

5V Input 3A 2.5MHz Synchronous Step-Down DC/DC Converter

DESCRIPTION

The MT8593 is a 2.5MHz, 3A constant on-time (COT) controlled synchronous step-down converter. It can operate with input voltage from 2.5V to 5.5V and provide output range from 0.6V to input level, thanks to its 100% duty cycle operation. The constant on-time control scheme simplifies loop compensation and offers excellent load transient response. MT8593 consumes extremely low 18µA quiescent current hence achieves superior light load efficiency. The high gain error amplifier in the control loop provides excellent load and line regulation. Proprietary adaptive on-time helps MT8593 to achieve nearly constant switching frequency across load range. MT8593 has cycle-by-cycle current limit and hiccup mode to protect over-load or short circuit fault conditions. MT8593 is available in low profile 8 leads DFN 2mm x 2mm and SOT23_5L/6L packages.

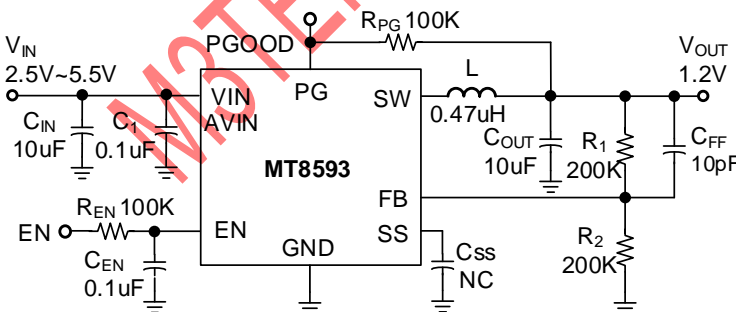
FEATURES

- Wide Input Range from 2.5V to 5.5V
- MT8593N: 2.5MHz with Pulse Skip Mode (PSM)
- MT8593A: 2.5MHz with Forced PWM Mode (FPWM)
- 3A Continuous Output Current
- Proprietary Fast Transient Constant On Time Architecture Stable with low ESR Ceramic Output Capacitors
- +/- 2% 0.6V Feedback Voltage
- 2.5MHz Switching Frequency
- 18µA Low Quiescent Current
- Up to 95% Efficiency
- 100% Duty Cycle Operation
- Built-in 85mΩ/52mΩ(DFN2X2) Power Switches
- Internal 1msec Soft-Start
- Cycle-by-cycle Current Limit Protection
- Over-Load and Short Circuit Hiccup Mode
- Open Drain Power Good Indication
- Output Discharge
- Thermal Shutdown Protection
- Available in Small DFN2x2_8L & SOT23_5L/6L
- Pb-Free RoHS Compliant

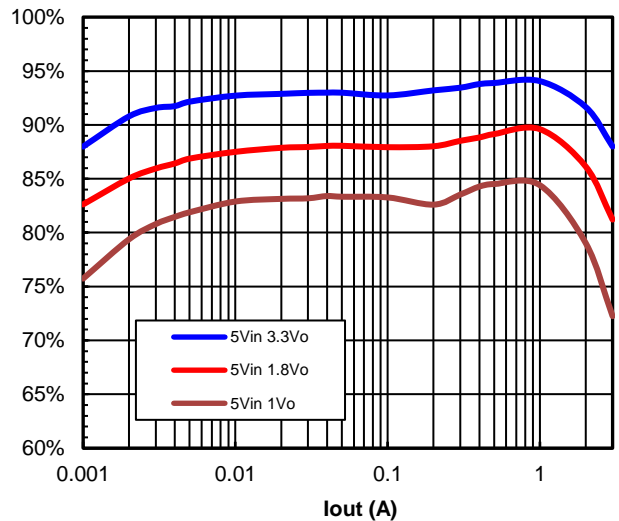
APPLICATIONS

- Solid-State and Hard Disk Drives
- Smart Phone and Tablets
- WiFi RF Modules
- DC/DC Micro Modules

Typical Applications



Efficiency



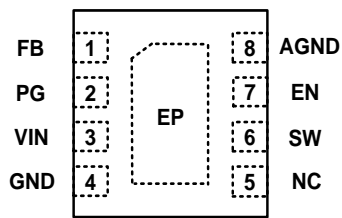
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Ordering Information

Part No.	Marking	Temp. Range	Remark	Package	MOQ
MT8593NDAR	8593 YWxx	-40°C ~+85°C	Adjustable Vout	DFN2x2_8L	3000/Tape & Reel
MT8593ADAR	593A YWxx	-40°C ~+85°C	Adjustable Vout	DFN2x2_8L	3000/Tape & Reel
MT8593NSBR	8593 YWWxx	-40°C ~+85°C	Adjustable Vout	SOT23_5L	3000/Tape & Reel
MT8593ASBR	8593A YWWxx	-40°C ~+85°C	Adjustable Vout	SOT23_5L	3000/Tape & Reel
MT8593NSCR	8593 YWWxx	-40°C ~+85°C	Adjustable Vout	SOT23_6L	3000/Tape & Reel
MT8593ASCR	8593A YWWxx	-40°C ~+85°C	Adjustable Vout	SOT23_6L	3000/Tape & Reel

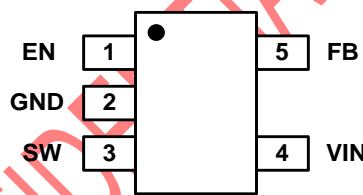
Note: Y: Year, W: Week, xx: Manufacture Code

Pin Configuration

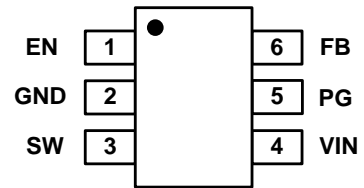


EXPOSED PAD ON BACKSIDE

DFN2x2_8L



SOT23_5L



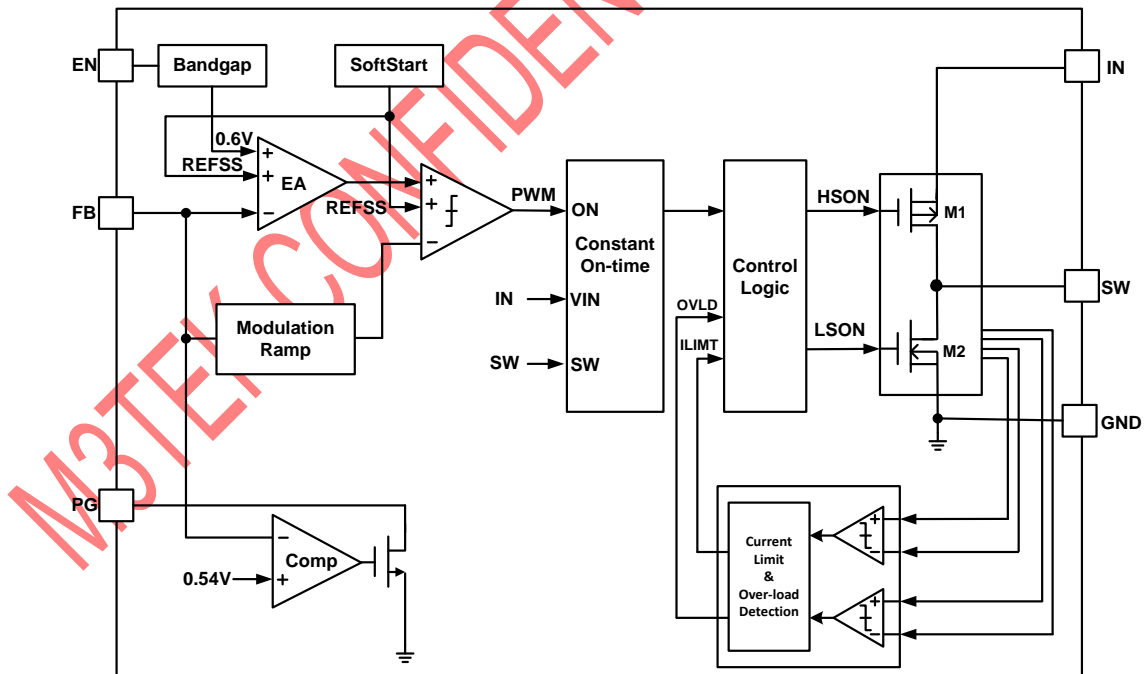
SOT23_6L

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Pin Description

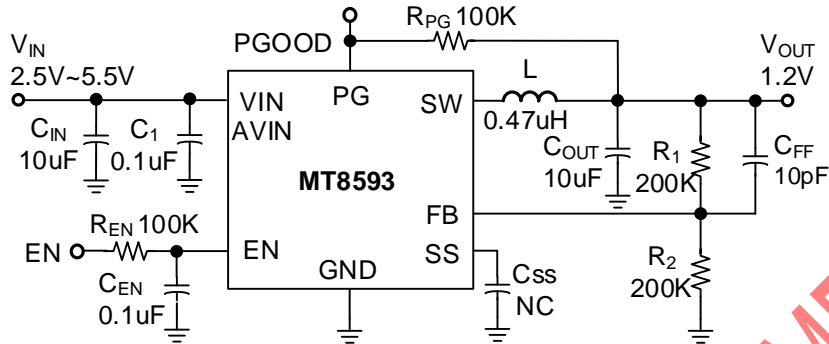
DFN2x2_8L Pin No.	SOT23_5L Pin No.	SOT23_6L Pin No.	Symbol	Description
1	5	6	FB	Voltage Feedback Input. Connect a resistor divider between output and FB to program the output voltage. VFB is regulated to 0.6V.
2	-	5	PG	Power Good Open-drain Output. Connect a 100kΩ pull-up resistor to V _{IN} or V _{OUT} .
3	4	4	VIN	Input Supply Voltage
4, EP	2	2	GND	Ground
5	-	-	NC	No connection
6	3	3	SW	Power Switch Node
7	1	1	EN	Don't float this pin. This pin has a pull-down resistor of typically 1MΩ to GND. <ul style="list-style-type: none"> • Drive EN above 1.05V to turn on the converter • Drive EN below 0.4V to turn off the converter and discharge output
8	-	-	AGND	Analog Ground

Functional Block Diagram



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MT8593 Application Schematic



EVB BOM List

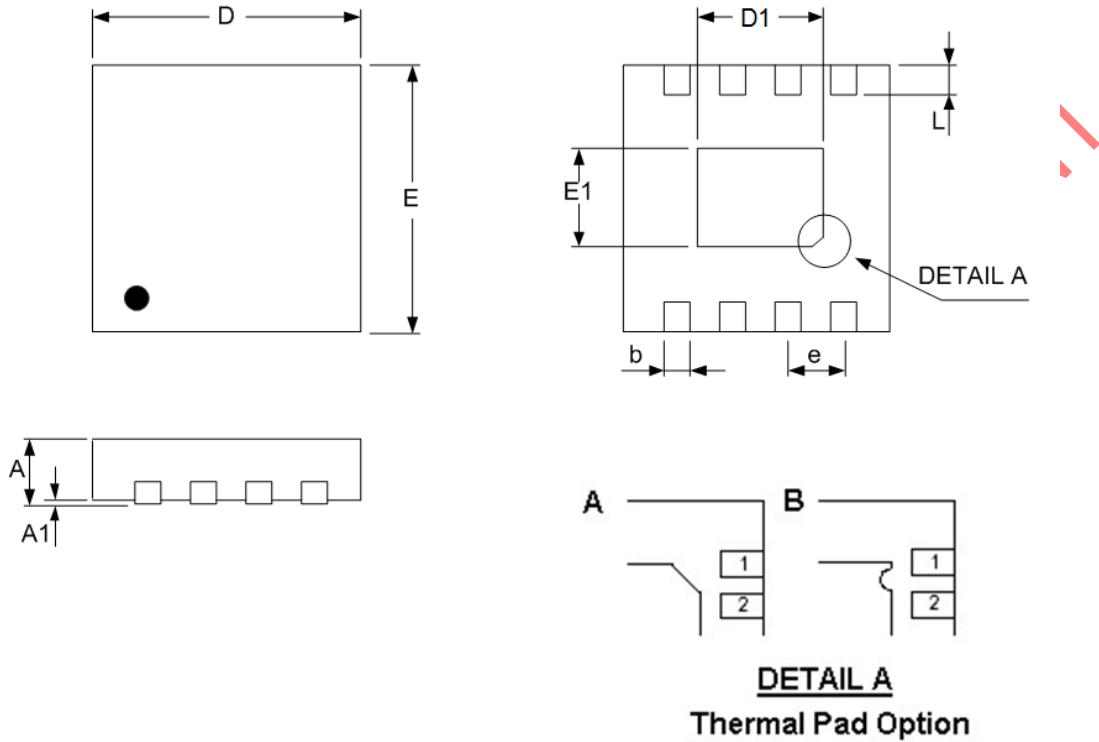
Qty	Ref	Value	Description	Package	
1	C _{IN}	10μF	Ceramic Capacitor, 10V, X5R	0805	
1	C _{OUT}	10μF	Ceramic Capacitor, 10V, X5R	0805	
2	C ₁ , C _{EN}	0.1μF	Ceramic Capacitor, 10V, X5R	0603	
1	C _{FF}	10pF	Ceramic Capacitor, 10V, X5R	0603	
1	L	0.47uH	Inductor, BMRA00040420R47MA1, 14mΩ, 9.5A	SMD	
1	R1	Vout=3.3V	200KΩ	Resistor, ±1%	0603
		Vout=2.5V	240KΩ		
		Vout=1.8V	200KΩ		
		Vout=1.2V	200KΩ		
		Vout=1.0V	100KΩ		
1	R2	Vout=3.3V	43KΩ	Resistor, ±1%	0603
		Vout=2.5V	75KΩ		
		Vout=1.8V	100KΩ		
		Vout=1.2V	200KΩ		
		Vout=1.0V	150KΩ		
2	R _{PG} , R _{EN}	100KΩ	Resistor, ±1%	0603	
1	Power IC	MT8593	Step-Down DC/DC Converter	DFN2x2_8L SOT23_5L/6L	

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Package Information

DFN 8L 2x2mm Outline Dimensions

Unit: inches/mm



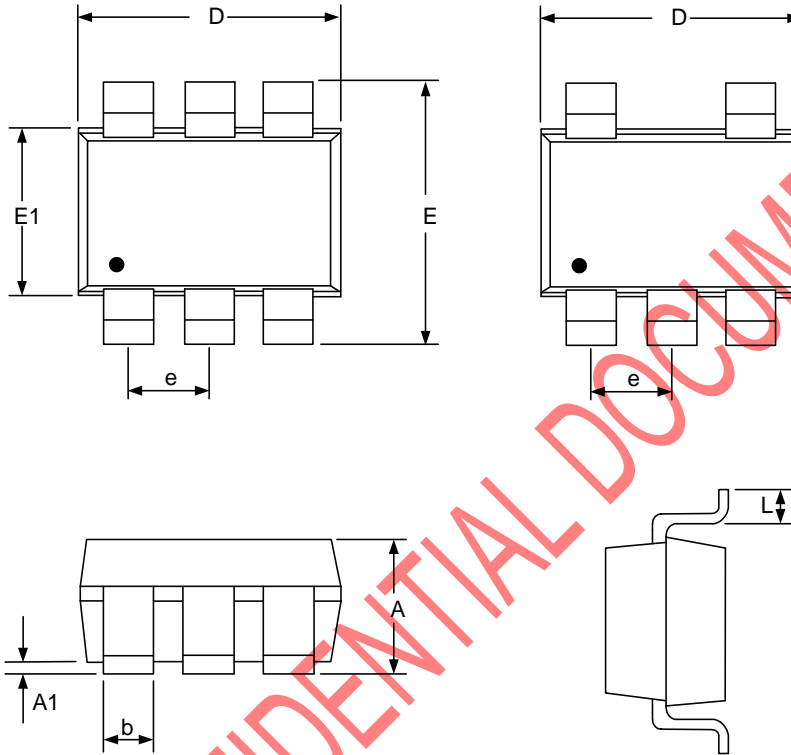
SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.70	0.80	0.028	0.031
A1	0.00	0.05	0.000	0.002
b	0.18	0.30	0.007	0.012
D	1.90	2.10	0.075	0.083
D1	1.10	1.65	0.043	0.065
E	1.90	2.10	0.075	0.083
E1	0.50	1.10	0.020	0.043
e	0.50		0.020	
L	0.25	0.45	0.010	0.018

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Package Information

SOT23_5L and SOT23_6L Outline Dimensions

Unit: inches/mm

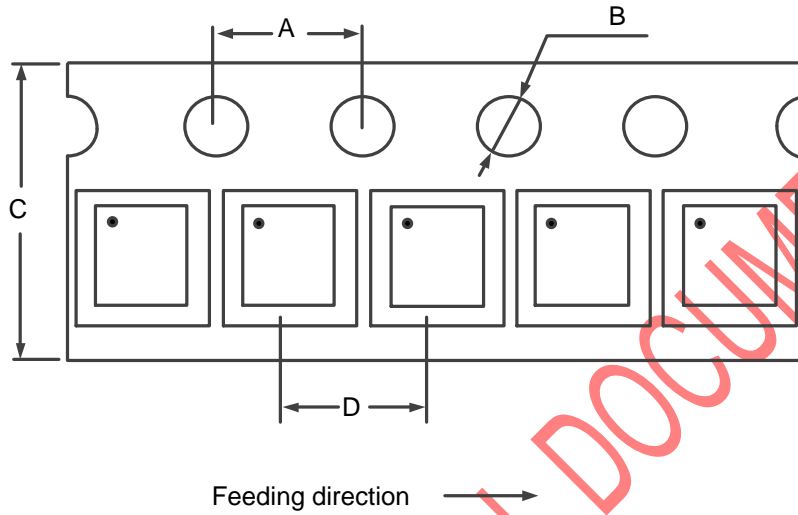


SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.89	1.45	0.035	0.057
A1	0.00	0.15	0.000	0.006
b	0.30	0.50	0.012	0.020
D	2.70	3.10	0.106	0.122
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
E	2.60	3.00	0.102	0.118
L	0.30	0.60	0.012	0.024

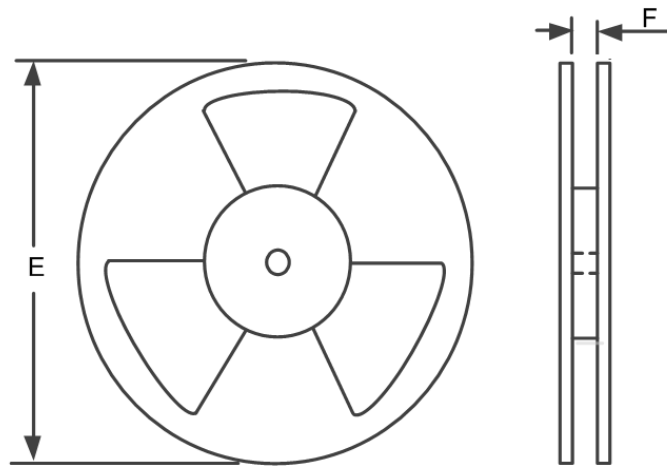
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Carrier Tape & Reel Dimensions (Packing Spec DFN2x2_8L)

1. Orientation / Carrier Tape Information:



2. Reel Information:



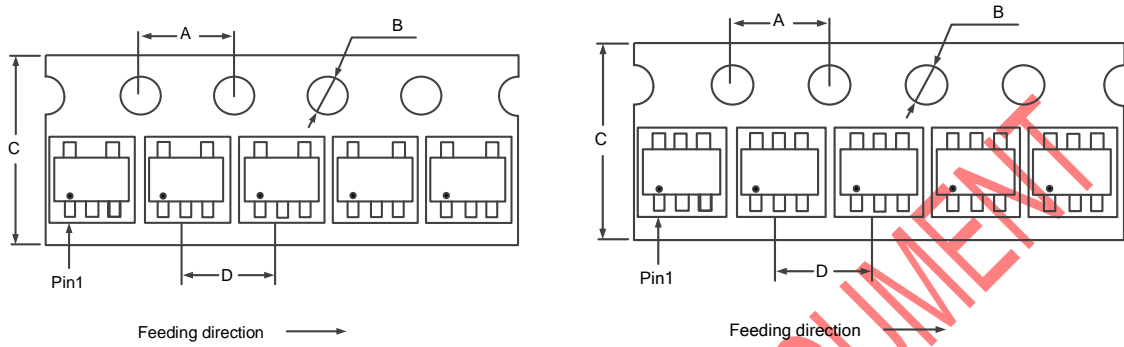
3. Dimension Details:

PKG Type	A	B	C	D	E	F	Q'ty/Reel
DFN2x2	4.0 mm	1.5 mm	8.0 mm	4.0 mm	7 inches	9.0 mm	3,000

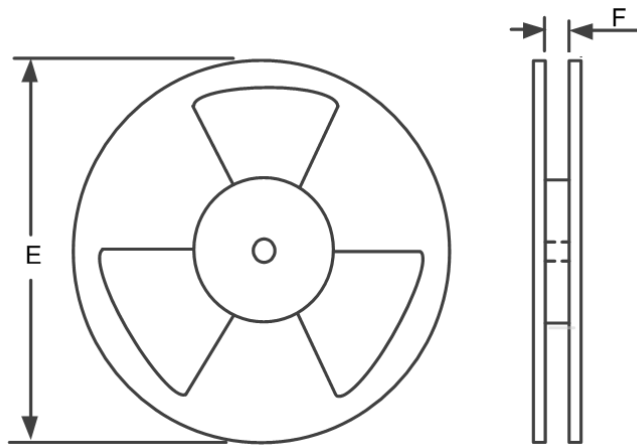
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Tape & Reel Carrier Dimensions

1. Orientation / Carrier Tape Information: SOT23_5L and SOT23_6L



2. Reel Information:



3. Dimension Details:

PKG Type	A	B	C	D	E	F	Q'ty/Reel
SOT23_5L/6L	4.0 mm	1.5 mm	8.0 mm	4.0 mm	7 inches	9.0 mm	3,000

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Reflow Profile

Classification Of IR Reflow Profile

Reflow Profile	Green Assembly
Average Ramp-Up Rate ($T_{s_{min}}$ to T_p)	1~2°C/second, 3°C/second max.
Preheat & Soak	
-Temperature Min($T_{s_{min}}$)	150°C
-Temperature Max($T_{s_{max}}$)	200°C
-Time($t_{s_{min}}$ to $t_{s_{max}}$)	60~120 seconds
Time maintained above:	
-Temperature(T_L)	217°C
-Time(t_L)	60~150 seconds
Peak Temperature(T_p)	See Classification Temp in table 1
Time within 5°C of actual Peak Temperature(t_p)	30 seconds max.
Ramp-Down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

* Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum.

** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

Table 1. Pb-free Process – Classification Temperatures (T_c)

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
2.5 mm	250 °C	245 °C	245 °C

Note: For all temperature information, please refer to topside of the package, measured on the package body surface.

