HU2106

1A, High Efficiency LDS Module

FEATURES:

- High Density LDS Module
- 1000mA Output Current
- 94% Peak Efficiency at 5 Vin to 3.3 Vout
- Input Voltage Range from 4.5 V to 18V
- Adjusted Output Voltage
- Enable Function
- Protections (UVLO, OCP: Non-latching)
- Internal Soft Start
- Compact Size: 3.9mm*2.6mm*1.7mm(Max.)
- Pb-free for RoHS compliant
- MSL 2, 260C Reflow

GENERAL DESCRIPTION:

The HU2106 is non-isolated dc-dc converters. The PWM switching regulator, high frequency power inductor, and most of support components are integrated in one hybrid package.

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 (3.9mm × 2.6mm x 1.7mm) is suitable for automated assembly by standard surface mount equipment. The HU2106 is Pb-free and RoHS compliance.

APPLICATIONS:

- DSL Modem / LCD TV
- Portable TV / Access Point Router

TYPICAL APPLICATION CIRCUIT & PACKAGE:

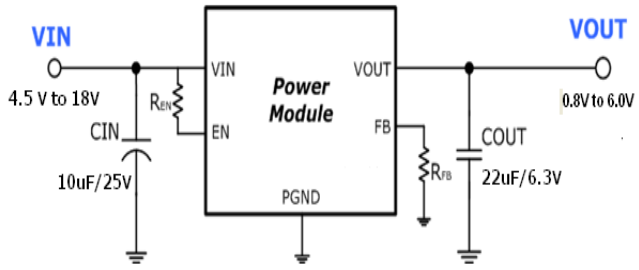

FIGURE.1 TYPICAL APPLICATION CIRCUIT

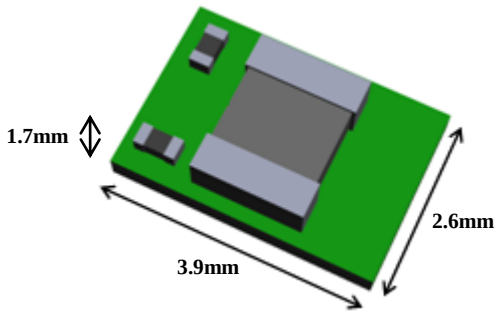

FIGURE.2 HIGH DENSITY LOW PROFILE LDS MODULE

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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 not covered by warranty.

Parameter	Description	Min.	Typ.	Max.	Unit
■ Absolute Maximum Ratings					
VIN to GND		-	-	+20	V
VOUT to GND		-	-	+6	V
EN to GND	Note 1	-	-	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)	-	-	500	V
■ Recommendation Operating Ratings					
VIN	Input Supply Voltage	+4.5	-	+18	V
VOUT	Adjusted Output Voltage	+0.8	-	+6.0	V
Ta	Ambient Temperature	-40	-	+85	°C

NOTES:
1. Parameters guaranteed by power IC vendor design and test prior to module assembly.
2. Rth(j_{choke}-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 4 layers. The test condition is complied with JEDEC EIJ/JESD 51 Standards.

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ELECTRICAL SPECIFICATIONS: (Cont.)

Conditions: TA = 25 ºC, Vin = 3.3V, Vout = 1.8V, Cin=22uF/X5R/6.3V , Cout=47uF/X5R/6.3V, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
■ Input Characteristics						
$I_{SD(IN)}$	Input shutdown current	Vin = 3.3V, EN = GND	-	50	-	uA
$I_{Q(IN)}$	Input supply bias current	Vin = 3.3V, Iout = 0A EN = VIN Vout = 1.8V	-	120	-	uA
$I_{S(IN)}$	Input supply current	Vin = 3.3V, EN = VIN	-	-	-	-
		Iout = 5mA Vout = 1.8V	-	3.2	-	mA
		Iout = 1.5A Vout = 1.8V	-	0.91	-	A
		Iout = 3.0A Vout = 1.8V	-	2	-	A
■ Output Characteristics						
$I_{OUT(DC)}$	Output continuous current range	Vin=3.3V, Vout=1.8V	0	-	3	A
$V_{O(SET)}$	Ouput Voltage Set Point	With 0.5% tolerance for external resistor used to set output voltage	-3.0	-	+3.0	% $V_{O(SET)}$
ΔV_{OUT} /ΔV_{IN}	Line regulation accuracy	Vin = 3.3V to 5V Vout = 1.8V, Iout = 3.0A	-	0.1	-	% $V_{O(SET)}$
ΔV_{OUT} /ΔI_{OUT}	Load regulation accuracy	Iout = 0A to 3.0A Vin = 3.3V, Vout = 1.8V	-	0.5	-	% $V_{O(SET)}$
$V_{OUT(AC)}$	Output ripple voltage	Vin = 3.3V, Vout = 1.8V EN = VIN	-	-	-	-
		IOUT = 5mA,	-	50	-	mVp-p
		IOUT = 3.0A,	-	15	-	mVp-p
$C_{OUT(MAX)}$	Maximum capacitive load	Iout = 3.0A, ESR≧1 mΩ	-	-	150	uF

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ELECTRICAL SPECIFICATIONS: (Cont.)

Conditions: TA = 25 ºC, Vin = 12V, Vout = 3.3V, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency				1.2		MHz
■ Input Characteristics						
IQ(IN)	Input supply bias current	Vin = 12V, Iout = 0A EN = With pull-up 100kΩ to VIN Vout = 3.3V	-	14	-	mA
IS(IN)	Input supply current	Iout = 5mA Vout = 3.3V	-	14.3	-	mA
		Iout = 100mA Vout = 3.3V	-	41.7	-	mA
		Iout = 1000mA Vout = 3.3V	-	319	-	mA
■ Output Characteristics						
IOUT(DC)	Output continuous current range	Vin=12V, Vout=3.3V	0	-	1000	mA
ΔVOUT /ΔVIN	Line regulation accuracy	Vin = 12V to 5V Vout = 3.3V, Iout = 1000mA		0.2		% VO(SET)
ΔVOUT /ΔIOUT	Load regulation accuracy	Iout = 0A to 1000mA Vin = 12 V, Vout = 3.3V		0.5		% VO(SET)
VOUT(AC)	Output ripple voltage	Vin = 5V, Vout = 3.3V IOUT = 1000mA		11		mVp-p
		Vin = 12V, Vout = 3.3V IOUT = 1000mA		12		mVp-p

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1A, High Efficiency LDS Module

ELECTRICAL SPECIFICATIONS: (Cont.)

Conditions: T_A = 25 ºC, Vin = 12V, Vout = 3.3V, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
■ Control Characteristics						
V_{EN_TH}	Rising Threshold threshold voltage	Note 1	1.5			V
	Enable lower threshold voltage	Note 1			0.4	V
■ Fault Protection						
V_{UVLO_TH}	Input under voltage lockout threshold	Falling, Note 1	-		4.5	V
T_{OTP}	Over temp protection	Note 1	-	150		℃
I_{LIMIT_TH}	Current limit threshold	Peak value of inductor current, Note 1	-	2.2		A

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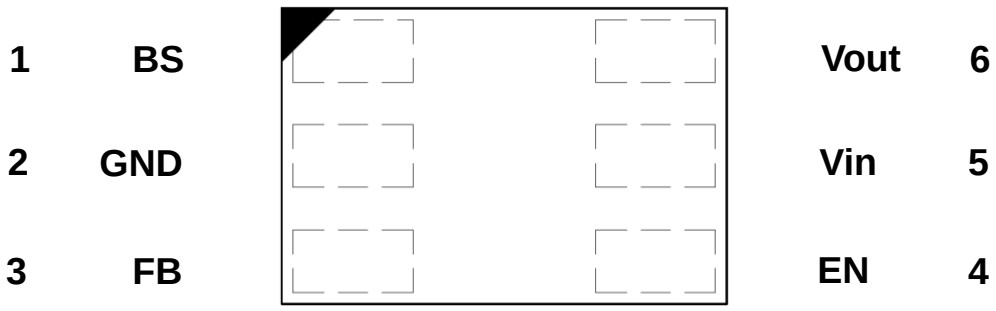
PIN CONFIGURATION:



TOP VIEW

PIN DESCRIPTION:

Symbol	Pin No.	Description
BS	1	Boot-Strap Pin.
GND	2	Power ground pin for signal, input, and output return path. This pin needs to be connected to one or more ground planes directly.
FB	3	Feedback input. Connect to output through a voltage dividing resistor between this pin to GND for adjusting output voltage. Place this resistor as closely as possible to this pin.
EN	4	On/Off control pin for module.
VIN	5	Input pin. Decouple this pin to GND pin with 10uF ceramic cap
VOUT	6	Power output pin. Connect to output for the load.

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1A, High Efficiency LDS Module

TYPICAL PERFORMANCE CHARACTERISTICS: (3.3VOUT)

Conditions: TA = 25 ºC, 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 3.3 Vout.

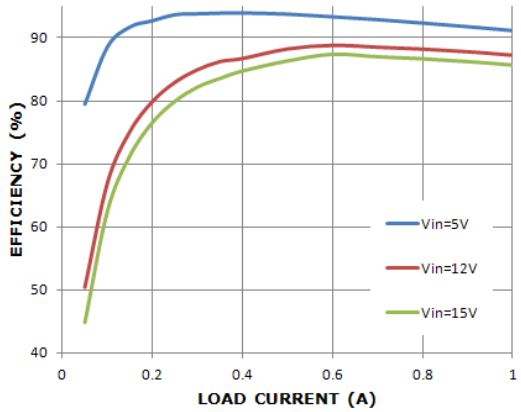

FIG.3 EFFICIENCY V.S. LOAD CURRENT

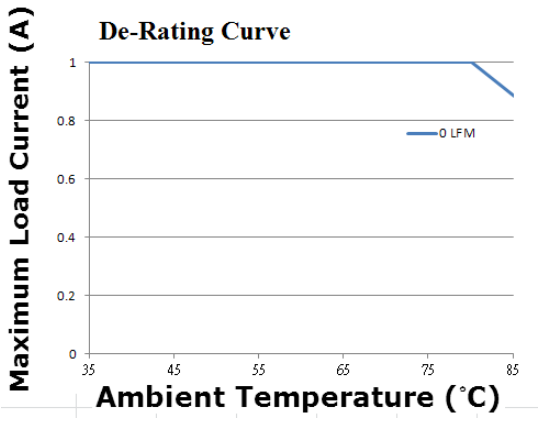

FIG.4 DE-RATING CURVE

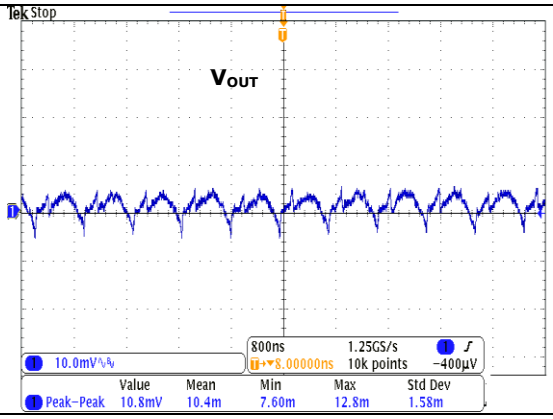

FIG.5 OUTPUT RIPPLE
(12VIN, IOUT=0A)

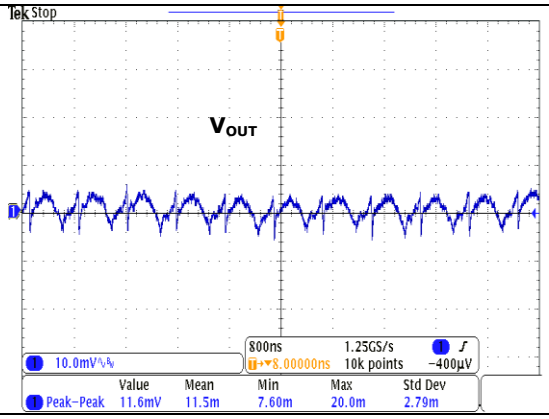

FIG.6 OUTPUT RIPPLE
(12VIN, IOUT=1A)

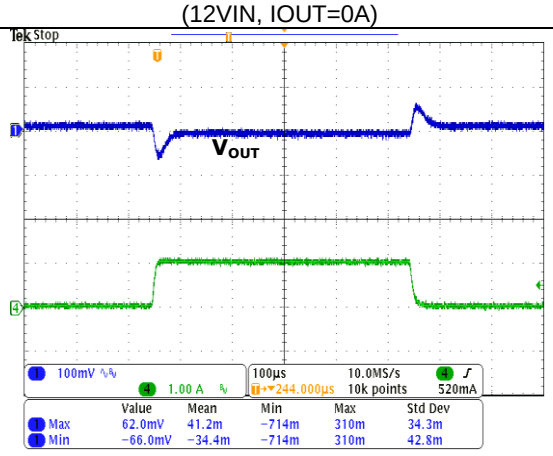

FIG.7 TRANSIENT RESPONSE
(12VIN, 0% to 100% LOAD STEP)

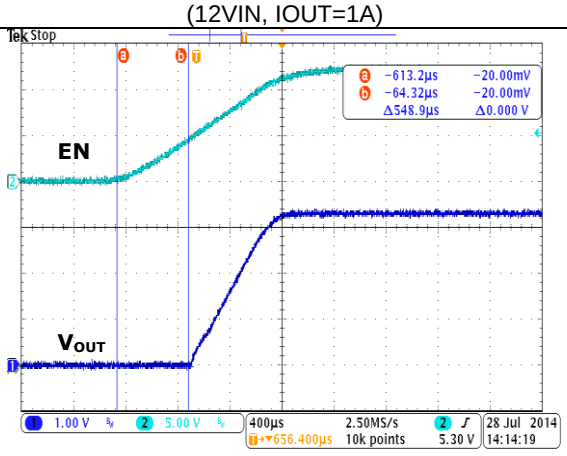

FIG.8 TURN-ON
(12VIN, IOUT=1A)

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TYPICAL PERFORMANCE CHARACTERISTICS: (3.3VOUT)

Conditions: TA = 25 ºC, 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 3.3 Vout.

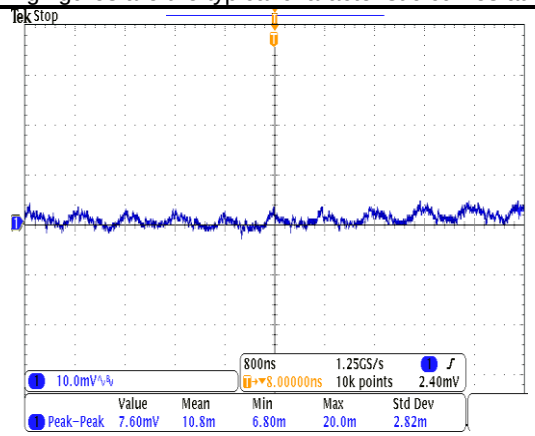

FIG.9 OUTPUT RIPPLE
(5V VIN, IOUT=0 A)

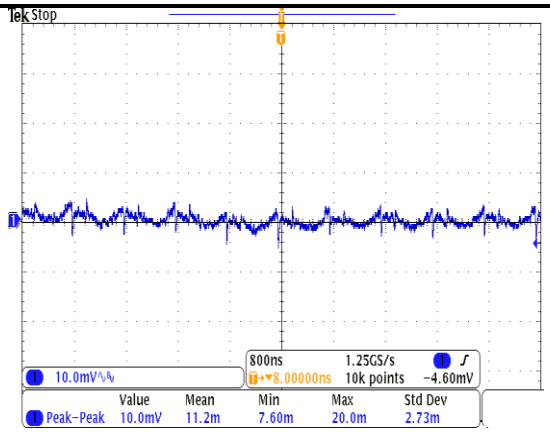

FIG.10 OUTPUT RIPPLE
(5V VIN, IOUT=1 A)

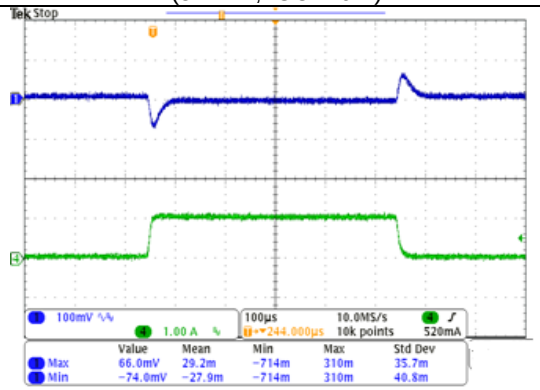

FIG.11 TRANSIENT RESPONSE
(5V VIN, 0% to 100% LOAD STEP)

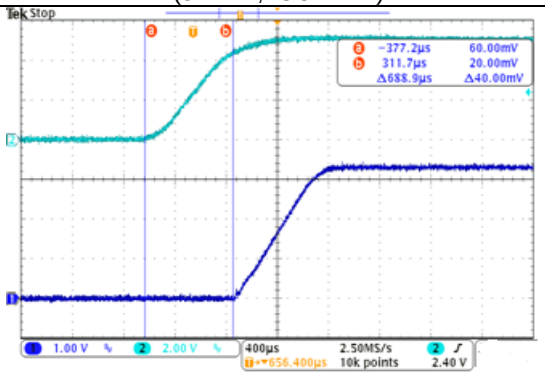

FIG.12 TURN-ON
(5V VIN, IOUT=1 A)

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1A, High Efficiency LDS Module

TYPICAL PERFORMANCE CHARACTERISTICS: (3.3VOUT)

Conditions: TA = 25 ºC, 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 3.3 Vout.

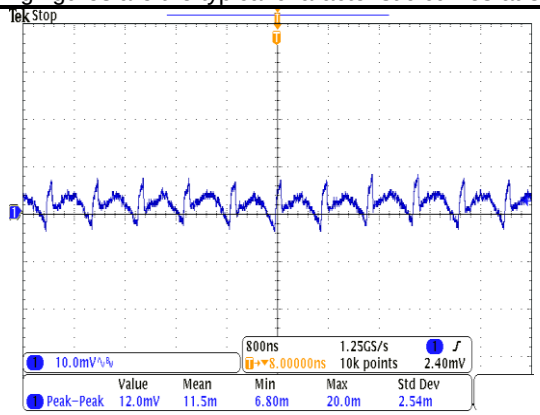

FIG.13 OUTPUT RIPPLE
(15V VIN, IOUT=0 A)

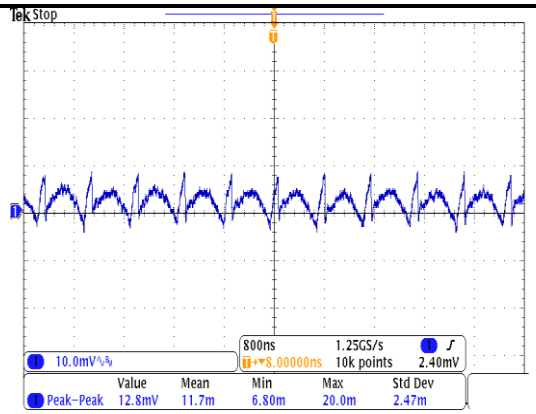

FIG.14 OUTPUT RIPPLE
(15V VIN, IOUT=1 A)

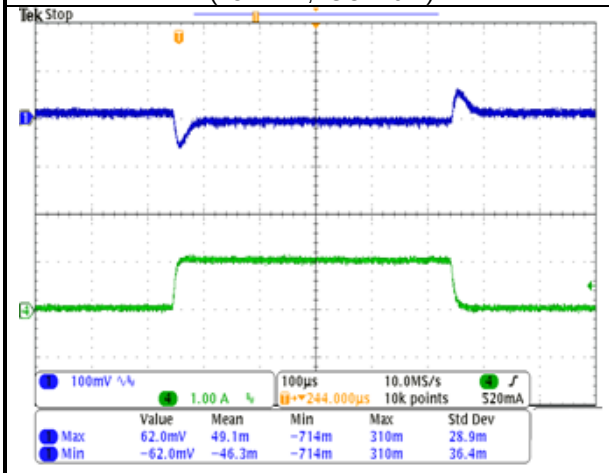

FIG.15 TRANSIENT RESPONSE
(15V VIN, 0% to 100% LOAD STEP)

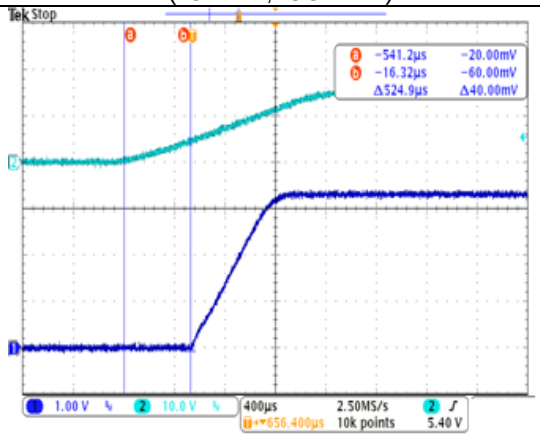

FIG.16 TURN-ON
(15V VIN, IOUT=1 A)

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1A, High Efficiency LDS Module

TYPICAL PERFORMANCE CHARACTERISTICS: (5VOUT)

Conditions: T_A = 25 ºC, unless otherwise specified. Test Board Information: 76.2mm×76.2mm×1.6mm, 4 layers.
The output ripple and transient response measurement is short loop probing and 20MegHz bandwidth limited.

The following figures provide the typical characteristic curves at 5Vout.

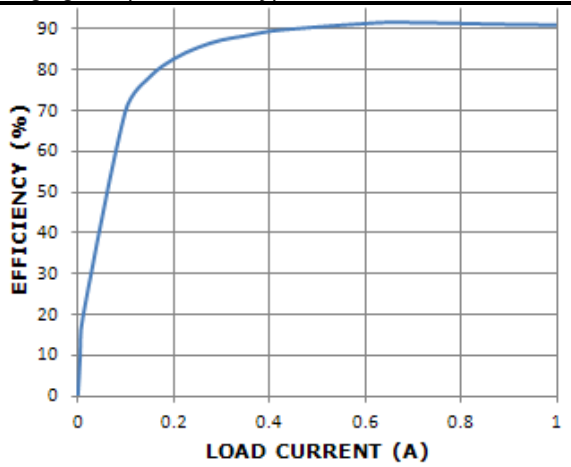

FIG.17 EFFICIENCY V.S. LOAD CURRENT
12 Vin

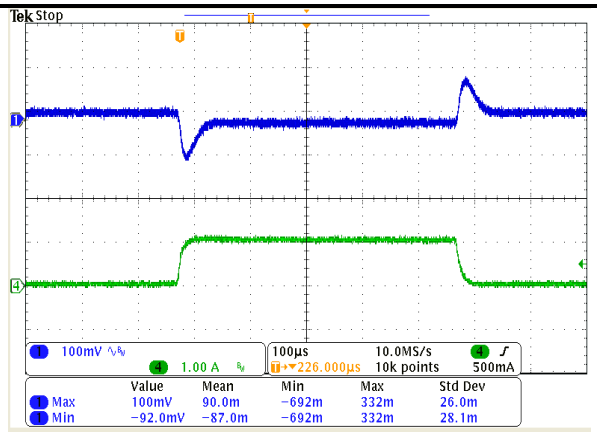

FIG.18 DE-RATING CURVE
(12V VIN, 0% to 100% LOAD STEP)

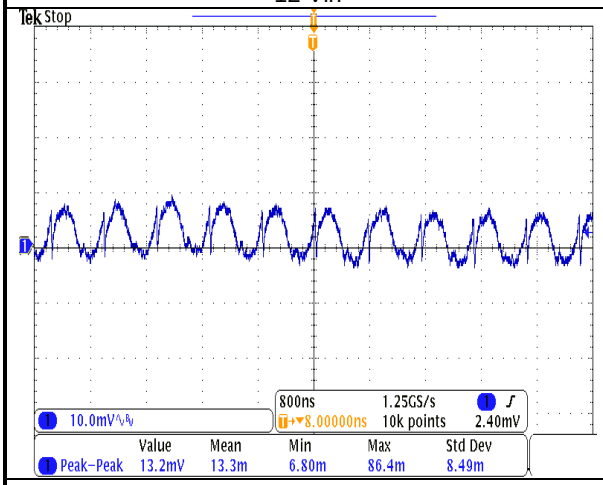

FIG.19 OUTPUT RIPPLE
(12VIN, IOUT=0A)

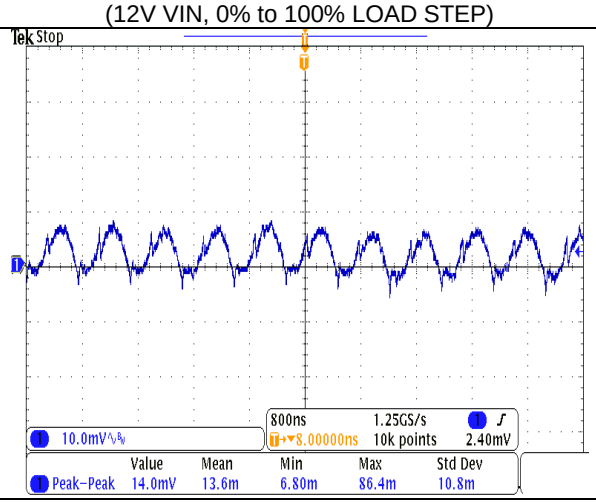

FIG.20 OUTPUT RIPPLE
(12VIN, IOUT=1A)

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APPLICATIONS INFORMATION:

LOAD TRANSIENT CONSIDERATIONS:

The HU2106 integrates the compensation components to achieve good stability and fast transient responses. In some applications, adding a 100pF ceramic cap between Vout and FB may further speed up the load transient responses and is thus recommended for applications with large load transient step requirements. Fig.21 shows the module application schematics

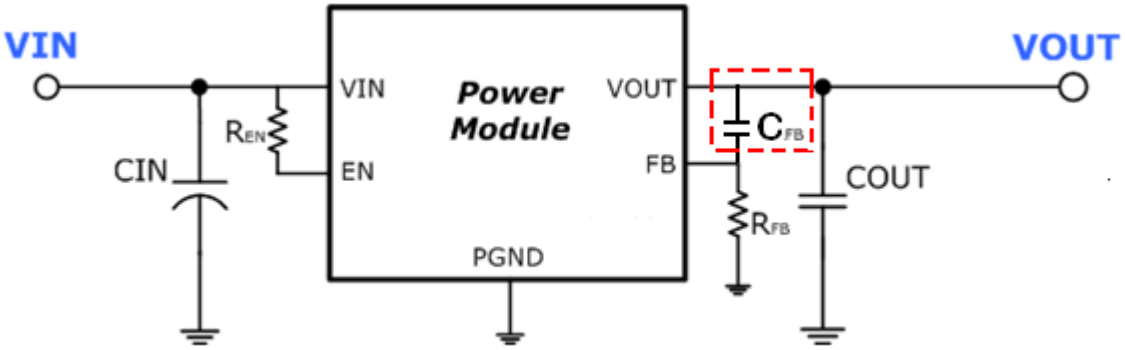

FIG.21 REFERENCE CIRCUIT FOR GENERAL APPLICATION

REFERENCE CIRCUIT FOR GENERAL APPLICATION:

Figure 22 shows the module application schematics for input voltage +12V and turn on by input voltage directly through enable resistor (R1).

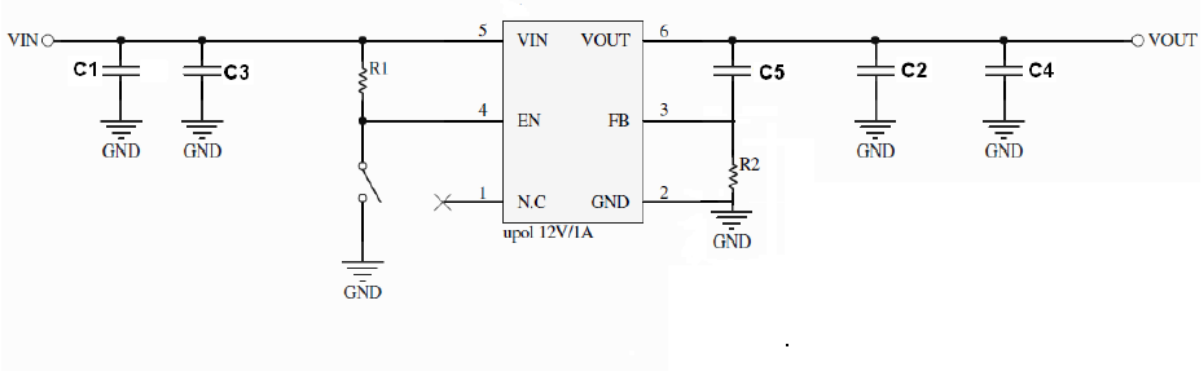

FIG.22 REFERENCE CIRCUIT FOR GENERAL APPLICATION

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1A, High Efficiency LDS Module

RECOMMEND PCB LAYOUT:

Figure 23 shows recommendation PCB layout for using LDS module,

- C3/C4 are bypass filter for high frequency noise.
- Design paths of main current wide and short as Make the traces of the main current paths as short and wide as possible.
- Place the input/out capacitor as close as possible to the LDS module pins.
- Ensure all feedback network connections are short and direct.
- The GND pin and should be connected to a strong ground plane for heat dissipating.

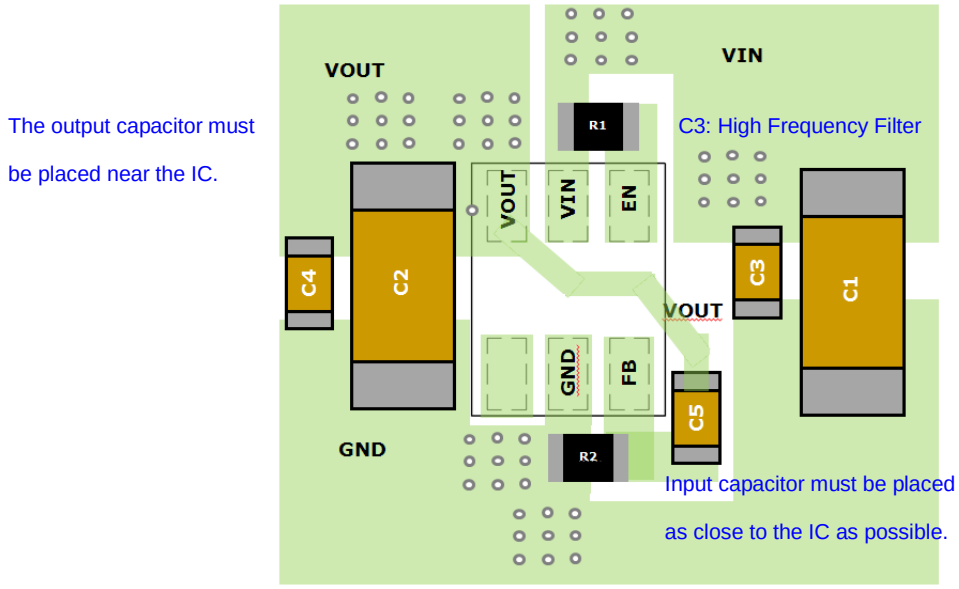

FIG.23 PCB LAYOUT

APPLICATIONS INFORMATION: (Cont.)

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 low AC impedance source supply and a highly inductive source or line inductance can affect the stability of the module. An input capacitor must be placed directly to the input pin of the module, to minimize input ripple voltage and ensure module stability.

OUTPUT FILTERING:

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

PROGRAMMING OUTPUT VOLTAGE:

The module has an internal 0.62V±2% reference voltage. The output voltage can be programed by the dividing resistance RFB which respects to FB pin and GND pin. The output voltage can be calculated as shown in Equation 1.(R1 is integrated in Module :100KΩ+/-1%)

$$Vout=0.62*(1+R1/RFB)$$

Vout (V)	1	1.2	1.5	1.8	2.5	3.3
RFB	165KΩ	107KΩ	69.8KΩ	52.3KΩ	32.4KΩ	23.2KΩ

TABLE.01 Resistor values for common output voltages

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 4 layers. The case temperature of module sensing point is shown as Figure 24. Then Rth(jchoke-a) is measured with the component mounted on an effective thermal conductivity test board on 0 LFM condition. The HU2106 module is designed for using when the case temperature is below 110°C regardless the change of output current, input/output voltage or ambient temperature.

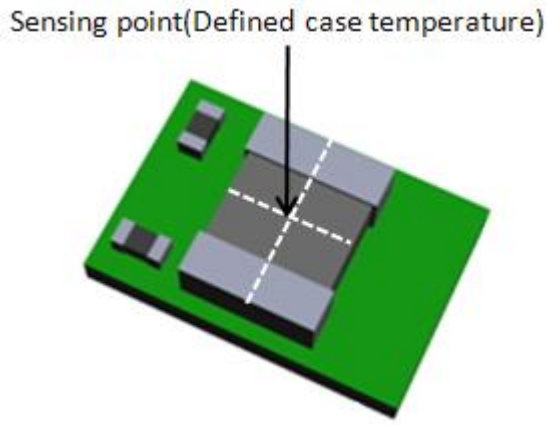

FIG 24. Case Temperature Sensing Point

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REFLOW PARAMETERS:

Lead-free soldering process is a standard of making electronic products. Many solder alloys like Sn/Ag, Sn/Ag/Cu, Sn/Ag/Bi and so on are used extensively to replace traditional Sn/Pb alloy. Here the Sn/Ag/Cu alloy (SAC) are recommended for process. In the SAC alloy series, SAC305 is a very popular solder alloy which contains 3% Ag and 0.5% Cu. It is easy to get it. Figure 25 shows an example of reflow profile diagram. Typically, the profile has three stages. During the initial stage from 70°C to 90°C, the ramp rate of temperature should be not more than 1.5°C/sec. The soak zone then occurs from 100°C to 180°C and should last for 90 to 120 seconds. Finally the temperature rises to 230°C to 245°C and cover 220°C in 30 seconds to melt the solder. 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 user could switch to optimize the profile according to various solder type and various manufactures' formula.

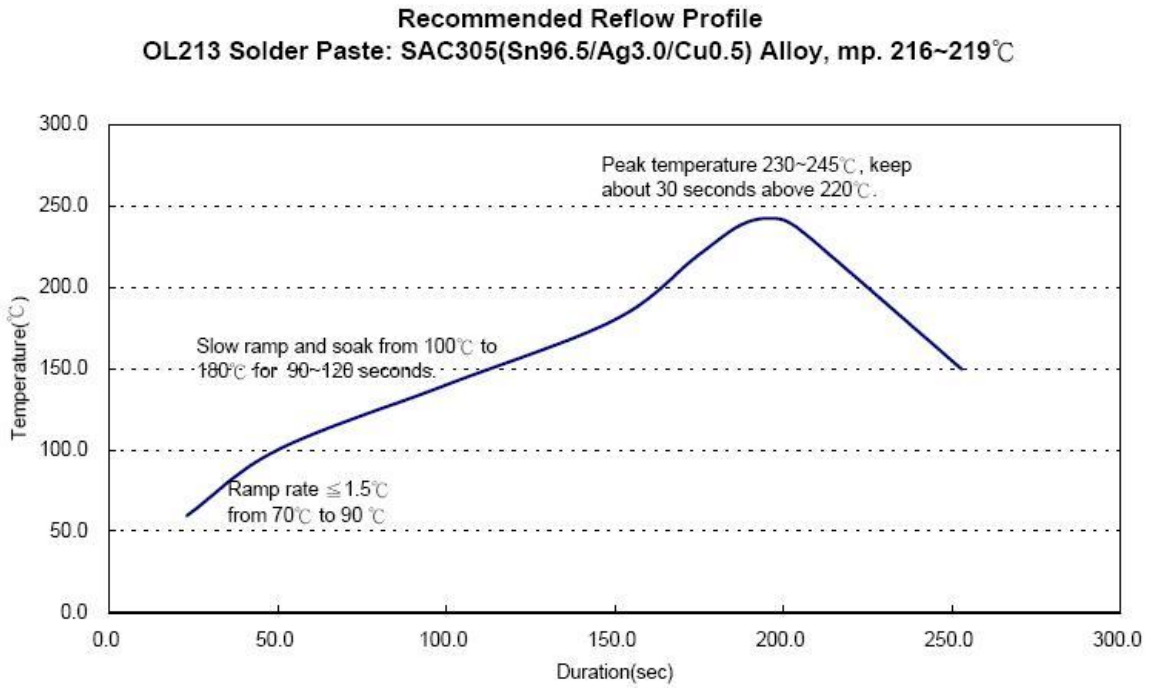

FIG.25 Recommendation Reflow Profile

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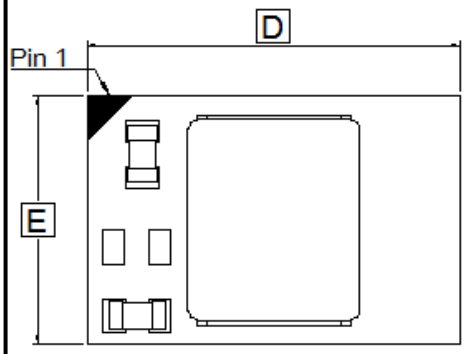
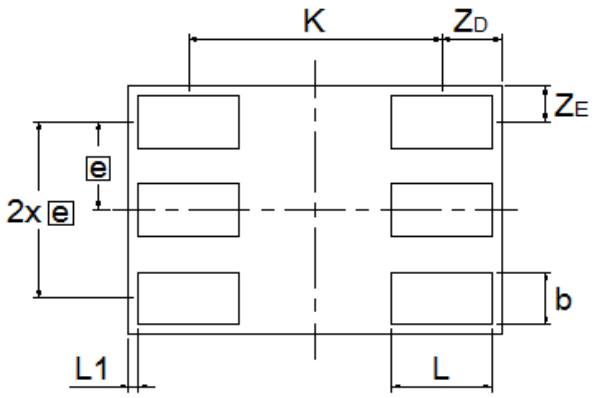
PACKAGE OUTLINE DRAWING:

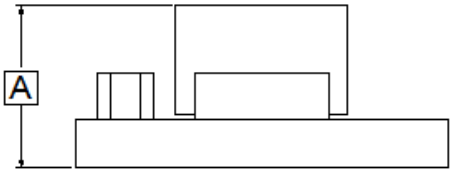
Unit:mm



Top View



Bottom View



End View

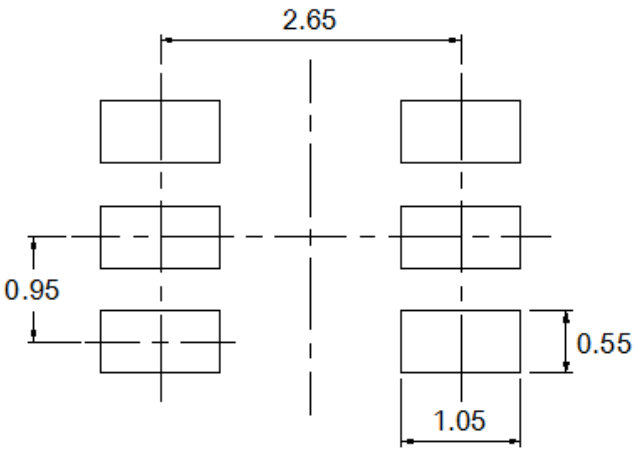
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	1.40	1.55	1.70
D	3.8	3.9	4.0
E	2.5	2.6	2.7
K	2.55	2.65	2.75
e	0.85	0.95	1.05
b	0.45	0.55	0.65
L	0.95	1.05	1.15
L1	0.00	0.10	0.20
Z_D	0.50	0.65	0.80
Z_E	0.25	0.40	0.55

HU2106

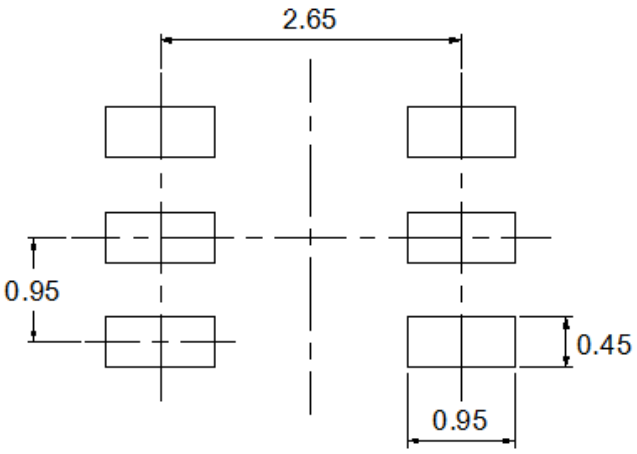
1A, High Efficiency LDS Module

LAND PATTERN REFERENCE:

Unit:mm



RECOMMENDED LAND PATTERN



RECOMMENDED STENCIL PATTERN
BASED ON 130um THICK STENCIL

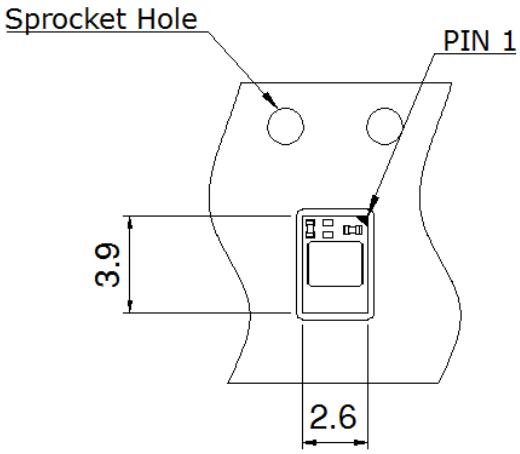
HU2106

1A, High Efficiency LDS Module

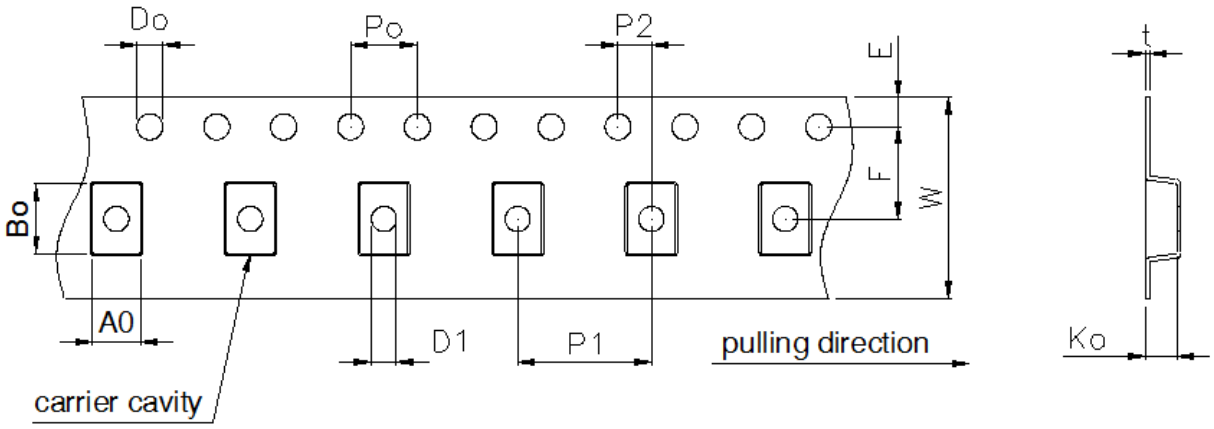
PACKING REFERENCE:

Unit: mm

Package In Tape Loading Orientation



Tape Dimension



A0	2.9± 0.10	E	1.75 ± 0.10
B0	4.2 ± 0.10	K0	1.88 ± 0.10
F	5.50 ± 0.05	P0	4.00 ± 0.10
W	12.00 ±0.30	P1	8.00 ± 0.10
D0	φ1.55 ±0.05	P2	2.00 ± 0.05
D1	φ1.50± 0.10	t	0.25 ± 0.10

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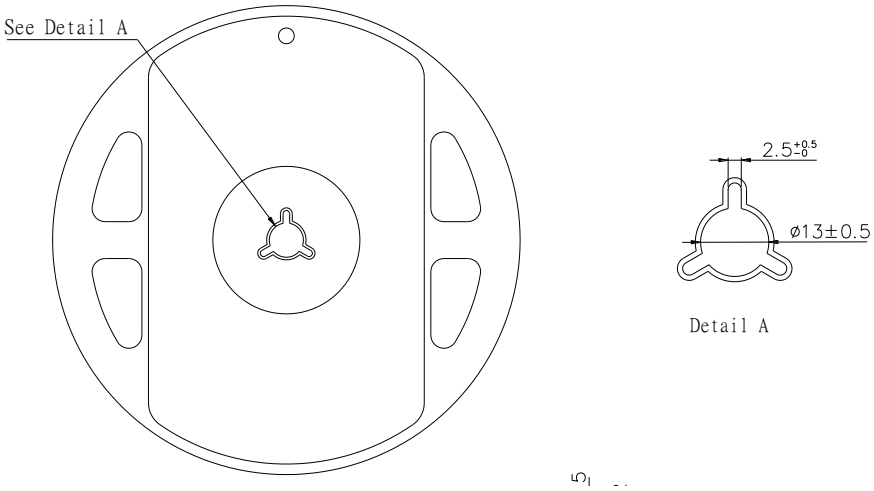
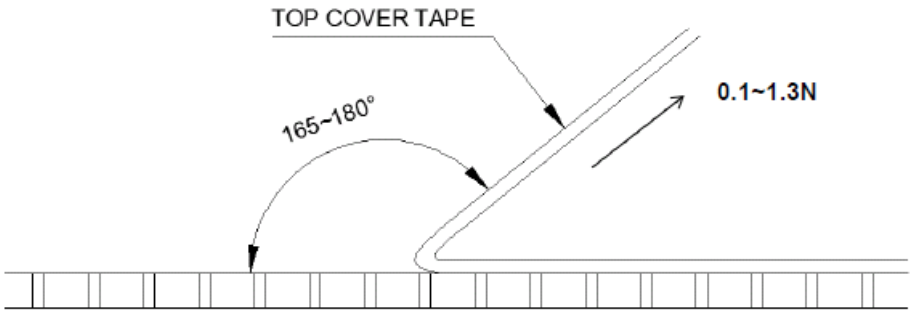
1A, High Efficiency LDS Module

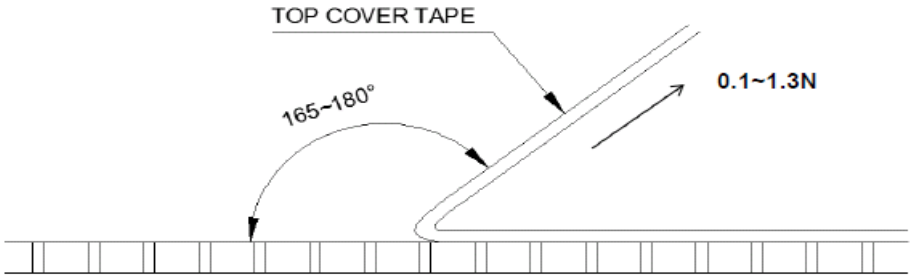
PACKING REFERENCE: (Cont.)

Unit: mm

Reel Dimension







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1A, High Efficiency LDS Module

REVERSION HISTORY:

Date	Revision	Changes
2014.08.01	00	Preliminary Spec. issued initially.
2014.08.07	01	Change Vout range.
2014.10.23	02	Change figure of module; Add Load Transient Consideration.
2015.01.07	03	Add package information.
2015.06.29	04	Add reflow parameters. Add reference circuit for general application.