Low-Noise Step-up DC-DC Converter

Features
- 90% Efficiency
- Adjustable Output from V_{IN} to 20V
- 0.2Ω, 24V Power MOSFET
- Cycle-by-Cycle 2A Current Limit
- 2.5V to 5.5V Input Range
- 600kHz/1.2MHz Switching Frequency
- MSOP-8, TDFN3X3-8 Package

Applications
- LCD Displays
- Portable Applications
- Hand-Held Devices

General Description
The G5108 boost converter in corporate high-performance, current-mode, frequency selectable pulse width modulation (PWM) circuitry with a built-in 0.2Ω n-channel MOSFET to provide a highly efficient regulator.

High switching frequency allows easy filtering and faster loop performance. An external compensation pin provides the user flexibility in determining loop dynamics, allowing the use of small, low ESR ceramic output capacitors. The device can produce an output voltage as high as 20V. User programmed soft-start with an external capacitor determines the input current ramp rate.

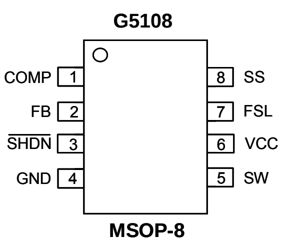
The G5108 is available in a space-saving MSOP-8 and TDFN3X3-8 package.

Ordering Information

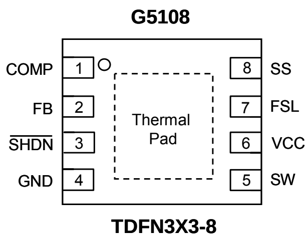
ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G5108P8U	G5108	-40°C ~ +85°C	MSOP-8
G5108RDU	5108	-40°C ~ +85°C	TDFN3X3-8

Note: P8: MSOP-8 RD:TDFN3X3-8
U: Tape & Reel

Pin Configuration



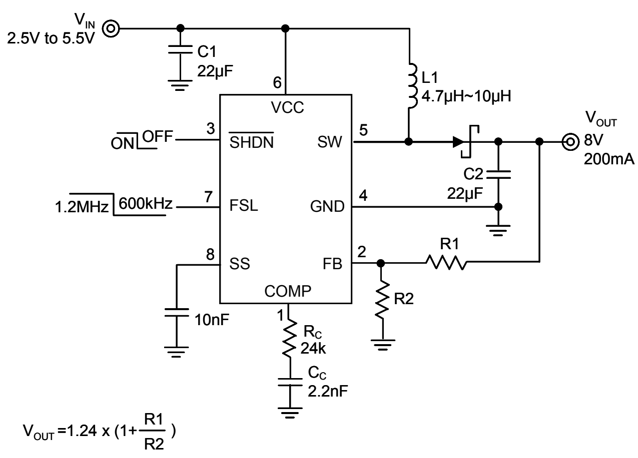
MSOP-8



TDFN3X3-8

Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Typical Application Circuit



Absolute Maximum Ratings

VCC, $\overline{SHDN}$ to GND. . . . .-0.3V to +7V
FB, COMP to GND. . . . .-0.3V to VCC+0.3V
SW to GND. . . . . -0.3V to 24V
SW to GND. . . . . -2V (<20ns)
Thermal Resistance Junction to Ambient, (θ_{JA})
MSOP-8 . . . . .225°C/W(1)
TDFN3X3-8 . . . . .226°C/W(1)
TDFN3X3-8 (1in^2) . . . . .98°C/W(2)
Continuous Power Dissipation (T_A = +25°C)
MSOP-8 . . . . 0.5W(1)
TDFN3X3-8 . . . . 0.5W(1)
TDFN3X3-8 (1in^2) . . . . 1.1W(2)
Thermal Resistance Junction to Case, (θ_{JC})
MSOP-8 . . . . .70°C/W
TDFN3X3-8 . . . . .28°C/W
Operating Temperature . . . . -40°C to 85°C
Junction Temperature. .125°C
Storage Temperature . . . .-65°C to 150°C
Reflow Temperature (soldering, 10sec) . . . . . .260°C

Stress beyond those listed under “Absolute Maximum Rating” may cause permanent damage to the device.

Note:
(1) : Please refer to Minimum Footprint PCB Layout Section.
(2): Please refer to 1in^2 of 1oz PCB Layout Section.

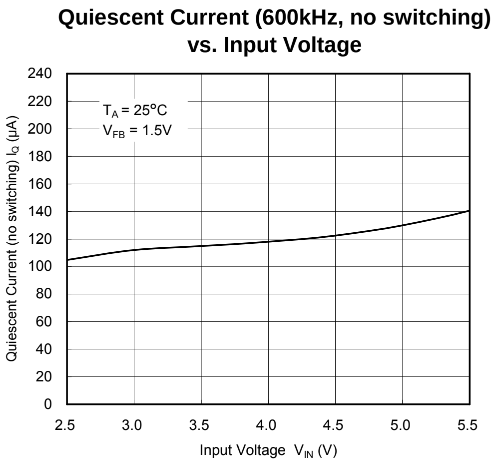
Electrical Characteristics

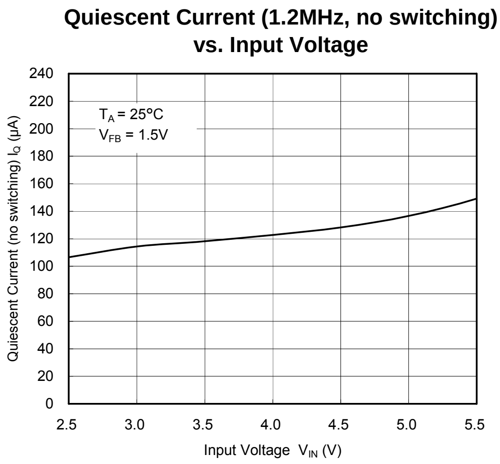
(V_{CC} = $V_{\overline{SHDN}}$ = 3V, T_A = 25°C)

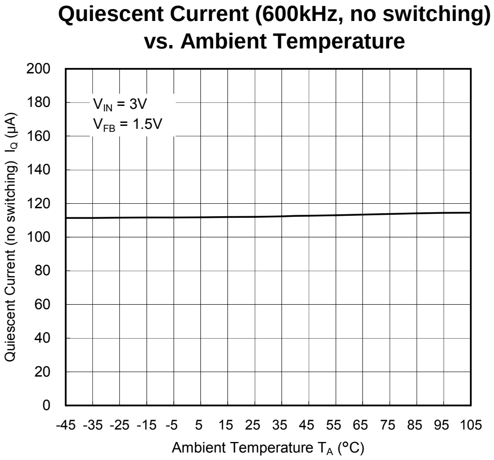
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		2.5	---	5.5	V
Input Voltage UVLO (UVP)		1.7	2.0	2.3	V
Quiescent Current	No switching, V_{FB}=1.5V	---	100	200	µA
	$V_{\overline{SHDN}}$ = 0V	---	0.1	1	µA
Feedback Voltage	Initial Accuracy	1.222	1.24	1.258	V
	Temperature Coefficient	---	100	---	ppm/°C
Feedback Voltage Line Regulation	2.5V< V_{CC}< 5.5V	-0.1	0.01	+0.1	%
Feedback Pin Bias Current	2.5V< V_{CC}< 5.5V	-20	0	20	nA
Feedback Pin Overvoltage Protection (OVP)		1.261	1.327	1.480	V
Error Amp Transconductance		100	150	200	µmho
Error Amp Voltage Gain		---	200	---	V/V
Switching Frequency	V_{FSL} = 0V	450	600	750	kHz
	V_{FSL} = V_{CC}	0.9	1.2	1.5	MHz
Maximum Duty		85	---	---	%
NMOS Switch $R_{DS(ON)}$	I_{SW} = 1A	---	0.2	0.4	Ω
NMOS Switch Leakage Current	V_{SW} = 20V	---	0.1	10	µA
NMOS Switch Current Limit		1.5	2	2.8	A
Thermal Protection	Trigger	---	145	---	°C
	Hysteresis	---	10	---	°C
Soft Start Current		---	2.3	---	µA
$\overline{SHDN}$ Pin Voltage High		2	---	---	V
$\overline{SHDN}$ Pin Voltage Low		---	---	0.8	V
$\overline{SHDN}$ Pin Current	$V_{\overline{SHDN}}$ = 0V	-0.1	0	0.1	µA
	$V_{\overline{SHDN}}$ = V_{CC}	-0.1	0	0.1	µA

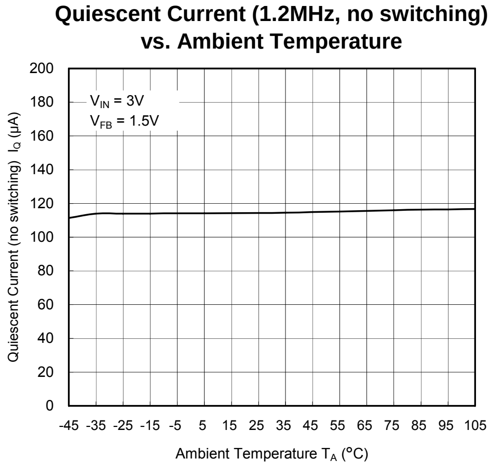
Typical Performance Characteristics

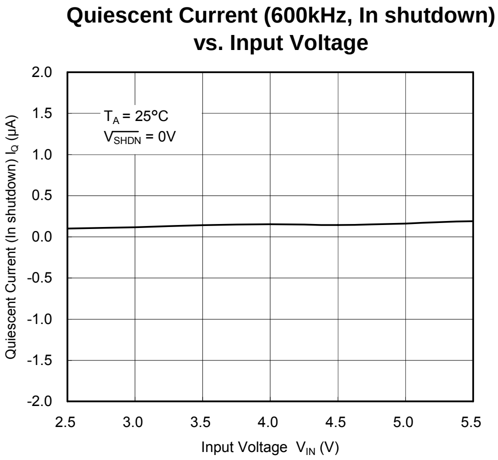
(V_{IN} = $V_{\overline{SHDN}}$ = 3V, C_{IN} = C_{OUT} = 22µF, R_C= 24kΩ, C_C= 2.2nF, C_{SS}= 10nF, T_A=25°C, unless otherwise noted.)

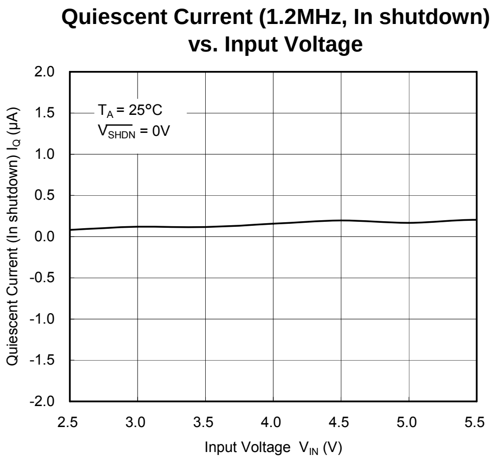




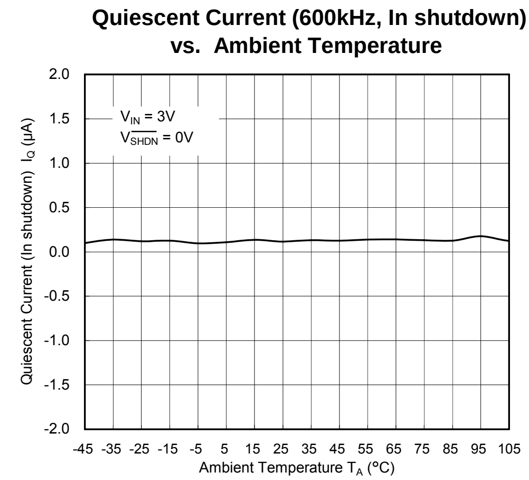


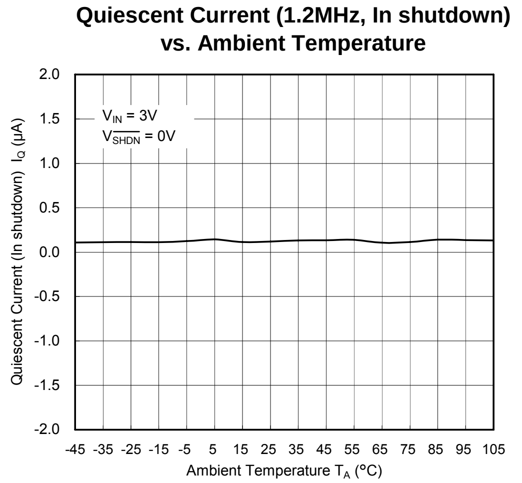


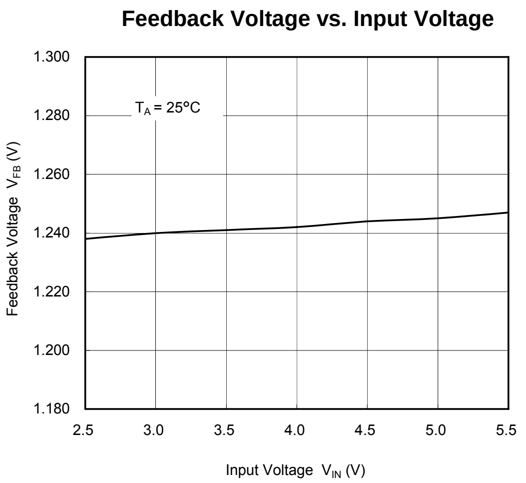


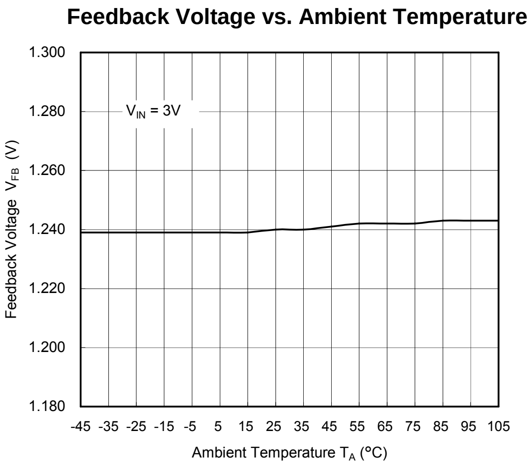


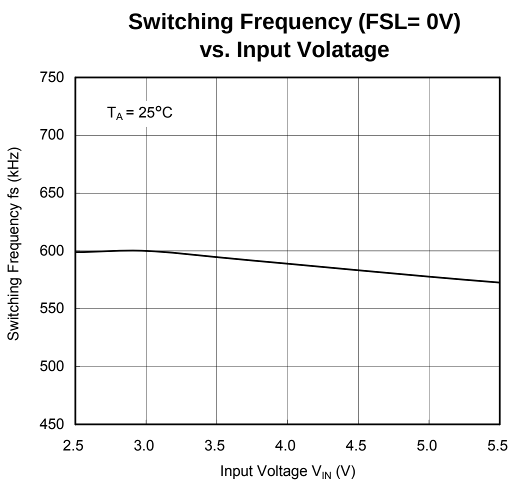
Typical Performance Characteristics (continued)

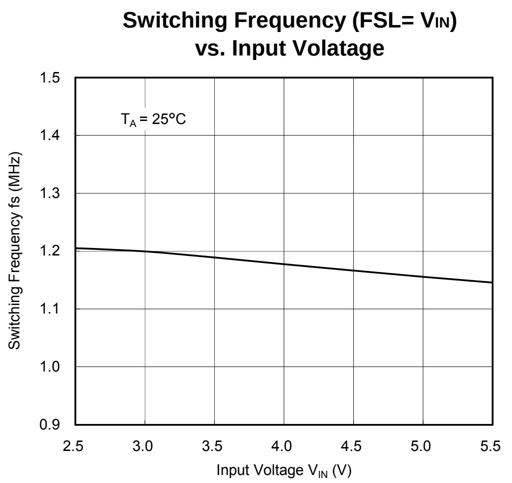






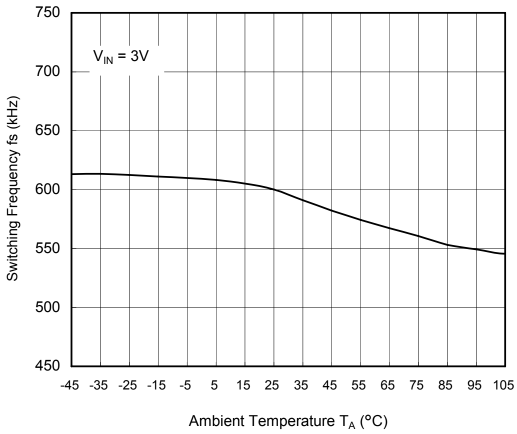




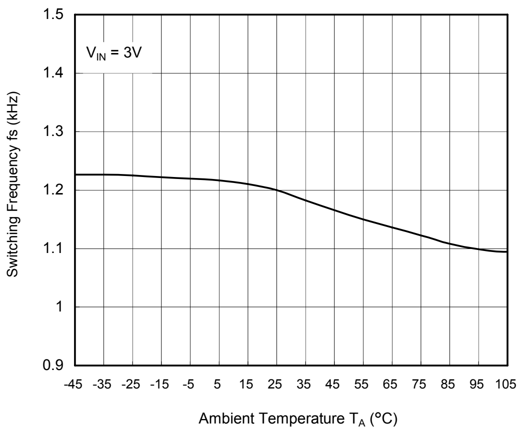


Typical Performance Characteristics (continued)

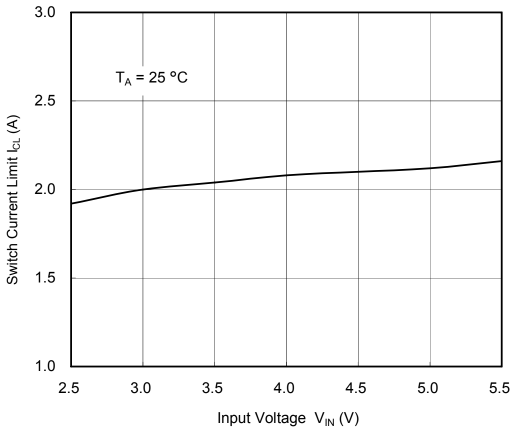
Switching Frequency (FSL= 0V) vs. Ambient Temperature



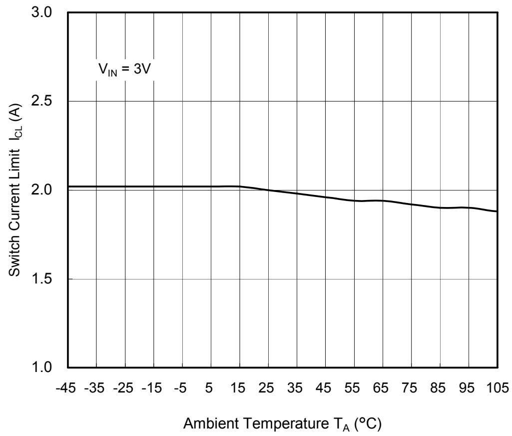
Switching Frequency (FSL = VIN) vs. Ambient Temperature



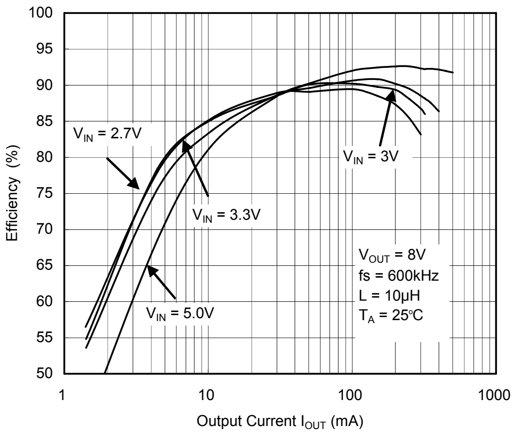
Switch Current Limit vs. Input Voltage



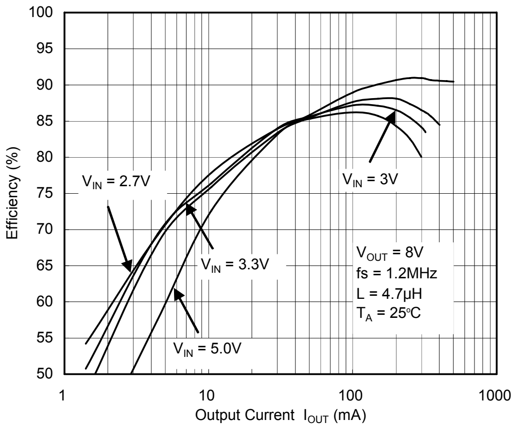
Switch Current Limit vs. Ambient



Efficiency vs. Output Current (fs= 600kHz)

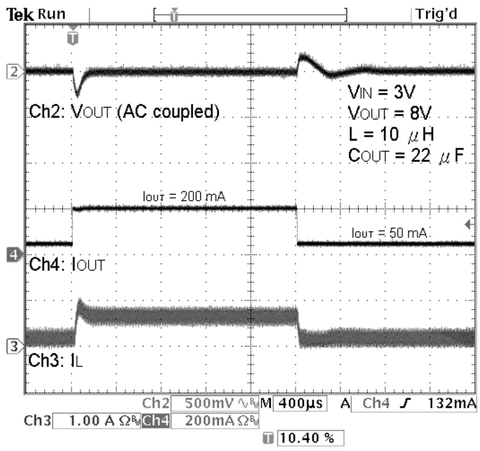


Efficiency vs. Output Current (fs= 1.2MHz)

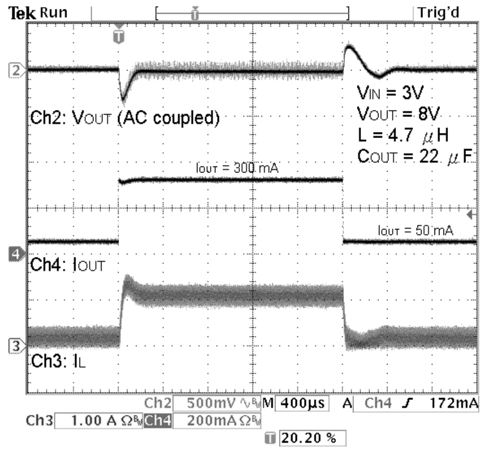


Typical Performance Characteristics (continued)

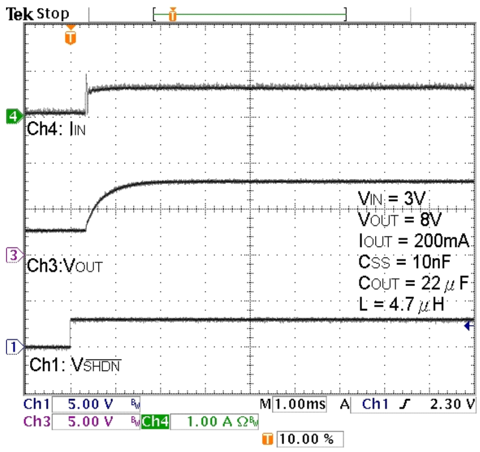
Load Transient Response (fs = 600kHz)



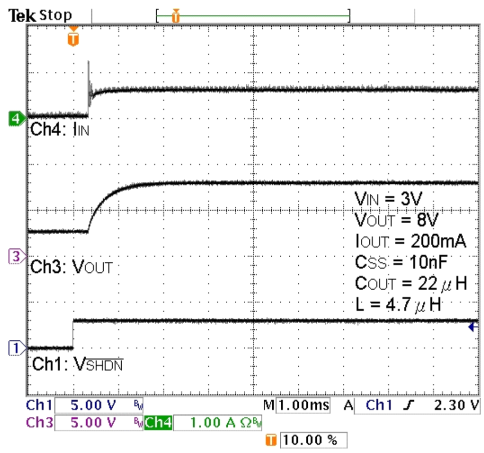
Load Transient Response (fs = 1.2MHz)



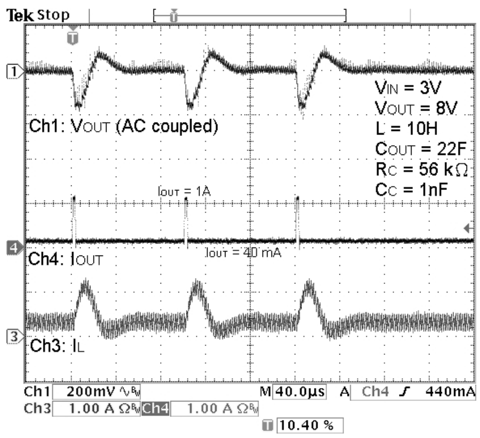
Start Up Waveform (Inrush Current) of fs = 600kHz



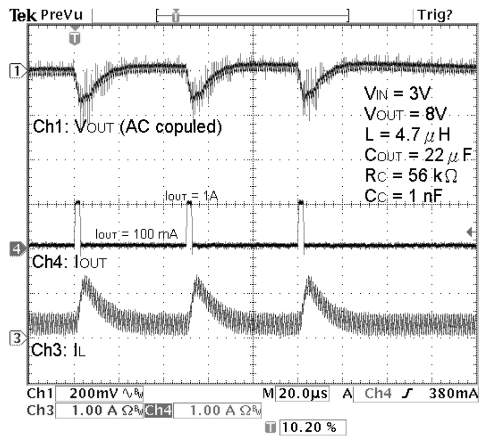
Start Up Waveform (Inrush Current) of fs = 1.2MHz



Pulsed Load Transient (fs = 600kHz)

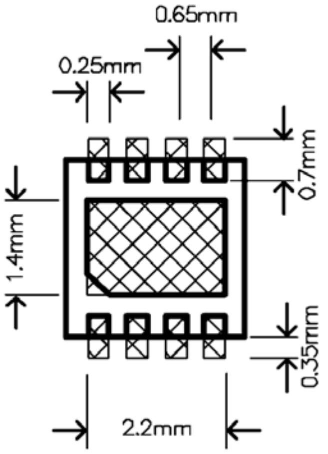


Pulsed Load Transient (fs = 1.2MHz)

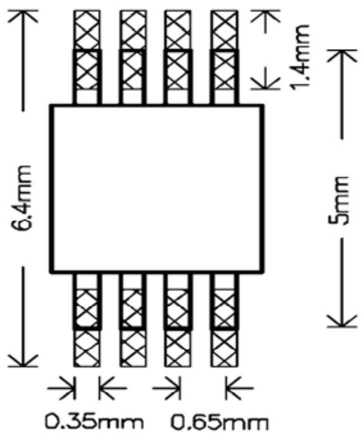


Minimum Footprint PCB Layout Section

TDFN3X3-8

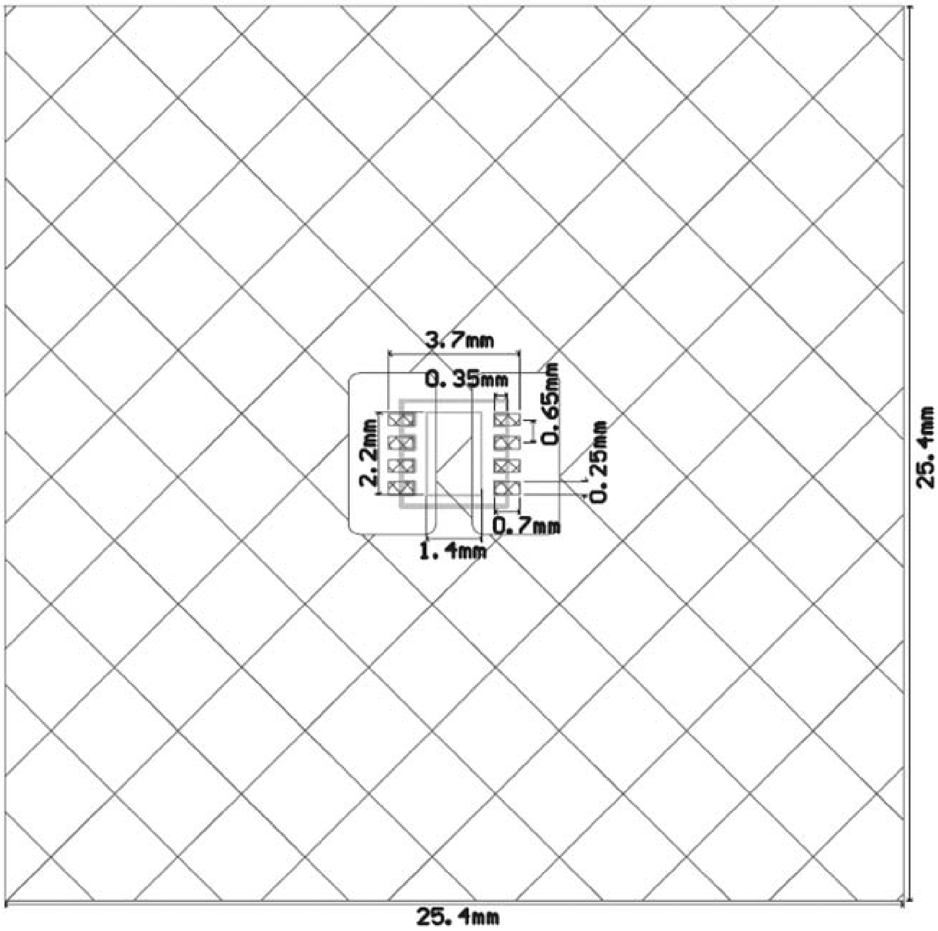


MSOP-8



1in^2 of 1oz PCB Layout Section

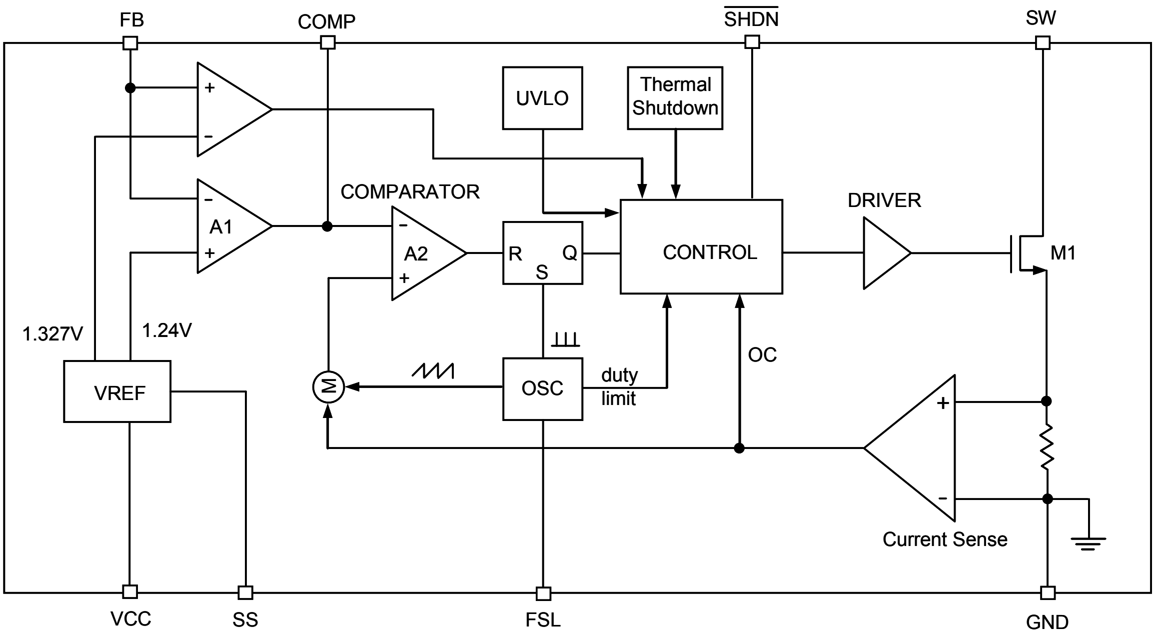
TDFN3X3-8



Pin Description

PIN		NAME	FUNCTION
MSOP	TDFN3X3-8		
1	1	COMP	**Compensation Pin**.
2	2	FB	**Feedback Pin**. V_{OUT} = (1+R1/R2) * 1.24
3	3	$\overline{\text{SHDN}}$	**Active Low Shutdown Pin**.
4	4	GND	**Ground Pin**.
5	5	SW	**Switch Pin**. The drain of the internal NMOS power switch. Connect this pin to inductor.
6	6	VCC	**Input Supply Pin**. Bypass this pin with a capacitor as close to the device as possible.
7	7	FSL	**Frequency Selection Pin**. Connect this pin to logic high for 1.2MHz switching frequency. Otherwise, connect it to ground, or leave it floating to choose 600kHz switching frequency.
8	8	SS	**Soft-Start Pin**. Connect a capacitor to this pin as an internal reference voltage bypass capacitor. The ramping time is determined by internal driving current.

Block Diagram



Function Description

Normal Operation

The G5108 uses a constant frequency control scheme to provide excellent line and load regulation. Operation can be best understood by referring to the block diagram. At the start of each oscillator cycle, the SR latch is set, which turns on the power switch M1. The current signal is added to an artificial ramp (slope compensation) to the positive terminal of the PWM comparator A2. When this voltage exceeds the level at the negative input of A2, the SR latch is reset turning off the power switch. The level at the negative input of A2 is set by the error amplifier A1, and is simply an amplified version of the difference between the feedback voltage and the reference voltage of 1.26V. In this manner, the error amplifier sets the correct current level to keep the output in regulation.

Over Voltage Protection

The G5108 includes an OVP comparator which always monitors the output by FB pin. In case the non-inverting input of the OVP comparator greater then the threshold (1.24V*1.07=1.327V), it outputs a logic high signal to turn off the switch M1. The priority of this signal is higher than the duty control circuit. Even the duty control circuit wants switching, the switch M1 remains off when the comparator output still logic high. The switch M1 keeps off until the output voltage drops below the OVP threshold. And the duty control circuit takes the control back.

Over Current Protection

Each cycle M1 switch turns on, current sensor monitor the current flow through M1 switch.
In case the current exceed the limit, no matter if the loop control still want more current, M1 switch turned off immediately.
It also limits the input current from drains too much power from source power supply.

Application Information

Loop Compensation

As shown in Typical Application Circuit, the voltage feedback loop needs proper compensation to prevent excessive output ripple and poor efficiency caused by instability. Connect a R_C and C_C in series from COMP pin to GND. R_C is chosen to set the high-frequency integrator gain for fast transient response, while C_C is chosen to set the integrator zero to maintain loop stability. For optimal performance, choose the components by the following equations:

$$R_C = \frac{180 \times V_{IN} \times V_{OUT} \times C_{OUT}}{L \times I_{OUT(MAX)}}$$

$$C_C = \frac{V_{OUT} \times C_{OUT}}{10 \times I_{OUT(MAX)} \times R_C}$$

The best gauge of correct loop compensation is by inspecting the transient response of the G5108. Adjust R_C and C_C as necessary to obtain optimal transient performance.

Inductor Selection

A 4.7μH or 10μH inductor is recommended for small ripple applications. Small form factor and high efficiency are the major concerns for most G5108 applications. Inductor with low core losses and small DCR (cooper wire resistance) are good choice for G5108 applications.

Capacitor Selection

The small size of ceramic capacitors makes them suitable for G5108 applications. X5R and X7R types are recommended because they retain their capacitance over wider voltage and temperature ranges than other types such as Y5V or Z5U. A 10μF or 22μF capacitor for input and output are recommended for most applications.

Diode Selection

Schottky diodes, with their low forward voltage drop and fast reverse recovery, are the ideal choices for G5108 applications. The forward voltage drop of a Schottky diode represents the conduction losses in the diode, while the diode capacitance (C_T or C_D) represents the switching losses. For diode selection, both forward voltage drop and diode capacitance need to be considered. Schottky diodes with higher current ratings usually have lower forward voltage drop and larger diode capacitance, which can cause significant switching losses of the G5108. A Schottky diode rated at 2A is sufficient for most G5108 applications.

Application Circuit

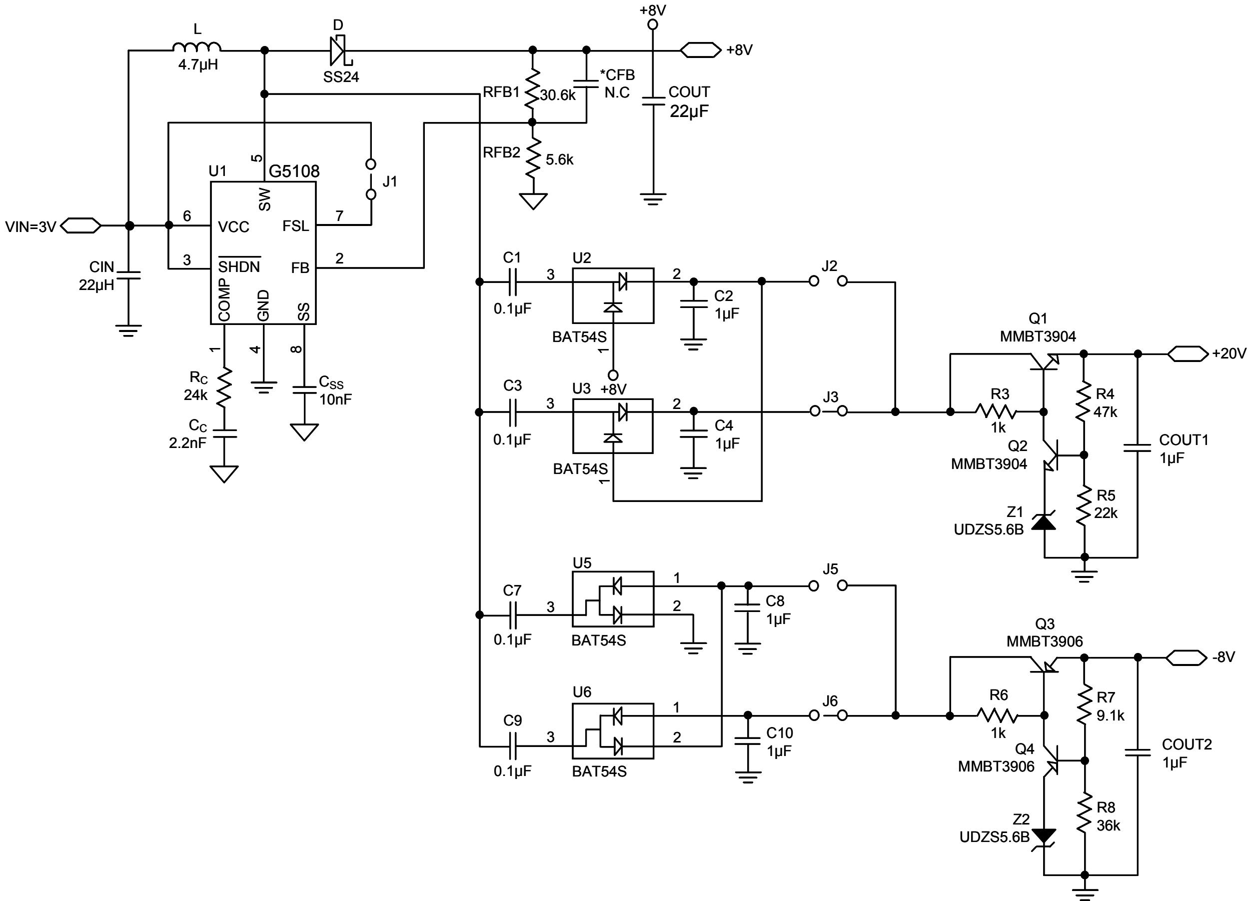
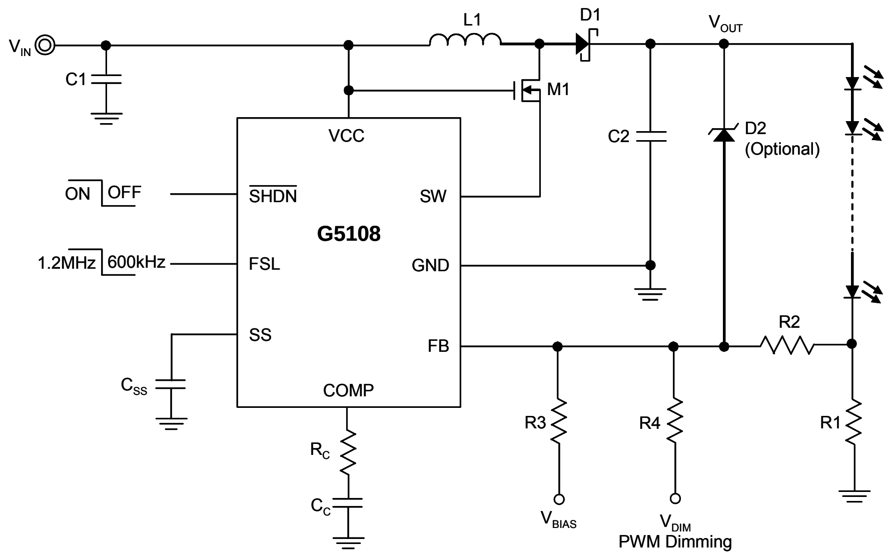
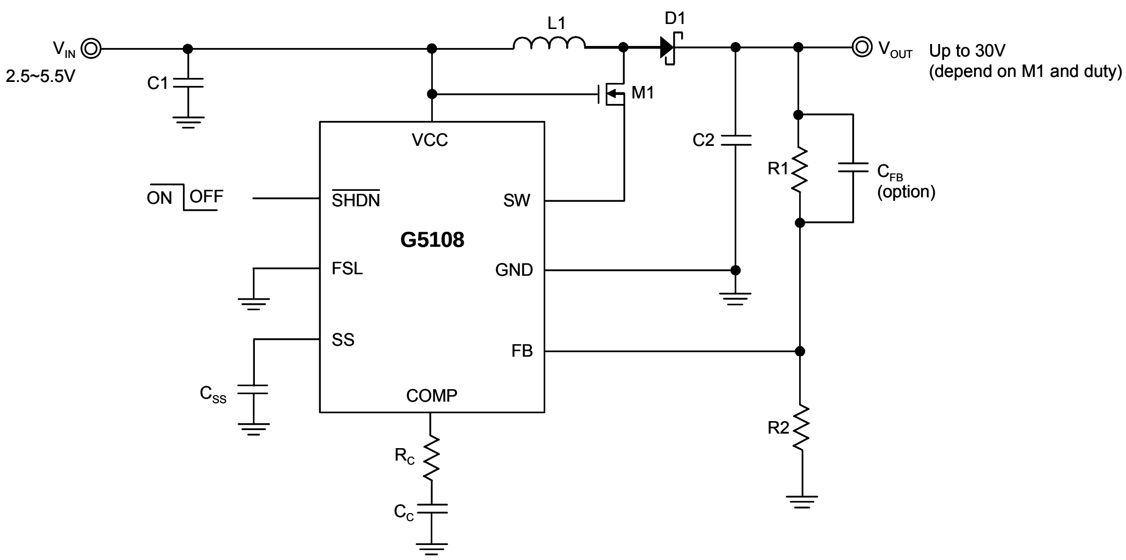


Figure 1. Triple Output TFT Bias (1.2MHz operation)

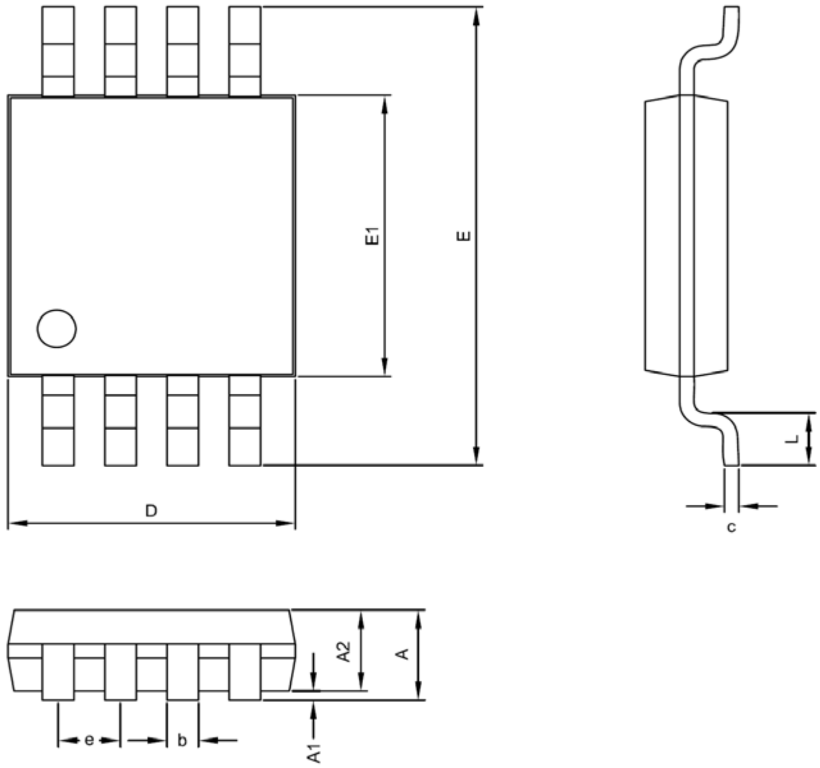
White LED Driver



High Voltage Boost Converter



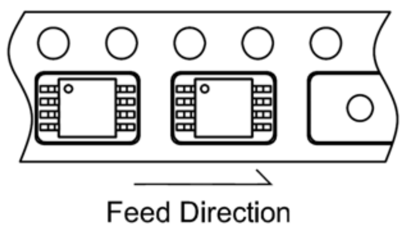
Package Information



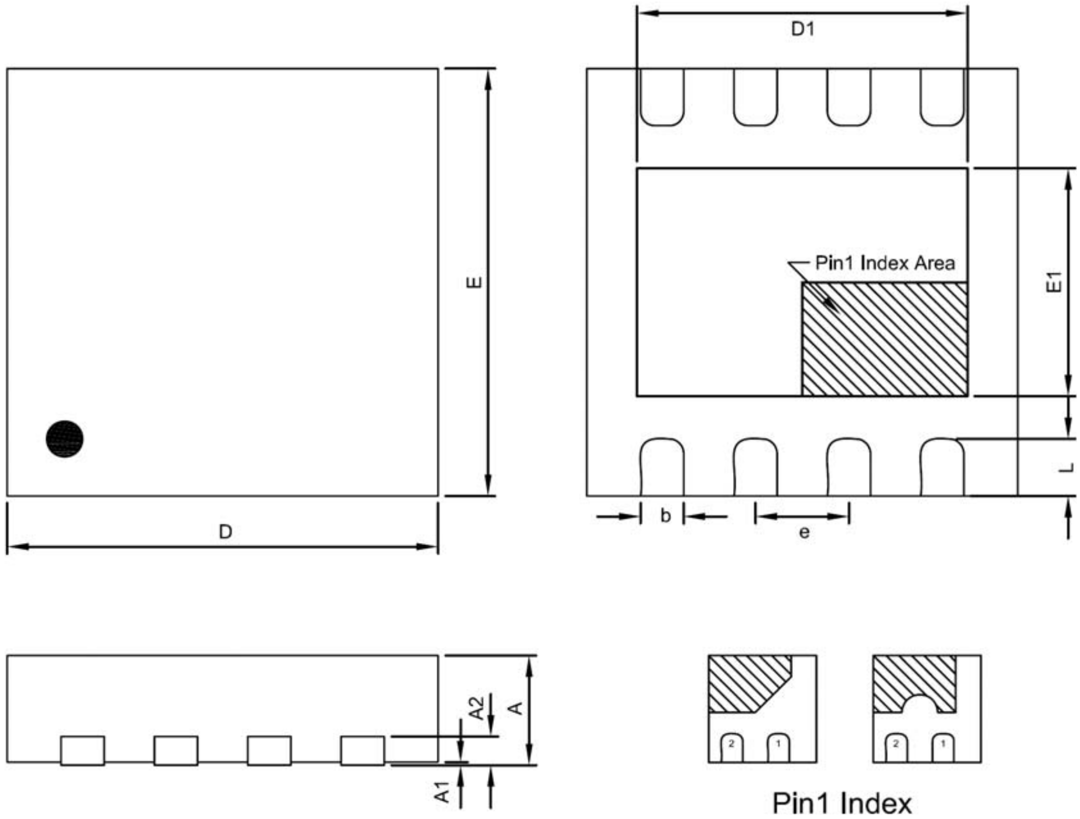
MSOP-8 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.81	0.95	1.10	0.032	0.037	0.043
A1	0.00	- - -	0.15	0.000	- - -	0.006
A2	0.76	0.86	0.96	0.030	0.034	0.038
D	2.85	3.00	3.15	0.112	0.118	0.124
E	4.75	4.90	5.05	0.187	0.193	0.199
E1	2.85	3.00	3.15	0.112	0.118	0.124
c	0.13	0.15	0.23	0.005	0.006	0.009
b	0.28	0.30	0.38	0.011	0.012	0.015
e	0.65 BSC			0.026 BSC		
L	0.4	0.53	0.8	0.016	0.021	0.031

Taping Specification



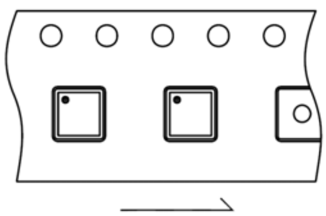
PACKAGE	Q'TY/REEL
MSOP-8	3,000 ea



TDFN3X3-8 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	- - -	0.05	0.0000	- - -	0.0020
A2	0.19	0.20	0.21	0.0075	0.0079	0.0083
D	2.95	3.00	3.05	0.1161	0.1181	0.1201
E	2.95	3.00	3.05	0.1161	0.1181	0.1201
D1	2.20	2.30	2.40	0.0866	0.0906	0.0945
E1	1.40	1.50	1.60	0.0551	0.0591	0.0630
b	0.25	0.30	0.35	0.0098	0.0118	0.0138
e	0.65 BSC			0.0256 BSC		
L	0.35	0.45	0.525	0.0138	0.0177	0.0207

Taping Specification



PACKAGE	Q'TY/REEL
TDFN3X3-8	3,000 ea