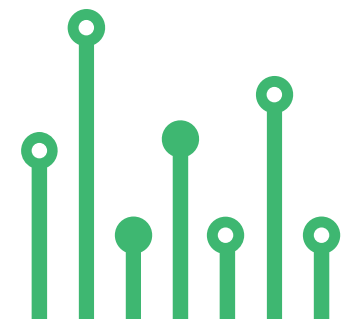


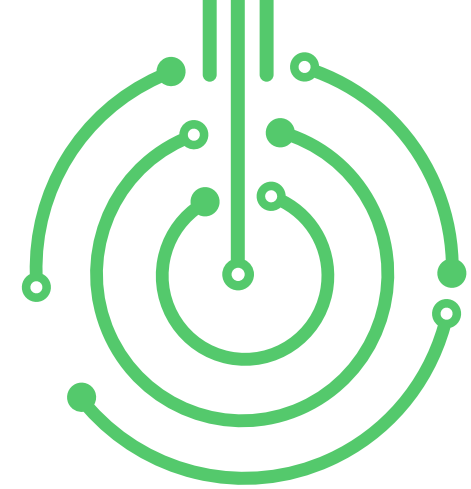
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“ High Power Bipolar Stepper Motor Driver with SPI Interface



SKU: EL138922

High Power Bipolar Stepper Motor Driver with SPI Interface



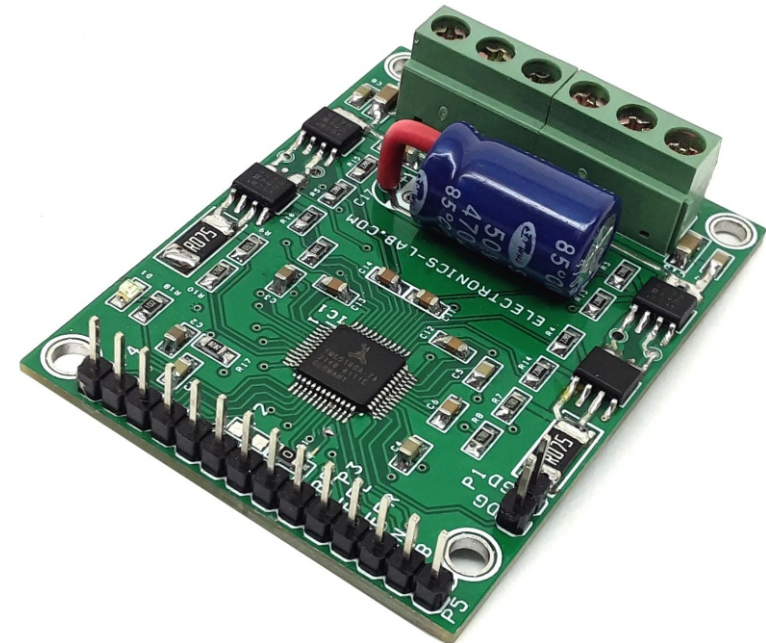
This is a compact high-power stepper motor driver built for bipolar stepper motors. The driver can be controlled using a serial communication interface (SPI). It combines a flexible ramp generator for automatic target positioning with the industry's most advanced stepper motor driver. Using external transistors, the driver ensures absolutely noiseless operation combined with maximum efficiency and the best motor torque. High integration, high energy efficiency, and a small form factor enable miniaturized. The complete solution reduces the learning curve to a minimum while giving the best performance in class. The project has the option to interface an external incremental encoder for easy control of position and step-loss operations.

Note 1: Refer Data sheet of TMC5160 to understand SPI interface and control system.

Note 2: This board only work with serial-SPI mode, it doesn't support standalone mode.

Features

- Power Supply Motor 9 to 36V DC
- 2.8A Continues Current (3.1A Peak)
- Configuration & Control via SPI
- S/D mode selectable via solder option
- Header Connectors for All signal Inputs
- Screw Terminal Connectors for Power Supply and Easy Motor Connections
- Low Ohmic MOSFETS for High Efficiency and Low Heat
- On Board Power LED
- Encoder Interface and 2xRef-Switch Input
- Highest Resolution 256 Microsteps Per Full Step
- Step/Dir Interface with microstep interpolation MicroPlyer™
- Motion Controller with SixPoint™ ramp
- StealthChop2™ for quiet operation and smooth motion
- Resonance Dampening for mid-range resonances
- SpreadCycle™ highly dynamic motor control chopper
- DcStep™ load dependent speed control



- StallGuard2™ high precision Sensorless motor load detection
- CoolStep™ current control for energy savings up to 75%
- Passive Braking and freewheeling mode
- Full Protection & Diagnostics
- PCB Dimensions 57.79 X 43.18MM
- 4 X 3MM Mounting Holes

This project offers two basic modes.

MODE 1: Full Featured Motion Controller & Driver

All stepper motor logic is completely within the TMC5160. No software is required to control the motor – just provide target positions. Enable this mode by tying low pin SD_MODE. Install Resistor R2 0 Ohms to select this mode. Do not install R1.

MODE 2: Step & Direction Driver

An external high-performance S-ramp motion controller like the TMC4361 or a central CPU generates step & direction signals synchronized to other components like additional motors within the system. The TMC5160 takes care of intelligent current and mode control and delivers feedback on the state of the motor. The Micro Plyer automatically smoothens motion. Tie SD_MODE high. Install Resistor R1 0 Ohms to select this mode. Do not install R2.

Mode Selection

-

Soldering R2/ not R1 = Internal ramp generator active with Trinamic's 6-point-ramp (default mode)

Soldering R1/ not R2 = Step/Direction interface active for use with external motion controller (STEP = REFL, DIR = REFR)

Automatic Standstill Power Down

An automatic current reduction drastically reduces application power dissipation and cooling requirements. Modify stand still current, delay time and decay via register settings. Automatic freewheeling and passive motor braking are provided as an option for stand still. Passive braking reduces motor standstill power consumption to zero, while still providing effective dampening and braking! An option for faster detection of standstill is provided for both, ramp generator and STEP/DIR operation.

Encoder Interface

TMC5160 board provides an encoder interface for external incremental encoders. The encoder allows automatic checking for step loss and can be used for homing of the motion controller (alternatively to reference switches), or for software-controlled correction of step-loss or position stabilization. Its programmable pre-scaler allows the adaptation of the encoder resolution to the motor resolution. A 32-bit encoder counter is provided.

Key Concepts

The TMC5160 board implements advanced features which are exclusive to TRINAMIC products. These features contribute toward greater precision, greater energy efficiency, higher reliability, smoother motion, and cooler operation in many stepper motor applications.

StealthChop2™ No-noise, high-precision chopper algorithm for inaudible motion and inaudible standstill of the motor. Allows faster motor acceleration and deceleration than StealthChop™ and extends StealthChop to low stand still motor currents.

SpreadCycle™ High-precision chopper algorithm for highly dynamic motion and absolutely clean current wave. Low noise, low resonance, and low vibration chopper.

DcStep™ Load dependent speed control. The motor moves as fast as possible and never loses a step.

StallGuard2™ Sensorless stall detection and mechanical load measurement. **CoolStep™** Load-adaptive current control reducing energy consumption by as much as 75%.

MicroPlyer™ Microstep interpolator for obtaining full 256 microstep smoothness with lower resolution step inputs starting from fullstep

In addition to these performance enhancements, TRINAMIC motor drivers offer safeguards to detect and protect against shorted outputs, output open circuit, overtemperature, and undervoltage conditions for enhancing safety and recovery from equipment malfunctions.

Control Interfaces

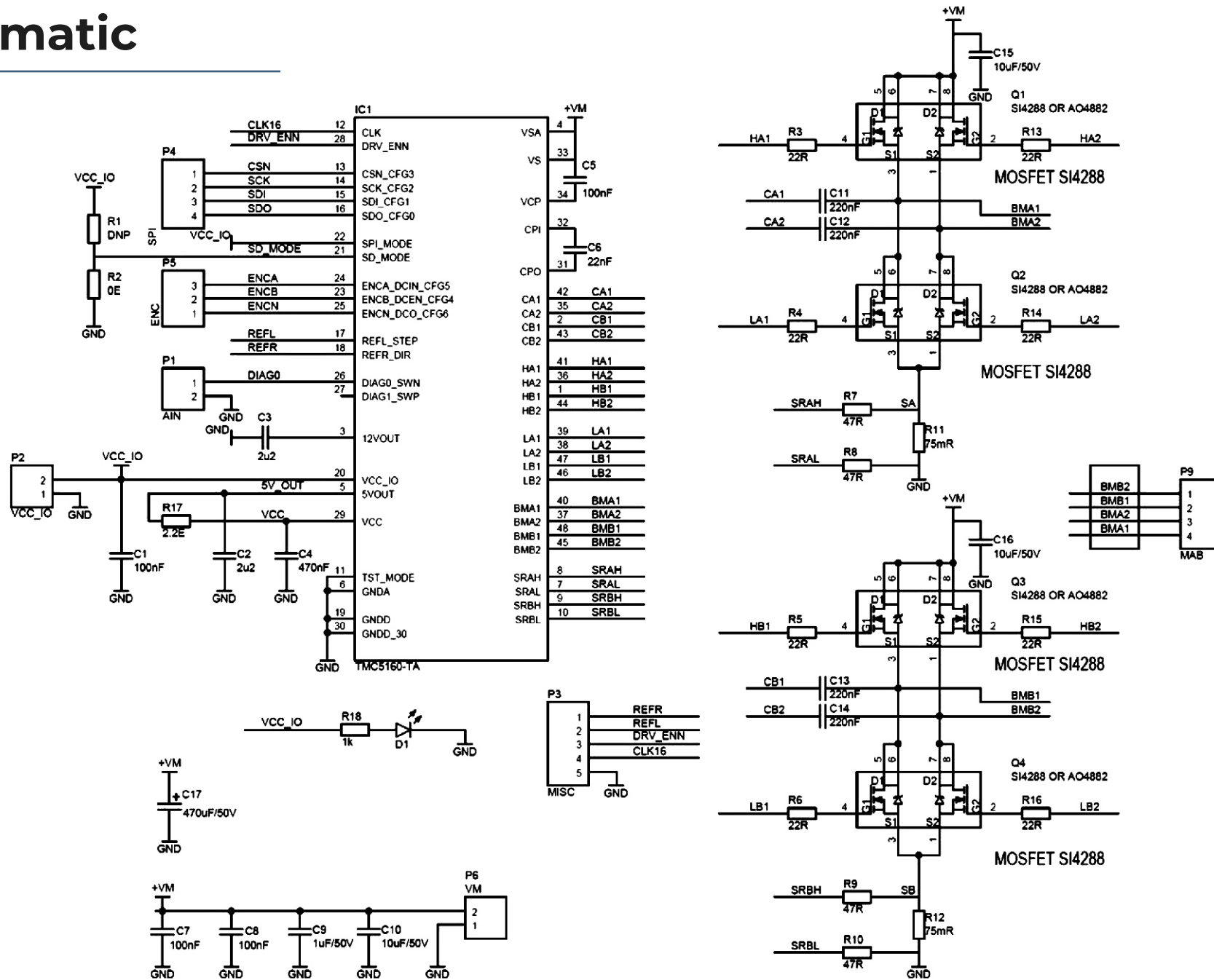
The TMC5160 board supports both, an SPI interface and a UART based single wire interface with CRC checking. Additionally, a standalone mode is provided for pure STEP/DIR operation without use of the serial interface. Selection of the actual interface is done via the configuration pins SPI_MODE and SD_MODE, which can be hardwired to GND or VCC_IO depending on the desired interface.

SPI Interface

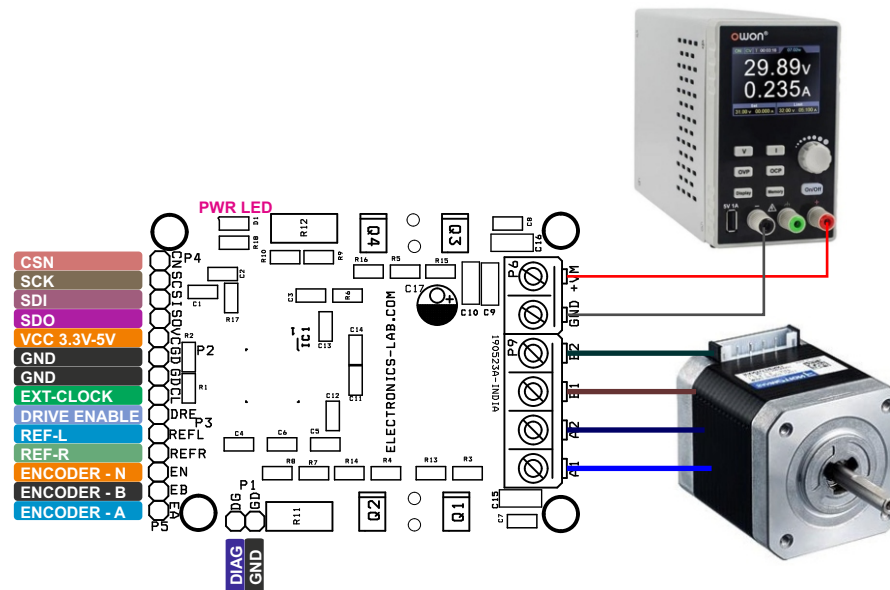
The SPI interface is a bit-serial interface synchronous to a bus clock. For every bit sent from the bus master to the bus node another bit is sent simultaneously from the node to the master. Communication between an SPI master and the TMC5160 node always consists of sending one 40-bit command word and receiving one 40-bit status word.

The TMC5160 scores with complete motion controlling features, powerful external MOSFET driver stages, and high-quality current regulation. It offers a versatility that covers a wide spectrum of applications from battery powered high efficiency systems up to embedded applications with 10A or more motor current per coil. The TMC5160 contains the complete intelligence which is required to drive a motor. Receiving target positions, the TMC5160 manages motor movement. Based on TRINAMICs unique features StallGuard2, Cool Step, DC Step, Spread Cycle, and Stealth Chop, it optimizes drive performance. It trades off velocity vs. motor torque, optimizes energy efficiency, smoothness of the drive, and noiselessness. The small form factor of the TMC5160 keeps costs down and allows for miniaturized layouts. Extensive support at the chip, board, and software levels enables rapid design cycles and fast time-to-market with competitive products. High energy efficiency and reliability deliver cost savings in related systems such as power supplies and cooling.

Schematic



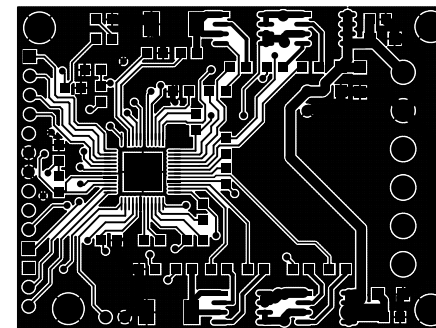
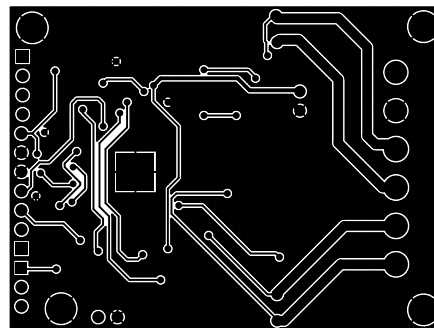
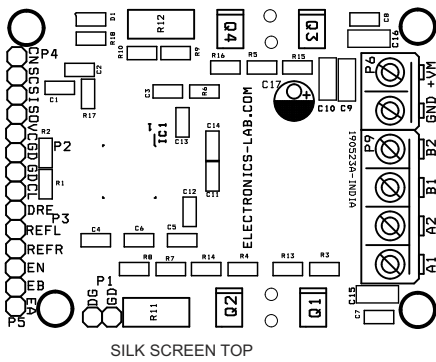
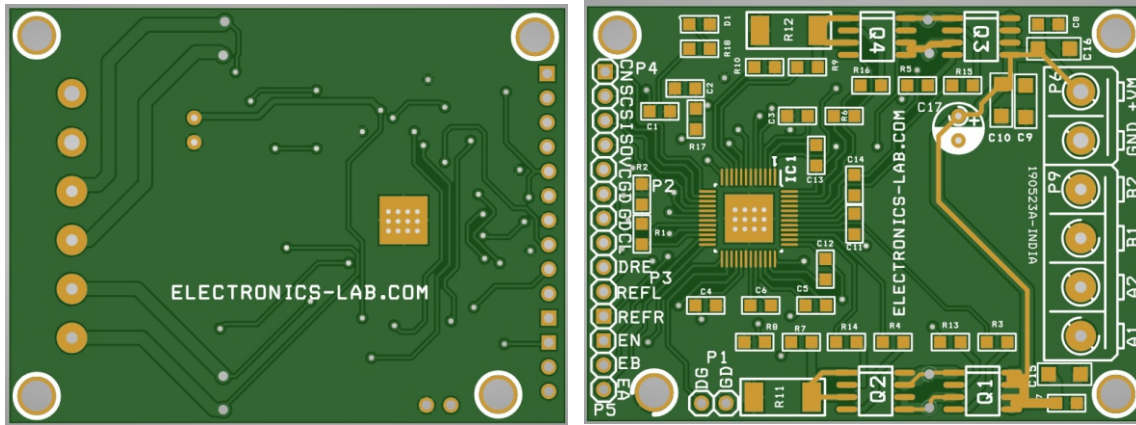
Connections



Connections and Other Details

- P1: Pin1 = DIAG, Pin 2 = GND
- P2: Pin1 = GND, Pin 2 = VCC 3.3V/5V DC Input
- P3: Pin1 = REFR, Pin 2 = REFL, Pin 3 = DRV_ENB, Pin 4 = CLK16, Pin 5 GND
- P4: Pin1 = CSN, Pin 2 = SCK, Pin 3 = SDI, Pin 4 = SDO
- P5: Pin1 = Encoder A, Pin 2 = Encoder B, Pin 3 = Encoder N
- P6: Pin1 = GND, Pin 2 = Motor Supply + 9V to 36V DC
- P9: Pin1 = Motor B2, Pin 2 = Motor B1, Pin 3 = Motor A2, Pin 4 = Motor A1
- D1: VCC Power LED

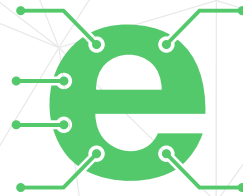
PCB



PCB DIMENSIONS 57.79 X 43.18MM

Parts List

BOM						
NO.	QNTY.	REF.	DESC	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	4	C1,C5,C7,C8	100nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
2	2	C2,C3	2u2/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
3	1	C4	470nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
4	1	C6	22nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
5	1	C9	1uF/50V CERAMIC SMD SIZE 1206	YAGEO/MURATA	DIGIKEY	
6	1	C10,C15,C16	10uF/50V CERAMIC SMD SIZE 1206	YAGEO/MURATA	DIGIKEY	
7	4	C11,C12,C13,C14	220nF/50V CERAMIC SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
8	4	R7,R8,R9,R10	47E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
9	1	C17	470uF/50V ELECTROLYTIC THT	PANASONIC	DIGIKEY	P10400TB-ND
10	1	D1	LED SMD RED SIZE 0805	OSRAM	DIGIKEY	475-1278-1-ND
11	1	IC1	TMC5160A-TA	ANALOG DEVICE	DIGIKEY	175-TMC5160A-TA-ND
12	1	P1	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
13	1	P2	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
14	1	P3	5 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5318-ND
15	1	P4	4 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5317-ND
16	1	P5	3 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5316-ND
17	1	P6	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
18	2	P9	2X2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
19	4	Q1,Q2,Q3,Q4	SI4288 OR AO4882	VISHAY	DIGIKEY	SI4288DY-T1-GE3CT-ND
20	2	R1,R2	OR SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
21	8	R3,R4,R5,R6,R13,R14,R15,R16	22E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
22	2	R11,R12	75mR 1% 2W SMD SIZE 2512	YAGEO/MURATA	DIGIKEY	
23	1	R17	2.2E 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	
24	1	R18	1K 5% SMD SIZE 0805	YAGEO/MURATA	DIGIKEY	



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