

DATA SHEET

Silicon Schottky Barrier Diodes: Packaged, Bondable Chips and Beam-Leads

Applications

- Detectors

Features

- Both P-type and N-type low barrier silicon available
- Low 1/f noise
- Bonded junctions for reliability
- Planar passivated beam-lead and chip construction
- See also zero bias silicon schottky barrier detector diodes

Description

Skyworks packaged, beam-lead and chip Schottky barrier detector diodes are designed for applications through 40 GHz in Ka band. They are made by the deposition of a suitable barrier metal on an epitaxial silicon substrate to form the junction. The process and choice of materials result in low series resistance along with a narrow spread of capacitance values for close impedance control. p-type silicon is used to obtain superior 1/f noise characteristics. n-type silicon is also available.

Packaged diodes are suitable for use in waveguide, coaxial, and stripline applications.

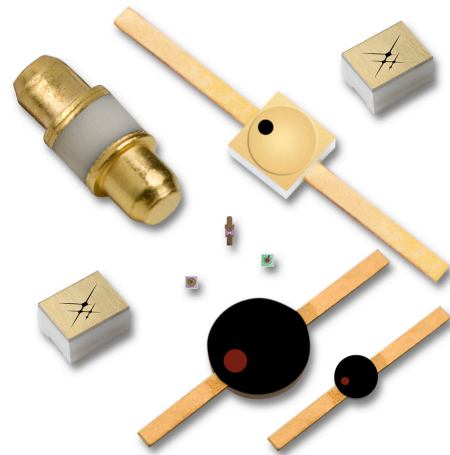
Beam-lead and chip diodes can also be mounted in a variety of packages or on special customer substrates.

Unmounted beam-lead diodes are especially well suited for use in MIC applications. Mounted beam-lead diodes can be easily used in MIC, stripline or other such circuitry.

The “Universal Chips” are designed for a high degree of device reliability in both commercial and industrial uses. The offset bond pad assures that no mechanical damage will occur at the junction during the wire bonding. Additionally the 4 mil bond pad eliminates performance variation due to bonding and is ideal for automated assembly, and improves efficiency during manual operations as well.

The choice on n- and p-type silicon allows for the designer to optimize the silicon material for the intended application.

- Doppler mixers, high-sensitivity detectors will benefit from using the low noise characteristics of the p-type silicon.
- Low conversion loss mixers and biased detectors can be designed using standard n-type material.



Applications

These diodes are categorized by TSS (Tangential Signal Sensitivity) for detector applications in four frequency ranges: S, X, Ku, and Ka band. However, they can also be used as modulators, high-speed switches and low-power limiters.

TSS is a parameter that describes a diode’s detector sensitivity. It is defined as the amount of signal power, below a one-milliwatt reference level, to produce an output pulse whose amplitude is sufficient to raise the noise fluctuations by an amount equal to the average noise level. TSS is approximately 4 dB above the Minimum Detectable Signal.

The p-type Schottky diodes in this data sheet are optimized for low noise, in the 1/f region. They require a small forward bias (to reduce video resistance) if efficient operation is required. Bias not only increases sensitivity but also reduces parameter variation due to temperature change. Video impedance is a direct function of bias and follows the $26/I$ (mA) relationship. This is important to pulse fidelity, since the video impedance in conjunction with the detector output capacitance affects the effective amplifier bandwidth.

Bias does, however, increase typical noise, particularly in the 1/f region. Therefore, it should be kept at as low a level as possible (typically 5–50 microamps). Typical voltage output versus power input as a function of load resistance and bias is shown in Figures 1a and 1b.

Assembly and Handling Procedure

Die Attach Methods

Universal chips are compatible with both eutectic and conductive epoxy die attach methods.

Eutectic composition performs of Au/Sn or Au/Ge are useful when soldering devices in circuit. Gold/silicon eutectic die attach can be accomplished by scrubbing the chip directly to the gold plated bonding area.

Epoxy die attach with silver or gold filled conductive epoxies can also be used where thermal heat sinking is not a requirement.

Wire Bonding

Two methods can be used to connect wire, ribbon, and wire mesh to the chips:

- Thermocompression
- Ballbonding

Skyworks recommends use of pure gold wire (0.7–1.25 mil diameter).

Beam-Lead P-Type Detector Schottky Diodes

Frequency Band	Part Number	Electrical Characteristics					Test Conditions		Outline Drawing
		TSS – dBm ^{1,2}	R _V (Ω)		C _J @ 0V (pF)	V _F @ 1 mA (mv)	V _B @ 10 mA (V)	Frequency (GHz)	
		Typ.	Min.	Max.	Max.				
X	DDB2503-000	50	500	700	0.15	200–350	2	10	491-006
Ku	DDB2504-000	48	500	700	0.10	200–350	2	16	491-006
K	DDB2265-000	50 ³	800 ³	1200 ³	0.10	300–450	3	24.15	491-006

1. Bias = 50 μA.
2. Video bandwidth = 10 MHz.
3. Bias = 30 μA.

Epoxy and Hermetic Packaged Beam-Lead P-Type Detector Schottky Diodes

Epoxy Stripline 250	Epoxy Stripline 230	Hermetic Stripline 220
DDB2503-250	DDB2503-230	DDB2503-220
DDB2504-250	DDB2504-230	DDB2504-220
DDB2265-250	DDB2265-230	DDB2265-220

P-Type Detector Schottky Diode Universal Chips

Frequency Band	Part Number	Electrical Characteristics					Outline Drawing
		TSS – dBm ^{1,2,4}	C _J @ 0V (pF)	V _F @ 1 mA (mv)	R _T @ 10 mA (Ω)	V _B @ 10 mA (V)	
		Min.	Max.		Max.	Min.	
Ku	CDB7620-000	40	0.15	250–350	30	2	571-006
K	CDB7619-000	50 ³	0.10	300–450	40	3	571-006

1. Bias = 50 μA.
2. Video bandwidth = 10 MHz.
3. Bias = 30 μA.
4. R_V = 2800 Ω.

Hermetic Packaged P-Type Detector Schottky Diode Chips

Hermetic Pill 207	Hermetic Pill 203	Hermetic 109
CDB7620-207	CDB7620-203	SMS7620-109
CDB7619-207	CDB7619-203	SMS7619-109

N-Type Detector Schottky Diode Chips

Frequency Band	Part Number	Electrical Characteristics					Outline Drawing Number
		Barrier	V _F @ 1 mA (mV)	Max. C _J @ 0V (pF)	Max. R _T @ 10 mA (Ω)	Min. V _B @ 10 μA (V)	
X	CDF7623-000	Low	240-300	0.30	10	2	571-011
K	CDF7621-000	Low	270-350	0.10	20	2	571-011
Ku	CME7660-000	Med	350-450	0.15	10	3	571-011
K	CDE7618-000	Med	375-500	0.10	20	3	571-011
Ku	CDP7624-000	Med/High	450-575	0.15	15	3	571-011

Hermetic Packaged Beam-Lead N-Type Detector Schottky Diode Chips

Hermetic Ceramic Pill 207	Hermetic Ceramic Pill 203	Hermetic Surface Mount 108
CDF7623-207	CDF7623-203	SMS7623-108
CDF7621-207	CDF7621-203	SMS7621-108
CME7660-207	CME7660-203	SMS7660-108
CDE7618-207	CDE7618-203	SMS7618-108
CDP7624-207	CDP7624-203	SMS7624-108

SPICE Model Parameters

Parameter	Unit	Part Number			
		CDF7620-000	CDF7621-000	CDC7623-000	CDB7619-000
I _S	A	4e-08	9e-08	1.1e-7	3e-08
R _S	Ω	4	6	5	30
n	-	1.2	1.1	1.1	1.04
T _D	s	1e-11	1e-11	1e-11	1e-11
C _{J0}	pF	0.15	0.11	0.2	0.11
m	-	0.35	0.3	0.3	0.32
E _G	eV	0.69	0.69	0.69	0.69
V _J	V	0.495	0.51	0.51	0.54
X _{TI}	-	2	2	2	2
FC	-	0.5	0.5	0.5	0.5
B _V	V	10	2.5	2.5	3
I _{BV}	A	1e-05	1e-05	1e-05	1e-05

Shipping Information

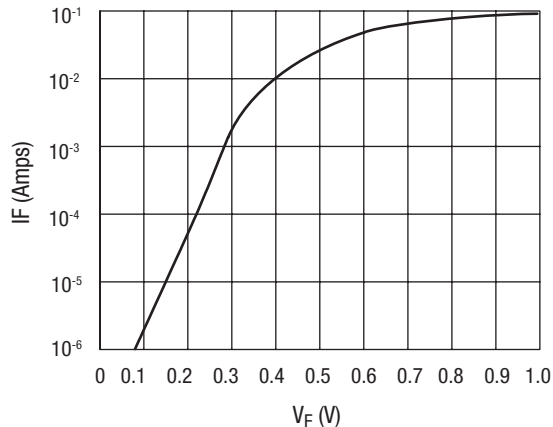
Individual Chips

Standard packaging procedures at Skyworks are for “waffle pack” delivery. Devices can also be packaged on “Gel Pack” carriers.

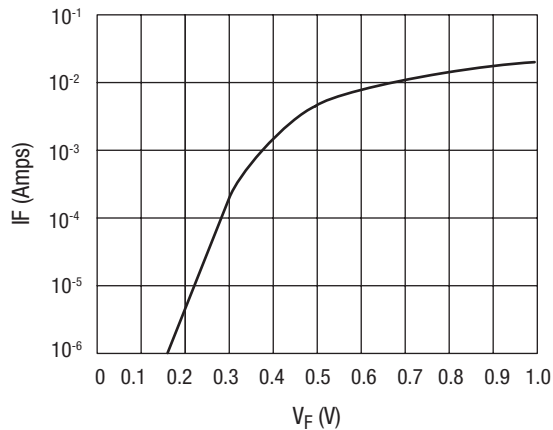
Wafer Shipment for Whole Wafer

Packaging options include delivery for devices on film frame where wafer is sawn on wafer gel pack for uncut, unsawn wafer.

Typical I-V Characteristics



CDF7621-000



CDB7619-000

Typical Performance Data

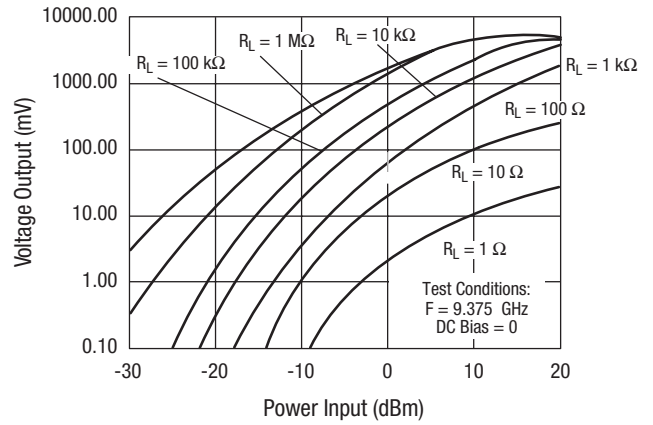


Figure 1a. Voltage Output vs. Power Input As a Function of Load Resistance

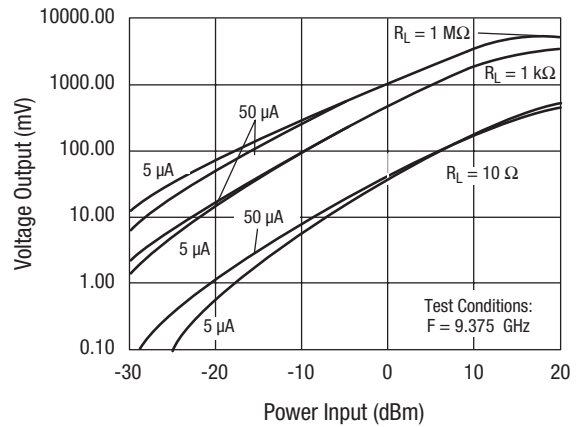
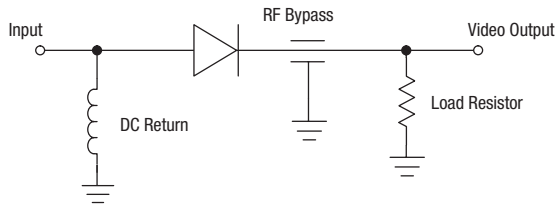
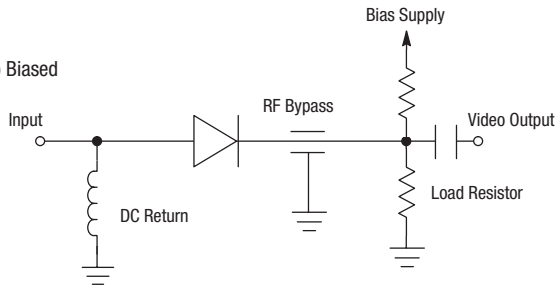


Figure 1b. Voltage Output vs. Power Input As a Function of Load Resistance and Bias

a) Unbiased

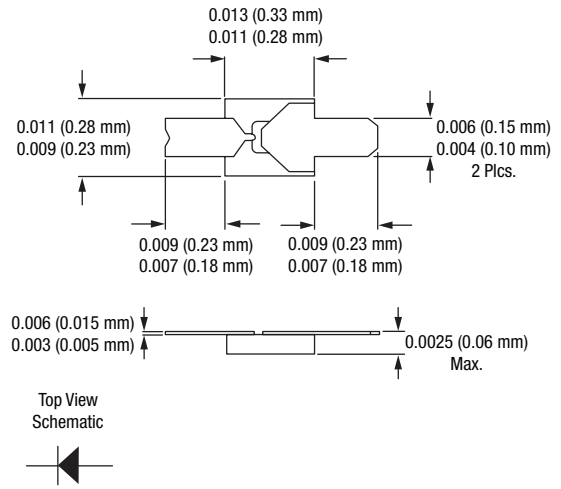


a) Biased

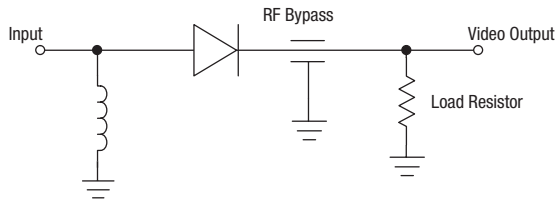


Multi-Octave-High Sensitivity

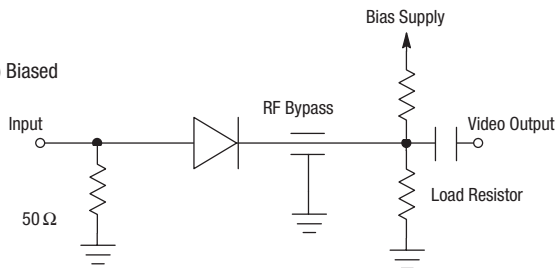
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a) Unbiased



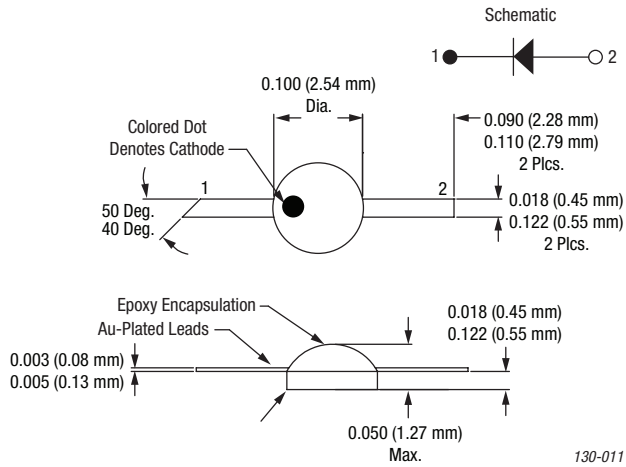
a) Biased



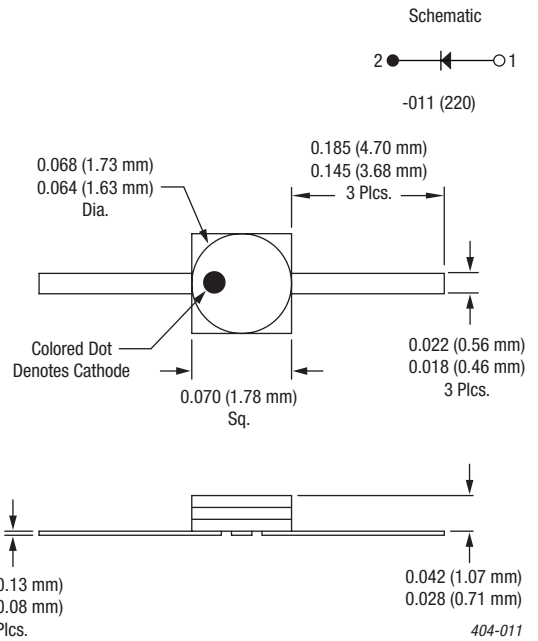
Broadband-Low Sensitivity

Figure 2. Typical Video Detector Circuits

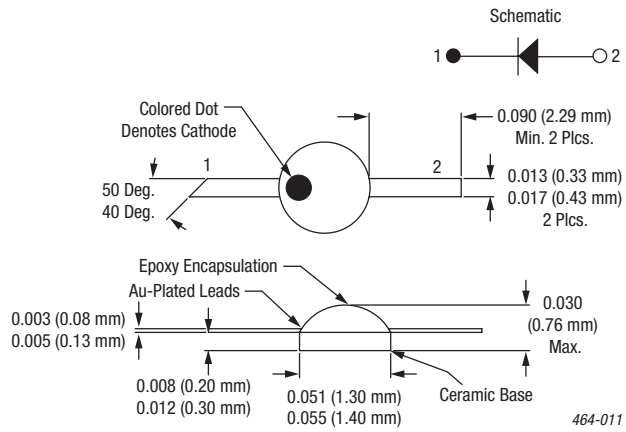
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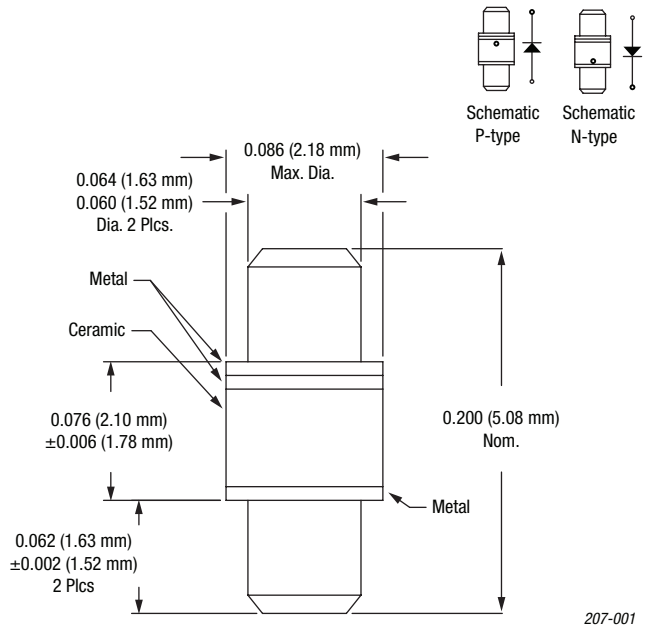
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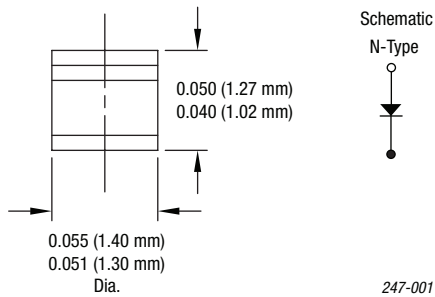
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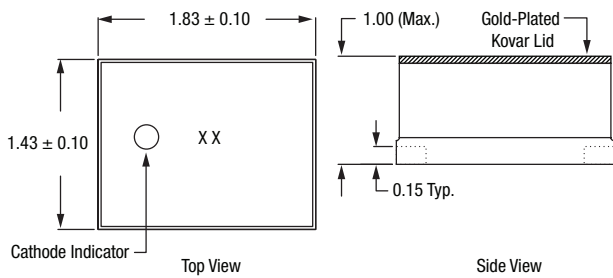
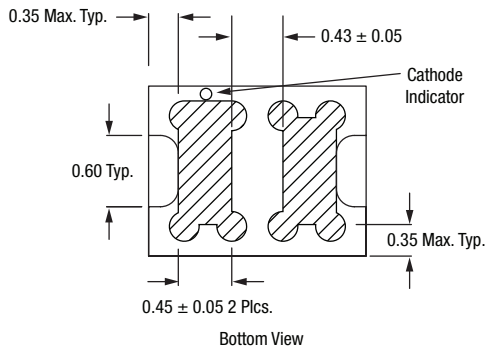
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-203



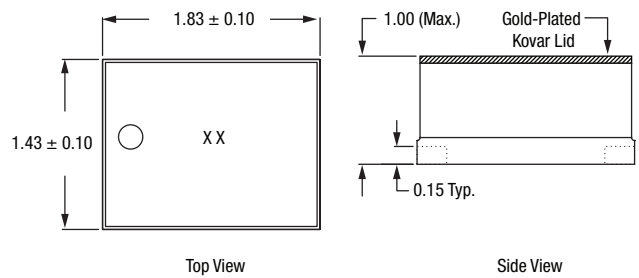
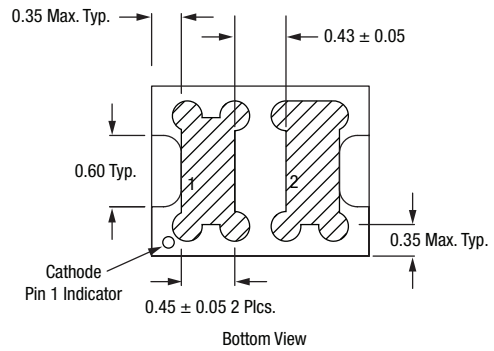
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All dimensions in mm

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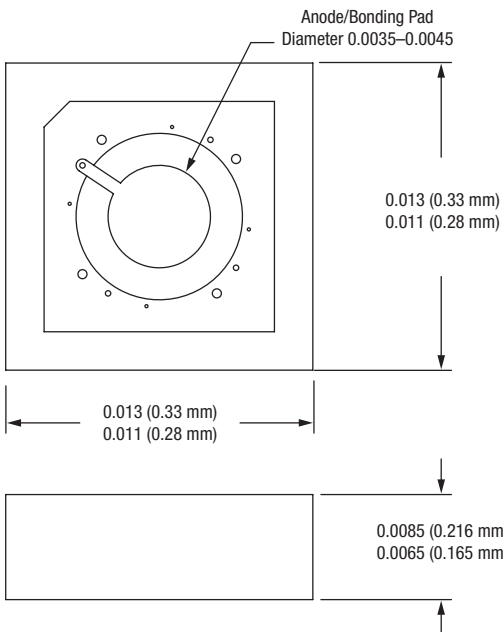
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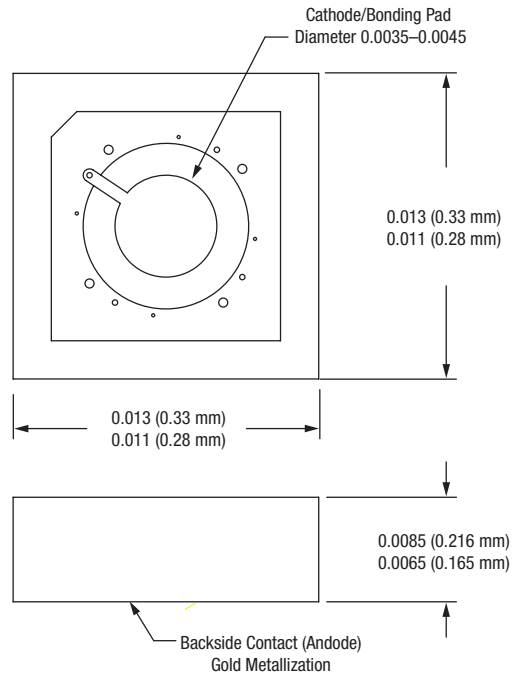
All dimensions in mm

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