBm
Maximum operating junction temperature T_{JMAX}	150°C
Storage temperature T_{STG}	-65°C to 150°C
Ambient temperature T_{amb}	-40°C to 105°C
Lead temperature (soldering 10 seconds)	260°C
ESD[4]	
HBM	±2kV
CDM	±1kV
Latch-Up	
JESD78E	+IT: 450mA -IT: -450mA

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: Warning: due to internal ESD diode protection, the applied DC voltage should not exceed 3.6V in order to avoid excess current.

NOTE3: The RF input and RF output are AC coupled through internal DC blocking capacitor.

NOTE4: HBM standard: ESDA/JEDEC JS-001-2017, CDM standard: ESDA/JEDEC JS-002-2018.

Electrical Characteristics

DC Characteristics and turn-on (off) time

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	-	1.08	-	3.3	V
I_{SD}	Shut-Down Current	EN=Low	-	-	1	μA
I_{CC}	Supply Current, V_{CC} =2.8V&1.8V	EN=High	-	6.5	9	mA
	Supply Current, V_{CC} =1.2V		-	5	7.5	
V_{EN}	Digital Input-Logic High	-	0.8	-	V_{CC}	V
V_{EN}	Digital Input-Logic Low	-	-	-	0.4	V
K	Stability factor	f=20MHz…10GHz	1	-	-	-
t_{on}	turn-on time, V_{CC}=2.8V&1.8V	time from V_{EN} ON to 90% of the final gain	-	3	5	μs
	turn-on time, V_{CC} =1.2V		-	3.5	5	
t_{off}	turn-off time, V_{CC}=2.8V&1.8V	time from V_{EN} OFF to 10% of the gain	-	0.35	1	μs
	turn-off time, V_{CC}=1.2V		-	0.4	1	

Typically: V_{CC}=2.8V, V_{EN_H}=2.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1550	1575.42	1615	MHz
Gp	Power Gain	Pin=-30dBm	16.5	18.5	20.5	dB
RL_{in}	Input Return Loss		7.5	8.8	-	dB
RL_{out}	Output Return Loss		7	9	-	dB
ISL	Reverse Isolation	-	25	30	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.65	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1575.42MHz	-6.5	-2.5	-	dBm
$IIP3_{ib}$	Inband input 3^{rd}-order intercept point	f1=1575.42MHz; f2=1576.42MHz; Pin=-25dBm	-1	4	-	dBm
$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1712.7MHz; -65dBm@f2=1850MHz	-0.5	4.5	-	dBm
H2-input referred	LTE band-13 2^{nd} Harmonic	f=787.76MHz; Pin=-25dBm	-	-51	-45	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.8V, V_{EN_H}=1.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1550	1575.42	1615	MHz
Gp	Power Gain	Pin=-30dBm	16	18	20	dB
RL_{in}	Input Return Loss		7.5	8.8	-	dB
RL_{out}	Output Return Loss		7	9	-	dB
ISL	Reverse Isolation	-	25	30	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.65	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1575.42MHz	-11.5	-7.5	-	dBm

$IIP3_{ib}$	Inband input
	3rd-order
	intercept point
		f1=1575.42MHz;
		f2=1576.42MHz;
		Pin=-25dBm
			-4	1	-	dBm

$IIP3_{oob}$	Out-of-band input 3rd-order intercept point	-20dBm@f1=1712.7MHz; -65dBm@f2=1850MHz	-1.7	3.3	-	dBm
H2-input referred	LTE band-13 2nd Harmonic	f=787.76MHz; Pin=-25dBm	-	-50	-45	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.2V, V_{EN_H}=1.2V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1550	1575.42	1615	MHz
Gp	Power Gain	Pin=-30dBm	14.5	16.5	18.5	dB
RL_{in}	Input Return Loss		6	8	-	dB
RL_{out}	Output Return Loss		6.5	8.5	-	dB
ISL	Reverse Isolation	-	25	30	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.75	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1575.42MHz	-14.5	-10.5	-	dBm

$IIP3_{ib}$	Inband input
	3rd-order
	intercept point
		f1=1575.42MHz;
		f2=1576.42MHz;
		Pin=-25dBm
			-8	-3	-	dBm

$IIP3_{oob}$	Out-of-band input 3rd-order intercept point	-20dBm@f1=1712.7MHz; -65dBm@f2=1850MHz	-4	1	-	dBm
H2-input referred	LTE band-13 2nd Harmonic	f=787.76MHz; Pin=-25dBm	-	-49	-45	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=2.8V, V_{EN_H}=2.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1215	1227.6	1300	MHz
Gp	Power Gain	Pin=-30dBm	16.5	18.5	20.5	dB
RL_{in}	Input Return Loss		5.5	7	-	dB
RL_{out}	Output Return Loss		8	10	-	dB
ISL	Reverse Isolation	-	28	32	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.6	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1227.6MHz	-10	-6	-	dBm

$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1226.6MHz;
		f2=1227.6MHz;
		Pin=-25dBm
			-3	2	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1850MHz; -65dBm@f2=2485MHz	6.5	11.5	-	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.8V, V_{EN_H}=1.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1215	1227.6	1300	MHz
Gp	Power Gain	Pin=-30dBm	16.5	18.5	20.5	dB
RL_{in}	Input Return Loss		5.5	7	-	dB
RL_{out}	Output Return Loss		9	11	-	dB
ISL	Reverse Isolation	-	28	32	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.6	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1227.6MHz	-15.5	-11.5	-	dBm

$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1226.6MHz;
		f2=1227.6MHz;
		Pin=-25dBm
			-7.5	-2.5	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1850MHz; -65dBm@f2=2485MHz	6	11	-	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.2V, V_{EN_H}=1.2V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1215	1227.6	1300	MHz
Gp	Power Gain	Pin=-30dBm	14.5	16.5	18.5	dB
RL_{in}	Input Return Loss		5	6.5	-	dB
RL_{out}	Output Return Loss		9	11	-	dB
ISL	Reverse Isolation	-	27	31	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.7	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1227.6MHz	-18	-14	-	dBm

$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1226.6MHz;
		f2=1227.6MHz;
		Pin=-25dBm
			-9.5	-4.5	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1850MHz; -65dBm@f2=2485MHz	4.5	9.5	-	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=2.8V, V_{EN_H}=2.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1160	1176.45	1215	MHz
Gp	Power Gain	Pin=-30dBm	16.5	18.5	20	dB
RL_{in}	Input Return Loss		5.5	7	-	dB
RL_{out}	Output Return Loss		7	9.5	-	dB
ISL	Reverse Isolation	-	28	32	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.6	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1176.45MHz	-10	-6	-	dBm

$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1175.45MHz;
		f2=1176.45MHz;
		Pin=-25dBm
			-3.5	1.5	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1800MHz; -65dBm@f2=2400MHz	6.5	11.5	-	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.8V, V_{EN_H}=1.8V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1160	1176.45	1215	MHz
Gp	Power Gain	Pin=-30dBm	16.5	18.5	20	dB
RL_{in}	Input Return Loss		5.5	7	-	dB
RL_{out}	Output Return Loss		7.5	9.5	-	dB
ISL	Reverse Isolation	-	28	32	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.6	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1176.45MHz	-15	-11	-	dBm

$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1175.45MHz;
		f2=1176.45MHz;
		Pin=-25dBm
			-8	-3	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1800MHz; -65dBm@f2=2400MHz	6	11	-	dBm

[1] 0.08dB PCB losses are subtracted.

Typically: V_{CC}=1.2V, V_{EN_H}=1.2V, V_{EN_L}=0V and TA=+25°C, unless otherwise noted

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency Range		-	1160	1176.45	1215	MHz
Gp	Power Gain	Pin=-30dBm	15.5	17.5	19.5	dB
RL_{in}	Input Return Loss		5	6.5	-	dB
RL_{out}	Output Return Loss		6	8	-	dB
ISL	Reverse Isolation	-	27	31	-	dB
NF	Noise Figure[1]	Zs=50 ohm; No jammer	-	0.65	1.0	dB
IP1dB	Inband input 1dB-compression point	f=1176.45MHz	-18	-14	-	dBm

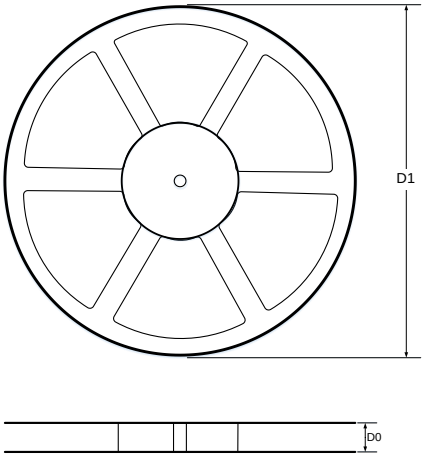
$IIP3_{ib}$	Inband input
	3^{rd}-order intercept point
		f1=1175.45MHz;
		f2=1176.45MHz;
		Pin=-25dBm
			-10	-5	-	dBm

$IIP3_{oob}$	Out-of-band input 3^{rd}-order intercept point	-20dBm@f1=1800MHz; -65dBm@f2=2400MHz	4.5	9.5	-	dBm

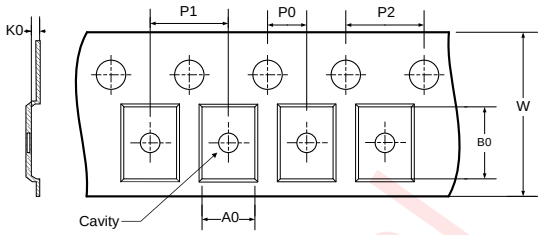
[1] 0.08dB PCB losses are subtracted.

Tape And Reel Information

REEL DIMENSIONS

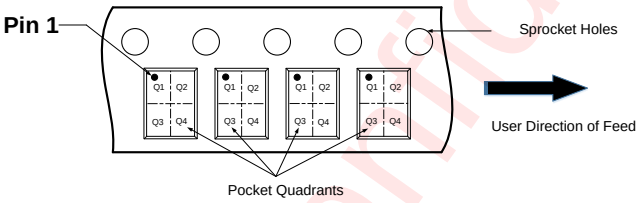


TAPE DIMENSIONS



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



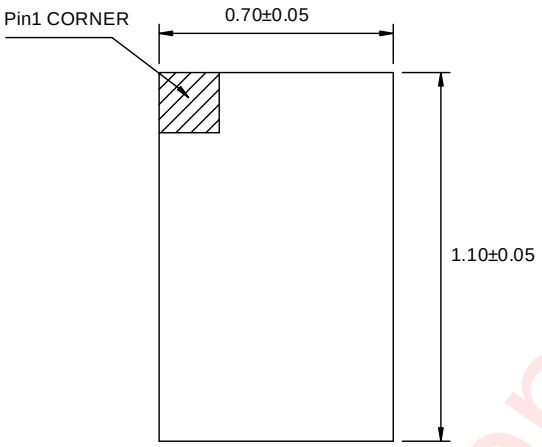
Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

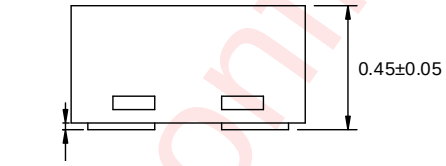
D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	0.82	1.22	0.55	2	2	4	8	Q1

All dimensions are nominal

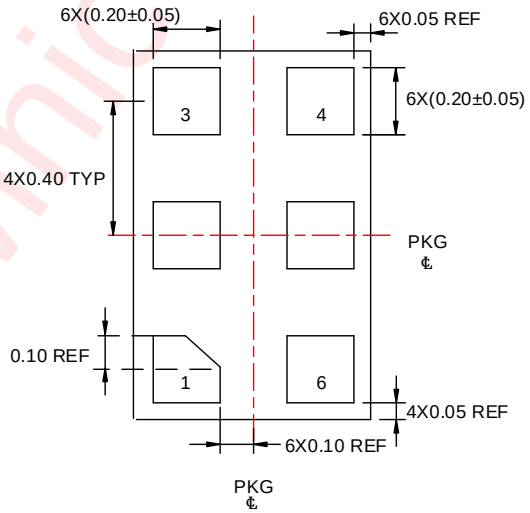
Package Description



TOP VIEW



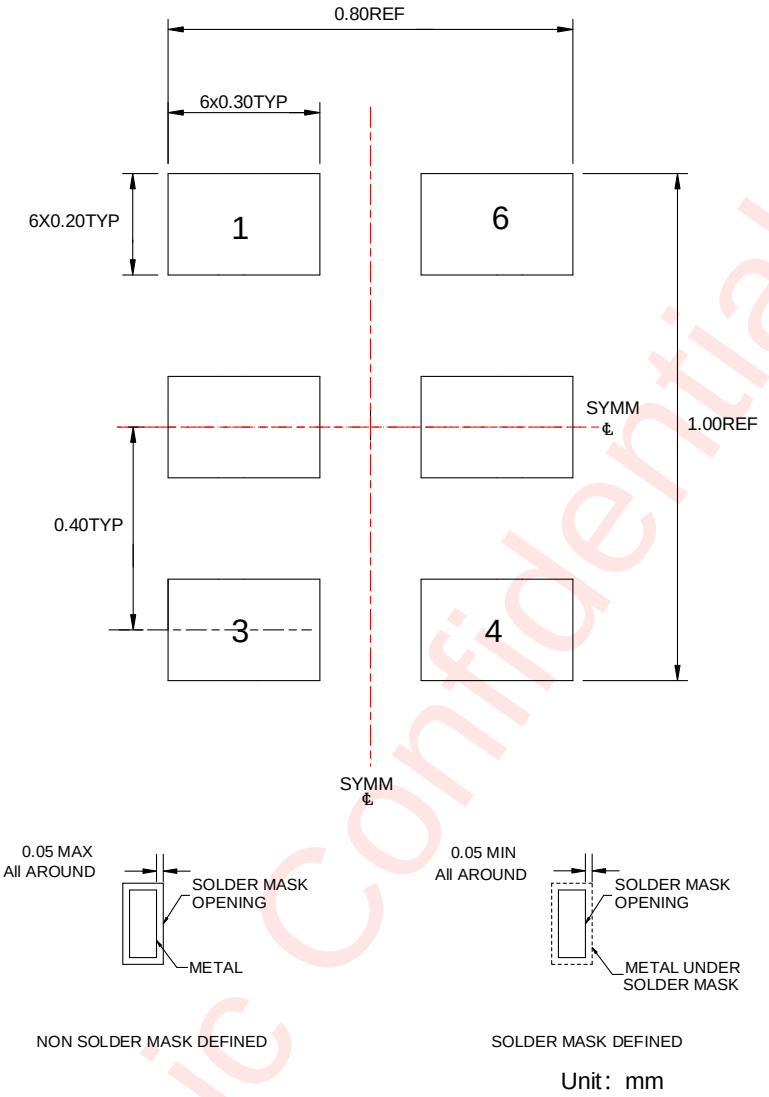
SIDE VIEW



BOTTOM VIEW

Unit：mm

Land Pattern Data



Unit：mm

REVISION HISTORY

Version	Date	Change Record
V1.0	Mar 2024	Officially released.
V1.1	Sept 2025	Update Package Information.

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