MC33460, MC33461

Under Voltage Detector Series

The MC33460 and MC33461 series are ultra–low power CMOS under–voltage detectors with very tight threshold accuracy specifically designed for accurate monitoring of power supplies. The devices are optimized for use in battery powered systems where low quiescent current and small packaging are required. The device generates an active–low signal whenever the input voltage falls below the factory set ±2% threshold. Hysteresis is provided to ensure reliable output switching.

The MC33460/1 series features a highly accurate voltage reference, a comparator with a precision voltage threshold, and built–in hysteresis to prevent erratic operation and a choice of output configurations between Open Drain (MC33460) and complementary push–pull (MC33461). The products are offered in 9 standard voltage thresholds ranging from 0.9V to 4.5V. Other threshold voltages from 1.0 to 5.0V are available in 100mV steps. The devices can operate to a very low input voltage level and are housed in the ultra–miniature SC–82AB package.

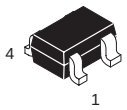
Features

- Available in Open Drain or Push–Pull Output
- Output State Guaranteed to V_{in} = 0.8 V
- Tight Detector Voltage Accuracy (±2.0%)
- Extended Temperature Operation (–40°C to 85°C)
- Ultra Low Quiescent Current (0.8 μA at V_{in} = 1.5 V typical)
- Wide Range of Operating Voltage (0.7 V to 10 V)

Applications

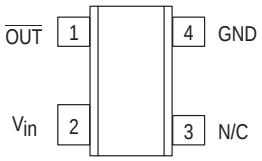
- Low Battery Detector
- Power–Fail Indicator
- Microprocessor Reset Generator
- Window Comparator
- Battery Backup Circuit

ON Semiconductor
Formerly a Division of Motorola
http://onsemi.com



SC–82AB
SQ SUFFIX
CASE 419C

PIN CONNECTIONS



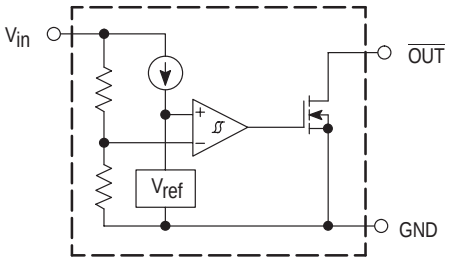
(Top View)

ORDERING INFORMATION

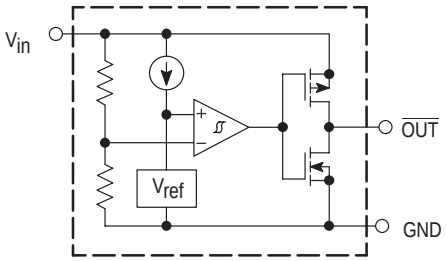
See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

Representative Block Diagrams

MC33460
Nch Open Drain Configuration



MC33461
CMOS Configuration



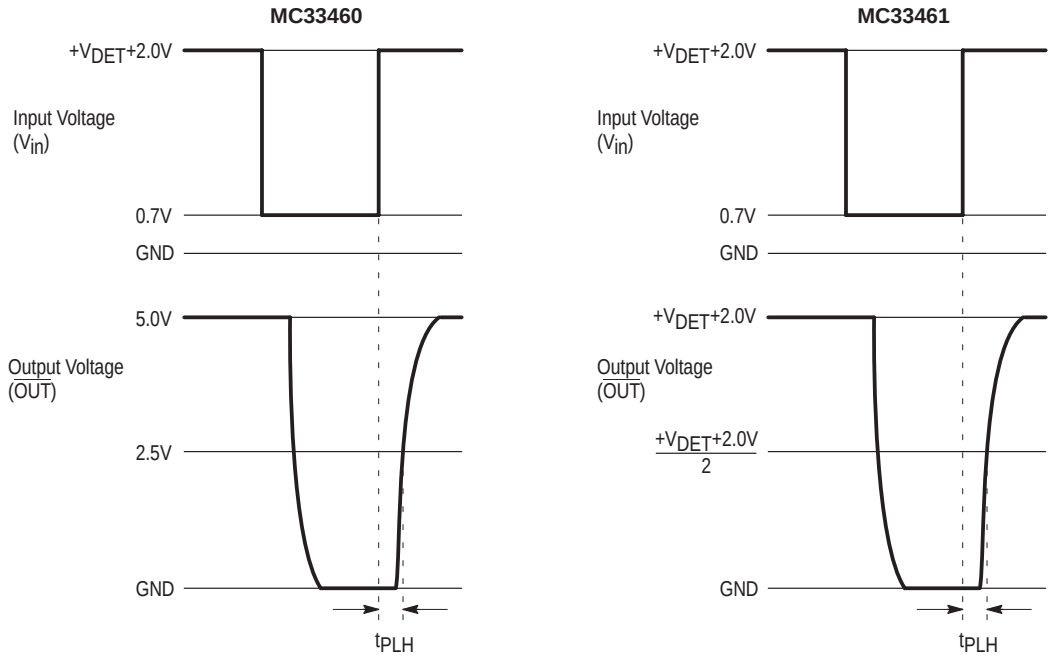
ORDERING INFORMATION

Device	Threshold Voltage	Type	Marking	Package (Qty/Reel)
MC33460SQ–09ATR	0.9	Nch Open Drain	K9	3000 Units on 7 inch Reel
MC33460SQ–20ATR	2.0		M0	
MC33460SQ–27ATR	2.7		M7	
MC33460SQ–28ATR	2.8		M8	
MC33460SQ–30ATR	3.0		N0	
MC33460SQ–32ATR	3.2		N2	
MC33460SQ–43ATR	4.3		P3	
MC33460SQ–45ATR	4.5		P5	
MC33461SQ–09CTR	0.9	CMOS	T9	
MC33461SQ–20CTR	2.0		V0	
MC33461SQ–27CTR	2.7		V7	
MC33461SQ–28CTR	2.8		V8	
MC33461SQ–30CTR	3.0		W0	
MC33461SQ–32CTR	3.2		W2	
MC33461SQ–43CTR	4.3		X3	
MC33461SQ–45CTR	4.5		X5	

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{in}	12	V
Output Voltage (CMOS)	V_{OUT1}	–0.3 to V_{in}+0.3	V
Output Voltage (Nch Open Drain)	V_{OUT2}	–0.3 to 12	V
Output Current	I_{OUT}	70	mA
Power Dissipation	P_D	150	mW
Operating Ambient Temperature	T_A	–40 to +85	°C
Storage Temperature Range	T_{stg}	–40 to +125	°C
Lead Temperature (Soldering)	T_{solder}	260°C, 10 s	–

Figure 1. T_{pd} Measurement Conditions



Note: Measured with 470k pullup resistor from $\overline{OUT}$ to +5V.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 0.9						
Detector Threshold (V_{in} Falling)		V_{DET-}	0.882	0.900	0.918	V
Detector Threshold Hysteresis		V_{HYS}	0.027	0.045	0.063	V
Supply Current	(V_{in} = 0.8 V) (V_{in} = 2.9 V)	I_{in}	– –	0.8 1.0	2.4 3.0	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$) Nch CMOS Output High	 (V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 0.85V) (V_{out} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 0.05 1.0	 0.05 0.50 2.0	 – – –	 mA mA mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 2.0						
Detector Threshold (V_{in} Falling)		V_{DET-}	1.96	2.00	2.04	V
Detector Threshold Hysteresis		V_{HYS}	0.06	0.10	0.14	V
Supply Current	(V_{in} = 1.9 V) (V_{in} = 4.0 V)	I_{in}	– –	0.9 1.1	2.7 3.3	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$) Nch CMOS Output High	 (V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V) (V_{out} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 1.0 1.0	 0.05 2.0 2.0	 – – –	 mA mA mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 2.7						
Detector Threshold (V_{in} Falling)		V_{DET-}	2.646	2.700	2.754	V
Detector Threshold Hysteresis		V_{HYS}	0.081	0.135	0.189	V
Supply Current	(V_{in} = 2.6 V) (V_{in} = 4.7 V)	I_{in}	– –	0.9 1.1	2.7 3.3	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$)		I_{OUT}				
Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)		0.01 1.0	0.05 2.0	– –	mA mA
CMOS Output High	(V_{out} = 2.4V, V_{in} = 4.5V)		1.0	2.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 2.8						
Detector Threshold (V_{in} Falling)		V_{DET-}	2.744	2.800	2.856	V
Detector Threshold Hysteresis		V_{HYS}	0.084	0.140	0.196	V
Supply Current	(V_{in} = 2.7 V) (V_{in} = 4.8 V)	I_{in}	– –	0.9 1.1	2.7 3.3	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$)		I_{OUT}				
Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)		0.01 1.0	0.05 2.0	– –	mA mA
CMOS Output High	(V_{out} = 2.4V, V_{in} = 4.5V)		1.0	2.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 3.0						
Detector Threshold (V_{in} Falling)		V_{DET-}	2.94	3.00	3.06	V
Detector Threshold Hysteresis		V_{HYS}	0.09	0.15	0.21	V
Supply Current	(V_{in} = 2.87 V) (V_{in} = 5.0 V)	I_{in}	– –	1.0 1.2	3.0 3.6	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$)		I_{OUT}				
Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)		0.01 1.0	0.05 2.0	– –	mA mA
CMOS Output High	(V_{out} = 2.4V, V_{in} = 4.5V)		1.0	2.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 3.2						
Detector Threshold (V_{in} Falling)		V_{DET-}	3.136	3.200	3.264	V
Detector Threshold Hysteresis		V_{HYS}	0.096	0.160	0.224	V
Supply Current	(V_{in} = 3.07 V) (V_{in} = 5.2 V)	I_{in}	– –	1.0 1.2	3.0 3.6	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$)		I_{OUT}				
Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)		0.01 1.0	0.05 2.0	– –	mA mA
CMOS Output High	(V_{out} = 2.4V, V_{in} = 4.5V)		1.0	2.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 4.3						
Detector Threshold (V_{in} Falling)		V_{DET-}	4.214	4.300	4.386	V
Detector Threshold Hysteresis		V_{HYS}	0.129	0.215	0.301	V
Supply Current	(V_{in} = 4.14 V) (V_{in} = 6.3 V)	I_{in}	– –	1.1 1.3	3.3 3.9	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$) Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)	I_{OUT}	 0.01 1.0	 0.05 2.0	 – –	 mA mA
CMOS Output High	(V_{out} = 2.4V, V_{in} = 4.5V)		1.0	2.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

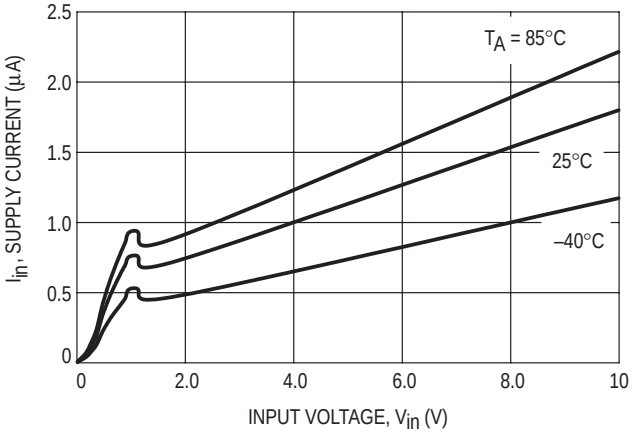
ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

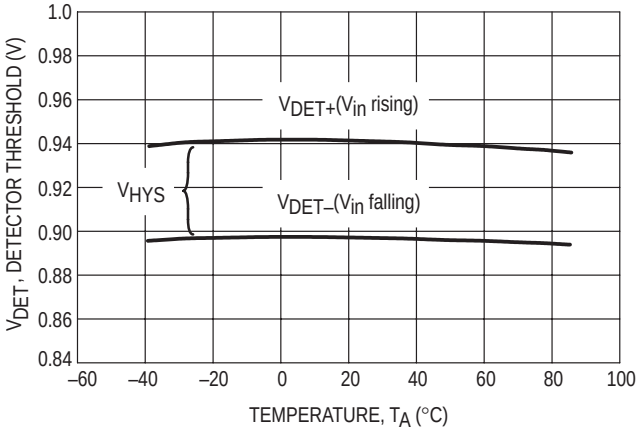
Characteristic		Symbol	Min	Typ	Max	Unit
MC33460/461 – 4.5						
Detector Threshold (V_{in} Falling)		V_{DET-}	4.410	4.500	4.590	V
Detector Threshold Hysteresis		V_{HYS}	0.135	0.225	0.315	V
Supply Current	(V_{in} = 4.34 V) (V_{in} = 6.5 V)	I_{in}	– –	1.1 1.3	3.3 3.3	μA
Maximum Operating Voltage		$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage	 (–40°C≤T_A≤85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Output Current ($\overline{OUT}$) Nch	(V_{out} = 0.05V, V_{in} = 0.70V) (V_{out} = 0.50V, V_{in} = 1.5V)	I_{OUT}	 0.01 1.0	 0.05 2.0	 – –	 mA mA
CMOS Output High	(V_{out} = 6.9V, V_{in} = 8.0V)		1.5	3.0	–	mA
Output Delay Time (Note 1)		t_{pd}	–	–	100	μs
Detector Threshold Temperature Coefficient	(–40°C≤T_A≤85°C)	$\Delta V_{DET-}/\Delta T$	–	±100	–	PPM/°C

NOTES: 1.Refer to Figure 1 for test conditions for measurement.

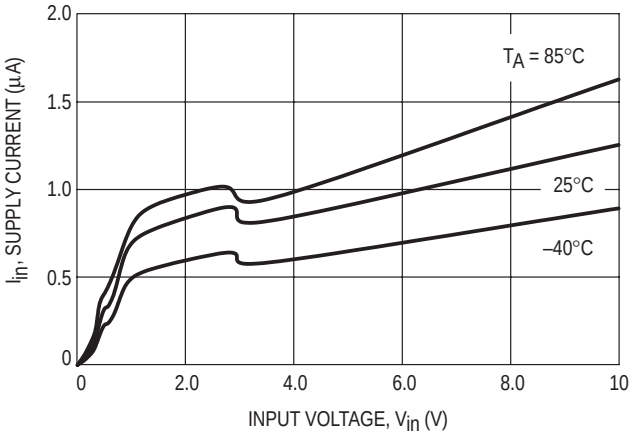
TYPICAL CHARACTERISTICS

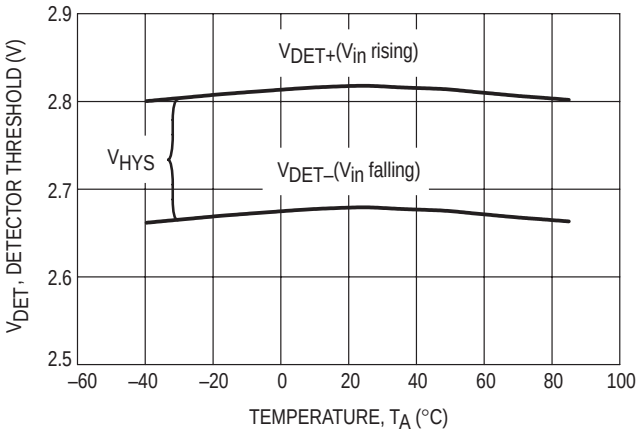
MC33461–0.9



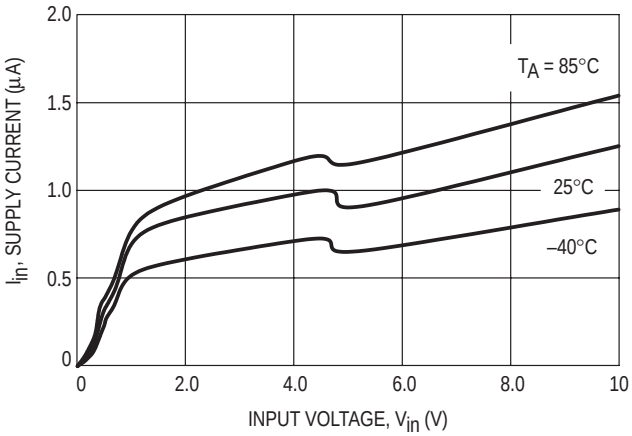


MC33461–2.7





MC33461–4.5



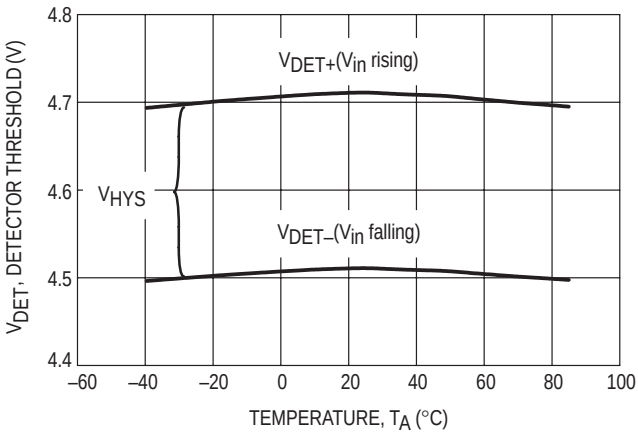
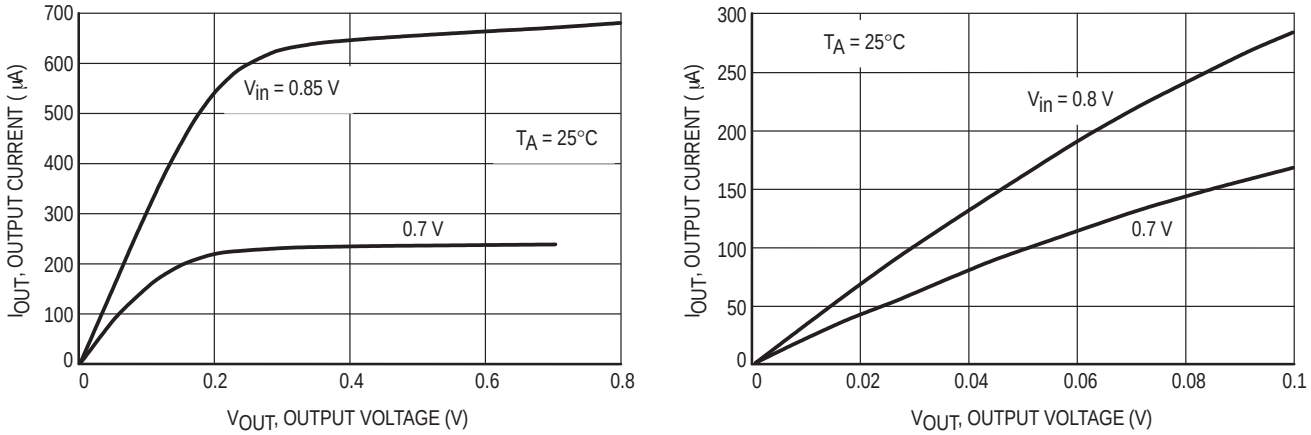


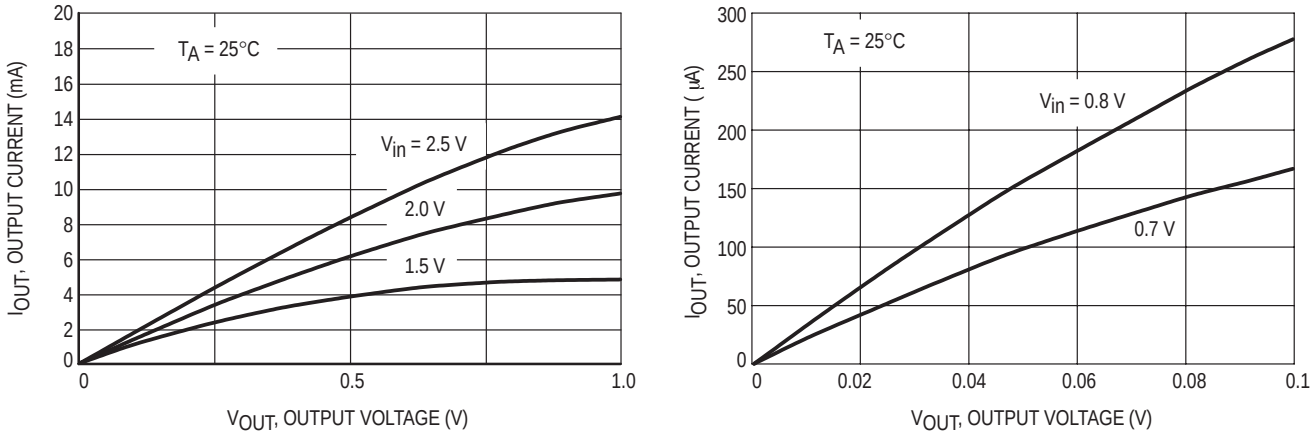
Figure 2. Supply Current vs. Input Voltage

Figure 3. Detector Threshold Hysteresis vs. Temperature

MC33461–0.9



MC33461–2.7



MC33461–4.5

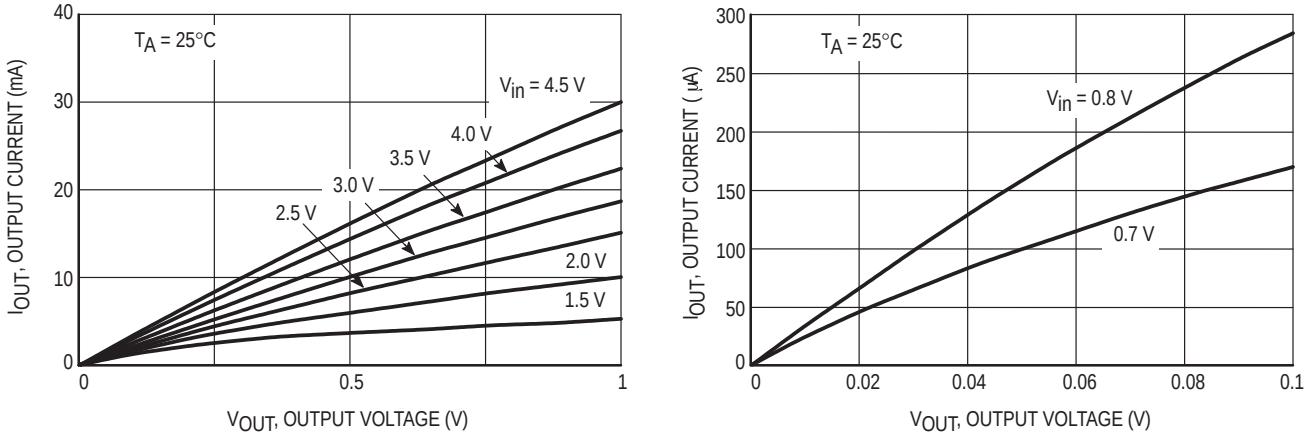
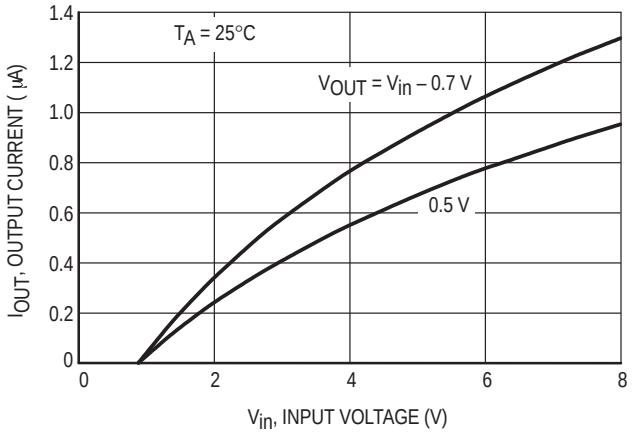
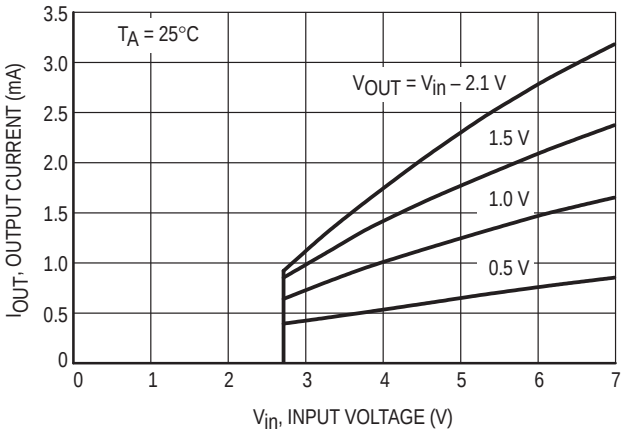


Figure 4. Nch Output Current versus V_{in}

MC33461–0.9



MC33461–2.7



MC33461–4.5

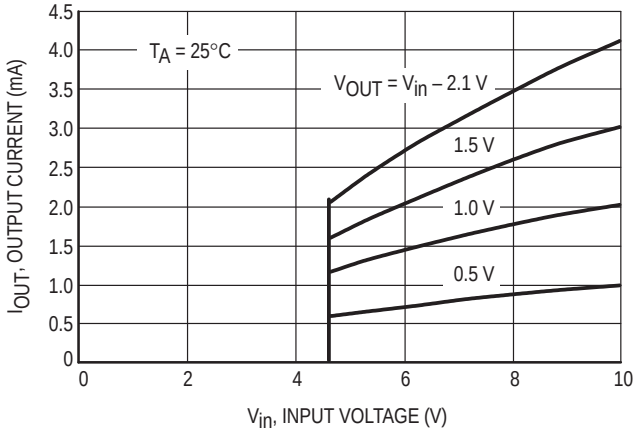
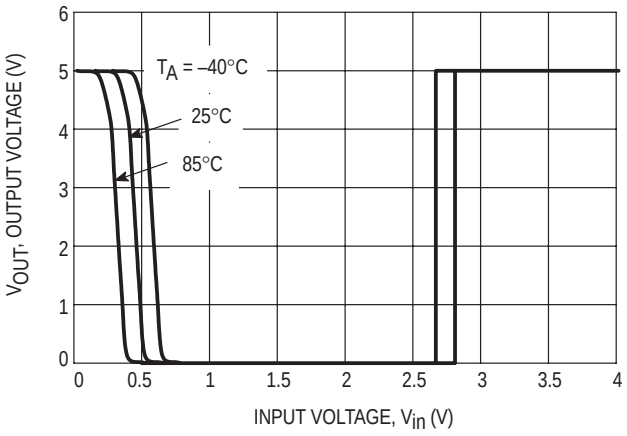


Figure 5. Output Current High versus Input Voltage

MC33460–2.7



MC33461–2.7

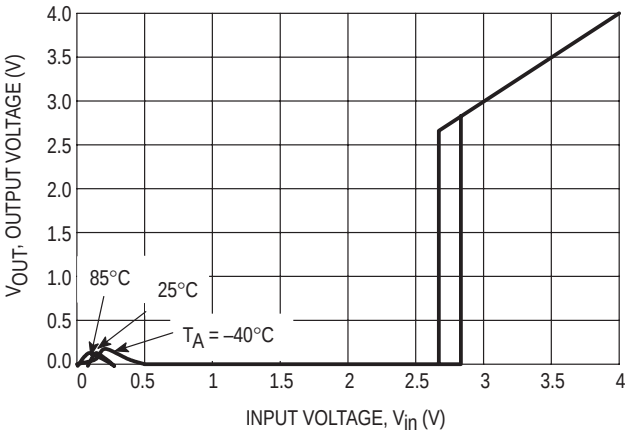


Figure 6. Typical Output Voltage versus Input Voltage

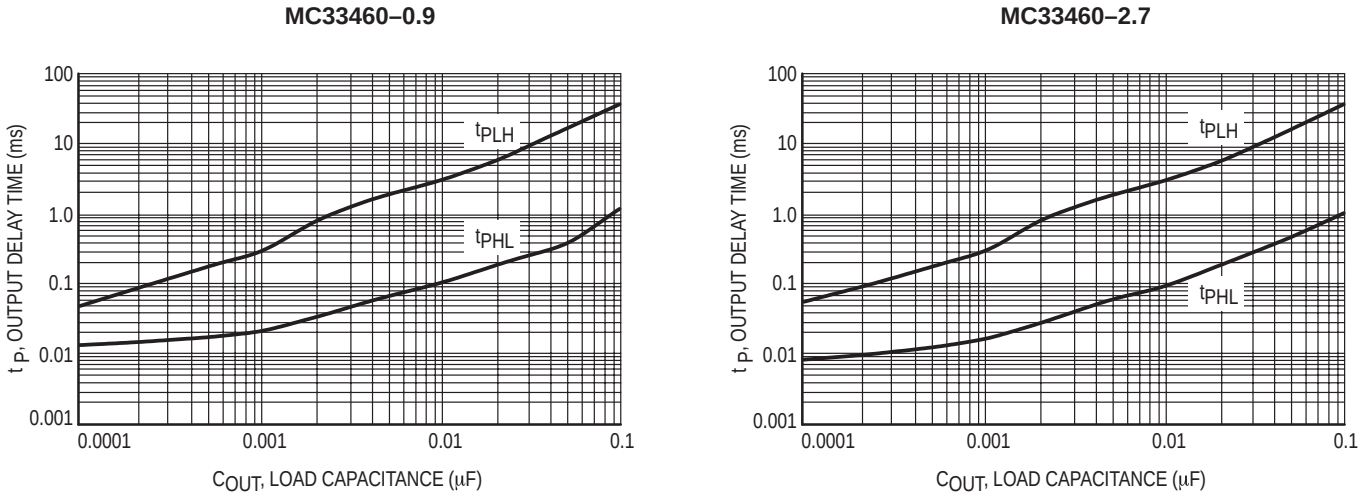


Figure 7. Output Delay Time versus Load Capacitance

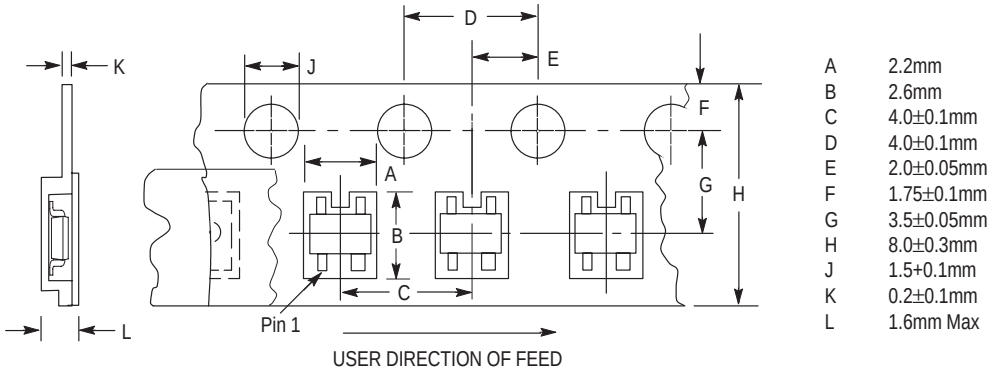


Figure 8. Taping Specifications

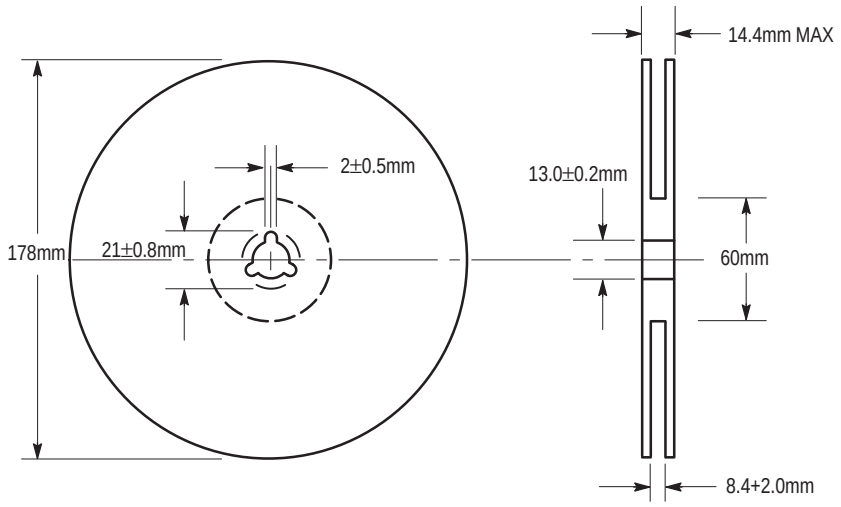
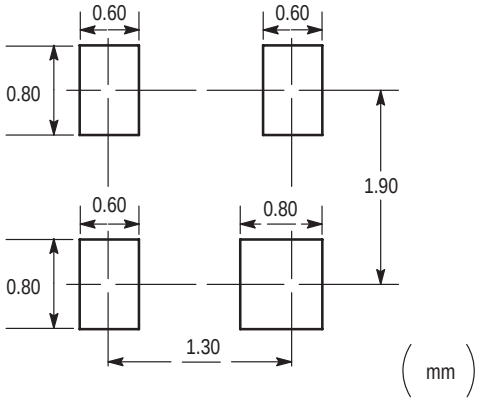


Figure 9. Reel Dimensions

INFORMATION FOR USING THE SC−82AB SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



SC−82AB

SOLDERING PRECAUTIONS

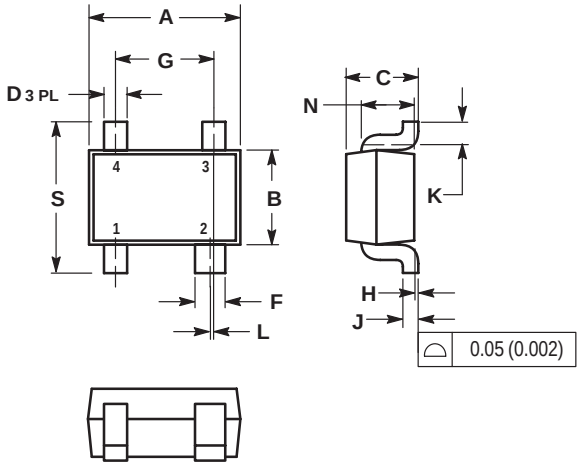
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

PACKAGE DIMENSIONS

(SC–82AB)
SQ SUFFIX
PLASTIC PACKAGE
CASE 419C–01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	1.8	2.2	0.071	0.087
B	1.15	1.45	0.045	0.057
C	0.8	1.1	0.031	0.043
D	0.2	0.4	0.008	0.016
F	0.3	0.5	0.012	0.020
G	1.1	1.5	0.043	0.059
H	0.0	0.1	0.000	0.004
J	0.10	0.26	0.004	0.010
K	0.1	—	0.004	—
L	0.05 BSC		0.002 BSC	
N	0.7 REF		0.028 REF	
S	1.8	2.4	0.07	0.09

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