FD2105M

40V Half-Bridge Gate Driver

Description

The FD2105M is a half-bridge gate driver designed to drive high voltage，high speed N-channel power MOSFETs. The floating high side driver is capable of working with rail voltages up to 40V. Under-voltage lockout disables the gate driver in case of insufficient supply. A disable function can be used to turn off both high side and low side. And a single external resistor can be used to program the switching transition dead-time.

Features

- Fully operational to +40V
- Gate driver supply range from 3.2 to 21V
- 1.2A peak output source current
- 1.8A peak output sink current
- 3.3V and 5V logic input compatible
- Under-voltage lockout
- External programmable dead-time
- Disable function
- High side output in phase with input，Low side output out of phase with input
- RoHS compliant and halogen free

Package

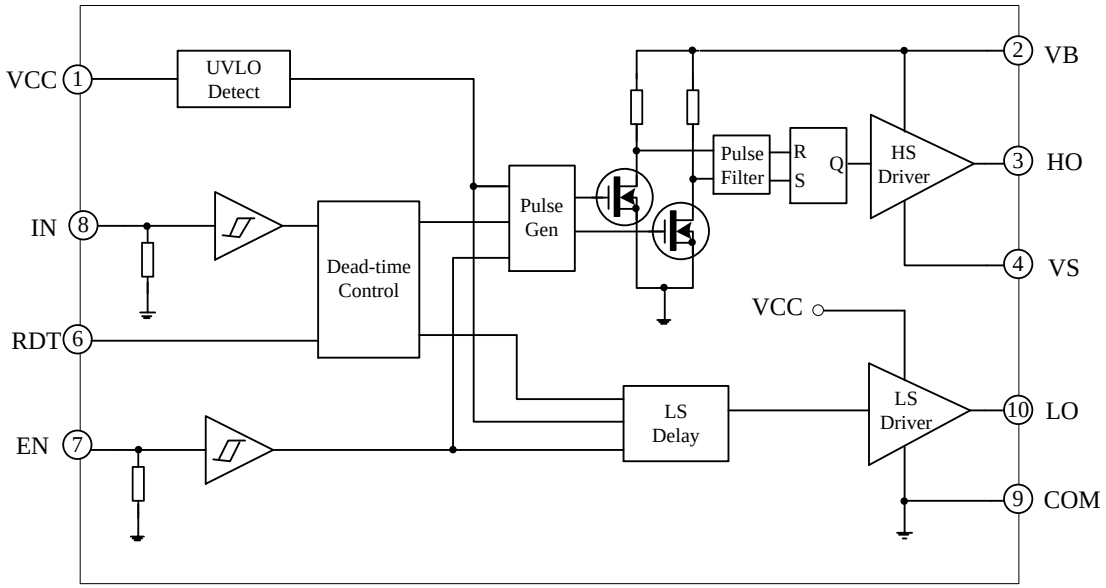
MSOP10

Applications

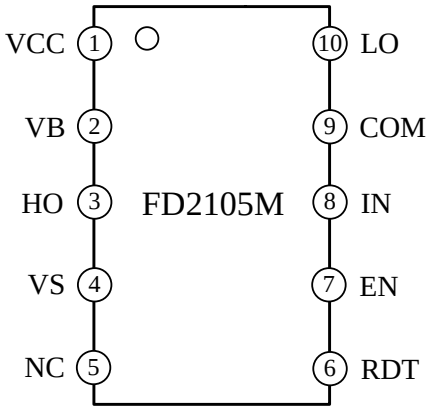
Half and Full Bridge power converters

Two switch forward power converters

Functional Block Diagram



Lead Assignments

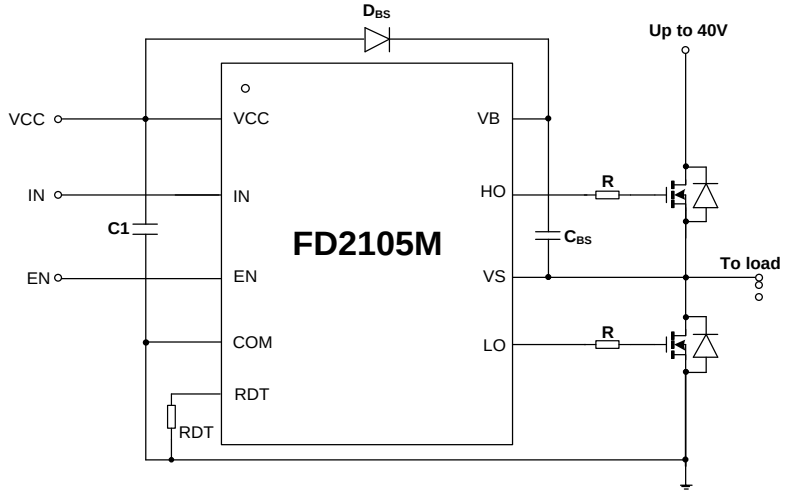


10-Lead MSOP

Lead Definitions

Pin	Symbol	Description
1	VCC	Low side and logic fixed supply
2	VB	High side floating supply
3	HO	High side gate driver output
4	VS	High side floating supply return
5	NC	Not connected
6	RDT	Dead-time programming pin
7	EN	Logic input for driver enable/disable
8	IN	Logic input for gate driver
9	COM	Low side return
10	LO	Low side gate driver output

Typical Connection



Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Parameter	Symbol	Min~Max	Units
High side floating absolute voltage	V_B	-0.3～65	V
High side floating supply offset voltage	V_S	V_B-25～V_B+0.3	V
High side floating output voltage	V_{HO}	V_S-0.3～V_B+0.3	V
Low side and logic fixed supply voltage	V_{CC}	-0.3～25	V
Low side output voltage	V_{LO}	-0.3～V_{CC}+0.3	V
Logic input voltage（IN, EN）	V_{IN}	-0.3～V_{CC}+0.3	V
Allowable offset supply voltage transient	dV_S/dt	≤50	V/ns
Package power dissipation @T_A≤25°C	P_D	1.0	W
Thermal resistance, junction to ambient	R_{thJA}	125	°C/W
Junction temperature	T_j	≤150	°C
Storage temperature	T_{stg}	-55～150	°C

Recommended Operating Conditions

For proper operation the device should be used within the recommended conditions. The V_S offset rating is tested with all supplies biased at a 12V differential.

Parameter	Symbol	Min	Max	Units
High side floating absolute voltage	V_B	V_S+3.2	V_S+21	V
High side floating supply offset voltage	V_{SN}	COM-3(note 1)	40	V
High side floating output voltage	V_{HO}	V_S	V_B	V
Low side and logic fixed supply voltage	V_{CC}	3.2	21	V
Low side output voltage	V_{LO}	0	V_{CC}	V
Logic input voltage（IN, EN）	V_{IN}	0	V_{CC}	V
Ambient temperature	T_A	-40	125	°C

Note 1 : Logic operational for V_S of -3 to +40V. Logic state held for V_S of -3V to -V_{BS}.

Static Electrical Characteristics

Unless otherwise specified, T_A =25°C, V_{CC}=V_{BS}=12V, V_S=COM, RDT=100kΩ

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Currents						
V_{CC} quiescent current	I_{QCC}		--	0.4	0.8	mA
V_{CC} operating current	I_{PCC}	500kHz，no load	--	0.8	1.6	mA
V_B quiescent current	I_{QBS}		--	40	80	uA
V_B operating current	I_{PBS}	500kHz，no load	--	0.8	1.6	mA
Offset supply leakage current	I_{LK}	V_B=V_S=40V	--	0.1	5.0	μA
Input IN						
Logic“1”input voltage	V_{IH}		--	2.1	2.7	V
logic “0”input voltage	V_{IL}		0.8	1.9	--	V
Logic“1”input bias current	I_{IN+}	V_{IN}=5V	12	20	30	μA
logic “0”input bias current	I_{IN-}	V_{IN}=0V	--	--	1	μA
Input pull-down resistance	R_{IN}		160	260	400	kΩ
Input EN						
Logic“1”input voltage	$V_{EN,TH+}$		--	2.1	2.7	V
Logic “0”input voltage	$V_{EN,TH-}$		0.8	1.9	--	V
Logic“1”input bias current	I_{EN+}	V_{EN}=5V	12	20	30	μA
Logic “0”input bias current	I_{EN-}	V_{EN}=0V	--	--	1	μA
Input pull-down resistance	R_{EN}		160	260	400	kΩ
Under-voltage Protection						
V_{CC} rising threshold	V_{CCUV+}		2.5	2.9	3.3	V
V_{CC} falling threshold	V_{CCUV-}		2.3	2.7	3.1	V
V_{CC} threshold hysteresis	V_{CCUVH}		0.1	0.2	--	V
Dead-time Control						
Nominal voltage at RDT	V_{RDT}		4.3	4.9	5.5	V
RDT pin current limit	I_{RDT}	RDT=0	0.75	1.0	1.25	mA
High Side Gate Driver						
High level output voltage	V_{OHH}	I_O=-20mA	--	0.1	0.18	V
Low level output voltage	V_{OLH}	I_O=20mA	--	0.035	0.07	V
Peak pull-up current	I_{OHH}	V_O=0V，V_{IN}=5V	0.8	1.2	--	A
Peak pull-down current	I_{OLH}	V_O=12V，V_{IN}=0V	1.2	1.8	--	A
Low Side Gate Driver						
High level output voltage	V_{OHL}	I_O=-20mA	--	0.1	0.18	V
Low level output voltage	V_{OLL}	I_O=20mA	--	0.035	0.07	V
Peak pull-up current	I_{OHL}	V_O=0V，V_{IN}=0V	0.8	1.2	--	A
Peak pull-down current	I_{OLL}	V_O=12V，V_{IN}=5V	1.2	1.8	--	A

Dynamic Electrical Characteristics

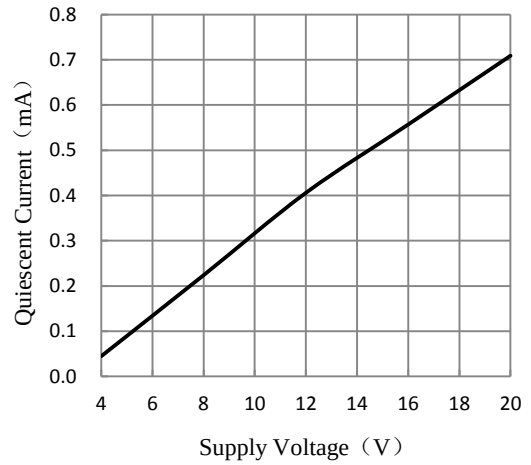
Unless otherwise specified, T_A =25℃, V_{CC}=V_{BS}=12V, V_S=COM, RDT=100kΩ

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Turn on propagation delay	t_{on}	RDT=10k	--	140	240	ns
		RDT=100k	--	450	600	ns
Turn off propagation delay	t_{off}		--	70	140	ns
Dead-time, LS turn-off to HS turn-on & HS turn-off to LS turn-on	DT	RDT=10k	--	70	--	ns
		RDT=30k	--	130	--	ns
		RDT=100k	--	400	--	ns
Turn on rise time	t_r	C_L=2200pF	--	30	--	ns
Turn off fall time	t_f	C_L=2200pF	--	20	--	ns
Delay matching, HS & LS turn on/off	MT	RDT=10k	--	--	30	ns
		RDT=100k	--	--	50	ns
Enable propagation delay	t_{en}	RDT=10K	--	140	240	ns
Shutdown propagation delay	t_{sd}		--	70	140	ns

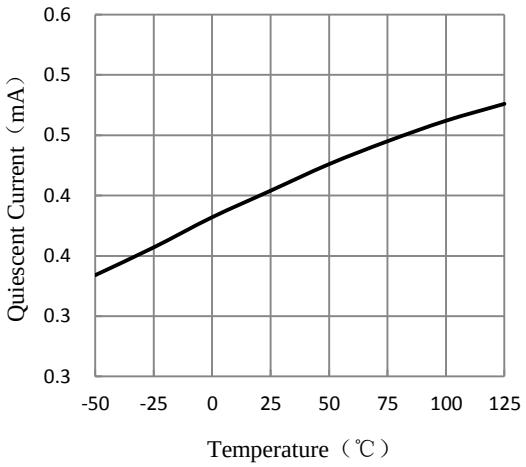
Typical Performance Characteristics

Unless otherwise specified, T_A =25℃，V_{CC}=V_{BS}=12V，V_S=COM，RDT=100kΩ

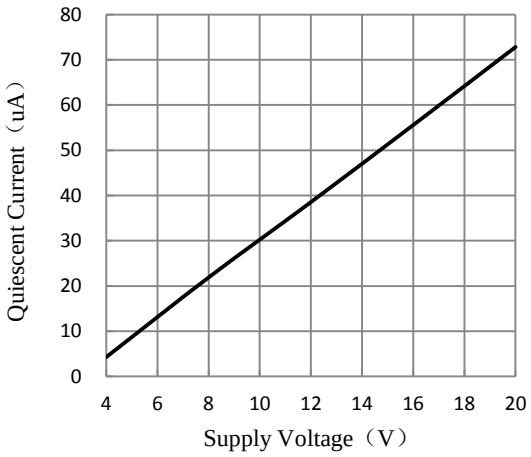
VCC Quiescent Current vs Supply Voltage



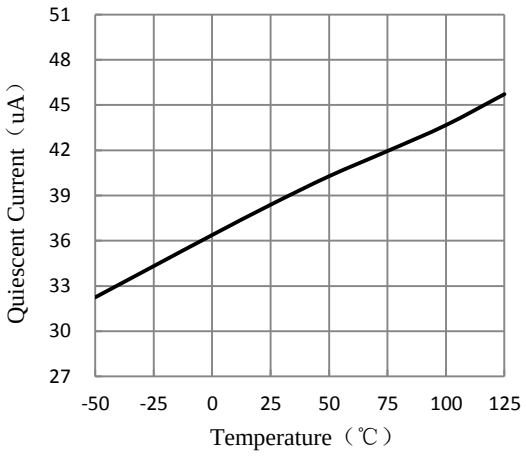
VCC Quiescent Current vs Temperature



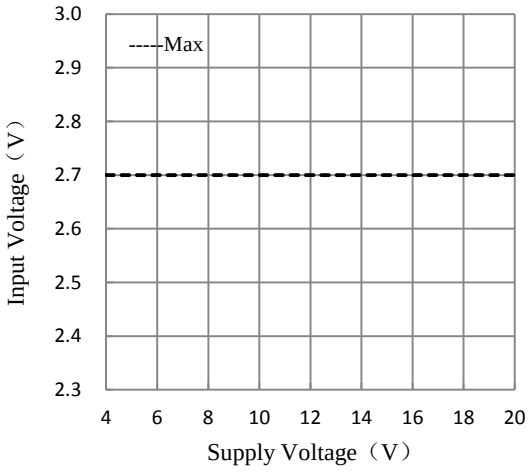
VB Quiescent Current vs Supply Voltage



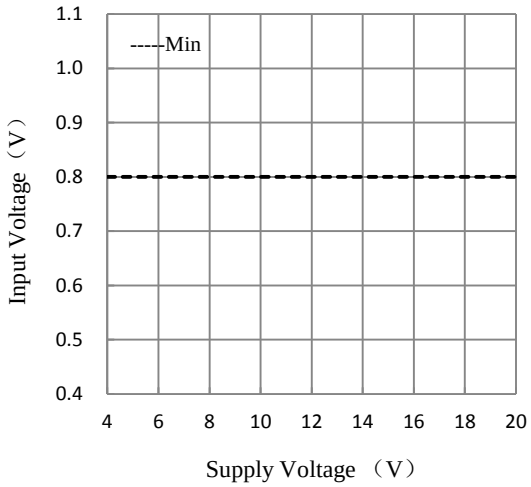
VB Quiescent Current vs Temperature



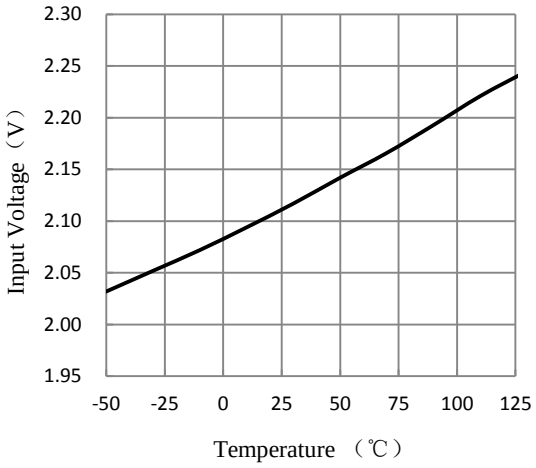
Logic '1' Input Voltage vs Supply Voltage



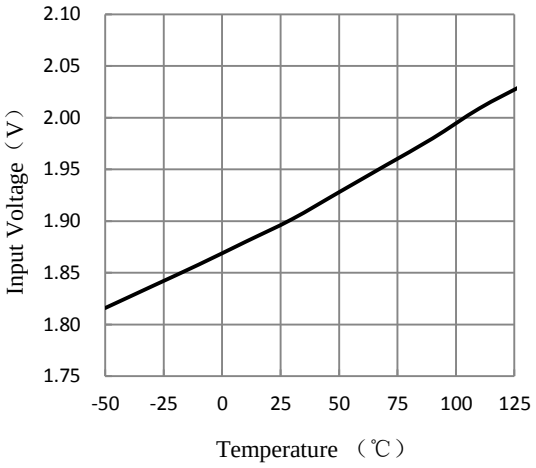
Logic '0' Input Voltage vs Supply Voltage



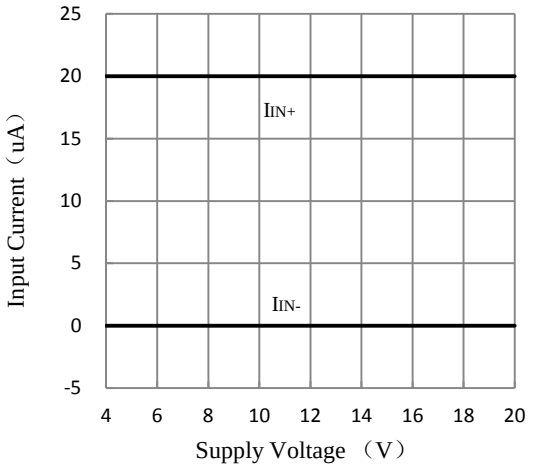
Logic '1' Input Voltage vs Temperature



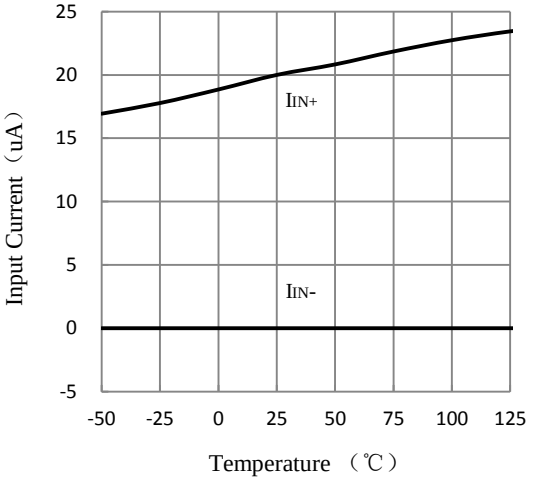
Logic '0' Input Voltage vs Temperature



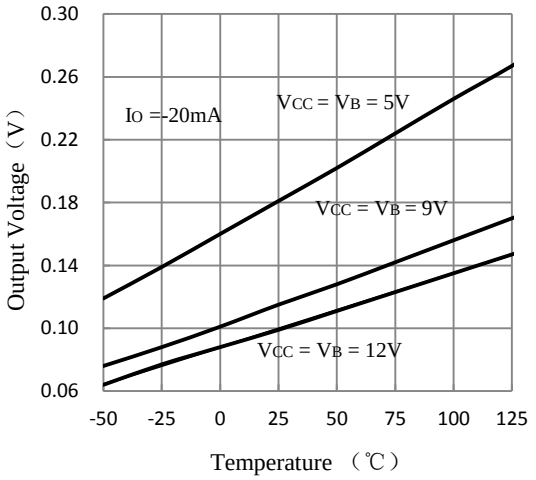
Input Bias Current vs Supply Voltage



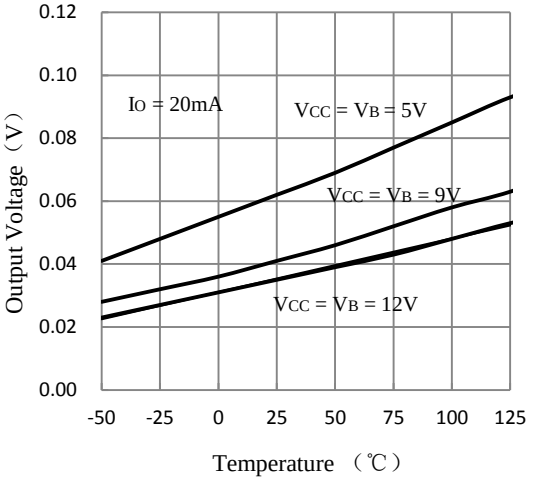
Input Bias Current vs Temperature



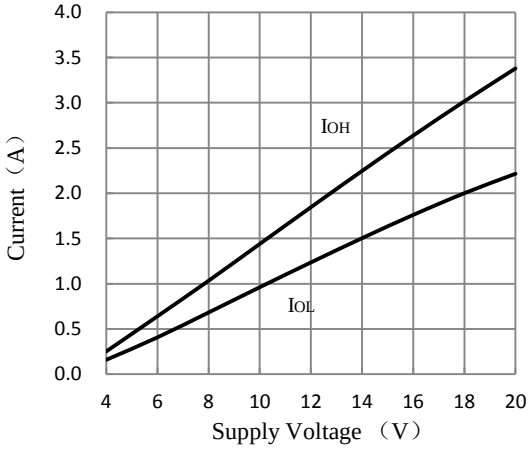
High Level Output Voltage vs Temperature



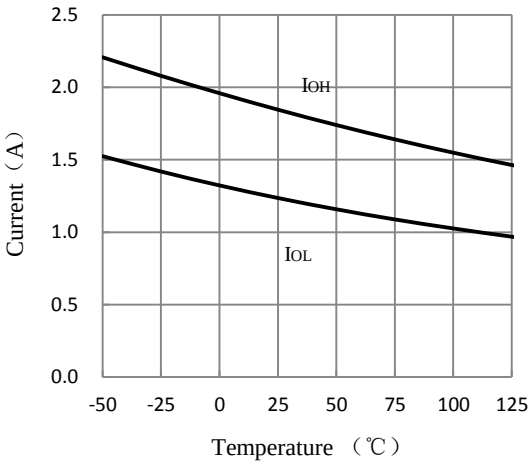
Low Level Output Voltage vs Temperature



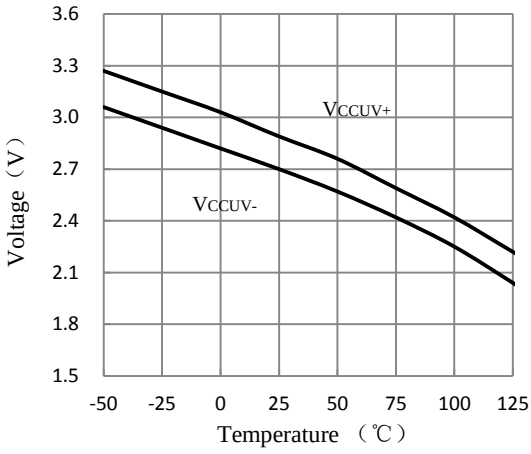
Peak Output Current vs Supply Voltage



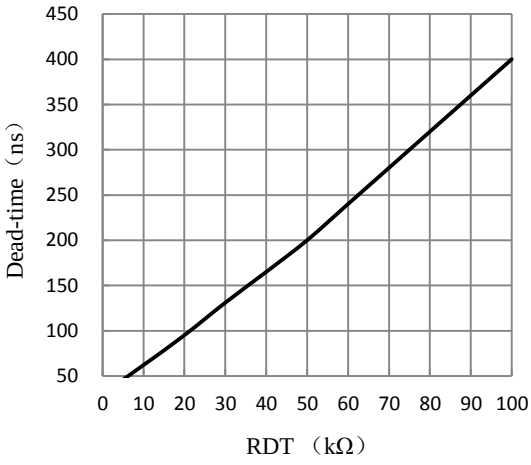
Peak Output Current vs Temperature



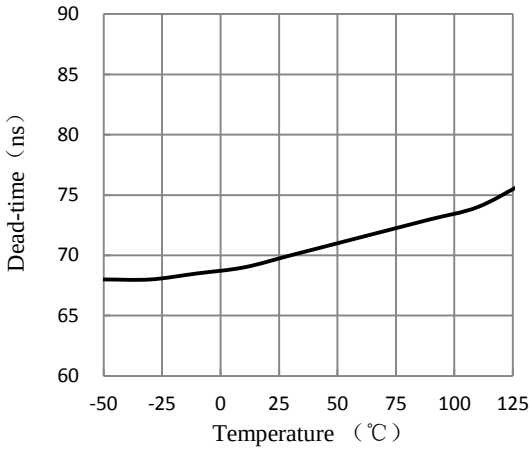
Undervoltage Threshold vs Temperature



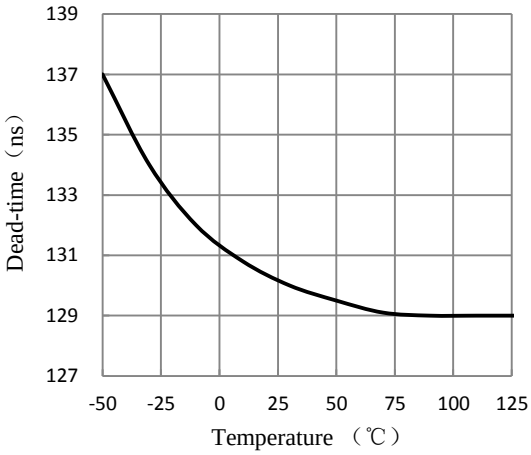
Dead-time vs RDT Resistor Value



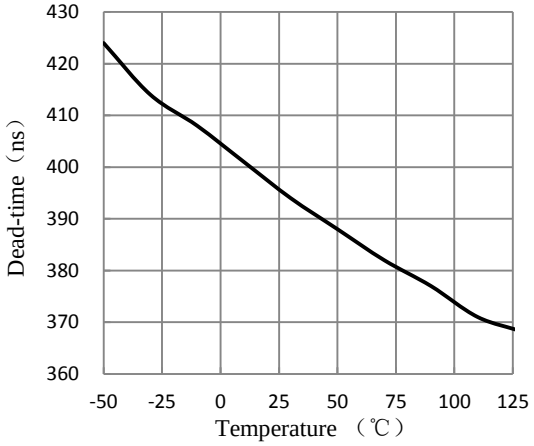
Dead-time vs Temperature（RDT=10k）



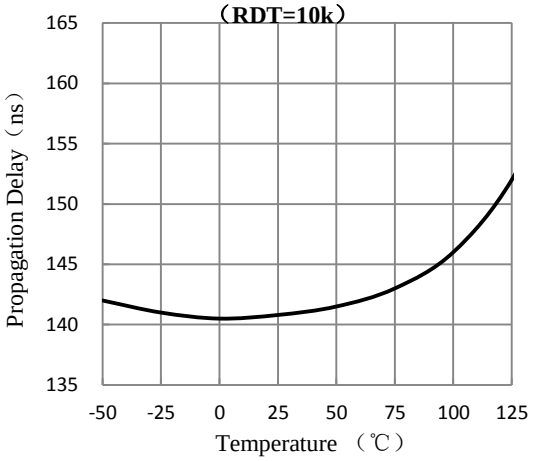
Dead-time vs Temperature（RDT=30k）



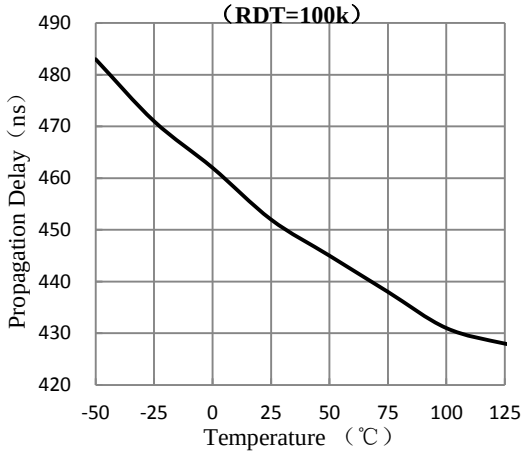
Dead-time vs Temperature（RDT=100k）



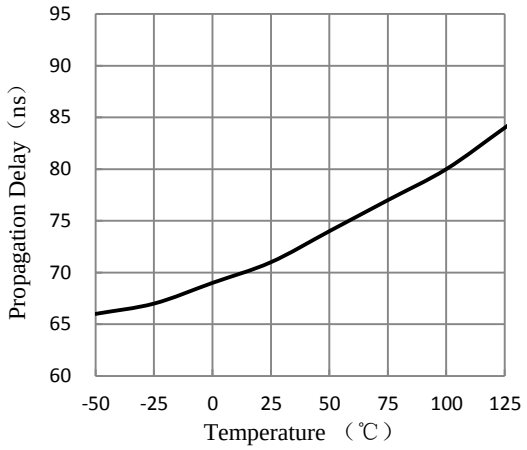
Turn on Propagation Delay vs Temperature（RDT=10k）



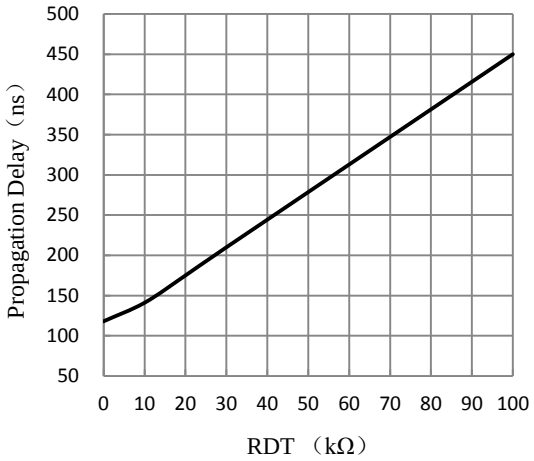
Turn on Propagation Delay vs Temperature（RDT=100k）



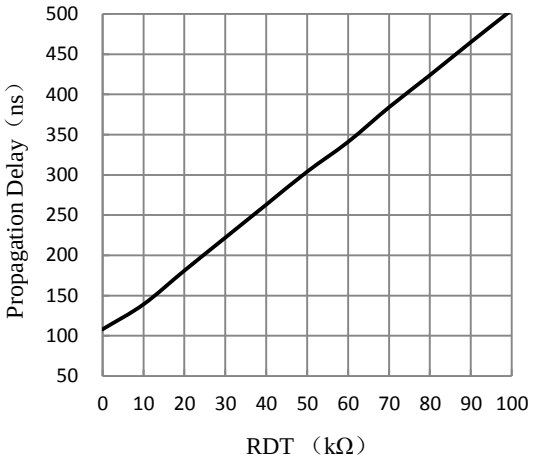
Turn off Propagation Delay vs Temperature



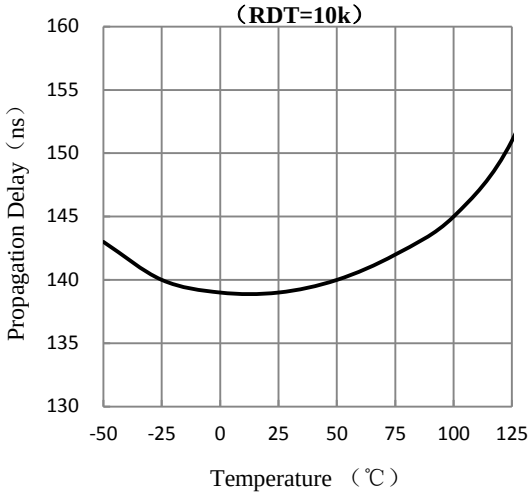
Turn on Propagation Delay vs RDT Resistor Value



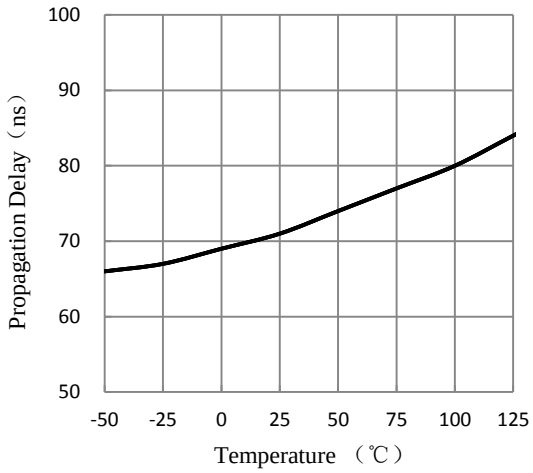
Enable Propagation Delay vs RDT Resistor Value



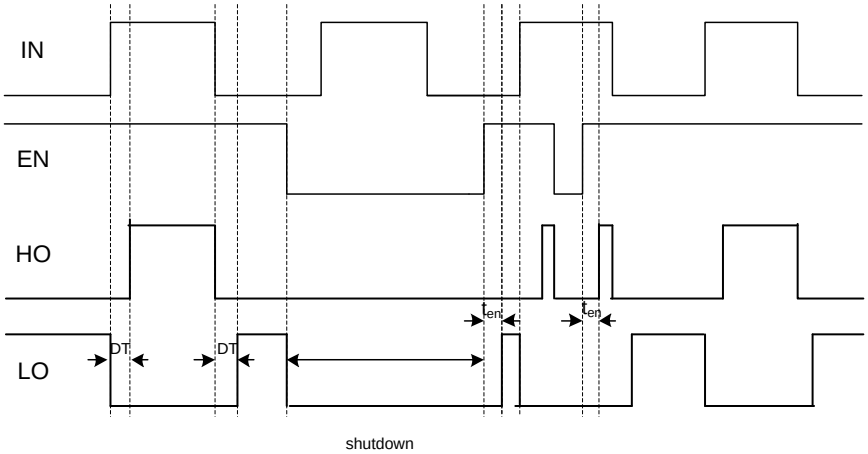
Enable Propagation Delay vs Temperature （RDT=10k）



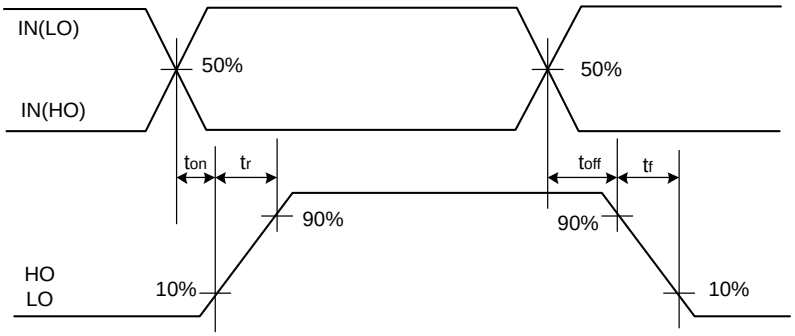
Shutdown Propagation Delay vs Temperature



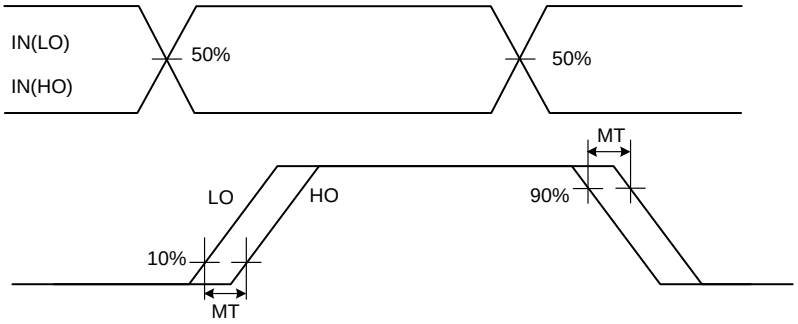
Input/Output Timing Diagram



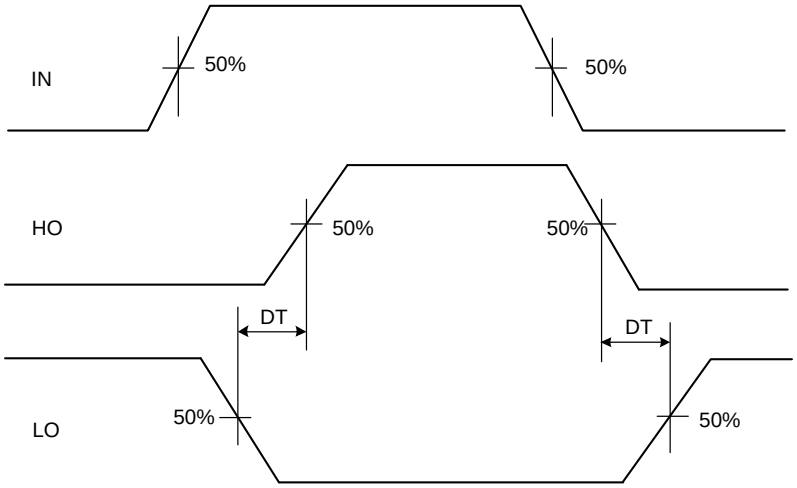
Switching Time Waveform Definitions



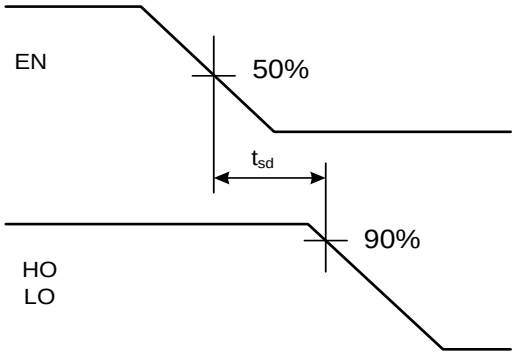
Delay Matching Waveform Definitions



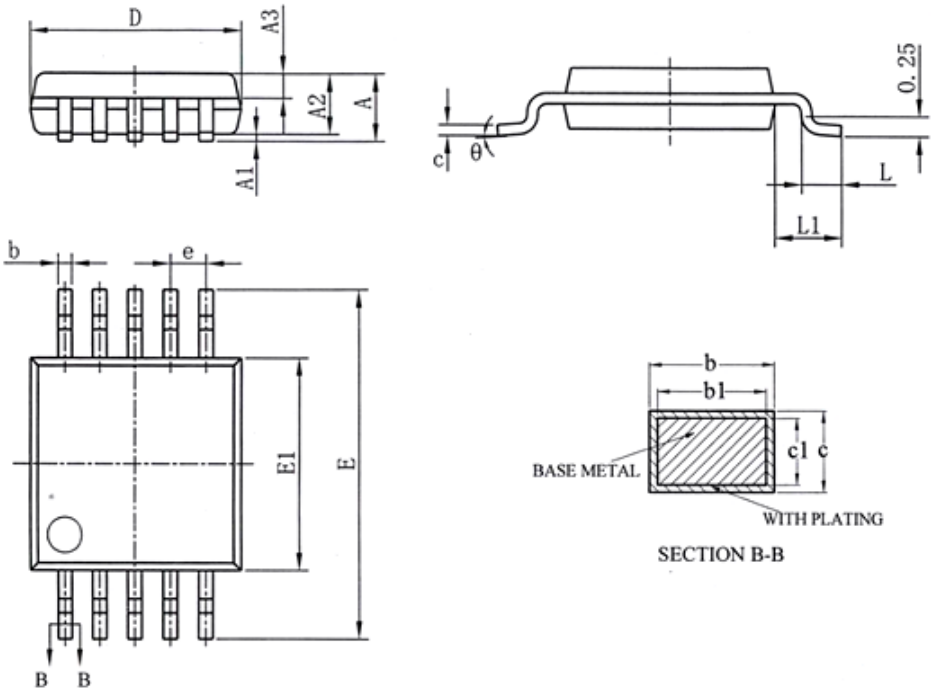
Dead-time Waveform Definitions



Shutdown Waveform Definitions



Package Dimensions（MSOP10）



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	-	-	1.10
A1	0.05	-	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.19	-	0.28
b1	0.18	0.20	0.23
c	0.15	-	0.20
c1	0.14	0.152	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.50BSC		
L	0.40	-	0.70
L1	0.95BSC		
θ	0	-	8°

Part Number	Package Type	Marking ID	Package Method	Quantity
FD2105M	MSOP10	FD2105M	Tape&Reel	3000

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