Lead-Free

AZ7500B

PULSE-WIDTH-MODULATION CONTROL CIRCUITS

Description

The DIODES™ AZ7500B is a voltage mode pulse-width-modulation switching regulator control circuit designed primarily for power supply control.

The AZ7500B consists of a reference voltage circuit, two error amplifiers, an on-chip adjustable oscillator, a dead-time control (DTC) comparator, a pulse-steering control flip-flop, and an output control circuit. The precision of voltage reference (V_{REF}) is improved up to ±1% through trimming and this provides a better output voltage regulation. The AZ7500B provides for push-pull or single-ended output operation, which can be selected through the output control.

The difference between AZ7500B and DIODES™ AZ7500C is that they have 4.95V and 5V reference voltage respectively.

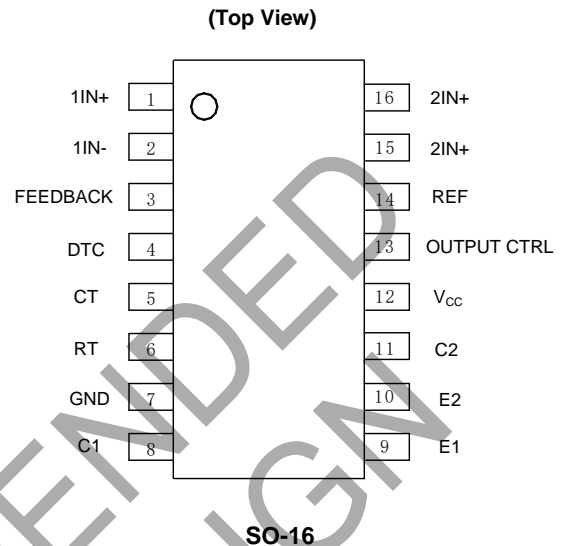The AZ7500B is available in standard package of SO-16.

Features

- Stable 4.95V Reference Voltage Trimmed to ±1.0% Accuracy
- Uncommitted Output TR for 200mA Sink or Source Current
- Single-End or Push-Pull Operation Selected by Output Control
- Internal Circuitry Prohibits Double Pulse at Either Output
- Complete PWM Control Circuit with Variable Duty Cycle
- On-Chip Oscillator with Master or Slave Operation
- **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.

Pin Assignments

(Top View)
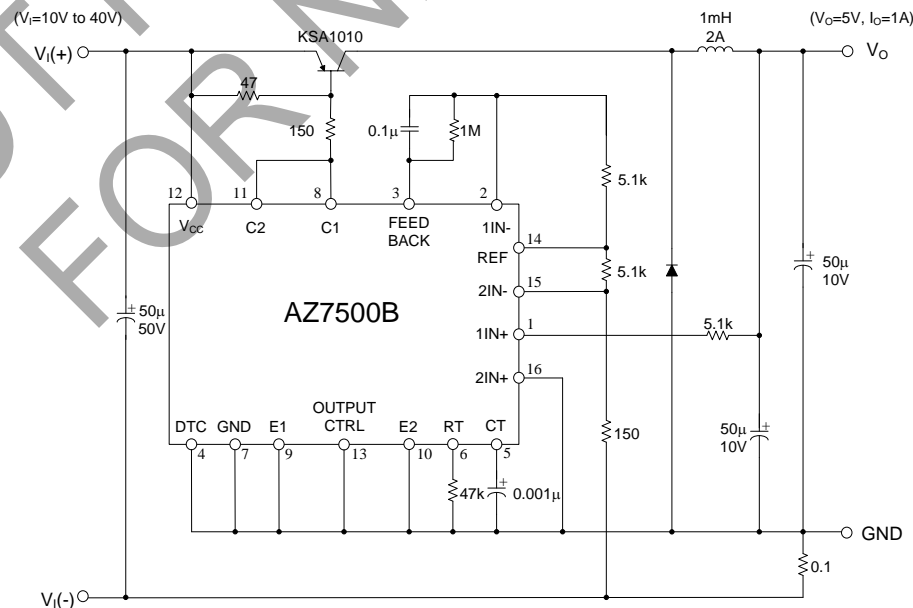
Pin	Name		Pin	Name
1	1IN+		16	2IN+
2	1IN-		15	2IN+
3	FEEDBACK		14	REF
4	DTC		13	OUTPUT CTRL
5	CT		12	V_{CC}
6	RT		11	C2
7	GND		10	E2
8	C1		9	E1

SO-16

Applications

- SMPS
- Back light inverters
- Chargers

Typical Applications Circuit

(V_I=10V to 40V)   KSA1010   1mH 2A   (V_O=5V, I_O=1A)

Pulse-Width Modulated Step-Down Converter

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Output Function Table

Signal for Output Control	Output Function
V_I = GND	Single-ended or parallel output
V_I = V_{REF}	Normal push-pull operation

Functional Block Diagram

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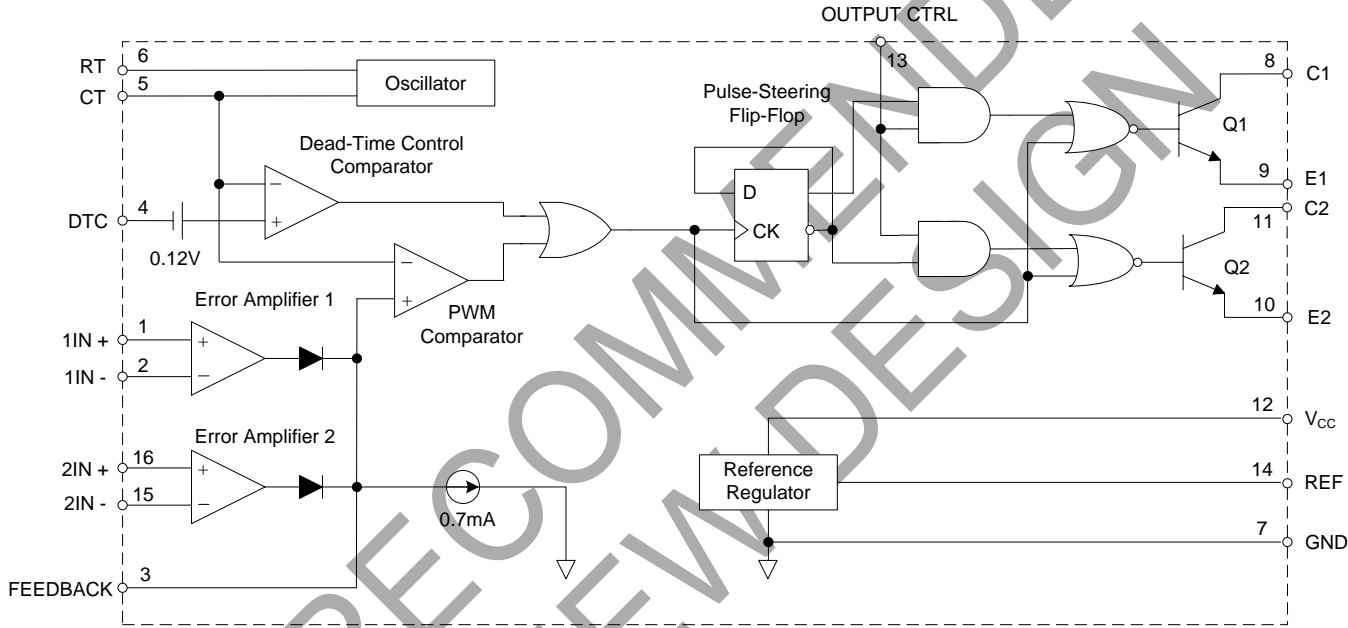
Absolute Maximum Ratings (Note 3)

Symbol	Parameter	Rating	Unit
V_{CC}	Supply Voltage (Note 4)	40	V
V_I	Amplifier Input Voltage	-0.3 to V_{CC} + 0.3	V
V_O	Collector Output Voltage	40	V
I_O	Collector Output Current	250	mA
$R_{\theta JA}$	Package Thermal Impedance (Note 5)	73	°C/W
−	Lead Temperature 1.6mm from case for 10 seconds	+260	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
−	ESD Rating (Machine Model)	200	V

Notes: 3. Stresses greater than those listed under *Absolute Maximum Ratings* can 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 under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.
4. All voltage values are with respect to the network ground terminal.
5. Maximum power dissipation is a function of T_J(max), $R_{\theta JA}$ and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/R_{\theta JA}$. Operating at the absolute maximum T_J of +150ºC can affect reliability.
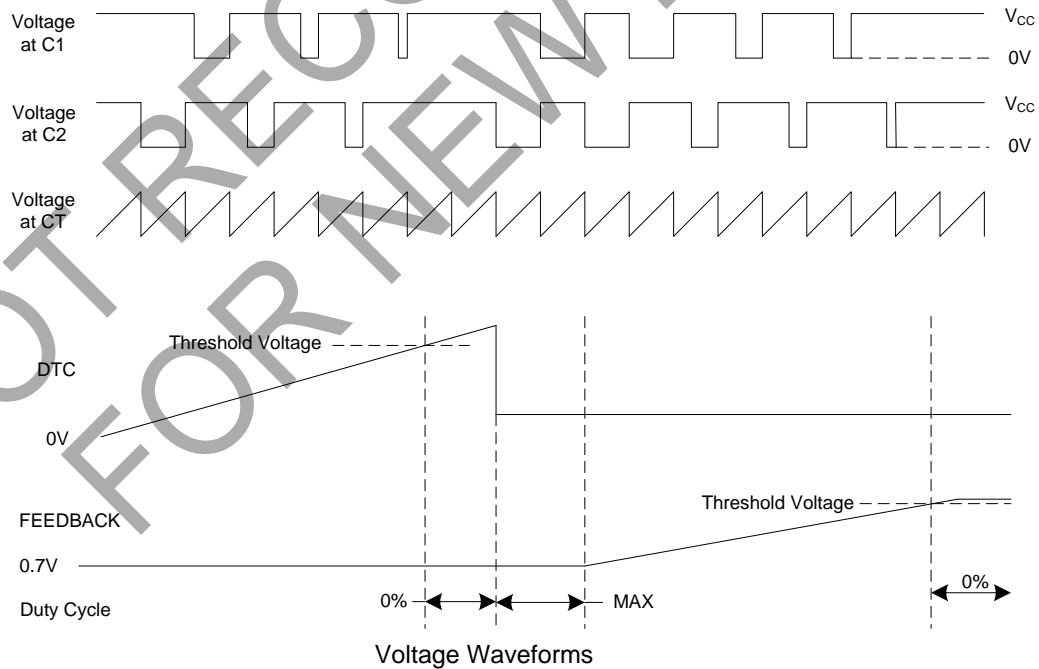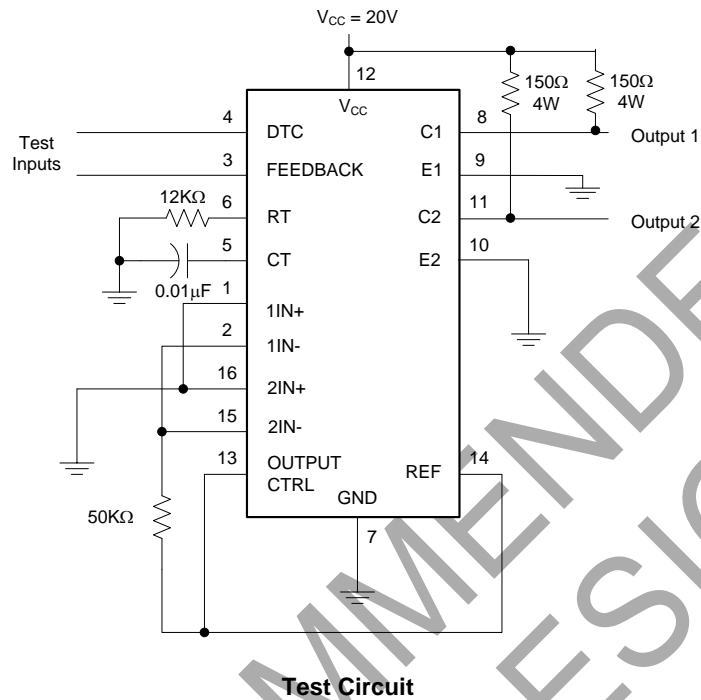
Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	7	15	36	V
V_{C1}, V_{C2}	Collector Output Voltage	—	30	36	V
I_{C1}, I_{C2}	Collector Output Current (Each Transistor)	—	—	200	mA
V_I	Amplifier Input Voltage	0.3	—	V_{CC}-2	V
I_{FB}	Current Into Feedback Terminal	—	—	0.3	mA
I_{REF}	Reference Output Current	—	—	10	mA
C_T	Timing Capacitor	0.00047	0.001	10	µF
R_T	Timing Resistor	1.8	30	500	kΩ
f_{OSC}	Oscillator Frequency	1.0	40	200	kHz
—	PWM Input Voltage (Pin 3, 4, 14)	0.3	—	5.3	V
T_A	Operating Free-Air Temperature	-40	—	+85	°C

## Electrical Characteristics (@V$_{CC}$=20V, T$_A$= +25°C, f=10kHz, unless otherwise specified.)

Symbol	Parameters		Conditions	Min	Typ	Max	Unit
Reference Section							
V$_{REF}$	Output Reference Voltage		I$_{REF}$=1mA	4.90	4.95	5.0	V
			I$_{REF}$=1mA, T$_A$= -40 to +85°C	4.85	4.95	5.05	V
R$_{LINE}$	Line Regulation		V$_{CC}$ = 7V to 36V	—	2	25	mV
R$_{LOAD}$	Load Regulation		I$_{REF}$=1mA to 10mA	—	1	15	mV
I$_{SC}$	Short-Circuit Output Current		V$_{REF}$ = 0V	10	35	50	mA
Oscillator Section							
f$_{OSC}$	Oscillator Frequency		C$_T$=0.001µF, R$_T$=30KΩ	—	40	—	kHz
			C$_T$=0.01µF, R$_T$=12KΩ	9.2	10	10.8	
			C$_T$=0.01µF, R$_T$=12KΩ, T$_A$= -40 to +85°C	9.0	—	12	
Δf /ΔT	Frequency Change with Temperature		C$_T$=0.01µF, R$_T$=12KΩ, T$_A$= -40 to +85°C	—	—	1	%
Dead-Time Control Section							
I$_{BIAS}$	Input Bias Current		V$_{CC}$=15V, V4= 0 to 5.25V	—	-2	-10	µA
D(MAX)	Maximum Duty Cycle		V$_{CC}$=15V, V4= 0V, Pin 13= V$_{REF}$	45	—	—	%
V$_{ITH}$	Input Threshold Voltage		Zero Duty Cycle	—	3	3.3	V
			Maximum Duty Cycle	0	—	—	
Error-Amplifier Section							
V$_{IO}$	Input Offset Voltage		V3 = 2.5V	—	2	10	mV
I$_{IO}$	Input Offset Current		V3 = 2.5V	—	25	250	nA
I$_{BIAS}$	Input Bias Current		V3 = 2.5V	—	0.2	1	µA
V$_{CM}$	Common-Mode Input Voltage Range		V$_{CC}$=7V to 36V	-0.3	—	V$_{CC}$-2	V
G$_{VO}$	Open-Loop Voltage Gain		V$_O$ =0.5V to 3.5V	70	95	—	dB
BW	Unity-Gain Bandwidth		—	—	650	—	kHz
CMRR	Common-Mode Rejection Ratio		—	65	80	—	dB
I$_{SINK}$	Output Sink Current (Feedback)		V$_{ID}$ = -15mV to -5V, V3 = 0.7V	-0.3	-0.7	—	mA
I$_{SOURCE}$	Output Source Current (Feedback)		V$_{ID}$=15mV to 5V, V3 = 3.5V	2	—	—	mA
PWM Comparator Section							
V$_{ITH}$	Input Threshold Voltage		Zero duty cycle	—	4	4.5	V
I$_{SINK}$	Input Sink Current		V3 = 0.7V	-0.3	-0.7	—	mA
Output Section							
V$_{CE}$(SAT)	Output Saturation Voltage	Common Emitter	V$_E$ = 0V, I$_C$ =200mA	—	1.1	1.3	V
V$_{CC}$(SAT)		Emitter Follower	V$_{CC}$ = 15V, I$_E$ = -200mA	—	1.5	2.5	
I$_C$ (OFF)	Collector Off-State Current		V$_{CE}$ = 36V, V$_{CC}$=36V	—	2	100	µA
I$_E$(OFF)	Emitter Off-State Current		V$_{CC}$ = V$_C$ = 36V, V$_E$ = 0	—	—	-100	µA
Total Device							
I$_{CC}$	Supply Current		Pin 6 = V$_{REF}$, V$_{CC}$=15V	—	6	10	mA
Output Switching Characteristics							
t$_R$	Rise Time		Common Emitter Common Collector	—	100	200	ns
t$_F$	Fall Time		Common Emitter Common Collector	—	25	100	ns

Parameter Measurement Information
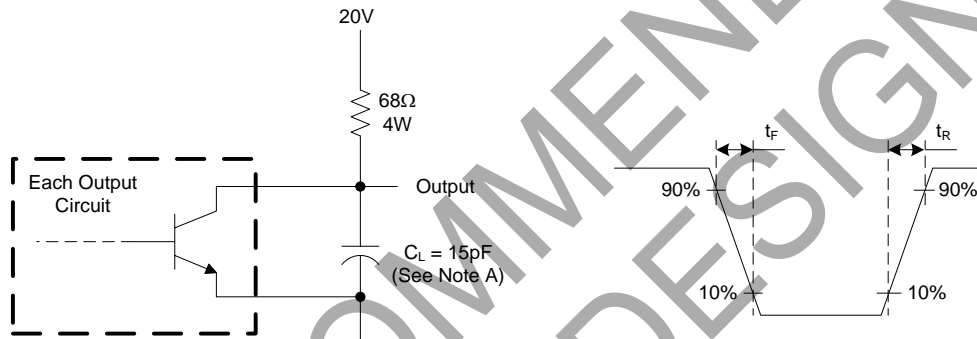

Test Circuit

Voltage Waveforms

Figure 1. Operational Test Circuit and Waveforms

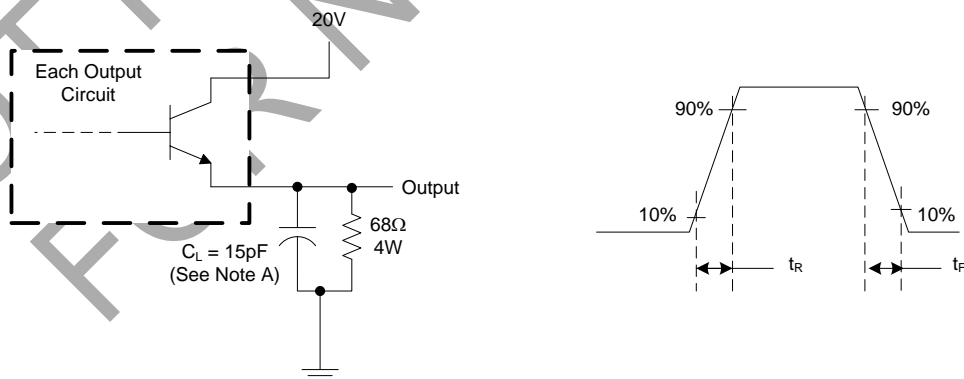## Parameter Measurement Information (continued)
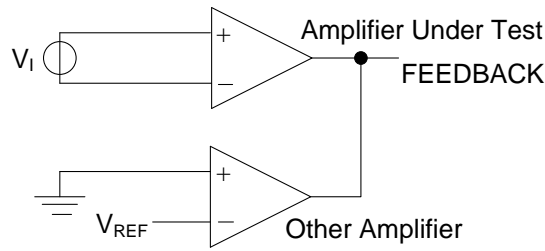
Figure 2. Error Amplifier Characteristics

Note A: C_L includes probe and jig capacitance.
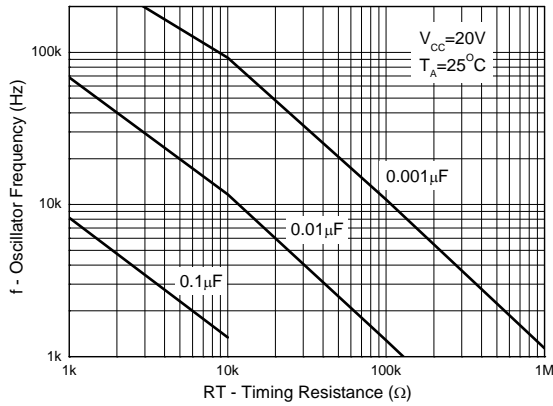
Figure 3. Common-Emitter Configuration

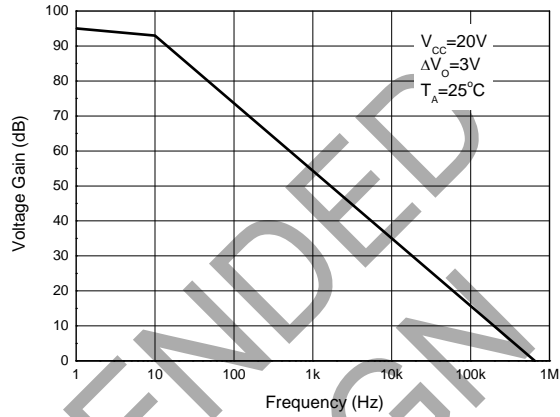Note A: C_L includes probe and jig capacitance.

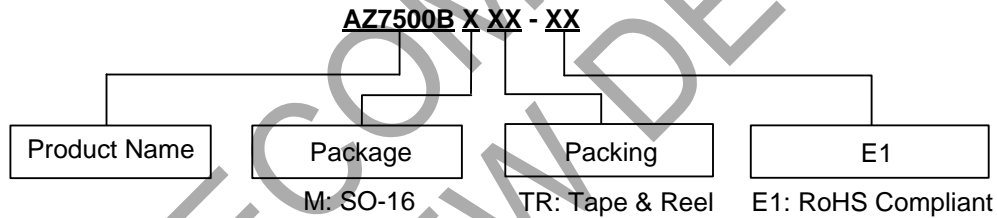**Figure 4. Emitter-Follower Configuration**

Performance Characteristics

Oscillator Frequency vs. RT and CT

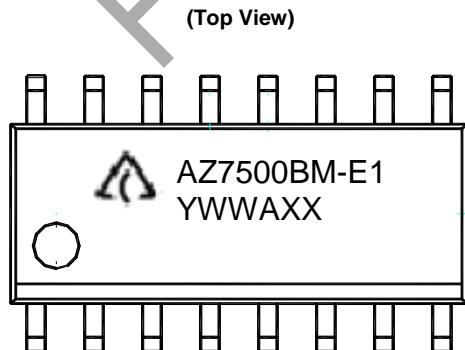**Error Amplifier Small-Signal Voltage Gain vs. Frequency**

Ordering Information

AZ7500B X XX - XX

Product Name	Package	Packing	E1
	M: SO-16	TR: Tape & Reel	E1: RoHS Compliant

Part Number	Package	Temperature Range	Marking ID	Packing	
				Qty.	Carrier
AZ7500BMTR-E1	SO-16	-40 to +85°C	AZ7500BM-E1	4000	Tape and Reel

## Marking Information

(Top View)

AZ7500BM-E1
YWWAXX

First Line: Logo and Marking ID
(See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

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Package Outline Dimensions (All dimensions in mm(inch).)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SO-16
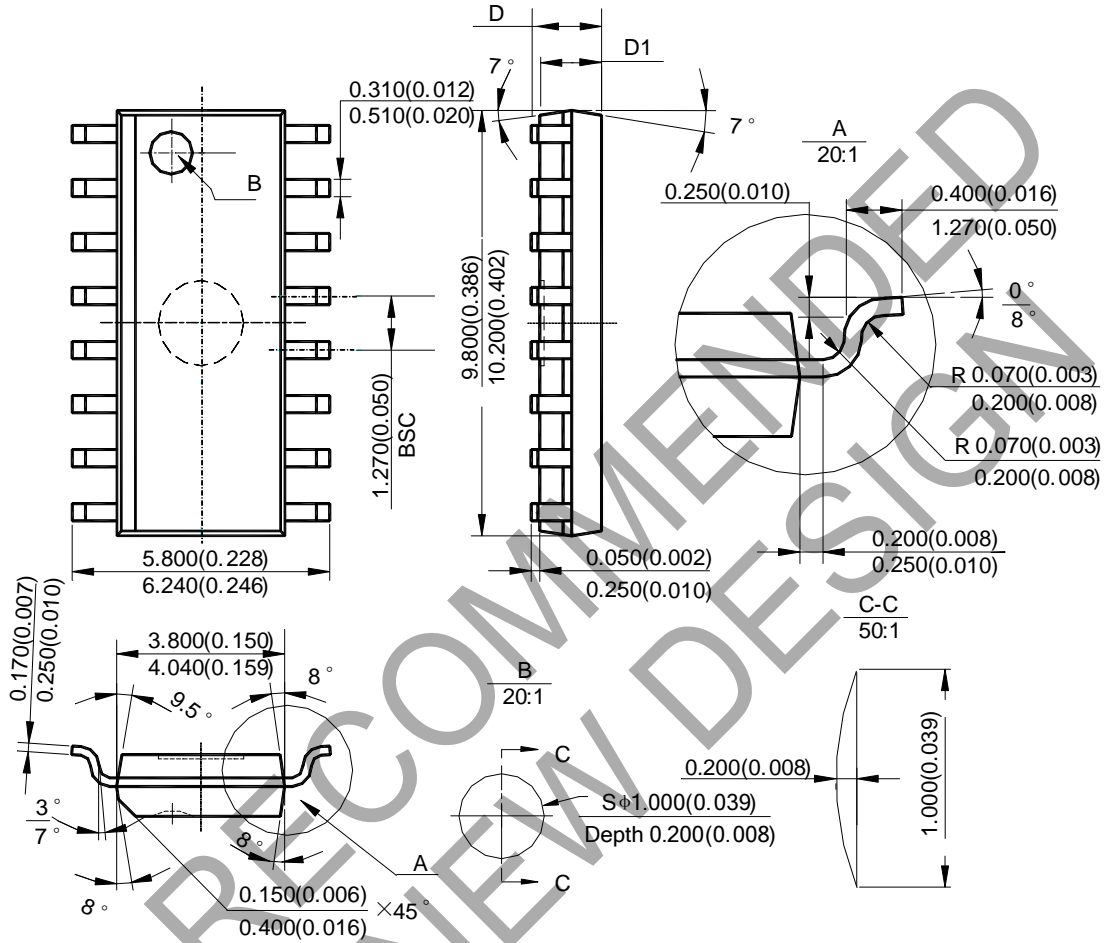
Note: Eject hole, oriented hole and mold mark is optional.

Symbol	D				D1			
	min(mm)	max(mm)	min(inch)	max(inch)	min(mm)	max(mm)	min(inch)	max(inch)
Option1	1.350	1.750	0.053	0.069	1.250	1.650	0.049	0.065
Option2	-	1.260	-	0.050	1.020	-	0.040	-

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Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1)   Package Type: SO-16
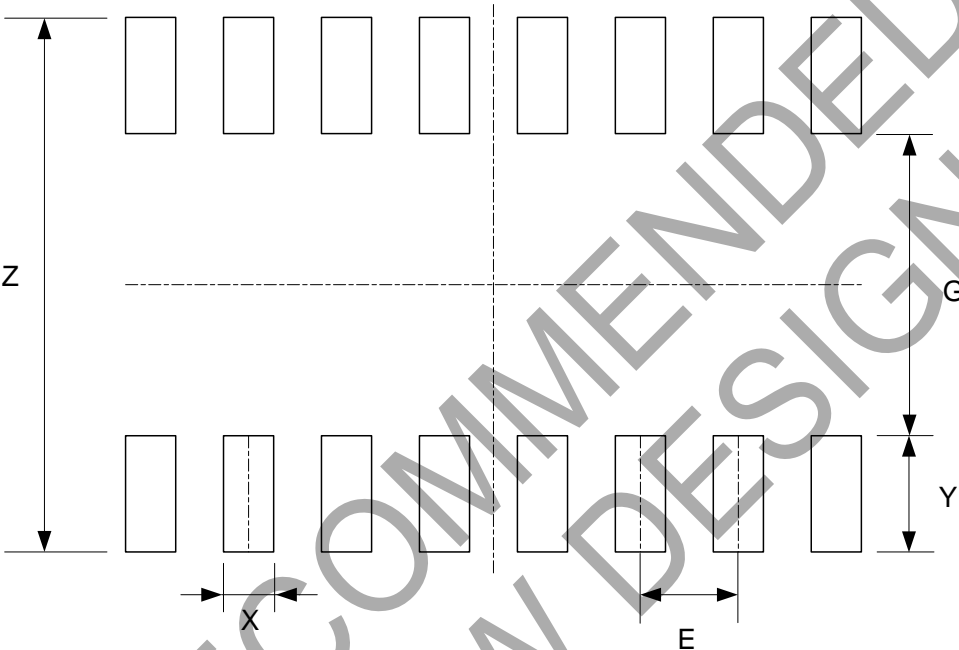
Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

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