



## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

$V_S$ , Unregulated Supply Voltage 15V  
 $V_{REG}$ , Regulated Supply Voltage 7V

Modulus Control Input Voltage 7V  
 Open-Collector Output Voltage 7V  
 Operating Free Air Temperature Range  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$   
 Storage Temperature Range  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$

## Recommended Operating Conditions

Symbol	Parameter	Conditions	DS8615-4 DS8616-4		DS8615-2 DS8616-2		Units
			Min	Max	Min	Max	
$V_S$	Unregulated Supply Voltage	$V_{REG} = \text{Open}$	6.8	13.5	5.5	13.5	V
$V_{REG}$	Regulated Supply Voltage	$V_S$ and $V_{REG}$ Shorted	4.5	5.5	4.5	5.5	V
$f_{MAX}$	Toggle Frequency	$V_{IN} = 100 \text{ mVrms}$	20	130		225	MHz
$V_{IN}$	Input Signal Amplitude		100	300	40	300	mVrms
$V_{SLW}$	Slew Rate		20		20		V/ $\mu\text{s}$
$I_{OH}$	High Level Output Current			-400		-400	$\mu\text{A}$
$I_{OL}$	Low Level Output Current			2.0		2.0	mA

## DC Electrical Characteristics (Notes 2 and 3)

Symbol	Parameter	Conditions	DS8615-4 DS8616-4		DS8615-2 DS8616-2		Units
			Min	Max	Min	Max	
$V_{IH}$	High Level MC Input Voltage	$V_S = 13.5\text{V}$ , $V_{REG} = \text{Open}$	2.0		2.0		V
$V_{IL}$	Low Level MC Input Voltage	$V_{REG} = V_S = 4.5\text{V}$		0.8		0.8	V
$V_{OH}$	High Level Output Voltage	$I_{OH} = -0.4 \text{ mA}$ , Pins 2 and 3 Shorted	$V_{REG} - 2$		$V_{REG} - 2$		V
$I_{CEX}$	Open-Collector High Level Output	Lower Output = 5.5V		100		100	$\mu\text{A}$
$V_{OL}$	Low Level Output Voltage	$V_{REG} = 4.5\text{V}$ , $I_{OL} = 2 \text{ mA}$		0.5		0.5	V
$I_I$	Max MC Input Current	$V_S = 13.5\text{V}$ , $V_{REG} = \text{Open}$ , $V_{IH} = 7\text{V}$		100		100	$\mu\text{A}$
$I_{IH}$	High Level MC Input Current	$V_{REG} = 4.5\text{V}$ , $V_{IH} = 2.7\text{V}$		20		20	$\mu\text{A}$
$I_{IL}$	Low Level MC Input Current	$V_S = 13.5\text{V}$ , $V_{REG} = \text{Open}$ , $V_{IL} = 0.4\text{V}$		-200		-200	$\mu\text{A}$
$I_S$	Supply Current, Unregulated Mode	$V_S = 13.5\text{V}$ , $V_{REG} = \text{Open}$		10		10	mA
$I_{REG}$	Supply Current, Regulated Mode	$V_S = V_{REG} = 5.5\text{V}$		10		10	mA

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Unless otherwise specified Min/Max limits apply across the  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  range.

**Note 3:** All current into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as Max or Min on absolute value basis.

## AC Electrical Characteristics $V_{CC} = 5V \pm 10\%$ , $T_A = -30^\circ\text{C}$ to $+70^\circ\text{C}$

Symbol	Parameter	Conditions	Min	Max	Units
$t_{\text{MODULUS}}$	Modulus Set-Up Time (Notes 4 and 5)	DS8615, DS8616		65	ns
$R_{\text{IN}}$	AC Input Resistance	$V_{\text{IN}} = 100\text{ MHz}$ and $50\text{ mVrms}$	1.0		k $\Omega$
$C_{\text{IN}}$	Input Capacitance	$V_{\text{IN}} = 100\text{ MHz}$ and $50\text{ mVrms}$	3	10	pF

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

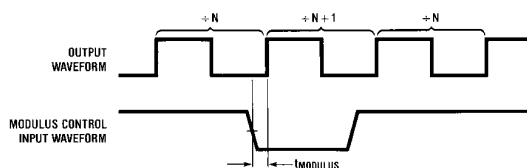
**Note 2:** Unless otherwise specified min/max limits apply across the  $-30^\circ\text{C}$  to  $+70^\circ\text{C}$  temperature range.

**Note 3:** All currents into device pins are shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

**Note 4:**  $t_{\text{MODULUS}}$  = the period of time the modulus control level must be defined prior to the positive transition of the prescaler output to ensure proper modulus selection.

**Note 5:** See Timing Diagrams.

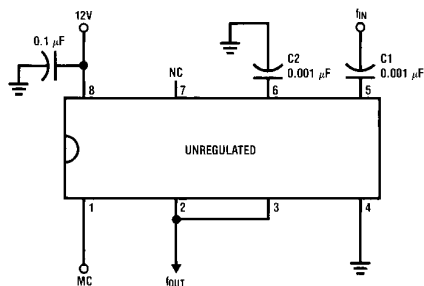
## Timing Diagram



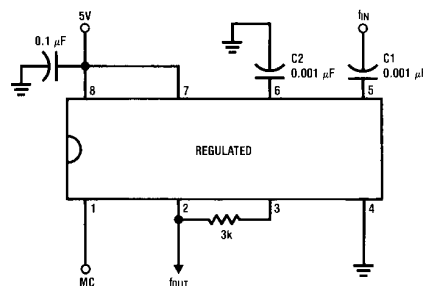
TL/F/5240-3

The logical state of the modulus control input just prior to the output's rising edge will determine the modulus ratio of the device immediately following that rising edge. The pulse width difference of N and N + 1 operation occurs during the output = HI conditions.

## Typical Applications

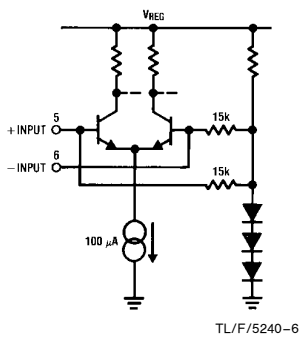


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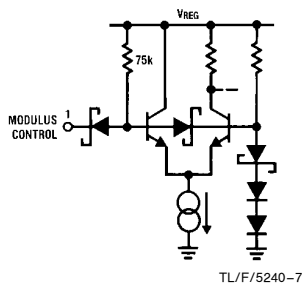


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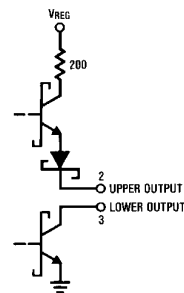
## Schematic Diagrams



TL/F/5240-6



TL/F/5240-7



TL/F/5240-8

## Application Hints

### OPERATING NOTES

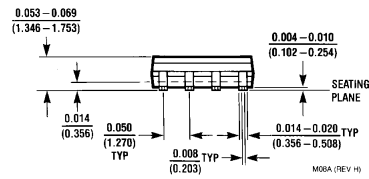
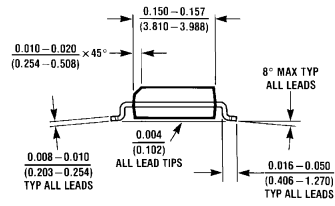
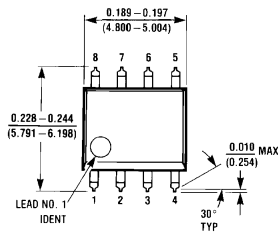
The signal source is usually capacitively coupled to the input. At higher frequencies a 0.001  $\mu\text{F}$  input capacitor (C1) is usually sufficient, with larger values used at the lower frequencies. If the input signal is likely to be interrupted, it may be desirable to connect a 100 k $\Omega$  resistor between one input and ground to stabilize the device. In the single-ended mode, it is preferable to connect the resistor to the unused input. In the differential mode, the resistor can be connected to either input. The addition of the 100 k $\Omega$  pulldown resistor causes a loss of input sensitivity, but prevents circuit oscillations under no signal (open circuit) conditions. In addition, in

the single ended mode, a capacitor of 0.001  $\mu\text{F}$  (C2) should be connected between the unused input and the ground plane to provide a good high frequency bypass. The capacitor should be made larger for lower frequencies.

The input waveform may be sinusoidal, but below about 20 MHz the operation of the circuit becomes dependent on the slew rate of the input rather than amplitude. A square wave input with a slew rate of greater than 20 V/ $\mu\text{s}$  will permit correct operation down to lower frequencies, provided the proper input coupling capacitor is provided.

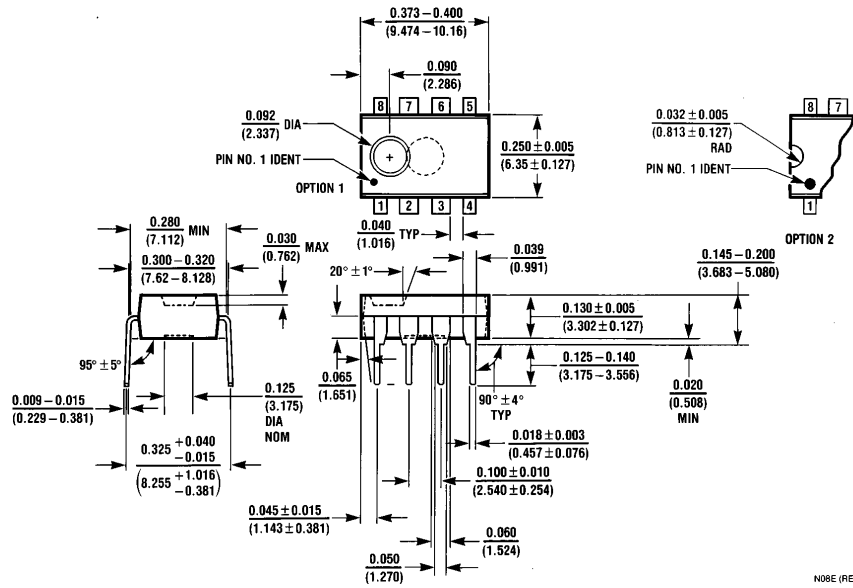
For regulated mode operation connect  $V_S$  to  $V_{\text{REG}}$  to ensure proper operation (see Typical Application diagram).

**Physical Dimensions** inches (millimeters)



**Molded Dual-In-Line Package (M)**  
**Order Number DS8614M-4, DS8615M-4, DS8616M-4 or DS8617M-4**  
**NS Package Number M08A**

**Physical Dimensions** inches (millimeters) (Continued)



**Molded Dual-In-Line Package (N)**  
**Order Number DS8614N, DS8615N, DS8616N or DS8617N (-4, -3, -2)**  
**NS Package Number N08E**

N08E (REV F)

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