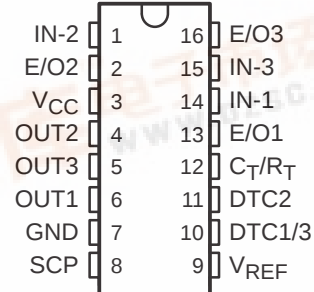


- **Low Voltage Operation . . . 2.5 V to 7 V**
- **Low Power . . . 3.5 mA**
(f = 500 kHz, Duty = 50%)
- **Internal Undervoltage Lockout Protection**
- **Internal Short Circuit Protection**
- **Wide Operating Frequency . . . 50 kHz to 1 MHz**
- **Internal Precision Reference . . . 1.25 V $\pm$ 1% (25°C)**
- **On/Off Switch for CH1/3 Pair and Ch2 (see Function Table)**
- **0 to 100% Dead Time Control**
- **Totem Pole Output Stage**
- **Small Package . . . 16 Pin TSSOP**

**PW PACKAGE
(TOP VIEW)**



description

The TPS5100 is a triple PWM control circuit, primarily designed to compose the power supply for LCD display. Each PWM channel has own error amplifier, PWM comparator, dead-time control and output driver. The trimmed voltage reference, oscillator, undervoltage lockout and short circuit protection are common for all channels.

This device includes two boost exclusive circuits (ch1,3) and a buck-boost exclusive circuit (ch2). The operating frequency is set with external resistor and capacitor, and dead time is continuously adjustable from 0% to 100% duty cycle with resistive divider network. Soft start function can be implemented by adding a capacitor to dead time divider network. Two dead time control inputs are assigned for ch1,3 pair and ch2 individually and each dead time control input can be used to control on/off operation. TPS5100 can operate from 2.5 V supply voltage and ch1,3 pair and ch2 operate with reverse phase switching each other to achieve efficient operation in low power and battery powered system.

The TPS5100 is characterized for operation from –20°C to 85°C.

FUNCTION TABLE

CONDITION	OUTPUT		
	CH-1	CH-2	CH-3
DTC1/3 > 0.3 V, DTC2 > 0.3 V	ON H	ON L	ON H
DTC1/3 > 0.3 V, DTC2 < 0.2 V	ON H	OFF H	ON H
DTC1/3 < 0.2 V, DTC2 > 0.3 V	OFF L	ON L	OFF L
DTC1/3 < 0.2 V, DTC2 < 0.2 V	OFF L	OFF H	OFF L

AVAILABLE OPTIONS

T _A	PACKAGE
	TSSOP (PW)
–20°C to 85°C	TPS5100PW

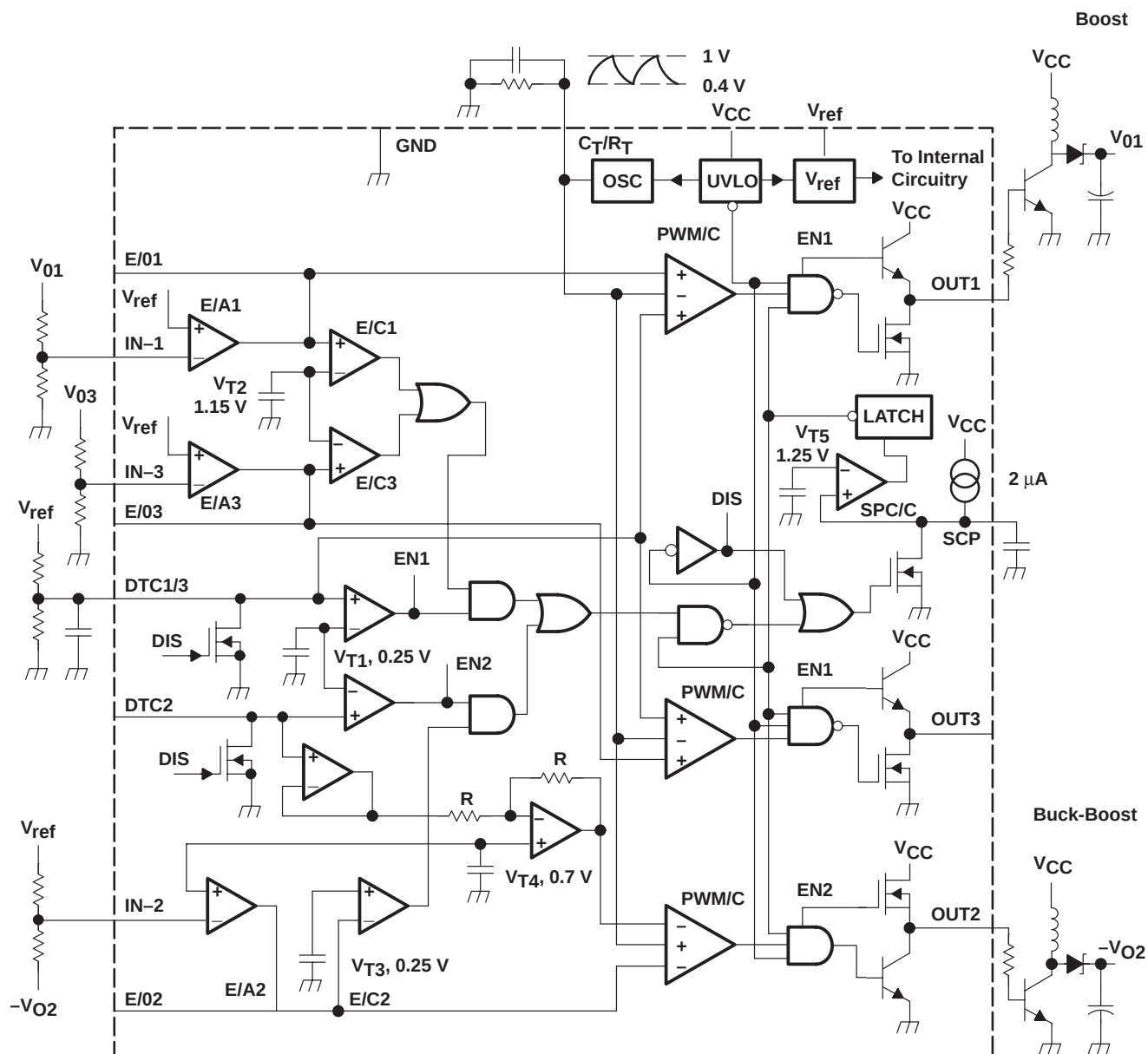
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TPS5100

TRIPLE-CHANNEL PWM CONTROL CIRCUITS

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functional block diagram



NOTE A: All voltages and currents listed are nominal.

TPS5100

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electrical characteristics over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V}$ (unless otherwise noted) (see Note 1)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{REF} Reference voltage	$I_{REF} = -1\text{ mA}$, $T_A = 25^\circ\text{C}$	1.237	1.250	1.263	V
$V_{REF(dev)}$ Reference voltage change with T_A	$I_{REF} = -1\text{ mA}$, See Note 2		15	25	mV
R_{EGIN} Input regulation	$I_{REF} = -1\text{ mA}$, $V_{CC} = 2.5\text{ V to }7\text{ V}$		2	5	mV
R_{EGL} Output regulation	$I_{REF} = -0.1\text{ mA to }-1\text{ mA}$		1	5	mV
I_{OS} Short-circuit output current	$V_{REF} = 0$	-2	-10	-30	mA

NOTES: 1. Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.
2. The deviation parameter $V_{REF(dev)}$ is defined as the difference between the maximum and minimum values obtained over the recommended free-air temperature range (-20°C to 85°C).

undervoltage lockout section

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{TH} Upper threshold voltage	$T_A = 25^\circ\text{C}$	2.2	2.3	2.4	V
V_{TL} Lower threshold voltage	$T_A = 25^\circ\text{C}$	2	2.1	2.2	V
V_{hys} Hysteresis ($V_{TH} - V_{TL}$)	$T_A = 25^\circ\text{C}$	0.1	0.2	0.3	V

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

protection control section

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{SCP} Input terminal source current		-1.4	-2	-2.6	μA
V_{T2} Input threshold voltage	CH-1, 3	1.10	1.15	1.20	V
V_{T3}	CH-2	0.20	0.25	0.30	
V_R Latch reset threshold voltage	$T_A = 25^\circ\text{C}$	0.8	1.5		V
V_{T5} Threshold voltage		1.20	1.25	1.30	V

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

oscillator section

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{OSC} Frequency	$C_T = 130\text{ pF}$, $R_T = 7\text{ k}\Omega$	400	500	600	kHz
f_{dV} Frequency change with V_{CC}	$V_{CC} = 2.5\text{ V}$, $T_A = 25^\circ\text{C}$, $C_T = 130\text{ pF}$, $R_T = 7\text{ k}\Omega$		1%	2%	
f_{dT} Frequency change with T_A	$C_T = 130\text{ pF}$, $R_T = 7\text{ k}\Omega$		5%	10%	
$I_{CT/RT}$ Output source current		-180	-200	-220	μA
V_{OSCH} H level output voltage		0.95	1	1.05	V
V_{OSCL} L level output voltage		0.35	0.40	0.45	V

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

dead time control section

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{BDT1/3}$	$V_{DTC1/3} = 0.35\text{ V to }1.05\text{ V}$			200	nA
I_{BDT2}			± 2	± 20	
V_{T1}	Comparator threshold voltage	0.2	0.25	0.3	V
$V_{T0(DTC1/3)}$	Input threshold voltage (DTC1/3) (see Note 3)	Duty = 0%	$f_{OSC} = 500\text{ kHz}$	0.3	V
$V_{T100(DTC1/3)}$		Duty = 100%		0.9	
$V_{T0(DTC2)}$	Input threshold voltage (DTC2) (see Note 3)	Duty = 0%	$f_{OSC} = 500\text{ kHz}$	0.3	V
$V_{T100(DTC2)}$		Duty = 100%		0.9	

NOTES: 1. Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.
3. These specifications are not production tested. They are specified as ensured values on circuit design.

TPS5100

TRIPLE-CHANNEL PWM CONTROL CIRCUITS

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electrical characteristics over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V}$ (unless otherwise noted) (see Note 1) (continued)

error amplifier section

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	CH1, 3, $A_V = 1$			15	mV
I_{IB}	Input bias current	CH1, 3, $V_I = -.95\text{ V to }1.55\text{ V}$		± 10	± 20	nA
		CH2, $V_I = 0.4\text{ V to }1\text{ V}$		± 10	± 20	
V_{IR}	Input voltage range	CH1, 3,	0.95		1.55	V
		CH2	0.4		1	
A_{VD}	Open-loop voltage amplification	$R_{FB} = 200\text{ k}\Omega$		60		dB
B_1	Unity-gain bandwidth			1		MHz
V_{OM+}	Output voltage swing	$V_{ID} = 0.1\text{ V}$	$I_O = 60\text{ }\mu\text{A}$	1.2		V
V_{OM-}						
I_{OM+}	Output sink current	$V_{ID} = 0.1\text{ V}$, $V_O = 0.2\text{ V}$	0.2	1		mA
I_{OM-}	Output source current	$V_{ID} = 0.1\text{ V}$, $V_O = 1.2\text{ V}$	-60	-100		μA
V_{T4}	Input bias voltage	CH2, $A_V = 1$, $T_A = 25^\circ\text{C}$	678	700	722	mV
		CH2, $A_V = 1$	665	700	735	

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

output section

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	$I_O = 20\text{ mA (CH2)}$	2.9	3.05		V
		$I_O = -40\text{ mA (CH1, 3)}$	1.9	2.2	2.6	
V_{OL}	Low-level output voltage	$I_O = 20\text{ mA (CH1, 3)}$		0.2	0.4	V
		$I_O = 40\text{ mA (CH2)}$	0.2	0.3	0.6	
t_r	Rise time	$CL = 1000\text{ pF}$		130		ns
t_f	Fall time	$I_O = 1000\text{ pF}$		50		ns

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

total device

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{CC}	Supply current	Output OFF state		2.5	4	mA
I_{CCA}	Average supply current	$F_{OSC} = 500\text{ kHz}$, Duty = 50%, No load		3.5	5	mA

NOTE 1: Typical values of all parameters except for $V_{REF(dev)}$ and f_{dT} are specified at $T_A = 25^\circ\text{C}$.

TYPICAL CHARACTERISTICS

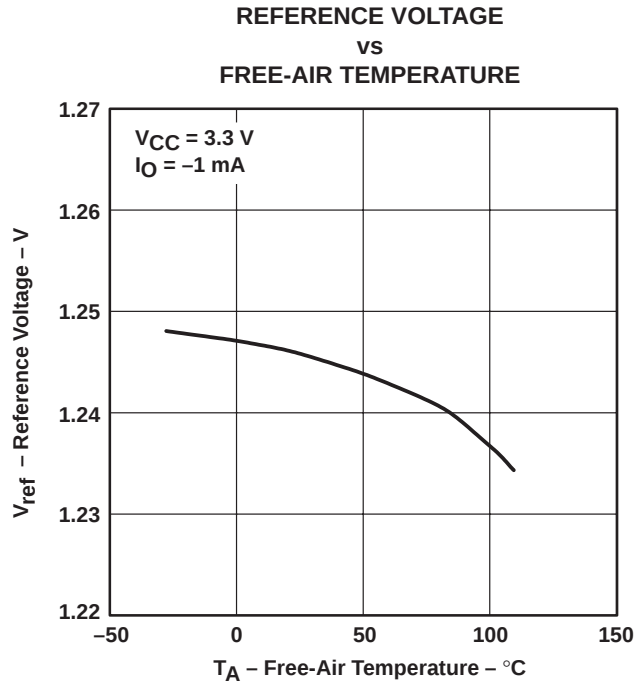


Figure 1

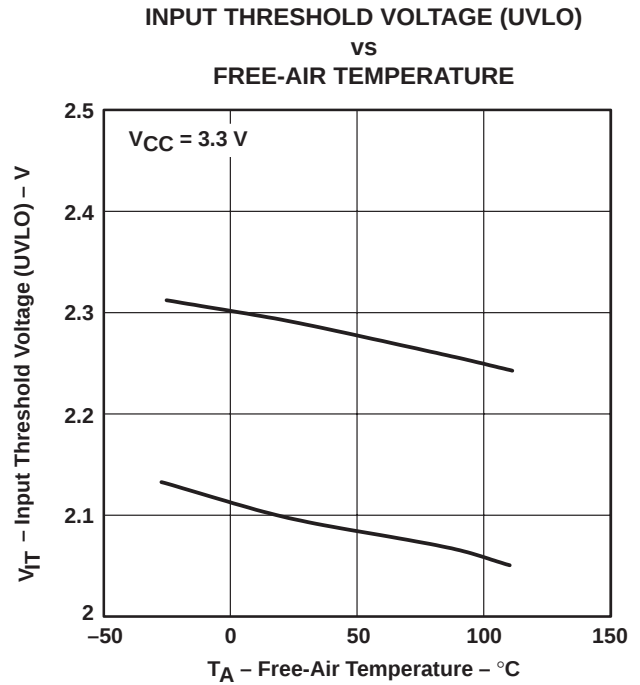


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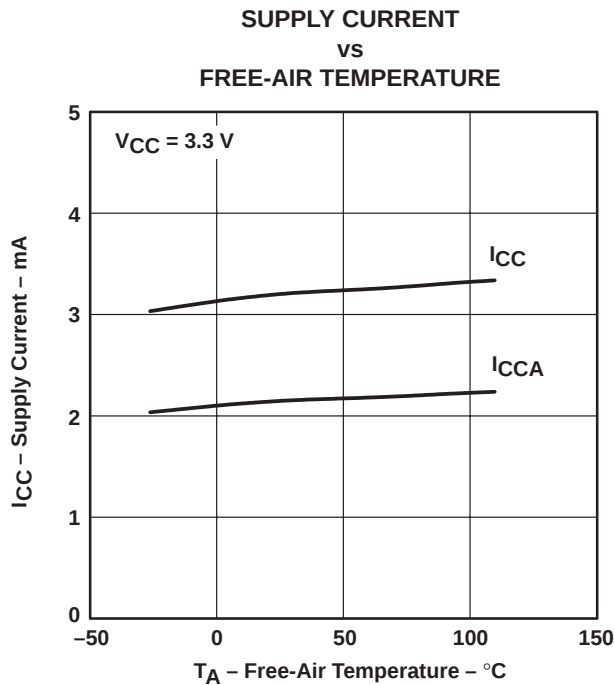


Figure 3

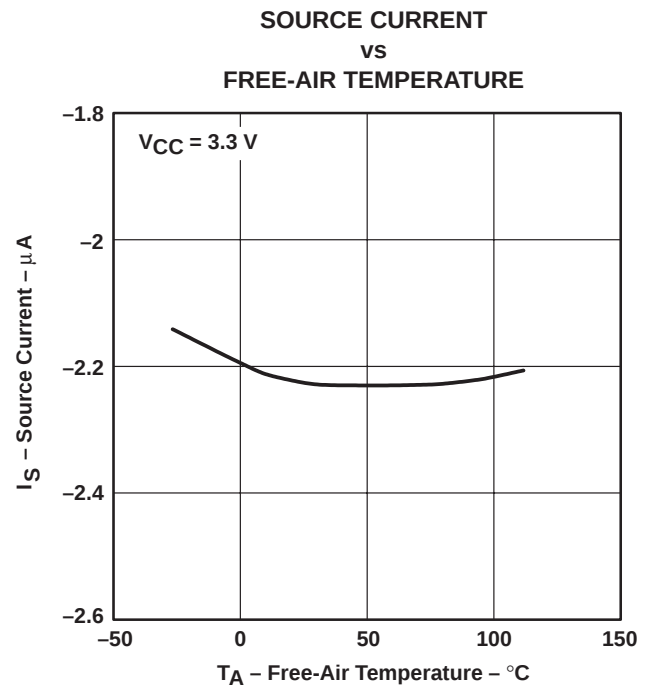


Figure 4

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TYPICAL CHARACTERISTICS

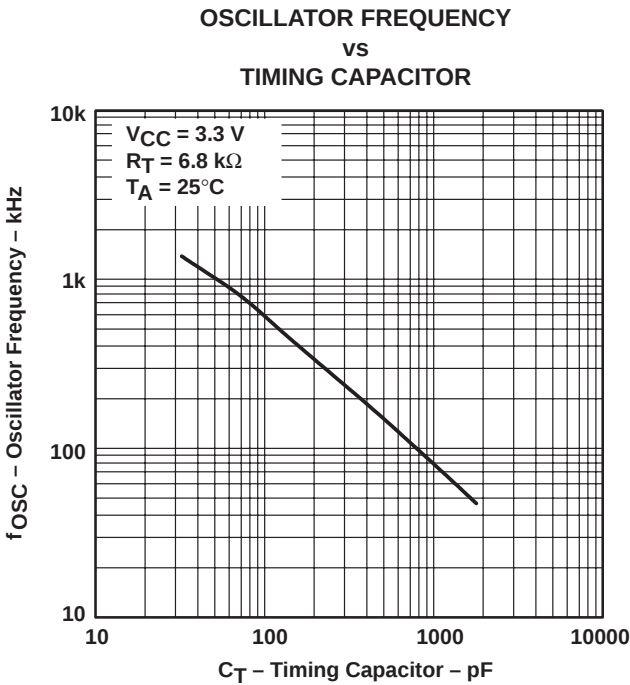


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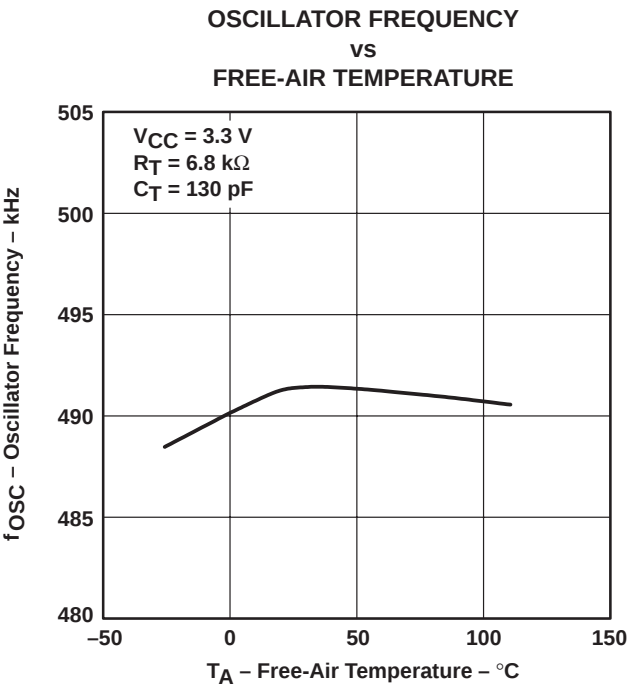


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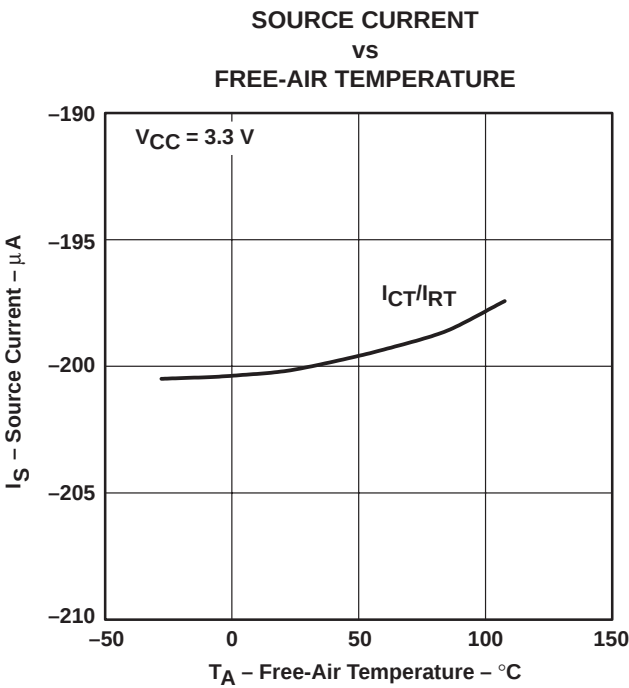


Figure 7

TYPICAL CHARACTERISTICS

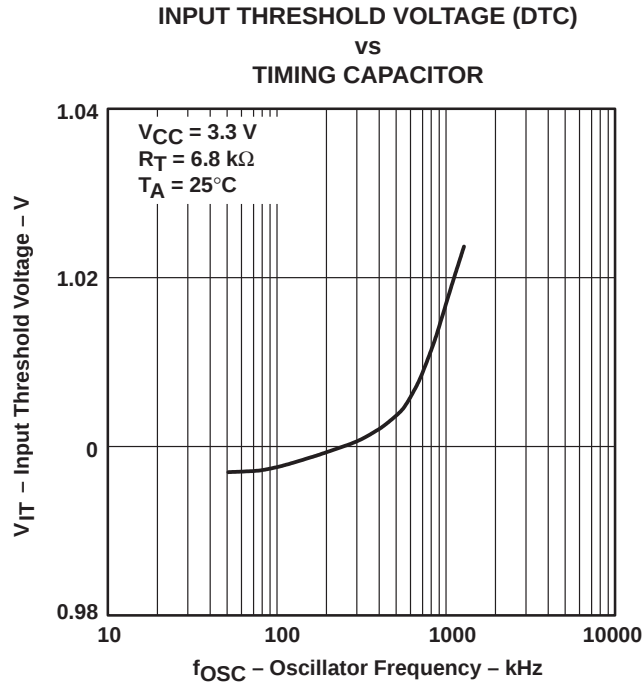


Figure 8

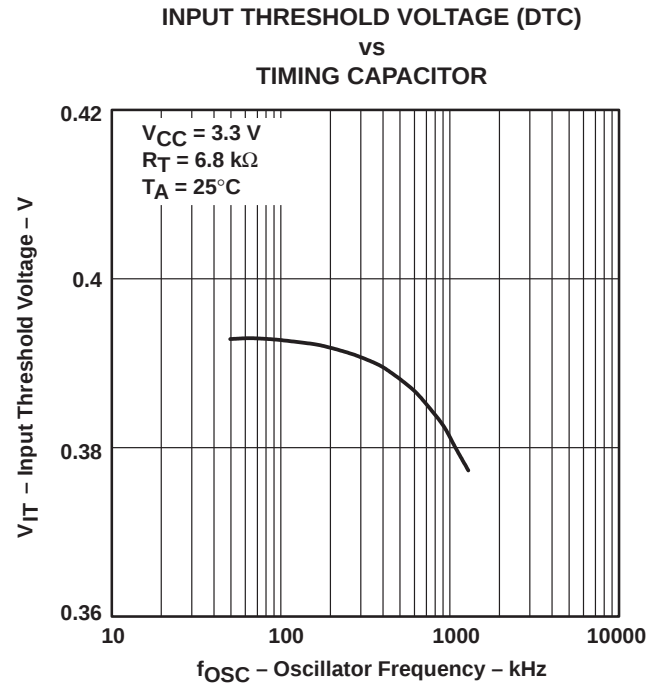


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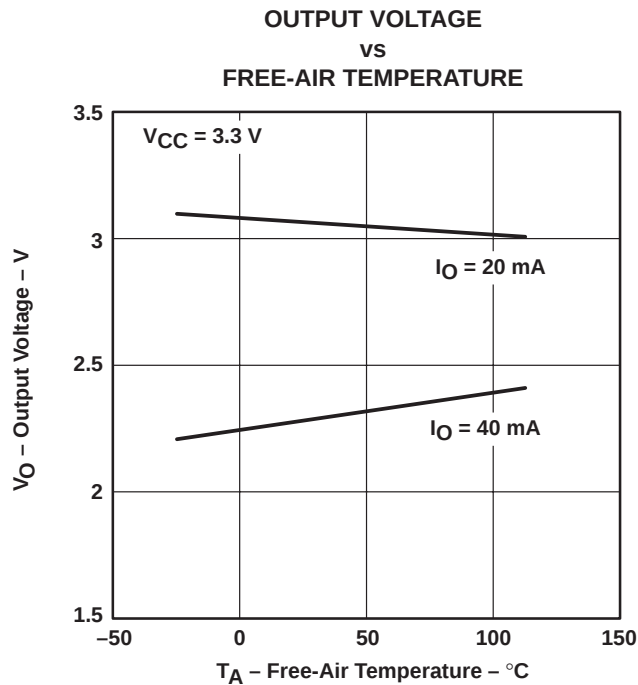


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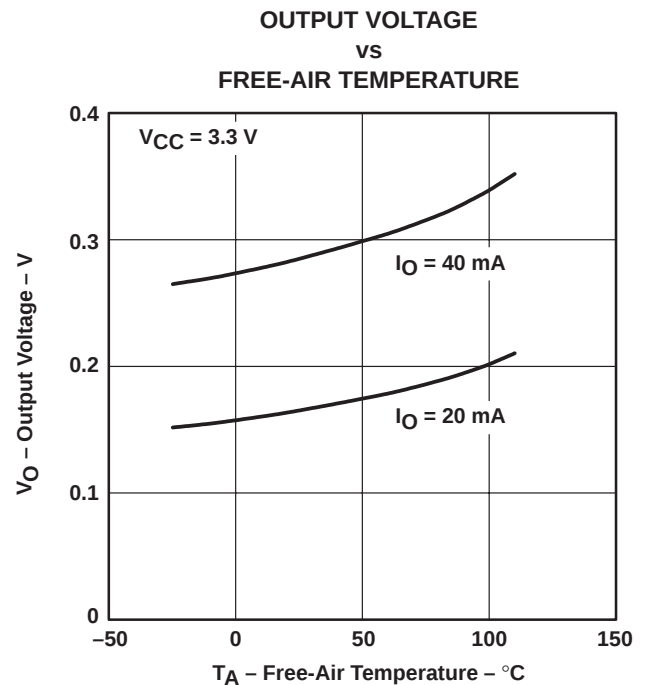


Figure 11

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TRIPLE-CHANNEL PWM CONTROL CIRCUITS

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TYPICAL CHARACTERISTICS

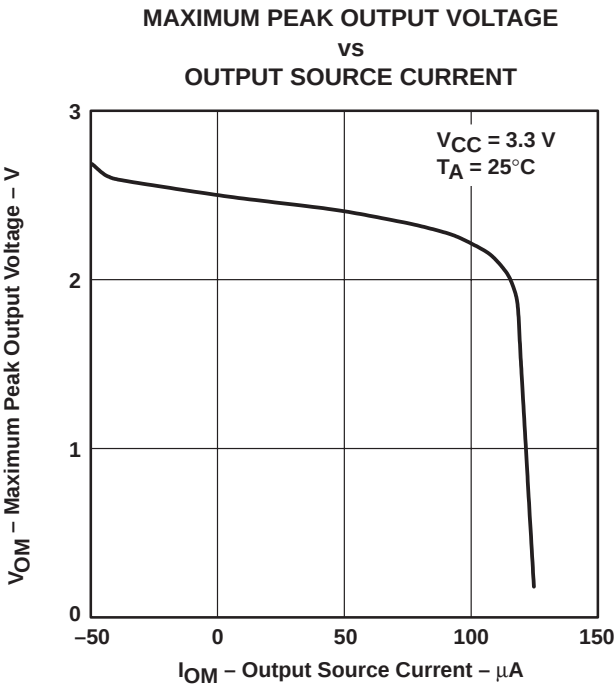


Figure 12

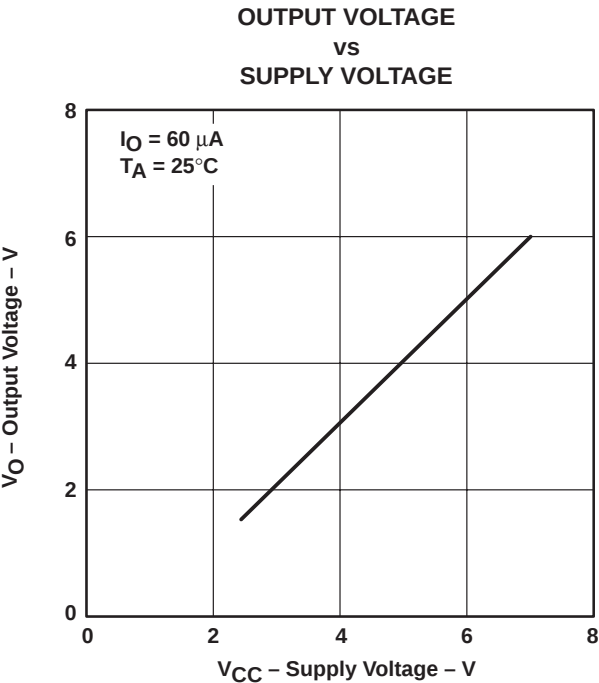


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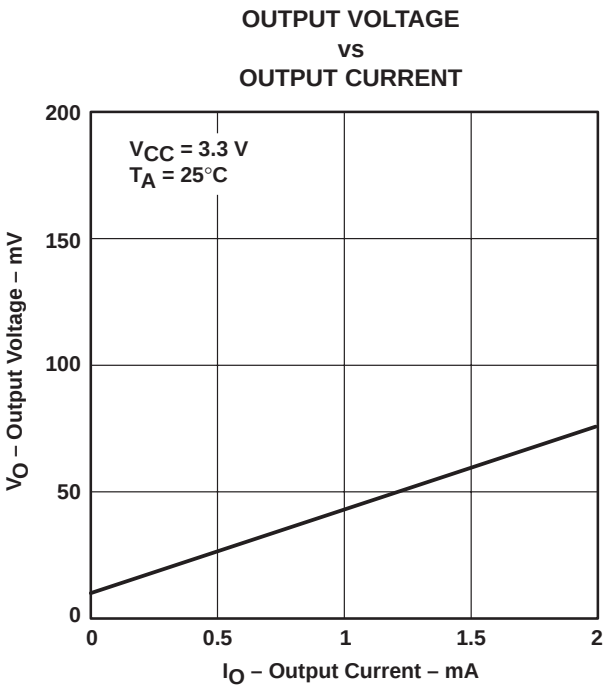


Figure 14

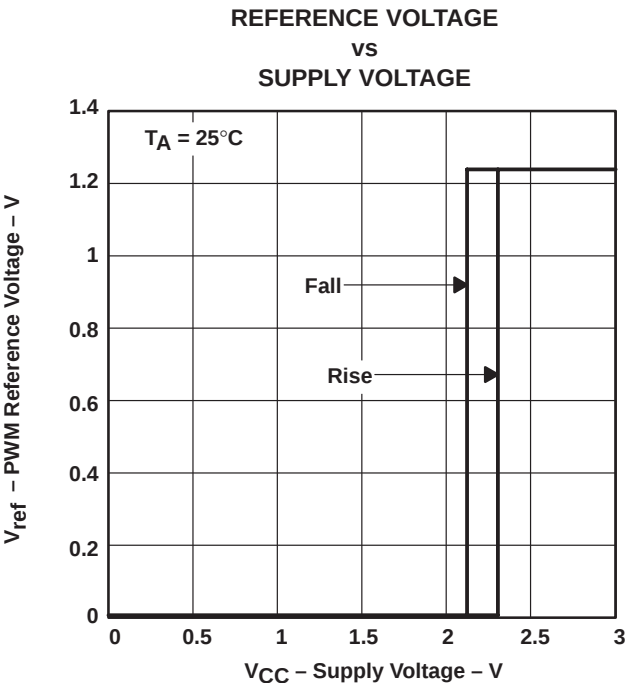


Figure 15

TYPICAL CHARACTERISTICS

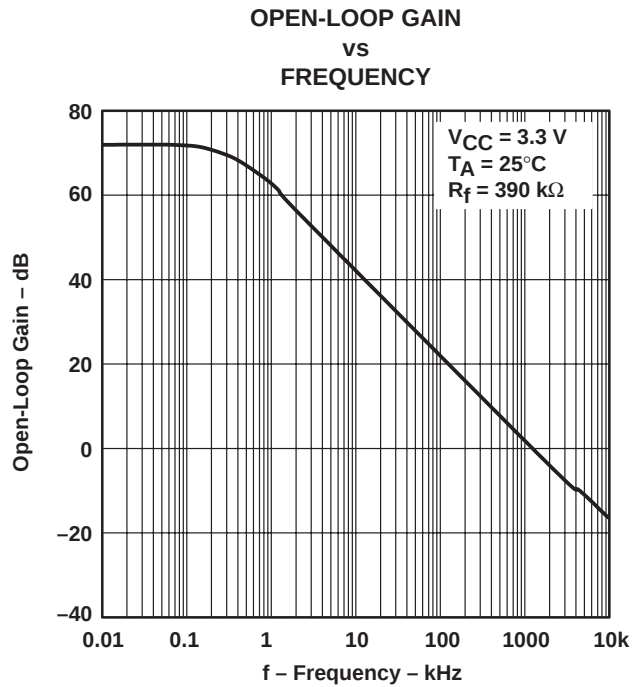


Figure 16

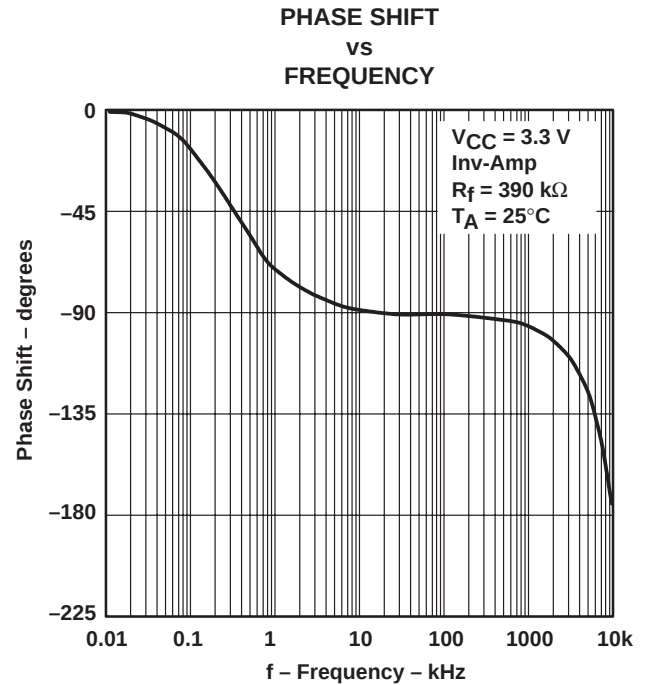


Figure 17

TPS5100

TRIPLE-CHANNEL PWM CONTROL CIRCUITS

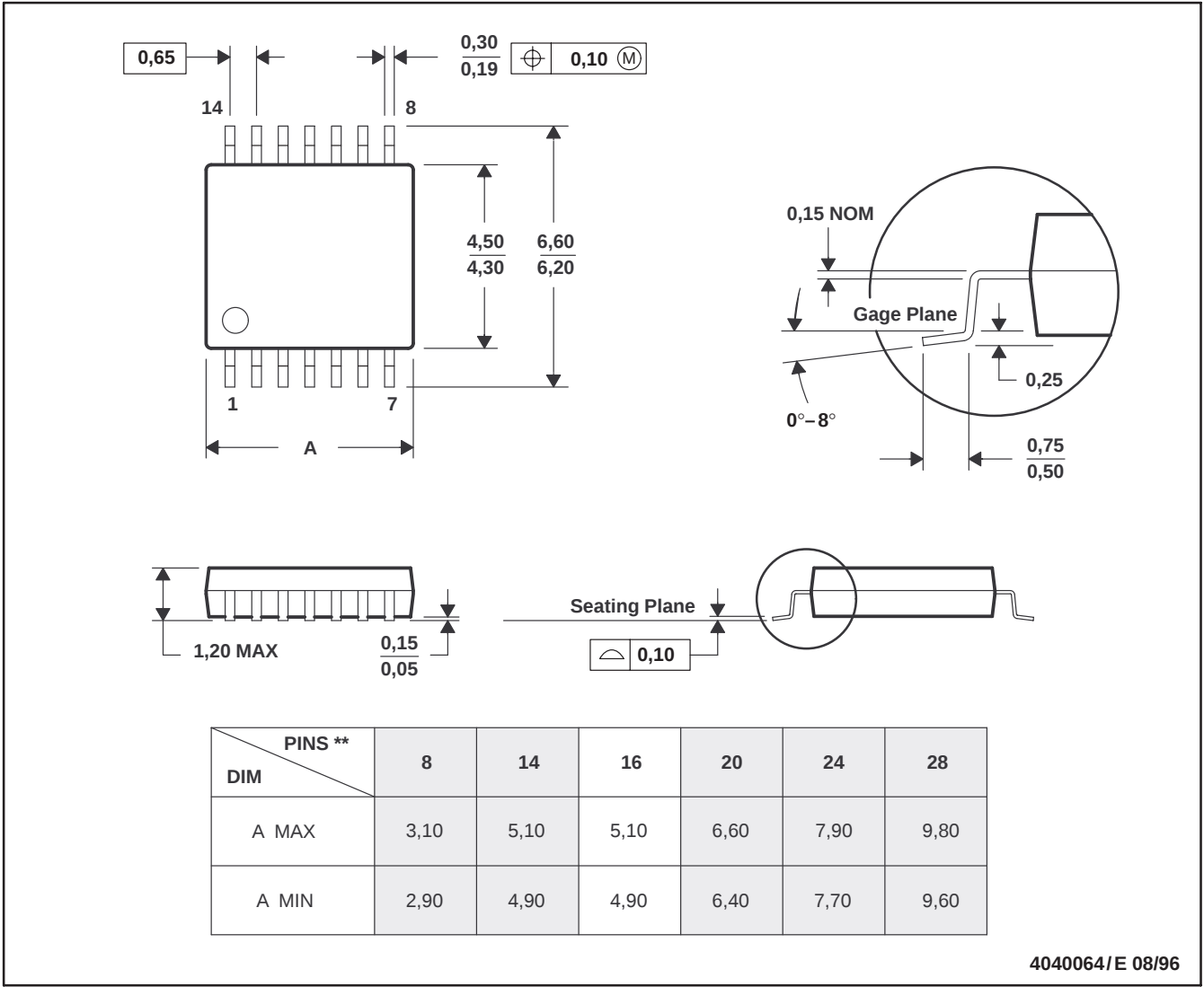
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MECHANICAL DATA

PW (R-PDSO-G**)

14 PIN SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 - D. Falls within JEDEC MO-153

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