Product Overview

Brushed and Stepper Motor Drivers in Video Surveillance

Video Surveillance cameras are becoming more common today as new technology is making it easier and more cost effective for broad use. IP Network, analog security, thermal imaging, video doorbell and baby or pet monitors are examples of the diverse application base. Within these different devices there are three main motor applications; Infrared (IR) filter, lens motors (zoom and focus) and camera motors (pan and tilt). Figure 1 provides and overview for these different functions and Table 1 provides a list of devices with system benefits.

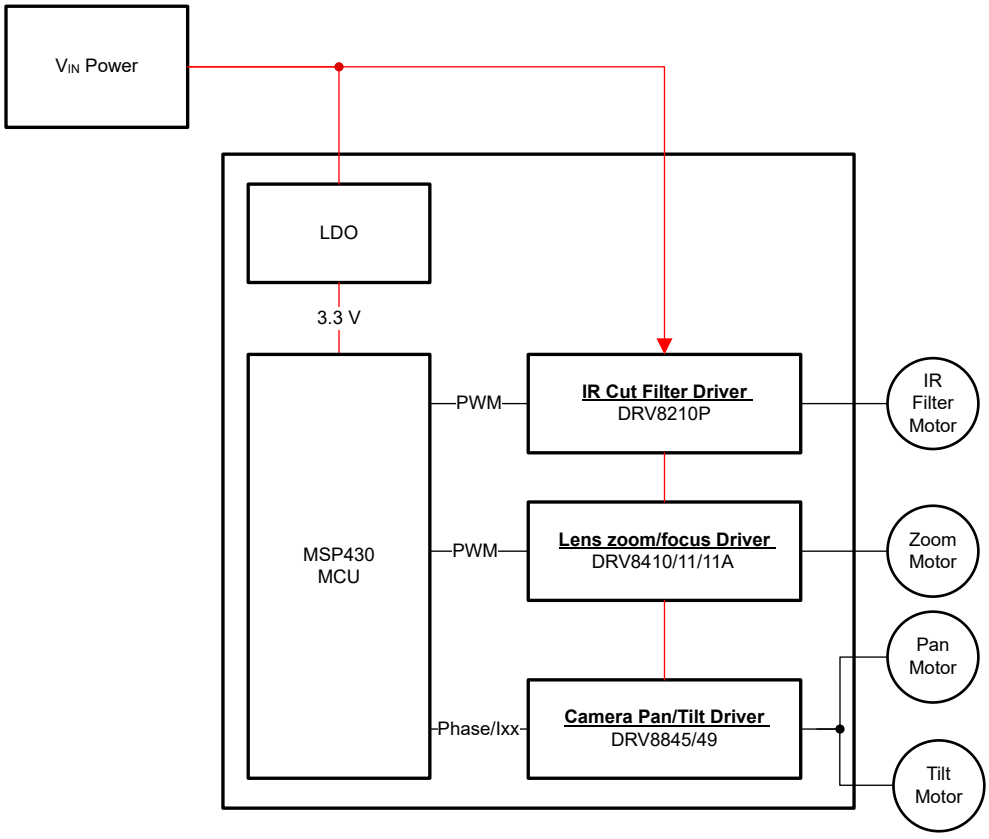

Figure 1. Video Surveillance Motor Drive Applications

IR Filter

Infrared cut filters are a common application in cameras to help achieve both day and night vision. Most cameras sensors can see the whole visible light and IR spectrum which is advantageous in dark settings but during the day the IR waves need to be blocked. Low voltage brushed DC motors can be used to move this filter in and out of place. Device such as the DRV8210P provide a small footprint for space conscious boards that can reduce a layout size by up to 93% when compared to a discrete design as shown in Figure 2.

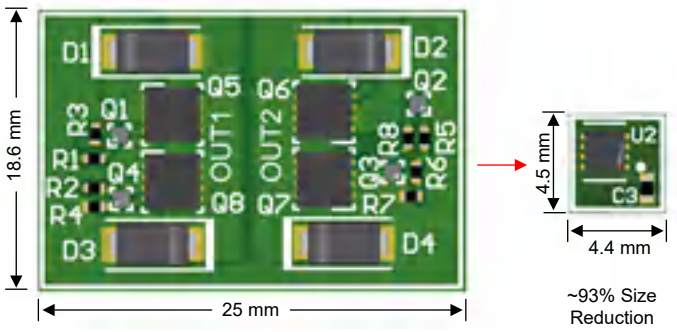

Figure 2. Discrete vs DRV8210 and DRV8220 Layout Size

Another benefit of an integrated design is low-power sleep mode for when the motor is not in operation which helps to conserve power and battery. The IR filter only needs to move a few times a day so insuring that the motor driver is not draining too much power when idle is important. Lastly the DRV8210P also integrates protection features such as thermal shutdown, under voltage lockout and overcurrent protection to increase system reliability.

Lens Motors (Zoom and Focus)

Video surveillance is becoming more advanced with the adoption of lens motor driving to zoom and focus the image. Older cameras have a way to manually change the zoom but today this same function is achieved through low torque stepper motors. To drive these motors, TI offers a range of benefits to fit different designs such the DRV8410, DRV8411 or DRV8411A. The DRV841x family offers advanced sensing and control, industry common footprint, low-power sleep mode and is cost competitive. DRV8410 and DRV8411 provide design flexibility in the industry common 5.00mm × 6.2mm, 16-pin HTSSOP package while DRV8411A takes integration a step further by included integrated current sensing. Figure 3 shows that by adding this feature, external sense resistors are no longer need.

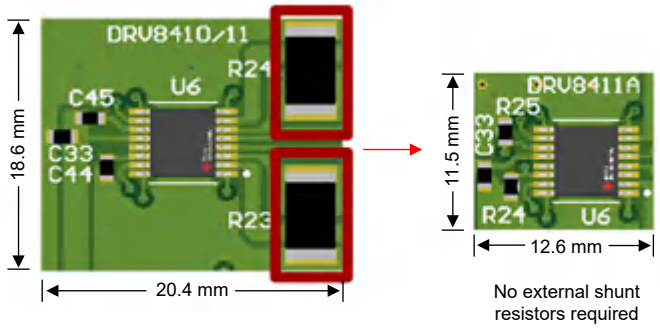

Figure 3. Integrated Current-Sensing Size Comparison on DRV8411A

The DRV8411A does not require these external sense resistors to sense current because the device performs this function internally. Check out the Advantages of Integrated Current Sensing Application Note for more information. This device also creates a proportional, scaled down current that is sent out through the “IPROPI” pin (IPROPI = Current proportional Current) allowing for further diagnostic ability.

The DRV8410, DRV8411, and DRV8411A are also available in a 3mm × 3mm QFN package which becomes adventitious when trying to make smaller

Camera Motors (Pan and Tilt)

The last area to discuss is the pan and tilt functions that allows for the camera view to be changed left or right and up or down. This function requires more torque than the lens zoom features because now the whole camera is moving and not just the lens. For this application there are a couple different options starting with the DRV8845. This device is able to support the higher torque load but comes with minimal features to provide the benefits of integrated drivers but also be cost competitive in an industry common, 36-pin QFN package.

DRV8434A which adds a couple more features, notably this device has sensorless stall detection. The DRV8434A is able to detect the change in phase between the motor winding and back-EMF. By detecting back-EMF phase shift between rising and falling current quadrants of the motor current, the DRV8434A can detect a motor overload stall condition or an end-of-line travel. Without Stall Detection, the driver continues to drive through the obstacle, causing heating, audible noise and damage to the system. Figure 4 shows this shift.

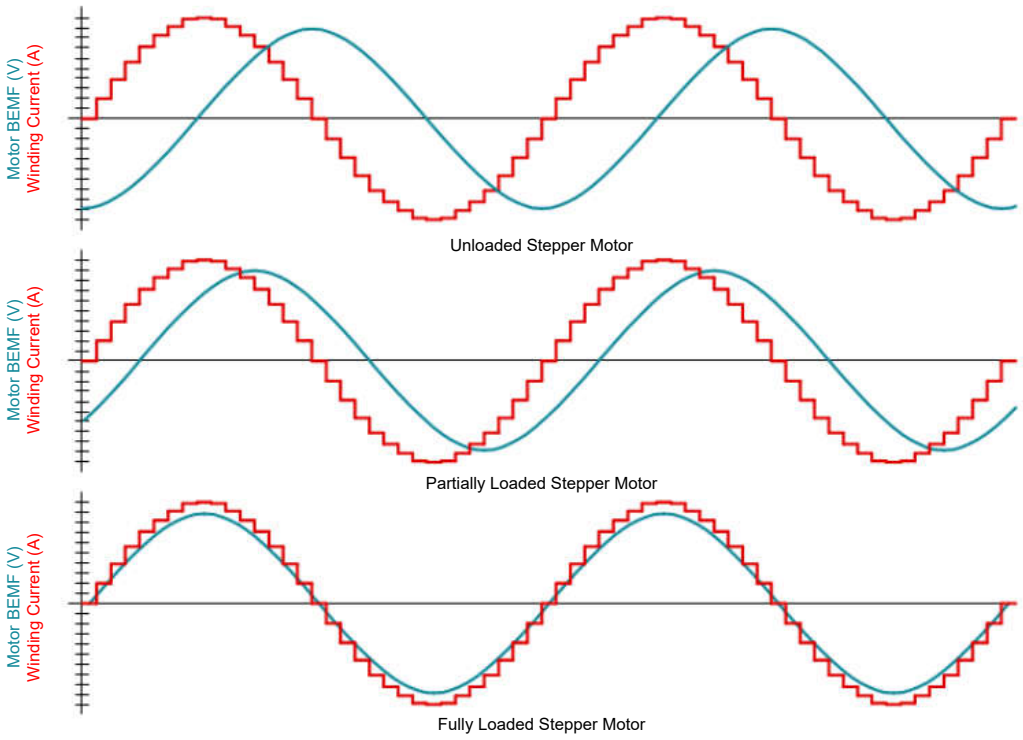

Figure 4. Stall Detection by Monitoring Motor Back-EMF

This article detailed just a few key considerations when selecting a motor driver for an IR cut filter, zoom and focus and pan and tilt but there are still many more ways to implement these features. TI motor drivers provided a wide range of voltages, currents and features to help meet the design needs for IP Network cameras, analog security cameras, thermal imaging, video doorbell and baby or pet monitors.

Table 1. Video Surveillance Motor Drive Applications

Function	Application	TI Device	Benefit
IR Cut Filter	Control the amount of IR light that passes through to the camera sensor, allowing for night vision Low-voltage brushed DC motors	DRV8210P | Single H-Bridge 1.65V to 11V, 1.76A	• Industry common footprint options (2mm × 2mm WSON) • Smallest BDC packaging available in 1.2mm × 1.6mm DRL package (DRV8210DRL) • Low-power sleep mode (< 85nA) • Integrated protection features such as thermal shutdown, undervoltage, lockout and overcurrent protection
Lens Motors Zoom and Focus	Open loop system with no sensors to change field of view Low torque stepper motors	DRV8410, DRV8411 | 1.65V to 11V, 2.5A and 4A dual H-bridge motor driver with current regulation DRV8411A | 1.65V to 11V, 4A dual H-bridge motor driver with current regulation and IPROPI DRV8847 | 18V, 2A dual H-bridge motor driver with current regulation and independent Half-bridge control	• Internal current regulation • Integrated current monitoring • Integrated charge pump for low voltage operation and allows for 100% duty cycle operation • Integrated protection features such as thermal shutdown, undervoltage, lockout, Auto-retry, and fault indication
Camera Motor Pan and Tilt	Open loop system with position feedback to move camera up, down, left, and right Higher torque stepper motors	DRV8845 | 35V, 1.5A quad H-bridge motor driver with Smart Tune technology DRV8849 | 35V, 1.5A quad H-bridge motor driver with Smart Tune and integrated current sensing DRV8434A, DRV8434S | 48V, 2.5A dual H-bridge motor driver with integrated current sensing and stall detection (S Version has SPI) DRV8428 | 35V, 1A dual H-bridge motor driver with integrated current sensing and 1/256 micro-stepping	• 1/256 micro-stepping • Integrated current sensing • Sensorless stall detection • Smart Tune adaptive decay • Integrated protection features such as thermal shutdown, undervoltage, lockout, Auto-retry, and fault indication

For more information, see https://www.ti.com/motor-drivers/.

Extra Resources

- Texas Instruments, *Advantages of Integrated Current Sensing* Application Brief
- Texas Instruments, *Smart tune for quiet and smooth stepper motor operation* Application Brief
- Texas Instruments, *[FAQ] How to configure IPROPI and current sensing* E2E™ forum
- Texas Instruments, *Motor Module Design for IP Network Camera Based on MSP430FR2155* Application Note

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