System Reset (with battery back-up)
Monolithic IC MM1027, 1081

Outline

These ICs were developed for STATIC-RAM (S-RAM) battery back-up, and have built-in switching circuit for main power supply and battery, back-up timing circuit and battery checker.
Power ON/OFF and momentary power interruptions can damage S-RAM data on equipment that contains an S-RAM. These ICs switch the S-RAM to back-up mode (CS signal makes S-RAM CE pin low and $\overline{CE}$ pin high) when power supply voltage goes below a set voltage (detection voltage 4.2V typ., variable), preventing damage to data. Further, when power supply voltage drops, these ICs switch from main power supply to battery back-up (switching voltage 3.3V typ.). Then, when power supply voltage rises, they first switch the S-RAM from battery back-up state to main power supply (switching voltage 3.3V typ.), and from back-up mode to normal mode (CS signal makes S-RAM CE pin high and $\overline{CE}$ pin low). These signal processes provide reliable protection against data damage. The CS signal also can absorb power supply chattering and roughness through the external capacitor.
There is a built-in battery checker to monitor the back-up battery voltage, and this circuit is turned ON/OFF by the control pin.

Features

1. Battery back-up			
1. Low IC current consumption (loss current)			0.3µA typ.
2. Drop voltage inside IC (input/output voltage difference)		I_O=10µA	0.2V typ.
3. Reverse current (reverse leak current)			0.1µA max.
2. Normal operation			
MM1027			
Drop voltage inside IC (input/output voltage difference)		I_O=70mA	0.2V typ.
Output voltage	V_{CC}=5V	I_O=10mA	4.8V typ.
Current consumption	D.CONT OPEN		3.0mA max.
External transistor drive current			25mA typ.
MM1081			
Drop voltage inside IC (input/output voltage difference)		I_O=120mA	0.25V typ.
Output voltage	V_{CC}=5V	I_O=120mA	4.75V typ.
Current consumption			350µA max.
External transistor drive current (for output current increase)			25mA typ.
TC source current			3.0µA typ.
3. Battery-Vcc switching voltage			3.3V typ.
4. Detection voltage (CS, $\overline{CS}$) variable			4.2V typ.
5. Battery checker 1	X type		2.70V typ.
	N type		2.50V typ.
6. Battery checker 2	X type		2.55V typ.
	N type		2.35V typ.

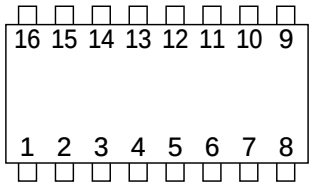
Package

TSOP-20A (MM1027XV, MM1027NV, MM1081XV)
SOP-16A (MM1027XF, MM1027NF)
DIP-16A (MM1027XD)

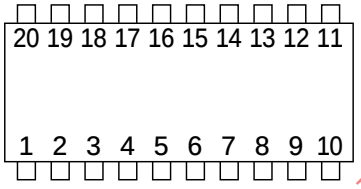
Applications

1. IC memory cards (RAM cards)
2. PCs, word processors
3. Fax machines, photocopiers, other office equipment
4. Other equipment with S-RAMs (equipment requiring back-up)

Pin Assignment



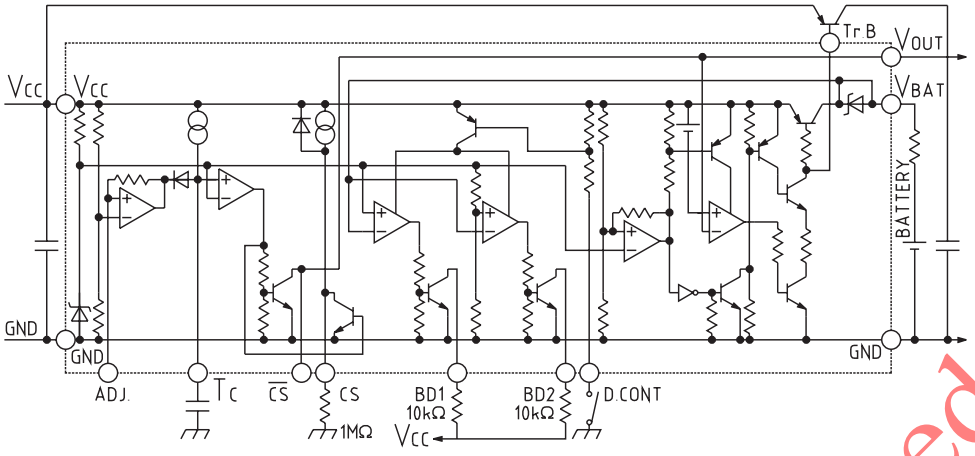
SOP-16A/DIP-16A



TSOP-20A

Pin no.	Function		
	TSOP-20A	SOP-16A	DIP-16A
1	GND	GND	GND
2	ADJ.	NC	NC
3	NC	ADJ.	ADJ.
4	TC	TC	TC
5	NC	CS	CS
6	CS	NC	NC
7	NC	$\overline{CS}$	$\overline{CS}$
8	$\overline{CS}$	DET.CONT	DET.CONT
9	NC	Bat.DET1	Bat.DET1
10	DET.CONT	NC	NC
11	Bat.DET1	Bat.DET2	Bat.DET2
12	NC	Battery	Battery
13	Bat.DET2	V_{OUT}	V_{OUT}
14	NC	External drive	External drive
15	Battery	NC	NC
16	NC	V_{CC}	V_{CC}
17	V_{OUT}		
18	NC		
19	External drive		
20	V_{CC}		

Block Diagram



Absolute Maximum Ratings (Ta=25℃)

Item		Symbol	Rating	Units
Storage temperature		TSTG	-40~+125	℃
Operating temperature		TOPR	-20~+70	℃
Power supply voltage		VCC max.	7	V
Operating voltage		VCCOP	7	V
Allowable loss		Pd	300	mW
Output current	MM1027	IO1	90	mA
	MM1081	IO1	120	mA
Output current		IO2	200	μA

Note : IO1 expresses VCC output current value, and IO2 expresses VBATT output current value.

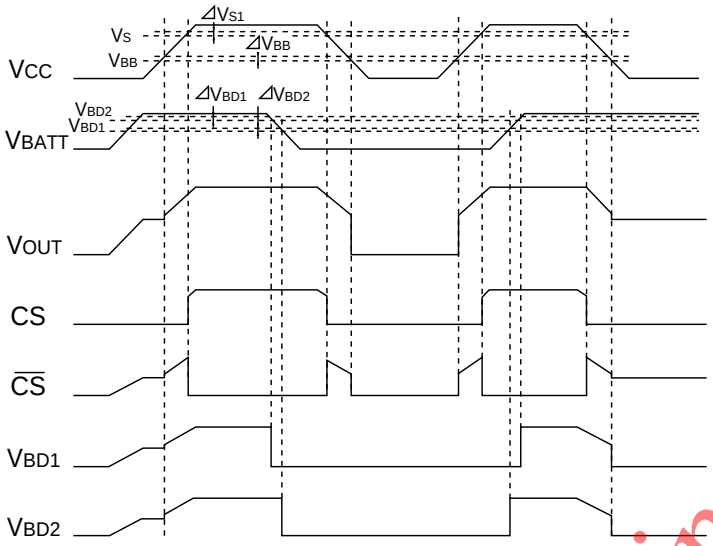
Electrical Characteristics (Except where noted otherwise, Ta=25℃, VCC=5V, VBAT=3V)

Item			Symbol	Measurement conditions	Min.	Typ.	Max.	Units
All circuits	Consumption current 1	MM1027	ICC1	VCC=5V, VBAT=3V, IO=0mA D.CONT pin : OPEN	0.9	1.7	3.0	mA
		MM1081		VCC=5V, VBAT=3V, IO=0mA	150	210	350	μA
	Consumption current 2	MM1027	ICC2	VCC=5V, VBAT=3V, IO=0mA D.CONT pin : GND	1.2	2.2	3.5	mA
CS·$\overline{CS}$ circuit unit	CS, $\overline{CS}$ detection voltage 1		VS1	VCC=H→L, VBAT=3V, ADJ pin : OPEN	4.05	4.20	4.35	V
	CS, $\overline{CS}$ hysteresis voltage 1		⊿VS1	VCC=L→H	0.05	0.10	0.20	V
	Detection voltage temperature characteristic	MM1027	VS/⊿T				±0.08	%/℃
		MM1081					±0.06	
	CS, $\overline{CS}$ detection voltage 2		VS2	VCC=H→L, VBAT=3V ADJ pin : 12kΩ PULL UP (to VCC)	3.25	3.50	3.75	V
	CS, CS hysteresis voltage 2		⊿VS2	VCC=L→H	0.05	0.10	0.20	V
	CS output voltage L		VCSL	VCC=3V, ICS=3μA		0.05	0.10	V
	CS output voltage H		VCSH	VCC=5V, ICS=-3μA	4.85	4.95		V
	CS source current		ICSH	VCC=5V, VCS=4.6V current measured	8	15		μA

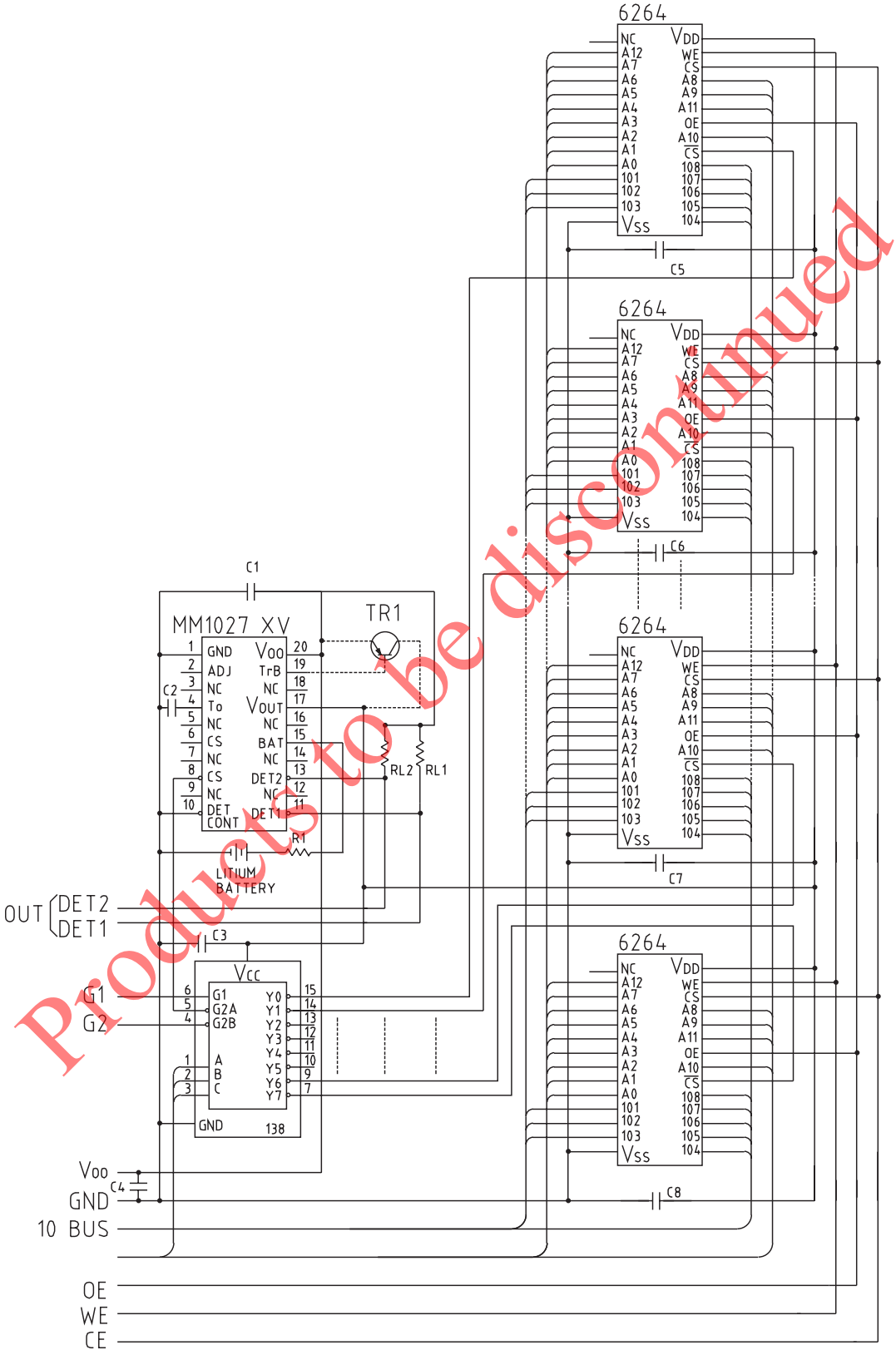
Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{CC}=5V, V_{BAT}=3V)

Item			Symbol	Measurement conditions	Min.	Typ.	Max.	Units
$\overline{CS}$·CS circuit unit	CS sync current		I_{CSL}	V_{CC}=3.5, V_{CS}=0.4V Current measured	0.5	2.0	-	mA
	$\overline{CS}$ output voltage L		$V_{\overline{CSL}}$	V_{CC}=5V, I_{CS}=3µA	-	0.10	0.25	V
	$\overline{CS}$ output voltage H		$V_{\overline{CSH}}$	V_{CC}=4V, V_{OUT}-V_{CSH}, I_{CS}=-3µA	-	0.14	0.40	V
	$\overline{CS}$ sync current		$I_{\overline{CSL}}$	V_{CC}=5V, V_{CS}=0.4V Current measured	0.3	1.0	-	mA
	Operation limit voltage L		V_{OPL}	Minimum power supply voltage at which CS pin can hold low level V_{CS} ≦ 0.4V	-	2.0	2.4	V
	ON delay time 1		$t_{PLH}1$	V_{CC}=L→H, TC : OPEN, C1=47pF	-	30	-	µS
	OFF delay time 1		$t_{PHL}1$	V_{CC}=H→L, TC : OPEN, C1=47pF	-	2.0	5	µS
	ON delay time 2		$t_{PLH}2$	V_{CC}=L→H, TC : 1nF, C1=47pF	-	0.8	-	mS
	OFF delay time 2		$t_{PHL}2$	V_{CC}=H→L, TC : 1nF, C1=47pF	-	2.0	10	µS
BD circuit unit	BATT detection voltage 1	MM1027X MM1081N	VBD1	V_{CC}=5V, R1=10kΩ PULL UP V_{BAT}=H→L (to V_{CC})	2.60	2.70	2.80	V
	BATT hysteresis voltage 1		⊿VBD1	V_{CC}=5V, R1=10kΩ PULL UP V_{BAT}=L→H(to V_{CC})	0.05	0.10	0.20	V
	BATT detection voltage 2	MM1027X MM1081N	VBD2	V_{CC}=5V, R2=10kΩ PULL UP V_{BAT}=H→L (to V_{CC})	2.45	2.55	2.65	V
	BATT hysteresis voltage 2		⊿VBD2	V_{CC}=5V, R2=10kΩ PULL UP V_{BAT}=L→H (to V_{CC})	0.05	0.10	0.20	V
	BD output voltage L		VBDL	V_{CC}=5V, V_{BAT}=0V	-	0.2	0.4	V
	BD output sink current		IBDSNK	V_{CC}=5V, V_{BAT}=0V, VBD=4V	1.0	3.0	-	mA
	Leakage current		IBDH	V_{CC}=5V, V_{BAT}=3V, VBD=5V	-	-	0.2	µA
Backup circuit unit	I/O voltage difference 1	MM1027 MM1081	$V_{SAT}1$	V_{CC}=5V, I_O=70mA V_{CC}=5V, I_O=120mA	- -	0.2 0.25	0.3 0.4	V
	I/O voltage difference 2		$V_{SAT}2$	V_{BAT}=3V, I_O=10µA	-	0.2	0.3	V
	I/O voltage difference 3		$V_{SAT}3$	V_{BAT}=3V, I_O=100µA	-	0.3	0.4	V
	External transistor driving current		I_{BUD}	V_{CC}=5V, V (T_B) =4.5V	16	25	-	mA
	Power supply switching voltage		V_{BB}	V_{CC}=H→L, V_{BAT}=3V	3.15	3.30	3.45	V
	Hysteresis voltage		⊿V_{BB}	V_{CC}=L→H, V_{BAT}=3V	0.05	0.10	0.20	V
	Switching voltage temperature characteristic	MM1027 MM1081	V_{BB}/⊿T		- 	- 	±0.08 ±0.06	%/℃
	Loss current		I_{LOS}	V_{CC}=0V, V_{BAT}=3V, I_O=0µA D.CONT pin : GND	-	-	0.3	µA
	Reverse current		I_{OREV}	V_{CC}=0V, V_{BAT}=3V, I_O=0µA D.CONT pin : OPEN	-	-	0.1	µA
TC source current			I_{TCSCE}	V_{CC}=5V, V_{TC}=0V	2.0	3.0	5.0	µA

Timing Chart

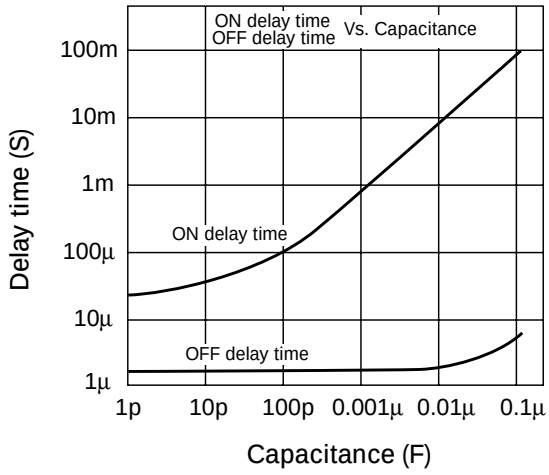


Application Circuits (Example : MM1027XV)



Characteristics (MM1027X)

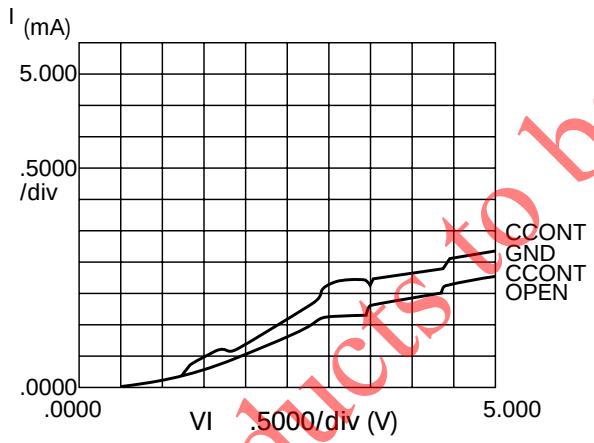
CS pin ON delay time Vs. Capacitance



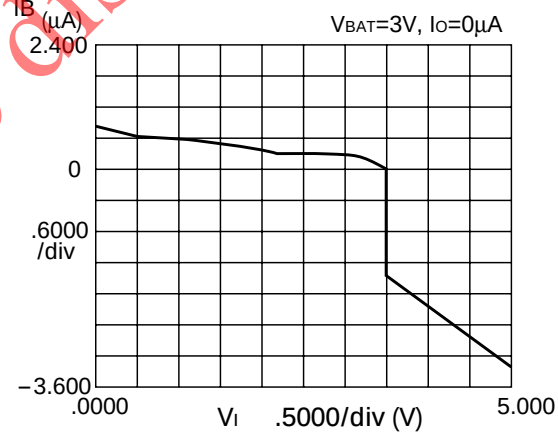
Note : CS and $\overline{CS}$ output waveforms may be disturbed if delay time is more than 10mS.

Characteristics (MM1027 series)

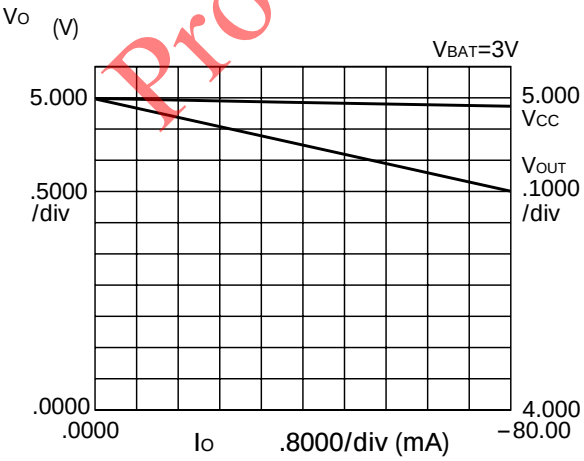
Current consumption



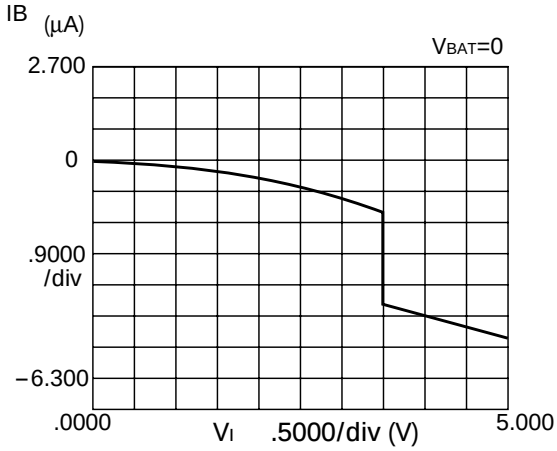
Loss current during back-up



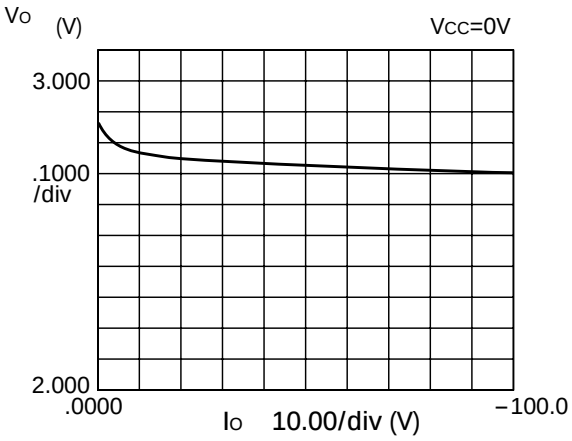
Output voltage 1



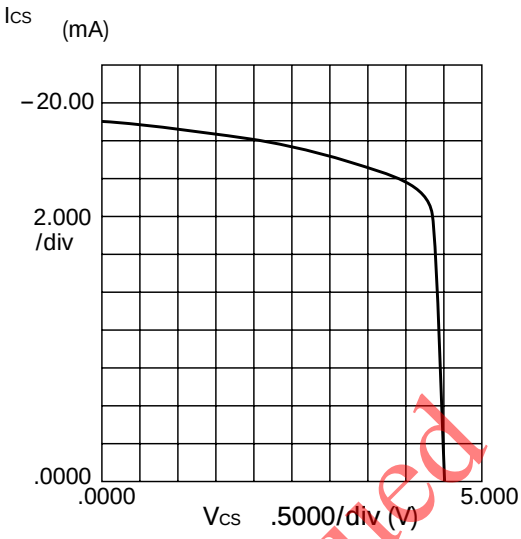
Shot key barrier diode reverse current



Output voltage 2 3

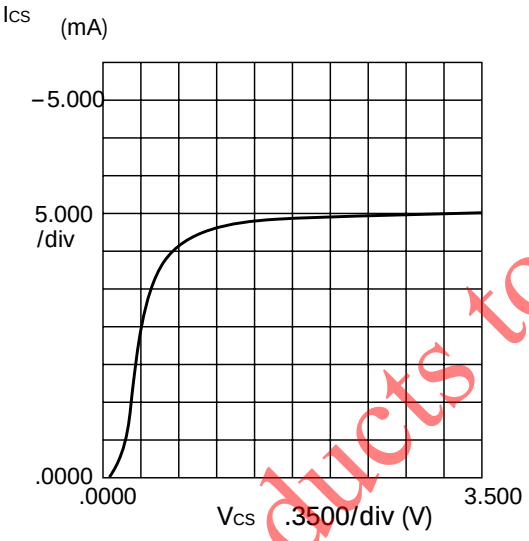


Ics-Vcs 1



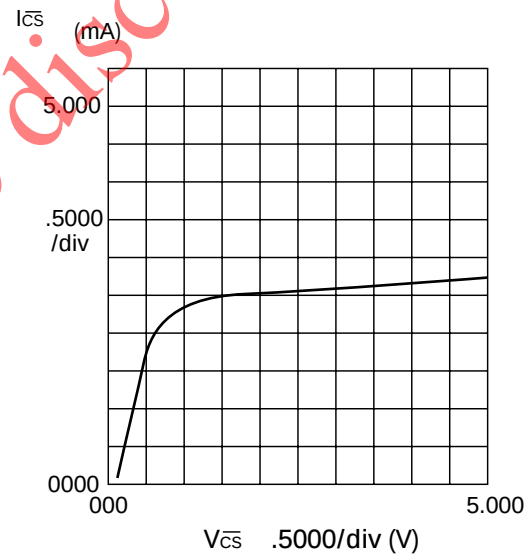
CS pin
Sink current
Vcc=4.5V
Vcs=Variable

Ics-Vcs 2



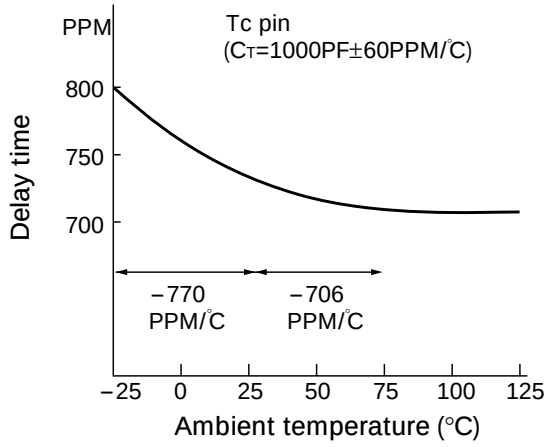
CS pin
Sink current
Vcc=3.5V
Vcs=Variable

Ics-V$\overline{cs}$

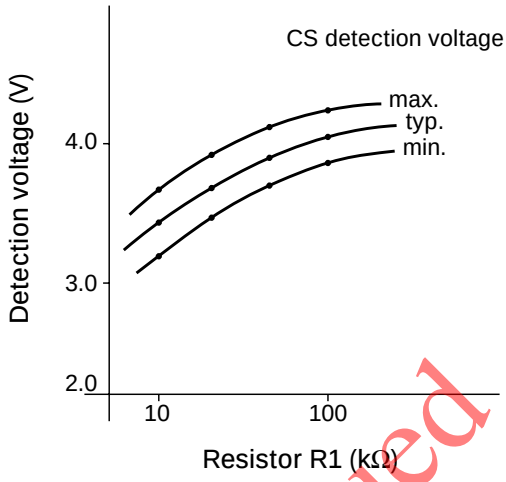


Vcc=5V
V$\overline{cs}$=Variable

ON delay time-Temperature



CS detection voltage adjustment (ADJ pin)

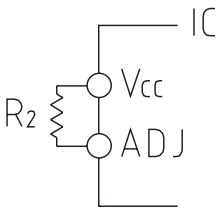


How to Adjust Detection Voltage Vs1

1. Connecting a resistor between ADJ pin and Vcc pin (effective only when lowering detection voltage)

   [Calculated min. and max. values take into account resistance, etc. variance inside the IC.]

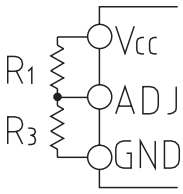
   Refer to Figure 1



2. Using resistors to divide Vcc potential and connect to ADJ pin

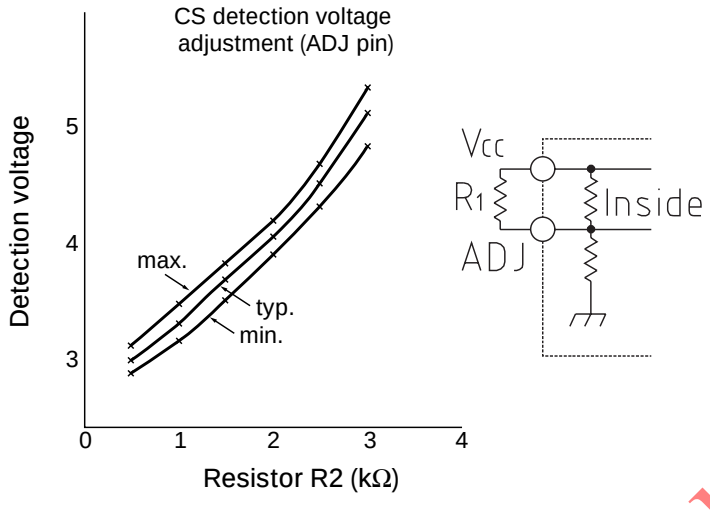
   Detection voltage can be determined close to external resistance value by setting external R2 and R3 values small.

   Refer to Figure 2

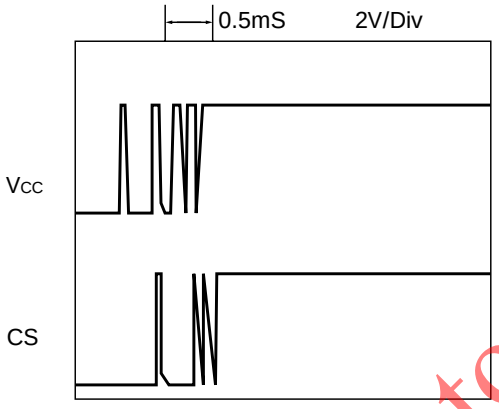


   (However, current increases when R_2 and R_3 are made smaller, so set at around $R_2+R_3=6k\Omega$.)

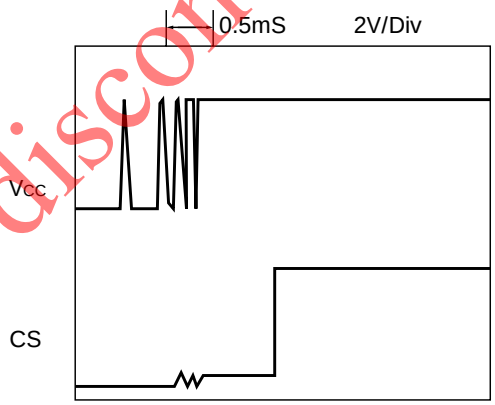
CS detection voltage adjustment (ADJ pin)



CS Output

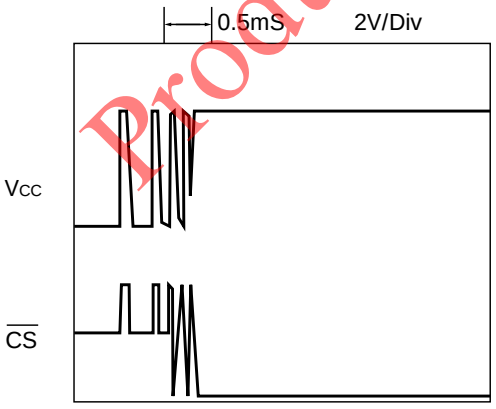


✱TC pin OPEN

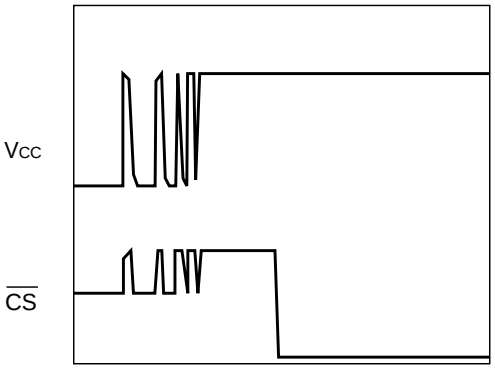


✱TC pin 1000pF

$\overline{CS}$ Output



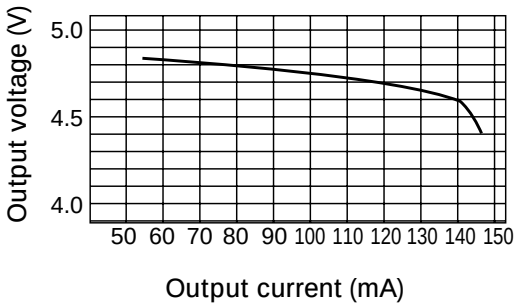
✱TC pin OPEN



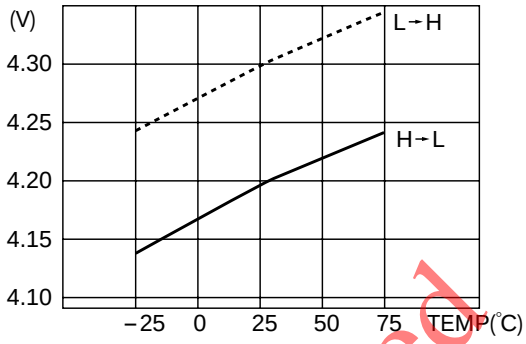
✱TC pin 1000pF

Characteristics (MM1081 series)

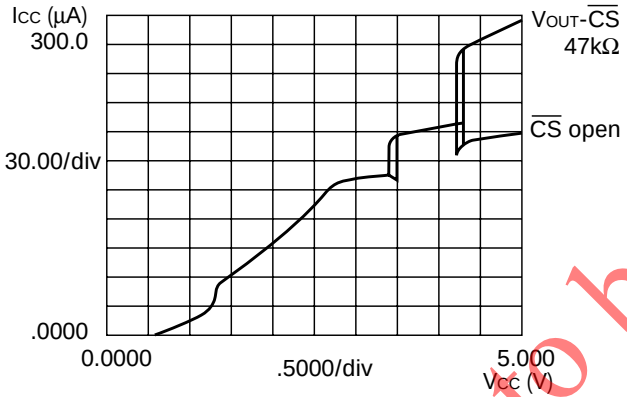
Input/output voltage difference 1 (Vcc=5.0V)



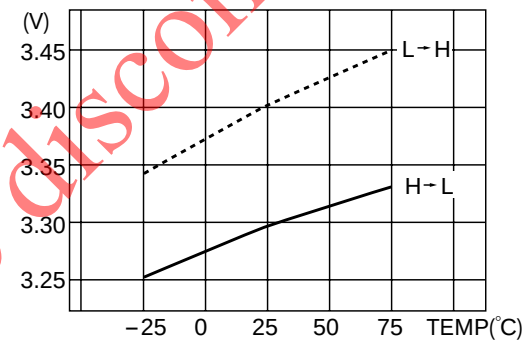
CS-$\overline{CS}$ detection voltage-Temperature



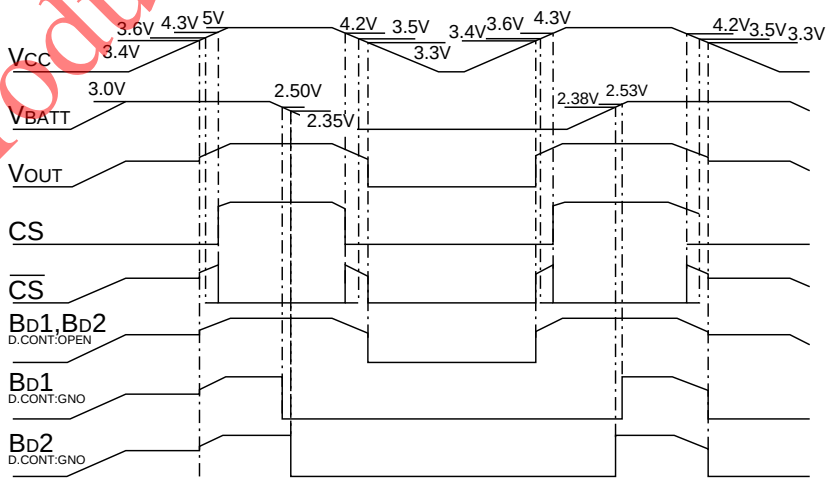
Vcc-Icc



Power supply switching voltage-Temperature



Timing Chart



The broken lines for CS and $\overline{CS}$ indicate timing when the ADJ pin is pulled up to Vcc by 12kΩ.