



The Future of Analog IC Technology®

MP1653

High-Efficiency, 3A, 17V, 800kHz Synchronous, Step-Down Converter In SOT 563

PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

DESCRIPTION

The MP1653 is a fully-integrated high-frequency, synchronous rectified, step-down, switch-mode converter with internal power MOSFETs. It offers a very compact solution to achieve a 3A continuous output current over a wide input range, with excellent load and line regulation. The MP1653 has synchronous-mode operation for higher efficiency over the output current-load range.

Constant On-Time control operation provides very fast transient response and easy loop design as well as very tight output regulation.

Full protection features include SCP, OCP, UVP, and thermal shutdown.

The MP1653 requires a minimal number of readily-available, standard, external components and is available in a space-saving SOT563 (1.6mmx1.6mm) package.

FEATURES

- Wide 4.2V-to-17V Operating Input Range
- 63mΩ/36mΩ Low- $R_{DS(ON)}$ Internal Power MOSFETs
- 180μA Low IQ Current
- High-Efficiency Synchronous-Mode Operation
- Power Save Mode at Light Load
- Fast Load Transient Response
- 800kHz Switching Frequency
- Internal Soft-Start
- Over-Current Protection and Hiccup
- Thermal Shutdown
- Output Adjustable from 0.8V
- Available in a SOT563(1.6mmx1.6mm) package

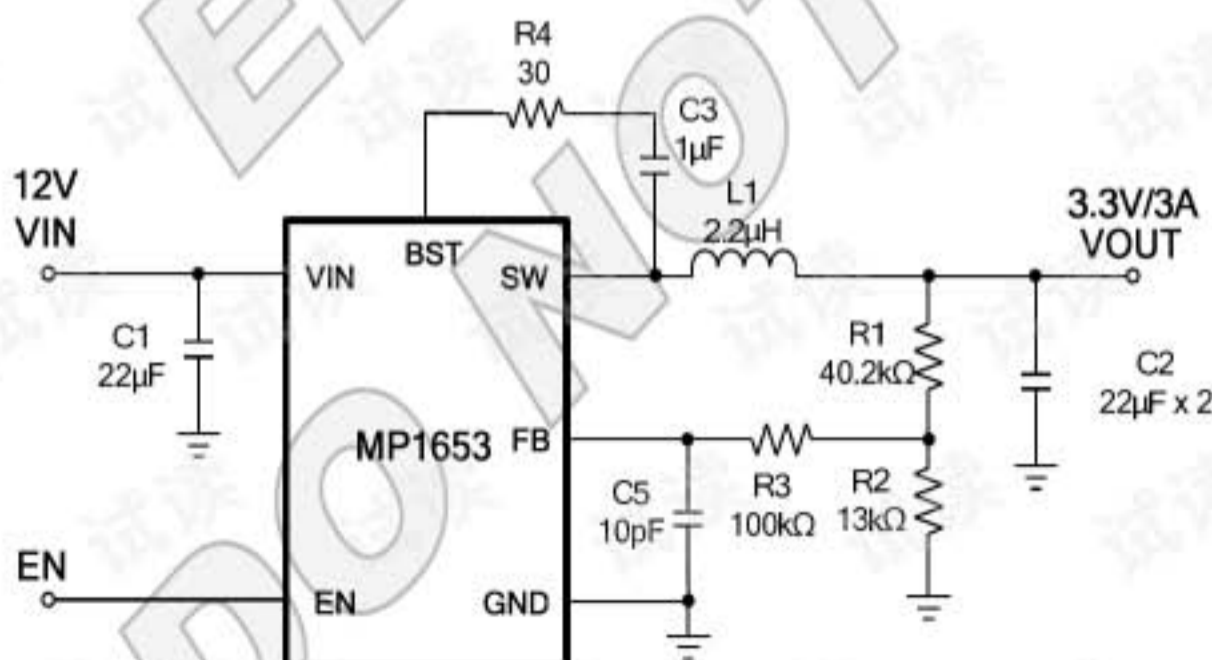
APPLICATIONS

- Security Camera
- Digital Set-Top Boxes
- Flat-Panel Television and Monitors
- General Purposes

All MPS parts are lead-free, halogen free, and adhere to the RoHS directive. For MPS green status, please visit MPS website under Quality Assurance.

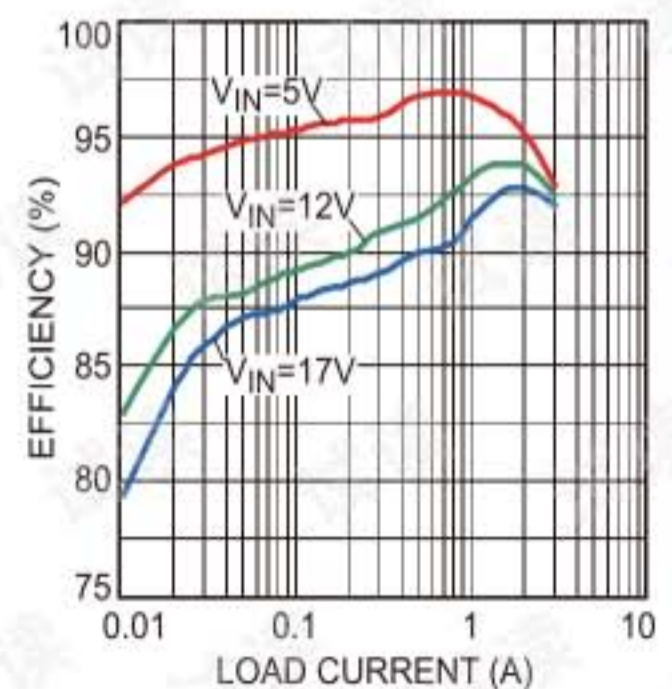
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TYPICAL APPLICATION



Efficiency

$V_{OUT}=3.3V, L=2.2\mu H, DCR=11.4m\Omega$



ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

V_{IN}	-0.3V to 18V
V_{SW}	-0.6V (-5V for <10ns) to 18V (19V for <10ns)
V_{BST}	$V_{SW}+3.3V$
V_{EN}	-0.3V to 6.5V ⁽²⁾
All Other Pins	-0.3V to 5V
Continuous Power Dissipation ($T_A = +25^\circ C$) ⁽³⁾	1W
Junction Temperature	150°C
Lead Temperature	260°C
Storage Temperature	-65°C to 150°C

Recommended Operating Conditions ⁽⁴⁾

Supply Voltage V_{IN}	4.2V to 17V
Output Voltage V_{OUT}	0.8V to $V_{IN} \times D_{MAX}$ or 10V max
Operating Junction Temp. (T_J)	-40°C to +125°C

Thermal Resistance ⁽⁵⁾	θ_{JA}	θ_{JC}	
SOT563(1.6mmx1.6mm)	130	60	°C/W

Notes:

- 1) Exceeding these ratings may damage the device.
- 2) For details of the EN's ABS max rating, please refer to the EN control section on page 10.
- 3) The maximum allowable power dissipation is a function of the maximum junction temperature T_J (MAX), the junction-to-ambient thermal resistance θ_{JA} , and the ambient temperature T_A . The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D (MAX) = $(T_J$ (MAX)- T_A)/ θ_{JA} . Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
- 4) The device is not guaranteed to function outside of its operating conditions.
- 5) Measured on JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

$V_{IN} = 12V$, $T_J = -40^{\circ}C$ to $+125^{\circ}C$ ⁽⁶⁾, typical value is tested at $T_J = +25^{\circ}C$, unless otherwise noted

Parameter	Symbol	Condition	Min	Typ	Max	Units
Supply Current (Shutdown)	I_{IN}	$V_{EN} = 0V$			10	μA
Supply Current (Quiescent)	I_q	$V_{EN} = 2V$, $V_{FB} = 0.85V$		180		μA
HS Switch-On Resistance	HS_{RDS-ON}	$V_{BST-SW} = 3.3V$		63		m Ω
LS Switch-On Resistance	LS_{RDS-ON}			36		m Ω
Switch Leakage	SW_{LKG}	$V_{EN} = 0V$, $V_{SW} = 12V$			10	μA
Valley Current Limit	I_{LIMIT}	$V_{OUT} = 0V$		4.2		A
ZCD ⁽⁷⁾	I_{ZCD}	$V_{OUT} = 3.3V$, $L_o = 2.2\mu H$		40		mA
Oscillator Frequency	f_{SW}	$V_{FB} = 0.75V$		800		kHz
Minimum On Time ⁽⁷⁾	T_{ON_MIN}			30		ns
Minimum Off Time	T_{OFF_MIN}			140		ns
Feedback Voltage	V_{REF}	$T_J = +25^{\circ}C$	786	798	810	mV
Feedback Current	I_{FB}			10	50	nA
FB UV threshold(H to L)	V_{UV_th}	Hiccup Entry		75%		Vref
Hiccup duty cycle ⁽⁷⁾	D_{Hiccup}				25	%
EN Rising Threshold	V_{EN_RISING}		1.14	1.2	1.26	V
EN Hysteresis	V_{EN_HYS}			100		mV
EN Input Current	I_{EN}	$V_{EN} = 2V$ $V_{EN} = 0V$		2 0		μA
V_{IN} Under-Voltage Lockout Threshold—Rising	$INUV_{Vth}$		3.7	4	4.15	V
V_{IN} Under-Voltage Lockout Threshold Hysteresis	$INUV_{HYS}$			330		mV
Soft-Start Period	T_{SS}		1.7	2.5	3	ms
Thermal Shutdown ⁽⁷⁾	TSD			150		$^{\circ}C$
Thermal Hysteresis ⁽⁷⁾	TSD_{HYS}			20		$^{\circ}C$

Notes:

- 6) Not tested in production. Guaranteed by over-temperature correlation.
- 7) Guaranteed by design and engineering sample characterization.

ORDERING INFORMATION

Part Number*	Package	Top Marking
MP1653GTF	SOT563(1.6mmx1.6mm)	See Below

* For Tape & Reel, add suffix -Z (e.g. MP1653GTF-Z).

TOP MARKING

AUCY

LLL

AUC: product code of MP1653GTF;
 Y: year code;
 LLL: lot number;

PACKAGE REFERENCE

