

UCC571xx: Texas Instrument's First Low-Side Protection Drivers With DESAT (UCC5710x), OCP (UCC5714x, UCC5713x)



Jeremiah Vo

The UCC5710x devices are the first low-side gate driver family that uses desaturation (DESAT) protection released at Texas Instruments. The UCC5714x and UCC5713x devices are the first low-side gate driver family with over-current protection (OCP, or OC protection) released at Texas Instruments. These single-channel families were designed primarily for both automotive and industrial topologies that require additional protection. The UCC571x8 devices target IGBT while the UCC571x2 devices target SiC FETs based off of common undervoltage lockout (UVLO) requirements. Some of the benefits are discussed below:

Protection

The UCC5710x devices have DESAT protection, which is a voltage-based detection of the collector of a FET. When the DESAT threshold is tripped, the outputs of the gate driver are turned off, preventing system damage.

The UCC5714x and UCC5713x devices have OCP, which is a current-based detection which utilizes a shunt resistor or sensing-FET. Using a voltage threshold at the OC pin, when the voltage across the shunt resistor is higher than the voltage threshold of the gate driver, the output of the driver turns off.

During a short-circuit event, both gate driver families turns off the outputs of the driver, and the fault pin is pulled to ground. The integrated fault reporting maintains the fault signal to the MCU and keeps the outputs of the driver off until the fault is cleared. This extra level of protection compared to a comparable driver without protection allows for a safer system in noisy or harsh environments. For more information, please refer to this [application note](#) for other protection considerations while driving SiC FETs.

Feature Options

The UCC571xx devices have pinouts which add useful features depending on what the system requires:

- Bipolar ground: UCC571xxB devices in the D package have bipolar ground which provides negative clearance below ground; this prevents accidental turn-on from Miller capacitor-induced noise.
- Split output: UCC571xxC devices in the D package have split outputs which utilizes separate pins for sourcing and sinking current. This allows for complete control and customizable gate resistance for turn-on and turn-off.
- Enable: UCC5710xW devices have an enable pin, which is an additional condition to make output high. In the event of a system fault, turning Enable low can quickly shut off the gate drive.

Internal Voltage Reference

The UCC5710x devices have an integrated LDO which creates a 5V bias with a max of 20mA. This LDO can provide an additional bias supply without needing to redesign the power rail. The LDO can be used to bias digital isolators, thermistors, modulators, and other components. For more information, please refer to this [application brief](#) on more reference voltage applications.

Table 1. UCC5710x Overview Table

Product Features	Feature Impact	Key Applications
DESAT Protection	Integrated protection from short-circuits	xEV Thermal Management xEV Traction Inverter Servo Drives Power Tools A/C Inverter
Thermal shutdown	Shuts down driver when at the temperature threshold	
Fault Reporting	Reports faults to MCU	
30V Max VDD	Allows driver to survive transients and noise at inputs and VDD	
-5V Negative Voltage Handling		
8V or 12V UVLO Options	Optimized for IGBT and SiC FET applications	
Bipolar Ground Option	Allows for negative clearance below 0V ground	
Split Output Option	Complete and separate control over drive source and sink strength. Removes diode used in single output drivers	
Enable Option	Allows the power stage to be controlled independently of main control logic	

Table 2. UCC5714x and UCC5713x Overview Table

Product Features	Feature Impact	Key Applications
OC Protection	Integrated protection from short-circuits	Residential HVAC
Thermal shutdown	Shuts down driver when at the temperature threshold	xEV OBC/DC-DC
Fault Reporting	Reports faults to MCU	Servo Drives
30V Max VDD	Allows driver to survive transients and noise at inputs and VDD	Power Tools
-5V Negative Voltage Handling		A/C Inverter
8V or 12V UVLO Options	Optimized for IGBT and SiC FET applications	
Bipolar Ground (UCC57132 only)	Allows for negative clearance below 0V ground	
Split Output (UCC57138 only)	Complete and separate control over drive source and sink strength	

There are some technical features that can provide benefits to a design engineer.

Table 3. UCC571xx System Benefits

System Requirement	Product Features	System Benefits
Robustness	DESAT Protection (UCC5710x)	Integrated protection in the gate drivers provides protection during short-circuit events
	OC Protection (UCC5714x, UCC5713x)	
	Thermal shutdown	Protects driver from over-temperature, protecting driver during harsh environments
	Fault Reporting	Reports faults to MCU for diagnostics
	30V Max VDD	Driver can more easily handle transients and noise on VDD and inputs, providing robustness in system
	-5V Negative Voltage Handling	
	Bipolar Ground (UCC5710xB, UCC57132)	Protects systems that use SiC FETs by preventing accidental turn-on from miller capacitor-induced noise
Flexibility	8V or 12V UVLO Options	Optimizes driver UVLO for multiple switch types
Minimized Size and Cost	Integrated LDO (UCC5710xB, UCC5710xC)	Adds convenient additional bias supply separate from the power rail
	DESAT Protection	Integrated DESAT prevents need of a larger discrete DESAT circuit
	Split Output (UCC5710xC, UCC57138)	Split output reduces cost by removing need for the output diode

The UCC571xx family of devices have a wide variety of end equipments that have targeted sockets. Below are some topologies and end equipments where the UCC5710x family of devices can fit.

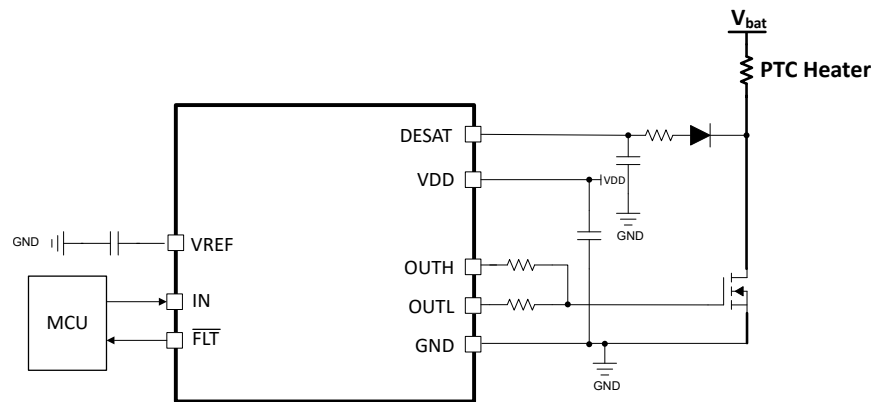


Figure 1. UCC5710x-Q1 in Automotive PTC Heater

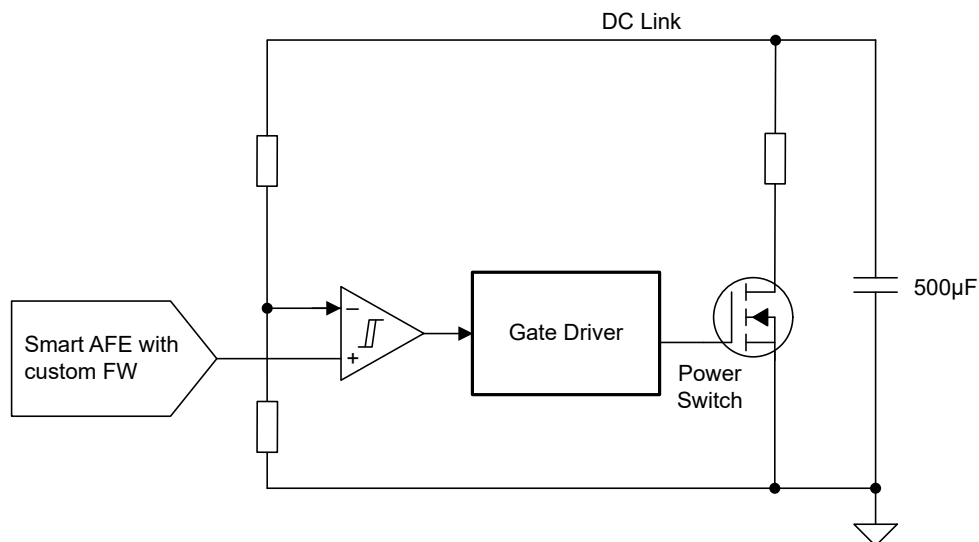


Figure 2. UCC5710x-Q1 in xEV Traction Inverter

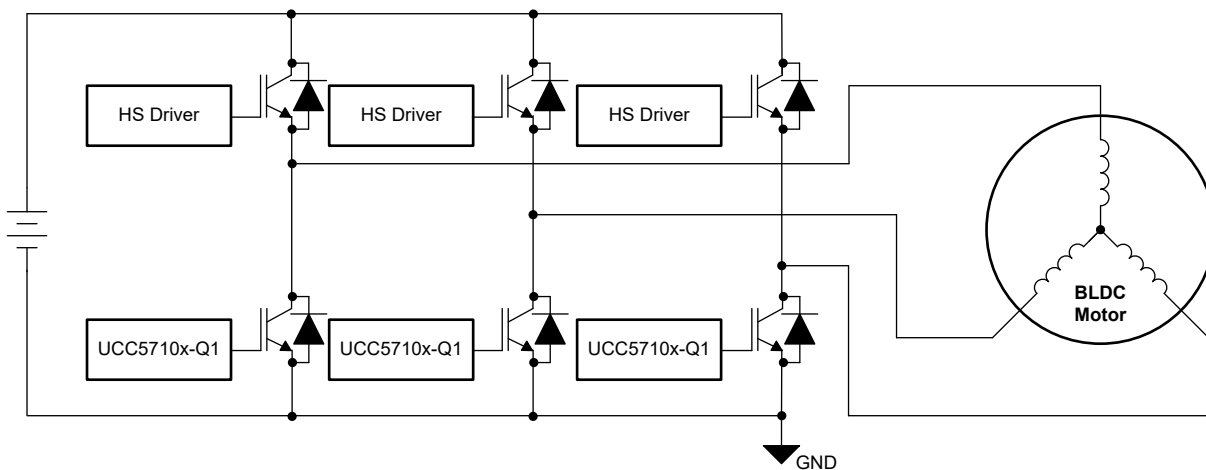


Figure 3. UCC5710x-Q1 in Automotive HVAC Compressor

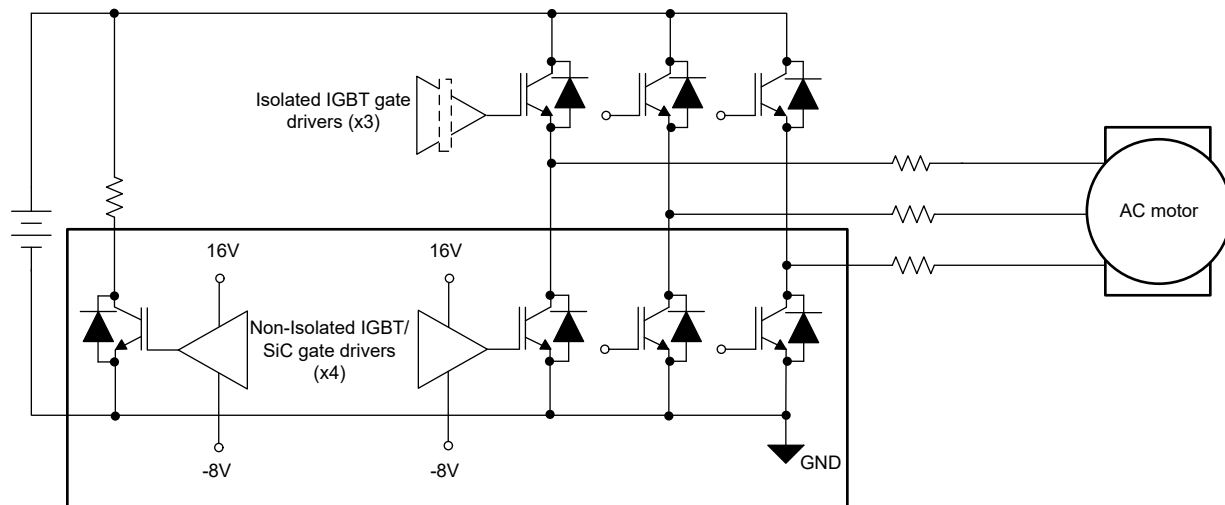


Figure 4. UCC571xx in Servo Drives

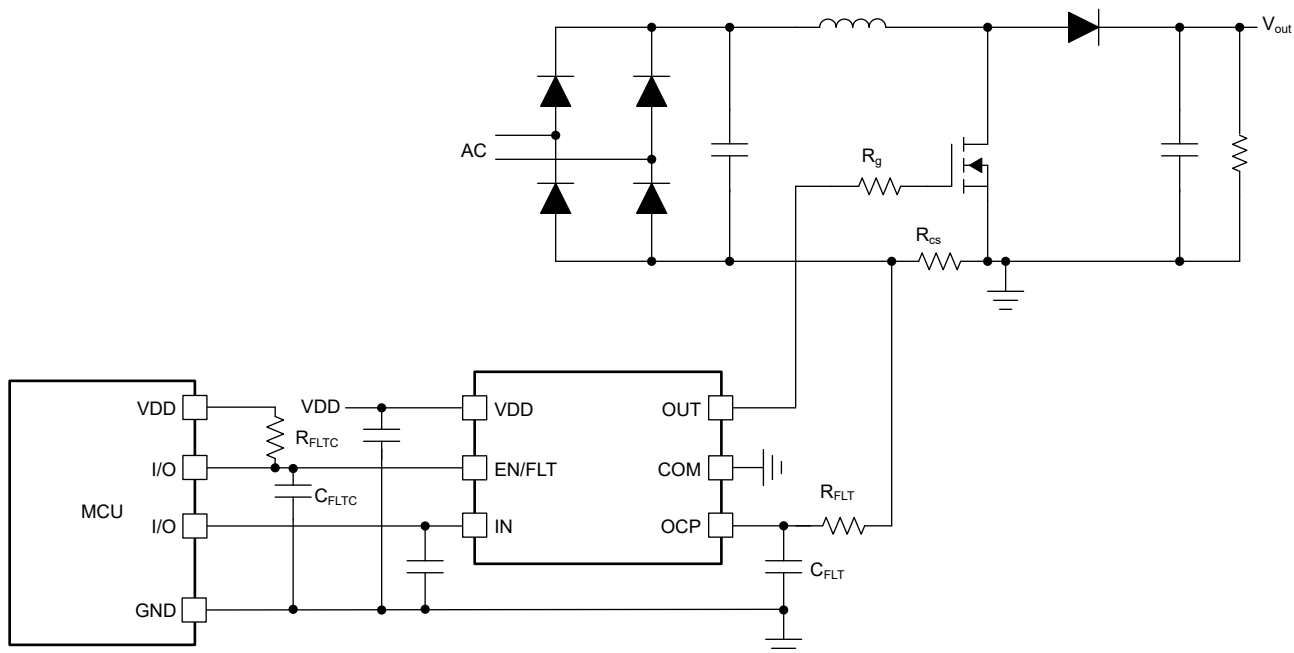


Figure 5. UCC5714x in Residential Air Conditioner

Device Selection Guides

The UCC5710x devices have distinct features, electrical specifications, and pinouts. To aid in selection, [Table 4](#) through [Table 7](#) help distinguish major differences between part numbers, variants, and provide insight comparing to legacy devices.

Table 4. UCC571xx Generic Part Number Comparison Table

Device	Channel Count	Drive Current	UVLO	Package Options	Protection Type
UCC57108 (-Q1)	1	3A/3A	8V	D	DESAT
UCC57102 (-Q1)	1	3A/3A	12V	D	DESAT
UCC57102Z (-Q1)	1	3A/3A	12V	D	DESAT
UCC57148 (-Q1)	1	3A/3A	8V	DBV	Negative OCP
UCC57142 (-Q1)	1	3A/3A	12V	DBV	Negative OCP

Table 4. UCC571xx Generic Part Number Comparison Table (continued)

Device	Channel Count	Drive Current	UVLO	Package Options	Protection Type
UCC57132 (-Q1)	1	3A/3A	12V	D	Positive OCP
UCC57138 (-Q1)	1	3A/3A	8V	D	Positive OCP

Table 5. UCC5710x Pinouts by Variants

	Pinouts		
Variant	UCC5710xB, UCC57102Z	UCC5710xC	UCC5710xW
UVLO	8V, 12V	8V, 12V	8V, 12V
Variant Feature	Bipolar ground	Split output	Enable
Pinout			

Table 6. UCC5714x and UCC5713x Pinouts by Variants

	Pinouts		
Variant	UCC5714xA	UCC57132B	UCC57138C
UVLO	8V, 12V	12V	8V
Variant Feature	-250mV OCP	+500mV OCP	+500mV OCP
Pinout			

Table 7. Legacy Devices Similar to UCC571xx

Legacy Device	New Replacement GPN	Pin-to-Pin	Key Advantages
UCC27531	UCC57108C	No	Adds DESAT protection, fault reporting, and VREF while maintaining split output and 8V UVLO option.
UCC2753x	UCC57148	No	Adds OC protection and fault reporting while maintaining DBV package and 8V UVLO option.
UCC27511[A]	UCC5710xC	No	Adds DESAT protection, fault reporting, and VREF while maintaining split output and increasing VDD to 30V.
UCC27511[A]	UCC5714x	No	Adds OC protection and fault reporting while maintaining DBV package.
UCC44273	UCC5714x	No	Adds OC protection and fault reporting while maintaining DBV package.

Additional Information:

Additional References:

- [Applications and Benefits of UCC5710x-Q1](#)
- [Design Considerations for Automotive PTC Heater Modules](#)
- [Designing a Robust Traction Inverter Redundant Power Supply From 800V Battery](#)
- [Selecting Gate Drivers for HVAC Systems](#)
- [How to Choose a Gate Driver for DC Motor Drives](#)
- [Reference Voltage Applications in the UCC57108, UCC57102, and UCC57102Z Gate Drivers](#)
- [Driving SiC MOSFETs with Non-Isolated Gate Drivers](#)
- [Advancing Gate Driver Performance: Miller Clamp vs Bipolar Output](#)

Table 8. UCC571xx Orderable Part Numbers

Orderable Device	Package Type	Pins	Op Temp (°C)	Device Marking
UCC57108BDR	SOIC	8	-40 to 125	UC108B
UCC57108BQDRQ1	SOIC	8	-40 to 125	U108BQ
UCC57102BDR	SOIC	8	-40 to 125	UC102B
UCC57102BQDRQ1	SOIC	8	-40 to 125	U102BQ
UCC57108CDR	SOIC	8	-40 to 125	UC108C
UCC57108CQDRQ1	SOIC	8	-40 to 125	U108CQ
UCC57102CDR	SOIC	8	-40 to 125	UC102C
UCC57102CQDRQ1	SOIC	8	-40 to 125	U102CQ
UCC57108WDR	SOIC	8	-40 to 125	UC108W
UCC57108WQDRQ1	SOIC	8	-40 to 125	U108WQ
UCC57102WDR	SOIC	8	-40 to 125	UC102W
UCC57102WQDRQ1	SOIC	8	-40 to 125	U102WQ
UCC57102ZDR	SOIC	8	-40 to 125	UC102Z
UCC57102ZQDRQ1	SOIC	8	-40 to 125	U102ZQ
UCC57148ADBVR	SOT-23	6	-40 to 125	U148
UCC57148AQDBVRQ1	SOT-23	6	-40 to 125	U48Q
UCC57142ADBVR	SOT-23	6	-40 to 125	U142
UCC57142AQDBVRQ1	SOT-23	6	-40 to 125	U42Q
UCC57132BDR	SOIC	8	-40 to 125	UC132B
UCC57132BQDRQ1	SOIC	8	-40 to 125	U132BQ
UCC57138CDR	SOIC	8	-40 to 125	UC138C
UCC57138CQDRQ1	SOIC	8	-40 to 125	U138CQ

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