

Power MOSFET

TO-220AB


N-Channel MOSFET

FEATURES

- Dynamic dV/dt rating
- 175 °C operating temperature
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



Available
RoHS*
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220AB package is universally preferred for commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

PRODUCT SUMMARY

V_{DS} (V)	60	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.028
Q_g (Max.) (nC)	67	
Q_{gs} (nC)	18	
Q_{gd} (nC)	25	
Configuration	Single	

ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	IRFZ40PbF
Lead (Pb)-free and halogen-free	IRFZ40PbF-BE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	60	V
Gate-source voltage			V_{GS}	± 20	
Continuous drain current	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	50	A
		$T_C = 100\text{ }^{\circ}\text{C}$		36	
Pulsed drain current ^a			I_{DM}	200	
Linear derating factor				1.0	W/ $^{\circ}\text{C}$
Single pulse avalanche energy ^b			E_{AS}	100	mJ
Maximum power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$		P_D	150	W
Peak diode recovery dV/dt ^c			dV/dt	4.5	V/ns
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$
Soldering recommendations (peak temperature) ^d	For 10 s			300	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 44\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 51\text{ A}$ (see fig. 12)
- $I_{SD} \leq 51\text{ A}$, $dI/dt \leq 250\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 175\text{ }^\circ\text{C}$
- 1.6 mm from case
- Current limited by the package, (die current = 51 A)

THERMAL RESISTANCE RATINGS

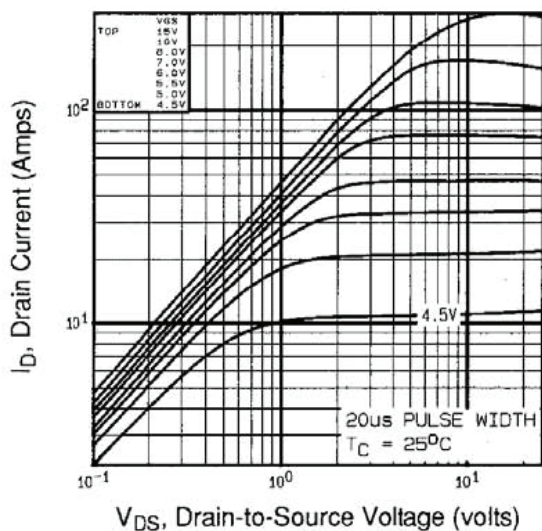
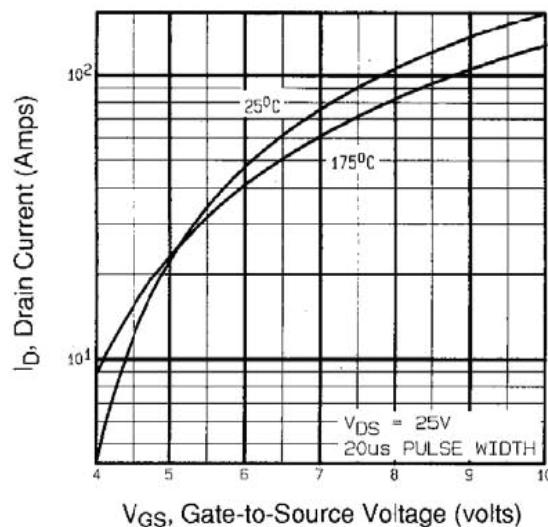
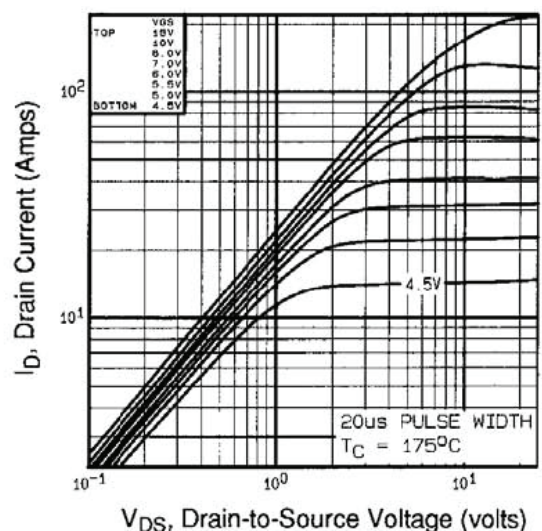
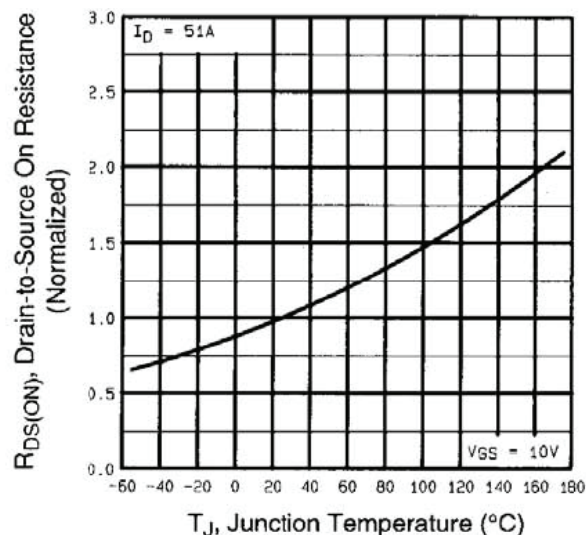
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Case-to-sink, flat, greased surface	R_{thCS}	0.50	-	
Maximum junction-to-case (drain)	R_{thJC}	-	1.0	

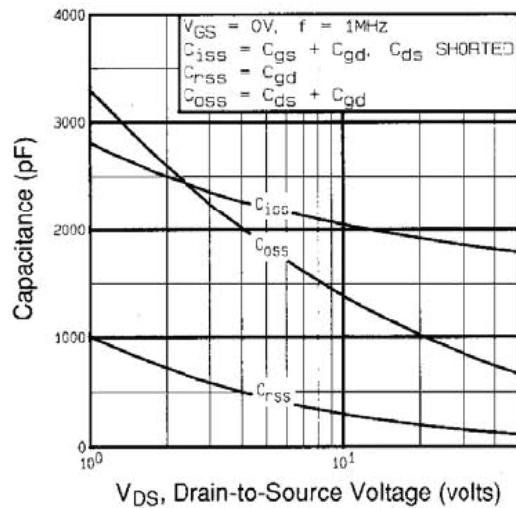
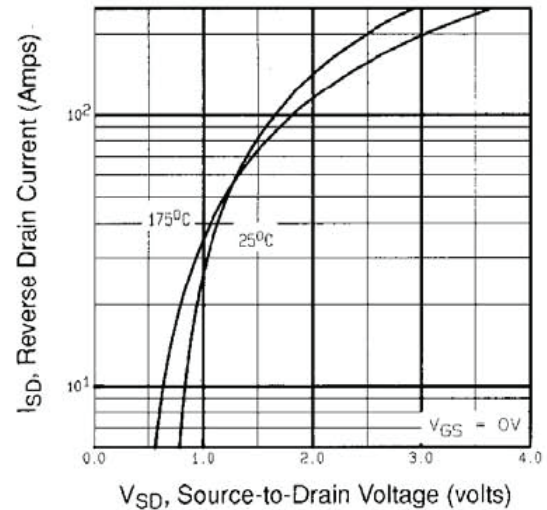
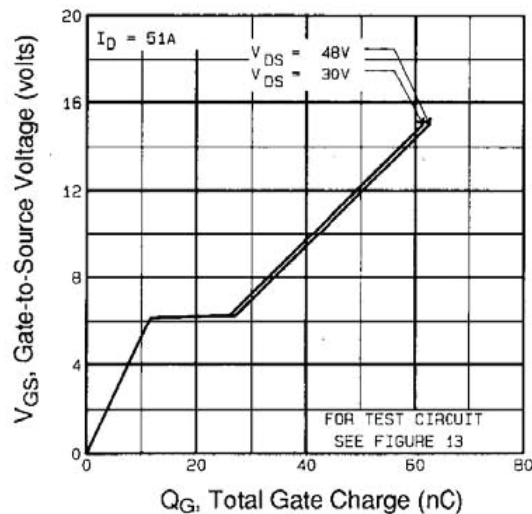
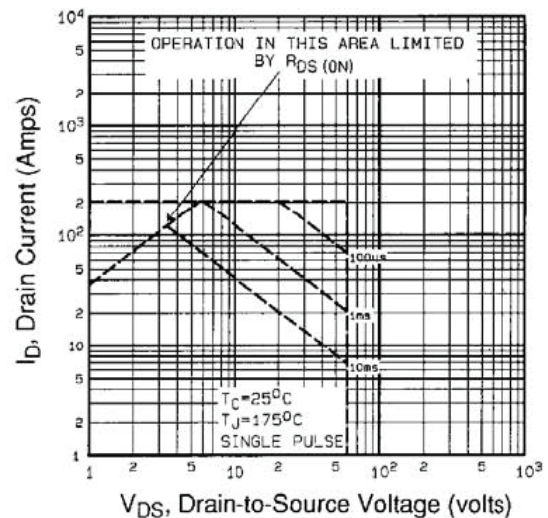
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

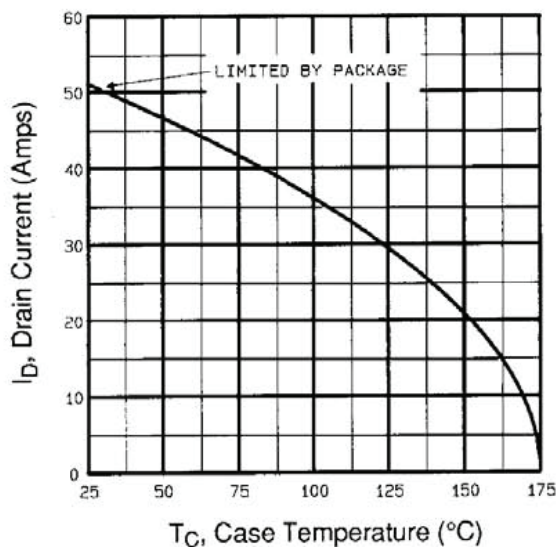
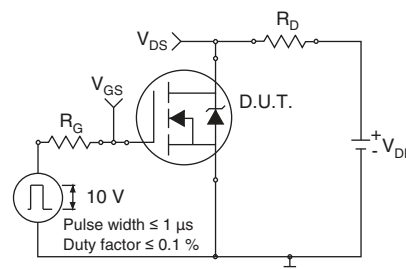
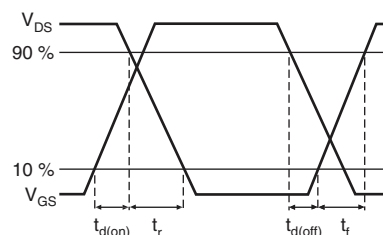
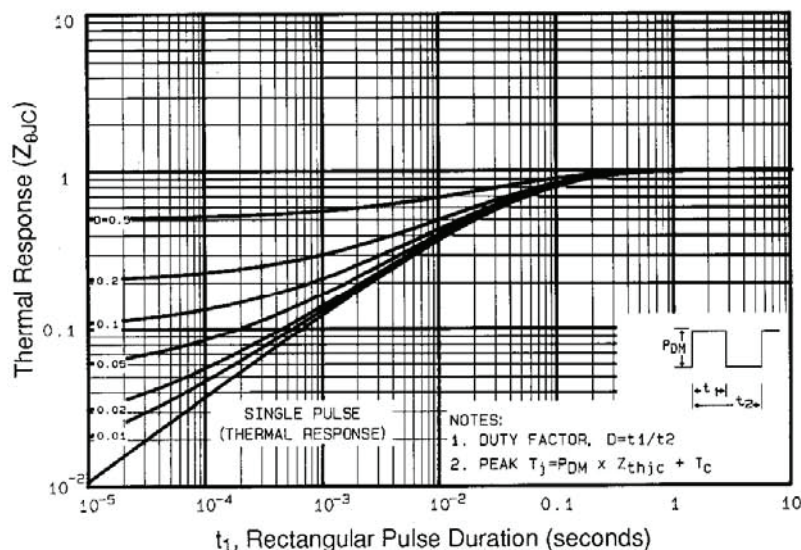
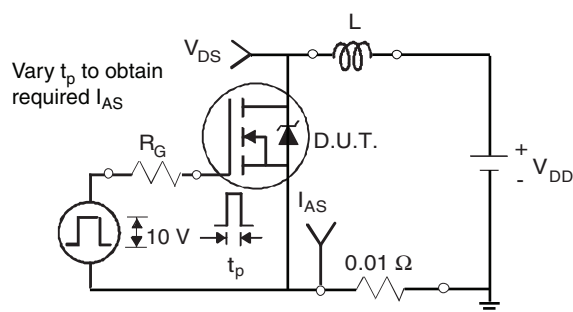
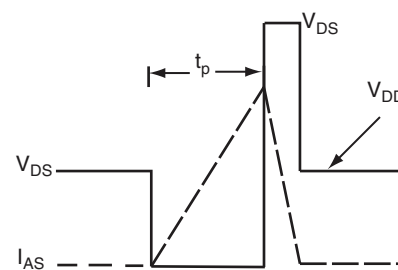
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		60	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.060	-	V/°C
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V		-	-	25	μA
		V _{DS} = 48 V, V _{GS} = 0 V, T _J = 125 °C		-	-	250	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 31 A ^b	-	-	0.028	Ω
Forward transconductance	g _{fs}	V _{DS} = 25 V, I _D = 31 A		15	-	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	1900	-	pF
Output capacitance	C _{oss}			-	920	-	
Reverse transfer capacitance	C _{rss}			-	170	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 51 A, V _{DS} = 48 V, see fig. 6 and 13 ^b	-	-	67	nC
Gate-source charge	Q _{gs}			-	-	18	
Gate-drain charge	Q _{gd}			-	-	25	
Turn-on delay time	t _{d(on)}	V _{DD} = 30 V, I _D = 51 A, R _g = 9.1 Ω, R _D = 0.55 Ω, see fig. 10 ^b		-	14	-	ns
Rise time	t _r			-	110	-	
Turn-off delay time	t _{d(off)}			-	45	-	
Fall time	t _f			-	92	-	
Internal drain inductance	L _D	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	nH
Internal source inductance	L _S			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	50	A
Pulsed diode forward current ^a	I _{SM}			-	-	200	
Body diode voltage	V _{SD}	T _J = 25 °C, I _S = 51 A, V _{GS} = 0 V ^b		-	-	2.5	V
Body diode reverse recovery time	t _{rr}	T _J = 25 °C, I _F = 51 A, dI/dt = 100 A/μs		-	120	180	ns
Body diode reverse recovery charge	Q _{rr}			-	0.53	0.80	nC
Forward turn-on time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^{\circ}\text{C}$

Fig. 3 - Typical Transfer Characteristics

Fig. 2 - Typical Output Characteristics, $T_C = 175\text{ }^{\circ}\text{C}$

Fig. 4 - Normalized On-Resistance vs. Temperature


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

Fig. 8 - Maximum Safe Operating Area


Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 10a - Switching Time Test Circuit

Fig. 10b - Switching Time Waveforms

Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig. 12a - Unclamped Inductive Test Circuit

Fig. 12b - Unclamped Inductive Waveforms

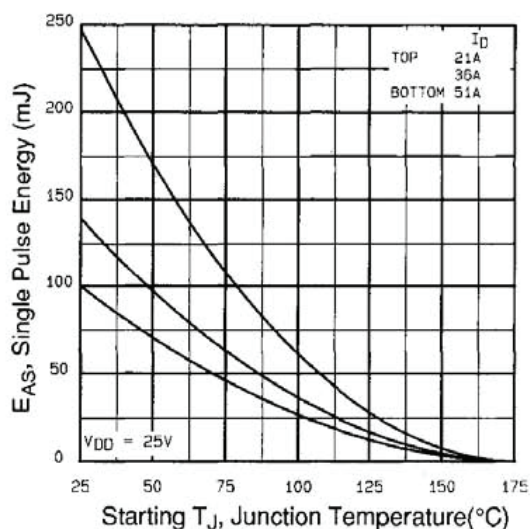


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

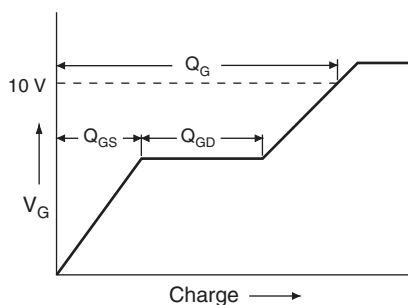


Fig. 13a - Basic Gate Charge Waveform

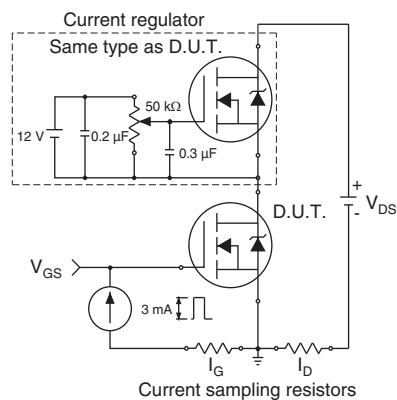


Fig. 13b - Gate Charge Test

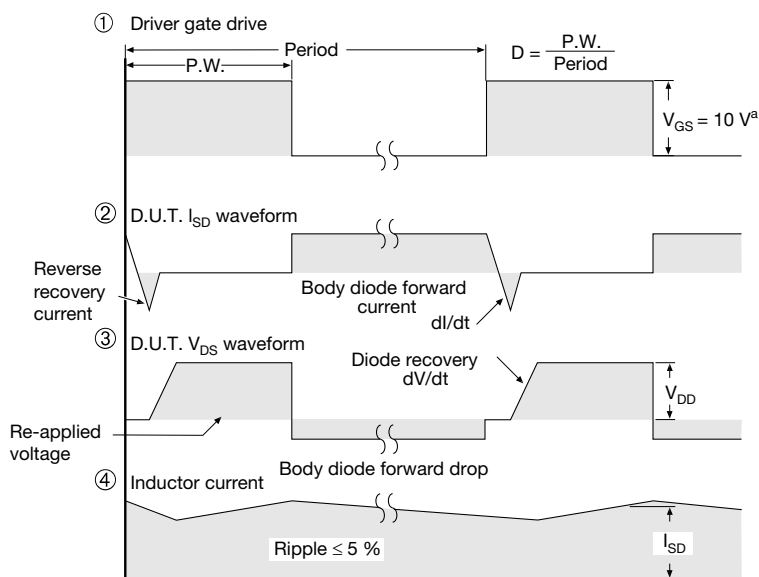
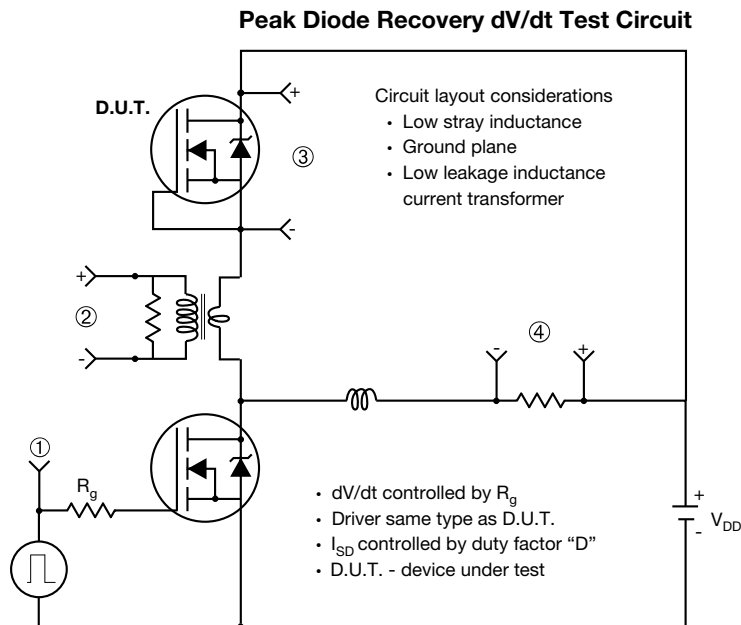


Fig. 14 - For N-Channel

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