

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

## TPCA8053-H

Switching Regulator Applications

Motor Drive Applications

DC-DC Converter Applications

Unit: mm

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge:  $Q_{SW} = 6.9 \text{ nC}$  (typ.)
- Low drain-source ON-resistance:  $R_{DS(ON)} = 13.9 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 46 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 60 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 0.2 \text{ mA}$ )

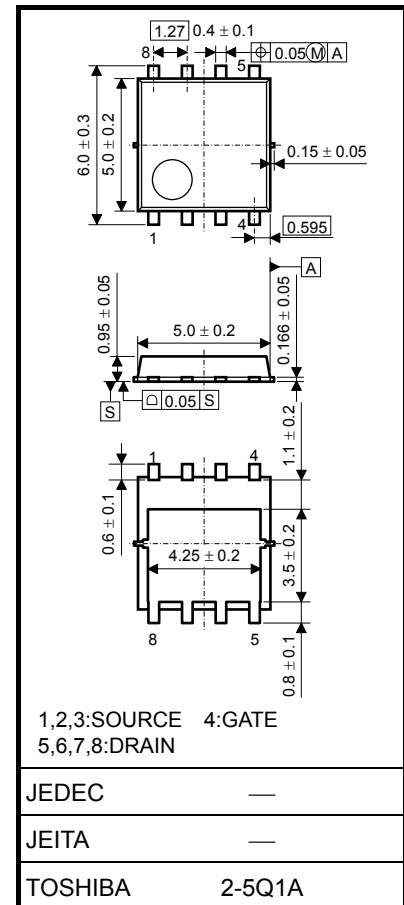
### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| 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)     | $I_D$     | 15         | A                |
|                                                                   | Pulsed (Note 1) | $I_{DP}$  | 45         |                  |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ )              |                 | $P_D$     | 30         | 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)                            |                 | $E_{AS}$  | 16         | mJ               |
| Avalanche current                                                 |                 | $I_{AR}$  | 15         | A                |
| Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4) |                 | $E_{AR}$  | 1.53       | 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.

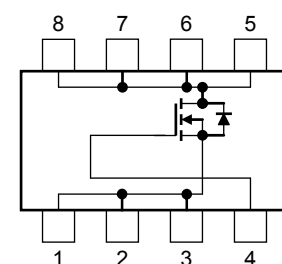
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within 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.



Weight: 0.069 g (typ.)

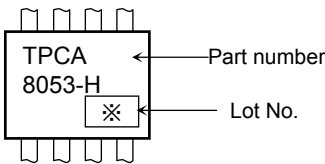
### Circuit Configuration



Thermal Characteristics

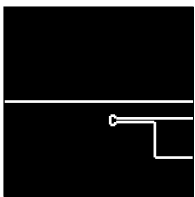
| Characteristic                                                               | Symbol          | Max  | Unit                 |
|------------------------------------------------------------------------------|-----------------|------|----------------------|
| Thermal resistance, channel to case<br>( $T_c = 25^{\circ}\text{C}$ )        | $R_{th (ch-c)}$ | 4.17 | $^{\circ}\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\text{ s}$ )<br>(Note 2a) | $R_{th (ch-a)}$ | 44.6 | $^{\circ}\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\text{ s}$ )<br>(Note 2b) | $R_{th (ch-a)}$ | 78.1 | $^{\circ}\text{C/W}$ |

Marking (Note 5)



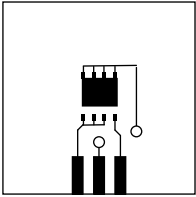
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



(a)

FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)



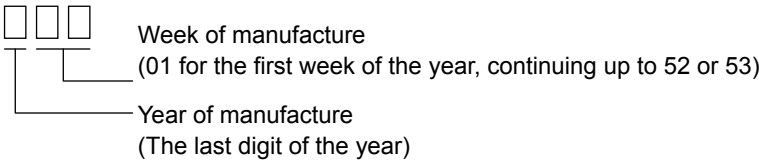
(b)

FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

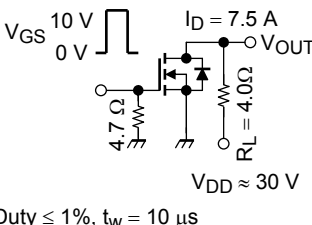
Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 100\text{ }\mu\text{H}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AR} = 15\text{ A}$

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

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

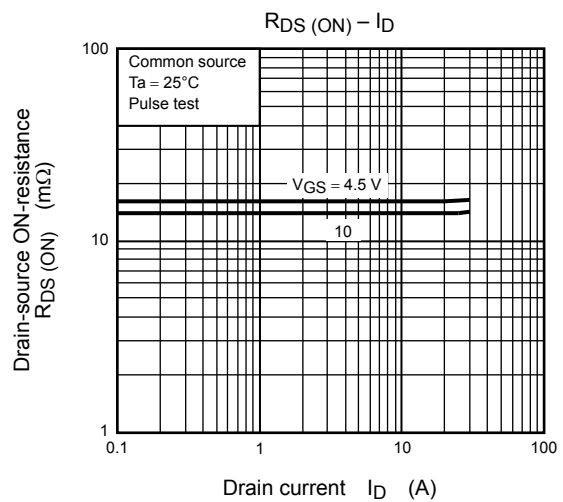
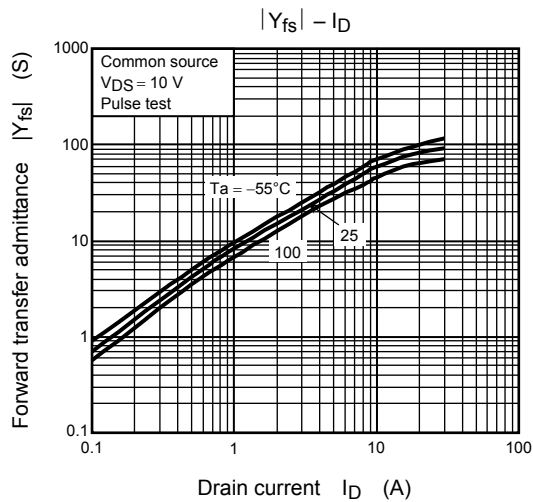
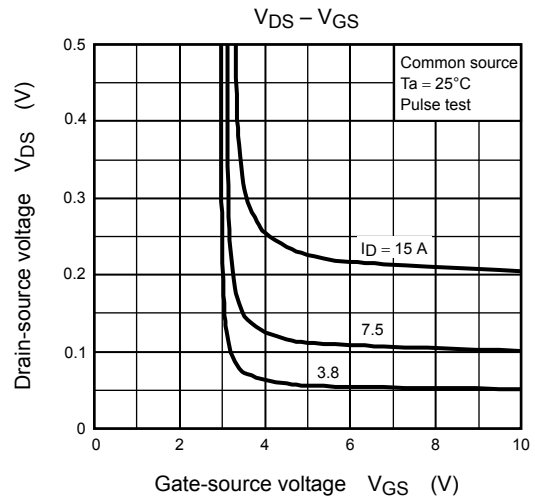
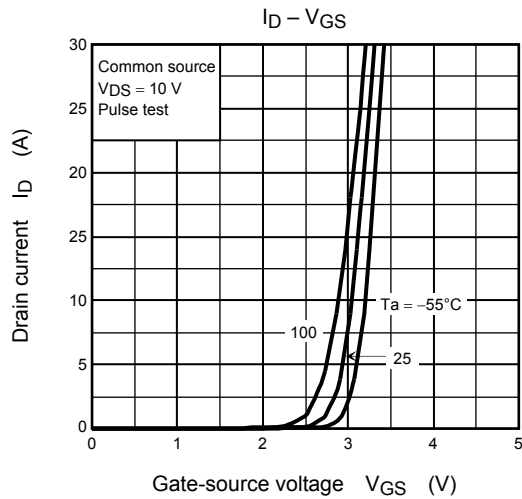
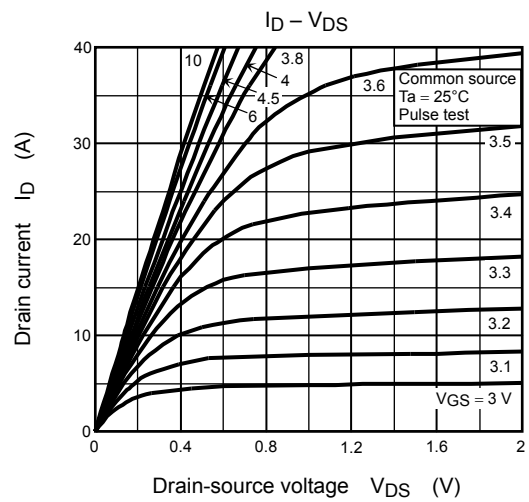
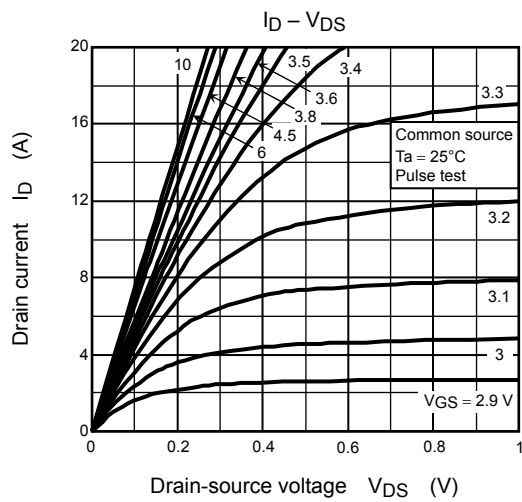


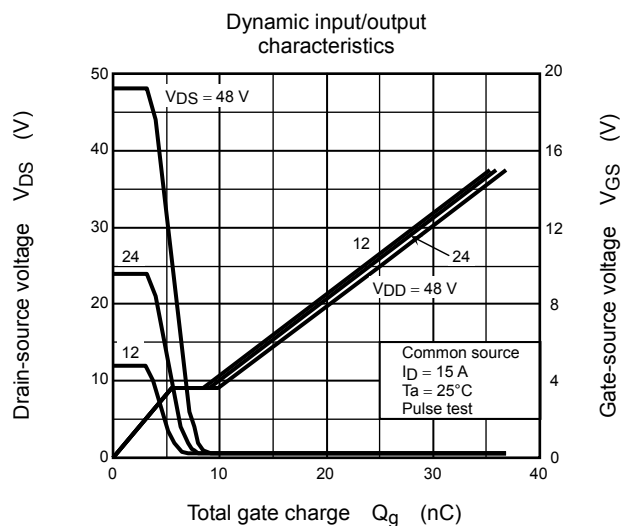
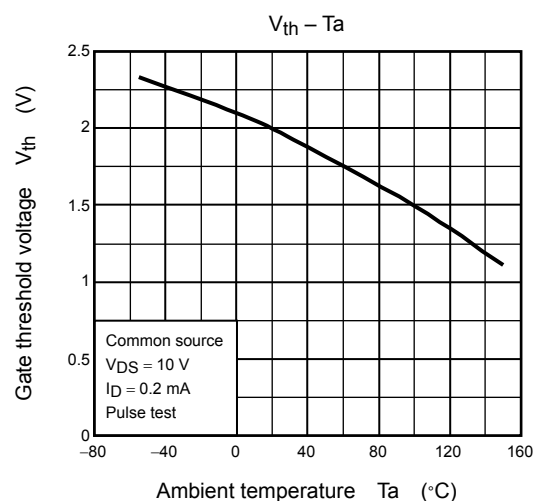
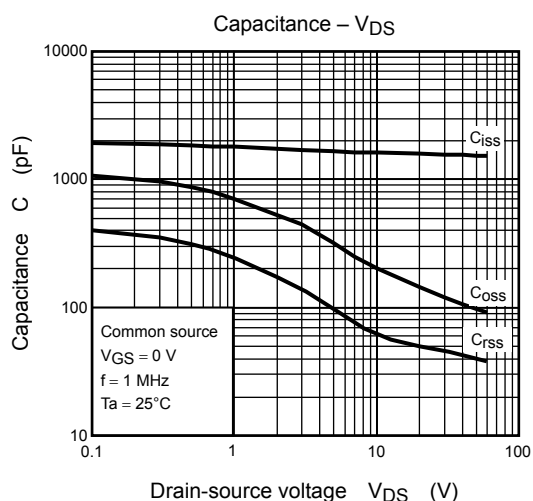
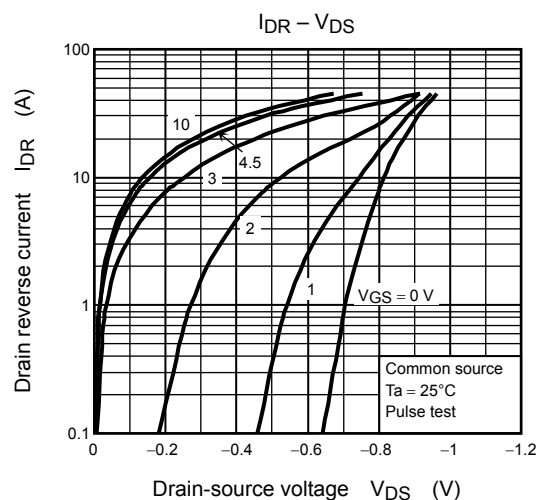
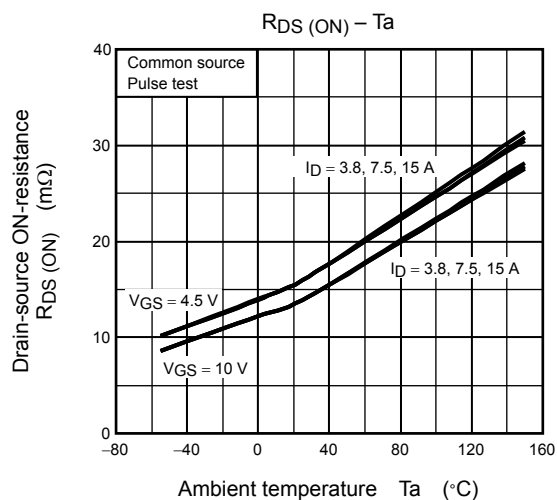
**Electrical Characteristics (Ta = 25°C)**

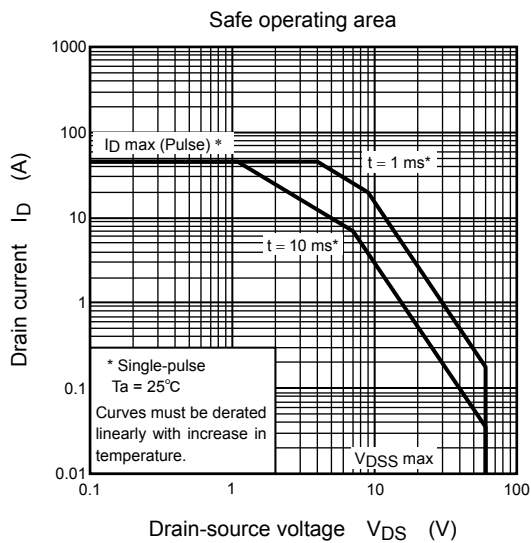
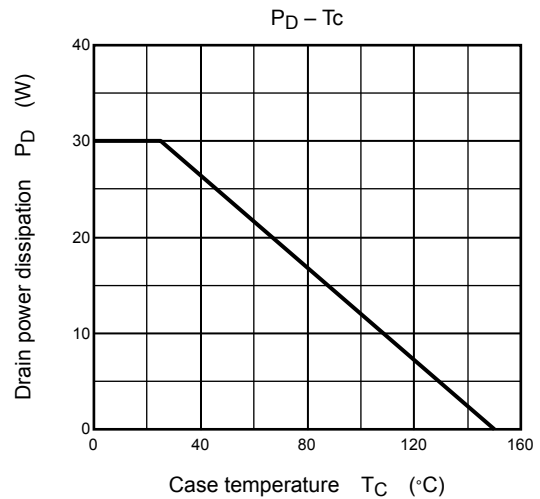
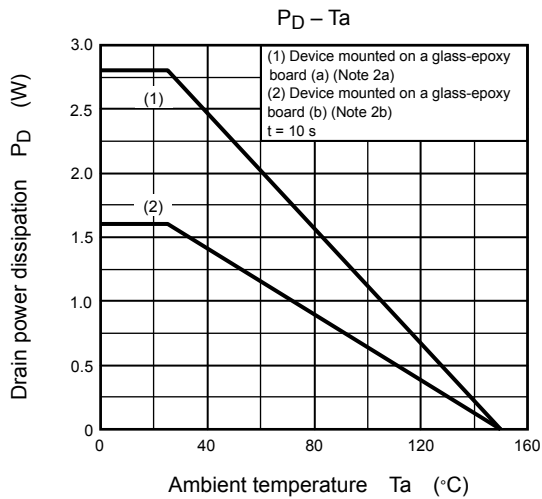
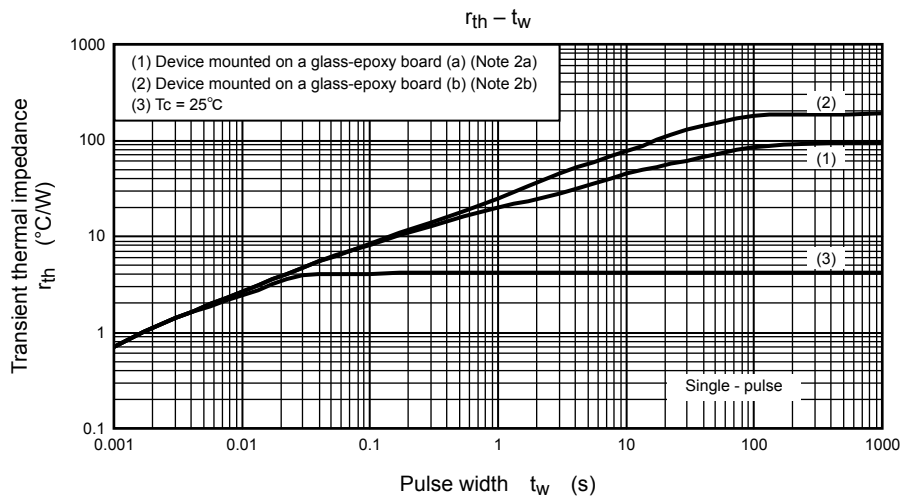
| Characteristic                                  |               | Symbol                | Test Condition                                                                                                                                                                                                                                                                              | 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> = 60 V, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                               | —   | —    | 10   | μA   |
| Drain-source breakdown voltage                  |               | V <sub>(BR)</sub> DSS | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                               | 60  | —    | —    | V    |
|                                                 |               | V <sub>(BR)</sub> DSX | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = −20 V                                                                                                                                                                                                                                             | 43  | —    | —    |      |
| Gate threshold voltage                          |               | V <sub>th</sub>       | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.2 mA                                                                                                                                                                                                                                             | 1.3 | —    | 2.3  | V    |
| Drain-source ON-resistance                      |               | R <sub>DS</sub> (ON)  | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.5 A                                                                                                                                                                                                                                             | —   | 15.6 | 24.0 | mΩ   |
|                                                 |               |                       | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A                                                                                                                                                                                                                                              | —   | 13.9 | 22.3 |      |
| Forward transfer admittance                     |               | Y <sub>fs</sub>       | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 7.5 A                                                                                                                                                                                                                                              | 23  | 46   | —    | S    |
| Input capacitance                               |               | C <sub>iss</sub>      | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                                                                                                                                                                                    | —   | 1620 | 2110 | pF   |
| Reverse transfer capacitance                    |               | C <sub>rss</sub>      |                                                                                                                                                                                                                                                                                             | —   | 60   | 90   |      |
| Output capacitance                              |               | C <sub>oss</sub>      |                                                                                                                                                                                                                                                                                             | —   | 200  | —    |      |
| Gate resistance                                 |               | r <sub>g</sub>        | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 5 MHz                                                                                                                                                                                                                                    | —   | 2.3  | 3.5  | Ω    |
| Switching time                                  | Rise time     | t <sub>r</sub>        |  <p>V<sub>GS</sub> 10 V<br/>0 V</p> <p>I<sub>D</sub> = 7.5 A</p> <p>V<sub>OUT</sub></p> <p>4.7 kΩ</p> <p>R<sub>L</sub> = 4.0 kΩ</p> <p>V<sub>DD</sub> ≈ 30 V</p> <p>Duty ≤ 1%, t<sub>w</sub> = 10 μs</p> | —   | 2.4  | —    | ns   |
|                                                 | Turn-on time  | t <sub>on</sub>       |                                                                                                                                                                                                                                                                                             | —   | 9.1  | —    |      |
|                                                 | Fall time     | t <sub>f</sub>        |                                                                                                                                                                                                                                                                                             | —   | 7.0  | —    |      |
|                                                 | Turn-off time | t <sub>off</sub>      |                                                                                                                                                                                                                                                                                             | —   | 33   | —    |      |
| Total gate charge (gate-source plus gate-drain) |               | Q <sub>g</sub>        | V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A                                                                                                                                                                                                                       | —   | 25   | —    | nC   |
|                                                 |               |                       | V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 15 A                                                                                                                                                                                                                        | —   | 13   | —    |      |
| Gate-source charge 1                            |               | Q <sub>gs1</sub>      | V <sub>DD</sub> ≈ 48 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A                                                                                                                                                                                                                       | —   | 5.5  | —    |      |
| Gate-drain (“Miller”) charge                    |               | Q <sub>gd</sub>       |                                                                                                                                                                                                                                                                                             | —   | 4.4  | —    |      |
| Gate switch charge                              |               | Q <sub>SW</sub>       |                                                                                                                                                                                                                                                                                             | —   | 6.9  | —    |      |

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

| Characteristic          |                | Symbol    | Test Condition                                | Min | Typ. | Max  | Unit |
|-------------------------|----------------|-----------|-----------------------------------------------|-----|------|------|------|
| Drain reverse current   | Pulse (Note 1) | $I_{DRP}$ | —                                             | —   | —    | 45   | A    |
| Forward voltage (diode) |                | $V_{DSF}$ | $I_{DR} = 15 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | —    | -1.2 | V    |







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