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# LV52205MU



ON Semiconductor®

www.onsemi.com

Bi-CMOS IC

## LED Boost Driver with PWM Dimming

### Overview

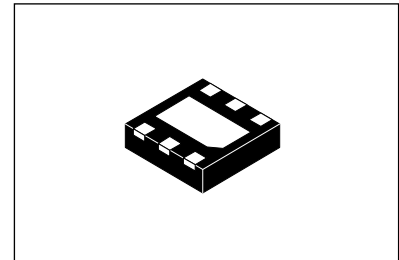
The LV52205MU is a high voltage boost driver for LED drive. LED current is set by the external resistor R1 and LED dimming can be done by changing FB voltage with PWM control.

### Feature

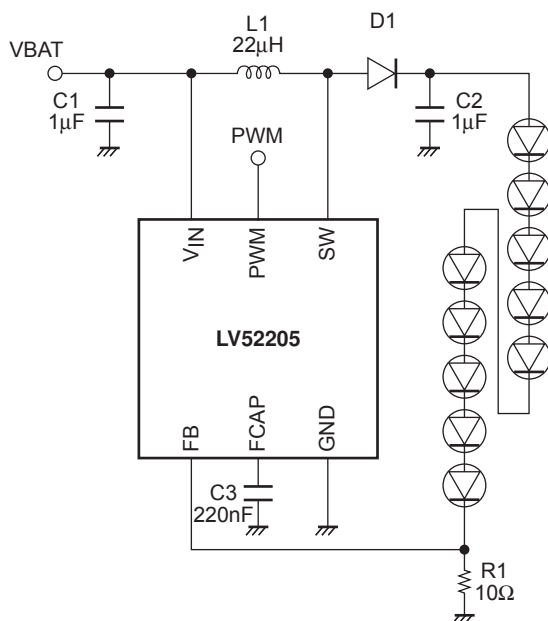
- Operating Voltage from 2.7V to 5.5V
- Integrated 42V MOSFET
- PWM dimming for Brightness Control
- 600kHz Switching Frequency

### Typical Applications

- LED Display Backlight Control



UDFN6 2x2, 0.65P



### ORDERING INFORMATION

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

# LV52205MU

## Specifications

### Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$	$V_{CC}$	5.5	V
Maximum pin voltage1	$V1\text{ max}$	SW	42	V
Maximum pin voltage2	$V2\text{ max}$	Other pin	5.5	V
Allowable power dissipation	$Pd\text{ max}$	$T_a = 25^\circ\text{C} *1$	2.05	W
Operating temperature	$T_{opr}$		-30 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +125	$^\circ\text{C}$

\*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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range1	$V_{CC\text{ op}}$	$V_{CC}$	2.7 to 5.5	V
PWM frequency	$F_{pwm}$		300 to 100k	Hz

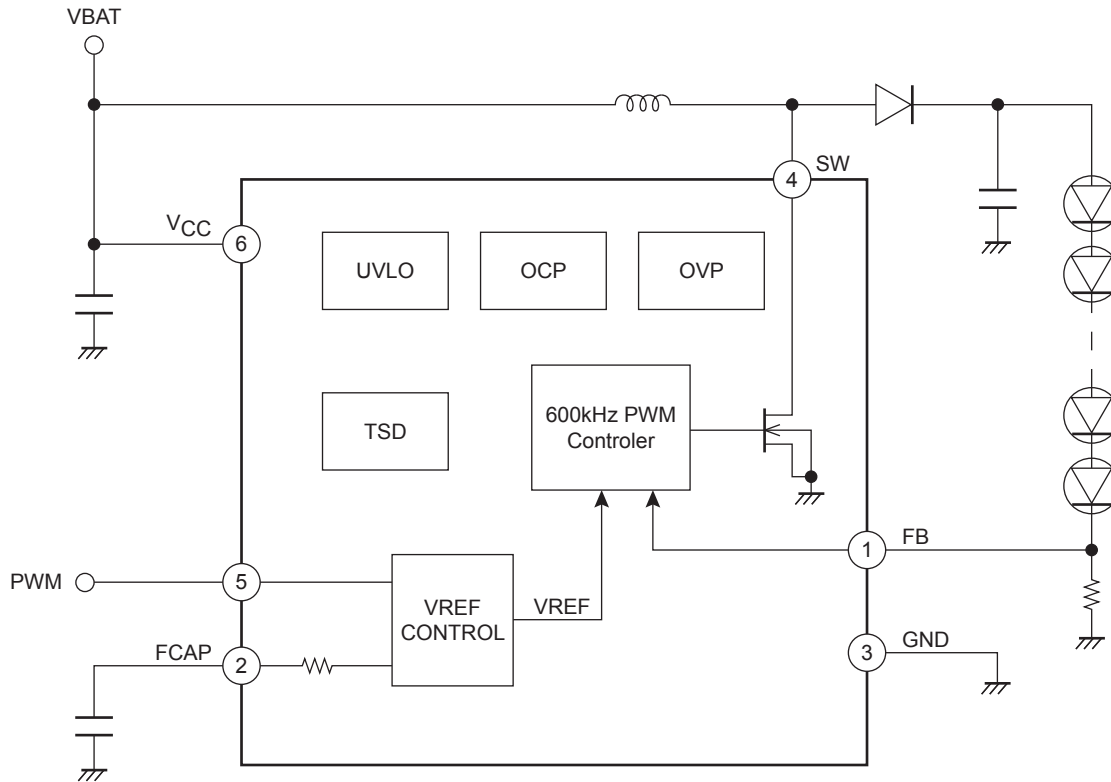
Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

### Electrical Characteristics Analog block at $T_a = 25^\circ\text{C}$ , $V_{CC} = 3.6\text{V}$ , unless otherwise specified

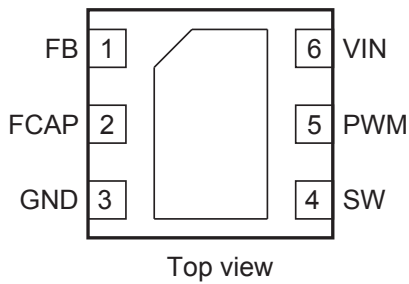
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Standby current dissipation	$I_{CC1}$	SHUTDOWN		0	5	$\mu\text{A}$
DC/DC current dissipation	$I_{CC2}$	$V_{OUT} = 30\text{V}$ , $I_{LED} = 20\text{mA}$			1	mA
FB voltage	$V_{fb}$	PWM duty 100%	0.19	0.2	0.21	V
FB pin leak current	$I_{fb}$				1	$\mu\text{A}$
OVP voltage	$V_{ovp}$	SW	40	41	42	V
SWOUT ON resistance	$R_{on}$	$I_L = 100\text{mA}$		700		$\text{m}\Omega$
NMOS switch current limit	$I_{LIM}$	$V_{fb} = 200\text{mV}$		0.7		A
OSC frequency	$F_{osc}$			600		kHz
High level input voltage	$V_{INH}$	PWM	1.5		$V_{CC}$	V
Low level input voltage	$V_{INL}$	PWM	0		0.4	V
Under voltage lockout	$V_{uvlo}$	$V_{IN}$ falling		2.2		V
PWM setup time from shutdown	$T_{on}$		20			us
PWM low time to shutdown	$T_{off}$		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**

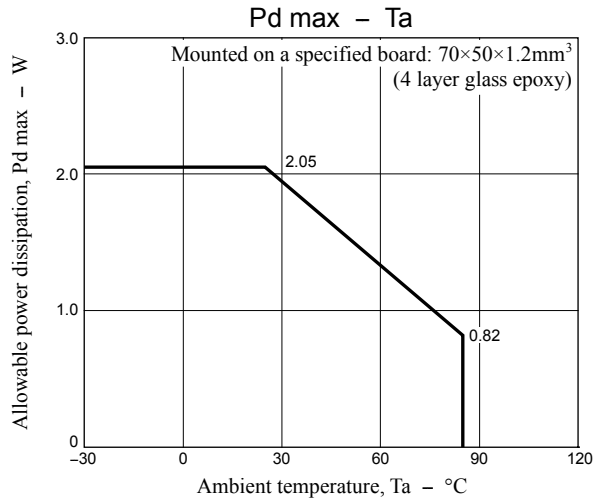


**Pin Connections**



**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 <sub>CC</sub>	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 controlled 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  $f_c = 1/2\pi RC_{FCAP}$ . The  $V_{FB}$  can be adjusted by altering the duty cycle of the PWM signal (See Fig.1).

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

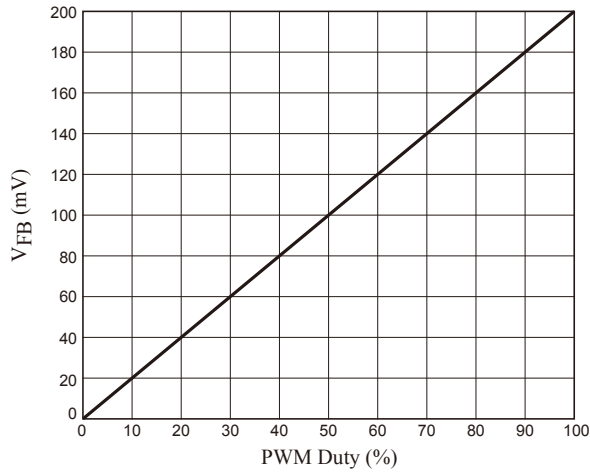
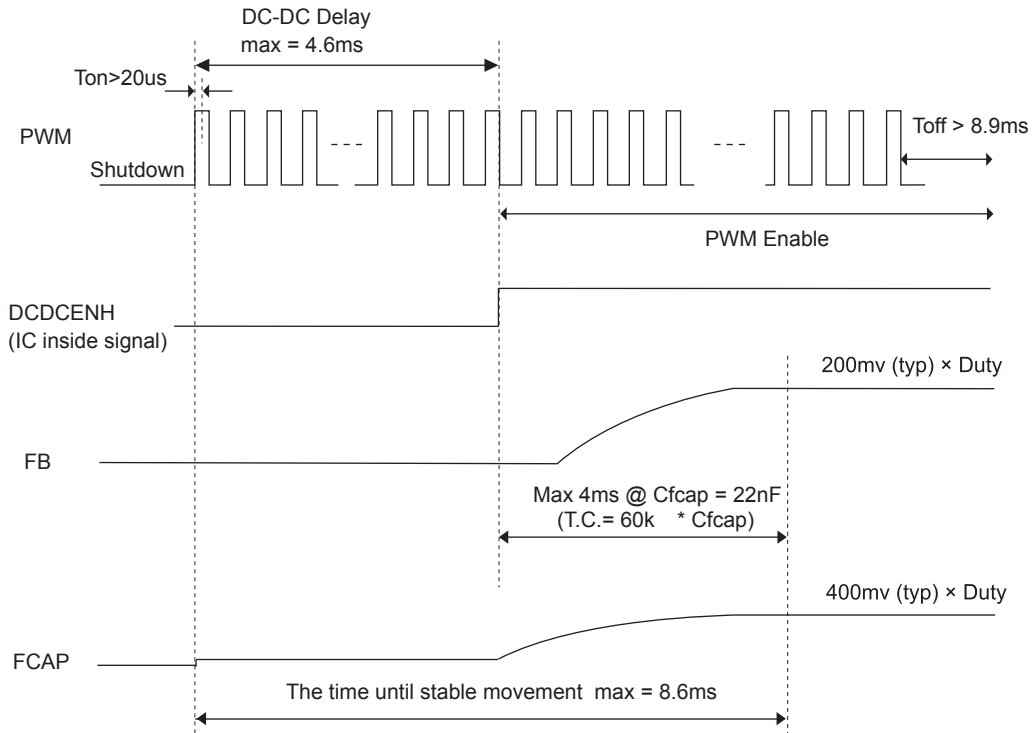


Fig1.  $V_{FB}$  vs. PWM Duty

**PWM Control**



*Fig2. Timing Diagram in PWM signal*

**Open LED Protection**

If SW terminal voltage exceeds a threshold  $V_{ovp}$  (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.

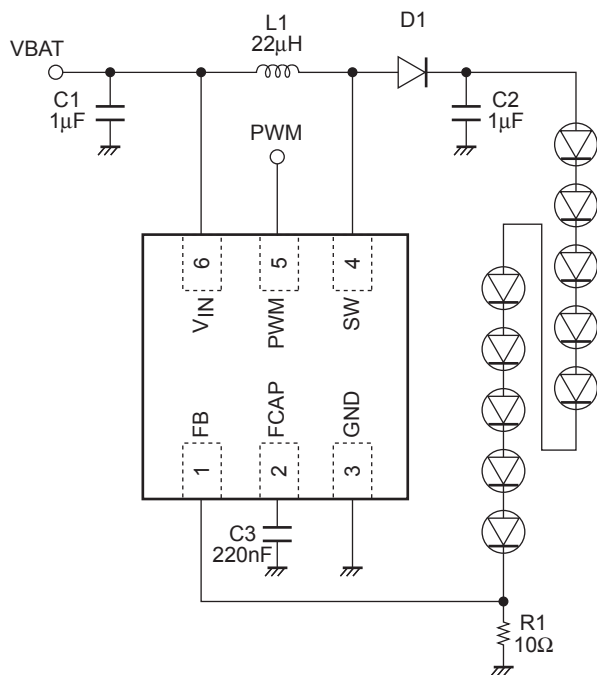
**Thermal Shutdown**

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



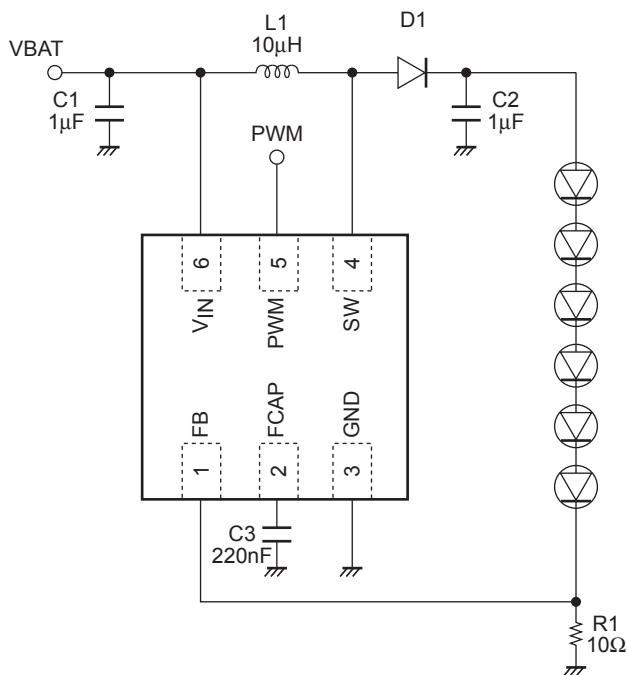
Application Circuit Diagram

10LEDs



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

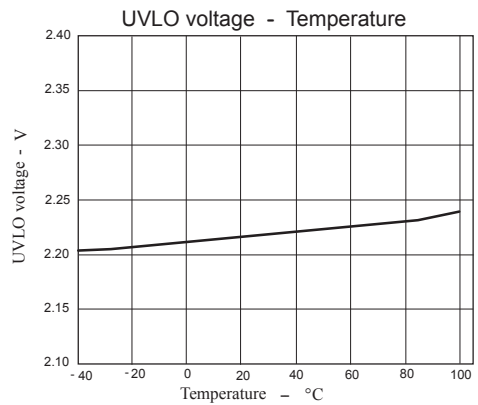
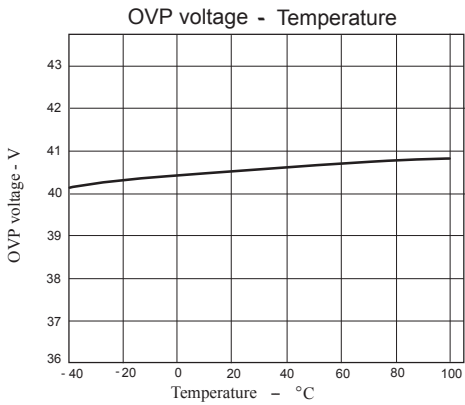
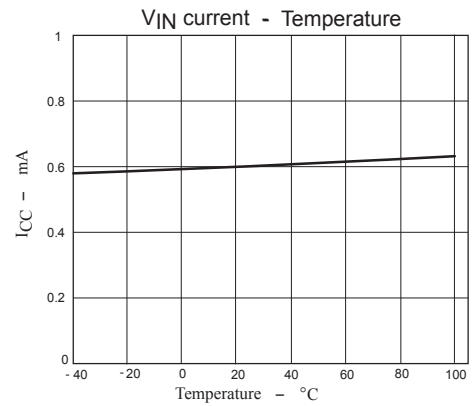
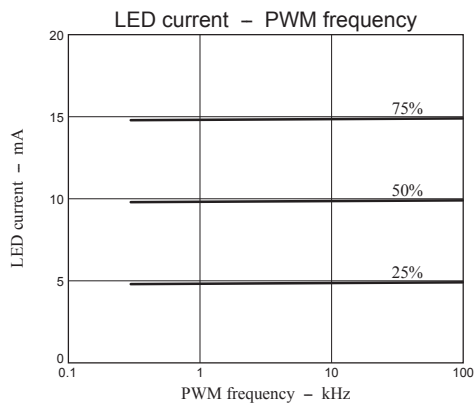
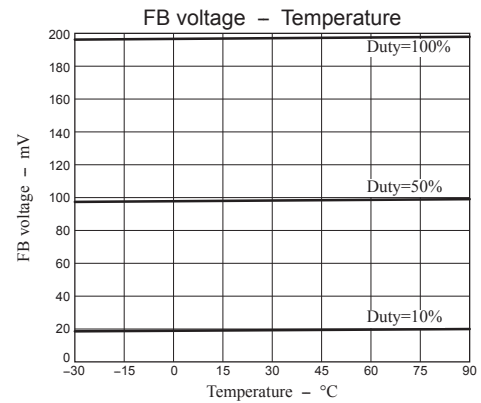
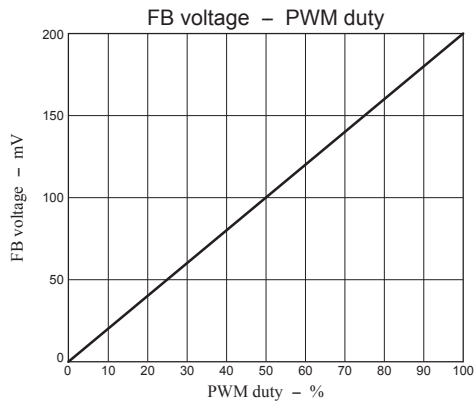
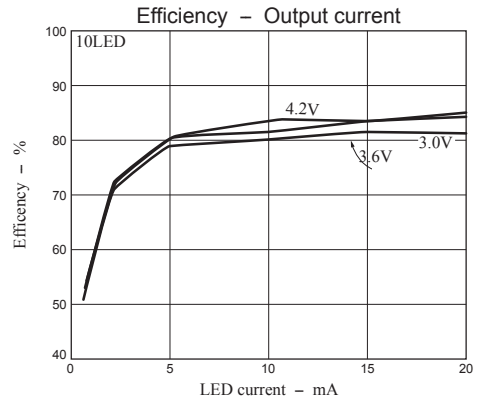
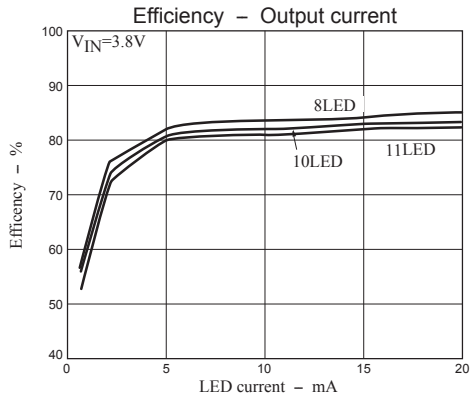
6LEDs



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

# LV52205MU

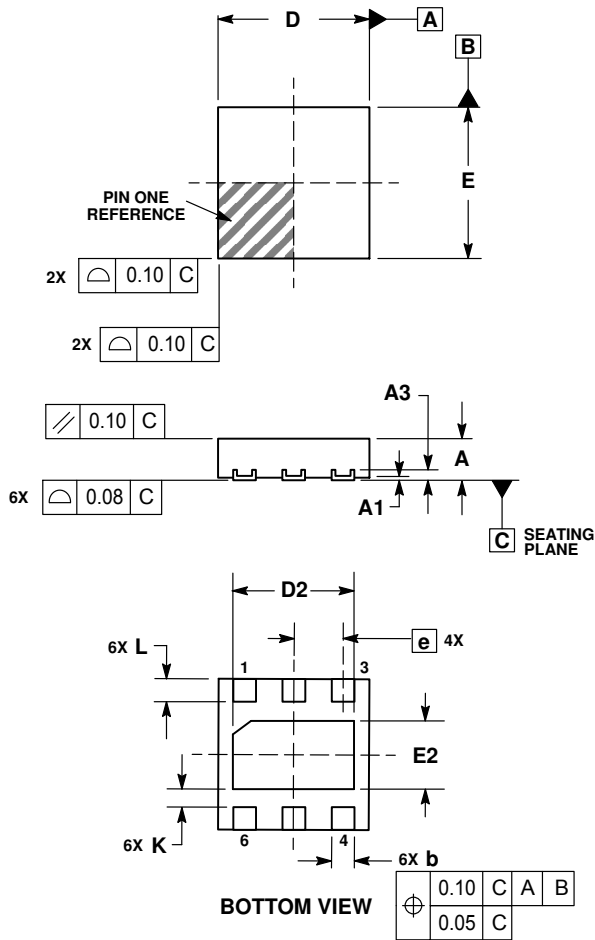
Typical Characteristics ( $V_{IN} = 3.6V$ ,  $L = 22\mu H$ ,  $T = 25^\circ C$ , unless otherwise specified)





**PACKAGE DIMENSIONS**

UDFN6 2x2, 0.65P  
CASE 517AB

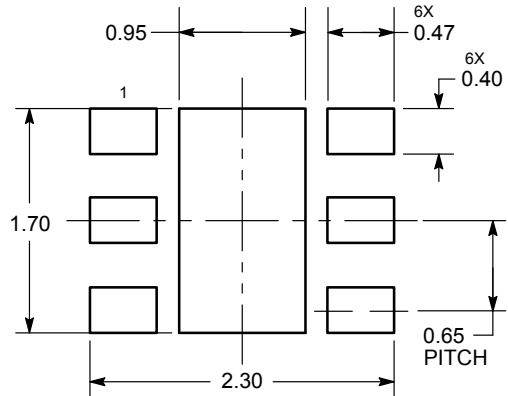


NOTES:

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.

DIM	MILLIMETERS	
	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\***

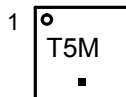


DIMENSIONS: MILLIMETERS

\*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**



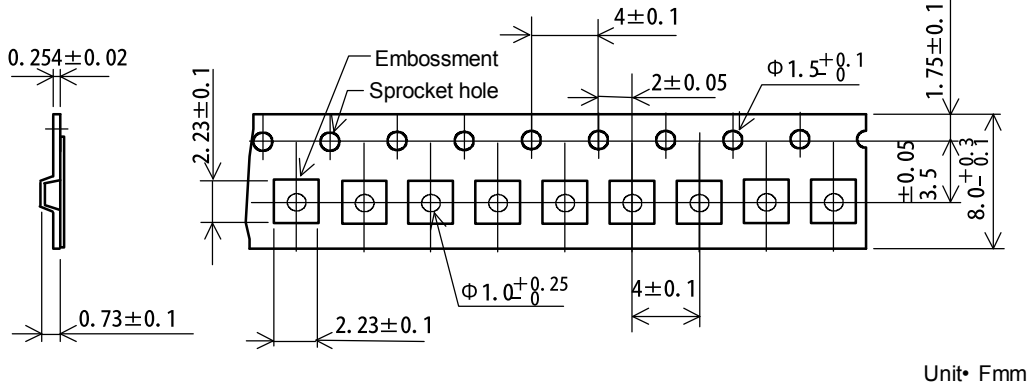
- T5 = Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

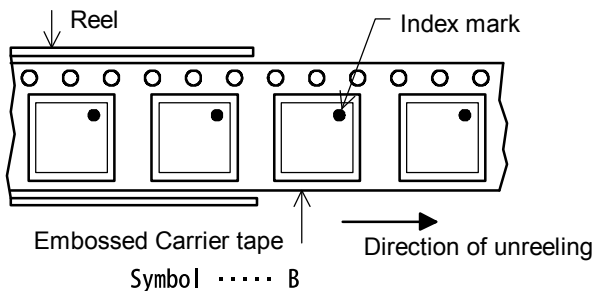
**Packing Specification of Embossed Carrier Taping**  
**UDFN6 (2.0×2.0) 3,000 pcs/reel**

1.EMBOSSED CARRIER TAPING

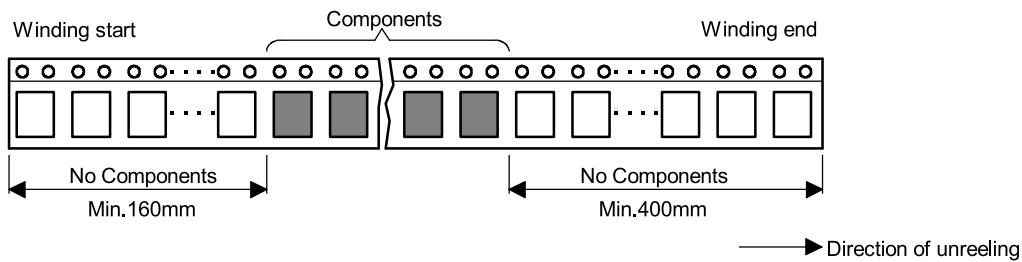
1 - 1 .Embossed carrier tape dimensions



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

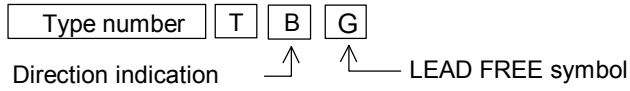
2 - 2 .Peel strength of the top cover tape

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

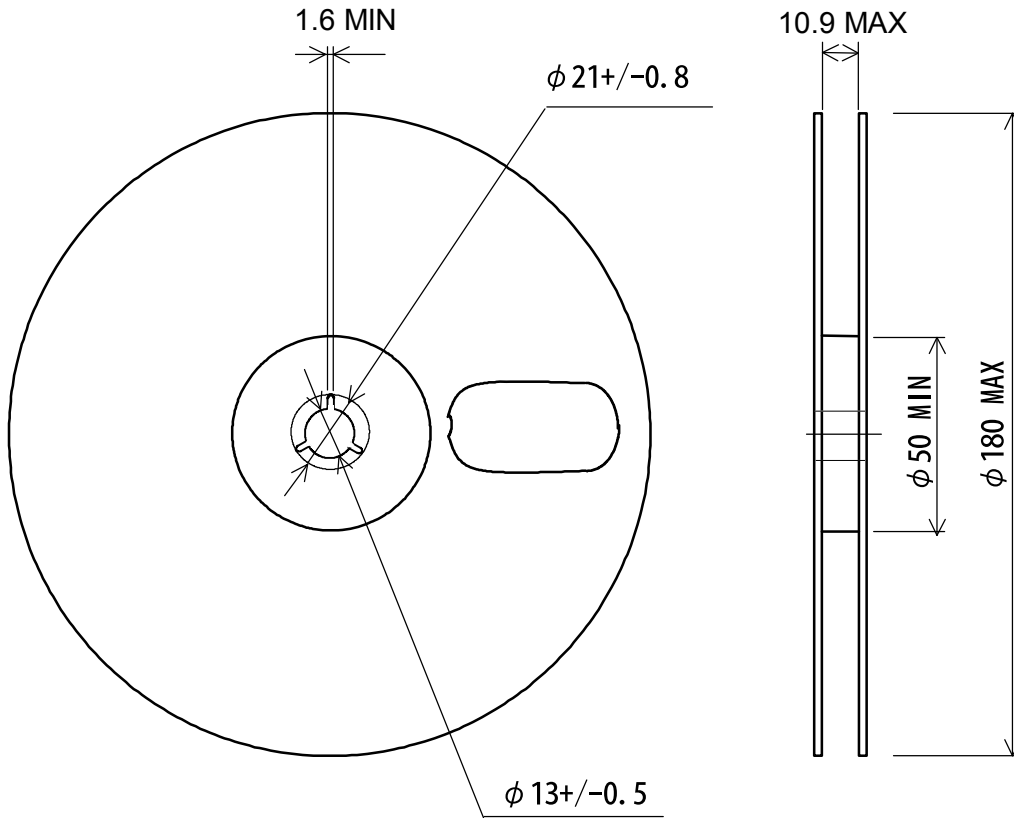
( b )Peel rate : 300mm / minute

( c )Peel of strength : 0.1N to 1.0N

3 .PARTS No. ON BAR CODE LABEL



4 .REEL DIMENSIONS

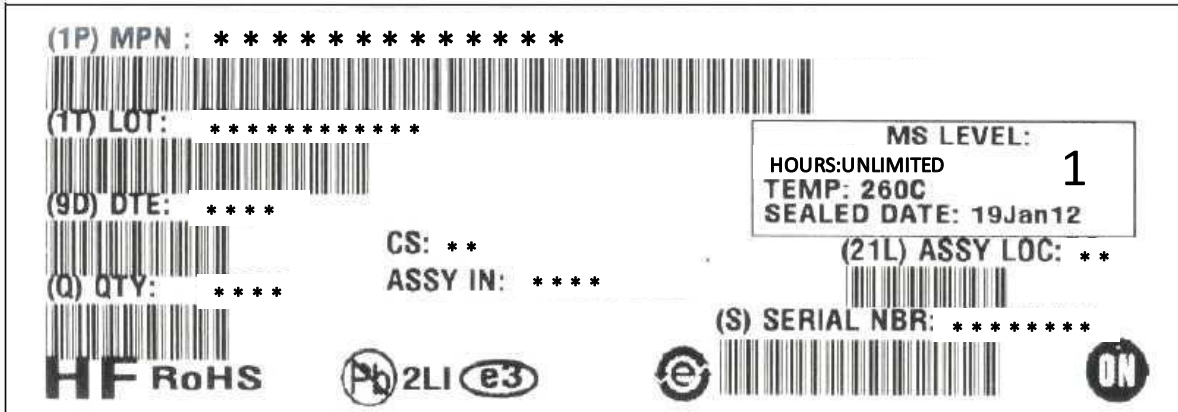


TYPE:P-RRM-08B  
UNIT:mm

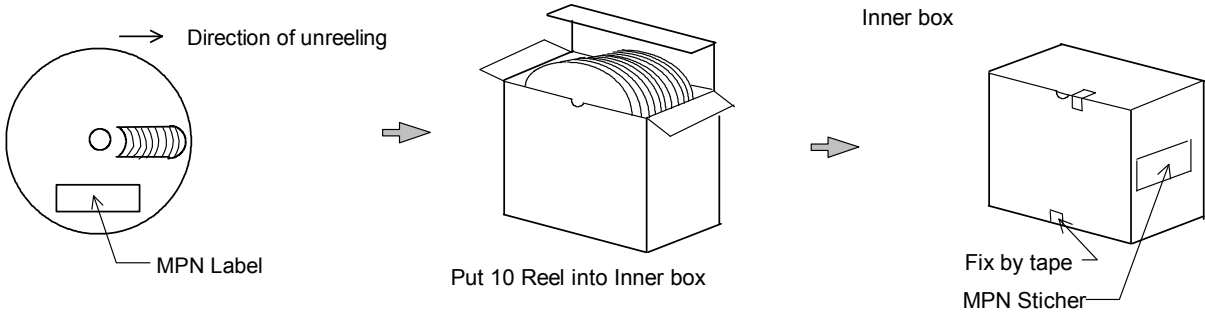
# LV52205MU

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

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