



Smart Power High-Side Switch

PRODUCT SUMMARY

Overvoltage Protection $V_{bb(AZ)}$ (V)	Operating Voltage $V_{bb(on)}$ (V)	On-State Resistance R_{ON} (m Ω)	Nominal Load Current $I_{L(nom)}$ (A)
41	5 – 15	50	2.0

FEATURES

- Overload Protection
- Current Limitation
- Short Circuit Protection
- Thermal Shutdown with Restart
- Overvoltage Protection (Including Load Dump)
- Reverse Battery Protection with External Resistor
- CMOS Compatible Input

- Start A Cold Filament Lamp
- ESD Protection
- Low Standby Current

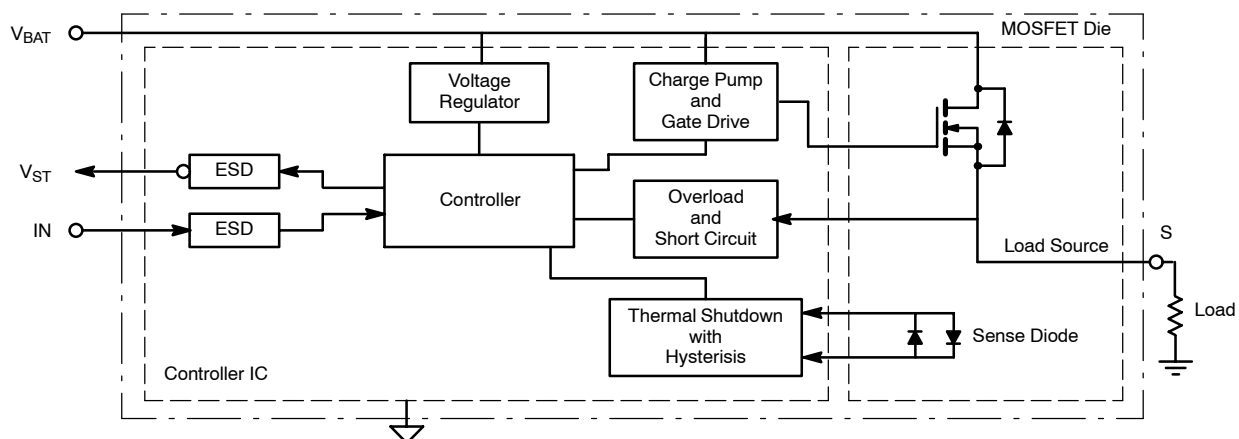
APPLICATIONS

- All Types of Resistive, Inductive and Capacitive Loads
- μ C Compatible Power Switch for 12-V dc Applications
- Replaces Electromechanical Relays and Discrete Circuits

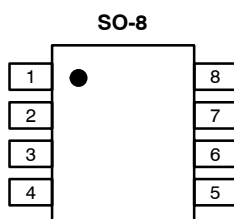
DESCRIPTION

The Si4750DY is an n-channel verticle power FET with charge pump, ground referenced CMOS compatible input, and fully protected by embedded protection functions.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



Top View

Ordering Information: Si4750DY—E3
Si4750DY-T1—E3 (with Tape and Reel)

TRUTH TABLE

IN	MOSFET
H	ON
L	OFF

PIN DESCRIPTION

Pin Number	Symbol	Description
1	IN	Input Logic Signal
2, 3, 4	V _{BAT}	V _{BAT} /MOSFET Drain, Bypass Cap is Mandatory
5, 6	S	MOSFET Source
7	GND	Ground
8	V _{ST}	Status Output Pin

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C UNLESS OTHERWISE NOTED)

Parameter		Symbol	Limit	Unit
Supply Voltage		V _{bb}	15	V
Supply Voltage For Full Short Circuit Protection (T _A = −40 to 150°C)		V _{bb(SC)}	15	
Continuous Input Voltage		V _{IN}	−0.7 to 7.5	
Load Current (Short Circuit Current—see page 3)		I _L	Self-Limit	A
Current Through Input Pin (dc)		I _{IN}	± 1	mA
Operating Temperature		T _A	−40 to 150	°C
Storage Temperature		T _{stg}	−55 to 150	
Power Dissipation ^a		P _{tot}	1.14	W
Inductive Load Switch-Off Energy Dissipation Single Pluse (T _A = 25°C)		E _{AS}	20	mJ
Load Dump Protection ^{b, c} (t _d = 15 μs, V _{IN} = low or high, V _{bb} = 14.5 V)		V _{LOADDUMP}	25	V
Electrostatic Discharge Voltage (Human Body Model) ^d	Input Pin	V _{ESD}	± 1.2	kV
	All Other Pins		± 5	

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Junction-to-Ambient	R _{thJA}		88	110	°C/W
Junction-to-Case (Drain) ^a	R _{thJC}		29	36	

Notes

- When Mounted on 1" x 1" PCB FR4 Board.
- Not tested, specified by design.
- V_{LOADDUMP} is setup without the DUT connected to the generator per ISO 7637-1 and DIN 40839. Supply voltages higher than V_{bb(AZ)} require an external current limit for the GND pin, e.g. with a 150-Ω resistor in GND connection. A resistor for the protection of the input is integrated.
- According to ANSI EOS/ESD-S5.1-1983 ESD STM5.1-1998.

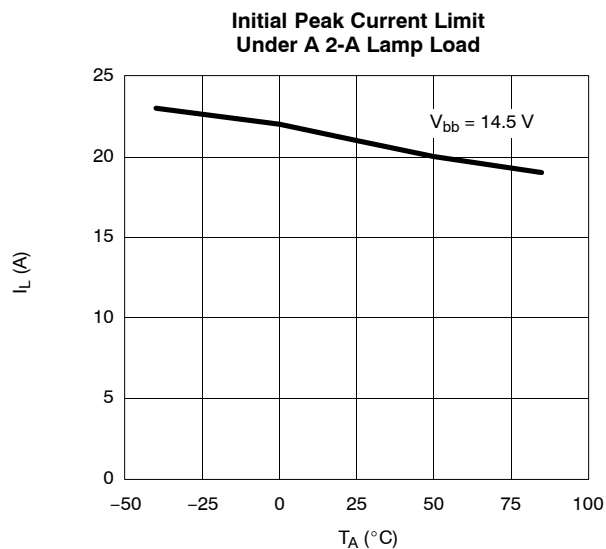
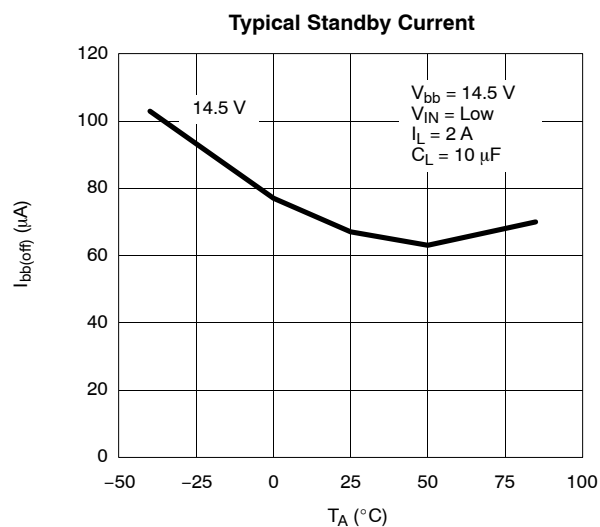
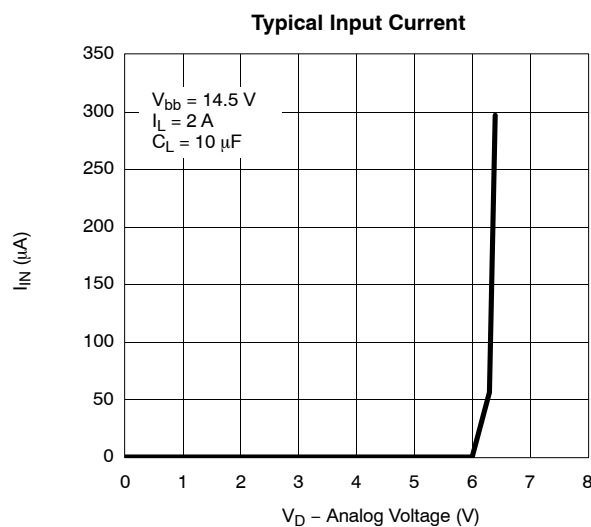
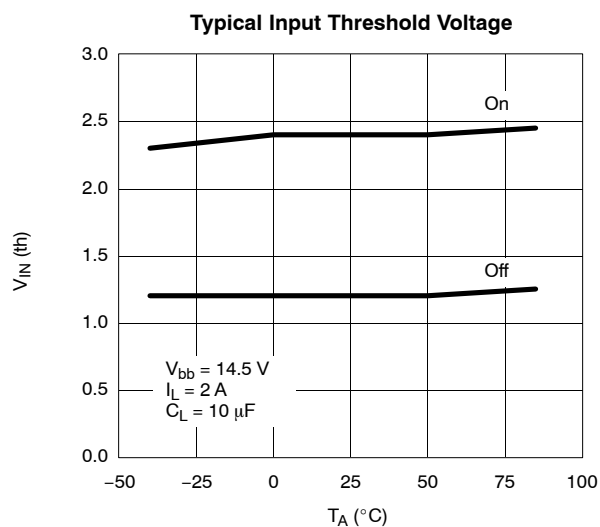
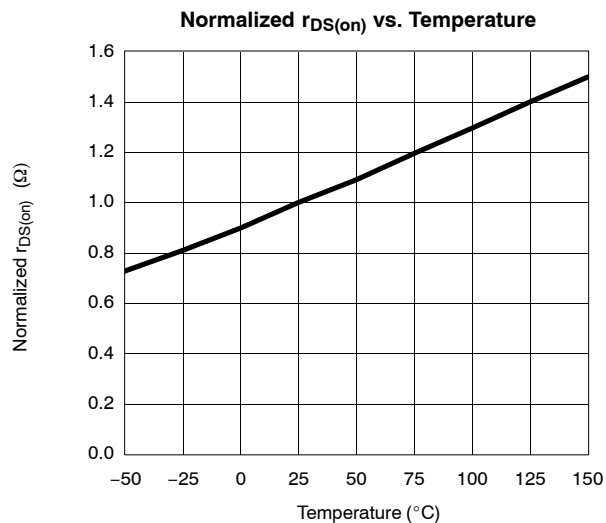
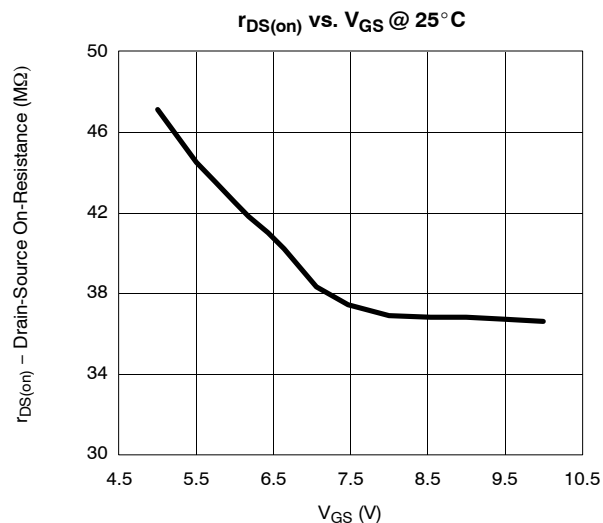


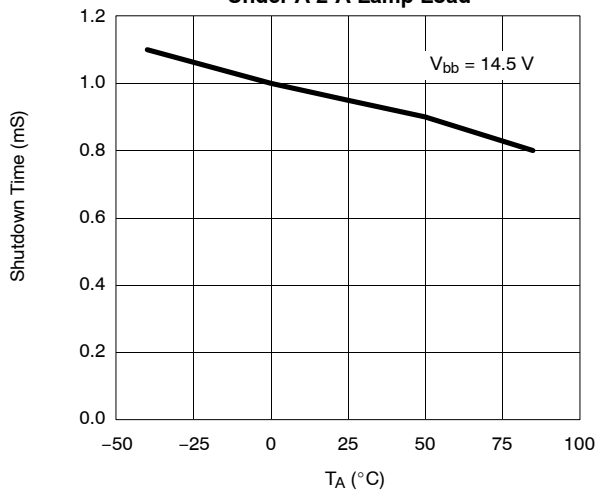
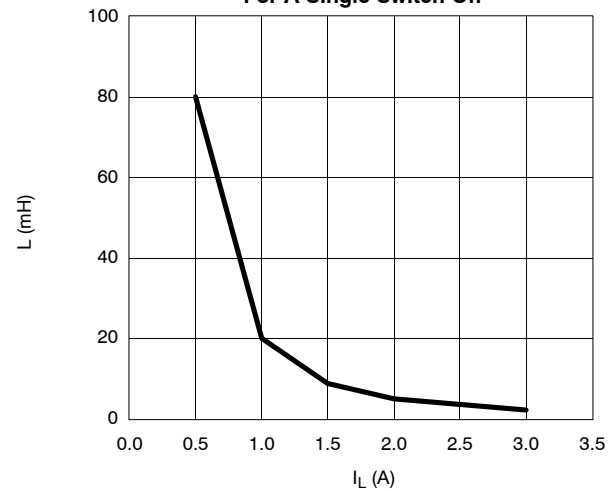
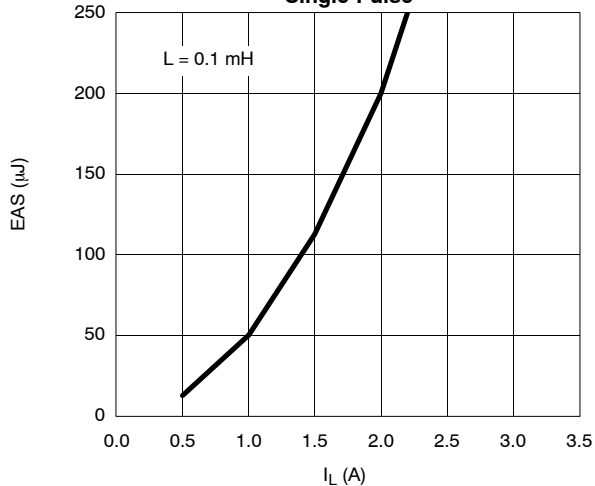
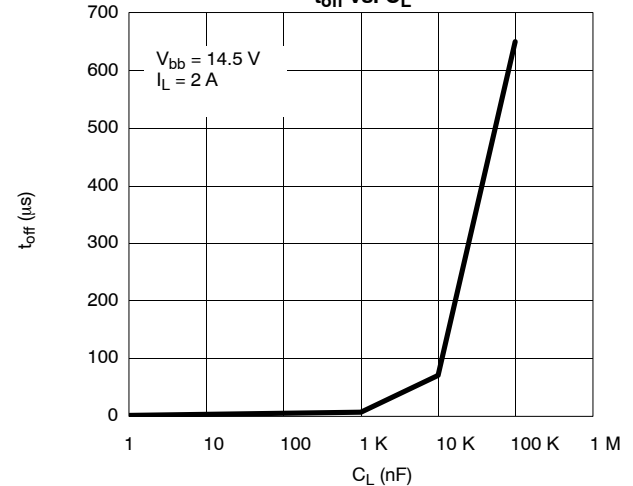
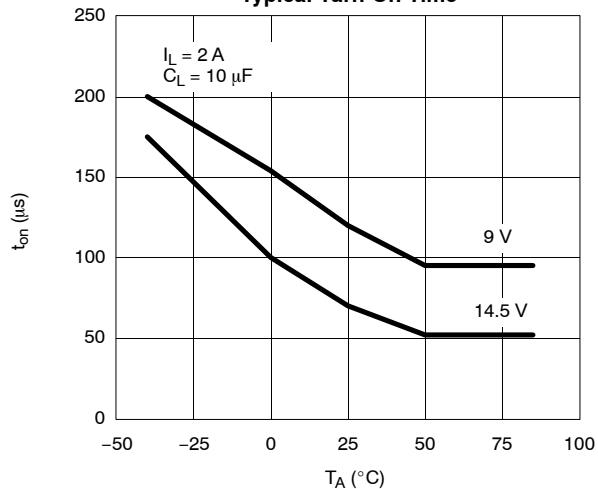
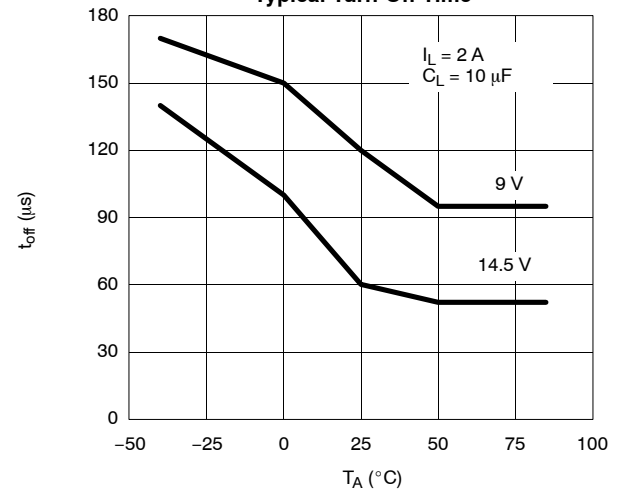
SPECIFICATIONS						
Parameter	Symbol	Test Conditions Unless Otherwise Noted $T_A = 25^{\circ}\text{C}$, $V_{bb} = 14.5\text{ V}$	Min	Typ	Max	Unit
Load Switching Capabilities and Characteristics						
On-State Resistance	r_{ON}	$I_L = 2\text{ A}$, $V_{bb} = 9\text{ to }14.5\text{ V}$		34	50	$\text{m}\Omega$
Nominal Load Current	$I_{\text{L(nom)}}$			2		A
Turn-On- Time to 90% V_{OUT}	t_{ON}	$I_L = 2\text{ A}$, $C_L = 2\text{ }\mu\text{A}$		70	150	μs
Turn-Off Time to 10% V_{OUT}	t_{off}			60	150	
Slew Rate On	$\text{dV}/\text{dt}_{\text{on}}$			0.22		$\text{V}/\mu\text{s}$
Slew Rate Off	$-\text{dV}/\text{dt}_{\text{on}}$			0.08		
Operating Parameters						
Operating Voltage	$V_{bb(\text{on})}$		9		41	V
Undervoltage Shutdown of Charge Pump	$V_{bb(\text{under})}$	$T_A = -40\text{ to }85^{\circ}\text{C}$		6.7	8	
Undervoltage Restart of Charge Pump	$V_{bb(\text{ucp})}$			7.1	8	
Standby Current	$I_{bb(\text{off})}$	$T_A = -40\text{ to }85^{\circ}\text{C}$, $V_{\text{IN}} = 0\text{ V}$		70		μA
Leakage Output Current (Included in $I_{bb(\text{off})}$)	$I_{\text{L(off)}}$	$V_{\text{IN}} = 0\text{ V}$			0.5	
Protection Features						
Initial Peak Short Circuit Current Limit	$I_{\text{L(SCp)}}$	$t_m = 500\text{ }\mu\text{s}$, $T_A = 25^{\circ}\text{C}$		21		A
		$t_m = 500\text{ }\mu\text{s}$, $T_A = 25^{\circ}\text{C}$		19		
Thermal Overload Trip Temperature	T_J	$I_L = 2\text{ A}$	150			$^{\circ}\text{C}$
Thermal Hysteresis	T_{HYS}			12		
Reverse Battery						
Reverse Battery ^b	$-V_{bb}$				25	V
Drain-Source Diode Voltage	$-V_{\text{ON}}$	$V_{\text{OUT}} > V_{bb}$, $T_J = 150^{\circ}\text{C}$		600		mV
Input						
Input Turn-On Threshold Voltage	$V_{\text{IN(T+)}}$	See Figure 1		2.3	3.0	V
Input Turn-Off Threshold Voltage	$V_{\text{IN(T-)}}$		0.8			
Input Threshold Hysteresis	$\Delta V_{\text{IN(T)}}$			1		
Off-State Input Current	$I_{\text{IN(off)}}$	$V_{\text{IN}} = 0.7\text{ V}$, See Figure 1			2	μA
On-State Input Current	$I_{\text{IN(on)}}$	$V_{\text{IN}} = 5\text{ V}$, See Figure 1			2	
Input Resistance	R_L	Input Resistance, See Figure 1		3000		k Ω

Notes

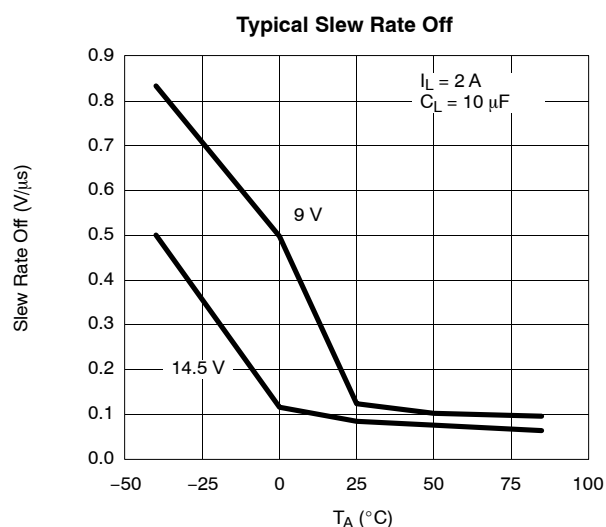
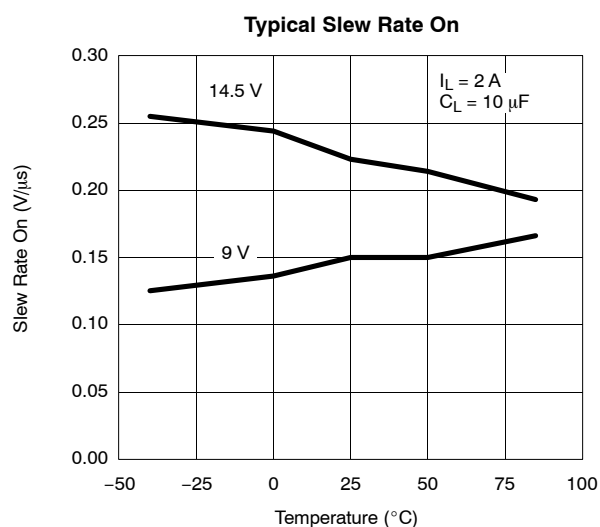
- a. Not to exceed $T_{PULSE} = 50\text{ ns}$.
- b. Requires a 150- Ω resistor in GND connection. The reverse load current through the intrinsic drain-source diode has to be limited by the connected load. Power dissipation is higher compared to normal operating conditions due to the voltage drop across the drain-source diode. The temperature protection is not active during reverse current operation. Input current has to be limited. (See Maximum Ratings, page 2.)

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TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)


**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)****Initial Shutdown Time
Under A 2-A Lamp Load****Maximum Allowable Load Inductance
For A Single Switch Off****Maximum Inductive Switch Off Energy
Single Pulse** **t_{off} vs. C_L** **Typical Turn-On Time****Typical Turn-Off Time**

TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



SETUP

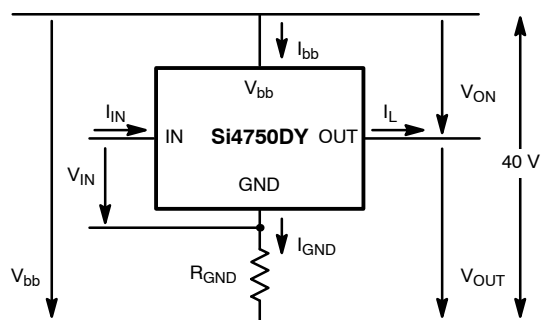


FIGURE 1.

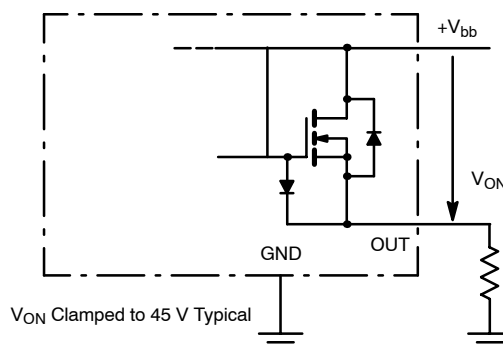


FIGURE 2. Inductive and Overvoltage Output Clamp

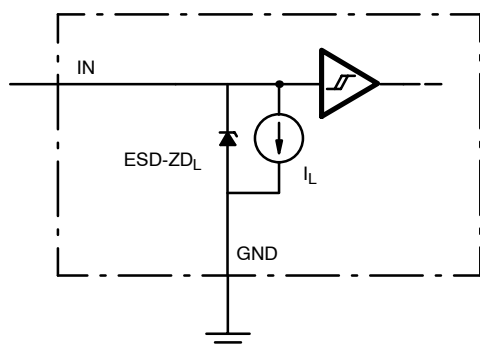


FIGURE 3. Input Circuit (ESD Protection)

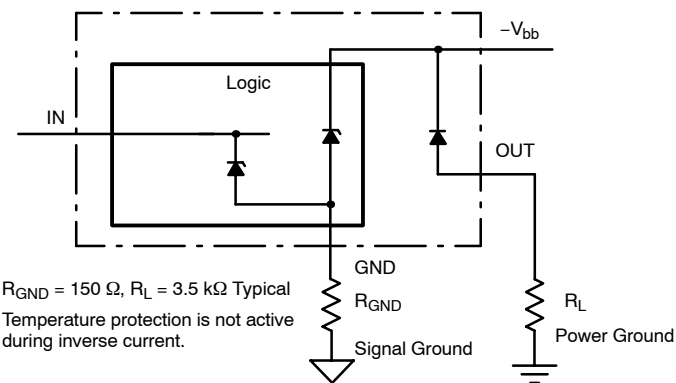


FIGURE 4. Reverse Pattern Protection

TIMING DIAGRAMS

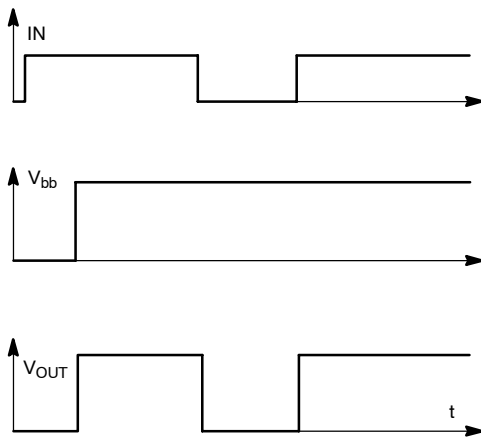


FIGURE 5. V_{bb} Turn-On

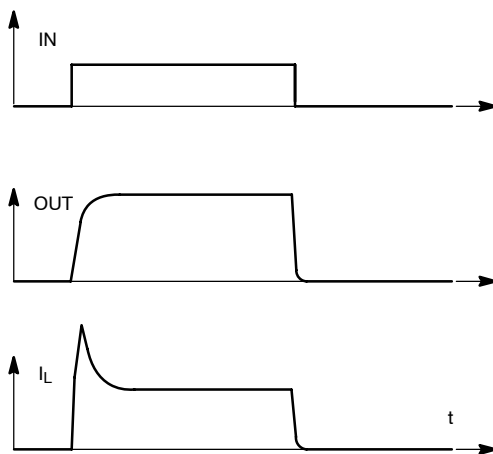


FIGURE 7. Switching A Lamp

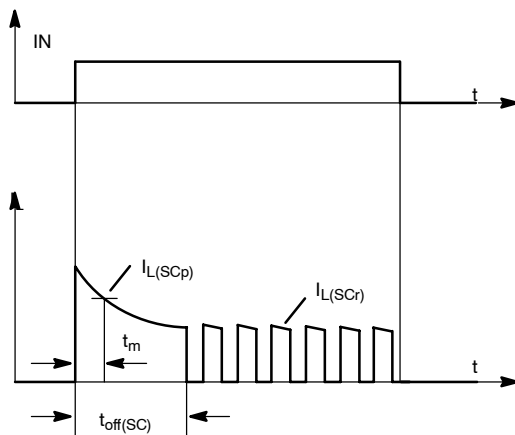


FIGURE 9. Turn-On Into Short Circuit
Driving A Cold Filament

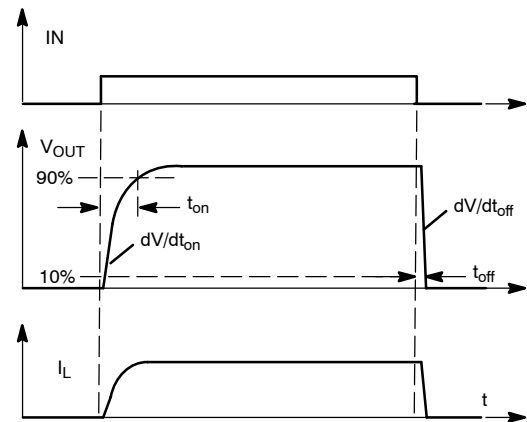


FIGURE 6. Switching A Resistive Load, Turn-on/Off
Time and Slew Rate Definition

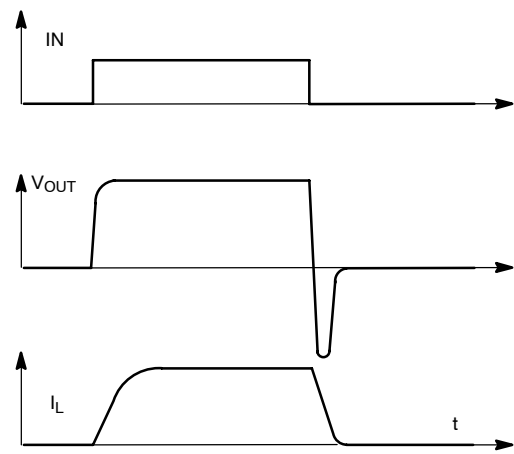


FIGURE 8. Switching An Inductive Load

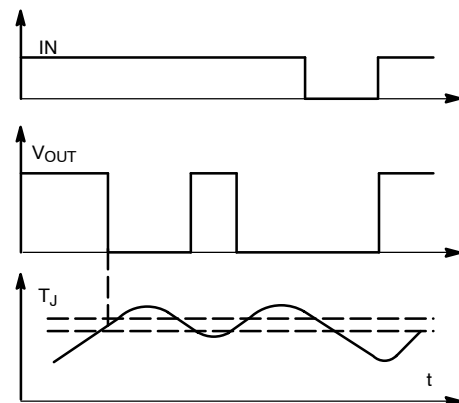
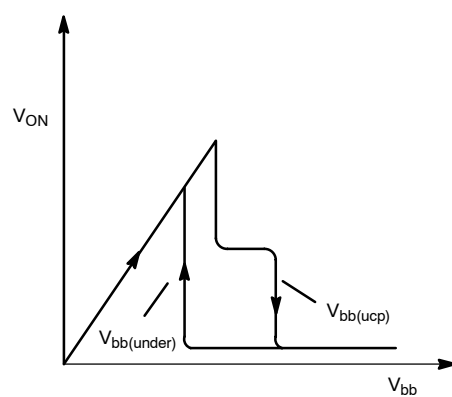


FIGURE 10. Overtemperature: Reset If $T_J < T_{JT}$

TIMING DIAGRAMS**FIGURE 11.** Undervoltage Restart of Charge Pump



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