Application Brief
Multi-Function Pins for Easy Designing

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Multi-Function Pins are Easy... to Understand

A multi-function pinout is when two or more features are integrated into one pin. A table found in the device's data sheet is used to decipher what features are available with guidance of how to select the desired combination. Table 1 is an example of the mode pin selection of TPS563211 data sheet. There are two feature selections with a total of four combinations. A resistor value (in the range of acceptable values) strapped from ground to the mode pin is used to select both feature operations. Not all multi-function pins cover the same features, some are bifunctional, either-or, while others, such as mode or S-config pins, cover 2, 3, 4+ features in just one pin, exemplified in Table 2.

Table 1. MODE Pin Settings

| Mode Resistor Range	Recommended Mode Resistor Value	Operation Mode in Light Mode	Function of PG/SS Pin
[0, 12] kΩ	0	Eco-mode	Power Good
[30, 50] kΩ	47 kΩ	Eco-mode	Soft Start
[83, 120] kΩ	100 kΩ	FCCM	Soft Start
[180, ∞] kΩ	Float	FCCM	Power Good

Multi-Function Pins are Easy... to Design With

Since multi-function pins combine what used to be individual pins into one, the resulting smaller package has less pins that need to be configured. Less pins mean less time researching to find the right passive, less time calculating to find the right values, and less time placing each component in a layout. The more features a single pin incorporates, the better the flexibility to design time ratio.

Table 2. Features Configurable by a Single Multifunction Pin

Feature Covered by one Multi-function Pin (Mode/S-config)	TPS62913/2	TPS62903/2/1	TPS563211 / 2211
Package Size	2 x 2 mm	1.5 x 2 mm	1.2 x 2.1 mm
Function of Vset/FB pin		X	
Fsw	X	X	
Spread Spectrum	X		
Output Discharge	X	X	
Synchronization	X		
Light load or FPWM/FCCM		X	X
FUNCTION OF PG/SS PIN			X

Multi-Function Pins are Easy... to Reuse

The ability to reuse a design for various projects with minimal alteration saves time and development cost. Multi-functional pins are ideal when it comes to this copy and paste methodology – a simple resistor change could be all that is needed from one project to another. In some cases, such as the TPS62903, multiple multi-function pins are used for additional flexibility shown in Figure 1 to cover very different applications with just one part, from space constrained smart locks needing low quiescent current, to data centers needing high efficiency.
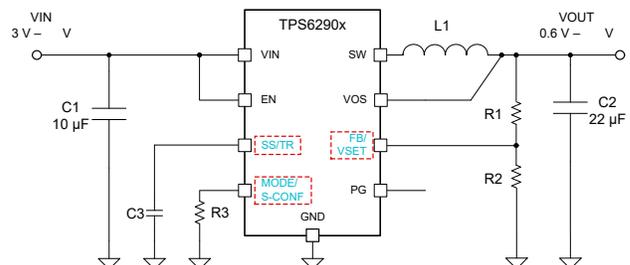
Figure 1. Multi-Function Pins

Multi-Function Pins are Easy... for Supply Chain

Multi-function pins help simplify a design with fewer external components to configure the feature sets. Fewer passives needed to design-in a given part results in a smaller total solution size and cost. See the second reference in Additional Resources section. Using the same device on multiple projects and a smaller BOM count both contribute to drastically simplifying the supply chain.

Reducing package size is the driving factor behind the creation of multi-function pinouts, but there are many more benefits that they bring to the table. Using products that incorporate one or more multi-function pins can result in reduced solution size and BOM count, increased application flexibility, quicker time-to-market, and a simplified supply chain. All making life a little easier.

Additional Resources

- Texas Instruments, Understanding the Trade-offs and Technologies to Increase Power Density
- Texas Instruments, Which Pinout is Best? How Individual, Multifunctional and Trimmed Pinouts Help Address Design Challenges

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