150KHZ，2A PWM BUCK DC/DC CONVERTER

FSP3125

■ FEATURES

- Output voltage: 3.3V, 5V, 12V and adjustable output version
- Adjustable version output voltage range, 1.23V to 18V ± 4%
- 150KHz ±15% fixed switching frequency
- Voltage mode non-synchronous PWM control
- Thermal-shutdown and current-limit protection
- ON/OFF shutdown control input
- Operating voltage can be up to 22V
- Output load current: 2A
- SOP8L packages
- Low power standby mode
- Built-in switching transistor on chip

■ Typical Application

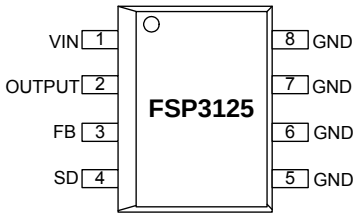
- Simple High-efficiency step-down regulator
- On-card switching regulators
- Positive to negative converter

■ GENERAL DESCRIPTION

The FSP3125 series are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving a 2A load without additional transistor. It saves board space. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control having 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. If current limit function occurs and FB is down below 0.5V, the switching frequency will be reduced. The FSP3125 series operates at a switching frequency of 150KHz thus allow 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 chips are available in a standard SOP8L package.

■ PIN ASSIGNMENT

(Top View)



■ PIN DESCRIPTION

Name	No.	Description
VIN	1	Operating Voltage Input
OUTPUT	2	Switching Output
FB	3	Output Voltage Feedback Control
SD	4	On/Off Shutdown
GND	5	Ground
GND	6	Ground
GND	7	Ground
GND	8	Ground

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit
Supply Voltage	+24	V
On/Off Pin Input Voltage	-0.3 to +18	V
Feedback Pin Voltage	-0.3 to +18	V
Output Voltage to Ground	-1	V
Power Dissipation	Internally Limited	W
Storage Temperature	-65 to +150	℃
Operating Temperature	-40 to +125	℃
Operating Voltage	+4.5 to +22	V

■ ELECTRICAL CHARACTERISTICS

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

Parameter		Symbol	Test 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
Short Circuit Oscillator Frequency		F_{CSP}	When Current Limit Occur and V_{FB} ＜ 0.5V, T_A=25°C		10	30	50	kHz
Saturation Voltage		V_{SAT}	I_{OUT}= 2A, No Outside Circuit , V_{FB} = 0V force drive on			1.25	1.4 **1.5**	V
Maximum Duty Cycle(On)		DC	V_{FB} = 0V force drive on				100	%
Minimum 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		3.6 **3.4**		6.9 **7.5**	A
Output=0	Output Leakage Current	I_L	No Outside Circuit , V_{FB} = 12V force drive off				-50	μA
Output=-1			V_{IN} = 22V				-30	mA
Quiescent Current		I_Q	V_{FB} = 12V force drive off			5	10	mA
Standby Quiescent Current		I_{STBY}	ON/OFF Pin=5V,V_{IN} = 22V			70	200 **250**	μA
ON/OFF Pin Logic Input Threshold Voltage		V_{IL}	Low (Regulator ON)			1.3	0.6	V
		V_{IH}	High (Regulator OFF)		2.0			
ON/OFF Pin Input Current		I_L	V_{LOGIC}=0.5V(ON)				-5	μA
ON/OFF Pin Logic Input Current		I_H	V_{LOGIC}=2.5V(OFF)				-15	
Thermal Resistance		θ_{JC}	SOP8L	Junction to Case		15		℃/W
Thermal Resistance with Copper Area of Approximately 3 in^2		θ_{JA}	SOP8L	Junction to Ambient		70		

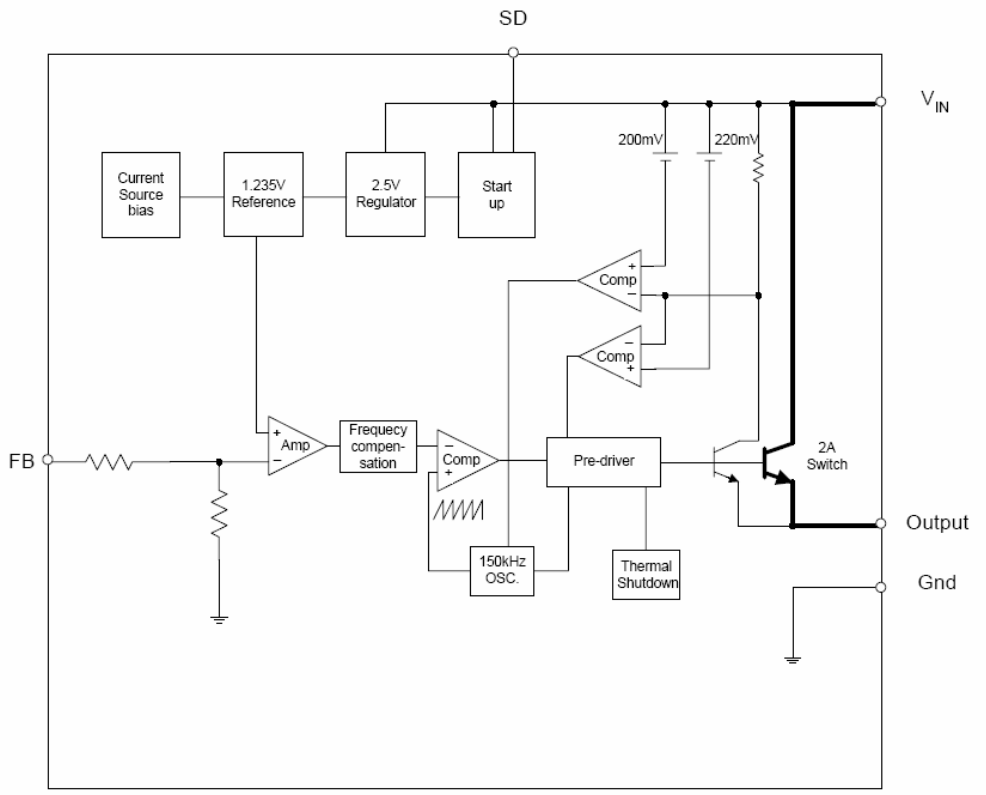
■ ELECTRICAL CHARACTERISTICS(CONTINUED)

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

Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Output Feedback	FSP3125-ADJ	V_{FB}	4.5V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A V_{OUT} Programmed for 3V	1.193 **1.18**	1.23	1.267 **1.28**	V
Efficiency		η	V_{IN} =12V, I_{LOAD}= 2A	75			%
Output Feedback	FSP3125-3.3V	V_{OUT}	4.5V ≤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			%
Output Feedback	FSP3125-5.0V	V_{OUT}	7V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A	4.8 **4.75**	5	5.2 **5.25**	V
Efficiency		η	V_{IN} =12V, I_{LOAD}= 2A	83			%
Output Feedback	FSP3125-12V	V_{OUT}	15V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A	11.52 **11.4**	12	12.48 **12.6**	V
Efficiency		η	V_{IN} =15V, I_{LOAD}= 2A	90			%

Specifications with boldface are for full operating temperature range, the other type are for T_J=25°C

■ FUNCTIONAL BLOCK DIAGRAM



■ Function Description

Pin Description

+VIN

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

Ground

Circuit Ground

Output

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 minimized.

Feedback

Sense the regulated output voltage to complete the feedback loop.

SD

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 150uA. 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, the SD pin can be wired to the ground pin.

Thermal Considerations

The SOP8L package needs a heat sink under most conditions. The size of the heatsink depends on the input voltage, the output voltage, the load current and the ambient temperature. The FSP3125 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 FSP3125(SOP8L package) operating as a buck-switching regulator in an ambient temperature 25℃ (still air). These temperature increments are all approximate and are affected by many factors. Higher ambient temperatures requires more heat sinker.

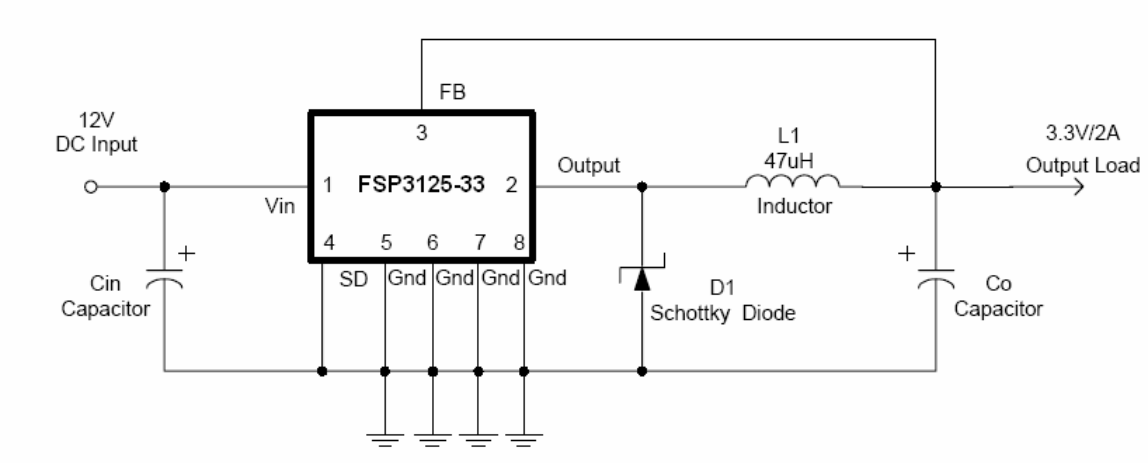
For the best thermal performance, wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (One exception is the output (switch) pin, which should not have large areas of copper.) Large areas of copper provide the best transfer of heat (lower thermal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

Package thermal resistance and junction temperature increments are all approximate. The increments are affected by a lot of 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 the amount of solder on the board.

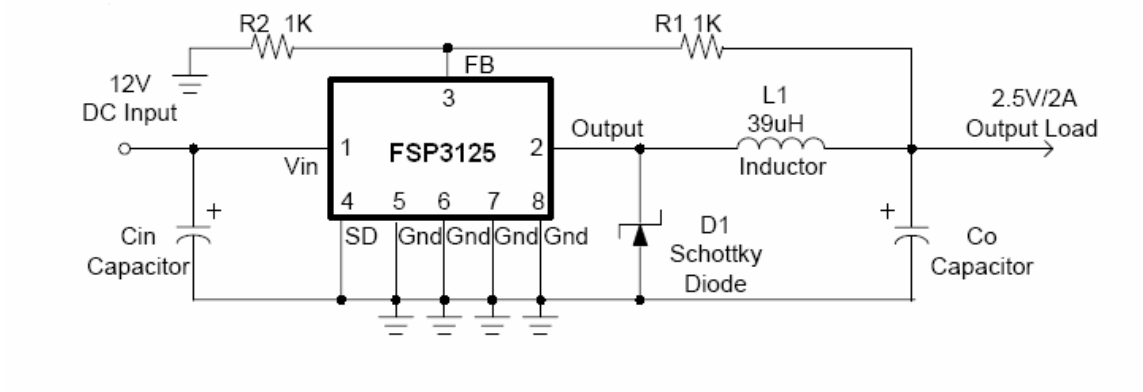
The effectiveness of the PC board to dissipate heat also depends on the size, quantity and spacing of other components on the board, as well as whether the surrounding air is still or moving. Furthermore, some of these components such as the catch diode will add heat to the PC board and the heat can 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 Output Version Circuit

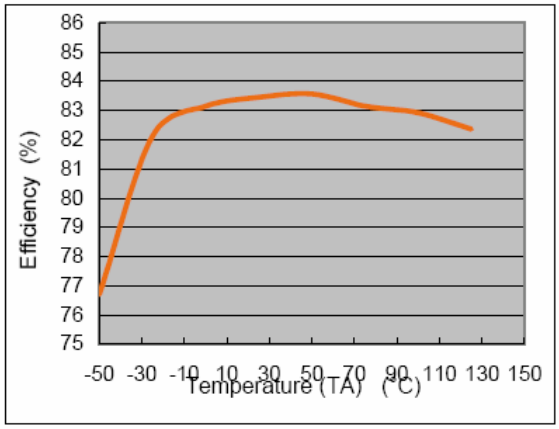


(2) Adjustable Version Circuit

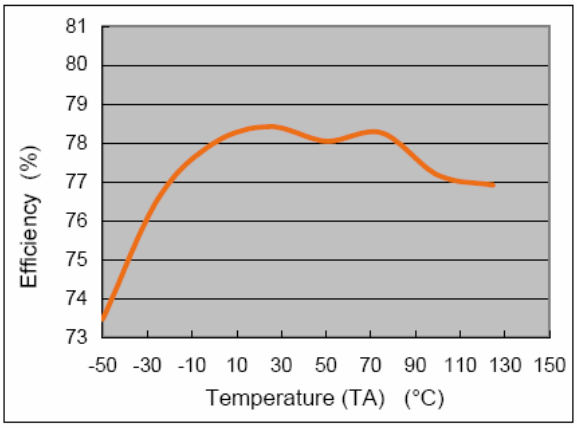


■ TYPICAL CHARACTERISTICS

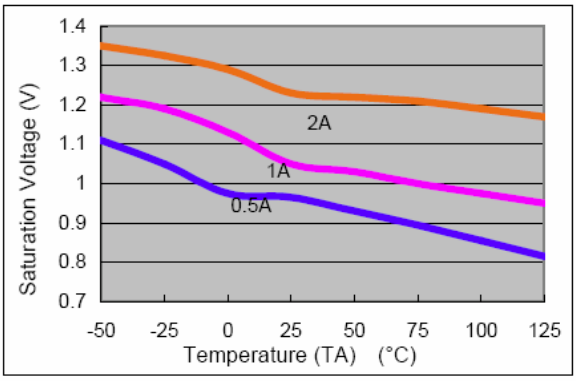
FSP3125 Efficiency v.s. Temperature (Vin=12V,Vout=5V,Io=2A)



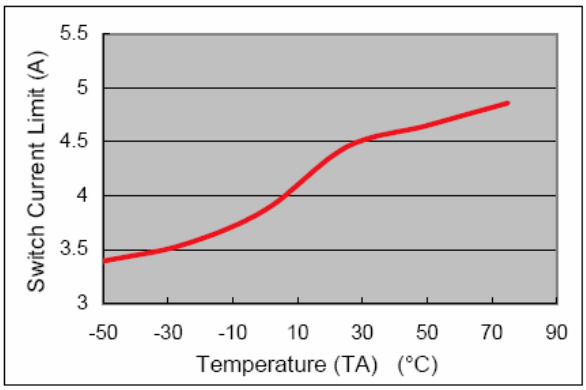
FSP3125 Efficiency v.s. Temperature (Vin=12V,Vout=3.3V,Io=2A)



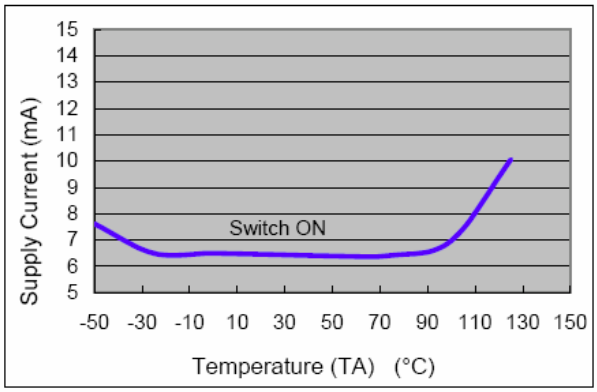
FSP3125 Saturation Voltage v.s. Temperature (Vcc=12V,Vfb=0V,VSD=0)

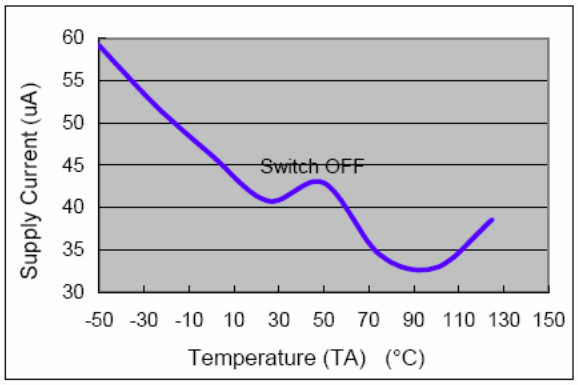


FSP3125 Switch Current Limit v.s. Temperature (Vcc=12V,Vfb=0V)



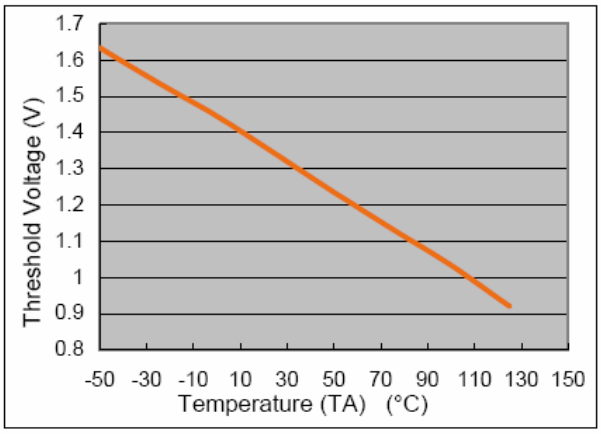
FSP3125 Supply Current v.s. Temperature (Vcc=12V , No Load ,Von/off =0V(Switch ON) ,Von/off =5V(Switch OFF))



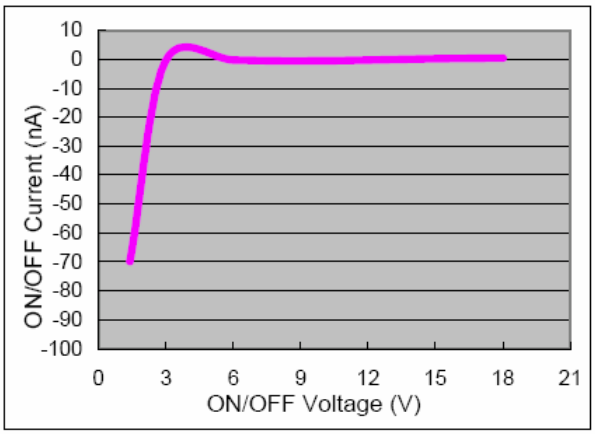


■ TYPICAL CHARACTERISTICS(CONTINUED)

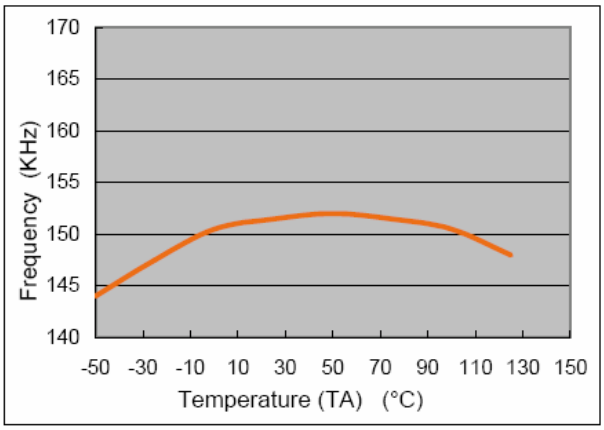
FSP3125 Threshold Voltage v.s. Temperature (Vcc=12V , Io=100mA)



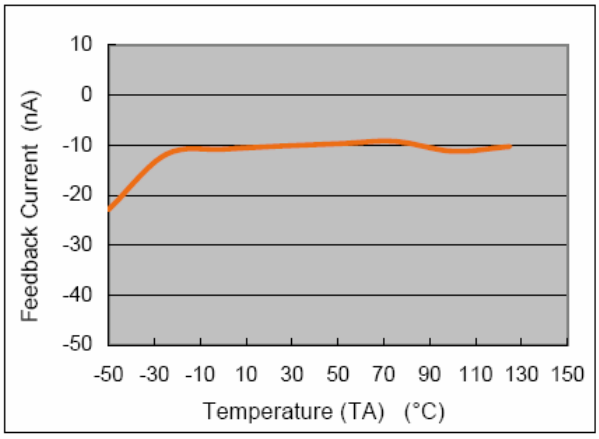
FSP3125 ON/OFF Current v.s. ON/OFF Voltage (Vin=12V)



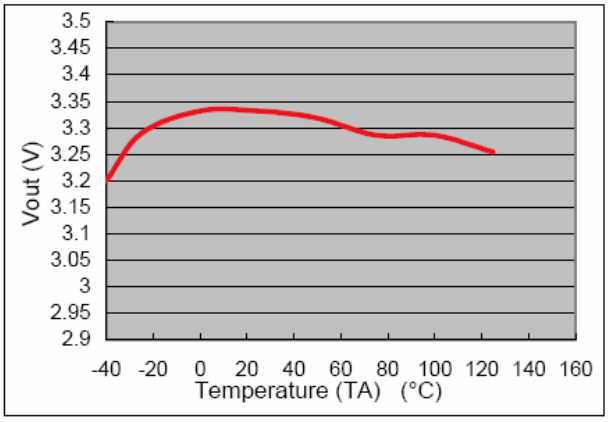
FSP3125 Frequency v.s. Temperature (Vcc=12V , Io=500mA ,Vout=5V)



FSP3125Feedback Current v.s. Temperature (Vcc=12V , Vout=5V,Vfb=1.3V)



FSP3125Output Voltage v.s. Temperature (Vin=12V ,Io=2A)

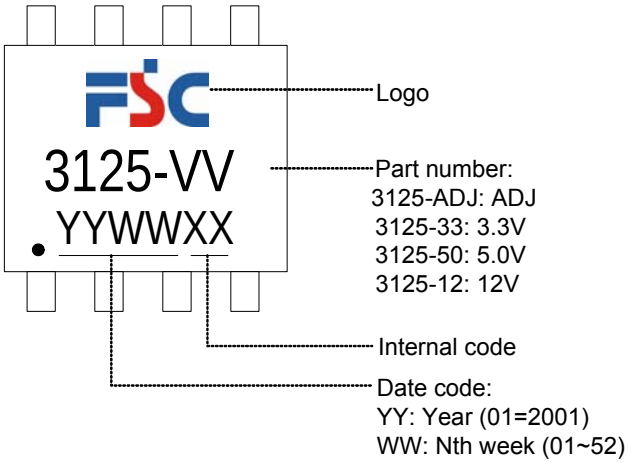


■ ORDER INFORMATION

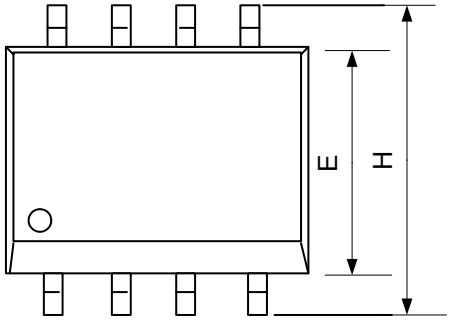
FSP3125XXXX

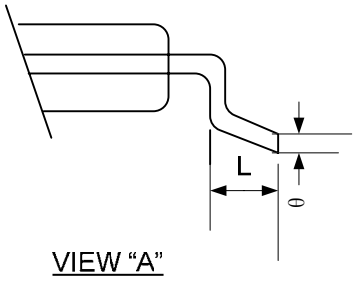
Package:	Output Voltage:	Packing:	Temperature Grade:
S: SOP8L	Blank: ADJ 33: 3.3V 50: 5.0V 12: 12V	Blank: Tube or Bulk A: Tape & Reel	E: -40~125℃

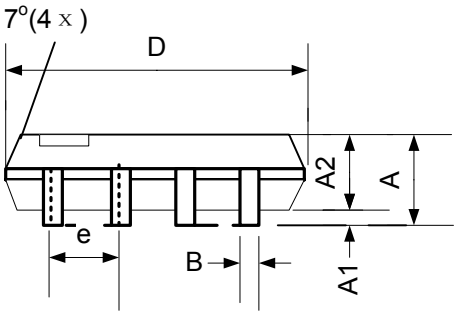
■ MARKING INFORMATION

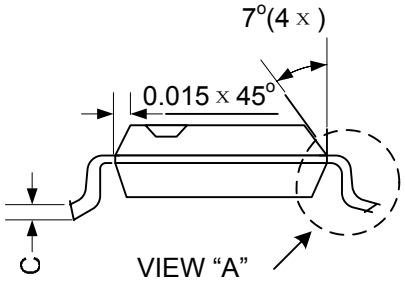


■ PACKAGE INFORMATION









Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.35	1.60	1.75	0.053	0.063	0.069
A1	0.10		0.25	0..004		0.010
A2	1.35	1.45	1.55	0.053	0.057	0.061
B	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.80	4.90	5.00	0.192	0.196	0.200
E	3.80	3.90	4.00	0.148	0.154	0.160
e	1.27TYP.			0.050TYP.		
H	5.80	5.99	6.30	0.228	0.236	0.248
L	0.38	0.71	1.27	0.015	0.028	0.050
θ	0°		8°	0°		8°