



ALPHA & OMEGA
SEMICONDUCTOR



AO3401A

P-Channel Enhancement Mode Field Effect Transistor

General Description

The AO3401A/L uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation gate voltages as low as 2.5V. This device is suitable for use as a load switch or other general applications. AO3401A and AO3401AL are electrically identical.

-RoHS Compliant

-AO3401AL is Halogen Free

Features

V_{DS} (V) = -30V

I_D = -4.3A (V_{GS} = -10V)

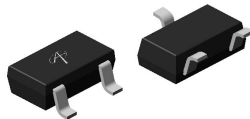
$R_{DS(ON)}$ < 46m Ω (V_{GS} = -10V)

$R_{DS(ON)}$ < 55m Ω (V_{GS} = -4.5V)

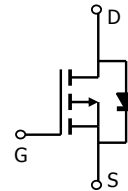
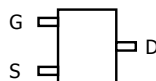
$R_{DS(ON)}$ < 80m Ω (V_{GS} = -2.5V)

R_g, C_{iss}, C_{oss}, C_{rss} Tested

**TO-236
(SOT-23)**



Top View



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	-30	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current ^{A,F}	$T_A=25^\circ\text{C}$	-4.3	A
	$T_A=70^\circ\text{C}$	-3.8	
Pulsed Drain Current ^B	I_{DM}	-25	
Power Dissipation ^A	$T_A=25^\circ\text{C}$	1.4	W
	$T_A=70^\circ\text{C}$	0.9	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^{AF}	$t \leq 10\text{s}$	$R_{\theta JA}$	65	90	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		85	125	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	43	80	$^\circ\text{C/W}$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =-250μA, V _{GS} =0V	-30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-30V, V _{GS} =0V T _J =55°C			-1 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±12V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =-250μA	-0.6	-1	-1.3	V
I _{D(ON)}	On state drain current	V _{GS} =-4.5V, V _{DS} =-5V	-25			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-10V, I _D =-4.3A T _J =125°C		36 52	44 63	mΩ
		V _{GS} =-4.5V, I _D =-3.5A		44	55	mΩ
		V _{GS} =-2.5V, I _D =-2.5A		62	80	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-4.3A		13		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V		-0.75	-1	V
I _S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V, f=1MHz		933	1200	pF
C _{oss}	Output Capacitance			108		pF
C _{rss}	Reverse Transfer Capacitance			81		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		6	9	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-15V, I _D =-4.3A		9.3	12.2	nC
Q _{gs}	Gate Source Charge			1.5		nC
Q _{gd}	Gate Drain Charge			3.7		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-10V, V _{DS} =-15V, R _L =3.5Ω, R _{GEN} =6Ω		5.2		ns
t _r	Turn-On Rise Time			6.8		ns
t _{D(off)}	Turn-Off DelayTime			42		ns
t _f	Turn-Off Fall Time			15		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-4.3A, dI/dt=100A/μs		21	28	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-4.3A, dI/dt=100A/μs		14.3		nC

A: The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The value in any given application depends on the user's specific board design.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

F: The current rating is based on the t ≤ 10s thermal resistance rating.

Rev2: Aug.2008

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

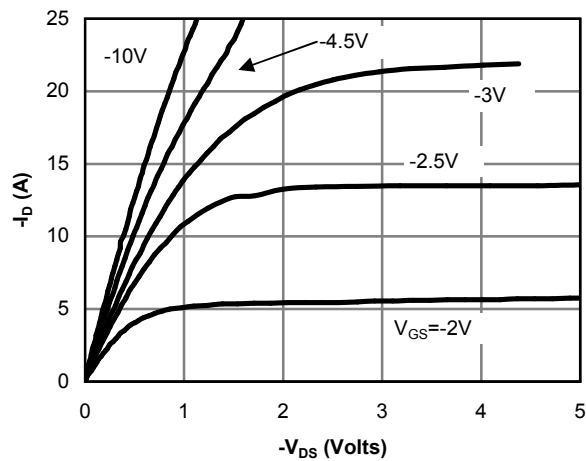


Figure 1: On-Region Characteristics

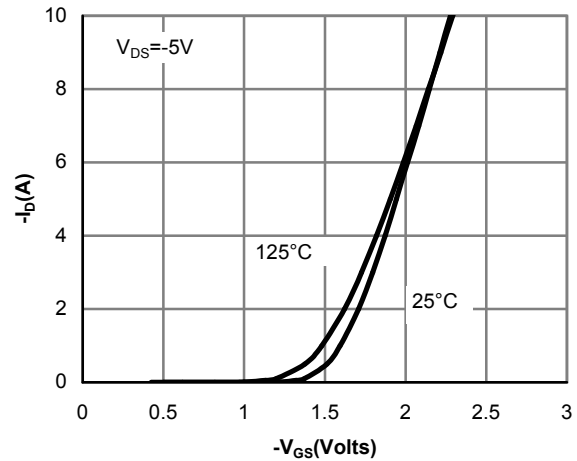


Figure 2: Transfer Characteristics

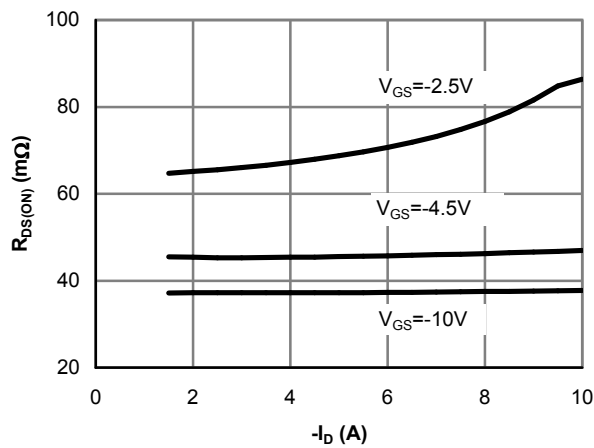


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

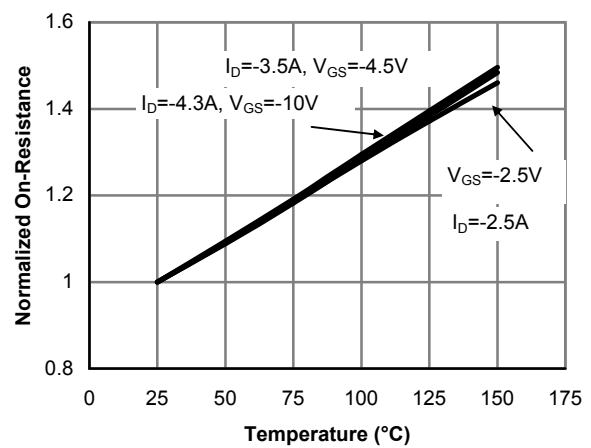


Figure 4: On-Resistance vs. Junction Temperature

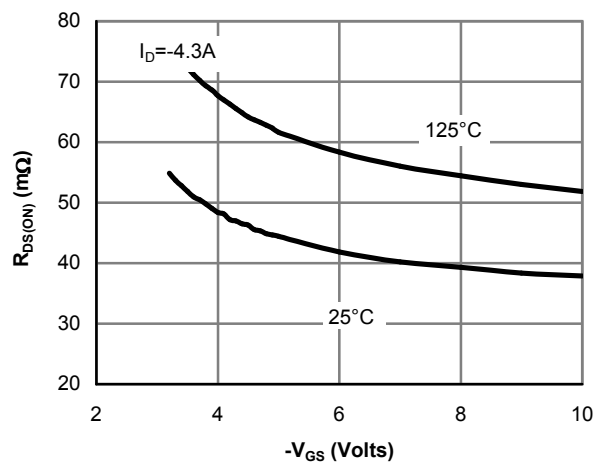


Figure 5: On-Resistance vs. Gate-Source Voltage

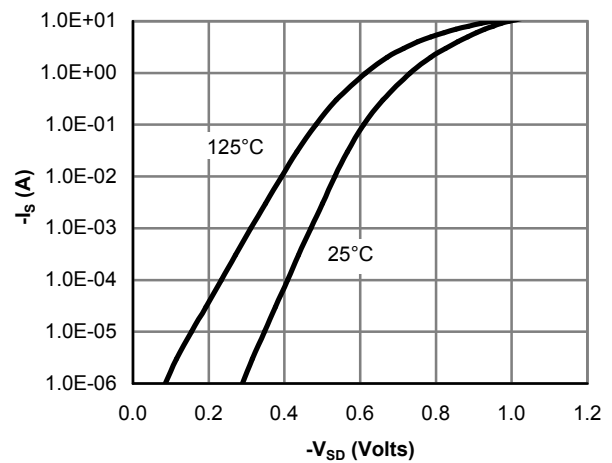


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

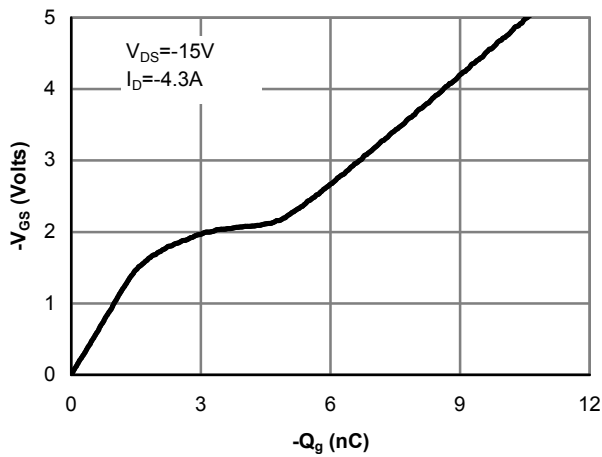


Figure 7: Gate-Charge Characteristics

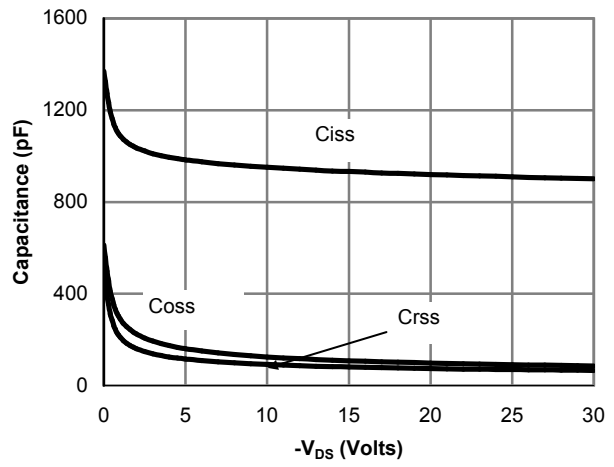


Figure 8: Capacitance Characteristics

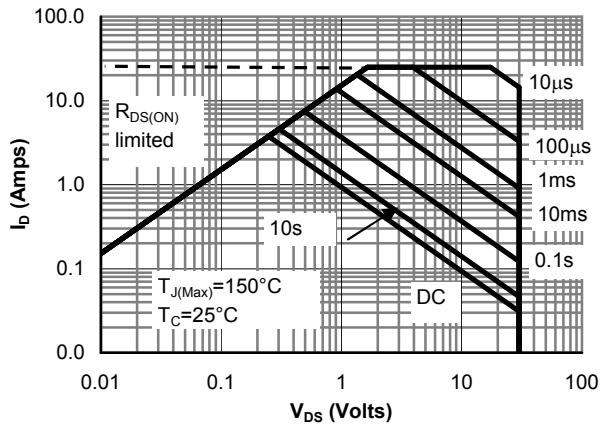


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

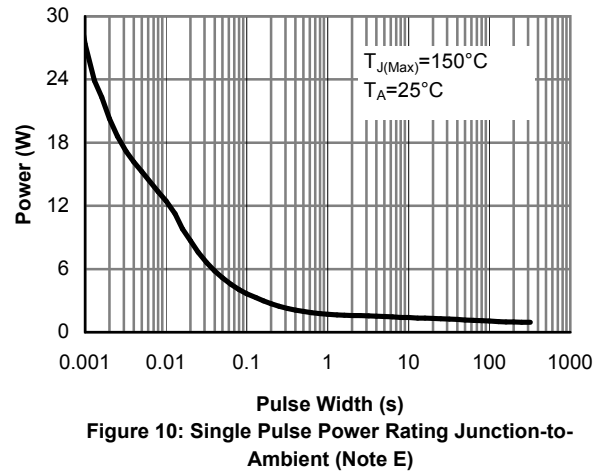


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

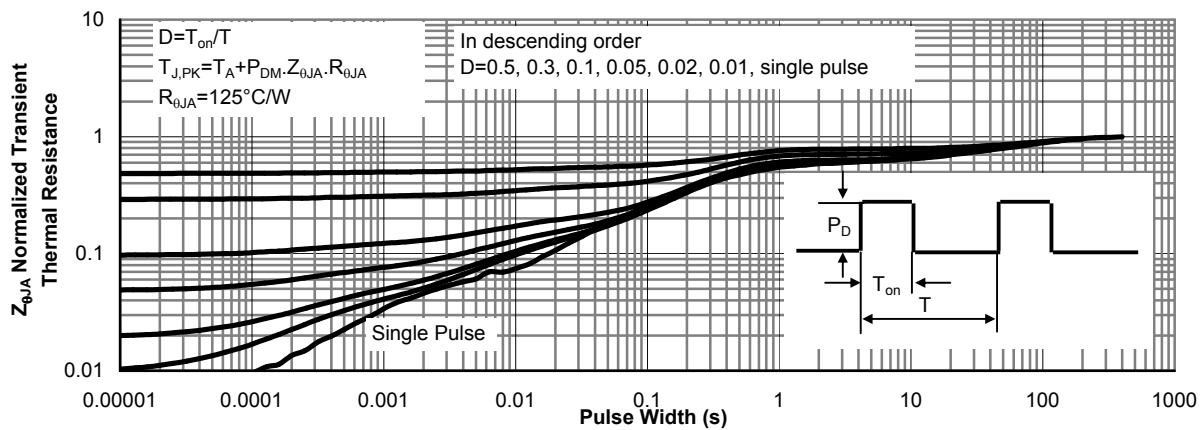
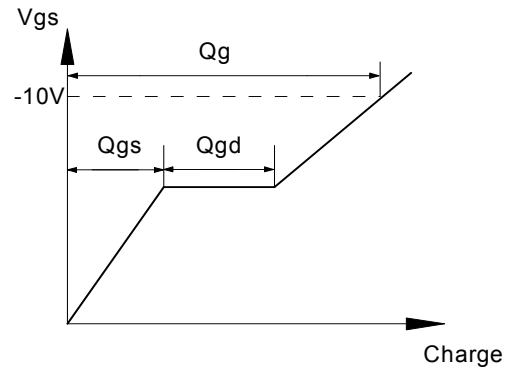
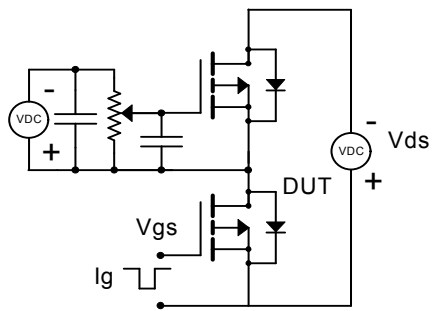
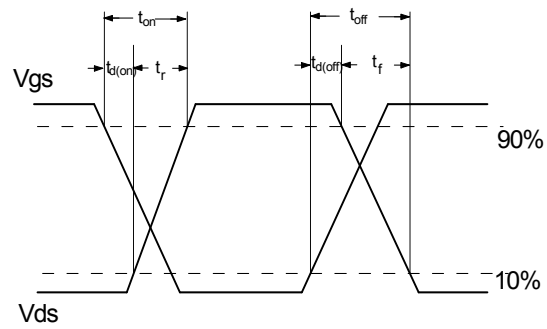
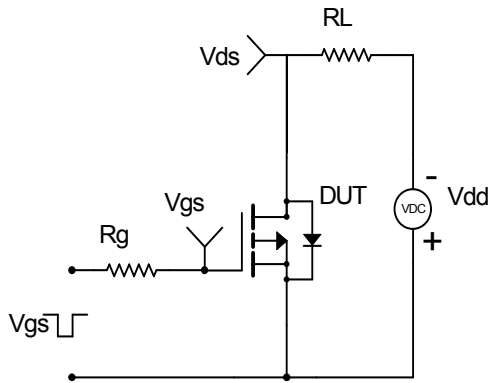


Figure 11: Normalized Maximum Transient Thermal Impedance

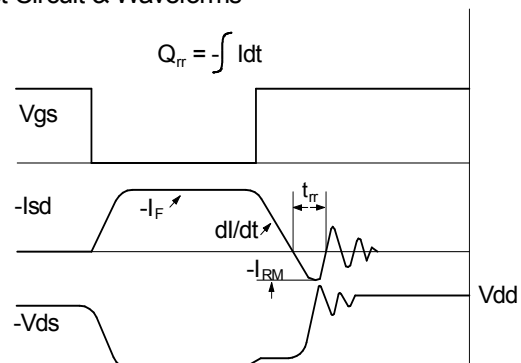
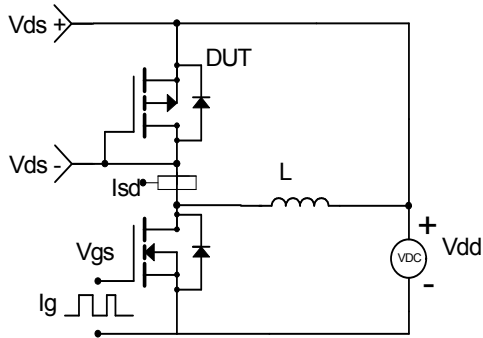
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



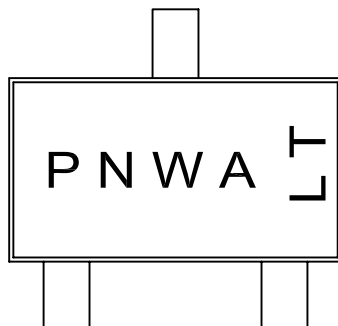
Diode Recovery Test Circuit & Waveforms



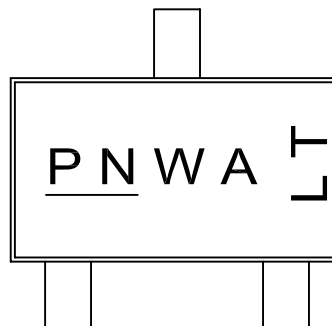


Document No.	PD-00660
Version	A
Title	AO3401A Marking Description

SOT-23 PACKAGE MARKING DESCRIPTION



Standard product



Green product

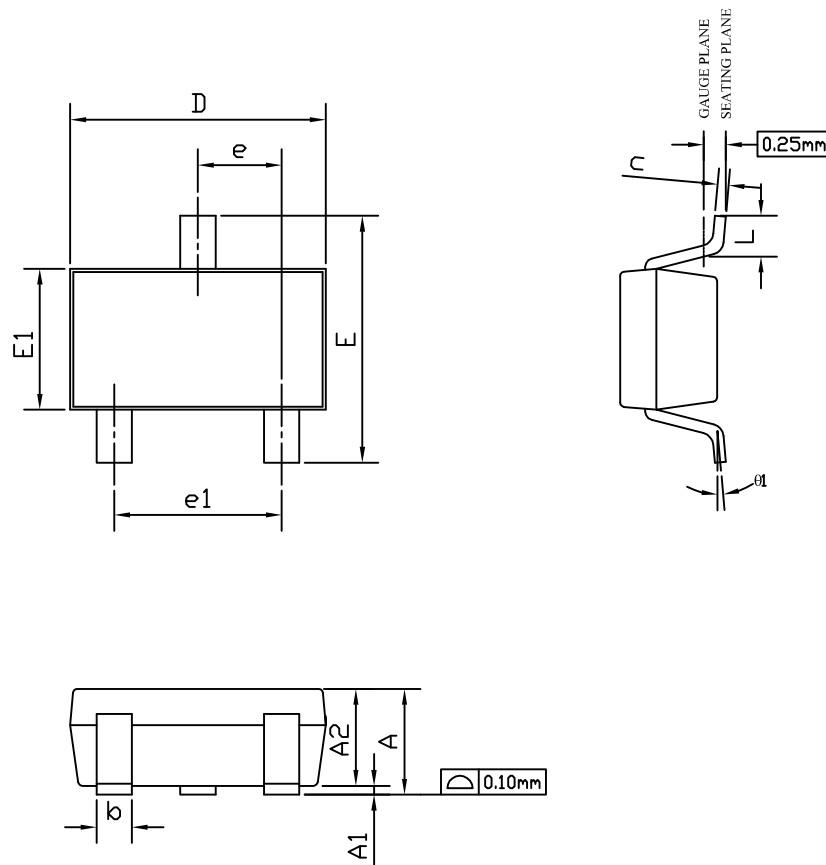
NOTE:

- P - Package and product type
- N - Last digital of product number
- W - Week code
- A - Assembly location code
- L&T - Assembly lot code

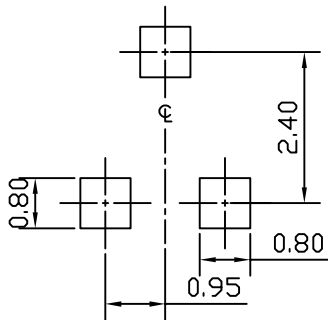
PART NO.	DESCRIPTION	CODE (PN)
AO3401A	Standard product	X1
AO3401AL	Green product	<u>X1</u>



SOT23 PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	---	1.25	0.033	---	0.049
A1	0.00	---	0.13	0.000	---	0.005
A2	0.70	1.00	1.15	0.028	0.039	0.045
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.08	0.13	0.20	0.003	0.005	0.008
D	2.80	2.90	3.10	0.110	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.40	1.60	1.80	0.055	0.063	0.071
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	---	0.60	0.012	---	0.024
01	0°	5°	8°	0°	5°	8°

NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH OR GATE BURRS.
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 5 MILS EACH.
2. TOLERANCE ± 0.100 mm (4 mil) UNLESS OTHERWISE SPECIFIED.
3. DIMENSION L IS MEASURED IN GAUGE PLANE.
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. ALL DIMENSIONS ARE IN MILLIMETERS.