

PIN Diode SPDT 120 W Switch

0.05 - 4 GHz



MASW-011258
Rev. V1

Features

- Exceptional Broadband Performance
- Low Insertion Loss:
T_x = 0.20 dB @ 2.7 GHz
- High Isolation:
R_x = 42 dB @ 2.7 GHz
- High T_x RF Input Power:
120 W CW @ 2.0 GHz, +85°C
- High T_x RF Input Peak Power: 1000 W
- Positive DC Bias Only Required
- Surface Mount 4 mm PQFN Package
- RoHS* Compliant

Applications

- Suitable for High Power LTE, TD-SCDMA, WiMAX, and Military Radio Applications

Description

The MASW-011258 is a SPDT high power, broadband, high linearity, PIN diode T/R switch for 0.05 - 4.0 GHz applications, including WiMAX & WiFi. The device is provided in an industry standard lead free 4 mm PQFN plastic package.

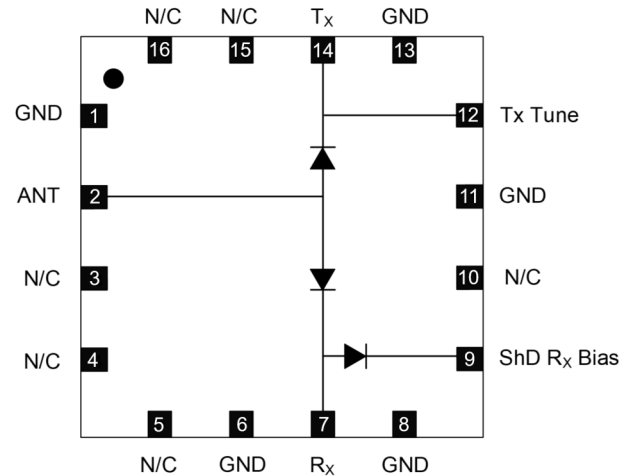
This device incorporates PIN diode die fabricated with a low loss, high isolation switching diode process.

Ordering Information¹

Part Number	Package
MASW-011258-TR1000	1000 Part Reel
MASW-011258-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration²

Pin #	Pin Name	Description
1, 6, 8, 11, 13	GND	Ground
2	ANT	Antenna
3 - 5, 10, 15, 16	N/C	Not Connected Internally
7	R _x	Receive
9	ShD R _x Bias	ShD R _x Bias
12	T _x Tune	T _x Tune ³
14	T _x	Transmit

2. The exposed pad centered on the package bottom must be connected to RF, DC and Thermal ground.
3. Optional tuning pin. See note 5 for details.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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Pin Description

Pin #	Name	Description
1, 6, 8, 11, 13	GND	Pins grounded internally
2	ANT	Antenna pin. DC coupled.
3 - 5, 10, 15, 16	N/C	Not connected internally. MACOM recommends connecting these pins to ground on PCB board.
7	R _x	Receive pin. DC coupled.
9	ShD R _x Bias	Bias pin for RX receive path shunt diode. DC coupled.
12	Tx Tune	Optional tuning pin. DC coupled.
14	T _x	Transmit pin. DC coupled.
17	EP	Exposed backside paddle. Needs to be connected to electrical and thermal ground on PCB.

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Electrical Specifications: $P_{IN} = -5$ dBm, $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$, (See Bias Table).

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (RX Mode)	R _X to ANT, 0.8 GHz, RX Mode R _X to ANT, 2.0 GHz, RX Mode R _X to ANT, 2.7 GHz, RX Mode R _X to ANT, 3.5 GHz, RX Mode	dB	—	0.20 0.35 0.45 0.60	— 0.55 0.75 0.95
Insertion Loss (TX Mode)	T _X to ANT, 0.8 GHz, TX Mode T _X to ANT, 2.0 GHz, TX Mode T _X to ANT, 2.7 GHz, TX Mode T _X to ANT, 3.5 GHz, TX Mode	dB	—	0.09 0.10 0.15 0.32	—
Isolation (RX Mode)	R _X to ANT, 2.0 GHz, RX Mode R _X to ANT, 2.7 GHz, RX Mode R _X to ANT, 3.5 GHz, RX Mode	dB	36 35 25	42 42 32	—
Isolation (TX Mode)	T _X to ANT, 2.0 GHz, TX Mode T _X to ANT, 2.7 GHz, TX Mode T _X to ANT, 3.5 GHz, TX Mode	dB	—	16 14 13	—
Return Loss (RX Mode)	R _X Port, 2.0 GHz, RX Mode R _X Port, 2.7 GHz, RX Mode R _X Port, 3.5 GHz, RX Mode	dB	—	20 22 23	—
Return Loss (TX Mode)	T _X Port, 2.0 GHz, TX Mode T _X Port, 2.7 GHz, TX Mode T _X Port, 3.5 GHz, TX Mode	dB	—	30 23 17	—
Input P0.1 dB (TX Mode)	T _X to ANT, 2.0 GHz T _X to ANT, 2.7 GHz T _X to ANT, 3.5 GHz	dBm	—	>50	—
Input P0.1 dB (RX Mode)	R _X to ANT, 2.0 GHz R _X to ANT, 2.7 GHz R _X to ANT, 3.5 GHz	dBm	—	>40	—
IIP3 (TX Mode)	$P_{IN} = 30$ dBm: F1 = 2.7 GHz, F2 = 2.71 GHz F1 = 3.5 GHz, F2 = 3.51 GHz	dBm	—	81 76	—
CW Input Power (TX Mode)	85°C Base plate 2.0 GHz 2.7 GHz 3.5 GHz	dBm / W	—	50.8 / 120 50.0 / 100 49.0 / 80	—
CW Input Power (RX Mode)	85°C Base plate 2.0 GHz	dBm W	—	41.5 14.0	—
RX to TX Mode Switching Speed	(10 - 90% RF Voltage) 1 MHz Rep Rate in Modulating Mode	ns	—	200	—

Bias Table

Mode	Switch State	T _X Bias	R _X Bias	ShD R _X Bias	ANT Bias
RX Mode (RXM)	R _X to ANT Switch Path On, T _X Port Isolated	(+28 V), 0 mA	(GND), -100 mA	(+28 V), 0 mA	+5 V
TX Mode (TXM)	T _X to ANT Switch Path On, R _X Port Isolated	(GND), -100 mA	(+28 V), +56 mA	(GND), -56 mA	+5 V

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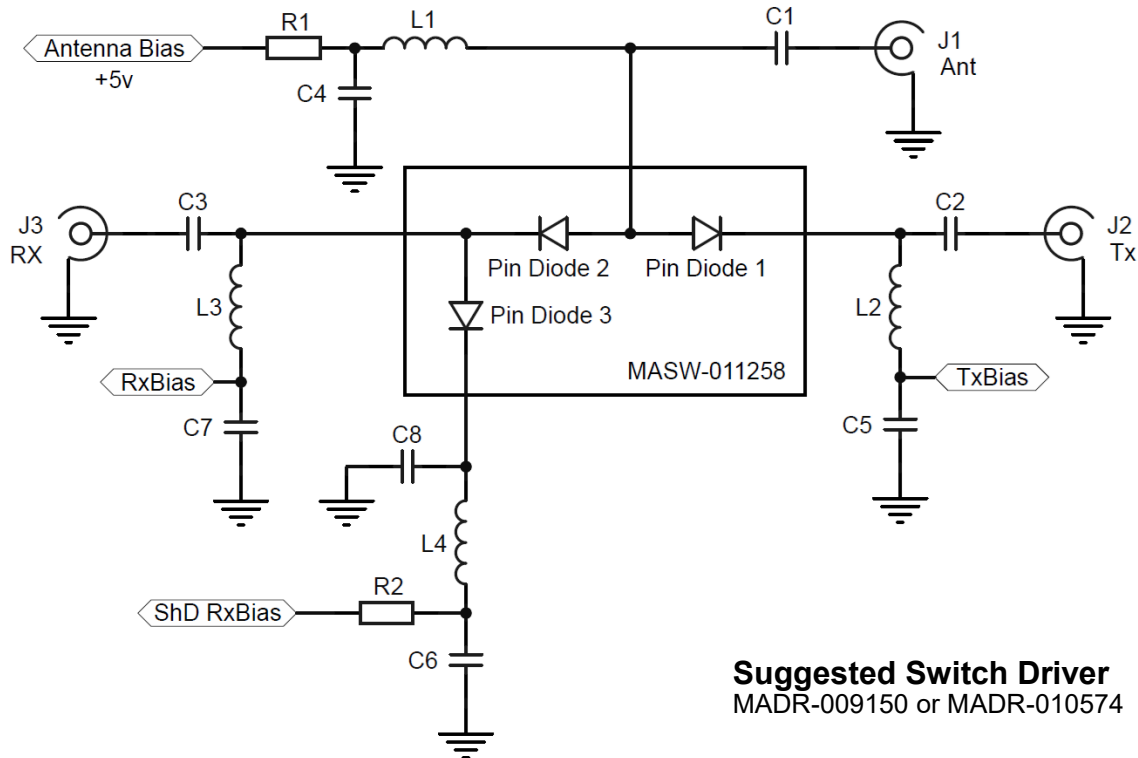
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Bias Schematic



Suggested Switch Driver
MADR-009150 or MADR-010574

Parts List^{4,5}

Component	Value	Package
C1 - C7	27 pF	0603
C8 ⁶	3.3 pF	0402
L1 - L4	68 nH	0603
R1	39 Ω	See note 7
R2	480 Ω	See note 7

- Parts listing optimized specifically for the 0.5 - 3.6 GHz band on MACOM evaluation board. For custom tunes within the 0.05 - 4 GHz band please contact MACOM applications support.
- Not shown, adding an LC network to pin 12 can improve R_x performance between 2.0 and 2.7 GHz but may limit performance above 3.0 GHz. For broadband applications MACOM recommends not using pin 12 and not connecting it to any metal trace.
- C8 needs to be connected as close as possible to the ShD Rx bias pin (Pin 9)
- R1 and R2 values equal to $((Applied\ Bias\ Voltage) - (Forward\ Voltage\ of\ Diode)) / (I_{bias})$ where the Forward Voltage of Diode (V_f) can be approximated as 1 V. The size of the package will depend on the power rating needed.

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Absolute Maximum Ratings^{8,9,10}

@ T_A = +25°C (unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	150 mA
DC Reverse Voltage	130 V
T _X Incident CW Power	See Power De-rating Curve
T _X Incident Peak Power (10 μs Pulse Width ¹¹)	1000 W
R _X Incident CW Power	41.5 dBm (14 W) @ 2 GHz, +85°C
Junction Temperature	+175°C
Operating Temperature	-40°C to +100°C
Storage Temperature	-55°C to +150°C

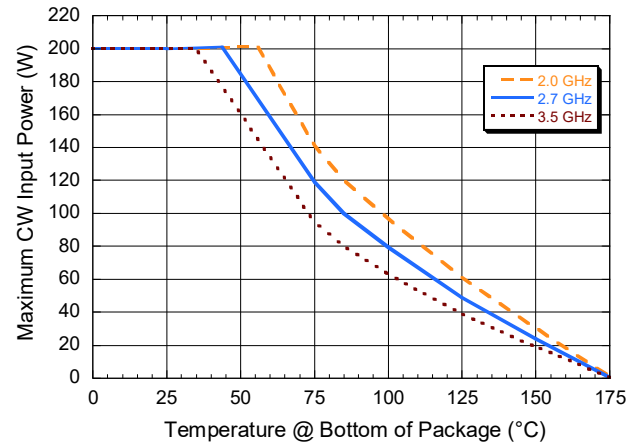
8. Exceeding these limits may cause permanent damage.
9. MACOM does not recommend sustained operation near these survivability limits.
10. Operating at nominal conditions with T_J ≤ +175°C will ensure MTTF > 1 x 10⁶ hours.
11. Measured with 4 ms pulse period, up to +100°C case temperature.

Minimum Reverse Bias Voltage¹²

Frequency (MHz)	DC Voltage (V)
50	130 ¹³
500	91 ¹³
1000	57 ¹³
2000	31
4000	16

12. Minimum DC bias voltage to maintain low loss under 120 W of Tx power with 1.5:1 VSWR
13. The MADR-009150 switch driver has a maximum output voltage of 55 V. If a higher output voltage is desired, then one may want to consider using the MADR-010574 switch driver.

T_X Input Power De-rating @ 20 dB I/O Return Loss



Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Parameter	Rating	Standard
Human Body Model (HBM)	1000 V (Class 1C)	ESDA/JEDEC JS-001
Charged Device Model (CDM)	500 V (Class C2)	ESDA/JEDEC JS-002

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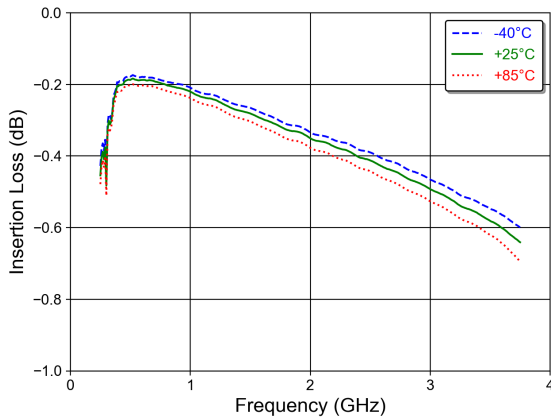
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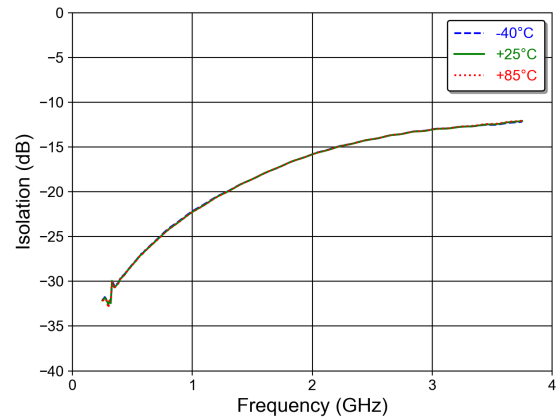
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Typical SMB Performance Curves: (0.5 - 3.6 GHz Tune⁴):
P_{IN} = -5 dBm, Z₀ = 50 Ω, RX Mode (See Bias Table)

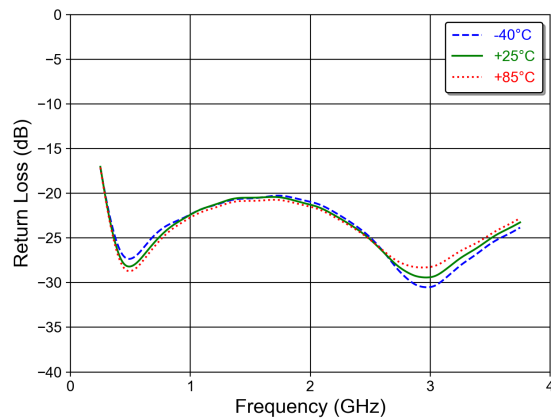
Insertion Loss¹⁴, ANT to R_X Port



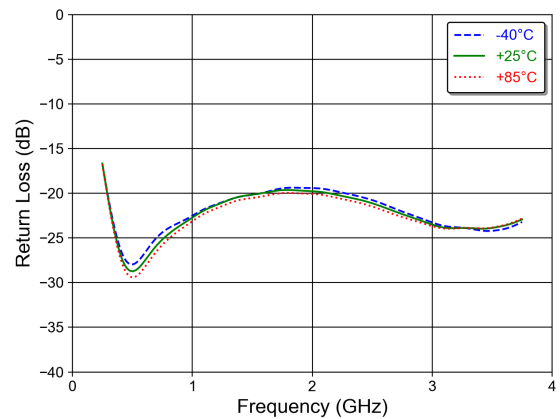
Isolation¹⁴, ANT to T_X Port



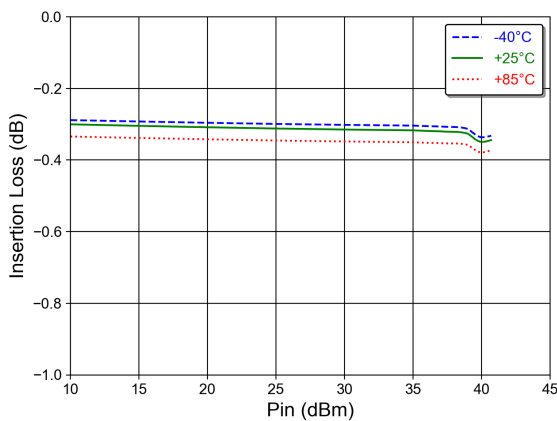
Input Return Loss, ANT Port



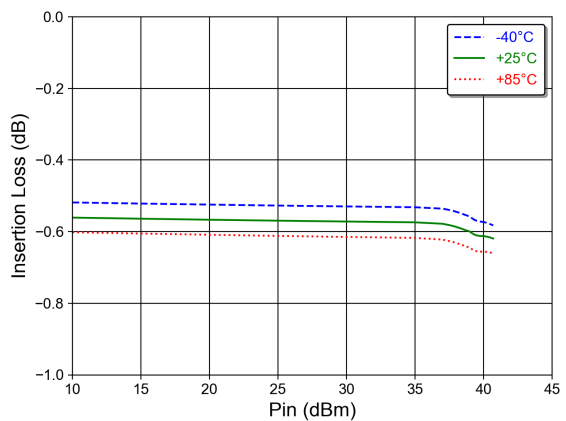
Output Return Loss, R_X Port



Insertion Loss¹⁴ vs. Power (2 GHz), ANT to R_X Port



Insertion Loss¹⁴ vs. Power (3.5 GHz), ANT to R_X Port



14. For insertion loss and isolation plots, RF trace and connector losses are de-embedded.

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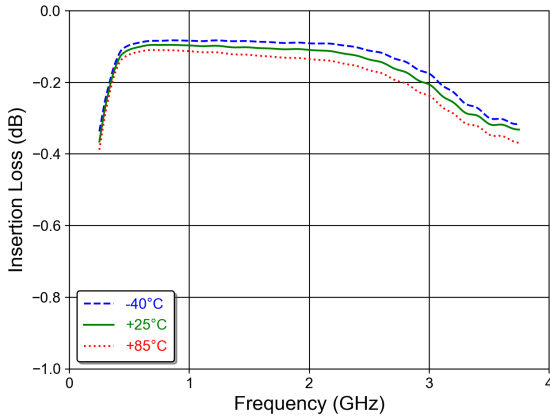


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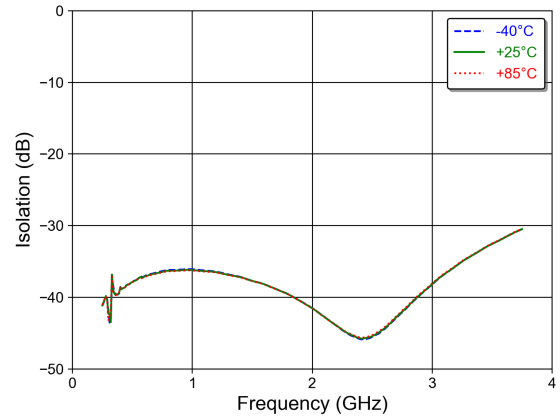
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Typical SMB Performance Curves: (0.5 - 3.6 GHz Tune⁴):
 $P_{IN} = -5$ dBm, $Z_0 = 50 \Omega$, TX Mode (See Bias Table)

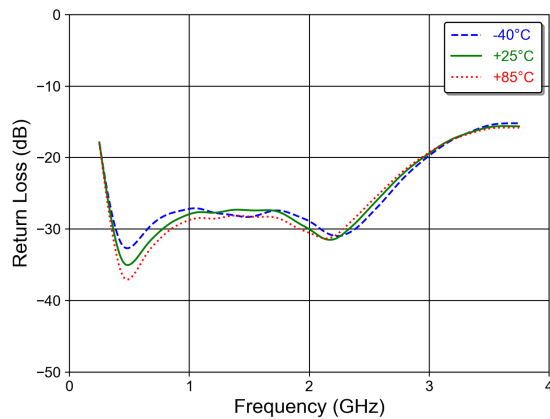
Insertion Loss¹⁴, ANT to T_X Port



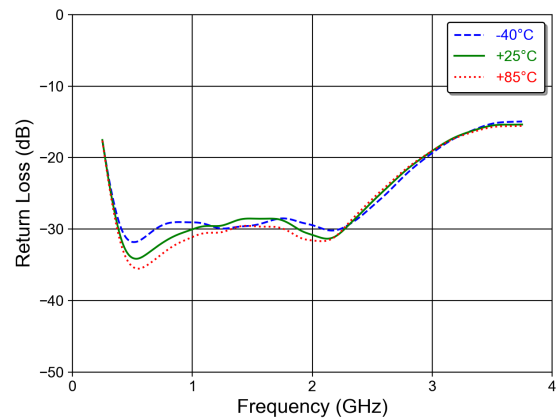
Isolation¹⁴, ANT to R_X Port



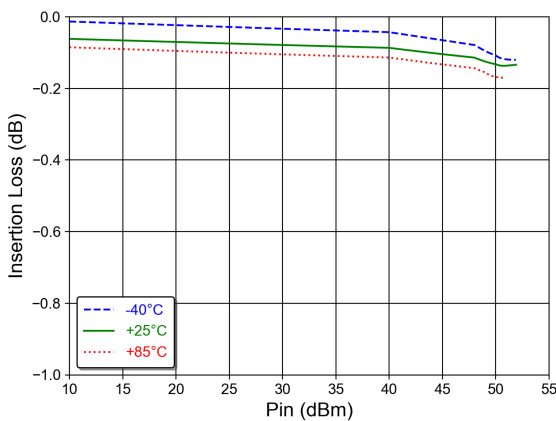
Input Return Loss, ANT Port



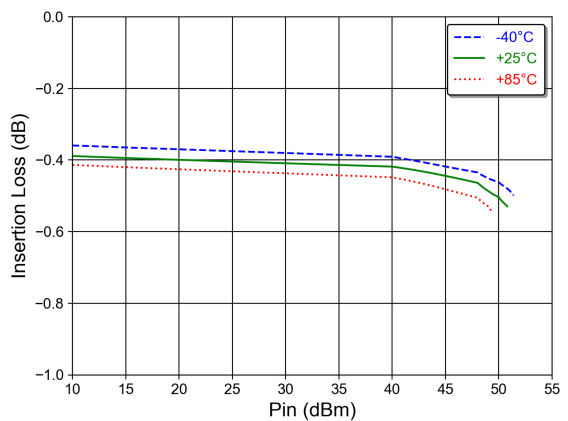
Output Return Loss, T_X Port



Insertion Loss¹⁴ vs. Power (2 GHz), ANT to T_X Port



Insertion Loss¹⁴ vs. Power (3.5 GHz), ANT to T_X Port



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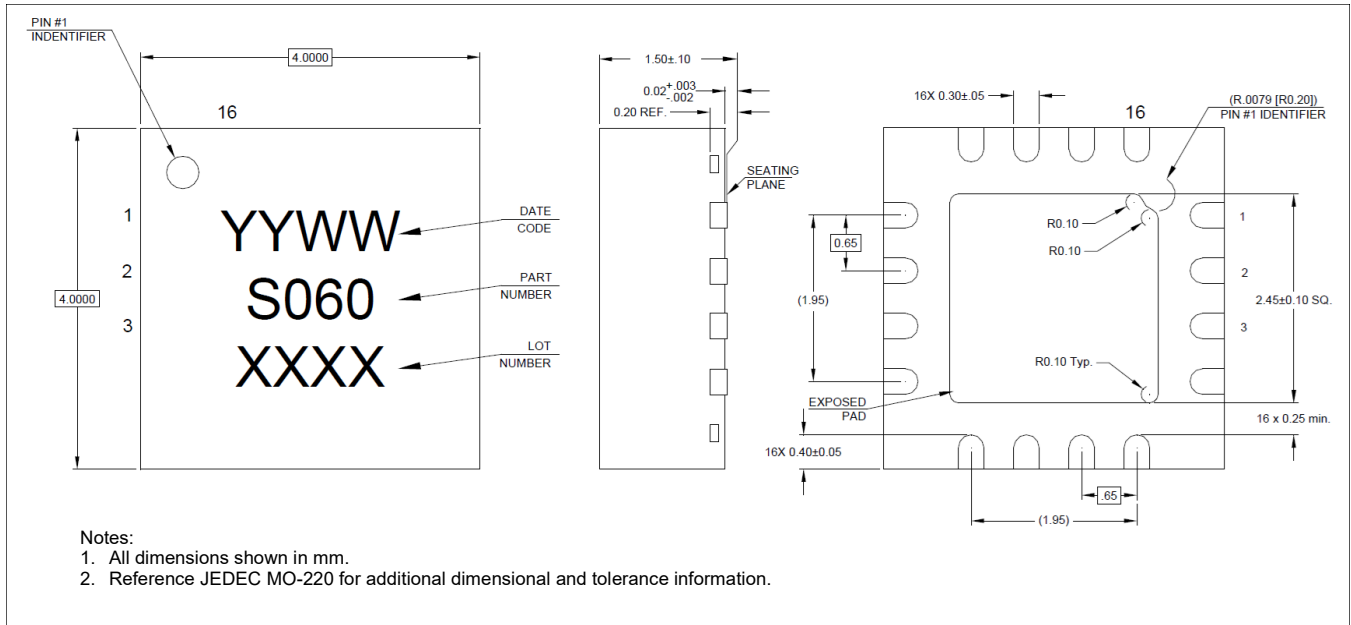
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Lead-Free 4 mm 16-Lead PQFN[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 1 requirements.
Plating is NiPdAuAg.

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Revision History

Rev	Date	Change Description
V1	12/16/24	Production release.

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