

# MC33465

## Micropower Undervoltage Sensing Circuits with Programmable Output Delay

The MC33465 series are micropower undervoltage sensing circuits that are specifically designed for use with battery powered microprocessor based systems, where extended battery life is required. A choice of several threshold voltages from 0.9 V to 4.5 V are available. This device features a very low quiescent bias current of 1.0  $\mu$ A typical.

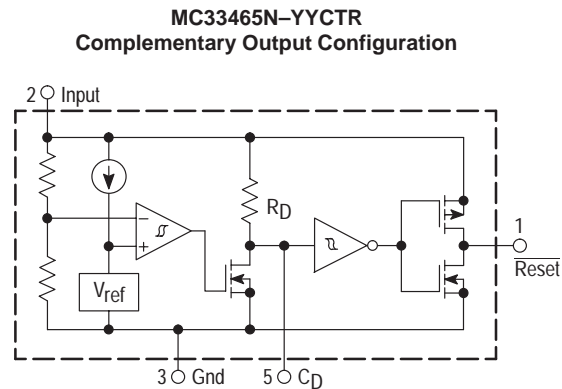
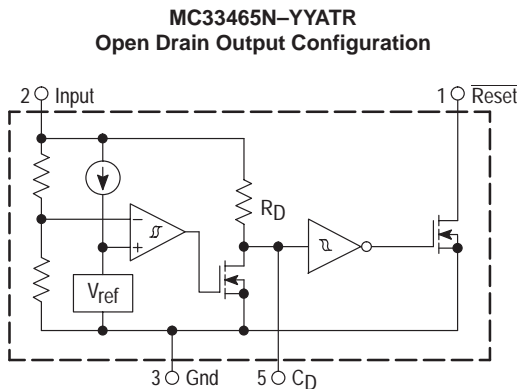
The MC33465 series features a highly accurate voltage reference, a comparator with precise thresholds and built-in hysteresis to prevent erratic reset operation, a choice of output configurations between open drain or complementary, a time delayed output, which can be programmed by the system designer, and guaranteed operation below 1.0 V with extremely low standby current. This device is available in a SOT-23 5-pin surface mount package.

Applications include direct monitoring of the MPU/logic power supply used in appliance, automotive, industrial and portable equipment.

### Features:

- Extremely Low Standby Current of 1.0  $\mu$ A at  $V_{in} = 3.5$  V
- Wide Input Voltage Range (0.7 V to 10 V)
- Monitors Power Supply Voltages from 1.1 V to 5.0 V
- High Accuracy Detector Threshold ( $\pm 2.5\%$ )
- Two  $\overline{\text{Reset}}$  Output Types (Open Drain or Complementary Drive)
- Programmable Output Delay by External Capacitor (100 ms typ. with 0.15  $\mu$ F)
- Surface Mount Package (SOT-23 5-Pin)
- Convenient Tape and Reel (3000 per Reel)

### Representative Block Diagrams



YY Denotes Threshold Voltage

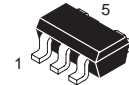
This device contains 28 active transistors.



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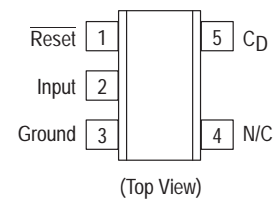
Formerly a Division of Motorola

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**SOT-23-5**  
**N SUFFIX**  
**CASE 1212**

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Input Supply Voltage	$V_{in}$	0 to 12	V
Reset Output Voltage	$V_O$	-0.3 to 12	V
Reset Output Current (Source or Sink)	$I_O$	70	mA
Power Dissipation and Thermal Characteristics			
Maximum Power Dissipation at $T_A = 25^\circ\text{C}$	$P_D$	150	mW
Case 1212 (SOT-23) N Suffix Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	667	$^\circ\text{C/W}$
Operating Junction Temperature	$T_J$	+125	$^\circ\text{C}$
Operating Ambient Temperature	$T_A$	-40 to +85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to +125	$^\circ\text{C}$
Lead Temperature (Soldering)	$T_{solder}$	260 $^\circ\text{C}$ , 10 s	

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## ELECTRICAL CHARACTERISTICS (For all values $T_A = 25^\circ\text{C}$ (Note 1), unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>SENSE COMPARATOR</b>					
Threshold Voltage High to Low State Output ( $V_{in}$ Decreasing)	$V_{IL}$				V
09 Suffix		0.878	0.9	0.922	
20 Suffix		1.950	2.0	2.050	
22 Suffix		2.145	2.2	2.255	
27 Suffix		2.633	2.7	2.767	
28 Suffix		2.730	2.8	2.870	
30 Suffix		2.925	3.0	3.075	
32 Suffix		3.120	3.2	3.280	
34 Suffix		3.315	3.4	3.485	
38 Suffix		3.705	3.8	3.895	
43 Suffix		4.193	4.3	4.407	
44 Suffix		4.290	4.4	4.510	
45 Suffix		4.387	4.5	4.612	
46 Suffix		4.485	4.6	4.715	
47 Suffix	4.583	4.7	4.817		
Threshold Hysteresis ( $V_{in}$ Increasing)	$V_H$				V
09 Suffix		0.027	0.045	0.063	
20 Suffix		0.060	0.100	0.140	
22 Suffix		0.066	0.110	0.154	
27 Suffix		0.081	0.135	0.189	
28 Suffix		0.084	0.140	0.196	
30 Suffix		0.090	0.150	0.210	
32 Suffix		0.096	0.160	0.224	
34 Suffix		0.102	0.170	0.238	
38 Suffix		0.114	0.190	0.266	
43 Suffix		0.129	0.215	0.301	
44 Suffix		0.132	0.220	0.308	
45 Suffix		0.135	0.225	0.315	
46 Suffix		0.138	0.230	0.322	
47 Suffix	0.141	0.235	0.329		
Threshold Voltage Temperature Coefficient	$T_C$	–	$\pm 100$	–	PPM/ $^\circ\text{C}$
<b>RESET OUTPUT</b>					
Output Voltage High State (Complementary Output: $I_{\text{source}} = 1.0 \text{ mA}$ ) Low State (Complementary or Open Drain Output: $I_{\text{sink}} = 1.0 \text{ mA}$ )	$V_{OH}$ $V_{OL}$	$V_{in} - 2.1$ –	$V_{in} - 1.0$ 0.25	$V_{in}$ 0.5	V
Output Sink Current ( $V_{in} = 1.5 \text{ V}$ , $V_{OL} = 0.5 \text{ V}$ )	$I_{OL}$	1.0	2.0	–	
Output Source Current ( $V_{in} = 4.5 \text{ V}$ , $V_{OH} = 2.4 \text{ V}$ )	$I_{OH}$	1.0	2.0	–	mA
<b>DELAY OUTPUT</b>					
Output Sink Current ( $V_{in} = 1.5 \text{ V}$ , $V_{OL} = 0.5 \text{ V}$ )	$I_{OL}$	0.2	0.8	–	mA
Delay Resistance	$R_D$	0.5	1.0	2.0	$M\Omega$
<b>TOTAL DEVICE</b>					
Operating Input Voltage Range	$V_{in}$	0.8 to 10	–	–	V
Quiescent Input Current $V_{in} = 4.34 \text{ V}$ $V_{in} = 6.50 \text{ V}$	$I_{in}$	– –	5.5 1.3	11 3.9	$\mu\text{A}$

**NOTE:** 1. Low duty pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

Figure 1. Reset Low State Sink Current versus Output Voltage

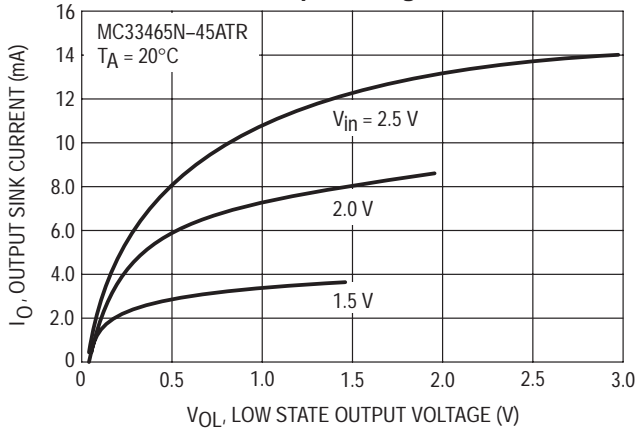


Figure 2. Output Voltage versus Input Voltage

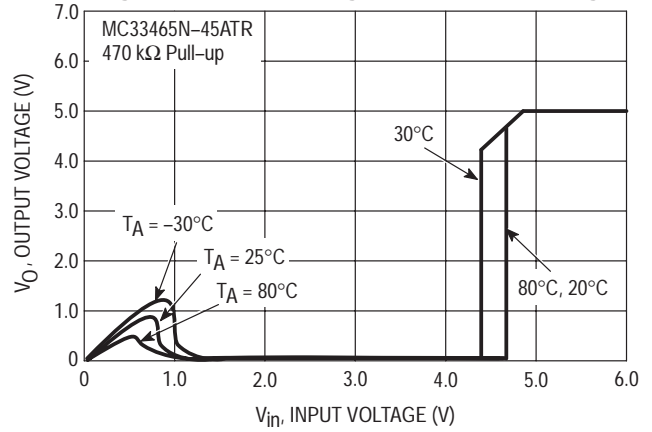


Figure 3. Input Current versus Input Voltage

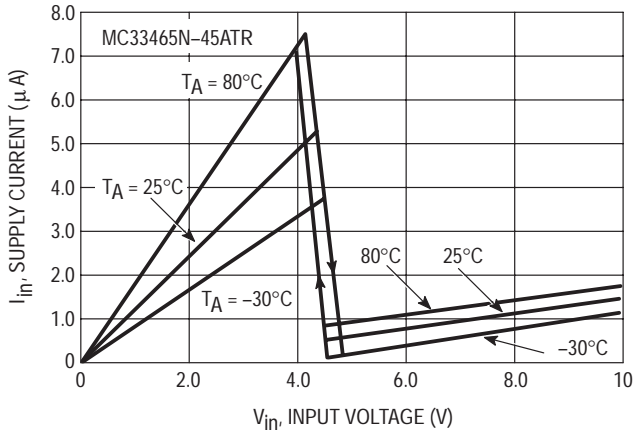


Figure 4. Comparator Input Threshold Voltage versus Temperature

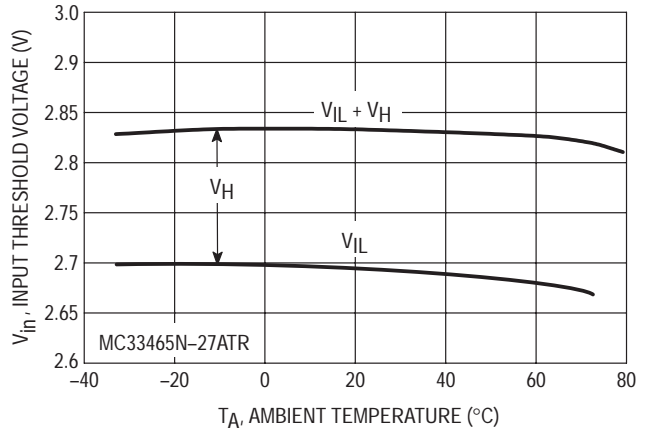


Figure 5. Reset Output Sink Current versus Input Voltage

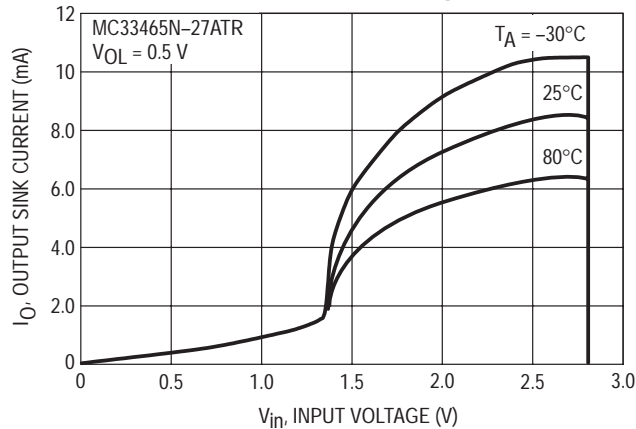
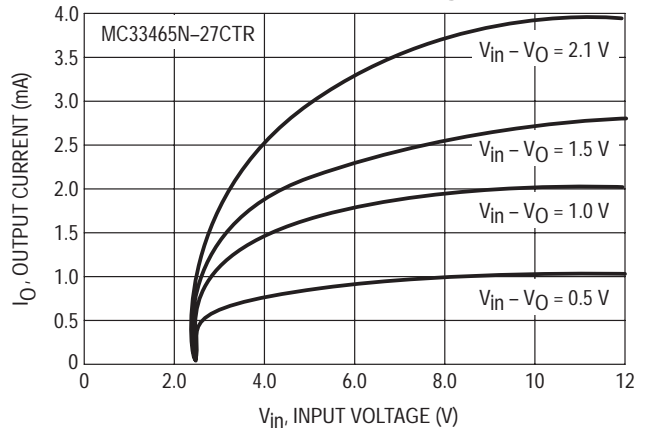
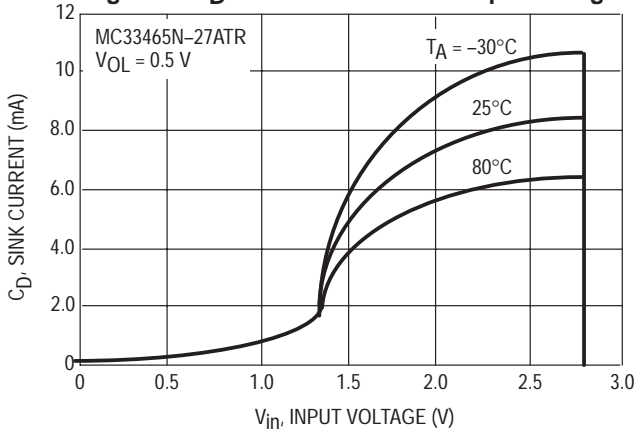


Figure 6. Reset Output Source Current versus Input Voltage

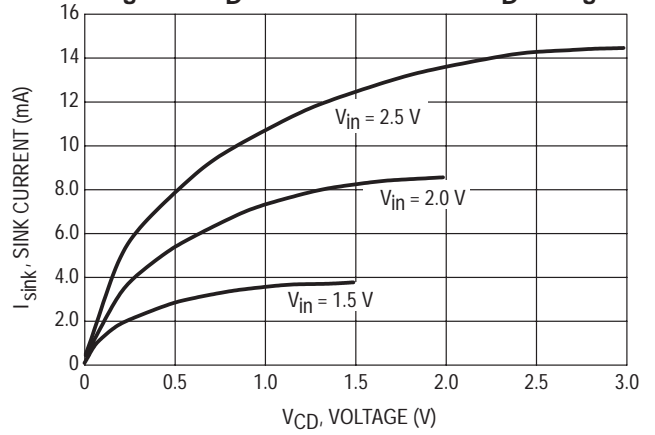


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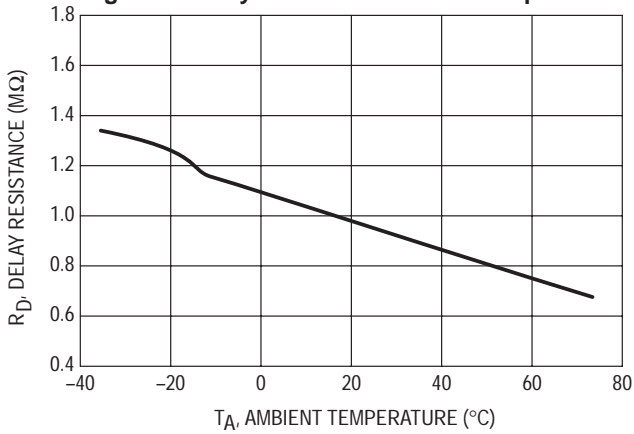
**Figure 7.  $C_D$  Sink Current versus Input Voltage**



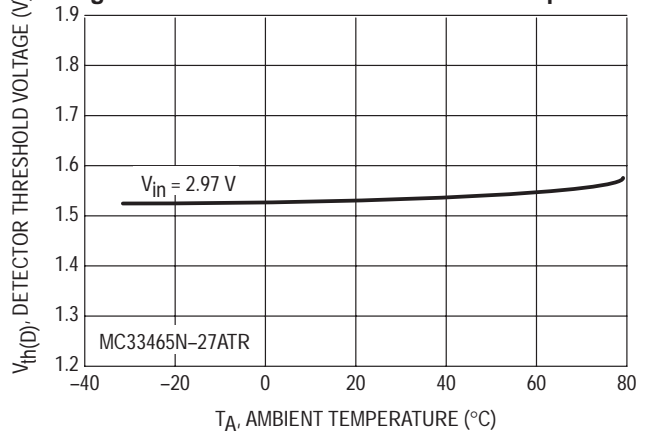
**Figure 8.  $C_D$  Sink Current versus  $C_D$  Voltage**



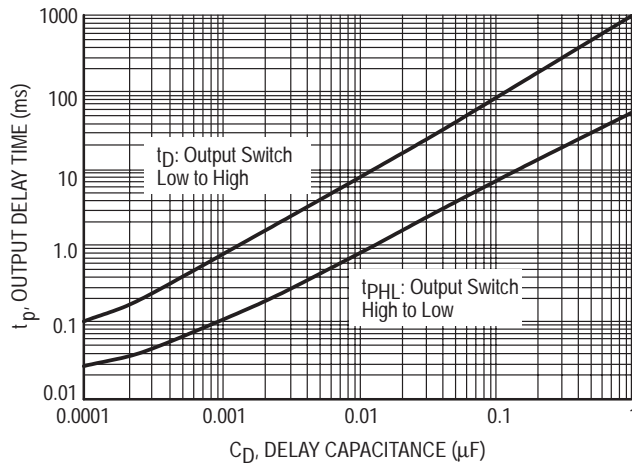
**Figure 9. Delay Resistance versus Temperature**



**Figure 10. Detector Threshold versus Temperature**



**Figure 11. Output Delay Time versus Delay Capacitance**



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Figure 12. Typical Open Drain Application

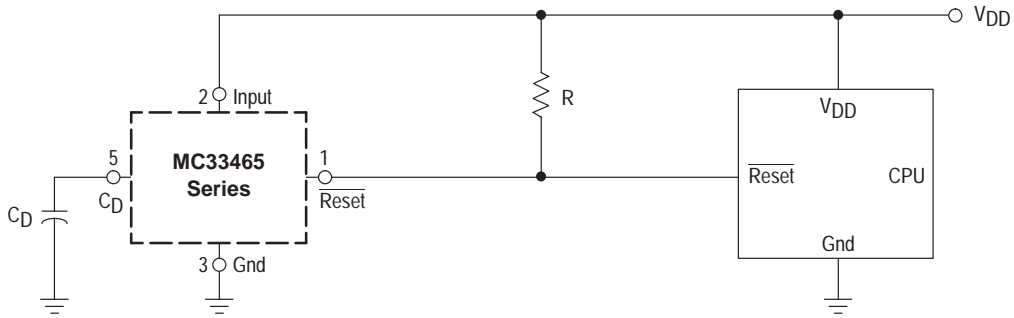
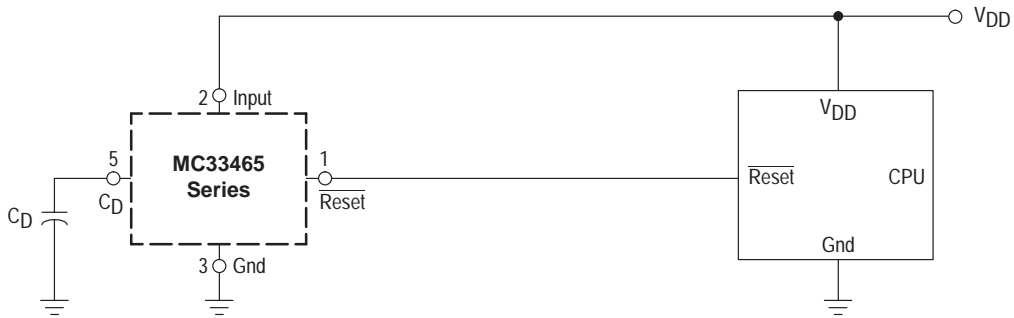


Figure 13. Typical Complementary Output Application



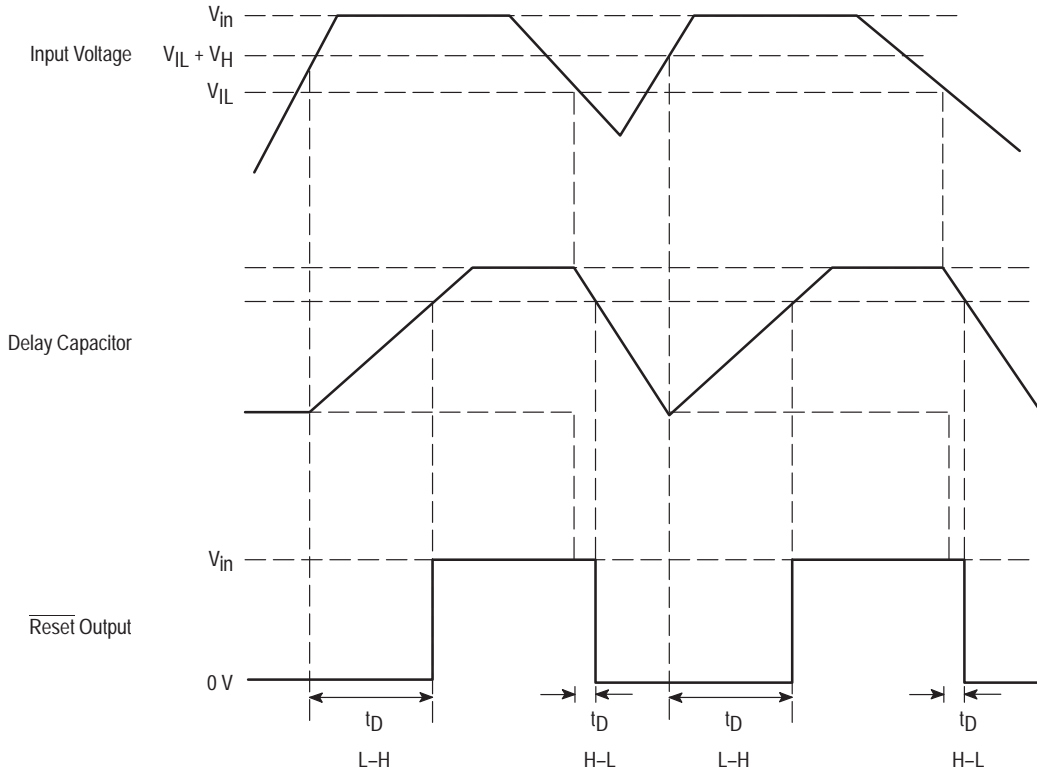
## APPLICATION CIRCUIT INFORMATION

The MC33465 series are micropower undervoltage sensing circuits which offer a programmable time delayed output with the choice of either complementary output drive or open drain output configurations. Figure 14 shows the timing relationships between the input voltage and the resulting circuit waveforms. When the input voltage ( $V_{IN}$ ) exceeds the sense comparator threshold, the timing capacitor is allowed to charge through the internal delay resistor. When the output inverting driver threshold is exceeded, the Reset output switches from a logic "0" to a

logic "1". The top curve of Figure 11 provides the nominal delay time for a given value of delay capacitance. When  $V_{IN}$  drops below the comparator threshold minus hysteresis voltage, the delay capacitor discharges. When the capacitance voltage drops below the inverting driver threshold, the output switches from a logic "1" to a logic "0". The bottom curve in Figure 11 provides typical delay time for given delay capacitance values. The inverting driver threshold voltage is typically about  $V_{IN}/2$ , as shown in Figure 10.

# MC33465

Figure 14. Timing Waveforms



## ORDERING INFORMATION

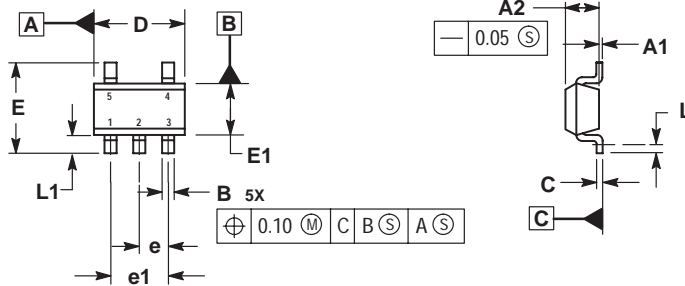
Device	Threshold Voltage	Type	Marking	Package	Package
MC33465N-09ATR	0.9	Open Drain Reset	$\bar{A}9$	SOT-23 5-Lead	3000 Tape & Reel
MC33465N-20ATR	2.0		$\bar{C}0$		
MC33465N-22ATR	2.2		$\bar{C}2$		
MC33465N-27ATR	2.7		$\bar{C}7$		
MC33465N-28ATR	2.8		$\bar{D}8$		
MC33465N-30ATR	3.0		$\bar{D}0$		
MC33465N-32ATR	3.2		$\bar{D}2$		
MC33465N-34ATR	3.4		$\bar{D}4$		
MC33465N-38ATR	3.8		$\bar{D}8$		
MC33465N-45ATR	4.5		$\bar{E}5$		
MC33465N-46ATR	4.6	$\bar{E}6$			
MC33465N-47ATR	4.7	$\bar{E}7$			
MC33465N-09CTR	0.9	Compl. MOS Reset	$9\bar{A}$		
MC33465N-20CTR	2.0		$0\bar{C}$		
MC33465N-27CTR	2.7		$7\bar{C}$		
MC33465N-30CTR	3.0		$0\bar{D}$		
MC33465N-43CTR	4.3		$3\bar{E}$		
MC33465N-44CTR	4.4		$4\bar{E}$		
MC33465N-45CTR	4.5	$5\bar{E}$			

Other voltages from 0.9 to 6.0 V, in 0.1 V increments, are available. Consult factory for information.

# MC33465

## PACKAGE DIMENSIONS

(SOT-23)  
N SUFFIX  
PLASTIC PACKAGE  
CASE 1212-01  
ISSUE O

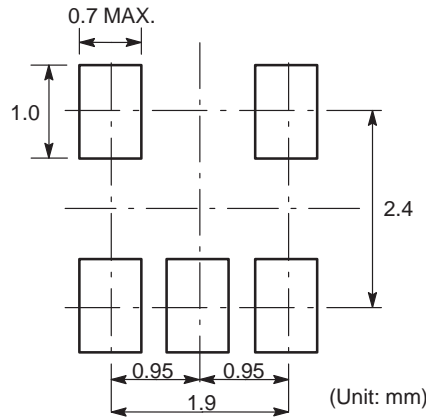


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DATUM C IS A SEATING PLANE.

MILLIMETERS		
DIM	MIN	MAX
A1	0.00	0.10
A2	1.00	1.30
B	0.30	0.50
C	0.10	0.25
D	2.80	3.00
E	2.50	3.10
E1	1.50	1.80
e	0.95 BSC	
e1	1.90 BSC	
L	0.20	---
L1	0.45	0.75

### Recommended Footprint for Surface Mount Applications



### SOT-23-5

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