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With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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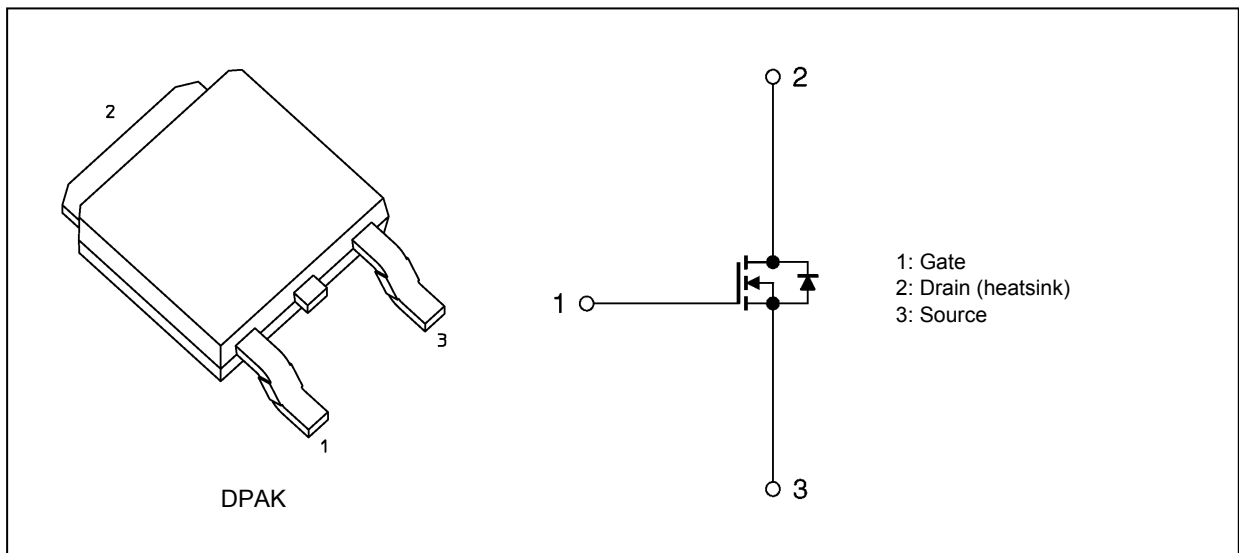
1. Applications

- Switching Voltage Regulators
- Motor Drivers
- Power Management Switches

2. Features

- (1) High-speed switching
- (2) Low gate charge: $Q_{SW} = 3.7 \text{ nC}$ (typ.)
- (3) Low drain-source on-resistance: $R_{DS(ON)} = 19 \text{ m}\Omega$ (typ.) ($V_{GS} = 10 \text{ V}$)
- (4) Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 40 \text{ V}$)
- (5) Enhancement mode: $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 0.1 \text{ mA}$)

3. Packaging and Internal Circuit



Start of commercial production

2010-01

4. Absolute Maximum Ratings (Note) ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	40	V
Gate-source voltage	V_{GSS}	± 20	
Drain current (DC) (Note 1)	I_D	20	A
Drain current (pulsed) (Note 1)	I_{DP}	60	
Power dissipation ($T_c = 25^\circ\text{C}$)	P_D	27	W
Single-pulse avalanche energy (Note 2)	E_{AS}	10.4	mJ
Single-pulse avalanche current	I_{AS}	20	A
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to 150	

Note: 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).

5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance	$R_{th(ch-c)}$	4.62	$^\circ\text{C}/\text{W}$
Channel-to-ambient thermal resistance	$R_{th(ch-a)}$	125	

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

Note 2: $V_{DD} = 32\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 20\ \mu\text{H}$, $R_G = 1.2\ \Omega$, $I_{AS} = 20\text{ A}$

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

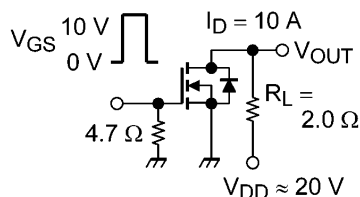
6. Electrical Characteristics

6.1. Static Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	± 0.1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	40	—	—	V
	$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$	25	—	—	
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}, I_D = 0.1\text{ mA}$	1.3	—	2.3	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$	—	23	34	$\text{m}\Omega$
		$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	—	19	29	

6.2. Dynamic Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	985	—	pF
Reverse transfer capacitance	C_{rss}		—	37	—	
Output capacitance	C_{oss}		—	159	—	
Gate resistance	r_g	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 5\text{ MHz}$	—	3.4	5.1	Ω
Switching time (rise time)	t_r	See Figure 6.2.1.	—	2.7	—	ns
Switching time (turn-on time)	t_{on}		—	8.1	—	
Switching time (fall time)	t_f		—	5.1	—	
Switching time (turn-off time)	t_{off}		—	22	—	



Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$
Fig. 6.2.1 Switching Time Test Circuit

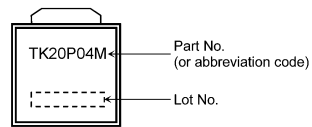
6.3. Gate Charge Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	—	15	—	nC
		$V_{DD} \approx 32\text{ V}, V_{GS} = 5\text{ V}, I_D = 20\text{ A}$	—	7.6	—	
Gate-source charge 1	Q_{gs1}	$V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	—	4.1	—	
Gate-drain charge	Q_{gd}		—	1.7	—	
Gate switch charge	Q_{sw}		—	3.7	—	

6.4. Source-Drain Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (pulsed)	(Note 3) I_{DRP}	—	—	—	60	A
Diode forward voltage	V_{DSF}	$I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}$	—	—	-1.2	V

Note 3: Ensure that the channel temperature does not exceed 150°C .

7. Marking**Fig. 7.1 Marking**

8. Characteristics Curves (Note)

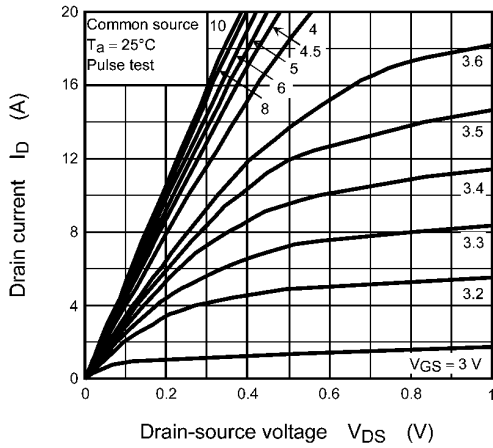


Fig. 8.1 $I_D - V_{DS}$

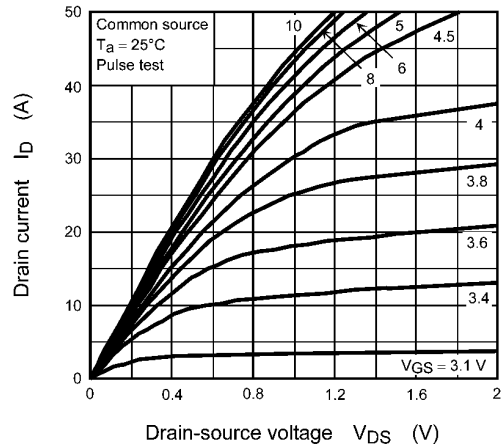


Fig. 8.2 $I_D - V_{DS}$

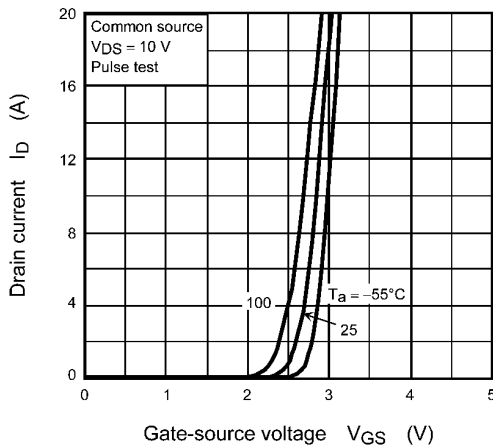


Fig. 8.3 $I_D - V_{GS}$

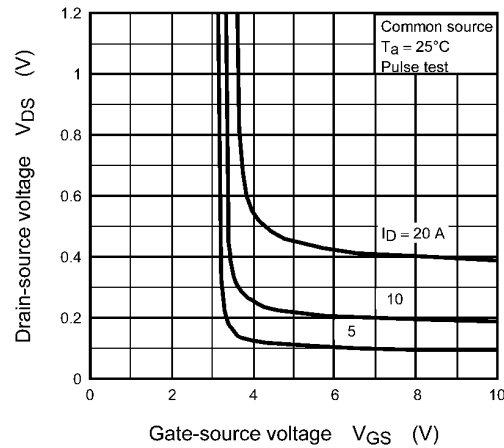


Fig. 8.4 $V_{DS} - V_{GS}$

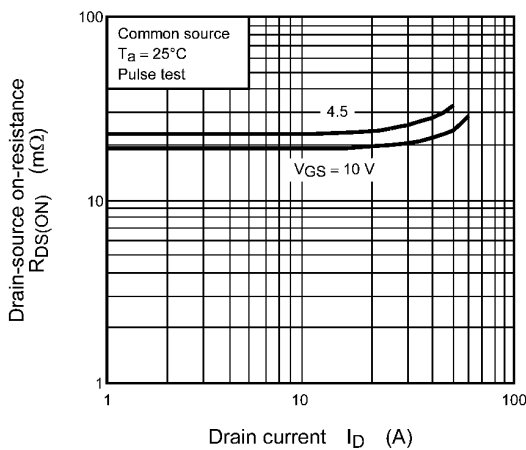


Fig. 8.5 $R_{DS(ON)} - I_D$

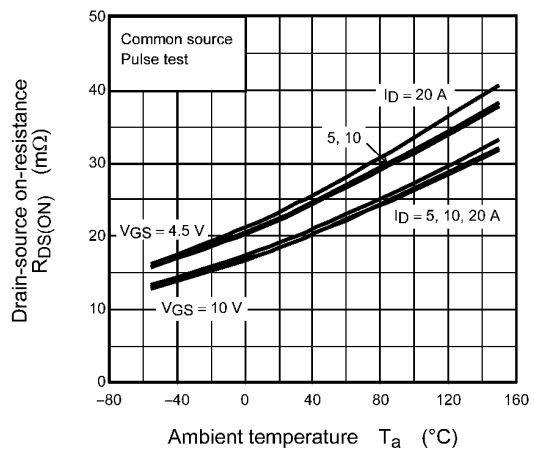


Fig. 8.6 $R_{DS(ON)} - T_a$

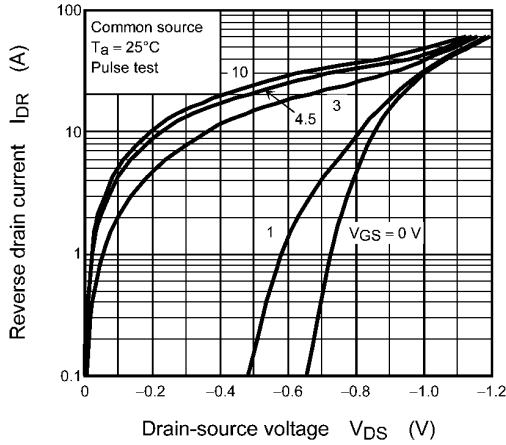


Fig. 8.7 $I_{DR} - V_{DS}$

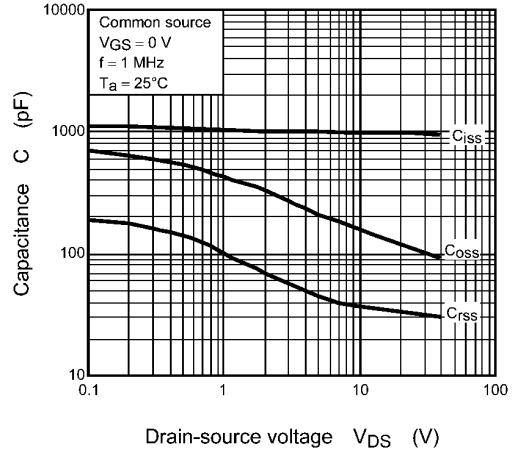


Fig. 8.8 Capacitance - V_{DS}

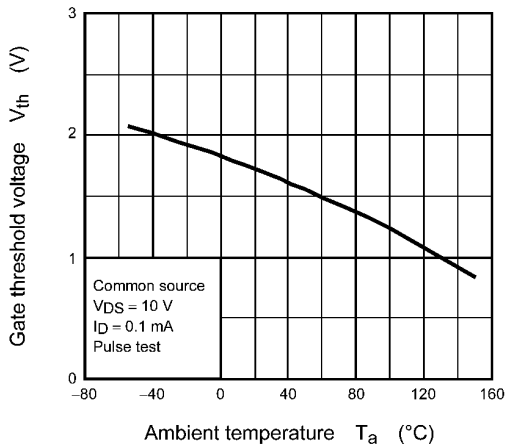


Fig. 8.9 $V_{th} - T_a$

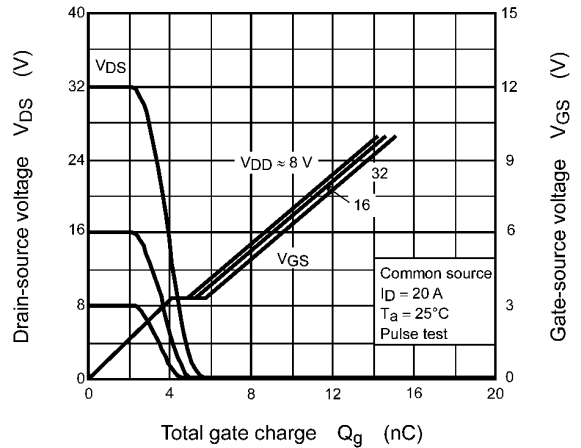


Fig. 8.10 Dynamic Input/Output Characteristics

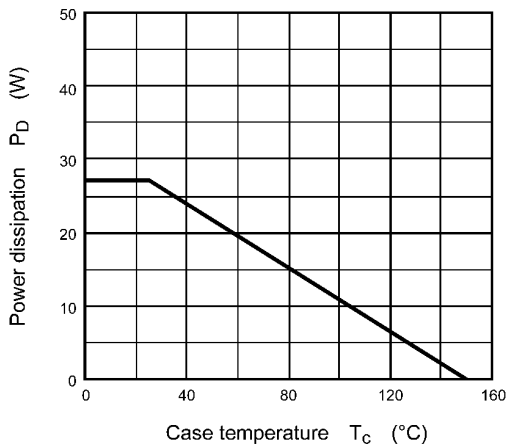


Fig. 8.11 $P_D - T_c$
 (Guaranteed Maximum)

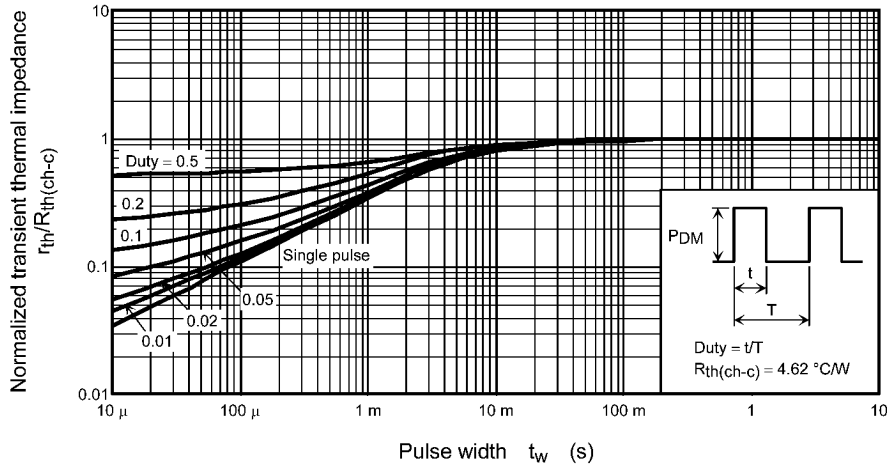


Fig. 8.12 $r_{th}/R_{th(ch-c)} - t_w$
(Guaranteed Maximum)

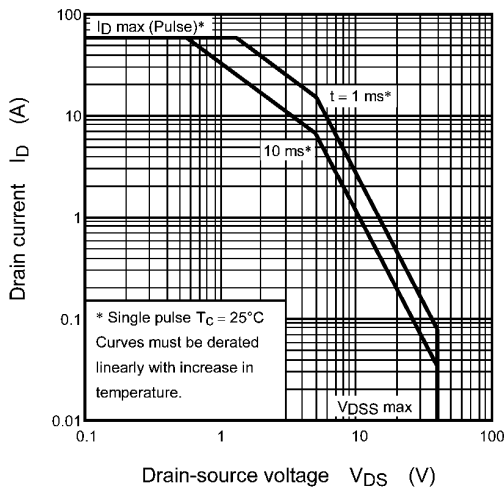


Fig. 8.13 Safe Operating Area
(Guaranteed Maximum)

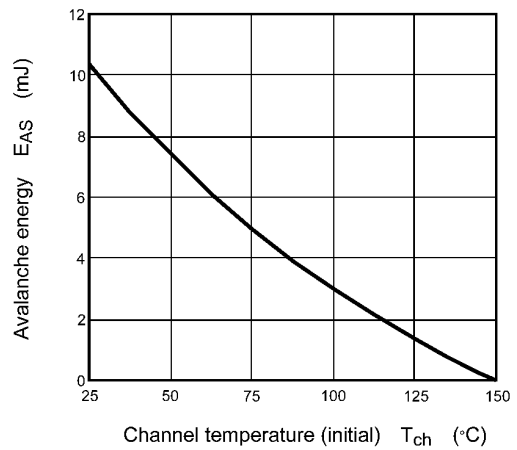


Fig. 8.14 $E_{AS} - T_{ch}$
(Guaranteed Maximum)

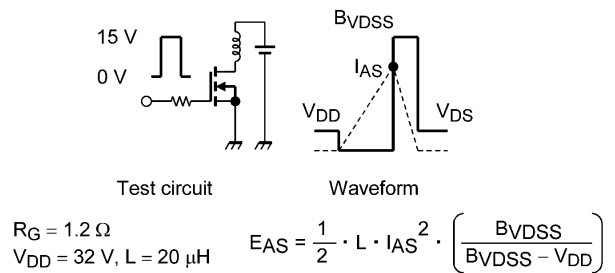


Fig. 8.15 Test Circuit/Waveform

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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