ETC690/ETC692
µP Supervisory Circuits

Description

The ETC690 is a multifunction circuit which monitors battery control functions and power supplies in microprocessor based systems. The circuit functions include a watchdog timer, microprocessor reset, back-up battery switchover, and power failure warning.

The power supply line is monitored with a comparator and an internal voltage reference. $\overline{\text{RESET}}$ is forced low when an out-of-tolerance condition exists and remains asserted for 200ms after V_{CC} rises above the threshold voltage (4.65V or 4.40V). The $\overline{\text{RESET}}$ pin will remain logic low with V_{CC} as low as 1.4V. Battery-backup mode is activated when V_{CC} falls below both the reset threshold and V_{BATT}. V_{CC} is connected to V_{OUT} through a low impedance PMOS switch and is capable of currents up to 250mA.

The Watchdog input (WDI) monitors µP activity and will assert $\overline{\text{RESET}}$ if no µP activity has occured within the watchdog timeout period. The watchdog timeout period has a nominal period of 1.6 seconds. The Power Fail input (PFI) is connected to an internal comparator and is useful for early power-fail warnings or low battery conditions.

Typical Applications

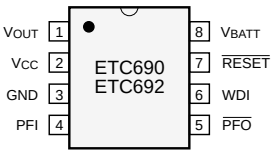
- Automotive Systems
- Intelligent Instruments
- Critical Microprocessor Power Monitoring
- Battery Powered Computers
- Controllers

Ordering Information

Part	Package	Temp. Range
ETC690NC	8-Lead PDIP	0°C to +70°C
ETC690MC	8-Lead SOIC	0°C to +70°C
ETC690D	Tested Die	0°C to +70°C
ETC692NC	8-Lead PDIP	0°C to +70°C
ETC692MC	8-Lead SOIC	0°C to +70°C
ETC692D	Tested Die	0°C to +70°C

Pin Configuration

Top View

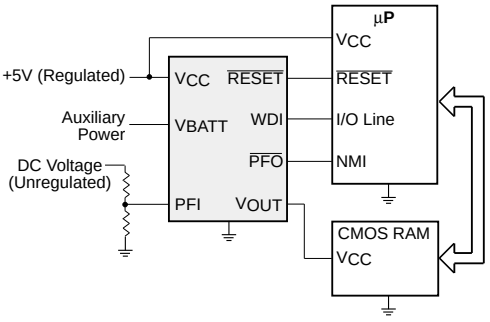


ETC690N - 8 Lead Plastic DIP Package
ETC690M - 8 Lead Plastic SOIC Package

Features

- Power OK/Reset Time Delay, 200ms
- Watchdog Timer, 1.6s
- 4.65V or 4.4V Precision Voltage Monitor
- V_{OUT} Capable of Sourcing up to 250mA
- Available in 8-pin Surface Mount (SO)
- <1µA Standby Current
- Early Power Fail Warning or Low Battery Detect

Typical Operating Circuit



Electronic Technology

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Absolute Maximum Ratings

Terminal Voltage
  V_{CC}, V_{BATT} . . . . . -0.3V to 6.0V
  All Other Inputs . . . . . -0.3V to (V_{OUT} + 0.3V)
Input Current
  V_{CC} 250mA
  V_{BATT}, Gnd, All Other Inputs 25mA

Operating Temperature Range
  ETC69_NC, ETC69_MC, ETC69_D . . . . . 0°C to 70°C
Storage Temperature Range . . . . . -65°C to 150°C
Lead Temperature (Soldering - 10 sec.) . . . . . 300°C
Power Dissipation 700mW

Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability. Operating ranges define those limits between which the functionality of the device is guaranteed.

Electrical Characteristics

V_{CC} = 4.75V to 5.5V, V_{BATT} = 2.8V, T_A = Operating Temperature Range, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Units
Battery Backup Switching					
Operating Voltage Range, V_{CC} & V_{BATT} (see note 1)		0		5.5	V
Supply Current (Excludes I_{OUT})			35	100	µA
Supply Current, Battery-Backup Mode	V_{BATT} = 2.8V, T_A = 25°C T_A = Operating Temp. Range		0.001	1 5	µA
Battery Standby Current	$V_{CC} \geq V_{BATT}$ + 0.2V, T_A = 25°C T_A = Operating Temp. Range	-0.1 -1.0		0.02 0.02	µA
V_{OUT} Output Voltage	V_{CC} = 4.5V, I_{OUT} = 25mA V_{CC} = 4.5V, I_{OUT} = 250mA	V_{CC} - 0.05 V_{CC} - 0.3	V_{CC} - 0.025 V_{CC} - 0.25		V
V_{OUT}, Battery-Backup Mode	$V_{CC} < V_{BATT}$ - 0.2V, I_{OUT} = 250µA	V_{BATT} - 0.1	V_{BATT} - 0.02		V
V_{CC} to V_{OUT} On Resistance	V_{CC} = 4.5V		0.7	1.2	Ω
V_{BATT} to V_{OUT} on Resistance	V_{BATT} = 4.5V V_{BATT} = 2.8V			15 25	Ω
Battery Switchover Threshold	Power Up Power Down		V_{BATT} + 0.03 V_{BATT} - 0.03		mV
Battery Switchover Hysteresis			60		mV

Electrical Characteristics

V_{CC} = 4.75V to 5.5V, V_{BATT} = 2.8V, T_A = Operating Temperature Range, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Units
Reset and Watchdog Timer					
Reset Voltage Threshold	ETC690 ETC692	4.50 4.25	4.65 4.4	4.75 4.5	V
Reset Threshold Hysteresis			25		mV
Reset Active Timeout Period		140	200	320	ms
$\overline{RESET}$ Output Voltage	I_{Source} = 1.6mA, V_{CC} = 5V I_{Sink} = 3.2mA I_{Sink} = 50µA, V_{CC} = 1.4V (V_{CC} falling), V_{BATT} = 0V	3.5		 0.4 0.3	V
Watchdog Timeout Period		1.0	1.6	2.60	sec
WDI Minimum Input Pulse	V_{IL} = 0.8V, V_{IH} = 75% of V_{CC}	100			ns
WDI Threshold Voltage	V_{IH} V_{IL}	0.75 X V_{CC}		 0.7	V
WDI Input Current	WDI = 0V WDI = V_{OUT}	-50	-10 20	 50	µA
Power Fail Detector					
PFI Input Threshold	ETC69_, V_{CC} = 5V	1.2	1.25	1.3	V
PFI Leakage Current		-25	0.01	+25	nA
$\overline{PFO}$ Output Voltage	I_{Sink} = 3.2mA V_{CC} = 5V, I_{Source} = 1µA	 3.5		0.4	V

Note 1: V_{CC} or V_{BATT} can go to 0V if the other is ≥ 2V.

Pin Functions

Pin 1: **V_{OUT}** - Output for supply voltage. During normal operation ($V_{CC} > V_{BATT}$), V_{CC} is routed to V_{OUT} through a PMOS switch with a typical on resistance of less than 1Ω. The V_{OUT} pin can source a continuous current of up to 250mA. When V_{CC} drops below V_{BATT}, auxiliary power is routed from the V_{BATT} pin to V_{OUT} through a PMOS switch with a typical on resistance of less than 15Ω. The V_{OUT} pin can source a continuous current of up to 25mA when in battery backup mode ($V_{CC} < V_{BATT}$).

Pin 2: **V_{CC}** - Primary supply input, +5V.

Pin 3: **GND** - IC ground pin, 0V reference.

Pin 4: **PFI** - Power fail input. Internally connected to the power fail comparator which is referenced to 1.25V. The power fail output ($\overline{PFO}$) remains high if PFI is above 1.25V. PFI should be connected to GND or V_{OUT} if the power fail comparator is not used.

Pin 5: **$\overline{PFO}$** - Power fail output. The power fail comparator is independent of all other functions on this device.

Pin 6: **WDI** - Watchdog input. The WDI input monitors microprocessor activity, an internal watchdog timer resets itself with each transition on the watchdog input. If the WDI pin is held high or low for longer than the watchdog timeout period, $\overline{RESET}$ is forced to active low for a minimum of 140ms. The watchdog function can be disabled by floating the WDI pin. The watchdog timer is also disabled when V_{CC} falls below V_{BATT}.

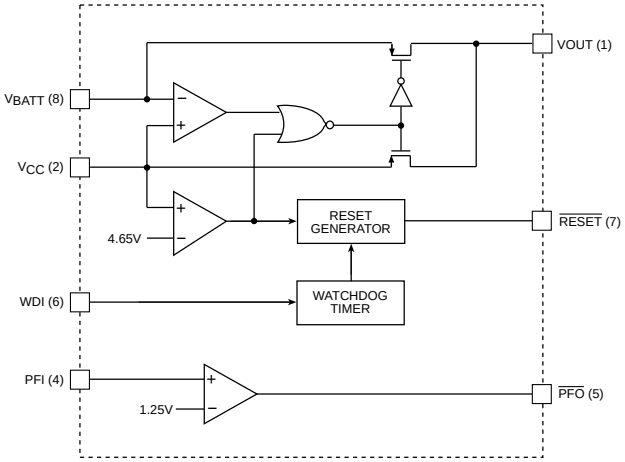
Pin 7: **RESET** - $\overline{RESET}$ is asserted if either V_{CC} goes below the reset threshold or the watchdog times out. $\overline{RESET}$ remains asserted for one reset timeout period (200ms) after V_{CC} exceeds the reset threshold or after the watchdog times out.

Pin 8: **V_{BATT}** - Backup battery/auxiliary power input. When V_{CC} falls below V_{BATT}, auxiliary power is routed to V_{OUT} through a PMOS switch. V_{BATT} pin should be connected to GND if backup battery or auxiliary power is not used.

I/O Status in Backup Mode

Pin	Status
V_{OUT}	V_{OUT} is connected to V_{BATT} through an internal PMOS switch.
V_{CC}	V_{CC} is disconnected from V_{OUT}.
PFI	Power fail input is ignored, power fail comparator is disabled.
$\overline{PFO}$	Logic low.
WDI	Watchdog input is ignored, watchdog timer is disabled.
$\overline{RESET}$	Logic low.
V_{BATT}	V_{BATT} is connected to V_{OUT} through an internal PMOS switch.

Block Diagram



Circuit Description

Battery Switchover Section

The ETC690/ETC692 monitors the supply voltage applied to the V_{CC} pin. Whenever V_{CC} falls below the reset threshold voltage and V_{BATT}, the device enters battery-backup mode. When this happens, the auxiliary supply on V_{BATT} is routed through a low impedence PMOS switch to the V_{OUT} pin. The V_{OUT} pin is capable of sourcing upto 25mA when in the backup mode. V_{CC} is routed to V_{OUT} through a large PMOS switch during normal operation ($V_{CC} > V_{BATT}$) and can source continuous currents of up to 250mA. V_{OUT} can be used to drive CMOS RAM. The BATT ON pin can be used to indicate the status of battery backup mode or as the base drive for an external pass transistor when V_{OUT} has to source more than 25mA in battery-backup mode. V_{CC} is connected to V_{OUT} and the substrate whenever V_{CC} exceeds the reset threshold. If V_{BATT} is connected to a voltage source that is greater than 0.6V above V_{CC}, the parasitic diode of the V_{BATT} switch will conduct from V_{BATT} to the substrate.

Power Fail Warning

An additional comparator which is independent of other functions on the ETC690/ETC692 is provided for early warning of power failure. An external voltage divider can be used to compare unregulated DC to an internal 1.25V reference. The voltage divider ratio on the input of the power-fail comparator (PFI) can be chosen so as to trip the power fail comparator a few milliseconds before V_{CC} falls below the maximum reset threshold voltage. The output of the power-fail comparator ($\overline{PFO}$) can be used to interrupt the microprocessor when used in this mode and execute shut-down procedures prior to power loss. Hysteresis can be added to this comparator with external resistors, as is commonly done with any comparator. When $V_{CC} < V_{BATT} - 1.2V$ (typ.), the power-fail comparator is turned off and $\overline{PFO}$ is pulled low in order to conserve power.

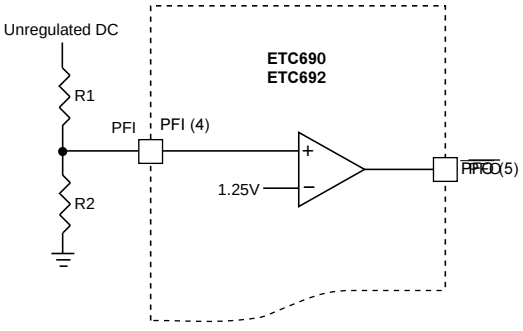


Figure 1. Power Fail Comparator

Circuit Description

Microprocessor Reset

The $\overline{\text{RESET}}$ pin is asserted whenever V_{CC} falls below the reset threshold voltage. The reset pin remains

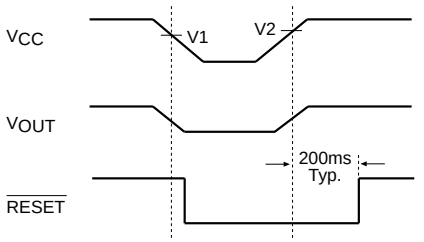


Figure 2. Reset Timing Diagram

asserted for a period of 200ms after V_{CC} has risen above the reset threshold voltage. The reset timeout period can also be selected by the end user (see Table 1). The reset function ensures the microprocessor is properly reset and powers up into a known condition after a power failure. $\overline{\text{RESET}}$ will remain valid with V_{CC} as low as 1.4V and when auxiliary power is connected to V_{BATT} (V_{BATT} > 2.0V), the reset pin will remain valid with V_{CC} from 0V to 5.5V.

Watchdog Timer

The microprocessor can be monitored by connecting the WDI pin (watchdog input) to a bus line or I/O line. If a transition doesn't occur on the WDI pin within the watchdog timeout period (see Table 1), the microprocessor is reset. $\overline{\text{RESET}}$ will remain asserted for 200ms when this occurs. A minimum pulse of 100ns or any transition low-to-high or high-to-low on the WDI pin will reset the watchdog timer. The output of the watchdog timer (WDO) will remain high if WDI sees a valid transition within the watchdog timeout period or if V_{CC} falls below the reset threshold as the watchdog timer is disabled when this happens.

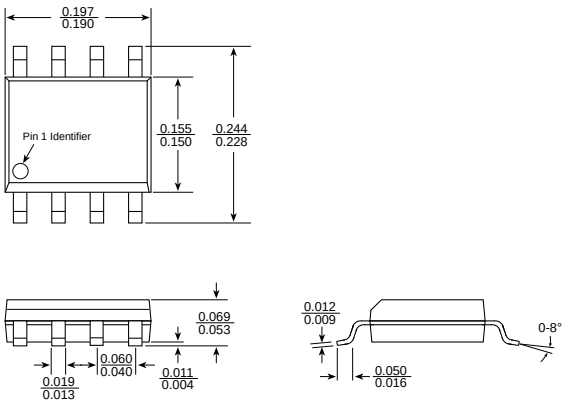
Alternate Source Cross Reference Guide

Industry P/N	ETC Direct Replacement
MAX690ACPA	ETC690NC
MAX690ACSA	ETC690MC
MAX690AC/D	ETC690DC
LTC690CS8	ETC690MC
LTC690CN8	ETC690NC

Industry P/N	ETC Direct Replacement
MAX692ACPA	ETC692NC
MAX692ACSA	ETC692MC
MAX692AC/D	ETC692DC
LTC692CS8	ETC692MC
LTC692CN8	ETC692NC

Packaging Information

M Package, 8-Pin Small Outline



N Package, 8-Pin Plastic Dual-In-Line