



Secrets of the S3R-M3

How, exactly, does Dinan Engineering make its 462-hp supercharged S3R-M3 outhandle the stock M3 while simultaneously riding better? Steve Dinan explains...at 150 mph.

By Mike Miller Photography by Jackie Jouret

Most of the M3s we encounter with superchargers, performance-tuned suspensions and massive wheel/tire upgrades tend to be highly-strung, stiffly-sprung bobcats on PCP that can be competently driven and worked on only by their owners. Sometimes even that is optimistic, judging by how often we see the "check engine" light illuminated in these machines.

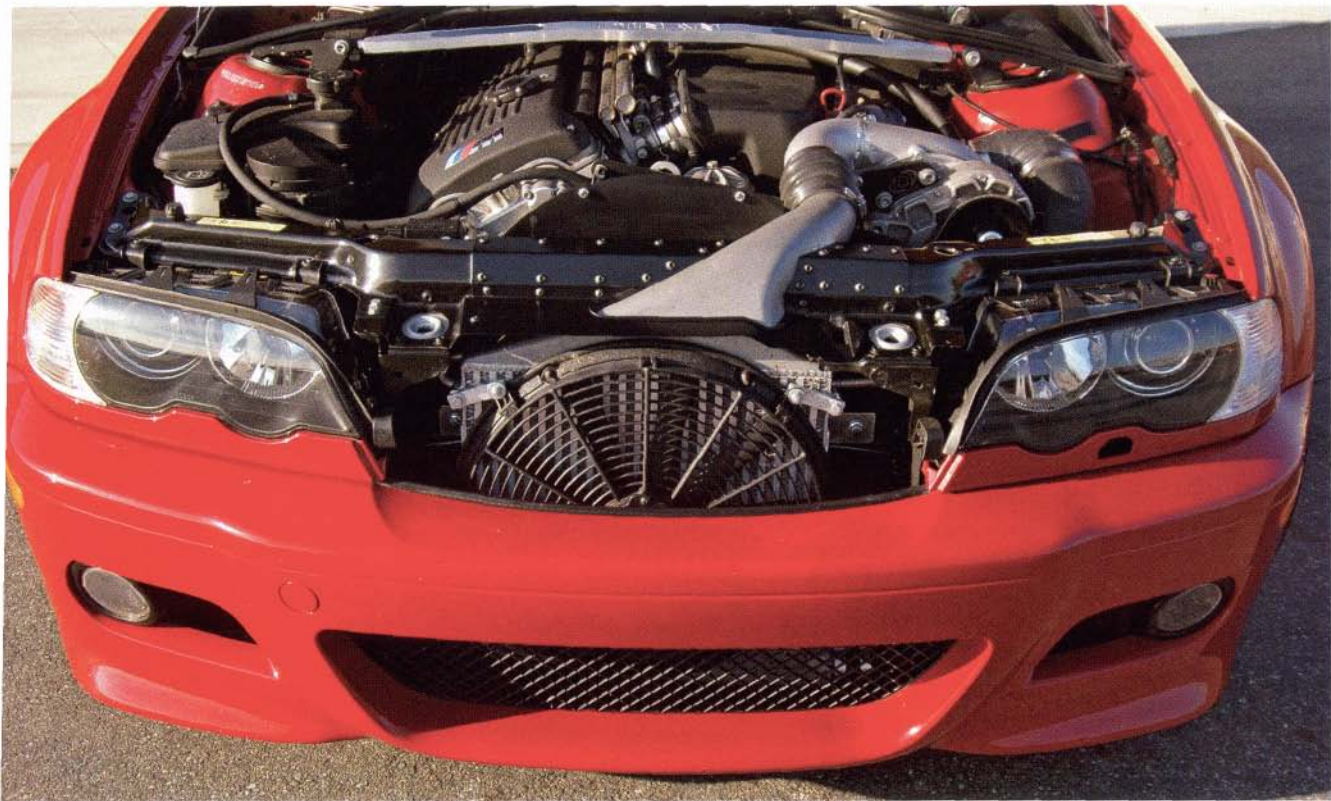
From the factory, however, BMW M cars strive to deliver the exact opposite. They offer detuned race engines combined with upgraded drivetrain components and brakes in eminently streetable packages that nearly

anyone can drive. They're not without their compromises, however, and it is in rectifying those compromises that Dinan Engineering found its niche long ago where both M cars and other Bimmers are concerned.

Steve Dinan's philosophy is to take great cars and make them better by upping the power, yes, but also by devoting resources to areas of the car where BMW simply could not (for reasons of cost and production volume). Dinan's efforts are directed to improving durability, drivability and user-friendliness along with performance.

Dinan Engineering also challenges the notion that a four- or five-hundred horse-

power car can't be as usable as a lesser machine when it comes to normal vehicle function. Most cars with that kind of power—and you read about them all the time on internet message boards—are not cars you can use to pick up your mother at the hairdresser without frizzing the new "do," nor are they cars you load your family into for a three-day weekend at grandma's house or use to pick up your stodgy old boss at the airport. Dinan cars are different: Even when they make really big horsepower like the S3R-M3 being featured here, they're every bit as drivable as a stock M3, maybe even more so.



R: More power, better handling

We first drove the S3-M3 back in *Bimmer* #54 (November 2005), but the "R" form of the car is even more powerful and better handling. First, power is increased from 423 to 462 hp thanks to an air-to-air intercooler that sits in front of the air conditioning condenser. Heat is an issue with this much power, so Dinan created an automatic cooling fan activation system. The radiator fan automatically activates whenever the supercharger comes on its 5.5 psi boost, and it remains activated for three minutes afterward (even if boost is not required) to reduce overall temperature as well as heat-soaking.

Oil temperatures are reduced by a new oil cooler that doubles capacity compared to the original BMW unit but remains thermostatically controlled. Finally, the engine management software was tweaked for added power.

"One of our goals is to maintain 100,000-

mile-plus durability with this engine, given good maintenance," said Steve Dinan, "You'll see people out there with more boost, nitrous oxide, etc., but those engines aren't going to be alive as long as ours. Of course, we also warranty our work. Lots of people think we're crazy for doing that, but that's how confident we are of our craftsmanship and engineering."

That confidence extends beyond the engine bay to the suspension, where Dinan cars tend to ride even better than their stock counterparts while also handling better—normally antithetical qualities. Drivers of stock and "tuned" E46 M3s tend to ask the same question after piloting a Dinan S2, S3 or S3R: "The handling is far better than stock, but how the heck do they make it ride so well?" That's a good question—the E46 M3 has been criticized by fussier owners for its harsh ride, and it tends to get even harsher if you bolt on aftermarket shocks and

shorter, firmer coil springs.

"We have to have a firm car to obtain good roll and pitch control, yet most suspensions are too low and too firm," Dinan told us. "They want to give you the race car look in terms of ride height, but this means the suspension can hit the bump stops more often than we want. We researched shocks, springs and bump stops extensively to determine that improved ride quality comes from controlling bump stop impact speed and the progressive nature of the bump stop itself."

Genius at 150 mph

Many of us have, at least for a moment or two, discovered ourselves in the presence of genius. One of this writer's moments came while interviewing Steve Dinan about his choice of JRZ shocks for the S3R-M3 instead of the more typical and well-respected Bilsteins or Konis.



Dinan's supercharged and intercooled S3R-M3 puts out a tire-shredding 462 hp. The real treat in driving this car, however, lies in its sublime suspension. Carefully tuned by Steve Dinan himself, the JRZ setup improves both handling and ride quality. Wheels are Dinan's own 19-inchers.



While simultaneously driving at about 150 mph, Dinan offered the following explanation: "Koni is a twin-tube shock; Bilstein makes a monotube shock. Konis, because they have a conventional arrangement like a regular street shock with the shock on the bottom and the shaft up on top, can use a conventional BMW exterior bump stop. The Bilstein design is an inverted shock with the shock on top and the shaft inside the housing, which means they have to use a smaller, internal bump stop. Consequently they have what I feel are ride quality issues, particularly with the front struts.

"But because Bilsteins are monotube shocks, they are more responsive and they run cooler. When we made our JRZs we decided we wanted a monotube shock like a Bilstein but adjustable like a Koni, and instead of a high-speed [compression damping] adjustment we wanted a low-speed

adjustment—a low-speed bleeder on the piston to control pitch and roll very precisely. They are a billet design, so you can thread them and rebuild them like a racing shock, but they don't have an external reservoir like a racing shock. They're pretty trick, and it took a long time to develop them."

They're also expensive at about \$500 per shock, which goes some way toward explaining why JRZs are rarely seen on street cars. Of course, Dinan doesn't just buy JRZs off the rack but orders them with custom valving that's been specified by Steve Dinan himself after extensive testing on the shock dyno and the street. The man is also a master of race car setup; he often spends the workday testing various configurations on the roads around the shop, bringing the cars in for constant adjustment until he finds the setup he likes. All Dinan-JRZ and Koni shocks come pre-adjusted, with the settings Dinan prefers marked on the housing.

We asked Dinan what would happen if a customer specified Bilstein or Koni shocks instead. "If we used Bilsteins, the ride quality would be much firmer in front and the suspension would move around more because it wouldn't have that low-speed bleeder. Konis would ride softer, not as good as with the JRZs, but the car would move around even more than with Bilsteins," he said. "There is a cost savings using Bilsteins or Konis instead of JRZs—about \$250 per shock. You can also buy remote-reservoir racing shocks for these cars from JRZ or Moton, but they're about

\$1,500 per shock. We wanted race car shock performance without race car shock price, and we were able to make that happen for about one-third the price of a racing shock."

Of course, the real secret is in how all these parts—coilsprings, anti-roll bars, and Dinan-JRZ shocks—work together, along with the secret ingredient: those little foam BMW bump stops we take off and throw away when fitting (front) Bilsteins.

"We spent a lot of time with bump stops," Dinan said. "We measured all the BMW bump stops available. We used data acquisition to see what bump stop absorption and bump stop contact velocity on the shock was with each bump stop. We tune the bump stops as part of the suspension kit. That's one of the reasons our kits ride so well.

"Using shock damping curves from our shock dyno, we found that if you take high-speed rebound and compression out of the car, you give the shock what's called more nose. With a low-speed shock, the car will have good weight transfer control, but when you hit a bump and the shock moves fast it will 'blow off' and absorb the bump better because the high-speed [damping] forces are lower. Our high-speed damping forces are lower than Bilsteins, Konis and BMWs. That's another secret to our ride quality."

Genius.

High on power, low on bling

Outwardly, all Dinan cars are thankfully free of bling. Not that there's anything wrong





with showing off, but for me, driving a car with stock bodywork is a matter of personal preference, and probably age.

Nonetheless, in walking up to the Dinan S3R M3 one cannot help but be drawn to the lowered suspension and the humongous 275/30-19 front and 285/30-19 rear tires, mounted on Dinan's own 9.5x19 front and 10x19-inch rear wheels. These are the absolute largest tires you can fit on the E46 M3 with stock bodywork, and you can do so only with these wheels—really. The wheels weigh just 20 lbs. each, and the combination adds over four inches of rubber to the front axle alone. The extra grip makes the M3's notorious understeer a thing of the past, like cheap gas.

Driving the Dinan S3R M3 off-boost is almost anticlimactic, and we think that's the effect Dinan is looking for. Apart from the vastly improved sound courtesy of a Dinan exhaust system and the softer ride quality, the car sports around town like a stock M3. It has zero drivability issues, and low-speed driving is not the challenging affair it normally is in highly tuned, high-horsepower Bimmers.

Once you get to a nice back road—and the best one in Northern California starts just south of Dinan HQ—the S3R comes into its own. A certain amount of squat is inevitable with this much power, and flooring the car in second gear unleashes the hounds of Hell. You'd better know what you're doing, even though the M3's usual understeer is gone and the steering is positively telepathic. We steered faster and pushed each corner progressively harder until we lost the nerve to take it further—it is, after all, a \$91,000 car,

and we were on a public road.

We also had Steve Dinan in the right seat of the S3R-M3 during our test drive, which was kind of like having a woman's father come along on a date. But he's a cool customer, Mr. Dinan, and he had no such reservations, hauling the S3R up to 165 mph on a safe, smooth straight with no side-road access. "That's not the top speed," he said. "It's more like 190-something." Even with 462 hp, however, it takes a lot of road to get there.

Nailing the Dinan-Brembo brakes from 90 mph revealed perfectly linear and highly efficient deceleration with zero modulation, and repeated braking for the corners revealed zero fade, as well.

We knew what to expect when the S3R was floored, but part-throttle acceleration is also a joy, aided by the Dinan 3.91 differential that takes the place of the stock 3.64 unit. "The 3.91 actually increases the top speed, because the car won't pull a 3.64 in sixth gear," Dinan said.

Dinan builds a lot of differentials these days, picking up where BMW left off. "We make our own ring and pinion gear sets for a couple of reasons. First, BMW stopped lapping gears, which makes them louder. I believe BMW felt that they improved the manufacturing and machine process to the point where it wasn't necessary anymore, and the car is well insulated. But you can hear the whine under acceleration. Second was price. We can actually make ring and pinion gears for less than it would cost to buy them from BMW Motorsport, and our gears are lapped."

Dinan makes up for another of the M3's deficiencies by installing better toe bushings

at the rear. Off-throttle transitions can be eye-opening experiences in high-powered E3 and E46 cars when these bushings become, bit worn, and closing the throttle to set up for a turn or a lane change can make the rear end feel squirrely. Dinan says BMW just didn't spend enough money on the parts.

"Toe bushings have been a chronic problem in the E36 and E46 3 Series, as you know, and BMW came out with an updated toe bushing that is improved but not great," he said. "We have two different fixes: travel limiters, which stop the bushings from moving around so much so they don't tear, and a monoball kit, which this car has.

"We take the bushing out and put a bearing in there. Our monoball kit is designed to run quieter, unlike others that work great but make noises. Ours have little barbs on the mono balls, so when you press them in the housing doesn't move around. We have a threaded collar to hold the bearing in so it doesn't move, and we also use very, very expensive bearings so we have no play. The combination of all that yields a very quiet monoball setup compared to the less expensive ones. They are not on the market yet; this is the prototype car."

It is this level of attention to detail that makes driving a Dinan BMW the rarified experience it is. Enthusiasts tend to compare parts like bushings, shocks and go-fast engine parts on the basis of prices and numbers, but there's a lot more to building a high-powered, tuned BMW if you want it to remain livable and streetable. A Dinan BMW is the product of that extra effort: It may cost more, but it's also worth more. 🍀