

# FMK Series DC-DC Converters

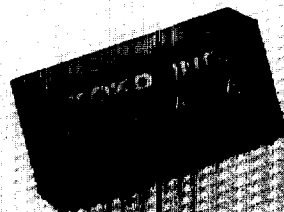
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## ■ OVERVIEW

TOKO's engineers designed these converter modules with primary emphasis on small size, lightweight and low cost. Conversion efficiencies of up to 75%. These non-floating type converters were developed for applications not requiring isolation between input and output circuits.

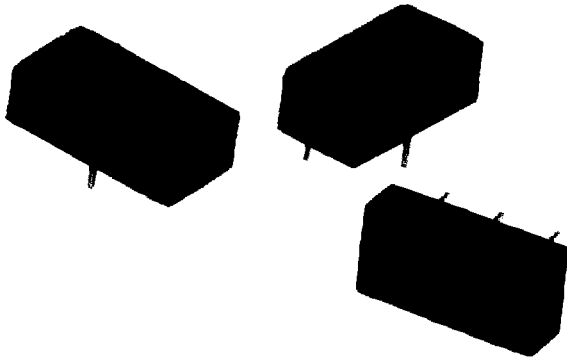
## ■ KEY APPLICATIONS

Measuring instruments, displays, printers, communications equipment, numerical control instruments, computers and other data equipment.



**TOKO DC-DC CONVERTERS**

# FMK Series DC-DC Converters (0.25, 0.5, 1.0W)



## ■ FEATURES

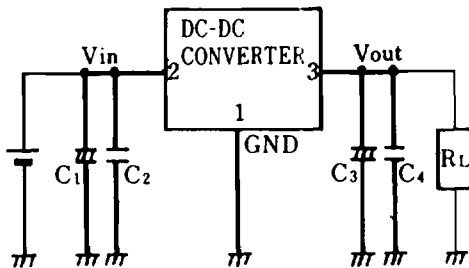
- High conversion efficiency
- Optimum load and line regulation
- Ripple and noise filters available
- Epoxy moulding for high reliability

## ■ GENERAL SPECIFICATIONS

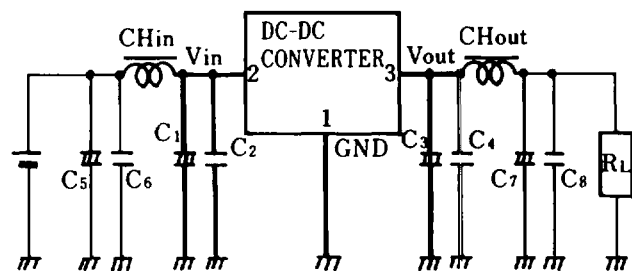
Operating Temperature Range:	- 10 ~ + 60°C
Storage Temperature Range:	- 25 ~ + 85°C
Operating Humidity:	10 ~ 85% R.H.
Storage Humidity:	10 ~ 90% R.H.

## ■ CONNECTIONS

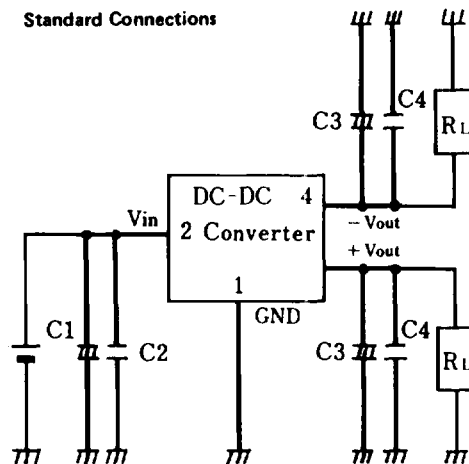
### 1-Channel Output Type Standard Connections



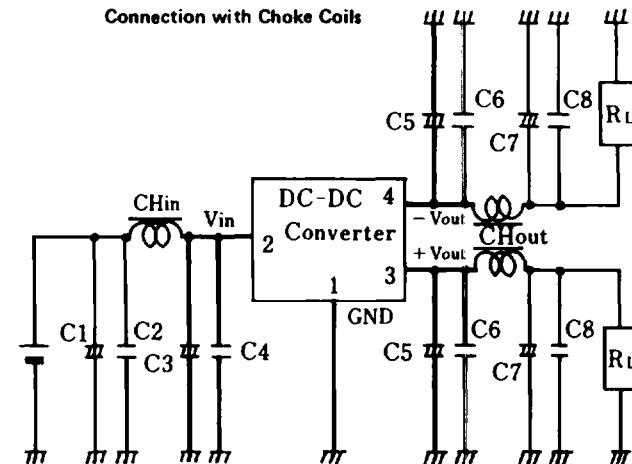
### Connections with Choke Coils



### 2-Channel Output Type Standard Connections



### Connection with Choke Coils



## NOTES

1. Short leads, less than 20mm, should be used to connect choke coils and capacitors at the input and output of the converter. Such leads are indicated with heavy lines in the figures.
2. Voltage rating and polarities of electrolytic capacitors, 33 $\mu$ F or 47 $\mu$ F, for C1, C3, C5, C7, should match circuit conditions.
3. Voltage rating of ceramic capacitor, 0.01 $\mu$ F, for C2, C4, C6, C8 should match the input or output voltages.
4. C choke coils, CH<sub>in</sub>, CH<sub>out</sub>: Select from those indicated in the LIST of STANDARD CHOKE COILS.

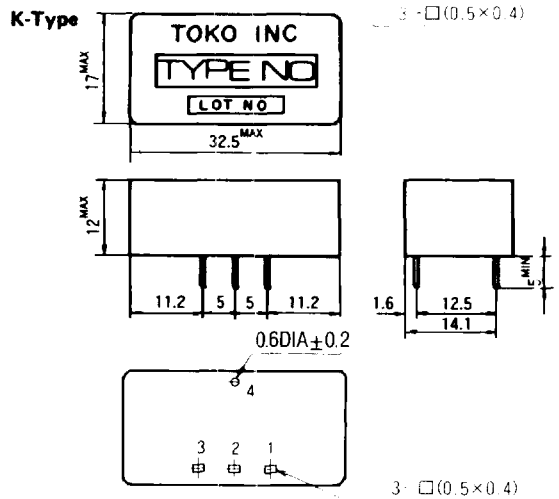
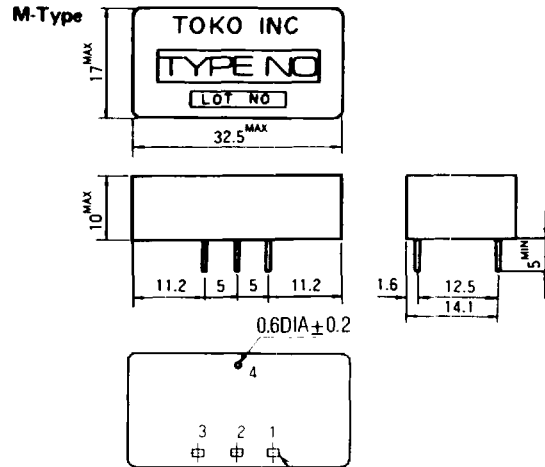
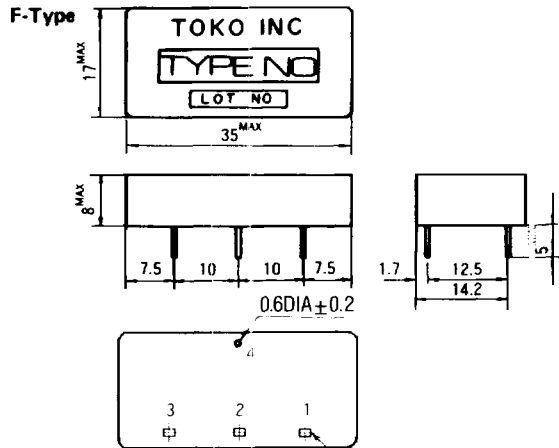
# FMK Series DC-DC Converters

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■ PHYSICAL DIMENSIONS AND PIN ASSIGNMENTS

1-Channel Output Type



Unit: mm  
General Tolerance of Dimensions  
±0.3

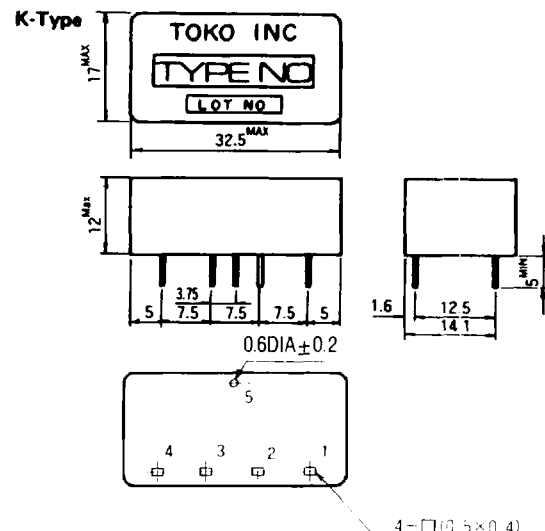
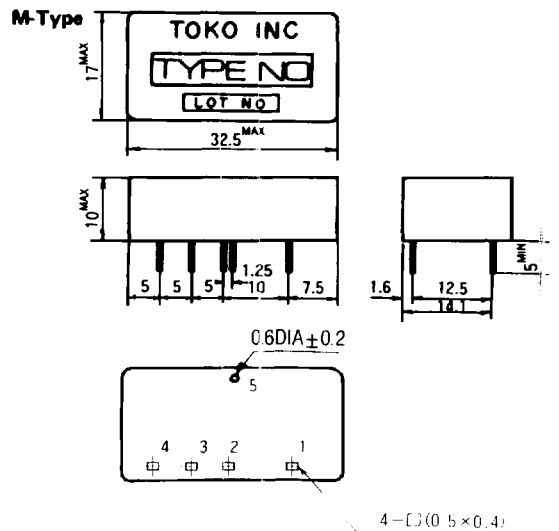
Pin Assignment for 1-Channel Output Type

- 1. GND
- 2.  $V_{in}$
- 3.  $V_{out}$
- 4. NC

Pin Assignment for 2-Channel Output Type

- 1. GND
- 2.  $V_{in}$
- 3.  $V_{out}$  (+ Output)
- 4.  $V_{out}$  (- Output)
- 5. NC

2-Channel Output Type



# FMK Series DC-DC Converters

## ■ 1-CHANNEL OUTPUT TYPE, WITH POSITIVE (+) OUTPUT SPECIFICATIONS

Input Voltage,  $V_{in}$ : +5V  $\pm$  10%

Type No.	PKG.	Output Voltage <sup>*1</sup>		Output Current $I_o$ (mA)	Rated Output Power $P_o$ (mW)	Conversion Efficiency <sup>*2</sup> $\eta$ (%)	Temp. Coeff. (%/°C)	Regulation (%) <sup>*3</sup>		Ripple (mV <sub>pp</sub> ) <sup>*4</sup>		Recommended Choke Coils	
		$V_{out}$ (V)	TOL (%)					Line	Load	Std.	w/Chokes	CH <sub>in</sub>	CH <sub>out</sub>
6P02F 1-A	F	+6	$\pm 4$	25~ 42	250	65	-0.1	$\pm 0.7$	1.2	200	50	CH-18	CH-17
6P05M 1-A	M			50~ 84	500	70	-0.1	$\pm 1.0$	1.6	300	60	CH-08	CH-08
6P10K 1	K			100~167	1000	70	-0.1	$\pm 1.7$	3.5	500	80	CH-05	CH-04
9P02F 1-A	F	+9		16~ 28	250	70	0.1	$\pm 0.4$	1.0	200	50	CH-18	CH-16
9P05M 1-A	M			33~ 56	500	75	0.1	$\pm 1.0$	1.2	300	60	CH-08	CH-07
9P10K 1	K			66~112	1000	75	0.1	$\pm 1.0$	1.6	500	70	CH-05	CH-03
12P02F 1-A	F	+12		12~ 21	250	70	0.1	$\pm 0.4$	0.9	200	40	CH-18	CH-16
12P05M 1-A	M			25~ 42	500	75	0.1	$\pm 0.8$	1.6	300	50	CH-08	CH-07
12P10K 1	K			50~ 84	1000	75	0.1	$\pm 0.8$	1.1	500	60	CH-05	CH-03
15P02F 1-A	F	+15		10~ 17	250	70	0.1	$\pm 0.4$	0.8	200	40	CH-18	CH-16
15P05M 1-A	M			20~ 34	500	75	0.1	$\pm 0.6$	1.5	300	50	CH-08	CH-07
15P10K 1	K			40~ 67	1000	75	0.1	$\pm 0.6$	1.0	500	60	CH-05	CH-03
20P02F 1-A	F	+20	7~ 13	250	75	0.1	$\pm 0.5$	0.7	200	40	CH-18	CH-16	
20P05M 1-A	M		15~ 25	500	75	0.1	$\pm 0.4$	0.8	300	50	CH-08	CH-07	
20P10K 1	K		30~ 50	1000	75	0.1	$\pm 0.5$	0.9	500	50	CH-05	CH-02	
24P02F 1-A	F	+24	6~ 11	250	75	0.1	$\pm 0.4$	0.6	200	40	CH-18	CH-16	
24P05M 1-A	M		12~ 21	500	75	0.1	$\pm 0.4$	0.7	400	50	CH-08	CH-07	
24P10K 1	K		25~ 42	1000	75	0.1	$\pm 0.5$	0.8	600	50	CH-05	CH-02	

## ■ 1-CHANNEL OUTPUT TYPE, WITH NEGATIVE (-) OUTPUT SPECIFICATIONS

Input Voltage,  $V_{in}$ : +5V  $\pm$  10%

Type No.	PKG.	Output Voltage <sup>*1</sup>		Output Current $I_o$ (mA)	Rated Output Power $P_o$ (mW)	Conversion Efficiency <sup>*2</sup> $\eta$ (%)	Temp. Coeff. (%/°C)	Regulation (%) <sup>*3</sup>		Ripple (mV <sub>pp</sub> ) <sup>*4</sup>		Recommended Choke Coils	
		$V_{out}$ (V)	TOL (%)					Line	Load	Std.	w/Chokes	CH <sub>in</sub>	CH <sub>out</sub>
5N02F 1-A	F	-5	$\pm 4$	30~ 50	250	60	0.15	$\pm 0.6$	2.5	200	50	CH-18	CH-17
5N05M 1	M			60~100	500	55	0.15	$\pm 0.7$	2.5	300	60	CH-09	CH-08
5N10K 1	K			120~200	1000	55	0.15	$\pm 1.0$	2.6	500	80	CH-05	CH-04
6N02F 1	F	-6		25~ 42	250	65	0.15	$\pm 0.4$	1.4	200	50	CH-18	CH-17
6N05M 1	M			50~ 84	500	60	0.15	$\pm 0.6$	2.0	300	60	CH-09	CH-08
6N10K 1	K			100~167	1000	60	0.15	$\pm 0.4$	1.4	500	80	CH-05	CH-04
9N02F 1	F	-9		16~ 28	250	70	0.15	$\pm 0.4$	1.0	200	50	CH-18	CH-16
9N05M 1	M			33~ 56	500	65	0.15	$\pm 0.4$	1.1	300	60	CH-09	CH-07
9N10K 1	K			66~112	1000	60	0.15	$\pm 0.6$	2.5	500	70	CH-05	CH-03
12N02F 1	F	-12		12~ 21	250	70	0.15	$\pm 0.4$	0.9	200	40	CH-18	CH-16
12N05M 1	M			25~ 42	500	70	0.15	$\pm 0.4$	1.0	300	50	CH-09	CH-07
12N10K 1	K			50~ 84	1000	65	0.15	$\pm 0.5$	2.0	500	60	CH-05	CH-03
15N02F 1	F	-15	10~ 17	250	70	0.15	$\pm 0.4$	0.8	200	40	CH-18	CH-16	
15N05M 1	M		20~ 34	500	70	0.15	$\pm 0.4$	0.9	350	50	CH-09	CH-07	
15N10K 1	K		40~ 67	1000	65	0.15	$\pm 0.5$	1.0	500	60	CH-05	CH-03	
20N02F 1	F	-20	7~ 13	250	70	0.15	$\pm 0.4$	0.7	200	40	CH-18	CH-16	
20N05M 1	M		15~ 25	500	70	0.15	$\pm 0.4$	0.8	350	50	CH-08	CH-07	
20N10K 1	K		30~ 50	1000	70	0.15	$\pm 0.4$	0.9	500	60	CH-05	CH-02	

# FMK Series DC-DC Converters

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## ■ 2-CHANNEL OUTPUT TYPE, WITH (+) AND (-) OUTPUT SPECIFICATIONS

Input Voltage,  $V_{in}$ :  $+5V \pm 10\%$

Typ No.	PKG.	Output Voltage <sup>*1</sup>		Output Current <sup>*5</sup> $I_o$ (mA)	Rated Output Power <sup>*6</sup> $P_o$ (mW)	Conversion Efficiency <sup>*2</sup> $\eta$ (%)	Temp. Coeff. (%/°C)	Regulation (%) <sup>*3</sup>		Ripple (mV <sub>pp</sub> ) <sup>*4</sup>		Recommended Choke Coils	
		$V_{out}$ (V)	TOL (%)					Line	Load	Std.	w/Chokes	CH <sub>in</sub>	CH <sub>out</sub>
6D02M1-A	M	±6	±5	±12~±21	250	65	-0.15	±1.8	3.5	200	50	CH-08	CH-07
6D05M1	M			±25~±42	500	60	-0.15	±1.0	4.0	300	60	CH-09	CH-07
6D10K1	K			±50~±84	1000	55	-0.15	±1.5	5.0	500	80	CH-05	CH-03
9D02M1	M	±9	±5	± 8~±14	250	65	0.15	±0.5	2.0	200	50	CH-08	CH-07
9D05M1	M			±16~±28	500	65	0.15	±0.7	3.0	300	60	CH-09	CH-07
9D10K1	K			±33~±56	1000	60	0.15	±1.0	3.5	500	70	CH-05	CH-02
12D02M1	M	±12	±5	± 6~±11	250	65	0.15	±0.4	2.0	200	40	CH-08	CH-07
12D05M1	M			±12~±21	500	70	0.15	±0.5	2.0	300	50	CH-09	CH-07
12D10K1-A	K			±25~±42	1000	60	0.15	±1.0	2.5	500	60	CH-05	CH-02
15D02M1	M	±15	±5	± 5~± 9	250	65	0.15	±0.4	2.0	200	40	CH-08	CH-07
15D05M1	M			±10~±17	500	70	0.15	±0.5	2.0	350	50	CH-09	CH-07
15D10K1	K			±20~±34	1000	60	0.15	±0.5	2.5	500	60	CH-05	CH-02
20D02M1	M	±20	±5	± 3~± 7	250	70	0.15	±0.4	2.5	200	40	CH-08	CH-07
20D05M1	M			± 7~±13	500	70	0.15	±0.5	2.0	350	50	CH-09	CH-07
20D10K1	K			±15~±25	1000	60	0.15	±0.5	2.5	500	60	CH-05	CH-02

### NOTES

All data in the tables were measured under the following conditions

\*1. Output Voltage:  $V_{in} = +5V$ ;  $I_o = I_o$  max. X0.8

\*2. Conversion Efficiency:  $V_{in} = +5V$ ;  $I_o = I_o$  max. X0.8

\*3. Regulation:  $V_{in}$  at min ~ max.  $I_o$  at min - max.

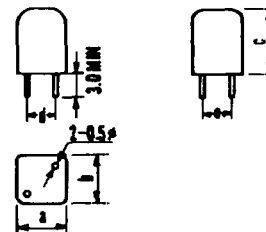
\*4. Ripple: Standard = w/standard connections, w/choke = with choke option connections.

\*5. Output Current: When using the 2-Channel type with unbalance in + and - output currents, the total current must be within the min. to max. rating.

\*6. Rated Output Power: The total output is indicator.

## ■ STANDARD CHOKE COILS

Typ.No.	PKG.	Inductance, L (μH) ±30%	DC Resistance, R (Ω) ±20%	Max. Current, I <sub>max</sub> (mA)	Typ.No.	PKG.	Inductance, L (μH) ±30%	DC Resistance, R (Ω) ±20%	Max. Current, I <sub>max</sub> (mA)
CH-01	12H	2350	4.88	30	CH-11	11H	640	2.17	30
CH-02	12H	590	1.19	60	CH-12	11H	193	0.61	60
CH-03	12H	150	0.28	140	CH-13	11H	50	0.15	140
CH-04	12H	37	0.08	250	CH-14	11H	16	0.05	280
CH-05	12H	16	0.04	450	CH-15	11H	6.1	0.02	500
CH-06	11H	990	3.09	30	CH-16	08H	150	1.11	30
CH-07	11H	340	0.88	60	CH-17	08H	53	0.33	60
CH-08	11H	80	0.20	140	CH-18	08H	12	0.07	160
CH-09	11H	21	0.06	280	CH-19	08H	3.8	0.03	300
CH-10	11H	10	0.03	500	CH-20	08H	1.3	0.01	600



Dimension

Unit : mm

Typ.No.	a <sub>Max</sub>	b <sub>Max</sub>	c <sub>Max</sub>	d	e
12H	8.5	8.5	12.0	4.5	4.5
11H	8.0	8.0	11.0	4.5	4.5
08H	6.0	6.0	8.0	3.5	3.5

Precautions in Use of DC-DC Converter:

- Conditions under which the specified performance of the converters may not be obtained and further cause possible damage are as follows:
  - Short-circuiting the output terminals, or excessive overloading for 30 seconds or longer.
  - Operating at over 1.5 times the rated output current for 10 minutes or longer.
  - Application of over-voltage, approximately X2, at the input side for 10 minutes or longer.
  - Others, such as use at abnormal conditions, i.e., with incorrect terminal connections other than as indicated, etc.
- When using the converter under conditions not within the specifications or range of application, or when there are questions, please contact a Toko engineer.
- For the 2-channel output type, when there is an unbalance in the + and - output currents, the total output must be within the min. to max. current rating.