

GENERAL DESCRIPTION

The SGM41011 family are battery protection ICs for Li-Ion/polymer rechargeable batteries, including the high-accuracy voltage detection circuits and the delay circuits. The device is designed to protect 1-cell Li-Ion/polymer rechargeable battery pack against over-charge, over-discharge and over-current.

The SGM41011 is available in Green SOT-23-6 and UTDFN-1.4×1.8-6L packages. It can operate in the -40°C to +85°C ambient temperature range.

APPLICATIONS

Li-Ion Rechargeable Battery Pack

Lithium Polymer Rechargeable Battery Pack

SIMPLIFIED SCHEMATIC

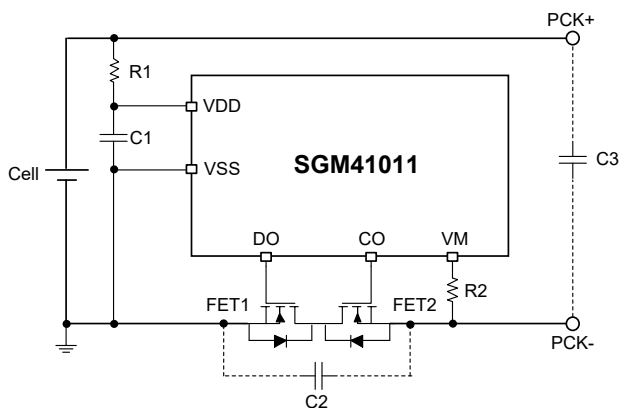


Figure 1. Simplified Schematic

FEATURES

- **High-Accuracy Voltage Detection Circuit**
 - ♦ **Over-Charge Detection Voltage:**
3.5V to 5.0V (5mV Step), Accuracy: ±15mV
 - ♦ **Over-Charge Hysteresis Voltage:**
0mV to 400mV (50mV Step), Accuracy: ±50mV
 - ♦ **Over-Discharge Detection Voltage:**
2.0V to 3.4V (10mV Step), Accuracy: ±15mV
 - ♦ **Over-Discharge Hysteresis Voltage:**
0mV to 700mV (100mV Step), Accuracy: ±55mV
 - ♦ **Discharge Over-Current Detection Voltage:**
10mV to 200mV (5mV Step), Accuracy: ±5mV
 - ♦ **Load Short-Circuiting Detection Voltage:**
20mV to 500mV (25mV Step), Accuracy: ±18mV
 - ♦ **Charge Over-Current Detection Voltage:**
-200mV to -10mV (5mV Step), Accuracy: ±6mV
- **Detection Delay Times are Generated Only by an Internal Circuit (No External Capacitors Required)**
- **0V Battery Charge Function:**
 - ♦ Enabled
- **Power-Down Function**
 - ♦ Available/Unavailable
- **Output Available during Power-On**
- **Conditional Retry when OCD/SCP Occurs**
 - ♦ Load Disconnection/Charger Connection
- **Release Voltage of OCD/SCP:** V_{OCD}/V_{OCD_R}
- **Operating Temperature Range:** -40°C to +85°C
- **Low Current Consumption**
 - ♦ During Operation: 1.7µA (TYP)
 - ♦ During Power-Down: 1nA (TYP)
 - ♦ During Over-Discharge: 0.6µA (TYP)
- **Available in Green SOT-23-6 and UTDFN-1.4×1.8-6L Packages**

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM41011-AA	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AAUHE6G/TR	304 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AAYN6G/TR	XXXXX 3XA	Tape and Reel, 3000
SGM41011-AB	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ABYUHE6G/TR	3V2 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ABYN6G/TR	XXXXX 3XB	Tape and Reel, 3000
SGM41011-AC	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ACYUHE6G/TR	3V3 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ACYN6G/TR	XXXXX 3XC	Tape and Reel, 3000
SGM41011-AD	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ADYUHE6G/TR	3V4 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ADYN6G/TR	XXXXX 3XD	Tape and Reel, 3000
SGM41011-AE	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AEYUHE6G/TR	3V5 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AEYN6G/TR	XXXXX 3XF	Tape and Reel, 3000
SGM41011-AG	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AGYUHE6G/TR	3V6 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AGYN6G/TR	XXXXX 3XE	Tape and Reel, 3000
SGM41011-AH	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AHYUHE6G/TR	3V7 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AHYN6G/TR	XXXXX 3XG	Tape and Reel, 3000
SGM41011-AJ	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AJYUHE6G/TR	3V8 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AJYN6G/TR	XXXXX 3XH	Tape and Reel, 3000
SGM41011-AK	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AKYUHE6G/TR	3V9 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AKYN6G/TR	XXXXX 3XI	Tape and Reel, 3000
SGM41011-AL	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ALYUHE6G/TR	3VA XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ALYN6G/TR	XXXXX 3XJ	Tape and Reel, 3000
SGM41011-AM	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AMYUHE6G/TR	3VB XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AMYN6G/TR	XXXXX 3XK	Tape and Reel, 3000
SGM41011-AN	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ANYUHE6G/TR	3VC XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ANYN6G/TR	XXXXX 3XL	Tape and Reel, 3000
SGM41011-AR	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ARYUHE6G/TR	3VD XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ARYN6G/TR	XXXXX 3XM	Tape and Reel, 3000
SGM41011-AS	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ASYUHE6G/TR	3VE XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ASYN6G/TR	XXXXX 3XN	Tape and Reel, 3000

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM41011-AT	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-ATYUHE6G/TR	3VF XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-ATYN6G/TR	XXXXX 3XO	Tape and Reel, 3000
SGM41011-AU	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AUYUHE6G/TR	3VG XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AUYN6G/TR	XXXXX 3XP	Tape and Reel, 3000
SGM41011-AW	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AWYUHE6G/TR	3VH XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AWYN6G/TR	XXXXX 3XQ	Tape and Reel, 3000
SGM41011-AX	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-AXYUHE6G/TR	3VI XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-AXYN6G/TR	XXXXX 3XR	Tape and Reel, 3000
SGM41011-BB	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-BBYUHE6G/TR	3KZ XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-BBYN6G/TR	XXXXX 3GY	Tape and Reel, 3000
SGM41011-BF	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-BFYUHE6G/TR	3VQ XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-BFYN6G/TR	XXXXX 3KW	Tape and Reel, 3000
SGM41011-CG	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-CGYUHE6G/TR	305 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-CGYN6G/TR	XXXXX 3XS	Tape and Reel, 3000
SGM41011-CP	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-CPYUHE6G/TR	3VR XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-CPYN6G/TR	XXXXX 3KX	Tape and Reel, 3000
SGM41011-DN	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-DNYUHE6G/TR	306 XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-DNYN6G/TR	XXXXX 3XT	Tape and Reel, 3000
SGM41011-EG	UTDFN-1.4×1.8-6L	-40°C to +85°C	SGM41011-EGYUHE6G/TR	3VS XXX	Tape and Reel, 3000
	SOT-23-6	-40°C to +85°C	SGM41011-EGYN6G/TR	XXXXX 307	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXX = Date Code and Trace Code. XXXXX = Date Code, Trace Code and Vendor Code.

UTDFN-1.4×1.8-6L

Y Y Y — Serial Number
X X X
 Trace Code
 Date Code - Year

SOT-23-6

X X X X X
 Vendor Code
 Trace Code
 Date Code - Year

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

PRODUCT LIST

Table 1. Product Name List

Product Name ⁽¹⁾	Over-Charge Detection Voltage (V _{OV})	Over-Charge Release Voltage (V _{OV_R})	Over-Discharge Detection Voltage (V _{UV})	Over-Discharge Release Voltage (V _{UV_R})	Discharge Over-Current Detection Voltage (V _{OCD})	Load Short-Circuiting Detection Voltage (V _{SHORT})	Charge Over-Current Detection Voltage (V _{OCC})	0V Battery Charge Function	Power-Down Function	Release Condition after OCD	Delay Time Combination ⁽²⁾
SGM41011-AA	4.425V	4.225V	2.500V	2.800V	0.055V	0.255V	-0.055V	Enabled	Unavailable	Load Disconnection	4
SGM41011-AB	4.475V	4.275V	2.500V	2.900V	0.065V	0.190V	-0.050V	Enabled	Unavailable	Load Disconnection	1
SGM41011-AC	4.420V	4.220V	2.500V	2.900V	0.050V	0.300V	-0.040V	Enabled	Unavailable	Load Disconnection	2
SGM41011-AD	4.420V	4.220V	2.500V	2.900V	0.050V	0.300V	-0.040V	Enabled	Unavailable	Charger Connection	2
SGM41011-AE	4.425V	4.225V	2.500V	2.900V	0.100V	0.500V	-0.100V	Enabled	Unavailable	Load Disconnection	3
SGM41011-AG	4.425V	4.225V	2.500V	2.900V	0.100V	0.300V	-0.060V	Enabled	Unavailable	Charger Connection	5
SGM41011-AH	4.425V	4.225V	2.500V	2.500V	0.180V	0.500V	-0.125V	Enabled	Available	Charger Connection	3
SGM41011-AJ	4.425V	4.225V	2.500V	2.800V	0.025V	0.075V	-0.025V	Enabled	Unavailable	Charger Connection	3
SGM41011-AK	4.475V	4.275V	2.500V	2.800V	0.025V	0.075V	-0.025V	Enabled	Unavailable	Charger Connection	3
SGM41011-AL	4.475V	4.275V	2.500V	2.900V	0.045V	0.095V	-0.040V	Enabled	Unavailable	Charger Connection	6
SGM41011-AM	4.475V	4.275V	2.500V	2.900V	0.130V	0.305V	-0.100V	Enabled	Unavailable	Charger Connection	4
SGM41011-AN	4.280V	4.280V	2.800V	2.800V	0.050V	0.500V	-0.100V	Enabled	Available	Load Disconnection	7
SGM41011-AR	4.475V	4.275V	2.500V	2.900V	0.130V	0.380V	-0.125V	Enabled	Unavailable	Load Disconnection	4
SGM41011-AS	4.425V	4.225V	3.000V	3.000V	0.030V	0.205V	-0.030V	Enabled	Available	Load Disconnection	3
SGM41011-AT	4.280V	4.080V	3.000V	3.000V	0.030V	0.205V	-0.030V	Enabled	Available	Load Disconnection	3
SGM41011-AU	4.475V	4.275V	2.500V	2.800V	0.060V	0.160V	-0.050V	Enabled	Unavailable	Load Disconnection	3
SGM41011-AW	4.475V	4.275V	2.500V	2.800V	0.030V	0.105V	-0.030V	Enabled	Unavailable	Load Disconnection	3
SGM41011-AX	4.550V	4.250V	2.000V	2.300V	0.130V	0.380V	-0.125V	Enabled	Unavailable	Load Disconnection	8
SGM41011-BA	4.425V	4.225V	2.500V	2.900V	0.130V	0.380V	-0.130V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BB	4.520V	4.320V	2.500V	2.900V	0.160V	0.500V	-0.160V	Enabled	Unavailable	Load Disconnection	3
SGM41011-BC	4.520V	4.320V	2.500V	2.900V	0.130V	0.480V	-0.130V	Enabled	Unavailable	Charger Connection	3
SGM41011-BD	4.475V	4.275V	2.500V	2.900V	0.150V	0.400V	-0.150V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BE	4.475V	4.275V	2.500V	2.800V	0.055V	0.255V	-0.055V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BF	4.200V	4.050V	2.500V	2.800V	0.100V	0.200V	-0.050V	Enabled	Available	Charger Connection	3
SGM41011-BG	4.475V	4.275V	2.500V	2.900V	0.160V	0.360V	-0.125V	Enabled	Unavailable	Charger Connection	4
SGM41011-BH	4.425V	4.225V	2.500V	2.900V	0.160V	0.360V	-0.125V	Enabled	Unavailable	Charger Connection	4
SGM41011-BJ	4.425V	4.225V	2.800V	3.000V	0.130V	0.380V	-0.130V	Enabled	Unavailable	Load Disconnection	2
SGM41011-BK	4.475V	4.275V	2.400V	2.800V	0.150V	0.350V	-0.125V	Enabled	Unavailable	Charger Connection	4
SGM41011-BL	4.550V	4.250V	2.000V	2.400V	0.075V	0.250V	-0.055V	Enabled	Unavailable	Charger Connection	6
SGM41011-BM	4.475V	4.275V	2.500V	2.900V	0.080V	0.280V	-0.080V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BN	4.475V	4.275V	2.500V	2.900V	0.100V	0.300V	-0.100V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BR	4.500V	4.350V	2.400V	2.500V	0.110V	0.235V	-0.105V	Enabled	Available	Charger Connection	6
SGM41011-BU	4.475V	4.275V	2.500V	2.900V	0.055V	0.255V	-0.045V	Enabled	Unavailable	Load Disconnection	4

SGM41011

Battery Protection IC for 1-Cell Pack

Product Name ⁽¹⁾	Over-Charge Detection Voltage (V _{OV})	Over-Charge Release Voltage (V _{OV_R})	Over-Discharge Detection Voltage (V _{UV})	Over-Discharge Release Voltage (V _{UV_R})	Discharge Over-Current Detection Voltage (V _{OCD})	Load Short-Circuiting Detection Voltage (V _{SHORT})	Charge Over-Current Detection Voltage (V _{OCC})	0V Battery Charge Function	Power-Down Function	Release Condition after OCD	Delay Time Combination ⁽²⁾
SGM41011-BW	4.475V	4.275V	2.500V	2.900V	0.075V	0.300V	-0.060V	Enabled	Unavailable	Load Disconnection	4
SGM41011-BX	4.425V	4.225V	2.500V	2.900V	0.075V	0.300V	-0.060V	Enabled	Unavailable	Load Disconnection	4
SGM41011-CB	4.475V	4.275V	2.500V	2.800V	0.034V	0.109V	-0.030V	Enabled	Unavailable	Load Disconnection	3
SGM41011-CC	4.475V	4.275V	2.400V	2.800V	0.075V	0.250V	-0.075V	Enabled	Unavailable	Charger Connection	9
SGM41011-CE	4.350V	4.200V	2.400V	2.500V	0.195V	0.245V	-0.150V	Enabled	Available	Charger Connection	6
SGM41011-CF	4.510V	4.310V	2.500V	2.800V	0.055V	0.205V	-0.055V	Enabled	Unavailable	Charger Connection	9
SGM41011-CG	4.500V	4.300V	2.500V	2.900V	0.100V	0.300V	-0.080V	Enabled	Unavailable	Charger Connection	6
SGM41011-CH	4.500V	4.300V	2.500V	2.900V	0.130V	0.380V	-0.100V	Enabled	Unavailable	Charger Connection	6
SGM41011-CJ	4.325V	4.075V	2.500V	2.900V	0.050V	0.200V	-0.030V	Enabled	Available	Charger Connection	2
SGM41011-CK	4.250V	4.000V	2.500V	3.000V	0.150V	0.500V	-0.150V	Enabled	Available	Load Disconnection	4
SGM41011-CL	3.800V	3.700V	2.200V	2.300V	0.100V	0.200V	-0.100V	Enabled	Available	Charger Connection	4
SGM41011-CN	4.475V	4.275V	2.500V	2.900V	0.045V	0.120V	-0.040V	Enabled	Unavailable	Load Disconnection	6
SGM41011-CP	3.650V	3.450V	2.100V	2.300V	0.150V	0.500V	-0.020V	Enabled	Unavailable	Charger Connection	4
SGM41011-CR	4.500V	4.350V	2.300V	2.700V	0.185V	0.235V	-0.150V	Enabled	Available	Charger Connection	6
SGM41011-CU	4.475V	4.275V	2.500V	2.900V	0.055V	0.155V	-0.050V	Enabled	Unavailable	Load Disconnection	10
SGM41011-CW	4.280V	4.080V	2.800V	2.800V	0.050V	0.150V	-0.050V	Enabled	Available	Charger Connection	9
SGM41011-DB	4.280V	4.180V	2.300V	2.300V	0.180V	0.480V	-0.175V	Enabled	Available	Load Disconnection	11
SGM41011-DC	3.800V	3.600V	2.200V	2.400V	0.150V	0.500V	-0.150V	Enabled	Available	Charger Connection	6
SGM41011-DF	4.500V	4.350V	2.400V	2.500V	0.195V	0.245V	-0.150V	Enabled	Available	Charger Connection	12
SGM41011-DG	4.475V	4.275V	2.400V	2.800V	0.075V	0.250V	-0.075V	Enabled	Unavailable	Charger Connection	9
SGM41011-DH	4.280V	3.880V	2.500V	3.000V	0.180V	0.480V	-0.180V	Enabled	Available	Load Disconnection	4
SGM41011-DJ	4.100V	3.850V	2.500V	2.900V	0.150V	0.500V	-0.150V	Enabled	Available	Charger Connection	4
SGM41011-DK	4.450V	4.250V	2.650V	2.850V	0.135V	0.260V	-0.115V	Enabled	Available	Load Disconnection	6
SGM41011-DM	4.350V	4.200V	2.400V	2.500V	0.095V	0.245V	-0.150V	Enabled	Available	Charger Connection	6
SGM41011-DN	4.375V	4.175V	2.400V	2.800V	0.100V	0.500V	-0.100V	Enabled	Unavailable	Load Disconnection	12
SGM41011-DS	4.425V	4.225V	2.500V	2.900V	0.050V	0.100V	-0.050V	Enabled	Available	Charger Connection	4
SGM41011-DU	4.275V	4.075V	2.300V	2.300V	0.120V	0.345V	-0.040V	Enabled	Available	Charger Connection	7
SGM41011-DW	4.550V	4.350V	2.500V	2.900V	0.075V	0.300V	-0.060V	Enabled	Unavailable	Load Disconnection	9
SGM41011-DX	4.550V	4.350V	2.600V	3.000V	0.045V	0.095V	-0.040V	Enabled	Unavailable	Charger Connection	6
SGM41011-EA	4.250V	4.050V	2.500V	2.900V	0.100V	0.500V	-0.100V	Enabled	Unavailable	Load Disconnection	15
SGM41011-EC	4.475V	4.275V	2.400V	2.800V	0.150V	0.500V	-0.125V	Enabled	Unavailable	Charger Connection	13
SGM41011-ED	4.350V	4.150V	2.500V	2.800V	0.100V	0.500V	-0.050V	Enabled	Unavailable	Load Disconnection	5
SGM41011-EE	4.280V	4.080V	2.600V	2.700V	0.075V	0.200V	-0.050V	Enabled	Unavailable	Load Disconnection	3
SGM41011-EF	4.500V	4.300V	2.500V	2.900V	0.045V	0.095V	-0.040V	Enabled	Unavailable	Charger Connection	6
SGM41011-EG	4.225V	4.025V	2.800V	3.000V	0.050V	0.150V	-0.050V	Enabled	Unavailable	Load Disconnection	9

Product Name ⁽¹⁾	Over-Charge Detection Voltage (V _{OV})	Over-Charge Release Voltage (V _{OV_R})	Over-Discharge Detection Voltage (V _{UV})	Over-Discharge Release Voltage (V _{UV_R})	Discharge Over-Current Detection Voltage (V _{OCD})	Load Short-Circuiting Detection Voltage (V _{SHORT})	Charge Over-Current Detection Voltage (V _{OCC})	0V Battery Charge Function	Power-Down Function	Release Condition after OCD	Delay Time Combination ⁽²⁾
SGM41011-EJ	4.300V	4.100V	2.300V	2.800V	0.085V	0.485V	-0.085V	Enabled	Unavailable	Load Disconnection	17
SGM41011-EM	4.475V	4.275V	2.500V	2.800V	0.060V	0.185V	-0.060V	Enabled	Unavailable	Charger Connection	9
SGM41011-EN	4.475V	4.275V	2.500V	2.800V	0.060V	0.210V	-0.060V	Enabled	Unavailable	Charger Connection	9
SGM41011-EP	4.375V	4.175V	2.800V	2.800V	0.050V	0.150V	-0.050V	Enabled	Available	Charger Connection	9
SGM41011-ER	4.495V	4.295V	2.500V	2.700V	0.045V	0.145V	-0.045V	Enabled	Available	Load Disconnection	11
SGM41011-ET	4.550V	4.350V	2.500V	2.900V	0.060V	0.135V	-0.030V	Enabled	Unavailable	Charger Connection	6
SGM41011-EU	4.475V	4.275V	2.500V	2.800V	0.060V	0.185V	-0.060V	Enabled	Available	Charger Connection	1
SGM41011-EW	4.350V	4.200V	2.000V	2.200V	0.095V	0.145V	-0.070V	Enabled	Available	Charger Connection	6
SGM41011-FA	4.560V	4.360V	2.400V	2.600V	0.100V	0.300V	-0.060V	Enabled	Unavailable	Charger Connection	22
SGM41011-FD	4.495V	4.295V	2.500V	2.700V	0.060V	0.185V	-0.060V	Enabled	Available	Charger Connection	10
SGM41011-FH	4.500V	4.300V	3.000V	3.200V	0.050V	0.100V	-0.050V	Enabled	Available	Charger Connection	6
SGM41011-FK	4.280V	4.130V	2.500V	2.700V	0.090V	0.490V	-0.090V	Enabled	Available	Charger Connection	9
SGM41011-FL	4.280V	4.080V	3.000V	3.000V	0.080V	0.205V	-0.030V	Enabled	Available	Load Disconnection	3
SGM41011-FM	4.275V	4.175V	2.800V	2.900V	0.100V	0.500V	-0.100V	Enabled	Available	Charger Connection	11
SGM41011-FP	4.275V	4.175V	2.800V	2.900V	0.100V	0.500V	-0.100V	Enabled	Available	Charger Connection	11
SGM41011-FR	4.545V	4.345V	2.500V	2.700V	0.060V	0.185V	-0.060V	Enabled	Available	Charger Connection	10
SGM41011-FS	4.240V	4.040V	2.700V	3.100V	0.050V	0.100V	-0.050V	Enabled	Unavailable	Load Disconnection	3
SGM41011-FT	4.290V	4.090V	2.600V	3.000V	0.075V	0.250V	-0.075V	Enabled	Unavailable	Charger Connection	22
SGM41011-FW	4.495V	4.295V	2.500V	2.700V	0.060V	0.235V	-0.060V	Enabled	Available	Charger Connection	12
SGM41011-GD	4.280V	4.080V	3.000V	3.000V	0.080V	0.205V	-0.060V	Enabled	Available	Charger Connection	3
SGM41011-GH	4.280V	4.080V	3.100V	3.100V	0.030V	0.205V	-0.030V	Enabled	Available	Load Disconnection	3
SGM41011-GJ	4.625V	4.475V	2.500V	2.700V	0.050V	0.120V	-0.050V	Enabled	Unavailable	Load Disconnection	6

NOTES:

1. The product name is in range of SGM41011-AA to SGM41011-XX. For products other than the above, please contact our sales representatives.
2. Please refer to the Table 2 for details of the delay time combinations.

PRODUCT LIST (continued)

Table 2. Delay Time Combination

Delay Time Combination ⁽³⁾	Over-Charge Detection Delay Time (t _{OV})	Over-Discharge Detection Delay Time (t _{UV})	Discharge Over-Current Detection Delay Time (t _{OCD})	Load Short-Circuiting Detection Delay Time (t _{SHORT})	Charge Over-Current Detection Delay Time (t _{OCC})
1	1024ms	36ms	16ms	310μs	4ms
2	1024ms	68ms	16ms	310μs	8ms
3	1024ms	36ms	8ms	310μs	8ms
4	1024ms	68ms	8ms	310μs	8ms
5	1024ms	68ms	8ms	310μs	4ms
6	1024ms	68ms	16ms	310μs	16ms
7	1024ms	128ms	8ms	310μs	8ms
8	1024ms	36ms	16ms	560μs	16ms
9	1024ms	36ms	16ms	310μs	16ms
10	1024ms	36ms	16ms	310μs	8ms
11	1024ms	128ms	16ms	310μs	8ms
12	1024ms	36ms	8ms	310μs	16ms
13	1024ms	68ms	8ms	560μs	8ms
14	512ms	128ms	16ms	560μs	16ms
15	1024ms	128ms	16ms	560μs	16ms
16	256ms	128ms	8ms	310μs	8ms
17	1024ms	68ms	16ms	560μs	16ms
18	256ms	36ms	8ms	310μs	16ms

NOTE:

3. The delay times can be changed within the range shown in Table 3. Please contact our sales representatives for more information.

Table 3. Delay Time Options

Delay Time	Symbol	Selection Range			Remark
Over-Charge Detection Delay Time	t _{OV}	256ms	512ms	1024ms	Select a value from the left.
Over-Discharge Detection Delay Time	t _{UV}	36ms	68ms	128ms	Select a value from the left.
Discharge Over-Current Detection Delay Time	t _{OCD}	4ms	8ms	16ms	Select a value from the left.
Load Short-Circuiting Detection Delay Time	t _{SHORT}	310μs	560μs		Select a value from the left.
Charge Over-Current Detection Delay Time	t _{OCC}	4ms	8ms	16ms	Select a value from the left.

ABSOLUTE MAXIMUM RATINGS

Input Voltage Range between VDD Pin and VSS Pin, V_{DS}	
..... $V_{SS} - 0.3V$ to $V_{SS} + 6V$	
VM Pin Input Voltage Range, V_{VM}	
..... $V_{DD} - 28V$ to $V_{DD} + 0.3V$	
DO Pin Output Voltage Range, V_{DO}	
..... $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$	
CO Pin Output Voltage Range, V_{CO}	
..... $V_{VM} - 0.3V$ to $V_{DD} + 0.3V$	
Package Thermal Resistance	
UTDFN-1.4×1.8-6L, θ_{JA}	165.6°C/W
UTDFN-1.4×1.8-6L, θ_{JB}	122.6°C/W
UTDFN-1.4×1.8-6L, $\theta_{JC (TOP)}$	132.8°C/W
UTDFN-1.4×1.8-6L, $\theta_{JC (BOT)}$	97.6°C/W
SOT-23-6, θ_{JA}	190°C/W
SOT-23-6, θ_{JB}	87.1°C/W
SOT-23-6, θ_{JC}	131.4°C/W
Junction Temperature.....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility ^{(1) (2)}	
HBM.....	±5000V
CDM.....	±1500V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range.....	0V to 6V
Operating Temperature Range.....	-40°C to +85°C

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

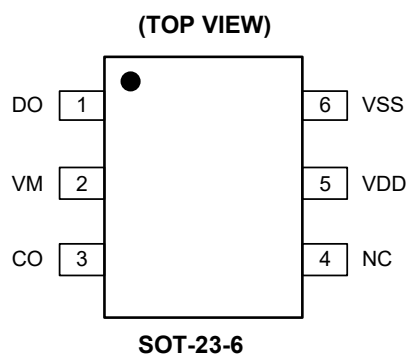
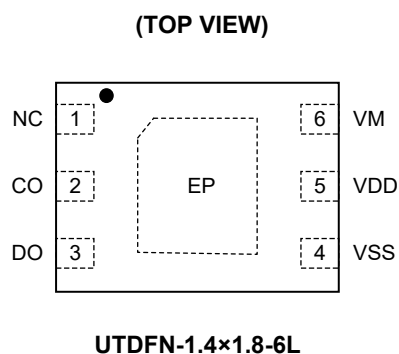
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

PIN		NAME	TYPE	FUNCTION
UDFN-1.4x1.8-6L	SOT-23-6			
1	4	NC	–	No Connection.
2	3	CO	O	Charge Control FET Gate Connection Pin (CMOS Output).
3	1	DO	O	Discharge Control FET Gate Connection Pin (CMOS Output).
4	6	VSS	P	Negative Power Supply Input Pin.
5	5	VDD	P	Positive Power Supply Input Pin.
6	2	VM	I	Over-Current Detection/Charger Detection Input Pin.
Exposed Pad	–	EP	–	Exposed Pad. It is recommended to leave this pin floating.

NOTE: I = input, O = output, P = power.

ELECTRICAL CHARACTERISTICS

(T_J = -40°C to +85°C, typical values are measured at T_J = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Detection Voltage							
Over-Charge Detection Voltage ⁽¹⁾	V _{OV}	Test circuit 1, see Figure 3	T _J = +25°C	V _{OV} - 0.015	V _{OV}	V _{OV} + 0.015	V
			T _J = -20°C to +60°C	V _{OV} - 0.040		V _{OV} + 0.040	
			T _J = -40°C to +85°C	V _{OV} - 0.060		V _{OV} + 0.040	
Over-Charge Release Voltage ⁽¹⁾	V _{OV_R}	200mV option, V _{OV_R} ≠ V _{OV} , test circuit 1, see Figure 3	T _J = +25°C	V _{OV_R} - 0.050	V _{OV_R}	V _{OV_R} + 0.050	V
			T _J = -20°C to +60°C	V _{OV_R} - 0.060		V _{OV_R} + 0.055	
			T _J = -40°C to +85°C	V _{OV_R} - 0.075		V _{OV_R} + 0.060	
Over-Charge Hysteresis Voltage	V _{OVHYS}	0mV to 400mV, 50mV Step	T _J = +25°C		V _{OVHYS}		mV
			T _J = -20°C to +60°C				
			T _J = -40°C to +85°C				
Over-Discharge Detection Voltage	V _{UV}	Test circuit 2, see Figure 4	T _J = +25°C	V _{UV} - 0.015	V _{UV}	V _{UV} + 0.015	V
			T _J = -20°C to +60°C	V _{UV} - 0.030		V _{UV} + 0.030	
			T _J = -40°C to +85°C	V _{UV} - 0.045		V _{UV} + 0.045	
Over-Discharge Release Voltage	V _{UV_R}	400mV option, test circuit 2, see Figure 4	T _J = +25°C	V _{UV_R} - 0.055	V _{UV_R}	V _{UV_R} + 0.055	V
			T _J = -20°C to +60°C	V _{UV_R} - 0.065		V _{UV_R} + 0.060	
			T _J = -40°C to +85°C	V _{UV_R} - 0.075		V _{UV_R} + 0.065	
Over-Discharge Hysteresis Voltage	V _{UVHYS}	0mV to 700mV, 100mV Step	T _J = +25°C		V _{UVHYS}		mV
			T _J = -20°C to +60°C				
			T _J = -40°C to +85°C				
Discharge Over-Current Detection Voltage ⁽¹⁾	V _{OCD}	Test circuit 2, see Figure 4	T _J = +25°C	V _{OCD} - 5	V _{OCD}	V _{OCD} + 5	mV
			T _J = -20°C to +60°C	V _{OCD} - 8		V _{OCD} + 8	
			T _J = -40°C to +85°C	V _{OCD} - 10		V _{OCD} + 10	
Discharge Over-Current Release Voltage ⁽¹⁾	V _{OCD_R}	Test circuit 2, see Figure 4	T _J = +25°C	V _{DD} - 1.2	V _{DD} - 0.8	V _{DD} - 0.5	V
			T _J = -20°C to +60°C	V _{DD} - 1.3		V _{DD} - 0.4	
			T _J = -40°C to +85°C	V _{DD} - 1.3		V _{DD} - 0.4	
Load Short-Circuiting Detection Voltage	V _{SHORT}	V _{DD} = 3.4V, test circuit 2, see Figure 4	T _J = +25°C	V _{SHORT} - 18	V _{SHORT}	V _{SHORT} + 18	mV
			T _J = -20°C to +60°C	V _{SHORT} - 25		V _{SHORT} + 25	
			T _J = -40°C to +85°C	V _{SHORT} - 30		V _{SHORT} + 30	
Charge Over-Current Detection Voltage ⁽¹⁾	V _{OCC}	Test circuit 2, see Figure 4	T _J = +25°C	V _{OCC} - 6	V _{OCC}	V _{OCC} + 6	mV
			T _J = -20°C to +60°C	V _{OCC} - 10		V _{OCC} + 10	
			T _J = -40°C to +85°C	V _{OCC} - 13		V _{OCC} + 13	
0V Battery Charge							
0V Battery Charge Starting Charger Voltage	V _{0CHA}	0V battery charge enabled, test circuit 2, see Figure 4	T _J = +25°C	0	1.0	1.5	V
			T _J = -20°C to +60°C	0	1.0	1.6	
			T _J = -40°C to +85°C	0	1.0	1.7	

ELECTRICAL CHARACTERISTICS (continued)(T_J = -40°C to +85°C, typical values are measured at T_J = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Internal Resistance							
Resistance between VDD Pin and VM Pin	R _{VMD}	V _{DD} = 1.8V, V _{VM} = 0V, test circuit 3, see Figure 5	T _J = +25°C	750	1250	1900	kΩ
			T _J = -20°C to +60°C	500	1250	2200	
			T _J = -40°C to +85°C	500	1250	2500	
Resistance between VM Pin and VSS Pin	R _{VMS}	V _{DD} = 3.4V, V _{VM} = 3V, test circuit 3, see Figure 5	T _J = +25°C	10	22	30	kΩ
			T _J = -20°C to +60°C	7.5	22	40	
			T _J = -40°C to +85°C	7.5	22	40	
Input Voltage							
Operation Voltage between VDD Pin and VSS Pin	V _{DSOP1}			1.5		6	V
Operation Voltage between VDD Pin and VM Pin	V _{DSOP2}			1.5		28	V
Input Current							
Current Consumption during Operation	I _{OPE}	V _{DD} = 3.4V, V _{VM} = 0V, test circuit 3, see Figure 5	T _J = +25°C		1.7	2.3	μA
			T _J = -20°C to +60°C		1.7	2.7	
			T _J = -40°C to +85°C		1.7	2.7	
Current Consumption during Power-Down (Power-Down Function Available)	I _{PDN}	V _{DD} = V _{VM} = 1.7V, test circuit 3, see Figure 5	T _J = +25°C		1	50	nA
			T _J = -20°C to +60°C		1	60	
			T _J = -40°C to +85°C		1	100	
Current Consumption during Over-Discharge (Power-Down Function Unavailable)	I _{OPED}	V _{DD} = V _{VM} = 1.7V, test circuit 3, see Figure 5	T _J = +25°C		0.6		uA
			T _J = -20°C to +60°C		0.6	0.9	
			T _J = -40°C to +85°C		0.6	0.9	
Output Resistance							
CO Pin Resistance "H"	R _{COH}	Test circuit 4, see Figure 6	T _J = +25°C	5	11.5	18	kΩ
			T _J = -20°C to +60°C	2.5	11.5	25	
			T _J = -40°C to +85°C	2.5	11.5	25	
CO Pin Resistance "L"	R _{COL}	Test circuit 4, see Figure 6	T _J = +25°C	5	10.5	18	kΩ
			T _J = -20°C to +60°C	2.5	10.5	25	
			T _J = -40°C to +85°C	2.5	10.5	25	
DO Pin Resistance "H"	R _{DOH}	Test circuit 4, see Figure 6	T _J = +25°C	5	11.5	18	kΩ
			T _J = -20°C to +60°C	2.5	11.5	25	
			T _J = -40°C to +85°C	2.5	11.5	25	
DO Pin Resistance "L"	R _{DOL}	Test circuit 4, see Figure 6	T _J = +25°C	5	10.5	18	kΩ
			T _J = -20°C to +60°C	2.5	10.5	25	
			T _J = -40°C to +85°C	2.5	10.5	25	

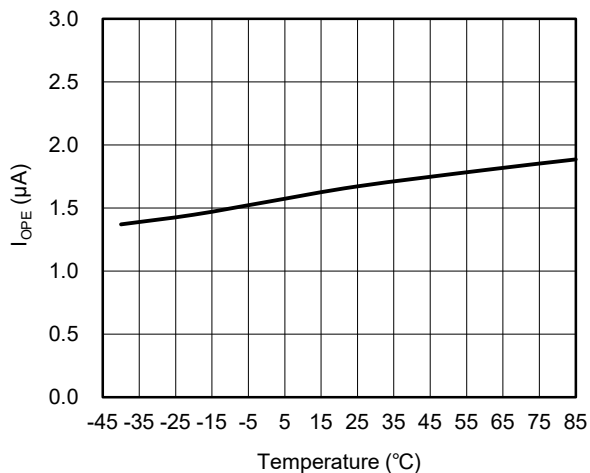
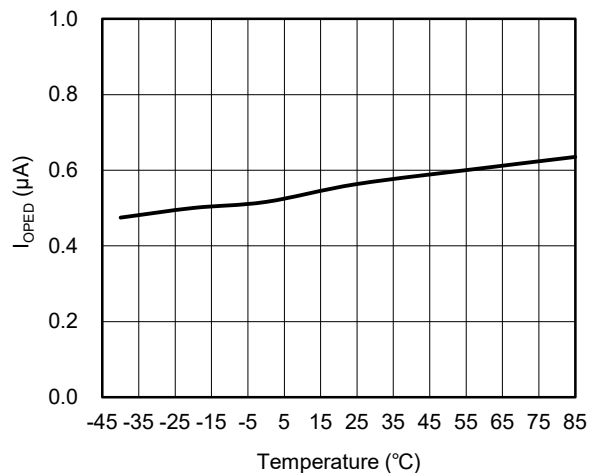
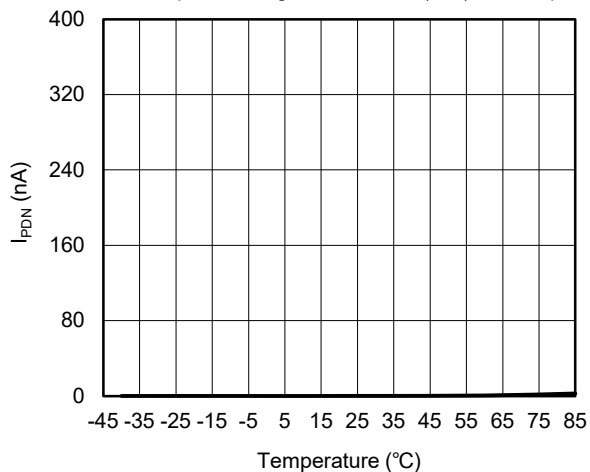
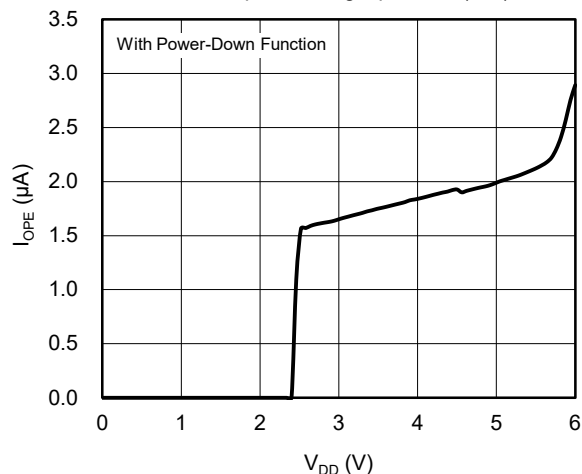
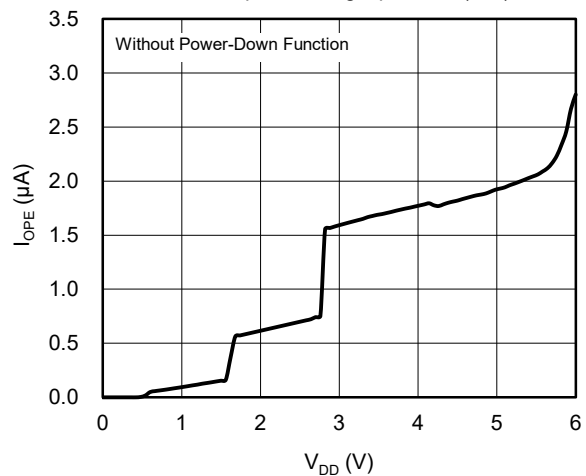
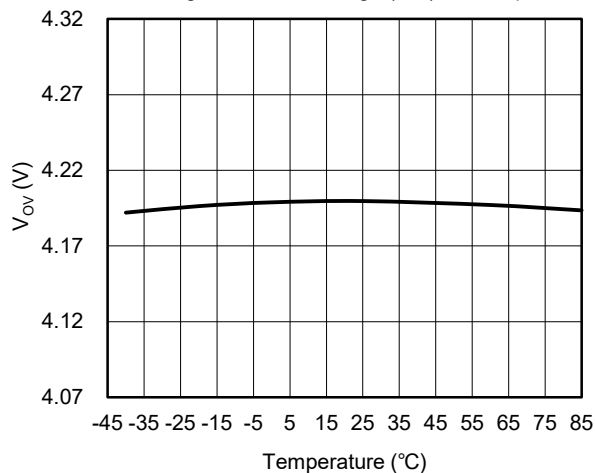
ELECTRICAL CHARACTERISTICS (continued)(T_J = -40°C to +85°C, typical values are measured at T_J = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Delay Time ⁽¹⁾						
Over-Charge Detection Delay Time	t _{OV}	Test circuit 5, see Figure 7	T _J = +25°C	t _{OV} × 0.75	t _{OV} × 1.29	ms
			T _J = -20°C to +60°C	t _{OV} × 0.56	t _{OV} × 1.64	
			T _J = -40°C to +85°C	t _{OV} × 0.5	t _{OV} × 1.8	
Over-Discharge Detection Delay Time	t _{UV}	Test circuit 5, see Figure 7	T _J = +25°C	t _{UV} × 0.66	t _{UV} × 1.39	ms
			T _J = -20°C to +60°C	t _{UV} × 0.5	t _{UV} × 1.77	
			T _J = -40°C to +85°C	t _{UV} × 0.44	t _{UV} × 1.95	
Discharge Over-Current Detection Delay Time	t _{OCD}	Test circuit 5, see Figure 7	T _J = +25°C	t _{OCD} × 0.75	t _{OCD} × 1.25	ms
			T _J = -20°C to +60°C	t _{OCD} × 0.56	t _{OCD} × 1.59	
			T _J = -40°C to +85°C	t _{OCD} × 0.5	t _{OCD} × 1.75	
Load Short-Circuiting Detection Delay Time	t _{SHORT}	Test circuit 5, see Figure 7	T _J = +25°C	t _{SHORT} × 0.75	t _{SHORT} × 1.25	μs
			T _J = -20°C to +60°C	t _{SHORT} × 0.56	t _{SHORT} × 1.59	
			T _J = -40°C to +85°C	t _{SHORT} × 0.5	t _{SHORT} × 1.75	
Charge Over-Current Detection Delay Time	t _{OCC}	Test circuit 5, see Figure 7	T _J = +25°C	t _{OCC} × 0.75	t _{OCC} × 1.25	ms
			T _J = -20°C to +60°C	t _{OCC} × 0.56	t _{OCC} × 1.59	
			T _J = -40°C to +85°C	t _{OCC} × 0.5	t _{OCC} × 1.75	

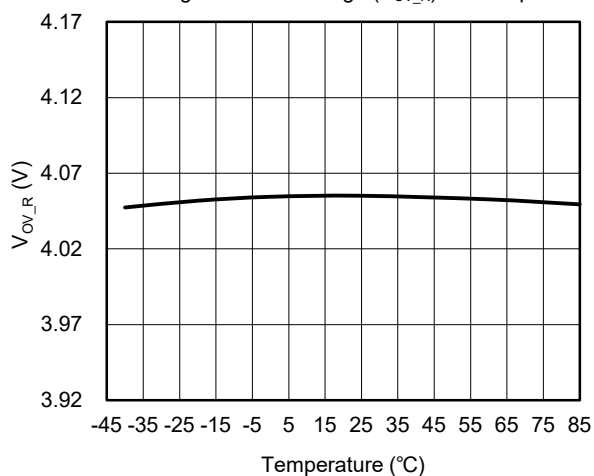
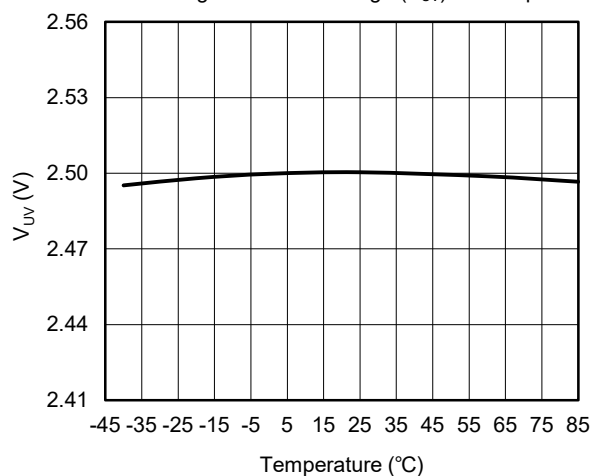
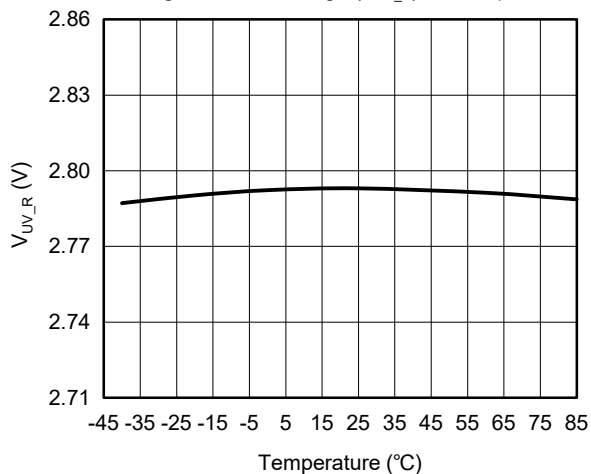
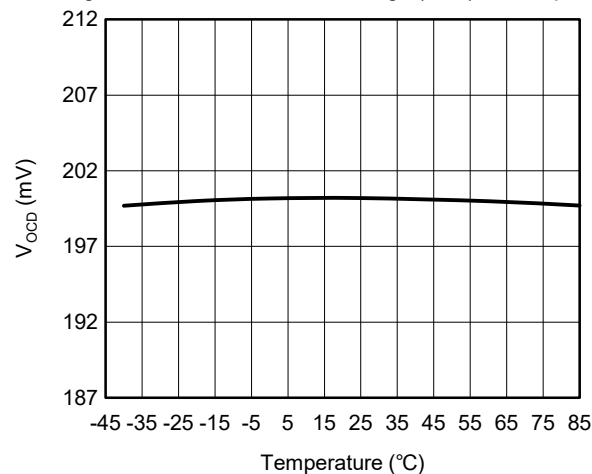
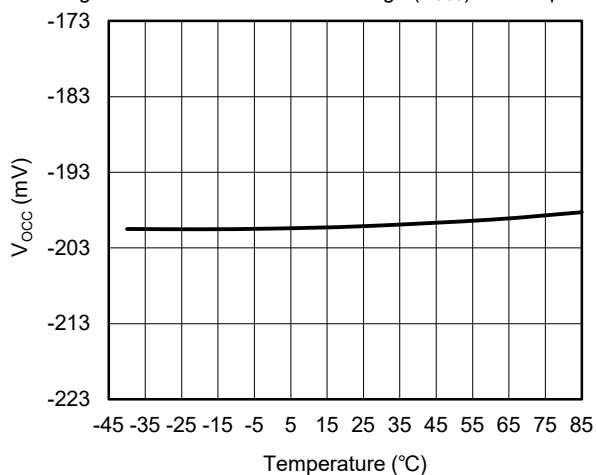
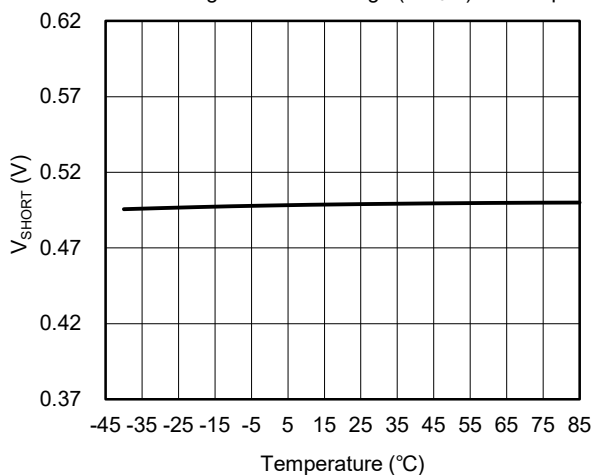
NOTE:

1. The best estimate from product characterization, guaranteed by correlated test in production.

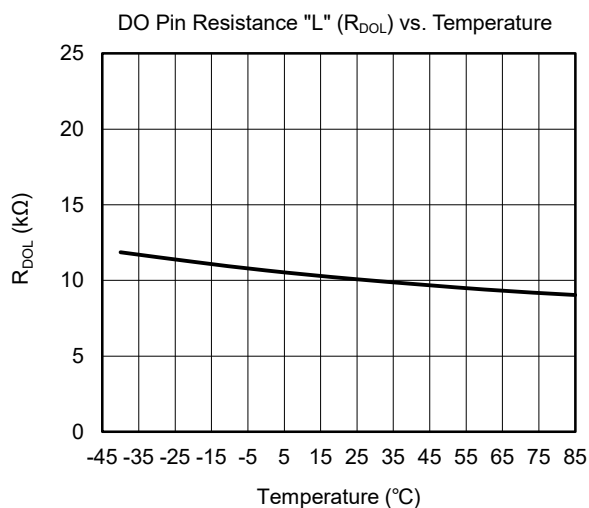
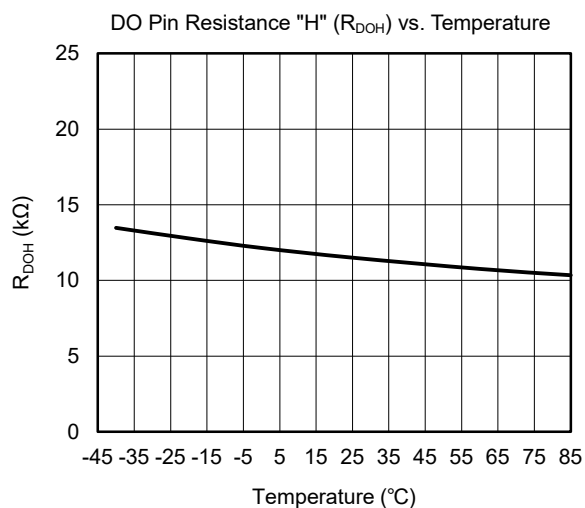
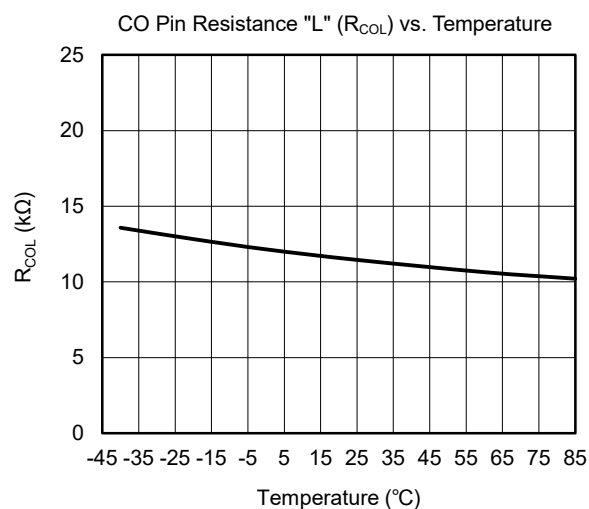
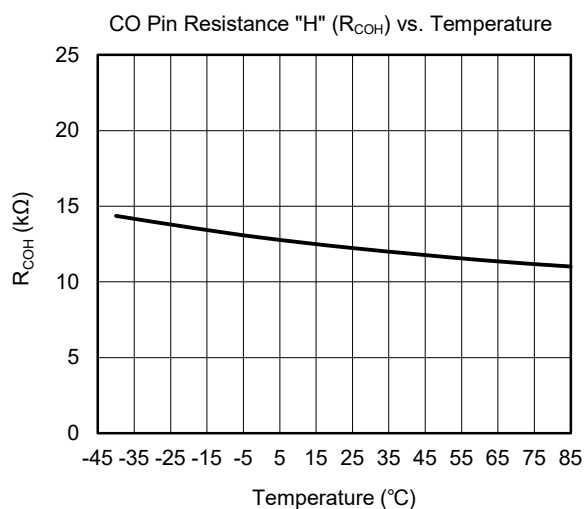
TYPICAL PERFORMANCE CHARACTERISTICS

Current Consumption during Operation (I_{OPE}) vs. TemperatureCurrent Consumption during Over-Discharge (I_{OPED}) vs. TemperatureCurrent Consumption during Power-Down (I_{PDN}) vs. TemperatureCurrent Consumption during Operation (I_{OPE}) vs. V_{DD} Current Consumption during Operation (I_{OPE}) vs. V_{DD} Over-Charge Detection Voltage (V_{OV}) vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Over-Charge Release Voltage (V_{OV_R}) vs. TemperatureOver-Discharge Detection Voltage (V_{UV}) vs. TemperatureOver-Discharge Release Voltage (V_{UV_R}) vs. TemperatureDischarge Over-Current Detection Voltage (V_{OCD}) vs. TemperatureCharge Over-Current Detection Voltage (V_{OCC}) vs. TemperatureLoad Short-Circuiting Detection Voltage (V_{SHORT}) vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (continued)



FUNCTIONAL BLOCK DIAGRAM

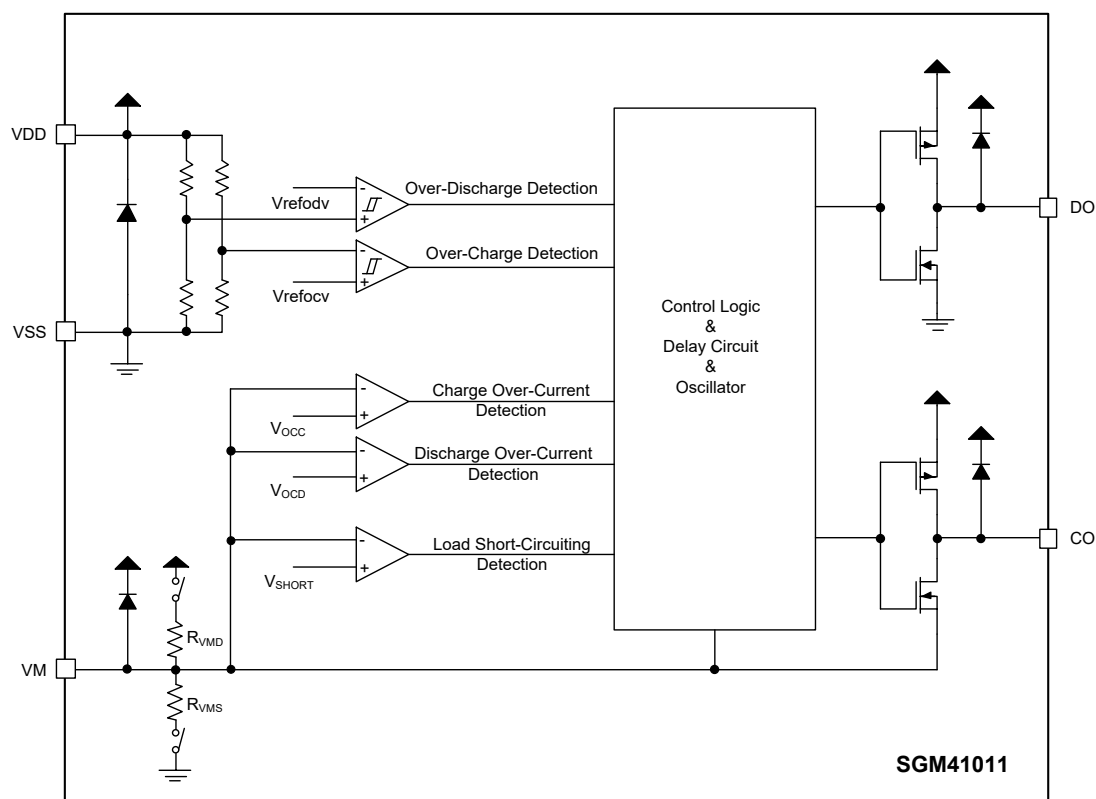


Figure 2. Block Diagram

TEST CIRCUITS

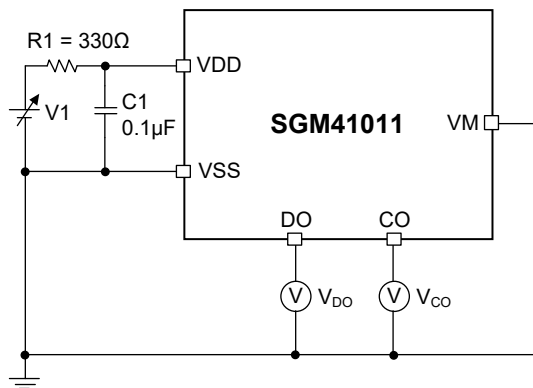


Figure 3. Test Circuit 1

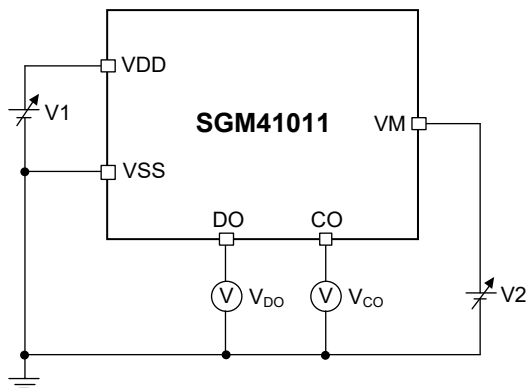


Figure 4. Test Circuit 2

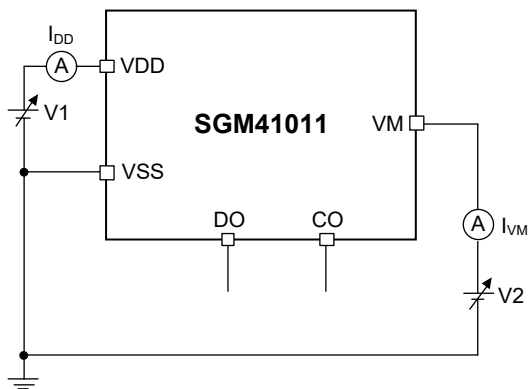


Figure 5. Test Circuit 3

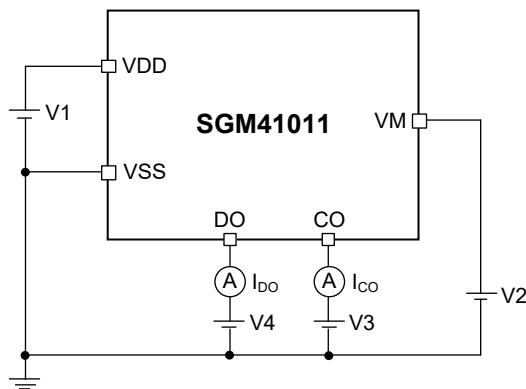


Figure 6. Test Circuit 4

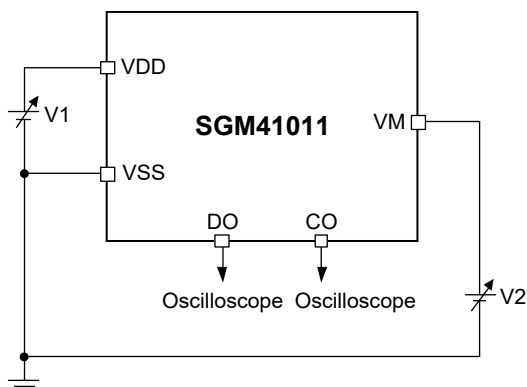


Figure 7. Test Circuit 5

TEST CIRCUITS (continued)

Note that unless otherwise specified, the CO pin output logic level respects to V_{VM} and the DO pin level respects to V_{SS} . And the output voltage levels "H" and "L" at both CO and DO pins are judged by the threshold voltage (typical 1.0V) of the N-FET.

Over-Charge Detection Voltage & Release Voltage (Test Circuit 1)

V_{OV} : Over-charge detection voltage, it is defined as the V1 voltage at which V_{CO} goes from "H" to "L" when gradually increasing V1 voltage after setting $V1 = 3.4V$.

V_{OV_R} : Over-charge release voltage, it is defined as the V1 voltage at which V_{CO} goes from "L" to "H" when gradually decreasing the V1 voltage.

V_{OVHYS} : Over-charge hysteresis voltage, it is defined as $V_{OV} - V_{OV_R}$.

Over-Discharge Detection & Release Voltage (Test Circuit 2)

V_{UV} : Over-discharge detection voltage, it is defined as the V1 voltage at which V_{DO} goes from "H" to "L" when gradually decreasing V1 voltage after setting $V1 = 3.4V$, $V2 = 0V$.

V_{UV_R} : Over-discharge release voltage, it is defined as the V1 voltage at which V_{DO} goes from "L" to "H" when setting $V2 = 0.035V$ and gradually increasing the V1 voltage.

V_{UVHYS} : Over-discharge hysteresis voltage, it is defined as $V_{UV_R} - V_{UV}$.

Discharge Over-Current Detection Voltage (Test Circuit 2)

V_{OCD} : Discharge over-current detection voltage, it is defined as the V2 voltage at which V_{DO} goes from "H" to "L" with a delay time t_{OCD} when increasing the V2 voltage after setting $V1 = 3.4V$, $V2 = 0V$.

Load Short-Circuiting Detection Voltage & Release Voltage (Test Circuit 2)

V_{SHORT} : Load short-circuiting detection voltage, it is defined as the V2 voltage at which V_{DO} changing from "H" to "L" with a delay time t_{SHORT} when the V2 voltage increasing after setting $V1 = 3.4V$, $V2 = 0V$.

V_{OCD_R} : Discharge over-current release voltage, it is defined as the V2 voltage at which V_{DO} goes from "L" to "H" when setting $V2 = 3.4V$ and then gradually decreasing the V2 voltage.

Charge Over-Current Detection Voltage (Test Circuit 2)

V_{OCC} : Charge over-current detection voltage, it is defined as the V2 voltage at which V_{CO} changing from "H" to "L" with a charge over-current detection delay time (t_{OCC}) when the V2 voltage decreasing after setting $V1 = 3.4V$, $V2 = 0V$.

Current Consumption (Test Circuit 3)

I_{OPE} : Current consumption during operation, it is defined as the current that flows through the VDD pin (I_{DD}) under conditions of $V1 = 3.4V$, $V2 = 0V$ during operation.

With Power-Down Function

I_{PDN} : Current consumption during power-down, it is defined as I_{DD} under conditions of $V1 = V2 = 1.7V$, during power-down.

Without Power-Down Function

I_{OPED} : Current consumption during over-discharge, it is defined as I_{DD} under conditions of $V1 = V2 = 1.7V$ during UVP state.

Resistance between VDD Pin and VM Pin (Test Circuit 3)

R_{VMD} : Resistance between VDD pin and VM pin, it is tested under conditions of $V1 = 1.8V$, $V2 = 0V$.

Resistance between VM Pin and VSS Pin (Test Circuit 3)

R_{VMS} : Resistance between VM pin and VSS pin, it is tested under conditions of $V1 = 3.4V$, $V2 = 3V$.

CO & DO Pin Resistance "H" & "L" (Test Circuit 4)

R_{COH} : CO pin resistance "H", it is defined as the resistance between the VDD pin and CO pin under conditions of $V1 = 3.4V$, $V2 = 0V$, $V3 = 3.0V$.

R_{COL} : CO pin resistance "L", it is defined as the resistance between the VM pin and CO pin under conditions of $V1 = 5.1V$, $V2 = 0V$, $V3 = 0.4V$.

R_{DOH} : DO pin resistance "H", it is defined as the resistance between the VDD pin and DO pin under conditions of $V1 = 3.4V$, $V2 = 0V$, $V4 = 3.0V$.

R_{DOL} : DO pin resistance "L", it is defined as the resistance between the VSS pin and DO pin under conditions of $V1 = 1.9V$, $V2 = 0V$, $V4 = 0.4V$.

TEST CIRCUITS (continued)

Over-Charge & Over-Discharge Detection Delay Time (Test Circuit 5)

t_{OV} : Over-charge detection delay time, it is defined as the interval time from V1 voltage exceeds V_{OV} until V_{CO} goes to "L", after setting $V1 = 3.4V$, $V2 = 0V$ and increasing V1 voltage.

t_{UV} : Over-discharge detection delay time, it is defined as the interval time from V1 voltage falls below V_{UV} until V_{DO} goes to "L", after setting $V1 = 3.4V$, $V2 = 0V$ and decreasing V1 voltage.

Discharge Over-Current Detection Delay Time (Test Circuit 5)

t_{OCD} : Discharge over-current detection delay time, it is defined as the interval time from V2 voltage exceeds V_{OCD} until V_{DO} goes to "L", after setting $V1 = 3.4V$, $V2 = 0V$, and increasing V2 voltage.

Load Short-Circuiting Detection Delay Time (Test Circuit 5)

t_{SHORT} : Load short-circuiting detection delay time, it is defined as the interval time from V2 voltage exceeds V_{SHORT} until V_{DO} goes to "L", after setting $V1 = 3.4V$, $V2 = 0V$ and increasing V2 voltage.

Charge Over-Current Detection Delay Time (Test Circuit 5)

t_{OCC} : Charge over-current detection delay time, it is defined as the interval time from V2 voltage falls below V_{OCC} until V_{CO} goes to "L", after setting $V1 = 3.4V$, $V2 = 0V$ and decreasing V2 voltage.

0V Battery Charge Starting Charger Voltage (0V Battery Charge Enabled Option) (Test Circuit 2)

V_{0CHA} : 0V battery charge starting charger voltage, it is defined as the absolute V2 voltage value at which V_{CO} goes to "H" ($V_{CO} = V_{VDD}$) when gradually decreasing V2 voltage after setting $V1 = V2 = 0V$.

DETAILED DESCRIPTION

Operation

Normal Status

The SGM41011 monitors the battery voltage between VDD and VSS pins, and the voltage between VM and VSS pins to control charging and discharging.

When the battery voltage is between V_{UV} (over-discharge detection voltage) and V_{OV} (over-charge detection voltage), and the VM pin voltage is between V_{OCC} (charge over-current detection voltage) and V_{OCD} (discharge over-current detection voltage), the SGM41011 turns both the charge and discharge control FETs on. This status is defined as normal status.

During normal status, charging and discharging can be freely, the R_{VMD} (resistance between VDD pin and VM pin) and R_{VMS} (resistance between VM pin and VSS pin) are not connected.

Over-Charge Status

$V_{OV_R} \neq V_{OV}$ Options

In normal status, if the battery voltage rises higher than V_{OV} during charging and it lasts for t_{OV} (over-charge detection delay time) or longer, the SGM41011 will turn the charge control FET off to stop charging. This status is defined as over-charge status, and this status can be released in the following two cases:

1. When $V_{VM} < V_{OCD}$, the SGM41011 releases the over-charge status when the battery voltage falls below V_{OV_R} (over-charge release voltage).
2. When $V_{VM} \geq V_{OCD}$, the SGM41011 releases the over-charge status when the battery voltage falls below V_{OV} (over-charge detection voltage).

During over-charge status, the VM pin voltage rises due to the charge control FET's parasitic diode once a load is connected to start discharge. If $V_{VM} \geq V_{OCD}$ (TYP), the SGM41011 releases the over-charge status when the battery voltage $\leq V_{OV}$.

Caution: When the battery is charged to a voltage higher than V_{OV} , even if a heavy load is connected, the battery voltage does not fall below V_{OV} , then the discharge over-current detection and load short-circuiting detection are not performed until the battery voltage falls below V_{OV} . Because the internal impedance of the actual battery is tens of mΩ, the battery voltage drops immediately after a heavy load that causes over-current is connected, and discharge over-current detection and load short-circuiting detection function.

$V_{OV_R} = V_{OV}$ Options

In normal status, if the battery voltage rises higher than V_{OV} during charging and it lasts for t_{OV} (over-charge detection delay time) or longer, the SGM41011 will turn the charge control FET off to stop charging. This status is defined as over-charge status.

When the VM pin voltage is equal to or higher than 0V and the battery voltage falls below V_{OV} , the SGM41011 releases the over-charge status.

Caution: 1. When the battery is charged to a voltage higher than V_{OV} , even if a heavy load is connected, the battery voltage does not fall below V_{OV} , then the discharge over-current detection and load short-circuiting detection are not performed until the battery voltage falls below V_{OV} . Because the internal impedance of the actual battery is tens of mΩ, the battery voltage drops immediately after a heavy load that causes over-current is connected, and discharge over-current detection and load short-circuiting detection function.

2. Connect a charger in the over-charge state, although the battery voltage is lower than V_{OV_R} and will not release the over-charge status. The over-charge status is released when the discharge current flows and the VM pin voltage goes over 0V by removing the charger.

Over-Discharge Status

When the battery voltage falls below V_{UV} during discharging in the normal status and the condition continues for the over-discharge detection delay time (t_{UV}) or longer, the SGM41011 turns the discharge control FET off to stop discharging. This status is defined as over-discharge status.

During the over-discharging state, VM is pulled up to VDD by R_{VMD} . R_{VMS} is disconnected during the over-discharge status.

With Power-Down Function

When a battery is not connected to a charger, the SGM41011 maintains the over-discharge status and goes to the power-down state even when the battery voltage reaches V_{UV} or higher.

When connecting a charger in the over-discharge status, the battery voltage reaches V_{UV_R} or higher and the SGM41011 releases the over-discharge status if the VM pin voltage is between 0V (TYP) and 0.7V (TYP).

When connecting a charger in the over-discharge status, the battery voltage reaches the over-discharge detection voltage (V_{UV}) or higher and the SGM41011 releases the over-discharge status if the VM pin voltage is below 0V (TYP).

DETAILED DESCRIPTION (continued)***Without Power-Down Function***

When a battery is not connected to a charger, the SGM41011 maintains the over-discharge status and releases the over-discharge status when the battery voltage reaches V_{UV_R} or higher.

When connecting a charger in the over-discharge status, the battery voltage reaches V_{UV_R} or higher and the SGM41011 releases the over-discharge status if the VM pin voltage is not below 0V (TYP).

When connecting a charger in the over-discharge status, the battery voltage reaches the over-discharge detection voltage (V_{UV}) or higher and the SGM41011 releases the over-discharge status if the VM pin voltage is below 0V (TYP).

Discharge Over-Current Status (Discharge Over-Current, Load Short-Circuiting)

When the battery is in a normal status, the VM pin voltage is $\geq V_{OCD}$ because the discharge current is equal to or higher than the specified value, and the continuous discharge over-current detection delay time (t_{OCD}) or longer in this status, the discharge control FET is turned off and the discharging is stopped. This status is defined as the discharge over-current status.

Release Condition of Discharge Over-Current with "Load Disconnection" and Release Voltage " V_{OCD} "

Under the discharge over-current status, VM pin and VSS pin are shorted by R_{VMS} in the SGM41011. However, as long as the load is connected, the VM pin voltage is the VDD pin voltage. When the load is disconnected, the VM pin voltage is equal to the VSS pin voltage.

The SGM41011 keeps discharge MOSFET off until the VM pin voltage is lower than the V_{OCD} . And the discharge over-current condition is released.

R_{VMD} is disconnected during the discharge over-current status.

Release Condition of Discharge Over-Current with "Load Disconnection" and Release Voltage " V_{OCD_R} "

Under the discharge over-current status, VM pin and VSS pin are shorted by R_{VMS} in the SGM41011. However, as long as the load is connected, the VM pin voltage is the VDD pin voltage. When the load is disconnected, the VM pin voltage is equal to the VSS pin voltage.

The SGM41011 keeps discharge MOSFET off until the VM pin voltage is lower than the V_{OCD_R} . And the discharge over-current condition is released.

R_{VMD} is disconnected during the discharge over-current status.

Release Condition of Discharge Over-Current with "Charger Connection"

Under the discharge over-current status, VM pin and VDD pin are shorted by R_{VMD} in the SGM41011. When the load is disconnected, the VM pin voltage is equal to the VDD pin voltage.

The SGM41011 keeps discharge MOSFET off until the VM pin voltage is lower than the V_{OCD} . And the discharge over-current condition is released.

R_{VMS} is disconnected during the discharge over-current status.

Charge Over-Current Status

When the battery is in a normal status, the VM pin voltage is $\leq V_{OCC}$ because the charge current is equal to or higher than the specified value, and the continuous charge over-current detection delay time (t_{OCC}) or longer in this status, the charge control FET is turned off and charging is stopped. This status is defined as the charge over-current status.

The SGM41011 releases the charge over-current status when the discharge current flows and the VM pin voltage is 0V (TYP) or higher by removing the charger.

There is no charge over-current protection function during the over-discharge status.

DETAILED DESCRIPTION (continued)

0V Battery Charge Enabled

The 0V charging function allows the charger to charge a battery with a voltage of 0V due to self-discharge. Connect a charger between PCK+ and PCK- pins, the charger voltage reaches 0V battery charge starting charger voltage (V_{0CHA}) or higher, the gate of the charge control FET is connected to the VDD pin voltage.

The external charger makes the voltage between the gate and source of the charge control FET is equal to or higher than the threshold voltage, the charge control FET begins charging at the same time, the discharge control FET is turned off, and the charging current flows through the parasitic diode of the discharge control FET. If the battery

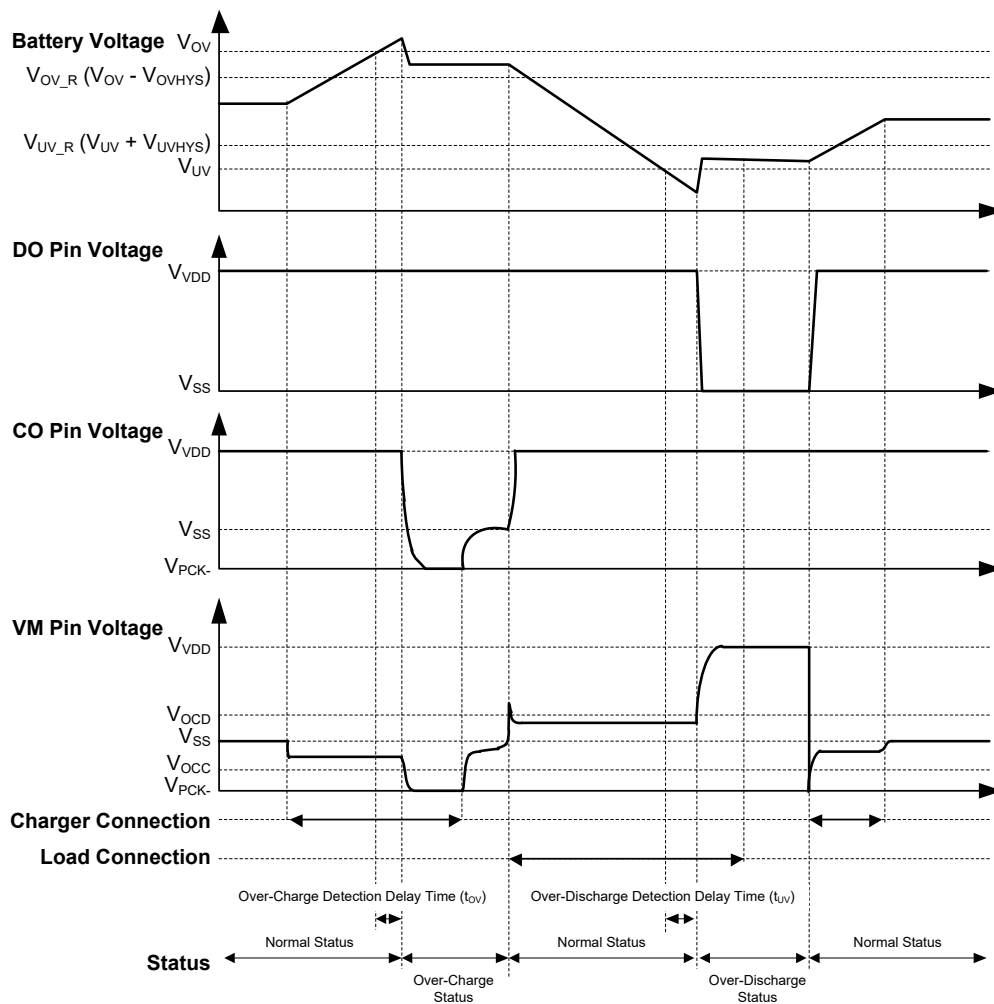
voltage is equal to or higher than V_{UV} , the SGM41011 goes back to the normal status.

Caution: 1. Some battery suppliers do not recommend charging a fully self-discharged Li-Ion rechargeable battery. Please check with the battery supplier to determine whether 0V battery charging is enabled or inhibited.

2. The 0V battery charge priority is higher than the charge over-current detection function. Therefore, a product that enables the use of the 0V battery charge is forced to charge a battery, and when the battery voltage is lower than V_{UV} , the charge over-current cannot be detected.

Timing Charts

Over-Charge Detection, Over-Discharge Detection



NOTE: Assume that the charger charges at constant current.

Figure 8. Over-Charge Detection, Over-Discharge Detection

DETAILED DESCRIPTION (continued)

Discharge Over-Current Detection

Release Condition of Discharge Over-Current with "Load Disconnection"

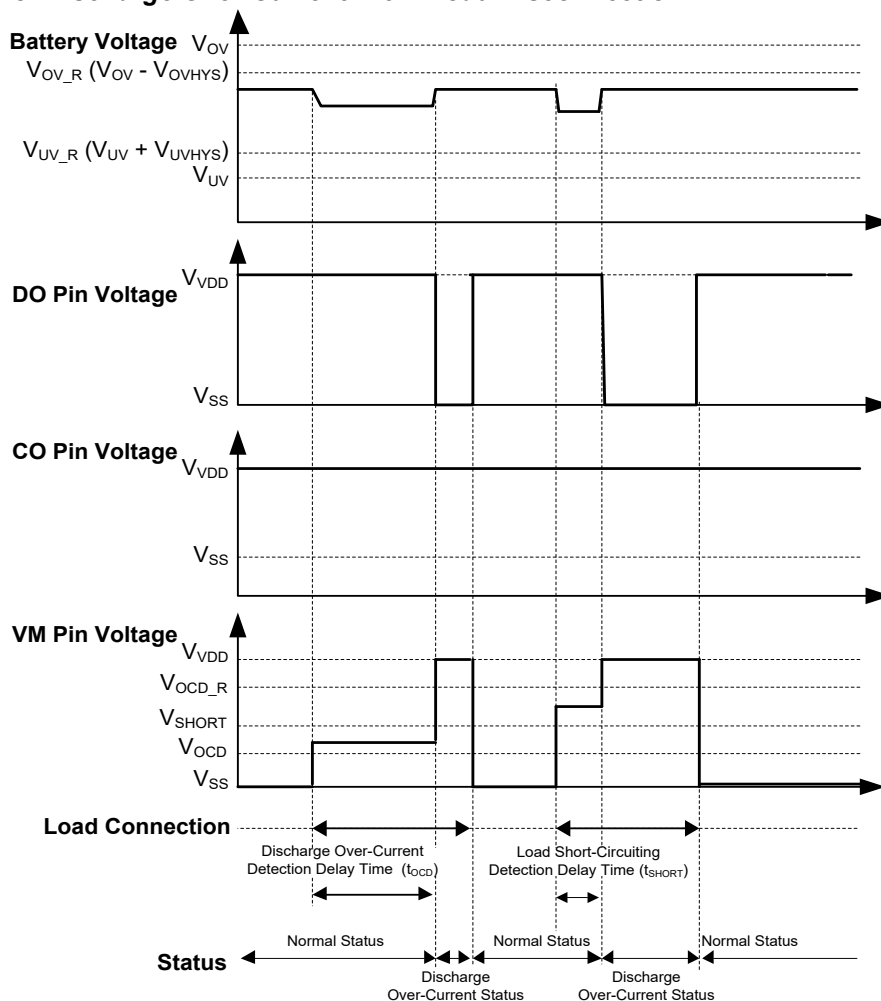


Figure 9. Discharge Over-Current Detection with Load Disconnection

DETAILED DESCRIPTION (continued)

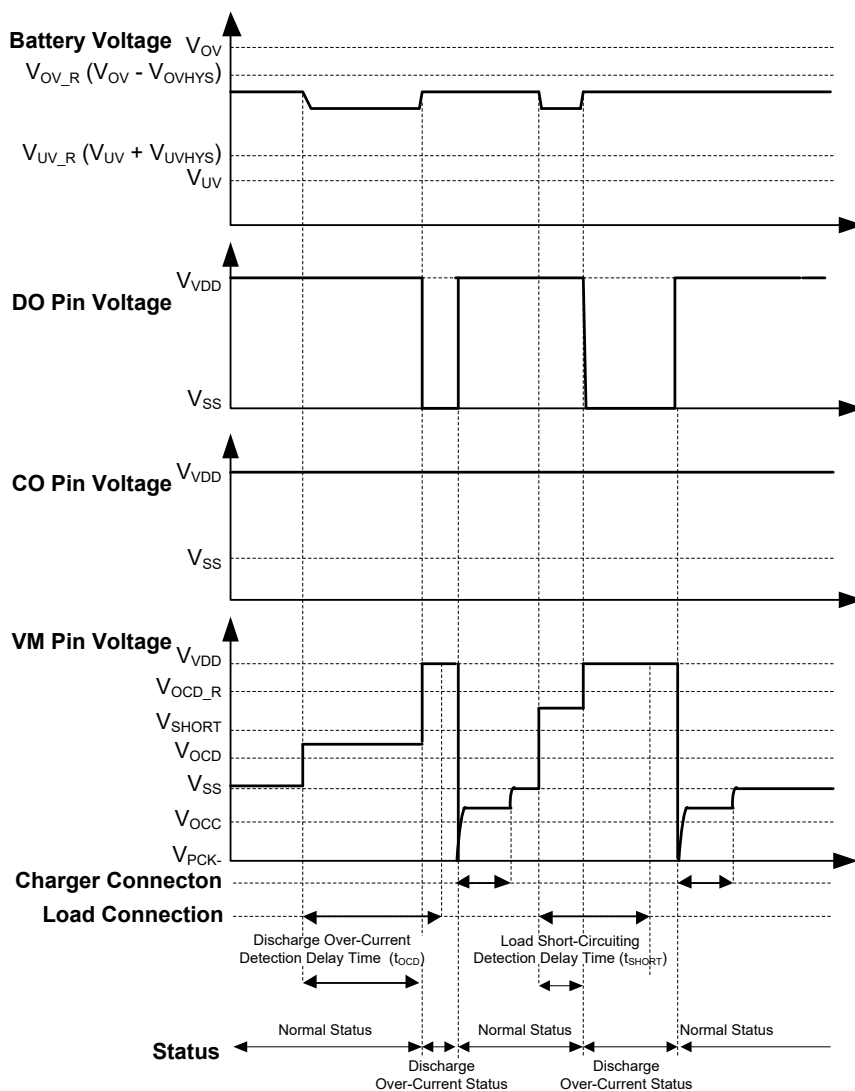
Release Condition of Discharge Over-Current with "Charger Connection"

Figure 10. Discharge Over-Current Detection with Charger Connection

DETAILED DESCRIPTION (continued)

Charge Over-Current Detection

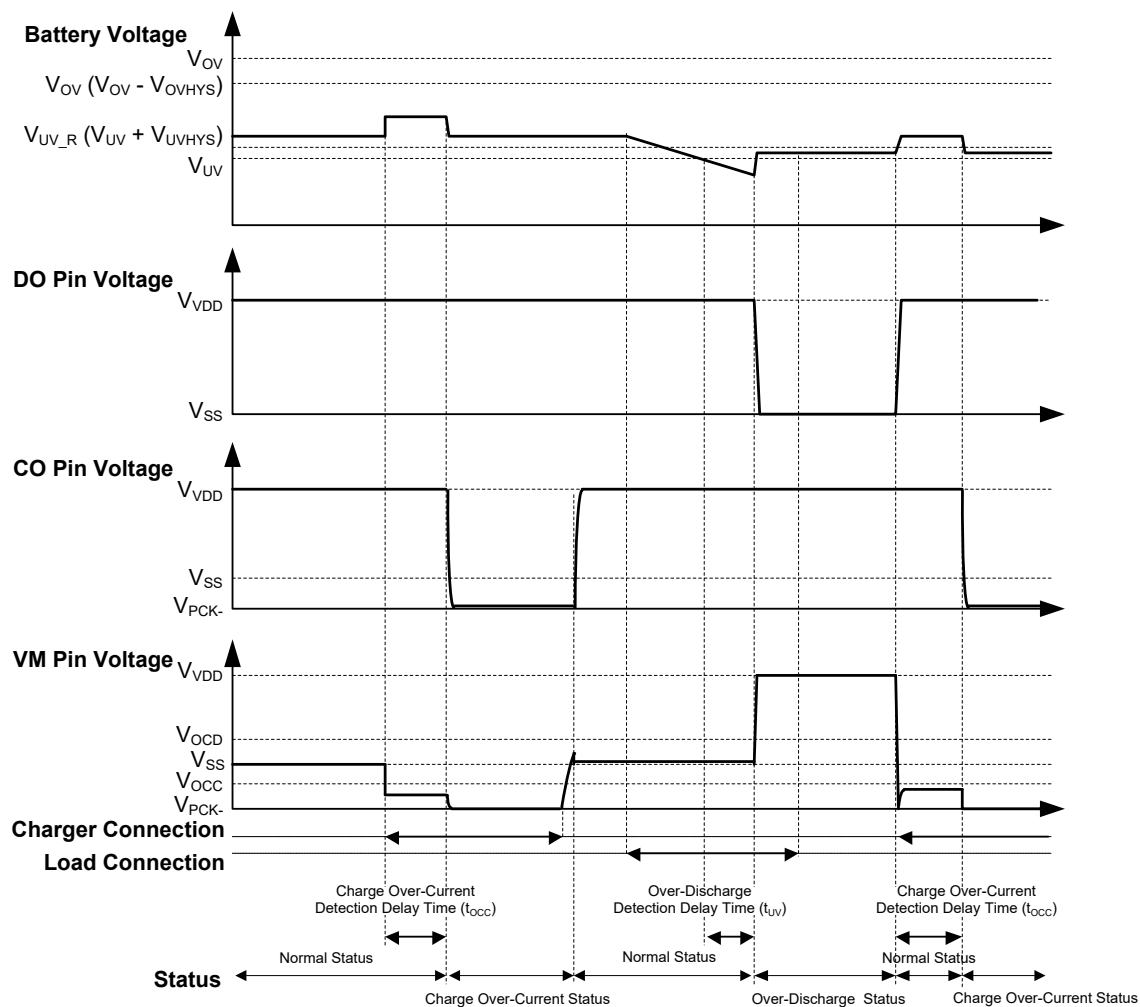


Figure 11. Charge Over-Current Detection

DETAILED DESCRIPTION (continued)

Battery Protection IC Connection Example

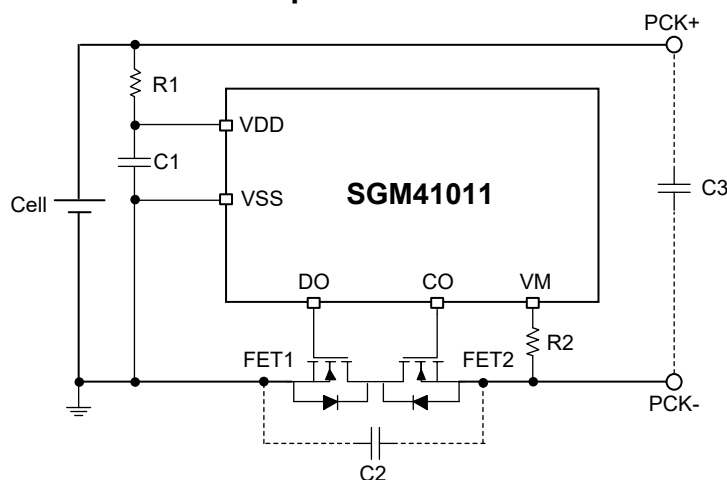


Figure 12. Battery Protection IC Connection Example

Table 4. External Components Constants ^{(3) (4)}

PARAMETER	SYMBOL	FUNCTION	MIN	TYP	MAX
Resistor	R1	ESD Protection, for Power Fluctuation	270Ω	330Ω	1.2kΩ ⁽¹⁾
	R2	ESD Protection, Protection for Reverse Connection of a Charger	270Ω	470Ω	4kΩ
Capacitor	C1	For Power Fluctuation	0.068μF	0.1μF	2.2μF
	C2, C3	ESD Protection, for Power Fluctuation		0.1μF	
N-Channel MOSFET	FET1	Discharge Control Threshold Voltage ≤ Over-Discharge Detection Voltage ⁽²⁾			
	FET2	Charge Control Threshold Voltage ≤ Over-Charge Detection Voltage ⁽²⁾			

NOTES:

1. The over-charge detection voltage accuracy is guaranteed by R1 = 330Ω. Setting the resistance to the other values will reduce the accuracy.
2. When using a FET with a threshold voltage equal to or higher than the over-discharge detection voltage, the discharging can be stopped before the over-discharge is detected.
3. The parameters are subject to change without notice.
4. The circuits other than the connection example have not been confirmed to operate properly, and the connection examples and constants are not guaranteed to function properly. The parameters are set based on a comprehensive evaluation of the actual application.

Precautions

- The application conditions (including the input voltage, output voltage, and load current) cannot exceed the power dissipation.
- Avoid applying an electrostatic discharge to the IC that goes beyond the rated performance of the integrated electrostatic protection circuit.
- Disclaim any dispute arising out of or in connection with the infringement of third party patents by products including this IC.

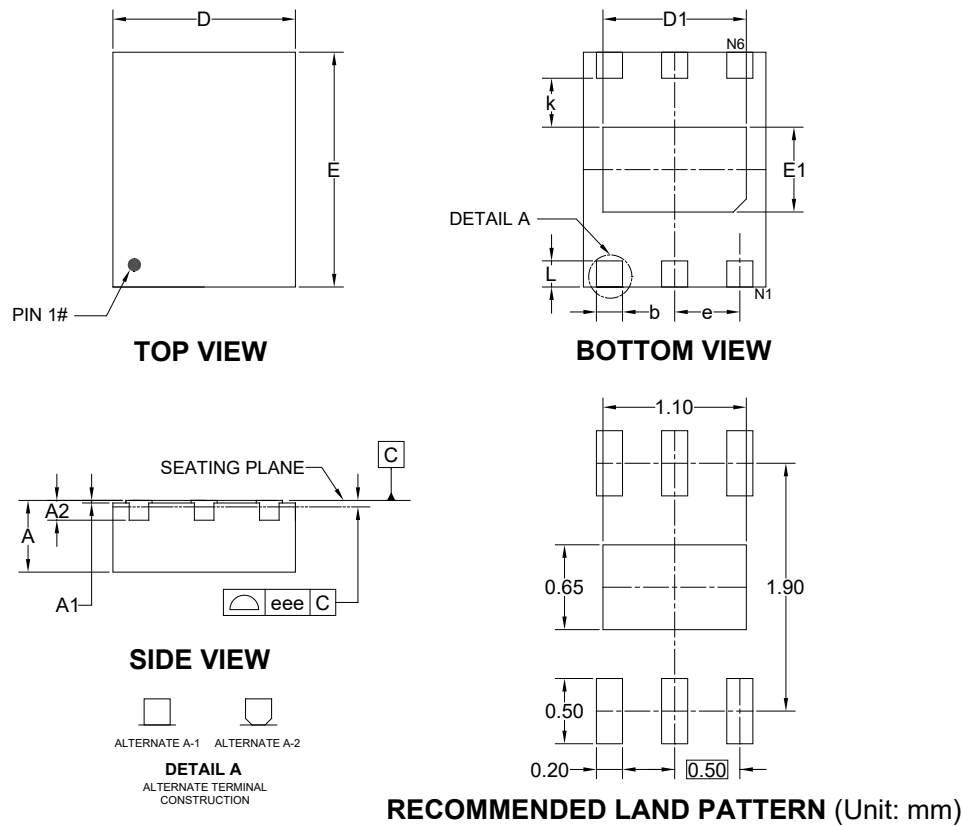
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

OCTOBER 2026 – REV.A to REV.A.1		Page
Added SOT-23-6 package		All
Changes from Original to REV.A (SEPTEMBER 2026)		Page
Changed from product preview to production data.....		All

PACKAGE OUTLINE DIMENSIONS

UTDFN-1.4×1.8-6L

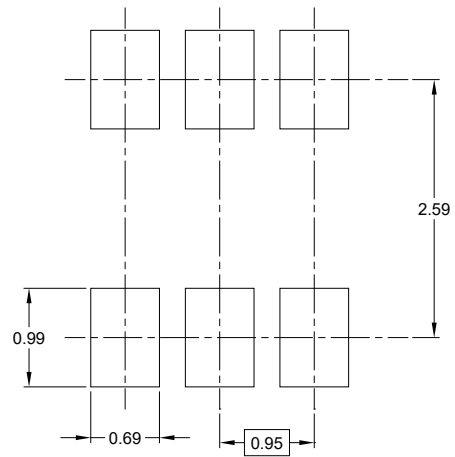
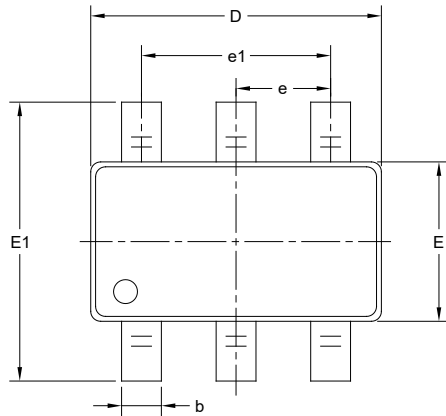


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.500	0.550	0.600
A1	0.000	-	0.050
A2	0.152 REF		
b	0.150	0.200	0.250
D	1.300	1.400	1.500
D1	1.000	1.100	1.200
E	1.700	1.800	1.900
E1	0.550	0.650	0.750
e	0.500 BSC		
k	0.375 REF		
L	0.150	0.200	0.250
eee	-	0.050	-

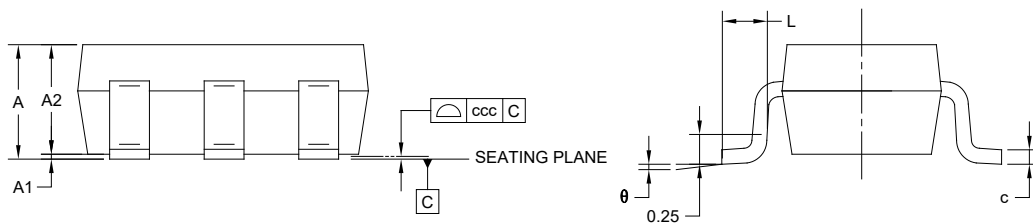
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

SOT-23-6



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

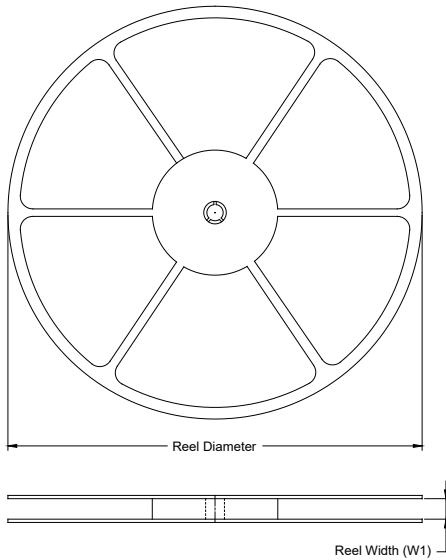
NOTES:

1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

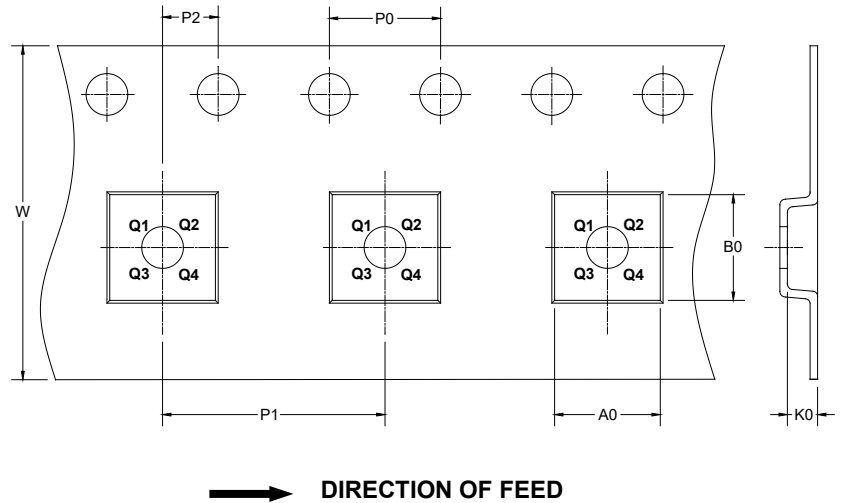
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

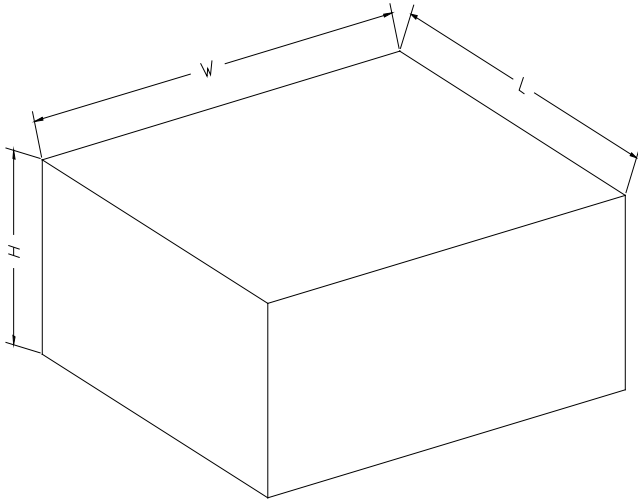
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
UTDFN-1.4×1.8-6L	7"	9.5	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q2
SOT-23-6	7"	9.5	3.23	3.17	1.37	4.0	4.0	2.0	8.0	Q3

DD0001

PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002