

GENERAL DESCRIPTION

The SGM3750 is a high efficiency white LED driver with a 650kHz boost converter. With the fixed switching frequency and an internal 40V switch FET, the SGM3750 can use small components. The driver also achieves improved efficiency and reduced output ripple.

The SGM3750 is capable of driving 10 white LEDs in series. The FB feedback voltage is regulated at 200mV typically. The default LED current is programmed by an external R_{SET} resistor. During the operation, the LED current can be controlled by applying a PWM signal to the CTRL pin. The feedback voltage depends on the PWM signal duty cycle. For PWM dimming control, there are no audible noises on the output capacitor.

The SGM3750 integrates LED open protection. It prevents the device from damaging due to the over-voltage during LED open conditions..

The SGM3750 is available in Green TDFN-2x2-6L and TSOT-23-6 packages. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Input Voltage Range: 2.7V to 20V**
- **Up to 90% Efficiency**
- **Switching Frequency: 650kHz**
- **Feedback Voltage: 200mV**
- **PWM Dimming Control**
- **PWM Dimming Frequency: 5kHz to 100kHz**
- **38V LED Open Protection**
- **600kΩ Pull-Down Resistor on CTRL Pin**
- **Automatic Soft-Start for Reducing Inrush Current**
- **Dimming Stable in More than 1:500 PWM Range**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TDFN-2x2-6L and TSOT-23-6 Packages**

APPLICATIONS

- Mobile Phones
- Portable Media Players
- GPS Receivers
- Backlight for Media Form Factor Display

TYPICAL APPLICATION

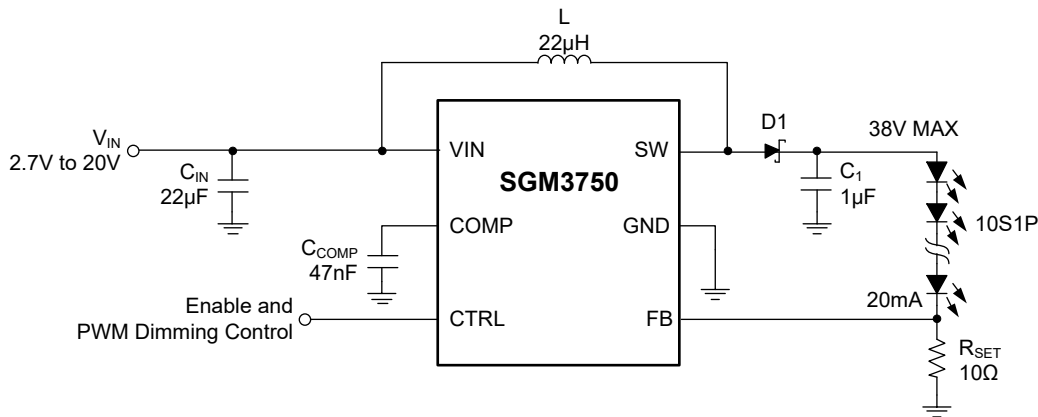


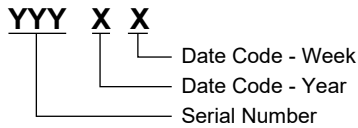
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3750	TDFN-2×2-6L	-40°C to +85°C	SGM3750YTDI6G/TR	3750 XXXX	Tape and Reel, 3000
	TSOT-23-6	-40°C to +85°C	SGM3750YTN6G/TR	SVEXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage on VIN.....	-0.3V to 22V
Voltage on CTRL	-0.3V to 6V
Voltages on FB and COMP.....	-0.3V to 3V
Voltage on SW	-0.3V to 40V
Package Thermal Resistance	
TDFN-2×2-6L, θ_{JA}	120°C/W
TSOT-23-6, θ_{JA}	190°C/W
Junction Temperature.....	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10sec)	+260°C
ESD Susceptibility	
HBM.....	4000V
MM.....	300V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range	2.7V to 20V
Operating Temperature Range	-40°C to +85°C

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

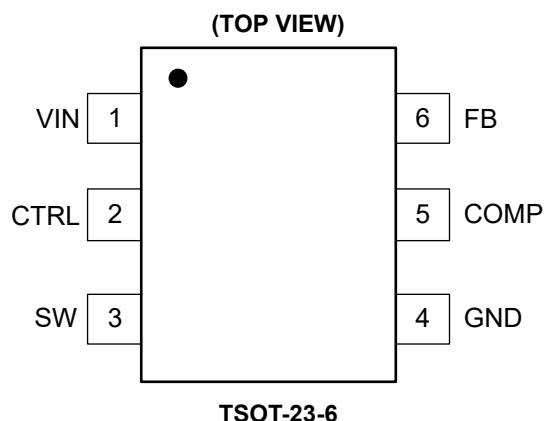
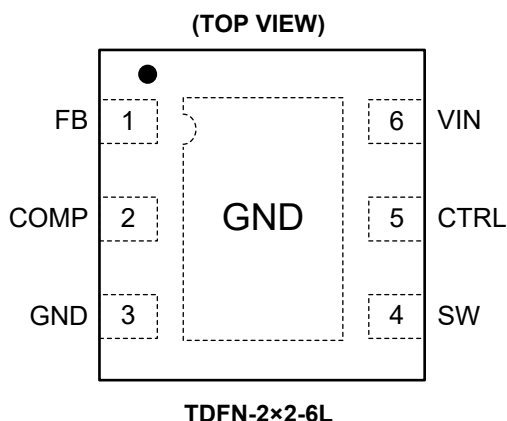
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

PIN		NAME	I/O	FUNCTION
TSOT-23-6	TDFN-2x2-6L			
1	6	VIN	I	Input Supply Pin.
2	5	CTRL	I	Boost Regulator Control Pin. It is used for enable control and PWM dimming control.
3	4	SW	I	Boost Switching Node. The device monitors the output voltage on this pin for LED open protection. Connect an inductor between the VIN and SW pins
4	3	GND	O	Ground Pin.
5	2	COMP	O	Transconductance Error Amplifier Output. Connect an external capacitor from COMP to GND to compensate the converter.
6	1	FB	I	Feedback Input for Current. Connect the sense resistor from FB to GND.
—	Exposed Pad	GND	—	Exposed Pad. It should be soldered to the analog ground plane. If possible, use thermal via connection to ground plane for enhanced power dissipation.

ELECTRICAL CHARACTERISTICS

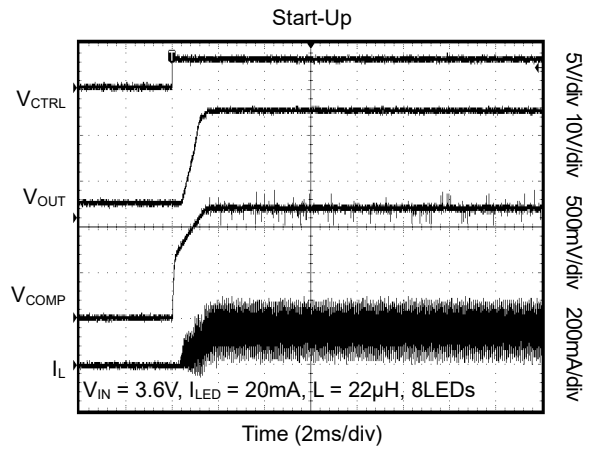
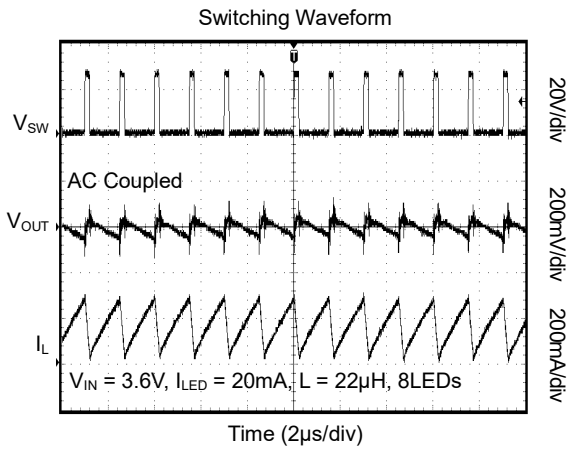
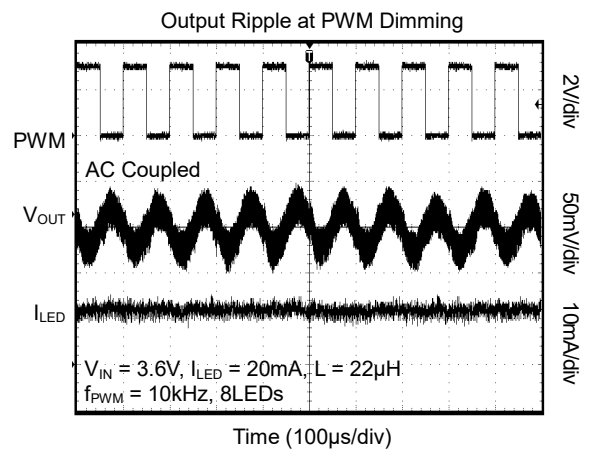
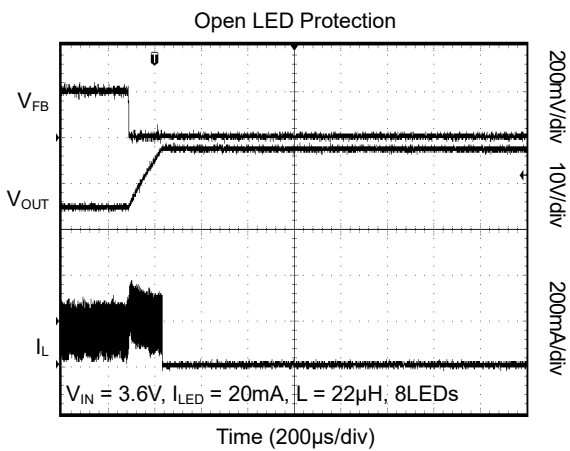
(V_{IN} = 3.6V, V_{CTRL} = V_{IN}, C_{IN} = 22μF, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supply							
Input Voltage Range	V _{IN}		+25°C	2.7		20	V
Operating Quiescent Current into VIN	I _Q	V _{FB} = 400mV	+25°C		0.4	0.6	mA
Shutdown Current	I _{SD}	V _{CTRL} = GND, V _{IN} = 4.2V	+25°C			1	μA
Under-Voltage Lockout Threshold	UVLO	V _{IN} falling	+25°C		2.2	2.5	V
Under-Voltage Lockout Hysteresis	V _{HYS}		+25°C		70		mV
Enable and Reference Control							
CTRL Logic High Voltage	V _{CTRLH}	V _{IN} = 2.7V to 20V	Full	1.5			V
CTRL Logic Low Voltage	V _{CTRL}	V _{IN} = 2.7V to 20V	Full			0.35	V
CTRL Pull-Down Resistor	R _{CTRL}		+25°C	400	600	800	kΩ
CTRL Pulse Width to Shutdown	t _{OFF}	CTRL high to low	+25°C	2.5			ms
Power Switch							
N-Channel MOSFET On-Resistance	R _{DS(ON)}	V _{IN} = 3.6V	+25°C		0.3	0.55	Ω
		V _{IN} = 3.0V	+25°C			0.6	
N-Channel Leakage Current	I _{LN_NFET}	V _{SW} = 35V, T _A = 25°C	+25°C			1	μA
Voltage and Current Control							
Voltage Feedback Regulation Voltage	V _{REF}	V _{IN} = 3.6V	+25°C	196	200	204.5	mV
Voltage Feedback Regulation Voltage Under Brightness Control	V _{REF_PWM}	V _{IN} = 3.6V, f _{PWM} = 10kHz, duty cycle = 25%	+25°C	48	50.5	53.5	mV
		V _{IN} = 3.6V, f _{PWM} = 10kHz, duty cycle = 10%	+25°C	19	20.5	22.5	
		V _{IN} = 3.6V, f _{PWM} = 10kHz, duty cycle = 1%	+25°C	1.7	2.5	3.3	
		V _{IN} = 3.6V, f _{PWM} = 10kHz, duty cycle = 0.2%	+25°C		1.25		
Voltage Feedback Input Bias Current	I _{FB}	V _{FB} = 200mV	Full		0.001	0.2	μA
Oscillator Frequency	f _S		Full	500	650	800	kHz
Minimum ON Pulse Width	t _{MIN_ON}		+25°C		80		ns
COMP Pin Sink Current	I _{SINK}		+25°C		40		μA
COMP Pin Source Current	I _{SOURCE}		+25°C		20		μA
Error Amplifier Transconductance	G _{EA}		Full	160	280	400	μmho
Over-Current and Open Led Protection							
N-Channel MOSFET Current Limit	I _{LIM}		+25°C	0.65	0.95	1.3	A
Open LED Protection Threshold	V _{OVP}	Measured on the SW pin	Full	35.5	38	39.5	V
V _{REF} Filter Time Constant	t _{REF}		+25°C		130		μs
Pwm Brightness Control							
PWM Dimming Frequency	f _{PWM}		Full	5		100	kHz
Minimum PWM On-Time			+25°C	30			ns
Minimum Stable Duty Cycle	D _{MIN}		+25°C	0.2			%
Thermal Shutdown							
Thermal Shutdown Threshold	T _{SHDN}				150		°C
Thermal Shutdown Threshold Hysteresis	T _{HYS}				15		°C

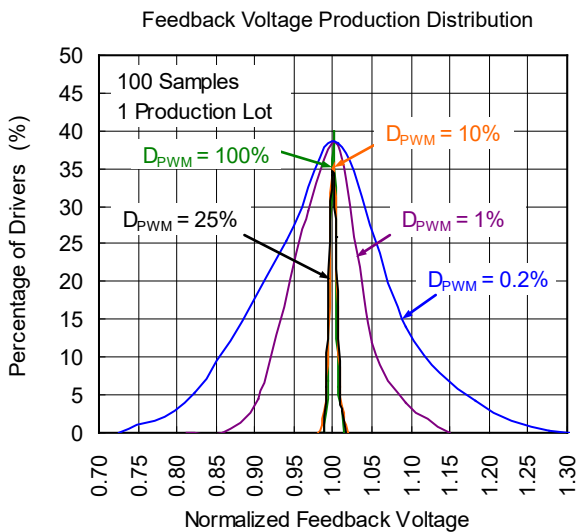
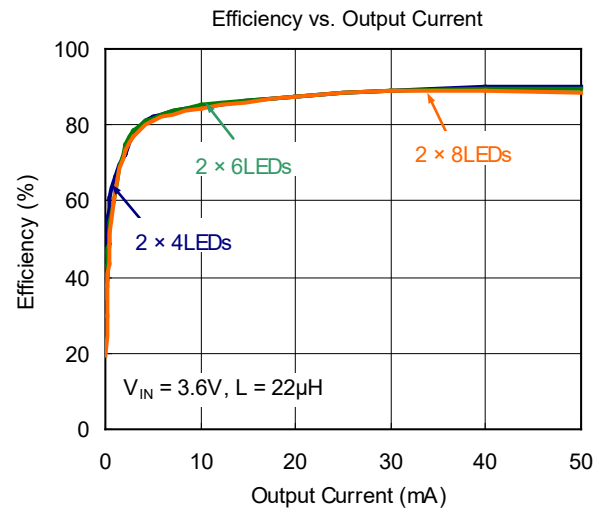
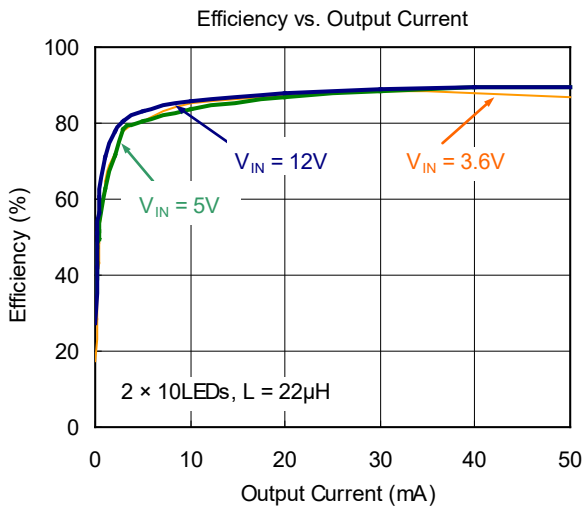
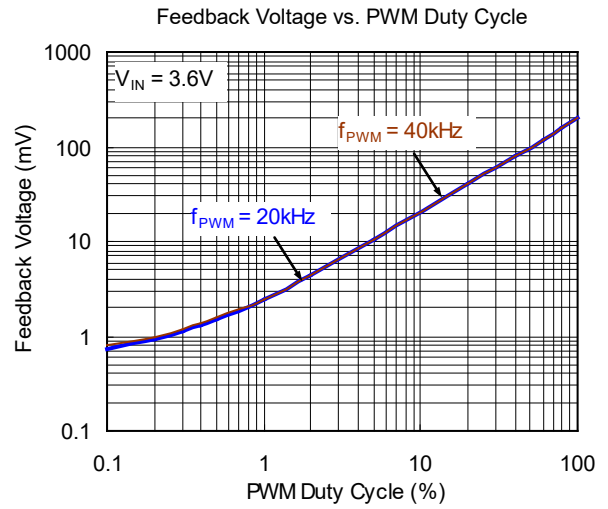
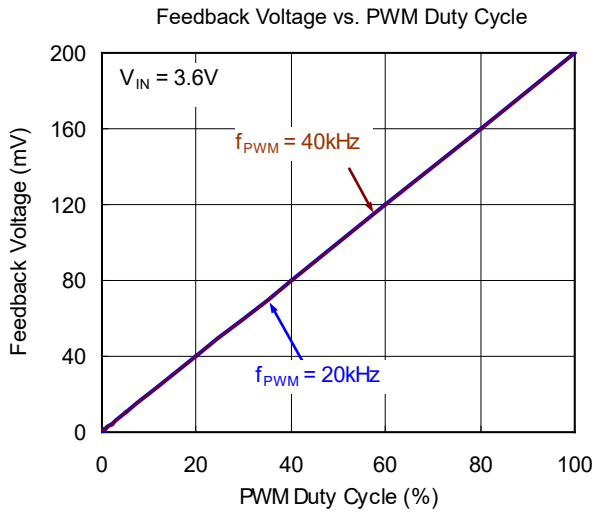
RECOMMENDED COMPONENTS OF TEST CIRCUITS

	COMPONENT		COMPONENT
INDUCTOR	22 μ H/CD75NP-220KC	CAPACITOR	22 μ F/C2012X7R1H226KT
	10 μ H/CD75NP-100KC		1 μ F/C2012X7R1H105KT
DIODE	MBR0540		47nF/C0603X7S0J473M030BB

TYPICAL PERFORMANCE CHARACTERISTICS



TYPICAL PERFORMANCE CHARACTERISTICS (continued)



ADDITIONAL TYPICAL APPLICATIONS

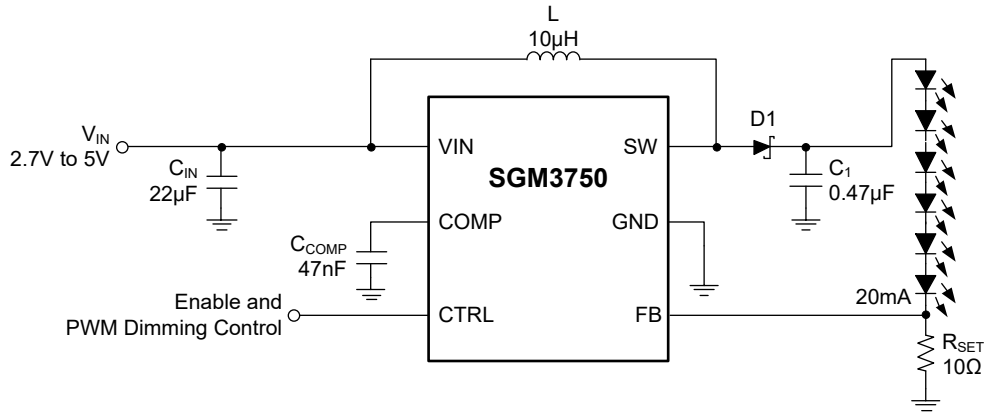


Figure 2. Li-Ion Driver for 6 White LEDs

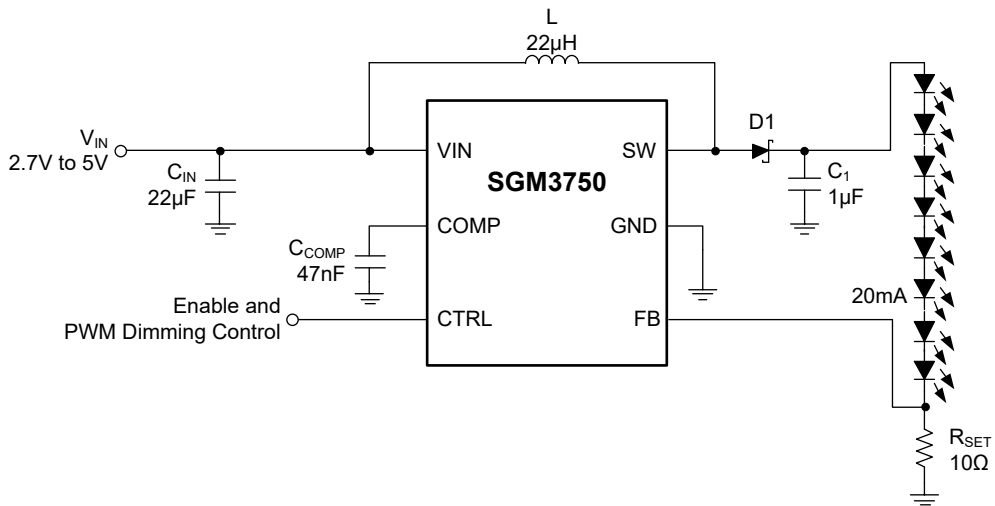


Figure 3. Li-Ion Driver for 8 White LEDs

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

JULY 2016 – REV.A.1 to REV.A.2

Changed Features item from: PWM Dimming Stable in 1:500 Range to: Dimming Stable in More than 1:500 PWM Range	1
Changed Minimum PWM On-Time parameter	4
Changed capacitor selection.....	5
Changed Equation 2.....	9
Changed Package Outline Dimensions section	15, 16

JUNE 2015 – REV.A to REV.A.1

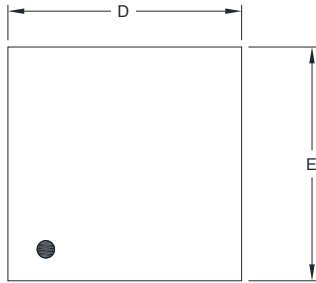
Added the graph of Feedback Voltage Production Distribution	6
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Changes from Original (APRIL 2015) to REV.A

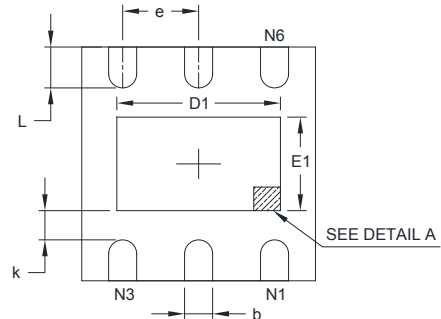
Changed from product preview to production data.....	All
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PACKAGE OUTLINE DIMENSIONS

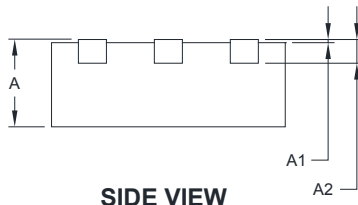
TDFN-2x2-6L



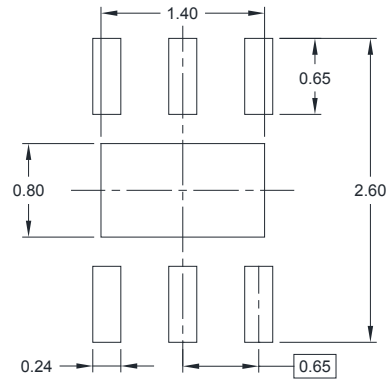
TOP VIEW



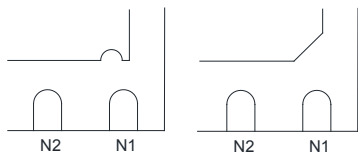
BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



DETAIL A

Pin #1 ID and Tie Bar Mark Options

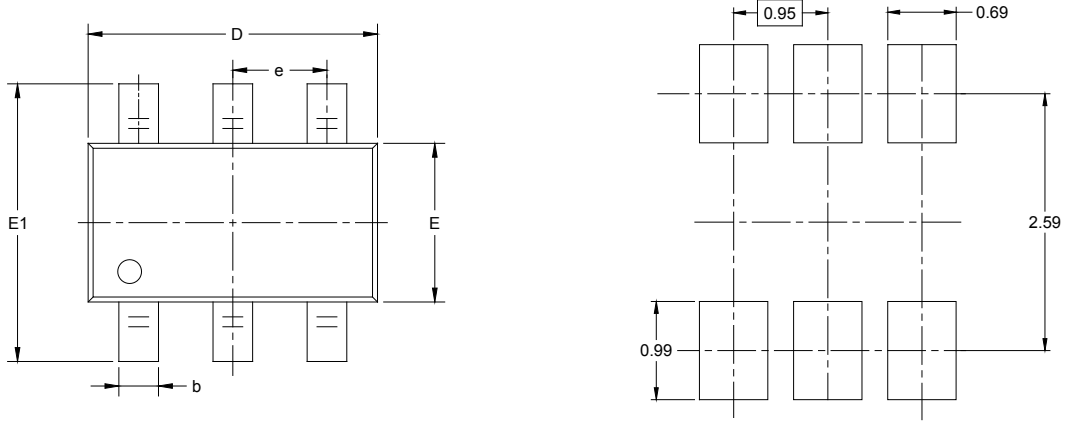
NOTE: The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	1.900	2.100	0.075	0.083
D1	1.100	1.450	0.043	0.057
E	1.900	2.100	0.075	0.083
E1	0.600	0.850	0.024	0.034
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.250	0.450	0.010	0.018

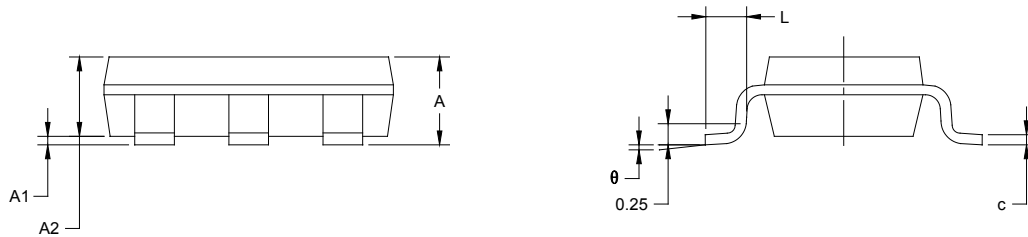
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

TSOT-23-6



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.000		0.043
A1	0.000	0.100	0.000	0.004
A2	0.700	0.900	0.028	0.039
b	0.300	0.500	0.012	0.020
c	0.080	0.200	0.003	0.008
D	2.850	2.950	0.112	0.116
E	1.550	1.650	0.061	0.065
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TDFN-2×2-6L	7"	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q1
TSOT-23-6	7"	9.5	3.20	3.10	1.10	4.0	4.0	2.0	8.0	Q3

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PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002