

The Guitar



The **guitar** is a musical instrument of the [chordophone](#) family, being a stringed instrument played by plucking, either with fingers or a pick. The guitar consists of a body with a rigid neck to which the strings, generally six in number but sometimes more, are attached. Guitars are traditionally constructed of various woods and strung with animal gut or, more recently, with either nylon or steel strings. Some modern guitars are made of [polycarbonate](#) materials. Guitars are made and repaired by [luthiers](#). There are two primary families of guitars: acoustic and electric.

Acoustic guitars (and similar instruments) which have hollow bodies, have been in use for over a thousand years. There are three main types of modern acoustic guitar: the [classical guitar](#) (nylon-string guitar), the [steel-string acoustic guitar](#), and the [archtop guitar](#). The tone of an acoustic guitar is produced by the vibration of the strings which is amplified by the body of the guitar, which acts as a resonating chamber. The [classical guitar](#) is often played as a *solo instrument* using a comprehensive fingerpicking technique. [Electric guitars](#), introduced in the 1930s, rely on an [amplifier](#) that can electronically manipulate tone. Early amplified guitars employed a hollow body, but a solid body was found more suitable. Electric guitars have had a continuing profound influence on [popular culture](#). Guitars are recognized as a primary instrument in Genres such as [flamenco](#), [Rock music](#), [Reggae](#), [blues](#), [country](#), [mariachi](#), [Jazz](#), [Soul](#), and many forms of [pop](#).

Before the development of the electric guitar and the use of synthetic materials, a guitar was defined as being an instrument having "a long, fretted neck, flat wooden soundboard, ribs, and a flat back, most often with incurved sides".^[1] The term is used to refer to a number of related instruments that were developed and used across Europe beginning in the 12th century and, later, in the Americas.^[2] These instruments are descended from ones that existed in ancient [central Asia and India](#). For this reason guitars are distantly related to modern instruments from these regions, including the [tanbur](#), the [setar](#) and the [sitar](#), among others. The oldest known iconographic representation of an instrument displaying the essential features of a guitar is a 3,300 year old stone carving of a [Hittite](#) bard.^[3]

The modern word "guitar" was adopted into English from Spanish *guitarra* (German *Gitarre*, French *Guitare*),^[4] loaned from the medieval [Andalusian Arabic](#) قيثارة *qithara*,^[5] itself derived from the [Latin](#) *cithara*, which in turn came from the earlier [Greek](#) word *kithara* (κithάρα),^[6] a descendant of [Old Persian](#) *sihtar* (رات یس) (*Tar* means *string* in [Persian](#)).^[7]


The guitar is descended from the [Roman cithara](#) brought by the Romans to [Hispania](#) around 40 AD, and further adapted and developed with the arrival of the four-string [oud](#), brought by the [Moors](#) after their [conquest](#) of Iberia in the 8th century.^[8] Elsewhere in Europe, the indigenous six-string Scandinavian *lut* ([lute](#)), had gained in popularity in areas of Viking incursions across the continent. Often depicted in carvings c. 800 AD, the Norse hero

Gunther (also known as Gunnar), played a lute with his toes as he lay dying in a snake-pit, in the legend of Siegfried.^[9] By 1200 AD, the four-string "guitar" had evolved into two types: the *guitarra moresca* (Moorish guitar) which had a rounded back, wide fingerboard and several soundholes, and the *guitarra latina* (Latin guitar) which resembled the modern guitar with one soundhole and a narrower neck.^[10] In the 14th and 15th centuries the qualifiers "moresca" and "latina" were dropped and these four course instruments were simply called guitars.^[11]

The Spanish [vihuela](#) or (in Italian) "viola da mano", a guitar-like instrument of the 15th and 16th centuries, is often considered a major influence in the development of the modern guitar. It had six courses (usually), lute-like [tuning](#) in fourths and a guitar-like body, although early representations reveal an instrument with a sharply-cut waist. It was also larger than the contemporary four course guitars. By the late 15th century some vihuelas began to be played with a bow, leading to the development of the [viol](#). By the sixteenth century the vihuela's construction had more in common with the modern guitar, with its curved one-piece ribs, than with the viols, and more like a larger version of the contemporary four-[course](#) guitars. The vihuela enjoyed only a short period of popularity in Spain and Italy during an era dominated elsewhere in Europe by the [lute](#); the last surviving published music for the instrument appeared in 1576. Meanwhile the five-course [baroque guitar](#), which was documented in Spain from the middle of the 16th century, enjoyed popularity, especially in Spain, Italy and France from the late 16th century to the mid 18th century.^{[12][13]} Confusingly, in Portugal, the word *vihuela* referred to the guitar, whereas *guitarra* meant the "[Portuguese guitar](#)", a variety of [cittern](#).

Types of guitars



 The guitar player (c. 1672), by [Johannes Vermeer](#)

Guitars can be divided into two broad categories, acoustic and electric:

Acoustic guitars

There are several notable subcategories within the acoustic guitar group: classical and flamenco guitars; steel-string guitars, which include the flat-topped, or "folk," guitar; [twelve-string guitars](#); and the arched-top guitar. The acoustic guitar group also includes unamplified

guitars designed to play in different registers, such as the acoustic bass guitar, which has a similar tuning to that of the electric bass guitar.

Renaissance and Baroque guitars

These are the gracile ancestors of the modern [classical guitar](#). They are substantially smaller and more delicate than the classical guitar, and generate a much quieter sound. The strings are paired in courses as in a modern [12-string guitar](#), but they only have four or five courses of strings rather than six. They were more often used as rhythm instruments in ensembles than as solo instruments, and can often be seen in that role in [early music](#) performances. ([Gaspar Sanz](#)' *Instrucción de Música sobre la Guitarra Española* of 1674 constitutes the majority of the surviving solo corpus for the era.) Renaissance and Baroque guitars are easily distinguished because the Renaissance guitar is very plain and the Baroque guitar is very ornate, with ivory or wood inlays all over the neck and body, and a paper-cutout inverted "wedding cake" inside the hole.

Classical guitars



Eminent South American guitarist, [Agustin Barrios](#)

These are typically strung with nylon strings, plucked with the fingers,^[14] played in a seated position and are used to play a diversity of musical styles including [classical music](#). The classical guitar's wide, flat neck allows the musician to play scales, arpeggios and certain chord forms more easily and with less adjacent string interference than on other styles of guitar. [Flamenco guitars](#) are very similar in construction, but are associated with a more percussive tone. In Mexico, the popular [mariachi](#) band includes a range of guitars, from the tiny [requinto](#) to the [guitarrón](#), a guitar larger than a cello, which is tuned in the bass register. In Colombia, the traditional quartet includes a range of instruments too, from the small bandola (sometimes known as the Deleuze-Guattari, for use when traveling or in confined rooms or spaces), to the slightly larger [tiple](#), to the full sized classical guitar. The requinto also appears in other Latin-American countries as a complementary member of the guitar family, with its smaller size and scale, permitting more projection for the playing of single-lined melodies. Modern dimensions of the classical instrument were established by the Spaniard [Antonio de Torres Jurado](#) (1817-1892).

Extended-range classical guitar

An Extended-range classical guitar is a classical guitar with more than 6 strings, usually up to 13.

[Flamenco guitars](#)

The [flamenco](#) guitar is similar to the classical guitar, but of lighter construction, with a cypress body and spruce top. Tuning pegs like those of a violin are traditional, although many modern flamenco guitars have machine heads. A distinguishing feature of all flamenco guitars is the tapping plates (*golpeadores*) glued to the table, to protect them against the taps with the fingernails that are an essential feature of the flamenco style.

Many modern soloists (following the lead of [Paco de Lucía](#)) play what is called a *flamenca negra*, a hybrid of the flamenco and classical guitar constructions

[Flat-top \(steel-string\) guitars](#)

Similar to the [classical guitar](#), however, within the varied sizes of the steel-stringed guitar the body size is usually significantly larger than a classical guitar and it has a narrower, reinforced neck and stronger structural design. The robust X-bracing typical of the steel-string was developed in the 1840s by German-American luthiers of whom [C. F. Martin](#) is the best known. Originally used on gut-strung instruments, the strength of the system allowed the guitar to withstand the additional tension of steel strings when this fortunate combination arose in the early 20th century. The steel strings produce a brighter tone, and according to many players, a louder sound. The acoustic guitar is used in many kinds of music including folk, country, bluegrass, pop, jazz and blues. Many variations are possible from the roughly classical-sized [OO](#) and [Parlour](#) to the large [Dreadnought](#) and [Jumbo](#). [Ovation](#) makes a modern variation, with a rounded back/side assembly molded from artificial materials.

[Archtop guitars](#)

These are steel-string instruments in which the top (and often the back) of the instrument are carved from a solid billet in a curved rather than a flat shape; this violin-like construction is usually credited to the American [Orville Gibson](#) (1856-1918). [Lloyd Loar](#) of the [Gibson Mandolin-Guitar Mfg. Co](#) introduced the violin-inspired f-hole design now usually associated with archtop guitars, after designing a style of [mandolin](#) of the same type. The typical archtop guitar has a large, deep, hollow body whose form is much like that of a mandolin or violin family instrument. Nowadays, most archtops are equipped with magnetic pickups and are therefore both acoustic and electric. F-hole archtop guitars were immediately adopted upon their release by both [jazz](#) and [country](#) musicians and have remained particularly popular in jazz music, usually with flatwound strings.

[Selmer-Maccaferri guitars](#)

These are usually played by those who follow the style of [Django Reinhardt](#). It is an unusual-looking instrument, distinguished by a fairly large body with squarish bouts, and either a "D"-shaped or longitudinal oval soundhole. The strings are gathered at the tail like an archtop guitar, but the top is formed from thin spruce (like a flat-top or classical) forced into a shallow dome. It also has a wide fingerboard and slotted head

like a nylon-string guitar. The loud volume and penetrating tone make it suitable for single-note [soling](#) and it is frequently employed as a [lead instrument](#) in [gypsy swing](#).



An 8-string [baritone](#) tricone [resonator guitar](#).

[Resonator](#), resophonic or [Dobro](#) guitars

All three principal types of resonator guitars were invented by the Slovak-American [John Dopyera](#) (1893-1988) for the National and Dobro (**Dopyera Brothers**) companies. Similar to the flat top guitar in appearance, but with a body which may be made of brass, nickel-silver or steel as well as wood, the sound of the resonator guitar is produced by one or more aluminum resonator cones mounted in the middle of the top. The physical principle of the guitar is therefore similar to the [loudspeaker](#). The original purpose of the resonator was to produce a very loud sound; this purpose has been largely superseded by electrical amplification, but the resonator guitar is still played because of its distinctive tone. Resonator guitars may have either one or three resonator cones. The method of transmitting sound resonance to the cone is either a "biscuit" bridge, made of a small piece of hardwood at the vertex of the cone (Nationals), or a "spider" bridge, made of metal and mounted around the rim of the (inverted) cone (Dobros). Three-cone resonators always use a specialized metal bridge. The type of resonator guitar with a neck with a square cross-section – called "square neck" or "Hawaiian" – is usually played face up, on the lap of the seated player, and often with a metal or glass [slide](#). The round neck resonator guitars are normally played in the same fashion as other guitars, although slides are also often used, especially in blues.

[12-string guitars](#)

The twelve-string guitar usually has steel strings and is widely used in [folk music](#), [blues](#) and [rock and roll](#). Rather than having only six strings, the 12-string guitar has six [courses](#) made up of two strings each, like a [mandolin](#) or [lute](#). The highest two courses are tuned in unison, while the others are tuned in octaves. The 12-string guitar is also made in electric forms.

[Russian guitars](#)

These are seven-string acoustic guitars which were the norm for Russian guitarists throughout the 19th and well into the 20th centuries. The guitar is traditionally tuned to an open G major.

Acoustic bass guitars



Prime and bass acoustic guitars

These have steel strings or gut strings and often the same tuning as an electric [bass guitar](#).

Guitarrón

The guitarrón is a very large, deep-bodied Mexican 6-string acoustic bass played in mariachi bands. It is fretless with heavy gauge nylon strings, and is usually played by doubling notes at the octave, which is facilitated by the unusual tuning of A D G C E A.

Tenor guitars

A number of classical guitarists call the Niibori prime guitar a "Tenor Guitar" on the grounds that it sits in pitch between the alto and the bass. Elsewhere^{[[citation needed](#)]} the name is taken for a 4-string guitar with a scale length of 23" (585 mm) – about the same as a Terz Guitar. The tenor guitar is tuned in fifths, C G D A, as is the tenor banjo and the cello. It is generally accepted^{[[citation needed](#)]} that the tenor guitar was created to allow a tenor banjo player to follow the fashion as it evolved from Dixieland Jazz towards the more progressive Jazz that featured guitar. It allows a tenor banjo player to provide a guitar-based rhythm section with little to learn. A small minority of players (such as Nick Reynolds of the Kingston Trio) close tuned the instrument to D G B E to produce a deep instrument that could be played with the 4-note chord shapes found on the top 4 strings of the guitar or ukulele. The deep pitch warrants the wide-spaced chords that the banjo tuning permits, and the close tuned tenor does not have the same full, clear sound.

Harp guitars

Harp Guitars are difficult to classify as there are many variations within this type of guitar. They are typically rare and uncommon in the popular music scene. Most consist of a regular guitar, plus additional 'harp' strings strung above the six normal strings. The instrument is usually acoustic and the harp strings are usually tuned to lower notes than the guitar strings, for an added bass range. Normally there is neither fingerboard nor frets behind the harp strings. Some harp guitars also feature much higher pitch strings strung below the traditional guitar strings. The number of harp strings varies greatly, depending on the type of guitar and also the player's personal preference (as they have often been made to the player's specification).^[15] The Picasso guitar; 4 necks, 2 sound holes, 42 strings] and also the Oracle Harp [Sympitar](#); 24 strings (with 12 sympathetic strings protruding through the neck) are modern examples.

Extended-range guitars

For well over a century guitars featuring [seven](#), [eight](#), [nine](#), [ten](#) or more strings have been used by a minority of guitarists as a means of increasing the range of pitch available to the player. Usually, it is bass strings that are added. Classical guitars with an extended range are useful for playing [lute](#) repertoire, some of which was written for lutes with more than six courses. A typical example is the modern 11 string *archguitar*, invented and played by Peter Blanchette.^[16]

[Guitar battente](#)

The battente is smaller than a classical guitar, usually played with four or five metal strings. It is mainly used in [Calabria](#) (a region in southern Italy) to accompany the voice.

Electric guitars

Main article: [Electric guitar](#)



 [Glen Campbell](#) playing a Fender electric guitar with three single-coil pickups

Electric guitars can have solid, semi-hollow, or hollow bodies, and produce little sound without amplification. [Electromagnetic pickups](#) convert the vibration of the steel strings into [signals](#), which are fed to an [amplifier](#) through a [cable](#) or [radio transmitter](#). The sound is

frequently modified by other electronic devices or the natural [distortion](#) of valves ([vacuum tubes](#)) in the amplifier. There are two main types of pickup, [single](#) and double coil (or [humbucker](#)), each of which can be [passive](#) or [active](#). The electric guitar is used extensively in [jazz](#), [blues](#), [R & B](#), and [rock and roll](#). The first successful magnetic pickup for a guitar was invented by [George Beauchamp](#), and incorporated into the 1931 Ro-Pat-In (later [Rickenbacker](#)) "[Frying Pan](#)" lap steel; other manufacturers, notably [Gibson](#), soon began to install pickups in archtop models. After World War II the completely solid-body electric was popularized by Gibson in collaboration with [Les Paul](#), and independently by [Leo Fender](#) of [Fender Music](#). The lower fretboard action (the height of the strings from the fingerboard), lighter (thinner) strings, and its electrical amplification lend the electric guitar to some techniques which are less frequently used on acoustic guitars. These include [tapping](#), extensive use of [legato](#) through [pull-offs](#) and [hammer-ons](#) (also known as slurs), [pinch harmonics](#), [volume swells](#), and use of a [tremolo arm](#) or [effects pedals](#).

The first electric guitarist of note to use a seven-string guitar was jazz guitarist [George Van Eps](#), who was noted as a pioneer of this instrument. [Solid body seven-strings](#) were popularized in the 1980s and 1990s in part due to the release of the [Ibanez Universe](#) guitar, endorsed by [Steve Vai](#). Other artists go a step further, by using an [eight-string guitar](#) with two extra low strings. Although the most common seven-string has a low B string, [Roger McGuinn](#) (of [The Byrds](#) and [Rickenbacker](#)) uses an octave G string paired with the regular G string as on a 12-string guitar, allowing him to incorporate chiming 12-string elements in standard six-string playing. In 1982 [Uli Jon Roth](#) developed the "Sky Guitar", with a vastly extended number of frets, which was the first guitar to venture into the upper registers of the violin. Roth's seven-string and 33-fret "Mighty Wing" guitar features an altogether six-octave range.

The [electric bass guitar](#) is similar in tuning to the traditional [double bass](#) viol. Hybrids of acoustic and electric guitars are also common. There are also more exotic varieties, such as guitars with [two](#), three,^[17] or rarely four necks, all manner of alternate string arrangements, [fretless fingerboards](#) (used almost exclusively on bass guitars, meant to emulate the sound of a [stand-up bass](#)), [5.1 surround guitar](#), and such.

Some electric guitar and electric bass guitar models feature [piezoelectric](#) pickups, which function as [transducers](#) to provide a sound closer to that of an acoustic guitar with the flip of a switch or knob, rather than switching guitars. Those that combine piezoelectric pickups and magnetic pickups are sometimes known as hybrid guitars.^[18]

Guitar construction and components



1. [Headstock](#)
2. [Nut](#)
3. [Machine heads](#) (or pegheads, tuning keys, tuning machines, tuners)
4. [Frets](#)
5. [Truss rod](#)
6. [Inlays](#)
7. [Neck](#)
8. Heel (acoustic) – Neckjoint (electric)
9. [Body](#)
10. [Pickups](#)
11. [Electronics](#)
12. [Bridge](#)
13. [Pickguard](#)
14. Back
15. [Soundboard](#) (top)
16. Body sides (ribs)
17. [Sound hole](#), with [Rosette](#) inlay
18. [Strings](#)
19. Saddle
20. [Fretboard](#) (or Fingerboard)

General

Guitars can be constructed to meet the demands of both left and right-handed players. Traditionally the dominant hand is assigned the task of plucking or strumming the strings. For the majority of people this entails using the right hand. This is because musical expression (dynamics, tonal expression and colour etc) is largely determined by the plucking

hand, while the fretting hand is assigned the lesser mechanical task of depressing and gripping the strings. This is similar to the convention of the [violin](#) family of [instruments](#) where the right hand controls the bow. Left-handed players generally choose a left-handed (mirror) instrument, although some play in a standard right-handed manner, others play a standard right-handed guitar reversed, and still others (for example [Jimi Hendrix](#)) play a right-handed guitar strung in reverse. This last configuration differs from a true left-handed guitar in that the [saddle](#) is normally angled in such a way that the bass strings are slightly longer than the treble strings to improve [intonation](#). Reversing the strings therefore reverses the relative orientation of the saddle (negatively affecting intonation), although in Hendrix' case this is believed to have been an important element in his unique sound.

Headstock

Main article: [Headstock](#)

The headstock is located at the end of the guitar neck furthest from the body. It is fitted with machine heads that adjust the tension of the strings, which in turn affects the pitch. Traditional tuner layout is "3+3" in which each side of the headstock has three tuners (such as on [Gibson Les Pauls](#)). In this layout, the headstocks are commonly symmetrical. Many guitars feature other layouts as well, including six-in-line (featured on [Fender Stratocasters](#)) tuners or even "4+2" (Ernie Ball Music Man). However, some guitars (such as [Steinbergers](#)) do not have headstocks at all, in which case the tuning machines are located elsewhere, either on the body or the bridge.

Nut

Main article: [Nut \(instrumental\)](#)

The nut is a small strip of [bone](#), [plastic](#), [brass](#), [corian](#), [graphite](#), [stainless steel](#), or other medium-hard material, at the joint where the headstock meets the fretboard. Its grooves guide the strings onto the fretboard, giving consistent lateral string placement. It is one of the endpoints of the strings' vibrating length. It must be accurately cut, or it can contribute to tuning problems due to string slippage, and/or string buzz. To reduce string friction in the nut, which can adversely affect tuning stability, some guitarists fit a roller nut. Some instruments use a zero fret just in front of the nut. In this case the nut is used only for lateral alignment of the strings, the string height and length being dictated by the zero fret.

Fretboard

Main article: [Fingerboard](#)

Also called the **fingerboard**, the [fretboard](#) is a piece of wood embedded with metal frets that comprises the top of the neck. It is flat on [classical guitars](#) and slightly curved crosswise on acoustic and electric guitars. The curvature of the fretboard is measured by the fretboard radius, which is the radius of a hypothetical circle of which the fretboard's surface constitutes a segment. The smaller the fretboard radius, the more noticeably curved the fretboard is. Most modern guitars feature a 12" neck radius, while older guitars from the 1960s and 1970s usually feature a 6-8" neck radius. Pinching a string against the fretboard effectively shortens the vibrating length of the string, producing a higher pitch. Fretboards are most commonly made of [rosewood](#), [ebony](#), [maple](#), and sometimes manufactured or composite materials such

as HPL or resin. See below on section "Neck" for the importance of the length of the fretboard in connection to other dimensions of the guitar.

Frets

Main article: [Fret](#)

Frets are metal strips (usually nickel alloy or stainless steel) embedded along the fretboard and located at exact points that divide the scale length in accordance with a specific mathematical formula. Pressing a string against a fret determines the strings' vibrating length and therefore its resultant pitch. The pitch of each consecutive fret is defined at a half-step interval on the [chromatic scale](#). Standard classical guitars have 19 frets and electric guitars between 21 to 24 frets (though Caparison Guitars issue guitars with as many as 27 frets).^[19]

Frets are laid out to a mathematical ratio that results in [equal tempered](#) division of the octave. The [ratio](#) of the spacing of two consecutive frets is the [twelfth root of two](#). The twelfth fret divides the [scale length](#) in two exact halves and the 24th fret position divides the [scale length](#) in half yet again. Every twelve frets represents one octave. In practice, [luthiers](#) determine fret positions using the constant 17.817, which is derived from the [twelfth root of two](#) ($17.817 = (1-2^{-1/12})^{-1}$). The [scale length](#) divided by this value yields the distance from the nut to the first fret. That distance is subtracted from the [scale length](#) and the result is divided in two sections by the constant to yield the distance from the first fret to the second fret. Positions for the remainder of the frets are calculated in like manner.^[20] Actual fret spacing does not use this exact value; the fret spacing on the fretboard was also done by trial and error (testing) method over the ages.

There are several different fret gauges, which can be fitted according to player preference. Among these are "jumbo" frets, which have much thicker gauge, allowing for use of a slight vibrato technique from pushing the string down harder and softer. "Scalloped" fretboards, where the wood of the fretboard itself is "scooped out" between the frets allows a dramatic vibrato effect. Fine frets, much flatter, allow a very low string-action but require other conditions such as curvature of the neck to be well maintained in order to prevent buzz.

On steel-string guitars, frets are eventually bound to wear down; when this happens, frets can be replaced or, to a certain extent, leveled, polished, recrowned, or reshaped as required.

Truss rod

Main article: [Truss rod](#)

The **truss rod** is a metal rod that runs along the inside of the neck. It is used to correct changes to the neck's curvature caused by the neck timbers aging, changes in humidity or to compensate for changes in the tension of strings. The tension of the rod and neck assembly is adjusted by a hex nut or an allen-key bolt on the rod, usually located either at the headstock, sometimes under a cover, or just inside the body of the guitar underneath the fretboard and accessible through the sound hole. Some truss rods can only be accessed by removing the neck. The truss rod counteracts the immense amount of tension the strings place on the neck, bringing the neck back to a straighter position. Turning the truss rod clockwise will tighten it, counteracting the tension of the strings and straightening the neck or creating a backward bow. Turning the truss rod counter-clockwise will loosen it, allowing string tension to act on

the neck and creating a forward bow. Adjusting the truss rod affects the intonation of a guitar as well as the height of the strings from the fingerboard, called the action. Some truss rod systems, called "double action" truss systems, tighten both ways, allowing the neck to be pushed both forward and backward (standard truss rods can only be released to a point beyond which the neck will no longer be compressed and pulled backward).

Classical guitars do not require truss rods as their nylon strings exert a lower tensile force with lesser potential to cause structural problems. However their necks are often reinforced with a strip of harder wood, such as an [ebony](#) strip running down the back of a [cedar](#) neck. There is no tension adjustment on this form of reinforcement.

Inlays

Main article: [Inlay \(guitar\)](#)

Inlays are visual elements set into the exterior surface of a guitar. The typical locations for inlay are on the fretboard, headstock, and on acoustic guitars around the soundhole, known as the [rosette](#). Inlays range from simple plastic dots on the fretboard to intricate works of art covering the entire exterior surface of a guitar (front and back). Some guitar players have used [LEDs](#) in the fretboard to produce a unique lighting effects onstage.

Fretboard inlays are most commonly shaped like dots, diamond shapes, parallelograms, or large blocks in between the frets. Dots are usually inlaid into the upper edge of the fretboard in the same positions, small enough to be visible only to the player. These usually appear on the odd numbered frets, but also on the 12th fret (the one [octave](#) mark) instead of the 11th and 13th frets. Some older or high-end instruments have inlays made of mother of pearl, abalone, ivory, coloured wood or other exotic materials and designs. Simpler inlays are often made of plastic or painted. High-end classical guitars seldom have fretboard inlays as a well trained player is expected to know his or her way around the instrument.

In addition to fretboard inlay, the headstock and soundhole surround are also frequently inlaid. The manufacturer's logo or a small design is often inlaid into the headstock. Rosette designs vary from simple concentric circles to delicate fretwork mimicking the historic rosette of lutes. Bindings that edge the finger and sound boards are sometimes inlaid. Some instruments have a filler strip running down the length and behind the neck, used for strength and/or to fill the cavity through which the trussrod was installed in the neck.

Elaborate inlays are a decorative feature of many limited edition, high-end and custom-made guitars. Guitar manufacturers often release such guitars to celebrate significant or historic milestones.

Neck

Main article: [Neck \(music\)](#)

A guitar's [frets](#), [fretboard](#), [tuners](#), [headstock](#), and [truss rod](#), all attached to a long wooden extension, collectively constitute its [neck](#). The wood used to make the fretboard will usually differ from the wood in the rest of the neck. The bending stress on the neck is considerable, particularly when heavier gauge strings are used (see [Tuning](#)), and the ability of the neck to resist bending (see [Truss rod](#)) is important to the guitar's ability to hold a constant pitch

during tuning or when strings are fretted. The rigidity of the neck with respect to the body of the guitar is one determinant of a good instrument versus a poor one. The shape of the neck can also vary, from a gentle "C" curve to a more pronounced "V" curve. There are many different types of neck profiles available, giving the guitarist many options. Some aspects to consider in a guitar neck may be the overall width of the fingerboard, scale (distance between the frets), the neck wood, the type of neck construction (for example, the neck may be glued in or bolted on), and the shape (profile) of the back of the neck. Other type of material used to make guitar necks are graphite ([Steinberger guitars](#)), aluminium ([Kramer Guitars](#), [Travis Bean](#) and [Veleno guitars](#)), or carbon fiber ([Modulus Guitars](#) and [ThreeGuitars](#)).

[Double neck](#) electric guitars have two necks, allowing the musician to quickly switch between guitar sounds.

Neck joint or 'Heel'

See also: [Set-in neck](#), [Bolt-on neck](#), and [Neck-through](#)

This is the point at which the neck is either bolted or glued to the body of the guitar. Almost all acoustic steel-string guitars, with the primary exception of Taylors, have glued (otherwise known as set) necks, while electric guitars are constructed using both types. Most classical guitars have a neck and headblock carved from one piece of wood, known as a "Spanish heel."

Commonly used set neck joints include [mortise and tenon](#) joints (such as those used by CF Martin & Co. guitars), dovetail joints (also used by CF Martin on the D28 and similar models) and Spanish heel neck joints which are named after the shoe they resemble and commonly found in classical guitars. All three types offer stability. Bolt-on necks, though they are historically associated with cheaper instruments, do offer greater flexibility in the guitar's set-up, and allow easier access for neck joint maintenance and repairs.

Another type of neck, only available for solid body electric guitars, is the [neck-through-body](#) construction. These are designed so that everything from the machine heads down to the bridge are located on the same piece of wood. The sides (also known as wings) of the guitar are then glued to this central piece. Some luthiers prefer this method of construction as they claim it allows better sustain of each note. Some instruments may not have a neck joint at all, having the neck and sides built as one piece and the body built around it.

Strings

See also: [Classical guitar strings](#)

The standard guitar has six [strings](#) but [four-](#), [seven-](#), [eight-](#), [nine-](#), [ten-](#), [eleven-](#), [twelve-](#), [thirteen-](#) and [eighteen-string](#) guitars are also available.

Classical and flamenco guitars historically used [gut](#) strings but these have been superseded by polymer materials, such as nylon and fluorocarbon.

Modern guitar [strings](#) are constructed of metal, polymers, or animal or plant product materials. Instruments utilising "steel" strings may have strings made of alloys incorporating

steel, nickel or phosphor bronze. Bass strings for both instruments are wound rather than monofilament.

Body (acoustic guitar)

See also: [Sound box](#)

In acoustic guitars, string vibration is transmitted through the bridge and saddle to the body via [sound board](#). The sound board is typically made of tone woods such as spruce or cedar. Timbers for tone woods are chosen for both strength and ability to transfer mechanical energy from the strings to the air within the guitar body. Sound is further shaped by the characteristics of the guitar body's resonant cavity.

In electric guitars, [transducers](#) known as [pickups](#) convert [string vibration](#) to an electric signal, which in turn is [amplified](#) and fed to speakers, which vibrate the air to produce the sounds we hear. Nevertheless, the body of the electric guitar still performs a role in shaping the resultant tonal signature.

In an acoustic instrument, the body of the guitar is a major determinant of the overall sound quality. The guitar top, or soundboard, is a finely crafted and engineered element made of [tonewoods](#) such as [spruce](#) and [red cedar](#). This thin piece of wood, often only 2 or 3 mm thick, is strengthened by differing types of [internal bracing](#). The top is considered by many luthiers to be the dominant factor in determining the sound quality. The majority of the instrument's sound is heard through the vibration of the guitar top as the energy of the vibrating strings is transferred to it.

Body size, shape and style has changed over time. 19th century guitars, now known as salon guitars, were smaller than modern instruments. Differing patterns of internal bracing have been used over time by luthiers. Torres, Hauser, Ramirez, Fleta, and C.F. [Martin](#) were among the most influential designers of their time. Bracing not only strengthens the top against potential collapse due to the stress exerted by the tensioned strings, but also affects the resonance characteristics of the top. The back and sides are made out of a variety of timbers such as mahogany, Indian [rosewood](#) and highly regarded Brazilian rosewood (*Dalbergia nigra*). Each one is primarily chosen for their aesthetic effect and can be decorated with inlays and purfling.

The body of an acoustic guitar has a sound hole through which sound is projected. The sound hole is usually a round hole in the top of the guitar under the strings. Air inside the body vibrates as the guitar top and body is vibrated by the strings, and the response of the air cavity at different frequencies is characterised, like the rest of the guitar body, by a number of resonance modes at which it responds more strongly.

Instruments with larger areas for the guitar top were introduced by Martin in an attempt to create louder volume levels. The popularity of the larger "[dreadnought](#)" body size amongst acoustic performers is related to the greater sound volume produced.

Body (electric guitar)

See also: [Solid body](#)

Most electric guitar bodies are made of wood and include a plastic pick guard. Boards wide enough to use as a solid body are very expensive due to the worldwide depletion of hardwood stock since the 70's, so the wood is rarely one solid piece. Most bodies are made of two pieces of wood with some of them including a seam running down the centre line of the body. The most common woods used for electric guitar body construction include [maple](#), [basswood](#), [ash](#), [poplar](#), [alder](#), and [mahogany](#). Many bodies will consist of good sounding but inexpensive woods, like ash, with a "top", or thin layer of another, more attractive wood (such as maple with a natural "flame" pattern) glued to the top of the basic wood. Guitars constructed like this are often called "flame tops". The body is usually carved or routed to accept the other elements, such as the bridge, pickup, neck, and other electronic components. Most electrics have a polyurethane or [nitrocellulose](#) lacquer finish. Other alternative materials to wood, are used in guitar body construction. Some of these include carbon composites, plastic material (such as polycarbonate) and aluminium alloys.

Pickups

Main article: [Pick up \(music technology\)](#)



This [Fender Stratocaster](#) has features common to many electric guitars: multiple pickups, a vibrato unit/tremolo bar, volume and tone knobs.

[Pickups](#) are [transducers](#) attached to a guitar that detect (or "pick up") string vibrations and convert the mechanical energy of the string into electrical energy. The resultant electrical signal can then be electronically [amplified](#). The most common type of pickup is [electromagnetic](#) in design. These contain magnets that are tightly wrapped in a coil, or coils, of copper wire. Such pickups are usually placed right underneath the guitar strings. Electromagnetic pickups work on the same principles and in a similar manner to an [electrical generator](#). The vibration of the strings causes a small voltage to be created in the coils surrounding the magnets; this signal voltage is later amplified.

Traditional electromagnetic pickups are either [single-coil](#) or double-coil. Single-coil pickups are susceptible to noise induced from electric fields, usually mains-frequency (60 or 50 hertz) hum. The introduction of the double-coil [humbucker](#) in the mid-1950s did away with this problem through the use of two coils, one of which is wired in a reverse polarity orientation.

The types and models of pickups used can greatly affect the tone of the guitar. Typically, humbuckers, which are two magnet-coil assemblies attached to each other are traditionally associated with a heavier sound. Single-coil pickups, one magnet wrapped in copper wire, are used by guitarists seeking a brighter, twangier sound with greater dynamic range.

Modern pickups are tailored to the sound desired. A commonly applied approximation used in selection of a pickup is that less wire (lower DC resistance) = brighter sound, more wire = "fat" tone. Other options include specialized switching that produces coil-splitting, in/out of phase and other effects. Guitar circuits are either active, needing a battery to power their circuit, or, as in most cases, equipped with a passive circuit.

[Fender Stratocaster](#) type guitars generally utilize three single-coil pickups, while most [Gibson Les Paul](#) types use humbucker pickups.

Piezoelectric, or piezo, pickups represent another class of pickup. These employ [piezoelectricity](#) to generate the musical signal and are popular in hybrid electro-acoustic guitars. A crystal is located under each string, usually in the saddle. When the string vibrates, the shape of the crystal is distorted, and the stresses associated with this change produce tiny voltages across the crystal that can be amplified and manipulated.

Some piezo-equipped guitars use what is known as a hexaphonic pickup. "Hex" is a prefix meaning six. In a hexaphonic pickup separate outputs are obtained from discrete piezoelectric pickups for each of the six strings. This arrangement allows the signal to be easily modified by on-board modelling electronics, as in the Line 6 Variax brand of electric guitars; the guitars allow for a variety of different sounds to be obtained by digitally manipulating the signal. This allows a guitar to mimic many vintage models of guitar, as well as output alternate tunings without the need to adjust the strings.

Another use for hexaphonic pickups is to send the output signals to a MIDI interpretation device, which determines the note pitch, duration, attack and decay characteristics and so forth. The MIDI ([Musical Instrument Digital Interface](#)) interpreter then sends the note information to a sound bank device. The resulting sound can closely mimic numerous types of instruments.

Electronics

On guitars that have them, these components and the wires that connect them allow the player to control some aspects of the sound like volume or tone. These at their simplest consist of passive components such as [potentiometers](#) and [capacitors](#), but may also include specialized [integrated circuits](#) or other active components requiring [batteries](#) for power, for preamplification and signal processing, or even for assistance in tuning. In many cases the electronics have some sort of shielding to prevent pickup of external interference and noise.

Lining, Binding, and Purfling

The top, back and ribs of an acoustic guitar body are very thin (1–2 mm), so a flexible piece of wood called lining is glued into the corners where the rib meets the top and back. This interior reinforcement provides 5 to 20 mm of solid gluing area for these corner joints. Solid linings are often used in classical guitars, while kerfed lining is most often found in steel string acoustics. Kerfed lining is also called kerfing (because it is scored, or kerfed to allow it to bend with the shape of the rib).

During final construction, a small section of the outside corners is carved or routed out and then filled with binding material on the outside corners and decorative strips of material next to the binding, which are called [purfling](#). This binding serves to seal off the endgrain of the

top and back. Purfling can also appear on the back of an acoustic guitar, marking the edge joints of the two or three sections of the back.

Binding and purfling materials are generally made of either wood or plastic.

Bridge

Main article: [Bridge \(instrument\)](#)

The main purpose of the bridge on an acoustic guitar is to transfer the vibration from the strings to the soundboard, which vibrates the air inside of the guitar, thereby amplifying the sound produced by the strings.

On all electric, acoustic and original guitars, the bridge holds the strings in place on the body. There are many varied bridge designs. There may be some mechanism for raising or lowering the bridge to adjust the distance between the strings and the fretboard (action), and/or fine-tuning the intonation of the instrument. Some are spring-loaded and feature a "[whammy bar](#)", a removable arm which allows the player to modulate the pitch moving the bridge up and down. The whammy bar is sometimes also referred to as a "tremolo bar" (see [Tremolo](#) for further discussion of this term – the effect of rapidly changing pitch produced by a whammy bar is more correctly called "vibrato"). Some bridges also allow for alternate tunings at the touch of a button.

On almost all modern electric guitars, the bridge is adjustable for each string so that intonation stays correct up and down the neck. If the open string is in tune but sharp or flat when frets are pressed, the bridge can be adjusted with a screwdriver or hex key to remedy the problem. In general, flat notes are corrected by moving the bridge forward and sharp notes by moving it backwards. On an instrument correctly adjusted for intonation, the actual length of each string from the nut to the bridge saddle will be slightly but measurably longer than the [scale length](#) of the instrument. This additional length is called compensation, which flattens all notes a bit to compensate for the sharpening of all fretted notes caused by stretching the string during fretting.

Saddle

The saddle of a guitar refers to the structure on or parallel to the bridge. The saddle is most commonly found on acoustic guitars, but some models of hollow-bodied electric guitars have it. Its basic purpose is to hold the strings above the bridge and guitar, and to mute the vibration of the string so the strings do not buzz and/or damage themselves or the bridge. It is comparable in size and function to the nut, and variations in its design are not uncommon.

Pickguard

Main article: [Pickguard](#)

Also known as a scratchplate. This is usually a piece of laminated plastic or other material that protects the finish of the top of the guitar from damage due to the use of a plectrum or fingernails. Electric guitars sometimes mount pickups and electronics on the pickguard. It is a common feature on steel-string acoustic guitars. Vigorous performance styles such as

[flamenco](#), which can involve the use of the guitar as a percussion instrument, call for a scratchplate to be fitted to nylon-string instruments.

Whammy Bar (Tremolo Arm)

Main article: [Tremolo arm](#)

Many electric guitars are fitted with a vibrato and pitch bend device known as a "tremolo bar (or arm)", "sissy bar", "wang bar", "slam handle", "whammy handle", and "whammy bar". The latter two terms led [stompbox](#) manufacturers to use the term 'whammy' in coming up with a pitch raising effect introduced by popular guitar effects pedal brand [Digitech](#).

The tremolo arm is common enough that there is a technical term, *hard tail*, for a guitar without one.

[Leo Fender](#), who did much to create the electric guitar, also created much confusion over the meaning of the terms "tremolo" and "vibrato" by the naming the "[tremolo](#)" unit on many of his guitars and also the "[vibrato](#)" unit on his "Vibrolux" amps. In general, *vibrato* is a variation in [pitch](#), whereas *tremolo* is a variation in volume, so the tremolo bar is actually a vibrato bar and the "Vibrolux" amps actually had a tremolo effect. However, following Fender's example, electric guitarists traditionally reverse these meanings when speaking of hardware devices and the effects they produce. See [vibrato unit](#) for a more detailed discussion, and [tremolo arm](#) for more of the history.

Another type of pitch bender is the [B-Bender](#), a spring and lever device mounted in an internal cavity of a solid body electric, guitar that allows the guitarist to bend just the B string of the guitar using a lever connected to the strap handle of the guitar. The resulting pitch bend is evocative of the sound of the [pedal steel guitar](#).