

Radiation Hardened High Voltage Synchronous Step-Down Controller

DESCRIPTION

The **RH3845MW** is a high voltage, synchronous, current mode controller for medium to high power, high efficiency supplies. It offers a wide 7.5V to 60V input range. With an external V_{CC} supply, the input can drop to 4V and continue to operate after startup. An onboard regulator simplifies the biasing requirements by providing IC power directly from V_{IN} .

Additional features include an adjustable fixed operating frequency synchronizable to an external clock for noise sensitive applications, gate drivers capable of driving large N-channel MOSFETs, a precision undervoltage lockout, low shutdown current, short-circuit protection and a programmable soft-start, and overtemperature protection.

Note that Burst Mode® operation, available in the LT®3845, is not available in the RH3845 version.

RH3845MW-1 operates in pulse skip mode where reverse inductor current is disallowed. Regulation is achieved at light loads by skipping cycles. Operation in pulse skip mode yields higher light load efficiency, but higher output voltage ripple.

RH3845MW-2 operates in forced continuous mode where reverse inductor current is allowed. This mode of operation maintains a constant frequency over all loads making it suitable for noise sensitive applications. However, forced continuous mode is less efficient at light loads.

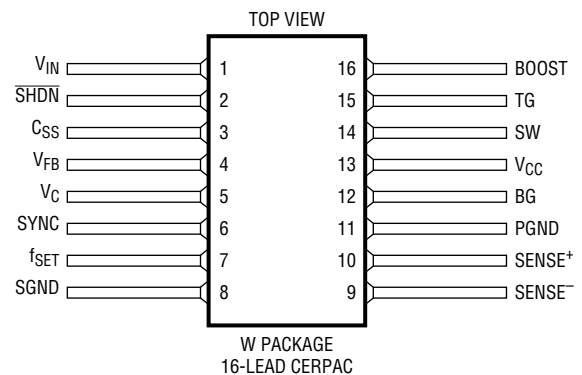
ABSOLUTE MAXIMUM RATINGS

(Note 1, 4)

V_{IN}	65V
BOOST	80V
BOOST to SW	24V
V_{CC}	24V
SENSE ⁺ , SENSE ⁻	40V
SENSE ⁺ to SENSE ⁻	±1V
SYNC, V_{FB} and C_{SS}	5V
SHDN Pin Current	1mA
Junction Temperature	150°C
Storage Temperature Range	-65°C to 150°C

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PACKAGE INFORMATION



Order Part Number
RH3845MW-1
RH3845MW-2

RH3845MW

TABLE 1: ELECTRICAL CHARACTERISTICS (Pre-Irradiation) Unless specified, specifications are at $V_{IN} = 20V$, $V_{CC} = BOOST = 10V$, $\overline{SHDN} = 2V$, $R_{SET} = 49.9k\Omega$, $SENSE^- = SENSE^+ = 10V$, $SGND = PGND$, $SW = 0V$.

PARAMETER	CONDITIONS	SUB-GROUP	$T_A = 25^\circ C$			SUB-GROUP	$-55^\circ C \leq T_A \leq 125^\circ C$			UNITS
			MIN	TYP	MAX		MIN	TYP	MAX	
V_{IN} Minimum Start Voltage (Note 2)		1			7.5	2, 3			7.5	V
V_{IN} UVLO Threshold (Falling)		1	3.6	3.8	4.0	2, 3	3.6	3.8	4.0	V
V_{IN} Supply Current	$V_{CC} > 9V$	1		130	200	2, 3			800	μA
V_{IN} Shutdown Current	$V_{SHDN} = 0.3V$	1		65	100	2, 3			200	μA
BOOST Supply Current (Note 3)		1		1.4	2	2, 3			3.5	mA
V_{CC} Supply Current		1		3.8	4.5	2, 3			6.1	mA
V_{CC} Current Limit		1	-40	-150		2, 3	-40			mA
\overline{SHDN} Enable Threshold (Rising)		1	1.30	1.35	1.4	2, 3	1.30		1.5	V
\overline{SHDN} Hysteresis		1		140		2, 3	100		200	mV
Reference Voltage		1	1.222	1.232	1.244	2, 3	1.214		1.250	V
V_{FB} Input Bias Current	RH3845MW-1 RH3845MW-2	1		± 60 ± 20	± 200 ± 150	2, 3		± 60 ± 20		nA nA
V_{FB} Error Amp Transconductance		1	350	450		2, 3	340		540	μS
Error Amp Sink/Source Current		1	35	50		2, 3	20			μA
Peak Current Limit Sense Voltage		1	90	105	120	2, 3	85		125	mV
Soft-Start Charge Current		1	8	12	14	2, 3	8		16	μA
Sense Pins Common-Mode Range		1	0		36	2, 3	0		36	V
Sense Pins Input Current	$V_{SENSE(CM)} > 4V$	1		320	400	2, 3			500	μA
Reverse Protect Sense Voltage	RH3845MW-2	1		108	120	2, 3			140	mV
Reverse Current Sense Voltage Offset	RH3845MW-1	1		15	20	2, 3			25	mV
Switching Frequency	$R_{SET} = 49.9k$	1	270	300	360	2, 3	240		390	kHz
Programmable Frequency Range		1	100		500	2, 3	100		500	kHz
External Sync Frequency Range		1	100		600	2, 3	100		600	kHz
Non-Overlap Time TG to BG		1		250		2, 3				ns
Non-Overlap Time BG to TG		1		250		2, 3				ns
TG Minimum On-Time		1		400		2, 3				ns
TG Minimum Off-Time		1		300		2, 3				ns
TG, BG Drive On Voltage		1	8	8.75		2, 3	8			V
TG, BG Drive Off Voltage		1			0.1	2, 3			0.1	V
TG, BG Drive Rise Time	$C_{TG} = C_{BG} = 3300pF$	1		45		2, 3				ns
TG, BG Drive Fall Time	$C_{TG} = C_{BG} = 3300pF$	1		45		2, 3				ns

TABLE 2: ELECTRICAL CHARACTERISTICS (Post-Irradiation) Unless specified, specifications are at TA = 25°C, V_{IN} = 20V, V_{CC} = BOOST = 10V, SHDN = 2V, R_{SET} = 49.9kΩ, SENSE⁻ = SENSE⁺ = 10V, SGND = PGND, SW = 0V.

PARAMETER	CONDITIONS	10KRAD (Si)		20KRAD (Si)		50KRAD (Si)		100KRAD (Si)		200KRAD (Si)		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
V _{IN} Minimum Start Voltage (Note 2)		7.5		7.5		7.5		7.5		7.5		V
V _{IN} UVLO Threshold (Falling)		4		4		4		4		4		V
V _{IN} Supply Current	V _{CC} > 9V	200		200		200		200		200		μA
V _{IN} Shutdown Current	V _{SHDN} = 0.3V	100		100		100		100		100		μA
BOOST Supply Current (Note 3)		2		2		2		2		2		mA
V _{CC} Supply Current		4.5		4.5		4.5		4.5		4.5		mA
V _{CC} Current Limit		-40		-40		-40		-40		-40		mA
SHDN Enable Threshold (Rising)		1.30	1.5	1.30	1.5	1.30	1.5	1.30	1.5	1.30	1.5	V
SHDN Hysteresis		100	180	100	180	100	180	100	180	80	180	mV
Reference Voltage		1.222	1.244	1.218	1.244	1.216	1.244	1.212	1.244	1.195	1.244	V
V _{FB} Input Bias Current	RH3845MW-1 RH3845MW-2		±200 ±150		±250 ±200		±300 ±250		±400 ±350		±450 ±400	nA nA
V _{FB} Error Amp Transconductance		350		330		300		280		250		μS
Error Amp Sink/Source Current		35		35		35		35		30		μA
Peak Current Limit Sense Voltage		90	120	85	120	85	120	80	120	75	120	mV
Soft-Start Charge Current		8	16	8	16	6	16	5	16	4	16	μA
Sense Pins Common-Mode Range			36		36		36		36		36	V
Sense Pins Input Current	V _{SENSE(CM)} > 4V		400		400		400		400		400	μA
Reverse Protect Sense Voltage	RH3845MW-2		120		120		120		120		120	mV
Reverse Current Sense Voltage Offset	RH3845MW-1		20		20		20		23		26	mV
Switching Frequency	R _{SET} = 49.9k	270	370	270	370	270	370	270	370	270	370	kHz
Programmable Frequency Range		100	500	100	500	100	500	100	500	100	500	kHz
External Sync Frequency Range		100	600	100	600	100	600	100	600	100	600	kHz
TG, BG Drive On Voltage		8		8		8		8		8		V
TG, BG Drive Off Voltage			0.1		0.1		0.1		0.1		0.1	V

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability.

Note 2: V_{IN} voltages below the start-up threshold (7.5V) are only supported when the V_{CC} is externally driven above 6.5V.

Note 3: Supply current specification does not include switch drive currents. Actual supply currents will be higher.

Note 4: This IC includes overtemperature protection that is intended to protect the device during momentary overload conditions. When junction temperatures exceed 140°C, nominally, the device will cease operation until temperature decreases. Continuous operation above specified maximum operation temperature may impair device reliability.

ELECTRICAL CHARACTERISTICS: BURN-IN DELTA PARAMETERSSpecifications are at $T_A = 25^\circ\text{C}$.

PARAMETER	CONDITIONS	ENDPOINT LIMITS		DELTA LIMITS		UNITS
		MIN	MAX	MIN	MAX	
Reference Voltage	$V_{IN} = 20\text{V}$, $V_{CC} = \text{Boost} = 10\text{V}$, $\text{SHDN} = 2\text{V}$, $R_{SET} = 49.9\text{k}$, $\text{SENSE-} = \text{SENSE+} = 10\text{V}$, $\text{SGND} = \text{PGND} = \text{SW} = 0\text{V}$	1.222	1.244			V
				-3	3	mV

ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements (Method 5004)	1*, 2, 3
Group A Test Requirements (Method 5005)	1, 2, 3
Group B and D for Class S, End Point Electrical Parameters (Method 5005)	1, 2, 3

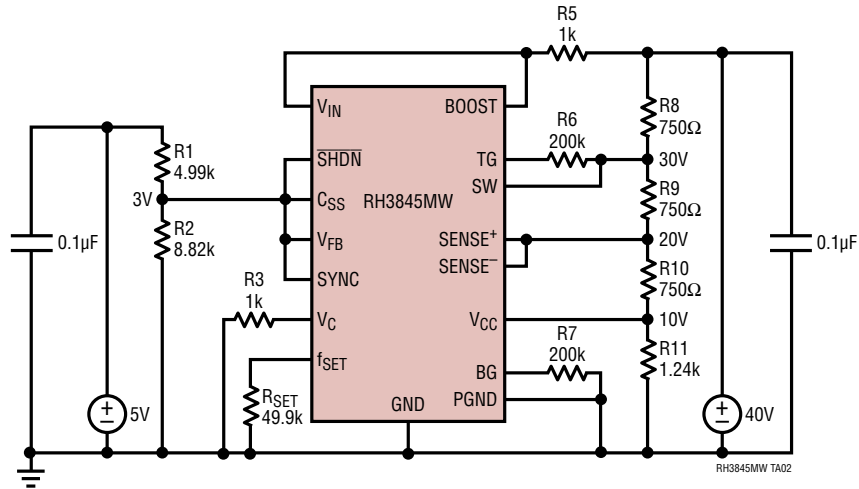
*PDA applies to subgroup 1. See PDA Test Notes.

PDA Test Notes

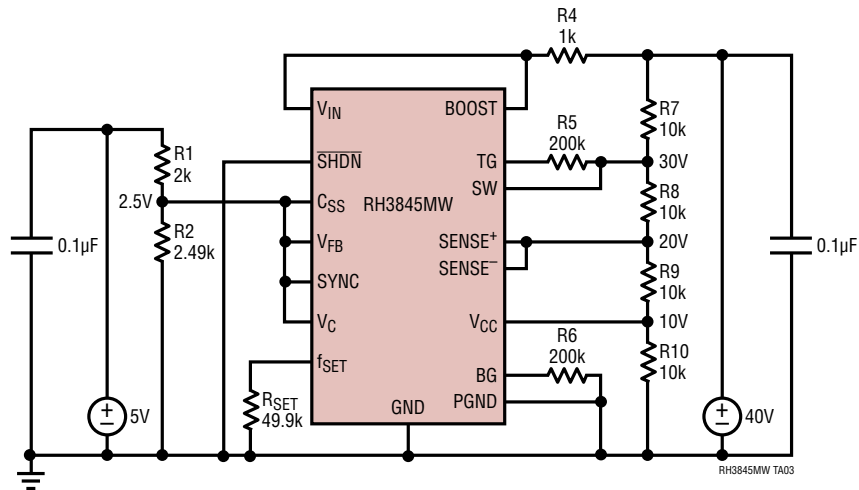
The PDA is specified as 5% based on failures from Group A, Subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883. The verified failures of Group A, Subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

Analog Devices reserves the right to test to tighter limits than those given.

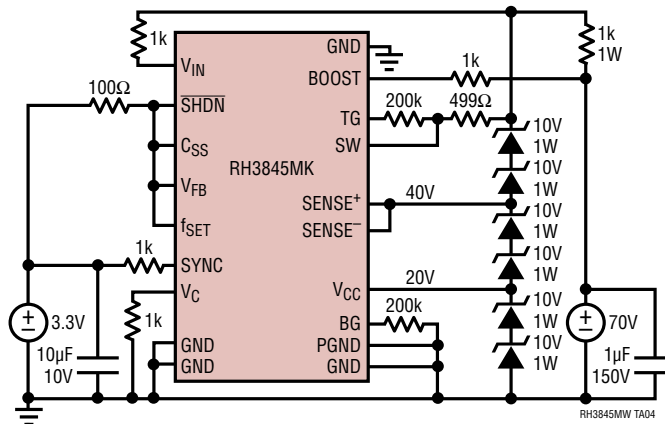
TOTAL DOSE BIAS CIRCUIT — RUN MODE



TOTAL DOSE BIAS CIRCUIT — SHUTDOWN MODE

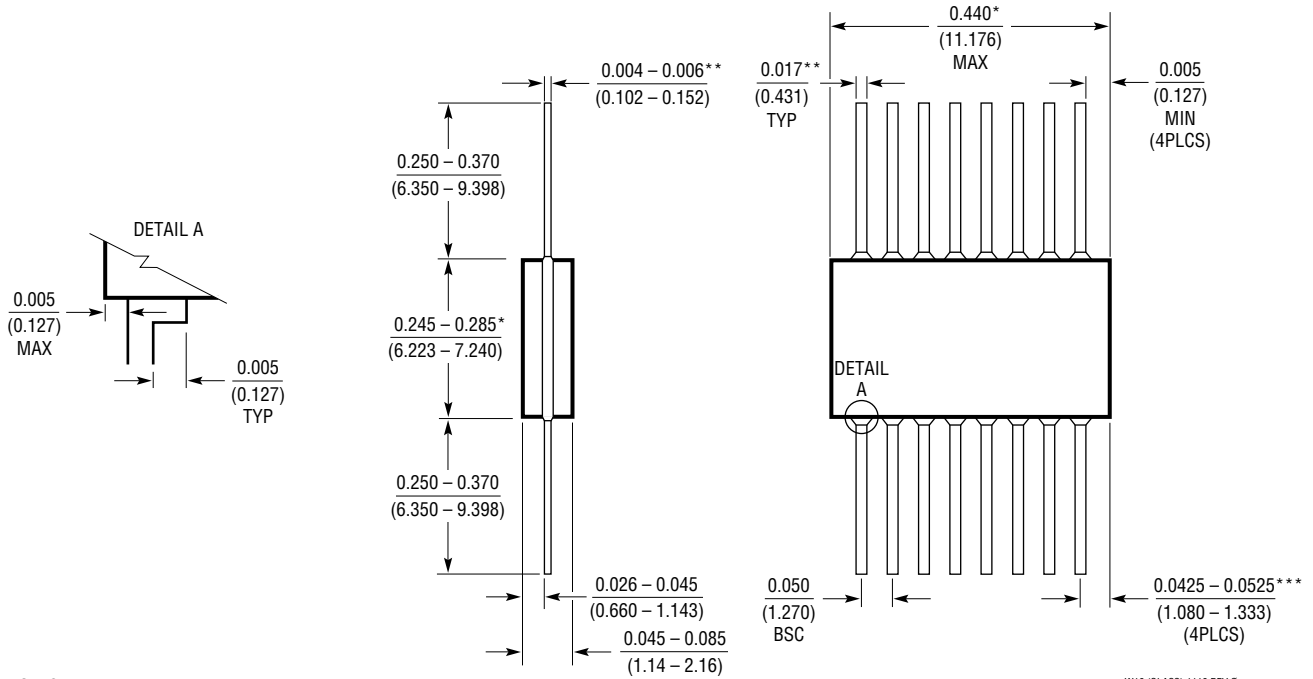


BURN-IN CIRCUIT—RUN MODE



PACKAGE DESCRIPTION

W Package 16-Lead Flatpak Glass Sealed (Hermetic) (Reference LTC DWG # 05-08-7003 Rev 0)



NOTES:

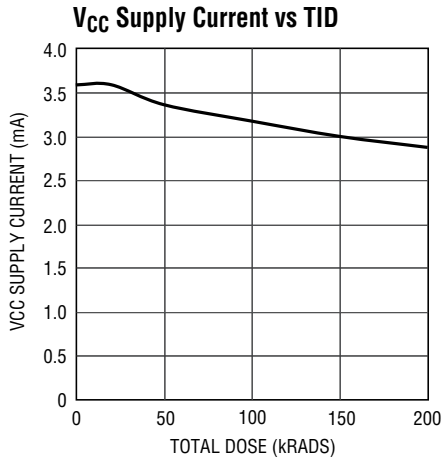
- *THIS DIMENSION DOES NOT ALLOW FOR OFF-CENTER LID, MENISCUS AND GLASS OVERRUN
- **INCREASE DIMENSIONS BY 0.003 INCHES (0.076mm) WHEN LEAD FINISH A IS APPLIED (SOLDER DIPPED)
- ***THIS DIMENSION NOT INCLUDE FOR A MAXIMUM 0.020 INCHES (0.508mm) OFF-SET TO CENTER LID

W16 (GLASS) 1119 REV 0

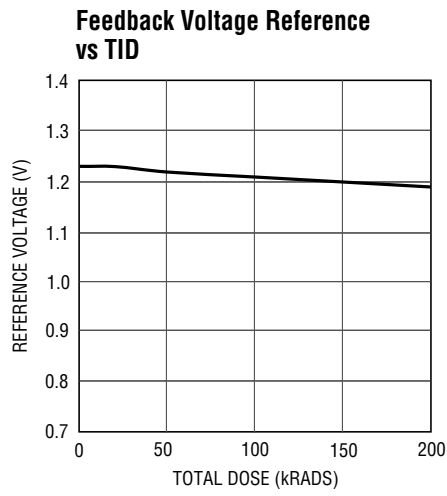
REVISION HISTORY

REV	DATE	DESCRIPTION	PAGE NUMBER
A	04/21	Removed Typical Application circuit; added detail on startup conditions in product description.	1

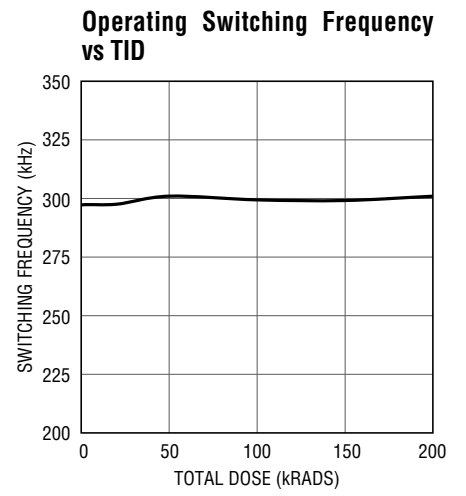
TYPICAL PERFORMANCE CHARACTERISTICS



RH3845MW G01



RH3845MW G02



RH3845MW G03