

# MT2301A

## P-Channel Enhancement Mode Field Effect Transistor

### Product Summary

- $V_{DS} = -20V$
- $I_D = -2.0A$
- $R_{DS(ON)} = 88m\Omega$   
@ $V_{GS} = -4.5V, I_D = -2.0A$
- $R_{DS(ON)} = 120m\Omega$   
@ $V_{GS} = -2.5V, I_D = -1.0A$

### Features

- Advanced Trench Process Technology.
- High Density Cell Design for Ultra Low
- On-Resistance.
- Lead free product is acquired.
- RoHS Compliant.

### Applications :

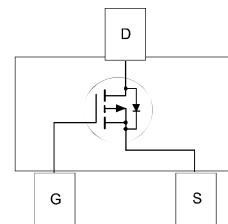
- Load Switch.
- PWM Applications.



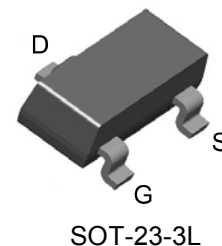
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### Simplified Schematic



### MARKING DIAGRAM & PIN ASSIGNMENT



### Absolute Maximum Ratings ( $T_A = 25^\circ C$ unless otherwise noted)

Symbol	Parameter	Steady State	Units
$V_{DS}$	Drain-Source Voltage	-20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Continuous Drain Current <sup>1</sup>	-2.0	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-7.0	A
$I_S$	Continuous Source Current (Diode Conduction) <sup>1</sup>	-2.0	A
$P_D$	Maximum Power Dissipation <sup>1</sup>	0.4	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55~150	$^\circ C$

Notes:

1. Surface Mounted on 1" x 1" FR4 Board,  $t \leq 10$  Sec.
2. Pulse width limited by maximum junction temperature.

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
1AYW	MT2301A	SOT23	-	-	3000

**Thermal Characteristic**

Thermal Resistance ,Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	250	$^{\circ}\text{C/W}$
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**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-20	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	- 0.4	-0.65	-1.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-2.0A	-	88	120	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-1.0A	-	120	150	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-15V, I <sub>D</sub> =-2.0A	10	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, F=1.0MHz	-	600	-	PF
Output Capacitance	C <sub>oss</sub>		-	90	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	70	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-20V, ,R <sub>L</sub> =2Ω V <sub>GS</sub> =-10V, R <sub>GEN</sub> =3Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	8	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	28	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-20V, I <sub>D</sub> =-2.0A, V <sub>GS</sub> =-10V	-	3.8	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	0.9	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	0.8	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A	-	-0.8	-1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	-2.0	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Typical Electrical and Thermal Characteristics

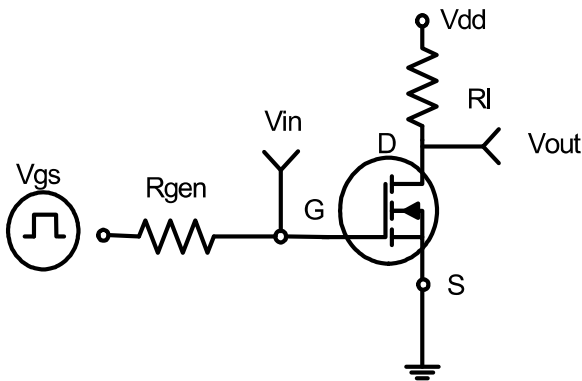


Figure 1: Switching Test Circuit

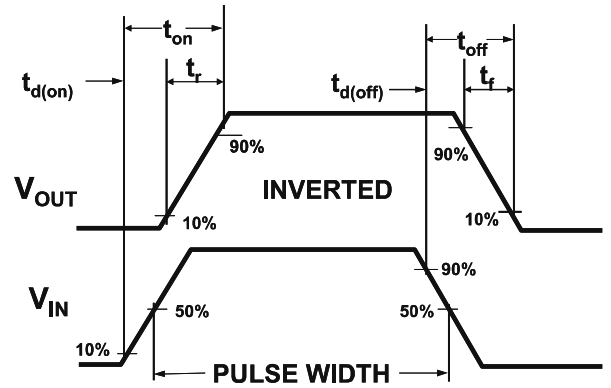


Figure 2: Switching Waveforms

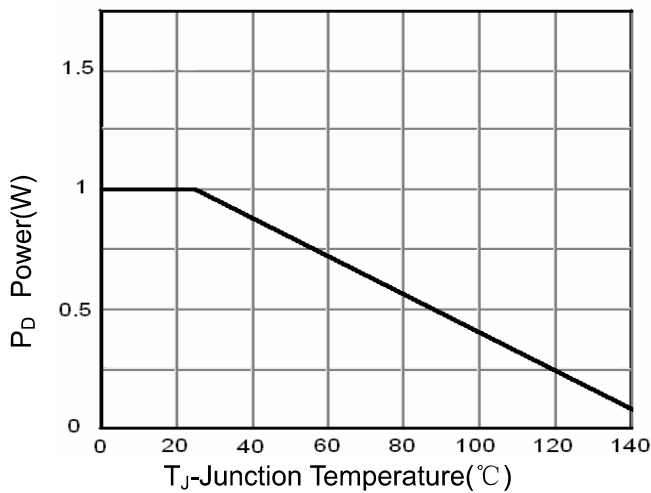


Figure 3 Power Dissipation

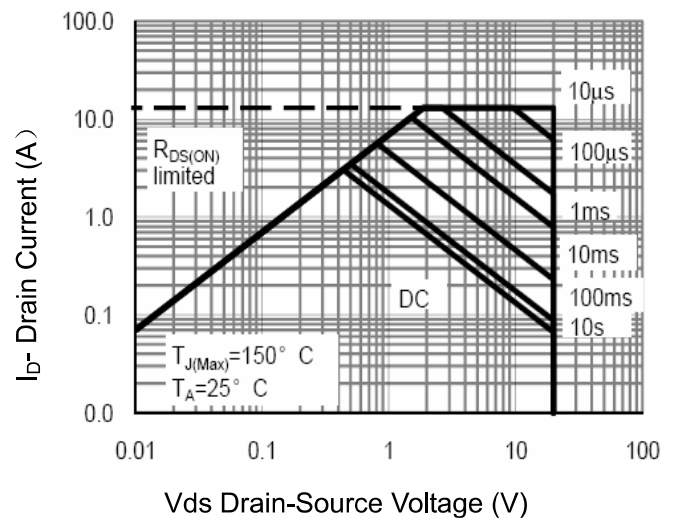


Figure 4 Safe Operation Area

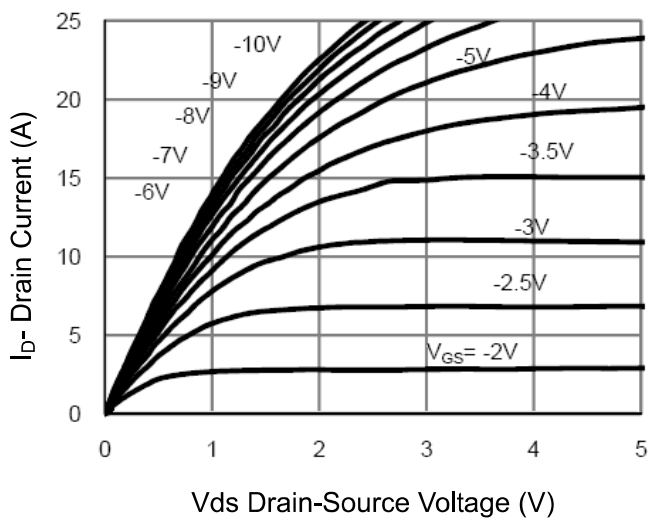


Figure 5 Output Characteristics

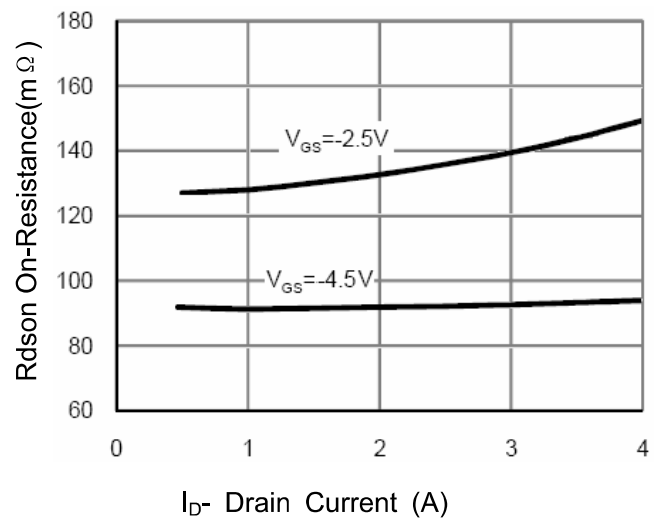
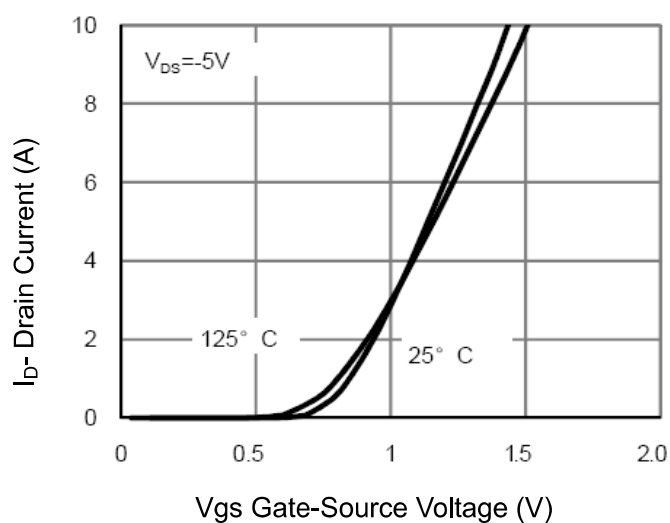
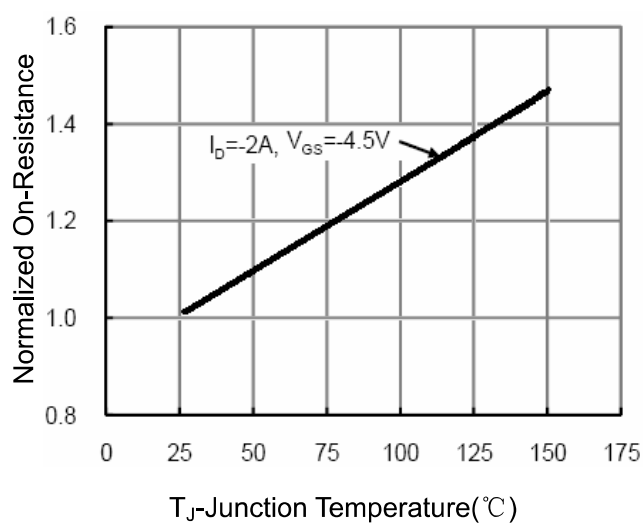


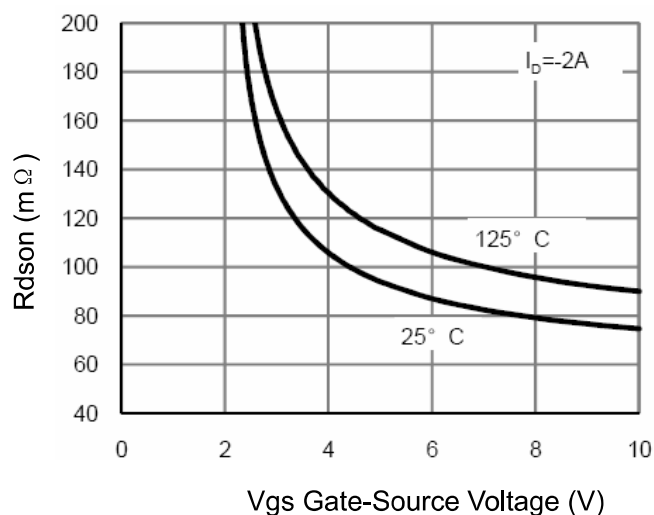
Figure 6 Drain-Source On-Resistance



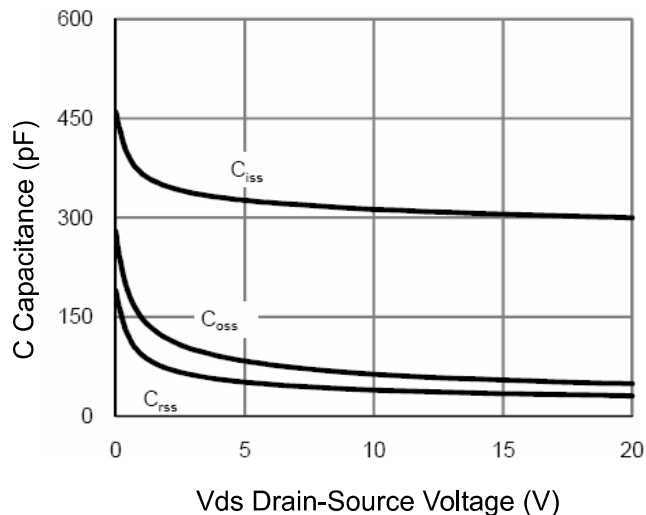
**Figure 7 Transfer Characteristics**



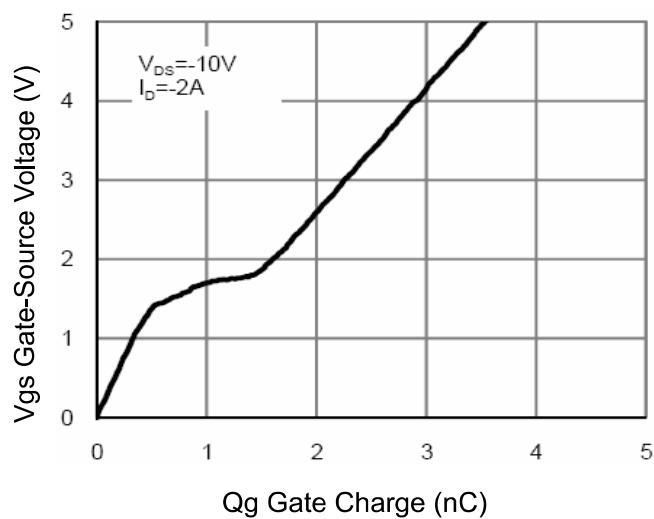
**Figure 8 Drain-Source On-Resistance**



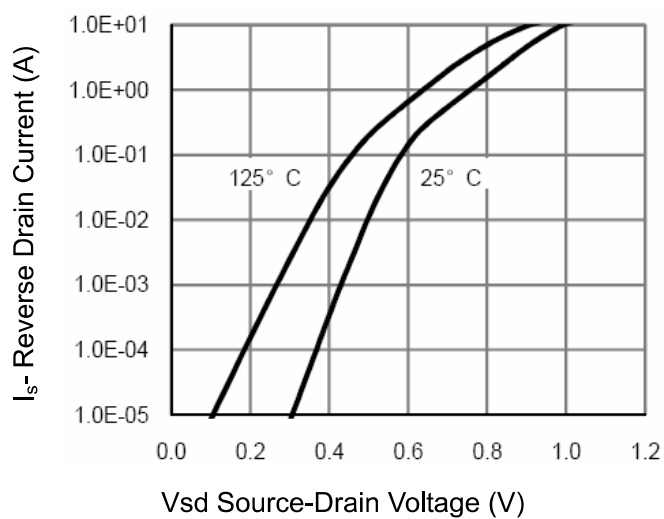
**Figure 9 Rdson vs Vgs**



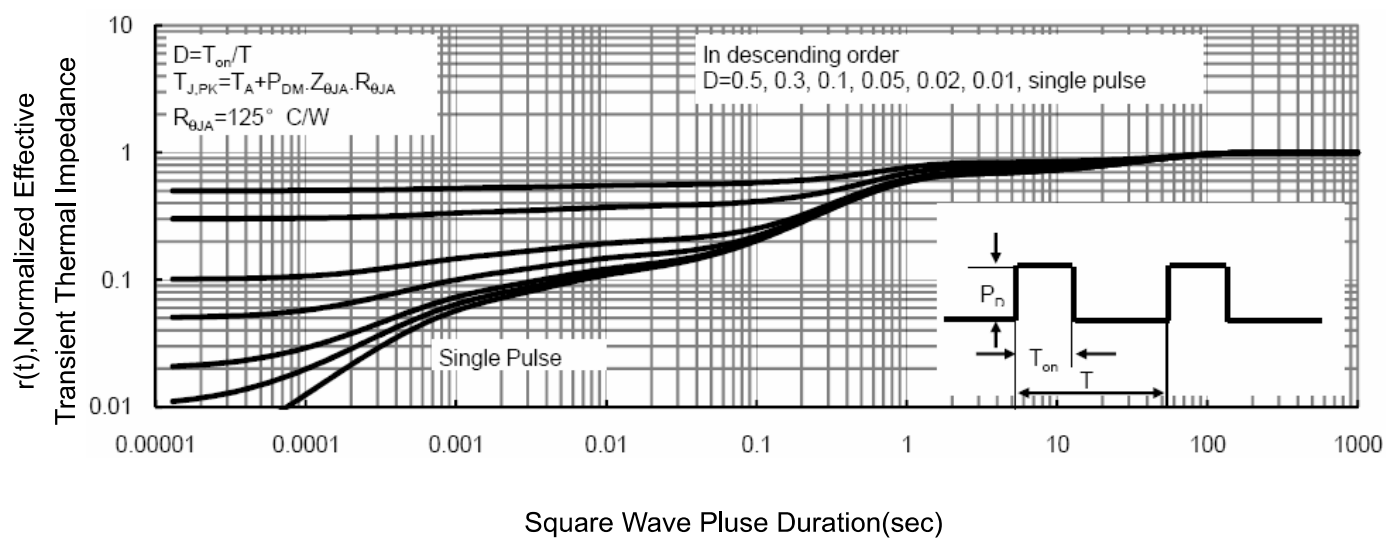
**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**



**Figure 13 Normalized Maximum Transient Thermal Impedance**

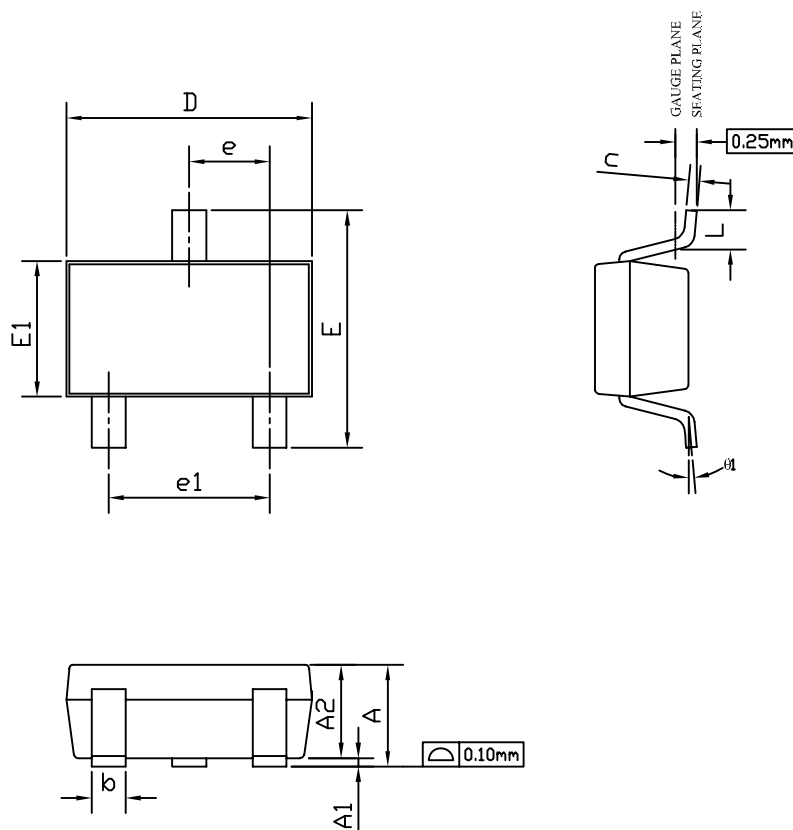
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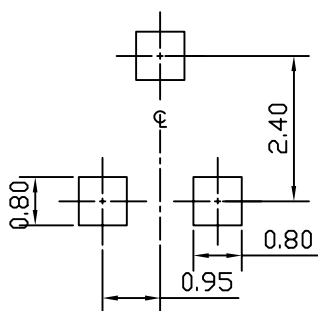
Version

L

## 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	2.50	2.70	2.90	0.102	0.110	0.118
E1	1.30	1.50	1.70	0.050	0.060	0.667
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°

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## 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  $\pm 0.100$  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.

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