One Channel Reversible Motor Driver AM2182

The AM2182 is a Reversible motor driver of higher Vom driver capability and Vom compensation function. Package material is Pb Free for purpose of environmental protection.

● Applications

Audio-visual equipment, PC peripherals, Car audios, Car navigation system, OA equipment.

● Features

1) A power saving mode is enabled (PS=”L”) by power-save terminal.
2) Small surface mounting power package (ETSSOP20)
3) Separating Vcc into Pre and Pow, can make better power efficiency
4) Thermal-shut-down circuit built in
5) Motor driver:
   a. The output voltage is adjustable by output voltage control terminal. (Only “H” side voltage)
   b. Brake circuit built in
   c. Circuit protection diode built in.
   d. Vom compensation function

● Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Supply voltage	PREVCC, POWVCC	13.5	V
Maximum output current	Iout	1.3	A
Power dissipation	Pd	3.5W *	W
Operating temperature	Topr	-40 ~ +85	℃
Storage temperature	Tstg	-55 ~ +150	℃

* JDEC (76.2X114.6X1.6mm) dual FR4 board mounting.

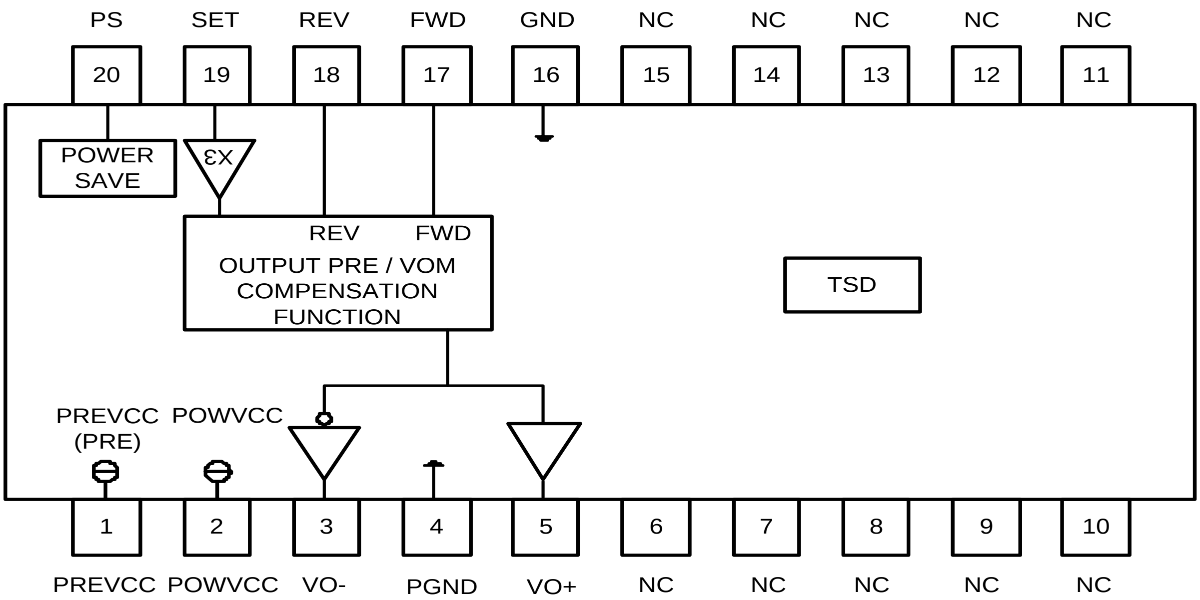
● Guaranteed Operating Ranges

PREVCC	4.3 ~ 13.2V
POWVCC	4.3 ~ PREVCC

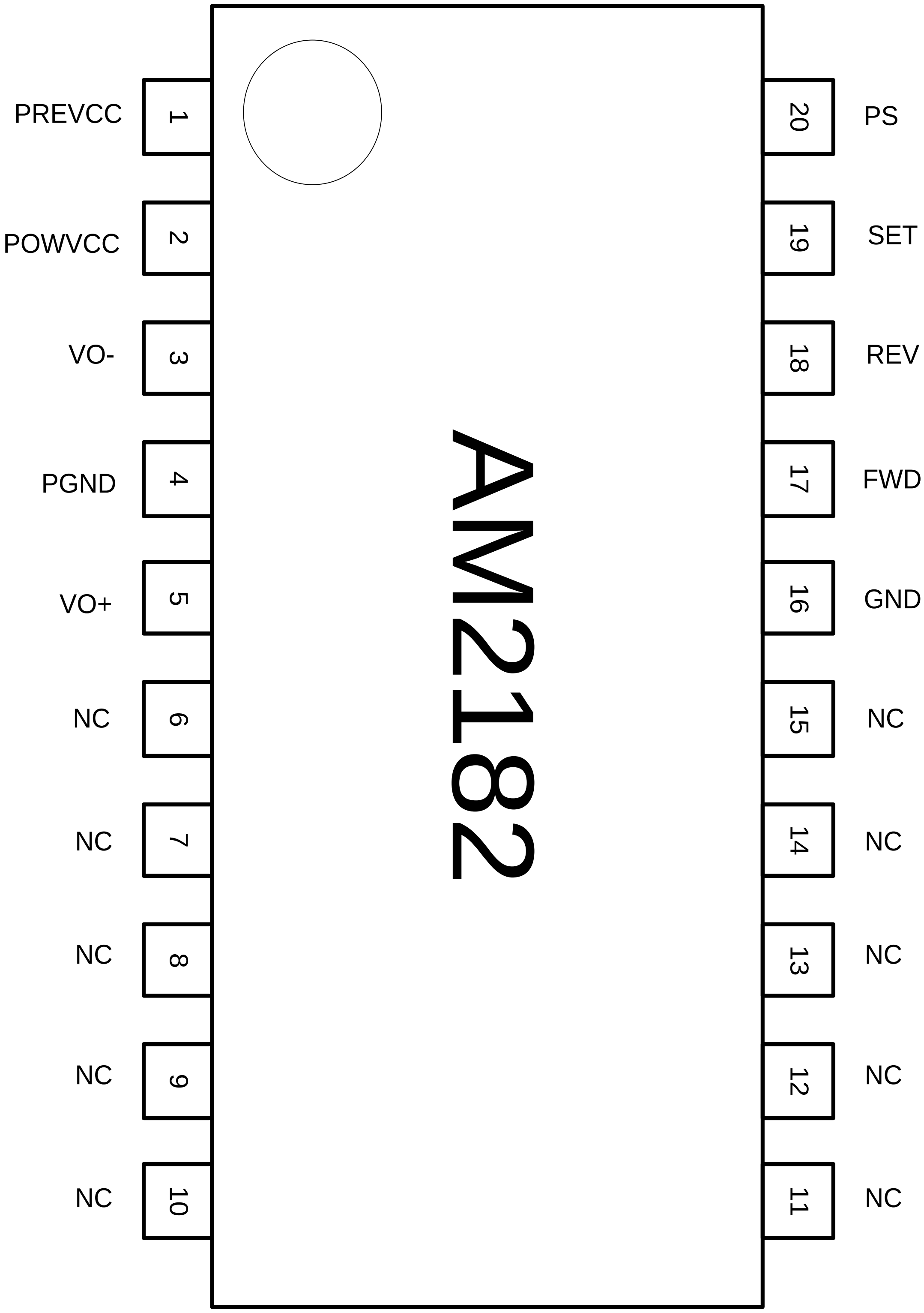
Electrical Characteristics (Unless otherwise specified, Ta = 25℃, PREVCC = 12V, POWVCC = 5V, PS = 2V)

Parameter	Symbol	Conditions	Limit			Unit
			Min	Typ	Max	
Quiescent Current	ICC	FWD = REV = “L”, PS = “H”, RL = ∞	-	10	15	mA
Power save on current	IPS	FWD = REV = PS = “L”, RL = ∞	-	0.1	0.3	mA
Power save on voltage	VPSON		-	-	0.5	V
Power save off voltage	VPSOFF		2.0	-	-	V
<Motor Driver>						
Output saturation voltage 1	VSAT1	Upper ＋ Lower saturation, IL = 200mA, POWVCC=8V	0.6	0.9	1.4	V
Output saturation voltage between F&R	ΔVSAT1	Output saturation voltage 1 between FWD and REV	-	-	0.1	V
Output saturation voltage 2	VSAT2	Upper ＋ Lower saturation, IL = 500mA, POWVCC=8V	0.7	1.2	2.0	V
Output adjustable gain on “H” side voltage	GVH	“H” side output for input (SET)	7.4	9.4	11	dB
<Motor driver input logic>						
Input high level voltage	VIHM		1.5	-	VCC	V
Input low level voltage	VILM		-0.3	-	0.5	V
Input high level current	IIHLD	FWD = REV = 5V	-	90	180	μA

Block Diagram



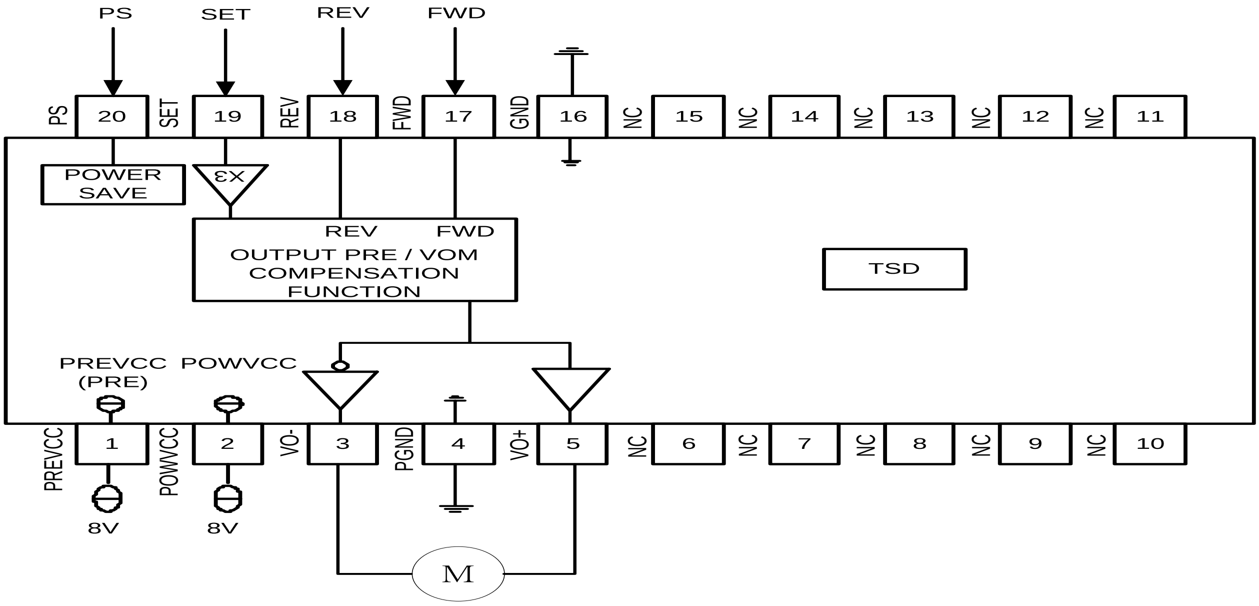
- **Pin configuration**



Pin Description

PIN No	Pin Name	Description
1	PREVCC	Pre unit power supply input terminal
2	POWVCC	Power unit power supply input terminal
3	VO-	Motor output negative terminal
4	PGND	Power GND
5	VO+	Motor output positive terminal
6	NC	NC
7	NC	NC
8	NC	NC
9	NC	NC
10	NC	NC
11	NC	NC
12	NC	NC
13	NC	NC
14	NC	NC
15	NC	NC
16	GND	Ground
17	FWD	Forward input terminal for Motor
18	REV	Reverse input terminal for Motor
19	SET	Motor output voltage setting input terminal
20	PS	Control terminal for power saving mode

- **Application circuit**



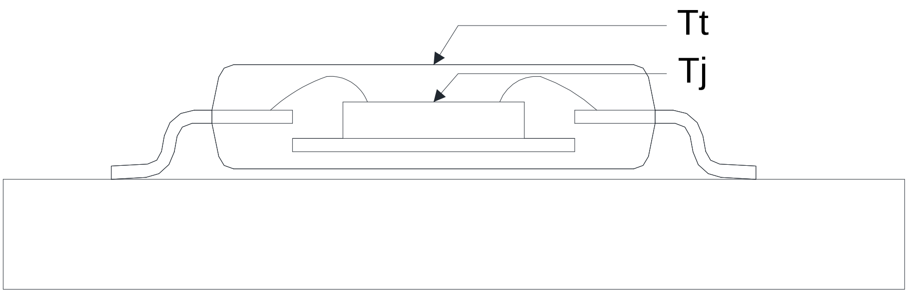
- **Power dissipation curve :**

- **Thermal Information**

θja	junction-to-ambient thermal resistance	35.51℃/W
Ψjt	junction-to-top characterization parameter	0.53℃/W

- **Θja** is obtained in a simulation on a JEDEC-standard 2s2p board as specified inJESD-51.
- The **Θja** number listed above gives an estimate of how much temperature rise is expected if the device was mounted on a standard JEDEC board.
- When mounted on the actual PCB, the **Θja** value of JEDEC board is totally different than the **Θja** value of actual PCB.
- **Ψjt** is extracted from the simulation data to obtain **Θja** using a procedure described in JESD-51, which estimates the junction temperature of a device in an actual PCB.

- The thermal characterization parameter, **Ψjt**, is proportional to the temperature difference between the top of the package and the junction temperature. Hence, it is useful value for an engineer verifying device temperature in an actual PCB environment as described in JEDEC JESD-51-12.
- When Greek letters are not available, **Ψjt** is written Psi-jt.
- Definition:



DFEINITION: $\psi_{jt} = (T_j - T_t) / P_d$

Where :

Ψjt (Psi-jt) = Junction-to-Top(of the package) °C/W
Tj= Die Junction Temp. °C
Tt= Top of package Temp at center. °C
Pd= Power dissipation. Watts

- Practically, most of the device heat goes into the PCB, there is a very low heat flow through top of the package, So the temperature difference between **Tj** and **Tt** shall be small, that is any error caused by PCB variation is small.

- This constant represents that **Ψjt** is completely PCB independent and could be used to predict the **Tj** in the environment of the actual PCB if **Tt** is measured properly.

- **How to predict Tj in the environment of the actual PCB**

Step 1 : Used the simulated **Ψjt** value listed above.

Step 2 : Measure **Tt** value by using

- **Thermocouple Method**
  We recommend use of a small ~40 gauge(3.15mil diameter) thermocouple. The bead and thermocouples wires should touch the top of the package and be covered with a minimal amount of thermally conductive epoxy. The wires should be heat-insulated to prevent cooling of the bead due to heat loss into wires. This is important towards preventing “too cool” **Tt** measurements, which would lead to the calculated **Tj** also being too cool.

- **IR Spot Method**
  An IR Spot method should be utilized only when using a tool with a small enough spot area to acquire the true top center “hot spot”.
  Many so-called “small spot size” tools still have a measurement area of 0~100+mils at “zero” distance of the tool from the surface. This spot area is too big for many

smaller packages and likely would result in cooler readings than the small thermocouple method. Consequently, to match between spot area and package surface size is important while measuring **Tt** with IR sport method.

Step 3 : calculating power dissipation by

$$P \cong (VCC - |V_{o\_Hi} - V_{o\_Lo}|) \times I_{out} + VCC \times Icc$$

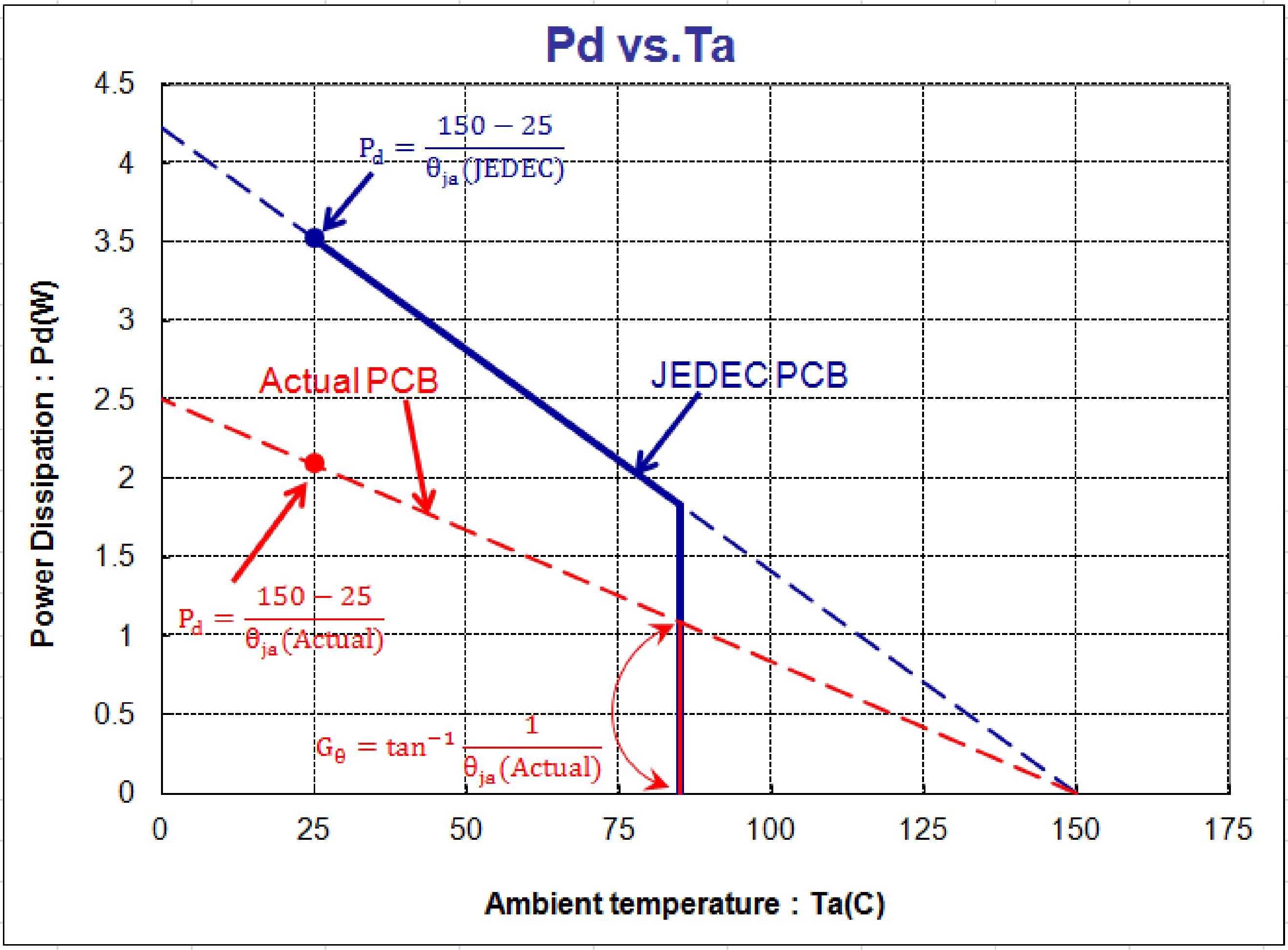
Step 4 : Estimate **Tj** value by

$$\mathbf{Tj = \Psi jt \times P + Tt}$$

Step 5: Calculated Θja value of actual PCB by the known **Tj**

$$\Theta ja_{(actual)} = (Tj - Ta)/P$$

Maximum Power Dissipation (de-rating curve) under JEDEC PCB & actual PCB



- **ETSSOP THERMALINFORMATION**

The thermally enhanced ETSSOP package is based on the 20-pin ETSSOP, but includes a thermal pad (see Figure 7) to provide an effective thermal contact between the IC and the PCB. The Thermal-pad package (thermally enhanced ETSSOP) combines fine-pitch, surface-mount technology with thermal performance comparable to much larger power packages. The Thermal-pad package is designed to optimize the heat transfer to the PCB. Because of the small size and limited mass of an ETSSOP package, thermal enhancement is achieved by improving the thermal conduction paths that remove heat from the component. The thermal pad is formed using a lead-frame design and manufacturing technique to provide a direct connection to the heat-generating IC. When this pad is soldered or otherwise thermally coupled to an external heat dissipater, high power dissipation in the ultra-thin, fine-pitch, surface-mount package can be reliably achieved.

- **Thermal Methodology for the ETSSOP package**

The thermal design for the ETSSOP part (e.g., thermal pad soldered to the board) should be similar to the design in the following figures. The cooling approach is to conduct the dissipated heat into the via pads on the board, through the vias in the board, and into a heat-sink (aluminum bar) (if necessary).Figure 7 shows a recommended land on the PCB.

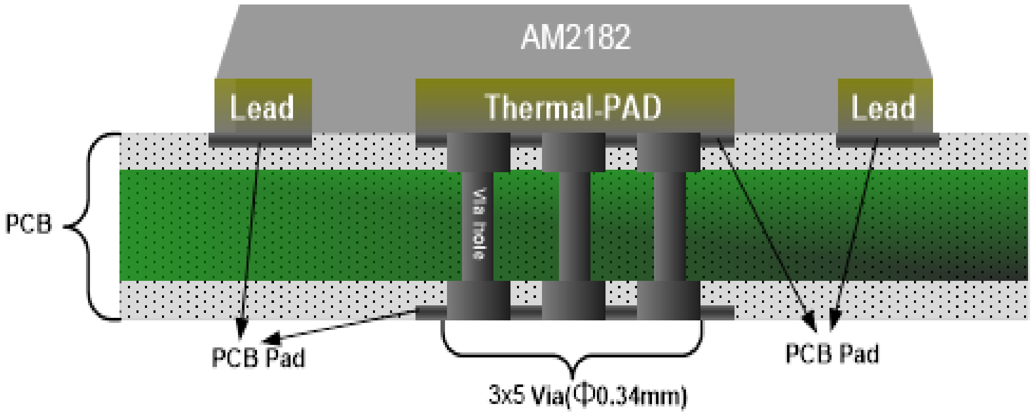


Figure 7 Recommended Via holes placement

The lower via pad area, slightly larger than the IC pad itself, is exposed with a window in the solder resist on the bottom surface of the board. It is not coated with solder during the board construction to maintain a flat surface. In production, this can be accomplished with a peeled solder mask.
We suggest the dimension of via should be ϕ0.34mm in order to let solder be filled in via to optimize the heat transfer to the PCB.
The number of via should be as much as possible to cover whole pad area in order to optimize the heat transfer to the PCB.

Operation notes

1) The built-in thermal shutdown circuit mutes the output current when the chip temperature reaches 175℃ (typ.). The hysteresis is set to 25℃ (typ.), so the circuit will start up again when the chip temperature falling to 150℃ (typ.).
2) Insert the bypass capacitor (~ 0.1uF) between Vcc pin and GND pin as close as possible.
3) Motor output driver logic input:

FWD (pin17)	REV (pin18)	VO+ (pin5)	VO- (pin3)	Function
L	L	OPEN	OPEN	Open mode
L	H	L	H	Reverse mode
H	L	H	L	Forward mode
H	H	L	L	Brake mode

Input circuit of pin17 and pin18 is designed to avoid simultaneous activation of upper and lower output tr. ; however, in order to improve reliability, apply motor forward/reverse input once through open mode.
We recommend time period for open longer than 10msec.

"H" side Output voltage on output voltage (VO+, VO-) varies depending on output control terminal for Motor output (pin19). "H" side output voltage is set three times (9.2dB Typ.) SET(pin19). And, "L" side output voltage is equal to output saturation voltage.

4) Motor output CH Vom compensation function:

This Vom compensation function allows low Vom (for example: 4.7V) setting to have superior noise-less performance with different type motors application.

The Vom won't be dropped seriously when output CH is blocked by external force.

Condition of Soldering

1).Manual Soldering

Pb-free: Time / Temperature $\leq$ 3 sec / 400 $\pm$ 10 °C （2 Times）

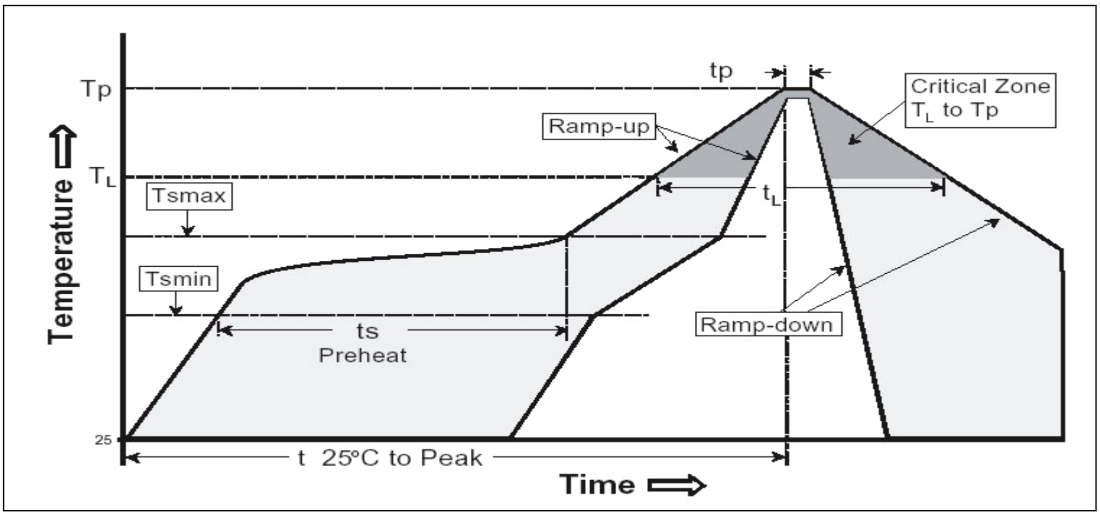
Test Results：0 fail/ 22 tested

Manual Soldering count：2 Times

2).Re-flow Soldering (follow IPC/JEDEC J-STD-020D)

Classification Reflow Profile

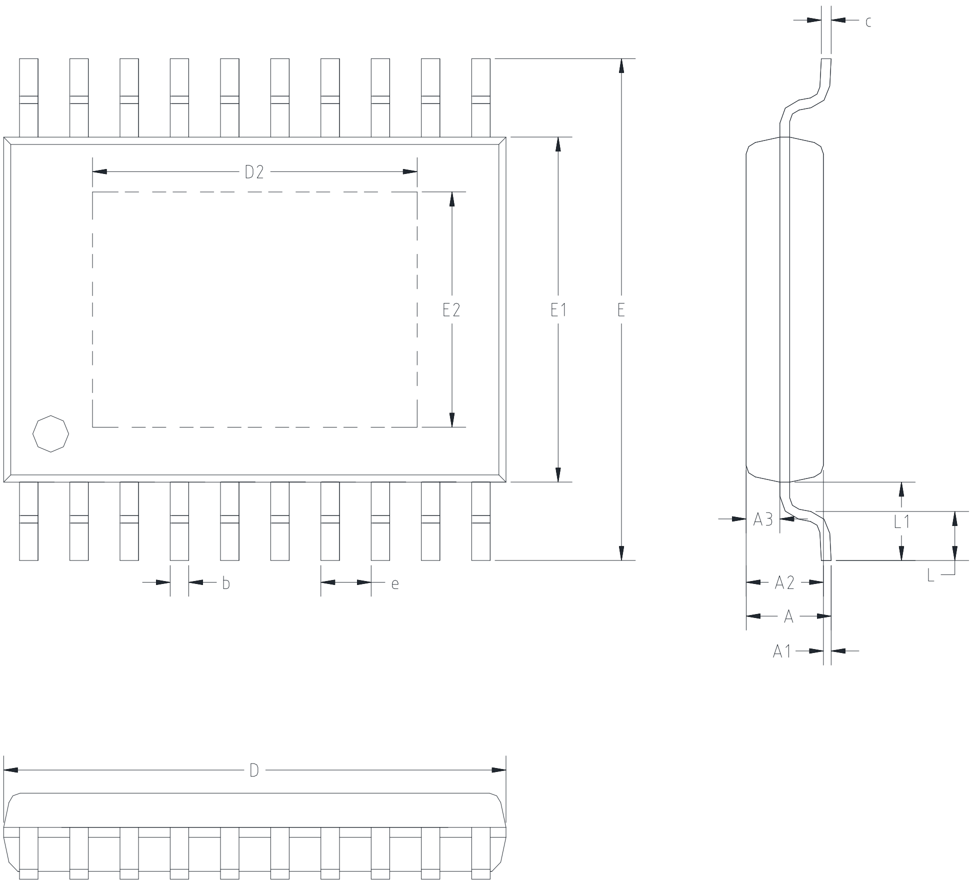
Profile Feature	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max.
Preheat - Temperature Min (Ts min) - Temperature Max (Ts max) - Time (min to max) (ts)	 150°C 200°C 60-180 seconds
Ts max to T_L - Temperature Min (Ts min)	 3°C/second max.
Time maintained above: - Temperature (T_L) - Time (t_L)	 217°C 60-150 seconds
Peak Temperature (T_P)	260 +0/-5°C
Time with 5°C of actual Peak - Temperature (tp)	20-40 seconds
Ramp-down Rate	6°C/second max.
Tme 25°C to Peak Temperature	8 minutes max.



- Test Results：0 fail/ 32 tested
- Reflow count：3 cycles

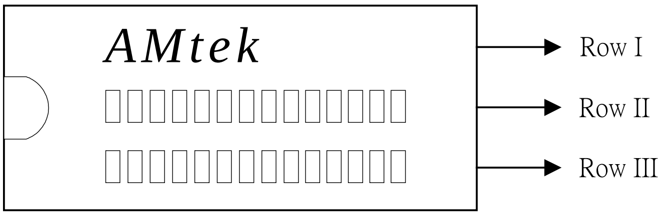
- **Packaging outline**

eTSSOP 20L **Unit : mm**



SYMBOL	MILLIMETERS		INCHES	
	Min.	Max.	Min.	Max.
A	-	1.20	-	0.047
A1	0.05	0.15	0.002	0.006
A2	0.80	1.05	0.031	0.041
A3	0.39	0.49	0.015	0.019
b	0.19	0.30	0.007	0.012
c	0.09	0.20	0.004	0.007
D	6.40	6.60	0.252	0.260
E1	4.30	4.50	0.169	0.173
E	6.20	6.60	0.244	0.260
D2	4.10	4.30	0.161	0.169
E2	2.90	3.10	0.114	0.122
L	0.45	0.75	0.018	0.030
L1	1.00BSC		0.039 BSC	
e	0.65 BSC		0.026 BSC	

- **Marking Identification**



Row I
AMtek

Row II
AM2182

Row III
Lot number