



## General Description

OST50N65K7UM2AF-A uses advanced Oriental-Semi's patented Trident-Gate Bipolar Transistor (TGBT™) technology to provide extremely low  $V_{CE(sat)}$ , low gate charge, and excellent switching performance. This device is suitable for mid to high range switching frequency converters.

## Features

- Advanced TGBT™ technology
- Excellent conduction and switching loss
- Excellent stability and uniformity



## Applications

- Induction converters
- On-board charger

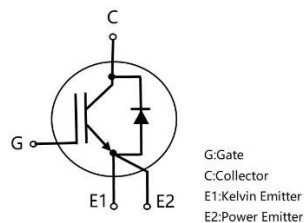
## Key Performance Parameters

| Parameter                        | Value | Unit        |
|----------------------------------|-------|-------------|
| $V_{CES, min} @ 25^{\circ}C$     | 650   | V           |
| Maximum junction temperature     | 175   | $^{\circ}C$ |
| $I_C, pulse$                     | 150   | A           |
| $V_{CE(sat)}, typ @ V_{GE}=15 V$ | 1.5   | V           |
| $Q_g$                            | 106   | nC          |

## Marking Information

| Product Name      | Package  | Marking        |
|-------------------|----------|----------------|
| OST50N65K7UM2AF-A | TO263-7L | OST50N65K7UM2A |

## Package & Pin Information




**Absolute Maximum Ratings** at  $T_{vj}=25\text{ }^{\circ}\text{C}$  unless otherwise noted

| Parameter                                                                        | Symbol                 | Value      | Unit               |
|----------------------------------------------------------------------------------|------------------------|------------|--------------------|
| Collector emitter voltage                                                        | $V_{CES}$              | 650        | V                  |
| Gate emitter voltage                                                             | $V_{GES}$              | $\pm 20$   | V                  |
| Transient gate emitter voltage, $T_P \leq 10\text{ }\mu\text{s}$ , $D < 0.01$    |                        | $\pm 30$   | V                  |
| Continuous collector current <sup>1)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$  | $I_C$                  | 80         | A                  |
| Continuous collector current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$ |                        | 50         | A                  |
| Pulsed collector current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$      | $I_{C, \text{ pulse}}$ | 150        | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$         | $I_F$                  | 80         | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$        |                        | 50         | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$          | $I_{F, \text{ pulse}}$ | 150        | A                  |
| Power dissipation <sup>3)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$             | $P_D$                  | 272        | W                  |
| Power dissipation <sup>3)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$            |                        | 136        | W                  |
| Operation and storage temperature                                                | $T_{stg}, T_{vj}$      | -55 to 175 | $^{\circ}\text{C}$ |

**Thermal Characteristics**

| Parameter                                          | Symbol          | Value | Unit                 |
|----------------------------------------------------|-----------------|-------|----------------------|
| IGBT thermal resistance, junction-case             | $R_{\theta JC}$ | 0.55  | $^{\circ}\text{C/W}$ |
| Diode thermal resistance, junction-case            | $R_{\theta JC}$ | 0.75  | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient <sup>4)</sup> | $R_{\theta JA}$ | 40    | $^{\circ}\text{C/W}$ |

**Electrical Characteristics** at  $T_{vj}=25\text{ }^{\circ}\text{C}$  unless otherwise specified

| Parameter                            | Symbol        | Min. | Typ. | Max. | Unit          | Test condition                                                                  |
|--------------------------------------|---------------|------|------|------|---------------|---------------------------------------------------------------------------------|
| Collector-emitter breakdown voltage  | $V_{(BR)CES}$ | 650  |      |      | V             | $V_{GE}=0\text{ V}$ , $I_C=0.5\text{ mA}$                                       |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ |      | 1.5  | 2.0  | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$ , $T_{vj}=25\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 1.72 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$ , $T_{vj}=125\text{ }^{\circ}\text{C}$ |
|                                      |               |      | 1.86 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$ , $T_{vj}=175\text{ }^{\circ}\text{C}$ |
| Gate-emitter threshold voltage       | $V_{GE(th)}$  | 3.5  | 4.0  | 4.5  | V             | $V_{CE}=V_{GE}$ , $I_C=0.5\text{ mA}$                                           |
| Diode forward voltage                | $V_F$         |      | 2.8  |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_{vj}=25\text{ }^{\circ}\text{C}$   |
|                                      |               |      | 2.4  |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_{vj}=125\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 2.2  |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_{vj}=175\text{ }^{\circ}\text{C}$  |
| Gate-emitter leakage current         | $I_{GES}$     |      |      | 100  | nA            | $V_{CE}=0\text{ V}$ , $V_{GE}=20\text{ V}$                                      |
| Zero gate voltage collector current  | $I_{CES}$     |      |      | 10   | $\mu\text{A}$ | $V_{CE}=650\text{ V}$ , $V_{GE}=0\text{ V}$                                     |

**Dynamic Characteristics**

| Parameter                    | Symbol       | Min. | Typ. | Max. | Unit | Test condition                                                                                                                       |
|------------------------------|--------------|------|------|------|------|--------------------------------------------------------------------------------------------------------------------------------------|
| Input capacitance            | $C_{ies}$    |      | 5447 |      | pF   | $V_{GE}=0\text{ V}$ ,<br>$V_{CE}=25\text{ V}$ ,<br>$f=100\text{ kHz}$                                                                |
| Output capacitance           | $C_{oes}$    |      | 131  |      | pF   |                                                                                                                                      |
| Reverse transfer capacitance | $C_{res}$    |      | 19   |      | pF   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 31   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=50\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 15   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 128  |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 15   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.53 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.41 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 30   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=25\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 9    |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 140  |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 16   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.23 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.19 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 31   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=50\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 18   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 139  |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 18   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.86 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.51 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 29   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=25\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 11   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 158  |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 14   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.38 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.25 |      | mJ   |                                                                                                                                      |



### Gate Charge Characteristics

| Parameter             | Symbol   | Min. | Typ. | Max. | Unit | Test condition                                                         |
|-----------------------|----------|------|------|------|------|------------------------------------------------------------------------|
| Total gate charge     | $Q_g$    |      | 106  |      | nC   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=520\text{ V}$ ,<br>$I_C=50\text{ A}$ |
| Gate-emitter charge   | $Q_{ge}$ |      | 37   |      | nC   |                                                                        |
| Gate-collector charge | $Q_{gc}$ |      | 28   |      | nC   |                                                                        |

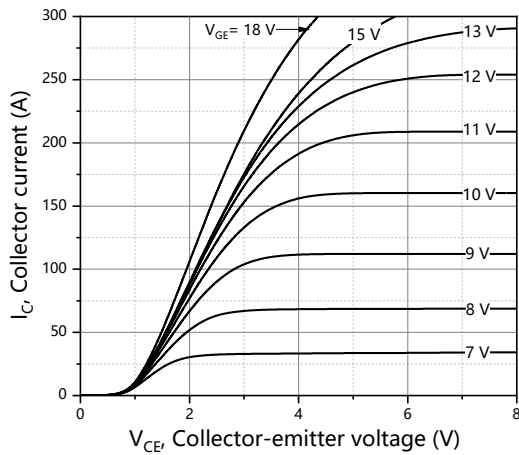
### Body Diode Characteristics

| Parameter                           | Symbol    | Min. | Typ. | Max. | Unit          | Test condition                                                                                                             |
|-------------------------------------|-----------|------|------|------|---------------|----------------------------------------------------------------------------------------------------------------------------|
| Diode reverse recovery time         | $t_{rr}$  |      | 32   |      | ns            | $V_R=400\text{ V}$ ,<br>$I_F=50\text{ A}$ ,<br>$di_F/dt=1000\text{ A}/\mu\text{s}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Diode reverse recovery charge       | $Q_{rr}$  |      | 0.24 |      | $\mu\text{C}$ |                                                                                                                            |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 13   |      | A             |                                                                                                                            |
| Diode reverse recovery time         | $t_{rr}$  |      | 103  |      | ns            | $V_R=400\text{ V}$ ,<br>$I_F=50\text{ A}$ ,<br>$di_F/dt=1000\text{ A}/\mu\text{s}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Diode reverse recovery charge       | $Q_{rr}$  |      | 1.09 |      | $\mu\text{C}$ |                                                                                                                            |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 20   |      | A             |                                                                                                                            |

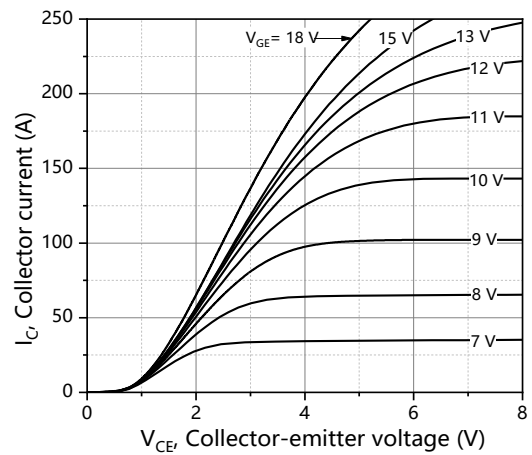
### Note

- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3)  $P_d$  is based on max. junction temperature, using junction-case thermal resistance.
- 4) The value of  $R_{\theta JA}$  is measured with the device mounted on 1 inch<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_a=25\text{ }^\circ\text{C}$ .

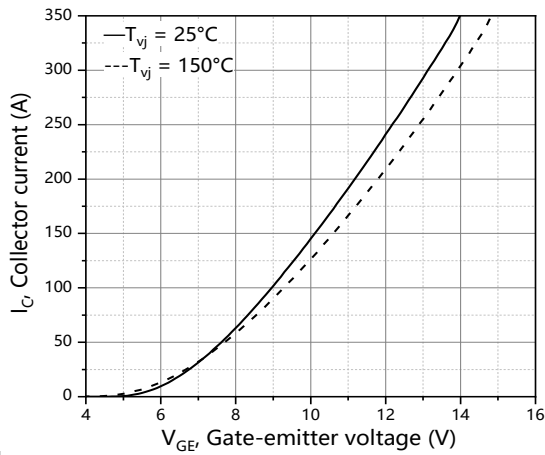
## Electrical Characteristics Diagrams



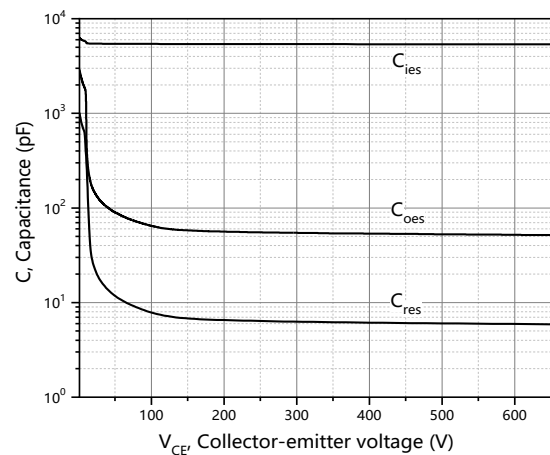
**Figure 1. Typical output characteristics**  
( $T_{vj}=25\text{ }^{\circ}\text{C}$ )



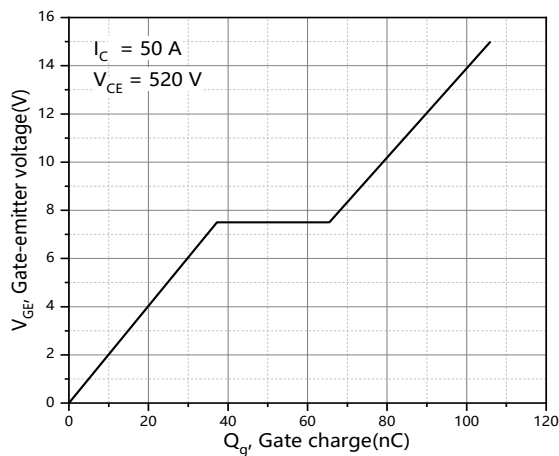
**Figure 2. Typical output characteristics**  
( $T_{vj}=150\text{ }^{\circ}\text{C}$ )



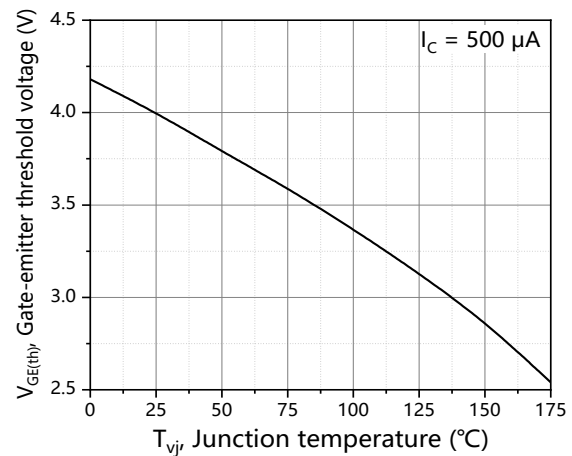
**Figure 3. Typical transfer characteristics**  
( $V_{CE}=20\text{ V}$ )



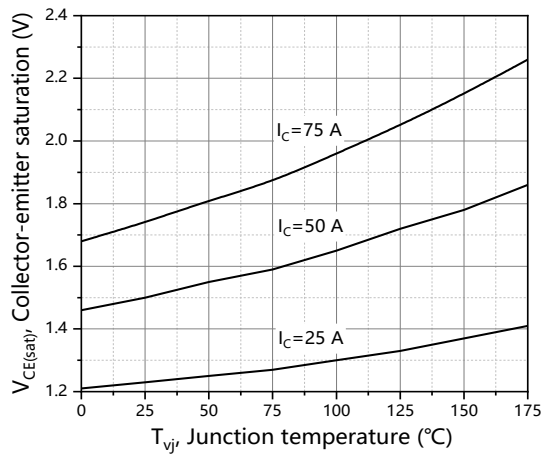
**Figure 4. Typical capacitance**  
( $V_{GE}=0\text{ V}$ ,  $f=100\text{ kHz}$ )



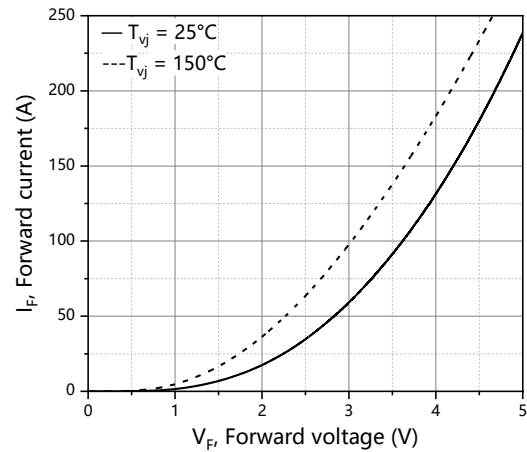
**Figure 5. Typical gate charge**



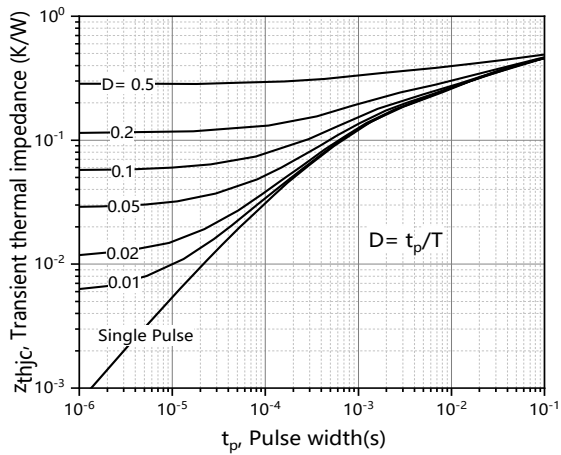
**Figure 6. Gate-emitter threshold voltage**



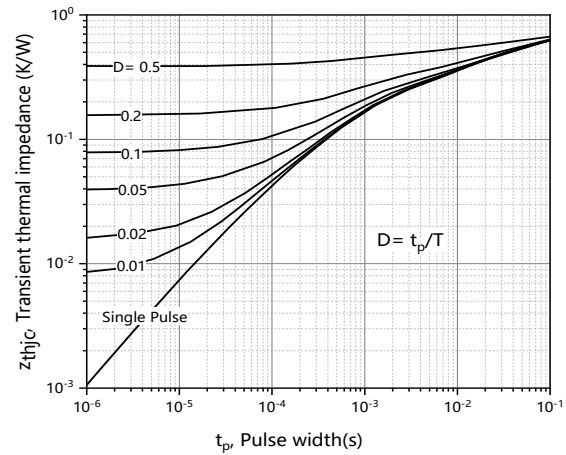
**Figure 7. Typical collector-emitter voltage**



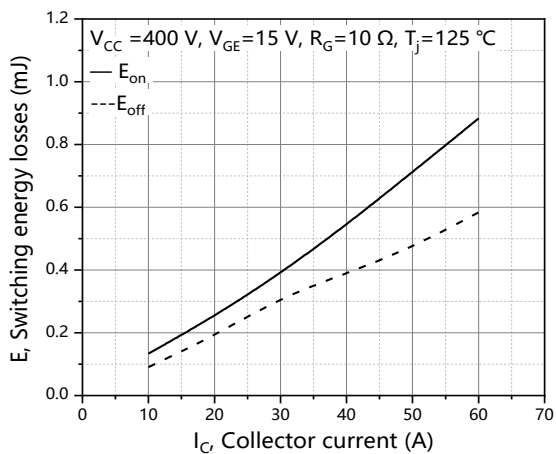
**Figure 8. Forward characteristic of diode**



**Figure 9. IGBT transient thermal impedance**

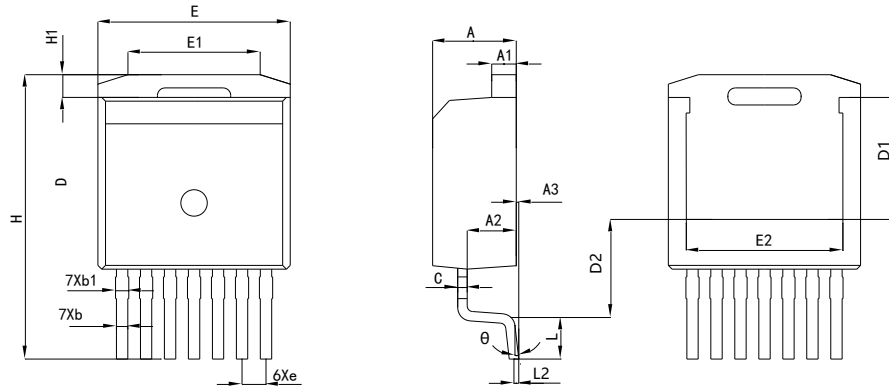


**Figure 10. Diode transient thermal impedance**



**Figure 11. Switching energy vs. collector current**

## Package Information



| Symbol   | mm       |       |       |
|----------|----------|-------|-------|
|          | Min      | Nom   | Max   |
| A        | 4.30     | 4.43  | 4.56  |
| A1       | 1.20     | 1.30  | 1.40  |
| A2       | 2.45     | 2.60  | 2.75  |
| A3       | 0.00     | 0.13  | 0.25  |
| b        | 0.50     | 0.60  | 0.70  |
| b1       | 0.60     | 0.70  | 0.90  |
| c        | 0.45     | 0.50  | 0.60  |
| D        | 8.93     | 9.08  | 9.23  |
| D1       | 6.30     | 6.45  | 6.60  |
| D2       | 5.18 REF |       |       |
| e        | 1.27 BSC |       |       |
| E        | 10.08    | 10.18 | 10.28 |
| E1       | 7.00 REF |       |       |
| E2       | 7.90     | 8.30  | 8.70  |
| H        | 14.53    | 15.03 | 15.53 |
| H1       | 0.98     | 1.20  | 1.42  |
| L        | 1.90     | 2.20  | 2.50  |
| L2       | 0.25 BSC |       |       |
| $\theta$ | 0°       | 3°    | 7°    |

Version : TO263-7L-P package outline dimension

**Ordering Information**

| Package Type | Units/ Reel | Reel / Inner Box | Units/ Inner Box | Inner Boxes/ Carton Box | Units/ Carton Box |
|--------------|-------------|------------------|------------------|-------------------------|-------------------|
| TO263-7L-P   | 800         | 1                | 800              | 5                       | 4000              |

**Product Information**

| Product           | Package  | Pb Free | RoHS | Halogen Free |
|-------------------|----------|---------|------|--------------|
| OST50N65K7UM2AF-A | TO263-7L | yes     | yes  | yes          |

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## Revision History

| Version | Revision History | Data       |
|---------|------------------|------------|
| V1.0    | Initial release  | 2025-07-07 |