GAPTEC®
GREEN TECHNOLOGY

60DAW4_1.6 Series

60W - Single/Dual Output - Wide Input - Isolated & Regulated
DIP DC-DC Converter

DC-DC Converter 60 Watt

- **High efficiency up to 93%**
- **4:1 wide input voltage range**
- **Isolation voltage 1600VDC**
- **Six-sided metal shield**
- **Short circuit protection (SCP) (automatic recovery)**
- **Operating temperature: -40°C to +85°C**
- **Over temperature protection**
- **Industry standard pinout**
- **Under voltage lockout**

The 60DAW4_1.6 series offers 60W of output, wide input voltage of 9-36VDC, 18-75VDC and features 1600VDC isolation, six-sided metal shield over current and short circuit protection.

All models are particularly suited to industry control systems, semiconductor equipment, wireless network, telecom/datacom, measurement etc.

Common specifications

Cooling:	Nature convection
Short circuit protection:	Continuous, auto-recovery
Operation temperature range:	-40°C~+100°C
Storage temperature range:	-55°C~+125°C
Case temperature:	110°C
Lead temperature range:	260°C MAX, 1.5mm from case for 10 sec
Thermal impedance: (Mounting at FR4 (5.9*2.75inch) PCB)	without heatsink: 9.5°C/W, min. with heatsink: 8.5°C/W, min.
Switching frequency:	225kHz TYP
Humidity:	non-condensing, 5%-95% MAX
Case material:	Copper
Potting material:	Epoxy (UL94V-0 rated)
Design meets safety:	IEC60950-1/EN60950-1
MTBF (MIL-HDBK-217F @25°C):	>210,000 hours
Weight:	45g

Input specifications

Item	Test condition	Min	Typ	Max	Units
Under voltage lockout Module ON/OFF	• 24Vin • 48Vin		8.6/7.9 17.8/16		VDC VDC
Start-Up time[1)]			60		mS
Filter	Pi type				
Input reflected ripple current[2)]	Nominal Vin and full load		20		mAp-p
Remote ON/OFF[3)]	• ON • OFF • Off idle current	3.0 ... 12VDC or open circuit 0 ... 1.2VDC or Short circuit pins 2, 3 5			mA

1) Nominal Vin and constant resistive load
2) Measured with a simulated source inductance of 1µH
3) The ON/OFF control pin is referenced to -Vin (pin2).

Output specifications

Item	Test condition	Min	Typ	Max	Units
Voltage accuracy				±1	%
External trim adj. range	of output			±10	%
Over load protection	Input voltage range		150		%Io
Line regulation				±0.5	%
Load regulation (0%-100%)	• Single • Dual			±0.5 ±1	% %
Cross regulation	Dual, 25%-100% load			±5	%
Ripple and noise	20MHz Bandwidth, 1.0µF ceramic capacitor			100	mVpk-pk
Over voltage protection (Zener diode clamp)	• 5VDC • 12VDC • 15VDC		6.2 15 20		V V V
Over load protection	of Iout		120~140		%
Temperature coefficient			±0.02		%/°C
Transient recovery time	25% load step change		250		µs
Transient response deviation	25% load step change			±3	%

Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage	for 10 seconds		1600		VDC
Isolation resistance	Test at 500VDC	1000			MΩ
Isolation capacitance			2200		pF

Model selection:
WCTV_xxyyN##
W= Watt; **C=**Case; **T=** Type; **V=** Voltage Variation (omitted ± 10%);
xx= Vin; **yy=** Vout; **N=** Numbers of Output; **##=** Isolation (kVDC)

Example:
60DAW4_2415S1.6
60= 60Watt; D= DIP; A= series; W4= wide input (4:1) 9-36Vin; 15Vout; S= single output; 1.6= 1600VDC

Note:
1. Input voltage can't exceed this value, or will cause the permanent damage.
2. The load shouldn't be less than 5%, otherwise ripple will increase dramatically.
3. Max. Capacitive Load is tested on Vin-nominal and full load.
4. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
5. In this datasheet, all the test methods of indications are based on corporate standards.
6. Only typical models listed, other models may be different, please contact our technical person for more details.
7. Specifications subject to change without notice.

EMC specifications				
Radiated emissions*	EN55032 Class A			
Conducted emissions*	EN55032 Class A			
ESD	IEC/EN61000-4-2	Air	±8KV	perf. Criteria A
RS	IEC/EN61000-4-3	10V/m	perf. Criteria A	
EFT	IEC/EN61000-4-4	±2KV	perf. Criteria B	
Surge	IEC/EN61000-4-5	±1KV	perf. Criteria B	
CS	IEC/EN61000-4-6	10 Vr.m.s	perf. Criteria A	
PFMF	IEC/EN61000-4-8	10 Vr.m.s	perf. Criteria A	

* The 60DAW4_1.6 series can meet EN55032 Class A with an external filter in parallel with the input pins.
** An external filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.

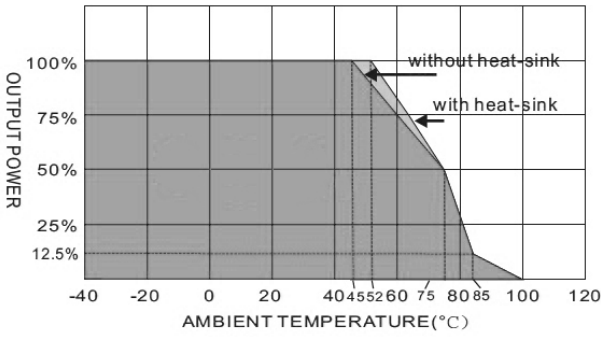
Part Number	Input Voltage Range [VDC]	Input current [mA, typ] no load	full load	Output Voltage [VDC]	Output Current [mA]	Output Ripple & Noise [mVp-p, max.]	Efficiency [%, Typ.]	Capacitive load* [µF, max.]
60DAW4_2405S1.6	9-36	25	2703	5	12000	100	92.5	30000
60DAW4_2412S1.6	9-36	25	2703	12	5000	100	92.5	5850
60DAW4_2415S1.6	9-36	25	2688	15	4000	100	93	3900
60DAW4_4805S1.6	18-75	25	1344	5	12000	100	93	30000
60DAW4_4812S1.6	18-75	25	1351	12	5000	100	92.5	5850
60DAW4_4815S1.6	18-75	25	1344	15	4000	100	93	3900
60DAW4_2412D1.6	9-36	40	2747	±12	±2500	100	91	±3900
60DAW4_2415D1.6	9-36	50	2747	±15	±2000	100	91	±2400
60DAW4_4812D1.6	18-75	40	1373	±12	±2500	100	91	±3900
60DAW4_4815D1.6	18-75	50	1373	±15	±2000	100	91	±2400

* Test by normal Vin and constant resistive load.

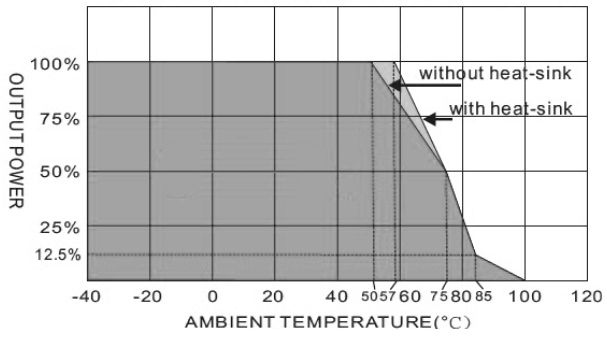
Typical characteristics

Temperature derating curves

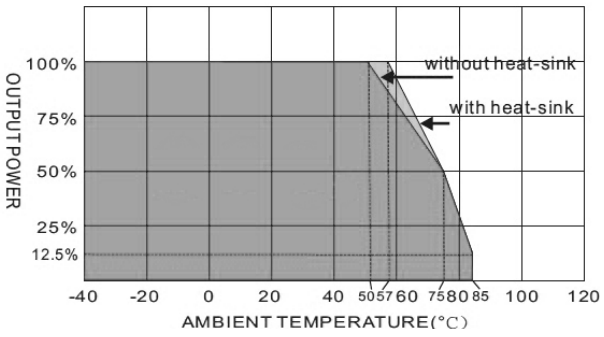
60DAW4_2405S1.6



All other types

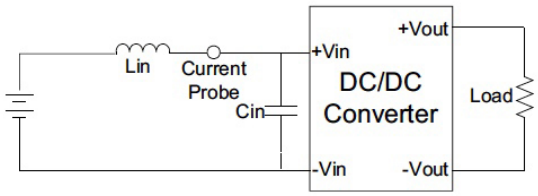


60DAW4_4812D1.6, 60DAW4_4815D1.6

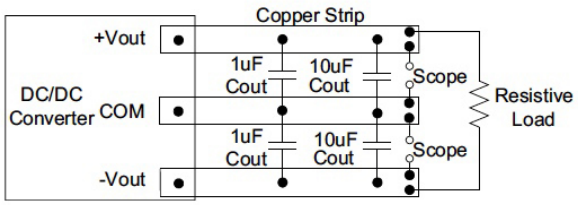


Test configurations

Input reflected ripple current test step
Input reflected ripple current is measured though a source indicator Lin (1μH) and a source capacitor Cin (22μF, ESR<1.0Ω at 100KHz) at nominal input and full load.



Output ripple & noise measurement test
To reduce ripple and noise, it is recommended to use a 1μF ceramic disk capacitor and a 10μF ceramic disk capacitor at the output.



Design and feature configurations

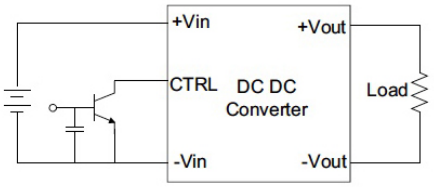
Over voltage protection
The module includes an internal output over voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over voltage set point, the module will activate the control loop of internal circuit to clamp the output voltage.

Over temperature protection
The over temperature protection consists of circuitry that provides protection from thermal damage. If the temperature exceeds the over temperature threshold the module will shut down.

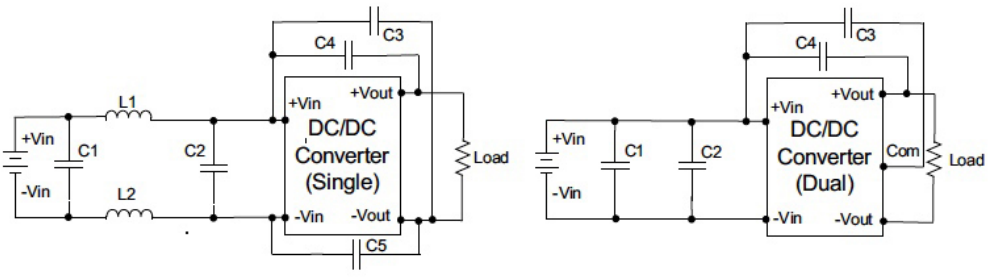
The module will try to restart after shut down. If the over temperature condition still exists during restart, the module will shut down again. This restart trial will continue until the temperature is within specification.

Over current protection
The module includes an internal over current protection circuit, which will endure current limiting for an unlimited duration during output over load condition. If the output current exceeds the OCP set point, the module will shut down autmatically (hiccup).
The module will restart after shut down. If the over load condition still exists, the module will shut down again.

CTRL module ON/OFF
Positive logic turns on the mofule during high logic and off during low logic. Ctrl module on/off can be controlled by an external switch between the ctrl terminal and -Vin terminal. The switch can be an open collector or open drain. For positive logic if the ctrl feature ist not used, please leave the ctrl pin floating.



EMI filter



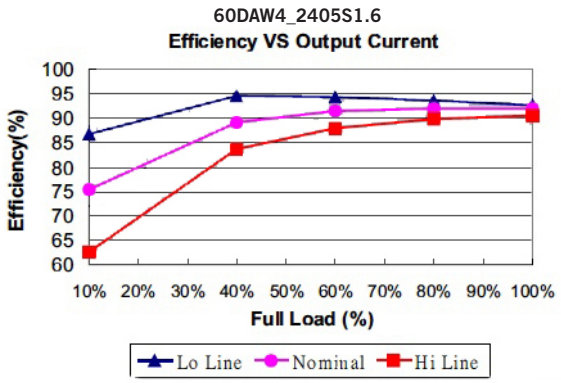
Input filter components (C1~C5, L1/L2) are used to help meet conducted emissions.

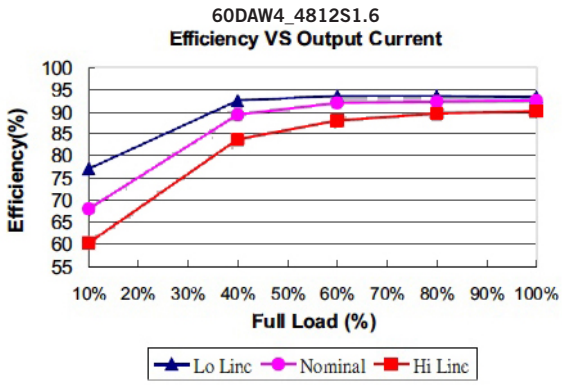
These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.

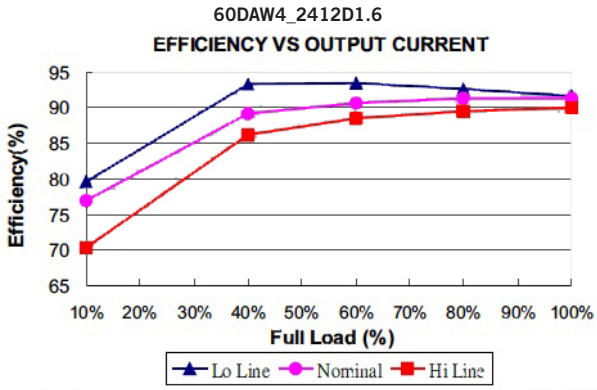
Single	C1	L1/L2	C2	C3	C4	C5
60DAW4_24xx	1812, 4.7μF, 50V	12μH	1812, 4.7μF, 50V	1206, 470pF, 2KV	1206, 1000pF, 2KV	1206, 1000pF, 2KV
60DAW4_48xx	1812, 1.5μF, 100V	12μH	1812, 1.5μF, 100V	1206, 470pF, 2KV	1206, 1000pF, 2KV	1206, 1000pF, 2KV

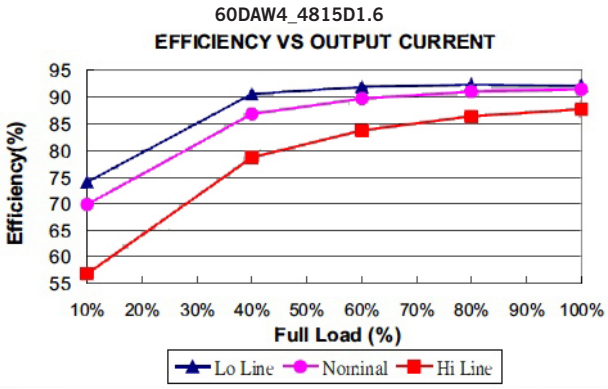
Dual	C1	C2	C3	C4
60DAW4_24xx	1812, 4.7μF, 50V	1812, 4.7μF, 50V	1206, 220pF, 2KV	1206, 1500pF, 2KV
60DAW4_48xx	1812, 1.5μF, 100V	1812, 1.5μF, 100V	1206, 220pF, 2KV	1206, 1500pF, 2KV

Efficiency



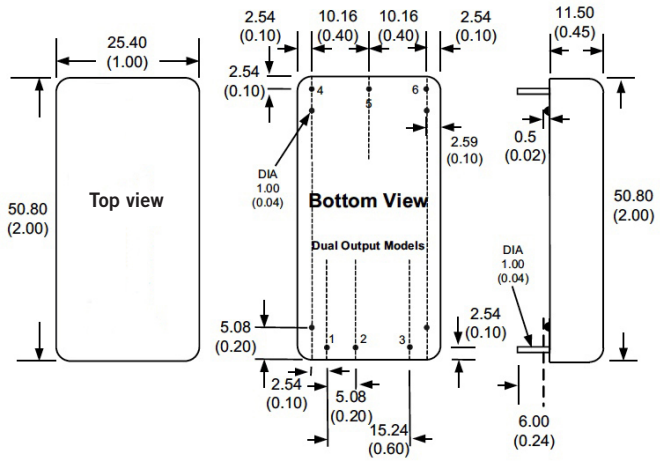






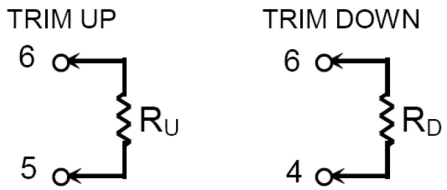
Mechanical dimensions

Without heatsink



Note:
Unit: mm[inch]
Pin diameter: 1.0 ±0.05mm [0.04 ±0.002inch]
Pin pitch and length tolerance: ±0.35mm [±0.014inch]
Case tolerance: ±0.5mm [±0.02inch]
Stand-off tolerance: ±0.1mm [±0.004inch]

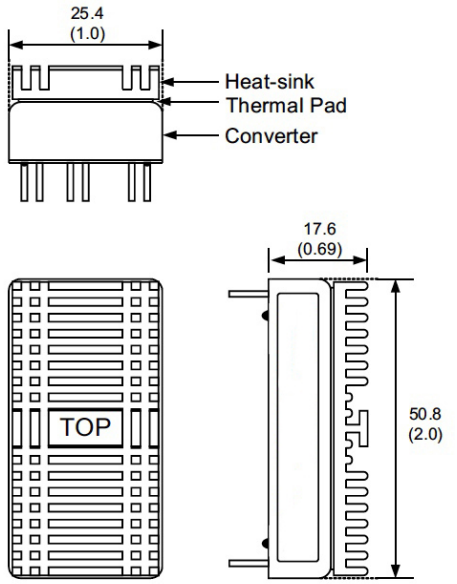
External output trimming
Output can be externally trimmed by using the method as below (single output models only)



PIN connections		
PIN	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL	CTRL
4	+Vout	+Vout
5	-Vout	Com
6	Trim	-Vout

Mechanical dimensions with heatsink

With heatsink



Note:
Material: Aluminium
Finish: Anodic treatment (black)
Weight: 11g (without converter)

Converters will be supplied with heat-sinks already mounted. Please contact factory for quotation.