

2ch switching regulator IC

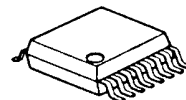
■GENERAL DESCRIPTION

The **NJU7680** is a high-speed low voltage operation switching regulator control IC. It features a totem pole driver that can directly drive an external MOS-FET.

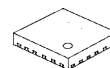
Each channel has an on/off switch. Therefore, the power sequence can be activated externally.

Internal soft-start function, dead time control and timer latch function are included, and those functions can be easily controlled by external component.

■PACKAGE OUTLINE



NJU7680V



**NJU7680SED
(U.D.)**

■FEATURES

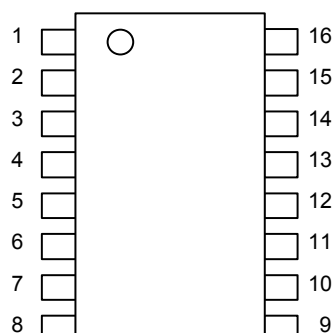
- Step-Down, Step-Up/SEPIC circuit
- PWM switching control
- Operating Voltage 2.3V to 7V
- Wide Oscillator Range 300kHz to 1MHz
- Soft-Start Function Internal: 4ms typ. or adjustable
- Channel ON/OFF Function
- Standby Quiescent Current 1μA max.
- Dead Time Control
- Timer Latch for Short Circuit Protection
- C-MOS Technology
- Package Outline

NJU7680V	: SSOP16
NJU7680SED	: PCSP24-ED (U.D.)

NJU7680

■PIN CONFIGURATION

<SSOP16 package>



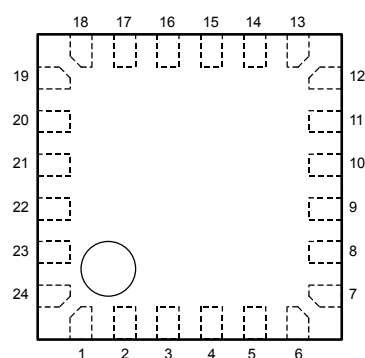
(Top View)

NJU7680V

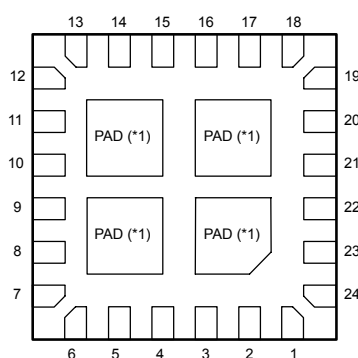
PIN FUNCTION

1. SCP	9. OUT1
2. CE1	10. DTC1
3. CE2	11. GND
4. FB2	12. GND
5. IN-2	13. RT
6. V ⁺	14. VREG
7. DTC2	15. IN-1
8. OUT2	16. FB1

<PCSP24-ED package>



(Top View)



(Bottom View)

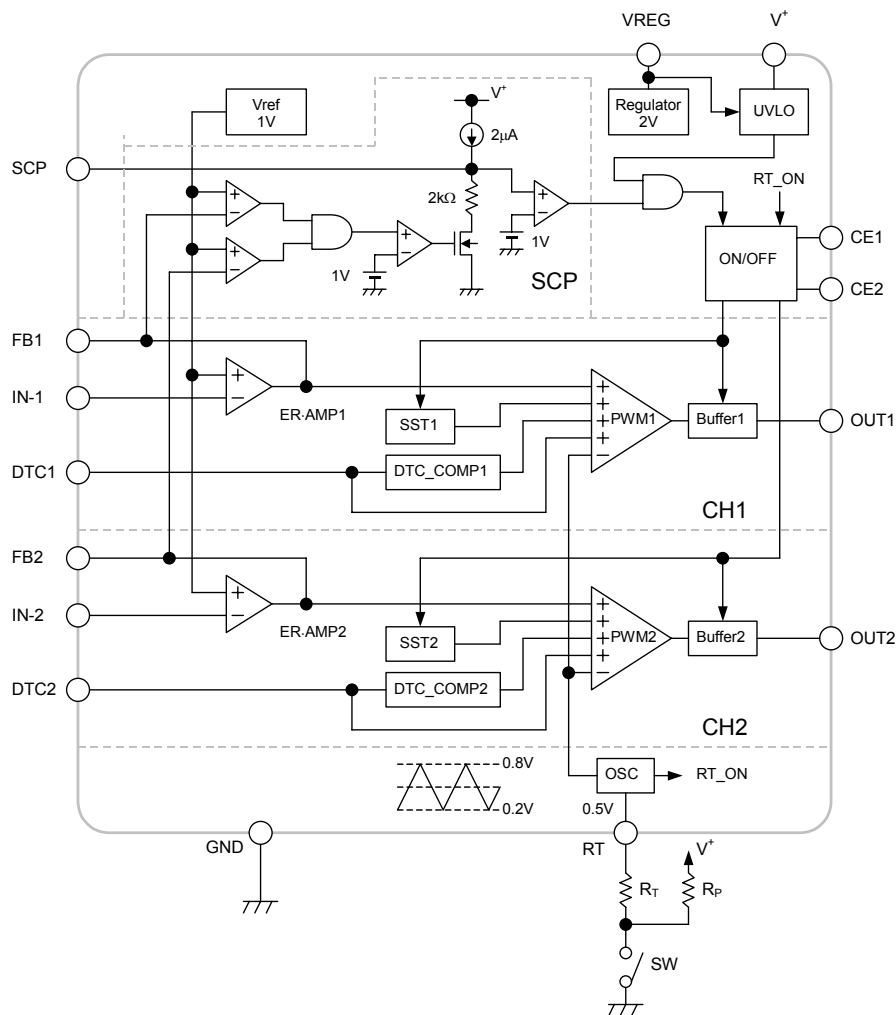
NJU7680SED (U.D.)

PIN FUNCTION

1. N.C.	13. DTC1
2. FB2	14. GND
3. IN-2	15. GND
4. N.C.	16. RT
5. V ⁺	17. VREG
6. N.C.	18. N.C.
7. DTC2	19. IN-1
8. N.C.	20. FB1
9. OUT2	21. N.C.
10. N.C.	22. SCP
11. OUT1	23. CE1
12. N.C.	24. CE2

(*1) The PAD is not connected to an IC chip electrically.

■BLOCK DIAGRAM



●On/Off Function

The On/Off switch for each channel is controlled by CE pin.

→ Setting the CE low will turn off all applicable channels' circuit.

→ Turning off both channels will turn off all circuit.

→ Opening the RT pin will turn off all circuit regardless of input signals from CE pin.

Input Signal			Operating State	
RT	CE1	CE2	CH1	CH2
H	H	H	ON	ON
H	H	L	ON	OFF
H	L	H	OFF	ON
H	L	L	OFF Standby Mode	
L	H	H		
L	H	L		
L	L	H		
L	L	L		

●Soft Start Feature (Soft Start)

The soft-start is internally set for 4ms typ. To adjust the time, insert resistance or connect capacitor to the DTC pin.

●Max Duty

Max Duty is set 90% for CH1 (Step-up) and 100% for CH2 (Step-down).

Max Duty can be adjusted by connecting the VERG pin to the DTC pin. When not limiting Max Duty, short the DTC pin to the VREG terminal.

●Short Circuit Protection

The short circuit protection block employs time latch, and protection delay time can be adjusted by a capacitor connected to SCP pin. The program of timer latch circuit can be reset by restarting the power (supply voltage must be lower than UVLO sensing voltage), setting IC to standby status, or lowering SCP pin to GND level.

■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Supply Voltage	V ⁺	+8	V
Output Pin Current	I _O	±50	mA
CE1 Pin Voltage	V _{CE1}	+8 (*2)	V
CE2 Pin Voltage	V _{CE2}	+8 (*2)	V
Power Dissipation	P _D	SSOP16 : 300 PCSP24-ED : 475 (*3)	mW
Operating Temperature Range	T _{OPR}	-40 ~ +85	°C
Storage Temperature Range	T _{STG}	-40 ~ +125	°C

(*2): When input voltage is less than 8V, the absolute maximum control voltage is equal to the input voltage.

(*3): Mounted on glass epoxy board based on EIA/JEDEC. (114.3 × 76.2 × 1.6mm: 2Layers)

■RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V ⁺	2.3	—	7	V
Oscillator Timing Resistor	R _T	30	47	120	kΩ
Oscillation Frequency	f _{OSC}	300	700	1,000	kHz

■ELECTRICAL CHARACTERISTICS ($V^+=V_{CE1}=V_{CE2}=3.3V$, $R_T=47k\Omega$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Regulator Block						
Regulator Output Voltage	V_{REG}		1.97	2.0	2.03	V
Line Regulation	V_{REG_LINE}	$V^+=2.2 \sim 7V$	—	± 5	± 15	mV
Load Regulation	V_{REG_LOAD}	$I_{REG}=0 \sim 2mA$	-10	-1	—	mV
Maximum Output Current	I_{REG_MAX}	$V_{REG}=1.9V$	4	—	—	mA
Temp Fluctuations	V_{REG_TC1}	$T_a=-40 \sim +85^\circ C$	—	± 0.5	—	%
Under Voltage Lockout Block						
ON Threshold Voltage	V_{T_ON}	$V^+=L \rightarrow H$	2.1	2.2	2.3	V
OFF Threshold Voltage	V_{T_OFF}	$V^+=H \rightarrow L$	2.0	2.1	2.2	V
Hysteresis Voltage	V_{HYS}		60	100	—	mV
Regulator Output Detection ON Threshold Voltage	$V_{T_ON_REG}$	$V_{REG}=L \rightarrow H$	1.6	1.7	1.8	V
Regulator Output Detection OFF Threshold Voltage	$V_{T_OFF_REG}$	$V_{REG}=H \rightarrow L$	1.5	1.6	1.7	V
Regulator Output Detection Hysteresis Voltage	V_{HYS_REG}		60	100	—	mV
Short Circuit Protection Block						
Input Threshold Voltage 1	V_{T_PC1}	FB1 Pin	0.95	1.00	1.05	V
Input Threshold Voltage 2	V_{T_PC2}	FB2 Pin	0.95	1.00	1.05	V
Charge Current	I_{CHG}	$V_{SCP}=0V$	1.5	2	2.5	μA
Latch Mode ON Threshold Voltage	V_{T_LA}	SCP Pin	0.90	1.00	1.10	V
Latch Mode OFF Threshold Voltage	V_{T_LAOFF}	SCP Pin	0.35	0.6	0.85	V
Soft Start Block						
Soft Start Time 1	T_{SS1}	$V_{T_ON} \rightarrow \text{Duty1}=80\%$	3	4	6	ms
Soft Start Time 2	T_{SS2}	$V_{T_ON} \rightarrow \text{Duty2}=80\%$	3	4	6	ms
Oscillator Block						
RT Pin Voltage	V_{RT}		-5%	0.5	+5%	V
Oscillation Frequency	f_{OSC}		630	700	770	kHz
Oscillate Supply Voltage Fluctuations	f_{DV}	$V^+=2.2 \sim 7V$	—	1	—	%
Oscillate Temperature Fluctuations	f_{DT}	$T_a=-40^\circ C \sim +85^\circ C$	—	3	—	%
Standby RT Terminal Resistance	R_{T_STB}		—	2	—	$M\Omega$

■ELECTRICAL CHARACTERISTICS ($V^+=V_{CE1}=V_{CE2}=3.3V$, $R_T=47k\Omega$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
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Error Amplifier Block

Reference Voltage 1	V_{B1}		-1.5%	1.00	+1.5%	V
Reference Voltage 2	V_{B2}		-1.5%	1.00	+1.5%	V
Input Bias Current 1	I_{B1}		-0.1	—	0.1	μA
Input Bias Current 2	I_{B2}		-0.1	—	0.1	μA
Open Loop Gain	A_V		—	80	—	dB
Gain Bandwidth Product	G_B		—	1	—	MHz
Output Source Current 1	I_{OM+1}	$V_{FB1}=1V$, $V_{IN-1}=0.9V$	17	32	47	μA
Output Source Current 2	I_{OM+2}	$V_{FB2}=1V$, $V_{IN-2}=0.9V$	17	32	47	μA
Output Sink Current 1	I_{OM-1}	$V_{FB1}=1V$, $V_{IN-1}=1.1V$	0.5	2.5	5.0	mA
Output Sink Current 2	I_{OM-2}	$V_{FB2}=1V$, $V_{IN-2}=1.1V$	0.5	2.5	5.0	mA

PWM Compare Block

Input Threshold Voltage 1	$V_{T_0_1}$	Duty1=0%	0.15	0.22	0.29	V
	$V_{T_50_1}$	Duty1=50%	0.46	0.53	0.60	V
Input Threshold Voltage 2	$V_{T_0_2}$	Duty2=0%	0.15	0.22	0.29	V
	$V_{T_50_2}$	Duty2=50%	0.46	0.53	0.60	V
Maximum Duty Cycle 1 (*4)	$M_{AX}D_{UTY11}$	$V_{FB1}=0.9V$	85	90	95	%
	$M_{AX}D_{UTY12}$	$V_{FB1}=0.9V$, $V_{DTC1}=0.53V$	40	50	60	%
Maximum Duty Cycle 2 (*4)	$M_{AX}D_{UTY21}$	$V_{FB2}=0.9V$	100	—	—	%
	$M_{AX}D_{UTY22}$	$V_{FB2}=0.9V$, $V_{DTC2}=0.53V$	40	50	60	%

Output Block

Output High Level ON Resistance 1	R_{OH1}	$I_{OUT1}=-20mA$	—	5	10	Ω
Output High Level ON Resistance 2	R_{OH2}	$I_{OUT2}=-20mA$	—	5	10	Ω
Output Low Level ON Resistance 1	R_{OL1}	$I_{OUT1}=+20mA$	—	5	10	Ω
Output Low Level ON Resistance 2	R_{OL2}	$I_{OUT2}=+20mA$	—	5	10	Ω

ON/OFF Block

ON Control Voltage 1	V_{ON1}	$CE1=L \rightarrow H$	1.2	—	V^+	V
OFF Control Voltage 1	V_{OFF1}	$CE1=H \rightarrow L$	—	—	0.6	V
ON Control Voltage 2	V_{ON2}	$CE2=L \rightarrow H$	1.2	—	V^+	V
OFF Control Voltage 2	V_{OFF2}	$CE2=H \rightarrow L$	—	—	0.6	V

General Characteristics

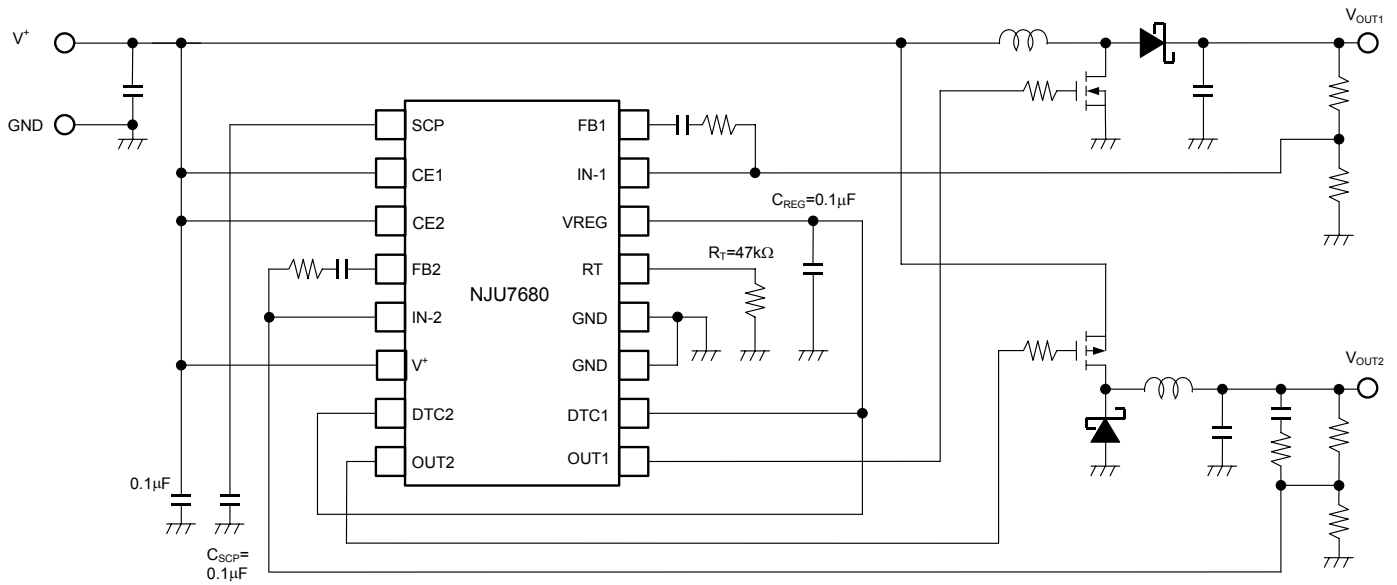
Quiescent Current 1	I_{DD1}	$R_L=Non\ Load$	—	1	1.6	mA
Quiescent Current 2	I_{DD2}	Per channel ON	—	0.7	1.2	mA
Standby Current 1	$I_{DD\ STB1}$	$V_{CE1}=V_{CE2}=0V$	—	—	3.0	μA
Standby Current 2	$I_{DD\ STB2}$	$RT=OPEN$	—	—	1.0	μA

(*4):

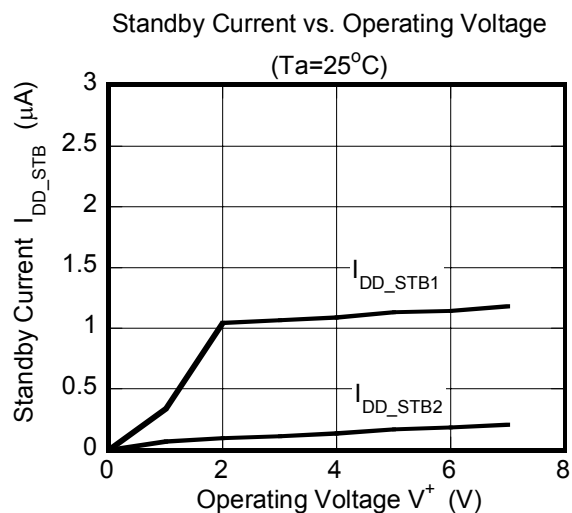
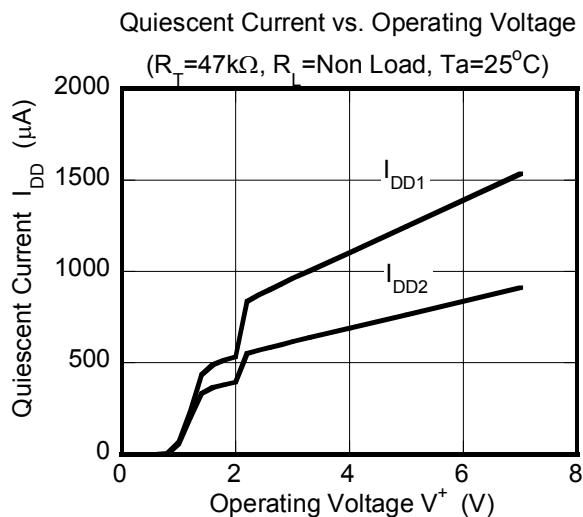
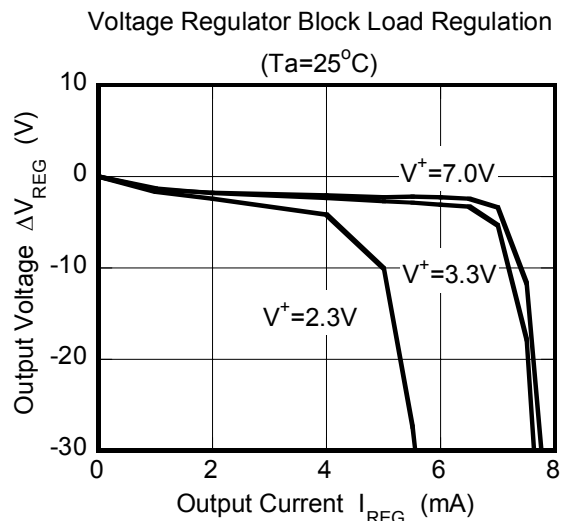
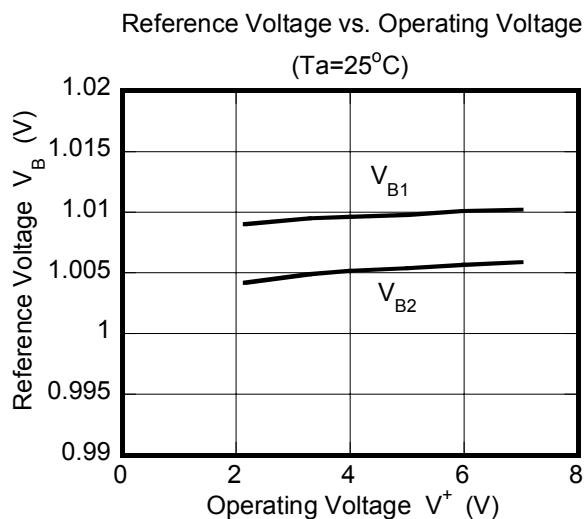
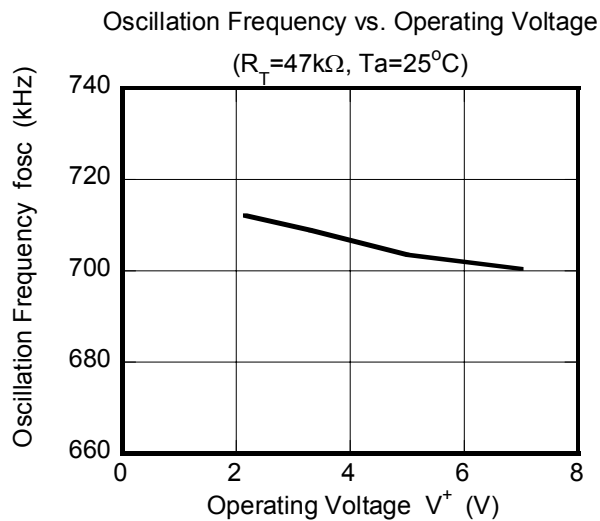
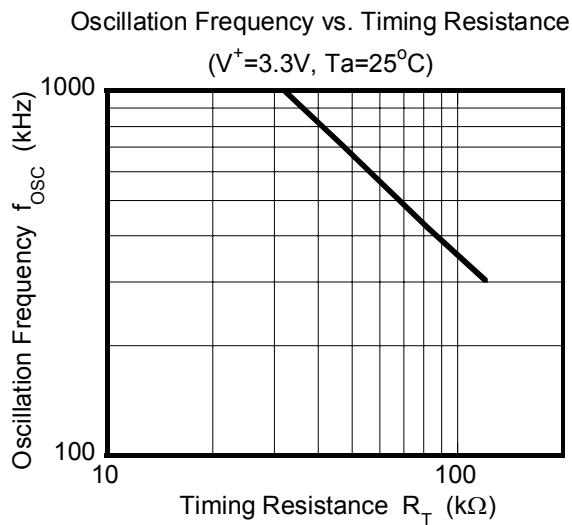
CH1 is a step-up converter that is intended to drive Nch MOSFET. OUT1 terminal output as High levels is defined as the maximum duty cycle.

CH2 is a step-down converter that is intended to drive Pch MOSFET. OUT2 terminal output as Low level is defined as the maximum duty cycle.

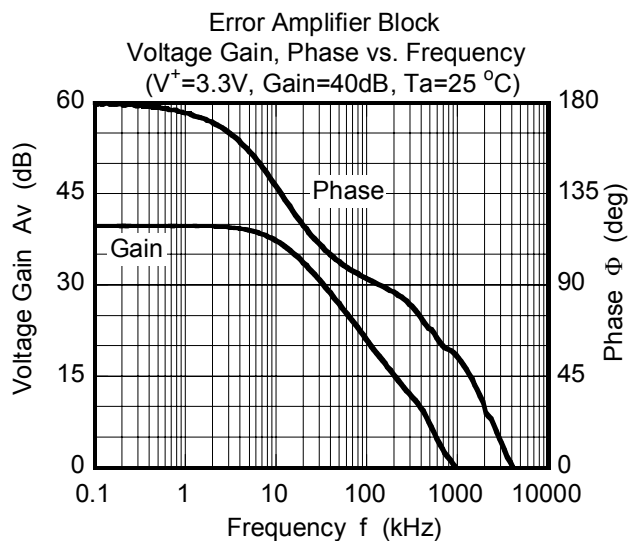
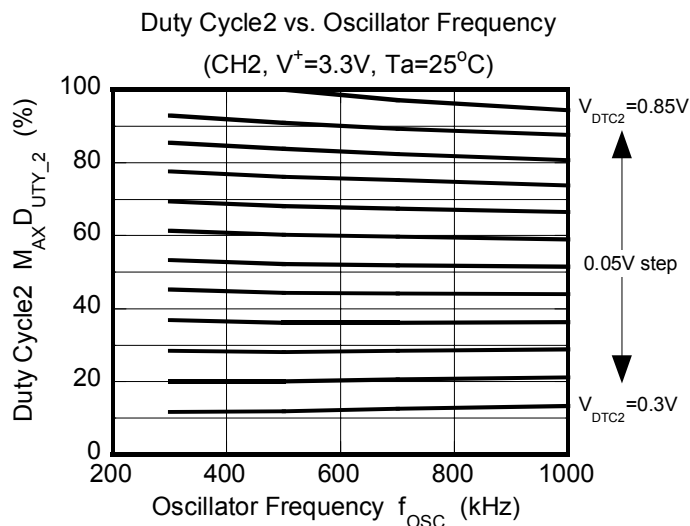
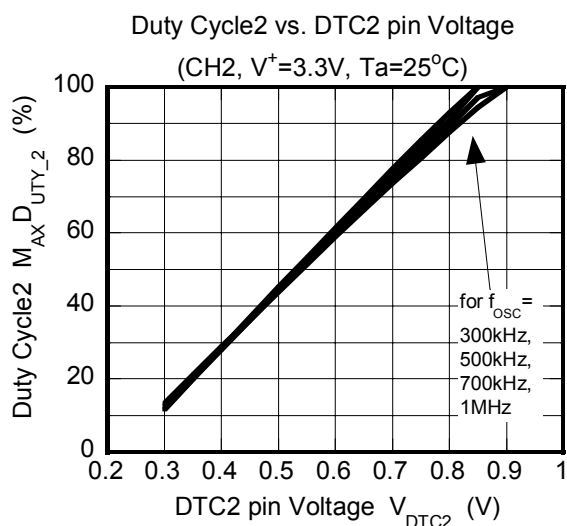
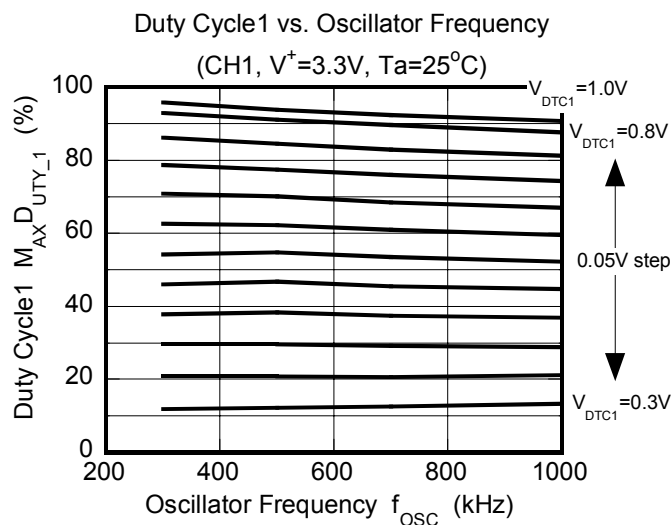
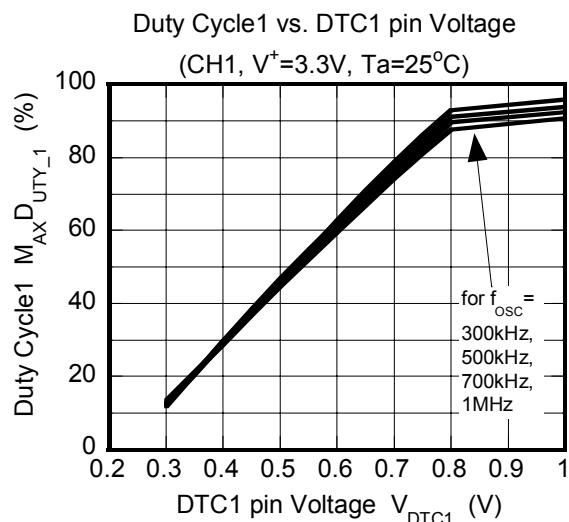
■TYPICAL APPLICATIONS



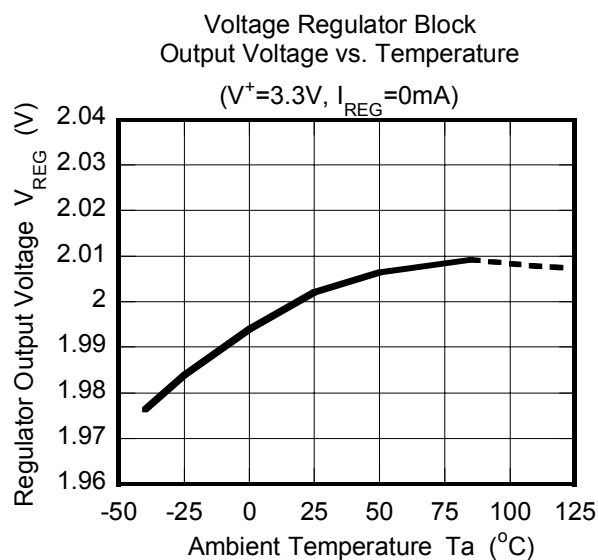
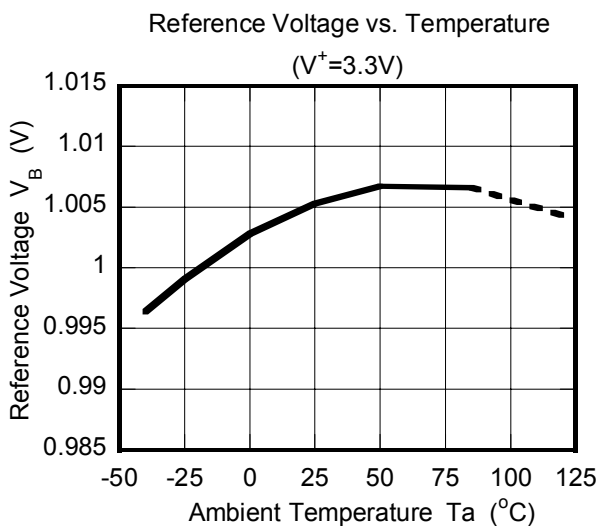
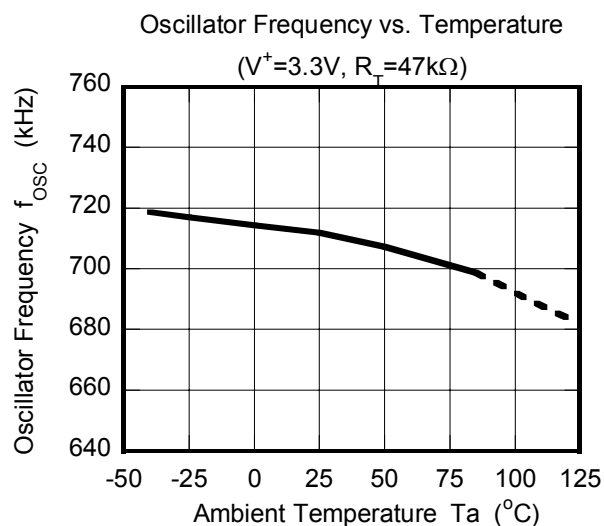
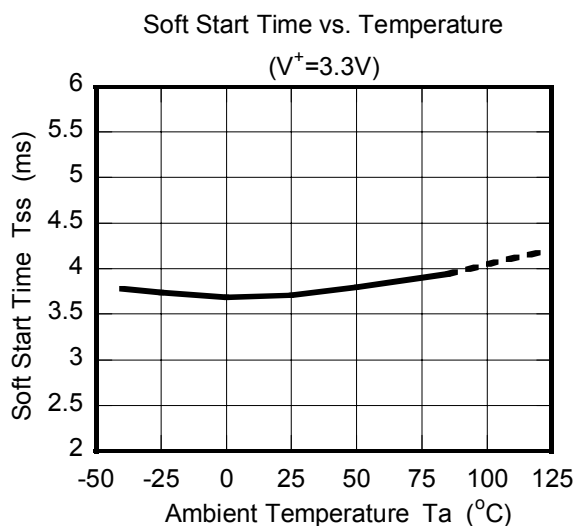
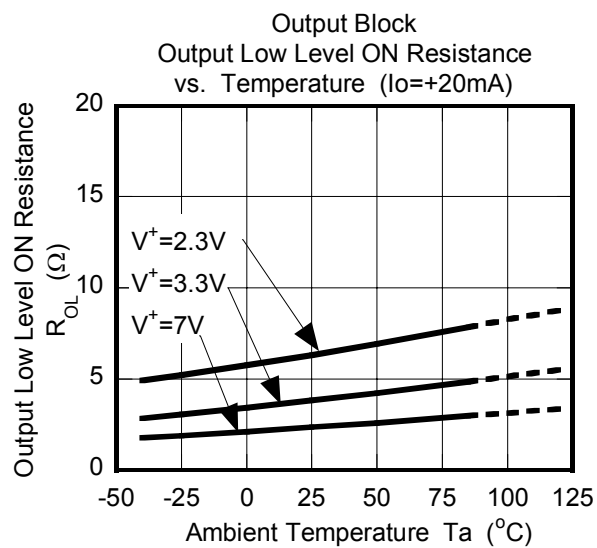
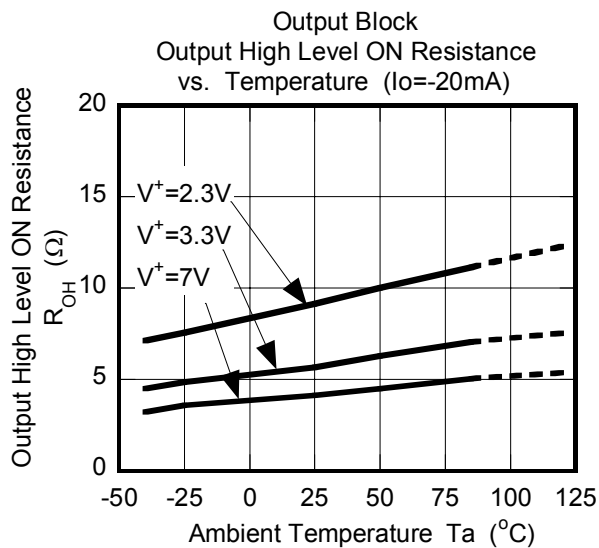
■ TYPICAL CHARACTERISTICS



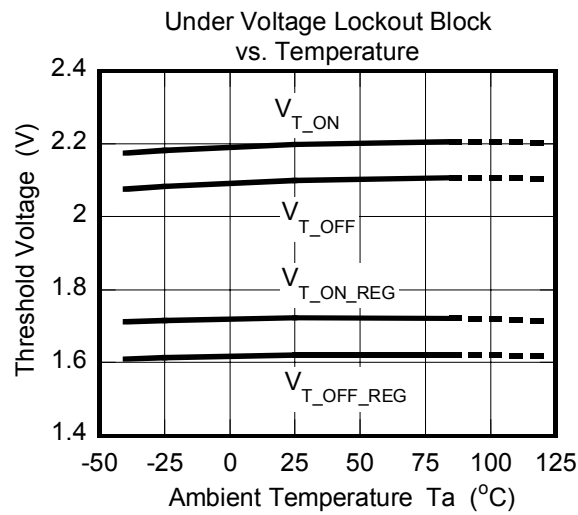
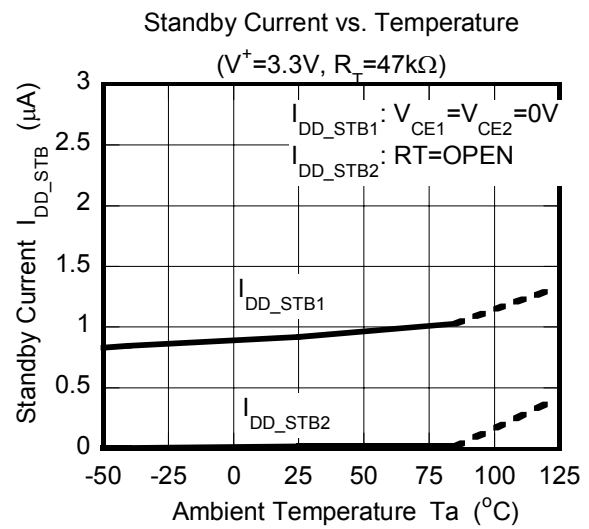
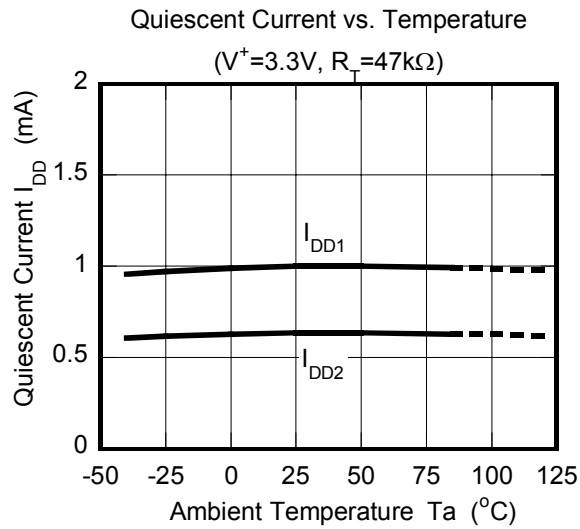
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



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