



## General Description

OST50N120H4EMF-E 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
- Fast and soft antiparallel diode



## Applications

- Induction converters
- Uninterruptible power supplies

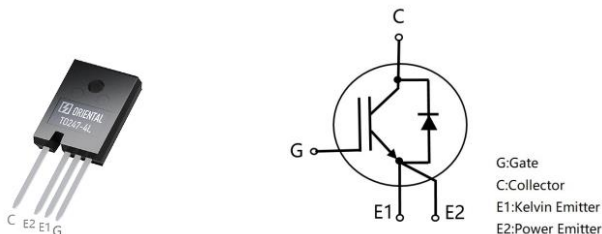
## Key Performance Parameters

| Parameter                                       | Value | Unit               |
|-------------------------------------------------|-------|--------------------|
| $V_{CES, min} @ 25\text{ }^{\circ}\text{C}$     | 1200  | V                  |
| Maximum junction temperature                    | 175   | $^{\circ}\text{C}$ |
| $I_C, \text{ pulse}$                            | 200   | A                  |
| $V_{CE(sat)}, \text{ typ} @ V_{GE}=15\text{ V}$ | 1.48  | V                  |
| $Q_g$                                           | 252   | nC                 |

## Marking Information

| Product Name     | Package  | Marking       |
|------------------|----------|---------------|
| OST50N120H4EMF-E | TO247-4L | OST50N120H4EM |

## Package & Pin Information



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

| Parameter                                                                        | Symbol                 | Value      | Unit               |
|----------------------------------------------------------------------------------|------------------------|------------|--------------------|
| Collector emitter voltage                                                        | $V_{CES}$              | 1200       | 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> , $T_C = 25\text{ }^{\circ}\text{C}$      | $I_{C, \text{ pulse}}$ | 200        | 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> , $T_C = 25\text{ }^{\circ}\text{C}$          | $I_{F, \text{ pulse}}$ | 200        | A                  |
| Power dissipation <sup>3)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$             | $P_D$                  | 395        | W                  |
| Power dissipation <sup>3)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$            |                        | 198        | 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  | $R_{\theta JC}$ | 0.38  | $^{\circ}\text{C/W}$ |
| Diode thermal resistance, junction-case | $R_{\theta JC}$ | 0.6   | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient    | $R_{\theta JA}$ | 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  | $V_{(BR)CES}$ | 1200 |      |      | V             | $V_{GE}=0\text{ V}$ , $I_C=0.5\text{ mA}$                                          |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ |      | 1.48 | 1.85 | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$<br>$T_{vj}=25\text{ }^{\circ}\text{C}$    |
|                                      |               |      | 1.83 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$ ,<br>$T_{vj}=125\text{ }^{\circ}\text{C}$ |
|                                      |               |      | 2.06 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=50\text{ A}$ ,<br>$T_{vj}=175\text{ }^{\circ}\text{C}$ |
| Gate-emitter threshold voltage       | $V_{GE(th)}$  | 4.5  | 5.3  | 6.5  | V             | $V_{CE}=V_{GE}$ , $I_C=0.5\text{ mA}$                                              |
| Diode forward voltage                | $V_F$         |      | 2.65 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$<br>$T_{vj}=25\text{ }^{\circ}\text{C}$     |
|                                      |               |      | 2.34 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$ ,<br>$T_{vj}=125\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 2.14 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=50\text{ A}$ ,<br>$T_{vj}=175\text{ }^{\circ}\text{C}$  |
| 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   | $\mu\text{A}$ | $V_{CE}=1200\text{ V}$ , $V_{GE}=0\text{ V}$                                       |

**Dynamic Characteristics**

| Parameter                    | Symbol       | Min. | Typ.  | Max. | Unit | Test condition                                                                                                                       |
|------------------------------|--------------|------|-------|------|------|--------------------------------------------------------------------------------------------------------------------------------------|
| Input capacitance            | $C_{ies}$    |      | 10787 |      | pF   | $V_{GE}=0\text{ V}$ ,<br>$V_{CE}=25\text{ V}$ ,<br>$f=100\text{ kHz}$                                                                |
| Output capacitance           | $C_{oes}$    |      | 171   |      | pF   |                                                                                                                                      |
| Reverse transfer capacitance | $C_{res}$    |      | 30    |      | pF   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 70    |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=50\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 21    |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 265   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 65    |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 1.58  |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 1.65  |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 67    |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=25\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 12    |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 306   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 40    |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.77  |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.90  |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 65    |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=50\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 27    |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 309   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 103   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 3.09  |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 2.24  |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 60    |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=25\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 16    |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 359   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 68    |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 1.64  |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 1.20  |      | mJ   |                                                                                                                                      |



### Gate Charge Characteristics

| Parameter             | Symbol   | Min. | Typ. | Max. | Unit | Test condition                                                         |
|-----------------------|----------|------|------|------|------|------------------------------------------------------------------------|
| Total gate charge     | $Q_g$    |      | 252  |      | nC   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=960\text{ V}$ ,<br>$I_C=50\text{ A}$ |
| Gate-emitter charge   | $Q_{ge}$ |      | 83   |      | nC   |                                                                        |
| Gate-collector charge | $Q_{gc}$ |      | 74   |      | nC   |                                                                        |

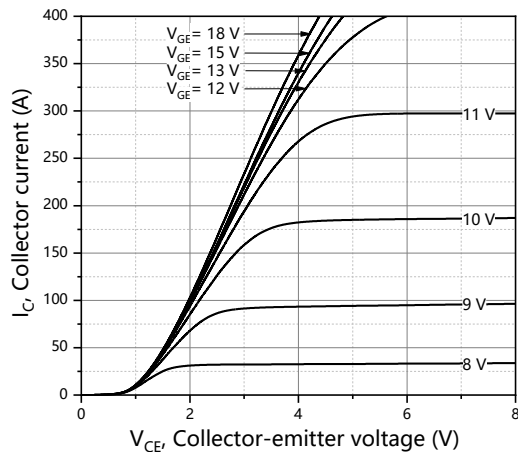
### Body Diode Characteristics

| Parameter                           | Symbol    | Min. | Typ. | Max. | Unit          | Test condition                                                                                                             |
|-------------------------------------|-----------|------|------|------|---------------|----------------------------------------------------------------------------------------------------------------------------|
| Diode reverse recovery time         | $t_{rr}$  |      | 199  |      | ns            | $V_R=600\text{ V}$ ,<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       | $Q_{rr}$  |      | 1.89 |      | $\mu\text{C}$ |                                                                                                                            |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 23   |      | A             |                                                                                                                            |
| Diode reverse recovery time         | $t_{rr}$  |      | 291  |      | ns            | $V_R=600\text{ V}$ ,<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       | $Q_{rr}$  |      | 5.59 |      | $\mu\text{C}$ |                                                                                                                            |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 44   |      | A             |                                                                                                                            |

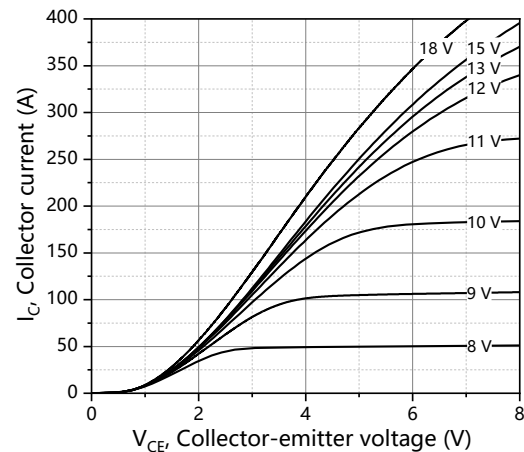
### Note

- 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.

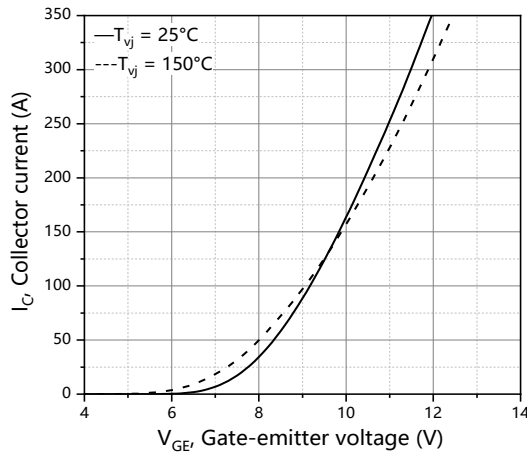
## Electrical Characteristics Diagrams



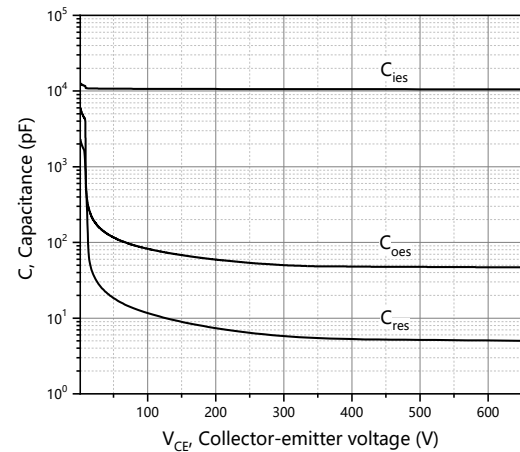
**Figure 1. Typical output characteristics**  
( $T_{vj}=25\text{ }^{\circ}\text{C}$ )



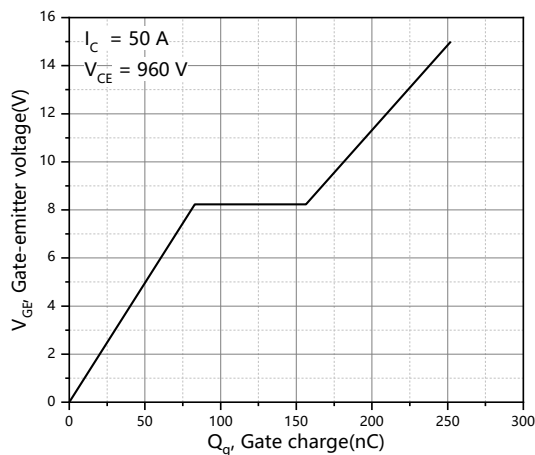
**Figure 2. Typical output characteristics**  
( $T_{vj}=150\text{ }^{\circ}\text{C}$ )



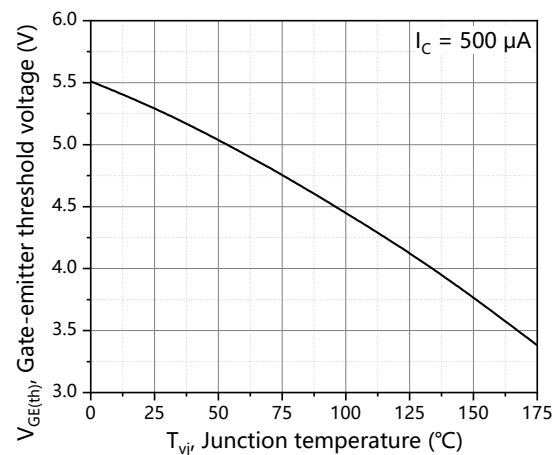
**Figure 3. Typical transfer characteristics**  
( $V_{CE}=20\text{ V}$ )



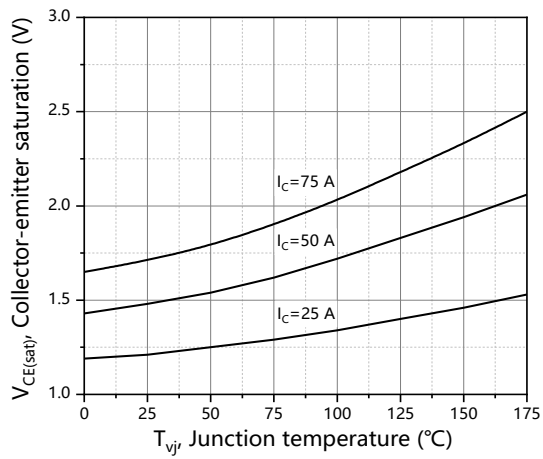
**Figure 4. Typical capacitance**  
( $V_{GE}=0\text{ V}$ ,  $f=100\text{ kHz}$ )



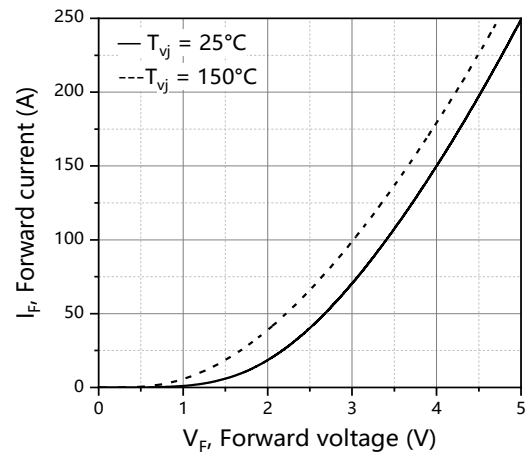
**Figure 5. Typical gate charge**



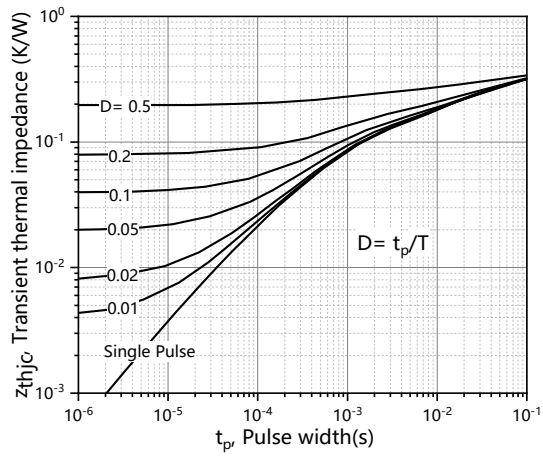
**Figure 6. Gate-emitter threshold voltage**



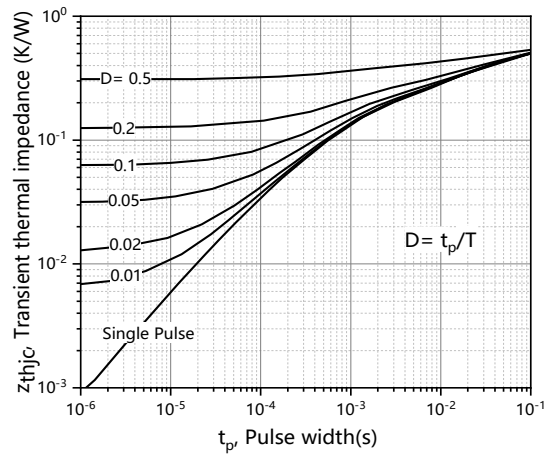
**Figure 7. Typical collector-emitter voltage**



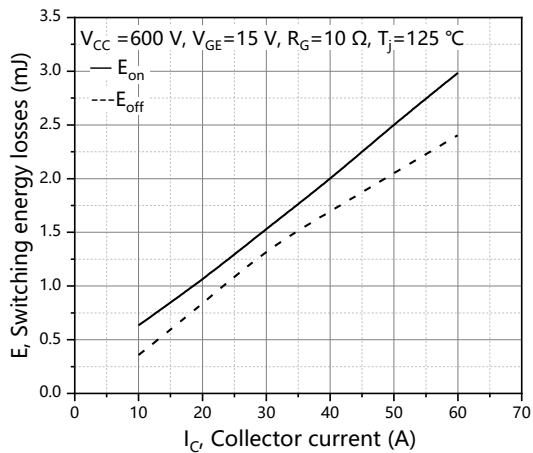
**Figure 8. Forward characteristic of diode**



**Figure 9. IGBT transient thermal impedance**

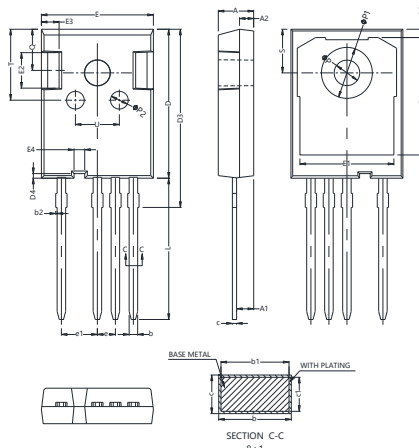


**Figure 10. Diode transient thermal impedance**



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

## Package Information



| SYMBOL | MIN     | NOM   | MAX   |
|--------|---------|-------|-------|
| A      | 4.90    | 5.00  | 5.10  |
| A1     | 2.31    | 2.41  | 2.51  |
| A2     | 1.90    | 2.00  | 2.10  |
| b      | 1.16    |       | 1.29  |
| b1     | 1.15    | 1.2   | 1.25  |
| b2     | 0.00    |       | 0.20  |
| c      | 0.59    |       | 0.66  |
| c1     | 0.58    | 0.60  | 0.62  |
| D      | 20.90   | 21.00 | 21.10 |
| D1     | 16.25   | 16.55 | 16.85 |
| D2     | 1.05    | 1.20  | 1.35  |
| D3     | 24.97   | 25.12 | 25.27 |
| D4     | 0.55    | 0.65  | 0.75  |
| E      | 15.70   | 15.80 | 15.90 |
| E1     | 13.10   | 13.30 | 13.50 |
| E2     | 4.90    | 5.00  | 5.10  |
| E3     | 2.40    | 2.50  | 2.60  |
| E4     | 1.40    | 1.50  | 1.60  |
| e      | 2.44    | 2.54  | 2.64  |
| e1     | 4.98    | 5.08  | 5.18  |
| L      | 19.80   | 19.92 | 20.10 |
| P      | 3.50    | 3.60  | 3.70  |
| P1     |         |       | 7.40  |
| P2     | 2.40    | 2.50  | 2.60  |
| Q      | 5.60    |       | 6.00  |
| S      | 6.15BSC |       |       |
| T      | 9.80    |       | 10.20 |
| U      | 6.00    |       | 6.40  |

Version : TO247-4L-J package outline dimension

### Ordering Information

| Package Type | Units/ Tube | Tubes/ Inner Box | Units/ Inner Box | Inner Boxes/ Carton Box | Units/ Carton Box |
|--------------|-------------|------------------|------------------|-------------------------|-------------------|
| TO247-4L-J   | 30          | 20               | 600              | 4                       | 2400              |

### Product Information

| Product          | Package  | Pb Free | RoHS | Halogen Free |
|------------------|----------|---------|------|--------------|
| OST50N120H4EMF-E | TO247-4L | yes     | yes  | yes          |

### Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Oriental Semiconductor hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

For further information on technology, delivery terms and conditions and prices, please contact the Oriental Semiconductor sales representatives ([www.orientalsemi.com](http://www.orientalsemi.com)).

© Oriental Semiconductor Co.,Ltd. All Rights Reserved 

**Revision History**

| Version | Revision History | Data       |
|---------|------------------|------------|
| V1.0    | Initial release  | 2025-07-08 |