

Diwi Rajmohan

Introduction

Traditional discrete gate driver implementation often adds unnecessary complexity, increase in board size, and introduces invariability in performance. The UCC27517A, UCC27444 and LM2x0x family of devices are cost effective, high-performance gate drivers ICs that directly address these challenges. By incorporating critical drive functions and protective features into a single IC, this reduces the need for extra components such as resistors, comparators, level shifters and bootstrap circuit.

These devices are optimized for low-to-mid voltage motor and power switching applications making them preferred for many cost sensitive applications: power tools, vacuum cleaners, battery disconnect systems and more.

By using the UCC27517A, UCC27444 and LM2X0X family of devices, designers drastically reduces BOM (bill of materials) count, simplify PCB layout and improve overall system reliability while preserving or improving performance while integrating a smart integrated approach to power design.

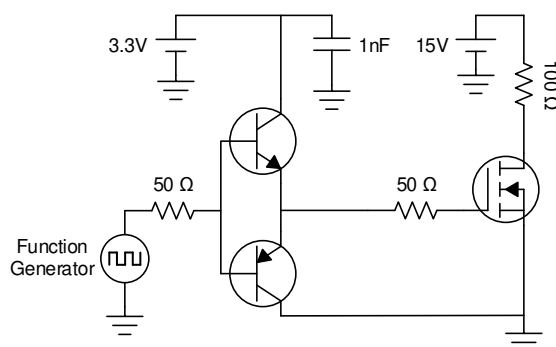


Figure 1. BJT Gate Driver Topology

Challenges of Discrete Gate Driver Implementation

Designers frequently use discrete gate driver implementation to reduce upfront component costs. However, in practice this strategy involves a number of underlying problems that gradually eliminates any initial savings.

Across real world customer use cases, there are often the following pain points:

High BOM Count and Sourcing Challenges	Complex Layouts and Longer Design Cycles	Higher Field Failure Rates and Reliability Risks
- Requires six to 10+ components per channel - Involves resistors, transistors, level shifters, diodes, protection circuits - Increases sourcing burden across multiple vendors - Exposes design to supply chain volatility	- Requires a larger board area - Requires careful wiring to avoid interference, ground loops, and noise - Reliable switching often needs multiple design/layout revisions - Adds technical workload and project delays	- More components increase points of failure - Tolerance variations cause inconsistent behavior - Performance varies under temperature or voltage changes - Risk of shoot-through or undervoltage lockout if unmanaged

These challenges are especially greater in high volume and highly space-constrained applications like power tools, vacuum cleaners and battery powered system where board space, design time, and BOM cost are critical.

This is why integrated gate drivers such as UCC27517A, UCC27444 and LM2x0x series are gaining popularity. It addresses these issues head on by providing all of the necessary gate drive functions in a single small packaged, lower design complexity, boosting performance and lower system cost.

Background of Discrete Design

Discrete gate drivers are often organized with individual components to execute or realize key functions. A typical discrete gate driver employs an op-amp or comparator to detect the input control signal, transistors or logic gates to shift levels and buffer the signal and a bootstrap circuit (diodes and resistor) for high side switching. Gate resistors and Zener diodes are commonly used to adjust switching speed and protect the gate from voltage spikes. These components work together to create the voltage and timing required to turn the power MOSFET or IGBT on and off.

However, because each function is handled by a different component, the design necessitates precise coordination, matching and routing. Timing mismatch, parasitic interference and layout limitations can all have an impact on performance and reliability. This complexity is precisely what integrated gate drivers like the UCC27517A, UCC27444 and UCC21X series are intended to eliminate by merging all of these operations into a single small, efficient IC.

Table 1. Difference Between Discrete and Integrated Design

Features	Discrete Component Design	Gate Driver IC solution (Integrated)
UVLO	No (requires further components)	Integrated
Driver Current Independent of Input	Directly proportional to input	Consistent regardless of control input
Level Shifting	Typically requires 5+ extra components	No external circuitry required
Shoot Through Protection	No	Yes (Available, not necessary)
Noise Immunity	Poor	Excellent
HS dV/dt	Unknown, must watch layout and placement	Provided in data sheet
Protection Feature	Extra component and space	Integrated option
Cost	Higher	Lower
BOM Count	10+	5

Layout Diagrams

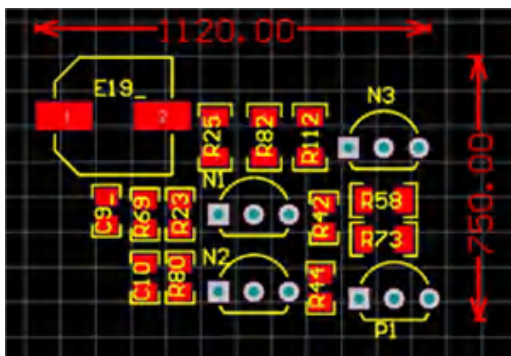


Figure 2. Discrete Layout

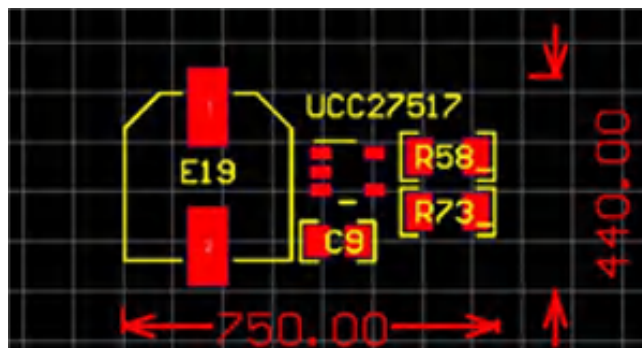


Figure 3. Integrated Layout

Cost-Competitive Integrated Parts

Instead of creating a gate driver circuit from several discrete components, designers can use integrated gate driver ICs such as the UCC27517A, UCC27444 and LM2x0x series. These devices are intended to simplify the implementation of the gate driver by combining critical functionality like signal conditioning, level shifting and protection into a single, cost optimized, compact package.

UCC27517A	UCC27444	LM2x0x
- Single Channel - UVLO 4A/4A Peak Source & Sink - Dual Input +/- - Negative Voltage	- Dual Channel 4A/4A Peak Source & Sink - Enable Pin 3-Volt Power Reset - Negative Voltage	- Half Bridge 0.5A/0.8A Peak source/sink current - Boot strap diode option 5V/8V UVLO Option - Interlock Option - Inverting Input Option

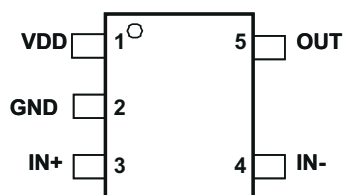


Figure 4. UCC27517A: DBV Package

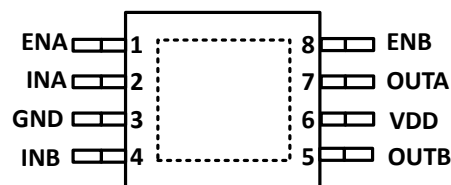


Figure 5. UCC27444: DGN Package

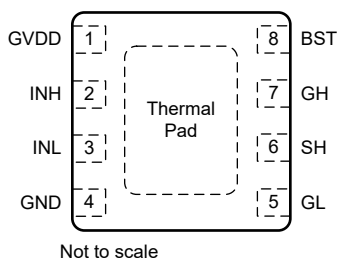


Figure 6. LM2X0X: DSG Package

Additional Considerations

- [UCC27517A Product Page](#)
- [UCC27444 Product Page](#)
- [LM2X0X Product Page](#)
- [Replacing BJTs with Integrated solution](#)

Trademarks

All trademarks are the property of their respective owners.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025