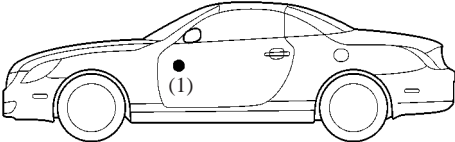
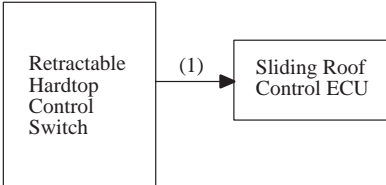
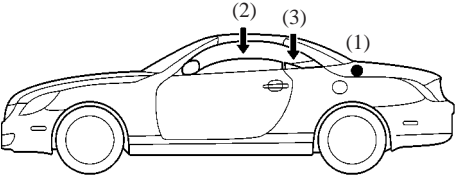
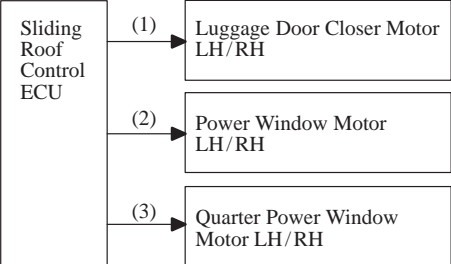
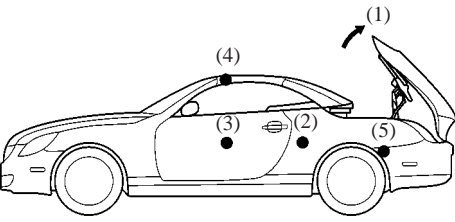
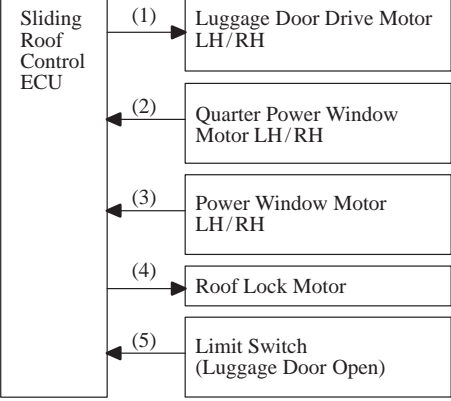
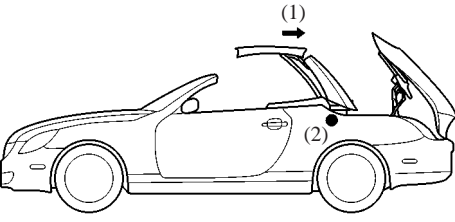
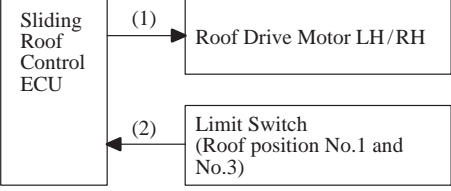
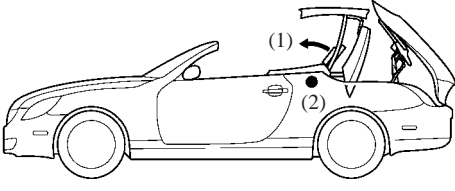
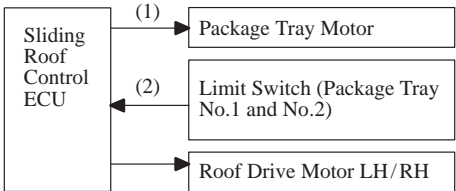
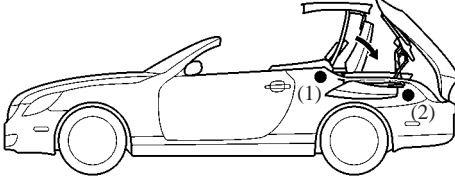
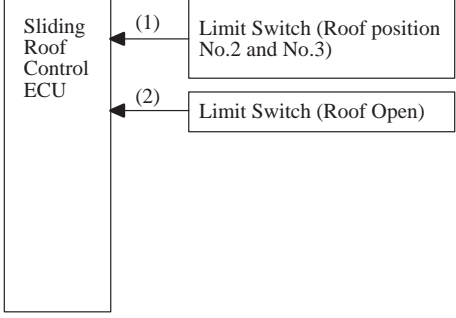
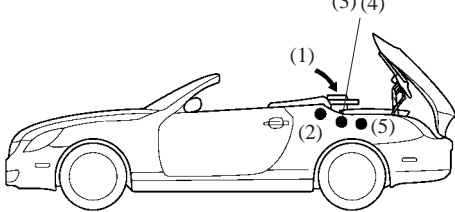
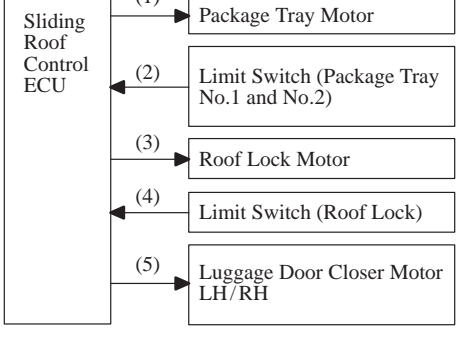
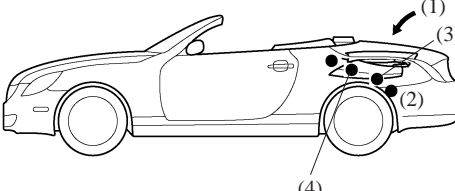
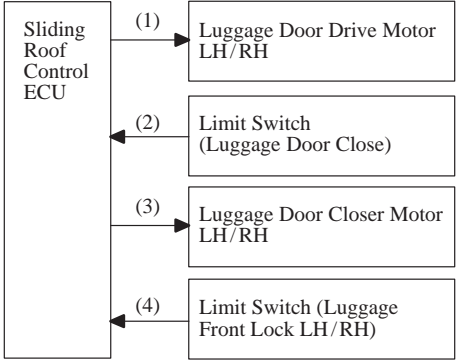


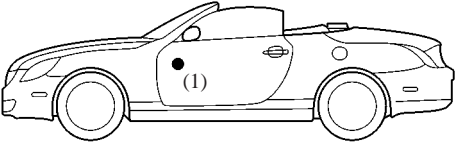
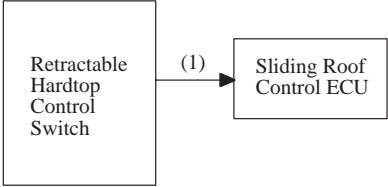
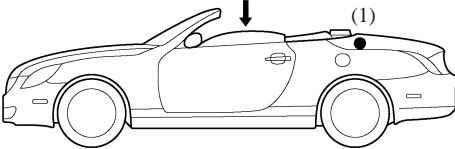
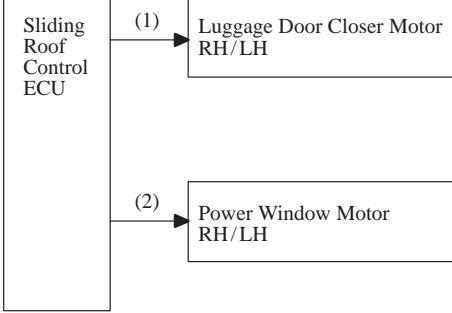
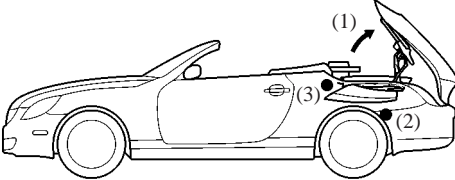
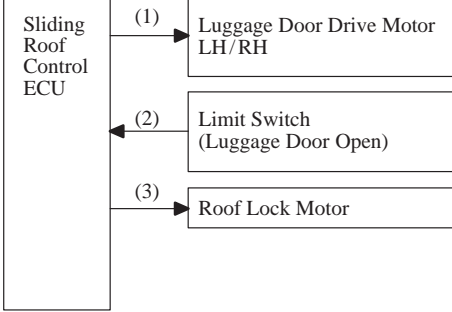
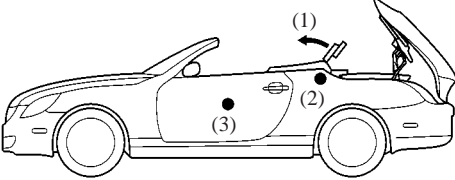
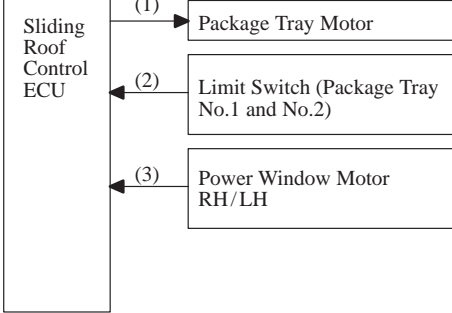
■ SYSTEM CONTROL

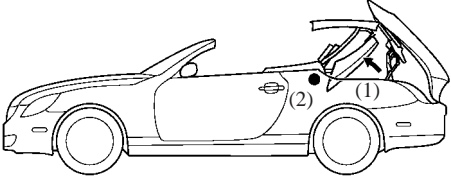
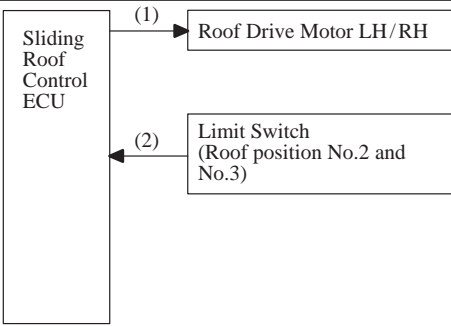
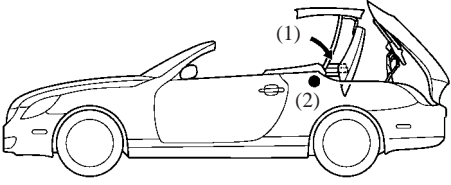
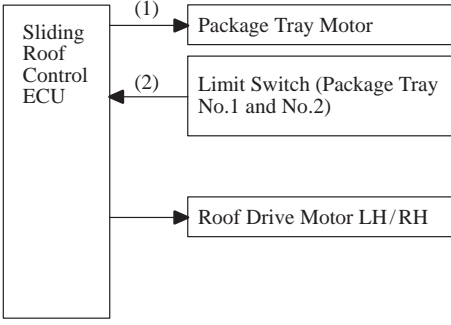
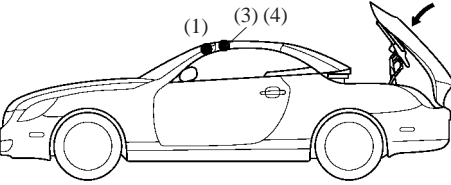
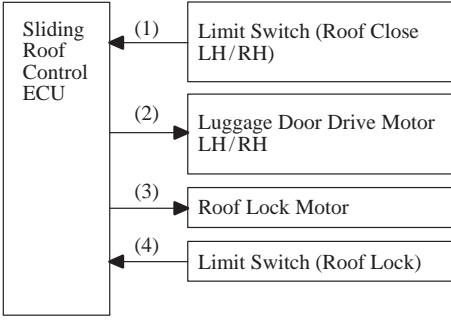
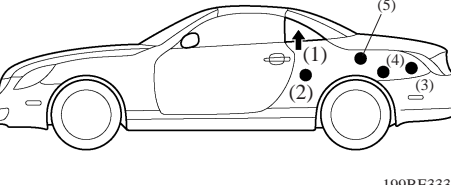
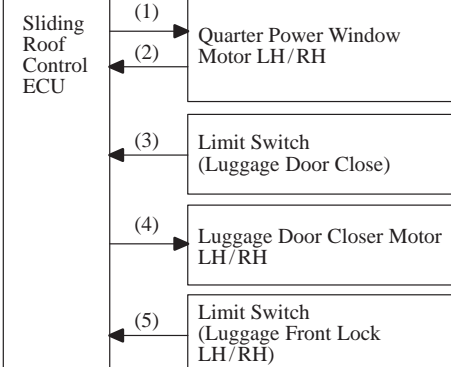
1. Operation of Roof Opening

Retractable hardtop condition	Control signal	Description
<p>1. Full close condition</p>  <p>199BE318</p>		<p>(1) Operates Retractable hardtop control switch to open</p>
<p>2. Luggage door front lock release operation</p>  <p>199BE319</p>		<p>(1) Unlocks Luggage door front lock LH/RH (2) Opens Door window LH/RH (3) Opens Quarter window LH/RH</p>
<p>3. Luggage door front side open</p>  <p>199BE320</p>		<p>(1) Opens Luggage door front (2) Detects Quarter window full open condition (3) Detects Door window opening position (4) Releases Roof lock (5) Detects Luggage door front full open condition</p>
<p>4. Roof opening operation (1)</p>  <p>199BE321</p>		<p>(1) Opens Roof (2) Detects Roof position</p>

<p>5. Package tray trim tilt-up operation</p>  <p>199BE322</p>		<p>(1) Tilt-up Package tray trim (2) Detects Package tray trim tilt-up position</p> <p>Under Roof opening</p>
<p>6. Roof opening operation (2)</p>  <p>199BE323</p>		<p>(1) Detects Roof position (2) Detects Roof full open condition</p>
<p>7. Package tray trim tilt-down operation</p>  <p>199BE324</p>		<p>(1) Operates Package tray trim (2) Detects tilt down and swing operation of Package tray trim (3) Operates Roof lock in luggage compartment (4) Detects Roof lock completion (5) Changes Luggage door front lock position in neutral position</p>
<p>8. Luggage door front side closing operation</p>  <p>199BE325</p>		<p>(1) Closes Luggage door front (2) Detects Luggage door full close condition (3) Locks Luggage door front lock (4) Detects lock completion of Luggage door front lock</p>

2. Operation of Roof Closing

Retractable hardtop condition	Control signal	Description
<p>1. Full open condition</p>  <p style="text-align: right;">199BE326</p>		<p>(1) Operates Retractable hardtop control switch to close</p>
<p>2. Luggage door front lock release operation</p>  <p style="text-align: right;">199BE327</p>		<p>(1) Unlocks Luggage door front lock LH/RH (2) Opens Door window LH/RH</p>
<p>3. Luggage door front side opening operation</p>  <p style="text-align: right;">199BE328</p>		<p>(1) Opens Luggage door front (2) Detects Luggage door front full-open condition (3) Unlocks Roof lock</p>
<p>4. Package tray trim tilt-up operation</p>  <p style="text-align: right;">199BE329</p>		<p>(1) Operates Package tray trim (Tilt-up and swing) (2) Detects Package tray trim tilt-up position (3) Detects Door window opening position</p>

<p>5. Roof closing operation (1)</p>  <p>199BE330</p>		<p>(1) Closes Roof (2) Detects Roof position</p>
<p>6. Package tray trim tilt-down operation</p>  <p>199BE331</p>		<p>(1) Tilt-down Package tray trim (2) Detects Package tray trim tilt-down position</p> <p>Under Roof closing</p>
<p>7. Luggage door front side closing operation</p>  <p>199BE332</p>		<p>(1) Detects Roof full close condition (2) Closes Luggage door front (3) Locks Roof lock (4) Detects Roof lock completion</p>
<p>8. Quarter window closing operation</p>  <p>199BE333</p>		<p>(1) Closes Quarter window (2) Detects Quarter window full close condition (3) Detects Luggage door full close condition (4) Locks Luggage door front lock (5) Detects lock completion of Luggage front lock</p>

3. Operating Condition

In case that the following conditions are satisfied with “and”-condition, this retractable hard top system will operate.

- IG switch is “ON”
- Vehicle speed : less than 5 km/h or Approx. 3 mph
- Luggage opener main switch is “ON”
- Tonneau cover switch is “ON” when roof opening only (Tonneau cover is in Pull out blind)
- Luggage compartment door lock motor and Detection SW is “ON”
(When the switch failure, operation is inhibited. When the communication failure on BEAN, this condition is omitted)
- Outside temperature is more than approx. –20 degrees centigrade

4. Package Tray Trim Linked Control

Operation

- Package tray trim assembly is operated when Roof reaches to specified position detected by three limit switches (Roof position No.1, No.2 and No.3)

Package tray await control

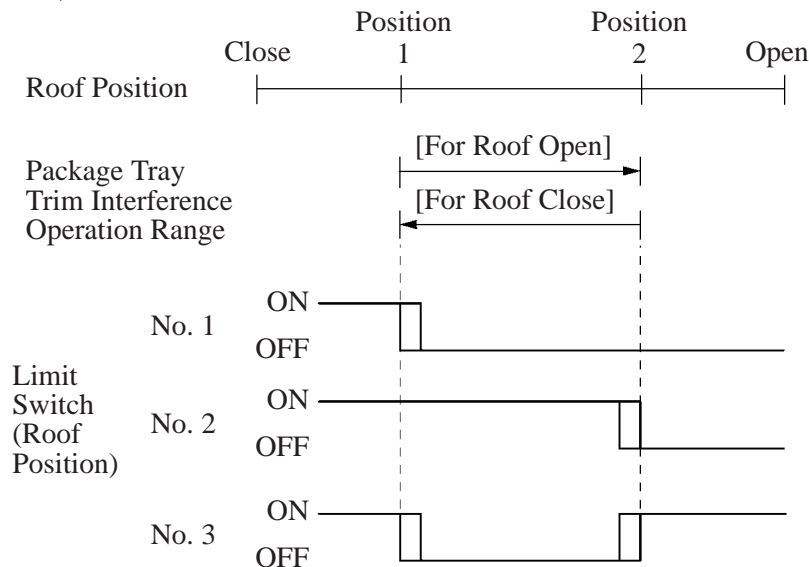
(1) Open control:

In case that the roof is in the middle (position 2) and the package tray trim assembly is not fully open, it returns to the middle (position 1) and waits for the operation of the package tray trim assembly.

(2) Close control:

In case that the roof is in the middle (position 1) and the package tray trim assembly is not fully closed, it stops operation and waits for the operation of the package tray trim assembly.

(Switching position)



199BE352

5. Door Window Linked Control

- While operating the opening and closing of the retractable hardtop, if the door window is closed, it will go down before the retractable hardtop starts operating.
- When door windows open 1/3 or more, Retractable hardtop starts to operate
- Power window switch is operated manually while Door window linked control, Retractable hardtop operation is continued if door window is opened 1/3 or more.

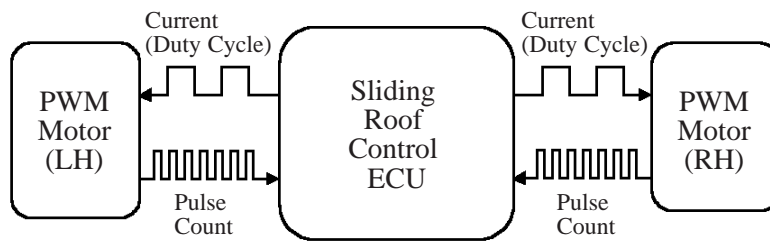
6. Other Control

Motor Speed Control

1) Speed Control

- The roof motors (LH/RH) and the luggage motors (LH/RH) control speed with current controlled by duty cycle (PWM-Pulse Width Modulator), and these motors feed back motor pulse count to detect the motor rotation position and speed.
Thus realizing the crosswise synchronous control and optimal speed control as a slow start/slow stop control.

(Motor control)

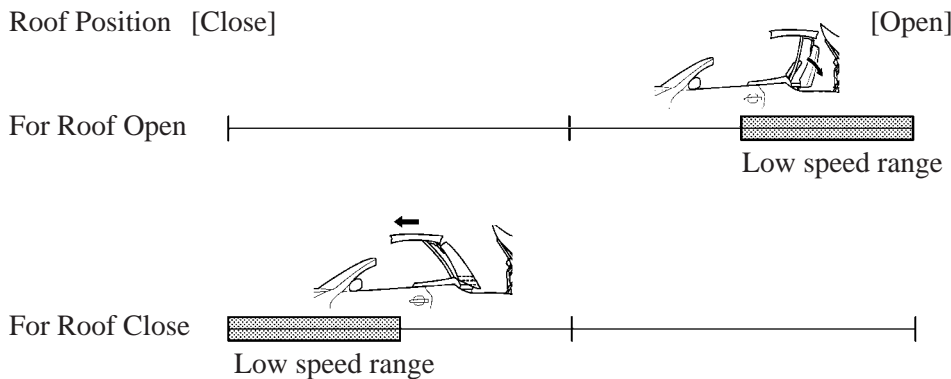


199BE353

2) Slow Start/Slow Stop Control

- At the time of starting the retractable hardtop operation, the operation of the roof is started at low speed and the speed is increased gradually.
- In the low speed range when the roof is just before fully closed or fully opened, opening and closing operation speed is gradually decreased to low speed.
- In case of the roof opening and closing from the low speed range, the roof keeps the low speed retention operation.
- The recognition of the low speed range is judged by the motor pulse count. When the motor pulse signal of the roof is abnormal, the roof always keeps the low speed retention operation.

(Switching position)



199BE351

3) Synchronization Control

- It has been adopted for the roof drive motor LH/RH to drive the roof and the luggage door drive motor LH/RH to drive the luggage door.
- By memorizing the motor position at the time of starting the retractable hardtop operation as an initial position, it counts the number of the motor pulse in order to make both right and left motor run with the same speed and detects the motor rotation position (roof position), and controls to make the speed per unit time equal.

Door Window Manual Operation Control

When the following operation is done, door window is closed automatically after completion of retractable hardtop operation both opening/closing;

- Retractable hardtop control switch is depressed continuously
- Retractable hardtop control switch is depressed again after the completion of operation

Warning Control

Condition	Indicator light	Warning Buzzer
When starting roof operation	Off to On	Single beep
Under roof half-open condition	On	—
When completing roof operation	On to Off	Single beep
When driving with the roof half-open	On	Continuous beep
Non-conformity of operation conditions	Blinking	—

The vehicle speed at the time of warning for driving with a half-open roof is more than 6 km/h (approx. 3.8 mph).

4) Fail-safe

In case of occurrence of abnormality of motor and limit switch, the system will operate to prevent vehicle breakdown or driving with a half-open roof as much as possible.

Item	Operation
Limit Switch/Motor pulse abnormality	In case of failure at the portion where the interference will not occur due to link operation, it opens or closes the roof temporarily and then stops
Motor circuit failure	Quarter window motor If open circuit occurs, operation is stopped and the roof can be only closed
	Package tray trim motor If open circuit occurs during roof operation, <ul style="list-style-type: none"> ● Swing package tray trims are closed, roof can be closed ● Swing package tray trims are opened, roof can be opened ● Other position of Swing package tray trims, roof is stopped
	Other motor Short or open circuit : It stops the output to the motor with abnormality. Motor locking : The operation is stopped once, then it starts when the Retractable hardtop control switch is depressed again. * Motor locking condition is detected by current increasing to motor. ECU corrects the current at motor locking depending on outside temperature.
Vehicle speed sensor signal failure	This system operates correctly if shift position is in “P” range. Sliding roof control ECU uses shift position “P” range signal instead of vehicle speed signal.

7. Diagnosis Function

- In case of detecting the abnormality in the following portions,
 - The Sliding roof control ECU stops the operation. No warning light or beeper indication
 - The Sliding roof control ECU outputs the DTC code and the code can be read by LEXUS Hand Held Tester only that is connected to DLC3
- The Sliding roof control ECU does not memory the DTC code. If the abnormality in the following portion is recovered normally, the DTC code in the ECU will be cleared.

Code	Condition
B2501	Short in Roof drive motor (RH)
B2502	Open in Roof drive motor circuit (RH)
B2503	Short in Roof drive motor (LH)
B2504	Open in Roof drive motor circuit (LH)
B2505	Short in Luggage compartment door drive motor (RH)
B2506	Open in Luggage compartment door drive motor circuit (RH)
B2507	Short in Luggage compartment door drive motor (LH)
B2508	Open in Luggage compartment door drive motor circuit (LH)
B2509	Short (to GND) in pulse width modulation circuit motor (RH)
B2510	Short (to GND) in pulse width modulation circuit motor (LH)
B2511	Open in Roof lock motor
B2512	Short in Luggage compartment door closer motor (RH)
B2513	Open in Luggage compartment door closer motor circuit (RH)
B2514	Short in Luggage compartment door closer motor (LH)
B2515	Open in Luggage compartment door closer motor circuit (LH)
B2516	Open in Quarter power window motor circuit (RH)
B2517	Open in Quarter power window motor circuit (LH)
B2518	Open in Package tray motor circuit
B2520	Limit switch (Roof lock) malfunction
B2521	Limit switch (Roof close RH) malfunction
B2522	Limit switch (Roof close LH) malfunction
B2523	Limit switch (Roof position No.1) malfunction
B2524	Limit switch (Roof position No.2) malfunction
B2525	Limit switch (Roof position No.3) malfunction
B2526	Limit switch (Roof position) malfunction
B2527	Limit switch (Roof open) malfunction
B2528	Full close switch on Limit switch (Luggage compartment door open and close) malfunction
B2529	Limit switch (Luggage front lock RH) malfunction
B2530	Limit switch (Luggage front lock LH) malfunction
B2531	Full open switch on Limit switch (Luggage compartment door open and close) malfunction
B2532	Limit switch (Package tray No.1) malfunction
B2533	Limit switch (Package tray No.2) malfunction
B2534	Limit switch (Package tray) malfunction
B2535	Limit switch (Tonneau cover) malfunction
B2536	Luggage compartment door courtesy switch malfunction
B2537	Sliding Roof Control Switch malfunction
B2538	Abnormal Roof drive motor pulse (RH)
B2539	Abnormal Roof drive motor pulse (LH)
B2540	Abnormal difference between RH and LH Roof drive motor pulse
B2541	Abnormal Luggage compartment door drive motor pulse (RH)
B2542	Abnormal Luggage compartment door drive motor pulse (LH)
B2543	Abnormal difference between RH and LH Luggage compartment door drive motor pulse
B2544	Transponder ECU communication stop
B2545	ECM communication stop
B2546	Meter ECU communication stop
B2547	Luggage room J/B ECU communication stop
B2548	Driver side J/B ECU communication stop
B2549	Driver door ECU communication stop
B2550	Passenger door ECU communication stop
B2551	Pulse width modulation circuit motor (RH) power supply malfunction
B2552	Pulse width modulation circuit motor (LH) power supply malfunction
B2553	Sliding roof control ECU malfunction
B2554	Retractable hard top system malfunction