4.3 AC characteristics

4.3.1 Testing Waveforms

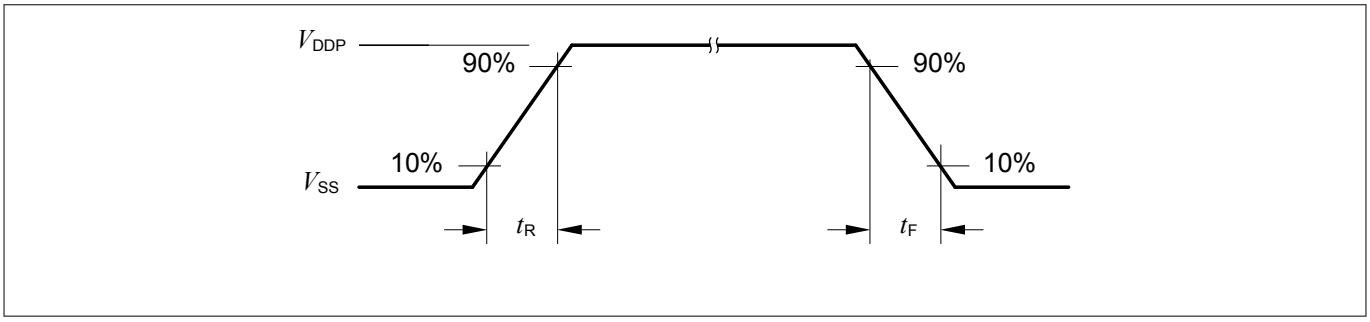

Figure 10 **Rise/Fall Time Parameters**

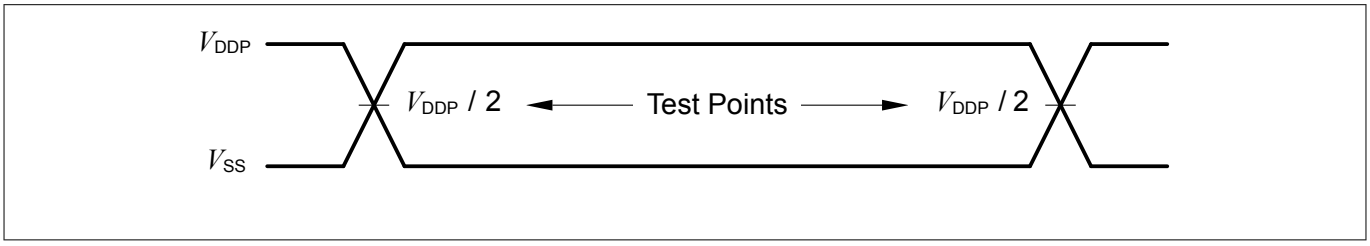

Figure 11 **Testing Waveform, Output Delay**

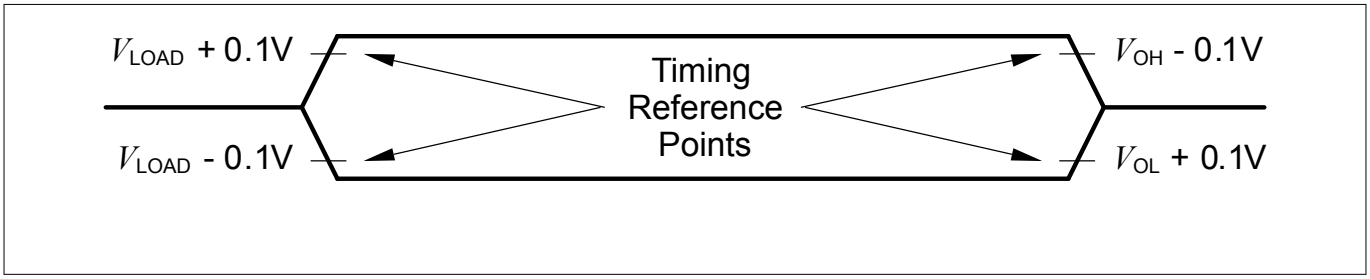

Figure 12 **Testing Waveform, Output High Impedance**

4.3.2 On-Chip Oscillator Characteristics

Table 14 provides the characteristics of the 96 MHz digital controlled oscillator DCO1. The DCO1 is used as the time base during normal operation.

Note: These parameters are not subject to production test, but verified by design and/or characterization.

Table 14 **96 MHz DCO1 Characteristics**

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min.	Typ.	Max.		
Nominal frequency	f_{NOM} CC	-	96	-	MHz	under nominal conditions after trimming

Table 14 96 MHz DCO1 Characteristics (continued)

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min.	Typ.	Max.		
Accuracy with adjustment algorithm [9] based on temperature sensor	Δf_{LTTS} CC	-0.6	–	+0.6	%	with respect to f_{NOM}(typ), T_A from 0°C to 105°C
		-1.9	–	+1.0	%	with respect to f_{NOM}(typ), T_A from -25 °C to 105°C
		-2.6	–	+1.3	%	with respect to f_{NOM}(typ), T_A from -40° C to 105 °C
Accuracy	Δf_{LT} CC	-1.7	–	+3.4	%	with respect to f_{NOM}(typ), T_A from 0 ° C to 85 °C
		-3.9	–	+4.0	%	with respect to f_{NOM}(typ), T_A from -40° C to 105 °C

Table 15 provides the characteristics of the 32 kHz digital controlled oscillator used internally as a secondary clock source for the internal watchdog.

Table 15 32 kHz WD DCO Characteristics

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min.	Typ.	Max.		
Nominal frequency	f_{NOM} CC	32.5	32.75	33	kHz	under nominal conditions[10] after trimming
Accuracy	Δf_{LT} CC	-1.7	–	+3.4	%	with respect to f_{NOM}(typ), T_A from 0 ° C to 85 °C
		-3.9	–	+4.0	%	with respect to f_{NOM}(typ), T_A from -40° C to 105 °C

9 MCE version newer or equal to V1.03.00, clock adjustment algorithm for improved accuracy enabled
10 The deviation is relative to the factory trimmed frequency at nominal V_{DDC} and T_A = + 25°C.

4.3.3 Dynamic parameters gate driver

V_{CC} = V_{BS} = 15 V, V_S = V_{SS} = V_{COM} unless otherwise specified. All parameters are valid for T_a=25 °C.

Table 16 Dynamic parameters

Parameter	Symbol	Values			Unit	Note or Test Condition
		Min.	Typ.	Max.		
Turn-on propagation delay	t_{on}	400	530	800	ns	
Turn-off propagation delay	t_{off}	400	530	800	ns	
Turn-on rise time	t_r	–	60	100	ns	C_L = 1 nF
Turn-off fall time	t_f	–	26	45	ns	C_L = 1 nF
Dead time	DT	150	310	–	ns	
Matching delay ON, max(ton)-min(ton), ton are applicable to all 6 driver outputs	MT_{ON}	–	20	100	ns	
Matching delay OFF, max(toff)-min(toff), toff are applicable to all 6 driver outputs	MT_{OFF}	–	40	100	ns	
Output pulse width matching. P_{win}-P_{Wout}	PM	–	10	100	ns	

4.3.4 Timing diagrams

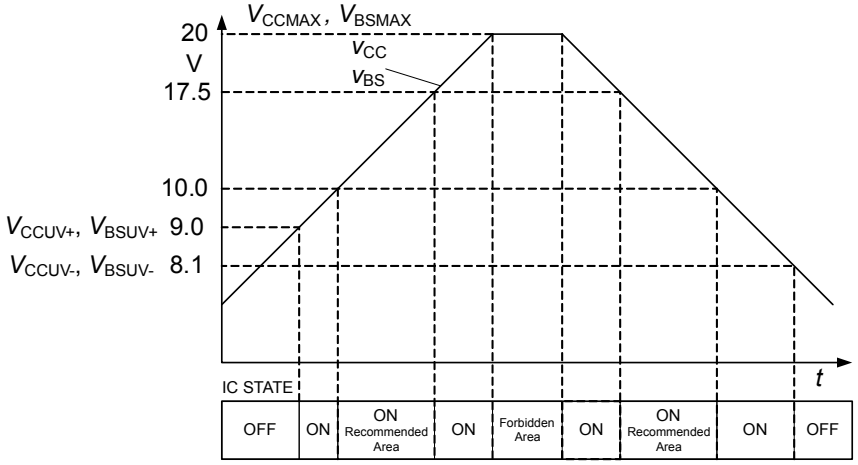

Figure 13 **Operating Areas**

4.4 Motor Control Parameters

The following parameters are defined in the iMOTION™ Motion Control Engine (MCE) software.

4.4.1 PWM Characteristics

Table 17 Electrical characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Motor PWM Frequency[11)]	f_{PWM}	5	16	40	kHz	Min. and Max defined by SW

4.4.2 Current Sensing

Table 18 Motor Current Sensing

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Input range	I_{PWM}	V_{SS}-0.05	-	V_{DD}+0.05	V	
Configurable analog gain		-	1/ 3/ 6/ 12	-		
Itrip input range	$I_{PWMTRIP}$	V_{SS}-0.05	-	V_{DD}+0.05	V	
Itrip offset		-	±8	-	mV	

11 Min. and Max limits subject to change in future SW revisions

4.4.3 Fault Timing

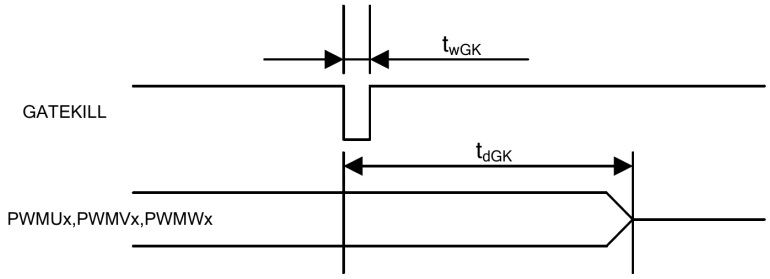

Figure 14 **Fault timing**

Table 19 **Gatekill timing**

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Motor Fault reset timing	t_{RESET}	-	1.84	-	ms	fault reset command via UART to PWM reactivation
Itrip to PWM shutoff	t_{PWMOFF}	0.075	1.0	10	µs	Configurable in SW

4.5 Power Factor Correction (PFC) parameters

The parameters specified for the power factor correction only refer to products with integrated PFC control algorithms.

4.5.1 Boost PFC characteristics

Table 20 Electrical characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
PFC frequency	f_{PFC}	-	40		kHz	Max defined by SW

4.5.2 Totem Pole PFC characteristics

Table 21 Electrical characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
PFC frequency	f_{PFC}	-	40		kHz	Max defined by SW

4.5.3 PFC Current Sensing

The current sensing specification applies to both PFC algorithms, boost mode and totem pole.

Table 22 PFC Current Sensing

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Input range	I_{PFC}	V_{SS}- 0.05	-	V_{DD}+ 0.05	V	V_{DD}= 3.3 or 5.0 V
Configurable analog gain		-	1/ 3/ 6/ 12	-		
PFC Itrip input range	$I_{PFCTRIP}$	V_{SS}-0.05	-	V_{DD}+ 0.05	V	V_{DD}= 3.3 or 5.0 V
Itrip offset		-	± 3	-	mV	Input voltage difference > 200mV