LV52205MU

Bi-CMOS IC

LED Boost Driver with PWM Dimming

ON Semiconductor®

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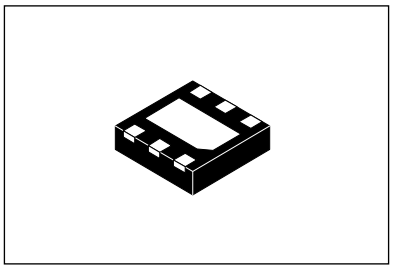
Overview

The LV52205MU is a high voltage boost driver for LED drive. LED current is set by the external resistor R1 and LED dimming can be done by changing FB voltage with PWM control.



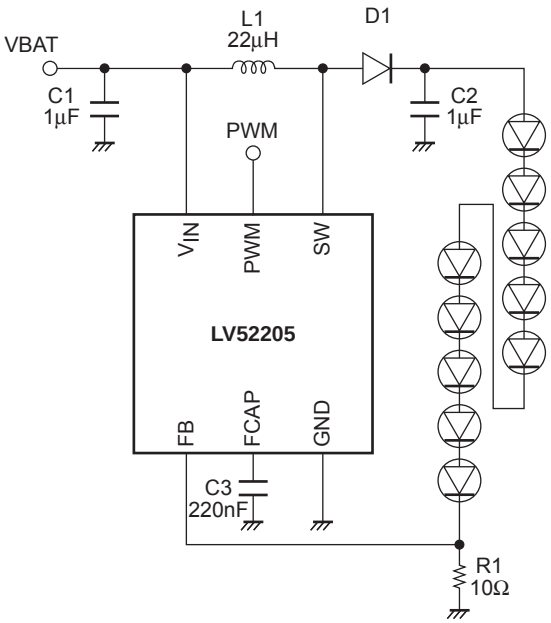
UDFN6 2×2, 0.65P

Feature

- Operating Voltage from 2.7V to 5.5V
- Integrated 42V MOSFET
- PWM dimming for Brightness Control
- 600kHz Switching Frequency

Typical Applications

- LED Display Backlight Control



ORDERING INFORMATION

See detailed ordering and shipping information on page 12 of this data sheet.

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	V_{CC}	5.5	V
Maximum pin voltage1	V1 max	SW	42	V
Maximum pin voltage2	V2 max	Other pin	5.5	V
Allowable power dissipation	Pd max	Ta = 25°C *1	2.05	W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-55 to +125	°C

*1 Mounted on a specified board: 70mm×50mm×1.2mm (4 layer glass epoxy)

Caution 1) Absolute maximum ratings represent the values which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Recommendation Operating Condition at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range1	V_{CC} op	V_{CC}	2.7 to 5.5	V
PWM frequency	Fpwm		300 to 100k	Hz

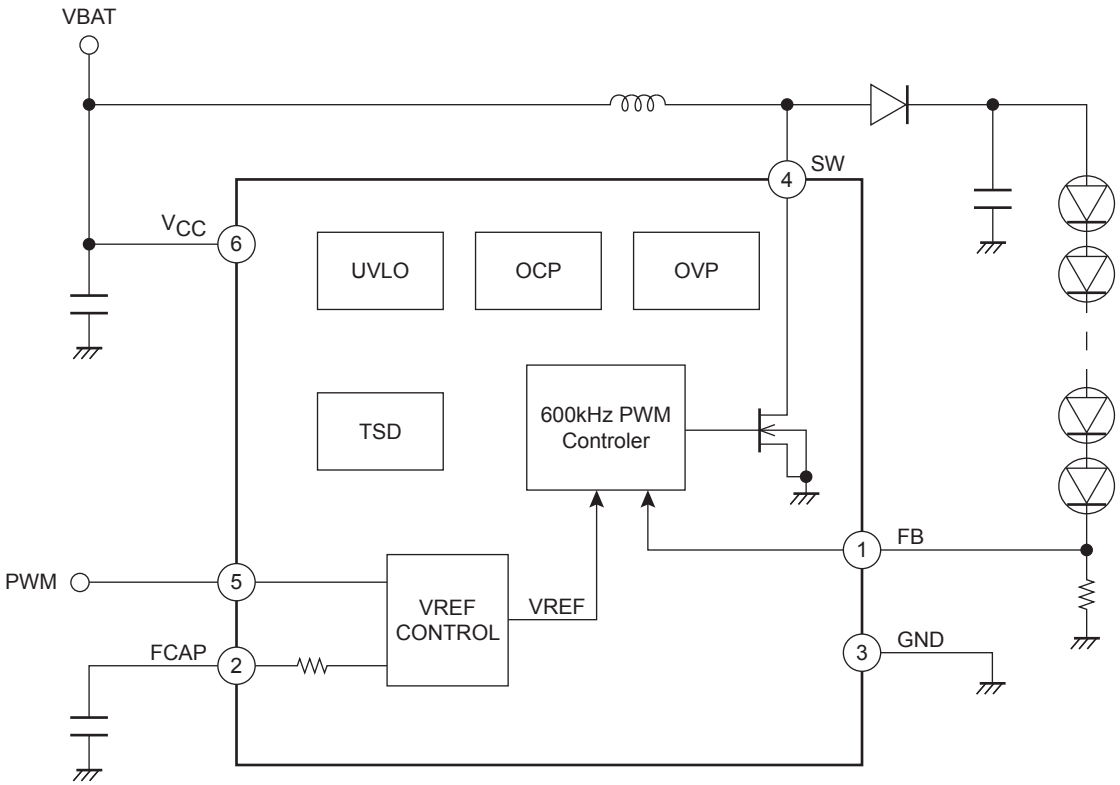
Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Electrical Characteristics Analog block at Ta = 25°C, V_{CC} = 3.6V, unless otherwise specified

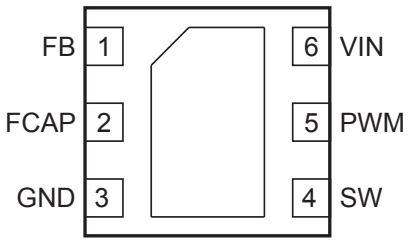
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Standby current dissipation	$I_{CC}1$	SHUTDOWN		0	5	μA
DC/DC current dissipation	$I_{CC}2$	V_{OUT} = 30V, I_{LED} = 20mA			1	mA
FB voltage	Vfb	PWM duty 100%	0.19	0.2	0.21	V
FB pin leak current	Ifb				1	μA
OVP voltage	Vovp	SW	40	41	42	V
SWOUT ON resistance	Ron	IL = 100mA		700		mΩ
NMOS switch current limit	ILIM	Vfb = 200mV		0.7		A
OSC frequency	Fosc			600		kHz
High level input voltage	$V_{IN}H$	PWM	1.5		V_{CC}	V
Low level input voltage	$V_{IN}L$	PWM	0		0.4	V
Under voltage lockout	Vuvlo	V_{IN} falling		2.2		V
PWM setup time from shutdown	Ton		20			us
PWM low time to shutdown	Toff		8.9			ms

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Block Diagram



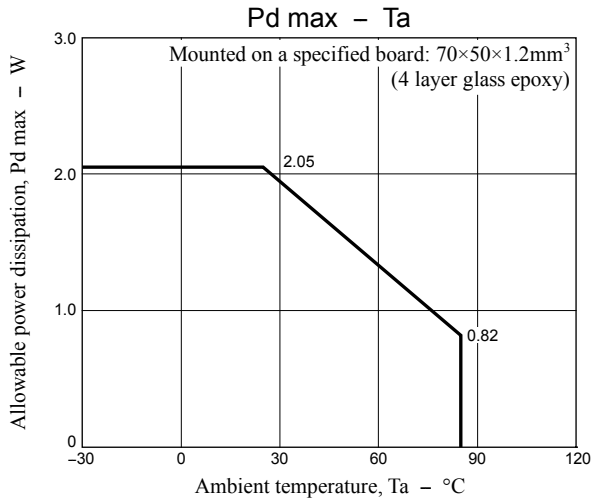
Pin Connections



Top view

Pin Function

PIN #	Pin Name	Description
1	FB	Feedback pin.
2	FCAP	Filtering capacitor terminal for PWM signal.
3	GND	Ground
4	SW	Switch pin. Drain of the internal power FET.
5	PWM	PWM dimming input (active High).
6	V_{CC}	Supply voltage.
	Expose-pad	Connect to GND on PCB.



LED Current Setting

LED current is set by an external resistor connected between the FB pin and ground.

$$I_{LED} = V_{FB}/R_{FB}.$$

The V_{FB} can be controled by PWM signal. PWM input is converted into a near DC current by the internal resistor R that was equivalent to 60kΩ (±10%) and the external capacitor C_{FCAP} as a low pass filter with a cut-off frequency fc = $1/2\pi RC_{FCAP}$. The V_{FB} can be adjusted by altering the duty cycle of the PWM signal (See Fig.1).

$$V_{FB} = 200\ (mV) \times PWM\ Duty\ (\%)$$

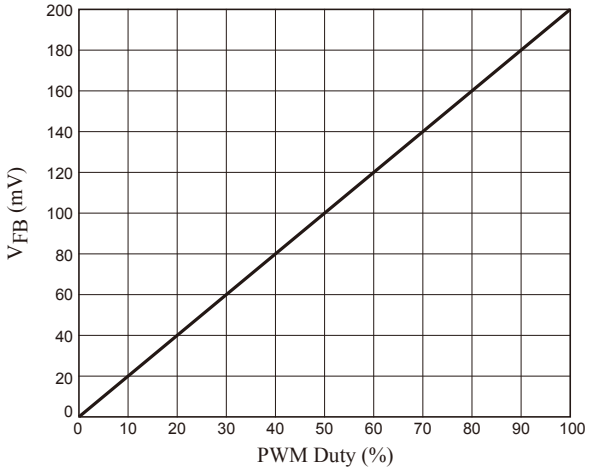


Fig1. V_{FB} vs. PWM Duty

PWM Control

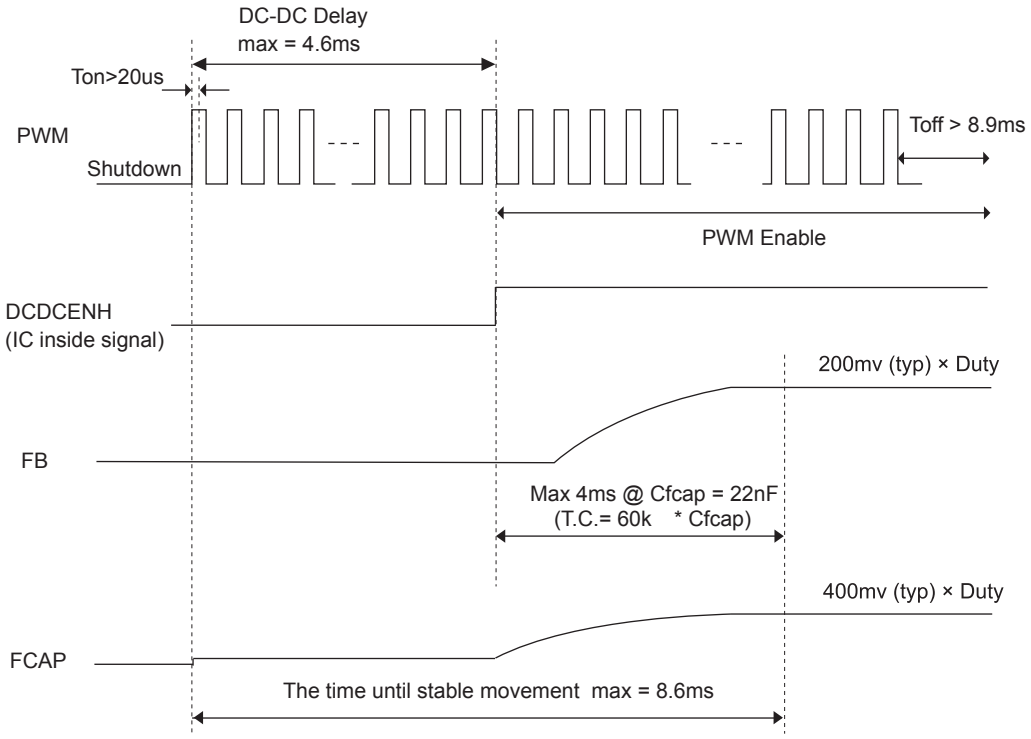


Fig2.Timing Diagram in PWM signal

Open LED Protection

If SW terminal voltage exceeds a threshold Vovp (41V typ) for 8 cycles, boost converter enters shutdown mode. In order to restart the IC, PWM setup signal is required again.

Over Current Protection

Current limit value for built-in power MOS is around 0.7A. The power MOS is turned off for each switching cycle when peak current through it exceeds the limit value.

Under Voltage Lock Out (UVLO)

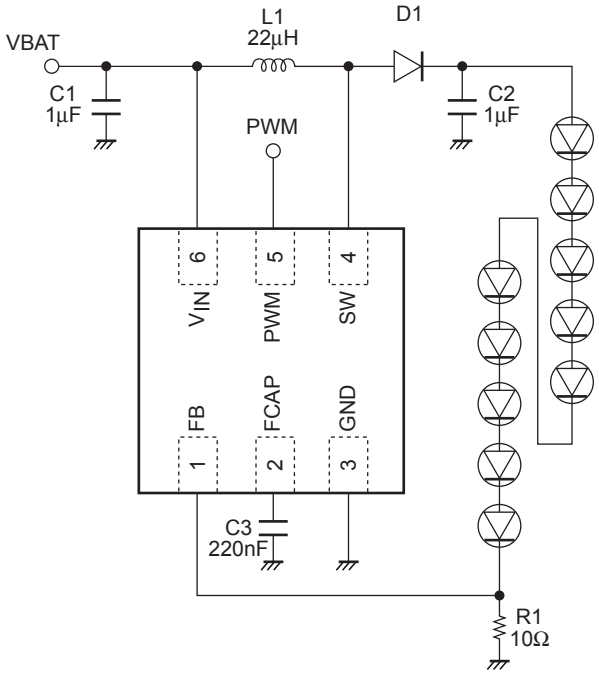
UVLO operation works when V_{IN} terminal voltage is below 2.2V.

Thermal Shutdown

When chip temperature is too high, boost converter is stopped.

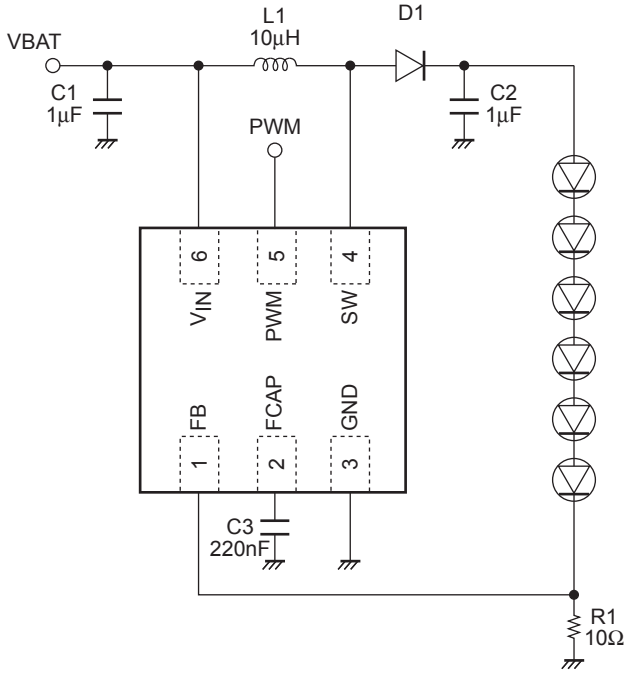
Application Circuit Diagram

10LEDs



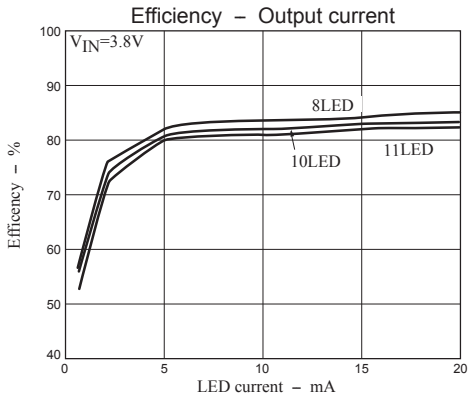
L1: VLS3012T-220M49 (TDK), VLF504015MT-220M (TDK)
D1: MBR0540T1 (ONsemi), NSR05F40 (ONsemi)
C2: GRM21BR71H105K (Murata), C1608X5R1H105K (TDK)

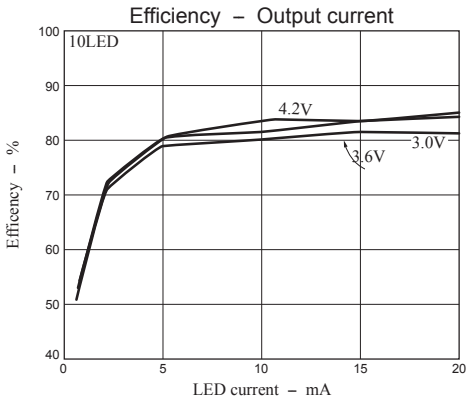
6LEDs

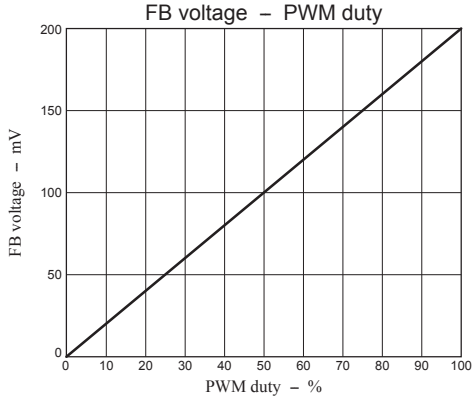


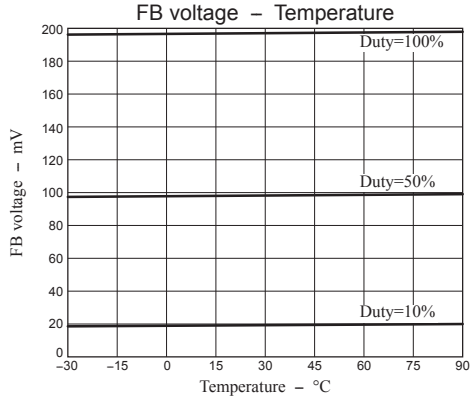
L1: VLS3012T-100M72 (TDK), VLF302512M-100M (TDK)
D1: MBR0540T1 (ONsemi), NSR05F40 (ONsemi)
C2: GRM21BR71H105K (Murata), C1608X5R1H105K (TDK)

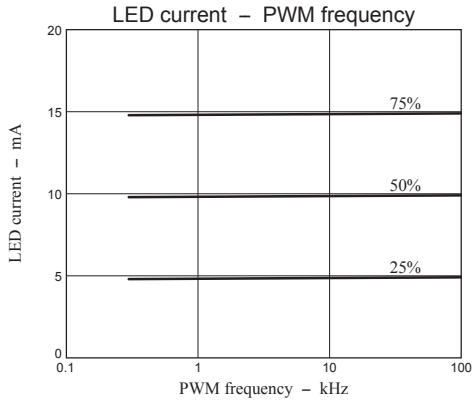
Typical Characteristics (V_{IN} = 3.6V, L = 22μH, T = 25°C, unless otherwise specified)

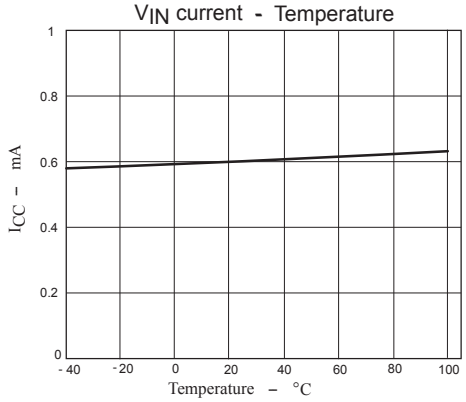


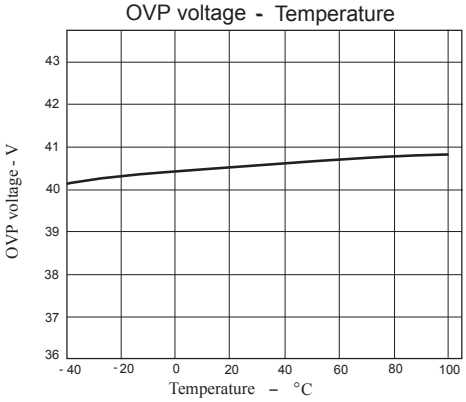


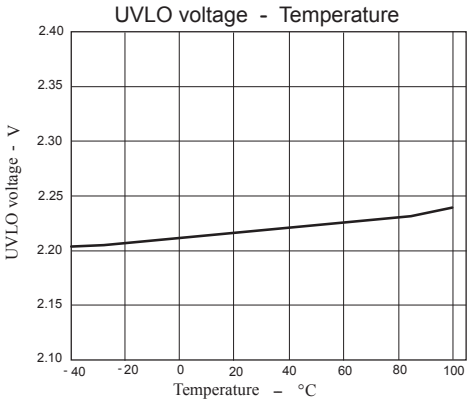






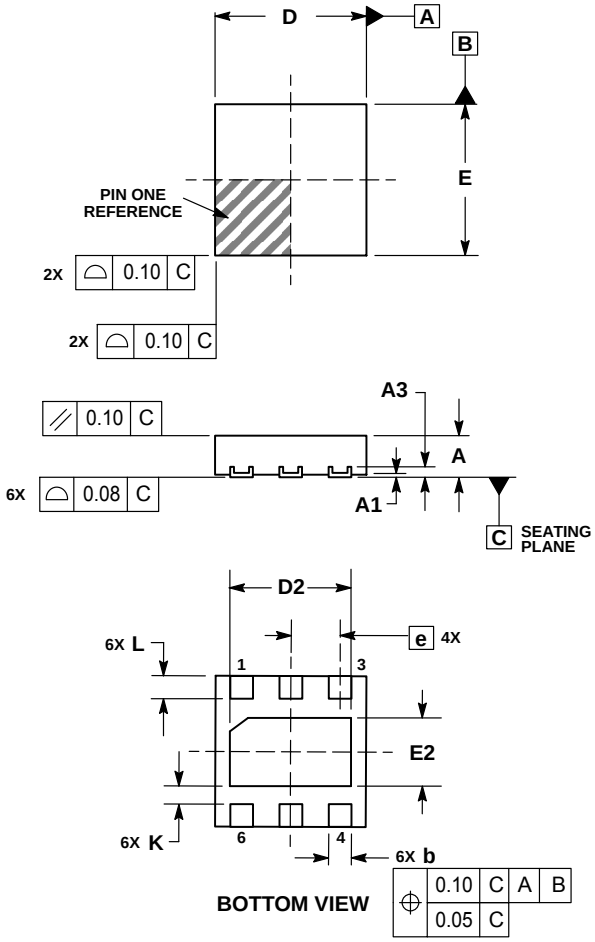






PACKAGE DIMENSIONS

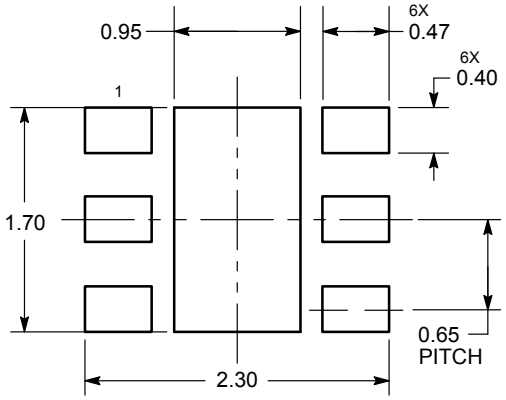
UDFN6 2x2, 0.65P
CASE 517AB



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.127 REF	
b	0.25	0.35
D	2.00 BSC	
D2	1.50	1.70
E	2.00 BSC	
E2	0.80	1.00
e	0.65 BSC	
K	0.20	---
L	0.25	0.35

SOLDERING FOOTPRINT*

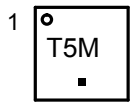


DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

LV52205MU is as follows.

MARKING DIAGRAM



T5 = Device Code
M = Date Code
▪ = Pb−Free Package

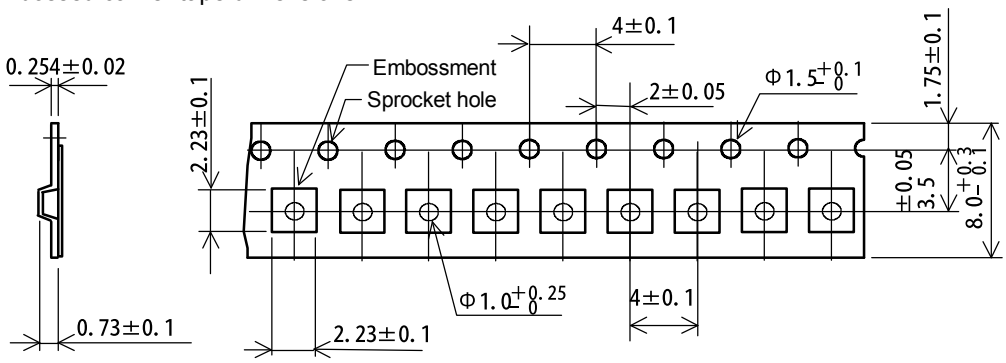
(Note: Microdot may be in either location)

Packing Specification of Embossed Carrier Taping

UDFN6 (2.0×2.0) 3,000 pcs/reel

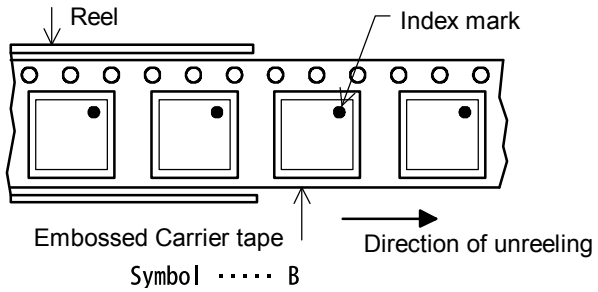
1 .EMBOSSED CARRIER TAPING

1 - 1 .Embossed carrier tape dimensions

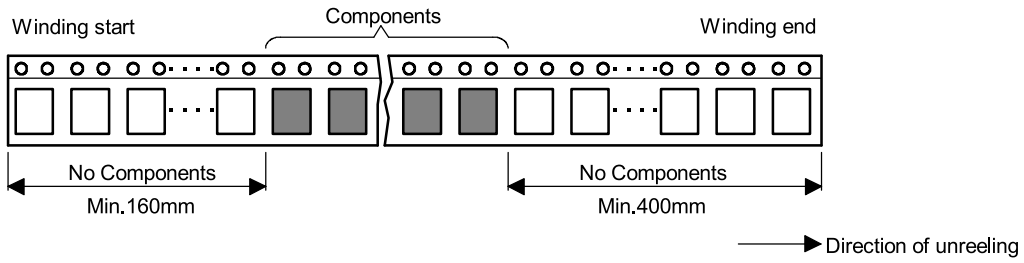


Unit• Fmm

1 - 2 .Tape mounting direction



1 - 3 .Reel winding start and reel winding end



2 .TAPE STRENGTH

2 - 1 .Tensile strength of the carrier tape ： Min.10N

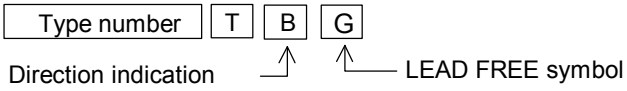
2 - 2 .Peel strength of the top cover tape

(a)Peel angle ： 165° to 180° relative to the tape adhesive surface

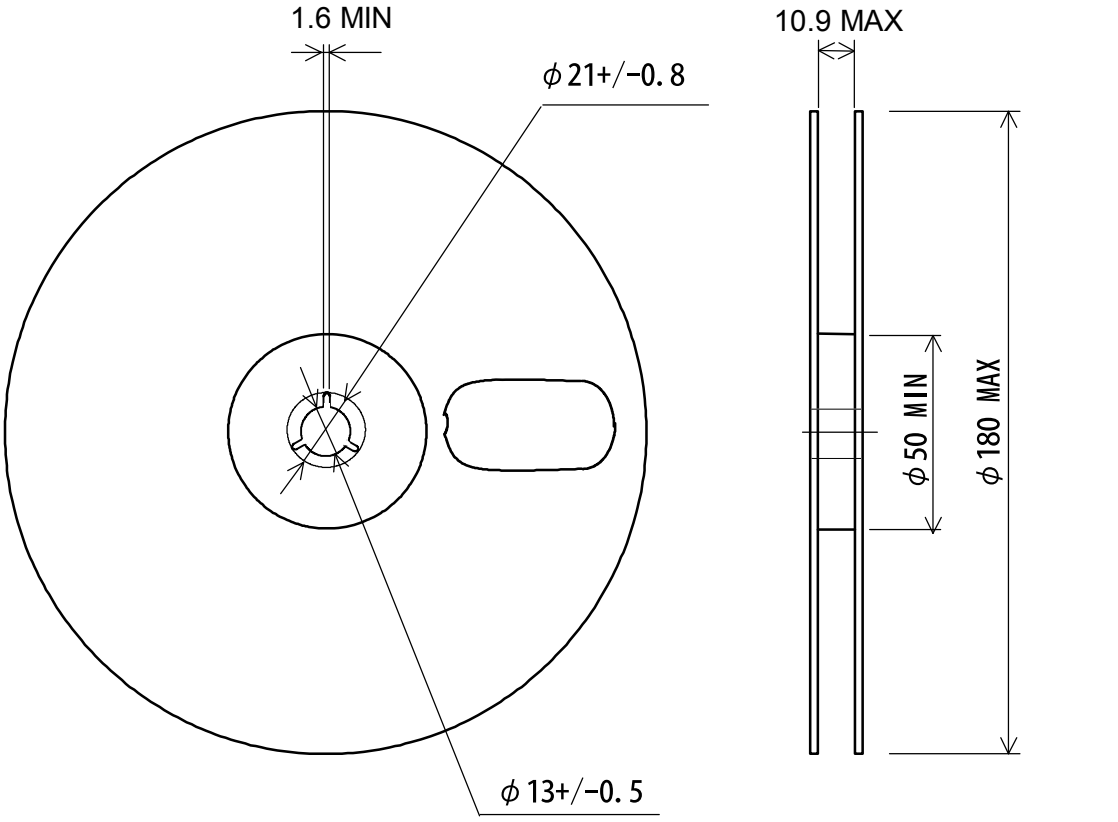
(b)Peel rate ： 300mm / minute

(c)Peel of strength ： 0.1N to 1.0N

3 .PARTS No. ON BAR CODE LABEL



4 .REEL DIMENSIONS

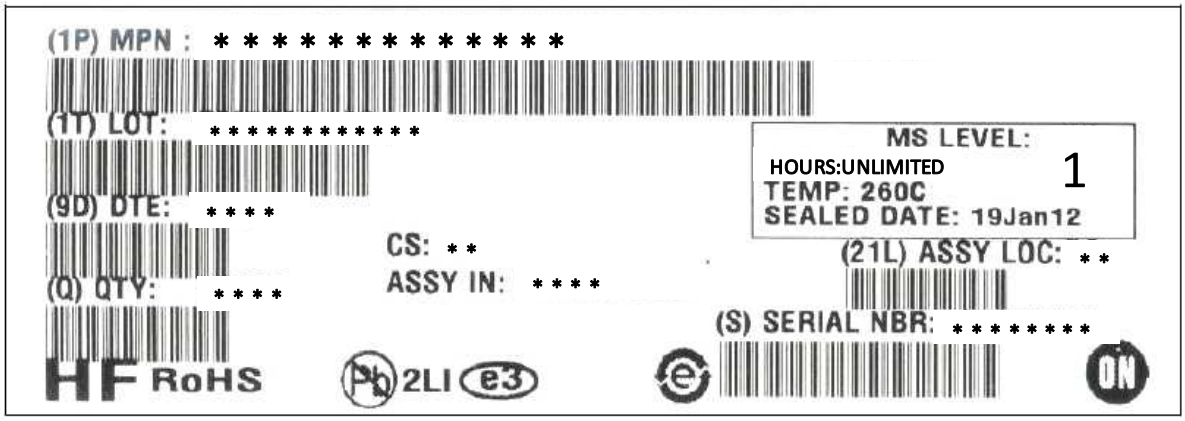


TYPE:P-RRM-08B

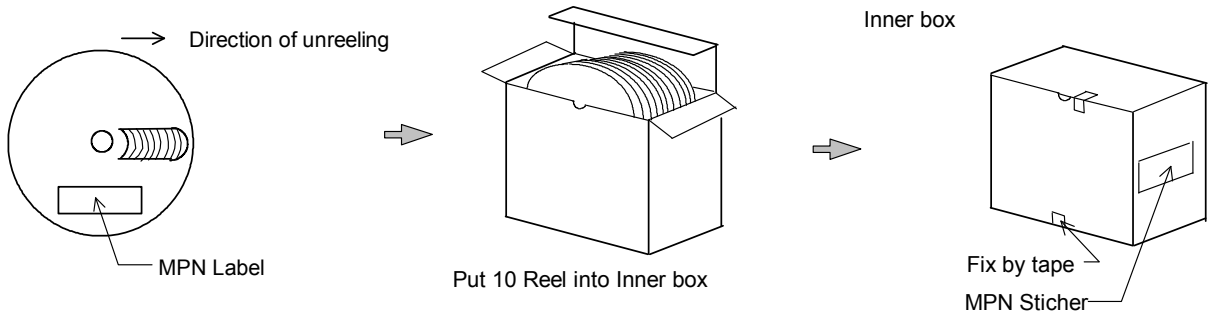
UNIT:mm

Carrier tape type number	SANYO Package code	Maximum number of ICs contained (pcs.)		Packing form
		Reel	Inner box	Inner box. B50766P001
N22986D001	UDFN6(2.0*2.0)	3,000	30,000	10 Reels contained Dimensions:mm 190 × 136 × 186

MPN Label



Packing Method



ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LV52205MUTBG	UDFN6 (2x2) (Pb-Free)	3000 / Tape & Reel