

August 1991

### Features

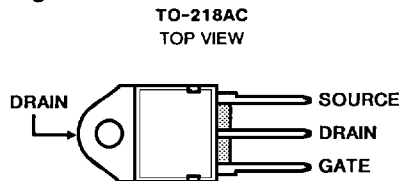
- 45A, 50V and 60V
- $r_{DS(on)} = 0.040\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device
- High-Current, Low-Inductance Package

### Description

The RFH45N05 and RFH45N06 are n-channel enhancement-mode silicon-gate power field-effect transistors designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. These types can be operated directly from integrated circuits.

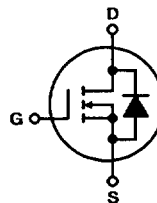
The RFH-types are supplied in the JEDEC TO-218AC plastic package.

### Package



### Terminal Diagram

#### N-CHANNEL ENHANCEMENT MODE



### Absolute Maximum Ratings ( $T_C = +25^\circ\text{C}$ ), Unless Otherwise Specified

	RFH45N05	RFH45N06	UNITS	
Drain-Source Voltage .....	$V_{DS}$	50	60	V
Drain-Gate Voltage ( $R_{GS} = 1M\Omega$ ) .....	$V_{DGR}$	50	60	V
Continuous Drain Current .....	$I_D$	45	45	A
Pulsed Drain Current .....	$I_{DM}$	100	100	A
Gate-Source Voltage .....	$V_{GS}$	$\pm 20$	$\pm 20$	V
Maximum Power Dissipation				
$T_C = +25^\circ\text{C}$ .....	$P_D$	150	150	W
Linear Derating Factor .....		1.2	1.2	W/ $^\circ\text{C}$
Operating and Storage Temperature .....	$T_J, T_{STG}$	-55 to +150	-55 to +150	$^\circ\text{C}$

## Specifications RFH45N05, RFH45N06

**ELECTRICAL CHARACTERISTICS, at Case Temperature ( $T_c$ ) = 25°C unless otherwise specified.**

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFH45N05		RFH45N06		
			Min.	Max.	Min.	Max.	
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D = 1 \text{ mA}$ $V_{GS} = 0$	50	—	60	—	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$ $I_D = 1 \text{ mA}$	2	4	2	4	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40 \text{ V}$ $V_{DS} = 50 \text{ V}$	—	1	—	—	$\mu\text{A}$
		$T_c = 125^\circ\text{C}$ $V_{DS} = 40 \text{ V}$ $V_{DS} = 50 \text{ V}$	—	50	—	50	
			—	—	—	—	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}$ $V_{DS} = 0$	—	100	—	100	nA
Drain-Source On Voltage	$V_{DS(on)}^{\#}$	$I_D = 22.5 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	0.9	—	0.9	V
		$I_D = 45 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	3.6	—	3.6	
Static Drain-Source On Resistance	$r_{DS(on)}^{\#}$	$I_D = 22.5 \text{ A}$ $V_{GS} = 10 \text{ V}$	—	.04	—	.04	$\Omega$
Forward Transconductance	$g_{fs}^{\#}$	$V_{DS} = 10 \text{ V}$ $I_D = 22.5 \text{ A}$	10	—	10	—	mho
Input Capacitance	$C_{iss}$	$V_{DS} = 25 \text{ V}$	—	3000	—	3000	pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0 \text{ V}$	—	1800	—	1800	
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{MHz}$	—	750	—	750	
Turn-On Delay Time	$t_d(on)$	$V_{DS} = 30 \text{ V}$	40(typ)	80	40(typ)	80	ns
Rise Time	$t_r$	$I_D = 22.5 \text{ A}$	310(typ)	475	310(typ)	475	
Turn-Off Delay Time	$t_d(off)$	$R_{\theta en} = R_{\theta gs} = 50\Omega$	220(typ)	350	220(typ)	350	
Fall Time	$t_f$	$V_{GS} = 10 \text{ V}$	240(typ)	375	240(typ)	375	
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	RFH45N05, RFH45N06 Series	—	0.83	—	0.83	$^\circ\text{C/W}$

$\#$ Pulsed: Pulse duration = 300  $\mu\text{s}$  max., duty cycle = 2%.

### SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			RFH45N05		RFH45N06		
			Min.	Max.	Min.	Max.	
Diode Forward Voltage	$V_{SD}^*$	$I_{SD} = 22.5\text{A}$	—	1.4	—	1.4	V
Reverse Recovery Time	$t_{rr}$	$I_F = 4\text{A}$ , $d_f/d_r = 100 \text{ A}/\mu\text{s}$	150 (typ.)		150 (typ.)		ns

\* Pulse Test: Width  $\leq 300 \mu\text{s}$ , Duty cycle  $\leq 2\%$ .

**4**  
**N-CHANNEL POWER MOSFETS**

# RFH45N05, RFH45N06

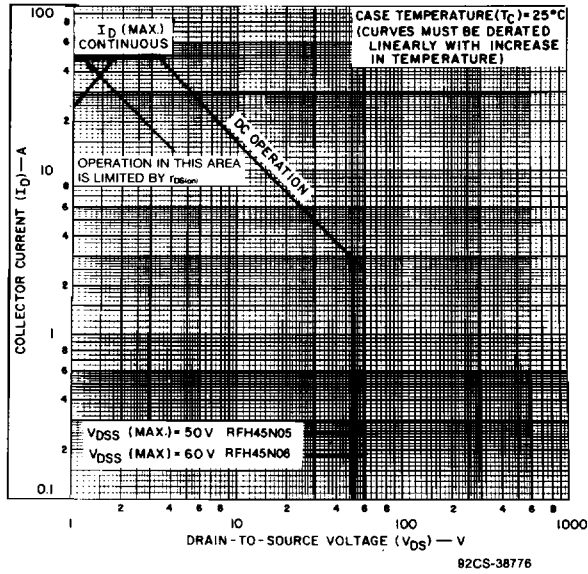


Fig. 1 - Maximum safe operating areas for all types.

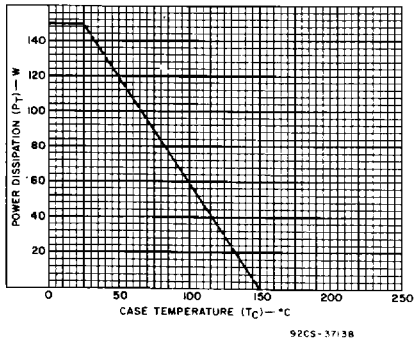


Fig. 2 - Power vs. temperature derating curve for all types.

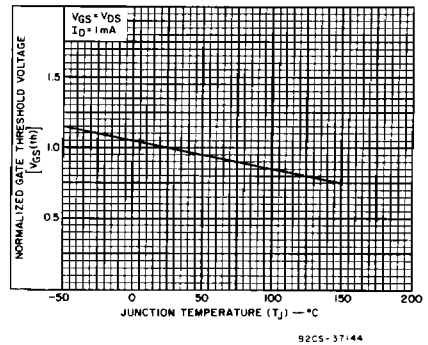


Fig. 3 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

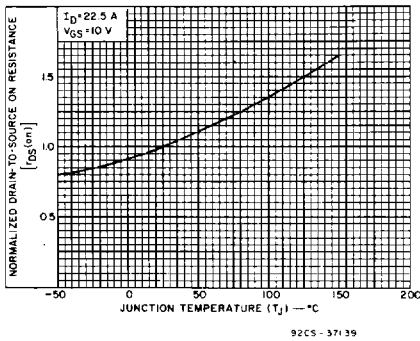


Fig. 4 - Normalized drain-to-source on resistance to junction temperature for all types.

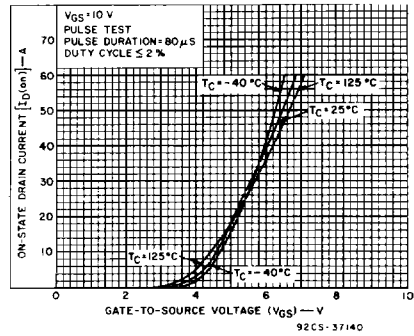


Fig. 5 - Typical transfer characteristics for all types.

# RFH45N05, RFH45N06

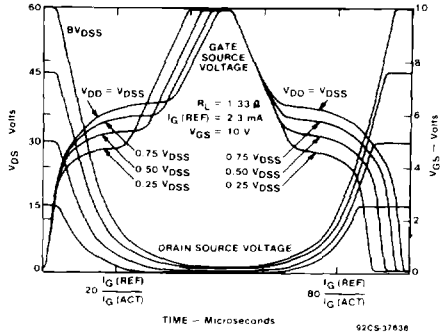


Fig. 6 - Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN-7254 and AN-7260

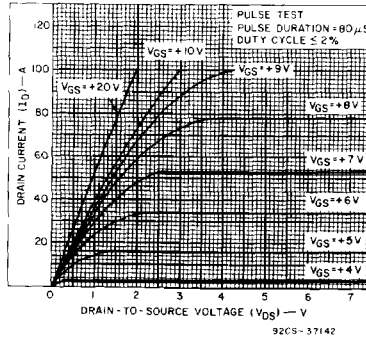


Fig. 7 - Typical saturation characteristics for all types.

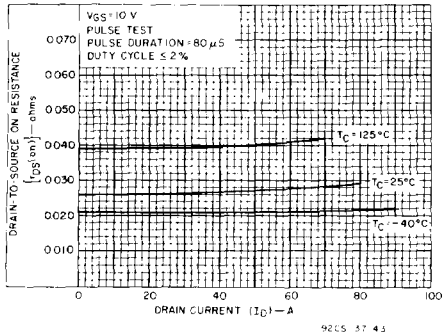


Fig. 8 - Typical drain-to-source on resistance as a function of drain current for all types.

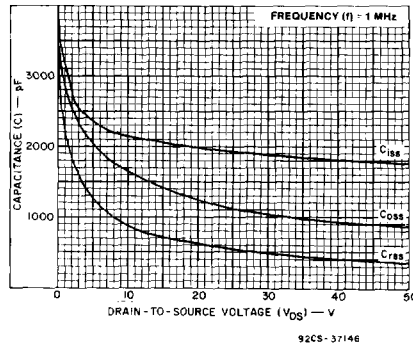


Fig. 9 - Capacitance as a function of drain-to-source voltage for all types.

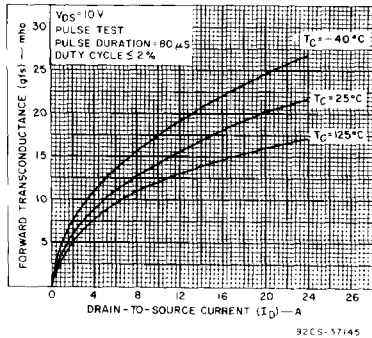


Fig. 10 - Typical forward transconductance as a function of drain current for all types.

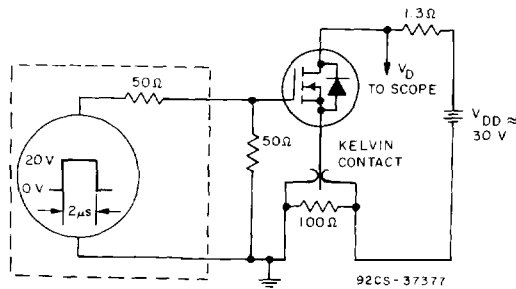


Fig. 11 - Switching Time Test Circuit.

4  
N-CHANNEL  
POWER MOSFETS