SGM42600
Dual H-Bridge Motor Driver

GENERAL DESCRIPTION

The SGM42600 is a motor driver device with two integrated H-bridges that can run one bipolar stepper motor or two DC brush motors. It can be used in a variety of applications such as printers and battery-powered toys.

Each H-bridge consists of four N-MOSFETs to drive one motor winding. The SGM42600 can supply up to 2A peak or 1.5A RMS output current (with proper heatsinking at V_{CC} = 5V and T_A = +25℃). At lower V_{CC} voltages, the current capability is decreased slightly.

Internal protection functions are provided for over-current protection (OCP), power supply under-voltage lockout (UVLO), charge pump under-voltage lockout (CPUV) and over-temperature protection (OTP). Fault conditions are indicated by the nFAULT pin.

Sleep mode allows saving power when the device is not driving the motor. The SGM42600 will enter into sleep mode when nSLEEP is low.

The SGM42600 is available in Green TQFN-4×4-16L and TSSOP-16 (Exposed Pad) packages. It operates over an ambient temperature range of -40℃ to +125℃.

FEATURES

- **Power Supply Voltage Range: 2.7V to 24V**
- **Dual H-Bridge Motor Driver**
- **Drives Two DC Motors or One Bipolar Stepper Motor**
- **Low On-Resistance: 0.41Ω for HS + LS, @ +25℃**
- **1.5A RMS Output Current per H-Bridge**
- **2A Peak Current per H-Bridge at V_{CC} = 5V, T_A = +25℃**
- **Active Low Fault Indication Pin (nFAULT)**
- **Available in Green TSSOP-16 (Exposed Pad) and TQFN-4×4-16L Packages**

APPLICATIONS

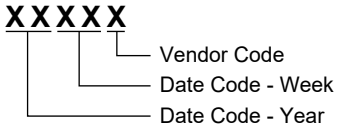
Printers
Robotics
Cameras
Battery-Powered Toys
Gaming Machines
Office Automation Machines

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42600	TSSOP-16 (Exposed Pad)	-40℃ to +125℃	SGM42600XPTS16G/TR	SGM42600 XPTS16 XXXXX	Tape and Reel, 4000
	TQFN-4×4-16L	-40℃ to +125℃	SGM42600XTQE16G/TR	SGM42600 XTQE16 XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage Range, V_{CC} ..... -0.3V to 28V
Digital Input Pin Voltage Range ..... -0.3V to 6V
AISEN/BISEN Pin Voltage Range ..... -0.3V to 0.5V
Package Thermal Resistance
TSSOP-16 (Exposed Pad), θ_{JA} ..... 34.1℃/W
TSSOP-16 (Exposed Pad), θ_{JB} ..... 13℃/W
TSSOP-16 (Exposed Pad), $\theta_{JC\ (TOP)}$ ..... 27.3℃/W
TSSOP-16 (Exposed Pad), $\theta_{JC\ (BOT)}$ ..... 2.5℃/W
TQFN-4×4-16L, θ_{JA} ..... 35.9℃/W
TQFN-4×4-16L, θ_{JB} ..... 11.8℃/W
TQFN-4×4-16L, $\theta_{JC\ (TOP)}$ ..... 28℃/W
TQFN-4×4-16L, $\theta_{JC\ (BOT)}$ ..... 2℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 5000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Power Supply Voltage Range, V_{CC} ..... 2.7V to 24V
Digital Input Pin Voltage Range ..... -0.3V to 5.5V
AISEN/BISEN Pin Voltage Range ..... -0.3V to 0.5V
Continuous DC/RMS Output Current per Bridge 1.5A
Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

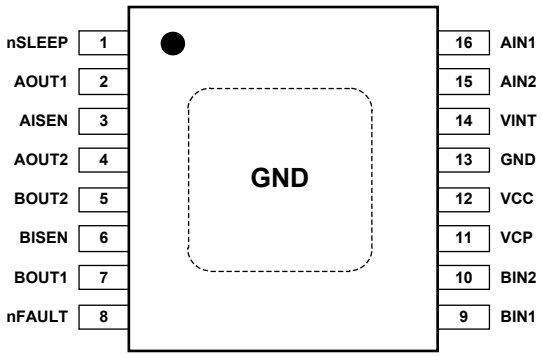
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

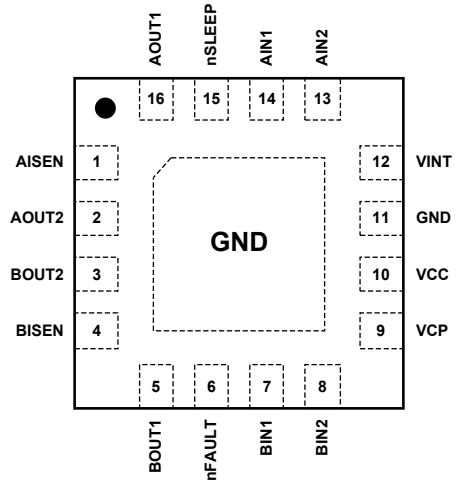
PIN CONFIGURATIONS

(TOP VIEW)



TSSOP-16 (Exposed Pad)

(TOP VIEW)



TQFN-4×4-16L

PIN DESCRIPTION

NAME	I/O	FUNCTION
AOUT1	O	Bridge A Output 1.
AOUT2	O	Bridge A Output 2.
BOUT1	O	Bridge B Output 1.
BOUT2	O	Bridge B Output 2.
AIN1	I	Bridge A Input 1. Internal pull-down.
AIN2	I	Bridge A Input 2. Internal pull-down.
BIN1	I	Bridge B Input 1. Internal pull-down.
BIN2	I	Bridge B Input 2. Internal pull-down.
nSLEEP	I	Active-Low Sleep Mode Input. Apply high to enable device, and low to enter in the low-power sleep mode.
nFAULT	OD	Active-Low Fault Flag. Go low when a fault occurs (over-current, power supply under-voltage, charge pump under-voltage, over-temperature).
AISEN	IO	Bridge A I_{SENSE} (GND). Connect through a current sense resistor to GND for bridge A.
BISEN	IO	Bridge B I_{SENSE} (GND). Connect through a current sense resistor to GND for bridge B.
VCP	IO	Charge Pump Output. Connect a 0.01μF, 30V (MIN) ceramic capacitor to VCC pin.
VCC	P	Power Supply Pin. Connect this pin to the motor supply and bypass with a 10μF (MIN) ceramic capacitor to GND.
GND	G	Ground.
VINT	–	Internal Supply Bypass. Bypass to GND with a 2.2μF, 6.3V capacitor.
Exposed Pad	G	GND.

NOTE: I = input, O = output, IO = input or output, OD = open-drain output, G = ground, P = power for the circuit.

ELECTRICAL CHARACTERISTICS

(V_{CC} = 5V, Full = -40℃ to +125℃. Typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supplies (VCC)							
Power Supply Voltage	V_{CC}		Full	2.7		24	V
Power Supply Current	I_{VCC}	xIN1 = 0V, xIN2 = 0V	+25℃		1.7	2.3	mA
Sleep Mode Supply Current	I_{VCCQ}		+25℃		0.7	1.6	μA
Under-Voltage Lockout Voltage	V_{UVLO}		+25℃		2.3	2.4	V
Under-Voltage Lockout Voltage Hysteresis	V_{HYS}		+25℃		100		mV
Logic Level Inputs							
Input Logic Low Voltage	V_{IL}	nSLEEP, V_{CC} = 2.7V to 24V	Full			0.7	V
		All other pins, V_{CC} = 2.7V to 24V	Full			0.7	
Input Logic High Voltage	V_{IH}	nSLEEP, V_{CC} = 2.7V to 24V	Full	2.3			V
		All other pins, V_{CC} = 2.7V to 24V	Full	2.1			
Input Logic Hysteresis	V_{HYS}		+25℃		200		mV
Input Pull-Down Resistance	R_{PD}	nSLEEP	+25℃		520		kΩ
		All except nSLEEP	+25℃		160		
Input Logic Low Current	I_{IL}	V_{IN} = 0V	Full	-1		1	μA
Input Logic High Current	I_{IH}	V_{IN} = 5V, nSLEEP	Full		10	13	μA
		V_{IN} = 5V, all except nSLEEP	Full		32	43	
Input Deglitch Time	t_{DEG}	V_{IN} = 5V	+25℃		460		ns
nFAULT Output (Open-Drain Output)							
Output Logic Low Voltage	V_{OL}	V_{IN} = 2V, I_O = -5mA	+25℃			0.6	V
Output Logic High-Impedance Leakage Current	I_{OH}		+25℃			1	μA
H-Bridge FETs							
High-side FET On-Resistance	R_{DSON_H}	V_{CC} = 5V, I_O = 200mA	+25℃		230		mΩ
		V_{CC} = 5V, I_O = 200mA	Full			500	
		V_{CC} = 2.7V, I_O = 200mA	+25℃		290		
		V_{CC} = 2.7V, I_O = 200mA	Full			590	
Low-side FET On-Resistance	R_{DSON_L}	V_{CC} = 5V, I_O = -200mA	+25℃		180		mΩ
		V_{CC} = 5V, I_O = -200mA	Full			440	
		V_{CC} = 2.7V, I_O = -200mA	+25℃		230		
		V_{CC} = 2.7V, I_O = -200mA	Full			490	
Off-State Leakage Current	I_{OFF}	V_{CC} = 24V, V_{OUT} = 0V	+25℃	-4		2	μA
Motor Driver							
Current Control PWM Frequency	f_{PWM}	Internal PWM Frequency	+25℃		45		kHz
Rise Time	t_R	R_L = 16Ω to GND, 10% to 90% V_{CC}	+25℃		80		ns
Fall Time	t_F	R_L = 16Ω to V_{CC}, 90% to 10% V_{CC}	+25℃		50		ns
Propagation Delay INx to OUTx	t_{PROP}		+25℃		1.2		μs
Dead Time (1)	t_{DEAD}		+25℃		550		ns

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 5V, Full = -40℃ to +125℃. Typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Protection Circuits							
Over-Current Protection Trip Level	I_{OCP}		+25℃	2.5	3.7		A
OCP Deglitch Time	t_{DEG}		+25℃		4.7		μs
Over-Current Protection Period	t_{OCP}		+25℃		1.4		ms
Thermal Shutdown Temperature	T_{SD}	Die Temperature			170		℃
Thermal Shutdown Hysteresis	T_{HYS}				20		℃
Current Control							
xISEN Trip Voltage	V_{TRIP}		+25℃	160	195	230	mV
Current Sense Blanking Time	t_{BLANK}		+25℃		4		μs
nSLEEP Mode							
Start-Up Time	t_{WAKE}	nSLEEP inactive high to H-bridge on	Full			1.3	ms

NOTE: 1. Internal dead time. External implementation is not necessary.

FUNCTIONAL BLOCK DIAGRAM

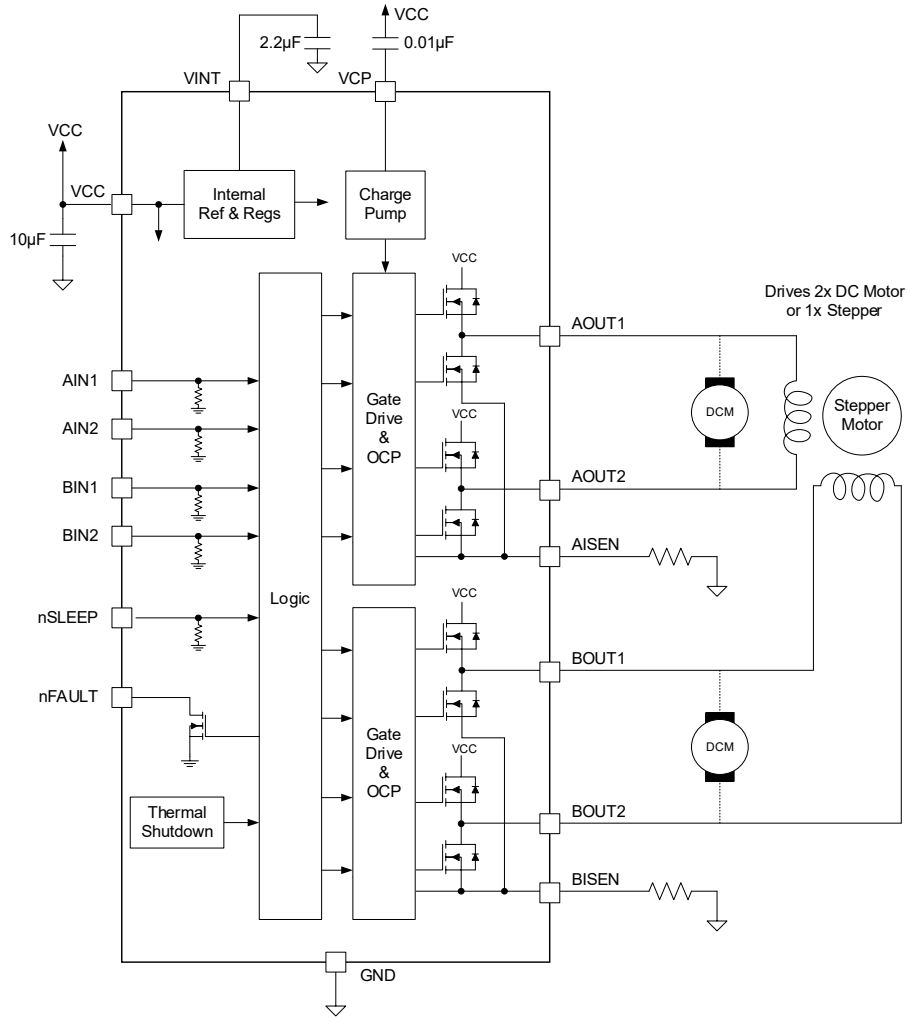


Figure 1. SGM42600 Block Diagram

DETAILED DESCRIPTION

PWM Motor Drivers

Block diagram of the integrated motor driver including current control PWM H-bridges is shown in Figure 2.

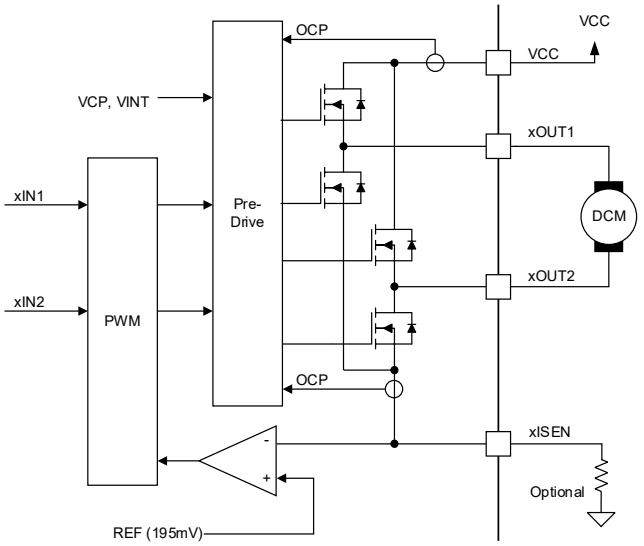


Figure 2. Motor Control Circuitry

Bridge Control and Decay Modes

The AINx and BINx input pins control the output states of the AOUTx and BOUTx respectively, as shown in Table 1.

Table 1. H-Bridge Logic

xIN1	xIN2	xOUT1	xOUT2	FUNCTION
0	0	Z	Z	Coast/Fast Decay
0	1	L	H	Reverse
1	0	H	L	Forward
1	1	L	L	Brake/Slow Decay

The SGM42600 supports PWM mode of input to control motor current. When the PWM driving on time ends, current begins to decay through a recirculation path since it must continue to flow. There are two different decay modes available for the H-bridge as shown in Figure 3. In fast mode, current flows through the body diode when the whole H-bridge is disabled. In slow decay mode, current recirculates in low-side MOSFETs when the high-side MOSFETs is disabled.

When external PWM modulate signal is applied to one xIN pin while the other is held low, the bridge is in fast decay mode; when the other xIN pin is held high, the bridge is in slow decay mode (see Table 2).

Table 2. PWM Control of Motor Speed

xIN1	xIN2	FUNCTION
PWM	0	Forward PWM, Fast Decay
1	PWM	Forward PWM, Slow Decay
0	PWM	Reverse PWM, Fast Decay
PWM	1	Reverse PWM, Slow Decay

If connecting a sense resistor from xISEN pin to GND, the internal current limit is always enabled. To disable this function, please short the xISEN pin to GND directly. Please refer to Figure 3 for the current path of the drive and the decay modes.

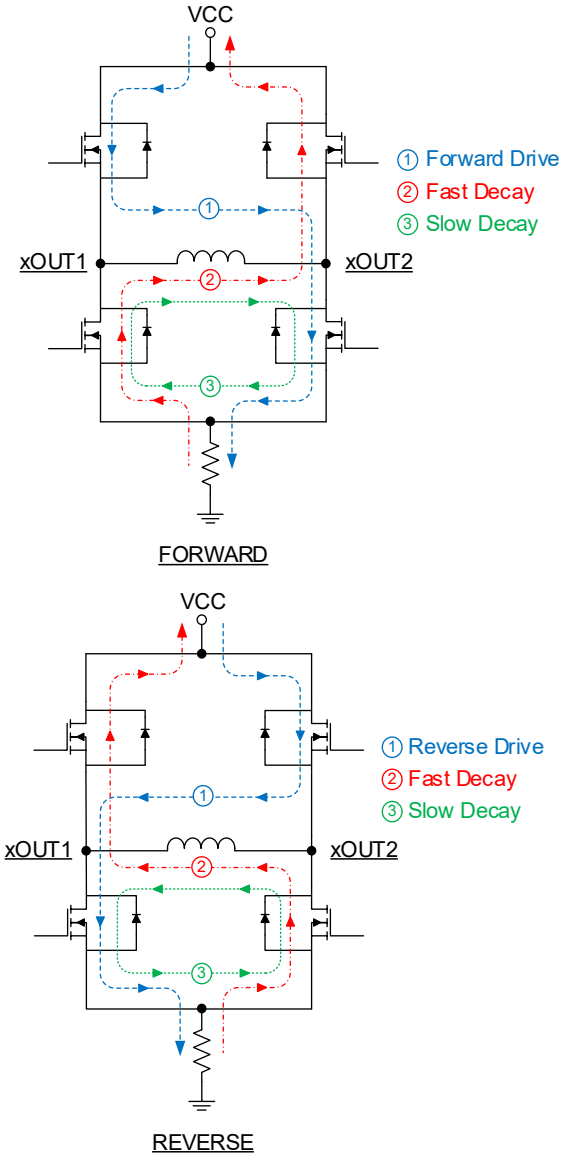


Figure 3. Drive and Decay Modes

DETAILED DESCRIPTION (continued)

Decay Mode

After any drive phase, when phase current reaches the current limit setting point, the H-bridge turns to slow decay mode (two low-side MOSFETs on), lasting for (t_{PWM} - t_{DRIVE}).

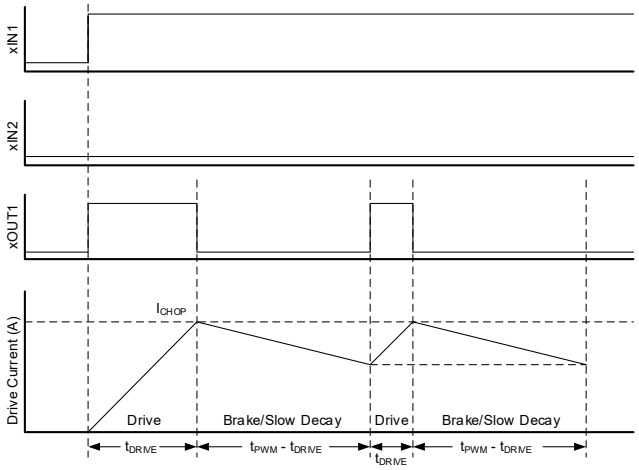


Figure 4. Current Chopping Operation

Current Control

Current is regulated by a fixed-frequency PWM regulation when chopping conditions are met. For DC motor applications, it is possible to limit the current to prevent overshoot when motor startup or stall. For stepper motor applications, current control can provide a constant current.

When the output is enabled, the motor current rises up depending on the power supply and motor inductance, and the xISEN pin voltage is ignored for a fixed blanking time of about 4μs. After that, if the xISEN voltage reaches the internal reference voltage (V_{TRIP}) of typically 195mV, the high-side MOSFETs may be turned off, and both low-side MOSFETs may be turned on for a fixed time of (t_{PWM} - t_{DRIVE}).The PWM chopping current is set by a comparator that compares the voltage across a current sense resistor connected to the xISEN pins with a reference voltage. The reference voltage (V_{TRIP}) is fixed at 195mV nominally.

The chopping current is calculated in Equation 1.

$$I_{CHOP} = \frac{195mV}{R_{xISEN}} \quad (1)$$

For example:
Example: If a 1Ω sense resistor is used, the chopping current will be 195mV/1Ω = 195mA.

Note that if current control is not needed, the xISEN pins need to be shorted to ground directly.

nSLEEP Operation

To idle the device and put it in the low power sleep mode, the nSLEEP pin can be pulled low. In the sleep mode, all H-bridges and drivers are disabled, and the device will not respond to input signals in any way until it resumes operation. When waking up from sleep mode, it takes at least t_{WAKE} to fully recover.

Over-Current Protection (OCP)

Each MOSFET has an independent over-current protection current. When the operating current exceeds the over-current point and lasts for more than the OCP deglitch time, the H-bridge will be shut down and OCP fault will be reported on nFAULT pin. The driver will be re-enabled periodically at OCP retry intervals.

The OCP protection circuit works even if the xISEN pin is shorted to GND.

Thermal Shutdown (TSD)

All bridges and drivers are shutdown if a junction over-temperature occurs in the device and the nFAULT pin will be driven low. Once the temperature goes back to the safe level, the device resumes its operation.

Under-Voltage Lockout (UVLO)

If the voltages on VCC pin fall below their under-voltage lockout thresholds, the device will be disabled and internal logic will be reset. Device resumes operation when all of them go back above their UVLO thresholds. The UVLO event is not reported on the nFAULT pin.

APPLICATION INFORMATION

Power Supply Recommendations

The SGM42600 operates from a supply voltage range of 2.7V to 24V. It is recommended to connect at least one ceramic capacitor between VCC and GND, as close as possible to the VCC pin of the device.

Bypass Capacitance for Motor Drive Systems

The selection of bypass capacitors is crucial for motor drive system. The following conditions should be considered during design, including:

- Maximum power supply voltage
- Parasitic inductance in the power supply wiring
- Type of motor (brushed DC, brushless DC, stepper)
- Motor speed
- Motor braking method

Motor datasheets generally specify the capacitance value, however, it is recommended to do a system level test to size the bypass capacitors properly.

Layout Guidelines

Use a low ESR ceramic bypass capacitor connected between VCC pin and GND pin. The capacitor should be placed near the VCC pin and connected to the GND pin and PPAD of the device using thick wires or ground plane.

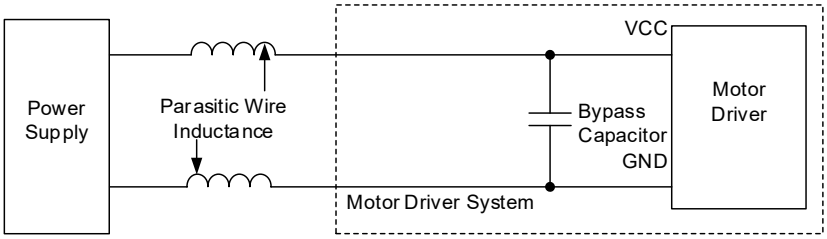


Figure 5. Setup of Motor Drive System with External Power Supply

REVISION HISTORY

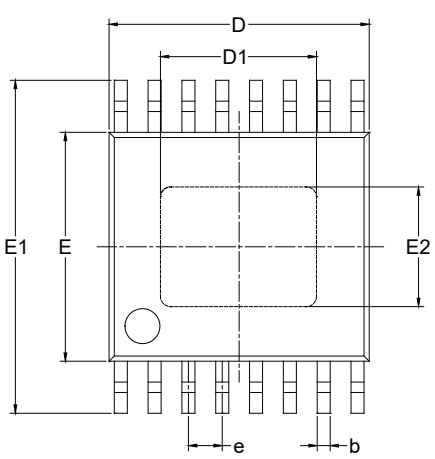
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

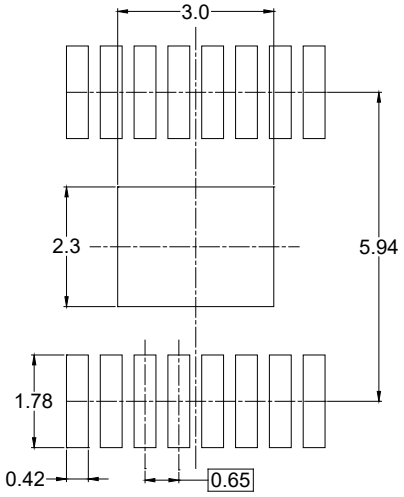
JUNE 2026 – REV.A to REV.A.1	Page
Updated Absolute Maximum Ratings	2
Updated Detailed Description and Application Information sections	All

Changes from Original to REV.A (APRIL 2017)	
Changed from product preview to production data	All

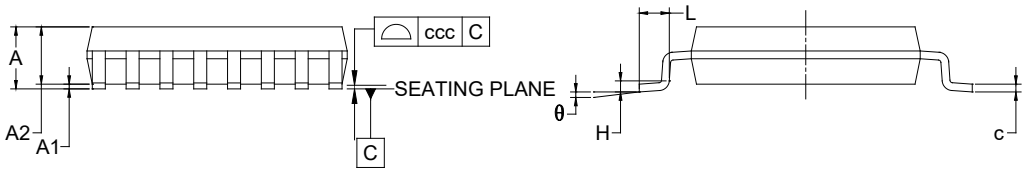
PACKAGE OUTLINE DIMENSIONS

TSSOP-16 (Exposed Pad)





RECOMMENDED LAND PATTERN (Unit: mm)

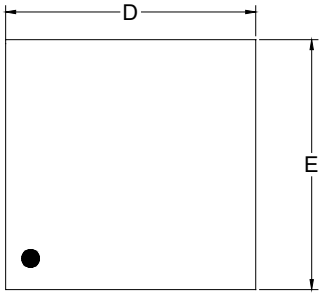


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
D1	2.900	-	3.400
E	4.300	-	4.500
E1	6.200	-	6.600
E2	2.200	-	2.980
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

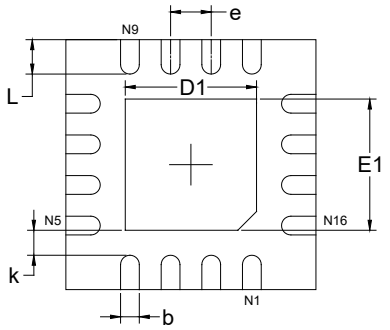
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions, or gate burrs.
3. Reference JEDEC MO-153.

PACKAGE OUTLINE DIMENSIONS

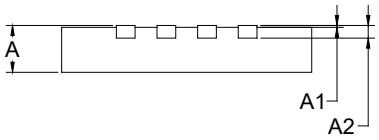
TQFN-4×4-16L



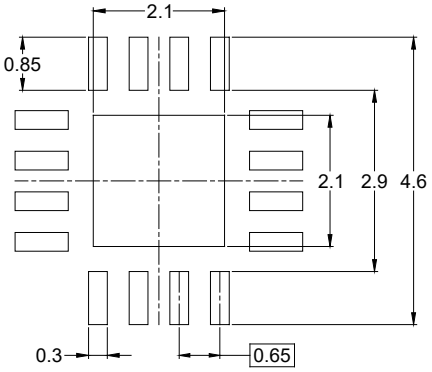
TOP VIEW



BOTTOM VIEW



SIDE VIEW



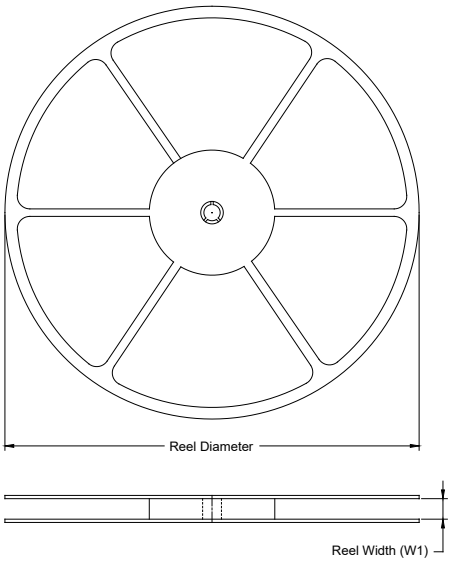
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	3.900	4.100	0.154	0.161
D1	2.000	2.200	0.079	0.087
E	3.900	4.100	0.154	0.161
E1	2.000	2.200	0.079	0.087
k	0.200 MIN		0.008 MIN	
b	0.250	0.350	0.010	0.014
e	0.650 TYP		0.026 TYP	
L	0.450	0.650	0.018	0.026

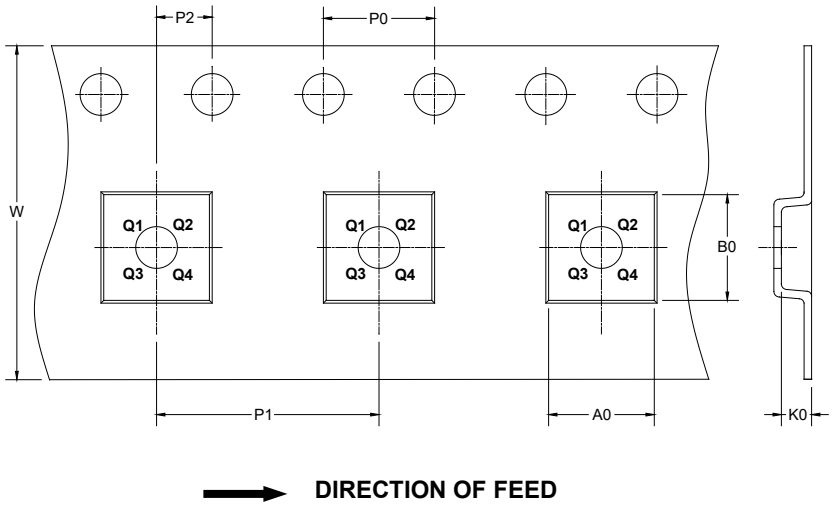
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



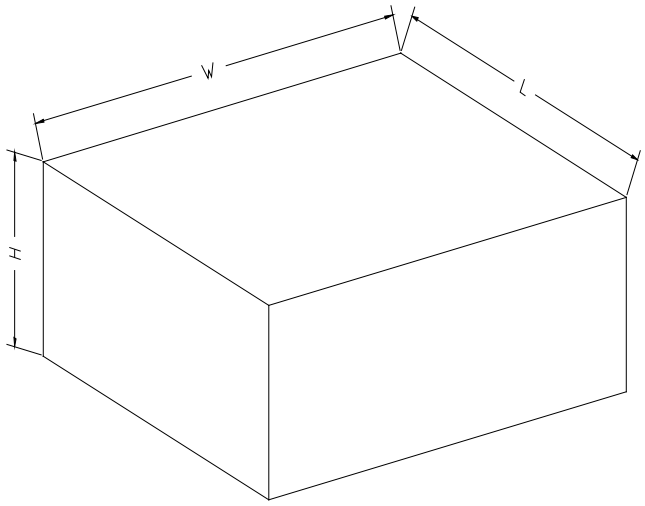
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-16 (Exposed Pad)	13″	12.4	6.80	5.40	1.50	4.0	8.0	2.0	12.0	Q1
TQFN-4×4-16L	13″	12.4	4.30	4.30	1.10	4.0	8.0	2.0	12.0	Q2

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

DD0002