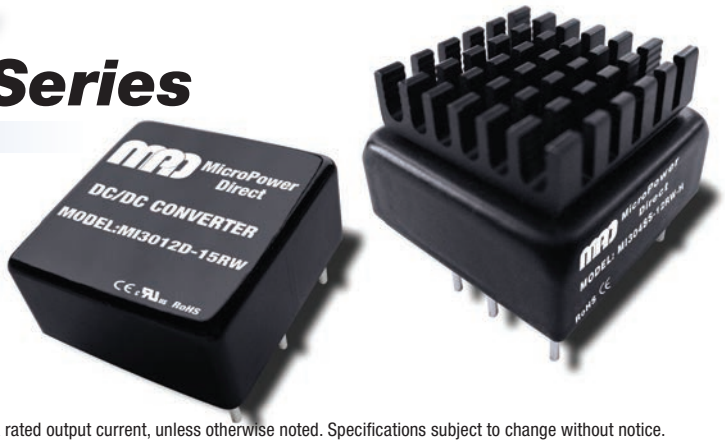
MI3000RW Series

Miniature 1 x 1” 30W Single & Dual Output DC/DC Converters



Key Features:

- 30W Output Power
- Miniature 1 x 1 In Case
- Wide 2:1 Input Range
- EN 60950 Approved
- 1,600 VDC Isolation
- High Efficiency
- Remote On/Off Control

4:1 Input Models Available

Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Range	12 VDC Input	9.0	12.0	18.0	VDC
	24 VDC Input	18.0	24.0	36.0	
	48 VDC Input	36.0	48.0	75.0	
Undervoltage Shutdown	12 VDC Input		7.9	8.6	VDC
	24 VDC Input		16.5	17.8	
	48 VDC Input		32.5	34	
Input Reflected Ripple Current			30		mA P - P
Input Filter	π (Pi) Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0		%
Line Regulation	VIN = Min to Max			±0.5	%
Load Regulation, See Note 2	Single Output			±0.5	%
	Dual Output			±1.0	
Cross Regulation	See Note 3		±5.0		%
Ripple & Noise, See Note 4	Single Output			75	mV P - P
	Dual Output			60	
Temperature Coefficient			±0.02		%/°C
Transient Recovery Time			250		µSec
Transient Response Deviation, See Note 5	3.3 VOUT Models			±5.0	%
	All Other Models			±3.0	
Output Over Voltage Protection	See Model Selection Chart (Page 2)				
Output Over Current Protection	Autorecovery		150		%IOUT
Over Temperature Protection	Autorecovery		115		°C
Output Short Circuit	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, 60 Seconds	Input/Output	1,600			VDC
	Case/Input & Output	1,600			
Isolation Resistance	1,000 VDC	1,000			MΩ
Isolation Capacitance	10 kHz/1V			2,000	pF
Switching Frequency	3.3 & 5 VOUT Models		270		kHz
	All Other Models		330		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+80	°C
	Case			+105	
Thermal Impedance	See Note 6				
Storage Temperature Range		-40		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Diagrams (Page 4)
Case Material	Copper With Non-Conductive Base (UL94-V0)
Weight	See Mechanical Diagrams (Page 4)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	370			kHours
Safety Standards	UL/cUL 60950-1 Recognition (UL certificate)				

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (100 mSec)	12 VDC Input			25.0	VDC
	24 VDC Input			50.0	
	48 VDC Input			100.0	
Lead Temperature	1.5 mm From Case for 10 Sec			260	°C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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CME CompuMess Elektronik
Power mit System

Model Selection Guide

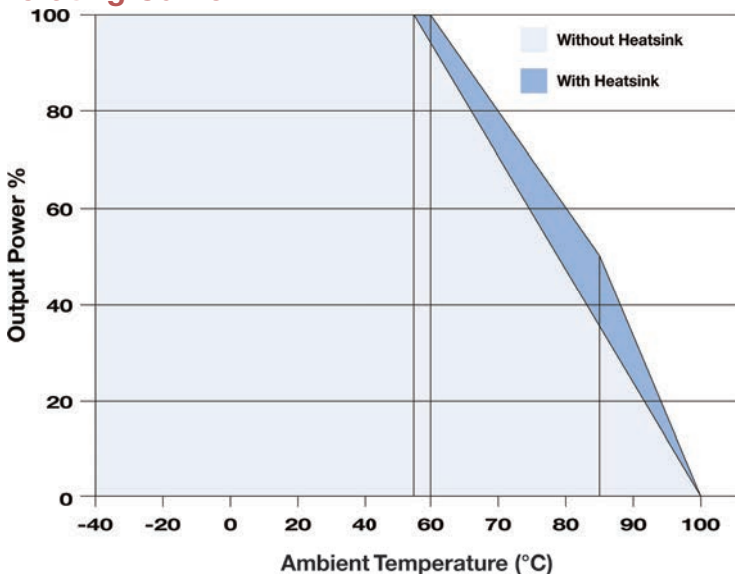
Model Number	Input				Output			Efficiency (%, Typ)	Over Voltage Protection (VDC Typ)	Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MI3012S-03RW	12	9.0 - 18.0	2,212	10	3.3	7,000	0.0	87	3.9	10,000	6,000
MI3012S-05RW	12	9.0 - 18.0	2,809	10	5.0	6,000	9.0	89	6.2	7,200	6,000
MI3012S-12RW	12	9.0 - 18.0	2,809	12	12.0	2,500	0.0	89	15.0	1,200	6,000
MI3012S-15RW	12	9.0 - 18.0	2,778	12	15.0	2,000	0.0	90	18.0	1,000	6,000
MI3012D-12RW	12	9.0 - 18.0	2,809	12	±12.0	±1,250	±0.0	89	±15.0	750	6,000
MI3012D-15RW	12	9.0 - 18.0	2,778	14	±15.0	±1,000	±0.0	90	±18.0	500	6,000
MI3024S-03RW	24	18.0 - 36.0	1,106	10	3.3	7,000	0.0	87	3.9	10,000	3,000
MI3024S-05RW	24	18.0 - 36.0	1,389	10	5.0	6,000	9.0	90	6.2	7,200	3,000
MI3024S-12RW	24	18.0 - 36.0	1,389	10	12.0	2,500	0.0	90	15.0	1,200	3,000
MI3024S-15RW	24	18.0 - 36.0	1,373	10	15.0	2,000	0.0	91	18.0	1,000	3,000
MI3024D-12RW	24	18.0 - 36.0	1,389	10	±12.0	±1,250	±0.0	90	±15.0	750	3,000
MI3024D-15RW	24	18.0 - 36.0	1,374	10	±15.0	±1,000	±0.0	91	±18.0	500	3,000
MI3048S-03RW	48	36.0 - 75.0	541	8	3.3	7,000	0.0	89	3.9	10,000	1,500
MI3048S-05RW	48	36.0 - 75.0	687	8	5.0	6,000	9.0	91	6.2	7,200	1,500
MI3048S-12RW	48	36.0 - 75.0	687	8	12.0	2,500	0.0	91	15.0	1,200	1,500
MI3048S-15RW	48	36.0 - 75.0	679	8	15.0	2,000	0.0	92	18.0	1,000	1,500
MI3048D-12RW	48	36.0 - 75.0	687	8	±12.0	±1,250	±0.0	91	±15.0	750	1,500
MI3048D-15RW	48	36.0 - 75.0	679	8	±15.0	±1,000	±0.0	92	±18.0	500	1,500

Models with a 4:1 input are also available. See the **MI30xxx-xxRU**

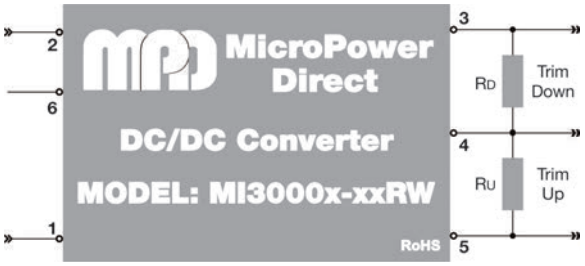
For the heatsink option, add suffix "-H" to the model number (i.e. **MI3024S-12RW-H**)

Notes:
1. The specified maximum capacitive load is for each output. Capacitive load is tested at minimum VIN and with a constant resistive load.
2. Load regulation is measured with the output power varied from 0% to 100%. Dual outputs are balanced.
3. Cross regulation is measured on dual output models with one output at 100% load while the other output is varied from 25% load to 100% load.
4. Output ripple & noise is measured with an external capacitor (10 µF) connected from the +VOUT to the -VOUT pins for single output units and from each output to common for dual output models. See the typical connection diagram on page 3.
5. Transient recovery is measured to within a 1% error band for a load step change of 25%.
6. Operation at no-load will not damage these units. However, they may not meet all specifications.
9. To meet the requirements of EN 61000-4-4, external components are needed. The connection diagrams on page 3 shows external components that would typically achieve this. Contact the factory for more information.
10. To meet the requirements of EN 61000-4-5, external filter components are needed. This can be done as shown in the connection diagrams on page 3. Contact the factory for more information.
11. It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

Derating Curve



External Trim



External Trim Notes:
On single output units, an external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at left.

Values for R_U and R_D are given in the tables below.

Output Trim Resistor Values: (Trim Down)

Model	1%	2%	3%	4%	5%
MI30xxS-03RW	817.5 kΩ	362.2 kΩ	215.4 kΩ	143.0 kΩ	99.7 kΩ
MI30xxS-05RW	119.9 kΩ	63.6 kΩ	40.4 kΩ	27.7 kΩ	19.7 kΩ
MI30xxS-12RW	345.0 kΩ	164.8 kΩ	98.9 kΩ	64.6 kΩ	43.7 kΩ
MI30xxS-15RW	174.3 kΩ	91.1 kΩ	56.6 kΩ	37.7 kΩ	25.8 kΩ

Model	6%	7%	8%	9%	10%
MI30xxS-03RW	71.1 kΩ	50.6 kΩ	35.3 kΩ	23.4 kΩ	14.0 kΩ
MI30xxS-05RW	14.2 kΩ	10.2 kΩ	7.1 kΩ	4.7 kΩ	2.7 kΩ
MI30xxS-12RW	29.6 kΩ	19.4 kΩ	11.7 kΩ	5.7 kΩ	0.87 kΩ
MI30xxS-15RW	17.6 kΩ	11.6 kΩ	7.0 kΩ	3.5 kΩ	0.55 kΩ

Output Trim Resistor Values (Trim Up)

Model	1%	2%	3%	4%	5%
MI30xxS-03RW	567.6 kΩ	263.2 kΩ	158.5 kΩ	105.5 kΩ	73.5 kΩ
MI30xxS-05RW	618.0 kΩ	223.4 kΩ	133.3 kΩ	93.4 kΩ	70.9 kΩ
MI30xxS-12RW	1,015.7 kΩ	448.9 kΩ	280.6 kΩ	199.8 kΩ	152.4 kΩ
MI30xxS-15RW	661.5 kΩ	231.3 kΩ	134.0 kΩ	91.0 kΩ	66.8 kΩ

Model	6%	7%	8%	9%	10%
MI30xxS-03RW	52.1 kΩ	36.8 kΩ	25.2 kΩ	16.3 kΩ	9.1 kΩ
MI30xxS-05RW	56.4 kΩ	46.4 kΩ	38.9 kΩ	33.2 kΩ	28.7 kΩ
MI30xxS-12RW	121.2 kΩ	99.1 kΩ	82.6 kΩ	69.9 kΩ	59.7 kΩ
MI30xxS-15RW	51.3 kΩ	40.4 kΩ	32.5 kΩ	26.4 kΩ	21.5 kΩ

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EMC Specifications

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 1	EN 55032		Class A
Conducted Emissions, See Note 1	EN 55032		Class A
ESD	EN 61000-4-2	A	±6 kV Contact
			±8 kV Air
RS	EN 61000-4-3	A	20V/m
EFT, See Note 2	EN 61000-4-4	A	±2 kV
Surge, See Note 3	EN 61000-4-5	A	±2 kV
CS	EN 61000-4-6	A	10 Vrms
PFMF	EN 61000-4-8	A	100 A/m

Notes:
1. To meet conducted emission limits, 12 VDC input models require C_1 & L_1 be connected as shown in the simple connection diagram below. Contact the factory for more information.
2. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.

Simple Connection

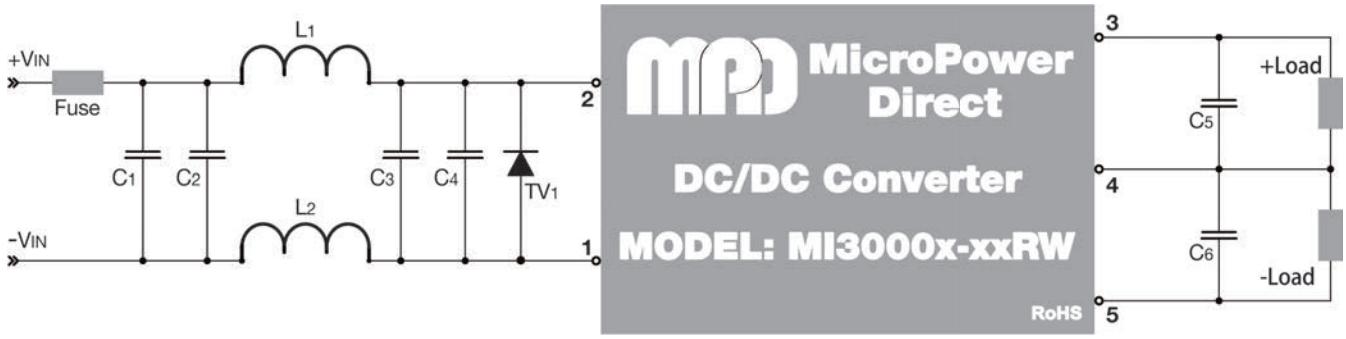


To meet conducted emission standards, the 12 V_{IN} models of the **MI3000xRW** series require the input components shown in the simple connection at left. Recommended values are:

Model	C_1	L_1
MI3012x-xxRW	1206, 335k/50V, XR7	0.82 µH
MI3024x-xxRW	None Required	
MI3048x-xxRW		

Recommended values for C_5 & C_6 are given in the table below.

Typical Connection: With External EMC Components

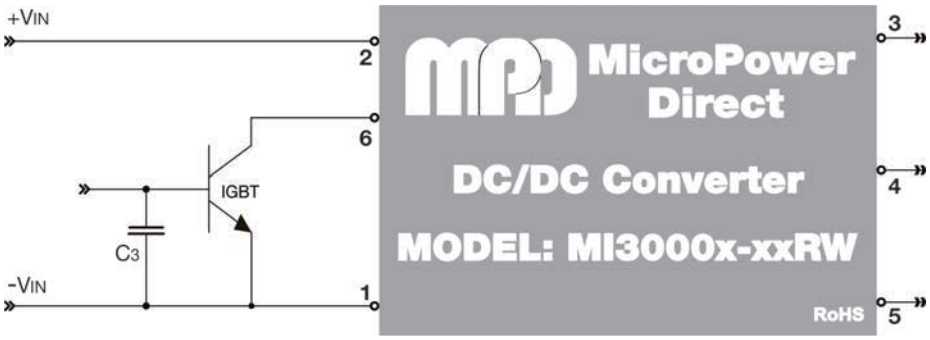


Model Number	External Components									
	Fuse	C_1	C_2	L_1	L_2	C_3	C_4	TVS	C_5	C_6
MI3012x-xxRW	6A/1 kV	330 µF/100V	470 µF/100V	1.0 µH	1.0 µH	330 µF/100V	470 µF/100V	---	10 µF	10 µF
MI3024x-xxRW	3A/1 kV	330 µF/100V	---	---	---	---	---	SMDJ58A	10 µF	10 µF
MI3048x-xxRW	1.5A/1 kV	330 µF/100V	---	---	---	---	---	SMDJ120A	10 µF	10 µF

For applications that require meeting higher EMC standards, the circuit shown above is recommended. Some notes on this diagram (starting with the input circuit) are:

1. It is recommended that an external fuse be used. The fuse should be a slow blow type.
2. Capacitors C_1, and C_3 are aluminum electrolytic capacitors. C_1 is needed to meet EN 61000-4-4 and EN 61000-4-5 on all models. Capacitor C_3 is also required on 12V input models.
3. Capacitors C_2, and C_4 are aluminum electrolytic capacitors. Both capacitors are needed to meet EN 61000-4-4 & EN 61000-4-5 on 12V input models. The 24 V_{IN} and 48 V_{IN} models do not require these capacitors.
4. The inductors, L_1 and L_2 are required on 12 V_{IN} models to meet EN 61000-4-4 and EN 61000-4-5. They are not needed for 24 V_{IN} and 48 V_{IN} models.
5. The 24 V_{IN} & 48 V_{IN} models require a TVS (TV_1) connected in parallel with the input capacitor to meet EN 61000-4-4 and EN 61000-4-5. For the 24VIN models a device specified at 58V with 3 kW peak pulse power is recommended. For the 46 VIN models a device specified at 120V with 3 kW peak pulse power is recommended.
6. Capacitors C_5 & C_6 are high frequency ceramic disc capacitors.
7. Derating on all capacitors should be 80% or more.

Remote On/Off



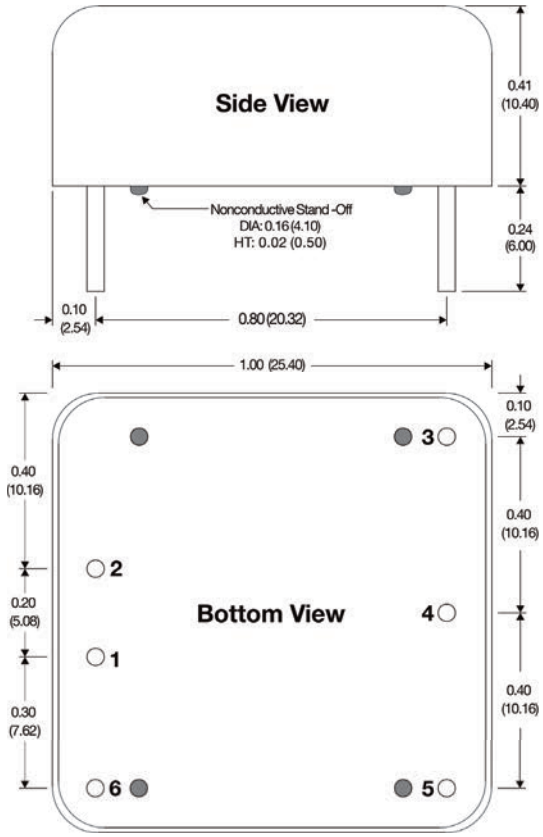
Remote On/Off

Parameter	Min.	Typ.	Max.	Units
Unit On	3.0		12.0	VDC
Unit Off	0		1.2	VDC
Off Idle Current		2.0		mA

A positive logic Remote On/Off input (Pin 6) can be used to control the converter. An open collector (or open drain) switch (Q_1) is placed between the control input (Pin 6) and the -V Input (Pin 2).

If not being used, the control input should be left open.

Mechanical Dimensions



Pin Connections

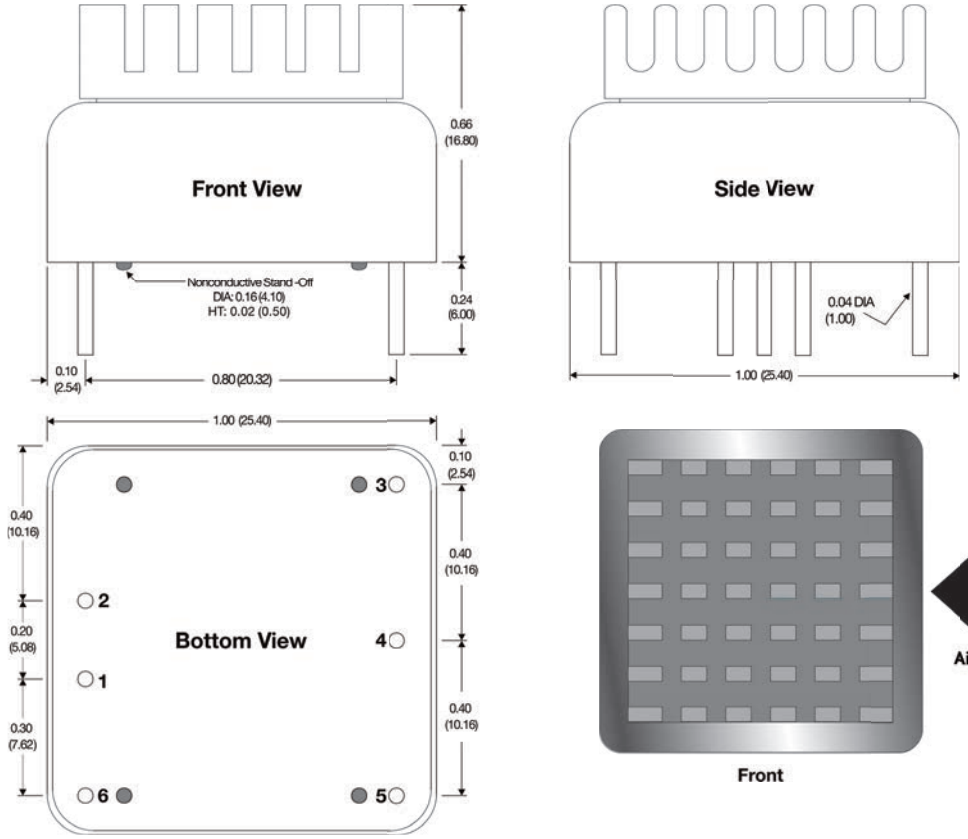
Pin	Single Output
1	-VIN
2	+VIN
3	+VOUT
4	Trim
5	-VOUT
6	Remote On/Off

Pin	Dual Output
1	-VIN
2	+VIN
3	+VOUT
4	Common
5	-VOUT
6	Remote On/Off

Notes:

- All dimensions are typical in inches (mm)
- Pin Section Tolerance x.xxx = ±0.004 (±0.100)
- General Tolerance x.xx = ±0.01 (±0.25)
- Weight: 0.42 Oz (19g)

Mechanical Dimensions: With Optional Heatsink



For the heatsink option, add suffix "-H" to the model number (i.e. **MI3024S-05RW-H**)

Pin Connections

Pin	Single Output
1	-VIN
2	+VIN
3	+VOUT
4	Trim
5	-VOUT
6	Remote On/Off

Pin	Dual Output
1	-VIN
2	+VIN
3	+VOUT
4	Common
5	-VOUT
6	Remote On/Off

Air flow is not required to meet the specified performance of the **MI30xxx-xxRW** series. However, if it is used, directing the flow into the side of the heatsink will provide optimum benefit. This is illustrated at left.

Notes:

- All dimensions are typical in inches (mm)
- Pin Section Tolerance x.xxx = ±0.004 (±0.100)
- General Tolerance x.xx = ±0.01 (±0.25)
- Weight: 0.52 Oz (21.9g)

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