HD7008Q/HD7008MQ/HD7008PQ

Automotive Single-Channel Smart High-Side Driver

1. FEATURES

- Compliant with AEC-Q100 Grade 1
- Single-channel high-side driver with integrated current sense feedback
- Operation voltage range: 4V to 28V, AMR 40V
- On resistance (HD7008(x)QSSOP16P):
  - 6.2mΩ (Typ, T_J = 25°C)
  - 10.5mΩ (Typ, T_J =150°C)
- Nominal load current: 12A (Typ)
- Maximum overcurrent limit: 70A (Typ)
- Very low standby current consumption: 0.1μA (Max)
- Support down to 2.85V V_{CC} during deep cold crank
- 3V/5V CMOS compatible input
- Multiple diagnostics through CS pin
  - High accuracy analog output proportional to loading current
  - Sensor output linearly related to V_{CC} or junction temperature
  - Overload and output short to ground alarm
  - Open load diagnostic in OFF state
  - Output short to V_{CC} detection
  - Support CS output enable/disable
- Protections
  - V_{CC} undervoltage shutdown
  - V_{DS} clamp for protection of inductive load
  - Thermal shutdown
  - Overcurrent protection
  - Dynamic overtemperature protection
  - Output latch/auto-retry through the FaultRST pin
  - Loss of ground and loss of V_{CC} protection
  - Battery reverse insertion protection
  - ESD protection

2. APPLICATIONS

- Automotive resistive, inductive, and capacitive loads
- Automotive indicator and rear lights, or LED modules
- Heating elements
- Power distribution for ECUs

3. DESCRIPTION

The HD7008(x)Q is an automotive single-channel smart high-side driver. It features 3V/5V CMOS compatible input control interface and one high power output channel. It can also provide smart protections and diagnostics. The HD7008(x)Q is extensively used in 12V automotive power supply systems.

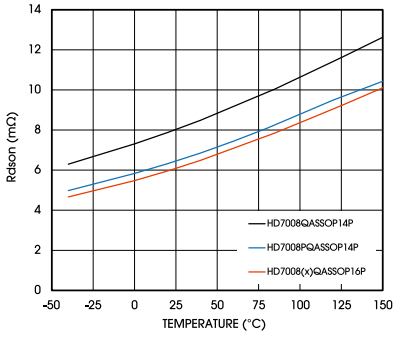
The HD7008(x)Q integrates advanced protection functions, including overcurrent limit protection, and dynamic overtemperature protection. Additionally, HD7008(x)QASSOP16P provides configurable output latch/auto-retry function through the FaultRST pin when thermal shutdown or overcurrent event occurs.

The HD7008(x)Q also integrates multiplexed analog output through the CS pin to provide complex diagnostic functions, including accurate analog output proportional to loading current, overload, and output short to ground alarms, output short to V_{CC}, and open load detection in OFF state.

The SEL1/SEL0 pins of the HD7008MQASSOP16P can also provide sensor output linearly related to V_{CC} or junction temperature to provide the application with real-time monitoring of the power supply voltage and junction temperature of the power FET.

The HD7008(x)Q SEn pin provides the function of enable/disable of diagnostic functions, which can be used to obtain low power consumption if disabled. When multiple HD7008(x)Q devices are used in one system, MCU can achieve sampling of CS voltage through one single ADC channel by connecting CS outputs of multiple HD7008(x)Q devices together. This greatly reduces system cost.

The HD7008(x)Q supports the SSOP16PP and SSOP14PP packages. See Table 1 for the order information.



Note: HD7008(x)Q refers to HD7008Q/HD7008MQ/HD7008PQ in this document.

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Table 1. Order Information

ORDER NUMBER	PACKAGE	MARK	V_{CC} / T_J SENSE OUTPUT	Rdson (mΩ)	I_{Limit} (A)	K_2	RATING	PKG. OPTION
HD7008QASSOP16P	SSOP16PP	HD7008Q XXXXXX	No	6.2	70	5950	Auto	T/R-3000
HD7008MQASSOP16P	SSOP16PP	HD7008MQ XXXXXX	Yes	6.2	70	5950	Auto	T/R-3000
HD7008PQASSOP14P	SSOP14PP	HD7008PQ XXXXXX	No	6.5	70	5400	Auto	T/R-3000
HD7008QASSOP14P	SSOP14PP	HD7008Q XXXXXX	No	8.1	60	5400	Auto	T/R-3000

Note: "XXXXXX": For internal use.

Devices can be ordered via the following two ways:
1. Place orders directly on our website (www.analogysemi.com), or;
2. Contact our sales team by mailing to sales@analogysemi.com.

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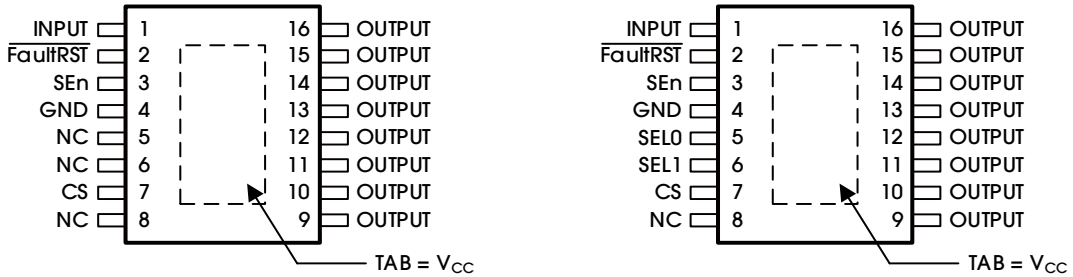
4. PIN CONFIGURATION AND FUNCTIONS

4.1 SSOP16PP PACKAGE

Figure 1 illustrates the pin configuration (SSOP16PP package).



HD7008QASSOP16P HD7008MQASSOP16P

Figure 1. Pin Configuration (SSOP16PP Package)

Table 2 lists the pin functions (SSOP16PP package).

Table 2. Pin Functions (SSOP16PP Package)

POSITION	NAME	TYPE	DESCRIPTION
1	INPUT	Input	Voltage controlled input pin with hysteresis, compatible with 3V and 5V CMOS outputs. It controls output switch state.
2	$\overline{\text{FaultRST}}$	Input	Active low compatible with 3V and 5V CMOS outputs pin; it unlatches the output in case of fault; If kept low, sets the outputs in auto-restart mode.
3	SEn	Input	Active high compatible with 3V and 5V CMOS outputs pin; it enables the CS diagnostic pin.
4	GND	Ground	Ground connection. Must be reverse battery protected by an external diode / resistor network.
5-6	NC or SEL0/SEL1	—	NC for HD7008QASSOP16P Not connect for this pin. SEL0/SEL1 for HD7008MQASSOP16P Active high compatible with 3V and 5V CMOS outputs pin; addressing the CS output multiplexer.
7	CS	Output	Analog current sense output pin. It delivers a current proportional to the load current, fault indication, or V_{CC} / T_J sense depending on the configuration of pins 5 and 6.
8	NC	—	Not connect for this pin.
9-16	OUTPUT	Output	Power outputs. All the pins must be connected together.
—	V_{CC}	Power	Battery connection

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4.2 SSOP14PP PACKAGE

Figure 2 illustrates the pin configuration (SSOP14PP package).

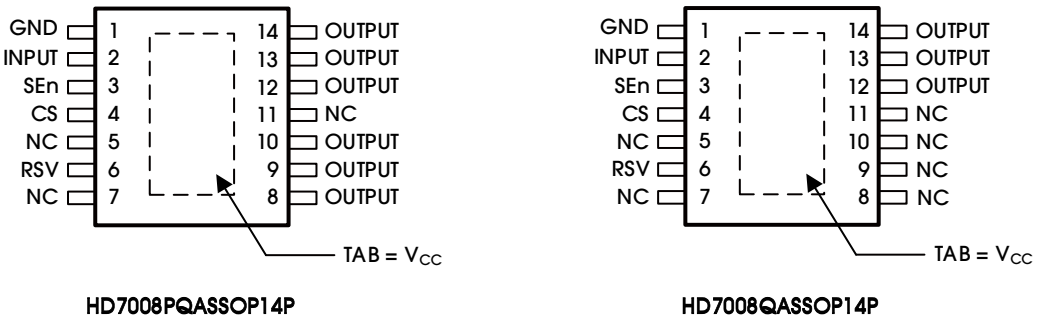

Figure 2. Pin Configuration (SSOP14PP Package)

Table 3 lists the pin functions (SSOP14PP package).

Table 3. Pin Functions (SSOP14PP Package)

POSITION	NAME	TYPE	DESCRIPTION
1	GND	Ground	Ground connection. Must be reverse battery protected by an external diode / resistor network.
2	INPUT	Input	Voltage controlled input pin with hysteresis, compatible with 3V and 5V CMOS outputs. It controls output switch state.
3	SEn	Input	Active high compatible with 3V and 5V CMOS outputs pin; it enables the CS diagnostic pin.
4	CS	Ground	Analog current sense output pin. It delivers a current proportional to the load current or fault indication.
5, 7, 11	NC	Input	Not connect for this pin.
6	RSV	—	Reserved for internal use. Pulled down to GND internally. Please leave this pin floating in application.
8-10	OUTPUT or NC	—	OUTPUT for HD7008PQASSOP14P Power outputs. All the pins must be connected together. NC for HD7008QASSOP14P Not connected for this pin.
12-14	OUTPUT	Output	Power outputs. All the pins must be connected together.
—	V_{CC}	Power	Battery connection

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9. LAYOUT

9.1 LAYOUT GUIDELINES

The HD7008(x)Q is supposed to carry large output current which could generate significant heat on the power transistor integrated in the device. Both the SSOP16PP and SSOP14PP packages have good thermal impedance, which helps to dissipate the generated heat with proper PCB layout. Below are several guidelines for good PCB design.

- The thermal pad of both the SSOP16PP and SSOP14PP packages provides the most important heat sink path. Try to make the copper area connected to the V_{CC} pin as large as possible.
- The coppers connected to OUTPUT are the secondarily important heat sink path. Try to make the copper area connected to the OUTPUT pin as large as possible.
- Maximize the copper coverage on the PCB to increase the thermal conductivity of the board. The major heat-flow path from the package to the ambient is through the copper on the PCB. Maximum copper is extremely important when there are not any heat sinks attached to the PCB on the other side of the board opposite to the package.
- Add as many thermal vias as possible directly under the package thermal pad to optimize the thermal conductivity of the board.

9.2 LAYOUT EXAMPLES

Refer to the HD7008(x)Q EVM for a PCB layout example.

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10. PACKAGE INFORMATION

The HD7008(x)Q is available in the SSOP16PP and SSOP14PP packages.

10.1 SSOP16PP PACKAGE

Figure 16 shows the SSOP16PP package view.

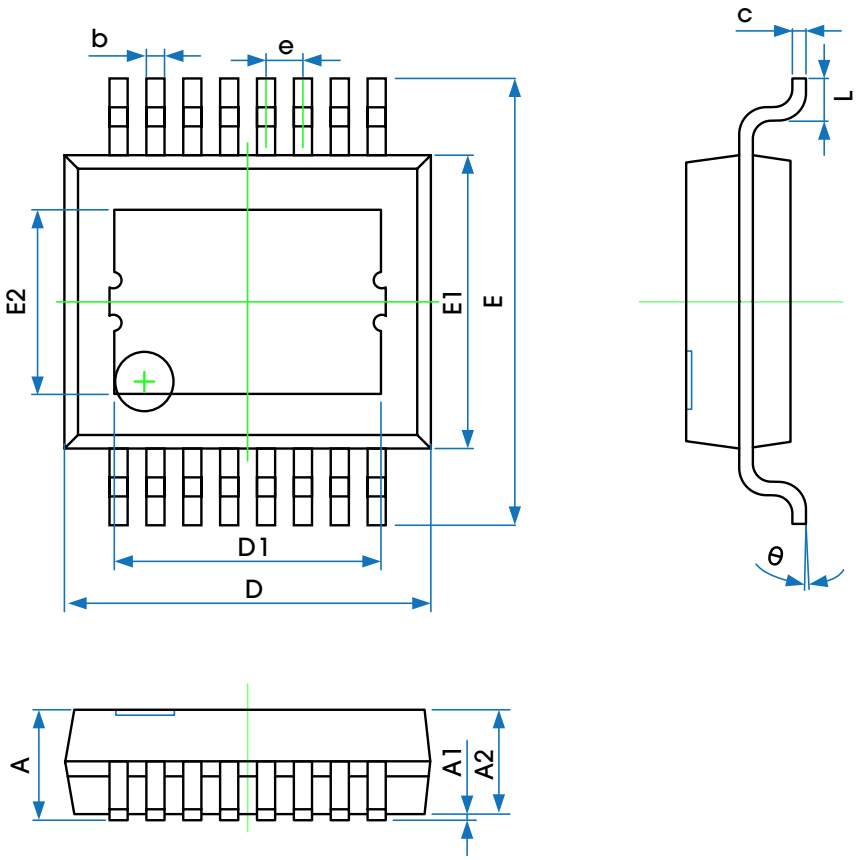

Figure 16. SSOP16PP Package View

Table 14 provides detailed information about the dimensions of the SSOP16PP package.

Table 14. Dimensions of the SSOP16PP Package

SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.650	0.053	0.065
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.510	3.710	0.138	0.146
E	6.050	6.200	0.238	0.244
E1	3.800	4.000	0.150	0.157
E2	2.400	2.600	0.094	0.102
e	0.500 (BSC)		0.020 (BSC)	
L	0.400	0.900	0.016	0.035
θ	0°	8°	0°	8°

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10.2 SSOP14PP PACKAGE

Figure 17 shows the SSOP14PP package view.

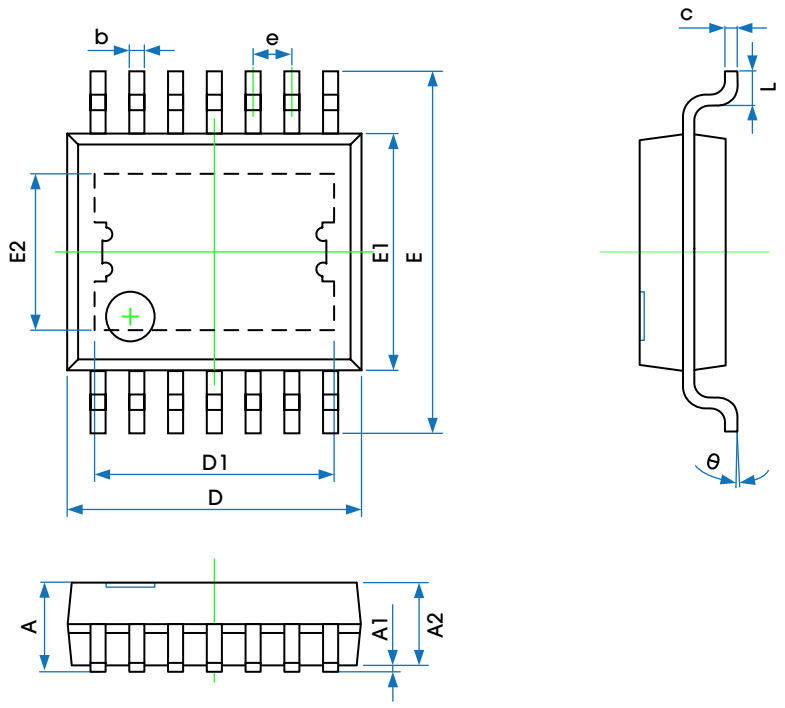

Figure 17. SSOP14PP Package View

Table 15 provides detailed information about the dimensions of the SSOP14PP package.

Table 15. Dimensions of the SSOP14PP Package

SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.650	0.053	0.065
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.900	4.100	0.154	0.161
E	6.050	6.200	0.238	0.244
E1	3.800	4.000	0.150	0.157
E2	2.440	2.640	0.096	0.104
e	0.6500 (BSC)		0.026 (BSC)	
L	0.400	0.900	0.016	0.035
θ	0°	8°	0°	8°

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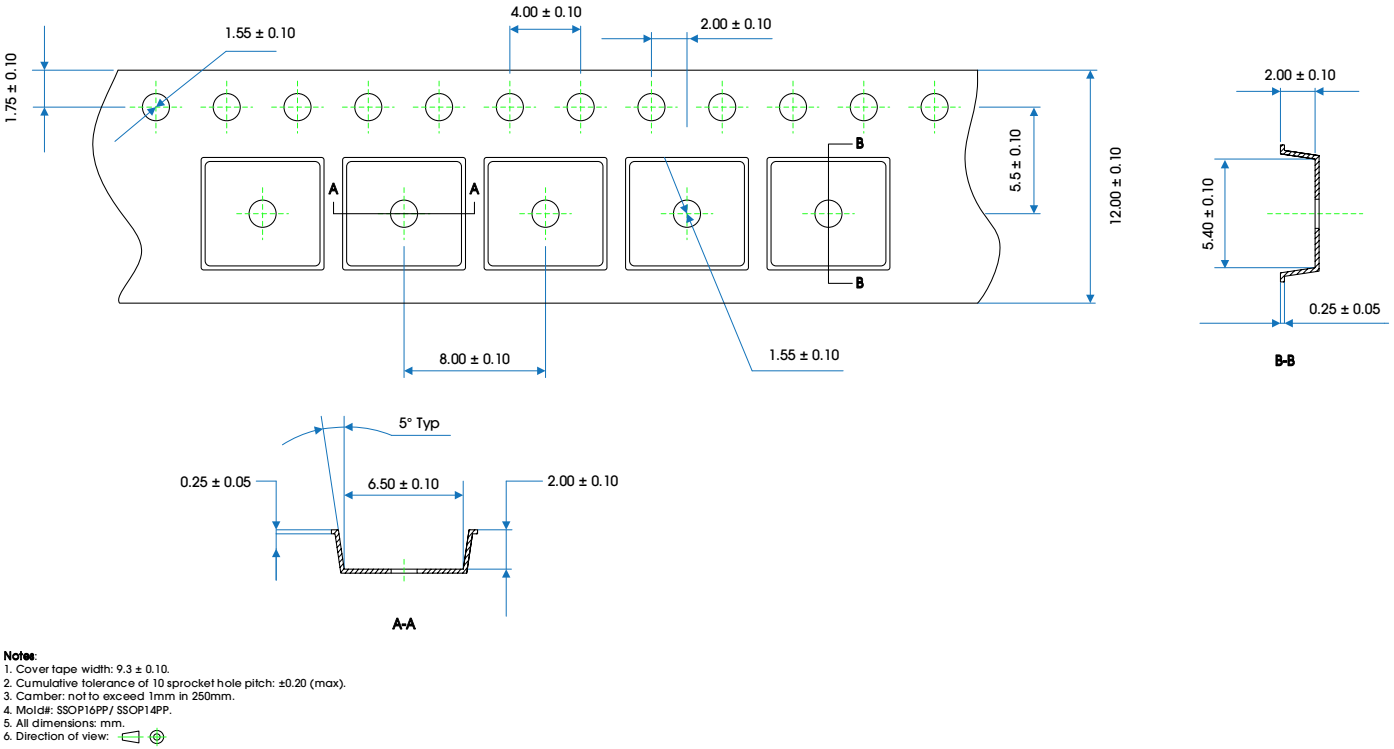
11. TAPE AND REEL INFORMATION

Figure 18 illustrates the carrier tape.



Notes:
1. Cover tape width: 9.3 ± 0.10.
2. Cumulative tolerance of 10 sprocket hole pitch: ±0.20 (max).
3. Camber: not to exceed 1mm in 250mm.
4. Mold#: SSOP16PP/ SSOP14PP.
5. All dimensions: mm.
6. Direction of view:

Figure 18. Carrier Tape Drawing

Table 16 provides information about tape and reel.

Table 16. Tape and Reel Information

PACKAGE TYPE	REEL	QTY/REEL	REEL/ INNER BOX	INNER BOX/ CARTON	QTY/CARTON	INNER BOX SIZE (MM)	CARTON SIZE (MM)
SSOP16PP/ SSOP14PP	13''	3000	1	8	24000	360*352*52	435*390*380

Figure 19 shows the product loading orientation—pin 1 is assigned at Q1.

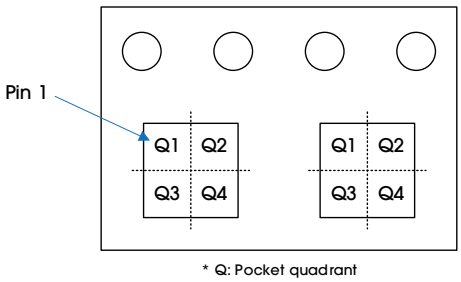


Figure 19. Product Loading Orientation

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