

TOSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode
Silicon N-Channel MOS Type (U-MOS V-H)

TPCA8A04-H

High Efficiency DC-DC Converter Applications

Notebook PC Applications

Portable Equipment Applications

- Built-in a schottky barrier diode
Low forward voltage: $V_{DSF} = -0.6 \text{ V}$ (max)
- High-speed switching
- Small gate charge: $Q_{SW} = 13.4 \text{ nC}$ (typ.)
- Low drain-source ON-resistance: $R_{DS(ON)} = 2.3 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 127 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 100 \text{ }\mu\text{A}$ (max) ($V_{DS} = 30 \text{ V}$)
- Enhancement mode: $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

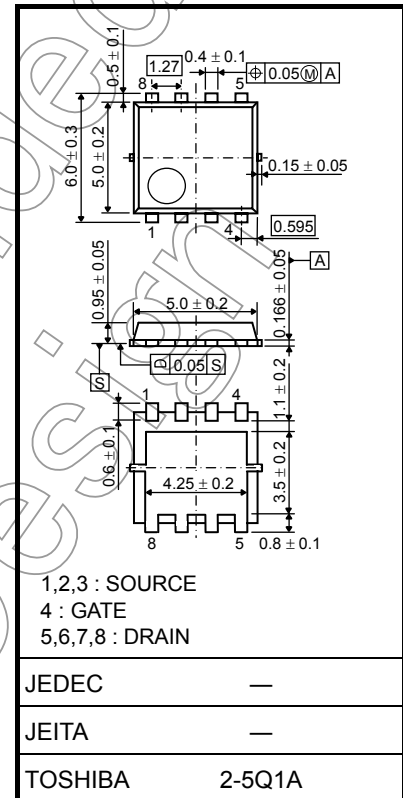
Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	30	V
Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)		V_{DGR}	30	V
Gate-source voltage		V_{GSS}	± 20	V
Drain current	DC (Note 1)	I_D	44	A
	Pulsed (Note 1)	I_{DP}	132	
Drain power dissipation ($T_c = 25^\circ\text{C}$)		P_D	45	W
Drain 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}	252	mJ
Avalanche current		I_{AR}	44	A
Repetitive avalanche energy ($T_c = 25^\circ\text{C}$) (Note 4)		E_{AR}	3.32	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.).

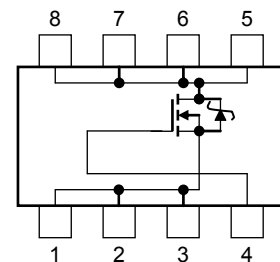
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

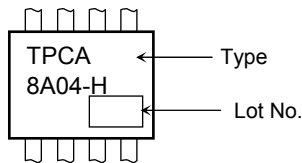
Circuit Configuration



Thermal Characteristics

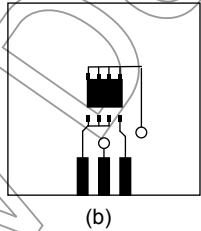
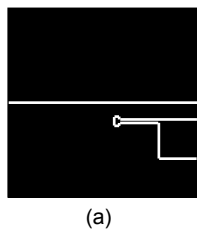
Characteristic	Symbol	Max	Unit
Thermal resistance, channel to case ($T_c=25^{\circ}\text{C}$)	$R_{th(ch-c)}$	2.78	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2a)	$R_{th(ch-a)}$	44.6	$^{\circ}\text{C/W}$
Thermal resistance, channel to ambient ($t = 10\text{ s}$)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

Marking (Note 5)

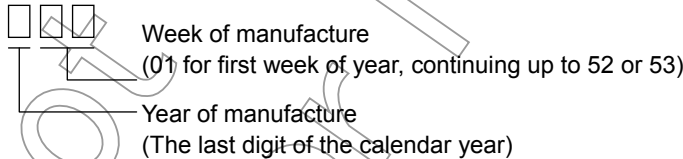


Note 1: Ensure that the channel temperature does not exceed 150°C .

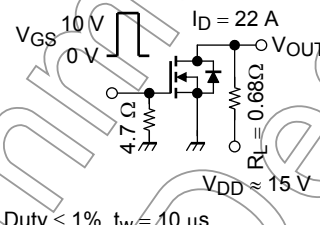
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



Note 3: $V_{DD} = 24\text{ V}$, $T_{ch} = 25^{\circ}\text{C}$ (initial), $L = 0.1\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AR} = 44\text{ A}$
 Note 4: Repetitive rating: pulse width limited by maximum channel temperature
 Note 5: * Weekly code: (Three digits)

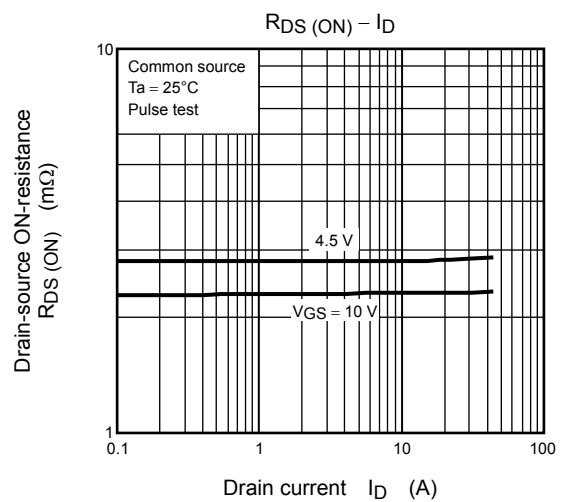
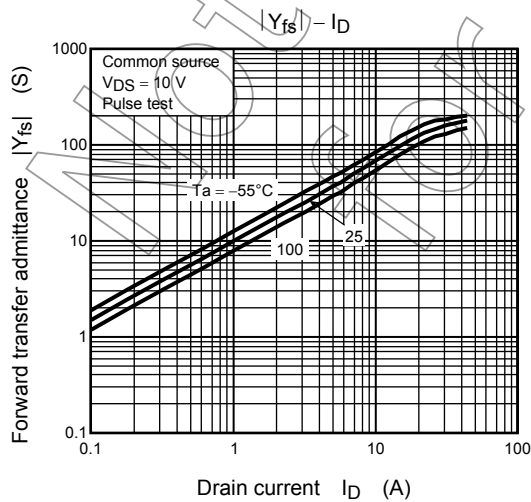
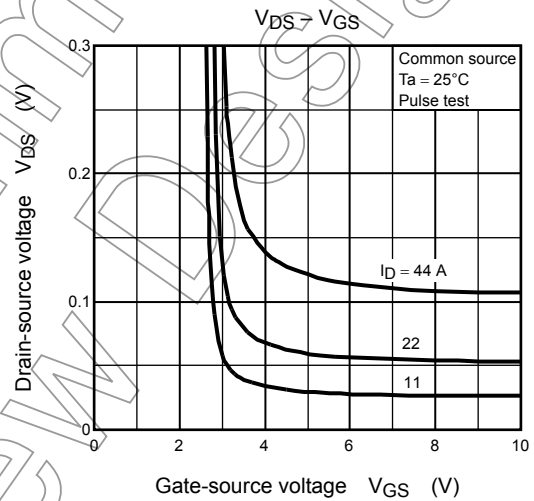
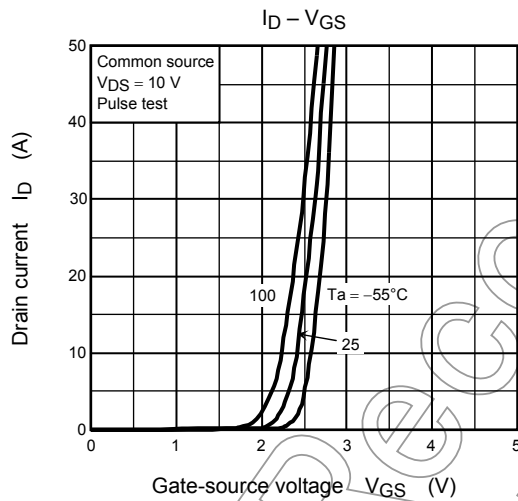
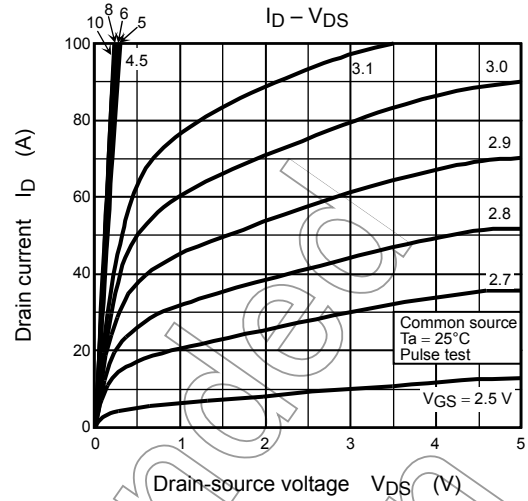
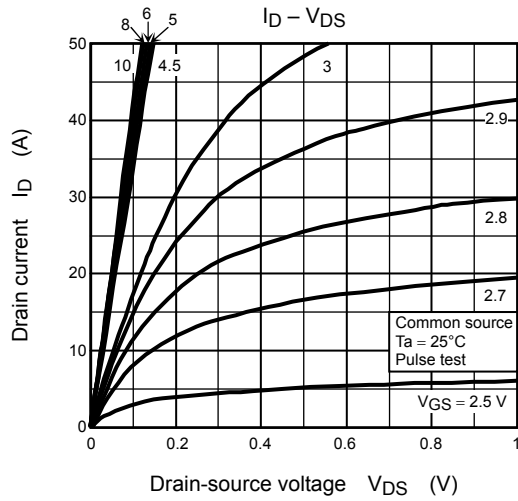


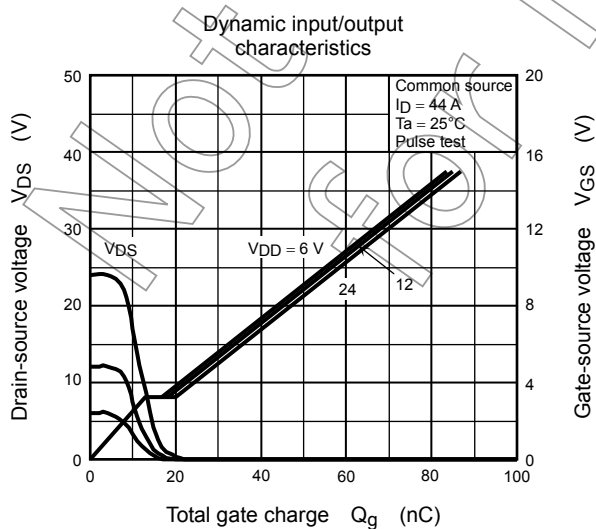
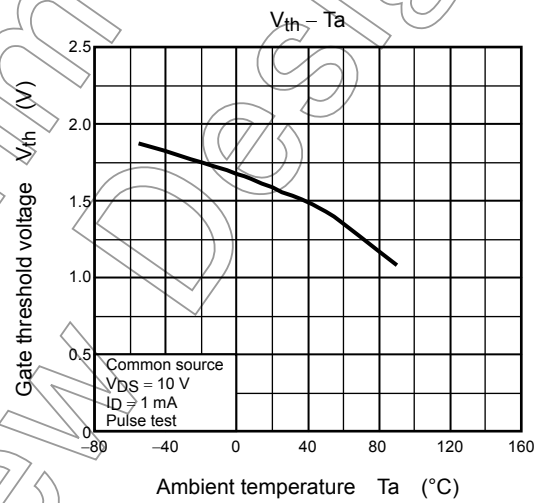
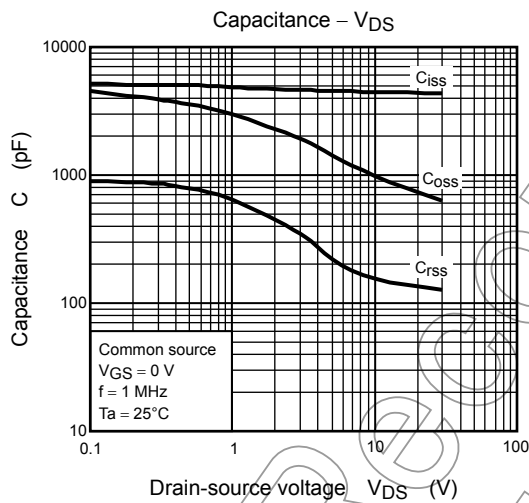
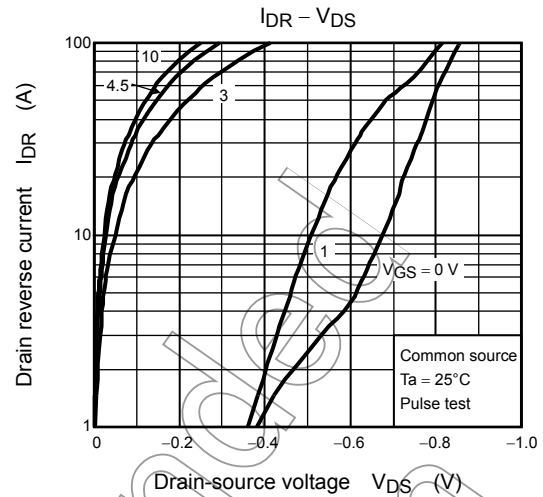
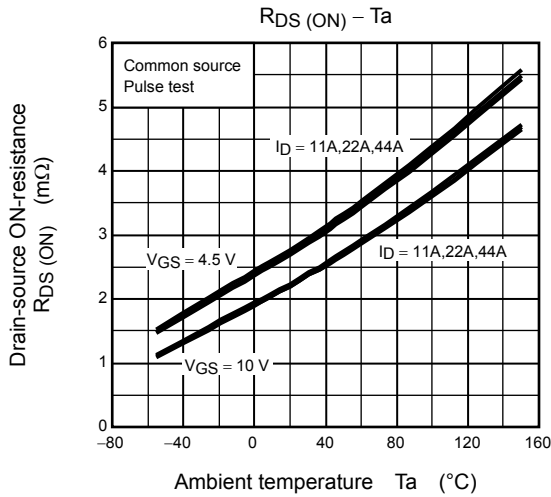
Electrical Characteristics (Ta = 25°C)

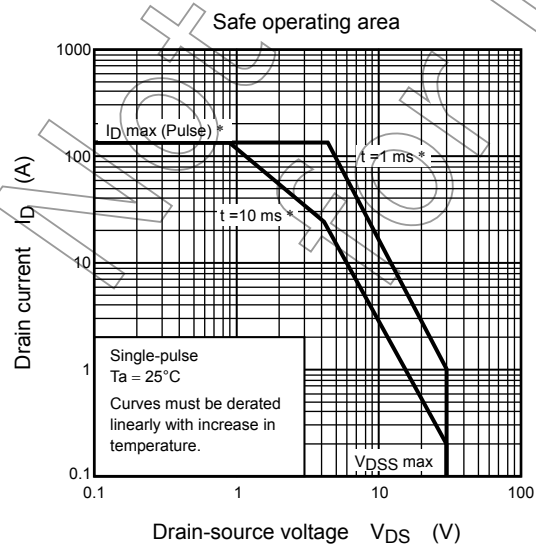
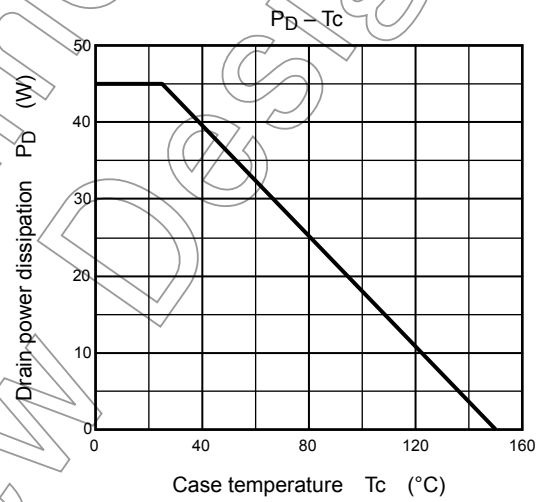
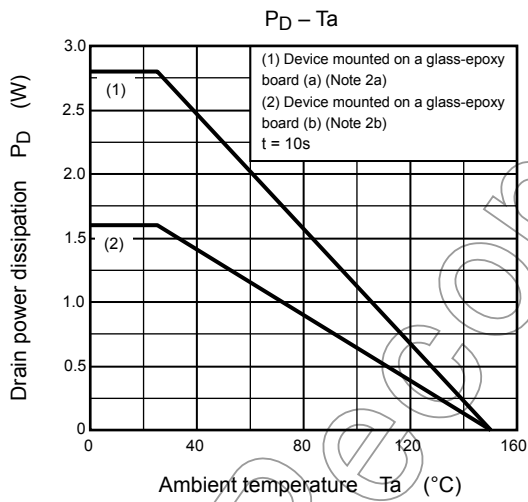
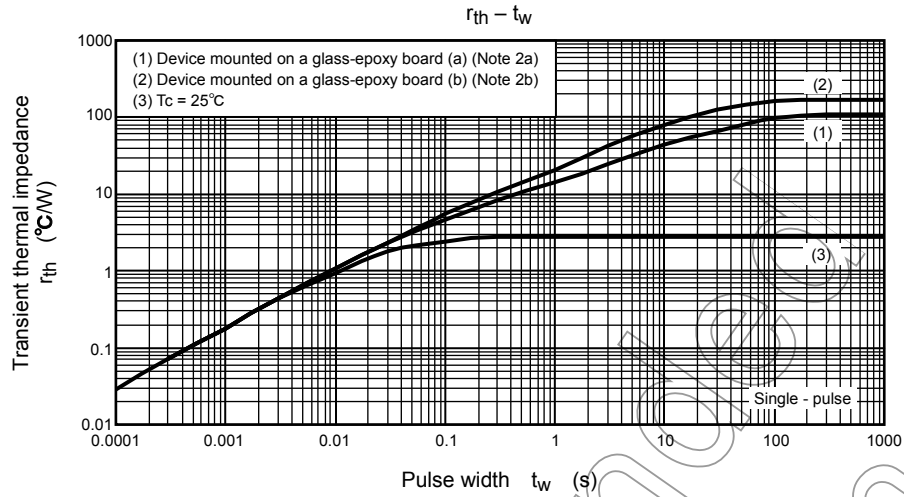
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V	—	—	±100	nA
Drain cutoff current		I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V	—	—	100	μA
Drain-source breakdown voltage		V (BR) DSS	I _D = 10 mA, V _{GS} = 0 V	30	—	—	V
		V (BR) DSX	I _D = 10 mA, V _{GS} = -20 V	15	—	—	
Gate threshold voltage		V _{th}	V _{DS} = 10 V, I _D = 1 mA	1.3	—	2.3	V
Drain-source ON-resistance		R _{DS (ON)}	V _{GS} = 4.5 V, I _D = 22 A	—	2.9	4.1	mΩ
			V _{GS} = 10 V, I _D = 22 A	—	2.3	3.2	
Forward transfer admittance		Y _{fs}	V _{DS} = 10 V, I _D = 22 A	64	127	—	S
Input capacitance		C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz	—	4400	5700	pF
Reverse transfer capacitance		C _{rss}		—	180	270	
Output capacitance		C _{oss}		—	990	—	
Gate resistance		r _g	V _{DS} = 10 V, V _{GS} = 0 V, f = 5 MHz	—	1.0	1.5	Ω
Switching time	Rise time	t _r		—	4.9	—	ns
	Turn-on time	t _{on}		—	15	—	
	Fall time	t _f		—	8.3	—	
	Turn-off time	t _{off}		Duty ≤ 1%, t _w = 10 μs	—	57	
Total gate charge (gate-source plus gate-drain)		Q _g	V _{DD} ≈ 24 V, V _{GS} = 10 V, I _D = 44 A	—	59	—	nC
			V _{DD} ≈ 24 V, V _{GS} = 5 V, I _D = 44 A	—	30	—	
Gate-source charge 1		Q _{gs1}	V _{DD} ≈ 24 V, V _{GS} = 10 V, I _D = 44 A	—	13	—	
Gate-drain ("Miller") charge		Q _{gd}		—	7.0	—	
Gate switch charge		Q _{SW}		—	13.4	—	

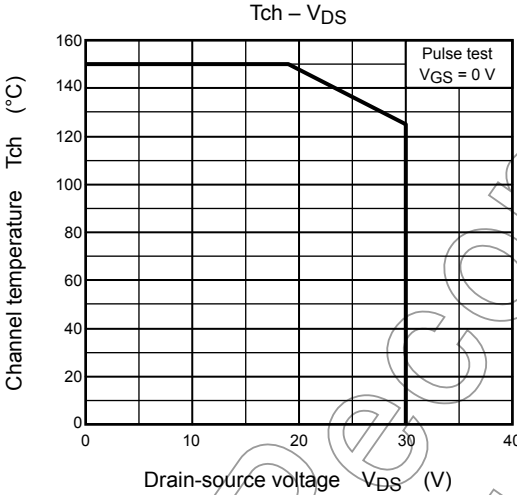
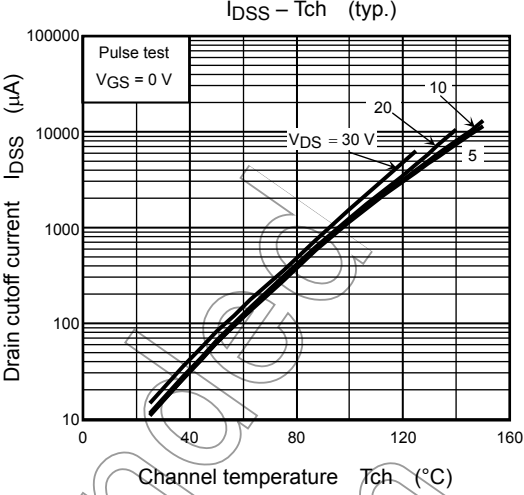
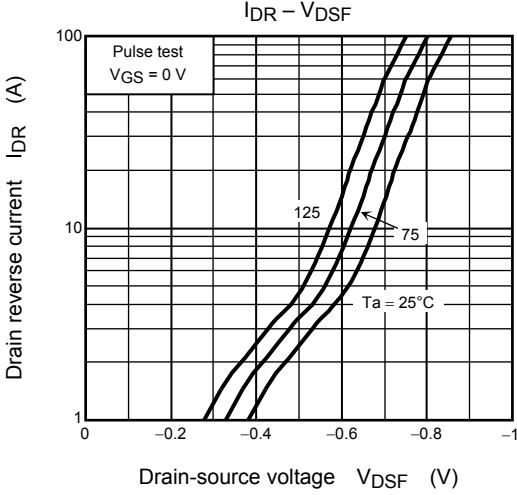
Source-Drain Ratings and Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	132	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}$	—	-0.4	-0.6	V
			$I_{DR} = 44 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.2	V









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