Product Description

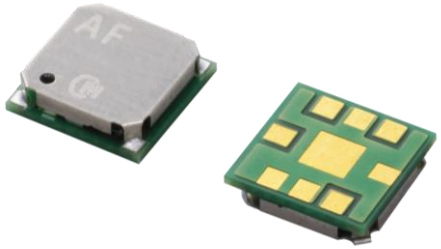
MYLSM00502ERPL is a surface mount type of DC-DC power converter for embedded applications.
The module has a small form factor, measuring only 7.9 x 7.9 x 2.3 mm.
Applications include powering FPGA/CPU's, datacom/telecom systems, Distributed Bus Architectures (DBA), programmable logic and mixed voltage systems.
The converter operates over input voltage ranges of 4.5 to 17.0V and a maximum output current of 2.5A.
Based on high-frequency synchronous buck converter switching topology, the high-power conversion efficient PoL features settable output voltage 1.0 to 5.25V and On/Off control.
The converter also includes under-voltage lockout (UVLO), output short circuit protection and over-current protection.

Features

- Settable output voltage range from 1.0V to 5.25V
- Wide input voltage range 4.5 to 17V
- Up to 2.5A of output current
- Quick response to load change
- Small surface mount package 7.9 x 7.9 x 2.3mm
- High efficiency up to 88%
- Short Circuit Protection
- On/Off control (Positive logic)

Typical Applications

- PCIe / Server applications
- FPGA and DSP
- Datacom / Telecom systems
- Distributed bus architectures (DBA)
- Programmable logic and mixed voltage



MYLSM00502ERPL

Efficiency

V_{IN} = 12V, V_{OUT} = 1.0V, T_A = 25degC
V_{IN} = 12V, V_{OUT} = 3.3V, T_A = 25degC
V_{IN} = 12V, V_{OUT} = 5.25V, T_A = 25degC

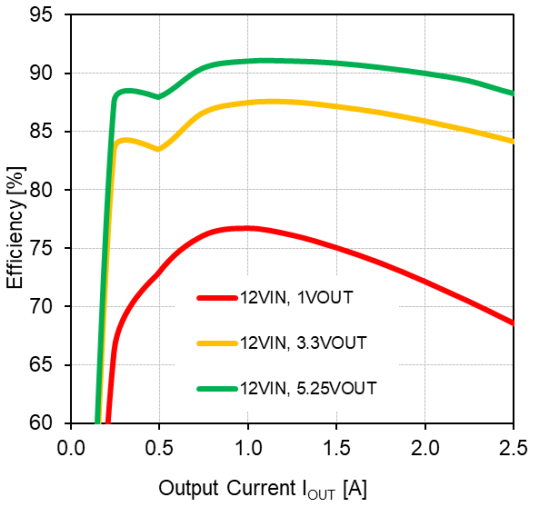


Figure 1. Efficiency Curve

Simplified Application Circuit

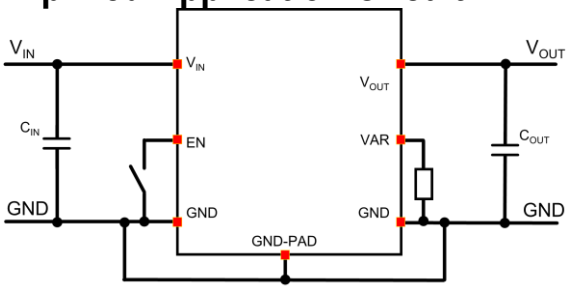


Figure 2. Simplified Circuit Diagram

Performance Specifications Summary and Ordering Information

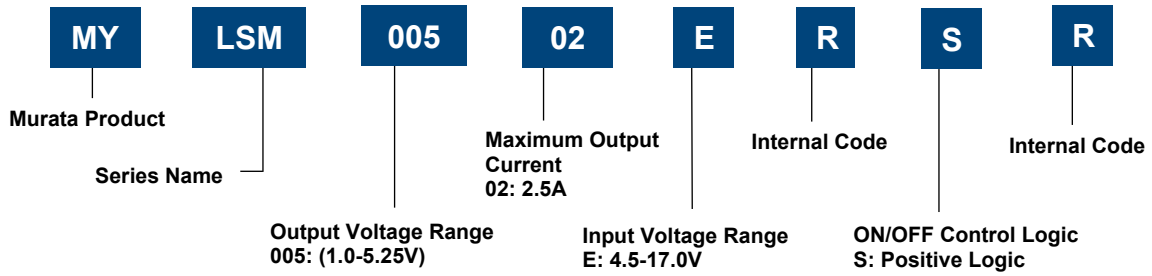
Table 1. Performance Specifications Summary and Ordering Information

PART NUMBER	OUTPUT		INPUT			Efficiency [%]	EN	Package [mm]	MSL	Quantity/ Packing
	V_{OUT} [V]	I_{OUT} (max.) [A]	V_{IN} (typ.) [V]	Range [V]	I_{IN} full load [A]					
MYLSM00502ERPL	1.0-5.25	2.5	12	4.5-17.0	1.25	88	Yes (Positive)	7.9 x 7.9 x 2.3 LGA	2	1000 units/T&R

1. All Specifications are typical at +25degC, V_{IN} = typical 12V, V_{OUT} = typical +5.25V, full load, external capacitors and natural convection unless otherwise indicated. All models are tested and specified with external 47uF x 1 ceramic output capacitors and 10uF x 1 ceramic and plenty of electrolytic external input capacitors. See detailed specifications. Input and Output capacitors are necessary for our test equipment.
2. Use adequate ground plane and copper thickness adjacent to the converter.

Table 2. Part Numbering

PART NUMBER STRUCTURE



Top Marking Specifications

Because of the small size of these products, the product marking contains a character-reduced code to indicate the model number and manufacturing date code. Not all items on the marking are always used. Please note that the marking differs from the product photograph. Here is the layout of the marking.

Layout (reference)

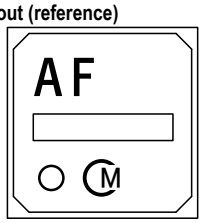


Figure 3. Top Marking Specification

Table 3. Code Description

CODE	DESCRIPTION
AF	Product code
▭	Internal manufacturing code
Ⓜ	Murata Manufacturing ID
○	1pin mark

Pin Configuration

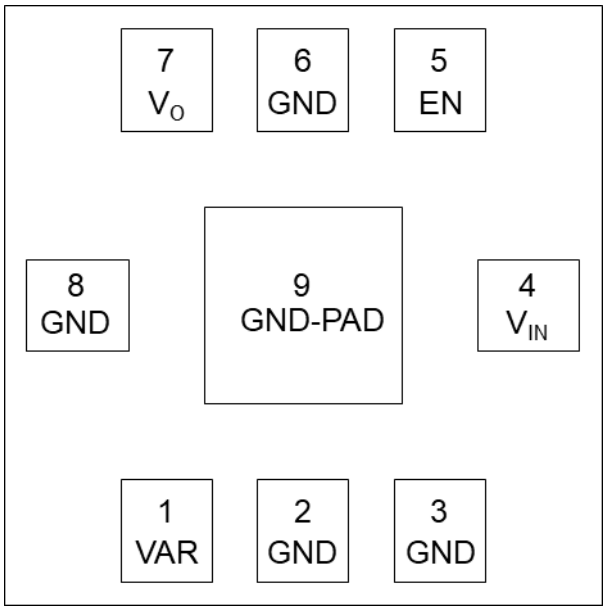


Figure 4. Module Terminals (Top View)

Pin Function and Descriptions

Table 4. Pin Function and Descriptions

PIN No.	NAME	FUNCTION and DESCRIPTION
1	VAR	Output voltage setting pin. The resistor must be connected between the VAR pin and GND to set the output voltage correctly.
2, 3, 6, 8	GND	Ground pins. Connect to the GND plane.
4	V_{IN}	Power input voltage.
5	EN	Remote ON/OFF pin. The module can be turned ON or OFF using EN pin. It is internally connected to GND through a resistor. When the pin is applied to over 1.0 V, the module is turned ON (enable).
7	V_O	Power output voltage.
9	GND (Thermal Pad)	Ground pins. Connect to the GND plane.

Absolute Maximum Ratings (1)(2)

Table 5. Absolute Maximum Ratings

PARAMETER	MIN	MAX	UNITS
V_{IN}	-0.3	18	V
EN	-0.3	V_{IN}	V
VAR	Do not apply voltage		
V_{OUT}	-0.3	5.41	V
Output Current (I_{OUT})	0	2.5	A
Storage Temperature (T_{stg})	-40	85	degC
Soldering / Reflow Temperature (3)	-	250	degC
Maximum Number of Reflows Allowed	-	1	
ESD Tolerance, HBM	-	±500	V

Notes:
(1) The application of any stress beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device, and exposure at any of these ratings for extended periods may reduce the reliability of the device. The above “Absolute Maximum Ratings” are stress ratings only; the notation of these conditions does not imply functional operation of the device at these or any other conditions that fall outside of the range identified by the operational sections of this specification.
(2) All Voltages are with respect to GND plane.
(3) Recommended Reflow profile is written in “Soldering Guidelines”.

Recommended Operating Conditions (1)

Table 6. Recommended Operating Conditions

PARAMETER	MIN	MAX	UNITS
Input Voltage (V_{IN})	4.5	17	V
Ambient Temperature (T_A) (2)	-40	85	degC
Output Current (I_{OUT})	0	2.5	A

Notes:
(1) Device should not be operated outside the operating conditions. The reliability is tested at the maximum voltage of the recommended operating condition. Above of recommended operation may reduce reliability of the device.
(2) See the temperature derating curves in the thermal deratings. However, do not condensate.

Electrical Characteristics (1)

Electrical Characteristics Table

V_{IN} = 12V, V_{OUT} = 5.25V, I_{OUT} = 3.5A, T_A = 25degC, unless otherwise noted

Table 7. Electrical Characteristics Table

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
INPUT SUPPLY							
Input Voltage	V_{IN}			4.5	12	17	V
V_{IN} Under-Voltage Lockout Threshold, V_{IN} Rising	V_{IN_UVH}	V_{OUT} = 1.0V, I_{OUT} = 0A		-	3.6	-	V
V_{IN} Under-Voltage Lockout Threshold, V_{IN} Falling (10)	V_{IN_UVL}	V_{OUT} = 1.0V, I_{OUT} = 0A		-	2.9	-	V
V_{IN} Current Supply, Full load	I_{IN_FULL}	V_{IN} = 12V, V_{OUT} = 5.25V, I_{OUT} = 2.5A		-	1.25	-	A
V_{IN} Current Supply, Switching	I_{IN_SW}	V_{IN} = 12V, V_{OUT} = 5.25V, I_{OUT} = 0A		-	0.5	-	mA
V_{IN} Current Supply, Shutdown	I_{IN_SD}	EN = 0V		-	0.1	-	mA
ENABLE INPUT (ON/OFF PIN)							
Threshold High	V_{TH_ENH}			1	-	V_{IN}	V
Threshold Low	V_{TH_ENL}				OPEN		
				-0.3	-	0.3	V
ON/OFF Pin Input Current	I_{EN}	See Figure 8					
CONVERTER							
Efficiency	EFF	V_{IN} = 12V, V_{OUT} = 5.25V, I_{OUT} = 2.5A		-	88.0	-	%
Fixed Switching Frequency	F_{SW}			-	2500	-	kHz
Start-up Time (V_{IN} ON)	T_{START_UP}	from Vin on to 90% of V_{OUT}		-	1.6	-	ms
Start-up Time (Enable ON)		from Remote on to 90% of V_{OUT}		-	1.6	-	ms
OUTPUT							
Output Current (2)	I_{OUT}			0	-	2.5	A
Output Voltage Range (8)	V_{OUT}			1.0	-	5.25	V
Output Voltage Accuracy	V_{OUT_ACC}	T_A = 25degC	R_{VER} = 0 ohm	5.09	5.25	5.41	V
			R_{VER} = 1.047 ohm	4.85	5.0	5.15	V
			R_{VER} = 14k ohm	3.20	3.3	3.40	V
			R_{VER} = 96.3k ohm	1.45	1.5	1.55	V
			R_{VER} = 382k ohm	0.97	1.0	1.03	V
Line Regulation (13)	V_{OUT_LINE}	V_{IN}=min. to max.		-	±2.0	-	%
Load Regulation (13)	V_{OUT_LOAD}	I_{OUT} = min. to max.		-	±2.0	-	%
Temperature Variation (13)	V_{OUT_TEMP}	-40 ≤ T_A ≤ 85degC		-	±1.0	-	%
Dynamic Load Peak Deviation (13)	V_{OUT_DYN}	V_{OUT} = 1.8V or 4V, I_{OUT} = 50 to 100%, SR = 0.5A/us		-	±3.0	-	%
Ripple and Noise (20MHz bandwidth) (5)	V_{RIP}	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 2.5A		-	15	30	mVp-p
External Output Capacitance Range (9)	C_{OUT}	V_{OUT} ≤ 2.5V		47	-	120	uF
		2.5V < V_{OUT}		20	-	60	uF
PROTECTION							
Over Current Protection Threshold	I_{OCPTH}	V_{IN} = 12V, V_{OUT} = 3.3V, HICCUP operating (4)		-	3.8	-	A
Thermal Protection (7)(12)	T_{OTPTH}	Shutdown operating		-	160	-	degC
Thermal Protection Hysteresis (7)(12)	T_{OTPHYS}			-	20	-	degC
Pre-bias Start-up				Converter will start up if the external output voltage is equal or less than 95% set V_{OUT}.			
ENVIRONMENTAL							
Moisture Sensitivity Level					2		
Calculated MTBF (3)		T_A = 25degC, V_{IN} = 16.0V, V_{OUT} = 1.0V to 5.25V, I_{OUT} = 100%		-	2.16 x10^6	-	hours

Notes

(1) Specifications are typical at +25degC, V_{IN} = typical +12V, V_{OUT} = typical +5.25V, full load, external capacitors and natural convection unless otherwise indicated.
All models are tested and specified with external 47uF x 1 ceramic output capacitors and 10uF x 1 ceramic and plenty electrolytic external input capacitors. All capacitors are low ESR types. These capacitors are necessary to accommodate our test equipment and may not be required to achieve specified performance in your applications. However, Murata recommends installation of these capacitors except from electrolytic external input capacitors.

(2) Note that Maximum Power Derating curves indicate an average current at typical input voltage. At higher temperatures and/or no airflow, the converter will tolerate brief full current outputs if the total RMS current over time does not exceed the Derating curve.

(3) Mean Time Between Failure is calculated using the MIL-HDBK-217F NOTICE 2 method, +25degC, half output load, natural air convection.

(4) “Hiccup” overcurrent operation repeatedly attempts to restart the converter with a brief, full-current output. If the overcurrent condition still exists, the restart current will be removed and then tried again. This short current pulse prevents overheating and damaging the converter. Once the fault is removed, the converter immediately recovers normal operation.

(5) Output noise may be further reduced by adding an external filter.

(6) Regulation specifications describe the deviation as the line input voltage or output load current is varied from a midpoint value to either extreme.

(7) Thermal Protection/Shutdown temperature is measured with the semiconductor in the converter.

(8) Do not exceed maximum power specifications when adjusting the output trim.

(9) The maximum output capacitive loads depend on the Equivalent Series Resistance (ESR) of the external output capacitor and, to a lesser extent, the distance and series impedance to the load. Larger caps will reduce output noise but may change the transient response. Newer ceramic caps with very low ESR may require lower capacitor values to avoid instability. Thoroughly test your capacitors in the application.

(10) Do not allow the input voltage to degrade lower than the input under voltage shutdown voltage at all times. Otherwise, you risk having the converter turn off. The Under-voltage shutdown is not latching and will attempt to recover when the input is brought back into normal operating range.

(11) The outputs are intended to sink appreciable reverse current.

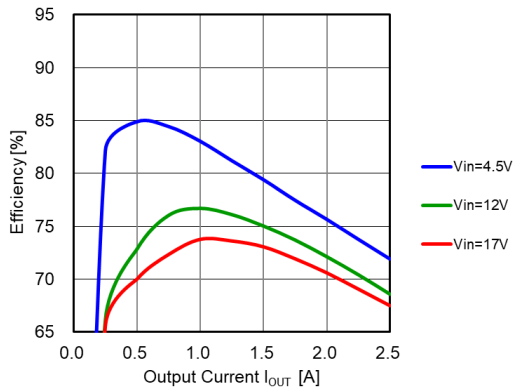
(12) When the temperature decreases below the turn-on threshold, the converter will automatically restart.

(13) Ensured by design. Not production tested.

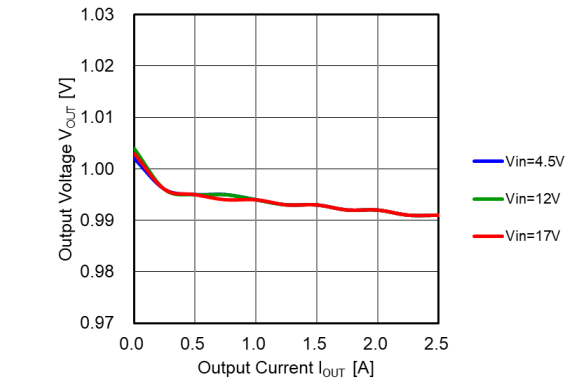
Typical Performance Characteristics

The following data demonstrates the performance of MYLSM00502ERPL.
The test results represent the typical performance of the evaluation board, measured at T_A = 25degC with no airflow unless otherwise noted.

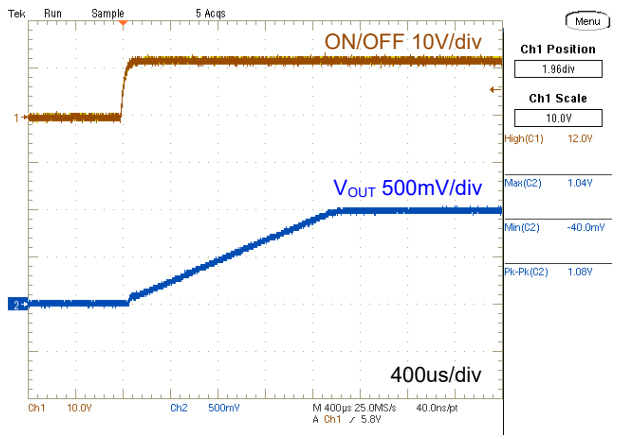
MYLSM00502ERPL V_{OUT} = 1.0V



Efficiency vs. Load Current

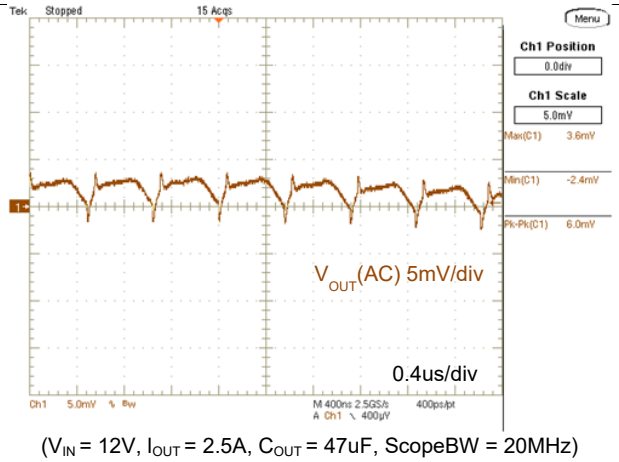


V_{OUT} vs. Load Current



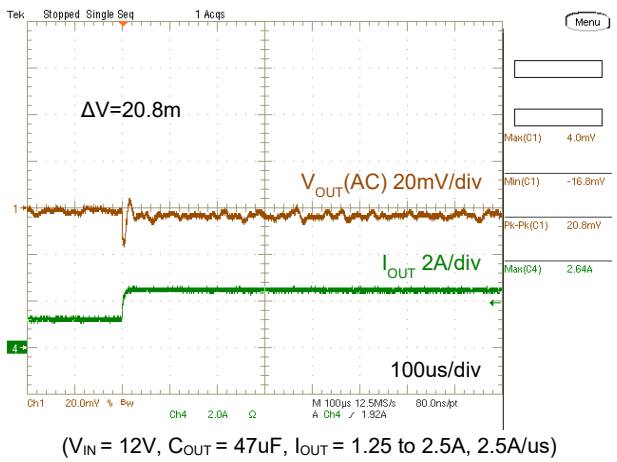
(V_{IN} = 12V, I_{OUT} = 2.5A, C_{OUT} = 47uF)

On/Off Enable Waveform



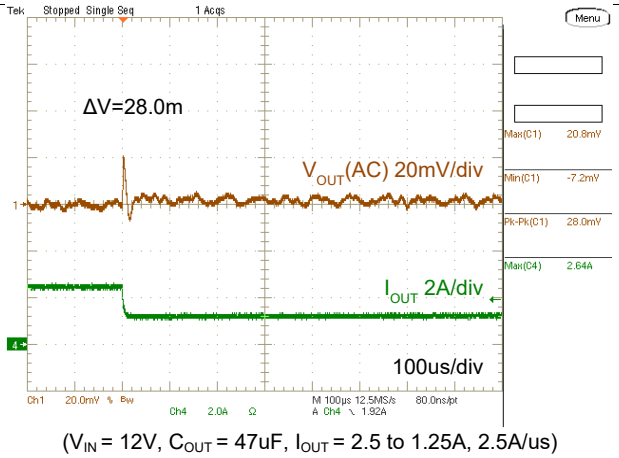
(V_{IN} = 12V, I_{OUT} = 2.5A, C_{OUT} = 47uF, ScopeBW = 20MHz)

Output Ripple and Noise



(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 1.25 to 2.5A, 2.5A/us)

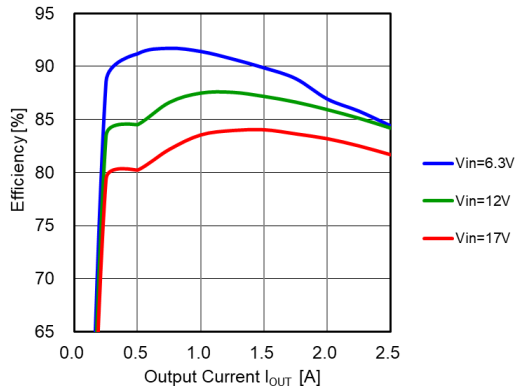
Step Load Transient Response



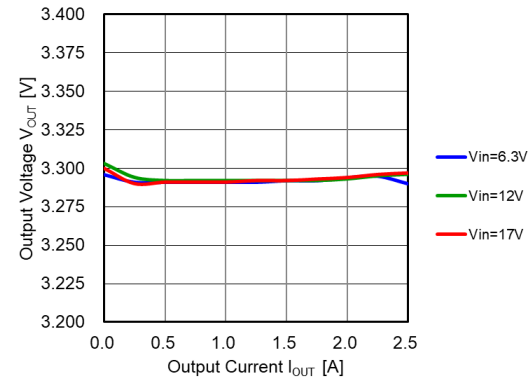
(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 2.5 to 1.25A, 2.5A/us)

Step Load Transient Response

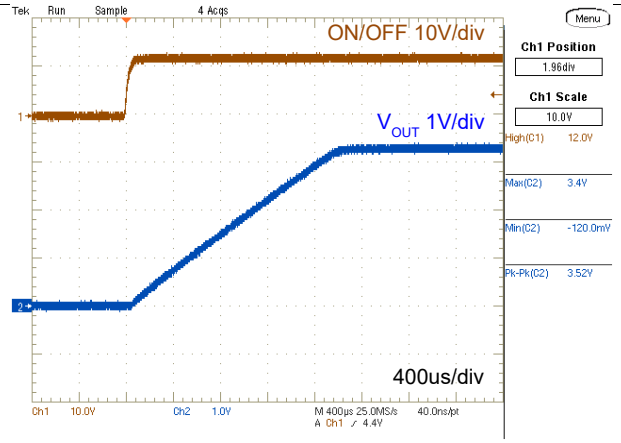
MYLSM00502ERPL V_{OUT} = 3.3V



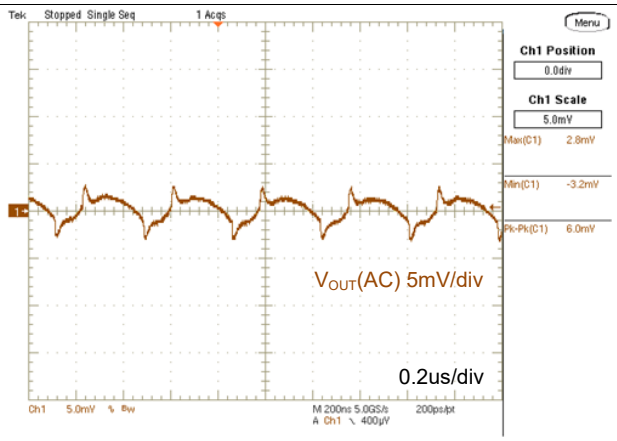
Efficiency vs. Load Current



V_{OUT} vs. Load Current

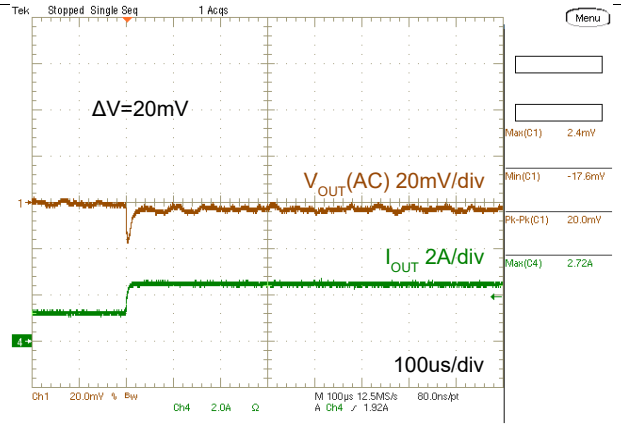


(V_{IN} = 12V, I_{OUT} = 2.5A, C_{OUT} = 47uF)



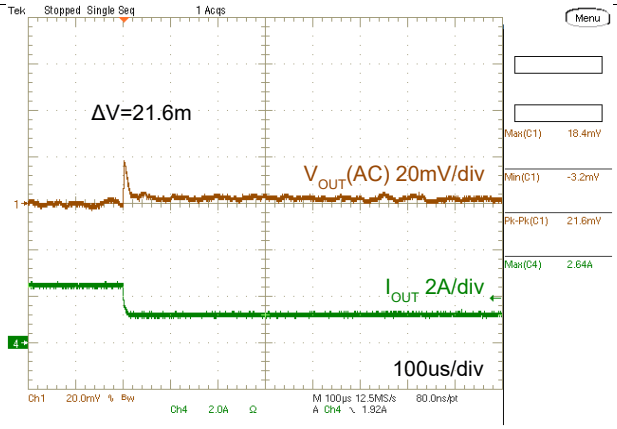
(V_{IN} = 12V, I_{OUT} = 2.5A, C_{OUT} = 47uF, ScopeBW = 20MHz)

On/Off Enable Waveform



(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 1.25 to 2.5A, 2.5A/us)

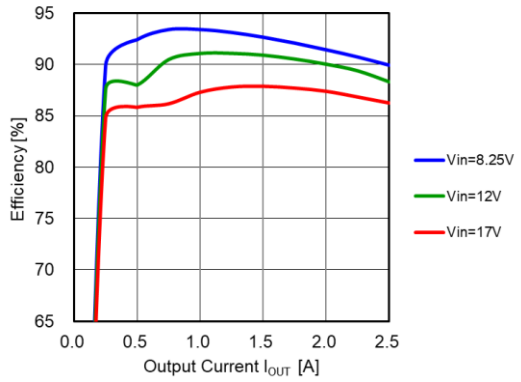
Output Ripple and Noise

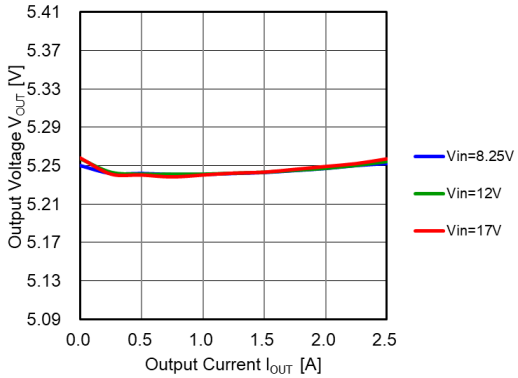


(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 2.5 to 1.25A, 2.5A/us)

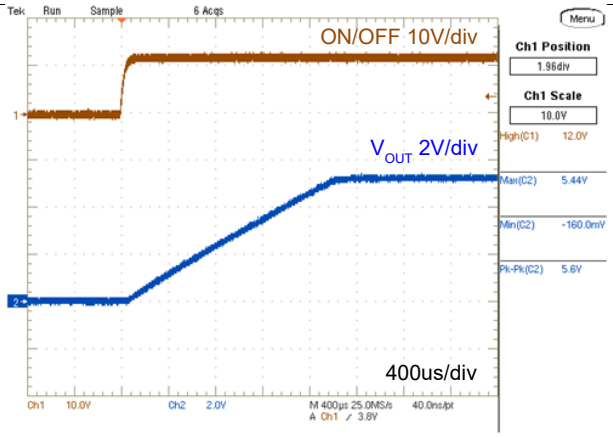
Step Load Transient Response | **Step Load Transient Response**

MYLSM00502ERPL V_{OUT} = 5.25V



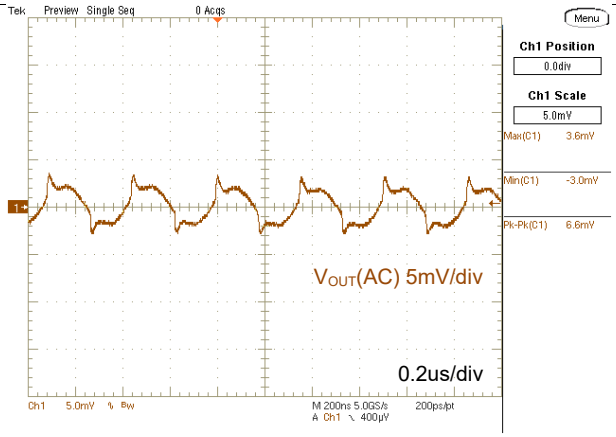


Efficiency vs. Load Current



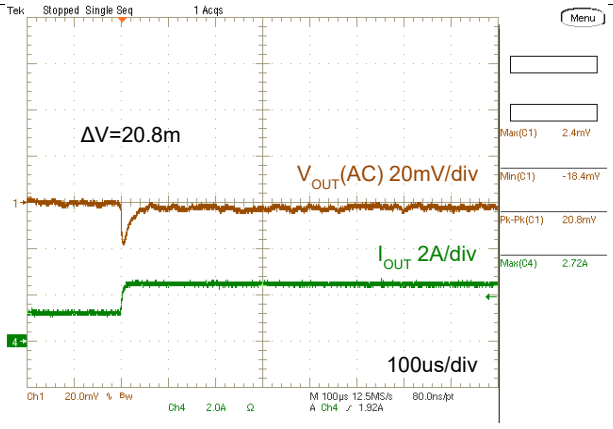
(V_{IN} = 12V, I_{OUT} = 2.5A)

V_{OUT} vs. Load Current



(V_{IN} = 12V, I_{OUT} = 2.5A, C_{OUT} = 47uF, ScopeBW = 20MHz)

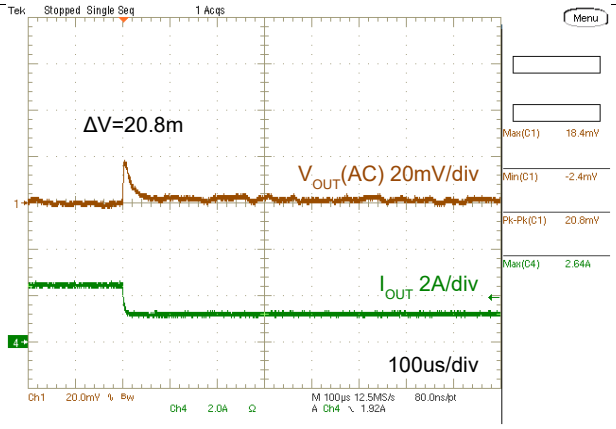
On/Off Enable Waveform



(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 1.25 to 2.5A, 2.5A/us)

Step Load Transient Response

Output Ripple and Noise



(V_{IN} = 12V, C_{OUT} = 47uF, I_{OUT} = 2.5 to 1.25A, 2.5A/us)

Step Load Transient Response

Thermal Deratings (Reference Data)

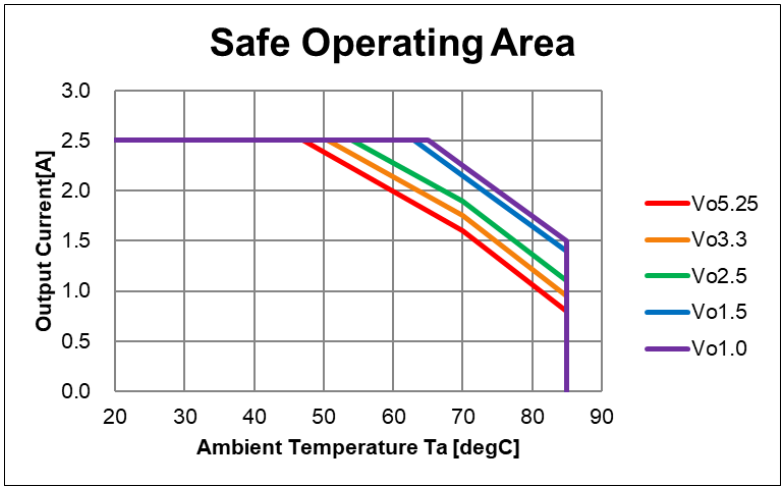


Figure 5. Safe Operating Area

Thermal deratings are evaluated in following conditions.

- Input Voltage is 13.2V.
- The products are mounted on 100mm x 50mmx 1.6mm(4 Layer, 1oz copper each) FR-4 board respectively.

Test Circuit

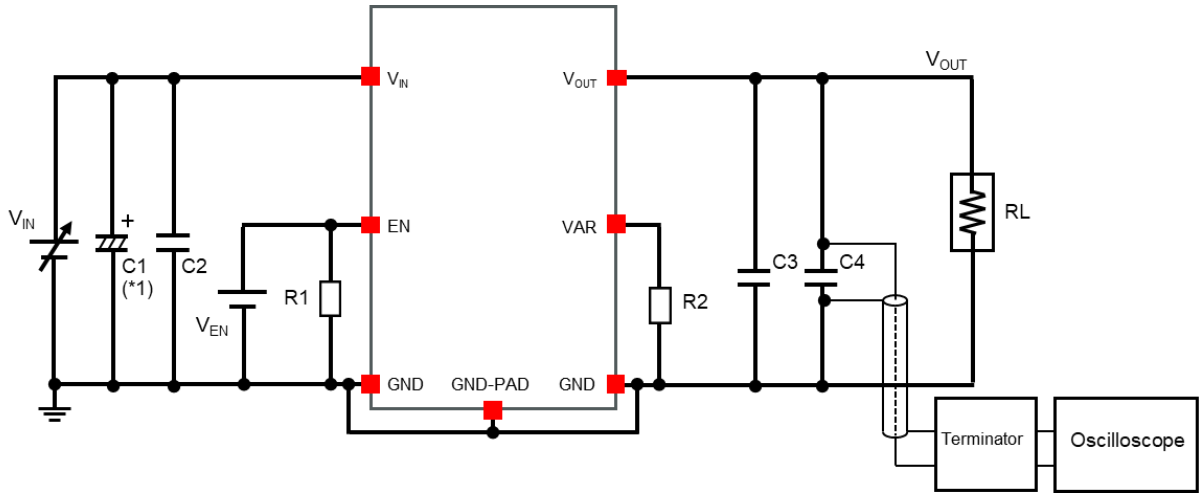


Figure 6. Test Circuit

*1: If there is a non-negligible parasitic impedance between the power supply and the converter, such as during evaluation, the optional input capacitor “C1” may be required to reduce the impedance. The recommended optional capacitor is an example. Please consider the optimum value for the case. This capacitor is usually an aluminum electrolytic type. It is not necessary to place the capacitor near the input terminal of the converter.

Table 8. Test Circuit Part List

REFERENCE	VALUE	DESCRIPTION	PART AND EQUIPMENT
C2	10uF	Input Capacitor Ceramic capacitor, 10uF, 25V, ±10%, X7R	GRM31CR71E106KA12 (Murata)
C3	47uF	Output Capacitor Ceramic capacitor, 47uF, 6.3V, ±10%, X6S	GRM31CC80J476KE18 (Murata)
R1	100k ohm	Chip resistor, 1/10W, ±5%	RK73B1ETTP104J (KOA)
R2	-	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	
C1	50uF/56V	Electrolytic Capacitor (Optional)	
Oscilloscope	-	Digital Oscilloscope	DPO5034 or TDS5034 (Tektronix)
Terminator	-	Terminator	TRC-50F2 (KEISOKU GIKEN)

Detailed Description

Input Under-Voltage Shutdown and Start-Up Threshold

Under normal start-up conditions, converters will not begin regulating properly until the ramping-up input voltage exceeds and remains at the Start-Up Threshold Voltage (see Specifications). Once operating, converters will not turn off until the input voltage drops below the Under-Voltage Shutdown Limit. Subsequent restart will not occur until the input voltage rises again above the Start-Up Threshold. This built-in hysteresis prevents any unstable ON/OFF operation at a single input voltage.

Users should be aware however of input sources near the Under-Voltage Shutdown whose voltage decays as input current is consumed (such as capacitor inputs), the converter shuts off and then restarts as the external capacitor recharges. Such situations could oscillate. To prevent this, make sure the operating input voltage is well above the UV Shutdown voltage at all times.

Start-Up Time

Assuming that the output current is set at the rated maximum, the V_{IN} to V_{OUT} Start-Up Time (see Specifications) is the time interval between the point when the ramping input voltage crosses the Start-Up Threshold and the fully loaded regulated output voltage enters and remains within its specified accuracy band. Actual measured times will vary with input source impedance, external input capacitance, input voltage slew rate and final value of the input voltage as it appears at the converter.

This converter includes a soft start circuit to moderate the duty cycle of its PWM controller at power up, thereby limiting the input inrush current.

The ON/OFF Remote Control interval from ON command to V_{OUT} regulated assumes that the converter already has its input voltage stabilized above the Start-Up Threshold before the ON command. The interval is measured from the ON command until the output enters and remains within its specified accuracy band. The specification assumes that the output is fully loaded at maximum rated current. Similar conditions apply to the ON to V_{OUT} regulated specification such as external load capacitance and soft start circuitry.

Output Noise

The converter is tested and specified for output noise using designated external output components, circuits and layout as shown in the figures below. In the figure below, the two copper strips simulate real-world printed circuit impedances between the power supply and its load. In order to minimize circuit errors and standardize tests between units, scope measurements should be made using BNC connectors or the probe ground should not exceed one half inch and soldered directly to the test circuit.

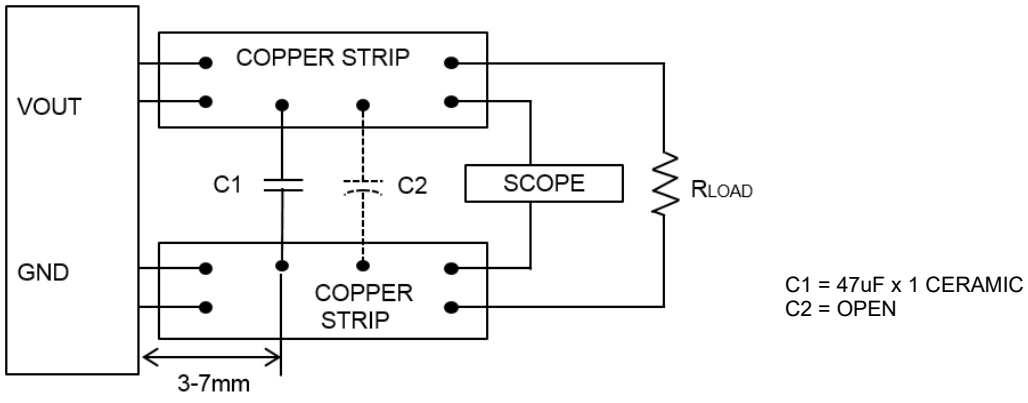


Figure 7. Circuits and Layout

Minimum Output Loading Requirements

The converters regulate within specification and are stable under no load to full load conditions. Operation under no load might slightly increase output ripple and noise.

Thermal Shutdown

To prevent many over temperature problems and damage, the converters include thermal shutdown circuitry. If environmental conditions cause the temperature of the converter to rise above the Operating Temperature Range up to the shutdown temperature, an on-board electronic temperature sensor will shut down the unit. When the temperature decreases below the turn-on threshold, the converter will automatically restart.
CAUTION: If you operate too close to the thermal limits, the converter may shut down suddenly without warning. Be sure to thoroughly test your application to avoid unplanned thermal shutdown.

Temperature Derating Curves

The graph in this datasheet illustrates typical operation under a variety of conditions. The derating curves show the maximum continuous ambient air temperature. Note that these are AVERAGE measurements.
Note that the temperatures are of the ambient airflow, not the converter itself which is obviously running at higher temperature than the outside air. Also note that very low flow rates (below about 25 LFM) are similar to “natural convection,” that is, not using fan-forced airflow. Murata uses both thermocouples and an infrared camera system to observe thermal performance.
CAUTION: The graph is collected at slightly above Sea Level altitude. Be sure to reduce the derating for higher density altitude.

Output Current Limiting

Current limiting inception is defined as the point at which full power falls below the rated tolerance. See the Performance/Functional Specifications. Note particularly that the output current may briefly rise above its rated value in normal operation as long as the average output power is not exceeded. This enhances reliability and continued operation of your application. If the output current is too high, the converter will enter the short circuit condition.

Output Short Circuit Condition

The module provides protection against heavy load and output short circuit conditions. When the output current reaches the current limit threshold, the converter enters over-current protection mode, and the output voltage gradually decreases as the load current demand increases.
If the output voltage drops to approximately 0.5V or below, the converter enters short circuit protection mode, where the output current is further limited. If the short circuit condition persists, the converter periodically attempts to restart after a timeout period and ramps the output voltage up again. If the short circuit condition remains, the protection cycle repeats. This repetitive ON/OFF operation is referred to as “hiccup mode.”
Hiccup mode reduces the average output current, thereby preventing excessive internal temperature rise and protecting the module from component damage. As a result, continuous short circuit conditions can be tolerated indefinitely.
When the heavy load or short circuit condition is removed and the output voltage recovers above approximately 0.5V, the module automatically returns to normal operation. Unlike latch-type protection systems, no input power reset is required for recovery.

Enable (ON/OFF)

Please refer to the Connection Diagram on page 1 for EN connections.
Positive logic models are enabled when the EN pin is pulled high to +Vin with respect to -Vin.
The pin is internally connected to GND through a resistor. Positive-polarity devices are disabled when it is grounded or is left open.
Dynamic control of the EN function should be able to sink appropriate signal current when brought low and withstand appropriate voltage when brought high.
Be aware that there is a finite time in microseconds (approximately 50usec) between the time of EN Control activation and stable, regulated output. The time will vary slightly with output load type and current and input conditions.

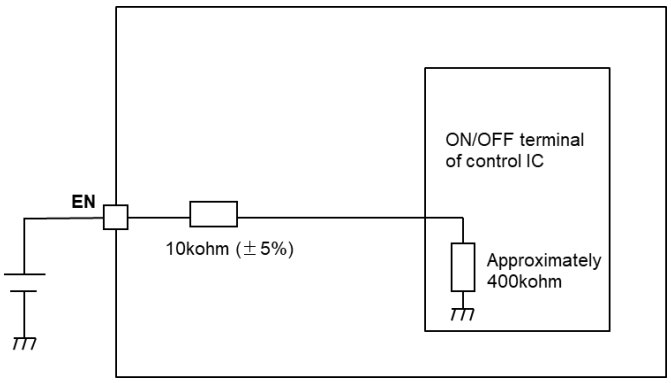


Figure 8. ON/OFF Internal Circuit Diagram

Table 9. ON/OFF Control

OUTPUT	ON/OFF PIN
ON	H
OFF	OPEN
	L

Output Capacitive Load

Users should only consider adding capacitance to reduce switching noise and/or to handle spike current load steps. Install only enough capacitance to achieve noise objectives. Excess external capacitance may cause regulation problems, degraded transient response and possible oscillation or instability.

Output Voltage Adjustment

The output voltage can be adjusted within a specified range by connecting an external VAR resistor (V_{VAR}) between the VAR pin and GND pin. The R_{VAR} resistor must be a 1/10W precision metal film type, ±0.5% accuracy (or better) with low temperature coefficient, ±100 ppm/ degC or better. Mount the resistor close to the converter with very short leads or use a surface mount trim resistor.
In the table below, the estimated resistance is given at limited condition; V_{IN}: typ., T_A: 25degC, I_{OUT}: max., C_{OUT}: 47uF. (Please look at Test Circuit which is shown below).

*Determine the R_{TRIM} value using following formula.

R_{VAR} [kohm] = 80 / (V_{OUT} – 0.8) – 18

Table10. R_{VAR} Calculation Example

OUTPUT VOLTAGE [V]	ESTIMATED RTRIM [kohm]
	MYLSM00502ERPL
1.0	382
1.5	96.3
3.3	14
5.0	1.047
5.25	0

CAUTION

Do not exceed the specified limits of the output voltage or the converter's maximum power rating when applying these resistors. Also, avoid high noise at the VAR input. However, to prevent instability, you should never connect any capacitors between VAR pin and GND pin.

Please observe the limits below for voltage input and output ranges.

$V_{IN} > V_{OUT}+3.0$

The limits apply at all output currents
(Ta = 25degC).

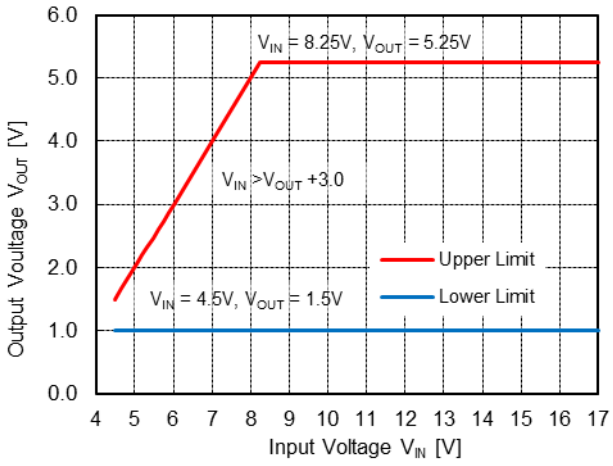


Figure 9. Output Voltage Range

Application Information

Application Circuit & Part List

Examples of the standard components are shown in Table 14 and Table 15. Components must be chosen referring to the system requirements like Voltage, Temperature, etc.

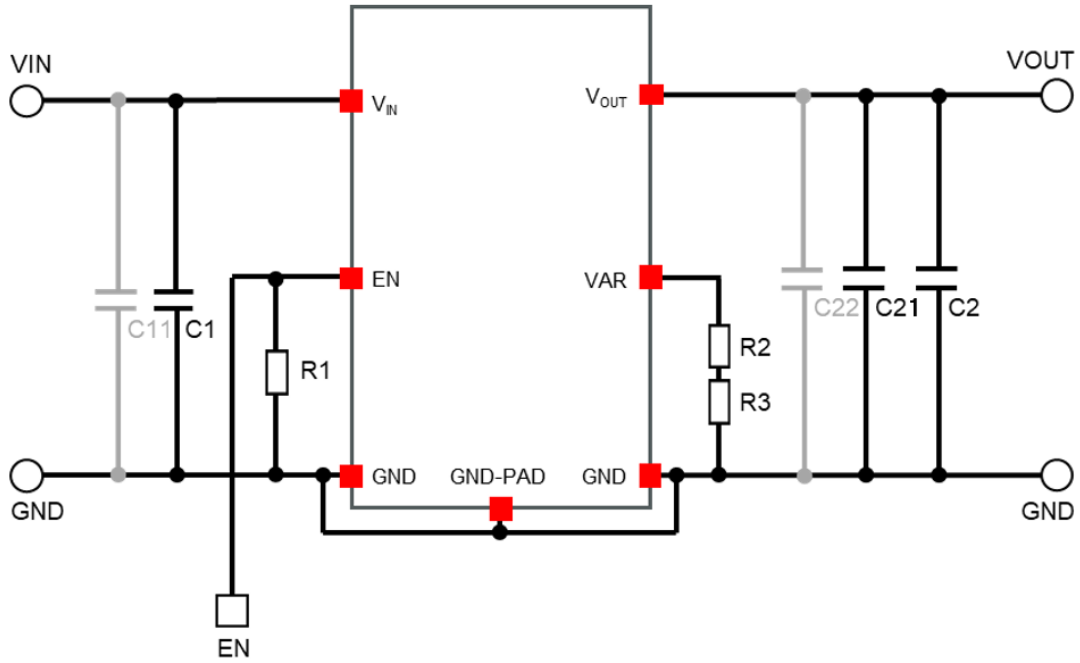
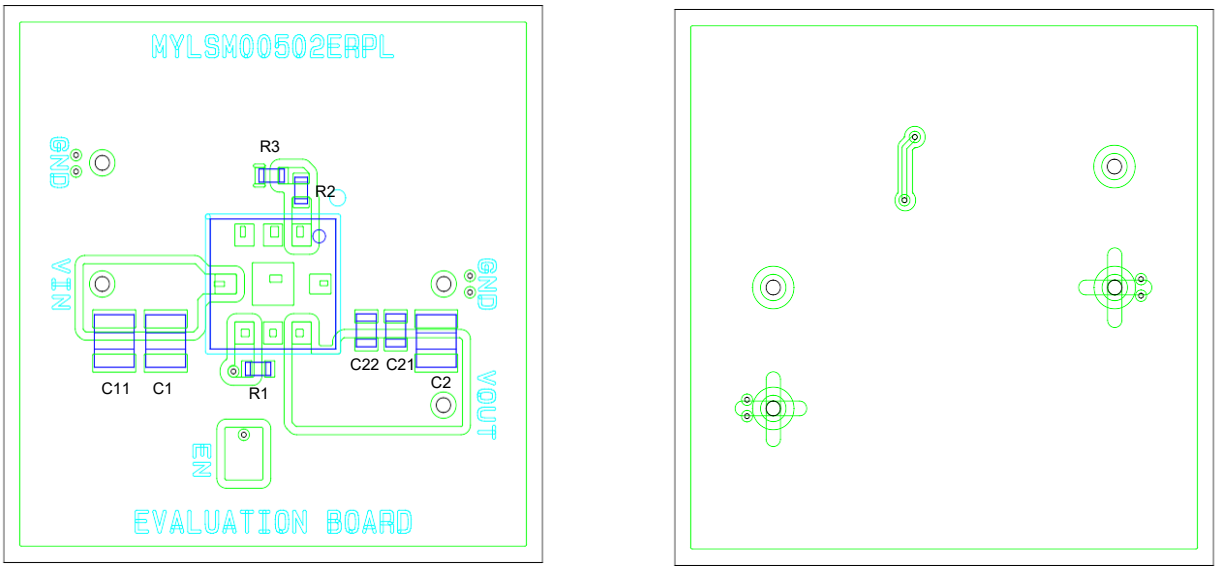


Figure 10. Application Circuit

Table 11. Application Circuit Part List

REFERENCE	VALUE	DESCRIPTION	PART AND EQUIPMENT
C1	10uF	Input Capacitor Ceramic capacitor, 10uF, 25V, ±10%, X7R	GRM31CR71E106KA12 (Murata)
C2	47uF	Output Capacitor Ceramic capacitor, 47uF, 6.3V, ±10%, X6S	GRM31CC80J476KE18 (Murata)
C21	0.1uF	Output Capacitor Ceramic capacitor, 0.1uF, 50V, ±10%, R Ceramic capacitor, 0.1uF, 50V, ±10%, X7R	GRM21BR11H104KA01 (Murata) GRM155R71H104KE14 (Murata)
R1	100k ohm	Chip resistor, 1/10W, ±5%	RK73B1ETTP104J (KOA)
R2, R3	-	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	
C11, C22		OPEN	

Example of Pattern Layout



Top View Bottom view

Figure 11. Example of Pattern Layout (Top View)

Application Board Example

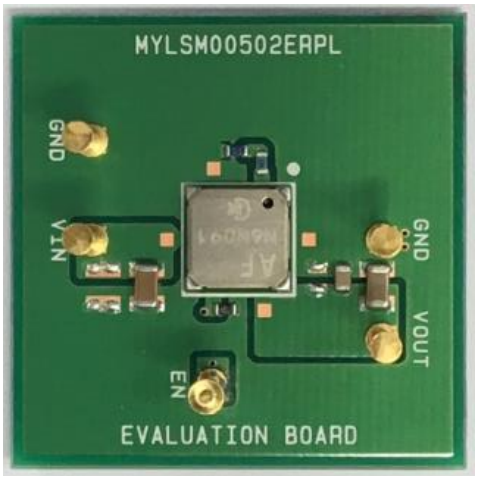


Figure 12. Application Board Example

Component Selection

Input Fuse

Certain applications and/or safety agencies may require fuses at the inputs of power conversion components. Fuses should also be used when there is the possibility of sustained input voltage reversal which is not current limited. For greatest safety, we recommend a fast blow fuse installed in the ungrounded input supply line. The installer must observe all relevant safety standards and regulations. For safety agency approvals, install the converter in compliance with the end-user safety standard.

Recommended Input Filtering

The user must assure that the input source has low AC impedance to provide dynamic stability and that the input supply has little or no inductive content, including long distributed wiring to a remote power supply. For best performance, we recommend installing a low-ESR capacitor immediately adjacent to the converter's input terminals.
The capacitor should be a ceramic type such as the Murata GRM31 series or GRM21 series and an electrolytic type such as Panasonic OS-CON series. Initial suggested capacitor values are 10uF ceramic type, rated at twice the expected maximum input voltage. Make sure that the input terminals do not go below the under voltage shutdown voltage at all times. More input bulk capacitance may be added in parallel (either electrolytic or tantalum) if needed.

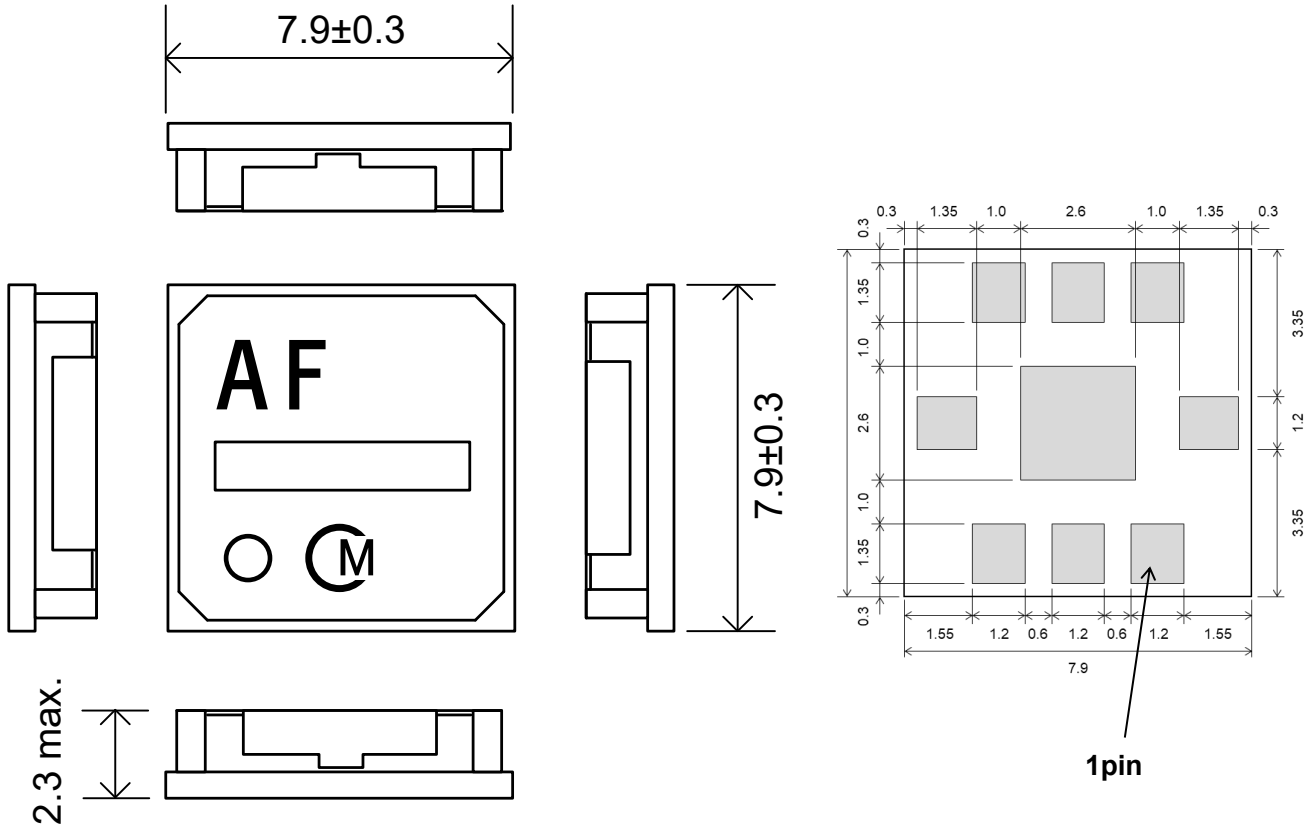
Recommended Output Filtering

The converter will achieve its rated output ripple and noise with additional external capacitor. The user may install more external output capacitance reduce the ripple even further or for improved dynamic response. Again, use low-ESR ceramic. Initial suggested capacitor values are 47uF(V_{OUT}≤2.5V) or 20uF(V_{OUT}>2.5V) ceramic type. Mount these close to the converter. Measure the output ripple under your load conditions.
Use only as much capacitance as required to achieve your ripple and noise objectives. Excessive capacitance can make step load recovery sluggish or possibly introduce instability. Do not exceed the maximum rated output capacitance listed in the specifications.

Packaging Information

This section provides packaging data including the moisture sensitivity level, package drawing, package marking and tape-and-reel information.

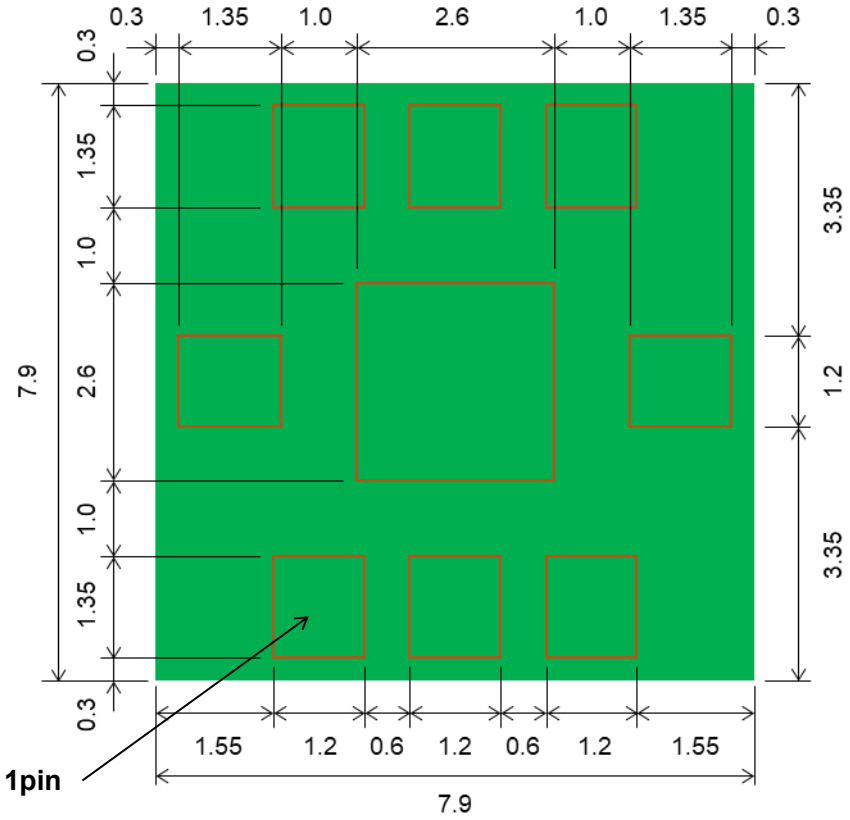
Package Drawing



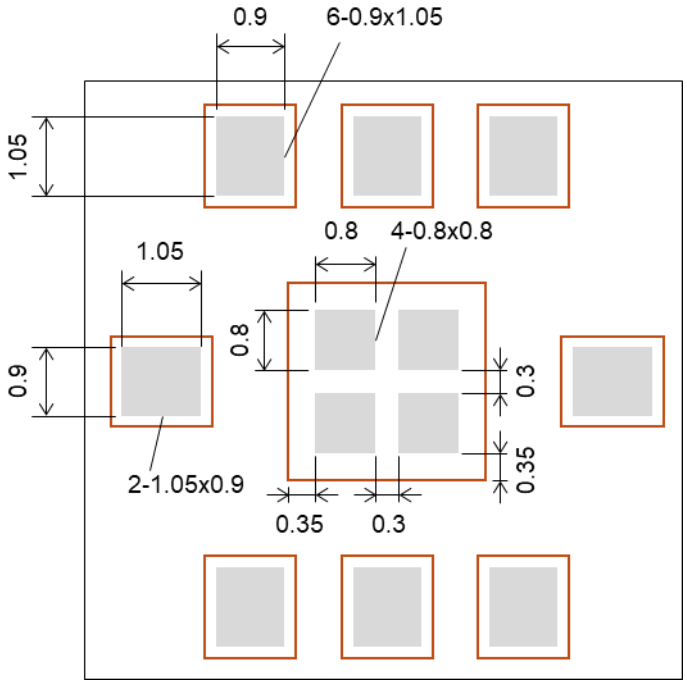
Top View / Side View **Bottom View**

Figure 13. Package Outline Drawing

Recommended Board Land Pattern (Top View)



(a) Board Land Pattern

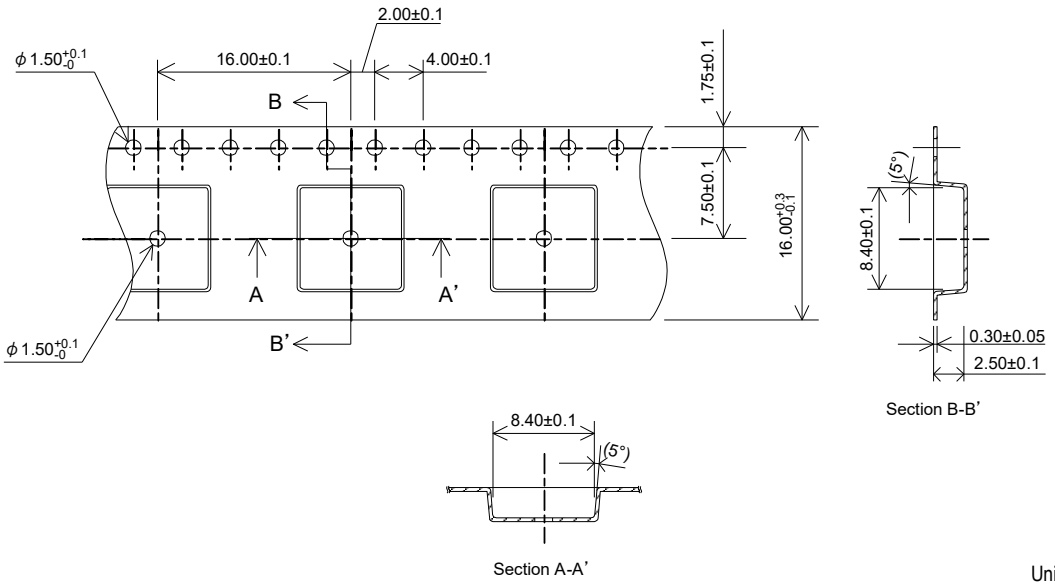


Solder thickness:120um (Ref.)
(b) Metal Mask Design

Figure 14. Recommended Board Pattern (Top View)

Tape and Reel Information

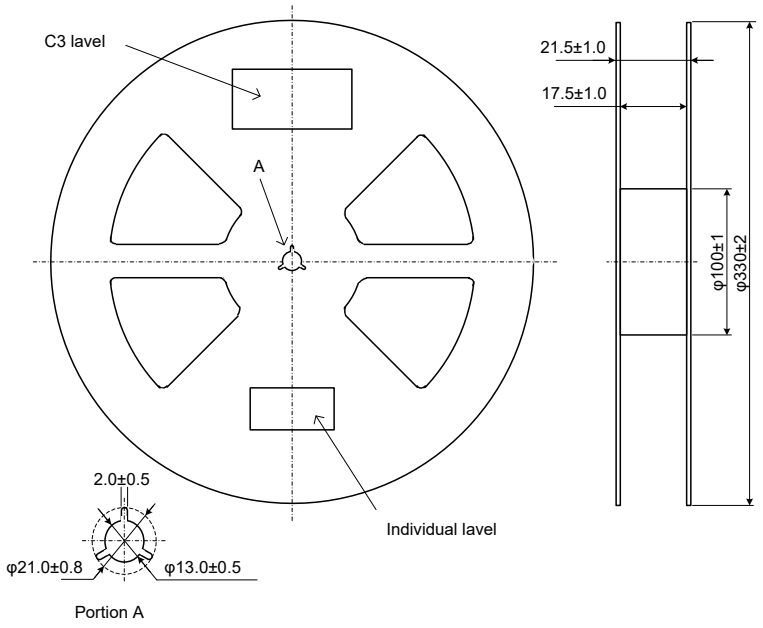
Tape Dimension



Unit: mm

Figure 15. Tape Dimension

Reel Dimension



Unit: mm

Figure 16. Reel Dimension

Tape Specifications

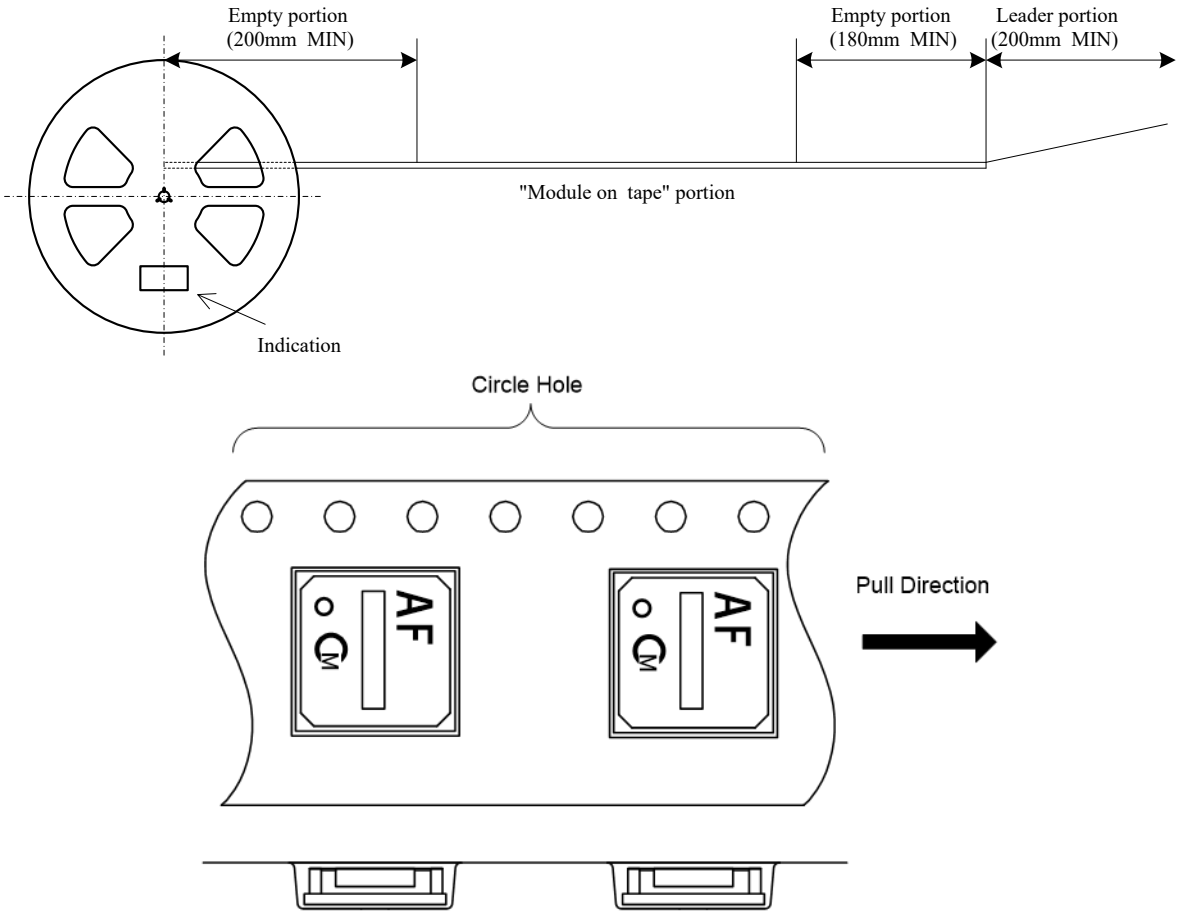


Figure 17. Tape Specifications

Notes
1. The adhesive strength of the protective tape must be within 0.1-1.3N.
2. Each reel contains the quantities such as the table below.
3. Each reel is set in moisture-proof packaging because of MSL 2.
4. No vacant pocket in “Module on tape” section.
5. The reel is labeled with Murata part number and quantity.
6. The color of reel is not specified.

Part Number	QTY
MYLSM00502ERPL	1000

Soldering Guidelines

Murata recommends the specifications below when installing these converters. These specifications vary depending on the solder type.
Exceeding these specifications may cause damage to the product. Your production environment may differ therefore please thoroughly review these guidelines with your process engineers.
This product can be reflowed once.

Table 12. Reflow Solder Operations for Surface-Mount Products

For Sn/Ag/Cu BASED SOLDERS	
Preheat Temperature	Less than 1degC per second
Time Over Liquidus.	30 to 75 seconds
Maximum Peak Temperature	250degC
Cooling Rate	Less than 1degC per second

Recommended Lead-free Solder Reflow Profile

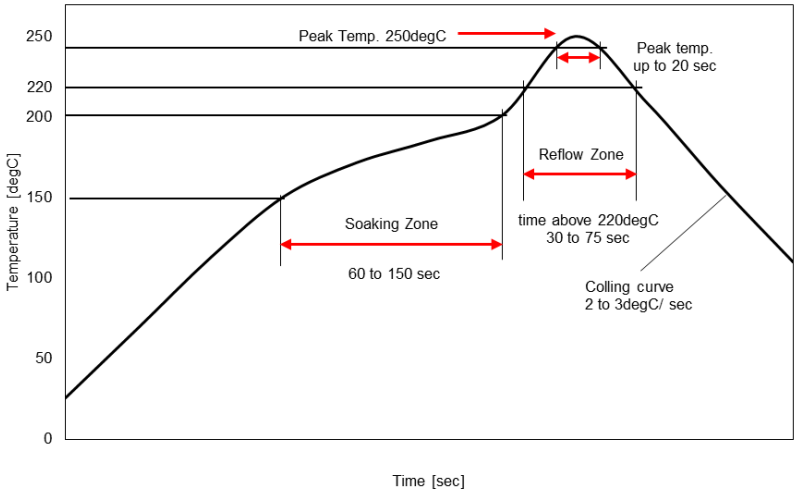


Figure 18. Recommended Lead-free Solder Reflow Profile

Pb-free Solder Processes

For Pb-free solder processes, the product is qualified for MSL 2 according to IPC/JEDEC standard J-STD-020D.
During reflow PRODUCT must not exceed 250degC at any time.

Dry Pack Information

Products intended for Pb-free reflow soldering processes are delivered in standard moisture barrier bags according to IPC/JEDEC standard J-STD-033.
(Handling, packing, shipping and use of moisture/reflow sensitivity surface mount devices.)
Using products in high temperature Pb-free soldering processes requires dry pack storage and handling. In case the products have been stored in an uncontrolled environment and no longer can be considered dry, the modules must be baked according to J-STD-033.

Revision History

VERSION	DATE	MODIFICATION	PAGE
B01	SEP-2017	New document	
B02	JAN-2019	Added Product Liability-related statements Updated marking notation Updated recommended capacitors Updated external appearance image	
B03	JAN-2025	Updated FUNCTIONAL SPECIFICATIONS：OUTPUT Updated SPECIFICATIONS NOTES Updated Output Over Current Circuit Protection	p.3 p.3 p.12
B04	JUN-2026	Added Storage Updated documentation content	p.27 -

Notices

Scope

This datasheet is applied to MYLSM00502ERPL.
- Specific applications: Consumer Electronics, Industrial Equipment

⚠ CAUTION

Limitation of Applications

The products listed in the datasheet (hereinafter the product(s) is called the “Product(s)”) are designed and manufactured for applications specified in the specification or the datasheet. (hereinafter called the “Specific Application”). We shall not warrant anything in connection with the Products including fitness, performance, adequateness, safety, or quality, in the case of applications listed in from (1) to (11) written at the end of this precautions, which may generally require high performance, function, quality, management of production or safety. Therefore, the Product shall be applied in compliance with the specific application.

We disclaim any loss and damages arising from or in connection with the products including but not limited to the case such loss and damages caused by the unexpected accident, in event that (i) the product is applied for the purpose which is not specified as the specific application for the product, and/or (ii) the product is applied for any following application purposes from (1) to (11) (except that such application purpose is unambiguously specified as specific application for the product in our catalog specification forms, datasheets, or other documents officially issued by us*).

(1) Aircraft equipment
(2) Aerospace equipment
(3) Undersea equipment
(4) Power plant control equipment
(5) Medical equipment
(6) Transportation equipment (such as vehicles, trains, ships)
(7) Traffic control equipment
(8) Disaster prevention / crime prevention equipment
(9) Industrial data-processing equipment
(10) Combustion/explosion control equipment
(11) Application of similar complexity and/or reliability requirements to the applications listed in the above

For exploring information of the Products which will be compatible with the particular purpose other than those specified in the datasheet, please contact our sales offices, distribution agents, or trading companies with which you make a deal, or via our web contact form.
Contact form: https://www.murata.com/contactform
*We may design and manufacture particular Products for applications listed in (1) to (11). Provided that, in such case we shall unambiguously specify such Specific Application in specification or datasheet without any exception. Therefore, any other documents and/or performances, whether exist or non-exist, shall not be deemed as the evidence to imply that we accept the applications listed in (1) to (11).

Storage

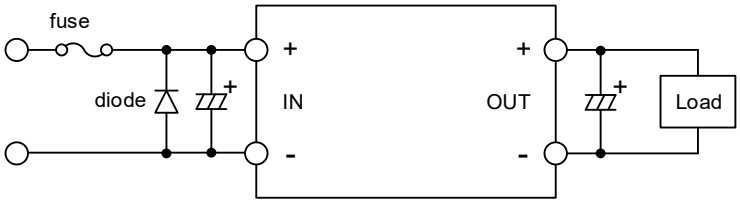
Please store the products in room where direct sunlight cannot come in and use the products within 6 months after delivery
and maintain an appropriate storage condition using the following conditions.
- A temperature is +5 degC to +40 degC and a relative humidity is 20% to 70% as a standard condition. The temperature recommendation is less than 30 degC.
- If the storage period exceeds six months, check packaging, mounting, etc. before use.
- In addition, this may cause oxidation of the electrodes. If more than one year has elapsed since delivery, also check the solderability before use.
- Please do not store the products in the places such as : in a dusty place, in a place exposed directly to sea breeze, in an atmosphere containing corrosive gas (Cl_2, NH_3, SO_2, NO_X and so on).

This product is MSL2.
After opening bags, please store the products under maximum condition of 30degC, 60%RH and use the products within 1 year.
If the MSL floor life exceeds, it is recommended to proceed baking under the following conditions.
- 125 +10/-0 degC, 5 hours (for product)
- 40 degC, 5 %RH, 8 days (for reel packing or tray)

Fail-Safe Function

Be sure to add an appropriate fail-safe function to your finished product to prevent secondary damage in the unlikely event of an abnormality function or malfunction in our product.

Please connect the input terminal by right polarity. If you mistake the connection, it may break the DC-DC converter. In the case of destruction of the DC-DC converter inside, over input current may flow. Please add a diode and fuse as following to protect them.



Please select diode and fuse after confirming the operation.

Figure 19. Circuit example with a diode and fuse

⚠ Note

1. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
2. You are requested not to use our product deviating from the reference specifications.
3. If you have any concerns about materials other than those listed in the RoHS directive, please contact us.
4. Please don't wash this product under any conditions.

Product Specification

Product Specifications in this datasheet are as of June 2026. Specifications and features may change in any manner without notice. Please check with our sales representatives.

Contact Form

https://www.murata.com/contactform?Product=Power%20Device

Disclaimers

The information described in this datasheet was carefully crafted for accuracy. However this product is based on the assumption that it will be used after thoroughly verifying and confirming the characteristics and system compatibility. Therefore, Murata is not responsible for any damages caused by errors in the description of the datasheet.

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The buyer of this product and developer of systems incorporating this product must analyze, evaluate, and make judgements at their own risk in designing applications using this product. The buyer and the developer are responsible for verifying the safety of this product and the applications, and complying with all applicable laws, regulations, and other requirements.

Furthermore, the buyer and developer are responsible for predicting hazards and taking adequate safeguards against potential events at your own risk in order to prevent personal accidents, fire accidents, or other social damage. When using this product, perform thorough evaluation and verification of the safety design designed at your own risk for this product and the application.

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