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ENGINE DECODED**

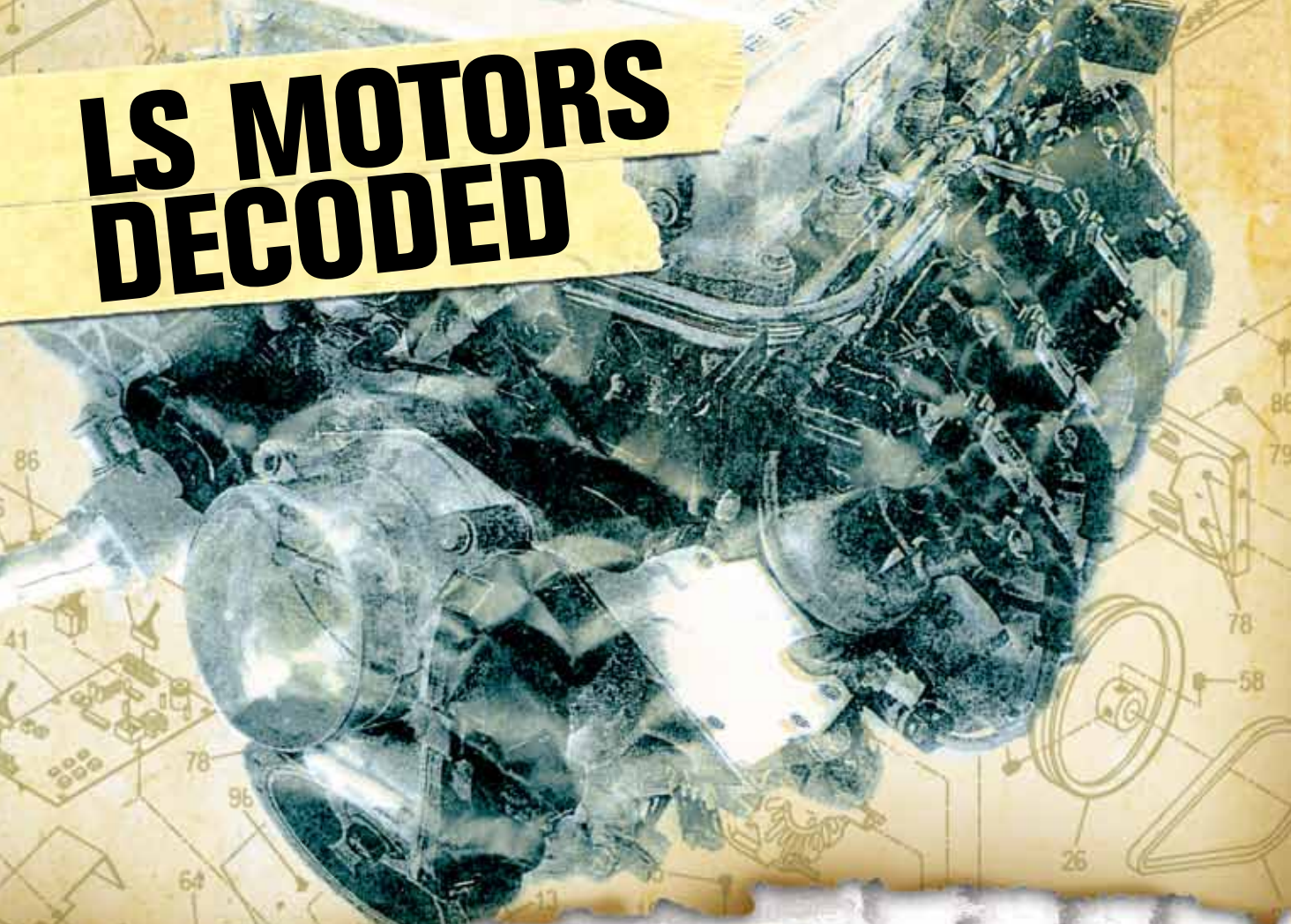


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# LS MOTORS DECODED



## The Ultimate Guide to Every Gen III and IV Small-Block Ever Built

Text & photos: Stephen Kim

Some hot rodders are reluctant to embrace the indisputable virtues of technology. Let's call them traditionalists. Others would rather push a Ford than drive a Chevy. Let's call them victims of brand loyalty. Then there are those who are more impressed by the number of valves an engine has, and the rpm it turns, than the tally it posts in the hp column. Now they're just out of their mind. In just a little over a decade, GM's LS engine platform has converted hoards of traditionalists and even Ford loyalists alike. These days, Gen III and IV small-blocks are popping up in everything from Chevilles to Mustangs, to BMWs, to Mazdas, to Jaguars, to Hondas, to Datsuns, and even Porsches. Staggering power, low mass, compact external dimensions, and excellent fuel mileage have made the Gen III/IV small-block the new King of engine swaps. Perhaps the most significant factor is the sheer number of LS motors now piling up in boneyards—which translates to cheap cores—and the constant influx of affordable aftermarket parts. Some of the cheapest and most potent hardware of all comes straight from the factory, as GM has continually updated the platform since its inception. There are now more than two dozen Gen III and IV variants in existence, so we've set up this guide to explain the differences between them to help you decide which is most appealing for your project car.

Much like the Gen I and II small-blocks, almost all the hardware amongst the different LS variants are interchangeable. In fact, except for the smallest (4.8L) and largest (7.0L) motors in the LS lineup, all share the same 3.622-inch stroke. In most instances, the cylinder heads, camshafts, crankshafts, and intake manifolds can all be mixed between different LS motors. Furthermore, while Gen III and IV truck motors are usually labeled "Vortec," they share the exact same architecture and many of the same parts as their "LS" designated counterparts. Vortecs were once distinguishable by their iron blocks and heads, but that's no longer the case since many trucks now come equipped

with all-aluminum engines. Interestingly, only minor differences distinguish Gen III from Gen IV small-blocks. Gen IVs feature provisions for variable valve timing, active cylinder deactivation, and a revised camshaft position sensor location. Otherwise, both generations of motors are very similar.

The engines outlined in this guide represent every Gen III and IV small-block ever installed by GM in a production car or truck. Whenever possible, or relevant, we've included cam specs. At the current rate of LS engine development, it's quite possible that we'll need to add an appendix to this story in a couple of years. Happy swapping!

### QUICK NOTES

#### WHAT WE DID

Compile descriptions and vital stats of every production Gen III/IV small-block in existence

#### BOTTOM LINE

LS motors are cheaper, more plentiful, and more powerful than ever

#### COST (APPROX)

\$500-\$22,000

## LS1

Although the one that started it all is already considered relatively old, no one could have predicted the impact the original Gen III LS1 would have on the hot rodding public. The LS1's greatest asset is its revolutionary 15-degree cylinder heads, which are capable of owing over 320 cfm in the hands of a skilled porter. So good were these castings, in fact, that it took the aftermarket over ve years to even attempt to top the factory design. Simply massaging the stock heads and swapping in a larger cam had LS1s easily approaching the 550hp mark in no time. Furthermore, bone stock LS1s routinely pushed F-bodies into the 12s. While LS1 F-bodies were rated at 40 hp less than their Corvette-spec brethren, they essentially produced the same power despite minute differences in cam specs. Likewise, all '01-04 LS1s were upgraded from the factory with the same valvesprings and high-ow intake manifold as found in the LS6. One of the biggest drawbacks of the LS1

<b>DISPLACEMENT:</b>	346 ci
<b>BLOCK:</b>	Cast aluminum
<b>HEADS:</b>	Aluminum 15-degree cathedral port
<b>BORE/STROKE:</b>	3.900 x 3.622
<b>COMPRESSION:</b>	10:1
<b>CAMSHAFT ('01+ F-body):</b>	196/207 @ 0.050; 0.467/0.479; 116
<b>OUTPUT:</b>	305-350 hp and 335-375 lb-ft
<b>WHAT IT'S IN:</b>	'98-02 F-body, '97-04 Corvette, '04 GTO
<b>GMPP PN:</b>	17801267

are its thin iron cylinder liners that can only be bored about 0.010 over. Anything larger requires re-sleeving the block with aftermarket liners, which isn't cheap, but doing so enables displacement gures well in excess of 400 ci. Likewise, the standard 3.900-inch bore isn't compatible with the latest and greatest GM L92 cylinder heads. Nonetheless, the original LS1 provides more than enough power potential for the vast majority of hot rods, and there are still a ton of them available in salvage yards ready for plucking.



## LS2

The rst of the Gen IV small-blocks, the 400hp LS2 was rst unveiled in the '05 Corvette. Compared to its LS1 and LS6 forbears, it boasted a larger 4.000-inch bore while retaining a 3.622-inch stroke, which bumped displacement to an even 6.0 liters. At its core, the LS2 resembles an enlarged LS6. It utilizes LS6 cylinder heads, as well as an '01-spec LS6 camshaft. Subtle differences include a larger 90mm throttle body (75mm on LS1/LS6), a higher 10.9:1 compression ratio, and a different intake manifold. Interestingly, the LS2 intake manifold features slightly greater plenum volume and recontoured runners, which actually ows less than the LS6 intake. For hot rodders, one of the key advantages the LS2 has over its smaller-bore counterparts is that it's compatible with the highly desirable rectangle-port L92 cylinder heads.

<b>DISPLACEMENT:</b>	364 ci
<b>BLOCK:</b>	Cast aluminum
<b>HEADS:</b>	Aluminum 15-degree cathedral port
<b>BORE/STROKE:</b>	4.000 x 3.622
<b>COMPRESSION:</b>	10.9:1
<b>CAMSHAFT:</b>	204/211 @ 0.050; 0.525/0.525; 116
<b>OUTPUT:</b>	400 hp and 400 lb-ft
<b>WHAT IT'S IN:</b>	'05-07 Corvette, '05-06 SSR and GTO, '06-07 CTS-V, '06-09 Trailblazer SS
<b>GMPP PN:</b>	19156261



# LS MOTORS DECODED

## LS3/L92/L99

Adequately covering the LS3's history requires first examining the L92. This trick Gen IV mill debuted in the '07 Cadillac Escalade, and is rated at 403 hp. Its outstanding output is largely attributable to a set of rectangle-port cylinder heads that borrow their basic port design from the LS7. These castings owe 330 cfm out of the box, and are available for just \$800 fully assembled from GMPP. Blurring the lines between GM's car and truck lines of engines, the L92 was the first Vortec motor with an aluminum block, and the first GM small-block ever to utilize variable valve timing. The bump in displacement to 6.2L over the LS2 and Vortec 6000 comes courtesy of a larger 4.065-inch bore. By dropping the L92's variable valve timing capabilities and fitting a lower-profile intake manifold, GM created the LS3 to serve as the base motor in the '08-and-up Corvette. In addition to a slightly stronger block than the LS2, the LS3 is fitted with an '01 LS6 cam that's been tweaked with a smidgen more intake lobe lift. The result is 430 hp and 428 lb-ft. As with prior generations, the base Corvette motor also powers the top-of-the-line 2010 Camaro. However, automatic-equipped SS Camaros have an L99 under their hoods, which is a slightly detuned LS3 with active cylinder deactivation that produces 400 hp and 410 lb-ft.

**DISPLACEMENT:** 376 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree rectangle port  
**BORE/STROKE:** 4.065 x 3.622  
**COMPRESSION:** 10.7:1  
**CAMSHAFT (LS3):** 204/211 @ 0.050; 0.551/0.525; 116  
**OUTPUT:** 400-430 hp and 410-428 lb-ft  
**WHAT IT'S IN:** '08+ Corvette, '10 Camaro, '08+ G8 GTP (LS3), '07+ Escalade, Tahoe, Silverado, Yukon, Sierra, Hummer H2 (L92), '10 Camaro automatic (L99)  
**GMPP PN (LS3):** 19201992



## LS4

The oddball of the LS family, the Gen IV LS4 was designed specifically for transverse mounting in front-wheel-drive Impalas and Monte Carlos. To accomplish this, GM shortened the LS4's overall length—from crankshaft to explate—by 13mm and streamlined the accessory drive. Furthermore, it shares the same 3.780 x 3.622-inch bore and stroke dimensions as Vortec 5300 truck motors,

but is based on an aluminum block and topped with LS6 cylinder heads. Despite their displacement handicap, LS4s are relatively stout for their size, producing between 290-303 hp. However, they're almost as expensive as LS1s and LS6s on the secondhand market, so it's of little value to muscle car buffs seeking a swap candidate.

**DISPLACEMENT:** 325 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree cathedral port  
**BORE/STROKE:** 3.780 x 3.622  
**COMPRESSION:** 10:1  
**OUTPUT:** 290-303 hp and 325 lb-ft  
**WHAT IT'S IN:** '06+ Impala SS, '06-07 Monte Carlo SS, '05-08 Grand Prix GXP, '08+ LaCrosse



## LS6

First introduced in the '01 Corvette Z06, the Gen III LS6 is basically a hopped up version of the LS1. In fact, it shares much more in common with the LS1 than the LS2, LS3, or LS4. Compared to the LS1, the LS6 boasts improved cylinder heads, a larger camshaft, a better-owing intake manifold, a more durable valvetrain, a bump in compression, and stronger main bearing bulkheads. Furthermore, the LS6 head design features a raised port over, and a smoother transition at the short-turn radius for improved flow. The exhaust ports were also altered from an oval to a D-shaped design. These mods bumped hp to 385 in '01, and to 405 in '02 thanks to an even larger cam. There was a time when factory LS6 heads were the hot ticket for enthusiasts, but the design has long been superseded by superior factory and aftermarket offerings.

**DISPLACEMENT:** 346 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree cathedral port  
**BORE/STROKE:** 3.900 x 3.622  
**COMPRESSION:** 10.5:1  
**CAMSHAFT ('01):** 204/211 @ 0.050; 0.525/0.525; 116  
**CAMSHAFT ('02+):** 204/218 @ 0.050; 0.555/0.551; 117.5  
**OUTPUT:** 385-405 hp and 385-400 lb-ft  
**WHAT IT'S IN:** '01-04 Corvette Z06, '04-05 CTS-V  
**GMPP PN:** 17801268



## LS7

Granted it falls 133 hp shy of the LS9's staggering output—which is substantial in anyone's book—but in many respects the 505hp LS7 is an even more impressive engineering feat. Without the assistance of a factory-installed blower, the Gen IV LS7 gets the job done the old-fashioned way, with lots of cubic inches and airflow. Its design was heavily influenced by the Le Mans-winning factory Corvette racing program, and as such, the LS7 packs loads of bonafide race-bred hardware. To achieve its epic 427 ci of displacement, the LS7 incorporates press-fit iron cylinder liners in lieu of the cast-in sleeves found in lesser Gen III/IV small-blocks, which enables boring the block out to 4.125 inches. The short-block is further fortified with a 4.000-inch forged steel 4140 crank, titanium rods, 11:1 hypereutectic pistons, and doweled steel main caps. With nearly 0.600 inches of lift, the 211/230 @ 0.050 cam is just epic, and the dry sump oil system is simply unheard of for a production motor. Displacement is just half of the battle, and the LS7's cylinder heads are equally impressive.

These revolutionary CNC-ported 12-degree castings feature 2.20/1.61-inch valves (the intakes are titanium), and owe an astounding 370 cfm. That's enough to put most big-block heads to shame. Best of all, these castings are available from GMPP for about \$2,500. The end product of all this pimp hardware is a motor that revs freely to 7,000 rpm and spits out 505 hp, which makes it the baddest naturally aspirated small-block ever built.

**DISPLACEMENT:** 427 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 12-degree rectangle port  
**BORE/STROKE:** 4.125 x 4.000  
**COMPRESSION:** 11:1  
**CAMSHAFT:** 211/230 @ 0.050; 0.591/0.591; 120.5  
**OUTPUT:** 505 hp and 470 lb-ft  
**WHAT IT'S IN:** '06+ Corvette Z06  
**GMPP PN:** 7802397



# LS MOTORS DECODED

## LS9

The big boss in LS land, at least for the moment, is the factory-supercharged 638hp small-block that powers the new Corvette ZR1.

Not only is the Gen IV LS9 the most powerful engine ever conceived by GM, it easily produces the fattest torque curve of any Chevy in history. While its torque peak of 604 lb-ft at 3,800 rpm is very impressive, the fact that it belts out 350 lb-ft at just 1,000 rpm is downright breathtaking. At its core, the LS9 shares more in common with the LS3 and L92—found in base Corvettes and Cadillac Escalades, respectively—than the LS7. To enhance block rigidity, GM passed on the LS7's 4.125-inch bore dimensions for the thicker cylinder walls afforded by smaller 4.065-inch holes. Furthermore, the block is cast from 319-T7 aluminum and features larger bulkheads, which makes it substantially stronger than prior LS units. It encases a steel crank, titanium rods, and forged 9.1:1 pistons. With a remarkably efficient 2.3L Eaton blower huffing out 10.5 psi through a dual-core intercooler, the exotic race-ported 12-degree LS9 cylinder heads were deemed unnecessary. Instead, GM opted for 15-degree rectangle-port castings that are very

similar in design to the L92 and LS3 heads, but built from more durable A-356T6 aluminum. Sometime this summer, GM Performance Parts will start selling complete LS9 crate motors (PN: 19201990) for about \$22,000. Granted that isn't cheap, it's still a heck of a lot less than trying to replicate a motor of this caliber that's also emissions legal and capable of lasting 100,000 miles. Moreover, the rugged LS9 block will certainly be a popular foundation for LS stroker buildups once it's released.



**DISPLACEMENT:** 376 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree rectangle port  
**BORE/STROKE:** 4.065 x 3.622  
**COMPRESSION:** 9.1:1  
**CAMSHAFT:** 211/230 @ 0.050; 0.562/0.558; 122.5  
**OUTPUT:** 638 hp and 604 lb-ft  
**WHAT IT'S IN:** '09+ Corvette ZR1  
**GMPP PN:** 19201990

## LSA

Think of the LSA as the LS9's detuned little brother. Even so, the LSA's 556 hp and 551 lb-ft have helped make the '09 Cadillac CTS-V the quickest four-door sedan to ever lap Germany's famed Nurburgring road course. Major differences between it and the LS9 are the use of hypereutectic pistons instead of forged slugs, and powdered metal connecting rods instead of titanium units. While the LSA also utilizes an Eaton blower, it's slightly smaller at 1.9L, and produces 1.5 fewer psi of boost. It's a very impressive setup, indeed, but the limited production numbers of Cadillac's top dog means there will be very few LSA's to extract from your local boneyard.

**DISPLACEMENT:** 376 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree rectangle port  
**BORE/STROKE:** 4.065 x 3.622  
**COMPRESSION:** 9.1:1  
**OUTPUT:** 556 hp and 551 lb-ft  
**WHAT IT'S IN:** '09+ CTS-V



## LQ4/LQ9

As the LS6 was being developed inside GM, engineers were so enamored with its performance that they decided to spread some love to the truck line as well. By bolting LS6-style heads to a big-bore iron block, GM created the LQ4. Offered as the top-of-the-line gasoline engine in fullsize pickups and SUVs, the LQ4 was rated at a stout 300 hp and 360-370 lb-ft. In '02, Cadillac wanted a piece of the action too, and added a bigger cam and more compression to boost output to 347 hp. Due to their rugged iron blocks, generous 4.000-inch bore diameters, and excellent cylinder heads, the LQ4 and LQ9 are among the

**DISPLACEMENT:** 364 ci  
**BLOCK:** Cast iron  
**HEADS:** Aluminum or iron 15-degree cathedral port  
**BORE/STROKE:** 4.000 x 3.622  
**COMPRESSION:** 9.4:1-10:1  
**CAMSHAFT ('99-00 LQ4):** 191/190 @ 0.050; 0.457/0.466; 114  
**CAMSHAFT ('01-04 LQ4 and LQ9):** 196/207 @ 0.050; 0.467/0.479; 116  
**OUTPUT:** 300-347 hp and 360-380 lb-ft  
**WHAT IT'S IN:** '99-04 Silverado, Suburban, Yukon, and Hummer H2 (LQ4); '02-06 Escalade, '03-07 Silverado SS and Sierra (LQ9)  
**GMPP PN (LQ9):** 19156262



most coveted Gen III/IV motors on the secondhand market. With the exception of their larger combustion chambers, the LQ4/LQ9 heads are virtually identical to the LS6 castings. Furthermore, their 4.000-inch bores enable them to be paired with GM L92 cylinder heads. By bolting a set of these budget \$800 rectangle-port castings to a stock 6.0L short-block, you can make some serious power for peanuts. Unless you're excessively fastidious about saving a few pounds, it makes little sense to pass up on an LQ4/LQ9 for a comparably priced LS1/LS6.

## LY6

When it came time to update the venerable LQ4 in '07, GM bolted on a set of L92 heads and increased the compression to create the LY6. These simple tweaks bumped output to 352 hp. The addition of variable valve timing helps broaden the powerband as well. The LY6 is currently offered for heavy-duty hauling applications in 3/4-ton pickups and SUVs. While it's too new to be lying up boneyards just yet, expect it to be a very popular choice amongst engine swappers in a couple of years.

**DISPLACEMENT:** 364 ci  
**BLOCK:** Cast iron  
**HEADS:** Aluminum 15-degree rectangle port  
**BORE/STROKE:** 4.000 x 3.622  
**COMPRESSION:** 9.67:1  
**OUTPUT:** 352 hp and 382 lb-ft  
**WHAT IT'S IN:** 3/4-ton '07+ Silverado, Sierra, Suburban, and Yukon



# LS MOTORS DECODED

## L76

Used primarily in light-duty trucks, the L76 is essentially an aluminum block variant of the LY6. Major differences include a higher compression ratio and a slightly larger cam, which boosts output to 366 hp and 376 lb-ft. Like the LY6, the L76 utilizes variable valve timing, but ups the ante even further with active cylinder deactivation. Interestingly, the L76 also powers the Pontiac G8 GT. The car version of the L76 drops variable valve timing and features an LS3 intake manifold, which sacrifices some hp while picking up some torque.

**DISPLACEMENT:** 364 ci  
**BLOCK:** Cast aluminum  
**HEADS:** Aluminum 15-degree rectangle port  
**BORE/STROKE:** 4.000 x 3.622  
**COMPRESSION:** 10.4:1  
**OUTPUT:** 366 hp and 376 lb-ft (trucks); 361 hp and 385 lb-ft (cars)  
**WHAT IT'S IN:** '07+ Silverado, Sierra, Suburban, Yukon, Avalanche, and G8 GT



## VORTEC 5300



## VORTEC 4800

The smallest of the Gen III/IV platform is also the least desirable. While they're very capable mills for their intended application and can power stock Silverados to respectable 14-second e.t.'s, their lack of cubes make them unlikely candidates for engine swaps. This assessment is only reinforced by the fact that they're just as expensive as the 5.3L at the wrecking yard. The Gen III LR4 was built from '99-06 for fullsize trucks and SUVs, and was replaced in '07 by the Gen IV LY2. Other than tweaks universal to all Gen IV motors, the difference between Gen III and Gen IV 4.8L small-blocks are negligible.

**DISPLACEMENT:** 293 ci  
**BLOCK:** Cast iron or aluminum  
**HEADS:** Iron or aluminum 15-degree cathedral port  
**BORE/STROKE:** 3.780 x 3.267  
**COMPRESSION:** 9.5:1  
**OUTPUT:** 270-295 hp and 285-305 lb-ft  
**WHAT IT'S IN:** '99-06 Silverado, Tahoe, Yukon, and Sierra (LR4); '07+ Silverado, Tahoe, Yukon, and Sierra (LY2)



Many consider the 5.7L LS1 as "the new 350 Chevy," but that title more accurately goes to the 5.3L Vortec truck motor. As the bread-and-butter small-block from '99 onwards, GM installs the 5.3L in the vast majority of its fullsize trucks and SUVs. Considering that GM has built way more trucks than cars in the last 10 years, the 5.3L is far more plentiful and cheaper than its 5.7-, 6.0-, 6.2-, and 7.0L big brothers. For roughly \$500 at your local boneyard, complete 5.3L motors can be had for a fraction of the price of an LS1 or an LS6. Price alone, however, isn't what makes the 5.3L the biggest sleeper in the Gen III/IV camp. Its cylinder heads ow just as well in ported trim as 5.7L LS1 castings. In fact, in the early days of Gen III tweaking, before aftermarket heads became widely available, many enthusiasts preferred 5.3L heads to 5.7L LS1 heads due to the slight bump in compression that their smaller combustion chambers afforded. For those that see the 5.3L's smaller displacement as a drawback, it has sufficient cylinder wall thickness to easily accommodate the same 3.900-inch bore diameter as the 5.7L. The added durability of an iron block is tough to beat as well. From '99-07, GM built several versions of the Gen III Vortec 5300, of which the LM7 is the most common. The LM4 and L33 are aluminum-block variants of the LM7, while the L59 is a ex-fuel spinoff. GM began phasing in Gen IV 5.3Ls in '05 with the launch of the all-aluminum LH6, which replaced the LM4 in midsize SUVs. Then in '07, the iron-block, 320hp LY5 was introduced as an update to the stalwart LM7 for use in fullsize trucks and SUVs. Also that year, the LMG and LC9 were unveiled as ex-fuel versions of the LY5 and LH6, respectively. Finally, the LH8 is a slightly detuned 300hp 5.3L that powers the '09-and-up Chevy Colorado pickup. **CHP**

**DISPLACEMENT:** 325 ci  
**BLOCK:** Cast iron or aluminum  
**HEADS:** Iron or aluminum 15-degree cathedral port  
**BORE/STROKE:** 3.780 x 3.622  
**COMPRESSION:** 9.5-10:1  
**OUTPUT:** 285-320 hp and 325-340 lb-ft  
**WHAT IT'S IN:** '99+ mid/fullsize trucks and SUVs  
**GMPP PN:** 19165628

### GET THE HOOKUP

**GM PERFORMANCE PARTS**  
 gmperformanceparts.com

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 800.345.4545 · jeps.com

**SCOGGIN-DICKEY PARTS CENTER**  
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