

Dual Channel 3.0kV_{RMS}/5.0kV_{RMS} Isolated Gate Driver

GENERAL DESCRIPTION

The SiLM824x-AQ isolated driver family is an isolated dual channel gate driver with different configurations. The SiLM8243/4-AQ are configured as high-side/low-side drivers, while the SiLM8245-AQ are configured as dual drivers. The peak source output current is 4.0A and the peak sink output current is 6.0A. Programmable dead time (DT) feature is available in SiLM8243/4-AQ. Pulling high the DIS pin shuts down both outputs simultaneously, and allows for normal operation when the DIS pin is open or pulled low. As a fail-safe measure, primary-side logic failures force both outputs low.

The VDDA and VDDB supply voltage are up to 33 V. A wide input VDDI range from 3 V to 18 V makes the driver suitable for interfacing with both analog and digital controllers. All the supply voltage pins have under voltage lock-out (UVLO) protection.

The SiLM824x-AQ has 5.0kV_{RMS} isolation in SOP16W package and 3.0kV_{RMS} isolation in SOP16 package per UL1577.

High CMTI, low propagation delay, small size and flexible configuration make the SiLM824x-AQ family is suitable for a wide range of isolated MOSFET/IGBT and SiC or GaN FET gate drive applications.

FEATURE

- AEC-Q100 qualified for automotive application
 - Temperature grade 1: -40°C to +125°C, T_A
- 4.0A peak source current
- 6.0A peak sink current
- 48ns (Typ.) propagation delay
- 150kV/us (Min.) common mode transient immunity (CMTI)
- Wide input voltage: 3V to 18V
- Up to 33V driver output voltage
- 5V reverse polarity voltage handling capability on input stage
- Safety certifications:
 - 5kV_{RMS} isolation for 1 minute per UL 1577 with SOP16W, SOP14W package
 - 3kV_{RMS} isolation for 1 minute per UL 1577 with SOP16 package
 - CQC certification per GB4943.1-2022
 - TUV certification per IEC 61010-1: 2010+A1 and IEC 62368-1: 2018
 - DIN VDE 0884-17: 2021-10 (Pending)

APPLICATION

- AC/DC or DC/DC power supplies in server, telecom and industry
- DC/AC solar inverters
- EV battery charging

APPLICATION CIRCUIT

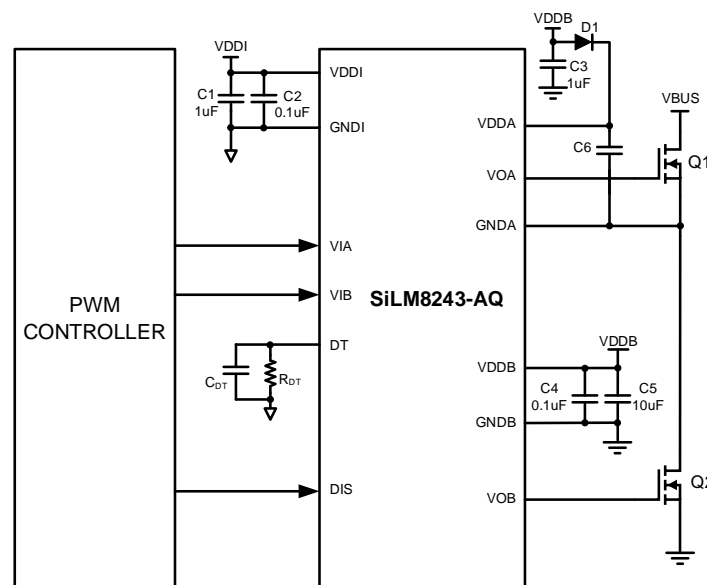


Figure 1. SiLM8243-AQ Application Circuit

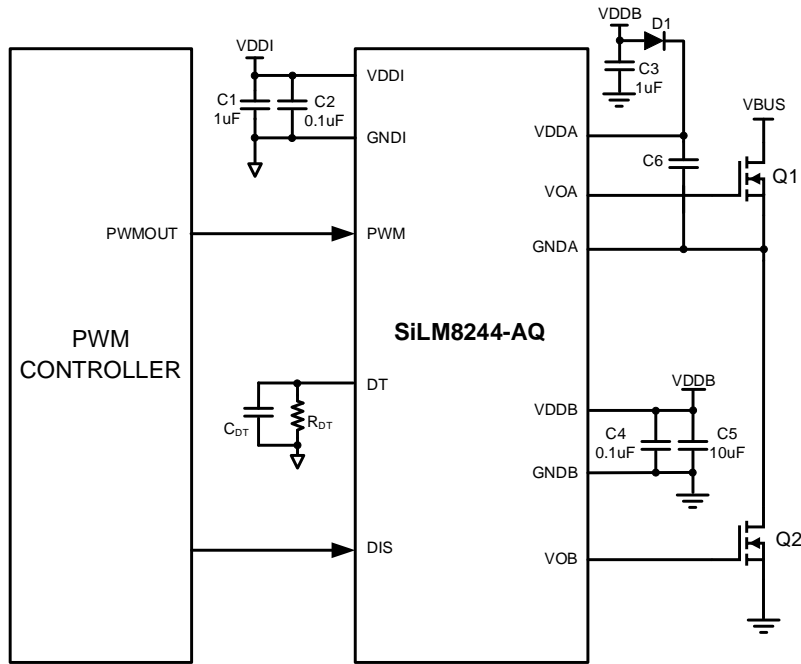


Figure 2. SiLM8244-AQ Application Circuit

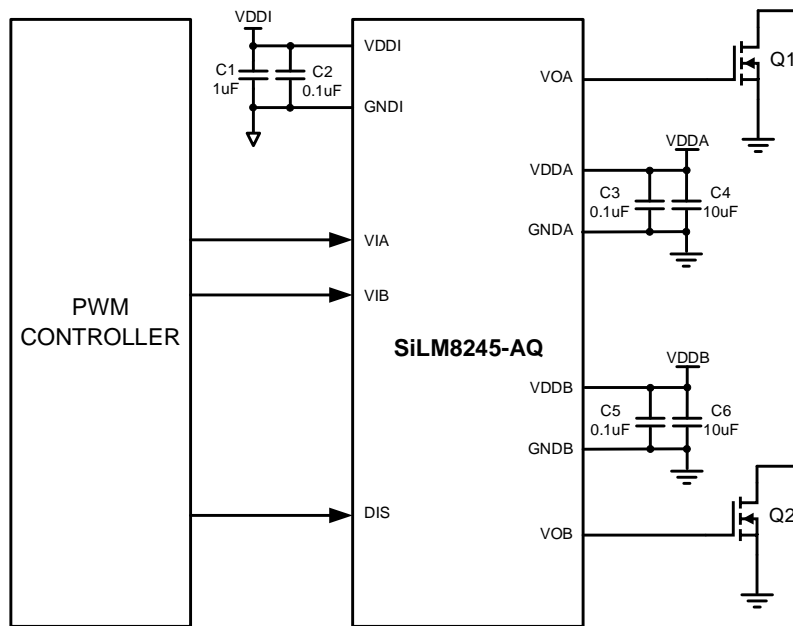


Figure 3. SiLM8245-AQ Application Circuit

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PIN CONFIGURATION

Part Number	Pin Configuration (Top View)	
	SOP16/ SOP16W	SOP14W
SiLM8243-AQ		
SiLM8244-AQ		
SiLM8245-AQ		

PIN DESCRIPTION
Table 1. SiLM8243-AQ Pin Description

No.	Pin	Description
1	VIA	Input of driver A. The output of driver A is in phase with the input. This pin is pulled low internally if left open. Recommend to connect this pin to ground if not used for better noise immunity.
2	VIB	Input of driver B. The output of driver B is in phase with the input. This pin is pulled low internally if left open. Recommend to connect this pin to ground if not used for better noise immunity.
3	VDDI	Input power supply. A local low ESR and ESL capacitor should be connected between VDDI and GNDI.
4	GNDI	Input power ground.
5	DIS	Device disable input. When DIS pin is high, both driver is disabled and driver output is low. When DIS pin is low, it allows the device to perform in normal operation.
6	DT	Dead time programming input. Connect a resistor between DT and GNDI to program the dead time. A bypassing capacitor, 2.2nF or greater, is recommended to be put between DT and GNDI to achieve better noise immunity.
7	NC	No connection
8	VDDI	Input power supply. This pin is internally connected to pin3.
9	GNDB	Power ground of driver B.
10	VOB	Output of driver B.
11	VDDB	Power supply of driver B. A local low ESR and ESL capacitor should be connected between VDDB and GNDB.
12	NC	No connection. Pin12 is removed in SOP14W
13	NC	No connection. Pin13 is removed in SOP14W
14	GNDA	Power ground of driver A.
15	VOA	Output of driver A.
16	VDDA	Power supply of driver A. A local low ESR and ESL capacitor should be connected between VDDA and GNDA.

Table 2. SiLM8244-AQ Pin Description

No.	Pin	Description
1	PWM	PWM input. The output of driver A is in phase with PWM input and the output of driver B is out of phase with PWM input.
2	NC	No connection
3	VDDI	Input power supply. A local low ESR and ESL capacitor should be connected between VDDI and GNDI.
4	GNDI	Input power ground.
5	DIS	Device disable input. When DIS pin is high, both driver is disabled and driver output is low. When DIS pin is low, it allows the device to perform in normal operation.
6	DT	Dead time programming input. Connect a resistor between DT and GNDI to program the dead time. A bypassing capacitor, 2.2nF or greater, is recommended to be put between DT and GNDI to achieve better noise immunity.

No.	Pin	Description
7	NC	No connection
8	VDDI	Input power supply. This pin is internally connected to pin3.
9	GNDB	Power ground of driver B.
10	VOB	Output of driver B.
11	VDDB	Power supply of driver B. A local low ESR and ESL capacitor should be connected between VDDB and GNDB.
12	NC	No connection. Pin12 is removed in SOP14W
13	NC	No connection. Pin13 is removed in SOP14W
14	GNDA	Power ground of driver A.
15	VOA	Output of driver A.
16	VDDA	Power supply of driver A. A local low ESR and ESL capacitor should be connected between VDDA and GNDA.

Table 3. SiLM8245-AQ Pin Description

No.	Pin	Description
1	VIA	Input of driver A. The output of driver A is in phase with the input. This pin is pulled low internally if left open. Recommend to connect this pin to ground if not used for better noise immunity.
2	VIB	Input of driver B. The output of driver B is in phase with the input. This pin is pulled low internally if left open. Recommend to connect this pin to ground if not used for better noise immunity.
3	VDDI	Input power supply. A local low ESR and ESL capacitor should be connected between VDDI and GNDA.
4	GNDI	Input power ground.
5	DIS	Device disable input. When DIS pin is high, both driver is disabled and driver output is low. When DIS pin is low, it allows the device to perform in normal operation.
6	NC	No connection
7	NC	No connection
8	VDDI	Input power supply. This pin is internally connected to pin3.
9	GNDB	Power ground of driver B.
10	VOB	Output of driver B.
11	VDDB	Power supply of driver B. A local low ESR and ESL capacitor should be connected between VDDB and GNDB.
12	NC	No connection. Pin12 is removed in SOP14W
13	NC	No connection. Pin13 is removed in SOP14W
14	GNDA	Power ground of driver A.
15	VOA	Output of driver A.
16	VDDA	Power supply of driver A. A local low ESR and ESL capacitor should be connected between VDDA and GNDA.

FUNCTIONAL BLOCK DIAGRAM

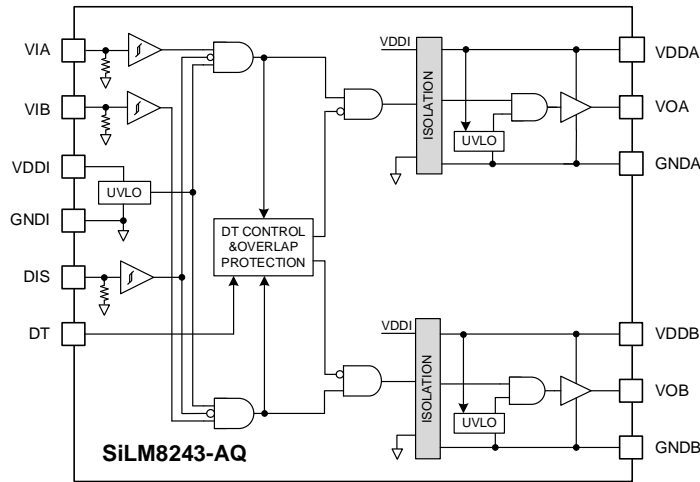


Figure 4. SiLM8243-AQ Functional Block Diagram

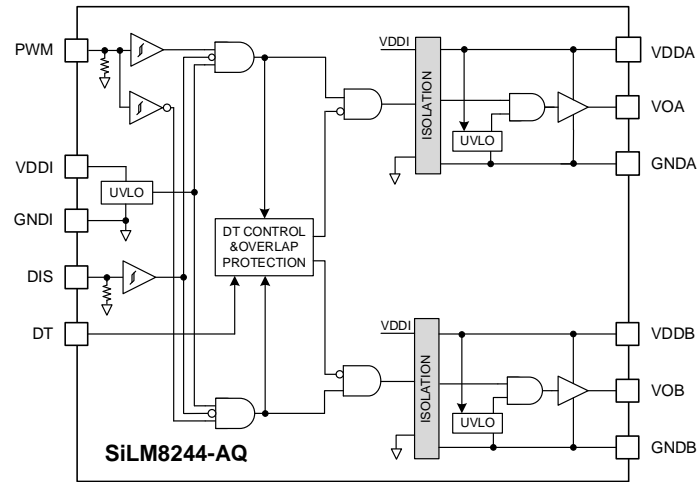


Figure 5. SiLM8244-AQ Functional Block Diagram

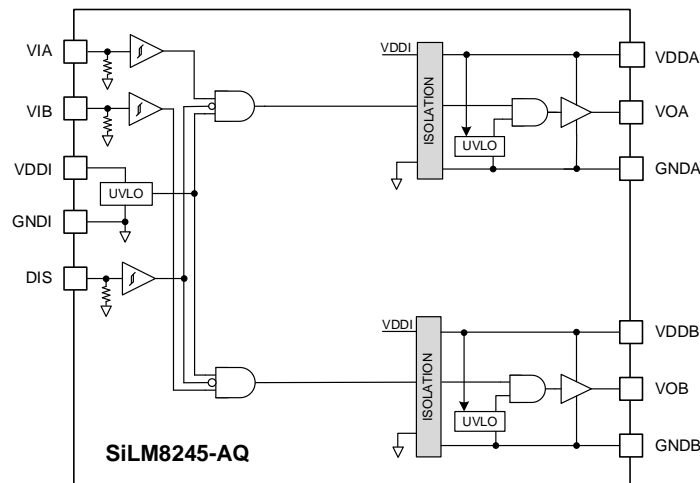


Figure 6. SiLM8245-AQ Functional Block Diagram

ORDERING INFORMATION

Order Part No.	Package	QTY
SiLM8243GDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8243ADCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8243BDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8243DDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8244GDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8244ADCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8244BDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8244DDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8245GDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8245ADCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8245BDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8245DDCG-AQ	SOP16W, Pb-Free	1500/Reel
SiLM8243GDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8243ADGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8243BDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8243DDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8244GDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8244ADGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8244BDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8244DDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8245GDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8245ADGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8245BDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8245DDGP-AQ	SOP14W, Pb-Free	1500/Reel
SiLM8243GBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8243ABCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8243BBCL-AQ	SOP16, Pb-Free	3000/Reel

SiLM8243DBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8244GBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8244ABCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8244BBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8244DBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8245GBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8245ABCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8245BBCL-AQ	SOP16, Pb-Free	3000/Reel
SiLM8245DBCL-AQ	SOP16, Pb-Free	3000/Reel

FAMILY OVERVIEW

Part Number	Input Configuration	Output Configuration	Programmable Dead Time	Overlap Protection	Isolation Rating	UVLO
SiLM8243GD	VIA, VIB	HS/LS	Yes	Yes	5 kV _{RMS}	3.5V/3V
SiLM8243AD	VIA, VIB	HS/LS	Yes	Yes	5 kV _{RMS}	5.5V/5V
SiLM8243BD	VIA, VIB	HS/LS	Yes	Yes	5 kV _{RMS}	8.5V/7.5V
SiLM8243DD	VIA, VIB	HS/LS	Yes	Yes	5 kV _{RMS}	12.5V/11.5V
SiLM8244GD	PWM	HS/LS	Yes	Yes	5 kV _{RMS}	3.5V/3V
SiLM8244AD	PWM	HS/LS	Yes	Yes	5 kV _{RMS}	5.5V/5V
SiLM8244BD	PWM	HS/LS	Yes	Yes	5 kV _{RMS}	8.5V/7.5V
SiLM8244DD	PWM	HS/LS	Yes	Yes	5 kV _{RMS}	12.5V/11.5V
SiLM8245GD	VIA, VIB	Dual Driver	No	No	5 kV _{RMS}	3.5V/3V
SiLM8245AD	VIA, VIB	Dual Driver	No	No	5 kV _{RMS}	5.5V/5V
SiLM8245BD	VIA, VIB	Dual Driver	No	No	5 kV _{RMS}	8.5V/7.5V
SiLM8245DD	VIA, VIB	Dual Driver	No	No	5 kV _{RMS}	12.5V/11.5V
SiLM8243GB	VIA, VIB	HS/LS	Yes	Yes	3 kV _{RMS}	3.5V/3V
SiLM8243AB	VIA, VIB	HS/LS	Yes	Yes	3 kV _{RMS}	5.5V/5V
SiLM8243BB	VIA, VIB	HS/LS	Yes	Yes	3 kV _{RMS}	8.5V/7.5V
SiLM8243DB	VIA, VIB	HS/LS	Yes	Yes	3 kV _{RMS}	12.5V/11.5V
SiLM8244GB	PWM	HS/LS	Yes	Yes	3 kV _{RMS}	3.5V/3V
SiLM8244AB	PWM	HS/LS	Yes	Yes	3 kV _{RMS}	5.5V/5V
SiLM8244BB	PWM	HS/LS	Yes	Yes	3 kV _{RMS}	8.5V/7.5V
SiLM8244DB	PWM	HS/LS	Yes	Yes	3 kV _{RMS}	12.5V/11.5V
SiLM8245GB	VIA, VIB	Dual Driver	No	No	3 kV _{RMS}	3.5V/3V
SiLM8245AB	VIA, VIB	Dual Driver	No	No	3 kV _{RMS}	5.5V/5V
SiLM8245BB	VIA, VIB	Dual Driver	No	No	3 kV _{RMS}	8.5V/7.5V
SiLM8245DB	VIA, VIB	Dual Driver	No	No	3 kV _{RMS}	12.5V/11.5V

ABSOLUTE MAXIMUM RATINGS¹

Symbol	Definition	Min	Max	Unit
V _{DDI}	Input Power Supply Voltage	-0.3	20	V
V _{IA} , V _{IB} , V _{DIS} , V _{PWM}	Input Signal Voltage	-7	20	V
V _{DDA} , V _{DDB}	Driver Power Supply	-0.3	35	V
V _{OUTA} , V _{OUTB}	Driver Output Voltage	-0.3	V _{DDA} +0.3, V _{DDB} +0.3	V
	Driver Output Voltage, Transient for 200ns ²	-3	V _{DDA} +0.3, V _{DDB} +0.3	V
V _{ch2ch}	Channel to Channel Voltage	SOP16W/SOP16	1500	V
		SOP14W	1850	V
T _J	Junction Temperature	-40	150	°C
T _S	Storage Temperature	-65	150	°C

RECOMMENDED OPERATION CONDITIONS¹

Symbol	Definition	Min	Max	Unit
V _{DDI}	Input Power Supply Voltage	3	18	V
V _{IA} , V _{IB} , V _{DIS} , V _{PWM}	Input Signal Voltage	-5	18	V
V _{DDA} , V _{DDB}	Driver Power Supply for 3.5V UVLO	4.0	33	V
V _{DDA} , V _{DDB}	Driver Power Supply for 5.5V UVLO	6.0	33	V
V _{DDA} , V _{DDB}	Driver Power Supply for 8.5V UVLO	9.1	33	V
V _{DDA} , V _{DDB}	Driver Power Supply for 12.5V UVLO	13.5	33	V
R _{DT}	Resistance range on DT	5	220	kΩ
C _{DT}	Capacitance on DT		10	nF
T _J	Junction Temperature	-40	150	°C
T _A	Ambient Temperature	-40	125	°C

ESD RATINGS

Symbol	Definition	Value	Units
V _{ESD}	HBM	±3000	V
	CDM	±2000	

THERMAL INFORMATION

Symbol	Definition	Value		Unit
		SOP16W/SOP14W	SOP16	
R _{θJA}	Junction to ambient thermal resistance	100	150	°C/W
R _{θJC(TOP)}	Junction to case (top) thermal resistance	40	38	°C/W

Note 1: V_{DDI}, V_{IA}, V_{IB}, V_{DIS}, V_{PWM} are reference to GNDI; V_{DDA}, V_{OUTA} are referenced to GNDA; V_{DDB}, V_{OUTB} are referenced to GNDB;

Note 2: Values are verified by characterization on bench

PACKAGE SPECIFICATIONS

Symbol	Definition	Min.	Typ.	Max.	Units
R _{IO}	Resistance (Input Side to Output Side)		10 ¹²		Ω
C _{IO}	Capacitance (Input Side to Output Side)		1.8		pF

INSULATION SPECIFICATIONS

Symbol	Definition	Test Condition	Value		Units
			SOP16	SOP16W/ SOP14W	
CLR	External clearance	Shortest terminal to terminal distance through air	>4.0	>8.0	mm
CPG	External creepage	Shortest terminal to terminal distance across the package surface	>4.0	>8.0	mm
DTI	Distance through the insulation	Minimum internal gap	>20	>20	um
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11), IEC 60112	>600	>600	V
	Material Group		I	I	
	Overvoltage category	Rated mains voltages ≤150Vrms	I-IV	I-IV	
		Rated mains voltages ≤300Vrms	I-III	I-IV	
		Rated mains voltages ≤600Vrms	I-II	I-III	
		Rated mains voltages ≤1000Vrms	I-I	I-II	
DIN V VDE 0884-11⁽¹⁾					
V _{IORM}	Maximum repetitive peak isolation voltage		1000	1500	V _{PK}
V _{IOWM}	Maximum isolation working voltage		707	1060	V _{RMS}
V _{IOTM}	Maximum transient isolation voltage	60s	4242	7000	V _{PK}
V _{IOSM}	Maximum surge isolation voltage	Test method per IEC62368-1, 1.2/50us waveform, V _{TEST} =1.6 x V _{IOSM} for SOP16W/SOP14W; V _{TEST} =1.3 x V _{IOSM} for SOP16	6000	6250	V _{PK}
q _{pd}	Apparent charge	Method b2: V _{pd(m)} =1.875 x V _{IORM} for SOP16W/SOP14W and V _{pd(m)} =1.5 x V _{IORM} for SOP16, tm=1 s	≤5	≤5	pC
	Climatic Category		40/125/21	40/125/21	
	Pollution Degree		2	2	
UL1577					
V _{ISO}	Withstand Isolation Voltage	V _{TEST} =V _{ISO} , t=60s (qualification), V _{TEST} =1.2 x V _{ISO} , t=1s (100% production)	3000	5000	V _{RMS}

Note 1: Certification pending

SAFETY RELATED CERTIFICATIONS(SOP16W/SOP14W)

VDE	UL	CQC
DIN VDE 0884-17: 2021-10	UL 1577 component recognition program	Certified according to GB4943.1-2022
Reinforced Insulation	Single protection, 5000 V _{RMS}	Reinforced insulation, Altitude ≤ 5000m, Tropical climate
Certification Pending	File number: E521801	File number: CQC23001379622

SAFETY LIMITING VALUES (SOP16W/SOP14W)

Symbol	Parameter	Condition	Side	Value	Unit
I _s	Safety output current	V _{DDA} =V _{DDDB} =16V, R _{θJA} =100°C/W, T _J =150°C, T _A =25°C	Driver A and Driver B	73	mA
P _s	Safety input, output, or total power	V _{DDA} =V _{DDDB} =16V, R _{θJA} =100°C/W, T _J =150°C, T _A =25°C	Input	36	mW
			Driver A	584	
			Driver B	584	
			Total	1204	
T _s	Maximum safety temperature			150	°C

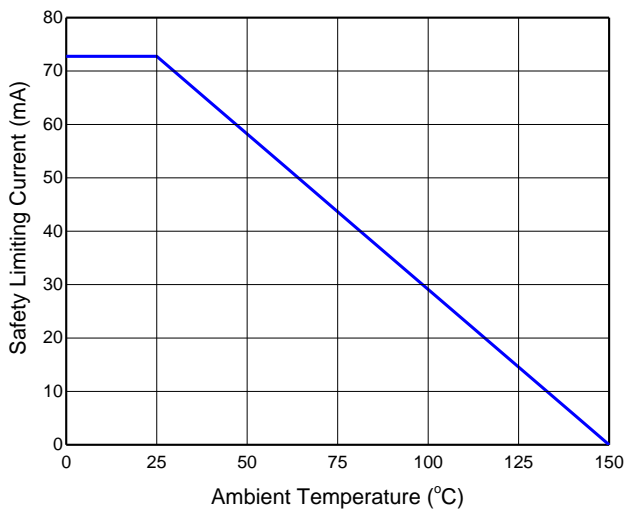


Figure 7. Thermal Derating Curve for Limiting Current per VDE (Current in VDDA and VDDDB), SOP16W/SOP14W

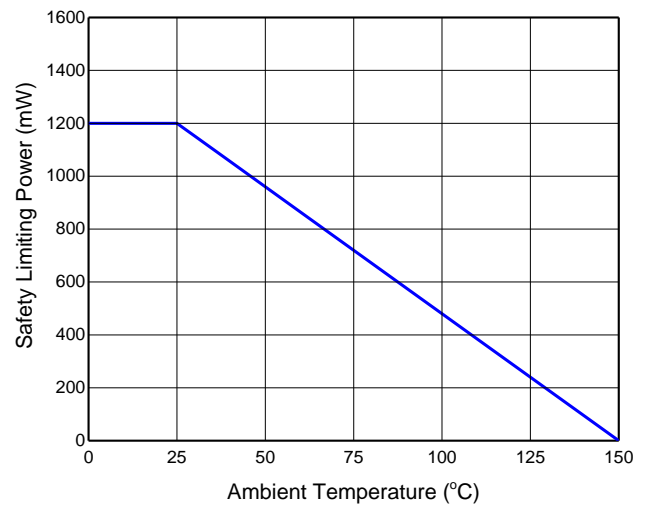


Figure 8. Thermal Derating Curve for Limiting Power per VDE, SOP16W/SOP14W

SAFETY RELATED CERTIFICATIONS(SOP16)

VDE	UL	CQC	TUV
DIN VDE 0884-17: 2021-10	UL 1577 component recognition program	Certified according to GB4943.1-2022	Certified according to IEC 61010-1: 2010+A1 and IEC 62368-1: 2018
Reinforced Insulation	Single protection, 3000 V_{RMS}	Reinforced insulation, Altitude \leq 5000m, Tropical climate	3000Vrms basic insulation, 400Vrms maximum working voltage
Certification Pending	File number: E521801	File number: CQC23001379622	Ref.Certif.No: DE 2-039416 Ref.Certif.No: JPTUV-148964

SAFETY LIMITING VALUES (SOP16)

Symbol	Parameter	Condition	Side	Value	Unit
I_s	Safety output current	$V_{DDA}=V_{DDB}=16V$, $R_{\theta JA}=150^{\circ}C/W$, $T_J=150^{\circ}C$, $T_A=25^{\circ}C$	Driver A and Driver B	49.8	mA
P_s	Safety input, output, or total power	$V_{DDA}=V_{DDB}=16V$, $R_{\theta JA}=150^{\circ}C/W$, $T_J=150^{\circ}C$, $T_A=25^{\circ}C$	Input	36	mW
			Driver A	399	
			Driver B	399	
			Total	834	
T_s	Maximum safety temperature			150	$^{\circ}C$

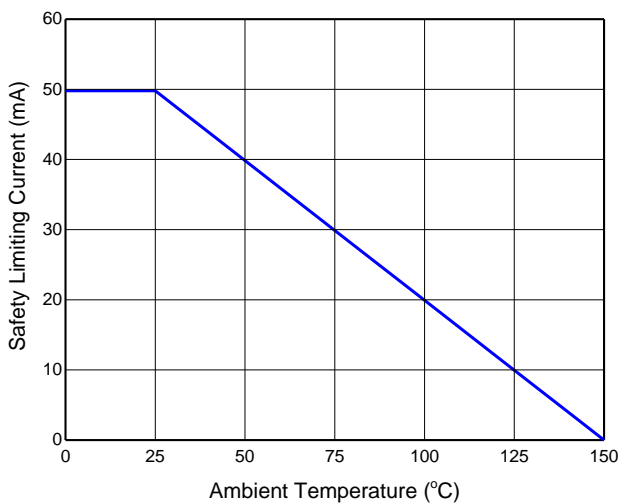


Figure 9. Thermal Derating Curve for Limiting Current per VDE (Current in VDDA and VDDB), SOP16

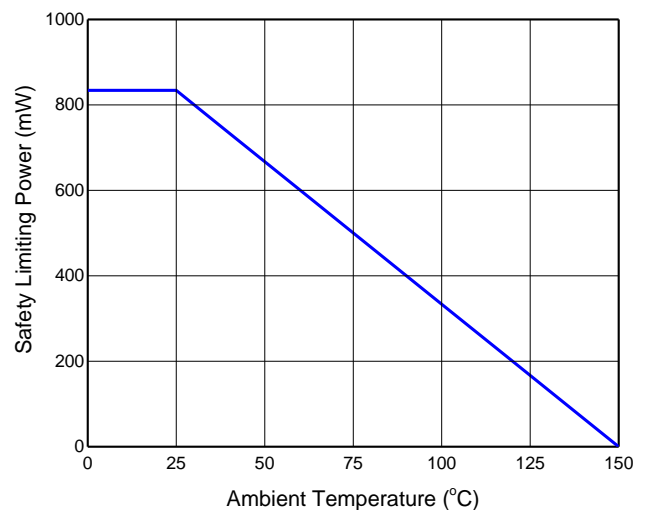


Figure 10. Thermal Derating Curve for Limiting Power per VDE, SOP16

ELECTRICAL CHARACTERISTICS (DC)

$V_{DDI} = 5\text{ V}$, $0.1\mu\text{F}$ capacitor from V_{DDI} to $GNDI$, $V_{DDA} = V_{DDB} = 15\text{V}$, $1\mu\text{F}$ capacitor from V_{DDA} and V_{DDB} to $GNDA$ and $GNDB$, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Input Power Supply						
V_{DDI}	Input Supply Voltage		3		18	V
$V_{UVLO_VDDI_R}$	VDDI UVLO Rising		2.5	2.7	2.9	V
$V_{UVLO_VDDI_F}$	VDDI UVLO Falling		2.3	2.5	2.7	V
V_{UVLO_HYS}	VDDI UVLO Hysteresis			0.2		V
I_{VDDI}	Quiescent Current	$V_{IA} = 0\text{V}$, $V_{IB} = 0\text{V}$ (SiLM8243/45)	1.5	2	2.5	mA
		$V_{PWM} = 0\text{V}$ (SiLM8244)	2.25	3.0	3.75	mA
	Operation Current	$C_{LOAD} = 100\text{pF}$, $f_{sw} = 50\text{kHz}$, 50% Duty Cycle, each channel (SiLM8243/45)	1.9	2.5	3.1	mA
		$C_{LOAD} = 100\text{pF}$, $f_{sw} = 50\text{kHz}$, 50% Duty Cycle (SiLM8244)	2.25	3.0	3.75	mA
Logic Interface						
V_{IH}	High Level Input Threshold Voltage at VIA, VIB, DIS and PWM			1.7	2.1	V
V_{IL}	Low Level Input Threshold Voltage at VIA, VIB, DIS and PWM		0.8	1.1		V
R_{PD}	Pull down Resistance on VIA, VIB, DIS and PWM		100	170	280	k Ω
Driver Power Supply						
$V_{UVLO_VDDA_R}$, $V_{UVLO_VDDB_R}$	VDDA, VDDB UVLO Rising	3.5V UVLO Version	3.2	3.5	3.8	V
		5.5V UVLO Version	5.1	5.5	5.9	V
		8.5V UVLO Version	8	8.6	9.1	V
		12.5V UVLO Version	11.5	12.5	13.5	V
$V_{UVLO_VDDA_F}$, $V_{UVLO_VDDB_F}$	VDDA, VDDB UVLO Falling	3.5V UVLO Version	2.7	3	3.3	V
		5.5V UVLO Version	4.6	5	5.4	V
		8.5V UVLO Version	7	7.6	8.1	V
		12.5V UVLO Version	10.5	11.5	12.5	V
$V_{UVLO_VDDA_HYS}$, $V_{UVLO_VDDB_HYS}$	VDDA, VDDB UVLO Hysteresis	3.5V UVLO Version		0.5		V
		5.5V UVLO Version		0.5		V
		8.5V UVLO Version		1		V

Symbol	Parameter	Condition	Min	Typ	Max	Unit
		12.5V UVLO Version		1		V
I _{VDDA} , I _{VDDB}	Quiescent Current	V _{IA} = 0V, V _{IB} = 0V	0.8	1.3	2	mA
	Operation Current	C _{LOAD} =100pF, f _{sw} =50kHz, (50% Duty Cycle), each channel	1.2	1.7	2.3	mA
OUTPUT						
I _{OH}	Peak Source Current			4		A
I _{OL}	Peak Sink Current			6		A
V _{OH}	High Level Output Voltage	I _O =-10mA		13	24	mV
V _{OL}	Low Level Output Voltage	I _O =10mA		7	14	mV
Dead Time						
t _{DT}	Dead time	R _{DT} =20kΩ	160	200	240	ns

SWITCHING CHARACTERISTICS (AC)

V_{DDI} = 5 V, 0.1μF capacitor from V_{DDI} to G_{NDI}, V_{DDA} = V_{VDDB} = 15V, 1μF capacitor from V_{DDA} and V_{VDDB} to G_{ND}A and G_{ND}B, T_A = -40°C to +125°C, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Switching Characteristics						
t _{PLH}	Propagation Delay, Low to High	C _{LOAD} =1nF, f _{sw} =1kHz, (50% Duty Cycle)		48	68	ns
t _{PHL}	Propagation Delay, High to Low			48	68	ns
t _r	Turn on Rise Time			6	15	ns
t _f	Turn off Fall Time			4	10	ns
t _{PWD}	Pulse Width Distortion				20	ns
t _{DM}	Propagation Delay Matching between OUTA and OUTB				18	ns
t _{UVLO_REC_VDDI}	V _{DDI} UVLO Recovery Delay			15		μs
t _{UVLO_REC_VDDA/B}	V _{DDA} , V _{VDDB} UVLO Recovery Delay			20	30	μs
CMT _{IH}	High Level Static Common Mode Transient Immunity	V _{CM} =1000V, T _A =25°C	150	200		kV/μs
CMT _{IL}	Low Level Static Common Mode Transient Immunity	V _{CM} =1000V, T _A =25°C	150	200		kV/μs

PARAMETER MEASUREMENT INFORMATION

Propagation Delay and Pulse Width Distortion

Figure 11 shows the timing diagram of the propagation delay t_{PLH} and t_{PHL} , pulse distortion t_{PWD} and delay matching t_{DM} from the input V_{IA} and V_{IB} . Short the DT pin to VDDI to disable the dead time function.

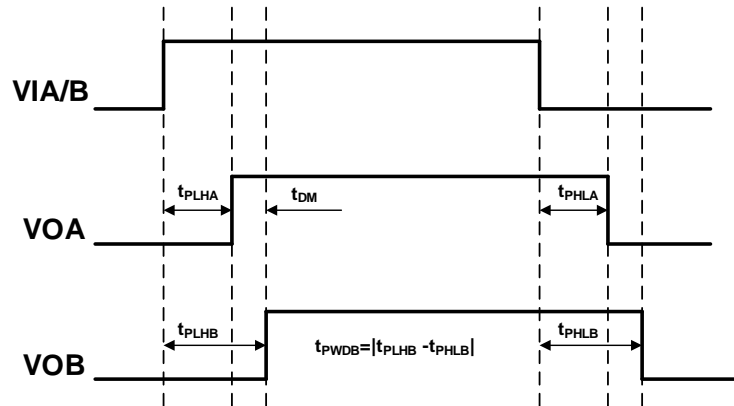


Figure 11. Propagation Delay and Pulse Width Distortion

Rise and Fall Time Testing

Figure 12 shows the criteria for measuring rise time (t_r) and fall time (t_f).

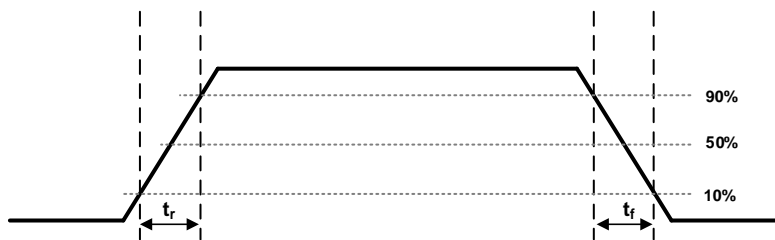


Figure 12. Turn On Rise Time and Turn Off Fall Time

CMTI Testing

Figure 13 is the simplified diagram of the CMTI testing. Common mode voltage is set to 1000V.

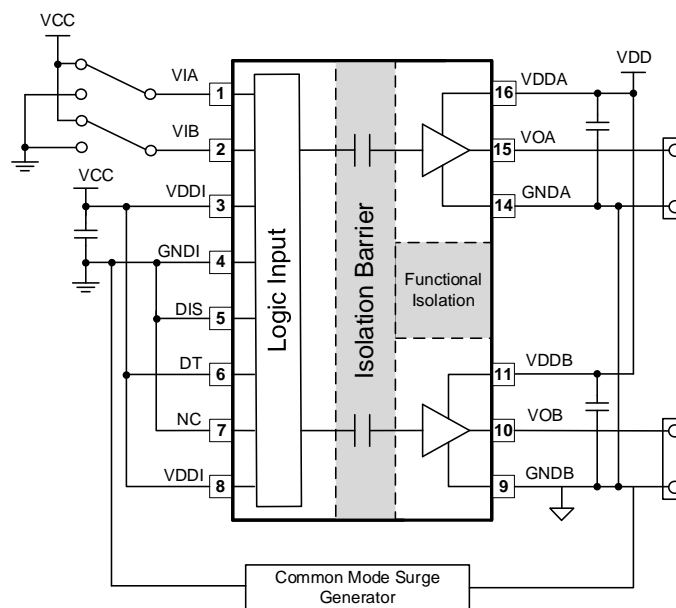


Figure 13. CMTI Test Circuit

FEATURE DESCRIPTION

SiLM824x-AQ is a flexible dual channel isolated gate driver that can drive IGBTs and MOSFETs. It has 4.0A peak output current capability with maximum output driver supply voltage of 33V. SiLM824x-AQ has many features that allow it to integrate well with control circuitry and protect the gates it drives such as: resistor programmable dead time control, an DIS pin, and under voltage lock out (UVLO) for both input and output voltages.

Under Voltage Lockout

The SiLM824x-AQ has under voltage lock out (UVLO) protection feature on each driver power supply voltage between the VDDA (VDDB) and GNDA (GNDB) pins. When the VDDx voltage is lower than $V_{UVLO_VDDX_R}$, during device start up or lower than $V_{UVLO_VDDX_F}$, after start up, the VDDA (VDDB) UVLO feature holds the driver output low, regardless of the status of the input pins. A hysteresis on the UVLO feature prevents glitch when there is noise from the power supply.

The SiLM824x-AQ also monitors the input power supply and there is an internal under voltage lock out protection feature on the VDDI. The driver outputs (VOA and VOB) are hold low when the voltage on the VDDI is lower than $V_{UVLO_VDDI_R}$ during start up or lower than $V_{UVLO_VDDI_F}$ after start up. There is a hysteresis on the VDDI UVLO feature to prevent glitch due the noise on the VDDI power supply.

Disable Input Function

When the DIS is pulled high, the VOA and VOB are pulled low regardless of the states of VIA and VIB. When the DIS pin is pulled low, the VOA and VOB are allowed for normal operation and controlled by the VIA and VIB.

The DIS input has no effect if VDDI is below its UVLO threshold and VOA, VOB remain low. There is an internal pull down resistor on the DIS pin.

Control Input and Output Logic

The VIA and VIB input control the corresponding output channel, VOA and VOB. A logic high signal on VIA (VIB) causes the output of VOA (VOB) to go high. And a logic low on VIA (VIB) causes the output of VOA (VOB) to go low.

For PWM input versions (SiLM8244-AQ), when the PWM input is high, the VOA is high and VOB is low. And when the PWM input is low, the VOA is low and VOB is high.

The Table 4 and Table 5 show the relationship between VIA, VIB, PWM, DIS, UVLO and Output of VOA and VOB.

Table 4. Relationship between Input and Output with VIA, VIB input

VIA	VIB	DIS	VDDI UVLO	VDDA UVLO	VDDB UVLO	VOA	VOB	Note
H	L	L	No	No	No	H	L	
L	H	L	No	No	No	L	H	
L	L	L	No	No	No	L	L	
H	H	L	No	No	No	H	H	Dual driver
						L	L	HS/LS
X	X	H	No	No	No	L	L	Device disabled
X	X	X	Yes	No	No	L	L	VDDI UVLO active
H	X	L	No	No	Yes	H	L	VDDB UVLO active
					Yes	L	L	
X	H	L	No	Yes	No	L	H	VDDA UVLO active
X	L	L	No	Yes	No	L	L	

Table 5. Relationship between Input and Output with PWM input

PWM	DIS	VDDI UVLO	VDDA UVLO	VDDB UVLO	VOA	VOB	Note
H	L	No	No	No	H	L	
L	L	No	No	No	L	H	
X	H	No	No	No	L	L	Device disabled
X	X	Yes	No	No	L	L	VDDI UVLO active
H	L	No	No	Yes	H	L	VDDB UVLO active
L	L	No	No	Yes	L	L	VDDB UVLO active
H	L	No	Yes	No	L	L	VDDA UVLO active
L	L	No	Yes	No	L	H	VDDA UVLO active

Dead-time Program

For the high side/low side configuration driver, there is a dead-time between VOA and VOB. The dead-time delay (t_{DT}) is programmed by a resistor (R_{DT}) connected from the DT input to ground and it can be calculated with below equation.

$$t_{DT}[\text{ns}] \approx 10 \times R_{DT}[\text{k}\Omega]$$

Here, t_{DT} is the dead-time delay, R_{DT} is the resistance value between DT and ground.

The DT pin can be connected to VDDI or left floating to provide a nominal dead time at approximately 400 ps.

A bypassing capacitor, 2.2nF or greater, is recommended to be put between DT and GNDI to achieve better noise immunity.

The Figure 14 shows the input and output logic with dead-time in different condition.

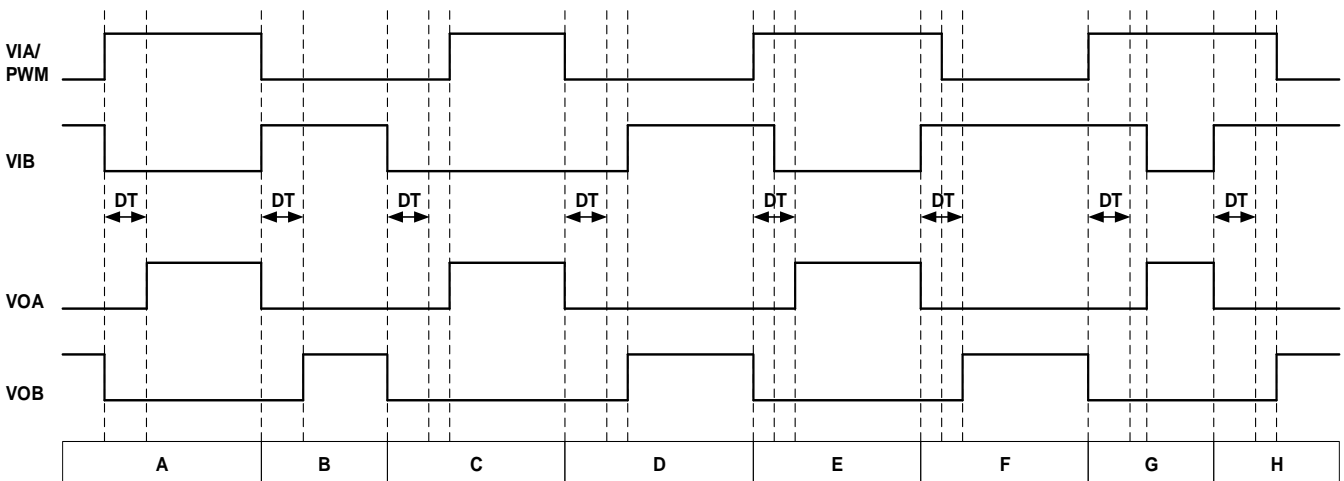


Figure 14. Input and output logic with dead-time

Condition A: VIA goes high and VIB goes low. VOB goes low immediately and VOA goes high after the programmed dead-time.

Condition B: VIA goes low and VIB goes high. VOA goes low immediately and VOB goes high after the programmed dead-time.

Condition C: VIB goes low and VIA still low. VOB goes low immediately. Since the VIA input dead-time is longer than the programmed dead-time, the VOA goes high immediately when the VIA input goes high.

Condition D: VIA goes low and VIB still low. VOA goes low immediately. Since the VIB input dead-time is longer than the programmed dead-time, the VOB goes high immediately when the VIB input goes high.

Condition E: VIA goes high while VIB and VOB are still high, the overlap time is shorter than the programmed dead-time. To avoid overshoot, VOB goes low immediately when the VIA goes high. The VOA goes high after the programmed dead-time.

Condition F: VIB goes high while VIA and VOA are still high, the overlap time is shorter than the programmed dead-time. To avoid overshoot, VOA goes low immediately when the VIB goes high. The VOB goes high after the programmed dead-time.

Condition G: VIA goes high while VIB and VOB are still high, the overlap time is longer than the programmed dead-time. To avoid overshoot, VOB goes low immediately when the VIA goes high. Since the overlap time is longer than the programmed dead-time, the VOA goes high immediately when the VIB goes low.

Condition H: VIB goes high while VIA and VOA are still high, the overlap time is longer than the programmed dead-time. To avoid overshoot, VOA goes low immediately when the VIB goes high. Since the overlap time is longer than the programmed dead-time, the VOB goes high when the VIA goes low.

APPLICATION INFORMATION

The circuit in Figure 15 shows the typical application circuit for SiLM824x-AQ to driver a typical half bridge configuration which could be used in several popular power converter topologies such as synchronous buck, synchronous boost, half bridge, full bridge, LLC etc. topologies and 3-phase motor drive applications.

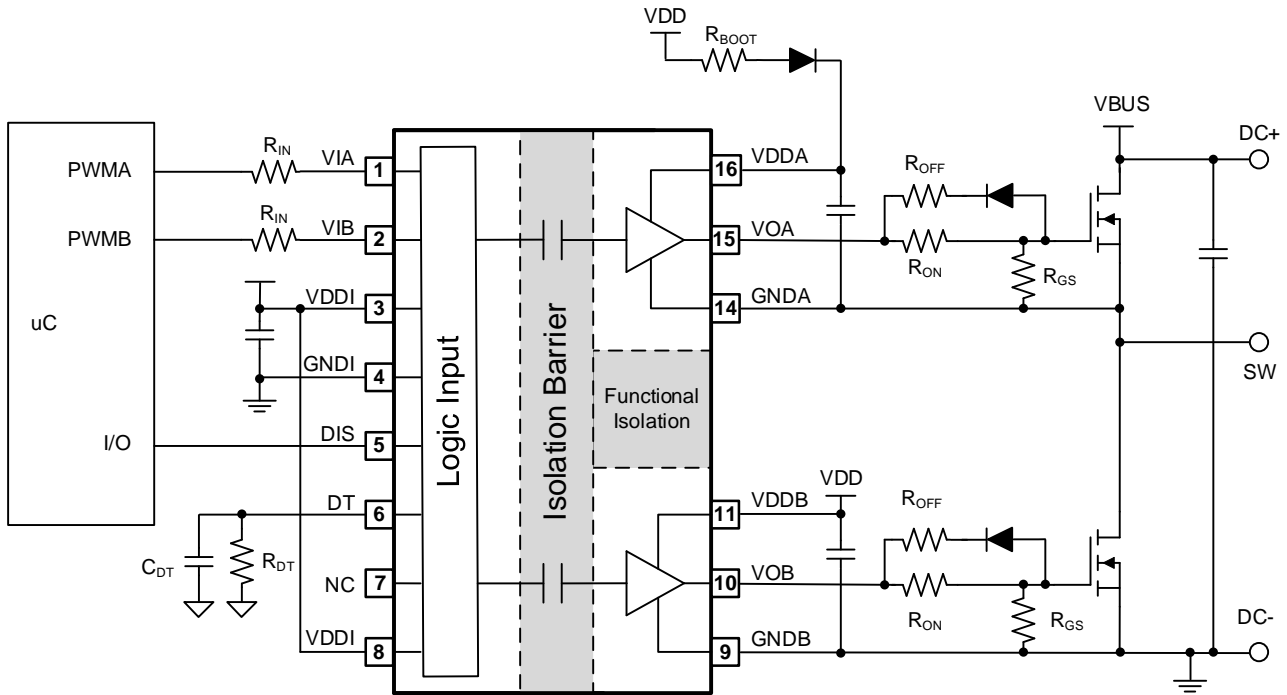


Figure 15. Typical Application Schematic

PACKAGE CASE OUTLINES

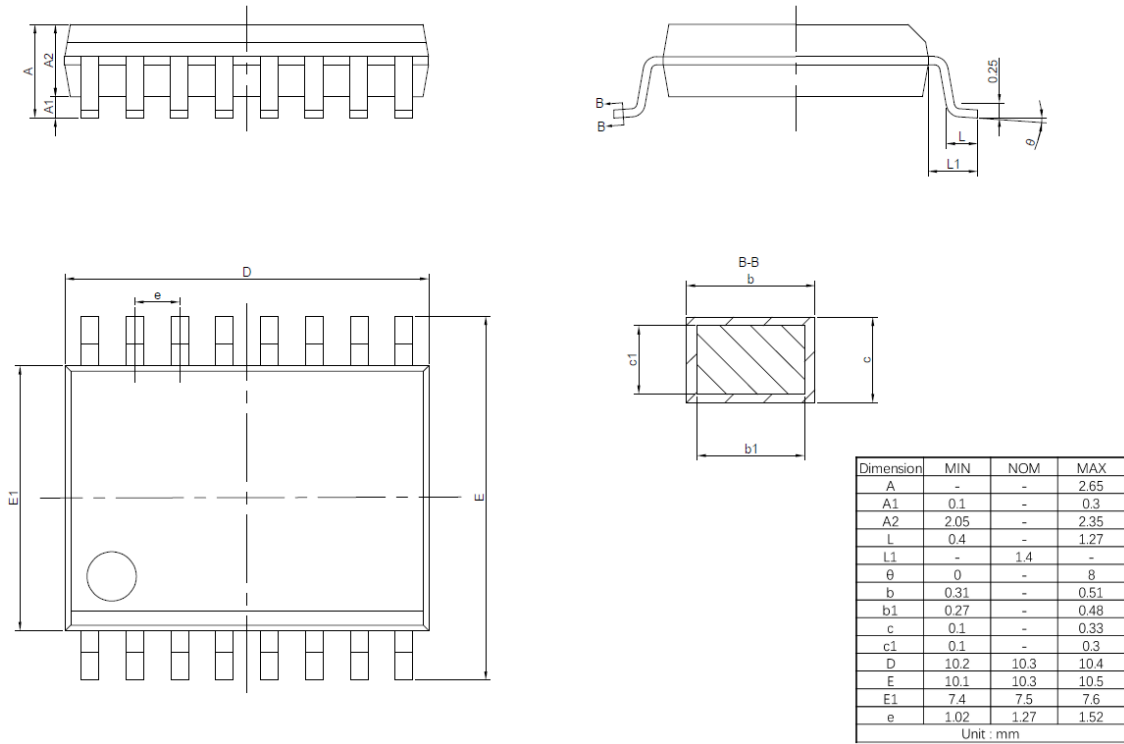


Figure 16. SOP16W Package Outline Dimensions

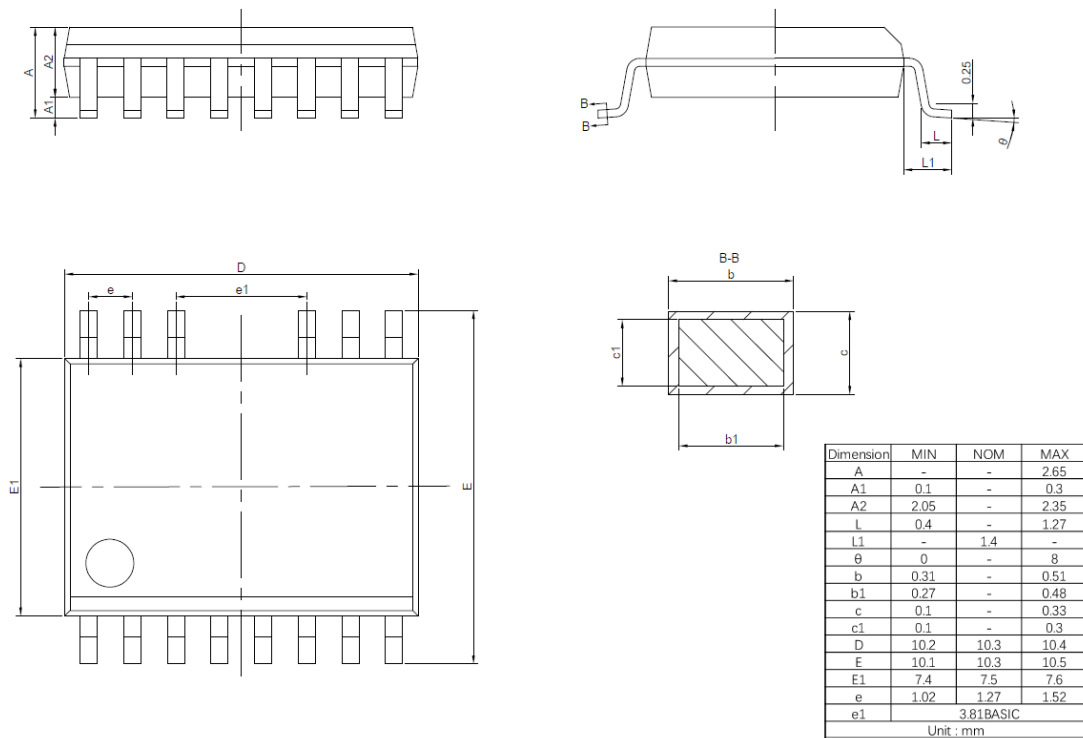


Figure 17. SOP14W Package Outline Dimensions

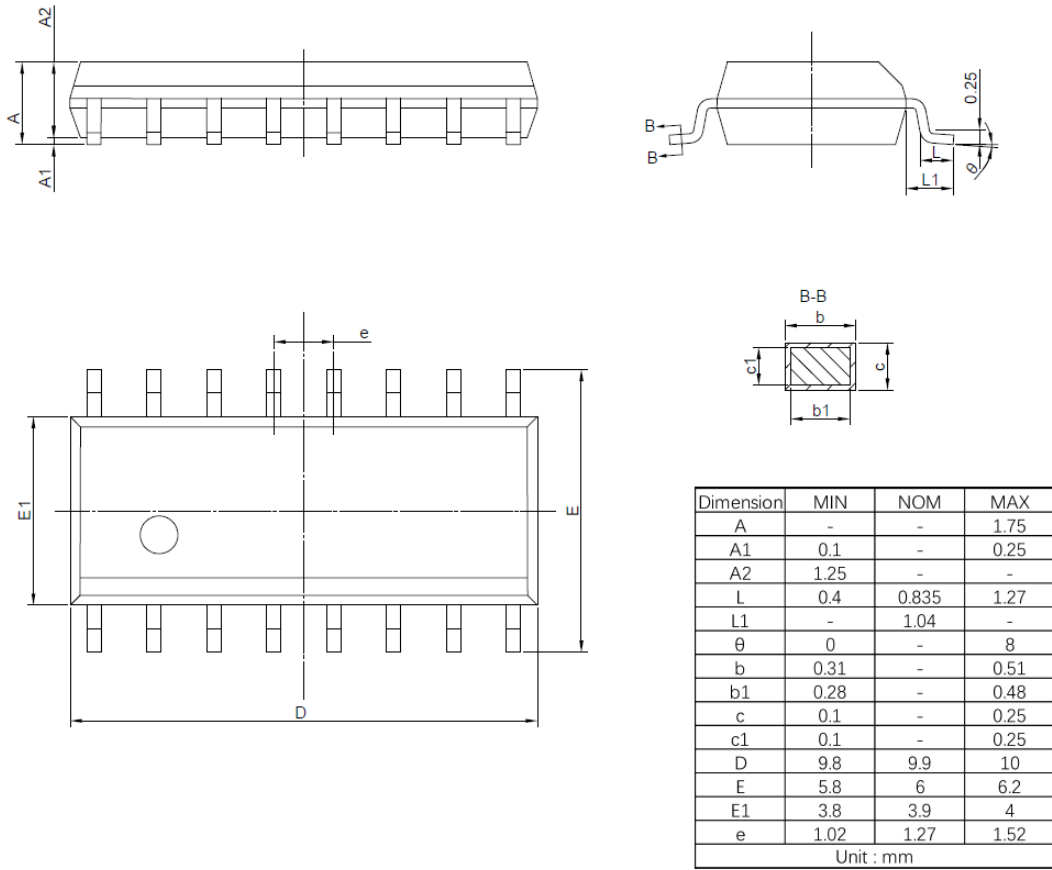


Figure 18. SOP16 Package Outline Dimensions

REVISION HISTORY

Note: page numbers for previous revisions may differ from page numbers in current version

Page or Item	Subjects (major changes since previous revision)
Rev 1.0 datasheet: 2023-Jun-30	
Whole document	Initial datasheet release