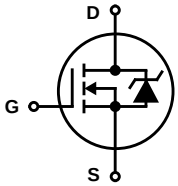
20A, 20V, 0.022 Ohm, N-Channel, Logic Level Power MOSFETs

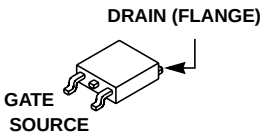
The HUF76013 is an application-specific MOSFET optimized for switching when used as the upper switch in synchronous buck applications. The low gate charge and low input capacitance results in lower driver and lower switching losses thereby increasing the overall system efficiency.

Symbol

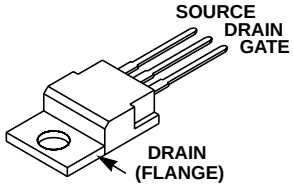


Packaging

HUF76013D3S
JEDEC TO-252AA



HUF76013P3
JEDEC TO-220AB



Features

- 20A, 20V
  - $r_{DS(ON)}$ = 0.022Ω, V_{GS} = 10V
  - $r_{DS(ON)}$ = 0.030Ω, V_{GS} = 5V
- PWM Optimized for Synchronous Buck Applications
- Fast Switching
- Low Gate Charge
  - Q_g Total 14nC (Typ)
- Low Capacitance
  - C_{ISS} 624pF (Typ)
  - C_{RSS} 71pF (Typ)

Ordering Information

PART NUMBER	PACKAGE	BRAND
HUF76013P3	TO-220AB	76013P
HUF76013D3S	TO-252AA	76013D

NOTE: When ordering, use the entire part number. Add the suffix T to obtain the HUF76013D3S in tape and reel, e.g., HUF76013D3ST.

Absolute Maximum Ratings $T_C = 25^oC$, Unless Otherwise Specified

SYMBOL	PARAMETER	HUF76013P3, HUF76013D3S	UNITS
V_{DSS}	Drain to Source Voltage (Note 1)	20	V
V_{DGR}	Drain to Gate Voltage (R_{GS} = 20kΩ) (Note 1)	20	V
V_{GS}	Gate to Source Voltage	±16	V
	Drain Current		
I_D	Continuous ($T_C = 25^oC$, V_{GS} = 10V) (Figure 2)	20	A
I_D	Continuous ($T_C = 100^oC$, V_{GS} = 5V)	20	A
I_{DM}	Pulsed Drain Current	Figure 4	A
P_D	Power Dissipation	50	W
	Derate Above 25^oC	0.4	$W/^oC$
T_J, T_{STG}	Operating and Storage Temperature	-55 to 150	^oC
	Maximum Temperature for Soldering		
T_L	Leads at 0.063in (1.6mm) from Case for 10s	300	^oC
T_{pkg}	Package Body for 10s, See Techbrief TB334	260	^oC
THERMAL SPECIFICATIONS			
$R_{\theta JC}$	Thermal Resistance Junction to Case, TO-220, TO-252	2.5	$^oC/W$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-220	62	$^oC/W$
	Thermal Resistance Junction to Ambient TO-252	100	$^oC/W$

NOTE:

1. $T_J = 25^oC$ to 125^oC.

CAUTION: *Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

Electrical Specifications $T_C = 25^oC$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
OFF STATE SPECIFICATIONS							
Drain to Source Breakdown Voltage	BV_{DSS}	I_D = 250µA, V_{GS} = 0V (Figure 11)		20	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20V, V_{GS} = 0V		-	-	1	µA
		V_{DS} = 20V, V_{GS} = 0V, $T_C = 150^oC$		-	-	250	µA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±16V		-	-	±100	nA
ON STATE SPECIFICATIONS							
Gate to Source Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250µA (Figure 10)		1	-	3	V
Drain to Source ON Resistance	$r_{DS(ON)}$	I_D = 20A, V_{GS} = 10V (Figures 8, 9)		-	0.018	0.022	W
		I_D = 20A, V_{GS} = 5V (Figure 8)		-	0.025	0.030	W
SWITCHING SPECIFICATIONS (V_{GS} = 5V)							
Turn-On Time	t_{ON}	V_{DD} = 10V, I_D = 20A V_{GS} = 5V, R_{GS} = 19Ω (Figures 14, 18, 19)		-	-	197	ns
Turn-On Delay Time	$t_{d(ON)}$			-	11	-	ns
Rise Time	t_r			-	120	-	ns
Turn-Off Delay Time	$t_{d(OFF)}$			-	19	-	ns
Fall Time	t_f			-	30	-	ns
Turn-Off Time	t_{OFF}			-	-	72	ns
SWITCHING SPECIFICATIONS (V_{GS} = 10V)							
Turn-On Time	t_{ON}	V_{DD} = 10V, I_D = 20A V_{GS} = 10V, R_{GS} = 19Ω (Figures 15, 18, 19)		-	-	151	ns
Turn-On Delay Time	$t_{d(ON)}$			-	7	-	ns
Rise Time	t_r			-	93	-	ns
Turn-Off Delay Time	$t_{d(OFF)}$			-	37	-	ns
Fall Time	t_f			-	29	-	ns
Turn-Off Time	t_{OFF}			-	-	100	ns
GATE CHARGE SPECIFICATIONS							
Total Gate Charge at 10V	$Q_{g(TOT)}$	V_{GS} = 0V to 10V	V_{DD} = 10V, I_D = 20A, $I_{g(REF)}$ = 1.0mA (Figures 13, 16, 17)	-	14.4	17	nC
Total Gate Charge at 5V	$Q_{g(TOT)}$	V_{GS} = 0V to 5V		-	7.8	9	nC
Threshold Gate Charge	$Q_{g(TH)}$	V_{GS} = 0V to 1V		-	0.9	1	nC
Gate to Source Gate Charge	Q_{gs}			-	3.5	-	nC
Gate to Drain “Miller” Charge	Q_{gd}			-	3.2	-	nC
CAPACITANCE SPECIFICATIONS							
Input Capacitance	C_{ISS}	V_{DS} = 20V, V_{GS} = 0V, f = 1MHz (Figure 12)		-	624	-	pF
Output Capacitance	C_{OSS}			-	444	-	pF
Reverse Transfer Capacitance	C_{RSS}			-	71	-	pF

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage	V_{SD}	I_{SD} = 20A	-	-	1.25	V
		I_{SD} = 10A	-	-	1.0	V
Reverse Recovery Time	t_{rr}	I_{SD} = 20A, dI_{SD}/dt = 100A/µs	-	-	55	ns
Reverse Recovered Charge	Q_{RR}	I_{SD} = 20A, dI_{SD}/dt = 100A/µs	-	-	82	nC

Typical Performance Curves

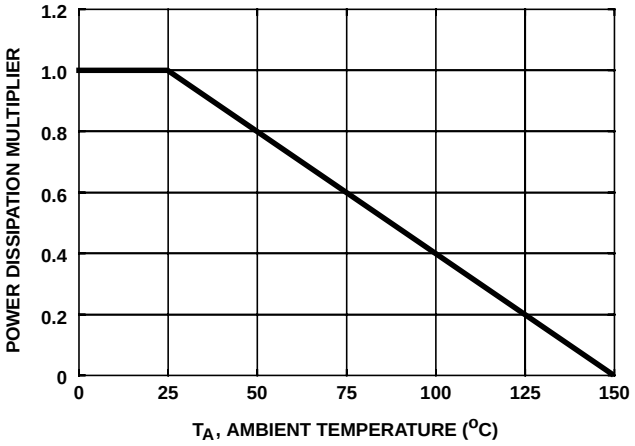


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

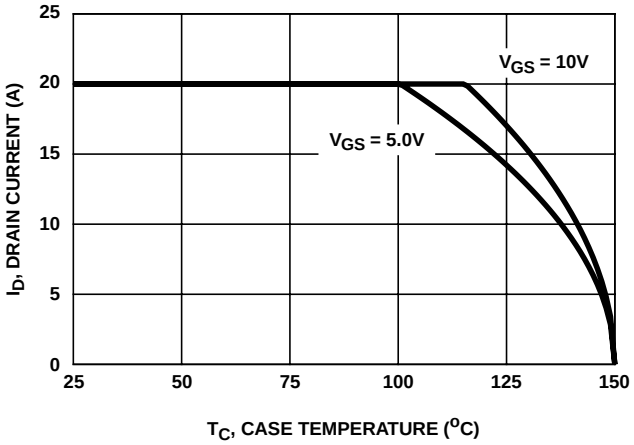


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

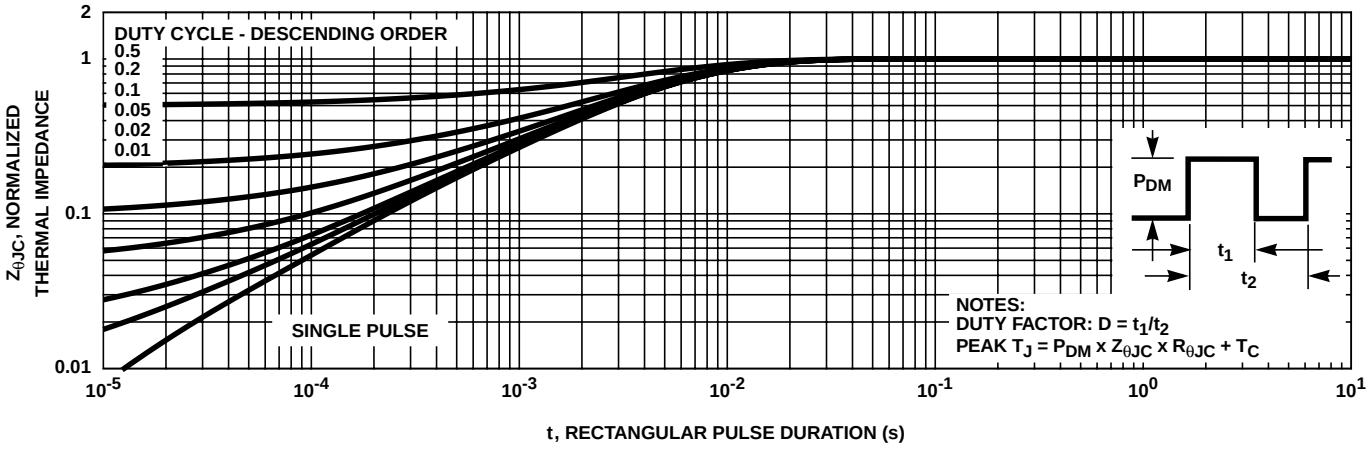


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

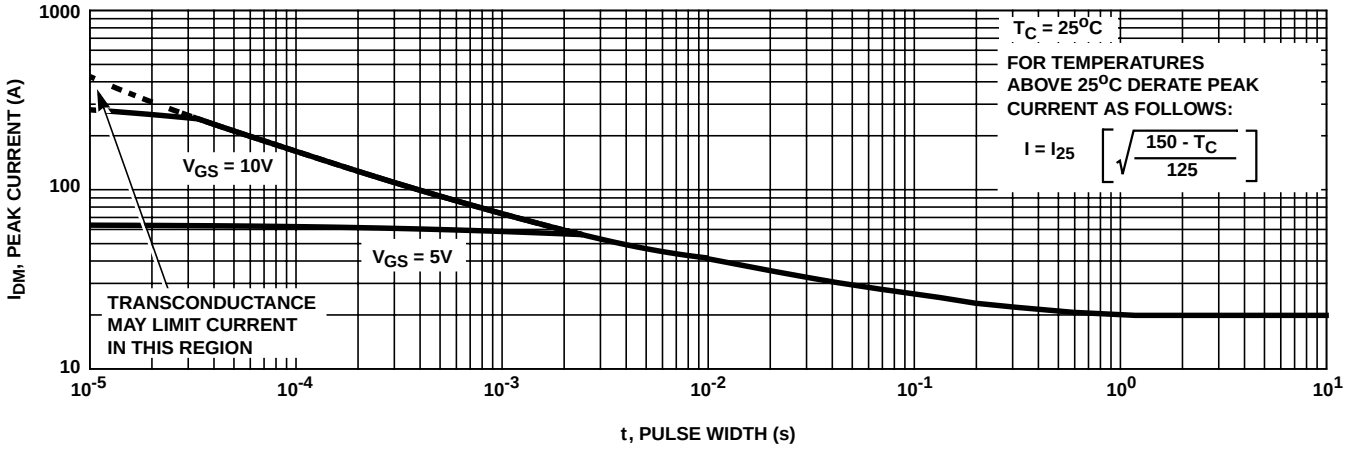


FIGURE 4. PEAK CURRENT CAPABILITY