Application Brief

Discrete Power Design for C2000™

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Introduction

The TMS320F28xxxx-Q1 is a member of the C2000™ real-time microcontroller family of scalable, ultra-low latency devices designed for efficiency in power electronics, including but not limited to: high power density, high switching frequencies, and supporting the use of GaN and SiC technologies. The C2000 supports key applications such as onboard chargers, DCDC controllers, traction inverters, and digital cockpit. The TMS320F28xxxx-Q1 supports up to 384KB (192KW) of flash memory divided into three 128KB (64KW) banks, which enable programming and execution in parallel. Up to 69KB (34.5KW) of on-chip SRAM is also available to supplement the flash memory.

Why Discrete Design?

The primary benefit of using discrete power components is flexibility. The ability to swap, add, or remove individual components provides an easy way to conform to any changes in system power requirements. For example, processor power requirements are trending towards higher power with each generation. A discrete power design can easily accommodate this increase in power demand with the addition or scaling-up of individual components. This results in a simplified product and a shorter design cycle time. Alternatively, a different system can draw less power and can have less stringent requirements for power supply performance. In this case, a more cost-optimized power supply is called for and can be achieved by removing or swapping power components as needed. Removing one or more power rails from an existing design can be as simple as not populating the board with the component. This can save time and money by utilizing a power design tailored exactly to the needs of the system.

Power Requirements

The TMS320F28xxxx-Q1 requires three power supply groups. The power supply groups include the 1.2V core supply (VDD), 3.3V analog supply (VDDA), and 3.3V digital supply (VDDIO). See also *TMS320F28003x Real-Time Microcontrollers Data Sheet* .

Table 1. C2000 Power Requirements

Power Device	Signal	V_{OUT} (V)	TMS320F2800157-Q1 TMS320F280049-Q1 TMS320F280039-Q1		TMS320F28P659DK-Q1	
			Device	I_{OUT} (mA)	Device	I_{OUT} (mA)
DC/DC	VDDIO VDDA	3.3	LMR43606-Q1	600	LMR43610-Q1	1000
LDO	VDD	1.2	TPS745-Q1	500	TPS746-Q1	1000
VREF	VREF_HI	3.0	LM4040-N-Q1	15	LM4040-N-Q1	15
SVS+WD	GPIOx_WDI GPIOx_nRST GPIOx_ACT MONx	NA	TPS389C03-Q1	NA	TPS389C03-Q1	NA

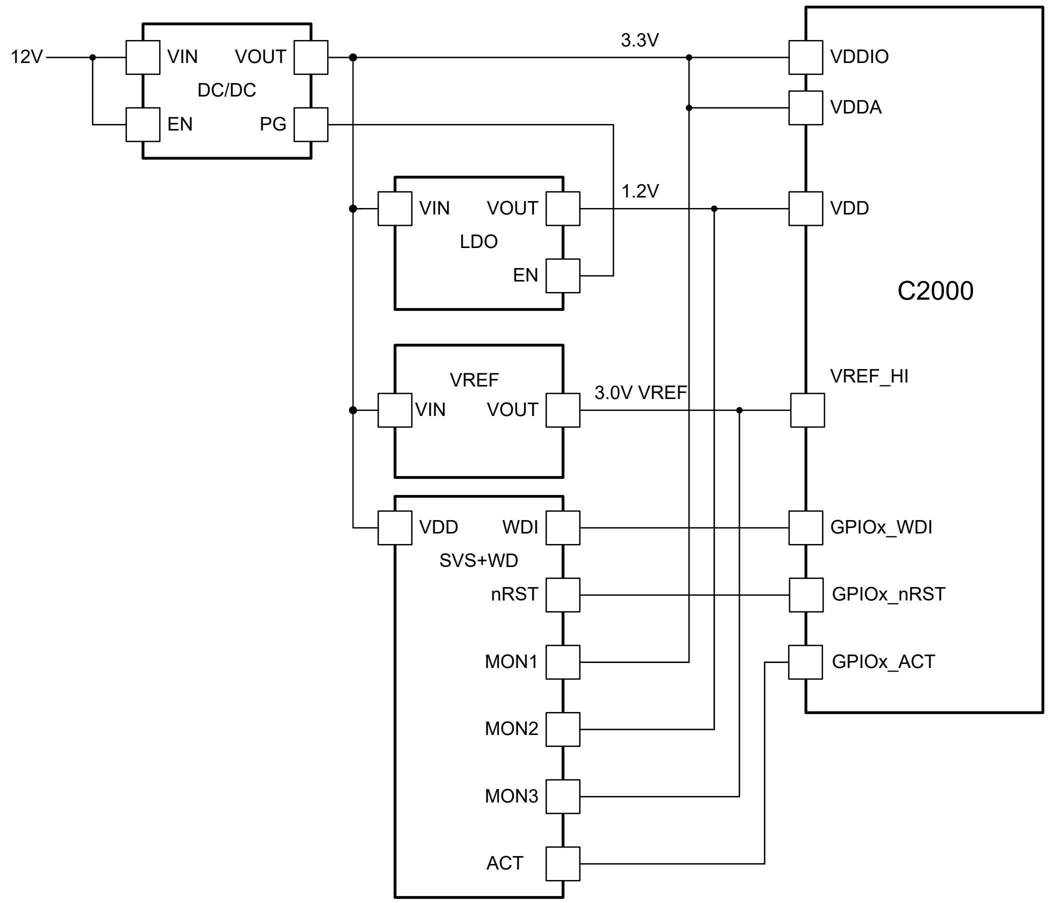

Figure 1. System Power Block Diagram

References

1. Texas Instruments, *Let's Break It Down: How Buck Converters Make Your Power Supply More Flexible Technical Article*
2. Texas Instruments, *LMR43606-Q1, 36V, 0.6A, Automotive Buck Converter Data Sheet*
3. Texas Instruments, *LMR436x0-Q1, 36V, 1A, Automotive Buck Converter Data Sheet*
4. Texas Instruments, *TPS745-Q1 Automotive, 500-mA LDO With Power-Good Data Sheet*
5. Texas Instruments, *TPS746-Q1 Automotive, 1000-mA LDO With Power-Good Data Sheet*
6. Texas Instruments, *LM4040-N/-Q1 Precision Micropower Shunt Voltage Reference Data Sheet*
7. Texas Instruments, *TPS389C03-Q1 Multichannel Overvoltage and Undervoltage I2C Programmable Voltage Supervisor and Monitor with Q&A Watchdog Data Sheet*
8. Texas Instruments, *TMS320F28003x Real-Time Microcontrollers Data Sheet*
9. Texas Instruments, *TMS320F28004x Real-Time Microcontrollers Data Sheet*
10. Texas Instruments, *TMS320F280015x Real-Time Microcontrollers Data Sheet*
11. Texas Instruments, *TMS320F28P65x Real-Time Microcontrollers Data Sheet*
12. *Note: Refer to the existing Discrete Power Solution for AM62x Application Note for detailed information.*

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