ROAD & TRACK Summer 1995

POWERCHIPS SUPERTEST

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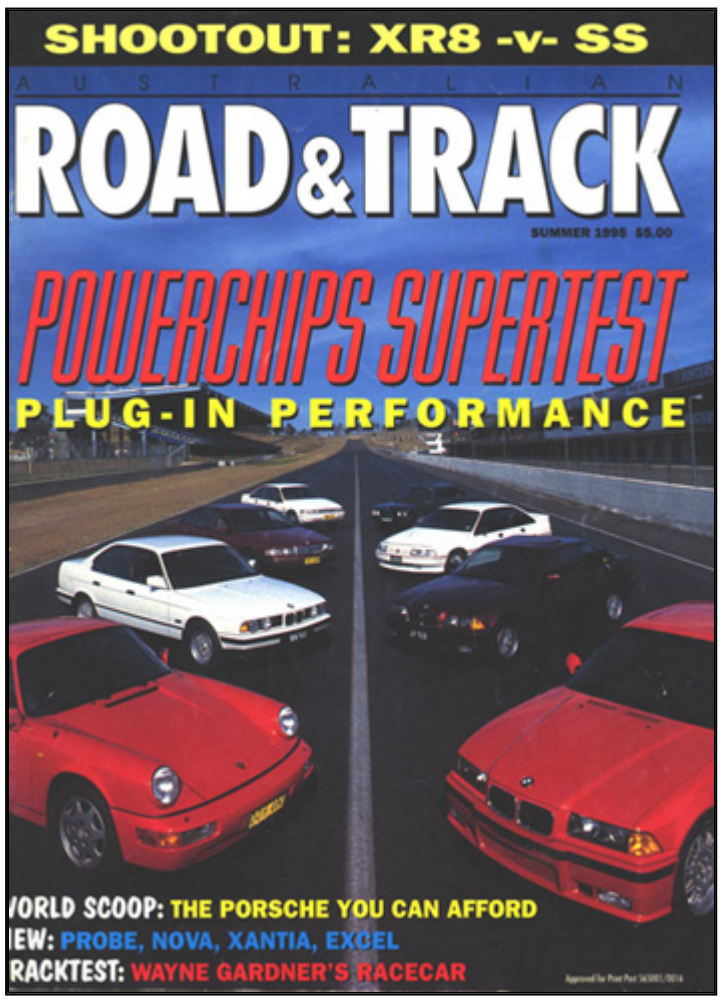


HOT CHIPS

CHIPS are the clip-in, drive-away, power-up solution for the modern automobile. We stack-up eight road cars in a back-to-back chip comparo...

The modern mass-stamped car is efficient, economical, high-tech, reliable - and boring!

Despite the commercial hype, volume production cars are frequently far from satisfying. Many are underpowered (particularly small-bore European and Japanese products), some are fuel sensitive and too many are sluggish and unresponsive in the upper gears - making mountains out of molehills and turning traffic into a tedious chore.

'Dead spots' occur at critical points in the power band - like just when you pull out for that critical overtaking move!

The average automatic gearshift does a very good impersonation of the great white gear-hunter, constantly searching up and down the box for the right slot. And even the best cars can have rough idle, getaway bog-down, jerky over-run, snatchy gearshift action, and 'black holes' in the torque curve.

This is no doubt the reason why up to 35% of cars on the road are modified by their disgruntled owners.

Unfortunately the speed shop is no longer the answer. Take a spanner to your car these days and you could

shoot down your warranty, dump a huge load of dollars and still end up with a serious compromise. And besides, who wants to catch the bus for a week?

Good news - there's a high-tech, low cost, quick fix. It's called the 'Hot Chip'.

These days, virtually every car has an electronic engine management system
-a snazzy term for an on-board computer. Car computers are the electronic brains that call the shots. They can control everything from spark and fuel delivery to gear change points, ABS brakes, electronic suspension, trip computer, climate control and service monitoring.

The critical 'commands' are contained in a single small chunk of silicon - the management 'chip'. These chips are 'programmed' by the manufacture and 'map' all the functions of the car.

After-market Chip modifiers simply re-write the programs to provide different 'maps'. Like all re-programming, setting up the program is an excellent science - time consuming and detailed.

But, like the program in the personal computer, once it has been developed,

it can be quickly and economically manufactured in volume.

The rest is simple - open the 'black box', remove the standard chip, plug-in the performance or 'hot chip'. It's an 'intelligent' solution.

Good 'Chips' are all things to all men. They interface with the modern fuel injection and electronic engine management systems with surgical precision. They avoid legal hassles (warranty and emissions) and they are 'invisible' to registration authorities and other bureaucratic nosey-parkers.

They fill in the gaps in the power and torque bands, smooth-out the lumps in the idle ranges and help the shifter to blend gearshifts smoothly up and down the box.

Chips can also provide an extended redline and reprogram the shift points and lock-up points of the torque-converters in slushboxes.

For those who are looking for free lodgings at Her Majesty's pleasure, chips can be reprogrammed to remove the top speed limiters (usually set to 250km/h, but occasionally much lower).

And they can also provide handy power and torque gains - plug-in, drive-away 'instant' performance boost.

A side benefit of performance engineering by computer chip is 'no grease monkeys'. Performance Chips are reprogrammed and manufactured by white-coated 'techs' in dust-proof labs. They can be fitted in hours (sometimes minutes) with power-driver and tweasers (forget the messy power-grinder and the milling lathe).

The market is dominated by a small batch of high profile suppliers, some specialized electronic engineering shops and a lot of backyarders, amateurs and hackers.

Key players are Powerchip of Melbourne, Autothority, Genie Superchips and Fueltronics.

This test used chips supplied by

TOP: PERFORMANCE CHIP is a small but effective component in the EEC (electronic control unit).

MIDDLE: VARIATIONS ON A THEME: Powerchips are custom-made to suit each vehicle installation.

BOTTOM: CHIPS ARE easily transported in the correct packaging but must be handled with care.

HOT CHIPS

Powerchip of Melbourne. Powerchip was early into the market and has amassed a good depth of experience in both road and competition cars.

Proprietor Wayne Besanko is one of the movers and shakers of the industry and is always keen to have his products independently evaluated.

Part of his philosophy is testing the chips in competition. A high percentage of vehicles competing in Targa Tasmania and other Classic Rallies use Powerchip 'implants'. Powerchip supplies club-racers (Porsche, Ferrari, BMW etc) and production race cars (such as Chris Wiles' successful 1.8 TX3 Laser).

Some chip suppliers have distributors and dealers in many states, offering a drive-in drive-out service.

D.I.Y. CHIPS

Or you can do-it-yourself. DIY chips are arguably the way of the future. This concept has been developed by Powerchip of Melbourne, a company which now provides mail-order chips for most makes and models on the market.

The Powerchip philosophy goes beyond the concept of the against-the-stopwatch gains. Some of the advantages claimed are...

- Increased rev limit
- Smoother idle
- Improved mid-range torque
- Improved fuel economy
- Pinging eliminated
- Fuel change enabled - from Premium unleaded to unleaded or Super to Unleaded (older cars)
- More throttle response in many situations
- Faster getaway
- Smoother shifting on autos
- Increased top speed (by removing engine limiters)

Our job was to test the claims...

The Test

Australian Road & Track wrote the brief for this test concept. We conducted the first scientific Chiptest in Australia - our 'Chips to Go' megatest in mid 1993 - now regarded as the benchmark for the industry.

The test program followed the same procedure. We selected a range of private cars. We used a stable test-ground for the performance testing - the unparalleled facility of Eastern Creek raceway in Sydney. We selected a range of test designed to prove whether the chips provided measurable gains. We conducted back-to-back tests.

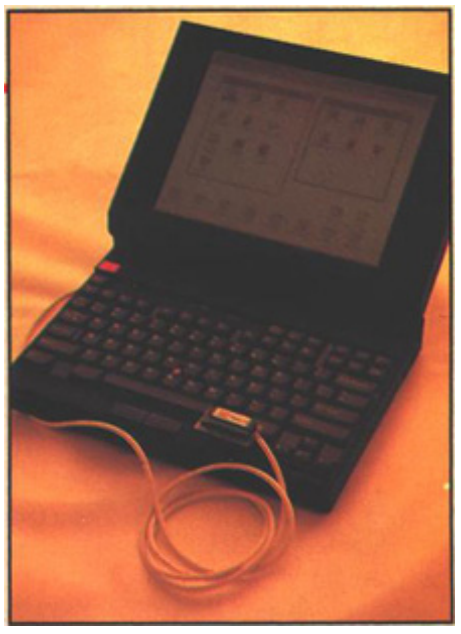
We selected vehicles that covered a range of models, provided a variety of outcomes and represented popular market examples. From Holden (six and V8) to Porsche and BMW (including older models).

Previously, we undertook extensive dyno testing and also evaluated noise and emissions. Road testing covered city and country driveability and fuel consumption.

The technical testing of emissions outputs showed few significant changes. Even where cars run richer mixtures, they still fell well within legal limits. Cheekier exhaust notes failed to push the legislated Db limits.

However, dyno-charting proved there were useful gains in power and torque - particularly in the mid-range where most driving is done. Testing on a range of independent dynos showed clear gains throughout the power and torque curves in most cases. This tends to neutralize the arguments of knockers who claim chips provide small and 'peaky' gains over a narrow rev band.

And our driveability tests highlighted highlighted



LAP - CHIP: In the near future, it will be possible to program via lap-top in the car.

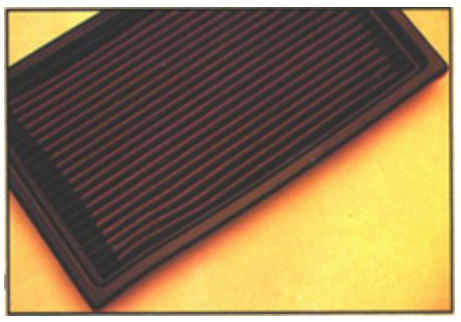
handy gains in smoothness from idle to getaway and gear shifting. During our acceleration tests, we were surprised by some of the outright performance gains provided by the Powerchip implants - surprised enough to re-run a couple of tests completely. In each case, the result achieved a second time around were completely consistent with the first.

The tests we used were selected to compare traditional acceleration standards as well as reflect everyday use - the in-gear intervals represent overtaking, hill climbing and short traffic busts.

Most of the cars employed had stage 11 kits, which combine the performance chip with a low cost air filter upgrade. Stage 111 kits insert a high performance exhaust system into the equation.

RIGHT: BREATHE-EASY: Filters improve breathing, and completements performance chips.

BELOW: Small but powerful. And 'invisible' to the bureaucrats.



HOT CHIPS

PORSCHE 911 CARRERA 2 (Stage II)

Standard:

It's a tall order to get a noticeable improvement out of a Porsche - but that's exactly what happened. In standard condition, the Carrera 2 proved to be one difficult beast to get off the line smoothly. Use less than 4000rpm for a (hard) launch and it bogged down - use 5000-plus revs, and (this example, at least) spun the wheels and lost traction. Even so, good times were posted for the 0-100km/h figure (6.75 seconds) and the standing quarter (14.38). Not bad for a 184kW (247bhp) coupe.

With chip:

The Powerchip gives the Porsche a 15% power gain - from 184kW (247bhp) to 212kW (291bhp). With the chip installed, the car steaked off the line with just 4500rpm - no wheelspin and no flat-spot. The acceleration was smooth and rapid - this earlier model felt just like the latest Carrera 2.

Up-shifts at the red-line were smoother, while (typical) Porsche traits of surge and backlash (when getting off and then back on the accelerator) disappeared. Midrange punch (torque) also improved. Oh, and the car sounded angrier!

This chip extracts more power with improved timing and delivers more fuel in high rev zones. The results are handy - even at Porsche performance levels.

PORSCHE 911 CARRERA 2 (manual)

	Stand	Chip
0-100	6.75	5.76
S 1/4	14.38	13.93
60-100km/h, 2nd	2.95	2.75
80-120km/h, 3rd	5.02	4.39

HOT CHIPS

FORD FAIRLANE V8 (Stage I)

Standard:

The V8 Fairlane in standard form is good at transporting a lot of car and five occupants smoothly. Red-lining at just 5000rpm, the Big Ford puts in a 10.04 second 0-100km/h time and 16.47 second quarter-mile pass (at 139.5km/h).

With chip:

The Powerchip in the Fairlane improves ignition timing. On our test car, noticeable pinging in the upper rev range disappeared, and the car became more 'driveable' from 2000-4000rpm (resulting in better upper-gear acceleration). The 'big yacht' was smoother and more responsive. It also revved an extra 500rpm (redline extended to 5500rpm) and had enough power to wheelspin of the line. This was a stage 1 conversion - the fitment of a low-restriction air filter would help times along even more.

FORD FAIRLANE V8 (auto)

	Stand	Chip
0-100km/h	10.04	8.96
S 1/4	16.47	16.58
60-100km/h, 1st/2nd	5.42	4.96
80-120km/h, 3rd	6.59	5.15

HOT CHIPS

HOLDEN COMMODORE VN SS V8 (Stage II)

Standard:

The standard VN SS Commodore is a quick machine, and comfortable too - but not smooth. The automatic transmission had a tendency to 'bang in' the next gear on upshifts (especially from first to second).

With Chip:

A rule-of-thumb with chip 'engineering' is: The bigger the capacity, the better the gain. It certainly worked for the V8 Holden - the SS showed improvement, with a smoother idle and the thump in the upshift thankfully eliminated. Shifts were also faster, resulting in faster times.

Powerchip says the SS chip liberates an extra 18kW (23bhp) at the flywheel (bringing power up to 183kW/245bhp) - one big gain. The increase in power can be felt in all ranges of acceleration - from the first 30 meters (traffic light Grand Prix) to standing quarters and upper-gear punch. There's just more 'instant on' power available, with less lag at 'throttle mash' applications. Powerchip says the leap in power comes not from a remapped fuel delivery curve, but from more precise timing. Economy, therefore, is the same (unless driven harder).

Drive hard, and another feature of the Powerchip shows itself - a lusty 'deep throat' roar.

HOLDEN COMMODORE VN SS V8 (auto)

	Stand	Chip
0-100km/h	8.55	7.95
S 1/4	16.58	16.00
60-100km/h, 2nd	5.50	4.18
80-120km/h, 3rd	9.42	6.38

HOLDEN COMMODORE VP V6 (Stage II)

Standard:

The Holden V6 unit has always sounded a little harsh, but made up for this by being a willing revver and good performer. The times gathered for the standard set-up compared favourably with some of the other cars, so good gains were expected with the chip. Transmission shifts were a little a rough, and the V6 had a flat-spot around 80-90km/h.

With chip:

Fitted with the chip and air filter, the V6 took on a new feel. The idle improved, while gearshifts were smoothed out. The Commodore moved off the line faster, and now had wheelspin as an option. The redline was also extended by 900rpm to 5900rpm (more noise than outright grunt at this height). Torque lock-up moved upstream (from 63 to 83km/h), and gave spectacular gains in 2/3 shifts and mid-range acceleration (good for passing or hill-climbing). Basically, the torque curve is now were it's needed most (see the 60-100 times)!

P-platers note: this V6 now SOUNDS like a V8 - just graft on some V8 badges!

HOLDEN COMMODORE VP V6 (auto)

	Stand	Chip
0-100km/h	9.31	8.80
S 1/4	16.54	16.37
60-100km/h, 2nd	6.75	4.95
80-120km/h, 3rd	8.55	6.83

HOT CHIPS

BMW M3

Standard:

This machine as an already potent performer, with 210kW (282bhp) driving the rear wheels to a (tested) 6.1 0-100km/h time - excellent for a normally-aspirated 3-litre inline six-cylinder. The M3 only needed 4.94 seconds to dispatch the 40-60km/h range - using FIFTH! Other hot times recorded include a 14.71 second quarter-mile time (157km/h), and a 2.84 second blast for 60-100km/h in second gear.

With chip:

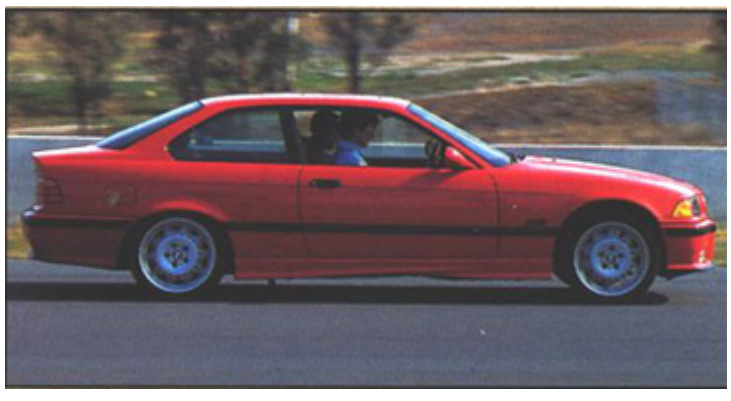
Evolution 2 Motorsport supplies the special-tune chip to Powerchip for this car. The problem lies in the M3 having TWO chips that control a variety of functions - it's not possible, therefore, to simply exchange chips. They must be completely re-programmed. The up-side of this unique conversion is that the car still keeps the standard program in it's memory. The M3 therefore offers the option of using either program (simply flick the switch Powerchip installs on the dash).

The hotter chip extends the revs to 7500rpm (up from 7280rpm) and removes the speed governor. Peak power develops slightly higher at 7150rpm (as opposed to 7000rpm). Interestingly, the variable power-steering assist unit is an electronically controlled item - Powerchip decided the increase in performance necessitated an upgrade in steering response as well. The weighting remains the same at parking speeds, but firms up at every other point. This upgrade requires the power-steering pump to be re-valved.

The upgrade chip information also eliminates pinging, smoothes gearchanges and gives more mid-range torque. The M3 is just smoother overall to drive (no hesitation anywhere). For those wondering, the Evolution 2 chip is very similar to the chips used in 'Group N' BMW race cars.

BMW M3

	Stand	Chip
0-100km/h	6.14	5.84
S 1/4	14.71	14.31
60-100km/h, 2nd	2.84	2.80
80-120km/h, 2nd/3rd	4.40	4.05



BMW 535i (E34 - stage II)

Standard:

The BMW 535i (3.5-litre six-cylinder model) is a good package - it wouldn't be a BMW if it wasn't. it'll do everything you ask it to do, with a little 'spice' mixed in. Go a little harder, and you'll encounter two large flat spots where the power just falls flat, then picks up again (around 3000 and 5500rpm). There's also a slight lag between gearchanges and an idle that isn't as smooth as it should be.

With chip:

Immediately noticeable was the improvement idle - now a steady 800rpm (not as rough or with the fluctuations of before). Hard stabs on the accelerator also indicated the slight pinging was gone, while full-blooded runs provided an extra 500rpm to play with (fully useable too).

A seamless power delivery to the old redline and beyond means the flat spots around 3000 and 5000rpm are gone. The engine note has improved, mirroring the good gains in acceleration. Fuel economy is about the same, though emissions run a little richer (still safely within EPA limits).

Powerchip says the performance gain is attributable to the 16kW it extracted with the chip, which raises power to 171kW/229bhp - an excellent figure for an engine of this size.

On the track, the 5-series cut a full second off most of the times recorded using the standard chip, with some runs up to two seconds quicker. Particularly noticeable was the drop in the 0-100 figure (2.5 seconds).

BMW 535i (E34 - auto)

	Stand	Chip
0-100km/h	11.1	8.60
S 1/4	17.18	16.39
60-100km/h, 2nd	5.87	4.76
80-120km/h, 3rd	9.03	8.19

HOT CHIPS

BMW 325i Vanos (E36 - stage II)

Standard:

Possibly the worst type of car to include in such a test - the 325i is already a very well balanced and hard-changing car. However, there are a few areas the need attention, notably the hesitation off the line and the over-run and sudden throttle jerk while on-off-on the power.

With chip:

These characteristics were removed with the Powerchip - the car was smoother starting and moving off the line. The idle was a little more stable, and the engine sounded slightly better. The chip also moved the torque down the rev range, resulting in acceleration runs more than a second quicker. The rev limit was increased by 500rpm (nice to have a free revving engine and still know it's safe), while the speed-governor (an electronic device that limits top speed) is removed. All round, the 325i was smoother to drive, and it's clean too - it complies with US emissions laws.

BMW 325i Vanos (E36 - manual)

	Stand	Chip
0-100km/h	9.34	8.65
S 1/4	16.40	15.84
60-100km/h, 2nd/3rd	5.64	3.93
80-120km/h, 3rd	6.20	5.88

BMW 535i (E28 - stage I)

Standard:

Standard, the older BM runs quite well, though a little slower than the E34 model. At idle, the 535i is fairly rough - continue up the rev range and gearchanges occur anywhere from 4700 - 5200rpm! Acceleration (to 100km/h) isn't that much slower than the E34's time, at 11.78 seconds, or for 60-100km/h increment. The same percentage of improvement was expected.

With chip:

Even without the low-restriction air filter fitted, the 535i was noticeably different to drive - a good example of radical improvement on an older model car. The chip extended the torque and power curves, and greatly smoothed out the idle. The engine fairly snarled off the line, and the auto transmission's irregular shift pattern made repeated changes at just one figure - 5500rpm. The rev limit is now out to 6000rpm, which is a useful extension for added acceleration.

The biggest gain for the BM was in the standing-start and upper gear figures. The gains were so good we repeated the figures to double-check. Powerchip says running the engine richer than normal produces the boost in power, but decreases fuel economy by only one litre/100km.

BMW 535i (E28 - auto)

	Stand	Chip
0-100km/h	11.78	9.03
S 1/4	16.84	16.1
60-100km/h, 2nd/3rd	6.04	4.77
80-120km/h, 3rd	8.45	6.22

HOT CHIPS

BULLET PERFORMERS

The table details just what sort of performance gains a hot chip can produce. With cars such as the BMW 325i, the most significant gains are in smoothness and upper-gear torque.

Although the figures for the 535i (E34) were spectacularly improved with the chip, the most important benefit was the elimination of two noticeable 'flat spots'

Similarly, the automatic in the VN SS Commodore didn't kick like a mule on every gearchange, the VP Commodore gained excellent mid-range punch and the Porsche lost it's throttle-snatch characteristics.

On figures alone, there were some star performers of the day, including these impressive improvements...

- BMW 535i (E28): 0-100km/h - 2.75 seconds
- BMW 535i (E34): 0-100km/h - 2.5 seconds
- Commodore VP V6: 60-100km/h - 1.8 seconds
- BMW 325i (E36): 60-100km/h - 1.71 seconds
- BMW 535i (E28): 80-120km/h - 2.23 seconds
- Commodore VN SS: 80-120km/h - 3.04 seconds (biggest gain of the day)

Counting the Cost

There is good news and there is more good news in this department.

Typical Powerchip replacements for the average car are a few hundred dollars.

Example...

Commodore V6 $340

Commodore V8 $450

High-performance cars which require chips with more complex programming cost a little more - $650 for most BMWs, Porsches etc.

There are no fitting costs.

High performance air filters are a low-cost option which are worthwhile installing together with the new chip. The average cost of a replacement air filter is around $80.

Most manufacturer exhaust systems are more restrictive than necessary. High-performance systems can provide quite significant gains, but it is important that they are combined with the right chip.

A good idea is to opt for stainless steel high performance systems - they cost very little more, but usually come with a lifetime guarantee.

There is a generous interpretation of the term 'high-performance exhaust system' so it is difficult to pin down pricing. However basic systems for volume produced cars start from as little as $300.

So the performance chip not only provides handy improvements in it's own right, it interfaces with other simple bolt-on modifications to amplify performance gains.

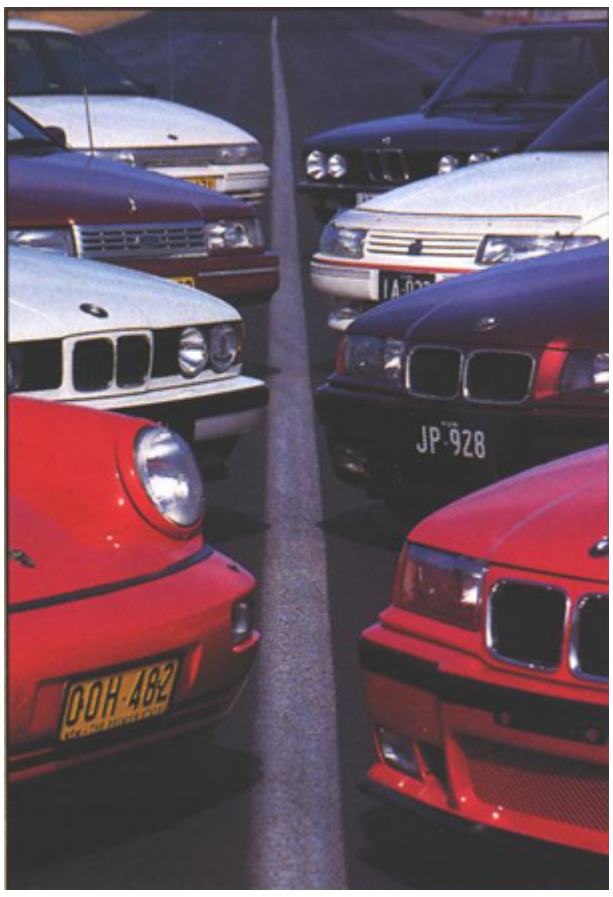
FUTURE GAINS

Already some chip manufactures are offering 'switchable' chips for street use - previously only used in race cars. A few high performance cars already feature this technology (incorporating two programs - standard and modified). These chips will shortly become the 'norm' and will offer greater choice of motoring styles for the driver - with push-button selection.

The techno-boffins are already reprogramming chips 'on the move' with on-board lap-tops - but the excitement doesn't end there. Future cars may have built-in mini-computers, with plug-in access slots in the dash, or press-button programs on the wheel. Whatever the path of development, hot chips are here to stay. Why not chip-in now?

CONTACTS

All enquiries should be addressed to Powerchip at: 106 Tope Street, South Melbourne 3000 - or phone (03) 9681 6888.



PERFORMANCE COMPARISON CHART

CAR	C2	F/lane	SS	VP	M3	535i (E34)	325i	535i (E28)
0-100								
Before	6.75	10.04	8.55	9.31	6.14	11.1	9.34	11.78
After	5.76	8.96	7.95	8.80	5.84	8.60	8.65	9.03
S 1/4								
Before	14.38	16.58	16.58	16.54	14.71	17.18	16.40	16.84
After	13.93	16.00	16.00	16.37	14.31	16.39	15.84	16.10
60-100								
Before	2.95	5.50	5.50	6.75	2.84	5.87	5.64	6.40
After	2.75	4.18	4.18	4.95	2.8	4.76	3.93	4.77
80-120								
Before	5.02	9.42	9.42	8.55	4.40	9.03	6.20	8.45
After	4.39	6.38	6.38	6.83	4.00	8.19	5.88	6.22