19-3637; Rev 0; 4/05

EVALUATION KIT AVAILABLE

Fast-Charge-Time Xenon Flash Charger for Digital Still Cameras and Camera Phones

MAX8622

General Description

The MAX8622 flyback switching regulator quickly and efficiently charges high-voltage photoflash capacitors. It is ideal for use in digital, film, cell-phone, and smartphone cameras that use either 2-cell alkaline/NiMH or single-cell Li+ batteries. An internal, low-on-resistance n-channel MOSFET improves efficiency by lowering switch power loss.

A current-limited, continuous-mode, transformer-switching scheme quickly charges the output capacitor. The cycle-by-cycle peak current-limit scheme has no inrush current. Current limit is programmable to control the maximum load drawn from the battery. An additional input-voltage monitor loop extends battery life by reducing the charge rate when the battery is nearly discharged. This also permits the current limit to be set for a faster charge rate under typical conditions, rather than a level dictated by the worst-case discharge state of the battery.

An open-drain DONE output indicates when the photoflash capacitor is completely charged. The MAX8622 automatically refreshes the output every 11s, efficiently maintaining the capacitor charge level with minimum battery drain.

The MAX8622 provides high charge accuracy by using an external resistor-divider to monitor the output voltage. Sensing directly at the transformer secondary prevents output-capacitor discharge through feedback resistors while still providing direct output sensing for optimum voltage accuracy that is not transformer turns-ratio dependent. The MAX8622 is offered in a 3mm x 3mm 10-pin TDFN package.

Applications

Digital Cameras

Cell-Phone Cameras

Film Cameras

Smartphone Cameras

Personal Media Players

Ordering Information

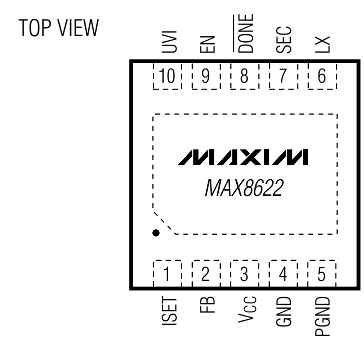
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX8622ETB+	-40°C to +85°C	10 TDFN 3mm x 3mm (T1033-1)	APF

+Indicates lead-free packaging.

Features

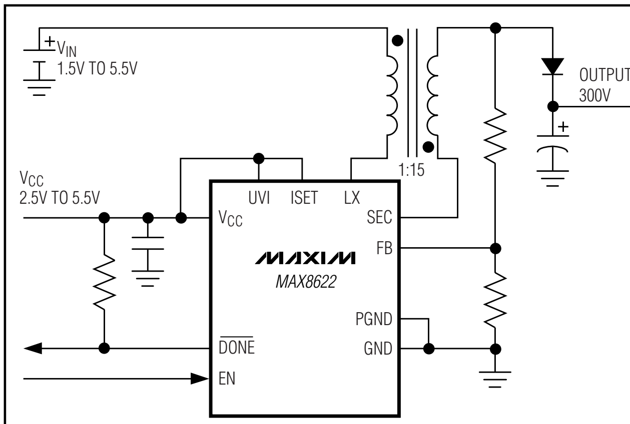
- ♦ Charges Any Size Photoflash Capacitor
- ♦ 2.8s to Charge 100µF to 300V
- ♦ No Inrush Current
- ♦ High Accuracy Not Dependent on Transformer Turns Ratio
- ♦ Extends Battery Life with Input Voltage Monitoring
- ♦ Programmable Input Current Limit Up to 1.6A
- ♦ Robust Architecture Allows Use of Low-Cost Transformers
- ♦ Automatic Refresh Mode
- ♦ Charge-Done Indicator
- ♦ Small, 3mm x 3mm, 10-Pin TDFN Package

Pin Configuration



TDFN 3mm × 3mm

Typical Operating Circuit



Fast-Charge-Time Xenon Flash Charger for Digital Still Cameras and Camera Phones

ABSOLUTE MAXIMUM RATINGS

LX to PGND ....-0.3V to +33V
$\overline{DONE}$, V_{CC}, UVI to GND ....-0.3V to +6V
FB, EN, ISET to GND.................................-0.3V to (V_{CC} + 0.3V)
PGND to GND .... -0.3V to +0.3V
$\overline{SEC}$ Current.. ±200mA
$\overline{DONE}$ Current..±25mA
Continuous Power Dissipation (T_A = +70°C)
TDFN (derate 18.5mW/°C above +70°C)..................1481mW

Operating Temperature Range ....-40°C to +85°C
Junction Temperature Range ....-40°C to +125°C
Storage Temperature Range ....-65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{CC} = V_{EN} = 3.3V, V_{FB} = 0V, R_{ISET} = 75kΩ, V_{UVI} = 1.5V, T_A = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.) (Note 1)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{CC} Voltage Range			2.5		5.5	V
V_{CC} Undervoltage Threshold	V_{CC} rising		2.180	2.300	2.425	V
	V_{CC} falling		2.095	2.210	2.325	
V_{CC} Supply Current	LX switching at 40kHz			1		mA
	LX switching at 300kHz			1.65		
	LX not switching, V_{CC} = 5.5V			60	100	µA
V_{CC} Shutdown Current	V_{EN} = 0V, V_{CC} = 5.5V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		
LX On-Resistance	I_{LX} = 200mA	V_{CC} = 3.3V		0.31	0.5	Ω
		V_{CC} = 2.5V		0.35	0.6	
LX Off-Leakage	V_{LX} = 5.5V, V_{EN} = 0V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		
LX Peak Current Limit	R_{ISET} = 200kΩ, T_A = 0°C to +85°C		0.54	0.61	0.72	A
	R_{ISET} = 75kΩ, T_A = 0°C to +85°C		1.44	1.60	1.76	
	ISET = V_{CC}, T_A = 0°C to +85°C		1.44	1.60	1.76	
Switching Frequency	Circuit of Figure 2, output 90% of final value			300		kHz
SEC Sense Resistance				1.7		Ω
SEC Valley Current Threshold	I_{SEC} falling, R_{ISET} = 200kΩ			10		mA
	I_{SEC} falling, R_{ISET} = 75kΩ			27		
	I_{SEC} falling, ISET = V_{CC}			27		
FB Trip Threshold	V_{FB} rising	T_A = 0°C to +85°C	1.238	1.250	1.262	V
		T_A = -40°C to +85°C	1.231	1.250	1.269	
FB Input Current	V_{FB} = 1.25V and EN = high, or V_{EN} = V_{FB} = 0V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		
Output Refresh Rate	From FB pulsed high to LX switching restarts			11		s
ISET Resistance Range	Sets peak current limit from 0.6A to 1.6A		75		200	kΩ
ISET Voltage	V_{EN} = V_{CC}			1.0		V
	V_{EN} = 0V			0		

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = V_{EN} = 3.3V, V_{FB} = 0V, R_{ISET} = 75kΩ, V_{UVI} = 1.5V, T_A = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.) (Note 1)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
UVI Trip Threshold Falling	External 25kΩ resistor in series with UVI	T_A = 0°C to +85°C	1.96	2.00	2.04	V
		T_A = -40°C to +85°C	1.94	2.00	2.06	
UVI Trip Threshold Rising	External 25kΩ resistor in series with UVI	T_A = 0°C to +85°C	2.10	2.14	2.18	V
		T_A = -40°C to +85°C	2.08	2.14	2.20	
UVI Pulldown Resistance				25		kΩ
UVI Input Current	V_{EN} = 0V, V_{UVI} = V_{CC} = 5.5V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		
EN Input Voltage	When charging starts/stops	V_{IH}			0.4	V
		V_{IL}	1.4			
EN Input Leakage Current	V_{EN} = 0 to 5.5V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		
$\overline{DONE}$ Output-Voltage Low	$I_{\overline{DONE}}$ = 5mA			40	150	mV
$\overline{DONE}$ Output-Current High	$V_{\overline{DONE}}$ = 5.5V	T_A = +25°C		0.1	1	µA
		T_A = +85°C		0.1		

Note 1: Limits are 100% production tested at T_A = +25°C. Limits over the operating temperature range are guaranteed by design and characterization.

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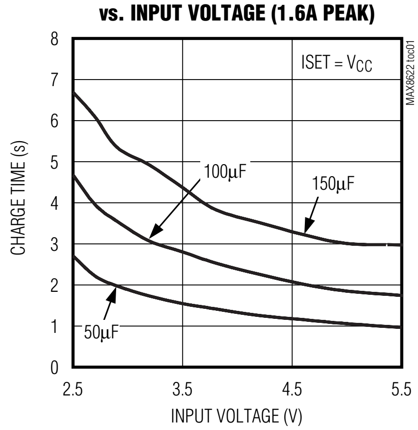
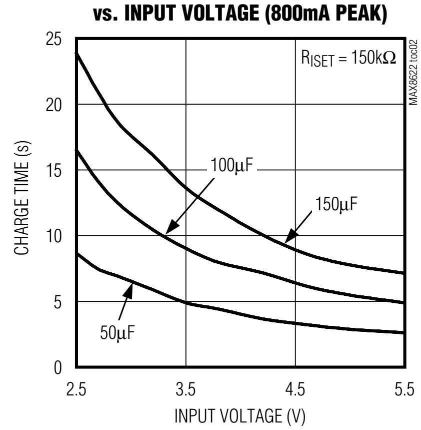
Typical Operating Characteristics

(V_{CC} = V_{IN} = V_{EN} = 3.5V, circuit of Figure 2, T_A = +25°C, unless otherwise noted.)

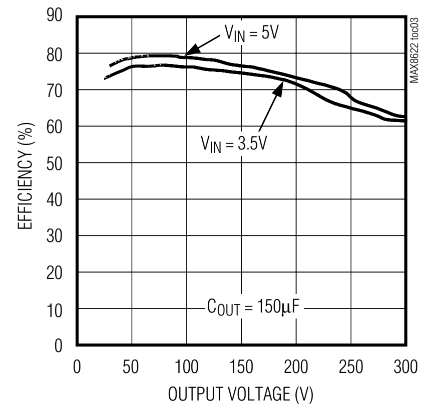
CHARGE TIME (FROM 30V TO 300V) vs. INPUT VOLTAGE (1.6A PEAK)



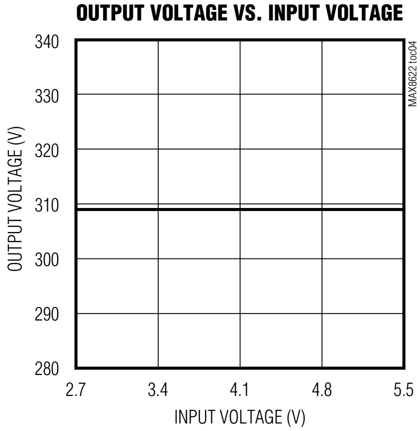
CHARGE TIME (FROM 30V TO 300V) vs. INPUT VOLTAGE (800mA PEAK)



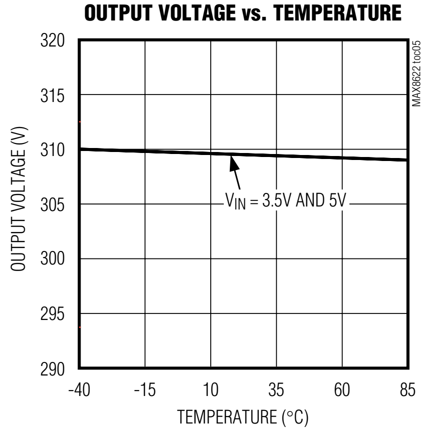
EFFICIENCY vs. OUTPUT VOLTAGE



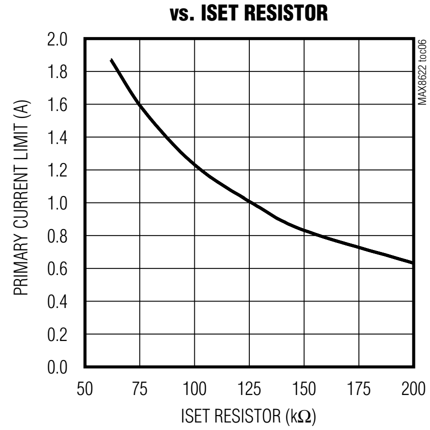
OUTPUT VOLTAGE VS. INPUT VOLTAGE



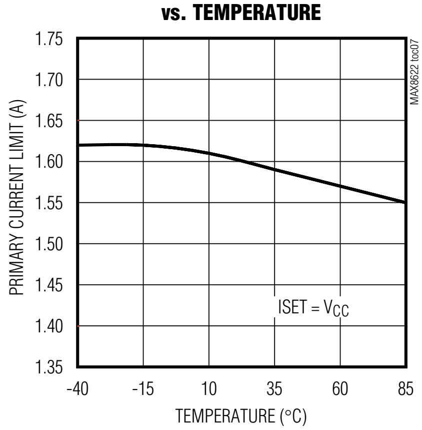
OUTPUT VOLTAGE vs. TEMPERATURE



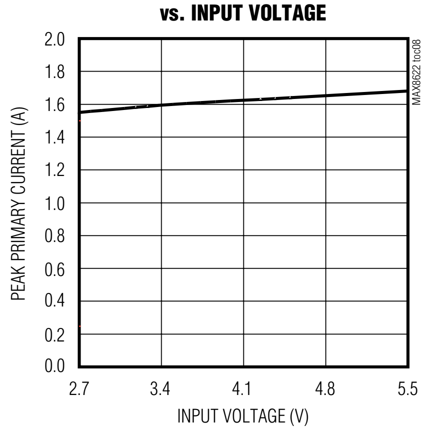
PRIMARY CURRENT LIMIT vs. ISET RESISTOR



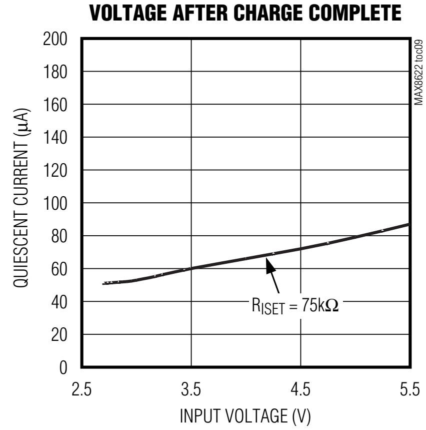
PRIMARY CURRENT LIMIT vs. TEMPERATURE



PEAK PRIMARY CURRENT vs. INPUT VOLTAGE



QUIESCENT CURRENT vs. INPUT VOLTAGE AFTER CHARGE COMPLETE



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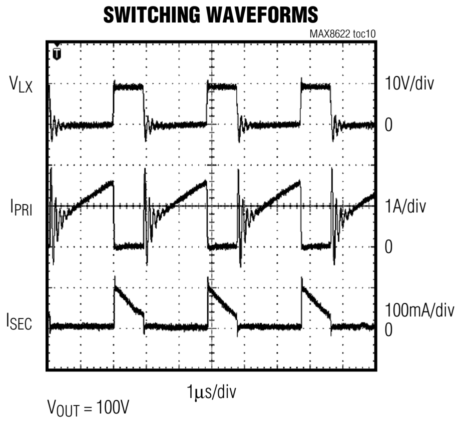
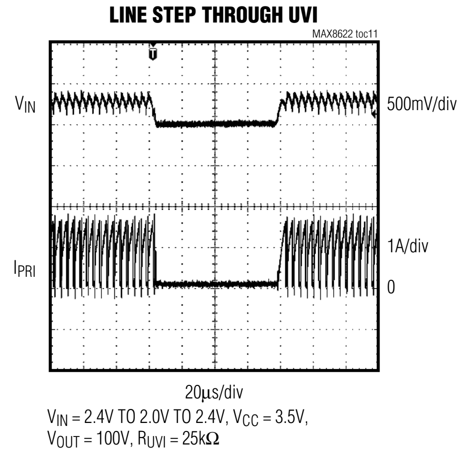
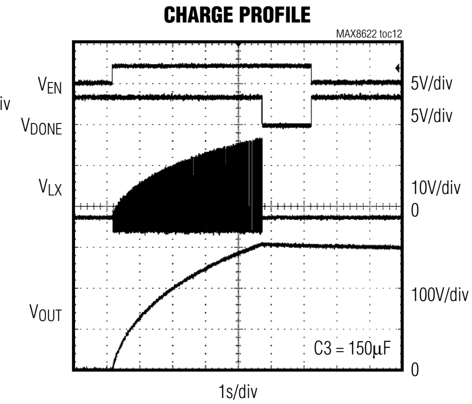
Typical Operating Characteristics (continued)

($V_{CC} = V_{IN} = V_{EN} = 3.5V$, circuit of Figure 2, $T_A = +25°C$, unless otherwise noted.)







Pin Description

PIN	NAME	FUNCTION
1	ISET	Current-Limit Set. Connect a resistor from ISET to GND to set the peak current limit through the primary winding ($R_{ISET} = 1.6A \times 75k\Omega / I_{PEAK}$), or connect ISET directly to V_{CC} for the default current limit of 1.6A.
2	FB	Output Feedback. Connect FB to a resistor-divider from the transformer secondary winding to set the output voltage at which charging is complete.
3	V_{CC}	Supply Voltage for the IC. Connect a 1µF capacitor from V_{CC} to GND.
4	GND	Analog Ground. Connect GND to the exposed pad.
5	PGND	Power Ground. Connect PGND to the exposed pad.
6	LX	Transformer Primary Connection. Connect LX to the transformer primary as shown in Figure 2.
7	SEC	Secondary Current Sensing. Connect SEC to the return of the secondary winding to sense secondary winding current. See Figure 2.
8	$\overline{DONE}$	Charge-Done Indicator. $\overline{DONE}$ is an open-drain output that pulls low when EN is high and the circuit has finished charging the output capacitor.
9	EN	Enable Input. Drive EN high to turn on the charger, or low to turn it off.
10	UVI	Input Undervoltage Detect. Connect a resistor from UVI to the battery to make a resistor-divider with an internal 25kΩ resistor. Input current is reduced when V_{UVI} drops below 1V. Connect UVI to V_{CC} when this feature is not used.
—	EP	Exposed Pad. Connect the exposed pad to GND and PGND.

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Detailed Description

The MAX8622 charges photoflash capacitors quickly and efficiently. It employs a transformer flyback DC-DC conversion topology and includes a 0.31Ω internal power switch. Figure 1 shows the functional diagram.

Control Scheme

The MAX8622 uses a constant peak and valley current control scheme to precisely control the photoflash capacitor charging current. A resistor at ISET and the transformer turns ratio sets the charge current.

Pulling EN high initiates charging. LX turns on and the current in the transformer primary winding rises to a peak current between 0.6A and 1.6A, depending on the ISET resistor (1.6A if ISET is connected to V_{CC}). LX then turns off, and current is delivered to the photoflash capacitor by the transformer secondary and rectifying diode. As secondary current ramps down, it is monitored through the SEC pin. When this current drops to 1.67% (with a 1:15 transformer turns ratio) of the peak current limit, the LX switch turns on and a new charge cycle begins. This cycle repeats itself, adding power to the photoflash capacitor until the target output voltage is reached.

Switching frequency is determined by the time required to ramp the primary-side inductance to the LX current limit and the discharge rate of the secondary current. The switching frequency changes as the output capacitor charges to the target output voltage. Once the target output voltage is reached, the MAX8622 automatically refreshes the output every 11s, efficiently maintaining the capacitor charge level with minimum battery drain. The MAX8622 draws only 60µA (typ) in automatic refresh mode. Automatic refresh can be overridden by pulling EN low.

Secondary Side Sensing

Output regulation is accomplished using a resistor-divider connected to the anode of the output rectifying diode (see Figure 2). This connection eliminates DC current drain on the output capacitor while still providing direct output sensing for optimum voltage accuracy that is not dependent on transformer turns ratio. The MAX8622 samples FB during the flyback phase (when LX is off). When FB rises above 1.25V, charging stops and $\overline{DONE}$ pulls low. If EN remains high, autorefresh then occurs every 11s. See the *Adjustable Output Voltage* section for information on selecting values for the resistor-divider.

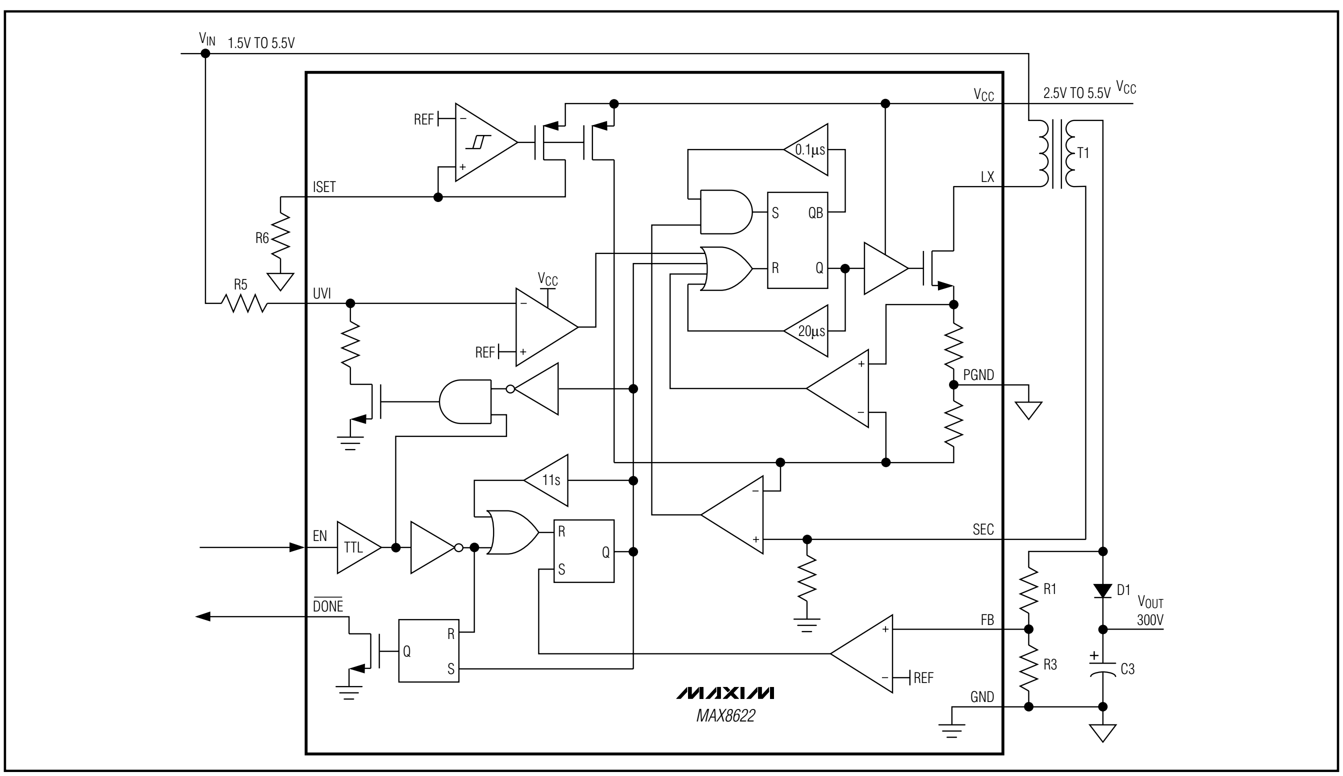

Figure 1. Functional Diagram

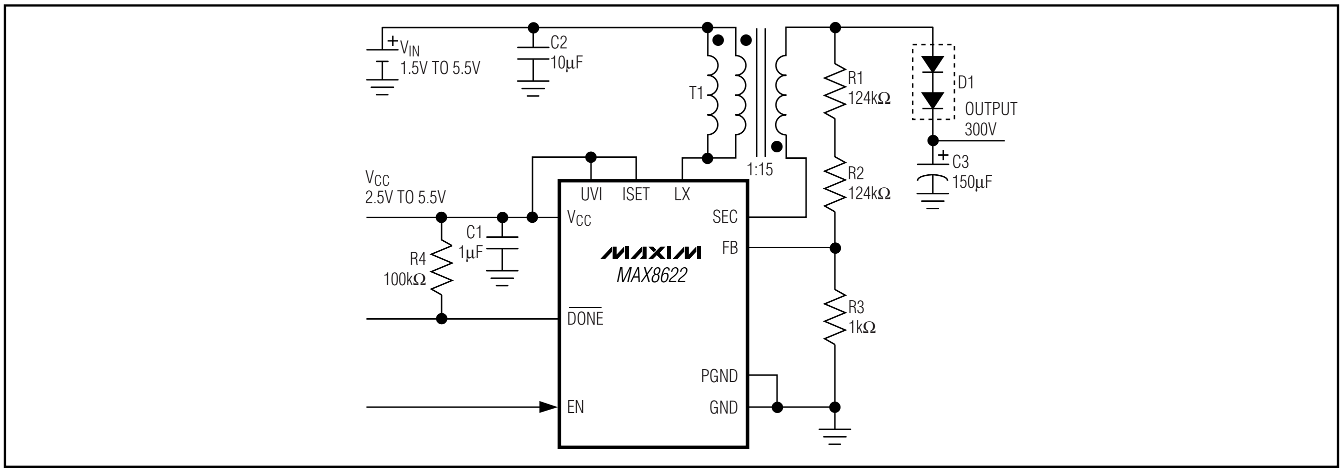

Figure 2. MAX8622 Typical Application Circuit with Default 1.6A Primary Current Limit

Table 1. Transformer Design Parameters

TRANSFORMER	TURNS RATIO (SEC/PRI)	PRIMARY INDUCTANCE (µH)	CAPACITANCE (pF)	DC RESISTANCE (Ω)	
				PRI	SEC
TDK LDT565630T-011	15	6	30	0.11	15
Tokyo Coil TTRN-038S-017-T	15	6.4	11	0.11	24
Tokyo Coil TTRN-SU20S-001-T	15	6.5	4	0.31	44

Extending Battery Life with UVI

The UVI circuit allows the output to charge as fast as possible without causing the input voltage to drop below the selected voltage level. This allows a camera to be ready to flash in a short time when the battery is fresh, while still charging the photoflash capacitor when the battery is at low capacity by extending charge time and limiting battery drain.

The UVI comparator determines if the input source is being pulled low as a result of the input current drawn by photoflash charging or some other process in the camera. When UVI drops below the UVI falling threshold, the LX control latch is reset and the internal MOSFET is immediately turned off. The LX switch remains off until the current in the transformer secondary drops to the valley trip threshold, or for 1µs, whichever is longer. The LX switch turns on only if the input is above the UVI rising threshold. This lowers the average charge current.

Applications Information

Transformer Design

The transformer is a key element in any transformer flyback design. The switching elements in this topology are subject to significantly large voltage and current stresses, depending on the transformer design. The transformer also plays a key role in the noise performance of the circuit. Proper selection, design, and construction of the transformer are crucial to the performance of a photoflash charger. Recommended transformers and their key parameters are listed in Table 1.

Transformer Turns Ratio

The transformer turns ratio should be high enough so that the transformer's peak primary voltage does not exceed the voltage rating (33V) of the internal MOSFET. The turns ratio is given by:

$$N \geq \frac{V_{OUT(MAX)} + V_{D1}}{33 - V_{IN}}$$

where V_{D1} is the forward voltage of D1.

If the target voltage for the photoflash capacitor is 300V, this implies a turns ratio of greater than 1:10 at a minimum input voltage of 1.8V. A transformer with a turns ratio of 1:15 is typically recommended for applications using the MAX8622.

Primary Inductance

The MAX8622 operates either in discontinuous-conduction mode (DCM) or in continuous-conduction mode (CCM). Generally, CCM operation offers higher efficien-

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cy and lower ripple currents for the same output power as compared to DCM operation. The capacitive switching losses in the switch are minimal at the boundary of DCM and CCM operation. The primary inductance for the transformer is therefore estimated based on the assumption that the MAX8622 is operating close to this boundary for highest efficiency and minimum charge time.

The MAX8622 has an on-time limit ($t_{ON(MAX)}$) of typically 25µs. Assuming the default current limit (I_{LIMIT}) of 1.6A, the maximum value of primary inductance for a 1.8V minimum input and a 1.6A primary current limit is given by:

$$L_{PRI(MAX)} = \frac{V_{IN(MIN)} \times t_{ON(MAX)}}{I_{LIMIT}} = \frac{1.8 \times 25 \times 10^{-6}}{1.6} = 28\mu H$$

The boundary of DCM/CCM operation is determined by monitoring the secondary valley current. The secondary current-sensing circuit in the MAX8622 has a blanking time of about 150ns. This implies a minimum off-time $t_{OFF(MIN)}$ of 250ns for the MAX8622 to have adequate time to sense the secondary valley current. Since the minimum discharge time occurs at the target output voltage $V_{OUT(MAX)}$, the minimum secondary inductance $L_{SEC(MIN)}$ is given by:

$$L_{SEC(MIN)} = \frac{V_{OUT(MAX)} \times t_{OFF(MIN)}}{I_{LIMIT} / N}$$

where N is the transformer turns ratio. This in turn implies a minimum primary inductance $L_{PRI(MIN)}$ given by:

$$L_{PRI(MIN)} = \frac{V_{OUT(MAX)} \times t_{OFF(MIN)}}{I_{LIMIT} \times N} = \frac{300 \times 250 \times 10^{-9}}{1.6 \times N} = \frac{47\mu H}{N}$$

For a typical turns ratio of 15 (see the *Transformer Turns Ratio* section), the $L_{PRI(MIN)}$ is calculated to be 3µH.

Choose a value between $L_{PRI(MIN)}$ and $L_{PRI(MAX)}$ based on other considerations for the leakage inductance and the transformer capacitance. A transformer with a primary inductance of 6µH is recommended for most applications.

Leakage Inductance

A particularly important transformer parameter is leakage inductance. In a practical transformer construction, all windings cannot be equally well-coupled to the core because of physical separation. If the primary inductance is high, the transformer may need multiple windings for the primary. A small amount of energy is stored between the windings and this energy is represented as leakage inductance. If the primary inductance is too small, the primary windings may not cover the width of the core and result in poor coupling to the secondary. This also increases the leakage inductance.

Leakage inductance does not participate in the primary to secondary energy transfer. Since the leakage inductance does not find a path for the current built up during the switch on-time, it results in voltage spikes and ringing at the drain of the MAX8622 power switch (LX), when it turns off. The MAX8622 internal switch is designed to be robust to withstand these voltage spikes; however, voltage overshoot should be minimized because it reduces total efficiency. Leakage inductance also delays the transfer of power from input to output causing an increase in charge time.

In addition, transformer secondary leakage inductance may couple with the reverse recovery current of the output rectifier diode to cause ringing when the diode turns off. The transformer secondary leakage inductance and the capacitance of the rectifier determine this resonant frequency. There is typically very little loss in the resonant circuit, so this network can generate many cycles of ringing after the spike. The ringing can therefore affect the peak primary current-sense signal used by the MAX8622. The transformer secondary leakage inductance is a function of the primary leakage inductance.

Care should be taken during transformer design while using techniques such as sandwiching the secondary between two primary windings to minimize leakage inductance. This can cause high winding-to-winding capacitance, reduce the efficiency of the circuit, and increase the charge time.

Transformer Secondary Capacitance

The total capacitance of the secondary should be minimized for both efficient and proper operation. Since the secondary of the transformer undergoes large voltage swings, capacitance on the secondary is a significant detriment to efficiency. This capacitance is reflected on the primary as an effective capacitance proportional to the square of the transformer turns ratio. It therefore dominates the resulting capacitance on the primary.

Both the leakage inductance and the secondary capacitance of the transformer should be minimized for efficient operation.

Rectifying Diode

The rectifying diode(s) must have sufficient reverse voltage and forward-current ratings. The peak reverse voltage $V_{R(PEAK)}$ seen by the diode(s) is given by:

$$V_{R(PEAK)} = V_{OUT(MAX)} + (N \times V_{IN})$$

is the same as the secondary peak current $I_{SBC(PEAK)}$. The peak current of the diode $I_{SEC(PEAK)}$ is determined by the peak primary current as:

$$I_{SEC(PEAK)} = \frac{I_{LIMIT}}{N}$$

Rectifier capacitance and transformer secondary leakage inductance couple to cause ringing when the diode turns off. The overshoot caused by this ringing may exceed the diode voltage rating and cause damage to the diode. The ringing can also affect the current-sense signal in the MAX8622. The rectifying diode should therefore have very low capacitance; 5pF or less is recommended.

The transition from the conduction to the blocking state in the diode takes a finite time, known as the reverse recovery time (t_{rr}). An ideal diode would have no reverse leakage current at any time. In a real diode, reverse leakage current flows from cathode to anode for a short period of time during reverse recovery to remove the injected carriers before the voltage can be blocked. The reverse recovery time should be as small as possible to reduce losses due to this reverse current. The reverse recovery waveforms also generate noise that may interfere with the current-sense signal. The slope of the waveform for recovery from the peak reverse current to 0A is used to characterize the diode as a soft recovery type if the slope is small, or a hard recovery type if the slope is steep. A soft recovery diode exhibits significantly lower switching noise than a hard recovery type. Snubbers can be used to make the reverse recovery waveform soft, but they also lower efficiency. A diode with a small t_{rr} and soft recovery is definitely an advantage. Recommended diodes are listed in Table 2.

Capacitor Selection

The V_{CC} and V_{IN} decoupling capacitors should be multilayer ceramic type with X5R or X7R dielectric for use across a wide temperature range. Use of Y5V and Z5U dielectrics is strongly discouraged due to the higher voltage and temperature coefficient of these materials.

Table 2. Recommended Diodes

PART NUMBER	SUPPLIER	MAXIMUM REVERSE VOLTAGE (V, EACH)	CAPACITANCE (pF, EACH)
BAV23S (dual)	Phillips	250	5
BAW101S (dual)	Phillips	300	2
CMPD2004S (dual)	Central	240	5

Adjustable Output Voltage

The MAX8622 uses secondary feedback to sense the output voltage (see Figure 2). The output voltage is set by the ratio of a resistor voltage-divider. Choose the lower resistor (R3 in Figure 2), connected from FB to GND, less than 2kΩ. A typical value for R3 is 1kΩ. Larger resistor values combined with parasitic capacitance at FB can slow the rise time of the FB voltage during each cycle. This could prevent the MAX8622 from detecting when the output has reached the desired level.

The value for the upper resistor (R1 and R2 in Figure 2) is found from:

$$R_{UPPER} = R1 + R2 = R3\left(\frac{V_{OUT}}{V_{FB}} - 1\right)$$

where V_{FB} is 1.25V. Make sure the voltage rating of the resistors is sufficient. It is often necessary to use two resistors in series for the upper resistor to meet the resistor voltage rating.

Choosing a Resistor for Lowering Charge Current

The peak primary current limit for the MAX8622 is set to the default value of 1.6A by connecting ISET to V_{CC}. This current limit works well for most applications. If a lower current limit is needed, connect a resistor (R6 in Figure 3) from ISET to GND. Select R6 as follows:

$$R6 = \frac{1.6A}{I_{LIMIT}} \times 75k\Omega$$

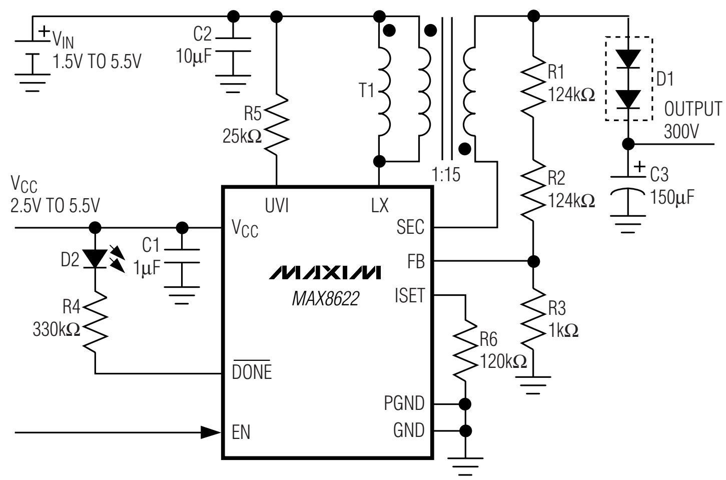


Figure 3. MAX8622 Typical Application Circuit with Resistor-Set Primary Current Limit Set by R6

Adjusting Battery Threshold for Lowering Charge Current

The UVI circuit allows a camera to be ready to flash in a short time when the battery is fresh, while still allowing flash pictures when the battery is at low capacity by extending the charge time to limit the battery drain. The MAX8622 does this by turning off the internal switch when the battery voltage dips below the set threshold. Set the UVI falling threshold by connecting a resistor (R5 in Figure 3) between UVI and the battery input, which forms a voltage-divider with an internal 25kΩ resistor. Select the UVI resistor value as follows:

$$R5 = 25k\Omega \times \left(\frac{V_{IN(MIN)}}{V_{UVI}} - 1\right)$$

where V_{UVI} is 1V and $V_{IN(MIN)}$ is the desired minimum-operating battery voltage.

When V_{CC} is connected to V_{IN}, the UVI falling threshold must be set to 2.5V or higher.

$\overline{\text{DONE}}$ Output

$\overline{\text{DONE}}$ is an open-drain output that pulls low when EN is high and the circuit has finished charging the output capacitor. Once the output capacitor is initially charged, $\overline{\text{DONE}}$ remains low until EN or V_{CC} goes low. To use $\overline{\text{DONE}}$ as a logic-level output, connect a pullup resistor (typically 100kΩ) from $\overline{\text{DONE}}$ to the logic supply rail. $\overline{\text{DONE}}$ can also directly drive an LED (connected as shown in Figure 3). When driving an LED, select the series resistor value so the current into $\overline{\text{DONE}}$ is less than 10mA. Note that in the DONE state, the MAX8622 autorefreshes every 11s as long as EN is high.

Layout Guidelines

The high-voltage operation of this application demands careful attention to board layout. Larger than minimum space between traces in the high-voltage area are recommended. This is essential to meet the breakdown specifications of the board. To minimize the high-frequency noise generated by switching, high dv/dt paths must be made as short as possible. Shortening high dv/dt paths reduces the size of antennas that radiate noise. A high di/dt loop creates noise due to radiated magnetic fields. To reduce high di/dt loop-generated noise, the loop needs to be made as small as possible. Keep the area for the high-voltage end of the secondary as small as possible. Refer to the MAX8622 evaluation kit data sheet for a layout example.

Warning: Lethal voltages are present in this circuit. Use caution when working with this circuit.

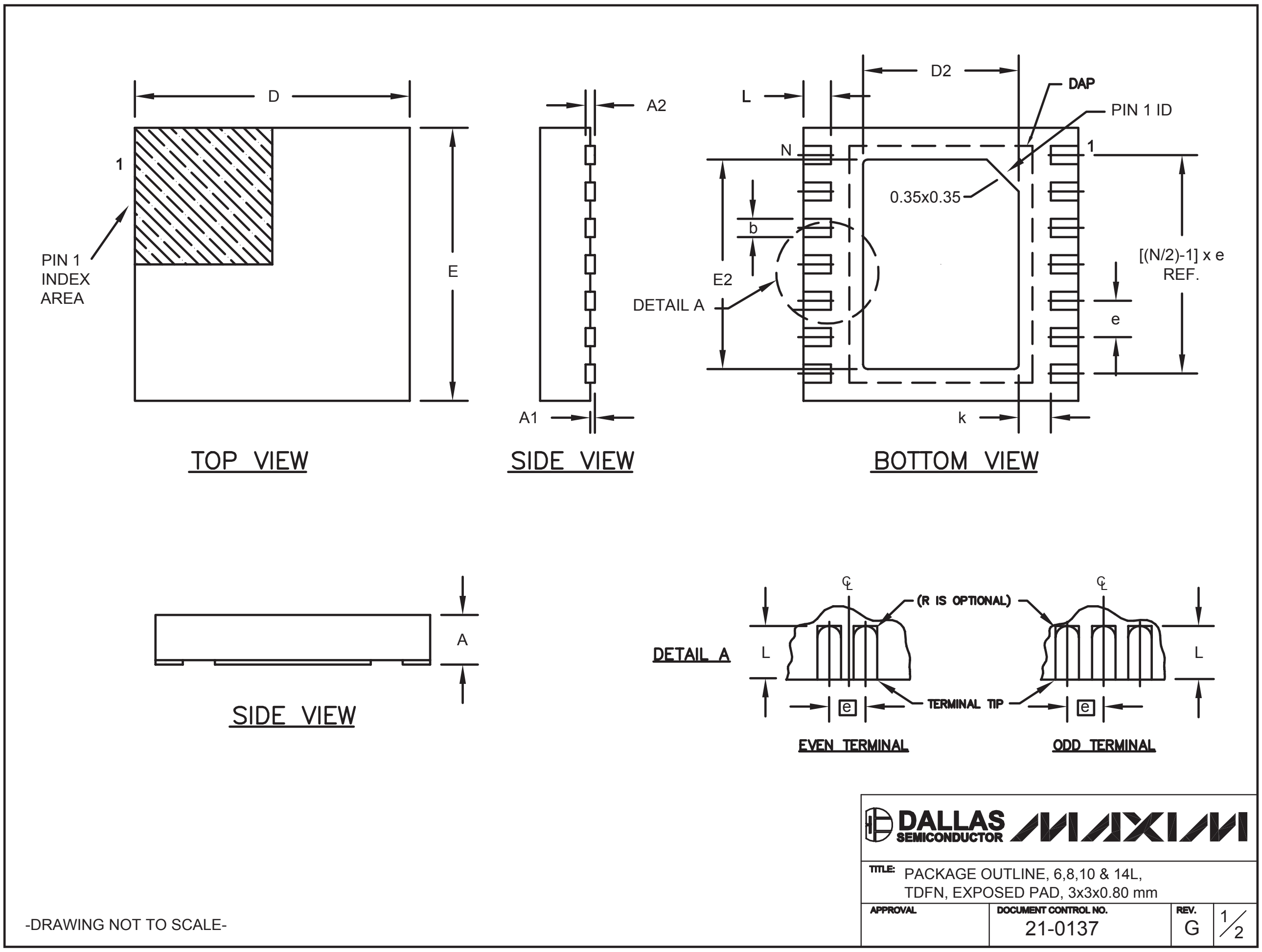
Chip Information

TRANSISTOR COUNT: 6062

PROCESS: BiCMOS

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



6, 8, &10L, DFN THIN.EPS

Fast-Charge-Time Xenon Flash Charger for Digital Still Cameras and Camera Phones

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

COMMON DIMENSIONS		
SYMBOL	MIN.	MAX.
A	0.70	0.80
D	2.90	3.10
E	2.90	3.10
A1	0.00	0.05
L	0.20	0.40
k	0.25 MIN.	
A2	0.20 REF.	

PACKAGE VARIATIONS								
PKG. CODE	N	D2	E2	e	JEDEC SPEC	b	[(N/2)-1] x e	DOWNBONDS ALLOWED
T633-1	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	NO
T633-2	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	NO
T833-1	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	NO
T833-2	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	NO
T833-3	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	YES
T1033-1	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	NO
T1433-1	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	YES
T1433-2	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	NO

NOTES:
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
6. "N" IS THE TOTAL NUMBER OF LEADS.
7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.

-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 6,8,10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0137	G	2/2