

# IG220 Series

## Compact, 3.5 kV ISO SiC MOSFET Driver DC/DC Converter



### Key Features:

- +12 VDC & 24 VDC Input
- +20/-4 VDC Outputs
- 80% Efficiency
- -40°C to 105°C Operation
- 3,500 VAC Isolation
- Low Isolation Capacitance
- Miniature SIP Case
- >3.5 MHour MTBF
- Short Circuit Protection
- Industry Standard Pin-Out



### 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
Supply Voltage Range	See Model Selection Guide				
Input Filter	Internal Capacitor				

#### Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	IG220-12	See Model Chart, Page 2			
	IG220-24	See Tolerance Graphs, Page 2			
Line Regulation, See Note 2	12 V <sub>IN</sub>		±1.5	±2.0	%
	24 V <sub>IN</sub>		±1.1	±1.3	
Load Regulation, See Note 3	IG220-12	20 V <sub>OUT</sub>	--	8.0	%
		-4 V <sub>OUT</sub>	--	13.0	
	IG220-24	20 V <sub>OUT</sub>	5.0	8.0	
		-4 V <sub>OUT</sub>	10.0	13.0	
Ripple & Noise (20 MHz), See Note 4	IG220-12	20 V <sub>OUT</sub>	60		mV P - P
		-4 V <sub>OUT</sub>	100		
	IG220-24	20 V <sub>OUT</sub>	60		
		-4 V <sub>OUT</sub>	75		
Capacitive Load				220	μF
Efficiency			80		%
Temperature Coefficient				±0.03	%/°C
Output Short Circuit	Continuous (Autorecovery)				

#### General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	3,500			VAC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz/0.1V		3.5		pF
Switching Frequency			100		kHz

#### EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 5	EN 55022		Class B
Conducted Emissions, See Note 5	EN 55022		Class B
ESD	EN 61000-4-2	B	±6 kV Contact

#### Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+105	°C
Storage Temperature Range	IG220-12	-50		+125	°C
	IG220-24	-55		+125	
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

#### Physical

Case Size & Weight	See Mechanical Diagram (Page 4)				
Case Material	Non-Conductive Black Plastic (UL94-V0)				

#### Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours

#### Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Max Supply Voltage (1 Sec)	12 V <sub>IN</sub>			18	VDC
	24 V <sub>IN</sub>			30	
Lead Temperature	1.5 mm From Case For 10 Sec			300	°C

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

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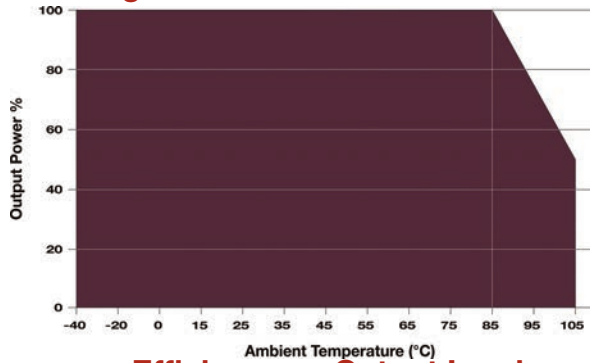
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Model Number	Input (Supply)				Output 1					Output 2					Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)			Current (mA)		Voltage (VDC)			Current (mA)		
	Nom.	Range	Full Load	No Load	Min.	Nom.	Max.	Max	Min	Min.	Nom.	Max.	Max	Min	
IG220-12	12	10.80 - 13.20	280	20	19.60	20.0	20.40	100.0	10.0	-3.70	-4.00	-4.10	-100.0	-10.0	500
IG220-24	24	21.60 - 26.40	125	13	---	20.0	---	100.0	10.0	---	-4.00	---	-100.0	-10.0	250

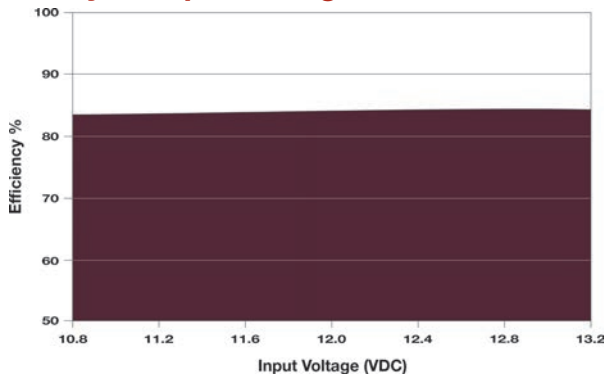
**Notes:**

1. Line regulation is measured for an input voltage change of  $\pm 10\%$ .
2. Load regulation is measured from 10% load to full load.
3. When measuring output ripple & noise, it is recommended that an external capacitor ( $1 \mu F$  to  $10 \mu F$ ) be placed from each output to common.
4. The unit will meet the radiated and conducted EMI specifications with the addition of external components as shown in the connection diagram on page 3.
5. Operation at no-load will not damage these units. However, they may not meet all specifications.
6. 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.

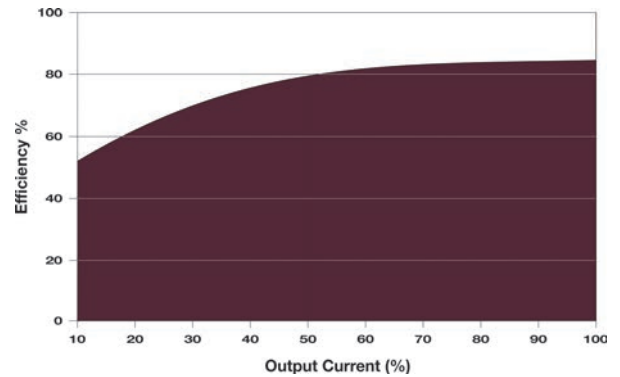
**Derating Curve**



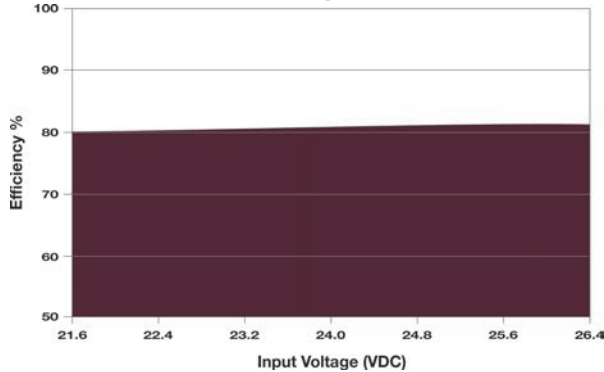
**Efficiency vs Input Voltage 12 VDC Input**



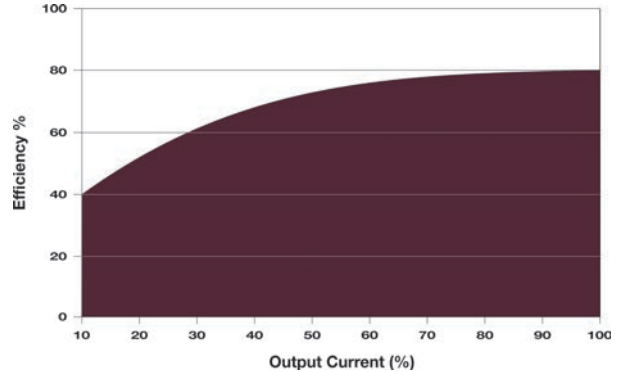
**Efficiency vs Output Load 12 VDC Input**



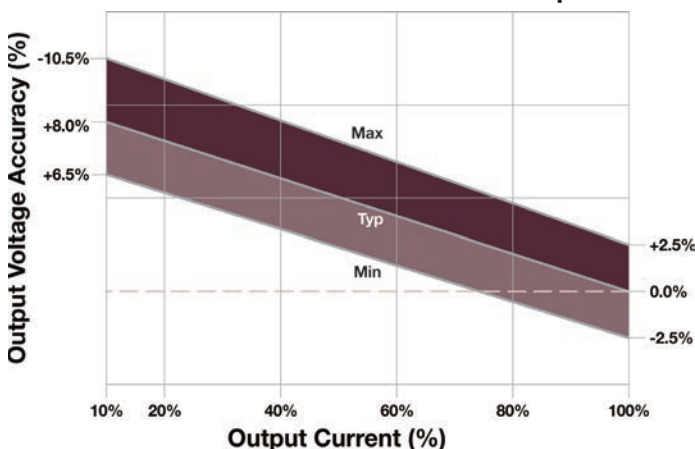
**Efficiency vs Input Voltage 24 VDC Input**



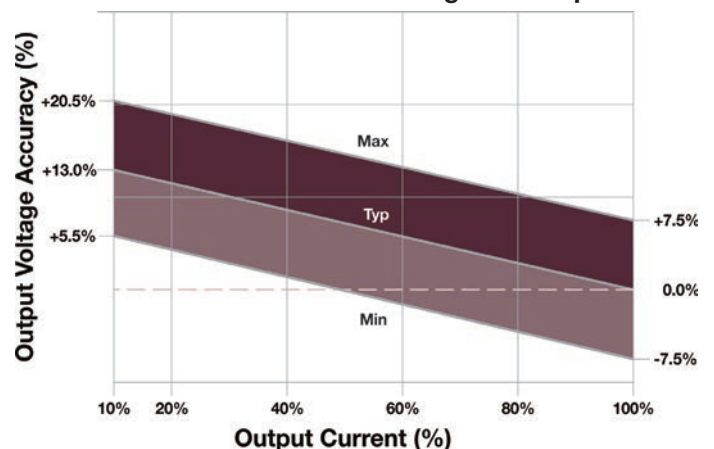
**Efficiency vs Output Load 24 VDC Input**



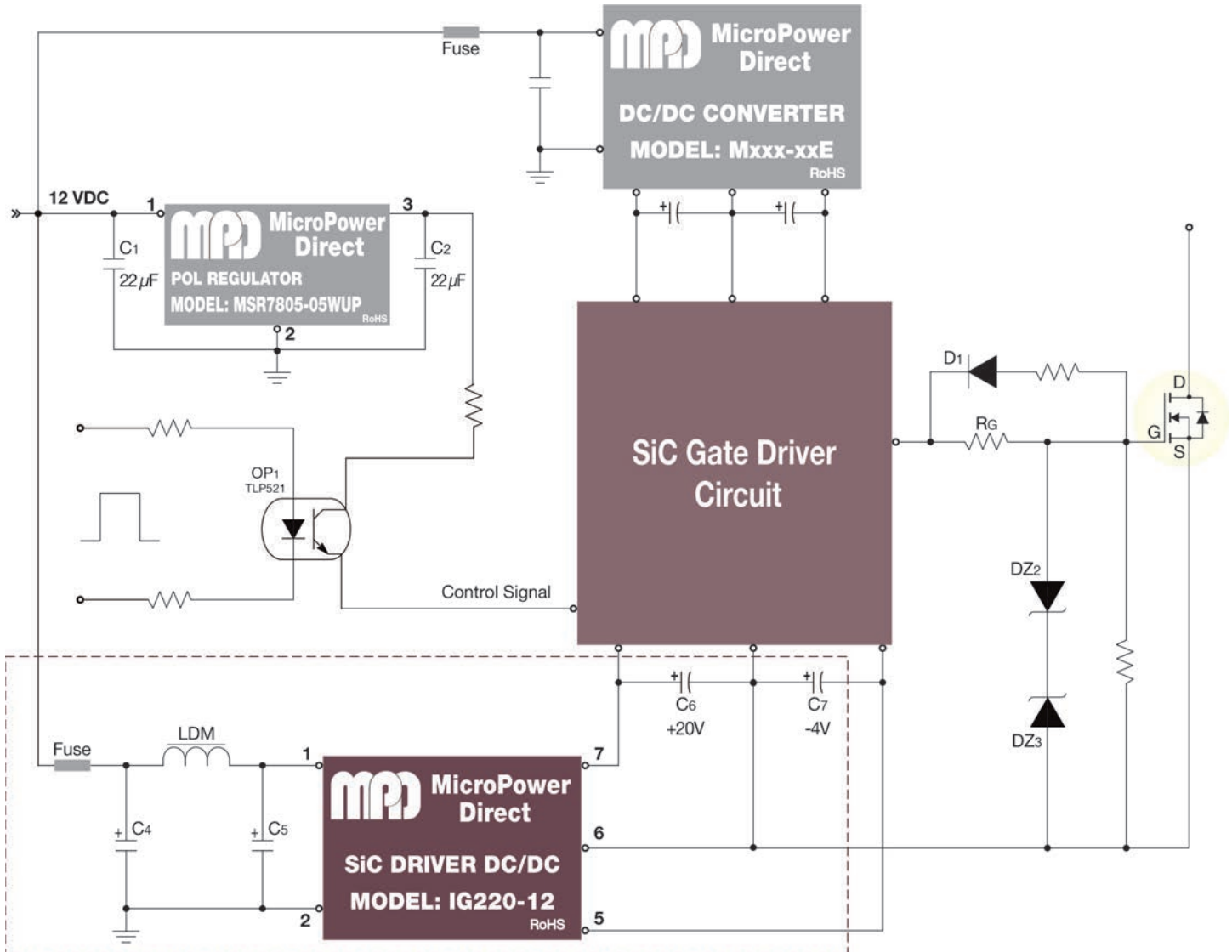
**IG220-24 VOUT Tolerance: Positive Output**



**IG220-24 VOUT Tolerance: Negative Output**



Typical Connection



The IG220-xx series is specifically designed for use in gate driver circuits. With asymmetrical outputs of +20 VDC & -4 VDC, an isolation barrier specified at 3.5 kVAC, very low isolation capacitance and a wide operating temperature range; they are an ideal choice for Silicon Carbide (SiC) MOSFET drive & control circuits.

SiC MOSFETs are often used in high voltage, very high frequency applications. The figure above illustrates a typical connection to a driver circuit. Again, MPD offers a number of power products that can be used in gate driver circuits (IGBT and SiC).

The circuit above uses three MPD parts. At the top, a DC/DC converter is used to convert the 12 VDC bus into voltage levels required by the driver components (if required). This converter also isolates the driver circuit from the power bus. MPD offers hundreds of standard DC/DC converters that can be used for this purpose.

The MSR7805-05WUP is a miniature, very low cost switching regulator. In this circuit, it converts the 12 VDC bus into a regulated 5 VDC that is used for the input signal pull-up.

The IG220-12 converts the input 12 VDC into asymmetrical +20 VDC & -4 VDC outputs. These outputs are used to set up the positive/minus gate bias required for high and low side switching.

The IG220-12 also provides power isolation for the gate drive. Both of the IG220 models are specified for 3.5 kVAC I/O isolation. The optocoupler provides isolation for the control signal.

Some notes on the IG220-xx connection (starting with the input) are:

1. The IG220-xx DC/DC should be mounted as close to the SiC driver as possible, to minimize the length of connecting board traces or wires.
2. The IG220 series does not include overload protection (typical of most low power DC/DC's). It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page two.
3. The addition of the input filter components (C4, C5 and LDM) will typically bring the IG220-xx circuit to within the limits of EN 55022 Class B. The recommended values for these components are shown in the table at right.

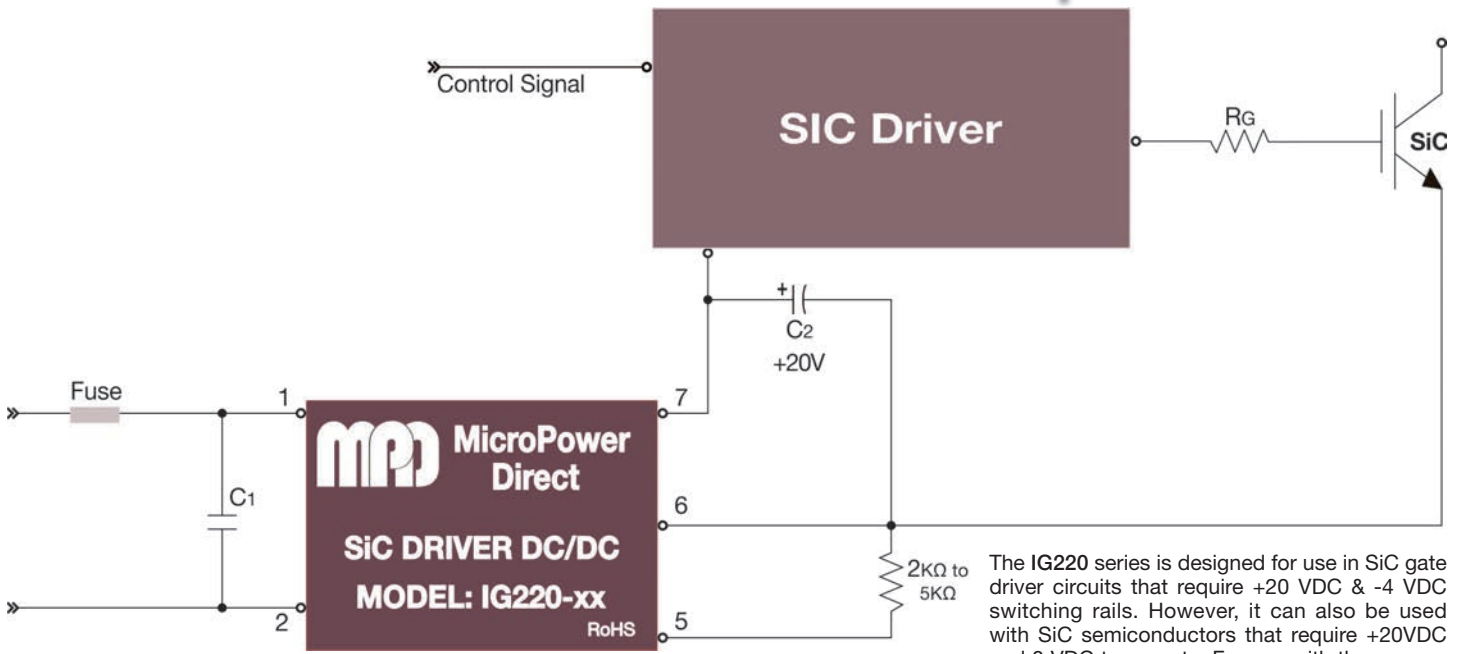
If meeting EN 55022 class A or B is not a concern, the inductor (LDM) and one capacitor (C4) can be eliminated.

4. The recommended values for the decoupling capacitors C6 and C7 are shown in the table below. These low ESR capacitors should be mounted as close to the driver circuit as possible.
5. Input filtering components (C4, C5 and LDM) should be mounted as close to the unit as possible. The PC board trace (or wire) between the DC/DC and the driver circuit should be as short as possible.
6. The use of tantalum capacitors in this circuit should be avoided.
7. Recommended values for components are:

Component	12 V <sub>IN</sub>	15 V <sub>IN</sub>	24 V <sub>IN</sub>
C4	4.7 μF/50V	4.7 μF/50V	4.7 μF/50V
LDM	6.8 μH	6.8 μH	6.8 μH
C5	4.7 μF/50V	4.7 μF/50V	4.7 μF/50V
C6	100 μF/35V	100 μF/35V	100 μF/35V
C7	100 μF/35V	100 μF/35V	100 μF/35V

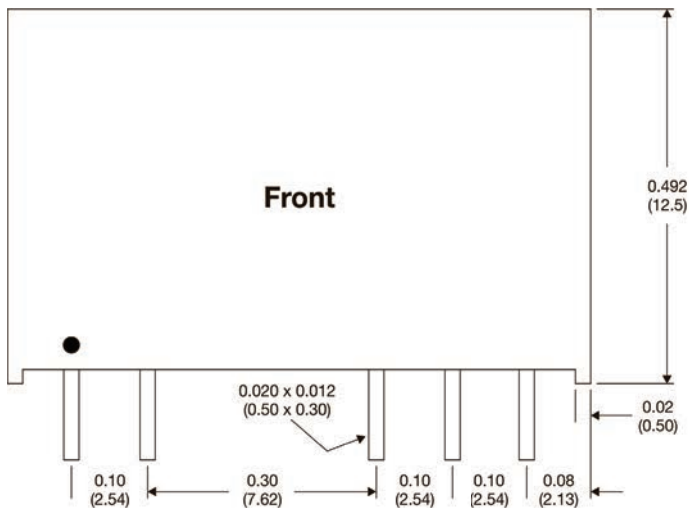
## Typical Connection, For +20V, 0V Requirements

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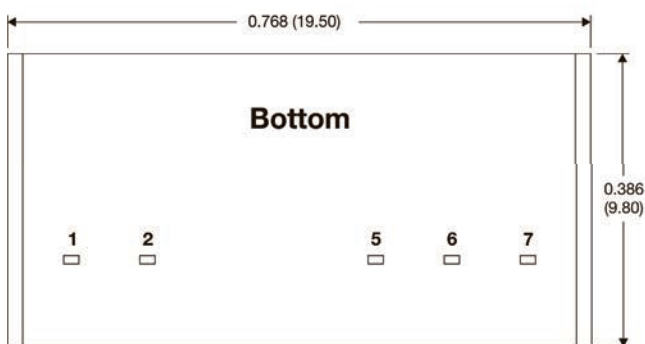
The IG220 series is designed for use in SiC gate driver circuits that require +20 VDC & -4 VDC switching rails. However, it can also be used with SiC semiconductors that require +20VDC and 0 VDC to operate. For use with these components, connect the IG220 as shown in the diagram above.

## Mechanical Dimensions



## Pin Connections

Pin	Function
1	+VIN
2	Gnd
5	-VOUT
6	Common
7	+VOUT



### Notes:

- All dimensions are typical in inches (mm)
- Pin Tolerance x.xxx =  $\pm 0.004$  ( $\pm 0.10$ )
- General Tolerance x.xx =  $\pm 0.010$  ( $\pm 0.25$ )
- Weight: 0.152 Oz (4.3g)
- Pin 1 is marked by a "dot" or indentation on the unit

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