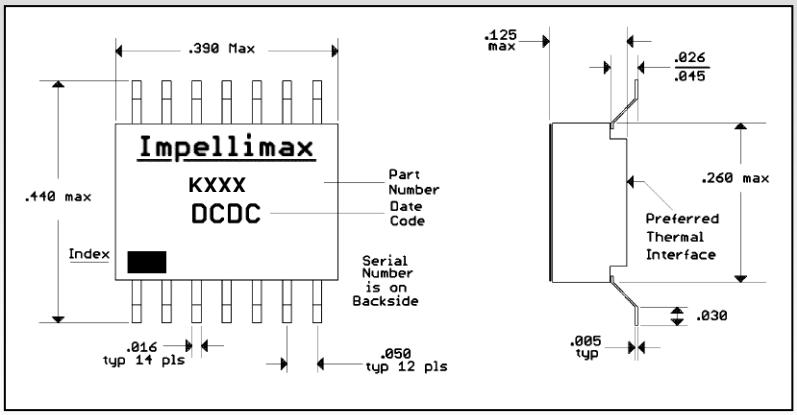
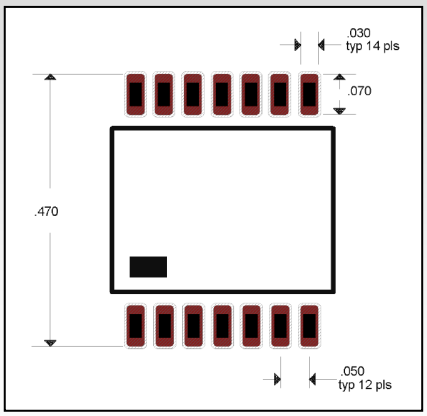
Impellimax K Series Building Block hybrids

These parts provide a wide variety of useful functions. Externally, they are all mechanically identical, and as shown in the diagram below. This very rugged package is hermetic and easily qualified to military applications, but at costs far lower than typical hybrids. Automated assembly, a standardized package, and laser fabrication keep costs and lead time at a minimum.





Devices are available in tube or on tape for auto insertion.

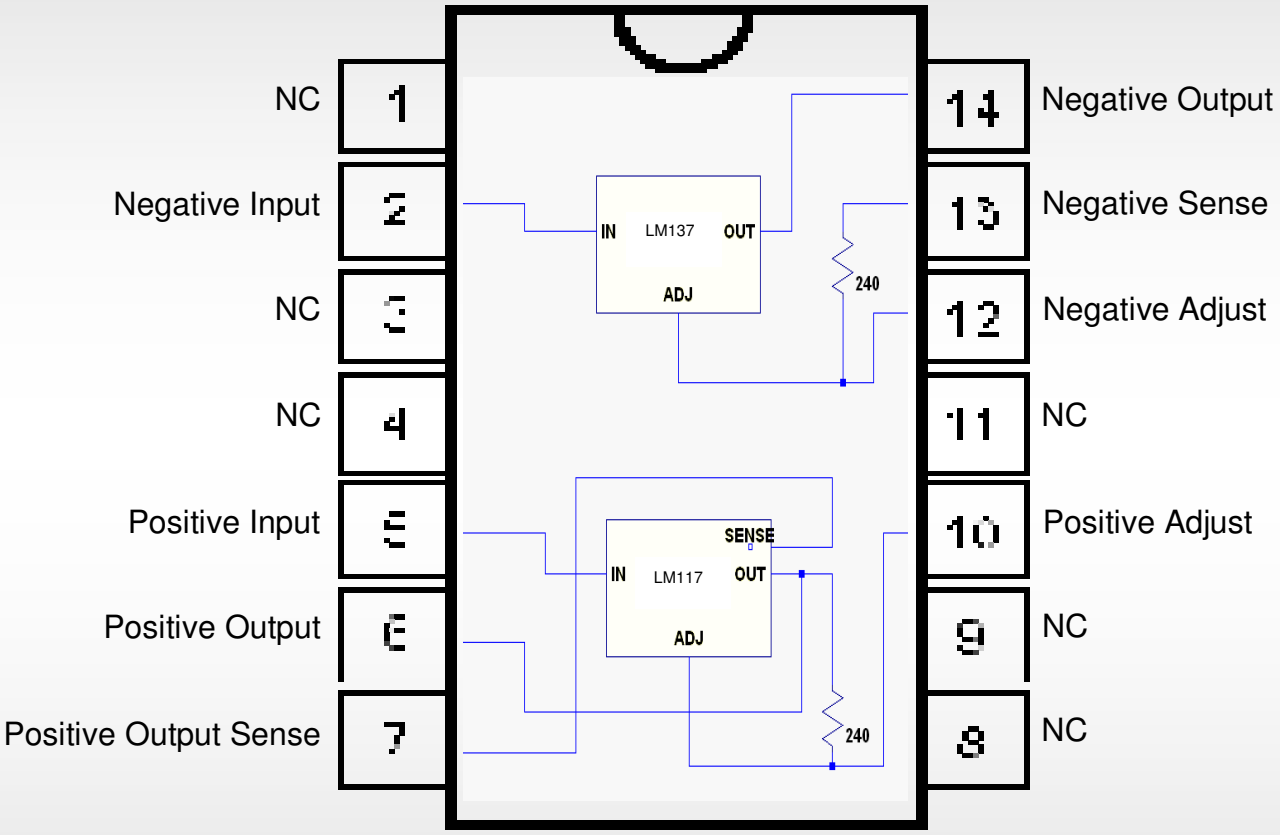
PCB land patterns & symbols are available for download.

Part#	Positive Regulator	Negative Regulator	Protection Diode	Bypass Cap	Logic	High Speed	Analog	High Power/Voltage	Driver	DC to DC	Temp Protection	Overvoltage Protection	Heater	Obsolete Replacement	
K1	Adjustable	Adjustable													
K2	+5V		V+ input		Ex-Or										
K3	+5V														
K4	+5V		V+ input												
K5	+5V				8 bit D/A converter										
K6							300V Curr. Mirror, 741								
K7										Isolated 5V					RADIATION TOLERANT
K8									SP2T PIN						RADIATION TOLERANT
K9			+5V input	.01uF on +5V	5 decode out		Line Recvr								
K10							300V Curr. Mirr. 100mOhm								RADIATION TOLERANT
K11							+/- 1 ampere Op-Amp							LH0041	
K12						Vgate window comparator									
K13			+5V input		1of 8 decoder			90mA outputs				Anti-kick diodes			
K14								Aircraft 28V in		+5 Isolated					
K15											auto shutoff		PWM controller		RADIATION TOLERANT
K16					Adj Vthresh			GaN MMIC driver, low current							RADIATION TOLERANT
K17					Adj Vthresh	15nsec			GaAs Sw Dr						RADIATION TOLERANT
K18					Ex-Or shutdn						overtemp shutdn	overV shutdn			
K19							+/- 40V Op-Amp							LH0004	RADIATION TOLERANT
K20								GaN Sw Dr -60V							RADIATION TOLERANT
K21						25 nsec		GaN Sw Dr -40V							RADIATION TOLERANT
K22					Open Collector		6 Chan BIT test				therm sense	over and under			RADIATION TOLERANT
K23								30V		Diode Mult					RADIATION TOLERANT
K24		GaN Volt Mon			Open Collector		Window comparator to -100V					Protect GaN			RADIATION TOLERANT
K25		Neg V for GaN					Low Iq Hi-Volt Reg, -30 to -70V								RADIATION TOLERANT

Additional K series Building Blocks are added continuously. Contact the factory with your requests.

K1

Adjustable Positive and Adjustable Negative 1.5 Ampere Regulators with Sense Resistors



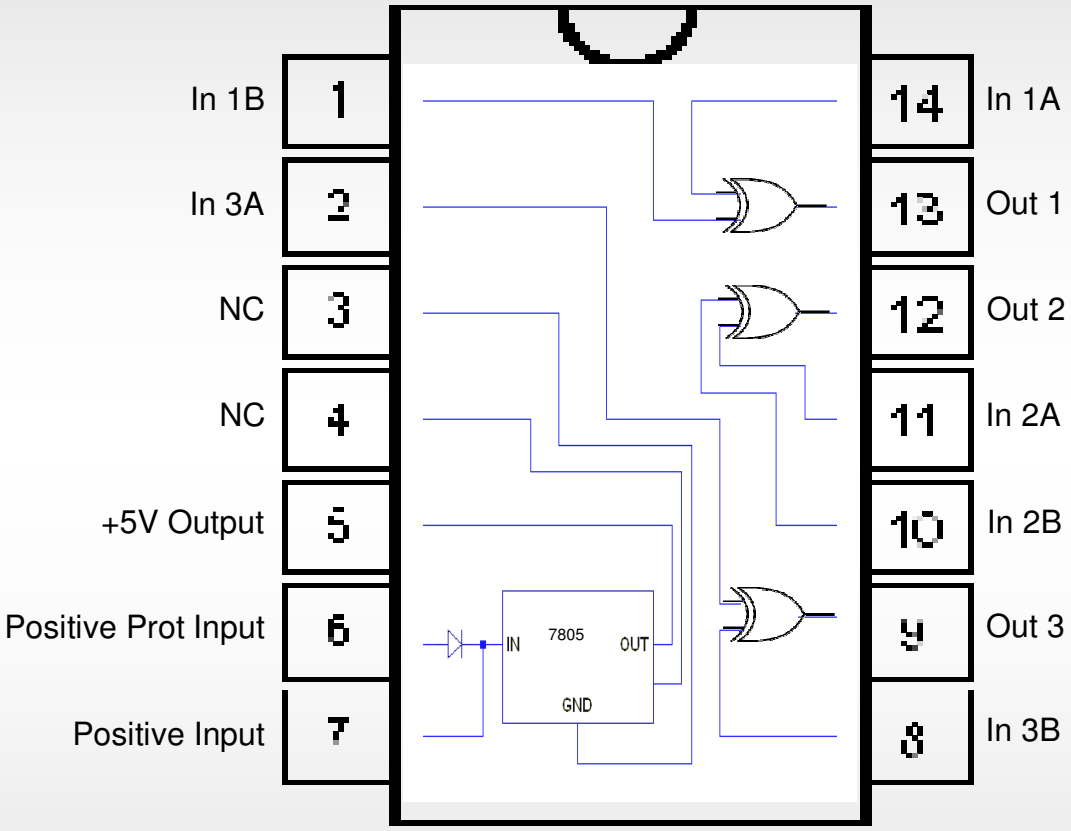
Electrically isolated adjustable positive and negative voltage regulators residing in a single package.

Each has its associated 240 ohm resistor internally integrated, so for most applications all that is needed are the set resistors. Positive Output Sense can be tied directly to Positive Output, or for greater accuracy, at the point of load.

Internal 240 ohm resistors are 1% accuracy.

K2

Fixed 5V Positive 1.5 Ampere Regulator with Reverse Protection Diode and 3 X-Or Gates

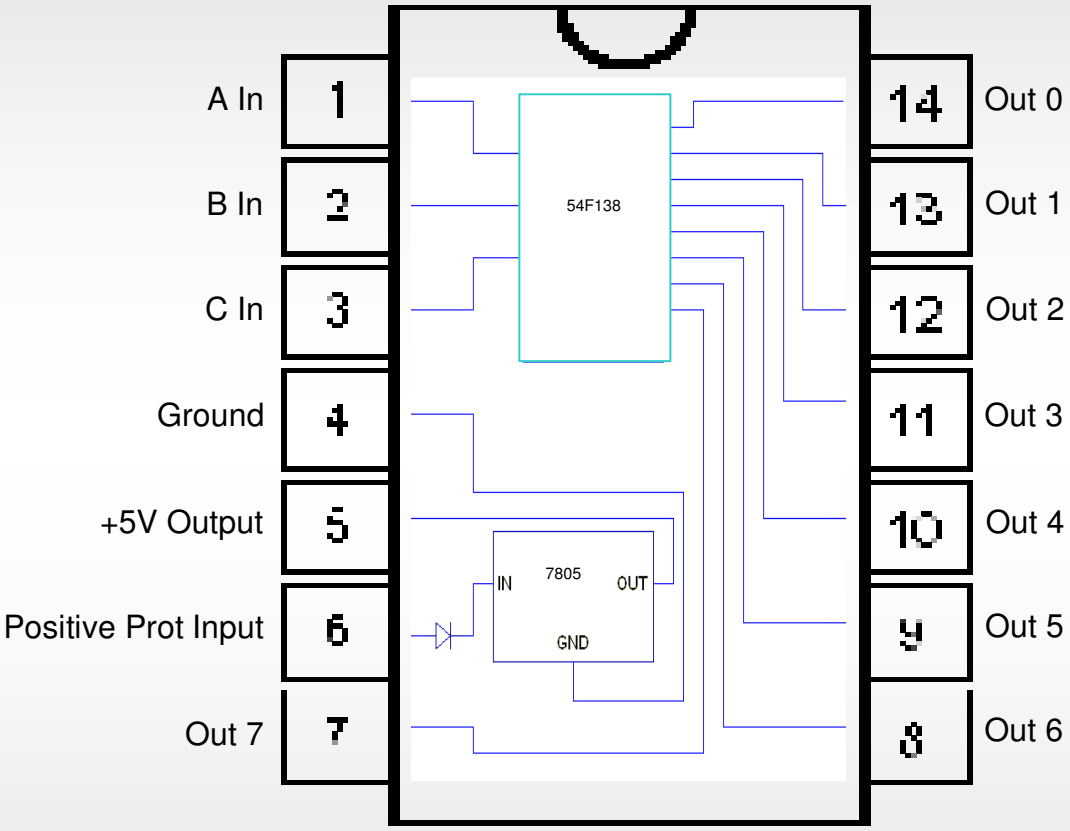


Electrically isolated fixed +5V voltage regulator and three 54F86 gates, residing in a single package.

The +V input line has a series protection diode, which can be bypassed to reduce drop, if so desired.

K3

+5V Fixed 1.5 Amp Regulator, Protection Diode, and 3 input / 8 output 54F138 Binary Decoder

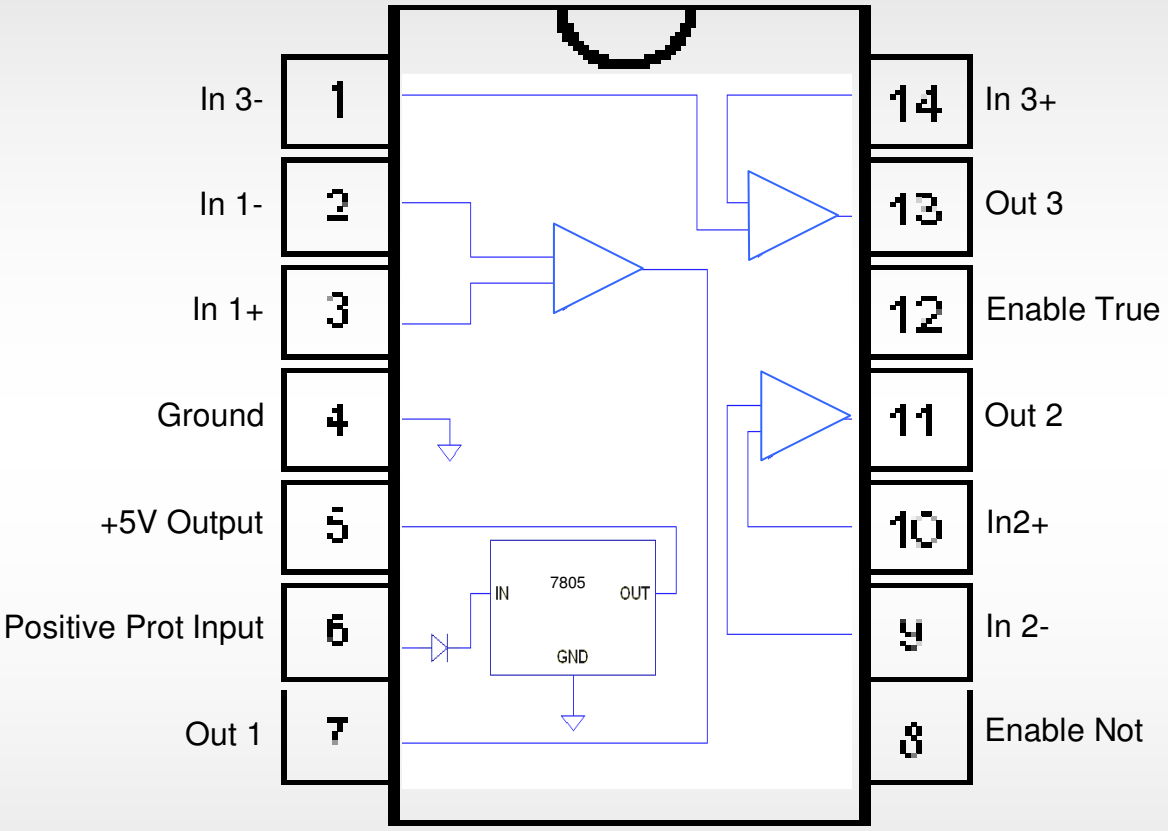


Electrically isolated fixed +5V voltage regulator and 54F138 binary decoder IC, residing in a single package.

The +V input line has a series protection diode, which can be bypassed to reduce drop, if so desired.

K4

+5V Fixed 1.5 Amp Regulator, Protection Diode, and 3 channels of AM26LS32 Line Receiver

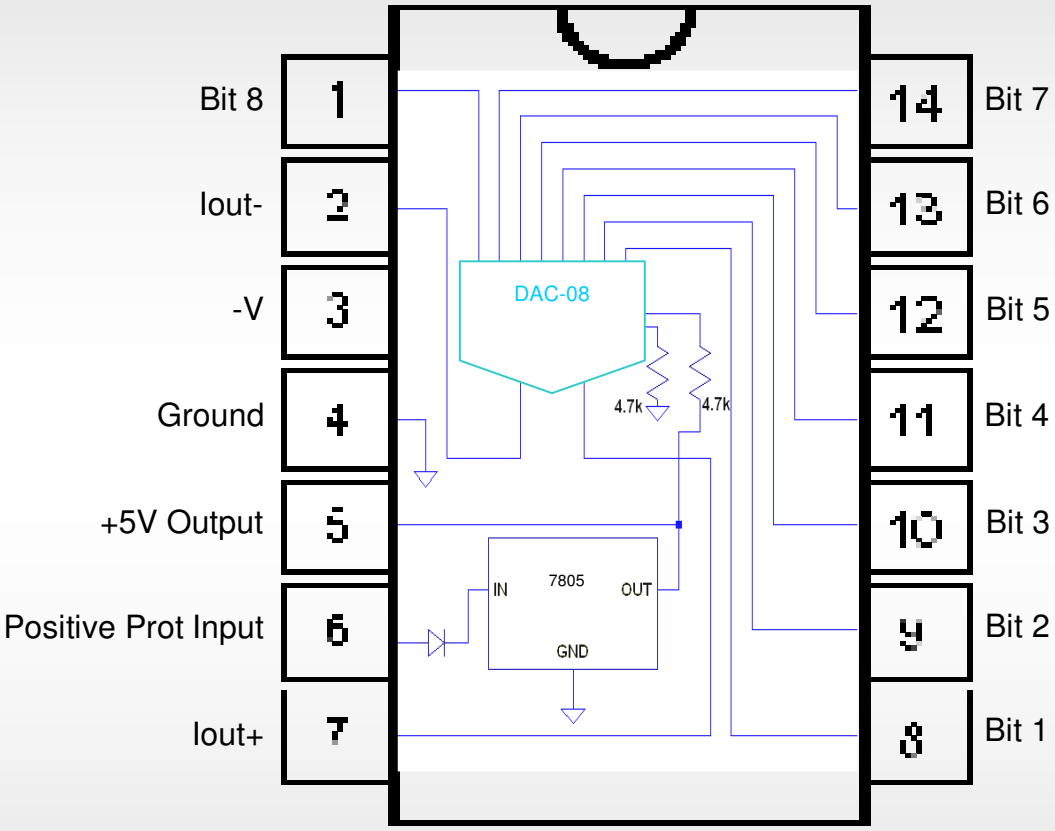


+5V voltage regulator and AM26LS32 line receiver IC, residing in a single package. The +5V regulator input is protected by a series diode.

The enable function is common to all three receivers and offers a choice of active-high or active-low input which controls the tri-state outputs of the channels.

K5

+5V Fixed 1.5 Amp Regulator, Protection Diode, and 8 bit DAC08 Digital to Analog Converter

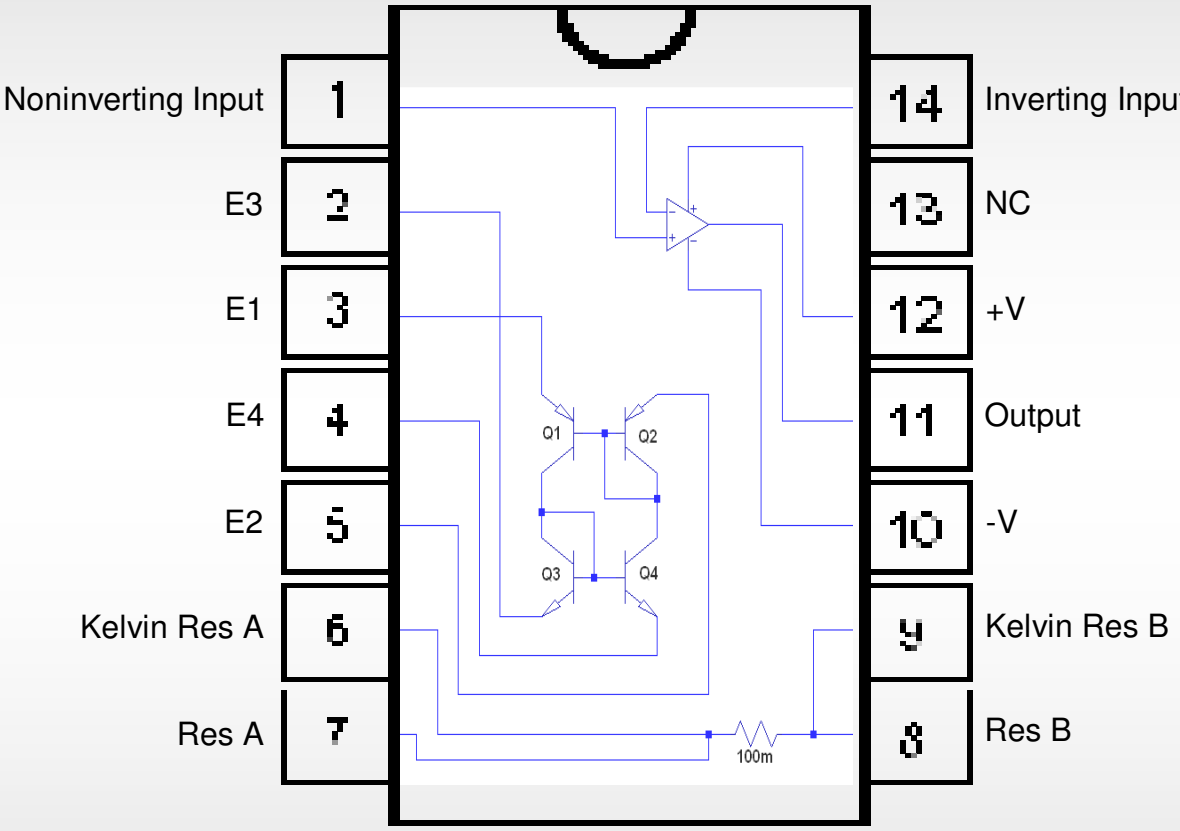


+5V voltage regulator and DAC08 D to A converter, residing in a single package. The +5V regulator input is protected by a series diode.

Two 4.7K resistors, of 1% tolerance, are included and connect to the regulator output to set the input reference. Logic threshold pin is internally connected to ground, which sets compatibility with TTL levels as an aid to integrating with typical TTL applications.

K6

High Voltage (300V) Precision Current Mirror, 100 milliohm Sense resistor, and 741 Op Amp



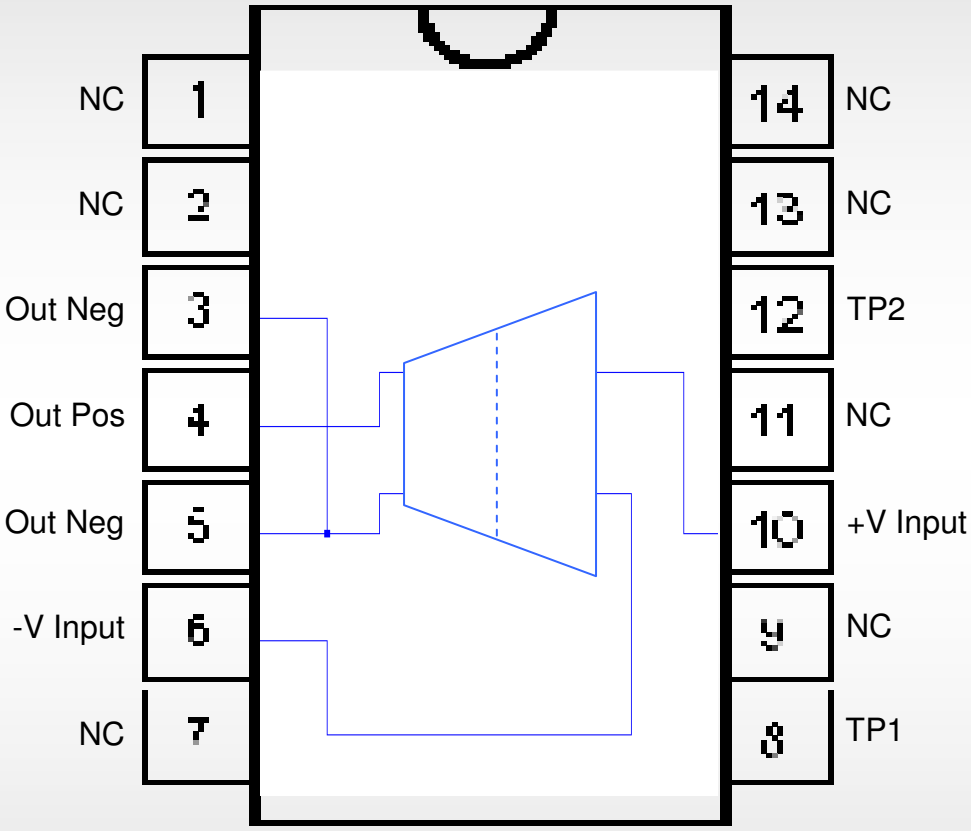
Q1 thru Q4 are lot-matched and thermally-bound high voltage transistors. They are interconnected to form a current mirror which allows the user to sense the current in either a high positive or high negative volt power supply line, for use up to 300 Volts. The internal precision 100 milliohm current sense resistor is connected in series with the line, and Kelvin connections to the resistor provide the most accurate sensing of the voltage drop.

The uncommitted 741-style op amp provides flexibility in setting the gain and bandwidth of this high-integration device.

Radiation tolerant, latchup-free

K7

Isolated DC to DC Converter, Non-magnetic, Accepts 5 to 20V, floating or ground-referenced input



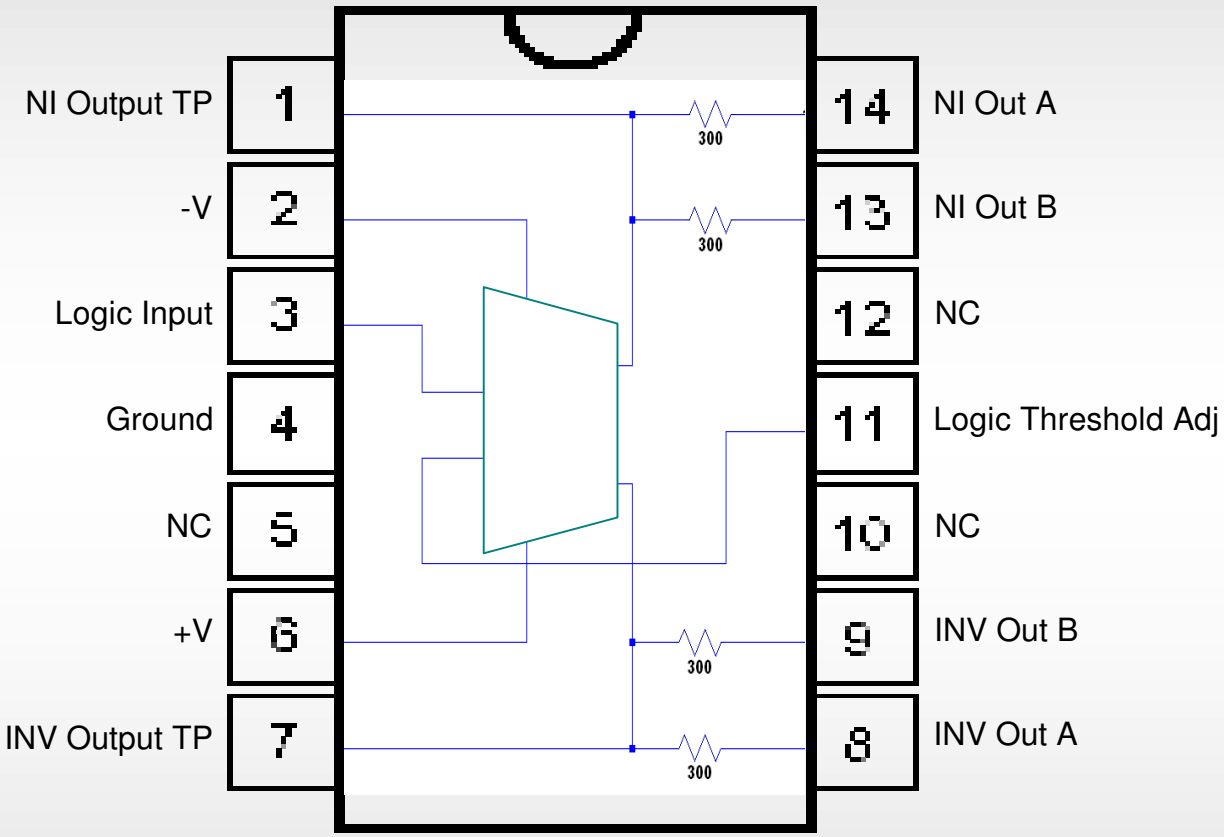
Input has no DC connection to output. To convert 28V aircraft power to +5V, first drop the 28V variable supply using a floating regulator in the range of 15 to 20V. Connect a 5.1V zener across the output, for the simplest regulation method. Output current in this condition is typically up to 5 mA.

Connect TP1 to TP2 for normal operation, or connect a resistive optocoupler between TP1 and TP2 to allow for input-side shutdown and/or burst-mode feedback.

Radiation tolerant, latchup-free

K8

SP2T PIN Switch Driver with logic threshold adjustment pin and multiple output options

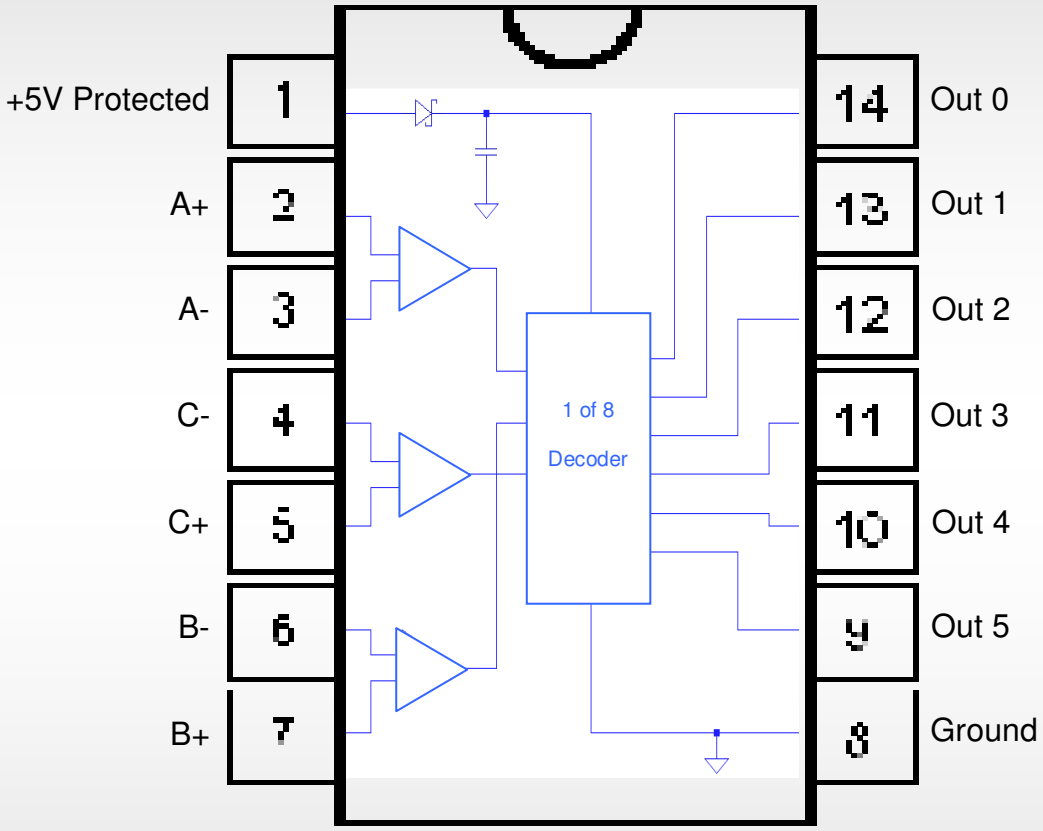


Unit provides two complementary outputs, and each output has a low-impedance output (no internal current limiting) which swings nearly from rail to rail, as well as two resistively limited outputs.

When operated without any connection to Logic Threshold Adjust, unit provides a TTL Threshold of ½ V+. Impedance at this pin is approximately 1.5K. Raise or lower this threshold with an external resistor to allow unit to switch at LSTTL, 2.5V, 3.3V, or any other single-line logic family with thresholds that can be achieved in this way. With proper external resistive arrangements, Logic Adj Threshold can be used as the inverting input for some families of balanced logic, as well. Switching speed is 20 to 40 nsec, depending on external connections and logic family used.

K9

Three Channels of AM26LS32 Line Receiver, which decode into 6 outputs of a 54F138 Binary Decoder



Three line receivers accept complementary logic over a +/-7V range, with a sensitivity of 200 mV and a built-in 50mV hysteresis for clean switching in noisy environments. This provides RS-422 compatibility, as well as compatibility with a wide range of balanced logic formats.

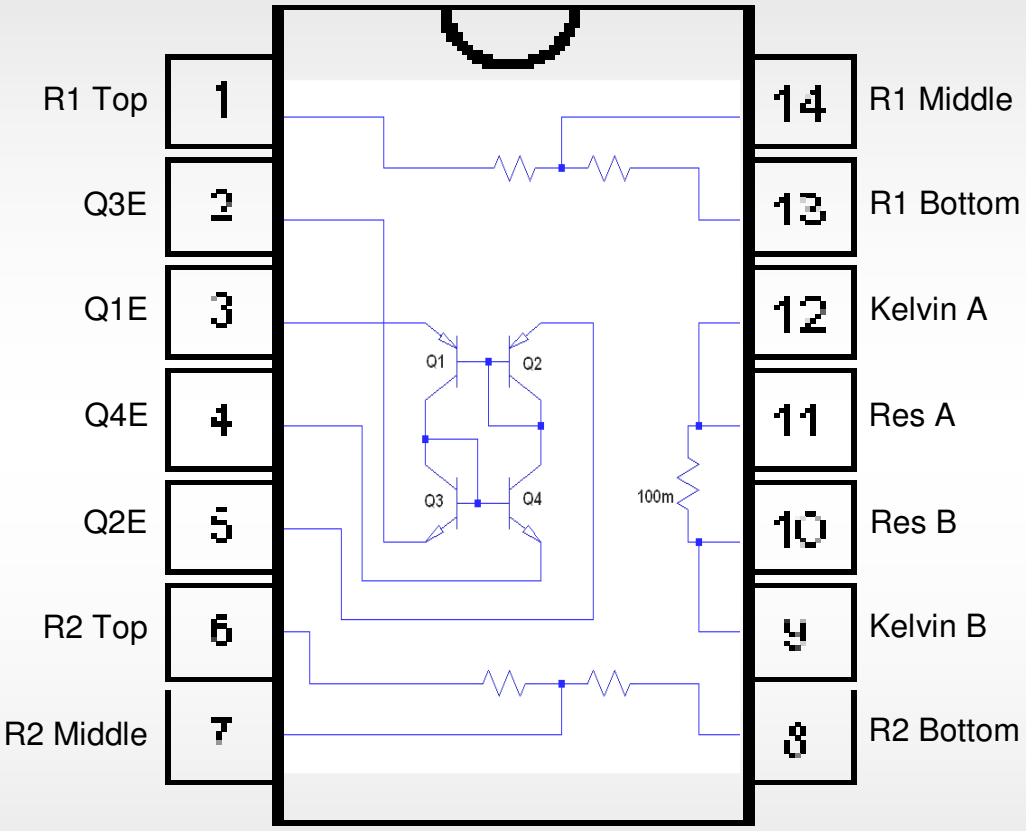
The outputs of the three decoders feeds into a one-of-six TTL Decoder to select one output to go low while the others remain hi.

The +5V input is diode-protected by a very low-drop shottky diode, and there is an internal .01 uF capacitor to even further simplify integration.

Radiation tolerant, latchup-free

K10

300V Current Mirror, with integrated 100 milliohm Sense Resistor and two center-tapped 1% 15K Resistors



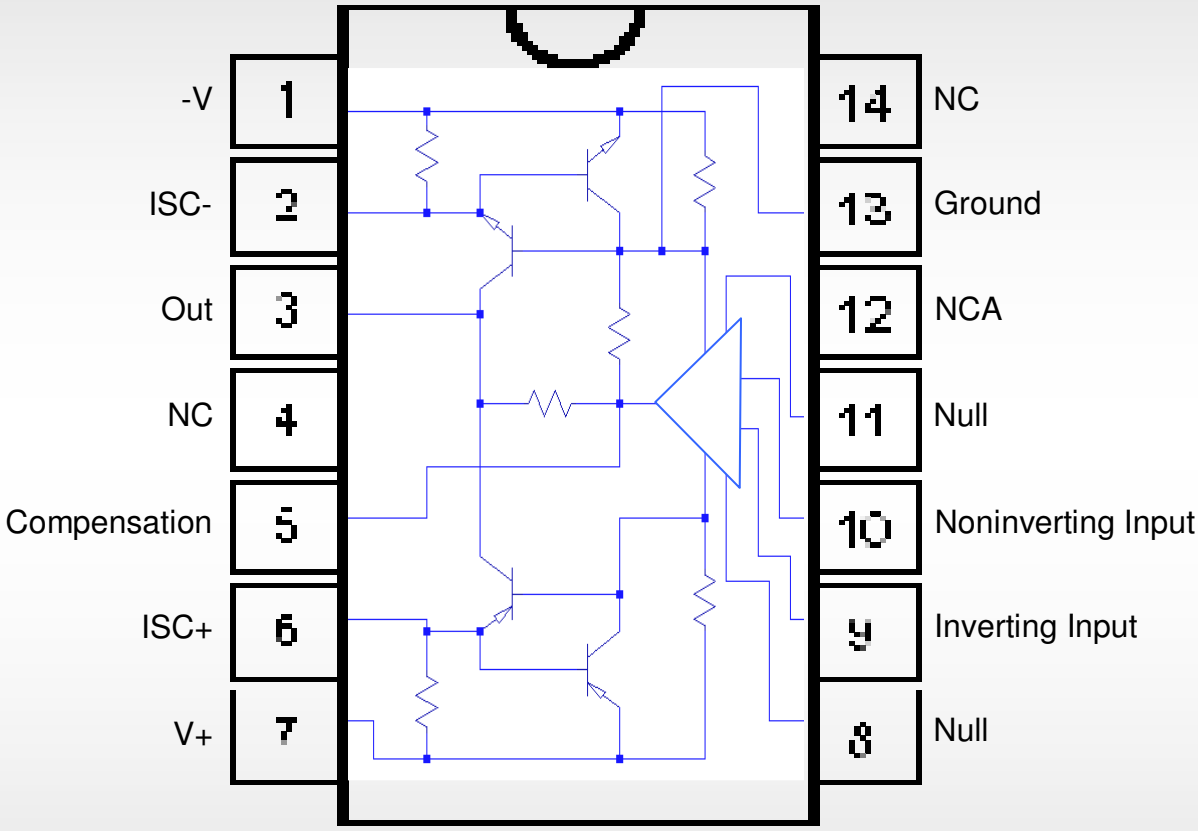
Q1 thru Q4 are lot-matched and thermally-bound high voltage transistors. They are interconnected to form a current mirror which allows the user to sense the current in either a high positive or high negative volt power supply line, for use up to 300 Volts.

The internal precision 100 milliohm current sense resistor is connected in series with the line, and Kelvin connections to the resistor provide the most accurate sensing of the voltage drop.

The uncommitted center-tapped 1% tolerance 15Kohm resistors provide high accuracy and tight temperature-tracking in this high-integration device.

K11

LH0041 Op-amp Buffer, High Current Output

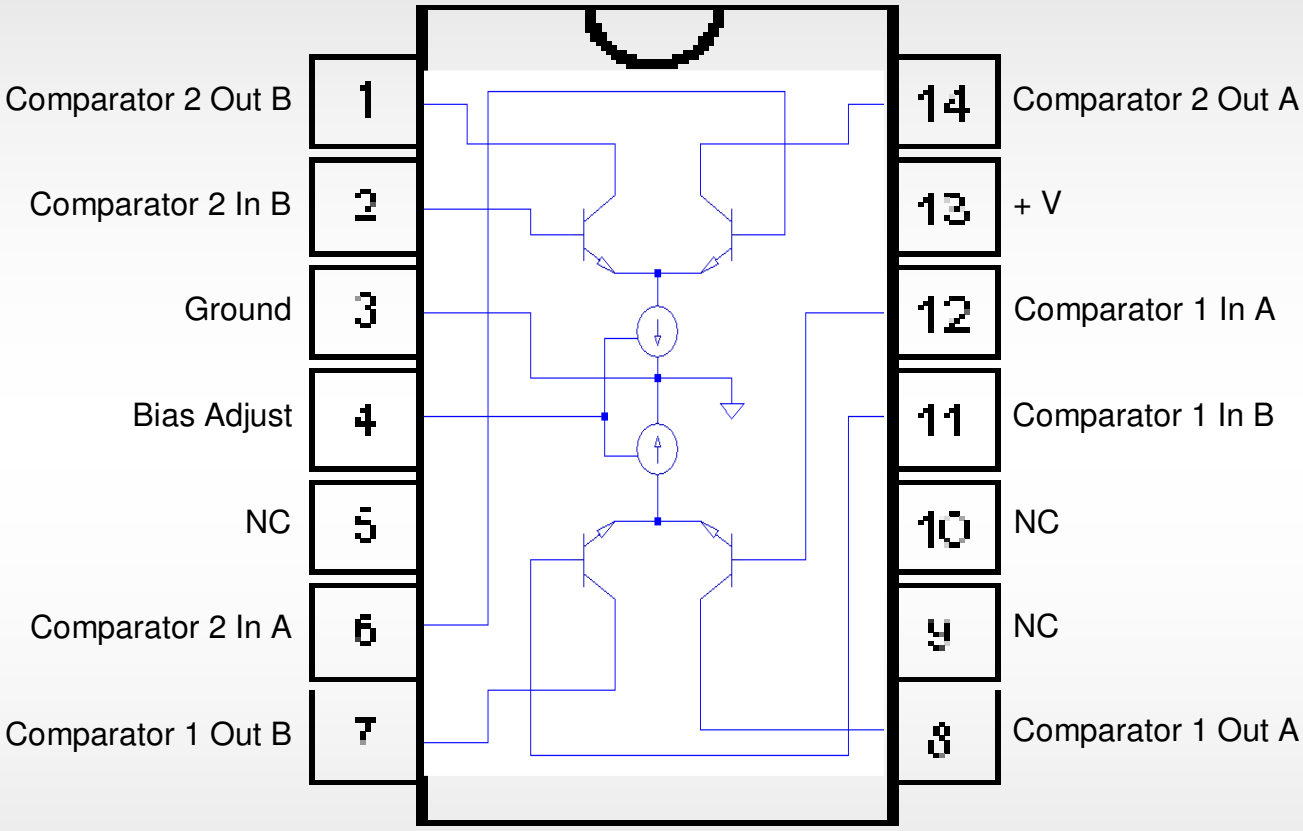


The K11 is capable of delivering large output currents not usually associated with conventional IC Op Amps. The K11 Building Block can provide up to +/-200 mA at voltage levels closely approaching the available power supplies.

The device has internal short-circuit protection, and maximum output current levels for positive and negative can be independently adjusted with external resistors.

K12

Very High-speed Vgate Voltage Monitor circuit, with Adjustable Over-voltage and Under-voltage logic output

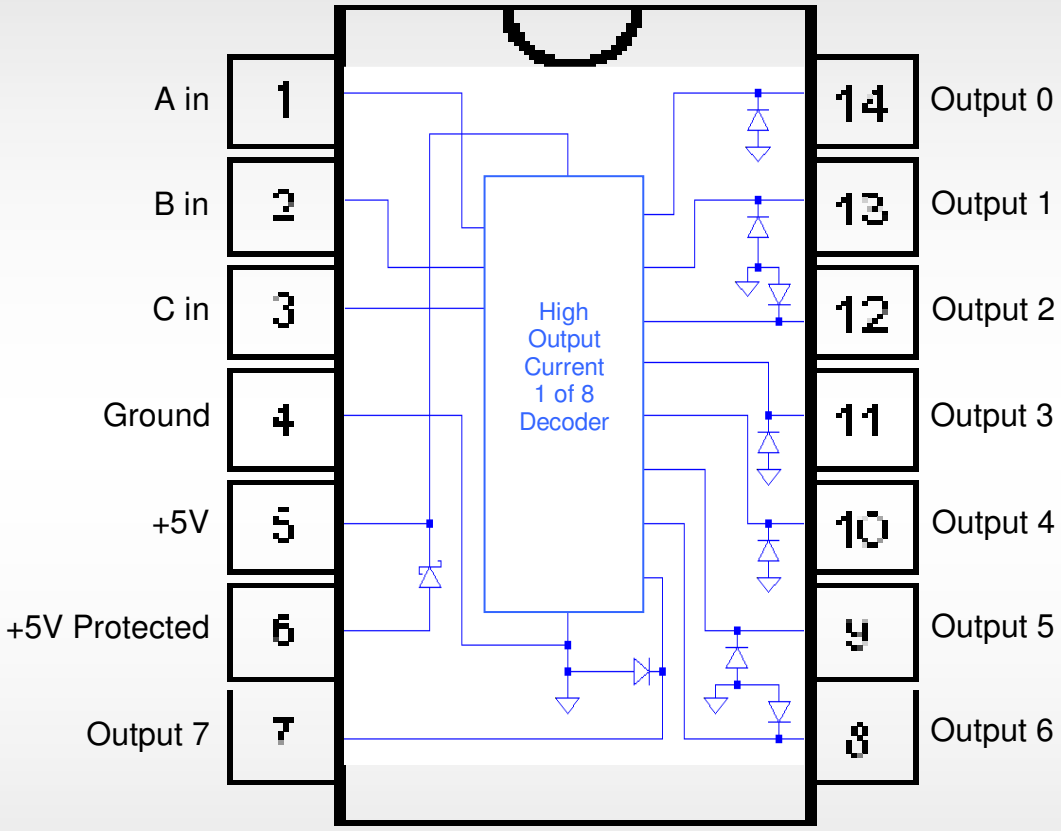


The K12 is a very open-ended K Series Building Block. It consists of two independent differential amplifiers with associated constant current transistors on a common monolithic substrate. The six transistors which comprise the amplifiers exhibit low 1/f noise and an fT in excess of 1GHz. These features make the K12 Building Block generally useful from DC to 500MHz. Bias adjustment testpoint and the uncommitted collectors provide maximum application flexibility.

Among its many uses, the K12 can easily be configured as a very high-speed window comparator. As such, it can be used to monitor FET Vgate voltages as a failsafe, or as a power level window comparator as a fast BIT test on amplifier operation.

K13

Output Buffered 1 of 8 Decoder, with kick protect diodes, for driving Relays and other High Current Loads

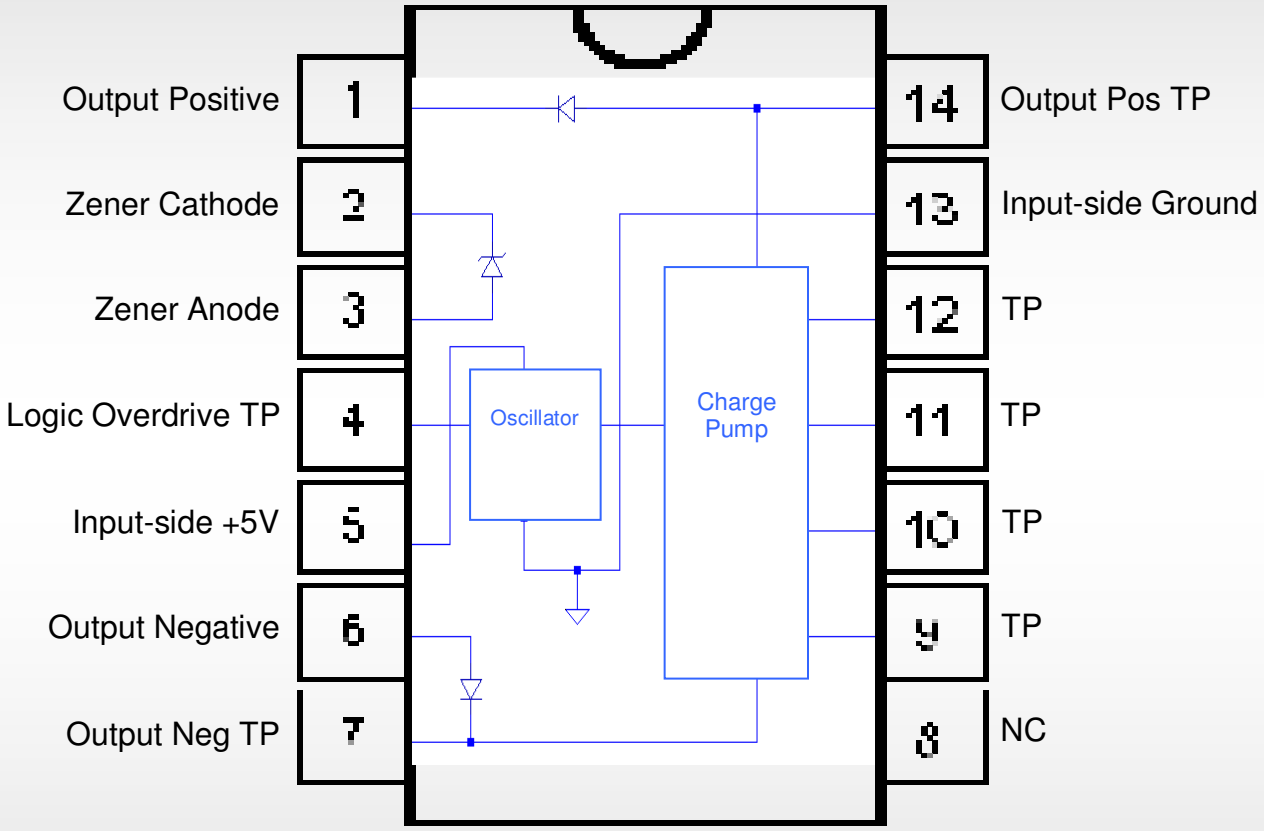


Logic inputs A, B and C are direct connection to a ACT family 1 of 8 decoder. All outputs stay “off” except for the one selected by the three-bit input word. The selected output goes positive, sourcing current into any ground-connected load. Each output of the decoder drives a high-current PNP transistor which allows for high output currents to 100 mA typically, to be driven. Internal snubbing diodes on each output make driving inductive loads very safe and simple.

The internal +5V protection diode is a very low-drop schottky. Access to the +5V after the protection diode allows the designer to avoid using the diode if so desired. It also allows the protected positive line to be bypassed by an external capacitor, if needed.

K14

Isolated DC-DC Converter, No Magnetics, uses +5V input, with 5V zener for Output Clamping



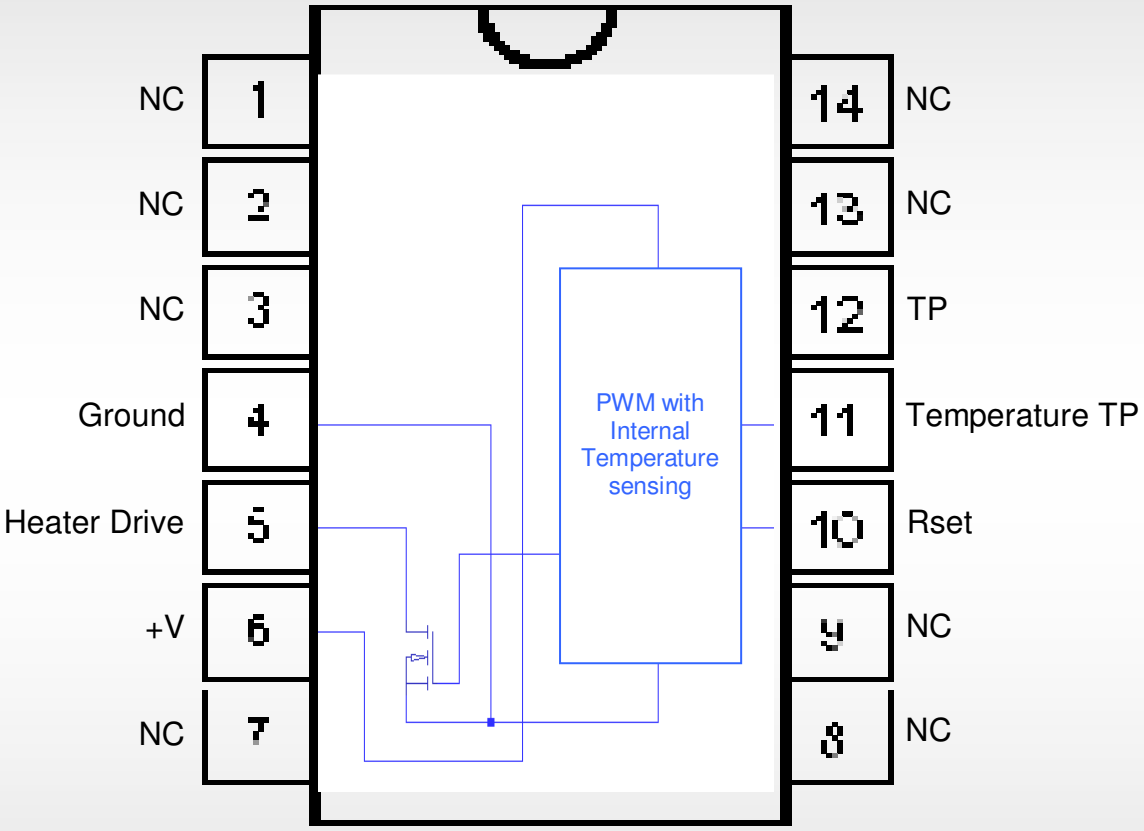
Apply a +5V and Ground connection to the input side. A floating output voltage will be developed across the Output Negative and Output Positive pins. This output voltage is capable to providing several milliamperes of output current. For convenience, the K14 Building Block includes an uncommitted 5.1V zener which ca be directly connected across the floating outputs for approximate regulation to 5V. The internal resistance of the charge pump is sufficient to protect the zener from overcurrent in this configuration.

A Logic Overdrive TP is provided, which is referenced to the input side. This can be used to force the internal oscillator to conform to an external clock. This can be useful in cases where the oscillator must be synchronized to sensors or A/D converters. This pin can also be used to force the clock to stop by connecting it to a 'low' open collector pin, or allowed to free run with a 'hi' open collector.

Radiation tolerant, latchup-free

K15

PWM Heater Controller with internal Temperature Sense and High-Current FET output, with Resistor Setpoint



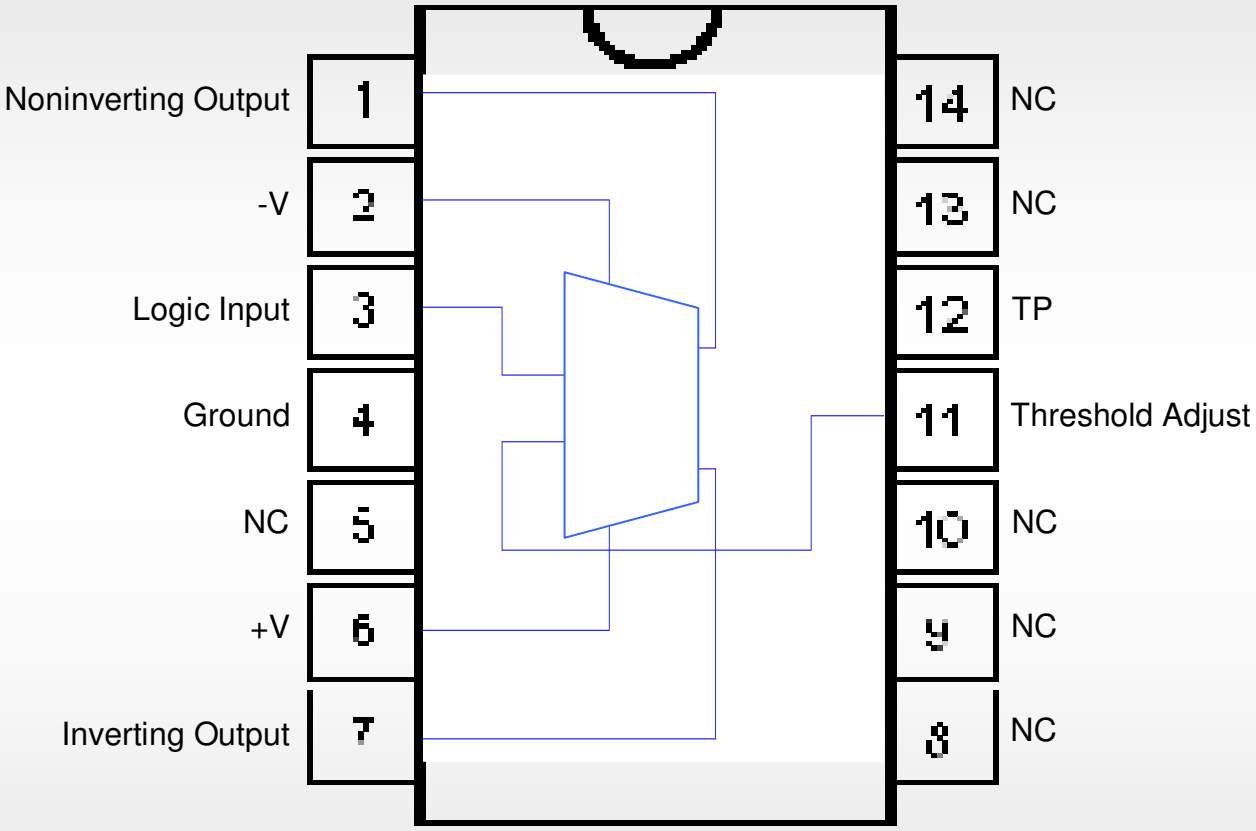
The K15 is a very easy to use PWM heater controller. Simply connect a power supply, a resistive heating element, and a single external Rset resistor to implement a complete heated temperature control system. The K15 includes an internal temperature sensor, and the K15 body can either be thermally attached, in a normal orientation, or it can be inverted and the gold lid of the unit can be soldered to the heated item to be temperature controlled.

The external resistive heater can be connected between any positive voltage between 1 to 30V, and the K15 itself can be operated with any regulated voltage between 5 and 18V. Note that the thermal setpoint will change dependent on the supply voltage, so the stability of the supply voltage is somewhat important. The output FET will go to full “on” when the K15 body temperature is low, it will go to full “off” when it is too hot, and it will proportionally PWM, using its internal oscillator, to maintain the sensed temperature near the setpoint which was determined by the external Rset.

Radiation tolerant, latchup-free

K16

Driver for -30 to -60V GaN MMIC switches, Ultra-low power, Adjustable logic threshold



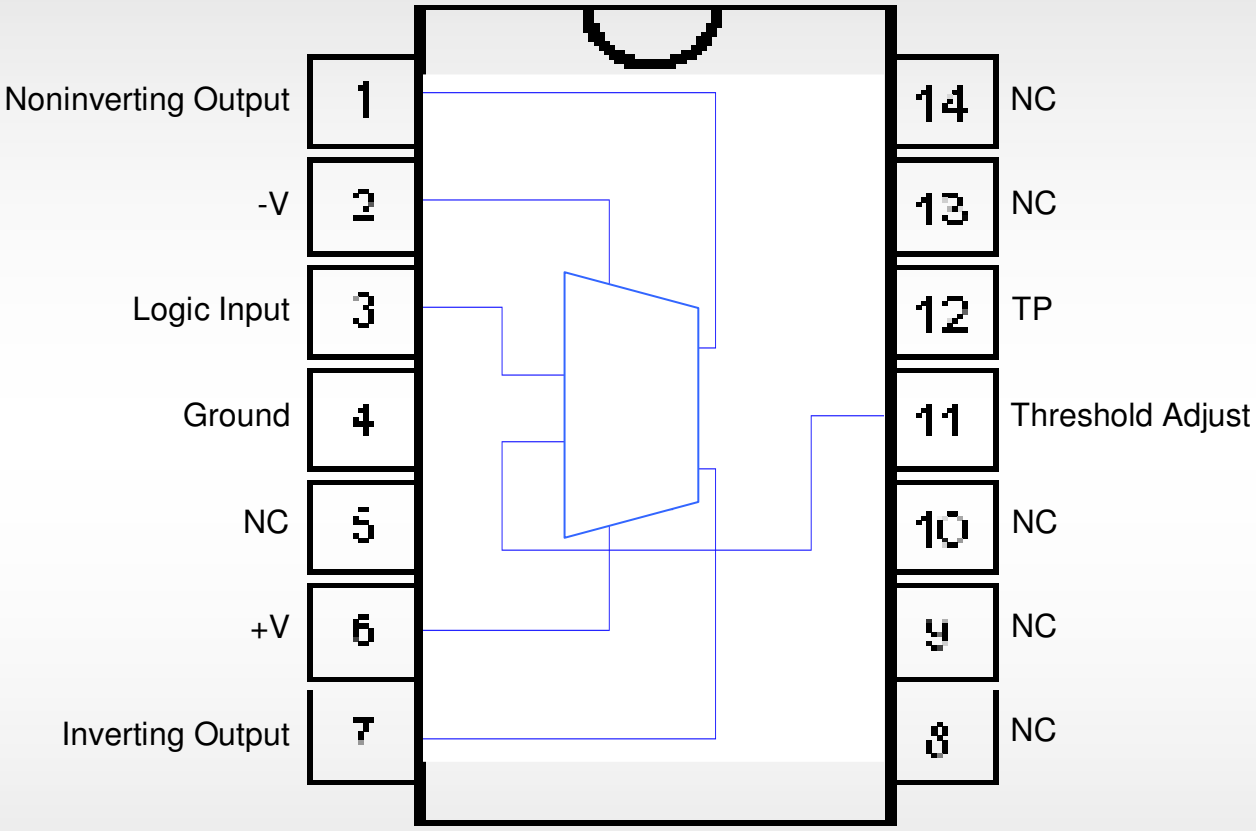
The K16 Building Block is a very low-current, easy-to-integrate driver for GaN MMIC switches that require high gate voltages for operation. The Threshold Adjust pin can be left disconnected for +3.5V to +5V CMOS compatibility, or adjusted with an external resistor for any threshold voltage over he wide range of typical logic families. Under most logic and supply conditions, the K16 requires less than 2 mA from the negative supply, and it switches in less than 300 nsec.

For applications where switching speed must be higher than the K16 can deliver, the K20 provides this although it draws a bit more supply current.

Radiation tolerant, latchup-free

K17

Driver for -8 to -15V GaAs MMIC switches, Low power, Adjustable logic threshold

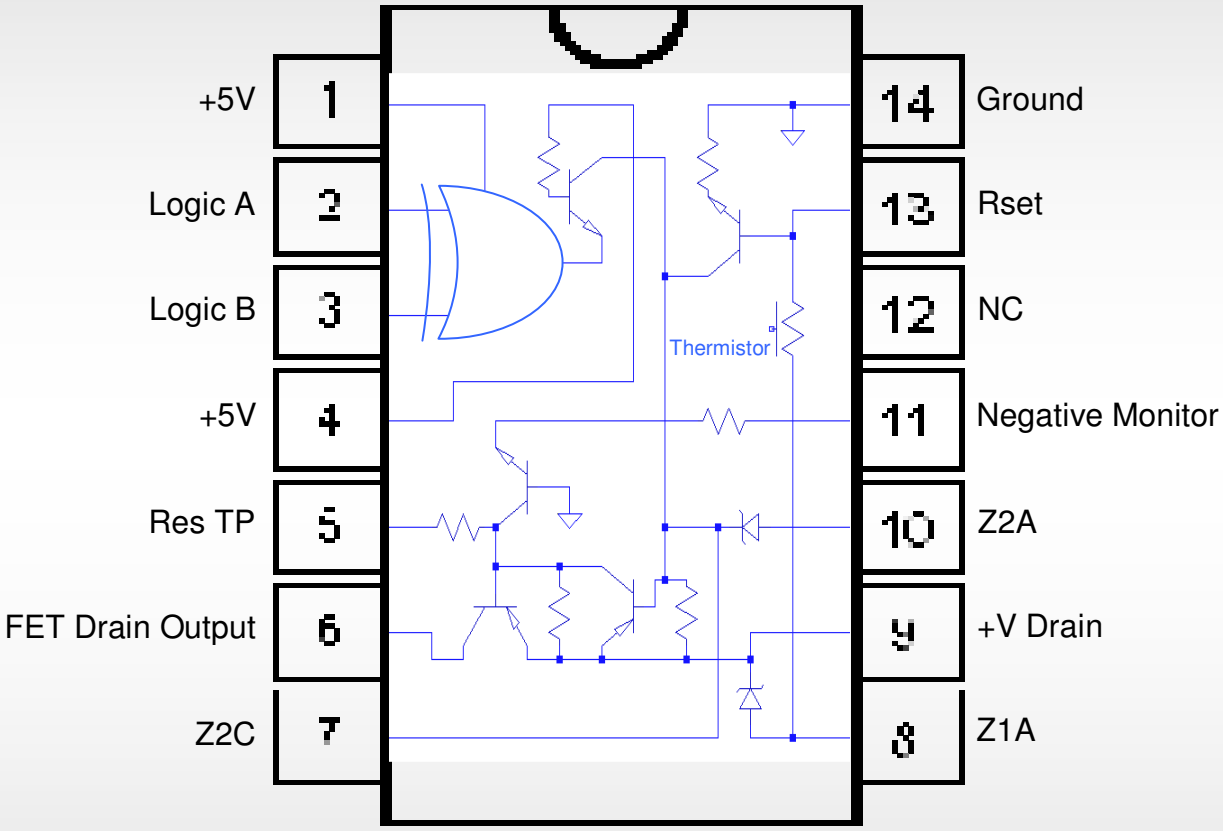


The K17 Building Block is a very low-current, easy-to-integrate driver for GaAs MMIC switches that require high gate voltages for operation. The Threshold Adjust pin can be left disconnected for +3.5V to +5V CMOS compatibility, or adjusted with an external resistor for any threshold voltage over a wide range of typical logic families.

Under most logic and supply conditions, the K17 requires less than 5 mA from the negative supply, and switches in less than 15 nsec.

K18

Multi-function FET amplifier protector, with Logic Shutdown, Over-temp, Under- and Over- voltage, more



The K18 Building Block is a multi-function subcircuit designed to provide several forms of protection and control for FET amplifiers. Several testpoints are provided, to facilitate varied applications.

If the K18 body is mounted in thermal contact with the FET amp, it will protect the amplifier from overheating because there is an internal thermistor and an external Rset resistor which can be set to deny Drain current to the amplifier if an overtemperature condition is sensed.

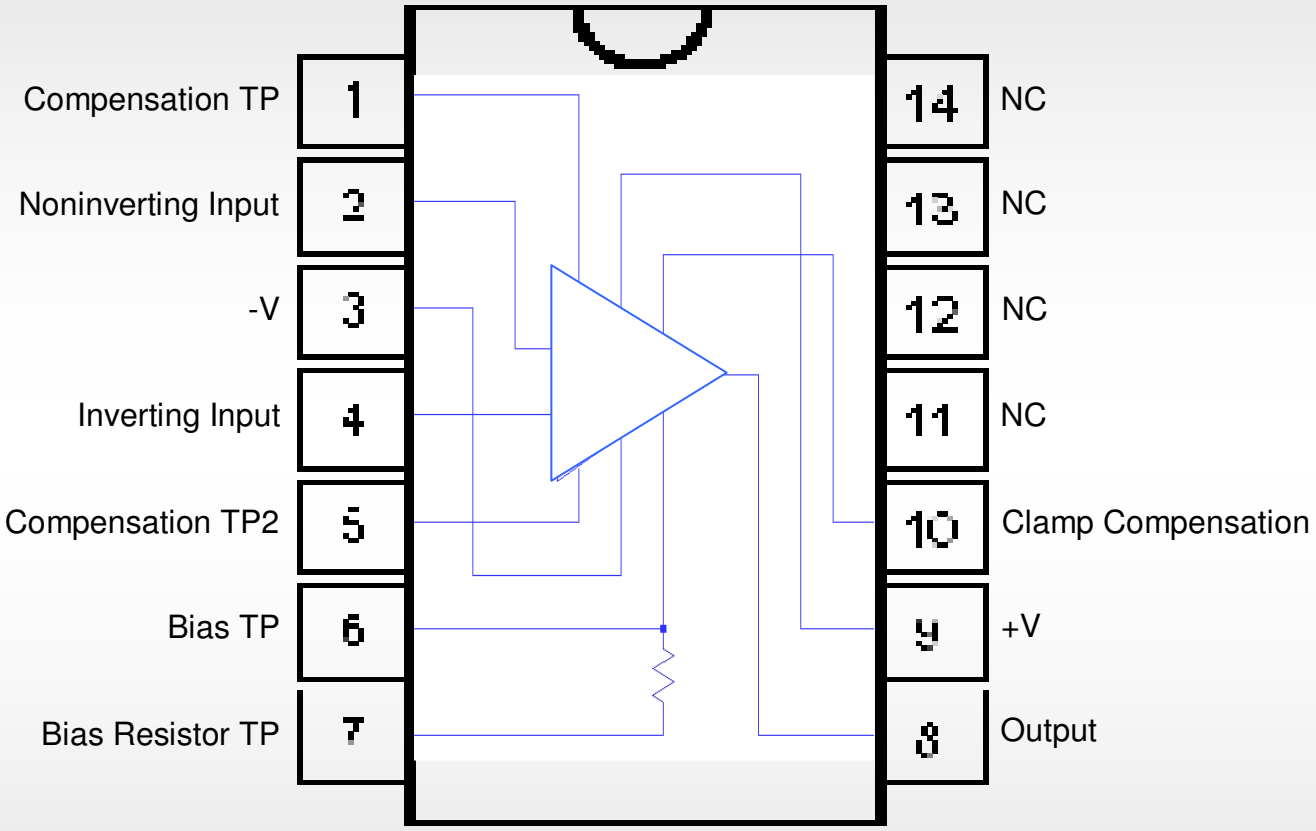
Two X-Or inputs are provided which can be used to force a shutdown of the amp by TTL logic.

The FET amp Vgate can be sensed by the Negative Monitor pin, and if the Vgate becomes absent or insufficient, it will force a protective shutdown of the amplifier Drain current.

Radiation tolerant, latchup-free

K19

High Voltage Op-amp, +/-40V output range, Similar to LH0004



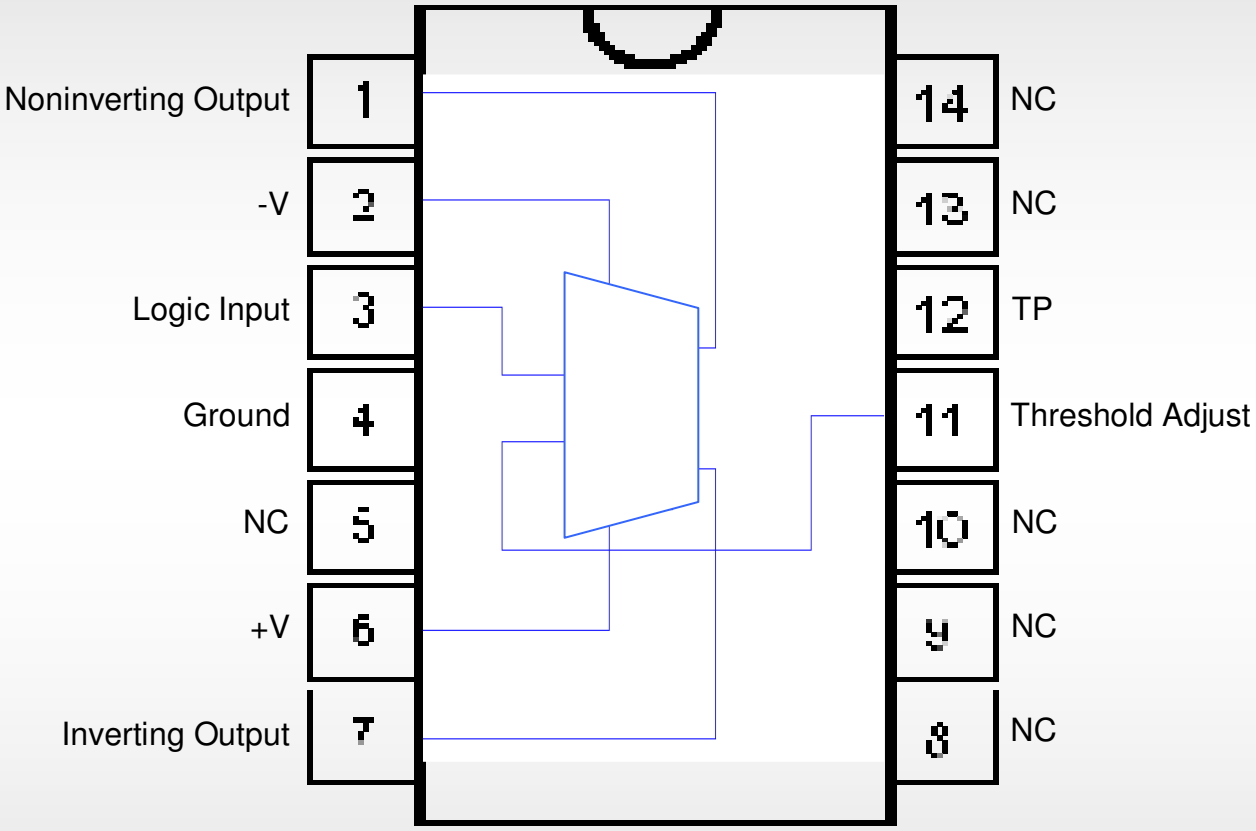
The LH0004 was a ground-breaking high voltage opamp, with good high-current output capability as well. The K19 provides an update to that circuit, now using modern transistors and an improved package to be even better than the original.

The high output current capability of the K19 Building Block makes it suitable for proportionally-controlled heaters, YIG oscillator dither coil driving, and electrochemical/electrothermal robotic actuators. The high voltage capability makes it a good choice for driving Lithium Niobate and Piezo materials that require high voltage for operation.

Radiation tolerant, latchup-free

K20

Driver for -20 to -60V GaN MMIC Switches, High Speed, Adjustable logic threshold



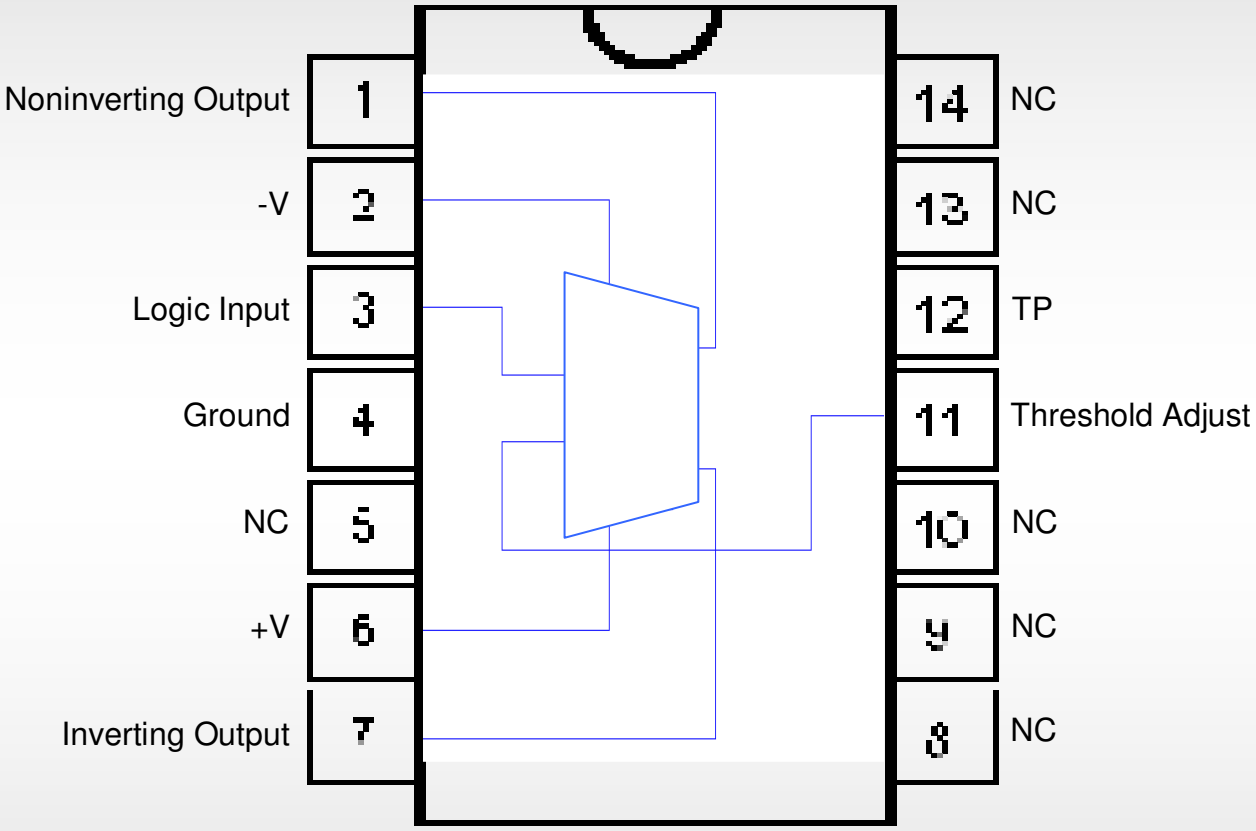
The K20 Building Block provides a high speed, easy-to-integrate driver for GaN MMIC switches that require high gate voltages for operation. The Threshold Adjust pin can be left disconnected for +3.5V to +5V CMOS compatibility, or adjusted with an external resistor for any threshold voltage over he wide range of typical logic families. Under most logic and supply conditions, the K20 switches in less than 40 nsec and draws typically less than 10 mA from the positive and negative supplies.

For applications where supply current is at a premium but switching speed is less critical, also consider the K16 which is a lower power version of the K20.

Radiation tolerant, latchup-free

K21

Driver for -10 to -40V GaN MMIC switches, Very high speed, Adjustable logic threshold



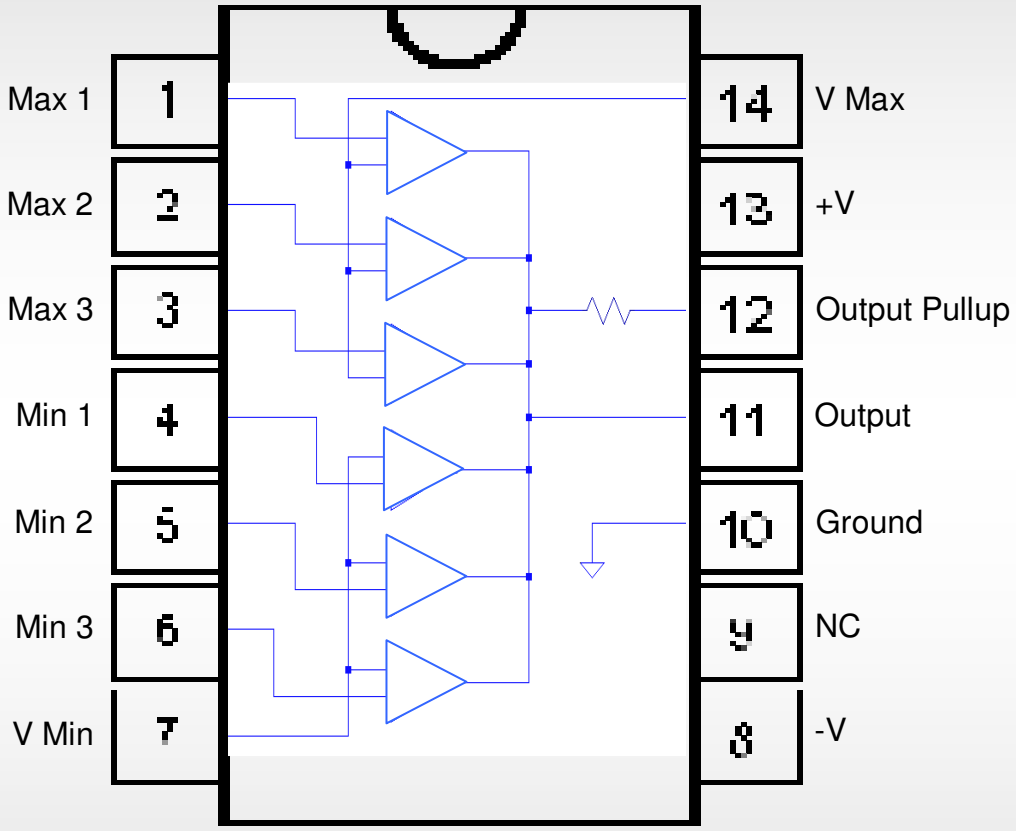
The K21 Building Block provides a high speed, easy-to-integrate driver for GaN MMIC switches that require moderately high gate voltages for operation. The Threshold Adjust pin can be left disconnected for +3.5V to +5V CMOS compatibility, or adjusted with an external resistor for any threshold voltage over he wide range of typical logic families. Under most logic and supply conditions, the K20 switches in less than 20 nsec and draws typically less than 20 mA from the positive and negative supplies.

For applications where supply current is at a premium but switching speed is less critical, also consider the K16 for a lower power version of the K21, with increased high voltage capability as well.

Radiation tolerant, latchup-free

K22

BIT Voltage Monitors, Six independent channels, Open collector output, Adjustable BIT threshold voltages



The K22 is a highly adaptable Building Block well suited to a range of Built-In Test monitoring functions. The open collector output of the K22 allows expansion to any number of monitored points, using multiple K22 units Or-tied together. Conversely, unused inputs can be tied off (to high or low voltages) if less points need to be monitored.

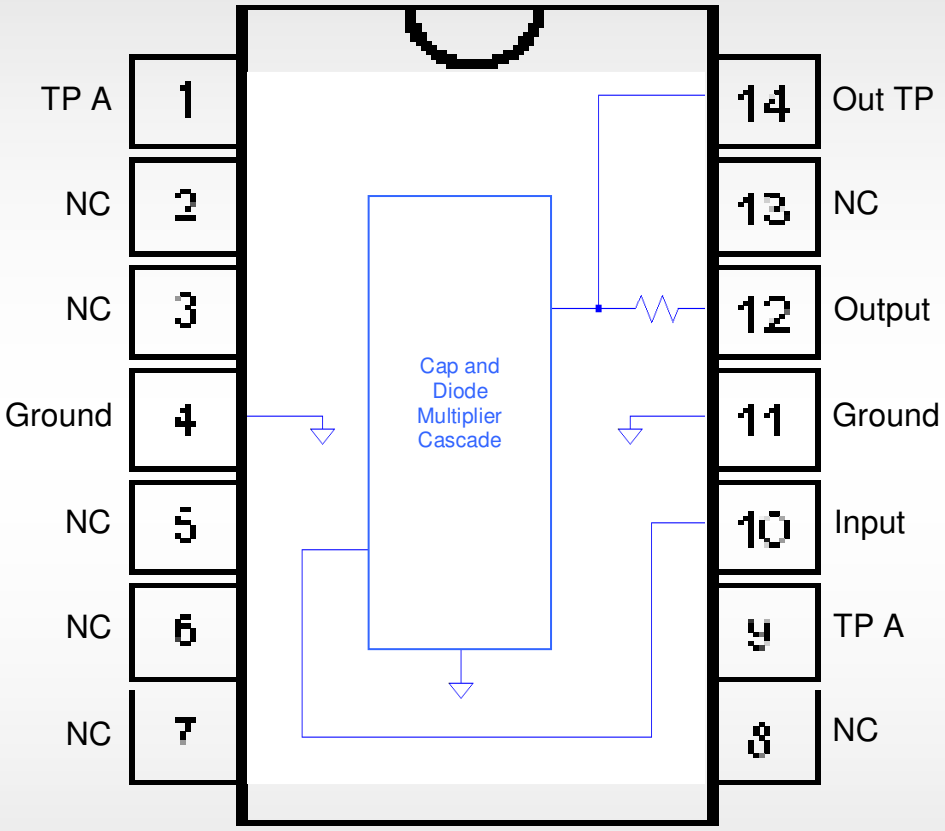
The input range of the K22 is very wide, so it can be used to monitor FET Vgates as well as Vdrains, or multiple power supplies, or voltages across PIN diodes in switches, RF detector voltages, etc.

By using Min and Max inputs connected together, window comparisons are easily implemented.

Radiation tolerant, latchup-free

K23

Voltage multiplier, Capacitor/Diode Cascade, Vinx4 (theoretical), up to 30V output



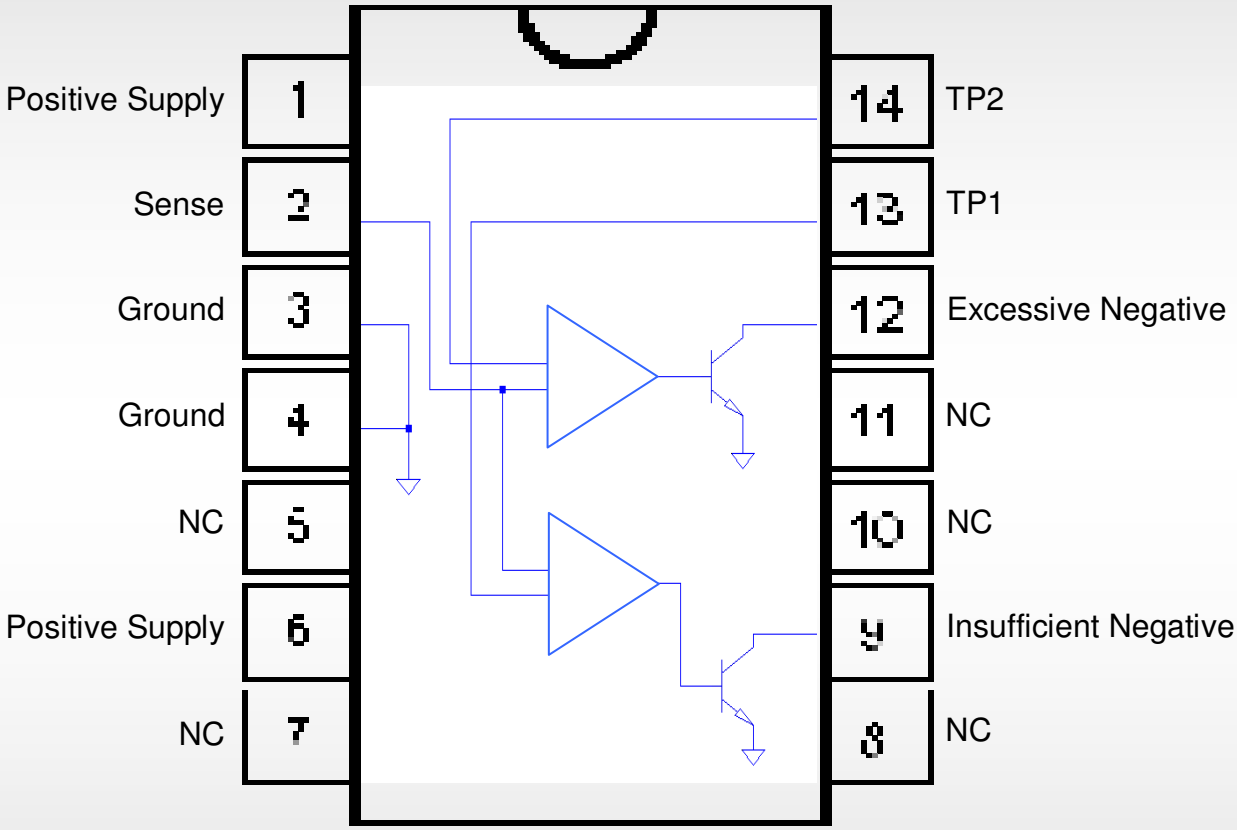
The K23 is a self-contained capacitor/diode charge pump array. When the input is driven by a sine wave or square wave input of V magnitude, the output will be a DC level which can be nearly as high as Vx4. The output is of moderately high impedance, so the K23 is best suited for applications where a high voltage DC supply is needed but very little current is required. It can be used for biasing Avalanche Photodiodes, providing a varactor bias supply, generating microphone phantom power, and driving GaN switches and attenuators.

Connect like-labeled pairs of pins together (TPA to TPA and Ground to Ground). Make no connection to all NC pins, since many are used internally as tie points. Out TP does not have current limiting, so for most applications it is better to use Output, which contains an internal 2k resistor to assist in output RC filtering. Connect a large capacitor from Output to ground for best DC smoothing.

Radiation tolerant, latchup-free

K24

GaN Bias Voltage Monitor, Requires +5V only, but monitors over a -5 to -100V range, User-set Hi and Low points



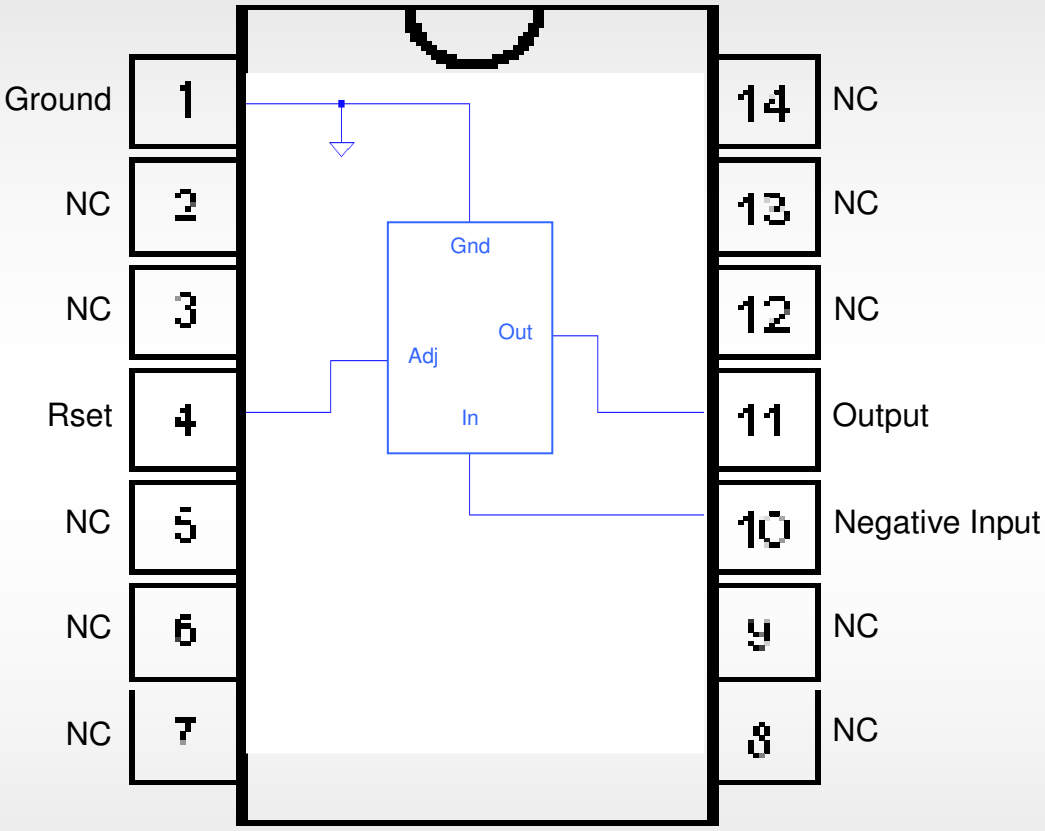
The K24 Building Block is a dual comparator that is optimized for the task of monitoring negative voltages while only requiring a single positive supply, which can be in the range of +3.5V to +10V, as long as it is stable. Furthermore, it is designed with open collector outputs, to make it easy to implement a window comparator function that can provide a logic low output when a monitored negative voltage falls outside of an acceptable range. The K24 can be used to assure the safe operation of GaN switches, FET amps, etc, and can also be used as a power level BIT test when measuring RF detector voltages, among its many uses.

Connect both +V supply inputs externally, since they are not internally connected. Note that the diagram above is intended to show the functionality of the part, but details of the internal circuitry differ slightly from this. Consult the K24 appnote for details on selecting the threshold set resistors.

Radiation tolerant, latchup-free

K25

High Voltage, Low Power GaN Negative Supply Voltage Regulator, to -70V Range



Using much less than a milliamp of supply current, the K25 Building Block provides a stable, accurate negative regulated voltage which is essential for safe optimized operation of GaN MMIC devices.

Output voltage is set by a single external resistor to the output. The K25 includes an internal temperature-compensated voltage reference and high voltage pass transistor which can deliver output to within a 500 mV of the negative supply rail.

The K25 provides a quick start-up into regulation upon application of supply voltage.

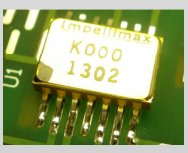
Impellimax K Series, K1 thru K25

The first 25 Building Blocks

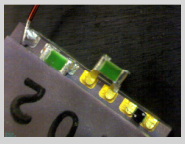
K1	Adjustable Positive and Adjustable Negative 1.5 Ampere Regulators with Sense Resistors
K2	Fixed 5V Positive 1.5 Ampere Regulator with Reverse Protection Diode and 3 X-Or Gates
K3	+5V Fixed 1.5 Amp Regulator, Protection Diode, and 3 input / 8 output 54F138 Binary Decoder
K4	+5V Fixed 1.5 Amp Regulator, Protection Diode, and 3 channels of AM26LS32 Line Receiver
K5	+5V Fixed 1.5 Amp Regulator, Protection Diode, and 8 bit DAC08 Digital to Analog Converter
K6	High Voltage (300V) Precision Current Mirror, 100 milliohm Sense resistor, and 741 Op Amp
K7	Isolated DC to DC Converter, Non-magnetic, Accepts 5 to 20V, floating or ground-referenced input
K8	SP2T PIN Switch Driver with logic threshold adjustment pin and multiple output options
K9	Three Channels of AM26LS32 Line Receiver, which decode into 6 outputs of a 54F138 Binary Decoder
K10	300V Current Mirror, with integrated 100 milliohm Sense Resistor and two center-tapped 1% 15K Resistors
K11	LH0041 Op-amp Buffer, High Current Output
K12	Very High-speed Vgate Voltage Monitor circuit, with Adjustable Over-voltage and Under-voltage Logic Outputs
K13	Output Buffered 1 of 8 Decoder, with kick protect diodes, for driving Relays and High Current Loads
K14	Isolated DC-DC Converter, No Magnetics, for use with +5V input, with 5V zener for Output Clamping
K15	PWM Heater Controller with internal Temperature Sense and High-Current FET output, Resistor Setpoint
K16	Driver for -30 to -60V GaN MMIC switches, Ultra-low power, Adjustable logic threshold
K17	Driver for -8 to -15V GaAs MMIC switches, Low power, Adjustable logic threshold
K18	Multi-function FET amplifier protector, with Logic Shutdown, Over-temp, Under- and Over- voltage, more
K19	High Voltage Op-amp, +/-40V output range, similar to LH0004
K20	Driver for -20 to -60V GaN MMIC Switches, High Speed, Adjustable logic threshold
K21	Driver for -10 to -40V GaN MMIC switches, Very high speed, Adjustable logic threshold
K22	BIT Voltage Monitors, Six independent channels, Open collector output, Adjustable BIT threshold voltages
K23	Voltage multiplier, Capacitor/Diode Cascade, Times 4, up to 30V output
K24	GaN Bias Voltage Monitor, Requires +5V only but monitors -20 to -100V range, User set Hi and Low points
K25	High Voltage, Low Power GaN Negative Supply Voltage Regulator, to -75V Range

Mounting / Integration Options

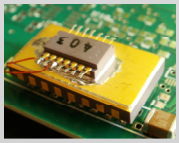
The K package is very strong, and durable, with dimensional repeatability and gold plating.
This makes K Series Building Blocks easy to incorporate into RF and PCB assemblies.



SMT onto PC traces
Can be machine-placed or hand-soldered to PCB traces. Either mounted on surface or with body dropped into a hole of the PCB.



Ribbon or Wire Bondable
With the unit mounted inverted, the ledge of the leads is exposed. These gold features can be soldered to, components mounted on them, or bonded to.



Solderable lid
The K package lid is gold plated and attached using high-temp AuSn, so that if lower temp solder is used, the package top lid may be step-soldered.