

Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	400	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	1.8
Q_g (Max.) (nC)	20	
Q_{gs} (nC)	3.3	
Q_{gd} (nC)	11	
Configuration	Single	

FEATURES

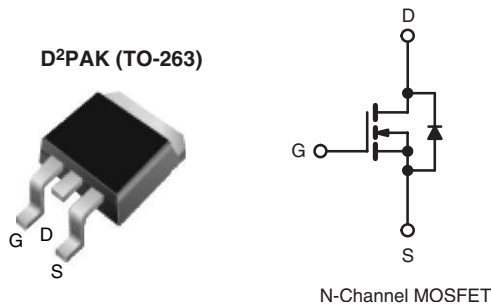
- Surface Mount
- Available in Tape and Reel
- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available


 Available
RoHS*
 COMPLIANT

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 D²PAK (TO-263) is a surface mount power package capable of accommodating die size up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²PAK (TO-263) is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface mount application.



ORDERING INFORMATION		
Package	D ² PAK (TO-263)	D ² PAK (TO-263)
Lead (Pb)-free	IRF720SPbF	IRF720STRRPbF ^a
	SiHF720S-E3	SiHF720STR-E3 ^a
SnPb	IRF720S	-
	SiHF720S	-

Note

- a. See device orientation.

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	400	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current	V_{GS} at 10 V	I_D	$T_C = 25$ °C	A
			$T_C = 100$ °C	
Pulsed Drain Current ^a		I_{DM}	13	W/°C
Linear Derating Factor			0.40	
Linear Derating Factor (PCB Mount) ^e			0.025	
Single Pulse Avalanche Energy ^b		E_{AS}	190	mJ
Avalanche Current ^a		I_{AR}	3.3	A
Repetitive Avalanche Energy ^a		E_{AR}	5.0	mJ
Maximum Power Dissipation	$T_C = 25$ °C	P_D	50	W
Maximum Power Dissipation (PCB Mount) ^e	$T_A = 25$ °C		3.1	
Peak Diode Recovery dV/dt^c		dV/dt	4.0	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s		300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 30$ mH, $R_G = 25$ Ω , $I_{AS} = 3.3$ A (see fig. 12).
- $I_{SD} \leq 3.3$ A, $dI/dt \leq 65$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Ambient (PCB Mount) ^a	R_{thJA}	-	40	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	2.5	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		400	-	- V	
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.51	- $V/^\circ\text{C}$	
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}	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100\text{ nA}$	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$		-	-	25 μA	
		$V_{DS} = 320\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250 μA	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 2.0\text{ A}^b$	-	-	1.8 Ω	
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 2.0\text{ A}^b$		1.7	-	- S	
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	410	-	
Output Capacitance	C_{oss}			-	120	-	pF
Reverse Transfer Capacitance	C_{rss}			-	47	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 3.3\text{ A}, V_{DS} = 320\text{ V}$, see fig. 6 and 13 ^b	-	-	20	
Gate-Source Charge	Q_{gs}			-	-	3.3	nC
Gate-Drain Charge	Q_{gd}			-	-	11	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 200\text{ V}, I_D = 3.3\text{ A}, R_G = 18\text{ }\Omega, R_D = 56\text{ }\Omega$, see fig. 10 ^b		-	10	-	
Rise Time	t_r			-	14	-	ns
Turn-Off Delay Time	$t_{d(off)}$			-	30	-	
Fall Time	t_f			-	13	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	
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		-	-	3.3	
Pulsed Diode Forward Current ^a	I_{SM}			-	-	13	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 3.3\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.6 V	
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 3.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	270	600 ns	
Body Diode Reverse Recovery Charge	Q_{rr}			-	1.4	3.0 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

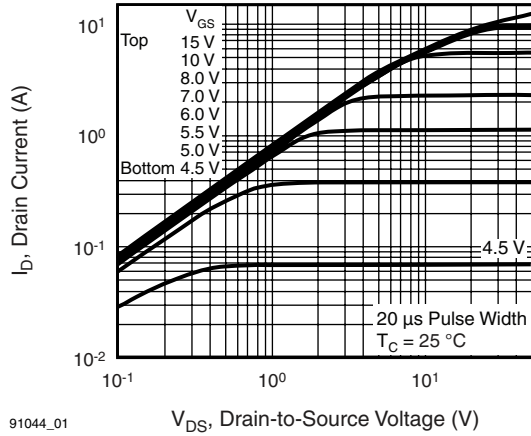


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

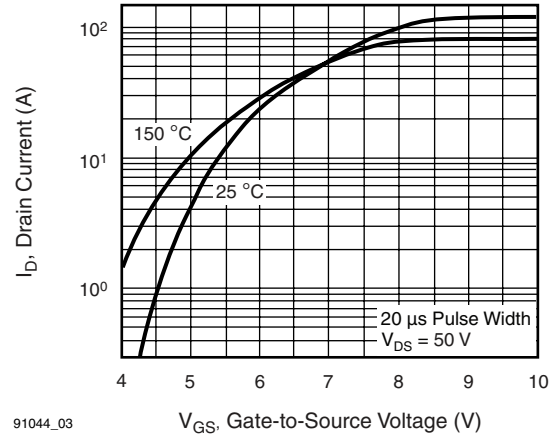


Fig. 3 - Typical Transfer Characteristics

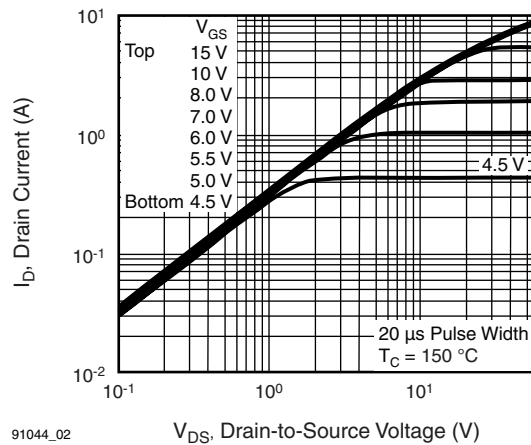


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

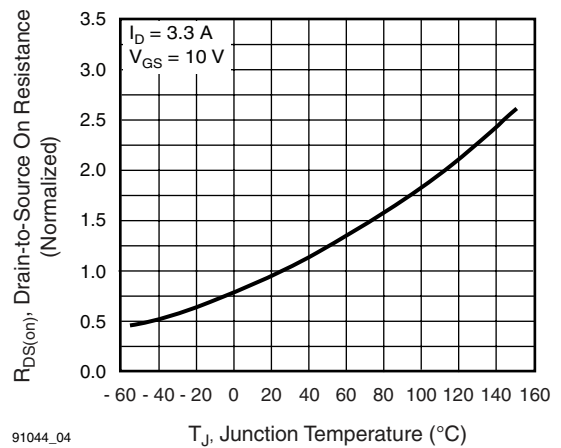
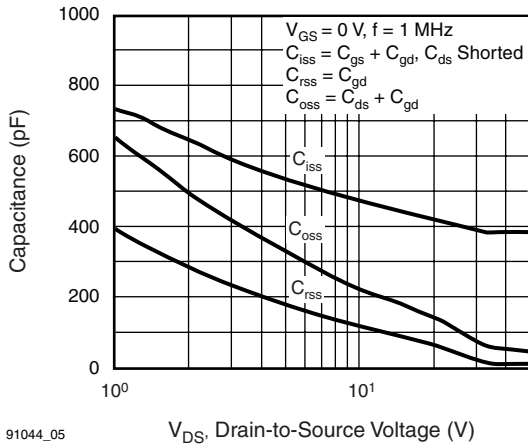
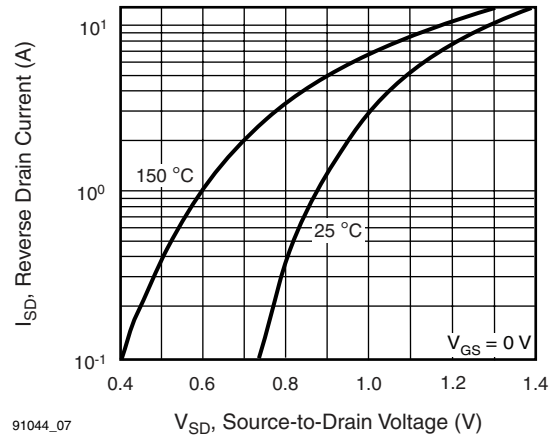


Fig. 4 - Normalized On-Resistance vs. Temperature



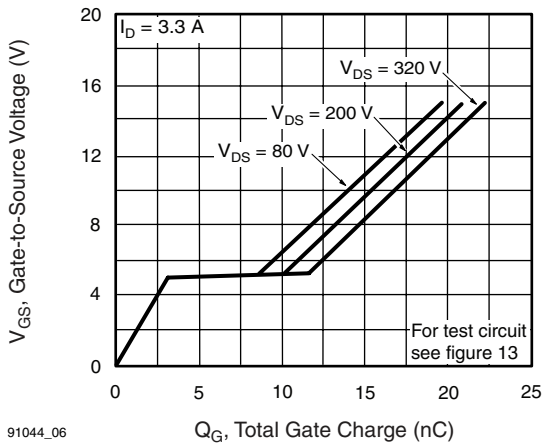
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Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



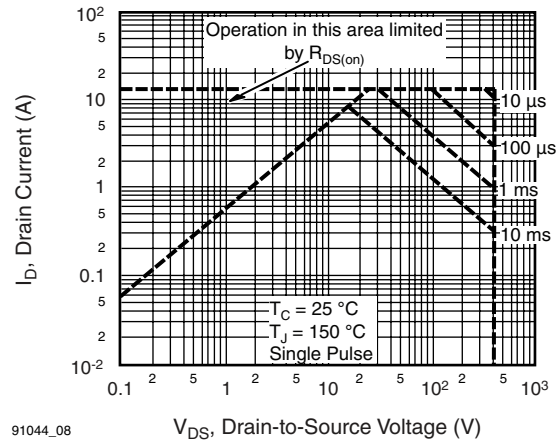
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Fig. 7 - Typical Source-Drain Diode Forward Voltage



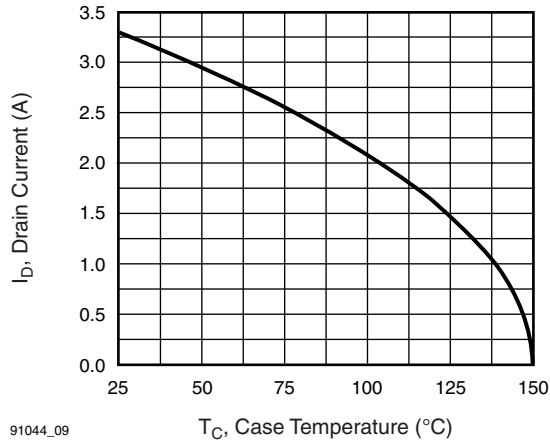
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Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



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Fig. 8 - Maximum Safe Operating Area



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Fig. 9 - Maximum Drain Current vs. Case Temperature

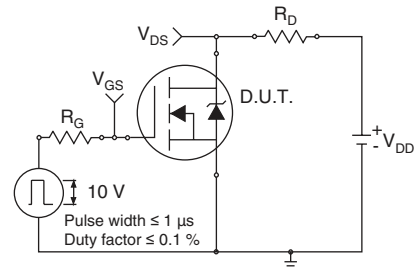


Fig. 10a - Switching Time Test Circuit

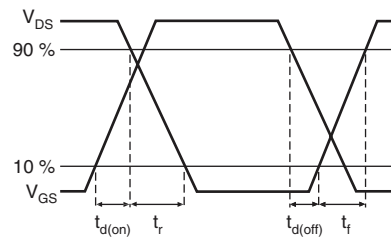
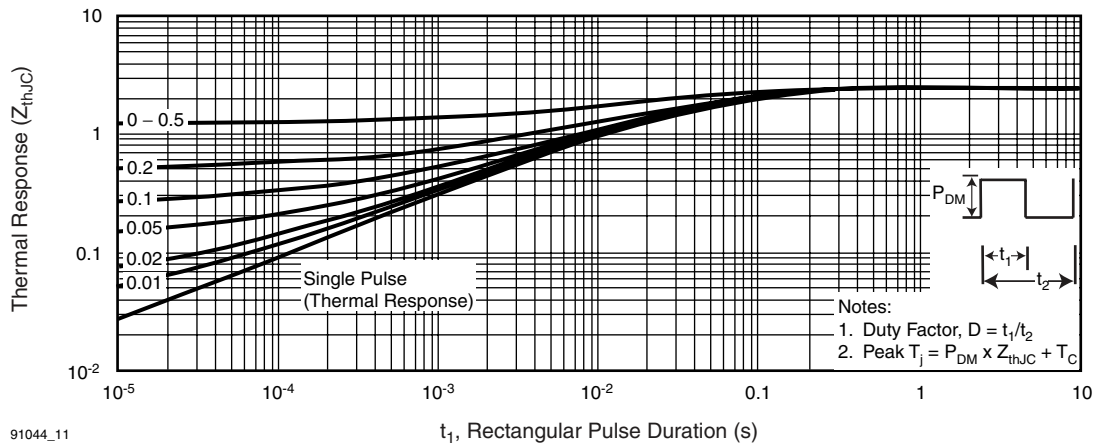


Fig. 10b - Switching Time Waveforms



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

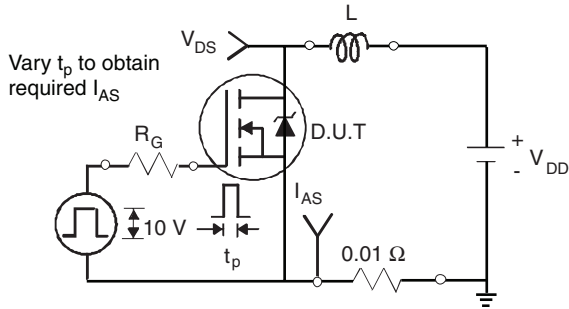
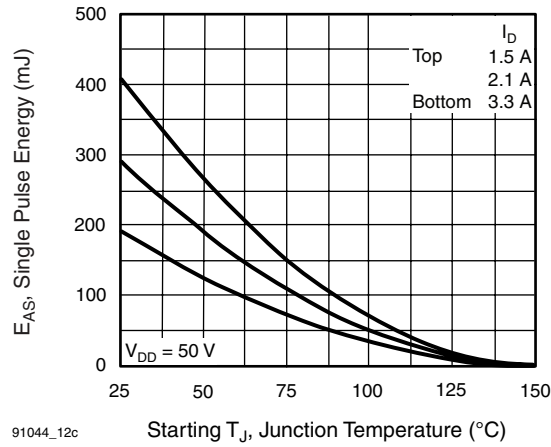


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms



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

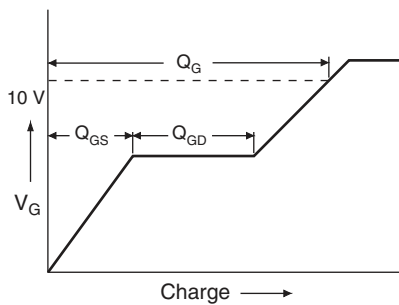


Fig. 13a - Basic Gate Charge Waveform

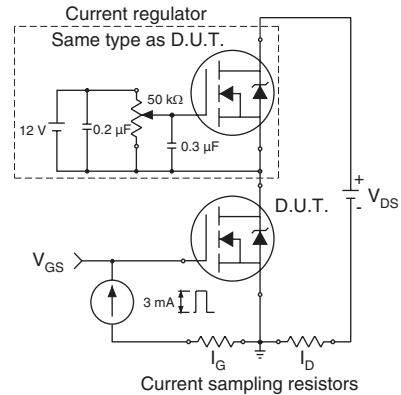
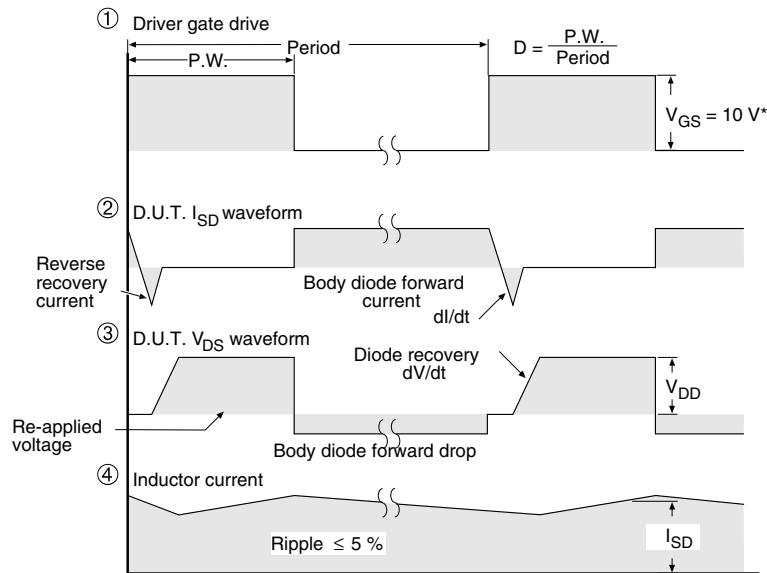


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



* $V_{GS} = 5V$ for logic level devices

Fig. 14 - For N-Channel

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