

TOSHIBA Field Effect Transistor Silicon P-Channel MOS Type (U-MOS III)

# TPCA8104

High-Side Switching Applications  
 Portable Equipment Applications

- Small footprint due to small and thin package
- Low drain-source ON-resistance:  $R_{DS(ON)} = 11 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 50 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = -10 \mu\text{A}$  (max) ( $V_{DS} = -60 \text{ V}$ )
- Enhancement mode:  $V_{th} = -0.8$  to  $-2.0 \text{ V}$  ( $V_{DS} = -10 \text{ V}$ ,  $I_D = -1 \text{ mA}$ )

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

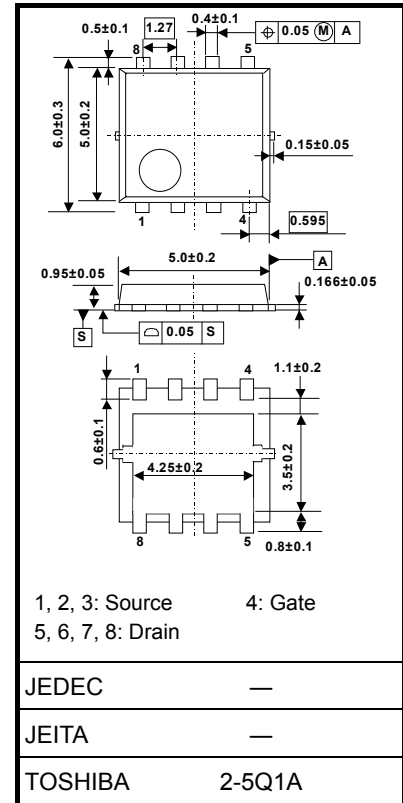
| Characteristic  |                | Symbol    | Rating     | Unit             |
|---|----------------|-----------|------------|------------------|
| Drain-source voltage  |                | $V_{DSS}$ | -60        | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )              |                | $V_{DGR}$ | -60        | V                |
| Gate-source voltage   |                | $V_{GSS}$ | $\pm 20$   | V                |
| Drain current   | DC (Note 1)    | $I_D$     | -40        | A                |
|   | Pulse (Note 1) | $I_{DP}$  | -120       |                  |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ )              |                | $P_D$     | 45         | W                |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)          |                | $P_D$     | 2.8        |                  |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)          |                | $P_D$     | 1.6        |                  |
| Single-pulse avalanche energy (Note 3)                            |                | $E_{AS}$  | 116        | mJ               |
| Avalanche current   |                | $I_{AR}$  | -40        | A                |
| Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4) |                | $E_{AR}$  | 4.5        | mJ               |
| Channel temperature   |                | $T_{ch}$  | 150        | $^\circ\text{C}$ |
| Storage temperature range   |                | $T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |

Note: For Notes 1 to 4, see the next page.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

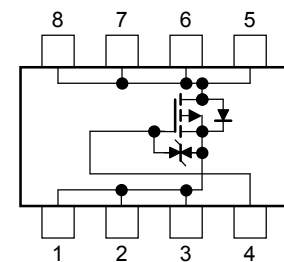
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.080 g (typ.)

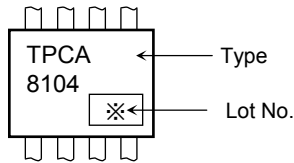
## Circuit Configuration



## Thermal Characteristics

| Characteristic  | Symbol         | Max  | Unit               |
|---|----------------|------|--------------------|
| Thermal resistance, channel to case ( $T_c = 25^\circ\text{C}$ )          | $R_{th(ch-c)}$ | 2.78 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\text{ s}$ ) (Note 2a) | $R_{th(ch-a)}$ | 44.6 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\text{ s}$ ) (Note 2b) | $R_{th(ch-a)}$ | 78.1 |                    |

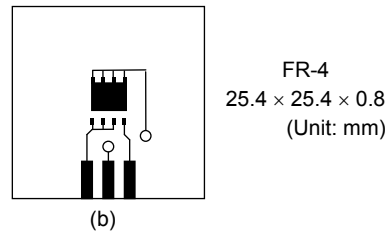
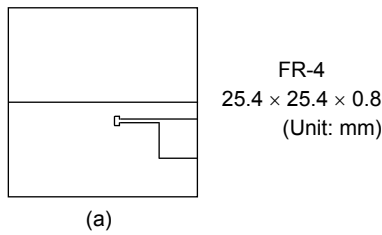
## Marking (Note 5)



Note 1: The channel temperature should not exceed  $150^\circ\text{C}$  during use.

Note 2: (a) Device mounted on a glass-epoxy board (a)

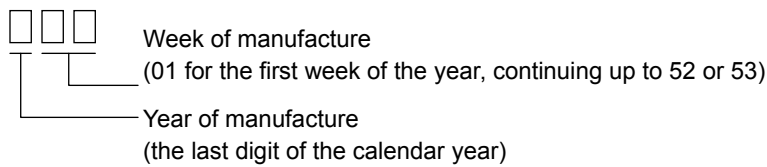
(b) Device mounted on a glass-epoxy board (b)



Note 3:  $V_{DD} = -24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 0.1\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = -40\text{ A}$

Note 4: Repetitive rating: pulse width limited by maximum channel temperature.

Note 5: \* Weekly code (three digits):

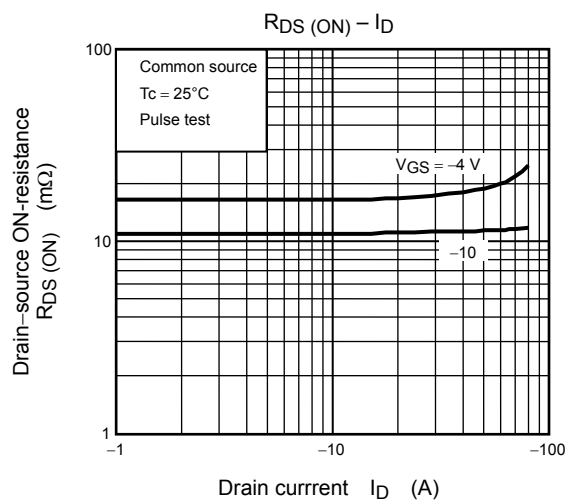
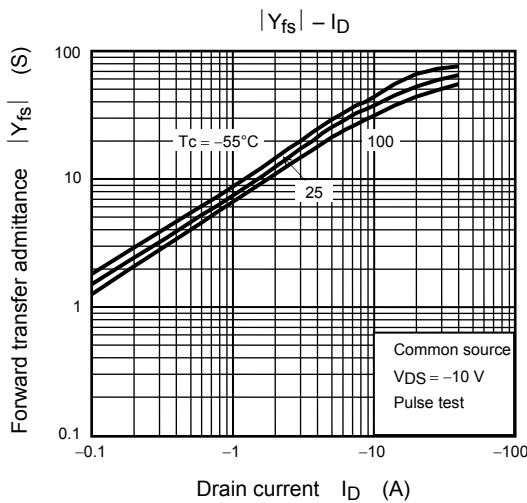
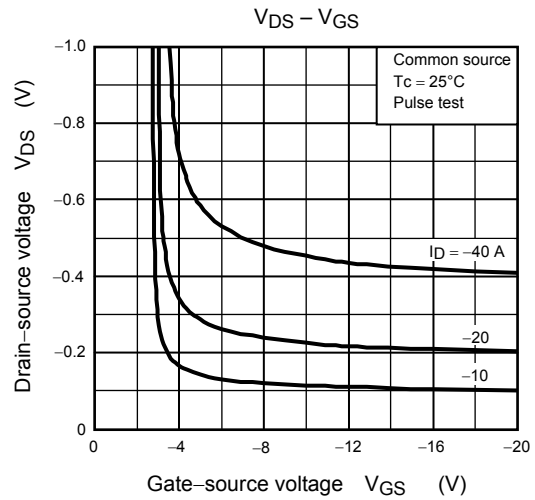
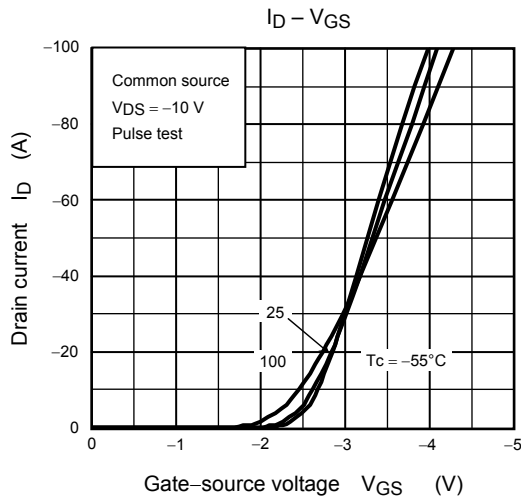
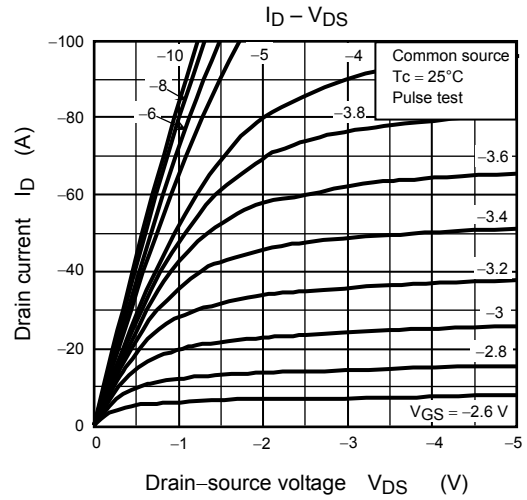
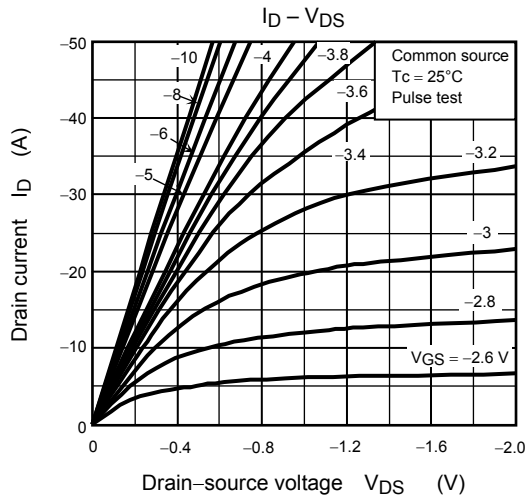


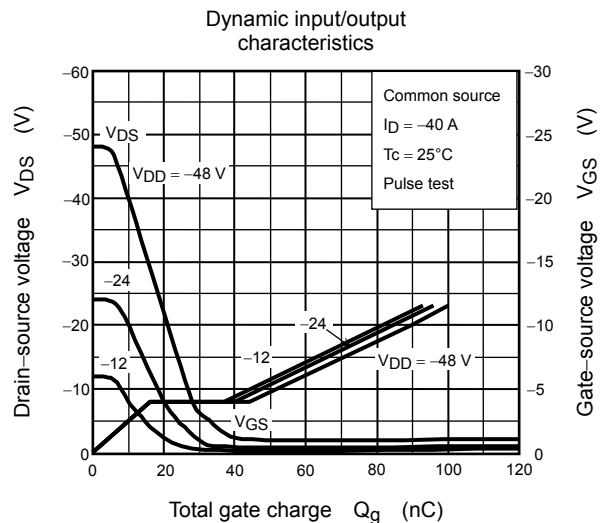
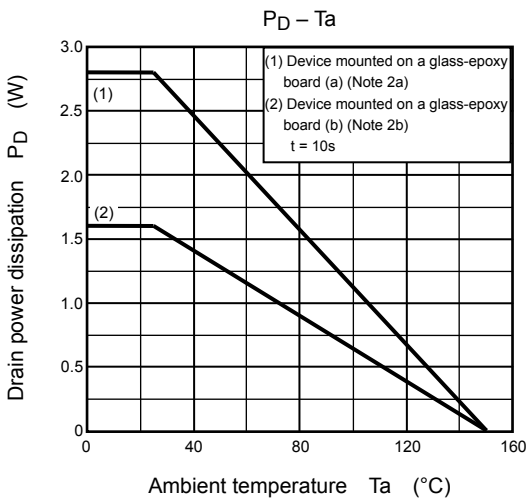
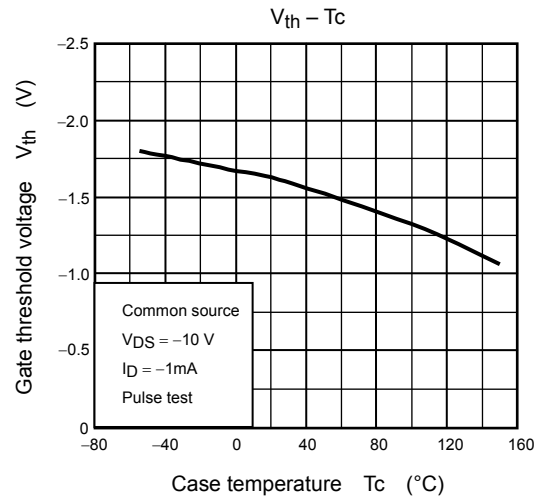
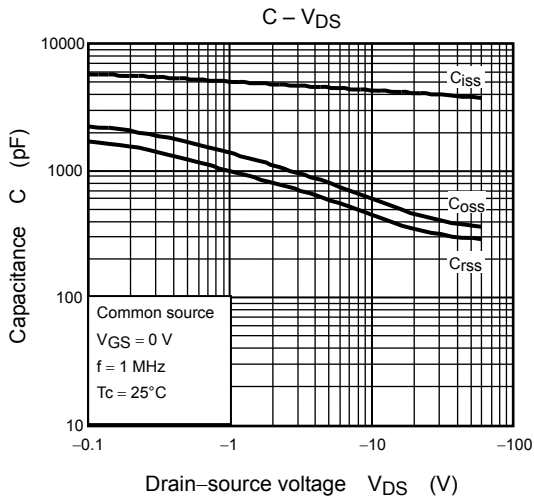
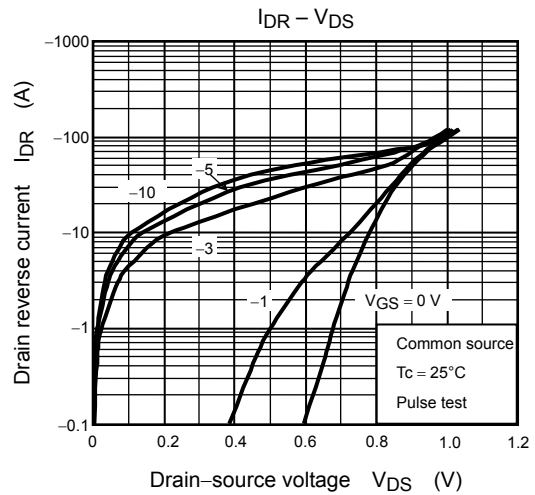
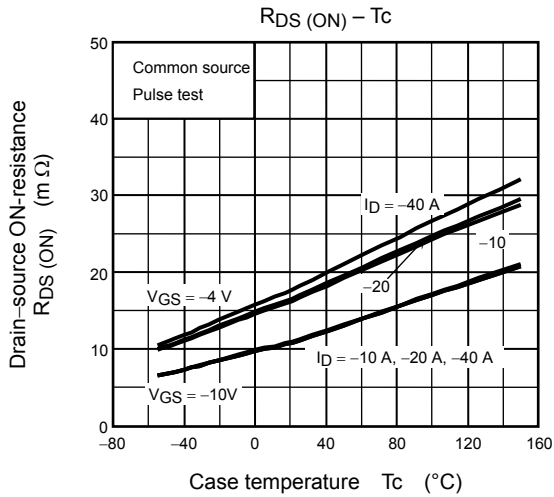
## Electrical Characteristics (Ta = 25°C)

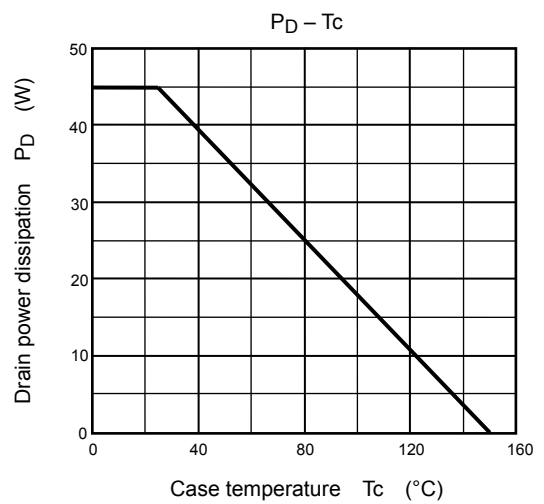
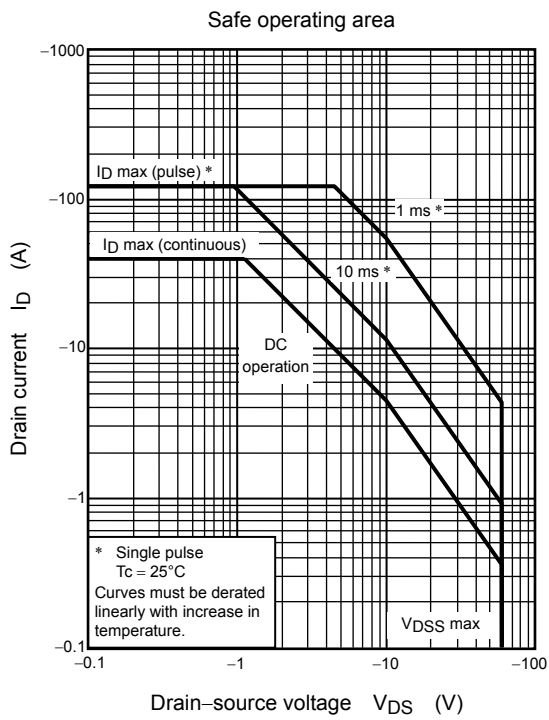
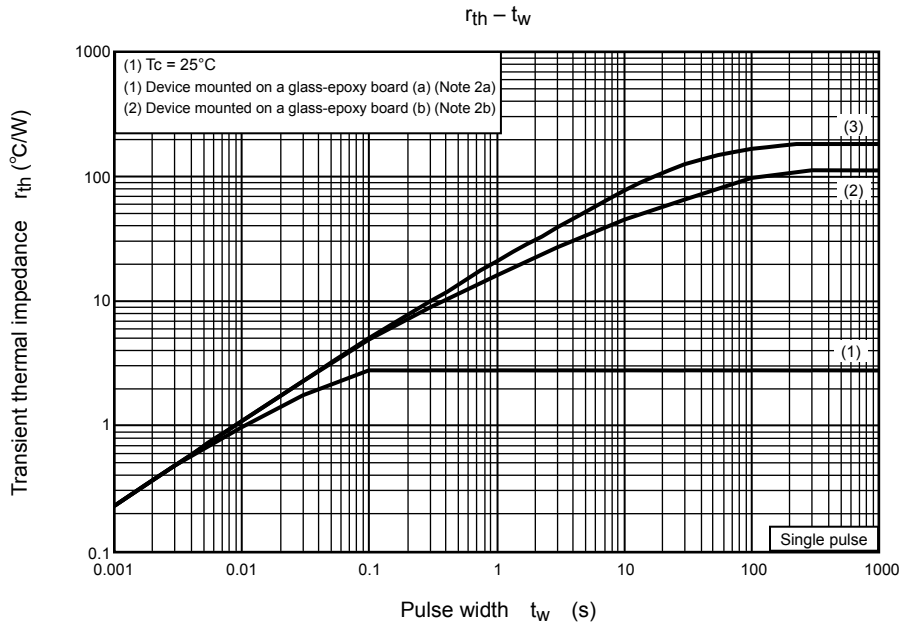
| Characteristic                                  |               | Symbol        | Test Condition   | Min                                       | Typ. | Max      | Unit          |   |
|---|---------------|---------------|--|---|------|----------|---------------|---|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$                | —   | —    | $\pm 10$ | $\mu\text{A}$ |   |
| Drain cutoff current                            |               | $I_{DSS}$     | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$                   | —   | —    | -10      | $\mu\text{A}$ |   |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$                     | -60                                       | —    | —        | V             |   |
|   |               | $V_{(BR)DSX}$ | $I_D = -10\text{ mA}, V_{GS} = 20\text{ V}$                    | -35                                       | —    | —        |               |   |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$                    | -0.8                                      | —    | -2.0     | V             |   |
| Drain-source ON-resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = -4\text{ V}, I_D = -20\text{ A}$                     | —   | 17   | 24       | m $\Omega$    |   |
|   |               |               | $V_{GS} = -10\text{ V}, I_D = -20\text{ A}$                    | —   | 11   | 16       |               |   |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = -10\text{ V}, I_D = -20\text{ A}$                    | 25  | 50   | —        | S             |   |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | —   | 4300 | —        | pF            |   |
| Reverse transfer capacitance                    |               | $C_{rss}$     |  | —   | 450  | —        |               |   |
| Output capacitance                              |               | $C_{oss}$     |  | —   | 600  | —        |               |   |
| Switching time                                  | Rise time     | $t_r$         |  | —   | 10   | —        | ns            |   |
|   | Turn-on time  | $t_{on}$      |  | —   | 20   | —        |               |   |
|   | Fall time     | $t_f$         |  | —   | 60   | —        |               |   |
|   | Turn-off time | $t_{off}$     |  | Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$ | —    | 200      |               | — |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}$           | —   | 90   | —        | nC            |   |
| Gate-source charge 1                            |               | $Q_{gs1}$     |  | $I_D = -40\text{ A}$                      | —    | 16       |               | — |
| Gate-drain ("Miller") charge                    |               | $Q_{gd}$      |  | —   | 28   | —        |               |   |

## Source-Drain Ratings and Characteristics (Ta = 25°C)

| Characteristic          |                | Symbol    | Test Condition                               | Min | Typ. | Max  | Unit |
|-------------------------|----------------|-----------|--|-----|------|------|------|
| Drain reverse current   | Pulse (Note 1) | $I_{DRP}$ | —  | —   | —    | -120 | A    |
| Forward voltage (diode) |                | $V_{DSF}$ | $I_{DR} = -40\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | 1.2  | V    |







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