

Power MOSFET

TO-220AB


N-Channel MOSFET

FEATURES

- Ultra low gate charge
- Reduced gate drive requirement
- Enhanced 30 V V_{GS} rating
- Reduced C_{iss} , C_{oss} , C_{rss}
- Extremely high frequency operation
- Repetitive avalanche rated
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


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

This new series of low charge power MOSFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing the new LCDMOS technology, the device improvements are achieved without added product cost, allowing for reduced gate drive requirements and total system savings. In addition, reduced switching losses and improved efficiency are achievable in a variety of high frequency applications. Frequencies of a few MHz at high current are possible using the new low charge MOSFETs.

These device improvements combined with the proven ruggedness and reliability that are characteristic of Power MOSFETs offer the designer a new standard in power transistors for switching applications.

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.85
Q_g max. (nC)	39	
Q_{gs} (nC)	10	
Q_{gd} (nC)	19	
Configuration	Single	

ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	IRF840LCPbF
Lead (Pb)-free and halogen-free	IRF840LCPbF-BE3

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

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V _{DS}	500	V
Gate-source voltage			V _{GS}	± 30	
Continuous drain current	V _{GS} at 10 V	T _C = 25 °C	I _D	8.0	A
		T _C = 100 °C		5.1	
Pulsed drain current ^a			I _{DM}	28	
Linear derating factor				1.0	W/°C
Single pulse avalanche energy ^b			E _{AS}	510	mJ
Repetitive avalanche current ^a			I _{AR}	8.0	A
Repetitive avalanche energy ^a			E _{AR}	13	mJ
Maximum power dissipation	T _C = 25 °C		P _D	125	W
Peak diode recovery dV/dt ^c			dV/dt	3.5	V/ns
Operating junction and storage temperature range			T _J , T _{stg}	-55 to +150	°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

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. $V_{DD} = 50\text{ V}$, starting $T_J = 25^\circ\text{C}$, $L = 14\text{ mH}$, $R_g = 25\ \Omega$, $I_{AS} = 8.0\text{ A}$ (see fig. 12)

c. $I_{SD} \leq 8.0\text{ A}$, $dI/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$

d. 1.6 mm from case

**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}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$		500	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.63	-	V/ $^\circ\text{C}$
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-source leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$		-	-	25	μA
		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 4.8\text{ A}^b$	-	-	0.85	Ω
Forward transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 4.8\text{ A}^b$		4.0	-	-	S
Dynamic							
Drain-source breakdown voltage	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5		-	1100	-	pF
V_{DS} temperature coefficient	C_{oss}			-	170	-	
Gate-source threshold voltage	C_{rss}			-	18	-	
Gate-source leakage	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 8.0\text{ A}$, $V_{DS} = 400\text{ V}$ see fig. 6 and 13 ^b	-	-	39	nC
Zero gate voltage drain current	Q_{gs}			-	-	10	
	Q_{gd}			-	-	19	
Drain-source on-state resistance	$t_{d(on)}$	$V_{DD} = 250\text{ V}$, $I_D = 8.0\text{ A}$, $R_g = 9.1\text{ }\Omega$, $R_D = 30\text{ }\Omega$ see fig. 10 ^b		-	12	-	ns
Forward transconductance	t_r			-	25	-	
Drain-source breakdown voltage	$t_{d(off)}$			-	27	-	
V_{DS} temperature coefficient	t_f			-	19	-	
Gate input resistance	R_g	$f = 1\text{ MHz}$, open drain		0.7	-	3.7	Ω
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 		-	-	8.0	A
Pulsed diode forward current ^a	I_{SM}			-	-	28	
Body diode voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}$, $I_S = 8.0\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	-	2.0	V
Body diode reverse recovery time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$, $I_F = 8.0\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}^b$		-	490	740	ns
Body diode reverse recovery charge	Q_{rr}			-	3.0	4.5	μC
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)

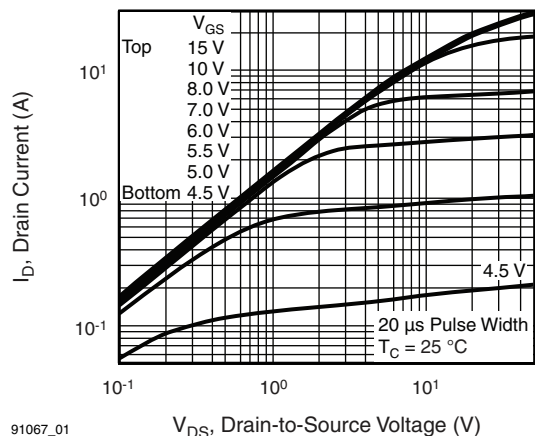


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ °C}$

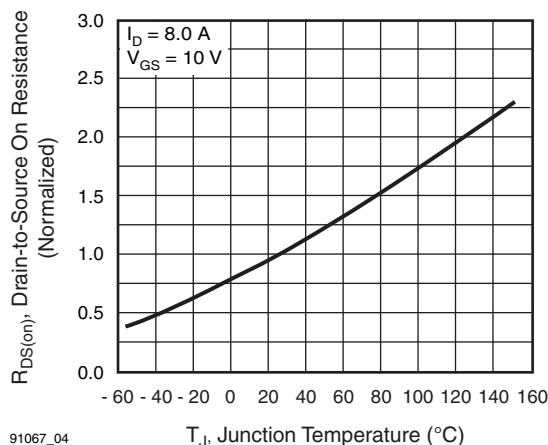


Fig. 4 - Normalized On-Resistance vs. Temperature

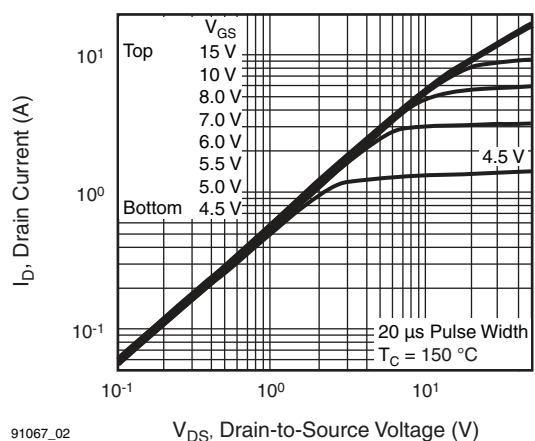


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ °C}$

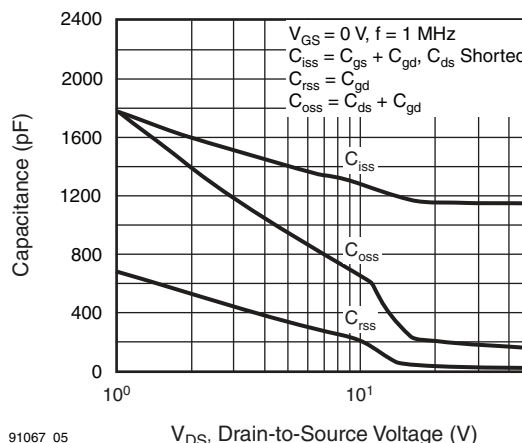


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

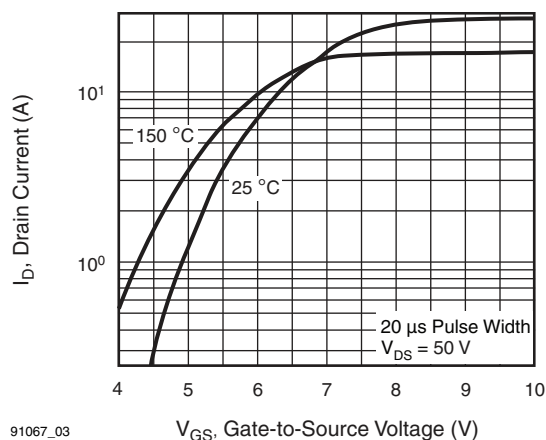


Fig. 3 - Typical Transfer Characteristics

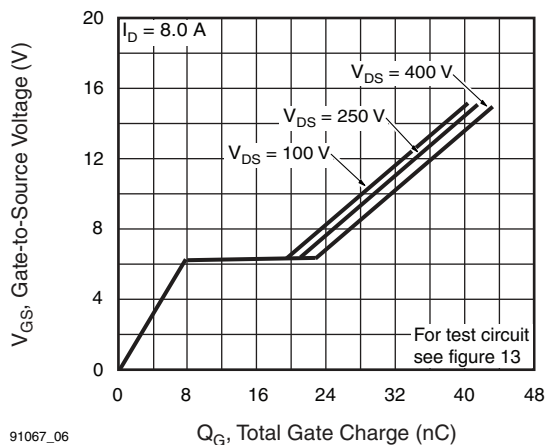
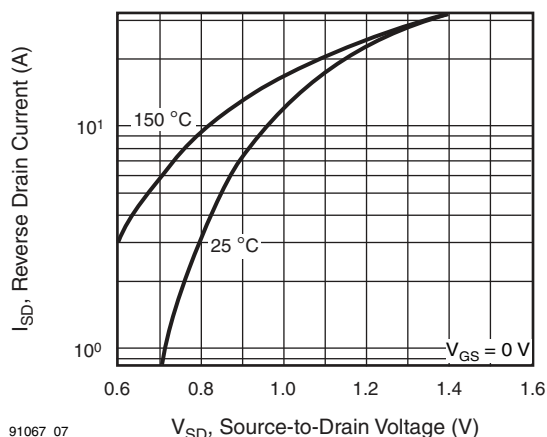
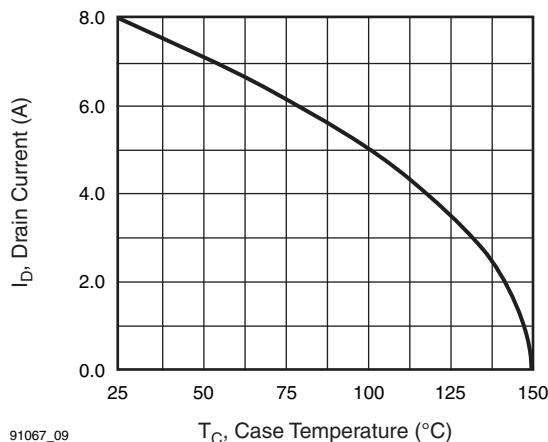
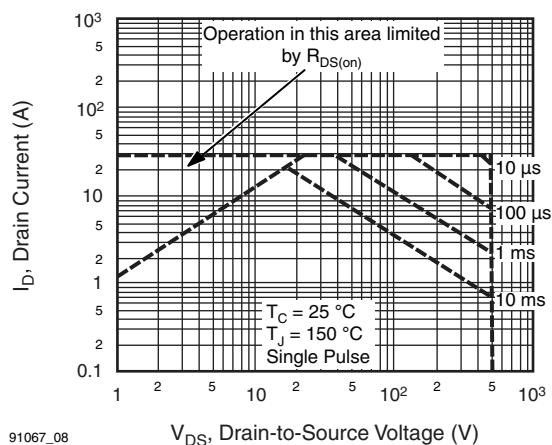
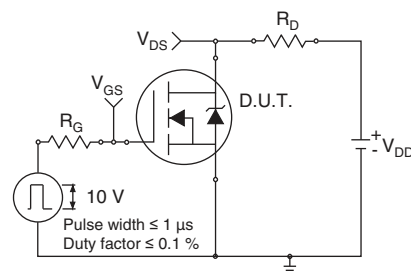
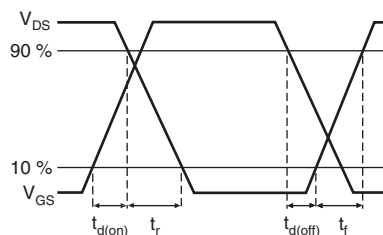
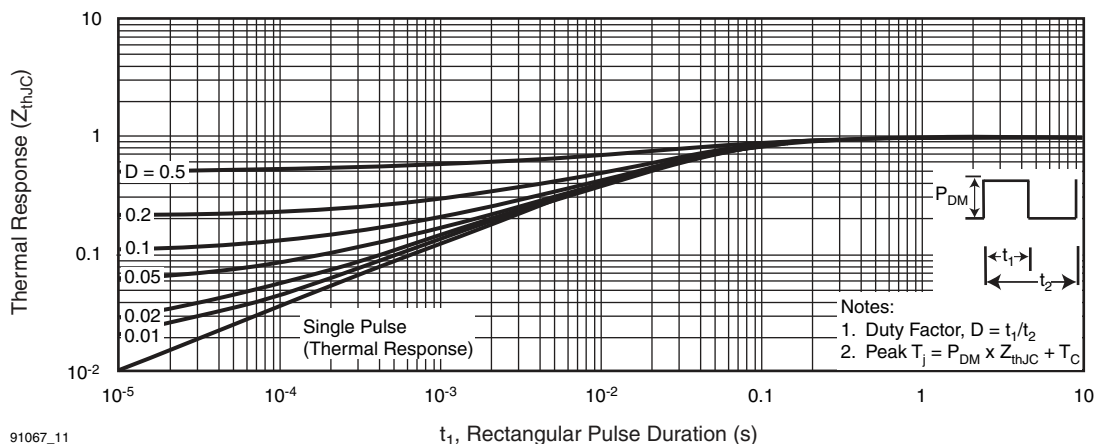
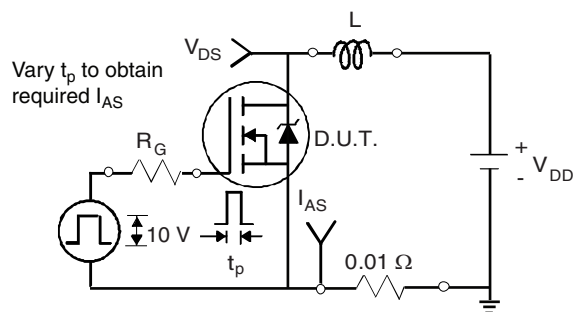
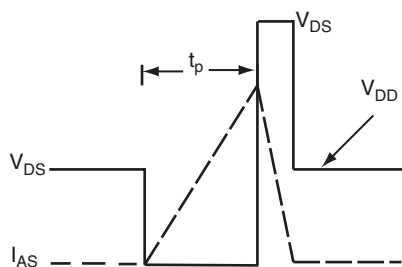
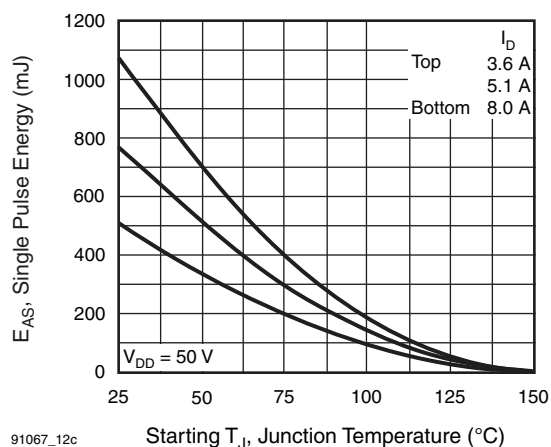
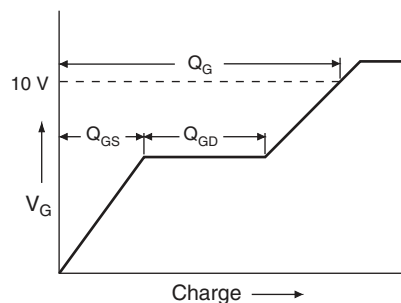
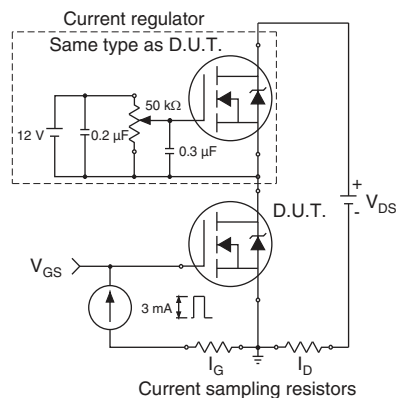


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage


Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Maximum Safe Operating Area

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 Circuit

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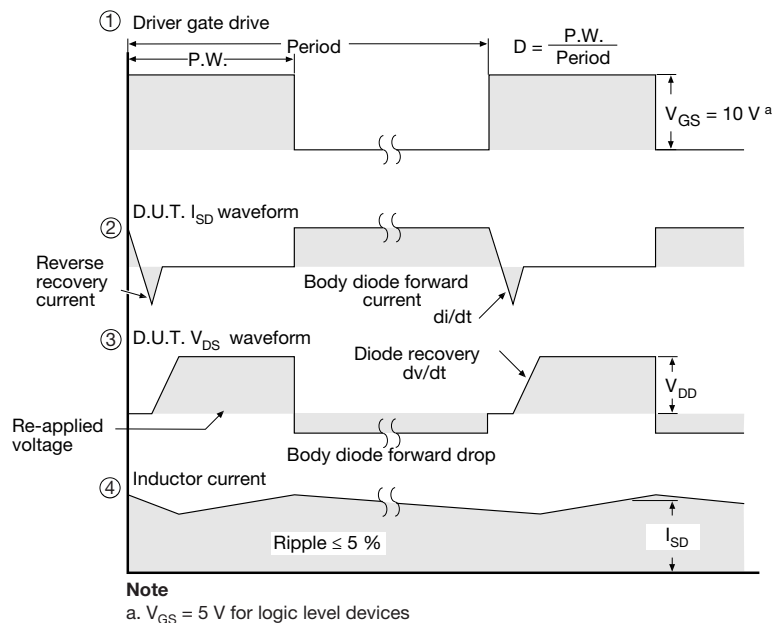
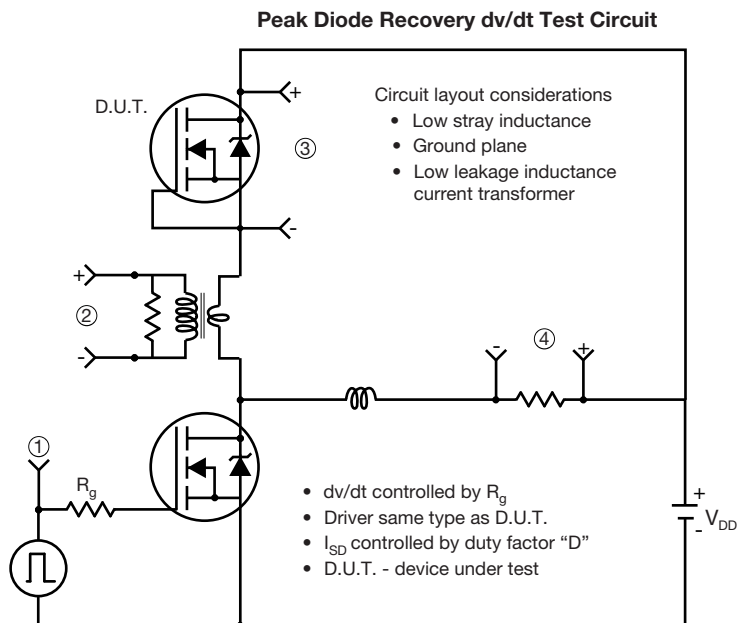


Fig. 14 - For N-Channel

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