SGM2588
Power Distribution Switch

GENERAL DESCRIPTION

The SGM2588 is a single channel power distribution switch. The switch operates from a wide range of 2.5V to 5.5V supply voltage, and is controlled by the EN pin. It can be used in USB power distribution applications.

A 100mΩ low R_{ON} N-MOSFET is integrated. The small size and quiescent current make the device very suitable for space limited, battery-powered applications.

A number of protection features are provided in the device including soft-start, current limit and thermal shutdown. Thermal shutdown shuts off the output MOSFET and asserts the nFAULT output if the die temperature exceeds +150℃, and the output MOSFET remains off until the die temperature drops to +130℃. The nFAULT pin asserts low during fault conditions after a 13ms blanking time to prevent false reporting.

SGM2588 is available in a Green SOT-23-5 package. It is rated over the -40℃ to +85℃ temperature range.

APPLICATIONS

Digital TV
Set-Top Box
Motherboard USB Power Switch
USB Device Power Switch

FEATURES

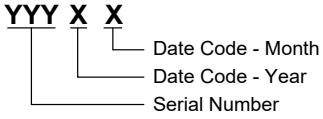
- **Input Voltage Range: 2.5V to 5.5V**
- **On-Resistance: 100mΩ (TYP)**
- **Three Current Limit Levels**
  SGM2588A/B/G: 1100 ± 110mA
  SGM2588C/D/I: 2100 ± 220mA
  SGM2588E/F/K: 2600 ± 310mA
- **Quiescent Current: 23μA (TYP)**
- **Shutdown Current: 0.1μA (TYP)**
- **Full Set of Protections**
  - **Soft-Start**
  - **Under-Voltage Lockout for VIN**
  - **No Reversed Leakage Current**
  - **Thermal Shutdown**
- **Quick Output Discharge: SGM2588A/B/C/D/E/F**
- **EN Pin Pull-Down Resistor: 500kΩ (SGM2588G/I/K)**
- **Evaluated to IEC 60950-1, Ed 2, Am1, Annex CC, Test Program 1 with CB Report (SGM2588A/C/E)**
- **Available in a Green SOT-23-5 Package**

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2588A (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588AYN5G/TR	SSCXX	Tape and Reel, 3000
SGM2588B (Active Low)	SOT-23-5	-40℃ to +85℃	SGM2588BYN5G/TR	SSDXX	Tape and Reel, 3000
SGM2588C (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588CYN5G/TR	SSEXX	Tape and Reel, 3000
SGM2588D (Active Low)	SOT-23-5	-40℃ to +85℃	SGM2588DYN5G/TR	ST0XX	Tape and Reel, 3000
SGM2588E (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588EYN5G/TR	ST1XX	Tape and Reel, 3000
SGM2588F (Active Low)	SOT-23-5	-40℃ to +85℃	SGM2588FYN5G/TR	ST2XX	Tape and Reel, 3000
SGM2588G (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588GYN5G/TR	G51XX	Tape and Reel, 3000
SGM2588I (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588IYN5G/TR	G52XX	Tape and Reel, 3000
SGM2588K (Active High)	SOT-23-5	-40℃ to +85℃	SGM2588KYN5G/TR	G53XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.



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.

ABSOLUTE MAXIMUM RATINGS

All Pins 6V
nFAULT Current 25mA
Power Dissipation, P_D @ T_A = +25℃
SOT-23-5 ..... 0.3W
Package Thermal Resistance
SOT-23-5, θ_{JA} ..... 220℃/W
SOT-23-5, θ_{JC} ..... 93℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 2000V
MM 400V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.5V to 5.5V
EN Voltage Range ..... -0.3V to 5.5V
All Other Pins ..... 0V to 5.5V
Operating Junction Temperature Range ..... -40℃ to +125℃
Operating Ambient Temperature Range ..... -40℃ to +85℃

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

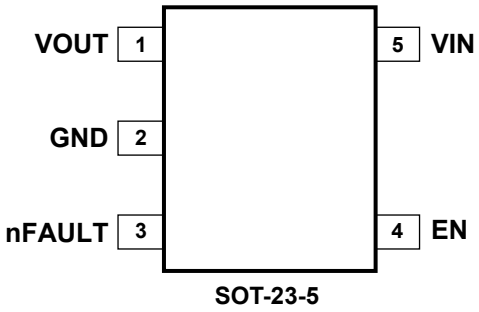
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

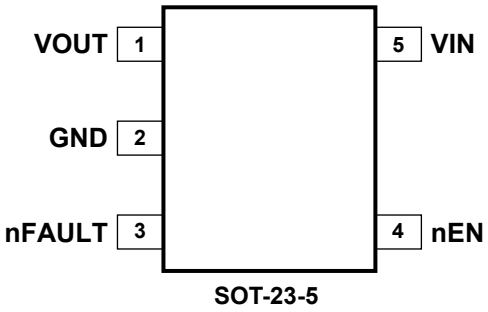
PIN CONFIGURATIONS

SGM2588A/C/E/G/I/K (TOP VIEW)



SOT-23-5

SGM2588B/D/F (TOP VIEW)



SOT-23-5

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	VOUT	Switch Input Pin.
2	GND	Ground.
3	nFAULT	Fault Flag Pin. Active low, open-drain output. Indicates over-current or thermal shutdown conditions. Over-current condition must last longer than t_D in order to assert nFAULT.
4	EN/nEN	Chip Enable Pin. Do not floating for SGM2588A/B/C/D/E/F. Active high for SGM2588A/C/E/G/I/K (EN) and active low for SGM2588B/D/F (nEN). SGM2588G/I/K have integrated a 500kΩ pull-down resistor at EN pin.
5	VIN	Switch Output Pin.

ELECTRICAL CHARACTERISTICS

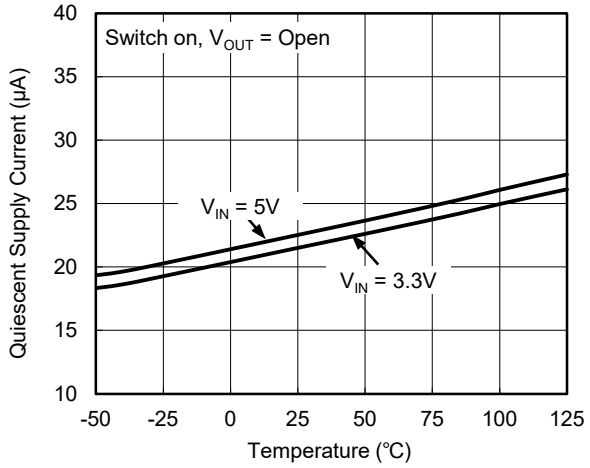
(T_A = +25℃, V_{IN} = 5V, unless otherwise noted.)

PARAMETER		SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		V_{IN}		2.5		5.5	V
Quiescent Supply Current		I_Q	Switch on, V_{OUT} = Open		23	35	μA
Shutdown Supply Current		I_{SD}	Switch off, V_{OUT} = Open		0.1		μA
Supply Leakage Current (SGM2588A/B/C/D/E/F)		$I_{LEAKAGE}$	Switch off, V_{OUT} = 0V		0.1		μA
Output Leakage Current (SGM2588G/I/K)			Switch off, V_{OUT} = 5V		0.1		μA
Enable Input Threshold		V_{IH}	V_{IN} = 2.5V to 5.5V	1.6			V
		V_{IL}	V_{IN} = 2.5V to 5.5V			0.4	
Enable Input Current (SGM2588A/B/C/D/E/F)		I_{EN}	V_{EN} = 0V to 5V		0.1		μA
EN Pin Pull-Down Resistor (SGM2588G/I/K)		R_{PULL_DOWN}			500		kΩ
Switch Resistance		$R_{DS(ON)}$	I_{OUT} = 500mA		100		mΩ
Output Turn-On Delay Time		t_{ON}	R_L = 10Ω, C_L = 1μF, Figure 3		2.3		ms
Output Turn-Off Delay Time		t_{OFF}	R_L = 10Ω, C_L = 1μF, Figure 3		25		μs
Current Limit Threshold	SGM2588A/B/G	I_{LIM}	Ramped load	1000	1100	1200	mA
	SGM2588C/D/I		Ramped load	1890	2100	2310	
	SGM2588E/F/K		Ramped load	2300	2600	2900	
Over-Current nFAULT Response Delay Time		t_D	Apply V_{OUT} = 0 until nFAULT is low		13		ms
Under-Voltage Lockout Threshold		V_{UVLO}	V_{IN} rising		2.15	2.3	V
Under-Voltage Lockout Threshold Hysteresis					0.1		V
nFAULT Output Resistance		R_{nFAULT}	nFAULT is low and I_{SINK} = 10mA		20		Ω
nFAULT Leakage Current		I_{nFAULT}	nFAULT is high		0.1		μA
VOUT Shutdown Discharge Resistance (SGM2588A/B/C/D/E/F)		R_{DIS}	Switch off		50		Ω
Thermal Shutdown Temperature			T_J increasing		150		℃
Thermal Shutdown Hysteresis					20		℃

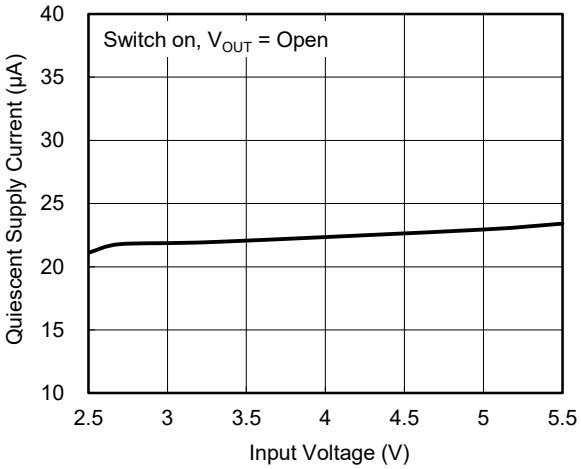
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

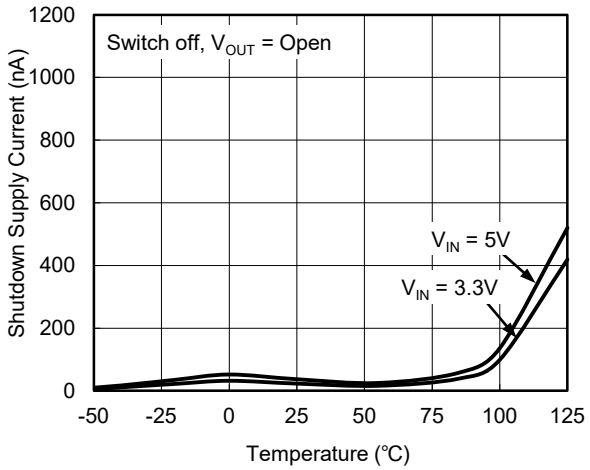
Quiescent Supply Current vs. Temperature



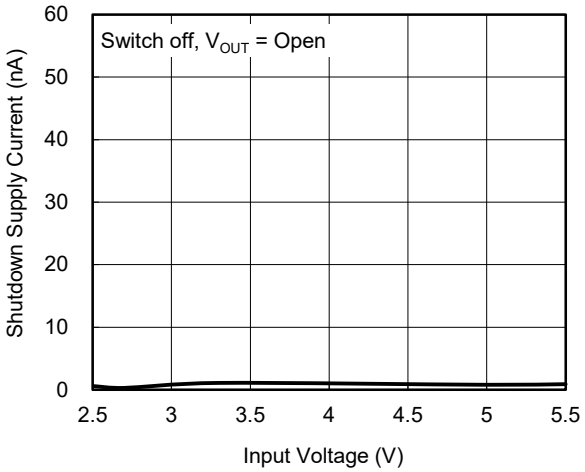
Quiescent Supply Current vs. Input Voltage



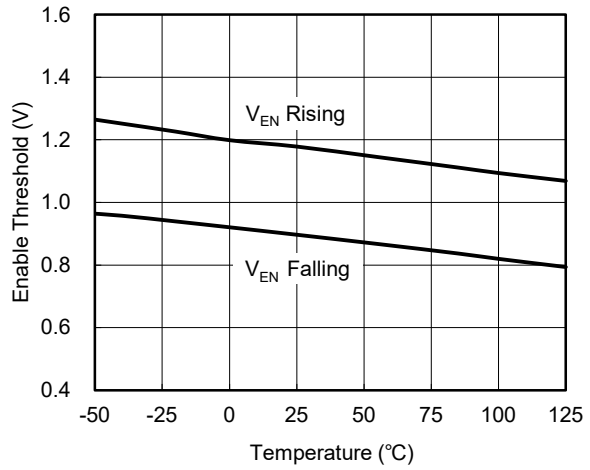
Shutdown Supply Current vs. Temperature



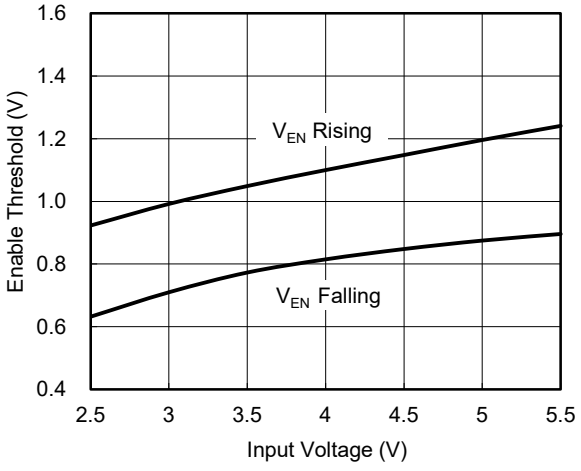
Shutdown Supply Current vs. Input Voltage



Enable Threshold vs. Temperature



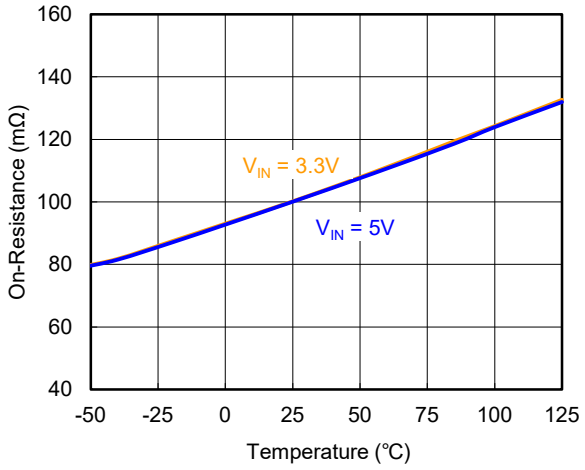
Enable Threshold vs. Input Voltage



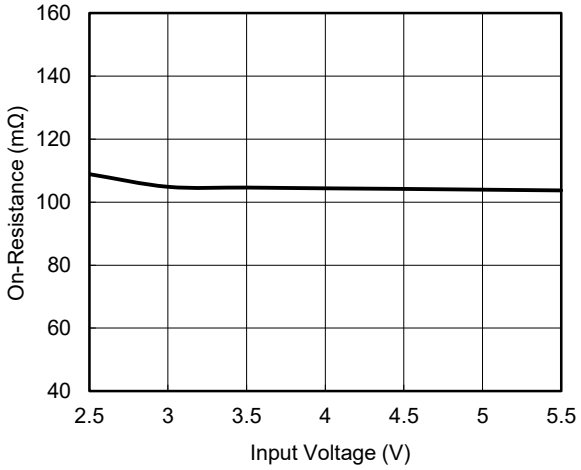
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

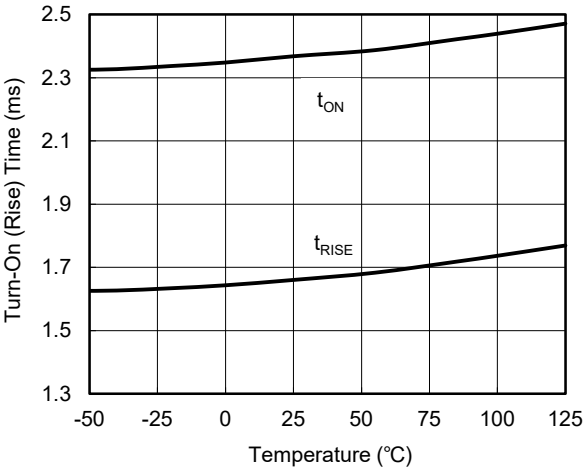
On-Resistance vs. Temperature



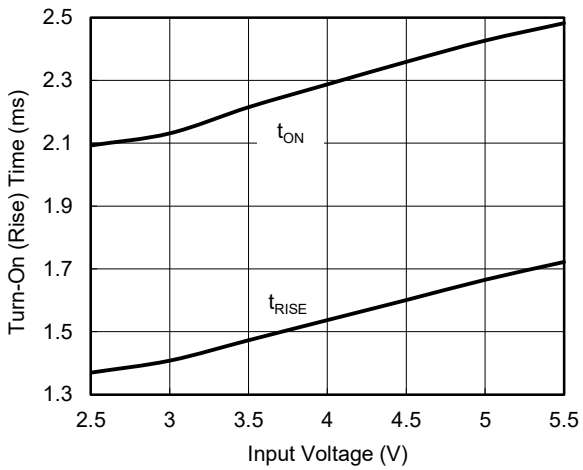
On-Resistance vs. Input Voltage



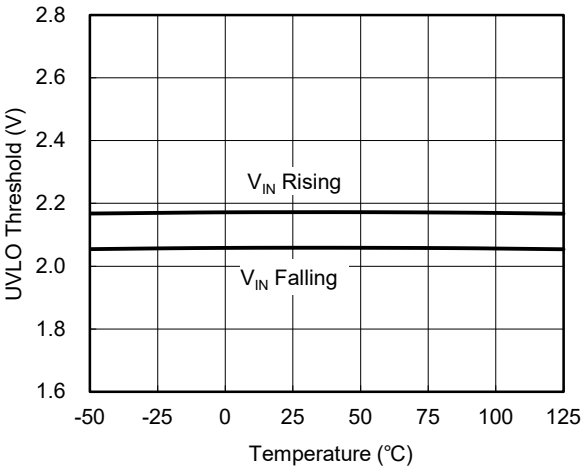
Turn-On (Rise) Time vs. Temperature



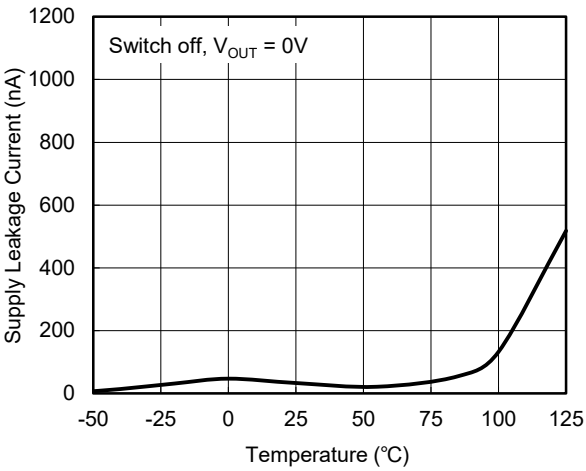
Turn-On (Rise) Time vs. Input Voltage



UVLO Threshold vs. Temperature



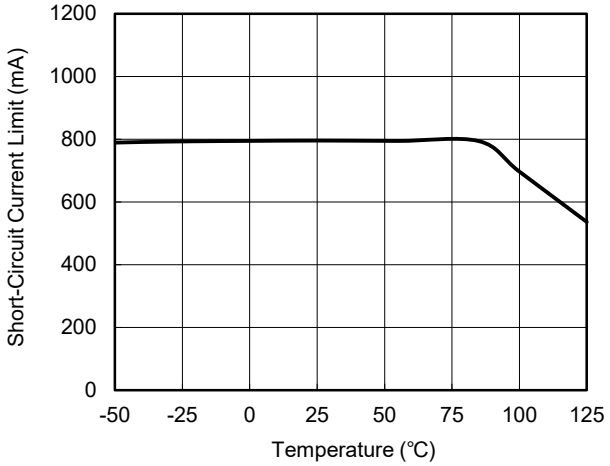
Supply Leakage Current vs. Temperature



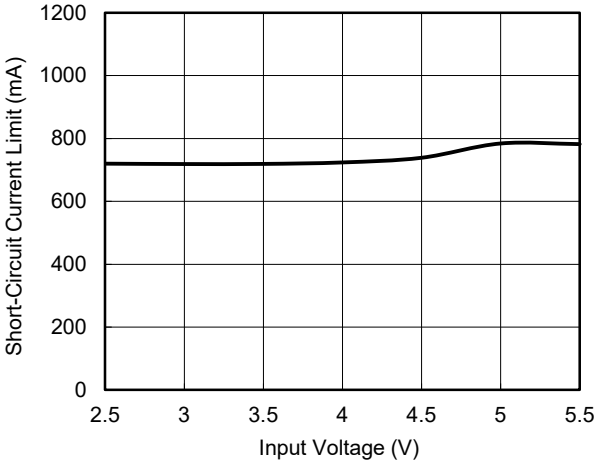
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

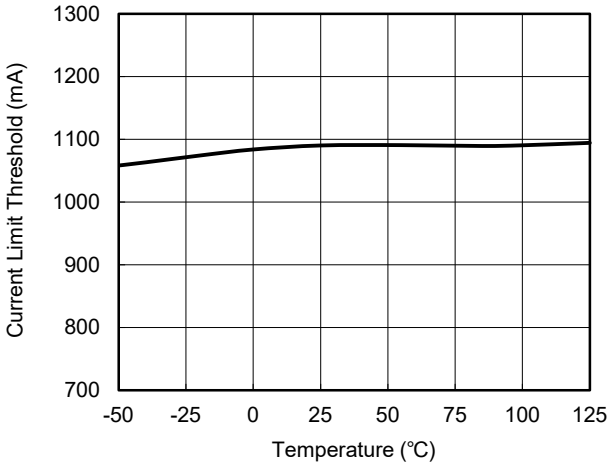
Short-Circuit Current Limit vs. Temperature
(SGM2588A/B/G)



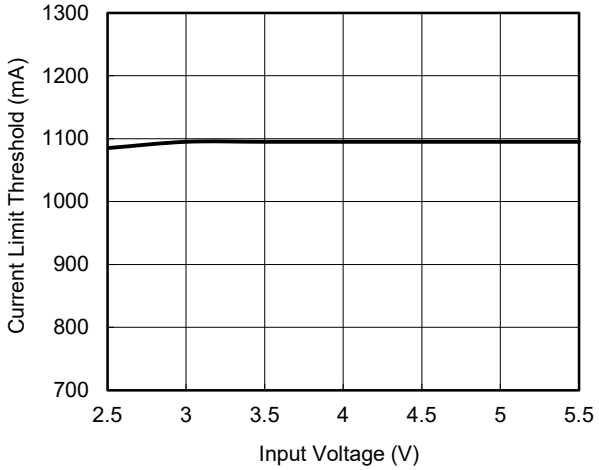
Short-Circuit Current Limit vs. Input Voltage
(SGM2588A/B/G)



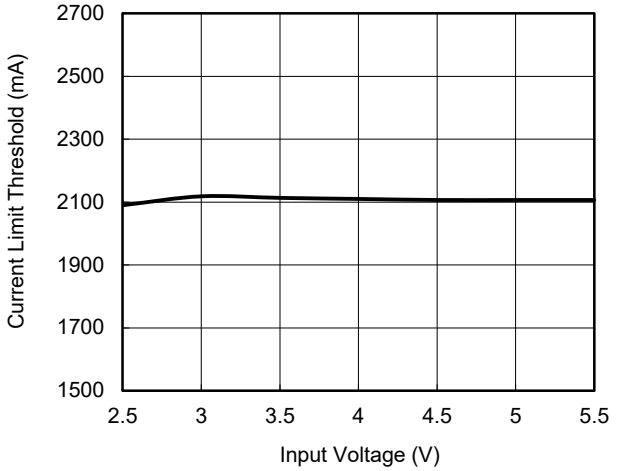
Current Limit Threshold vs. Temperature
(SGM2588A/B/G)



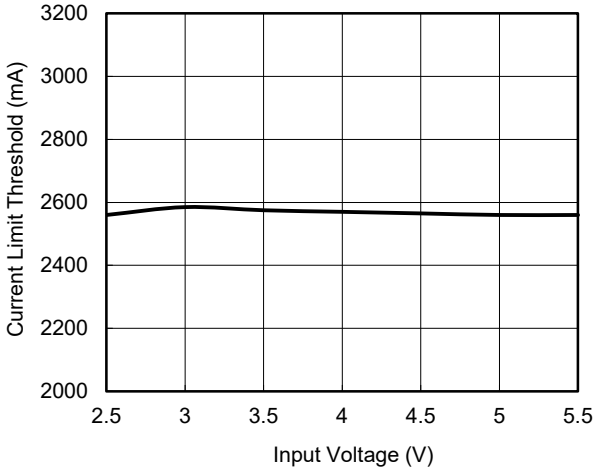
Current Limit Threshold vs. Input Voltage
(SGM2588A/B/G)



Current Limit Threshold vs. Input Voltage
(SGM2588C/D/I)



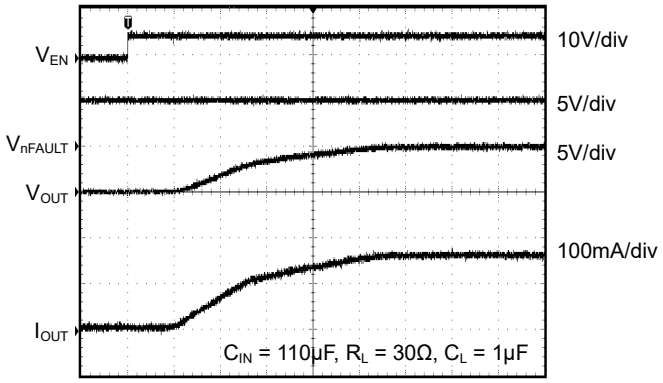
Current Limit Threshold vs. Input Voltage
(SGM2588E/F/K)



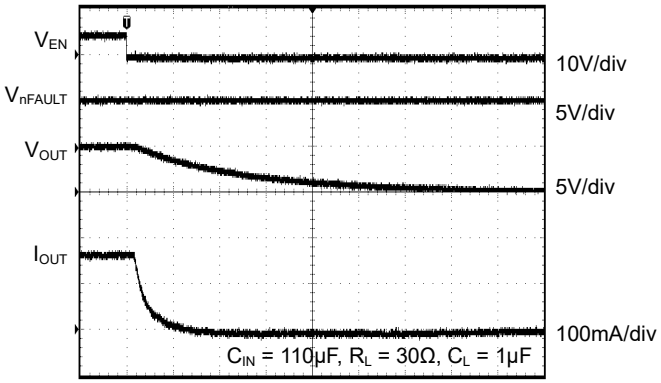
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

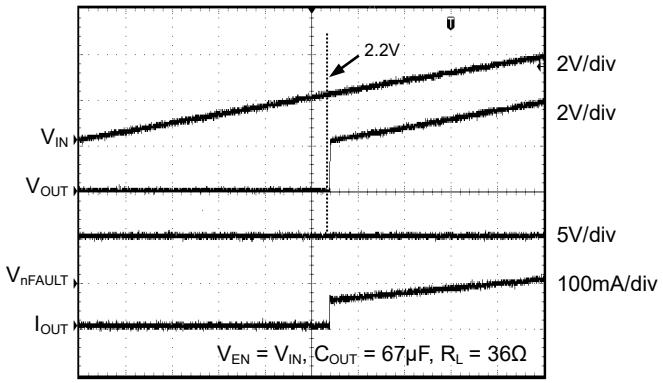
Turn-On Response (SGM2588A/C/E/G/I/K)



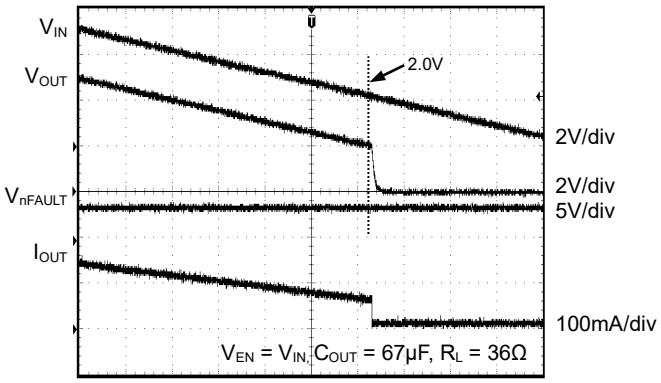
Turn-Off Response (SGM2588A/C/E/G/I/K)



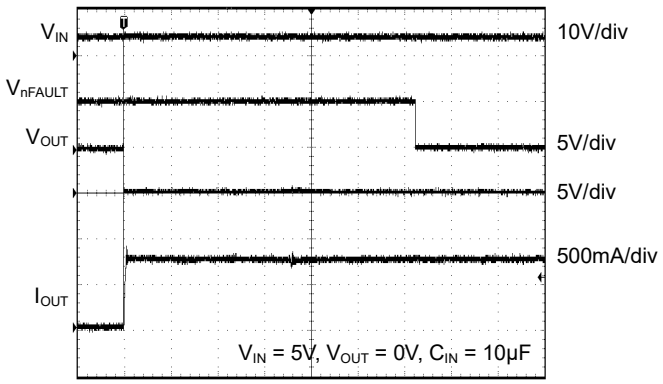
UVLO at V_{IN} Rising



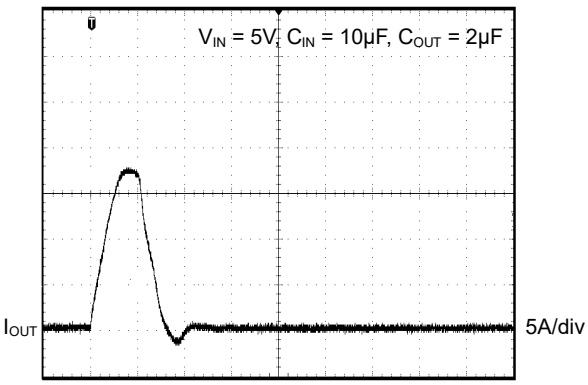
UVLO at V_{IN} Falling



Short-Circuit Response (SGM2588A/B/G)



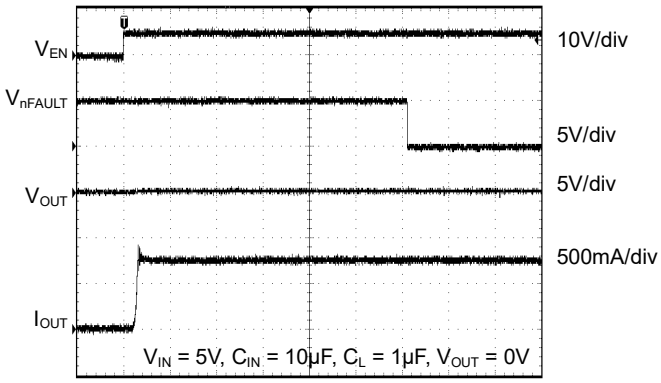
Short-Circuit Response (SGM2588A/B/G)



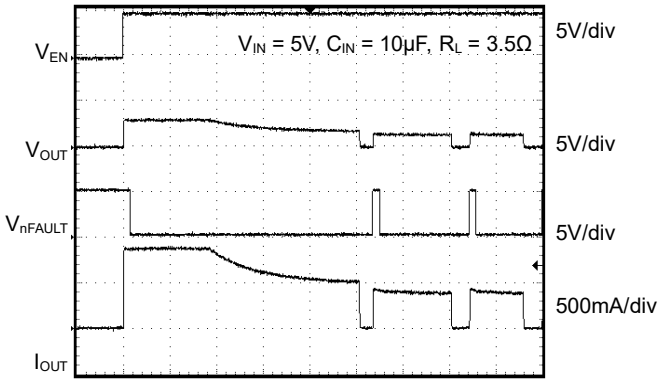
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

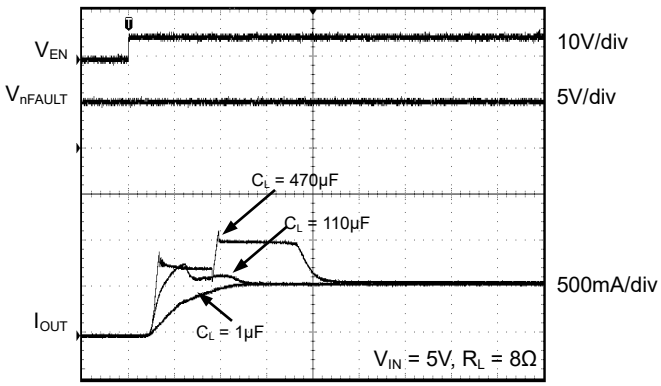
Enabled Into Short-Circuit (SGM2588A/G)



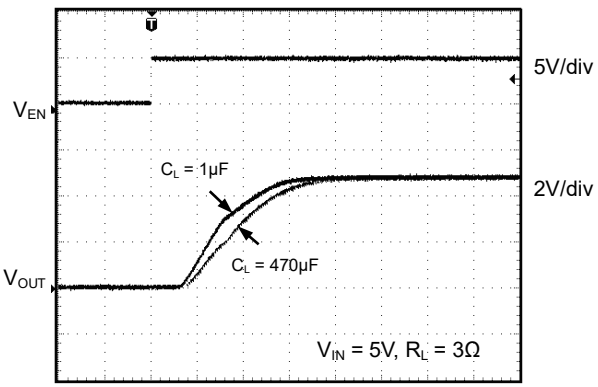
Thermal Shutdown Response (SGM2588A/G)



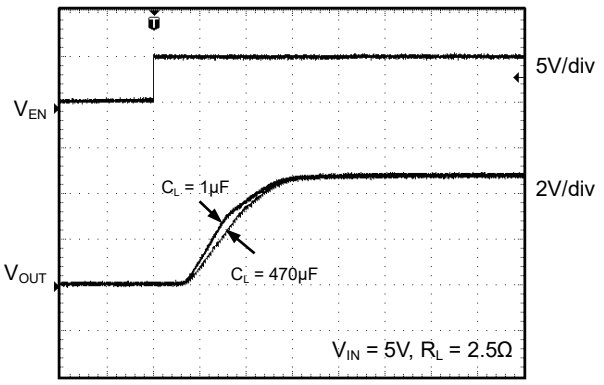
Inrush Current Response (SGM2588A/G)



Inrush Current Response (SGM2588C/I)



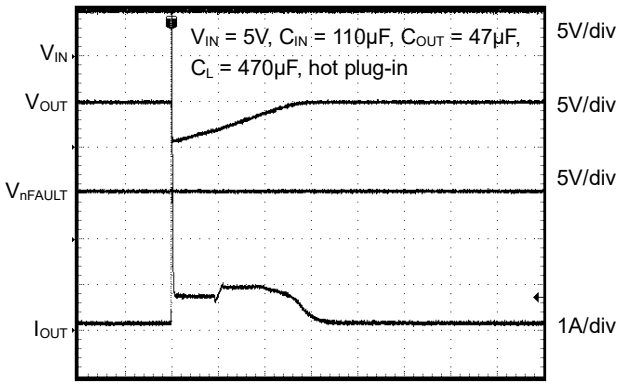
Inrush Current Response (SGM2588E/K)



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

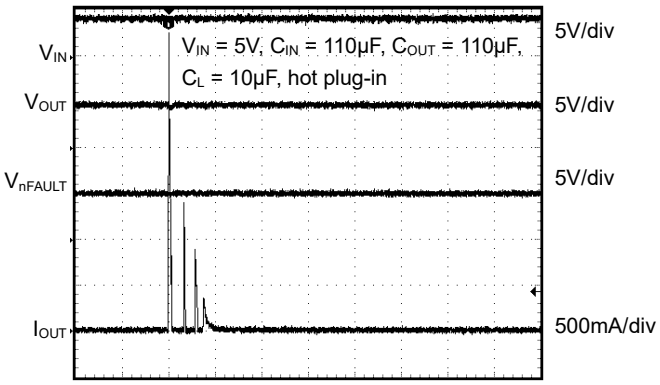
T_A = +25℃, V_{IN} = 5V, unless otherwise noted.

Capacitance Load Inrush Response
(SGM2588A/B/G)



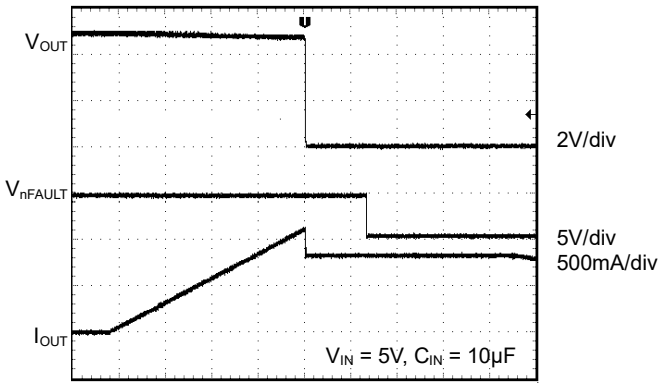
Time (1ms/div)

Capacitance Load Inrush Response
(SGM2588A/B/G)



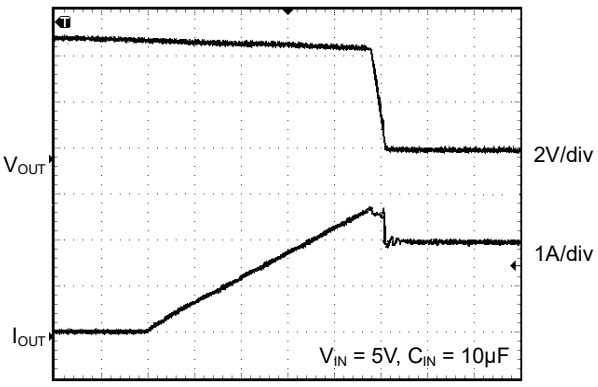
Time (200μs/div)

Ramped Load Response (SGM2588A/B/G)



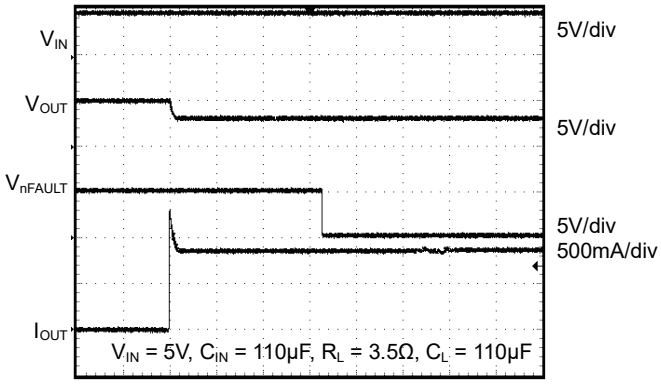
Time (10ms/div)

Ramped Load Response (SGM2588E/F/K)



Time (400μs/div)

Resistance Load Inrush Response
(SGM2588A/B/G)



Time (4ms/div)

REVISION HISTORY

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

FEBRUARY 2019 – REV.A.2 to REV.A.3	Page
Updated Absolute Maximum Ratings section	2

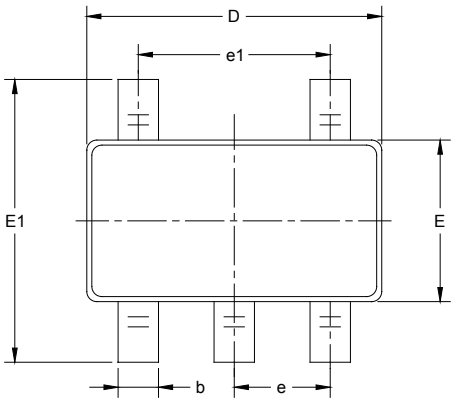
DECEMBER 2017 – REV.A.1 to REV.A.2	Page
Update Feature section	1

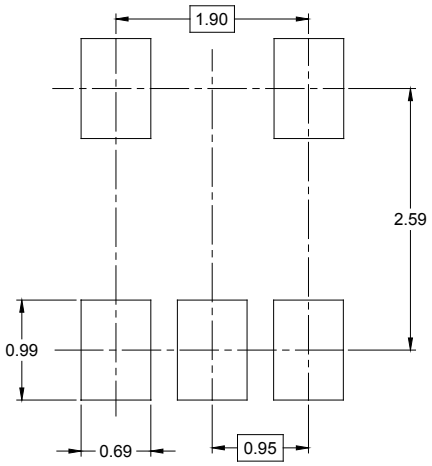
APRIL 2016 – REV.A to REV.A.1	Page
Changed Reverse-Voltage Protection section	10

Changes from Original (OCTOMBER 2015) to REV.A	Page
Changed from product preview to production data	All

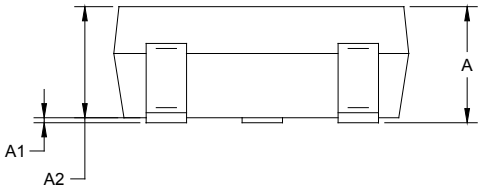
PACKAGE OUTLINE DIMENSIONS

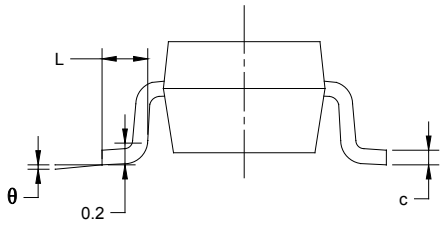
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

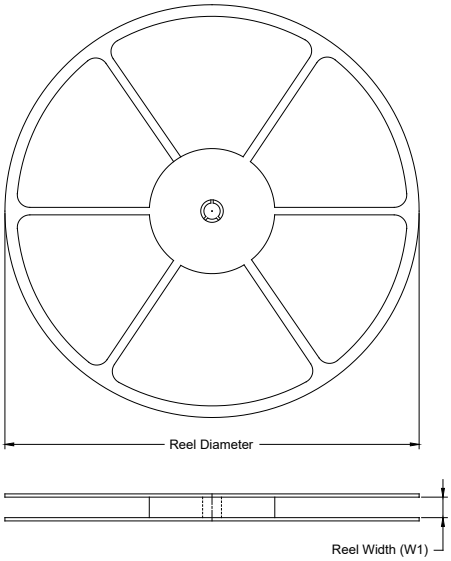




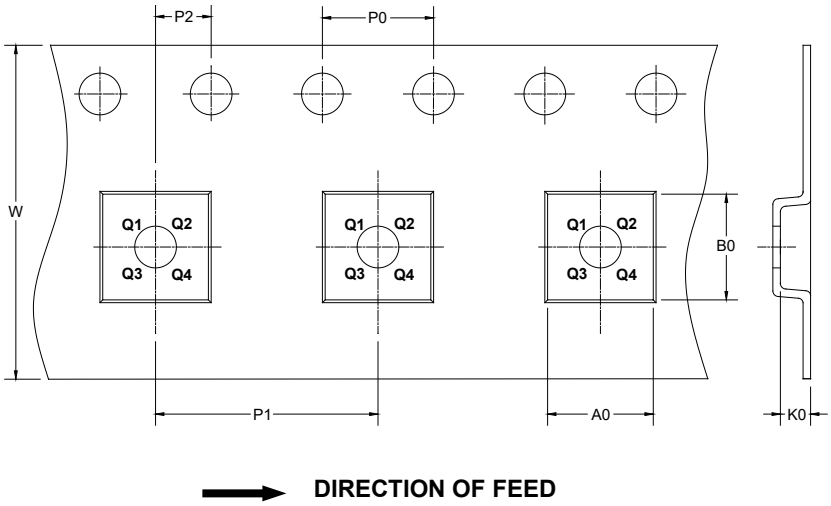
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



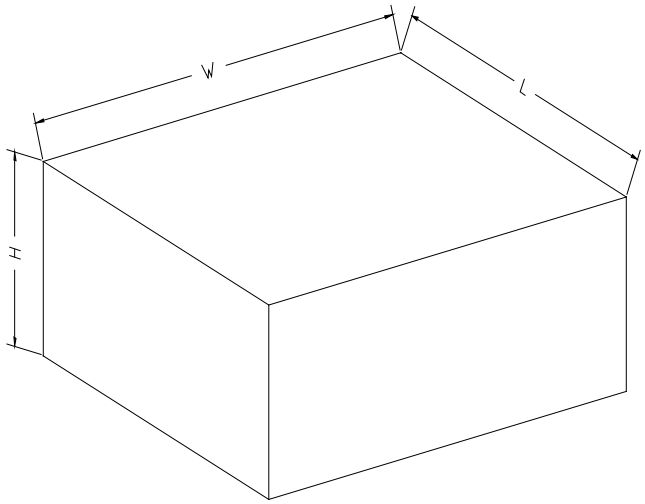
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-23-5	7″	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

DD0001

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