

# SMPS MOSFET IRF840APbF

® Power MOSFET

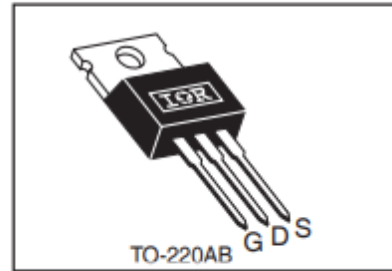
## Applications

- Switch Mode Power Supply ( SMPS )
- Uninterruptable Power Supply
- High speed power switching
- Lead-Free

## Benefits

- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective Coss Specified (See AN1001)

$V_{DSS}$	$R_{ds(on)}$ max	$I_D$
500V	0.85Ω	8.0A



## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D$ @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	8.0	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	5.1	
$I_{DM}$	Pulsed Drain Current ①	32	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ②	5.0	V/ns
$T_J$	Operating Junction and Storage Temperature Range	-55 to + 150	°C
$T_{STG}$			
	Soldering Temperature, for 10 seconds	300 (1.6mm from case )	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

## Typical SMPS Topologies:

- Two Transistor Forward
- Haft Bridge
- Full Bridge

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Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.58	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.85	$\Omega$	$V_{GS} = 10V, I_D = 4.8A$ ①
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25 250	$\mu A$	$V_{DS} = 500V, V_{GS} = 0V$ $V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -30V$

Dynamic @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$g_{fs}$	Forward Transconductance	3.7	—	—	S	$V_{DS} = 50V, I_D = 4.8A$
$Q_g$	Total Gate Charge	—	—	38	nC	$I_D = 8.0A$
$Q_{gs}$	Gate-to-Source Charge	—	—	9.0		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	18	ns	$V_{GS} = 10V$ , See Fig. 6 and 13 ①
$t_{d(on)}$	Turn-On Delay Time	—	11	—		$V_{DD} = 250V$
$t_r$	Rise Time	—	23	—		$I_D = 8.0A$
$t_{d(off)}$	Turn-Off Delay Time	—	26	—		$R_G = 9.1\Omega$
$t_f$	Fall Time	—	19	—		$R_D = 31\Omega$ , See Fig. 10 ①
$C_{iss}$	Input Capacitance	—	1018	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	155	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	8.0	—		$f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	1490	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	42	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$
$C_{oss\ eff.}$	Effective Output Capacitance	—	56	—		$V_{GS} = 0V, V_{DS} = 0V$ to $400V$ ①

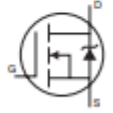
## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ①	—	510	mJ
$I_{AR}$	Avalanche Current ①	—	8.0	A
$E_{AR}$	Repetitive Avalanche Energy ①	—	13	mJ

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.0	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	8.0	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	32		
$V_{SD}$	Diode Forward Voltage	—	—	2.0	V	$T_J = 25^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$ ①
$t_{rr}$	Reverse Recovery Time	—	422	633	ns	$T_J = 25^\circ\text{C}, I_F = 8.0A$
$Q_{rr}$	Reverse Recovery Charge	—	2.16	3.24	$\mu\text{C}$	$di/dt = 100A/\mu\text{s}$ ①
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

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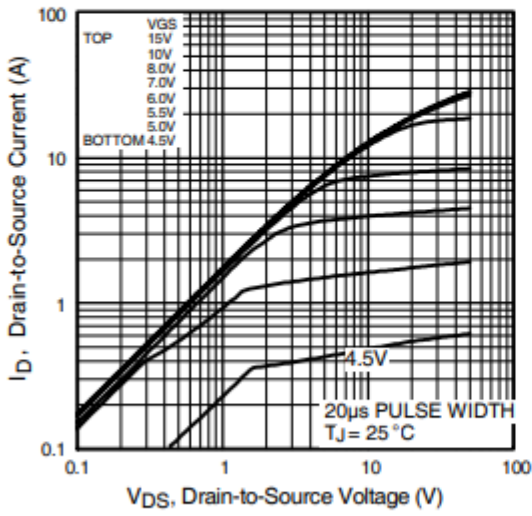


Fig 1. Typical Output Characteristics

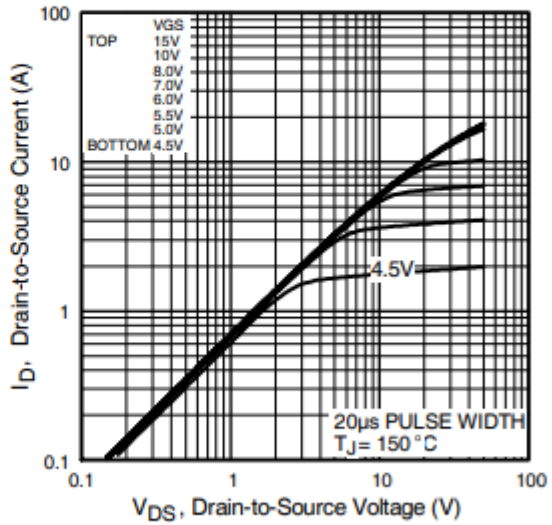


Fig 2. Typical Output Characteristics

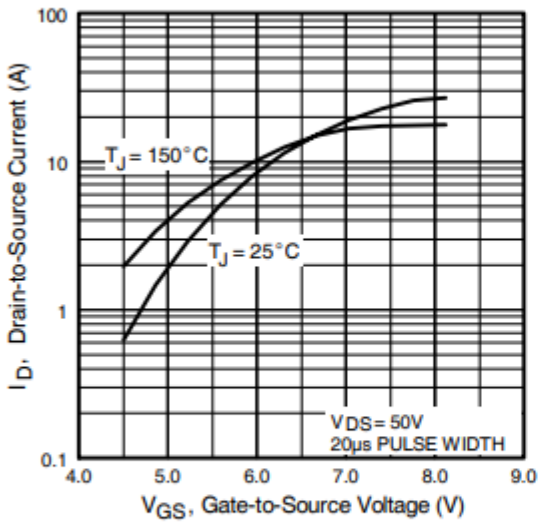


Fig 3. Typical Transfer Characteristics

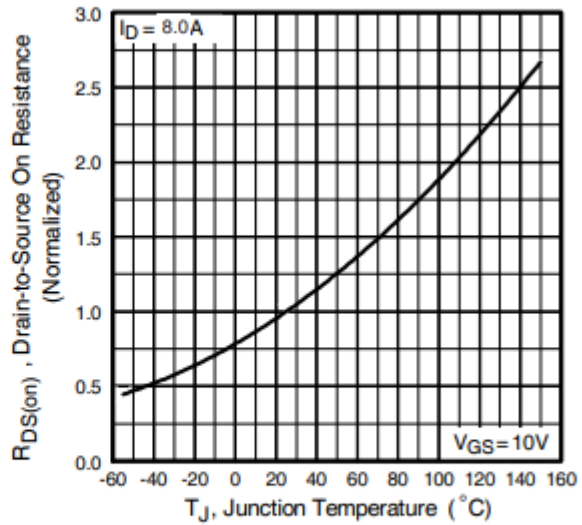
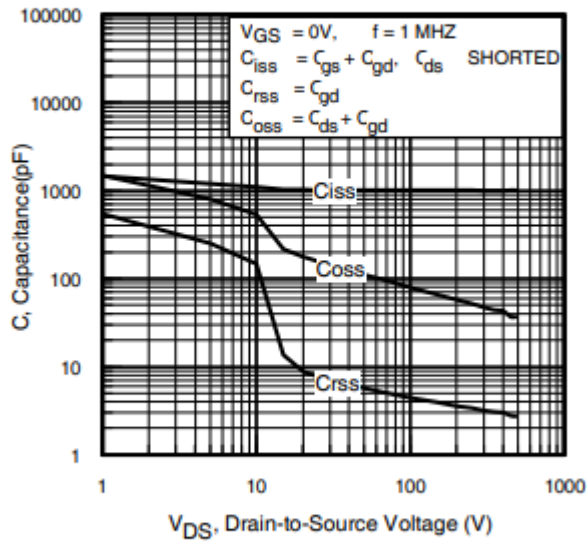
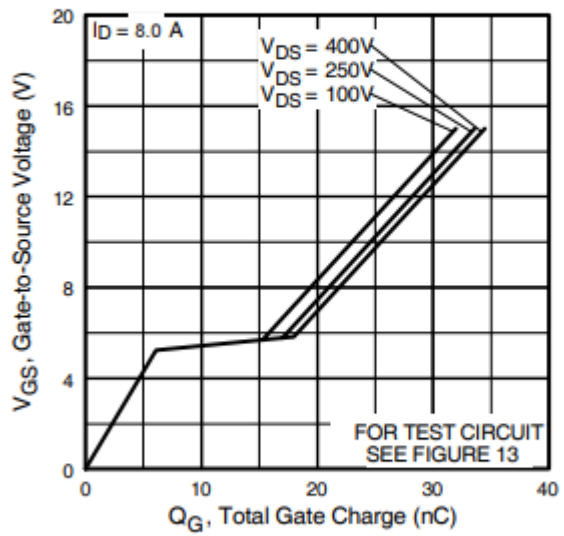


Fig 4. Normalized On-Resistance Vs. Temperature

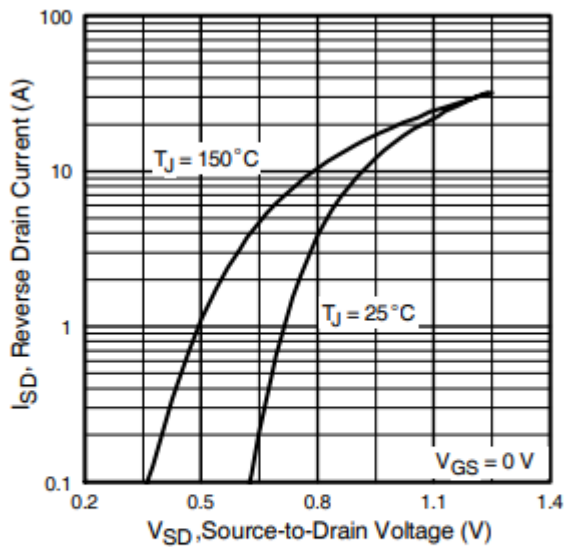
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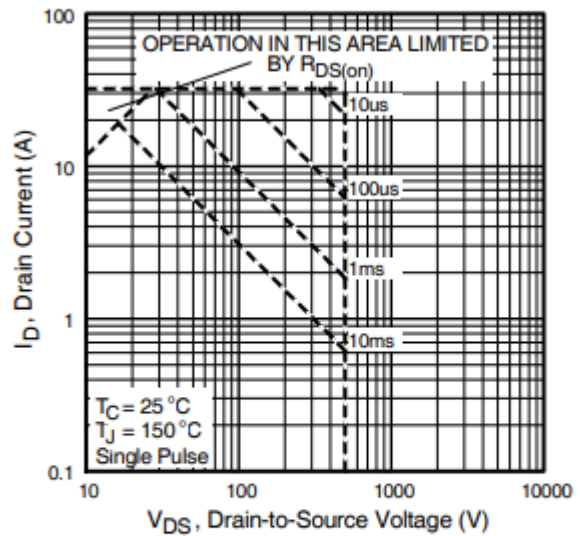
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

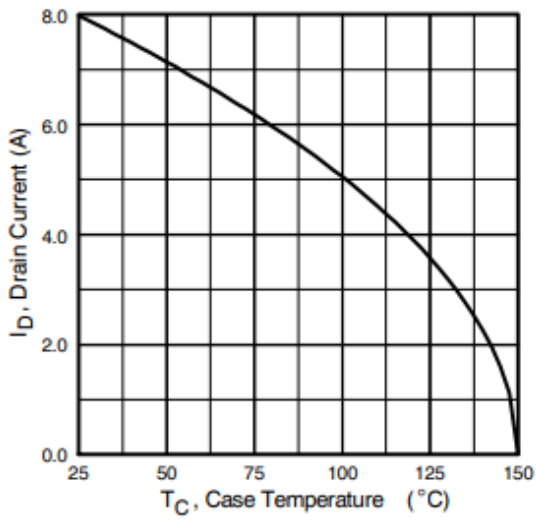


**Fig 7.** Typical Source-Drain Diode Forward Voltage

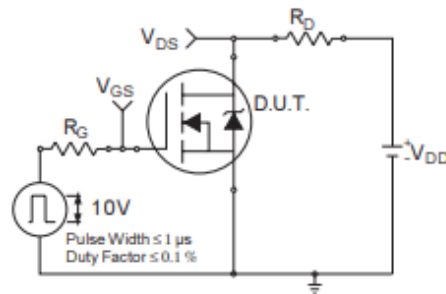


**Fig 8.** Maximum Safe Operating Area

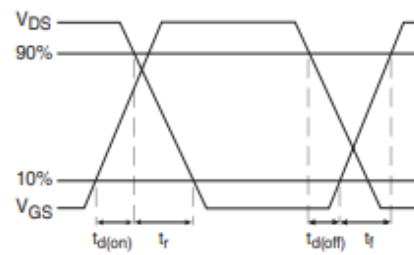
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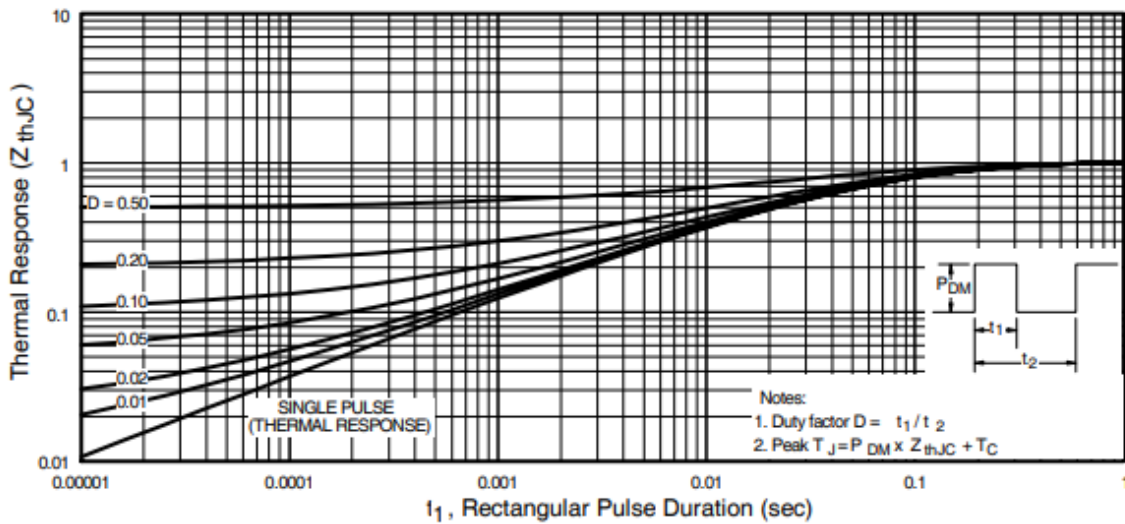
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit

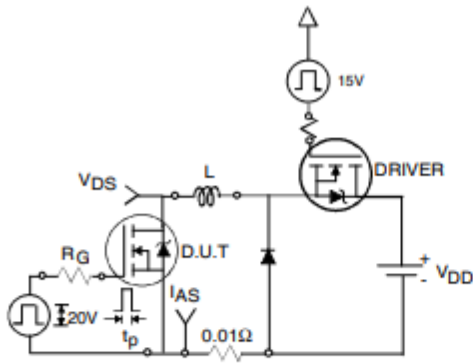


**Fig 10b.** Switching Time Waveforms

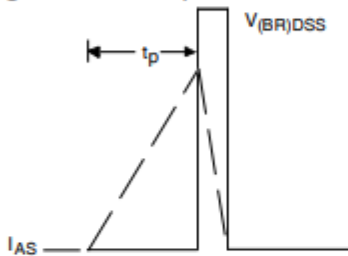


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

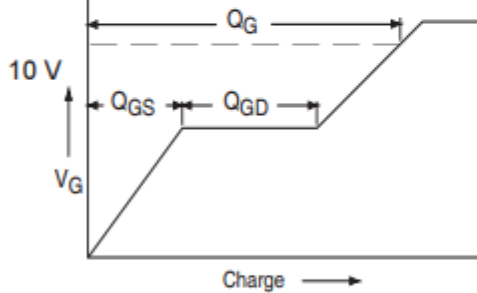
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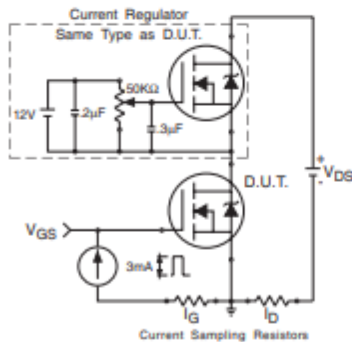
**Fig 12a.** Unclamped Inductive Test Circuit



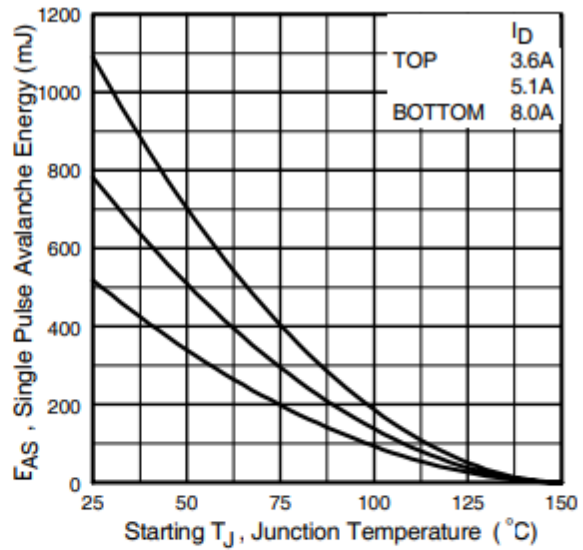
**Fig 12b.** Unclamped Inductive Waveforms



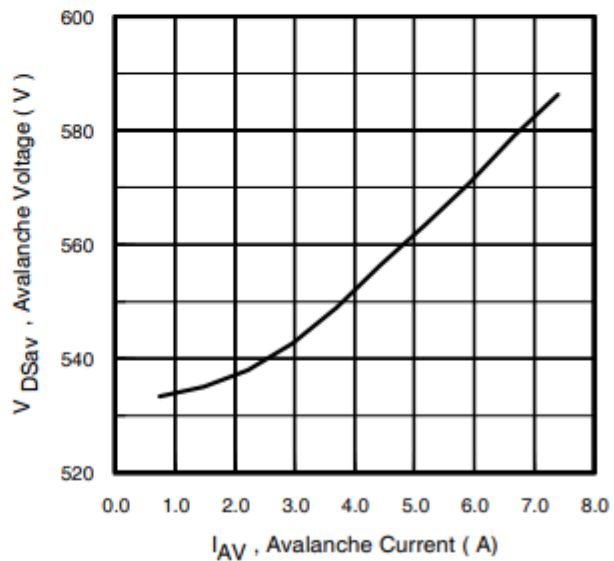
**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12d.** Typical Drain-to-Source Voltage Vs. Avalanche Current