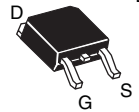


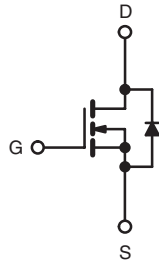
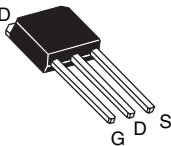
## Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	60
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$ 0.10
$Q_g$ (Max.) (nC)	25
$Q_{gs}$ (nC)	5.8
$Q_{gd}$ (nC)	11
Configuration	Single

**DPAK**  
(TO-252)



**IPAK**  
(TO-251)



N-Channel MOSFET

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Dynamic  $dV/dt$  Rating
- Surface Mount (IRFR020, SiHFR020)
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC

### 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 DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques.

ORDERING INFORMATION			
Package	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and Halogen-free	SiHFR020-GE3	SiHFR020TR-GE3	SiHFU020-GE3
Lead (Pb)-free	IRFR020PbF	IRFR020TRPbF <sup>a</sup>	IRFU020PbF
	SiHFR020-E3	SiHFR020T-E3 <sup>a</sup>	SiHFU020-E3
SnPb	IRFR020	IRFR020TR <sup>a</sup>	IRFU020
	SiHFR020	SiHFR020T <sup>a</sup>	SiHFU020

#### Note

- a. See device orientation.

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	$V_{GS}$		$\pm 20$	
Continuous Drain Current	$V_{GS}$ at 10 V	$T_C = 25\text{ }^\circ\text{C}$	14	A
		$T_C = 100\text{ }^\circ\text{C}$	9.0	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$		56	W/ $^\circ\text{C}$
Linear Derating Factor			0.33	
Linear Derating Factor (PCB Mount) <sup>e</sup>			0.020	
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$		91	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$		42	W
Maximum Power Dissipation (PCB Mount) <sup>e</sup>	$T_A = 25\text{ }^\circ\text{C}$		2.5	
Peak Diode Recovery $dV/dt^c$	$dV/dt$		5.5	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$		- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)	for 10 s		260 <sup>d</sup>	

#### Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b.  $V_{DD} = 25\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 541\text{ }\mu\text{H}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 14\text{ A}$  (see fig. 12).  
 c.  $I_{SD} \leq 17\text{ A}$ ,  $dI/dt \leq 110\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .  
 d. 1.6 mm from case.  
 e. When mounted on 1" square PCB (FR-4 or G-10 material).

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

# IRFR020, IRFU020, SiHFR020, SiHFU020

THERMAL RESISTANCE RATINGS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Maximum Junction-to-Ambient	$R_{thJA}$	-	-	110	°C/W	
Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup>	$R_{thJA}$	-	-	50		
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	-	3.0		

**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
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		60	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.073	-	V/°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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 8.4\text{ A}^b$	-	-	0.10	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 25\text{ V}, I_D = 8.4\text{ A}$		6.2	-	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$ , see fig. 5		-	640	-	pF
Output Capacitance	$C_{oss}$			-	360	-	
Reverse Transfer Capacitance	$C_{rss}$			-	79	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 17\text{ A}, V_{DS} = 48\text{ V},$ see fig. 6 and 13 <sup>b</sup>	-	-	25	nC
Gate-Source Charge	$Q_{gs}$			-	-	5.8	
Gate-Drain Charge	$Q_{gd}$			-	-	11	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, I_D = 17\text{ A},$ $R_G = 18\text{ }\Omega, R_D = 1.7\text{ }\Omega$ , see fig. 10 <sup>b</sup>		-	13	-	ns
Rise Time	$t_r$			-	58	-	
Turn-Off Delay Time	$t_{d(off)}$			-	25	-	
Fall Time	$t_f$			-	42	-	
Internal Drain Inductance	$L_D$	Between lead, 6 mm (0.25") from package and center of die contact <sup>c</sup>		-	4.5	-	nH
Internal Source Inductance	$L_S$			-	7.5	-	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	14	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$			-	-	56	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 14\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.5	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = 17\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	88	180	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	0.29	0.64	$\mu\text{C}$
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

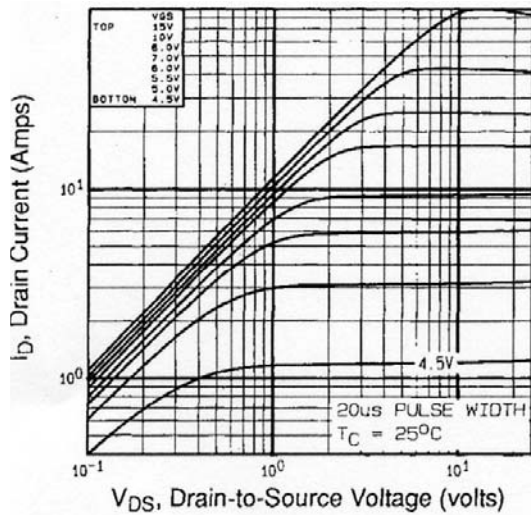


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$

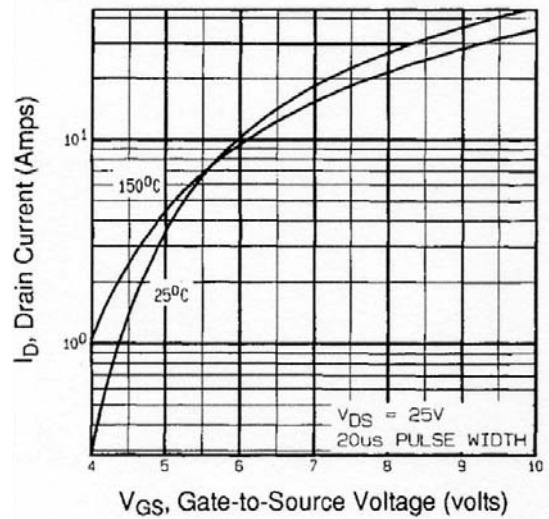


Fig. 3 - Typical Transfer Characteristics

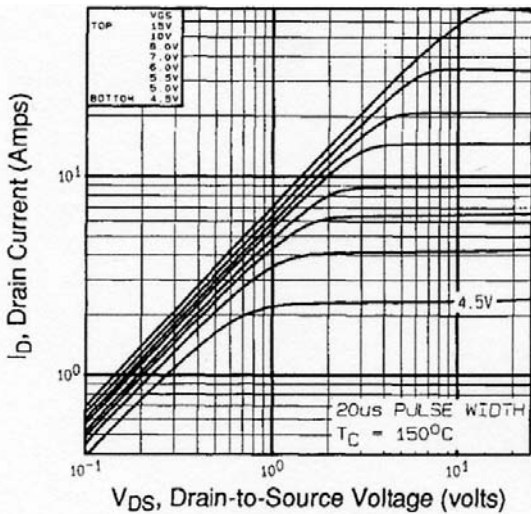


Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$

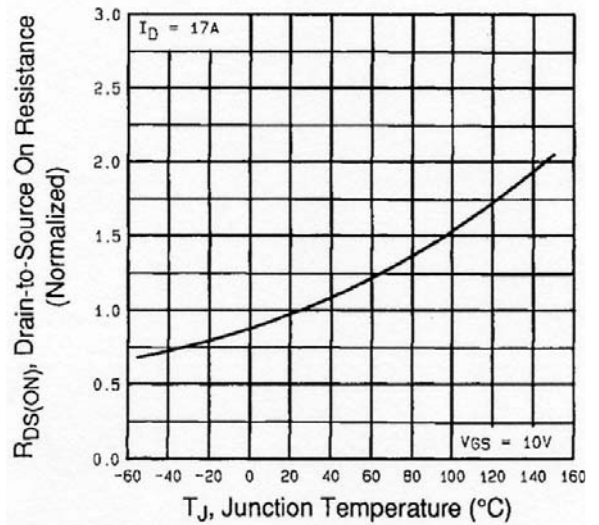


Fig. 4 - Normalized On-Resistance vs. Temperature