

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (U-MOSIV)

## TPCA8042

Lithium-Ion Battery Applications

Notebook PC Applications

Portable Equipment Applications

- Small footprint due to a small and thin package
- Low drain-source ON-resistance:  $R_{DS(ON)} = 2.6 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 94 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

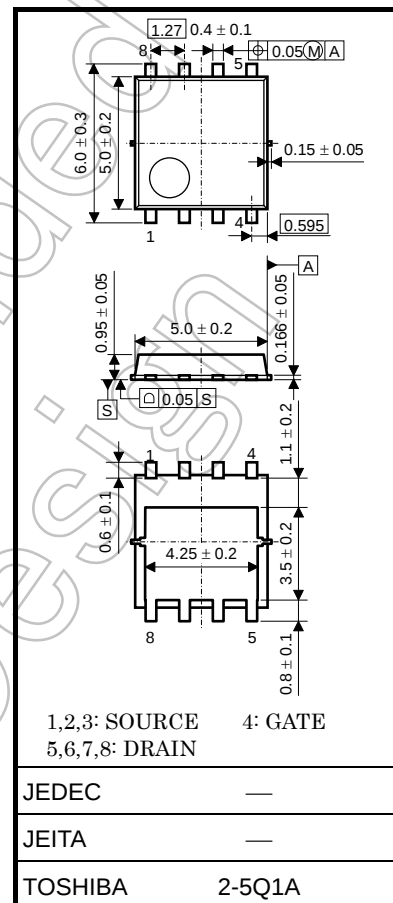
| Characteristic                                                    | Symbol          | Rating     | Unit             |
|-------------------------------------------------------------------|-----------------|------------|------------------|
| Drain-source voltage                                              | $V_{DSS}$       | 30         | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )              | $V_{DGR}$       | 30         | V                |
| Gate-source voltage                                               | $V_{GSS}$       | $\pm 20$   | V                |
| Drain current                                                     | DC (Note 1)     | $I_D$      | A                |
|                                                                   | Pulsed (Note 1) | $I_{DP}$   |                  |
| 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        | W                |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)          | $P_D$           | 1.6        | W                |
| Single-pulse avalanche energy (Note 3)                            | $E_{AS}$        | 263        | mJ               |
| Avalanche current                                                 | $I_{AR}$        | 45         | 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, refer to 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.).

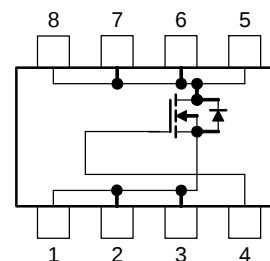
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

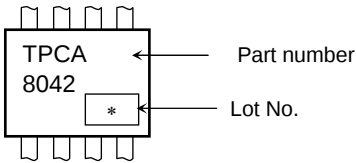
### Circuit Configuration



Thermal Characteristics

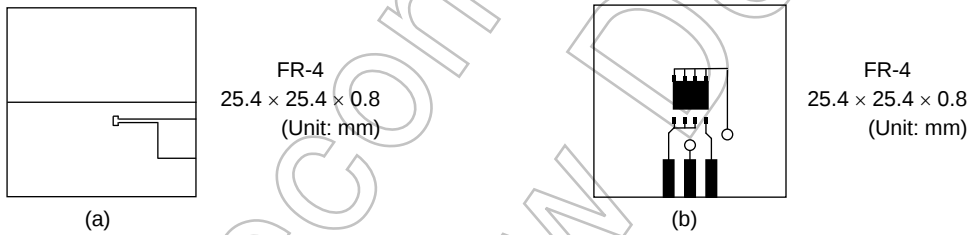
| Characteristic                                                            | Symbol         | Max  | Unit                 |
|---------------------------------------------------------------------------|----------------|------|----------------------|
| Thermal resistance, channel to case<br>( $T_c=25^{\circ}\text{C}$ )       | $R_{th(ch-c)}$ | 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 | $^{\circ}\text{C/W}$ |

Marking (Note 5)



Note 1: Ensure that the channel temperature does not exceed  $150^{\circ}\text{C}$ .

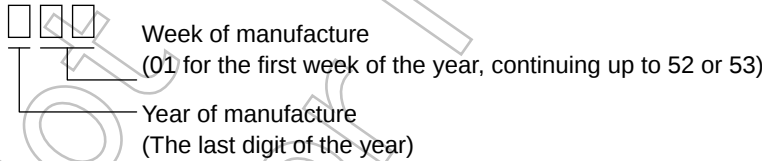
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



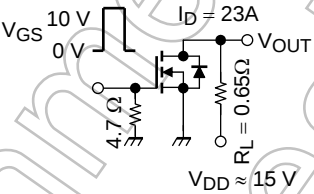
Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 0.1\text{ mH}$ ,  $I_{AR} = 45\text{ A}$

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

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

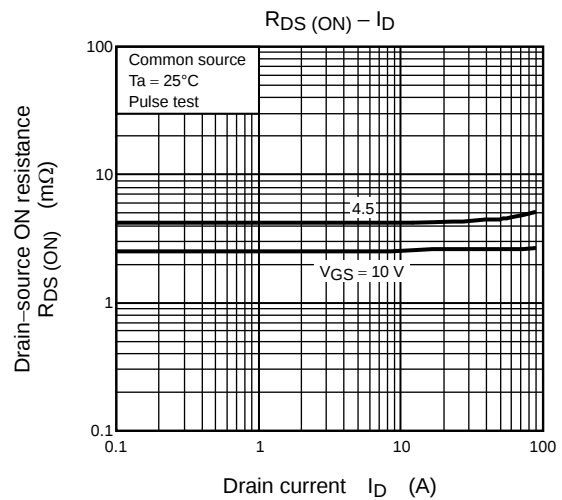
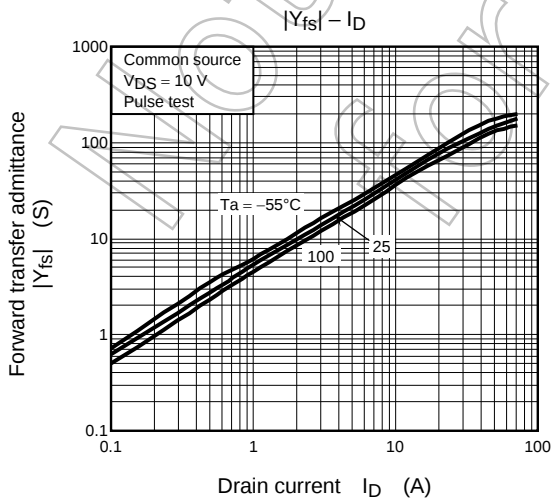
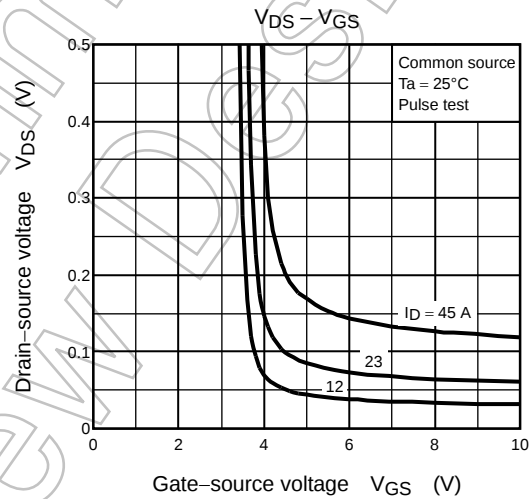
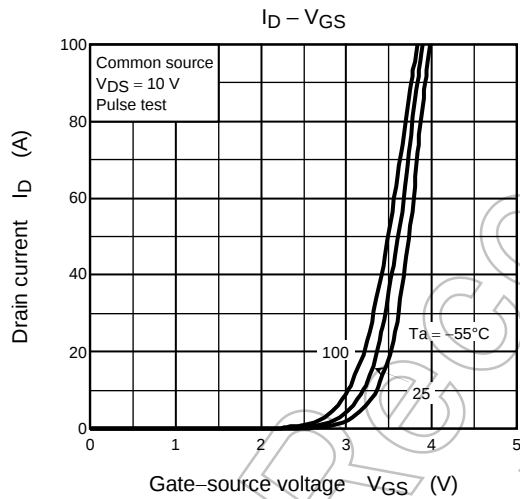
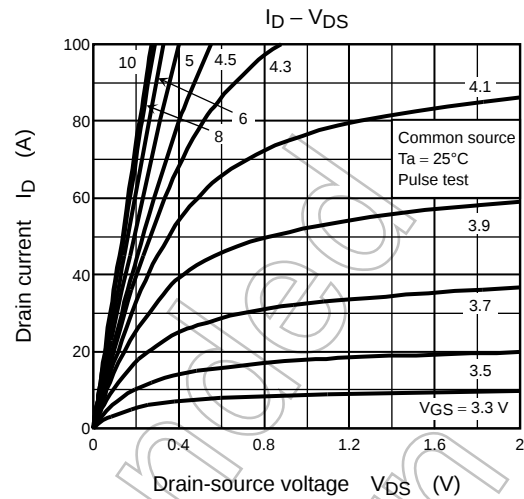
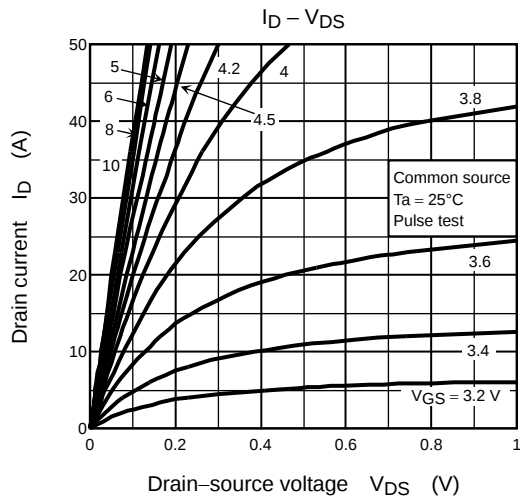


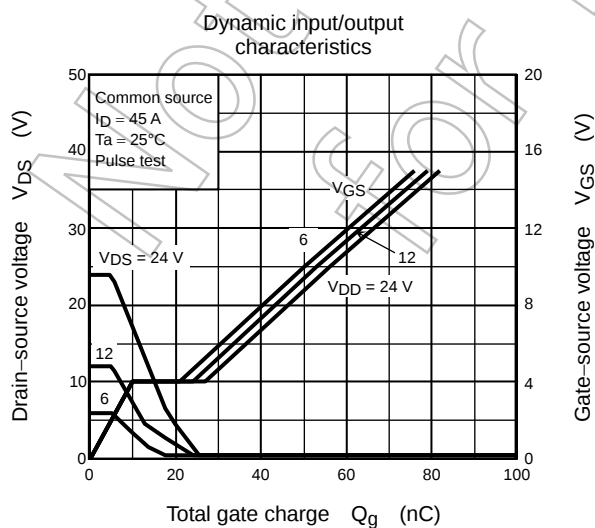
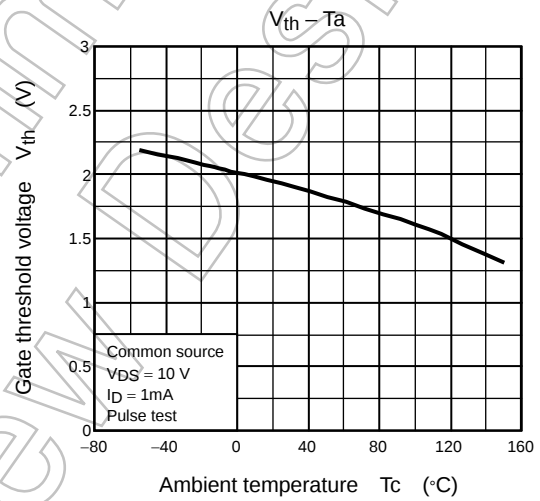
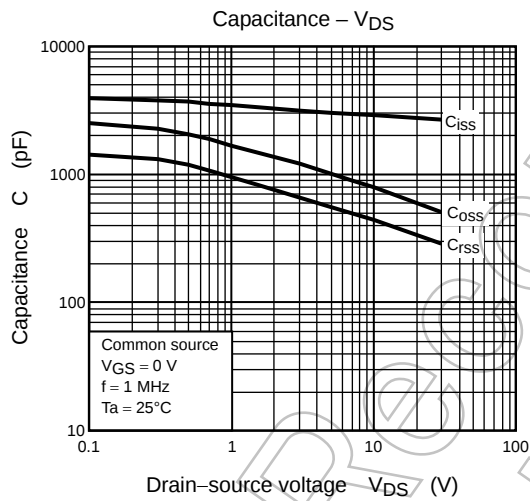
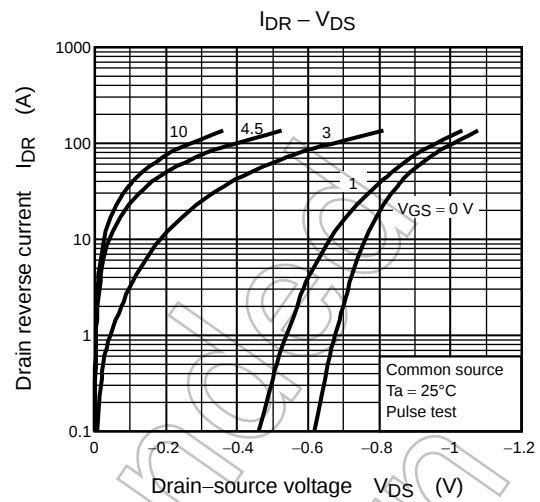
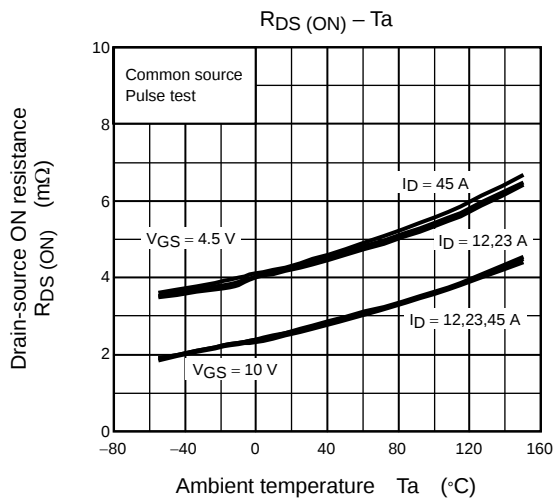
## Electrical Characteristics (Ta = 25°C)

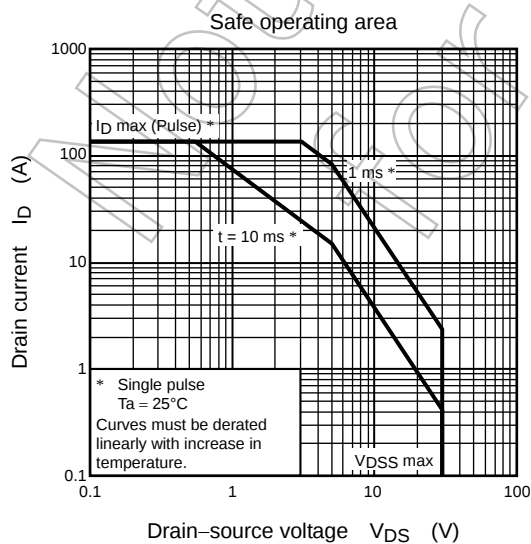
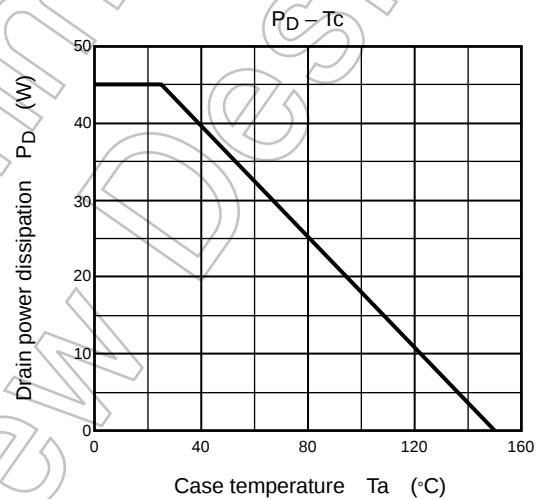
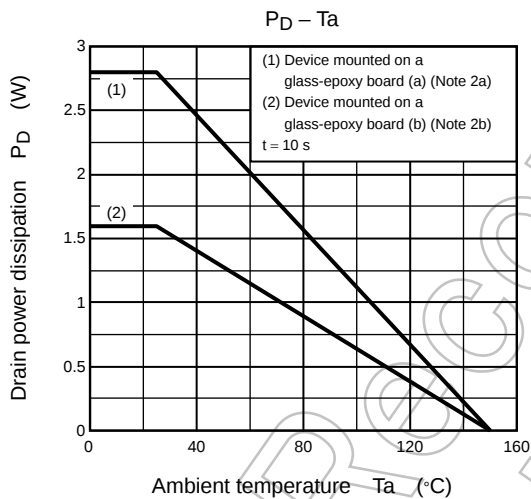
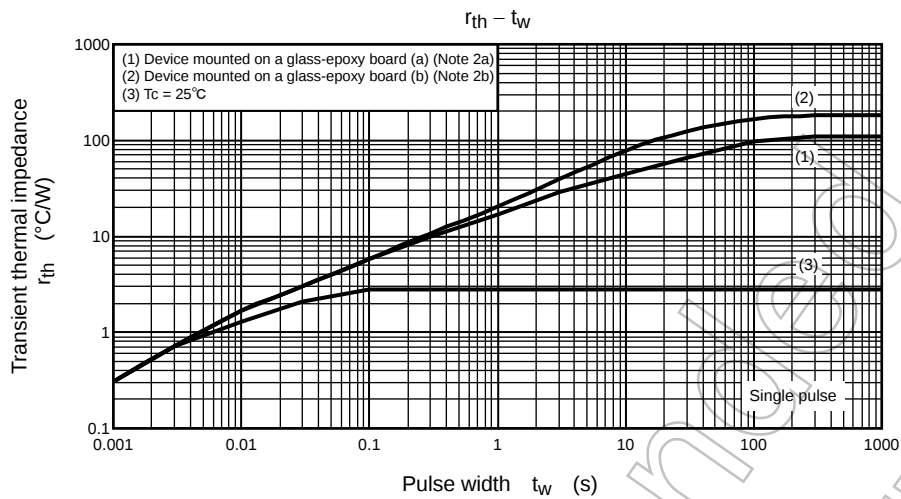
| Characteristic                                  |               | Symbol               | Test Condition                                                                                                                                                                                                                                | Min | Typ. | Max  | Unit |
|-------------------------------------------------|---------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| Gate leakage current                            |               | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V                                                                                                                                                                                                | —   | —    | ±100 | nA   |
| Drain cutoff current                            |               | I <sub>DSS</sub>     | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V                                                                                                                                                                                                 | —   | —    | 10   | μA   |
| Drain-source breakdown voltage                  |               | V (BR) DSS           | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V                                                                                                                                                                                                 | 30  | —    | —    | V    |
|                                                 |               | V (BR) DSX           | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = −20 V                                                                                                                                                                                               | 10  | —    | —    |      |
| Gate threshold voltage                          |               | V <sub>th</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA                                                                                                                                                                                                 | 1.3 | —    | 2.5  | V    |
| Drain-source ON-resistance                      |               | R <sub>DS (ON)</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 23 A                                                                                                                                                                                                | —   | 4.0  | 5.7  | mΩ   |
|                                                 |               |                      | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A                                                                                                                                                                                                 | —   | 2.6  | 3.3  |      |
| Forward transfer admittance                     |               | Y <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 23 A                                                                                                                                                                                                 | 47  | 94   | —    | S    |
| Input capacitance                               |               | C <sub>iss</sub>     | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                                                                                                                                      | —   | 2900 | —    | pF   |
| Reverse transfer capacitance                    |               | C <sub>rss</sub>     |                                                                                                                                                                                                                                               | —   | 460  | —    |      |
| Output capacitance                              |               | C <sub>oss</sub>     |                                                                                                                                                                                                                                               | —   | 800  | —    |      |
| Switching time                                  | Rise time     | t <sub>r</sub>       | <br>V <sub>GS</sub> 10 V<br>0 V<br>I <sub>D</sub> = 23A<br>V <sub>OUT</sub><br>4.7Ω<br>0.65Ω<br>V <sub>DD</sub> ≈ 15 V<br>Duty ≤ 1%, t <sub>W</sub> = 10 μs | —   | 12   | —    | ns   |
|                                                 | Turn-on time  | t <sub>on</sub>      |                                                                                                                                                                                                                                               | —   | 24   | —    |      |
|                                                 | Fall time     | t <sub>f</sub>       |                                                                                                                                                                                                                                               | —   | 23   | —    |      |
|                                                 | Turn-off time | t <sub>off</sub>     |                                                                                                                                                                                                                                               | —   | 78   | —    |      |
| Total gate charge (gate-source plus gate-drain) |               | Q <sub>g</sub>       | V <sub>DD</sub> ≈ 24 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 45 A                                                                                                                                                                         | —   | 56   | —    | nC   |
| Gate-source charge 1                            |               | Q <sub>gs1</sub>     |                                                                                                                                                                                                                                               | —   | 10   | —    |      |
| Gate-drain (“miller”) charge                    |               | Q <sub>gd</sub>      |                                                                                                                                                                                                                                               | —   | 17   | —    |      |

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

| Characteristic          |                | Symbol    | Test Condition                                | Min | Typ. | Max  | Unit |
|-------------------------|----------------|-----------|-----------------------------------------------|-----|------|------|------|
| Drain reverse current   | Pulse (Note 1) | $I_{DRP}$ | —                                             | —   | —    | 135  | A    |
| Forward voltage (diode) |                | $V_{DSF}$ | $I_{DR} = 45 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | —    | -1.2 | V    |







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