Data Sheet
October 23, 2003
Document No: DS03-111 ver. 2.0 (Replaces FDS01-074EPS)
PDF Name: smc_smw-series.pdf

tyco Electronics

SMC/SMW-Series Surface-Mount Power Modules: 18 Vdc to 36 Vdc and 36 Vdc to 75 Vdc Inputs, 10 W and 15 W

The SMC/SMW-Series Surface-Mount Power Modules use advanced, surface-mount technology and deliver high-quality, compact, dc-dc conversion at an economical price.

Options

- Negative remote on-off logic
- Synchronization
- Tight output voltage regulation
- Input voltage turn-on adjustment

Features

- Low profile: 10 mm x 30.2 mm x 49.5 mm (0.39 in. x 1.19 in. x 1.95 in.)
- Wide input voltage range: 18 Vdc to 36 Vdc and 36 Vdc to 75 Vdc
- Input-to-output isolation: 1500 V
- Operating case temperature range: –40 °C to +110 °C
- Overcurrent protection, unlimited duration
- Remote on/off
- Output voltage adjustment: 90% to 110% of $V_{O,\ nom}$
- Output overvoltage protection
- Undervoltage lockout
- No-slide mechanical retaining pins
- *UL** 60950 Recognized, *CSA*† C22.2 No. 60950-00 Certified, VDE 0805 (EN60950) Licensed
- CE mark meets 73/23/EEC and 93/68/EEC directives§ (SMW only)
- Within FCC and VDE Class A radiated limits

Applications

- Telecommunications
- Electronic data processing
- Distributed power architectures

Description

The SMC/SMW-Series Surface-Mount Power Modules are low-profile, dc-dc converters that operate over an input voltage range of 18 Vdc to 36 Vdc or 36 Vdc to 75 Vdc and provide a precisely regulated output. The output is isolated from the input, allowing versatile polarity configurations and grounding connections. The modules have a maximum power rating of 10 W to 15 W and efficiencies up to 82%. Built-in filtering for both input and output minimizes the need for external filtering.

These modules are designed and manufactured to be gull-winged surface-mounted power modules that are reflowed with other surface-mount components in a typical surface-mount fashion.

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.
§ This product is intended for integration into end-use equipment. All the required procedures for CE marking of end-use equipment should be followed. (The CE mark is placed on selected products.)

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input Voltage:						
Continuous	SMC	V_I	0	—	50	Vdc
	SMW	V_I	0	—	80	Vdc
Transient (100 ms)	SMW	$V_{I, trans}$	0	—	100	V
Operating Case Temperature	SMx015	T_C	–40	—	110*	°C
(See derating curves.)	SMx010	T_C	–40	—	105*	°C
Storage Temperature	All	T_{stg}	–55	—	120	°C
I/O Isolation Voltage	All	—	—	—	1500	Vdc

* Maximum case temperature varies based on power dissipation. See derating curves, Figures 8—10, for details.

Electrical Specifications

Table 1. Input Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	SMC	V_I	18	24	36	Vdc
	SMW	V_I	36	48	75	Vdc
Maximum Input Current	SMC	$I_{I, max}$	—	—	1.6	A
(V_I = 0 to $V_{I, max}$; I_O = $I_{O, max}$)	SMW	$I_{I, max}$	—	—	800	mA
Inrush Transient	All	I^2t	—	—	0.2	A^2s
Input Reflected-ripple Current (5 Hz to 20 MHz; 12 µH source impedance; T_A = 25 °C; see Figure 1.)	All	I_I	—	5	—	mAp-p
Input Ripple Rejection (100 Hz—120 Hz)	All	—	—	45	—	dB

Fusing Considerations

CAUTION: This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of a sophisticated power architecture. To preserve maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse with a maximum rating of 5 A (see Safety Considerations section). Based on the information provided in this data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data for further information.

Electrical Specifications (continued)

Table 2. Output Specifications

Parameter	Device Code or Suffix	Symbol	Min	Typ	Max	Unit
Output Voltage Set Point ($V_I = V_{I,\,nom}$; $I_O = I_{O,\,max}$; T_A = 25 °C)	A	$V_{O,\,set}$	4.85	5.0	5.20	Vdc
	B	$V_{O,\,set}$	11.52	12.0	12.48	Vdc
	C	$V_{O,\,set}$	14.40	15.0	15.60	Vdc
	D	$V_{O,\,set}$	1.92	2.0	2.08	Vdc
	F	$V_{O,\,set}$	3.17	3.3	3.43	Vdc
Output Voltage (Over all line, load, and temperature conditions until end of life; see Figure 3.)	A	V_O	4.80	—	5.25	Vdc
	B	V_O	11.40	—	12.60	Vdc
	C	V_O	14.25	—	15.75	Vdc
	D	V_O	1.90	—	2.10	Vdc
	F	V_O	3.13	—	3.47	Vdc
Output Regulation:						
Line ($V_I = V_{I,\,min}$ to $V_{I,\,max}$)	A, D, F	—	—	—	5	mV
	B, C	—	—	0.01	0.1	%V_O
Load ($I_O = I_{O,\,min}$ to $I_{O,\,max}$)	A, D, F	—	—	—	15	mV
	B, C	—	—	0.1	0.2	%V_O
Temperature (T_C = –40 °C to +85 °C)	A, D, F	—	—	25	100	mV
	B, C	—	—	0.5	2.0	%V_O
Output Ripple and Noise Voltage (Across two 0.47 µF ceramic capacitors; see Figure 2.):						
RMS	A, D, F	—	—	—	30	mVrms
	B, C	—	—	—	35	mVrms
Peak-to-peak (5 Hz to 20 MHz)	A, D, F	—	—	—	100	mVp-p
	B, C	—	—	—	120	mVp-p
External Load Capacitance	A, D, F	—	—	—	1000	µF
	B, C	—	—	—	200	µF
Output Current (At $I_O < I_{O,\,min}$, the modules may exceed output ripple specifications, but operation is guaranteed.) **Note:** For the SMx015D, the output voltage may exceed regulation when $I_O < I_{O,\,min}$.	SMx015A	I_O	0.3	—	3.0	A
	SMx015B	I_O	0.12	—	1.25	A
	SMx015C	I_O	0.10	—	1.0	A
	SMx015D	I_O	0.35	—	3.0	A
	SMx015F	I_O	0.4	—	3.0	A
	SMx010A	I_O	0.1	—	2.0	A
	SMx010B	I_O	0.08	—	0.83	A
	SMx010C	I_O	0.06	—	0.67	A
	SMx010F	I_O	0.15	—	2.0	A
Output Current-limit Inception (V_O = 90% $V_{O,\,set}$)	SMx015A	I_O	—	—	5	A
	SMx015B	I_O	—	—	3.1	A
	SMx015C	I_O	—	—	2.5	A
	SMx015D	I_O	—	—	7.5	A
	SMx015F	I_O	—	—	6.5	A
	SMx010A	I_O	—	—	4	A
	SMx010B	I_O	—	—	2.5	A
	SMx010C	I_O	—	—	2	A
	SMx010F	I_O	—	—	5	A

Electrical Specifications (continued)

Table 2. Output Specifications (continued)

Parameter	Device Code or Suffix	Symbol	Min	Typ	Max	Unit
Output Short-circuit Current	SMx015A, D, F	I_O	—	—	10	A
(V_O = 0.25 V)	SMx015B	I_O	—	—	4.5	A
	SMx015C	I_O	—	—	4.5	A
	SMx010A	I_O	—	—	6	A
	SMx010B	I_O	—	—	3.5	A
	SMx010C	I_O	—	—	3.5	A
	SMx010F	I_O	—	—	7.5	A
Efficiency	SMC015A	η	77	80	—	%
($V_I = V_{I,\,nom}$; $I_O = I_{O,\,max}$; T_A = 25 °C.)	SMC015B, C	η	73	76	—	%
	SMC015D	η	64	67	—	%
	SMC015F	η	74	77	—	%
	SMC010A, B, C	η	75	79	—	%
	SMC010F	η	71	75	—	%
	SMW015A	η	79	82	—	%
	SMW015B, C	η	75	78	—	%
	SMW015D	η	66	69	—	%
	SMW015F	η	76	79	—	%
	SMW010A, B, C	η	77	81	—	%
	SMW010F	η	73	77	—	%
Switching Frequency	All	—	—	265	—	kHz
Dynamic Response						
($\Delta I_O/\Delta t$ = 1A/10 µs; $V_I = V_{I,\,nom}$; T_A = 25 °C):						
Load Change from I_O = 50% to 75% of $I_{O,\,max}$:						
Peak Deviation	All	—	—	2	—	$\%V_{O,\,set}$
Settling Time (V_O < 10% of peak deviation)	All	—	—	0.8	—	ms
Load Change from I_O = 50% to 25% of $I_{O,\,max}$:						
Peak Deviation	All	—	—	2	—	$\%V_{O,\,set}$
Settling Time (V_O < 10% of peak deviation)	All	—	—	0.8	—	ms

Table 3. Isolation Specifications

Parameter	Device	Min	Typ	Max	Unit
Isolation Capacitance	All	—	2300	—	pF
Isolation Resistance	All	10	—	—	MΩ

Table 4. General Specifications

Parameter	Device	Min	Typ	Max	Unit
Calculated MTBF	SMx015		5,200,000		hours
(I_O = 80% of $I_{O,\,max}$; T_C = 40 °C)	SMx010		7,500,000		hours
Weight	All	—	—	28 (1.0)	g (oz.)

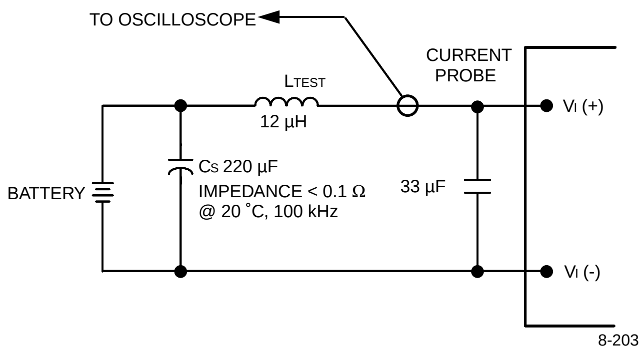
Electrical Specifications (continued)

Table 5. Feature Specifications

Parameter	Device Code or Suffix	Symbol	Min	Typ	Max	Unit
Remote On/Off Signal Interface (V_I = 0 V to $V_{I, max}$; open collector or equivalent compatible; signal referenced to V_I(–) terminal. See Figure 4 and Feature Descriptions.):						
Positive Logic—If Device Code Suffix “1” is not specified:						
Logic Low—Module Off						
Logic High—Module On						
Negative Logic—Device Code Suffix “1”:						
Logic Low—Module On						
Logic High—Module Off						
Module Specifications:						
On/Off Current—Logic Low	All	$I_{on/off}$	—	—	1.0	mA
On/Off Voltage:						
Logic Low	All	$V_{on/off}$	–0.7	—	1.2	V
Logic High ($I_{on/off}$ = 0)	All	$V_{on/off}$	—	—	10	V
Open Collector Switch Specifications:						
Leakage Current During Logic High ($V_{on/off}$ = 10 V)	All	$I_{on/off}$	—	—	50	µA
Output Low Voltage During Logic Low ($I_{on/off}$ = 1 mA)	All	$V_{on/off}$	—	—	1.2	V
Turn-on Delay and Rise Times (at 80% of $I_{O, max}$; T_A = 25 °C):						
Case 1: On/Off Input Is Set for Unit On and then Input Power Is Applied (delay from point at which $V_I = V_{I, min}$ until V_O = 10% of $V_{O, nom}$).	All	T_{delay}	—	5	20	ms
Case 2: Input Power Is Applied for at Least One Second, and then the On/Off Input Is Set to Turn the Module On (delay from point at which on/off input is toggled until V_O = 10% of $V_{O, nom}$).	All	T_{delay}	—	1	10	ms
Output Voltage Rise Time (time for V_O to rise from 10% of $V_{O, nom}$ to 90% of $V_{O, nom}$)	All	T_{rise}	—	0.2	5	ms
Output Voltage Overshoot (at 80% of $I_{O, max}$; T_A = 25 °C)	All	—	—	—	5	%
Output Voltage Set Point Adjustment Range	A, B, F	—	90	—	110	%$V_{O, nom}$
	C*	—	90	—	100	%$V_{O, nom}$
	D	—	90	—	125	%$V_{O, nom}$
Output Overvoltage Protection (clamp)	A	$V_{O, clamp}$	5.5	—	7.2	V
	B	$V_{O, clamp}$	13.2	—	17.0	V
	C	$V_{O, clamp}$	16.5	—	22.0	V
	D	$V_{O, clamp}$	2.5	—	4.0	V
	F	$V_{O, clamp}$	3.6	—	6.0	V
Undervoltage Lockout	SMC	V_{uvlo}	11	14	—	V
	SMW	V_{uvlo}	20	27	—	V

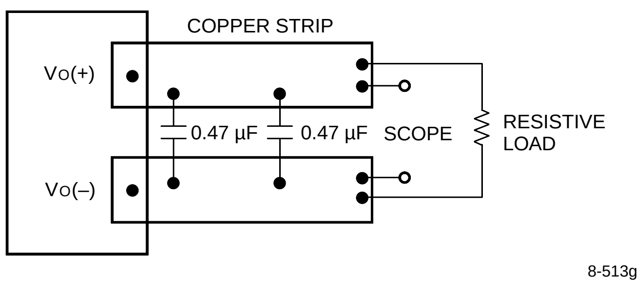
* The SMxxxxC module will only trim down.

Test Configurations



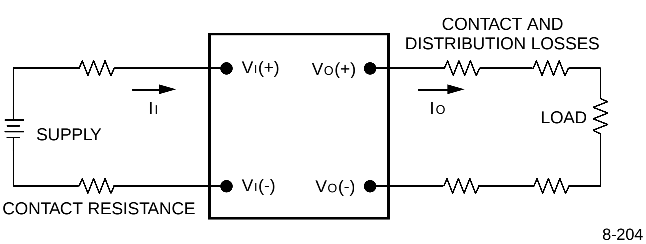
Note: Input reflected-ripple current is measured with a simulated source impedance of 12 µH. Capacitor Cs offsets possible battery impedance. Current is measured at the input of the module.

Figure 1. Input Reflected-Ripple Test Setup



Note: Use two 0.47 µF ceramic capacitors. Scope measurement should be made using a BNC socket. Position the load between 50 mm and 75 mm (2 in. and 3 in.) from the module.

Figure 2. Peak-to-Peak Output Noise Measurement Test Setup



Note: All measurements are taken at the module terminals. When socketing, place Kelvin connections at module terminals to avoid measurement errors due to socket contact resistance.

$$\eta = \left(\frac{[V_O(+) - V_O(-)]I_O}{[V_I(+) - V_I(-)]I_I}\right) \times 100 \quad \%$$

Figure 3. Output Voltage and Efficiency Measurement Test Setup

Design Considerations

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. If the source inductance exceeds 4 µH, a 33 µF electrolytic capacitor (ESR < 0.7 Ω at 100 kHz) mounted close to the power module helps ensure stability of the unit.

Solder Recommendations

Large surface-mount components typically require a thicker stencil than smaller components to ensure a reliable solder joint. The SMC/SMW-Series Surface-Mount Power Modules have been evaluated for solder joint reliability and shock and vibration requirements using 170,000 cubic mils (2.8 mm^3) of solder. This volume can be obtained by printing solder 12 mils thick on the copper pads on overprinting the copper pads 13 mils (0.33 mm) around the pad area with 8 mils of printed solder. Although this volume is recommended, tests have been conducted using lower volumes with successful results. Contact technical support for further assistance.

Safety Considerations

SMC Modules

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., *UL* 60950, *CSA* C22.2 No. 60950-00, and VDE 0805 (EN60950).

For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements.

The power module has extra-low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a maximum 5 A normal-blow fuse in the ungrounded lead.

Safety Considerations (continued)

SMW Modules

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., *UL* 60950, *CSA* C22.2 No. 60950-00, and VDE 0805 (EN60950).

If the input source is non-SELV (ELV or a hazardous voltage greater than 60 Vdc and less than or equal to 75 Vdc), for the module's output to be considered meeting the requirements of safety extra-low voltage (SELV), all of the following must be true:

- The input source is to be provided with reinforced insulation from any other hazardous voltages, including the ac mains; and
- One V_I pin and one V_O pin are to be grounded or both the input and output pins are to be kept floating; and
- The input pins of the module are not operator accessible; and
- Another SELV reliability test is conducted on the whole system, as required by the safety agencies, on the combination of supply source and the subject module to verify that under a single fault, hazardous voltages do not appear at the module's output.

Note: Do not ground either of the input pins of the module without grounding one of the output pins. This may allow a non-SELV voltage to appear between the output pins and ground.

The power module has extra-low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a maximum 5 A normal-blow fuse in the ungrounded lead.

Feature Descriptions

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current-limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. If the output voltage is pulled very low during a severe fault, the current-limit circuit can exhibit either foldback or
tailout characteristics (output-current decrease or increase). The unit operates normally once the output current is brought back into its specified range.

Remote On/Off

Two remote on/off options are available. Positive logic (if device code suffix “1” is not specified) remote on/off turns the module on during a logic-high voltage on the remote ON/OFF pin, and off during a logic low. Negative logic, device code suffix “1,” remote on/off turns the module off during a logic high and on during a logic low or when the remote ON/OFF pin is shorted to the $V_I(–)$ pin.

To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the $V_I(–)$ terminal ($V_{on/off}$). The switch may be an open collector or equivalent (see Figure 4). A logic low is $V_{on/off}$ = –0.7 V to 1.2 V. The maximum $I_{on/off}$ during a logic low is 1 mA. The switch should maintain a logic-low voltage while sinking 1 mA.

During a logic high, the maximum $V_{on/off}$ generated by the power module is 10 V. The maximum allowable leakage current of the switch at $V_{on/off}$ = 10 V is 50 µA.

The module has internal capacitance to reduce noise at the ON/OFF pin. Additional capacitance is not generally needed and may degrade the start-up characteristics of the module.

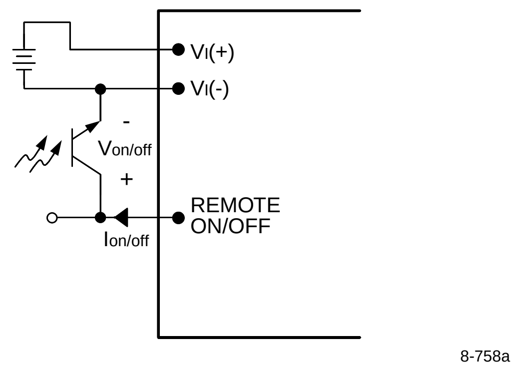


Figure 4. Remote On/Off Implementation

Feature Descriptions (continued)

Output Voltage Adjustment

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the $V_O(+)$ or $V_O(–)$ pins. With an external resistor between the TRIM and $V_O(+)$ pins ($R_{adj\text{-}down}$), the output voltage set point ($V_{O,\,adj}$) decreases (see Figure 5). The following equation determines the required external resistor value to obtain an output voltage change from $V_{O,\,nom}$ to $V_{O,\,adj}$:

$$R_{adj\text{-}down} = \left[\frac{(V_{O,\,adj} - L)G}{(V_{O,\,nom} - V_{O,\,adj})} - H\right]\Omega$$

where $R_{adj\text{-}down}$ is the resistance value connected between TRIM and $V_O(+)$, and G, H, and L are defined in the table below.

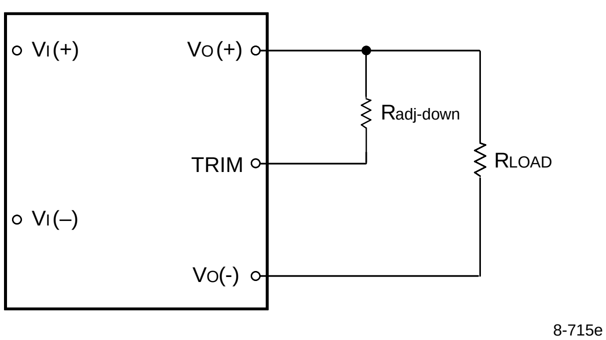


Figure 5. Circuit Configuration to Decrease Output Voltage

With an external resistor connected between the TRIM and $V_O(–)$ pins ($R_{adj\text{-}up}$), the output voltage set point ($V_{O,\,adj}$) increases (see Figure 6). The following equation determines the required external resistor value to obtain an output voltage from $V_{O,\,nom}$ to $V_{O,\,adj}$:

$$R_{adj\text{-}up} = \left(\left[\frac{GL}{[(V_{O,\,adj} - L) - K]}\right] - H\right)\Omega$$

where $R_{adj\text{-}up}$ is the resistance value connected between TRIM and $V_O(–)$, and the values of G, H, K, and L are shown in the following table.

	G	H	K	L
SMx010, 015A	5110	2050	2.5	2.5
SMx010, 015B	10,000	5110	9.5	2.5
SMx010, 015C	10,000	5110	NA	2.5
SMx015D	5110	2050	0.76	1.23
SMx010, 015F	5110	2050	2.06	1.24

The combination of the output voltage adjustment and the output voltage regulation cannot exceed 110% of the nominal output voltage between the $V_O(+)$ and $V_O(–)$ terminals.

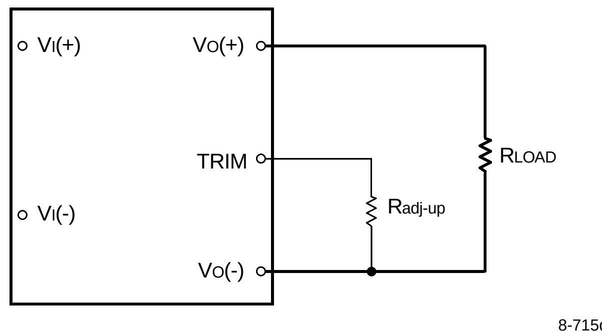


Figure 6. Circuit Configuration to Increase Output Voltage

The SMC/SMW-Series Surface-Mount Power Modules have a fixed current-limit set point. Therefore, as the output voltage is adjusted down, the available output power is reduced. In addition, the minimum output current is a function of the output voltage. As the output voltage is adjusted down, the minimum required output current can increase (i.e., minimum power is constant).

Output Overvoltage Protection

The output overvoltage clamp consists of control circuitry, independent of the primary regulation loop, that monitors the voltage on the output terminals. This control loop has a higher voltage set point than the primary loop (see Feature Specifications table). In a fault condition, the overvoltage clamp ensures that the output voltage does not exceed $V_{O,\,clamp,\,max}$. This provides a redundant voltage-control that reduces the risk of output overvoltage.

Feature Descriptions (continued)

Input Voltage Turn-On Adjustment (Optional)

The input voltage at which the unit turns on can be adjusted upward to add additional hysteresis between the points at which the modules turn on and turn off.

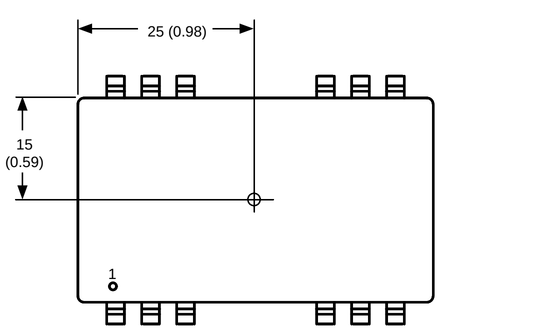
This feature can be useful when the power system has high impedance between the source voltage and the power unit causing the input to drop as the supply is turned on. Please consult the factory for application guidelines and/or a description of how to use this feature.

Synchronization (Optional)

With external circuitry, the unit is capable of synchronization from an independent time base with a switching rate of 256 kHz. Other frequencies may be available; please consult the factory for application guidelines and/or a description of the external circuit needed to use this feature.

Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat-dissipating components inside the unit are thermally coupled to the case. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the case temperature. The case temperature (T_C) should be measured at the position indicated in Figure 7.



Note: Dimensions are in millimeters and (inches). Pin locations are for reference only.

Figure 7. SMC and SMW Case Temperature Measurement Location

Note that the view in Figure 7 is of the surface of the module. The temperature at this location should not exceed the maximum case temperature indicated on the derating curves. The output power of the module should not exceed the rated power for the module as listed in the Ordering Information table.

Heat Transfer Characteristics

Increasing airflow over the module enhances the heat transfer via convection. Figures 8 through 10 show the maximum power that can be dissipated by the module without exceeding the maximum case temperature versus local ambient temperature (T_A) for natural convection through 3.0 ms^{-1} (600 ft./min.).

Systems in which these power modules are used typically generate natural convection airflow rates of 0.25 ms^{-1} (50 ft./min.) due to other heat-dissipating components in the system. Therefore, the natural convection condition represents airflow rates of approximately 0.25 ms^{-1} (50 ft./min.). Use of Figure 8 is shown in the following example.

Example

What is the minimum airflow necessary for an SMW010A operating at V_I = 48 V, an output current of 2.0 A, and a maximum ambient temperature of 91 °C?

Solution:

Given: V_I = 48 V, I_O = 2.0 A ($I_{O,\,max}$), T_A = 91 °C
Determine P_D (Figure 21): P_D = 2.5 W
Determine airflow (Figure 8): v = 2.0 ms^{-1} (400 ft./min.)

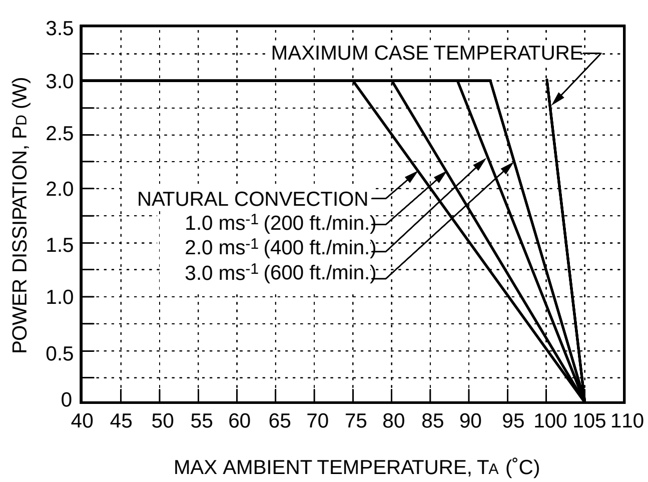


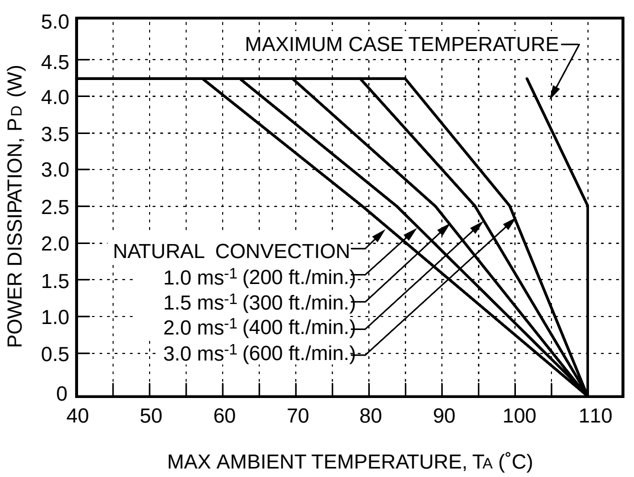
Figure 8. SMC010/SMW010 Forced Convection Power Derating; Either Orientation

Thermal Considerations (continued)

Not Available at
Time of Publishing;
Contact Technical Support

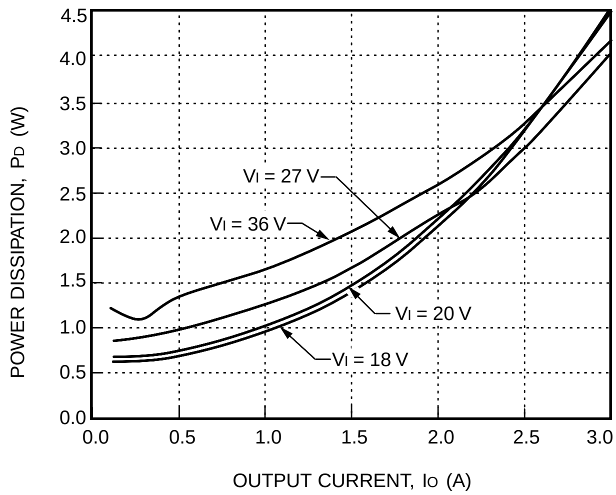
8-xxxx(C)

Figure 9. SMC015 Forced Convection Power Derating; Either Orientation



8-1376b

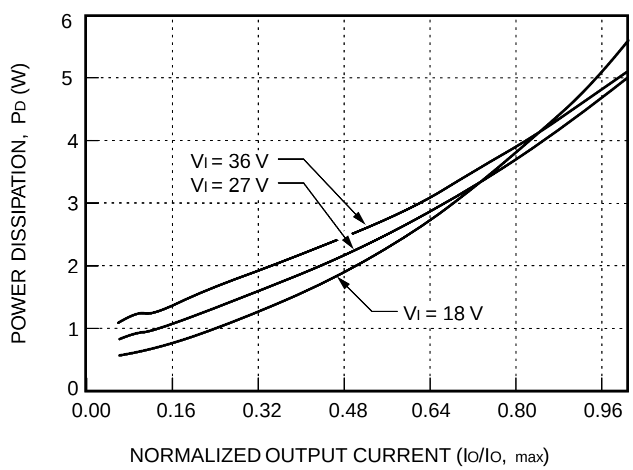
Figure 10. SMW015 Forced Convection Power Derating; Either Orientation



8-1382

Note: The power dissipation of this unit is shown at $T_C = T_{C,\,max}$ because the efficiency of this power module drops at high temperatures.

Figure 11. SMC015A Power Dissipation at Maximum Case Temperature



8-1808(C)

Figure 12. SMC015B, C Typical Power Dissipation vs. Normalized Output Current at T_C = 25 °C

Thermal Considerations (continued)

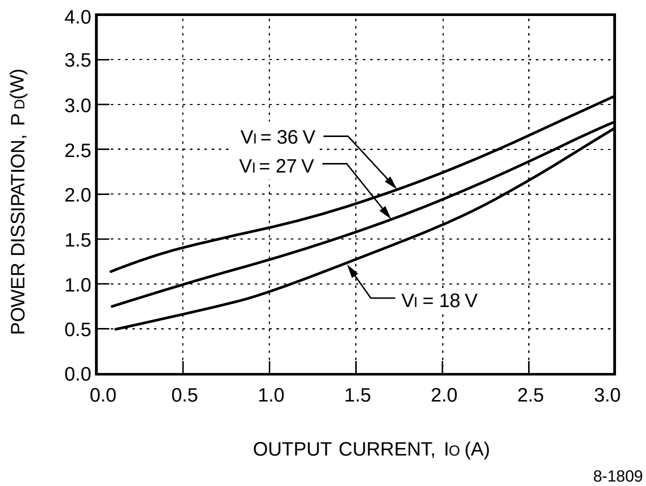
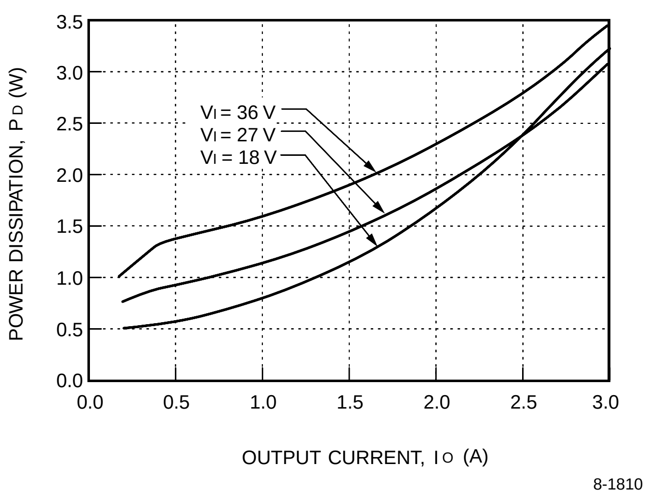


Figure 13. SMC015D Typical Power Dissipation vs. Output Current at T_C = 25 °C



Note: The power dissipation of this unit is shown at $T_C = T_{C,\ max}$ because the efficiency of this power module drops at high temperatures.

Figure 14. SMC015F Typical Power Dissipation vs. Output Current at Maximum Case Temperature

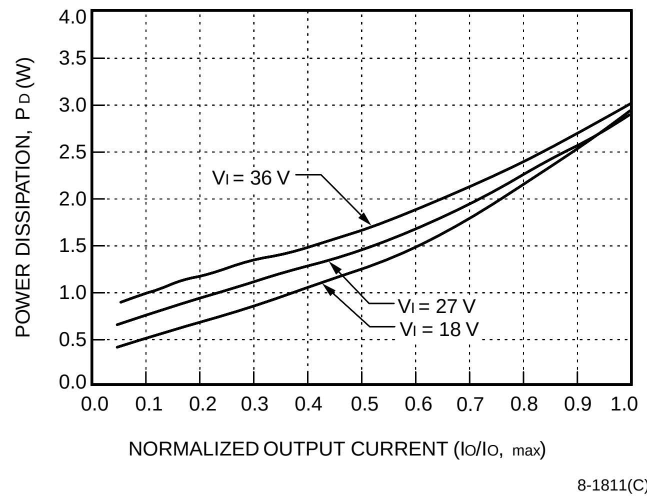


Figure 15. SMC010A, B, C Typical Power Dissipation vs. Normalized Output Current at T_C = 25 °C

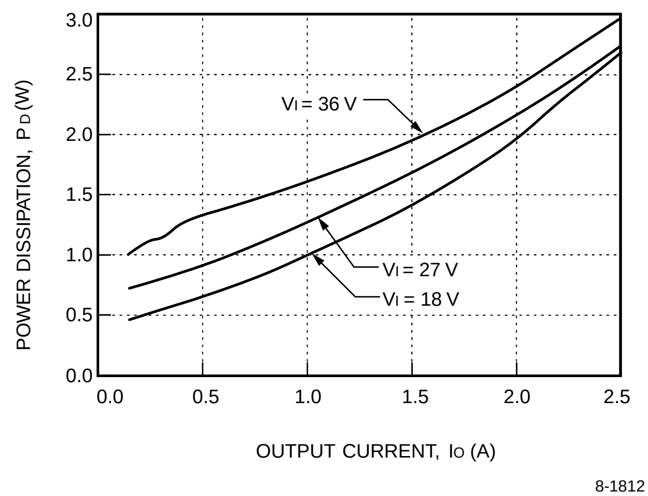
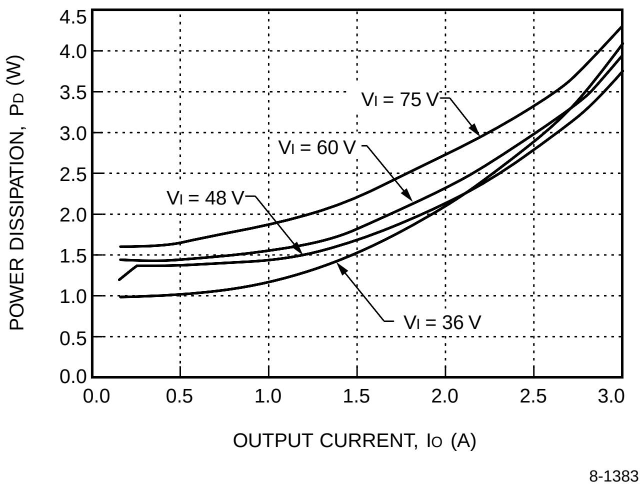


Figure 16. SMC010F Typical Power Dissipation vs. Output Current at T_C = 25 °C

Thermal Considerations (continued)



Note: The power dissipation of this unit is shown at $T_C = T_{C, max}$ because the efficiency of this power module drops at high temperatures.

Figure 17. SMW015A Power Dissipation at Maximum Case Temperature

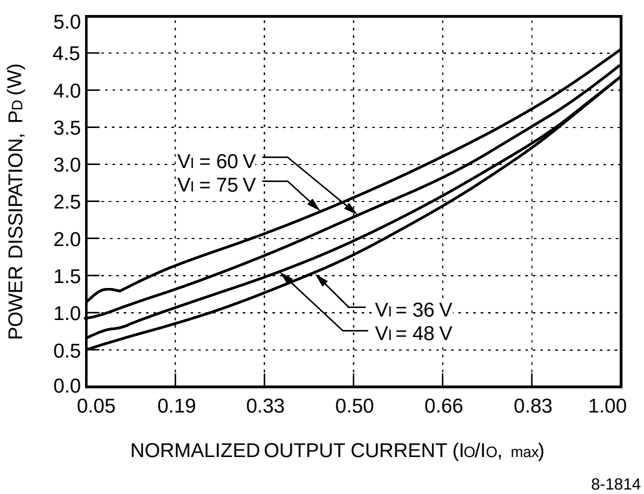


Figure 18. SMW015B, C Typical Power Dissipation vs. Normalized Output Current at T_C = 25 °C

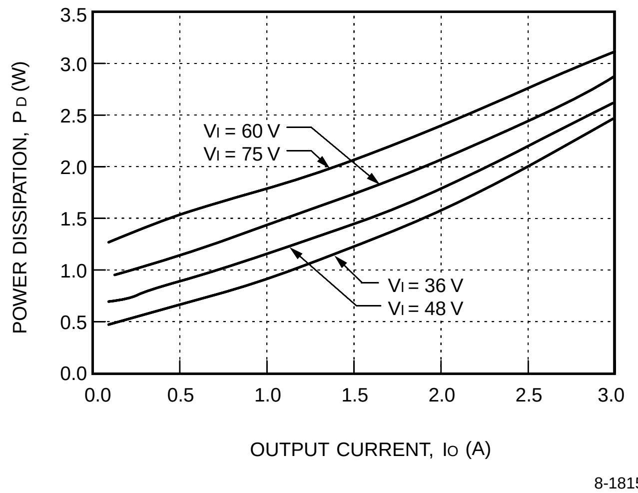
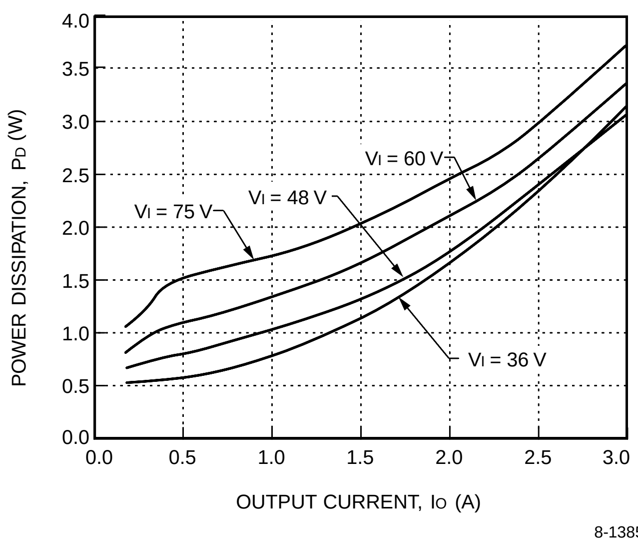


Figure 19. SMW015D Typical Power Dissipation vs. Output Current at T_C = 25 °C



Note: The power dissipation of this unit is shown at $T_C = T_{C, max}$ because the efficiency of this power module drops at high temperatures.

Figure 20. SMW015F Power Dissipation at Maximum Case Temperature

Thermal Considerations (continued)

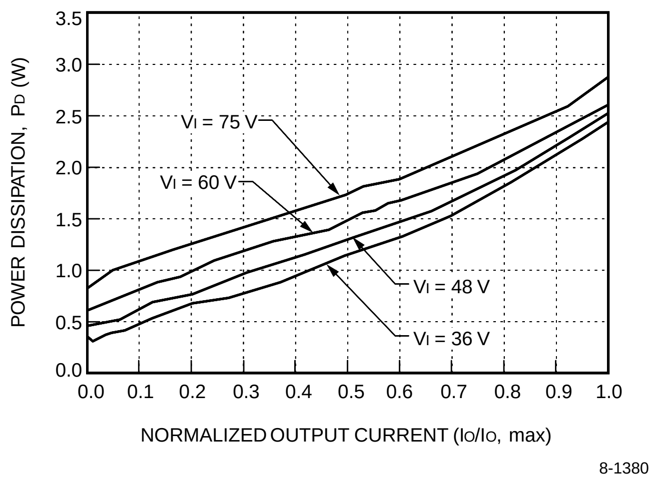


Figure 21. SMW010A, B, C Typical Power Dissipation vs. Normalized Output Current at T_C = 25 °C

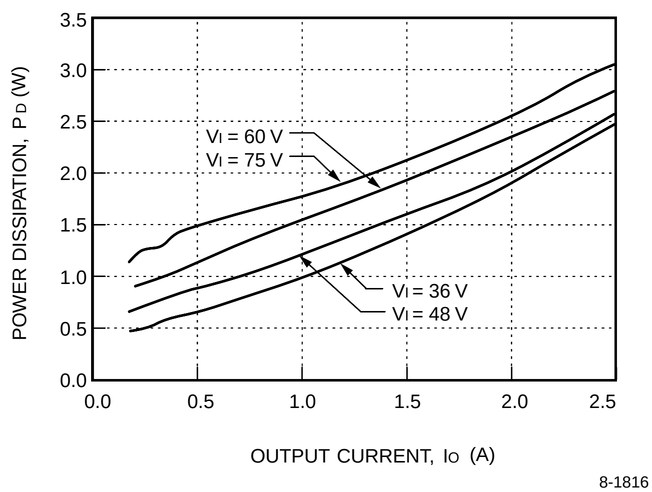
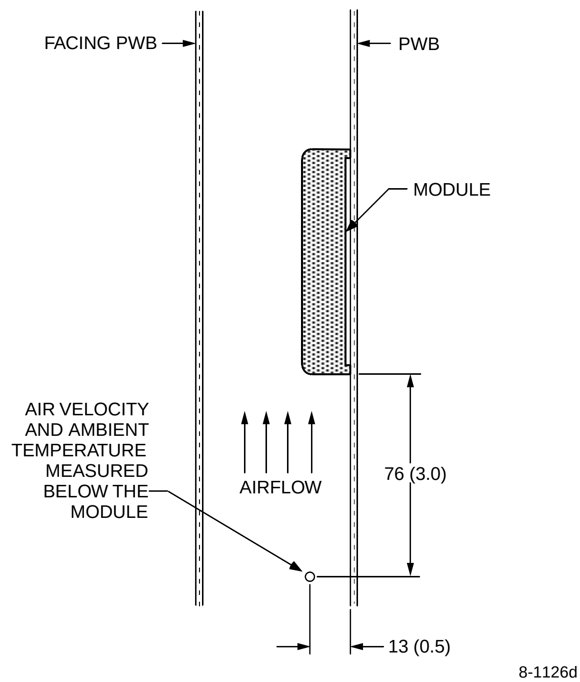


Figure 22. SMW010F Typical Power Dissipation vs. Output Current at T_C = 25 °C

Module Derating

The derating curves in Figures 8 through 10 were derived by measurements obtained in an experimental apparatus shown in Figure 23. Note that the module and the printed-wiring board (PWB) that it is mounted on are both vertically oriented. The passage has a rect-angular cross section.



Note: Dimensions are in millimeters and (inches).

Figure 23. Experimental Test Setup

Surface-Mount Power Module Solder Reflow Recommendation

The SMC/SMW-Series surface-mount power modules are constructed with SMT (surface-mount technology) components and assembly guidelines. Such large mass/low thermal resistance devices heat up slower than typical SMT components. It is recommended that the customer review data sheets in order to customize the solder reflow profile for application board assembly.

It is recommended that a reflow profile must be characterized for the module on the application board assembly. The solder paste type, component, and board thermal sensitivity must be considered in order to form the desired fused solder fillet. The power module leads are plated with tin (Sn) solder to prevent corrosion and ensure good solderability. Typically, the eutectic solder melts at 183 °C, wets the land, and subsequently wicks the device lead. Sufficient time must be allocated to fuse the plating on the lead and ensure a reliable solder joint.

There are several types of SMT reflow technologies currently used in the industry. These surface-mount power modules can be adequately soldered using natural convection, IR (radiant infrared), convection/IR, or forced convection technologies. The surface-mount power module solder reflow profile is established by accurately measuring the module gull-wing lead surface temperature.

The maximum oven temperature and conveyor speed should prevent the lead temperature from exceeding the maximum thermal profile limits as shown in Figure 24. The lead temperature during a typical reflow profile is shown in Figure 25. Failure to observe these maximum lead temperatures and duration may result in permanent damage to the power module.

Relative temperatures of the module gull-wing leads vary according to many factors, including surrounding components, internal paths, and connecting paths. Typically, pin 1 is a good choice for a conservative measurement since it is usually connected to heavy paths for current conduction which also tend to heat the lead faster. These variables make it difficult to compare various types of surface-mount modules; however, the unit has been found to be more robust during temperature profiles compared with other SMT modules available in the industry.

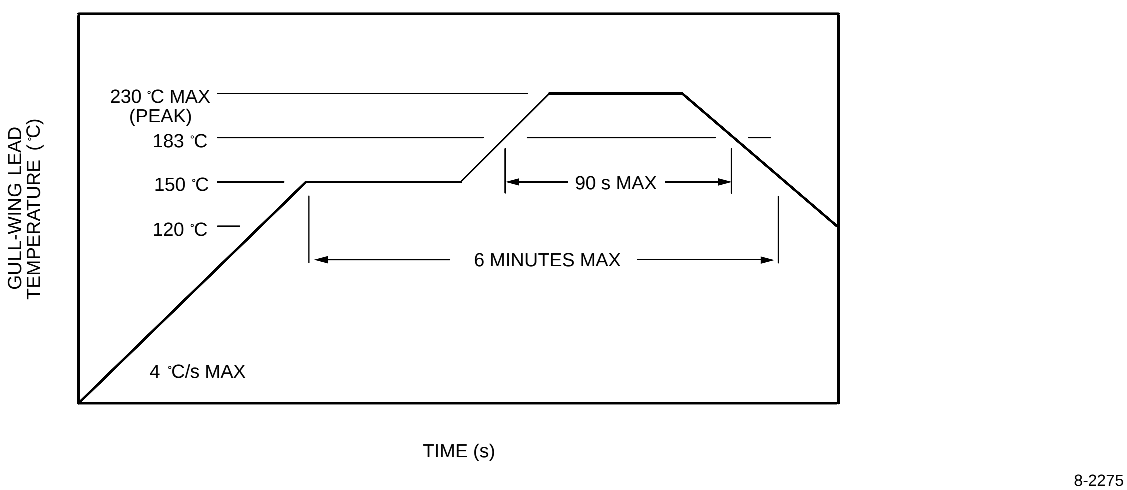


Figure 24. Maximum Thermal Profile Limits

Surface-Mount Power Module Solder Reflow Recommendation (continued)

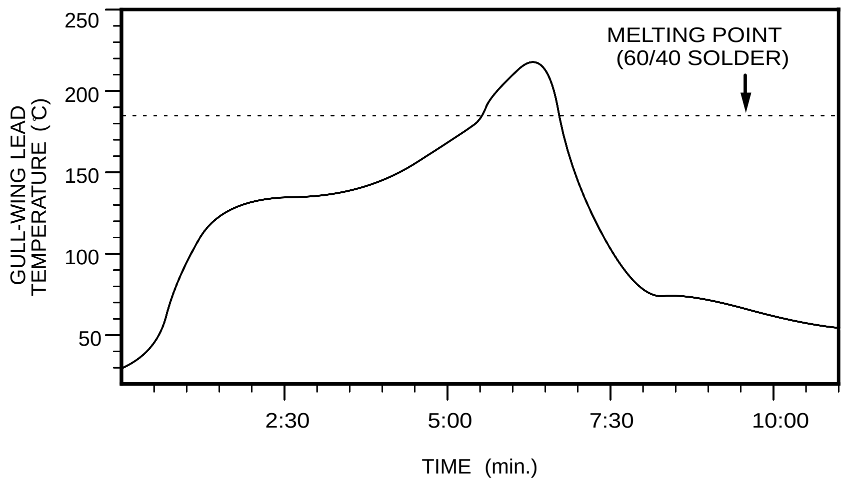
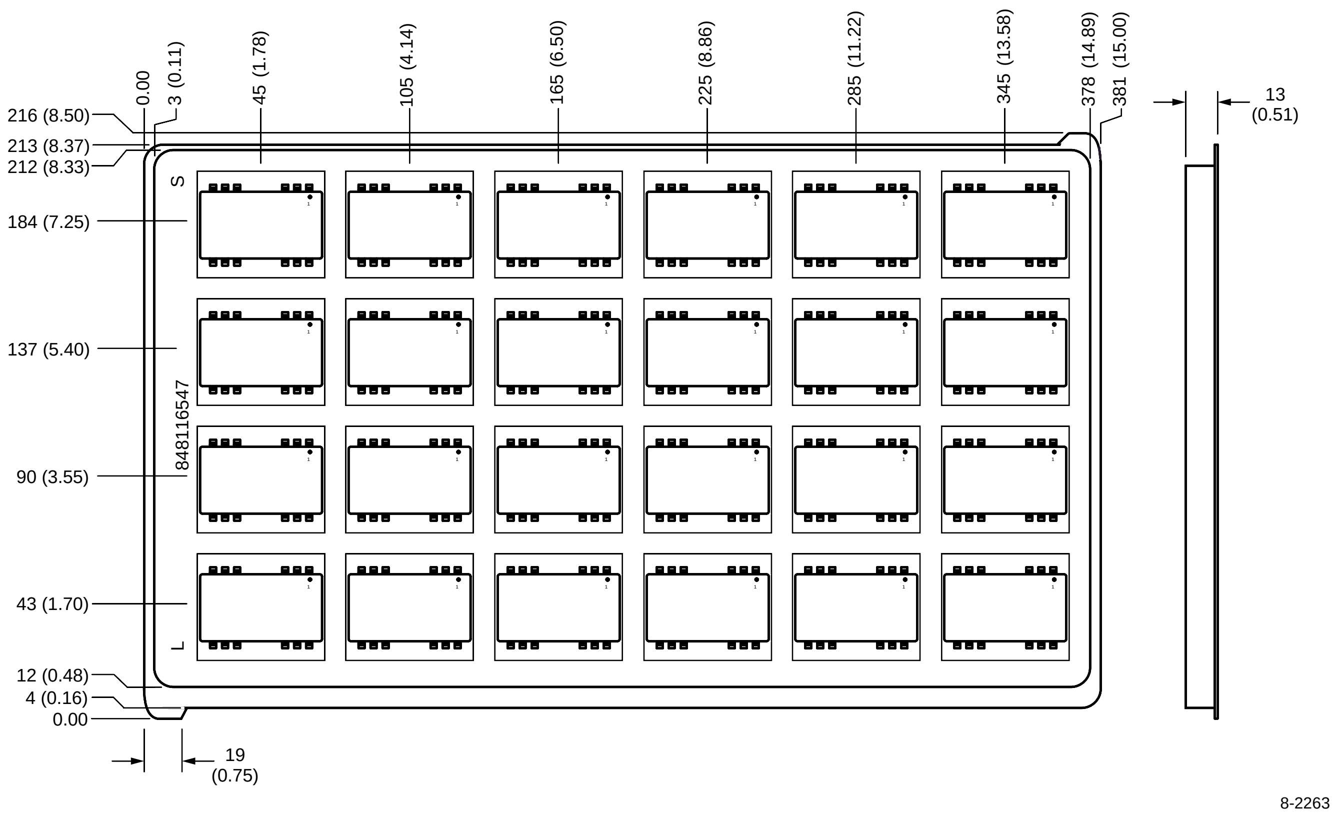


Figure 25. Typical Reflow Soldering Profile

Packaging Information

Vacuum Formed Trays

The SMC/SMW-Series surface-mount power modules are delivered in plastic vacuum formed trays (see Figure 26) that allow automated placement of the modules via a surface-mount pick and place machine.



Note: Dimensions are in millimeters and (inches).

Figure 26. Vacuum Formed Tray

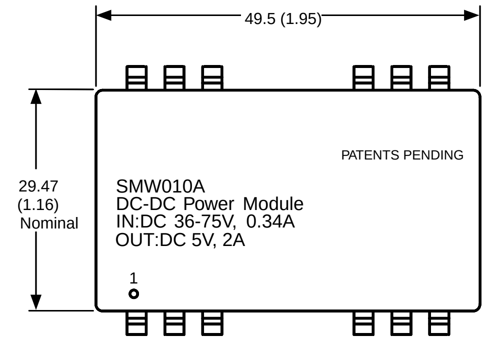
Specifications:

- Material: PVC (ESD protected)
- Capacity: 24 pieces/tray
- Weight: 90 g (3.2 oz.)

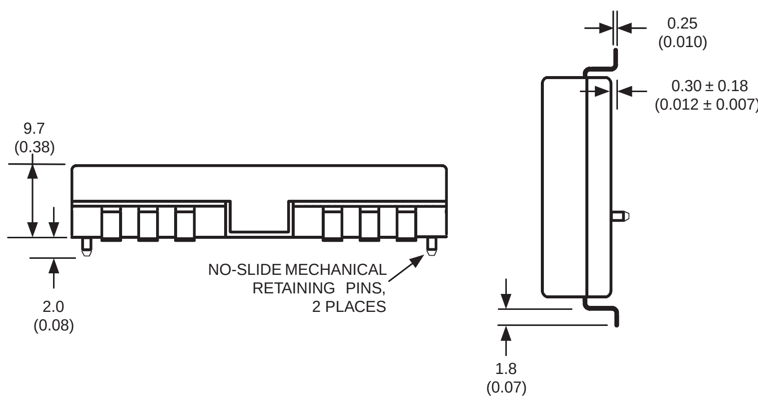
Outline Diagram

Dimensions are in millimeters and (inches). See next page for pin descriptions.
Tolerances: x.x ± 0.5 mm (0.020 in.); x.xx ± 0.4 mm (0.015 in.).

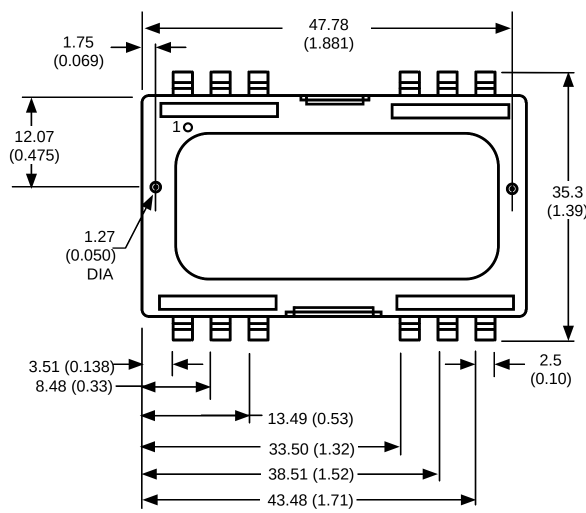
Top View



Side Views



Bottom View

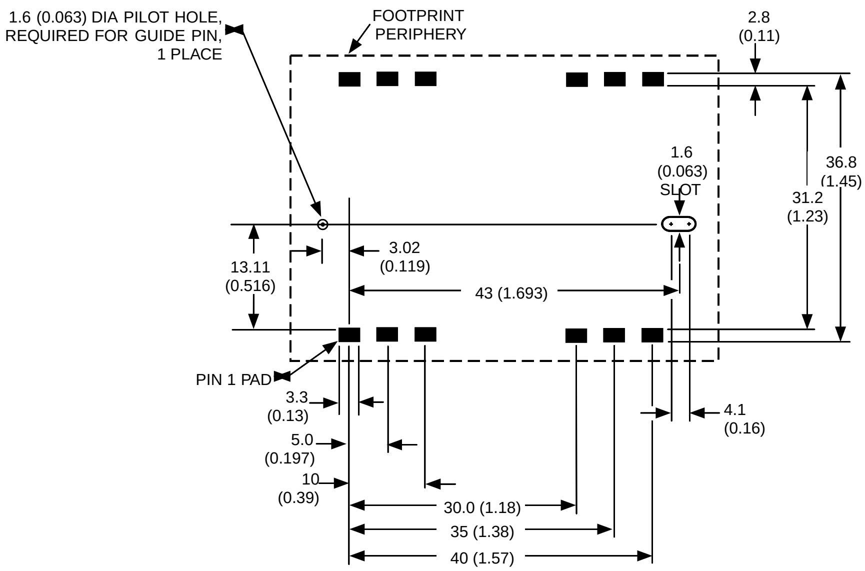


8-1507

Recommended Hole Pattern

Component-side footprint. Dimensions are in millimeters and (inches).
Tolerances: x.x ± 0.5 mm (0.020 in.); x.xx ± 0.4 mm (0.015 in.).

CAUTION: Care must be taken to ensure the board in the periphery of the footprint is flat.



8-1507

Pin	Function	Pin	Function
1	VO(+)	12	VI(+)
2	VO(–)	11	VI(–)
3	N/C†	10	N/C†
4	TRIM	9	SYNC (optional)
5	N/C†	8	ON/OFF
6	N/C†	7	TURN-ON ADJUSTMENT (optional)

* The recommended solder paste volume is 2.8 cubic mm (170,000 cubic mils/pin). See Design Considerations section.
† N/C may be used for internal module connections and should not be connected by the customer.

Ordering Information

Table 6. Device Codes

Input Voltage	Output Voltage	Output Power	Device Code	Comcode
24 V	2 V	6 W	SMC015D*	TBD
24 V	3.3 V	10 W	SMC015F	TBD
24 V	5 V	15 W	SMC015A	TBD
24 V	12 V	15 W	SMC015B	TBD
24 V	15 V	15 W	SMC015C	TBD
24 V	3.3 V	8 W	SMC010F*	TBD
24 V	5 V	10 W	SMC010A	108268376
24 V	12 V	10 W	SMC010B*	TBD
24 V	15 V	10 W	SMC010C*	TBD
48 V	2 V	6 W	SMW015D*	TBD
48 V	3.3 V	10 W	SMW015F	108386699
48 V	3.3 V	10 W	SMW015F1	108268418
48 V	5 V	15 W	SMW015A	108268392
48 V	5 V	15 W	SMW015A1	108593708
48 V	12 V	15 W	SMW015B	TBD
48 V	12 V	15 W	SMW015B1	108268400
48 V	15 V	15 W	SMW015C	TBD
48 V	3.3 V	8 W	SMW010F	108268384
48 V	5 V	10 W	SMW010A	107911661
48 V	12 V	10 W	SMW010B*	TBD
48 V	15 V	10 W	SMW010C*	TBD

* Items and options available by special request only.

Optional features may be ordered using the device code suffixes shown below. The feature suffixes are listed numerically in descending order. Please contact your Tyco Electronics' Account Manager or Field Application Engineer for pricing and availability.

Table 7. Device Options

Option	Device Code Suffix
Negative logic remote on/off	1

World Wide Headquarters
Tyco Electronics Power Systems, Inc.
3000 Skyline Drive, Mesquite, TX 75149, USA
+1-800-843-1797 FAX: +1-888-315-5182
(Outside U.S.A.: **+1-972-284-2626**, FAX: +1-972-284-2900)
www.tycopower.com
e-mail: techsupport1@tycoelectronics.com

Europe, Middle-East and Africa Headquarters
Tyco Electronics (UK) Ltd
Tel: +44 1344 469 300, Fax: +44 1344 469 301

Caribbean-Latin America-Brazil Headquarters
Tyco Electronics Power Systems
Tel: +56 2 209 8211, Fax: +56 2 223 1477

India Headquarters
Tyco Electronics Systems India Pte Ltd
Tel: +91 80 841 1633 x3001

Asia-Pacific Headquarters
Tyco Electronics Singapore Pte Ltd
Tel: +65 6416 4283, Fax: 65 6416 4299

October 23, 2003
Document No: DS03-111 ver. 2.0 (Replaces FDS01-074EPS)
PDF Name: smc_smw-series.pdf