AF9903M

2N and 2P-Channel Enhancement Mode Power MOSFET

■ Features

- Simple Drive Requirement
- Low On-Resistance
- Full Bridge Application on LCD Monitor Inverter
- Pb Free Plating Product

■ General Description

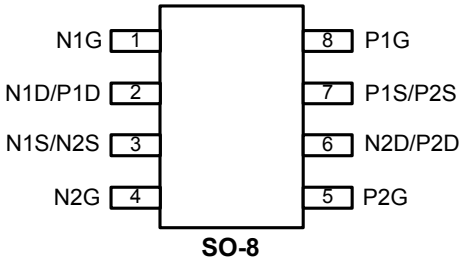
The advanced power MOSFET provides the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SO-8 package is universally preferred for all commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

■ Product Summary

CH	BV_{DSS} (V)	$R_{DS(ON)}$ (mΩ)	I_D (A)
N	35	48	4.3
P	-35	72	-3.6

■ Pin Assignments

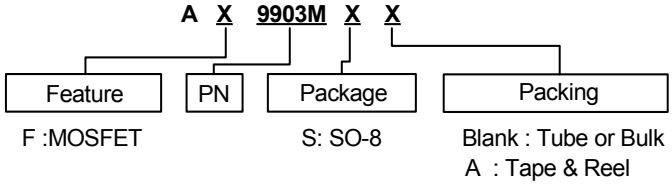


SO-8

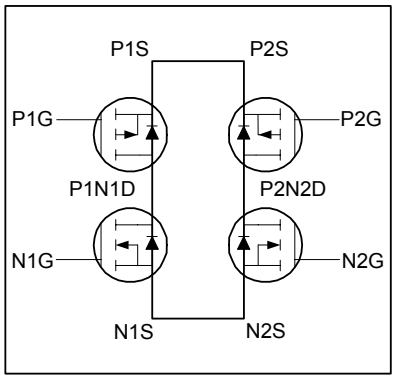
■ Pin Descriptions

Pin Name	Description
N1G	Gate (NMOS1)
N1D/P1D	Drain(NMOS1) / Drain(PMOS1)
N1S/N2S	Source(NMOS1) / Source(NMOS2)
N2G	Gate (NMOS2)
P2G	Gate (PMOS2)
N2D/P2D	Drain(NMOS2) / Drain(PMOS2)
P1S/P2S	Source(PMOS1) / Source(PMOS2)
P1G	Gate (PMOS1)

■ Ordering information



■ Block Diagram



■ Absolute Maximum Ratings

Symbol	Parameter		N-Channel	P-Channel	Units
V_{DS}	Drain-Source Voltage		35	-35	V
V_{GS}	Gate-Source Voltage		±20	±20	
I_D	Continuous Drain Current **(Note 1)**	T_A=25ºC	4.3	-3.6	A
		T_A=70ºC	3.4	-2.8	
I_{DM}	Pulsed Drain Current **(Note 2)**		20	-20	A
P_D	Total Power Dissipation	T_A=25ºC	1.38		W
	Linear Derating Factor		0.01		W/ºC
T_{STG}	Storage Temperature Range		-55 to 150		ºC
T_J	Operating Junction Temperature Range		-55 to 150		ºC

■ Thermal Data

Symbol	Parameter		Value	Units
$R_{\theta JA}$	Thermal Resistance Junction-Ambient **(Note 1)**	Max.	90	ºC/W

■ Electrical Characteristics (T_J=25ºC unless otherwise specified)

Symbol	Parameter		Test Conditions	Limits CH	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source breakdown Voltage		V_{GS}=0V, I_D=250uA	N	35	-	-	V
			V_{GS}=0V, I_D=-250uA	P	-35	-	-	
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient		Reference to 25 ºC, I_D=1mA	N	-	0.03	-	V/ºC
			Reference to 25 ºC, I_D=-1mA	P	-	-0.02	-	
$R_{DS(ON)}$	Static Drain-Source On-Resistance **(Note 3)**		V_{GS}=10V, I_D=4A	N	-	-	48	mΩ
			V_{GS}=4.5V, I_D=3A		-	-	70	
			V_{GS}=-10V, I_D=-3A	P	-	-	72	
			V_{GS}=-4.5V, I_D=-2A		-	-	100	
$V_{GS(th)}$	Gate-Threshold Voltage		V_{DS}= V_{GS}, I_D=250uA	N	1	-	3	V
			V_{DS}= V_{GS}, I_D=-250uA	P	-1	-	-3	
g_{fs}	Forward Transconductance		V_{DS}=10V, I_D=4A	N	-	8	-	S
			V_{DS}=-10V, I_D=-3A	P	-	6	-	
I_{DSS}	Drain-Source Leakage Current	T_J=25ºC	V_{DS}=30V, V_{GS}=0V	N	-	-	1	uA
		T_J=70ºC	V_{DS}=24V, V_{GS}=0V		-	-	25	
		T_J=25ºC	V_{DS}=-30V, V_{GS}=0V	P	-	-	-1	
		T_J=70ºC	V_{DS}=-24V, V_{GS}=0V		-	-	-25	
I_{GSS}	Gate-Source Leakage		V_{GS}=±20V	N	-	-	±100	nA
				P	-	-	±100	
Q_g	Total Gate Charge **(Note 3)**		N-Channel V_{DS}=28V, V_{GS}=4.5V I_D=4A P-Channel V_{DS}=-28V, V_{GS}=-4.5V I_D=-3A	N	-	6	10	nC
				P	-	6	10	
Q_{gs}	Gate-Source Charge			N	-	2	-	
				P	-	1	-	
Q_{gd}	Gate-Drain (“Miller”) Charge			N	-	3	-	
				P	-	3	-	

■ Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Limits				Unit
			CH	Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time **(Note 3)**	N-Channel V_{DS}=15V, V_{GS}=10V I_D=1A, R_G=3.3Ω, R_D=15Ω P-Channel V_{DS}=-15V, V_{GS}=-10V I_D=-1A, R_G=3.3Ω, R_D=15Ω	N	-	6	-	ns
			P	-	7	-	
t_r	Rise Time		N	-	5	-	
			P	-	5	-	
$t_{d(off)}$	Turn-Off Delay Time		N	-	14	-	
			P	-	19	-	
t_f	Fall-Time		N	-	4	-	
			P	-	4	-	
C_{iss}	Input Capacitance	N-Channel V_{GS}=0V, V_{DS}=25V f=1.0MHz P-Channel V_{GS}=0V, V_{DS}=-25V f=1.0MHz	N	-	490	780	pF
			P	-	420	1100	
C_{oss}	Output Capacitance		N	-	130	-	
			P	-	140	-	
C_{rss}	Reverse Transfer Capacitance		N	-	55	-	
			P	-	65	-	

■ Source-Drain Diode

Symbol	Parameter	Test Conditions	Limits				Unit
			CH	Min.	Typ.	Max.	
V_{SD}	Forward On Voltage **(Note 3)**	I_S=1.2A, V_{GS}=0V	N	-	-	1.2	V
		I_S=-1.2A, V_{GS}=0V	P	-	-	-1.2	
t_{rr}	Reverse Recovery Time	N-Channel I_S=4A, V_{GS}=0V dI/dt=100A/μs	N	-	18	-	ns
			P	-	20	-	
Q_{rr}	Reverse Recovery Charge	P-Channel I_S=-3A, V_{GS}=0V dI/dt=-100A/μs	N	-	11	-	nC
			P	-	16	-	

Note 1: Surface Mounted on 1 in^2 copper pad of FR4 board; t ≤10sec; 186°C/W when mounted on Min. copper pad.
Note 2: Pulse width limited by Max. junction temperature
Note 3: Pulse width ≤ 300us, duty cycle ≤ 2%.

■ Typical Performance Characteristics (N-Channel)

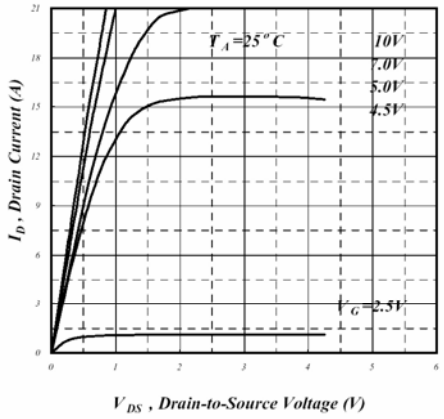


Fig 1. Typical Output Characteristics

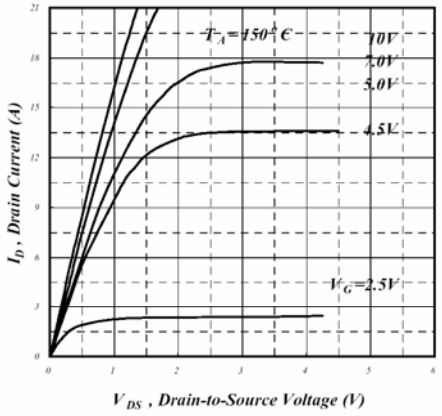


Fig 2. Typical Output Characteristics

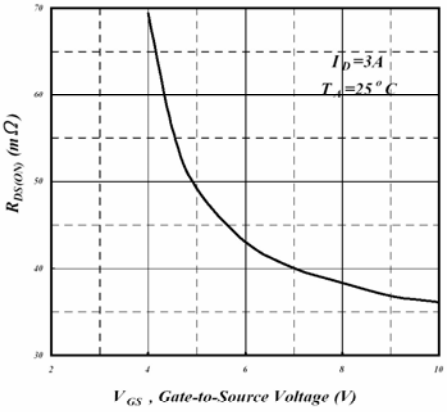


Fig 3. On-Resistance v.s. Gate Voltage

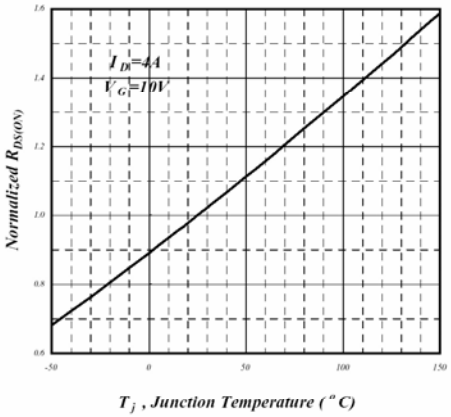


Fig 4. Normalized On-Resistance v.s. Junction Temperature

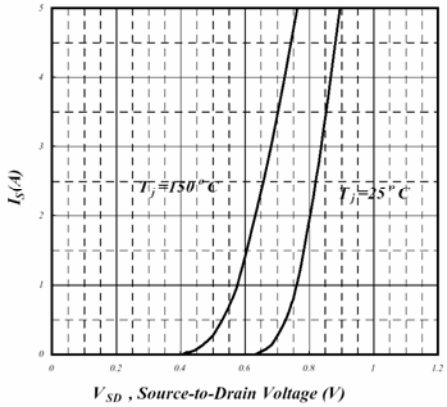


Fig 5. Forward Characteristic of Reverse Diode

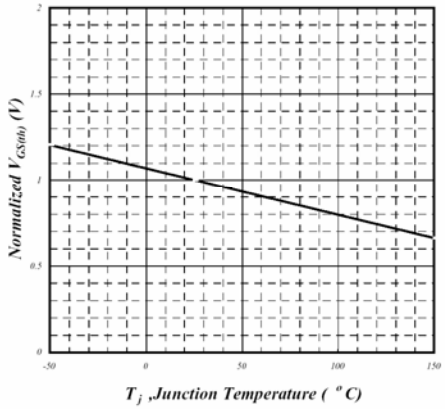


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

■ Typical Performance Characteristics (N-Channel) (Continued)

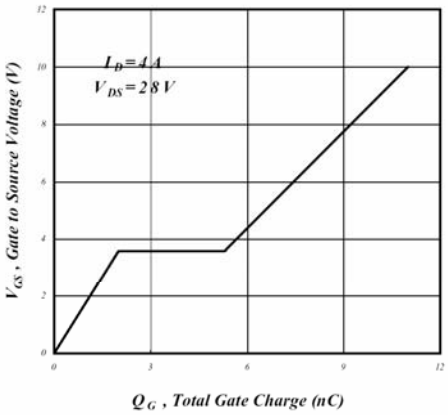


Fig 7. Gate Charge Characteristics

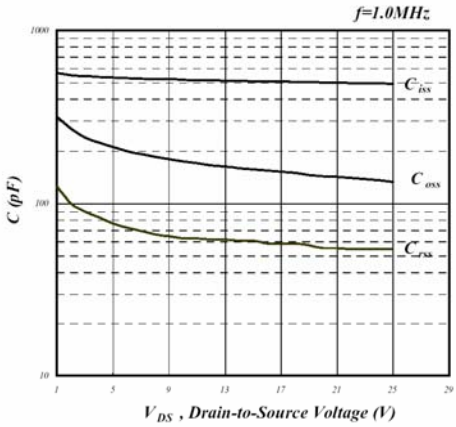


Fig 8. Typical Capacitance Characteristics

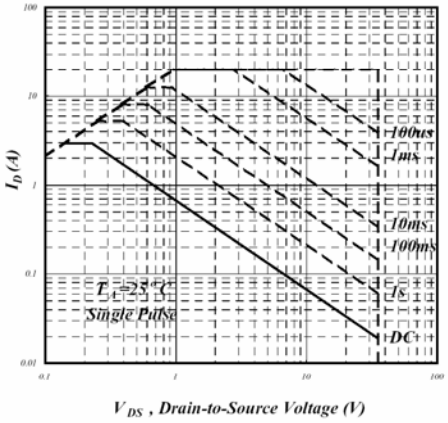


Fig 9. Maximum Safe Operating Area

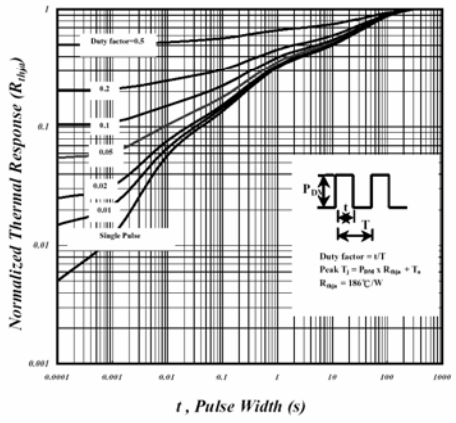


Fig 10. Effective Transient Thermal Impedance

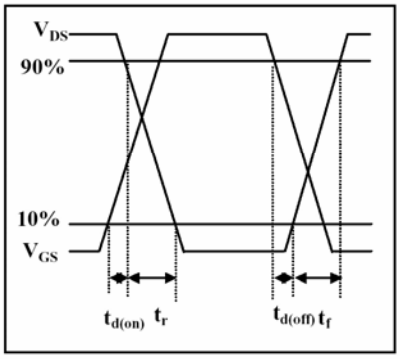


Fig 11. Switching Time Waveform

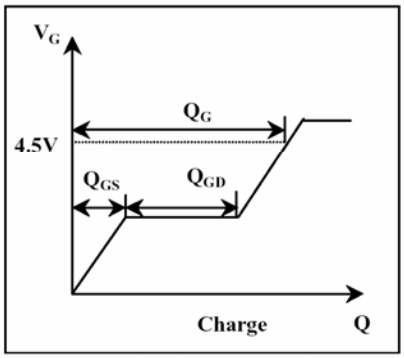


Fig 12. Gate Charge Waveform

■ Typical Performance Characteristics (P-Channel)

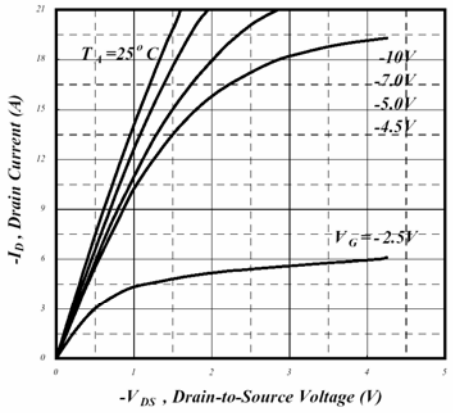


Fig 1. Typical Output Characteristics

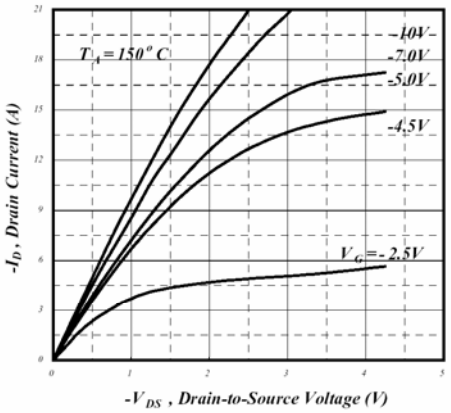


Fig 2. Typical Output Characteristics

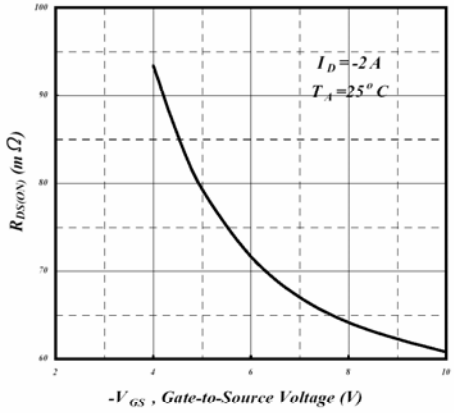


Fig 3. On-Resistance v.s. Gate Voltage

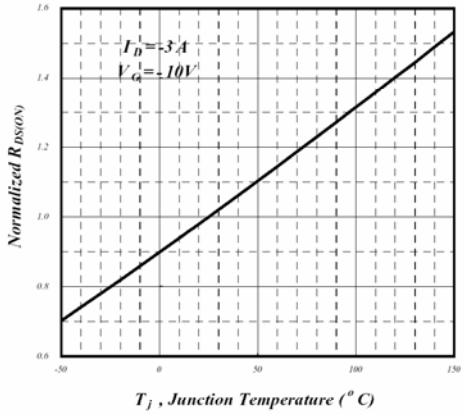


Fig 4. Normalized On-Resistance v.s. Junction Temperature

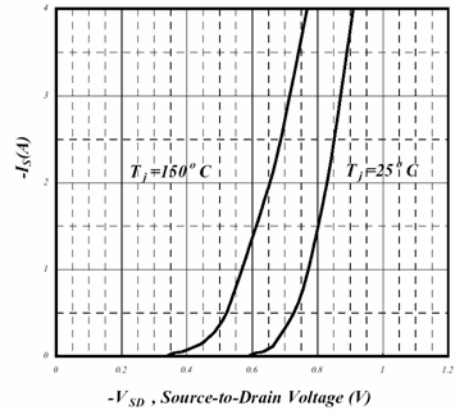


Fig 5. Forward Characteristic of Reverse Diode

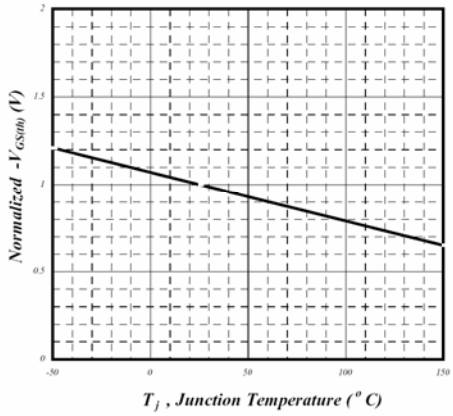


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

■ Typical Performance Characteristics (P-Channel) (Continued)

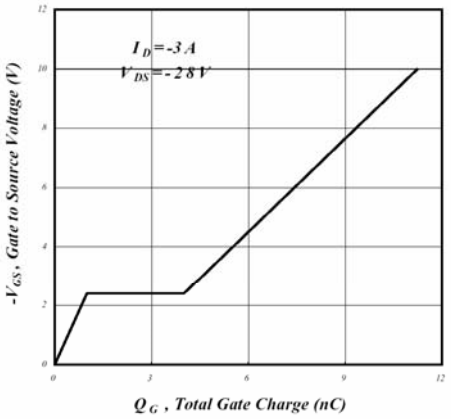


Fig 7. Gate Charge Characteristics

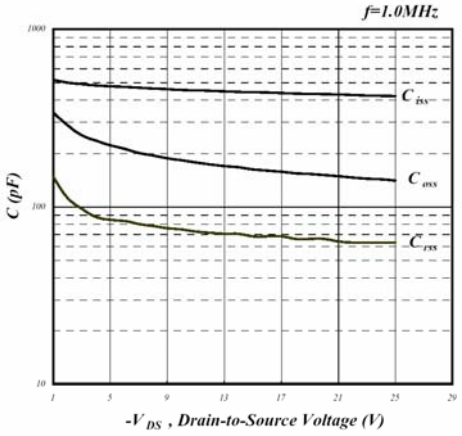


Fig 8. Typical Capacitance Characteristics

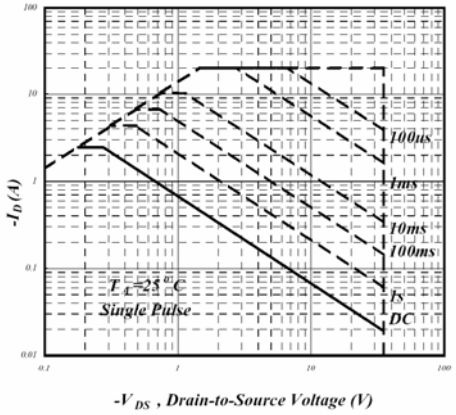


Fig 9. Maximum Safe Operating Area

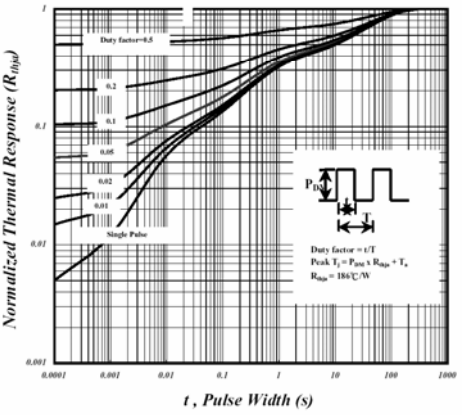


Fig 10. Effective Transient Thermal Impedance

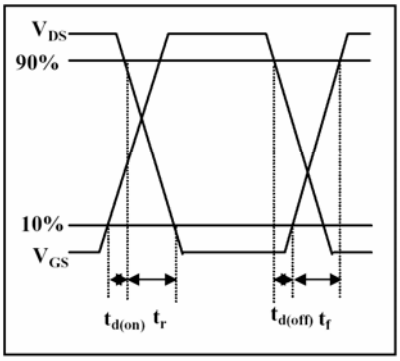


Fig 11. Switching Time Waveform

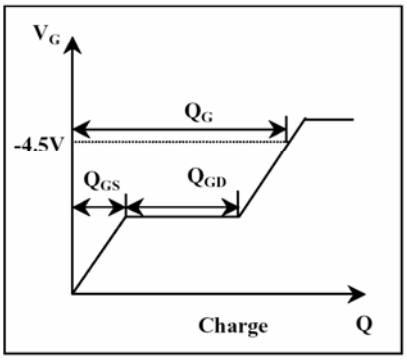
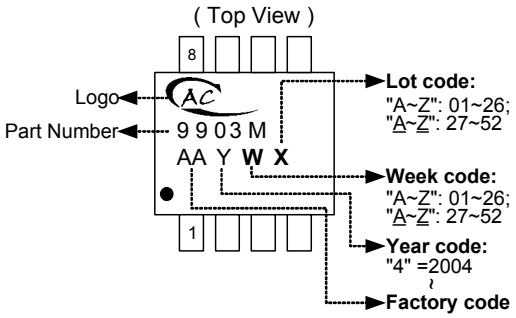


Fig 12. Gate Charge Waveform

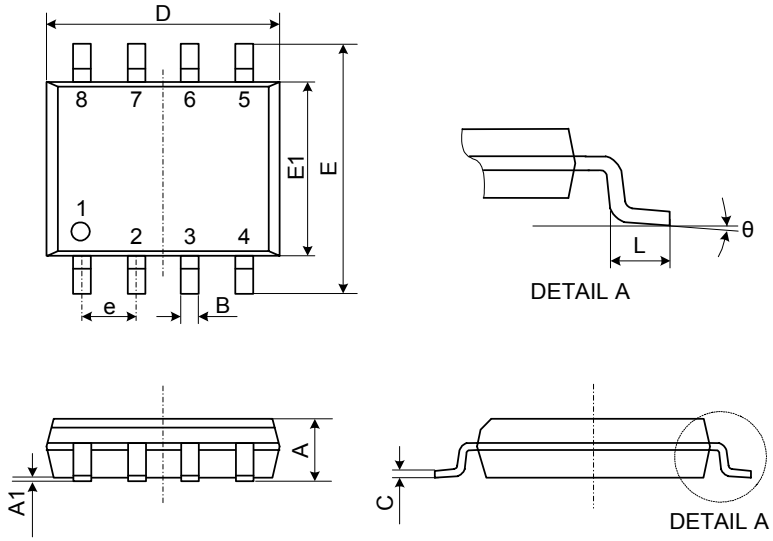
■ Marking Information

SO-8L



■ Package Information

Package Type: SO-8L



1. All Dimensions Are in Millimeters.
2. Dimension Does Not Include Mold Protrusions.

Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.33	0.41	0.51
C	0.19	0.22	0.25
D	4.80	4.90	5.00
E	5.80	6.15	6.50
E1	3.80	3.90	4.00
L	0.38	0.71	1.27
θ	0^o	4^o	8^o
e	1.27 TYP.		