

■ General Description

OCH11867 is a single-phase bipolar driving motor pre-driver with the variable speed function compatible with external PWM signal. With a few external parts, a highly-efficient and highly-silent variable drive fan motor with low power consumption can be achieved. This product is best suited for driving of the server requiring large air flow and large current and the fan motor of consumer appliances.

■ Features

- Direct drive P/N MOSFET
- The speed can be adjusted and controlled externally
- Soft start, and the time can be set externally
- FG speed signal output (OCH11867F)
- RD signal output (OCH11867R)
- Under voltage protection
- Periodic overcurrent protection
- Locked rotor protection
- Over temperature protection
- Adopting encapsulated SSOP-16L

■ Application

- Industrial fans、server fans、welding machine fans
- Purifier fan、mining machine fan
- Sweeper fan、equipment fan
- Brushless DC fan

■ Pin Configuration

SSOP-16L (Top View)

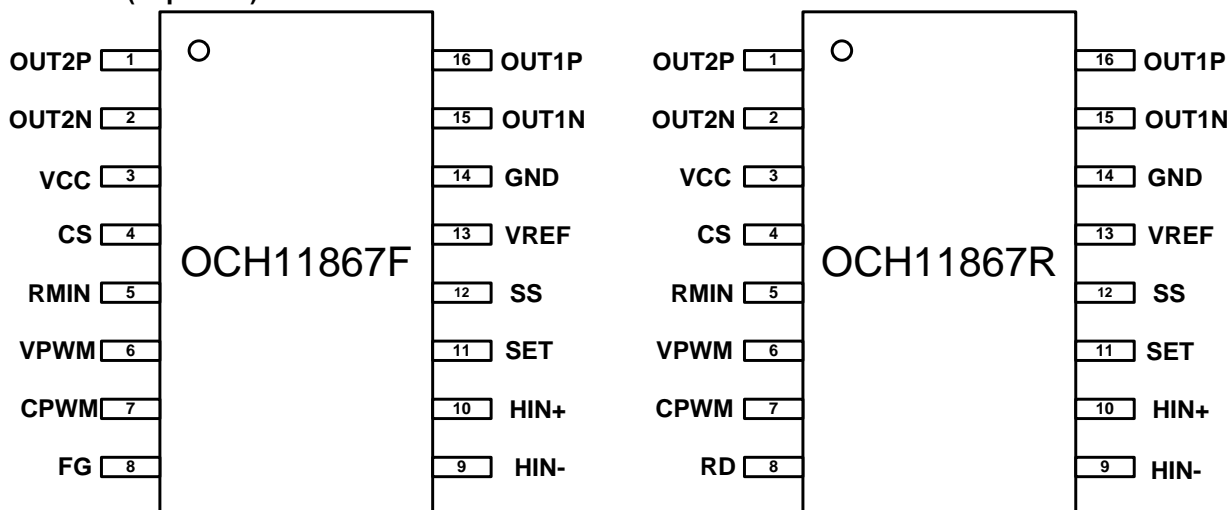


Figure 1, Pin Assignments Of OCH11867



■ Pin Description

Pin Number	Pin Name	Function
1	OUT2P	Second channel P-type driver output open-drain output, must be connected with pull-up resistor to drive external power devices in operation
2	OUT2N	Second channel N-type driver output push-pull output to drive external power devices
3	VCC	Power supply
4	CS	Current limiter indicator. Fixed to 0.2V internally. maximum allowable current is decided by external sample resistance. When the voltage of this pin exceeds 0.2V, the output will be shut down by current limit. If this function is not used, connect this pin to ground directly
5	RMIN	Minimum speed setting terminal connect it to VREF when disused. In case it is tied to other power supply for controlling, an isolated resistor is necessary
6	VPWM	Speed control terminal. It is full speed mode when connected to ground. If the speed is controlled by PWM mode, the frequency of control signal is 20kHz to 100kHz. moreover, a low pass network is necessary to transfer PWM to DC level
7	CPWM	PWM basic oscillation frequency generator when connected with a capacitor of 220pF. 30kHz frequency is available
8	FG/RD	"FG" means pin 8 is an output pin of FG signal which is used for detecting rotation speed. "RD" means pin 8 is an output pin of RD signal, and is used for detecting fan rotate-stop state. "FG" and "RD" can be selected according to the requirement. This pin need to be connected with pull-up resistor when used. A new pulse will be generated once input signal changed. Keep this pin open when it is not to be used
9	HIN-	Hall sensor negative input. To prevent noise, this pin is recommended to be placed as close as possible to Hall circuit. If necessary, a capacitor may be added between HIN+ and HIN- to reduce the influence caused by noise
10	HIN+	Hall sensor positive input. To avoid noise, this pin is recommended to be placed as close as possible to Hall circuit
11	SET	Lock protection and auto start frequency generator. It is connected with an external 0.47 μ F capacitor which decides lock-rotate time and start time. If lock-rotate protection function is disused, please connect this pin to GND
12	SS	Linear start terminal. this pin is connected to VREF externally via a capacitor of 0.47 μ F to 1 μ F which enables fan start steadily. Start time is dependent to the capacitance. If linear start function is not used, connect this pin to ground
13	VREF	5V voltage reference
14	GND	Ground for circuit control
15	OUT1N	First channel N-type driver output. push-pull output to drive external power devices
16	OUT1P	First channel P-type driver output. open-drain output, must be connected with pull-up resistor to drive external power devices in operation



■ Typical Application Circuit

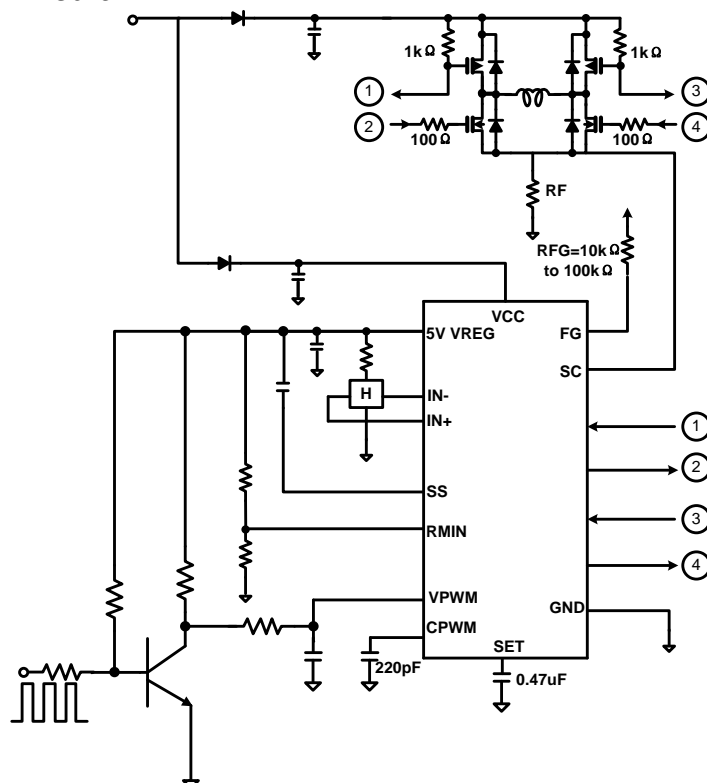


Figure 2, FG Signal Typical Application Circuit Of OCH11867F

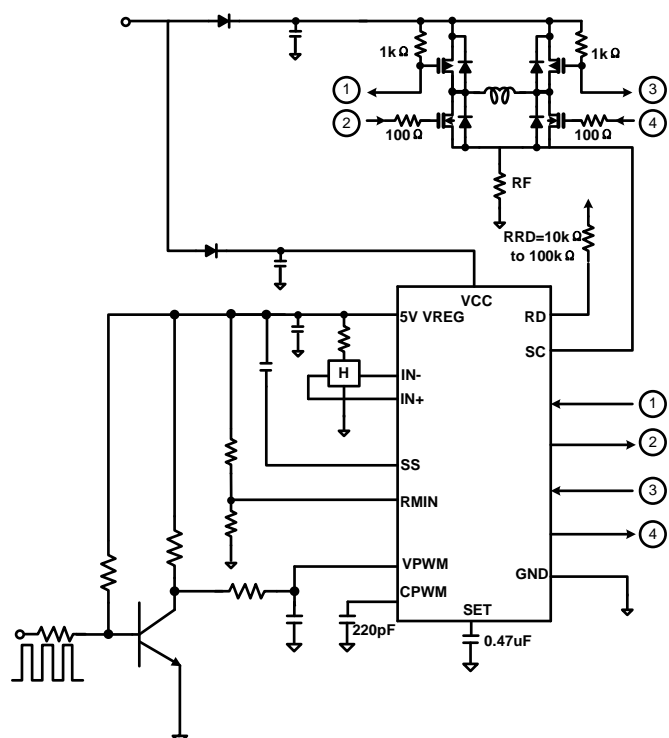


Figure 3, RD Signal Output Typical Application Circuit Of OCH11867R



■ Ordering Information

Part Number	Output Signal	Package Type	Packing Qty.	Temperature	Eco Plan	Lead
OCH11867FSAE	FG	SSOP-16L	3500pcs/Reel	-40 ~ +125°C	ROHS	Cu
OCH11867RSAE	RD	SSOP-16L	3500pcs/Reel	-40 ~ +125°C	ROHS	Cu

■ Block Diagram

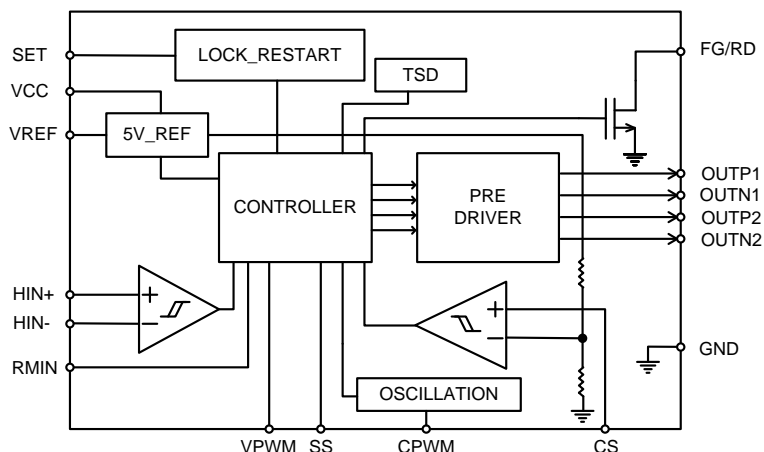


Figure 4, Block Diagram Of OCH11867

■ Absolute Maximum Ratings (Note1) (T_A=25°C, unless otherwise noted.)

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	20	V
OUT1N/OUT2N Source Current	I _{OUTN}	20	mA
OUT1P/OUT2P Output Current	I _{OUTP}	20	mA
OUT1N/OUT2N Withstand Voltage	V _{OUTN}	20	V
OUT1P/OUT2P Withstand Voltage	V _{OUTP}	20	V
VREF/VPWM/VMIN Withstand Voltage	V _{REF} /V _{VPWM} /V _{VMIN}	7	V
CPWM/SET/SS Withstand Voltage	V _{CPWM} /V _{SET} /V _{SS}	7	V
FG/RD Withstand Voltage	V _{FG} /V _{RD}	VCC	V
FG/RD Output Current	I _{FG} /I _{RD}	10	mA
VREF Output Current	I _{REF}	20	mA
Power Dissipation	P _D	800	mW
Storage Temperature Range	T _{STG}	-55 to 150	°C
ESD (Human Body Model)	ESD	2000	V

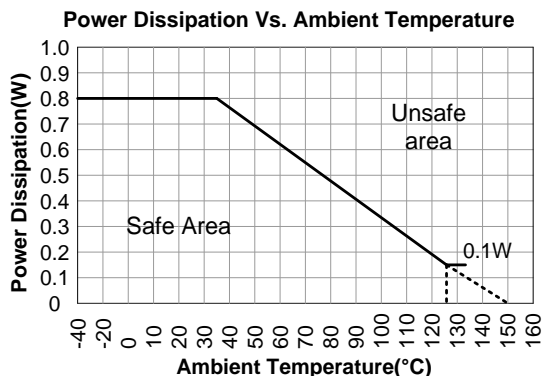


Figure 5, Pd Of OCH11867



■ Recommended Operating Conditions (Note2)

Parameter	Symbol	Rating	Unit
VCC Pin Voltage to GND	VCC	5 to 16	V
Operating junction Temperature Range	T _{OP}	-40 to +125	°C

Note 1: Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one absolute maximum rating should be applied at any one time.

Note 2: The device is not guaranteed to function outside of its operating conditions.



Electrical Characteristics (VCC=12V, TA =25°C unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent Current	I _{Q1}	Rotation Mode & Lock Mode	-	9.6	12	mA
	I _{Q2}	Shutdown Mode	-	9.6	12	
VREF Reference Voltage	VREF	I _{OUT} =5mA	4.6	5.0	5.5	V
VPWM High Level Voltage	V _{VPWMH}		-	3.4	-	V
VPWM Low Level Voltage	V _{VPWML}		-	1.1	-	V
Current Limit Voltage	V _{LIM}		-	200	-	mV
CPWM Frequency	F _{CPWM}	C _{CPWM} =220pF	25.5	30	35.5	kHz
Soft Start Charge Current	I _{SS}	V _{SS} =1V	-	0.5	0.7	μA
SET High Level Voltage	V _{SETH}		2.4	3.3	3.6	V
SET Low Level Voltage	V _{SETL}		1.0	1.3	1.6	V
SET Charge Current	I _{CHG}	V _{SET} = 0.5V	1.5	2	2.5	μA
SET Discharge Current	I _{DHG}	V _{SET} = 3.5V	0.13	0.2	0.25	μA
SET Charge and Discharge Ratio	R _{CD}	I _{CHG} /I _{DHG}	8.5	10	14.5	-
OUTN High Level Voltage	V _{ONH}	I _{OUT} = 10mA	VCC-1.8	VCC-0.85	VCC	V
OUTN Low Level Voltage	V _{ONL}	I _{OUT} = 10mA	-	0.9	1	V
OUTP Low Level Voltage	V _{OPL}	I _{OUT} = 10mA	-	0.5	0.65	V
Signal Hall Input Sensitivity	V _{HIN}	I _{HIN+} , I _{HIN-} difference voltage (include offset and hysteresis)	-	±10	-	mV
FG/RD Saturation Voltage	V _{SAT}	I _{SINK} = 5mA	-	200	500	mV
FG/RD Leakage Current	I _{FGL}	V _{FG} = VCC	-	-	1	μA
Over Thermal Protection Temperature	T _{OTP}		-	170	-	°C
Over Thermal Protection Hysteresis	T _{HY}		-	30	-	°C

Truth Table

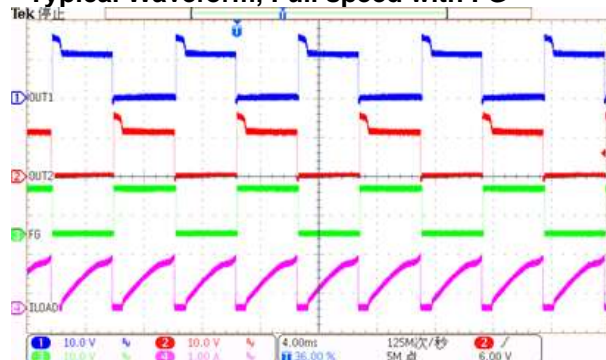
HIN-	HIN+	OUT1P	OUT1N	OUT2P	OUT2N	FG	RD	Mode
H	L	L	L	OFF	H	L	L	OUT1→OUT2 (Driver)
L	H	OFF	H	L	L	H	L	OUT2→OUT1 (Driver)
H	L	OFF	L	OFF	H	OFF	H	Lock Protection
L	H	OFF	H	OFF	L	OFF	H	



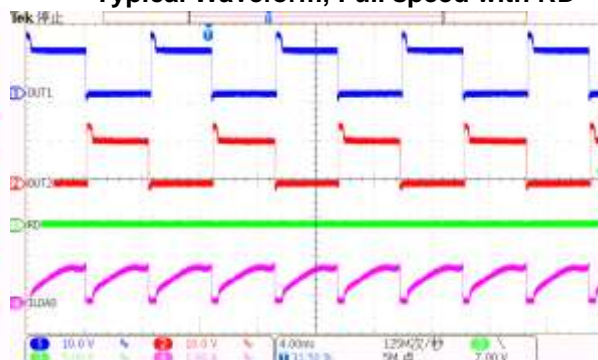
■ Typical Performance Characteristics

VCC = 12V, TA = 25°C, tested with fan unit, unless otherwise noted.

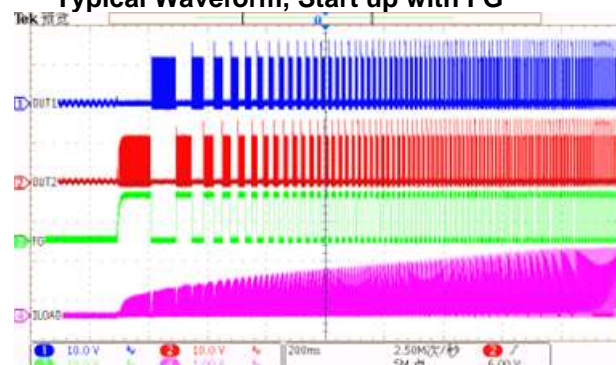
Typical Waveform, Full speed with FG



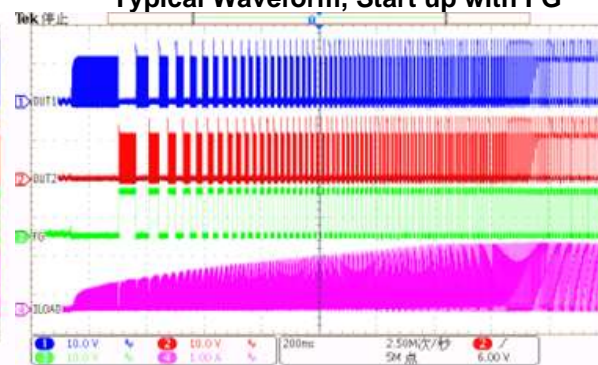
Typical Waveform, Full speed with RD



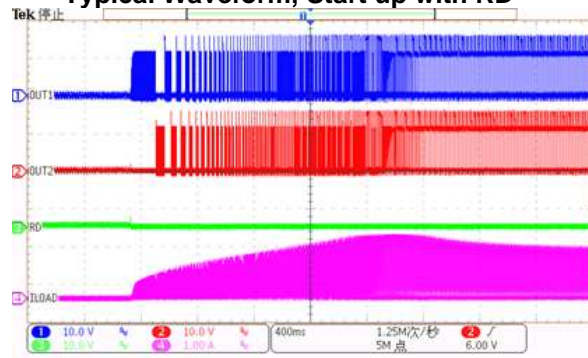
Typical Waveform, Start up with FG



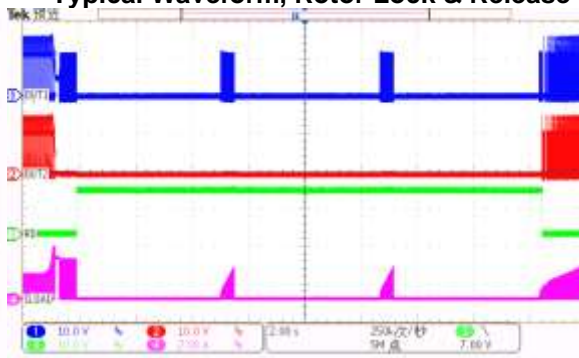
Typical Waveform, Start up with RD



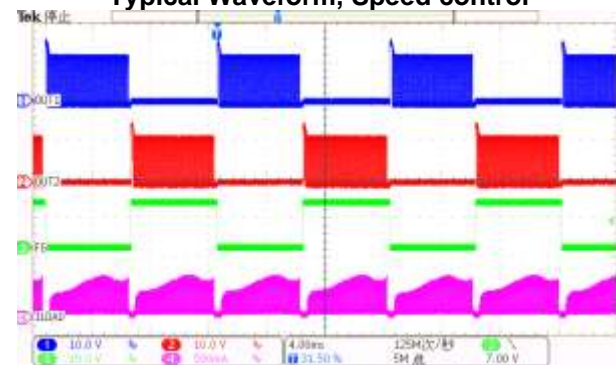
Typical Waveform, Start up with RD



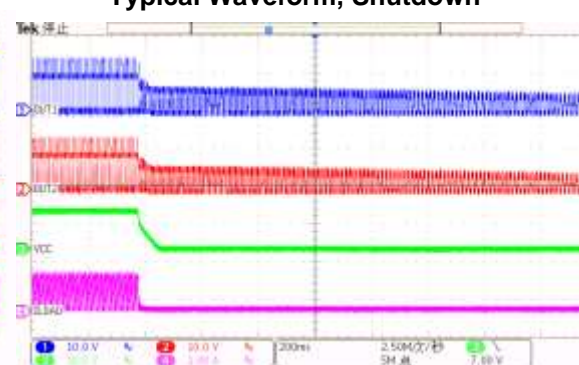
Typical Waveform, Rotor Lock & Release



Typical Waveform, Speed control



Typical Waveform, Shutdown



■ Operating Diagram

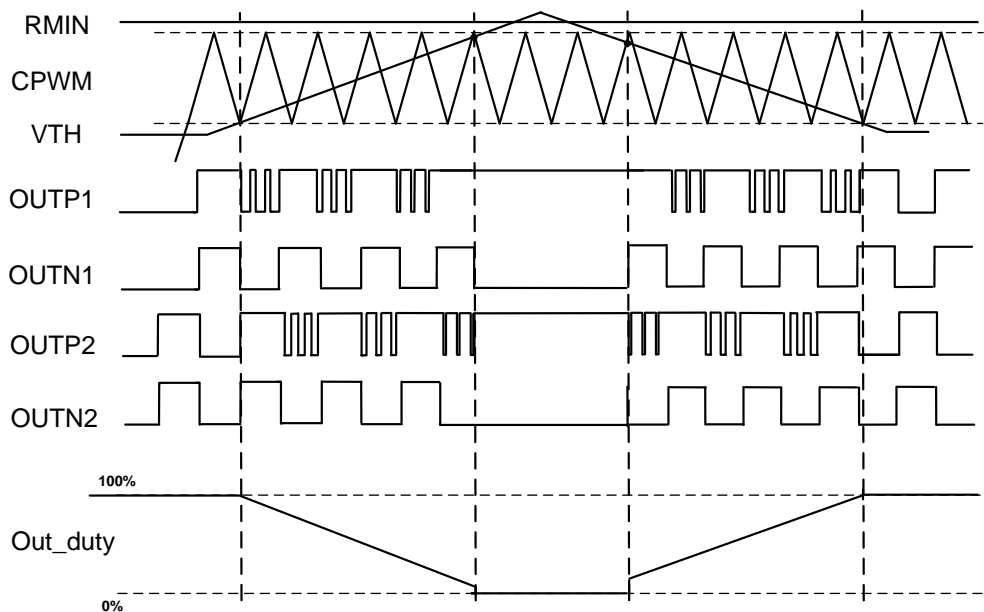


Figure 6, Operating Diagram Of OCH11867

1. Low speed ⇔ high speed

PMW control is made by comparing the CPWM oscillation voltage (1.1V⇔3.4V) and VTH voltage. Both upper and lower output TRs are turned ON when the VTH voltage is low. The upper output TR is turned OFF when the VTH voltage is high, regenerating the coil current in the lower TR. Therefore, as the VTH voltage increases, the output ON-DUTY decreases, causing decrease in the coil current, reducing the motor rotation speed.

2. Minimum speed setting (stop) mode

The low-speed fan rotation occurs at the minimum speed set with the RMI pin. When the minimum speed is not set (RMI pin pulled up to 5VREG), the motor stops.

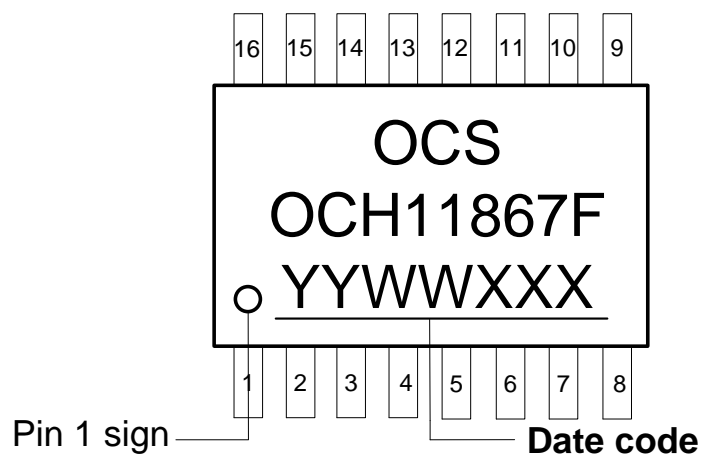
3. Full speed mode

The full speed mode becomes effective when the VTH voltage is 1.1V or less. (Set VTH = GND when the speed control is not to be made.)

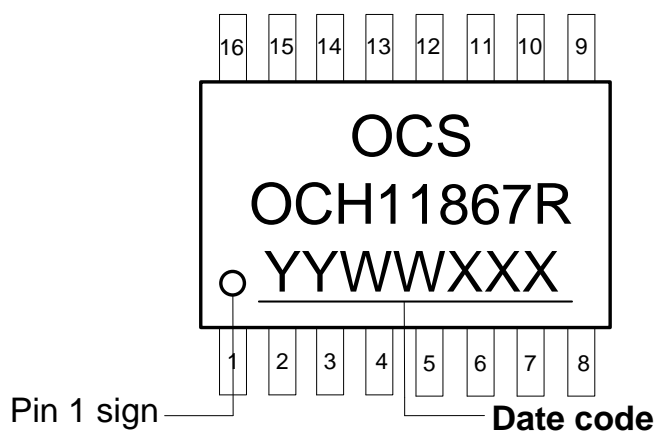


■ **Marking Information**

SSOP-16L:



OCH11867F

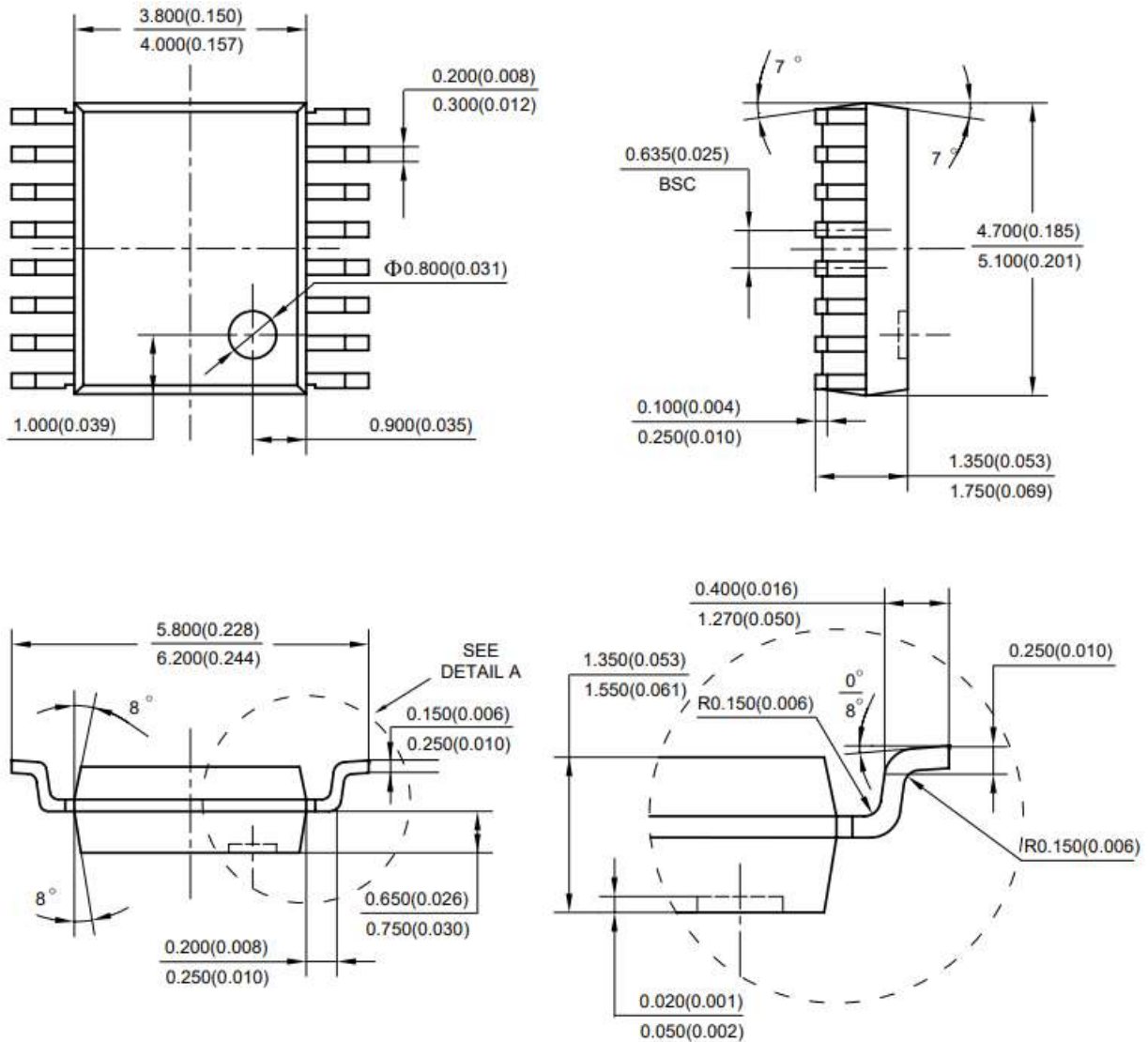


OCH11867R



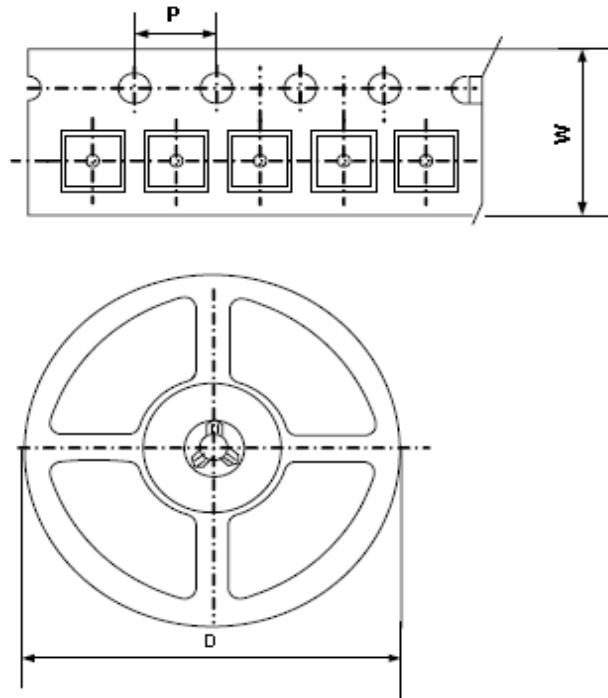
■ Package Information

SSOP-16L:

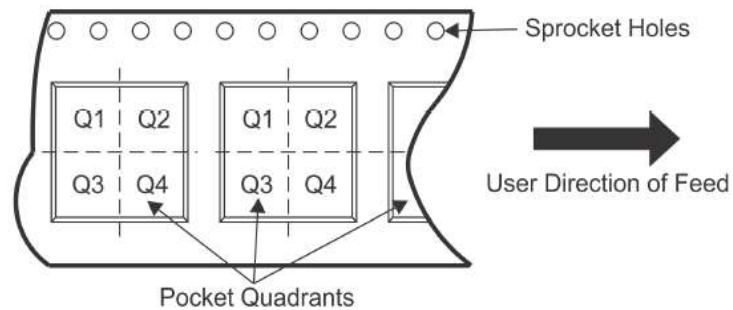


■ Packing Information

SSOP-16L:



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum	PIN1 Quadrant
SSOP-16L	12.0±0.1 mm	4.0±0.1 mm	330±1 mm	3500pcs	Q1

Note: Carrier Tape Dimension, Reel Size and Packing Minimum



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