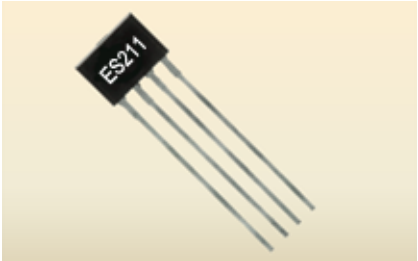
2 Phase DC Motor Drive IC **ES211**

1. Description



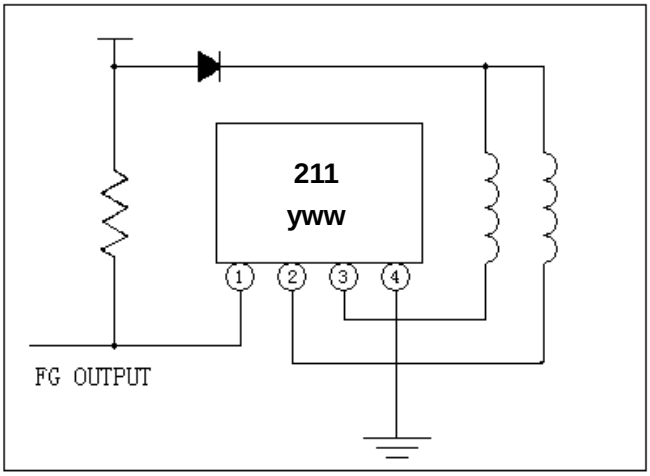
The ES211, a 1-chip composed of hall sensor and output coil drivers, applied to 2-phase DC motor. The high sensitivity of Hall Effect sensor is suitable for motors from mini-type CPU coolers to blowers and DC fans. The device also include an amplifier that amplifies the Hall voltage, and a Schmitt trigger to provide switching hysteresis for noise rejection, and complementary open-collector drivers for sinking large current loads. An internal bandgap regulator is used to provide temperature compensated supply voltage for internal circuits and allows a wide operating supply voltage.

Typical operation current is 0.3A and operating voltage range is wide. FG single, an open collector, provides a square waveform output for the detection of the motor speed.

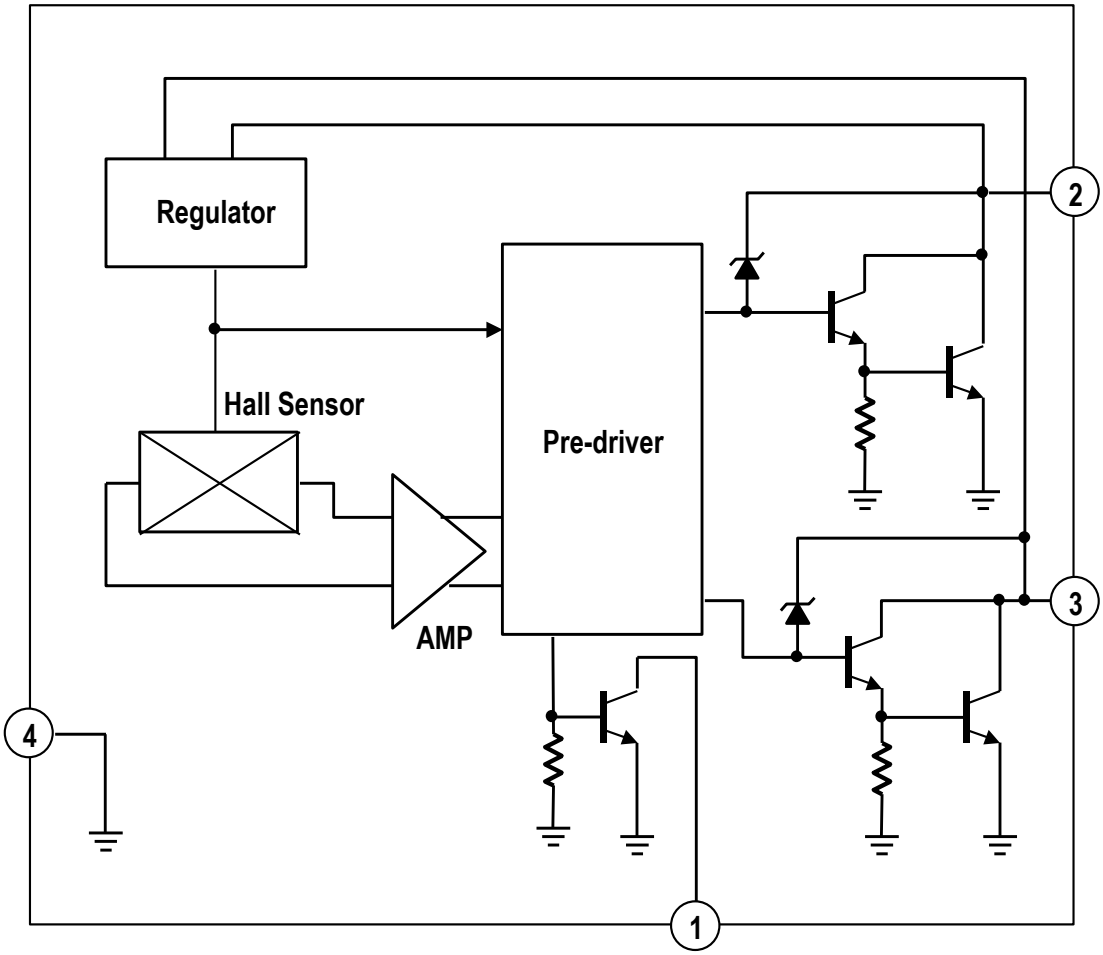
2. Features

- 1 chip hall sensor/drivers
- Wide operating voltage range: 4V~20V
- Output sink current up to 0.35A
- Low quiescent supply current under 5mA
- Built-in FG output
- Package: TO-94

3. Typical Application Circuit

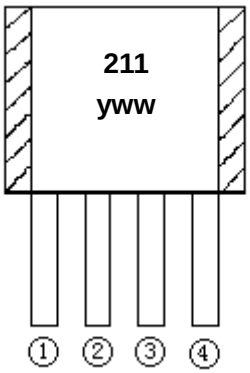


4. Functional Block Diagram



5. Pin Definitions and Descriptions

Name	No.	Status	Description
FG	1	O	Frequency output
NO	2	O/P	Output Pin of N pole
SO	3	O/P	Output Pin of S pole
GND	4		Ground Pin



6. Absolute Maximum Ratings

Parameter		Value	Units
Zener Breakdown Voltage (V_Z)		35	V
NO/SO pin voltage (V_{CC})		30	V
Continuous current (Icontinuous)		350	mA
Hold Current		500	mA
Peak Reverse Current (I_R)		100	mA
FG pin OFF voltage (V_{FG})		30	V
FG sink current (I_{FG})		20	mA
Power Dissipation	T_A=25℃	600	mW
	T_A=70℃	450	mW
Operating Temperature Range		-40 ~ 105	℃
Storage Temperature Range		-65 ~ 150	℃
Junction Temperature		150	℃
Lead Temperature (soldering, 10 seconds)		230	℃

7. Electrical Specifications

DC Electrical Characteristics

Parameter	Test Conditions	Test Circuit	Min	Typ	Max	Units
Operating voltage	I_{CC}<10mA	Fig 1	4.0		20	V
Quiescent Supply current	V_{CC}：4~20V	Fig 1	2.0		7	mA
NO/SO Saturation Voltage	I_O=300mA	Fig 1		0.94	1.2	V
FG Leakage Current	V_{FG}=30V	Fig 2			1	μA
FG Saturation Voltage	I_{FG}=5mA	Fig 2		0.2	0.5	V
Note: Fig1 the IC output state is under N magnetic field						

AC Electrical Characteristics

Parameter	Test Conditions	Test Circuit	Min	Typ	Max	Units
Rise time (T_R)	R_L=10K, C_L=10PF	Fig 3			500	nS
Fall time (T_F)	R_L=10K, C_L=10PF	Fig 3			500	nS
Propagation delay time(t_{PHL}/t_{PLH})	R_L=10K, C_L=10PF	Fig 3				μS
Response frequency (f)						KHz

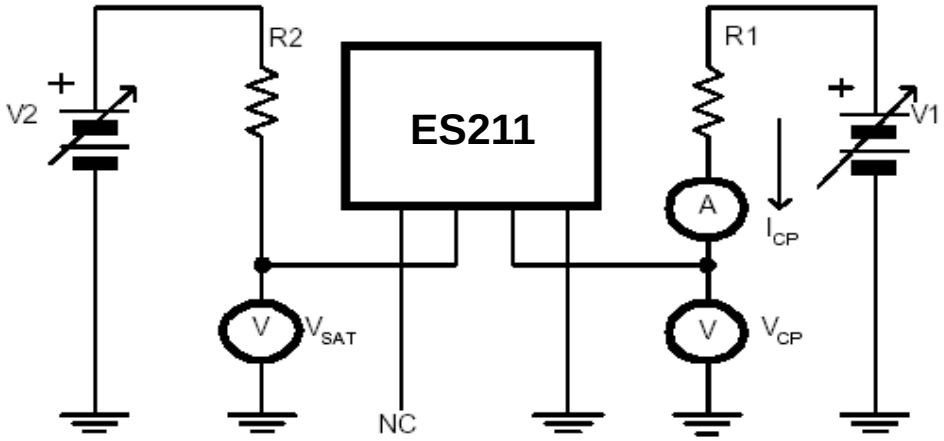


Fig.1 Test Circuit

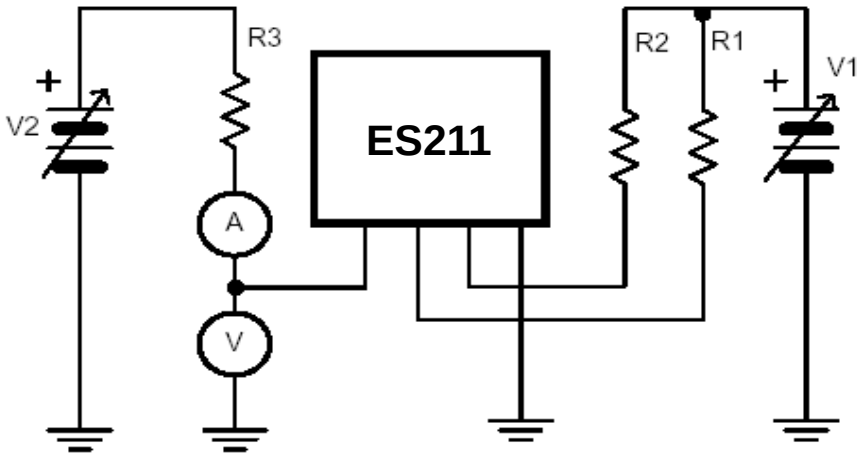


Fig.2 Test Circuit

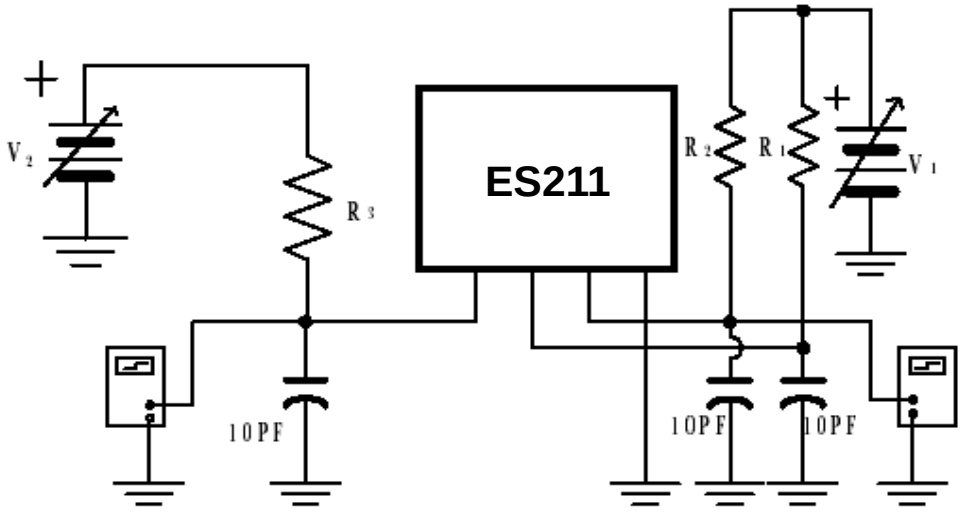


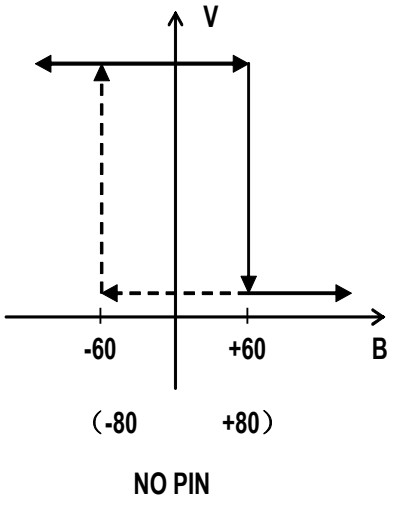
Fig. 3 Test Circuit

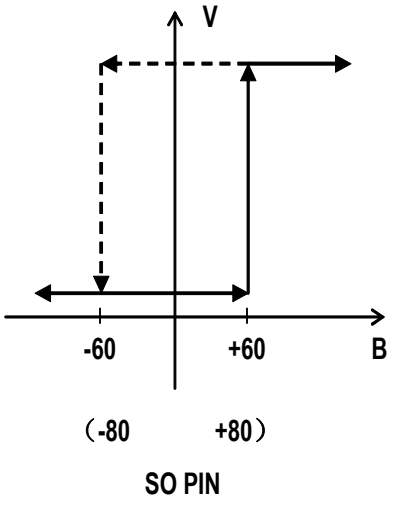
8. Magnetic Specifications

ES211-A		T_A=-40℃~105℃			
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Operating Point	B_{OP}	10		50	Gs
Release Point	B_{RP}	-50		-10	Gs
Hysteresis	B_{HYS}	40	70	100	Gs

ES211-B		T_A=-40℃~105℃			
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Operating Point	B_{OP}			70	Gs
Release Point	B_{RP}	-70			Gs
Hysteresis	B_{HYS}	40	70	100	Gs

ES211-C		T_A=-40℃~105℃			
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Operating Point	B_{OP}			90	Gs
Release Point	B_{RP}	-90			Gs
Hysteresis	B_{HYS}	40	70	100	Gs



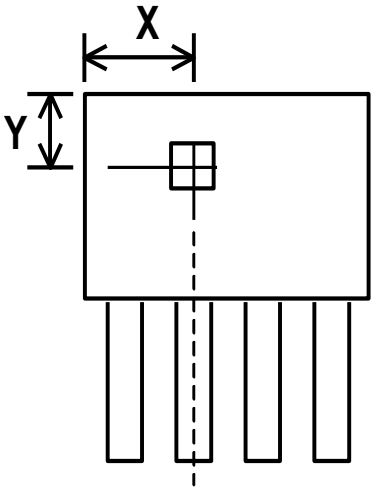


9. Function Descriptions

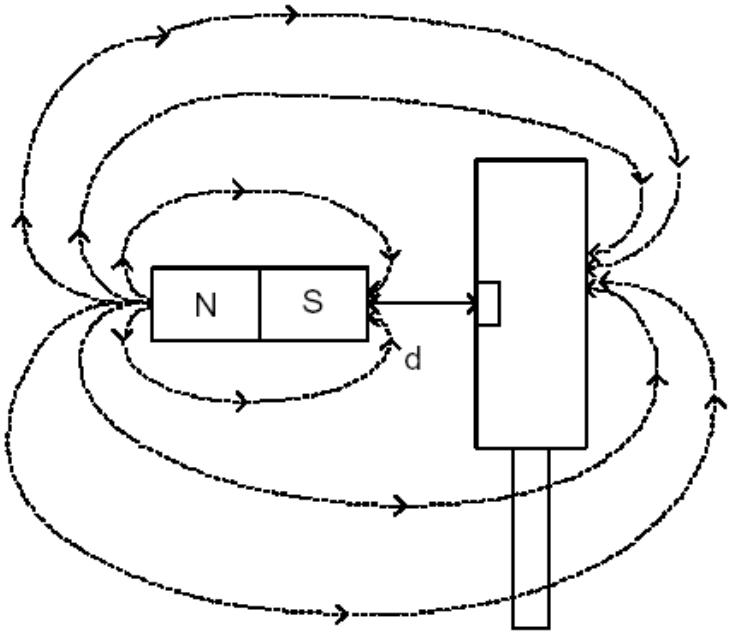
1) Hall Sensor Location

The following figure is the hall sensor location, where marks the IC number. The best sensitivity, which can be intensified as much as possible, depends on the vertical distance and

position between magnetic pole and the hall sensor. For the 2-phase motor, this design is very important.



		unit
X	1.75	mm
Y	1.35	mm



2) Darlington-pair Transistor Output

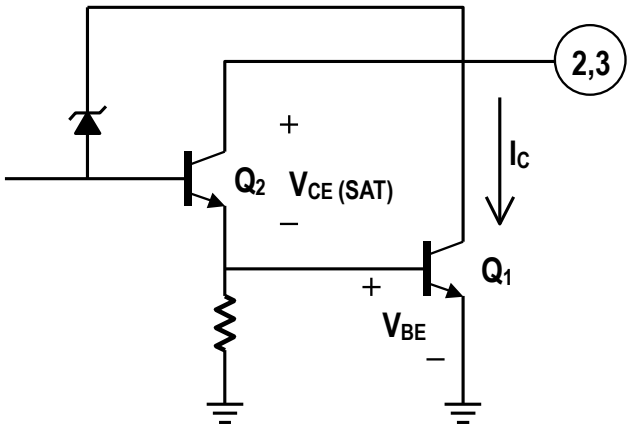
The following figure is the diagram circuit of Darlington-pair transistor. Under the heavy current loading, the power loss of the high saturation voltage can be calculated into the following formula:

$P_C=(V_{BEQ1}+V_{CE}(S_{AT})Q_2)*I_O$

According to the IC package and the curve of the power loss, the P_C should be applied to and

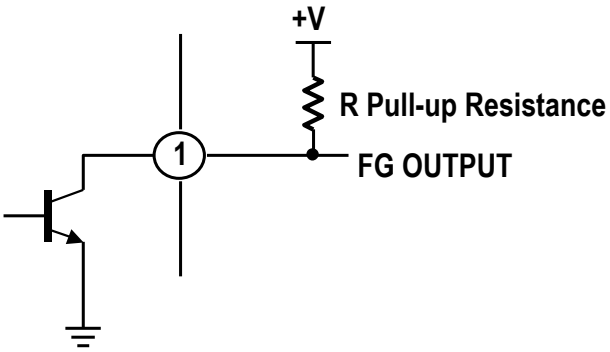
within the safety value.

30V is the voltage of Zener breakdown diode. However, if the voltage, excluding that of the power supply, is more than 30V under the long-time operation, the diode will be destroyed.



3) FG Output: The Circuit Diagram of Open Collector Transistor

In this figure, the small signal transistor output connected with the pull-up resistor is to limit the current and confirm the voltage level of rotation speed. The situation of the long-time operation with the high voltage or with the high current will do damage to the transistor and cause FG malfunction.



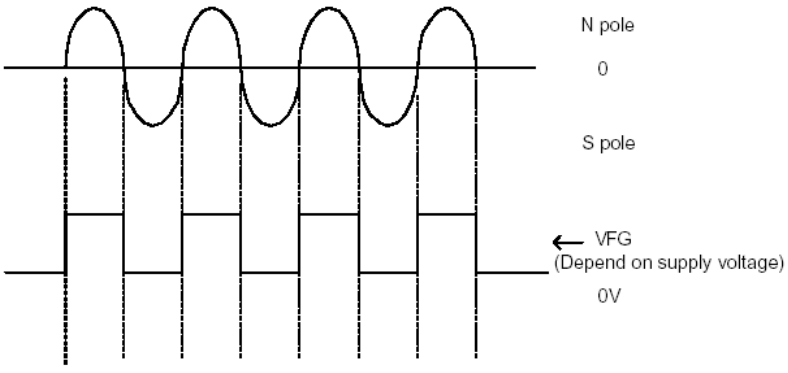


Fig.8 FG Waveform

10. Application Note

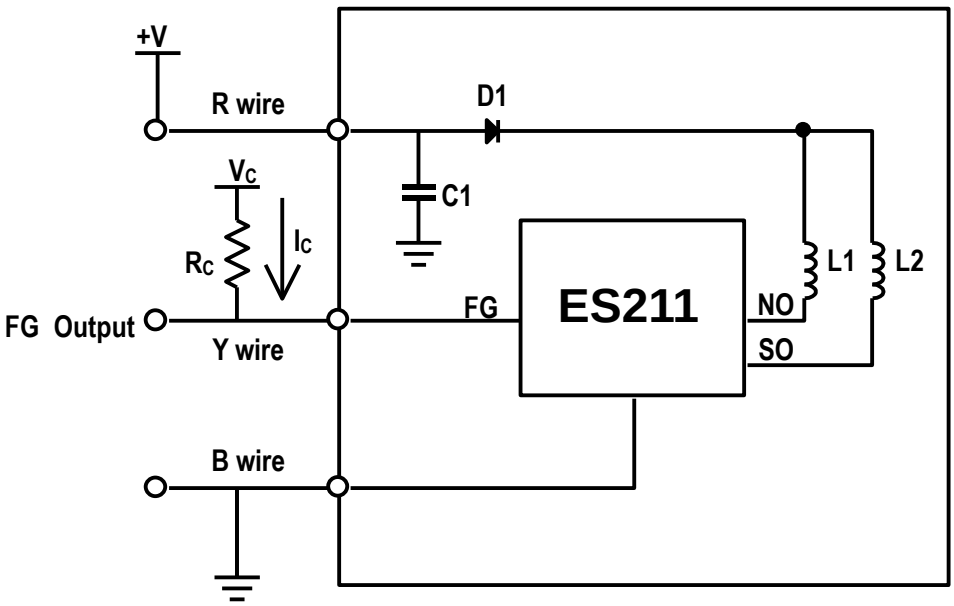
The following figure is the example of typical application circuit. The red, yellow, and black wires are the input points of the motor system: red, the input of power supply; yellow, the output of FG; black, the ground signal. Rc is an external pull-up resistance for the use of measuring FG signal. In view of the design, the value of Rc could be decided by the transistor saturation voltage (Von), sink current (Ic),and off-level voltage (Vc).

The formula is: Rc=(Vc-Von)/Ic

For example：Vc=5V for TTL level, Ic=5mA at 0.5V saturation voltage. The safety value of Rc=1kΩ.

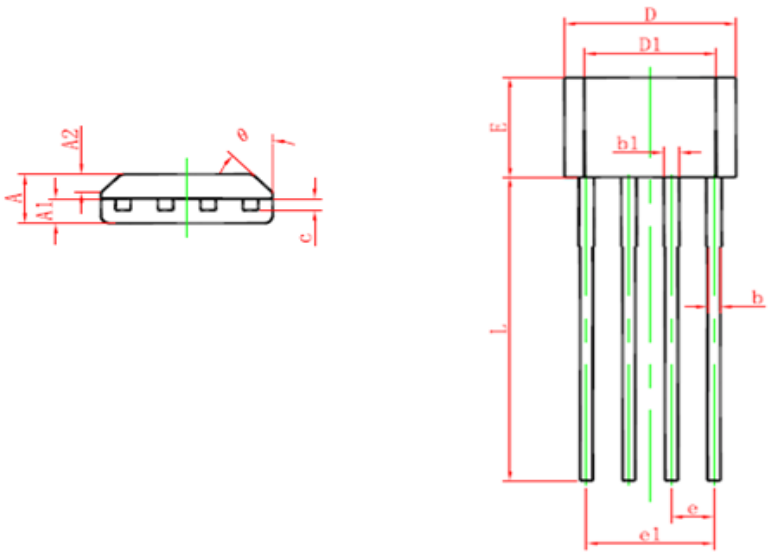
D1 is the reverse protection diode. As if the red and black wires reversely connect with the power source, the current will flow through the ground via IC and coils L1 and L2 to power supply. Under such kind of circumstance, the IC and coils are easy to be burned out. Therefore, D1, the reverse protection diode, is necessary for the design. However, D1 will also cause an extra voltage drop on the supply voltage.

C1 is a capacitor to reduce the ripple noise caused during the transient of the output stages. The volume of the ripple noise depends on the coil impedance and characteristics.



11. Package Information

VK（TO - 94）



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.800	0.055	0.071
A1	0.700	0.900	0.028	0.035
A2	0.500	0.700	0.020	0.028
b	0.360	0.500	0.014	0.020
b1	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.980	5.280	0.196	0.208
D1	3.780	4.080	0.149	0.161
E	3.450	3.750	0.136	0.148
e	1.270 TYP.		0.050 TYP.	
e1	3.710	3.910	0.146	0.154
L	14.900	15.300	0.587	0.602
θ	45° TYP.		45° TYP.	

12. Ordering Information

Part No.	Temperature Suffix	Package Code
ES211	-40℃ ~ 105℃	VK（TO-94）

Contact Information:

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