# IPL60R199CPAUMA1-VB Datasheet

## N-Channel 650V (D-S) Super Junction Power MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) at $T_J$ max. | 650 | |
| $R_{DS(on)}$ at 25 °C (Ω) | $V_{GS}$ = 10 V | 0.160 |

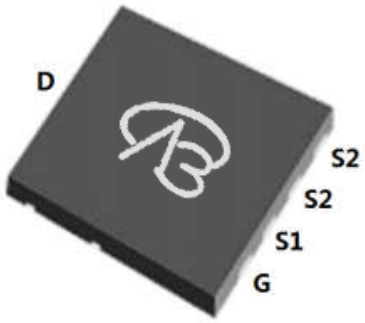
### FEATURES

- Low figure-of-merit (FOM) $R_{on}$ x $Q_g$
- Low input capacitance ($C_{iss}$)
- Reduced switching and conduction losses
- Ultra low gate charge ($Q_g$)
- Avalanche energy rated (UIS)

RoHS

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting

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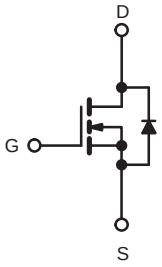



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | | | **SYMBOL** | **LIMIT** | **UNIT** |
| Drain-Source Voltage | | | $V_{DS}$ | 650 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ± 30 | |
| Continuous Drain Current ($T_J$ = 150 °C) | $V_{GS}$ at 10 V | $T_C$ = 25 °C | $I_D$ | 20 | A |
| | | $T_C$ = 100 °C | | 12 | |
| Pulsed Drain Current [a] | | | $I_{DM}$ | 60 | |
| Linear Derating Factor | | | | 1.67 | W/°C |
| Single Pulse Avalanche Energy [b] | | | $E_{AS}$ | 580 | mJ |
| Maximum Power Dissipation | | | $P_D$ | 90 | W |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | -55 to +150 | °C |
| Drain-Source Voltage Slope | $T_J$ = 125 °C | | dV/dt | 50 | V/ns |
| Reverse Diode dV/dt [d] | | | | 15 | |
| Soldering Recommendations (Peak Temperature) [c] | for 10 s | | | 260 | °C |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. $V_{DD}$ = 100 V, starting $T_J$ = 25 °C, L = 30mH, $R_g$ = 25 Ω, $I_{AS}$ =13A.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting $T_J$ = 25 °C.

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TYP.** | **MAX.** | **UNIT** |
| Maximum Junction-to-Ambient | $R_{thJA}$ | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | - | 0 . 3 8 | |

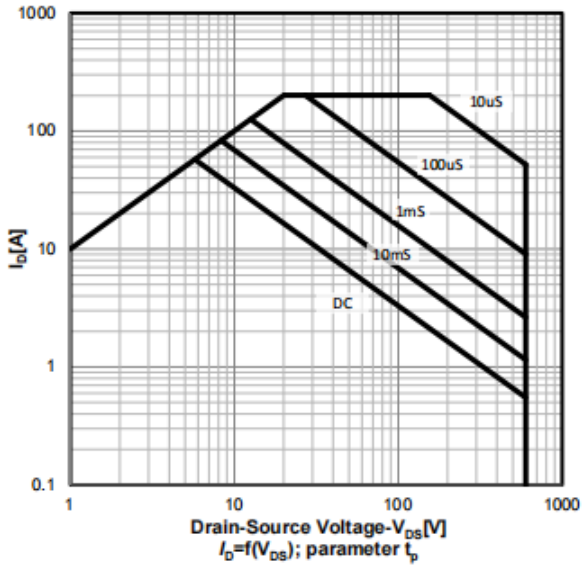
| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 650 | - | - | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.70 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2.5 | - | 4.5 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ± 20 V | - | - | ± 100 | nA |
| | | $V_{GS}$ = ± 30 V | - | - | ± 1 | µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 650V, $V_{GS}$ = 0 V | - | - | 1 | µA |
| | | $V_{DS}$ = 520 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 100 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ =1.5A | - | 0.160 | - | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 30 V, $I_D$ = 1.5A | - | 5.6 | - | S |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 100 V, f = 1 MHz | - | 2600 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 330 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 4 | - | |
| Effective Output Capacitance, Energy Related [a] | $C_{o(er)}$ | $V_{DS}$ = 0 V to 520 V, $V_{GS}$ = 0 V | - | 63 | - | |
| Effective Output Capacitance, Time Related [b] | $C_{o(tr)}$ | | - | 213 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = 10 V; $I_D$ = 20 A, $V_{DS}$ = 520 V | - | 60 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 39 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | - | 47 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 520 V, $I_D$ = 20A, $V_{GS}$ = 10 V, $R_g$ = 9.1 Ω | - | 18 | 25 | ns |
| Rise Time | $t_r$ | | - | 24 | 55 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 80 | - | |
| Fall Time | $t_f$ | | - | 12 | - | |
| Gate Input Resistance | $R_g$ | f = 1 MHz, open drain | - | 0.8 | - | Ω |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 20 | A |
| Pulsed Diode Forward Current | $I_{SM}$ | | - | - | 60 | |
| Diode Forward Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 8 A, $V_{GS}$ = 0 V | - | - | 1.5 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = $I_S$ = 8 A, dI/dt = 100 A/µs, $V_R$ = 400 V | - | 520 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 5.8 | - | µC |
| Reverse Recovery Current | $I_{RRM}$ | | - | 45 | - | A |

**Notes**

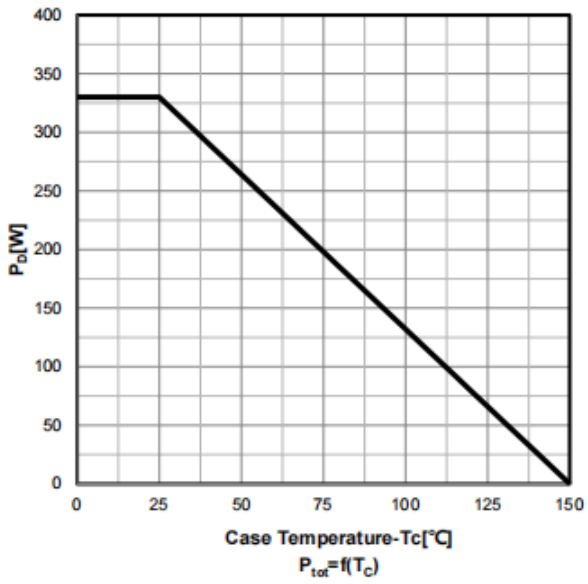
a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as $C_{oss}$ while $V_{DS}$ is rising from 0 % to 80 % $V_{DSS}$.

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 % to 80 % $V_{DSS}$.

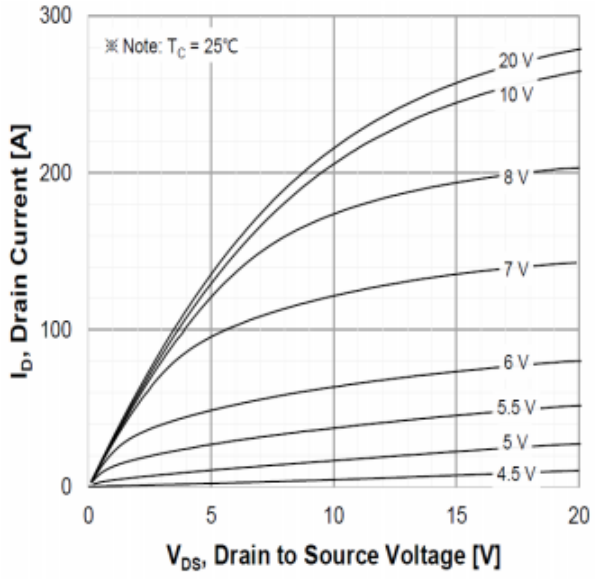
Safe operating area TC=25 ℃
TO-247



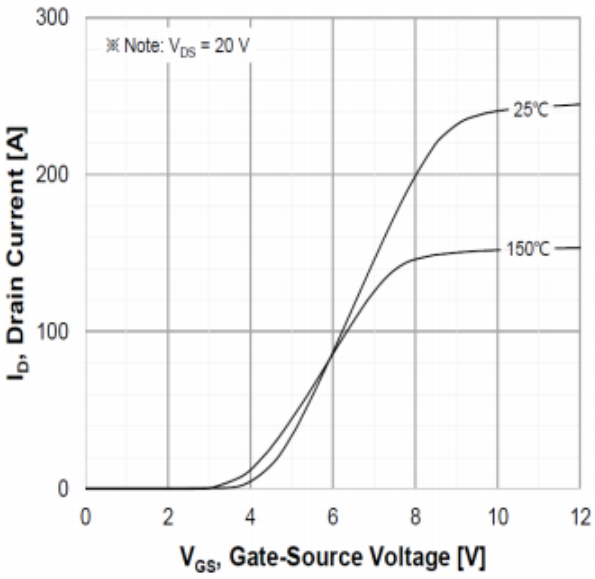

Power dissipation



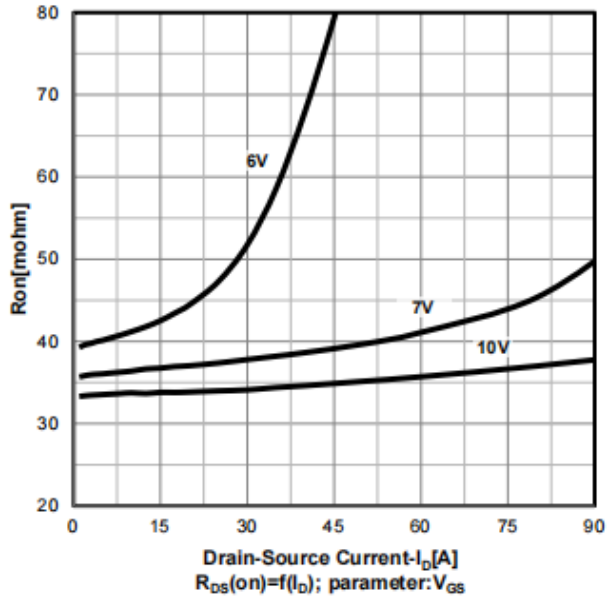

Typ. output characteristics $T_j$=25 ℃



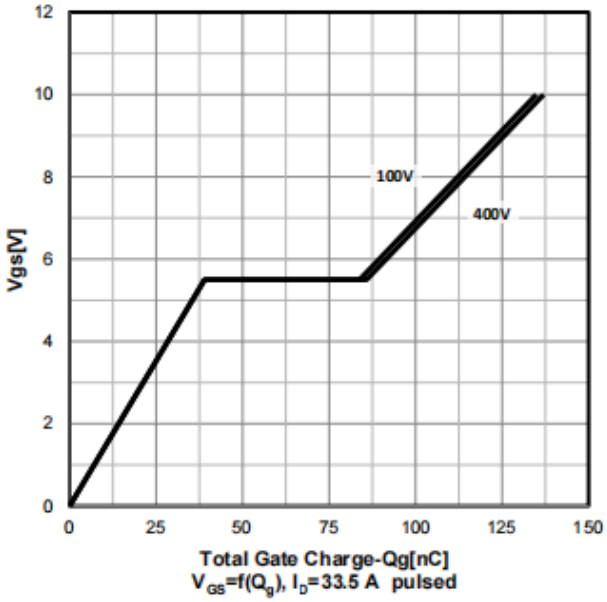

Transfer characteristics



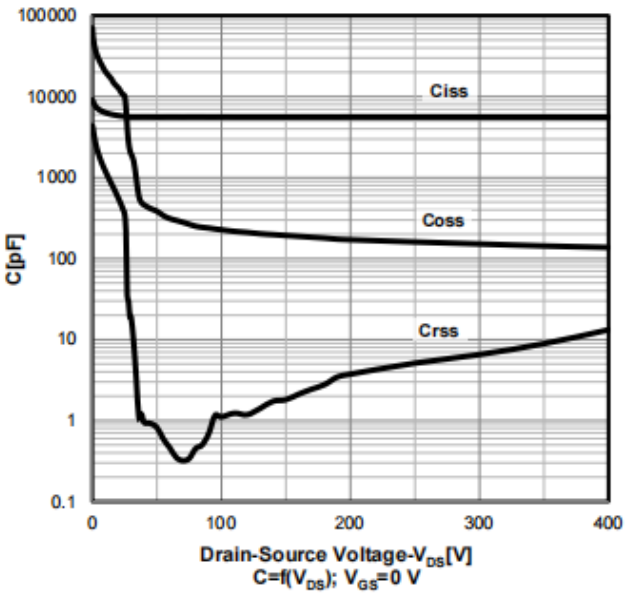
Typ. drain-source on-state resistance



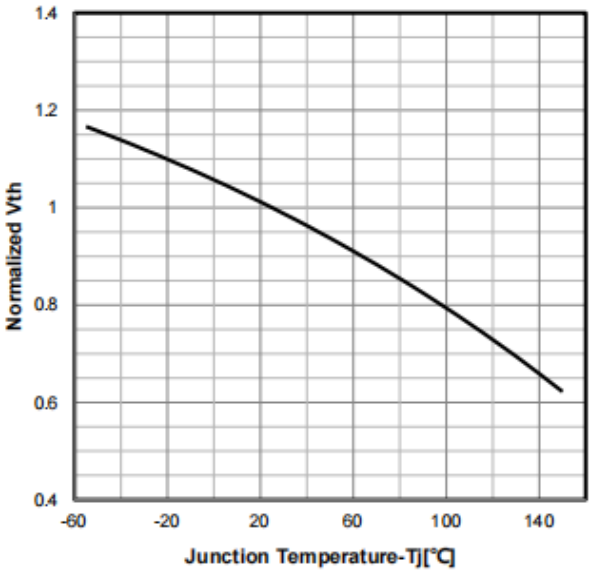

Typ. gate charge characteristics



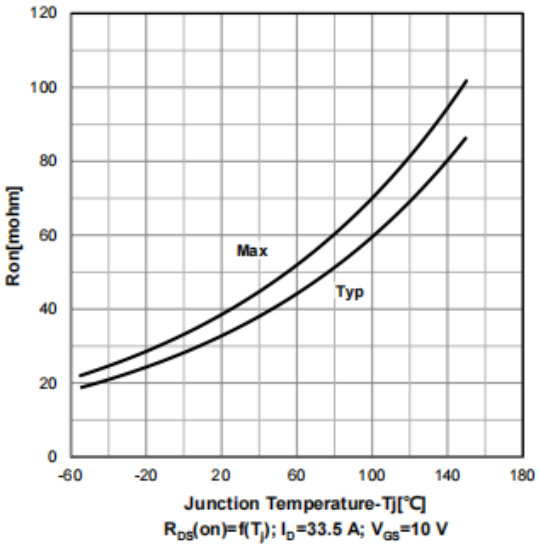

Typ. capacitances




Normalized $V_{GS(th)}$ characteristics

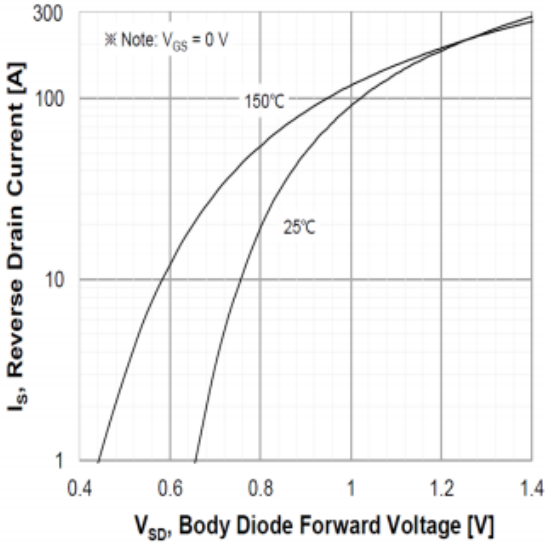


On-resistance vs temperature

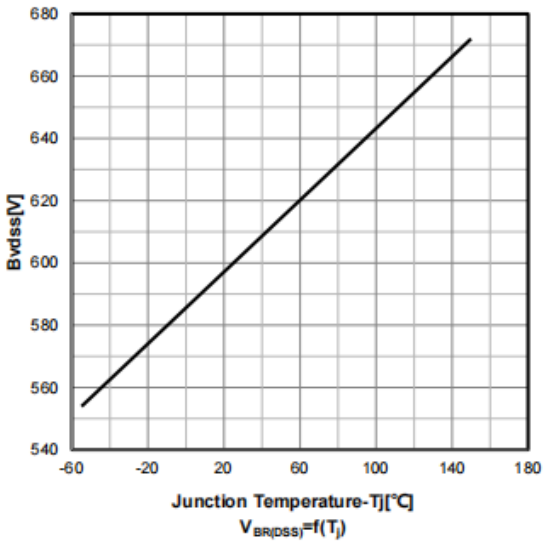



$R_{DS}(on)=f(T_j)$; $I_D$=33.5 A; $V_{GS}$=10 V

Forward characteristics of reverse diode

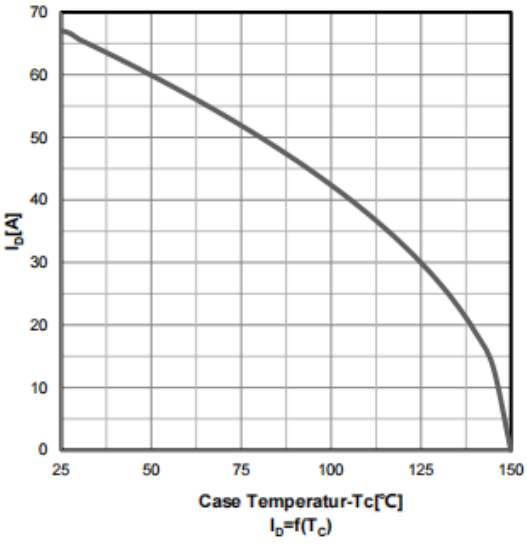



Drain-source breakdown voltage



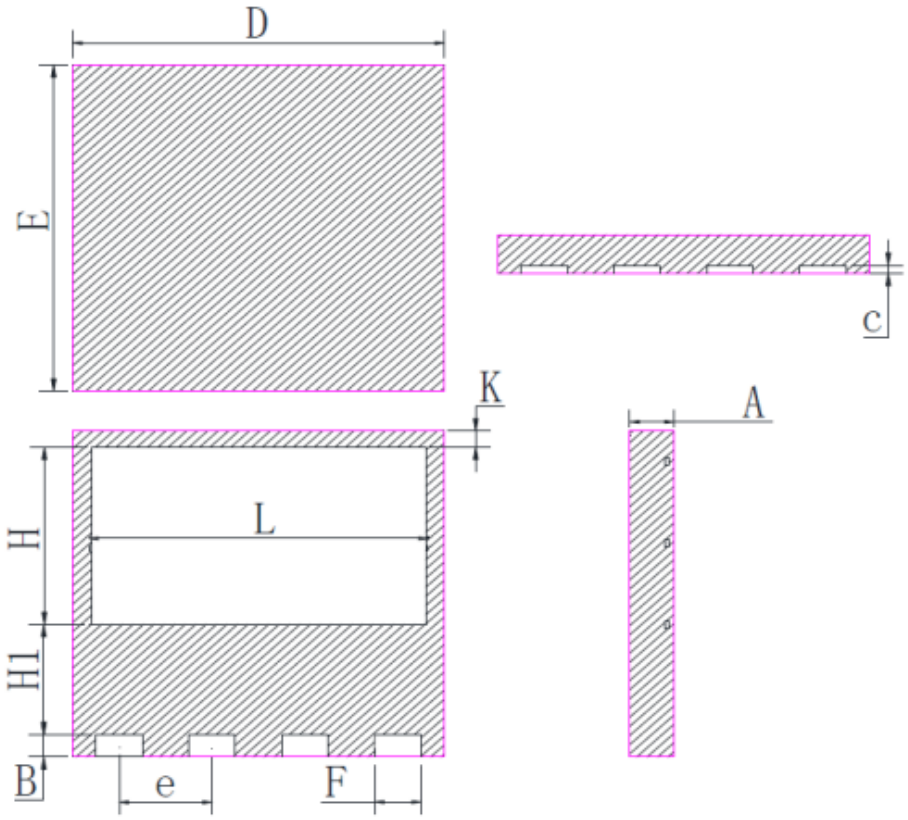

$V_{BR(DSS)}=f(T_j)$

Drain current vs temperature




$I_D=f(T_C)$

**Package Outline ：D F N 8 X 8**




| Symbol | Min | Typ | Max |
|---|---|---|---|
| A | 0.90 | 0.95 | 1.00 |
| B | 0.45 | 0.55 | 0.65 |
| C | 0.153 | 0.203 | 0.253 |
| D | 7.90 | 8.00 | 8.10 |
| E | 7.90 | 8.00 | 8.10 |
| e | 1.90 | 2.00 | 2.10 |
| F | 0.90 | 1.00 | 1.10 |
| H | 4.20 | 4.35 | 4.45 |
| H1 | 2.60 | 2.70 | 2.80 |
| K | 0.30 | 0.40 | 0.50 |
| L | 7.10 | 7.20 | 7.30 |

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