

15 W DC-DC Converters

IMX 15-Family IMY 15-Family

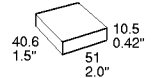
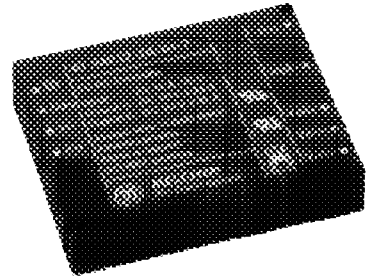
Input to output electric strength test up to 4 kV DC
Input voltage: 8.4...36, 16.8...75, 50...150 V DC
Single, dual and double outputs
Configurable output voltages from 3.3 to 48 V DC

- Extremely wide input voltage ranges
- Electrical isolation, also between outputs
- Emissions below EN 55022, level B
- Immunity to IEC/EN 61000-4-2,-3,-4,-5 and -6
- High efficiency (typ. 84%)
- Input undervoltage lock-out
- Shut down input, output voltages adjustable
- Flex power: Flexible load distribution on outputs
- Outputs no-load, overload and short-circuit proof
- Operating ambient temperature up to -40...85°C
- Thermal protection
- 2" x 1.6" case with 10.5 mm profile
- Supplementary insulation: 20/40 IMX 15 types
- Double or reinforced insulation: 110 IMY 15 types

Safety according to IEC/EN 60950, UL 1950



Approvals pending



¹ For 110 IMY 15 types

Summary

The IMX/IMY15 series of board mountable 15 W DC-DC converters has been designed according to the latest industry requirements and standards. The converters are particularly suitable for use in mobile or stationary applications in transport, railways, industry, or telecommunication applications where variable input voltages or high transient voltages are prevalent.

Covering a total input voltage range from 8.4 up to 150 V with 3 different types, the units are available with single, dual and electrically isolated double outputs from 3.3 up to 48 V externally adjustable, with flexible load distribution on dual and double output units. A shut down input allows remote converter on-off. Features include consistently high efficiency over the entire input voltage range, high reliability and excellent dynamic response to load and line changes.

The converters are designed and built according to the international safety standards IEC/EN 60950, UL 1950, CAN/CSA C22.2 No.950-95. LGA, UL and cUL approvals are in progress.

The 20/40 IMX 15 types provide supplementary insulation. Connected to a secondary circuit the 40 IMX 15 types provide SELV outputs even if the bus voltage at the converter

input exceeds the SELV-limit of 60 V DC. The 110 IMY 15 types provide double insulation and are CE marked. They may be connected to e.g. a rectified 110 V AC source without any further isolation barrier.

The circuit comprises integrated planar magnetics and all components are automatically assembled and solidly soldered onto a single PCB without any wire connection. Magnetic feedback ensures maximum reliability and repeatability in the control loop over all operating conditions. Careful considerations of possible thermal stresses ensure the absence of hot spots providing long life in environments where temperature cycles are a reality. The thermal design allows operation at full load up to an ambient temperature of 71°C in free air without using any potting material. For extremely high vibration environments the case has holes for screw mounting.

Various options as e.g. extended temperature range -40...85°C or an alternative pinout provide a high level of application specific engineering and design-in flexibility.

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Primary

Output 1		Output 2		Output power	Input voltage	Efficiency	Type designation	Options ²
$U_{o \text{ nom}}$ [V DC]	$I_{o \text{ nom}}^1$ [A]	$U_{o \text{ nom}}$ [V DC]	$I_{o \text{ nom}}^1$ [A]	$P_{o \text{ nom}}$ [W]	$U_{i \text{ min}} \dots U_{i \text{ max}}$ [V DC]	η_{typ} [%]		
5.1	2.3	-	-	11.7	8.4...36	81	20 IMX 15-05-7R	-8, i
5.1	2.5	-	-	12.8	16.8...75 ³	82	40 IMX 15-05-7R	-8, i
5.1	2.5	-	-	12.8	50...150 ⁴	82	110 IMY 15-05-7R	-8, i
5.1	1.35	3.3	1.35	11.3	8.4...36	79	20 IMX 15-0503-7R	-8, i
5.1	1.5	3.3	1.5	12.6	16.8...75 ³	80	40 IMX 15-0503-7R	-8, i
5.1	1.5	3.3	1.5	12.6	50...150 ⁴	80	110 IMY 15-0503-7R	-8, i
5	1.3	5	1.3	13	8.4...36	81	20 IMX 15-05-05-7	-8, R, K, i
5	1.4	5	1.4	14	16.8...75 ³	82	40 IMX 15-05-05-7	-8, R, K, i
5	1.4	5	1.4	14	50...150 ⁴	82	110 IMY 15-05-05-7	-8, R, i
12	0.65	12	0.65	15.6	8.4...36	83	20 IMX 15-12-12-7	-8, R, K, i
12	0.7	12	0.7	16.8	16.8...75 ³	84	40 IMX 15-12-12-7	-8, R, K, i
12	0.7	12	0.7	16.8	50...150 ⁴	84	110 IMY 15-12-12-7	-8, R, i
15	0.5	15	0.5	15	8.4...36	84	20 IMX 15-15-15-7	-8, R, K, i
15	0.56	15	0.56	16.8	16.8...75 ³	85	40 IMX 15-15-15-7	-8, R, K, i
15	0.56	15	0.56	16.8	50...150 ⁴	85	110 IMY 15-15-15-7	-8, R, i
24	0.32	24	0.32	15.4	8.4...36	84	20 IMX 15-24-24-7	-8, R, K, i
24	0.35	24	0.35	16.8	16.8...75 ³	85	40 IMX 15-24-24-7	-8, R, K, i
24	0.35	24	0.35	16.8	50...150 ⁴	85	110 IMY 15-24-24-7	-8, R, i

⁴ Short-time operation down to $U_{i, \min} \geq 43.2$ V possible. P_0 reduced to approx. 85% of rated output power.

Type Key

Input voltage range U_i		
8.4...36 V DC	20	
16.8...75 V DC	40	
50...150 V DC	110	
Family	IMX 15, IMY 15	
Output voltage type output 1	05, 12, 15, 24	
Dash designates double output unit with two independent electrically isolated outputs	- 1	
Output voltage type output 2	03, 05, 12, 15, 24	
Operating ambient temperature range T_A		
-25...71 °C	-7	
-40...85 °C (option)	-8 2	
Options:		
R input and magnetic feedback	R 23	
Alternative pinout	K 24	
Inhibit	I 25	

⁵ Option inhibit excludes shut down and option K.

Examples: 20 IMX 15-05-05-7: DC-DC converter, input voltage range 8.4...36 V, 2 electrically isolated outputs each providing 5 V, 2.3 A.
110 IMY 15-0503-7R: DC-DC converter, input voltage range 50...150 V, 2 outputs with common return providing +5.1 V, 1.5 A and +3.3 V, 1.5 A. Unit fitted with magnetic feedback for tight output voltage regulation.

Product Marking

Main face: Basic type designation, output voltages and currents, applicable safety approval and recognition marks, Melcher patent nos. and company logo.

Side label: Date code and serial no.

Mechanical Data

Dimensions in mm. Tolerances ± 0.3 mm unless otherwise indicated.

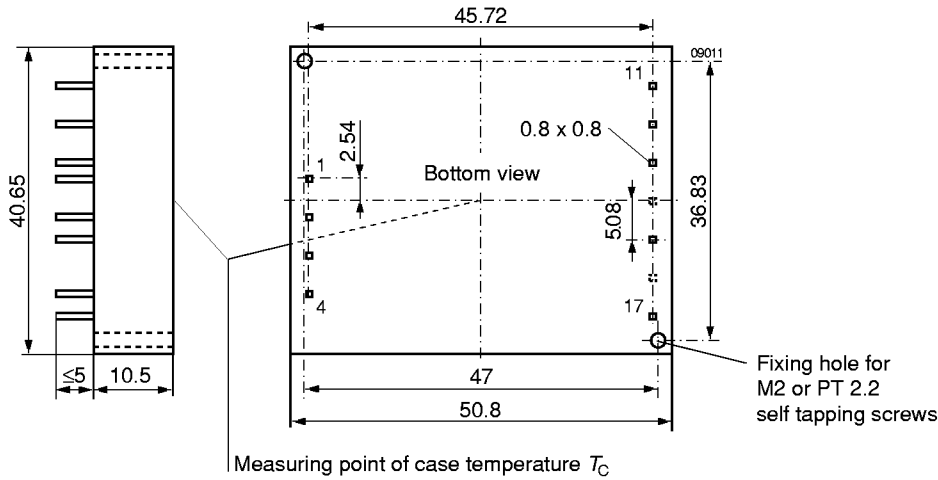


Fig. 1
Case IMX 12, IMY 12
Weight: <35 g

Safety and Installation Instructions

Installation Instructions

Installation of the DC-DC converters must strictly follow the national safety regulations in compliance with the enclosure, mounting, creepage, clearance, casualty, markings and segregation requirements of the end-use application.

Connection to the system shall be made via a printed circuit board with hole diameters of 1.4 mm \pm 0.1 mm for the pins.

The units should be connected to a secondary circuit.

Check for hazardous voltages before altering any connections.

Do not open the module.

Ensure that a unit failure (e.g. by an internal short-circuit) does not result in a hazardous condition. See also *Safety of operator accessible output circuit*.

Input Fuse

To prevent excessive current flowing through the input supply line in case of a short-circuit across the converter input an external fuse should be installed in a non earthed input supply line. We recommend a fast acting fuse F4.0A for 20 IMX 15 types, F2.0 A for 40 IMX 15 types and a fuse F1.0A for 110 IMY 15 types.

Standards and approvals

All DC-DC converters are pending to be UL recognized according to UL 1950, UL recognized for Canada to CAN/CSA C22.2 No. 950-95 and LGA approved to IEC/EN 60950 standards.

The units have been evaluated for:

- Building in
- Supplementary insulation input to output, based on their maximum input voltage (IMX 15 types)
- Reinforced insulation input to output, based on their maximum input voltage (IMY 15 types)
- The use in a pollution degree 2 environment
- Connecting the input to a secondary circuit which is subject to a maximum transient rating of 1500 V (IMX 15 types)
- Connecting the input to a primary circuit which is subject to a maximum transient rating of 2500 V (IMY 15 types)

After approvals the DC-DC converters are subject to manufacturing surveillance in accordance with the above mentioned UL, CSA, EN and with ISO 9001 standards.

Table 2: Pin allocation

Pin No.	Single output	-0503- output	Double output	Dual output option K
1	Vi+	Vi+	Vi+	Vi+
2	Vi-	Vi-	Vi-	Vi-
3	-	n.c.	Trim	-
4	$\overline{\text{SD}}$	$\overline{\text{SD}}$	$\overline{\text{SD}}$	$\overline{\text{SD}}$
11	-	Vo2+	Vo1+	Vo+
12	-	Go	Vo1-	-
13	Vo+	Vo1+	Vo2+	Go
15	Vo-	Go	Vo2-	Vo-
17	R	R	n.c./R	n.c.

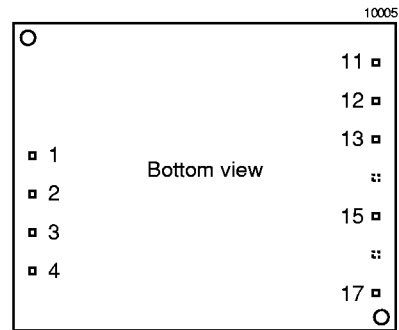


Fig. 2
Pin allocation

Protection Degree

The protection degree of the DC-DC converters is IP 40.

Cleaning Agents

In order to avoid possible damage, any penetration of cleaning fluids should be prevented, since the power supplies are not hermetically sealed.

Isolation

The electric strength test is performed as factory test in accordance with IEC/EN 60950 and UL 1950 and should not be repeated in the field. Melcher will not honour any guarantee claims resulting from electric strength field tests.

Table 3: Electric strength test voltages

Characteristic	Input to output		Output to output	Unit
	IMX 15	IMY 15		
Electric strength test voltage 1 s	1.2	3.0	0.1	kV _{rms}
	1.5	4.0	0.15	kV DC
Insulation resistance at 500 V DC	>100	>100	-	M Ω
Partial discharge extinction voltage	Consult factory		-	kV

Safety of operator accessible output circuit

If the output circuit of a DC-DC converter is operator accessible, it shall be an SELV circuit according to the IEC/EN 60950 related safety standards

The following table shows some possible installation configurations, compliance with which causes the output circuit of the DC-DC converter to be an SELV circuit according to

IEC/EN 60950 up to a configured output voltage (sum of nominal voltages if in series or +/– configuration) of 42 V.

However, it is the sole responsibility of the installer to ensure the compliance with the relevant and applicable safety regulations. More information is given in *Technical Information: Safety*.

Table 4: Insulation concept leading to an SELV output circuit

Conditions	Front end			DC-DC converter		Result
Supply voltage	Minimum required grade of isolation, to be provided by the AC-DC front end, including mains supplied battery charger	Maximum DC output voltage from the front end ¹	Minimum required safety status of the front end output circuit	Type	Measures to achieve the specified safety status of the output circuit	Safety status of the DC-DC converter output circuit
Mains ≤150 V AC	Operational (i.e. there is no need for electrical isolation between the mains supply voltage and the DC-DC converter input voltage)	≤150 V	Primary	IMY 15	Double or reinforced insulation, based on 150 V AC and DC (provided by the DC-DC converter)	SELV circuit
Mains ≤250 V AC	Basic	≤60 V	Earthed SELV circuit ²	IMX 15 IMY 15	Operational insulation (provided by the DC-DC converter)	Earthed SELV circuit
		≤75 V	Hazardous voltage secondary circuit	IMX 15	Input fuse ³ output suppressor diodes ⁴ , and earthed output circuit ²	
		≤150 V		IMY 15	Supplementary insulation based on 250 V AC and double or reinforced insulation, based on the maximum rated output voltage from the front end (provided by the DC-DC converter)	SELV circuit
	Double or reinforced	≤60 V	SELV circuit	IMX 15 IMY 15	Operational insulation (provided by the DC-DC converter)	SELV circuit
		≤75 V	Double or reinforced insulated unearthed hazardous voltage secondary circuit ⁵	IMX 15	Supplementary insulation based on the maximum rated output voltage from the front end (provided by the DC-DC converter)	
		≤120 V	TNV-2 circuit	IMY 15	Double or reinforced insulation, based on the maximum rated output voltage from the front end (provided by the DC-DC converter)	
		≤150 V	Double or reinforced insulated earthed or unearthed hazardous voltage secondary circuit			

¹ The front end output voltage should match the specified input voltage range of the DC-DC converter.

² The earth connection has to be provided by the installer according to the relevant safety standard, e.g. IEC/EN 60950.

³ The installer shall provide an approved fuse (type with the lowest rating suitable for the application) in a non-earthed input conductor directly at the input of the DC-DC converter (see fig. *Schematic safety concept*). For UL's purpose, the fuse needs to be UL-listed. See also *Input Fuse*.

⁴ Each suppressor diode should be dimensioned in such a way, that in the case of an insulation fault the diode is able to limit the output voltage to SELV (<60 V) until the input fuse blows (see fig. *Schematic safety concept*).

⁵ Has to be insulated from earth by at least basic insulation according to the relevant safety standard, based on the maximum output voltage from the front end.

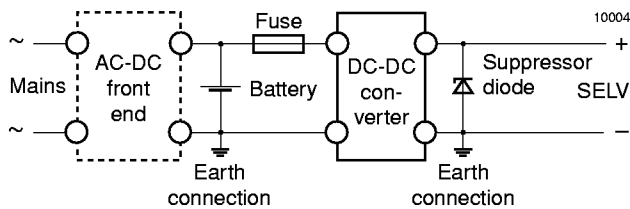


Fig. 3

Schematic safety concept. Use fuse, suppressor diode and earth connection as per table Safety concept leading to an SELV output circuit.

Description of Option

Option -8

Extended temperature range from standard $-25...71^{\circ}\text{C}$ to $-40...85^{\circ}\text{C}$. Output power reduced to approx. 85% of $P_{o\text{ nom}}$ according to table: *Type survey*.

Option R

R specifies magnetic feedback from the output for closer regulation of the output voltages of double output units. (Standard feature for single output units and -0503- types.) It enables the adjustment of the output voltages via the R-input on the secondary side by an external resistor or an external voltage source in the range of approximative 80...105% of $U_{o\text{ nom}}$. Option R excludes the Trim input (see also table: *Pin allocation*), option K as well as the possibility to operate several converters with the outputs connected in parallel.

Option K

Option K configures the electrically isolated double outputs to the alternative pinout with outputs connected in series ($V_{o+}/G_o/V_{o-}$) and common ground.

However instead of using units with option K, it is recommended to use the standard double output units by providing the printed circuit board with an additional pin hole (for pin 12 of double output units) connected to pin hole 13. This will provide more design-in flexibility since by that both pinouts may be used on the same PCB.

Option I Inhibit

Excludes shut down and option K.

The output(s) of the converter may be enabled or disabled by means of a logic signal (TTL, CMOS, etc.) applied to the inhibit pin. No output voltage overshoot will occur when the unit is turned on. If the inhibit function is not required the inhibit pin should be connected to V_{i-} to enable the output (active low logic, fail safe).

Converter operating:	$-10\text{ V}...0.8\text{ V}$
Converter inhibited or inhibit pin left open:	$2.4\text{ V}...U_{i\text{ max}}$

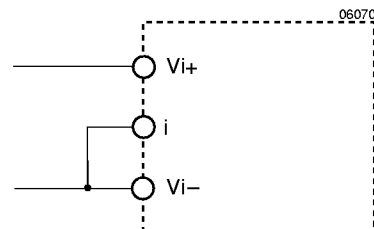


Fig. 4

If the inhibit is not used the inhibit pin should be connected to V_{i-}