1.2A Step-Down Switching Regulator with Output Current Limit

FEATURES

- **Wide Input Range:**
  - **Operation from 7.5V to 36V**
  - **Overvoltage Lockout Protects Circuit through 60V Transients**
- **Programmable Output Current Limit (0.4A to 1.2A)**
- **3.3V and 5V Fixed Output Voltage Options**
- **Integrated Boost Diode**
- Fixed Frequency, Peak Current Mode Control
  - LT3663 f_{SW} = 1.5MHz
  - LT3663-X f_{SW} = 1MHZ
- Low Switch V_{CESAT}: 275mV at 1A
- Internally Compensated
- Thermal Protection
- Thermally Enhanced 8-Pin 2mm × 3mm DFN and MSOP Packages

APPLICATIONS

- Distributed Supply Regulation
- Automotive Battery Regulation
- Industrial Supplies
- Wall Transformer Regulation

DESCRIPTION

The LT®3663 is a current mode step-down switching regulator with programmable output current limit. The current limit accurately controls the system power dissipation and reduces the size of the power path components.

The wide operating input voltage range of 7.5V to 36V (60V transient) suits the LT3663 to a variety of input sources, including unregulated 12V wall adapters, 24V industrial supplies, and automotive power.

The LT3663 includes a low current shutdown mode, input overvoltage and undervoltage lockout, and thermal shutdown. Internal compensation and boost diode minimize the number of external exponents. 3.3V and 5V fixed output voltage versions are available.

The LT3663 is available in 8-lead DFN and MSOP packages with exposed pads for low thermal resistance.

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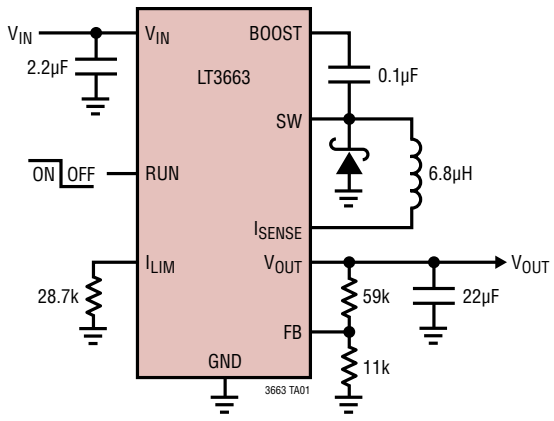
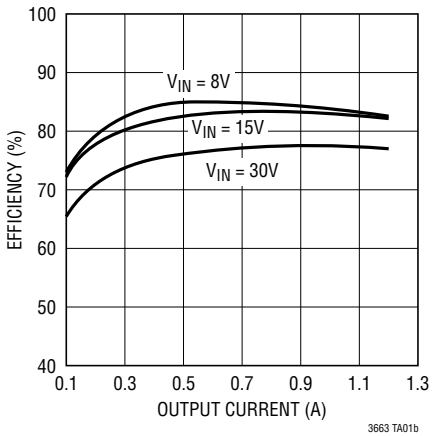
TYPICAL APPLICATION

5V Step-Down Converter



Efficiency



ABSOLUTE MAXIMUM RATINGS

(Note 1)

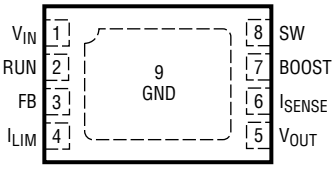
Input Voltage (V_{IN}) (Note 2) 60V
BOOST Pin Voltage 50V
BOOST Pin Above SW Pin 25V
V_{OUTS}, V_{OUT}, I_{SENSE}, FB Pins 6V
RUN Pin (Note 2) 60V

Operating Junction Temperature Range (Note 3)
LT3663E ..... –40°C to 125°C
LT3663I ..... –40°C to 125°C
LT3663H ..... –40°C to 150°C
Storage Temperature ..... –65°C to 150°C

PIN CONFIGURATION

LT3663

TOP VIEW

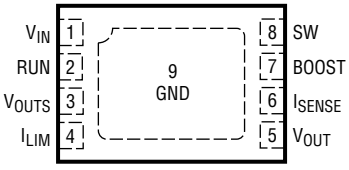


DCB PACKAGE
8-LEAD (2mm × 3mm) PLASTIC DFN

θ_{JA} = 64°C/W
EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

LT3663-X

TOP VIEW

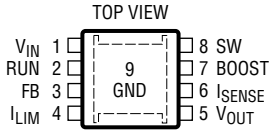


DCB PACKAGE
8-LEAD (2mm × 3mm) PLASTIC DFN

θ_{JA} = 64°C/W
EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

LT3663

TOP VIEW

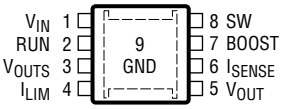


MSE PACKAGE
8-LEAD PLASTIC MSOP

θ_{JA} = 35°C/W
EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

LT3663-X

TOP VIEW



MSE PACKAGE
8-LEAD PLASTIC MSOP

θ_{JA} = 35°C/W
EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PART MARKING*	PACKAGE DESCRIPTION	TEMPERATURE RANGE
LT3663EDCB#PBF	LT3663EDCB#TRPBF	LDVK	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663IDCB#PBF	LT3663IDCB#TRPBF	LDVK	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663EDCB-3.3#PBF	LT3663EDCB-3.3#TRPBF	LFMW	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663IDCB-3.3#PBF	LT3663IDCB-3.3#TRPBF	LFMW	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663EDCB-5#PBF	LT3663EDCB-5#TRPBF	LFMY	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663IDCB-5#PBF	LT3663IDCB-5#TRPBF	LFMY	8-Lead (2mm × 3mm) Plastic DFN	–40°C to 125°C
LT3663EMS8E#PBF	LT3663EMS8E#TRPBF	LTDWT	8-Lead Plastic MSOP	–40°C to 125°C
LT3663IMS8E#PBF	LT3663IMS8E#TRPBF	LTDWT	8-Lead Plastic MSOP	–40°C to 125°C
LT3663HMS8E#PBF	LT3663HMS8E#TRPBF	LTDWT	8-Lead Plastic MSOP	–40°C to 150°C
LT3663EMS8E-3.3#PBF	LT3663EMS8E-3.3#TRPBF	LTFMX	8-Lead Plastic MSOP	–40°C to 125°C
LT3663IMS8E-3.3#PBF	LT3663IMS8E-3.3#TRPBF	LTFMX	8-Lead Plastic MSOP	–40°C to 125°C
LT3663HMS8E-3.3#PBF	LT3663HMS8E-3.3#TRPBF	LTFMX	8-Lead Plastic MSOP	–40°C to 150°C
LT3663EMS8E-5#PBF	LT3663EMS8E-5#TRPBF	LTFMZ	8-Lead Plastic MSOP	–40°C to 125°C

ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PART MARKING*	PACKAGE DESCRIPTION	TEMPERATURE RANGE
LT3663IMS8E-5#PBF	LT3663IMS8E-5#TRPBF	LTFMZ	8-Lead Plastic MSOP	–40°C to 125°C
LT3663HMS8E-5#PBF	LT3663HMS8E-5#TRPBF	LTFMZ	8-Lead Plastic MSOP	–40°C to 150°C

Consult LTC Marketing for parts specified with wider operating temperature ranges. *The temperature grade is identified by a label on the shipping container.
Consult LTC Marketing for information on non-standard lead based finish parts.

For more information on lead free part marking, go to: http://www.linear.com/leadfree/
For more information on tape and reel specifications, go to: http://www.linear.com/tapeandreel/

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{IN} = 12V, R_{ILIM} = 36.5k unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{IN} Undervoltage Lockout	Rising	●		7	7.5	V
V_{IN} Undervoltage Lockout Hysteresis				500		mV
V_{IN} Overvoltage Lockout	Rising	●	36	39	41	V
V_{IN} Overvoltage Lockout Hysteresis				1		V
V_{IN} Supply Current	Not Switching			2.4	3.2	mA
V_{IN} Supply Current in Shutdown	V_{RUN} = 0V			0.01	2	µA
Run Input Voltage High			2.5			V
Run Input Voltage Low					0.3	V
Run Pin Bias Current	V_{RUN} = 2.3V (Note4) V_{RUN} = 0V			6 0.01	15 0.1	µA µA
V_{OUT} Current Limit Range		●	0.4		1.2	A
V_{OUT} Current Limit		●	0.8	1	1.2	A
Operating Frequency	LT3663 LT3663-X		1350 900	1500 1000	1650 1100	kHz kHz
Maximum Duty Cycle		●	80	92		%
Feedback Voltage	LT3663	●	784	800	816	mV
FB Bias Current	V_{FB} = 0.8V, LT3663			50	150	nA
Regulated Output Voltage	LT3663-3.3 LT3663-5	● ●	3.234 4.900	3.3 5	3.366 5.100	V V
V_{OUTS} Bias Current	LT3663-X			90	120	µA
Switch Peak Current Limit	(Note 5)	●	1.6	2	2.5	A
Switch V_{CESAT}	I_{SW} = 1A			275		mV
Minimum BOOST Voltage	I_{SW} = 1A (Note 6)			1.85	2.2	V
Boost Diode Drop	I_{DIODE} = 60mA			0.9	1.2	V
Boost Pin Current	I_{SW} = 1A			28		mA

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Absolute Maximum Voltage at V_{IN} and RUN pins is 60V for nonrepetitive 1 second transients.

Note 3: The LT3663E is guaranteed to meet performance specifications from 0°C to 125°C. Specifications over the –40°C to 125°C operating temperature range are assured by design, characterization, and correlation with statistical process controls. The LT3663I specifications are guaranteed over the full –40°C to 125°C temperature range. The LT3663H specifications are guaranteed over the –40°C to 150°C operating temperature range. High junction temperatures degrade operating lifetimes. Operating lifetime is derated at junction temperatures greater than 125°C.

Note 4: Current flows into pin.

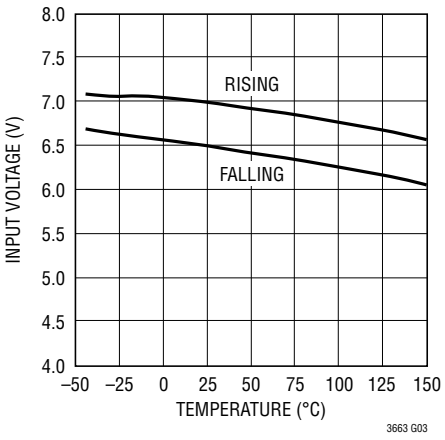
Note 5: Switch Peak Current Limit guaranteed by design and/or correlation to static test.

Note 6: This is the minimum voltage across the boost capacitor needed to guarantee full saturation of the switch.

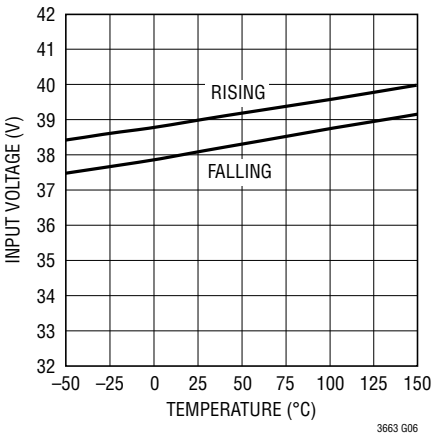
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = 25°C, unless otherwise noted.

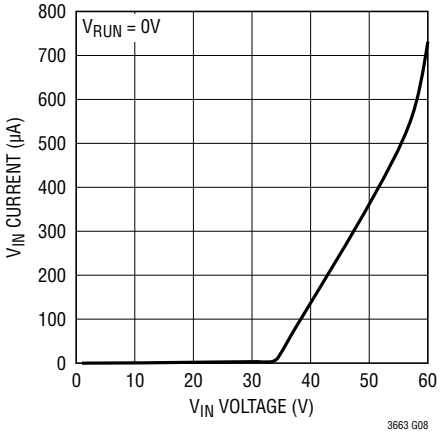
V_{IN} Undervoltage Lockout



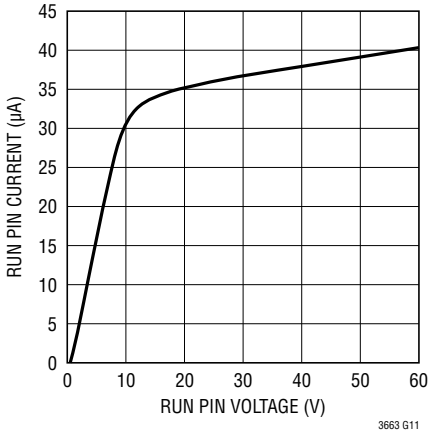
V_{IN} Overvoltage Lockout



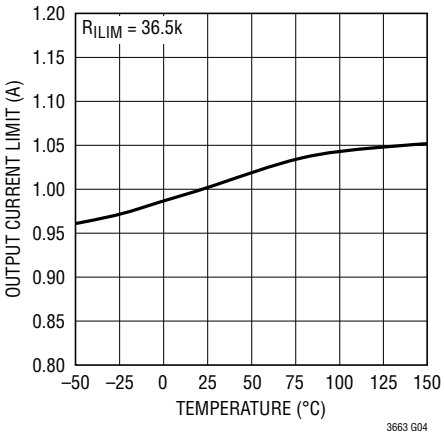
V_{IN} Shutdown Current



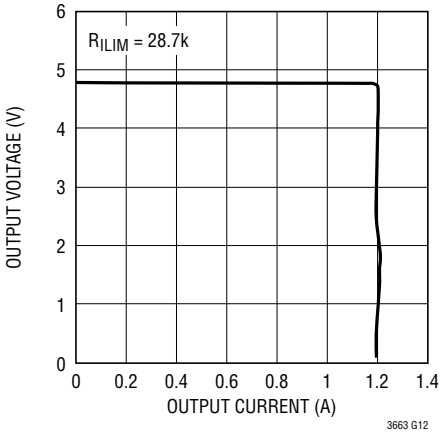
RUN Pin Current



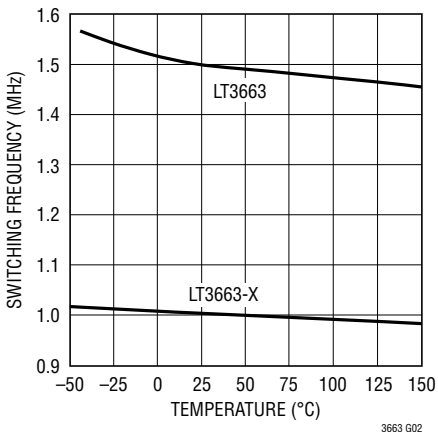
Output Current Limit



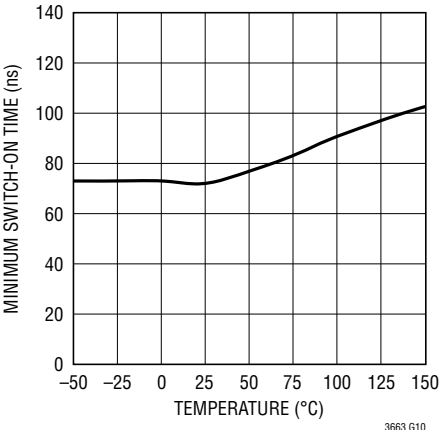
Output Current Limit



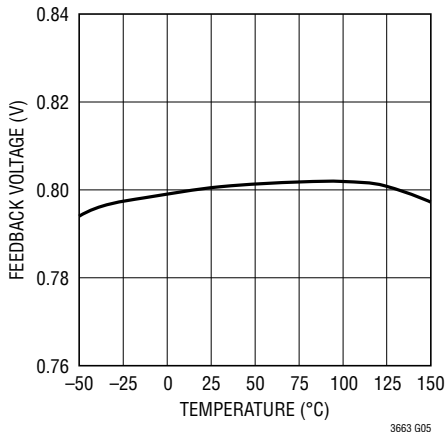
Switching Frequency



Minimum Switch On-Time



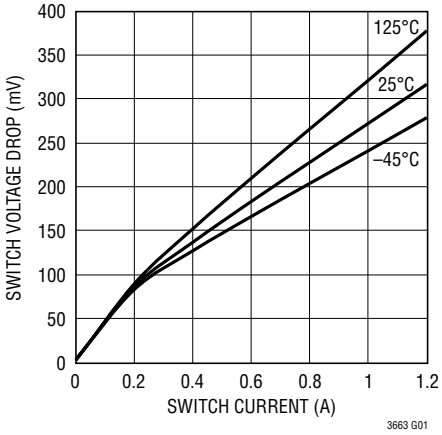
Feedback Voltage



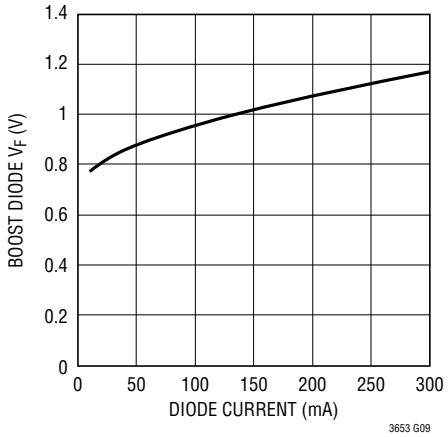
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = 25°C, unless otherwise noted.

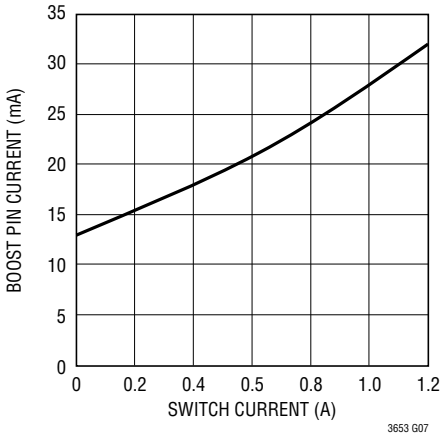
Switch Voltage Drop



Boost Diode V_f



BOOST Pin Current



PIN FUNCTIONS

BOOST: The BOOST pin is used to provide a drive voltage, higher than the input voltage, to the internal power switch. The BOOST pin is also internally connected to the cathode of the BOOST diode.

GND (Exposed Pad Pin 9) : Ground. The exposed pad must be soldered to the PCB and electrically connected to ground. Use a large ground plane and thermal vias to optimize thermal performance.

FB (LT3663): The LT3663 regulates the FB pin to 0.8V. Connect the feedback resistor divider tap to this pin.

I_{LIM}: Output Current Limit Program Pin. Connect a resistor to ground to program the regulator output current limit.

I_{SENSE}: The I_{SENSE} pin is the positive input to the internal output current limit sense resistor. The I_{SENSE} pin is also the anode to the internal BOOST diode.

RUN: The Run pin is used to put the LT3663 into shutdown mode. Tie to ground to shut down the LT3663. Tie to 2.5V or more for normal operation. If the shutdown feature is not used, connect this pin to V_{IN}.

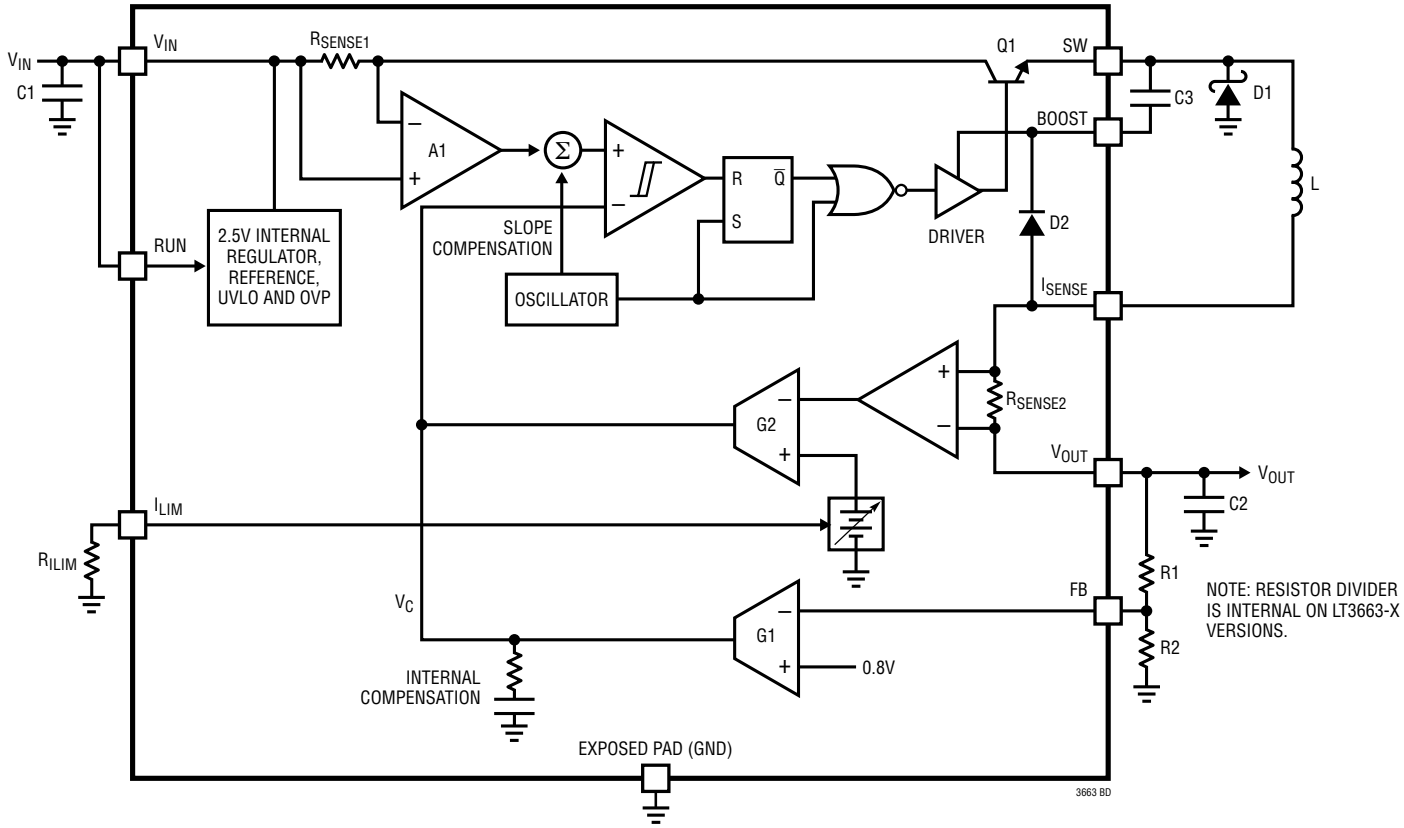
SW: The SW pin is the output of the internal power switch. Connect this pin to the inductor, catch diode and boost capacitor.

V_{IN}: The V_{IN} pin supplies current to the LT3663's internal regulator and internal power switch. Capacitively bypass the pin to ground.

V_{OUT}: The V_{OUT} pin is connected to the negative terminal of the internal output current limit sense resistor.

V_{OUTS} (LT3663-X): Output Voltage Sense Pin. Connect to the positive terminal of the output capacitor.

FUNCTIONAL BLOCK DIAGRAM



OPERATION (Refer to Block Diagram)

The LT3663 is a constant frequency, current mode step down regulator. A switch cycle is initiated when the oscillator enables the RS flip flop, turning on the internal power switch, Q1. The sense amplifier (A1) monitors the switch current via the voltage dropped across the current sense resistor R_{SENSE1}. The comparator compares the amplified current signal with the output (V_C) of the error amplifier (G1). The switch is turned off when this current exceeds a value determined by the V_C voltage. The error amplifier monitors the V_{OUT} voltage through an internal resistor divider and, when not driven externally, servos the V_C voltage to regulate V_{OUT}. If the V_{OUT} voltage drops, the V_C voltage will be driven higher increasing the output current and V_{OUT} voltage. An active clamp (not shown) on the V_C node provides current limit. The LT3663 is internally compensated with a pole-zero combination on the V_C node.

An external capacitor and internal diode, D2, generate a voltage at the BOOST pin that is higher than the input supply. This allows the driver to fully saturate the internal bipolar NPN power switch for efficient operation. The switch driver operates from either V_{IN} or BOOST to ensure startup.

An internal regulator provides power to the control circuitry. This regulator includes input undervoltage and overvoltage protection which disables switching action when V_{IN} is out of range. When switching is disabled, the LT3663 safely sustains input voltages up to 60V. Note that while switching is disabled the output will discharge.

Output current limiting is provided via the servo action of amplifier G2. The voltage across sense resistor, R_{SENSE2}, is compared to a voltage programmed by external resistor R_{ILIM} on the I_{LIM} pin. A capacitor averages the inductor ripple current. If the average inductor current exceeds the programmed value then the V_C voltage is pulled low, reducing the current in the regulator. The output current limit circuit allows for a lower current rated inductor and diode and provides better control of system power dissipation.

APPLICATIONS INFORMATION

FB Resistor Network

The output voltage of the LT3663 is programmed with a resistor divider. Choose the 1% resistors according to:

$$R1 = R2\ (V_{OUT}/0.8 - 1)$$

Reference designators refer to the Block Diagram.

The resistor divider is internal on the fixed output voltage versions, LT3663-X.

Minimum Duty Cycle

As the input voltage increases the duty cycle decreases. At some point, the minimum duty cycle of the IC is reached and pulse skipping begins. The output voltage continues to regulate but the output voltage ripple increases. The input voltage at which this occurs is calculated as follows:

$$V_{IN} = \frac{(V_{OUT} + V_F)}{DC_{MIN}} - V_F + V_{SW}$$

Where V_F is the forward voltage drop of the catch diode, D1, and V_{SW} is the voltage drop on the internal switch, Q1. LT3663 DC_{MIN} is typically 0.12.

For V_F = 0.4V, V_{SW} = 0.3V, and V_{OUT} = 3.3V pulse skipping occurs at about 24.5V.

Figure 1 illustrates switching waveforms in normal mode for a 3.3V output application with V_{IN} = 20V.

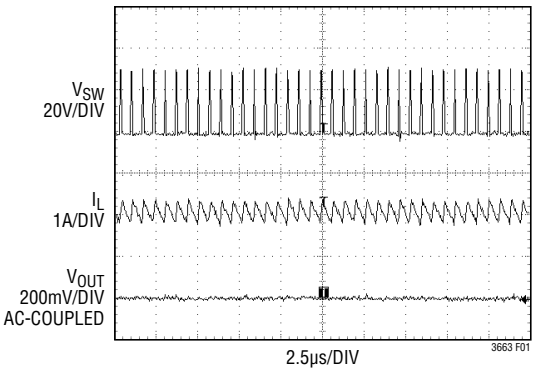


Figure 1. Normal Operation

Figure 2. illustrates switching waveforms in pulse skip mode a 3.3V output application with V_{IN} = 30V.

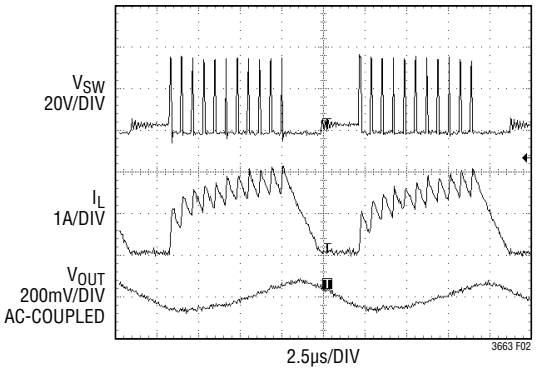


Figure 2. Pulse-Skip Mode

Inductor Selection

A good first choice for the inductor value is:

$$L = V_{OUT} + V_D\ (\mu H)$$

where V_D is the voltage drop of the catch diode (~0.4V) and L is in µH. With this value there is no sub-harmonic oscillation for applications with 50% or greater duty cycle. The inductor's RMS current rating must be greater than the maximum load current. Size the inductor so the saturation current rating is about 30% higher than the maximum load current. The output current limit circuit tightly controls the maximum average inductor current, therefore the inductor RMS current rating does not have to be overrated to handle short circuit or overload conditions. For high efficiency, keep the series resistance (DCR) less than 0.1Ω. A higher value inductor is larger in size and slows transient response but reduces output voltage ripple. A lower value inductor has higher ripple currents but is physically smaller or, for the same size, it has lower DCR typically resulting in higher efficiency.

APPLICATIONS INFORMATION

Catch Diode

The catch diode conducts current only during switch-off time. Average forward current in normal operation is calculated from:

$$I_{D(AVG)} = I_{OUT} \frac{V_{IN} - V_{OUT}}{V_{IN}}$$

where I_{OUT} is the maximum output load current programmed by the I_{LIM} resistor. Peak reverse voltage is equal to the regulator input voltage. Use a Schottky diode with a reverse voltage rating greater than the input voltage. The overvoltage protection feature in the LT3663 keeps the switch off when V_{IN} > 39V (typical) allowing the use of a 45V rated Schottky even when V_{IN} ranges up to 60V.

Input Capacitor

Bypass the input of the LT3663 circuit with a 1µF or higher value ceramic capacitor of X7R or X5R type. Y5V types have poor performance over temperature and applied voltage and are not recommended. If the input power source has high impedance, or there is significant inductance due to long wires or cables, additional bulk capacitance may be necessary. This can be provided with a low performance electrolytic capacitor. Step-down regulators draw current from the input supply in pulses with very fast rise and fall times. The input capacitor is required to reduce the resulting voltage ripple at the LT3663 and to force this very high frequency switching current into a tight local loop, minimizing EMI. Place the capacitor in close proximity to the LT3663 and the catch diode; (see the PCB Layout section).

Output Capacitor

A 10µF or greater ceramic capacitor is recommended to provide low output ripple and good transient response. Ceramic capacitors have very low equivalent series resistance (ESR) and provide the best ripple performance. Use X5R or X7R types and keep in mind that a ceramic capacitor biased with V_{OUT} has less than its specified nominal capacitance.

High performance electrolytic capacitors can be used for the output capacitor. Low ESR is important, so choose one that is intended for use in switching regulators. Keep the ESR less than 0.1Ω.

I_{LIM} Resistor

The LT3663 output current limit controls the maximum current delivered from the LT3663 regulator. This allows tighter control of the system power dissipation and also protects the inductor and diode from overheating during an overload or short circuit condition. A resistor connected from I_{LIM} pin to GND programs the output current. Table 1 details the I_{LIM} resistor values for specific output current limits.

Table 1. Output Current Limit vs R_{LIM} Value

OUTPUT CURRENT LIMIT (A)	R_{ILIM} VALUE (kΩ)
0.4	140
0.6	75
0.8	48.7
1.0	36.5
1.2	28.7

There may be a reason in some applications to move the output current limit. The following simple circuit demonstrates how the output current limit can be adjusted:

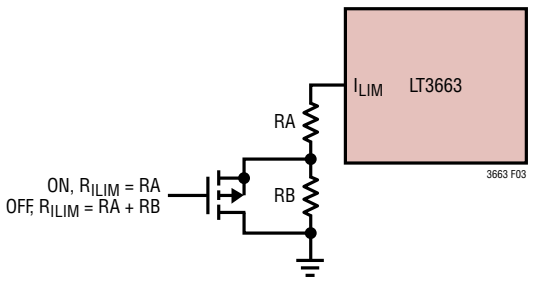
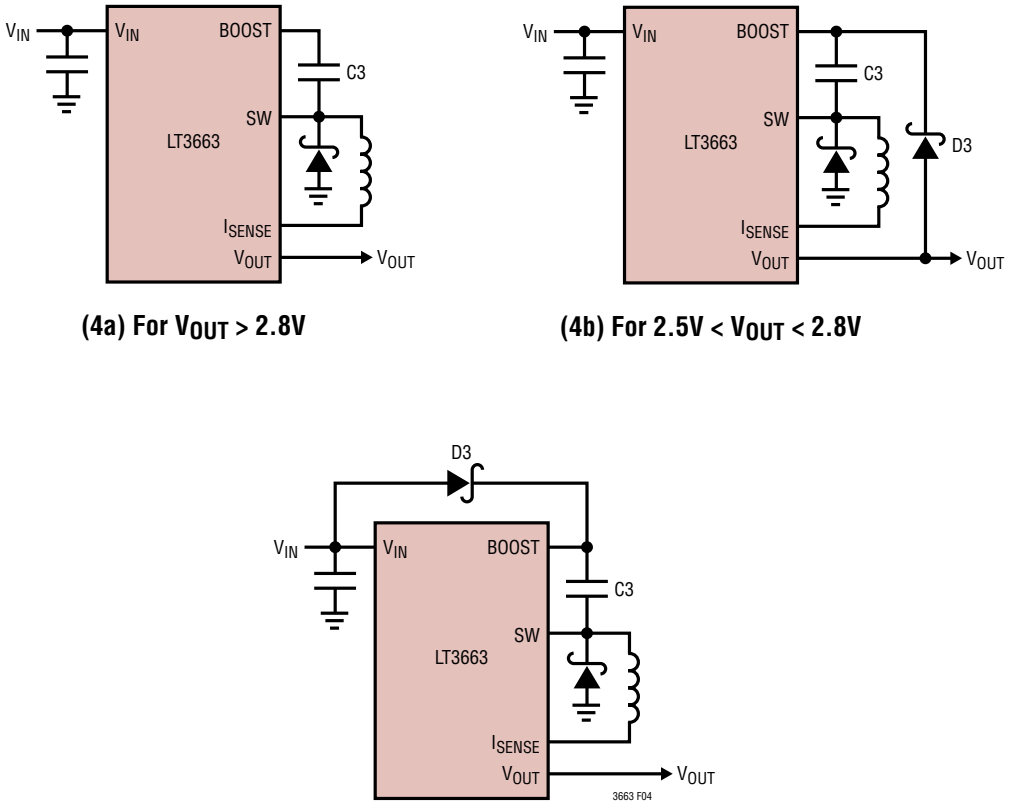


Figure 3. Circuit for Multiple Values of Output Current Limit

APPLICATIONS INFORMATION

BOOST and BIAS Pin Considerations

Capacitor C3 and the internal boost diode (see the Block Diagram) are used to generate a boost voltage that is higher than the input voltage. In most cases a 0.1µF capacitor works well. Figure 4 shows three ways to arrange the boost circuit. The BOOST pin must be more than 2.3V above the SW pin for best efficiency. For outputs of 3V and above, the standard circuit (Figure 4a) is best. For outputs between 2.8V and 3V, use a 1µF boost capacitor. A 2.5V output presents a special case because it is marginally adequate to support the boosted drive stage while using the internal boost diode. For reliable BOOST pin operation with 2.5V outputs use a good external Schottky diode (such as the ON Semi, MBR0540) and a 1µF boost capacitor (see Figure 4b). For lower output voltages connect an external Schottky diode to the input (Figure 4c), or to another supply greater than 2.8V. Using V_{IN} reduces the maximum input voltage to 25V. The circuit in Figure 4a is more efficient because the BOOST pin current comes from a lower voltage source. Take care to ensure that the maximum voltage ratings of the BOOST pin is not exceeded.



(4a) For $V_{OUT} > 2.8V$

(4b) For $2.5V < V_{OUT} < 2.8V$

(4c) For $V_{OUT} < 2.5V$; $V_{IN(MAX)} = 25V$

Figure 4. Three Circuits to Generate BOOST Pin Voltage

APPLICATIONS INFORMATION

PCB Layout

Proper operation and minimum EMI, requires careful printed circuit board layout. Figure 5 shows the recommended component placement with trace, ground plane and via locations. Note that large, switched currents flow in the LT3663's V_{IN} and SW pins, the catch diode (D2) and the input capacitor (C1). Keep the loop formed by these components as small as possible and tied to system ground in only one place. Locate these components, along with the inductor and output capacitor, on the same side of the circuit board, and keep their connections on that layer. Place a local, unbroken ground plane below these components, and tie this ground plane to system ground at one location, ideally at the ground terminal of the output capacitor C1. Make the SW and BOOST PCB trace as short as possible. Include vias near the exposed GND pad of the LT3663 to help remove heat from the LT3663 to the ground plane.

High Temperature Considerations

The die temperature of the LT3663 must not exceed the maximum rating. This is generally not a concern unless the ambient temperature is above 85°C. For higher temperatures, take care in the layout of the circuit to ensure good heat sinking of the LT3663. De-rate the maximum load current as the ambient temperature approaches the maximum temperature rating. Calculate the die temperature by multiplying the LT3663 power dissipation by the thermal resistance from junction to ambient. Estimate the power dissipation within the LT3663 by calculating the total power loss from an efficiency measurement and subtracting the catch diode loss. Thermal resistance depends on the layout of the circuit board, but 64°C/W is typical for the (2mm × 3mm) DFN (DCB) package.

Other Linear Technology Publications

Application Notes 19, 35 and 44 contain more detailed descriptions and design information for Buck regulators and other switching regulators. The LT1376 data sheet has a more extensive discussion of output ripple, loop compensation and stability testing. Design Note 100 shows how to generate a bipolar output supply using a Buck regulator.

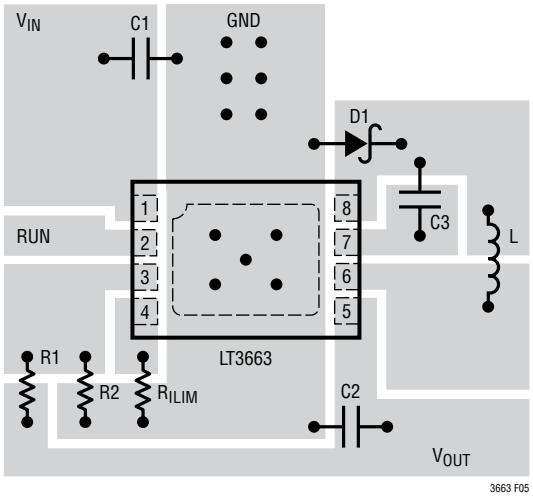
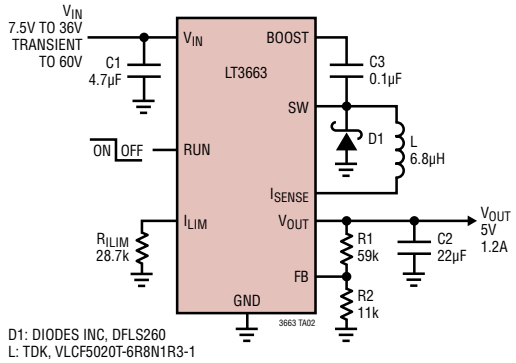


Figure 5. LT3663 PCB Layout

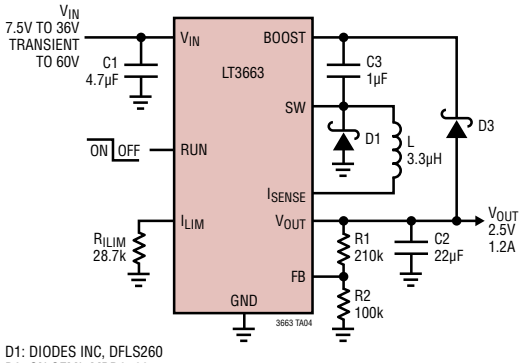
TYPICAL APPLICATIONS

5V Step-Down Converter



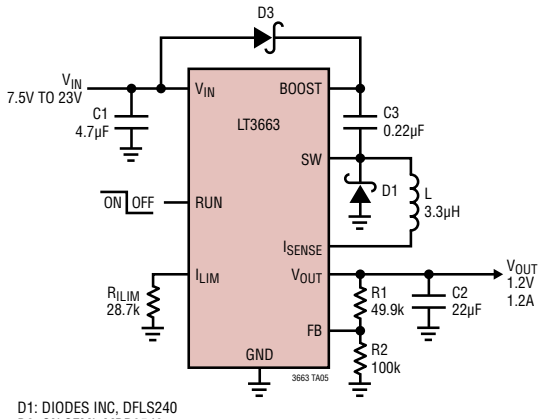
D1: DIODES INC, DFLS260
L: TDK, VLCF5020T-6R8N1R3-1

2.5V Step-Down Converter



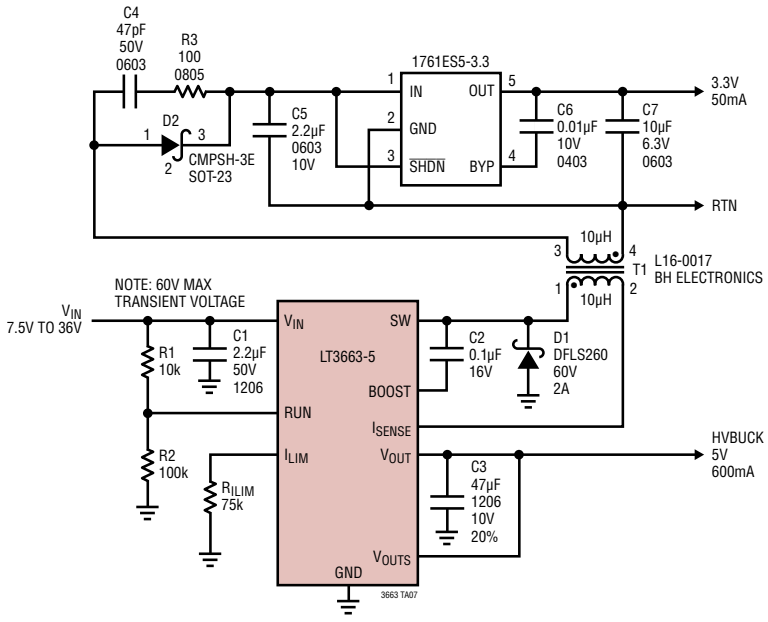
D1: DIODES INC, DFLS260
D3: ON SEMI, MBR0560
L: TDK, VLCF5020T-3R3N2R0-1

1.2V Step-Down Converter



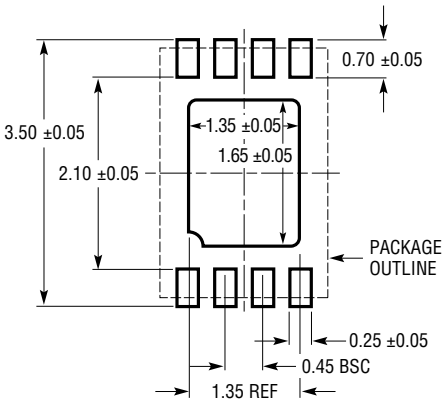
D1: DIODES INC, DFLS240
D3: ON SEMI, MBR0540
L: TDK, VLCF5020T-3R3N2R0-1

LT3663-5 5V Step-Down Regulator with Isolated 3.3V Output

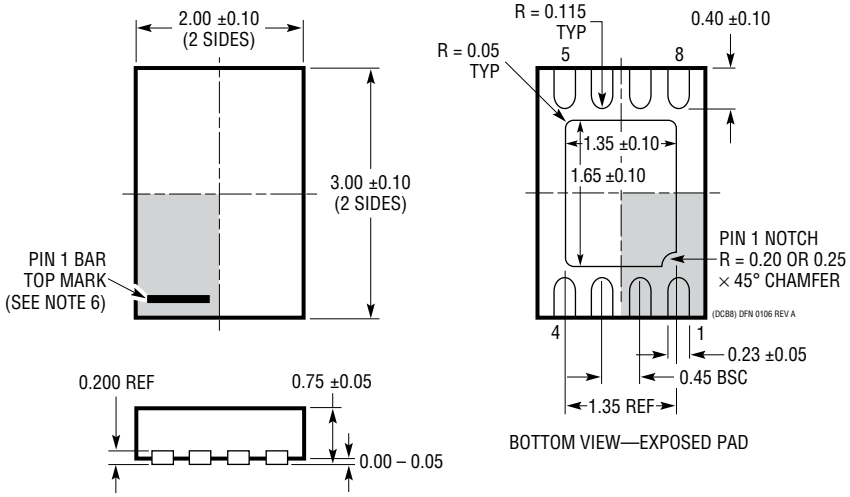


PACKAGE DESCRIPTION

DCB Package
8-Lead Plastic DFN (2mm × 3mm)
(Reference LTC DWG # 05-08-1718 Rev A)



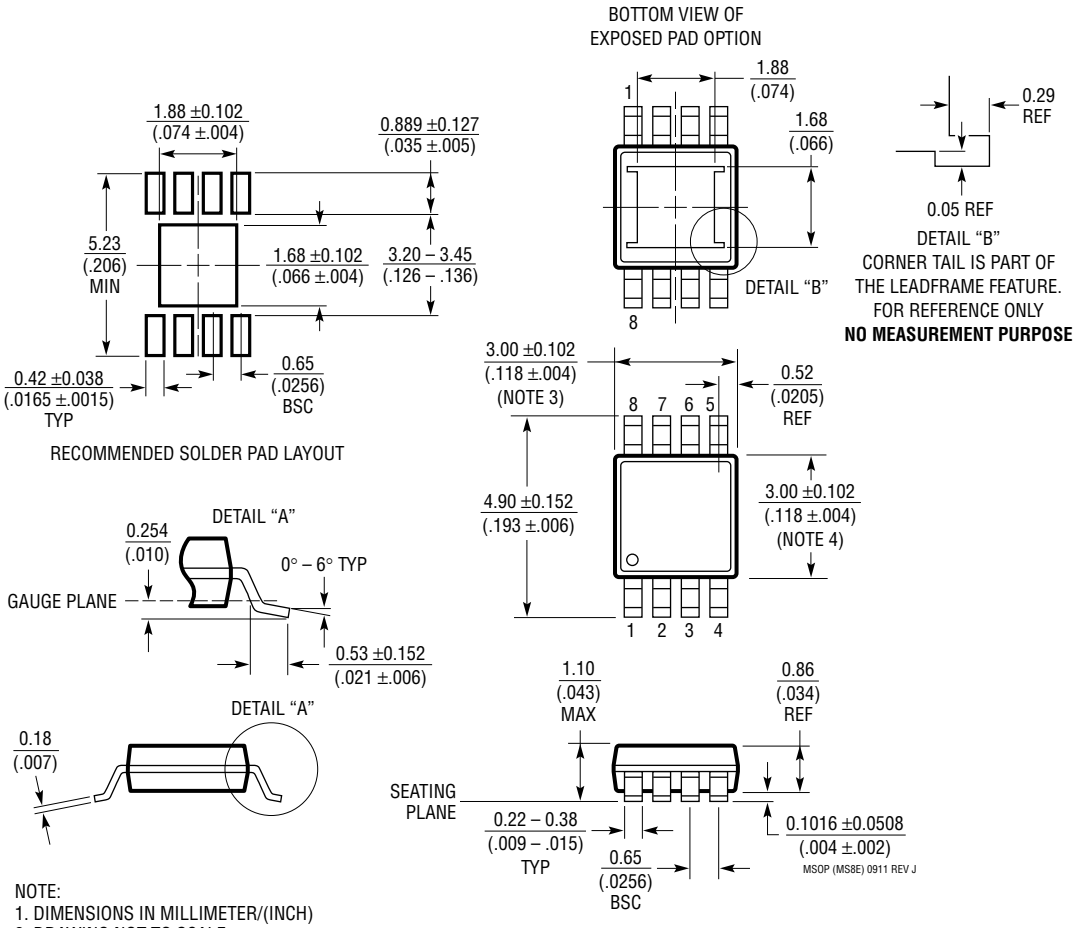
RECOMMENDED SOLDER PAD PITCH AND DIMENSIONS
APPLY SOLDER MASK TO AREAS THAT ARE NOT SOLDERED



BOTTOM VIEW—EXPOSED PAD

NOTE:
1. DRAWING IS NOT A JEDEC PACKAGE OUTLINE
2. DRAWING NOT TO SCALE
3. ALL DIMENSIONS ARE IN MILLIMETERS
4. DIMENSIONS OF EXPOSED PAD ON BOTTOM OF PACKAGE DO NOT INCLUDE MOLD FLASH. MOLD FLASH, IF PRESENT, SHALL NOT EXCEED 0.15mm ON ANY SIDE
5. EXPOSED PAD SHALL BE SOLDER PLATED
6. SHADED AREA IS ONLY A REFERENCE FOR PIN 1 LOCATION ON THE TOP AND BOTTOM OF PACKAGE

MS8E Package
8-Lead Plastic MSOP, Exposed Die Pad
(Reference LTC DWG # 05-08-1662 Rev J)



NOTE:
1. DIMENSIONS IN MILLIMETER/(INCH)
2. DRAWING NOT TO SCALE
3. DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
   MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
4. DIMENSION DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
   INTERLEAD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
5. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.102mm (.004") MAX
6. EXPOSED PAD DIMENSION DOES INCLUDE MOLD FLASH. MOLD FLASH ON E-PAD
   SHALL NOT EXCEED 0.254mm (.010") PER SIDE.

REVISION HISTORY (Revision history begins at Rev B)

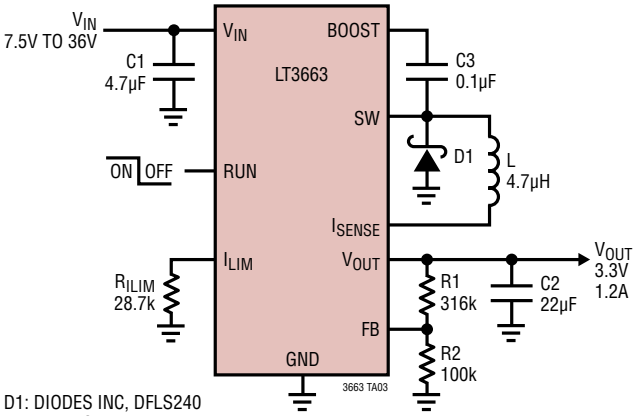
REV	DATE	DESCRIPTION	PAGE NUMBER
B	11/09	Additions to Features	1
		Text Changes to Description	1
		Addition of MSE Package to Pin Configuration	2
		Additions Made to Order Information	2, 3
		Changes to Electrical Characteristics	3
		Expanded Temperature Range of Typical Performance Curves	4, 5
		Addition of Note to Functional Block Diagram	6
		Text Changes to Applications Information	8, 11
		Addition of Typical Applications Drawing	12
		Addition of MS8E Package Drawing	14
C	05/13	Clarified PCB Layout	11

LINEAR TECHNOLOGY

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

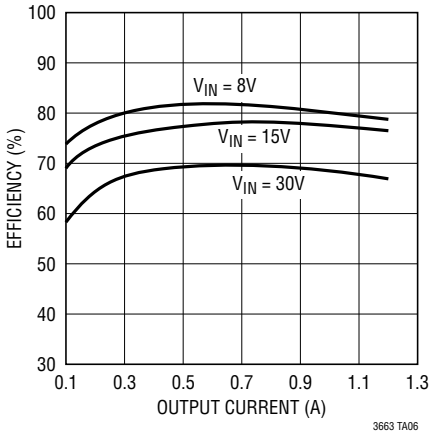
TYPICAL APPLICATION

3.3V Step-Down Converter



D1: DIODES INC, DFLS240
L: TDK, VLCF5020T-4R7N1R7-1

Efficiency



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1766	60V, 1.2A (I_{OUT}), 200kHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 5.5V to 60V, V_{OUTMAX} = 1.20V, I_Q = 2.5mA, I_{SD} = 25µA, TSSOP16/TSSOP16E Packages
LT1933	500mA(I_{OUT}), 500kHz Step-Down Switching Regulator in SOT-23	V_{IN}: 3.6V to 36V, V_{OUTMAX} = 1.2V, I_Q = 1.6mA, I_{SD} <1µA, ThinSOT Package
LT1936	36V, 1.4A(I_{OUT}) , 500kHz High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 36V, V_{OUTMAX} = 1.2V, I_Q = 1.9mA, I_{SD} <1µA, MS8E Package
LT1940	Dual 25V, 1.4A (I_{OUT}), 1.1MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 25V, V_{OUTMAX} = 1.20V, I_Q = 3.8mA, I_{SD} <30µA, TSSOP16E Package
LT1976/LT1977	60V, 1.2A (I_{OUT}), 200/500kHz, High Efficiency Step-Down DC/DC Converter with BurstMode® Operation	V_{IN}: 3.3V to 60V, V_{OUTMAX} = 1.20V, I_Q = 100µA, I_{SD} <1µA, TSSOP16E Package
LTC3407/ LTC3407-2	Dual 600mA/800mA, 1.5/2.25 MHz Syncronous Step-Down DC/DC Converter	V_{IN}: 2.5V to 5.5V, V_{OUTMAX} = 0.6V, I_Q = 40µA, I_{SD} <1µA, 3mm × 3mm DFN, MS10E Packages
LT3434/LT3435	60V, 2.4A (I_{OUT}), 200/500kHz, High Efficiency Step-Down DC/DC Converter with BurstMode Operation	V_{IN}: 3.3V to 60V, V_{OUTMAX} = 1.20V, I_Q = 100µA, I_{SD} <1µA, TSSOP16E Package
LT3437	60V, 400mA (I_{OUT}),MicroPower Step-Down DC/DC Converter with BurstMode Operation	V_{IN}: 3.3V to 60V, V_{OUTMAX} = 1.25V, I_Q = 100µA, I_{SD} <1µA, 3mm × 3mm DFN, TSSOP16E Packages
LT3493	36V, 1.4A(I_{OUT}), 750kHz High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 36V, V_{OUTMAX} = 0.8V, I_Q = 1.9mA, I_{SD} <1µA, 2mm × 3mm DFN Package
LT3501	Dual 25V, 3A (I_{OUT}), 1.5MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.3V to 25V, V_{OUTMAX} = 0.8V, I_Q = 3.7mA, I_{SD} <10µA, TSSOP-20E Package
LT3503	20V, 1A (I_{OUT}), 2.2MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 20V, V_{OUTMAX} = 0.78V, I_Q = 1.9mA, I_{SD} <1µA, 2mm × 3mm DFN, Package
LT3505	36V, 1.2A (I_{OUT}), 3MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 36V, V_{OUTMAX} = 0.78V, I_Q = 2mA, I_{SD} <2µA, 3mm × 3mm DFN, MS8E Packages
LT3506/ LT3506A	Dual 25V, 1.6A (I_{OUT}), 575kHz/1.1MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 25V, V_{OUTMAX} = 0.8V, I_Q = 3.8mA, I_{SD} <30µA, 4mm × 5mm DFN Package
LT3508	Dual 36V, 1.4A (I_{OUT}), 2.5MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.6V to 36V, V_{OUTMAX} = 0.8V, I_Q = 4.3mA, I_{SD} <1µA, 4mm × 4mm QFN, TSSOP16E Packages
LT3510	Dual 25V, 2A (I_{OUT}), 1.5MHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 3.3V to 25V, V_{OUTMAX} = 0.8V, I_Q = 3.7mA, I_{SD} <10µA, TSSOP-20E Package
LTC3548	Dual 400mA + 800mA, 2.25 MHz Syncronous Step-Down DC/DC Converter	V_{IN}: 2.5V to 5.5V, V_{OUTMAX} = 0.6V, I_Q = 40µA, I_{SD} <1µA, 3mm × 3mm DFN, MS10E Packages

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