

## AUTOMOTIVE LOW-DROPOUT VOLTAGE REGULATORS

Check for Samples: [TL750Mxx-Q1](#), [TL751Mxx-Q1](#)

### FEATURES

- Qualified for Automotive Applications
- Low Dropout Voltage, Less Than 0.6 V at 750 mA
- Low Quiescent Current
- TTL- and CMOS-Compatible Enable on TL751M Series
- Load-Dump Protection
- Overvoltage Protection
- Internal Thermal Overload Protection
- Internal Overcurrent-Limiting Circuitry

### DESCRIPTION

The TL750M and TL751M series are low-dropout positive voltage regulators specifically designed for automotive applications. The TL750M and TL751M series incorporate onboard overvoltage and current-limiting protection circuitry to protect the devices and the regulated system. Both series are fully protected against load-dump and reverse-battery conditions. Load-dump protection is up to a maximum of 60 V at the input of the device. Low quiescent current, even during full-load conditions, makes the TL750M and TL751M series ideal for use in applications that are permanently connected to the vehicle battery.

The TL750M and TL751M series offers 5-V, 8-V, and 12-V options. The TL751M series has the addition of an enable ( $\overline{\text{ENABLE}}$ ) input. The  $\overline{\text{ENABLE}}$  input gives complete control over power up, allowing sequential power up or shutdown. When  $\overline{\text{ENABLE}}$  is high, the regulator output is placed in the high-impedance state. The  $\overline{\text{ENABLE}}$  input is TTL and CMOS compatible.

The TL750Mxx and TL751Mxx are characterized for operation over the virtual junction temperature range  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

### AVAILABLE OPTIONS<sup>(1)</sup>

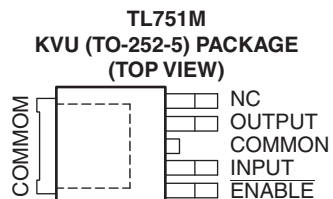
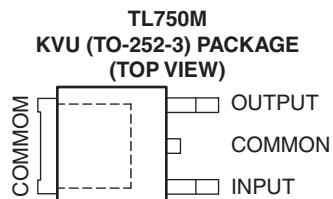
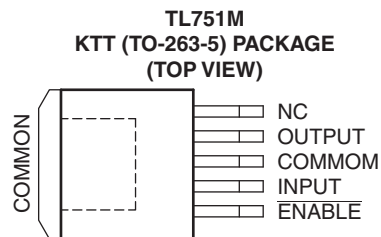
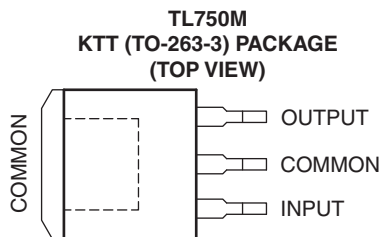
| $T_J$                                          | $V_O$<br>NOM (V) | PACKAGE <sup>(2)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|------------------------------------------------|------------------|------------------------|--------------|-----------------------|------------------|
| $-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$ | 5 V              | TO-263-3 – KTT         | Reel of 500  | TL750M05QKTTRQ1       | TL750M05Q1       |
|                                                |                  | TO-252-3 – KVU         | Reel of 2500 | TL750M05QKVURQ1       | 750M05Q          |
|                                                | 8 V              | TO-263-3 – KTT         | Reel of 500  | TL750M08QKTTRQ1       | TL750M08Q1       |
|                                                |                  | TO-252-3 – KVU         | Reel of 2500 | TL750M08QKVURQ1       | 750M08Q          |
|                                                | 12 V             | TO-263-3 – KTT         | Reel of 500  | TL750M12QKTTRQ1       | TL750M12Q1       |
|                                                |                  | TO-252-3 – KVU         | Reel of 2500 | TL750M12QKVURQ1       | 750M12Q          |
|                                                | 5 V              | TO-263-5 – KTT         | Reel of 500  | TL751M05QKTTRQ1       | TL751M05Q1       |
|                                                |                  | TO-252-5 – KVU         | Reel of 2500 | TL751M05QKVURQ1       | 751M05Q          |
|                                                | 8 V              | TO-263-5 – KTT         | Reel of 500  | TL751M08QKTTRQ1       | TL751M08Q1       |
|                                                |                  | TO-252-5 – KVU         | Reel of 2500 | TL751M08QKVURQ1       | 751M08Q          |
|                                                | 12 V             | TO-263-5 – KTT         | Reel of 500  | TL751M12QKTTRQ1       | TL751M12Q1       |
|                                                |                  | TO-252-5 – KVU         | Reel of 2500 | TL751M12QKVURQ1       | 751M12Q          |

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

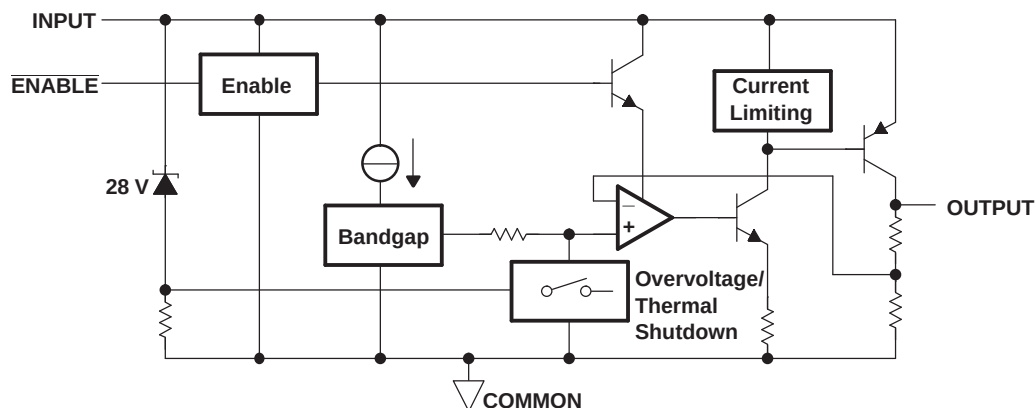


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



NOTE: The COMMON terminal is in electrical contact with the mounting base.  
NC – No internal connection

## TL751Mxx FUNCTIONAL BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                                                         |                                              |                     |                |
|---------------------------------------------------------|----------------------------------------------|---------------------|----------------|
| Continuous input voltage                                |                                              | 26 V                |                |
| Transient input voltage (see <a href="#">Figure 4</a> ) |                                              | 60 V                |                |
| Continuous reverse input voltage                        |                                              | –15 V               |                |
| Transient reverse input voltage                         |                                              | t = 100 ms<br>–50 V |                |
| $\theta_{JA}$                                           | Package thermal impedance <sup>(2) (3)</sup> | KTT package (3 pin) | 26.9°C/W       |
|                                                         |                                              | KTT package (5 pin) | 26.5°C/W       |
|                                                         |                                              | KVU package         | 38.6°C/W       |
|                                                         |                                              |                     |                |
| T <sub>J</sub>                                          | Virtual junction temperature range           |                     | –40°C to 150°C |
| T <sub>stg</sub>                                        | Storage temperature range                    |                     | –65°C to 150°C |

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can impact reliability. Due to variation in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.
- (3) The package thermal impedance is calculated in accordance with JESD 51.

## THERMAL INFORMATION

| THERMAL METRIC <sup>(1)</sup> |                                                             | TL750M05 | UNITS |
|-------------------------------|-------------------------------------------------------------|----------|-------|
|                               |                                                             | KT       |       |
|                               |                                                             | 3 PINS   |       |
| $\theta_{JA}$                 | Junction-to-ambient thermal resistance <sup>(2)</sup>       | 27.5     | °C/W  |
| $\theta_{JCTop}$              | Junction-to-case (top) thermal resistance <sup>(3)</sup>    | 43.2     |       |
| $\theta_{JB}$                 | Junction-to-board thermal resistance <sup>(4)</sup>         | 17.3     |       |
| $\psi_{JT}$                   | Junction-to-top characterization parameter <sup>(5)</sup>   | 2.8      |       |
| $\psi_{JB}$                   | Junction-to-board characterization parameter <sup>(6)</sup> | 9.3      |       |
| $\theta_{JCbott}$             | Junction-to-case (bottom) thermal resistance <sup>(7)</sup> | 0.3      |       |

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).
- (2) The junction-to-ambient thermal resistance under natural convection is obtained in a simulation on a JEDEC-standard, high-K board, as specified in JESD51-7, in an environment described in JESD51-2a.
- (3) The junction-to-case (top) thermal resistance is obtained by simulating a cold plate test on the package top. No specific JEDEC-standard test exists, but a close description can be found in the ANSI SEMI standard G30-88.
- (4) The junction-to-board thermal resistance is obtained by simulating in an environment with a ring cold plate fixture to control the PCB temperature, as described in JESD51-8.
- (5) The junction-to-top characterization parameter,  $\psi_{JT}$ , estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining  $\theta_{JA}$ , using a procedure described in JESD51-2a (sections 6 and 7).
- (6) The junction-to-board characterization parameter,  $\psi_{JB}$ , estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining  $\theta_{JA}$ , using a procedure described in JESD51-2a (sections 6 and 7).
- (7) The junction-to-case (bottom) thermal resistance is obtained by simulating a cold plate test on the exposed (power) pad. No specific JEDEC standard test exists, but a close description can be found in the ANSI SEMI standard G30-88.

## RECOMMENDED OPERATING CONDITIONS

|          |                                                     | MIN      | MAX | UNIT |
|----------|-----------------------------------------------------|----------|-----|------|
| $V_I$    | Input voltage                                       | TL75xM05 | 6   | V    |
|          |                                                     | TL75xM08 | 9   |      |
|          |                                                     | TL75xM12 | 13  |      |
| $V_{IH}$ | High-level $\overline{\text{ENABLE}}$ input voltage | TL751Mxx | 2   | V    |
| $V_{IL}$ | Low-level $\overline{\text{ENABLE}}$ input voltage  | TL751Mxx | 0   | V    |
| $I_O$    | Output current                                      | TL75xMxx | 750 | mA   |
| $T_J$    | Operating virtual junction temperature              | TL75xMxx | –40 | 125  |
|          |                                                     |          |     | °C   |

## TL751Mxx ELECTRICAL CHARACTERISTICS

$V_I = 14\text{ V}$ ,  $I_O = 300\text{ mA}$ ,  $T_J = 25^\circ\text{C}$

| PARAMETER                                                      | TL751Mxx | UNIT          |
|----------------------------------------------------------------|----------|---------------|
|                                                                | TYP      |               |
| Response time, $\overline{\text{ENABLE}}$ to output (start-up) | 50       | $\mu\text{s}$ |

## TL750M05/TL751M05 ELECTRICAL CHARACTERISTICS

$V_I = 14\text{ V}$ ,  $I_O = 300\text{ mA}$ ,  $\overline{\text{ENABLE}}$  at 0 V for TL751M05,  $T_J = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                | TEST CONDITIONS                                             | TL750M05<br>TL751M05 |     |      | UNIT          |
|------------------------------------------|-------------------------------------------------------------|----------------------|-----|------|---------------|
|                                          |                                                             | MIN                  | TYP | MAX  |               |
| Output voltage                           | $V_I = 6\text{ V}$ to $26\text{ V}$                         | 4.85                 | 5   | 5.15 | V             |
| Line regulation                          | $V_I = 9\text{ V}$ to $16\text{ V}$ , $I_O = 250\text{ mA}$ |                      | 10  | 25   | mV            |
|                                          | $V_I = 6\text{ V}$ to $26\text{ V}$ , $I_O = 250\text{ mA}$ |                      | 12  | 50   |               |
| Power-supply ripple rejection            | $V_I = 8\text{ V}$ to $18\text{ V}$ , $f = 120\text{ Hz}$   |                      | 55  |      | dB            |
| Load regulation                          | $I_O = 5\text{ mA}$ to $750\text{ mA}$                      |                      | 20  | 50   | mV            |
| Dropout voltage <sup>(2)</sup>           | $I_O = 500\text{ mA}$ , $T_J = 25^\circ\text{C}$            |                      |     | 0.5  | V             |
|                                          | $I_O = 750\text{ mA}$ , $T_J = 25^\circ\text{C}$            |                      |     | 0.65 |               |
| Current consumption<br>$I_q = I_I - I_O$ | $I_O = 750\text{ mA}$                                       |                      | 60  | 75   | mA            |
|                                          | $I_O = 10\text{ mA}$                                        |                      |     | 5    |               |
| Shutdown current (TL751M05 only)         | $\overline{\text{ENABLE}}$ $V_{IH} \geq 2\text{ V}$         |                      |     | 200  | $\mu\text{A}$ |

(1) Pulse-testing techniques maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1- $\mu\text{F}$  capacitor across the input and a 10- $\mu\text{F}$  tantalum capacitor on the output, with equivalent series resistance within the guidelines shown in [Figure 4](#).

(2) Measured when the output voltage,  $V_O$ , has dropped 100 mV from the nominal value obtained at  $V_I = 14\text{ V}$ .

## TL750M08/TL751M08 ELECTRICAL CHARACTERISTICS

$V_I = 14\text{ V}$ ,  $I_O = 300\text{ mA}$ ,  $\overline{\text{ENABLE}}$  at 0 V for TL751M08,  $T_J = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                | TEST CONDITIONS                                              | TL750M08<br>TL751M08 |     |      | UNIT          |
|------------------------------------------|--------------------------------------------------------------|----------------------|-----|------|---------------|
|                                          |                                                              | MIN                  | TYP | MAX  |               |
| Output voltage                           | $V_I = 6\text{ V}$ to $26\text{ V}$                          | 7.76                 | 8   | 8.24 | V             |
| Line regulation                          | $V_I = 10\text{ V}$ to $17\text{ V}$ , $I_O = 250\text{ mA}$ |                      | 12  | 40   | mV            |
|                                          | $V_I = 9\text{ V}$ to $26\text{ V}$ , $I_O = 250\text{ mA}$  |                      | 15  | 68   |               |
| Power-supply ripple rejection            | $V_I = 11\text{ V}$ to $21\text{ V}$ , $f = 120\text{ Hz}$   |                      | 55  |      | dB            |
| Load regulation                          | $I_O = 5\text{ mA}$ to $750\text{ mA}$                       |                      | 24  | 80   | mV            |
| Dropout voltage <sup>(2)</sup>           | $I_O = 500\text{ mA}$ , $T_J = 25^\circ\text{C}$             |                      |     | 0.5  | V             |
|                                          | $I_O = 750\text{ mA}$ , $T_J = 25^\circ\text{C}$             |                      |     | 0.65 |               |
| Current consumption<br>$I_q = I_I - I_O$ | $I_O = 750\text{ mA}$ , $T_J = 25^\circ\text{C}$             |                      | 60  | 75   | mA            |
|                                          | $I_O = 10\text{ mA}$                                         |                      |     | 5    |               |
| Shutdown current (TL751M08 only)         | $\overline{\text{ENABLE}}$ $V_{IH} \geq 2\text{ V}$          |                      |     | 200  | $\mu\text{A}$ |

(1) Pulse-testing techniques maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1- $\mu\text{F}$  capacitor across the input and a 10- $\mu\text{F}$  tantalum capacitor on the output, with equivalent series resistance within the guidelines shown in [Figure 4](#).

(2) Measured when the output voltage,  $V_O$ , has dropped 100 mV from the nominal value obtained at  $V_I = 14\text{ V}$ .

**TL750M12/TL751M12 ELECTRICAL CHARACTERISTICS**
 $V_I = 14\text{ V}$ ,  $I_O = 300\text{ mA}$ ,  $\overline{\text{ENABLE}}$  at 0 V for TL751M12,  $T_J = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                                | TEST CONDITIONS                                            | TL750M12<br>TL751M12 |     |       | UNIT          |
|------------------------------------------|------------------------------------------------------------|----------------------|-----|-------|---------------|
|                                          |                                                            | MIN                  | TYP | MAX   |               |
| Output voltage                           | $V_I = 13\text{ V to }26\text{ V}$                         | 11.76                | 12  | 12.24 | V             |
| Line regulation                          | $V_I = 14\text{ V to }19\text{ V}$ , $I_O = 250\text{ mA}$ |                      | 15  | 43    | mV            |
|                                          | $V_I = 13\text{ V to }26\text{ V}$ , $I_O = 250\text{ mA}$ |                      | 20  | 78    |               |
| Power-supply ripple rejection            | $V_I = 13\text{ V to }23\text{ V}$ , $f = 120\text{ Hz}$   | 50                   | 55  |       | dB            |
| Load regulation                          | $I_O = 5\text{ mA to }750\text{ mA}$                       |                      | 30  | 120   | mV            |
| Dropout voltage <sup>(2)</sup>           | $I_O = 500\text{ mA}$ , $T_J = 25^\circ\text{C}$           |                      |     | 0.5   | V             |
|                                          | $I_O = 750\text{ mA}$ , $T_J = 25^\circ\text{C}$           |                      |     | 0.6   |               |
| Current consumption<br>$I_q = I_I - I_O$ | $I_O = 750\text{ mA}$ , $T_J = 25^\circ\text{C}$           |                      | 60  | 75    | mA            |
|                                          | $I_O = 10\text{ mA}$                                       |                      |     | 5     |               |
| Shutdown current (TL751M12 only)         | $\overline{\text{ENABLE}}$ $V_{IH} \geq 2\text{ V}$        |                      |     | 200   | $\mu\text{A}$ |

- (1) Pulse-testing techniques maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.1- $\mu\text{F}$  capacitor across the input and a 10- $\mu\text{F}$  tantalum capacitor on the output, with equivalent series resistance within the guidelines shown in [Figure 4](#).
- (2) Measured when the output voltage,  $V_O$ , has dropped 100 mV from the nominal value obtained at  $V_I = 14\text{ V}$ .

## PARAMETER MEASUREMENT INFORMATION

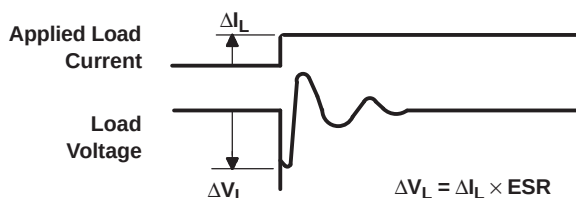
The TL750Mxx and TL751Mxx are low-dropout regulators. The output capacitor value and the parasitic equivalent series resistance (ESR) affect the bandwidth and stability of the control loop for these devices. For this reason, the capacitor and ESR must be carefully selected for a given operating temperature and load range. [Figure 2](#) and [Figure 3](#) can be used to establish the appropriate capacitance value and ESR for the best regulator transient response.

[Figure 2](#) shows the recommended range of ESR for a given load with a 10-μF capacitor on the output. [Figure 2](#) also shows a maximum ESR limit of 2 Ω and a load-dependent minimum ESR limit.

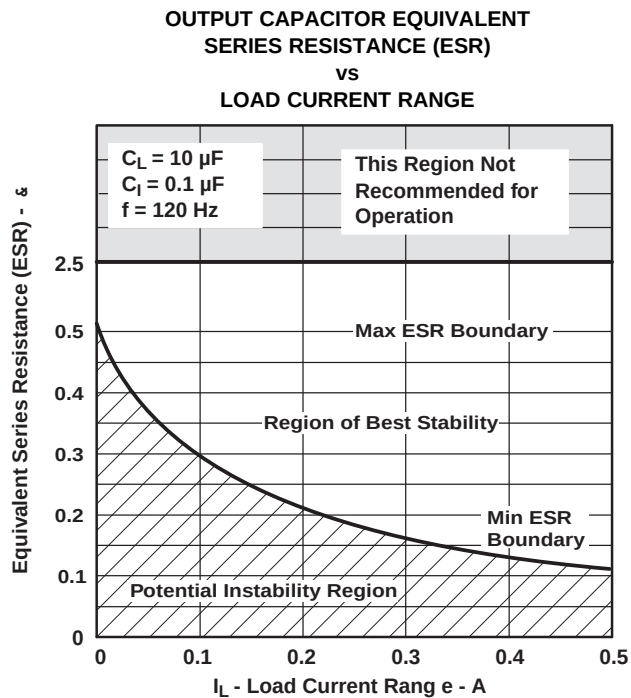
For applications with varying loads, the lightest load condition should be chosen because it is the worst case. [Figure 3](#) shows the relationship of the reciprocal of ESR to the square root of the capacitance, with a minimum capacitance limit of 10 μF and a maximum ESR limit of 2 Ω. This figure establishes the amount that the minimum ESR limit shown in [Figure 2](#) can be adjusted for different capacitor values. For example, where the minimum load needed is 200 mA, [Figure 2](#) suggests an ESR range of 0.8 Ω to 2 Ω for 10 μF. [Figure 3](#) shows that changing the capacitor from 10 μF to 400 μF can change the ESR minimum by greater than 3/0.5 (or 6). Therefore, the new minimum ESR value is 0.8/6 (or 0.13 Ω). This allows an ESR range of 0.13 Ω to 2 Ω, achieving an expanded ESR range by using a larger capacitor at the output. For better stability in low-current applications, a small resistance placed in series with the capacitor (see [Table 1](#)) is recommended, so that ESRs better approximate those shown in [Figure 2](#) and [Figure 3](#).

**Table 1. Compensation for Increased Stability at Low Currents**

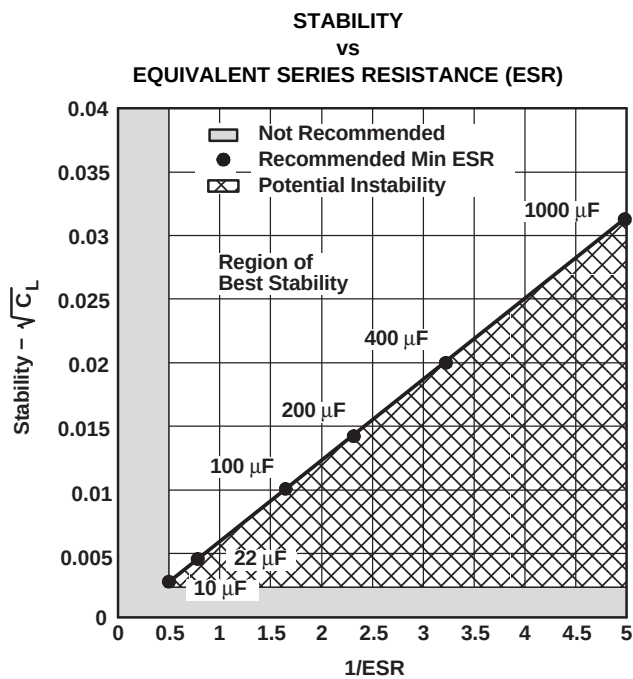
| MANUFACTURER | CAPACITANCE | ESR TYP | PART NUMBER    | ADDITIONAL RESISTANCE |
|--------------|-------------|---------|----------------|-----------------------|
| AVX          | 15 μF       | 0.9 Ω   | TAJB156M010S   | 1 Ω                   |
| KEMET        | 33 μF       | 0.6 Ω   | T491D336M010AS | 0.5 Ω                 |



**Figure 1.**



**Figure 2.**

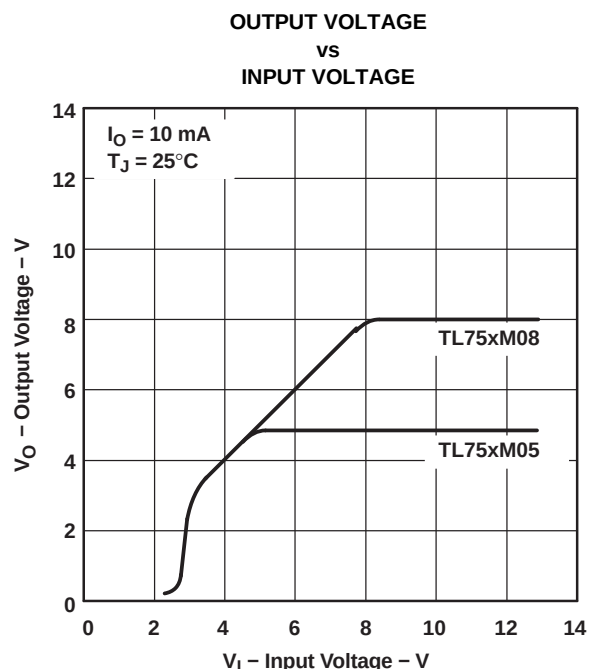
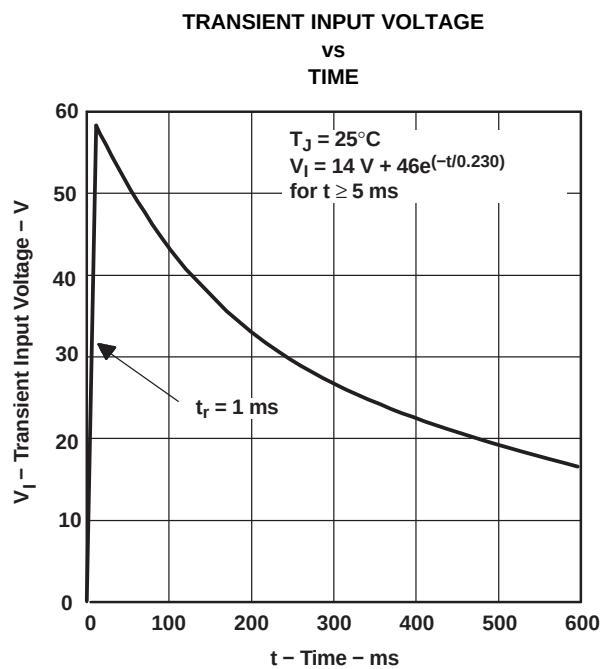


**Figure 3.**

## TYPICAL CHARACTERISTICS

Table 2. Table of Graphs

|                         |                   |                         | FIGURE |
|-------------------------|-------------------|-------------------------|--------|
| Transient input voltage | vs Time           |                         | 4      |
| Output voltage          | vs Input voltage  |                         | 5      |
| Input current           | vs Input voltage  | I <sub>O</sub> = 10 mA  | 6      |
|                         |                   | I <sub>O</sub> = 100 mA | 7      |
| Dropout voltage         | vs Output current |                         | 8      |
| Quiescent current       | vs Output current |                         | 9      |
| Load transient response |                   |                         | 10     |
| Line transient response |                   |                         | 11     |





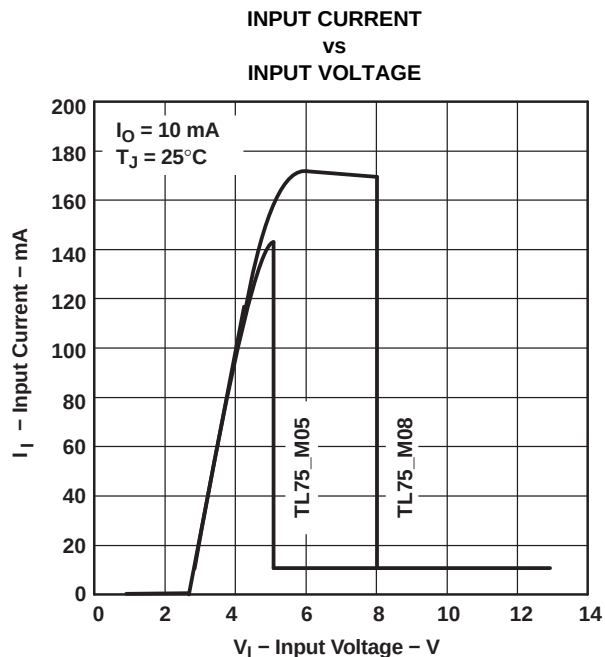


Figure 6.

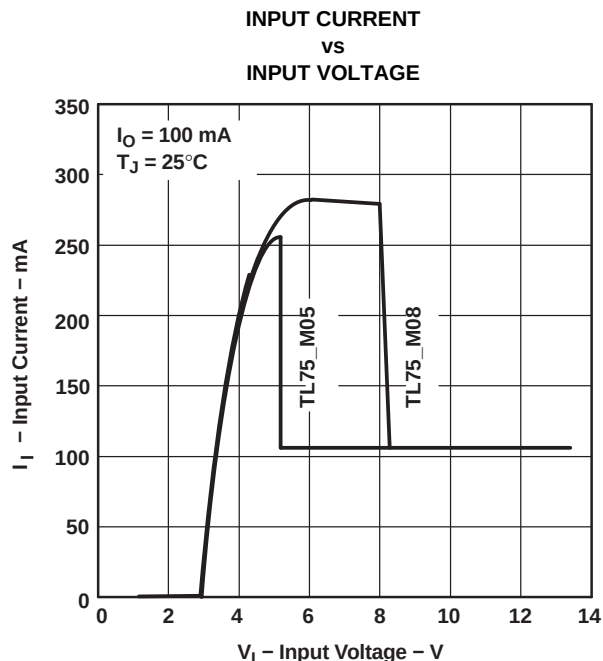


Figure 7.

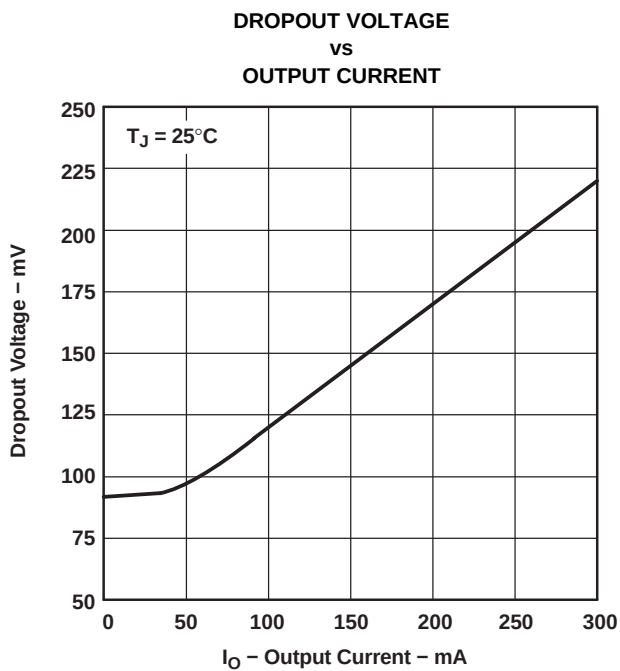


Figure 8.

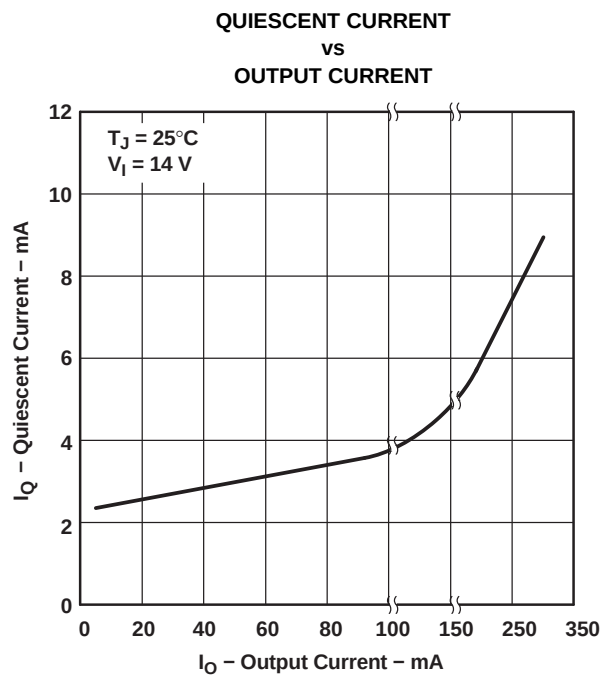


Figure 9.

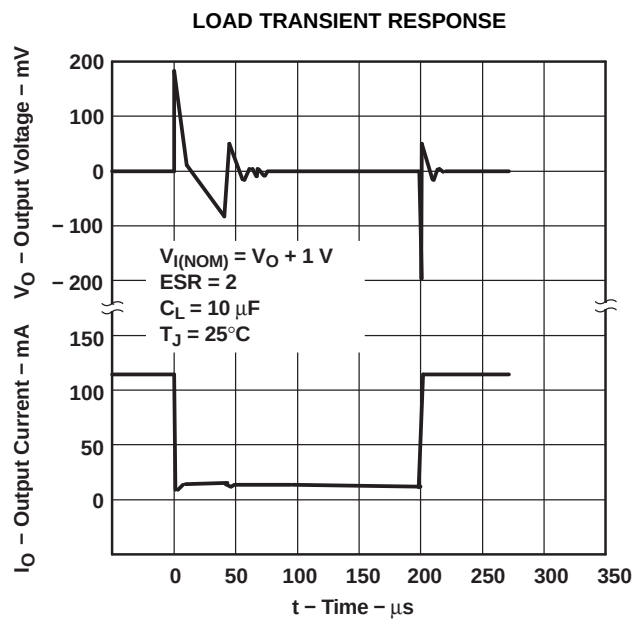


Figure 10.

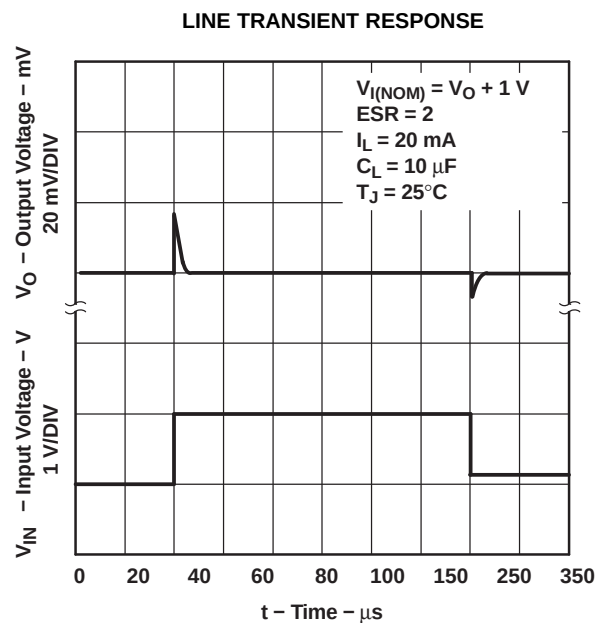


Figure 11.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type     | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|------------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL750M05QKTTRQ1  | ACTIVE        | DDPAK/<br>TO-263 | KTT                | 3    | 500            | RoHS & Green    | SN                                   | Level-3-245C-168 HR  | -40 to 125   | TL750M05Q1              | <a href="#">Samples</a> |
| TL750M05QKVURQ1  | ACTIVE        | TO-252           | KVU                | 3    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 750M05Q                 | <a href="#">Samples</a> |
| TL750M08QKVURQ1  | ACTIVE        | TO-252           | KVU                | 3    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 750M08Q                 | <a href="#">Samples</a> |
| TL750M12QKTTRQ1  | ACTIVE        | DDPAK/<br>TO-263 | KTT                | 3    | 500            | RoHS & Green    | SN                                   | Level-3-245C-168 HR  | -40 to 125   | TL750M12Q1              | <a href="#">Samples</a> |
| TL750M12QKVURQ1  | ACTIVE        | TO-252           | KVU                | 3    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 750M12Q                 | <a href="#">Samples</a> |
| TL751M05QKVURQ1  | ACTIVE        | TO-252           | KVU                | 5    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 751M05Q                 | <a href="#">Samples</a> |
| TL751M08QKTTRQ1  | ACTIVE        | DDPAK/<br>TO-263 | KTT                | 5    | 500            | RoHS & Green    | SN                                   | Level-3-245C-168 HR  | -40 to 125   | TL751M08Q1              | <a href="#">Samples</a> |
| TL751M08QKVURQ1  | ACTIVE        | TO-252           | KVU                | 5    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 751M08Q                 | <a href="#">Samples</a> |
| TL751M12QKTTRQ1  | ACTIVE        | DDPAK/<br>TO-263 | KTT                | 5    | 500            | RoHS & Green    | SN                                   | Level-3-245C-168 HR  | -40 to 125   | TL751M12Q1              | <a href="#">Samples</a> |
| TL751M12QKVURQ1  | ACTIVE        | TO-252           | KVU                | 5    | 2500           | RoHS & Green    | SN                                   | Level-3-260C-168 HR  | -40 to 125   | 751M12Q                 | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices 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.

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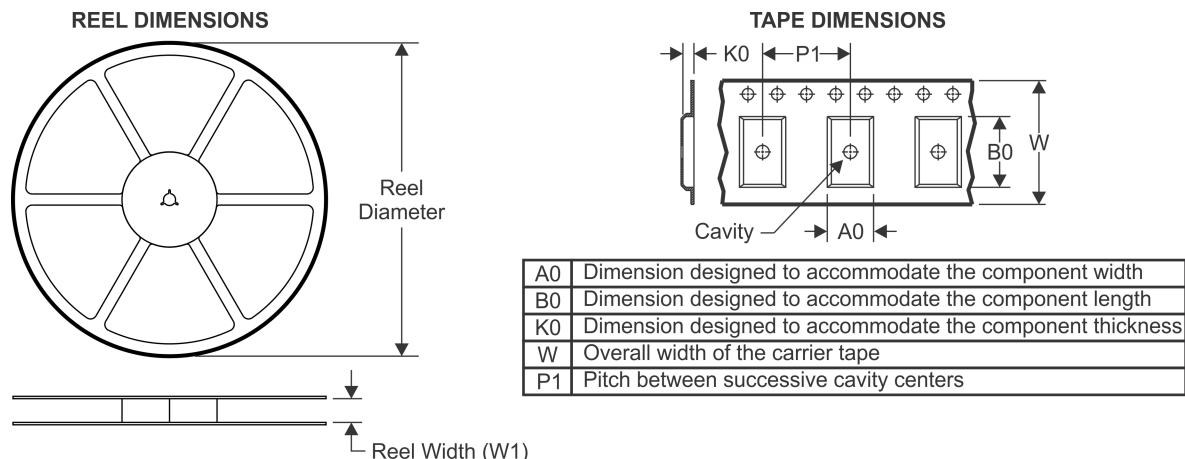
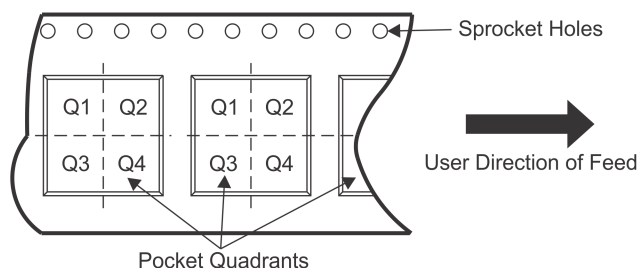
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF TL750M-Q1 :**

- Catalog: [TL750M](#)

NOTE: Qualified Version Definitions:

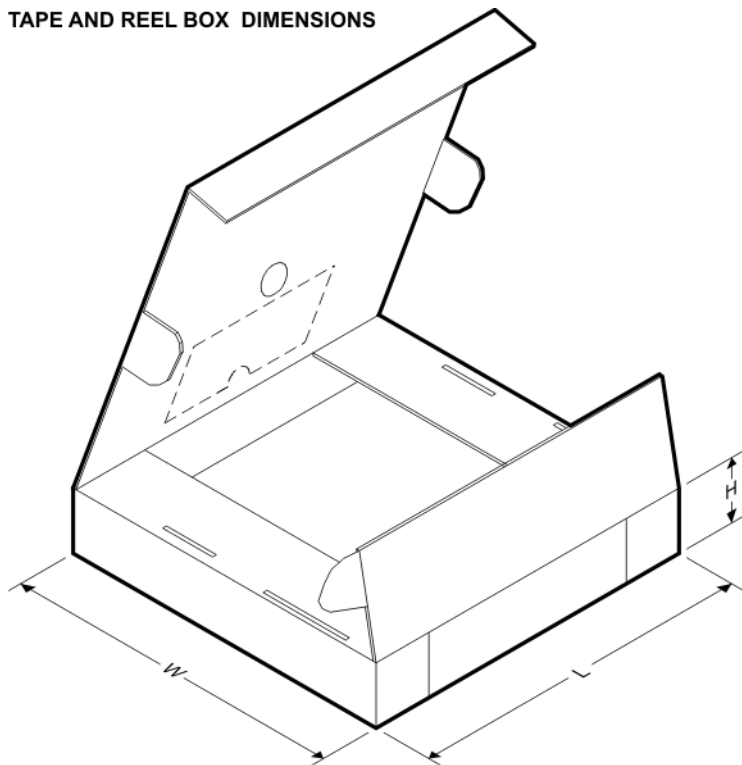
- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**

**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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL750M05QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |
| TL750M08QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |
| TL750M12QKTTRQ1 | DDPAK/TO-263 | KTU             | 3    | 500  | 330.0              | 24.4               | 10.6    | 15.8    | 4.9     | 16.0    | 24.0   | Q2            |
| TL750M12QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |
| TL751M05QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |
| TL751M08QKTTRQ1 | DDPAK/TO-263 | KTU             | 5    | 500  | 330.0              | 24.4               | 10.6    | 15.8    | 4.9     | 16.0    | 24.0   | Q2            |
| TL751M08QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |
| TL751M12QKTTRQ1 | DDPAK/TO-263 | KTU             | 5    | 500  | 330.0              | 24.4               | 10.6    | 15.8    | 4.9     | 16.0    | 24.0   | Q2            |
| TL751M12QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 330.0              | 16.4               | 6.9     | 10.5    | 2.7     | 8.0     | 16.0   | Q2            |

## TAPE AND REEL BOX DIMENSIONS

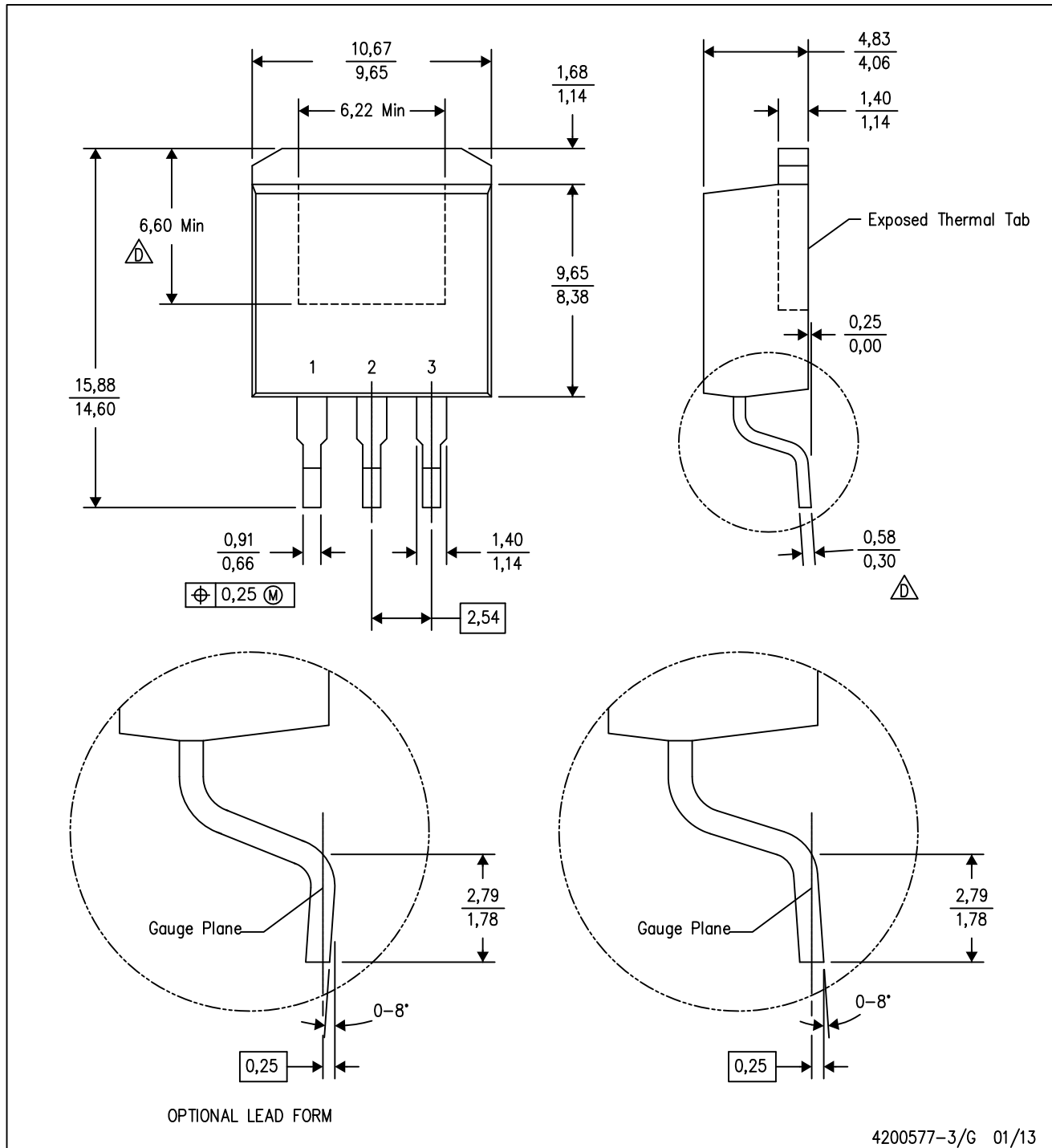


\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL750M05QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 340.0       | 340.0      | 38.0        |
| TL750M08QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 340.0       | 340.0      | 38.0        |
| TL750M12QKTTRQ1 | DDPAK/TO-263 | KTT             | 3    | 500  | 340.0       | 340.0      | 38.0        |
| TL750M12QKVURQ1 | TO-252       | KVU             | 3    | 2500 | 340.0       | 340.0      | 38.0        |
| TL751M05QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 340.0       | 340.0      | 38.0        |
| TL751M08QKTTRQ1 | DDPAK/TO-263 | KTT             | 5    | 500  | 340.0       | 340.0      | 38.0        |
| TL751M08QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 340.0       | 340.0      | 38.0        |
| TL751M12QKTTRQ1 | DDPAK/TO-263 | KTT             | 5    | 500  | 340.0       | 340.0      | 38.0        |
| TL751M12QKVURQ1 | TO-252       | KVU             | 5    | 2500 | 340.0       | 340.0      | 38.0        |

KTT (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

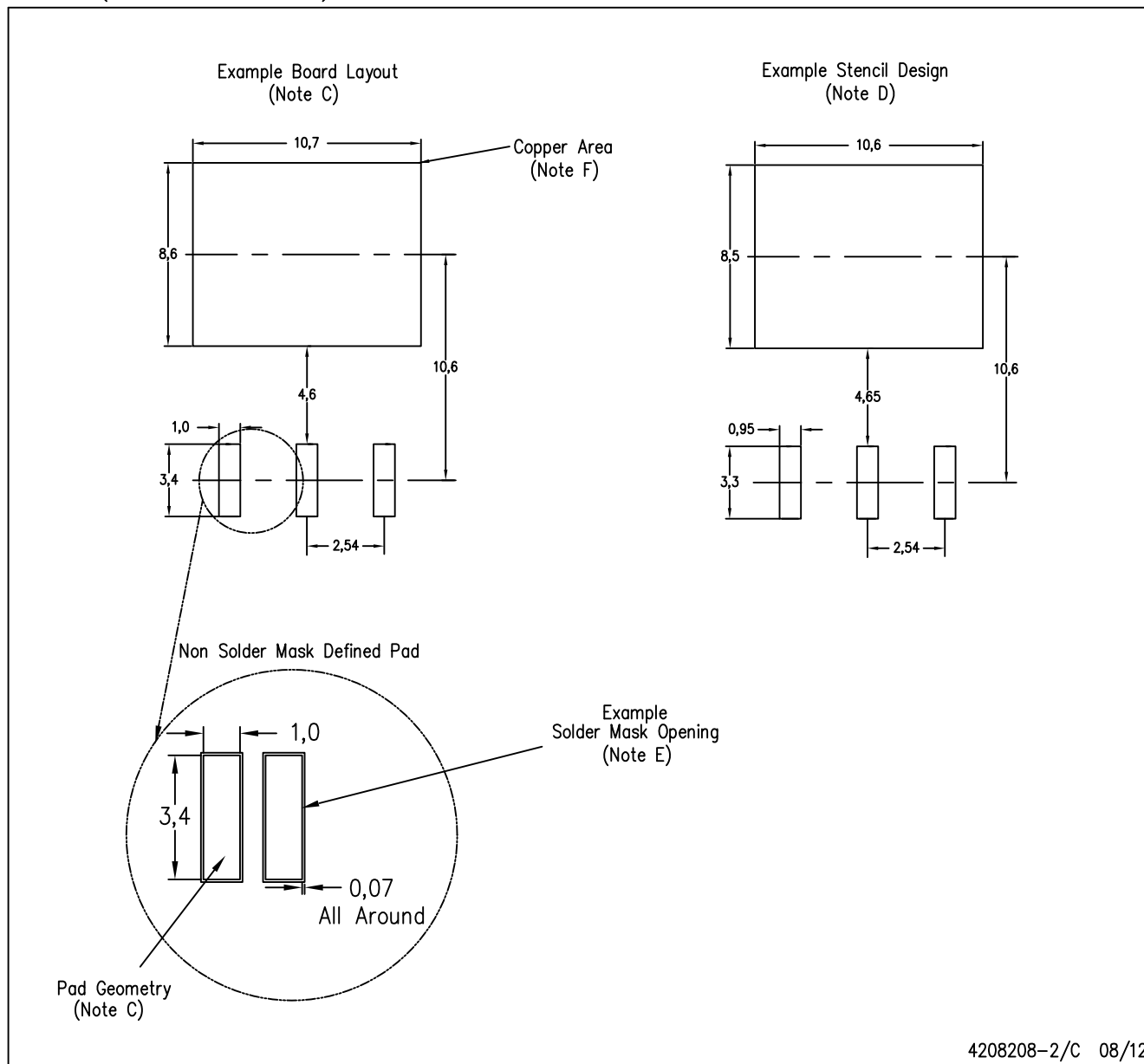


4200577-3/G 01/13

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.
- Falls within JEDEC TO-263 variation AA, except minimum lead thickness and minimum exposed pad length.

KTT (R-PSFM-G3)

PLASTIC FLANGE-MOUNT PACKAGE

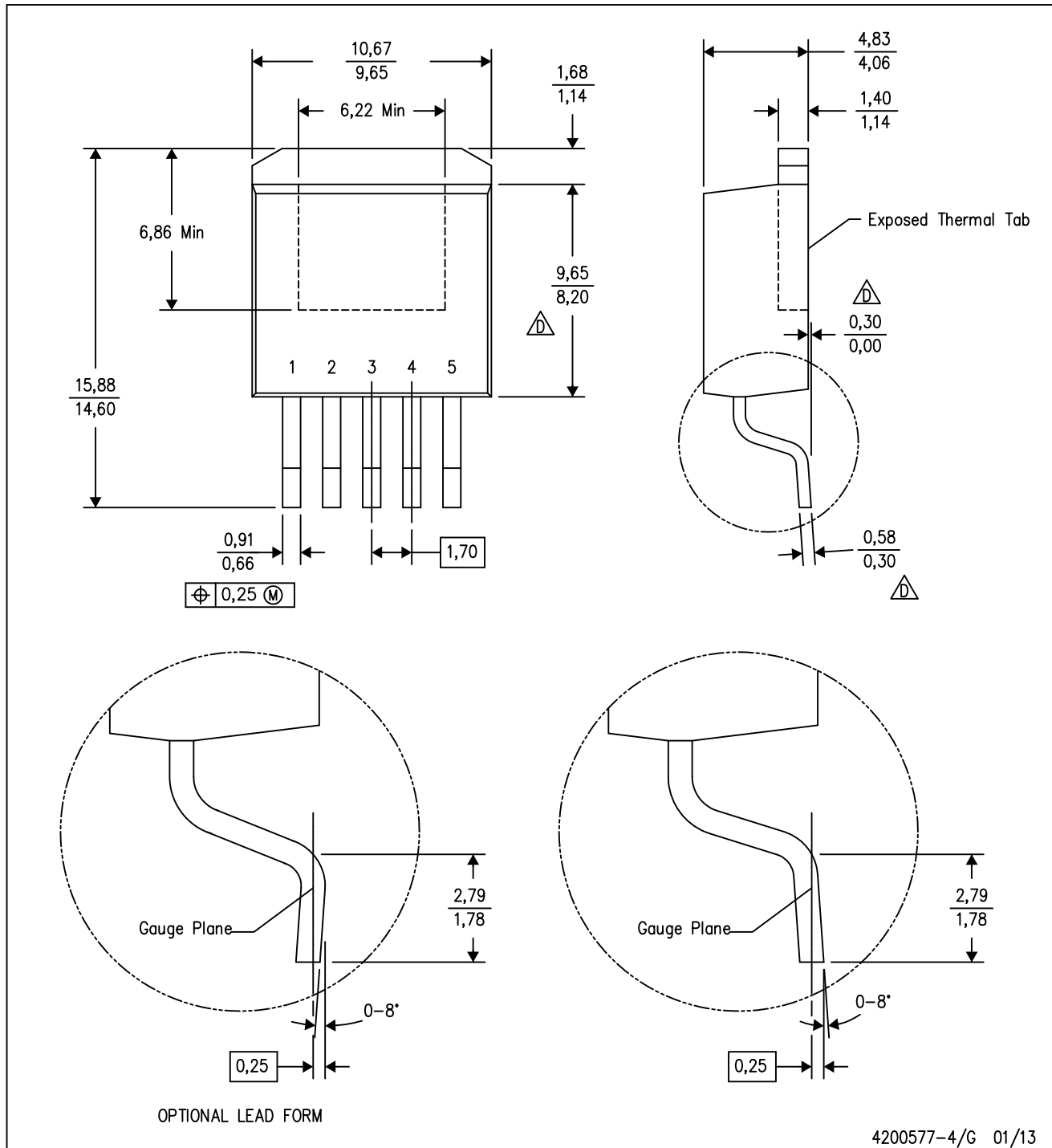


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-SM-782 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.
  - This package is designed to be soldered to a thermal pad on the board. Refer to the Product Datasheet for specific thermal information, via requirements, and recommended thermal pad size. For thermal pad sizes larger than shown a solder mask defined pad is recommended in order to maintain the solderable pad geometry while increasing copper area.



KTT (R-PSFM-G5)

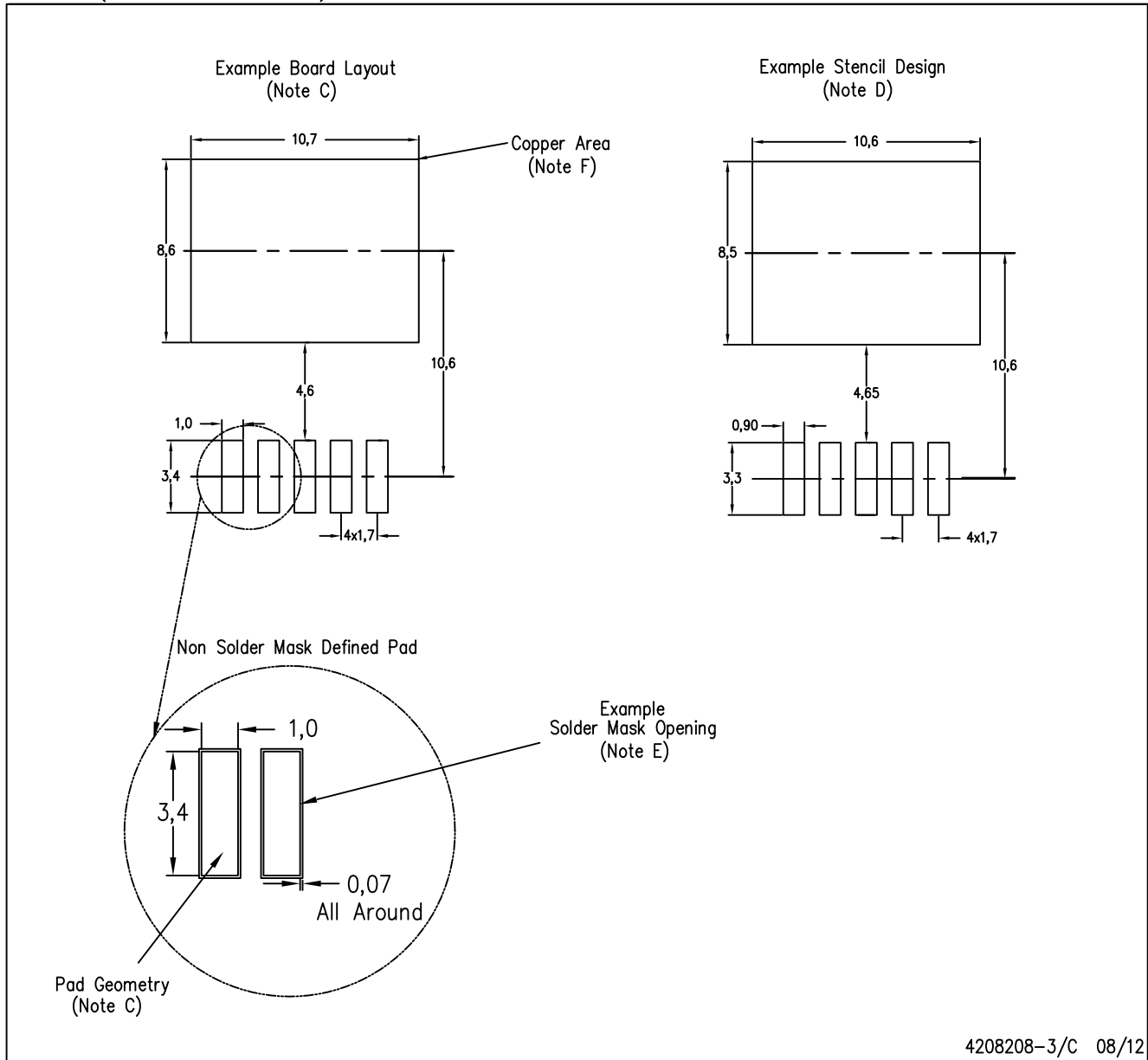
PLASTIC FLANGE-MOUNT PACKAGE



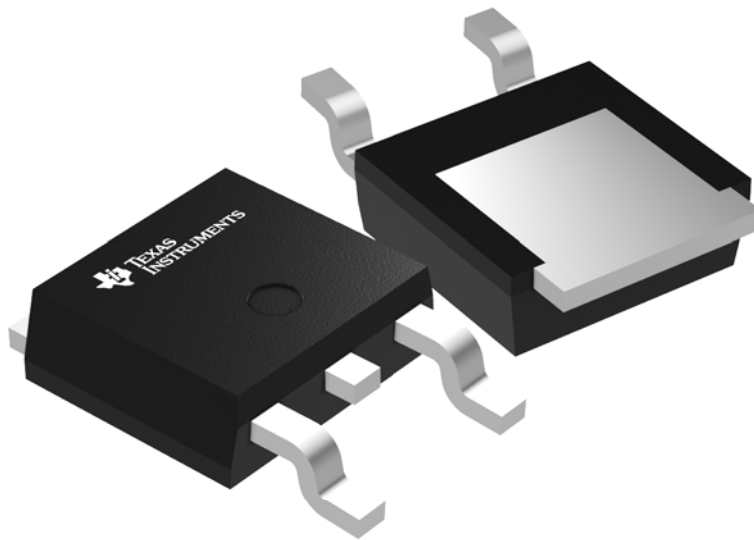
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.
- Falls within JEDEC TO-263 variation BA, except minimum lead thickness, maximum seating height, and minimum body length.

KTT (R-PSFM-G5)

PLASTIC FLANGE-MOUNT PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-SM-782 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.
  - This package is designed to be soldered to a thermal pad on the board. Refer to the Product Datasheet for specific thermal information, via requirements, and recommended thermal pad size. For thermal pad sizes larger than shown a solder mask defined pad is recommended in order to maintain the solderable pad geometry while increasing copper area.



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



**TO-252 - 2.52 mm max height**

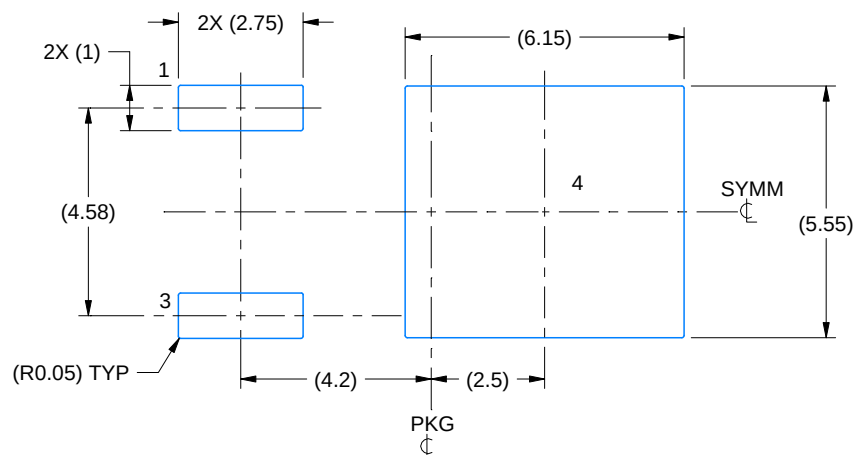
[illegible]

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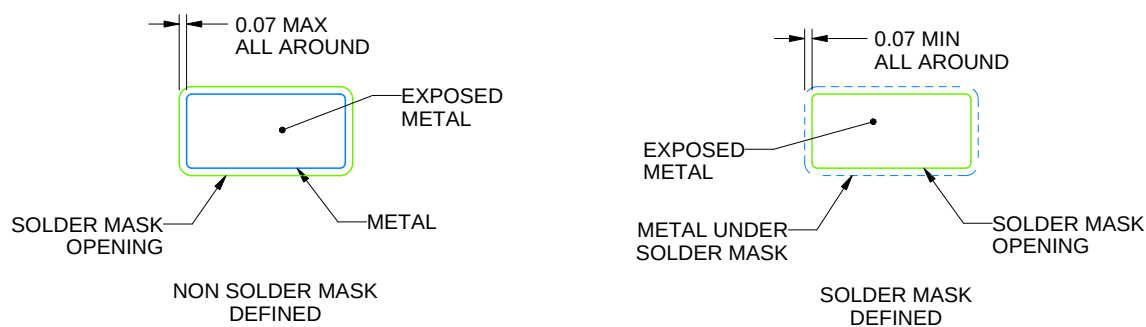
**KVU0003A**

**TO-252 - 2.52 mm max height**

TO-252



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:6X



SOLDER MASK DETAILS  
NOT TO SCALE

4218915/A 02/2017

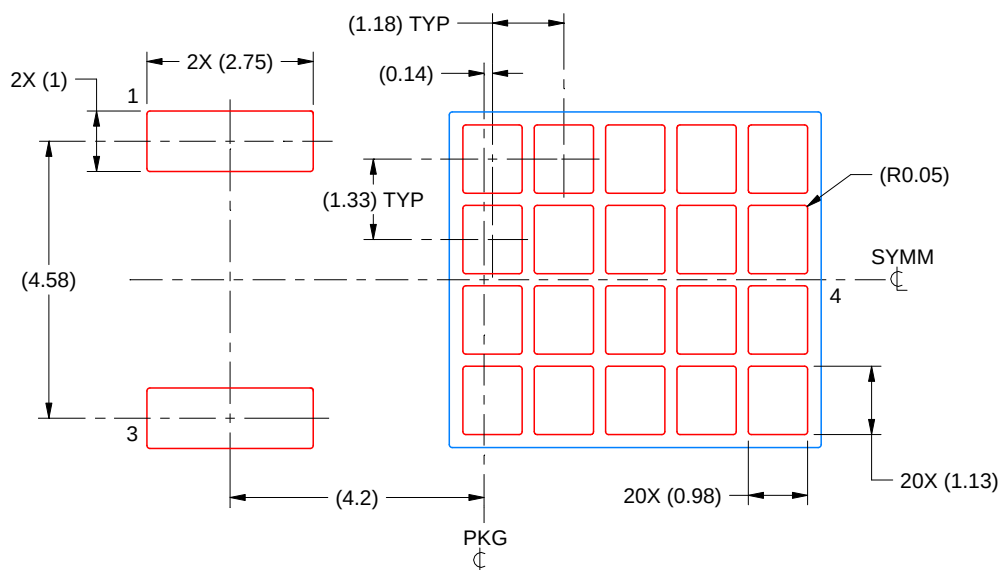
NOTES: (continued)

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](http://www.ti.com/lit/slm002)) and SLMA004 ([www.ti.com/lit/slma004](http://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.

**KVU0003A**

**TO-252 - 2.52 mm max height**

TO-252



## SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD  
65% PRINTED SOLDER COVERAGE BY AREA  
SCALE:8X

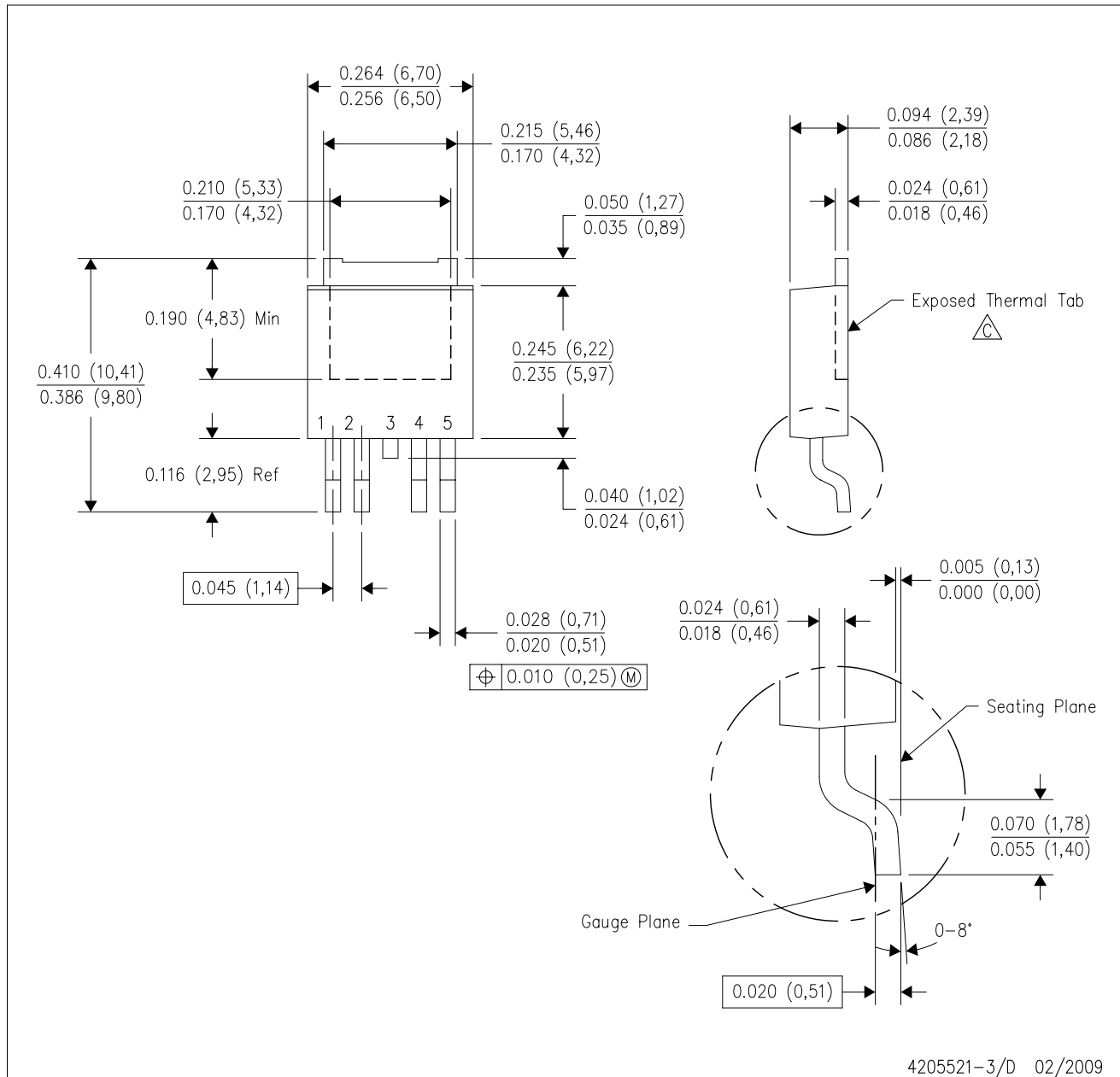
4218915/A 02/2017

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.

KVU (R-PSFM-G5)

PLASTIC FLANGE-MOUNT PACKAGE



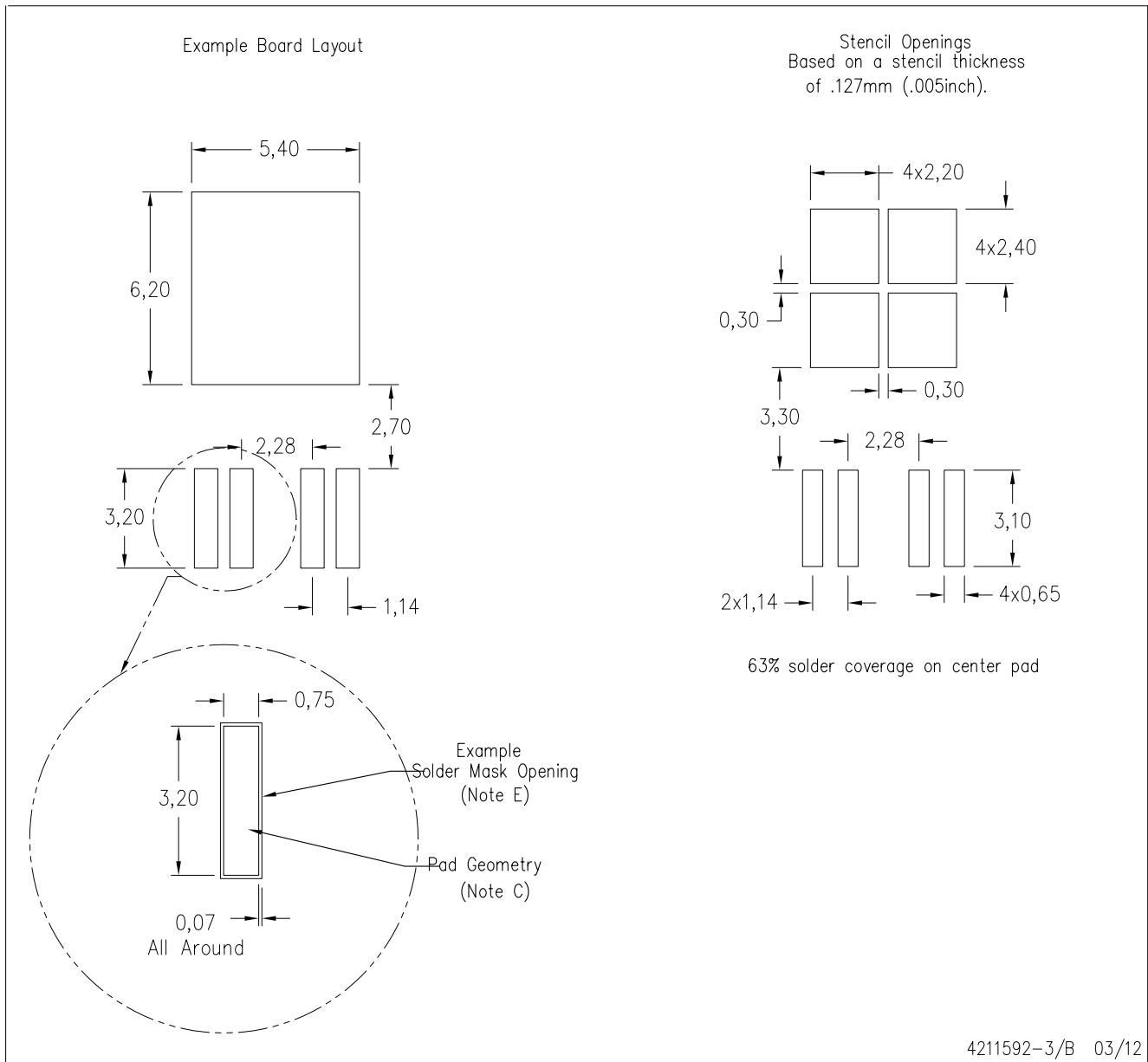
4205521-3/D 02/2009

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. The center lead is in electrical contact with the exposed thermal tab.
- D. Body Dimensions do not include mold flash or protrusions. Mold flash and protrusion shall not exceed 0.006 (0,15) per side.
- E. Falls within JEDEC TO-252 variation AD.

KVU (R-PSFM-G5)

PLASTIC FLANGE MOUNT PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-SM-782 is an alternate information source for PCB land pattern designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in thermal pad.



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