2A Step-down Voltage Regulator Power Converter 150kHz

Lead(Pb)-Free

General Description:

The WT2595M is a monolithic integrated circuit that provide all the active functions for a step-down switching regulator, capable of driving a 2A load without additional transistor component. Requiring a minimum number of external component, the board space can be saved easily. The external shutdown function can be controlled by TTL logic level and then come into standby mode. The internal compensation makes feedback control have good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. The WT2595M operates at a switching frequency of 150Khz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed +4% tolerance on output voltage under specified input voltage and output load conditions, and +15% on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The packages are available in a standard 8-lead SOP8.

Features:

* 3.3V, 5V, 12V and adjustable output versions
* Adjustable version output voltage range, 1.23V to 37V +4% max over line and load condiction
* SOP-8 packages
* Voltage mode non-synchronous PWM control
* Thermal-shutdown and current-limit protection
* ON/OFF shutdown control input
* Input voltage range up to 40V
* Output load current: 2A
* 150 kHz fixed frequency internal oscillator
* Low power standby mode
* Built-in switching transistor on chip

Applications:

* Simple High-efficiency step-down(buck) regulator
* Efficient preregulator for linear regulators
* On-card switching regulators
* Positive to negative converter
* Battery Charger

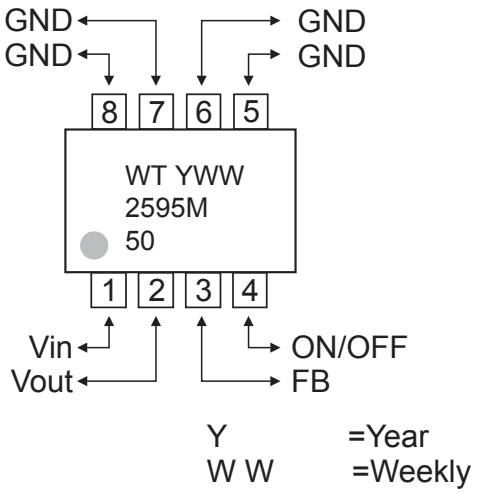
Ordering Information

Part Number	Voltage	Package	Packing Type
WT2595M33	3.3V	SOP-8	2,500Units / Tape & Reel
WT2595M50	5.0V	SOP-8	2,500Units / Tape & Reel
WT2595M12	12.0V	SOP-8	2,500Units / Tape & Reel
WT2595M	ADJ	SOP-8	2,500Units / Tape & Reel

Connection Diagrams

Surface Mount Package (Top View)

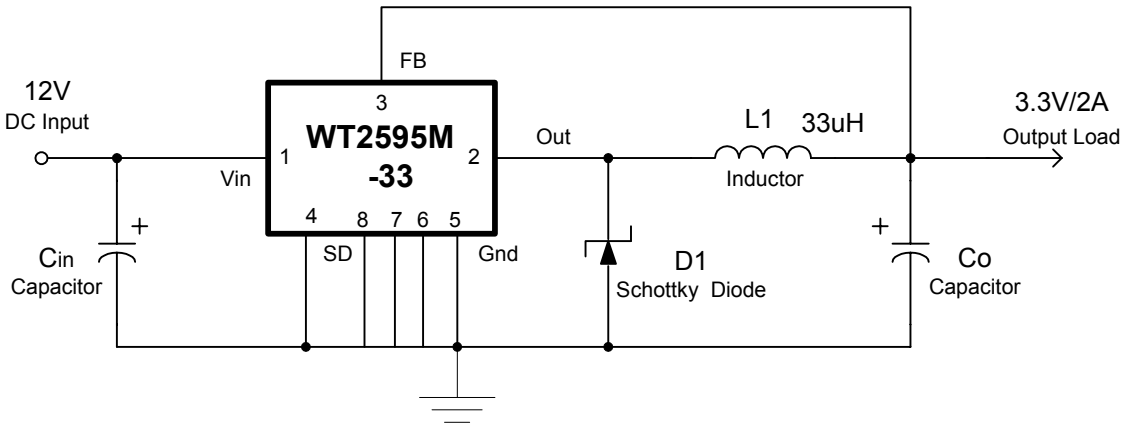
SOP- 8



Pin Descriptions

Name	Description
V_{IN}	Operating voltage input
Out	Switching output
Gnd	Ground
FB	Output voltage feedback control
ON/OFF	ON/OFF Shutdown

Typical Application Circuit



Function Description

Pin Functions

$+V_{IN}$

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

Out Internal switch and power output. The voltage at this pin switches between ($+V_{IN} - V_{SAT}$) and approximately –0.5V, with a duty cycle of approximately V_{OUT} / V_{IN}. The PC board copper area connected to this pin should be kept a minimum in order to reduce the coupling sensitivity to the circuitry

Ground

Circuit ground.

Feedback

Complete the feedback loop by sensing the regulated output voltage

$\overline{ON}$/OFF

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 100uA. Pulling this pin below a threshold voltage of approximately 1.3V turns the regulator on, and pulling this pin above 1.3V (up to a maximum of 25V) shuts the regulator down.

If this shutdown feature is not needed, the $\overline{ON}$/OFF pin must be wired to the ground pin, in either case the regulator will be in the ON condition.

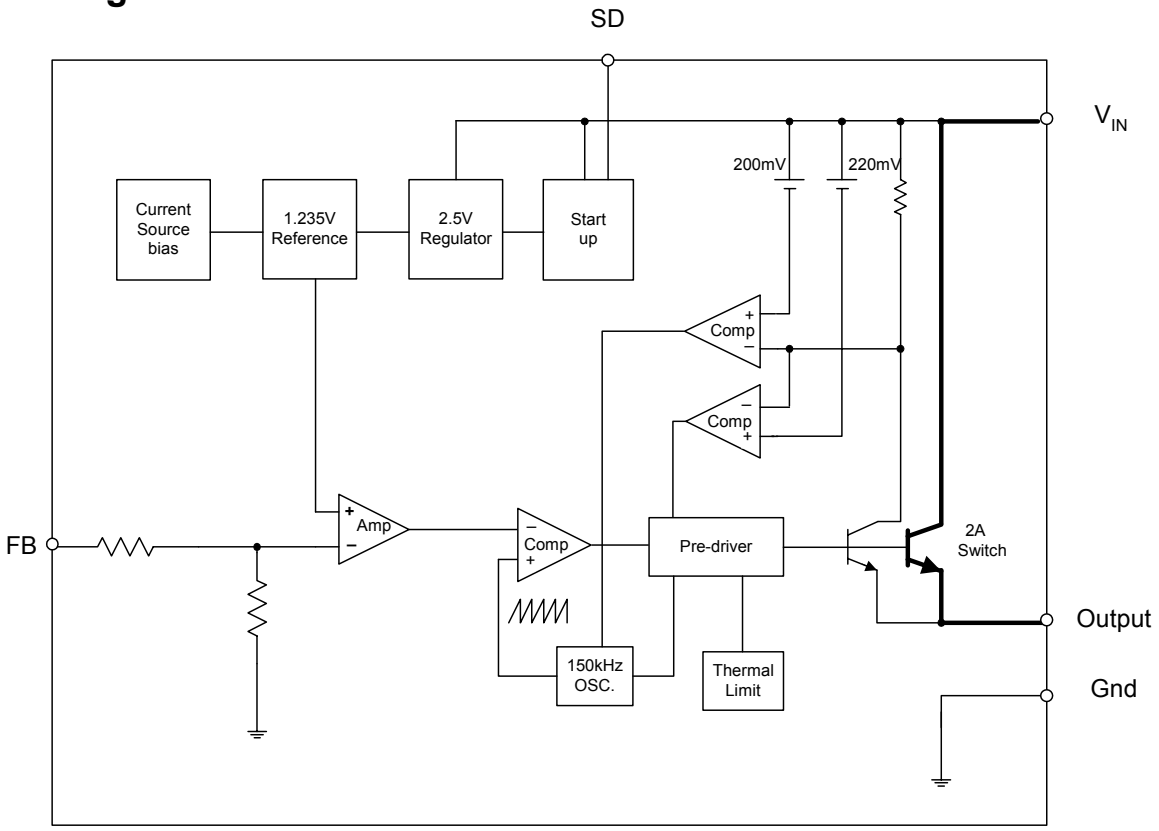
Thermal Considerations

The SOP-8 package needs a heat sink under most condictions . The size of the heatsink depends on the input voltage, the output voltage, the load current and the ambient temperature. The WT2595M junction temperature rises above ambient temperature for a 2A load and different input and output voltages. The data for these curves was taken with the WT2595M operating as a buck switching regulator in an ambient temperature of 25°C (still air). These temperature increments are all approximate and are affected by many factors. Some of these factors include board size, shape ,thickness ,position ,location, and even board temperature. Other factors are trace width, total printed circuit copper area, copper thickness , single or double-sided, multi-layer board and amount of solder on the board. Higher ambient temperatures require more heat sinking.

For the best thermal performance ,wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (One exception is the out(switch) pin, which should not have large areas of copper.) Large areas of copper provide the best transfer of heat(lower thermal resistance) to the surrounding air, and moving air lowers the thermal resistance even further.

The effectiveness of the PC board to dissipate heat also depends on the size, quantity and spacing of other components on the board , as well as whether the surrounding air is still or moving. Furthermore, some of these components such as the catch diode will add heat to the PC board and heat can vary as the input voltage changes. For the inductor, depending on the phical size, type of core material and the DC resistance, it could either act as a heat sink taking heat away from the board, or it could add heat to the board.

Block Diagram



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{CC}	Supply Voltage	+45	V
V_{SD}	ON/OFF Pin input voltage	-0.3 to +25	V
V_{FB}	Feedback Pin voltage	-0.3 to +25	V
V_{OUT}	Output voltage to Ground	-1	V
P_D	Power dissipation	Internally limited	W
T_{ST}	Storage temperature	-65 to +150	^oC
T_{OP}	Operating temperature	-40 to +125	^oC
V_{OP}	Operating voltage	+4.5 to +25	V

Electrical Characteristics

Unless otherwise specified, V_{IN}=12V for 3.3V, 5V, adjustable version and V_{IN}=24V for the 12V version. I_{LOAD} = 0.2A

Symbol	Parameter		Conditions	Min.	Typ.	Max.	Unit
I_B	Feedback bias current		V_{FB}=1.3V (Adjustable version only)		-10	-50	nA
						-100	
F_{OSC}	oscillator frequency			127	150	173	Khz
				110		**173**	
Fscp	Oscillator frequency of short circuit protect		When current limit occurred and V_{FB} <0.55V		30	70	Khz
V_{SAT}	saturation voltage		I_{OUT}=1.5A no outside circuit V_{FB}=0V force driver on		1.25	1.4	V
						1.5	
DC	Max. Duty Cycle(ON)		V_{FB}=0V force driver on		100		%
	Min. Duty cycle(OFF)		V_{FB}=12V force driver off		0		
I_{CL}	current limit		peak current no outside circuit V_{FB}=0 force driver on	2.4	2.8	3.3	A
						3.6	
I_L	Output = 0	Output leakage current	no outside circuit V_{FB}=12 force driver off			-200	uA
	Output = 1		V_{IN}=24V		-5		mA
I_Q	Quiescent Current		V_{FB}=12 force driver off		5	10	mA
I_{STBY}	Standby Quiescent Current		ON/OFF pin=5V V_{IN}=24V		70	150	uA
						200	
V_{IL}	ON/OFF pin logic input threshold voltage		Low (regulator ON)	-	1.3	0.6	V
V_{IH}			High (regulator OFF)	2.0		-	
I_H	ON/OFF pin logic input current		V_{LOGIC}=2.5V (OFF)			-0.01	uA
I_L	ON/OFF pin input current		V_{LOGIC}=0.5V (ON)		-0.1	-1	
Ts	Over temperature shutdown threshold		Tj increasing		175		°C
			Tj decreasing		150		

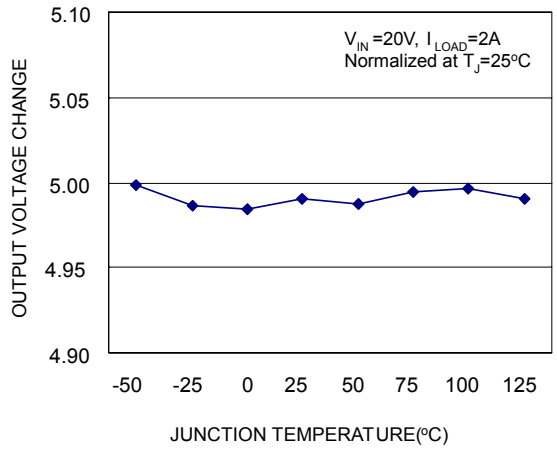
Electrical Characteristics (Continued)

	Symbol	Parameter	Conditions	Typ.	Limit	Unit
WT2595M-ADJ	V_{FB}	Output Feedback	$5V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 2A$ V_{OUT} programmed for 3V	1.235	1.193/**1.18** 1.267/**1.28**	V V_{MIN} V_{MAX}
		Efficiency	V_{IN} = 12V, I_{LOAD}=2A	75		%
WT2595M-3.3V	V_{OUT}	Output voltage	$5.5V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 2A$	3.3	3.168/**3.135** 3.432/**3.465**	V V_{MIN} V_{MAX}
		Efficiency	V_{IN} = 12V, I_{LOAD}=2A	75		%
WT2595M-5V	V_{OUT}	Output voltage	$8V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 2A$	5	4.8/**4.75** 5.2/**5.25**	V V_{MIN} V_{MAX}
		Efficiency	V_{IN} = 12V, I_{LOAD}=2A	80		%
WT2595M-12V	V_{OUT}	Output voltage	$15V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 2A$	12	11.52/**11.4** 12.48/**12.6**	V V_{MIN} V_{MAX}
		Efficiency	V_{IN} = 15V, I_{LOAD} = 2A	90		%

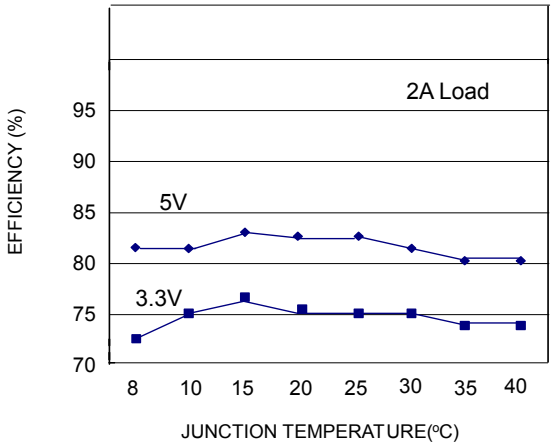
Specifications with **boldface type** are for full operating temperature range, the other type are for T_J=25ºC.

Typical Performance Characteristics

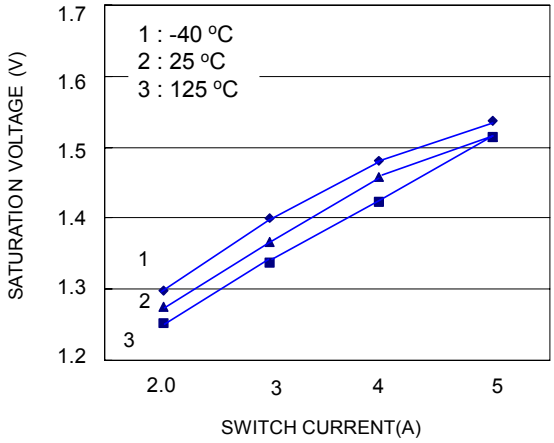
Normalized Output Voltage



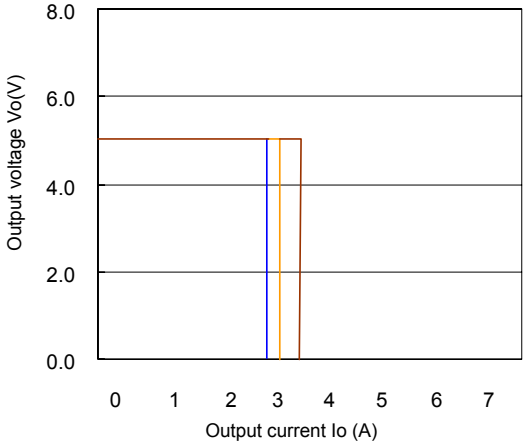
Efficiency



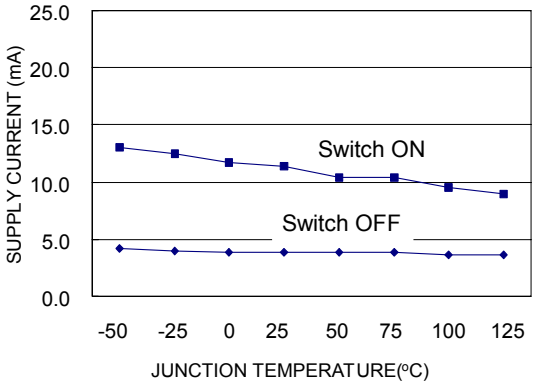
Switch Saturation Voltage



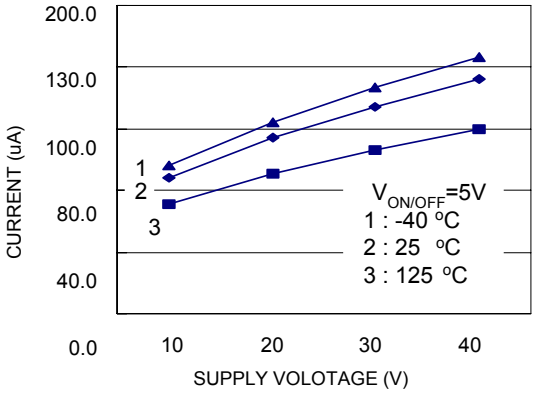
Switch Current Limit



Operating Quiescent Current

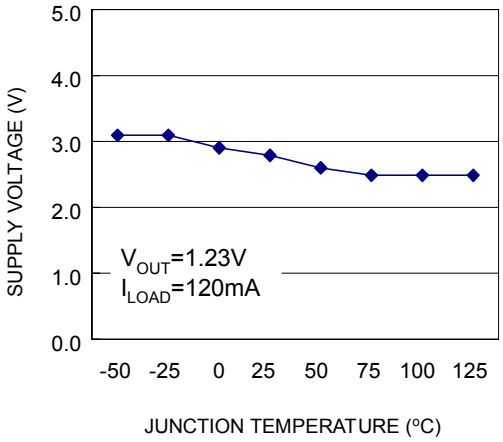


Shutdown Quiescent Current

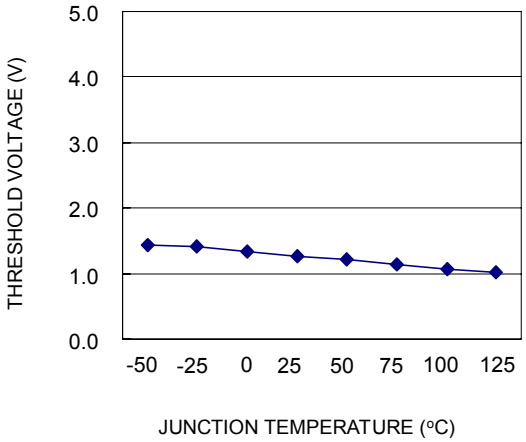


Typical Performance Characteristics

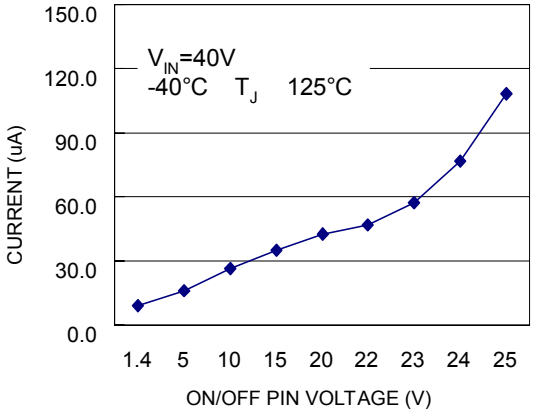
Minimum Operating Supply Voltage



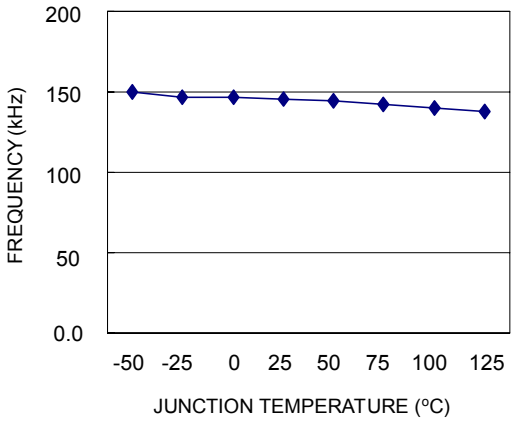
ON/OFF Threshold Voltage



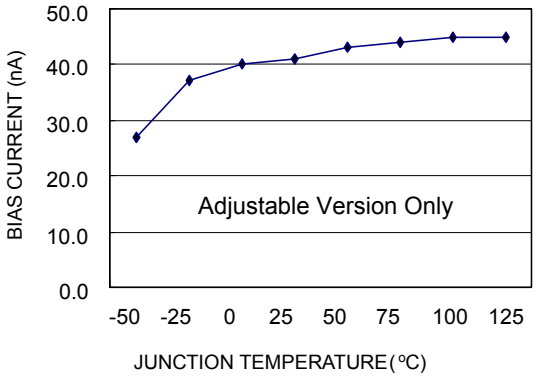
ON/OFF Pin Current (Sinking)



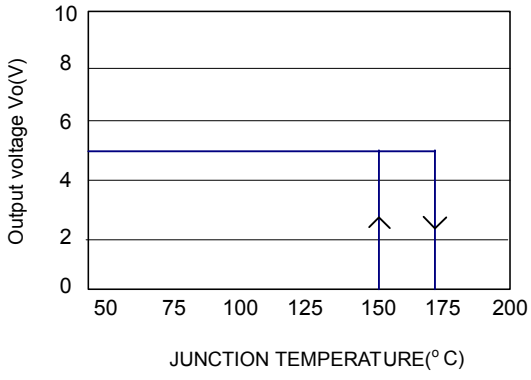
Switch Frequency



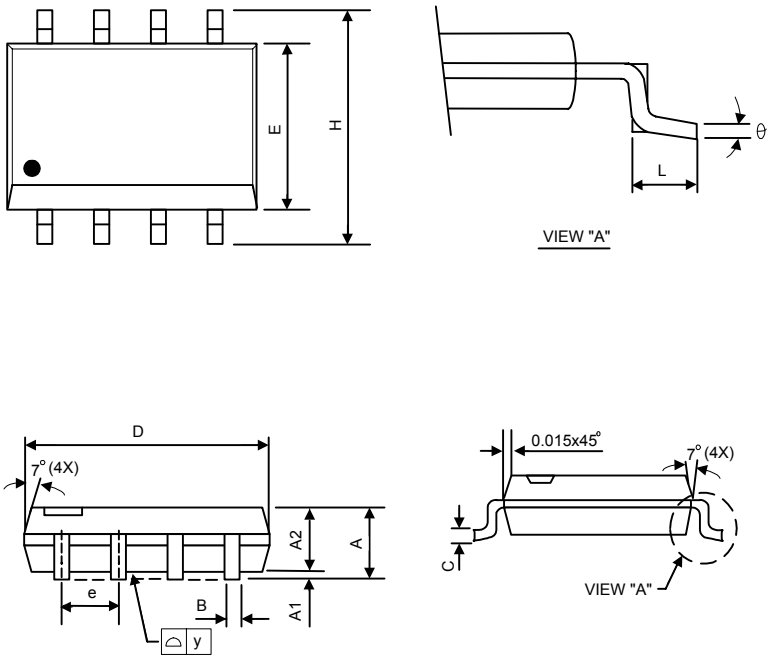
Feedback Pin Bias Current



Thermal protection



SOP-8 PACKAGE OUTLINE DIMENSIONS(Unit: mm)



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	1.40	1.60	1.75
A1	0.10	-	0.25
A2	1.30	1.45	1.50
B	0.33	0.41	0.51
C	0.19	0.20	0.25
D	4.80	4.85	5.05
E	3.80	3.91	4.00
e	-	1.27	-
H	5.79	5.99	6.20
L	0.38	0.71	1.27
y	-		0.10
	0°	-	8°

ORDERING NUMBER

WT2595 M XX

Circuit Type

Package
SOP-8

Output Voltage
33 : 3.3V
50 : 5.0V
12 : 12V
- : ADJ