

## Description

The AM9468 is a high performance ultra low noise single phase (single-coil) brushless direct current (BLDC) fan and motor driver. The integrated full-bridge driver output stage uses a BTL linear driver architecture to minimize audible switching noise and electromagnetic interference (EMI) providing a low noise solution.

For system flexibility the motor speed can be controlled by either an external PWM signal or by a DC voltage or from a thermistor network. Based on the input signal, the AM9468 adjusts the output duty cycle.

To help protect the motor coil, the AM9468 provides Rotor Lock Protection which shuts down the output drive if rotor lock is detected. The device automatically re-starts when the rotor lock is removed. In case of over voltage, the device shuts down the output drive and enters standby mode to help prevent over voltage stress on the coil. Over temperature shutdown provides thermal protection for the device.

A Tachometer output is provided by open-drain Frequency Generator (FG) Pin which allows external interface to monitor motor rotation or speed. The FG output is the magnetic change frequency. Additionally, a rotor lock detect output is provided by open-drain RD pin.

The AM9468 is available in power capable low profile TSSOP-16 package.

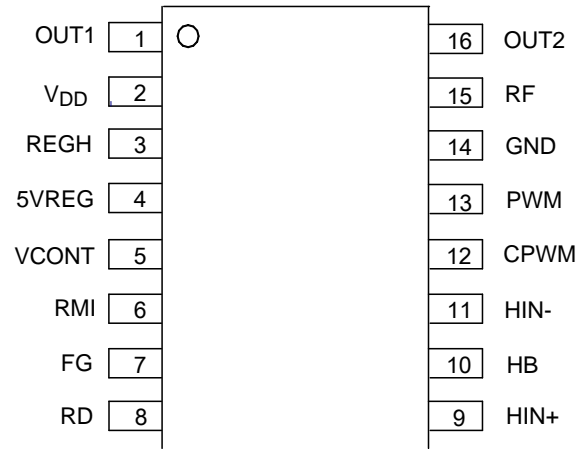
## Features

- Single-Phase Full Wave BLDC Fan/Motor Drive with BTL Output (BTL Amplifier Gain = 49dB)
- Low Noise Architecture
- Wide Operating Voltage Range: 2.4V to 18V
- PWM Speed Control with External PWM Input
- DC Voltage Speed Control by Adjusting VCONT and RMI Voltage
- Hall Bias Output:  $V_{HB} = 1.25V$
- Built-in Quick Start Circuit
- Lock Protection with Automatic Restart
- Frequency Generator (FG) Output
- Rotor Lock Detection (RD) Output
- Current Limit Circuit
- $R_F$  Defines The Current Limit;  
 $R_F = 1\Omega$  will Achieve 250mA Current Limit
- Thermal Shut-Down (TSD) Circuit
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds

## Pin Assignments

(Top View)



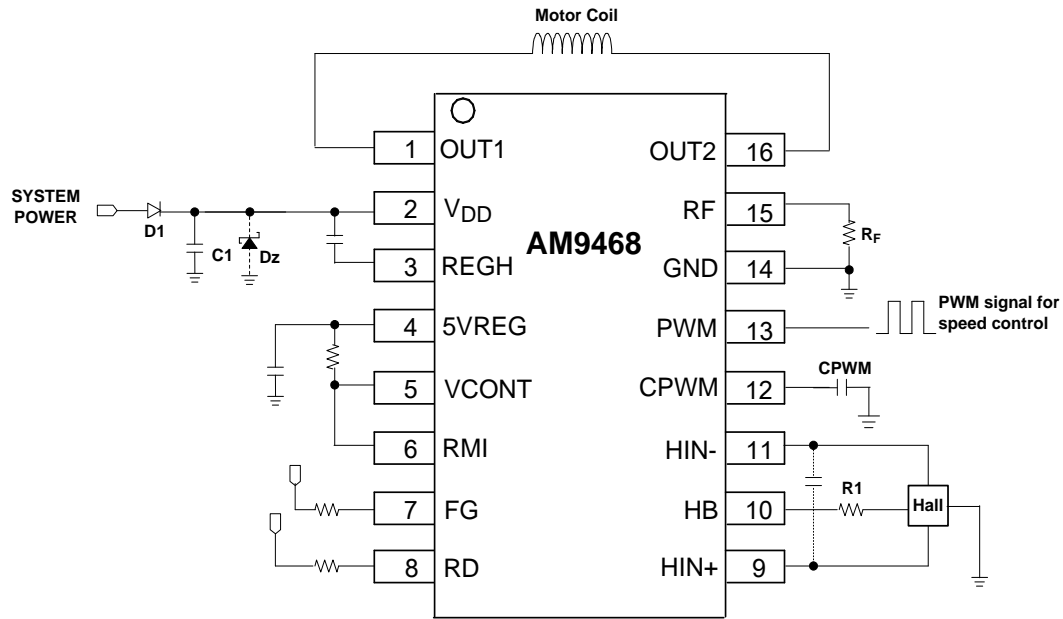
TSSOP-16

## Applications

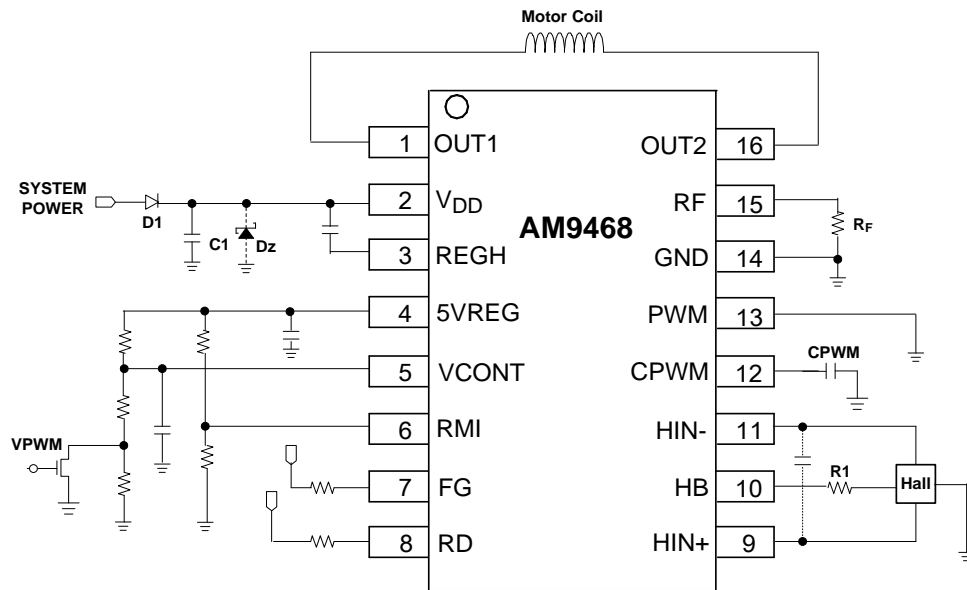
- 9V/ 12V / 15V BLDC Cooling Fans and Motors
- CPU Cooling Fans for Notebooks and Desktop BLDC Fans
- Instruments Cooling Fans
- Medium Voltage/ Low Power BLDC Motors

**Typical Applications Circuit** (Notes 4 and 5)

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**Typical Applications Circuit for PWM Speed Control**



**Typical Applications Circuit for VCONT/RMI Control**

Notes:

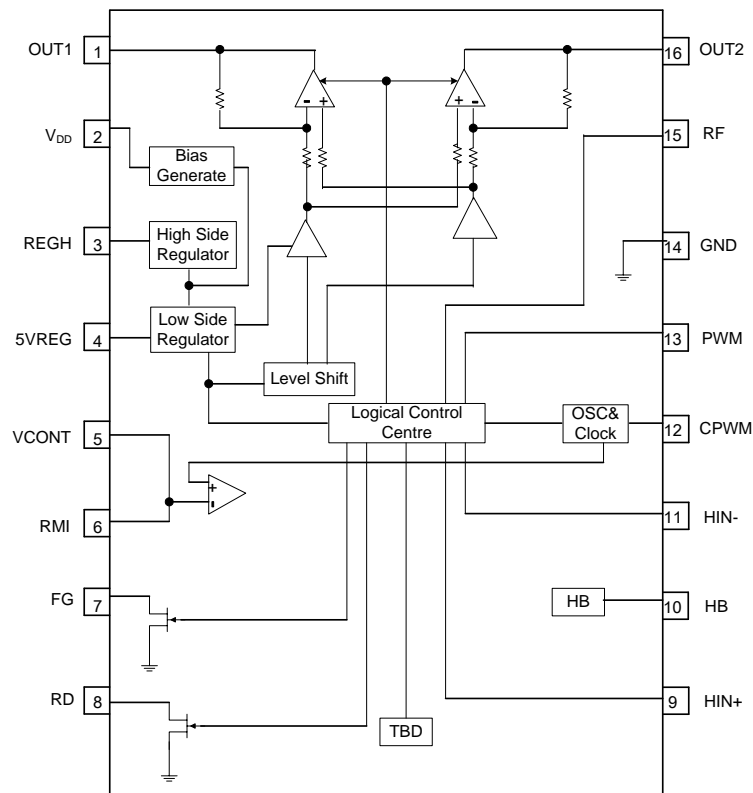
- C1 is for power stabilization and to strengthen the noise immunity and should be as close to the V<sub>DD</sub> pin as possible. The recommended value for C1 is 1μF typically. The value of capacitor can be optimized depending on the operating mode, motor voltage and the motor current. For PWM speed control mode, with datasheet current capability, the recommended capacitor value is 1μF. The value of the C1 should be checked in the motor design and route in its operating conditions if it is reduced or increased from the recommended value of 1μF.
- Diode D1 is for the reverse connection protection. In addition to power stabilization and noise immunity, C1 also absorbs regenerative motor spikes. Depending on the amount of regenerative voltage spike, value of C1 needs to be adjusted. The zener diode Dz is used to clamp the regenerative voltage spike from the motor operation to safe level when reverse blocking diode D1 is used. If reverse blocking diodes is not used, the use of zener clamp Dz depends on the supply voltage capability to effectively sink the regenerative energy and voltage spike. The value of C1 and the requirement Dz needs to be verified on each application design.

## Pin Descriptions

| Pin Number | Pin Name        | Description                                                                                                                                   |
|------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | OUT1            | Output drive - source & sink capable pin                                                                                                      |
| 2          | V <sub>DD</sub> | Power supply input pin                                                                                                                        |
| 3          | REGH            | High side regulator output voltage                                                                                                            |
| 4          | 5VREG           | 5V regulator output voltage                                                                                                                   |
| 5          | VCONT           | Output duty control pin in DC signal speed control mode; Voltage in VCONT is compared with triangular wave on CPWM for the output duty ratio. |
| 6          | RMI             | Output minimum duty (minimum speed) control pin for CPWM                                                                                      |
| 7          | FG              | Frequency Generator (FG) - The FG output is same as the magnetic change frequency                                                             |
| 8          | RG              | Rotor lock detect open drain output                                                                                                           |
| 9          | HIN+            | Hall device positive input pin                                                                                                                |
| 10         | HB              | Hall bias voltage                                                                                                                             |
| 11         | HIN-            | Hall device negative input pin                                                                                                                |
| 12         | CPWM            | Capacitor connection pin for PWM oscillator and main clock                                                                                    |
| 13         | PWM             | PWM signal input pin for PWM speed control mode. The PWM on this pin controls the output duty directly.                                       |
| 14         | GND             | Ground pin                                                                                                                                    |
| 15         | RF              | Current limit set pin; Connect a resistor between RF pin and GND, current limit is defined by $250\text{mV}/R_F$                              |
| 16         | OUT2            | Output drive - source & sink capable pin                                                                                                      |

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## Functional Block Diagram



**Absolute Maximum Ratings** (Note 6) @ $T_A = +25^\circ\text{C}$ , unless otherwise specified.

| Symbol          | Characteristics                    |          | Rating      | Unit             |
|-----------------|------------------------------------|----------|-------------|------------------|
| $V_{DD\_MAX}$   | Maximum Supply Voltage (Note 7)    |          | 24          | V                |
| $V_{REVERSE}$   | Reverse Supply Voltage on All Pins |          | -0.3        | V                |
| $V_{PWM\_MAX}$  | Maximum Voltage on Logic PWM Pin   |          | 7           | V                |
| $I_{OUT(PEAK)}$ | Maximum Output Current (Peak)      |          | 1,200       | mA               |
| $I_{OUT(CONT)}$ | Maximum Continuous Current         |          | 500         | mA               |
| $I_{RD}$        | Maximum RD Output Current          |          | 5           | mA               |
| $V_{RD}$        | Maximum RD Voltage                 |          | 24          | V                |
| $I_{FG}$        | Maximum FG Output Current          |          | 5           | mA               |
| $V_{FG}$        | Maximum FG Voltage                 |          | 24          | V                |
| $I_{HB}$        | Maximum HB Output Current          |          | 10          | mA               |
| $P_D$           | Power Dissipation (Notes 8 & 9)    | TSSOP-16 | 1,610       | mW               |
| $T_{STG}$       | Storage Temperature Range          |          | -65 to +150 | $^\circ\text{C}$ |
| $T_J$           | Maximum Junction Temperature       |          | +150        | $^\circ\text{C}$ |
| ESD HBM         | Human Body Model ESD Capability    |          | 4           | kV               |

- Notes:
- Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.
  - The absolute maximum  $V_{DD}$  of 24V is a transient stress rating and is not meant as a functional operating condition. It is not recommended to operate the device at the absolute maximum rated conditions for any period of time.
  - For thermal de-rating curves under different PCB sizes and layout conditions, see thermal performance section.
  - AM9468 exposed pad soldered to minimum recommended landing pads (see Package Outline Dimension section) on 3inch x 4.5inch four-layer 2oz.copper glass epoxy PCB (1.6mm thickness), calculated in accordance with JESD 51-7. See thermal performance section.

**Recommended Operating Conditions**

| Symbol       | Characteristic                                                                | Conditions                     | Min | Max                | Unit             |
|--------------|-------------------------------------------------------------------------------|--------------------------------|-----|--------------------|------------------|
| $V_{DD}$     | Supply Voltage When The Device Is Operating Normally With All Circuits Active | Operating; All circuits active | 2.4 | 18                 | V                |
| $V_{ICM}$    | Hall Input Common-Mode Input Voltage Range                                    | -                              | 0.3 | $V_{5VREG} - 1.5V$ | V                |
| $V_{CONTIN}$ | VCONT Input Voltage Range                                                     | -                              | 0.3 | $V_{5VREG}$        | V                |
| $V_{RMIN}$   | RMI Input Voltage Range                                                       | -                              | 0.3 | $V_{5VREG}$        | V                |
| $T_A$        | Operating Temperature Range                                                   | Operating                      | -40 | +105               | $^\circ\text{C}$ |

**Electrical Characteristics** (Note 10) (@ $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12V$ , unless otherwise specified.)

| Symbol         | Characteristics                                                | Conditions         | Min  | Typ  | Max  | Unit |
|----------------|----------------------------------------------------------------|--------------------|------|------|------|------|
| $I_{DD}$       | Supply Current                                                 | -                  | -    | 2.5  | 4.0  | mA   |
| $V_{OV\_TH}$   | Over Voltage Protection Threshold for Shutdown to Standby Mode | Voltage increasing | 19.5 | 20.5 | 21.5 | V    |
| $V_{OV\_RLTH}$ | Over Voltage Release Threshold                                 | Voltage decreasing | 18.3 | 19.5 | 20.5 | V    |

- Note: 10. Typical data is measured at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12V$ . The maximum and minimum parameters values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control.

**Electrical Characteristics** (Note 11) (@ $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12\text{V}$ , unless otherwise specified.) (Cont.)

| Symbol             | Characteristics                                     | Conditions                                                                                  | Min            | Typ            | Max            | Unit             |
|--------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|----------------|----------------|------------------|
| $V_O$              | Output On Voltage, Source + Sink                    | $I_{OUT} = 500\text{mA}$ (Source+Sink)<br>$T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$ | –              | 0.45           | 0.68           | V                |
| $V_{RF}$           | Current Limit Voltage                               | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 230            | 250            | 270            | mV               |
| $V_{RGL}$          | 5VREG Output Voltage                                | $I_{SVREG} = 5\text{mA}$ , $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                | 4.8            | 5              | 5.2            | V                |
| $V_{RGH}$          | REGH Output Voltage                                 | $I_{REGH} = 5\text{mA}$                                                                     | $V_{DD} - 4.6$ | $V_{DD} - 4.2$ | $V_{DD} - 3.9$ | V                |
| $V_{HB}$           | Hall Bias Output Voltage                            | $I_{HB} = 5\text{mA}$ , $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                   | 1.20           | 1.25           | 1.30           | V                |
| $I_{HIN}$          | Hall Input Bias Current                             | –                                                                                           | –              | –              | 0.5            | $\mu\text{A}$    |
| $V_{INOF5}$        | Hall Amplifier Output Offset Voltage                | –                                                                                           | -5             | –              | 5              | mV               |
| $G_H$              | Hall Amplifier Voltage Gain                         | –                                                                                           | 48             | 52             | –              | dB               |
| $V_{PWML}$         | PWM Pin Input Low                                   | –                                                                                           | 0              | –              | 1.2            | V                |
| $V_{PWHH}$         | PWM Pin Input High                                  | –                                                                                           | 1.8            | –              | 5VREG          | V                |
| $I_{PWM}$          | PWM Pin Bias Current                                | PWM=GND                                                                                     | -17            | -10            | -6             | $\mu\text{A}$    |
| $t_{PWM\_MIN}$     | Input PWM Smallest Width                            | –                                                                                           | 2              | –              | –              | $\mu\text{s}$    |
| $f_{PWM\_RANGE}$   | External Input PWM Frequency Range                  | –                                                                                           | 8              | –              | 100            | kHz              |
| $I_{CPC}$          | CPWM Charge Current                                 | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 16.4           | –              | 19.6           | $\mu\text{A}$    |
| $I_{CPD}$          | CPWM Discharge Current                              | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 16.4           | –              | 19.6           | $\mu\text{A}$    |
| $R_{CP}$           | CPWM Charge/Discharge Current Ratio                 | $R_{CP} = I_{CPC} / I_{CPD}$                                                                | 0.9            | 1              | 1.11           | –                |
| $V_{CPH}$          | CPWM Oscillation High Level                         | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 3.35           | 3.5            | 3.65           | V                |
| $V_{CPL}$          | CPWM Oscillation Low Level                          | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 0.95           | 1.0            | 1.05           | V                |
| $V_{CPA}$          | CPWM Oscillation Amplitude                          | $T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$                                           | 2.3            | 2.5            | 2.7            | V                |
| $f_{CPWM}$         | CPWM Oscillation frequency                          | CPWM = 100pF                                                                                | –              | 36             | –              | kHz              |
| $I_{CONT}$         | VCONT Pin Input Bias Current                        | –                                                                                           | –              | –              | 0.3            | $\mu\text{A}$    |
| $I_{RMI}$          | RMI Pin Input Bias Current                          | –                                                                                           | –              | –              | 0.3            | $\mu\text{A}$    |
| $V_{RD}$           | RD Output Low Voltage                               | $I_{RD} = 3\text{mA}$                                                                       | –              | –              | 0.3            | V                |
| $I_{RDL}$          | RD Output Leakage Current                           | $V_{RD} = 18\text{V}$                                                                       | –              | –              | 1              | $\mu\text{A}$    |
| $V_{FG}$           | FG Output Low Voltage                               | $I_{FG} = 3\text{mA}$                                                                       | –              | –              | 0.3            | V                |
| $I_{FGL}$          | FG Output Leakage Current                           | $V_{FG} = 18\text{V}$                                                                       | –              | –              | 1              | $\mu\text{A}$    |
| $\Delta V_{FG}$    | FG Comparator Hysteresis                            | –                                                                                           | –              | $\pm 5$        | –              | mV               |
| $t_{LCK\_DET\_ON}$ | Output ON Time in Lock Detection                    | $C_{PWM} = 100\text{pF}$                                                                    | –              | 0.5            | –              | s                |
| $t_{OFF}$          | Output OFF Time in Lock Mode                        | $C_{PWM} = 100\text{pF}$                                                                    | –              | 4.5            | –              | s                |
| $R_T$              | Output OFF/ON Ratio in Lock Detection               | $C_{PWM} = 100\text{pF}$ , $R_T = t_{ACT} / t_{DET}$                                        | –              | 9              | –              | s                |
| $T_{J\_SDN\_TH}$   | IC Junction Temperature Thermal Shutdown Threshold  | –                                                                                           | –              | +175           | –              | $^\circ\text{C}$ |
| $T_{J\_SDN\_HYST}$ | IC Junction Temperature Thermal Shutdown Hysteresis | –                                                                                           | –              | +25            | –              | $^\circ\text{C}$ |

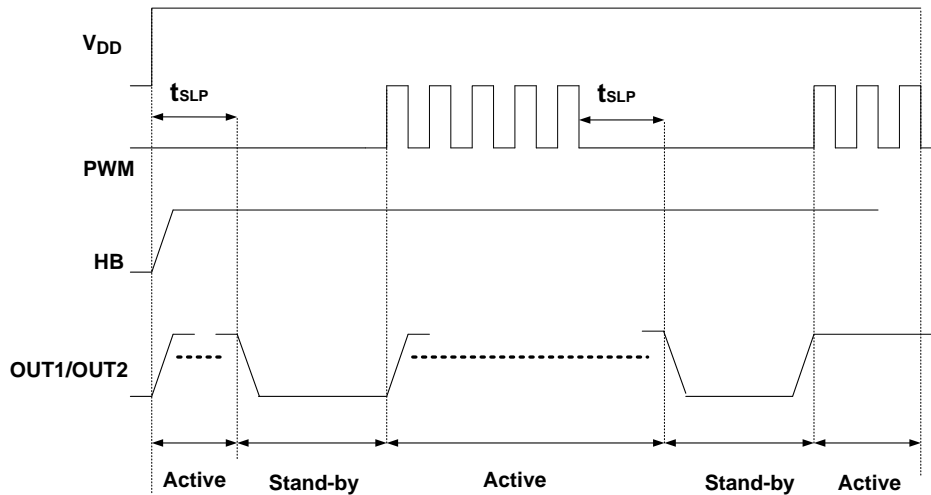
Note: 11. Typical data is measured at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12\text{V}$ . The maximum and minimum parameters values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control.

## Operating Characteristics

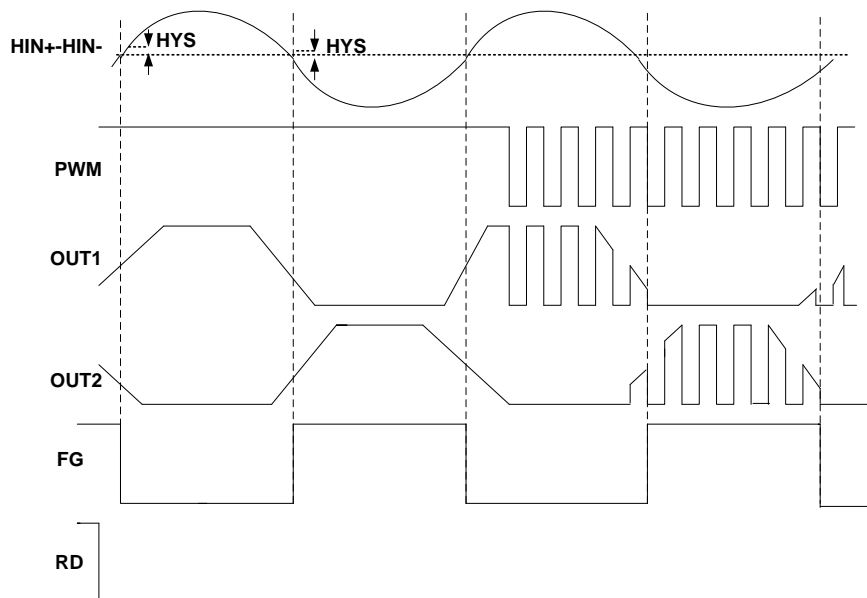
### Standby and Start-up Timing

When PWM pin input signal is logic "L" level continuously for time longer than  $t_{SLP}$ , the device enters standby mode as shown below. When PWM pin signal is "H" level, the device turns active and operates normally. The PWM pin is also used to control the motor speed with external PWM signal into this pin. The lowest frequency PWM signal is defined by  $t_{SLP}$ , i.e. the PWM duty low time has to be smaller  $t_{SLP}$  for motor speed control.

$t_{SLP} = 400\mu s$  typical



### In Normal Operation/Rotation

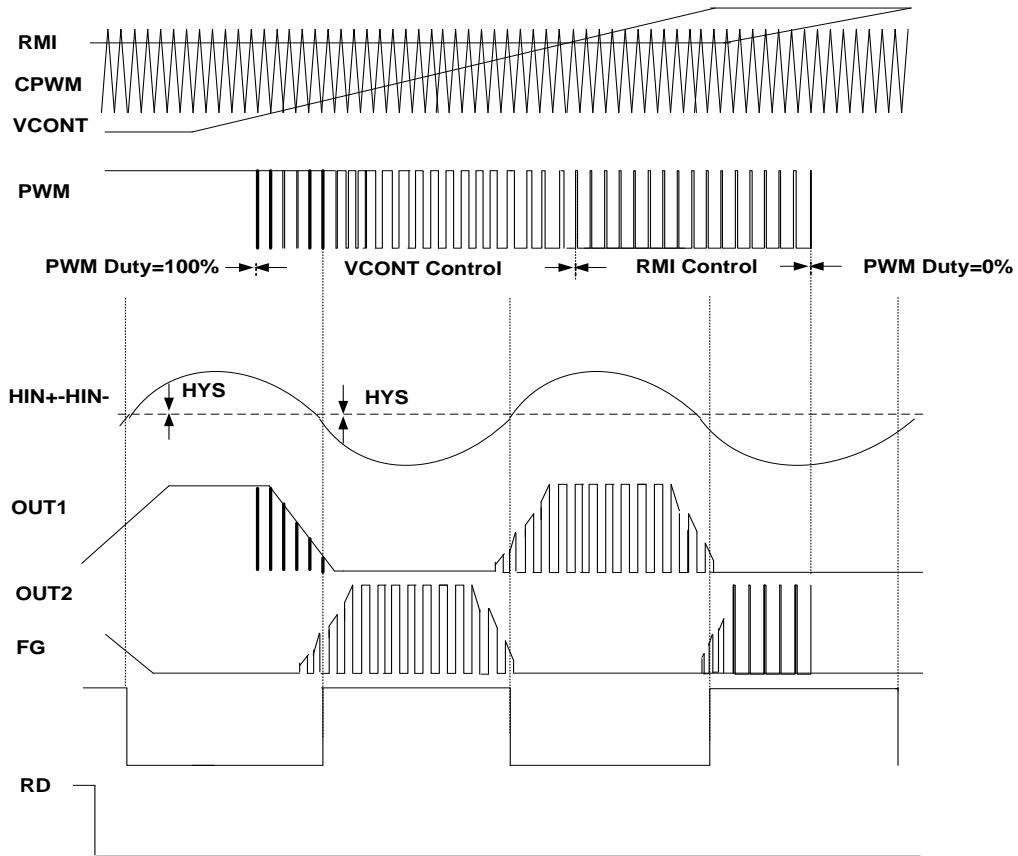


Truth Table for Various Modes with PWM pin

| HIN+ | HIN- | PWM | OUT1 | OUT2 | FG  | MODE       |
|------|------|-----|------|------|-----|------------|
| H    | L    | H   | H    | L    | L   | Drive      |
|      |      | L   | L    | L    |     | Regenerate |
| L    | H    | H   | L    | H    | OFF | Drive      |
|      |      | L   | L    | L    |     | Regenerate |

**Operating Characteristics (Cont.)**

**VCONT/RMI Control**



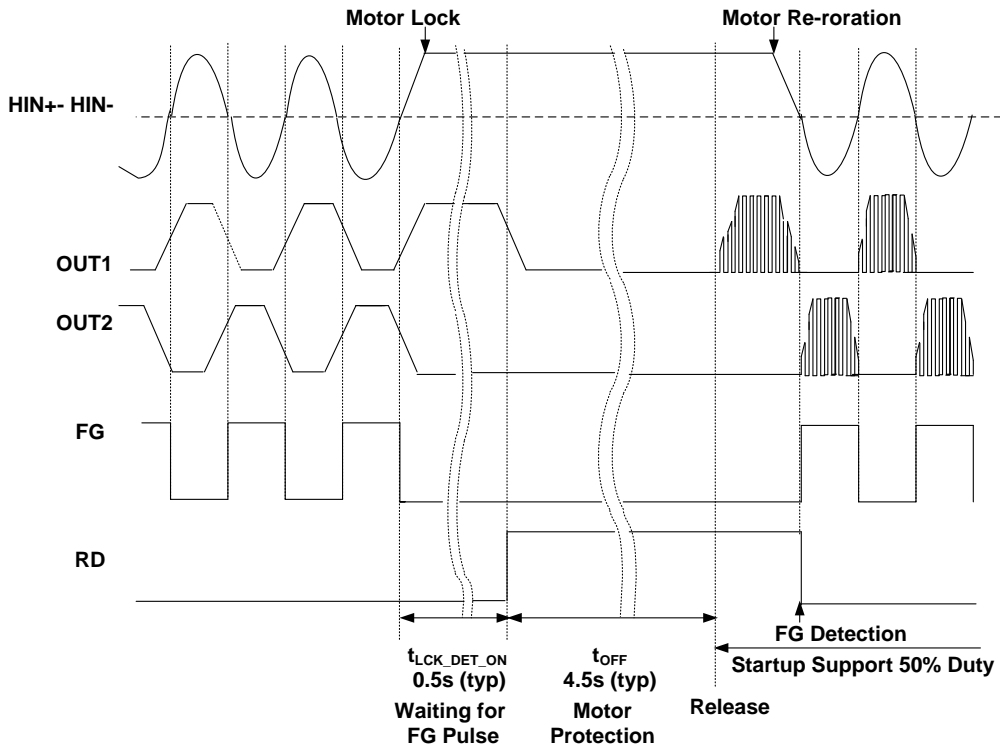
**Truth Table for Various Modes with VCONT/RMI PIN**

| HIN+ | HIN- | PWM2<br>(Note 12) | OUT1 | OUT2 | FG  | MODE       |
|------|------|-------------------|------|------|-----|------------|
| H    | L    | H                 | H    | L    | L   | Drive      |
|      |      | L                 | L    | L    |     | Regenerate |
| L    | H    | H                 | L    | H    | OFF | Drive      |
|      |      | L                 | L    | L    |     | Regenerate |

Note: 12. PWM2 is internal signal.

**Operating Characteristics (Cont.)**

**Motor Lock**



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## Application Note

### HIN-Bias – Hall Bias Output

This is a 1.25V nominal voltage source to bias a differential un-buffered Hall element sensor. If a Hall element requires a lower voltage than the HIN-Bias output, connect an appropriate value resistor between the HIN-Bias pin and the Hall element supply pin.

### HIN+ and HIN- – Hall Inputs

The rotor position is detected by a Hall sensor, with the output of Hall sensor applied to the HIN+ and HIN- pins. This sensor can be either a 4 pin 'naked' Hall device or of the 3 pin buffered switching type. For a 4 pin device the differential Hall output signal is connected to the HIN+ and HIN- pins. For a buffered Hall sensor the Hall device output is attached to the HIN+ pin, with a pull-up attached if needed, whilst the HIN- pin has an external potential divider attached to hold the pin at half  $V_{REF}$ . When HIN+ is high in relation to HIN-, OUT2 is the active drive.

### PWM Pin - External PWM Signal Input for PWM Speed Control Mode

In PWM speed control mode, external PWM signal is applied at this PWM pin to control the motors speed. The duty ratio of the PWM signal input to this pin controls the fan motor speed by varying the output PWM drive directly.

### CPWM Pin

Internal motor control triangular wave is generated based on the capacitor on this pin. A capacitor of 100pF ( $C_{PWM} = 100\text{pF}$ ), will provide a triangular wave of 36kHz (typ). The VCONT and RMI signals are compared with this triangular wave to generate the speed control PWM drive and minimum speed control clamp points. The output PWM drive frequency is same as the triangular waveform frequency.

### FG/RD Pin

FG is the Frequency Generator (tachometer) output and is a buffered signal from the Hall sensor. RD is the fan locked status detector. FG and RD are open-drain outputs and will require external pull-up resistors. Typically a pull-up resistor of 10k $\Omega$  is recommended from FG and RD pins to the supply voltage.

### RF Pin

The current limiter is activated when the voltage between current detection resistor exceeds 0.25V between GND and RF. The current limiter is activated at  $I_O = 250\text{mA}$  when  $R_F = 1\Omega$ . The current limit is set with a  $R_F$  resistor between RF pin and GND pin.

### RMI Pin – Minimum Speed Setting Pin

RMI is the minimum speed setting pin. DC voltage on this pin sets minimum speed value; If you do not use RMI (minimum speed control), please connect it to 5VREG.

### VCONT Pin – DC Voltage Speed Control

VCONT is DC voltage inputs speed control pin. The voltage on the VCONT pin is compared with the triangular oscillation on the CPWM pin to generate the output drive PWM signal. For the control method, refer to the timing chart.

### REGH/5VREG Pin

Please insert capacitor value 1 $\mu\text{F}$  between 5VREG and GND for regulated output voltage stabilization; insert capacitor value 1 $\mu\text{F}$  value between  $V_{DD}$  and REGH for stable output voltage.

### OUT1 and OUT2 pin

OUT1 and OUT2 pins provide H-bridge driver output for fan and motor coil connection.

### $V_{DD}$ – Device Supply Voltage

This provides the supply for the device.

### GND – Supply Return

This is the device supply ground return pin for control signal.

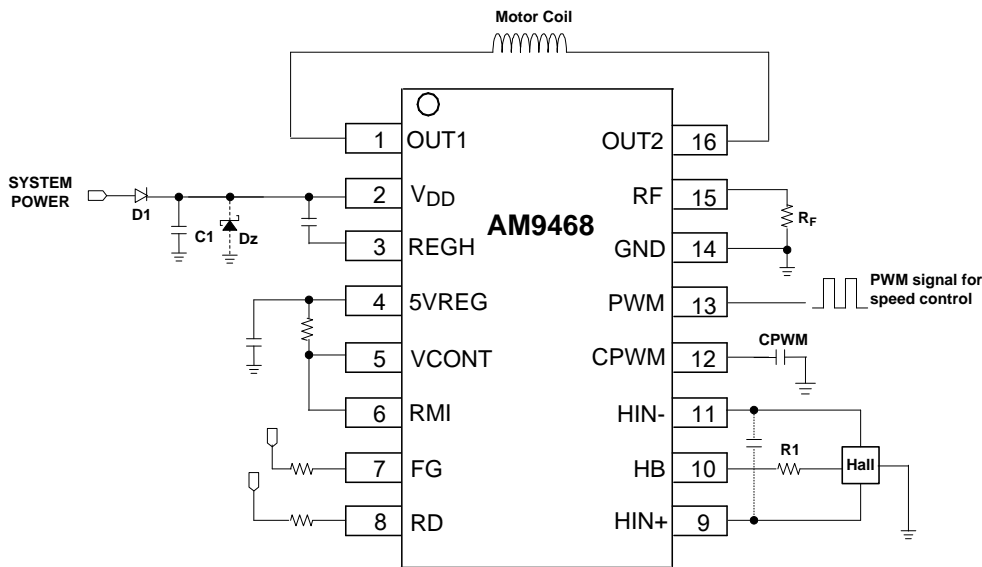
**Application Note** (Cont.)

**Speed Control**

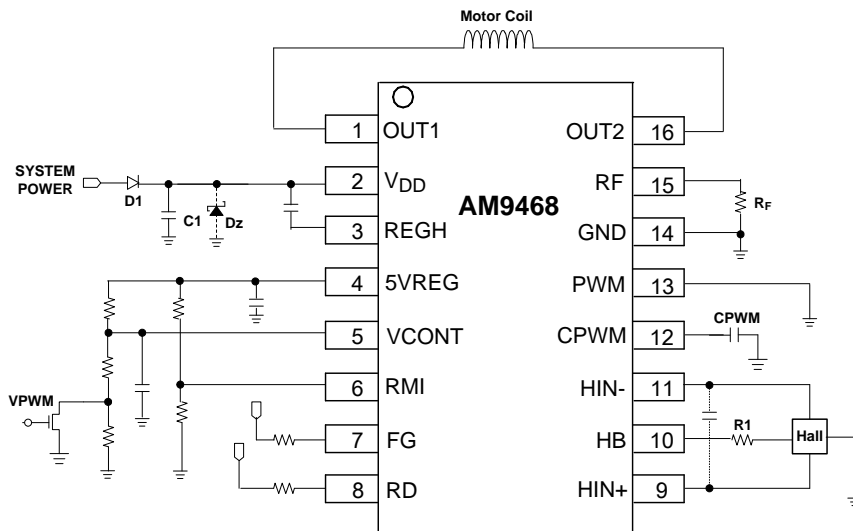
This device allows both DC voltage input and PWM signal input for speed control. Typically only one of the method is used to control the motor speed. In DC voltage speed control mode, the voltage on the VCONT pin is compared with the CPWM triangular wave to generate internal PWM signal to drive the output. In PWM speed control mode, the PWM signal on the PWM pin directly controls the output PWM drive.

The typical application circuits shows the two speed control methods.

**1. Speed Control by PWM Pin**

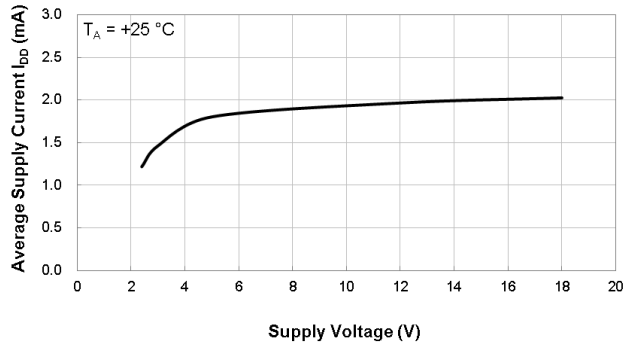


**2. Speed Control by VCONT/RMI Pin**

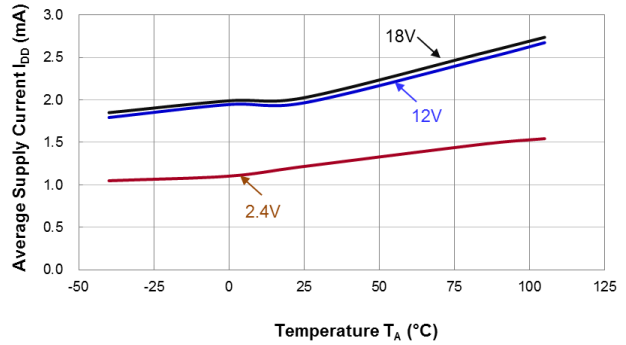


## Typical Operating Characteristics

### Average Supply Current

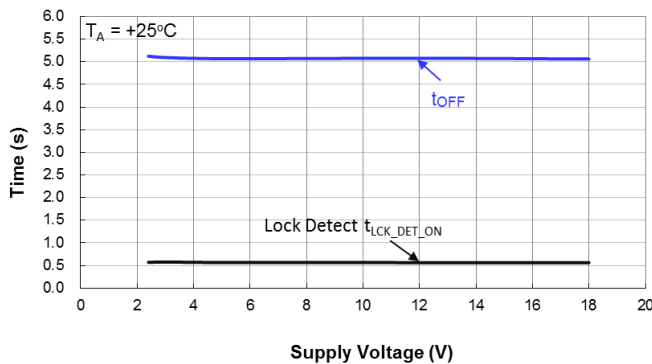


Average Supply Current vs. Supply Voltage

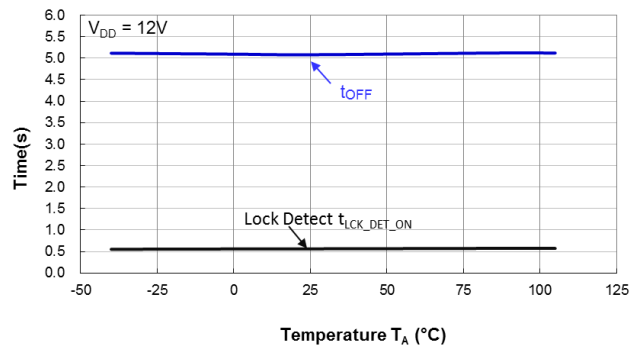


Average Supply Current vs. Temperature

### Lock Detect $t_{LCK\_DET\_ON}$ and Shutdown $t_{OFF}$ Periods

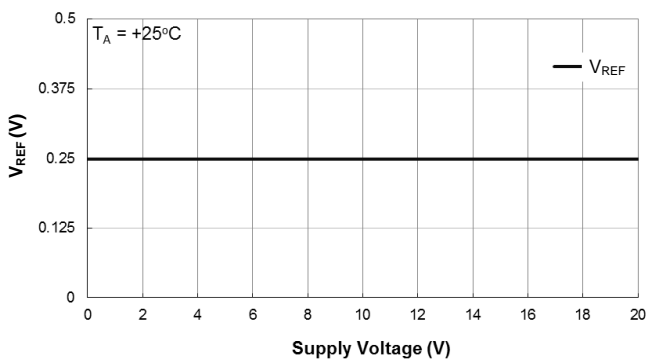


Lock Detect  $t_{LCK\_DET\_ON}$  And  $t_{OFF}$  vs. Supply Voltage

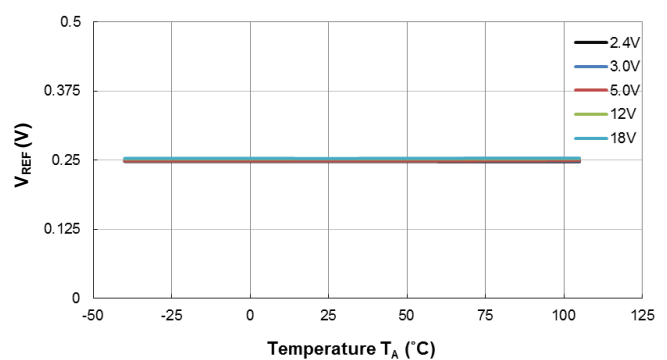


Lock Detect  $t_{LCK\_DET\_ON}$  And  $t_{OFF}$  vs. Temperature

### Current Limits



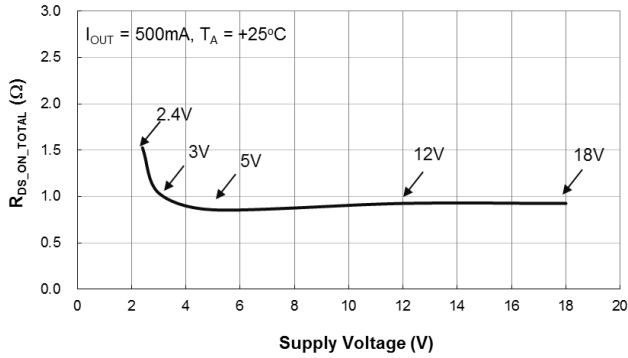
Current limit (250mV) vs. Supply Voltage



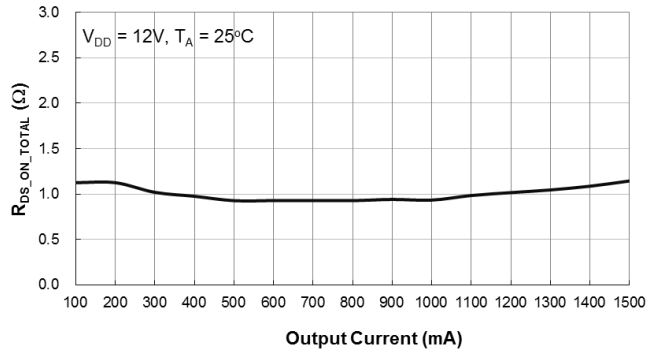
Current Limit (250mV) vs. Temperature

**Typical Operating Characteristics (Cont.)**

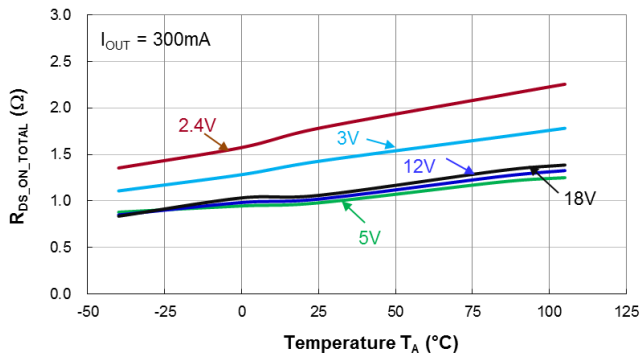
**AM9468 Total Resistance  
Total H-Bridge Path Resistance – Total  $R_{DS(ON)}$  of High Side and Low Side Switches**



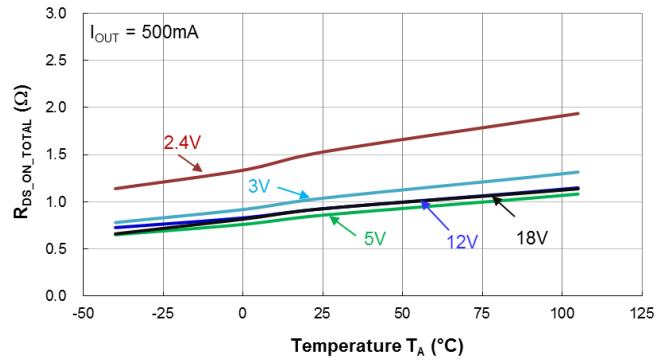
High+Low Side Resistance  $R_{DS\_ON\_TOTAL}$  vs. Supply Voltage



High+Low Side Resistance  $R_{DS\_ON\_TOTAL}$  vs. Current



High+Low Side Resistance  $R_{DS\_ON\_TOTAL}$  vs. Temperature

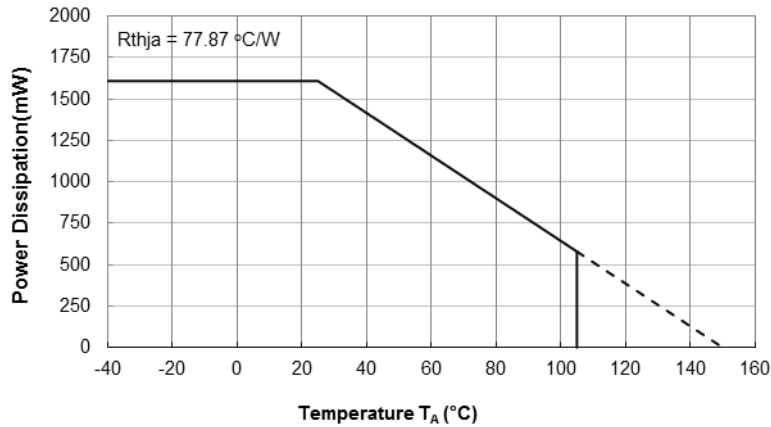


High+Low Side Resistance  $R_{DS\_ON\_TOTAL}$  vs. Temperature

**Thermal Performance**

TSSOP-16 Power Dissipation De-rating Curve 1 (Note 13)

| T <sub>A</sub> (°C) | -40   | 0     | 25    | 50    | 60    | 70    | 80    | 85    | 90    | 95    | 100   | 105   | 110   | 120 | 125 | 130 | 140 | 150 |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-----|-----|-----|
| P <sub>D</sub> (mW) | 3,520 | 3,520 | 3,520 | 2,816 | 2,534 | 2,253 | 1,971 | 1,830 | 1,690 | 1,549 | 1,408 | 1,267 | 1,126 | 845 | 704 | 563 | 282 | 0   |

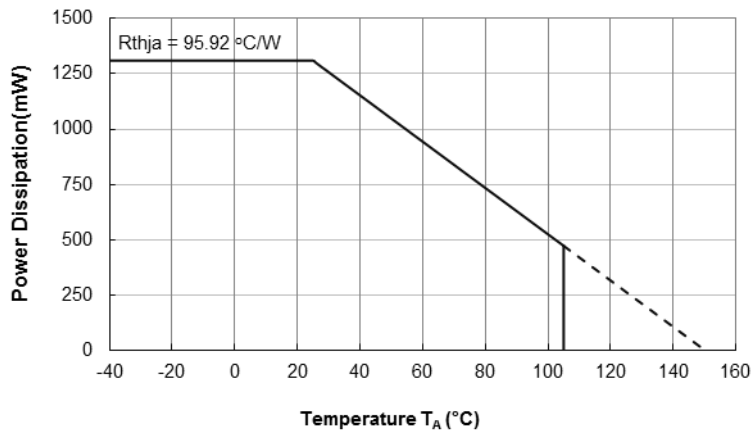


TSSOP-16 Thermal Derating Curve

Note 13: TSSOP-16 is soldered on FR-4 substrate 4-layer 1.6mm thickness PCB board, calculated in accordance with JESD 51-7.

TSSOP-16 Power Dissipation De-rating Curve 2 (Note 14)

| T <sub>A</sub> (°C) | -40   | 0     | 25    | 50    | 60    | 70    | 80    | 85    | 90    | 95  | 100 | 105 | 110 | 120 | 125 | 130 | 140 | 150 |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| P <sub>D</sub> (mW) | 2,090 | 2,090 | 2,090 | 1,672 | 1,505 | 1,338 | 1,170 | 1,087 | 1,003 | 920 | 836 | 752 | 669 | 502 | 418 | 334 | 167 | 0   |



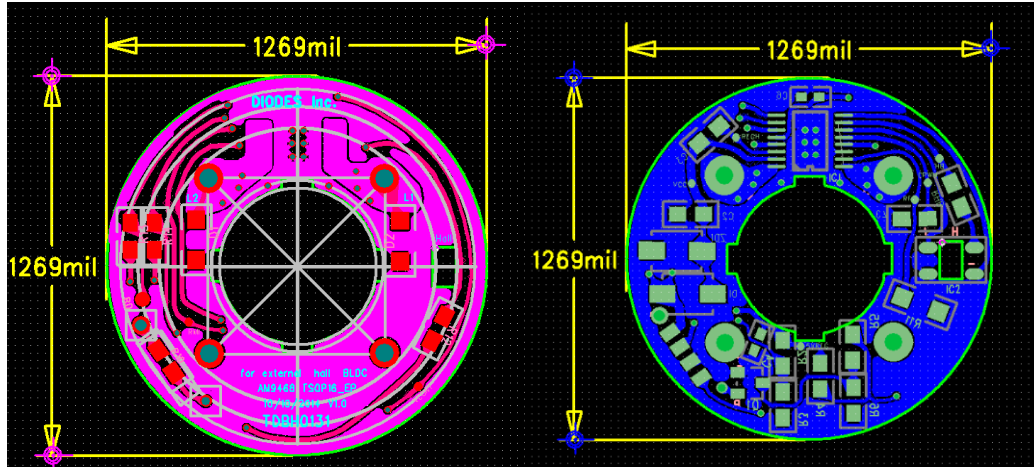
TSSOP-16 Thermal Derating Curve  
(Custom Circular PCB with Centre Hole Cut-Out)

Note 14: TSSOP-16 is soldered to the circular PCB diameter 1.2" with the center circular cutout diameter of 0.53". The Hall element space cut-out is 0.12"x0.08". 2-layer 2oz.copper FR-4 PCB (1.6mm thickness) with partial copper flood on the bottom layer.

## Thermal Performance

### Circular PCB Dimensions

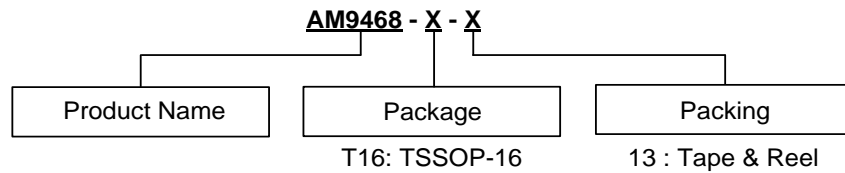
The circular PCB diameter is 1.2" with the centre circular cut-out diameter of 0.53". The Hall element space cut-out is 0.12"x0.08". 2-layer 2oz.copper FR-4 PCB (1.6mm thickness) with partial copper flood on the bottom layer.



Custom Circular PCB – Top View

Custom Circular PCB – Bottom View

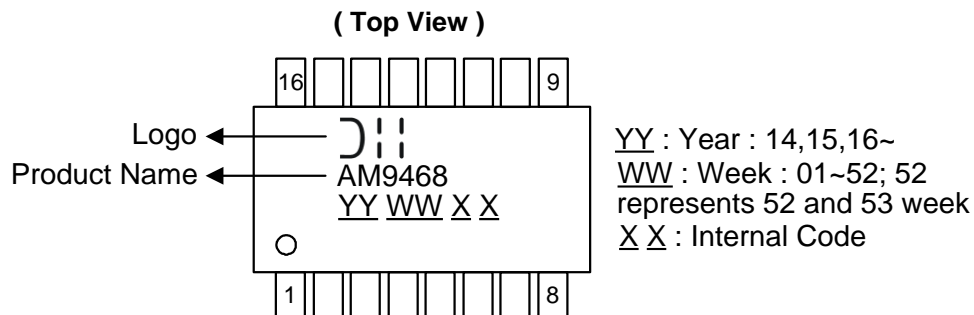
## Ordering Information



| Part Number   | Package Code | Packaging | 13" Tape and Reel |                    |
|---------------|--------------|-----------|-------------------|--------------------|
|               |              |           | Quantity          | Part Number Suffix |
| AM9468-T16-13 | T16          | TSSOP-16  | 2500/Tape & Reel  | -13                |

## Marking Information

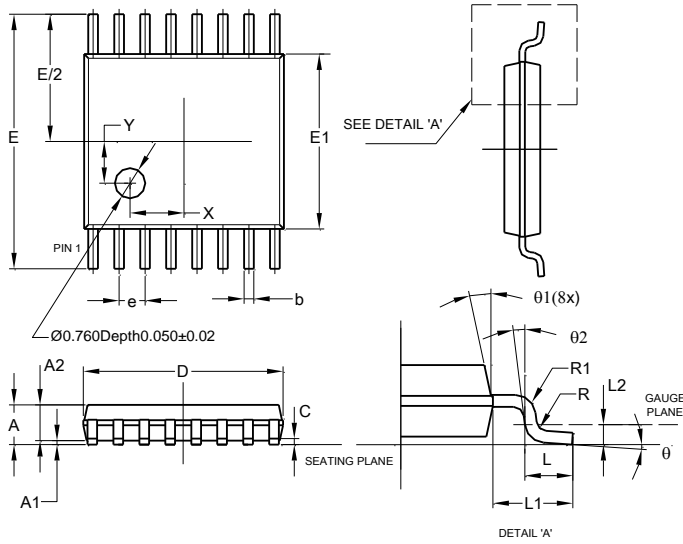
(1) Package Type: TSSOP-16



**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: TSSOP-16

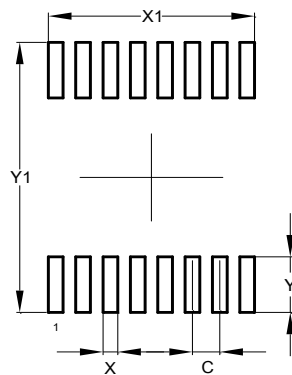


| TSSOP-16             |          |      |       |
|----------------------|----------|------|-------|
| Dim                  | Min      | Max  | Typ   |
| A                    | -        | 1.08 | -     |
| A1                   | 0.05     | 0.15 | -     |
| A2                   | 0.80     | 0.93 | -     |
| b                    | 0.19     | 0.30 | -     |
| c                    | 0.09     | 0.20 | -     |
| D                    | 4.90     | 5.10 | -     |
| E                    | 6.40 BSC |      |       |
| E1                   | 4.30     | 4.50 | -     |
| e                    | 0.65 BSC |      |       |
| L                    | 0.45     | 0.75 | -     |
| L1                   | 1.00 REF |      |       |
| L2                   | 0.25 BSC |      |       |
| R / R1               | 0.09     | -    | -     |
| X                    | -        | -    | 1.350 |
| Y                    | -        | -    | 1.050 |
| θ                    | 0°       | 8°   | -     |
| θ1                   | 5°       | 15°  | -     |
| θ2                   | 0°       | -    | -     |
| All Dimensions in mm |          |      |       |

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: TSSOP-16



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.650         |
| X          | 0.350         |
| X1         | 4.900         |
| Y          | 1.400         |
| Y1         | 6.800         |

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