

## 2.0A/40V/200kHz Synchronous Buck Converter

### Features

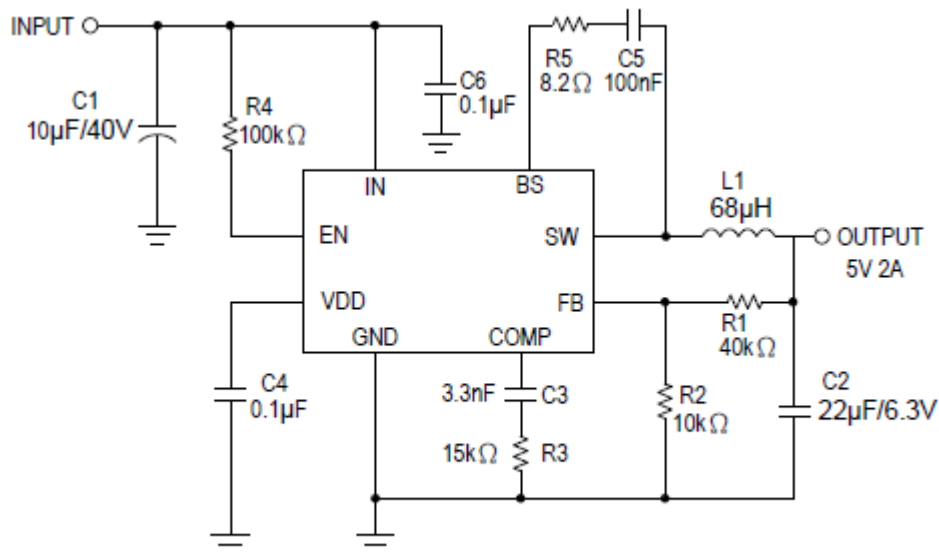
- Wide 8V to 40V Operating Input Range
- Integrated 160mΩ Power MOSFET Switches
- Output Adjustable from VFB(1V) to 20V
- Up to 93% Efficiency
- Internal Soft-Start
- Stable with Low ESR Ceramic Output Capacitors
- Fixed 200KHz Frequency
- Cycle-by-Cycle Over Current Protection
- Input Under Voltage Lockout

### Description

The GR5601 is a monolithic synchronous buck regulator. The device integrates two 160mΩ MOSFETs, and provides 2.0A of continuous load current over a wide input voltage of 8V to 40V. Current mode control provides fast transient response and cycle-by-cycle current limit.

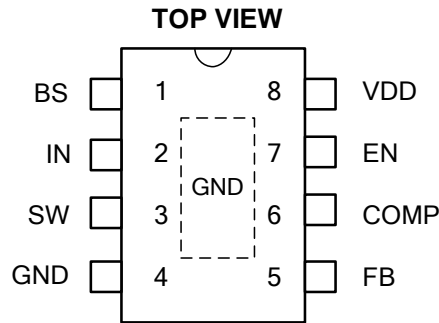
An adjustable soft-start prevents inrush current at turn-on. This device, available in SOP8-EP package, provides a very compact solution with minimal external components.

### Application Circuit



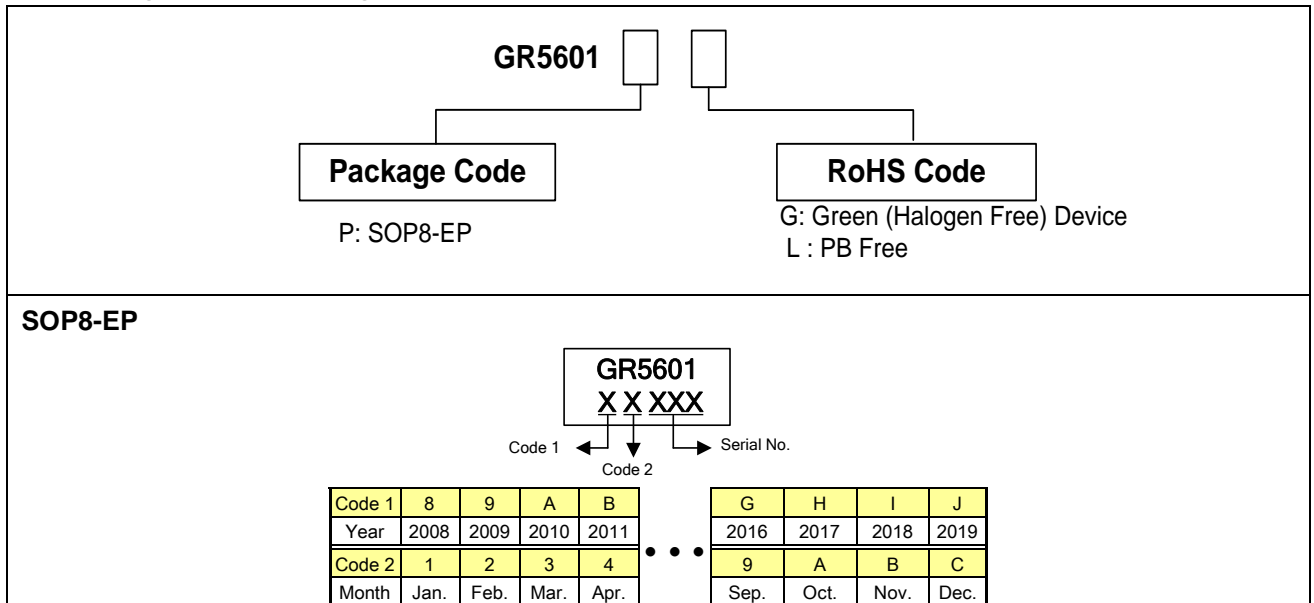
$$V_{OUT} = V_{FB} \times (1 + R1/R2), \quad V_{FB} = 1.00V, \quad R2 \text{ suggest } 10k \sim 30k\Omega$$

## Pin Configuration



## Pin Description

Pin No.	Symbol	Description
1	BS	Boot-Strap Pin. Supply high side gate driver. Decouple this pin to LX pin with 0.1uF ceramic cap.
2	IN	Power Input. IN supplies the power to the IC, as well as the step-down converter switches. Drive IN with a 8V to 40V power source. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC. See Input Capacitor.
3	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
4	GND	Ground.
5	FB	Feedback Input. FB senses the output voltage to regulate that voltage. Drive FB with a resistive voltage divider from the output voltage.
6	COMP	Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND to compensate the regulation control loop.
7	EN	Enable control. Pull high to turn on. Do not float.
8	VDD	Internal regulator pin

**Ordering and Marking Information**


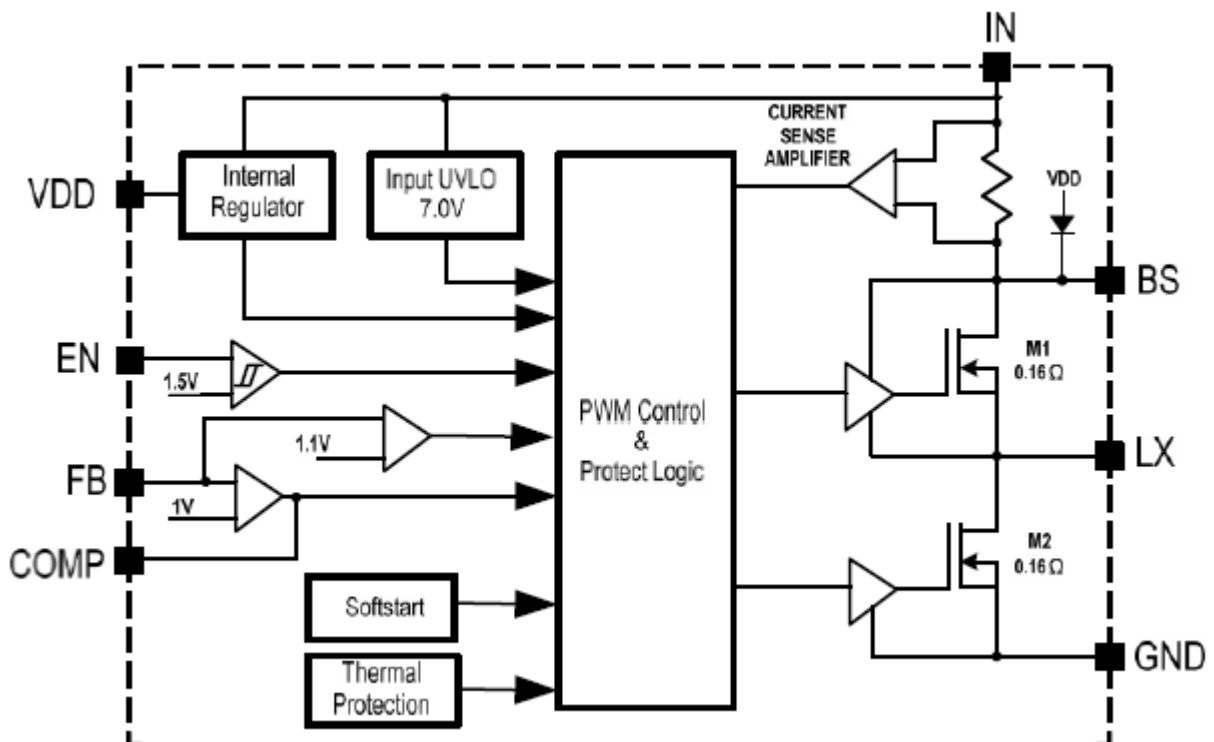
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## Absolute Maximum Ratings

Supply Voltage , $V_{IN}$	-----	-0.3V ~ +42V
Switch Node Voltage , $V_{SW}$	-----	-0.3V ~ $V_{IN}+0.3V$
Boost Voltage , $V_{BS}$	-----	$V_{SW} - 0.3$ to $V_{SW} + 6 V$
All Other Pins	-----	-0.3 ~ + 6V
Operating Junction Temperature	-----	150°C
Operating Ambient Temperature	-----	-40°C ~ 85°C
Storage Temperature Range	-----	-65°C ~ 150°C
Lead Temperature	-----	260°C
Output Voltage , $V_{OUT}$	-----	$V_{FB}-20V$
Thermal Resistance from Junction to case , $\theta_{JC}$	-----	SOP8L-EP:15°C/W
Thermal Resistance from Junction to ambient , $\theta_{JA}$	-----	SOP8L-EP:40°C/W

Note:  $\theta_{JA}$  is measured with the PCB copper area of approximately 1 in<sup>2</sup>(Multi-layer). That need connect to exposed pad.

## Block Diagram



**Electrical Characteristics** ( $V_{IN}=12V$ ,  $T_A = +25^{\circ}C$  unless otherwise stated)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input Voltage Range		8	-	40	V
Shutdown Supply Current , $V_{EN} = 0V$	ISD	-	0.7	1.2	mA
Quiescent Current , $V_{EN} = 2.0V$ ; $V_{FB} = 1.05V$	ICCQ	-	1	1.5	mA
Feedback Voltage , $8V \leq V_{IN} \leq 40V$	VFB	0.98	1.00	1.02	V
Feedback Overvoltage Threshold	OVP(FB)	-	1.1X	-	VFB
High-Side Switch On Resistance (Note)	RDS(ON)1	-	160	-	m $\Omega$
Low-Side Switch On Resistance (Note)	RDS(ON)2	-	160	-	m $\Omega$
High-Side Switch Leakage Current , $V_{EN} = 0V$ , $V_{SW} = 0V$		-	-	10	$\mu A$
Upper Switch Current Limit , Minimum Duty Cycle		2.8	3.5	-	A
Lower Switch Current Limit , From Drain to Source		-	0.7	-	A
Oscillation Frequency	FOSC1	-	200	-	KHz
Short Circuit Oscillation Frequency , $V_{FB} \leq 0.5V$	FOSC2	-	50	-	KHz
Maximum Duty Cycle	DMAX	-	90	-	%
Minimum On Time (Note)	TON(min)	-	220	-	ns
EN Lockout Threshold Voltage	ENH(LOCK)	-	2.5	-	V
EN Lockout Hysteresis		-	210	-	mV
Input Under Voltage Lockout Threshold , $V_{IN}$ Rising	UVLO	6.5	7.0	7.5	V
Input Under Voltage Lockout Threshold Hysteresis	UVLO-Hys	-	500	-	mV
Soft-Start Period		-	3	-	ms
Thermal Shutdown	TSD	-	150	-	$^{\circ}C$
Thermal Shutdown Hysteresis	TSH	-	35	-	$^{\circ}C$

Note: Guaranteed by design.

## Function Descriptions

The GR5601 is a synchronous rectified, current-mode, step-down regulator. It regulates input voltages from 8V to 40V down to an output voltage as low as VFB, and supplies up to 2.0A of load current.

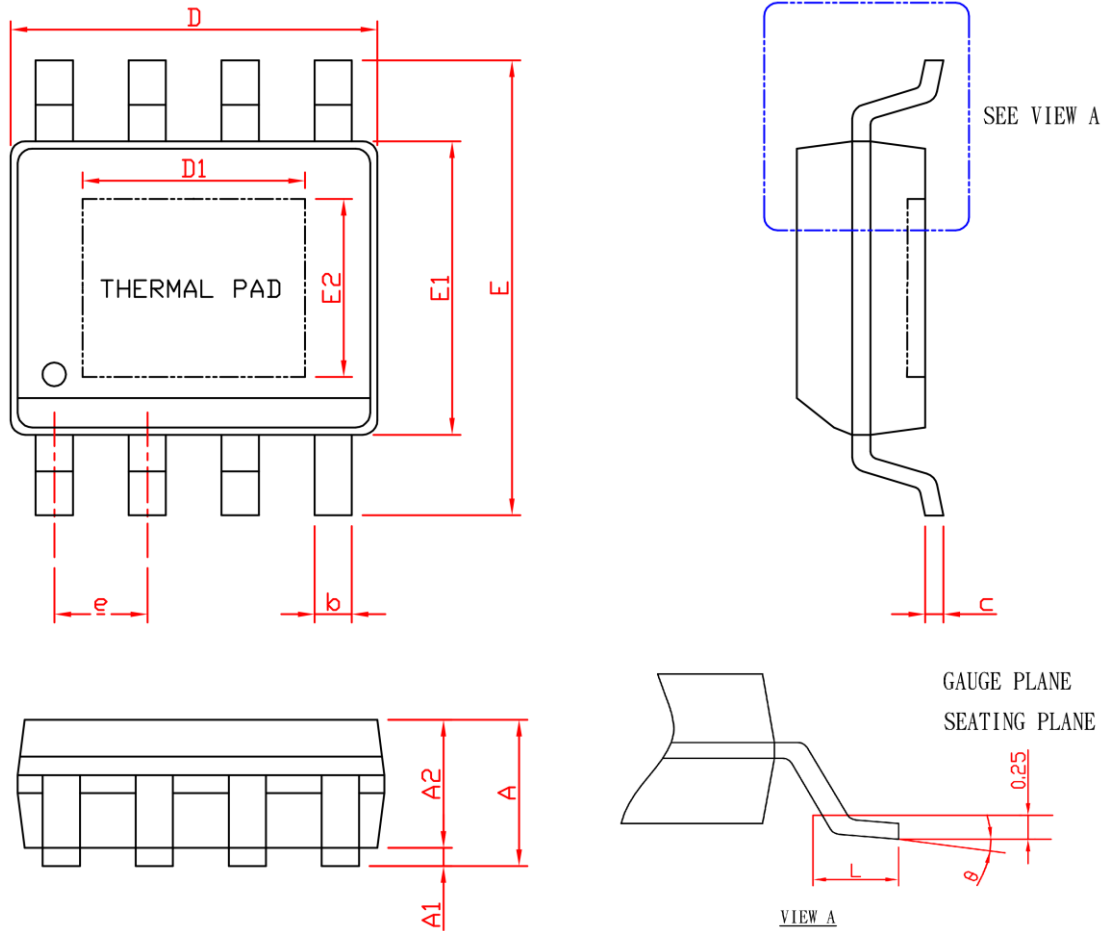
The GR5601 uses current-mode control to regulate the output voltage. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal Transconductance error amplifier. The voltage at the COMP pin is compared to the switch current measured internally to control the output voltage.

The converter uses internal N-Channel MOSFET switches to step-down the input voltage to the regulated output voltage. Since the high side MOSFET requires a gate voltage greater than the input voltage, a boost capacitor connected between SW and BS is needed to drive the high side gate. The boost capacitor is charged from the internal 5V rail when SW is low.

When the GR5601 FB pin exceeds 10% of the nominal regulation voltage of VFB, the over voltage comparator is tripped and the COMP pin is discharged to GND, forcing the high-side switch off.

## Package Information

### SOP8-EP

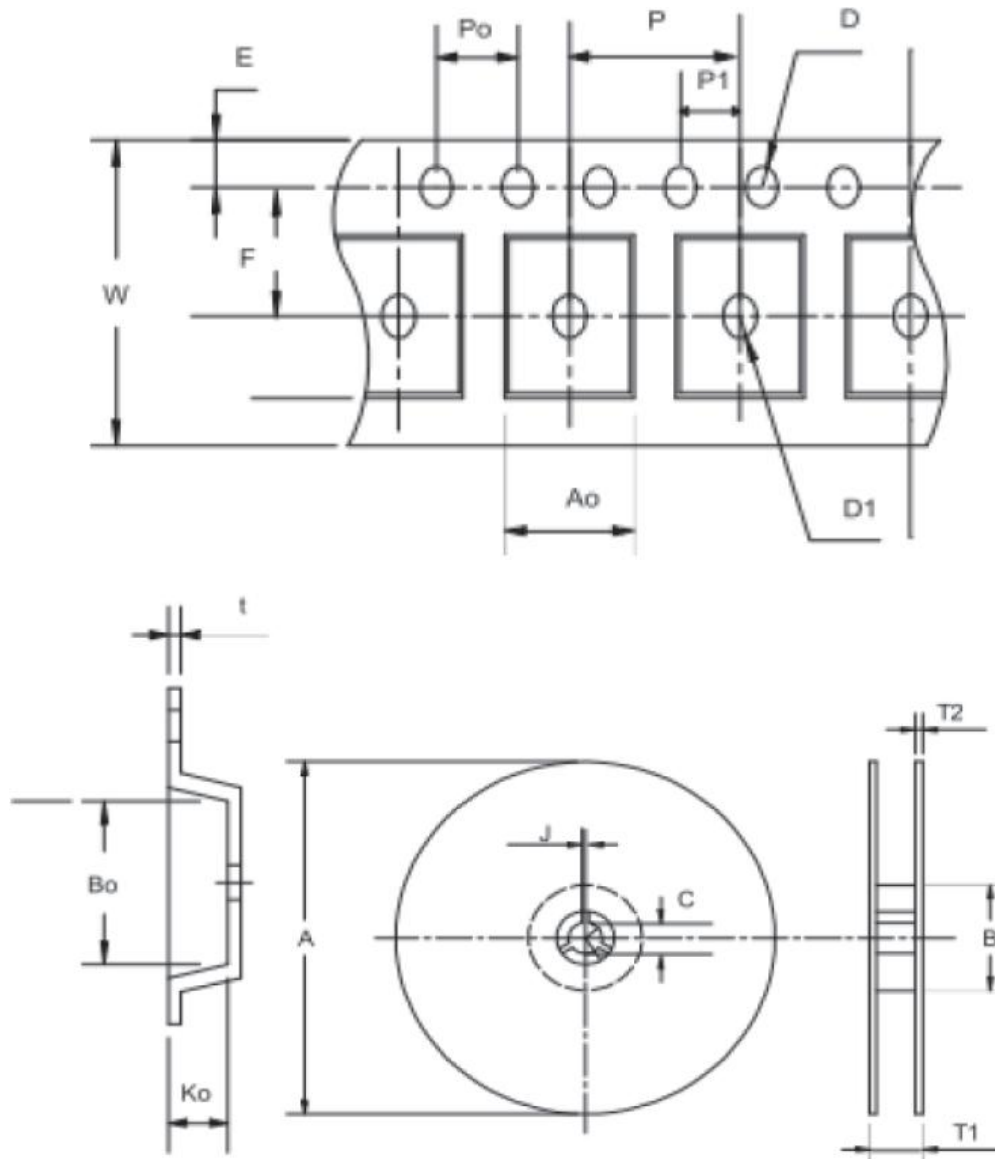


	(mm)						
	<b>A</b>	<b>A1</b>	<b>A2</b>	<b>b</b>	<b>c</b>	<b>D</b>	<b>D1</b>
MIN	-	0.00	1.25	0.31	0.10	4.70	2.50
MAX	1.75	0.15	-	0.51	0.25	5.10	3.50
	<b>E</b>	<b>E1</b>	<b>E2</b>	<b>e</b>	<b>L</b>	<b>θ</b>	
MIN	5.80	3.70	2.00	1.27BSC	0.40	0°	
MAX	6.20	4.10	3.00		1.27	8°	

Note: 1. Followed from JEDEC MS-012 BA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

**Carrier Tape & Reel Dimensions**  
**SOP8-EP**


PKG TYPE	W	E	F	P0	A0	P	P1	B0	K0	A	B	T1
SOT-8P	12±0.3	1.75±0.1	5.5±0.05	4±0.1	6.4±0.2	8±0.1	2±0.2	5.2±0.2	2.1±0.2	330±2	50min	12.4+2/-0

**Devices Per Unit**

Application	Carrier Width	Devices Per Reel
SOP8-EP	12	2500



## Taping Direction Information

### SOP8-EP

