LMS1585A 5A/LMS1587 5A and 3A Low Dropout Fast Response Regulators

Check for Samples: LMS1585A , LMS1587

FEATURES

- **Fast Transient Response**
- **Available in Adjustable, 1.5V, and 3.3V versions**
- **Current Limiting and Thermal Protection**
- **Commercial Temp. Tange: 0°C to 125°C**
- **Industrial Temp. Range: −40°C to 125°C**
- **Line Regulation 0.005% (typical)**
- **Load Regulation 0.05% (typical)**
- **Direct Replacement for LT® 1585A/87**

APPLICATIONS

- **Pentium® processor supplies**
- **PowerPC® supplies**
- **Other microprocessor supplies**
- **Low voltage logic supplies**

DESCRIPTION

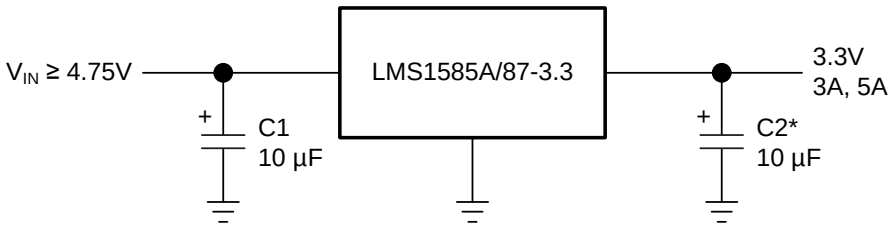
The LMS1585A and LMS1587 are low dropout positive regulators with output load current of 5A and 3A respectively. Their low dropout voltage (1.2V) and fast transient response make them an excellent solution for low voltage microprocessor applications.

The LMS1585A/87 are available in adjustable versions, which can set the output voltage with only two external resistors. In addition, they are also available in 1.5V and 3.3V fixed voltage versions(1).

The LMS1585A/87 circuits include a zener trimmed bandgap reference, current limiting and thermal shutdown. The LMS1585A/87 series are available in KTT (TO-263) and NDE (TO-220) packages.

(1) Consult factory for other fixed voltage options.

Typical Application



* Required for Stability

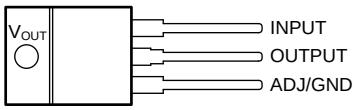


Figure 1. NDE (TO-220)
(Top View)

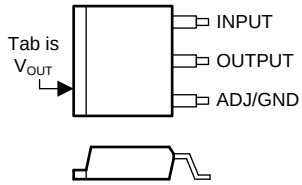


Figure 2. KTT (TO-263)
(Top View)

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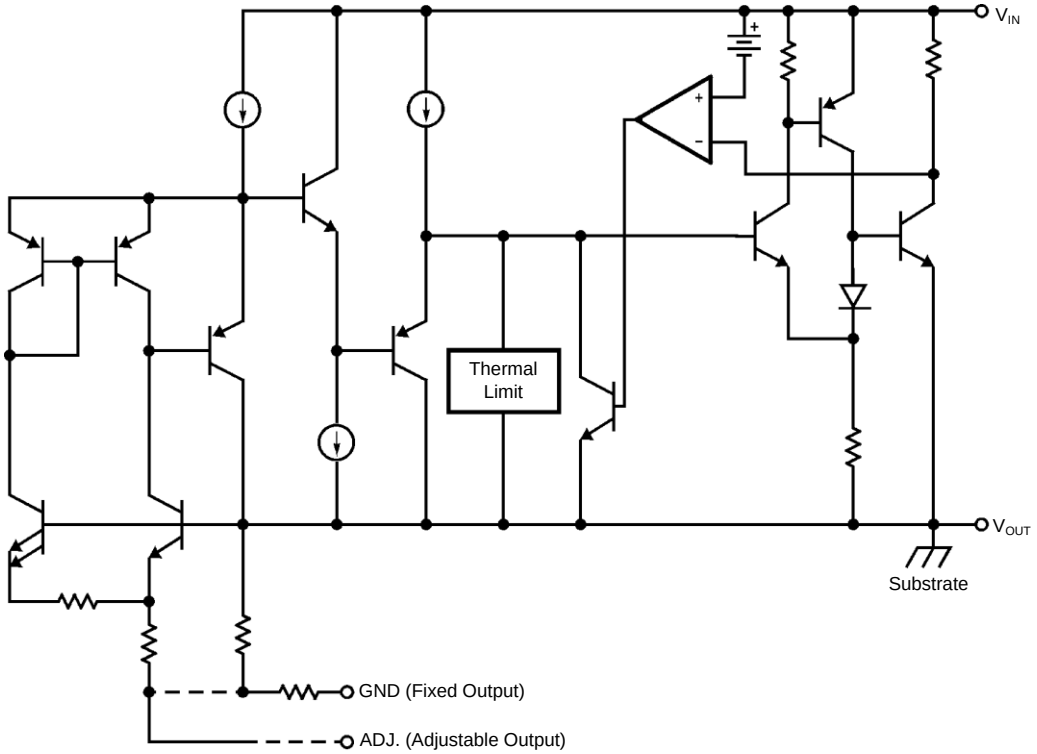


Table 1. LMS1585A/LMS1587 Device Options

Part Number	Output Voltage	Operating Temperature	Package Drawing	Package Type	Output Current
LMS1585AIS-1.5	1.5V	-40°C to 125°C	KTT	TO-263	5A
LMS1585AIS-3.3	3.3V				
LMS1585ACS-ADJ	Adjustable	0°C to 125°C			
LMS1585ACS-1.5	1.5V				
LMS1585ACS-3.3	3.3V				
LMS1585ACT-1.5	1.5V		NDE	TO-220	5A
LMS1585ACT-3.3	3.3V				
LMS1587IS-ADJ	Adjustable	–40°C to 125°C	KTT	TO-263	3A
LMS1587IS-1.5	1.5V				
LMS1587IS-3.3	3.3V				
LMS1587CS-ADJ	Adjustable	0°C to 125°C			
LMS1587CS-3.3	3.3V				
LMS1587CS-1.5	1.5V				
LMS1587IT-1.5	1.5V	–40°C to 125C	NDE	TO-220	
LMS1587CT-ADJ	Adjustable	0°C to 125°C			
LMS1587CT-3.3	3.3V				

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

ABSOLUTE MAXIMUM RATINGS(1)(2)

Maximum Input to Output Voltage (V_{IN} to GND)	13V
Power Dissipation(3)	Internally Limited
Junction Temperature (T_J)(3)	150˚C
Storage Temperature Range	-65˚C to 150˚C
Lead Temperature	260˚C, 10 sec
ESD Tolerance(4)	2000V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.
(2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/ Distributors for availability and specifications.
(3) The maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(max)} – T_A)/\theta_{JA}$. All numbers apply for packages soldered directly into a PC board.
(4) For testing purposes, ESD was applied using human body model, 1.5 kΩ in series with 100 pF.

ELECTRICAL CHARACTERISTICS

Typicals and limits appearing in normal type apply for T_J = 25˚C. Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, 0˚C to 125˚C for commercial grade and −40˚C to 125˚C for industrial grade.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
V_{REF}	Reference Voltage	LMS1585A-ADJ $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 10mA 10mA ≤ I_{OUT} ≤ 5A, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V	1.238 **1.225**	1.250 **1.250**	1.262 **1.275**	V V
		LMS1587-ADJ 10mA ≤ I_{OUT} ≤ 3A, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V	**1.225**	1.250	**1.275**	V
V_{OUT}	Output Voltage	LMS1585A-1.5 I_{OUT} = 0mA, V_{IN} = 5V 0 ≤ I_{OUT} ≤ 5A, 3V ≤ V_{IN} ≤ 7V	1.485 **1.470**	1.500	1.515 **1.530**	V V
		LMS1585A-3.3 I_{OUT} = 0mA, V_{IN} = 5V 0 ≤ I_{OUT} ≤ 5A, 4.75V ≤ V_{IN} ≤ 7V	3.267 **3.235**	3.300 3.300	3.333 **3.365**	V V
		LMS1587-1.5 V_{IN} = 5V, I_{OUT} = 0mA, TJ = 25˚C 0≤ I_{OUT} ≤ 3A, 3V ≤ V_{IN} ≤ 7V	1.485 **1.470**	1.500 1.500	1.515 **1.530**	V V
		LMS1587-3.3 0 ≤ I_{OUT} ≤ 3A, 4.75V ≤ V_{IN} ≤ 7V	**3.235**	3.300	**3.365**	V
ΔV_{OUT}	Line Regulation (3)	LMS1585A/87-ADJ I_{OUT} = 10mA, 2.75V ≤ V_{IN} ≤ 7V		0.005	**0.2**	%
		LMS1585A/87-3.3 I_{OUT} = 0mA, 4.75V ≤ V_{IN} ≤ 7V		0.005	**0.2**	%
		LMS1585A/87-1.5 I_{OUT} = 0mA, 3V ≤ V_{IN} ≤ 7V		0.005	0.2	%
ΔV_{OUT}	Load Regulation (3)	LMS1585A-ADJ $V_{IN}-V_{OUT}$ = 3V, 10mA ≤ I_{OUT} ≤ 5A		0.05	0.3 **0.5**	%
		LMS1585A-1.5/LMS1585A-3.3 V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 5A		0.05 0.05	0.3 **0.5**	%
		LMS1587-ADJ $V_{IN}-V_{OUT}$ = 3V, 10mA ≤ IOUT ≤ 3A		0.05 0.05	0.3 **0.5**	% %
		LMS1587-1.5/LMS1587-3.3 V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 3A		0.05 0.05	0.3 **0.5**	% %
$V_{IN}-V_{OUT}$	Dropout Voltage	LMS1585A-ADJ/LMS1587-ADJ ΔV_{REF} = 1%, I_{OUT} = 3A		1.15	**1.3**	V
		LMS1585A-3.3/LMS1587-3.3/ LMS1585A-1.5/LMS1587-1.5 ΔV_{OUT} = 1%, I_{OUT} = 3A		1.15	**1.3**	V
		LMS1585A-ADJ ΔV_{REF} = 1%, I_{OUT} = 5A		1.2	**1.4**	V
		LMS1585A-1.5/LMS1585A-3.3 ΔV_{OUT} = 1%, I_{OUT} = 5A		1.2	**1.4**	V

(1) All limits are specified by testing or statistical analysis.
(2) Typical Values represent the most likely parametric norm.
(3) Load and line regulation are measured at constant junction temperature, and are ensured up to the maximum power dissipation of 30W. Power dissipation is determined by the input/output differential and the output current. Ensured maximum power dissipation will not be available over the full input/output range.

ELECTRICAL CHARACTERISTICS (continued)

Typicals and limits appearing in normal type apply for T_J = 25˚C. Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, 0˚C to 125˚C for commercial grade and −40˚C to 125˚C for industrial grade.

I_{LIMIT}	Current Limit	LMS1585A-ADJ/LMS1585A-3.3/LMS1585A-1.5 $V_{IN}-V_{OUT}$ = 5.5V	**5.0**	6.6		A
		LMS1587-ADJ/LMS1587-3.3/LMS1587-1.5 $V_{IN}-V_{OUT}$ = 5.5V	**3.1**	4.3		A
	Minimum Load Current (4)	LMS1585A/87-ADJ 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V		2.0	**10.0**	mA
	Quiescent Current	LMS1585A-3.3/LMS1587-3.3/ LMS1585A-1.5/LMS1587-1.5 V_{IN} = 5V		7.0	**13.0**	mA
	Thermal Regulation	TA = 25˚C, 30ms Pulse		0.003		%/W
	Ripple Rejection	LMS1585A-ADJ f_{RIPPLE} = 120Hz, $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 5A, C_{OUT} = 25µF Tantalum		72		dB
		LMS1585A-1.5 f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 5A, V_{IN} = 4.5V	**60**	72		dB
		LMS1585A-3.3 f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 5A, V_{IN} = 6.3V		72		dB
		LMS1587-ADJ f_{RIPPLE} = 120 Hz, $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 3A C_{OUT} = 25 µF Tantalum		72		dB
		LMS1587-1.5 f_{RIPPLE} = 120 Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 3A, V_{IN} = 4.5V	**60**	72		dB
		LMS1587-3.3 f_{RIPPLE} = 120 Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 3A, V_{IN} = 6.3V		72		dB
	Adjust Pin Current			55	**120**	µA
	Adjust Pin Current	10mA ≤ I_{OUT} ≤ $I_{FULLLOAD}$, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V (5)		0.2		µA
	Temperature Stability			0.5		%
	Long Term Stability	TA = 125˚C, 1000Hrs		0.03		%
	RMS Output Noise (% of V_{OUT})	10Hz ≤ f ≤ 10kHz		0.003		%
	Thermal Resistance Junction-to-Case	3-Lead KTT (TO-263): Control/Output Section 3-Lead NDE (TO-220): Control/Output Section			0.65/2.7 0.65/2.7	*C/W *C/W

(4) The minimum output current required to maintain regulation.
(5) $I_{FULLLOAD}$ is 5A for LMS1585A and 3A for LMS1587.

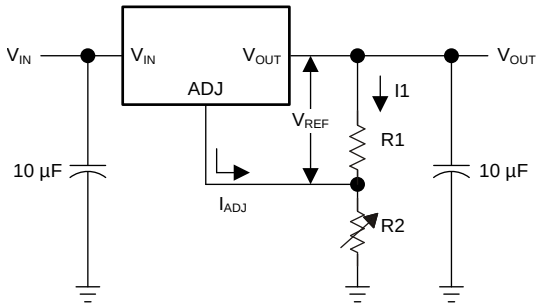
APPLICATION NOTE

OUTPUT VOLTAGE

The adjustable version develops at 1.25V reference voltage, (VREF), between the output and the adjust terminal. As shown in Figure 3, this voltage is applied across resistor R1 to generate a constant current I1. This constant current then flows through R2. The resulting voltage drop across R2 adds to the reference voltage to sets the desired output voltage.

The current I_{ADJ} from the adjustment terminal introduces an output error. But since it is small (120µA max), it becomes negligible when R1 is in the 100Ω range.

For fixed voltage devices, R1 and R2 are integrated inside the devices.



$$V_{OUT} = V_{REF} \left(1 + \frac{R2}{R1}\right) + I_{ADJ}R2$$

Figure 3. Basic Adjustable Regulator

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LMS1585AISX-3.3/NO	Active	Production	DDPAK/ TO-263 (KTT) | 3	500 | LARGE T&R	ROHS Exempt	SN	Level-3-245C-168 HR	-40 to 125	LMS1585 AIS-3.3
LMS1587CS-1.5/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	0 to 125	LMS1587 CS-1.5
LMS1587CS-3.3/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	0 to 125	LMS1587 CS-3.3
LMS1587CS-ADJ/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	0 to 125	LMS1587 CS-ADJ
LMS1587CT-3.3/NOPB	Active	Production	TO-220 (NDE) | 3	45 | TUBE	Yes	SN	Level-1-NA-UNLIM	0 to 125	LMS1587 CT-3.3
LMS1587CT-ADJ/NOPB	Active	Production	TO-220 (NDE) | 3	45 | TUBE	Yes	SN	Level-1-NA-UNLIM	0 to 125	LMS1587 CT-ADJ
LMS1587IS-1.5/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	-40 to 125	LMS1587 IS-1.5
LMS1587IS-3.3/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	-40 to 125	LMS1587 IS-3.3
LMS1587IS-ADJ/NOPB	Active	Production	DDPAK/ TO-263 (KTT) | 3	45 | TUBE	ROHS Exempt	SN	Level-3-245C-168 HR	-40 to 125	LMS1587 IS-ADJ
LMS1587IT-1.5/NOPB	Active	Production	TO-220 (NDE) | 3	45 | TUBE	Yes	SN	Level-1-NA-UNLIM	-40 to 125	LMS1587 IT-1.5

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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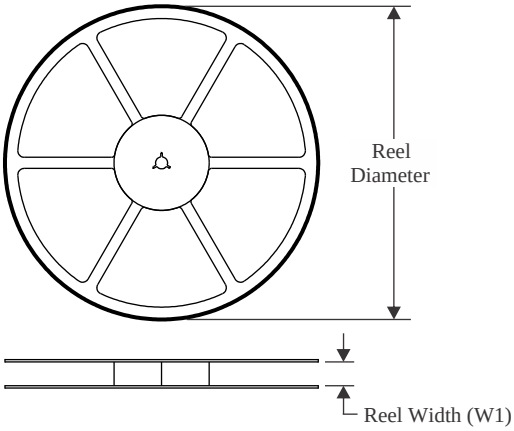
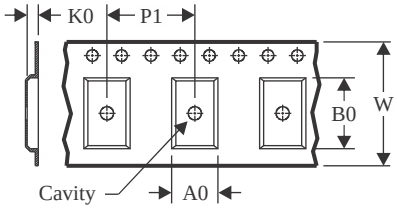
TAPE AND REEL INFORMATION

REEL DIMENSIONS

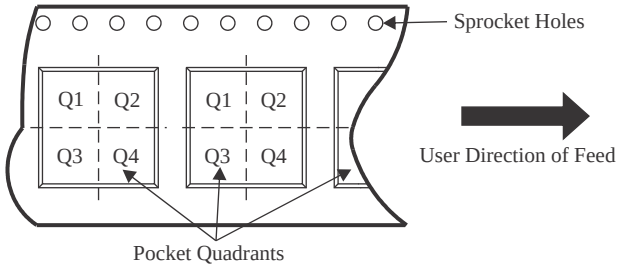


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

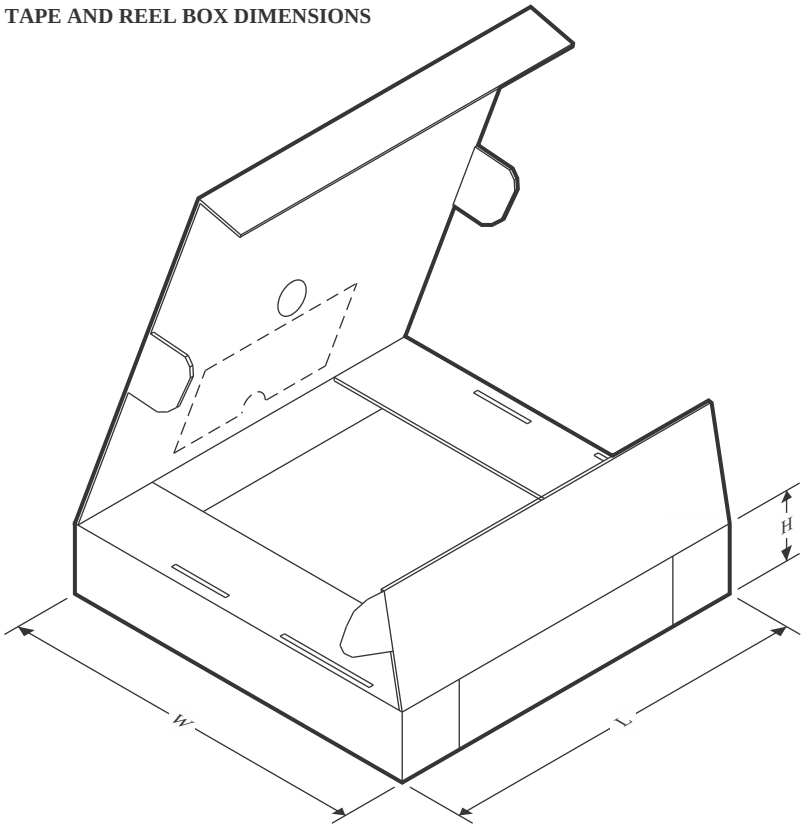
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LMS1585ACSX-1.5/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1585ACSX-3.3/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1585ACSX-ADJ/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1585AISX-3.3/NO	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1587CSX-1.5/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1587CSX-3.3/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1587CSX-ADJ/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1587ISX-3.3/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2
LMS1587ISX-ADJ/NOPB	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.75	14.85	5.0	16.0	24.0	Q2

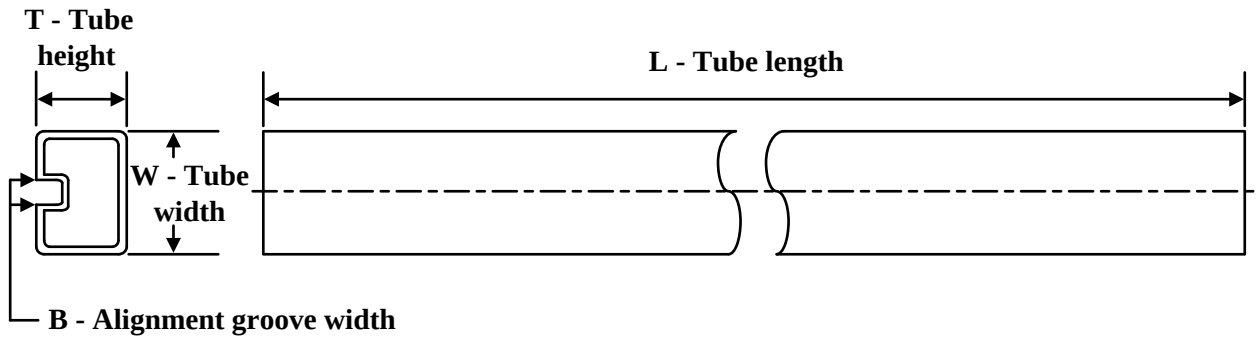
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMS1585ACSX-1.5/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1585ACSX-3.3/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1585ACSX-ADJ/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1585AISX-3.3/NO	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1587CSX-1.5/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1587CSX-3.3/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1587CSX-ADJ/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1587ISX-3.3/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0
LMS1587ISX-ADJ/NOPB	DDPAK/TO-263	KTT	3	500	356.0	356.0	45.0

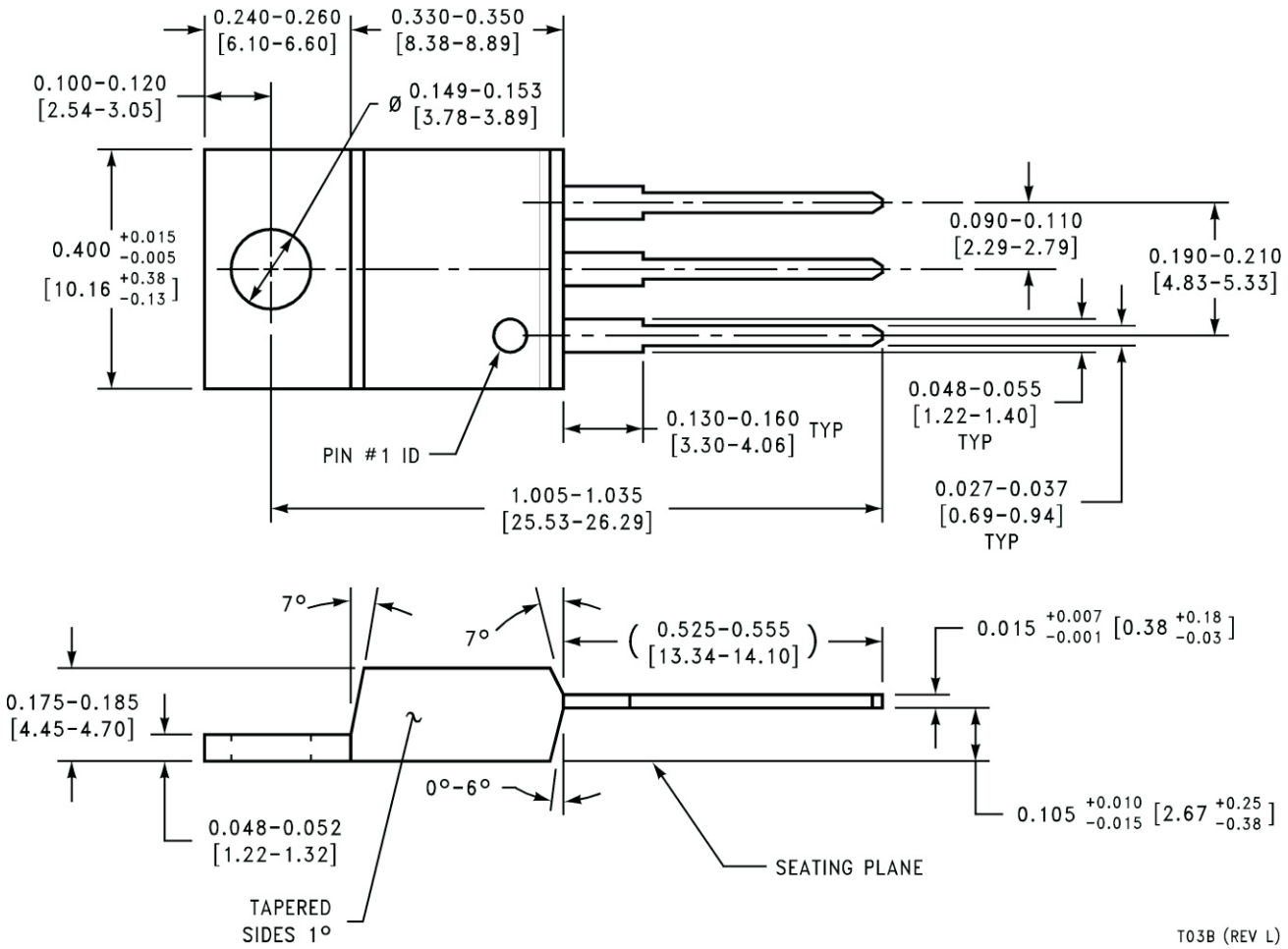
TUBE



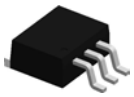
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
LMS1585ACS-1.5/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1585ACS-3.3/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1585ACT-1.5/NOPB	NDE	TO-220	3	45	502	33	6985	4.06
LMS1585ACT-3.3/NOPB	NDE	TO-220	3	45	502	33	6985	4.06
LMS1585AIS-1.5/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1585AIS-3.3/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587CS-1.5/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587CS-3.3/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587CS-ADJ/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587CT-3.3/NOPB	NDE	TO-220	3	45	502	33	6985	4.06
LMS1587CT-ADJ/NOPB	NDE	TO-220	3	45	502	33	6985	4.06
LMS1587IS-1.5/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587IS-3.3/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587IS-ADJ/NOPB	KTT	TO-263	3	45	502	25	8204.2	9.19
LMS1587IT-1.5/NOPB	NDE	TO-220	3	45	502	33	6985	4.06

NDE0003B



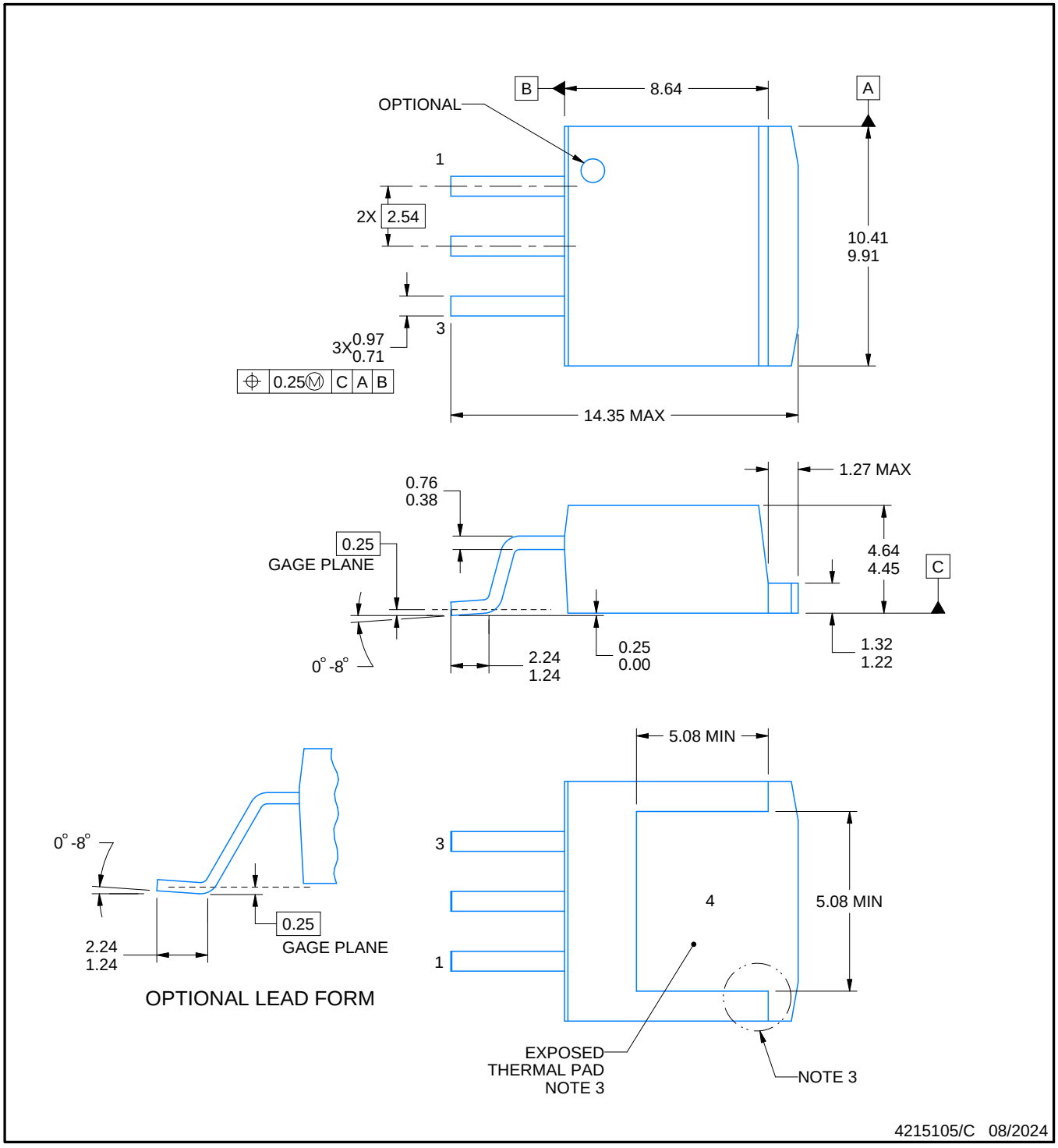
KTT0003B



PACKAGE OUTLINE

TO-263 - 4.83 mm max height

TRANSISTOR OUTLINE



NOTES:

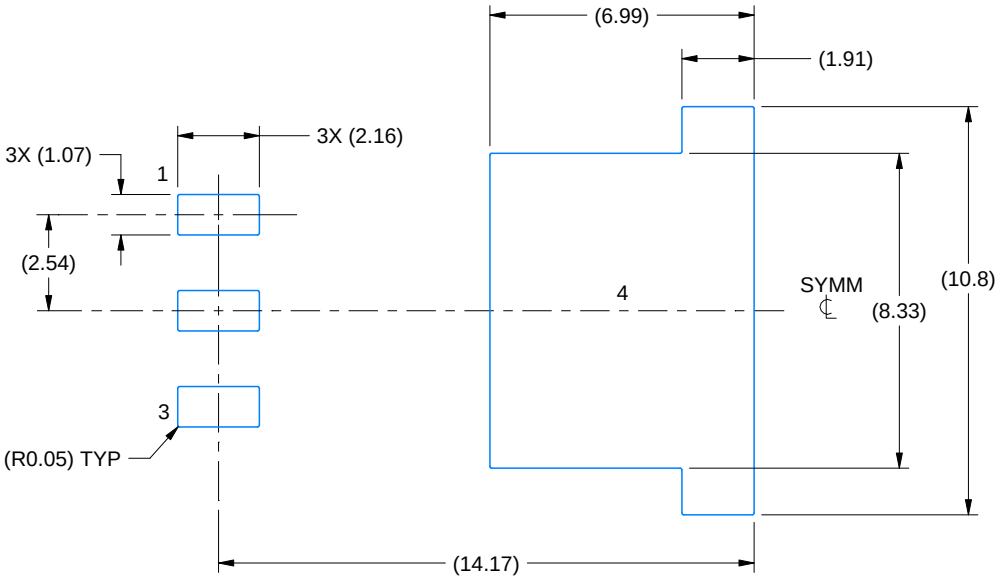
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Features may not exist and shape may vary per different assembly sites.
4. Reference JEDEC registration TO-263, except minimum lead thickness and minimum exposed pad length.

EXAMPLE BOARD LAYOUT

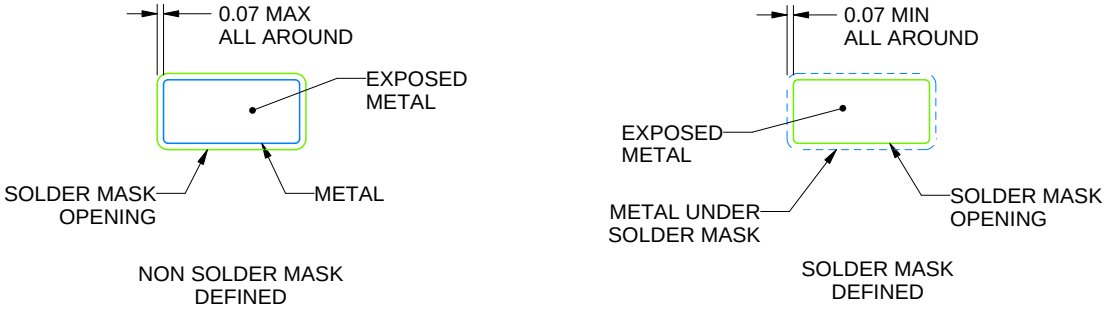
KTT0003B

TO-263 - 4.83 mm max height

TRANSISTOR OUTLINE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:5X



SOLDER MASK DETAILS

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NOTES: (continued)

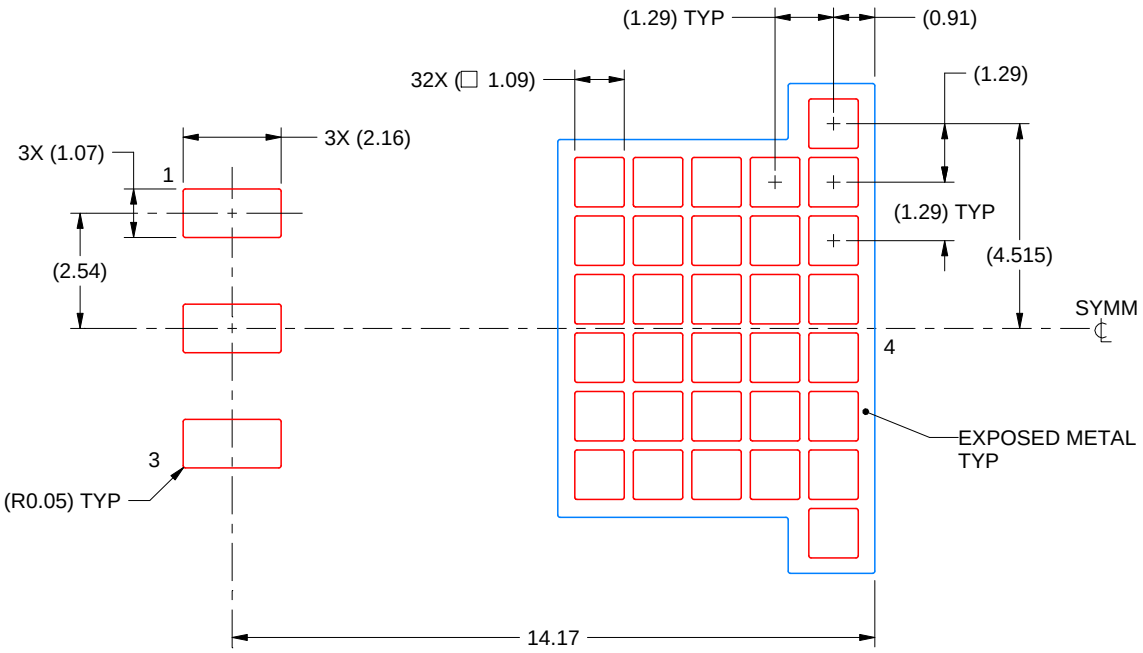
5. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002(www.ti.com/lit/slm002) and SLMA004 (www.ti.com/lit/slma004).
6. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

KTT0003B

TO-263 - 4.83 mm max height

TRANSISTOR OUTLINE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
60% PRINTED SOLDER COVERAGE BY AREA
SCALE:6X

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NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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