DC/DC Converters

TEN 60 Series, 60 Watt

Features

- Highest Power Density: 60W in a 51x51x10mm (2"x2"x0.4") Package
- Wide 2:1 Input Voltage Range
- Very high Efficiency up to 90%
- No Minimum Load required
- Over Temperature Protection
- Under Voltage Lockout
- Remote On/Off
- Shielded metal Case with insulated Baseplate
- Optional Heatsink
- Lead free Design - RoHS compliant
- 3 Years Product Warranty

The TEN 60 series is a family of high performance 60W dc-dc converter modules with wide 2:1 input voltage ranges in a compact low profile case with industry-standard footprint. A very high efficiency allows an operating temperature range of –40°C to 85°C. Built-in filters for both input and output minimizes the need for external filtering. Further standard features include remote On/Off, output voltage trimming, over voltage protection, under voltage lockout and short circuit protection.
Typical applications for these products are battery operated equipment and distributed power architectures in communication and industrial electronics, everywhere where isolated, tightly regulated voltages are required and space is limited on the PCB.

Models

Order code	Input voltage range	Output voltage	Output current max.	Efficiency typ.
TEN 60-2410	18 – 36 VDC	3.3 VDC	14.0 A	89 %
TEN 60-2411		5.0 VDC	12.0 A	89 %
TEN 60-2412		12 VDC	5.0 A	90 %
TEN 60-2413		15 VDC	4.0 A	90 %
TEN 60-4810	36 – 75 VDC	3.3 VDC	14.0 A	89 %
TEN 60-4811		5.0 VDC	12.0 A	90 %
TEN 60-4812		12 VDC	5.0 A	90 %
TEN 60-4813		15 VDC	4.0 A	90 %

Input Specifications

Input current at no load	24 V models: 48 V models:	120 mA typ. 100 mA typ.
Input current at full load (nominal input 24/48 Vin)	3.3 V output models: 5.0V models: 12V & 15 V output models:	2250 /1150 mA typ. 2850 /1450 mA typ. 2900 /1450 mA typ.
Input voltage variation (dv/dt)		5 V/ms, max. (complies with ETS300 132 part 4.4)
Start-up voltage / under voltage lockout	24 Vin models: 48 Vin models:	17 VDC / 15 VDC typ. 34 VDC / 32 VDC typ.
Surge voltage (100 msec. max.)	24 Vin models: 48 Vin models:	50 V 100 V
Conducted noise (input)		EN 55022 level A, FCC part 15, level A with external capacitor (see note 1)
ESD (input)		EN 61000-4-2, perf. criteria B
Fast transient (input)		EN 61000-4-4, perf. criteria B
Surge (input)		EN 61000-4-5, perf. criteria B

Output Specifications

Voltage set accuracy		± 1%
Output voltage adjustment		± 10%
Regulation	– Input variation Vin min. to Vin max. – Load variation 0 – 100 %	0.2% max. 0.5% max.
Temperature coefficient		± 0.02%/K max.
Ripple and noise (20 MHz Bandwidth)	3.3 V & 5 V outputs: 12 V & 15 V outputs:	75 mVpk-pk max. 100 mVpk-pk max.
Start up time (nominal Vin and constant resistive load)		20 ms typ.
Transient response time (25% load change)		250 µs typ.
Short circuit protection		indefinite (automatic recovery)
Over load protection		150% of Iout max typ.
Thermal shutdown		@ 110°C typ
Over voltage protection	3.3 V output: 5 V output: 12 V output: 15 V output:	3.7 V 5.6 V 13.5 V 16.8 V
Capacitive load output models		tba

General Specifications

Temperature ranges	– Operating – Case temperature – Storage	– 40 °C ... + 85 °C + 105 °C max. – 55 °C ... + 125 °C
Derating		see graph on page 3
Humidity (non condensing)		95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217 F)		> 110'000 h @ + 25 °C

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

General Specifications

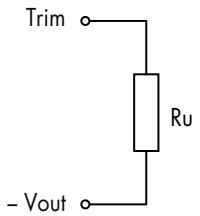
Isolation (Input/Output)	– Voltage – Capacity – Resistance	1'500 VDC 1500 pF max. > 1'000 M Ohm
Remote On/Off	– On: – Off: – Off idle current:	3.0 ... 12 VDC or open circuit. 0 ... 1.2 VDC or short circuit pin 3 and pin 2 3.0 mA max.
Switching frequency (fixed)		300 kHz typ. (Pulse width modulation PWM)
Vibration		10-55Hz, 10G, 30 minutes along X,Y,Z
Safety standards		UL 60950-1, EN 60950-1, IEC 60950-1
Safety approvals		UL /cUL pending

Note 1:

In order to meet conducted emissions EN55022-A a capacitor between +Vin and -Vin has to be installed. The capacitor should be capable to handle 1A ripple current. A suggestion is a 100µF/50V aluminium electrolytic capacitor (low ESR) for the 24VDC input models a 82µF/100V aluminium electrolytic capacitor (low ESR) for the 48VDC input models.

Output Voltage Adjustment

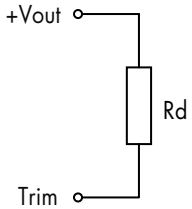
Trim up



Ru [kohm]*

output	3.3V	5V	12V	15V
+5%	tba	tba	tba	tba
+10%	tba	tba	tba	tba

Trim down

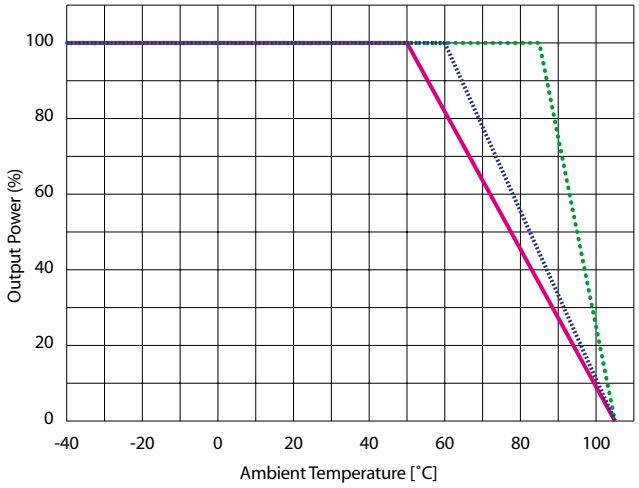


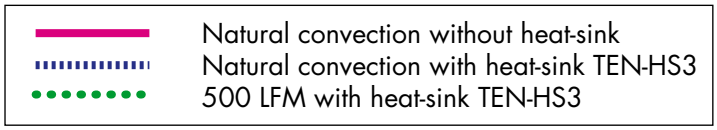
Ru [kohm]*

output	3.3V	5V	12V	15V
–5%	tba	tba	tba	tba
–10%	tba	tba	tba	tba

*approximate values

Power Derating



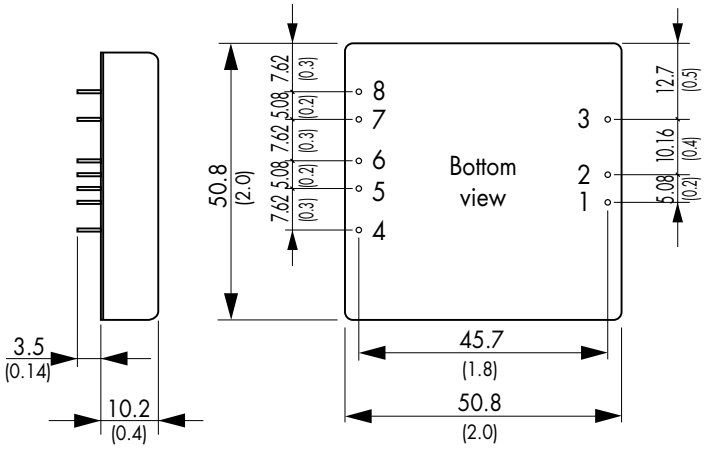


All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

Physical Specifications

Case material	copper, nickel plated
Baseplate material	none conductive FR4
Potting material	epoxy (UL 94V-0 -rated)
Weight	60 g (2.1 oz)
Soldering temperature	max. 265 °C / 10 sec.

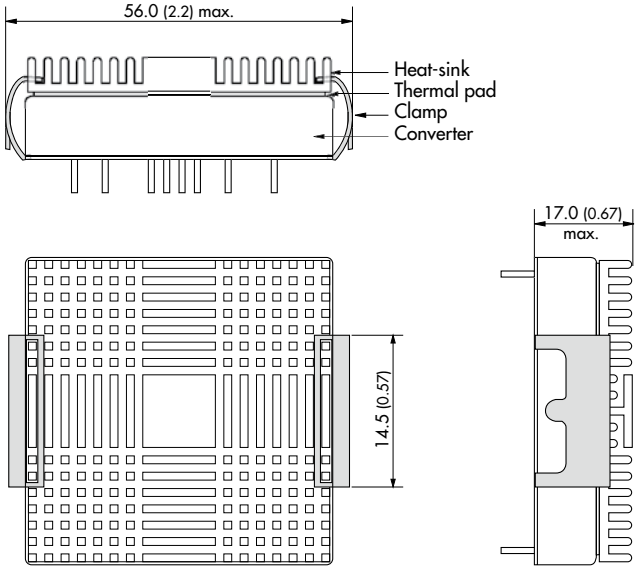
Outline Dimensions



Pin-Out	
Pin	
1	+Vin (Vcc)
2	–Vin (GND)
3	Remote On/Off
4	–Sense
5	+Sense
6	+Vout
7	–Vout
8	Trim

Dimensions in [mm], () = Inch
Pin diameter: 1.0 ±0.05 (0.02 ±0.002)
Pin pitch tolerances: ±0.35 (±0.014)
Case tolerances: ±0.5 (±0.02)

Heat-sink TEN-HS3



Order code: **TEN-HS3**
(cont.: heat-sink, thermal pad, 2 clamps)
Material: Aluminum
Finish: Anodic treatment (black)
Weight: 22g (0.78oz) (without converter)

Note:
The product label on converter has to be removed before mounting the heat-sink.
For volume orders converters will be supplied with heat-sinks already mounted. Please contact factory for quotation.
Separate heat-sinks are only available for prototypes and small quantity orders.

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