

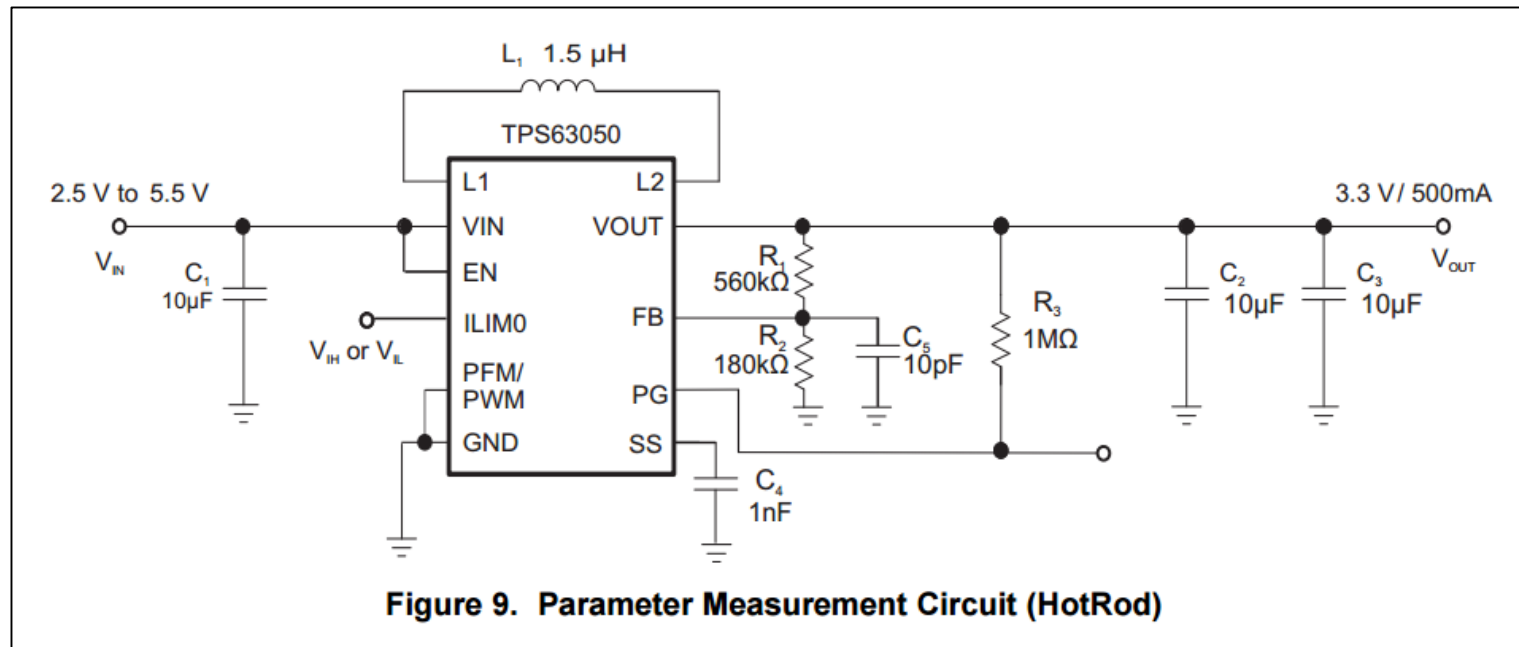
TPS63050 Support Request

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TPS63050 – Soft Start Not So Soft

- Set by 1uA Current filling C4 in picture below:
- Soft-Start does not work
- It works for a few microseconds and then is lifted and IC jumps to regulated voltage like normal



Soft Start Calculation:

8.3.5 Soft Start

To minimize inrush current and output voltage overshoot during start up, the device has a soft start. At turn on, the input current raises monotonically until the output voltage reaches regulation. The TPS6305x devices charge the soft start capacitor, at the SS pin, with a constant current of typically 1 μ A. The input current follows the current used to charge the capacitor at the SS pin. The soft start operation is completed once the voltage at the SS pin has reached typically 1.3 V. Figure 3 shows the value of the soft start capacitor in respect to the soft-start time.

The soft-start time is the time from when the EN pin is asserted to when the output voltage has reached 90% of its nominal value. There is typically a 100- μ s delay time from EN pin assertion to the start of the switching activity. The soft-start time depends on the load current, the input voltage, and the output capacitor. The soft-start time in boost mode is longer than the time in buck mode and it also depends on the load current, input voltage and output capacitor.

The soft-start time in Figure 3 is referred to typical application with 10- μ F effective output capacitance.

The inductor current is able to increase and always assure a soft start unless a real short circuit is applied at the output.

TPS63050 Datasheet:

Electrical Characteristics (continued)
 $V_{IN} = 3.6 \text{ V}$, $T_J = -40^\circ\text{C}$ to 125°C , typical values are at $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{SS_IN} Programmable inrush current limit ⁽³⁾	$I_{LIM0} = V_{IL}$, $I_{LIM1} = V_{IL}$, $V_{IN} = 3.0 \text{ V}$, $V_{OUT} = 3.3 \text{ V}$, (Available for DBGA only)		$0.4 \times I_{IN_MAX}$		mA
	$I_{LIM0} = V_{IH}$, $I_{LIM1} = V_{IL}$, $V_{IN} = 3.0 \text{ V}$, $V_{OUT} = 3.3 \text{ V}$, (Available for DBGA only)		$0.5 \times I_{IN_MAX}$		
	$I_{LIM0} = V_{IL}$, $I_{LIM1} = V_{IH}$, $V_{IN} = 3.0 \text{ V}$, $V_{OUT} = 3.3 \text{ V}$		$0.65 \times I_{IN_MAX}$		
	$I_{LIM0} = V_{IH}$, $I_{LIM1} = V_{IH}$, $V_{IN} = 3.0 \text{ V}$, $V_{OUT} = 3.3 \text{ V}$		I_{IN_MAX}		
I_{SS} Soft-start current TPS63051			1		μ A
I_{SS} Soft-start current TPS63050			3.2		μ A
Line regulation	$V_{IN} = 2.5 \text{ V}$ to 5.5 V , $I_{OUT} = 500 \text{ mA}$, PWM mode		0.963		mV/V
Load regulation	$V_{IN} = 3.6 \text{ V}$, $I_{OUT} = 0 \text{ mA}$ to 500 mA , PWM mode		4		mV/A

(3) For variation of this parameter with Input voltage see Figure 3.

Which is it?

- Datasheet Wording is not clear which is the SS current
- SS Pin does not settle at 1.3V
 - Both edited and not-edited DKs show $\sim 2.875\text{V}$ on SS pin when V_{out} is stable
- On TPS63050EVM-679, SS Pin (Top of C3) voltages moves with V_{in} . Shouldn't this be stable at 1.3V after startup?
- SS load current: $\sim 25\mu\text{A}$ only

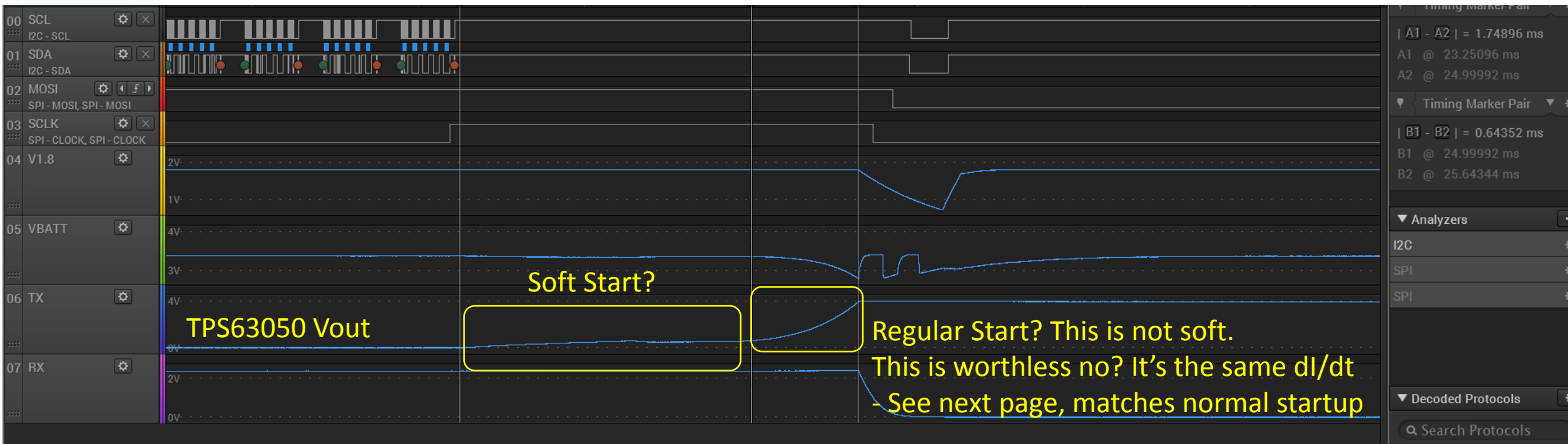
CC Calculation in Excel:

Soft-Start: MCR45		
Current:	3.20E-06	C/sec
Voltage:	1.3	V
Capacitance:	4.70E-09	C/V
Time:	1.91E-03	Sec

Does not match, we measure 1.5ms using a 10nF Cap

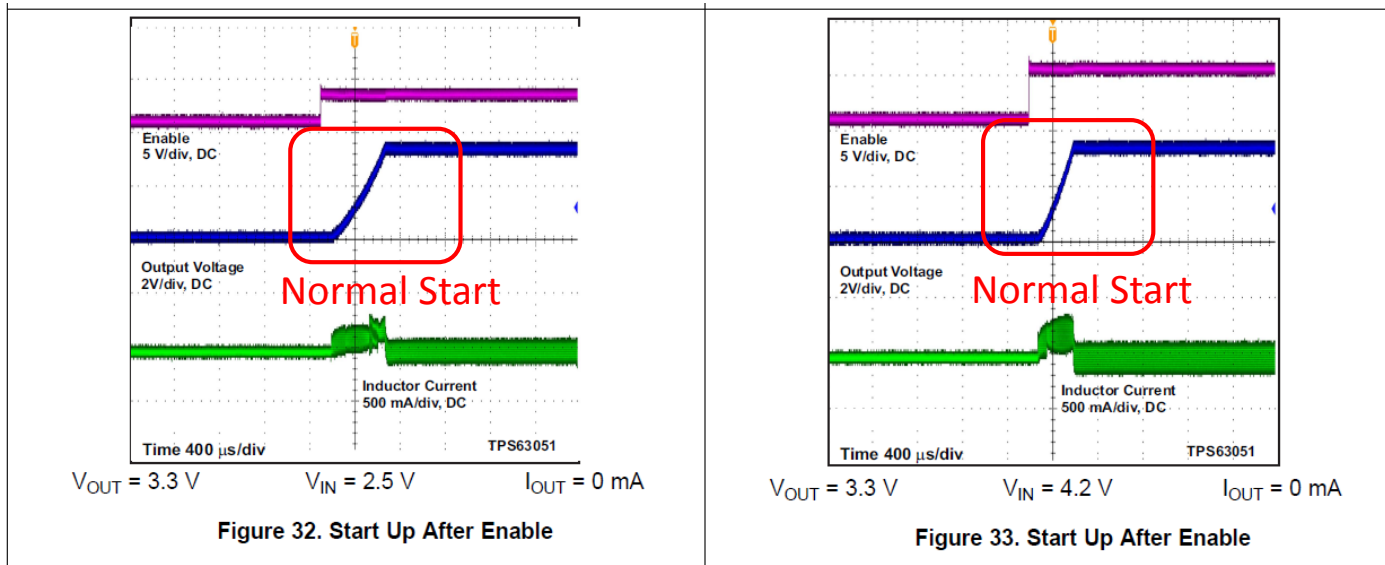
What we're seeing: Using TPS63050 Dev Kit

- TPS62050EVM-002 DevKit → C6 = 10nF
- ILim0, ILim1 both set low
 - We can see zero difference on this setting.



TPS63050 Datasheet Start-Up (Not Soft-Start)

- There is no datasheet screen short of soft-start
- This start ramp matches the 2nd phase of the startup we're seeing on the previous slide. This shows the soft-start is not staying engaged all the way until it reaches target output regulation voltage.



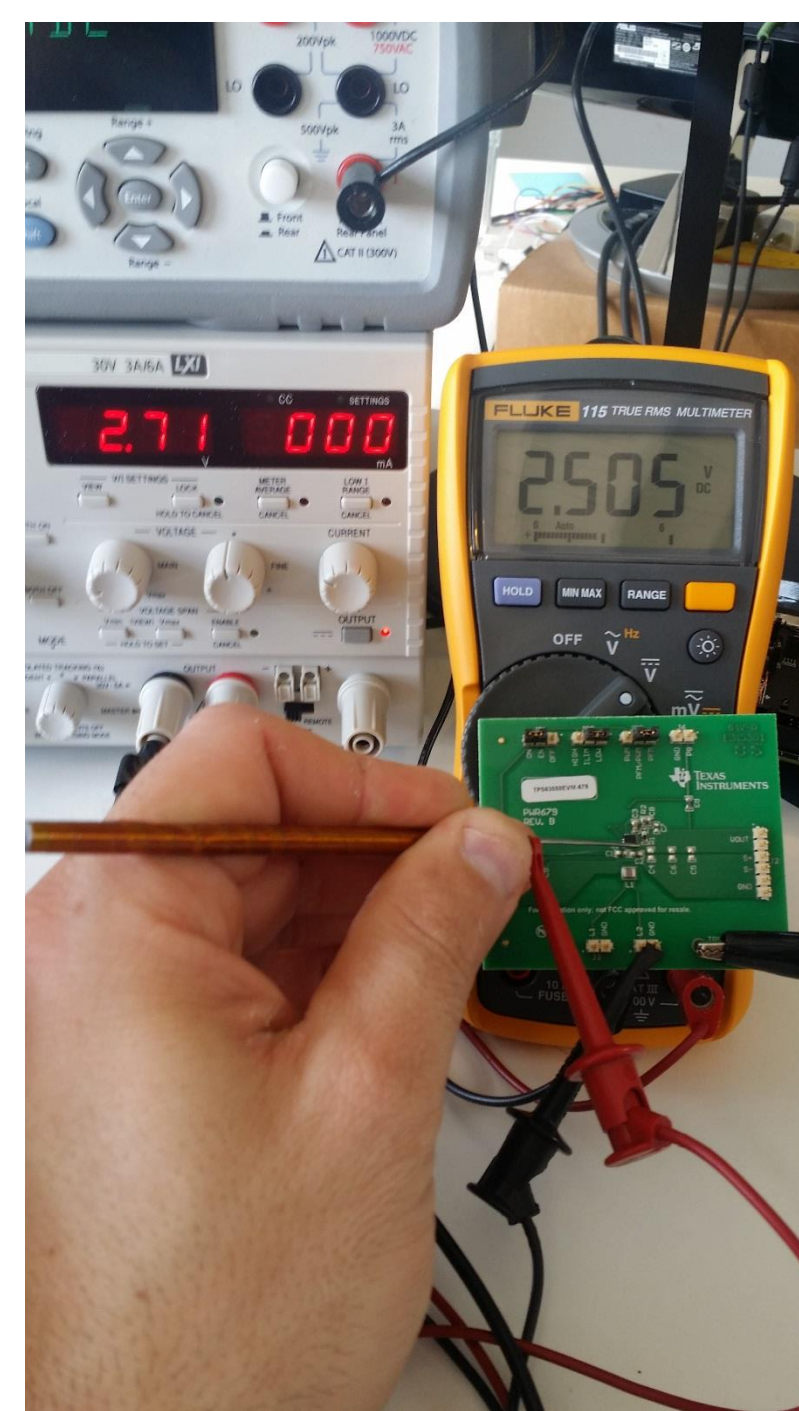
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It doesn't do this

SS Pin does not set to 1.3V as Spec'ed in Datasheet?

- TPS63050EVM-679 (QFN, adjustable, configured for 3.3V)
 - No Changes were made
- $V_{in} = 2.71V$, $V_{out} = 3.3V$, $V(ss-pin) = 2.505V$?
 - This should be stable at 1.3V right?
 - SS Voltage continues to rise even after V_{out} has settled
 - V_{out} settles to the correct target voltage set by adjustment resistors



Conclusion & Support Request

- Soft-Start is not show in datasheet
- Soft-Start not working as expected, works at first and then simply starts up using normal regulation (not soft)
- Soft-start Cap voltage is not 1.3V as spec'ed and varies with Vin.
- SS time calculation and cap selection never matches what is seen on measurement.
- Request immediate support as we are about to release pre-production product PCB
- Please contact Peter Twiss (310)781-0754, peter@mymotiv.com
 - ASAP please, thanks