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FAIRCHILD SEMICONDUCTOR®

April 2013

FAN7527B
Power Factor Correction Controller

Features

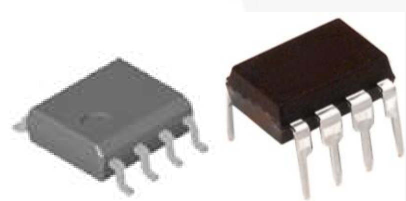
- Internal Startup Timer
- Internal R/C Filter Eliminates the Need for External R/C Filter
- Precise Adjustable Output Over-Voltage Protection
- Zero Current Detector
- One Quadrant Multiplier
- Trimmed 1.5% Internal Band Gap Reference
- Under-Voltage Lockout with 3 V of Hysteresis
- Totem-Pole Output with High-State Clamp
- Low Startup and Operating Current
- 8-Pin SOP or 8-Pin DIP

Applications

- Electronic Ballast
- SMPS

Description

The FAN7527B provides simple and high-performance active Power Factor Correction (PFC). The FAN7527B is optimized for electronic ballasts and low–power, high-density power supplies that require minimum board size, reduced external components, and low power dissipation. Because the R/C filter is included in the current-sense block, an external R/C filter is not necessary. Special circuitry prevents no-load runaway conditions. Regardless of the supply voltage, the output drive clamping circuit limits the overshoot of the power MOSFET gate drive, which improves system reliability.



Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
FAN7527BMX	-25 to +125°C	8-Lead, Small Outline Package (SOP)	Tape and Reel
FAN7527BN	-25 to +125°C	8-Lead, Dual Inline Package (DIP)	Tube

Block Diagram

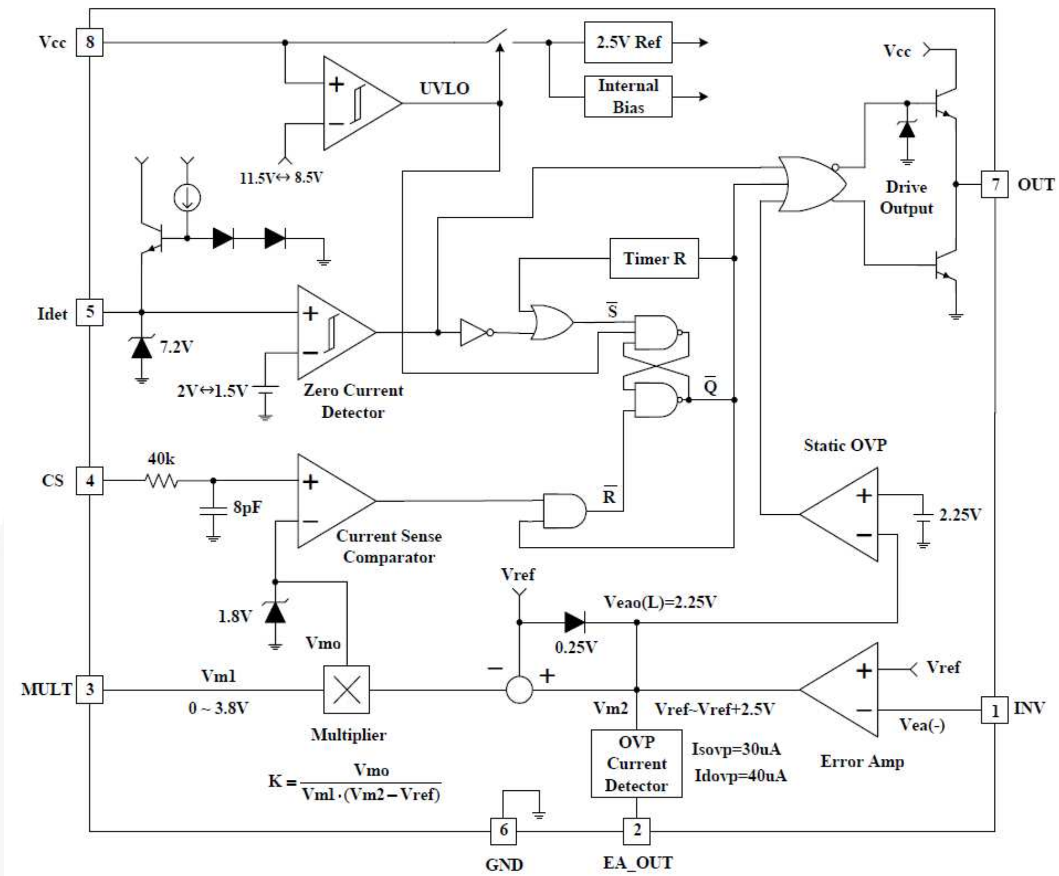


Figure 1. Block Diagram

Pin Configuration

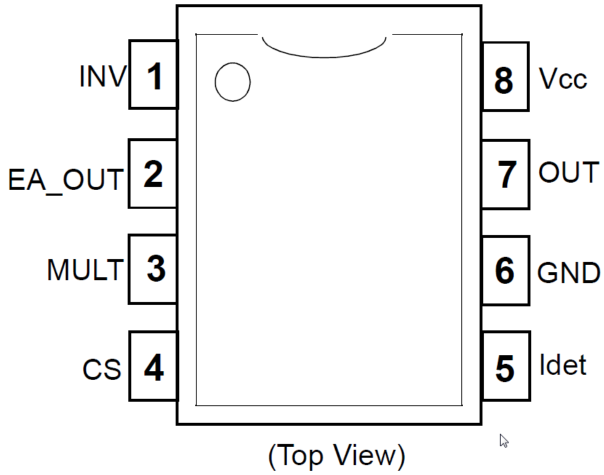


Figure 2. Pin Configuration

Pin Definitions

Pin #	Name	Description
1	INV	Inverting input of the error amplifier. The output of the boost converter should be resistively divided to 2.5 V and connected to this pin.
2	EA_OUT	Output of the error amplifier. Feedback compensation network is placed between this pin and the INV pin.
3	MULT	Input to the multiplier stage. The full-wave rectified AC voltage is divided to less than 2 V and is connected to this pin.
4	CS	Input of the PWM comparator. The MOSFET current is sensed by a resistor and the resulting voltage is applied to this pin. An internal R/C filter is included to reject high-frequency noise.
5	Idet	Zero Current Detection (ZCD) input.
6	GND	Ground
7	OUT	Gate driver output. Push-pull output stage is able to drive the power MOSFET with a peak current of 500 mA.
8	V_{CC}	Supply voltage of driver and control circuits.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Supply Voltage			30	V
I_{OH}, I_{OL}	Peak Drive Output Current			±500	mA
I_{CLAMP}	Driver Output Clamping Diodes $V_O > V_{CC}$ or V_O<-0.3 V			±10	mA
I_{DET}	Detector Clamping Diodes			±10	mA
V_{IN}	Error Amplifier Multiplier and Comparator Input Voltages		-0.3	6.0	V
T_J	Operation Junction Temperature			+150	°C
T_{OPR}	Operating Temperature Range		-25	+125	°C
T_{STG}	Storage Temperature Range		-65	+150	°C
P_D	Power Dissipation	8-SOP		0.8	W
		8-DIP		1.1	W
Θ_{JA}	Thermal Resistance Junction-Ambient	8-SOP		150	°C/W
		8-DIP		110	°C/W

Temperature Characteristics

-25°C ≤ T_A ≤ 125°C.

Symbol	Parameter	Min.	Typ.	Max.	Unit
ΔV_{REF}	Temperature Stability Reference Voltage (V_{REF})		20		mV
$\Delta K/\Delta T$	Temperature Stability for Multiplier Gain (K)		-0.2		% / °C

Electrical Characteristics

V_{CC}= 14 V, -25°C ≤ T_A ≤ 125°C, unless otherwise stated.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Under-Voltage Lockout						
$V_{th(st)}$	Start Threshold Voltage	V_{CC} Increasing	10.5	11.5	12.5	V
$H_{Y(st)}$	UVLO Hysteresis		2	3	4	V
Supply Current Section						
I_{ST}	Startup Supply Current	V_{CC} = $V_{th(st)}$ -0.2 V	10	60	100	µA
I_{CC}	Operating Supply Current	Output Not Switching		3	6	mA
$I_{CC(OVP)}$	Operating Current at OVP	V_{INV} = 3 V		1.7	4.0	mA
I_{DCC}	Dynamic Operating Supply Current	50 kHz, C_I = 1 nF		4	8	mA
Error Amplifier Section						
V_{REF}	Voltage Feedback Input Threshold	I_{REF} = 0 mA, T_A = 25°C	2.465	2.500	2.535	V
		25°C ≤ T_A ≤ 125°C	2.440	2.500	2.560	
ΔV_{FEF1}	Line Regulation	14 V ≤ V_{CC} ≤ 25 V		0.1	10.0	mV
ΔV_{FEF3}	Temperature Stability of V_{REF} (1)	-25°C ≤ T_A ≤ 125°C		20		mV
$I_{b(ea)}$	Input Bias Current		-0.5		0.5	µA
I_{SOURCE}	Output Source Current	V_{M2} = 4 V	-2	-4		mA
I_{SINK}	Output Sink Current	V_{M2} = 4 V	2	4		mA
$V_{EAO(H)}$	Output Upper Clamp Voltage(1)	I_{SOURCE} = 0.1 mA		6		V
$V_{EAO(L)}$	Output Lower Clamp Voltage(1)	I_{SINK} = 0.1 mA		2.25		V
G_V	Large Signal Open-Loop Gain(1)		60	80		dB
PSRR	Power Supply Rejection Ratio(1)	14 V ≤ V_{CC} ≤ 25 V	60	80		dB
GBW	Unity Gain Bandwidth(1)			1		MHZ
SR	Slew Rate(1)			0.6		V/µs
Multiplier Section						
$I_{b(m)}$	Input Bias Current (Pin 3)		-0.5		0.5	µA
ΔV_{M1}	M1 Input Voltage Range (Pin 3)				3.8	V
ΔV_{M2}	M2 Input Voltage Range (Pin 2)		V_{REF}		V_{REF}+2.5	V
K	Multiplier Gain(1)	V_{M1} = 1 V, V_{M2} = 3.5 V	0.36	0.44	0.52	1 / V
$V_{OMAX(m)}$	Maximum Multiplier Output Voltage	V_{INV} =0 V, V_{M1} = 4 V	1.65	1.80	1.95	V
$\Delta K/\Delta T$	Temperature Stability of K(1)	-25 ≤ T_A ≤ 125°C		-0.2		% / °C
Current Sense Section						
$V_{IO(CS)}$	Input Offset Voltage(1)	V_{M1} = 0 V, V_{M2} = 2.2 V	-10	3	10	mV
$I_{b(CS)}$	Input Bias Current	0 V ≤ V_{CS} ≤ 1.7 V	-1.0	-0.1	1.0	µA
$t_{D(CS)}$	Current Sense Delay to Output(1)			200	500	ns

Continued on the following page…

Electrical Characteristics (Continued)

V_{CC}= 14 V, -25°C ≤ T_A ≤ 125°C, unless otherwise stated.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Zero Current Detect Section						
$V_{TH(DET)}$	Input Voltage Threshold	V_{DET} Increasing	1.7	2.0	2.3	V
$H_{Y(DET)}$	Detect Hysteresis		0.2	0.5	0.8	V
$V_{CLAMP(I)}$	Input Low Clamp Voltage	I_{DET} = -100 µA	0.45	0.75	1.00	V
$V_{CLAMP(H)}$	Input High Clamp Voltage	I_{DET} = 3 mA	6.5	7.2	7.9	V
$I_{b(DET)}$	Input Bias Current	1 V ≤ V_{DET} ≤ 5 V	-1.0	-0.1	1.0	µA
$I_{CLAMP(D)}$	Input High/Low Clamp Diode Current(1)				±3	mA
Output Section						
V_{OH}	Output Voltage High	I_O = -10 mA	10.5	11.0		V
V_{OL}	Output Voltage Low	I_O = 10 mA		0.8	1.0	V
t_R	Rising Time(1)	C_L = 1 nF		130	200	ns
t_F	Falling Time(1)	C_L = 1 nF		50	120	ns
$V_{OMAX(O)}$	Maximum Output Voltage	V_{CC} = 20 V, I_O = 100 µA	12	14	16	V
$V_{OMIN(O)}$	Output Voltage with UVLO Activated	V_{CC} = 5 V, I_O = 100 µA			1	V
Restart Timer Section						
$t_{D(RST)}$	Restart Time Delay	V_{M1} = 1 V, V_{M2} = 3.5 V		150		µs
Over-Voltage Protection Section						
I_{SOVP}	Soft OVP Detecting Current		25	30	35	µA
I_{DOVP}	Dynamic OVP Detecting Current		35	40	45	µA
V_{OVP}	Static OVP Threshold Voltage	V_{INV} = 2.7 V	2.10	2.25	2.40	V

Note:
1. These parameters, although guaranteed, are not 100% tested in production.

Multiplier Gain:

$$K = \frac{Pin4\_Threshold}{V_{M1} \times (V_{M2} - V_{REF})}$$

where $V_{M1} = V_{PIN3}$, $V_{M2} = V_{PIN2}$

Typical Performance Characteristics

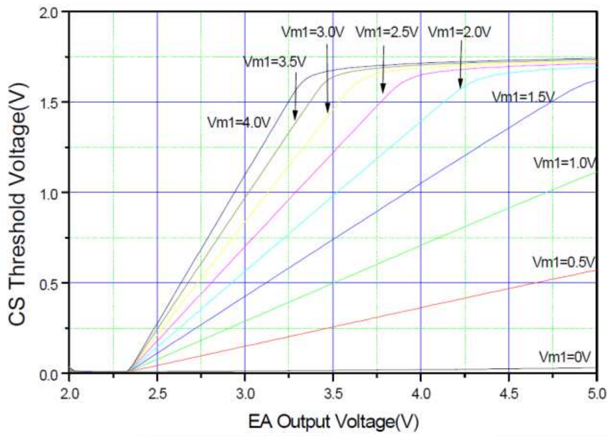


Figure 3. Error Amplifier Output Voltage vs. Current Sensing Threshold

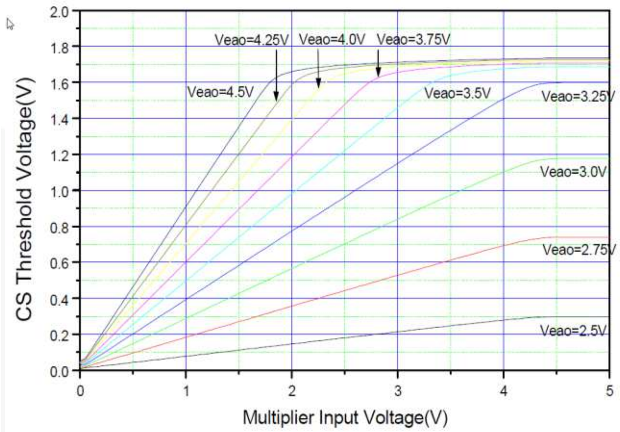


Figure 4. Multiplier Input Voltage vs. Current Sensing Threshold

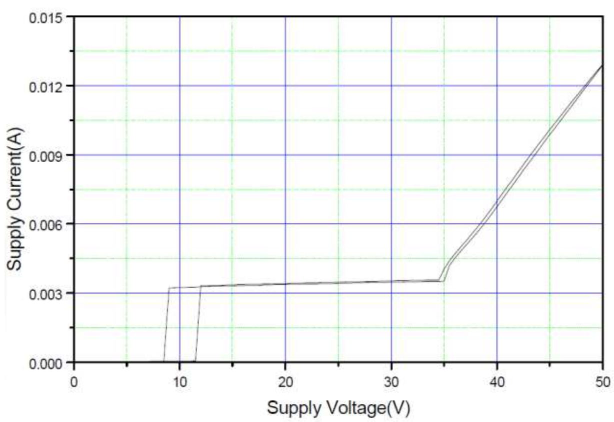


Figure 5. Supply Current vs. Supply Voltage

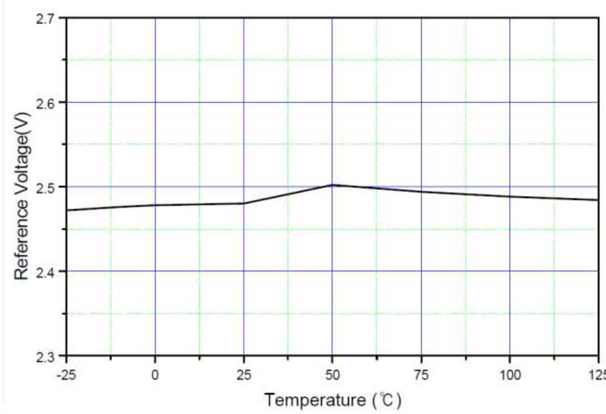


Figure 6. Reference Voltage vs. Temperature

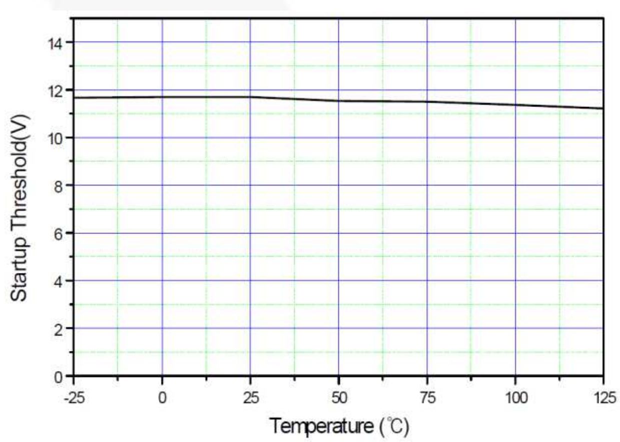


Figure 7. Startup Threshold vs. Temperature

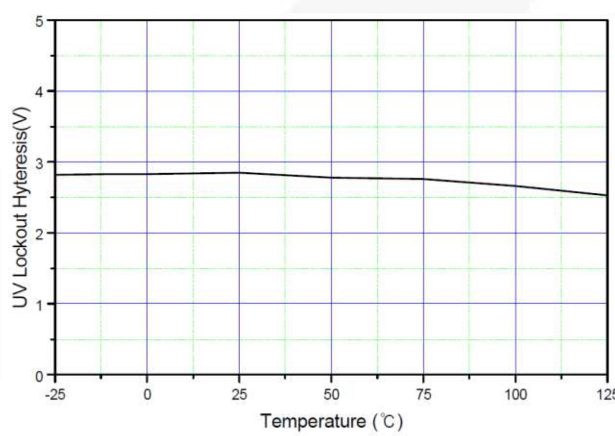


Figure 8. UVLO Hysteresis vs. Temperature

Typical Performance Characteristics (Continued)

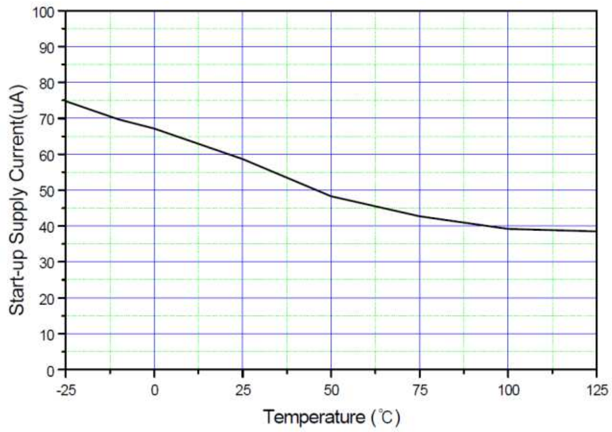


Figure 9. Startup Supply Current vs. Temperature

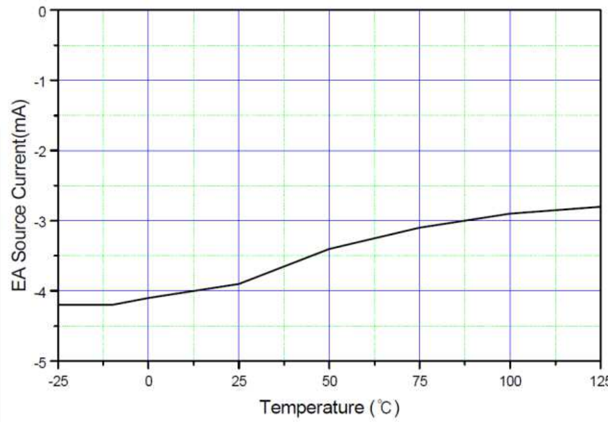


Figure 10. Error Amplifier Source Current

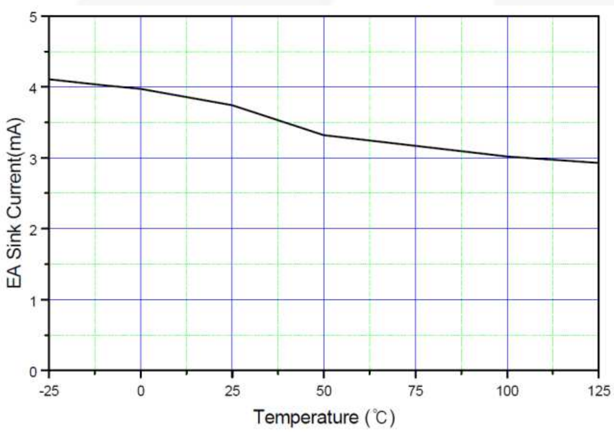


Figure 11. Error Amplifier Sink Current vs. Temperature

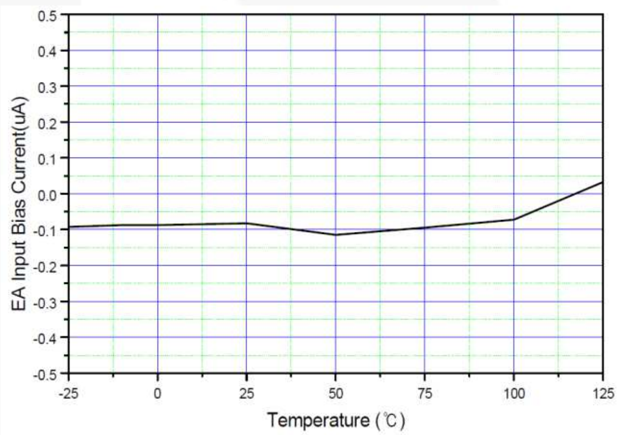


Figure 12. Error Amplifier Input Bias Current vs. Temperature

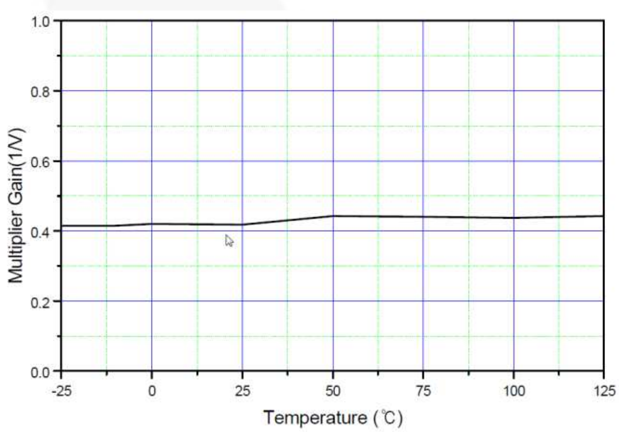


Figure 13. Multiplier Gain vs. Temperature

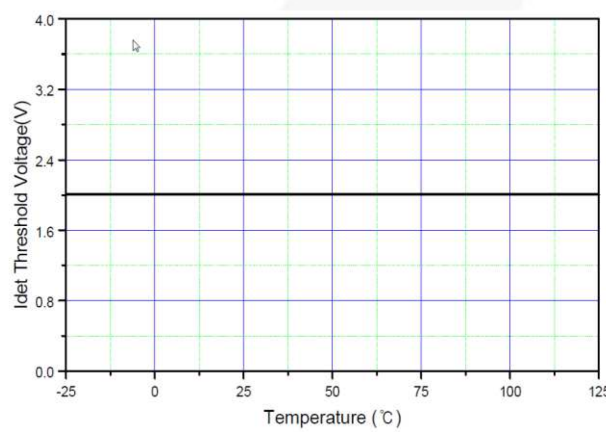


Figure 14. I_{DET} Threshold Voltage vs. Threshold

Typical Performance Characteristics (Continued)

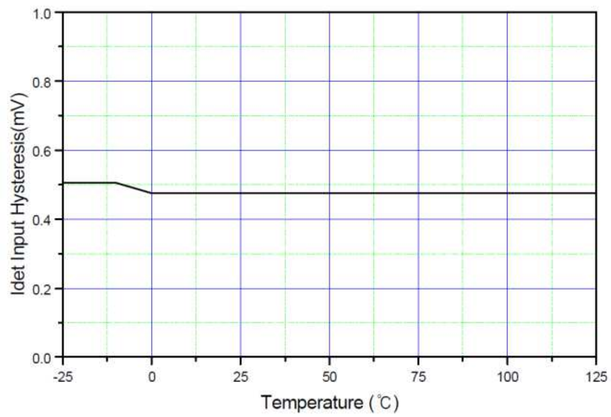


Figure 15. IDET Input Hysteresis vs. Temperature

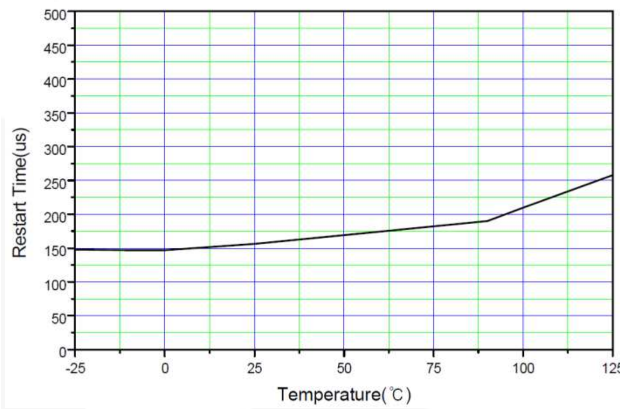


Figure 16. Restart Time vs. Temperature

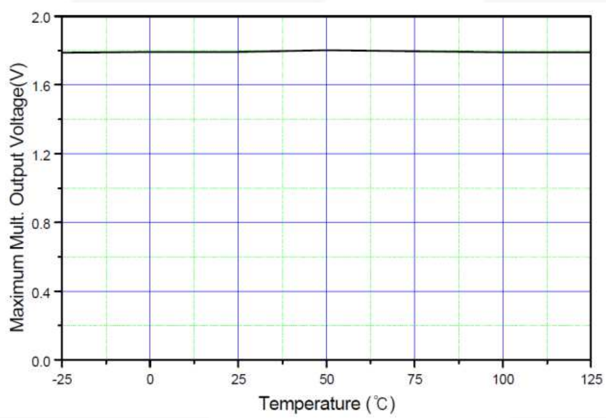


Figure 17. Maximum Multiplier Output Voltage vs. Temperature

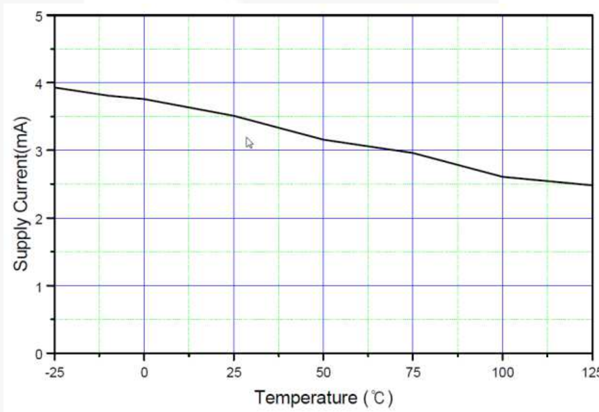
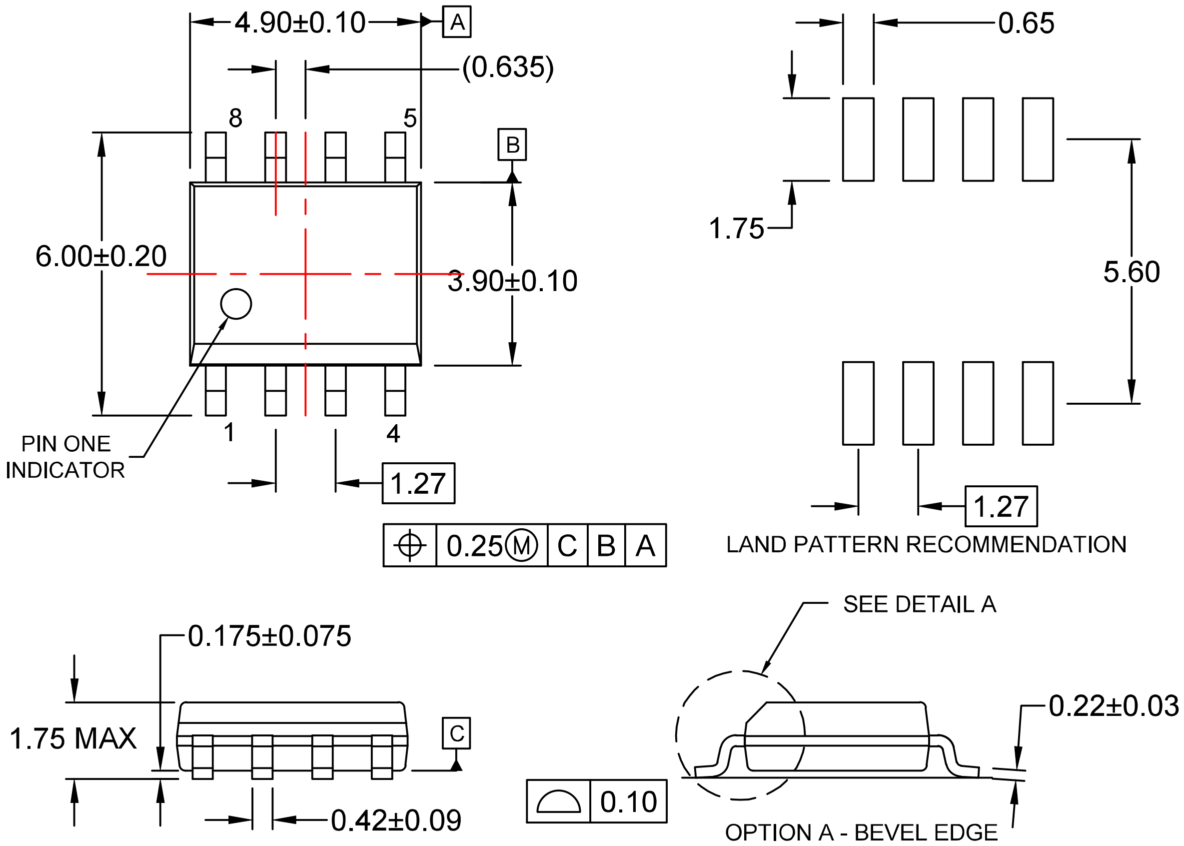
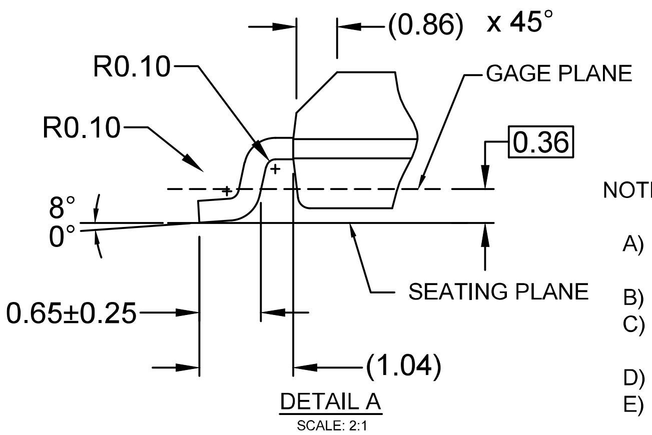
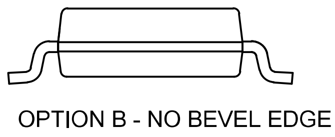


Figure 18. Supply Current vs. Temperature







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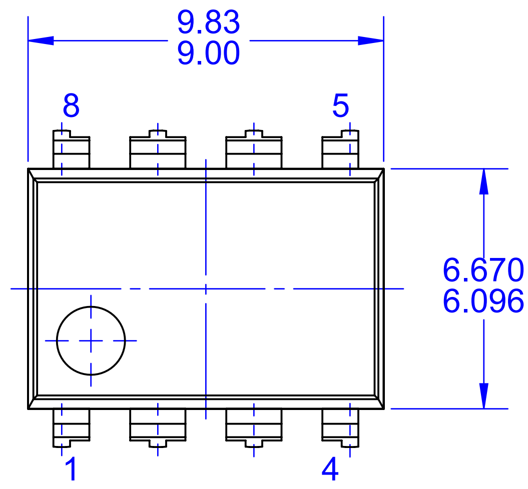
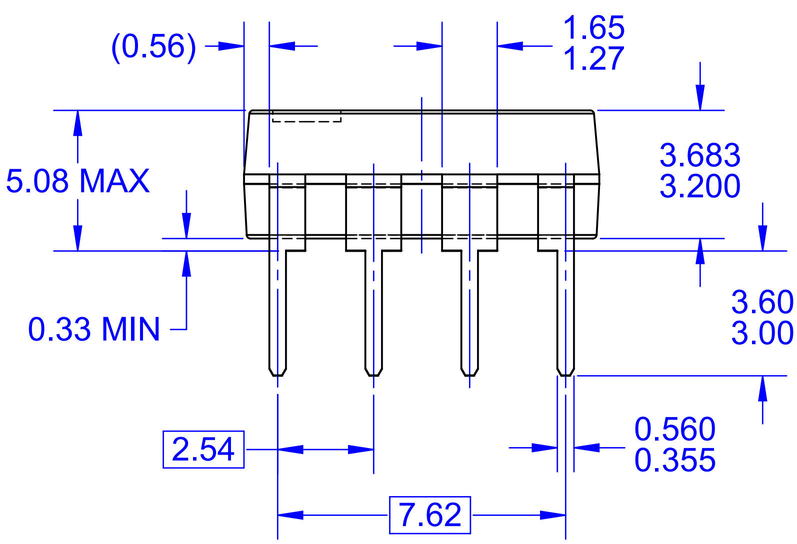
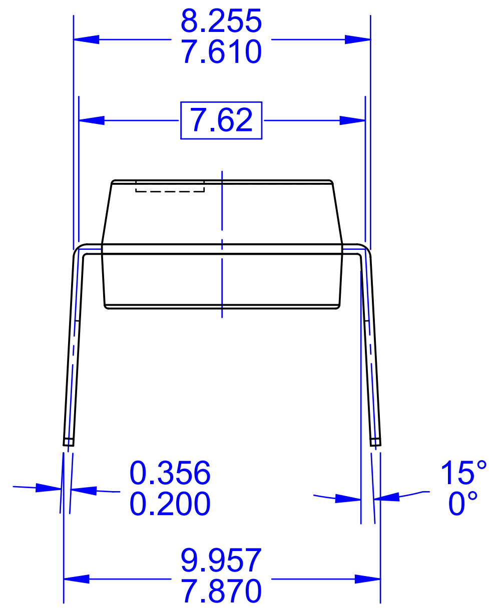


TOP VIEW



FRONT VIEW



SIDE VIEW

NOTES:

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