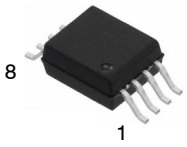
Precision Miniature Isolation Amplifier

FODC790, FODC79A, FODC79B



SOIC/LSOP−8
CASE 751FC

Description

The FODC79x devices are optically-coupled, high-precision, analog isolation amplifiers. Their input is a GaAlAs light-emitting-diode and a high-accuracy sigma-delta A/D converter. A high-accuracy D/A converter is situated at the differential output of these devices. They are well suited for current sensing applications including motor drives and inverters. In these applications the FODC79x devices will sense an analog voltage drop across an external sensing resistor and produce a differential output voltage that is proportional to the current sensed. The isolation allows for a smoother control in a high noise environment found in motor control systems.

Features

- 0.4 mV Input Offset Voltage
- 200 kHz Bandwidth
- 0.05% Nonlinearity
- 0.0012 V/V/°C Gain Drift Vs. Temperature
- 15 kV/μs Min. Common Mode Rejection (CMR) at V_{CM} = 1000 V
- Advanced Sigma-Delta (Σ-Δ) A/D Converter Technology
- Fully Differential Circuit Topology
- Operation Temperature: −40 °C to 105 °C

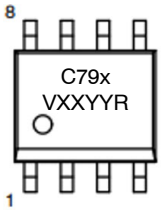
Applications

- General Purpose Analog Signal Isolation
- General Purpose Current and Voltage Sensing and Monitoring
- Switched Mode Power Supply Signal Isolation
- Inverter Current Sensing
- Industrial Process Control

Safety Mechanisms

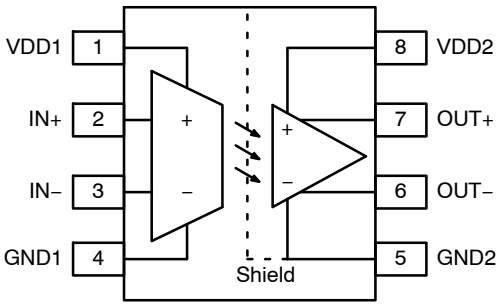
- UL/cUL Recognized 5000 V_{RMS} for 1 Minute
- IEC/EN/DIN EN 60747-5-5 V_{IORM} = 1414 V_{peak}

MARKING DIAGRAM



C79 = Device Number
x = Gain Rank: 0, A or B
V = DIN_EN/IEC60747−5−5 Option (only appears on component ordered with this option)
XX = Two Digit Year Code
YY = Two Digit Work Code
R = Assembly Package Code
S = Surface Mount Device
D = Through−Hole Device

BLOCK DIAGRAM



ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

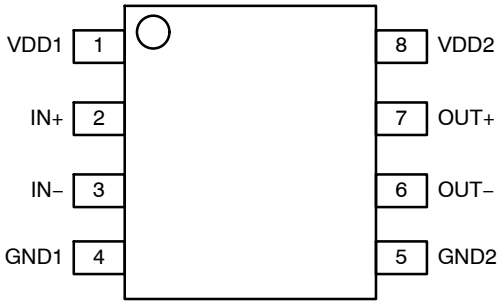


Figure 1. Pin Definitions

PIN DESCRIPTION

Pin No.	Name	Description
1	VDD1	Power Supply for Signal Input (analog side)
2	VIN+	Positive Analog Input, ±200 mV recommended input range.
3	VIN−	Negative Analog Input, ±200 mV recommended input range (Typically connected to GND1)
4	GND1	Ground Reference for Signal Input (analog side)
5	GND2	Ground Reference for Data Output (digital side)
6	VOUT−	Negative Output
7	VOUT+	Positive Output
8	VDD2	Power Supply for Data Output (digital side)

SAFETY AND INSULATION RATINGS (This device is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings must be ensured by means of protective circuits.)

Symbol	Rating		Min	Typ	Max	Unit
	Installation Classifications per DIN VDE 0110, Table 1	<150 V_{rms}	–	I to IV	–	
		<300 V_{rms}	–	I to IV	–	
		<450 V_{rms}	–	I to III	–	
	Material Group (DIN VDE 0110, 1.89, Table 1)		–	IIIa	–	
	Climatic Classification		–	40/105/21	–	
	Pollution Degree per DIN VDE 0110/39		–	2	–	
V_{IORM}	Maximum Working Insulation Voltage		1414	–	–	V_{PEAK}
V_{IOTM}	Highest Allowable Over Voltage (60 Seconds)		8000	–	–	V_{PEAK}
CTI	Comparative Tracking Index (DIN IEC 112/VDE 0303 Part 1)		300	–	–	V
E_{CR}	External Creepage		8	–	–	mm
E_{CL}	External Clearance		8	–	–	mm
DTI	Insulation Thickness		0.4	–	–	μm
T_S	Maximum Values in Failure; Case Temperature		–	–	175	°C
$I_{S, INPUT}$	Safety Input Current		–	–	230	mA
$P_{S, OUTPUT}$	Maximum Values in Failure; Output Power		–	–	600	mW
R_{IO}	Insulation Resistance $T_A = T_S$, V_{IO} = 500 V		10^9	–	–	Ω

INSULATION CHARACTERISTICS (Apply over all recommended conditions. All typical values are measured at T_A = 25 °C.)

Symbol	Rating	Test Conditions	Min	Typ	Max	Unit
V_{ISO}	Insulation Voltage per UL1577	RH ≤ 40−60%, t = 60 s (Note 1)	5000	–	–	V_{RMS}
R_{ISO}	Insulation Resistance	T_A = 25 °C, V_{IO} = 500 V	–	10^{12}	–	Ω
C_{ISO}	Insulation Capacitance	T_A = 25 °C, f = 1 MHz	–	0.5	–	pF

1. Device is considered a two-terminal device: pins 1, 2, 3, and 4 are shorted and pins 5, 6, 7, and 8 are shorted. Each photocoupler is tested by applying an insulation test voltage 6000 V_{RMS} for one second.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C unless otherwise noted)

Symbol	Rating	Value	Unit
V_{DD1}, V_{DD2}	Supply Voltage	0 to 5.5	V
V_{IN+}, V_{IN-}	Steady State Input Voltage Range 2 Second Transient	−2.0 to V_{DD1} + 0.5 −6.0 to V_{DD1} + 0.5	V
V_{OUT+}, V_{OUT-}	Output Voltage Range	−0.5 to V_{DD2} + 0.5	V
$T_{J(max)}$	Maximum Junction Temperature	125	°C
T_{STG}	Storage Temperature Range	−55 to 125	°C
T_{SLD}	Lead Temperature Soldering	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING RANGES

Symbol	Rating	Min	Max	Unit
T_A	Ambient Operating Temperature	−40	105	°C
V_{DD1}	V_{DD1} Supply Voltage	4.5	5.5	V
V_{DD2}	V_{DD2} Supply Voltage	3.0	5.5	V
V_{IN+}, V_{IN-}	Input Voltage (Accurate and Linear)	−200	200	mV

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS (Typical values at V_{IN+} = V_{IN-} = 0 V, V_{DD1} = 5 V, V_{DD2} = 3.3 V, T_A = 25 °C unless otherwise noted. Minimum and maximum specifications are at recommended operating conditions.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{OS}	Input Offset Voltage	T_A = 25 °C	−1	0.4	2	mV
$\Delta V_{OS}/\Delta T_A$	Magnitude of Input Offset Change vs. Temperature	T_A = −40 °C to 105 °C	–	−0.8	4.1	µV/°C
G0	Gain (FODC790 ±3%)	T_A = 25 °C	7.95	8.2	8.44	V/V
G1	Gain (FODC79A ±1%)	T_A = 25 °C	8.12	8.2	8.28	V/V
G2	Gain (FODC79B ±0.5%)	T_A = 25 °C	8.16	8.2	8.24	V/V
$\Delta G/\Delta T_A$	Magnitude of Gain Change vs. Temperature	T_A = −40 °C to 105 °C	–	−1.2	–	nV/°C
NL_{200}	Nonlinearity over ±200 mV Input Voltage	V_{IN+} = −200 mV to +200 mV, T_A = 25 °C	–	0.05	0.13	%
$\Delta NL_{200}/\Delta T_A$	Magnitude of NL_{200} Change vs. Temperature	T_A = −40 °C to 105 °C	–	0.0001	–	%/°C
NL_{100}	Nonlinearity over ±100 mV	V_{IN+} = −100 mV to +100 mV	–	0.03	0.06	%

AC ELECTRICAL CHARACTERISTICS (Typical values at $V_{IN+} = V_{IN-} = 0$ V, $V_{DD1} = 5$ V, $V_{DD2} = 3.3$ V, $T_A = 25$ °C unless otherwise noted. Minimum and maximum specifications are at recommended operating conditions.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
SNR	Signal-to-Noise Ratio	V_{IN+} = 300 mV_{pk-pk}, 10 kHz sine wave	–	59	–	dB
SNDR	Signal-to-Noise and Distortion Ratio	V_{IN+} = 300 mV_{pk-pk}, 10 kHz sine wave	–	58	–	dB
BW	V_{OUT} Bandwidth (–3 dB)	V_{IN+} = 300 mV_{pk-pk}, sine wave	140	200	–	kHz
t_{pd10}	V_{IN} to V_{OUT} Signal Delay (50% to 10%)	V_{IN+} = 0 mV to 200 mV step. Measured at output of OPA132	–	1.4	2.3	μs
t_{pd50}	V_{IN} to V_{OUT} Signal Delay (50% to 50%)		–	2.0	2.6	μs
t_{pd90}	V_{IN} to V_{OUT} Signal Delay (50% to 90%)		–	3.1	3.3	μs
$t_{R/F}$	V_{OUT} Rise/Fall Time (10% to 90%)		–	2.0	–	μs
CMTI	Common Mode Transient Immunity	T_A = 25 °C, V_{CM} = 1000 V	15	–	–	kV/μs
PSR	Power Supply Rejection	1 V_{pp} 1 kHz sine wave ripples on V_{DD1}, differential output	–	–75	–	dB

INPUT/OUTPUT CHARACTERISTICS (Typical values at $V_{IN+} = V_{IN-} = 0$ V, $V_{DD1} = 5$ V, $V_{DD2} = 3.3$ V, $T_A = 25$ °C unless otherwise noted. Minimum and maximum specifications are at recommended operating conditions.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
FSR	Full Scale Differential Voltage Input Range	$V_{IN} = V_{IN+} - V_{IN-}$	–	±300	–	mV
I_{IN+}	Input Current	$V_{IN+} = V_{IN-} = 0$ V	–1	–0.1	–	μA
$\Delta I_{IN+}/\Delta T_A$	Magnitude of I_{IN+} Change vs. Temperature		–	–0.23	–	nA/°C
I_{DD1}	Input Supply Current	V_{IN+} = +400 mV	–	9.1	18.5	mA
R_{IN}	Input Impedance	V_{IN+} or V_{IN-}, Single-Ended	–	25	–	kΩ
C_{IN}	Input Capacitance		–	30	–	pF
V_{OCM}	Output Common Mode Voltage	V_{OUT+} or V_{OUT-}	–	1.23	–	V
OVR	Output Voltage Range	V_{OUT+} or V_{OUT-}	–	0 to 2.5	–	V
$\|I_{OSC}\|$	Output Short-Circuit Current	V_{OUT+} or V_{OUT-}, Shorted to GND2 or V_{DD2}	–	12	–	mA
I_{DD2}	Output Supply Current	V_{DD2} = 5 V	–	4.6	12	mA
		V_{DD2} = 3.3 V	–	3.2	11	mA
R_{OUT}	Output Impedance	V_{OUT+} or V_{OUT-}	–	52	–	Ω
$CMRR_{IN}$	Input DC Common Mode Rejection Ratio		–	75	–	dB

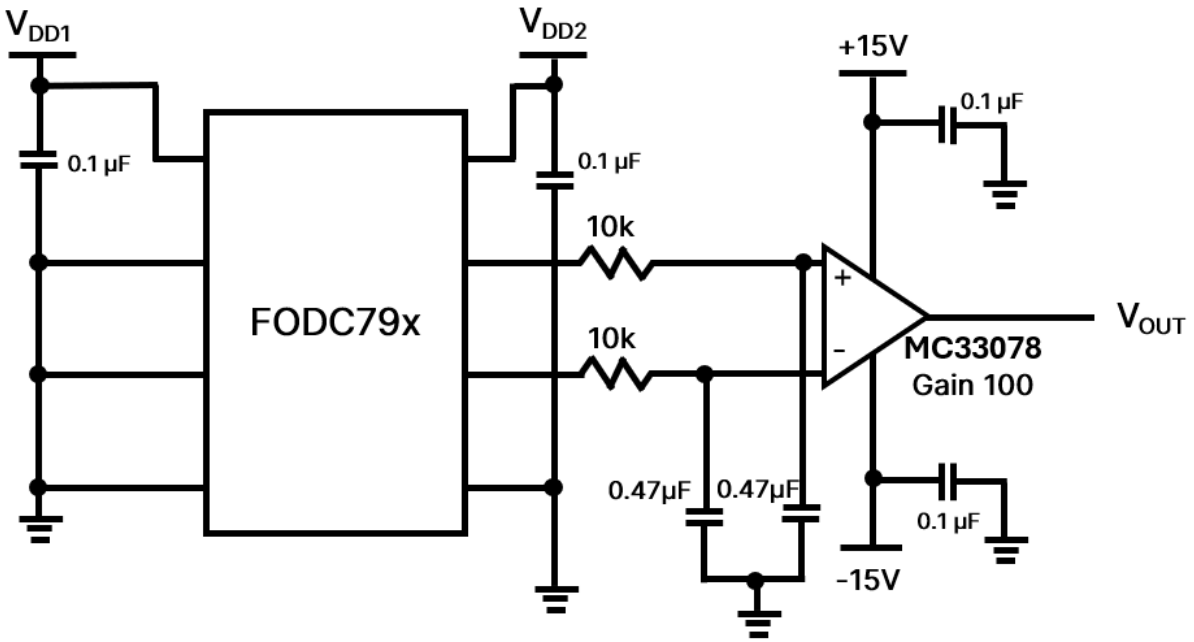


Figure 2. Input Voltage Test Circuit

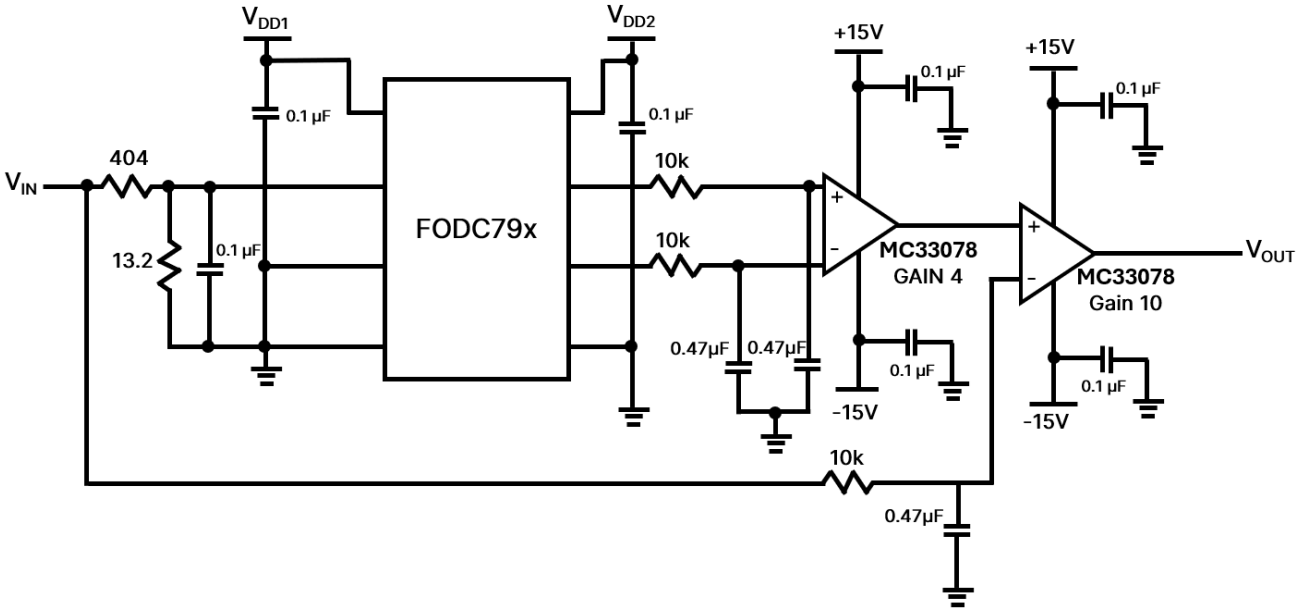


Figure 3. Gain and Nonlinearity Test Circuit

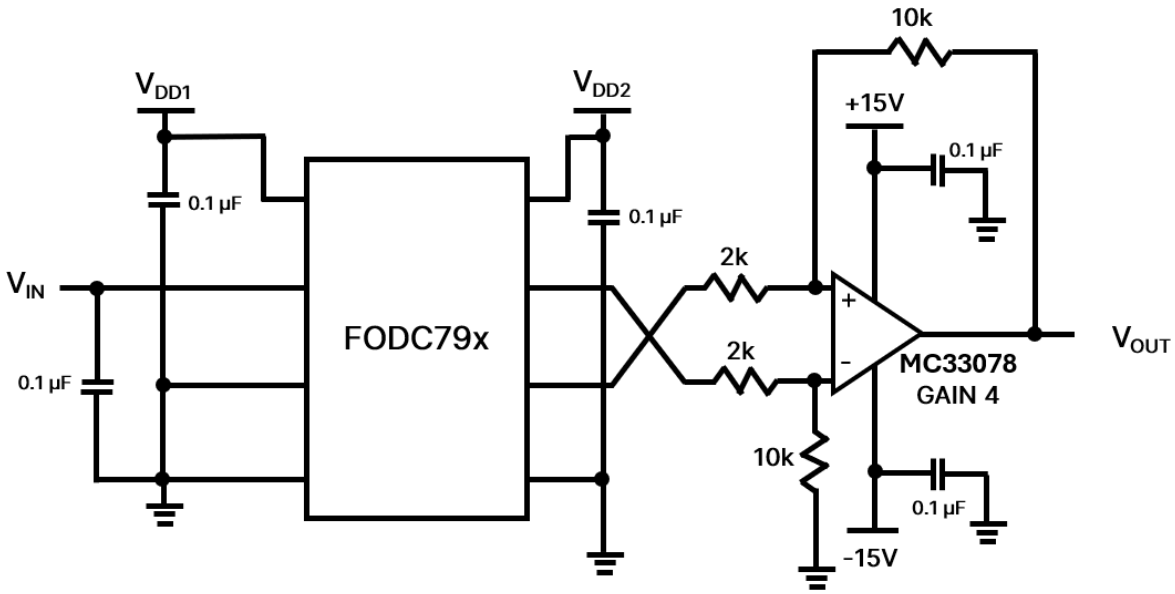


Figure 4. Propagation Delay Test Circuit

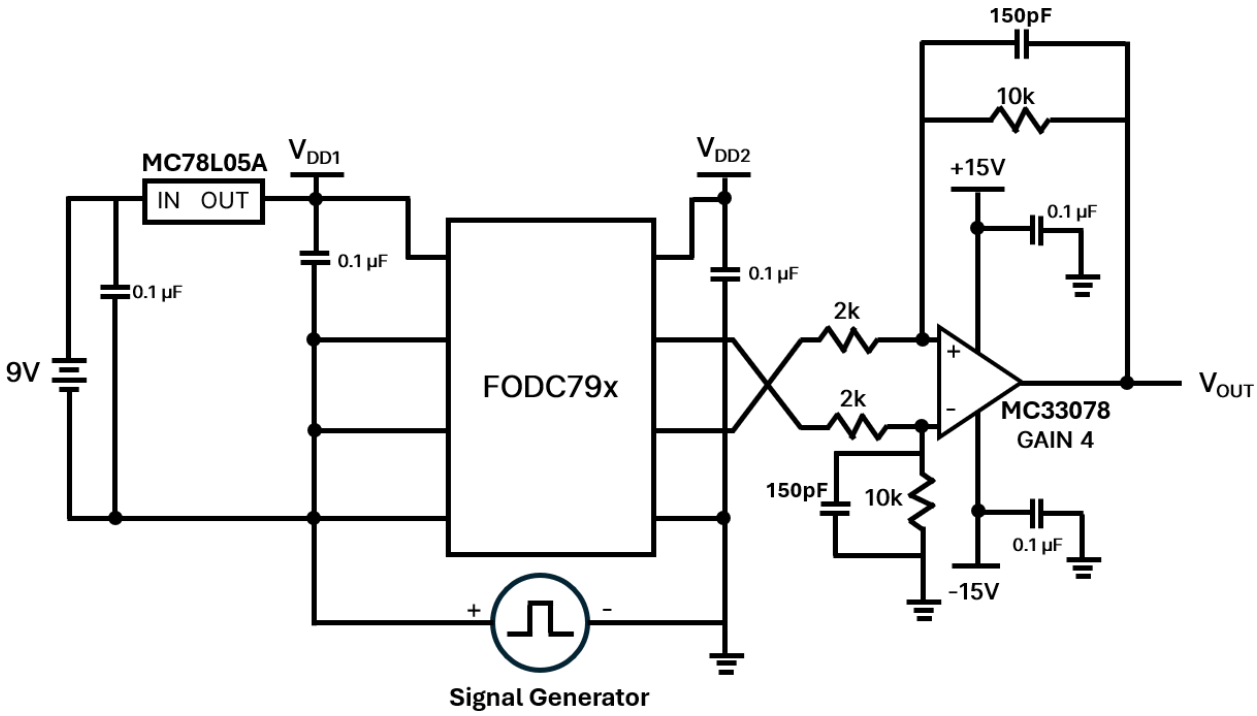


Figure 5. CMTI Test Circuit

APPLICATION INFORMATION

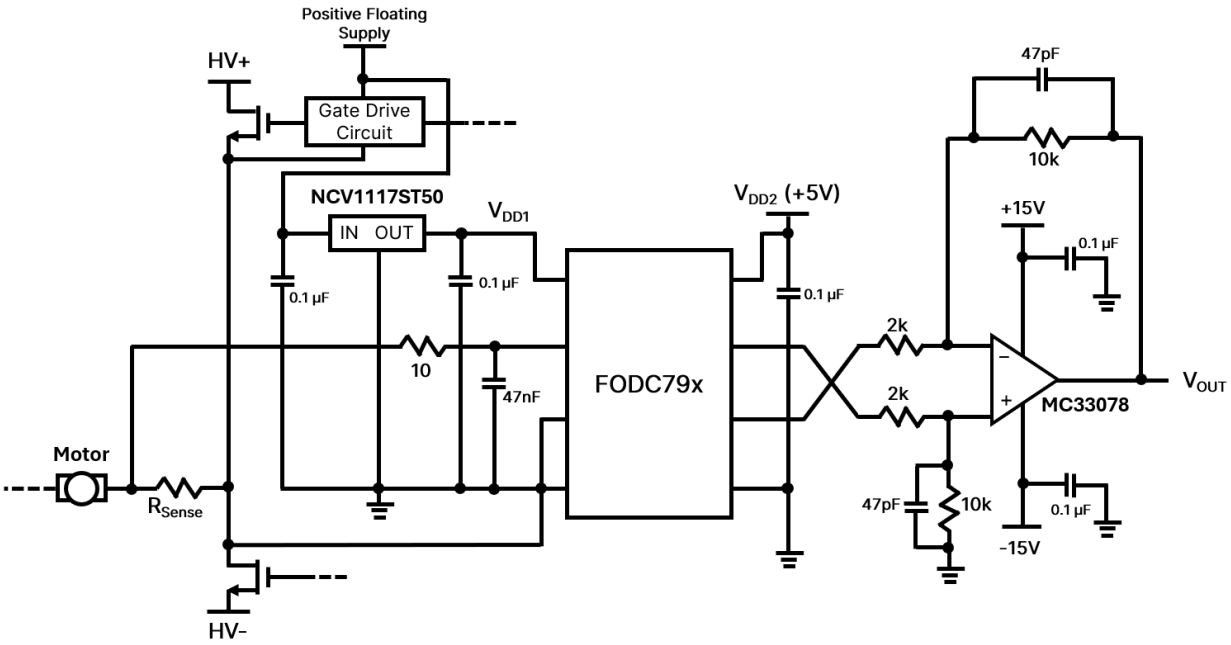


Figure 6. Application Schematic: Motor Drive

ORDERING INFORMATION

Part Number	CTR Gain Rank*	Isolation Rating (kV)	Comment	Package Type	Shipping†
FODC790R2	0	5	Pin 1 location at upper left of tape	LSOP8 (Pb-Free)	TBD
FODC790R2V	0	5	VDE approved option	LSOP8 (Pb-Free)	TBD
FODC79AR2	A	5	Pin 1 location at upper left of tape	LSOP8 (Pb-Free)	TBD
FODC79AR2V	A	5	VDE approved option	LSOP8 (Pb-Free)	TBD
FODC79BR2	B	5	Pin 1 location at upper left of tape	LSOP8 (Pb-Free)	TBD
FODC79BR2V	B	5	VDE approved option	LSOP8 (Pb-Free)	TBD

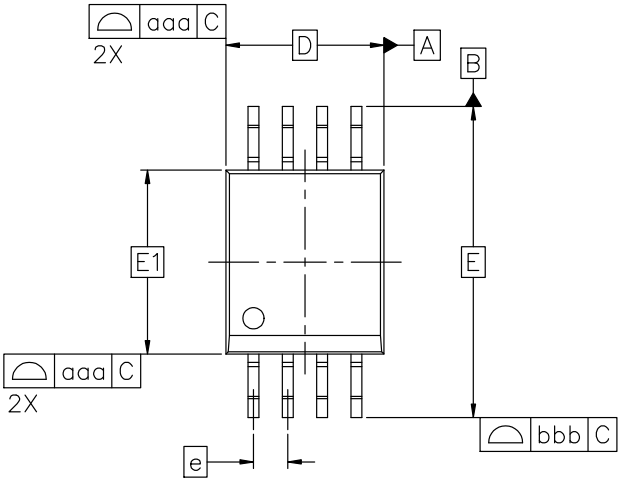
* Please refer to the DC ELECTRICAL CHARACTERISTICS table.
† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

REVISION HISTORY

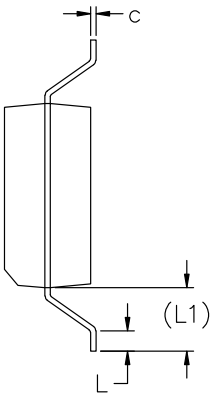
Revision	Description of Changes	Date
0	Initial datasheet release.	4/27/2026

PACKAGE DIMENSIONS

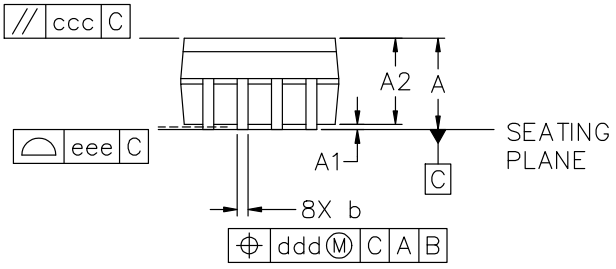
SOIC/LSOP-8 5.84x6.80x3.18, 1.27P
CASE 751FC
ISSUE O



TOP VIEW

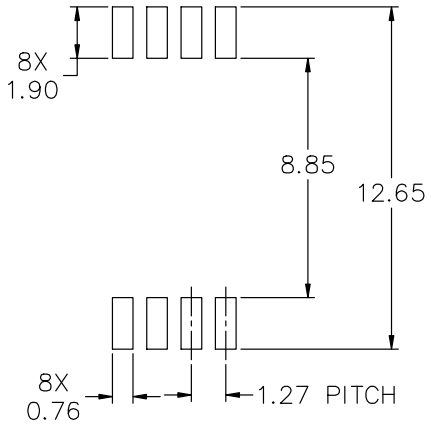


SIDE VIEW



END VIEW

MILLIMETERS			
DIM	MIN	NOM	MAX
A	3.18	3.38	3.58
A1	0.10	0.20	0.30
A2	3.08	3.18	3.28
b	0.30	0.40	0.50
c	0.20	0.25	0.30
D	5.84 BSC		
E	11.50 BSC		
E1	6.80 BSC		
e	1.27 BSC		
L	0.50	0.75	1.00
L1	2.35 REF		
POSITION FORM & TOLERANCE			
aaa	0.20		
bbb	0.25		
ccc	0.10		
ddd	0.25		
eee	0.10		



RECOMMENDED MOUNTING FOOTPRINT

*For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
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