

150KHz 2A PWM Buck DC/DC Converter

Product Description

The GS5220 series are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving a 2A load without external transistor. Due to reducing the number of external component, the board space can be saved easily. The external shutdown function can be controlled by 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 to prevent over current operating of the output switch. If current limit function occurred and VFB is down to 0.5V below, the switching frequency will be reduced.

The GS5220 series operate 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 and an adjustable type. The packages are available in a standard 5-lead TO-220, a 5-lead TO-263 or 8-lead PDIP, 8-lead SOP-8.

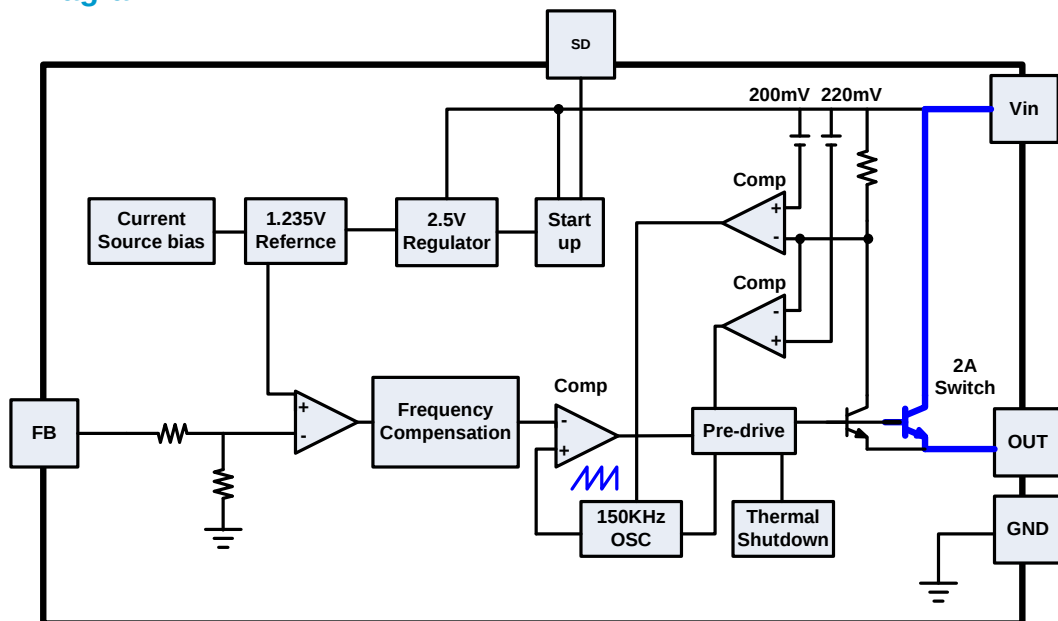
Features

- Output voltage: 3.3V, 5V and adjustable output version
- Adjustable version output voltage range, 1.23V to 18V $\pm$ 4%
- 150KHz $\pm$ 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
- TO220-5L, TO263-5L, PDIP-8 and SOP-8 packages
- Low power standby mode
- Built-in switching transistor on chip

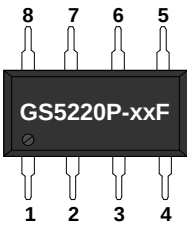
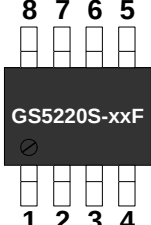
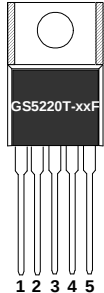
Applications

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

Block Diagram

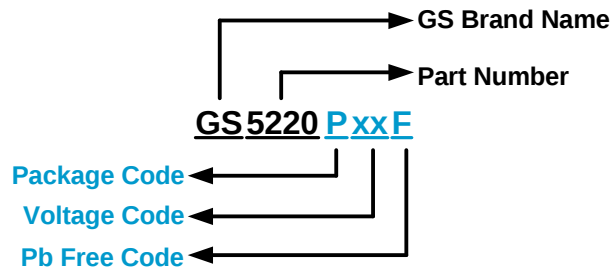


Packages & Pin Assignments

GS5220 (PDIP-8L)				GS5220(SOP-8)				GS5220(TO-263-5L)				GS5220(TO-220-5L)			
															
1	V _{IN}	5	GND	1	V _{IN}	5	GND	1	V _{IN}	5	SD	V _{IN}	V _{IN}	5	SD
2	V _{OUT}	6	GND	2	V _{OUT}	6	GND	2	V _{OUT}			2	V _{OUT}		
3	FB	7	GND	3	FB	7	GND	3	GND			3	GND		
4	SD	8	GND	4	SD	8	GND	4	FB			4	FB		

PIN Name	Description
V _{IN}	Operating voltage input
V _{OUT}	Switching output
GND	Ground
FB	Output voltage feedback control
SD	ON/OFF Shutdown

Ordering Information

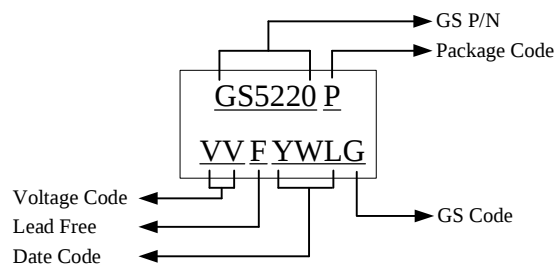


Part Number				Output Voltage
(PDIP-8L)	(SOP-8)	(TO-263-5L)	(TO-220-5L)	
GS5220PF	GS5220SF	GS5220MF	GS5220TF	ADJ
GS5220P33F	GS5220S33F	GS5220M33F	GS5220T33F	3.3
GS5220P50F	GS5220S50F	GS5220M50F	GS5220T50F	5.0

*Adjustable Version does not need Voltage Code.

**For other voltages, please contact factory

Marking Information



Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	+24	V
ON /OFF Pin Input Voltage	V_{SD}	-0.3 to +18	V
Feedback Pin Voltage	V_{FB}	-0.3 to +18	V
Output Voltage to Ground	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	W
Storage Temperature	T_{ST}	-65 to +150	°C
Operating Temperature	T_{OP}	-40 to +125	°C
Operating Voltage	V_{OP}	+4.5 to +22	V

Electrical Characteristics

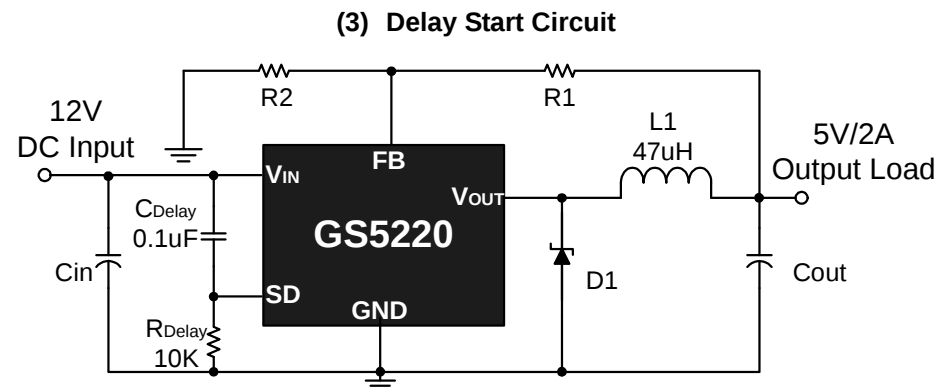
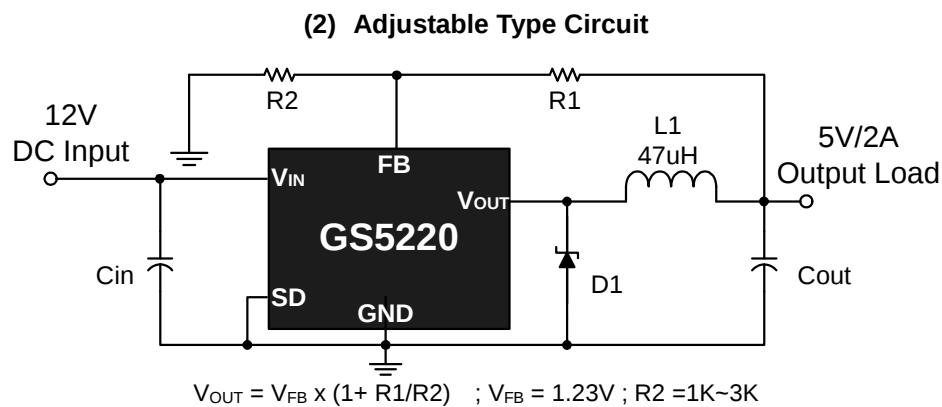
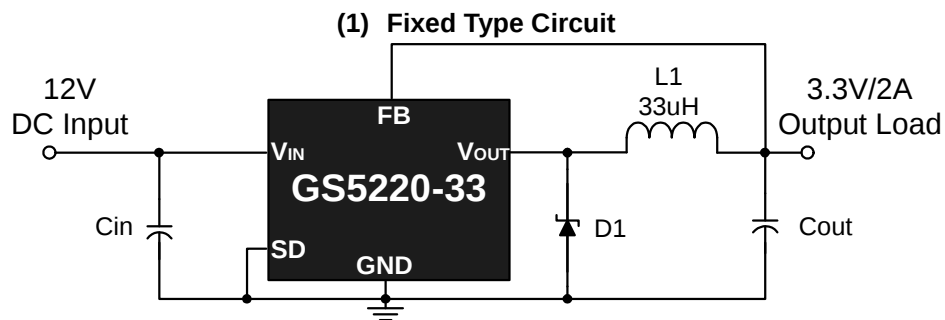
Unless otherwise specified, $V_{IH}=12V$ for 3.3V, 5V, adjustable version and $V_{in}=18V$ for the 12V version. $I_{LOAD}=0.5A$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Feedback Bias Current	I_{FB}	$V_{FB}=1.3V$		-10	-50	nA
		(Adjustable version only)			-100	
Oscillator Frequency	F_{OSC}	-	127 110	150	173 173	KHz
Oscillator Frequency of Short Circuit Protect	F_{SCP}	When current limit occurred and $V_{FB} < 0.5V, T_a=25^{\circ}C$	10	30	50	KHz
Saturation Voltage	V_{SAT}	$I_{OUT}=2A$ No outside circuit $V_{FB}=0V$ force driver on		1.4	1.6 1.7	V
Max Duty Cycle (ON)	DC	$V_{FB}=0V$ force driver on		100		%
Min Duty Cycle (OFF)		$V_{FB}=12V$ force driver off		0		
Current Limit	I_{CL}	Peak current No outside circuit $V_{FB}=0$ force driver on	2.5	3.6	5.5 6.5	A
Output=0V	Output Leakage Current	No outside circuit $V_{FB}=12V$ force driver off			-200	uA
Output=1V		$V_{IN}=22V$		-5		
Quiescent Current	I_Q	$V_{FB}=12V$ force driver off		5	10	mA
Standby Quiescent Current	I_{STBY}	ON/OFF pin=5V		70	150	uA
		$V_{IN}=22V$			200	
ON/OFF Pin Logic Input Threshold Voltage	V_{IL}	Low (regulator ON)		1.3	0.6	V
	V_H	High (regulator OFF)	2			
ON/OFF Pin Logic Input Current	I_H	$V_{LOGIC}=2.5V$ (OFF)			-0.01	uA
ON/OFF Pin Input Current	I_L	$V_{LOGIC}=0.5V$ (ON)		-0.1	-1	uA
Thermal Resistance Junction to Case	θ_{JC}	TO-220-5L		2.5		°C/W
		TO-263-5L		3.5		
		PDIP-8L		12		
		SOP-8		20		
Thermal Resistance Junction to Ambient	θ_{JA}	TO-220-5L		28		°C/W
		TO-263-5L		23		
		PDIP-8L		35		
		SOP-8		150		

Electrical Characteristics (Continue)

Part Number	Symbol	Parameter	Conditions	Typ	Limit	Unit
GS5220-Adj	V_{FB}	Output Feedback	$5V \leq V_{IN} \leq 22V$	1.23		V
			$0.2A \leq I_{LOAD} \leq 2A$		1.193/1.18	V_{MIN}
			V_{OUT} programmed for 3V		1.267/1.28	V_{MAX}
	η	Efficiency	$V_{IN}=12V, I_{LOAD}=2A$	74		%
GS5220-3.3	V_{OUT}	Output voltage	$5.5V \leq V_{IN} \leq 22V$	3.3	3.168/3.135	V_{MIN}
			$0.2A \leq I_{LOAD} \leq 2A$		3.432/3.465	V_{MAX}
	η	Efficiency	$V_{IN}=12V, I_{LOAD}=2A$	75		%
GS5220-5.0	V_{OUT}	Output voltage	$8V \leq V_{IN} \leq 22V$	5	4.8/4.75	V_{MIN}
			$0.2A \leq I_{LOAD} \leq 2A$		5.2/5.25	V_{MAX}
	η	Efficiency	$V_{IN}=12V, I_{LOAD}=2A$	80		%

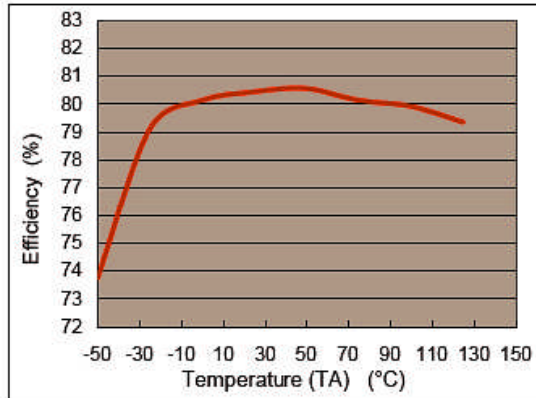
Typical Applications Circuit (To Packages)



Typical Performance Characteristics

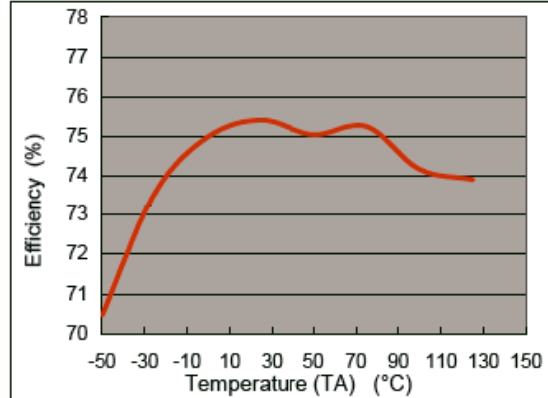
GS5220 Efficiency v.s. Temperature

($V_{IN}=12V$, $V_{OUT}=5V$, $I_O=2A$)



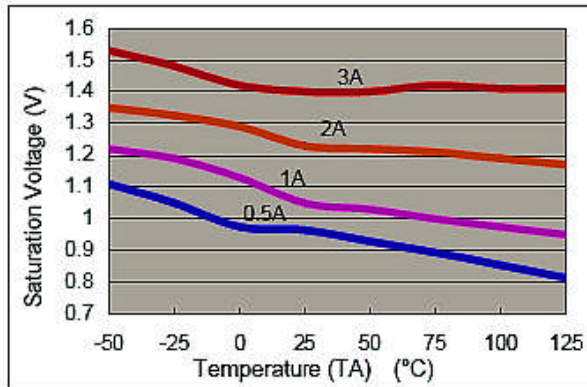
GS5220 Efficiency v.s. Temperature

($V_{IN}=12V$, $V_{OUT}=3.3V$, $I_O=2A$)



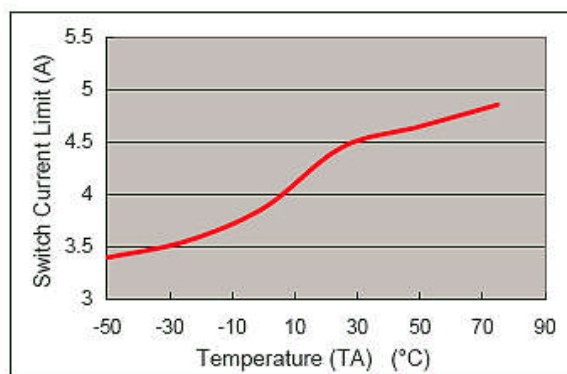
GS5220 Efficiency v.s. Temperature

($V_{CC}=12V$, $V_{FB}=0V$, $V_{SD}=0V$)



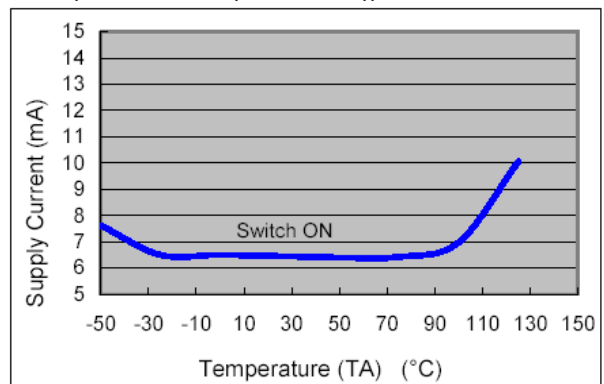
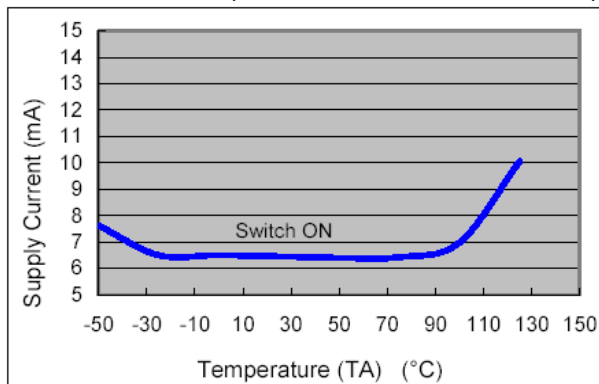
GS5220 Efficiency v.s. Temperature

($V_{CC}=12V$, $V_{FB}=0V$)



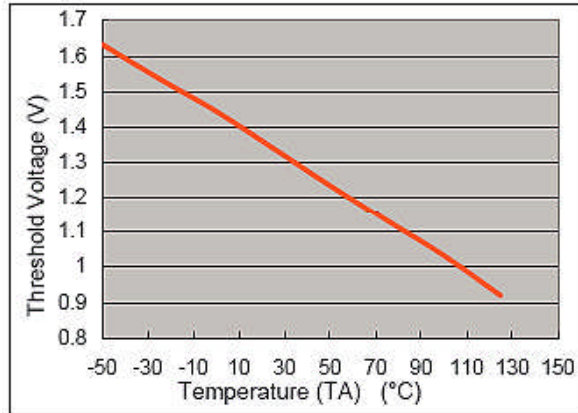
GS5220 Supply Current v.s. Temperature

($V_{CC}=12V$, No Load, $V_{ON/OFF}=0V$ (Switch ON), $V_{ON/OFF}=5V$ (Switch OFF))

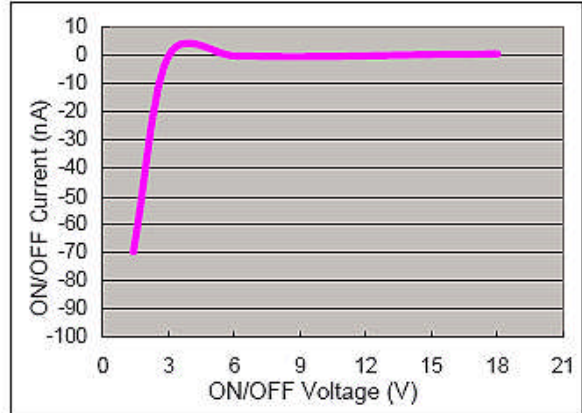


Typical Performance Characteristics (Continue)

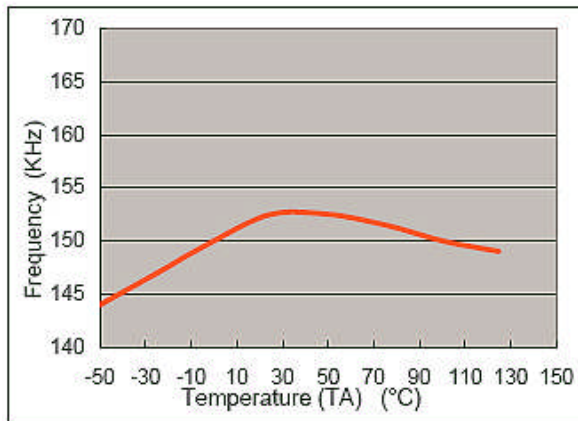
GS5220 Threshold Voltage v.s. Temperature
($V_{CC}=12V$, $I_O=100mA$)



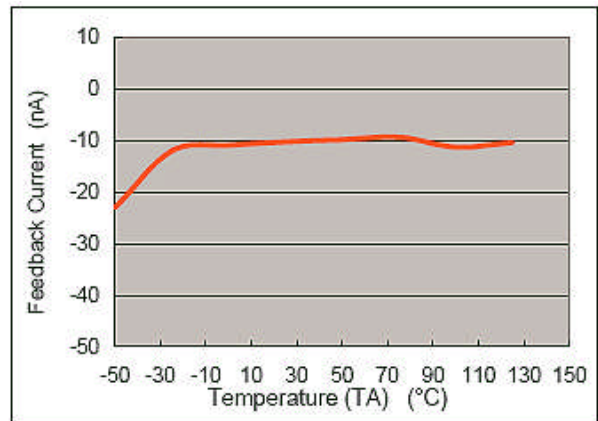
GS5220 ON/OFF Current v.s. ON/OFF Voltage
($V_{IN}=12V$)



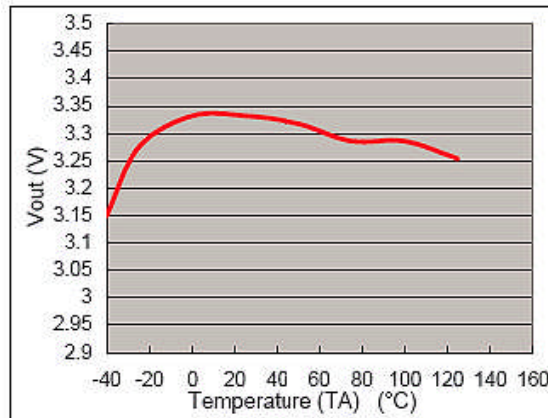
GS5220 Frequency v.s. Temperature
($V_{CC}=12V$, $I_O=500mA$, $V_{OUT}=5V$)



GS5220 Feedback Current v.s. Temperature
($V_{CC}=12V$, $V_{OUT}=5V$, $V_{FB}=1.3V$)



GS5220 Output Voltage v.s. Temperature
($V_{IN}=12V$, $I_O=2A$)



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.

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 kept a minimum.

Feedback (FB)

Senses the regulated output voltage to complete the feedback loop.

ON/OFF (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 ON/ OFF pin can be wired to the ground pin.

Thermal Considerations

The GS5220 is available in two packages : a 5-pin TO-220 and a 5-pin surface mount TO-263.

The TO-220 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 GS5220 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 GS5220(TO-220 package) operating as a buck-switching regulator in an ambient temperature of 25°C (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 sink.

The TO-263 surface mount package tab was designed to be soldering to the copper on a printed circuit board .The copper and the board are the heat sink for this package and the other heat producing components, such as the catch diode and inductor. The PC board copper area that the package is soldered to should be at least 0.8 in², and ideally should have 2 or more square inches of 2 oz. Additional copper area improves the thermal characteristics, but with copper areas greater than approximately 6 in², only small improvements in heat dissipation are realized. If further thermal improvements are needed double sided, multi-layer PC board with large copper areas and/or airflow will be recommended.

The GS5220 (TO-263 package) junction temperature rises above ambient temperature with a 2A load for various input and output voltages. This data was taken with the circuit operating as a buck-switching regulator with all components mounted on a PC board to simulate the junction temperature under actual operating conditions. This curve can be used for a quick check for the approximate junction temperature for various conditions, but be aware that there are many factors that can affect the junction temperature. When load currents higher than 2A are used, double sided or multi-layer PC boards with large copper areas and/or airflow might be needed, especially for high ambient temperatures and high output voltages.

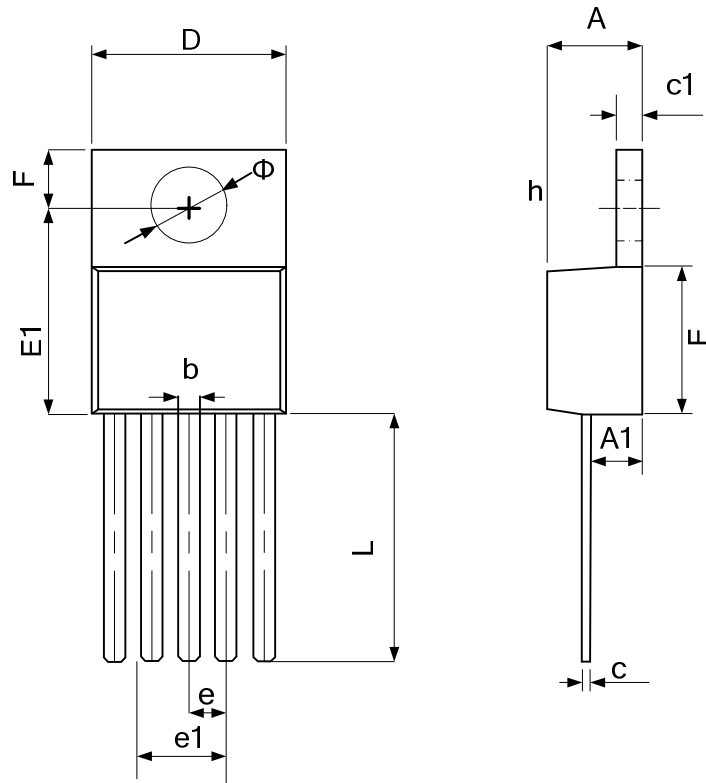
For the best thermal performance .wide copper traces and generous amounts of printed circuit board copper should be used in the board layout.

(Once 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 that 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 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.

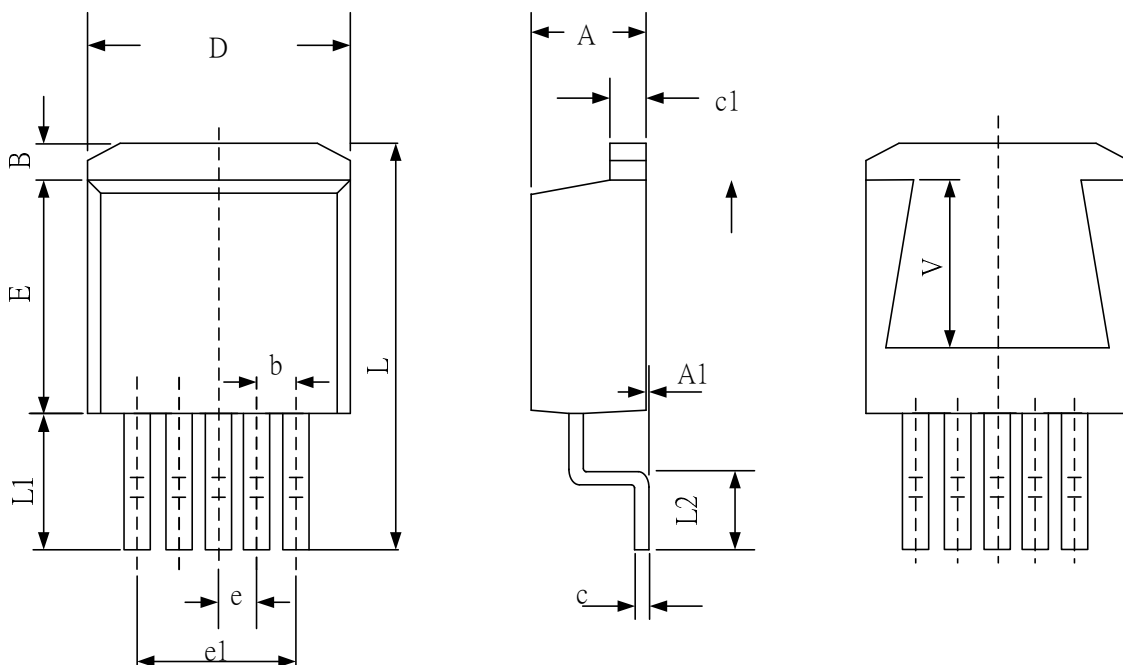
Package Dimension

TO-220-5L PLASTIC PACKAGE



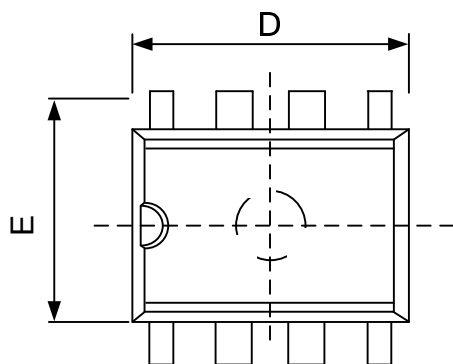
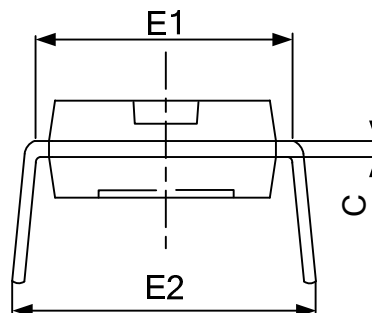
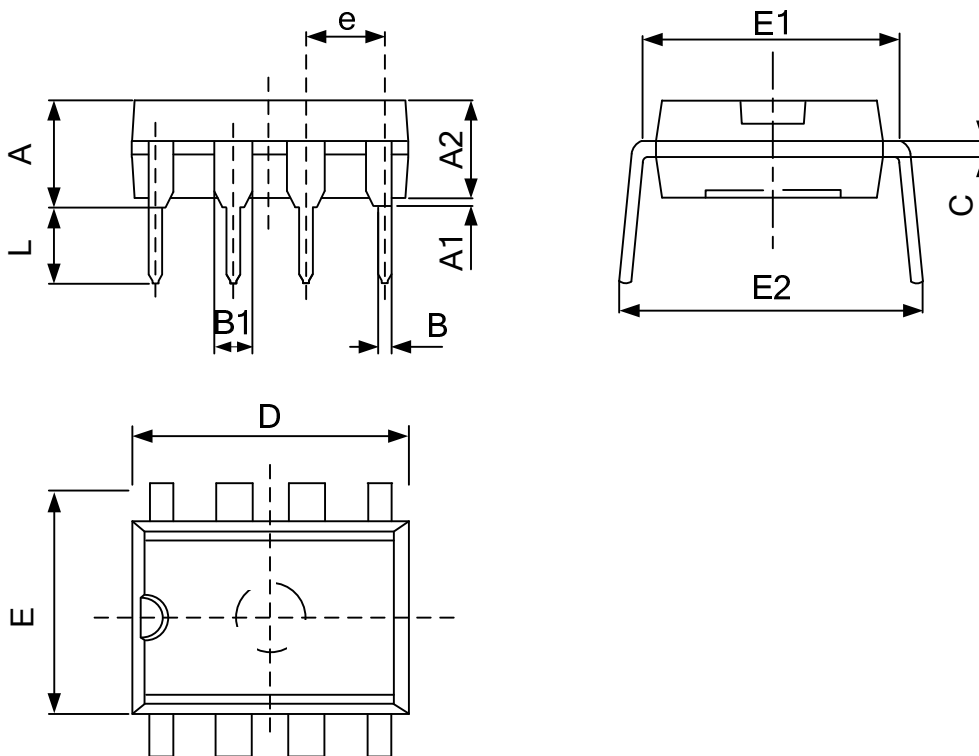
SYMBOL	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.47	4.67	.176	.184
A1	2.52	2.82	.099	.111
b	0.71	0.91	.028	.036
c	0.31	0.53	.012	.021
c1	1.17	1.37	.046	.054
D	9.85	10.15	.388	.400
E	8.20	8.60	.323	.339
E1	11.76	12.16	.463	.479
e	1.70 (TYP)		0.067(TYP)	
e1	6.70	6.90	.264	.272
F	2.59	2.89	.102	.114
L	13.50	13.90	.531	.547
Φ	3.79	3.89	.149	.153

TO-263-5L PLASTIC PACKAGE



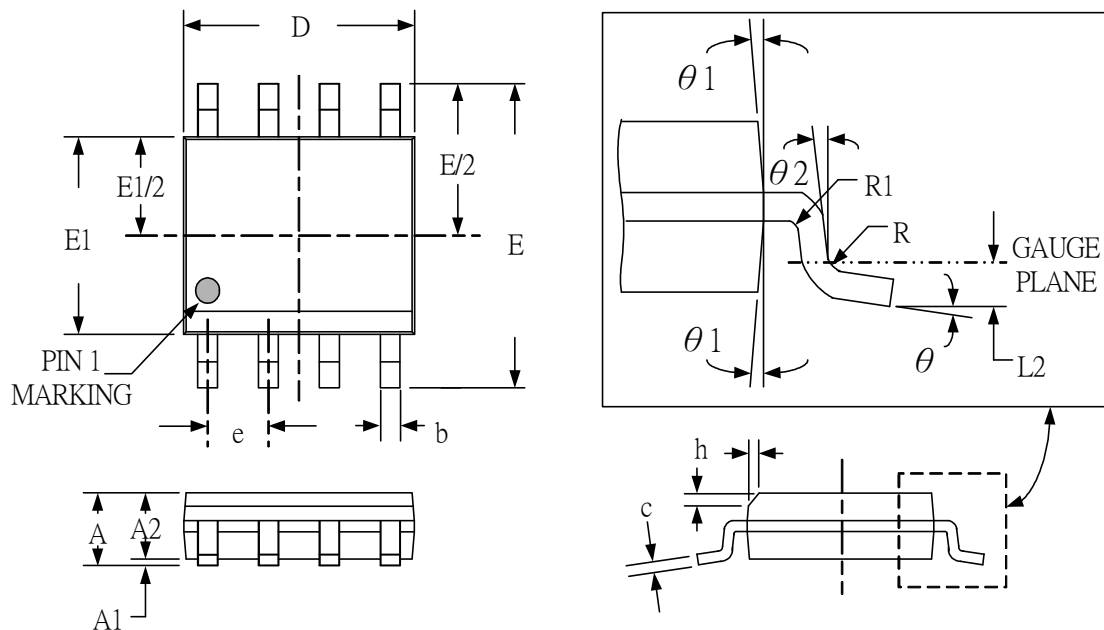
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.560	1.760	0.061	0.069
b	0.710	0.910	0.028	0.036
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	9.880	10.180	0.389	0.401
E	8.200	8.600	0.323	0.339
e	1.700TYP		0.067TYP	
e1	6.700	6.900	0.264	0.272
L	15.140	15.540	0.596	0.612
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
V	5.600 REF		0.220 REF	

PDIP-8 PLASTIC PACKAGE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	.146	.170
A1	0.510	-	.020	-
A2	3.200	3.600	.126	.142
B	0.380	0.570	.015	.022
B1	1.524(BSC)		0.060 (BSC)	
C	0.204	0.360	.008	.014
D	9.000	9.400	.354	.370
E	6.200	6.600	.244	.260
E1	7.320	7.920	.288	.312
e	2.540(BSC)		.100 (BSC)	
L	3.000	3.600	.118	.142
E2	8.400	9.000	.331	.354

SOP-8 PLASTIC PACKAGE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.35	1.75	.053	.069
A1	0.10	0.25	.004	.010
A2	1.25	1.65	.049	.065
b	0.31	0.51	.012	.020
c	0.17	0.25	.007	.010
D	4.90 (TYP)		.193 (TYP)	
E	6.00 (TYP)		.236 (TYP)	
E1	3.90 (TYP)		.154 (TYP)	
e	1.27 (TYP)		.050 (TYP)	
L	0.40	1.27	.016	.050
L1	1.04 (TYP)		.041 (TYP)	
L2	0.25 (TYP)		.010 (TYP)	
R	0.07	-	.003	-
R1	0.07	-	.003	-
h	0.25	0.50	.010	.020
θ	0°	8°	0°	8°
θ_1	5°	15°	5°	15°
θ_2	0°	-	0°	-

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