

Turbo2 ultrafast - high voltage rectifier for SMPS

Features

- ultrafast switching
- low reverse current
- low thermal resistance
- reduces conduction and switching losses

Description

The STTH20LCD06C uses ST Turbo2 technology. This device is specially suited for switching power supplies working with interleaved PFCs.

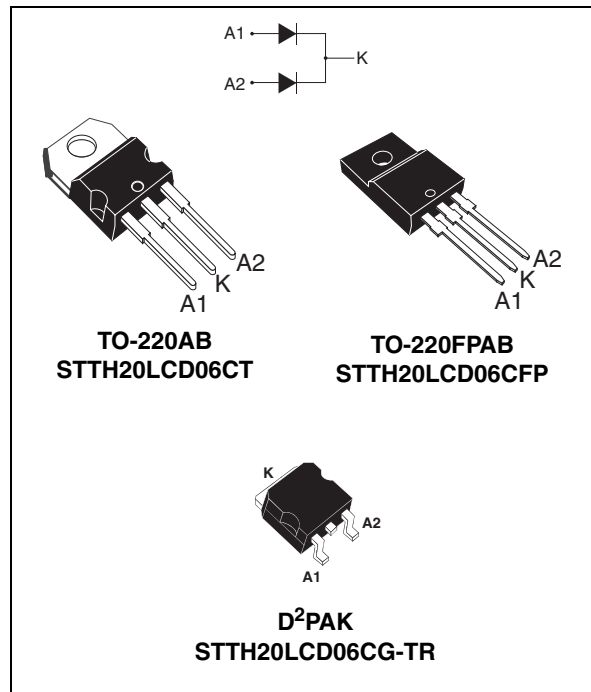


Table 1. Device summary

| | |
|----------------|----------|
| $I_{F(AV)}$ | 2 x 10 A |
| V_{RRM} | 600 V |
| T_j | 175 °C |
| V_F (typ) | 1.25 V |
| t_{rr} (max) | 50 ns |

1 Characteristics

Table 2. Absolute ratings⁽¹⁾

| Symbol | Parameter | | | Value | Unit | |
|---------------------|---|-----------------------------------|------------------------------|--------------|------|---|
| V _{RRM} | Repetitive peak reverse voltage | | | 600 | V | |
| I _{F(RMS)} | Forward current rms | | | 30 | A | |
| I _{F(AV)} | Average forward current, δ = 0.5 | T _c = 105 °C | TO-220AB, D ² PAK | Per diode | 10 | A |
| | | | | Per device | 20 | A |
| | | T _c = 60 °C | TO-220FPAB | Per diode | 10 | A |
| | | | | Per device | 20 | A |
| I _{FSM} | Surge non repetitive forward current | t _p = 10 ms sinusoidal | | 80 | A | |
| T _{stg} | Storage temperature range | | | -65 to + 175 | °C | |
| T _j | Maximum operating junction temperature ⁽²⁾ | | | 175 | °C | |

- Limiting values per diode at 25 °C, unless otherwise specified
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$ condition to avoid thermal runaway for a diode on its own heatsink

Table 3. Thermal resistance

| Symbol | Parameter | | Value | Unit |
|----------------------|------------------|------------------------------|-------|------|
| R _{th(j-c)} | Junction to case | TO-220AB, D ² PAK | 3.5 | °C/W |
| | | TO-220FPAB | 5.8 | |

Table 4. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------|-------------------------|-----------------------------------|------|------|------|------|
| I _R ⁽¹⁾ | Reverse leakage current | T _j = 25 °C | V _R = V _{RRM} | - | - | 1 | μA |
| | | T _j = 150 °C | | - | 10 | 100 | |
| V _F ⁽²⁾ | Forward voltage drop | T _j = 25 °C | I _F = 10 A | - | - | 2 | V |
| | | T _j = 150 °C | | - | 1.25 | 1.6 | |
| | | T _j = 25 °C | I _F = 20 A | - | - | 2.35 | |
| | | T _j = 150 °C | | - | 1.55 | 2 | |

- Pulse test: t_p = 5 ms, δ < 2 %
- Pulse test: t_p = 380 μs, δ < 2 %

To evaluate the conduction losses use the following equation:

$$P = 1.2 \times I_{F(AV)} + 0.04 \times I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------|--------------------------|--|------|------|------|------|
| t_{rr} | Reverse recovery time | $I_F = 0.5 \text{ A}$, $I_{rr} = 0.25 \text{ A}$, $I_R = 1 \text{ A}$, $T_j = 25 \text{ }^\circ\text{C}$ | | | 25 | ns |
| | | $I_F = 1 \text{ A}$, $di_F/dt = -50 \text{ A}/\mu\text{s}$, $V_R = 30 \text{ V}$, $T_j = 25 \text{ }^\circ\text{C}$ | | 35 | 50 | |
| I_{RM} | Reverse recovery current | $I_F = 10 \text{ A}$, $di_F/dt = -50 \text{ A}/\mu\text{s}$, $V_R = 400 \text{ V}$, $T_j = 125 \text{ }^\circ\text{C}$ | | 2 | 2.8 | A |
| t_{fr} | Forward recovery time | $I_F = 10 \text{ A}$, $di_F/dt = 100 \text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$, $T_j = 25 \text{ }^\circ\text{C}$ | | | 230 | ns |
| V_{FP} | Forward recovery voltage | $I_F = 10 \text{ A}$, $di_F/dt = 100 \text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$, $T_j = 25 \text{ }^\circ\text{C}$ | | 4 | | V |

Figure 1. Average forward power dissipation versus average forward current (per diode)

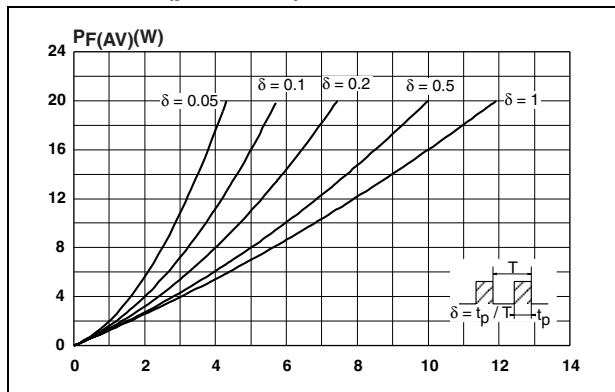


Figure 2. Forward voltage drop versus forward current (per diode)

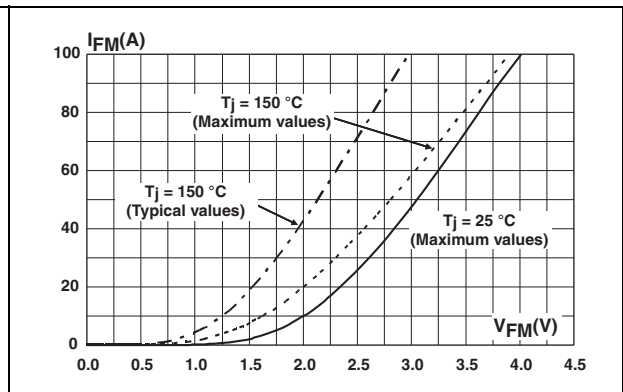


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AB, D²PAK)

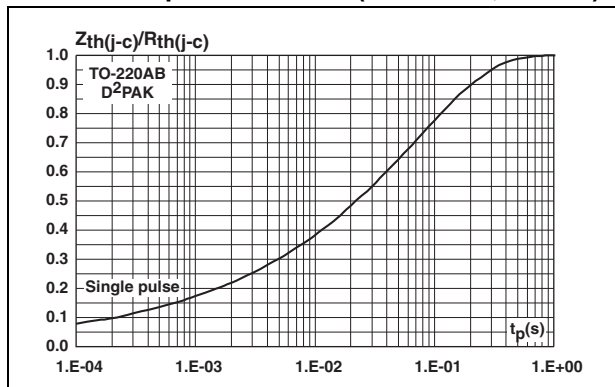


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAB)

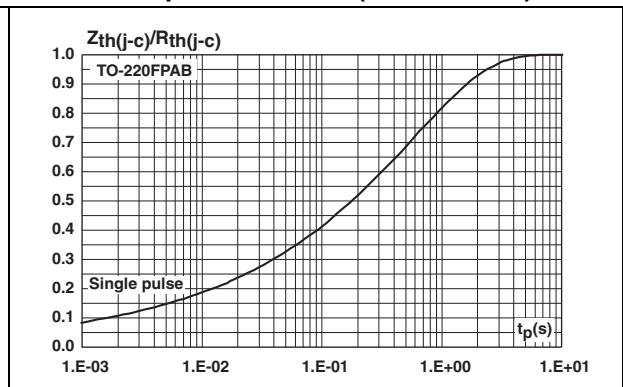


Figure 5. Peak reverse recovery current versus di_F/dt (typical values, per diode)

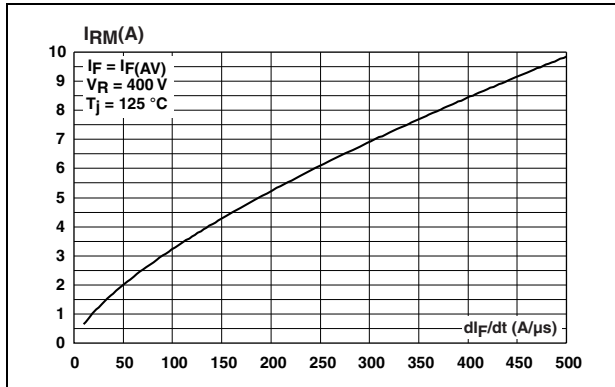


Figure 6. Reverse recovery time versus di_F/dt (typical values, per diode)

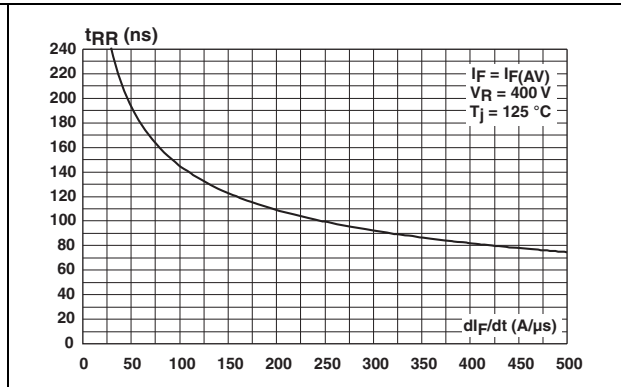


Figure 7. Reverse recovery charges versus di_F/dt (typical values, per diode)

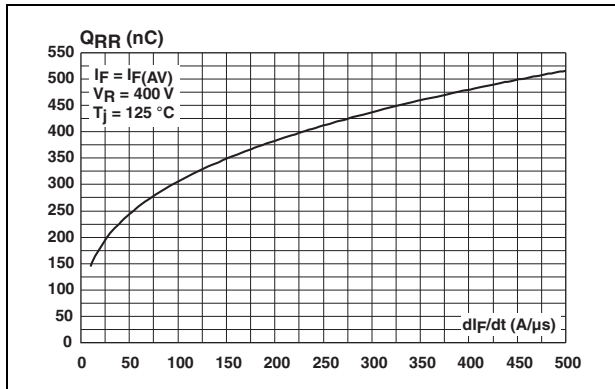


Figure 8. Reverse recovery softness factor versus di_F/dt (typical values, per diode)

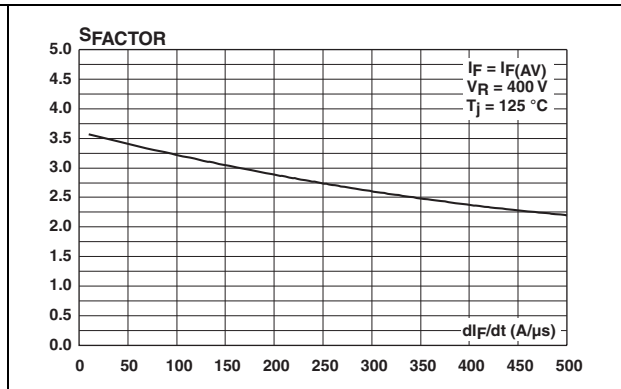


Figure 9. Relative variations of dynamic parameters versus junction temperature

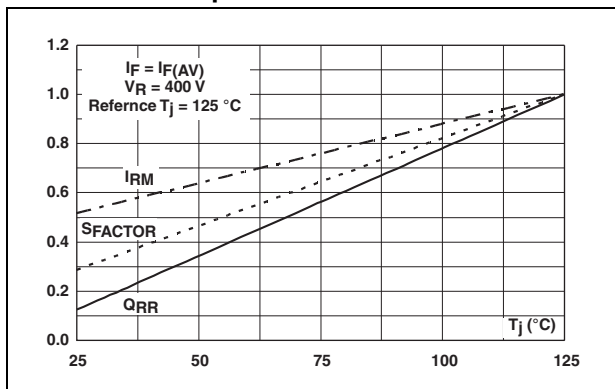


Figure 10. Transient peak forward voltage versus di_F/dt (typical values, per diode)

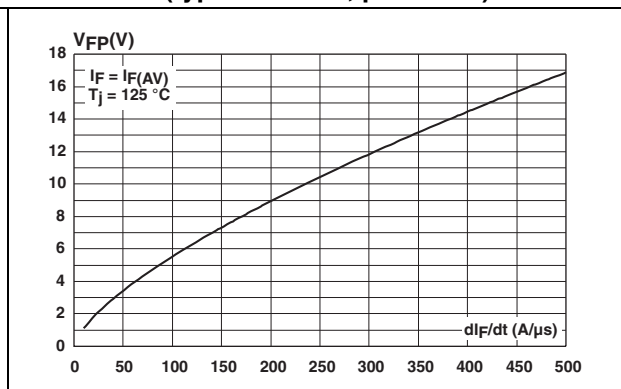


Figure 11. Forward recovery time versus di_F/dt (typical values, per diode) Figure 12. Junction capacitance versus reverse voltage applied (typical values, per diode)

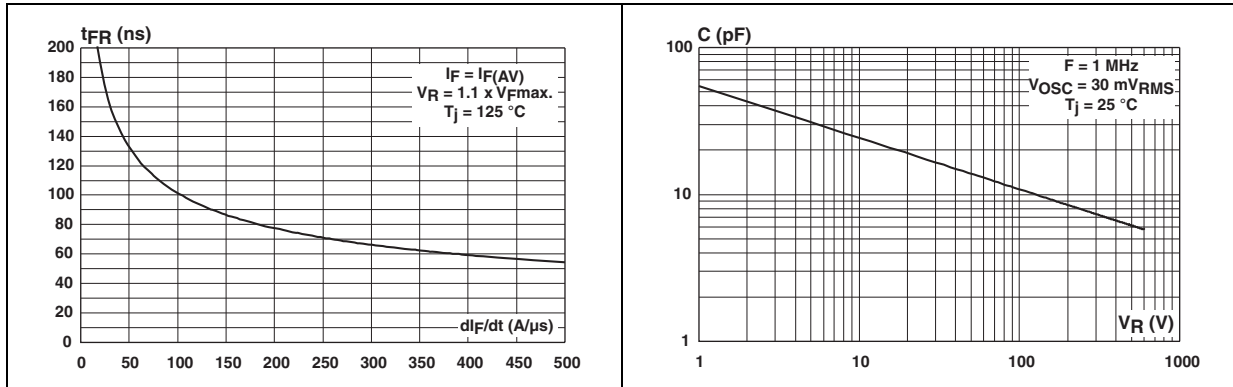
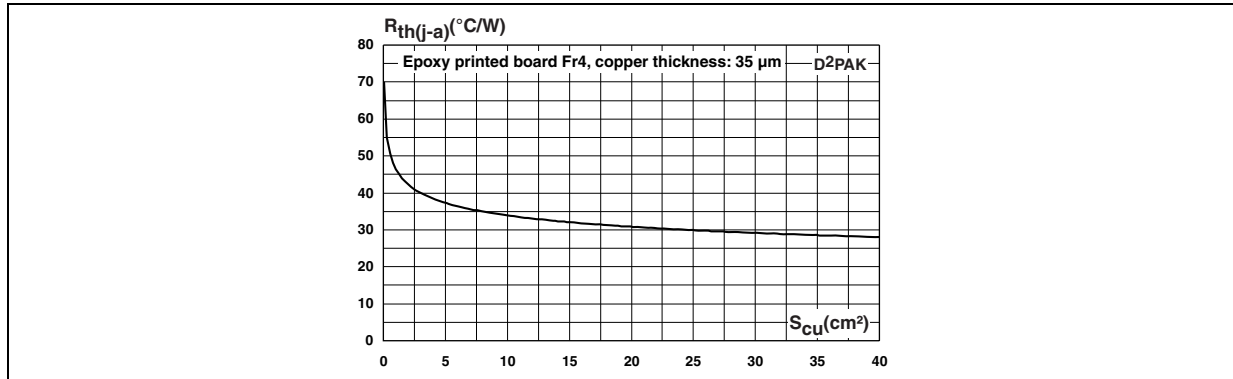


Figure 13. Thermal resistance junction to ambient versus copper surface under tab



2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 6. TO-220AB dimensions

| Ref. | Dimensions | | | |
|-------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| C | 1.23 | 1.32 | 0.048 | 0.051 |
| D | 2.40 | 2.72 | 0.094 | 0.107 |
| E | 0.49 | 0.70 | 0.019 | 0.027 |
| F | 0.61 | 0.88 | 0.024 | 0.034 |
| F1 | 1.14 | 1.70 | 0.044 | 0.066 |
| F2 | 1.14 | 1.70 | 0.044 | 0.066 |
| G | 4.95 | 5.15 | 0.194 | 0.202 |
| G1 | 2.40 | 2.70 | 0.094 | 0.106 |
| H2 | 10 | 10.40 | 0.393 | 0.409 |
| L2 | 16.4 typ. | | 0.645 typ. | |
| L4 | 13 | 14 | 0.511 | 0.551 |
| L5 | 2.65 | 2.95 | 0.104 | 0.116 |
| L6 | 15.25 | 15.75 | 0.600 | 0.620 |
| L7 | 6.20 | 6.60 | 0.244 | 0.259 |
| L9 | 3.50 | 3.93 | 0.137 | 0.154 |
| M | 2.6 typ. | | 0.102 typ. | |
| Diam. | 3.75 | 3.85 | 0.147 | 0.151 |

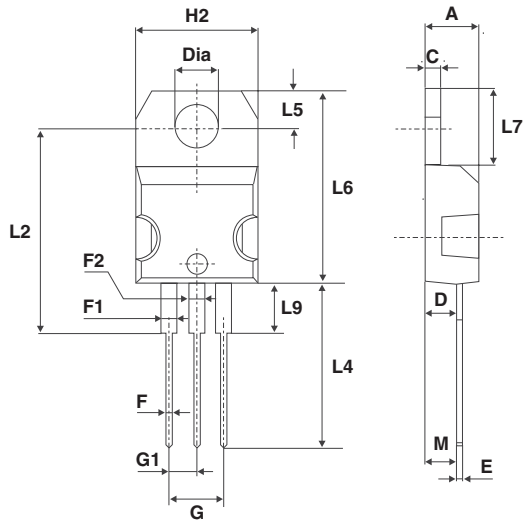
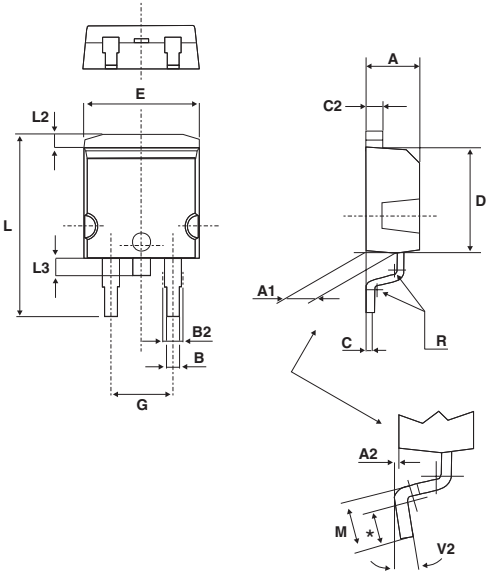


Table 7. TO-220FPAB dimensions

| Ref. | Dimensions | | | |
|------|-------------|------|-----------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.4 | 4.6 | 0.173 | 0.181 |
| B | 2.5 | 2.7 | 0.098 | 0.106 |
| D | 2.5 | 2.75 | 0.098 | 0.108 |
| E | 0.45 | 0.70 | 0.018 | 0.027 |
| F | 0.75 | 1 | 0.030 | 0.039 |
| F1 | 1.15 | 1.70 | 0.045 | 0.067 |
| F2 | 1.15 | 1.70 | 0.045 | 0.067 |
| G | 4.95 | 5.20 | 0.195 | 0.205 |
| G1 | 2.4 | 2.7 | 0.094 | 0.106 |
| H | 10 | 10.4 | 0.393 | 0.409 |
| L2 | 16 Typ. | | 0.63 Typ. | |
| L3 | 28.6 | 30.6 | 1.126 | 1.205 |
| L4 | 9.8 | 10.6 | 0.386 | 0.417 |
| L5 | 2.9 | 3.6 | 0.114 | 0.142 |
| L6 | 15.9 | 16.4 | 0.626 | 0.646 |
| L7 | 9.00 | 9.30 | 0.354 | 0.366 |
| Dia. | 3.00 | 3.20 | 0.118 | 0.126 |

Table 8. D²PAK dimensions



* FLAT ZONE NO LESS THAN 2mm

| Ref. | Dimensions | | | |
|------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| A1 | 2.49 | 2.69 | 0.098 | 0.106 |
| A2 | 0.03 | 0.23 | 0.001 | 0.009 |
| B | 0.70 | 0.93 | 0.027 | 0.037 |
| B2 | 1.14 | 1.70 | 0.045 | 0.067 |
| C | 0.45 | 0.60 | 0.017 | 0.024 |
| C2 | 1.23 | 1.36 | 0.048 | 0.054 |
| D | 8.95 | 9.35 | 0.352 | 0.368 |
| E | 10.00 | 10.40 | 0.393 | 0.409 |
| G | 4.88 | 5.28 | 0.192 | 0.208 |
| L | 15.00 | 15.85 | 0.590 | 0.624 |
| L2 | 1.27 | 1.40 | 0.050 | 0.055 |
| L3 | 1.40 | 1.75 | 0.055 | 0.069 |
| M | 2.40 | 3.20 | 0.094 | 0.126 |
| R | 0.40 typ. | | 0.016 typ. | |
| V2 | 0° | 8° | 0° | 8° |

3 Ordering information

Table 9. Ordering information

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|------------------|---------------|--------------------|--------|-----------|---------------|
| STTH20LCD06CT | STTH20LCD06CT | TO-220AB | 2.23 g | 50 | Tube |
| STTH20LCD06CG-TR | STTH20LCD06CG | D ² PAK | 1.48 g | 1000 | Tape and reel |
| STTH20LCD06CFP | STTH20LCD06C | TO-220FPAB | 2.04 g | 50 | Tube |

4 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 24-Jul-2009 | 1 | First issue. |
| 17-Jan-2011 | 2 | Updated dimensions and graphic in Table 7 . |

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