

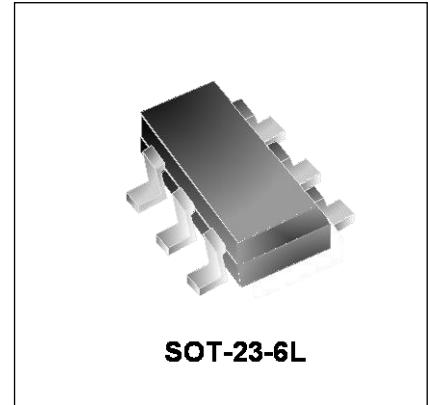


## Features

- Low operating voltage: 5V
- Low capacitance: 3pF
- Solid-state silicon-avalanche and active circuit triggering technology
- ESD protection for high-speed data lines
- Lead-free version available

## IEC Compatibility (EN61000-4)

- IEC 61000-4-2 (ESD)  $\pm 15\text{kV}$  (air),  $\pm 8\text{kV}$  (contact)
- IEC 61000-4-4 (EFT) Level-3, 40A (5/50ns)
- IEC 61000-4-5 (Lightning) 25A (8/20 $\mu\text{s}$ )



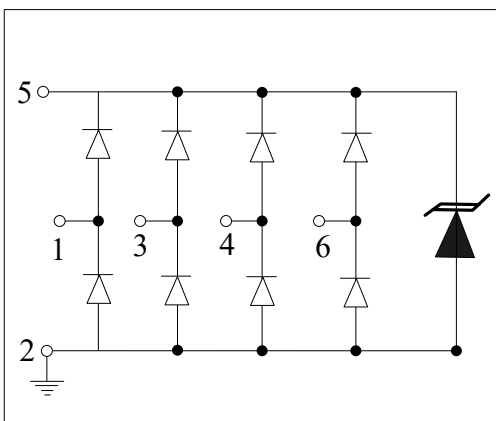
## Mechanical Characteristics

- SOT-23-6L package
- Molding compound flammability rating: UL 94V-0
- Marking: Marking Code
- Packaging: Tape and Reel
- RoHS Compliant

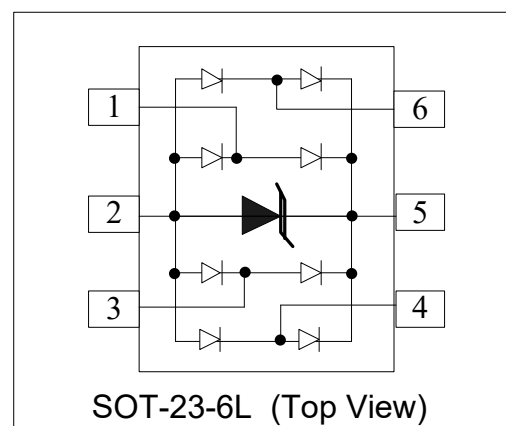
## Applications

- Video/Graphics Card
- Digital Video Interface (DVI)
- USB2.0 Power and Data lines protection
- Notebook and PC Computers
- Monitors and Flat Panel Displays

## Circuit Diagram



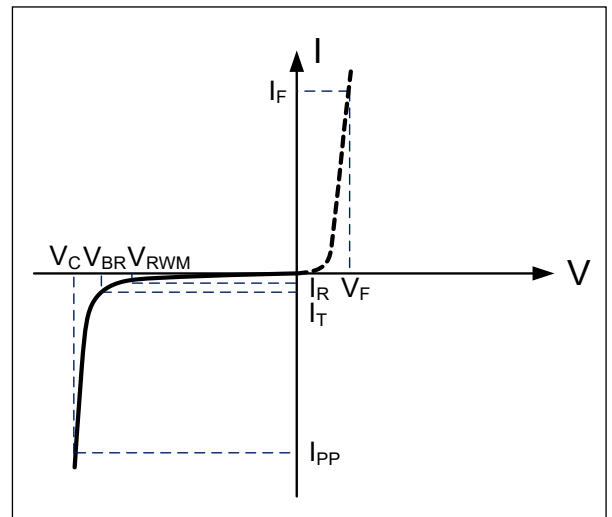
## Schematic & PIN Configuration



Absolute Maximum Rating			
Rating	Symbol	Value	Units
Peak Pulse Power ( $t_p = 8/20\mu s$ )	$P_{PP}$	375	Watts
Peak Pulse Current ( $t_p = 8/20\mu s$ )	$I_{pp}$	25	A
Operating Temperature	$T_J$	-55 to +125	°C
Storage Temperature	$T_{STG}$	-55 to +150	°C

### Electrical Parameters (T=25°C)

Symbol	Parameter
$I_{PP}$	Maximum Reverse Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$
$V_{RWM}$	Working Peak Reverse Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



### Electrical Characteristics

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	$V_{RWM}$	Pin5 to pin2 T=25°C			5.0	V
Reverse Breakdown Voltage	$V_{BR}$	$I_T=1mA$ Pin 5 to pin2	6.0			V
Reverse Leakage Current	$I_R$	$V_{RWM}=5V$ , T=25°C Pin 5 to pin2			0.5	μA
Clamping Voltage	$V_C$	$I_{PP}=1A$ , $t_p=8/20\mu s$ I/O pin to GND			9.7	V
Clamping Voltage	$V_C$	$I_{PP}=10A$ , $t_p=8/20\mu s$ I/O pin to GND			13.5	V
Clamping Voltage	$V_C$	$I_{PP}=25A$ , $t_p=8/20\mu s$ I/O pin to GND			17	V
Junction Capacitance	$C_j$	$V_R = 0V$ , $f = 1MHz$ I/O pin to GND			5	pF
		$V_R = 0V$ , $f = 1MHz$ Between I/O pins		3		pF



### Typical Characteristics

Figure 1: Peak Pulse Power vs. Pulse Time

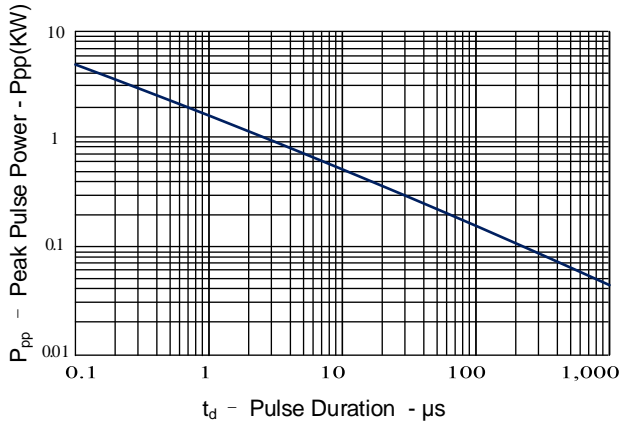


Figure 2: Power Derating Curve

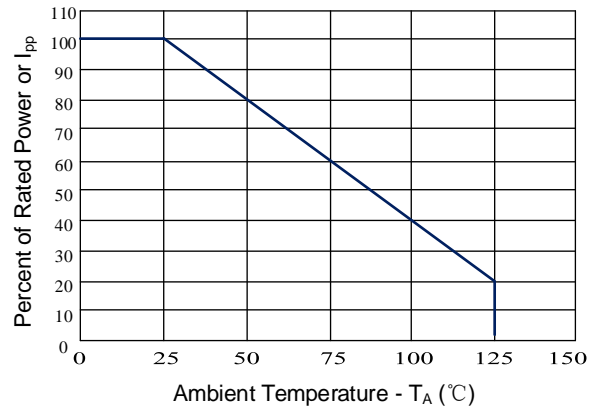


Figure 3: Pulse Waveform

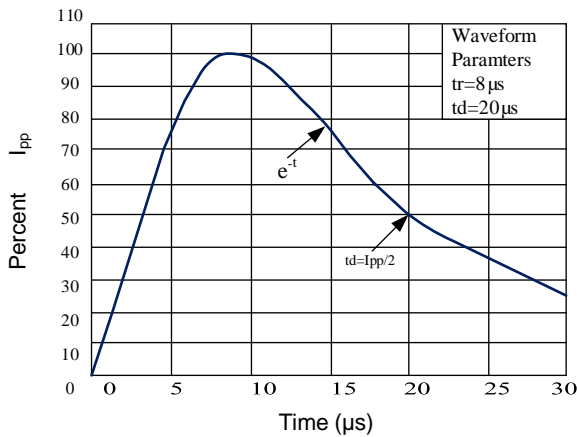


Figure 4: Clamping Voltage vs. Peak Pulse Current

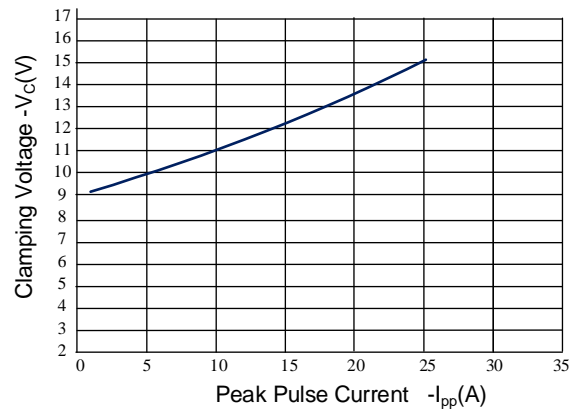


Figure 5: Normalized Capacitance vs. Reverse Voltage

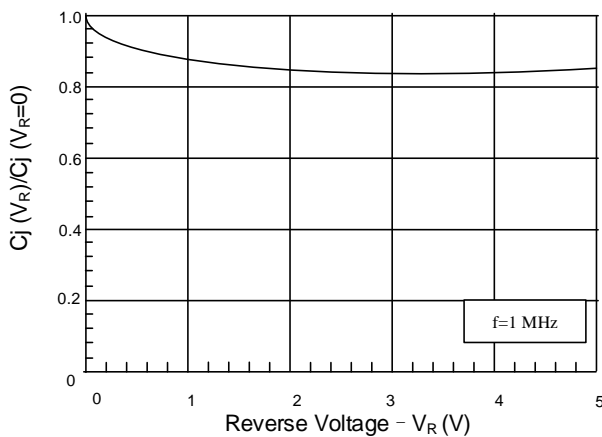
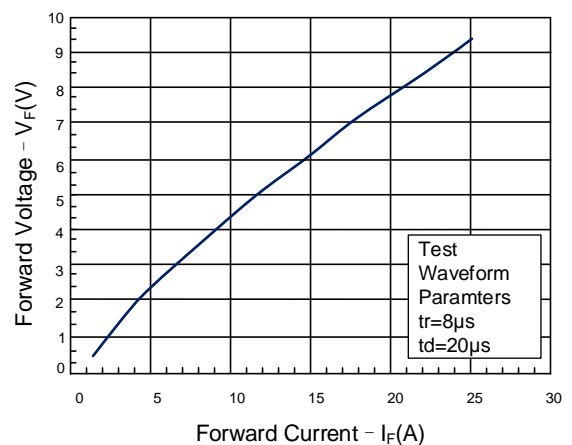


Figure 6: Forward Voltage vs. Forward Current



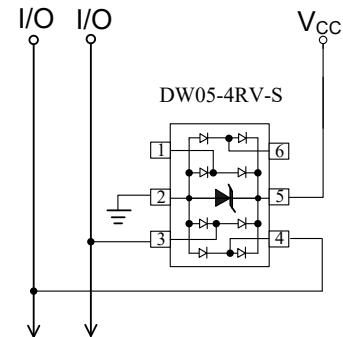
## Application Information

### Device Connection Options for Protection of Four High-Speed Data Lines

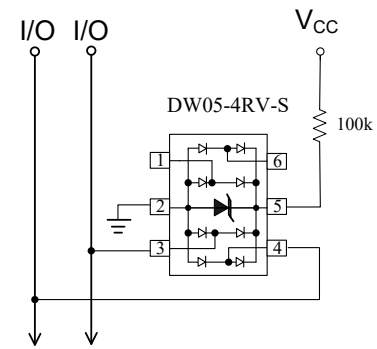
The DW05-4RV-S TVS is designed to protect four data lines from transient over-voltages by clamping them to a fixed reference. When the voltage on the protected line exceeds the reference voltage (plus diode  $V_F$ ) the steering diodes are forward biased, conducting the transient current away from the sensitive circuitry. Data lines are connected at pins 1, 3, 4 and 6. The negative reference (REF1) is connected at pin 2. This pin should be connected directly to a ground plane on the board for best results. The path length is kept as short as possible to minimize parasitic inductance. The positive reference (REF2) is connected at pin 5. The options for connecting the positive reference are as follows:

1. To protect data lines and the power line, connect pin 4 directly to the positive supply rail ( $V_{CC}$ ). In this configuration the data lines are referenced to the supply voltage. The internal TVS diode prevents over-voltage to the supply rail.
2. The DW05-4RV-S can be isolated from the power supply by adding a series resistor between pin 4 and  $V_{CC}$ . A value of  $10k\Omega$  is recommended. The internal TVS and steering diodes remains biased, providing the advantage of lower capacitance.
3. In applications where no positive supply reference is available, or complete supply isolation is desired, the internal TVS may be used as the reference. In this case, pin 4 is not connected. The steering diodes will begin to conduct when the voltage on the protected line exceeds the working voltage of the TVS (plus one diode drop).

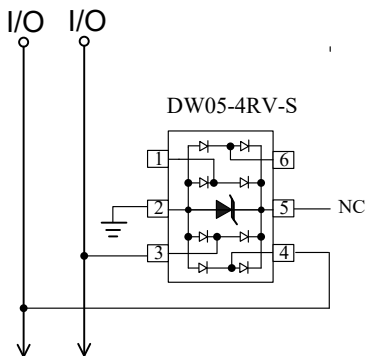
Data Line and Power Supply Protection Using  $V_{CC}$  as reference



Data Line Protection with Bias and Power Supply Isolation Resistor



Data Line Protection Using Internal TVS Diode as Reference





## Typical Applications

### Universal Serial Bus ESD Protection

The DW05-4RV-S may also be used to protect the USB ports on monitors, computers, peripherals or portable systems. Each device will protect up to two USB ports (Figure 1). When the voltage on the data lines exceed the bus voltage (plus one diode drop), the internal rectifiers are forward biased conducting the transient current away from the protected controller chip. The TVS diode directs the surge to ground. The TVS diode also acts to suppress ESD strikes directly on the voltage bus. Thus, both power and data pins are protected with a single device.

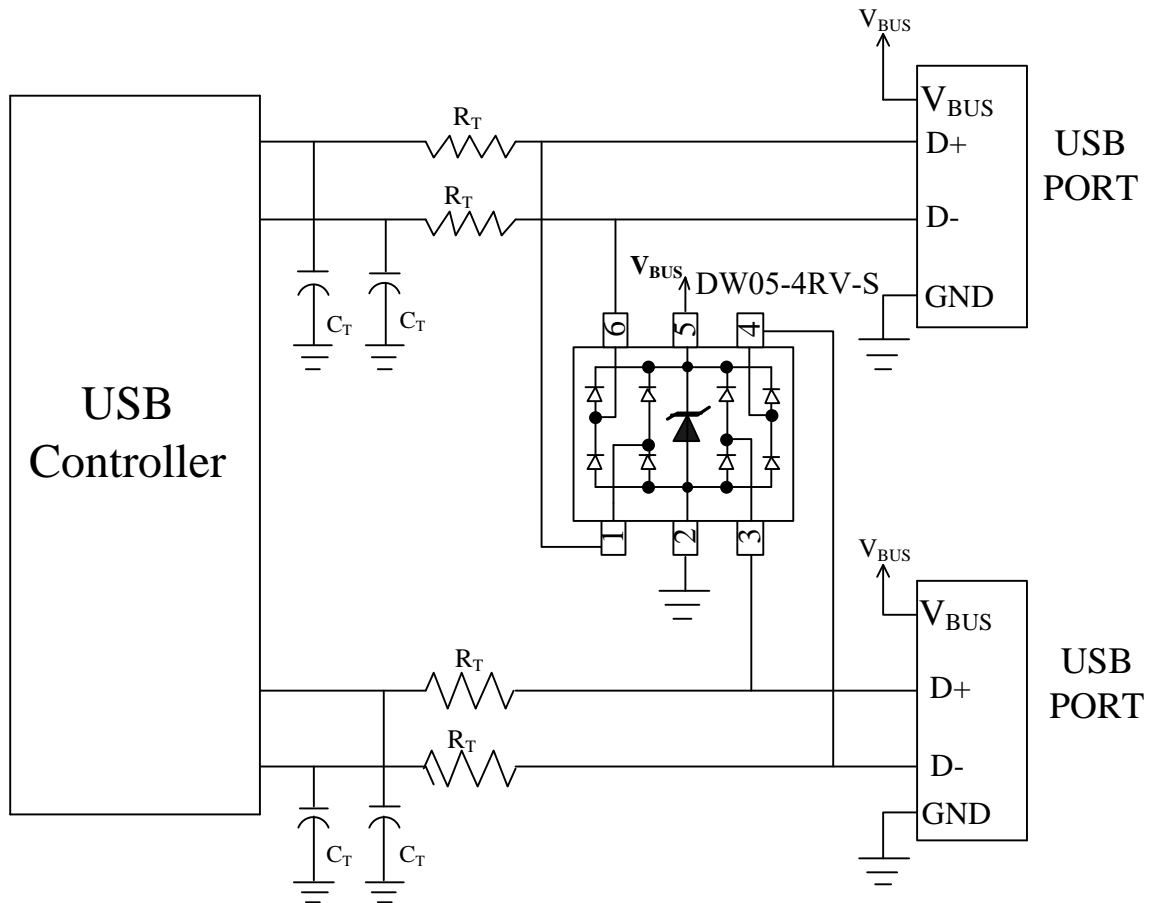


Figure 1 Dual USB Port Protection

## 10/100 ETHERNET PROTECTION

Ethernet ICs are vulnerable to damage from electrostatic discharge (ESD). The internal protection in the PHY chip, if any, often is not enough due to the high energy of the discharges specified by IEC 61000-4-2. If the discharge is catastrophic, it will destroy the protected IC. If it is less severe, it will cause latent failures that are very difficult to find.

10/100 Ethernet operates at 125MHz clock over a twisted pair interface. In a typical system, the twisted pair interface for each port consists of two differential signal pairs: one for the transmitter and one for the receiver, with the transmitter input being the most sensitive to damage. The fatal discharge occurs differentially across the transmit or receive line pair and is capacitively coupled through the transformer to the Ethernet chip. Figure 3 shows how to design the DW05-4RV-S on the IC side of the 10/100 Ethernet circuit to provide differential and common mode protection. The DW05-4RV-S can not be grounded on the line side because the hi-pot test requires the line side not to be grounded.

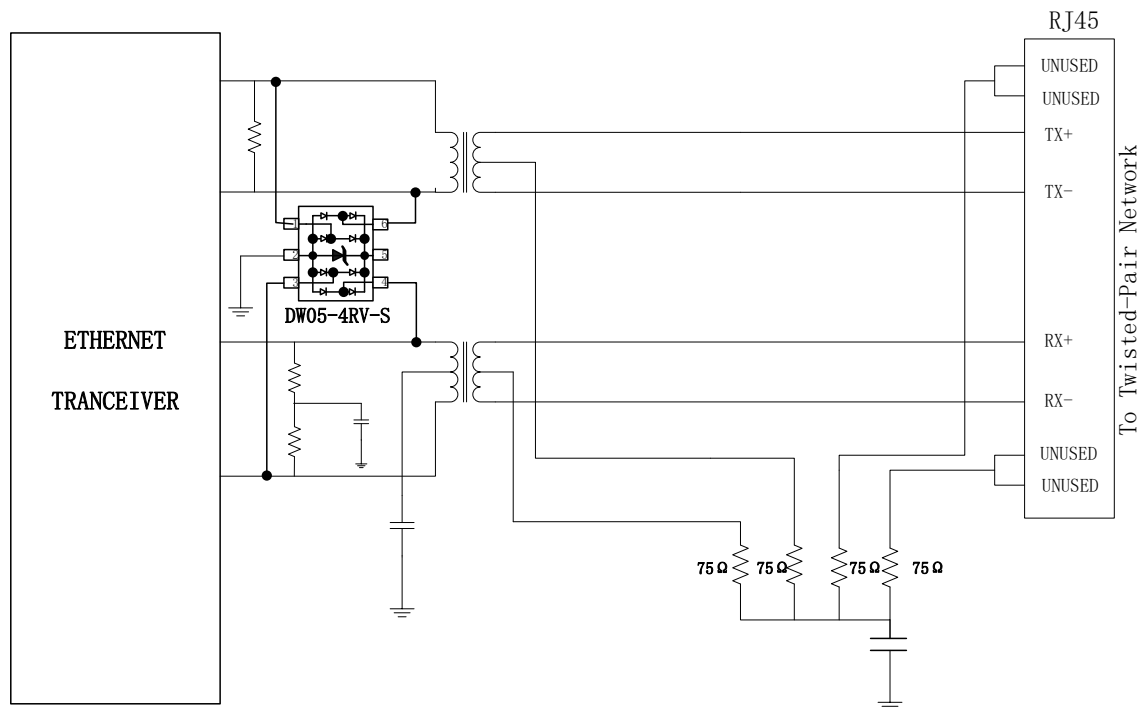
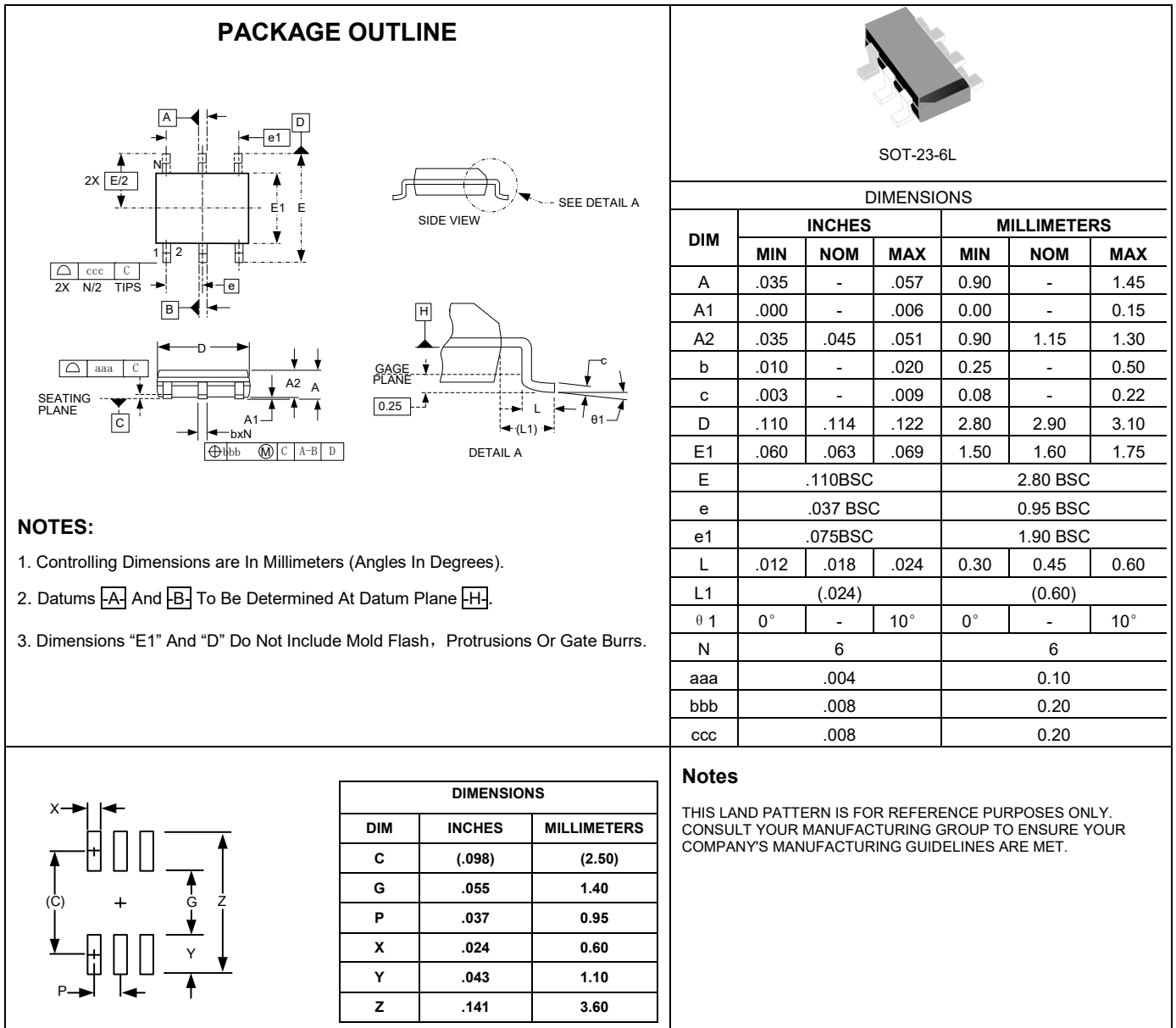


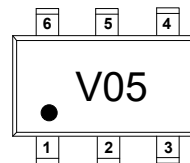
Figure 2 10/100 Ethernet Differential and Common Mode Protection

## Outline Drawing – SOT-23-6L



## Marking Codes

Part Number	DW05-4RV-S
Marking Code	V05



## Package Information

Qty: 3k/Reel