TPS2420 Reference Design

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1 Application

12 V to operate a hot plugged disk drive.

2 Introduction

The 12-V specification for a disk drive is approximately 1-A operating current and 2-A typical spin-up. Selecting a 2.5-A setting for I_{FAULT} would allow some margin for the operating current and satisfy the start current requirements.

3 Schematic

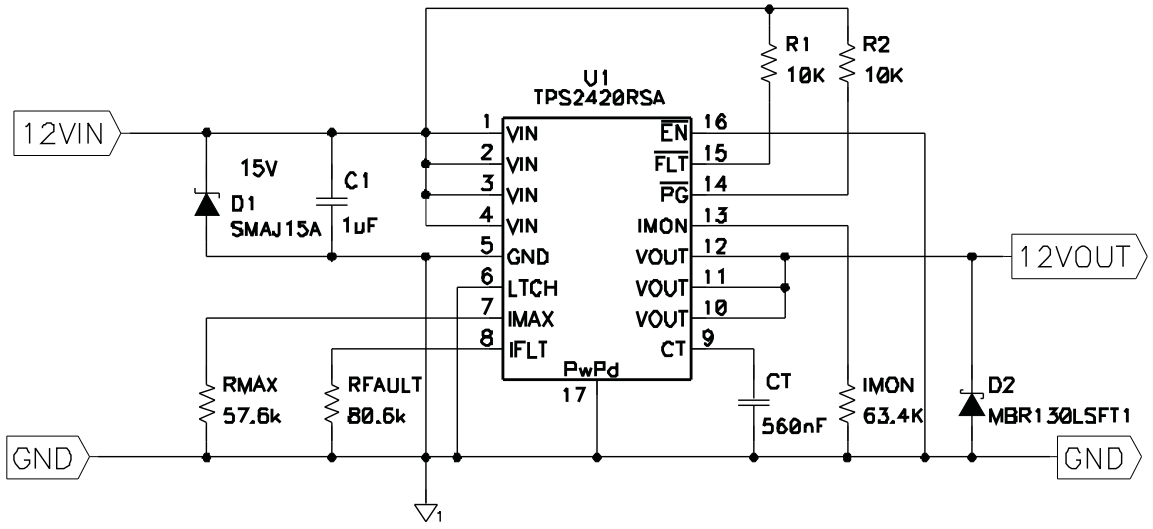

Figure 1.

4 Design Example

Calculate R_{RFLT} using Equation 1.

$$R_{RFLT} = \frac{200000}{2.5} = 80\ k\Omega,\ use\ 80.6\ k\Omega \tag{1}$$

The I_{MAX} setting, 3.5 A, is set by R_{RMAX} in Equation 2.

$$R_{RMAX} = \frac{201\ k\Omega}{I_{MAX}} = \frac{201000}{3.5} = 57.4,\ use\ 57.6\ k\Omega \tag{2}$$

Since I_{FAULT} satisfies the spin up current, the timer can be set for the additional loading of charging the capacitor. Estimate approximately 20 ms. Use Equation 3 to estimate the capacitance.

$$CT = \frac{20 \times 10^{-3}}{38.9 \times 103} = 0.514 \times 10^{-6}\ Farads,\ use\ 560\ nF \tag{3}$$

For a scaled analog readback of the current from VIN, set the I_{MON} resistor. In Equation 4 and Equation 5, the V_{AD_INMAX} is the desired full scale A/D converter voltage. The largest value of V_{AD_INMAX} 2.5 V. $I_{LOADMAX}$ is the full scale current, 2.5 A.

$$R_{IMON} = \frac{\left(63000 \times V_{AD\_INMAX}\right)}{I_{LOADMAX}} \tag{4}$$

$$R_{IMON} = \frac{\left(63000 \times 2.5\right)}{2.5} = 63\ k\Omega,\ use\ 62.5\ k\Omega \tag{5}$$

The read back voltage at I_{MON}, V_{IMON}, indicates the instantaneous current output. Using Equation 4 and Equation 5 again, determine the current output for example, a 1.8-V V_{IMON}. Substitute V_{IMON} for V_{AD_INMAX} and I_{LOAD} for $I_{LOADMAX}$ and solve for I_{LOAD}, (Equation 6 and Equation 7).

$$I_{LOAD} = \frac{\left(63000 \times V_{IMON}\right)}{R_{IMON}} \tag{6}$$

$$I_{LOAD} = \frac{\left(63000 \times 1.8\right)}{62500} = 1.81\ A \tag{7}$$

5 List of Materials

Table 1. List of Materials

COUNT	REF DES	DESCRIPTION	PART NUMBER	MFR
1	C1	Capacitor, ceramic, 30 V, X7R, 1 µF, 603	STD	muRata
1	CT	Capacitor, ceramic, 10 V, X7R, 560 nF, 603	STD	muRata
1	D1	Diode, transient voltage suppressor, 400 W, 15 V, SMA	SMAJ15A	Littelfuse
1	D2	Diode, Schottky, 1000 mA, 30 V, SOD123	MBR130LSFT1	STD
1	IMON	Resistor, chip, 1/16 W, 1%, 63.4 kΩ, 603	STD	Vishay
2	R1, R2	Resistor, chip, 1/16 W, 1%, 10 kΩ, 603	STD	Vishay
1	RFAULT	Resistor, chip, 1/16 W, 1%, 80.6 kΩ, 603	STD	Vishay
1	RMAX	Resistor, chip, 1/16 W, 1%, 57.6 kΩ, 603	STD	Vishay
1	U1	0 to 12-V Integrated FET Hot Swap, QFN-16	TPS2420RSA	TI

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