SGM42512
1.5A, 5.5V H-Bridge Driver for Motor/Coil

GENERAL DESCRIPTION

The SGM42512 is an integrated driver IC for driving motors and coils in industrial applications. The PH and EN/FAULT pins allow simple interfacing to controller circuits.

Internal protection functions are provided for under-voltage lockout (UVLO), over-current protection (OCP) and over-temperature protection (OTP). Fault conditions are indicated by the EN/FAULT pin.

The SGM42512 is available in a Green TSOT-23-6 package. It operates over an ambient temperature range of -40℃ to +125℃.

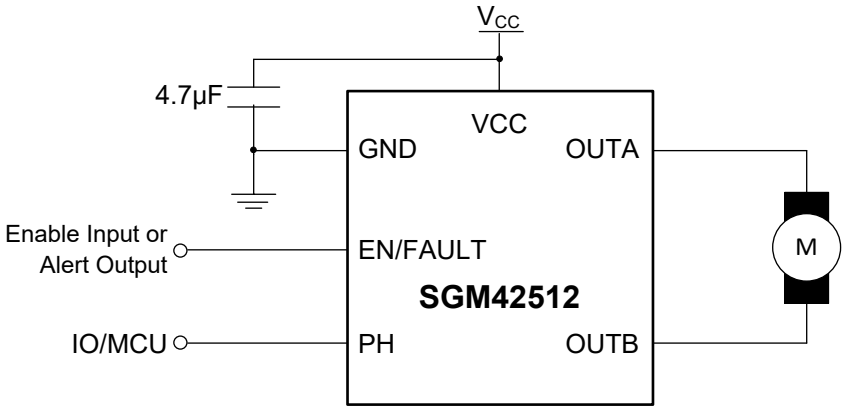
FEATURES

- **Sleep Mode Supply Current: 140nA (TYP)**
- **Internal OC/UV/OT Protections**
  - **Over-Current Threshold Options: 0.45A/0.9A/1.5A**
  - **Under-Voltage Threshold Options: 1.75V/2.8V/3.6V**
- **Up to 5.5V Supply Range for Applications Powered by:**
  - **1 Li+/Poly Cell**
  - **1/2/3 Dry Cell(s)**
  - **1 $LiSOCl_2$ Cell**
- **Optional Slow or Fast Decay Mode**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green TSOT-23-6 Package**

APPLICATIONS

Robot
Utility Meter
Solenoid

TYPICAL APPLICATION

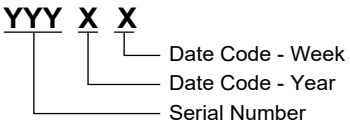


PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42512A-1.75	TSOT-23-6	-40℃ to +125℃	SGM42512A-1.75XTN6G/TR	MO0XX	Tape and Reel, 3000
SGM42512A-2.8	TSOT-23-6	-40℃ to +125℃	SGM42512A-2.8XTN6G/TR	MO1XX	Tape and Reel, 3000
SGM42512A-3.6	TSOT-23-6	-40℃ to +125℃	SGM42512A-3.6XTN6G/TR	MO2XX	Tape and Reel, 3000
SGM42512B-1.75	TSOT-23-6	-40℃ to +125℃	SGM42512B-1.75XTN6G/TR	MO3XX	Tape and Reel, 3000
SGM42512B-2.8	TSOT-23-6	-40℃ to +125℃	SGM42512B-2.8XTN6G/TR	MO4XX	Tape and Reel, 3000
SGM42512B-3.6	TSOT-23-6	-40℃ to +125℃	SGM42512B-3.6XTN6G/TR	MO5XX	Tape and Reel, 3000
SGM42512C-1.75	TSOT-23-6	-40℃ to +125℃	SGM42512C-1.75XTN6G/TR	MO6XX	Tape and Reel, 3000
SGM42512C-2.8	TSOT-23-6	-40℃ to +125℃	SGM42512C-2.8XTN6G/TR	MH9XX	Tape and Reel, 3000
SGM42512C-3.6	TSOT-23-6	-40℃ to +125℃	SGM42512C-3.6XTN6G/TR	MHAXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date 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.

SELECTABLE MODEL

MODEL	OVER-CURRENT PROTECTION THRESHOLD (A)	UNDER-VOLTAGE PROTECTION THRESHOLD (V)
SGM42512A-1.75	1.5	1.75
SGM42512A-2.8	1.5	2.8
SGM42512A-3.6	1.5	3.6
SGM42512B-1.75	0.9	1.75
SGM42512B-2.8	0.9	2.8
SGM42512B-3.6	0.9	3.6
SGM42512C-1.75	0.45	1.75
SGM42512C-2.8	0.45	2.8
SGM42512C-3.6	0.45	3.6

ABSOLUTE MAXIMUM RATINGS

V_{CC} ..... -0.3V to 6V
Digital Input Pin Voltage Range ..... -0.3V to V_{CC} + 0.3V
Package Thermal Resistance
TSOT-23-6, θ_{JA} ..... 217.8℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 6000V
MM 400V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

V_{CC} ..... 1.9V to 5.5V
Digital Input Pin Voltage Range ..... 0V to 5.5V
Ambient 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.

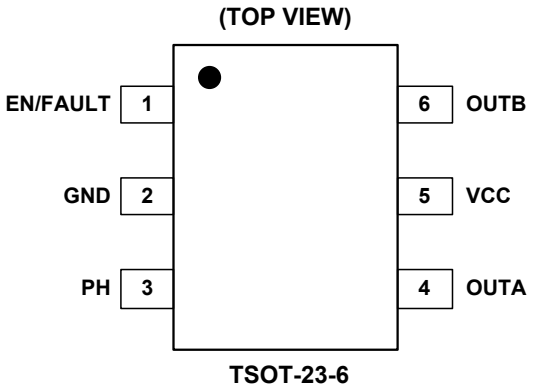
ESD SENSITIVITY CAUTION

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 CONFIGURATION



PIN DESCRIPTION

NAME	TYPE	FUNCTION
EN/FAULT	I/O	Enable Input or Alert Output (OTP, OCP, UVP) Pin. Logic high to enable normal operation, logic low (> t_{SLEEP}) to enter low power dissipation sleep mode and reset all internal logic. Internal pull-down. This output is not valid when the device into minimum power dissipation sleep mode.
GND	G	Ground.
PH	I	Direction Input Pin ($V_{PH} \le V_{CC}$). Logic high for sourcing from OUTA and sinking into OUTB; logic low for reverse driving. Internal pull-down.
OUTA	O	H-Bridge Output A.
VCC	P	Power Input. A 4.7μF (MIN) ceramic bypass capacitor to GND is recommended.
OUTB	O	H-Bridge Output B.

NOTE: I: input, O: output, I/O: input or output, G: ground, P: power for the circuit.

ELECTRICAL CHARACTERISTICS

(T_A = +25℃, V_{CC} = 5V, EN/FAULT pin connected to 5V through 500Ω resistor, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supplies							
Power Supply Voltage	V_{CC}		+25℃	1.9		5.5	V
Digital Input Voltage Range (EN/FAULT, PH)	V_{IN}		+25℃	0		5.5	V
Power Supply Current	I_{VCC}	No PWM	+25℃		40	70	μA
Sleep Mode Supply Current	I_{VCCQ}	EN/FAULT = GND	+25℃		140	500	nA
VCC Under-Voltage Lockout Voltage	V_{UVLO}	SGM42512A/B/C-1.75	+25℃		1.7	1.9	V
		SGM42512A/B/C-2.8	+25℃		1.95	2.15	
		SGM42512A/B/C-3.6	+25℃		1.7	1.85	
VCC Under-Voltage Lockout Voltage Hysteresis	V_{HYS}		+25℃		100		mV
VCC Under-Voltage Protection Voltage	V_{UVP}	SGM42512A/B/C-1.75	+25℃		1.75	1.9	V
		SGM42512A/B/C-2.8	+25℃		2.8	3.05	
		SGM42512A/B/C-3.6	+25℃		3.6	3.75	
VCC Under-Voltage Protection Voltage Hysteresis	V_{HYS}		+25℃		100		mV
Logic Level Inputs							
Input Low Voltage	V_{IL}		Full			0.4	V
Input High Voltage	V_{IH}		Full	1.6			V
Input Low Current	I_{IL}	V_{IN} = 0V	+25℃	-500		500	nA
Input High Weak Pull-Down Current	I_{IH_weak}	V_{IN} = 5.5V	+25℃		60	85	μA
Input High Strong Pull-Down Current	I_{IH_strong}	V_{IN} = 0.88V	+25℃		220	350	μA
Input Deglitch Time	t_{DEG}		+25℃		300		ns
EN/FAULT Output (Open-Drain Output)							
Output Low Voltage	V_{OL}	V_{CC} = 1.8V, I_{OUT} = -5mA	+25℃			300	mV
Output High Leakage Current	I_{OH}		+25℃			85	μA
H-Bridge FETs							
HS FET On-Resistance	$R_{DS(ON)}$	SGM42512A-X, I_{OUT} = 200mA	+25℃		365		mΩ
			Full			520	
		SGM42512B-X, I_{OUT} = 200mA	+25℃		370		
			Full			540	
		SGM42512C-X, I_{OUT} = 200mA	+25℃		395		
			Full			570	
LS FET On-Resistance	$R_{DS(ON)}$	SGM42512A-X, I_{OUT} = -200mA	+25℃		180		mΩ
			Full			320	
		SGM42512B-X, I_{OUT} = -200mA	+25℃		185		
			Full			340	
		SGM42512C-X, I_{OUT} = -200mA	+25℃		210		
			Full			360	
Off-State Leakage Current	I_{OFF}	V_{OUT} = 0V or 5.5V	+25℃	-500		500	nA

ELECTRICAL CHARACTERISTICS (continued)

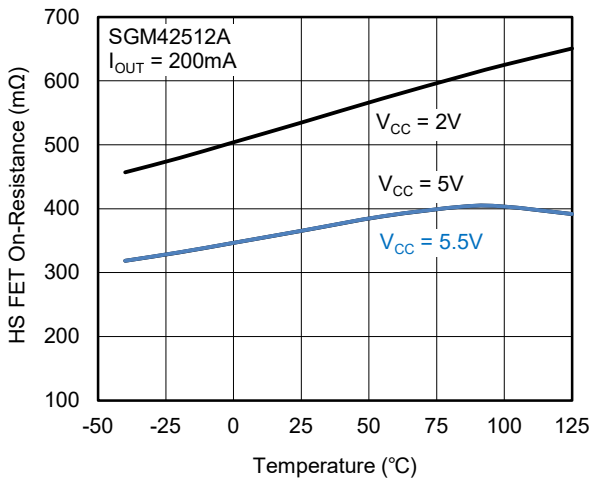
(T_A = +25℃, V_{CC} = 5V, EN/FAULT pin connected to 5V through 500Ω resistor, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Motor Driver							
Rise Time	t_R	R_L = 16Ω to GND, 10% to 90% V_{CC}	+25℃		125		ns
Fall Time	t_F	R_L = 16Ω to V_{CC}, 90% to 10% V_{CC}	+25℃		155		ns
Propagation Delay INx to OUTx	t_{PROP}		+25℃		1		μs
Dead Time (1)	t_{DEAD}		+25℃		255		ns
Protection Circuits							
Over-Current Protection Trip Level	I_{OCP}	SGM42512A-X	+25℃		1.5		A
		SGM42512B-X	+25℃		0.9		
		SGM42512C-X	+25℃		0.45		
Thermal Shutdown							
Thermal Shutdown Temperature	T_{TSD}				165		℃
Thermal Shutdown Temperature Hysteresis	T_{HYS}				30		℃
nSLEEP Mode							
Time to Enter Sleep Mode	t_{SLEEP}		+25℃	60		105	ms
Wake Time	t_{WAKE}	EN/FAULT inactive high to H-bridge on	+25℃			8.5	ms

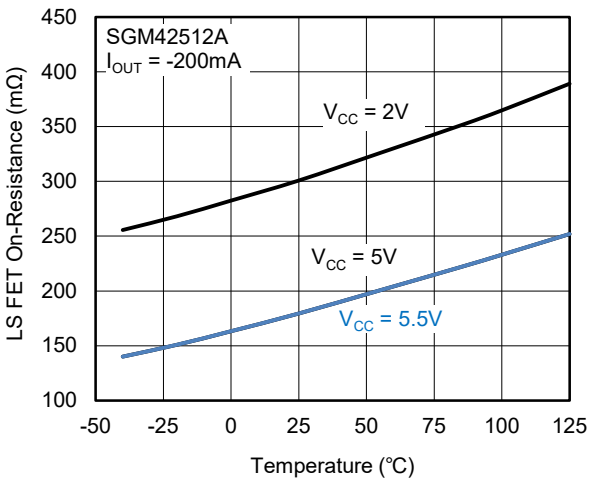
NOTE: 1. Internal dead time. External implementation is not necessary.

TYPICAL PERFORMANCE CHARACTERISTICS

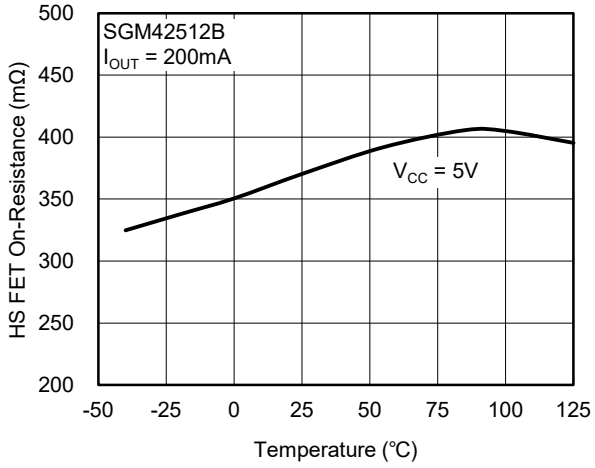
HS FET On-Resistance vs. Temperature



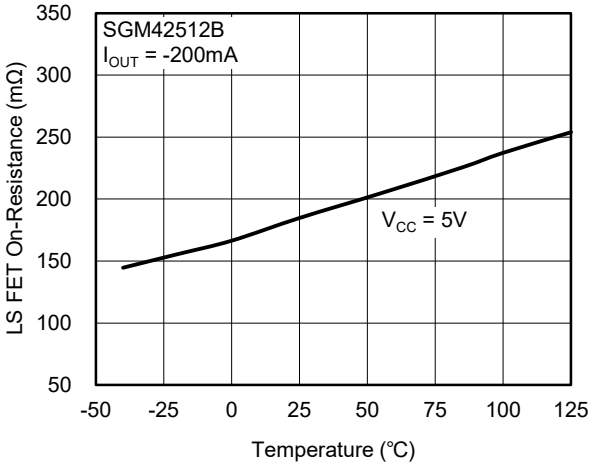
LS FET On-Resistance vs. Temperature



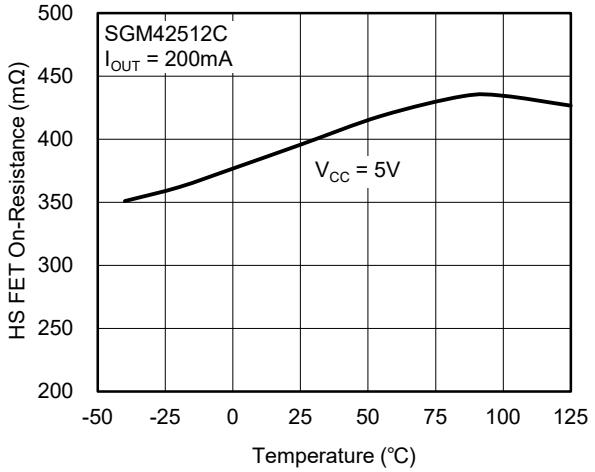
HS FET On-Resistance vs. Temperature



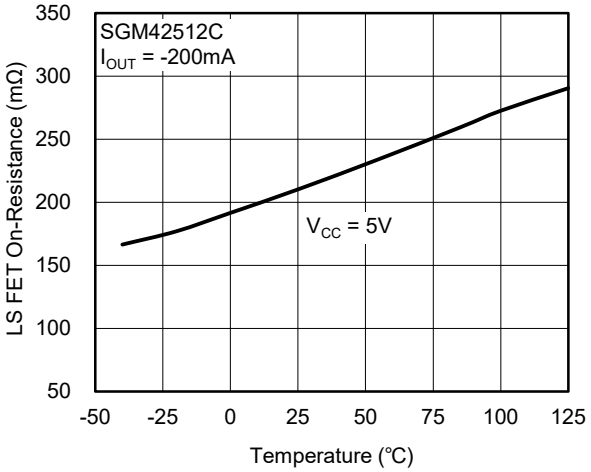
LS FET On-Resistance vs. Temperature



HS FET On-Resistance vs. Temperature

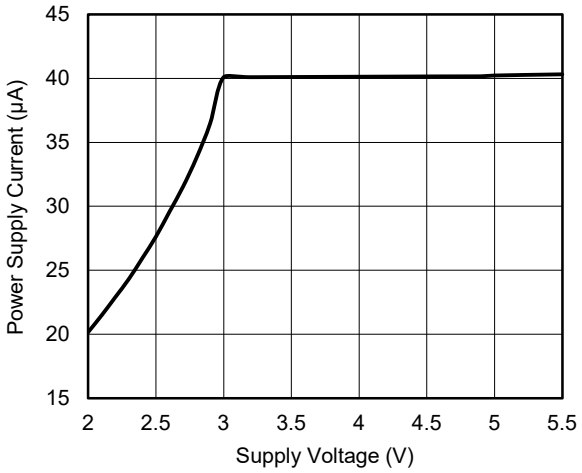


LS FET On-Resistance vs. Temperature

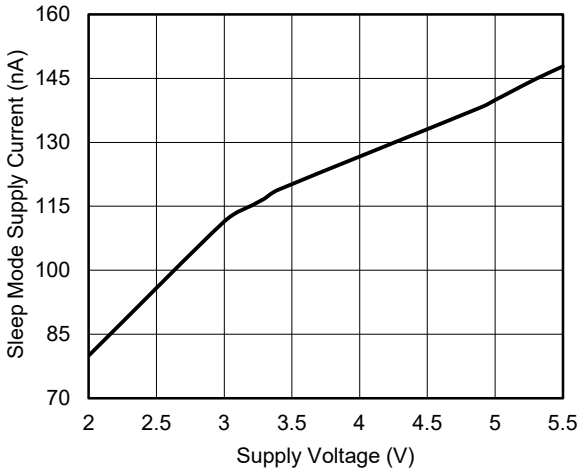


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

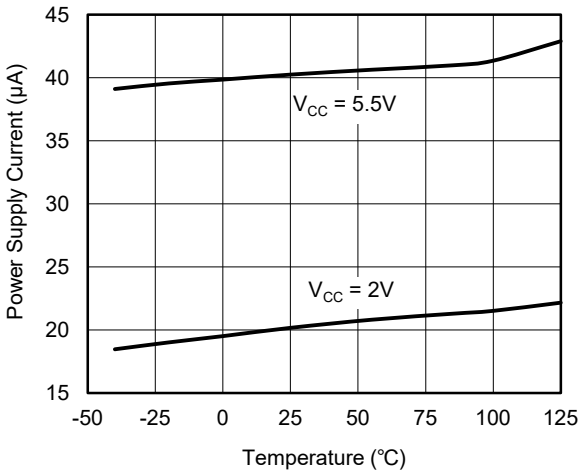
Power Supply Current vs. Supply Voltage



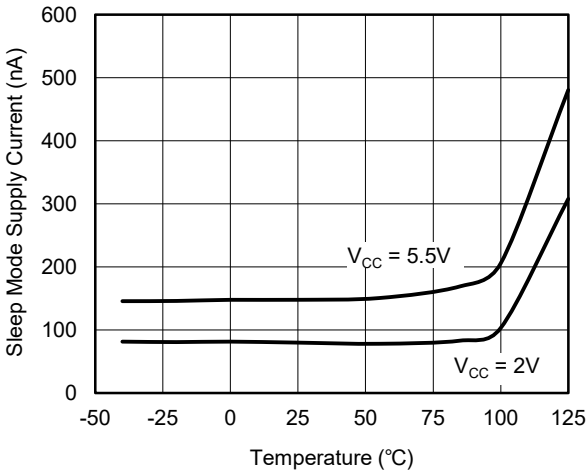
Sleep Mode Supply Current vs. Supply Voltage



Power Supply Current vs. Temperature



Sleep Mode Supply Current vs. Temperature



REVISION HISTORY

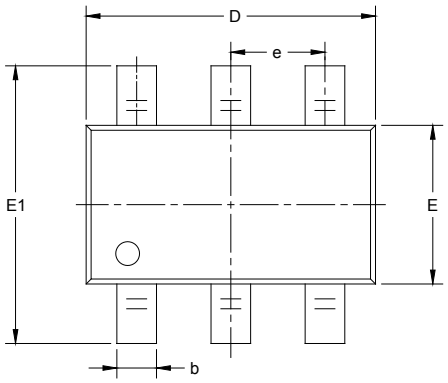
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

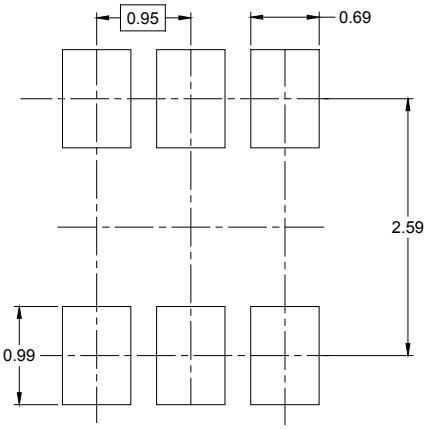
Changes from Original (DECEMBER 2018) to REV.A

Changed from product preview to production data	All

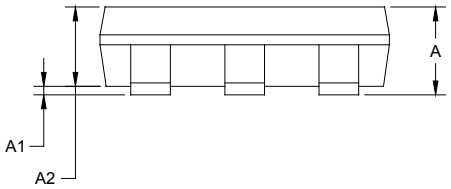
PACKAGE OUTLINE DIMENSIONS

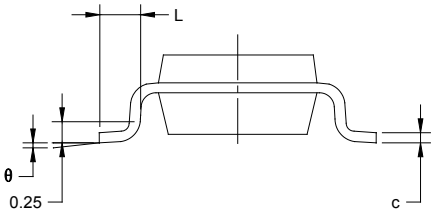
TSOT-23-6





RECOMMENDED LAND PATTERN (Unit: mm)

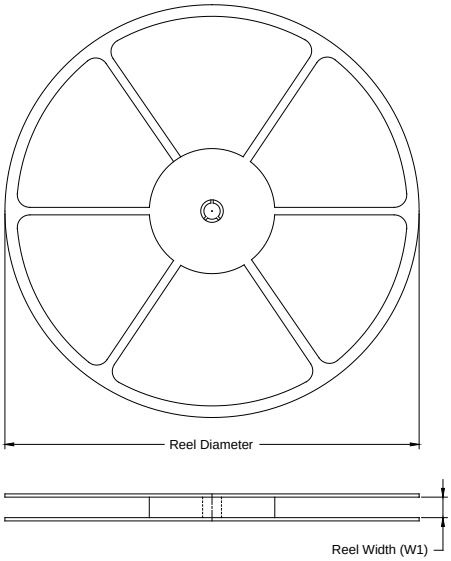




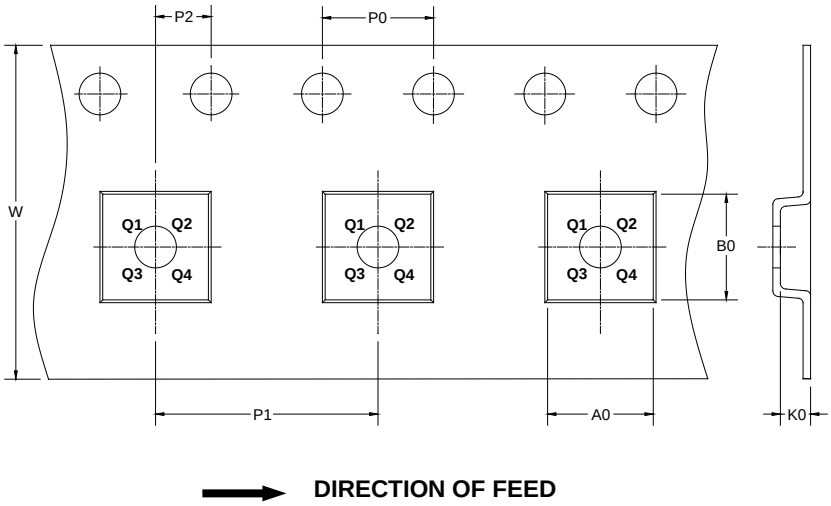
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.000		0.043
A1	0.000	0.100	0.000	0.004
A2	0.700	0.900	0.028	0.039
b	0.300	0.500	0.012	0.020
c	0.080	0.200	0.003	0.008
D	2.850	2.950	0.112	0.116
E	1.550	1.650	0.061	0.065
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



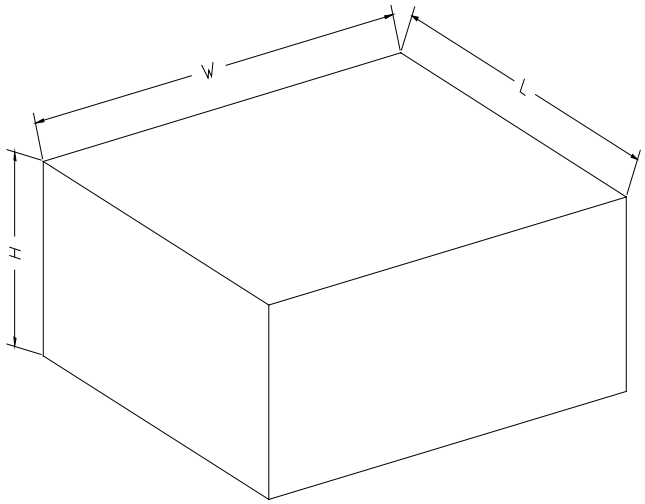
NOTE: The picture is only for reference. Please make the object as the standard.

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
TSOT-23-6	7″	9.5	3.20	3.10	1.10	4.0	4.0	2.0	8.0	Q3

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
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002