



**General Description**

- Trench Power MOSFET technology
- Low  $R_{DS(ON)}$
- Low Gate Charge
- RoHS and Halogen-Free Compliant

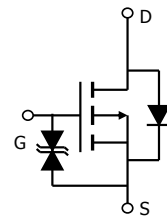
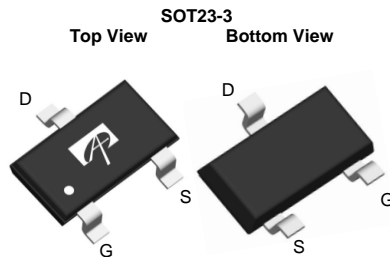
**Applications**

- This device is ideal for Load Switch

**Product Summary**

$V_{DS}$	-30V
$I_D$ (at $V_{GS}=-10V$ )	-4.3A
$R_{DS(ON)}$ (at $V_{GS}=-10V$ )	< 45m $\Omega$
$R_{DS(ON)}$ (at $V_{GS}=-4.5V$ )	< 65m $\Omega$

**Typical ESD protection**      **HBM Class 1C**



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AO3481C	SOT23-3	Tape & Reel	3000

**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	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_A=25^\circ\text{C}$	-4.3
		$T_A=70^\circ\text{C}$	-3.3
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	-30	A
Power Dissipation <sup>B</sup>	$P_D$	$T_A=25^\circ\text{C}$	1.3
		$T_A=70^\circ\text{C}$	0.8
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 <sup>A</sup> $t \leq 10\text{s}$	$R_{\theta JA}$	70	90	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A,D</sup> Steady-State		100	125	$^\circ\text{C/W}$
Maximum Junction-to-Lead	$R_{\theta JL}$	63	80	$^\circ\text{C/W}$

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V	-30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			±10	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.2	-1.7	-2.2	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.3A T <sub>J</sub> =125°C		37 52	45 64	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3.5A		52	65	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-4.3A		13		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		0.8	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				2	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		720		pF
C <sub>oss</sub>	Output Capacitance			80		pF
C <sub>riss</sub>	Reverse Transfer Capacitance			70		pF
R <sub>g</sub>	Gate resistance	f=1MHz		15	25	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-4.3A		12.5	23	nC
Q <sub>g(4.5V)</sub>	Total Gate Charge			6	12	nC
Q <sub>gs</sub>	Gate Source Charge			1.6		nC
Q <sub>gd</sub>	Gate Drain Charge			3		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =3.488Ω, R <sub>GEN</sub> =3Ω		8.5		ns
t <sub>r</sub>	Turn-On Rise Time			5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			39		ns
t <sub>f</sub>	Turn-Off Fall Time			14.5		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-4.3A, di/dt=500A/μs		10		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-4.3A, di/dt=500A/μs		13		nC

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150° C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25° C.

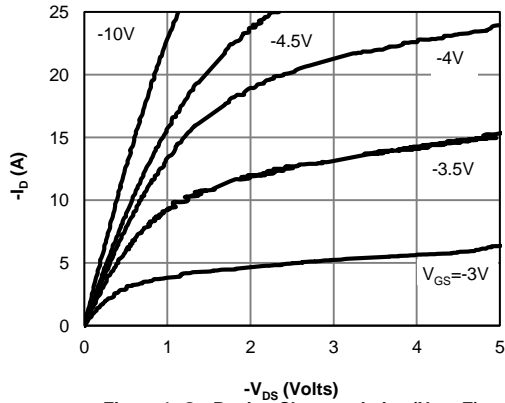
D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

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

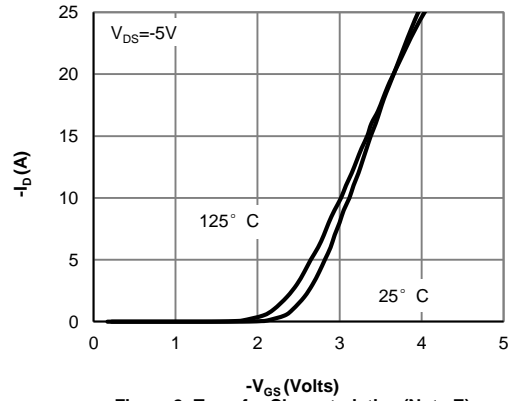
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

APPLICATIONS OR USE 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.

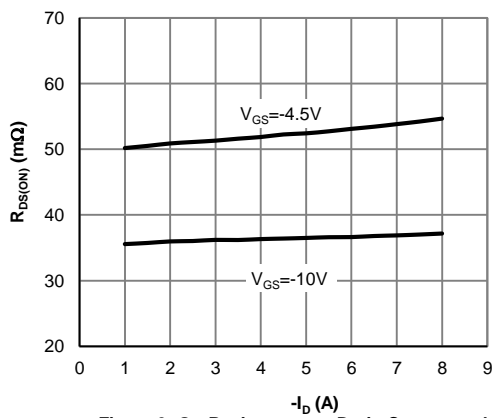
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



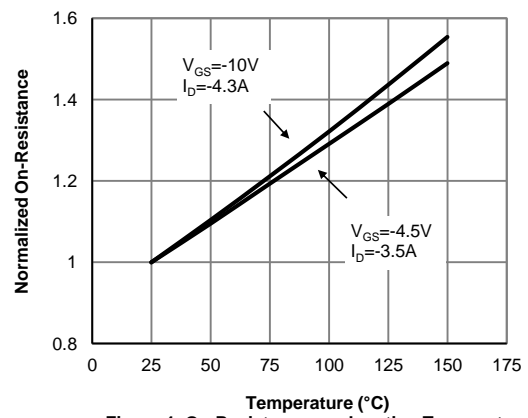
**Figure 1: On-Region Characteristics (Note E)**



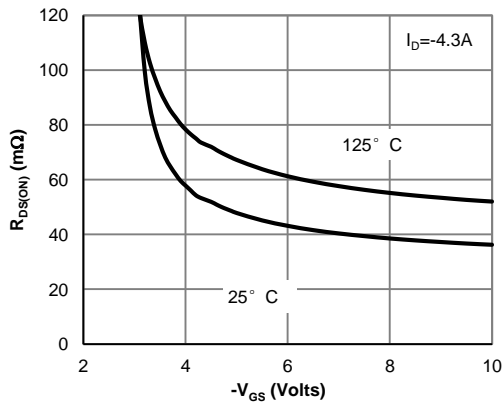
**Figure 2: Transfer Characteristics (Note E)**



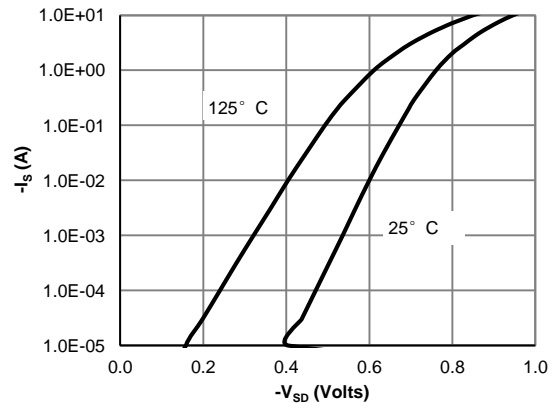
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

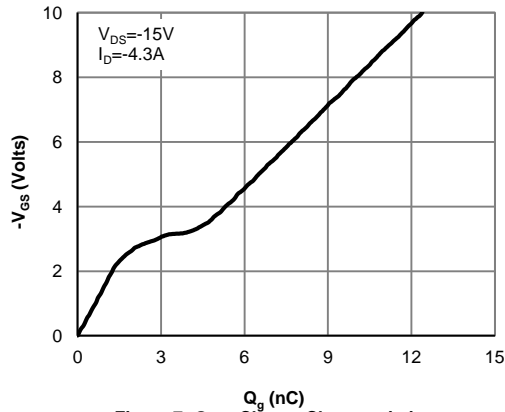


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

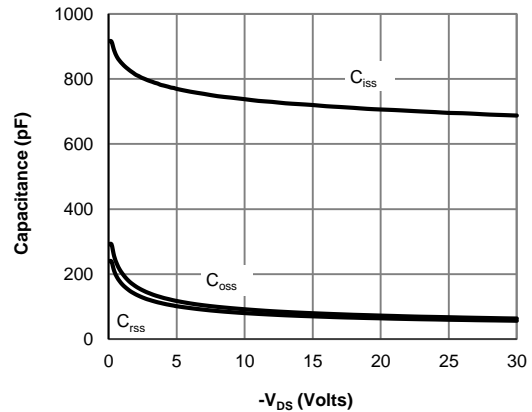


**Figure 6: Body-Diode Characteristics (Note E)**

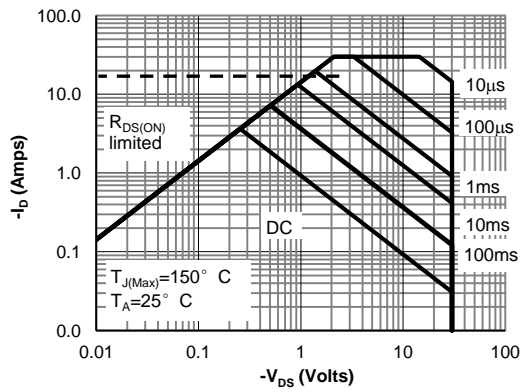
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



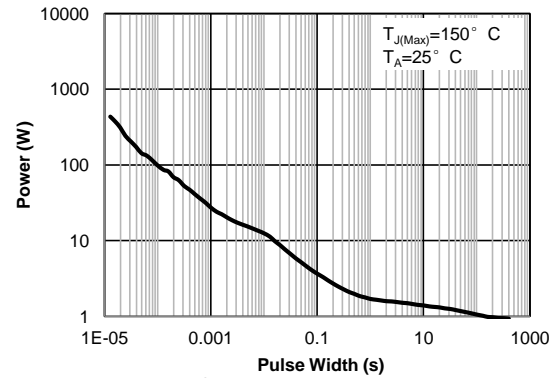
**Figure 7: Gate-Charge Characteristics**



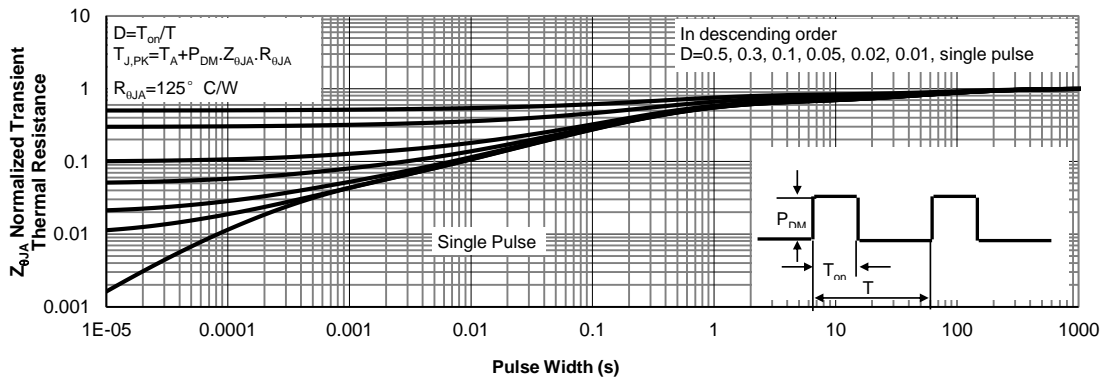
**Figure 8: Capacitance Characteristics**



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

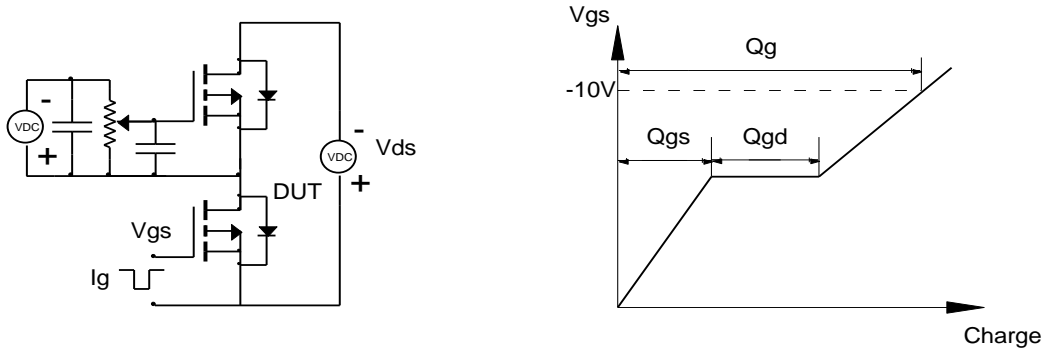


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)**

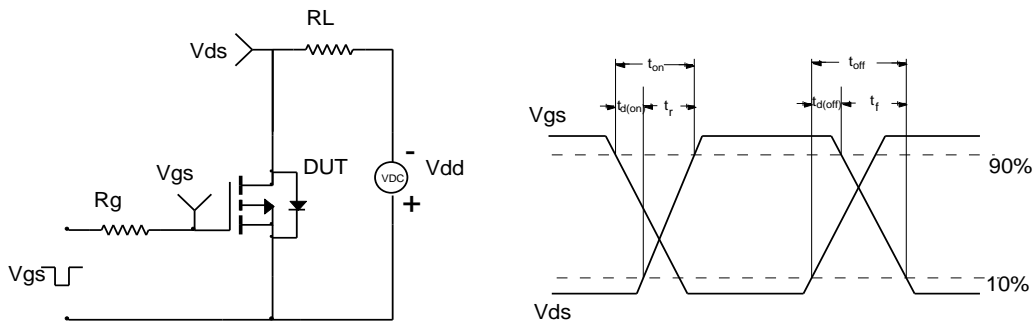


**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

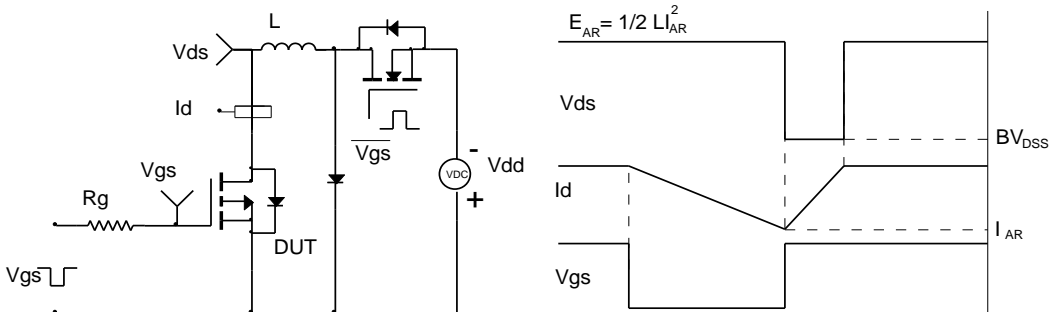
**Gate Charge Test Circuit & Waveform**



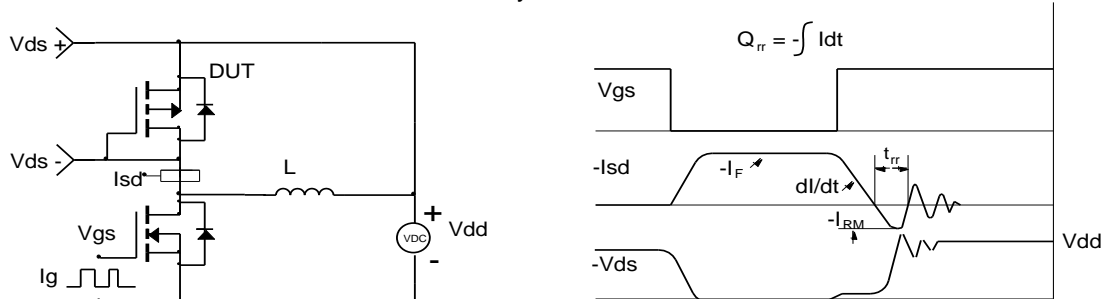
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**

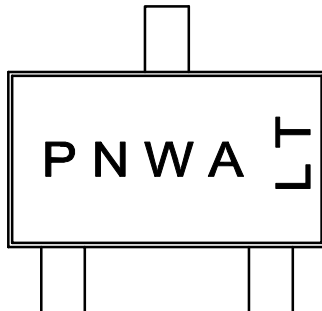


**Diode Recovery Test Circuit & Waveforms**



Document No.	PD-03454
Version	A
Title	AO3481C Marking Description

SOT-23 PACKAGE MARKING DESCRIPTION



Green product

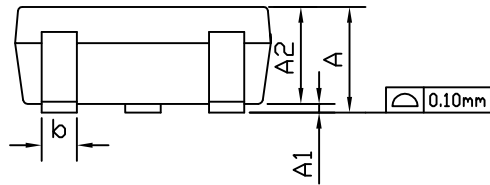
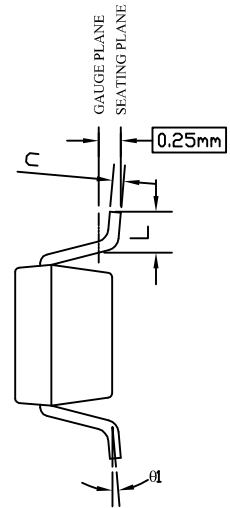
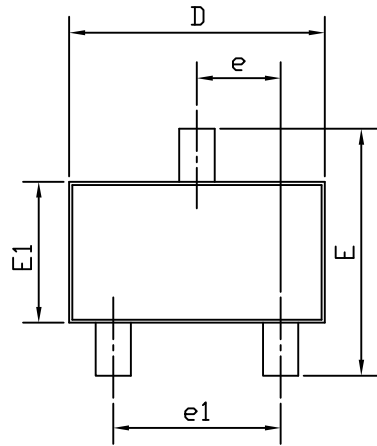
NOTE:

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

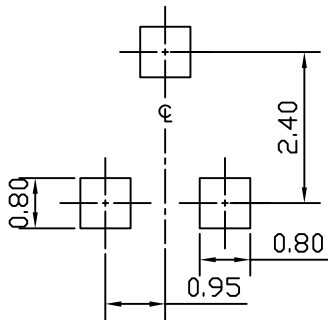
PART NO.	DESCRIPTION	CODE (PN)
AO3481C	Green product	N7



SOT23 PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

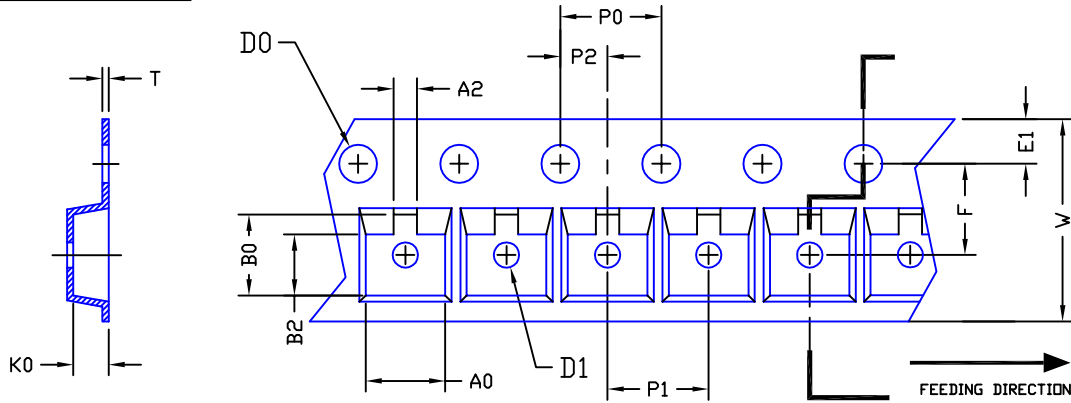
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	---	1.25	0.033	---	0.049
A1	0.00	---	0.13	0.000	---	0.005
A2	0.70	1.00	1.15	0.028	0.039	0.045
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.08	0.13	0.20	0.003	0.005	0.008
D	2.80	2.90	3.10	0.110	0.114	0.122
E	2.60	2.80	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
θ1	0°	5°	8°	0°	5°	8°

NOTE

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



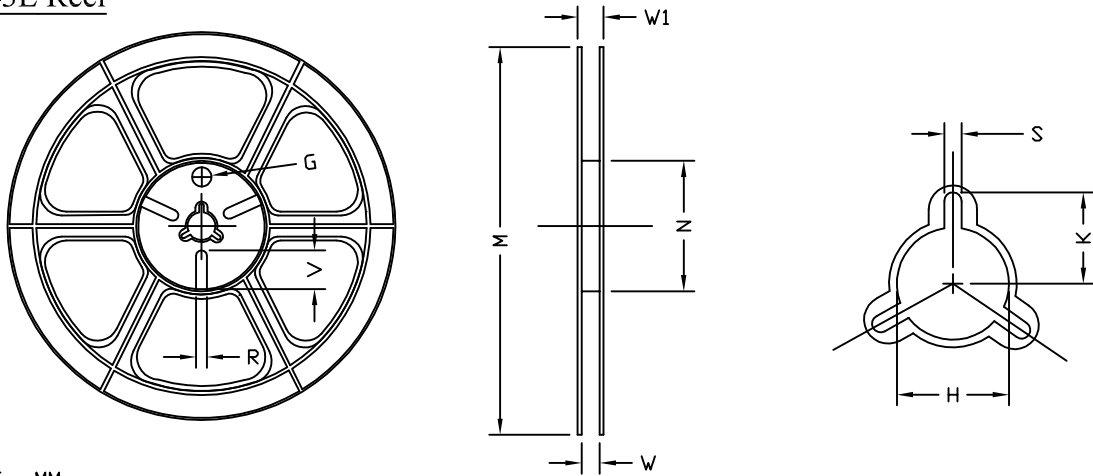
**SOT23-3L Carrier Tape**



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	W	E1	F	P0	P1	P2	T	A2	B2
SOT23-3L (8 mm)	3.05-3.40	3.00-3.38	1.20-1.47	1.55 ±0.05	1.00 ±0.25	8.00 ±0.30	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.18-0.25	0.84-1.24	2.29-2.69

**SOT23-3L Reel**



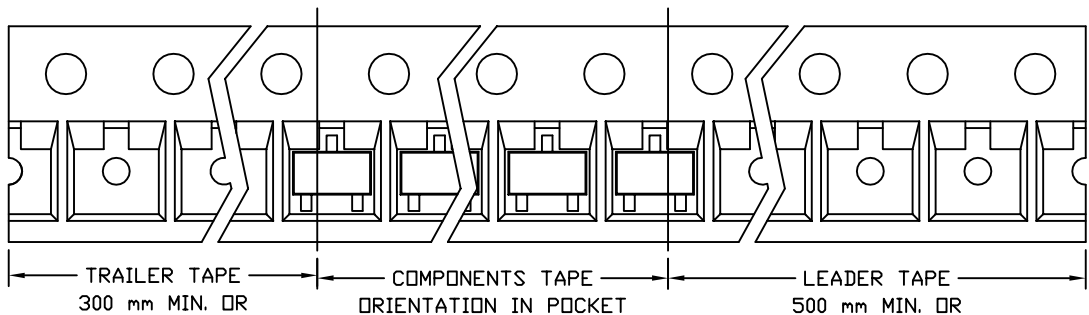
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
8 mm	φ178	φ178.00 ±1.00	φ54.00 ±0.50	9.00 ±0.30	11.40 ±1.00	φ13.00 +0.50 -0.20	10.60	2.00 ±0.50	φ9.00	5.00	18.00

**SOT23-3L Tape**

Leader / Trailer  
& Orientation

Unit Per Reel:  
3000pcs







# ***AOS Semiconductor Product Reliability Report***

**AO3481C**, rev A

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

**[www.aosmd.com](http://www.aosmd.com)**

Oct, 2019

This AOS product reliability report summarizes the qualification result for AO3481C. Accelerated environmental tests are performed on a specific sample size, and then followed by electrical test at end point. Review of final electrical test result confirms that AO3481C passes AOS quality and reliability requirements. The released product will be categorized by the process family and be routine monitored for continuously improving the product quality.

## I. Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Total Sample Size	Number of Failures	Reference Standard
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 / 1000 hours	462 pcs	0	JESD22-A108
HTRB	Temp = 150°C , Vds=100% of Vdsmax	168 / 500 / 1000 hours	462 pcs	0	JESD22-A108
Precondition (Note A)	168hr 85°C / 85%RH + 3 cycle reflow @260°C (MSL 1)	-	4620 pcs	0	JESD22-A113
HAST	130°C , 85%RH, 33.3 psia, Vds = 80% of Vdsmax	96 hours	693 pcs	0	JESD22-A110
H3TRB	85°C , 85%RH, Vds = 80% of Vdsmax	1000 hours	693 pcs	0	JESD22-A101
Autoclave	121°C , 29.7psia, RH=100%	96 hours	924 pcs	0	JESD22-A102
Temperature Cycle	-65°C to 150°C , air to air,	1000cycles	924 pcs	0	JESD22-A104
HTSL	Temp = 150°C	1000 hours	693 pcs	0	JESD22-A103
IOL	Δ Tj = 100°C	15000 cycles	693 pcs	0	MIL-STD-750 Method 1037

**Note:** The reliability data presents total of available generic data up to the published date.

Note A: MSL (Moisture Sensitivity Level) 1 based on J-STD-020

## II. Reliability Evaluation

**FIT rate (per billion): 3.82**

**MTTF = 29919 years**

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size. Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

**Failure Rate** =  $\text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 3.82$

**MTTF** =  $10^9 / \text{FIT} = 29919$  years

**Chi<sup>2</sup>** = Chi Squared Distribution, determined by the number of failures and confidence interval

**N** = Total Number of units from burn-in tests

**H** = Duration of burn-in testing

**Af** = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55°C)

Acceleration Factor [**Af**] =  $\text{Exp} [Ea / k (1/Tj u - 1/Tj s)]$

**Acceleration Factor ratio list:**

	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
<b>Af</b>	259	87	32	13	5.64	2.59	1

**Tj s** = Stressed junction temperature in degree (Kelvin), K = C+273.16

**Tj u** = The use junction temperature in degree (Kelvin), K = C+273.16

**k** = Boltzmann's constant,  $8.617164 \times 10^{-5} \text{eV} / \text{K}$