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Design Of Automotive Power Trunk Lift Motor Drive

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Abstract
This guide design illustrates how to operate a trunk or rear gate lift in a vehicle.A brushed DC (BDC) lift motor and electromagnetic clutch drive mechanisms are used in this design for a traditional gear-driven lift.A alert beeper, light-emitting diode (LED) indicator, and directional control using an automobile motor driver and high side switch are all part of the specification.Boost MOSFET performance and minimise switching spikes with a current-controlled gate driver with slew rate modulation. The MOSFET's drain-to-source voltage (VDS) is used for current sensing. The electromagnetic clutch allows the user to manually work the trunk with this configuration. For flexible microcontroller use, this specification contains the standard gui using the TI Launch Pad development kit. As compared to relay solutions, this design provides a simple, robust implementation with a low component count and little board room.

1 Introduction

Trunk control is a fairly complicated mechanism with all of the motorised arms and latches used to incorporate power trunk lifts, power lift gates, door locks, and clinch/latch features used in modern cars.The problem becomes designing effective, safe, and flexible solutions as the number of functions, and thus the number of motors and relays, grows.Our portfolio of low-ohmic, fully shielded high-side drivers, engineered with our patented VI Power technology and available in a variety of configurations including H-bridges for motors in conjunction with our SPC5 32-bit automotive-grade microcontrollers and power management ICs, will assist in the development of powerful and versatile trunk control systems.This drivers usually have a set of mechanical gears with a ratio that allows them to manoeuvre the enormous mechanical load with enough torque.This benefit raises the motor's effective torque thus lowering the rotation speed.The rotation is converted into a force that opens or closes the gate by a mechanical arm and linked linkage.

1.1 PRINTEDCIRCUITBOARD

Using conductive tracks, pads, and other features engraved from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate, a printed circuit board (PCB) physically supports and electrically links electronic circuits or electrical components. The layout of the circuit on a PCB requires further design effort, but production and assembly can be automated. Many of the layout function can be done with specialised CAD applications. Since modules are assembled and wired in one operation, mass-producing circuits using PCBs is less costly and quicker than other wiring approaches.Large batches of PCBs may be made at once, and the layout only has to be completed once.

1.2 OBJECTIVEOFPCBDESIGN:

PCB stands for printed circuit board, because it is a self-contained board with integrated electrical and electronic parts that can be used in a variety of instruments such as beepers, pagers, radios, radar, and computer systems. A thin film of conducting material is deposited on the outside of an insulating board known as the substrate to create circuits. Separate components are soldered to the connected circuits on the substrate's surface. A standard PCB consists of a flat sheet of insulating material laminated to the substrate and a layer of copper foil.

1.3 SINGLELAYERPCB:

Single sided PCB is another name for a single layer PCB. Since these PCBs are easy to build and produce, they are the most widely used. A coating of some conducting substance is added to one side of this PCB. Copper is usually used as a conducting medium for PCBs because of its excellent conductivity. A coat of solder mask is applied to shield the PCB from oxidation, and then a silk screen is used to identify all of the components on the board.

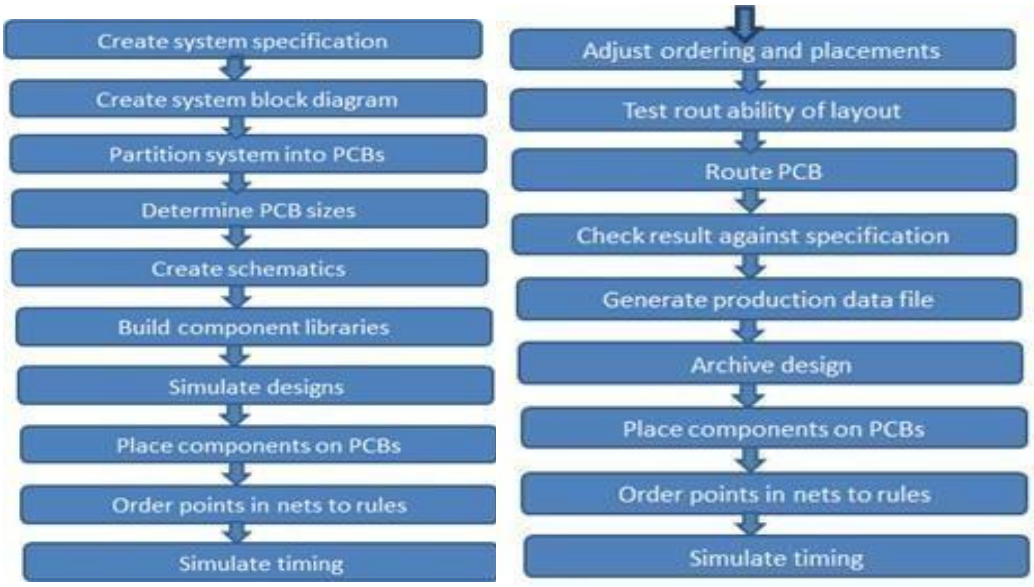
1.4 DOUBLE LAYER PCB:

Double-sided PCB is another name for double-layer PCB. A thin layer of conducting material, such as copper, is added to both the top and bottom sides of this type of PCB, as the name indicates. A hole in

the board connects them electrically. This kind of PCB board is more versatile, has a lower cost, and the most significant advantage is its smaller scale, which makes circuits more portable. Industrial controls, converters, UPS systems, HVAC applications, phones, amplifiers, and power management systems all use this form of PCB.

2 DESIGN FLOW:

Fig 1: SN65HVD23x



2.1 THESYSTEMSPECIFICATION:

A framework specification is created by the design team before starting a new design. This is a list of the tasks the design must execute, the circumstances under which it must work, the design's expense goals, construction plan, production costs, maintenance procedures, technologies to be used, weight and scale, and any other relevant parameters. To allow proper selection of materials, equipment, and instrumentation, a rough specification of each of these variables is required at the outset.

2.2 DESIGN TOOLS

Electronic design automation (EDA), also known as electronic computer-aided design (ECAD), is a category of technical techniques used in the design of electronic circuits. Electronic design. Integrated applications, for example. Printed circuit boards and loops. Chip manufacturers use the tools as part of a product flow to design and evaluate whole semiconductor chips. EDA tools are important for the design of modern semiconductor chips, which can have billions of components. Integrated circuits were planned and laid out by hand before EDA. The tapes for the Gerber picture plotter were produced using geometric tools in some specialised shops, but even those copied digital recordings of mechanically drawn components.

2.3 COMPUTERAIDED DESIGN

The use of computer programmes (or workstations) to help in the response, adjustment, analysis, and optimization of a concept is known as computer-aided design. CAD software is used to enhance the designer's efficiency, the accuracy of the design, collaboration by reporting, and the creation of a database for production. CAD production takes the form of electronic files that may be used for printing, machining, or other production processes. CADD (Computer Aided Design and Drafting) is another language used. Electronic design automation, or EDA, is the term for its use in the design of electronic devices.

2.4 XPEDITIONDESINGNTOOLFEATURES

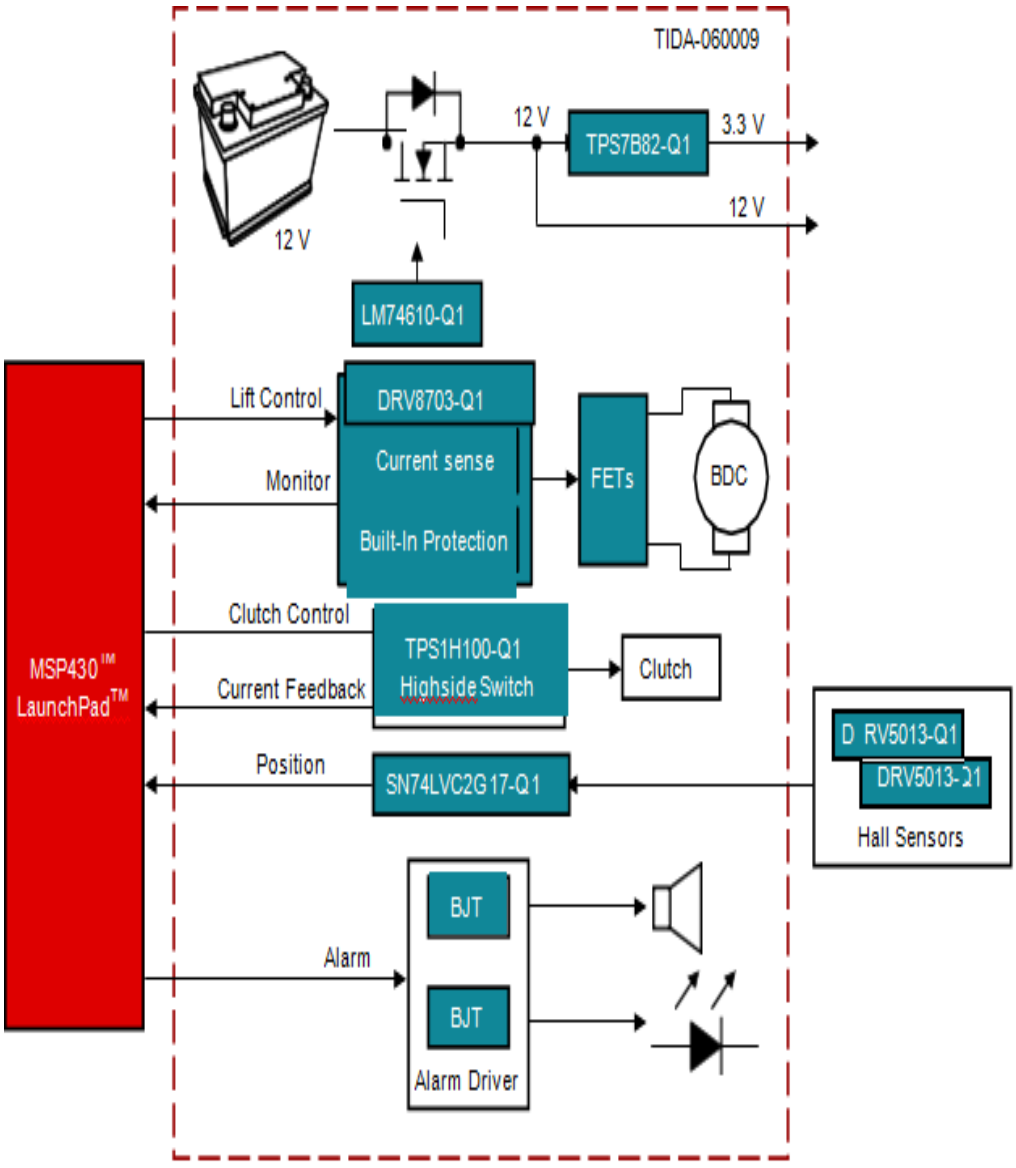
Xpedition Designer is a full schematic design solution that allows you to create, define, and reuse designs. In a concurrent team-based design environment, it offers everything required for circuit design and simulation, component selection, library management, and signal integrity preparation. Any main design development activity can be completed in a single, portable, parallel, and real-time environment with the integrated workspace. Its customizable project navigator filters hierarchical blocks, modules, nets, and assets as they are inserted, dynamically reflecting the project material during an extremely concurrent editing session.

2.5 LIBRARYCREATIONANDDATAMANAGEMENT

The formation of a library and data storage are the first steps to take when forming a council. When we build our own library icons, it will assist us in positioning the components for our specifications, and there will be no need for footprints for the components. Xpedition has a library that allows you to build and handle all of the physical parts needed for a complex PCB device. Both predefined symbols, pad stack, cockpit, and logical to physical pin mapping will be included. The symbol management and solution are modular, serving small design requirements all the way up to highly detailed and incorporated symbols. Users can save time by not having to check for components by using the library components that have been developed.

3 BLOCK DIAGRAM

Fig 2: Block Diagram



3.1 MICROCONTROLLER(MSP430FR4133)

Remote controllers, thermostats, smart metres, blood glucose sensors, and blood pressure monitors are examples of low-cost LCD applications that benefit from an integrated 10-bit ADC in the MSP430FR41xx ultra-low-power (ULP) microcontroller range. The MCUs have a powerful 16-bit RISC CPU, as well as 16-bit and constant generators, which help with code performance. The computer will wake up from low-power modes to active mode in less than 10 seconds thanks to the digitally powered oscillator (DCO). The architecture is designed for extended battery life in portable measuring applications, thanks to a variety of low-power modes.

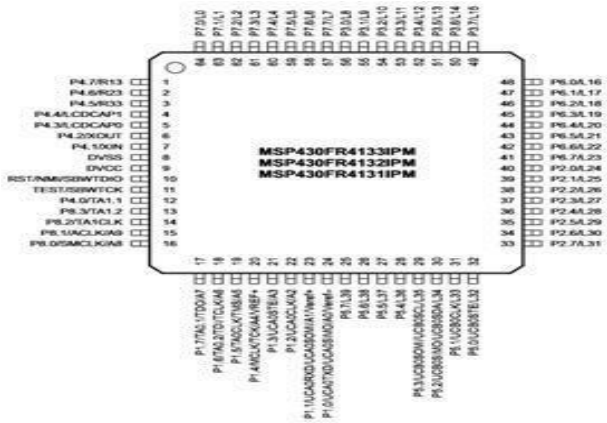


Fig 3: MSP430FR4133

3.2 SYSTEM DESCRIPTION

Electrically driven drivers are increasingly being used to boost and lower vehicle trunk lids, lift gates, and engine hoods. A brushed DC motor is used in the most common forms of trunk lift gates, and it responds to commands from control switches in the cabin or switches on a key fob. These drivers usually use a set of mechanical gears with a mechanical advantage to provide enough torque to shift the heavy mechanical load. This benefit raises the motor's effective torque thus lowering the rotation speed. The rotation is converted into a force by a mechanical arm and linked linkage, which is used to open or close the lock.

3.3 DRV8703-Q1:

The DRV8703-Q1 unit is an automotive H-Bridge gate drive that drives a bidirectional brushed-DC motor with four external N-channel MOSFETs. The DRV8703-Q1 platform also has security capabilities that go beyond standard discrete implementations, such as under voltage lockout (UVLO), over current protection (OCP), gate driver faults, and thermal shutdown (TSD). A built-in sense amplifier allows for variable current power. The integrated charge pump supports 100% duty cycle and can be used to control an external reverse battery switch. The gate driver has circuitry to control the use of fixed gates.

3.4 LIFT DRIVE CIRCUIT:

The lift's brushed motor derives voltage and current from the lift drive circuit. The 12-volt automotive battery system is the most common power source in automotive applications. Because of potential situations such as start-up or load-dump, the drive circuit's supply voltage may be up to 40 V. Since the lift gate does not work as the vehicle starts, slows, or travels, the operation voltage range of 8 V to 16 V is adequate in most situations. The DRV8703-Q1 unit is used in the lift drives circuit. The DRV8703-Q1 unit is a brushed motor H-bridge gate engine. Two half-bridge drivers can drive two N-MOSFETs in the device.

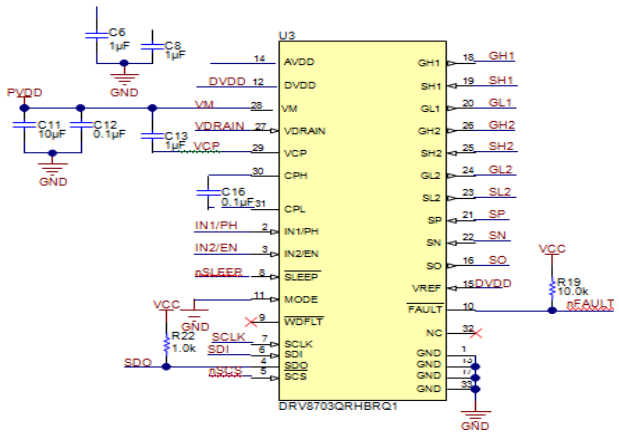


Fig 4: Lift Drive Circuit

3.5 POWER REVERSE PROTECTION:

The electrical schematic for the reverse battery safety sub circuit using the LM74610- Q1 unit. The rated value of the drain-to-source voltage and the rated value for the current carrying capacity are the most significant considerations in selecting the Q1 FET. In this configuration, the transistor chosen for Q1 is rated for automotive applications with a maximum temperature of 175°C and a drain-to-source voltage of 40 V. At

temperatures of up to 125°C, the continuous current will reach 62 A.The various amount of time and frequency at which the LM74610-Q1 unit refreshes its bias supply is affected by the capacitor C4. FET body diode. Because of the higher diode drop than the channel, the V12 voltage decreases when the Q1 transistor turns off.

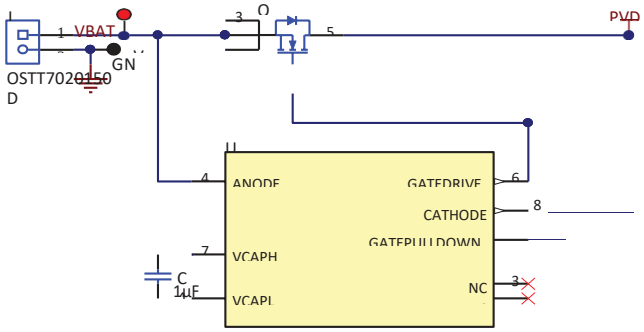
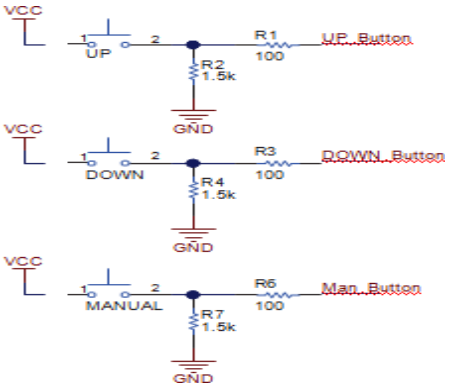


Fig 5: Power Reverse Protection

3.6 PUSH BACK BUTTON

In an automotive configuration, the open and close keys are usually found in the cabin or on the key fob. The board in this design has two pushbuttons that allow the device to be worked without the use of any additional hardware. Since no filtering capacitors are used in the design, the UP Button and DOWN Button signals can display switch bounce on transitions. A manual push-button (MAN Button) is used on the board in this version. For UP Button and DOWN Button, the circuit for manual action is the same.

Fig 6 : Push Back Button



3.7 CONTROLLER INTERFACE

A processor system's interface to a network or other interconnection is controlled and configured by an interface controller, which is a computer or module. In electronic devices, there are several different kinds of interfaces. Controllers usually initialise, manage current state, manage faults, and execute the algorithm used to transmit data to and from the Interface successfully. This may also include causing interrupt events to notify the processor when events involving the interface occur. A network access controller is an example of an interface controller (NIC). The single board controller comes in a rail housing that can be mounted on a rail.

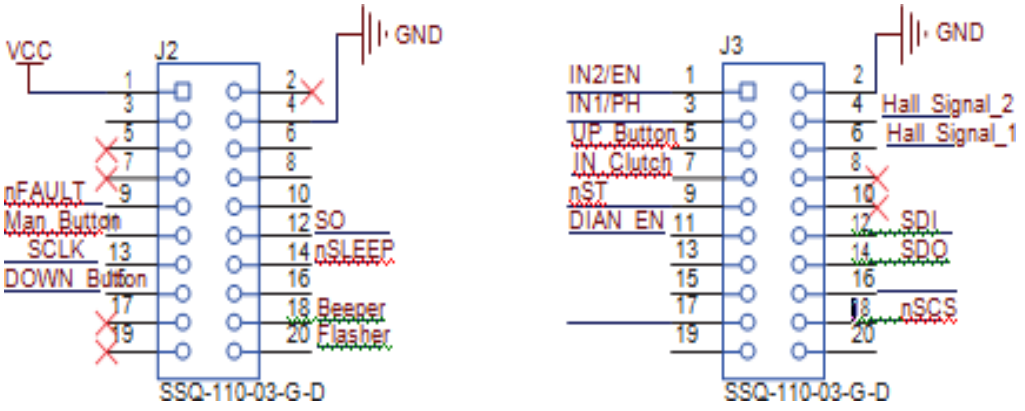


Fig 7: Interface Connector

3.8 POWER SUPPLY

A power supply capable of supplying a minimum of 30 A at 12 V is necessary for the operation of a standard lift assembly. The existent maximum power of the supply is determined by the size and rating value of the lift drive motor and clutch.

3.9 MOTOR CONNECTION

Connect the lift motor's two wires to the J4 terminal block. On the top of the J4 terminal block is a sticker that reads "Lift." The polarity of the links to the motor is determined by the mechanical configuration of the motor and system. To rotate the motor in the direction required to lift the test mechanism, apply a positive voltage to J4-1 (LiftMotor1) with respect to J4-2 (LiftMotor2). To rotate the motor in the direction required to lower the test mechanism, add a positive voltage to J4-2 with respect to J4-1. Interchange the motor wires on J4-1 and J4-2 to invert the polarity of the motor if rotation is not the desired response to commands from the microcontroller.

3.10 CLUTCH CONNECTION

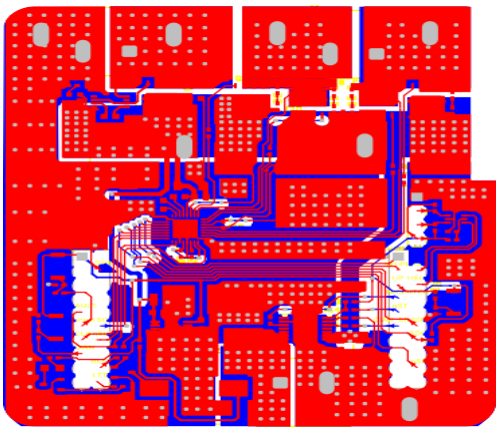
Connect the clutch coil's two wires to the J5 terminal block. On the top of the J5 terminal block is a sticker that says Clutch. Since the polarity of the voltage applied to the clutch coil has no effect on its output, connect the wires in any order

3.11 HALL EFFECT SENSOR CONNECTION

Connections for Hall effect (or similar) sensors with incremental location input from the mechanism are available on the four-contact header (J8).

4 OUTPUT:

Fig 8:M2 3D Step top



A Top pattern is a technical analysis charting pattern that denotes a change in direction and a reversal in momentum from previous leading market activity. It represents a stock or index dropping, rebounding, dropping again to the same or equivalent amount as before, and then rebounding again.

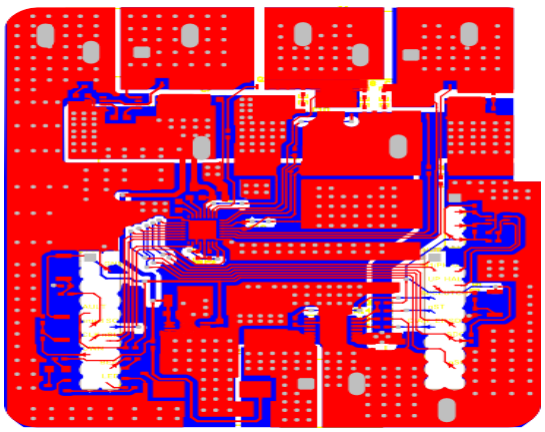


Fig 9:M4 3D Step bottom

A bottom pattern is a technical analysis charting pattern that denotes a change in direction and a reversal in momentum from previous leading market activity. It represents a stock or index dropping, rebounding, dropping again to the same or equivalent amount as before, and then rebounding again.

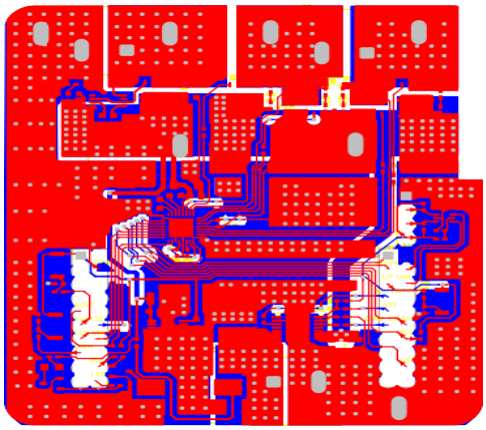


Fig 10:M18 Embedded Assembly System

A Embedded Assembly pattern is a technical analysis charting pattern that denotes a change in direction and a reversal in momentum from previous leading market activity. It represents a stock or index dropping, rebounding, dropping again to the same or equivalent amount as before, and then rebounding again.

4.1 CONCLUSION

As a result, we've decided to use the pcb design process to build the thermostat configuration. A thermostat is a part of a control device that detects the temperature of a system and holds it close to a fixed temperature. The thermostat keeps the temperature stable by turning on or off heating or cooling devices as required, or controlling the flow of a heat transfer fluid as needed.

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