800–1000 hp rated, LS F-body/RWD T56

Introduction

This Project shows the steps, parts, machining required to build a custom T56 6-speed, based upon the versatile F-body LS T56 case; the Corvette 5th generation (C5) / Holden-GTO / Cadillac CTS-v T56 internals with their advanced synchronizer and gear ratio selection; and the Chevrolet SSR truck T56, with it's 4760 pound (lb.) base curb weight and 6050 lb. GVWR rated output shaft.

History

The stock LS F-body T56s were only available in the MM6 gear set, and the narrow ratios proved very good for the powerful LS motor and approximately 3450 pound curb weight. Common performance upgrades were a steel 3-4 shift fork introduced in the Viper T56, solid metal synchronizer (synchro) keys replacing the stock stamped steel ones, and bronze shift fork pads replacing the stock plastic ones. These upgrades could boost the power handling and reliability of the LS F-body T56 towards a 700hp rating. The one exception was the (small 27-spline) output shaft that was prone to twist or break for Drag Racers and customizers installing the LS motor and T56 into classic and muscle cars, as well as performance trucks and other (Heavy) RWD projects. A popular upgrade (viper-spec) was developed for these uses where a Dodge Viper T56 output shaft (30-spline, 1.293" dia) and the F-body tail housing case, were machined to retrofit into the F-body case. Since the Viper shared the same basic gear set dimensions and the same double-cone synchros on 1-2, and single-cone synchros on 3-4, 5-6 as the F-body, no additional parts were needed for the retrofit.

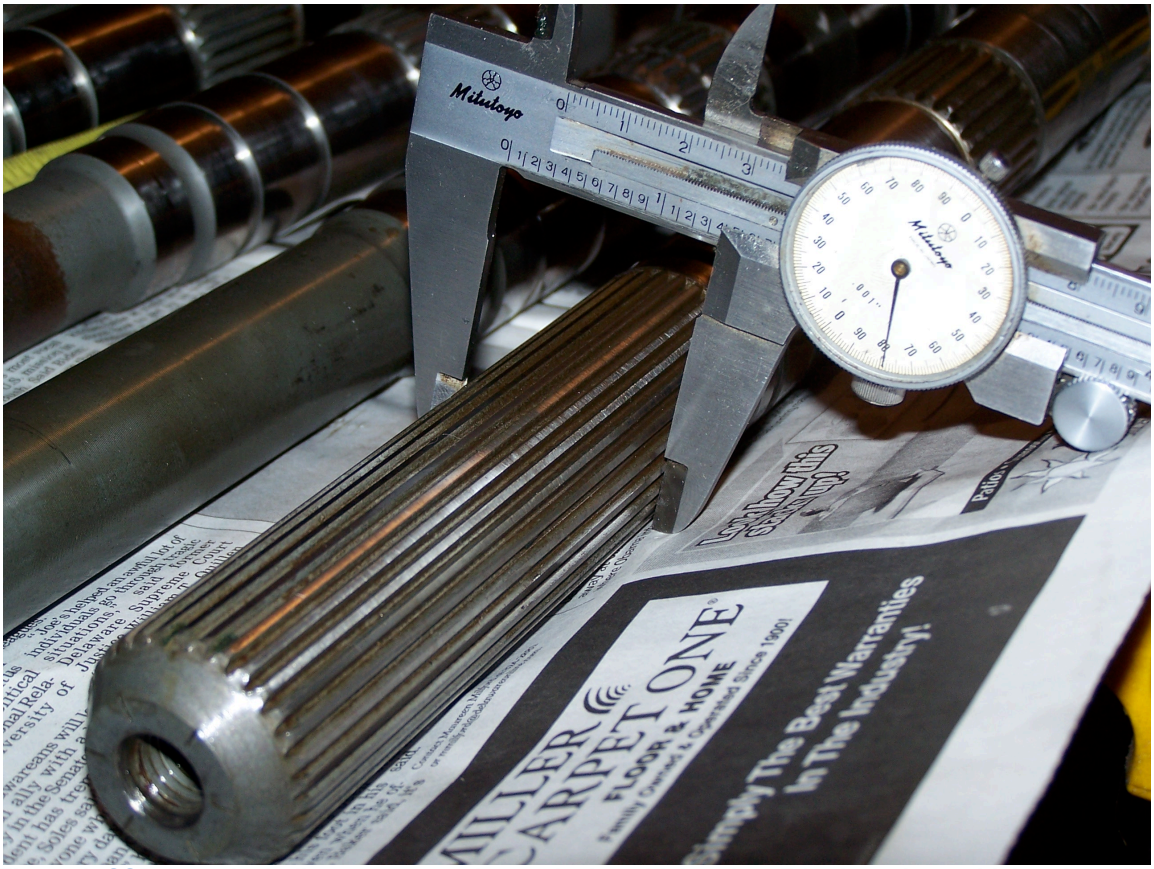


Figure 1: SSR 1.380-inch diameter output is .200 inches thicker than F-body and .090 thicker than Viper

Beginning in 1997 with the 5th Generation Corvette (C5), the 2004 Cadillac CTS-V, and the 2004 Pontiac GTO, the GM T56s were fitted with power handling and reliability upgrades to triple-cone synchros on 1-2 gears, and double-cone synchros on 3-4, and 5-6 gears. The F-body was discontinued after the 2002 model year and never saw any of these upgrades. (The triple-cone synchro blocker rings get their name because they have 3 cone shaped friction surfaces which block or speed match the gears during shifts.) ***These synchros allow crisp shifts up to 8000 rpms, while the older synchros are limited to less than 6500 rpms.*** The greater friction area, the greater power handling capability and smoothness of shifts all make the upgrade worthwhile in of itself.

Figure 2: Triple Cone 1st gear Synchro blocker

Figure 3: Older Double Cone 1st gear Synchro blocker

The GTO T56 carried the same external dimensions as the F-body T56 and became a popular swap. The Corvette Transaxle design with remote clutch and shifter, and the CTS-V remote shifter and flanged drive-shaft connection, made them undesirable for use in F-body and RWD LS projects. In addition, the CTS-V and GTO weighed in with 4250 pound and 3725 pound curb weights respectively, and used a new wide ratio gear set known as M12. First introduced in the 2001 Z06 corvette for quicker 0-60 times, the M12 traded some strength with the higher gear ratio, but allowed the heavier cars to accelerate quicker. This wide-ratio M12 gear set was of limited appeal to many lighter F-body and RWD project owners, and the GTO T56 was in somewhat limited production numbers which made that transmission harder to source. The GTO T56 used the same sized (27-spline) output shaft as the F-body, but because of the upgraded gear set and synchronizers, there was no Viper output shaft upgrade available for it.

Figure 4: Corvette T56 – Remote shifter & clutch

Figure 5: CTSv T56 – Remote shifter & flange output

Figure 6: SSR (TH400) 32-spline yoke dwarfs F-body 27-spline yoke

Finally, between 2003 and 2006, Chevrolet marketed a retro-looking truck platform called the SSR (Super Sport Roadster). With LS engine options, a 6050-pound GVWR rating, and a T56 manual transmission introduced in 2005, the SSR had a number of upgrades done to the T56 to handle its unique situation. The first was a new gear set that included an even lower ratio 1st gear and wider spread than the M12. This new gear set was known as the M10 (See Appendix C) and only about 2200 of them made it into production. The SSR T56 featured the upgraded synchro design, a strong 1-piece countershaft, and most important for this article, a maximum diameter (for T56 design) 32-spline output shaft. While anyone lucky enough to find one of the production M10 SSR T56s can use it with little changes in a F-body or RWD LS project, the limited number and much less desirable gearing makes the swap difficult.

Motivation

What drives this project is to take the best of all available stock parts, and layout a plan for creating a modern, strong, adaptable T56 RWD platform for heavy-duty service in Drag Racing, Heavy RWD project cars, or light/medium duty performance trucks. By combining the external case of the F-body LS T56, the triple/double-cone upgraded synchros in the C5/CTSv/GTO T56s, the gear ratio choices of the 1997-2007 Corvettes, and the strength of the SSR T56 output shaft, to make the most versatile RWD T56 available to the hot-rodding and performance community. **[Note: The GTO T56 mainshaft can be used in much the same way as the SSR, but without any machine work. You can transform any C5/C6/CTSv T56 into a GTO-T56 clone by following**

many of the same steps detailed below. The major downside to this is that you'll still have a "weak" 27-spline output shaft] While some of the parts are available through Tremec (Mfg of the T56), many parts are only available through GM as they own the rights to them and Tremec is only under contract to produce them. Alternate parts are suggested when known/found and machine work is kept to a minimum and described in a much detail as possible.

Planning and Procedure

The SSR main shaft (output shaft) is the building block for the project. Four main shafts are shown in Figure 7. From the bottom up are: 2006 CTS-V, SSR, GTO, and finally a LS F-body at the top. Interesting features to note are

- The overall length of the SSR shaft is the same as the GTO and F-body
- The CTS-V is much shorter, and is machined on the Left for a flange to be bolted onto it, not a slip-yoke like the others
- The output spline region of the SSR shaft doesn't neck down like the GTO and F-body
- From the Right-hand-side to the middle of the shaft, the machining and layout of the CTS-V, SSR, and GTO match almost exactly. (The CTS-V shaft pictured still has an old Bearing Race on the Right-hand end)
- The SSR and CTS-V have one groove in common, but different than the GTO near the 2nd splined area from the Right. (More about this later)
- The SSR and CTS-V mount a VSS reluctor wheel on the first machined service from the Left, after the splines end. The GTO and F-body mount a VSS reluctor in the Left splined area where 2 snap-ring groves are machined.

Figure 7: Main shaft Comparison

The larger output shaft requires a larger slip-yoke, and bushing&seal package to accommodate the larger size. The 32-spline output was used in the TH400 3-speed automatic transmission used in as far back as 1964, and called into service again with the SSR and modern HD truck/SUV automatic transmissions. The T56 case is made of 3 basic parts, the front plate (sometimes called the mid-plate) where the input shaft protrudes from and where the clutch activation mechanism usually mounts. The middle or main case is where the main components are housed for first through fourth gears. The main case is basically the same in every T56 made, regardless of application. The tail housing is on the end and is application specific depending on factors such as:

- Shifter location
- Drive shaft attachment
- Output shaft size and length
- Internal 5^{th}, 6^{th}, Reverse drive gear setup

The last two points are important for this project because the factory SSR included a heavy-duty 1-piece 5/6/Rev countershaft drive gear setup, and also had the much larger output shaft. Because of this, the project has opposing tail-housing requirements for a retrofit, either the 2-piece countershaft 5/6/Rev setup of most T56 transmissions, or the larger tail housing bushing/seal. A factory SSR tail housing is shown in Figures 8 and 9.

Figure 8: Factory SSR Bushing and Seal area

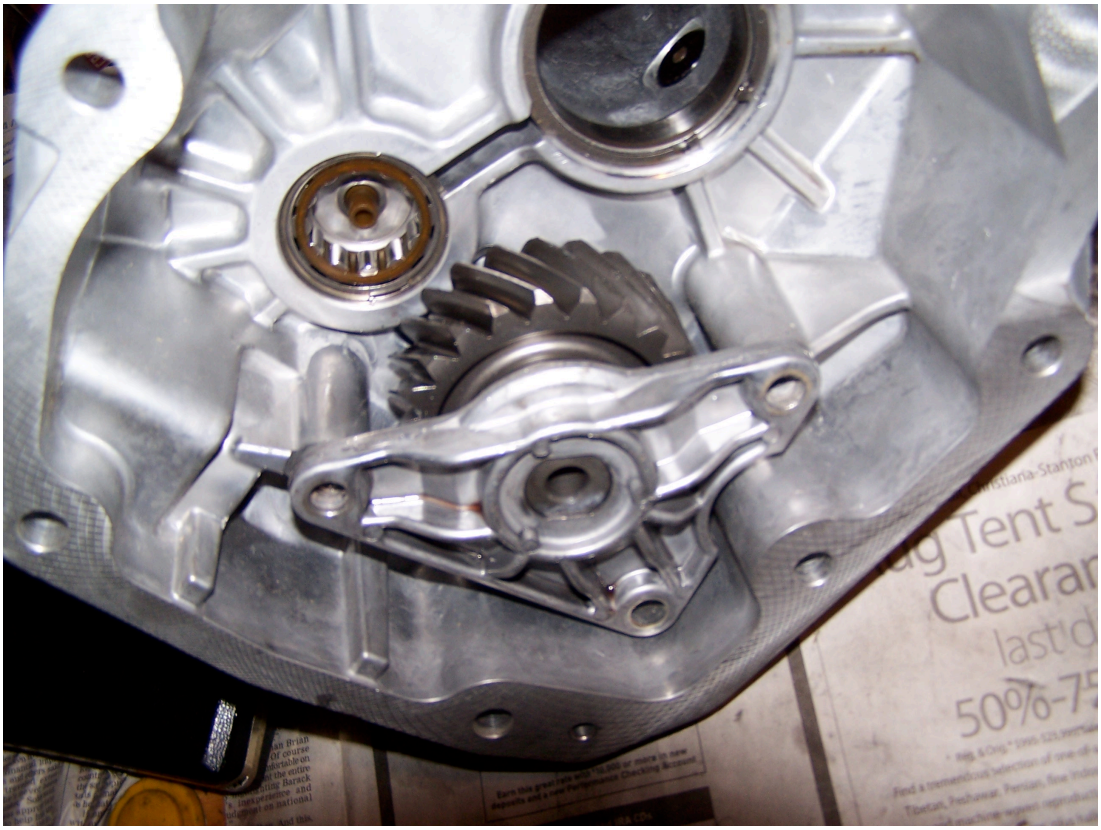


Figure 9: Factory SSR 1pc Countershaft support Bearing

There was only one other factory T56 from GM that had a 1-piece countershaft, and that was the 2006-2007 Z06 Corvette T56. The 2006-2007 Z06 introduced the 7.0 liter LS7 motor, and GM enhanced the performance of its T56 because of the LS7. It also used the MM6 gear ratios that F-body LS T56s used, for added strength. (Note: Higher numerical ratio gears like the 2.97:1 M12 and 3.01:1 M10 require more gear teeth in the same gear area. To make more gear teeth fit in the same area, the teeth have to be smaller and slightly weaker. The 2.66:1 1st gear ratio of the MM6 set has the largest, strongest gear teeth. See Appendix A.) The 1-piece counter shaft was machined flat on the end where a caged-needle bearing supported it in the tail housing. The much more common 2-piece countershaft used a tapered needle bearing and bearing race mounted in the tail housing to support it. The two methods are not compatible and shown in Figures 10 & 11.

For this project, a decision must be made (either by choice or from a pre-existing requirement) of which tail housing to use. To run the Factory SSR tail housing, either a 2006-2007 Z06 Corvette T56 (or Factory SSR) donor transmission must be used with their 1-piece countershafts. To use any other donor transmission (GTO, CTS-V, 1997-2007 Corvette) with a 1 or 2-piece countershafts, a F-body or GTO tail housing can be used and machined for a larger bushing & seal. The 3 options are detailed below.

Figure 10: 2pc Extension shaft with Tapered Bearing

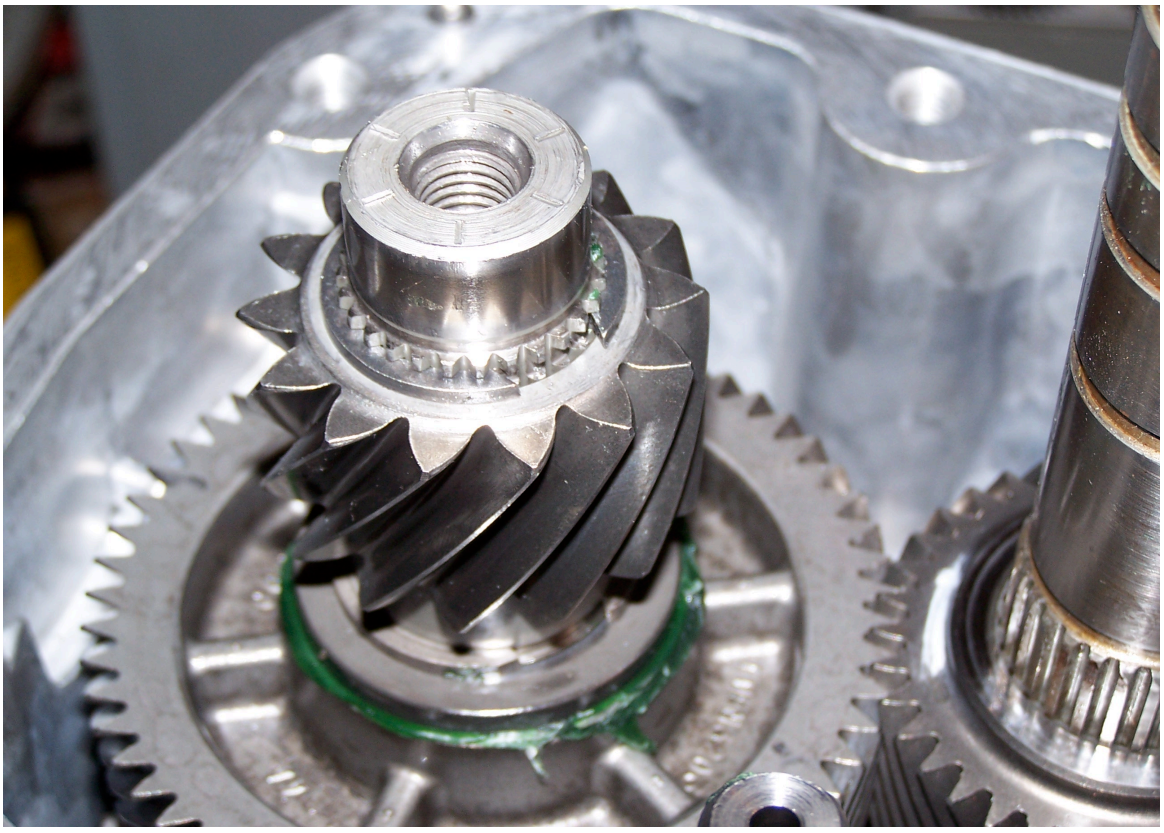


Figure 11: 1pc Countershaft with machined support

Tail Housing Options

There are 3 options for tail housings, 2 by modifying the F-body T56 tail housing, and a 3rd by using a factory SSR tailhousing. The SSR tailhousing was machined for the 1-pc countershaft of the SSR, thus can only be used with another 1-pc countershaft because of the smaller caged needle bearing support in the tail housing. The F-body tail housing has to be bored larger for the larger SSR mainshaft yokes, but can adapt to either the common 2-pc counter/extension shaft setup or the 1-pc countershaft.

One-Piece Countershaft tailhousing option

When using a 1pc countershaft (MM6/M10) you can use a Factory SSR tail housing. The SSR tail housing comes from the factory with the correct bushing and seal that accept the TH400 slip yoke. The SSR used a slightly taller leverage shifter than the F-body/GTO because of the longer shifter arm for the truck application. To use the SSR tailhousing with a F-body shifter, you must machine down the shifter mounting area of the tail housing. The SSR tail housing shifter pad requires exactly 0.430" milled off of it all around, and at least 0.500" forward of the mounting pad along the shift rail rib of the tail housing, to allow aftermarket shifters to sit flush. The F-body offset lever can then be used with the SSR tailhousing and any stock or aftermarket F-body shifter.

To add a 1pc MM6 countershaft to any standard C5 MM6 T56 from GM, use Part Number 89060072 and a Std. C5 donor for the mainshaft gears. (See Figure 12 and note additional parts required, as listed in the price list below.) Likewise, the 1pc SSR M10 countershaft can be added to a CTSv/GTO/C5-Z06 M12 donor along with a SSR or machined MM6 first gear, to make a true SSR M10 clone. (The SSR countershaft may be discontinued as of this update)

If using the F-body tail housing, you'll need to have the seal and bushing bored larger, like described below in the two-piece option, and you'll need a caged needle bearing with a machined spacer (Figure 13) to fit to the larger tapered bearing race hole in the F-body tail housing. (I try to keep some of these bearings w/spacers on-hand, if making one isn't an option for you.)

Figure 12: 1pc Countershaft option parts

Figure 13: Caged needle-bearing with Spacer

Figure 14: Machined shifter pad (0.430") of SSR tail housing

Two-Piece Countershaft option

When using a 2-pc counter/extension shaft in your build, you must use the F-body tail housing with the larger race support for the tapered bearing on the extension shaft. Because of the larger SSR output shaft, the F-body tail housing must be bored. There are 2 size options when boring the F-body tail housing. To use the SSR/TH400 slip-yoke and bushing, the tail housing must be bored out to the largest possible diameter. This option should not be used if you want to retain the stock F-body Torque-Arm mount or any exhaust hangers from the tail of the transmission. The second option is to use a "viper-modified" F-body tailhousing and machining a TH400 slip-yoke down to viper bushing size.

When boring a F-body/GTO tail housing for the SSR bushing and Seal, the original bushing and seal must first be removed. Afterwards, the bushing area can be enlarged from 1.640" to 2.050" and honed to final fit the SSR bushing. The SSR seal is not as deep as the F-body/GTO seal, but is larger. Enlarge the seal area from 2.365" to 2.560" and 0.400 down from the lip, leaving about 0.180" of the original lip between the seal and bushing diameters. (This will add to the strength in that area also) Using a cam installation tool or similar bushing installer, that supports the inside-diameter of the bushing, install it into the bored housing and then hone to fit the slip-yoke if needed. The finished F-body/GTO tail housing should look like Figure 15:

Figure 15: F-body tail housing machined for SSR bushing & seal

If you don't have ready-access to a machineshop that can bore the tail-housing correctly, a second option is to purchase a viper-mod F-body tailhousing from various T56 upgrade sources and machine the TH400 slip-yoke. The viper bushing is smaller than the TH400 and thus you don't remove as much material from the tail housing. This is the preferred method if you need to retain stock F-body Torque-arm mounts and/or exhaust hangers from the tail of the transmission, although both are still discouraged.

You will need to have a TH400 slip-yoke turned down (1.885)" to viper outside-diameter (1.682"), but this is something that most machineshops can do more easily than boring the tailhousing to a 0.0001" tolerance. (I try to keep a few spicer TH400 1350 yokes, machined to viper diameters, on hand if you don't have access to a machineshop) Since you're turning down the TH400 yoke from a .250" thickness to a .150" thickness, you might want to consider a billet yoke to perform this on, but also consider a stock viper yoke is only .175" thick and the 32-spline shaft is .090" larger diameter over the 30-spline viper shaft.

Figure 16: TH400 slip-yoke machined to Viper OD (shown with viper bushing&seal kit in background)

Upgraded 1-2 Synchro snap-ring

The last modification needed is to accommodate the new upgraded 1-2 synchro snap-ring (retaining ring) on the SSR main shaft. First seen in the 2006 and later 2007 M12 ratio transmissions, the M10 SSR also received this upgraded retaining ring. All previous (1993-2005) T56s used a simple snap-ring retainer, like those used throughout the rest of the T56. The upgraded retainer was developed to make it wider (stronger) than the snap-ring, and was made of 3 pieces and a check ball. The wider retainer took up the area under the 1st gear, usually made up by a spacer next to the needle bearing between the gear and main shaft. Because this retainer now needed an outside ring to keep it together, the 1st gear had to have a step machined into the inside-diameter to clear this ring. While the 2006/2007 M12 and M10 1st gears had this step machined from the factory, any other gears (1998-2005) used as donors in this project, need to have that lip machined into them. The retainer ring (p/n **89059975)** can be used as a guide, and most any machine shop with a metal lathe and carbide tooling can make the step. The retainer ring is 0.160" thickness, and 2.190" diameter. Adding 0.006" or more to the depth and width of the machined lip will provide adequate clearance. (**Stock SSR step is 2.208" diameter, depth of step is .170".)** The LS7 gear that was machined is shown in Figure 17 along with the retaining ring with machinist dye to highlight the ring from the gear**. If you don't have access to a good machine shop, you can purchase the 1st gear pre-machined from GM by ordering the 2006 CTSv 1st gear (M12) or the 2006 SSR 1st gear (MM6) depending on the gear set of your core. (See price list for part numbers)**

Figure 17: First Gear machined ID lip for lock retaining ring clearance

The upgraded synchro retainer is shown in Figure 18. There are 2 half-rings that fit into the main shaft groove, and a small ball bearing fits between a main shaft indentation and the ends of the half-rings, to keep the rings from rotating around the main shaft when installed. The larger outer ring keeps the 2 half-rings together, and it is what must be accounted for in the machined step required of the first gear. Figure 19 shows the SSR main shaft where it's slotted and indented for the upgraded retainer package to fit in. The splined area just below that is where the 1-2 synchro presses onto, with 2nd gear below it, and 1st gear above it as shown. If a 2006 or 2007 CTS-V transmission is used as a donor, then it will already have the stepped lip on 1st gear and the 3 piece upgrade retainer with ball bearing.

Figure 18: Upgraded 1-2 Synchro lock retaining ring

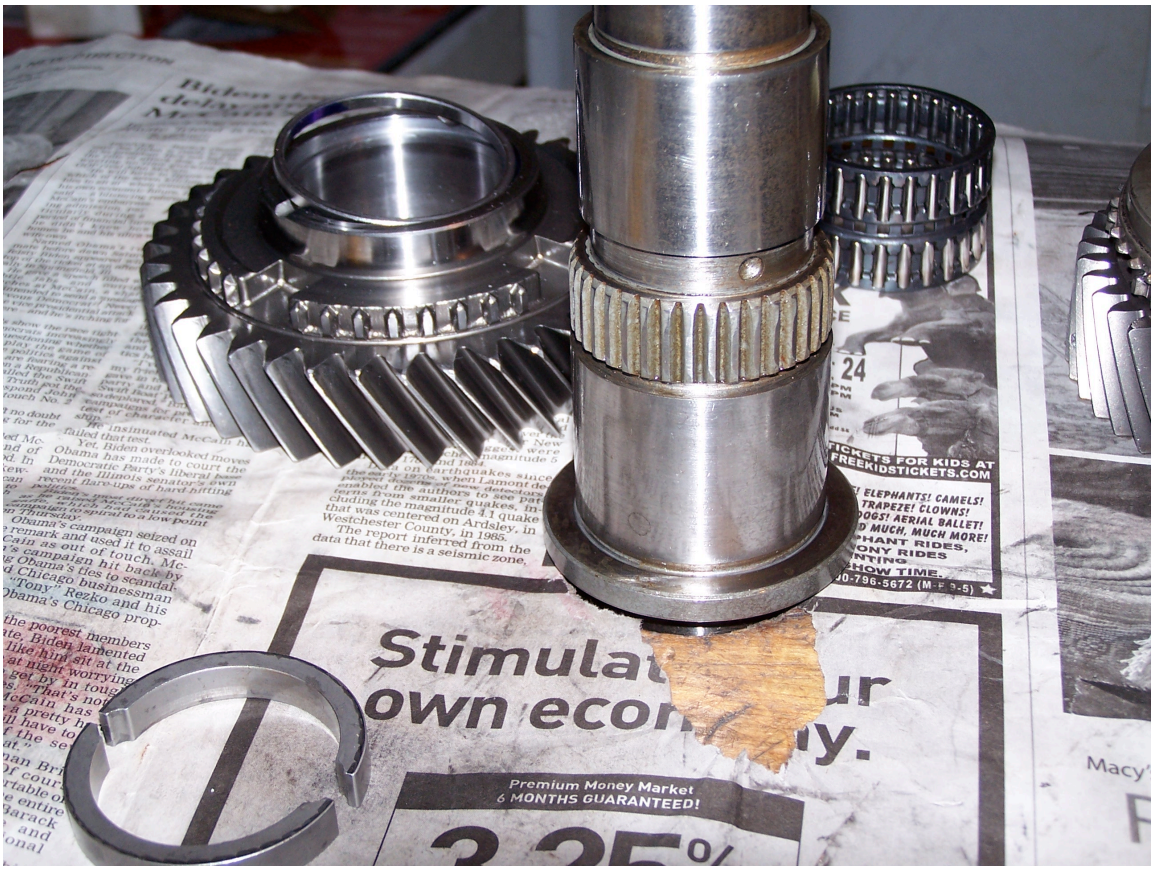


Figure 19: SSR main shaft 1-2 synchro lock retaining slot

Vehicle Speed Sensor (VSS)

Because the two different tail housings locate the VSS in different locations, you should be aware of which 2 or 3 VSS options in the Parts list and how they interact with the project. All VSS options are press-on / press-off for the SSR, not splined like the F-body/GTO applications. The Stock SSR tail housing locates the VSS forward of the F-body, and the factory VSS options are sized (1.380" ID) for this location. The stock SSR wheel is 40-tooth, and so may not be directly applicable to many retrofit applications regardless. Since the splines of the main shaft have to be smaller (1.375") to allow other parts to slide over them, there's no factory option for a VSS wheel when using a F-body/GTO tail housing. Instead you can use the Factory CTS-V VSS wheel, which is also a press-fit, but slightly smaller ID of 1.365". You can hone the ID of the CTS-V VSS to approximately 1.375" to allow a press fit of it down to the base of the main shaft output spline area. The CTS-V wheel can also be honed to 1.380" to press-fit onto the stock SSR location when a 17-tooth wheel is needed.

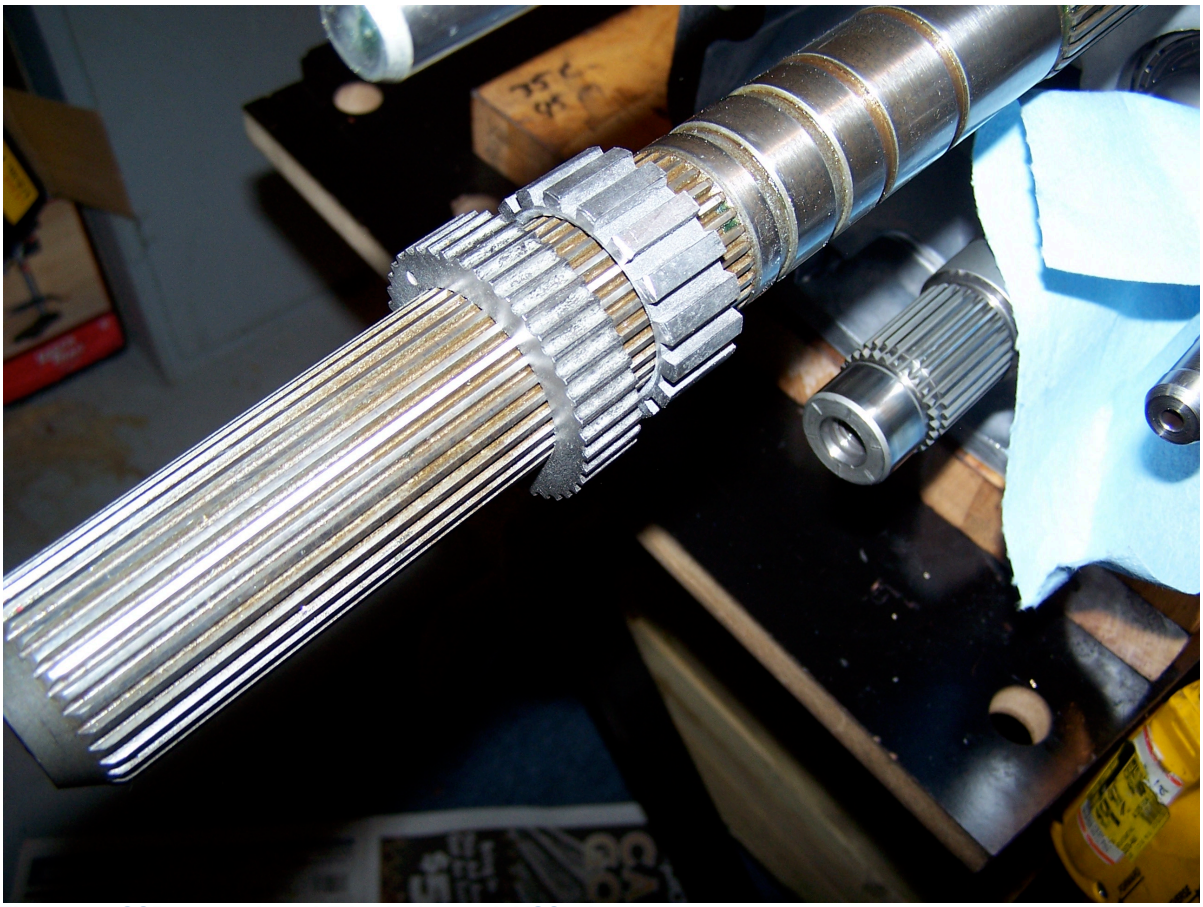


Figure 20: SSR 40-tooth and F-body 17-tooth VSS wheels

Parts Sources used for this write-up:

(GM) http://www.partszoneonline.com/
(Tremec) http://www.thegearbox.org/
(Tremec) http://www.autogear.net
(Spicer) http://www.drivetrainspecialists.com
(ACDelco) http://www.rockauto.com/

Parts & Labor / Assembly Sources used for this write-up:

(Maryland) http://rkt56.com/

Parts List and Pricing (as of 2010-03-28)

Part Number	Mfg / Source	Description	Qty. Req.	Price (Est.)
(1)		Mainshaft choices		
TUFP5211	Tremec	SSR Main shaft (32-spline output)	1	$160
89059965	GM	SSR Main shaft (32-spline output)	1	$185
TUFP2065	Tremec	GTO Main shaft (27-spline)	0/1	$150
92147285	GM	" " " "	0/1	$195
(2)		Tailhousing choices		
89059986	GM	SSR Tail housing (includes bushing and caged bearing)	0 / 1	$260
1386-566-024	Tremec	Fbody Tail housing	0 / 1	$160
(3)		Upgraded synchro retainer		
89059974	GM	Half-ring syncho washer	2	$75/ea
TURA 5203	Tremec	" " " "	2	$10/ea
89059975	GM	Outer-ring washer retainer	1	$18
TURA 5202	Tremec	" " " "	1	$10
N/A	N/A	4.75mm stainless ball bearing	1	N/A
(4)		Tail housing seal		
93432523	GM	SSR tail housing seal	0	$33
23049496	AC Delco	SSR tail housing seal	1	$6
(5)		VSS		
89059459	GM	SSR VSS (40-tooth)	0	$12
89059458	GM	CTS-V VSS (17-tooth)	1	$23
(6)		Extras		
89059987	GM	SSR tail caged bearing (FC67859) repair part.	0	$22
93436518	GM	SSR tail yoke bushing	0 / 1	$6
3-3-2431X	Spicer	TH400/SSR 1350 u-joint Slip-Yoke	1	$80
U1664	Strange	Billet Steel TH400/1350 Slip-yoke	0 / 1	$180
(7)		Misc for any conversion		
1386-100-007	Tremec	F-body Shift rail	0 / 1	$40
1386-014-008	Tremec	Shift guide plate	0 / 1	
1386-156-004	Tremec	" " detent spring	0 / 1	
1386-109-003	Tremec	" " detent ball	0 / 1	
1386-098-025	Tremec	" " offset lever	0 / 1	$32
1386-098-016	Tremec	Shifter offset lever	0 / 1	$30
1351-183-001	Tremec	Shifter bolts (M8x1.25)	0 / 4	
1386-039-001	Tremec	Shift guide inspection plate	0 / 1	$30
1332-043-004	Tremec	Roll pins 3/16x13/16	0 / 2	
TUEP2290	Tremec	LS F-body front-plate	0 / 1	$150

(8)		Machining (local costs)		
		1st gear step lip machining	1	$50
		Fbody tail housing bushing and seal bore for SSR	0 / 1	$100
		SSR tail housing shifter mount pad	0 / 1	$50
		CTS-v VSS hone	1	$20
(9)		Factory Parts for 1pc countershaft variations		
89059976	GM	2006 SSR (M10/MM6) 1st gear for upgraded 3pc synchro retainer	0	$150
TUEN5210	Tremec	" " " " "		$100
19132835	GM	2006 CTSv (M12) 1st gear for upgraded 3pc synchro retainer)	0	$130
89060072	GM	1pc Countershaft w/MM6 gear set	0/1	$360
89059979	GM	1pc Countershaft w/M10 gear set	0/1	$501
TURA4960	Tremec	1pc Countershaft 6th gear thrust washer	0/1	$18
19180037	GM	1pc Countershaft 5th gear thrust washer	0/1	$3
1386-193-004	Tremec	1pc Countershaft 5th gear thrust washer	0/1	$3
89059978	GM	1pc Countershaft Reverse splined drive gear	0/1	$140
AA20-070-009	Tremec	1pc Countershaft Reverse splined drive gear	0/1	$94
89059980	GM	5th drive gear for 1pc Countershaft	0/1	$140
TUEN4961	Tremec	5th drive gear for 1pc Countershaft		$128
89059981	GM	6th drive gear for 1pc Countershaft	0/1	$160
TUEN4962	Tremec	6th drive gear for 1pc Countershaft		$106
AA20-139-011	Tremec	Snap-Ring for splined Reverse gear	0/1	$15
12586566	GM	C6Z06 (MM6 1pc) T56	0	$3050
15229017	GM	SSR (M10) T56	0	$3475

Project Cost Examples

(Totals don't include donor transmission, repair items, wear items, Upgrade parts like steel fork, bronze fork pads, billet synchro keys, etc. and assembly labor if any)

Stock LS1 F-body T56 with C5 or C6 donor:

1)	SSR Mainshaft	$160
2)	Upgraded 1-2 synchro retainer	$175
3)	SSR bushing and Seal	$ 12
4)	CTS-V VSS	$ 23
5)	Spicer slip-yoke	$ 80
6)	Machining	
	a. 1st gear lip	
	b. F-body tail housing bore	
	c. VSS hone	
	d. Total Machine work	$170

Est. Total Parts/Machine-work $620

Stock LS1 F-body T56 with 2006 or later CTS-V donor:

1)	SSR Mainshaft	$160
2)	SSR bushing and Seal	$ 12
3)	Spicer slip-yoke	$ 80
4)	Machining	
	a. F-body tail housing bore	
	b. VSS hone	
	c. Total Machine work	$120

Est. Total Parts/Machine-work $372

No F-body core with C5 or C6 donor:

1)	SSR Mainshaft	$160
2)	Upgraded 1-2 synchro retainer	$175
3)	LS F-body front-plate	$150
4)	LS F-body tail housing	$160
5)	SSR bushing and Seal	$ 12
6)	CTS-V VSS	$ 23
7)	Spicer slip-yoke	$ 80
8)	Machining	
	a. 1st gear lip	
	b. F-body tail housing bore	
	c. VSS hone	
	d. Total Machine work	$170
9)	F-body shift rail components	~$150

Est. Total Parts/Machine-work $1080

No F-body core with 2006 or later CTS-V donor:

1)	SSR Mainshaft	$160
2)	LS F-body tail housing	$160
3)	SSR bushing and Seal	$ 12
4)	Spicer slip-yoke	$ 80
5)	Machining	
	a. F-body tail housing bore	
	b. VSS hone	
	c. Total Machine work	$170
6)	F-body shift rail components	~$150

Est. Total Parts/Machine-work $732

Acknowledgements

Special thanks goes out to Rick Kim (LS123 on ls1tech.com) of http://rkt56.com/ for assisting with information and parts to make this project possible. Long Engine Works in Elkton, MD (410.392.6887) did the local machine work. If you build one of these T56s, I'd love to hear from you and get pictures of you project.

Thanks! Mike Davis (85MikeTPI on ls1tech.com and most forums)

http://www.eecis.udel.edu/~davis/z28 ← and email to "davis@" with the "www" removed

Additional contributions:

Erik (**SYRacing on ls1tech.com) – Additional Tremec part numbers for building SSR OEM clone.**

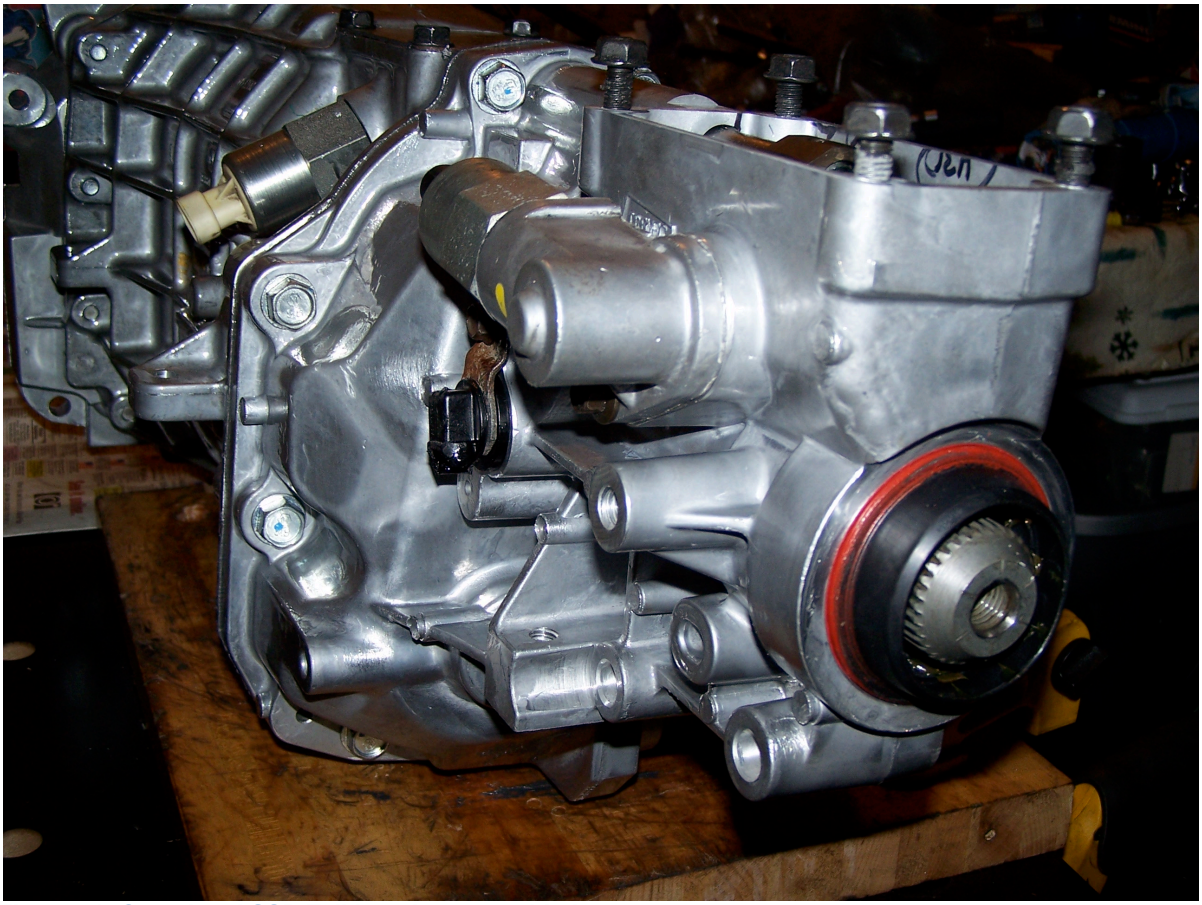


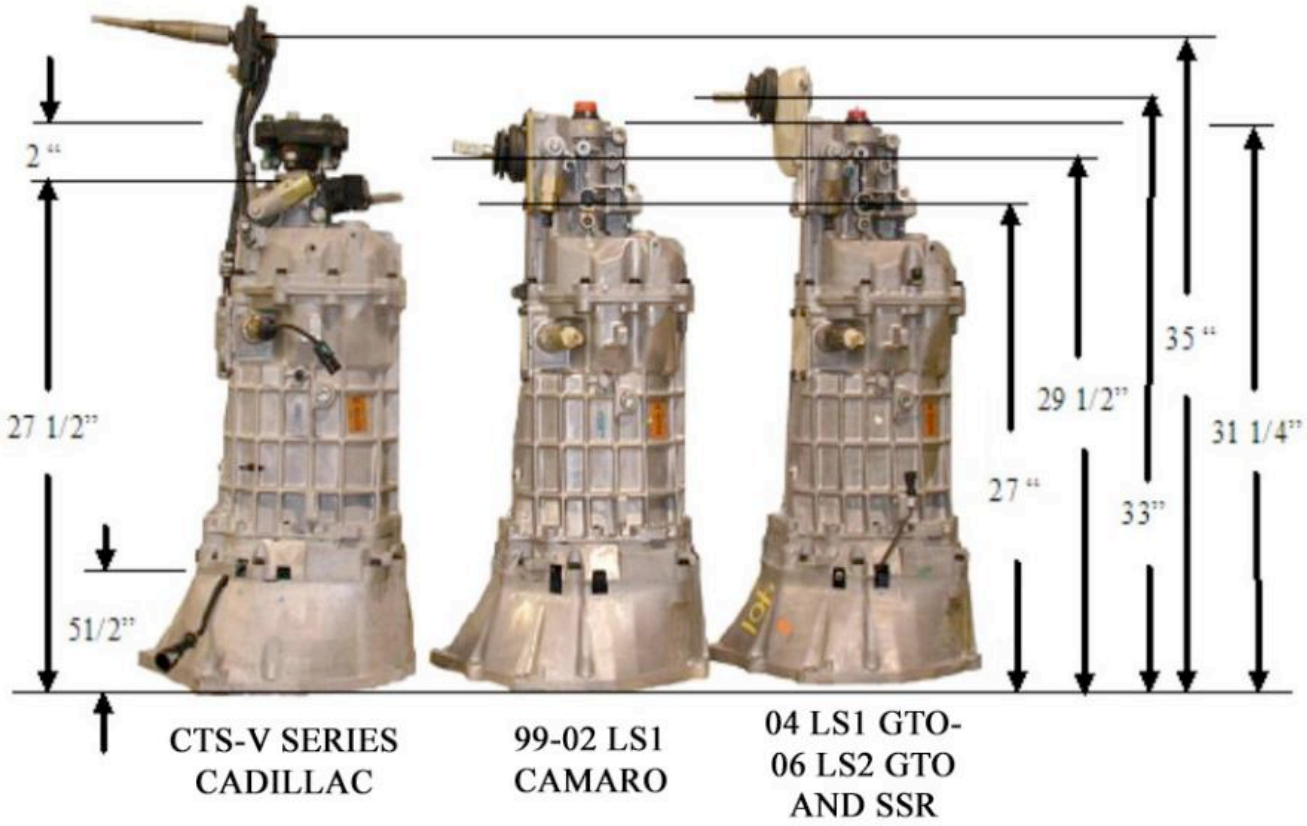
Figure 21: Completed SSR Tail housing assembled

Figure 22: LS1 F-body Front Plate with C6 input shaft

Appendix A: Gear Ratios

GM T56 Gear Ratios		'93 M28	'93 M29	MM6	M12	M10	MZ6
1		3.36	2.97	2.66	2.97	3.01	2.97
2		2.07	2.07	1.78	2.07	2.07	2.07
3		1.35	1.43	1.30	1.43	1.43	1.43
4		1.00	1.00	1.00	1.00	1.00	1.00
5		0.80	0.80	0.74	0.84	0.84	0.71
6		0.62	0.62	0.50	0.57	0.57	0.57
REV		3.28	3.28	2.90	3.28	3.28	3.28

Appendix B: Dimensions



Appendix C: GM T56 Gearset teeth counts

Gear Teeth - Driven/ Drive	'93 M28	'93 M29	MM6	M12	M10	MZ6
1	41/16	43/19	39/17	43/19	39/17	43/19
2	41/26	41/26	43/28	41/26	41/26	41/26
3	35/34	37/34	37/33	37/34	37/34	37/34
4*	38/29	38/29	36/31	38/29	38/29	38/29
5	36/59	36/59	37/58	37/58	37/58	34/63
6	31/65	31/65	29/67	29/67	29/67	29/67
REV	14/23/35	14/23/35	14/23/35	14/23/35	14/23/35	14/23/35

The gear ratios in Appendix A, are obtained from the gear tooth ratios in Appendix C and some insight into the T56 operation. (*)The input shaft is considered 4th gear, but the 1:1 4th gear ratio is a result of the input shaft being locked directly to the output(main) shaft. This has the least amount of parasitic losses and no torque-multiplication going on and why chassis dynometer testing should be done in 4th gear on T56 cars. When not in 4th, the gear teeth on the input shaft turn a countershaft (drive gears), which determines the gear ratios. In addition, since the input shaft and countershaft don't have the same number of teeth, then there is a "global" constant gear ratio value that affects all the other gears. We can use the MM6 gear set as an example:

MM6
The gear on the input shaft is 31 teeth, it drives the counter shaft gear with 36 teeth, for a constant .86 reduction in countershaft speed.

The 1st gear counter gear is 17t, mainshaft 39t = 2.294 / .86 = 2.66
The 2nd gear counter gear is 28t, mainshaft 43t = 1.536/ .86 = 1.78
The 3rd gear counter gear is 33t, mainshaft 37t = 1.121/ .86 = 1.30
4th gear is just locking the mainshaft to the input shaft = 1.0000000
The 5th gear ext. gear is 58t, mainshaft 37t = 0.638/ .86 = 0.740
The 6th gear ext. gear is 67t, mainshaft 29t = 0.433/ .86 = 0.503

Rev gear counter is 14t, mainshaft 35t, case 23t = 2.5 / .86 = 2.90

Notice that the SSR M10 is in fact, a hybrid of sorts already. GM took the stronger 1st gear tooth ratio of the MM6 along with the MM6 driven 1st gear, and applied it to the wide-ratio M12 gears to help move the 6050-pound GVWR of the SSR. The SSR input shaft, and the driven (mainshaft) 2nd and 3rd gears are all taken directly from the CTSv T56. It's not a coincidence that the SSR uses the same upgraded 1-2 synchronizer locking-ring as the CTSv T56. The strength of the SSR T56 is foremost in the mainshaft diameter. Performing the hybrid build as documented in this write-up does not result in a T56 weaker than the SSR, in most cases the hybrid will be stronger than the original. The only internal components new/unique in the SSR T56 were the mainshaft, which we use in the hybrid, and the 1pc countershaft, which we get if using the C6-Z06 donor. Otherwise the MM6/M12 2pc countershaft is tested durable, the only weak spot would be if trying to WOT shift into 5th or 6th gear. By shimming the 2pc extension shaft to a tight tolerance, it can be made to withstand a large portion of the power that a 1pc can handle. If the 1pc countershaft is a must-have item for your hybrid, I've pieced together the part numbers in the Parts List, section 9, for you. For under $800, you can add the C6-Z06 1pc countershaft, thrust washers, and splined reverse gear to duplicate the strength of the C6-Z06 on a base C5 T56 MM6 donor.