



## General Description

OST20N65DMF 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
- Motor drive

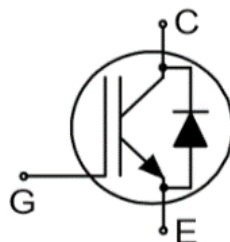
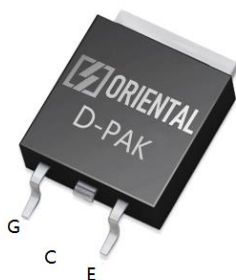
## Key Performance Parameters

| Parameter                                   | Value | Unit               |
|---------------------------------------------|-------|--------------------|
| $V_{CES, min} @ 25\text{ }^{\circ}\text{C}$ | 650   | V                  |
| Maximum junction temperature                | 175   | $^{\circ}\text{C}$ |
| $I_C, \text{ pulse}$                        | 80    | A                  |
| $V_{CE(sat), typ} @ V_{GE}=15\text{ V}$     | 1.73  | V                  |
| $Q_g$                                       | 48    | nC                 |

## Marking Information

| Product Name | Package | Marking    |
|--------------|---------|------------|
| OST20N65DMF  | D-PAK   | OST20N65DM |

## 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> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                             | $I_C$                  | 40         | A                  |
| Continuous collector current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                            |                        | 20         | A                  |
| Pulsed collector current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                 | $I_{C, \text{ pulse}}$ | 80         | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                    | $I_F$                  | 40         | A                  |
| Diode forward current <sup>1)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                                   |                        | 20         | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                     | $I_{F, \text{ pulse}}$ | 80         | A                  |
| Power dissipation <sup>3)</sup> , $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                                        | $P_D$                  | 150        | W                  |
| Power dissipation <sup>3)</sup> , $T_C = 100\text{ }^{\circ}\text{C}$                                                                                                                                                       |                        | 75         | W                  |
| Operation and storage temperature                                                                                                                                                                                           | $T_{stg}, T_{vj}$      | -55 to 175 | $^{\circ}\text{C}$ |
| Short circuit withstand time<br>$V_{GE} = 15\text{ V}$ , $V_{CC} \leq 400\text{ V}$<br>Allowed number of short circuits < 1000<br>Time between short circuits: $\geq 1.0\text{ S}$<br>$T_{vj} = 25\text{ }^{\circ}\text{C}$ | $t_{sc}$               | 7          | $\mu\text{s}$      |

**Thermal Characteristics**

| Parameter                                          | Symbol          | Value | Unit                 |
|----------------------------------------------------|-----------------|-------|----------------------|
| IGBT thermal resistance, junction-case             | $R_{\theta JC}$ | 1.0   | $^{\circ}\text{C/W}$ |
| Diode thermal resistance, junction-case            | $R_{\theta JC}$ | 0.71  | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient <sup>4)</sup> | $R_{\theta JA}$ | 62    | $^{\circ}\text{C/W}$ |

**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 | $V_{CE(sat)}$ |      | 1.73 | 2.0  | V             | $V_{GE}=15\text{ V}$ , $I_C=20\text{ A}$ , $T_{vj}=25\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 2.08 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=20\text{ A}$ , $T_{vj}=125\text{ }^{\circ}\text{C}$ |
|                                      |               |      | 2.27 |      | V             | $V_{GE}=15\text{ V}$ , $I_C=20\text{ A}$ , $T_{vj}=175\text{ }^{\circ}\text{C}$ |
| Gate-emitter threshold voltage       | $V_{GE(th)}$  | 5.5  | 6.0  | 6.5  | V             | $V_{CE}=V_{GE}$ , $I_C=0.5\text{ mA}$                                           |
| Diode forward voltage                | $V_F$         |      | 1.80 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=20\text{ A}$ , $T_{vj}=25\text{ }^{\circ}\text{C}$   |
|                                      |               |      | 1.72 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=20\text{ A}$ , $T_{vj}=125\text{ }^{\circ}\text{C}$  |
|                                      |               |      | 1.66 |      | V             | $V_{GE}=0\text{ V}$ , $I_F=20\text{ A}$ , $T_{vj}=175\text{ }^{\circ}\text{C}$  |
| 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            | $C_{ies}$    |      | 1873 |      | pF   | $V_{GE}=0\text{ V}$ ,<br>$V_{CE}=25\text{ V}$ ,<br>$f=100\text{ kHz}$                                                                |
| Output capacitance           | $C_{oes}$    |      | 46   |      | pF   |                                                                                                                                      |
| Reverse transfer capacitance | $C_{res}$    |      | 13   |      | pF   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 21   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=20\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 37   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 61   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 56   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.69 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.31 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 20   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=10\text{ A}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Rise time                    | $t_r$        |      | 14   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 86   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 65   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.29 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.18 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 21   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=20\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 37   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 71   |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 82   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 1.04 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.42 |      | mJ   |                                                                                                                                      |
| Turn-on delay time           | $t_{d(on)}$  |      | 19   |      | ns   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=400\text{ V}$ ,<br>$R_G=10\ \Omega$ ,<br>$I_C=10\text{ A}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Rise time                    | $t_r$        |      | 15   |      | ns   |                                                                                                                                      |
| Turn-off delay time          | $t_{d(off)}$ |      | 100  |      | ns   |                                                                                                                                      |
| Fall time                    | $t_f$        |      | 89   |      | ns   |                                                                                                                                      |
| Turn-on energy               | $E_{on}$     |      | 0.46 |      | mJ   |                                                                                                                                      |
| Turn-off energy              | $E_{off}$    |      | 0.23 |      | mJ   |                                                                                                                                      |



### Gate Charge Characteristics

| Parameter             | Symbol   | Min. | Typ. | Max. | Unit | Test condition                                                         |
|-----------------------|----------|------|------|------|------|------------------------------------------------------------------------|
| Total gate charge     | $Q_g$    |      | 48   |      | nC   | $V_{GE}=15\text{ V}$ ,<br>$V_{CC}=520\text{ V}$ ,<br>$I_C=20\text{ A}$ |
| Gate-emitter charge   | $Q_{ge}$ |      | 20   |      | nC   |                                                                        |
| Gate-collector charge | $Q_{gc}$ |      | 12   |      | nC   |                                                                        |

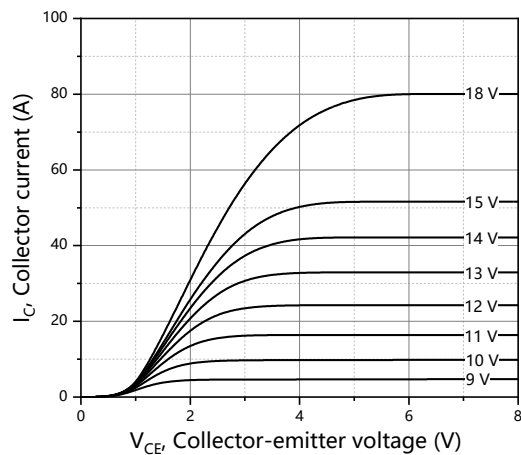
### Body Diode Characteristics

| Parameter                           | Symbol    | Min. | Typ. | Max. | Unit          | Test condition                                                                                                            |
|-------------------------------------|-----------|------|------|------|---------------|---------------------------------------------------------------------------------------------------------------------------|
| Diode reverse recovery time         | $t_{rr}$  |      | 86   |      | ns            | $V_R=400\text{ V}$ ,<br>$I_F=20\text{ A}$ ,<br>$di_F/dt=500\text{ A}/\mu\text{s}$ ,<br>$T_{vj}=25\text{ }^\circ\text{C}$  |
| Diode reverse recovery charge       | $Q_{rr}$  |      | 0.59 |      | $\mu\text{C}$ |                                                                                                                           |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 14   |      | A             |                                                                                                                           |
| Diode reverse recovery time         | $t_{rr}$  |      | 134  |      | ns            | $V_R=400\text{ V}$ ,<br>$I_F=20\text{ A}$ ,<br>$di_F/dt=500\text{ A}/\mu\text{s}$ ,<br>$T_{vj}=175\text{ }^\circ\text{C}$ |
| Diode reverse recovery charge       | $Q_{rr}$  |      | 1.22 |      | $\mu\text{C}$ |                                                                                                                           |
| Diode peak reverse recovery current | $I_{rrm}$ |      | 19   |      | A             |                                                                                                                           |

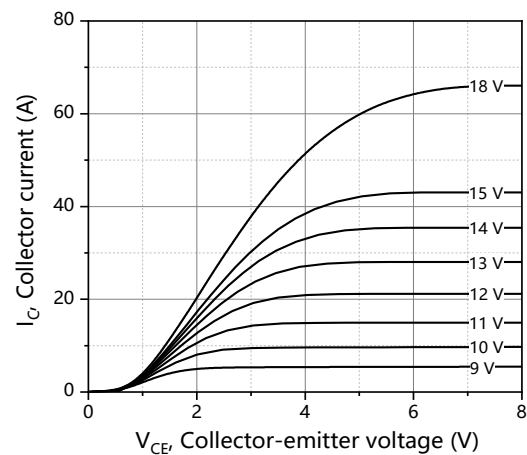
### Note

- 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  $T_a=25\text{ }^\circ\text{C}$ .

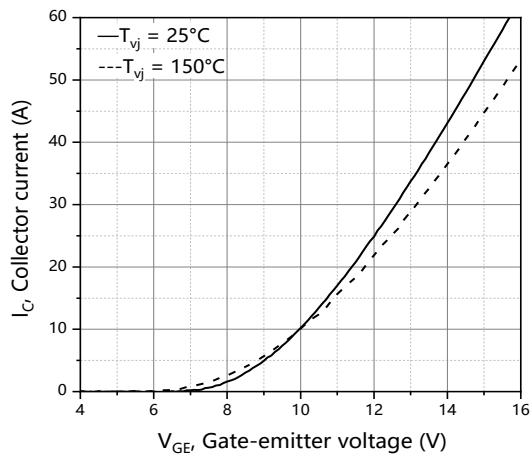
## Electrical Characteristics Diagrams



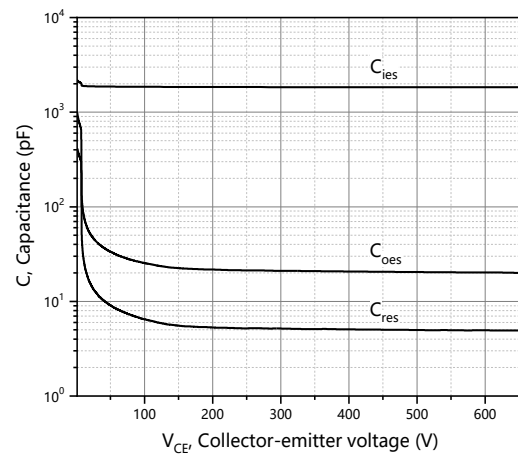
**Figure 1. Typical output characteristics**  
( $T_{vj}=25\text{ }^{\circ}\text{C}$ )



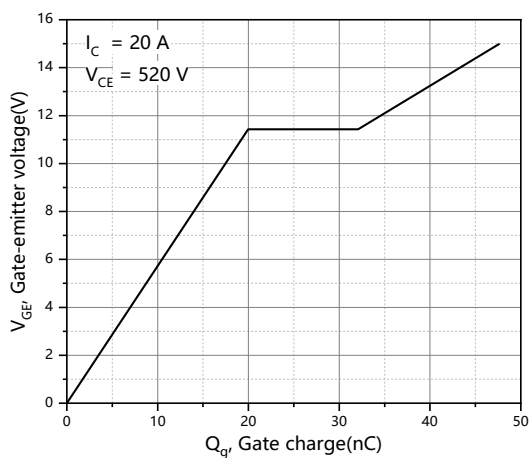
**Figure 2. Typical output characteristics**  
( $T_{vj}=150\text{ }^{\circ}\text{C}$ )



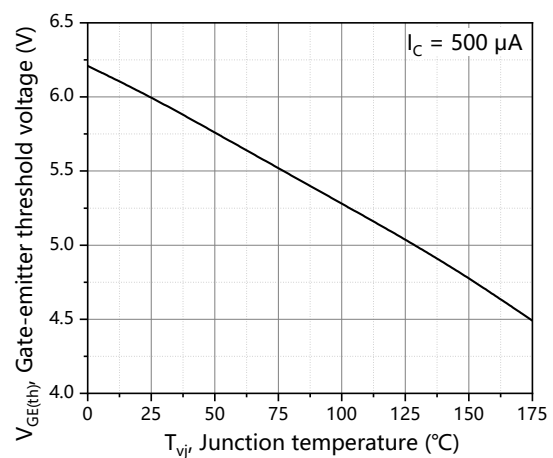
**Figure 3. Typical transfer characteristics**  
( $V_{CE}=20\text{ V}$ )



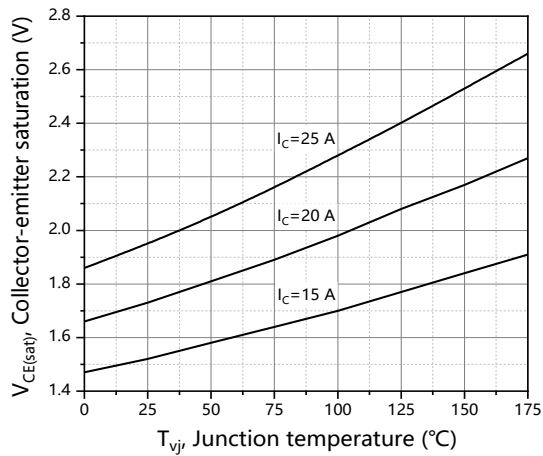
**Figure 4. Typical capacitance**  
( $V_{GE}=0\text{ V}$ ,  $f=100\text{ kHz}$ )



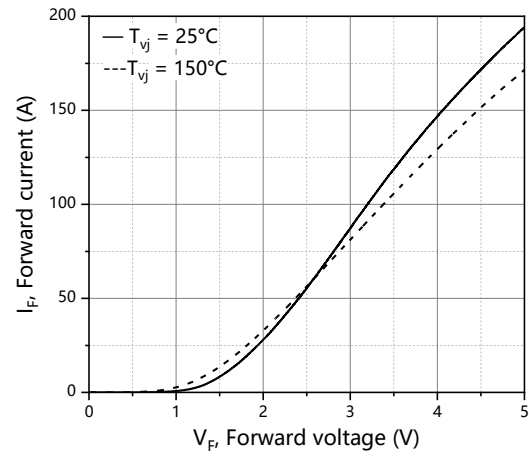
**Figure 5. Typical gate charge**



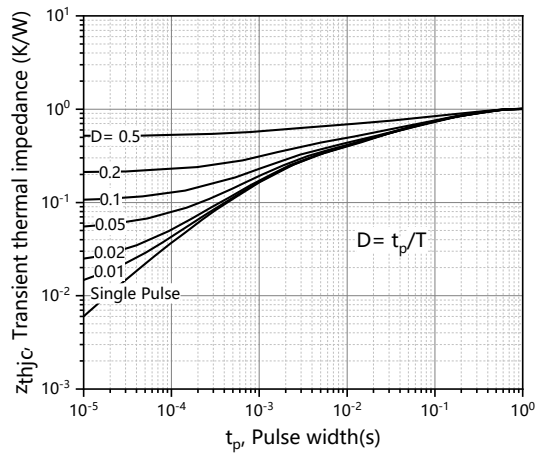
**Figure 6. Gate-emitter threshold voltage**



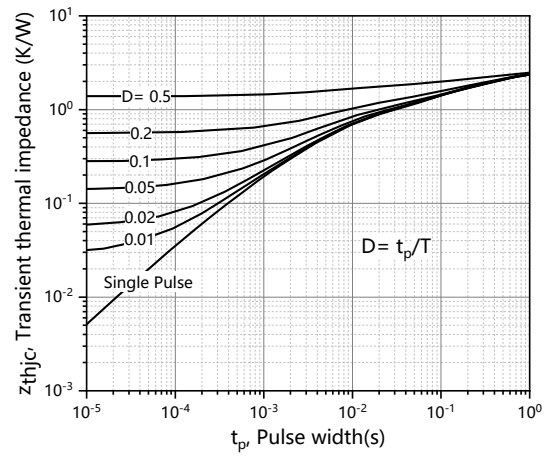
**Figure 7. Typical collector-emitter voltage**



**Figure 8. Forward characteristic of diode**

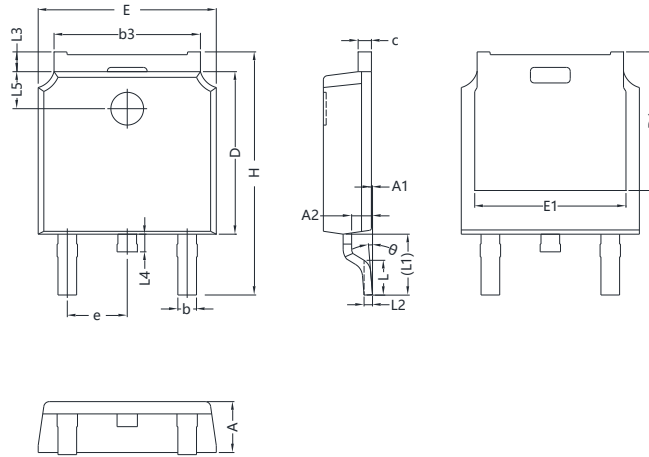


**Figure 9. IGBT transient thermal impedance**



**Figure 10. Diode transient thermal impedance**

## Package Information



| Symbol | mm       |       |       |
|--------|----------|-------|-------|
|        | Min      | Nom   | Max   |
| A      | 2.20     | 2.30  | 2.38  |
| A1     | 0.00     | -     | 0.12  |
| A2     | 0.97     | 1.07  | 1.17  |
| b      | 0.68     | 0.78  | 0.90  |
| b3     | 5.20     | 5.33  | 5.46  |
| c      | 0.43     | 0.53  | 0.61  |
| D      | 5.98     | 6.10  | 6.22  |
| D1     | 5.30REF  |       |       |
| E      | 6.40     | 6.60  | 6.73  |
| E1     | 5.00     | -     | -     |
| e      | 2.286BSC |       |       |
| H      | 9.40     | 10.10 | 10.50 |
| L      | 1.38     | 1.50  | 1.75  |
| L1     | 2.90REF  |       |       |
| L2     | 0.51BSC  |       |       |
| L3     | 0.88     | -     | 1.28  |
| L4     | 0.50     | -     | 1.00  |
| L5     | 1.65     | 1.80  | 1.95  |
| θ      | 0°       | -     | 8°    |

Version : D-PAK-P package outline dimension

### Ordering Information

| Package Type | Units/ Reel | Reels/ Inner Box | Units/ Inner Box | Inner Boxes/ Carton Box | Units/ Carton Box |
|--------------|-------------|------------------|------------------|-------------------------|-------------------|
| D-PAK-P      | 2500        | 2                | 5000             | 5                       | 25000             |

### Product Information

| Product     | Package | Pb Free | RoHS | Halogen Free |
|-------------|---------|---------|------|--------------|
| OST20N65DMF | D-PAK   | yes     | yes  | yes          |

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## Revision History

| Version | Revision History | Data       |
|---------|------------------|------------|
| V1.0    | Initial release  | 2025-08-04 |