Low Quiescent Current Power Distribution Switch

1 FEATURES

- **Integrated Single Channel Load Switch**
- **Input voltage range: 0.6 V to V_{BIAS}**
- **V_{BIAS} Voltage Range: 2.5 V to 5.5 V**
- **On Resistance**
  - **R_{ON} = 17 mΩ (TYP) at V_{IN} = V_{BIAS} = 5 V**
- **6A Maximum Continuous Switch Current**
- **Quiescent Current:**
  - **25μA (TYP) at V_{BIAS} = V_{IN} = 5V**
- **Control Input Threshold Enables Use of 1.2V, 1.8V, 2.5V, and 3.3V Logic**
- **Configurable Rise Time**
- **Thermal Shutdown**
- **Quick Output Discharge (QOD)**
- **DFN2X2-8 Package With Thermal Pad**
- **ESD Performance Tested per JESD 22**
  - **2000V HBM and 1000V CDM**

2 APPLICATIONS

- **PC and Notebooks**
- **Set-top Boxes and Residential Gateways**
- **Telecom Systems**
- **Solid State Drives (SSDs)**

3 DESCRIPTIONS

The RS2580C device is a load switch with controlled turn on, integrating N-channel MOSFET power devices to meet high-side load switch applications. The device can operate over an input voltage range of 0.6 V to 5.5 V, and can support a maximum continuous current of 6A per channel. The switch is independently controlled by an on and off input (ON), which can interface directly with low-voltage control signals. The RS2580C is capable of thermal shutdown when the junction temperature is above the threshold, turning the switch off. The switch turns on again when the junction temperature stabilizes to a safe range. The RS2580C also offers an integrated 220 Ω on-chip load resistor for quick output discharge when the switch is turned off.

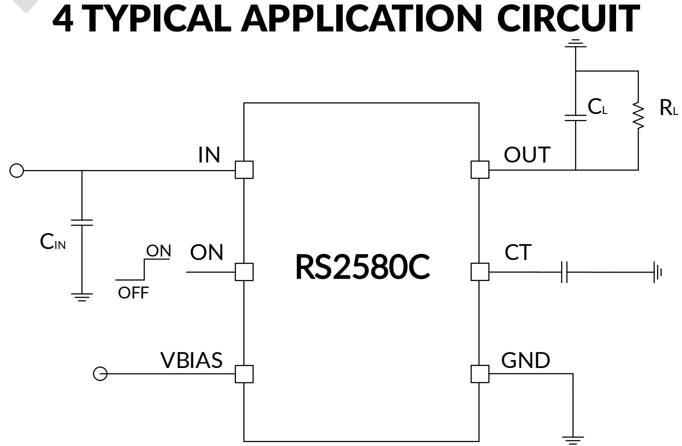
The RS2580C is available in a small, space-saving DFN2X2-8 package with integrated thermal pad allowing for high power dissipation. The device is characterized for operation over the free-air temperature range of -40°C to +105°C.

Device Information (1)

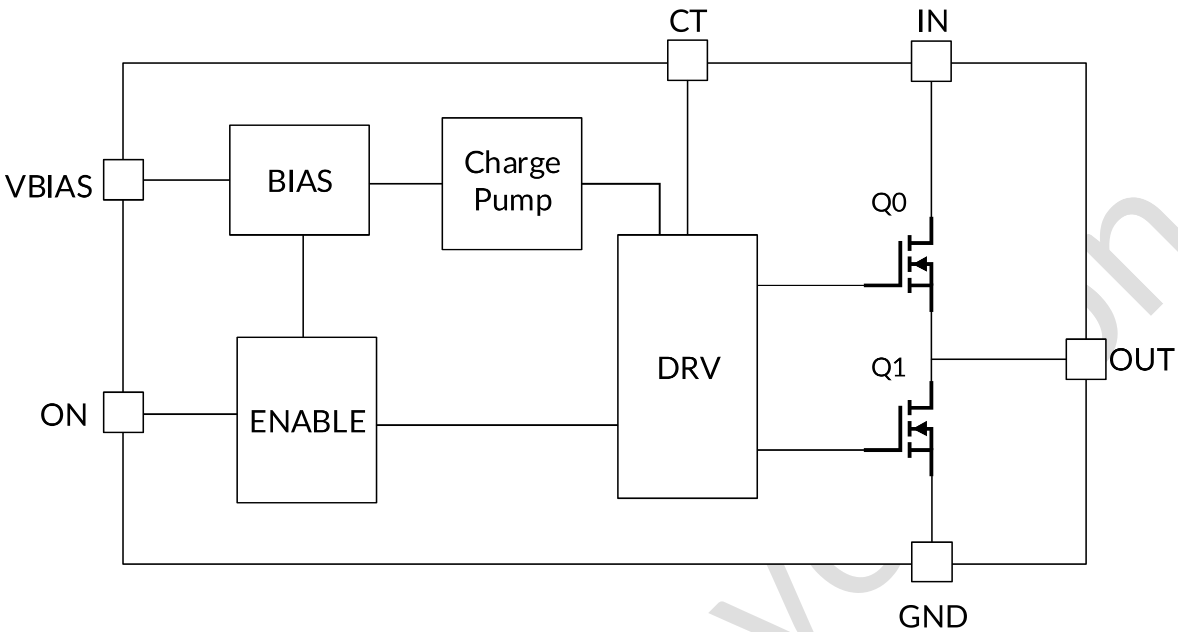
PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2580C	DFN2X2-8	2.00mm×2.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 TYPICAL APPLICATION CIRCUIT



5 FUNCTIONAL BLOCK DIAGRAM



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6 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

VERSION	Change Date	Change Item
A.0	2025/12/30	Preliminary version completed

7 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS2580C	RS2580CXTDE8	-40°C ~+105°C	DFN2X2-8	2580C	MSL3	Tape and Reel,3000

NOTE:

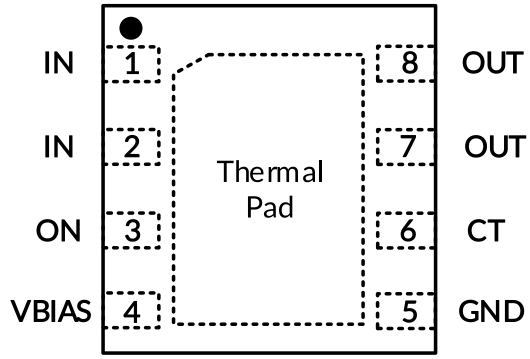
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

8 PIN CONFIGURATION AND FUNCTIONS

TOP VIEW



DFN2X2-8

PIN DESCRIPTION

PIN		I/O (1)	DESCRIPTION
NAME	NO.		
IN	1	I	Switch input. Recommended voltage range for these pins for optimal Ron performance is 0.6V to V_{BIAS}. Place an optional decoupling capacitor between these pins and GND to reduce V_{IN} dip during turn on of the channel.
	2		
ON	3	I	Active high switch control input. Must do not leave floating.
VBIAS	4	I	Bias voltage. Power supply to the device. Recommended voltage range for this pin is 2.5V to 5.5V.
GND	5	--	Ground.
CT	6	O	Switch slew rate control. Can be left floating.
OUT	7	O	Switch output.
	8		
Thermal Pad	--	--	Thermal pad (exposed center pad) to alleviate thermal stress. Tie to GND.

(1) I=input, O=output.

9 SPECIFICATIONS

9.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) [1][2]

			MIN	MAX	UNIT
V_{IN}	Input Voltage		-0.3	5.8	V
V_{OUT}	Output Voltage		-0.3	5.8	V
V_{ON}	ON Pin Voltage		-0.3	5.8	V
V_{BIAS}	BIAS Voltage		-0.3	5.8	V
I_{MAX}	Maximum continuous current per channel			6	A
$I_{MAX,PLS}$	Maximum pulsed switch current, pulse<300µs, 3% duty cycle			8	A
θ_{JA}	Package thermal impedance [3]	DFN2X2-8		75	°C/W
T_J	Operating junction temperature [4]			125	°C
T_{stg}	Storage temperature		-65	150	°C
	Lead Temperature (Soldering, 10secs)			260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may 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-rated conditions for extended periods may affect device reliability.
(2) All voltages are with respect to the GND pin.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

9.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), Mil-Std-883-3:2019	±2000	V
		Charge Device Model (CDM), ANSI/ ESDA /JEDEC JS-002-2022	±1000	V

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{IN}	Input Voltage	0.6	V_{BIAS}	V
V_{BIAS}	BIAS Voltage	2.5	5.5	V
V_{ON}	ON Pin Voltage	0	5.5	V
V_{OUT}	Output Voltage	0	V_{IN}	V
V_{IH}	High-Level Input Voltage, ON	1.2	5.5	V
V_{IL}	Low-Level Input Voltage, ON	0	0.5	V
C_{IN}	Input Capacitor	1		µF
Operating Ambient Temperature, T_A		-40	105	°C

9.4 Electrical Characteristics

(At V_{IN}=V_{BIAS}=5V, T_A = +25°C, unless otherwise noted.)

PARAMETER		TEST CONDITIONS		T_A	MIN(1)	TYP(2)	MAX(1)	UNIT
POWER SUPPLIES AND CURRENTS								
V_{IN}	Input Voltage				0.6		5.5	V
V_{BIAS}	Bias Input Voltage				2.5		5.5	V
$I_{Q,VBIAS}$	V_{BIAS} Quiescent Current	I_{OUT}=0mA, V_{IN}=V_{ON}=5V		-40°C to 105°C		25		μA
$I_{SD,VBIAS}$	V_{BIAS} Shutdown Current	V_{ON}=0V, V_{OUT}=0V		-40°C to 105°C		0.005		μA
$I_{SD,VIN}$	V_{IN} Shutdown Current	V_{ON}=0V, V_{OUT}=0V	V_{IN}=5V	-40°C to 105°C		0.04		μA
			V_{IN}=3.3V	-40°C to 105°C		0.02		μA
			V_{IN}=1.8V	-40°C to 105°C		0.01		μA
			V_{IN}=0.6V	-40°C to 105°C		0.01		μA
I_{ON}	ON Pin Leakage Current	V_{ON}=5.5V		-40°C to 105°C		0.005		μA
RESISTANCE CHARACTERISTICS								
R_{ON}	On-Resistance	I_{OUT}=-200mA	V_{IN}=5V	25°C		17		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			24	mΩ
			V_{IN}=3.3V	25°C		16		mΩ
				-40°C to 85°C			21	mΩ
				-40°C to 105°C			23	mΩ
			V_{IN}=1.8V	25°C		18		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			24	mΩ
			V_{IN}=1.2V	25°C		17		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			23	mΩ
			V_{IN}=1.05V	25°C		17		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			23	mΩ
			V_{IN}=0.8V	25°C		17		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			23	mΩ
			V_{IN}=0.6V	25°C		17		mΩ
				-40°C to 85°C			22	mΩ
				-40°C to 105°C			23	mΩ
ENABLE THRESHOLD CHARACTERISTICS								
$V_{ON,THH}$	Input logic-high voltage, ON			-40°C to 105°C	1.2			V
$V_{ON,THL}$	Input logic-low voltage, ON			-40°C to 105°C			0.5	V
$V_{ON,HYS}$	ON Pin Hysteresis			25°C		90		mV
OUT CHARACTERISTICS								
R_{PD}	Output Pulldown Resistance	V_{IN}=5V		-40°C to 105°C		205		Ω
THERMAL PROTECTION								
T_{TSD}	Thermal shutdown junction temperature threshold					165		°C
T_{TSD_HYS}	Thermal shutdown junction temperature hysteresis					20		°C

Electrical Characteristics

(At $V_{IN}=V_{BIAS}=2.5V$, T_A = +25°C, unless otherwise noted.)

PARAMETER		TEST CONDITIONS		T_A	MIN[1]	TYP[2]	MAX[1]	UNIT
POWER SUPPLIES AND CURRENTS								
$I_{Q,VBIAS}$	V_{BIAS} Quiescent Current	I_{OUT} =0mA, $V_{IN}=V_{ON}$=2.5V		-40°C to 105°C		33		μA
$I_{SD,VBIAS}$	V_{BIAS} Shutdown Current	$V_{ON1,2}$=0V, $V_{OUT1,2}$=0V		-40°C to 105°C		0.001		μA
$I_{SD,VIN}$	V_{IN} Shutdown Current	V_{ON}=0V, V_{OUT}=0V	V_{IN}=2.5V	-40°C to 105°C		0.02		μA
			V_{IN}=1.8V	-40°C to 105°C		0.01		μA
			V_{IN}=1.05V	-40°C to 105°C		0.005		μA
			V_{IN}=0.6V	-40°C to 105°C		0.001		μA
I_{ON}	ON Pin Leakage Current	V_{ON}=5.5V		-40°C to 105°C		0.001		μA
RESISTANCE CHARACTERISTICS								
R_{ON}	On-Resistance	I_{OUT}=-200mA	V_{IN}=2.5V	25°C		22		mΩ
				-40°C to 85°C			29	mΩ
				-40°C to 105°C			31	mΩ
			V_{IN}=1.8V	25°C		19		mΩ
				-40°C to 85°C			25	mΩ
				-40°C to 105°C			27	mΩ
			V_{IN}=1.5V	25°C		19		mΩ
				-40°C to 85°C			25	mΩ
				-40°C to 105°C			26	mΩ
			V_{IN}=1.2V	25°C		18		mΩ
				-40°C to 85°C			24	mΩ
				-40°C to 105°C			25	mΩ
			V_{IN}=1.05V	25°C		18		mΩ
				-40°C to 85°C			23	mΩ
				-40°C to 105°C			25	mΩ
			V_{IN}=0.8V	25°C		17		mΩ
				-40°C to 85°C			23	mΩ
				-40°C to 105°C			24	mΩ
			V_{IN}=0.6V	25°C		17		mΩ
				-40°C to 85°C			23	mΩ
				-40°C to 105°C			24	mΩ
ENABLE THRESHOLD CHARACTERISTICS								
$V_{ON,THH}$	Input logic-high voltage, ON			-40°C to 105°C	1.2			V
$V_{ON,THL}$	Input logic-low voltage, ON			-40°C to 105°C			0.5	V
$V_{ON,HYS}$	ON Pin Hysteresis			25°C		45		mV
OUT CHARACTERISTICS								
R_{PD}	Output Pulldown Resistance	V_{IN}=2.5V		-40°C to 105°C		220		Ω
THERMAL PROTECTION								
T_{TSD}	Thermal shutdown junction temperature threshold					165		°C
T_{TSD_HYS}	Thermal shutdown junction temperature hysteresis					20		°C

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(2) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

9.5 Switching Characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{BIAS} = V_{ON} = V_{IN} = 5V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		1398		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2283		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		274		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 3.3V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		939		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		1489		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		162		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 2.5V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		722		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		1152		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		2		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		148		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 1.8V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		518		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		822		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		115		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 1.5V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		422		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		664		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		111		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 1.2V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		344		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		532		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		94		
V_{BIAS} = V_{ON} = 5V, V_{IN} = 0.8V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		240		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		328		μs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1μF, C_T = 1000 pF		93		

V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 3.3V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		988		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		1565		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		177		
V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 2.5V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		758		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		1197		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		163		
V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 1.8V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		550		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		859		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		120		
V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 1.5V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		451		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		694		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		117		
V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 1.2V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		365		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		557		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		106		
V_{BIAS} = 3.3V, V_{ON} = 5V, V_{IN} = 0.8V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		256		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		340		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		98		
V_{BIAS} = 2.5V, V_{ON} = 5V, V_{IN} = 2.5V, T_A=25°C (unless otherwise noted)						
t_{ON}	Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		757		
t_{OFF}	Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_R	V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		1212		µs
t_F	V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D	ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		167		

V_{BIAS} = 2.5V, V_{ON} = 5V, V_{IN} = 1.8V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		553		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		4		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		870		µs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		117		
V_{BIAS} = 2.5V, V_{ON} = 5V, V_{IN} = 1.5V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		458		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		4		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		699		µs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		121		
V_{BIAS} = 2.5V, V_{ON} = 5V, V_{IN} = 1.2V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		370		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		4		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		551		µs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		112		
V_{BIAS} = 2.5V, V_{ON} = 5V, V_{IN} = 0.8V, T_A=25°C (unless otherwise noted)					
t_{ON} Turn on time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		257		
t_{OFF} Turn off time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		4		
t_R V_{OUT} rise time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		342		µs
t_F V_{OUT} fall time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		3		
t_D ON delay time	R_L = 10 Ω, C_L = 0.1µF, C_T = 1000 pF		106		

9.6 Parameter Measurement Information

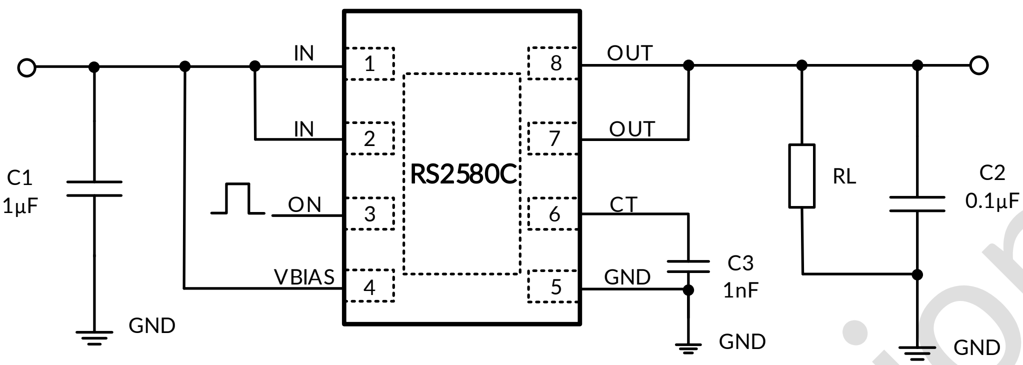


Figure 1. Test circuit

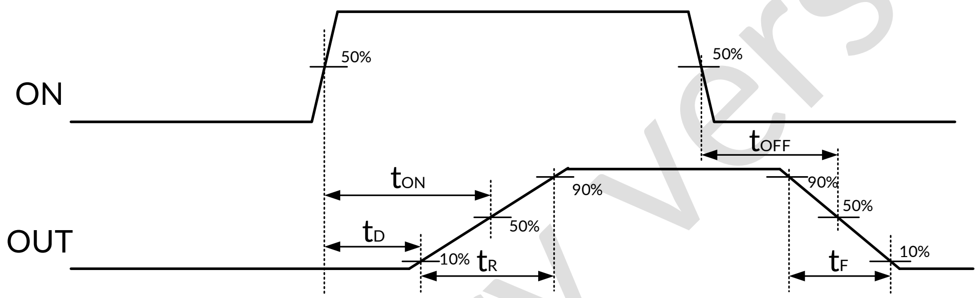


Figure 2. Switch Turn-On and Turn-Off Delay Times

9.7 Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

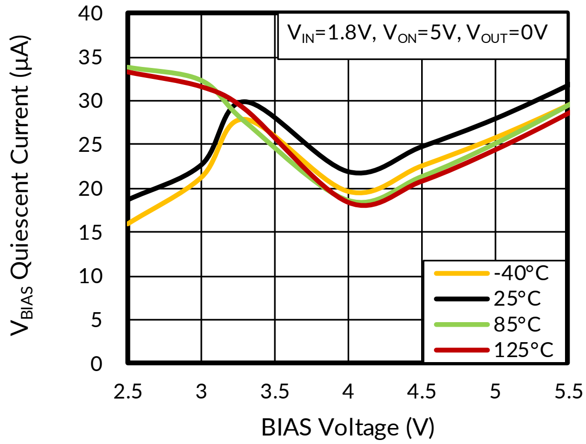


Figure 3. V_{BIAS} Quiescent Current vs BIAS Voltage

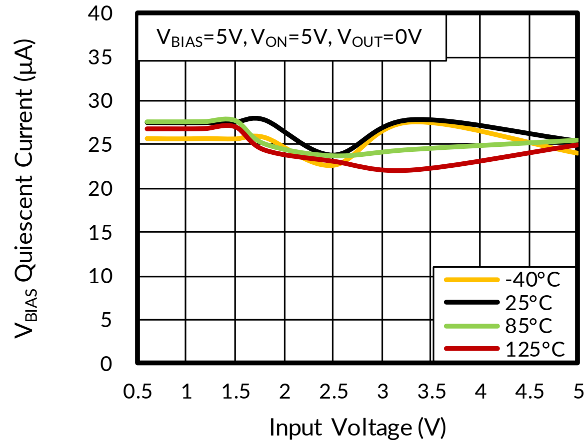


Figure 4. V_{BIAS} Quiescent Current vs Input Voltage

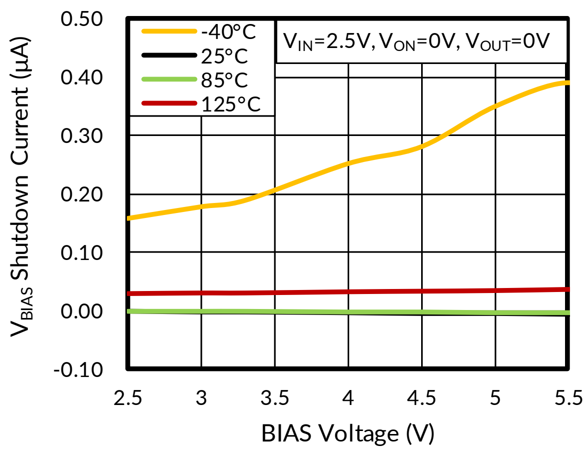


Figure 5. V_{BIAS} Shutdown Current vs BIAS Voltage

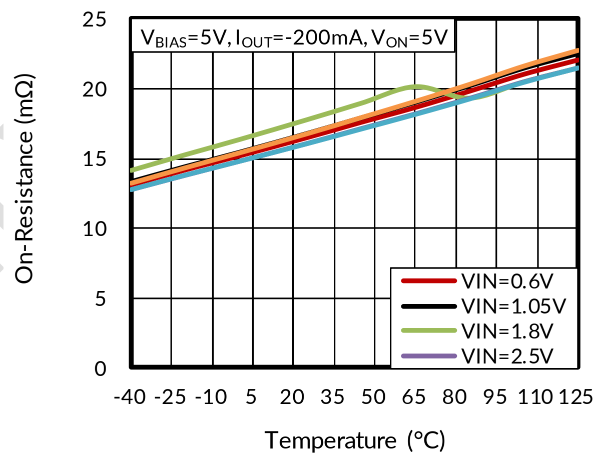


Figure 6. On Resistance vs Temperature

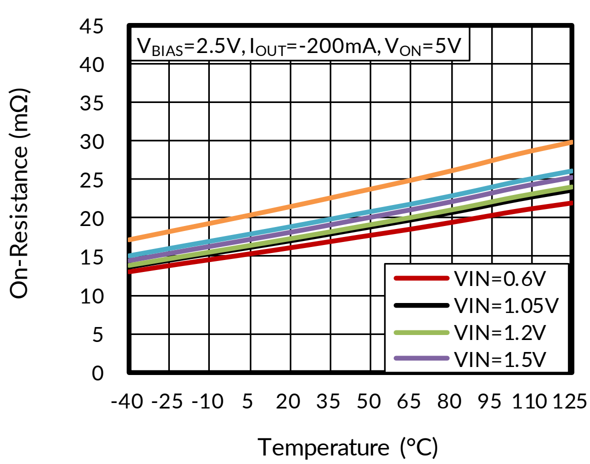


Figure 7. On Resistance vs Temperature

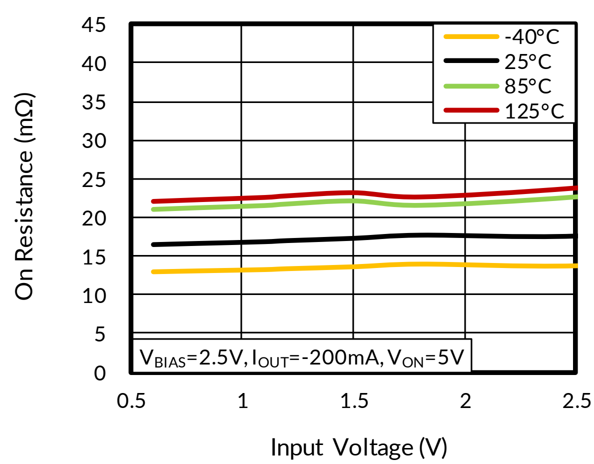


Figure 8. On Resistance vs Input Voltage

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

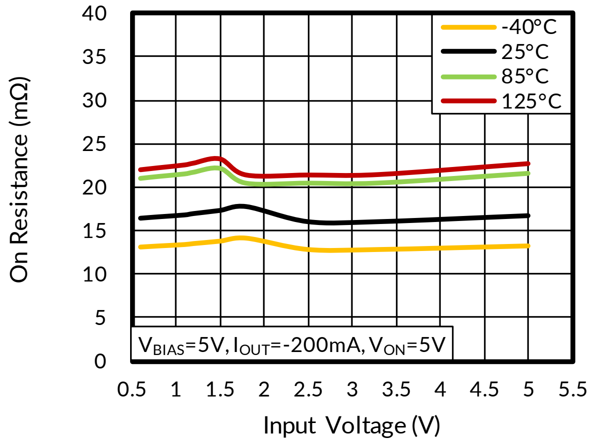


Figure 9. On Resistance vs Input Voltage

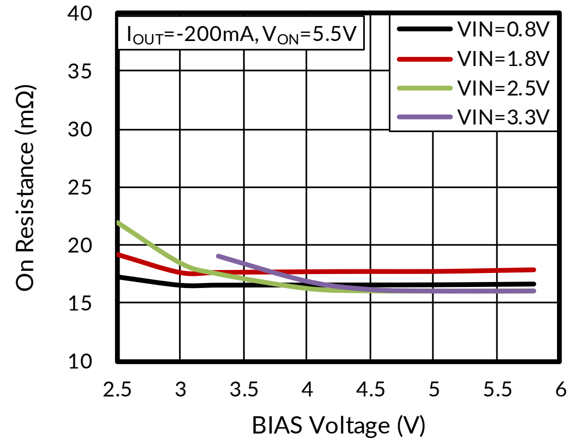


Figure 10. On Resistance vs BIAS Voltage

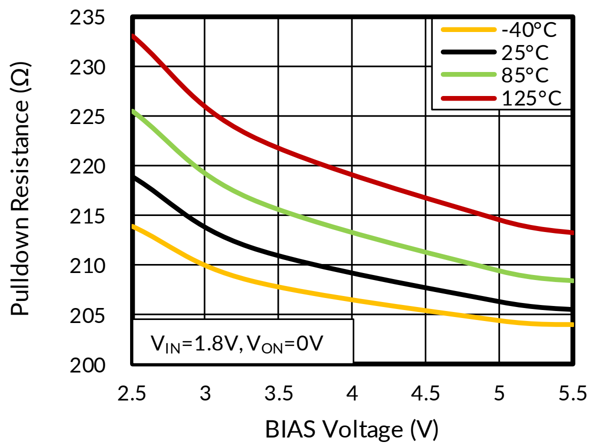


Figure 11. Pulldown Resistance vs BIAS Voltage

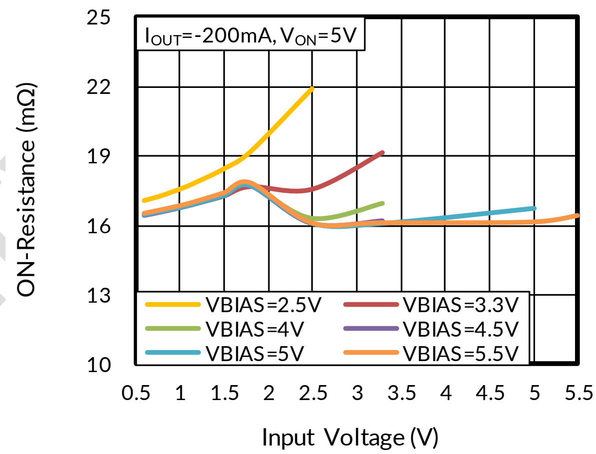


Figure 12. ON-Resistance vs Input Voltage

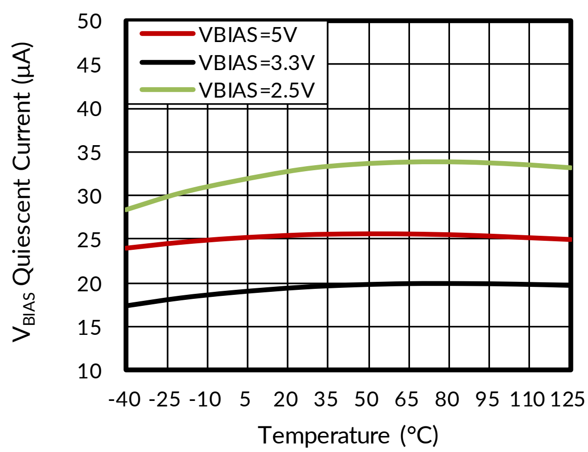


Figure 13. V_{BIAS} Quiescent Current vs Temperature

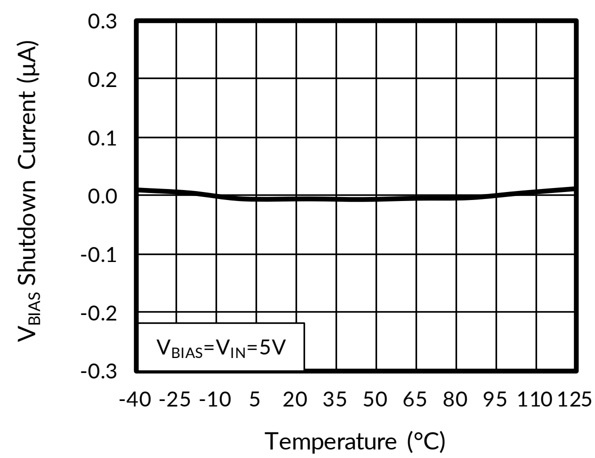


Figure 14. V_{BIAS} Shutdown Current vs Temperature

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

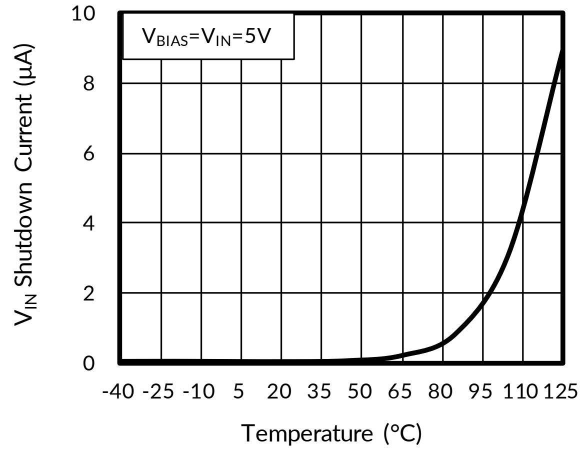


Figure 15. V_{IN} Shutdown Current vs Temperature

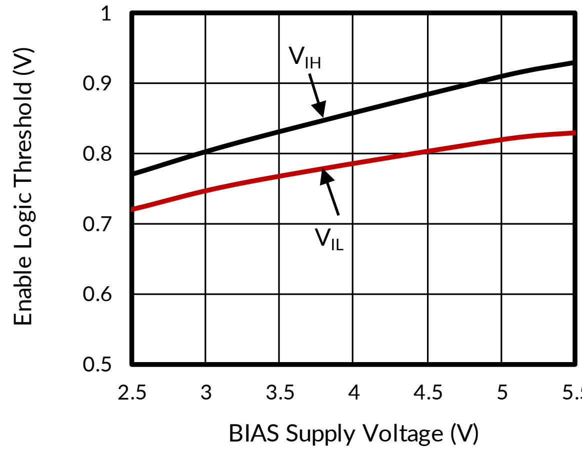


Figure 16. Enable Logic Threshold vs BIAS Supply Voltage

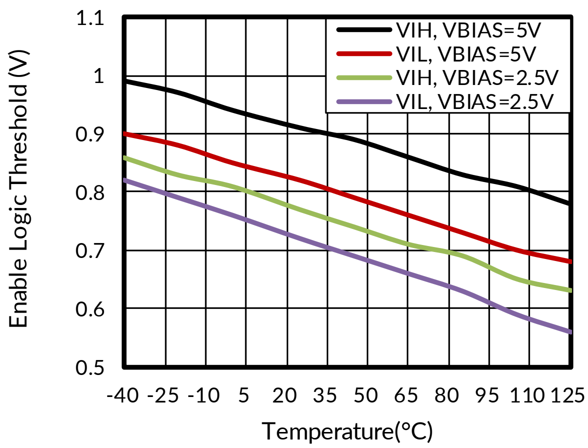


Figure 17. Enable Logic Threshold vs Temperature

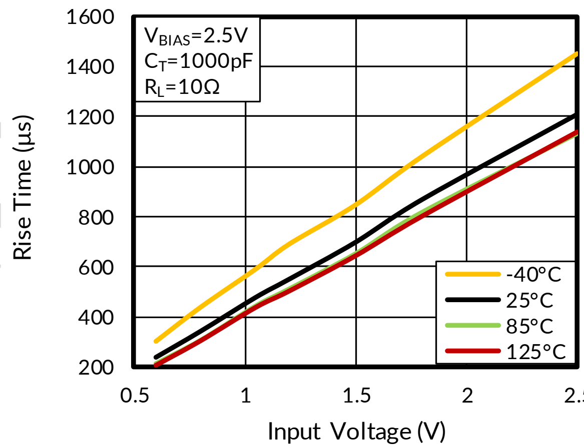


Figure 18. Rise Time vs Input Voltage

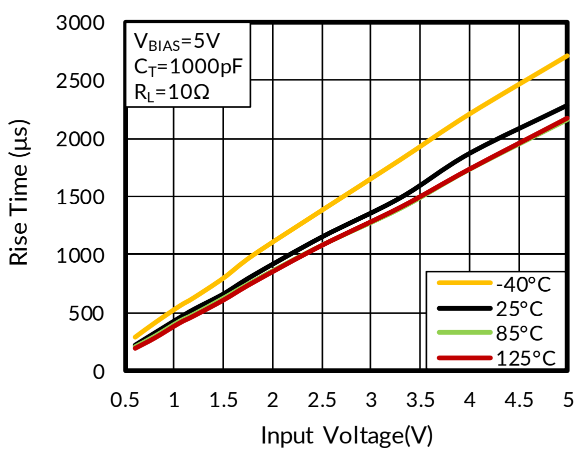


Figure 19. Rise Time vs Input Voltage

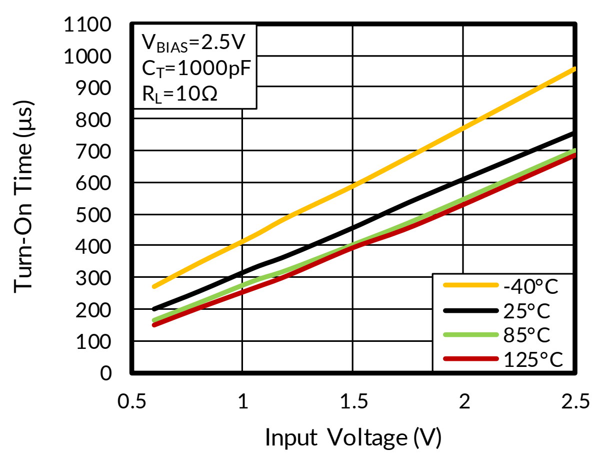


Figure 20. Turn-On Time vs Input Voltage

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

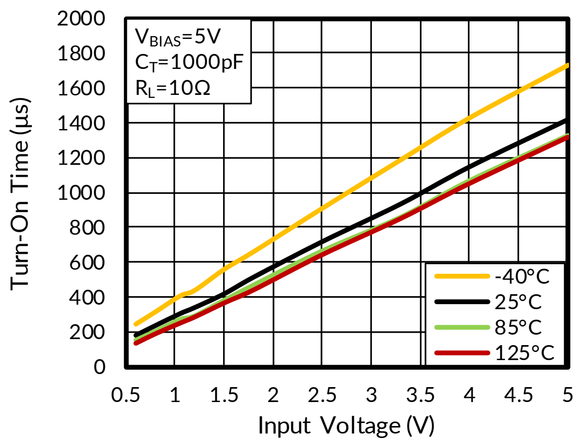


Figure 21. Turn-On Time vs Input Voltage

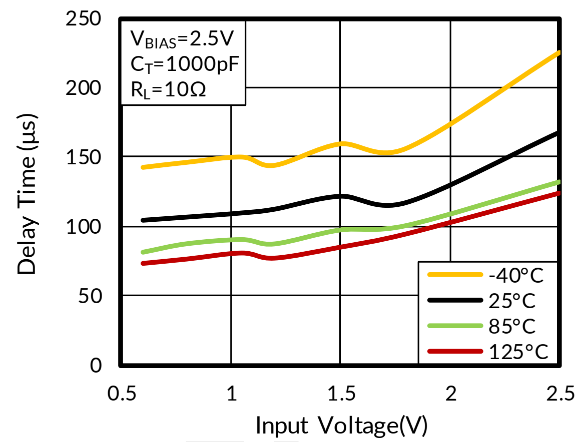


Figure 22. Delay Time vs Input Voltage

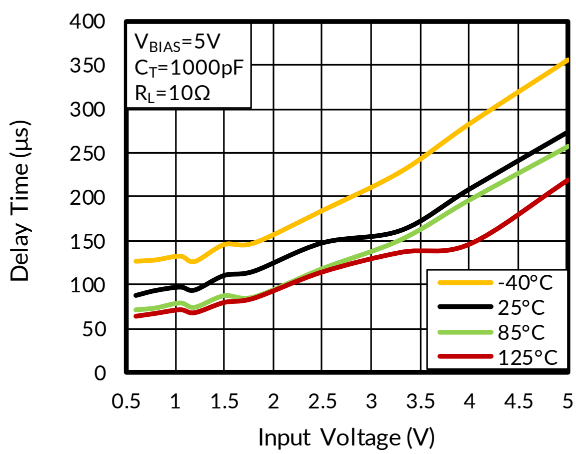


Figure 23. Delay Time vs Input Voltage

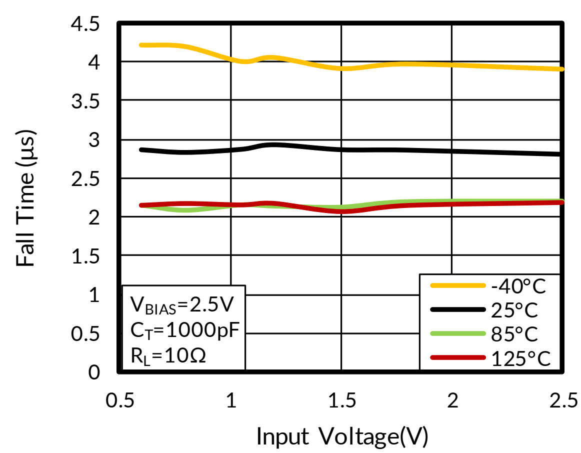


Figure 24. Fall Time vs Input Voltage

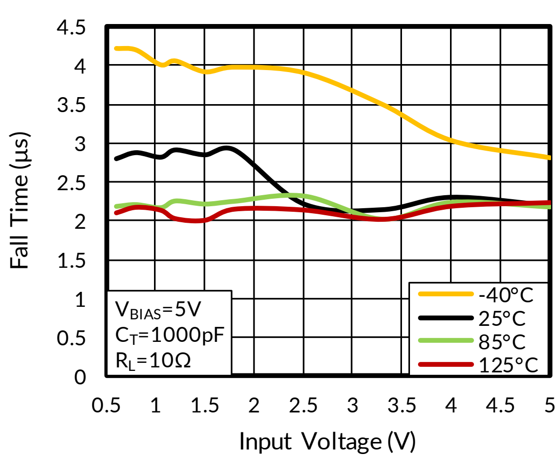


Figure 25. Fall Time vs Input Voltage

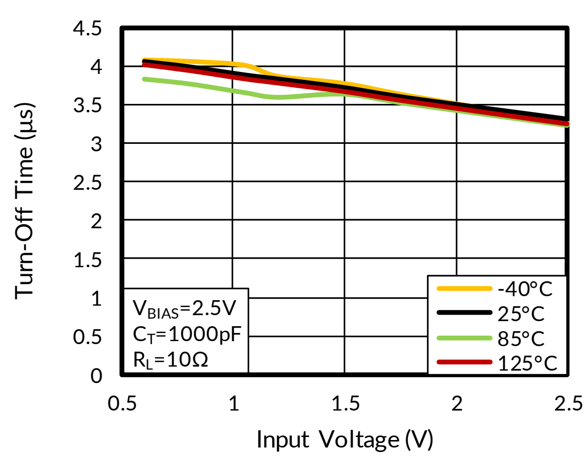


Figure 26. Turn-Off Time vs Input Voltage

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

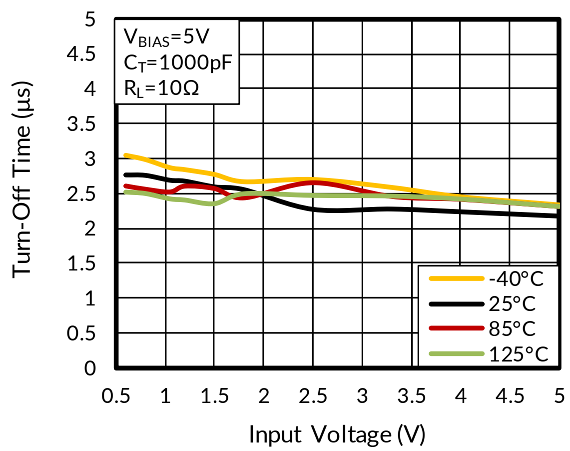


Figure 27. Turn-Off Time vs Input Voltage

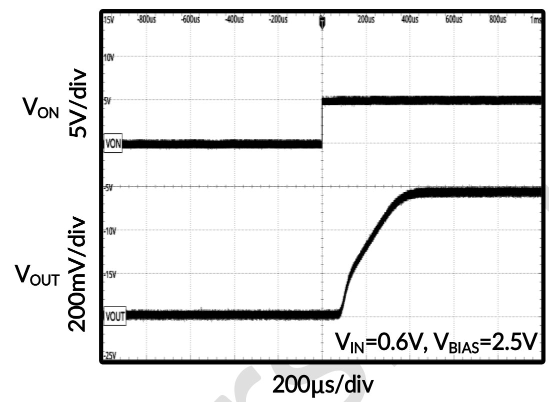


Figure 28. Turn-On Response Time

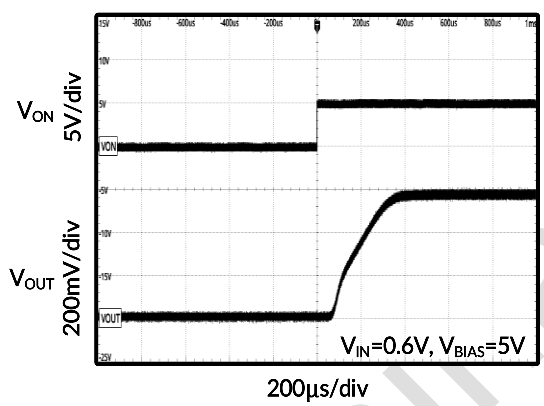


Figure 29. Turn-On Response Time

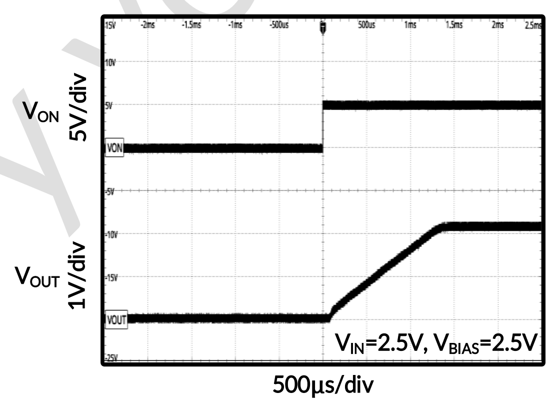


Figure 30. Turn-On Response Time

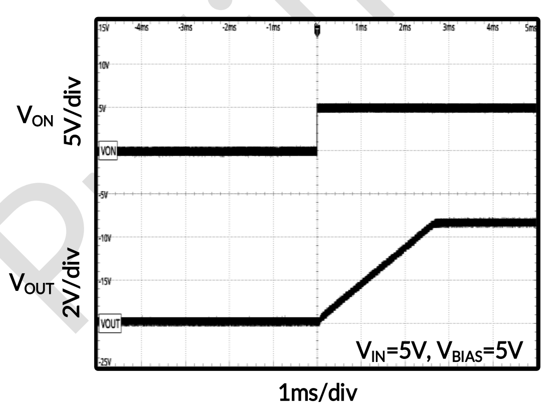


Figure 31. Turn-On Response Time

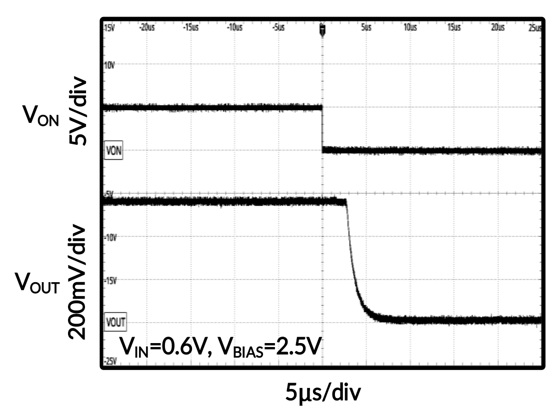


Figure 32. Turn-Off Response Time

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

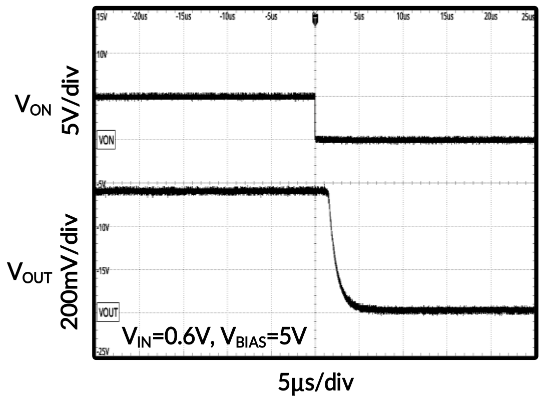


Figure 33. Turn-Off Response Time

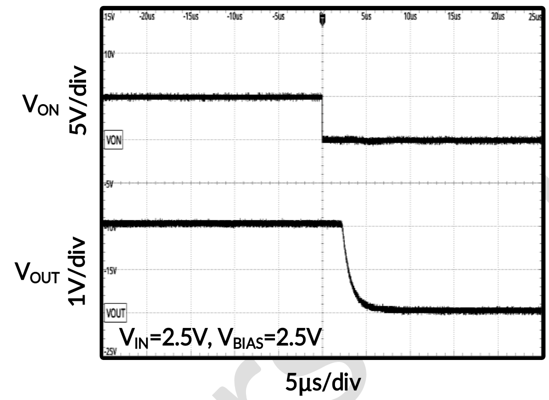


Figure 34. Turn-Off Response Time

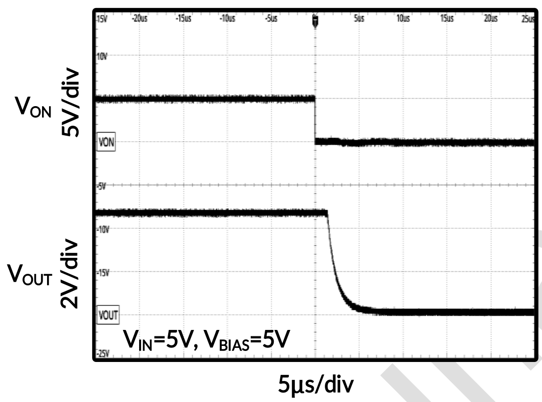


Figure 35. Turn-Off Response Time

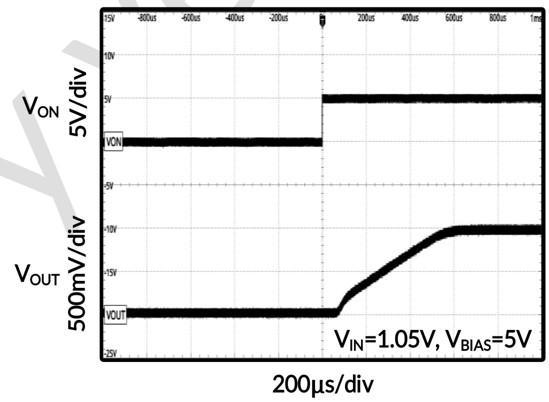


Figure 36. Turn-On Response Time

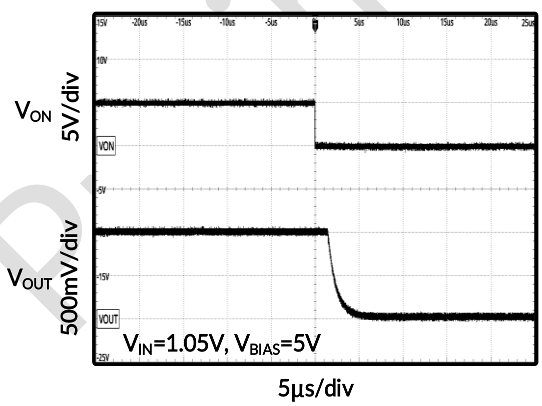


Figure 37. Turn-Off Response Time

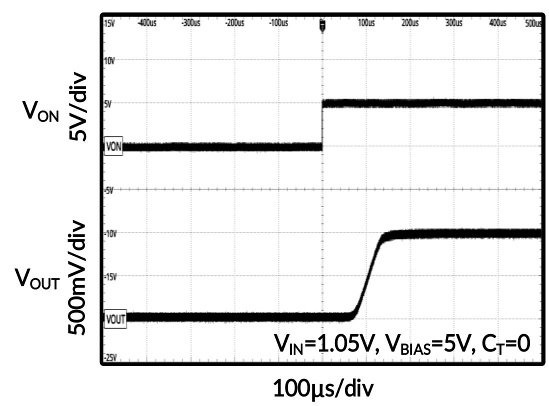


Figure 38. Turn-On Response Time

Typical Performance Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = +25°C, unless otherwise noted.

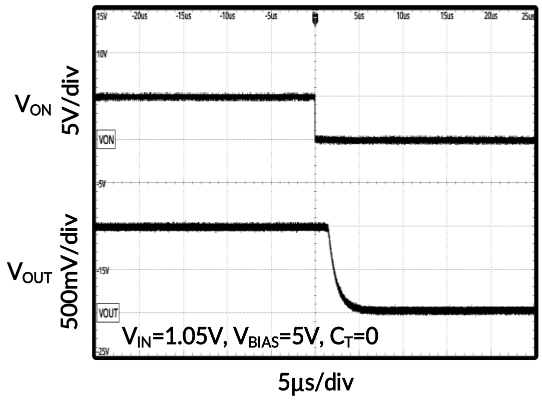


Figure 39. Turn-Off Response Time

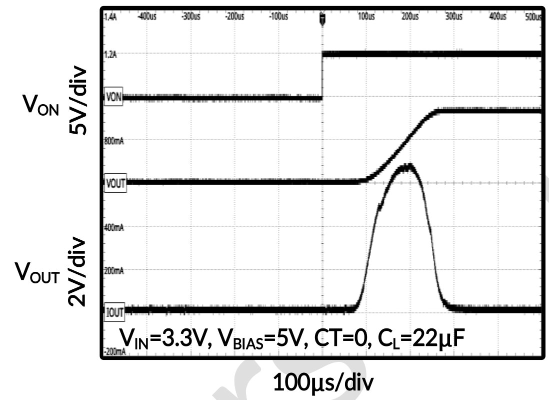


Figure 40. Turn-On Response Time

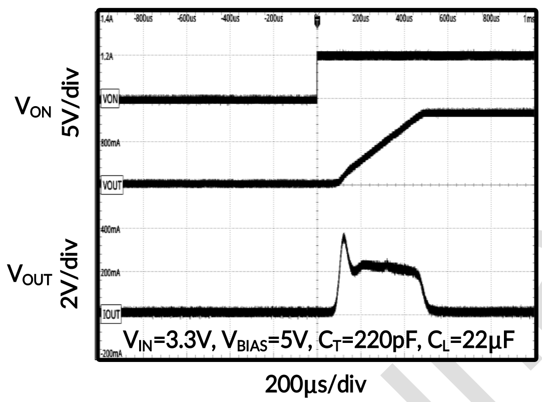


Figure 41. Turn-On Response Time

10 FUNCTIONAL DESCRIPTION

10.1 Overview

The RS2580C device is a load switch with controlled turn on, integrating N-channel MOSFET power devices to meet high-side load switch applications. The device can operate over an input voltage range of 0.6 V to 5.5 V, and can support a maximum continuous current of 6A per channel. The switch is independently controlled by an on and off input (ON), which can interface directly with low-voltage control signals. The RS2580C is capable of thermal shutdown when the junction temperature is above the threshold, turning the switch off. The switch turns on again when the junction temperature stabilizes to a safe range. The RS2580C also offers an integrated 220 Ω on-chip load resistor for quick output discharge when the switch is turned off.

The RS2580C is available in a small, space-saving DFN2X2-8 package with integrated thermal pad allowing for high power dissipation. The device is characterized for operation over the free-air temperature range of -40°C to +105°C.

10.2 BIAS Under-voltage Lockout (UVLO)

An under-voltage lockout (UVLO) circuit monitors the BIAS pins voltage to prevent wrong logic controls. The UVLO function initiates a soft-start process after the BIAS supply voltages exceed rising UVLO voltage threshold during powering on.

10.3 Soft-Start

The RS2580C Provides an adjustable soft-start circuitry to control rise rate of the output voltage and limit the current surge during start-up. The soft-start time is set with a capacitor from the CT pin to the ground. (see 10.7 Adjustable Rise Time for more details)

10.4 Enable Control

The ON pin controls the state of the switch. Asserting ON high enables the switch. ON is active high and has a low threshold, making it capable of interfacing with low-voltage signals. The ON pin can be used with any microcontroller with 1.2 V or higher GPIO voltage. This pin **cannot be left floating** and must be driven either high or low for proper functionality.

10.5 Turn-On & Turn-off the device

The RS2580C turns on when V_{BIAS}>UVLO & ON＝High. Make sure VBIAS **cannot be left floating** and **must be powered on before VIN**. For optimal R_{ON} performance, **make sure $V_{IN} \le V_{BIAS}$. Using ON=Low** to turn off the device instead of using V_{BIAS}<UVLO to prevent the ultra-low but unpredictable leakage current which from VIN to OUT result in rising up the OUT voltage.

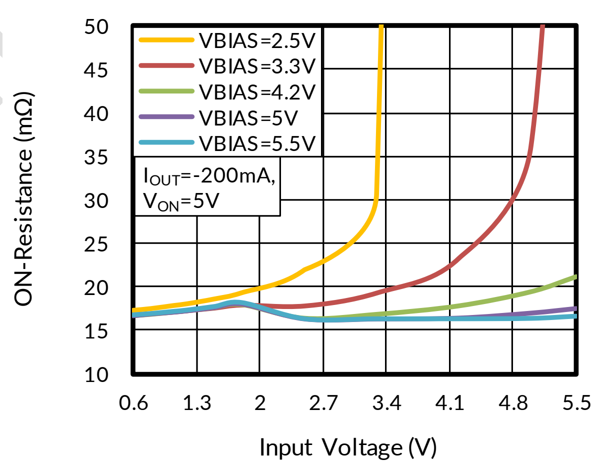


Figure 42. On-Resistance vs Input Voltage (V_{IN}>V_{BIAS})

10.6 Supply filter capacitor

To limit the voltage, drop on the input supply caused by transient inrush currents when the switch turns on into a discharged load capacitor, a capacitor needs to be placed between VIN and GND. A 1-µF ceramic capacitor, C_{IN}, placed close to the pins, is usually sufficient. Higher values of C_{IN} can be used to further reduce the voltage drop during high current applications. When switching heavy loads, it is recommended to have an input capacitor about 10 times higher than the output capacitor to avoid excessive voltage drop.
Because of the integrated body diode in the NMOS switch, a C_{IN} greater than C_L is highly recommended. A C_L greater than C_{IN} can cause V_{OUT} to exceed V_{IN} when the system supply is removed. This could result in current flow through the body diode from VOUT to VIN. A C_{IN} to C_L ratio of 10 to 1 is recommended for minimizing V_{IN} dip caused by inrush currents during startup; however, a 10 to 1 ratio for capacitance is not required for proper functionality of the device. A ratio smaller than 10 to 1 (such as 1 to 1) could cause slightly more VIN dip upon turn-on due to inrush currents. This can be mitigated by increasing the capacitance on the CT pin for a longer rise time (see 10.7 Adjustable Rise Time for more details).

10.7 Adjustable Rise Time

The soft-start capacitor on CT pin can reduce the inrush current and overshoot of output voltage. The soft-start time is set with a capacitor from the CT pin to the ground. The voltage on the CT pin can be as high as 5.5 V; therefore, the minimum voltage rating for the CT capacitor must be 10 V for optimal performance. The slew rate of VOUT is depended on CT capacitor, the relationship is shown in the equation as below:
SR = 0.38 × CT + 34
SR is the slew rate (in µs/V) from 10% to 90%
CT is the capacitance value on the CT pin (in pF)
The units for the constant 34 are µs/V. The units for the constant 0.38 are µs/(V×pF).
An approximate formula for the relationship between CT and slew rate when VBIAS is set to 3.3V is shown in **Table 1** as well VBIAS is set to 5V is shown in **Table 2.**

Table 1. Rise Time vs CT Capacitor

CT (pF)	TYPICAL VALUES at 25°C with a 25 V X7R 10% CERAMIC CAPACITOR on CT (1)					
	V_{IN} = 3.3V	V_{IN} = 1.8V	V_{IN} = 1.5V	V_{IN} = 1.2V	V_{IN} = 1.05V	V_{IN} = 0.8V
0	122	83	73	65	60	49
220	339	184	148	113	101	71
470	894	483	396	307	270	189
1000	1565	859	694	557	477	340
2200	3254	1801	1464	1176	1025	743
4700	7496	4145	3335	2697	2336	1715
10000	15353	8561	6929	5378	4826	3483

(1) Rise time (µs) 10% - 90%, C_L = 0.1 µF, C_{IN}= 1 µF, R_L=10 Ω, V_{BIAS} = 3.3V.

Table 2. Rise Time vs CT Capacitor

CT (pF)	TYPICAL VALUES at 25°C with a 25 V X7R 10% CERAMIC CAPACITOR on CT(1)						
	V_{IN} = 5V	V_{IN} = 3.3V	V_{IN} = 1.8V	V_{IN} = 1.5V	V_{IN} = 1.2V	V_{IN} = 1.05V	V_{IN} = 0.8V
0	157	112	79	68	57	56	46
220	512	328	177	140	109	96	68
470	1308	856	462	382	299	258	182
1000	2283	1489	822	664	532	458	328
2200	4828	3132	1772	1393	1124	974	701
4700	11277	7204	3954	3183	2584	2240	1612
10000	22969	15022	8263	6606	5230	4642	3316

(1) Rise time (µs) 10% - 90%, C_L = 0.1 µF, C_{IN}= 1 µF, R_L=10 Ω, V_{BIAS} = 5 V.

10.8 Inrush Current

When the switch is enabled, the output capacitors must be charged up from 0V to the set value. This charge arrives in the from of inrush current. Inrush current can be calculated as follow.

$$\text{Inrush current} = C \times dV/dt$$

Where

C is the output capacitance
dV is the output voltage
dt is the rise time depended on CT capacitance

10.9 Power dissipation

The device's junction temperature depends on several factors such as the load, PCB layout, ambient temperature, and package type. Equations that can be used to calculate power dissipation and junction temperature are found below:

$$P_D = R_{DS(ON)} \times I_{OUT}^2$$

To relate this to junction temperature, the following equation can be used:

$$T_J = P_D \times \theta_{JA} + T_A$$

Where:

T_J = junction temperature
T_A = ambient temperature
θ_{JA} = the thermal resistance of the package

11 LAYOUT

11.1 Layout Guidelines

For best performance, all traces must be as short as possible. To be most effective, the input and output capacitors must be placed close to the device to minimize the effects that parasitic trace inductances may have on normal operation. Using wide traces for VIN, VOUT, and GND helps minimize the parasitic electrical effects along with minimizing the case to ambient thermal impedance. The CT trace must be as short as possible to avoid parasitic capacitance.

11.2 Layout Example

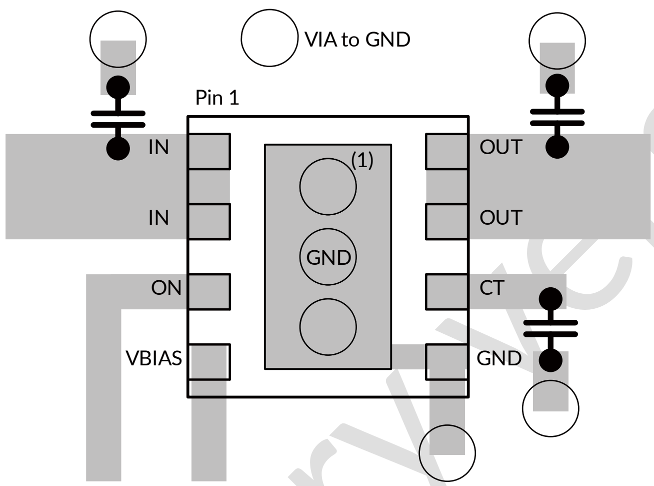
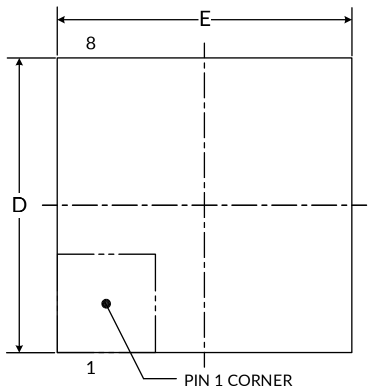


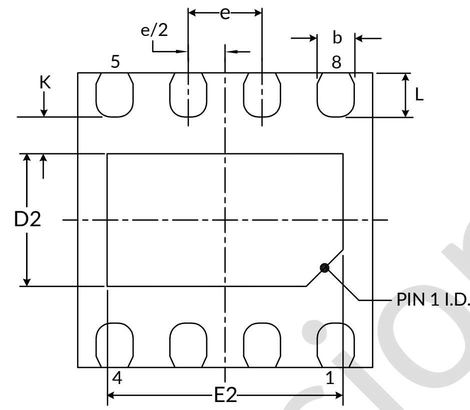
Figure 43. Layout Recommendation

12 PACKAGE OUTLINE DIMENSIONS

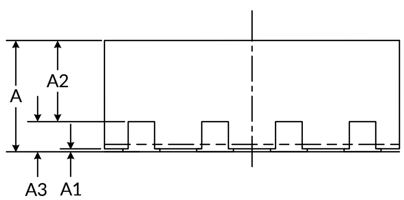
DFN2X2-8 (4)



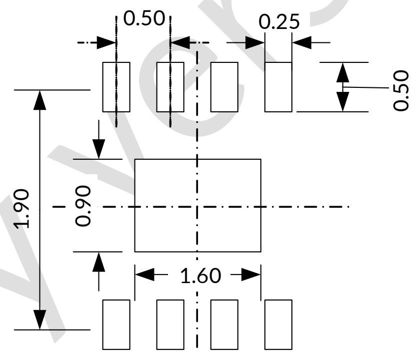
TOP VIEW



BOTTOM VIEW



SIDE VIEW



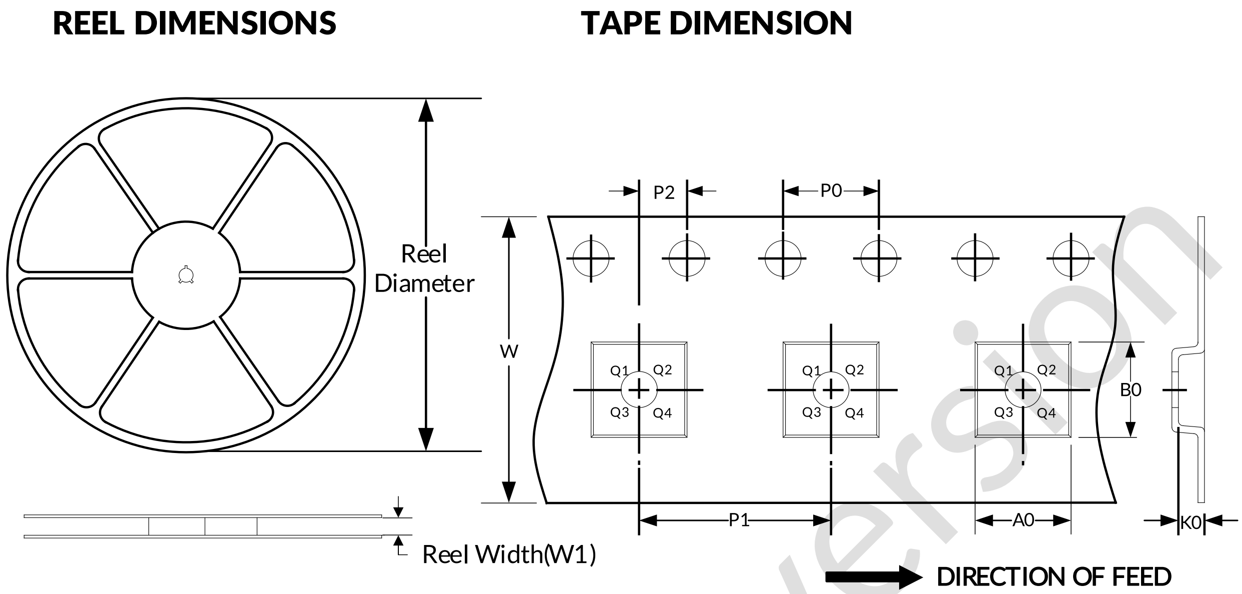
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.550 NOM		0.022 NOM	
A3	0.203 REF (2)		0.008 REF (2)	
b	0.200	0.300	0.008	0.012
D (1)	2.000 BSC (3)		0.079 BSC (3)	
E (1)	2.000 BSC (3)		0.079 BSC (3)	
e	0.500 BSC (3)		0.020 BSC (3)	
L	0.250	0.350	0.010	0.014
D2	0.800	1.000	0.032	0.039
E2	1.500	1.700	0.059	0.067
K	0.150	0.350	0.006	0.014

NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
4. This drawing is subject to change without notice.

13 TAPE AND REEL INFORMATION



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 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
DFN2X2-8	7"	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q2

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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