# TORQUE ON DEMAND(TOD)

3240-01

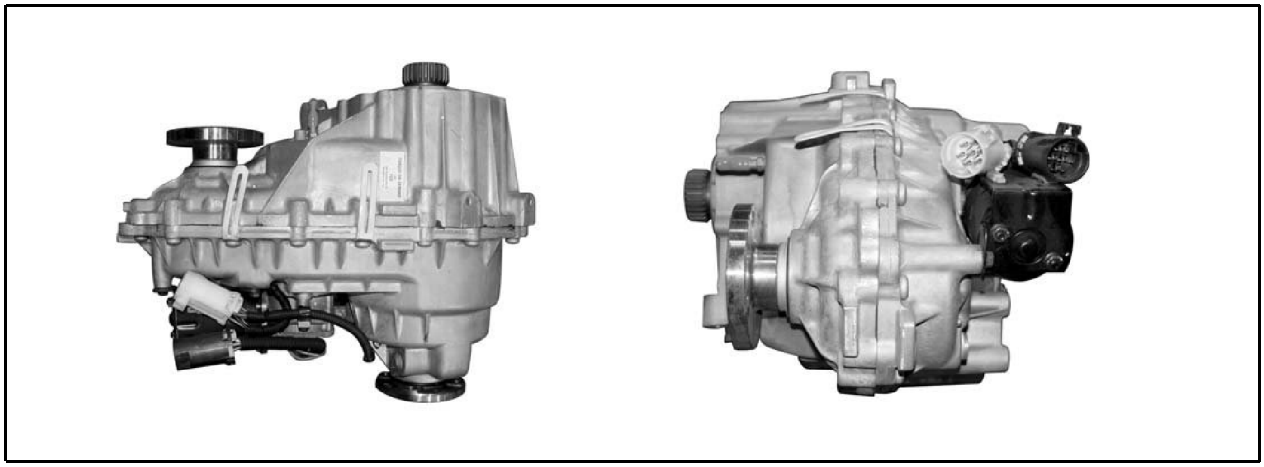
## GENERAL

## 1. SPECIFICATIONS

| Description | | | Specification |
|---|---|---|---|
| TOD | Model | | TOD transfer case |
| | Overall length | | 343.0 mm |
| | Weight (including oil) | | 37.9 kg |
| | Shifting mode | | 4H and 4L |
| | Gear ratio | High | 1:1 |
| | | Low | 2.48:1 |
| | Oil specification | Specification | Ssangyong genuine oil (ATF S-3, S-4 or Dexron II/III) |
| | | Capacity | ≒1.4ℓ |
| | | Change interval | Check at every 15,000 km, replace at every 60,000 km |
| TOD control unit | Maximum torque (front) | | Approx. 76 kg•m |
| | Voltage | Normal operating range | 9 ~ 16 V |
| | | CAN communication | 6 ~ 16 V |
| | Current (below maximum operating voltage) | IG switch OFF | 2 mA |
| | | IG switch ON | 1 A |
| | Maximum operating current | Motor OFF | 7 A |
| | | Motor ON | 20 A |

# OVERVIEW AND OPERATION PROCESS

## 1. OVERVIEW



TOD system means the full time 4WD system and the registered trade mark of Borg Warner.
TOD is an abbreviation of Torque On Demand.

TOD (Torque On Demand) system, which is superior than existing Full Time 4WD, checks the road surface and vehicle conditions via various sensors and, subsequently, according to the situations and conditions, distributes the most optimal driving force to front wheels and rear wheels by activating the electro-magnetic clutch located inside of TOD Transfer Case.

TOD receives the speed signals from speed sensors installed in front axle and rear axle, the TPS signals from engine, and the operating signals from ABS control unit via CAN. Based on these data, TOD control unit controls the electro-magnetic clutch to distribute the 3:97 ~ 44:56 of driving force to front wheels and rear wheels.

The conventional system uses "FR driving" (theoretically, the 100% of driving force is transferred to rear wheels) on normal paved road. When the system detects a slip in the rear wheels, a proper percentage of driving force is transferred to front wheels.

TOD control unit receives the wheel speed signals from the speed sensors in propeller shaft of transfer case and engine output information from the engine control unit. TOD control unit changes the pressure force of the electromagnetic clutch based on the analyzed data.



| | |
|---|---|
| Modification basis | |
| Application basis | |
| Affected VIN | |

# 1) Distribution of Driving Force According to Road Surface

1. On normal road surface In vehicle with existing part time transfer case, when a driver turns the steering wheel to park in the 4WD mode, the vehicle may halt sensation of tight corner braking phenomena. However, in vehicle with TOD system, this phenomena does not occur and the driving force is properly and automatically distributed.
2. On paved road with high speed Driving at high speed on roads such as highway mainly uses rear wheels as driving wheel. At this moment, some of torques is also distributed to front wheels so that the vehicle could maintain safe ground grab capacity against side winds and rain. Distribution ratio: 15% for front wheels and 85% for rear wheels.
3. When turning on the road with low friction rate During cornering on roads such as unpaved, snowy, icy and muddy, ground grab capacity is increased by distributing required torque and, at the same time, comfortable steering operation is maintained by controlling the ground grab capacity at high level.
   Distribution ratio: 30 % for front wheels and 70 % for rear wheels.
4. When climbing or starting off on the road with low friction rate In order to secure the maximum ground grab capacity and driving force during climbing or starting off on the roads such as unpaved, snowy and icy road, the system controls the driving force to distribute properly in full 4WD mode. Distribution ratio: 50 % for front wheels and 50 % for rear wheels.

## 2) Function

**Selection Mode**

The TOD system has 2 selectable mode, 4H and 4L. 4H is the normal operating mode when drive of which gear ratio is 1:1 and 4L mode distributes power to front and rear wheels 50 : 50 of which gear ratio is 2.48:1.

▶4L Mode

When selecting 4L mode, EMC is locked to apply maximum torque into front and rear propeller shafts. Shift motor rotates also 4L position by rotation of cam thus propeller shaft torque changes from 1:1 to 2.48:1 by planetary gear set.

**▶Releasing the 4L Mode**

When selecting 4H mode, 4L drive mode is released and 4H mode is resumed.

· "4H" switch: Self-return type
· "4L" switch: Push lock type

## 3) 4WD Operation Overview

| Application | Mode Position | | Operation Condition |
|---|---|---|---|
| Driving type | 4H | 4WD Drive (High Speed) | Normal Driving on the normal road or highway, or high speed driving.<br>Slipped road such as snow, rainy, sand, mud etc. |
| | 4L | 4WD Drive (Low Speed) | Max driving force requiring condition such as towing, rough road.<br>Same function as part time transfer case 4L. |
| Transferring | 4H ↔ 4L | 4WD Drive High Speed ↔ Low Speed | A vehicle should stop for transfer.<br>Manual Transmission<br>• Transfer starts after the vehicle stops and the clutch is applied<br>Automatic Transmission<br>• Transfer starts after the vehicle stops and the shift lever is shifted [N] position. |

**CAUTION**

- To make the mode shift easier, stop the vehicle, depress the brake pedal, select the mode switch, and move the selector lever with the sequence of [N-P-N].



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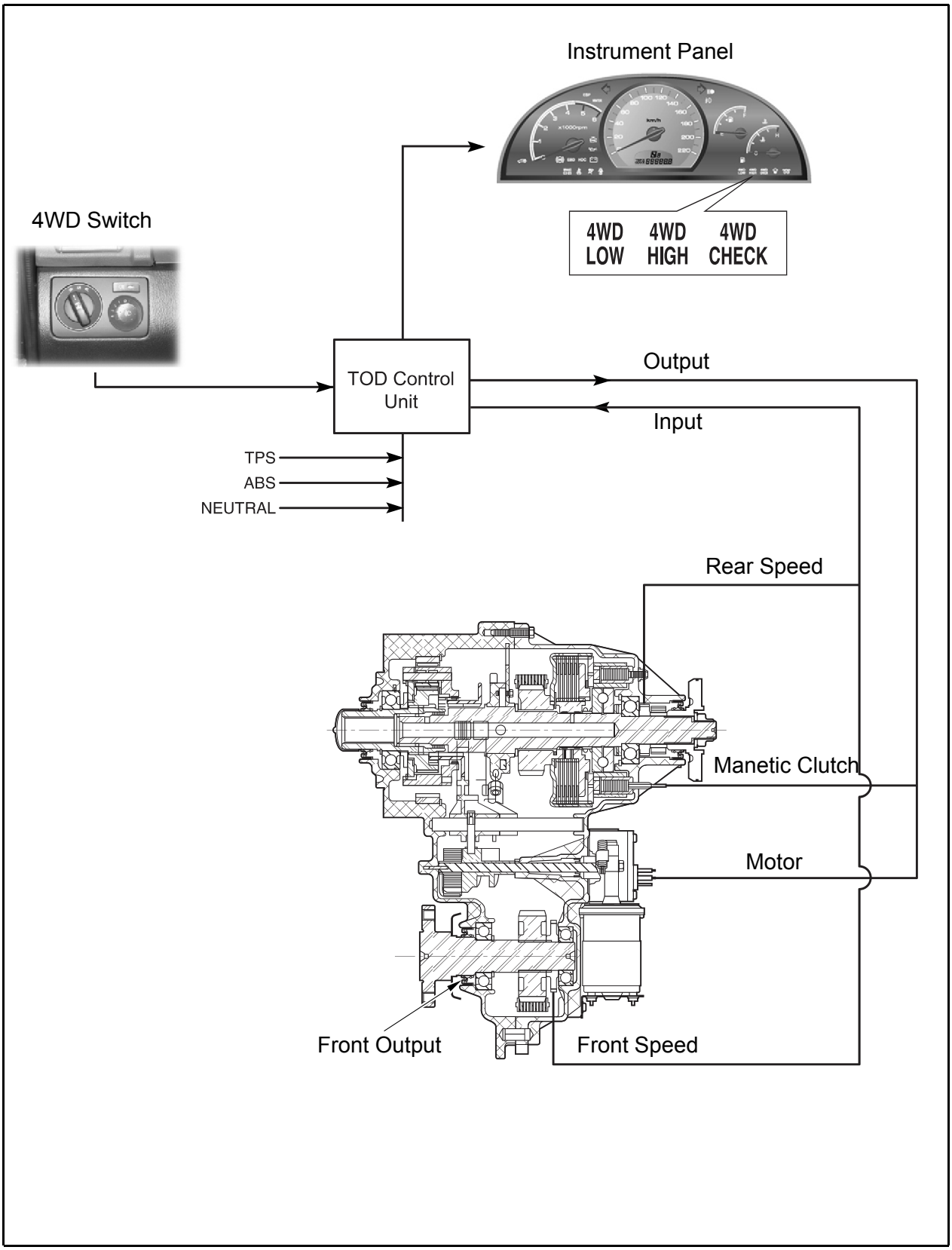
# 2. POWER FLOW

▶ System Layout

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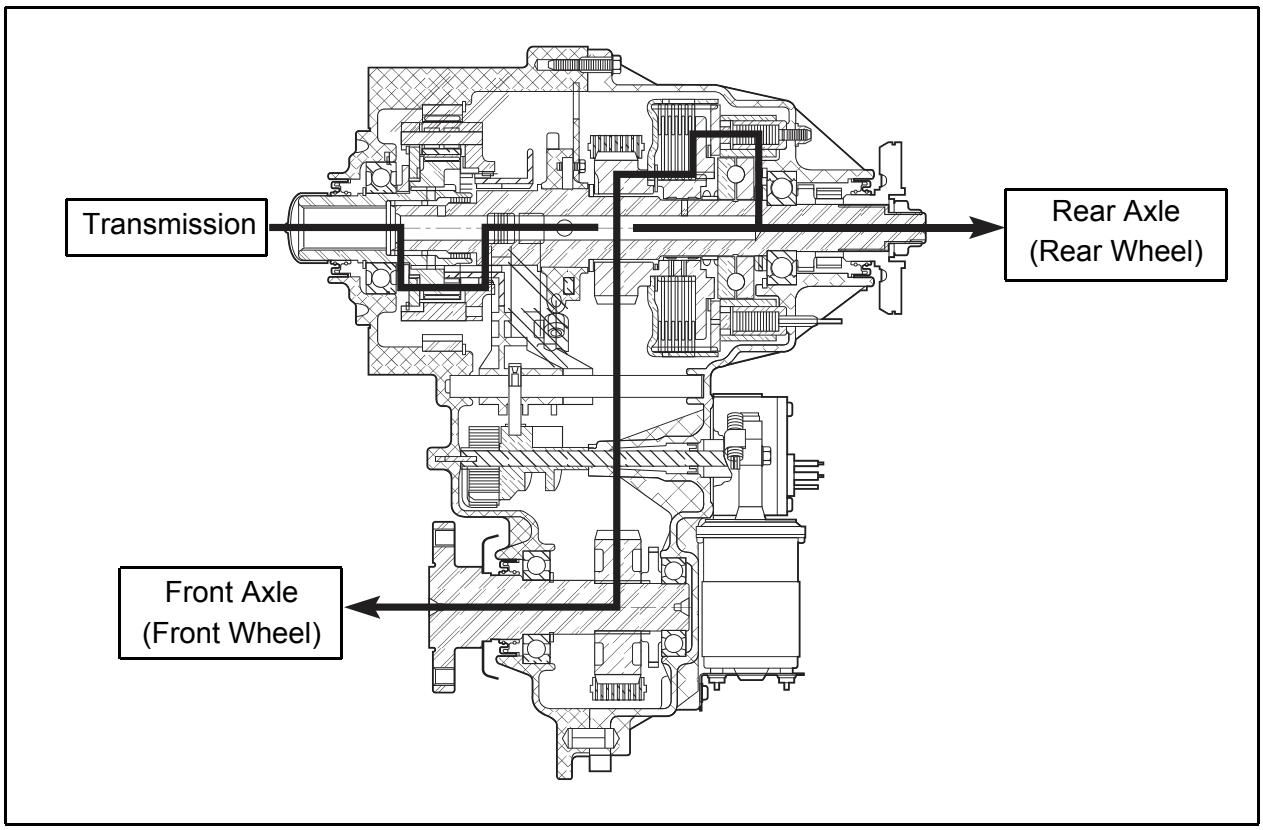
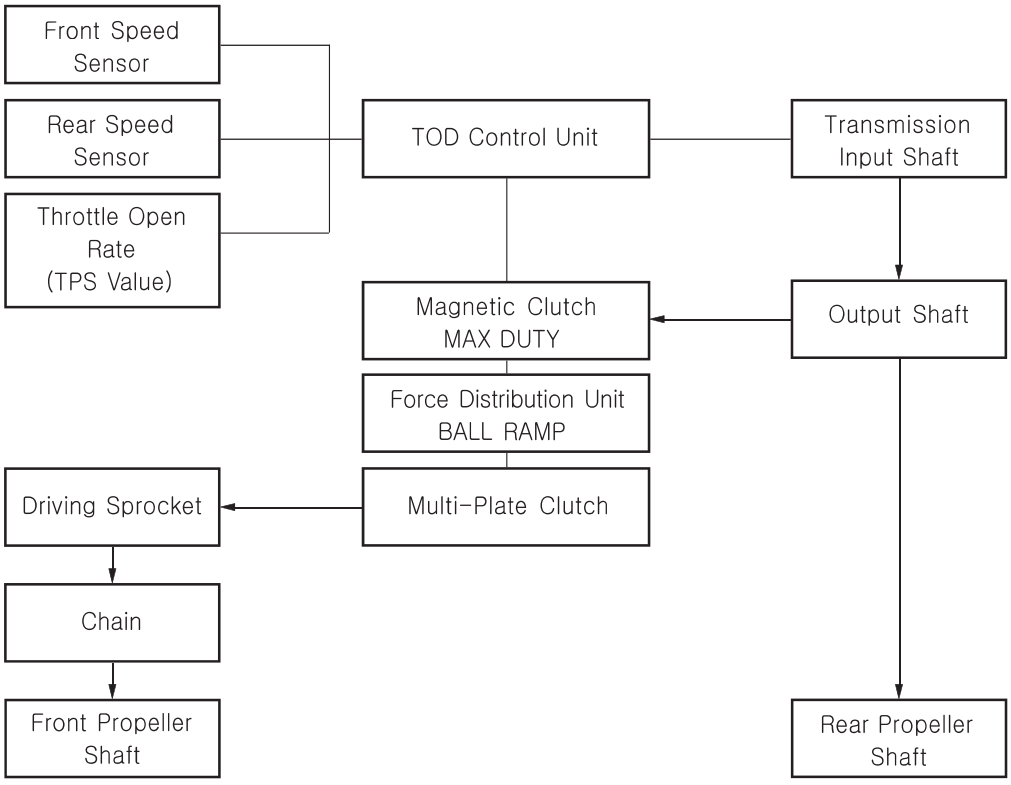
▶ 4H Mode (4WD Drive - High Speed)



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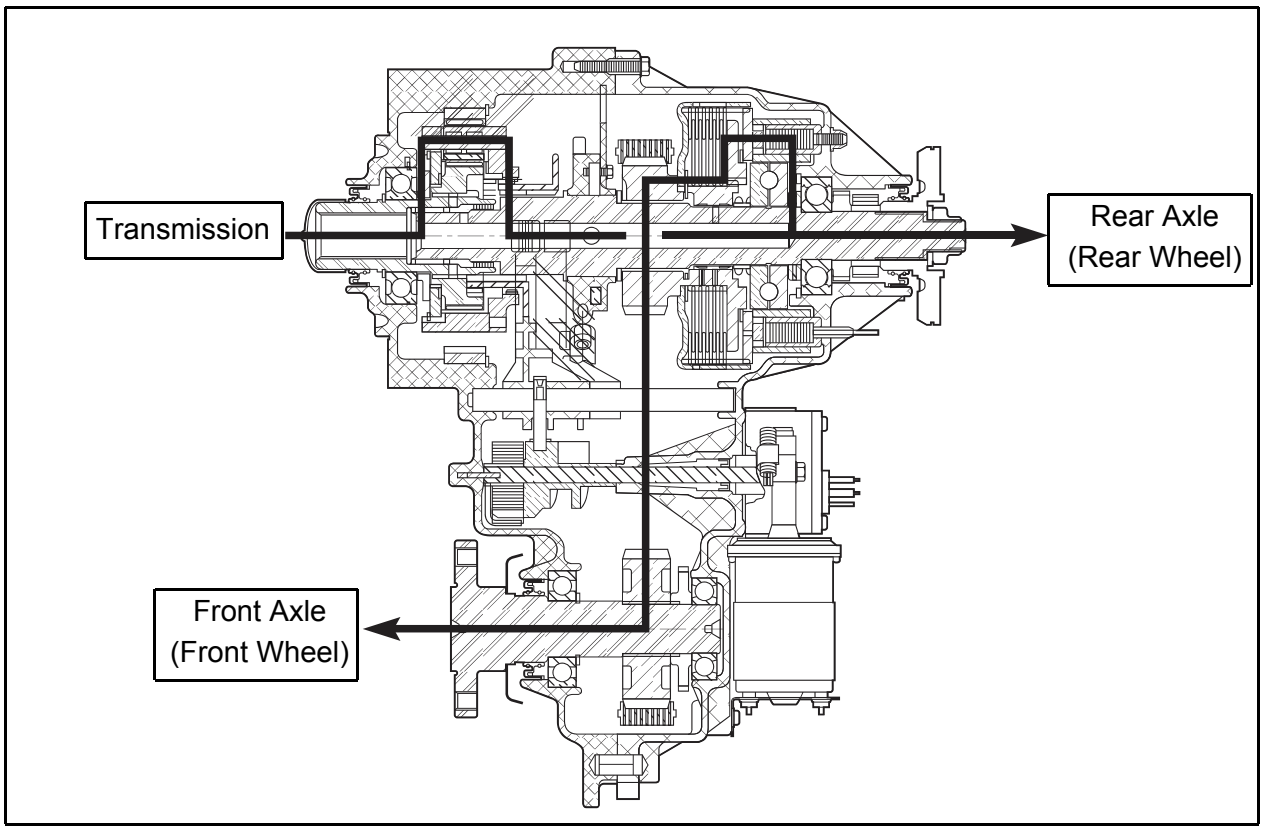
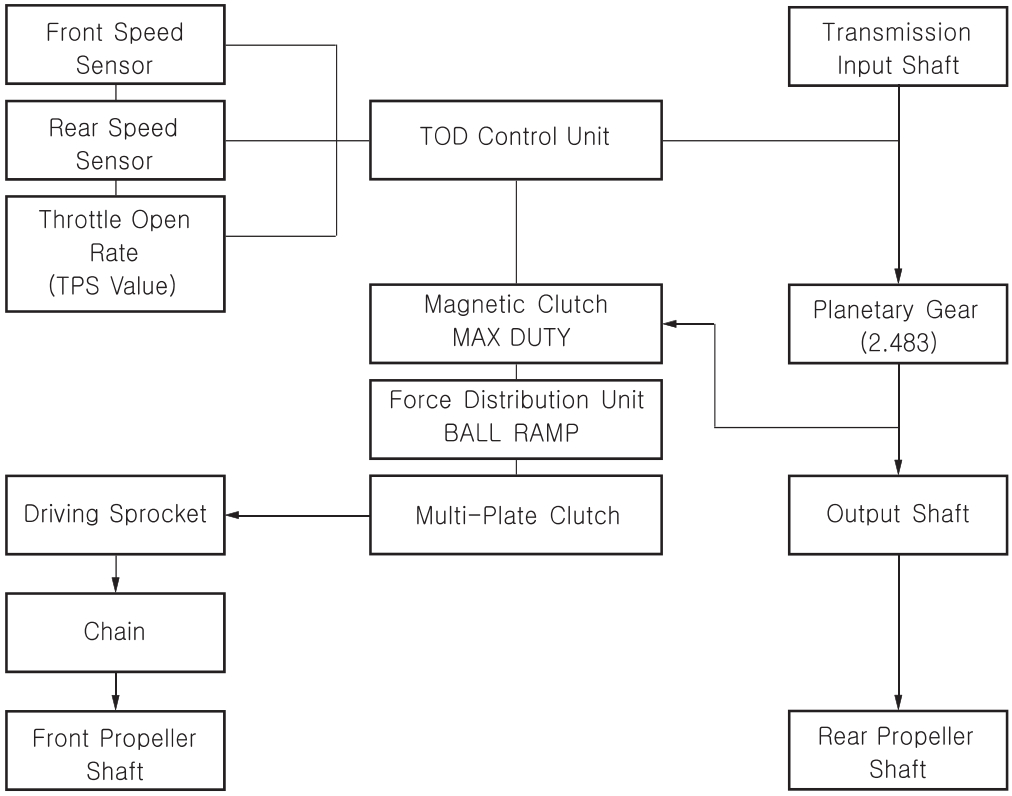
▶ 4L Mode (4WD Drive - Low Speed)

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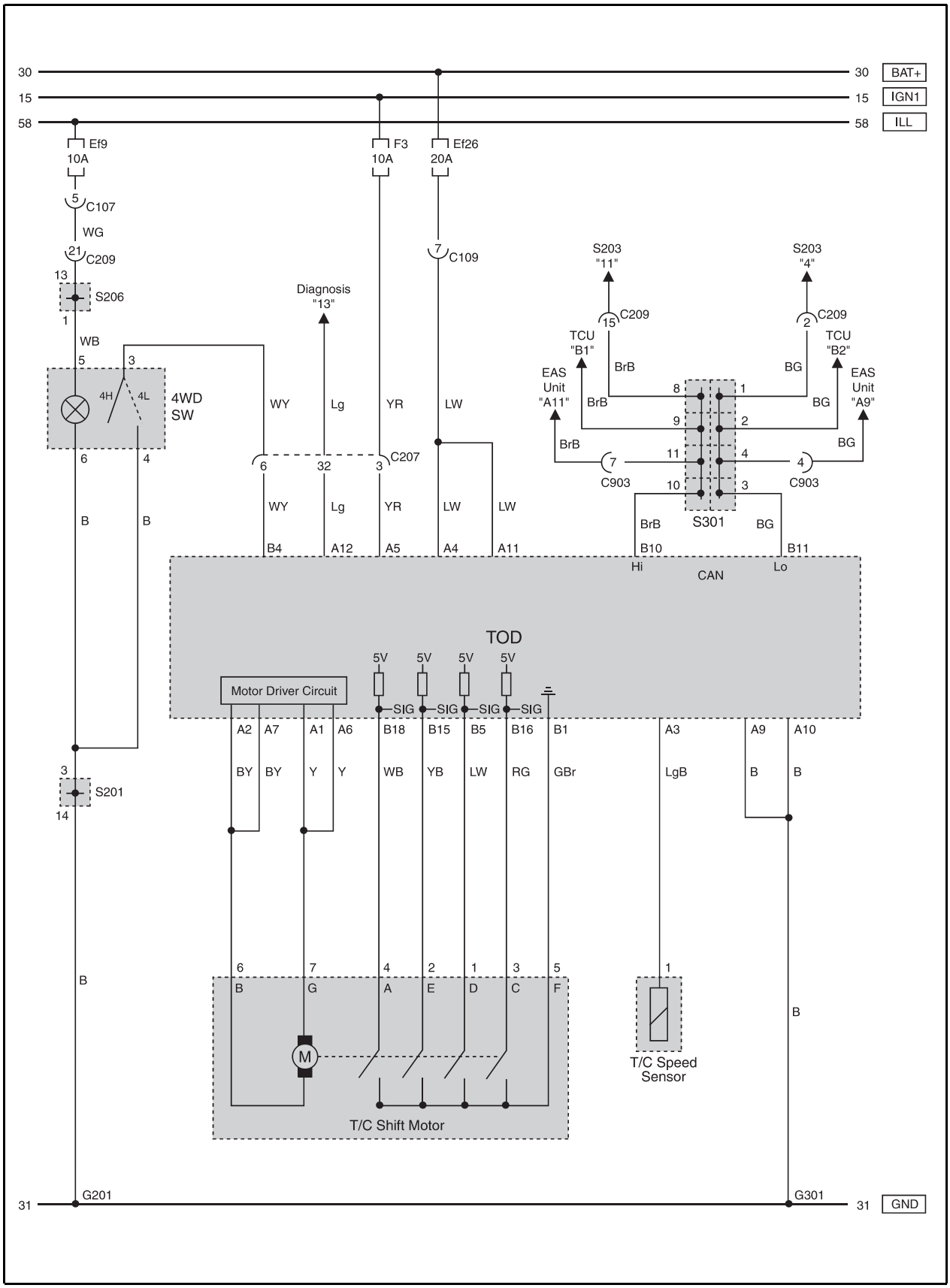
# 3. CIRCUIT DIAGRAM



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