

1.5A Synchronous Buck LED Driver With Flexible Dimming Options

Features

- 2.4V ~ 6V Input Voltage Operation.
- 95% Efficient DC/DC Converter
- Integrated 150mΩ(HS) / 90mΩ(LS) MOSFETs
- 1.5A continuous output current
- 100mV feedback regulation voltage
- 1% to 100% analog dimming with high accuracy
- 20KHz to 200KHz Dimming frequency for VREF dimming
- 100Hz to 2KHz Dimming frequency for ON/OFF dimming
- Force PWM mode for low output ripple(G2320)
- PSM mode for high efficiency in light load (G2320A)
- Full protection with over current, LED open/short, FB resistor open/short Thermal shutdown protection
- Available in SOT23-6 and TDFN2X2-6 package

Applications

- Video doorbell
- Smart doorlock

General Description

The G2320 is a monolithic, step-down, switch mode LED converter with built-in internal power MOSFETs. It achieves 1.5A continuous output current from a 2.4V to 6V input voltage with excellent load and line regulation.

The G2320 support the ON/OFF dimming and Vref dimming. The LED current dimming is achieved by adjusting the duty cycle of the DIM input with 1% to 100% range. From 100Hz to 2kHz dimming frequency, the G2320 support the ON/OFF dimming mode. In ON/OFF dimming mode, the LED turn on and off according to DIM pin duty cycle periodically. Dimming frequency from 20KHz to 200KHz will operate in VREF dimming mode. In this mode, the internal reference voltage is proportional to the duty cycle of the DIM.

For safety and protection, the G2320 device implement full protections, including LED+ short to GND, LED open, LED short, FB resistor open, FB resistor short and thermal shutdown.

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2320TB1G	2320x	-40°C~+85°C	SOT23-6
G2320ATB1G	230Ax	-40°C~+85°C	SOT23-6
G2320RB1U	2320	-40°C~+85°C	TDFN2X2-6
G2320ARB1U	2320A	-40°C~+85°C	TDFN2X2-6

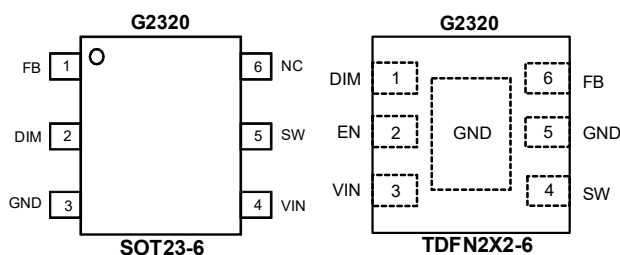
Note: TB: SOT23-6 RB: TDFN2X2-6

1: Bonding code

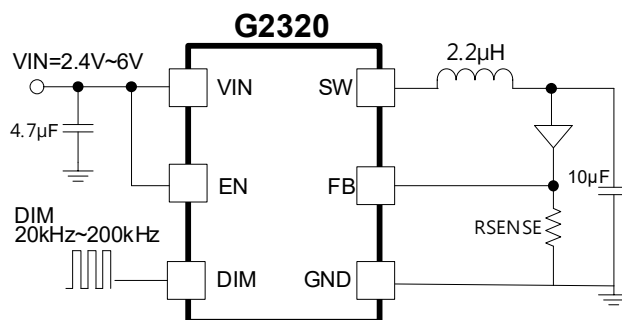
U & G: Tape & Reel

Green: Lead Free / Halogen Free

Pin Configuration



Typical Application Circuit



Absolute Maximum Ratings

VIN	-0.3V to +6.3V
FB,DIM,EN	-0.3V to +6.3V
SW	-0.3V to (VIN+0.3) V
SW (AC less than 10ns)	-0.3V to +10V
Thermal Resistance Junction to Ambient, (θ_{JA})	
SOT23-6	240°C/W
Continuous Power Dissipation ($T_A=25^\circ\text{C}$)	
SOT23-6	0.521W
Thermal Resistance Junction to Ambient, (θ_{JC})	
SOT23-6	80°C/W

Junction Temperature	-40°C to 150°C
Storage Temperature Range	-55°C to +150°C
Reflow Temperature (soldering, 10 sec)	260°C
ESD (HBM)	2KV

Recommended Operating Conditions

Supply Input Voltage	2.4V to 6V
Ambient Temperature Range	-40°C to 85°C
Junction Temperature Range	-40°C to 125°C

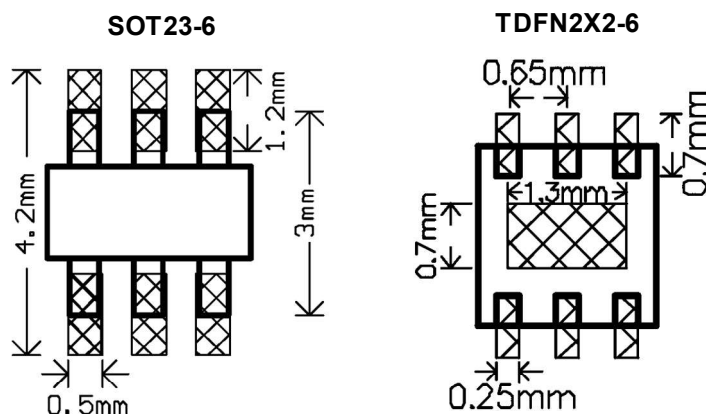
- Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5K Ω resistor into each pin.

Thermal Information

THERMAL METRIC		TDFN2X2-6	UNIT
$R_{\theta JA}$	Junction to ambient thermal resistance	67.8	°C/W
$R_{\theta JC_top}$	Junction to case top thermal resistance	92.0	°C/W
$R_{\theta JB}$	Junction to board thermal resistance	29.9	°C/W
Ψ_{JT}	Junction to top characterization parameter	3.0	°C/W
Ψ_{JB}	Junction to board characterization parameter	29.9	°C/W
$R_{\theta JC_bot}$	Junction to case bottom thermal resistance	5.4	°C/W

- Package thermal metric is obtained using the method described in JEDEC specification JESD51-7, using a four-layer board.
- The maximum power dissipation is $P_{D(MAX)} = \frac{(T_{JMAX} - T_A)}{R_{\theta JA}}$, Exceeding the maximum allowable power dissipation results in excessive die temperature, and the device will enter thermal shutdown.

Minimum Footprint PCB Layout Section



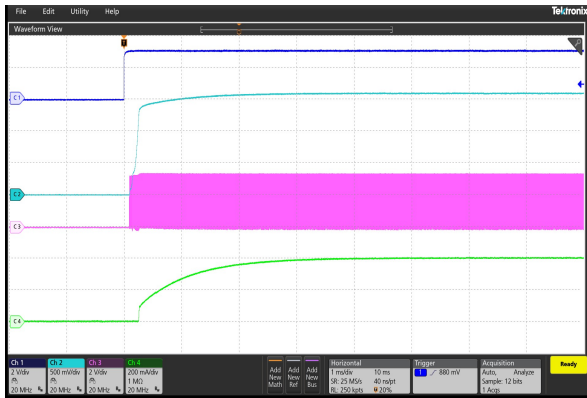
Electrical characteristics

(VIN=3.6V, TA=25°C, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VIN Operating Voltage for PMIC	V _{VIN_PMI}		2.4	---	6	V
VIN Under Voltage threshold	V _{VIN_UVLOF}	VIN falling	---	2.2	---	V
	V _{VIN_UVLOR}	VIN rising	---	2.3	---	V
Stand-by Supply Current	I _{VIN_PWM}	device not switching.	---	500	---	μA
	I _{VIN_PSM}	device not switching.	---	350	---	μA
Shutdown Current (with EN pin only)	I _{VIN_SD1}		---	0.1	---	μA
Shutdown Current (SOT-23-6 only)	I _{VIN_SD2}	V _{DIM} =0V	---	1	3	μA
Shutdown Current (TDFN2x2-6 only)	I _{VIN_SD3}	V _{EN} =VIN, V _{DIM} =0V	---	1	3	μA
Buck Converter						
FB pin reference voltage	V _{FB_100%}	DIM=100%	---	99	---	mV
	V _{FB_50%}	DIM=50%, F _{DIM} =20KHz~200KHz	---	50	---	mV
	V _{FB_5%}	DIM=5%, F _{DIM} =20KHz~200KHz	---	5	---	mV
	V _{FB_1%}	DIM=1%, F _{DIM} =20KHz~200KHz	---	1	---	mV
Switch ON Resistance	Ron1-N		---	90	---	mΩ
	Ron1-P		---	150	---	mΩ
Peak Current Limit	I _{LIM}		---	2.5	---	A
Switching frequency	F _{SW}		---	1.5	---	MHz
DIM Logic-Input Threshold	V _{TH_DIM}	High threshold	1	---	---	V
	V _{TL_DIM}	Low threshold	---	---	0.4	V
DIM Frequency	F _{DIM}	20KHz~200KHz for VREF DIMMING	20	---	200	KHz
	F _{DIM}	100Hz~2KHz for ON/OFF DIMMING	0.1	---	2	KHz
DIM off time	T _{DIM_OFF}	DIM minimum off time to disable device, V _{DIM} =0	---	36	---	mS
EN Logic-Input Threshold	V _{TH_EN}	High threshold	1.2	---	---	V
	V _{TL_EN}	Low threshold	---	---	0.4	V
Thermal Shutdown Detect	T _{SD}		---	150	---	°C
Thermal Shutdown Hysteresis	ΔT _{SD}		---	20	---	°C

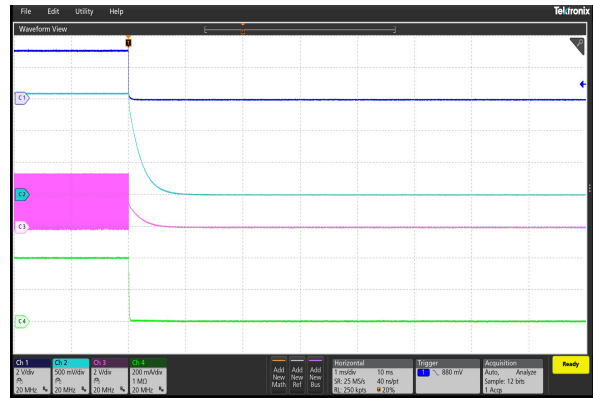
Typical Performance characteristics
G2320RB1U, $V_{IN}=3.6V$, $T_A=25^{\circ}C$

EN on control



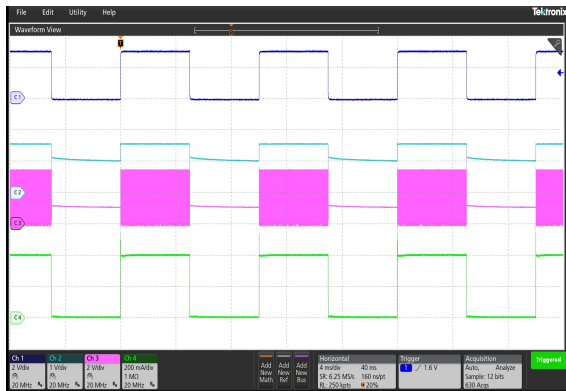
ch1:EN ch2:VO ch3:LX ch4:ILED

EN off control



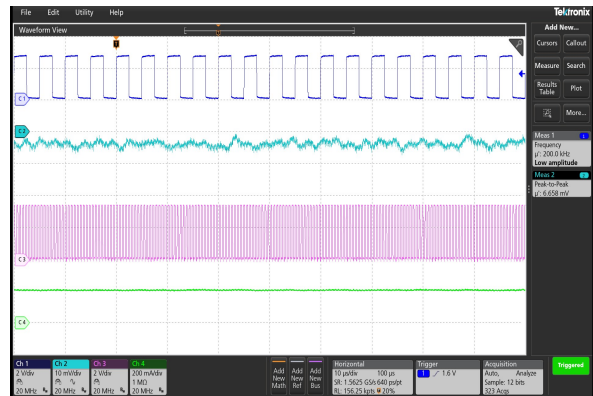
ch1:EN ch2:VO ch3:LX ch4:ILED

Dim 100Hz with Duty=50% control



ch1:DIM ch2:VO ch3:LX ch4:ILED

Dim 200kHz with Duty=50% control

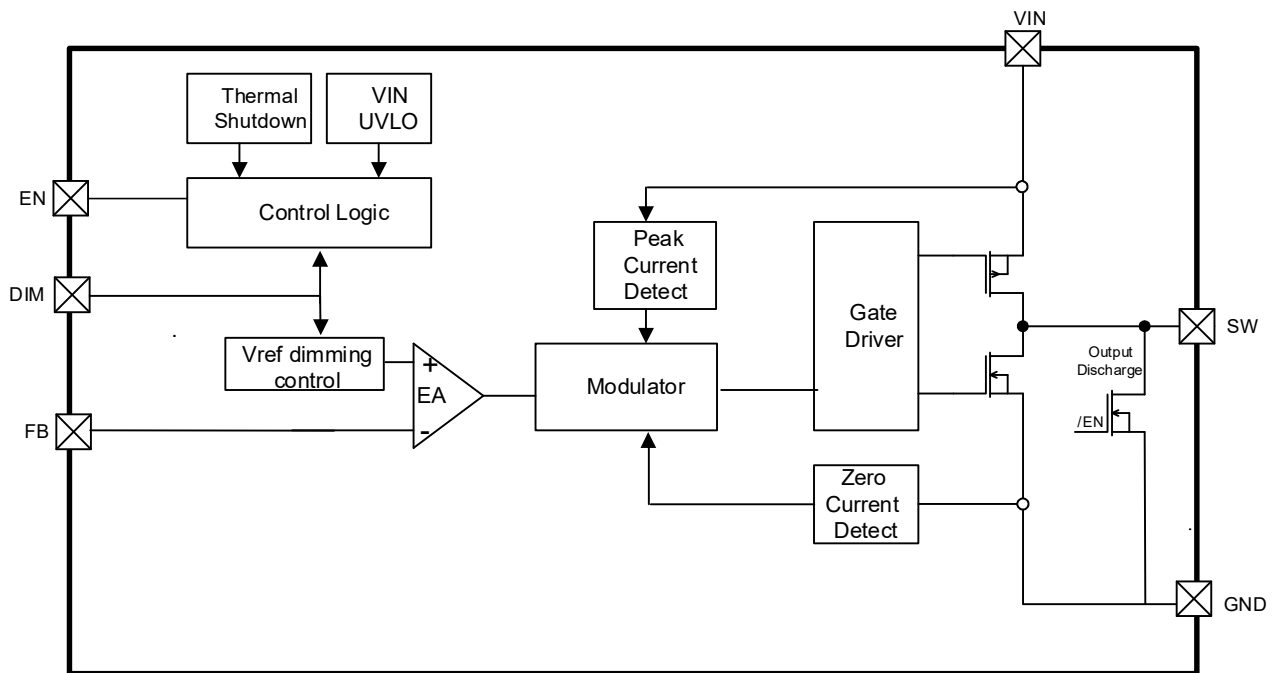


ch1:DIM ch2:VO(ac) ch3:LX ch4:ILED

Pin Description

PIN NUMBER			FUNCTION
Name	SOT23-6	TDFN2X2-6	
VIN	4	3	IC Power Supply Input pin.
GND	3	5	Chip ground
FB	1	6	LED current detection feedback
SW	5	4	Inductor switch node of converter.
DIM	2	1	Dimming input pin. LED current is turned ON and OFF according to PWM duty cycle periodically ($100\text{Hz} < F_{\text{DIM}} < 2\text{kHz}$). In Vref dimming mode, the internal reference is proportional to the PWM duty input ($20\text{kHz} < F_{\text{DIM}} < 200\text{kHz}$). Do not leave this pin floating. 1Mega ohm resistor to GND is recommended.
EN	NA	2	Enable signal input of chip, active-H. Do not leave this pin floating. 1Mega ohm resistor to GND is recommended.
EP	NA		Chip ground. For good thermal dissipation, connect EP to the ground plane.

Block Diagram & Application circuit



Operation

The G2320 is a high-efficiency 1.5A synchronous buck-type LED driver with 2.4V to 6V input range. The device operates at typically 1.5MHz pulse width modulation (PWM) mode in full current range. The integrated switches have the capability to deliver up to 1.5A constant current and no need for external Schottky diode.

The G2320 support the ON/OFF dimming and Vref dimming. From 100Hz to 2kHz dimming frequency the G2320 operated with ON/OFF dimming. From 20KHz to 200KHz dimming frequency the G2320 operated with Vref dimming. The LED current dimming is achieved by adjusting the duty cycle of the DIM input with 1% to 100% range. Full protection methods are implemented including LED open, LED short, FB resistor open, FB resistor short and thermal shutdown.

UVLO Protection

The G2320 has input Under Voltage Lockout protection (UVLO). If the input voltage exceeds the UVLO rising threshold voltage (2.3V typ.), the converter resets and prepares the PWM for operation. If the input voltage falls below the UVLO falling threshold voltage during normal operation, the device will stop switching. The UVLO rising and falling threshold voltage has a hysteresis to prevent noise-caused reset.

Enable

For TDFN2X2-6 package, when the input voltage is

greater than the under voltage lockout threshold and enable pin with a logic-high (>1.2V) to enables the converter; a logic-low (<0.4V) forces the IC into shutdown mode. Do not leave this pin floating.

For SOT23-6, when the input voltage is greater than the under voltage lockout threshold and Dim pin with a logic-high (>1V) to enables the converter; a logic-low (<0.4V) long for 36ms to forces the IC into shutdown mode. Do not leave this pin floating.

Soft-Start (SS)

There is an internal built-in soft-start to ramp the output voltage at a fixed slew rate to avoid in-rush current.

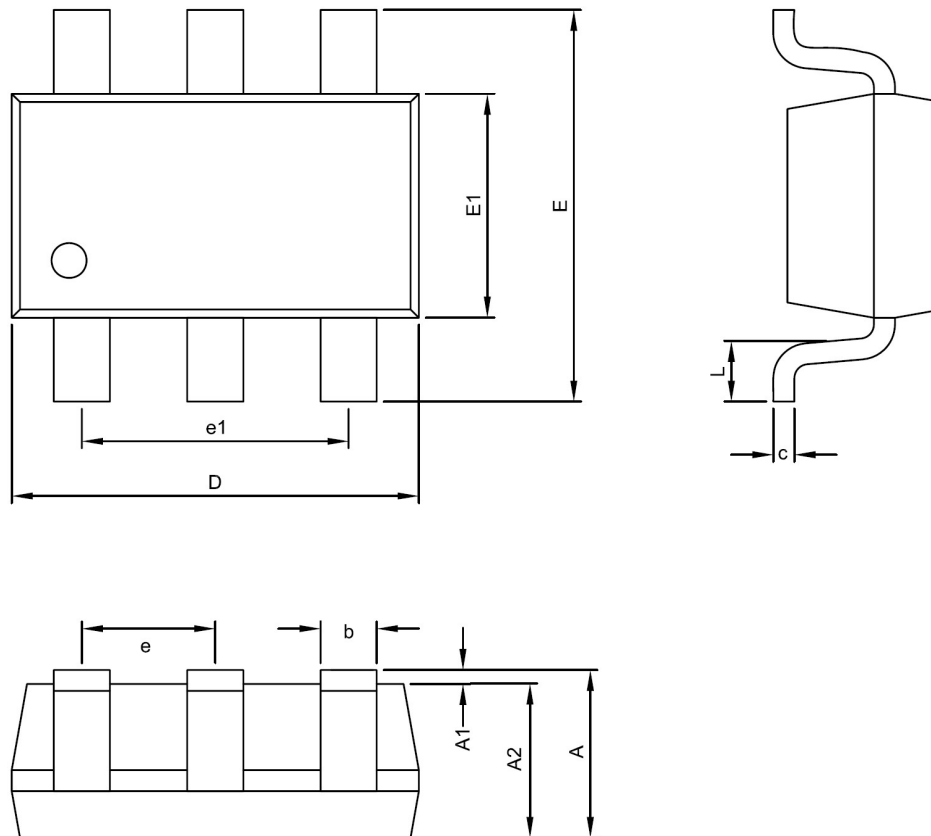
Current limit

The switch current limit prevents the device from high inductor current and drawing excessive current from input voltage supply. Excessive current might occur with a heavy load or shorted output circuit condition. The device adopts the peak current control by sensing the current of the high-side switch. Once the high-side switch current limit is reached, the high-side switch is turned off and low-side switch is turned on to discharge the inductor current.

Setting LED Current

The LED current is set by the external resistor between the LEDs cathode and GND. Because the FB pin voltage reference VFB_REF is fixed at 99 mV, the sensing resistor can be calculated by below Equation $I_{LED} = V_{FB} / R_{sense}$

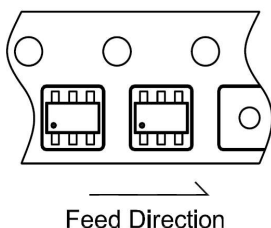
Package Information



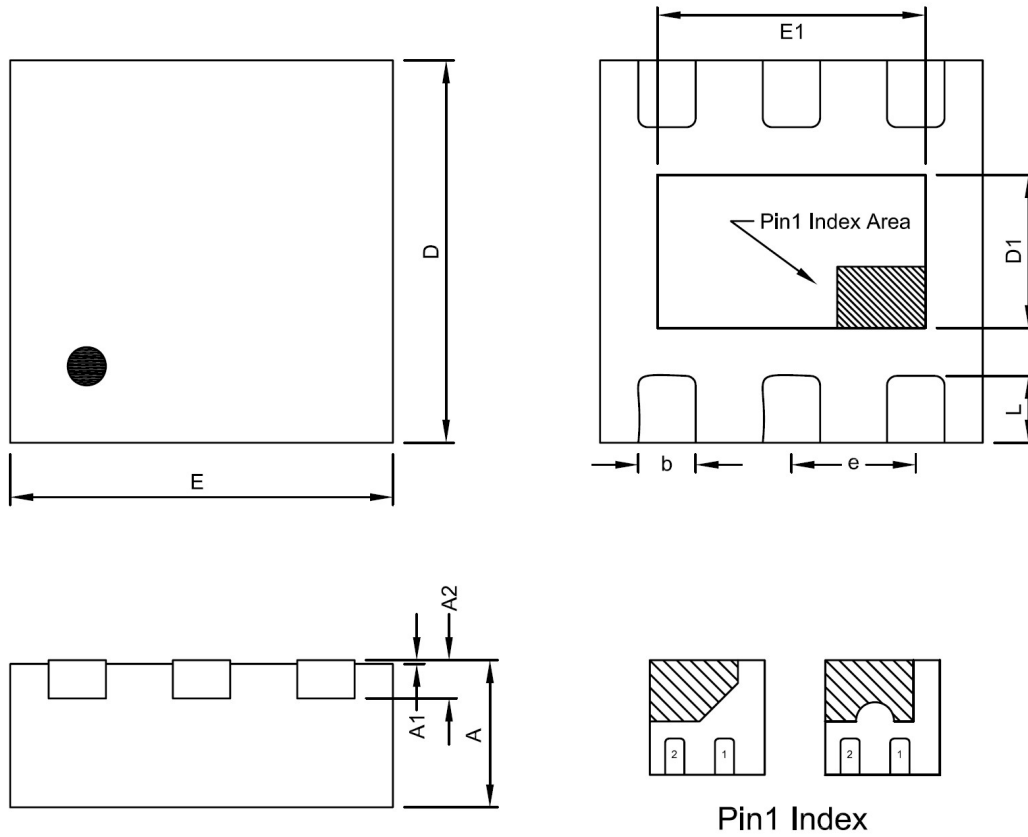
SOT23-6 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.10	1.45	0.037	0.043	0.057
A1	0.00	---	0.15	0.000	---	0.006
A2	0.90	1.10	1.30	0.035	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



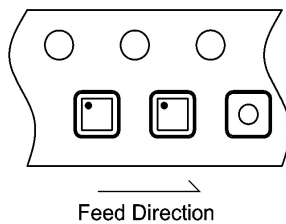
PACKAGE	Q'TY/REEL
SOT23-6	3,000 ea



TDFN2X2-6 Package

Symbol	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	0.20 REF			0.0079 REF		
D	1.95	2.00	2.05	0.0768	0.0787	0.0807
E	1.95	2.00	2.05	0.0768	0.0787	0.0807
D1	0.55	0.70	0.85	0.0217	0.0276	0.0335
E1	1.15	1.30	1.45	0.0453	0.0512	0.0571
b	0.20	0.30	0.35	0.0079	0.0118	0.0138
e	0.65 BSC			0.0256 BSC		
L	0.30	0.35	0.40	0.0118	0.0138	0.0157

Taping Specification



PACKAGE	Q'TY/REEL
TDFN2X2-6	3,000 ea

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