

# MC33560

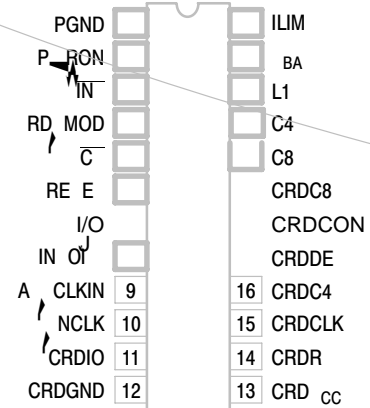
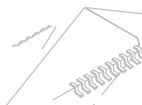
## Power Management and Interface IC for Smartcard Readers and Couplers

The MC33560 is an interface IC for smartcard reader/writer applications. It enables the management of any type of smart or memory card through a simple and flexible microcontroller interface. Moreover, several couplers can be coupled to it.



ON Semiconductor

<http://onsemi.com>



(Top View)

# MC33560

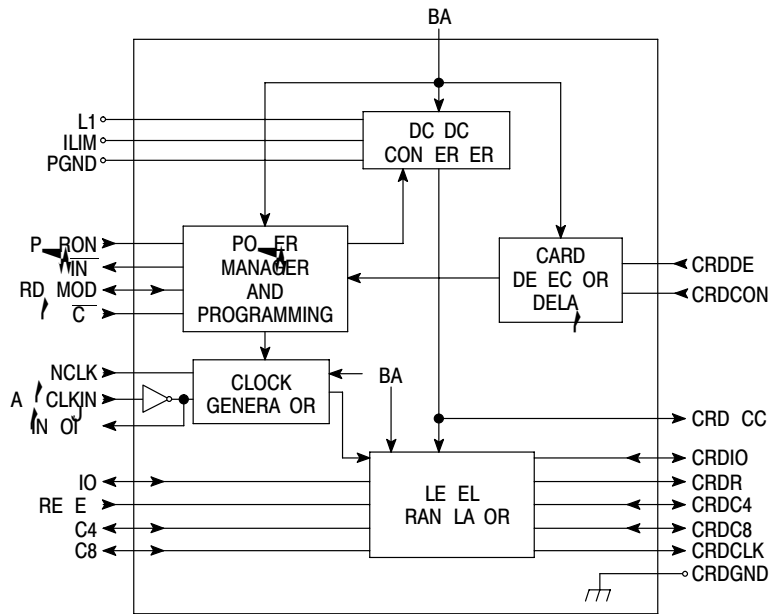


Figure 1. Simplified Functional Block Diagram

## MAXIMUM RATINGS (Note 1)

Symbol	Rating	Value	Unit
V <sub>BAT</sub>	Battery Supply Voltage	7.0	
BAT	Battery Supply Current	±200	

# MC33560

**ELECTRICAL CHARACTERISTICS** These specifications are written in the same style as common for standard integrated circuits. The convention considers current flowing into the pin (sink current) as positive and current flowing out of the pin (source current) as negative. (Conditions:  $V_{BAT} = 4.0\text{ V}$ ,  $V_{CC} = 5.0\text{ V nom}$ ,  $PWRON = V_{BAT}$ , Operating Mode,  $-I_{CC} = 10\text{ mA}$ ,  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $L_1 = 47\text{ }\mu\text{H}$ ,  $R_{LIM} = 0\text{ }\Omega$ ,  $CRDV_{CC}$  capacitor =  $10\text{ }\mu\text{F}$ , unless otherwise noted.)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
----------------	-----------------	--------	-----	-----	-----	------

## BATTERY POWER SUPPLY SECTION

Supply Voltage Range Normal operating range extended operating range (Note 4)		$V_{BAT}$	2.2 1.8	– –	6.0 6.6	V
MC33560 Standby Quiescent Current $PWRON = GND$ , $CRDCON = GND$ , $ASYCLKIN = GND$ , $V_{BAT} = 6.0\text{ V}$ , All Other Logic Inputs and Outputs Open		$I_{oBAT}$	–	–	30	$\mu\text{A}$
DC Operating Current $-I_{CC} = 10\text{ mA}$ ; $V_{CC} = 5.0\text{ V}$ , $V_{BAT} = 6.0\text{ V}$		$I_{BATop}$	–	–	12.5	mA

$V_{BAT}$

# MC33560

**ELECTRICAL CHARACTERISTICS (continued)** These specifications are written in the same style as common for standard integrated circuits. The convention considers current flowing into the pin (sink current) as positive and current flowing out of the pin (source current) as negative. (Conditions:  $V_{BAT} = 4.0\text{ V}$ ,  $V_{CC} = 5.0\text{ V nom}$ ,  $PWRON = V_{BAT}$ , Operating Mode,  $-I_{CC} = 10\text{ mA}$ ,  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $L_1 = 47\text{ }\mu\text{H}$ ,  $R_{LIM} = 0\text{ }\Omega$ , CRDV<sub>CC</sub> capacitor = 10  $\mu\text{F}$ , unless otherwise noted.)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>APPLICATION INTERFACE DC SECTION</b> ( $V_{BAT} = 5.0\text{ V}$ )						
Input High Threshold Voltage (increasing)	Pins 2, 4, 5, 6, 10, 17	$V_{IH}$	$0.55V_{BAT}$	–	$0.65V_{BAT}$	V
Input Low Threshold Voltage (decreasing)	Pins 2, 5, 6, 10 Pin 17 Pin 4	$V_{IL}$	$0.3V_{BAT}$ $0.2V_{BAT}$ $0.3V_{BAT}$	– – –	$0.45V_{BAT}$ $0.40V_{BAT}$ $0.5V_{BAT}$	V
Switching Hysteresis	Pins 2, 4, 5, 6, 10, 17	V				

## MC33560

**ELECTRICAL CHARACTERISTICS (continued)** These specifications are written in the same style as common for standard integrated circuits. The convention considers current flowing into the pin (sink current) as positive and current flowing out of the pin (source current) as negative. (Conditions:  $V_{BAT} = 4.0\text{ V}$ ,  $V_{CC} = 5.0\text{ V nom}$ ,  $PWRON = V_{BAT}$ , Operating Mode,  $-I_{CC} = 10\text{ mA}$ ,  $-25^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ ,  $L_1 = 47\text{ }\mu\text{H}$ ,  $R_{LIM} = 0\text{ }\Omega$ , CRDV<sub>CC</sub> capacitor = 10  $\mu\text{F}$ , unless otherwise noted.)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
----------------	-----------------	--------	-----	-----	-----	------

# MC33560

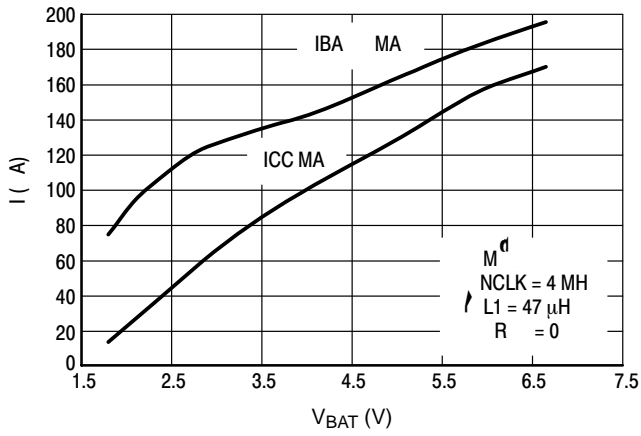


Figure 2. Maximum Battery and Card Supply Current vs.  $V_{BAT}$  ( $V_{CC} = 5.0$  V)

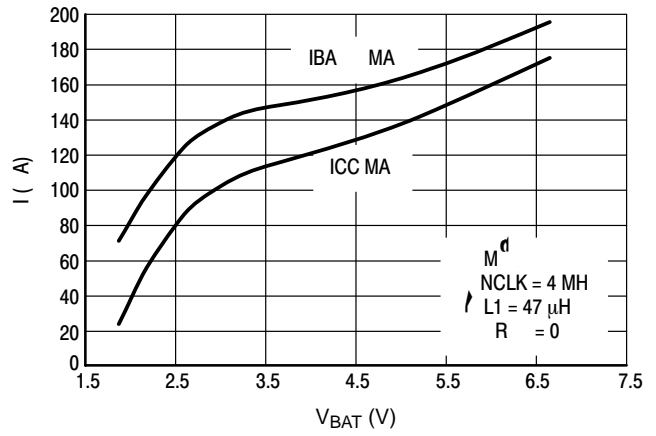


Figure 3. Maximum Battery and Card Supply Current vs.  $V_{BAT}$  ( $V_{CC} = 3.0$  V)

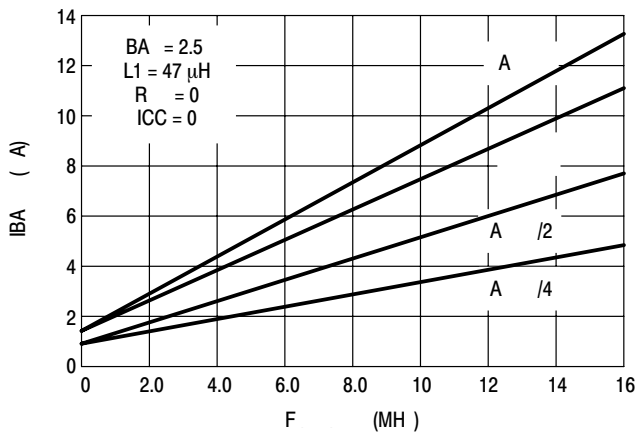


Figure 4. Battery Current vs. Input Clock Frequency ( $I_{CC} = 0$ ,  $V_{BAT} = 4.0$  V)

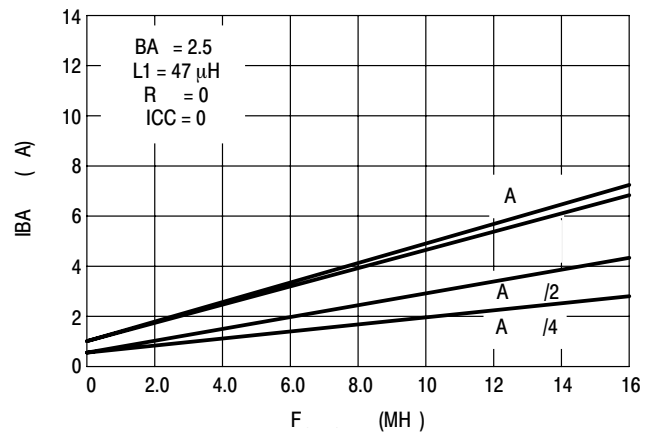


Figure 5. Battery Current vs. Input Clock Frequency ( $I_{CC} = 0$ ,  $V_{BAT} = 2.5$  V)

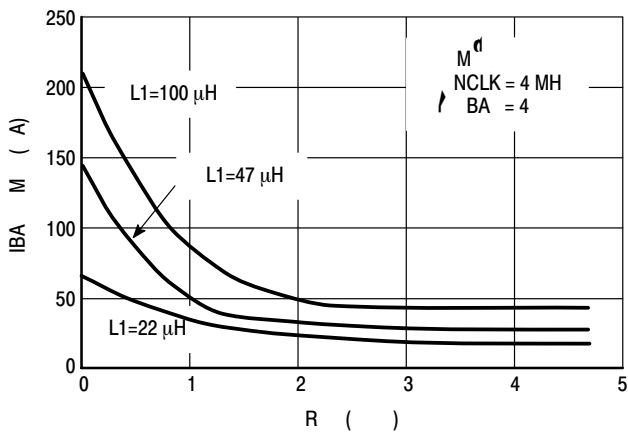


Figure 6. Maximum Battery Current vs.  $R_{LIM}$  ( $V_{CC} = 5.0$  V,  $V_{BAT} = 4.0$  V)

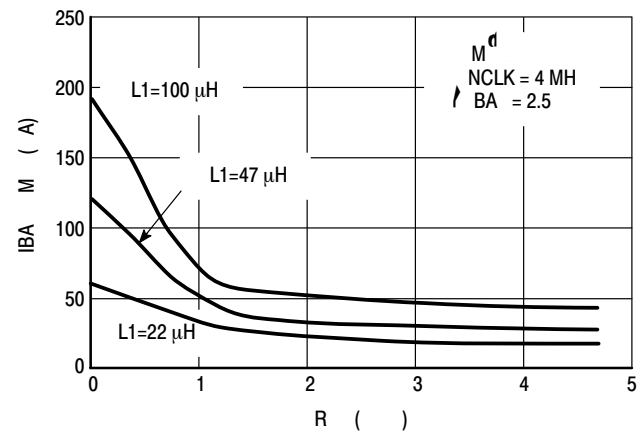
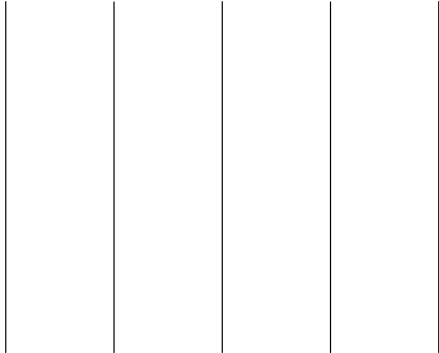


Figure 7. Maximum Battery Current vs.  $R_{LIM}$  ( $V_{CC} = 3.0$  V,  $V_{BAT} = 2.5$  V)

MC33560




# MC33560

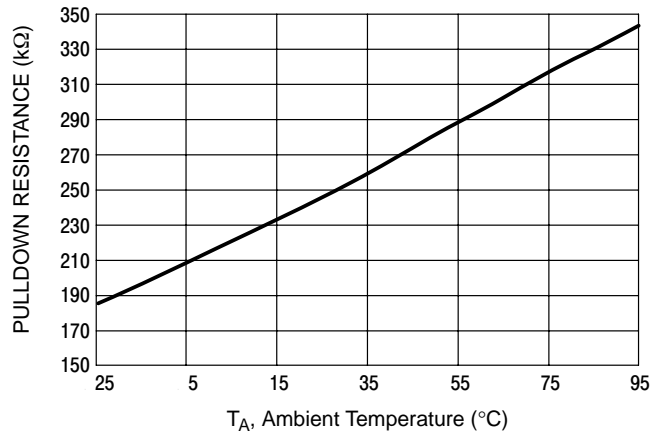


Figure 14. Pulldown Resistance vs. Temperature

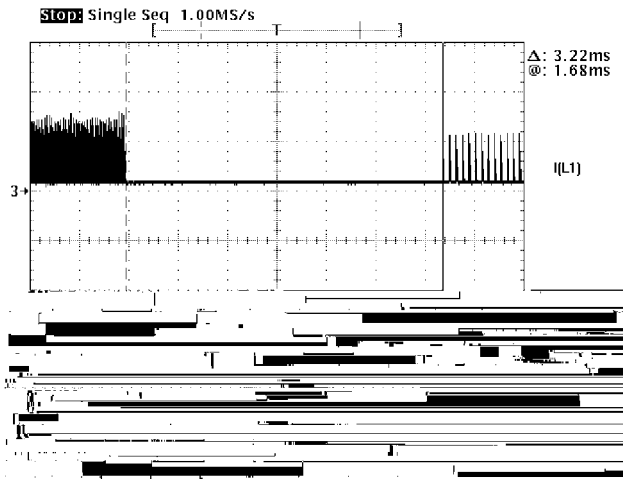


Figure 15. Transition from 5.0 V to 3.0 V Card Supply

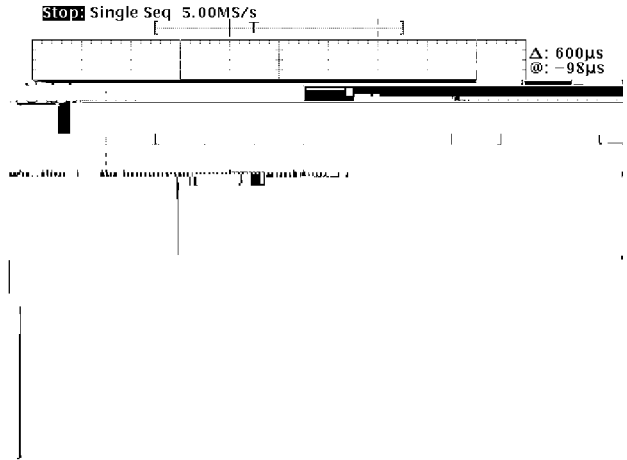


Figure 16. Transition from 3.0 V to 5.0 V Card Supply

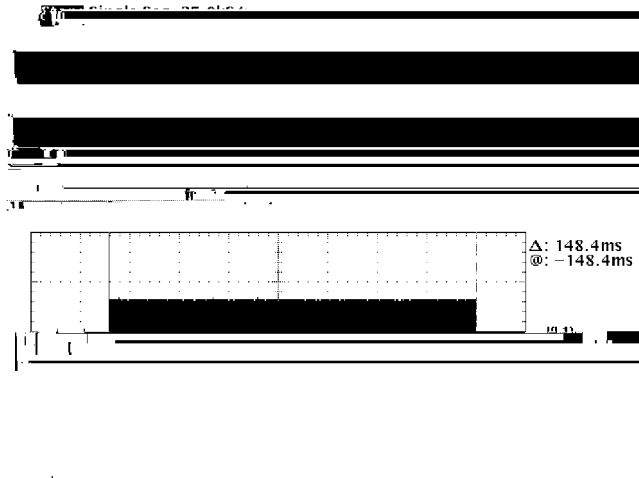


Figure 17. Overcurrent Shutoff ( $t_d = 160$  ms)

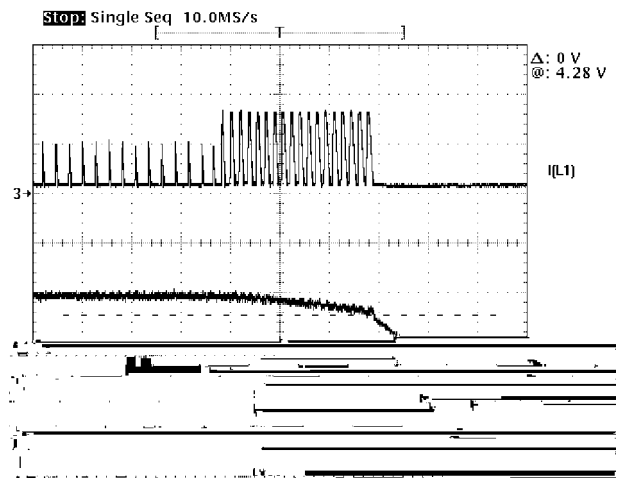


Figure 18. Undervoltage Shutoff ( $V_{T5L} = 4.6$  V)





# MC33560

**Table 1. PIN FUNCTION DESCRIPTION**

Pin	Symbol	Type	Name/Function
<b>CONTROLLER INTERFACE</b>			
2	PWRON	INPUT Pulldown	This pin is used to start operation of the internal DC–DC converter. In programming mode, this pin is used to set the “Output Voltage” switch. (See Table 2).
3	INT	OUTPUT Pullup	This open collector pin indicates a change in the card presence circuit status. When a card is inserted or extracted, the pin goes to logic level “0”. The signal is reset to logic level “1” upon the rising edge of $\overline{CS}$ or upon the rising edge of PWRON. In the case of a multislot application, two or more INT outputs are connected together and the microcontroller has to poll all the MC33560s to identify which slot was detected.
4	RDYMOD	I/O and Pullup	This bidirectional pin has tri–state output and Schmitt trigger input. * When RDYMOD is forced to 0, the MC33560 can be set to programming mode by a negative transition on $\overline{CS}$ . * When RDYMOD is connected to a high impedance, the MC33560 is in normal operating mode, and RDYMOD is in output mode (See Tables 2 and 4): – With $\overline{CS} = L$ and PWRON=H, RDYMOD indicates the status of the DC–DC converter. – With $\overline{CS} = L$ and PWRON=L, RDYMOD indicates the status of the card detector.
5	CS	INPUT Pullup	This is the MC33560 chip select signal. Pins 2, 6, 7, 10, 20, 21 are disabled when $\overline{CS} = H$ . When RDYMOD = L, the MC33560 enters programming mode upon the falling edge of $\overline{CS}$ .



## MC33560

### CARD $V_{CC}$ AND CARD CLOCK PROGRAMMING

The  $CRDV_{CC}$  and  $ASYCLK$  programming options allow the system clock frequency to be matched to the card clock frequency and to select 3.0 V or 5.0 V  $CRDV_{CC}$  supply. Table 3 shows the values of **PWRON**, **RESET** and **I/O** for the possible options. The default power reset condition is state 4 (synchronous clock and  $CRDV_{CC} = 5.0$  V). All states are latched for each output variable in programming mode at the positive transition of  $\overline{CS}$  (Figure 20).

# MC33560

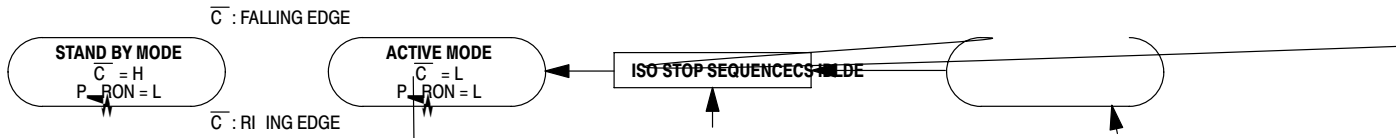


Figure 21. MC33560 Operating Modes



# MC33560

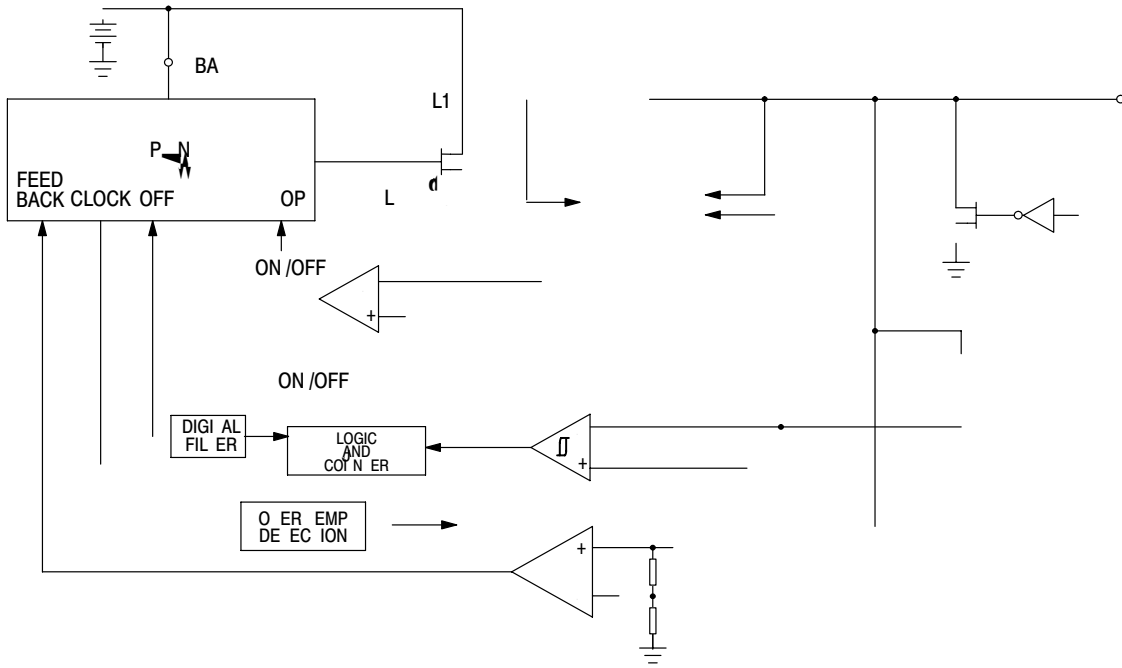


Figure 22. DC-DC Converter Functional Block

## MC33560

First, determine the maximum current that the application requires to supply to the card (ICCmax, on the y-axis)



**BIDIRECTIONAL LEVEL TRANSLATOR**

This module (used on **I/O/CRDIO**, **C4/CRDC4**, **C8/CRDC8**, Figure 24) adapts the signal voltage levels of the I/O and control lines between the micro controller (supplied by  $V_{BAT}$ ) and the smartcard (supplied by  $CRDV_{CC}$ )

When  $\overline{CS}$  is low, with  $CRDV_{CC}$  on, and start sequencing completed, this module is transparent for the data, and acts as if the card was directly connected to the reader microcontroller. The core of the level shifter circuit defined for the bidirectional **CRDIO**, **CRDC4** and **CRDC8** lines consists of a NMOS switch which can be driven to the logic low state from either side (microcontroller or card). If both sides work in transmission mode with opposite phase, then signal collision on the line is not avoidable. In this case, the peak current is limited to a safe value for the integrated circuit and the smartcard.

During high-to-low transitions, the NMOS transistor impedance ( $T1 = 250 \Omega$  maximum) is low enough to charge parasitic capacitance, and have a high enough  $dv/dt$ . On low to high transition, the NMOS transistor is not active above a certain voltage, and an acceleration circuit is activated to ensure a high  $dv/dt$ .

When the chip is disabled ( $\overline{CS} = H$ ) with the voltage supply  $CRDV_{CC}$  still active, the **I/O**, **C4** and **C8** lines keep their last logic state.

When

MC33560

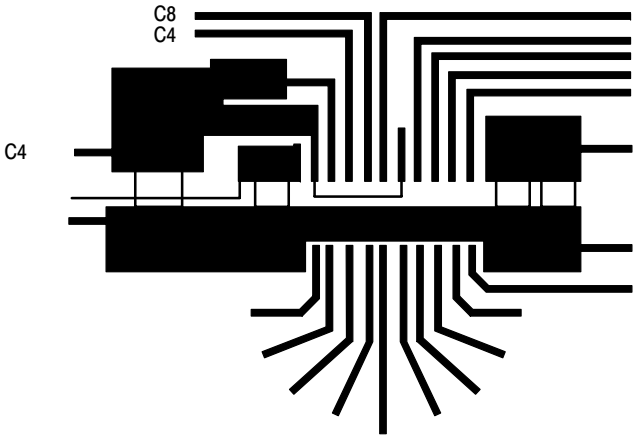


Figure 25. Example of Single Sided PCB Layout for MC33560



FB P RON  
FB FB

CRD CC  
CRDDE  
IN  
C  
BB MOD

Signal Security and Unexpected Extraction

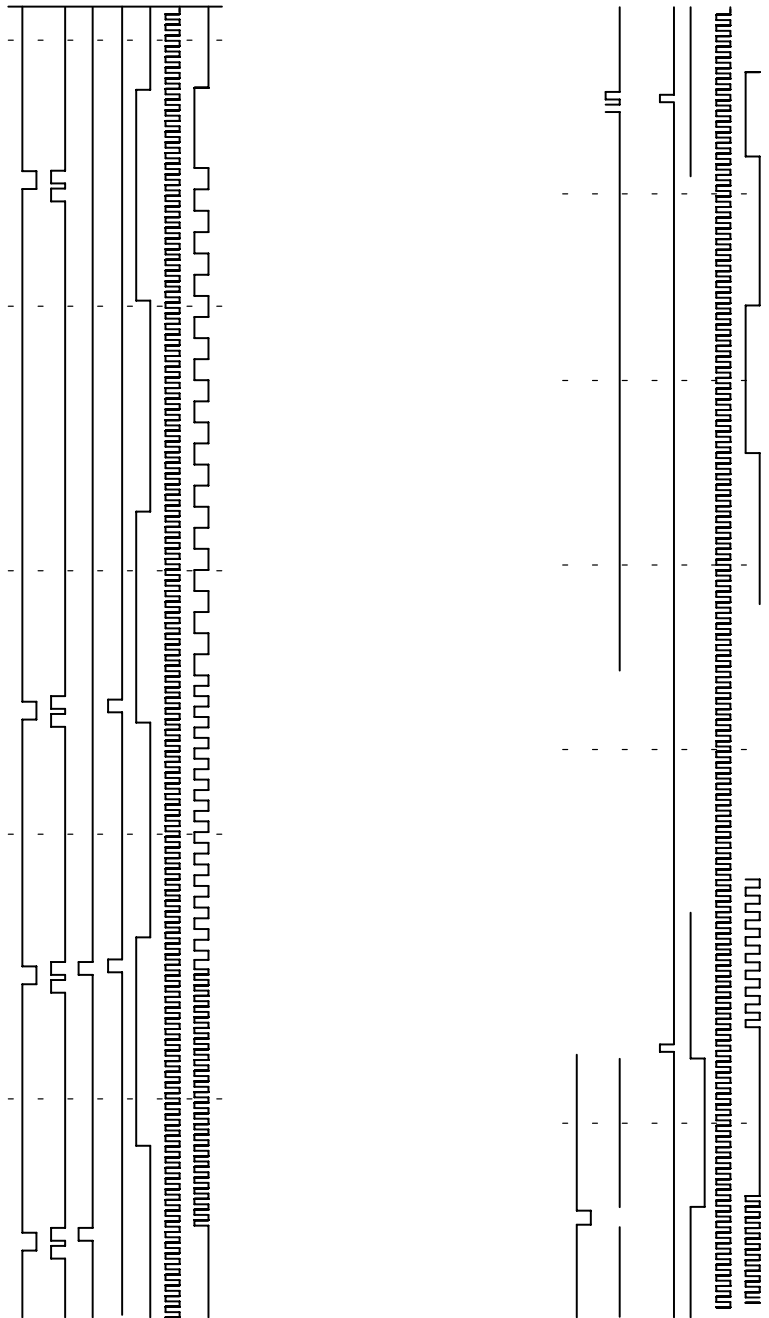


Figure 29. “On-the-Fly” Card Clock Selection Examples

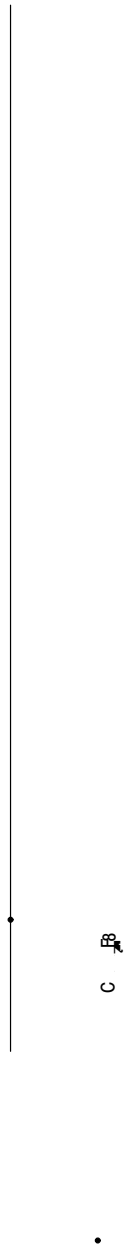
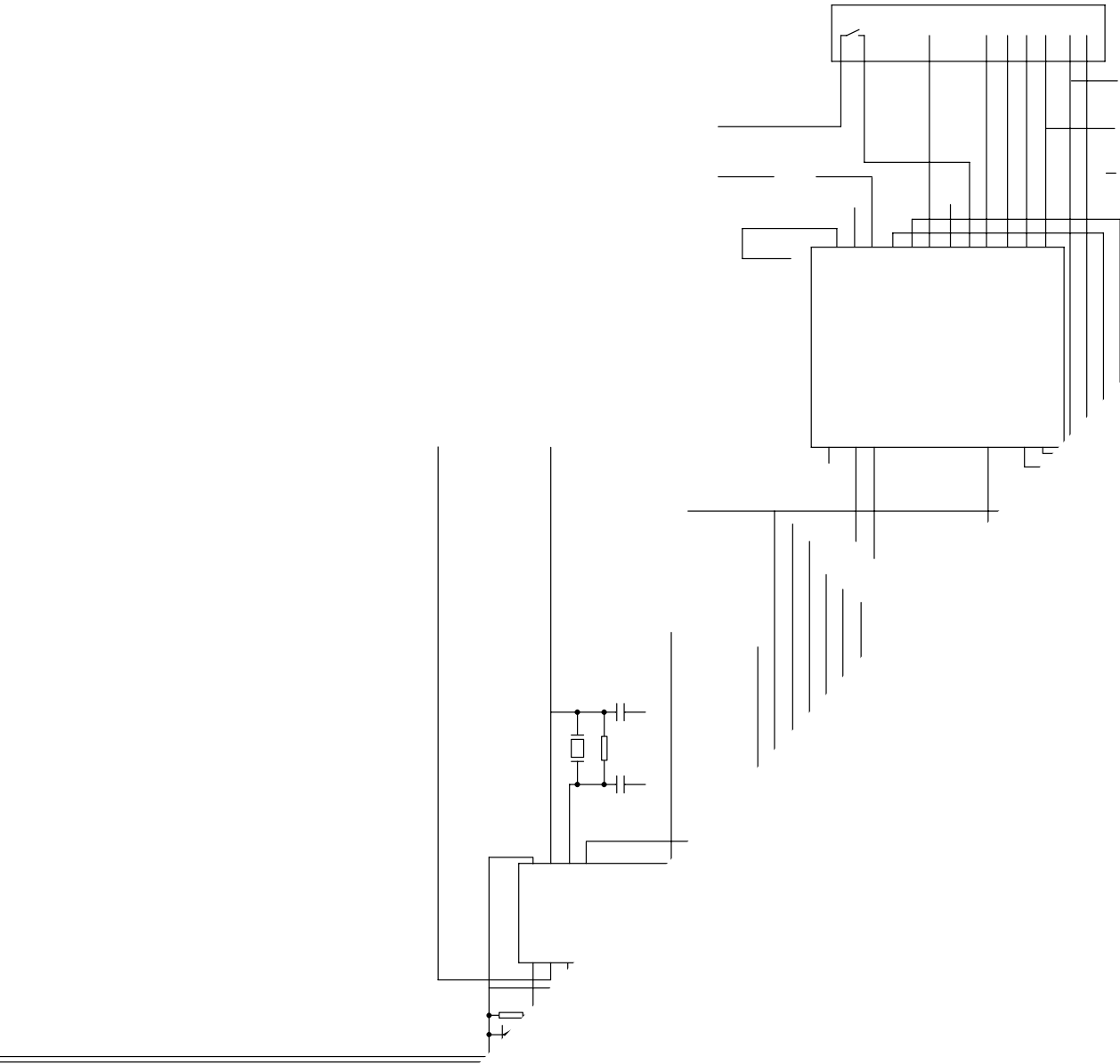


Figure 30. Card Reader/Writer Application

MC33560



# MC33560

## ORDERING INFORMATION

Device	Package	Shipping†
MC33560DTB	TSSOP-24	62 Units / Rail
MC33560DTBR2	TSSOP-24	2500 / Tape & Reel
MC33560DTBR2G	TSSOP-24 (Pb-Free)	2500 / Tape & Reel
MC33560DW	SO-24	30 Units / Rail
MC33560DWR2	SO-24	1000 / Tape & Reel
MC33560DWR2G	SO-24 (Pb-Free)	1000 / Tape & Reel

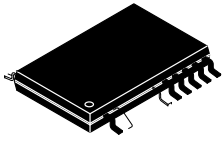


4/10/12

**SOIC-24 WB**  
CASE 751E-04  
ISSUE F

DATE 03 JUL 2012

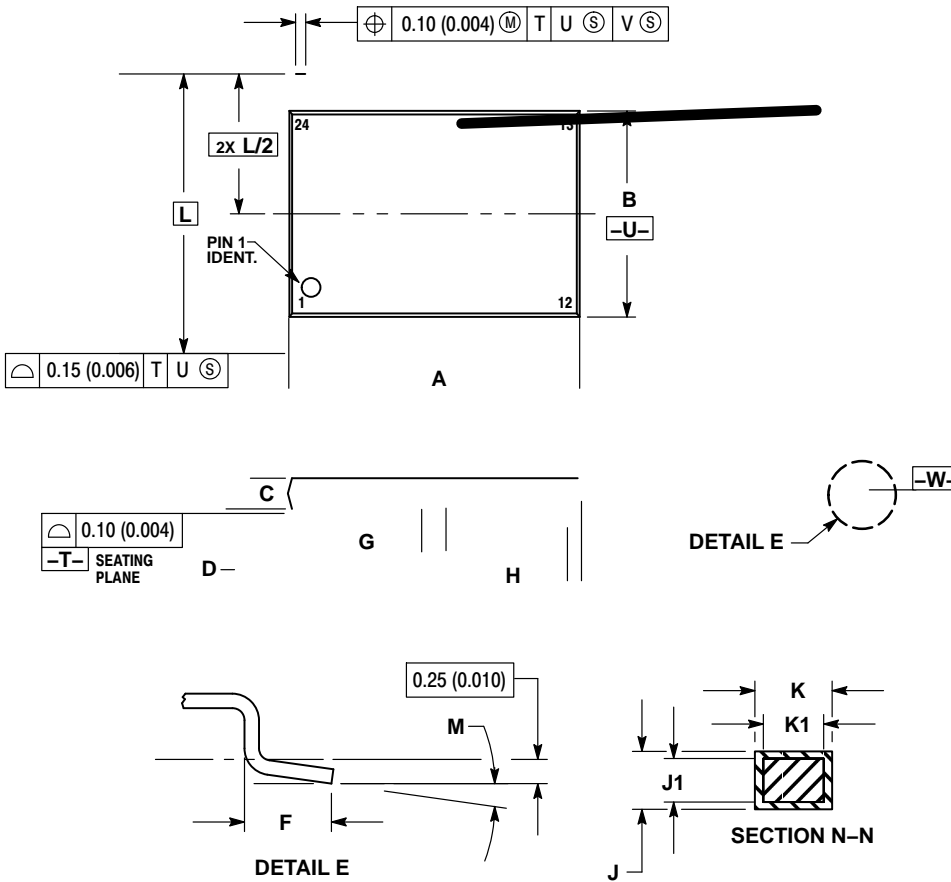




SCALE 2:1

**TSSOP24 WB**  
CASE 948K  
ISSUE O

DATE 17 FEB 2000



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-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.70	7.90	0.303	0.311
B	5.50	5.70	0.216	0.224
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	0.27	0.37	0.011	0.015
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	7.60 BSC		0.299 BSC	
M	0°	8°	0°	8°

**onsemi**, **onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi**

---

---