TomcoTechtips

TM

ISSUE 40

Peak and Hold Injector Patterns

Last issue we looked at saturated injector patterns. This issue we will look at Peak and Hold injector patterns. First lets review how a peak & hold injector circuit works. (It may be helpful to refer to Tech Tip 38 for a full explanation of a peak and hold driver circuit.)

Peak and hold injectors are typically low resistance injectors. Ohms Law tells us that the current draw in lower resistance injectors will be higher than the current draw in higher resistance injectors. So on a peak & hold injector system when the injector is initially energized it will draw a lot of current. This initial opening period is called the peak portion of the pattern. Once the injector is open it will take less current to hold it open. Therefore, once the injector is open, the PCM reduces the amount of current to the injector. As the current is reduced a voltage spike is induced. The PCM then holds the injector open for the duration of the desired pulse width with a lower current. This is called the hold portion. Now lets take a look at the patterns.

In Fig # 1 we have a pattern of a typical peak and hold injector. The scope is set at 10 volts per division with a time base of 2.5 milliseconds per division. This pattern comes from a 1989 Chrysler LeBaron, 2.5L Turbo Engine.

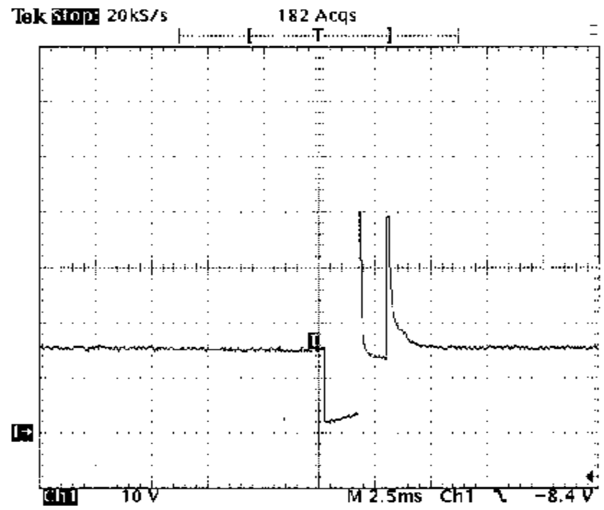

Figure 1

Point A in Fig # 2 is the voltage supplied to the injector, typically battery or charging system voltage. We can see in Fig # 3 that this voltage is 15.6 volts. If this voltage is lower than system voltage we would have to check the power supply or circuit to find the problem.

Point B in Fig # 2 is when the PCM first turns on the injector. This is the beginning of the peak portion of the pattern. At this point the PCM has input a “High” signal to the base of the injector driver transistor (Refer to Tech Tip # 38). This signal energizes the transistor driver causing the collector to short to the emitter, thus allowing current to flow through the injector. This creates a magnetic field which lifts the injector pintle off of its seat.

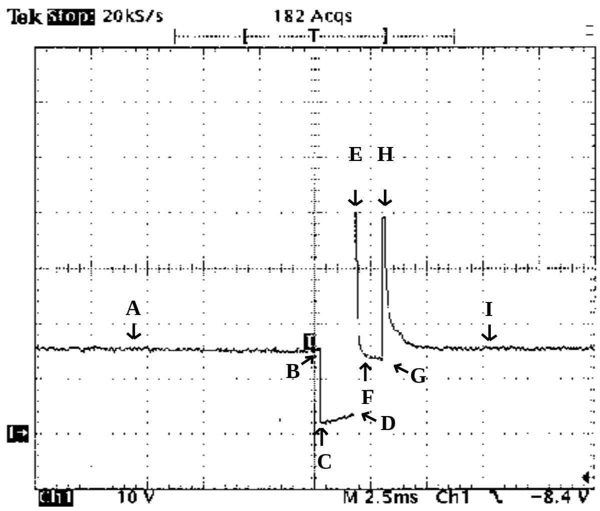

Figure 2

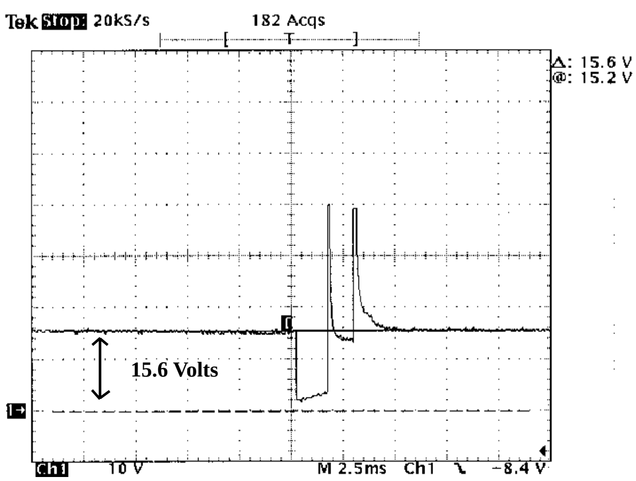

Figure 3

This should bring the pattern down to ground. Remember as we discussed before, that this may be higher than the typical voltage drop of 50 to 100 millivolts we are used to seeing on an electrical circuit. This is because of the circuitry used to trigger the injector. In Fig # 4 the voltage drop is 600 millivolts. Note that the voltage setting has been changed to 2 volts per division so that an accurate measurement of the voltage drop could be obtained.

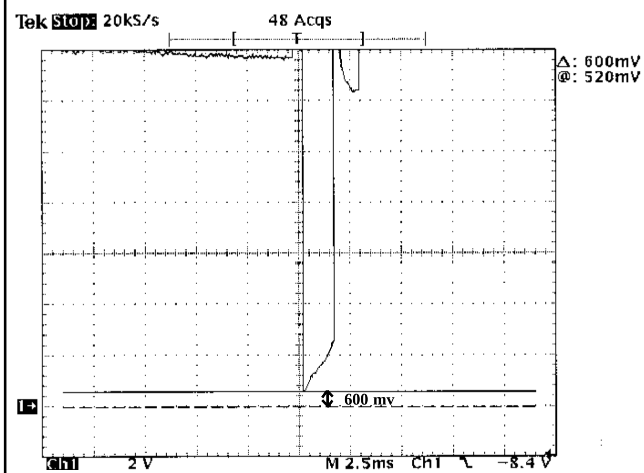

Figure 4

Point C to D in Fig # 2 is the initial on time of the injector. This portion of the pattern is typically a constant value. Even when the pulse width is increased this portion will stay constant . That value depends on the manufacturer, but it is usually around the 1 to 1.5 milliseconds range. Fig # 5 shows us the peak on time on this injector pattern is 1.5 milliseconds.

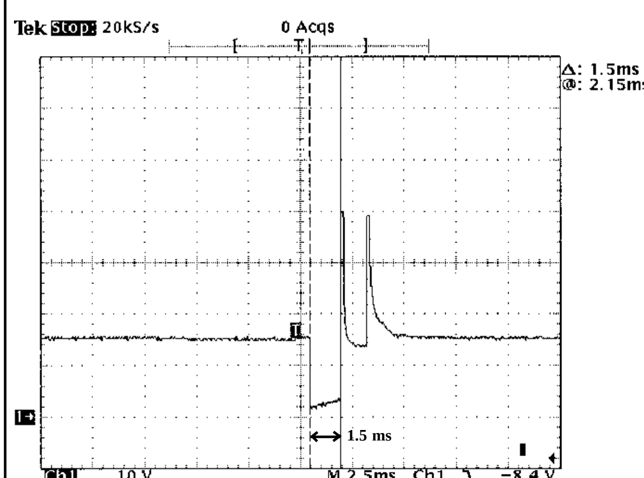

Figure 5

Point D in Fig # 2 is where the logic circuit in the PCM has sensed that peak current has been reached. This is the end of the peak portion of the pattern and the beginning of the hold portion.

At this point the PCM reduces the amount of current to the injector. This results in an inductive spike which is reflected in points D to E in Fig # 2. Our inductive kick for this pattern is 40.6 volts as shown in Fig # 6.

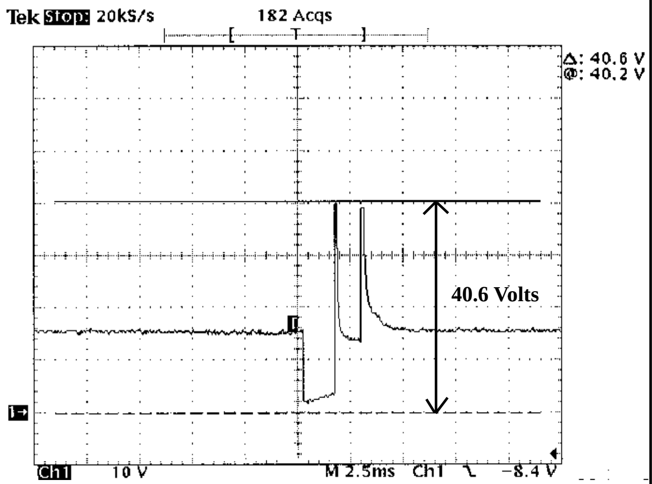

Figure 6

Remember the voltage spike is an important value. When we energize and deenergize the injector coil we should expect to see a certain amount of kick back voltage. If the kick back voltage is too low there may be a problem. The supply voltage could be low producing less of a magnetic field, therefore a lower kick back voltage . A quick look at the source voltage on the pattern would verify this.

A second possiblity could be that the injector is shorted. This would lower the resistance thereby lowering the kick back voltage.

Points F to G in Fig # 2 reflects the holding current of the pattern. This is when the injector is being held open with less current. You can see that the voltage level has changed due to the change in current flow.

This portion of the pattern correlates to the hold time of the injector, that is the amount of time the PCM is holding the injector open. In Fig # 7 we see that the hold time of this injector is 1.4 milliseconds.

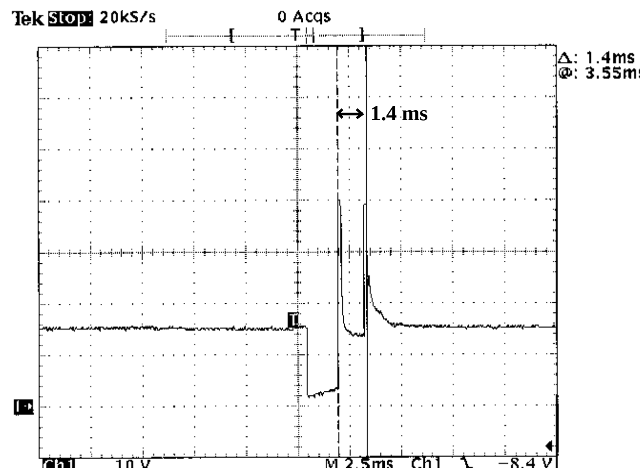

Figure 7

Points F to G are also the portion of the pattern that changes when a change in pulse width is required. You can see in Fig # 8 a side by side comparison as we snap the throttle and look at the change in the hold pulse width. The hold portion on the lower pattern is increasing to accommodate the extra fuel needed as we snap the throttle.

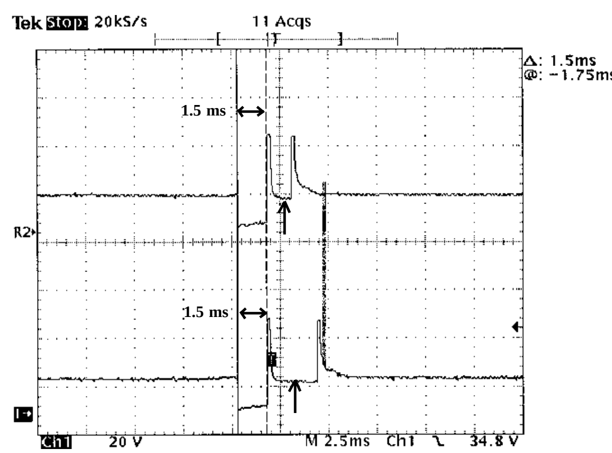

Figure 8

Notice also that the peak portion remains the same even when we snap the throttle. As we can see in Fig # 8 the on time for the peak portion is still 1.5 milliseconds.

If we look in Fig # 9 we see that the hold portion has increased to 3.35 milliseconds as the throttle is snapped. At idle our hold portion was only 1.4 milliseconds. That is a change of 1.95 milliseconds in pulse width.

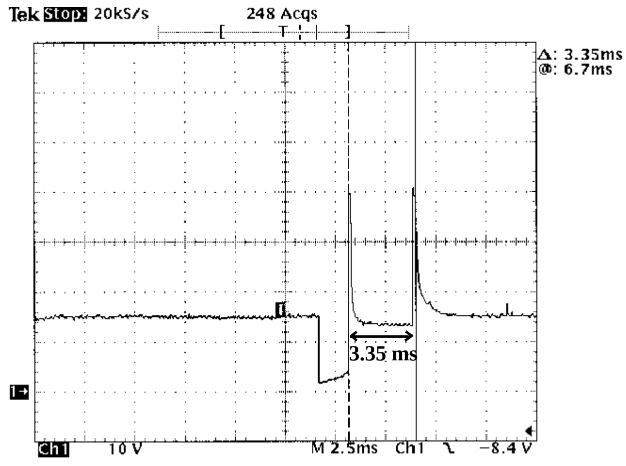

Figure 9

Points G to H in Fig # 2 is when the PCM has turned off the injector. This once again results in an induced voltage spike because of the collapsing magnetic field. This voltage spike is 39.6 volts as shown in Fig # 10.

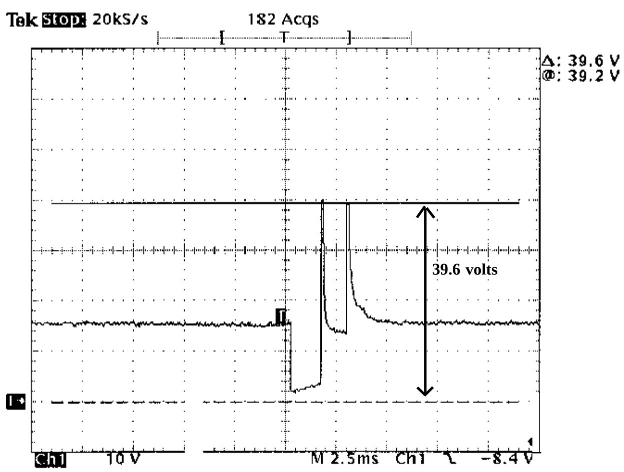

Figure 10

Point I in Fig # 2 shows where the injector is deenergized and we have returned back to our normal system voltage.

So our total on time for this injector is the combination of the peak & hold time. For example in Fig # 11. The injector on time of this pattern is 2.9 milliseconds. That is 1.5 milliseconds peak and 1.4 milliseconds hold.

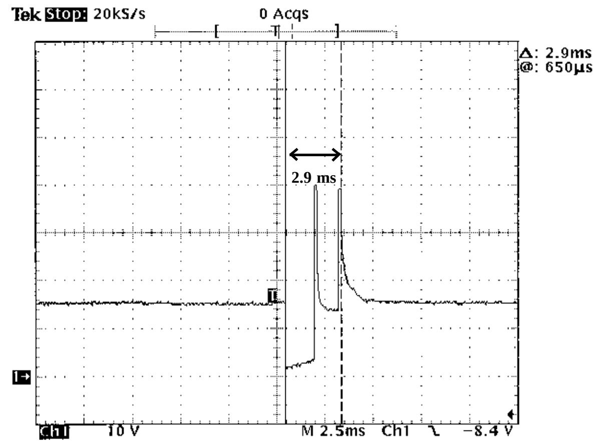

Figure 11

Our total injector on time for the slight snap throttle pattern is shown in Fig # 12. That is 1.5 milliseconds peak, 3.35 milliseconds hold for a total on time of 4.85 milliseconds.

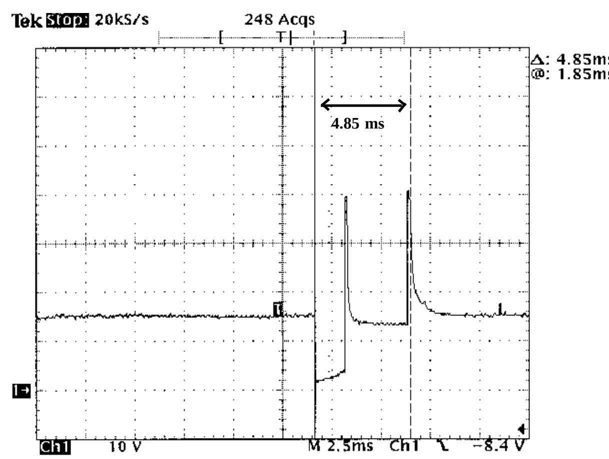

Figure 12

We will continue to look at more injector patterns next issue.

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