

FEATURES:

- High Density Power Module
- 600mA Output Current
- Input Voltage Range from 2.7V to 5.5V
- Fixed Output Voltage
- 100% Maximum Duty Cycle with Low Dropout
- Enable Function
- Automatic Power Saving/PWM Mode
- Protections (UVLO, OCP: Non-latching)
- Internal Soft Start
- Compact Size: 2.5mm*2.0mm*1.1mm
- Pb-free for RoHS compliant
- MSL 2, 260C Reflow

APPLICATIONS:

- Single Li-Ion Battery-Powered Equipment
- LDOs Replacement
- Cell phone / PDAs / Palmtops

GENERAL DESCRIPTION:

The MUN3C1XR6-SB power module series is non-isolated dc-dc converters that can deliver up to 600mA of output current. The PWM switching regulator, high frequency power inductor are integrated in one hybrid package. It needs input and output capacitor only and no additional feedback circuit.

The MUN3C1XR6-SB power module series has automatic operation with PWM mode and power saving mode according to loading. Other features include remote enable function, internal soft-start, non-latching over current protection, and input under voltage locked-out capability.

The low profile and compact size package (2.5mm × 2.0mm × 1.1mm) is suitable for automated assembly by standard surface mount equipment. The MUN3C1XR6-SB power module is Pb-free and RoHS compliance.

TYPICAL APPLICATION CIRCUIT & PACKAGE:

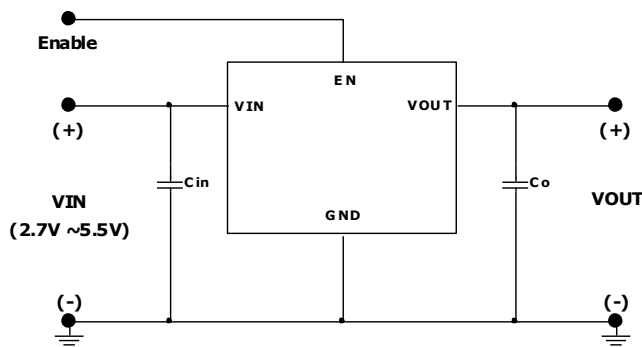


FIGURE 1 TYPICAL APPLICATION CIRCUIT

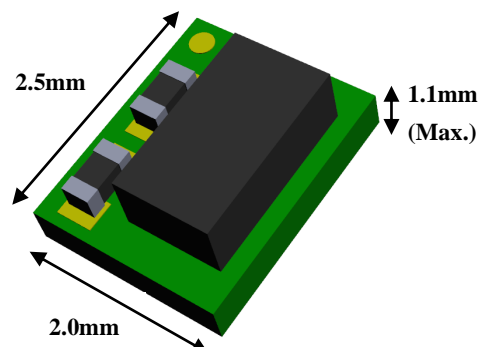


FIGURE 2 HIGH DENSITY LOW PROFILE
uPOL MODULE

ORDERING INFORMATION:

CAUTION: These devices have limited built-in ESD protection. The leads should be shorted together or the devices placed in conductive foam during the storage or handling to prevent electrostatic damage to internal circuit.

PART NUMBER	OUTPUT VOLTAGE	MARKING (Code: X)	ORDERING	QUANTITY
MHUN3C1BR6-SB	1.2V	B	MUN3C1BR6-SB	2000
MHUN3C1CR6-SB	1.25V	C	MUN3C1CR6-SB	2000
MHUN3C1DR6-SB	1.35V	D	MUN3C1DR6-SB	2000
MHUN3C1ER6-SB	1.5V	E	MUN3C1ER6-SB	2000
MHUN3C1HR6-SB	1.8V	H	MUN3C1HR6-SB	2000

ELECTRICAL SPECIFICATIONS:

CAUTION: Do not operate at or near absolute maximum rating listed for extended periods of time. This stress may adversely impact product reliability and result in failures outside of warranty.

Parameter	Description	Min.	Typ.	Max.	Unit
■ Absolute Maximum Ratings					
VIN to GND		-	-	+6.0	V
VOU to GND		-	-	+6.0	V
EN to GND		-	-	VIN+0.3	V
Tc	Case Temperature of Inductor	-	-	+110	°C
Tj	Junction Temperature	-40	-	+150	°C
Tstg	Storage Temperature	-40	-	+125	°C
ESD Rating	Human Body Model (HBM)	-	-	2k	V
	Machine Model (MM)	-	-	200	V
	Charge Device Model (CDM)	-	-	1k	V
■ Recommendation Operating Ratings					
VIN	Input Supply Voltage	+2.7	-	+5.5	V
Ta	Ambient Temperature	-40	-	+85	°C
■ Thermal Information					
Rth(jchoke-a)	Thermal resistance from junction to ambient. (Note 1)	-	55	-	°C/W

NOTES:

1. Rth(jchoke-a) is measured with the component mounted on an effective thermal conductivity test board on 0 LFM condition. The test board size is 30mm×30mm×1.6mm with 2 layers. The test condition is compliant with JEDEC EIJ/JESD 51 Standards.

ELECTRICAL SPECIFICATIONS: (Cont.)

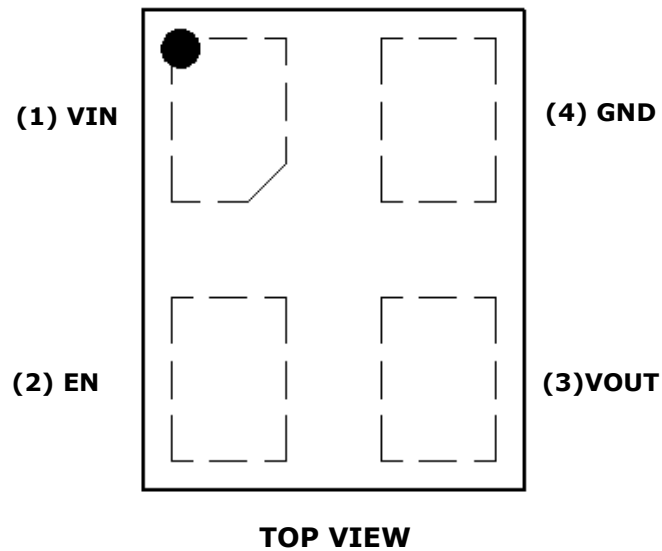
Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, $V_{in} = 3.3\text{V}$, $C_{in} = 4.7\mu\text{F}/6.3\text{V}/0603$, $C_{out} = 10\mu\text{F}/6.3\text{V}/0402$ unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
■ Input Characteristics						
$I_{SD(IN)}$	Input shutdown current	$V_{in} = 3.3\text{V}$, V_{in} connected EN by 100K ohm EN = GND	-	-	-	uA
		Vout=1.2 V	-	0.1	-	
		Vout=1.25 V		0.1		
		Vout=1.35 V	-	0.1	-	
		Vout=1.5 V	-	0.1	-	
		Vout=1.8 V	-	0.1	-	
$I_{Q(IN)}$	Input supply bias current	$V_{in} = 3.3\text{V}$, $I_{out} = 0\text{A}$ EN = VIN	-	-	-	uA
		Vout=1.2 V	-	50	-	
		Vout=1.25 V		52		
		Vout=1.35 V	-	56	-	
		Vout=1.5 V	-	60	-	
		Vout=1.8 V	-	70	-	
$I_{S(IN)}$	Input supply current	$V_{in} = 3.3\text{V}$, EN = VIN $I_{out} = 5\text{mA}$	-	-	-	mA
		Vout=1.2 V	-	2.2	-	
		Vout=1.25 V		2.3		
		Vout=1.35 V	-	2.5	-	
		Vout=1.5 V	-	2.7	-	
		Vout=1.8 V	-	3.2	-	
		$V_{in} = 3.3\text{V}$, EN = VIN $I_{out} = 600\text{mA}$	-	-	-	mA
		Vout=1.2 V	-	285	-	
		Vout=1.25 V		298		
		Vout=1.35 V	-	310	-	
		Vout=1.5 V	-	340	-	
		Vout=1.8 V	-	400	-	

ELECTRICAL SPECIFICATIONS: (Cont.)

Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, $V_{in} = 3.3\text{V}$, $C_{in} = 4.7\mu\text{F}/6.3\text{V}/0603$, $C_{out} = 10\mu\text{F}/6.3\text{V}/0603$ unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
■ Output Characteristics						
$I_{OUT(DC)}$	Output continuous current range	$V_{in}=3.3\text{V}$	0	-	600	mA
$V_{O(SET)}$	Output Voltage Set Point	$V_{in}=3.3\text{V}$	-3.0	-	+3.0	% $V_{O(SET)}$
$\Delta V_{OUT} / \Delta V_{IN}$	Line regulation accuracy	$V_{in} = 3.3\text{V to } 5\text{V}$ $I_{out} = 0\text{A}$ $I_{out} = 600\text{mA}$	-	-	1	% $V_{O(SET)}$
$\Delta V_{OUT} / \Delta I_{OUT}$	Load regulation accuracy	$I_{out} = 0\text{A to } 600\text{mA}$ $V_{in} = 3.3\text{V}$	-	1.5	-	% $V_{O(SET)}$
$C_{OUT(MAX)}$	Maximum capacitive load	$I_{out} = 600\text{mA}$, $ESR \geq 1\text{ m}\Omega$	-	-	22	μF
■ Control Characteristics						
F_{OSC}	Oscillator frequency	PWM Operation	-	3.0	-	MHz
V_{EN_TH}	Enable rising threshold voltage		1.5	-	-	V
	Enable falling threshold voltage		-	-	0.4	V
■ Fault Protection						
V_{UVLO_TH}	Input under voltage lockout threshold	Falling	-	-	2.5	V
T_{OTP}	Over temp protection		-	160	-	$^{\circ}\text{C}$
I_{LIMIT_TH}	Current limit threshold	Peak value of inductor current,	1.3		2.5	A

PIN CONFIGURATION:

PIN DESCRIPTION:

Symbol	Pin No.	Description
VIN	1	Power input pin. It needs to be connected to input rail with input capacitor. A 4.7uF capacitor at least for input.
EN	2	On/Off control pin for module. EN = LOW, the module is off. EN = HIGH, the module is on.
VOUT	3	Power output pin. Connect to output for the load with output capacitor. A 10uF capacitor at least for output.
GND	4	Power ground pin for signal, input, and output return path. This pin needs to be connected to one or more ground plane directly. Connect to thermal exposed pad of GND for heat transferring.

TYPICAL PERFORMANCE CHARACTERISTICS: (1.2VOUT)

Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified. Test Board Information: 30mm×30mm×1.6mm, 2 layers. The output ripple and transient response are measured by short loop probing and limited to 20 MegHz bandwidth. The following figures are the typical characteristic curves at 1.2Vout.

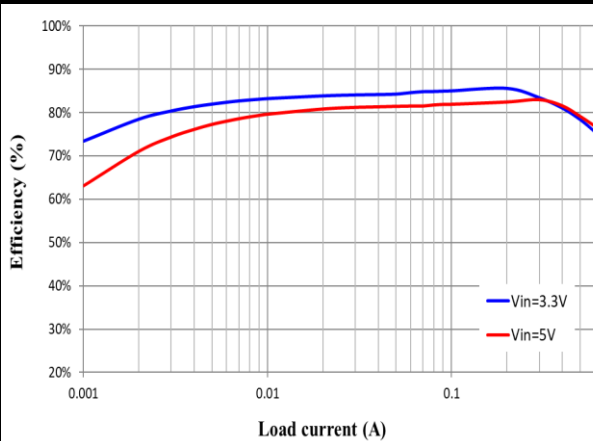


FIGURE 3 EFFICIENCY V.S. LOAD CURRENT

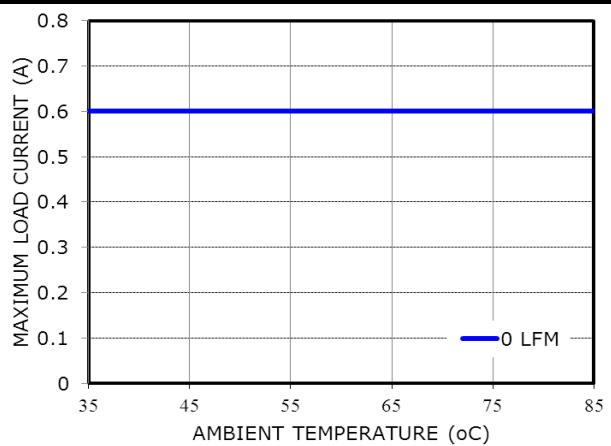
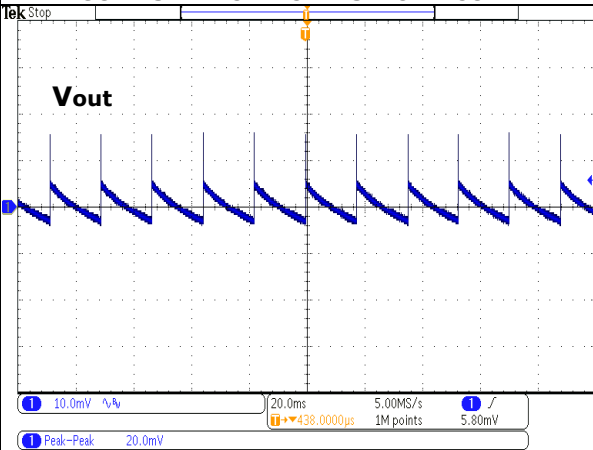
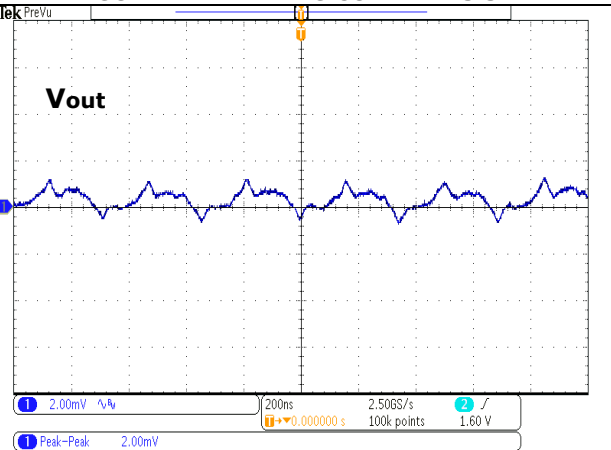


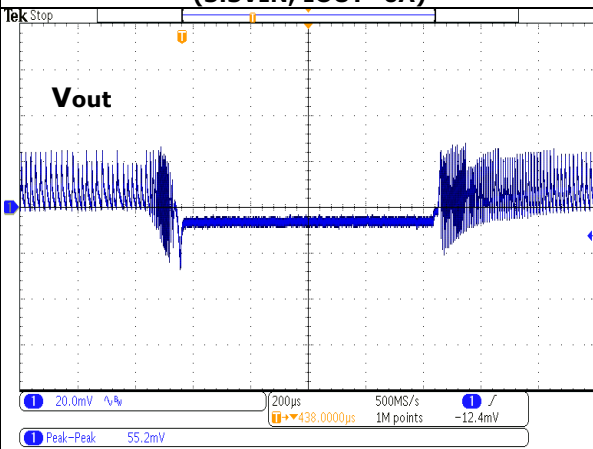
FIGURE 4 DE-RATING CURVE AT 3.3VIN



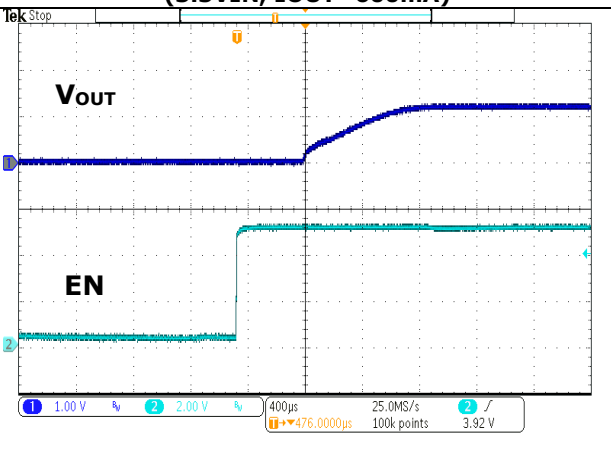
**FIGURE 5 OUTPUT RIPPLE
(3.3VIN, IOUT=0A)**



**FIGURE 6 OUTPUT RIPPLE
(3.3VIN, IOUT=600mA)**



**FIGURE 7 TRANSIENT RESPONSE
(3.3VIN, 0% to 50% LOAD STEP)**



**FIGURE 8 TURN-ON
(3.3VIN, IOUT=600mA)**

TYPICAL PERFORMANCE CHARACTERISTICS: (1.25VOUT)

Conditions: $T_A = 25^\circ\text{C}$, unless otherwise specified. Test Board Information: 30mm×30mm×1.6mm, 2 layers. The output ripple and transient response are measured by short loop probing and limited to 20 MegHz bandwidth. The following figures are the typical characteristic curves at 1.25Vout.

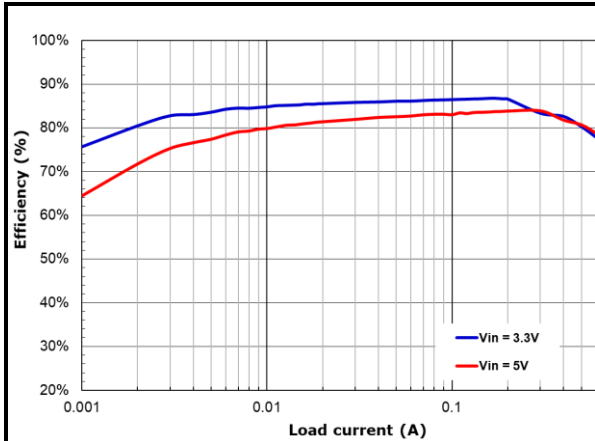


FIGURE 9 EFFICIENCY V.S. LOAD CURRENT

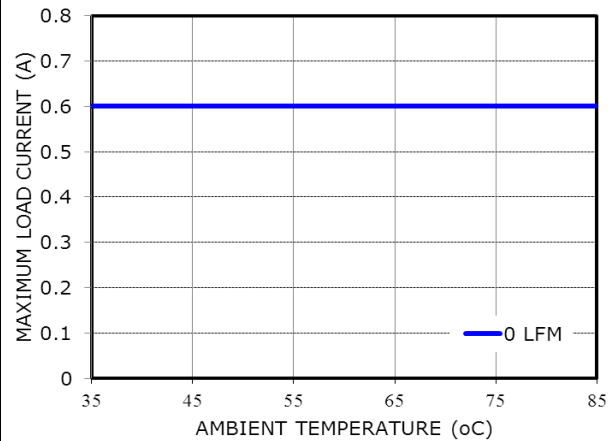
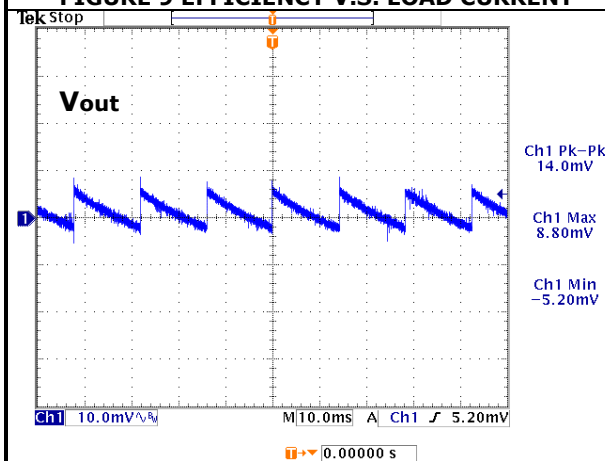
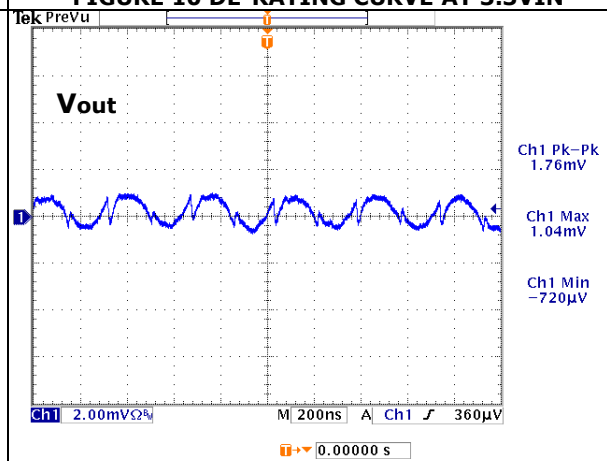


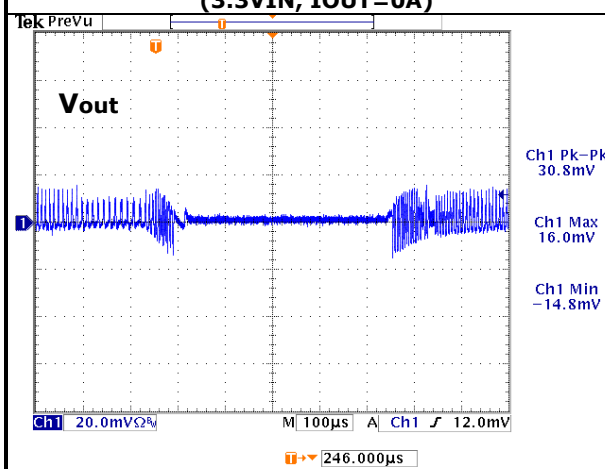
FIGURE 10 DE-RATING CURVE AT 3.3VIN



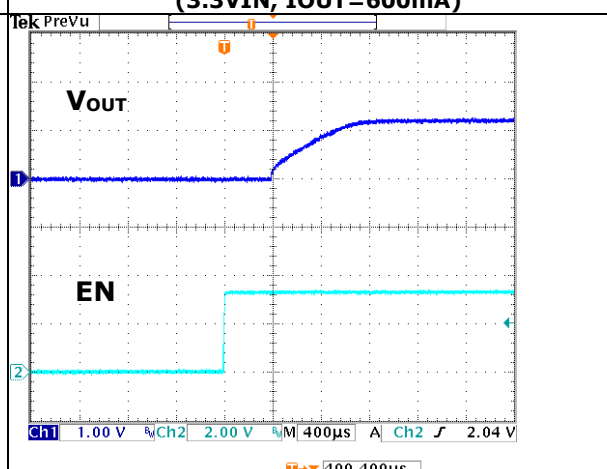
**FIGURE 11 OUTPUT RIPPLE
(3.3VIN, IOUT=0A)**



**FIGURE 12 OUTPUT RIPPLE
(3.3VIN, IOUT=600mA)**



**FIGURE 13 TRANSIENT RESPONSE
(3.3VIN, 0% to 50% LOAD STEP)**



**FIGURE 14 TURN-ON
(3.3VIN, IOUT=600mA)**

TYPICAL PERFORMANCE CHARACTERISTICS: (1.35VOUT)

Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified. Test Board Information: 30mm×30mm×1.6mm, 2 layers. The output ripple and transient response are measured by short loop probing and limited to 20MHz bandwidth. The following figures are the typical characteristic curves at 1.35Vout.

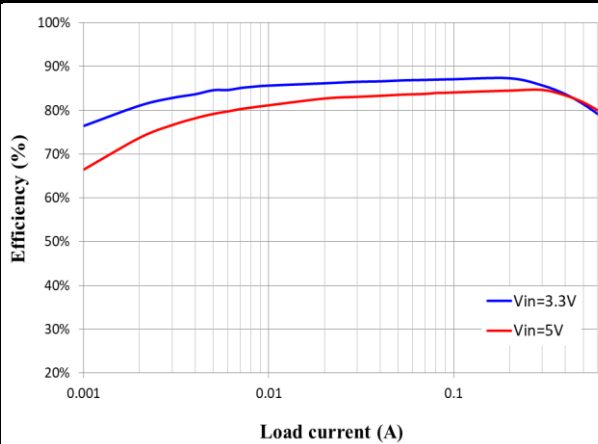


FIGURE 15 EFFICIENCY V.S. LOAD CURRENT

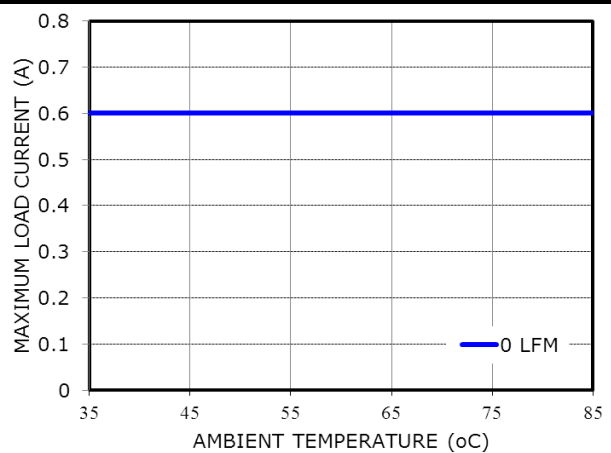
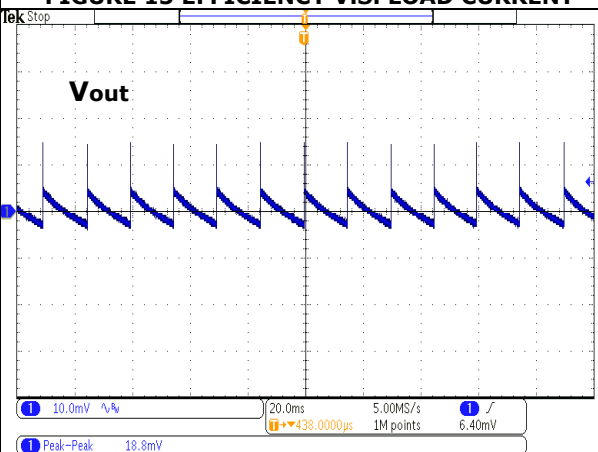
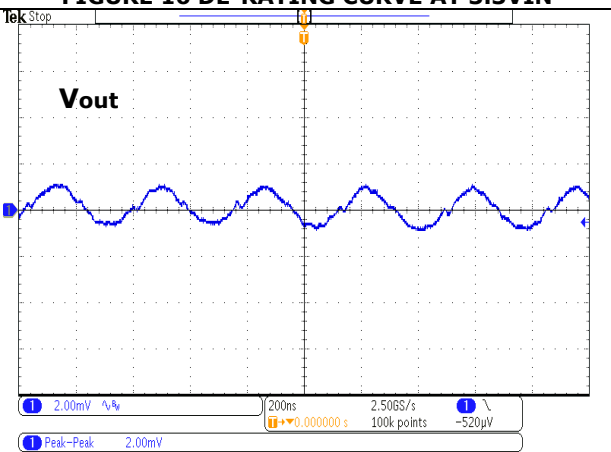


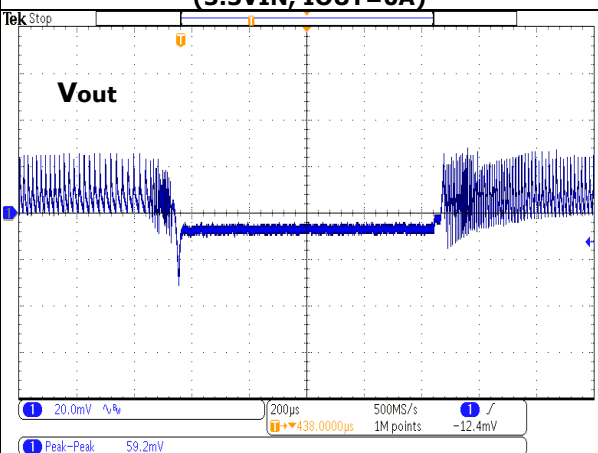
FIGURE 16 DE-RATING CURVE AT 3.3VIN



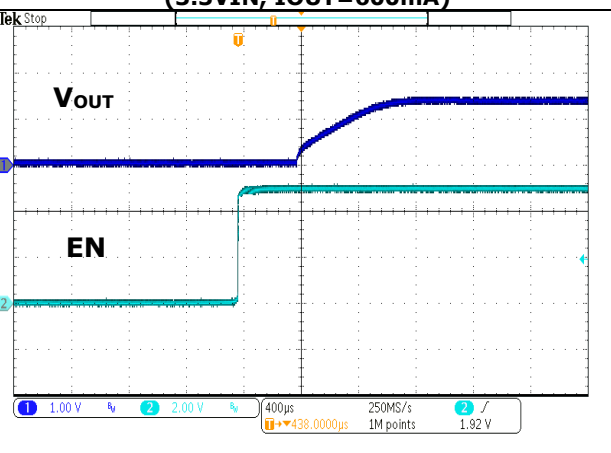
**FIGURE 17 OUTPUT RIPPLE
(3.3VIN, IOUT=0A)**



**FIGURE 18 OUTPUT RIPPLE
(3.3VIN, IOUT=600mA)**



**FIGURE 19 TRANSIENT RESPONSE
(3.3VIN, 0% to 50% LOAD STEP)**



**FIGURE 20 TURN-ON
(3.3VIN, IOUT=600mA)**

TYPICAL PERFORMANCE CHARACTERISTICS: (1.5VOUT)

Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified. Test Board Information: 30mm×30mm×1.6mm, 2 layers. The output ripple and transient response are measured by short loop probing and limited to 20MHz bandwidth. The following figures are the typical characteristic curves at 1.5Vout.

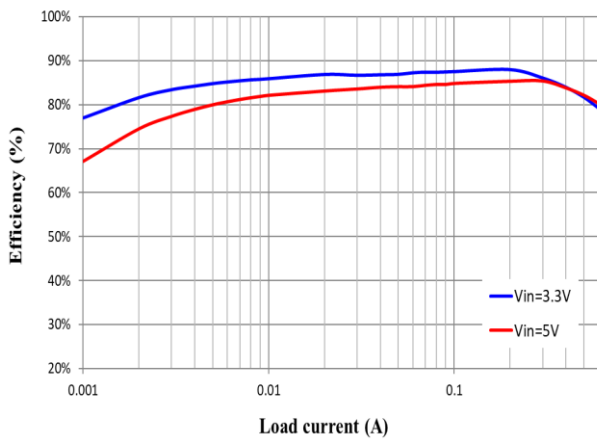


FIGURE 21 EFFICIENCY V.S. LOAD CURRENT

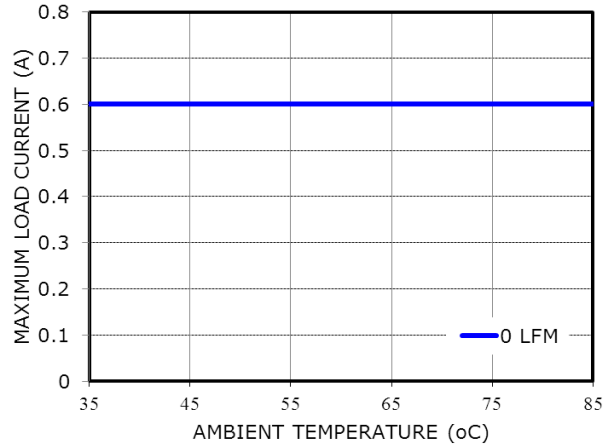
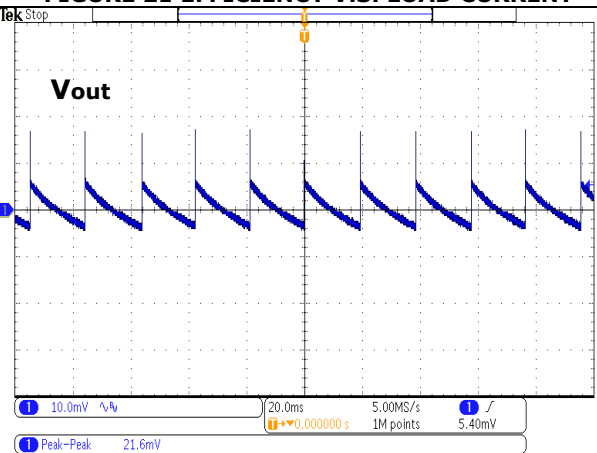
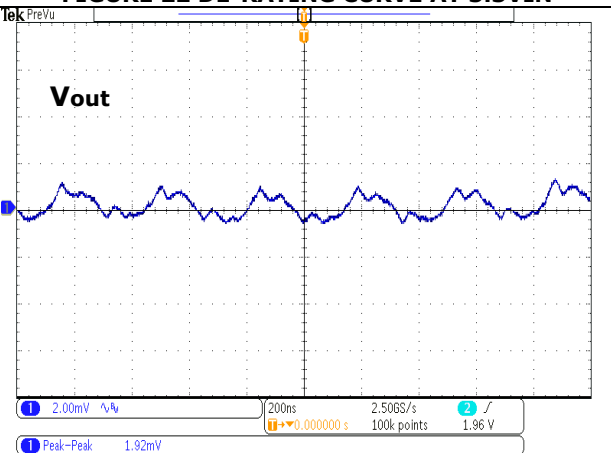


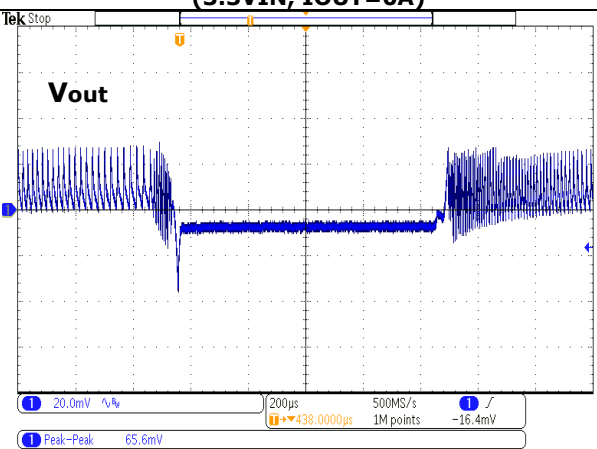
FIGURE 22 DE-RATING CURVE AT 3.3VIN



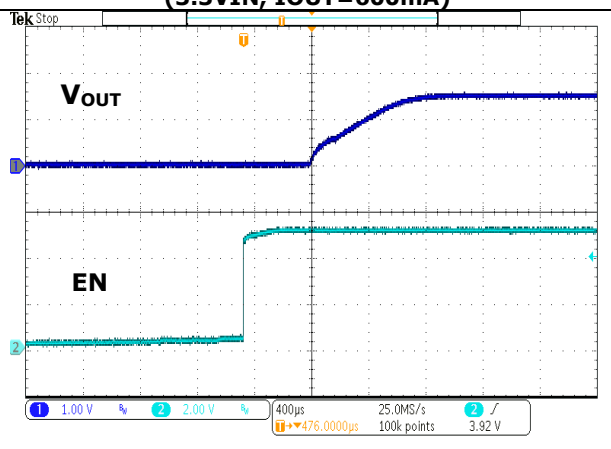
**FIGURE 23 OUTPUT RIPPLE
(3.3VIN, IOUT=0A)**



**FIGURE 24 OUTPUT RIPPLE
(3.3VIN, IOUT=600mA)**



**FIGURE 25 TRANSIENT RESPONSE
(3.3VIN, 0% to 50% LOAD STEP)**



**FIGURE 26 TURN-ON
(3.3VIN, IOUT=600mA)**

TYPICAL PERFORMANCE CHARACTERISTICS: (1.8VOUT)

Conditions: $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified. Test Board Information: 30mm×30mm×1.6mm, 2 layers. The output ripple and transient response are measured by short loop probing and limited to 20MHz bandwidth. The following figures are the typical characteristic curves at 1.8Vout.

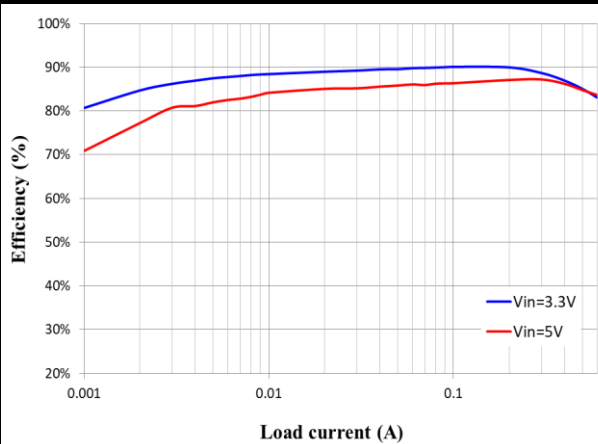


FIGURE 27 EFFICIENCY V.S. LOAD CURRENT

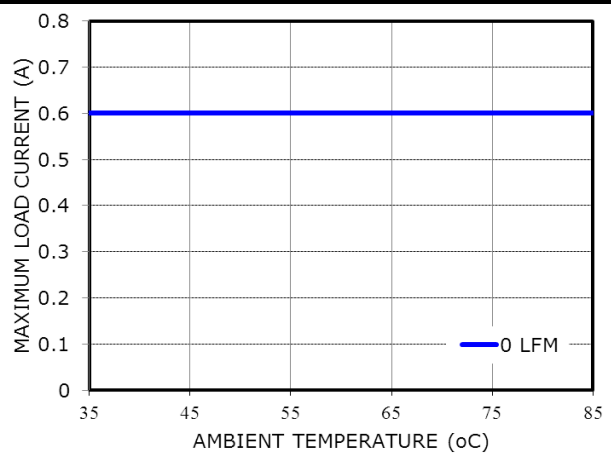


FIGURE 28 DE-RATING CURVE AT 3.3VIN

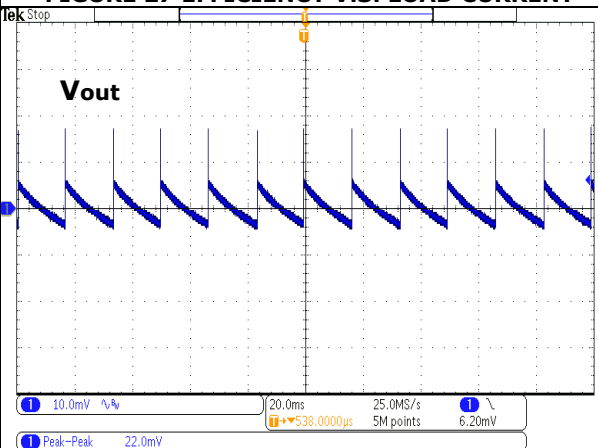


FIGURE 29 OUTPUT RIPPLE
(3.3VIN, IOUT=0A)

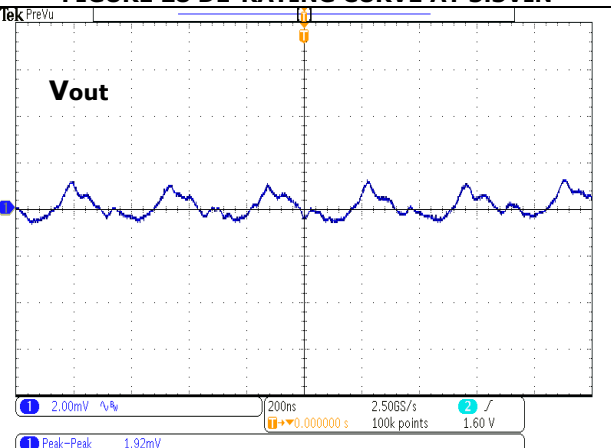


FIGURE 30 OUTPUT RIPPLE
(3.3VIN, IOUT=600mA)

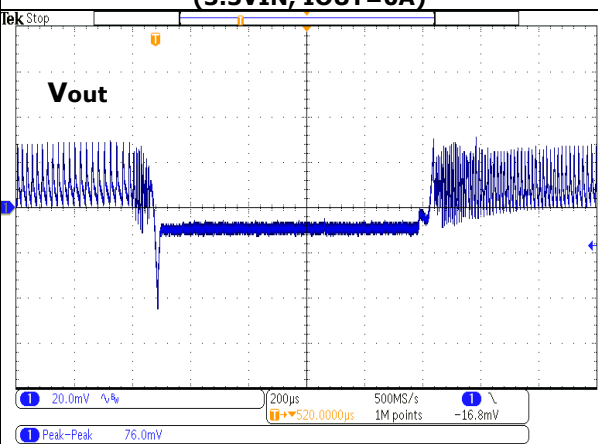


FIGURE 31 TRANSIENT RESPONSE
(3.3VIN, 0% to 50% LOAD STEP)

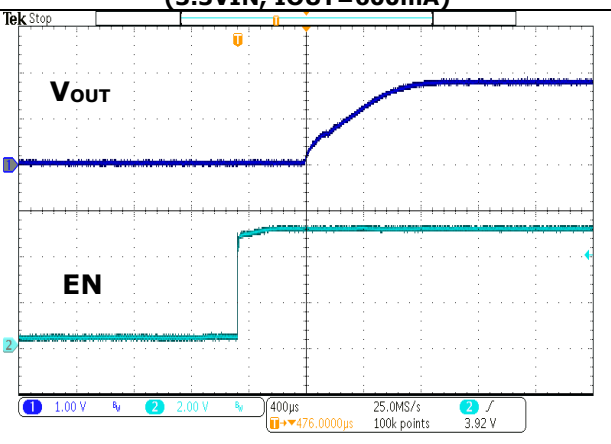


FIGURE 32 TURN-ON
(3.3VIN, IOUT=600mA)

APPLICATIONS INFORMATION:

REFERENCE CIRCUIT FOR GENERAL APPLICATION:

The Figure 33 shows the module application schematics for input voltage +5V or +3.3V and turn on by input voltage directly through enable resistor (Ren).

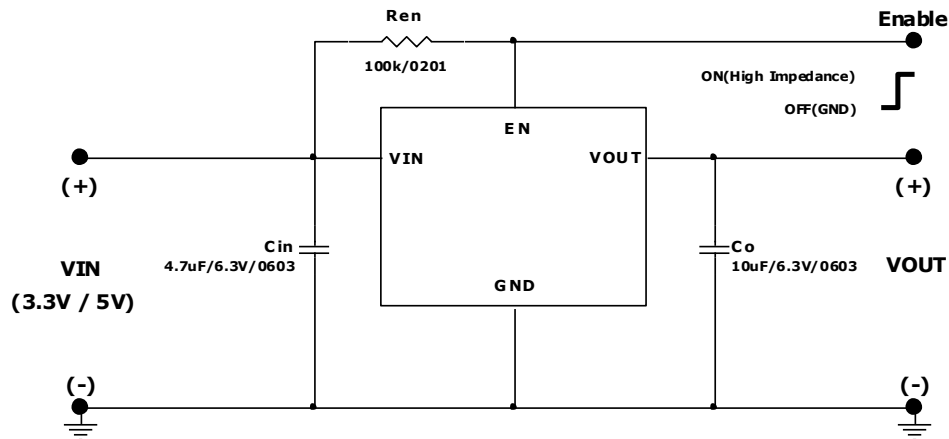


FIGURE 33 GENERAL APPLICATION CIRCUIT WITH TURN-ON BY INPUT VOLTAGE

SAFETY CONSIDERATIONS:

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.

INPUT FILTERING:

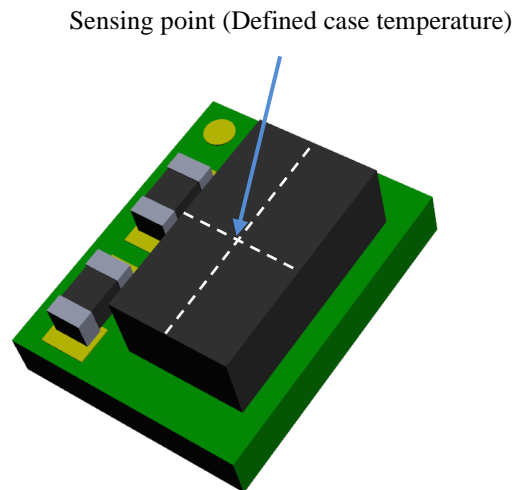
The module should be connected to a source supply of low AC impedance and high inductance in which line inductance can affect the module stability. An input capacitor must be placed as near as possible to the input pin of the module so to minimize input ripple voltage and ensure module stability.

OUTPUT FILTERING:

To reduce output ripple and improve the dynamic response as the step load changes, an additional capacitor at the output must be connected. Low ESR polymer and ceramic capacitors are recommended to improve the output ripple and dynamic response of the module.

APPLICATIONS INFORMATION: (Cont.)**Thermal Considerations:**

All of thermal testing condition is complied with JEDEC EIJ/JESD 51 Standards. Therefore, the test board size is 30mm×30mm×1.6mm with 2 layers. The case temperature of module sensing point is shown as Figure 34. Then $R_{th(j_{choke}-a)}$ is measured with the component mounted on an effective thermal conductivity test board on 0 LFM condition. The MUN3C1XR6-SB series modules are designed for using when the case temperature is below 110°C regardless the change of output current, input/output voltage or ambient temperature.

**Figure 34. CASE TEMPERATURE SENSING POINT**

APPLICATIONS INFORMATION: (Cont.)
REFLOW PARAMETERS:

Lead-free soldering process is a standard of electronic products production. Solder alloys like Sn/Ag, Sn/Ag/Cu and Sn/Ag/Bi are used extensively to replace the traditional Sn/Pb alloy. Sn/Ag/Cu alloy (SAC) is recommended for this power module process. In the SAC alloy series, SAC305 is a very popular solder alloy containing 3% Ag and 0.5% Cu and easy to obtain. Figure 35 shows an example of the reflow profile diagram. Typically, the profile has three stages. During the initial stage from room temperature to 150°C, the ramp rate of temperature should not be more than 3°C/sec. The soak zone then occurs from 150°C to 200°C and should last for 60 to 120 seconds. Finally, keep at over 217°C for 60~150 seconds to melt the solder and make the peak temperature at the range from 255°C to 260°C (Do not exceed 30 sec). It is noted that the time of peak temperature should depend on the mass of the PCB board. The reflow profile is usually supported by the solder vendor and one should adopt it for optimization according to various solder type and various manufacturers' formulae.

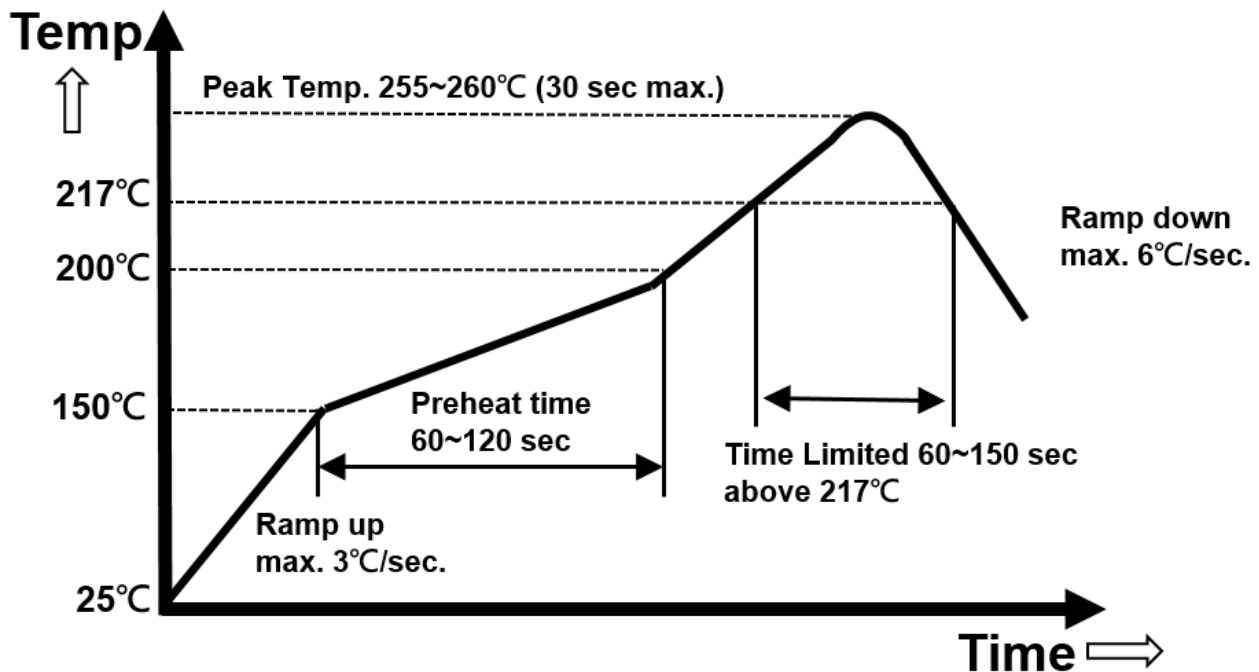
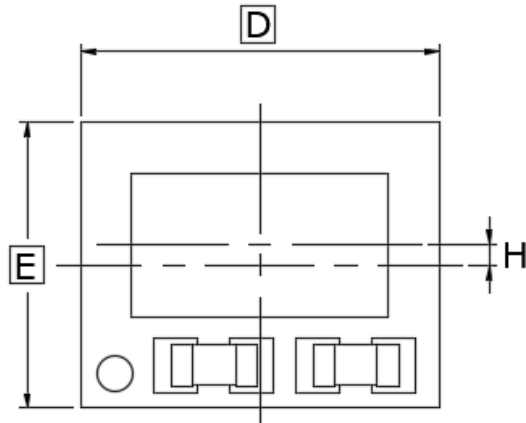


FIG.35 RECOMMENDATION REFLOW PROFILE*
(Not to scale)

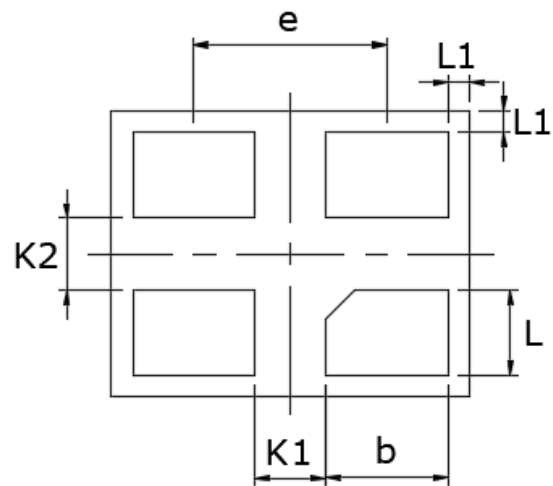
*Refer to the Classification Reflow Profile of J-STD-020.

PACKAGE OUTLINE DRAWING:

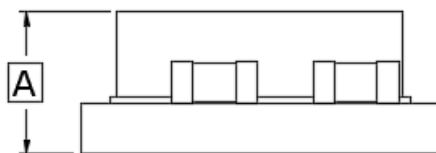
Unit: mm



TOP VIEW



BOTTOM VIEW

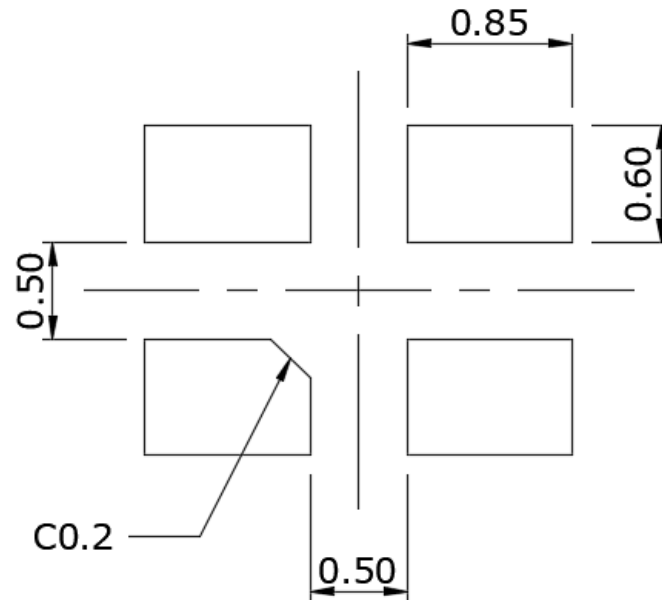


SIDE VIEW

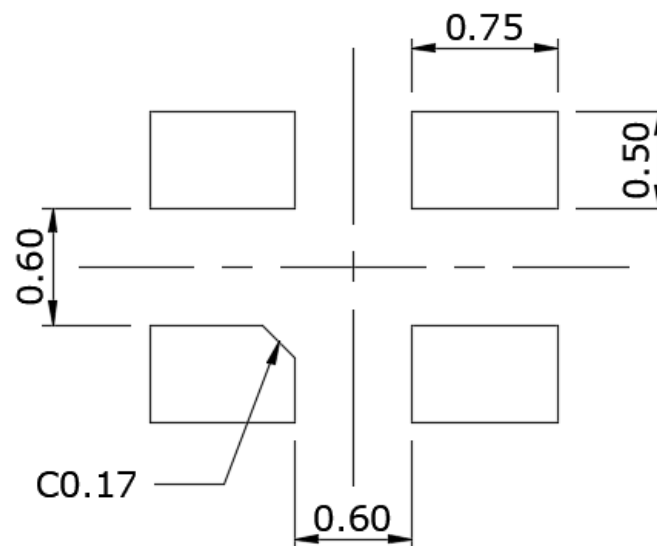
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	-	-	1.10
b	0.75	0.85	0.95
D	2.35	2.5	2.65
E	1.85	2.0	2.15
e	1.25	1.35	1.45
H	0.06	0.14	0.22
K1	0.40	0.5	0.60
K2	0.40	0.5	0.60
L	0.50	0.60	0.70
L1	0.00	0.15	0.30

LAND PATTERN REFERENCE:

Unit: mm



RECOMMENDED LAND PATTERN



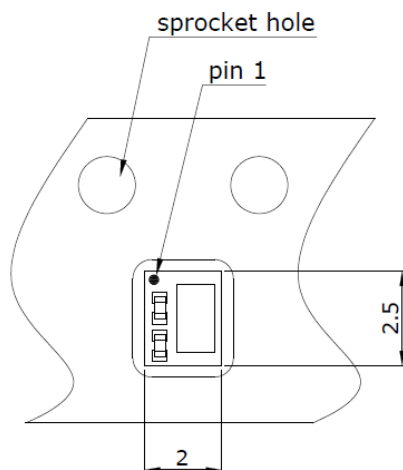
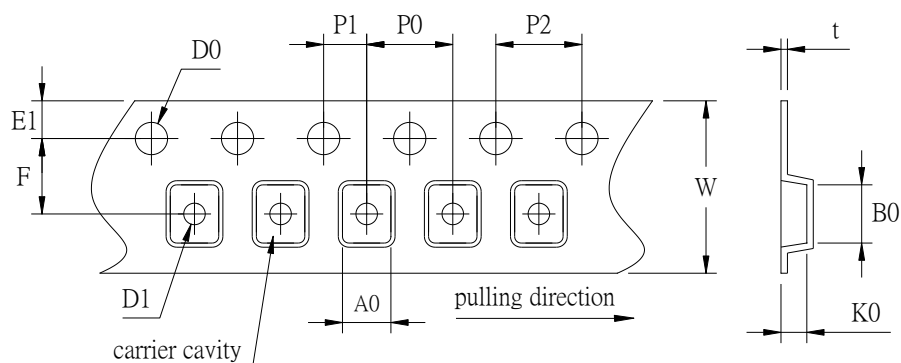
*RECOMMENDED STENCIL PATTERN

*Based on 0.1~0.15mm thickness stencil (Reference only)

*Recommended solder paste coverage 55~100%

PACKING REFERENCE:

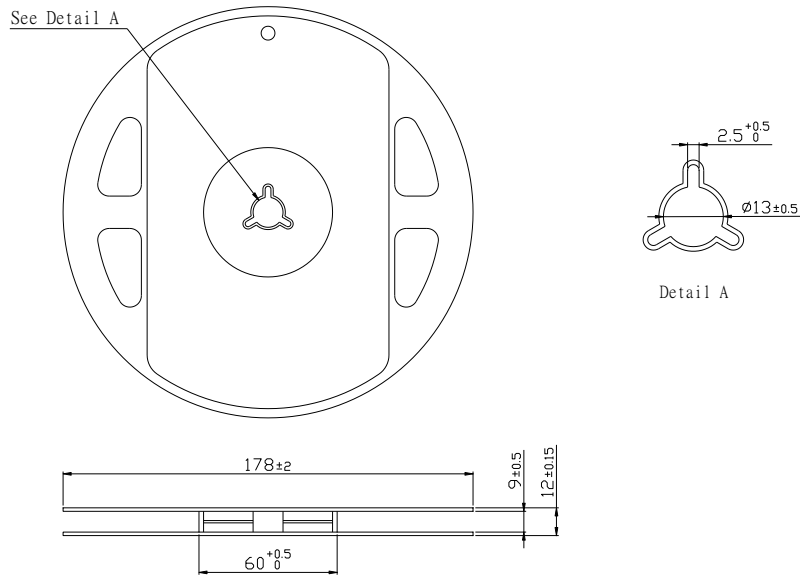
Unit: mm

Package In Tape Loading Orientation

Tape Dimension


A0	2.32 ± 0.10	E1	1.75 ± 0.10
B0	2.82 ± 0.10	K0	1.15 ± 0.10
F	3.50 ± 0.05	P0	4.00 ± 0.10
W	8.00 +0.30/-0.10	P1	2.00 ± 0.05
D0	φ1.50 +0.1/-0.0	P2	4.00 ± 0.10
D1	φ1.0 Min.	t	0.25 ± 0.05

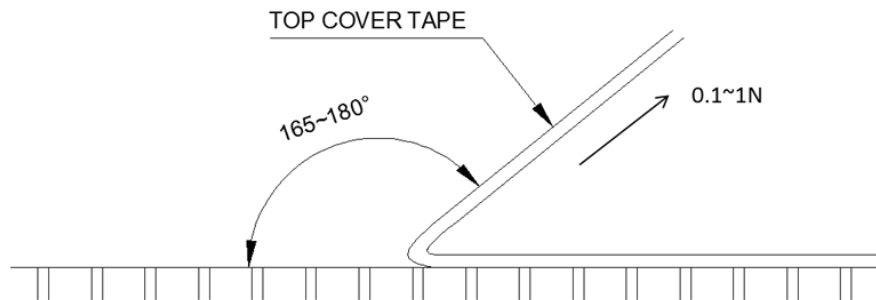
PACKING REFERENCE: (Cont.)

Unit: mm

Reel Dimension

Peel Strength of Top Cover Tape

The peel speed shall be about 300mm/min.

The peel force of top cover tape shall between 0.1N to 1.0N



REVISION HISTORY:

Date	Revision	Changes
2018.08.30	00	Initial released for preliminary datasheet.
2018.12.05	01	Add 1.35V output voltage
2019.07.02	02	Add thermal resistance from junction to ambient $R_{th(j_{choke}-a)}$
2019.08.22	03	Add 1.25V output voltage
2022.11.01	04	Add recommended reflow profile.