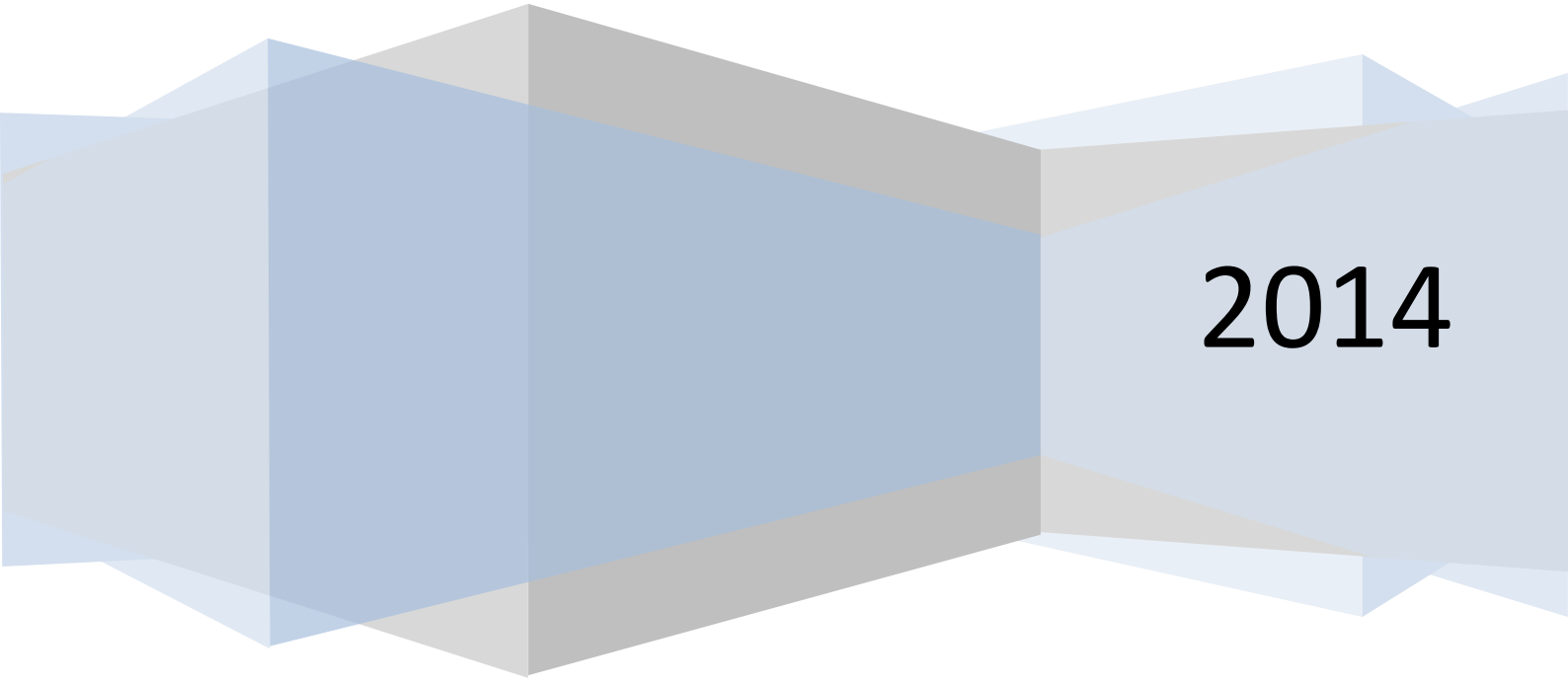
ANEXO 2

ESPECIFICACIONES DE COMPONENTES



2014

INDICE

Características técnicas del ARDUINO UNO

Arduino es una placa con un microcontrolador de la marca Atmel y con toda la circuitería de soporte, que incluye, reguladores de tensión, un puerto USB (En los últimos modelos, aunque el original utilizaba un puerto serie) conectado a un módulo adaptador USB-Serie que permite programar el microcontrolador desde cualquier PC de manera cómoda y también hacer pruebas de comunicación con el propio chip.

Un arduino dispone de 14 pines que pueden configurarse como entrada o salida y a los que puede conectarse cualquier dispositivo que sea capaz de transmitir o recibir señales digitales de 0 y 5 V.

También dispone de entradas y salidas analógicas. Mediante las entradas analógicas podemos obtener datos de sensores en forma de variaciones continuas de un voltaje. Las salidas analógicas suelen utilizarse para enviar señales de control en forma de señales PWM.

Arduino UNO es la última versión de la placa, existen dos variantes, la Arduino UNO convencional y la Arduino UNO SMD. La única diferencia entre ambas es el tipo de microcontrolador que montan.

- La primera es un microcontrolador Atmega en formato DIP.
- Y la segunda dispone de un microcontrolador en formato SMD.

Nosotros nos decantaremos por la primera porque nos permite programar el chip sobre la propia placa y después integrarlo en otros montajes.

Arduino UNO con microcontrolador en formato DIP

Arduino UNO con microcontrolador en formato SMD

Entradas y salidas:

Cada uno de los 14 pines digitales se puede usar como entrada o como salida. Funcionan a 5V, cada pin puede suministrar hasta 40 mA. La intensidad máxima de entrada también es de 40 mA.

Cada uno de los pines digitales dispone de una resistencia de pull-up interna de entre 20KΩ y 50 KΩ que está desconectada, salvo que nosotros indiquemos lo contrario.

Arduino también dispone de 6 pines de entrada analógicos que trasladan las señales a un conversor analógico/digital de 10 bits.

Pines especiales de entrada y salida:

- RX y TX: Se usan para transmisiones serie de señales TTL.
- Interrupciones externas: Los pines 2 y 3 están configurados para generar una interrupción en el atmega. Las interrupciones pueden dispararse cuando se encuentra un valor bajo en estas entradas y con flancos de subida o bajada de la entrada.
- PWM: Arduino dispone de 6 salidas destinadas a la generación de señales PWM de hasta 8 bits.
- SPI: Los pines 10, 11, 12 y 13 pueden utilizarse para llevar a cabo comunicaciones SPI, que permiten trasladar información full dúplex en un entorno Maestro/Esclavo.
- I^2C: Permite establecer comunicaciones a través de un bus I^2C. El bus I^2C es un producto de Phillips para interconexión de sistemas embebidos. Actualmente se puede encontrar una gran diversidad de dispositivos que utilizan esta interfaz, desde pantallas LCD, memorias EEPROM, sensores...

Alimentación de un Arduino

Puede alimentarse directamente a través del propio cable USB o mediante una fuente de alimentación externa, como puede ser un pequeño transformador o, por ejemplo una pila de 9V. Los límites están entre los 6 y los 12 V. Como única restricción hay que saber que si la placa se alimenta con menos de 7V, la salida del regulador de tensión a 5V puede dar menos que este voltaje y si sobrepasamos los 12V, probablemente dañaremos la placa.

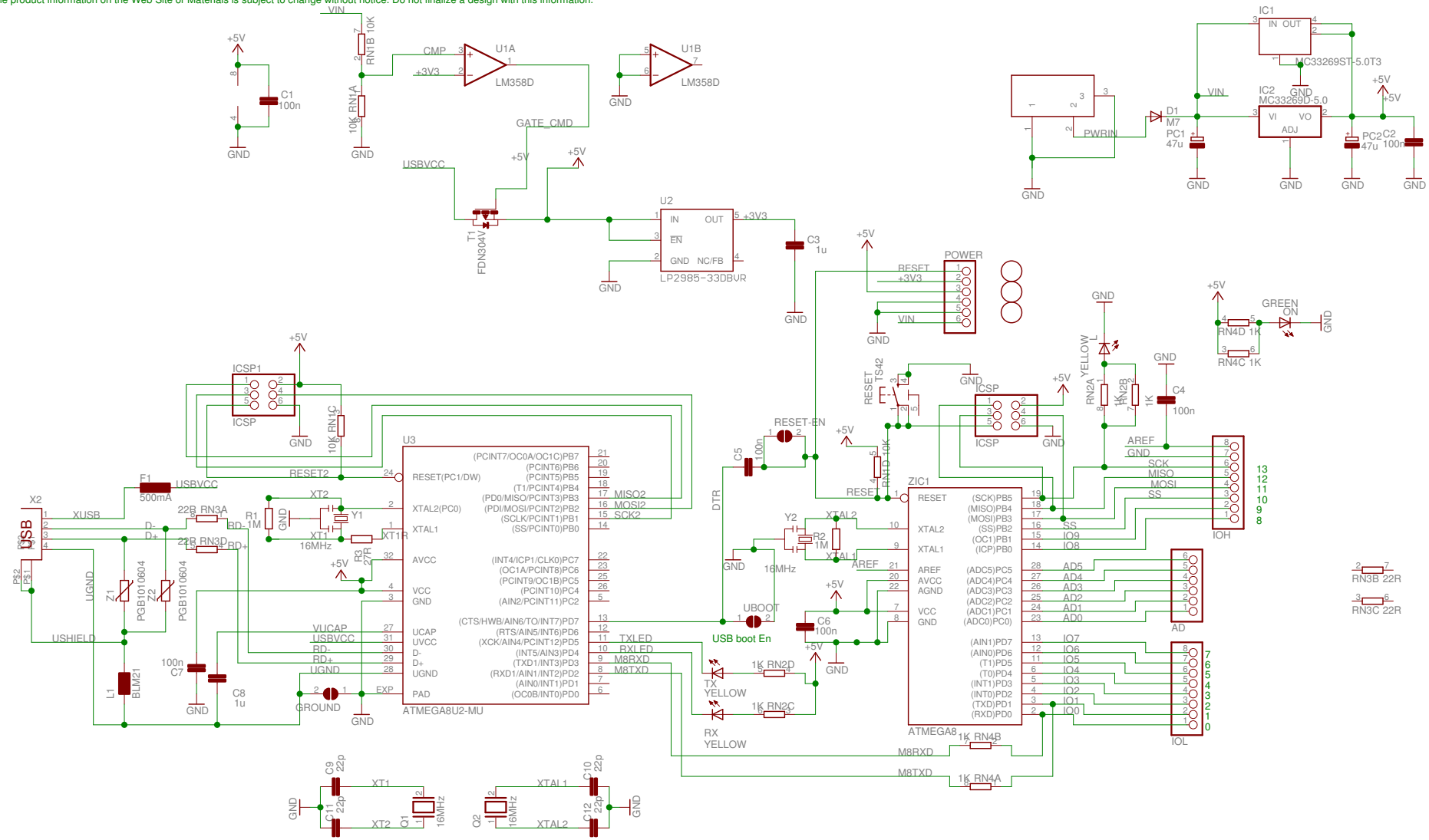
La alimentación puede conectarse mediante un conector de 2,1mm con el positivo en el centro o directamente a los pines Vin y GND marcados sobre la placa.

Hay que tener en cuenta que podemos medir el voltaje presente en el jack directamente desde Vin. En el caso de que el Arduino esté siendo alimentado mediante el cable USB, ese voltaje no podrá monitorizarse desde aquí.

Resumen de características Técnicas

Microcontrolador	Atmega328
Voltaje de operación	5V
Voltaje de entrada (Recomendado)	7 – 12V
Voltaje de entrada (Límite)	6 – 20V
Pines para entrada- salida digital.	14 (6 pueden usarse como salida de PWM)
Pines de entrada analógica.	6
Corriente continua por pin IO	40 mA
Corriente continua en el pin 3.3V	50 mA
Memoria Flash	32 KB (0,5 KB ocupados por el bootloader)
SRAM	2 KB
EEPROM	1 KB
Frecuencia de reloj	16 MHz

Arduino™ UNO Reference Design



TRU-TEST WB MILK METERS

ACCURACY STARTS HERE

TRU-TEST®

Milk Meters

A World of Solutions

TRU-TEST MILK METERS
HAVE BEEN SETTING THE STANDARD
FOR OVER 45 YEARS.

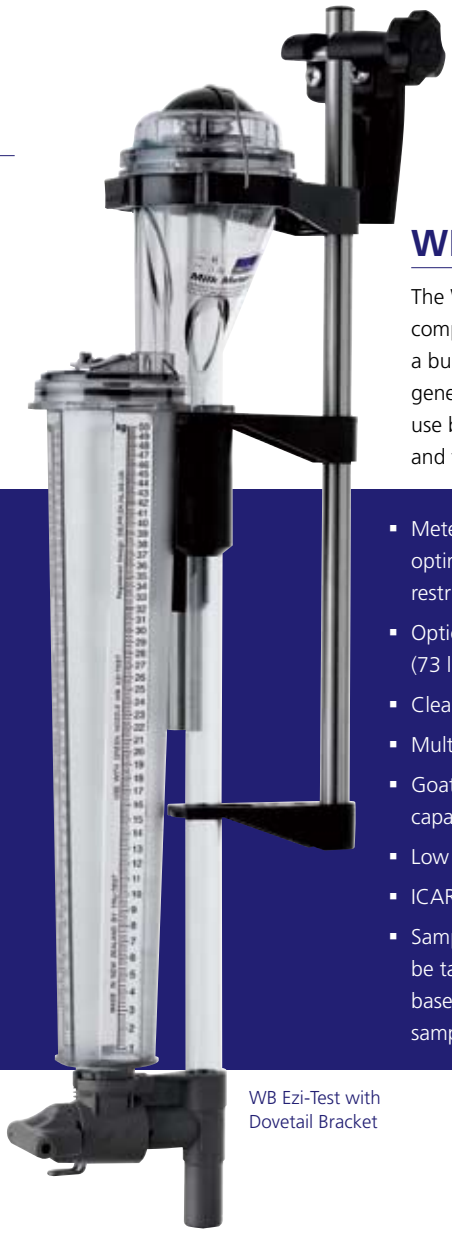
WB HI / Pull-Out with Hanger Bracket

WB HI / Pull-Out

The removable two flask system on the WB HI Milk Meter lets the farmer continue milking without any interruptions, as milk yield recording and sampling can be done while the next cow is being milked.

The WB HI is ideal for stanchion or tie stall barns but can be used in all parlour types.

- Meter body inlet and outlet area optimised to reduce vacuum restriction
- 50 kg (110 lb) or 33 kg (73 lb) large capacity flasks
- Scalloped flasks to maximize print life
- Flask foot allows for rapid removal by operator and will stand on a flat surface
- Goat version of Meter available, capacity 10 kg (22 lb)
- Low maintenance
- ICAR approved
- Two flasks for fast milk sampling and measurement.



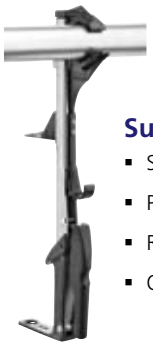
WB Ezi-Test with Dovetail Bracket

WB Ezi-Test

The WB Ezi-Test Milk Meter is a compact, clean in place Meter with a built in sampling valve. This is a general purpose Meter, suitable for use by herd recording technicians and farmers.

- Meter body inlet and outlet area optimised to reduce vacuum restriction
- Option of 50 kg (110 lb) or 33 kg (73 lb) large capacity flask
- Cleans in place during wash cycle
- Multiple bracket options
- Goat version of Meter available, capacity 10 kg (22 lb)
- Low maintenance
- ICAR approved
- Samples for individual animals can be taken easily via the valve at the base of the flask. Stir first and then sample.

ACCESSORIES

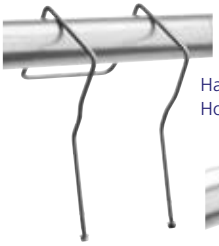


Super-Clamp Bracket

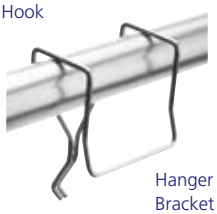
- Stainless steel
- Portable
- Rigid fixing
- One-handed operation

Dovetail Bracket

- Rigid mounting
- Parlour use
- Fit and forget
- Unique retention clip



Hanger Hook



Hanger Bracket

Hanger Hook / Hanger Bracket

- Stainless steel
- Two sizes
- Portable

WB Auto Sampler with
Super-Clamp Bracket

WB Auto Sampler

The WB Auto Sampler Milk Meter is designed for use with a patented automatic empty / sampling feature which means no time consuming stirring is required for sample taking.

This Milk Meter is ideal for larger parlour installations where time is critical or in applications where farmers take their own samples.

- Meter body inlet and outlet area optimised to reduce vacuum restriction
- Option of 50 kg (110 lb) or 33 kg (73 lb) large capacity flask
- Cleans in place during wash cycle
- Multiple bracket options
- No stirring or mixing of samples required, improves sample taking consistency
- Standard vial can be fitted to sampler
- Low maintenance
- ICAR approved
- Automated sampling and emptying for fast milking parlours.

WB Mini-Test with
Dovetail Bracket

WB Mini-Test

The WB Mini-Test Meter is designed for farmers to use when spot-checking animals and for prediction of feed requirements.

- Meter body inlet and outlet area optimised to reduce vacuum restriction
- Flask capacity 31 kg (68 lb)
- Cleans in place during wash cycle
- Low maintenance
- Suitable for goats, capacity 5.5 kg (12 lb)
- Samples for individual animals can be taken via the valve.

ICAR Approved

TRU-TEST®

Milk Meters

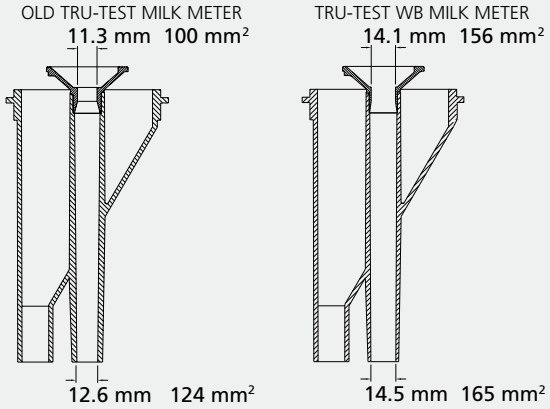
A World of Solutions

DON'T APPLY THE BRAKES... ON HERD TEST DAY

Better for higher milk flow rates

Tru-Test WB Milk Meters have 33% greater inlet and outlet area when compared to older Meter models.

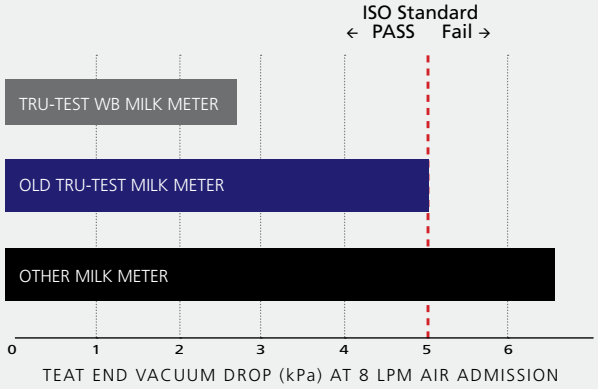
- Faster milking times
- Fewer delays on herd test day
- Less stress on cows and employees.



Better for low vacuum systems

Tru-Test WB Milk Meters easily pass ISO 5707.

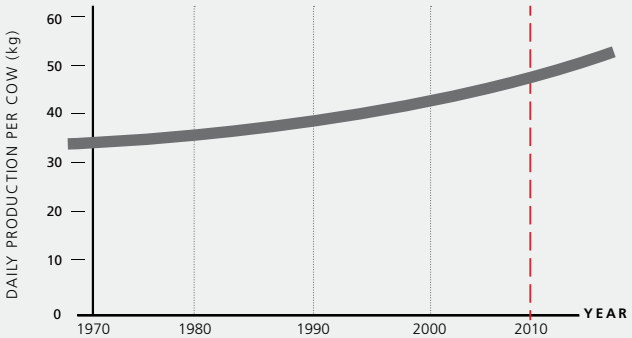
- Reduced need to increase vacuum on herd test day
- Reduced risk of mastitis from fluctuating or high vacuum.



Better for high milk yields

Tru-Test WB Milk Meters are made with high capacity flasks up to 50 kg (110 lb).

- Capacity to deal with very high yielding cows now and in the future.



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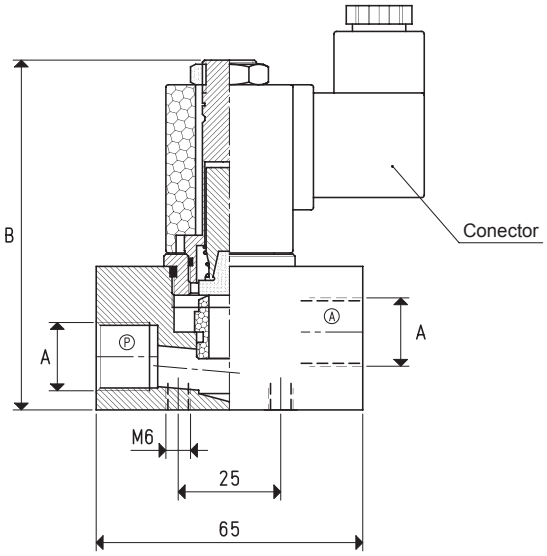
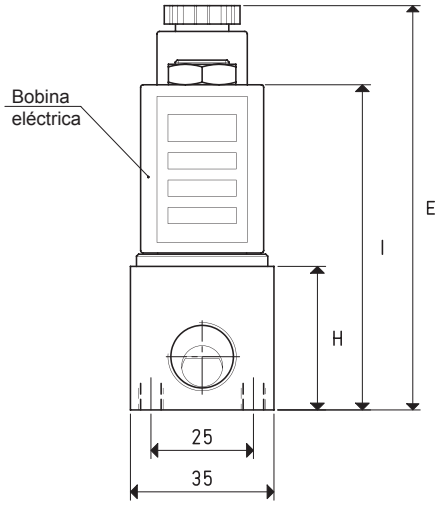
TRU-TEST GROUP

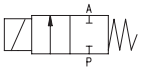
810634 03 1004

ELECTROPILOTOS DE VACÍO DE 2 VÍAS





2 / 2 NC

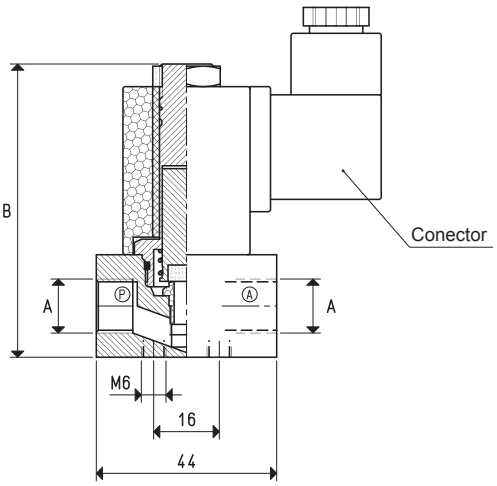


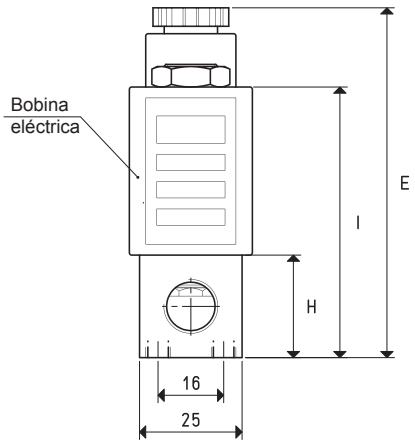
ELECTROPILOTOS DE 2 VÍAS

Art.	A	Caudal máx	Grado de vacío		Tiempos de reacción		Ø	Sección de paso	B	E	H	I	Peso
			mbar abs		mseg								
	Ø	m^3/h	mín	máx	energ.	desenerg.	orificio	mm^2					g
07 02 20	G3/8"	8	1000	0.5	22	10	10	78.5	85	98	35	79	384
07 03 20	G1/2"	10	1000	0.5	28	10	12	113.0	85	98	35	79	372

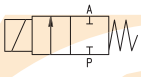
Nota: la bobina y el conector no forman parte del electropiloto, por lo tanto se adquieren por separado (Ver accesorios para electroválvulas).

Factores de conversión: inch = $\frac{mm}{25.4}$; pounds = $\frac{g}{453.6} = \frac{Kg}{0.4536}$





2 / 2 NC



P = Bomba
A = Aplicación

ELECTROPILOTOS DE 2 VÍAS

Art.	A	Caudal máx	Grado de vacío		Tiempos de reacción		Ø	Sección de paso	B	E	H	I	Peso
			mbar abs		mseg								
	Ø	m^3/h	mín	máx	energ.	desenerg.	orificio	mm^2					g
07 01 20	G1/4"	4	1000	0.5	15	8	6	28.3	73	86	25	67	244

Nota: la bobina y el conector no forman parte del electropiloto, por lo tanto se adquieren por separado (Ver accesorios para electroválvulas).

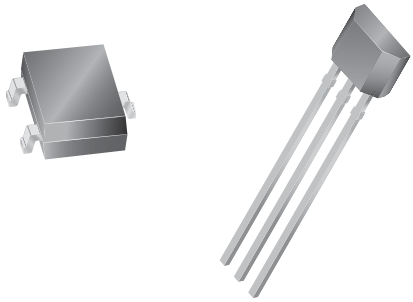
Factores de conversión: inch = $\frac{mm}{25.4}$; pounds = $\frac{g}{453.6} = \frac{Kg}{0.4536}$

Continuous-Time Ratiometric Linear Hall Effect Sensor ICs

Features and Benefits

- Low-noise output
- Fast power-on time
- Ratiometric rail-to-rail output
- 4.5 to 6.0 V operation
- Solid-state reliability
- Factory-programmed at end-of-line for optimum performance
- Robust ESD performance

Packages: 3 pin SOT23W (suffix LH), and 3 pin SIP (suffix UA)



Not to scale

Description

The A1301 and A1302 are continuous-time, ratiometric, linear Hall-effect sensor ICs. They are optimized to accurately provide a voltage output that is proportional to an applied magnetic field. These devices have a quiescent output voltage that is 50% of the supply voltage. Two output sensitivity options are provided: 2.5 mV/G typical for the A1301, and 1.3 mV/G typical for the A1302.

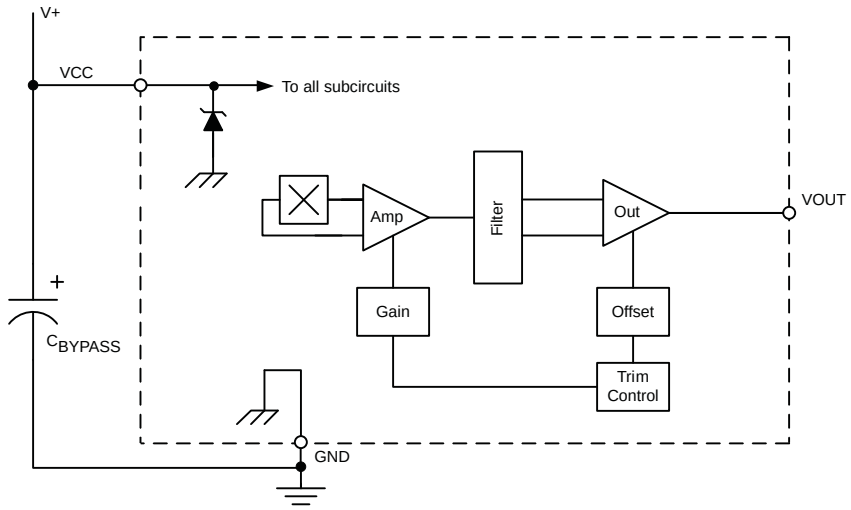
The Hall-effect integrated circuit included in each device includes a Hall circuit, a linear amplifier, and a CMOS Class A output structure. Integrating the Hall circuit and the amplifier on a single chip minimizes many of the problems normally associated with low voltage level analog signals.

High precision in output levels is obtained by internal gain and offset trim adjustments made at end-of-line during the manufacturing process.

These features make the A1301 and A1302 ideal for use in position sensing systems, for both linear target motion and rotational target motion. They are well-suited for industrial applications over extended temperature ranges, from –40°C to 125°C.

Two device package types are available: LH, a 3-pin SOT23W type for surface mount, and UA, a 3-pin ultramini SIP for through-hole mount. They are lead (Pb) free (suffix, –*T*) with 100% matte tin plated leadframes.

Functional Block Diagram



Selection Guide				
Part Number	Packing[1]	Package	Ambient, T_A	Sensitivity (Typical)
~~A1301ELHLT-T~~[2]	7-in. tape and reel, 3000 pieces/reel	Surface Mount	–40ºC to 85ºC	2.5 mV/G
A1301EUA-T	Bulk, 500 pieces/bag	SIP		
A1301KLHLT-T	7-in. tape and reel, 3000 pieces/reel	Surface Mount	–40ºC to 125ºC	
A1301KUA-T	Bulk, 500 pieces/bag	SIP		
A1302ELHLT-T	7-in. tape and reel, 3000 pieces/reel	Surface Mount	–40ºC to 85ºC	1.3 mV/G
~~A1302EUA-T~~[3]	Bulk, 500 pieces/bag	SIP		
A1302KLHLT-T	7-in. tape and reel, 3000 pieces/reel	Surface Mount	–40ºC to 125ºC	
A1302KUA-T	Bulk, 500 pieces/bag	SIP		

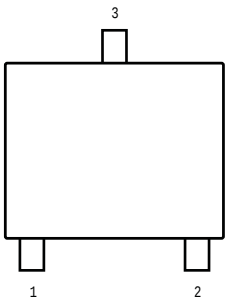
[1]Contact Allegro for additional packing options.
[2]Variant is in production but has been determined to be LAST TIME BUY. This classification indicates that the variant is obsolete and notice has been given. Sale of the variant is currently restricted to existing customer applications. The variant should not be purchased for new design applications because of obsolescence in the near future. Samples are no longer available. Status date change May 4, 2009. Deadline for receipt of LAST TIME BUY orders is November 4, 2009.
[3]Variant is in production but has been determined to be NOT FOR NEW DESIGN. This classification indicates that sale of the variant is currently restricted to existing customer applications. The variant should not be purchased for new design applications because obsolescence in the near future is probable. Samples are no longer available. Status change: May 4, 2009.

Absolute Maximum Ratings

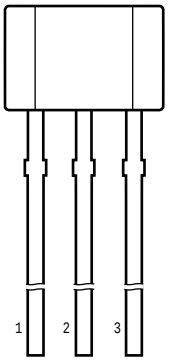
Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	V_{CC}		8	V
Output Voltage	V_{OUT}		8	V
Reverse Supply Voltage	V_{RCC}		–0.1	V
Reverse Supply Voltage	V_{RCC}		–0.1	V
Output Sink Current	I_{OUT}		10	mA
Operating Ambient Temperature	T_A	Range E	–40 to 85	ºC
		Range K	–40 to 125	ºC
Maximum Junction Temperature	T_J(max)		165	ºC
Storage Temperature	T_{stg}		–65 to 170	ºC

Pin-out Drawings

Package LH



Package UA



Terminal List

Symbol	Number		Description
	Package LH	Package UA	
VCC	1	1	Connects power supply to chip
VOUT	2	3	Output from circuit
GND	3	2	Ground

DEVICE CHARACTERISTICS over operating temperature range, T_A, and V_{CC} = 5 V, unless otherwise noted

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Electrical Characteristics						
Supply Voltage	V_{CC}	Running, T_J < 165°C	4.5	–	6	V
Supply Current	I_{CC}	Output open	–	–	11	mA
Output Voltage	$V_{OUT(High)}$	I_{SOURCE} = –1 mA, Sens = nominal	4.65	4.7	–	V
	$V_{OUT(Low)}$	I_{SINK} = 1 mA, Sens = nominal	–	0.2	0.25	V
Output Bandwidth	BW		–	20	–	kHz
Power-On Time	t_{PO}	$V_{CC(min)}$ to 0.95 $V_{OUT;}$ B = ±1400 G; Slew rate = 4.5 V/µs to 4.5 V/100 ns	–	3	5	µs
Output Resistance	R_{OUT}	I_{SINK} ≤ 1 mA, I_{SOURCE} ≥ –1 mA	–	2	5	Ω
Wide Band Output Noise, rms	V_{OUTN}	External output low pass filter ≤ 10 kHz; Sens = nominal	–	150	–	µV
Ratiometry						
Quiescent Output Voltage Error with respect to ΔV_{CC}[1]	$\Delta V_{OUTQ(V)}$	T_A = 25°C	–	–	±3.0	%
Magnetic Sensitivity Error with respect to ΔV_{CC}[2]	$\Delta Sens_{(V)}$	T_A = 25°C	–	–	±3.0	%
Output						
Linearity	Lin	T_A = 25°C	–	–	±2.5	%
Symmetry	Sym	T_A = 25°C	–	–	±3.0	%
Magnetic Characteristics						
Quiescent Output Voltage	V_{OUTQ}	B = 0 G; T_A = 25°C	2.4	2.5	2.6	V
Quiescent Output Voltage over Operating Temperature Range	$V_{OUTQ(\Delta T_A)}$	B = 0 G	2.2	–	2.8	V
Magnetic Sensitivity	Sens	A1301; T_A = 25°C	2.0	2.5	3.0	mV/G
		A1302; T_A = 25°C	1.0	1.3	1.6	mV/G
Magnetic Sensitivity over Operating Temperature Range	$Sens_{(\Delta T_A)}$	A1301	1.8	–	3.2	mV/G
		A1302	0.85	–	1.75	mV/G

[1]Refer to equation (4) in Ratiometric section on page 4.
[2]Refer to equation (5) in Ratiometric section on page 4.

$$= \frac{\qquad\qquad\qquad\qquad}{\qquad\qquad\qquad\qquad} \tag{1}$$

$$Sens = \frac{V_{OUT(-B)} - V_{OUT(+B)}}{2B} \tag{2}$$

$$\Delta Sens_{(\Delta T_A)} = \frac{Sens_{(T_A)} - Sens_{(25^oC)}}{Sens_{(25^oC)}} \times 100\% \tag{3}$$

$$\Delta V_{OUTQ(\Delta V)} = \frac{V_{OUTQ(V_{CC})} \,/\, V_{OUTQ(5V)}}{V_{CC} \,/\, 5\ V} \times 100\% \tag{4}$$

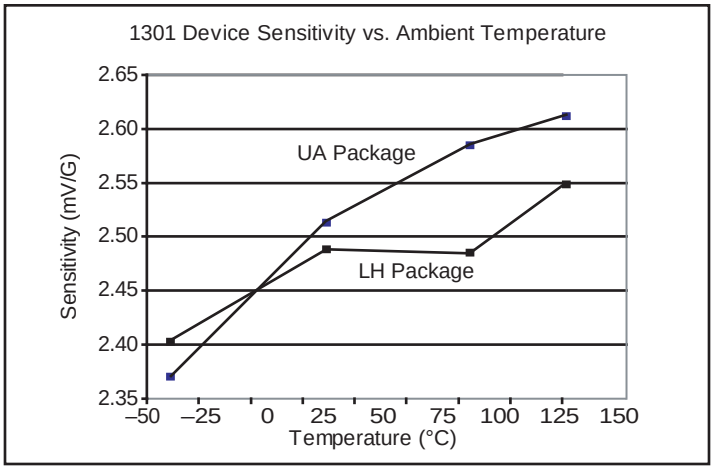
$$\Delta Sens_{(\Delta V)} = \frac{Sens_{(V_{CC})} \,/\, Sens_{(5V)}}{V_{CC} \,/\, 5\ V} \times 100\% \tag{5}$$

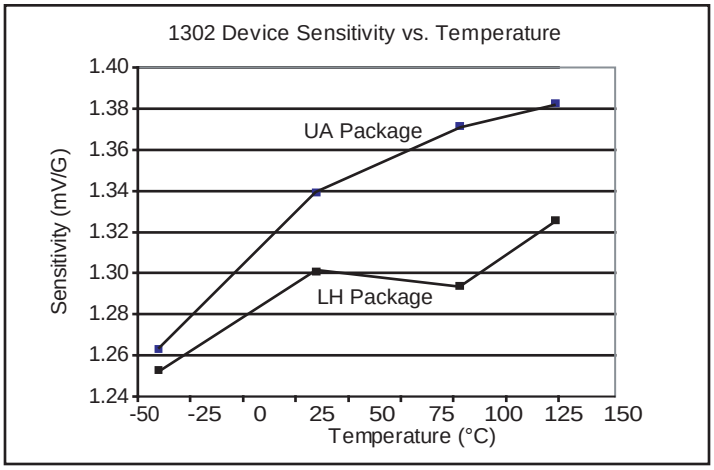
$$Lin+ = \frac{V_{OUT(+B)} - V_{OUTQ}}{2\,(V_{OUT(+B½)} - V_{VOUTQ})} \times 100\% \tag{6}$$

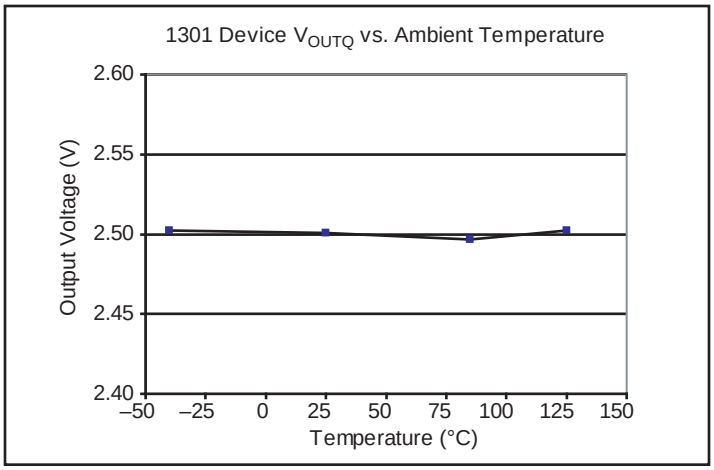
$$Lin- = \frac{V_{OUT(-B)} - V_{OUTQ}}{2(V_{OUT(-B½)} - V_{OUTQ})} \times 100\% \tag{7}$$

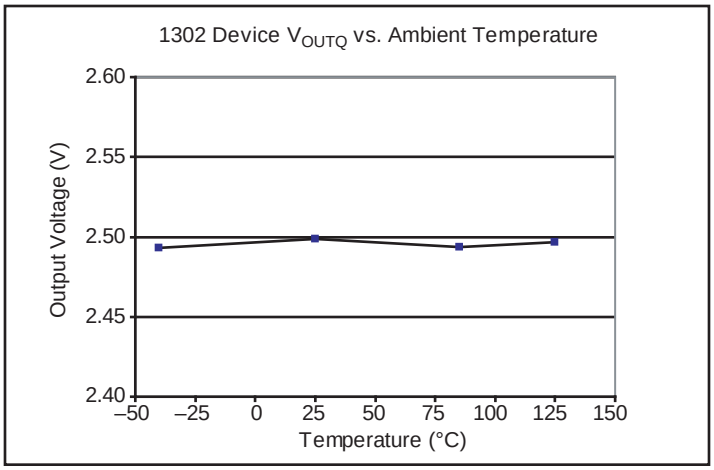
$$Sym = \frac{V_{OUT(+B)} - V_{OUTQ}}{V_{OUTQ} - V_{OUT(-B)}} \times 100\% \tag{8}$$

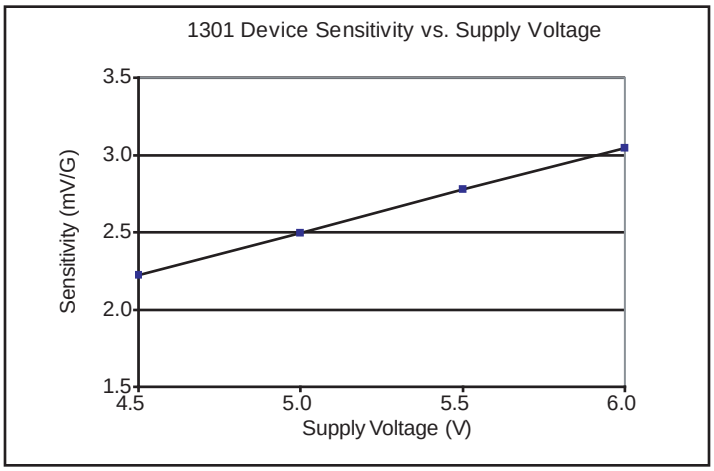
Continued on the next page...

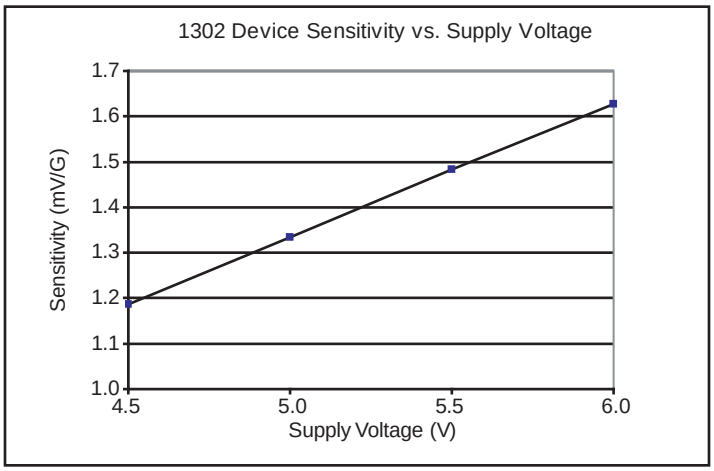


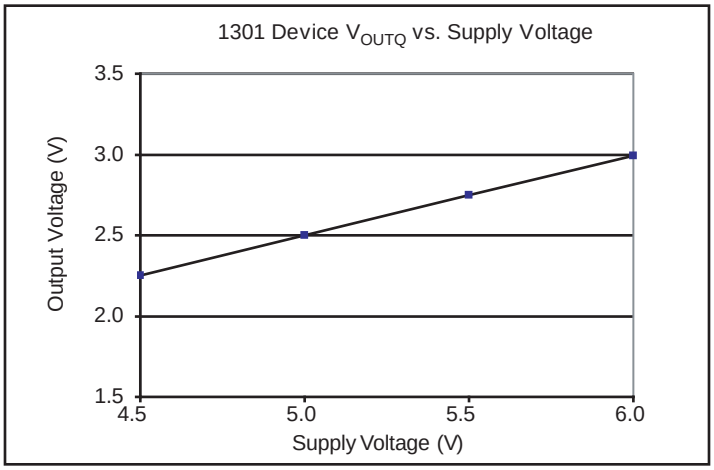


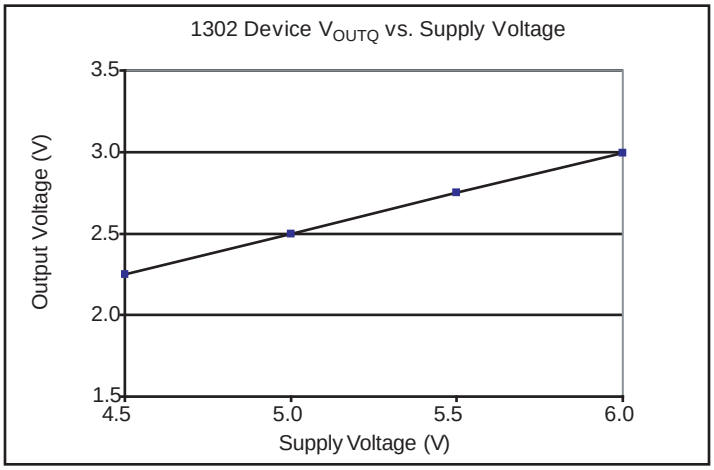


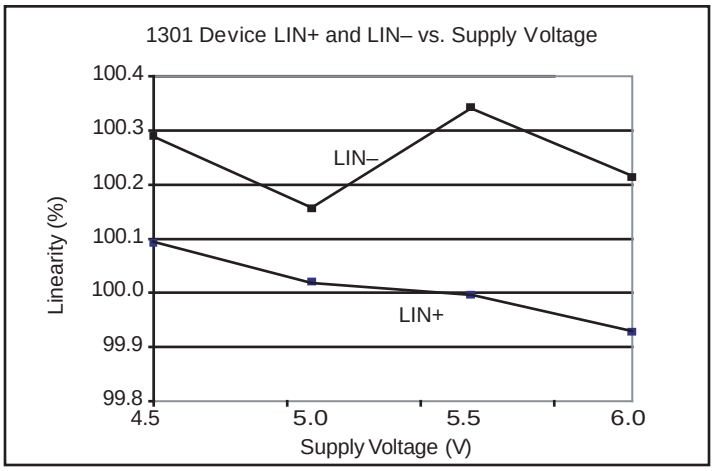


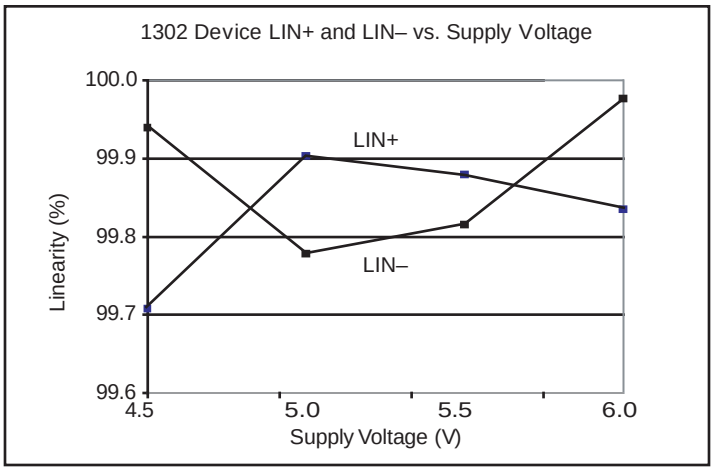


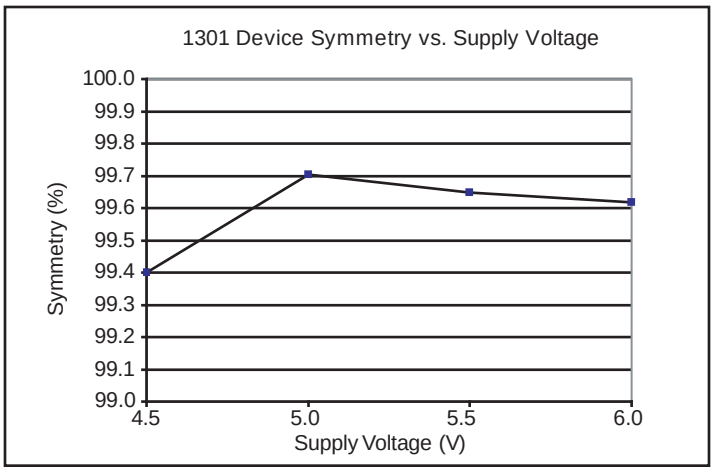


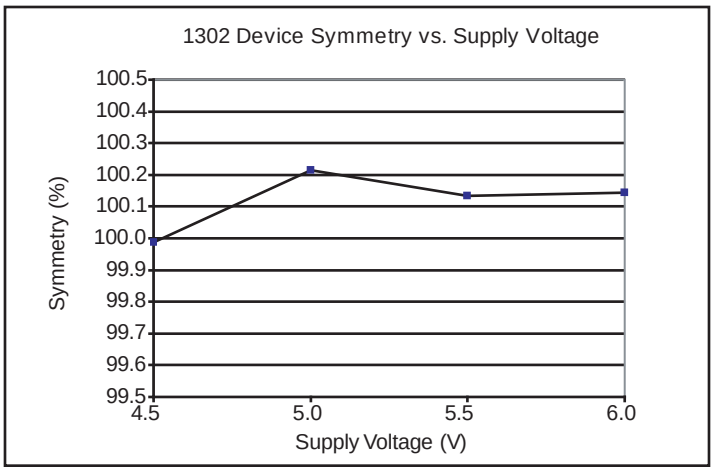

1301 Device V_{OUTQ} vs. Supply Voltage
Output Voltage (V)
3.5
3.0
2.5
2.0
1.5
4.5
5.0
5.5
6.0
Supply Voltage (V)

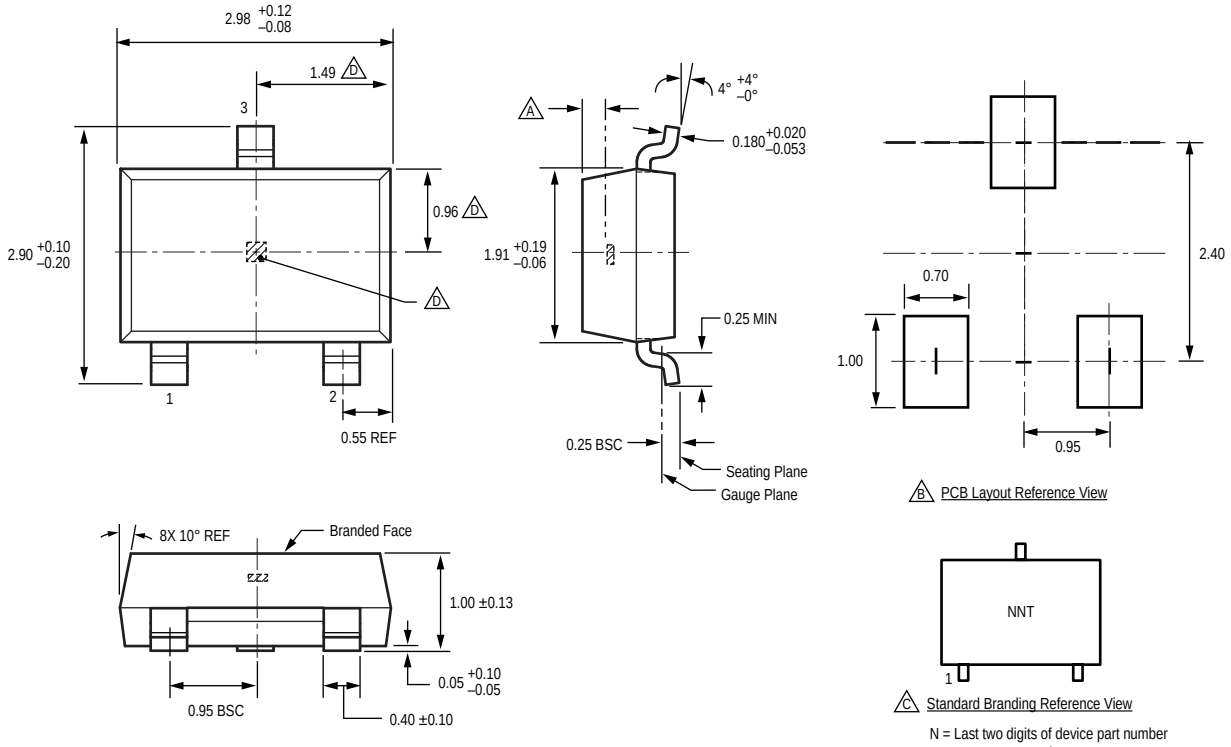

1302 Device V_{OUTQ} vs. Supply Voltage
Output Voltage (V)
3.5
3.0
2.5
2.0
1.5
4.5
5.0
5.5
6.0
Supply Voltage (V)


1301 Device LIN+ and LIN– vs. Supply Voltage
Linearity (%)
100.4
100.3
100.2
100.1
100.0
99.9
99.8
LIN–
LIN+
4.5
5.0
5.5
6.0
Supply Voltage (V)


1302 Device LIN+ and LIN– vs. Supply Voltage
Linearity (%)
100.0
99.9
99.8
99.7
99.6
LIN+
LIN–
4.5
5.0
5.5
6.0
Supply Voltage (V)


1301 Device Symmetry vs. Supply Voltage
Symmetry (%)
100.0
99.9
99.8
99.7
99.6
99.5
99.4
99.3
99.2
99.1
99.0
4.5
5.0
5.5
6.0
Supply Voltage (V)


1302 Device Symmetry vs. Supply Voltage
Symmetry (%)
100.5
100.4
100.3
100.2
100.1
100.0
99.9
99.8
99.7
99.6
99.5
4.5
5.0
5.5
6.0
Supply Voltage (V)



For Reference Only; not for tooling use (reference dwg. 802840)
Dimensions in millimeters
Dimensions exclusive of mold flash, gate burrs, and dambar protrusions
Exact case and lead configuration at supplier discretion within limits shown

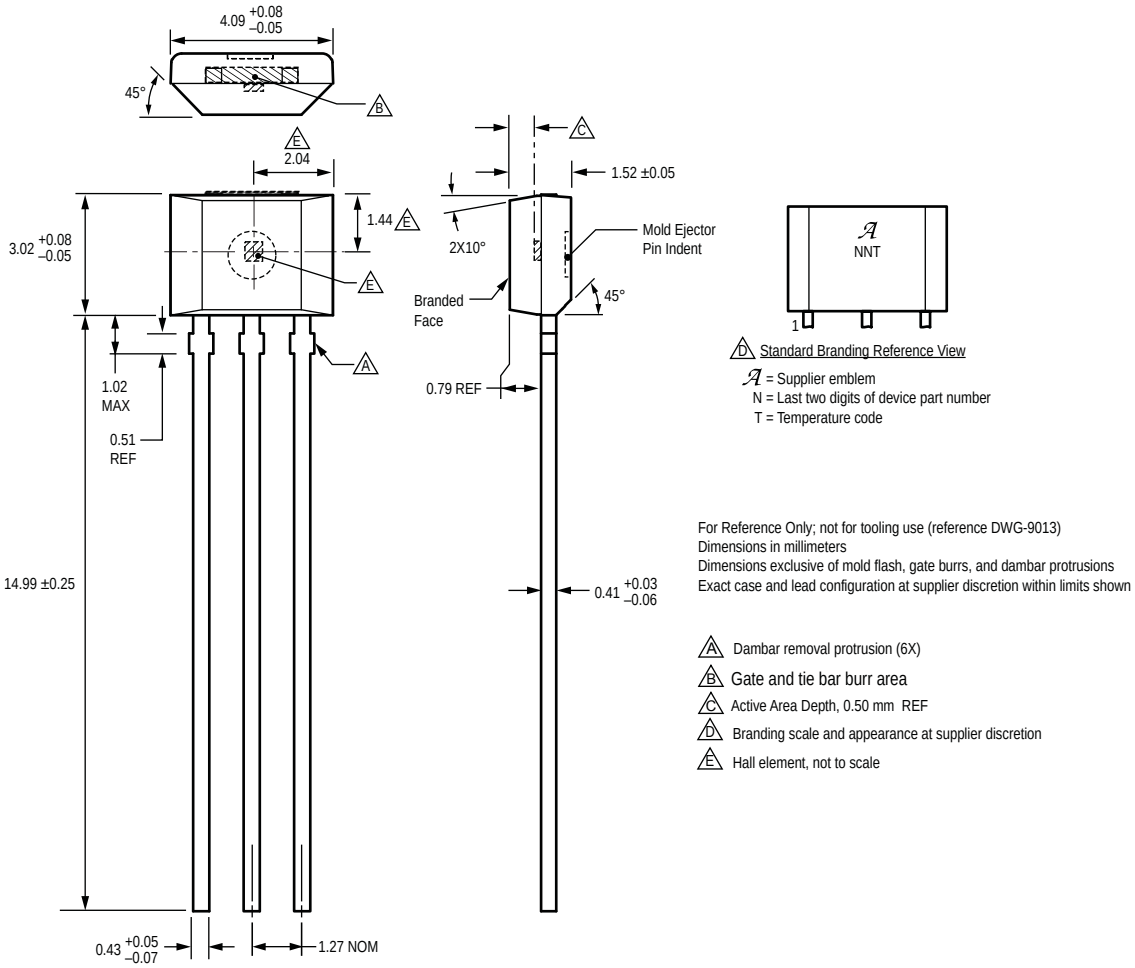
A Active Area Depth, 0.28 mm REF

B Reference land pattern layout
All pads a minimum of 0.20 mm from all adjacent pads; adjust as necessary to meet application process requirements and PCB layout tolerances

C Branding scale and appearance at supplier discretion

D Hall element, not to scale

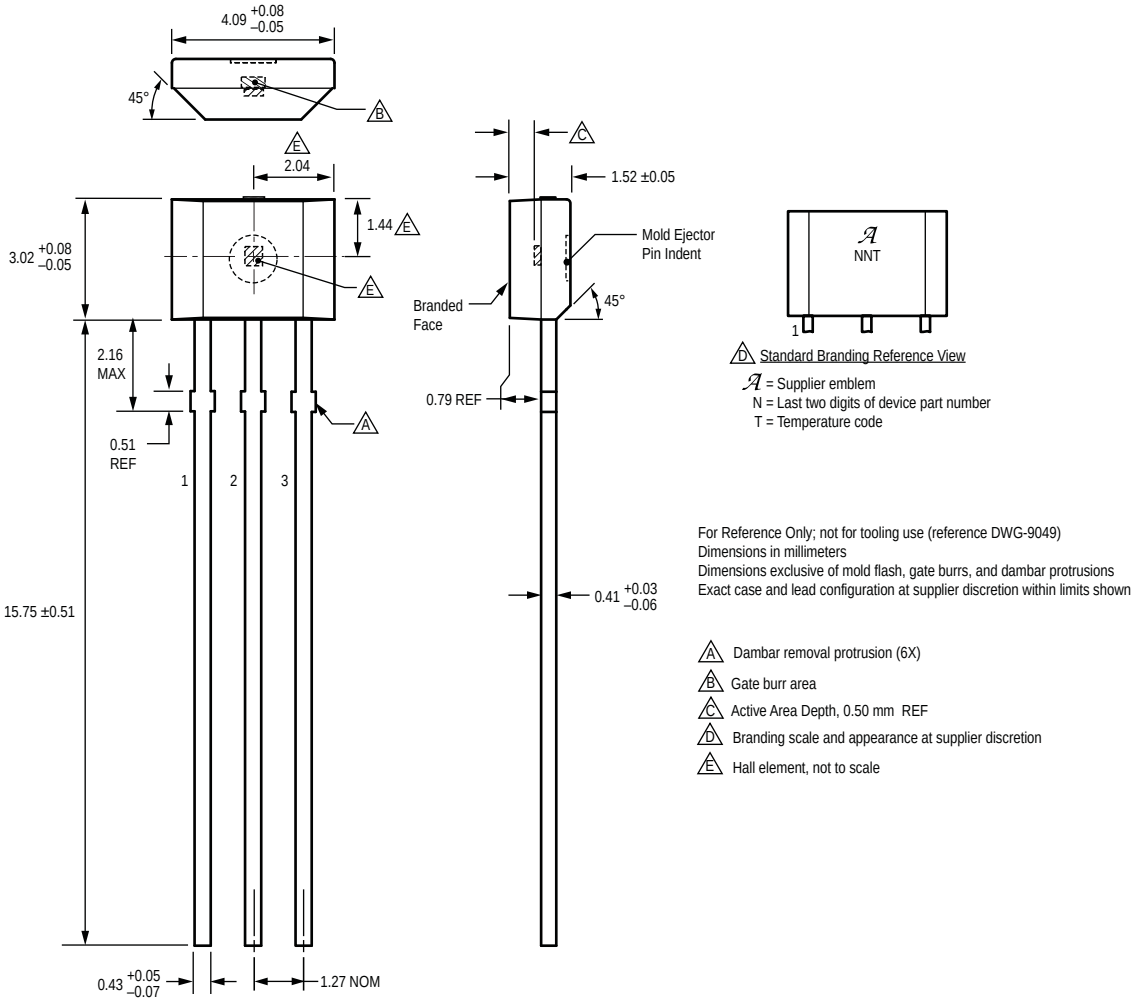
N = Last two digits of device part number
T = Temperature code



Please note that there are changes to the existing UA package drawing pending. Please contact the Allegro Marketing department for additional information.

Package UA, 3-Pin SIP

Conventional Leadframe



MC14051B, MC14052B, MC14053B

Analog Multiplexers/Demultiplexers

The MC14051B, MC14052B, and MC14053B analog multiplexers are digitally–controlled analog switches. The MC14051B effectively implements an SP8T solid state switch, the MC14052B a DP4T, and the MC14053B a Triple SPDT. All three devices feature low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range can be achieved.

- Triple Diode Protection on Control Inputs
- Switch Function is Break Before Make
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Analog Voltage Range ($V_{DD} – V_{EE}$) = 3.0 to 18 V
  Note: V_{EE} must be $\leq V_{SS}$
- Linearized Transfer Characteristics
- Low–noise – 12 nV/$\sqrt{\text{Cycle}}$, f ≥ 1.0 kHz Typical
- Pin–for–Pin Replacement for CD4051, CD4052, and CD4053
- For 4PDT Switch, See MC14551B
- For Lower R_{ON}, Use the HC4051, HC4052, or HC4053 High–Speed CMOS Devices

MAXIMUM RATINGS (Note 1.)

Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage (Referenced to V_{EE}, $V_{SS} \geq V_{EE}$)	–0.5 to +18.0	V
V_{in}, V_{out}	Input or Output Voltage Range (DC or Transient) (Referenced to V_{SS} for Control Inputs and V_{EE} for Switch I/O)	–0.5 to V_{DD} + 0.5	V
I_{in}	Input Current (DC or Transient) per Control Pin	±10	mA
I_{SW}	Switch Through Current	±25	mA
P_D	Power Dissipation, per Package (Note 2.)	500	mW
T_A	Ambient Temperature Range	–55 to +125	°C
T_{stg}	Storage Temperature Range	–65 to +150	°C
T_L	Lead Temperature (8–Second Soldering)	260	°C

1. Maximum Ratings are those values beyond which damage to the device may occur.
2. Temperature Derating:
   Plastic “P and D/DW” Packages: – 7.0 mW/°C From 65°C To 125°C

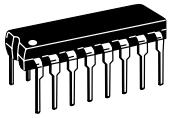
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high–impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS}, V_{EE} or V_{DD}). Unused outputs must be left open.

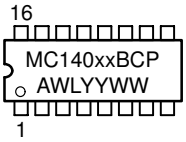
ON Semiconductor

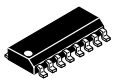
http://onsemi.com

MARKING DIAGRAMS

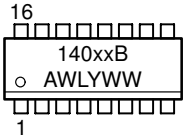


PDIP–16
P SUFFIX
CASE 648

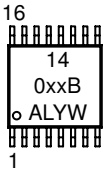


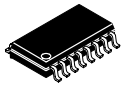


SOIC–16
D SUFFIX
CASE 751B

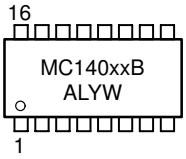


TSSOP–16
DT SUFFIX
CASE 948F





SOEIAJ–16
F SUFFIX
CASE 966



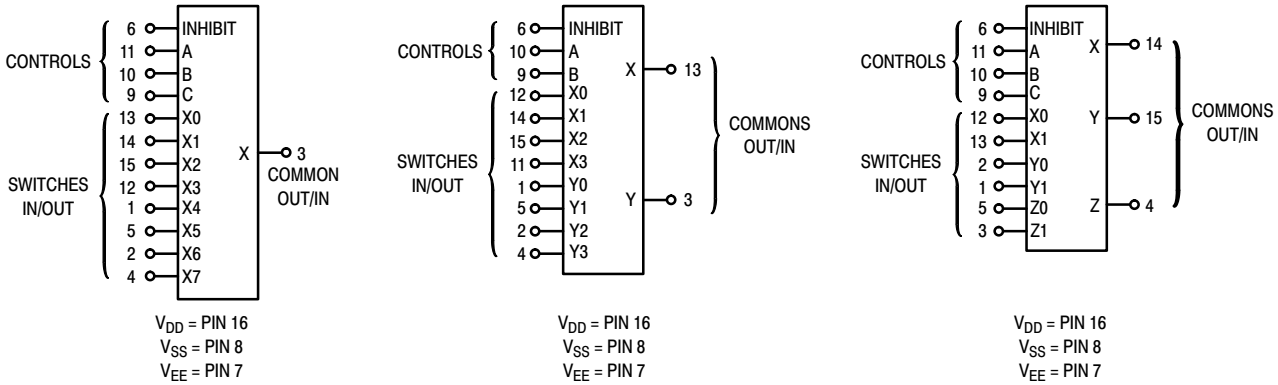
xx	= Specific Device Code
A	= Assembly Location
WL, L	= Wafer Lot
YY, Y	= Year
WW, W	= Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

August, 2000 – Rev. 4

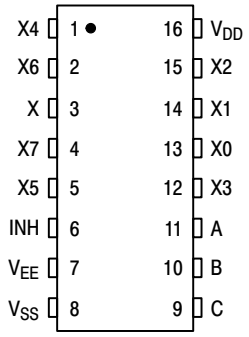
Publication Order Number:
MC14051B/D



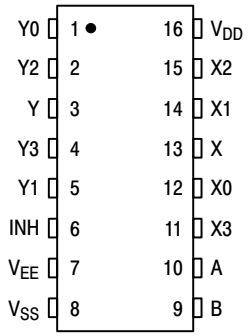
Note: Control Inputs referenced to V_{SS}, Analog Inputs and Outputs reference to V_{EE}. V_{EE} must be ≤ V_{SS}.

PIN ASSIGMENT

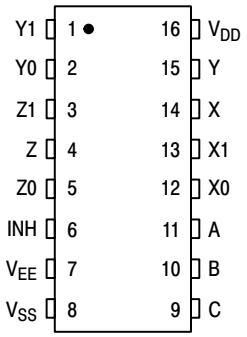
MC14051B



MC14052B



MC14053B



ELECTRICAL CHARACTERISTICS

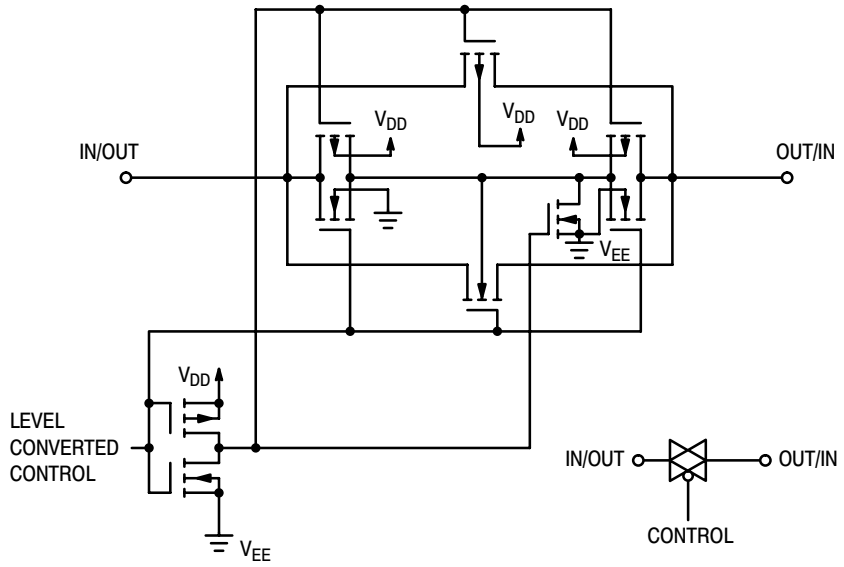
Characteristic	Symbol	V_{DD}	Test Conditions	– 55°C Min	– 55°C Max	25°C Min	25°C Typ (3.)	25°C Max	125°C Min	125°C Max	Unit
SUPPLY REQUIREMENTS (Voltages Referenced to V_{EE})											
Power Supply Voltage Range	V_{DD}	—	$V_{DD} - 3.0 \geq V_{SS} \geq V_{EE}$	3.0	18	3.0	—	18	3.0	18	V
Quiescent Current Per Package	I_{DD}	5.0 10 15	Control Inputs: $V_{in} = V_{SS}$ or V_{DD}, Switch I/O: $V_{EE} \leq V_{I/O} \leq V_{DD}$, and $\Delta V_{switch} \leq 500$ mV (4.)	— — —	5.0 10 20	— — —	0.005 0.010 0.015	5.0 10 20	— — —	150 300 600	µA
Total Supply Current (Dynamic Plus Quiescent, Per Package	$I_{D(AV)}$	5.0 10 15	$T_A = 25°C$ only (The channel component, $(V_{in} - V_{out})/R_{on}$, is not included.)	Typical			(0.07 µA/kHz) f + I_{DD} (0.20 µA/kHz) f + I_{DD} (0.36 µA/kHz) f + I_{DD}				µA
CONTROL INPUTS — INHIBIT, A, B, C (Voltages Referenced to V_{SS})											
Low–Level Input Voltage	V_{IL}	5.0 10 15	R_{on} = per spec, I_{off} = per spec	— — —	1.5 3.0 4.0	— — —	2.25 4.50 6.75	1.5 3.0 4.0	— — —	1.5 3.0 4.0	V
High–Level Input Voltage	V_{IH}	5.0 10 15	R_{on} = per spec, I_{off} = per spec	3.5 7.0 11	— — —	3.5 7.0 11	2.75 5.50 8.25	— — —	3.5 7.0 11	— — —	V
Input Leakage Current	I_{in}	15	V_{in} = 0 or V_{DD}	—	± 0.1	—	±0.00001	± 0.1	—	1.0	µA
Input Capacitance	C_{in}	—		—	—	—	5.0	7.5	—	—	pF
SWITCHES IN/OUT AND COMMONS OUT/IN — X, Y, Z (Voltages Referenced to V_{EE})											
Recommended Peak–to–Peak Voltage Into or Out of the Switch	$V_{I/O}$	—	Channel On or Off	0	V_{DD}	0	—	V_{DD}	0	V_{DD}	V_{PP}
Recommended Static or Dynamic Voltage Across the Switch (4.) (Figure 5)	ΔV_{switch}	—	Channel On	0	600	0	—	600	0	300	mV
Output Offset Voltage	V_{OO}	—	V_{in} = 0 V, No Load	—	—	—	10	—	—	—	µV
ON Resistance	R_{on}	5.0 10 15	$\Delta V_{switch} \leq 500$ mV (4.) $V_{in} = V_{IL}$ or V_{IH} (Control), and V_{in} = 0 to V_{DD} (Switch)	— — —	800 400 220	— — —	250 120 80	1050 500 280	— — —	1200 520 300	Ω
ΔON Resistance Between Any Two Channels in the Same Package	ΔR_{on}	5.0 10 15		— — —	70 50 45	— — —	25 10 10	70 50 45	— — —	135 95 65	Ω
Off–Channel Leakage Current (Figure 10)	I_{off}	15	$V_{in} = V_{IL}$ or V_{IH} (Control) Channel to Channel or Any One Channel	—	± 100	—	± 0.05	± 100	—	±1000	nA
Capacitance, Switch I/O	$C_{I/O}$	—	Inhibit = V_{DD}	—	—	—	10	—	—	—	pF
Capacitance, Common O/I	$C_{O/I}$	—	Inhibit = V_{DD} (MC14051B) (MC14052B) (MC14053B)	 — — —	 — — —	 — — —	 60 32 17	 — — —	 — — —	 — — —	pF
Capacitance, Feedthrough (Channel Off)	$C_{I/O}$	— —	Pins Not Adjacent Pins Adjacent	— —	— —	— —	0.15 0.47	— —	— —	— —	pF

3. Data labeled “Typ” is not to be used for design purposes, but is intended as an indication of the IC’s potential performance.
4. For voltage drops across the switch (ΔV_{switch}) > 600 mV (> 300 mV at high temperature), excessive V_{DD} current may be drawn, i.e. the current out of the switch may contain both V_{DD} and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded. (See first page of this data sheet.)

ELECTRICAL CHARACTERISTICS [5.] (C_L = 50 pF, T_A = 25°C) ($V_{EE} \leq V_{SS}$ unless otherwise indicated)

Characteristic	Symbol	$V_{DD} - V_{EE}$ Vdc	Typ [6.] All Types	Max	Unit
Propagation Delay Times (Figure 6)	t_{PLH}, t_{PHL}				ns
Switch Input to Switch Output (R_L = 10 kΩ)					
MC14051					
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 26.5 ns		5.0	35	90	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 11 ns		10	15	40	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 9.0 ns		15	12	30	
MC14052					ns
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 21.5 ns		5.0	30	75	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 8.0 ns		10	12	30	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 7.0 ns		15	10	25	
MC14053					ns
t_{PLH}, t_{PHL} = (0.17 ns/pF) C_L + 16.5 ns		5.0	25	65	
t_{PLH}, t_{PHL} = (0.08 ns/pF) C_L + 4.0 ns		10	8.0	20	
t_{PLH}, t_{PHL} = (0.06 ns/pF) C_L + 3.0 ns		15	6.0	15	
Inhibit to Output (R_L = 10 kΩ, $V_{EE} = V_{SS}$) Output "1" or "0" to High Impedance, or High Impedance to "1" or "0" Level	t_{PHZ}, t_{PLZ}, t_{PZH}, t_{PZL}				ns
MC14051B		5.0	350	700	
		10	170	340	
		15	140	280	
MC14052B		5.0	300	600	ns
		10	155	310	
		15	125	250	
MC14053B		5.0	275	550	ns
		10	140	280	
		15	110	220	
Control Input to Output (R_L = 10 kΩ, $V_{EE} = V_{SS}$)	t_{PLH}, t_{PHL}				ns
MC14051B		5.0	360	720	
		10	160	320	
		15	120	240	
MC14052B		5.0	325	650	ns
		10	130	260	
		15	90	180	
MC14053B		5.0	300	600	ns
		10	120	240	
		15	80	160	
Second Harmonic Distortion (R_L = 10KΩ, f = 1 kHz) V_{in} = 5 V_{PP}	—	10	0.07	—	%
Bandwidth (Figure 7) (R_L = 1 kΩ, V_{in} = 1/2 (V_{DD}–V_{EE}) p–p, C_L = 50pF 20 Log (V_{out}/V_{in}) = – 3 dB)	BW	10	17	—	MHz
Off Channel Feedthrough Attenuation (Figure 7) R_L = 1KΩ, V_{in} = 1/2 (V_{DD} – V_{EE}) p–p f_{in} = 4.5 MHz — MC14051B f_{in} = 30 MHz — MC14052B f_{in} = 55 MHz — MC14053B	—	10	– 50	—	dB
Channel Separation (Figure 8) (R_L = 1 kΩ, V_{in} = 1/2 (V_{DD}–V_{EE}) p–p, f_{in} = 3.0 MHz	—	10	– 50	—	dB
Crosstalk, Control Input to Common O/I (Figure 9) (R_1 = 1 kΩ, R_L = 10 kΩ Control $t_{TLH} = t_{THL}$ = 20 ns, Inhibit = V_{SS})	—	10	75	—	mV

5. The formulas given are for the typical characteristics only at 25°C.
6. Data labelled "Typ" is not lo be used for design purposes but In intended as an indication of the IC's potential performance.



TRUTH TABLE

Control Inputs				ON Switches					
Inhibit	Select C*	B	A	MC14051B	MC14052B		MC14053B		
0	0	0	0	X0	Y0	X0	Z0	Y0	X0
0	0	0	1	X1	Y1	X1	Z0	Y0	X1
0	0	1	0	X2	Y2	X2	Z0	Y1	X0
0	0	1	1	X3	Y3	X3	Z0	Y1	X1
0	1	0	0	X4			Z1	Y0	X0
0	1	0	1	X5			Z1	Y0	X1
0	1	1	0	X6			Z1	Y1	X0
0	1	1	1	X7			Z1	Y1	X1
1	x	x	x	None	None		None		

*Not applicable for MC14052
x = Don't Care

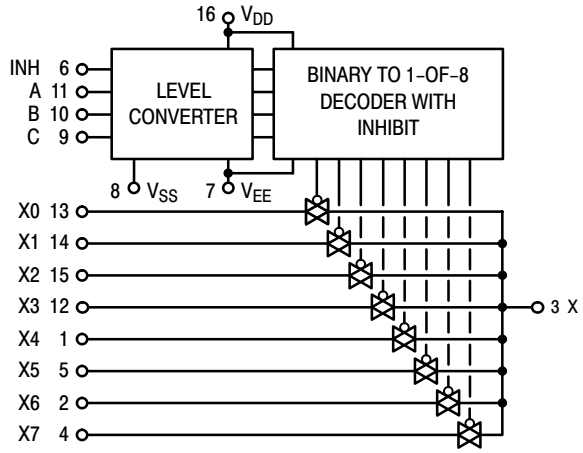


Figure 2. MC14051B Functional Diagram

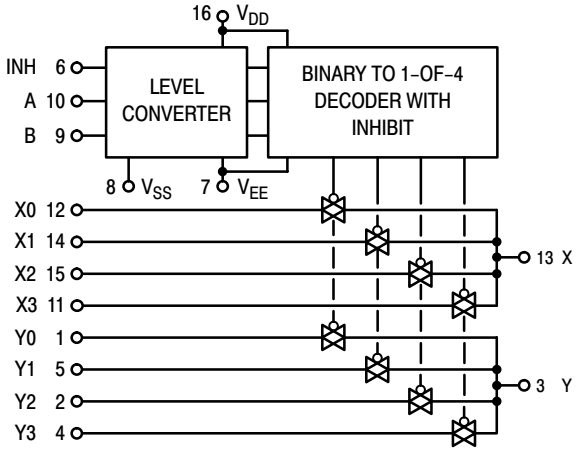


Figure 3. MC14052B Functional Diagram

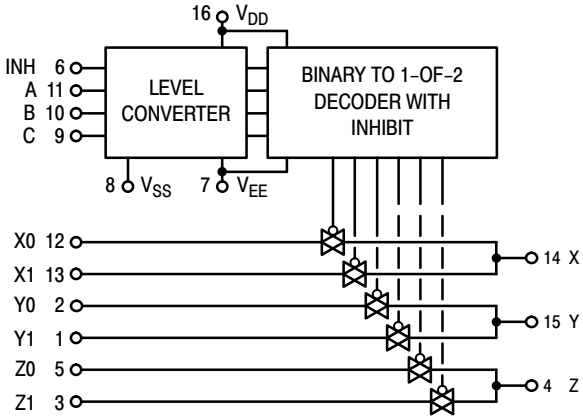
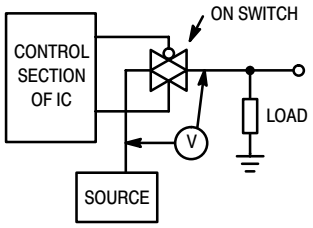
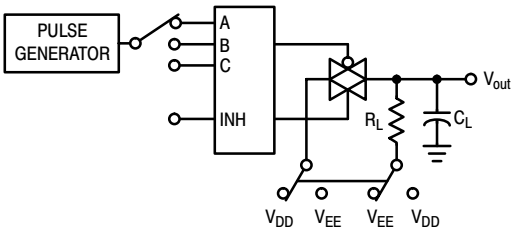


Figure 4. MC14053B Functional Diagram





A, B, and C inputs used to turn ON or OFF
the switch under test.

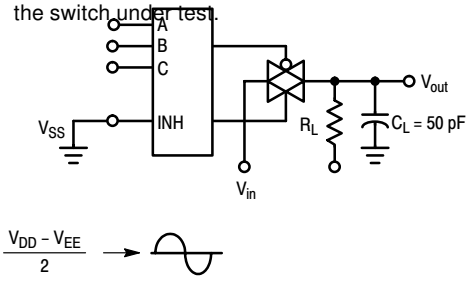


Figure 7. Bandwidth and Off–Channel Feedthrough Attenuation

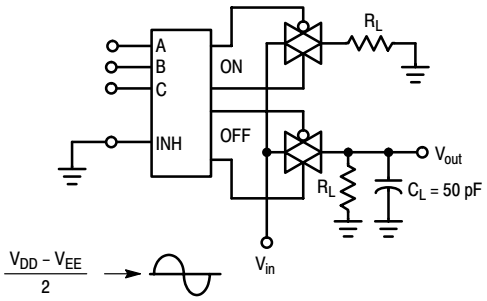


Figure 8. Channel Separation (Adjacent Channels Used For Setup)

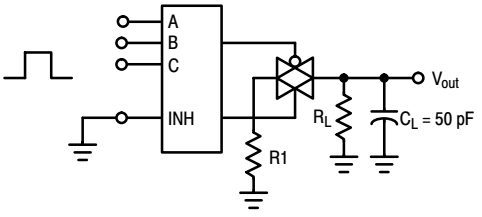


Figure 9. Crosstalk, Control Input to Common O/I

NOTE: See also Figures 7 and 8 in the MC14016B data sheet.

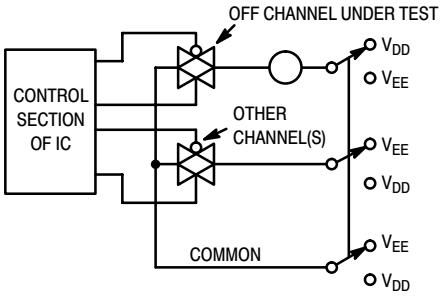
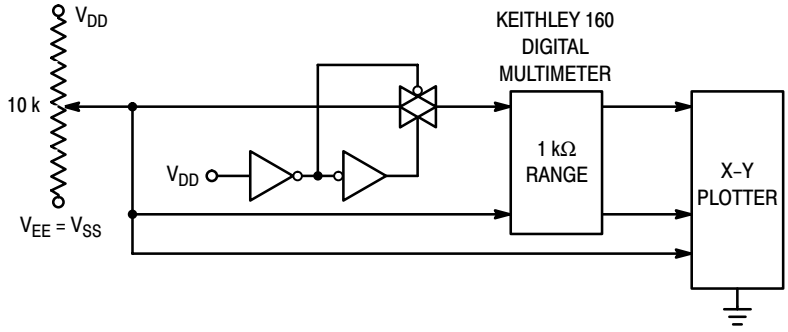


Figure 10. Off Channel Leakage



TYPICAL RESISTANCE CHARACTERISTICS

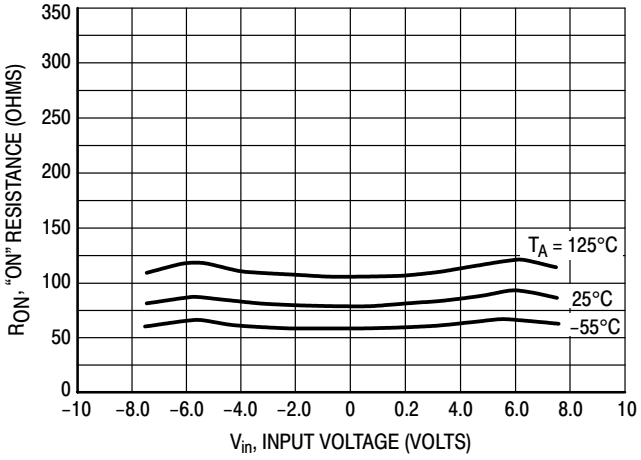


Figure 12. V_{DD} = 7.5 V, V_{EE} = – 7.5 V

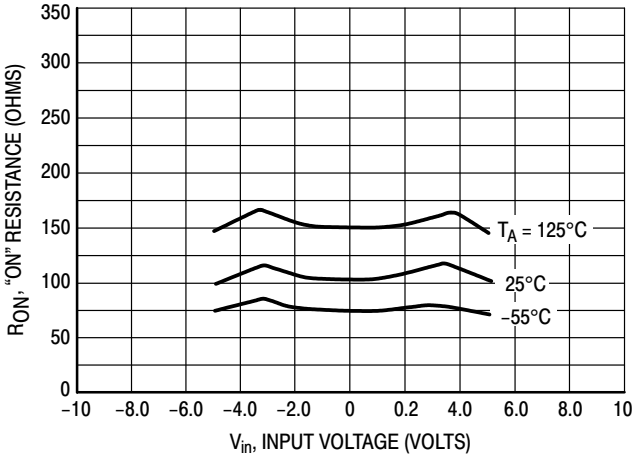


Figure 13. V_{DD} = 5.0 V, V_{EE} = – 5.0 V

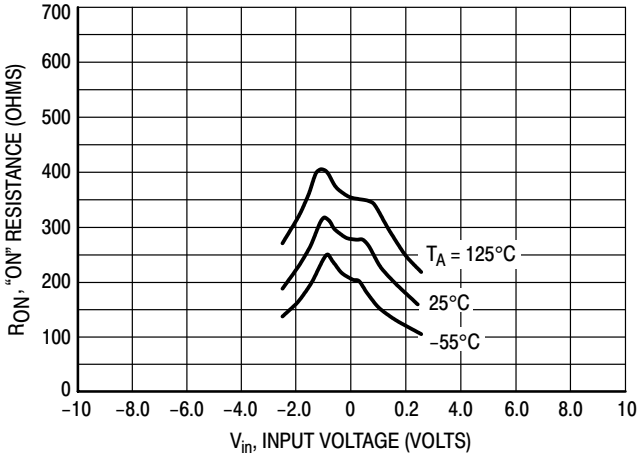


Figure 14. V_{DD} = 2.5 V, V_{EE} = – 2.5 V

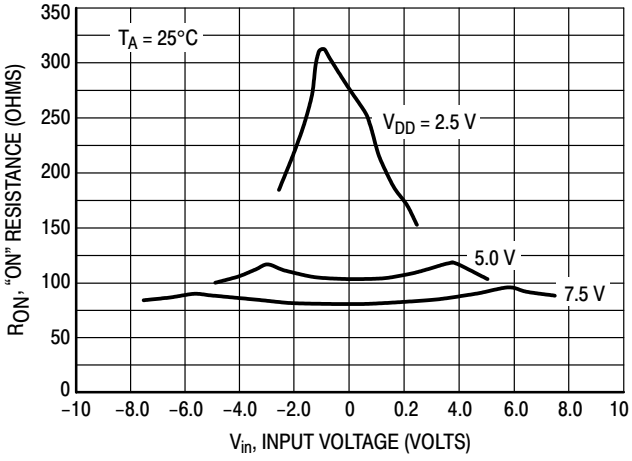


Figure 15. Comparison at 25°C, $V_{DD} = -V_{EE}$

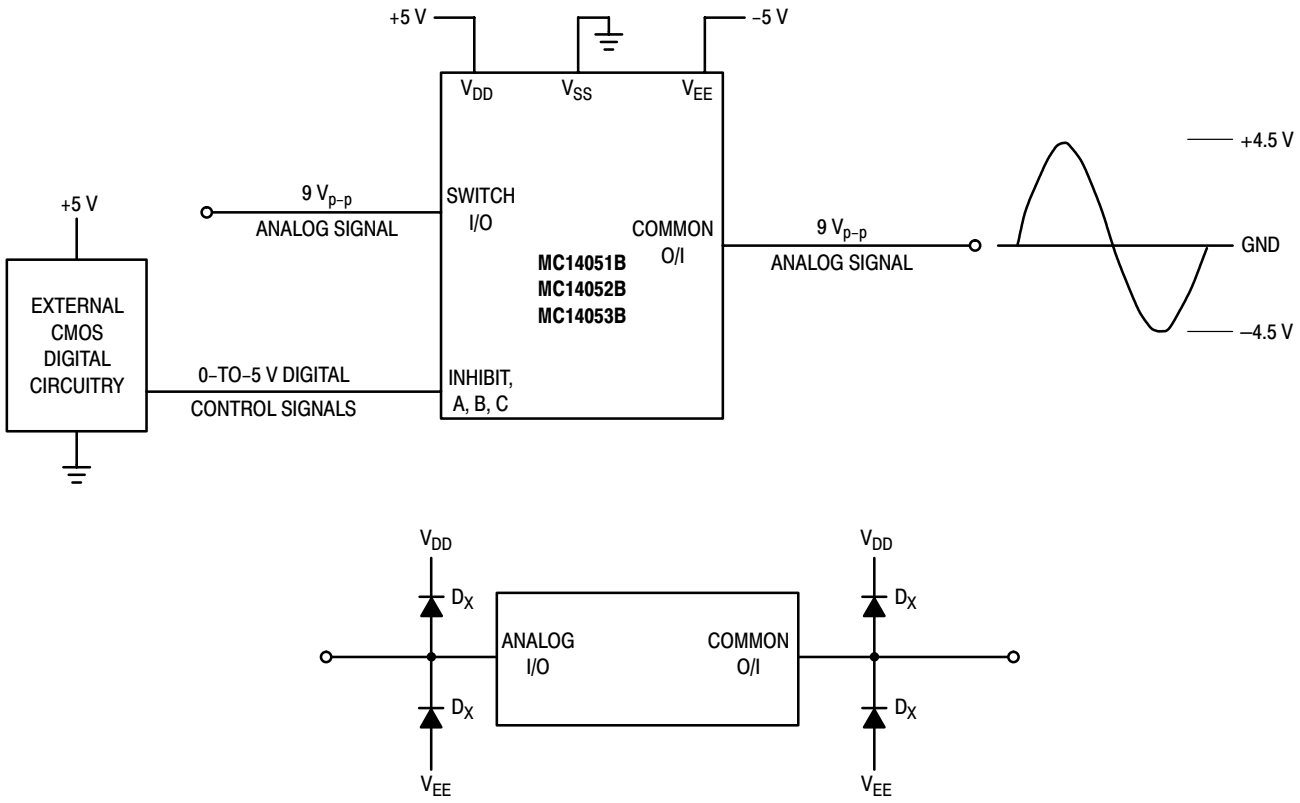
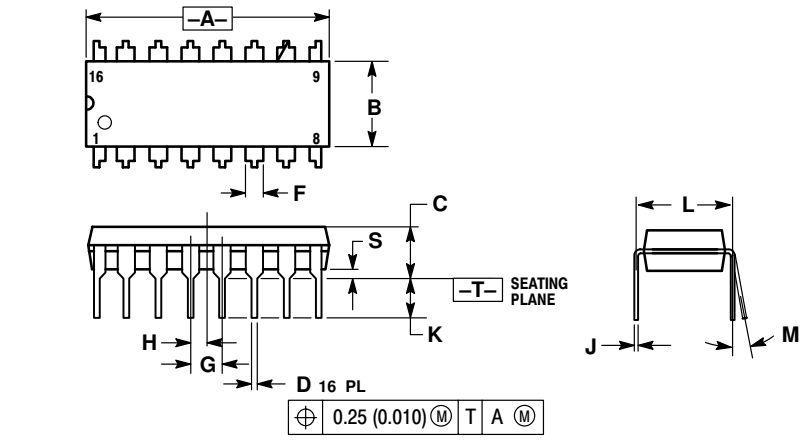


Figure B. External Germanium or Schottky Clipping Diodes

POSSIBLE SUPPLY CONNECTIONS

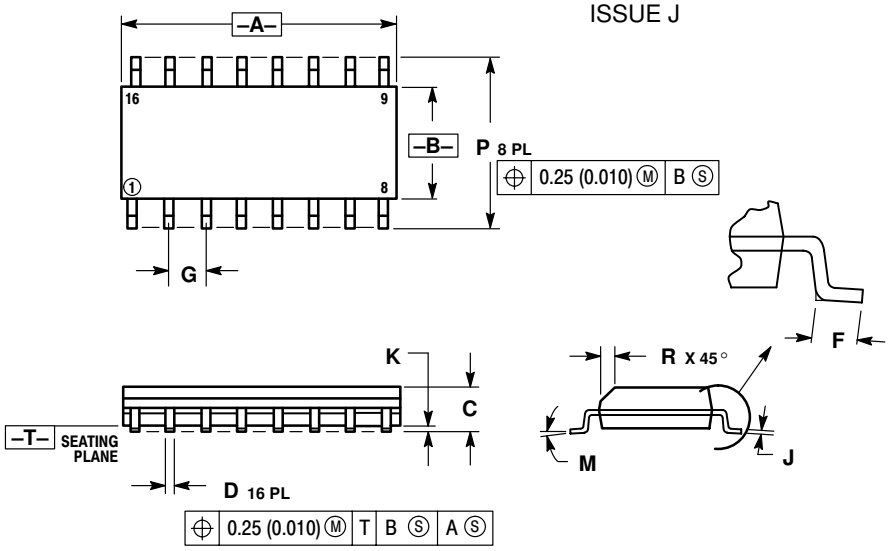
V_{DD} In Volts	V_{SS} In Volts	V_{EE} In Volts	Control Inputs Logic High/Logic Low In Volts	Maximum Analog Signal Range In Volts
+ 8	0	– 8	+ 8/0	+ 8 to – 8 = 16 V_{p-p}
+ 5	0	– 12	+ 5/0	+ 5 to – 12 = 17 V_{p-p}
+ 5	0	0	+ 5/0	+ 5 to 0 = 5 V_{p-p}
+ 5	0	– 5	+ 5/0	+ 5 to – 5 = 10 V_{p-p}
+ 10	+ 5	– 5	+ 10/ + 5	+ 10 to – 5 = 15 V_{p-p}



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

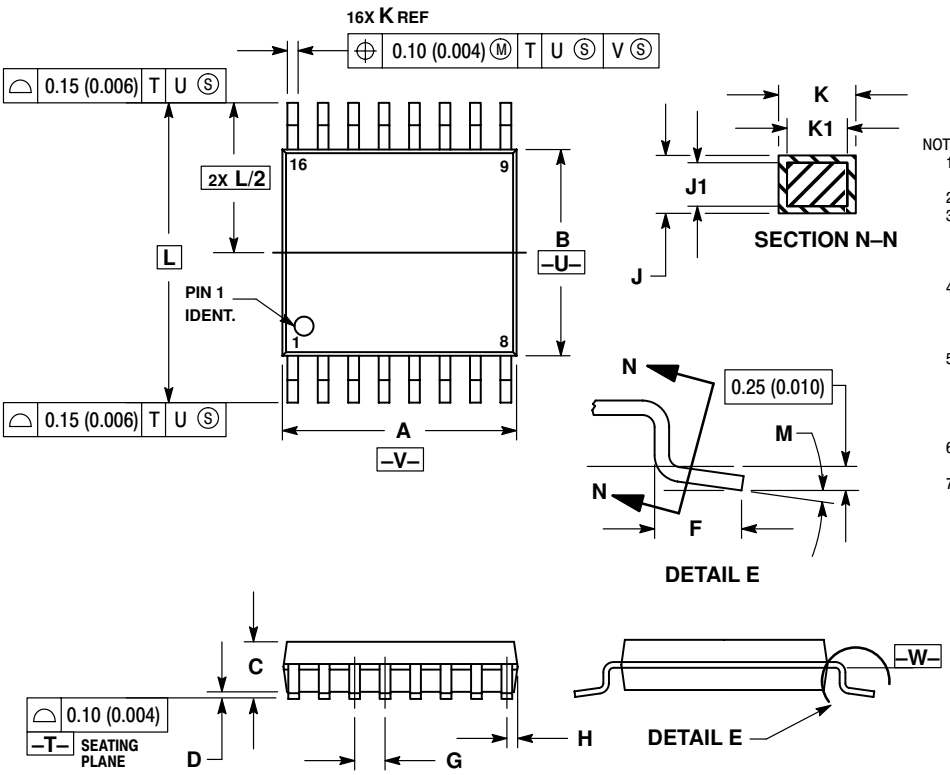
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

SOIC–16
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B–05
ISSUE J



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

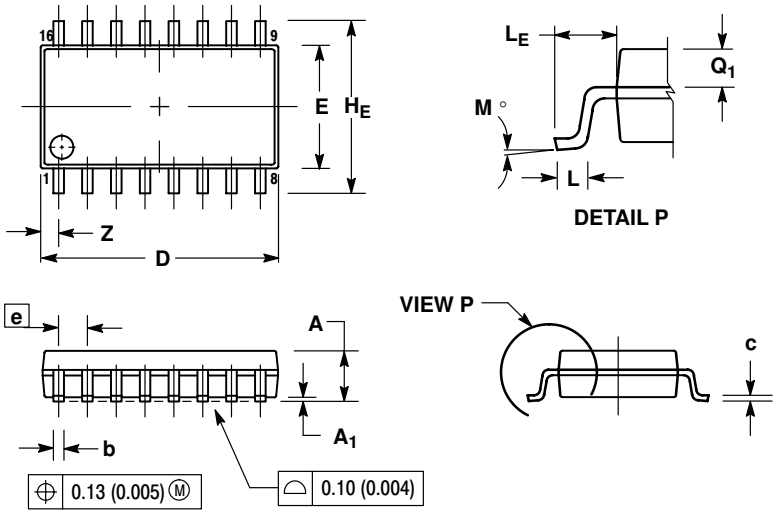
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE –W–.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOEIAJ–16
F SUFFIX
PLASTIC EIAJ SOIC PACKAGE
CASE 966–01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A_1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H_E	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L_E	1.10	1.50	0.043	0.059
M	0 °	10 °	0 °	10 °
Q_1	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

ORDERING & SHIPPING INFORMATION:

Device	Package	Shipping
MC14051BCP	PDIP–16	2000 Units per Box
MC14051BD	SOIC–16	48 Units per Rail
MC14051BDR2	SOIC–16	2500 Units / Tape & Reel
MC14051BDT	TSSOP–16	96 Units per Rail
MC14051BDTEL	TSSOP–16	2000 Units / Tape & Reel
MC14051BDTR2	TSSOP–16	2500 Units / Tape & Reel
MC14051BF	SOEIAJ–16	See Note 7.
MC14051BFEL	SOEIAJ–16	See Note 7.
MC14052BCP	PDIP–16	2000 Units per Box
MC14052BD	SOIC–16	48 Units per Rail
MC14052BDR2	SOIC–16	2500 Units / Tape & Reel
MC14052BDT	TSSOP–16	96 Units per Rail
MC14052BDTR2	TSSOP–16	2500 Units / Tape & Reel
MC14052BF	SOEIAJ–16	See Note 7.
MC14052BFEL	SOEIAJ–16	See Note 7.

ORDERING & SHIPPING INFORMATION:

MC14053BCP	PDIP–16	2000 Units per Box
MC14053BD	SOIC–16	48 Units per Rail
MC14053BDR2	SOIC–16	2500 Units / Tape & Reel
MC14053BDT	TSSOP–16	96 Units per Rail
MC14053BDTEL	TSSOP–16	2000 Units / Tape & Reel
MC14053BDTR2	TSSOP–16	2500 Units / Tape & Reel
MC14053BF	SOEIAJ–16	See Note 7.
MC14053BFEL	SOEIAJ–16	See Note 7.

7. For ordering information on the EIAJ version of the SOIC packages, please contact your local ON Semiconductor representative.

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TPF-30- M30
Industrial
LF RFID M30 Reader /Writer
Multifrequency
125 kHz / 134 kHz
FDX-B, HDX, HITAG, 4305...
ISO/IEC 11784/785
ISO/IEC 18000-2

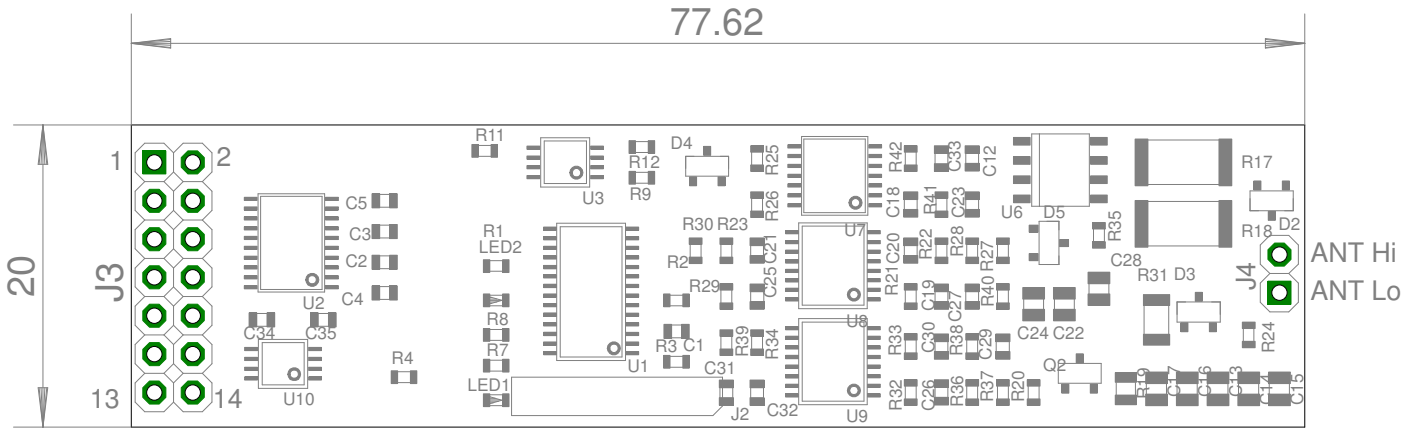
Description:	Industrial LF RFID Multifrequency Reader/ Writer M30 x 100 mm	
Transponder Types: to be selected (depends on firmware version)	134 kHz FDX-B and HDX according to ISO/IEC 11784/785 125 kHz 64 bits Read Only Unique EM4102, EM4100, 125 kHz 64 bits Read Write HITAG 1,2,S, Q5, 5567, EM4550, EM4305	
Dimensions / Housing:	Diameter 30 mm (M30) Lenght =100 mm	POM + PU housing with thread
Interface / Connector:	RS232 (other on request)	M12
Power Supply:	5 VDC	
Operating Frequency:	134 kHz / 125 kHz (Software switchable)	(At room temperature 20° C)
Operating Temperature:	-20°C ... +60°C	
Technical Certificates:	CE	
Other:	Electronics production ISO 9001:2000 CERTIFIED	RoHS
Features:	- TECTUS TLM-30 Reader Module Core - Frequency switchable by software command or automatic with TECTUS IDSEND software module	
Applications:	- Factory & Process Automation, Mechanical Engineering, Machinery Integration - Industrial identification, Industrial handshake, etc.	
Part name:	TPF-30-M30-RS232	

TPF-30- M30
Industrial
LF RFID M30 Reader /Writer
Multifrequency
125 kHz / 134 kHz
FDX-B, HDX, HITAG, 4305...
ISO/IEC 11784/785
ISO/IEC 18000-2

Rugged Standard:	IP65 Protected against splashing water and dust
Accessorry:	Industrial Cable: - length 5 m (standard) Optional: - length 10 m or - length 15 m
RFID TAGs:	TECTUS supplies a wide range of different standard and rugged RFID transponders including Mount on Metal and customized versions with best price + performance ratio. Please check our web site or send your request to us.

Reader head

M12 connector



Pin 1 Txd (TTL)
Pin 3 CTS (TTL)
Pin 5 Rxd (TTL)
Pin 7 RTS (TTL)
Pin 9 Button
Pin 11 XSHDN
Pin 13 GND

Pin 2 Txd (RS232)
Pin 4 CTS (RS232)
Pin 6 Rxd (RS232)
Pin 8 RTS(RS232)
Pin 10 A (RS485)
Pin 12 B (RS485)
Pin 14 Vin +5V

FEATURES

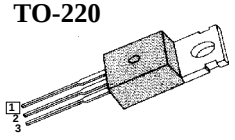
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- 175°C Operating Temperature
- Lower Leakage Current: 10μA (Max.) @ V_{DS} = 60V
- Lower $R_{DS(ON)}$: 0.020Ω (Typ.)

BV_{DSS} = 60 V

$R_{DS(on)}$ = 0.024Ω

I_D = 50 A

TO-220



1.Gate 2. Drain 3. Source

Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
V_{DSS}	Drain-to-Source Voltage	60	V
I_D	Continuous Drain Current (T_C=25°C)	50	A
	Continuous Drain Current (T_C=100°C)	35.4	
I_{DM}	Drain Current-Pulsed (1)	200	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}	Single Pulsed Avalanche Energy (2)	857	mJ
I_{AR}	Avalanche Current (1)	50	A
E_{AR}	Repetitive Avalanche Energy (1)	12.6	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	5.5	V/ns
P_D	Total Power Dissipation (T_C=25°C)	126	W
	Linear Derating Factor	0.84	W/°C
T_J , T_{STG}	Operating Junction and Storage Temperature Range	- 55 to +175	°C
T_L	Maximum Lead Temp. for Soldering Purposes, 1/8. from case for 5-seconds	300	

Thermal Resistance

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	1.19	°C/W
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

Rev. B

FAIRCHILD SEMICONDUCTOR™

Electrical Characteristics (T_C=25°C unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
BV_{DSS}	Drain-Source Breakdown Voltage	60	--	--	V	V_{GS}=0V,I_D=250μA
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.063	--	V/°C	I_D=250μA ***See Fig 7***
$V_{GS(th)}$	Gate Threshold Voltage	2.0	--	4.0	V	V_{DS}=5V,I_D=250μA
I_{GSS}	Gate-Source Leakage , Forward	--	--	100	nA	V_{GS}=20V
	Gate-Source Leakage , Reverse	--	--	-100		V_{GS}=-20V
I_{DSS}	Drain-to-Source Leakage Current	--	--	10	μA	V_{DS}=60V
		--	--	100		V_{DS}=48V,T_C=150°C
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.024	Ω	V_{GS}=10V,I_D=25A (4)
g_{fs}	Forward Transconductance	--	32.6	--	℧	V_{DS}=30V,I_D=25A (4)
C_{iss}	Input Capacitance	--	1770	2300	pF	V_{GS}=0V,V_{DS}=25V,f =1MHz ***See Fig 5***
C_{oss}	Output Capacitance	--	590	680		
C_{rss}	Reverse Transfer Capacitance	--	220	255		
$t_{d(on)}$	Turn-On Delay Time	--	20	40	ns	V_{DD}=30V,I_D=50A, R_G=9.1Ω ***See Fig 13*** (4) (5)
t_r	Rise Time	--	16	40		
$t_{d(off)}$	Turn-Off Delay Time	--	68	140		
t_f	Fall Time	--	70	140		
Q_g	Total Gate Charge	--	64	83	nC	V_{DS}=48V,V_{GS}=10V, I_D=50A ***See Fig 6 & Fig 12*** (4) (5)
Q_{gs}	Gate-Source Charge	--	12.3	--		
Q_{gd}	Gate-Drain (. Miller.) Charge	--	23.6	--		

Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I_S	Continuous Source Current	--	--	50	A	Integral reverse pn-diode in the MOSFET
I_{SM}	Pulsed-Source Current (1)	--	--	200		
V_{SD}	Diode Forward Voltage (4)	--	--	1.8	V	T_J=25°C,I_S=50A,V_{GS}=0V
t_{rr}	Reverse Recovery Time	--	85	--	ns	T_J=25°C,I_F=50A
Q_{rr}	Reverse Recovery Charge	--	0.24	--	μC	di_F/dt=100A/μs (4)

Notes;

(1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

(2) L=0.4mH, I_{AS}=50A, V_{DD}=25V, R_G=27Ω, Starting T_J=25°C

(3) I_{SD} ≤ 50A, di/dt ≤ 350A/μs, V_{DD} ≤ BV_{DSS} , Starting T_J=25°C

(4) Pulse Test : Pulse Width = 250μs, Duty Cycle ≤ 2%

(5) Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

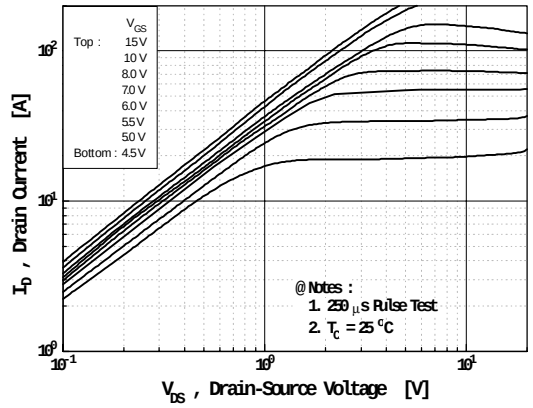


Fig 2. Transfer Characteristics

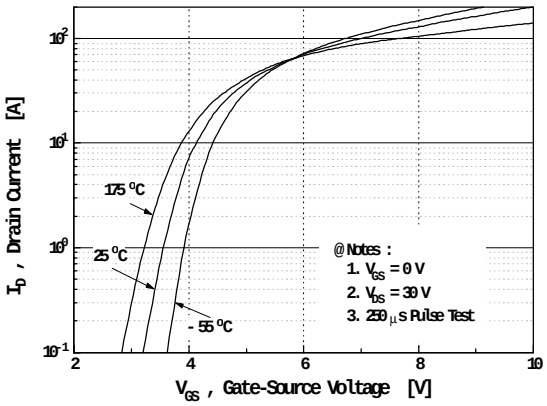


Fig 3. On-Resistance vs. Drain Current

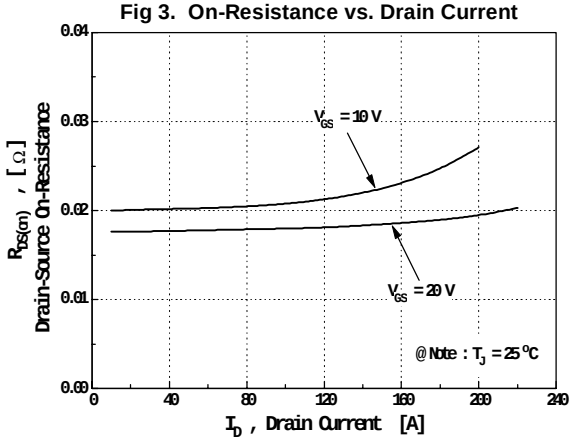


Fig 4. Source-Drain Diode Forward Voltage

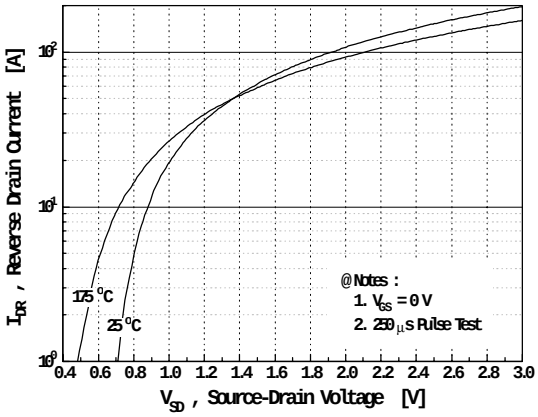


Fig 5. Capacitance vs. Drain-Source Voltage

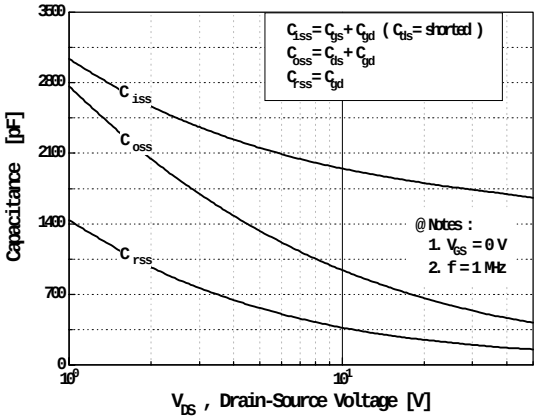


Fig 6. Gate Charge vs. Gate-Source Voltage

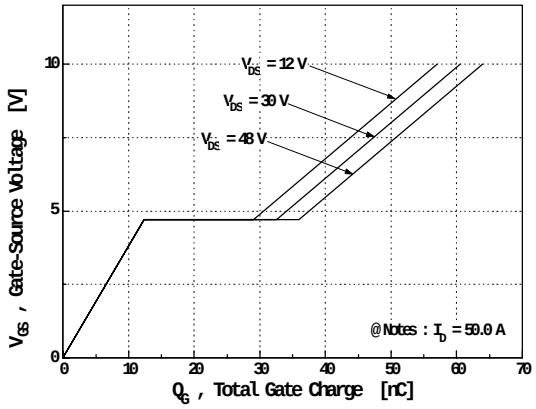


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Fig 7. Breakdown Voltage vs. Temperature

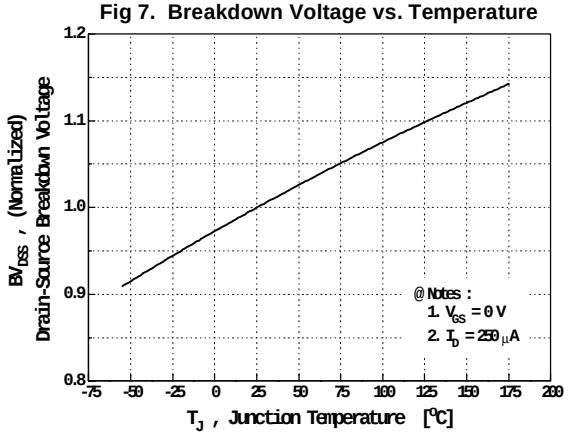


Fig 8. On-Resistance vs. Temperature

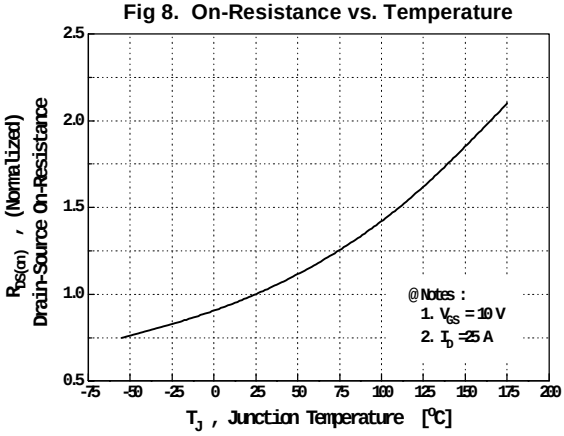


Fig 9. Max. Safe Operating Area

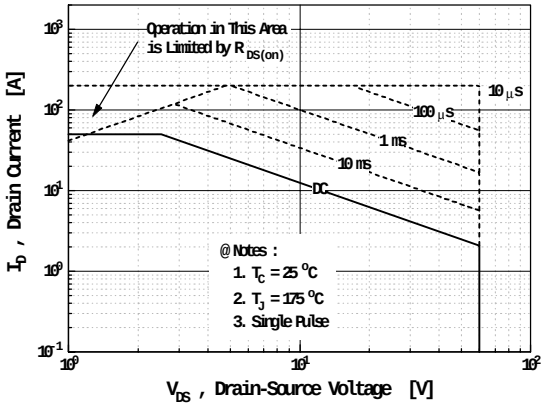


Fig 10. Max. Drain Current vs. Case Temperature

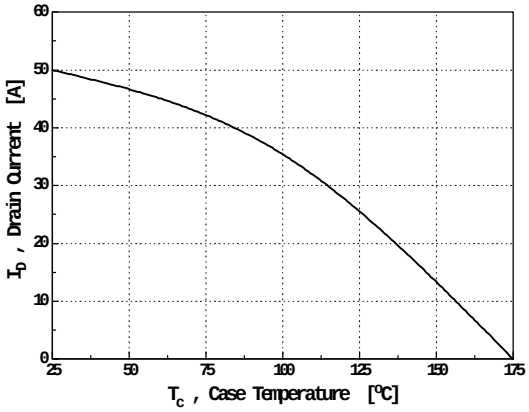


Fig 11. Thermal Response

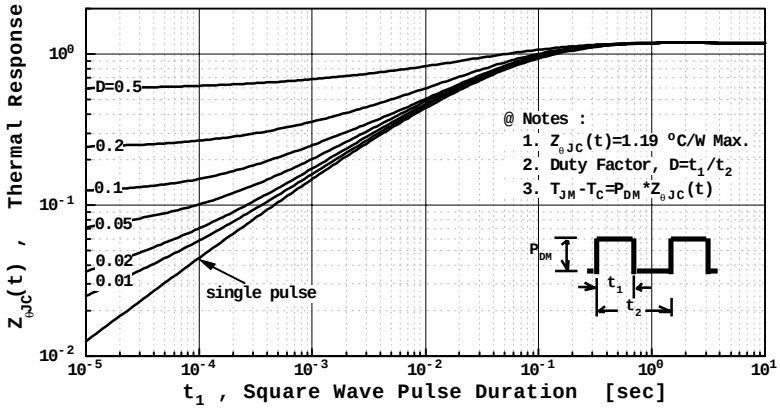


Fig 12. Gate Charge Test Circuit & Waveform

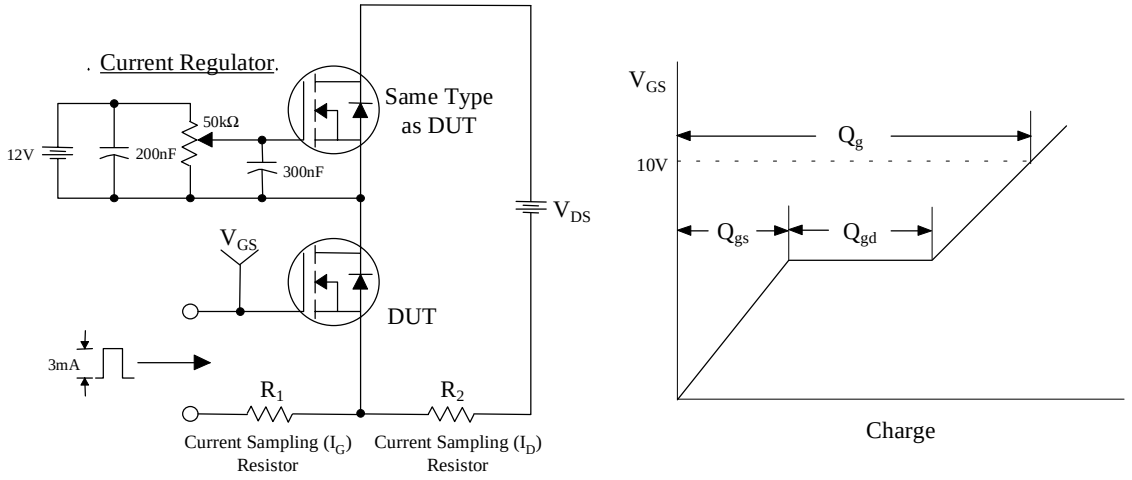


Fig 13. Resistive Switching Test Circuit & Waveforms

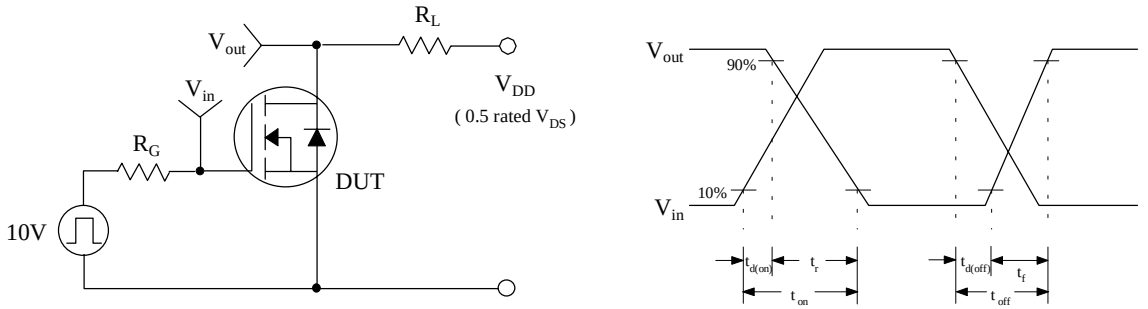


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

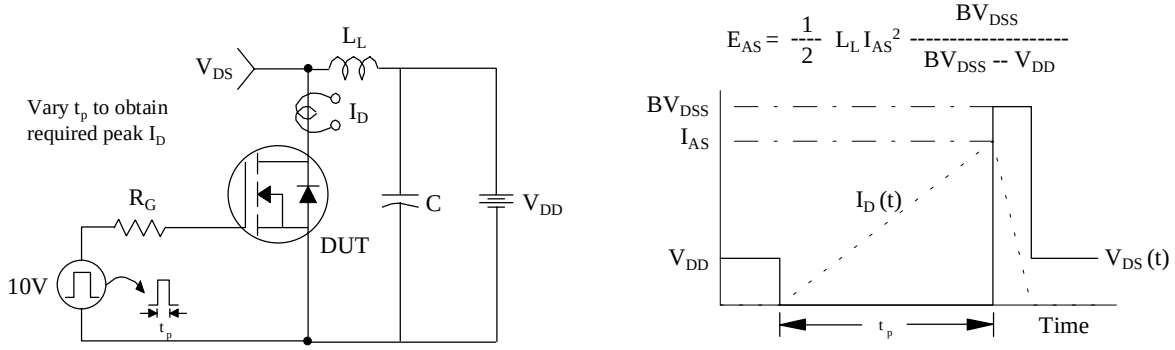
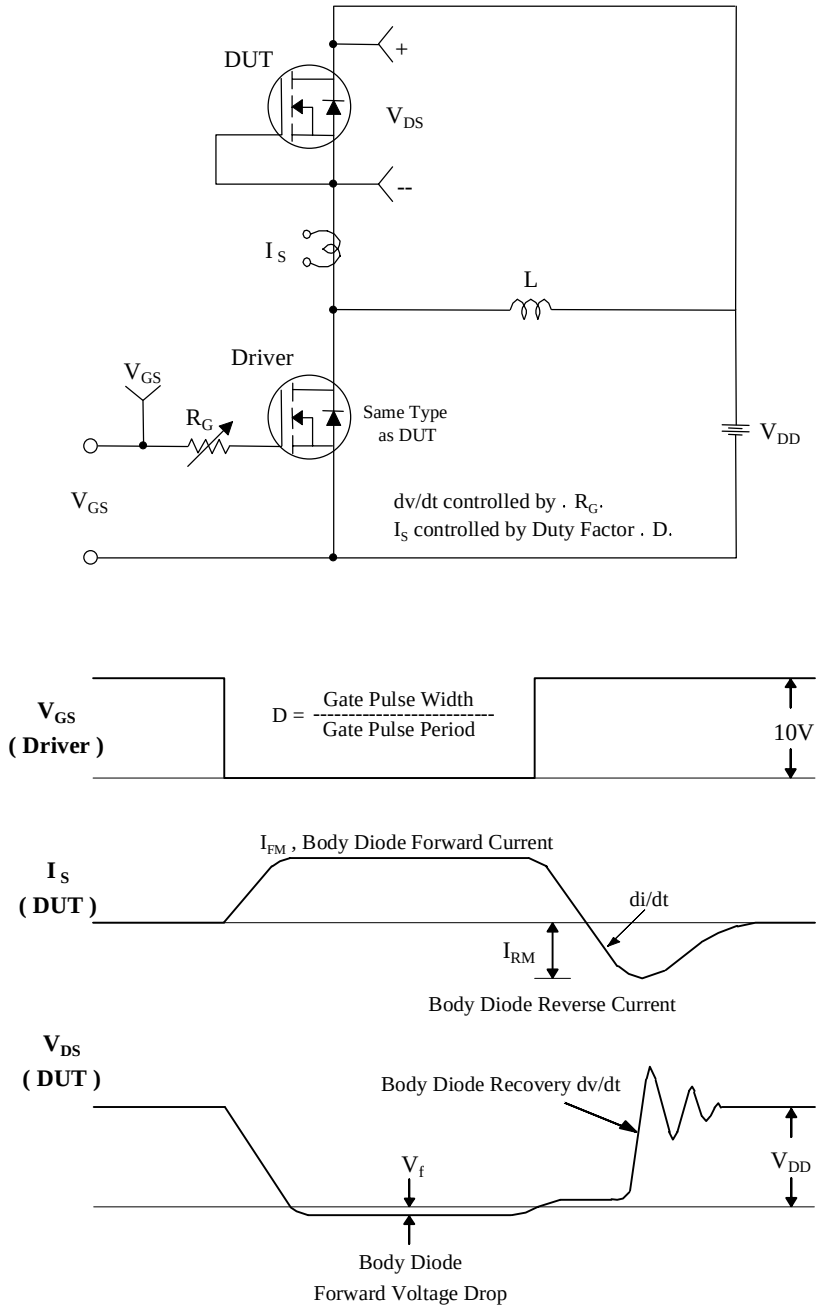


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

GEA Farm Technologies

Pulsation Systems

Setting the standard for durable and consistent pulsation

- Detacher controlled.
- Master controlled.
- Individual.
- Vacuum operated.

GEA Milking & Cooling | WestfaliaSurge

GEA Farm Technologies — The right choice.

Detacher controlled pulsation systems

Electronically efficient diaphragm pulsators

The Stimopuls Apex M and Autopuls Apex M connect directly to the detacher control — operated by the Metatron 21 Premium and Select, DemaTron 70, DemaTron 60 and 60S, and DeMax 55 and 55S systems. No additional power supplies or control are required for a simplified installation.

Pulsator shutoff at unit removal — for longer service life.

Settings downloaded from DairyPlan C21 or DairySetup software — changes are quick and accurate.

Flexible pulsation rates and ratios — adapts easily to different breeds and milking styles.

Electronic impulse solenoids — provides safe, low voltage and always-accurate pulses.

Quiet operation — means less noise in the parlor.

Bayonet base — simple ¼ turn removal and attachment.

Filtered air optional — provides longer service life.

Stimopuls Apex M

Provides individual pre-milking stimulation as well as the best milking operator — animals are stimulated individually depending on milkability and stage of lactation. With electronic stimulation the milk yield per cow may be increased. Stimulation is achieved through intensive massaging effect of the liner.

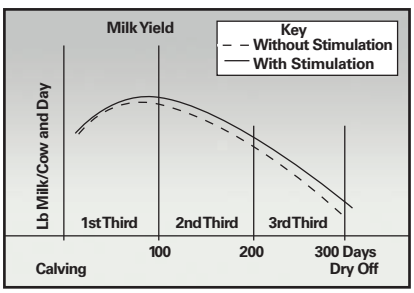
Autopuls Apex M

Offers state of the art pulsation with flexibility of rates and ratios. The Autopuls Apex M has all of the features mentioned to the left without stimulation capabilities.

Advantages of Stimopuls pulsation.

Better milk letdown, more effective milk-out — 30 to 60 seconds of stimulation prior to milking releases Oxytocin, the milk letdown hormone. The maximum effect of Oxytocin lasts only five minutes, so it's critical to begin milking immediately after stimulation. Premature attachment of a milking unit without proper stimulation slows the milking process and leaves milk in the udder at the end of milking. This milk is highest in butterfat content, so you may be missing the most valuable milk at the end of each milking.

More efficient than manual stimulation — as herd numbers grow and labor costs increase, it becomes increasingly difficult to provide 30 to 60 seconds of manual stimulation for each cow. You'll save time and effort with Stimopuls Apex M because you can put the milking unit on the cow immediately. What's more, electronic stimulation is consistent no matter who does the milking and the rate can be customized to each cow.

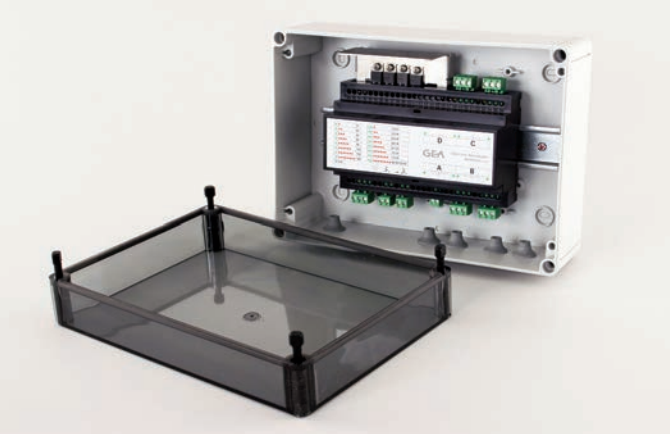


Stimulation Curve			
Vacuum Height	Pulsation Rate 300-310/min		Pulsation Rate 65/min
Phases	Stimulation 20, 40, 60, or 90 seconds	Change appr. 5 sec.	Milking
	Vacuum Height appr. 20 kPa (6 In. Hg)	Sliding Change to Milking	Pulsation Ratio 67:33

***Increased milk yields** — pre-milk stimulation may increase average milk yields over the entire lactation cycle.*

Master controlled diaphragm pulsation systems

Durable and accurate pulsators to fit any milking system



Centralpuls Apex Z

Large capacity — operates up to 16 alternating pulsators.

Power up to four groups of pulsators — provides better vacuum stability.

Adjustable pulsation rate — flexibility for each parlor.

Programmable milk to rest ratio — optimize for fast, gentle milking.

Operation independent from detachers — use with any equipment.

Autopuls Apex Z Pulsator

Operated by the Centralpuls controller — up to 16 pulsators working in groups of four.

Quiet operation — less noise in the parlor.

Electronic impulse solenoids — safe, low voltage with always-accurate pulses.

Upgradeable — will wire directly to detachers from GEA Farm Technologies (DemaTron, DeMax and Metatron) for independent operation and pulsator shut-off at unit removal.

Filtered air optional — provides longer service life.

Stand alone pulsator

An efficient way to customize pulsation

Autopuls Apex P

Stand alone system — can be used with any brand of equipment.

24-volt system — safe for cows and operators.

Electronic control resides within each pulsator — flexible system layout.

Adjustable pulsation rate and ratio — easily accommodates different breeds and installations.

Electronic impulse solenoids — always provides accurate pulses.

Filtered air optional — provides longer service life.

Each pulsator functions independently — better system vacuum stability.

Stand alone pulsation systems

The industry standard for reliability

Operation independent from detachers — use with any milking unit or detacher.

The direct-acting pulsator is available in permanently mounted and portable configurations — for flexibility of barn design and service needs.

Harsh environment plunger kits available — provides longer service life.

Safe 24-volt operation — means less exposure to stray voltage. Fused connection cards meet current electrical standards.

Filtered air optional — provides longer service life.

Heavy duty coils — low operating temperatures and robust electro-magnetic force provide long life and positive pulsator action.

Large porting — high air flow volume. More resistant to dirt.

Available in alternating and simultaneous versions — allowing for different milking styles.

Portable units have square bayonet-style nipple — less movement in stall cock, meaning less wear and better electrical connection.

Permanent mount direct acting with filtered air connection.

Permanent mount direct acting.

Portable direct acting.

VScom USB Industrial I/O Adapter

The VScom USB Industrial I/O Adapters consist of the following models:

- **USB to Single RS-422/485 Adapter (USB-COMi)**
- **USB to Single RS-422/485 Adapter**
  - with optical isolation and surge protection (USB-COMi-SI)
- **USB to Dual RS-422/485 Adapter (USB-2COMi)**
- **USB to Dual RS-422/485 Adapter**
  - with optical isolation and surge protection (USB-2COMi-SI)
- **USB to Quad RS-422/485 Adapter (USB-4COMi)**
- **USB to Quad RS-422/485 Adapter**
  - with optical isolation and surge protection (USB-4COMi-SI)

Introduction

The USB Industrial I/O Adapter is designed to make industrial communication port expansion quick and simple. Connecting to a USB port on your computer or USB hub, the USB Industrial I/O Adapter instantly adds industrial communication port to your system. By taking advantage of the USB bus, the USB Industrial I/O Adapter makes it easier than ever to add RS-422 or RS-485 device to your system with easy plug-and-play and hot plug features. Adapting the new technology, the industrial I/O communication port expansion now takes the new bus with easy and convenient connectivity.

Plugging the USB Industrial I/O Adapter to the USB port, the adapter is automatically detected and installed. There are no IRQ & COM port conflicts, since the port doesn't require any additional IRQ, DMA, memory as resources on the system. The serial port functions as native Windows COM port, and is compatible with Windows serial communication applications.

The USB Industrial I/O Adapter provides instant connectivity to RS-422/485 communication device for factory automation equipment, multi-drop data collection devices, barcode readers, time clocks, scales , data entry terminals, PC to PC long distance communications and serial communication in harsh environments. The USB Industrial I/O provides industrial solution for applications requiring single node or multi-drop communications over short and long distance.

Optical Isolation & Surge Protection

Optical isolation and surge protection are available to 3 models :

- **USB-COMi-SI USB to Single RS-422/485 Adapter**
- **USB-2COMi-SI USB to Dual RS-422/485 Adapter**
- **USB-4COMi-SI USB to Quad RS-422/485 Adapter**

Each RS-422/485 port is individually optically isolated with 2000 volt DC optical isolation. The optical isolation protects your PC or notebook from spikes and surges on the RS-422/485 network, by converting the electrical pulse into an optical signal and then changing it back into an electrical pulse. Your computer is well protected, since the surges and spikes cannot cross the optical link.

Each RS-422/485 port is individually protected by surge protector to withstand electrostatic discharge and power surges up to 25KV ESD. Surge suppression on all signals prevent from damages caused by lighting or high voltage.

Power Supply

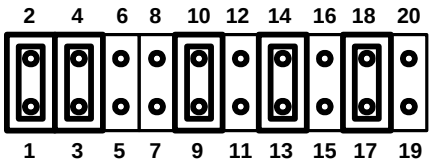
- **The single port versions, USB-COMi & USB-COMi-SI, are powered by the USB port. No external power supply is needed.**

- **The dual & quad port versions require an external power adapter.**
  The USB-2COMi, USB-2COMi-SI, USB-4COMi, USB-4COMi-SI are provided with an external power adapter in the package. You need to plug the power adapter to the power source first before driver installation.

Hardware Installation

Inside the unit, there is a 10 x 2 (20 pin) header block which is jumpered to select the mode of operation. You will need to open up the plastics covers and set the jumper settings to RS-422 mode or RS-485 mode as per the requirements of your application. After the setting of jumpers and connecting power supply to the adapter, you then plug the adapter to USB port to start driver installation. The RS-422 & RS-485 Mode Block Configuration Settings are listed as follows.

Example jumper block setting (RS-422 mode)



RS-422 Mode Block Configuration

Jumper	Function
1-2	TxD / RxD Termination of 120 Ohm. This jumper should always be populated for RS-422.
3-4	CTS/ RTS Termination of 120 Ohm. This jumper should always be populated for RS-422.
9-10	TxD Driver Always On. As RS-422 is full duplex point to point, the transmitter should always be enabled.
13-14	RxD Always Enabled. As RS-422 is full duplex point to point, the receiver should always be enabled.
17-18	Enable CTS Handshaking. This setting allows the data flow to be controlled using CTS/RTS handshaking if required by the application.

Note : all other positions = no jumper populated.

RS-485 Mode Block Configuration

Jumper	Function
1-2	TxD / RxD Termination of 120 Ohm. This jumper should only be populated at each end of the cable to meet RS-485 termination requirements.
5-6 7-8	TxD / RxD Single Pair (half duplex for RS485). Populate both these jumpers.
11-12	Enable TxD Driver only when transmitting. This is required by RS485 as multiple devices can transmit over the same twisted pair. When a RS-485 is not transmitting, it's transmitter must be turned off to allow other devices to communicate over the same wires.
EITHER 13-14 OR 15 - 16	RxD Always Enabled. In this mode characters transmitted by the RS485 device will also be received by the same device. These echoed characters are usually stripped out by the application software. Transmit Data Echo Suppression Mode. In this mode characters transmitted by the RS485 device will NOT be received by the same device. In this mode there is no need for the application software to strip out the transmitted data from the received data as it is handled by the hardware.
19-20	CTS Always Enabled. As there is no hardware handshaking in RS-485 , CTS should be permanently enabled to allow unrestricted flow of data. If handshaking is required for RS-485 it can be done using X-On / X-Off handshaking protocol.

Note : all other positions = no jumper populated.

Driver Installation

Windows 98 / SE/ ME Driver Installation

1. **Plug in the USB connector into the USB port on the Adapter, and connect the USB connector on the other end of the cable to the host USB port in your computer.**
2. **The connection brings up a "Building Driver Information Database" followed by the Add New Hardware Wizard.**
3. **The "Add New Hardware Wizard" searches for the new drivers for USB Serial Adapter. Click "Next".**
4. **Select "Search for the best driver for your device" and click "Next".**
5. **Select "Specify a location" and click "Next". In the "Copy Manufacturer's file from", type "D:\Win98\USB_Driver\USB-COM" where "D" is the location of your CD-ROM.**
6. **Windows driver file searches for the device "USB-COM Serial Adapter"**
7. **Click "Next" to continue.**
8. **Windows has finished installing the software. Click "Finish" to complete installation.**

Note: The "Add New Hardware Wizard" will appear again if you are installing USB Multiple Serial Ports Version, e.g. USB-2COM/i or USB-4COM/i. You need to repeat the installation procedures one more time for Dual- port version, and three more times for Quad-port version.

Check Installation

You can now verify the installation has completely successfully by looking under Device Manager of the System Properties screen. (Go there by Start-Setting-Control Panel-System-Device Manager).
The device should have installed as a "USB Serial Port (COMx)" attached to "USB High Speed Serial Converter".

Change COM Port Properties & COM Port Number

This feature is particularly useful for programs, such as HyperTerminal, which only work with COM1 through COM4. Please ensure that you do not change the COM Port Number already in use.

To change the virtual COM port properties:

- **Select the "USB Serial Port"**
- **Click "Properties".**
- **Select "Port Setting"**
- **Select "Advanced"**
- **Click the drop down arrow on COM Port Number and scroll to the required COM port.**
- **Select "OK".**
- **Return to the Device Manager Screen. You will see that the USB Serial Port installation has been changed to the new COM Port Number.**

Windows 2000 Driver Installation

You need to have administrator privileges to install any new drivers under Windows 2000. To install the driver or update the configuration please log onto Windows 2000 as "Administrator" or ask your system administrator to install the USB I/O adapter and driver.

Please proceed with the following steps to install the driver:

1. **Plug in the USB connector into the USB port on the Adapter, and connect the USB connector on the other end of the cable to the host USB port in your computer.**
2. **The connection brings up "Found New Hardware Wizard".**
3. **Click "Next".**
4. **Select "Search for the best driver for my device", and click "Next".**
5. **Select "Specify a location" and click "Next". In the "Copy Manufacturer's file from", type "D:\Win2000\USB_Driver\USB-COM" where "D" is the location of your CD-ROM.**
6. **Windows driver file searches for the device "USB-COM Serial Adapter"**
7. **Click "Next" to continue.**
8. **Windows has finished installing the software. Click "Finish" to complete the first part of installation.**
9. **The "Found New Hardware Wizard" appears again, and will complete the installation for the device "USB Serial Port".**
10. **Repeat step (4) to (8) to complete installation.**

Note: The "Found New Hardware Wizard" will appear again if you are installing USB Multiple Serial Ports Version, e.g. USB-2COM/i or USB-4COM/i. You need to repeat the installation procedures one more time for Dual- port version, and three more times for Quad-port version.

Check Installation

You can now verify the installation has completely successfully by looking under Device Manager of the System Properties screen. (Go there by Start-Setting-Control Panel-System Properties-Hardware-Device Manager-Select View-Device by connection).

The device should have installed as a "USB Serial Port (COMx)" attached to "USB High Speed Serial Converter".

Change COM Port Properties & COM Port Number

This feature is particularly useful for programs, such as HyperTerminal, which only work with COM1 through COM4. Please ensure that you do not change the COM Port Number already in use.

To change the virtual COM port properties:

- **Select the "USB Serial Port"**
- **Click "Properties".**
- **Select "Port Setting"**
- **Select "Advanced"**
- **Click the drop down arrow on COM Port Number and scroll to the required COM port.**
- **Select "OK".**
- **Return to the Device Manager Screen. You will see that the USB Serial Port installation has been changed to the new COM Port Number.**

Uninstalling Windows 9x Drivers

To uninstall the Windows 9x drivers :

- **Insert the provided CD-ROM**
- **Double click “My Computer”**
- **Select “D:\”, where “D” is the location of your CD-ROM**
- **Double click “Win98” or “WinME”**
- **Double click “USB_Drivers”**
- **Double click “USB-COM”**
- **Double click “ Ftdiunin”**
- **Select “OK” to delete the drivers.**
- **Select “Finish”.**
- **Reboot the computer to complete the driver uninstall.**

Uninstalling Windows 2000 Drivers

To uninstall the Windows 2000 drivers :

- **Insert the provided CD-ROM**
- **Double click “My Computer”**
- **Select “D:\”, where “D” is the location of your CD-ROM**
- **Double click “Win2000”**
- **Double click “USB_Drivers”**
- **Double click “USB-COM”**
- **Double click “ Ftdiun2K”**
- **Select “OK” to delete the drivers.**
- **Select “Finish”.**
- **Reboot the computer to complete the driver uninstall.**

Signal Pin-outs of DB-9 Male

Pin 1	TxD- (A)
Pin 2	TxD+(B)
Pin 3	RxD+(B)
Pin 4	RxD-(A)
Pin 5	GND
Pin 6	RTS- (A)
Pin 7	RTS+(B)
Pin 8	CTS+(B)
Pin 9	CTS- (A)

RS-422 Signal Wiring

- **Point-to-Point 4 Wire Full Duplex**

USB-COMi		RS-422 Device
2	TxD+(B) ⟷	RxD+ (B)
1	TxD- (A) ⟷	RxD- (A)
3	RxD+ (B) ⟷	TxD+(B)
4	RxD- (A) ⟷	TxD- (A)
5	GND ⟷	GND

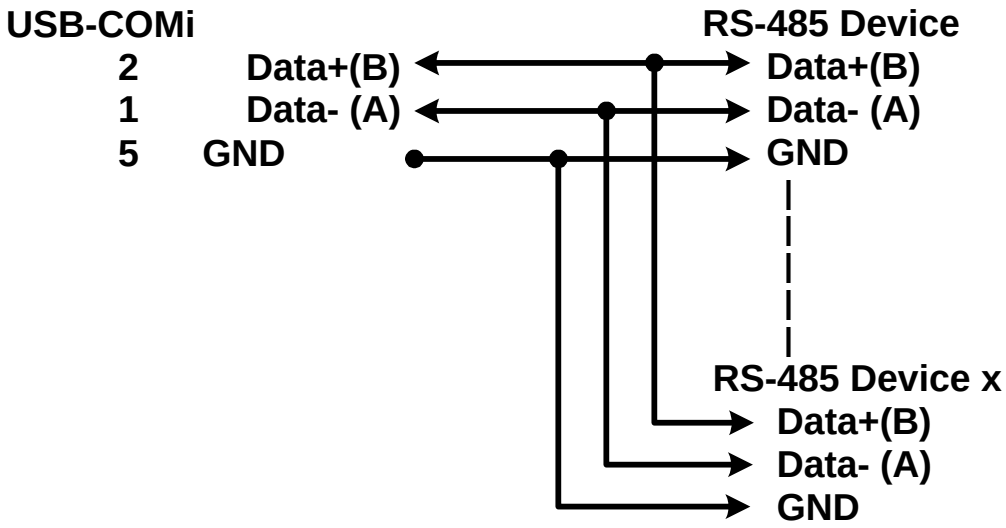
- **RS-422 with Handshaking**

USB-COMi		RS-422 Device
2	TxD+(B) ⟷	RxD+ (B)
1	TxD- (A) ⟷	RxD- (A)
3	RxD+ (B) ⟷	TxD+(B)
4	RxD- (A) ⟷	TxD- (A)
5	GND ⟷	GND
7	RTS+(B) ⟷	CTS+(B)
6	RTS- (A) ⟷	CTS- (A)
8	CTS+(B) ⟷	RTS+(B)
9	CTS- (A) ⟷	RTS- (A)

RS-485 Signal Pin-outs of DB-9 Male

Pin 1	**Data- (A)**
Pin 2	**Data+(B)**
Pin 5	**GND**

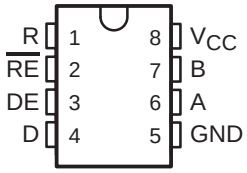
RS-485 Signal Wiring



- **Multidrop RS-485 2-Wire Half-duplex**

- **Bidirectional Transceiver**
- **Meets or Exceeds the Requirements of ANSI Standards EIA/TIA-422-B and ITU Recommendation V.11**
- **Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **3-State Driver and Receiver Outputs**
- **Individual Driver and Receiver Enables**
- **Wide Positive and Negative Input/Output Bus Voltage Ranges**
- **Driver Output Capability . . . ±60 mA Max**
- **Thermal-Shutdown Protection**
- **Driver Positive- and Negative-Current Limiting**
- **Receiver Input Impedance . . . 12 kΩ Min**
- **Receiver Input Sensitivity . . . ±200 mV**
- **Receiver Input Hysteresis . . . 50 mV Typ**
- **Operates From Single 5-V Supply**
- **Low Power Requirements**

D OR P PACKAGE
(TOP VIEW)



description

The SN75176A differential bus transceiver is a monolithic integrated circuit designed for bidirectional data communication on multipoint bus-transmission lines. It is designed for balanced transmission lines and meets ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11.

The SN75176A combines a 3-state differential line driver and a differential input line receiver, both of which operate from a single 5-V power supply. The driver and receiver have active-high and active-low enables, respectively, that can be externally connected together to function as a direction control. The driver differential outputs and the receiver differential inputs are connected internally to form differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus whenever the driver is disabled or V_{CC} = 0. These ports feature wide positive and negative common-mode voltage ranges making the device suitable for party-line applications.

The driver is designed to handle loads up to 60 mA of sink or source current. The driver features positive- and negative-current limiting and thermal shutdown for protection from line fault conditions. Thermal shutdown is designed to occur at a junction temperature of approximately 150°C. The receiver features a minimum input impedance of 12 kΩ, an input sensitivity of ±200 mV, and a typical input hysteresis of 50 mV.

The SN75176A can be used in transmission-line applications employing the SN75172 and SN75174 quadruple differential line drivers and SN75173 and SN75175 quadruple differential line receivers.

The SN75176A is characterized for operation from 0°C to 70°C.

Function Tables

DRIVER

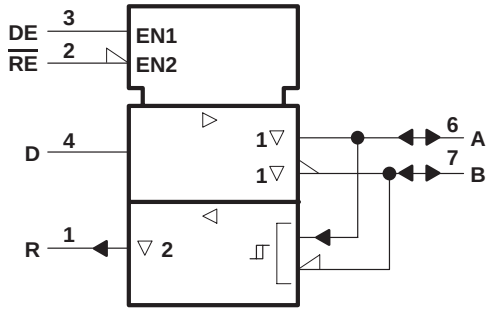
INPUT D	ENABLE DE	OUTPUTS A	OUTPUTS B
H	H	H	L
L	H	L	H
X	L	Z	Z

RECEIVER

DIFFERENTIAL INPUTS A – B	ENABLE $\overline{RE}$	OUTPUT R
$V_{ID} \geq 0.2$ V	L	H
-0.2 V $< V_{ID} < 0.2$ V	L	?
$V_{ID} \leq -0.2$ V	L	L
X	H	Z
Open	L	?

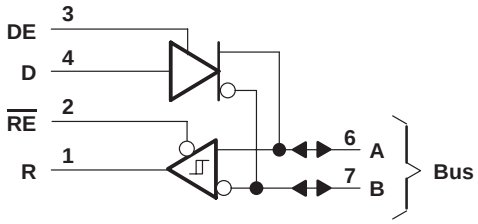
H = high level, L = low level, ? = indeterminate,
X = irrelevant, Z = high impedance (off)

logic symbol†

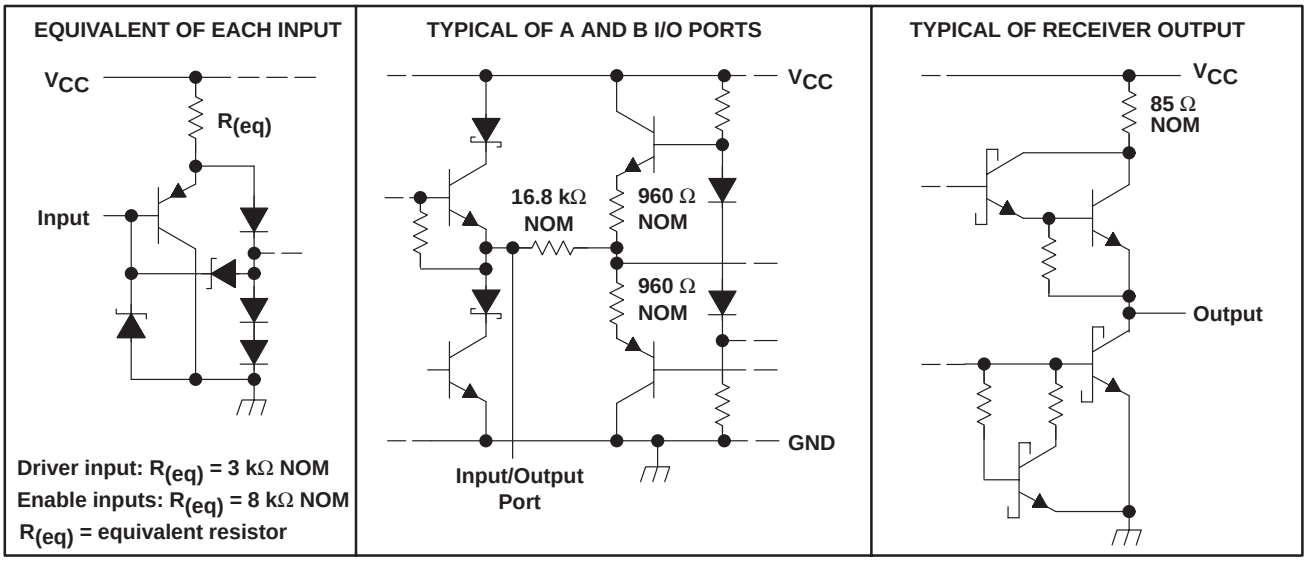


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



schematics of inputs and outputs



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Voltage range at any bus terminal . . . . . –10 V to 15 V
Enable input voltage, V_I . . . . . 5.5 V
Continuous total power dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values, except differential input/output bus voltage, are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 105°C$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	261 mW
P	1100 mW	8.8 mW/°C	704 mW	396 mW

recommended operating conditions

		MIN	TYP	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
Voltage at any bus terminal (separately or common mode), V_I or V_{IC}		–7		12	V
High-level input voltage, V_{IH}	D, DE, and $\overline{RE}$	2			V
Low-level input voltage, V_{IL}	D, DE, and $\overline{RE}$			0.8	V
Differential input voltage, V_{ID} (see Note 2)				±12	V
High-level output current, I_{OH}	Driver			–60	mA
	Receiver			–400	μA
Low-level output current, I_{OL}	Driver			60	mA
	Receiver			8	
Operating free-air temperature, T_A		0		70	°C

NOTE 2: Differential-input/output bus voltage is measured at the noninverting terminal A with respect to the inverting terminal B.

DRIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	Input clamp voltage	I_I = –18 mA				–1.5	V
V_{OH}	High-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = –33 mA			3.7		V
V_{OL}	Low-level output voltage	V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = 33 mA			1.1		V
$\|V_{OD1}\|$	Differential output voltage	I_O = 0				$2V_{OD2}$	V
$\|V_{OD2}\|$	Differential output voltage	R_L = 100 Ω,	See Figure 1	2	2.7		V
		R_L = 54 Ω,	See Figure 1	1.5	2.4		
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage‡					±0.2	V
V_{OC}	Common-mode output voltage§	R_L = 54 Ω or 100 Ω, See Figure 1				3	V
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage‡					±0.2	V
I_O	Output current	Output disabled, See Note 3	V_O = 12 V			1	mA
			V_O = – 7 V			–0.8	
I_{IH}	High-level input current	V_I = 2.4 V				20	μA
I_{IL}	Low-level input current	V_I = 0.4 V				–400	μA
I_{OS}	Short-circuit output current	V_O = – 7 V				–250	mA
		V_O = V_{CC}				250	
		V_O = 12 V				500	
I_{CC}	Supply current (total package)	No load	Outputs enabled		35	50	mA
			Outputs disabled		26	40	

† All typical values are at V_{CC} = 5 V and T_A = 25°C.
‡ $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC} respectively, that occur when the input is changed from a high level to a low level.
§ In ANSI Standard EIA/TIA-422-B, V_{OC}, which is the average of the two output voltages with respect to GND, is called output offset voltage, V_{OS}.
NOTE 3: This applies for both power on and off; refer to ANSI Standard EIA/TIA-422-B for exact conditions.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential-output delay time	R_L = 60 Ω,	See Figure 3		40	60	ns
$t_{t(OD)}$	Differential-output transition time				65	95	ns
t_{PZH}	Output enable time to high level	R_L = 110 Ω,	See Figure 4		55	90	ns
t_{PZL}	Output enable time to low level	R_L = 110 Ω,	See Figure 5		30	50	ns
t_{PHZ}	Output disable time from high level	R_L = 110 Ω,	See Figure 4		85	130	ns
t_{PLZ}	Output disable time from low level	R_L = 110 Ω,	See Figure 5		20	40	ns

RECEIVER SECTION

electrical characteristics over recommended ranges of common-mode input voltage, supply voltage, and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	V_O = 2.7 V, I_O = –0.4 mA				0.2	V
V_{IT-}	Negative-going input threshold voltage	V_O = 0.5 V, I_O = 8 mA		–0.2‡			V
V_{hys}	Input hysteresis voltage ($V_{IT+} – V_{IT-}$)				50		mV
V_{IK}	Enable clamp voltage	I_I = –18 mA				–1.5	V
V_{OH}	High-level output voltage	V_{ID} = 200 mV, See Figure 2	I_{OH} = –400 μA,	2.7			V
V_{OL}	Low-level output voltage	V_{ID} = –200 mV, See Figure 2	I_{OL} = 8 mA,			0.45	V
I_{OZ}	High-impedance-state output current	V_O = 0.4 V to 2.4 V				±20	μA
I_I	Line input current	Other input = 0 V, See Note 3	V_I = 12 V			1	mA
			V_I = –7 V			–0.8	
I_{IH}	High-level enable input current	V_{IH} = 2.7 V				20	μA
I_{IL}	Low-level enable input current	V_{IL} = 0.4 V				–100	μA
r_i	Input resistance			12			kΩ
I_{OS}	Short-circuit output current			–15		–85	mA
I_{CC}	Supply current (total package)	No load	Outputs enabled		35	50	mA
			Outputs disabled		26	40	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ The algebraic convention, in which the less-positive (more-negative) limit is designated minimum, is used in this data sheet for common-mode input voltage and threshold voltage levels only.
NOTE 3: This applies for both power on and power off. Refer to ANSI Standard EIA/TIA-422-B for exact conditions.

switching characteristics, V_{CC} = 5 V, C_L = 15 pF, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	V_{ID} = –1.5 V to 1.5 V, See Figure 6		21	35	ns
t_{PHL}	Propagation delay time, high-to-low-level output			23	35	ns
t_{PZH}	Output enable time to high level	See Figure 7		10	30	ns
t_{PZL}	Output enable time to low level			12	30	ns
t_{PHZ}	Output disable time from high level	See Figure 7		20	35	ns
t_{PLZ}	Output disable time from low level			17	25	ns

PARAMETER MEASUREMENT INFORMATION

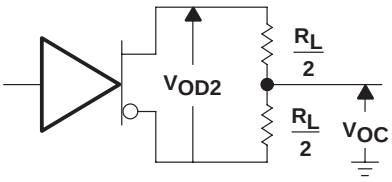


Figure 1. Driver V_{OD} and V_{OC}

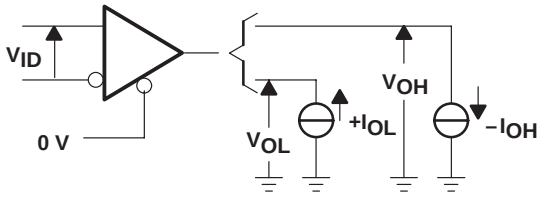
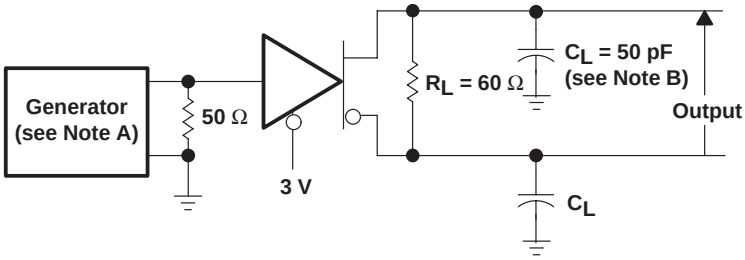
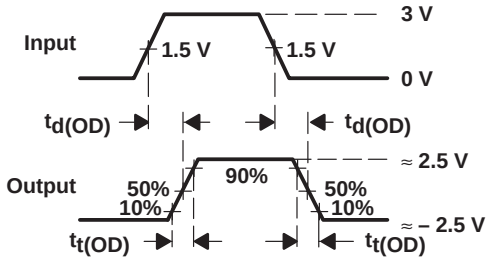


Figure 2. Receiver V_{OH} and V_{OL}



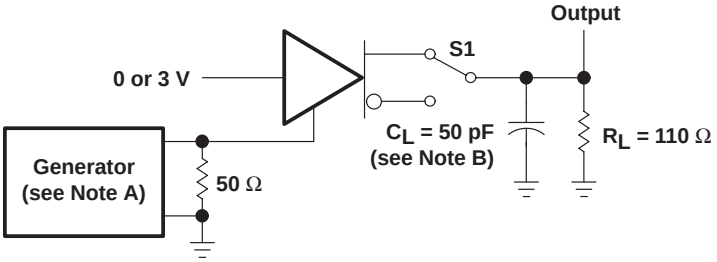
TEST CIRCUIT



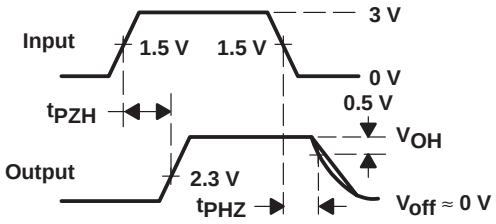
VOLTAGE WAVEFORMS

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, 50% duty cycle, $t_r \le 6$ ns, $t_f \le 6$ ns, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

Figure 3. Driver Test Circuit and Voltage Waveforms



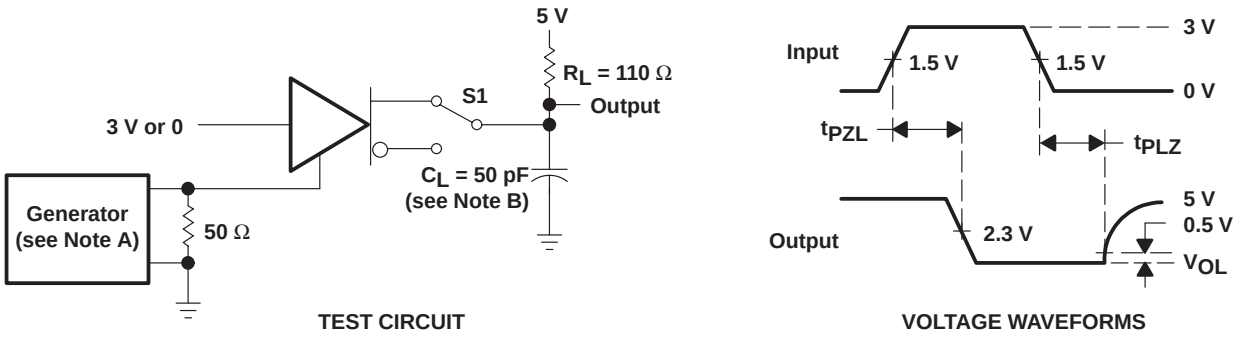
TEST CIRCUIT



VOLTAGE WAVEFORMS

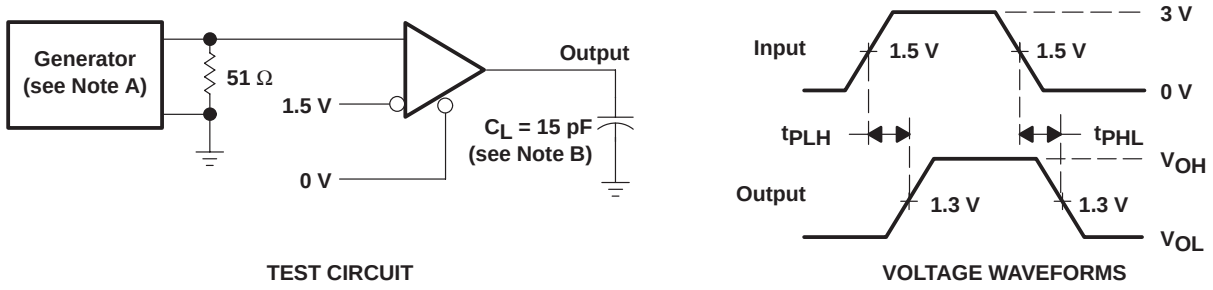
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, 50% duty cycle, $t_r \le 6$ ns, $t_f \le 6$ ns, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

Figure 4. Driver Test Circuit and Voltage Waveforms



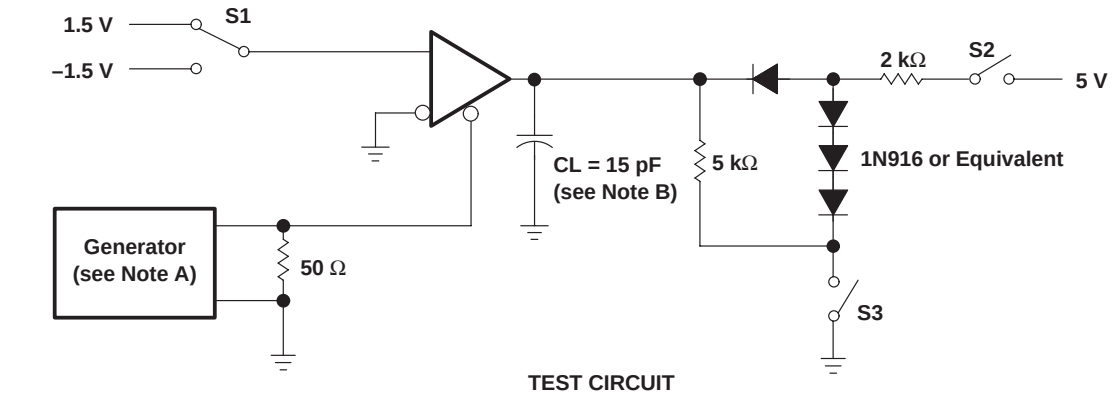
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, 50% duty cycle, $t_r \le 6$ ns, $t_f \le 6$ ns, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

Figure 5. Driver Test Circuit and Voltage Waveforms

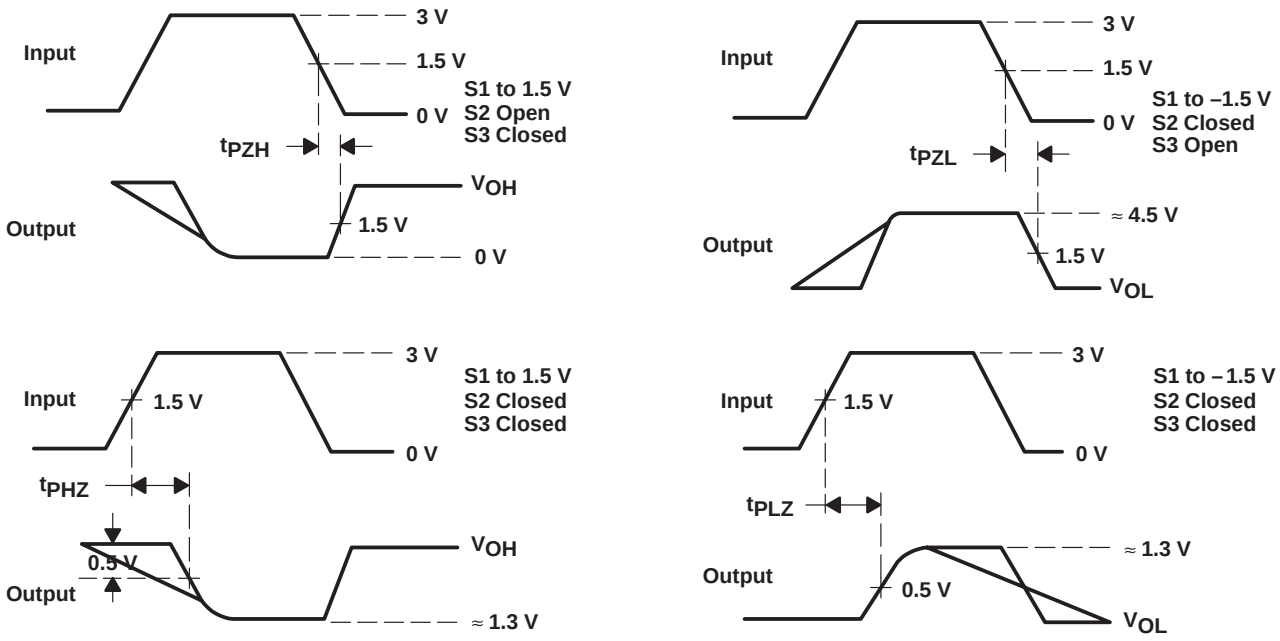


NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, 50% duty cycle, $t_r \le 6$ ns, $t_f \le 6$ ns, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

Figure 6. Receiver Test Circuit and Voltage Waveforms



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, 50% duty cycle, $t_r \le 6$ ns, $t_f \le 6$ ns, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

Figure 7. Receiver Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

DRIVER
HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

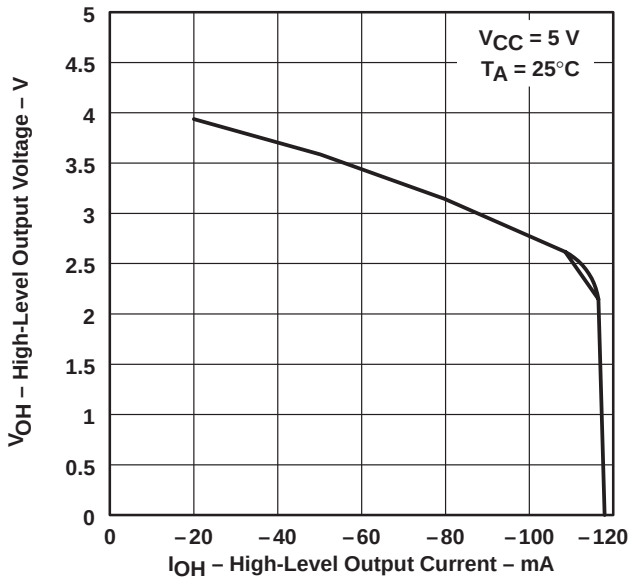


Figure 8

DRIVER
LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

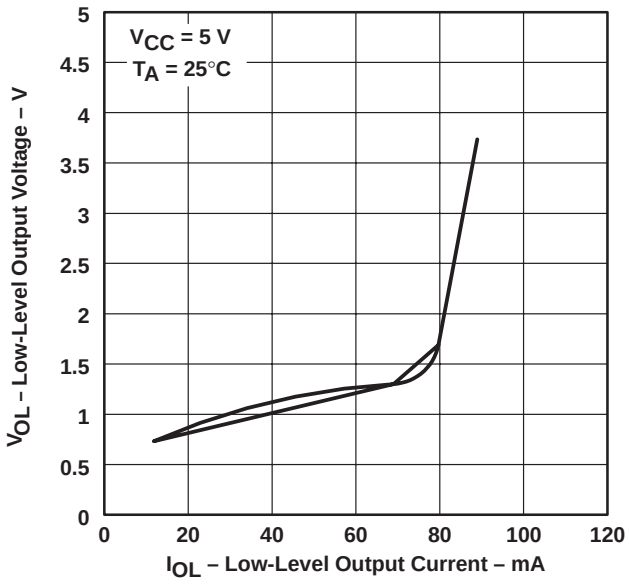


Figure 9

DRIVER
DIFFERENTIAL OUTPUT VOLTAGE
vs
OUTPUT CURRENT

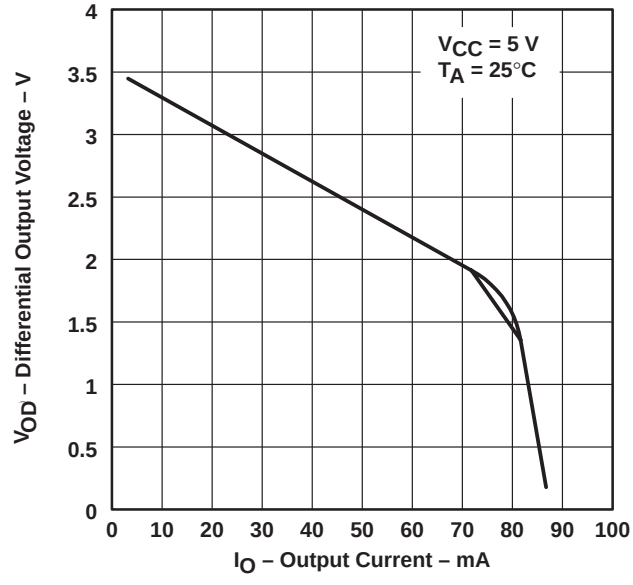


Figure 10

RECEIVER
LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

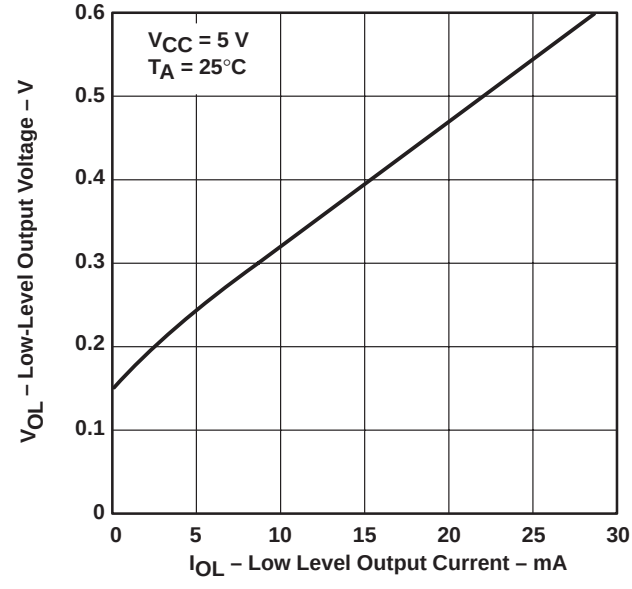


Figure 11

TYPICAL CHARACTERISTICS

RECEIVER
LOW-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

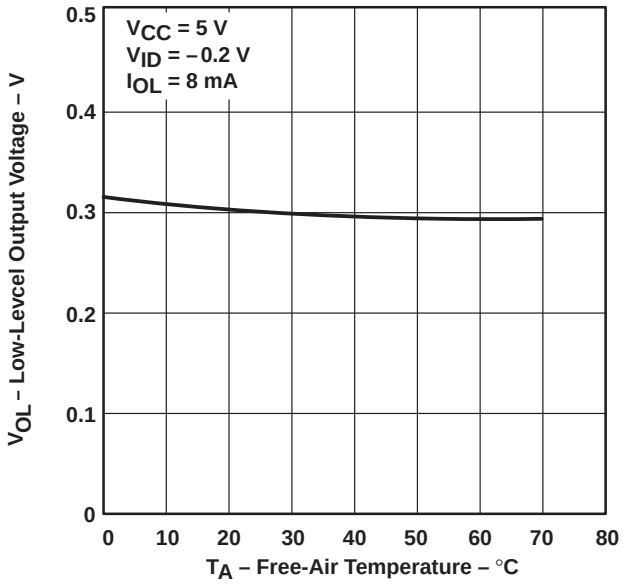


Figure 12

RECEIVER
OUTPUT VOLTAGE
vs
ENABLE VOLTAGE

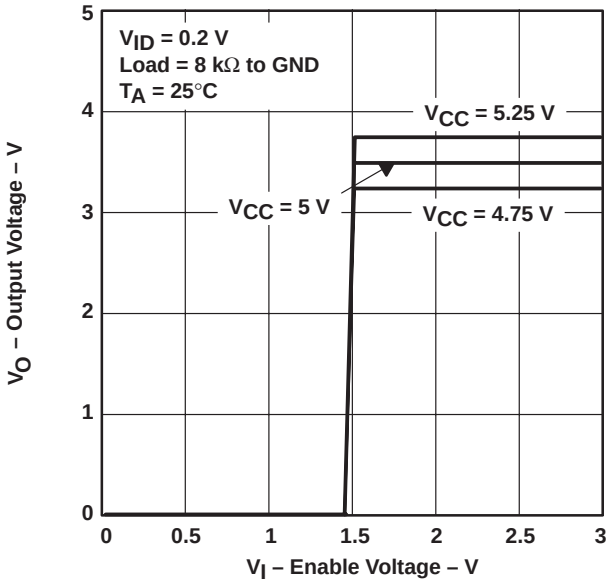


Figure 13

RECEIVER
OUTPUT VOLTAGE
vs
ENABLE VOLTAGE

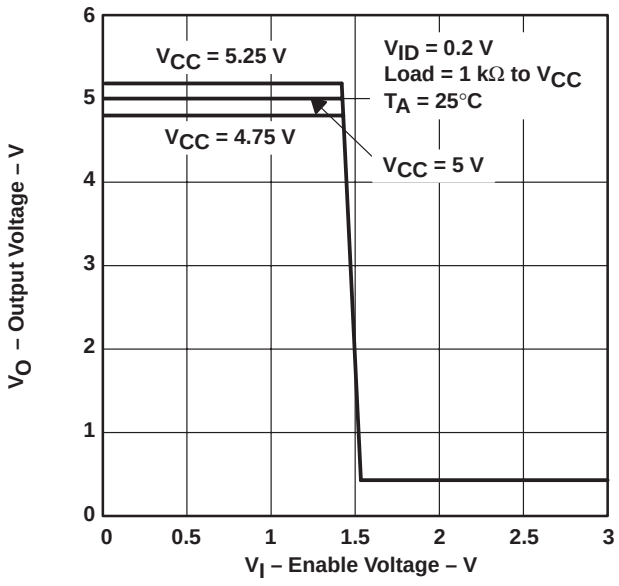
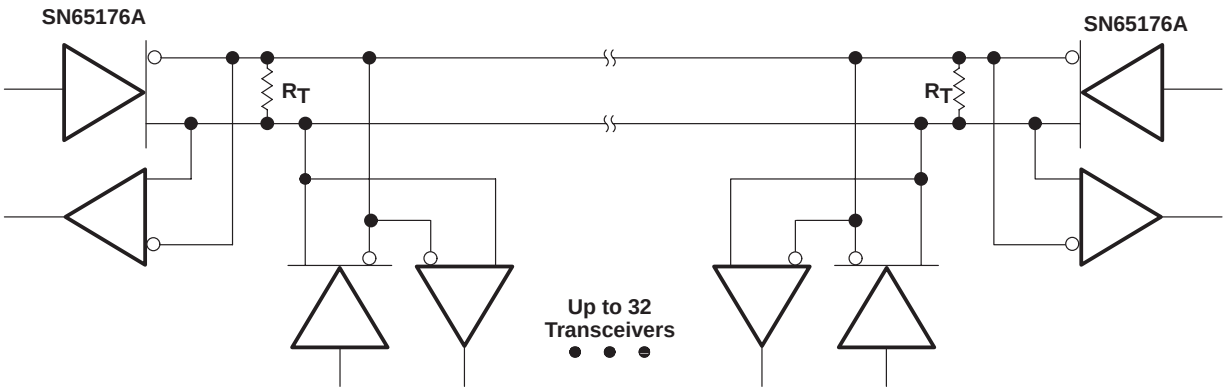


Figure 14

APPLICATION INFORMATION



NOTE A: The line should be terminated at both ends in its characteristic impedance ($R_T = Z_O$). Stub lengths off the main line should be kept as short as possible.

Figure 15. Typical Application Circuit

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN75176AD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176ADE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176ADG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176ADR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176ADRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176ADRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75176AP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75176APE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

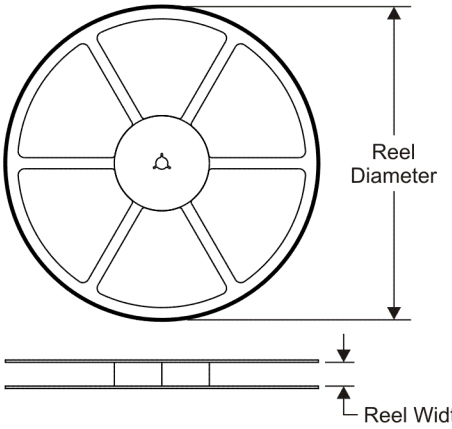
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

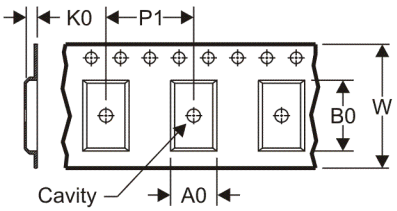
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

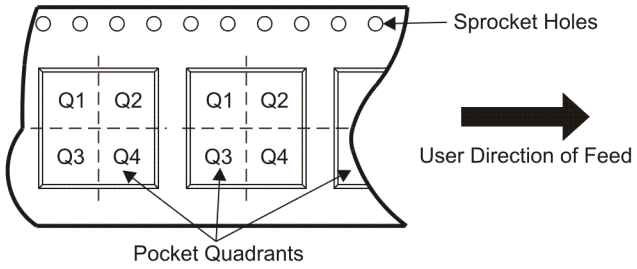


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

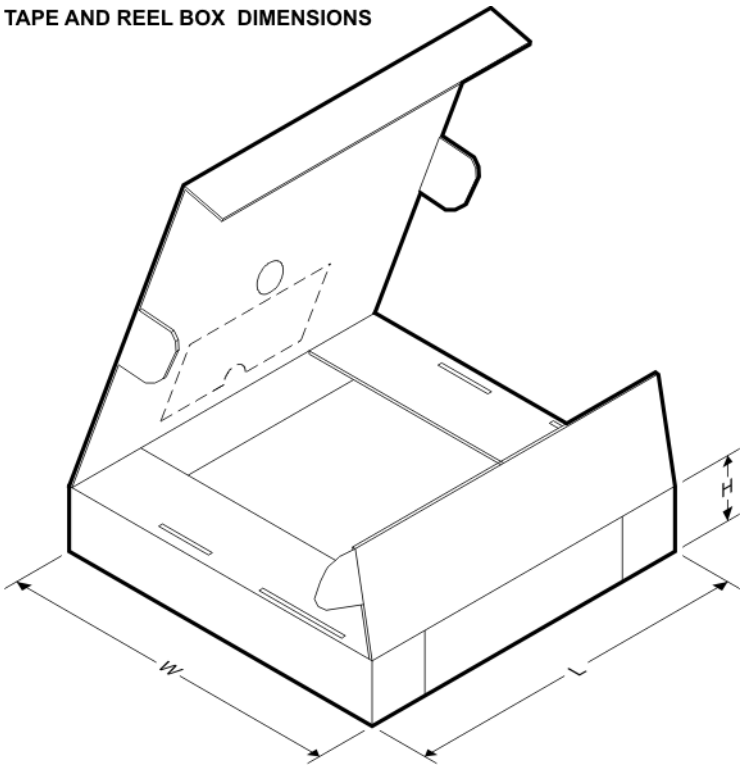
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75176ADR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

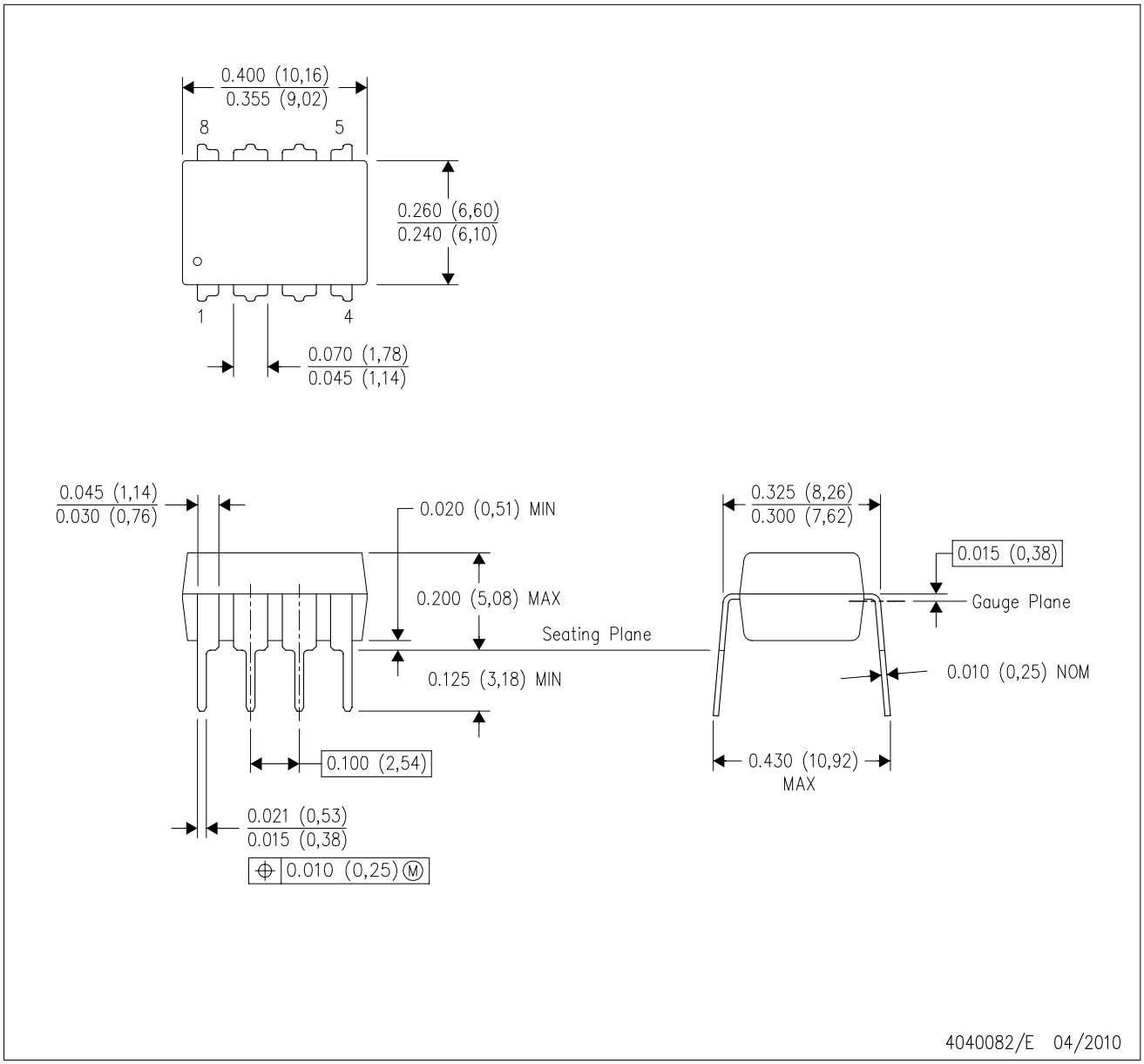
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

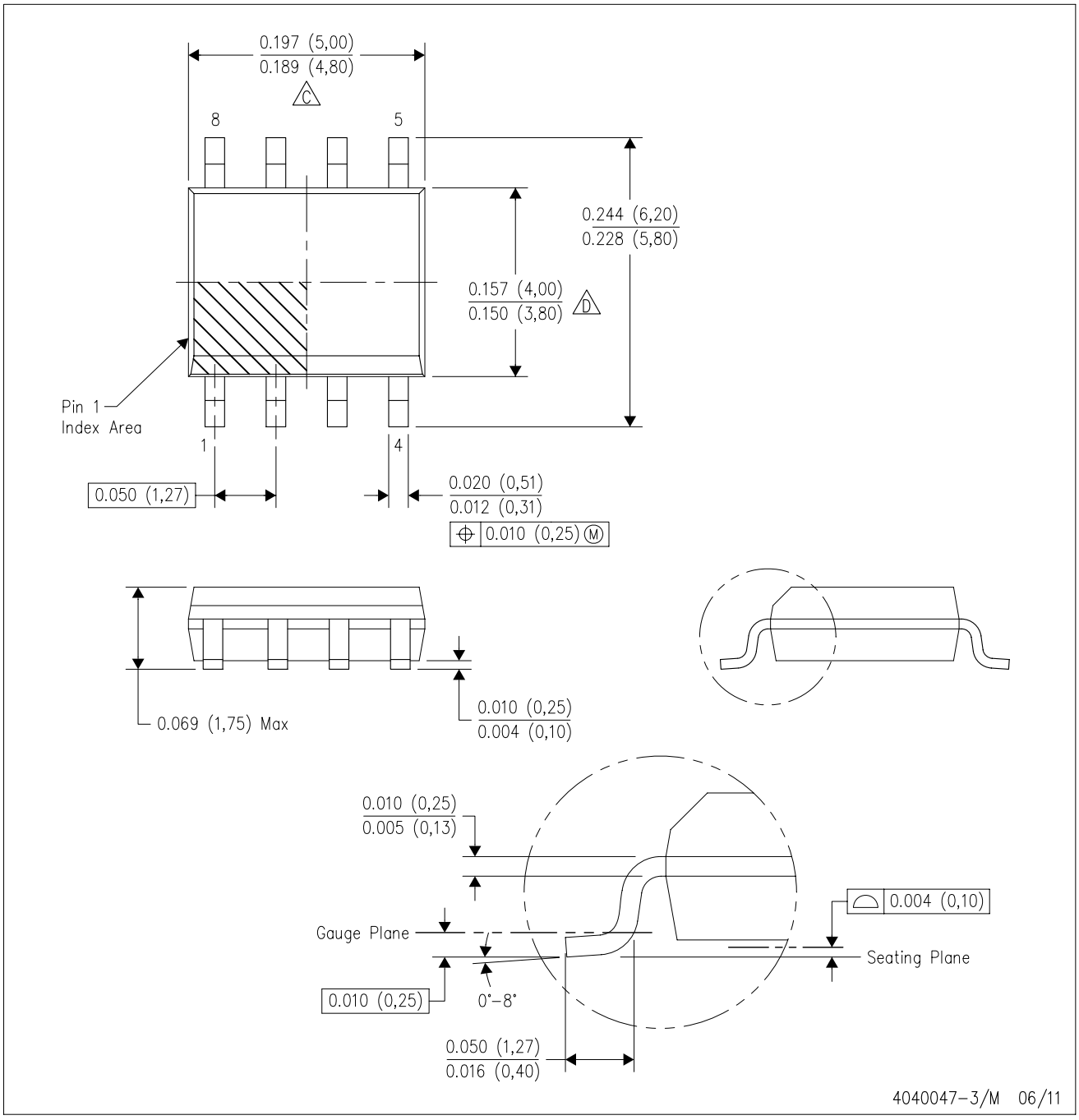
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75176ADR	SOIC	D	8	2500	340.5	338.1	20.6

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE



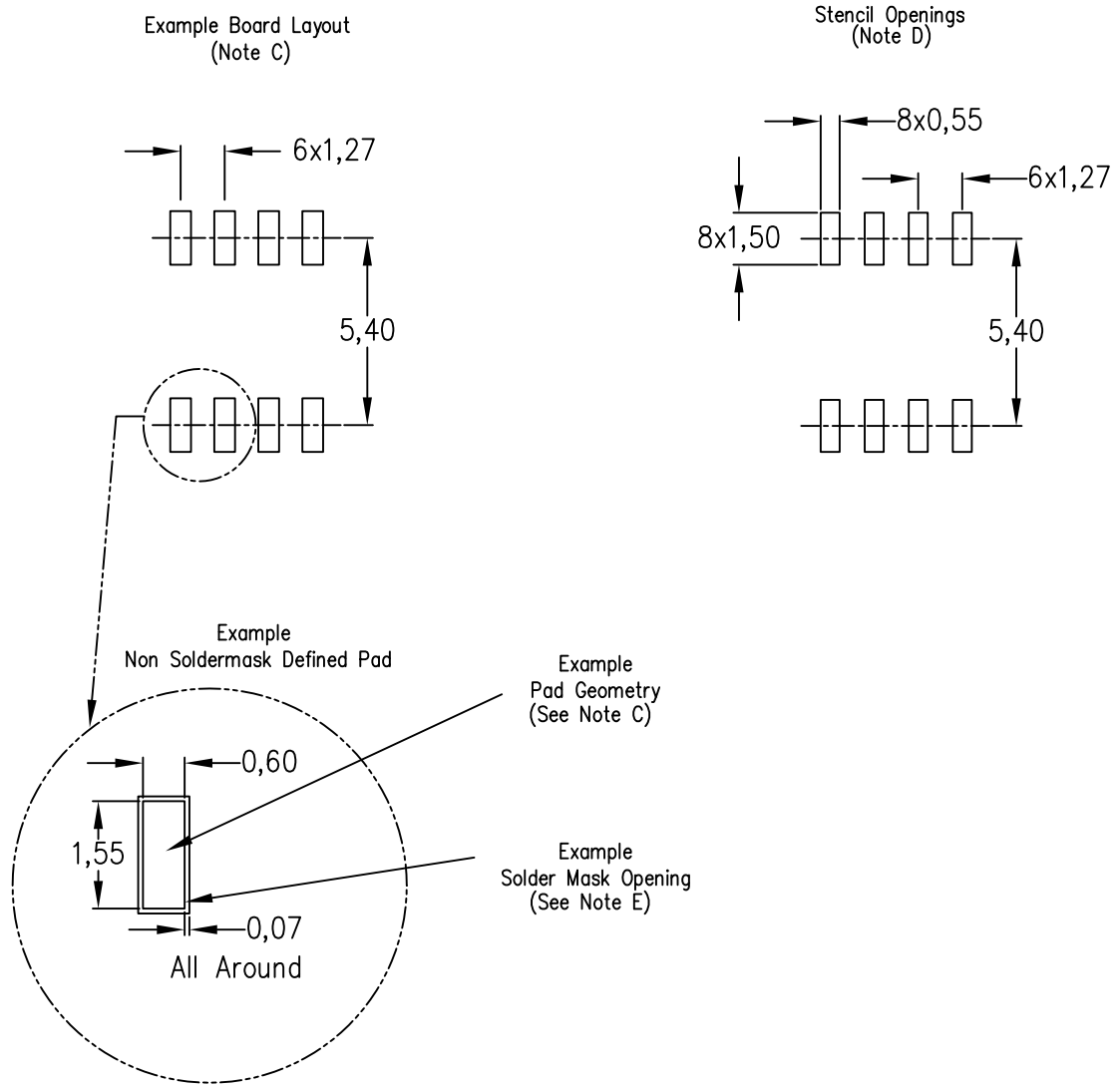
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

■ Features :

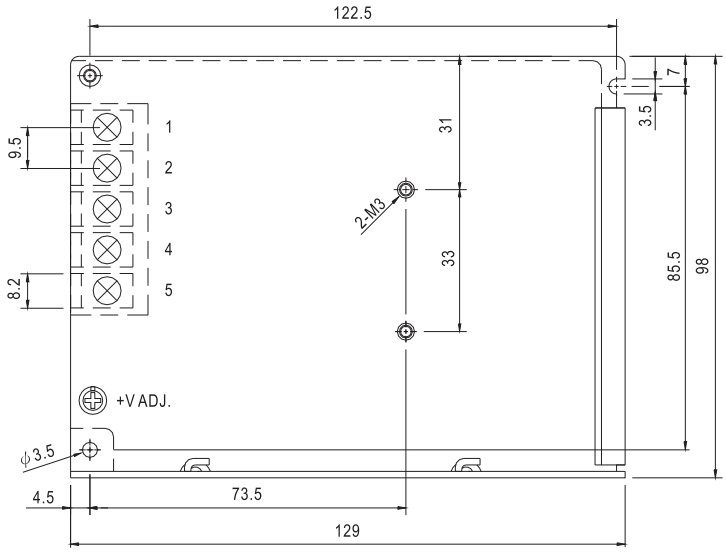
- Universal AC input/Full range
- Protections: Short circuit / Overload / Over voltage
- Cooling by free air convection
- 100% full load burn-in test
- 2 years warranty

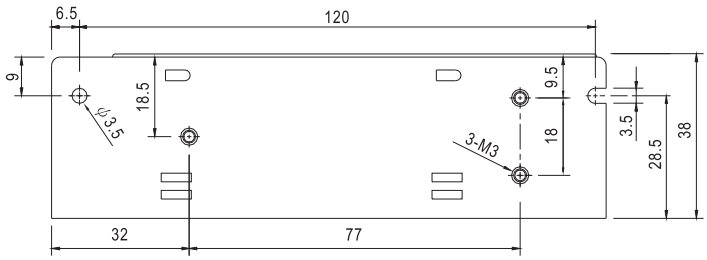
SPECIFICATION

MODEL		NES-50-5	NES-50-12	NES-50-15	NES-50-24	NES-50-48
OUTPUT	DC VOLTAGE	5V	12V	15V	24V	48V
	RATED CURRENT	10A	4.2A	3.4A	2.2A	1.1A
	CURRENT RANGE	0 ~ 10A	0 ~ 4.2A	0 ~ 3.4A	0 ~ 2.2A	0 ~ 1.1A
	RATED POWER	50W	50.4W	51W	52.8W	52.8W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	120mVp-p	150mVp-p	200mVp-p	240mVp-p
	VOLTAGE ADJ. RANGE	4.75 ~ 5.5V	10.8 ~ 13.2V	13.5 ~ 16.5V	21.6 ~ 26.4V	43.2 ~ 52.8V
	VOLTAGE TOLERANCE Note.3	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION Note.4	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	LOAD REGULATION Note.5	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	SETUP, RISE TIME	500ms, 30ms/230VAC 1200ms, 30ms/115VAC at full load				
	HOLD UP TIME (Typ.)	50ms/230VAC 10ms/115VAC at full load				
INPUT	VOLTAGE RANGE	85 ~ 264VAC 120 ~ 370VDC				
	FREQUENCY RANGE	47 ~ 63Hz				
	EFFICIENCY(Typ.)	79%	82%	83%	86%	87%
	AC CURRENT (Typ.)	1.1A/115VAC 0.65A/230VAC				
	INRUSH CURRENT (Typ.)	COLD START 45A				
	LEAKAGE CURRENT	<2mA / 240VAC				
PROTECTION	OVERLOAD	110 ~ 150% rated output power				
		Protection type : Hiccup mode, recovers automatically after fault condition is removed				
	OVER VOLTAGE	5.75 ~ 6.75V	13.8 ~ 16.2V	17.25 ~ 20.25	27.6 ~ 32.4V	55.2 ~ 64.8V
		Protection type : Shut down o/p voltage, re-power on to recover				
ENVIRONMENT	WORKING TEMP.	-20 ~ +60℃ (Refer to "Derating Curve")				
	WORKING HUMIDITY	20 ~ 90% RH non-condensing				
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH				
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 45℃)				
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes				
SAFETY & EMC (Note 7)	SAFETY STANDARDS Note.6	UL60950-1, CB(IEC60950-1),CCC GB4943.1:2011 approved				
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:2KVAC O/P-FG:0.5KVAC				
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms / 500VDC / 25℃/ 70% RH				
	EMC EMISSION	Compliance to EN55022 (CISPR22) Class B, EN61000-3-2,-3				
	EMC IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11, EN55024, EN61000-6-1, light industry level, criteria A				
OTHERS	MTBF	374.2K hrs min. MIL-HDBK-217F (25℃)				
	DIMENSION	129*98*38mm (L*W*H)				
	PACKING	0.41Kg; 30pcs/13.3Kg/0.72CUFT				
NOTE	1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. 3. Tolerance : includes set up tolerance, line regulation and load regulation. 4. Line regulation is measured from low line to high line at rated load. 5. Load regulation is measured from 0% to 100% rated load. 6. For the request of GB4943.1,the power supply is only suitable for use in the altitude 2000m below and the non tropical climate condition. 7. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to “EMI testing of component power supplies.” (as available on http://www.meanwell.com)					

■ Mechanical Specification

Case No. 903 Unit:mm



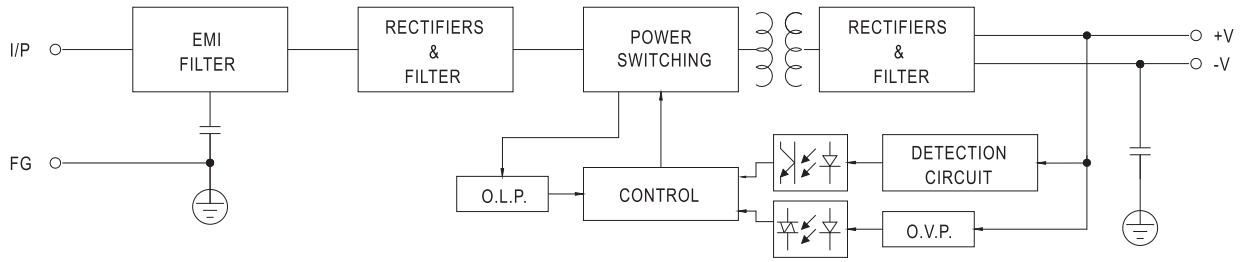


Terminal Pin No. Assignment

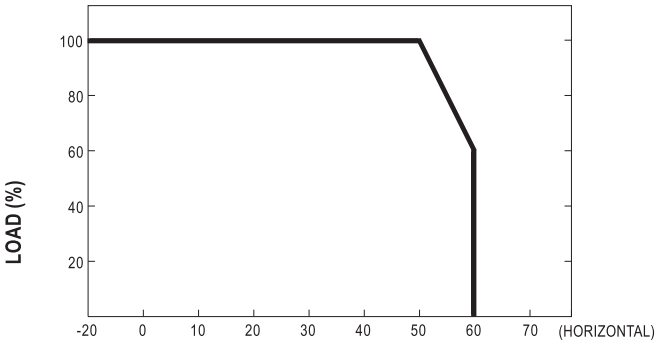
Pin No.	Assignment	Pin No.	Assignment
1	AC/L	4	DC OUTPUT -V
2	AC/N	5	DC OUTPUT +V
3	FG ⏚		

■ Block Diagram

fosc : 60KHz

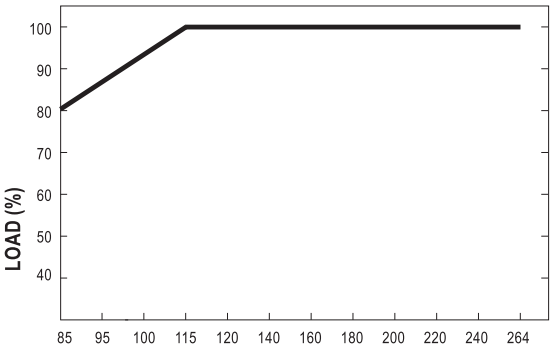


■ Derating Curve



AMBIENT TEMPERATURE (°C)

■ Output Derating VS Input Voltage



INPUT VOLTAGE (VAC) 60Hz