GSC2596M

150 KHz, 2A PWM Step-Down DC/DC Converter

Description

The GSC2596M series of regulators are monolithic integrated circuit that provides all active functions for a step-down (buck) switching regulator, capable of driving 2A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3v, 5v, 12v and an adjustable output version. The GSC2596M series operate at a switching frequency of 150 kHz; thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. The chips are available in a standard 8-lead SOP-8 package. Other feature include a guaranteed ±4% to tolerance on output voltage under specified input voltages and output load conditions. The 150 kHz ±15% is on the oscillator frequency. External shutdown is included, featuring 80uA (Typ.) standby current. The output switch includes cycle-by cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

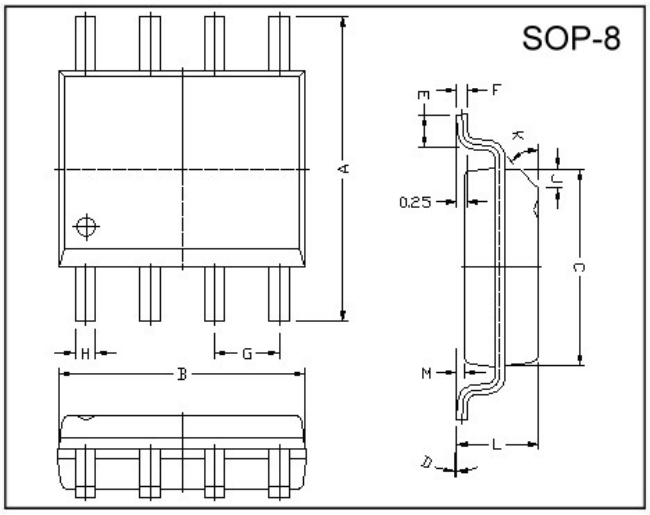
Features

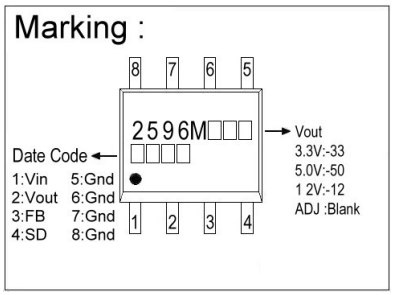
- 3.3V, 5.0V, 12V and adjustable output versions
- Guaranteed 2A output current
- Operating voltage can be up to 22V
- 150kHz fixed frequency internal oscillator
- Built-in TTL On/Off control
- TTL Shutdown Capability
- Uses readily available standard inductors
- Thermal shutdown and current limit protection

Applications

- High-efficiency step-down regulator
- One-ch switching regulators simple
- Positive to negative converter

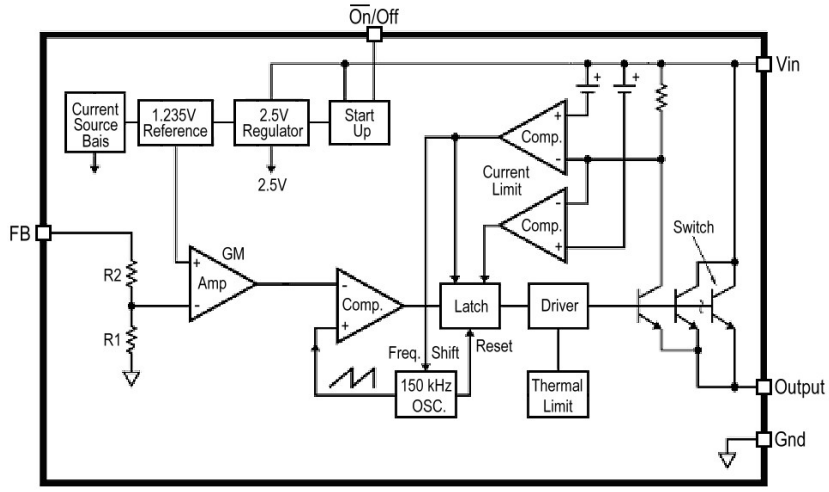
Package Dimensions





REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	5.80	6.20	M	0.10	0.25
B	4.80	5.00	H	0.35	0.49
C	3.80	4.00	L	1.35	1.75
D	0°	8°	J	0.375 REF.	
E	0.40	0.90	K	45°	
F	0.19	0.25	G	1.27 TYP.	

Block Diagram



Pin Function

Pin Name	Pin#	Function
V_{IN}	1	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 current needed by regulator.
Output	2	Internal switch. 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}. To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be keep to a minimum.
Feedback(FB)	3	Senses the regulated output voltage to complete the feedback loop.
$\overline{ON}$/OFF(SD)	4	Allows the switching regulator circuit to be shutdown using logic level signals. Thus drop the total input supply current to approximately 150μA. 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 18V) shuts the regulator down. If this shutdown feature is not needed, ON/OFF pin can be wired to the ground pin.
Ground	5,6,7,8	Circuit ground

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{CC}	24	V
$\overline{ON}$/OFF Pin Input Voltage	V_{SD}	-0.3 ~ +18	V
Feedback Pin Voltage	V_{FB}	-0.3 ~ +18	V
Output Voltage to ground	V_{OUT}	-1	V
Power Dissipation	P_D	Internally Limited	W
Storage Temperature	T_{ST}	-65 ~ +150	℃
Operating temperature	T_{OP}	-40 ~ +125	℃
Operating Voltage	V_{OP}	+4.5 ~ +22	V

GSC2596M Electrical Characteristics

Specifications in **boldface type** are for **full operating temperature range.** The other type are for T_J=25 ℃.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Feedback	V_{FB}	5≤ V_{IN} ≤ 22V, 0.2A ≤ I_{LOAD} ≤ 2A V_{OUT}=3V	1.180/**1.168**	1.230	1.280/**1.292**	V
Efficiency	η	V_{IN}=12V, I_{LOAD}=2A, V_{OUT}=3V		76		%

GSC2596M-33 Electrical Characteristics

Specifications in **boldface type** are for **full operating temperature range.** The other type are for T_J=25 ℃.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Feedback	V_{FB}	5.5V ≤ V_{IN} ≤ 22V 0.2A ≤ I_{LOAD} ≤ 2A	3.168/**3.135**	3.3	3.432/**3.465**	V
Efficiency	η	V_{IN}=12V, I_{LOAD}=2A		78		%

GSC2596M-50 Electrical Characteristics

Specifications in **boldface type** are for **full operating temperature range.** The other type are for T_J=25 ℃.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Feedback	V_{FB}	8V ≤ V_{IN} ≤ 22V 0.2A ≤ I_{LOAD} ≤ 2A	4.80/**4.75**	5.0	5.20/**5.25**	V
Efficiency	η	V_{IN}=12V, I_{LOAD}=2A		83		%

GSC2596M-12 Electrical Characteristics

Specifications in **boldface type** are for **full operating temperature range.** The other type are for T_J=25 ℃.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Feedback	V_{FB}	15V ≤ V_{IN} ≤ 22V 0.2A≤ I_{LOAD} ≤2A	11.52/**11.40**	12	12.48/**12.60**	V
Efficiency	η	V_{IN}=16V, I_{LOAD}=2A		90		%

All Output Voltage Version Electrical Characteristics

Specifications in **boldface type** are for **full operating temperature range.** The other type are for T_J=25 ℃.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Feedback bias current	I_{FB}	V_{FB}=1.3V (adjustable version only)	-	-10	-50/**-100**	nA
Oscillator frequency	F_{OSC}		127/**110**	150	173/**173**	kHz
Oscillator frequency of short circuit protect	F_{SCP}	When current limit occurred and V_{FB}<0.5V, T_A=25 ℃.	5	15	25	kHz
Saturation voltage	V_{SAT}	I_{LOAD}=2A No outside circuit V_{FB}=0V force drive on	-	1.25	1.4/**1.5**	V
Max. duty cycle (ON)	DC	V_{FB}=0V force drive on	-	100	-	%
Max. duty cycle (OFF)		V_{FB}=12V force drive off	-	0	-	
Current limit	I_{CL}	Peak current No outside circuit V_{FB}=0V force drive on	3	-	-	A
Output leakage current	I_L	Output=0V, No outside circuit V_{FB}=12V force drive off	-	-	-200	uA
		Output=-1V, V_{IN}=22V	-	-5	-	mA
Quiescent current	I_Q	V_{FB}=12V force drive off	-	5	10	mA
$\overline{ON}$/OFF pin logic input Threshold Voltage	V_{IL}	Low (Regulator ON)	-	-	0.6	V
	V_{IH}	High (Regulator OFF)	2.0	-	-	
$\overline{ON}$/OFF pin Logic input current	I_H	V_{LOGIC}=2.5V (Regulator OFF)	-	-	-0.01	uA
$\overline{ON}$/OFF pin input current	I_L	V_{LOGIC}=0.5V (Regulator ON)	-	-0.1	-1	
Standby quiescent current	I_{STBY}	$\overline{ON}$/OFF pin=5V, V_{IN}=12V	-	150	200	uA
Thermal Resistance	θ_{JC}	Junction to Case	-	15	-	℃/W
	θ_{JA}	Junction to Ambient with copper area of approximately 3 in^2	-	70	-	

Unless otherwise specified, V_{IN}=12V for 3.3V, 5V, adjustable version and V_{IN}=18V for the 12V version. I_{LOAD}=0.5A

Function Description

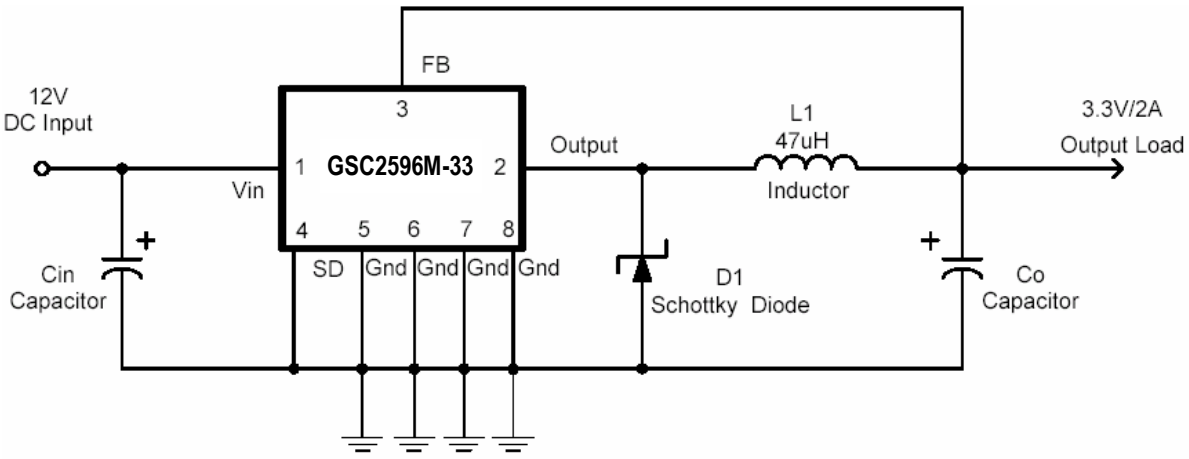
The SOP-8 package needs a heat sink under most conditions. The size of the heat sink depends on the input voltage, the output voltage, the load current and the ambient temperature. The GSC2596M junction temperature rises above ambient temperature with a 2A load and different input and output voltages. The data for these curves was taken with the GSC2596M operating as a buck-switching regulator in an ambient temperature of 25℃ (still air). These temperature rise numbers are all approximate and there are many factors that can affect these temperatures. 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 to this is the output (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.

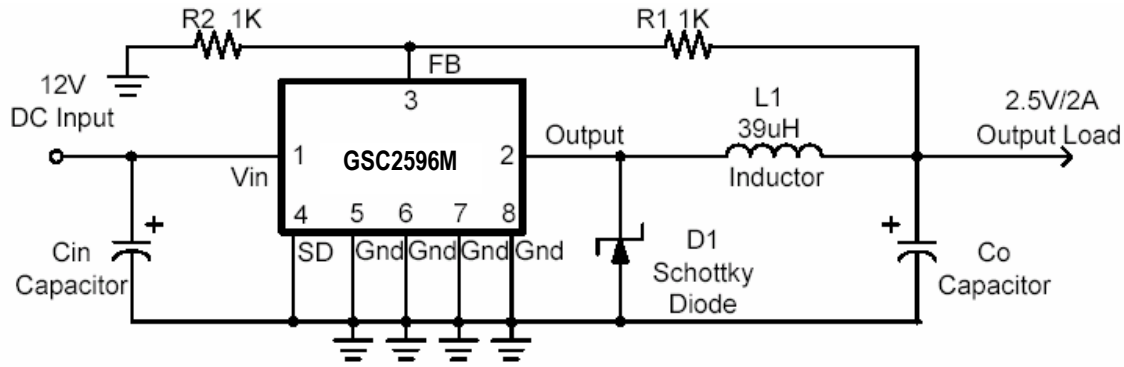
Package thermal resistance and junction temperature rise numbers are all approximate, and there are many factors will affect these numbers. Some of these factors include board size, shape, thickness, position, location and even board temperature. Other factors are, trace width, total printed circuit copper area, copper thickness, single or double-sided, multi-layer board and the amount of solder on the board. 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 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 the heat can vary as the input voltage changes. For the inductor, depending on the physical 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.

Typical Application Circuit

(1)Fixed Type Circuit



(2)Adjustable Type Circuit

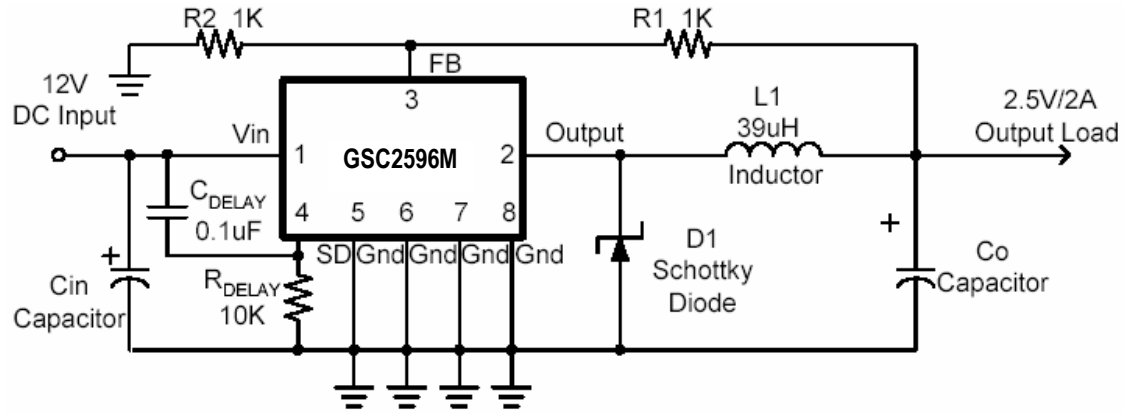


$$Vout = V_{FB} \times (1 + \frac{R1}{R2})$$

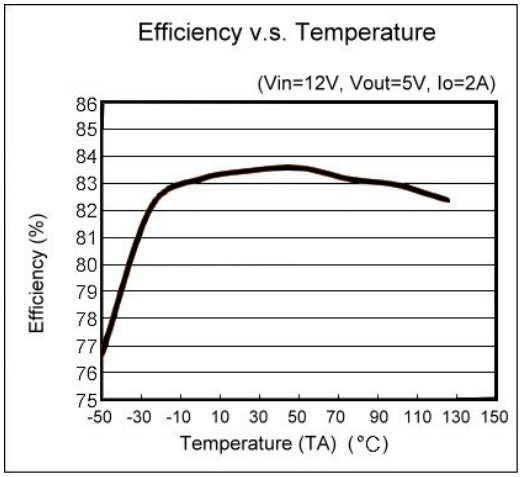
V_{FB} = 1.23V

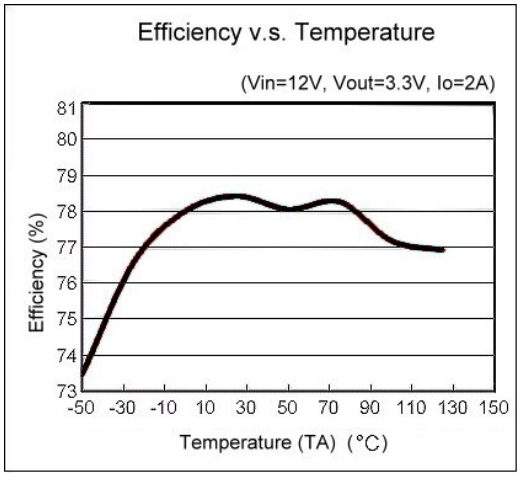
R2 = 1K ~ 3K

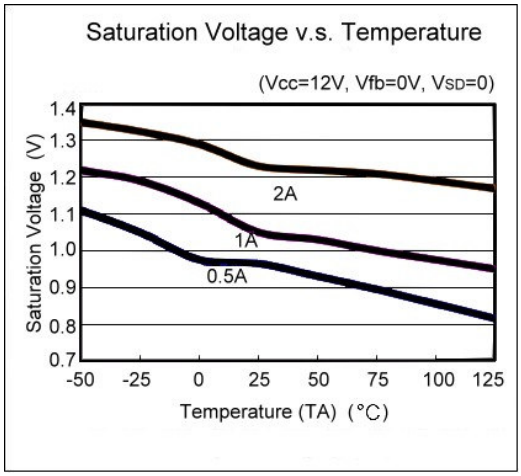
(3)Delay Start Circuit

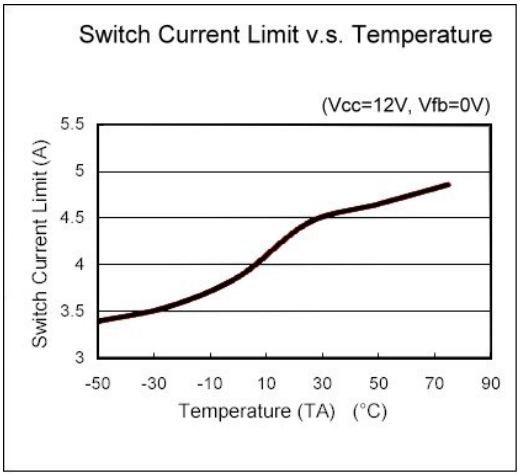


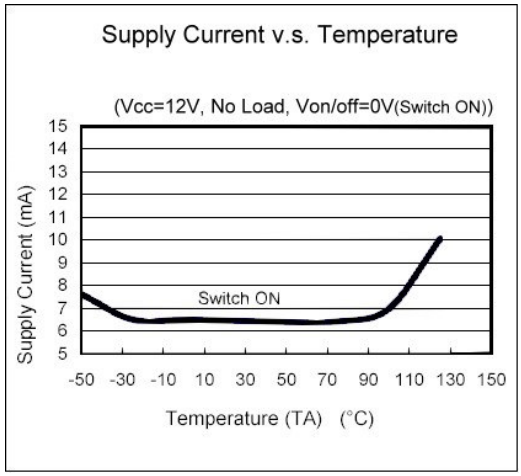
Typical Performance Characteristics

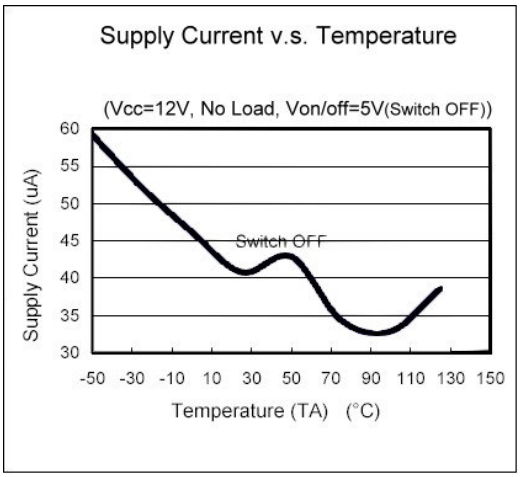


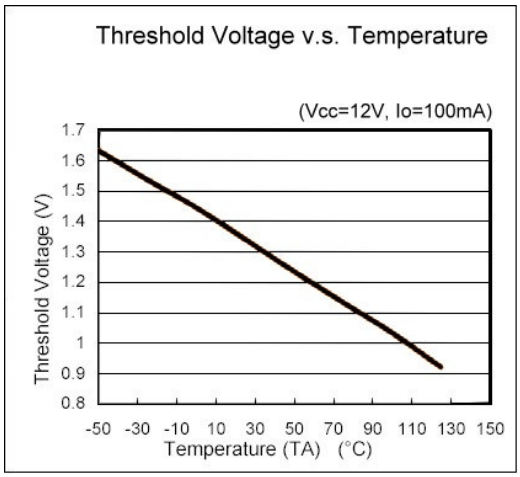


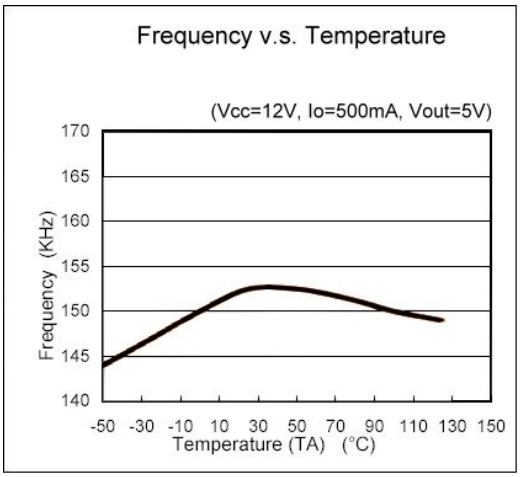


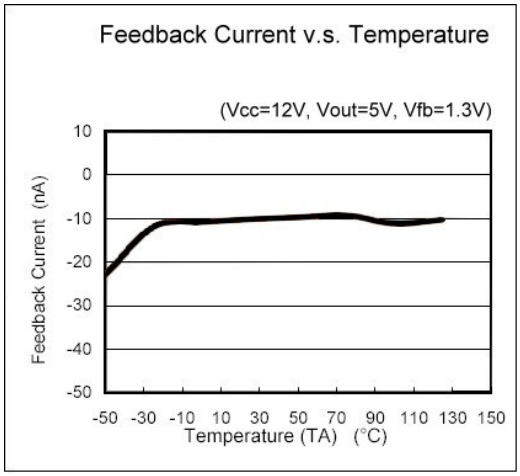


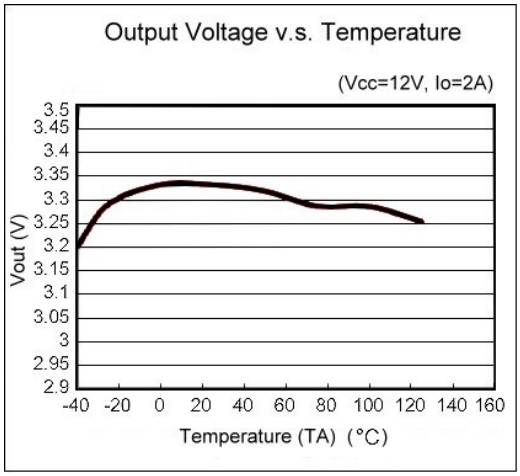


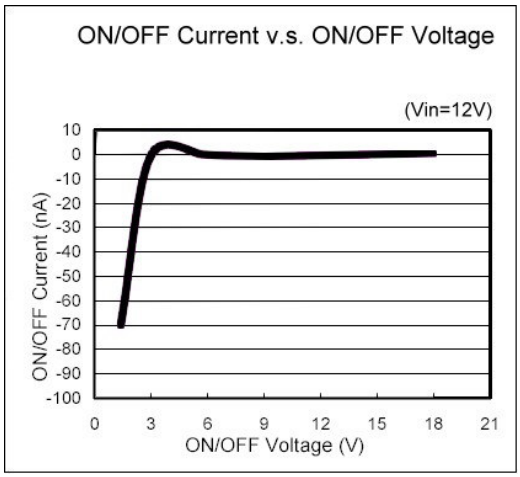












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