

## LM1771

# Low-Voltage Synchronous Buck Controller with Precision Enable and No External Compensation

### General Description

The LM1771 is an efficient synchronous buck switching controller with a precision enable requiring no external compensation. The constant on-time control scheme provides a simple design free of compensation components, allowing minimal component count and board space. The precision enable pin allows flexibility in sequencing multiple rails and setting UVLO. The LM1771 also incorporates a unique input feed-forward to maintain a constant frequency independent of the input voltage. The LM1771 is optimized for a low voltage input range of 2.8V to 5.5V and can provide an adjustable output as low as 0.8V. Driving an external high side PFET and low side NFET it can provide efficiencies as high as 95%.

Three versions of the LM1771 are available depending on the switching frequency desired for the application. Nominal switching frequencies are in the range of 100kHz to 1000kHz.

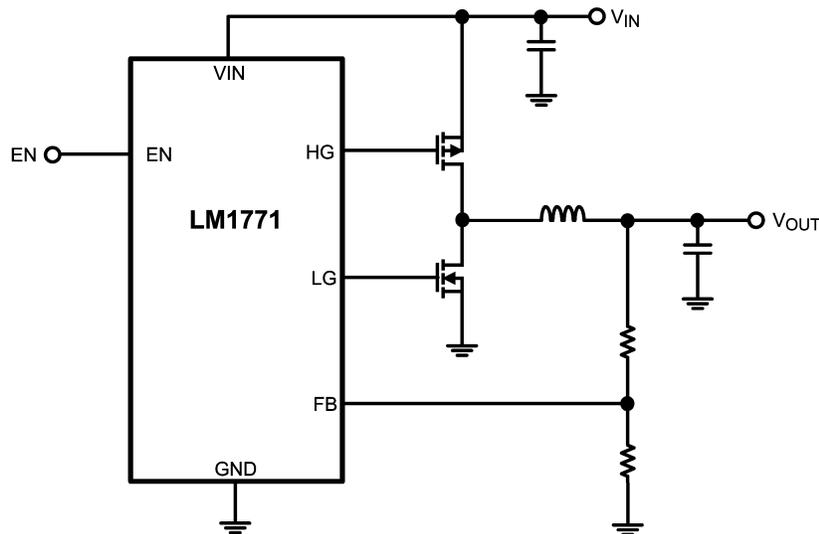
### Features

- Input voltage range of 2.8V to 5.5V
- 0.8V reference voltage
- Precision enable
- No compensation required
- Constant frequency across input range
- Low quiescent current of 400  $\mu$ A
- Internal soft-start
- Short circuit protection
- Tiny LLP-6 package and MSOP-8 package

### Applications

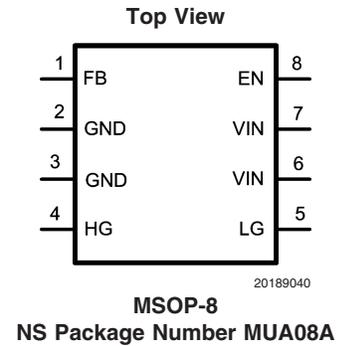
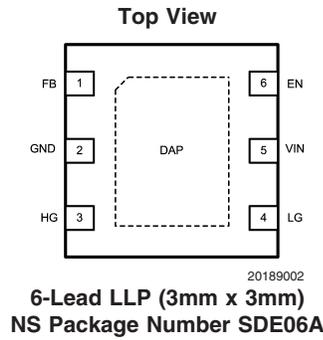
- Simple To Design, High Efficiency Step Down Switching Regulators
- FPGAs, DSPs, and ASIC Power Supplies
- Set-Top Boxes
- Cable Modems
- Printers
- Digital Video Recorders
- Servers
- Graphic Cards

### Typical Application Circuit



20189001

## Connection Diagrams



## Ordering Information

### For 6-Lead LLP Package

Order Number	Timing Option	Package Type	NSC Package Drawing	Top Mark	Supplied As
LM1771SSD	500ns	6-Lead LLP	SDE06A	1771S	1000 units Tape and Reel
LM1771SSDX				1771S	4500 units Tape and Reel
LM1771TSD	1000ns			1771T	1000 units Tape and Reel
LM1771TSDX				1771T	4500 units Tape and Reel
LM1771USD	2000ns			1771U	1000 units Tape and Reel
LM1771USDX				1771U	4500 units Tape and Reel

### For 8-Lead MSOP Package

Order Number	Timing Option	Package Type	NSC Package Drawing	Top Mark	Supplied As
LM1771SMM	500ns	MSOP-8	MUA08A	SNRB	1000 units Tape and Reel
LM1771SMMX				SNRB	3500 units Tape and Reel
LM1771TMM	1000ns			SNSB	1000 units Tape and Reel
LM1771TMMX				SNSB	3500 units Tape and Reel
LM1771UMM	2000ns			SNTB	1000 units Tape and Reel
LM1771UMMX				SNTB	3500 units Tape and Reel

## Pin Descriptions

Pin #		Name	Function
LLP-6	MSOP-8		
1	1	FB	Feedback Pin
2	2, 3	GND	Ground
3	4	HG	PFET Gate Drive
4	5	LG	NFET Gate Drive
5	6, 7	VIN	Input Supply
6	8	EN	Enable Pin
DAP		-	Die Attach Pad is internally connected to GND, but it cannot be used as the primary GND connection

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

$V_{IN}$	-0.3V to 6V
EN, FB, HG, LG	-0.3V to $V_{IN}$
Storage Temperature Range	-65°C to 150°C

Junction Temperature	150°C
Lead Temperature (soldering, 10sec)	260°C
ESD Rating	2kV

**Operating Ratings**

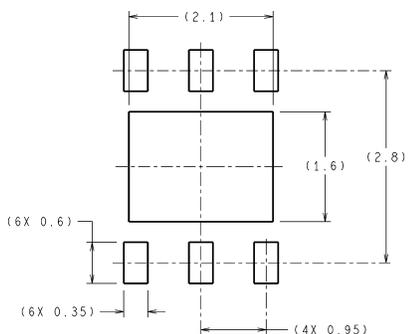
$V_{IN}$ to GND	2.8V to 5.5V
Junction Temperature Range ( $T_J$ )	-40°C to +125°C

**Electrical Characteristics** Specifications with standard typeface are for  $T_J = 25^\circ\text{C}$ , and those in **bold face type** apply over the full Junction Temperature Range (-40°C to +125°C). Minimum and Maximum limits are guaranteed through test, design or statistical correlation. Typical values represent the most likely parametric norm at  $T_J = 25^\circ\text{C}$  and are provided for reference purposes only. Unless otherwise specified  $V_{IN} = 3.3\text{V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{FB}$	Feedback pin voltage		<b>0.782</b>	0.8	<b>0.818</b>	V
$I_Q$	Quiescent current	$V_{FB} = 0.9\text{V}$		400	<b>700</b>	$\mu\text{A}$
$T_{ON}$	Switch On-Time	LM1771S - (500ns)	<b>0.4</b>	0.5	<b>0.6</b>	$\mu\text{s}$
		LM1771T - (1000ns)	<b>0.8</b>	1.0	<b>1.2</b>	
		LM1771U - (2000ns)	<b>1.6</b>	2.0	<b>2.4</b>	
$T_{OFF\_MIN}$	Minimum Off-Time	LM1771S - (500ns)		150	<b>250</b>	ns
		LM1771T - (1000ns)		135	<b>225</b>	
		LM1771U - (2000ns)		120	<b>220</b>	
$T_D$	Gate Drive Dead-Time			70		ns
$V_{IH\_EN}$	EN Pin Rising Threshold		<b>1.15</b>	1.2	<b>1.25</b>	V
$V_{EN\_HYS}$	EN Pin Hysteresis			50	<b>200</b>	mV
$I_{FB}$	Feedback pin bias current	$V_{FB} = 0.9\text{V}$		50		nA
$V_{UVLO}$	Under-voltage lock out	$V_{IN}$ Rising Edge		2.65	<b>2.8</b>	V
$V_{UVLO\_HYS}$	Under-voltage lock out hysteresis			50		mV
$V_{SC\_TH}$	Feedback pin Short Circuit Latch Threshold		<b>0.42</b>	0.55	<b>0.65</b>	V
$R_{DS(ON)1}$	HG FET driver pull-up On resistance	$I_{HG} = 20\text{ mA}$		4		$\Omega$
$R_{DS(ON)2}$	HG FET driver pull-down On resistance	$I_{HG} = 20\text{ mA}$		6		$\Omega$
$R_{DS(ON)3}$	LG FET driver pull-up On resistance	$I_{LG} = 20\text{ mA}$		4		$\Omega$
$R_{DS(ON)4}$	LG FET driver pull-down On resistance	$I_{LG} = 20\text{ mA}$		6		$\Omega$

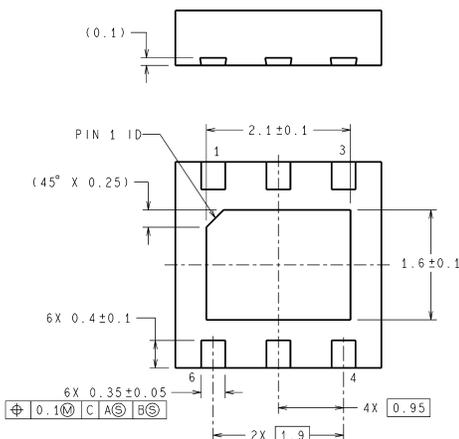
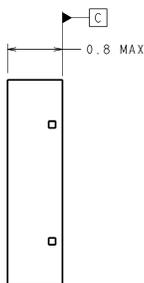
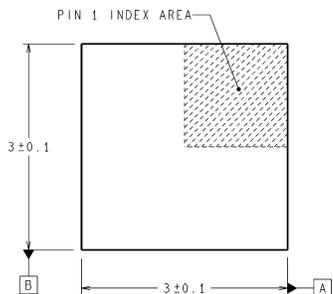
**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications, see Electrical Characteristics.

**Physical Dimensions** inches (millimeters) unless otherwise noted



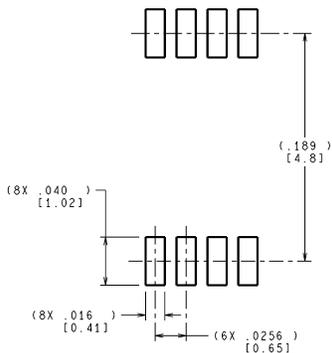
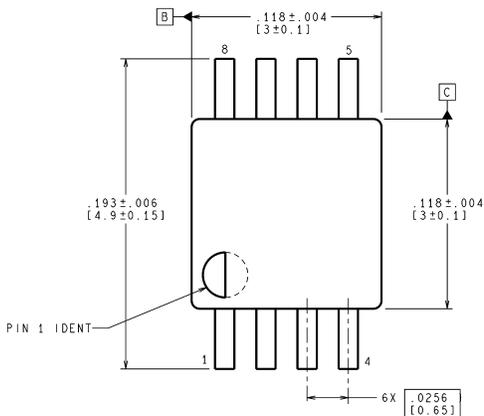
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RECOMMENDED LAND PATTERN

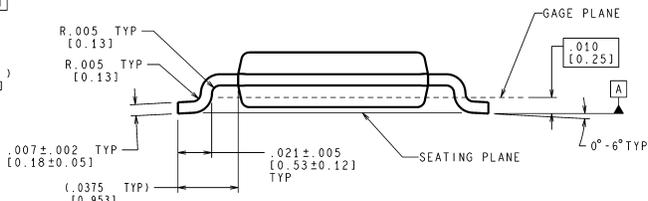
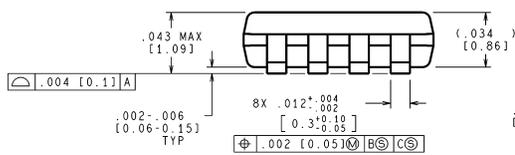


SDE06A (Rev A)

**LLP-6 Package**  
**NS Package Number SDE06A**



LAND PATTERN RECOMMENDATION



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

MUA08A (Rev E)

**MSOP-8 Package**  
**NS Package Number MUA08A**