



LC709201F

CMOS IC Battery Monitor IC

ON Semiconductor®

<http://onsemi.com>

Overview

The LC709201F is an IC that measures the remaining power level of 1-cell lithium-ion secondary batteries by monitoring the battery voltage without an external sense resistor, and detects the remaining battery power level by current prediction. It monitors the battery voltage and realizes a function that precisely measures the remaining battery charge. In addition, the IC realizes the function for calculating the remaining battery power level even more accurately by utilizing a temperature correction function that makes use of the temperature input from a thermistor.

Features

- Accuracy of remaining battery power level measurement
 - Accuracy of $\pm 5\%$ during discharging from 100% to 0% (at an ambient operating temperature of 0°C to 50°C)
- Measurement of remaining battery power level
 - The remaining power level is measured four times a second and calculated with each measurement undertaken.
- Interface
 - I²Cbus, communication in slave mode up to 100kHz supported
- Ports

• I ² C-bus communication pin	2 (SDA, SCL)
• Battery temperature reading control pin	1 (TSW)
• Analog voltage input pin for battery temperature	1 (TSENSE)
• Reset pin	1 (RESB)
• TEST pin	1 (TEST)
• Power supply pin	2 (VSS, VDD)
- Package form
 - MFP10S (225 mil): LC709201FM-01/02/03
 - VCT16 (2.6×2.6): LC709201FRD-01/02/03

Applications

- Cell phones, PDA devices, MP3 players, cordless phones, digital cameras, USB-related devices, etc.

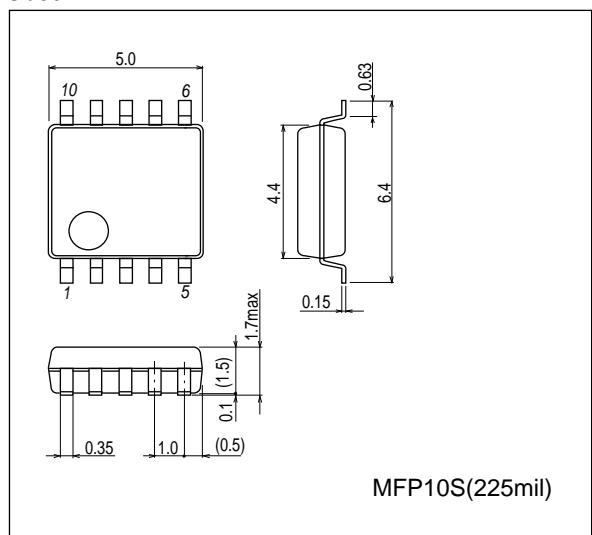
(Note) Depending on the kinds of battery, applicable model differs (LC709201F-01/02/03).

Please contact us for more detail information.

Package Dimensions

unit : mm (typ)

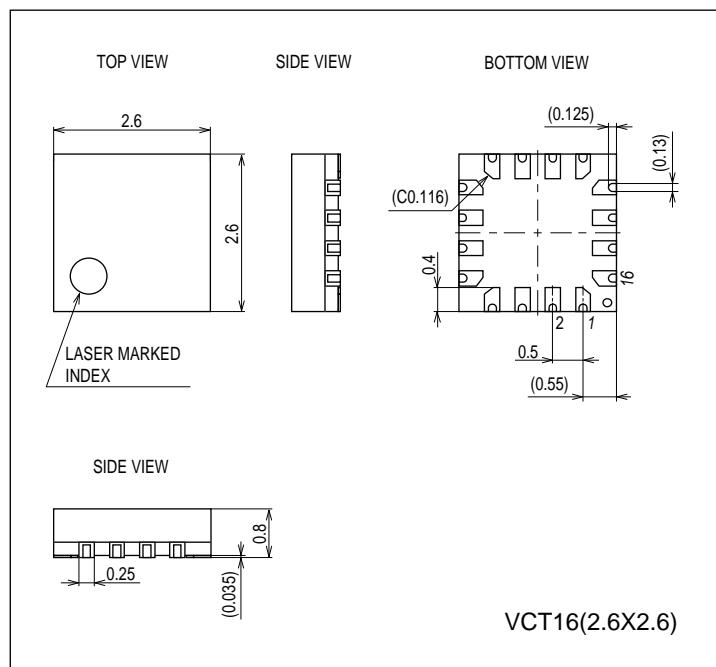
3086B



Package Dimensions

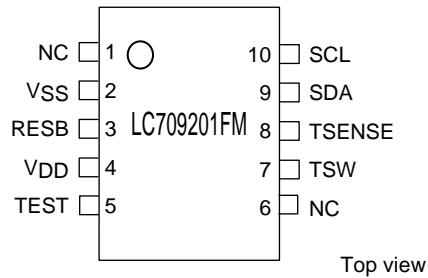
unit : mm (typ)

3318

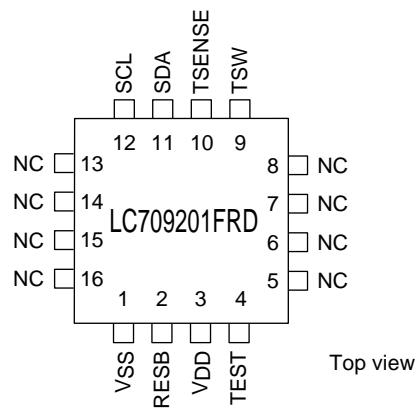


LC709201F

Pin Assignment

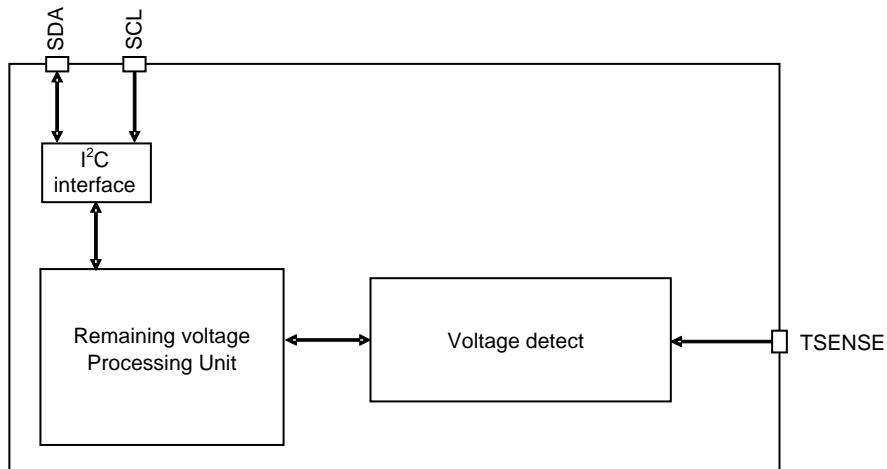


MFP10S (225mil) "Lead-free Type"



VCT16 (2.6×2.6) "Lead-free Type"

Block Diagram



Pin Function

Pin Name	I/O	Description
V_{SS}	-	- power pin
V_{DD}	-	+ power pin
RESB	I	Reset pin
TEST	I/O	Test pin *Connect an external $100\text{k}\Omega$ pull-down resistor.
SDA	I/O	I^2C data pin
SCL	I/O	I^2C clock pin
TSW	O	Battery temperature reading control pin *Set high when reading in the temperature, held low at other times.
TSENSE	I	Battery temperature analog voltage input pin

LC709201F

Absolute Maximum Ratings at Ta=25°C, V_{SS}=0V

Parameter	Symbol	Pin/Remarks	Conditions	Specification			Unit
				V _{DD} [V]	min	typ	
Maximum supply voltage	V _{DD} max	V _{DD}	Ta=-40 to +85°C		-0.3		+6.5
Input voltage	V _I (1)	RESB, TSENSE			-0.3		V _{DD} +0.3
Output voltage	V _O (1)	TSW			-0.3		V _{DD} +0.3
Input/output voltage	V _{IO} (1)	SDA, SCL, TEST			-0.3		V _{DD} +0.3
Allowable power dissipation	Pd max	MFP10S	Ta=-40 to +85°C				110
		VCT16					55
Operating ambient temperature	T _{opr}				-40		+85
Storage ambient temperature	T _{stg}				-55		-125

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Allowable Operating Conditions at Ta=-40 to +85°C, V_{SS}=0V

Parameter	Symbol	Pin/Remarks	Conditions	Specification			unit	
				V _{DD} [V]	min	typ		
Operating supply voltage	V _{DD} (1)	V _{DD}	Ta=-40 to +85°C		2.25		5.5	
High level input voltage	V _{IH} (1)	SDA, SCL		2.25 to 5.5	0.3V _{DD} +0.7		V _{DD}	
Low level input voltage	V _{IL} (1)	SDA, SCL		4.0 to 5.5	V _{SS}		0.1V _{DD} +0.4	
	V _{IL} (2)			2.25 to 4.0	V _{SS}		0.2V _{DD}	

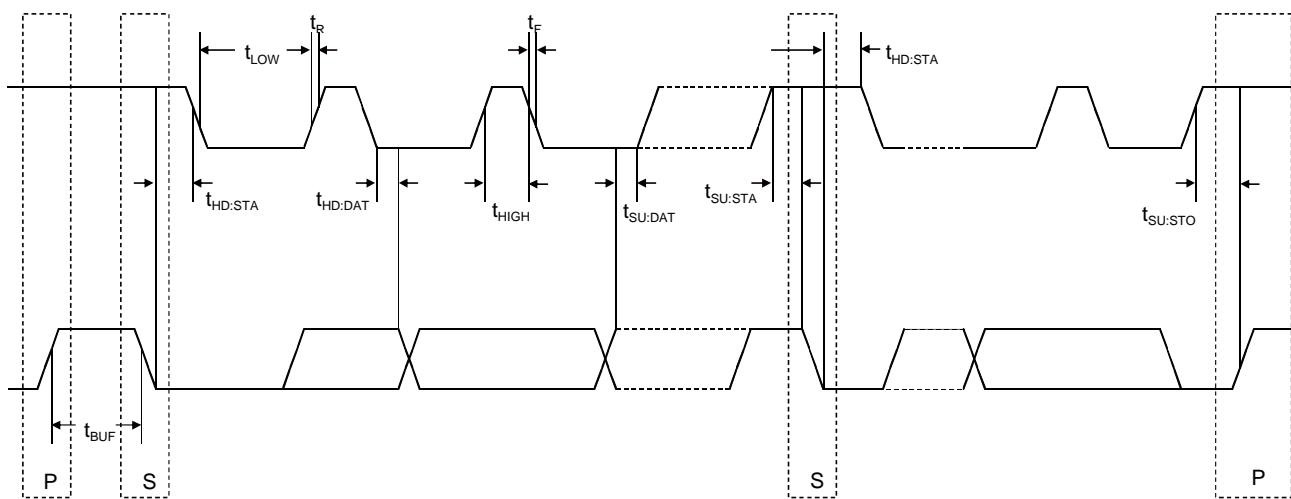
Electrical Characteristics at Ta=-40 to +85°C, V_{SS}=0V

Parameter	Symbol	Pin/Remarks	Conditions	Specification			Unit
				V _{DD} [V]	min	typ	
High level input current	I _{IH} (1)	RESB, SDA, SCL	V _{IN} =V _{DD} (including output transistor off leakage current)	2.25 to 5.5			1
Low level input current	I _{IL} (1)	RESB, SDA, SCL		2.25 to 5.5	-1		
High level output voltage	V _{OH} (1)	TSW	I _{OH} =-0.4mA	3.0 to 5.5	V _{DD} -0.4		μA
	V _{OH} (2)		I _{OH} =-0.2mA	2.25 to 5.5	V _{DD} -0.4		
Low level output voltage	V _{OL} (1)	TSW, SDA, SCL	I _{OL} =3.0mA	3.0 to 5.5			0.4
	V _{OL} (2)		I _{OL} =1.3mA	2.25 to 5.5			0.4
Hysteresis voltage	V _{HYS}	RESB, SDA, SCL		2.25 to 5.5		0.1V _{DD}	
Pin capacitance	CP	All pins	Pins other than the pin under test V _{IN} =V _{SS} f=1 MHz Ta=25°C	2.25 to 5.5		10	pF
Consumption current	I _{DD} (1)	V _{DD}		2.25 to 5.5		8	16
	I _{DD} (2)	When not detecting remaining capacity	2.25 to 5.5		5	12	

LC709201F

I²C Slave Characteristics at Ta=-40 to +85°C, V_{SS}=0V

Parameter	Symbol	Pin/Remarks	Conditions	V _{DD} [V]	Specification			unit
					min	typ	max	
Clock frequency	TSCL	SCL	See Fig. 1.	2.25 to 5.5			100	kHz
Bus free time between STOP condition and START condition	TBUF	SCL, SDA			4.7			μs
Hold time (repeated) START condition	THD: STA	SCL, SDA			4.0			μs
First clock pulse is generated after this interval					4.7			μs
Repeated START condition setup time	TSU: STA	SCL, SDA			4.0			μs
STOP condition setup time	TSU: STO	SCL, SDA			300			ns
Data hold time	THD: DAT	SCL, SDA			250			ns
Data setup time	TSU: DAT	SCL, SDA			4.7			μs
Clock low period	TLOW	SCL			4.0			μs
Clock high period	THIGH	SCL						
Clock/data fall time	TF	SCL, SDA					300	ns
Clock/data rise time	TR	SCL, SDA					1000	ns



Discharge Characteristics

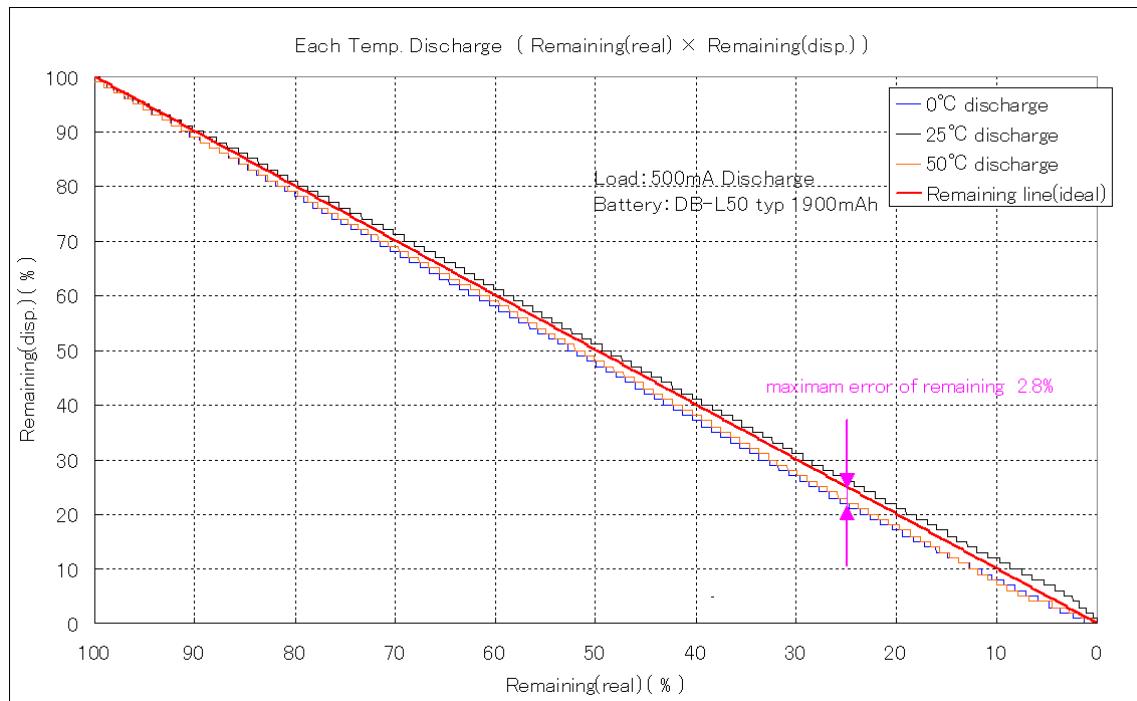


Figure2 Discharge Characteristics by Temperature Change

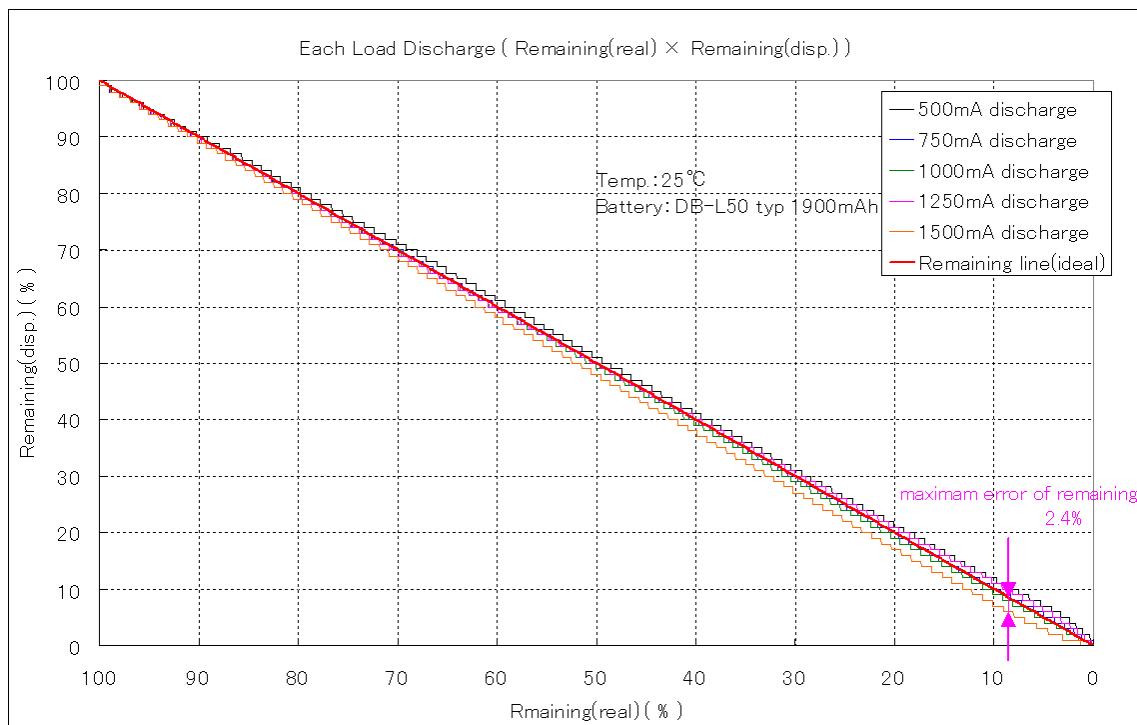


Figure 3 Discharge Characteristics by Load Change

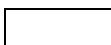
Communication Protocol

Communication protocol type: I²C

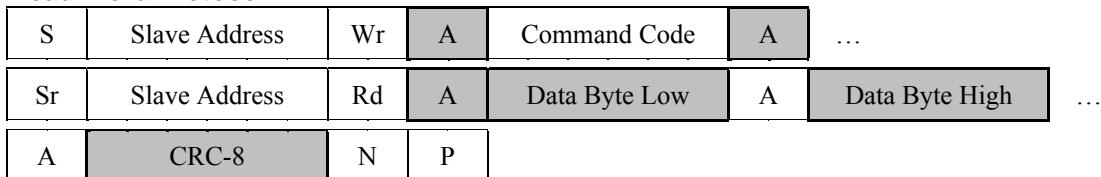
Frequency: 100kHz

Address: 0x16

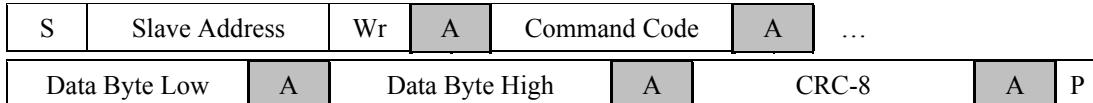
Bus Protocols

S	:	Start Condition
Sr	:	Repeated Start Condition
Rd	:	Read (bit value of 1)
Wr	:	Write (bit value of 0)
A	:	ACK (bit value of 0)
N	:	NACK (bit value of 1)
P	:	Stop Condition
CRC-8	:	Slave Address to Last Data (ex.3778mV: 0x16, 0x09, 0x17, 0xC2, 0x0E → 0x86)
	:	Master-to-Slave
	:	Slave-to-Master
...	:	Continuation of protocol

Read Word Protocol



Write Word Protocol



Slave Functions	Command Code	Range	Access	Unit
Cell Temperature	0x08	0 to 65535	R	0.1°K
Cell Voltage	0x09	0 to 65535	R	mV
Current	0x0A	-32768 to 32767	R	mA
Adjustment Pack	0x0B	0 to 255	R	Value
Relative State Of Charge	0x0D	0 to 100	R	%
Remaining Capacity	0x0F	0 to 65535	R	mAh
Full Charge Capacity	0x10	0 to 65535	R	mAh
IC Version	0x11	0 to 65535	R	Version
Adjustment Thermistor	0x12	0 to 255	R	Value
Set Relative State Of Charge	0x08	0xA500 + 0 to 100	W	0xA500 + %
Adjustment Pack	0x08	0x5A00 + 0 to 255	W	0x5A00 + Value
Adjustment Thermistor	0x08	0xAA00 + 0 to 255	W	0xAA00 + Value
Initial Relative State Of Charge	0x09	0xAA55	W	-

LC709201F

Application Circuit Example

Figure 4 Example of an application schematic using LC709201F

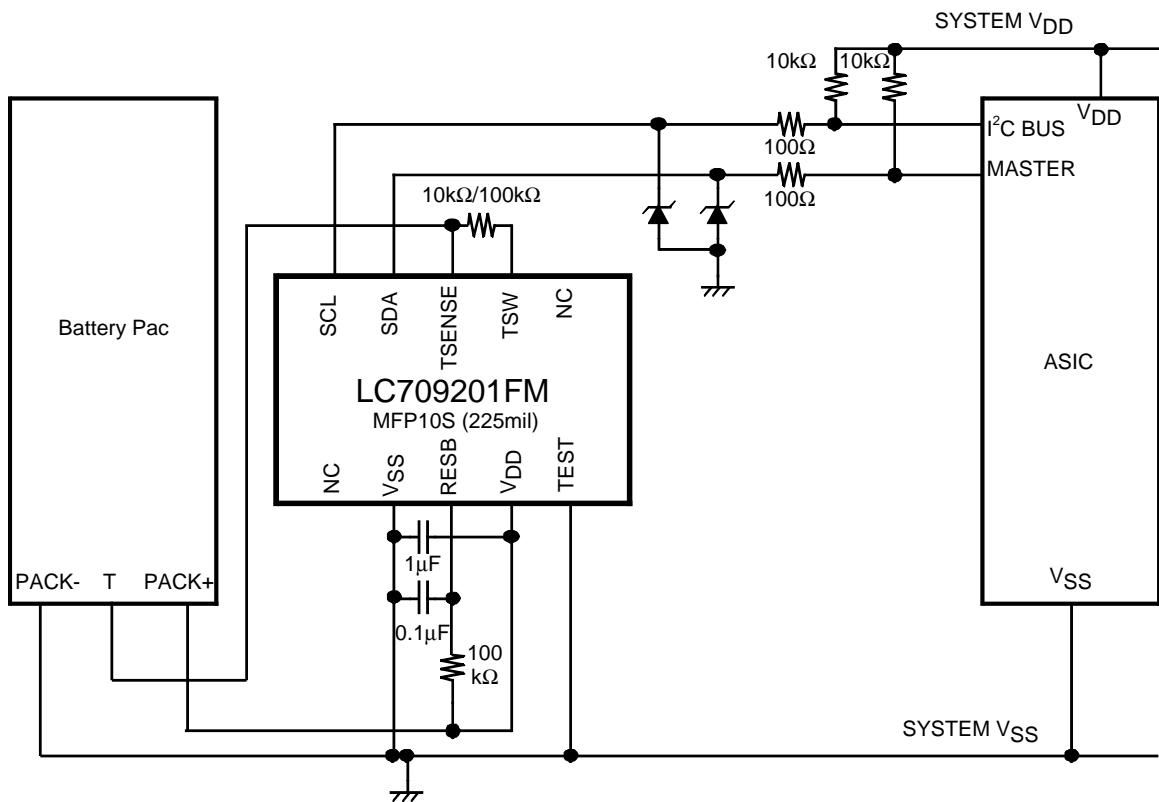
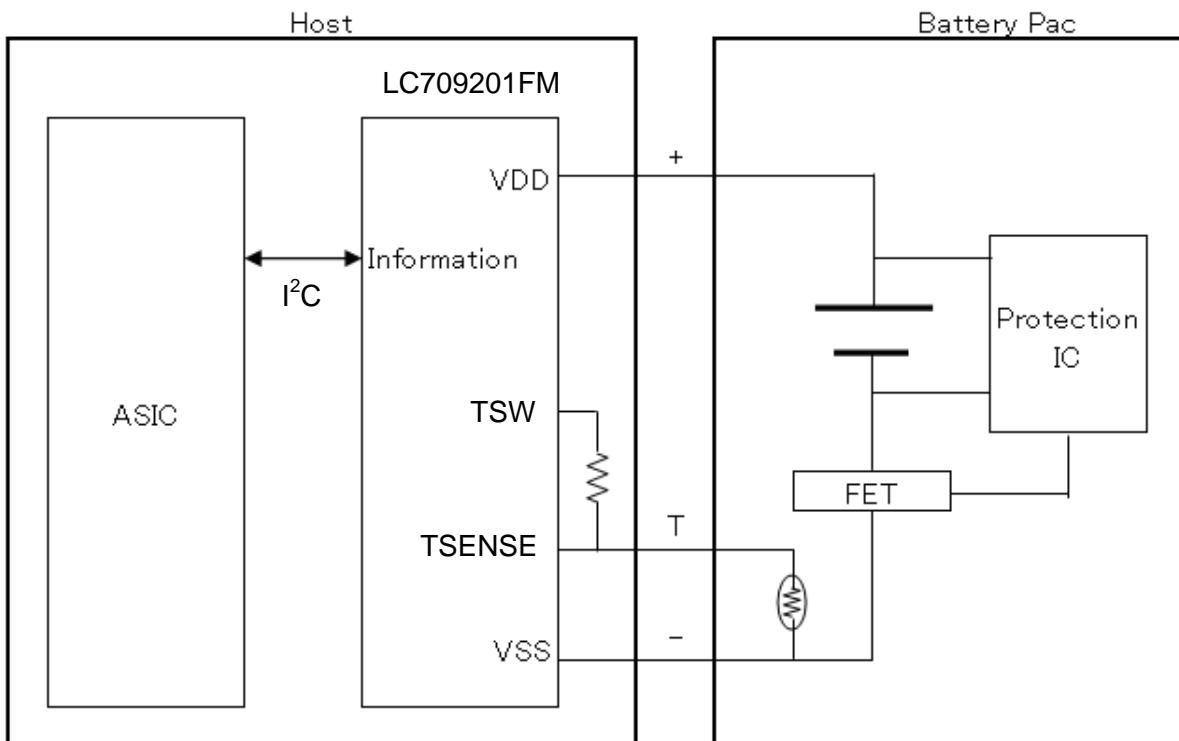


Figure 5 Conceptual diagram using LC709201F



ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



**Стандарт
Электрон
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литер Н,
помещение 100-Н Офис 331