



## General Description

OST40N120HM2F 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

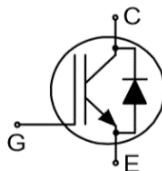
## Key Performance Parameters

| Parameter                               | Value | Unit |
|-----------------------------------------|-------|------|
| $V_{CES, min} @ 25\text{ °C}$           | 1200  | V    |
| Maximum junction temperature            | 175   | °C   |
| $I_C, pulse$                            | 160   | A    |
| $V_{CE(sat), typ} @ V_{GE}=15\text{ V}$ | 1.8   | V    |
| $Q_g$                                   | 139   | nC   |

## Marking Information

| Product Name  | Package | Marking      |
|---------------|---------|--------------|
| OST40N120HM2F | TO247   | OST40N120HM2 |

## 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> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                             | $I_C$                  | 56         | A                  |
| Continuous collector current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                            |                        | 40         | A                  |
| Pulsed collector current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                 | $I_{C, \text{ pulse}}$ | 160        | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                    | $I_F$                  | 56         | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                                   |                        | 40         | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                     | $I_{F, \text{ pulse}}$ | 160        | A                  |
| Power dissipation <sup>3)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                        | $P_D$                  | 395        | W                  |
| Power dissipation <sup>3)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                                       |                        | 197        | W                  |
| Operation and storage temperature                                                                                                                                                                                           | $T_{stg}, T_{vj}$      | -55 to 175 | $^{\circ}\text{C}$ |
| Short circuit withstand time<br>$V_{GE} = 15\text{ V}$ , $V_{CC} \leq 600\text{ V}$<br>Allowed number of short circuits < 1000<br>Time between short circuits: $\geq 1.0\text{ S}$<br>$T_{vj} = 25\text{ }^{\circ}\text{C}$ | $t_{sc}$               | 10         | $\mu\text{s}$      |

**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 | $R_{\theta JC}$ | 0.75  | $^{\circ}\text{C/W}$ |
| 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 | $V_{CE(sat)}$ |      | 1.8  | 2.1  | V             | $V_{GE}=15\text{ V}$ , $I_C=40\text{ A}$<br>$T_{vj}=25\text{ }^{\circ}\text{C}$    |
|                                      |               |      | 2.13 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=40\text{ A}$ ,<br>$T_{vj}=125\text{ }^{\circ}\text{C}$ |
|                                      |               |      | 2.37 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=40\text{ A}$ ,<br>$T_{vj}=175\text{ }^{\circ}\text{C}$ |
| Gate-emitter threshold voltage       | $V_{GE(th)}$  | 4.0  | 5.0  | 6.0  | V             | $V_{CE}=V_{GE}$ , $I_C=0.5\text{ mA}$                                              |
| Diode forward voltage                | $V_F$         |      | 2.6  | 3.0  | V             | $V_{GE}=0\text{ V}$ , $I_F=40\text{ A}$<br>$T_{vj}=25\text{ }^{\circ}\text{C}$     |
|                                      |               |      | 2.26 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=40\text{ A}$ ,<br>$T_{vj}=125\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 2.03 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=40\text{ A}$ ,<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            | $C_{ies}$    |      | 8134 |      | pF   | $V_{GE}=0\text{ V}$ ,<br>$V_{CE}=25\text{ V}$ ,<br>$f=100\text{ kHz}$                        |
| Output capacitance           | $C_{oes}$    |      | 150  |      | pF   |                                                                                              |
| Reverse transfer capacitance | $C_{res}$    |      | 3    |      | pF   |                                                                                              |
| Turn-on delay time           | $t_{d(on)}$  |      | 57   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=40\text{ A}$ |
| Rise time                    | $t_r$        |      | 47   |      | ns   |                                                                                              |
| Turn-off delay time          | $t_{d(off)}$ |      | 143  |      | ns   |                                                                                              |
| Fall time                    | $t_f$        |      | 210  |      | ns   |                                                                                              |
| Turn-on energy               | $E_{on}$     |      | 1.81 |      | mJ   |                                                                                              |
| Turn-off energy              | $E_{off}$    |      | 2.29 |      | mJ   |                                                                                              |
| Turn-on delay time           | $t_{d(on)}$  |      | 53   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=600\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=20\text{ A}$ |
| Rise time                    | $t_r$        |      | 24   |      | ns   |                                                                                              |
| Turn-off delay time          | $t_{d(off)}$ |      | 190  |      | ns   |                                                                                              |
| Fall time                    | $t_f$        |      | 206  |      | ns   |                                                                                              |
| Turn-on energy               | $E_{on}$     |      | 0.81 |      | mJ   |                                                                                              |
| Turn-off energy              | $E_{off}$    |      | 1.38 |      | mJ   |                                                                                              |

### Gate Charge Characteristics

| Parameter             | Symbol   | Min. | Typ. | Max. | Unit | Test condition                                                         |
|-----------------------|----------|------|------|------|------|------------------------------------------------------------------------|
| Total gate charge     | $Q_g$    |      | 139  |      | nC   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=960\text{ V}$ ,<br>$I_C=40\text{ A}$ |
| Gate-emitter charge   | $Q_{ge}$ |      | 84   |      | nC   |                                                                        |
| Gate-collector charge | $Q_{gc}$ |      | 12   |      | nC   |                                                                        |

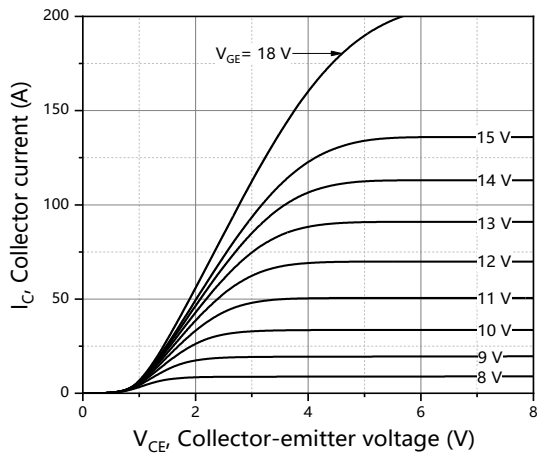
### Body Diode Characteristics

| Parameter                           | Symbol    | Min. | Typ. | Max. | Unit          | Test condition                                                                                                           |
|-------------------------------------|-----------|------|------|------|---------------|--------------------------------------------------------------------------------------------------------------------------|
| Diode reverse recovery time         | $t_{rr}$  |      | 219  |      | ns            | $V_R=600\text{ V}$ ,<br>$I_F=40\text{ A}$ ,<br>$di_F/dt=500\text{ A}/\mu\text{s}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$ |
| Diode reverse recovery charge       | $Q_{rr}$  |      | 1.49 |      | $\mu\text{C}$ |                                                                                                                          |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 14   |      | A             |                                                                                                                          |

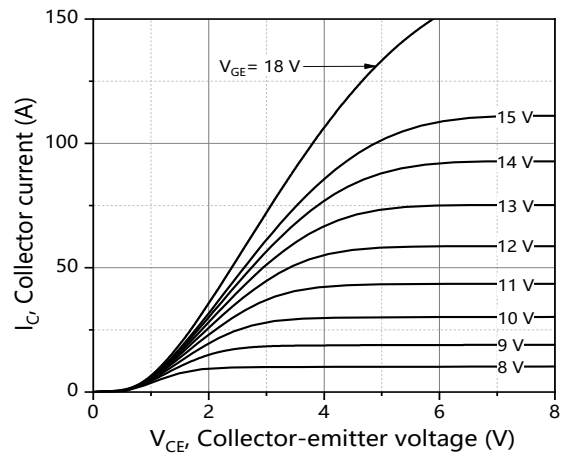
#### Note

- 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.

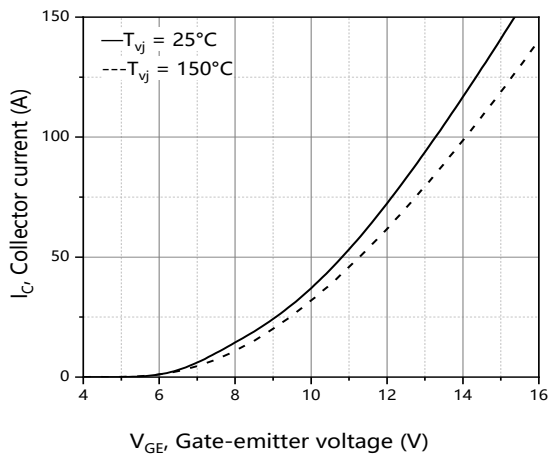
## Electrical Characteristics Diagrams



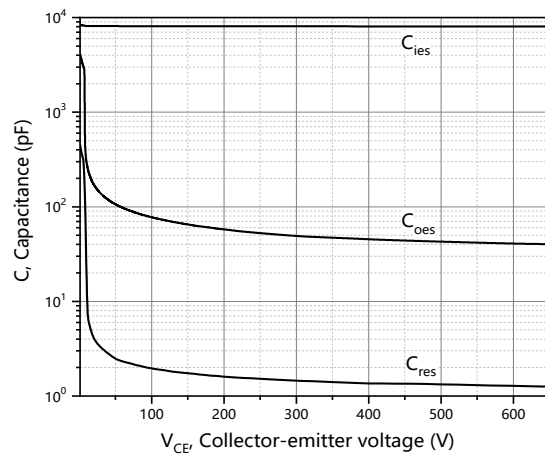
**Figure 1. Typical output characteristics**  
( $T_{vj}=25\text{ }^{\circ}\text{C}$ )



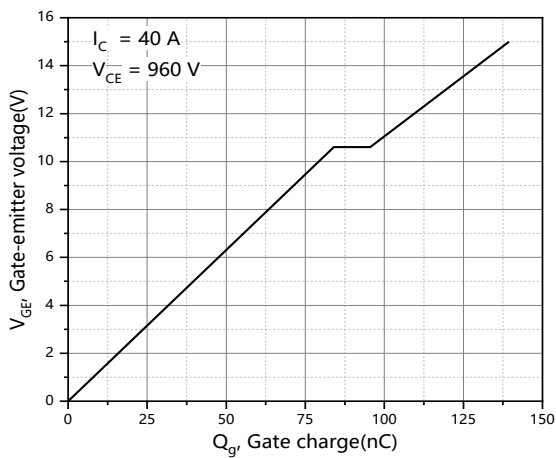
**Figure 2. Typical output characteristics**  
( $T_{vj}=150\text{ }^{\circ}\text{C}$ )



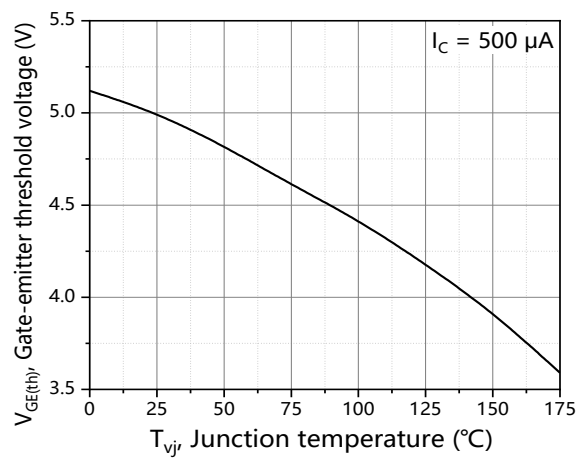
**Figure 3. Typical transfer characteristics**  
( $V_{CE}=20\text{ V}$ )



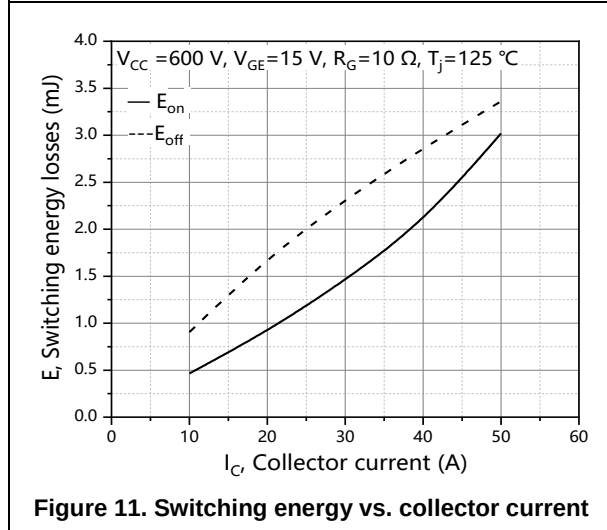
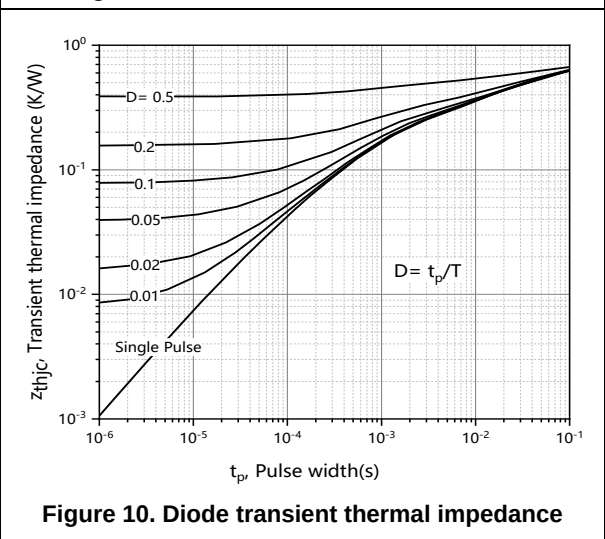
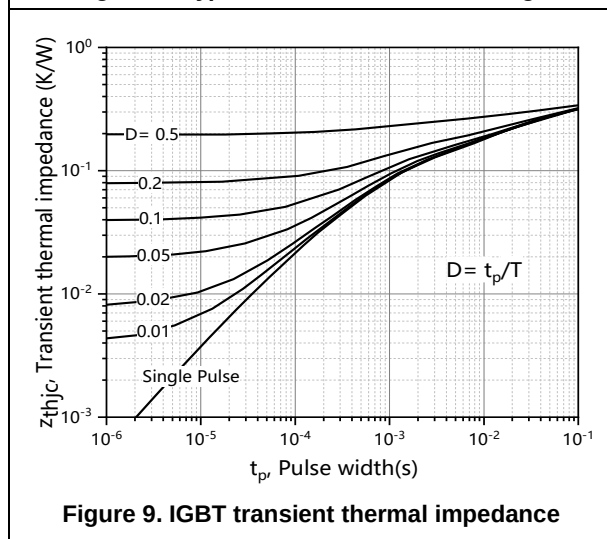
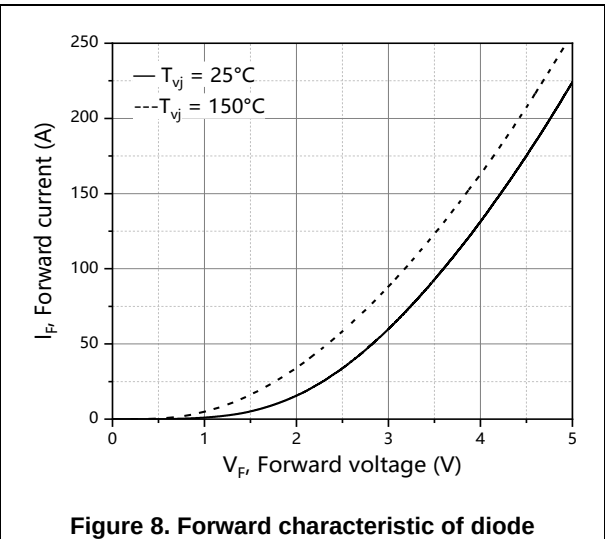
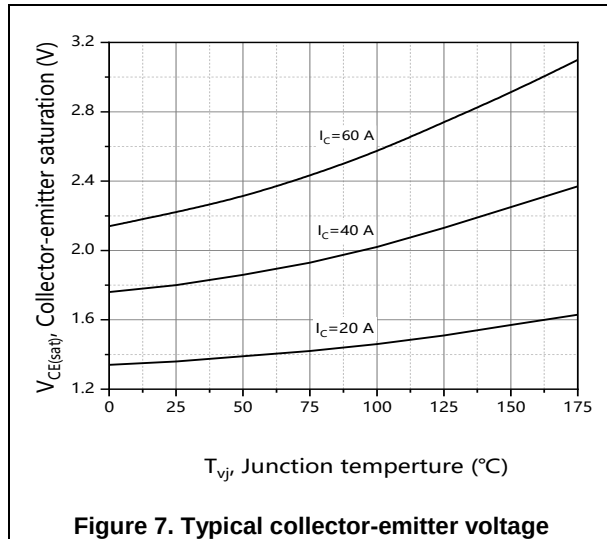
**Figure 4. Typical capacitance**  
( $V_{GE}=0\text{ V}$ ,  $f=100\text{ kHz}$ )



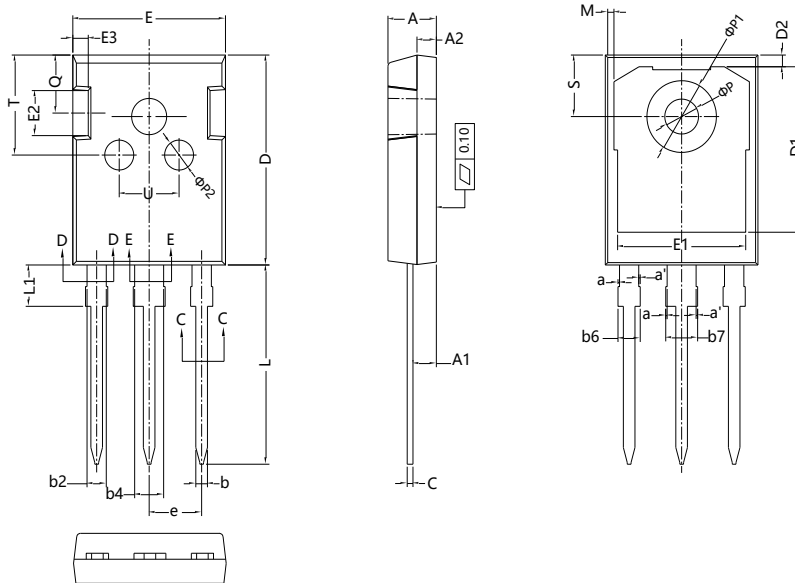
**Figure 5. Typical gate charge**



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



## Package Information



| Symbol | mm        |       |       |
|--------|-----------|-------|-------|
|        | Min       | Nom   | Max   |
| A      | 4.90      | 5.00  | 5.10  |
| A1     | 2.31      | 2.41  | 2.51  |
| A2     | 1.90      | 2.00  | 2.10  |
| a      | 0.00      | -     | 0.15  |
| a'     | 0.00      | -     | 0.15  |
| b      | 1.16      | -     | 1.26  |
| b2     | 1.96      | -     | 2.06  |
| b4     | 2.96      | -     | 3.06  |
| b6     | -         | -     | 2.25  |
| b7     | -         | -     | 3.25  |
| c      | 0.59      | -     | 0.66  |
| D      | 20.90     | 21.00 | 21.10 |
| D1     | 16.25     | 16.55 | 16.85 |
| D2     | 1.05      | 1.17  | 1.35  |
| E      | 15.70     | 15.80 | 15.90 |
| E1     | 13.10     | 13.30 | 13.50 |
| E2     | 4.40      | 4.50  | 4.60  |
| E3     | 1.50      | 1.60  | 1.70  |
| e      | 5.436 BSC |       |       |
| L      | 19.80     | 19.92 | 20.10 |
| L1     | -         | -     | 4.30  |
| M      | 0.35      | -     | 0.95  |
| P      | 3.40      | 3.50  | 3.60  |
| P1     | 7.00      | -     | 7.40  |
| P2     | 2.40      | 2.5   | 2.6   |
| Q      | 5.60      | -     | 6.0   |
| S      | 6.05      | 6.15  | 6.25  |
| T      | 9.8       | -     | 10.20 |
| U      | 6.00      | -     | 6.40  |

Version 1: TO247-J package outline dimension

### Ordering Information

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

### Product Information

| Product       | Package | Pb Free | RoHS | Halogen Free |
|---------------|---------|---------|------|--------------|
| OST40N120HM2F | TO247   | yes     | yes  | yes          |

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