

GENERAL DESCRIPTION

The SGM42221A is a high-side driver intended for a wide range of industrial applications. It drives resistive, capacitive and inductive load with the other terminal connected to GND.

The current limit function protects the device under overload conditions. When an overload occurs, current limit regulates the output current to a pre-set level. In the event of over-temperature, the current limit folds back to a lower value. If either condition persists for 20ms the thermal protection level is further reduced. These features deliver highly robust device protection.

Pulling IN pin low will disable the device and leave it in standby state with very low standby current.

The device supports stand-alone mode. IN, as a high voltage pin can be connected to VS directly, which allows the device to work without an MCU and uses GND pin switch to control device on/off.

The SGM42221A is available in a Green SOT-223-3 package.

FEATURES

- **Wide Supply Voltage Range:** 12V to 45V
- **R_{DS(on)}:** 200mΩ (TYP)
- **Very Low Standby Current:** 100nA
- **Overload and Short-to-GND Protection by Internal Current Limit**
- **Under-Voltage Shutdown with Auto-Restart and Hysteresis**
- **Voltage Clamp for Switching Inductive Load**
- **CMOS Compatible Input**
- **Thermal Shutdown with Restart**
- **ESD Protection**
- **Stand-Alone Mode**
- **Loss-of-GND and Loss-of-Battery Protection**
- **Reverse Battery Protection with External Circuitry**
- **Improved Electromagnetic Compatibility (EMC)**
- **-40°C to +125°C Operating Temperature Range**
- **Available in a Green SOT-223-3 Package**

APPLICATIONS

Designed for 12V and 24V DC Industrial Applications.

Wide Range of Loads: Resistive, Inductive, and Capacitive Loads.

A Reliable, Solid-State Alternative to Electromechanical Relays and Complex Discrete Designs.

TYPICAL APPLICATION

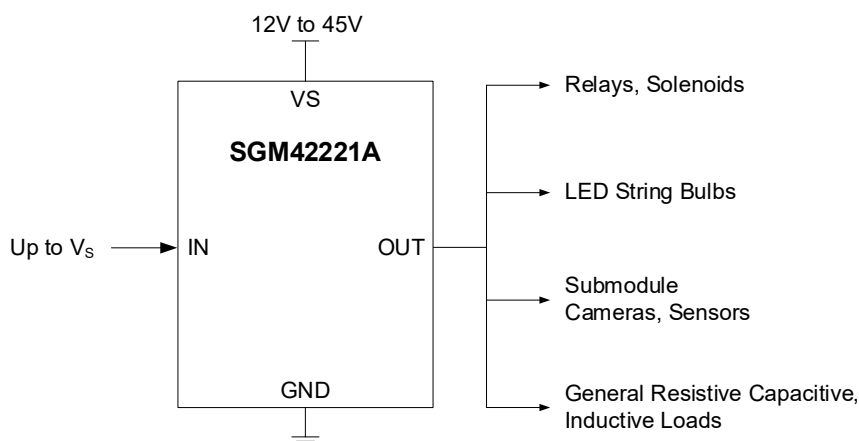


Figure 1. Typical Application Circuit

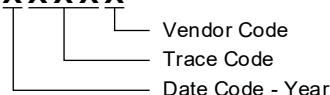
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42221A	SOT-223-3	-40°C to +125°C	SGM42221AXKC3G/TR	2CV XXXXX	Tape and Reel, 2500

MARKING INFORMATION

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

XXXXX



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

Supply Voltage, V_S	50V
Reverse Polarity Voltage ⁽¹⁾	> -36V
Current through Input Pin (DC) ^{(2) (3)}	±5mA
Voltage on OUT Pin	50V
Current on GND Pin ⁽³⁾	250mA
Load Current (Short-Circuit Current)	Internally Limited
Inductive Load Switch-Off Energy Dissipation Single Pulse, E_{AS}	270mJ
Load Dump According to ISO 16750-2:2023, $V_{Loaddump}$	58V
Package Thermal Resistance	
SOT-223-3, θ_{JA}	71.6°C/W
SOT-223-3, θ_{JB}	24.7°C/W
SOT-223-3, θ_{JC}	45.5°C/W
Package Thermal Characterization Parameter	
SOT-223-3, ψ_{JT}	5.2°C/W
SOT-223-3, ψ_{JB}	24.3°C/W
Junction Temperature	Internal Limited
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility ^{(4) (5)}	
HBM (IN Pin)	±3000V
HBM (All Other Pins)	±6000V
CDM	±1000V

NOTES:

- Reverse polarity condition: $V_{IN} = 0V$, reverse current < I_{R2} , GND pin 1kΩ resistor parallel with diode.
- At $V_{IN} > V_S$, the input current is not allowed to exceed ±5mA.
- Specified by design and characterization, not production tested.
- For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
- For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Operating Ambient Temperature Range -40°C to +125°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.

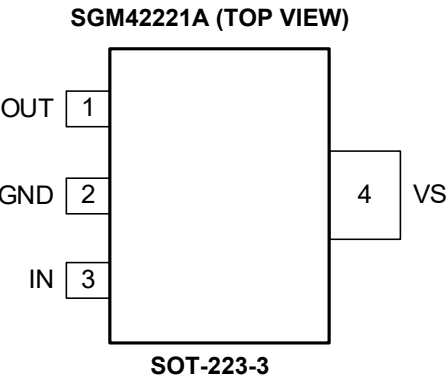
ESD SENSITIVITY CAUTION

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 CONFIGURATION



PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	OUT	O	Power Output. Connected to Load.
2	GND	G	Device Ground. Connect to power ground with resistor-diode network to activate reverse battery protection function.
3	IN	I	Voltage Controlled Input Pin. Control the output switch state.
4	VS	P	Power Supply. Battery Connection.

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

ELECTRICAL CHARACTERISTICS(V_S = 12V to 45V, T_A = -40°C to +125°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage						
Operating Voltage	V _{S_NOM}		12		45	V
Under-Voltage Turn-On	V _{S_UVR}	V _S rising up	8.2	9.4	10.6	V
Under-Voltage Shutdown	V _{S_UVF}	V _S falling down	7.7	8.9	10.1	V
Under-Voltage Shutdown Hysteresis	V _{UV_HYS}			0.5		V
Operating Current						
Nominal Operating Current	I _{OP}	V _{IN} = 5V, I _{OUT} = 0.5A		1.65	2.8	mA
Standby Current	I _{OFF}	V _{IN} = V _{OUT} = 0V		0.1	10	μA
Standby Mode Deglitch Time ⁽¹⁾	t _{OFF_DEG}	When IN is going from high-to-low, if deglitch time is longer than t _{OFF_DEG} , the device enters standby mode.	30	50	70	ms
Output Leakage Current in Off-State	I _{LKG_OUT}	V _{IN} = V _{OUT} = 0V		0.1	10	μA
Power Stage						
On-Resistance	R _{DS(on)}	V _S ≥ V _{S_UVR} , I _{OUT} = 0.5A, T _A = +25°C		200	220	mΩ
		V _S ≥ V _{S_UVR} , I _{OUT} = 0.5A, T _A = +125°C		300	350	mΩ
Internal Peak Current Limit ⁽¹⁾	I _{CL_PEAK}	Internal current limit value under overload		1.4		A
Internal Foldback Current Limit	I _{CL_FB}	Normal internal current limit value	0.55	0.95	1.35	A
Current Limit during Thermal Shutdown ⁽¹⁾	I _{CL_TSD}	Internal current limit value under thermal shutdown		0.57		A
Drain-to-Source Internal Clamp Voltage ⁽¹⁾	V _{DS_CLAMP}		51 ⁽¹⁾	55 ⁽¹⁾	60 ⁽¹⁾	V
Output Diode Characteristics						
Drain-to-Source Diode Voltage	V _F	V _{IN} = 0V, I _{OUT} = 1A		0.9	1.1	V
Continuous Reverse Drain Current ⁽¹⁾	I _{R1} , I _{R2}	t < 60s, V _{IN} = 0V, short-to-battery condition		2.5		A
		t < 60s, V _{IN} = 0V, Diode parallel with a 1kΩ resistor. Reverse polarity condition		2		

NOTE:

1. Value specified by design, not subject to production test.

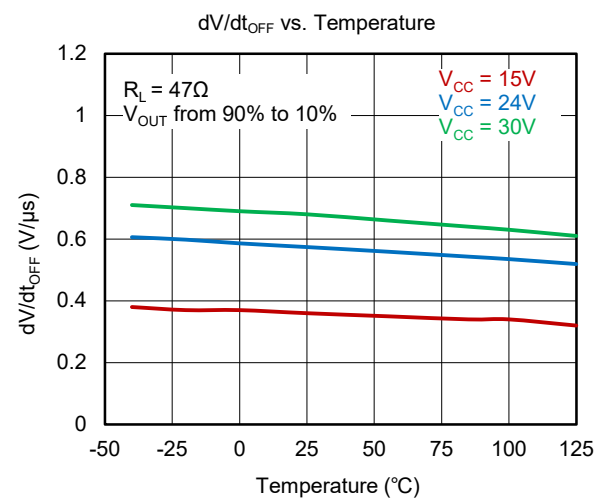
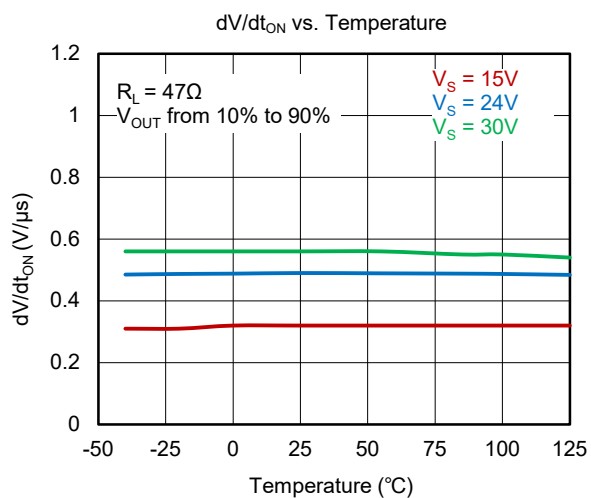
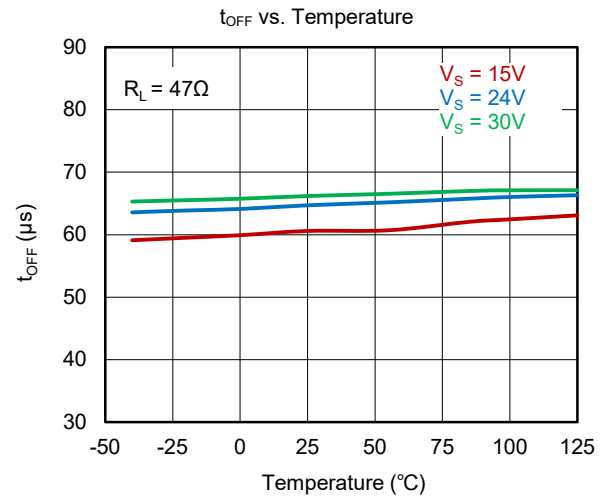
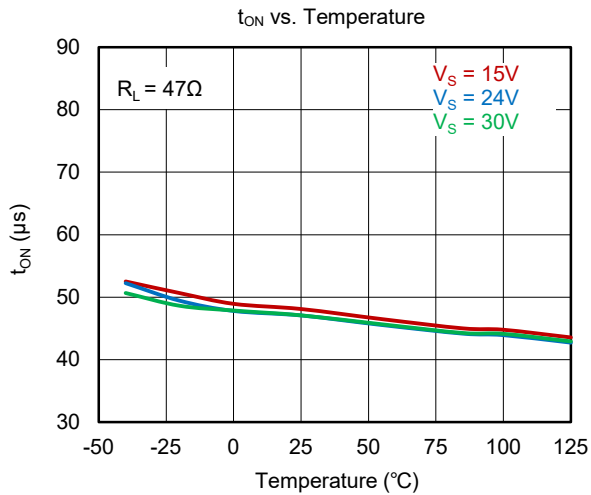
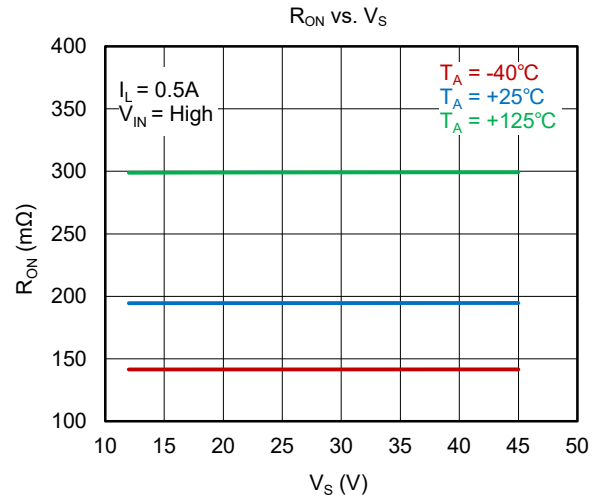
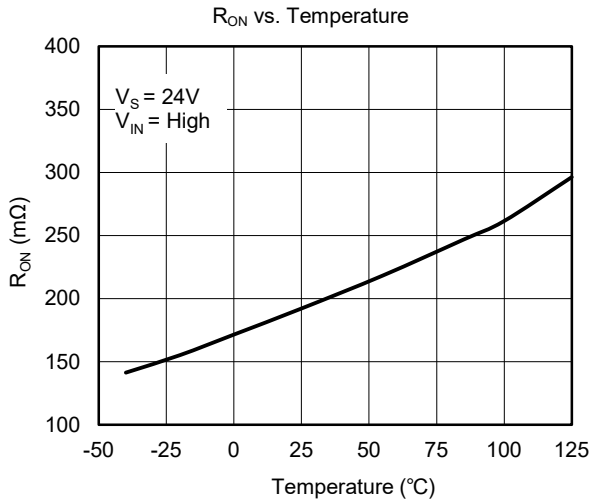
ELECTRICAL CHARACTERISTICS (continued)(V_S = 12V to 45V, T_A = -40°C to +125°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Logic Input Characteristics						
Continuous Input Voltage	V _{IN}		-10 ⁽¹⁾		V _S	V
Logic High-Level Voltage	V _{IH}			2.5	3	V
Logic Low-Level Voltage	V _{IL}		1.85	2.1		V
Logic Threshold Hysteresis	V _{I,HYS}			0.4		V
On-State Input Current	I _{IN_ON}	V _{IN} =V _{CC} =30V	30	70	110	μA
Logic Pin Pull-Down Resistor	R _{LOGIC_PD}	IN. V _{IN} = 5V	550	1150	1800	kΩ
Diagnostics						
Thermal Shutdown Threshold	T _{SD_H}	Thermal shutdown threshold		160		°C
	T _{SD_H_RST}	Thermal shutdown status reset threshold ⁽¹⁾		130		
	T _{SD_L}	Foldback thermal shutdown threshold		135		
	T _{SD_L_RST}	Foldback thermal shutdown status reset threshold ⁽¹⁾		110		
Hysteresis for Resetting Thermal Shutdown ⁽¹⁾	T _{HYS}			10		°C
Thermal Shutdown Threshold Foldback Reset Time ⁽¹⁾	t _{TSD_FB_RST}	From IN falling edge to reset thermal shutdown foldback status		8.5		ms
Thermal Shutdown Threshold Foldback Time ⁽¹⁾	t _{TSD_FB}	From short circuit or thermal shutdown to fold back thermal shutdown threshold		20		ms
Switching Characteristics						
Turn-On Time	t _{ON}	V _S = 24V, I _{OUT} = 0.5A, to 10% V _{OUT}		50	100	μs
Turn-Off Time	t _{OFF}	V _S = 24V, I _{OUT} = 0.5A, to 90% V _{OUT}		65	130	μs
Turn-On Slew Rate	dV/dt _{ON}	V _S = 24V, I _{OUT} = 0.5A, V _{OUT} from 10% to 90%	0.25	0.5	0.75	V/μs
Turn-Off Slew Rate	dV/dt _{OFF}	V _S = 24V, I _{OUT} = 0.5A, V _{OUT} from 90% to 10%	0.4	0.6	0.8	V/μs
V _S Turn-On Delay Time with High Logic Input	t _{D_VSON}	From V _S rising edge, to 20% V _{OUT}	15	30	45	μs

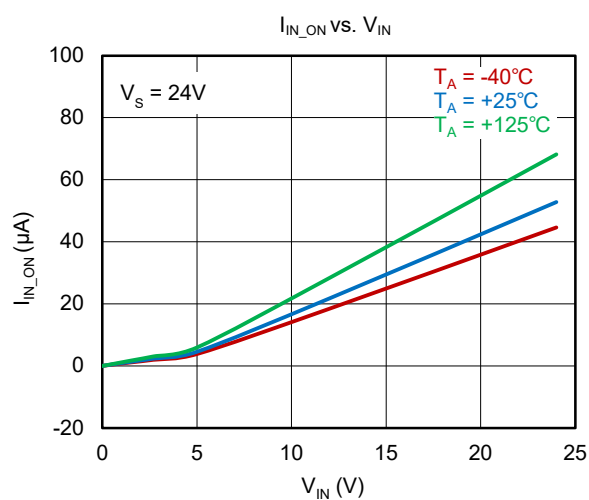
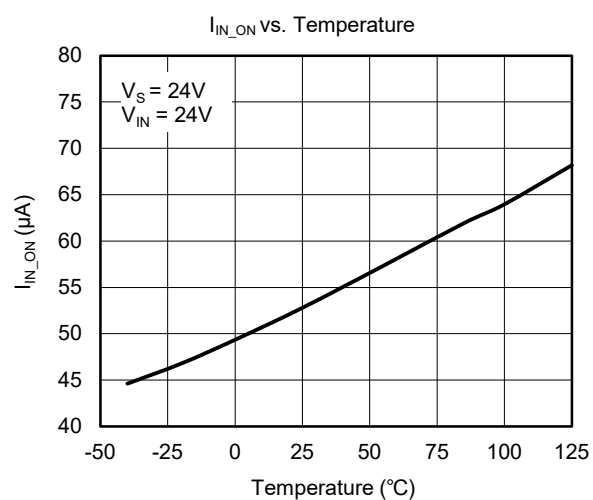
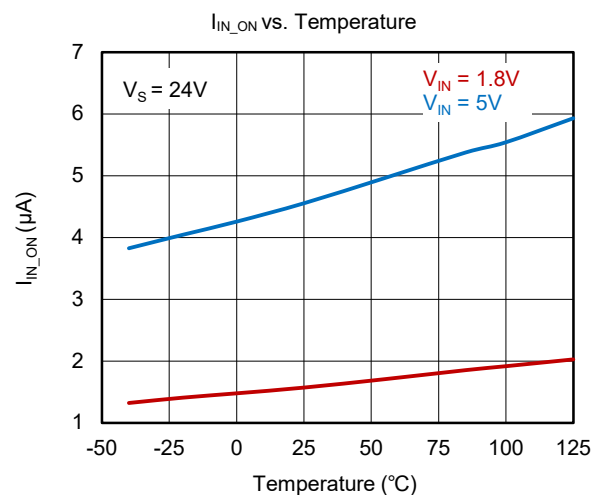
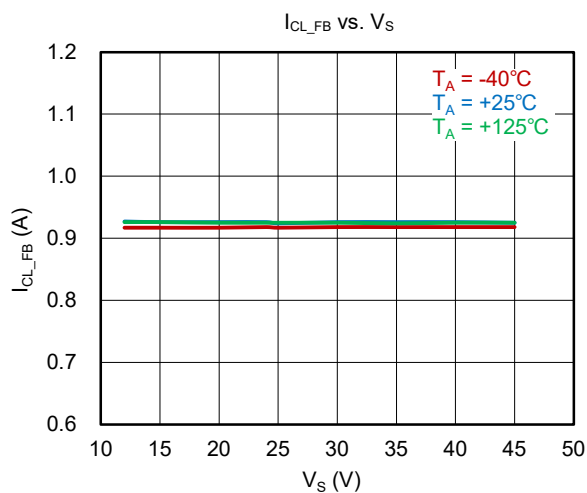
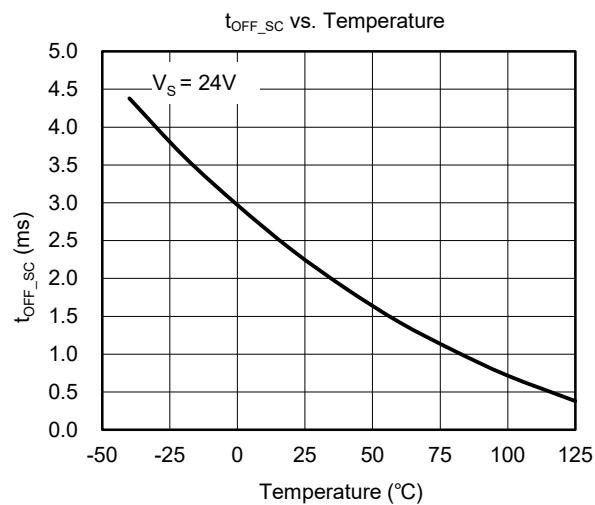
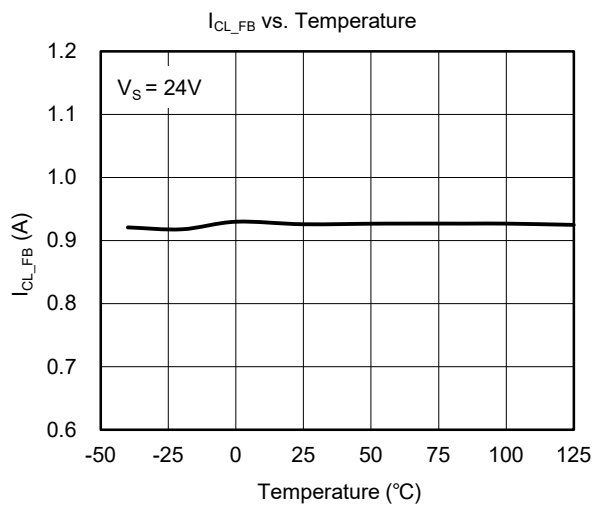
NOTE:

1. Guaranteed by design, not tested in production.

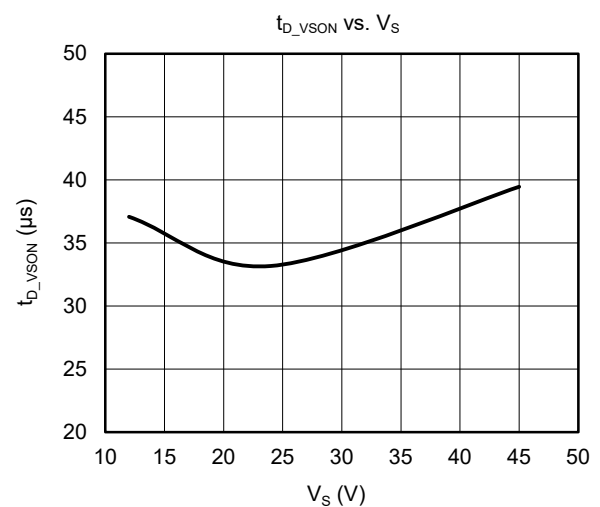
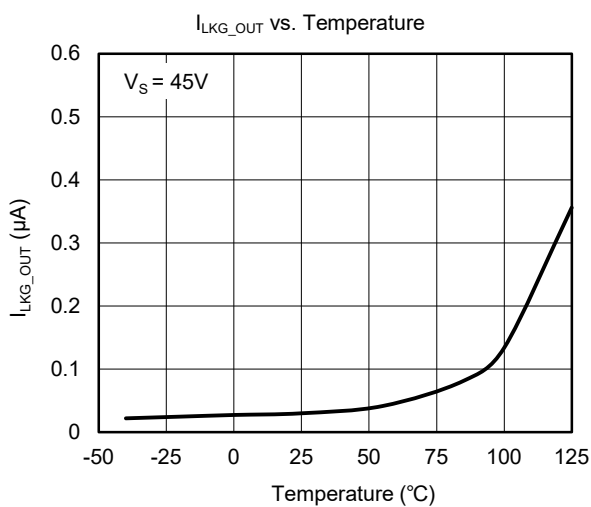
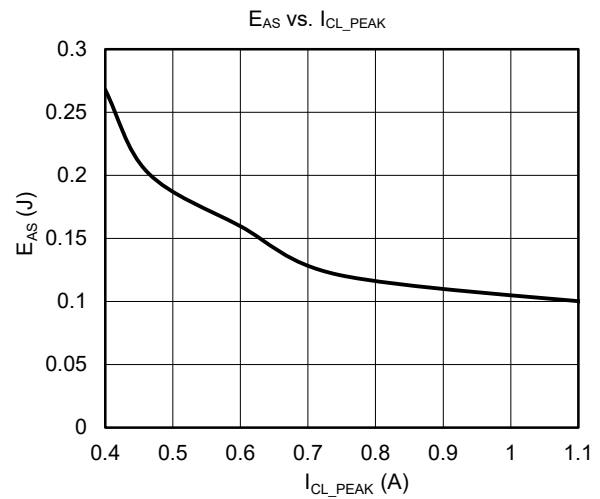
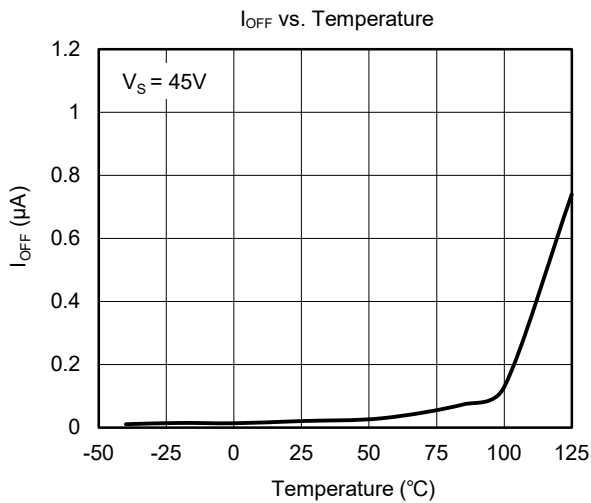
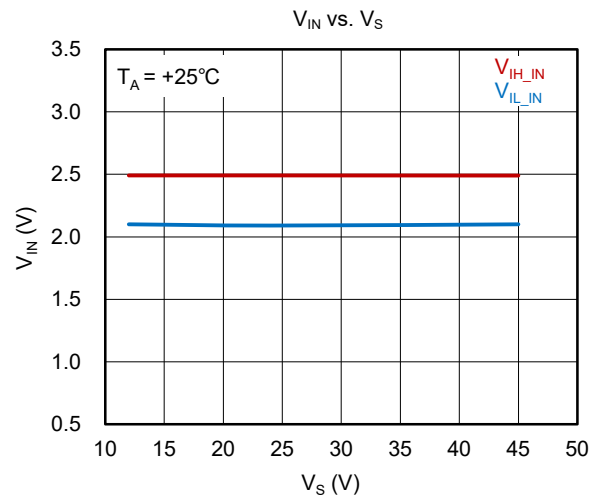
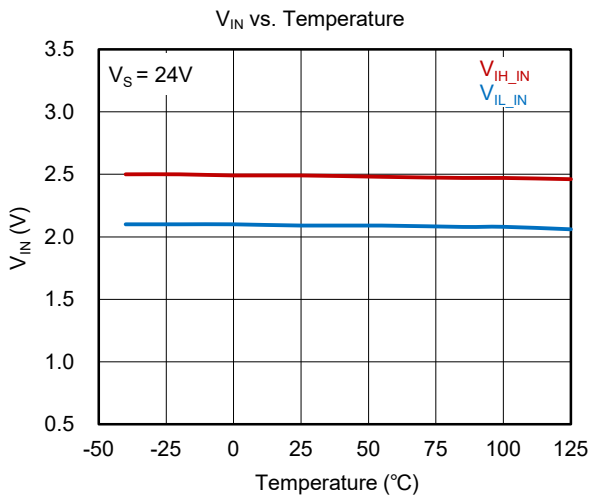
TYPICAL PERFORMANCE CHARACTERISTICS



TYPICAL PERFORMANCE CHARACTERISTICS (continued)



TYPICAL PERFORMANCE CHARACTERISTICS (continued)



FUNCTIONAL BLOCK DIAGRAM

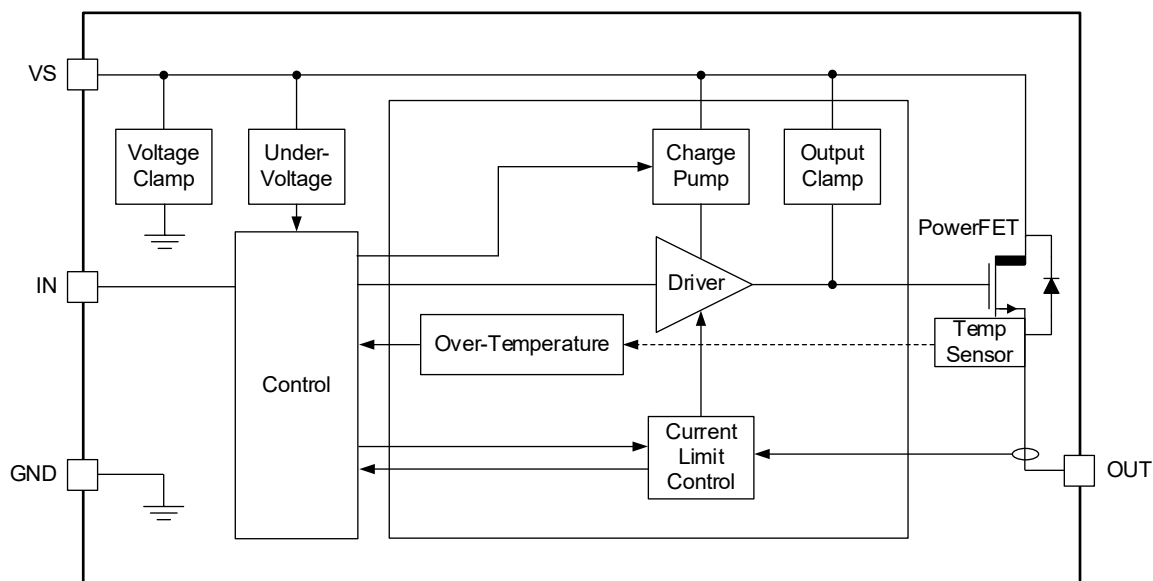


Figure 2. Block Diagram

TIMING DIAGRAMS

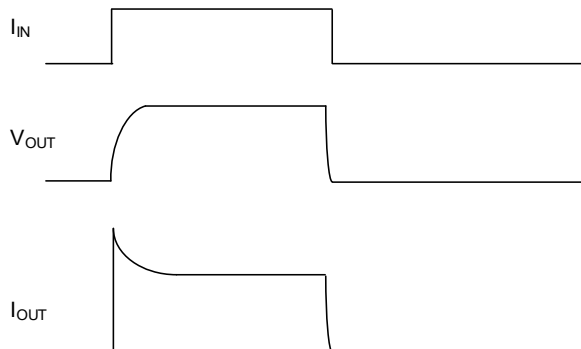


Figure 3. Switching a Lamp

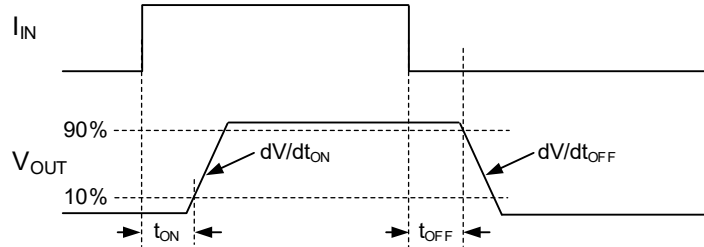


Figure 4. Switching a Resistive Load, Turn-On/Off Time and Slew Rate Definition

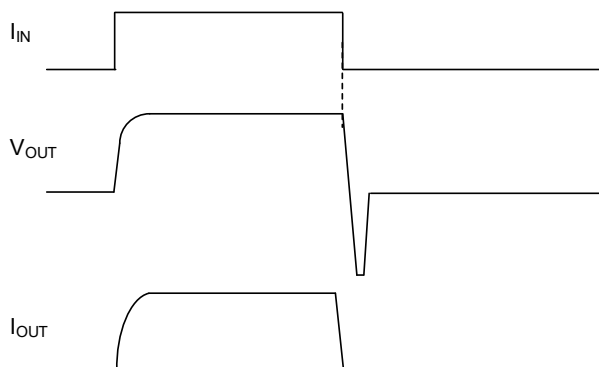


Figure 5. Switching an Inductive Load

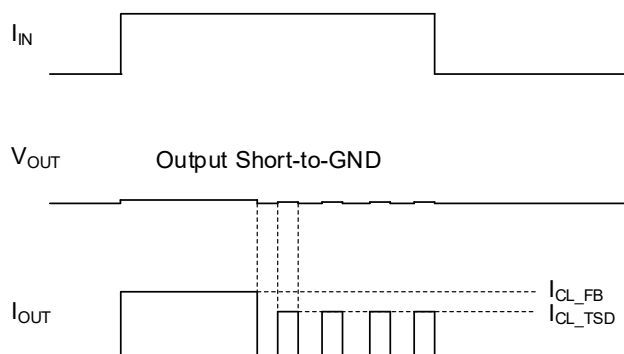


Figure 6. Turn on into Short-Circuit, Shutdown by Over-Temperature, Restart by Cooling

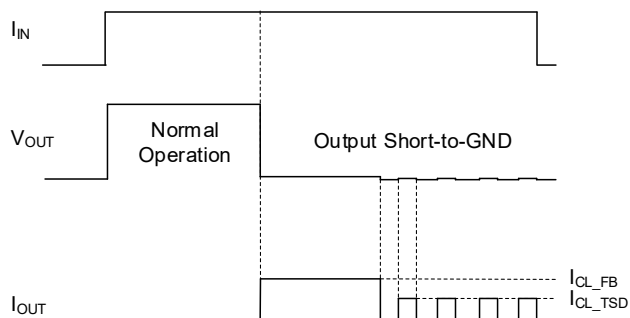


Figure 7. Short-Circuit in On-State Shutdown by Over-Temperature, Restart by Cooling

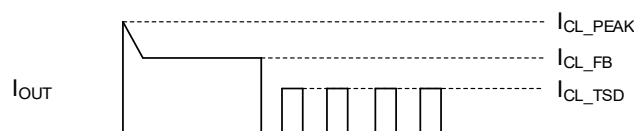


Figure 8. Overload Output-Current Characteristic

TIMING DIAGRAMS (continued)

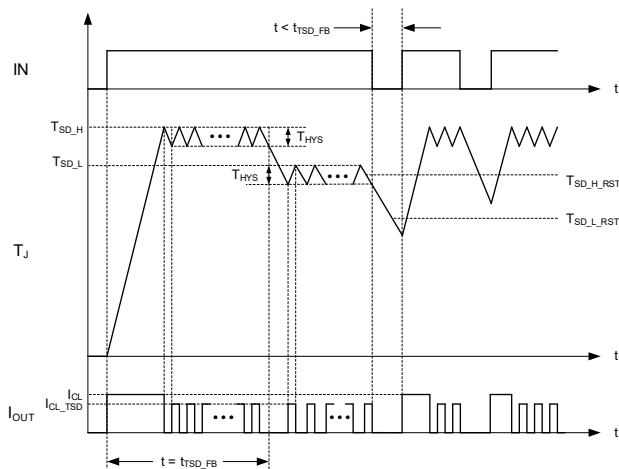


Figure 9. Thermal Behaviors after Short-to-GND (a)

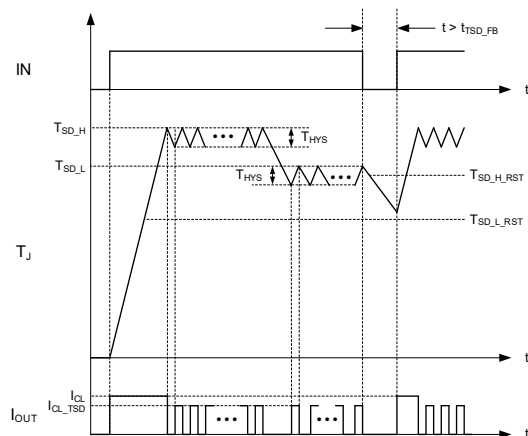


Figure 10. Thermal Behaviors after Short-to-GND (b)

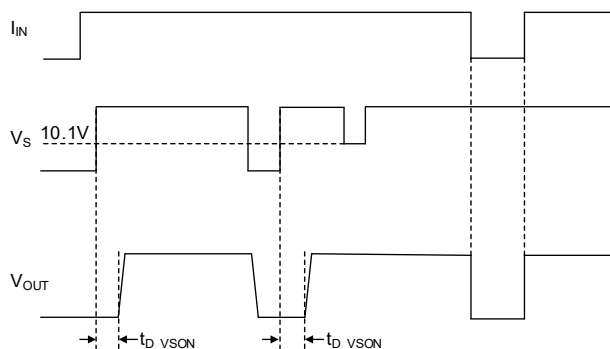


Figure 11. Under-Voltage Shutdown and Restart

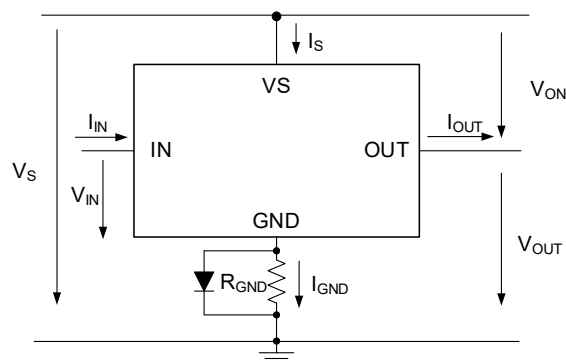


Figure 12. Terms

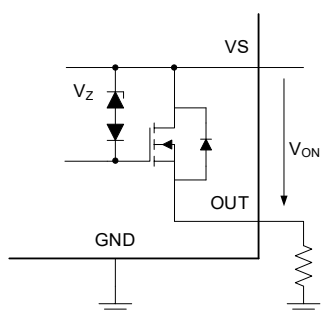


Figure 13. Inductive and Over-Voltage Output Clamp

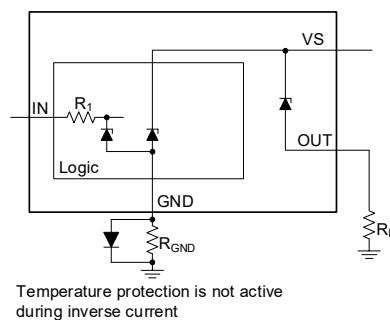


Figure 14. Reverse Battery Protection

REVISION HISTORY

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

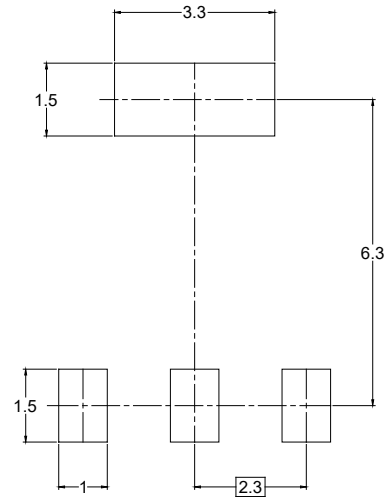
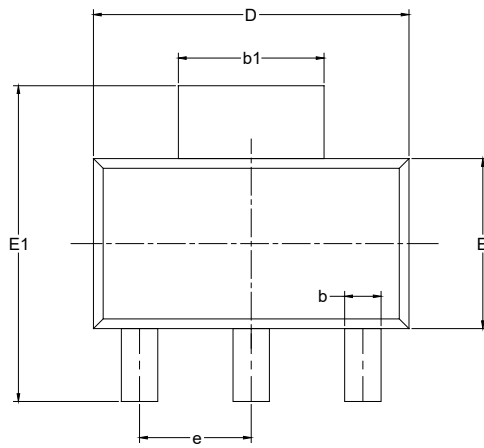
Changes from Original to REV.A (SEPTEMBER 2026)

Page

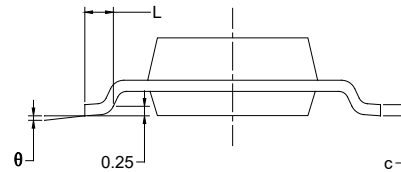
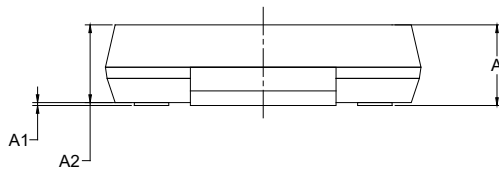
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PACKAGE OUTLINE DIMENSIONS

SOT-223-3



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.800		0.071
A1	0.020	0.100	0.001	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.840	0.026	0.033
b1	2.900	3.100	0.114	0.122
c	0.230	0.350	0.009	0.014
D	6.300	6.700	0.248	0.264
E	3.300	3.700	0.130	0.146
E1	6.700	7.300	0.264	0.287
e	2.300 BSC		0.091 BSC	
L	0.750		0.030	
θ	0°	10°	0°	10°

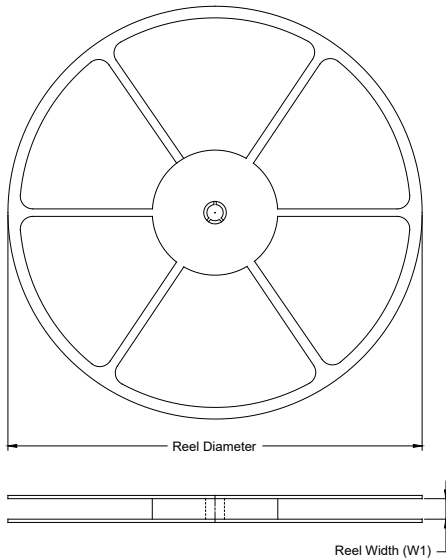
NOTES:

1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

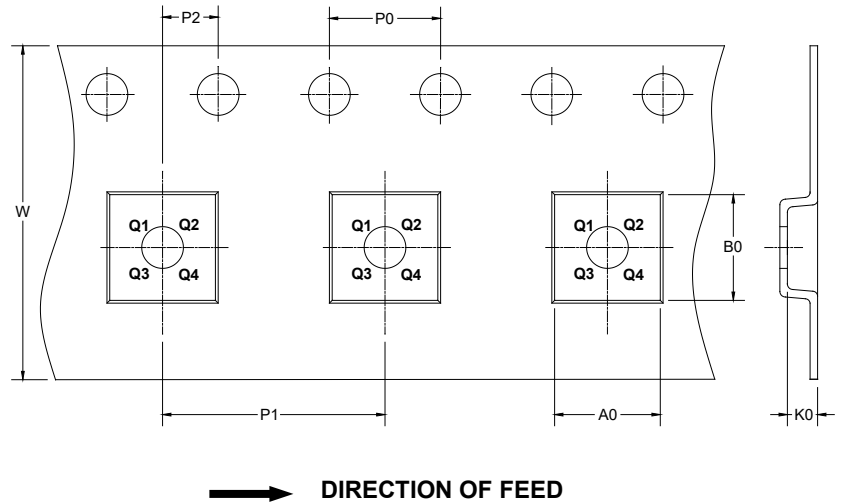
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

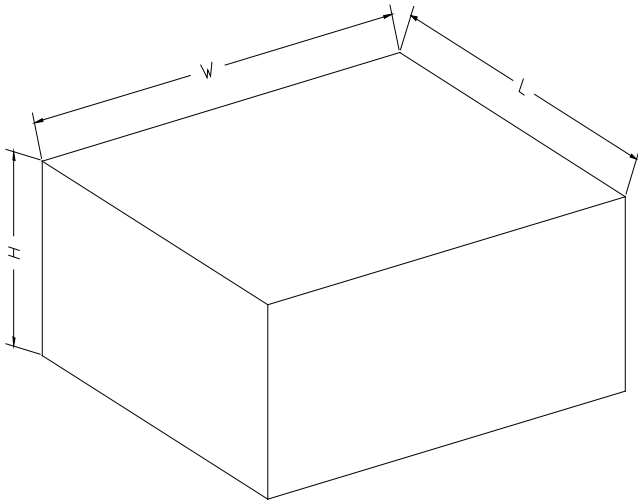
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-223-3	13"	12.4	6.55	7.25	1.90	4.0	8.0	2.0	12.0	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
13"	386	280	370	5

DD0002