FAST RESPONSE, 6A LOAD SWITCH

FEATURES

- Integrated 6A Single Channel Load Switch
- Input Voltage Range: 0.8V to 5.5V
- Ultra-low ON-Resistance R_{ON} = 4.5mΩ
- Low Threshold Control Input
- Quick Output Discharge Transistor
- ESD Performance Tested per JESD 22
  2KV HBM and 1KV CDM
- Halogen Free Product

APPLICATIONS

- Telecom Systems
- Industrial Systems
- Consumer Electronics
- Notebooks / Netbooks

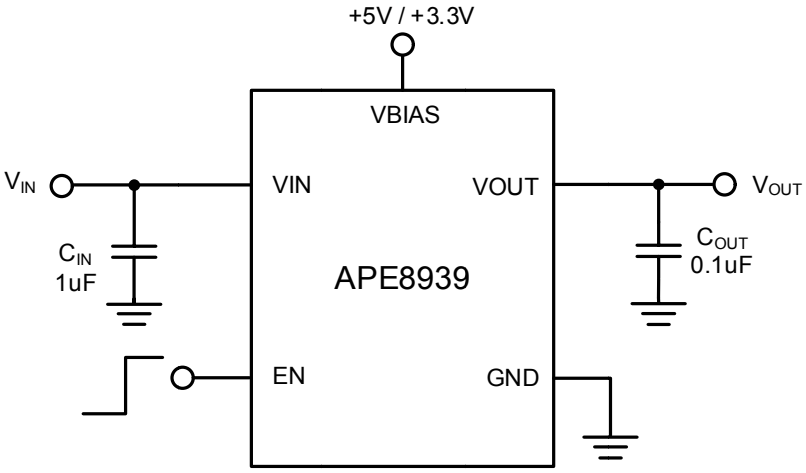
DESCRIPTION

The APE8939 is a small, ultra-low R_{ON} load switch with controlled turn on. It contains one N-channel MOSFET that can operate over an input voltage range of 0.8V to 5.5V and support maximum continuous current up to 6A. The switch is controlled by an on/off input (EN), which is capable of interfacing directly with low-voltage control signals.

Additional features include a 330Ω on-chip load resistor is added for output quick discharge when switch is turned off.

The APE8939 is available in DFN 3x3-8L package with smallest components.

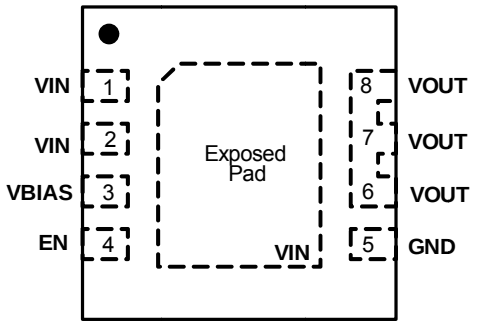
TYPICAL APPLICATION



ORDERING / PACKAGE INFORMATION

APE8939X
└ Package Type
GN3: DFN 3x3-8L

Top View
DFN 3x3-8L



ABSOLUTE MAXIMUM RATINGS (at T_A=25°C)

VIN	-0.3V to 6V
VOUT	VIN+0.3V
EN	-0.3V to 6V
VBIAS	-0.3 to 6V
I_{MAX}	6A
Storage Temperature Range (T_{ST})	-65 to +150°C
Junction Temperature (T_J)	150°C
Lead Temperature (Soldering, 10sec.)	260°C
Thermal Resistance from Junction to Ambient ($R\theta_{JA}$)	
DFN 3x3-8L	43°C/W
Thermal Resistance from Junction to Case(Top Case) ($R\theta_{JC}$)	
DFN 3x3-8L	42°C/W

RECOMMENDED OPERATING CONDITIONS

VIN	0.8V to 5.5V
VBIAS	2.5V to 5.5V (VBIAS≧VIN)
VOUT	V_{IN}
CIN	≧0.1uF
Junction Temperature (T_J)	125°C
Operating Temperature Range	-40°C to 85°C
Power Dissipation (P_D@T_A=25°C)	2.3W

ELECTRICAL SPECIFICATIONS

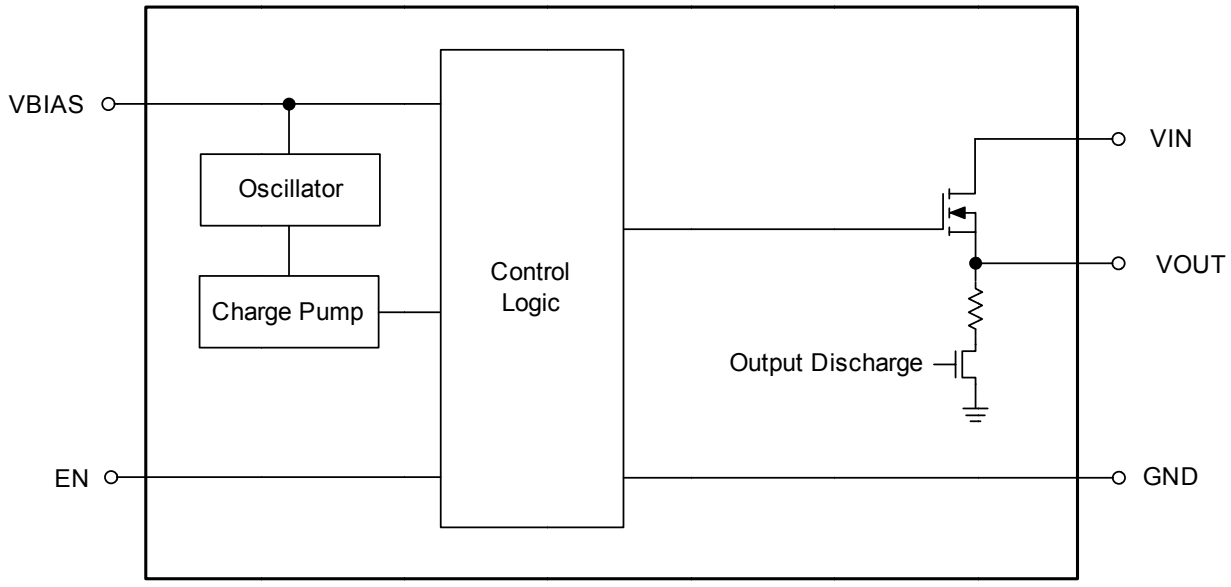
(V_{IN}=0.8V to 5.5V, V_{BIAS}=5V, C_{IN}=1uF, C_{OUT}=0.1uF, T_A =25°C, unless otherwise specified)

PARAMETER	SYM	TEST CONDITION	MIN	TYP	MAX	UNIT
Quiescent Current	I_{BIAS}	V_{BIAS}=V_{IN}=V_{EN}=5V, I_{OUT}=0A		30	50	uA
		V_{BIAS}=V_{IN}=V_{EN}=3.3V, I_{OUT}=0A		20	33	uA
Shutdown Current	I_{SD}	V_{EN}=GND			1	uA
ON Resistance	R_{ON}	VIN=5V, IOUT=-200mA		4.9	8	mΩ
		VIN=5V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
		VIN=3.3V, IOUT=-200mA		4.8	7.8	mΩ
		VIN=3.3V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
		VIN=1.8V, IOUT=-200mA		4.6	7.3	mΩ
		VIN=1.8V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
		VIN=1.5V, IOUT=-200mA		4.6	7.3	mΩ
		VIN=1.5V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
		VIN=1.05V, IOUT=-200mA		4.5	7.2	mΩ
		VIN=1.05V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
		VIN=0.8V, IOUT=-200mA		4.5	7.2	mΩ
		VIN=0.8V, IOUT=-200mA, -40°C < T_A < 85°C			10	mΩ
Rise Time	t_R	V_{IN}=1.05V, R_L=10Ω	7	14	20	us
Soft-Start Time	t_{SS}	V_{IN}=1.05V, R_L=10Ω		40	50	us
Output Pull-Down Resistance	R_{OPD}	V_{IN}=5V, V_{EN}=0V		330	400	Ω
EN Input Leakage Current	I_{EN}	V_{EN}=5V or GND			1	uA
EN Threshold	V_{IH}	on	1.3			V
	V_{IL}	off			0.5	V

PIN DESCRIPTIONS

PIN No.	PIN SYMBOL	PIN DESCRIPTION
1, 2	**VIN**	Input Power Supply
3	**VBIAS**	Bias Voltage
4	**EN**	Switch control input, active high. Do not leave floating.
5	**GND**	Ground
6, 7, 8	**VOUT**	Switch output
Exposed pad	**VIN**	Input Power Supply

BLOCK DIAGRAM



TYPICAL PERFORMANCE CHARACTERISTICS

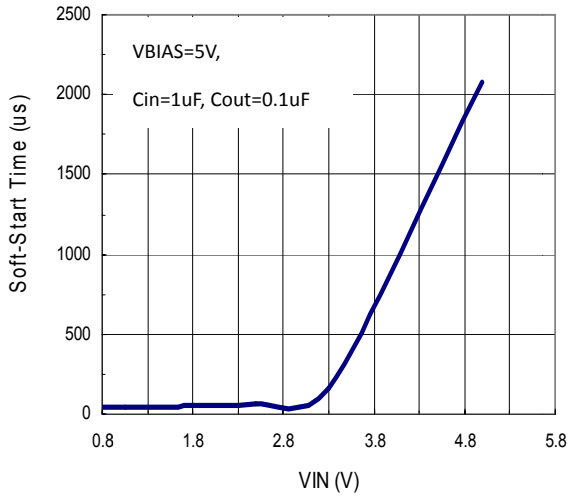


Fig.1 Soft-Start Time vs. V_{IN}

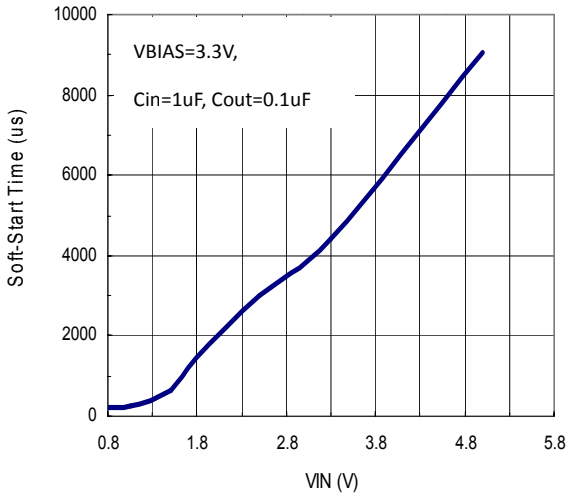


Fig.2 Soft-Start Time vs. V_{IN}

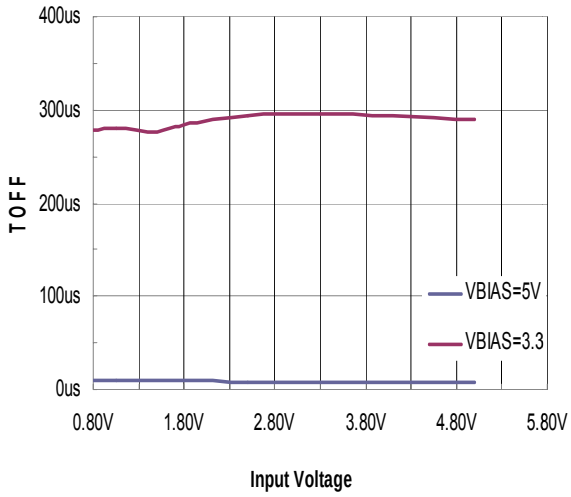


Fig.3 T_{OFF} vs. V_{IN}

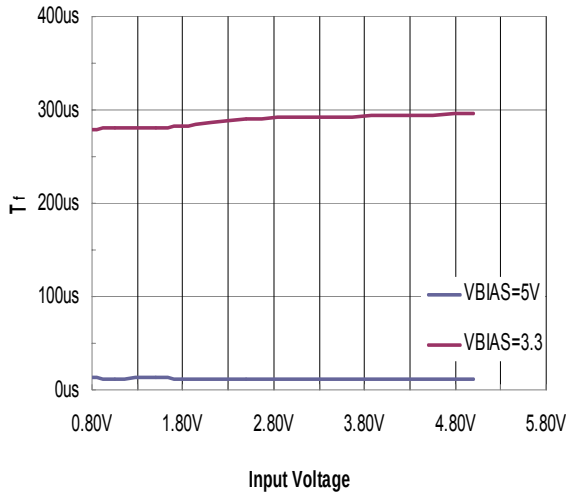


Fig.4 T_f vs. V_{IN}

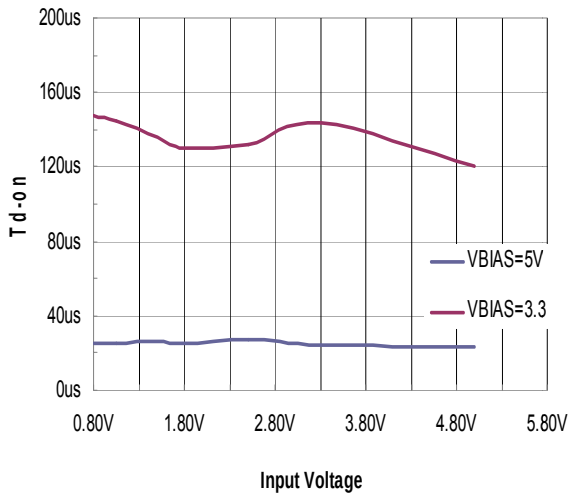


Fig.5 $T_{d\text{-}on}$ vs. V_{IN}

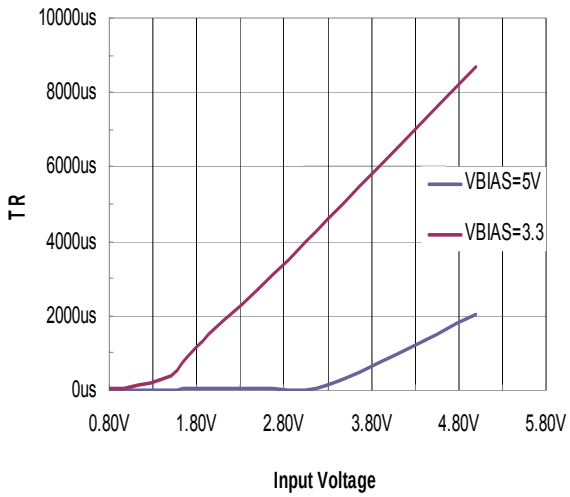


Fig.6 T_R vs. V_{IN}

TYPICAL PERFORMANCE CHARACTERISTICS

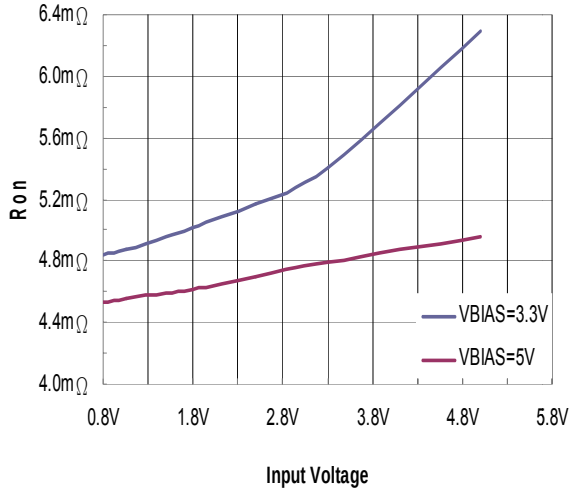


Fig.7 R_{ON} vs. V_{IN}

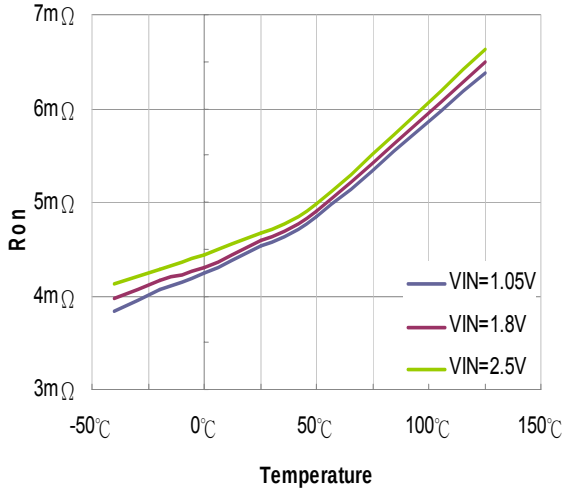


Fig.8 R_{ON} vs. Temperature

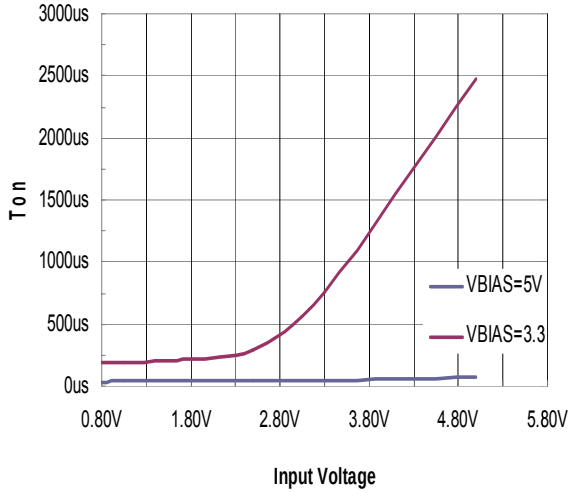


Fig.9 T_{ON} vs. V_{IN}

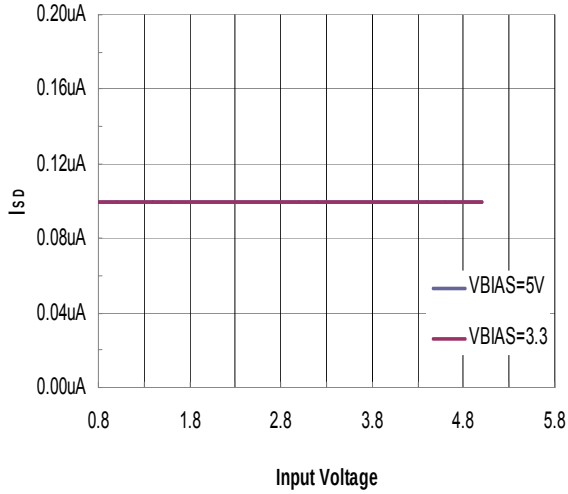


Fig.10 I_{SD} vs. V_{IN}

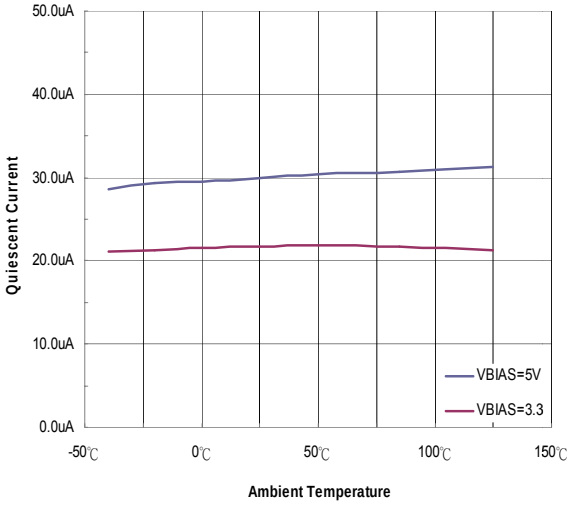


Fig.11 VBIAS Current vs. Temperature

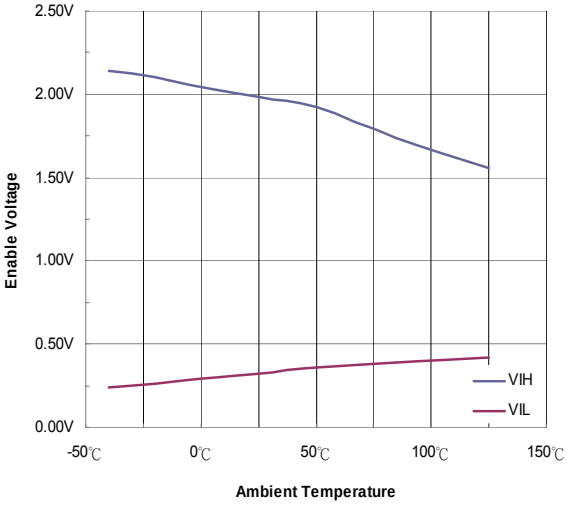


Fig.12 EN Threshold vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS

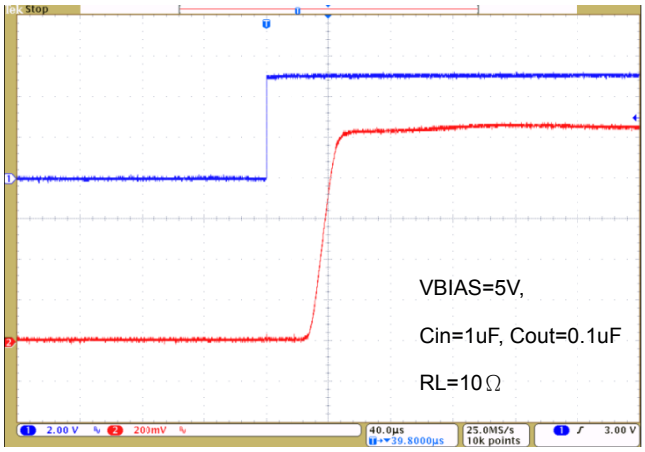


Fig.13 Enable Waveform, VIN=1.05V

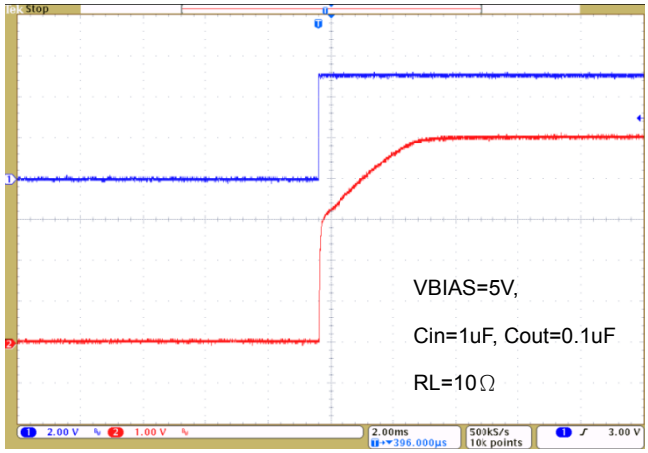


Fig.14 Enable Waveform, VIN=5V

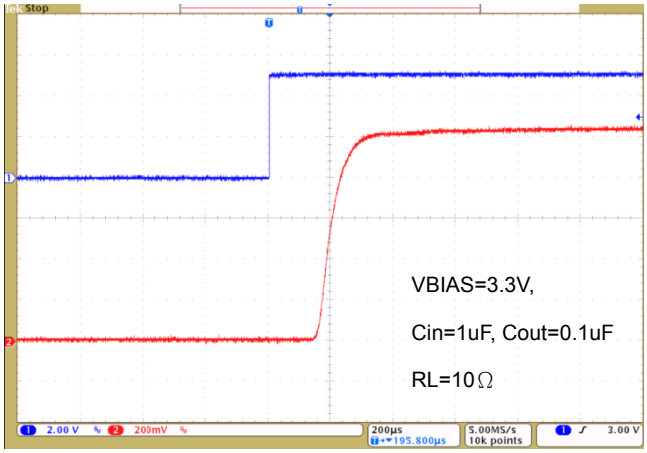


Fig.15 Enable Waveform, VIN=1.05V

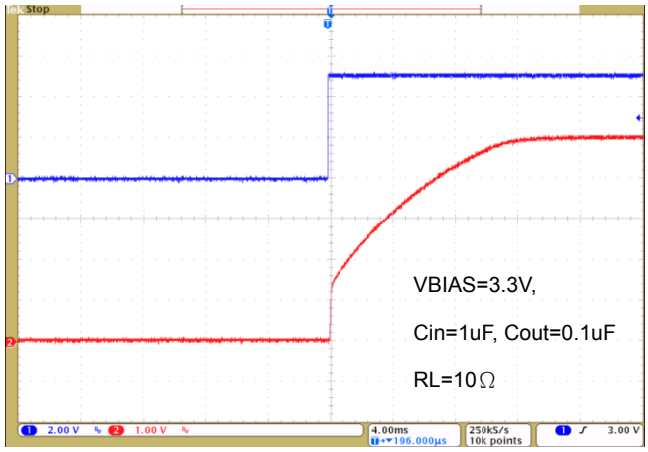


Fig.16 Enable Waveform, VIN=5.0V

APPLICATION INFORMATION

On/Off Control

The load switch is controlled by the EN pin. The EN pin is active high and has a low threshold making it capable of interfacing with low voltage signals. The EN pin can be used with standard 1.5V, 1.8V, 2.5V or 3.3V GPIO logic threshold. Do not leave the EN pin float.

The Figure17 shows the VOUT on/off definition.

t_{SS}: Soft start time

t_{D-ON}: VOUT turn on delay

t_R: VOUT rise time

t_{D-OFF}: VOUT turn off delay

t_F: VOUT fall time

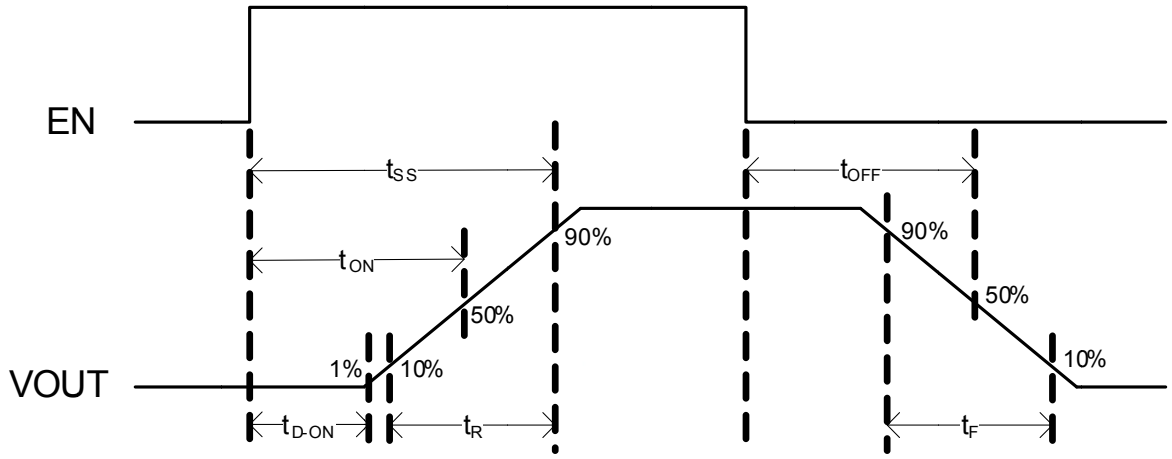


Fig.17 ON/OFF Waveform

Output Switch Time Control

The switch time shows on below Table 1 are typical measured value. Please refer it for determined rise time.

VIN	VBIAS=5V					
	VOUT					
	Td-on(us)	Tr(us)	T_{SS}(us)	Ton(us)	Toff(us)	Tf(us)
0.80V	25	11	41	34	9	13.2
1.05V	25	14	43	36	9	11.4
1.50V	26	19	48	39	8.88	12.7
1.80V	25	26	57	40	8.96	12.2
2.50V	26	40	68	43	8.54	11.8
3.30V	24	127	164	48	8.32	11.1
5.00V	23	2055	2080	68	7.9	12.2

Table 1

Input Capacitor

An input capacitor is recommended to be placed between VIN and GND to limit the voltage drop on the input supply during high current application.

Output Capacitor

Setting a C_{IN} greater than the C_{OUT} is highly recommended. Since the internal body diode is in the NMOS switch, this prevents the current flows through the body diode from VOUT to VIN when the system supply is removed.

Layout Considerations

Follow the below guidelines for PCB layout to achieve stable operation. Take below figure for reference.

1. Keep the high current paths (VIN, VOUT and GND) wide and short to obtain the best effect.
2. The input and output capacitors should be close to the device as possible to minimize the parasitic trace inductances.
3. Place the thermal vias under the exposed pad. This help for thermal diffusion away from the device.

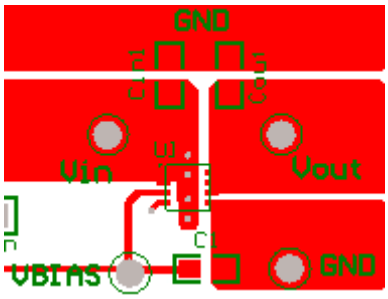


Fig.18 Reference layout

MARKING INFORMATION

DFN 3x3-8L