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# Microchip implant (animal)

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A **microchip implant** is an identifying [integrated circuit](#) placed under the skin of a [dog](#), [cat](#), or other animal. The chips are about the size of a large grain of rice and are based on a passive [RFID](#) technology.

[Tattooing](#) is another, older method for identifying animals.

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Microchip implant in a cat

## Uses and benefits

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Microchips have been particularly useful in the return of lost [pets](#). They can also assist where the ownership of an animal is in dispute.

[Animal shelters](#) and animal control centers benefit using microchip identification products by more quickly and efficiently returning pets to their owners. When a pet can be quickly matched to its owner, the shelter avoids the expense of housing, feeding, providing medical care, and outplacing or euthanizing the pet. Microchipping is becoming increasingly standard at shelters: many require all outplaced animals to receive a microchip, and provide the service as part of the adoption package.

In addition to shelters and veterinarians, microchips are used by [kennels](#), breeders, brokers, trainers, registries, [rescue groups](#), [humane societies](#), [clinics](#), [farms](#), [stables](#), animal clubs and associations, researchers and [pet stores](#). Animal control officers are also trained and equipped to scan animals.

Several countries require a microchip when importing an animal, as a proof that the animal and the [vaccination](#) record belong together.

Microchip tagging may be required for [CITES](#)-regulated international trade in certain rare animals; for example, [Asian Arowana](#) are so tagged, in order to ensure that only captive-bred fish are imported.

## System of recovery

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Effective pet identification and recovery depends on the following:

- A pet owner either adopts a pet at a shelter that microchips some or all adoptee animals, or the owner with an existing pet brings it to a veterinarian (or a shelter) that provides the service.
- The shelter or vet selects a microchip from their stock, makes a note of that chip's unique ID, and then inserts the chip into the animal with a syringe. The injection requires no anesthetic.
- Before sending the animal home, the vet or shelter performs a test scan on the animal. This helps ensure that the chip will be picked up by a scanner, and that its unique identifying number will be read correctly.
- An enrollment form is completed with the chip number, the pet owner's contact information, the name and description of the pet, the shelter's and/or veterinarian's contact information, and an alternate emergency contact designated by the pet owner. (Some shelters or vets, however, choose to designate themselves as the primary contact, and take the responsibility of contacting the owner directly. This allows them to be kept informed about possible problems with the animals they place.) The form is then sent to a registry keeper to be entered into its database. Depending on regional custom, selected chip brand, and the pet owner's preference, this registry keeper might be the chip's manufacturer or distributor, or an independent provider.<sup>[1]</sup> In some countries a single official national database may be used. The registry keeper typically provides a 24-hour, toll-free telephone service for pet recovery, good for the life of the pet.
- The pet owner is also provided the chip ID and the contact information of the recovery service. This is often in the form of a collar tag imprinted with the chip ID and the recovery service's toll-free number, to be worn by the animal.
- If the pet is lost or stolen, and is found by local authorities or taken to a shelter, it is scanned during intake to see if a chip exists. If one is detected, authorities call the recovery service and provide them the ID number, the pet's description, and the location of the animal. If the pet is wearing the collar tag, anyone who finds the pet can call the toll-free number, making it unnecessary to involve the authorities. (The owner can also preemptively notify the recovery service directly if a pet disappears. This is useful if the pet is stolen, and is taken to a vet who scans it and checks with the recovery service.)
- The recovery service notifies the owner that the pet has been found, and where to go to recover the animal.

Many veterinarians perform test scans on microchipped animals every time the animal is brought in for care. This ensures the chip still performs properly. Vets sometimes use the chip ID as the pet's ID in their databases, and print this number on all outgoing paperwork associated with its services, such as receipts, test results, vaccination certifications, and descriptions of medical or surgical procedures.

## Components of a microchip

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Microchips are passive, or inert, [RFID](#) devices and contain no internal power source. They are designed so that they do not act until acted upon.

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Three basic elements comprise microchips: A silicon chip (integrated circuit); a coil **inductor**, or a core of **ferrite** wrapped in copper wire; and a **capacitor**. The silicon chip contains the identification number, plus electronic circuits to relay that information to the scanner. The inductor acts as a **radio antenna**, ready to receive electrical power from the scanner. The capacitor and inductor act as a tuner, forming an **LC circuit**. The scanner presents an inductive field that excites the coil and charges the capacitor, which in turn energizes and powers the IC. The IC then transmits the data via the coil to the scanner.

These components are encased in a special **biocompatible** glass made from soda lime, and hermetically sealed to prevent any moisture or fluid entering the unit. Barring rare complications, dogs and cats are not affected physically or behaviorally by the presence of a chip in their bodies.

## Cross-compatibility and Standards Issues

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Because RFID implants for pets have been available since the 1980s, with no new chip types introduced since 1996, one might expect that any scanner today considered suitable for shelter use would be able to read **all** common chip types, making it easy for a shelter to scan an incoming animal and reunite it with its owner.

As of 2007, however, there are still many scanners used in shelters that lack the ability to read one or more of the four common chip types. In some cases, scanner makers simply left out support for one or more of the three well-known standardized chip transmission protocols. Also, in the U.S. especially, many vets have implanted pets with chips of still another type, which is made deliberately difficult to read due to **encryption** for security purposes. Not every scanner maker is able to decrypt these.

In late 2005, the U.S. Congress<sup>[2]</sup> directed the **Animal and Plant Health Inspection Service** (APHIS) to work on bringing about a "system of open microchip technology" with "universal reading ability." Many realized this should involve working to find a way to deal with the **AVID microchip** "Encrypted" microchip type, because all the other kinds are already Open Microchip Technology by their design, requiring no decryption. But instead, APHIS proposed a rule establishing one specific Open chip type as the standard for dogs and cats in certain circumstances. This was controversial because the type selected (**ISO 11784/11785**) is widely used in Europe, but is not yet widely supported by the infrastructure of scanners in the U.S. About 180 spirited comments were submitted to the APHIS during a comment period ending in September of 2006.<sup>[3]</sup>

The two companies which dominate the U.S. market – AVID and HomeAgain – both sell microchips which are optimized to operate at a frequency of 125 kHz. This allows the scanner of each to detect the presence of the other's microchip – even if it cannot actually decode the chip's encoded or encrypted ID. Some scanners manufactured by Digital Angel/Destron Corp. and distributed by HomeAgain for shelter use have for some time been able to both detect and decrypt the AVID "encrypted" ID chip.<sup>[4]</sup> Digital Angel/Destron Corp. seems to have been the first, after AVID itself, to join the group of manufacturers which is able to decrypt and recover the registration codes from these chips. Still, some of the Digital Angel/Destron models (often those used by vets rather than shelters) may only flash an acknowledgment that an AVID chip has been found, with no number given. AVID's base scanner model, however, doesn't give an indication of the presence of a chip of the type used by HomeAgain, even though no decryption is needed to find the chip. A more deluxe AVID scanner model reads both kinds.<sup>[5]</sup>

But in most countries outside the U.S., pets are now commonly implanted with microchips made according to the **International Organization for Standardization**, or ISO, standards **11784 and 11785**, which call for a design frequency of 134.2 kHz. Other types may still be found in some areas.<sup>[6]</sup>

The idea that mere frequencies are a main component of the universal scanner problem may be disinformation from the "microchip wars."<sup>[citation needed]</sup> All the common pet chip types operate at the frequency used by the scanner as long as it's suitably close to the chip's tuned frequency. A compromise excitation frequency can be used. In its APHIS submission, AVID confirmed that a compromise excitation frequency can be and has been used, mentioning 128 kHz,<sup>[7]</sup> but implied that it's hopeless to achieve good performance with it. Others would say,<sup>[who?]</sup> more important than frequency is whether the scanner maker chooses to support all the published "open" protocols applicable to common pet chip types, and whether it is able to decrypt the encrypted chips. It has been suggested that the AVID "encrypted" chip has obfuscation encryption rather than authentication encryption, because although decryption methods are needed to build a scanner to extract its original label code, enough information to make a clone or counterfeit (indistinguishable from the original by the AVID scanner) can be gathered just by "listening" to it for a short time. An experimenter's project<sup>[8]</sup> has been offered illustrating this.

In 2004, when Banfield Pet Hospitals began selling Crystal Tag microchips in the U.S. – chips made by Switzerland-based DATAMARS, and following ISO standards – not enough scanners were distributed to ensure that these chips could be detected. Customers were not aware that far fewer shelters and clinics were equipped to detect these chips than the other types. Later Banfield advocated double-chipping.<sup>[9]</sup>

In 2007, when the AKC Companion Animal Registry entered the microchip distribution business, it chose <sup>[10]</sup> Trovan brand chips, which have been in use in the United States since at least 1996 <sup>[11]</sup>.

Patents might be holding up universal scanners. It has been reported in several sources that AVID, and in some reports also Digital Angel Corp, hold patents on "125 kHz technology."<sup>[12]</sup> The specific U.S. patent number purported to cover 125 kHz technology is generally absent in these. One article<sup>[13]</sup> might look like an appropriate citation for an AVID 125 kHz patent, up to the point where it identifies the frequency of the products found to infringe on three patents of AVID as... 134.2 kHz. Might one of these three patents preclude any possible universal pet scanner regardless of the excitation frequency used? Another article<sup>[14]</sup> identifies the three patents. The first two patents listed are discussed only as covering "transponders," the implantable chips themselves, so they wouldn't be a problem for scanner designers. The third, number 5235326, <sup>[15]</sup> covers, along with some tag (transponder) claims, a wide variety of readers/scanners that contain something called "Mode Control Data" or use certain multi-step decoding methods. A universal single-frequency scanner that just listens simultaneously for all the common types of pet chips would seem not to need Mode Control Data or these multi-step methods, so it might be quite prudent for a scanner maker to not use them.

For those wishing to build an Open Microchip Technology scanner for all pet chip types, the numerous U.S. pets with the AVID "Encrypted" chip are a major obstacle. At least one Open Standards based work-around was submitted to the APHIS during its 2006 comment period.<sup>[16]</sup> Some may consider such schemes untidy, but work-arounds may be the only option for those who want to build a scanner for obfuscation-type chips and do not know the decryption algorithm. Through mid-2006 at least, encrypted chip manufacturers have not made scanners combining both obfuscation-type

and ISO-type pet chip reading capabilities available in the U.S. Some people have complained<sup>[17]</sup> that AVID itself sold such a scanner in other countries while claiming it wasn't good enough to sell at home. Digital Angel/Deatron Corp. reportedly<sup>[18]</sup> added ISO-chip detection capabilities, with no number readout, to its HomeAgain-distributed product only late in 2005. Then in its 2006 APHIS comment, it announced plans for shipping universal units that will fully decode the ISO-chip in 2007.<sup>[19]</sup> This change may be a reaction to (2006) additions to the group. This may include the European manufacturer Trovan, even though its decrypting<sup>[20]</sup> multi-scanner may be available in the U.S. only in a crippled variant with ISO support broken. More prominent may be the news that AVID's arch-rival Datamars used the necessary decryption in its "Black Label"<sup>[21]</sup> scanner.<sup>[22]</sup>

Some may view this expansion of the scanner makers with access to the decryption methods as benign; indeed, it may lead to the availability of multiple brands of scanners able to read encrypted type, ISO type, HomeAgain type, and Trovan type pet chips. Others might protest that this group has done nothing to earn its competitive advantage over non-members except that its leader marketed an unsuitable pet identification product, a dog tag made deliberately hard for the Good-Samaritan pet finder to read.

The mid-2007 recommendations of the U.S. [Animal and Plant Health Inspection Service](#) to Congress<sup>[23]</sup> could be seen as a significant victory for the manufacturers; after months of studying proposals for bringing the encrypted microchips into compliance with the Open Microchip Technology directive, APHIS endorsed only a strategy of waiting for patents to expire. This plan might be expected to have disappointing results for those willing to wait, because patents aren't what keep Open Technology scanners from reading these chips. The encryption/decryption algorithm is a secret; patents are public records. AVID's ability to keep the algorithm secret doesn't depend on the lifetime of any patent. It may be worthwhile to note that the scanners found to infringe on AVID patent rights in 2006<sup>[13]</sup> were not decrypting scanners. And when the judge in that case eventually ruled the AVID multi-mode scanner patent invalid,<sup>[24]</sup> (just two months after the APHIS made its recommendations,) this does not seem to have induced the encrypted group to publish its decryption methods.

The conscientious shelter operator should be equipped to read encrypted type, ISO type, HomeAgain type, and Trovan type chips, either by having a box of scanners or one good multiprotocol "four-banger." There is not a good one-stop source to get a full set of "specimen chips" for testing.

**Compatibility Table of Which Scanner can Read Which Chips**

Scanner to Test	Expected Results for chip type (OK=Good read NR=No read DO=Detect Only with no number given ??=Status Unclear, Updates Invited)			
	ISO Conformant Full-Duplex chip	AVID Encrypted "FriendChip"	U.S. HomeAgain, AVID "Eurochip", or FECAVA	"Trovan Unique" and Current AKC CAR chips
<b>Minimal ISO Conformant Scanner</b>	OK	NR	NR	NR
<b>Current AVID Basic U.S. Scanner</b>	NR	OK	NR	NR
<b>U.S. AVID Deluxe Scanner</b>	NR	OK	OK	NR
<b>AVID Universal Scanner sold outside U.S.</b>	OK	OK	OK	??
<b>Various vintages of U.S. HomeAgain "Universal" Shelter Scanners by Deatron/Digital Angel Corp.</b>	NR,DO, or OK	OK	OK	Possibly all OK
<b>Typical Deatron/Digital Angel Corp. U.S. Vet's scanner pre-2007</b>	NR	DO	OK	??
<b>Trovan LID-560 per mfr. specs on Web</b>	OK	OK	OK	OK
<b>U.S. Trovan scanner per AKC-CAR Web Site</b>	DO	OK	OK	OK
<b>Datamars Black Label Scanner</b>	OK	OK	OK	OK but Reliability Questioned
<b>Older Datamars Scanners</b>	OK	DO	OK	??

(One study<sup>[25]</sup> cites problems with certain Trovan chips on the Datamars Black Label scanner. In general the study found none of the tested scanners to read all four standards without some deficiency.)

## Implant location

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In [dogs](#) and [cats](#), chips are usually inserted below the skin at the back of the neck, between the shoulder blades on the dorsal midline. Continental European pets may be an exception; they get the implant in the left side of the neck, according to one reference.<sup>[26]</sup> The chip can often be manually detected by the owner by gently feeling the skin in that area. It stays in place as thin layers of [connective tissue](#) form around the biocompatible glass which encases it.

[Horses](#) are microchipped on the left side of the neck, half the distance between the poll and withers, and approximately one inch below the midline of the mane, into the nuchal ligament.

[Birds'](#) microchips are injected into their breast muscles. Because proper restraint is necessary, the operation either requires two people (an avian [veterinarian](#) and a veterinary [technician](#)), or general [anesthesia](#) is administered.

## Animal species

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Many species of animals have been microchipped, including cockatiels and other parrots, horses, [llamas](#), [alpacas](#), [goats](#), [sheep](#), miniature [pigs](#), [rabbits](#), [deer](#), [ferrets](#), [snakes](#), [lizards](#), [alligators](#), [turtles](#), [toads](#), [frogs](#), rare [fish](#), [mice](#), and [prairie dogs](#) – even [whales](#) and [elephants](#). The U.S. Fish and Wildlife Service uses microchipping in its research of wild [bison](#), black-footed ferrets, [grizzly bears](#), [elk](#), [white-tailed deer](#), giant land [tortoises](#) and [armadillos](#).

## World-wide use

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Microchips are not in universal use, but there are legal requirements in some jurisdictions, such as the state of [New South Wales](#), [Australia](#).<sup>[27]</sup> Some countries, such as [Japan](#), require ISO-compliant microchips on dogs and cats being brought into the country, or for the person bringing the pet into the country to also bring a microchip reader that can read the non-ISO-compliant microchip.<sup>[28]</sup>

In [New Zealand](#), all dogs first registered after [1 July 2006](#) are to be microchipped. Farmers protested that [farm dogs](#) should be exempt, drawing a parallel to the [Dog Tax War](#) of 1898.<sup>[29]</sup> Farm dogs were exempted from microchipping in an amendment to the legislation passed in June 2006.<sup>[30]</sup>

## Criticism

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A decade long study found that microchip implants have been found to increase risk of cancer in laboratory mice and rats.<sup>[31]</sup> Noted veterinary associations<sup>[32]</sup> responded with continued support for the procedure as reasonably safe for cats and dogs, pointing to rates of serious complications on the order of one in a million in the U.K. which supposedly has a system for tracking such adverse reactions and has chipped over half of all its pet dogs.

## See also

[\[edit\]](#)

- [Microchip implant \(human\)](#)
- [Proximity card](#)
- [National Animal Identification System \(United States\)](#) – some animals, including horses)

Published in veterinary and toxicology journals between 1996 and 2006, the studies found that lab mice and rats injected with microchips sometimes developed subcutaneous "sarcomas" – malignant tumors, most of them encasing the implants.

\_ A 1998 study in Ridgefield, Conn., of 177 mice reported cancer incidence to be slightly higher than 10 percent \_ a result the researchers described as "surprising."

\_ A 2006 study in France detected tumors in 4.1 percent of 1,260 microchipped mice. This was one of six studies in which the scientists did not set out to find microchip-induced cancer but noticed the growths incidentally. They were testing compounds on behalf of chemical and pharmaceutical companies; but they ruled out the compounds as the tumors' cause. Because researchers only noted the most obvious tumors, the French study said, "These incidences may therefore slightly underestimate the true occurrence" of cancer.

\_ In 1997, a study in Germany found cancers in 1 percent of 4,279 chipped mice. The tumors "are clearly due to the implanted microchips," the authors wrote.

## Notes

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- <sup>^</sup> In the U.S., AVID is an example of a manufacturer that also provides a registry, HomeAgain is an example of a distributor (of microchips made by Digital Angel) that operates a registry, and The [American Kennel Club Companion Animal Recovery Corp.](#), the nation's largest not-for-profit pet recovery service which has been in business since 1995, is an example of a registry that, for a time in 2005-2006, wasn't even affiliated with a chip distributor, but since 2007 has distributed the Trovan chip in the United States.
- <sup>^</sup> [Report Containing U.S. "Open Microchip Technology" Directive](#) (Search for "microchip" in the text.)
- <sup>^</sup> [APHIS Comment Submissions Index Page](#)
- <sup>^</sup> [Test Results from American Humane](#)
- <sup>^</sup> [Descriptions of AVID Scanners](#)
- <sup>^</sup> [World Microchip Survey 2002](#) (Reports that as of 2002, at least one country outside the U.S. was using the AVID Encrypted type.)
- <sup>^</sup> [APHIS Comment Submission from AVID](#) (page 8 in the referenced .pdf file.)
- <sup>^</sup> [Experimental Scanner Construction Project](#)
- <sup>^</sup> [Banfield Pet Hospitals' Double-Chipping Program](#)
- <sup>^</sup> [AKC-CAR Introduces Microchip](#)
- <sup>^</sup> [City of Los Angeles Selects InfoPet Identification Systems and Trovan® Technology for Identifying Pets in City Shelters](#)
- <sup>^</sup> [Coalition Presses Microchip Makers for Global Scanner](#) (Search for "patent" in the text.)
- <sup>^</sup> <sup>a</sup> <sup>b</sup> [AVID Court Case Article from IP Frontline](#)
- <sup>^</sup> [AVID Court Case Article from RFID News](#)
- <sup>^</sup> [U.S. Patent 5,235,326](#)
- <sup>^</sup> [Workaround Method Submitted to APHIS](#)
- <sup>^</sup> [Pet's Death Rekindles Electronic ID Debate in JAVMA News](#) (Search for "best" in the text.)
- <sup>^</sup> [Digital Angel Corp. Press Release](#) (The full date of this release, November 14, 2005, appears only in [this index page](#).)
- <sup>^</sup> [APHIS Comment Submission from Digital Angel Corp](#) (page 2 in the referenced .doc file.)
- <sup>^</sup> [Trovan Multi Scanner specs](#)
- <sup>^</sup> [Datamars Multi Scanner specs](#)
- <sup>^</sup> [Datamars' U.S. importer had actually sued AVID and Digital Angel Corp. alleging them to be a scanner cartel that was anticompetitive and unjust.](#)
- <sup>^</sup> [APHIS July 2007 Recommendations to Congress](#)
- <sup>^</sup> [Multi-Mode Scanner Patent Invalidated on a technicality](#)
- <sup>^</sup> [Nov. 2007 Scanner Evaluation from EID Limited](#)
- <sup>^</sup> [Microchip Implantation Sites \(World Small Animal Veterinary Association\)](#)
- <sup>^</sup> [WSAVA - Australian Microchip Standard](#)
- <sup>^</sup> [Entering Japan: Dogs & Cats](#)
- <sup>^</sup> [The Year of the Dog War \(New Zealand Herald\)](#)
- <sup>^</sup> [Farm Dogs Exempted from Microchipping](#)
- <sup>^</sup> [Chip Implants Linked to Animal Tumors - washingtonpost.com](#)
- <sup>^</sup> [Position Statement from World Small Animal Veterinary Association](#)

## External links

[[edit](#)]

- [AKC Companion Animal Recovery](#)
- [A1 ID Systems](#)
- [Article on chips](#)
- [24PetWatch](#)
- [Pet\\*Id Shortcut Home](#)
- [AVID](#)
- [Home Again](#)
- [ANIMALDATA](#)
- [Crystal Tag](#)
- [Injunction on Banfield Microchip Sales](#)
- [Family dog with microchip found after almost 3 years](#)
- [PIT Tags used on Peregrine Falcon Research](#)
- [Build yourself a universal pet scanner and learn about obfuscation encryption](#)
- [Proposal for adoption of a U.S. official work-around for obfuscation-encrypted pet chips](#)
- [Microchip Frequently Asked Questions](#)

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