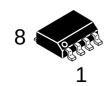
N 84045



SOIC 8
CASE 751 07
STYLE 11

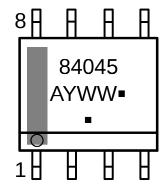
Features

Typical Applications

FEATURE SUMMARY

R_{DSon} (typical) T_J = 25°C	R_{ON}	50	mΩ
Output Current Limit (typical)	I_{lim}	32	A
OFF−state Supply Current (max)	$I_{D(off)}$	0.5	µA

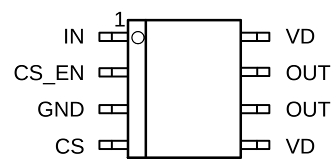
MARKING DIAGRAM



84045 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NCV84045DR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

BLOCK DIAGRAM & PIN CONFIGURATION

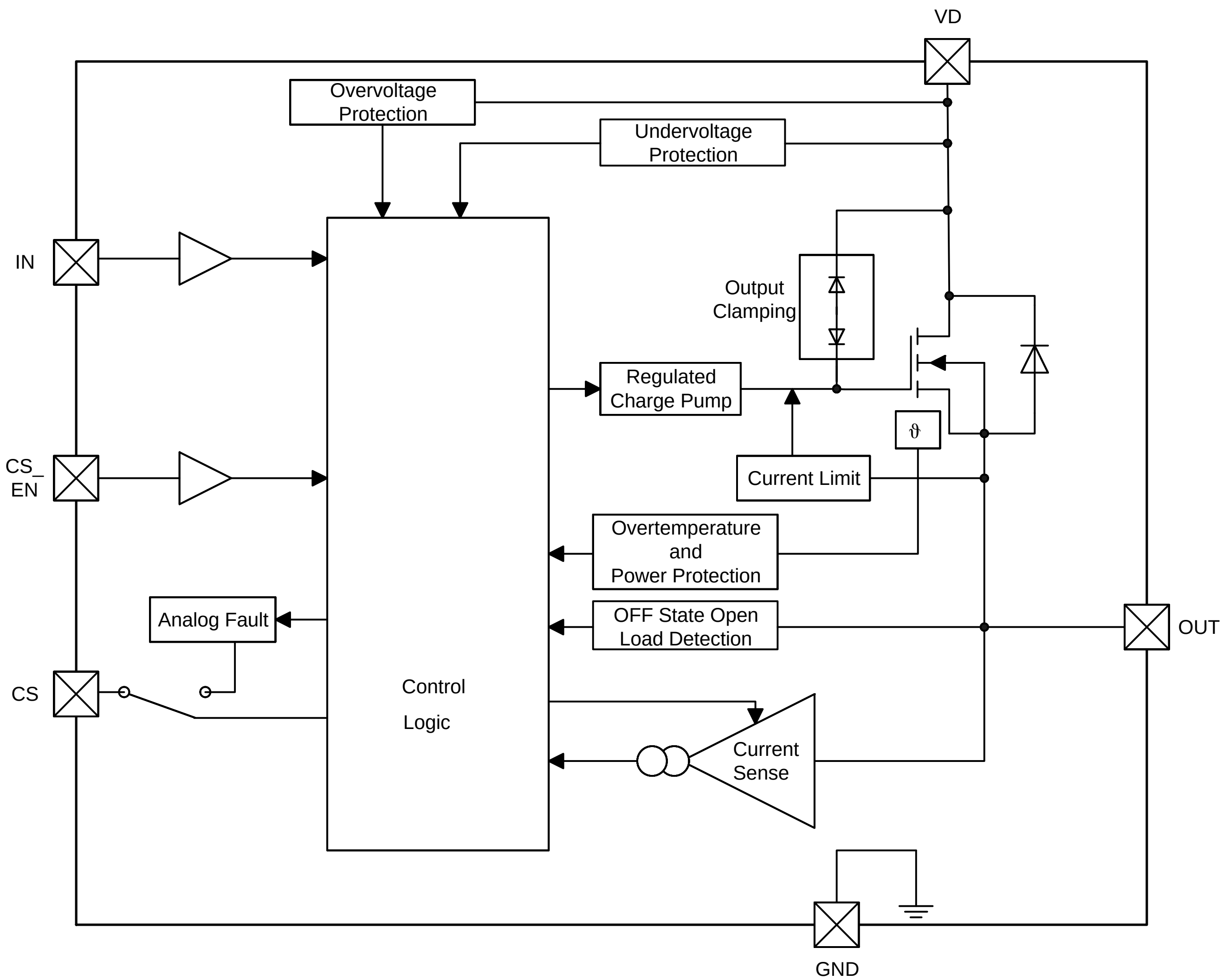
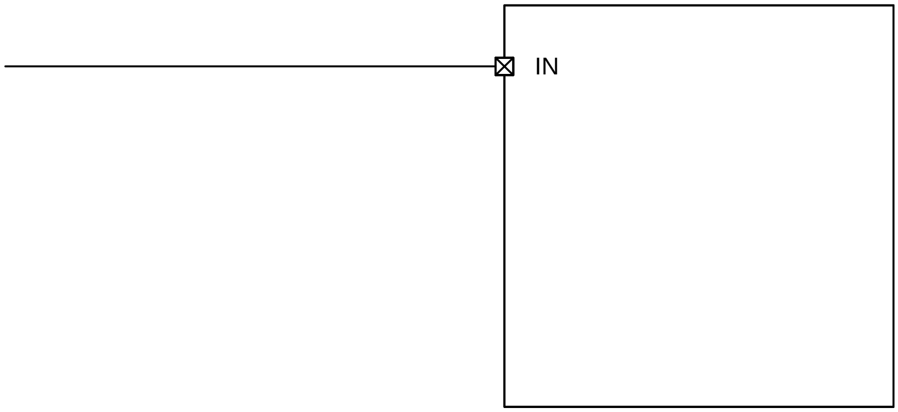


Figure 1. Block Diagram

Table 1. SO8 PACKAGE PIN DESCRIPTION

Pin #	Symbol	Description
1	IN	Logic Level Input
2	CS_EN	Current Sense Enable
3	GND	Ground
4	CS	Analog Current Sense Output
5	V_D	Supply Voltage
6	OUT	Output
7	OUT	Output
8	V_D	Supply Voltage


IN

ELECTRICAL CHARACTERISTICS (7 V ≤ V_D ≤ 28 V; −40°C < T_J < 150°C unless otherwise specified)

Table 5. POWER

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Operating Supply Voltage	V_D		4	–	28	V
Undervoltage Shutdown	V_{UV}		–	3.5	4	V
Undervoltage Shutdown Hysteresis	V_{UV_hyst}		–	0.4	–	V
On Resistance	R_{ON}	I_{OUT} = 3.5 A, T_J = 25°C	–	50	–	mΩ
		I_{OUT} = 3.5 A, T_J = 150°C	–	–	110	
		I_{OUT} = 3.5 A, V_D = 4.5 V, T_J = 25°C	–	–	105	
Supply Current (Note 7)	I_D	OFF−state: V_D = 13 V, V_{IN} = V_{OUT} = 0 V, T_J = 25°C	–	0.2	0.5	μA
		OFF−state: V_D = 13 V, V_{IN} = V_{OUT} = 0 V, T_J = 85°C (Note 8)	–	0.2	0.5	μA
		OFF−state: V_D = 13 V, V_{IN} = V_{OUT} = 0 V, T_J = 125°C	–	–	3	μA
		ON−state: V_D = 13 V, V_{IN} = 5 V, I_{OUT} = 0 A	–	1.9	3.5	mA
On State Ground Current	$I_{GND(ON)}$	V_D = 13 V, V_{CS_EN} = 5 V V_{IN} = 5 V, I_{OUT} = 1 A	–	–	6	mA
Output Leakage Current	I_L	V_{IN} = V_{OUT} = 0 V, V_D = 13 V, T_J = 25°C	–	–	0.5	μA
		V_{IN} = V_{OUT} = 0 V, V_D = 13 V, T_J = 125°C	–	–	3	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

7. Includes PowerMOS leakage current.
8. Not subjected to production testing.

Table 6. LOGIC INPUTS (V_D = 13.5 V; −40°C < T_J < 150°C)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Input Voltage – Low	V_{in_low}		–	–	0.9	V
Input Current – Low	I_{in_low}	V_{IN} = 0.9 V	1	–	–	μA
Input Voltage – High	V_{in_high}		2.1	–	–	V
Input Current – High	I_{in_high}	V_{IN} = 2.1 V	–	–	10	μA
Input Hysteresis Voltage	V_{in_hyst}		–	0.2	–	V
Input Clamp Voltage	V_{in_cl}	I_{IN} = 1 mA	12	13	14	V
		I_{IN} = −1 mA	−14	−13	−12	
CS_EN Voltage – Low	V_{CSE_low}		–	–	0.9	V
CS_EN Current – Low	I_{CSE_low}	V_{CS_EN} = 0.9 V	1	–	–	μA
CS_EN Voltage – High	V_{CSE_high}		2.1	–	–	V
CS_EN Current – High	I_{CSE_high}	V_{CS_EN} = 2.1 V	–	–	10	μA
CS_EN Hysteresis Voltage	V_{CSE_hyst}		–	0.2	–	V
CS_EN Clamp Voltage	V_{CSE_cl}	I_{CS_EN} = 1 mA	12	13	14	V
		I_{CS_EN} [redacted]				

Table 7. SWITCHING CHARACTERISTICS (V_D = 13 V, −40°C < T_J < 150°C)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Turn−On Delay Time	t_{d_on}	V_{IN} high to 20% V_{OUT}, R_L = 6.5 Ω, T_J = 25°C	5	60	120	μs
Turn−Off Delay Time	t_{d_off}	V_{IN} low to 80% V_{OUT}, R_L = 6.5 Ω, T_J = 25°C	5	40	100	μs
Slew Rate On	dV_{out}/dt_{on}	20% to 80% V_{OUT}, R_L = 6.5 Ω, T_J = 25°C	0.1	0.27	0.7	V / μs
Slew Rate Off	dV_{out}/dt_{off}	80% to 20% V_{OUT}, R_L = 6.5 Ω, T_J = 25°C	0.1	0.35	0.7	V / μs
Turn−On Switching Loss (Note 9)	E_{on}	R_L = 6.5 Ω	–	0.15	0.33	mJ
Turn−Off Switching Loss (Note 9)	E_{off}	R_L = 6.5 Ω	–	0.1	0.33	mJ
Differential Pulse Skew, ($t_{(OFF)} - t_{(ON)}$) see Figure 4 (Switching Characteristics)	t_{skew}	R_L = 6.5 Ω	−50	–	50	μs

9. Not subjected to production testing.

Table 8. OUTPUT DIODE CHARACTERISTICS

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Forward Voltage	V_F	I_{OUT} = −2 A, T_J = 150°C, V_F = V_{OUT} − V_D	–	–	0.7	V

Table 9. PROTECTION FUNCTIONS (Note 10) (7 V ≤ V_D ≤ 18 V, −40°C < T_J < 150°C)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Temperature Shutdown (Note 11)	T_{SD}		150	175	200	°C
Temperature Shutdown Hysteresis (T_{SD} − T_R) (Note 11)	T_{SD_hyst}		–	7	–	°C
Reset Temperature (Note 11)	T_R		T_{RS}+1	T_{RS}+7	–	°C
Thermal Reset of Status (Note 11)	T_{RS}		135	–	–	°C
Delta T Temperature Limit (Note 11)	T_{DELTA}	T_J = −40°C, V_D = 13 V	–	60	–	°C
DC Output Current Limit	I_{limH}	V_D = 13 V	22	32	46	A
		4 V < V_D < 18 V	–	–	46	A
Short Circuit Current Limit during Thermal Cycling (Note 11)	$I_{limTCycling}$	V_D = 13 V T_R < T_J < T_{TSD}	–	11	–	A
Switch Off Output Clamp Voltage	V_{out_clamp}	I_{OUT} = 0.5 A, V_{IN} = 0 V, L = 20 mH	V_D − 41	V_D − 46	V_D − 52	V
Overvoltage Protection	V_{OV}	V_{IN} = 0 V, I_D = 20 mA	41	46	52	V
Output Voltage Drop Limitation	V_{DS_ON}	I_{OUT} = 0.2 A	–	20	–	mV

10. To ensure long term reliability during overload or short circuit conditions, protection and related diagnostic signals must be used together

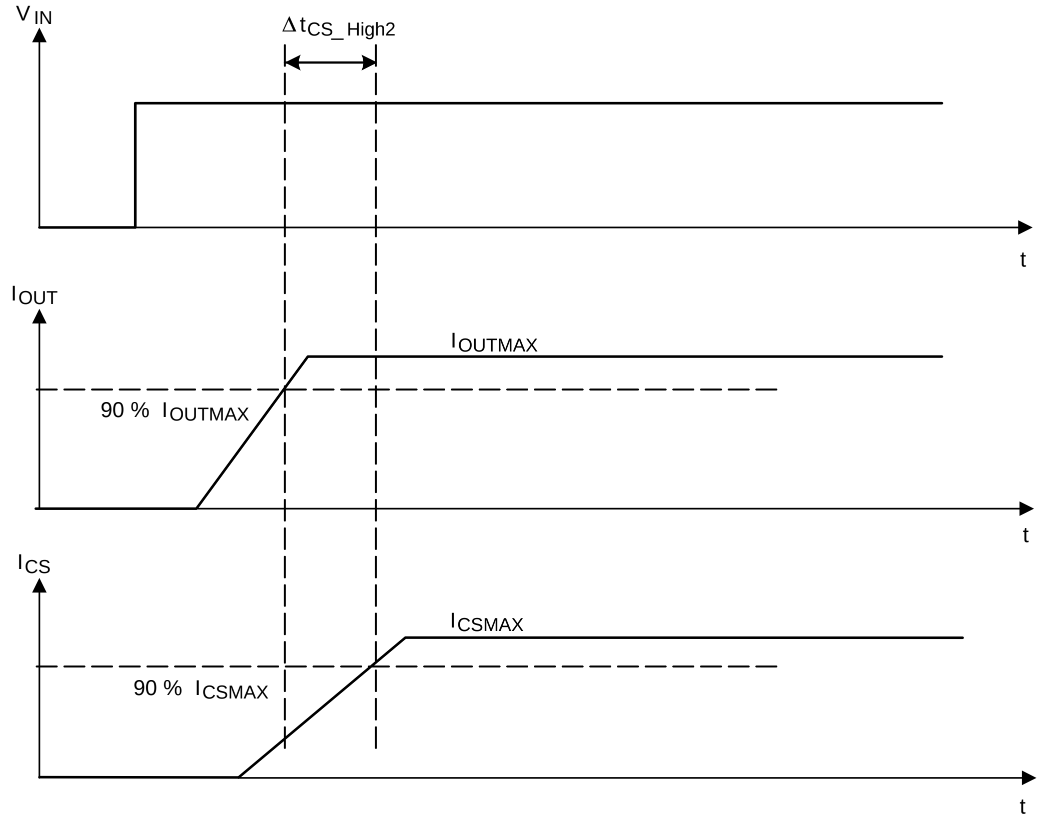


Figure 6. Delay Response from Rising Edge of IOUT and Rising Edge of CS (for CS_EN = 5V)

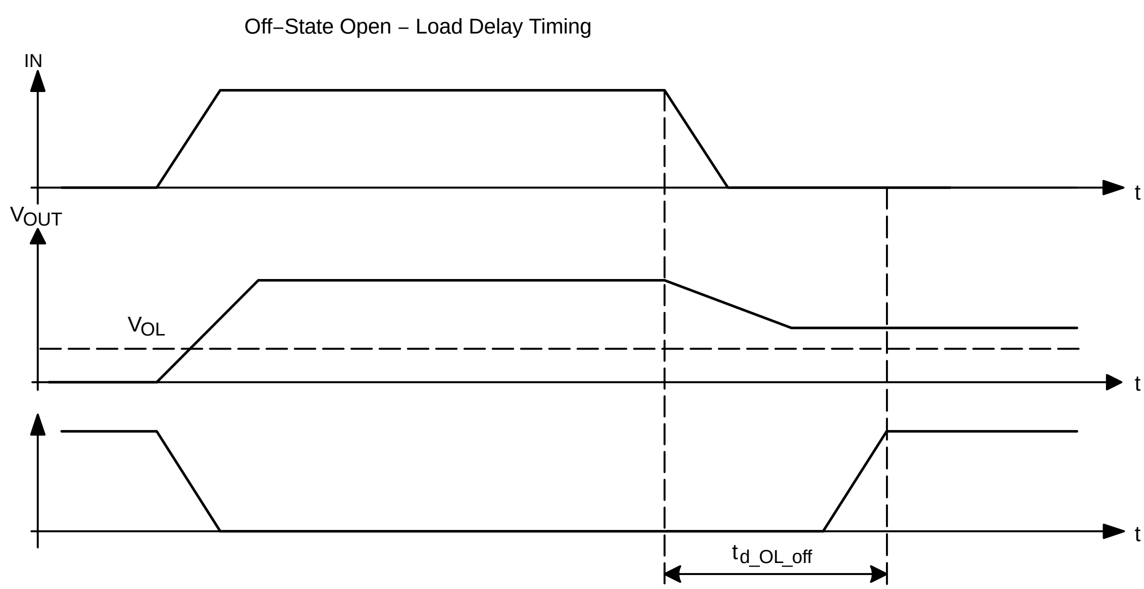
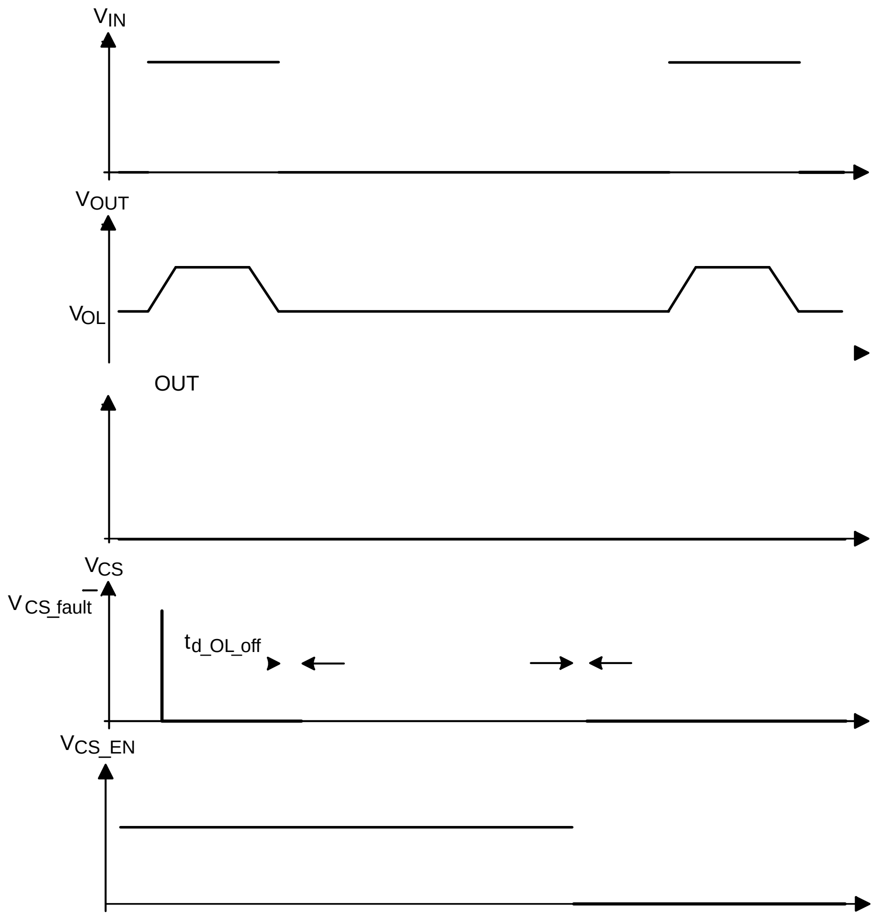


Figure 7. OFF State Open Load Flag Delay Timing



VIN
VOUT
VOL
OUT
VCS
VCS_fault
td_OL_off
VCS_EN

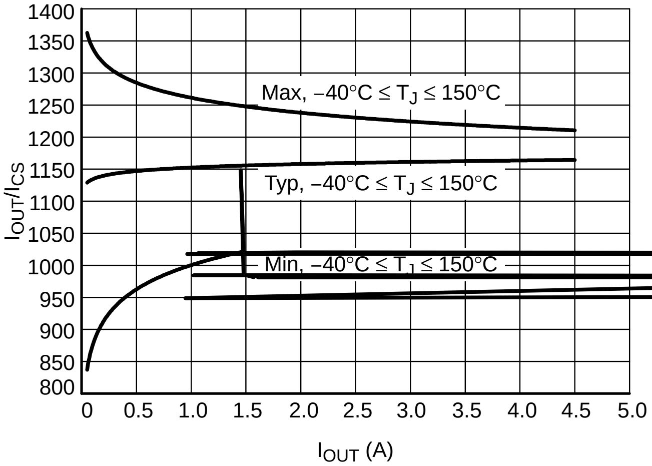


Figure 10. I_{OUT}/I_{CS} vs. I_{OUT}

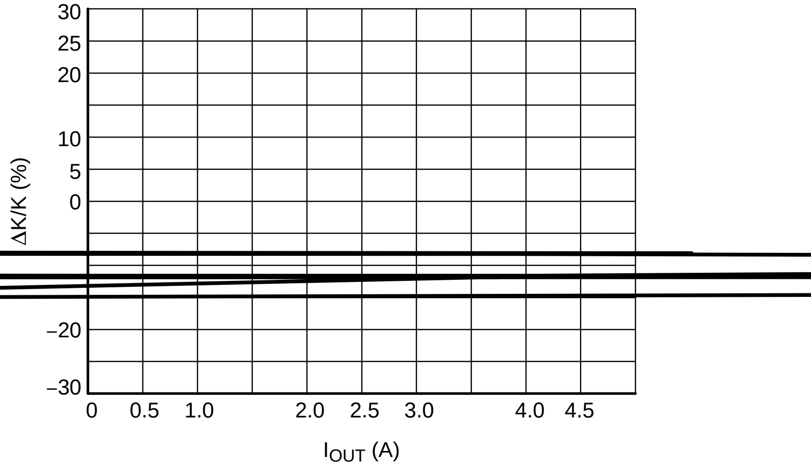


Figure 11. Maximum Current Sense Ratio Drift vs. Load Current

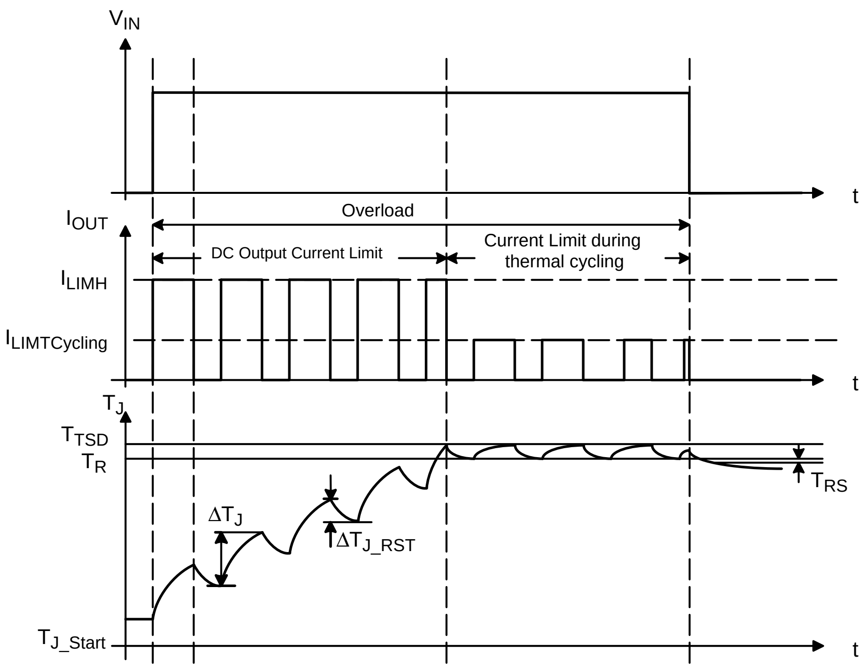


Figure 13. How T_J progresses During Short to GND or Overload

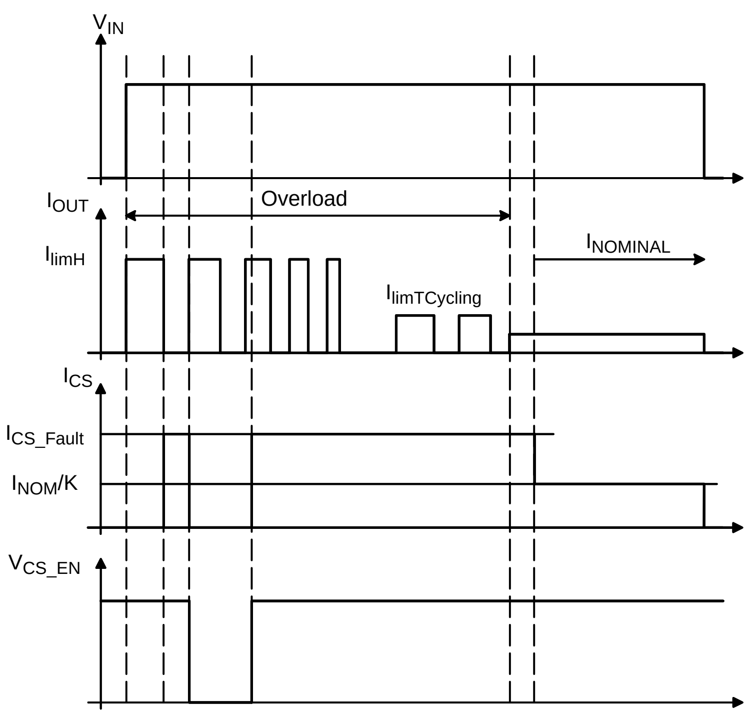


Figure 14. Discontinuous Overload or Short to GND

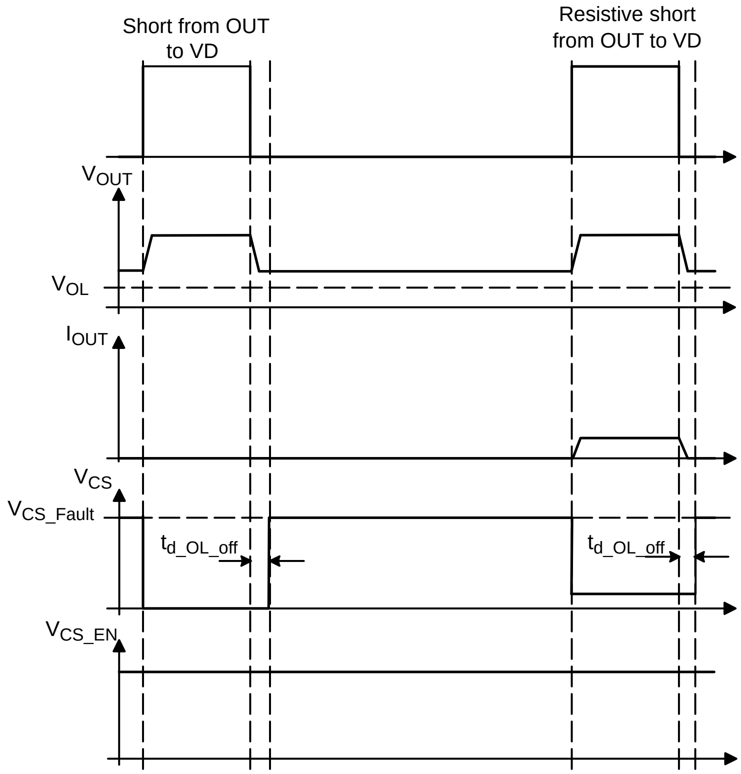


Figure 15. Short Circuit from OUT to VD

TYPICAL CHARACTERISTICS

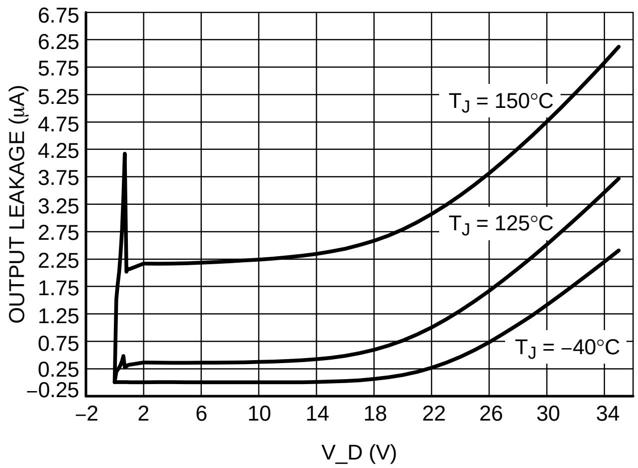


Figure 16. Output Leakage Current vs. VD Voltage & Temperature, V_OUT = 0 V

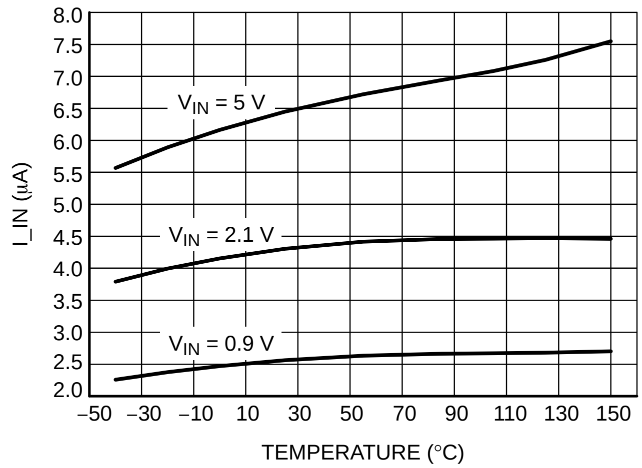


Figure 17. Input Current vs. Temperature

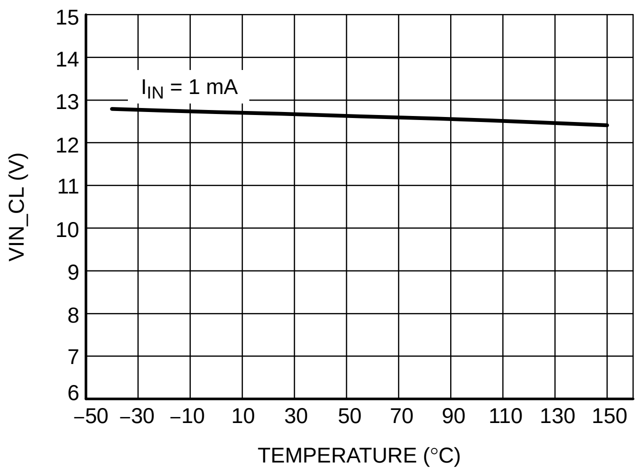


Figure 18. Input Clamp Voltage (Positive) vs. Temperature

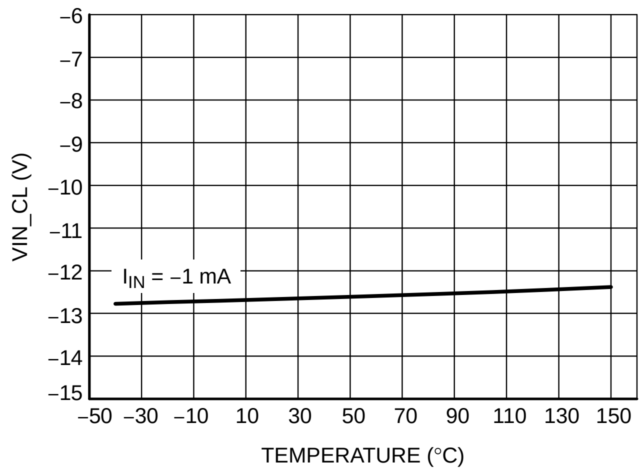


Figure 19. Input Clamp Voltage (Negative) vs. Temperature

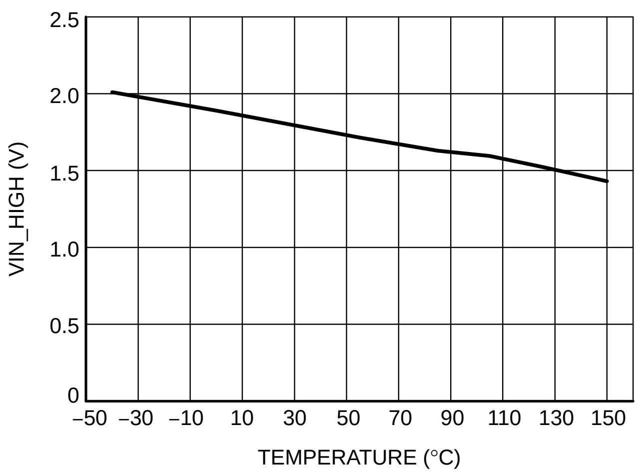


Figure 20. V_IN Threshold High vs. Temperature

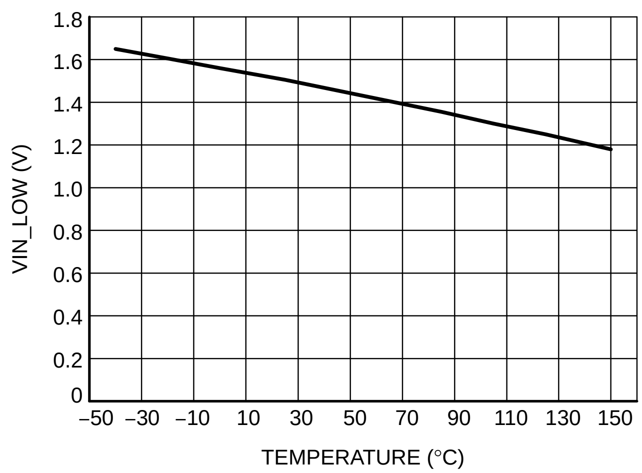


Figure 21. V_IN Threshold Low vs. Temperature

TYPICAL CHARACTERISTICS

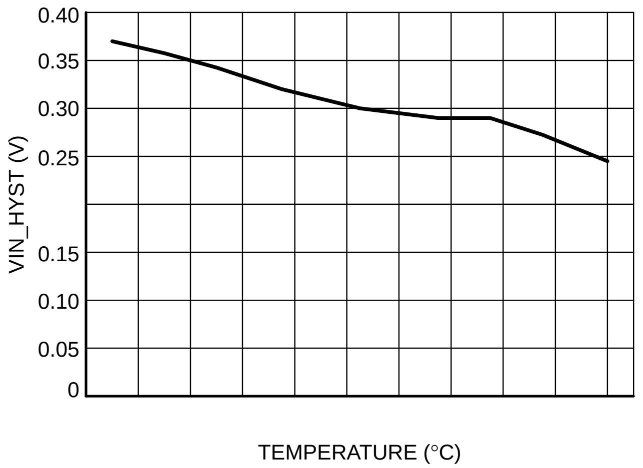


Figure 22. Hysteresis Input Voltage vs. Temperature

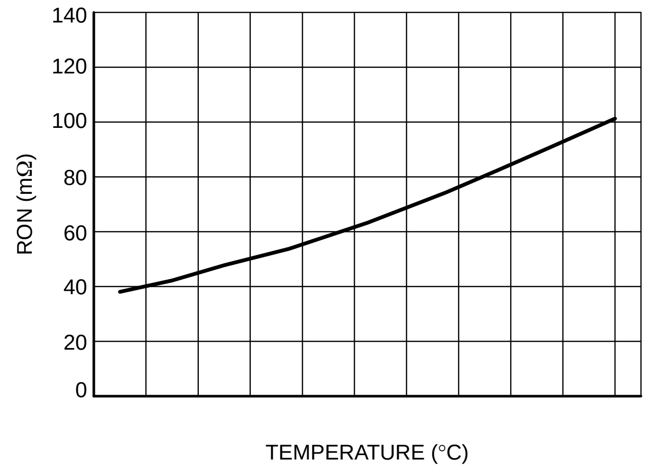


Figure 23. R_ON vs. Temperature

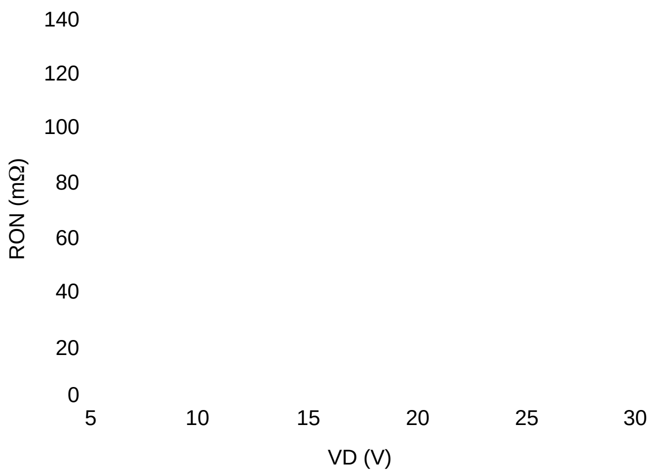


Figure 24. R_ON vs. V_D Voltage

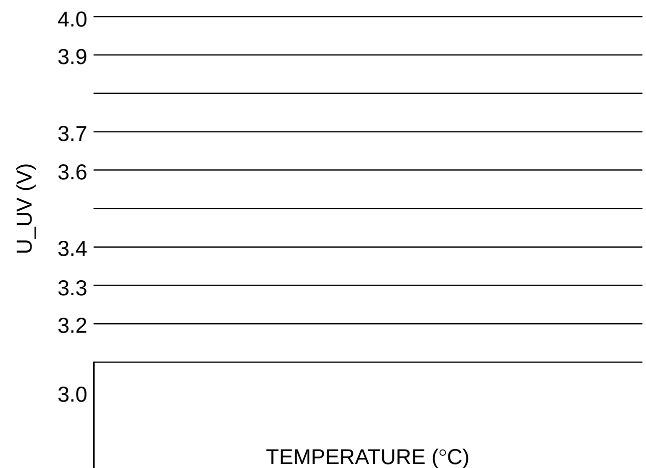


Figure 25. Undervoltage Shutdown vs. Temperature

TYPICAL CHARACTERISTICS

Figure 28. Current Limit vs. Temperature

Figure 29. CS_EN Threshold High vs. Temperature

Table 13. ISO 7637 2: 2011(E) PULSE TEST RESULTS

ISO 7637 2:2011(E) Test Pulse	Test Severity Levels, 12 V System			Delays and Impedance	# of Pulses or Test Time	Pulse / Burst Rep. Time
	I / II	III	IV			
1	−75	−112	−150	2 ms, 10 Ω	500 pulses	0.5 s
2a	+37	+55	+112			

APPLICATION INFORMATION

Figure 33. Application Schematic

LOSS OF GROUND PROTECTION

UNDERVOLTAGE PROTECTION

–

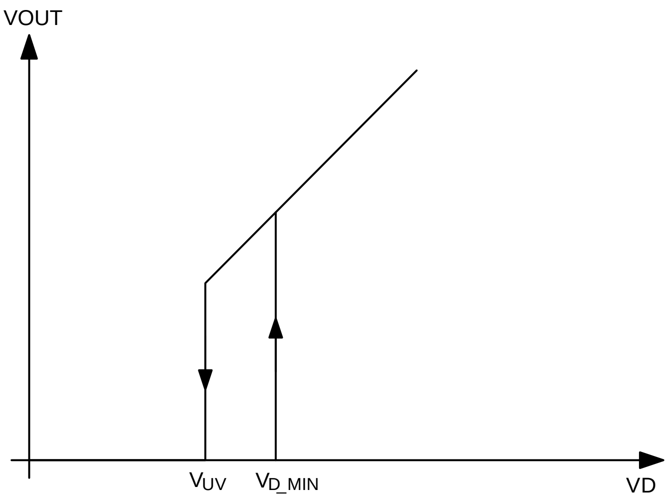


Figure 35. Undervoltage Behavior

Overvoltage Protection

Output Clamping with Inductive Load Switch Off

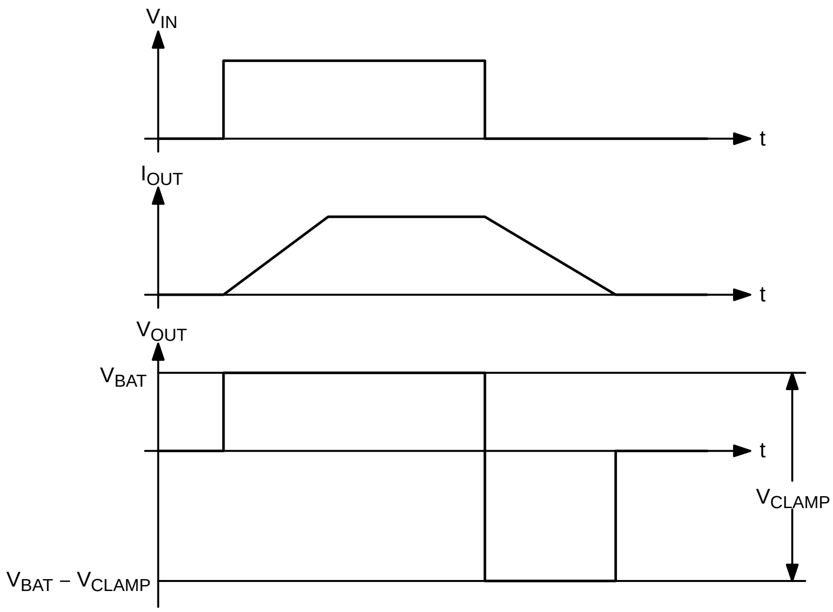


Figure 36. Inductive Load Switching

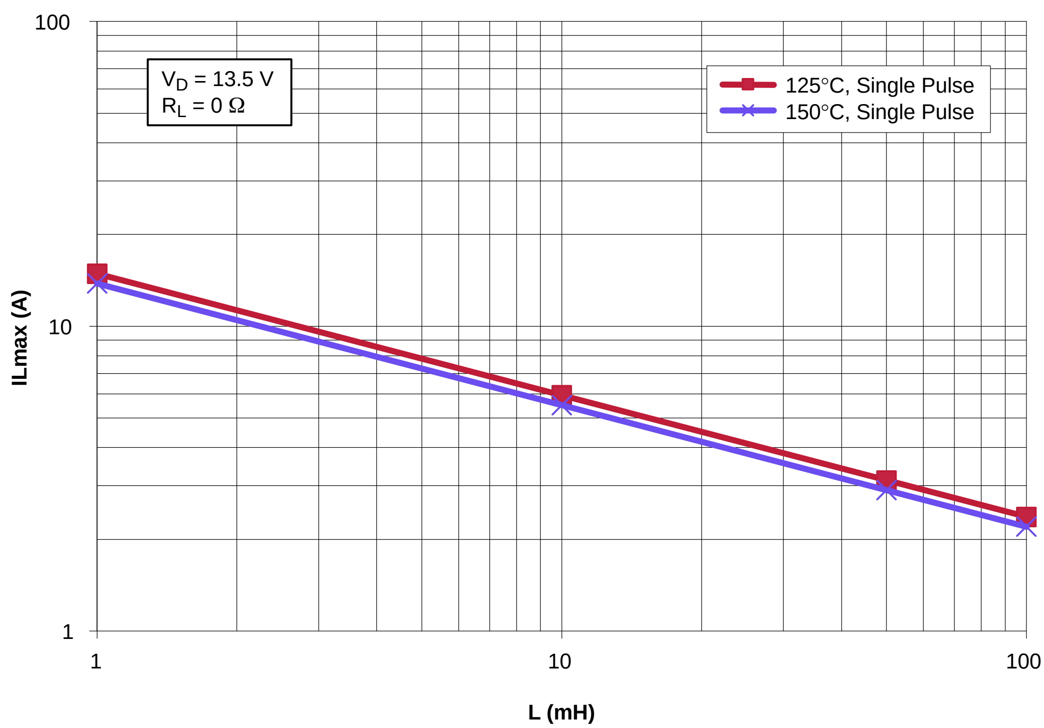


Figure 37. Maximum Switch Off Current vs. Load Inductance, V_D = 13.5 V, R_L = 0 Ω

OPEN LOAD DETECTION IN OFF STATE

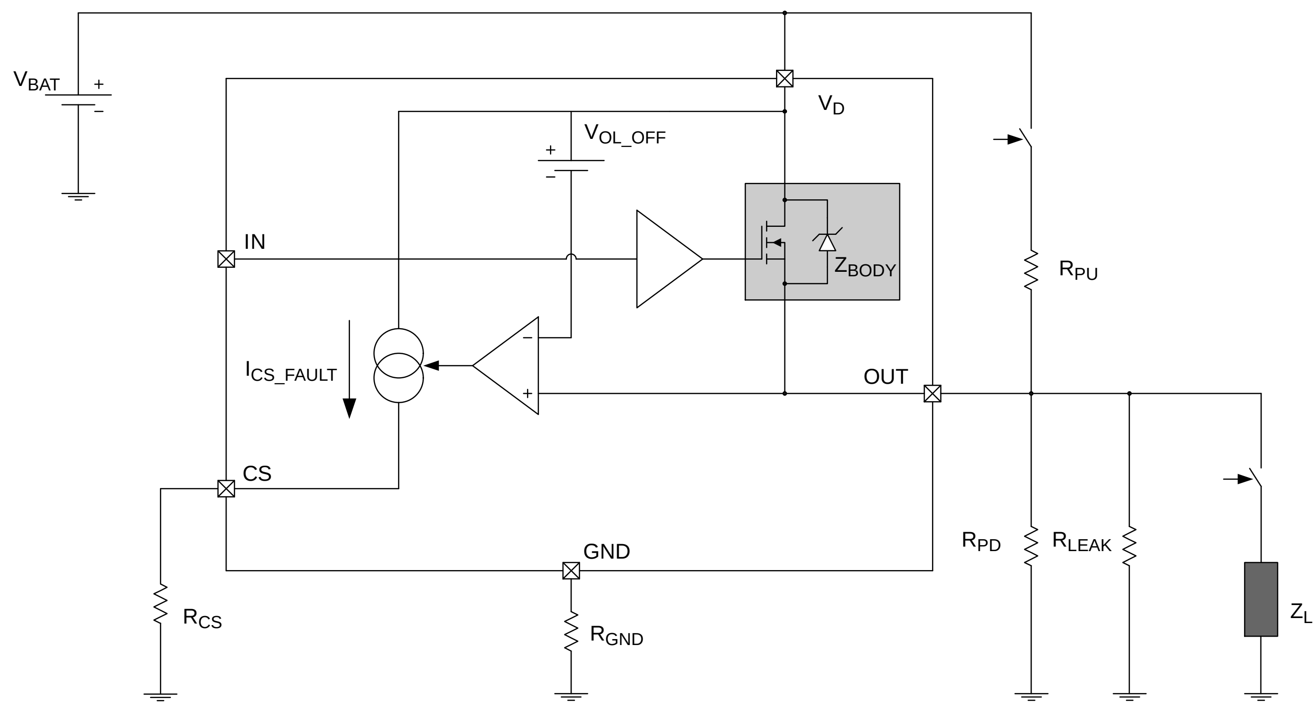


Figure 38. Open Load Detection in Off State

CURRENT SENSE IN PWM MODE

Δ

HINTS

EMC Performance

SOIC 8 NB
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ISSUE AK

DATE 16 FEB 2011