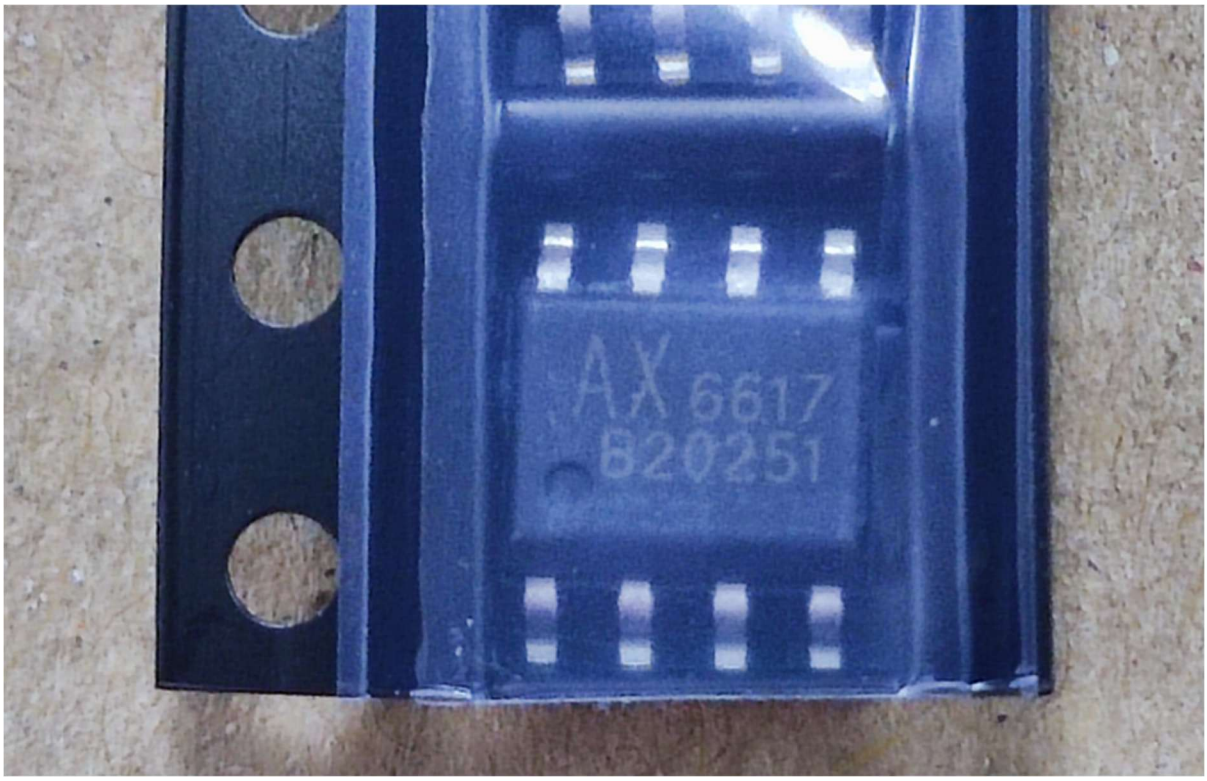


設計驗證
工程課
2025 -03- 05
發行
鈺緯科技開發股份有限公司

慧格科技股份有限公司
Hi-Gauge Technology Co.,LTD

承 認 書
APPROVAL SHEET

COMPANY	鈺緯科技開發股份有限公司
BRAND	AXELITE
PART NO.	AX6617BESA
PACKAGE	SOP-8L-EP
DESCRIPTION	3A Ultra Low Dropout Linear Regulator
Manufacture Type No.	3AAX661701Y(A0556)

We are pleased in sending you herewith our specification and drawings for your approval.
Please return to us one copy "APPROVAL SHEET" with your approved signatures.

承認章 (APPROVAL MARK)		
Date:		
	設計驗證 工程課 2025 -03- 05 發行 鈺緯科技開發股份有限公司	慧格科技(股)公司 發行章 Hi-Gauge Technology Co., Ltd.

PLEASE RETURN ONE SHEET AFTER YOUR EXAMIN ACTION WITH APPROVAL MARK AND SIGNATURE

Tel: 02-8227-7708 Fax: 02-8227-6009
新北市中和區建康路158號4樓
http://www.hgt-semi.com.tw

SENDING DATE: 3-Mar-25

3A Ultra Low Dropout Linear Regulator

❖ GENERAL DESCRIPTION

The AX6617 series is a 3A ultra low dropout linear regulator. This product is specifically designed to provide well supply voltage for front-side-bus termination on motherboards and NB applications. The IC needs two supply voltages, a control voltage for the circuitry and a main supply voltage for power conversion, to reduce power dissipation and provide extremely low dropout. The AX6617 series integrates many functions. A Power-On-Reset (POR) circuit monitors both supply voltages to prevent wrong operations. A thermal shutdown and current limit functions protect the device against thermal and current over-loads. A POK indicates the output status with time delay which is set internally. It can control other converter for power sequence. The AX6617 series can be enabled by other power system. Pulling and holding the EN pin below 0.6V shuts off the output.

The AX6617 series is available in SOP-8L-EP and TDFN-10L package, being applicable in 2~3W applications.

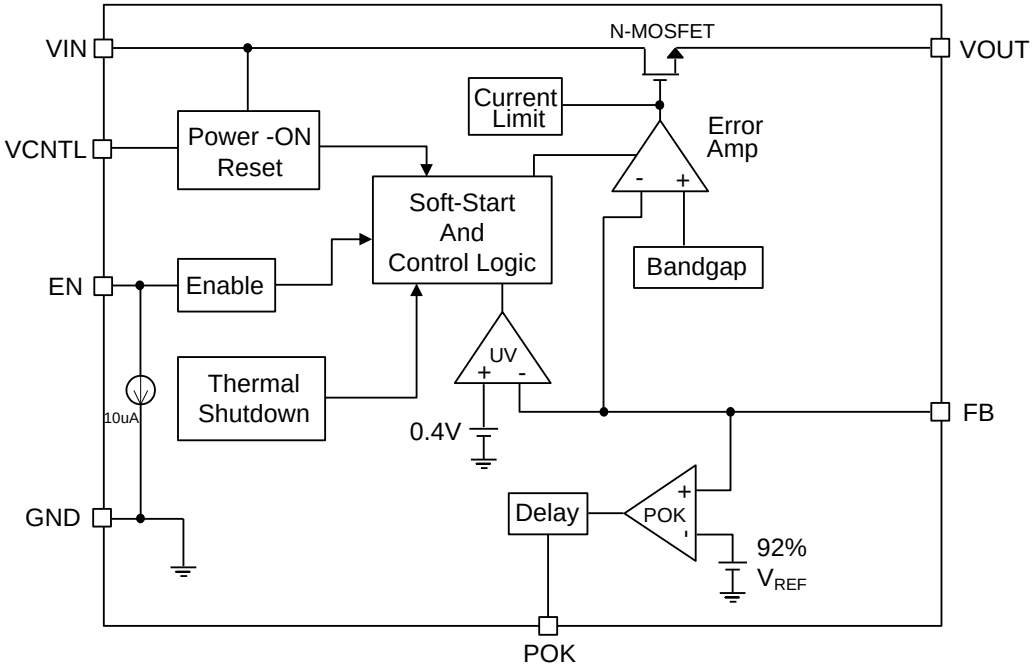
❖ FEATURES

- Ultra Low Dropout 0.23V(typical) @ 2A Output Current for 1.2V output Voltage
- Low ESR Output Capacitor (Multi-layer Chip Capacitors (MLCC)) Applicable
- EN internal pull-low for AX6617A
  EN internal pull-high for AX6617B
- Fast Transient Response
- Adjustable Output Voltage by External Resistors
- Power-On-Reset Monitoring on Both V_{CNTL} and V_{IN} Pins
- Internal Soft-Start
- Under-Voltage Protection
- Current-Limit and Thermal Shutdown Protection
- Power-OK Output with a Delay Time
- SOP-8L with Exposed and TDFN-10L Pad Pb-Free Package
- RoHS and Halogen free compliance

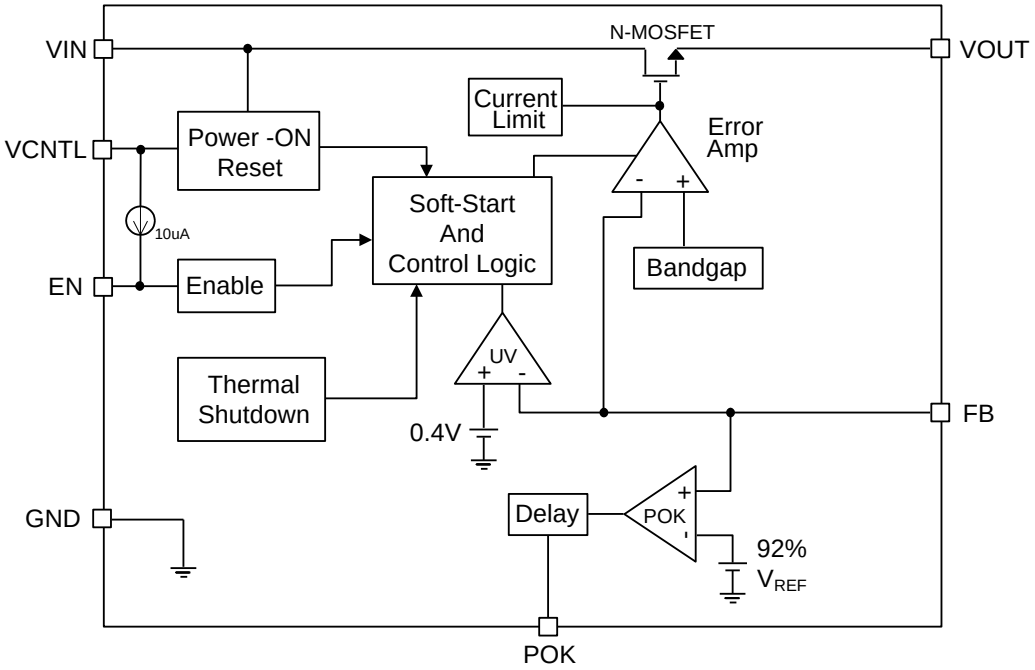
Axelite Confidential Materials, do not copy or distribute without written consent.

❖ BLOCK DIAGRAM

AX6617A:



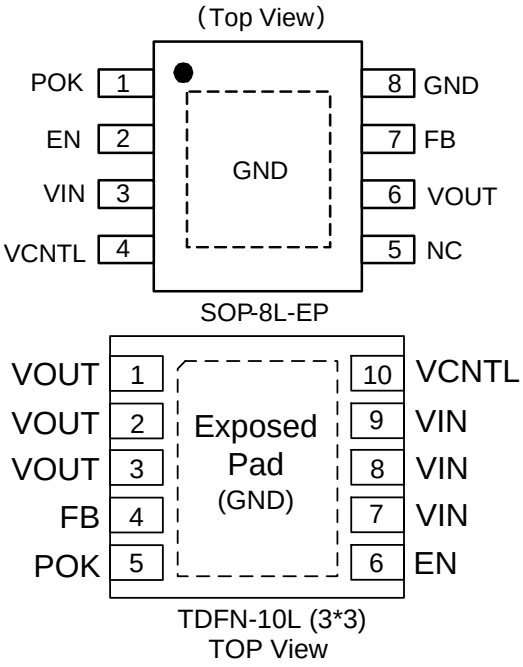
AX6617B:



Axelite Confidential Materials, do not copy or distribute without written consent.

❖ PIN ASSIGNMENT

The packages of AX6617 are SOP-8L-EP and TDFN-10L; the pin assignment is given by:



Name	Description
GND	GND pin
FB	Feedback pin
V_{OUT}	Output pin
EN	Internal Pull High (AX6617B) or Pull Low (AX6617A) EN=high → Enable EN=Low → Shutdown mode
POK	Power OK Output Pin
VCNTL	CNTL Pin Input Voltage
VIN	Input Voltage
NC	No connect

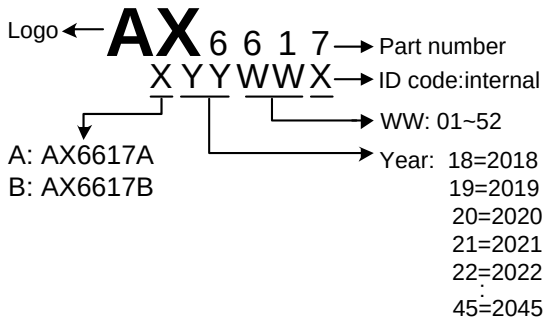
❖ ORDER/MARKING INFORMATION

Order Information

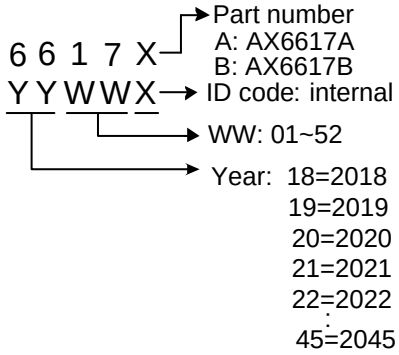
AX6617 X XXX X

- EN Function: A: EN pull low; B: EN pull high
- Package Type: ES: SOP-8L-EP; J10: TDFN-10L
- Packing: Blank: Tube; A: Taping

Top Marking (SOP-8L-EP)



Top Marking (TDFN-10L)



Axelite Confidential Materials, do not copy or distribute without written consent.

❖ ABSOLUTE MAXIMUM RATINGS (at T_A = 25°C)

Characteristics		Symbol	Rating	Unit
V_{CNTL} Supply Voltage		V_{CNTL}	-0.3 to 6.5	V
V_{IN} Supply Voltage		V_{IN}	-0.3 to 6.5	V
Output Voltage		V_{OUT}	0.8 to 6	V
EN and FB Pin Voltage		$V_{I/O}$	-0.3 to V_{CNTL}+0.3	V
Power good Voltage		V_{POK}	-0.3 to 6.5	V
Power Dissipation		PD	2.5	W
Storage Temperature Range		T_{ST}	-65 to +150	°C
Junction Temperature Range		T_J	-40 to 150	°C
Thermal Resistance from Junction to case	SOP-8L-EP	θ_{JC}	15	°C/W
	TDFN-10L		20	
Thermal Resistance from Junction to ambient	SOP-8L-EP	θ_{JA}	40	°C/W
	TDFN-10L		55	

Note: θ_{JA} is measured with the PCB copper area (need connect to Expose-Pad) of approximately 1.5 in^2 (Multi-layer)

❖ RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Conditions	Rating	Unit
Operating Junction Temperature Range	T_{OJ}		-40 to 125	°C
Operating Ambient Temperature Range	T_{OA}		-40 to 85	°C
VCNTL Supply Voltage	V_{CNTL}		3 to 6.0	V
V_{IN} Supply Voltage	V_{IN}		1.1 to 5.5	V
Output Voltage	V_{OUT}	V_{CNTL}-V_{OUT}>1.9V	0.8 to 2.8	V
Output Current	I_{OUT}		0 to 3	A

Axelite Confidential Materials, do not copy or distribute without written consent.

❖ ELECTRICAL CHARACTERISTICS

(V_{CNTL}= 5V, V_{IN}=1.8V, V_{OUT}=1.2V, T_A=25°C unless otherwise specified)

Characteristics	Symbol	Conditions		Min	Typ	Max	Units
VCNTL POR Threshold	V_{CNTL}			2.5	2.7	2.9	V
VCNTL POR Hysteresis	$V_{CNTL(hys)}$			-	0.4	-	V
VIN POR Threshold	$V_{IN(POR)}$			0.8	0.9	1.0	V
VIN POR Hysteresis	$V_{IN(hys)}$			-	0.5	-	V
VCNTL Nominal Supply Current	I_{CNTL}	EN= V_{CNTL}		0.4	1	1.5	mA
VCNTL Shutdown Current	I_{SD}	EN= 0V	AX6617A	-	-	1	uA
			AX6617B	-	10	30	
VIN Shutdown Current	I_{SD_VIN}	EN= 0V,FB=1	AX6617A	-	-	1	uA
			AX6617B	-	-	1	
Feedback Voltage	V_{FB}	V_{CNTL}=5V, I_{OUT} =10mA		0.788	0.8	0.812	V
Feedback Current	I_{FB}	V_{FB}=1V		-	5	-	nA
Line Regulation		V_{CNTL}= V_{EN} =5V V_{IN} = V_{OUT} + 0.5V~5V I_{OUT} =10mA		-	0.01	0.1	%/V
Load Regulation		I_{OUT}=0A ~ 2A		-	0.2	1	%
On Resistance	$R_{DS(ON)}$	I_{OUT}=100mA, V_{CNTL}=5.0V, V_{OUT}=1.2V		-	115	150	mΩ
Dropout Voltage	V_{DROP}	I_{OUT} = 2A, V_{CNTL}=5V	V_{OUT}=1.2V	-	0.23	0.3	V
VOUT Pull Low Resistance		EN=0V		-	90	-	Ω
Soft Start Time	T_{SS}			1	2	3	mS
EN Pin Logic input threshold voltage	V_{ENH}	Enable		1.2	-	-	V
	V_{ENL}	Disable		-	-	0.6	
EN Hysteresis				-	40	-	mV
EN Pin Pull- High or Pull- Low Current	I_{EN}	EN=5V, AX6617A		-	10	20	uA
		EN=GND, AX6617B		-	10	20	
Current Limit	I_{LIM}	V_{CNTL}=5V V_{IN}=V_{OUT}+1V		3.6	-	6	A
Ripple Rejection	V_{IN}	PSRR	F=120Hz, I_{OUT}=100mA	-	65	-	dB
	V_{CNTL}			-	65	-	
Inrush current		V_{CNTL}=5V, C_{OUT}=10uF EN startup, I_{OUT}=2A		-	0.5	-	A
Under-Voltage Threshold		V_{FB} Falling		-	0.4	-	V

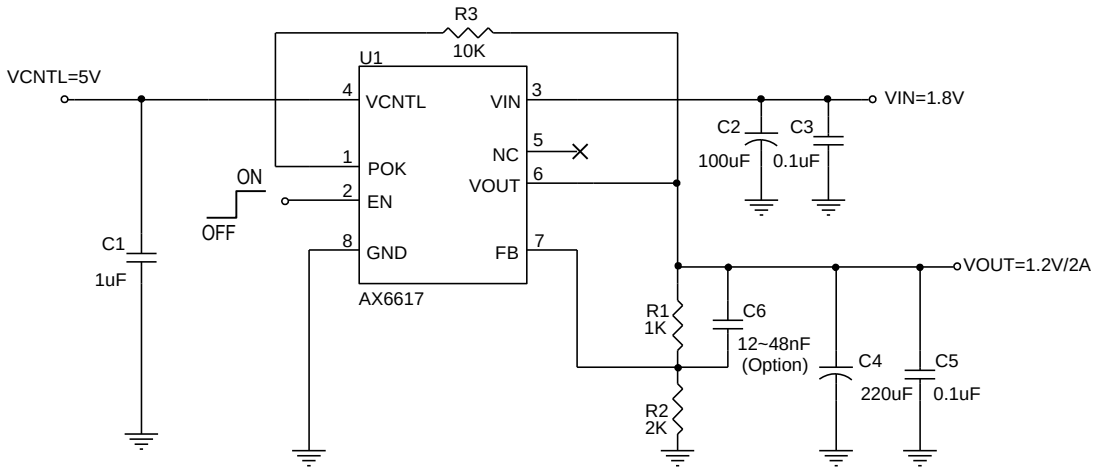
Axelite Confidential Materials, do not copy or distribute without written consent.

❖ ELECTRICAL CHARACTERISTICS (CONTINUOUS)

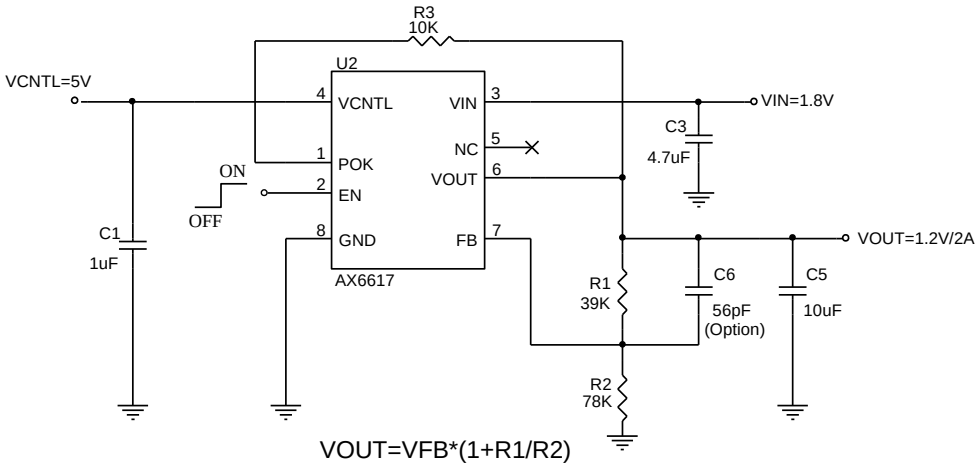
Characteristics	Symbol	Conditions	Min	Typ	Max	Units
POK Threshold Voltage for Power OK	V_{POK}	V_{FB} Rising	88%	92%	96%	V_{FB}
POK Threshold Voltage for Power Not OK	V_{PNOK}	V_{FB} Falling	-	81%	-	V_{FB}
POK Low Voltage		POK sinks 5mA	-	0.25	0.4	V
POK Delay Time	T_{DELAY}		0.8	2	4	mS
Thermal shutdown Temp	T_{SD}		-	160	-	°C
Thermal Shutdown Hysteresis	T_{SH}		-	40	-	°C

❖ APPLICATION CIRCUIT

1. Using an Aluminum Electrolytic Output Capacitor



2. Using an MLCC Output Capacitor



VOUT=VFB*(1+R1/R2)
VFB = 0.8V

Axelite Confidential Materials, do not copy or distribute without written consent.

❖ FUNCTION PIN DESCRIPTIONS

FB

Connecting this pin to an external resistor divider receives the feedback voltage of the regulator. The output voltage set by the resistor divider is determined by:

$$V_{OUT} = 0.8 \cdot \left(1 + \frac{R1}{R2}\right) \quad (V)$$

Where R1 is connected from VOUT to FB with Kelvin sensing and R2 is connected from FB to GND. A bypass capacitor may be connected with R1 in parallel to improve load transient response. The R2 range in 1K~4.7KΩ for AL output capacitor and 30K~100KΩ for MLCC output capacitor are recommended.

VIN

Main supply input pins for power conversions. The voltage at this pin is monitored for Power-On Reset purpose.

VCNTL

Power input pin of the control circuitry. Connecting this pin to a +5V (recommended) supply voltage provides the bias for the control circuitry. The voltage at this pin is monitored for Power-On Reset purpose.

POK

Power-OK signal output pin. This pin is an open-drain output used to indicate status of output voltage by sensing FB voltage. This pin is pulled low when the rising FB voltage is not above the VPOK threshold or the falling FB voltage is below the VPOK threshold, indicating the output is not OK.

EN

Enable control pin. Pulling and holding this pin below 0.6V shuts down the output. When re-enabled, the IC undergoes a new soft-start cycle. For AX6617B, this pin is internal pulled up to VCNTL voltage, enabling the regulator. For AX6617A, this pin is internal pulled down to GND voltage, shutdown the regulator. The pull-high or pull-low current is 10uA (typ.)

Axelite Confidential Materials, do not copy or distribute without written consent.

VOUT

Regulator output pin. Please connect Pin 6 using wide tracks. It is necessary to connect an output capacitor with this pin for closed-loop compensation and improving transient responses.

❖ FUNCTION DESCRIPTIONS

Power-On-Reset

A Power-On-Reset (POR) circuit monitors both input voltages at VCNTL and VIN pins to prevent wrong logic controls. The POR function initiates a soft-start process after the two supply voltages exceed their rising POR threshold voltages during powering on. The POR function also pulls low the POK pin regardless the output voltage when the VCNTL voltage falls below its falling POR threshold.

Internal Soft-Start

An internal soft-start function controls rise rate of the output voltage to limit the current surge at start-up. The typical soft-start interval is about 2mS.

Output Voltage Regulation

An error amplifier working with a temperature compensated 0.8V reference and an output NMOS regulates output to the preset voltage. The error amplifier designed with high bandwidth and DC gain provides very fast transient response and less load regulation. It compares the reference with the feedback voltage and amplifies the difference to drive the output NMOS which provides load current from VIN to VOUT.

Current-Limit

The AX6617 monitors the current via the output NMOS and limits the maximum current to prevent load and AX6617 from damages during overload or short circuit conditions.

Axelite Confidential Materials, do not copy or distribute without written consent.

Under-Voltage Protection (UVP)

The AX6617 monitors the voltage on FB pin after soft-start process is finished. Therefore the UVP is disabling during soft-start. When the voltage on FB pin falls below the under-voltage threshold, the UVP circuit shuts off the output immediately. After a while, the AX6617 starts a new soft-start to regulate output.

Thermal Shutdown

A thermal shutdown circuit limits the junction temperature of AX6617. When the junction temperature exceeds +160°C, a thermal sensor turns off the output NMOS, allowing the device to cool down. The regulator regulates the output again through initiation of a new soft-start cycle after the junction temperature cools by 40°C, resulting in a pulsed output during continuous thermal overload conditions. The thermal shutdown designed

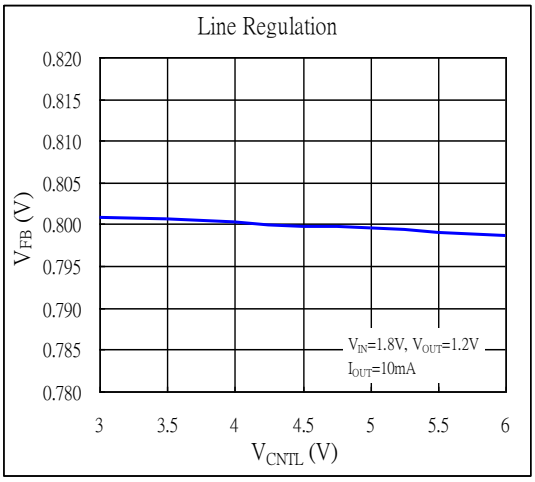
❖ APPLICATION INFORMATION

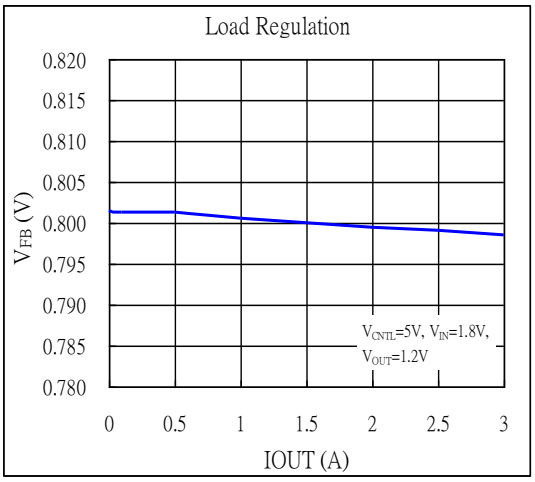
Capacitor Selection

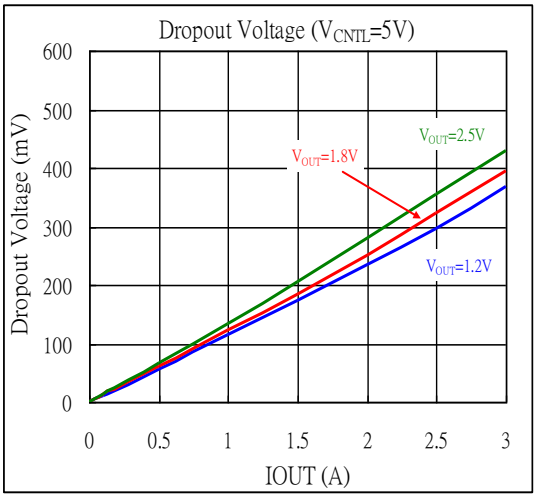
Normally, use a MLCC capacitor on the input and output of the AX6617. Larger input capacitor values provide better supply-noise rejection and transient response. A higher-value output capacitor may be necessary if large, fast transients are anticipated and the device is located several inches from the power source. The X5R and X7R type in MLCC is recommended. For aluminum electrolytic capacitor application, 100uF in input capacitor and 220uF in output capacitor (30mΩ < ESR < 200mΩ) are recommended. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR.

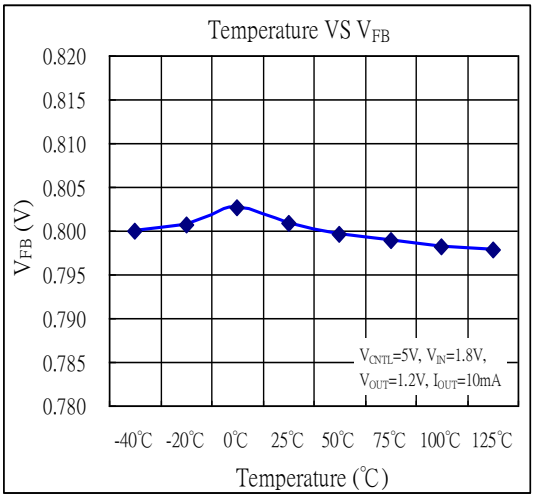
Axelite Confidential Materials, do not copy or distribute without written consent.

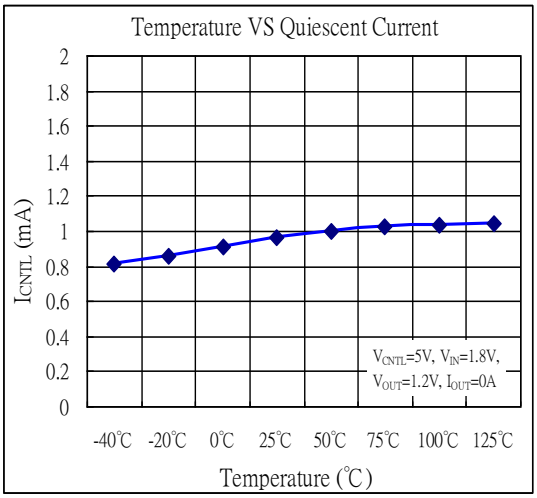
❖ TYPICAL CHARACTERISTICS

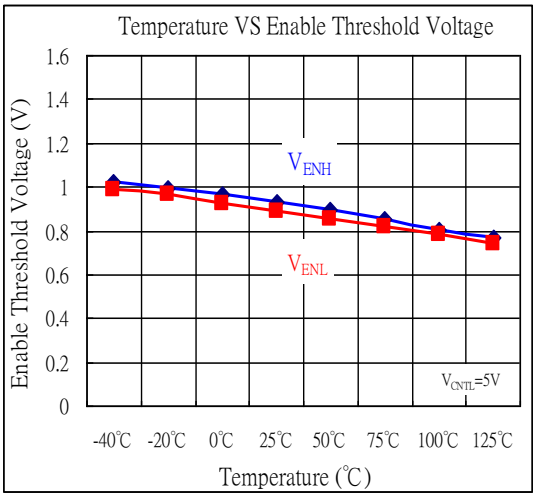






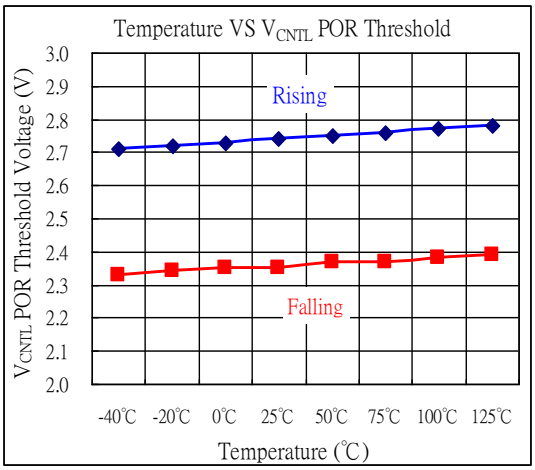


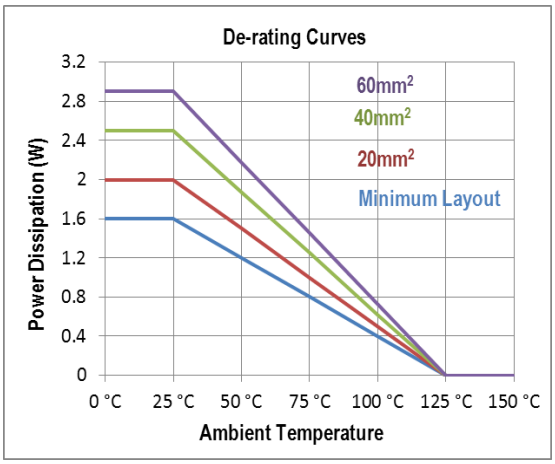




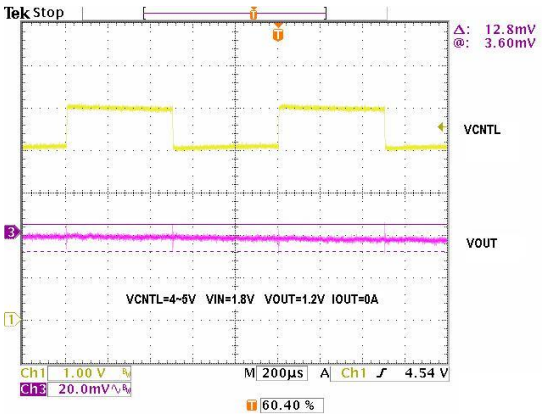
Axelite Confidential Materials, do not copy or distribute without written consent.

❖ TYPICAL CHARACTERISTICS (CONTINUOUS)

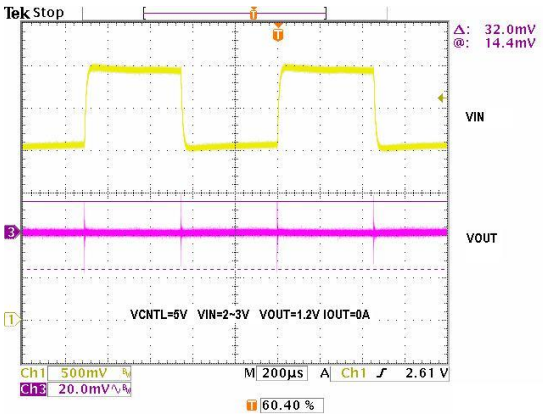




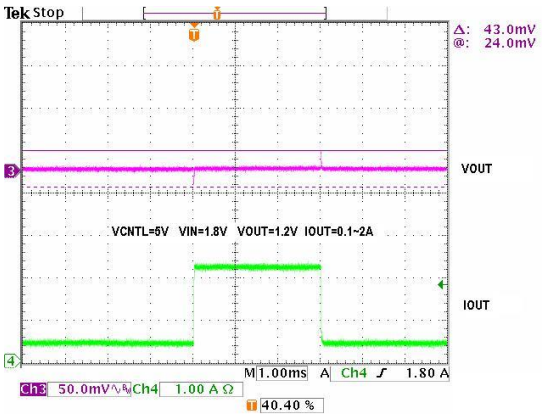
Line Transient



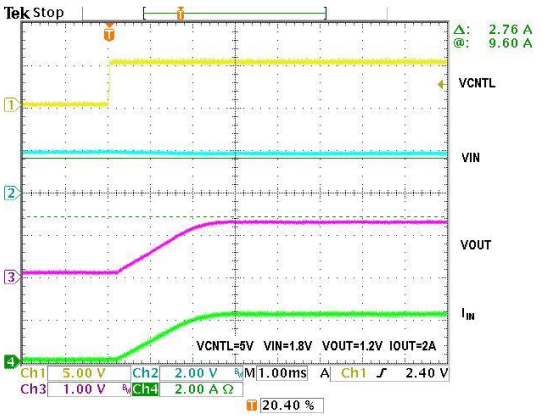
Line Transient



Load Transient



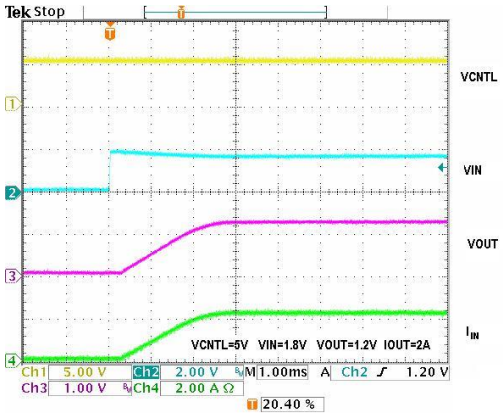
VCNTL Power –ON



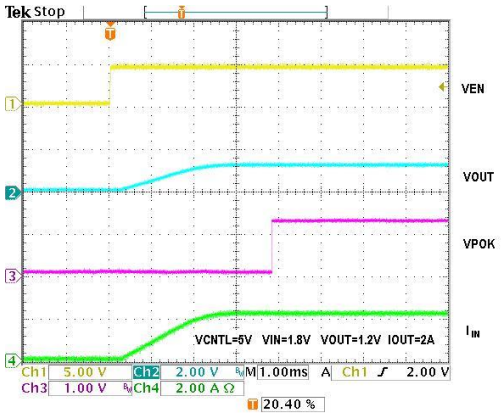
Axelite Confidential Materials, do not copy or distribute without written consent.

❖ TYPICAL CHARACTERISTICS (CONTINUOUS)

VIN Power –ON



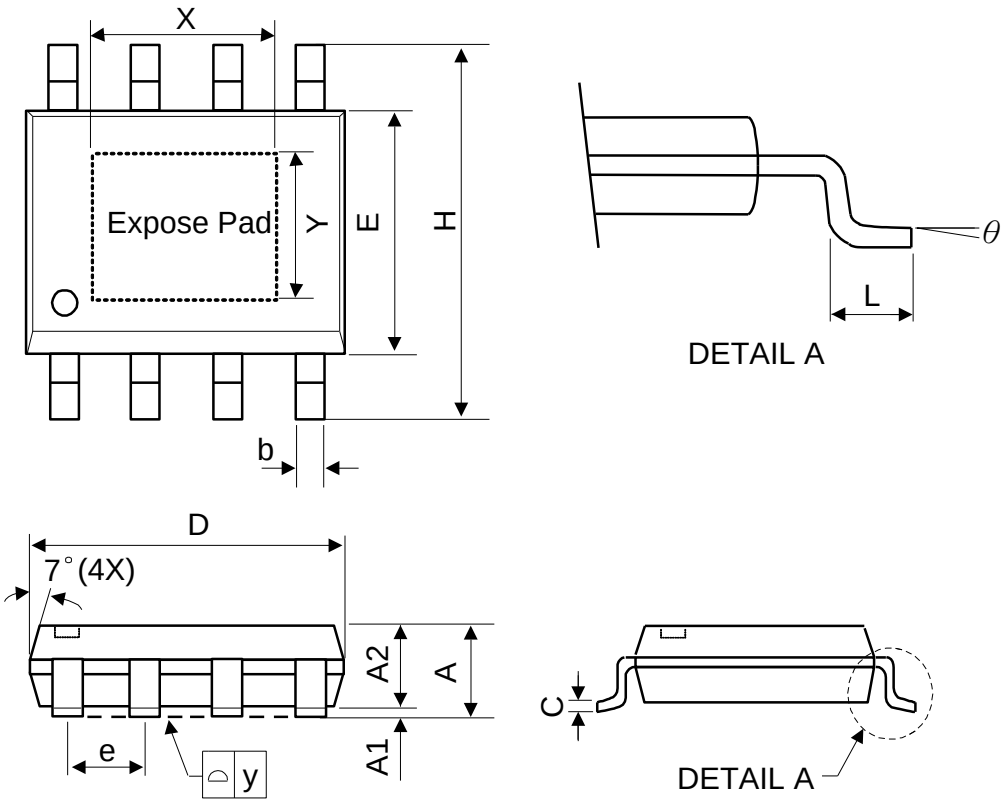
Enable –ON with POK Delay



Axelite Confidential Materials, do not copy or distribute without written consent.

❖ PACKAGE OUTLINES

(1) SOP-8L-EP



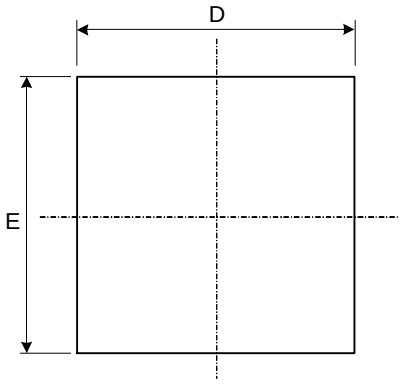
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0	-	0.15	0	-	0.06
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
X	-	2.34	-	-	0.092	-
Y	-	2.34	-	-	0.092	-
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side

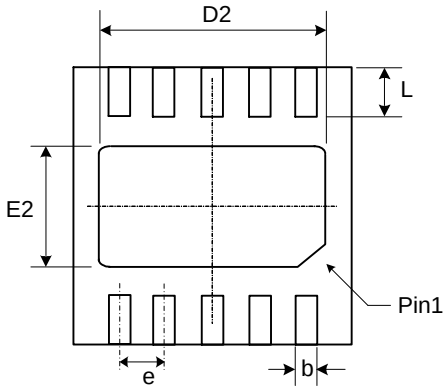
JEDEC outline: MS-012 BA

Axelite Confidential Materials, do not copy or distribute without written consent.

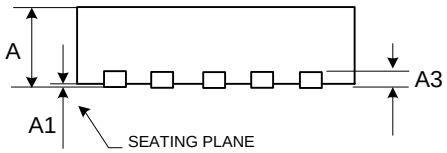
(2) TDFN-10L (3*3 0.75mm)



(Top View)



(Bottom View)



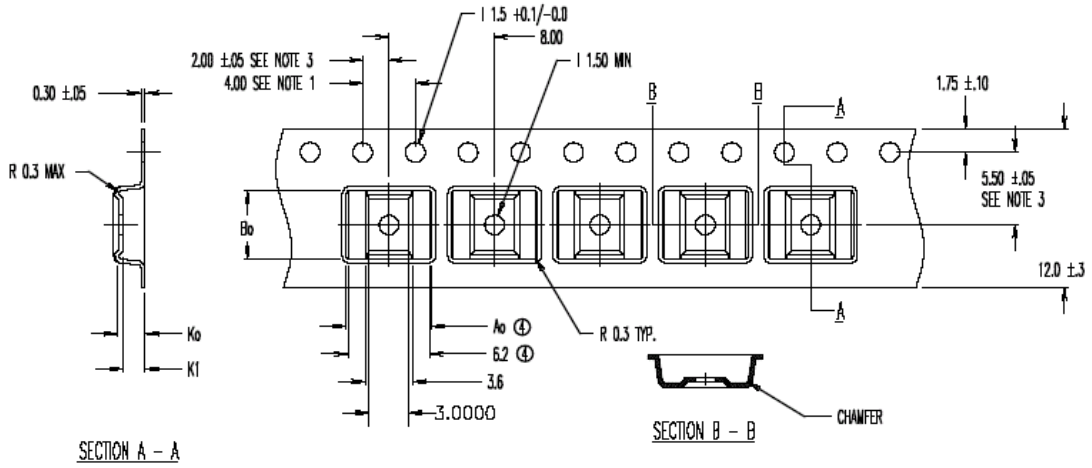
(SIDE View)

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.7	0.75	0.8	0.028	0.03	0.031
A1	0	0.02	0.05	0	0.001	0.002
A3	0.20 REF.			0.008 REF.		
b	0.18	0.25	0.3	0.007	0.01	0.012
D	2.9	3	3.1	0.114	0.118	0.122
D2	2.2	2.4	2.5	0.087	0.094	0.098
E	2.9	3	3.1	0.114	0.118	0.122
E2	1.5	1.6	1.7	0.059	0.063	0.07
e	0.50 BSC.			0.020 BSC.		
L	0.3	0.4	0.5	0.012	0.016	0.02

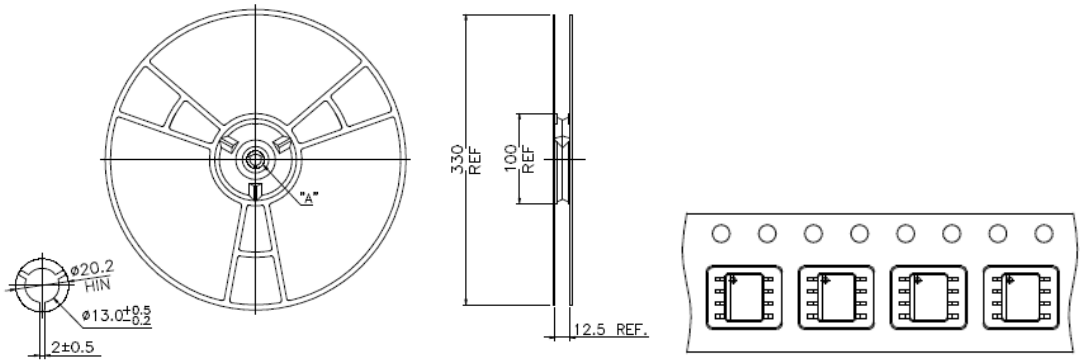
Axelite Confidential Materials, do not copy or distribute without written consent.

❖ CARRIER TAPE DIMENSION

(1) SOP8L-EP

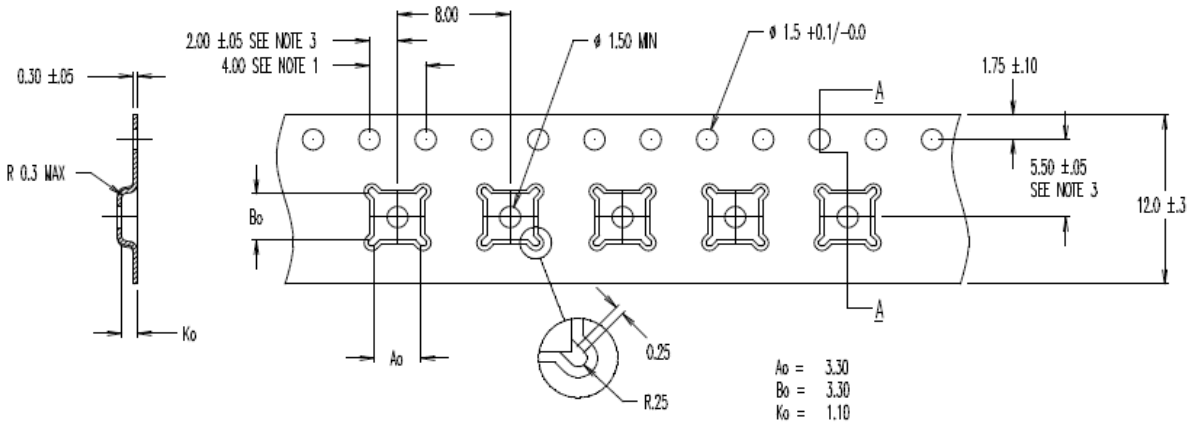


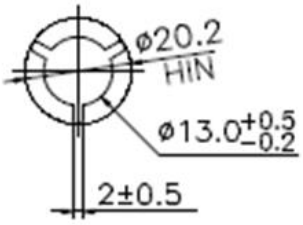
Ao =	6.50
Bo =	5.20
Ko =	2.10
K1 =	1.70

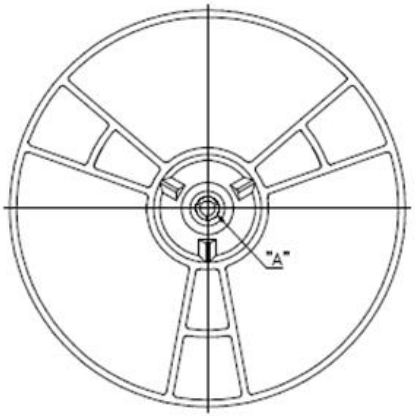


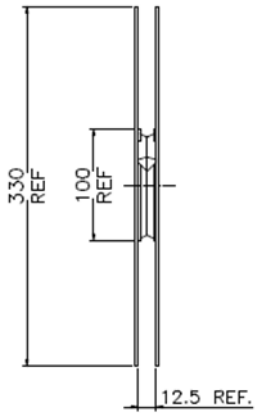
Axelite Confidential Materials, do not copy or distribute without written consent.

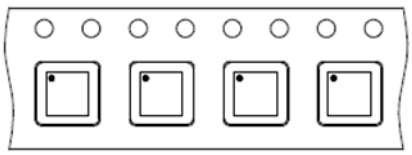
(2) TDFN-10L (3*3 0.75mm)











Axelite Confidential Materials, do not copy or distribute without written consent.