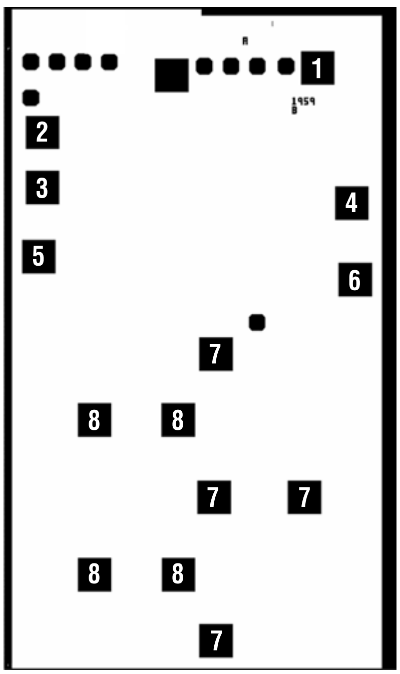
DICE/DWF SPECIFICATION

RH1959MILDICE
4.5A, 500KHz Step-Down Switching Regulator



PAD FUNCTION

1. GND
2. VC
3. SHDN
4. FB
5. SYNC
6. BOOST
7. V_{IN}
8. SW

80mils × 138mils,
Backside metal: Alloyed gold layer
Backside potential: GND

DIE CROSS REFERENCE

LTC Finished Part Number	Order Part Number
RH1959MK	RH1959MILDICE
RH1959MK	RH1959MILDWF*

Please refer to LTC standard product data sheet for other applicable product information.
***DWF = DICE in wafer form.**

DESCRIPTION

The RH1959 is a 500kHz monolithic buck mode switching regulator with an on-die 4.5A switch. It can accept inputs up to $16V_{IN}$ to generate outputs as low as $1.21V_{OUT}$. All necessary circuitry including oscillator, control logic, comparators, error amplifiers, and reference are included on die, keeping solution size minimal and saving external components. High switching frequency allows a considerable reduction in the size of external capacitors and inductor. The topology is current mode for fast transient response and good loop stability. A special high speed bipolar process and new design techniques achieve high efficiency at high switching frequency. High efficiency is maintained over a wide output current range by keeping quiescent supply current to 4mA and by utilizing a boost capacitor to saturate the NPN power switch. Full cycle-by-cycle short-circuit protection and thermal shutdown are provided for safe operation in overload conditions. A shutdown signal reduces supply current to 20µA while synchronization allows an external logic level signal to vary adjust switching frequency between 580kHz and 1MHz.

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Input Voltage..16V
Boost Voltage...30V
Boost Pin Above Input Voltage.................................15V
$\overline{\text{SHDN}}$ Pin Voltage...7V
FB Pin Voltage...3.5V
FB Pin Current...1mA
SYNC Pin Voltage..7V

RH1959MILDICE

DICE/DWF ELECTRICAL TEST LIMITS

For non-specified test conditions, $T_A = 25°C$, $T_J = 25°C$, $V_{IN} = 5V$, $V_C = 1.5V$, Boost = $V_{IN} + 5V$, switch open. (Note 2)

PARAMETER	CONDITIONS	MIN	MAX	UNITS
Feedback Voltage (Adjustable)	All Conditions	1.19	1.23	V
Reference Voltage Line Regulation	$4.3V \le V_{IN} \le 15V$	–0.03	0.03	%/V
Feedback Input Bias Current		–0.5	0.5	µA
Error Amplifier Voltage Gain (Note 3)		200		
Error Amplifier Transconductance (Note 9)	DI (VC) = ±10mA	1500	2700	mMho
Error Amplifier Source Current	$V_{FB} = 1.05V$	140	320	mA
Error Amplifier Sink Current $V_{FB} = 1.35V$	$V_{FB} = 1.35V$	140	320	mA
Switch Current Limit (Note 9)	VC Open, $V_{FB} = 1.05V$, DC ≤ 50%	4.5	8.5	A
Switch On Resistance (Notes 8, 9)	$I_{SW} = 4.5A$		0.1	Ω
Maximum Switch Duty Cycle $V_{FB} = 1.05V$	$V_{FB} = 1.05V$	90		%
Switch Frequency	VC Set to Give 50% Duty Cycle	460	540	kHz
Switch Frequency Line Regulation	$4.3V \le V_{IN} \le 15V$	–0.15	0.15	%/V
Frequency Shifting Threshold on FB Pin	Df = 10kHz	0.5	1	V
Minimum Input Voltage (Note 4)			4.3	V
Minimum Boost Voltage (Notes 5, 9)	$I_{SW} \le 4.5A$		3	V
Boost Current (Notes 6, 9)	$I_{SW} = 1A$ $I_{SW} = 4.5A$		35 140	mA mA
Input Supply Current (Note 7)			5.4	mA
Shutdown Supply Current	$V_{SHDN} = 0V$, $V_{SW} = 0V$, VC Open		50	µA
Lockout Threshold	VC Open, $V_{FB} = 1.05V$, DC ≤ 50%	2.3	2.46	V
Shutdown Thresholds	VC Open Device Shutting Down Device Starting Up	0.13 0.25	0.6 0.7	V V
Synchronization Threshold			2.2	V
Synchronizing Range		580	1000	kHz

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 and lifetime.

Note 2: Dice are probe tested at 25°C to the limits shown except for high current tests. Dice are tested under low current conditions which assure full load current specifications when assembled in packaging systems approved by Linear Technology.

Note 3: Gain is measured with a VC swing equal to 200mV above the switching threshold level to 200mV below the upper clamp level.

Note 4: Minimum input voltage is not measured directly, but is guaranteed by other tests. It is defined as the voltage where internal bias lines are still regulated so that the reference voltage and oscillator frequency remain constant. Actual minimum input voltage to maintain a regulated output will depend on output voltage and load current.

Note 5: This is the minimum voltage across the boost capacitor needed to guarantee full saturation of the internal power switch.

Note 6: Boost current is the current flowing into the boost pin with the pin held 5V above input voltage. It flows only during switch on time.

Note 7: Input supply current is the bias current drawn by the input pin with switching disabled.

Note 8: Switch on resistance is calculated by dividing V_{IN} to V_{SW} voltage by the forced current (4.5A).

Note 9: This parameter is not measured directly, but is guaranteed by design.

Wafer level testing is performed per the indicated specifications for dice. Considerable differences in performance can often be observed for dice versus packaged units due to the influences of packaging and assembly on certain devices and/or parameters. Please consult factory for more information on dice performance and lot qualifications via lot sampling test procedures.

Dice data sheet subject to change. Please consult factory for current revision in production.

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