Description

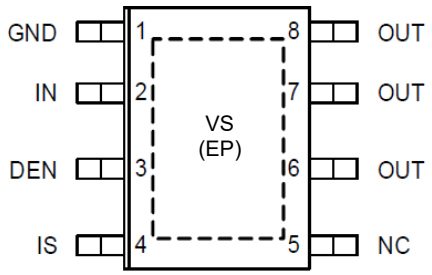
The ZXMS81030SPQ is a single-channel, high-side power switch in a SO-8EP (Type E) exposed heatsink package incorporating protective and diagnostic functions.

The device comprises a monolithic n-channel vertical power MOSFET with integrated temperature and current sensors with a charge-pumped gate supply and has a low quiescent current in OFF state.

The device is enabled by active high 3.3V and 5V logic-level drive to the inputs. The device includes a diagnostic current-sense output proportional to load current and a defined diagnostic fault signal in case of overload operation, overtemperature, short-circuit or open-load conditions.

Pin Assignment

(Top View)



SO-8EP (Type E)

Features

Protection Functions

- Reverse-Battery Protection Using External Components
- Voltage Dependent Current Limiting
- Overtemperature Protection with Auto-Restart
- Overvoltage Protection Including Load Dump
- Stable Undervoltage Protection
- ESD Protection
- Loss Of Ground Protection with External Components
- Enhanced Short-Circuit Protection

Diagnostic Functions

- Proportional Load Current-Sense Output
  - Linear Voltage Drop Regulation to Maintain Sense Accuracy Even at Very Low Load Currents
  - Enabled by Logic Input
  - Defined Temperature and Current Dependency
- Open-Load Detection
  - Using Load Current Sense in ON State
  - Using Output Voltage Detection in OFF State
- Defined Fault Signal in Case of Overload Operation, Overtemperature, or Short Circuit and Open Load in OFF State

Miscellaneous

- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The ZXMS81030SPQ is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

Applications

- High-side switching with diagnostic feedback for:
  - 12V grounded loads
  - Resistive, inductive and capacitive loads
- Suitable for high inrush current loads
  - Incandescent lamps (2 x P21W), motors, LEDs, etc.
- Compact low-power replacement for:
  - Relays, fuses and discrete circuits

Summary Specifications

Parameter	Symbol	Rating
Operating Voltage	V_S	5V to 28V
Maximum Supply Voltage	$V_{S(LD)}$	41V
Maximum ON Resistance T_J = 150°C	$R_{DS(ON)}$	60mΩ
Nominal Load Current	$I_{L(NOM)}$	5A
Typical Current Sense Ratio, I_L = 0.5A	K_{ILIS}	2180
Minimum Current Limitation	$I_{L5(SC)}$	36A
Maximum Standby Current T_J = 25°C	$I_{S(OFF)}$	0.5µA

Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

IntelliFET® is a registered trademark of Diodes Incorporated in the United States and other countries.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Typical Application Circuit

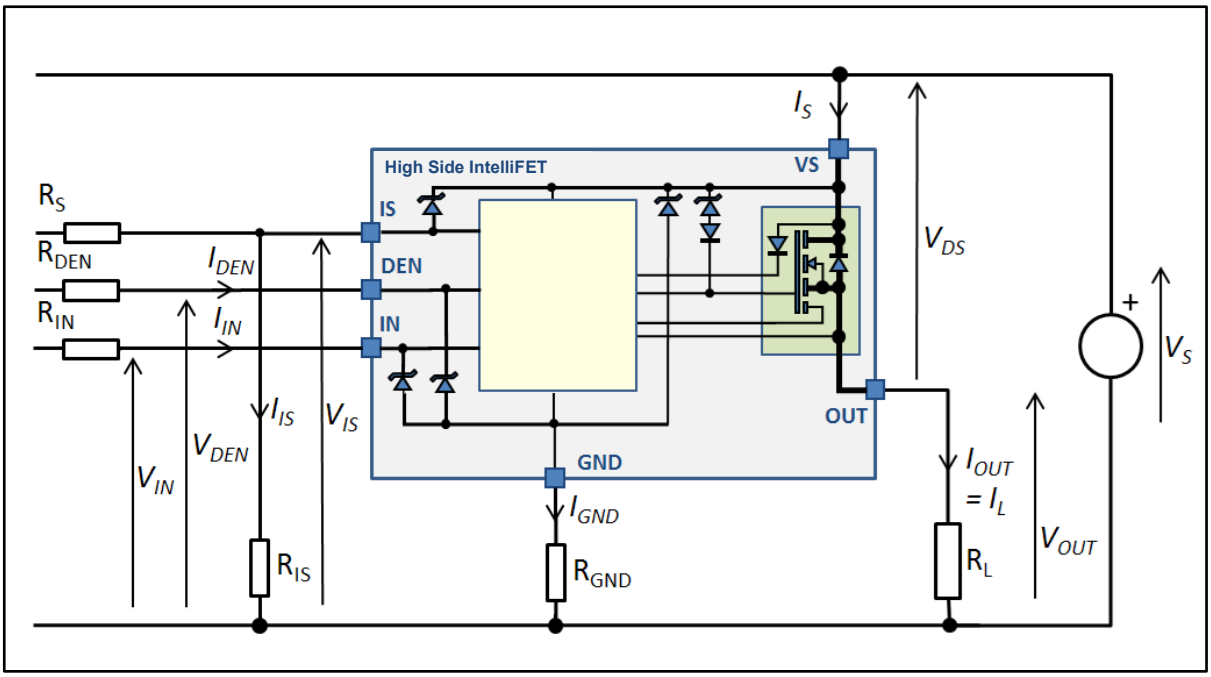


Figure 1. Typical Application Configuration

R_{GND}, R_{IN}, R_{DEN} and R_S are optional. They may be replaced by shorts depending on the application. Non-zero resistors may be used to:

- Reduce peak currents during supply voltage transients that exceed the $\pm V_S$ internal clamp voltages
  - Typically, transients exceeding 41V or may activate the internal clamps
- Protect the customer's application from high currents during transients exceeding 41V
- Keep within rated current during reverse battery, recommended is $R_S = R_{DEN} = R_{IN} = 4.7k\Omega$, $R_{GND} = 150\Omega$
- Ensure that the device is off when there is loss of ground connection to the device or module

Pin Description

Pin Number	Pin Name	Function and Description
1	GND	Ground or Negative Supply
2	IN	Input, activates the output
3	DEN	Diagnostic Enable, allows common connection of the IS pin with multiple devices
4	IS	Diagnostic Output, provides an analog sense current proportional to the load current under normal operation, or a defined current under overload or shutdown conditions
5	NC	Not Connected
6, 7, 8	OUT	Output to the Load, must be connected together
EP	VS	Voltage Supply or Battery Positive

Table 1. Pin Description

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Functional Block Diagram

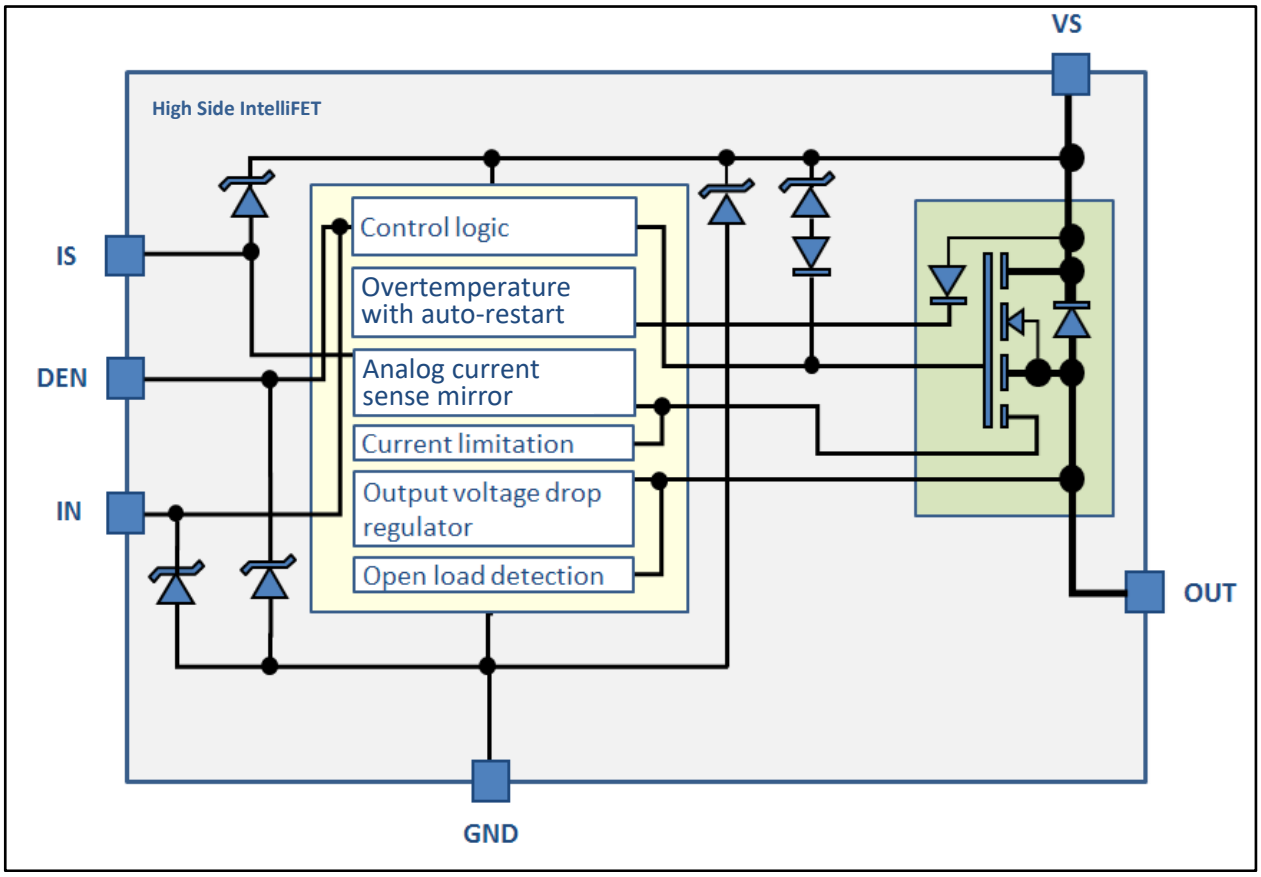


Figure 2. Functional Block Diagram of ZXMS81030SPQ

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Absolute Maximum Ratings (Notes 4, 5) (Unless otherwise specified: T_J = +25°C)

Symbol	Parameter	Ratings		Unit	Conditions
		Min	Max		
Supply Voltage					
V_S	Supply Voltage	-0.3	28	V	—
$V_{S(REV)}$	Reverse Supply Voltage	0	16	V	$R_L \geq 4\Omega$, $R_{GND} = 150\Omega$ T_{amb} = 25°C, t < 2 mins
$V_{S(SC)}$	Supply Voltage for Short-Circuit Protection (Note 6)	0	24	V	—
$V_{S(LD)}$	Supply Voltage for Load-Dump Protection (ISO 7637)	—	41	V	$R_{IN} = 2\Omega$, $R_L = 4\Omega$
Interface Pins					
V_{IN}	IN Pin Voltage	-0.3	6	V	—
		—	7	V	t < 2 mins
I_{IN}	Current in IN Pin	-2	2	mA	—
V_{DEN}	DEN Pin Voltage	-0.3	6	V	—
		—	7	V	t < 2 mins
I_{DEN}	Current in DEN Pin	-2	2	mA	—
V_{IS}	IS Pin Voltage	-0.3	V_S	V	—
I_{IS}	Current in IS Pin	-25	50	mA	—
Output Stage					
I_L	Load Current (Note 7)	—	Self-limited	A	—
P_{TOT}	Power Dissipation	—	1.7	W	T_{amb} = 85°C, T_J < 150°C
E_{AS}	Energy Dissipation (Single Pulse)	—	55	mJ	V_S = 13.5V, I_L = 6A T_J = 150°C
V_{DS}	VS to OUT Pin Voltage	—	41	V	—
N_{RSC}	Repetitive Short-Circuit Capability (Note 8)	—	300	kcyc	t_{ON} = 300ms
Current					
I_{GND}	Current in GND Pin	-10	10	mA	—
		-150	20	mA	t < 2 mins
Temperature					
T_J	Junction Temperature	-40	150	°C	—
T_{STG}	Storage Temperature	-55	150	°C	—
Electrostatic Discharge					
$V_{ESD(HBM)}$	ESD Capability HBM (All Pins)	-2	2	kV	EIA/JESD 22-A 114B
	ESD Capability HBM OUT to GND and V_S Shorted	-4	4	kV	
$V_{ESD(CDM)}$	ESD Capability CDM	-0.75	0.75	kV	AEC-Q100-011

Notes:
4. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.
5. Not subject to production test, guaranteed by design.
6. Short-circuit protection is outside normal operation and is limited to single pulse and allowed combinations of resistance and inductance.
7. Current limit is a protection feature and operation in current limitation, e.g. with short-circuit loads, is outside the normal operation range.
8. Repetitive short-circuit protection characterisation also carried out according to AEC-Q100-012 at 14V.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Package Thermal Data

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 9)	—	5.2	—	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient Mounted on PCB (Notes 9, 10)	—	42	—	°C/W

Notes: 9. Device mounted on vertical PCB, 2" x 2" x 1.6mm, FR4 with 2oz copper for all connections.
10. Not subject to production test, guaranteed by design.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{S(NOM)}$	Nominal Operating Voltage (Note 11)	8	18	V
$V_{S(OP)}$	Extended Operating Voltage (Note 12)	5	28	V

Notes: 11. For normal function and protection features.
12. Operation across an extended range is possible but is load dependant – device may have reduced protection against faulty (overload or short-circuit) loads.

Operational Electrical Characteristics

(Unless otherwise specified: -40°C < T_J < +150°C; typical values based on T_J = +25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
General						
$V_{S(OP)}$	Extended Operating Voltage	V_{IN} = 4.5V, V_{DS} < 0.5V	5	13.5	28	V
$V_{S(OP_MIN)}$	Undervoltage Restart	V_{IN} = 4.5V, R_L = 6Ω	3.8	4.2	5	V
$V_{S(UV)}$	Undervoltage Shutdown	V_{IN} = 4.5V, V_{DEN} = 0V R_L = 6Ω	3	3.3	4.1	V
$V_{S(UV_HYS)}$	Undervoltage Hysteresis	—	—	0.85	—	V
I_{GND}	Operating Current	V_{IN} = V_{DEN} = 5.5V, V_S = 18V device in $R_{DS(ON)}$	—	2	6	mA
$I_{S(OFF)}$	Standby Current	V_{IN} and V_{DEN} floating V_{OUT} = 0V, V_S = 18V T_J ≤ 85°C	—	0.1	0.5	µA
		V_{IN} and V_{DEN} floating V_{OUT} = 0V, V_S = 18V T_J = 150°C	—	4	20	µA
$I_{S(OFF_DEN)}$	Standby Current with Diagnostic Pin Active	V_{IN} floating, V_{OUT} = 0V V_S = 18V, V_{DEN} = 5.5V	—	1	—	mA

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Output ON-State Characteristics

The ON-state resistance $R_{DS(ON)}$ depends on the supply voltage V_S and junction temperature T_J.

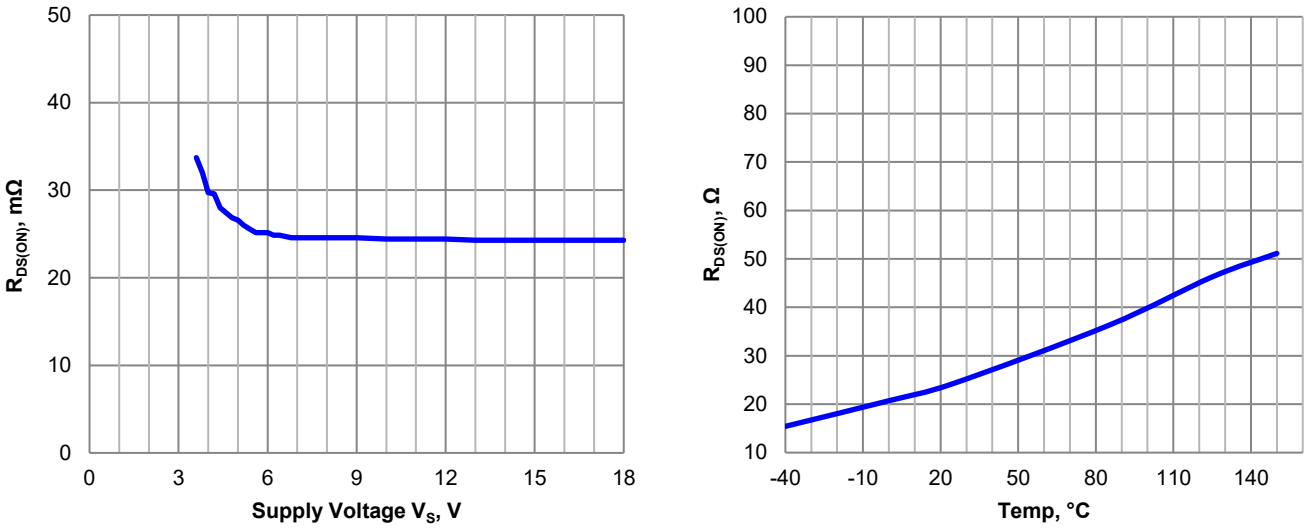


Figure 3. Typical R_{DS} ON-State Resistance

At low load current I_L, the MOSFET gate drive is reduced to maintain a near constant output voltage drop $V_{DS(NL)}$. This limits the effect of internal op-amp offset voltage, to maintain useful K_{ILIS} ratio accuracy even at very low I_L.

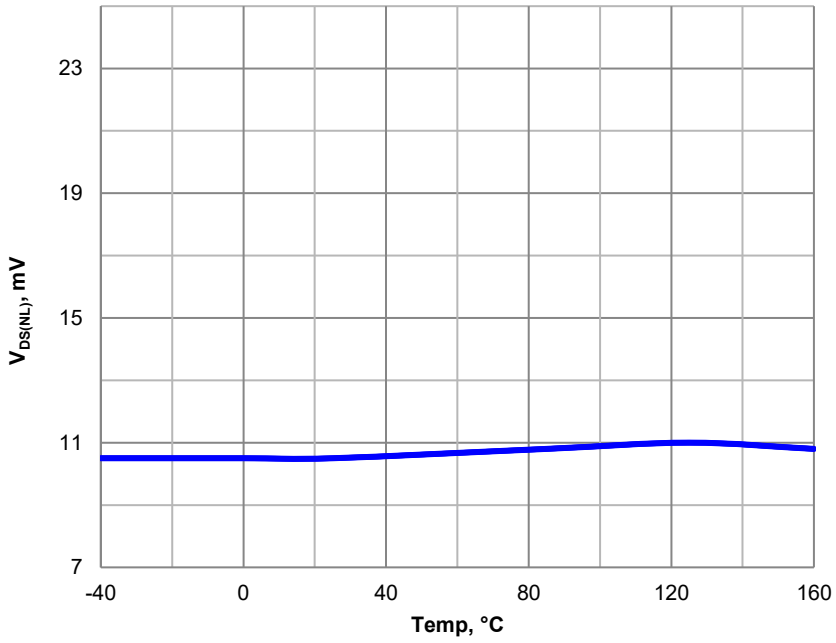


Figure 4. Output Voltage Drop Regulation, I_{OUT} = 50mA

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Resistive Load Switching

The power MOSFET turn-ON and turn-OFF processes are determined by the device itself, with rates suitable for EMC compatibility.

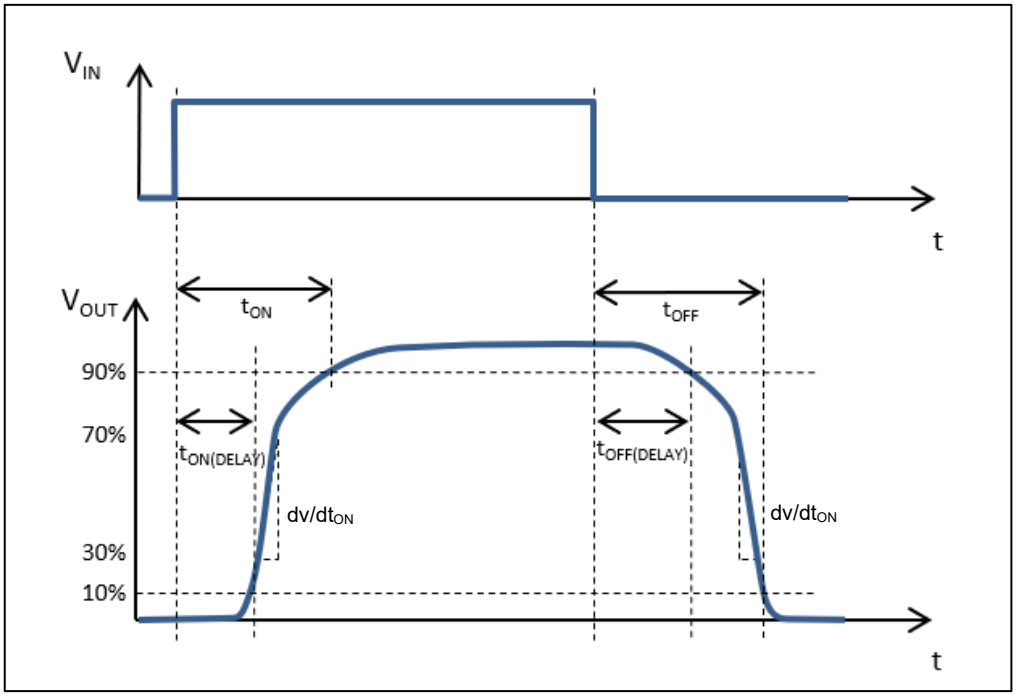


Figure 5. Switching a Resistive Load

Output Inductive Load Clamp

To de-energise inductive loads the OUT terminal must be allowed to swing below ground (V_{OUT} rings negative) during the OFF-state.

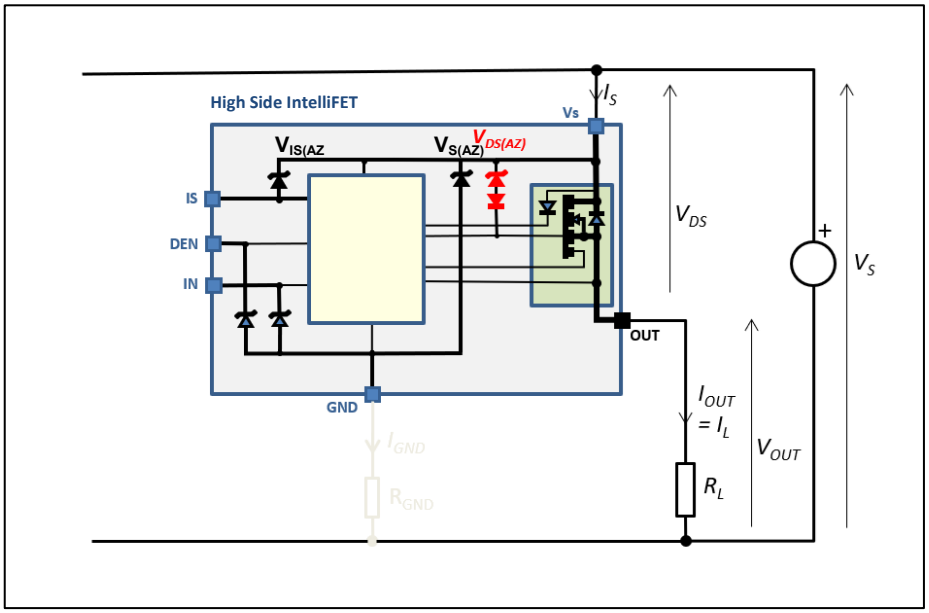


Figure 6. Output Clamp

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Output Inductive Load Clamp (continued)

A low-impedance active voltage clamp uses the MOSFET channel to limit the maximum voltage across the MOSFET drain-source terminals, limiting the swing of OUT below V_S to safe $V_{DS(AZ)}$. This prevents avalanche of the MOSFET or associated circuitry.

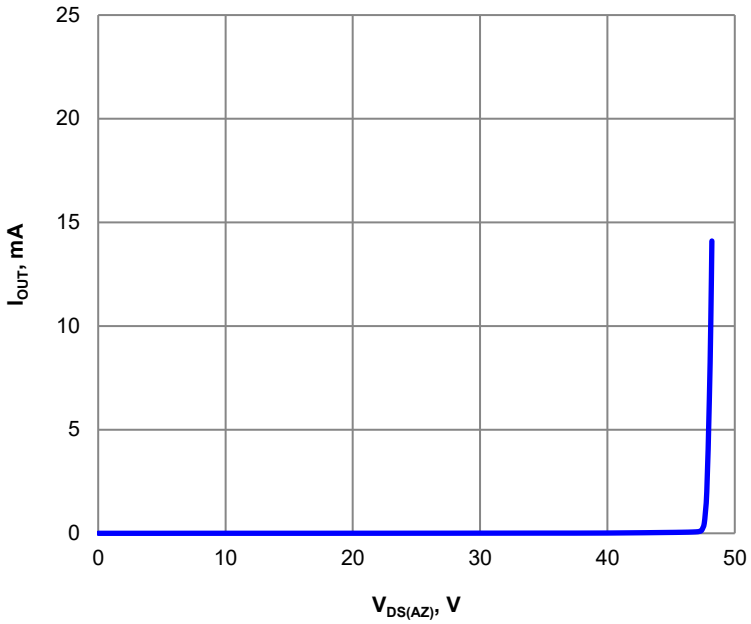


Figure 7. Typical OUT Clamp Characteristic

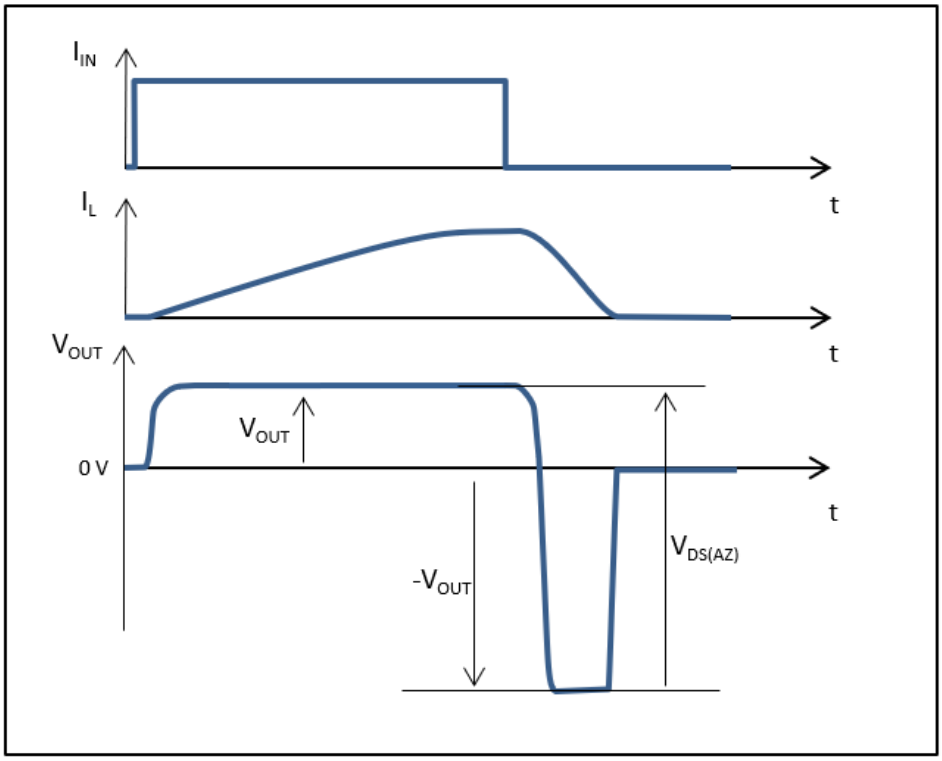


Figure 8. Switching an Inductive Load

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Maximum Load Inductance

Stored inductive load ring-off energy is dissipated in the MOSFET during switching and load ring-off clamping. Additional energy is also supplied to the system by the V_S supply until the load current I_L reaches zero. This causes a temporary rise in MOSFET temperature after turn-OFF begins. The temperature reached depends on the starting temperature, thermal environment, load current I_L, load inductance L_L, load resistance R_L and supply voltage V_S.

Inverse Current Capability

In the ON-state the device will remain on if the output current becomes inverse until or unless the inverse current becomes high enough to create a $-V_{DS}$ approaching body diode conduction. During inverse current conduction, $I_{L(INV)}$, the IS sense output will be zero. If body diode conduction occurs all functions are disabled or unspecified until the inverse current becomes very small.

If inverse current is present in the OFF-state body diode conduction occurs and all functions are disabled or unspecified. When inverse current is removed or becomes very small then turn-ON and normal function become possible.

Power Stage Electrical Characteristics

(Unless otherwise specified: 8V < V_S < 18V, -40°C < T_J < +150°C; typical values based on V_S = 13.5V, T_J = +25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Output Characteristics						
$R_{DS(ON)}$	ON-State Resistance	V_{IN} = 4.5V, I_L = 7A T_J = 150°C	—	50	60	mΩ
		V_{IN} = 4.5V, I_L = 7A	—	25	—	mΩ
$I_{L(NOM)}$	Nominal Load Current (Note 13)	T_{amb} = 85°C, T_J < 150°C	—	5	—	A
$V_{DS(NL)}$	Voltage Drop Regulation at Low I_L	I_L = 50mA	—	12	25	mV
$V_{DS(AZ)}$	Output Clamp Voltage	I_L = 20mA	41	47	53	V
$I_{L(OFF)}$	Output Leakage Current	V_{IN} floating, V_{OUT} = 0V	—	0.1	0.5	µA
		V_{IN} floating, V_{OUT} = 0V T_{amb} = 150°C	—	2	10	µA
$I_{L(INV)}$	Inverse Output Current (Note 14)	V_S < V_{OUT}	—	4	—	A
Timings						
dv/dt_{ON}	Slew Rate ON, 30% to 70% V_S	R_L = 4Ω, V_S = 13.5V	0.1	0.25	0.5	V/µs
dv/dt_{OFF}	Slew Rate OFF, 70% to 30% V_S		0.1	0.5	0.75	V/µs
t_{ON}	Turn-ON Time to 90% V_S		30	100	230	µs
t_{OFF}	Turn-OFF Time to 10% V_S		30	100	230	µs
$t_{ON(DELAY)}$	Turn-ON Delay to 10% V_S		10	35	100	µs
$t_{OFF(DELAY)}$	Turn-OFF Delay to 90% V_S		30	35	100	µs
E_{ON}	Switch ON Energy	R_L = 4Ω, V_S = 18V V_{OUT} = 90% V_S	—	1.2	—	mJ
E_{OFF}	Switch OFF Energy	R_L = 4Ω, V_S = 18V V_{OUT} = 10% V_S	—	0.5	—	mJ

Notes: 13. Device mounted on vertical 50mm x 50mm x 1.5mm FR4 single-sided PCB with 6cm² 2oz copper in free air.
14. ON-state reverse conduction, functional test only.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Protection Features

Loss of Ground Protection

The device will turn off in the case that the ground pin connection is lost and the load remains connected. It is recommended to use high ohmic input resistors in the interface pins to ensure that the device is turned off by limiting the current in the paths from the ground pin, through the input and diagnostic enable ESD diodes, to the external driving circuits.

Undervoltage Protection

The device will not turn on if the V_S supply voltage is below the minimum operating voltage $V_{S(OP)}$ where protection functions may not be operational. If the device is already on then the supply voltage has to drop to below the undervoltage threshold $V_{S(UV)}$ to turn the output off. 0 shows the undervoltage mechanism.

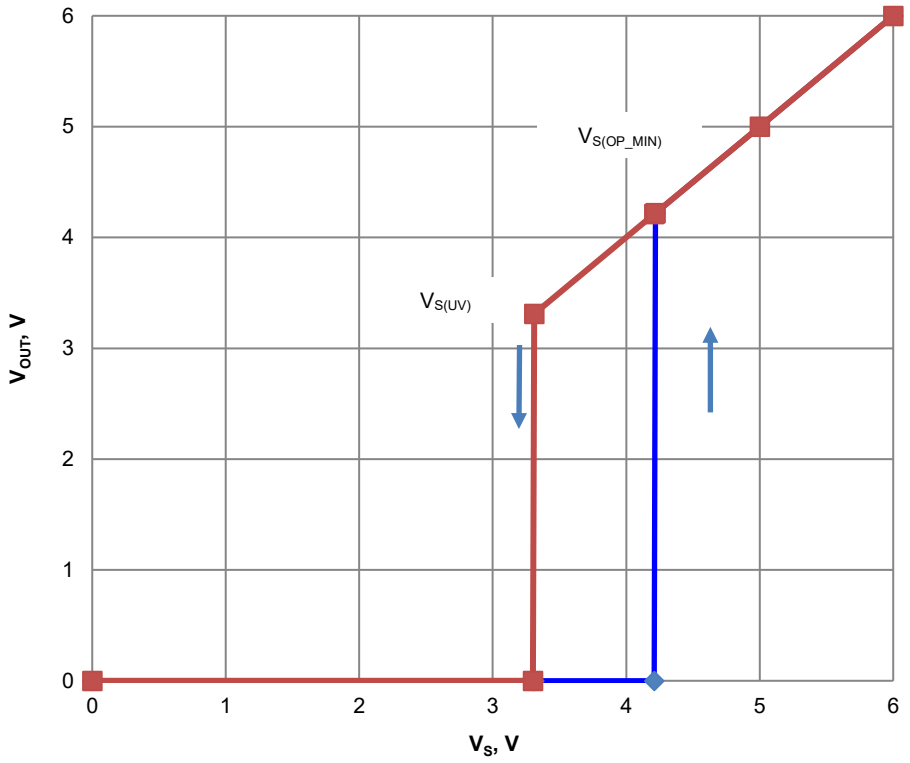


Figure 9. Undervoltage Behaviour

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Protection Features (continued)

Overvoltage Protection

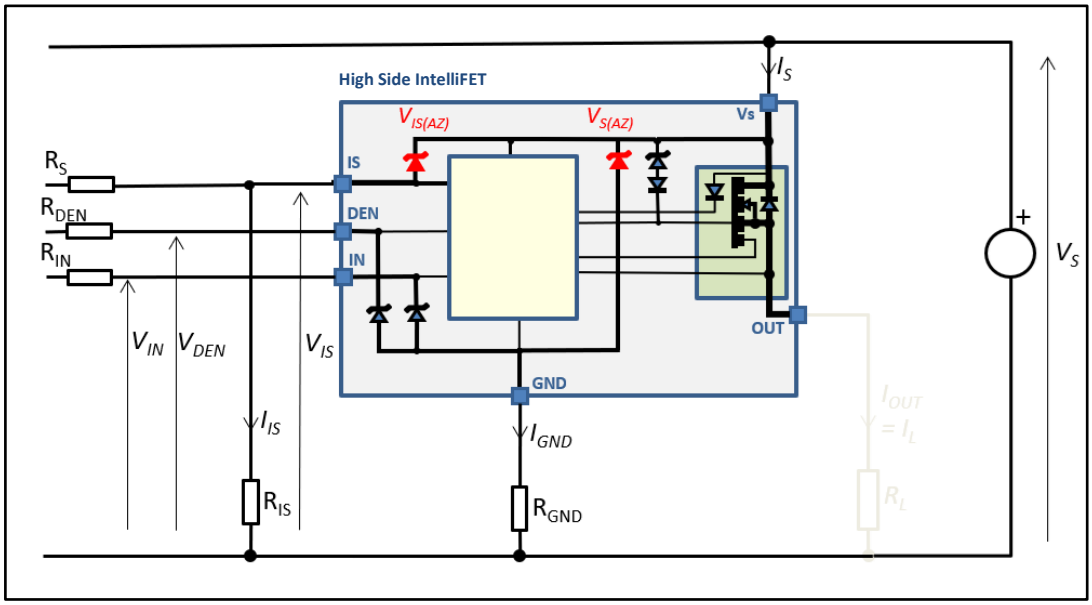


Figure 10. Overvoltage Clamping Circuit

The GND pin has an active protection clamp, operating much as a low noise high voltage Zener device, to protect it from overvoltage for high V_S transients. During V_S transient overvoltage the voltage is clamped and the excess voltage, V_S-$V_{S(AZ)}$, is applied across the ground resistor R_{GND} raising the potential on the GND pin. Additional high ohmic series resistors may be needed to prevent high V_{IN} and V_{DEN} being applied directly to the driving circuits.

The IS pin also has an active protection clamp and during V_S transient overvoltage the voltage is clamped and excess voltage, V_S-$V_{IS(AZ)}$, is applied across the sense resistor R_{IS}. An additional high ohmic series resistor may be needed in the application to prevent high V_{IS} being applied directly to the application monitoring circuit.

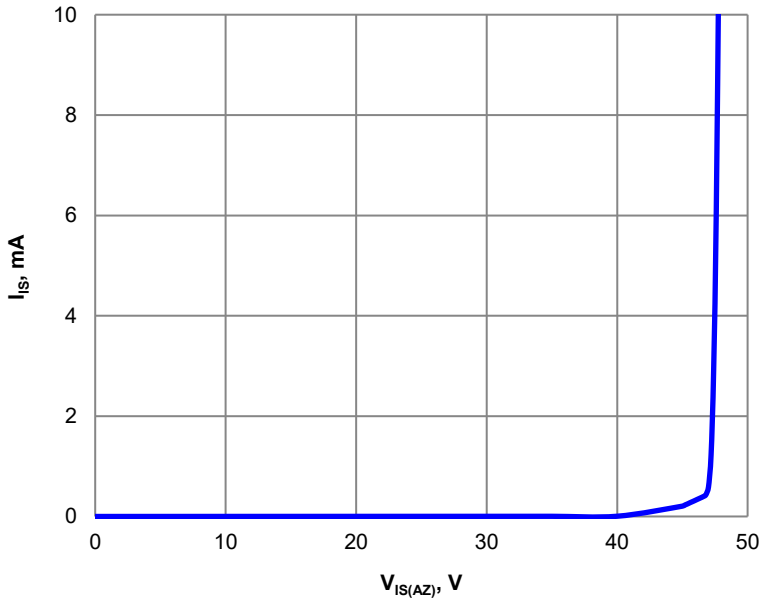


Figure 11. Typical IS Overvoltage Clamp Characteristic

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Protection Features (continued)

Overvoltage Protection (continued)

Also during V_S overvoltage transient the voltage V_S-OUT is clamped and the excess voltage, V_S-$V_{DS(AZ)}$, is applied across the load R_L. V_S-OUT is the same clamp described under the earlier section *Output Inductive Load Clamp*.

Reverse-Battery Protection

During reverse battery the output body diode is conducting current limited by the load itself resulting in power dissipation and the current in the ground and logic inputs has to be limited by external resistor components. No operating functions are available in this condition.

Overload Protection

During overload the output current is limited to a value depending on the V_{DS} voltage resulting in high dissipation in the output power stage. Sustained operation in this mode will raise the internal junction temperature ($T_{J(MOS)}$) until dynamic or absolute overtemperature protection cycling begins. There is a dynamic ($\Delta T_{J(SW)}$) and an absolute ($T_{J(SC)}$) temperature sensor. Figure 12 gives a sketch of overload protection.

If the temperature rise of the power stage versus the cooler control area exceeds $\Delta T_{J(SW)}$ then the device will be turned off until the rise falls to a reset level. Each cycle causes the absolute temperature to increase a little.

If the absolute temperature reaches $T_{J(SC)}$ then the device will be turned off until the absolute temperature falls by $\Delta T_{J(SC)}$. The device will continue to cycle to $T_{J(SC)}$ as long as the fault condition remains.

The IS pin outputs $I_{IS(FAULT)}$ during load current limitation, during dynamic overtemperature cycling, and absolute overtemperature cycling.

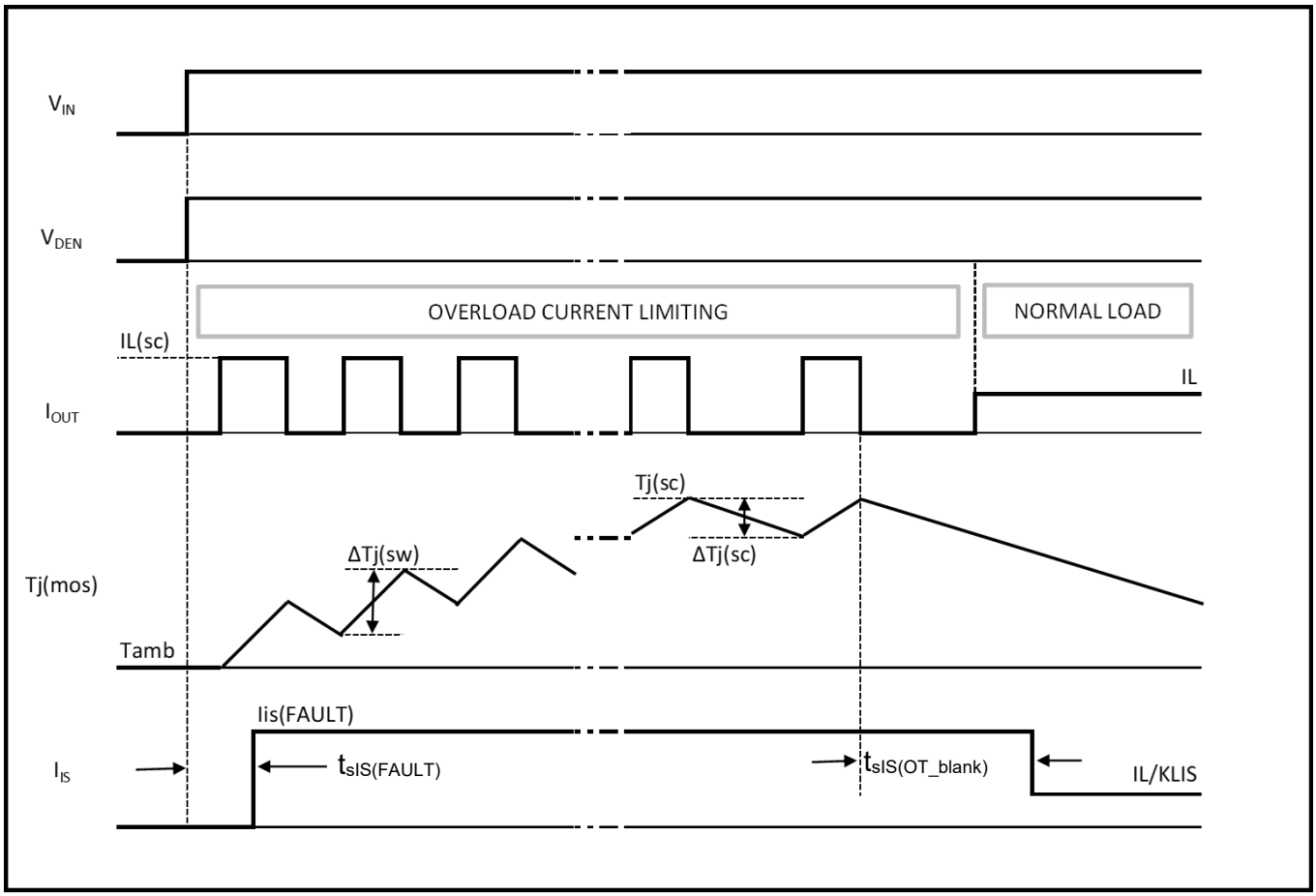


Figure 12. Overload Protection Diagram

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Protection Electrical Characteristics

(Unless otherwise specified: 8V < V_S < 18V, -40°C < T_J < +150°C; typical values based on V_S = 13.5V, T_J = +25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Loss of Ground Protection						
$I_{OUT(GND)}$	Output Leakage Current (Note 15)	V_S = 28V GND disconnected	—	0.1	—	mA
Reverse-Battery Protection						
$V_{DS(REV)}$	Reverse Output Voltage (Note 16)	I_L = -4A, T_J = 150°C	0.2	0.65	0.7	V
Overvoltage Protection						
$V_{S(AZ)}$	VS to GND Clamping	I_S = 5mA	41	47	53	V
Overload Protection						
$I_{L5(SC)}$	Load Current Limit	V_{DS} = 5V	50	52	58	A
$I_{L28(SC)}$	Load Current Limit (Note 15)	V_{DS} = 28V	—	23	—	A
$I_{L(RMS)}$	Load Current During Overtemperature Cycling (Note 15)	R_{SHORT} = 0.1Ω L_{SHORT} = 5µH	—	5	—	A
$\Delta T_{J(SW)}$	Dynamic Temperature Rise During Cycling (Note 17)	—	—	80	—	K
$T_{J(SC)}$	Thermal Shutdown Temperature (Note 18)	—	150	170	200	°C
$\Delta T_{J(SC)}$	Thermal Hysteresis (Notes 17, 18)	—	—	20	—	K

Notes: 15. Not subject to production test, guaranteed by design.
16. During reverse battery the body-drain diode will conduct with voltage drop $V_{DS(REV)}$.
17. Functional test only.
18. Functional test only at T_J = +150°C.

Diagnostic Functionality – Detailed Description

In normal operation the IS pin outputs a small analog sense current proportional to the main OUT current flowing in the power MOSFET. In the case where it is disabled by the DEN pin it becomes high impedance. During overload, current limit operation, overtemperature, high temperature gradient or open load in the OFF-state, the IS pin outputs a defined current $I_{IS(FAULT)}$ greater than normal sense currents for normal loads. During ON-state operation with open load, normal OFF-state, or OFF-state with inductive load ring-off current still flowing, the IS current is approximately zero.

Operating Condition	V_{IN}	V_{DEN}	V_{OUT}	IS Output Current, I_{IS}
Normal Operation	L H	H H	Z H	Z = I_L / K_{ILIS}
Current Limiting	H	H	H	$I_{IS(FAULT)}$
Short-Circuit OUT to GND	L H	H H	L L	Z $I_{IS(FAULT)}$
Overtemperature	L H	H H	Z Z	Z $I_{IS(FAULT)}$
Short-Circuit OUT to V_S	L H	H H	H H	$I_{IS(FAULT)}$ < I_L / K_{ILIS} (Note 19)
Open Load	L L H	H H H	< $V_{OL(OFF)}$ > $V_{OL(OFF)}$ H	Z $I_{IS(FAULT)}$ < $I_{IS(OL)}$ (Note 20)
Inverse Load Current	L H	H H	H H	$I_{IS(FAULT)}$ $I_{IS(OL)}$
All	X	L	X	Z

Table 2. Operational Truth Table (Note 21)

Notes: 19. A low resistance short between OUT and V_S will reduce the output current, I_L and therefore reduce the analog sense current, I_{IS}.
20. With external pullup resistor.
21. H = high level; L = low level; Z = high impedance, voltage depends on external circuit; X = don't care.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Diagnostic Diagrams

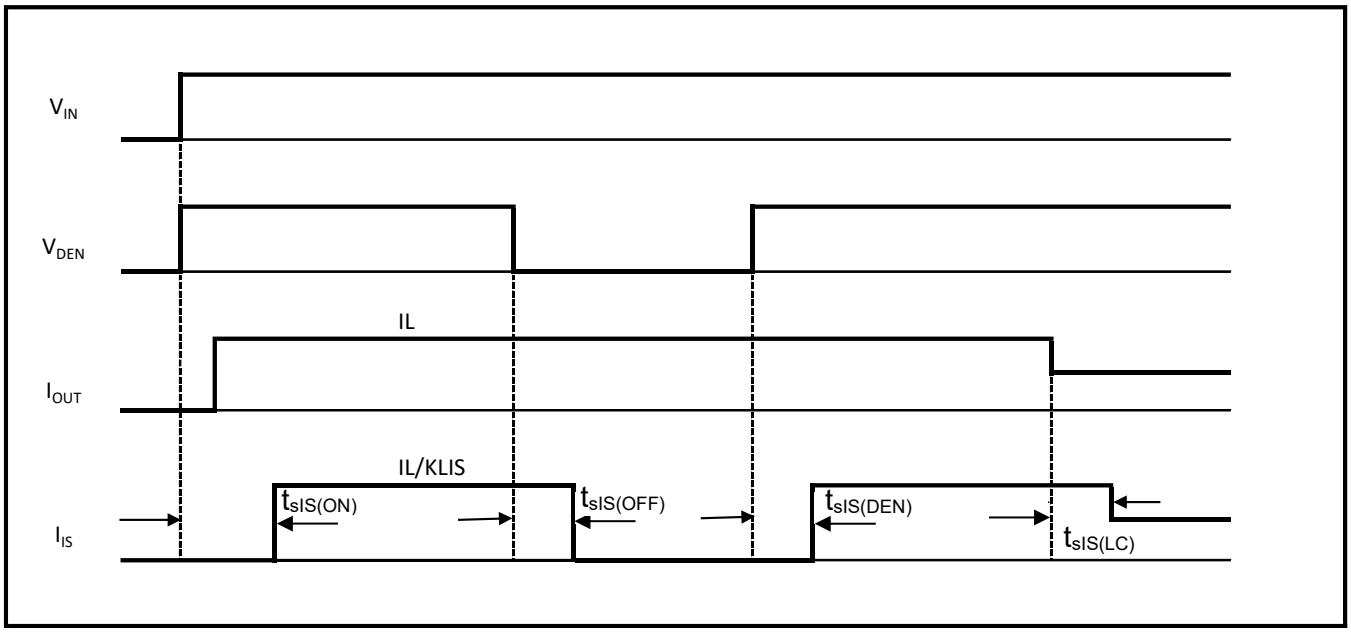


Figure 13. IS Signal Timing Diagram

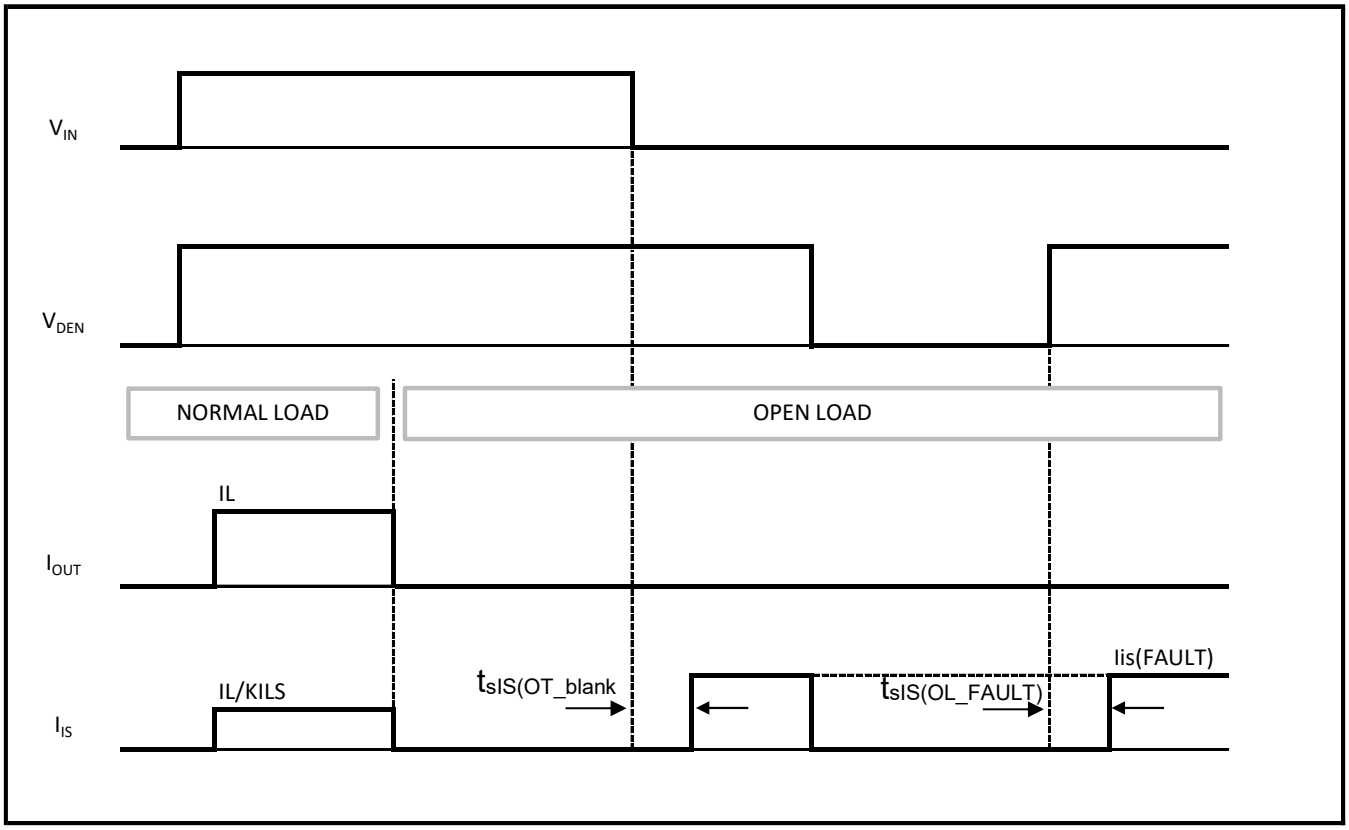


Figure 14. Open-Load Timing Diagram

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Diagnostic Electrical Characteristics

(Unless otherwise specified: 8V < V_S < 18V, -40°C < T_J < +150°C; typical values based on V_S = 13.5V, T_J = +25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Open-Load Detection						
$V_{DS(OL)}$	Open-Load OFF-State Detection Voltage	V_{IN} = 0V, V_{DEN} = 4.5V	3.5	—	5.2	V
$I_{L(OL)}$	Open-Load ON-State Detection Current	V_{IN} = V_{DEN} = 4.5V $I_{IS(OL)}$ = 5.6µA	5	—	30	mA
Current Sense Pin						
$I_{IS(DIS)}$	Current Sense Leakage Current	V_{IN} = 4.5V, V_{DEN} = 0V I_L = 7A	—	—	1	µA
$V_{IS(SAT)}$	VS to IS Saturation Voltage	V_{IN} = 0V, V_{DEN} = 4.5V I_{IS} = 6mA, V_{OUT} = V_S > 10V	—	—	3	V
$I_{IS(FAULT)}$	Current Sense under Fault Conditions	V_{IN} = V_{IS} = 0V, V_{DEN} = 4.5V V_{OUT} = V_S > 10V	6	15	35	mA
$V_{IS(AZ)}$	VS to IS Clamp Voltage	I_{IS} = 5mA	41	47	53	V
Load Current Sense						
K_{ILIS0}	Sense Current Ratio I_L = 50mA	V_{IN} = V_{DEN} = 4.5V	-50%	2300	+50%	—
K_{ILIS1}	Sense Current Ratio I_L = 0.5A		-20%	2650	+20%	
K_{ILIS2}	Sense Current Ratio I_L = 2A		-8%	2260	+8%	
K_{ILIS3}	Sense Current Ratio I_L = 4A		-6.5%	2200	+6.5%	
K_{ILIS4}	Sense Current Ratio I_L = 7A		-5.5%	2200	+5.5%	
ΔK_{ILIS}	Sense Current Ratio Variation I_L = 4A vs. I_L = 2A		-6%	—	+6%	
Diagnostic Timings						
$t_{sIS(ON)}$	Current Sense Settling Time to 90% I_{IS} after IN and DEN High	V_S = 13.5V, V_{IN} = V_{DEN} = 4.5V I_L = 4A, R_{IS} = 1.2kΩ	—	—	250	µs
$t_{sIS(DEN)}$	Current Sense Settling Time to 90% I_{IS} after DEN High	V_S = 13.5V, V_{IN} = 4.5V I_L = 4A, R_{IS} = 1.2kΩ	—	—	20	µs
$t_{sIS(LC)}$	Current Sense Settling Time to 90% I_{IS} after Load Current Change	V_S = 13.5V, V_{IN} = V_{DEN} = 4.5V I_L = 2A to 4A, R_{IS} = 1.2kΩ	—	—	20	µs
$t_{sIS(OL_FAULT)}$	Diagnostic Fault Current Settling Time to 90% $I_{IS(FAULT)}$ after DEN High with OFF-State Open-Load Condition	V_{IN} = 0V, V_{OUT} = V_S = 13.5V R_{IS} = 1.2kΩ	—	—	150	µs
$t_{sIS(FAULT)}$	Diagnostic Fault Current Settling Time to 90% $I_{IS(FAULT)}$ after IN and DEN High with Overload Condition	V_{DS} = 5V, R_{IS} = 1.2kΩ	—	—	250	µs
$t_{sIS(OT_blank)}$	Diagnostic Fault Current Off Delay Time to 90% $I_{IS(FAULT)}$ after Overtemperature Condition Returning to Normal Operation (Note 22)	V_{IN} = V_{DEN} = 4.5V R_{IS} = 1.2kΩ	—	150	—	µs
$t_{sIS(OFF)}$	Current Sense Fall Time to < 50% I_{IS} after DEN Low	V_{IN} = 4.5V, I_L = 4A R_{IS} = 1.2kΩ	—	—	30	µs

Note: 22. Not subject to production test, guaranteed by design.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Input Pins

The input circuit is compatible with 3.3V and 5V logic levels. The input diode provides ESD protection. If the pin is left open the internal tie down resistor will keep the output off. A Schmitt trigger provides switching hysteresis to avoid an undefined state if there is a slowly rising or falling voltage on the IN pin. Figure 15 shows the electrical equivalent circuit.

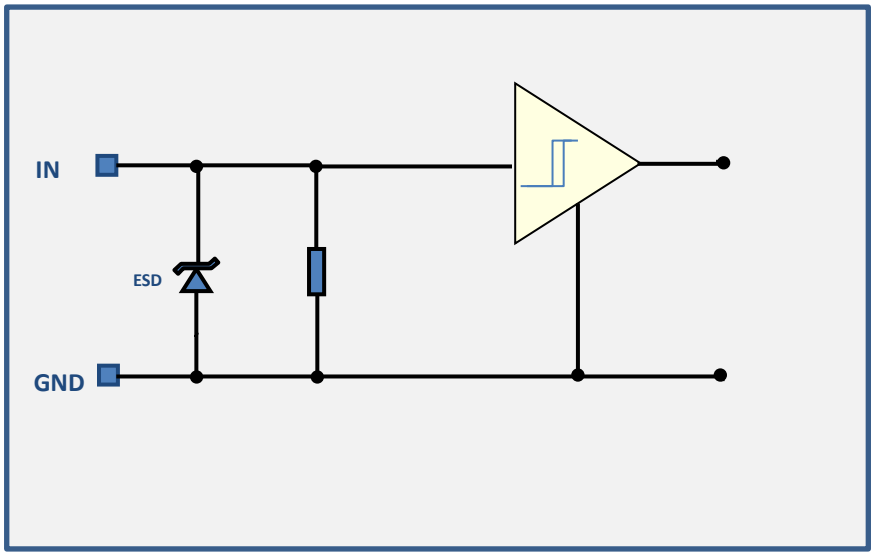


Figure 15. Input Pin Circuitry

The DEN pin has the same circuitry as the IN pin above.

Input Electrical Characteristics

(Unless otherwise specified: 8V < V_S < 18V, -40°C < T_J < +150°C; typical values based on V_S = 13.5V, T_J = +25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IN Pin						
$V_{IN(L)}$	Low-Level Input Voltage	—	-0.3	—	0.8	V
$V_{IN(H)}$	High-Level Input Voltage	—	2	—	6	V
$V_{IN(HYS)}$	Input Voltage Hysteresis	—	—	0.25	—	V
$I_{IN(L)}$	Low-Level Input Current	V_{IN} = 0.8V	1	3	25	µA
$I_{IN(H)}$	High-Level Input Current	V_{IN} = 5.5V	2	8	25	µA
DEN Pin						
$V_{DEN(L)}$	Low-Level Input Voltage	—	-0.3	—	0.8	V
$V_{DEN(H)}$	High-Level Input Voltage	—	2	—	6	V
$V_{DEN(HYS)}$	Input Voltage Hysteresis	—	—	0.25	—	V
$I_{DEN(L)}$	Low-Level Input Current	V_{DEN} = 0.8V	1	3	25	µA
$I_{DEN(H)}$	High-Level Input Current	V_{DEN} = 5.5V	2	8	25	µA

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – General Product

Minimum Functional Supply Voltage

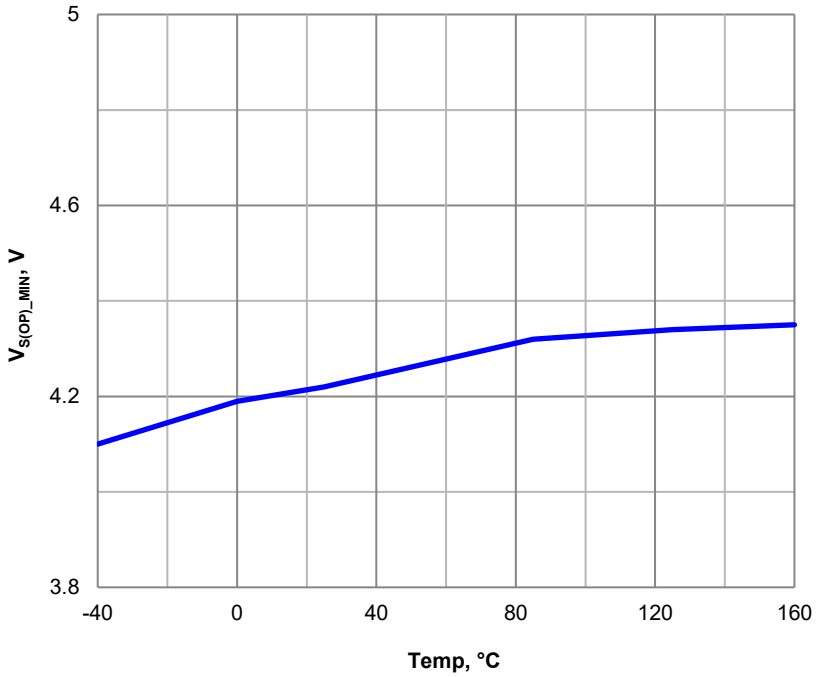


Figure 16. Minimum Functional Supply Voltage $V_{S(OP_MIN)} = f(T_J)$

Undervoltage Shutdown

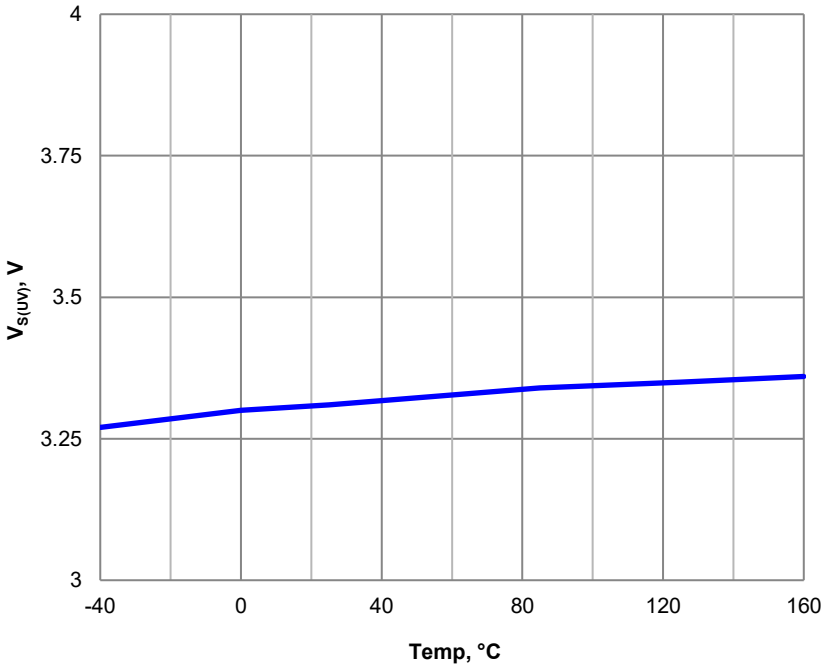


Figure 17. Undervoltage Shutdown $V_{S(UV)} = f(T_J)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – General Product (continued)

Current Consumption Channel Active

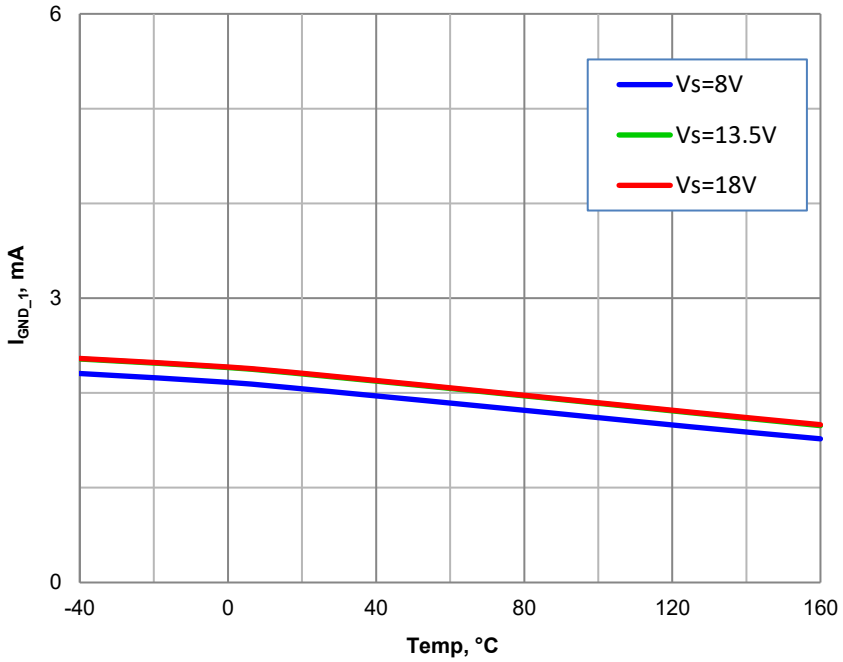


Figure 18. Current Consumption for Whole Device with Load, Channel Active $I_{GND} = f(T_J;V_S)$

Standby Current for Whole Device with Load

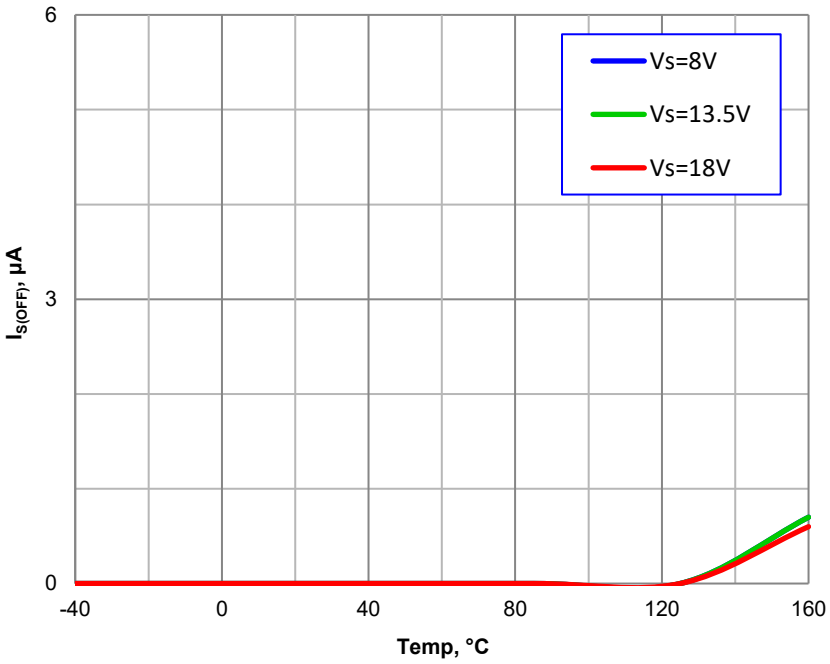


Figure 19. Standby Current for Whole Device with Load $I_{S(OFF)} = f(T_J;V_S)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Power Stage

Output Voltage Drop Limitation at Low Load Current

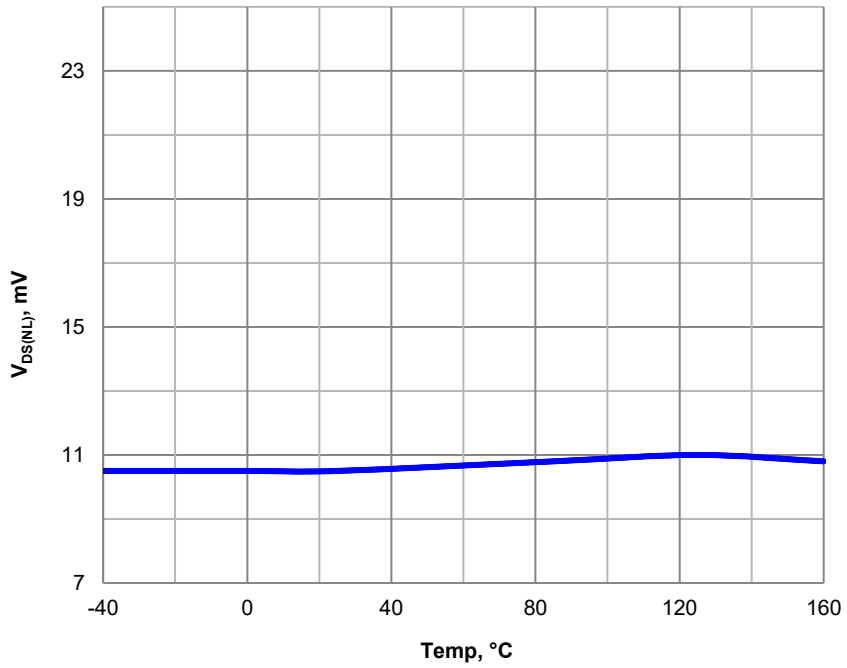


Figure 20. Output Voltage Drop Limitation at Low Load Current $V_{DS(NL)} = f(T_J)$, I_{Load} = 50mAf

Drain to Source Clamp Voltage

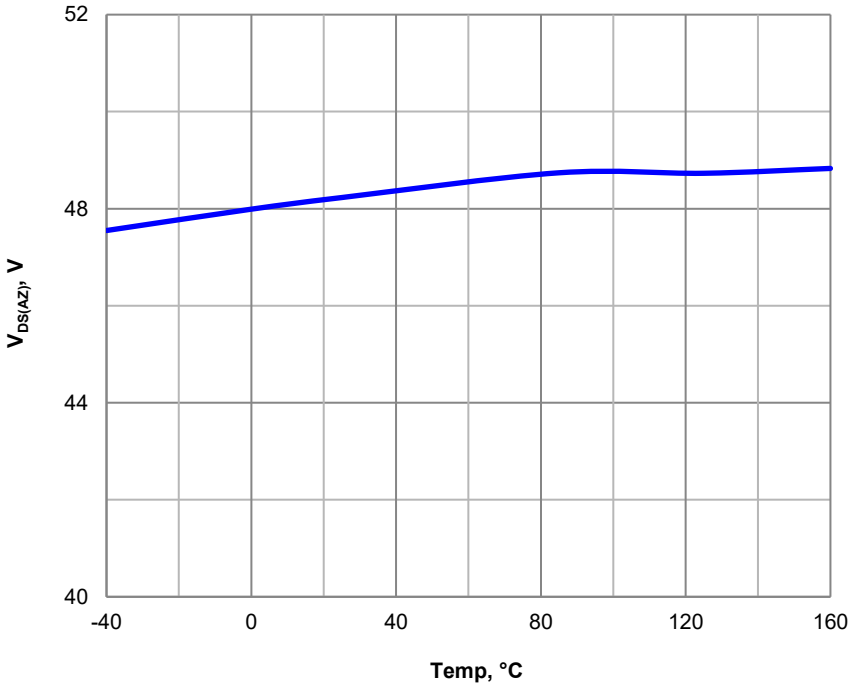


Figure 21. Drain to Source Clamp Voltage $V_{DS(AZ)} = f(T_J)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Power Stage (continued)

Slew Rate at Turn-ON

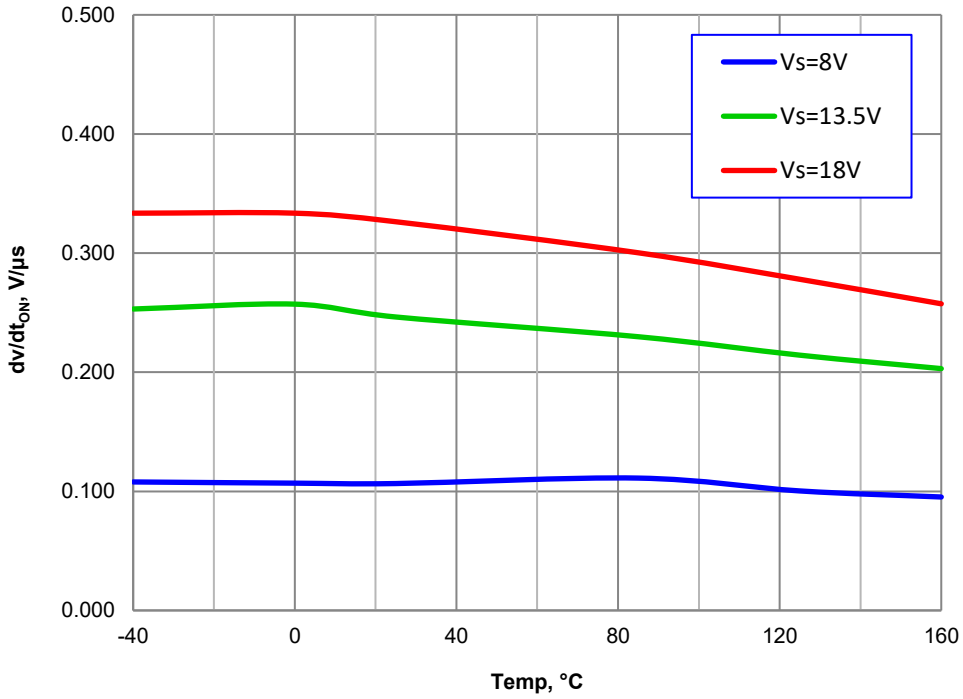


Figure 22. Slew Rate at Turn-ON $dv/dt_{ON} = f(T_J;V_S)$, $R_L = 4\Omega$

Slew Rate at Turn-OFF

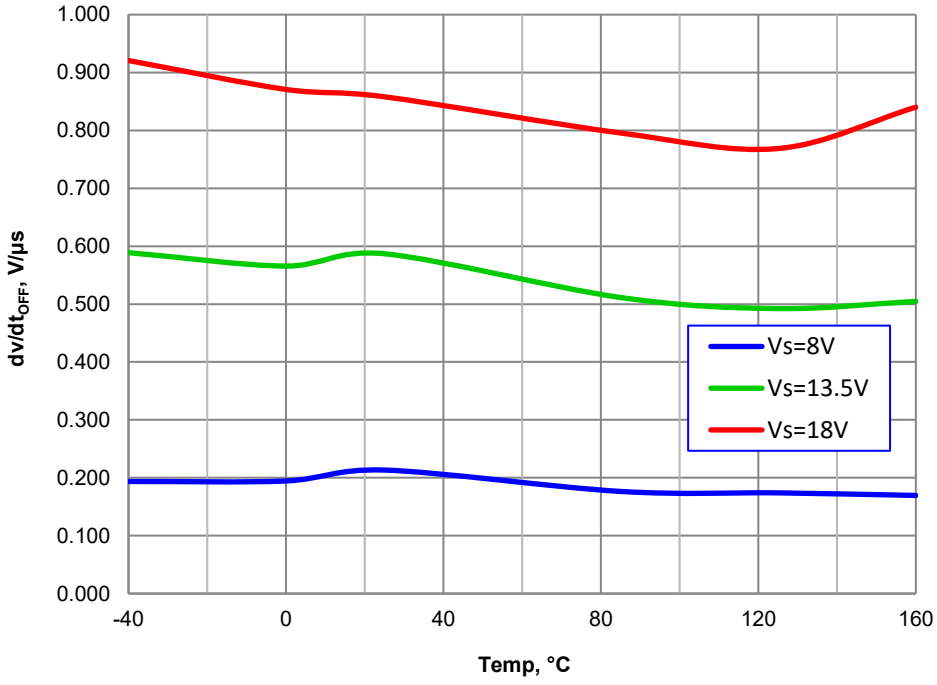


Figure 23. Slew Rate at Turn OFF $dv/dt_{OFF} = f(T_J;V_S)$, $R_L = 4\Omega$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Power Stage (continued)

Turn-ON Time

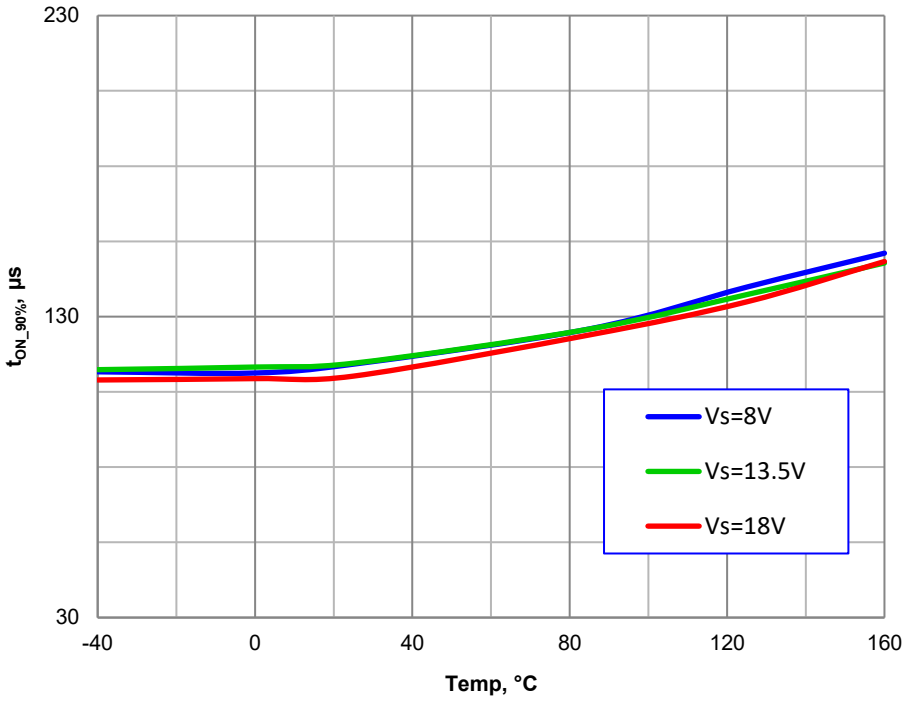


Figure 24. Turn-ON $t_{ON} = f(T_J;V_S)$, $R_L = 4\Omega$

Turn-OFF Time

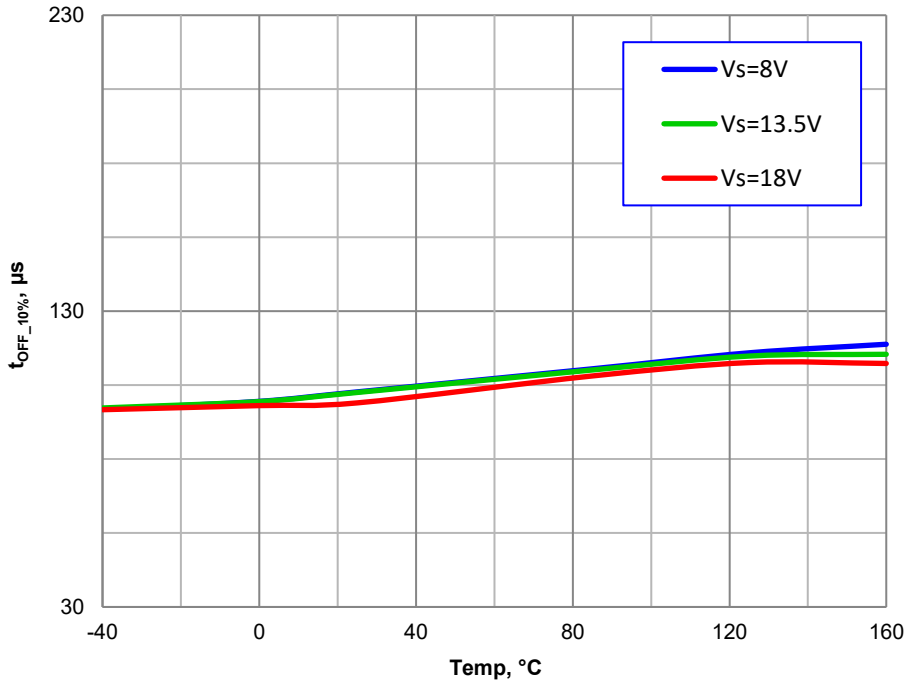


Figure 25. Turn-OFF $t_{OFF} = f(T_J;V_S)$, $R_L = 4\Omega$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Power Stage (continued)

Switch-ON Energy

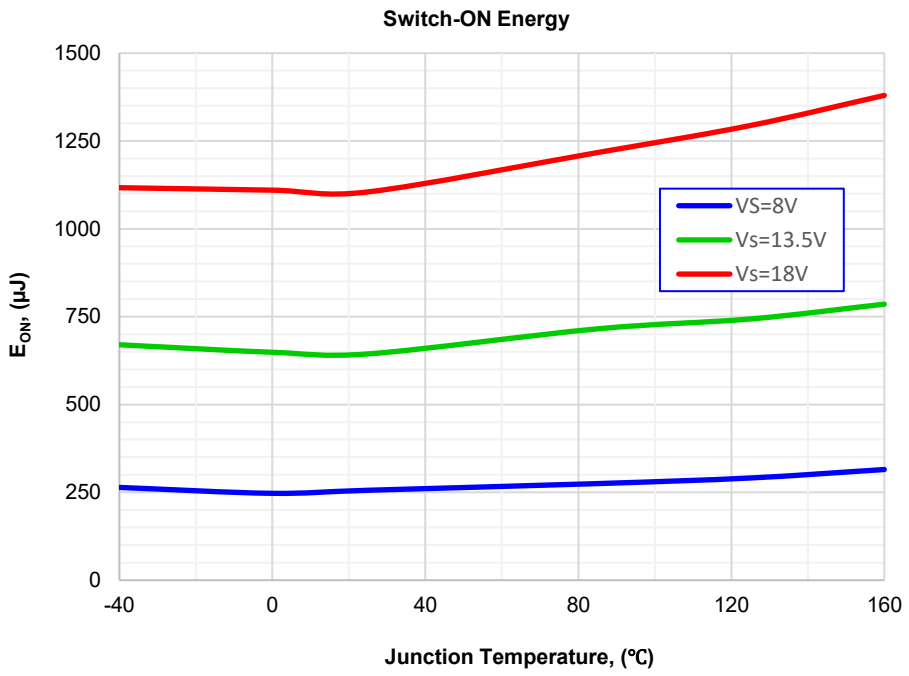


Figure 26. Switch ON Energy $E_{ON} = f(T_J;V_S)$, $R_L = 4\Omega$

Switch-OFF Energy

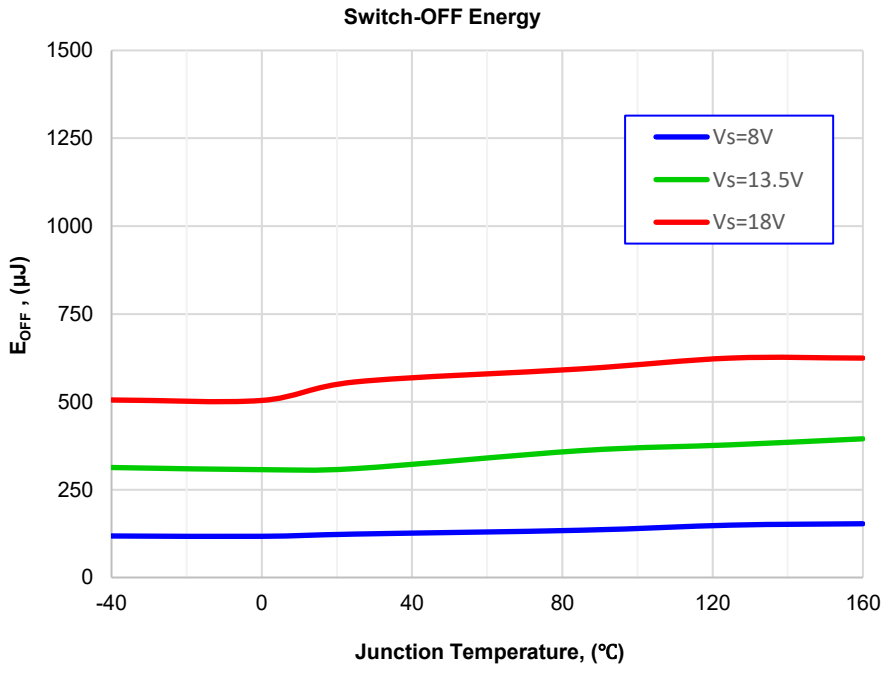


Figure 27. Switch OFF Energy $E_{OFF} = f(T_J;V_S)$, $R_L = 4\Omega$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Protection

Overload Condition with Low Output Voltage Drop

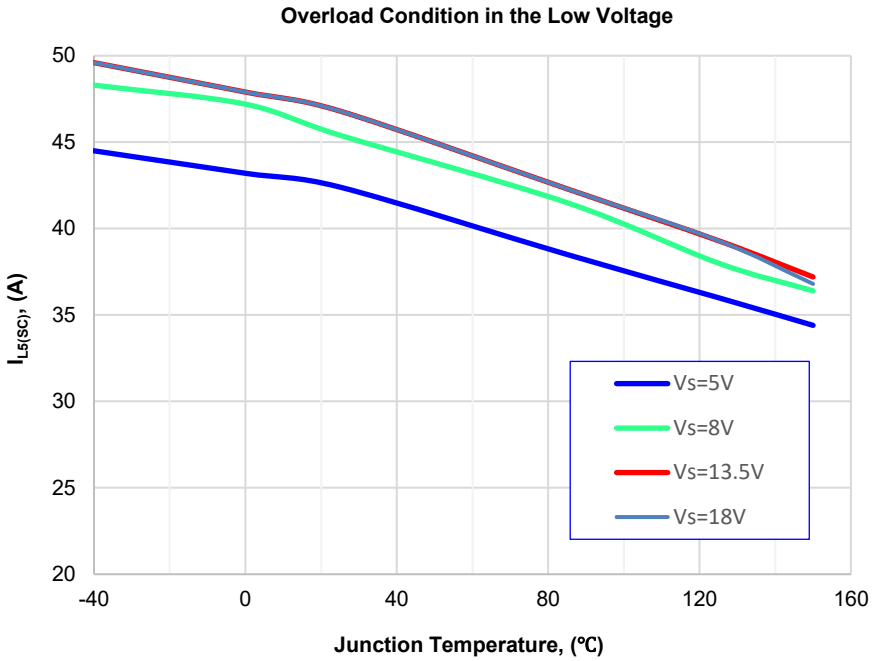


Figure 28. Overload Condition with Low Output Voltage Drop $I_{L5(SC)} = f(T_J)$

Overload Condition with High Output Voltage Drop

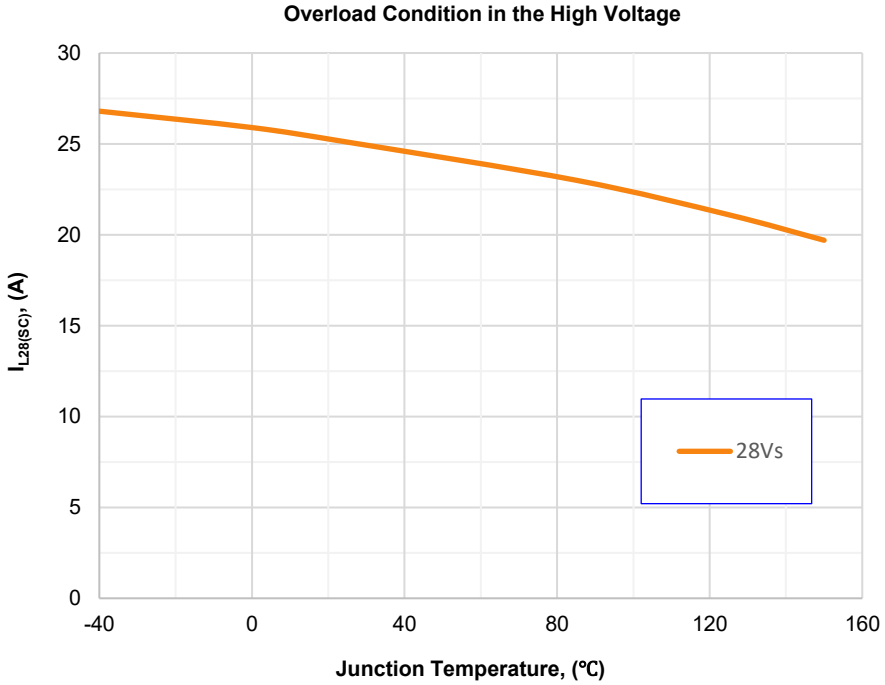


Figure 29. Overload Condition with High Output Voltage Drop $I_{L28(SC)} = f(T_J)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Diagnostic Mechanism

Current Sense at No Load

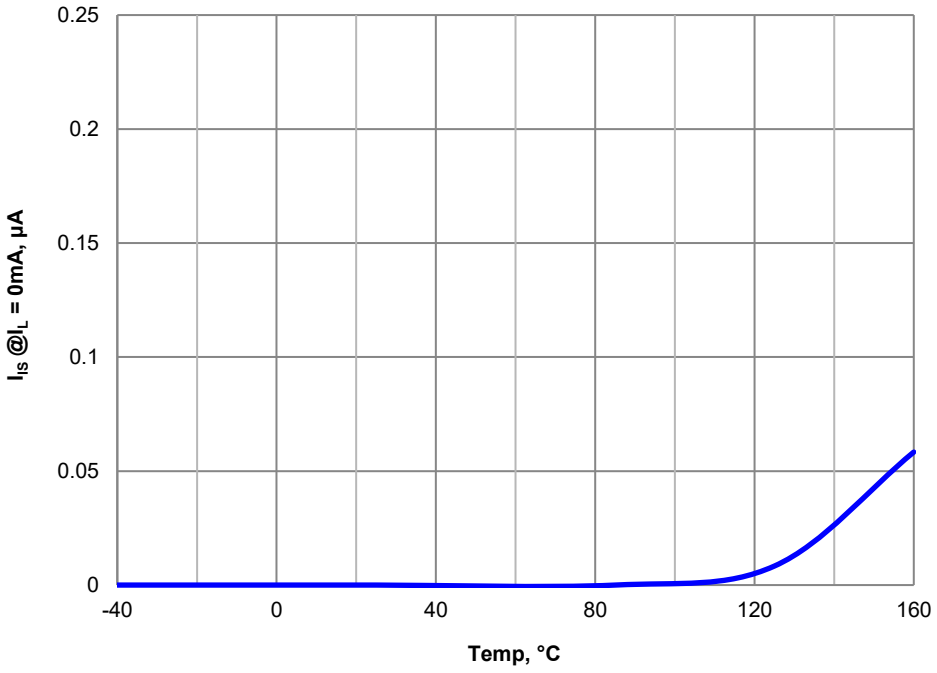


Figure 30. Current Sense at No Load $I_{IS} = f(T_J)$

Open-Load Detection Threshold in ON State

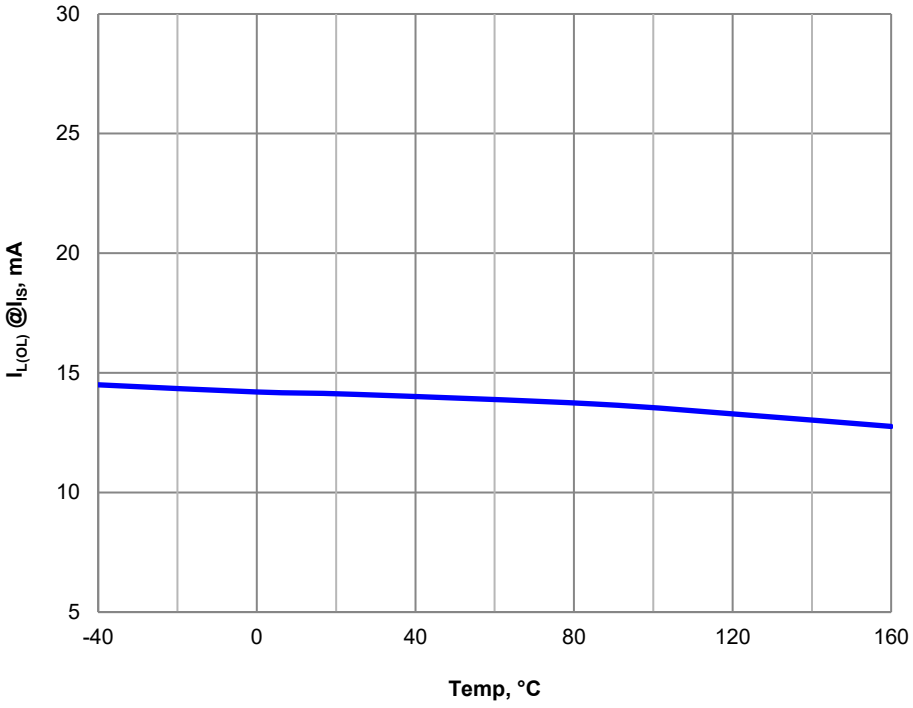


Figure 31. Open-Load Detection ON-State Threshold $I_{L(OL)} = f(T_J)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Diagnostic Mechanism (continued)

Sense Signal Maximum Voltage

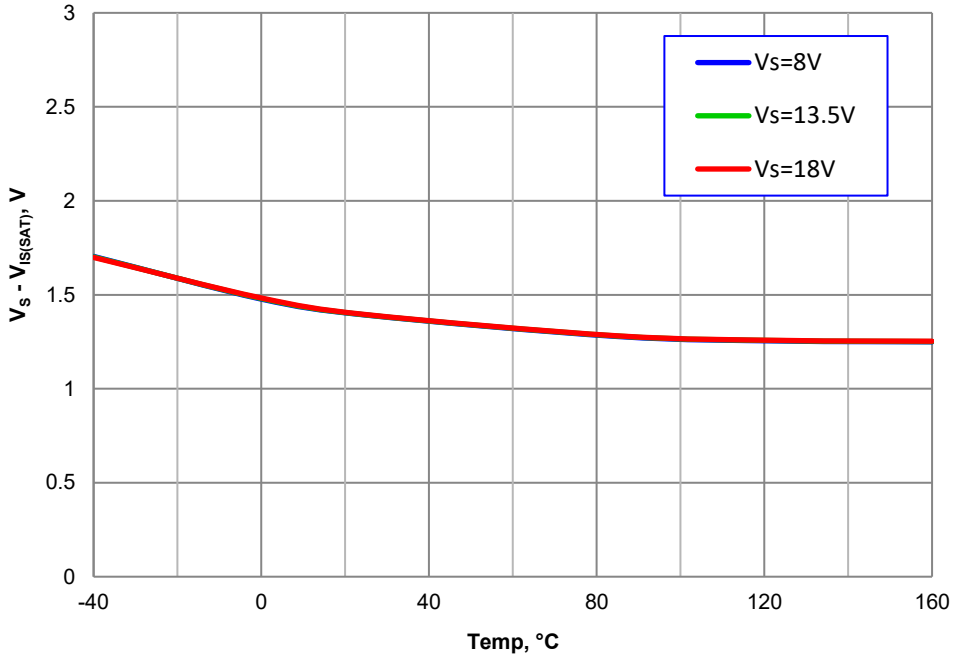


Figure 32. Sense Signal Maximum Voltage $V_{IS(SAT)} = f(T_J;V_S)$

Sense Signal Maximum Current

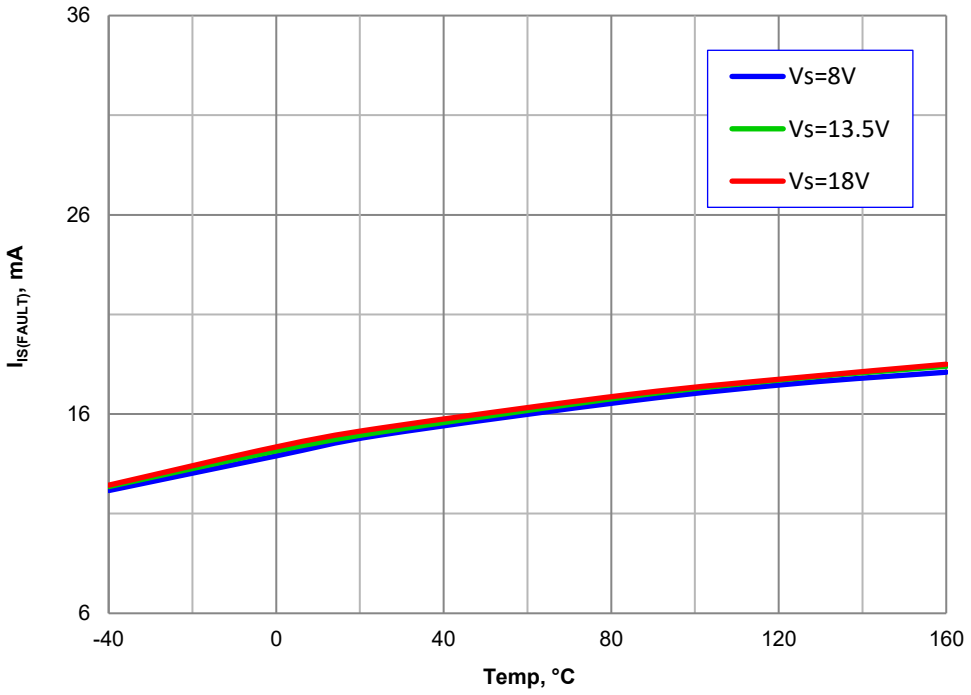


Figure 33. Sense Signal Maximum Current in Fault Condition $I_{IS(FAULT)} = f(T_J;V_S)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Input Pins

Input Voltage Threshold ON to OFF

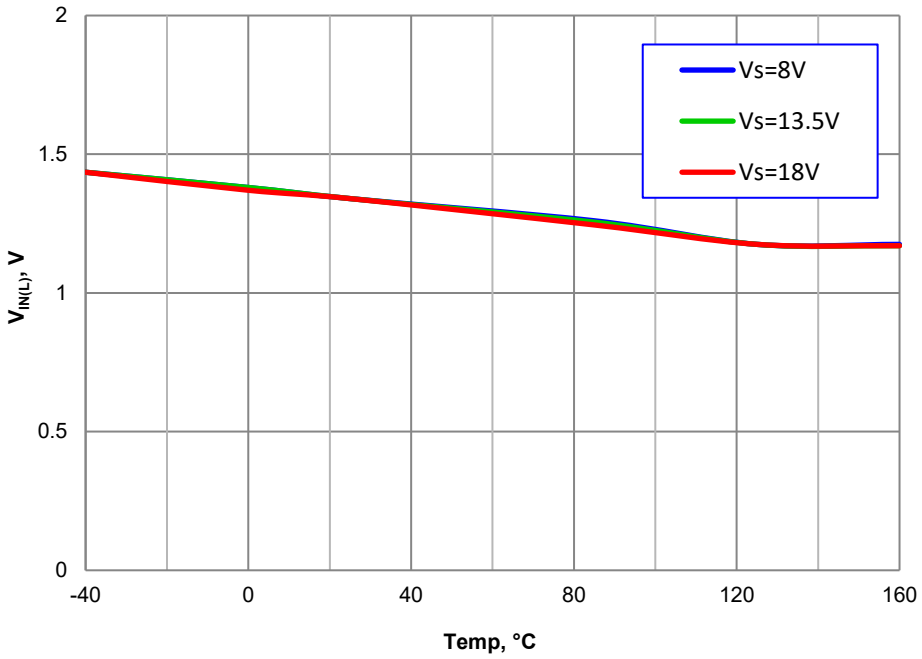


Figure 34. Input Voltage Threshold $V_{IN(L)} = f(T_J;V_S)$

Input Voltage Threshold OFF to ON

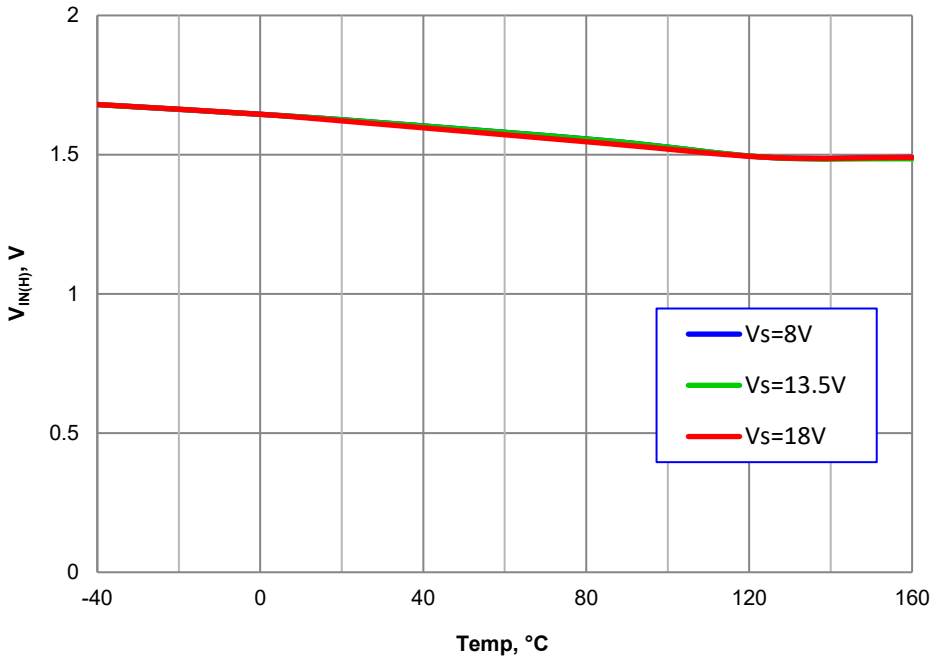


Figure 35. Input Voltage Threshold $V_{IN(H)} = f(T_J;V_S)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Characterisation – Input Pins (continued)

Input Voltage Hysteresis

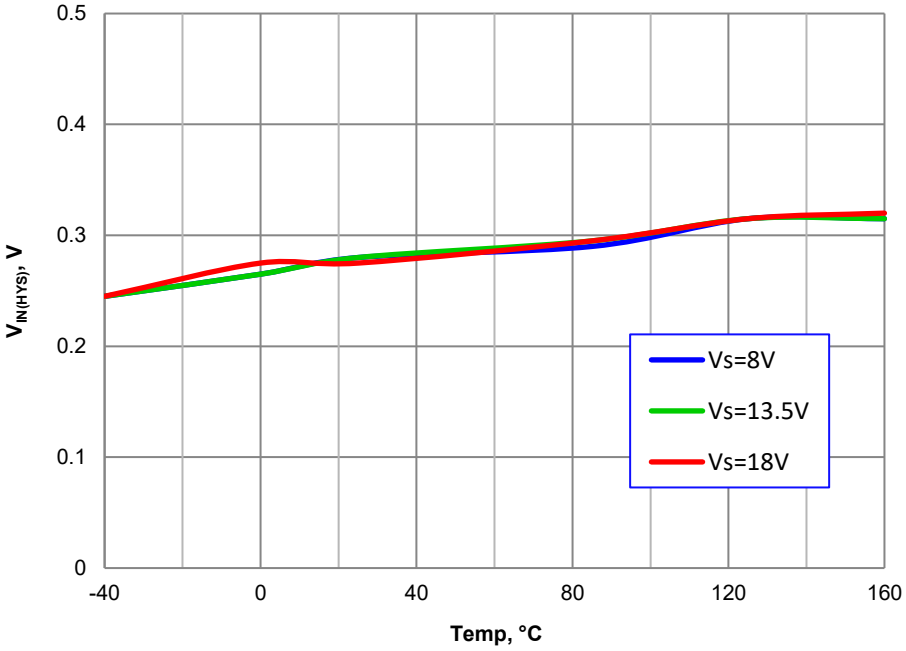


Figure 36. Input Voltage Hysteresis $V_{IN(HYS)} = f(T_J;V_S)$

Input Current High Level

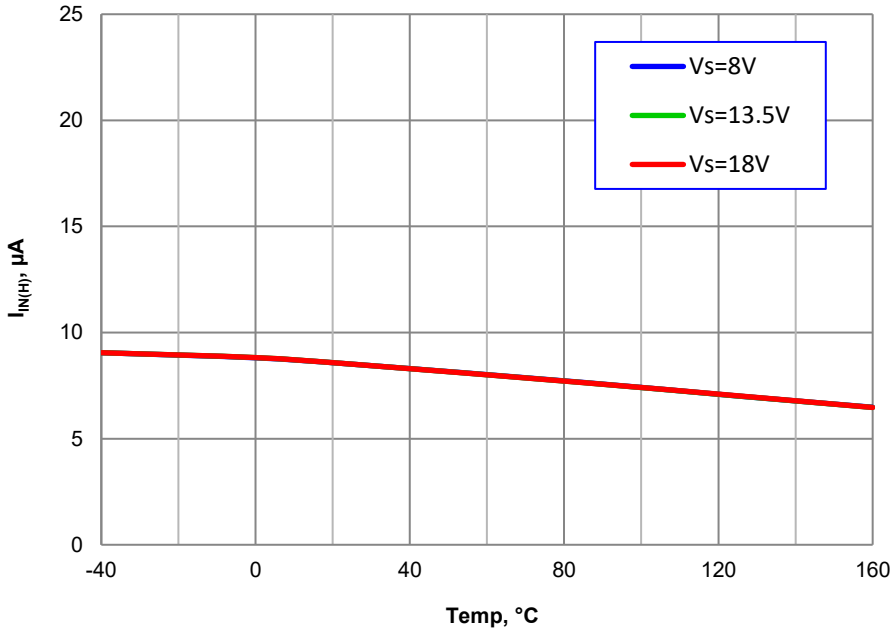


Figure 37. Input Current High Level $I_{IN(H)} = f(T_J;V_S)$

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Application Information (Note 23)

Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device:

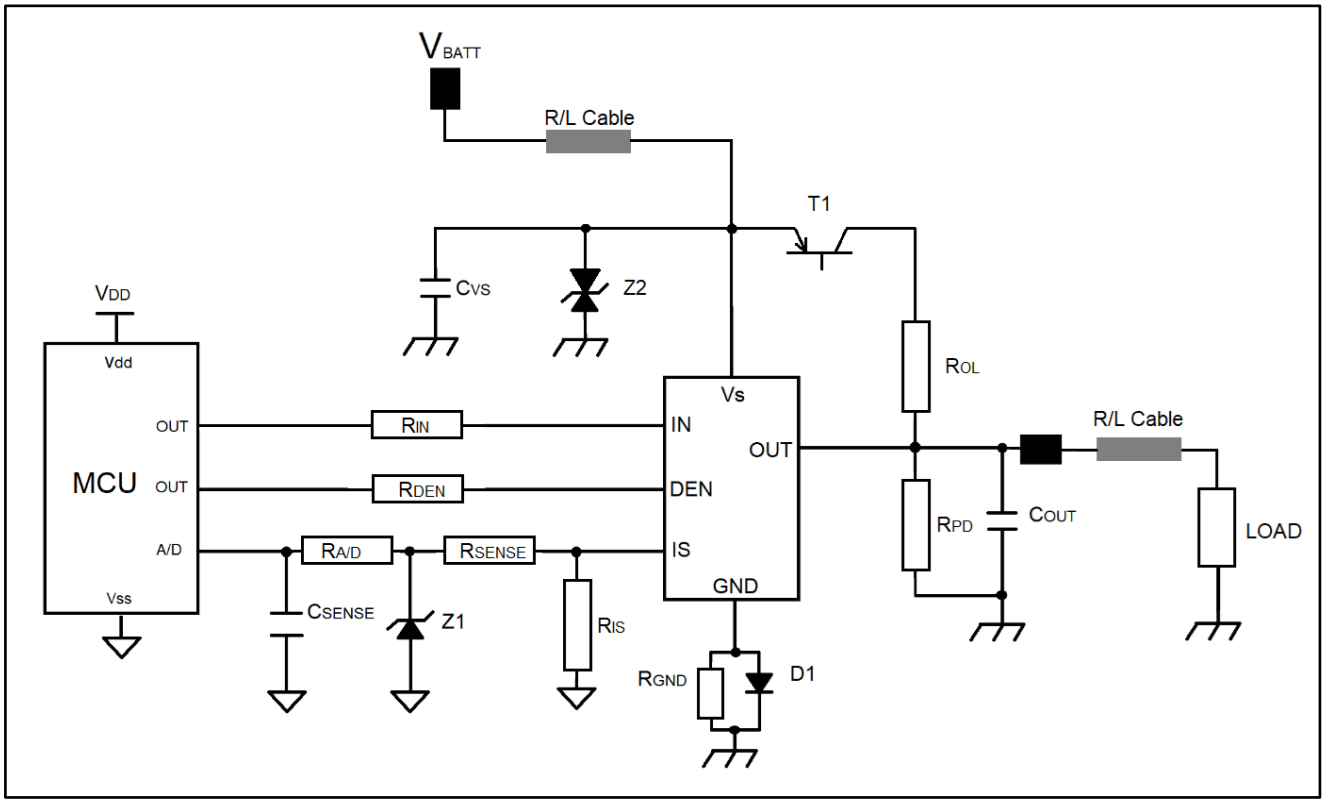


Figure 38. Application Circuit Diagram

Note: 23. This is a simplified example of an application circuit. The function must be verified in the real application.

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Application Information (continued)

Reference	Value	Purpose
R_{IN}	4.7kΩ	Connect to the micro controller for overvoltage, reverse-polarity protections
R_{DEN}	4.7kΩ	Connect to the micro controller for overvoltage, reverse-polarity protections
R_{PD}	47kΩ	Improve immunity to electromagnetic noise
R_{IS}	1.2kΩ	Sense resistor
R_{SENSE}	4.7kΩ	Overvoltage, reverse polarity, loss of ground. Value to be tuned with micro controller specification
R_{OL}	1.5kΩ	For open load in OFF diagnostic
$R_{A/D}$	4.7kΩ	Protection for the micro controller during overvoltage, reverse polarity
R_{GND}	1kΩ	To keep the device GND at a stable potential during clamping
D1	BAS21	Protection of the device during reverse polarity
Z1	7V Zener diode	Protection of the micro controller during overvoltage
Z2	36V Zener diode	Protection of the device during overvoltage
T1	BC 807	Switch the battery voltage for open load in OFF diagnostic
C_{SENSE}	100pF	Sense signal filtering
C_{VS}	100nF	Filtering of the voltage spikes on the battery line
C_{OUT}	4.7nF	Protection of the device during ESD and BCI

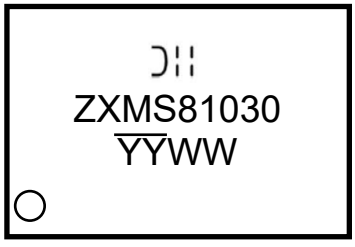
Table 3. Bill of Materials

Ordering Information (Note 24)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
ZXMS81030SPQ-13	SO-8EP (Type E)	ZXMS81030	13	12	2500	Reel

Note: 24. For packaging details, please visit our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information



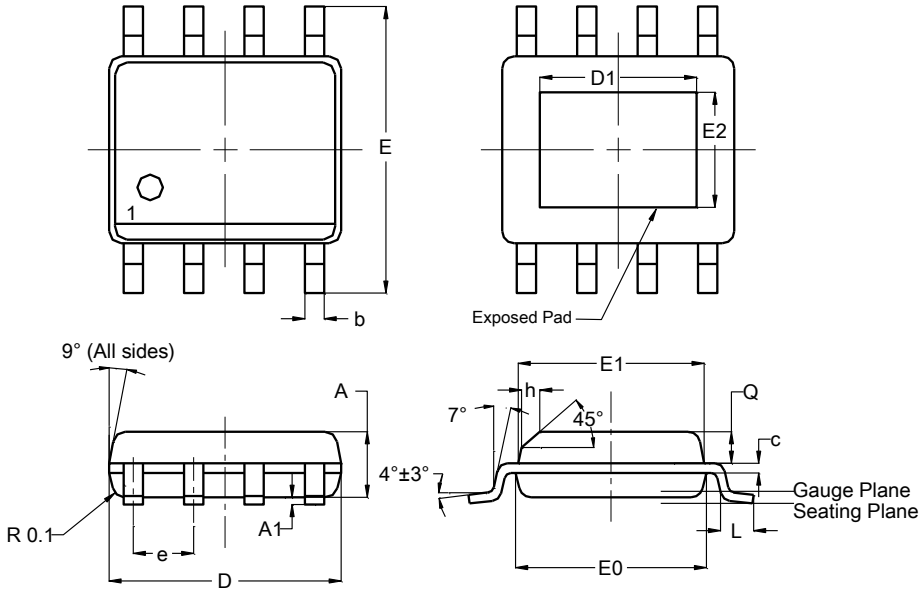
: Manufacturer's Code Marking
ZXMS81030: Product Type Marking Code
YY or $\overline{YY}$: Year (ex: 26 = 2026)
WW or $\overline{WW}$: Week 01 to 52;
52 represents week 52 and 53

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SO-8EP (Type E)

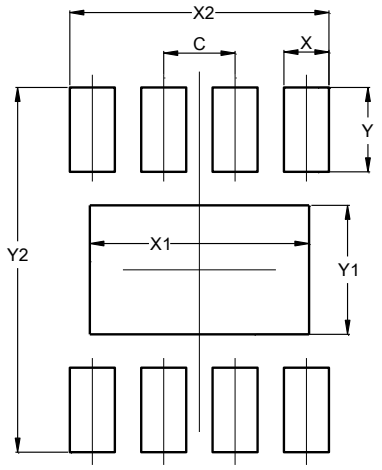


SO-8EP (Type E)			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.50	1.45
A1	0.00	0.13	--
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
D1	2.65	3.75	3.70
E	5.90	6.10	6.00
E0	3.85	3.95	3.90
E1	3.80	3.90	3.85
E2	2.05	2.15	2.10
e	--	--	1.27
h	--	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SO-8EP (Type E)



Dimensions	Value (in mm)
C	1.270
X	0.802
X1	3.900
X2	4.612
Y	1.505
Y1	2.300
Y2	6.500

Mechanical Data

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.08 grams (Approximate)

© 2026 Copyright Diodes Incorporated. All Rights Reserved.

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

The Diodes logo is a registered trademark of Diodes Incorporated in the United States and other countries.
All other trademarks are the property of their respective owners.
© 2026 Diodes Incorporated. All Rights Reserved.

www.diodes.com

© 2026 Copyright Diodes Incorporated. All Rights Reserved.